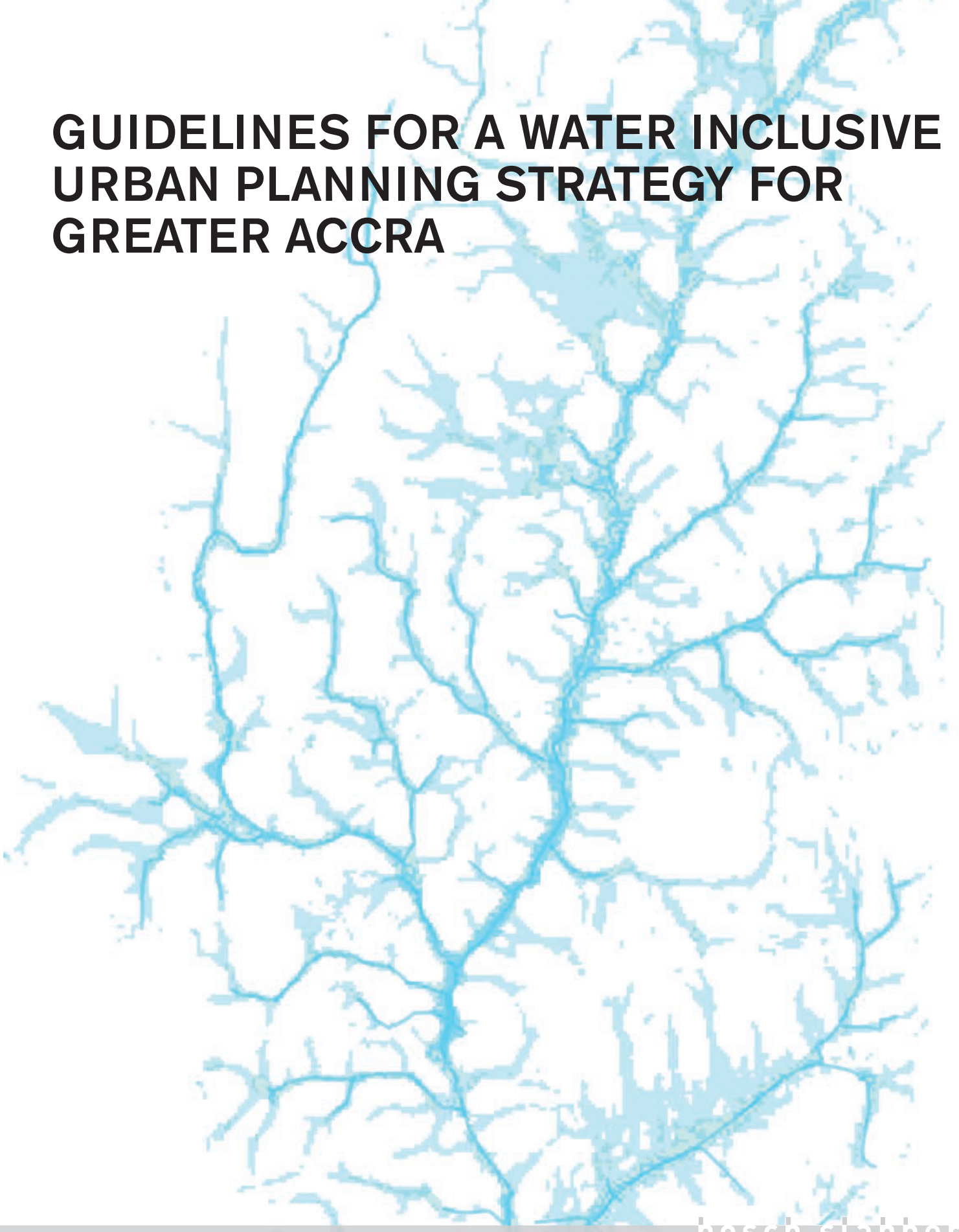
GUIDELINES FOR A WATER INCLUSIVE URBAN PLANNING STRATEGY FOR GREATER ACCRA



bosch slabbers

COLOFON

DEVELOPED BY
Bosch Slabbers Landscape + Urban Design;
Steven Slabbers,
Clim Soree,
Rosanne Vlaar,
Cor Simon,
Rachel Backbier

CLIENT
World Bank

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IMAGES
figure 1.2: http://www.bostonherald.com/
figure 2.2 & 3.8 & 3.9: Durk Klopstra
figure 2.20: Ale Jihan
other figures: Bosch Slabbers

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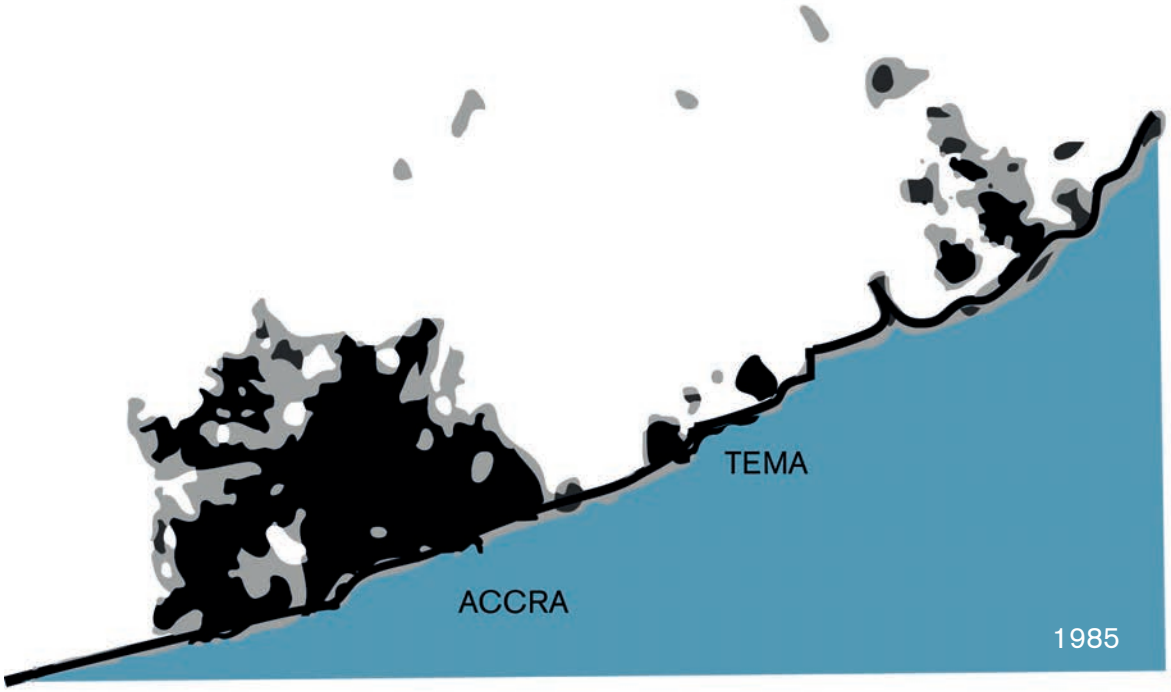


Figure 1.3: Urban area in Greater accra metropolitan area, 1985

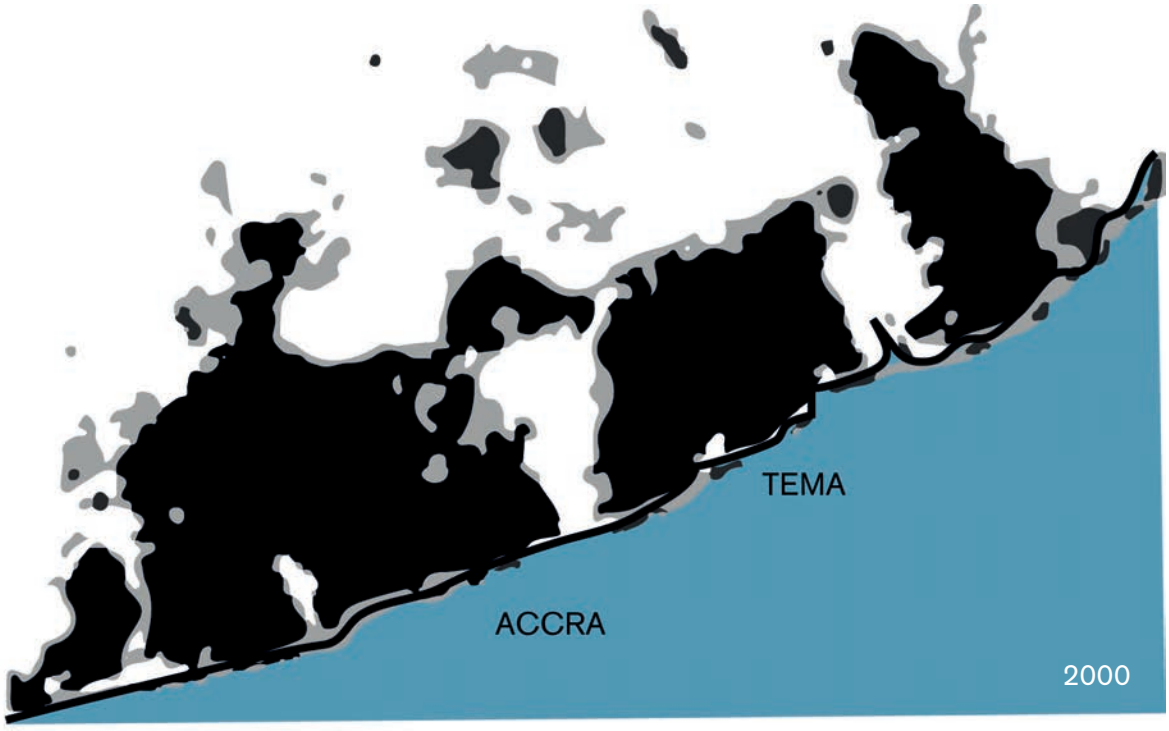


Figure 1.4: Urban area in Greater accra metropolitan area, 2000

1 INTRODUCTION

Accra, capital of Ghana, is situated on the Gulf of Guinea (figure 1.1). From the higher grounds in the hinterland, numerous creeks and rivers flow into the ocean.
Accra is a highly dynamic city. Over the last decades Accra has gone through an accelerated expansion. Today, Greater Accra has 4.7 million citizens. For 2037 9.4 million inhabitants are expected: a doubling of the amount of people in twenty years (figure 1.3 & 1.4). A substantial part of the growth of the population is situated in the so called 'informal settlements'.

One of the main issues for Accra is how to deal with the negative effects of climate change: periods of heavy rainfall are interspersed with periods of extreme drought. In addition, densely populated Accra is prone to urban heat-stress.
Water safety definitely is one of Accra's main problems. The city is struggling with floods during and after heavy rains. These floods are caused by the rains themselves and by the influx of rain water from the high grounds. Sealevel rise hardly appears to be a factor in the floods, it is almost all about precipitation.

Streets, houses and critical infrastructure like power plants and gas stations are regular ly flooded. This leads to unacceptable risks. In 2015 over one hundred people died when a flooded gas station exploded and in November 2017 another exploded gas station caused the death of 7 people (figure 1.2).

The lack of water safety hinders the economic development. Therefore, the World Bank asked HKV for a concrete policy that, in the short term, greatly improves the water safety in the central city area and for a vision that, on the long term, leads to a water resilient development of Greater Accra.

Figure 1.1: Location of Accra, Ghana

Figure 1.2: Explosion gas station, November 2017

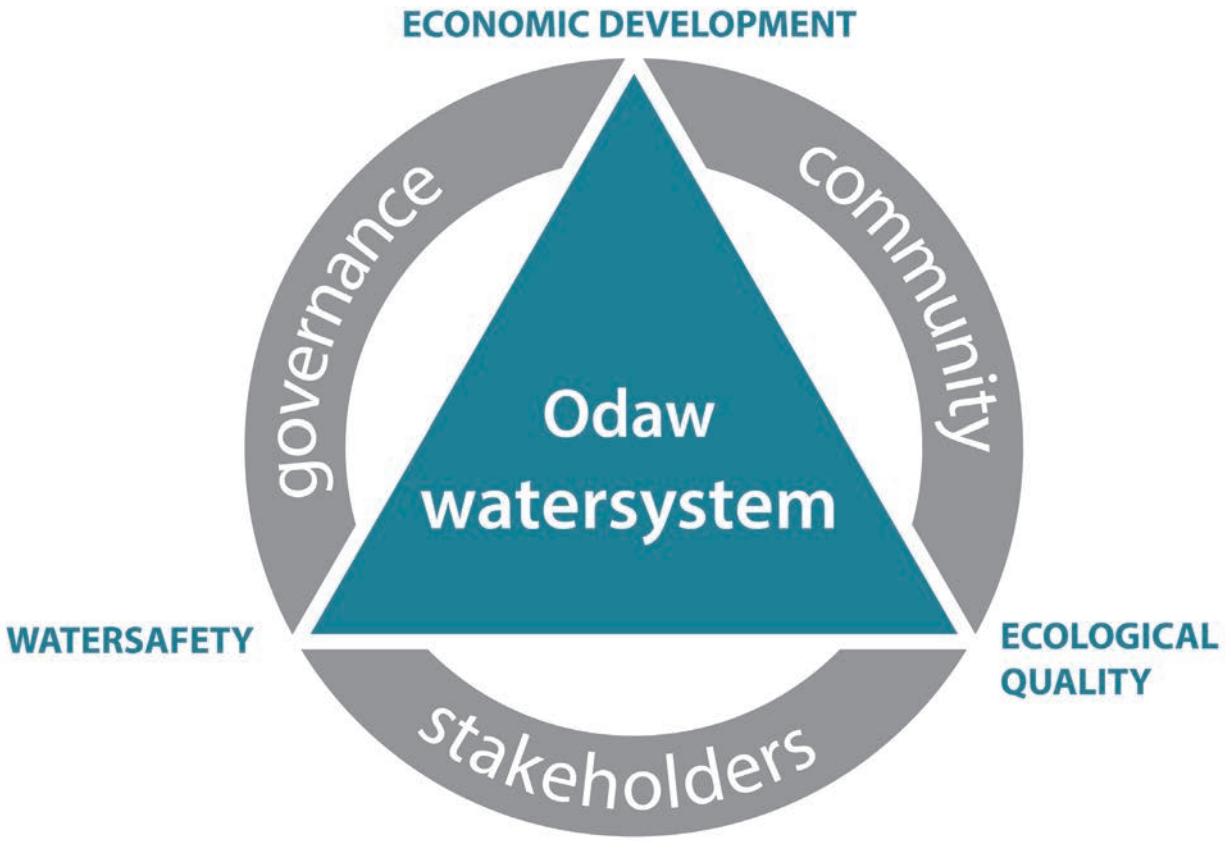


Figure 1.5: Triangle of the Odaw watersystem

The World Bank asked, on the level of a pre-feasibility study:

- to identify for the Odaw-area which measures must be prepared in 2018 to protect the central city district against flooding.
- to develop guidelines for a water resilient development of Greater Accra.
- to develop a comprehensive long-term perspective; how can Accra around 2037 deal with both the growth of population and the negative effects of climate change? How can this city be a home to twice as much people, store a double amount of water and reduce heat-stress?

The focus lies on the first two bullets.

HKV invited Bosch Slabbers, landscape + urban planning, to join the consortium to make concrete how we can develop Accra adaptively and attractively. Together HKV and Bosch Slabbers searched for solutions that both work and add value, for measures that turn Accra into a water resilient city and at the same time make Accra even a more interesting place to live, to work, to stay and add resilience; a city where people are willing to invest in. All measures have to find their basis in water safety. It is 'safety first, quality too'.

This exploration is about water safety and adding quality, but also about how to facilitate urban growth. Therefore, Accra needs to redevelop existing urban areas in a more dense and water inclusive way and to plan new expansions in a water inclusive way too (figure 1.6).

WORKING FROM THE TRIANGLE

Water safety and environmental quality are preconditions for economic development.
Without water safety and without sufficient environmental quality a sustainable economic development won't get realized. You can design the most ambitious plans, but if you cannot assure that the area won't get flooded and you cannot offer a proper environment no one is willing to invest (figure 1.5).

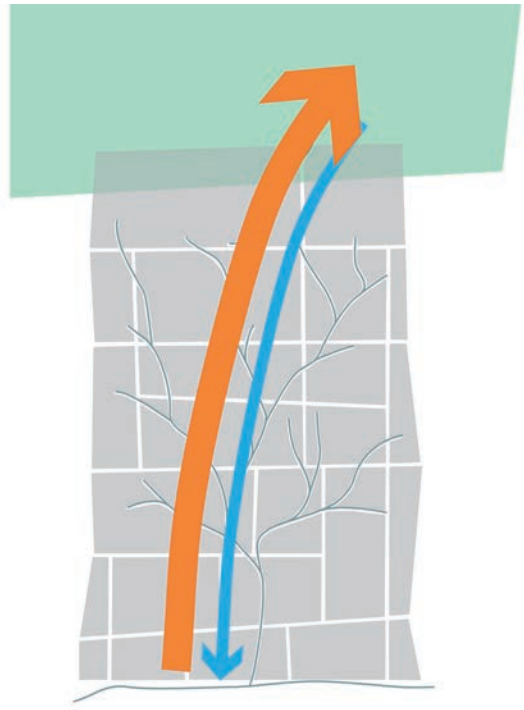


Figure 1.6: The water runs off, but the city runs up

Today you hardly cannot realize any plan on your own, so many parties are involved. You need to develop co-ownership. Together you can make Accra smile even more. That makes the difference between a plan and a realized plan


1.7


1.8


1.9


1.10


1.11


1.12

Figure 1.7 - 1.12: Photos of workshop, November 16th

METHODOLOGY : ACCRA DIALOGUE

Any plan is doomed to fail when people don't recognize the urgency and when there is no sense of co-ownership. You can't realize a plan on your own. Almost always a plan needs a combination of parties working together to get realized.

Sense of urgency and *co-ownership* are crucial for the success of a plan.
Starting a dialogue about the problems to be solved, the pursued goals, the long-term ambitions of Accra, the identity of the city, is the best way to develop both. Such a dialogue can also change the attitude from:

- 'how can we reduce damage?' into 'how can we make our city water-resilient and at the same time add spatial-, social-, economic- and ecological value'?
- 'what's in it for me?' into 'what's in it for us?'

A dialogue offers the opportunity to learn from each other's experience. A dialogue:

- brings together different kinds of expertise
- connects local knowledge with international expertise
- uses drawing as Esperanto.

Dialogues here are pressure cooker workshops where different disciplines look through the scales and in which Dutch experts work together with experts of Accra. They are condensed explorations with the aim to achieve joint discoveries and to learn from each other's experience. They are an excellent way to force a breakthrough, to change a mindset, or to reframe the question.

In these workshops drawing is used as Esperanto, not only between different languages but most of all between different disciplines and between professionals and citizens. Drawing is an excellent medium for speeding up the process and it gives focus to the discussion. It is the best way to develop a shared vision.
During the dialogues we worked in different groups and looked through the scales, in a geographic way as well as in time. We work from the scale of the city, to the scale of the development of the Odaw area to elaborations for more local situations within the area, as for instance the waterside. A long-term perspective, a dot on the horizon, is linked with a program of short-term measures.

In this process we come to joined discoveries and a shared vision. We find out which solution fits best for the situation, which solution not just solves the problem, but also creates the most co-benefits.
This process generates a community that is not only aware of the urgency, but also believes in the opportunities of the solution and adopts the developed strategy as 'their' vision. So the process creates co-ownership and by that a strong willingness to realize the plan.

You cannot overestimate the importance of drawing as a tool to develop a shared design.
A good drawing can clarify a complex situation and show hidden connections.
By drawing you also can investigate the bandwidth of the possible solutions. When you know the kind of measures, or combinations of measures, that might lead to solving the problem, then you can determine which of those possible solutions are that promising that they are worth to work out further.
The third step is to decide which of those promising solutions will be the preferred solution. In that step design can seduce, uncover unexpected relations, and visualize unsuspected opportunities.
So these dialogues are not only about safety, it is all about safety and adding new quality; ecological, spatial, urban, social quality. It is about making stronger identities, about creating more attractive areas. That is why designers are on earth.

The Accra Dialogues were held on November 16th and December 6th, 2017.
The results of these two dialogues are worked out in this report

You always have to start from a larger perspective, in scale as well as in time. You need a regional approach and a dot on the horizon. The trick is to link the long-term perspective with specific short-term measures.

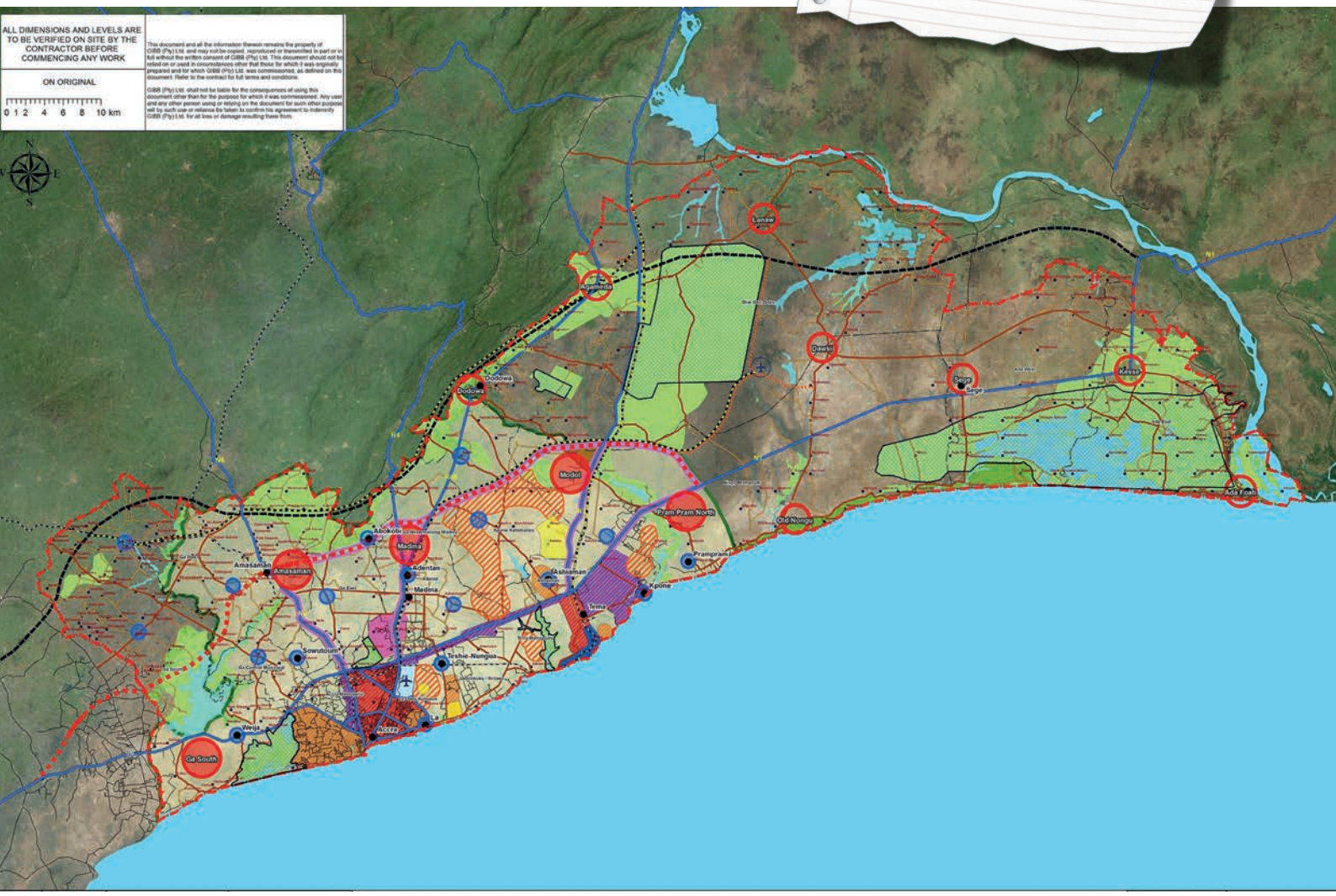


Figure 2.1: Masterplan Greater Accra 2037 - GIBB

2 VISION FOR GREATER ACCRA 2037

In May 2017 the Government of Ghana adopted an integral masterplan for the spatial, social and economic development of the area of Greater Accra 2037 (figure 2.1). This plan, prepared by by GIBB, offers a Spatial Development Framework. This is a thorough plan, it sketches the main features of the socio-economic and spatial development up to 2037 and gives serious attention to climate change adaptation and water management.
The recommendations contained in this plan are good but, due to the multitude of topics covered in the Masterplan 2037, quite abstract. In this study, the focus is on a water robust future. This makes it possible to reach more concrete recommendations.

2.1 COMMAND

For the long term the main question is to develop a water inclusive urban planning strategy for Greater Accra. Which measures facilitate an improved investment climate, stimulate the development of a strong and competitive city center or strengthen Accra's tourist attractions?

Although in Accra water plays a crucial role, today it hardly adds quality to the city. Can we realize a covenant between 'adaptive' and 'attractive'? Can we develop a strengthened relationship with the water, with the visor on the River, proud sea views and the lagoon as the main topic of an urban park? Can water in 2037 in a positive way determine the image of Accra?

The step from 4.7 million to 9.4 million inhabitants requires:
- restructuring of already occupied area;
- water robust design for new to be occupied area. This, for example, might lead to water inclusive forms of urbanization and/or the development of a robust 'blue' framework.

The perspective 2037 must indicate the water related options, without working them out, for that the budget is too limited.

2.2 AMBITION GREATER ACCRA 2037

In 2037 Greater Accra has to:
- be water safe and attractive
- offer a clean environment to its citizens
- accommodate the urban growth form 4.7 million to 9.4 million inhabitants.

This means the city will not only need all the money it can get or make, but also all the space it can get or make (figure 2.1).

Ghana has the ambition to develop into a global top tourist destination (figure 2.2). As captial with a long and rich history, Accra plays a crucial role in this ambition, and has to develop as a city that tells a layered story.


HOSPITALITY AND TOURISM GUIDE
Light up your world
GHANA TO BECOME TOP TOURISM DESTINATION GLOBALLY
- Vice President Dr. Bawumia

Figure 2.2: Newspaper article

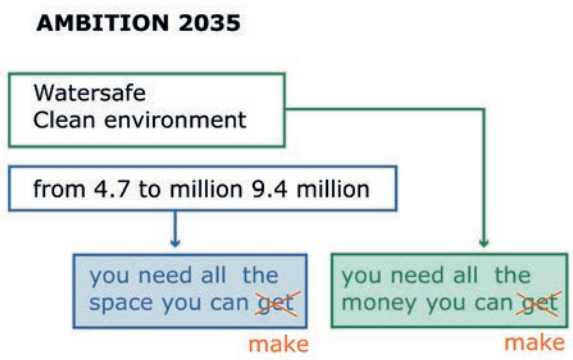


Figure 2.3: Strategy: make space & money

Figure 2.4: Insufficient water safety

Figure 2.5: Low environmental quality

Figure 2.6: Low density

Figure 2.7: Back to the water

Figure 2.8: Ignored cultural heritage

Figure 2.9: Life on the streets of Accra

Don't be satisfied with solutions that only work, search for solutions that both work and add value, for solutions that make Accra even a more interesting place to live, to work, to stay and at the same time add ecological resilience.

2.3 BOTTLENECKS, CORE QUALITY, OPPORTUNITY

2.3.1 Problems to solve

Today, Greater Accra has to deal with 6 main issues:

1. **Water safety**. As mentioned in the introduction, water safety is insufficient. Due to climate change, without intervening the situation will even get worse in the near future. The floods are caused by a lack of both retention- and water storage capacity. Water can't infiltrate and drains are too small and insufficient maintained. They are silted and clogged with waste (figure 2.4).
2. **Environmental quality.** The city is polluted, waste is dumped almost everywhere. Drains are clogged with millions of plastic bottles and sacks (figure 2.5).
3. **Low density.** For a city with 4.7 million inhabitants, Accra is built in a remarkable low density. Lots of refugees live in informal settlements in temporary constructions (figure 2.6).
4. **Lack of diversity.** The Urban Masterplan 2037 notes rightly a lack of diversity in the urban area. The city can be described as 'an ocean of relatively small houses', there are no real urban hot-spots with a distinctive range of activities or vibrant city areas.
5. **Accra doesn't take the benefits of the water**. Accra turns its back to the water, to the drains as well to the lagoons and to the ocean (figure 2.7).
6. **Lack of touristic quality, ignored cultural heritage.** Accra, and especially the coastal area, has an interesting history. Lots of elements still tell the story of Accra, like the lighthouse, the harbour of James town, Ussher Fort and prison, Osu Castle. But they are all in extremely bad condition and not connected to each other (figure 2.8).

2.3.2 Core quality to retain

Core quality are the people of Accra and the street life. It are the people who make Accra smile!

People live on the street, here they meet each other, here they sell and buy, they recycle, cook and eat, work and rest (figure 2.9).

2.3.3 Opportunity

Unlike most other cities, within Accra there is still a lot of space available, along the roads as well as within the neighbourhoods. Space that can be used for water retention or water storage.

2.4 MINDSHIFT

The problem with rainfall is that it never comes in the amount you wish, it is far too much, which leads to floods, or far too little, with drought as a result.

The existing system is based on the thought that you should always and everywhere drain as quickly as possible. But fresh water is too valuable to throw away. And it is needed in periods of drought. Furthermore, accelerating the discharge of water in the upstream drains also increases the pressure on the drains in the downstream areas, making the drainage system there overloaded.

Don't put all your cards on drainage. Drainage is the last card to play. Retain and store as long as possible and only drain when no other option is left (figure 2.10).

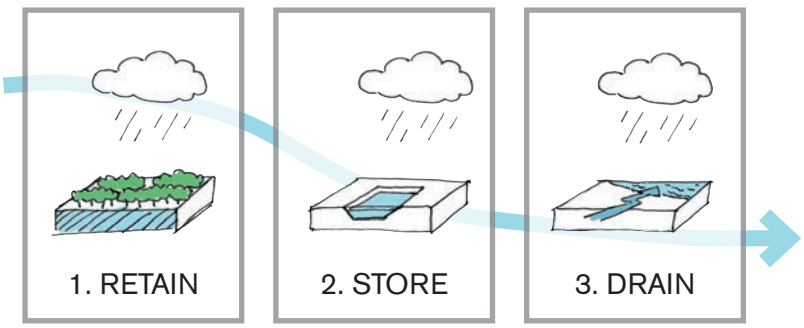


Figure 2.10: Strategies for water management

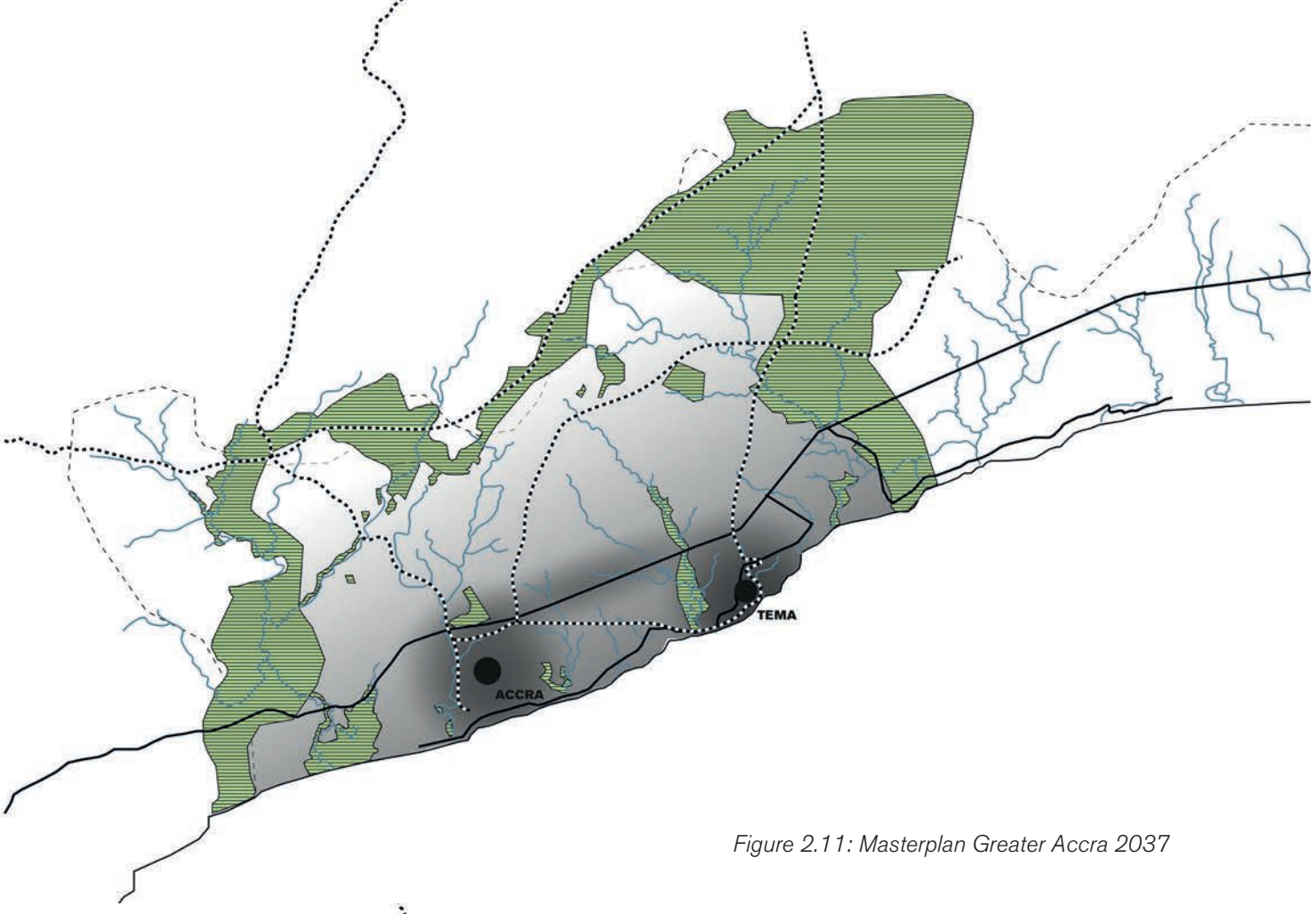


Figure 2.11: Masterplan Greater Accra 2037

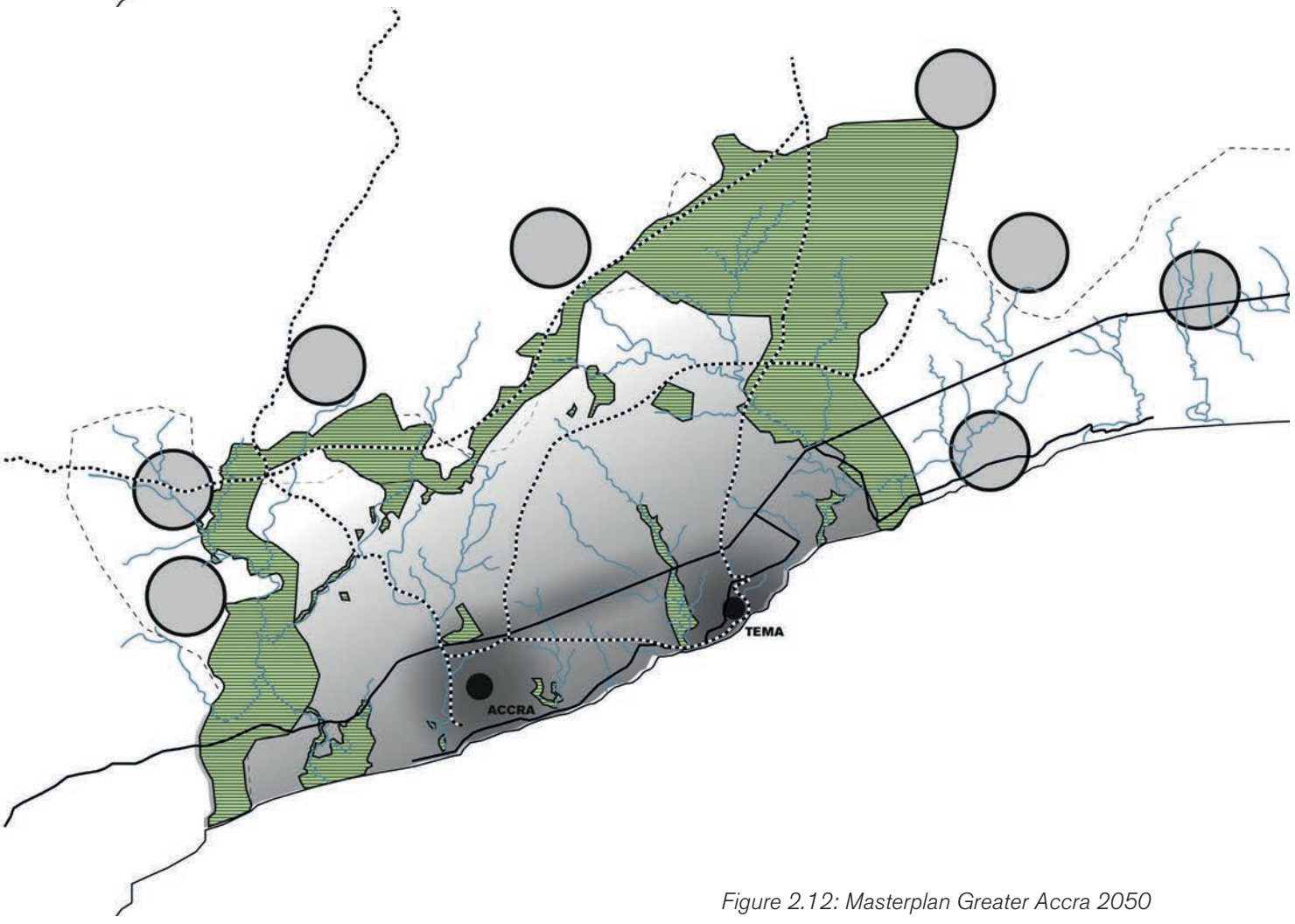
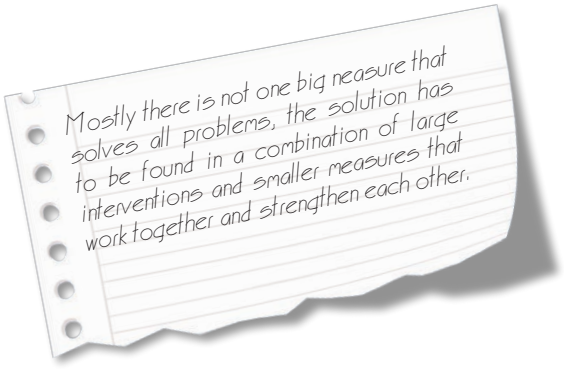


Figure 2.12: Masterplan Greater Accra 2050

2.5 OVERALL SKETCH

The illustrations show the long-term development of Greater Accra, up to 2037 (figure 2.11) and 2050 (figure 2.12).
Main principle is the development of:

- a more or less 'compact' city,
- with a variety of spheres and density,
- with two urban focus points (Accra and Tema),
- faced to the ocean,
- surrounded by a strong green belt,
- and veined by a series of creeks and rivers with their associated watershed,
- by the railroad connected with the hinterland,
- Satellites in 2050



LEGEND

- Urban area
- Proposed urban boundary - green zone
- Satellite
- Road
- Railroad
- Stream
- Greater Accra Region - boundary

'Compact' in the way that the urban area doesn't take more space than necessary and so the rural and natural areas east of the city, between city and Volta river, can be remained.
Within the urban area there is a variety of atmospheres and densities.
Accra and Tema are developed as urban focus points, as urban 'hot-spots' with a wide range of cultural and economic facilities.
In Accra and Tema the area adjacent to the ocean is most suitable for the development of the central business district, followed by a dense developed down-town area.
The midstream area is suitable for an urban development in a mid-density, in the upstream area you should strive for a lower density.

The area between the upstream area and the green belt gets developed as an 'urban sponge', an area where the water is retained and stored in retention ponds and waterparks.
This contributes to the relievement of the drainage system in the downstream areas.

Satellites

The green belt is not an ultimate border for urban development.
For the first decades the urban use of the area inside this green belt has to be optimized, which means developed in a higher density, making use of the free space still available in the urban fabric.

After that, when more room is needed, Greater Accra can cross the belt developing 'satellites' at the other site of the green belt.

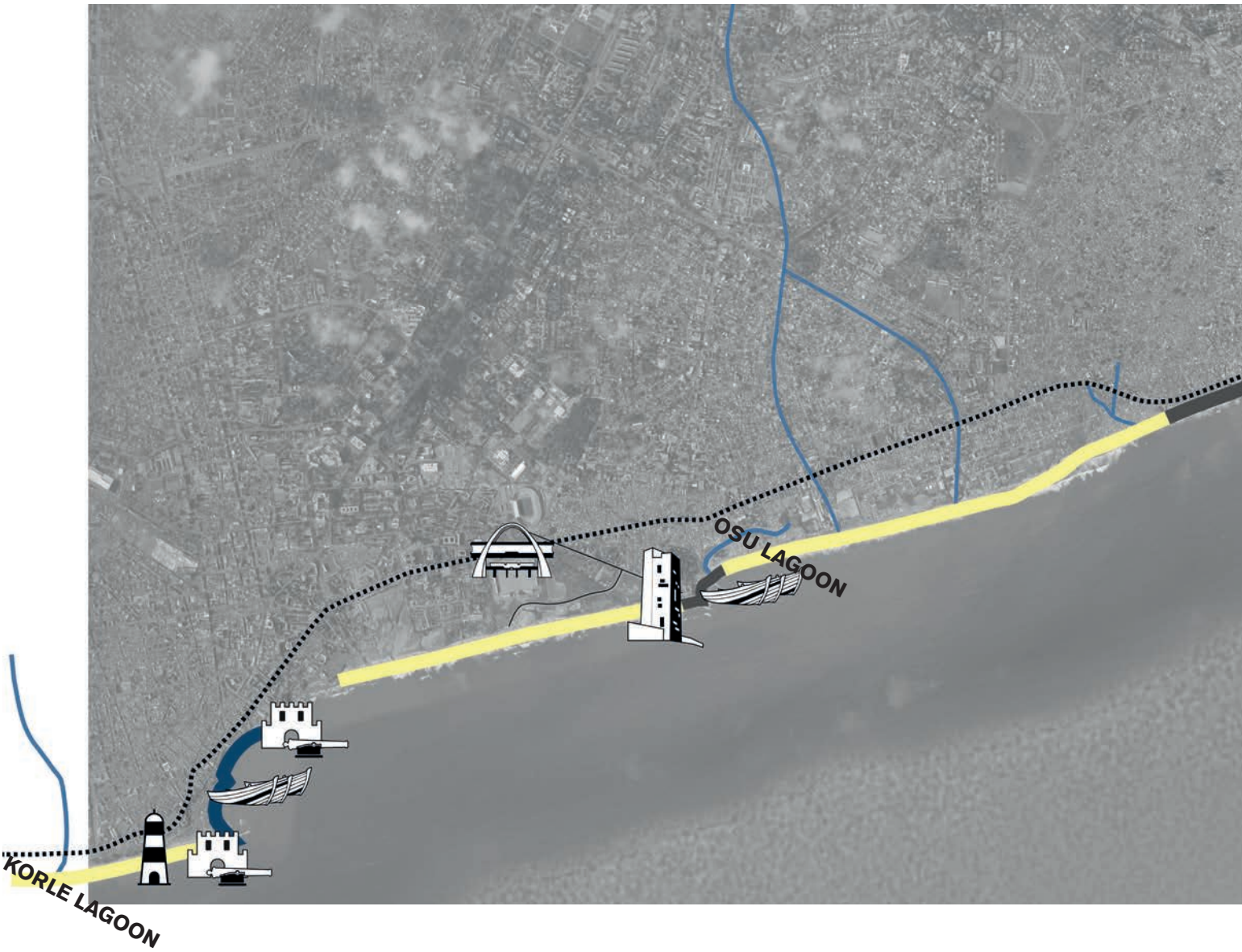
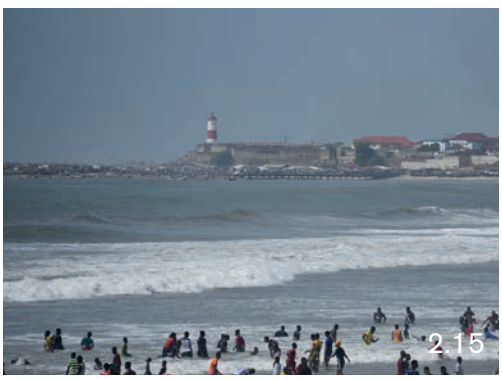


Fig. 2.14: Korle lagoon

Fig. 2.15: Lighthouse & Jamestown

Fig. 2.16: Ussher fort & prison



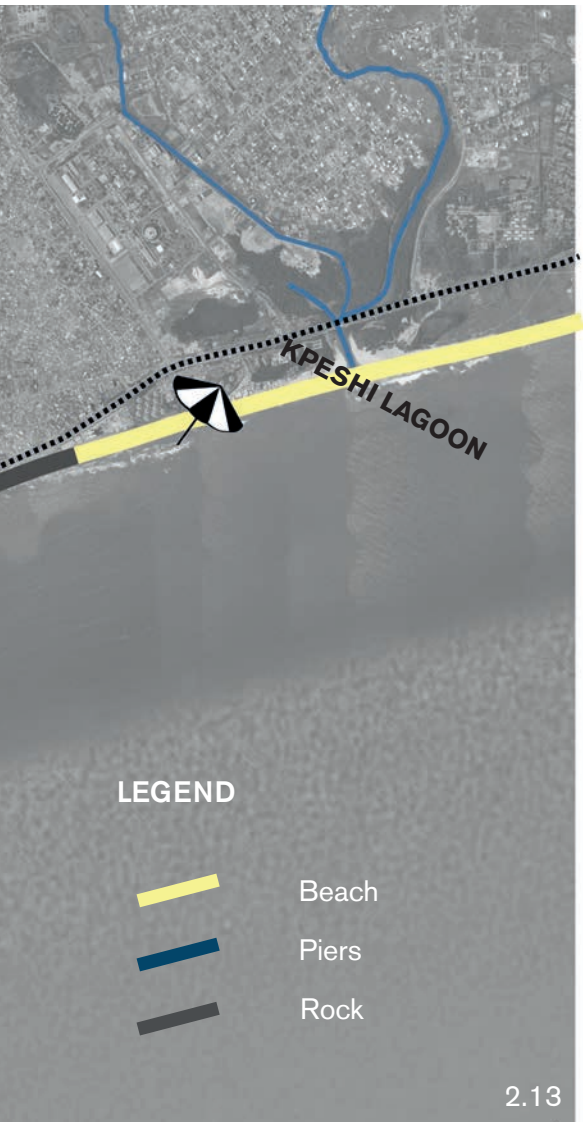


Figure 2.13: Ocean drive - Tourism program

Along the ocean, the 'ocean drive' is developed as a proud boulevard, connecting all the paradise beaches and the highlights of a rich cultural history and heritage and places of ecological/ natural interest (figure 2.13):

- Korle lagoon (figure 2.14)
- Lighthouse and Jamestown (figure 2.15)
- Ussher fort and prison (figure 2.16)
- Independence Monument and square
- Osu Castle (figure 2.17)
- Osu lagoon (figure 2.18)
- Labadi beach (figure 2.19)

Intensifying the railroad connection with the hinterland improves the accessibility of the center of Accra. Thereby a much larger area can benefit of the presence of a strong city center, providing labor, education, medical- and cultural facilities.

Fig. 2.17: Osu Castle

Fig.2.18: Osu lagoon

Fig. 2.19: Labadi beach

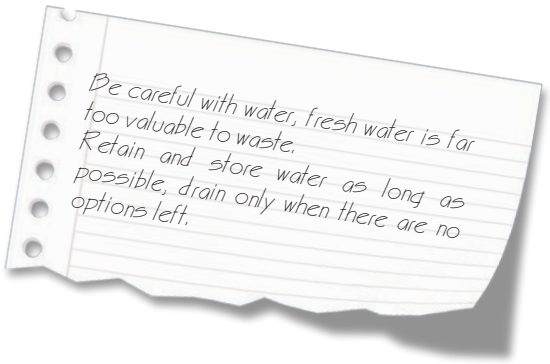
INTERMEZZO: CLEANING

One of the assignments in Accra is to improve the functioning of the existing drain system, to recover their discharge capacity. The drains are clogged with silt, but also by waste. In particular, the plastic is a serious problem.
Is there a way to clean up those huge amounts of plastic in the drain?

People in Accra consider the plastic as worthless waste. If they were told there was money floating in the water they wouldn't have known how fast they could fish it out.
How do we make money from waste? Can we make it so that they no longer consider plastic as waste but as a potential source of income?
In Rotterdam the "Better future factory" developed a system to transform plastic waste into a raw material with which a tradable product can be manufactured. They transform plastic into money and create employment and income for the locals living in the slums.
Machine 1 collects the plastic, machine 2 cleans and separates, machine 3 makes a plastic wire after which the three-dimensional printer generates tradable products.
Last year Rotterdam University / RDM campus went to Bangladesh with 10 small 3D printers. There they paid the residents of the slums a small amount for every kilo plastic they collected and made a plastic wire out of it. They learned the people how to use that plastic wire to print plastic tiles, and how they can sell those tiles as paving material.
This leads to a chain of benefits: the plastic waste is cleaned up, people in the slums earn some 'low schooled' income by collecting the waste and in addition money is earned by production and selling of the tiles.

It is crucial that drains get cleaned and will be kept clean. That this is doable is proofed by the city of Jakarta. Until last year the canals and drains in Jakarta were in the same condition as in Accra. After a huge clean-up the canals are recognized as a valuable addition to the city and urban life (figure 2.20).

Figure 2.20: Clean up of the canals, Jakarta



2.6 STREAMS AND CATCHMENT AREAS

2.6.1 Keywords

As mentioned, Greater Accra is veined by a series of creeks and streams with their adjacent catchment areas or watersheds.
These streams and watersheds are crucial in the strategy for the urban component.

Keywords in the proposed strategy for Greater Accra are:
- Retain
- Store
- Drain

but also
- Maintain
- Educate & communicate.

Retain means
- Keep the water longer in the system
- Delay the run off
- Develop retention ponds
- Enlarge the possibilities to infiltrate/ permeability

Store means
- Increase storage capacity
- Widen the drains
- Add water gardens and water squares to the urban areas
- Develop storage ponds and floodplains

Drain means
- Extend and densify the network
- Take away obstacles
- Widen the outlet to the ocean

Maintain means
- Free the drainage system of the waste
- Dredge / unsilt the drains

Educate & communicate are about
- Strengthen awareness
- Explain the urgency
- Create co-ownership
- A combined approach with improved living conditions in settlements

2.6.2 Different areas require a different appraoch

Within the catchment area the upstream-, midstream- and downstream area requires a different approach.
In this figure the Odaw catchment area is drawn in a schematic way. But the proposed approach is applicable and replicable for all other streams within the urban component of Greater Accra (figure 2.21 - 2.24).

Upstream retention and delay are key issues. Develop the upstream area as a sponge.
Midstream increase of storage capacity is the main theme. Therefore, you have to widen and densify the system.
Downstream, in periods of heavy rains you have to flush the water as soon as possible, therefore you need to accelerate the drainage and widen the outlet to the ocean.

Future urban patterns can follow the same gradient. The area adjacent to the ocean is most suitable for the development of the central business district, followed by a dense developed down-town area.
The midstream area is suitable for an urban development in a mid-density, and in the upstream area you strive for a lower density.

The solution is to be found in a combination of large interventions and smaller measures that work together and strengthen each other.

The solution is not always in the same spot as where the problem occurs. Sometimes the solution is to be found elsewhere.

Upstream

- Where helpful, afforest the steep slopes to prevent siltation.
- Develop sandtraps to collect the silt, so that hereafter you don't have to dredge the whole system but only to empty those 'sandbuckets' (figure 2.25).
- Delay the run off.
- Retain the water, develop retention ponds and areas / spongy areas.
- Prevent them from informal and formal urbanization. This requires an effective land use planning to make sure that spongy areas will be remained.
- Develop new urban areas water inclusive.

Midstream

Midstream solutions are crucial to prevent downstream flooding.

This is a highly urbanized area.

- Dredge! Unsilt.
- Increase water storage capacity:
  - o Widen the Odaw,
  - o Assemble the remaining open spaces along the drains in a connecting network and develop them as wadis.
  - o In addition, make use of the open space along the main roads.

Figure 2.21: Upstream

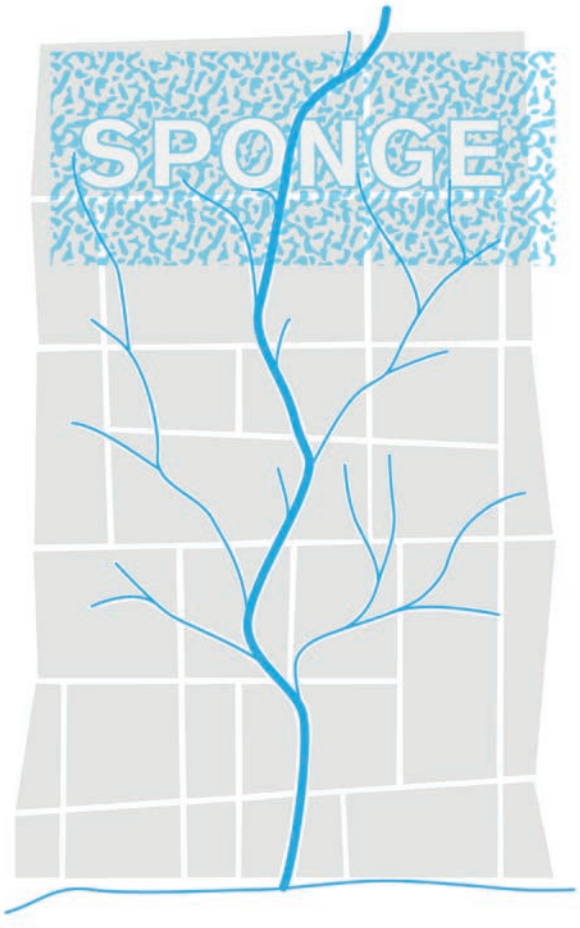


Figure 2.22: Midstream (1)

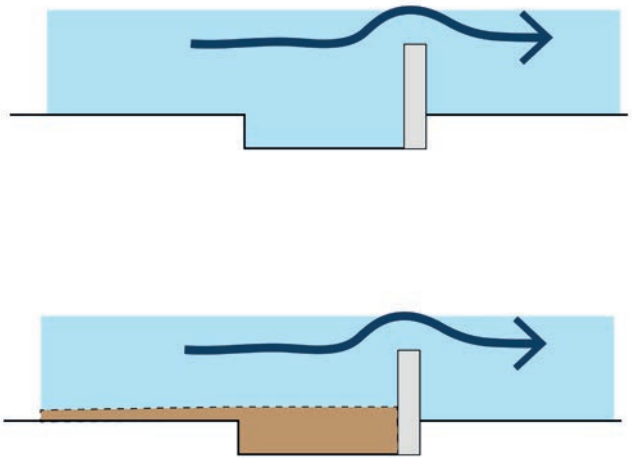


Figure 2.25: Principle of sandtrap

Downstream (specific for the Odaw)

- Dredge the Korle lagoon
- At least, keep the interceptor weir free from waste. Maintain this structure, not as weir but as connection. As a wear it doesn't add the expected ecological value and the operation costs are too high.
- If you can't keep the Interceptor free from waste, then you can better remove it and replace it by a bridge for the people in Sodom and Gomorra.
- Lowering the unbuilt areas along the lagoon is useful to prevent them from further informal urbanization.
- Widening the outlet to the ocean accelerates the drainage.

Figure 2.23: Midstream (2)

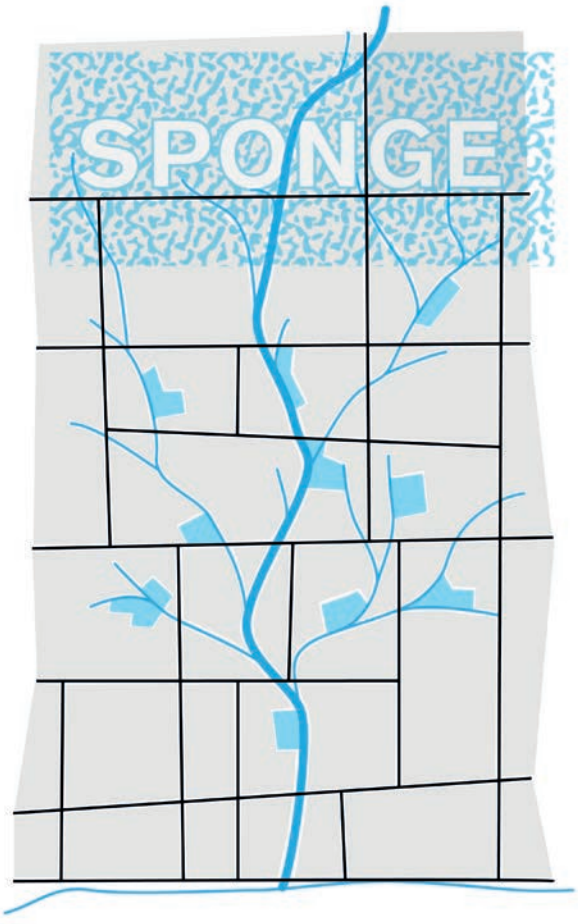
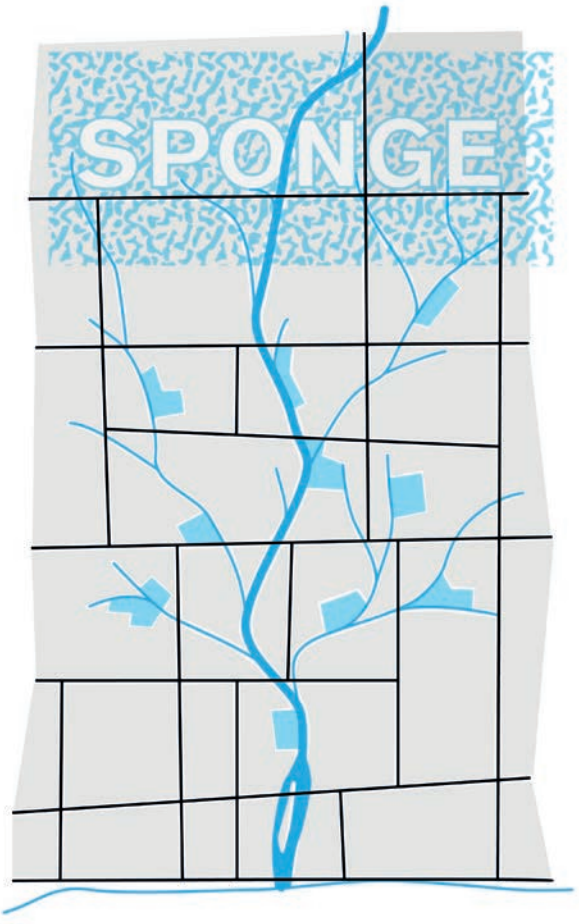


Figure 2.24: Downstream



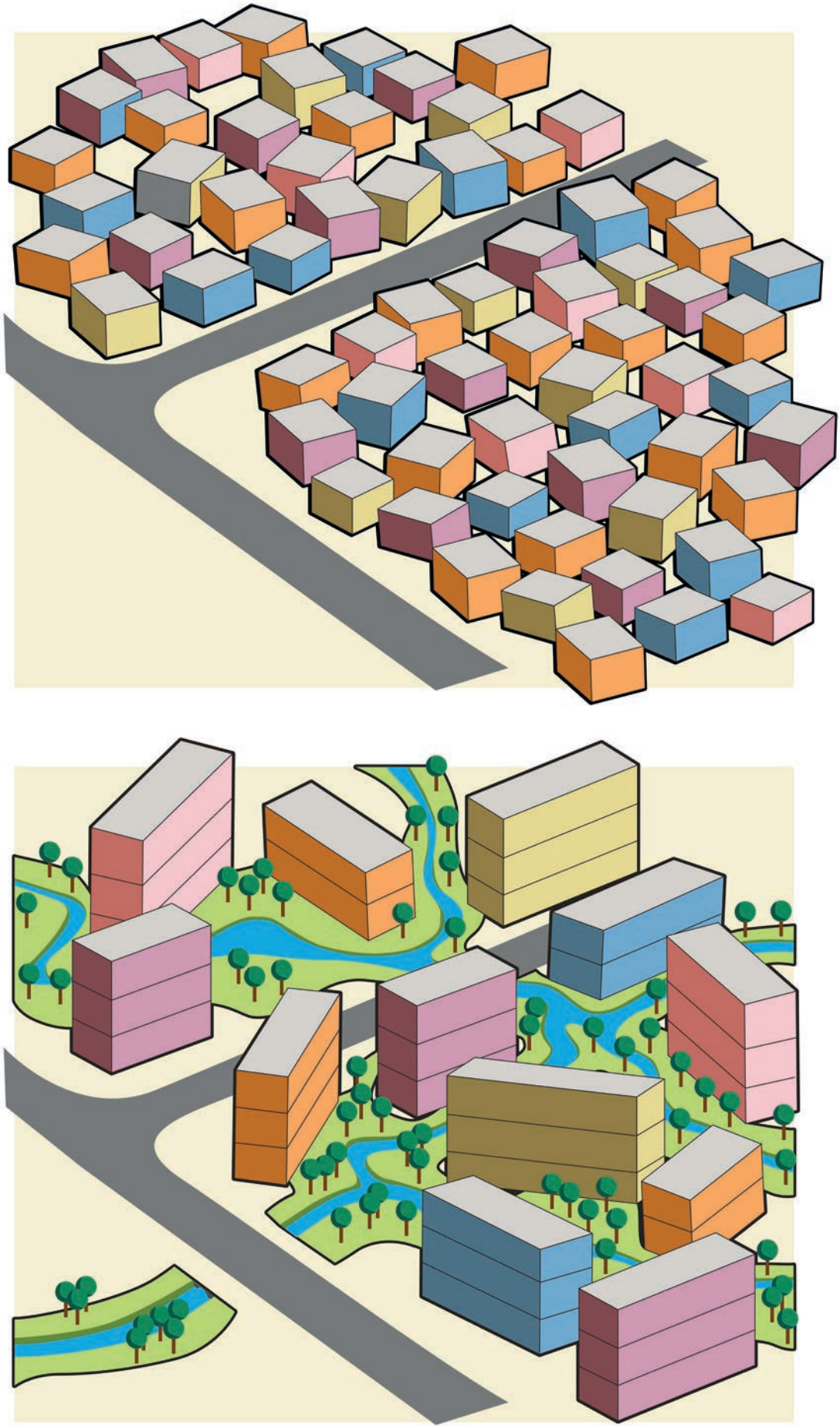
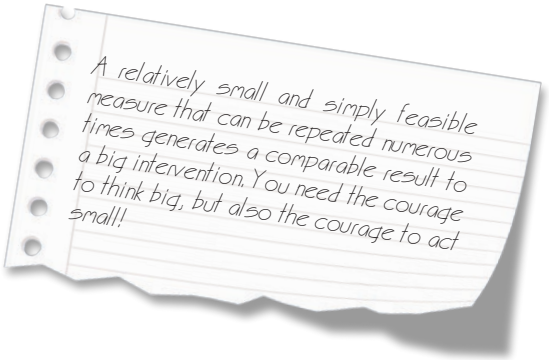


Figure 2.26: Principle of proposed restructuring



2.7 REDEVELOPMENT OF URBAN AREAS

In the next 20 years the amount of people living in Greater Accra will double from 4.7 million to 9.4 million inhabitants. This growth requires:

- restructuring of existing urban areas in a higher density
- development of new city extensions.

2.7.1 Restructure

Parts of Accra are developed in an extensive way, with one floor buildings on relatively large plots. Main question is how can they get restructured in a higher density while maintaining the core quality of street life?

Most, if not all, informal settlements are densely occupied in a more or less temporary way. How can they get redeveloped as permanent living areas in such a way that they give home to at least the same amount of families?

It is all about scale, about room for water, about avoiding heat stress.

Scale: these areas must be redeveloped in a scale that the people who live there still feel connected with the ground level. That is a precondition for maintaining street life.

So, no high-rise, but multi-floor buildings.

Room for water: the redevelopment must supply room for water storage and room for water to infiltrate.

Avoiding heat-stress: the redeveloped area has to offer coolness, shady places.

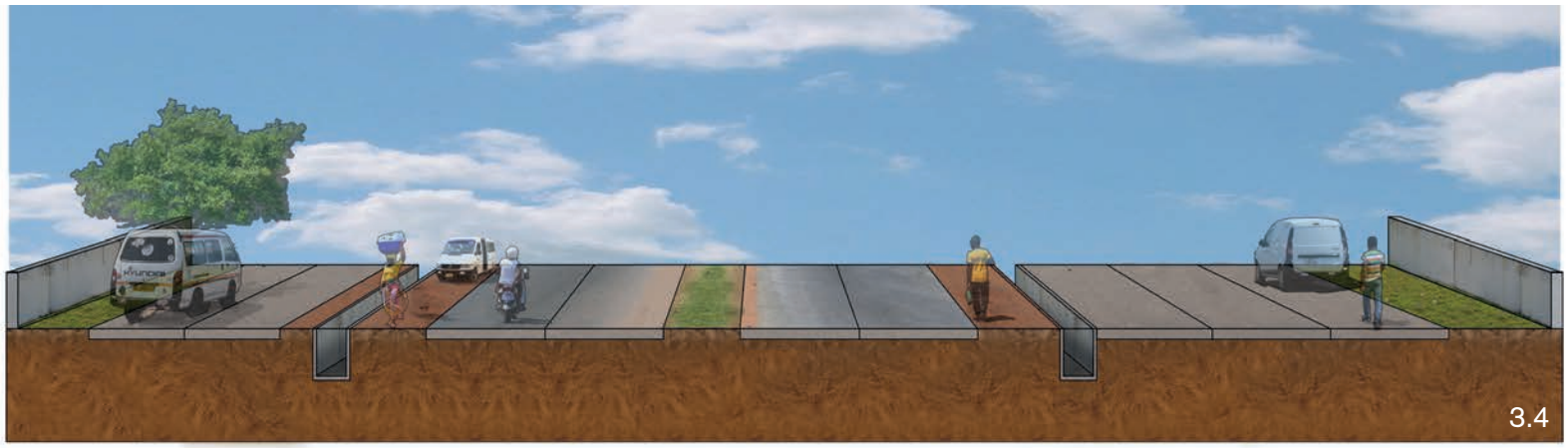


Figure 3.4: Water storage along road - current situation

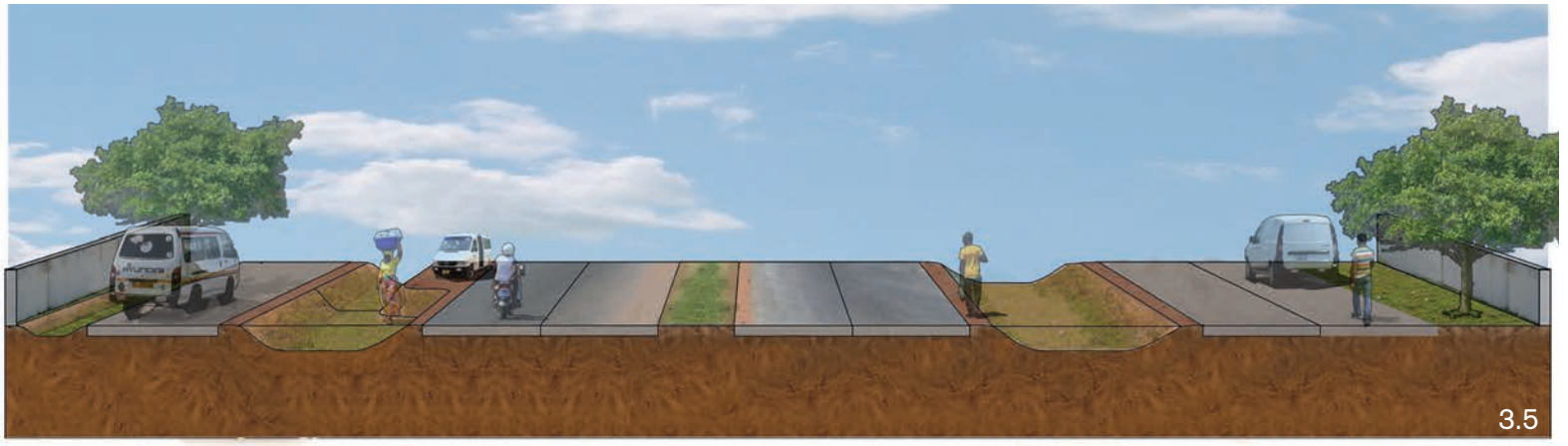


Figure 3.5: Water storage along road - new retention areas

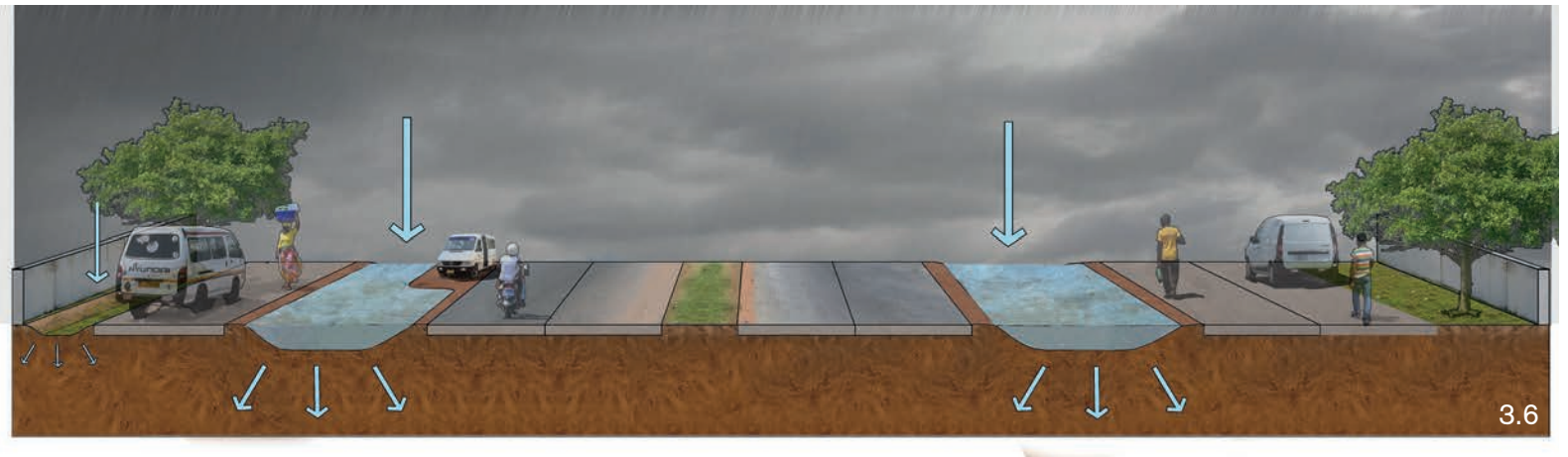
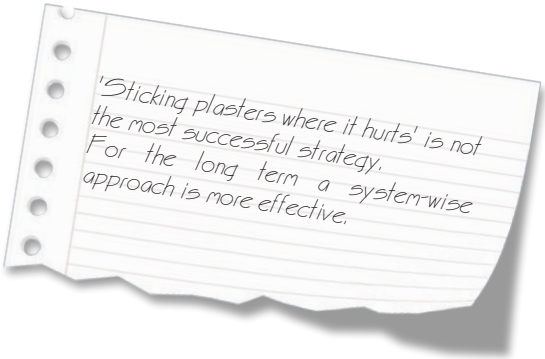


Figure 3.6: Water storage along road - retention areas during rainfall

3 ODAW REGION

Figure 3.1: Graphic Road

Figure 3.2: Ring Road



There isn't one big measure that solves all problems, the solution has to be found in a combination of large interventions and smaller measures that work together and strengthen each other.
Upstream retention and delay are key issues. Midstream increase of storage capacity is the main theme. Therefore, you have to widen and densify the system. Downstream, you have to accelerate the drainage.

3.1 INCREASE STORAGE CAPACITY ALONG THE MAIN ROADS

Along most main roads there is still a lot of space available that can be used for water storage and drainage. Examples of this in the Odaw region are Graphic Road (figure 3.1) and Ring Road (figure 3.2).

3.1.1 From drain to wadi

The term 'wadi' (Arabic for 'valley') is derived from a dry river bed in a desert. Usually the wadi is dry (figure 3.3), only after a rain shower it fills with water.

In the current situation drains protect the road from flooding, they are meant to flush of the water as soon as possible. By lowering the outside of the drain roadsides can be developed as wadis, as retention areas and for water storage during extreme circumstances (figure 3.4 - 3.6).
In the wadi, water can infiltrate. These wadis create a greener, less stoney environment.

3.1.2 Graphic Road

Take for instance the Graphic road, one of the main transport arteries of the city, to which the busy Agblobloshie market is located. In 2015 this was also the area that was hit most by flooding. That makes action here more than urgent.

Figure 3.8: Flooding due to insufficient capacity of drains

Figure 3.9: Heavy drainage due to insufficient capacity of drains

Here are opportunities for covered retention under the vent roads / parallel roads as well as for the development of green roadsides that emerge space for infiltration. Trees in these green berms offer shade, and thus cooling, to the city.

3.2 WIDEN THE MAIN DRAINS

Although the main drains are huge concrete structures, their capacity is insufficient (figure 3.8 & 3.9).
Calculations by HKV point out that the main drains have to be widened from 35 to 100 meters. Especially, but not only, widening the drain between Circle and Agblobloshie, is urgent. In addition to widening also maintenance is urgent; silt and waste need to be taken out.

Problem is that these drains don't always contain water. Periodically they transport so much water that they overflow, which has to be changed, periodically they don't contain any water, which unfortunately can't be changed. Unfortunately, because under dry conditions the drain is a smelly open sewer, far from attractive (figure 3.13).

For widening the drains we investigated two options:

- maintain them as an open drain, including all their disadvantages;
- develop them as covered drains.

3.2.1 Open drain

For the section between Circle and Agblobloshie we investigated the possibilities to widen the drain from 35 to 100 meters.
Figure 3.7 shows the existing drain and the proposed extention. Sometimes the extention is situated on one side, more often it is on both sides of the existing drain.
In the urban fabric 100 meters is a hefty size, the drain shouldn't run as a 'deep canyon' through the city.
The scale can optically be reduced by building new blocks on stilts within the drain. To a certain level this can add new attractiveness, but this doesn't take away the objection of an open sewer (figure 3.14).

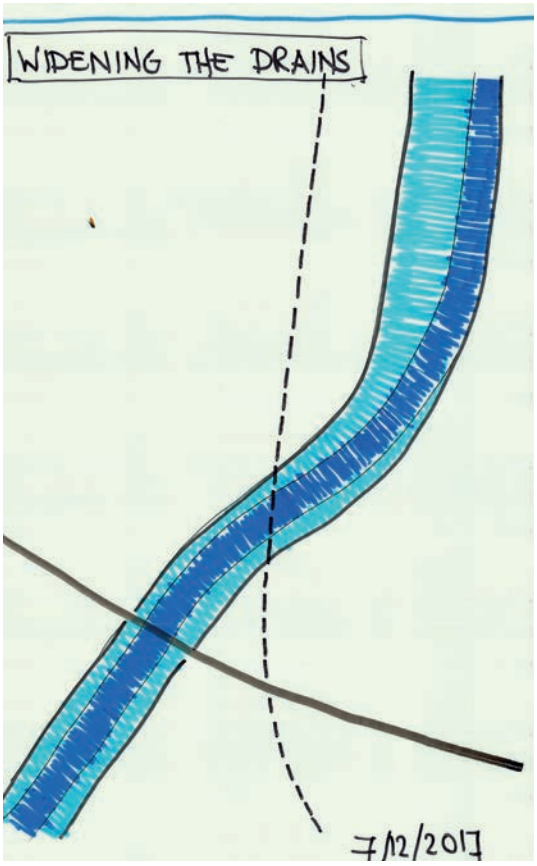
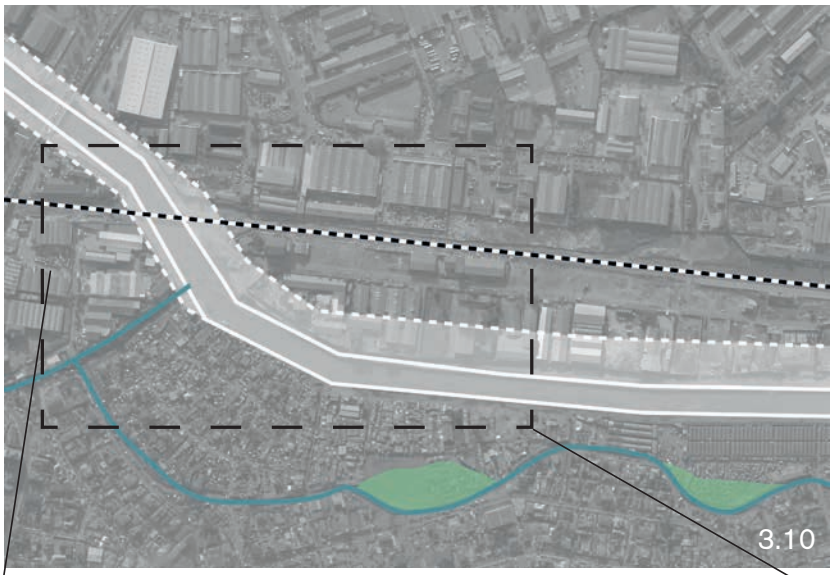


Figure 3.7: Proposed extension of drain



LEGEND

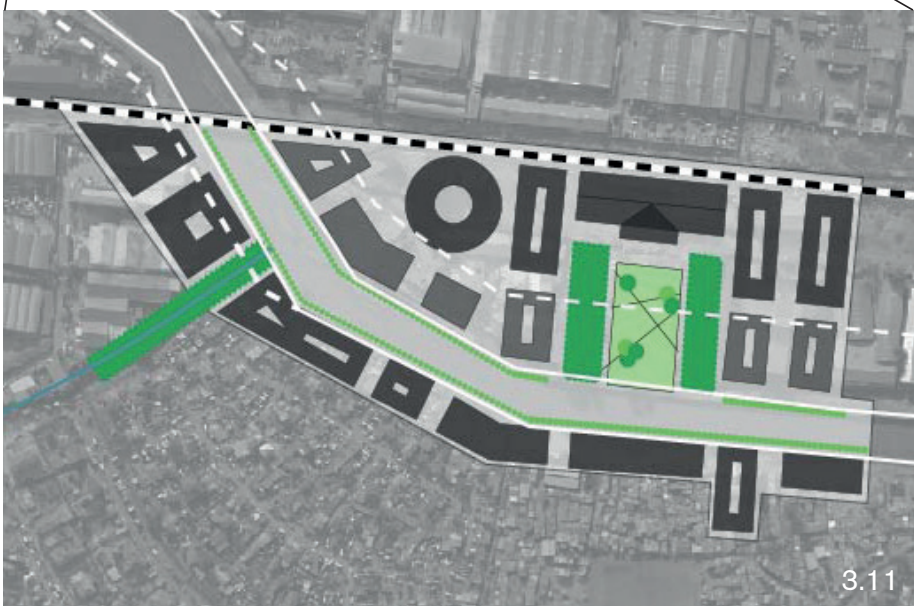
Existing wall

New, replaced wall

Existing creek

Added flood area/wadi

Railroad



LEGEND

Central railway station

Park

Lane trees

6 floor building

4-6 floor building

Figure 3.10: Result of charrettes: Widening of the drain

Figure 3.11: Result of charrettes: Railway Businessdistrict

3.2.2 Covered drain

To accommodate the expected growth of the population all space is needed. In fact, you can hardly afford an unbuilt area of such a size in the central district of your city (figure 3.10).
The alternative is to cover the drain and to exploit this 'new realized urban area' as part of the central business district.
The value of the ground in this area can double when it takes benefit of the presence of the railroad.

We propose to develop this area into the central railway district, adjacent to the new main central station (figure 3.11 & 3.15).
Building blocks of 6, max 8 floors (living and offices) fit to the scale of the city center (figure 3.12).
Covering the drain is a costly operation. But the profits from the ground operation and the new project development might make it possible to finance this. In the next phase this should be worked out and further investigated in detail.

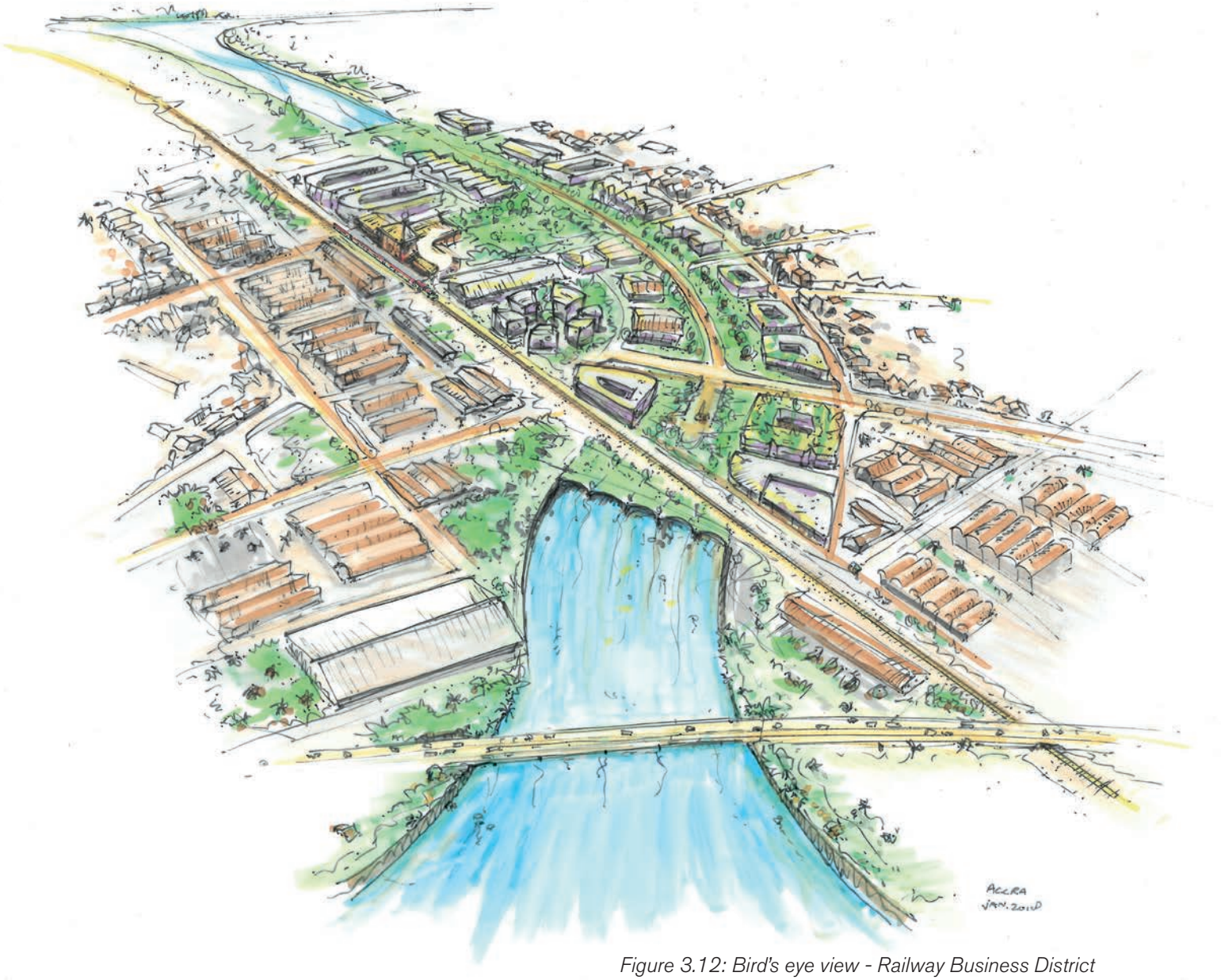
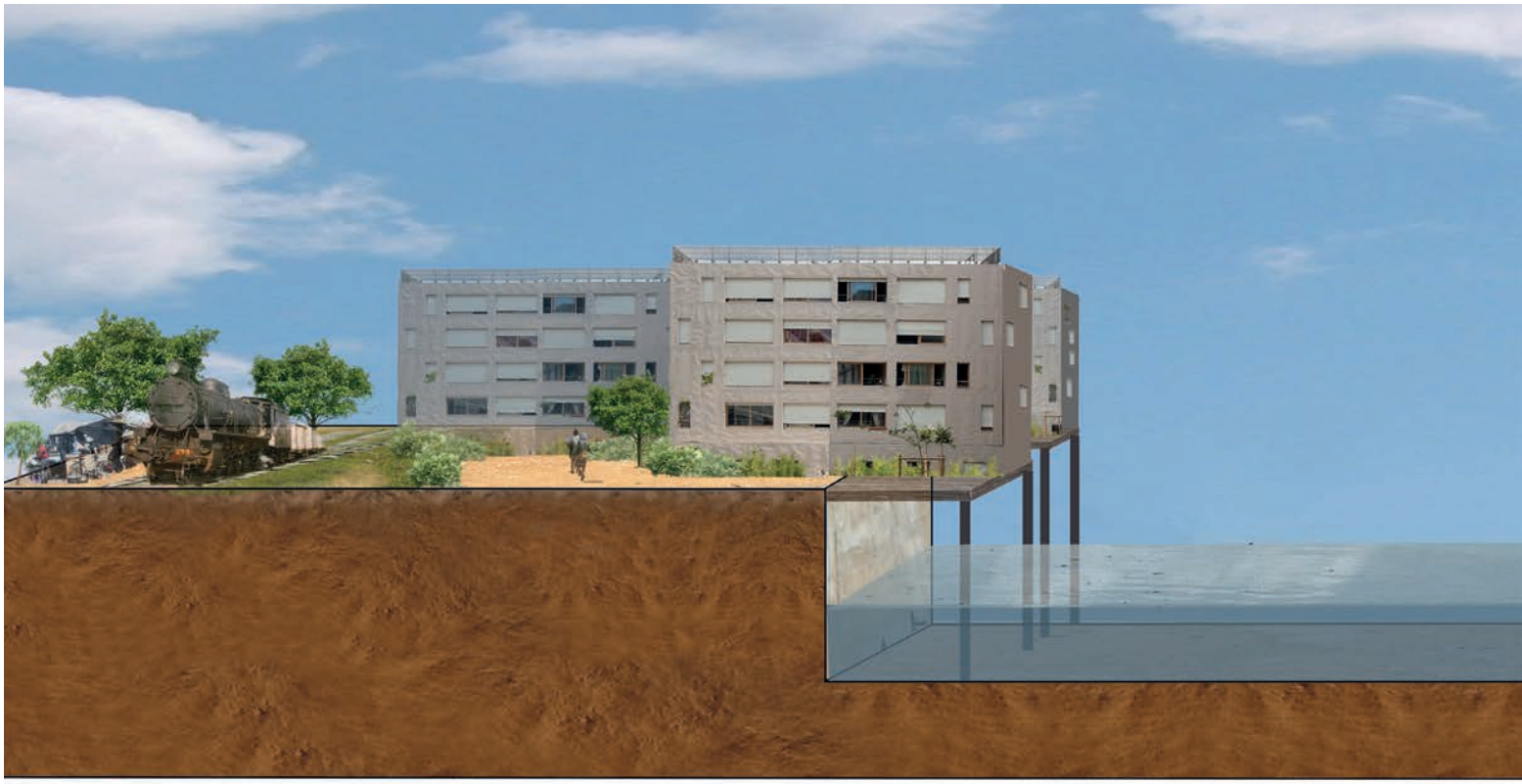


Figure 3.12: Bird's eye view - Railway Business District



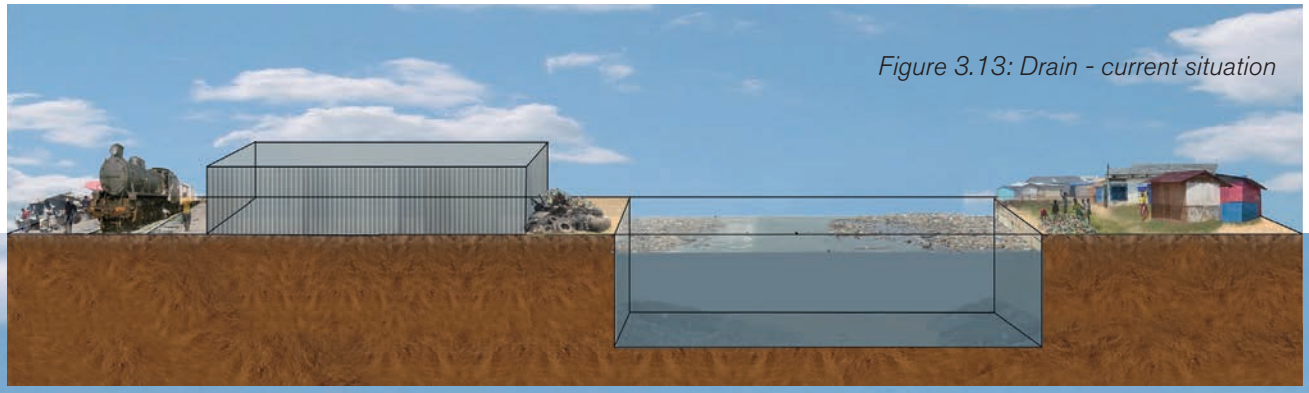


Figure 3.13: Drain - current situation

Figure 3.14: Option 1: open drain

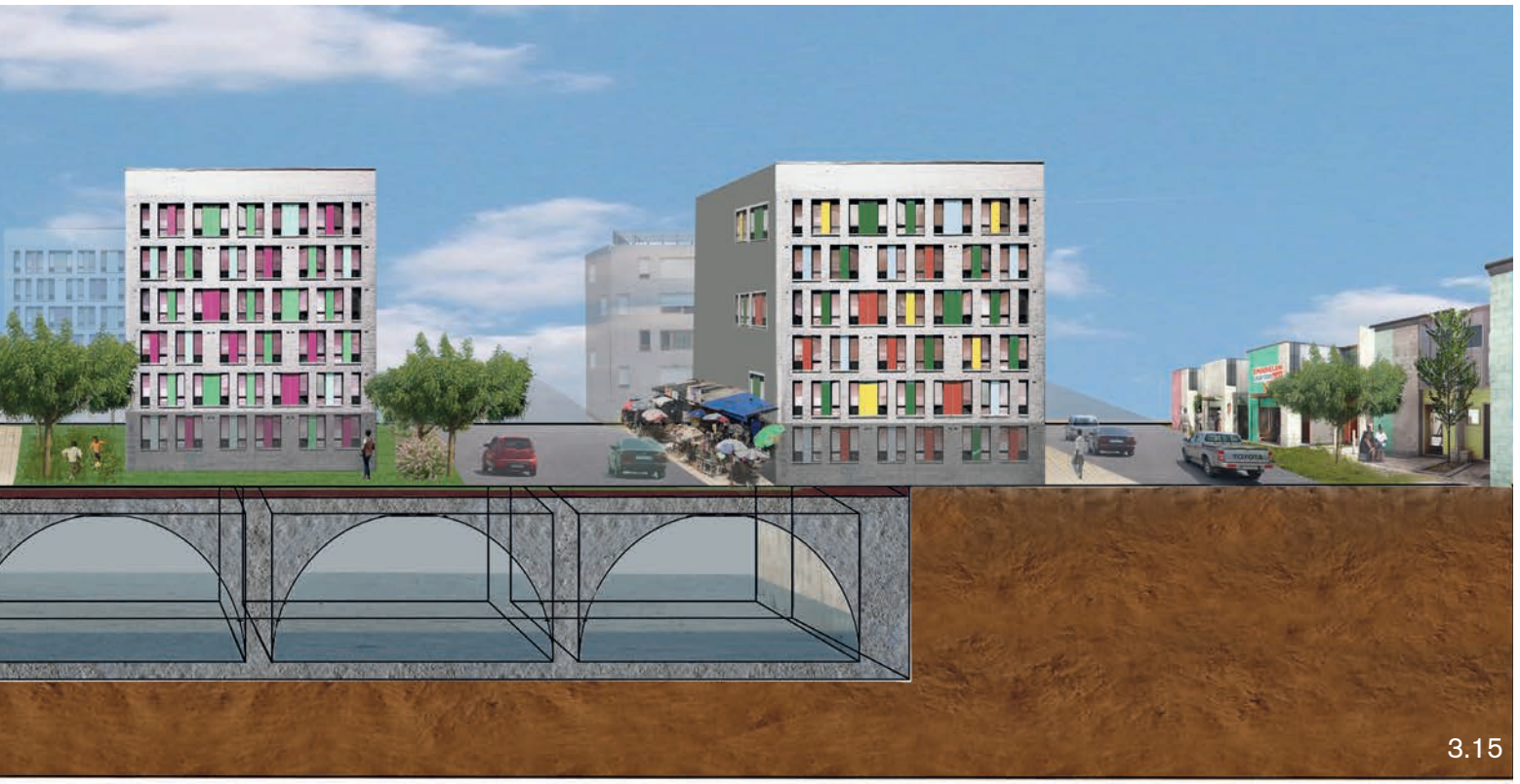


Figure 3.15: Option 2: closed drain

Figure 3.16 : Bird's eye view - Central Business District

Figure 3.17 : Bird's eye view - Central Business District

It is more effective to work along with the natural system then against this system. Analyze the natural system, when you know how it works you can work along with it.

3.3 KORLE LAGOON

The Korle Lagoon is in open connection with the ocean and **always contains water.** That is a large, but still unused, distinctive quality.
Here the salt water of the sea comes together with the fresh water in the lagoon, which is an environmentally interesting initial situation.

At this moment the opportunities of the Lagoon are not exploited, not in an economic way, neither in an ecological way.
The lagoon could add a spatial and economic distinctive urban environment to down-town Accra. An area where people find coolness, where they enjoy the waterfront, see over the water, watching the reflections in the water.
We propose to develop the lagoon as Accra's down-town top environment, with a mixture of working, living, education and leisure facilities.

Here you can develop liveliness that attracts the inhabitants of Accra as well the tourists visiting Accra.
Accra has the ambition to become a global tourist top destination, therefore you have to offer the visitors more diversity in a higher quality.

In the sketch (figure 3.18) the connectivity with the ocean is strengthened. The opening to the ocean is widened and in the lagoon two urban islands are drawn; 'boat' and 'fish'.
What the 'Ile de la cité' means for Paris, could these two islands be for Accra: places where people can live and work, where they can meet, relax and enjoy the view over the water (figure 3.16, 3.17 & 3.20).

This area can be developed in a higher density with buildings with a height of 8 floors. A few towers can be developed substantially higher, adding some elegant landmarks to Accra's skyline.

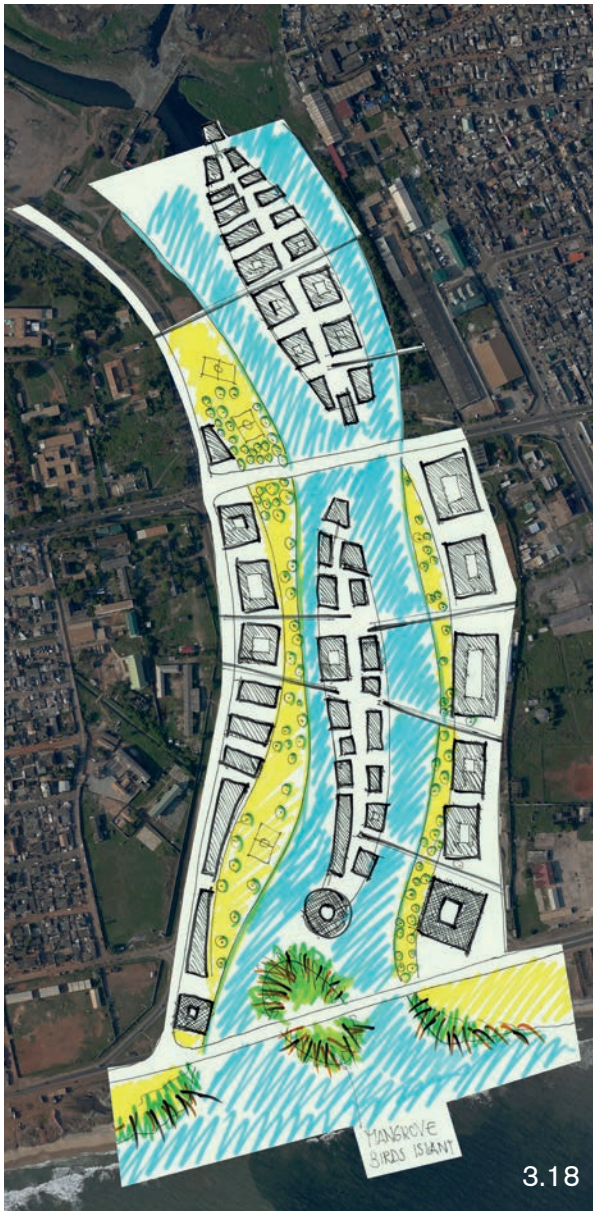


Figure 3.18: New Central Business District: Fish & Boat

Figure 3.19: Korle Lagoon - Current situation

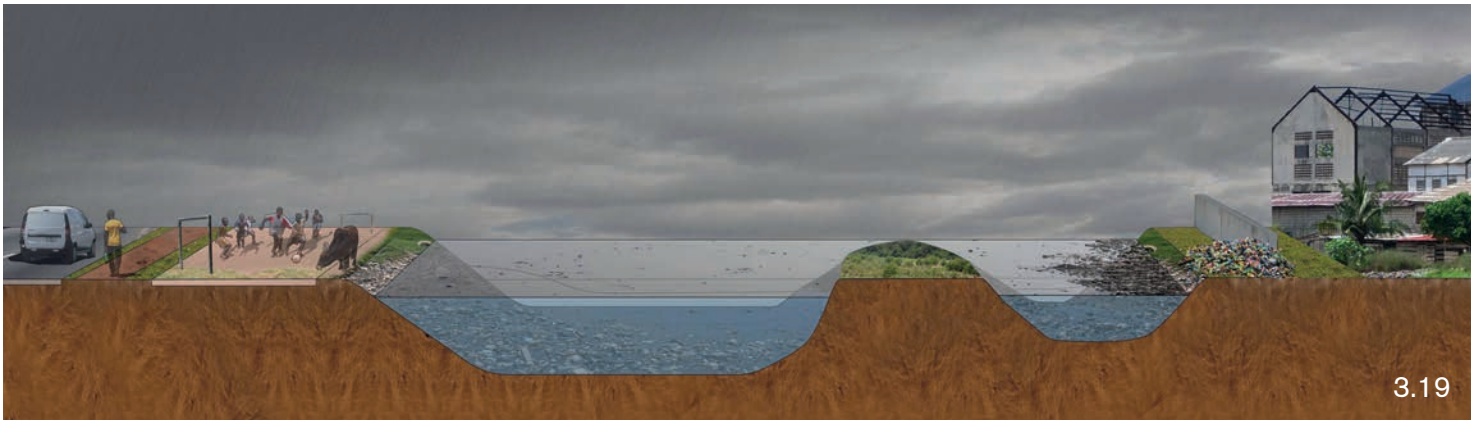
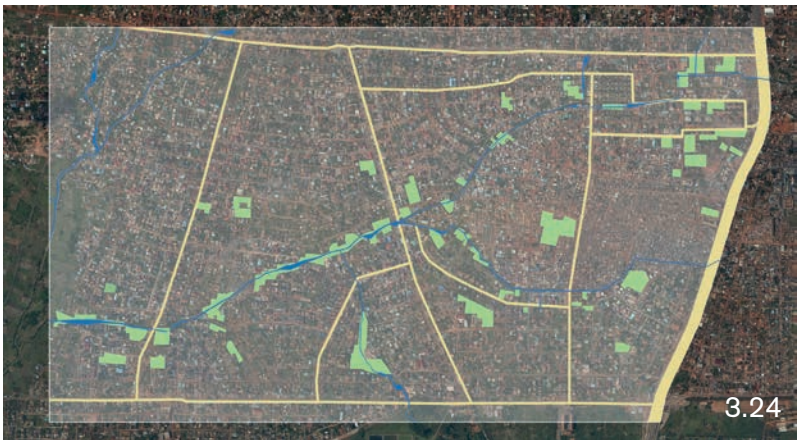
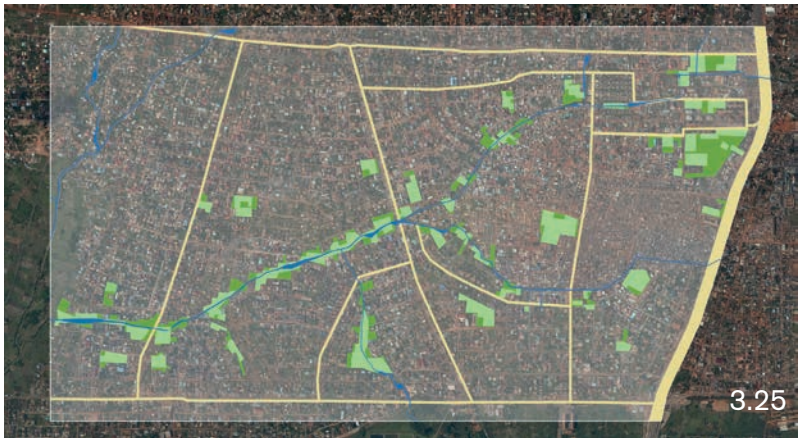


Figure 3.20: Korle Lagoon - Central Business District

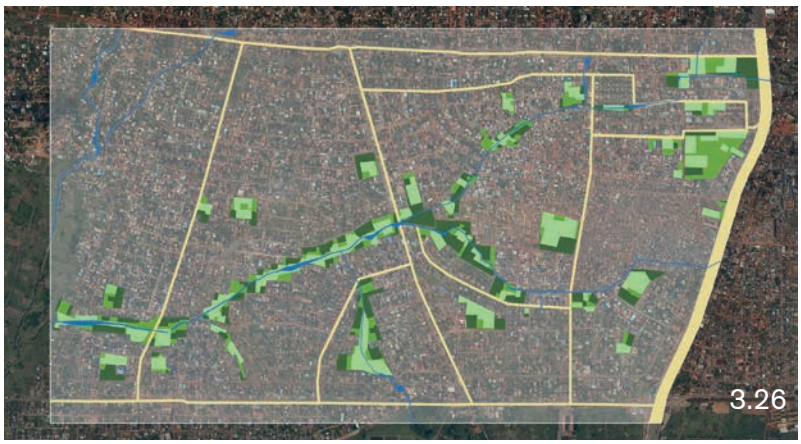
6% storage capacity
(infrastructure + streams)



10% storage capacity
(infrastructure + streams + green areas)



12,5% storage capacity
(infrastructure + streams + small resettlements)



16% storage capacity
(infrastructure + streams + more resettlements)

Cooperation is the key. A successful strategy against flooding can only be realized when people work together, when they built together and, even more important, when they maintain together.

Figure 3.21: Available space for infiltration next to a drain

Figure 3.22: Available space for infiltration next to a road

3.4 WITHIN THE NEIGHBORHOODS

We investigated the opportunities to develop the open space still available in the urban fabric as a wadi or watergarden. Unlike most other measures this can be performed step-by-step and expand when necessary. The storage capacity can grow along with the future necessity of additional space for water retention.

We were particularly interested in:

- the open space next to the drains. By developing the drains and the adjacent space in a more natural way the storage capacity is increased and the run-off is delayed.
- in the larger spots more centrally located in the residential area that can be developed as retention ponds.

By making use of the readily available space the system enlarges from less than 1 % to almost 6 %.
If it would be possible to resettle some families, the system grows up to 12.5%. It all depends on the urge of how much space is needed to protect society from flooding.

In addition, space could be found along the main roads. Along the main roads a lot of space seems available. Roadsides can be developed as wadis, as retention areas and for water storage during extreme circumstances.
This exercise learns that within the urban fabric, there seems more space available than initially thought.

Figure 3.23 - 3.36: An example of calculating storage capacity

4 TOP-10 JOINT DISCOVERIES

1. It is doable to solve the problems of water safety and water nuisance in Accra.

2. The solution is not be found in an accelerated disposal of all the water to the sea. That causes increased problems in downstream areas, right there where most people live and most capital is invested.

3. The solution is in a combination of large interventions and smaller measures that work together and strengthen each other. Upstream-, midstream- and downstream area each ask for a distinctive approach with different kinds of measures.

4. In the upstream area all measures are aimed at holding the water as long as possible (retention) and on slowing down the run off.

5. In the midstream areas, measures focus at both water storage as on an improved run off by the main drains.

6. Downstream measures focus on speeding up the run off to the sea, creating space to relieve the upstream system.

7. The main drains need considerable widening to handle extreme run off. It is worth to examine whether it is possible to cover these drains. As a result, they form less a (social, spatial and functional) barrier in the city, and is a multiple land use possible. In that case there also is a cost carrier for the investment.

8. The area between Circle and Agblobloshie Market and around the Korle Lagoon offer promising opportunities for the development of a railroad district and a central business district.

9. There are good opportunities for smaller measures within the residential areas that also lead to an improvement in the living conditions. Water storage in combination with improved sanitation, but also cleaning the drains combined with the reuse of the collected plastic.

10. It are the people who make Accra smile. They are the main capital of Accra. Make sure that with the future developments enough space for street-life resist.