Kingdom of the Netherlands



DRR-Team Mission ReportAngola

Flood Risk Management, ecological solutions, Improve the health conditions of the population.

Expert advice on flooding and sanitation in Soyo municipality

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June 26th 2018
DRR-Team Mission Report
Angola

DRR-TEAM [Angola]

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EXECUTIVE SUMMARY

Introduction

The government of Angola has asked the Dutch government for help to minimise risks for the population in the every time affected areas of the islands and the city of Soyo. Problems which concern the authorities are the living circumstances of the population in the area as hygienic conditions are worrisome as a result of lack of good quality drinking water, poor sanitation and stagnant water/ absence of drainage.

The formal request for support was submitted by the Governor of Zaire in January 2018 and backup by the Ministry of Energy and Water with a letter in March 2018. In the letter of the Ministry reference is made to the DRR team.

It was decided to support Angola by sending a DRR team with the following objectives:

Execution of a flood risk assessment which gives:

- *"Advice on Flood Risk Management plans incl. emergency plans.*
- *Advice on Flood Risk Measures including as well ecological as infrastructural advice*
- *Advice on the full scope of solutions to the problem, including ecological solutions, but also more infrastructural solutions such as sand filling of low lying areas.*
- *Advice on the finance options of the proposed solutions (donor/government financed, or sustainably through a positive business case)*
- *Improve the health conditions of the people in the area"*

The health issues the team encountered were not just related to flooding, consequently the team also focused on other factors like potable water, sanitation and urban planning. As a consequence the results vary slightly from what could be expected based on the objectives as described the ToR.

Main results

Islands
On the islands the health problems are caused by a combination of interrelated issues. High groundwater levels which makes it harder to build proper latrines. This in combination with frequent inundations leads to uncontrolled spreading of waste water contaminating water sources that are being used for drinking water. The water used on the island is not treated up to a level of proper drinking water. Lack of drainage systems leads to stagnant water and this in combination with poor sanitation leads to mosquito borne diseases. Overall urban planning including these water related aspects could mitigate these risks.

For the islands it is recommended to search for the best mix of locally applied technical solutions on single islands (mainly water treatment on solar energy, local elevations with latrines and drainage) and more centralized solutions on one or a few islands (applying the same techniques) in combination with improvement of the working conditions. Potable water and latrines could be arranged on every island but centralization means lower costs. Topography in combination with the potential for elevations and willingness of people to move will be decisive on what the best mix of solutions will be. This needs to be investigated. In the meantime one does not have to wait for the results of the study to implement the suggested solutions on islands that are likely to stay inhabited anyway.

Soyo city
The sites the team visited within the city of Soyo suffer from flooding caused by a combination of factors. Precipitation is not drained and infiltration capacity is reduced by high groundwater levels. These levels are also not controlled by subsurface drains. This in combination with poor urban planning (blocking natural runoff) leads to stagnant water at many locations within the city. On top of that the areas near the river are inundated by high tides or discharge from the river. Not witnessed at the sites the team visited but apparently a big issue in the peri-urban areas is access to potable water and sanitation.

Several technical measures to the locally observed water related issues are proposed, however it should be understood that only three local sites in the city of Soyo were visited and studied. It is expected that more similar sites with the same water related issues are present in the city of Soyo and they might be interconnected. This has been confirmed by the local authorities, but the quantity and magnitude could not be cleared up. It can be expected that the problems in the suburbs are not limited to these three sites. The absence of drainage is common. If indeed the problems are city wide preferably the locally to be implemented measures on water management and control should be part of a larger system. One cannot solve the problem on one site and leave the consequences to the other side of the road as has been witnessed on many sides bordering the main roads.

It is proposed to launch a water management study for the city of Soyo. The surface levels all over the city should be investigated and measured carefully as well as a complete inventory of the quantity and magnitude of the water related should be conducted. There should be a relation between the measured terrain deceptions and inventoried problem areas. Also the present water infrastructure including its dimensions should be inventoried to include them in the total solution.
This information together with the local precipitation information shall be studied, resulting in an integral water management plan containing suggestions for subsurface drains, culverts, pumping stations, local elevations of terrain and discharge channels. Even locally voluntary relocations could be considered. Logically the result of the study also should contain a timeframe and the community should be involved. For any isolated problems identified local technical solutions can be elaborated at short term.

Also from this moment one the city should search for the locations with best natural conditions for city extensions (at reasonable distance to the city, so working in the city and using the services of the city is feasible). Costs of development of the locations with the best potential should be estimated (elevations (if needed) + infrastructure). Once terrain has been made suitable for living newcomers and people living at harsh conditions in the city or the islands could be moved (not forced) here.

Finance
How to finance the local technical solutions, the studies to be conducted and the development of new area for city extensions has been elaborated. Noteworthy is a budget of 3 million USD Angola LNG has available every year for community projects. They are interested and willing to discuss good project proposals and can also co-finance in case additional funding (for example from the Netherlands) is arranged.

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LIST OF ABBREVIATIONS

DRR	Disaster Risk Reduction
INARH	National Institute for Water Resources
PDM	Plan Director Municipal
ToR	Terms of Reference
GEF	Global Environment Facility
MoGeCa	O Modelo de Gestão Comunitária de Água/ Community Water Management Model
DRP	Participatory rapid diagnosis
SOEs	State-Owned Enterprises

1 BACKGROUND

1.1 General introduction to the problem

The Republic of Angola is the seventh largest country of Africa. The population is almost 26 million people. Zaire is the North-Eastern province at the coast of Angola (the Cabinda enclave not included). The DRR mission was focussed on the municipality of Soyo in the Zaire province. Soyo is located in the North West corner of Angola/ Zaire at the mouth of the Zaire/ Congo River.

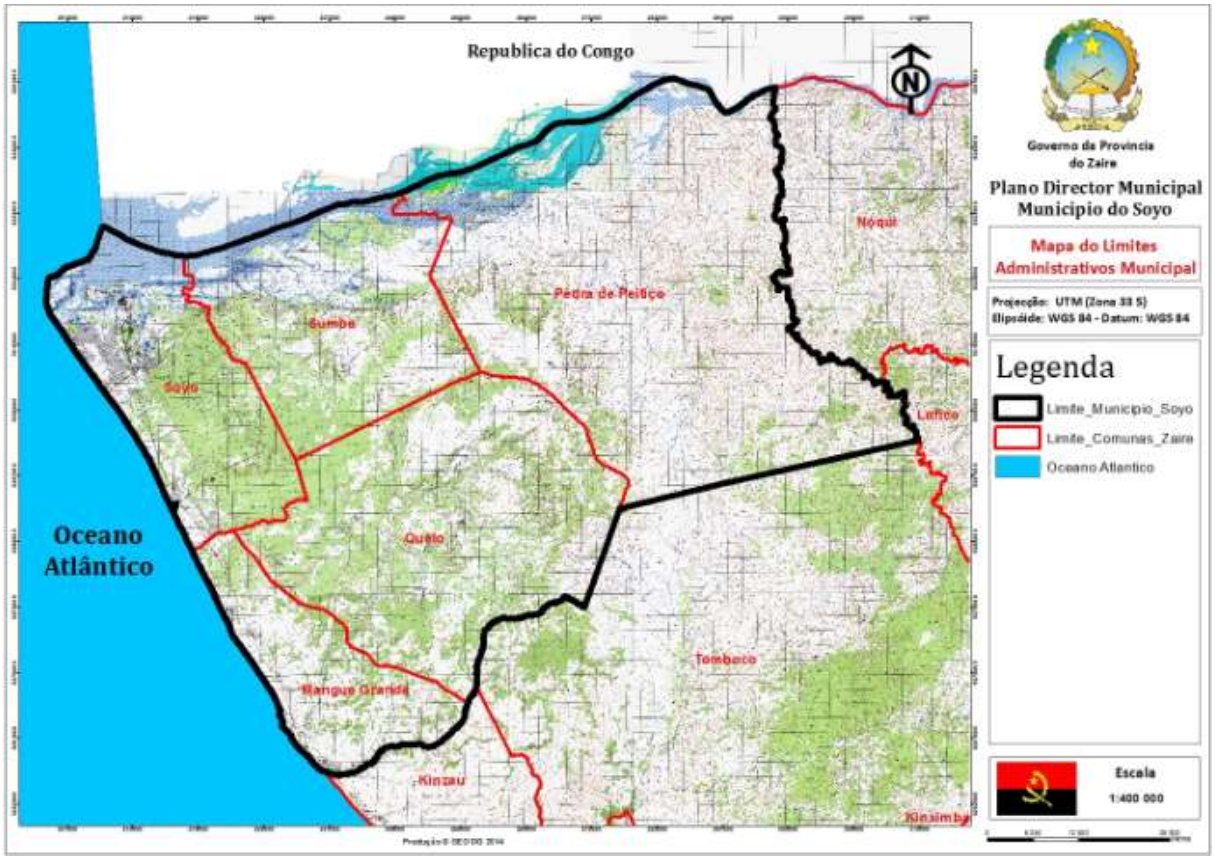


Figure 1Administrative map of Soyo, source: PDM (plan director municipal) municipality of Soyo

The Climate in Soyo is tropical and one can distinguish a dry and wet season. The rainy season is from November to May.

During the rainy season in recent years the mangrove area in the Soyo region of the Zaire province in Angola was heavily flooded as were parts within the city of Soyo. Cholera epidemics and Malaria repeatedly affected the population in the region especially during the rainy season.

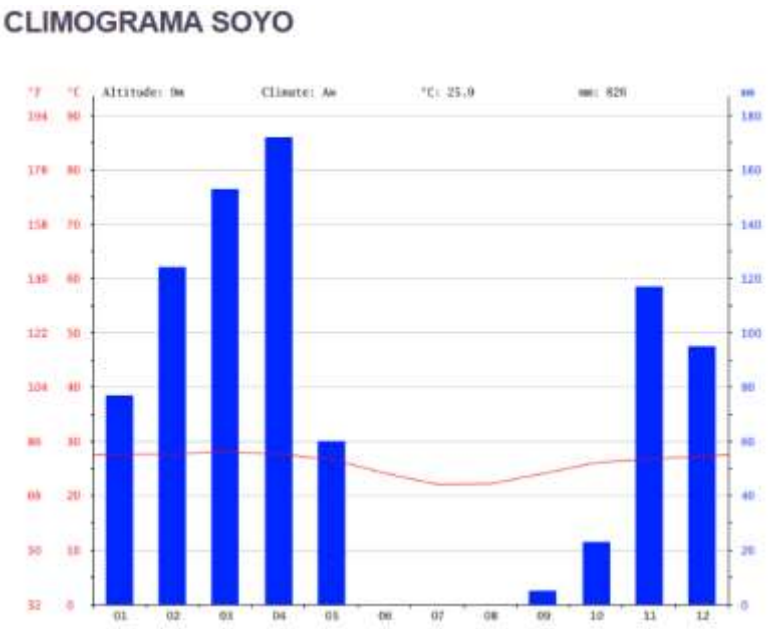


Figure 2 Climate data Soyo, source: climate-data.org

The government of Angola has asked the Dutch government for help to minimise risks for the population in the every time affected areas of the islands in the delta of the Zaire/ Congo River and the city of Soyo. Problems which worry the authorities are the living circumstances of the population in the area as hygienic circumstances are low as a result of lack of good quality drinking water, poor sanitation and stagnant water/ absence of drainage.

The intention of the government is to draft a plan to intervene and to protect the population of Soyo in the affected areas.

The water management sub-sector in Angola can be characterized as follows:

- Angola is a country endowed with abundant water resources, with the exception of a narrow coastal strip and the southern desert areas bordering Namibia. The management of water resources at the river basin scale is in its infancy.
- INARH (National Institute for Water Resources) is part of the Ministry of Energy and Water and was created in 2010. It became operational in 2012 with financial and technical assistance from the World Bank
- Investment in the rehabilitation of river monitoring systems (hydrometric network) has started with WB funds
- UNICEF, the GEF (Global Environment Facility) and other financiers have invested in the Flood Early Warning System (FEWS) of the Cuvelai basin in the south, shared with Namibia, given that the area is very flat and floods traditionally result in casualties. Flood warning is not yet well developed in Angola
- Water management in urban areas is generally poor and regularly results in urban floods, sometimes with high numbers of casualties (Lobito, 2015 – 70 dead of which 35 children). Some investment is made in drainage infrastructure (e.g. Luanda) but generally urban drainage is poor. Urban drainage is the responsibility of the municipalities.

In the past different water projects were executed in Angola. There was however very little involvement from The Netherlands. The ‘restructuring project of the water sector’ by the Angolan government stimulates the private sector to take part in these water supply projects. Countrywide

there is an investment program into the sector funded by Angola, the World Bank and the African Development Bank.

1.2 General introduction to the social economic situation

The native population of the Province of Zaire, the Bakongos, is one of the ethno linguistic groups that have better preserved their culture and language. They maintain strong social and cultural ties with bakongos from the Democratic Republic of Congo (DRC). A large number of people took refuge in Congo when the conflict erupted in Angola in the early 1960s and during recurrent cycles of war. After 2002 these refugees returned to the province of Zaire. Many people in the province did not speak Portuguese, which limits their access to information, success in the formal education system and participation in public affairs. A predominant cultural aspect in the Bakongo ethnicity is the tradition of matrilineal lineages.
At present, major changes are occurring in the Bakongo culture, mainly due to the social disruption of migration, urbanization and the expansion of the market economy. The woman's roles are also changing. Female entrepreneurs dominate informal markets, giving them increasing autonomy in relation to their income and family affairs. Within the family economy, women maintain primary responsibility for food and education of their children. The presence of women in the labor market (formal or informal), allows them, in addition to income, to create their own network of relationships outside the family sphere. The continued demand for women to maintain responsibility for domestic activities often prevents them from investing enough time and resources into their business. In order to develop their enterprises into larger companies, women need to devote most of their time and also separate their household expenses from their business accounts.
Fishing and timber (for firewood and construction) are being exploited economically by the small-scale population. Artisanal fishing has been the main economic activity of most communities along the coast of the municipality. About twenty-five percent of the population was traditionally involved in fishing activities. There is a strong division of labor between men and women. Men engage in fishing, while women engage in processing (drying and smoking) and commercialization of catches. In addition, fishing is essential for the diet of the population of these communities. Fishing activities also influence the local labor market, in particular on people involved in salt production, repair and construction of nets, construction and repair of vessels, drying and storage of fish processing - distribution and marketing. The scarcity of fishing materials and equipment and competition from large industrial vessels, however, pose a threat to the artisanal fisherman. Due to the decrease in catches of fishermen, more and more, engage in parallel farming activities to supplement their incomes. There is adequate agricultural land although under-exploited. Agriculture is practiced on a subsistence scale.
Diseases such as malaria, cholera and diarrhea are the most prevalent in the province and are the leading causes of infant mortality. HIV / AIDS, although at a lower level in Angola than in neighboring countries, has increased since the end of the conflict. Critical illnesses can be reduced through environmental improvements, including access to improved water and sanitation services. These systems need to be updated and expanded to serve the growing urban and peri-urban settlement. Partnerships between government and local communities are needed to ensure that water systems can become sustainable and are well maintained. Training in community management and cost recovery systems should be part of a strategy to improve basic services.

In Soyo the mangrove forests along the Zaire River support a wide aquatic biodiversity that serves as a natural habitat for the reproduction of a wide variety of aquatic species. Mangroves should be considered as environmentally fragile areas. Invasion of human settlements, soil erosion and deforestation has reduced the diversity of flora in these areas. The effects of pollution from oil exploration have affected the production of some agricultural crops (DW & Terra Group 2005).
Soyo has grown rapidly over the last decade, during the construction of the ALNG project. The ALNG project is seen as a strategic project of the Angolan Government to create an alternative to

the pole of economic and industrial growth to call the population outside of Luanda. A road corridor between Luanda and Soyo that is in the completion phase is hoped to create opportunities for the development of real estate and other investment opportunities.

Angola LNG invested significant resources for the local community in Soyo. In addition to promoting the use of local businesses and the provision of training and local jobs during the construction and operation phases, Angola LNG has contributed greatly to the growth and development of Soyo. Two main projects are the renovation and expansion of the municipal hospital of Soyo to improve the health of the community, and the remodeling and expansion of the School of the District of Marinha to develop a highly educated population. Other projects include improvements in the city's road infrastructure; and a gas factory to serve the local community.
The production and distribution of low-cost electricity from the gas plant was seen as the key incentive to attract private sector investments that would hopefully generate long-term sustainable employment, eventually absorbing the labor force that will inevitably be fired in the completion of the ALNG plant construction phase. It had been predicted that low-cost energy would stimulate agro-industrial development such as milling and processing of fuel and cold stores for freezing fish, fruits and vegetables.
In the ALNG project the factory was completed and handed over to the local government. However, the distribution system that will be needed to make electricity available to the general community of Soyo – is the responsibility of the local government - and new industrial enterprises has not yet been completed. Expectations of spin-offs and new jobs have not yet been met.
Unemployment in Soyo is increasing. Some migrant workers have returned to Luanda and the DRC, and others have sought employment on the spot, artisanal fishing and informal merchandise trade across the DRC border. A return to subsistence activities, especially fisheries, resulted in higher population densities in many of the traditional settlements in the mangrove and island areas. The negative impact on the environment in these areas can also have an impact on fisheries and the livelihoods of communities.

2 DRR-TEAM MISSION

2.1 Introduction

The government of Angola has asked the Dutch government for help to minimise risks for the population in the every time affected areas of the islands and the city of Soyo. Problems which concern the authorities are the living circumstances of the population in the area as hygienic conditions are worrisome as a result of lack of good quality drinking water, poor sanitation and stagnant water/ absence of drainage.

The formal request for support was submitted by the Governor of Zaire in January 2018 and backup by the Ministry of Energy and Water with a letter in March 2018. In the letter of the Ministry reference is made to the DRR team

2.2 Scope of Work

The DRR-team has received instructions, through a ToR (terms of reference), based on the letter of the governor of Zaire.

More in particular the DRR-Team was asked to assist:

- *"to make an inventory of the problem on the islands and other areas in the municipality of Soyo;*
- *on education on hygiene and environment*
- *in a thorough advice on development of the area by either ecological solutions and/or dredging and sand suppletion (both kind of solutions should be investigated)*
- *in identifying of possible financing of the projects to be selected"*

2.3 Objectives

The assistance as described in the scope of work was concretized in the ToR by the following objectives:

"For this a Flood Risk assessment in Soyo region should be executed by the DRR Team, which should give:

- *Advice on Flood Risk Management plans incl. emergency plans.*
- *Advice on Flood Risk Measures including as well ecological as infrastructural advice*
- *Advice on the full scope of solutions to the problem, including ecological solutions, but also more infrastructural solutions such as sand filling of low lying areas.*
- *Advice on the finance options of the proposed solutions (donor/government financed, or sustainably through a positive business case)*
- *Improve the health conditions of the people in the area"*

During the mission it became clear that the main objective of the authorities (municipality and province) is improving the health conditions. Referring to health issues most importantly cholera and mosquito-borne infectious disease like Malaria were mentioned. As the health issues we encountered are not just related to flooding the team also focused on other factors like potable water, sanitation and urban planning. Because of this the results may slightly vary from what could be expected based on the objectives as described the ToR.

2.4 Approach

Immediately after arriving in Soyo on the 30th of April the team travelled into the delta of the Zaire/ Congo River to visit 2 islands which are exemplary for the situation on the islands in the Zaire/ Congo delta. The team was accompanied by a delegation of municipal staff from various departments related to the problems. After seeing the islands and having discussions on location the team sat together with the municipal staff to get a deeper understanding of the situation at hand and wider context. Also the locations to be visited the next day were discussed.
The next day was completely spent on site visits within the city of Soyo where 5 locations were visited. Again a delegation of municipal staff from various departments related to the problems joined the team for discussions in the field.
On Wednesday the local operations of Royal Boskalis Westminster and Angola LNG were visited as both stakeholders were of interest for finding solutions and/ or finance for solutions. The time left was used for preparations of the debrief the next day. The financial expert travelled to Luanda on Wednesday to have meetings with financial stakeholders in the capital on Thursday and Friday.
The team had a debrief session with the municipality on Thursday morning in which the teams analyzed the observations, questions were answered, expectations from both sides were shared and the proposed way forward was discussed.
On Friday a 2nd debriefing sessions was scheduled with the vice governor in which the same items were on the agenda followed by additional meetings with the African Development Bank and Angola LNG in Luanda.

3 FINDINGS:ANALYSES, IDENTIFIED CHALLENGES/NEEDS

3.1 Introduction

In the following paragraphs our analysis of the situation is elaborated from a technical perspective (the main problems and causes of the problems) and socio economic perspective (relation to the problems and context within a solution would need to be found). Also an analysis of the institutional and financial setting has been conducted in order to understand who to involve to improve the situation and from which sources funding could be expected.

3.2 Urban planning

Although the issues at hand at the specific locations are water related there is a strong relation with urban planning. Proper urban planning which includes water management could have solved many of the issues at hand or at least prevent future problems. Therefore urban planning will have to play a big role in the further sustainable development of Soyo.

In the next satellite images the growth of the city of Soyo from 2002 until 2016 can be seen.

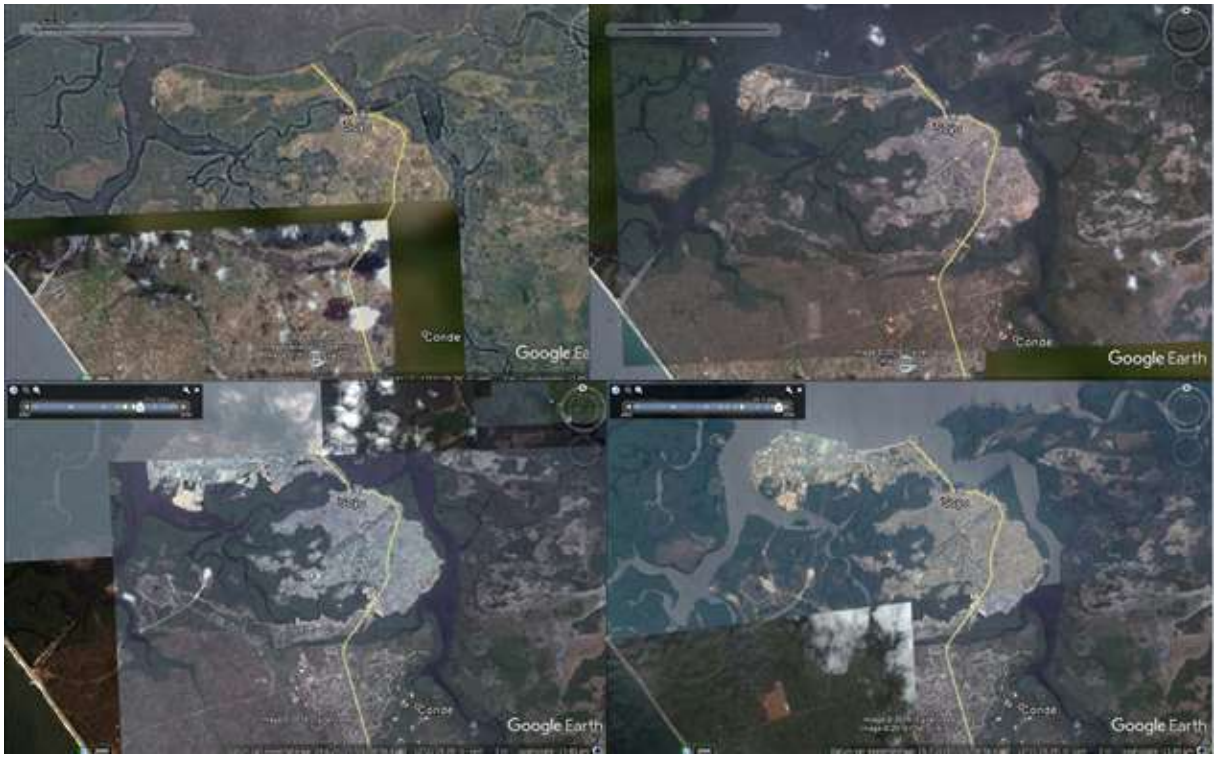


Figure 3 Growth of the city of Soyo 2002-2016 (source google earth)

It can be seen that the city expanded significantly because of population growth. It has been confirmed by the authorities that this growth was mainly uncontrolled. The city grew faster than it could make plans or supply proper infrastructure. On the images it can be seen that the city expanded also into less favourable low lying areas near the water. Since 2013 the outer areas of the city did not change much but the density of the developed area did increase. This leads to further blocking of natural drainage and in reduction of the infiltration capacity.

Besides growth into risk zones and blocking of drainage because of uncontrolled growth also some planned developments have impact on the water system of the city. Many examples of

roads have been seen that were constructed at a higher level than the surrounding lands blocking the natural drainage and leading to stagnant water accumulating on the surrounding plots and flooding wider areas. Also most roads were constructed without proper drainage.
These types of issues will need to be addressed in future developments to avoid further water issues.

3.3 Technical location specific

3.3.1 The Islands

The Islands of the Suma Community in the delta of the Zaire/ Congo River are located along the South Coast of the Delta. They vary in size but are generally small. There are about 100 islands of which 24 are inhabited (size of population uncertain) – fishermen and their families – live there.

The islands are formed by sand sedimentation from the Zaire River. They are long stretched and rather narrow. On the river side there is little mangrove and beach. On the back shore-side large mangrove areas are present. Almost all of the islands inundate up to half a meter during high tide and/or high water discharge through the river during the rainy season. The inundations vary from several times a week in the rainy season to several times a month in the dry season. The houses on the islands are therefore built on poles.
Except for 1 bigger island, there is no fresh potable water available. The inhabitants of the island drink, and cook using the brackish water of the river.

Suma Community – Sweke Island
Sweke Island is a few hundred meters long and up to 50 meters wide. There are no infrastructural devices like coastal protection, jetties or even elevations of parts of the island. The whole island floods several times a week during the rainy season. As for sanitation the inhabitants of the island use latrines. These latrines are located in the more remote places, but as the islands are crowded this is never far away from the houses. Due to the level of the islands, the level of the phreatic water is up to ground level. The infiltration capacity of the subsoil for sewage water from the latrines is limited. The latrines therefore do not function as they are supposed to do and the sewage spreads into the open water when the island and also latrines are inundated. As there is no fresh potable water facility – and the inhabitants use the brackish water from the river for drinking and cooking – this is the main source of contamination contributing to cholera and other water borne diseases. The only source for good quality potable water is on a bigger island near Soyo, or the city Soyo itself. The distance is significant and the carting capacity of the local non-motorized dugout type vessels is low, therefore the costs for good drinking water for the majority of the people on the island are too high.

The island is not drained but precipitation runs off mainly to the banks of the river or to the mangroves. Also the phreatic water is not drained. Where the water in the river is constantly moving – mainly downstream, the water in the mangroves is more stagnant. The brackish circumstances are favourable for the mangroves, but the stagnant more fresh waters are good incubators for malaria and other mosquito borne diseases, especially if in contact with the latrines or other dumped waste.

The community on the island and its houses/accommodations have developed over the years in an un-organized manner. Houses, cooking places, and latrines are scattered over the area. Although most of the latrines are wisely placed on the edge of the community the development of the island should be organized and regulated better.



Figure 4 This slide from Sweke Island was used in the presentations and summarizes the issues and its relations

In Figure 4 not only the main challenges observed are mentioned, also it is suggested there is a relation between all these issues. Due to the lack of drainage and high phreatic water levels the sewage from the latrines spread widely when inundations take place and this way contaminates the fresh water used for consumption. Bad drainage also leads to stagnant water in combination with poor sanitation leads to mosquito borne diseases. Better urban planning can mitigate the risks.

Suma Community – YengueWankengue Island
The second visited Island was even smaller about 100 meters long and about 75 meters wide. As tide was rising the inundation of the island was witnessed. A local woman showed her fresh/brackish water reserve in a barrel and explained it was treated with chloride tablets that were supplied by the government. These tablets help to mitigate the health problems, but as the tablets are distributed irregularly, shortage of fresh water happens more often than there is rather good potable water available.

The technical issues on the YengueWankengue Island are the same as showed in Figure 4.

3.3.2 Soyo city

Within Soyo 5 locations were visited. On the map below they are indicated with numbers:

1. Suburb Nona
2. Suburb NkunguyaNyenguele
3. Suburb Paróquia

4. Main potable water intake point
5. Marginal

The first 3 locations are locations with challenges related to the objectives of the mission and are elaborated below.



Figure 5 Visited locations in Soyo City

Nona

Nona is the first of the three visited suburbs of the city Soyo. It is located on the southern edge of the city and the inland mangrove swamp. Originally houses were built on higher grounds not affected by tide and/or floods due to rainfall. While the city and this suburb were expanding houses were built more and more on the edge towards lower grounds and into the mangrove swamp. In this rather narrow strip water due to rainfall accumulates and is interrupted from natural discharge due to high tide and blockings – such as houses and infrastructure.

On the higher grounds there are plenty of manmade circular water wells. It was noticed that rater (up to a distance of 5 meters) close to these water wells latrines were positioned. The distance between the latrines and the water wells is too short for a natural treatment of the sewage, thus the fresh water wells are potentially affected. It was confirmed that the water from these water wells was only used for cooking, not for drinking potable water. This potable water is available at central points in the suburbs in tanks where the water is provided by the municipality. Hygiene problems due to lack of fresh potable water do not seem to be the problem here.

The actual issue is the blockage of natural runoff of rainfall resulting in accumulation in pools and thus standstill water, plus inundations of the edges of the neighborhood in case of high water levels of the river (tide) in combination with heavy rain. Where on the higher grounds the subsoil is mostly sandy and infiltration relatively fast, the lower parts on the edge of the suburb are built on swampy grounds with hardly any infiltration capacity. Only natural surface runoff will discharge the surplus of precipitation.

Moreover the edges of the suburb built on the edge of the mangrove swamp are built on compressive soil layers. With the added weight of soil elevations and houses the compression will continue and accelerate, with settlement of the soil levels as result which invoke more frequent flooding's due to the lower level.



Figure 6 Situation in Soyo suburb Nona.

NkunguyaNyenguele

The suburb NkunguyaNyenguele is located at the eastern side of the city. This suburb is located on higher grounds and is not affected by the tide/ river. The natural deception in the terrain of this suburb gets filled with precipitation water during the rainy season and due to lack of infiltration capacity of the subsoil as well as limited surface runoff to lower grounds the water stays in large pools. This standstill/stagnant water is easily polluted and a nursery for malaria and other mosquito borne diseases. It was noticed that also due to a ring road on the edge of this suburb, that obviously was built on a higher level, natural runoff was blocked. It was confirmed by the locals that previously the standstill water pool still was present, but not this big and deep and did not stay for such a long time. The phreatic water levels are extremely high preventing natural infiltration. There is a lack of urban planning as the city grows:

- more houses are built, also in the natural deceptions in the area;
- infrastructure as roads is improved but no attention has been given to natural run off or drainage of the high phreatic water levels



Figure 7 Situation in SoyoSububNkunguyaNyenguele

Paróquia

Paróquia is located in the middle of Soyo, bordered on the northern side with the airport and on the south side by a new interlocal paved elevated road. Precipitation water can't infiltrate anymore as the phreatic water level is extremely high and surface runoff possibilities are blocked (airport and new road). It was witnessed in a nearby water well that indeed the phreatic water level was up to soil level. Local people explained that these high phreatic water levels developed the last 10 years – more or less simultaneously with the improvements of the airport and the more recently built new road. Also the suburb became more dense as more houses were built in the area.



Figure 8 Situation in Soyo suburb Paróquia

3.4 Institutional

During the discussions with the authorities (municipality and vice governor) the team tried to get a good understanding of the responsibilities of the various parties involved in water management in Soyo. A proper understanding and analyses of the institutional setting can lead to the identification of gaps or overlap in responsibilities. This may contribute to a better understanding of the (cause of the) water related challenges, feasibility of certain solutions or need for change.

The main water issues identified in the technical analyses were:

1. Drinking water (acces)
2. Drainage and sewerage (including issues with stagnant water)
3. Sewage treatment
4. Latrines
5. Flooding (from river and or sea, flooding by precipitation is covered at number 2).

These themes were divided in several typical steps of the infrastructure life cycle (planning, implementation, funding, maintenance, operation, and information management).

In the following tables the results for each issue are presented for the current and future[1] situation. These results are based on conversations only and therefore indicative, a check based on formal literature is to be recommended.

Drinking water	Planning	Implementation	Funding	Maintenance	Operation	Information/ Monitoring
Actual	Preparation: Municipality and Province Approval: Province Big projects support from central Government	Municipality (through contractor)	Province or Central Government depending on size (water is free of charge)	Contractor first 2 years after construction. Afterwards Concessionaire: Public Water Company (EPAL) Above a certain value Province	Concessionaire (contracted by the Province)	EPAL, Municipality in the lead and shared with Province.
Future			Municipality		Concessionaire (contracted by the Municipality) or Community Associations under MoGeCa	Concessionaire and the Municipality)

Table 1 Institutional setting drinking water supply

Drainage/ Sewerage	Planning	Implementation	Funding	Maintenance	Operation	Information/ Monitoring
Actual	Province Big projects approval by central Government	Municipality, Province, Central Government depending on the value of the project.	Province or Central Government depending on size	Municipality	Municipality	Municipality (not complete)
Future	Municipality, Province, Central Government depending on the value of the project.		Municipality			

Table 2 Institutional setting drainage and sewerage

[1]The team was informed the government has drafted legislation to enact certain reforms, which will lead to decentralization of responsibilities and a (presumably modest) degree of financial autonomy of local governments . If in the tables cells are left empty this means in the future the situation is the same as actual

Waste Water Treatment	Planning	Implementation	Funding	Maintenance	Operation	Information/ Monitoring
Actual	So far not arranged. One waste water treatment plant has been constructed as part of a private development. This plant has been handed over to the Municipality and Province for operation.			Municipality/ Province depending on value	Municipality/ Province depending on value	Municipality/ Province
Future						

Table 3 Institutional setting waste water treatment

Latrines	Planning	Implementation	Funding	Maintenance	Operation	Information/ Monitoring
Actual	Municipality (Health)	Municipality (Public Works and Environment)	Province	Municipality		
Future						

Table 4 Institutional setting latrines

Flooding	Planning	Implementation	Funding	Maintenance	Operation	Information/ Monitoring
Actual	Not many floodings of the Zaire river, only on the islands (3.3.1). No flood prevention infrastructure built so far.		Central Government			National Institute of Water Resources (Part of Ministry of Water and Energy (includes early warning) Zaire/ Congo River no data Civil Protection has a lot of knowledge of risk areas. Only with a disaster they become responsible
Future						

Table 5 Institutional setting flooding (river and sea, not precipitation)

In Angola decision making on sectoral programs is centralized between the different governmental levels (from municipality to province to central government). Depending on their scale, budgets and size, projects are being planned and funded on different levels. From the above tables this can also be derived.
At exactly what level or moment an initiative becomes someone else's responsibility was not studied but a risk of gaps or overlap in responsibilities when all levels are being involved exists. It is to be recommended to study this further.
Another risk is of this approach is that the people with most local knowledge are not always involved in decision making. So at a local level one needs to have the capacity to develop solid plans with good justifications which can and will be approved at a higher level. It was confirmed this was not the case as for bigger projects also technical assistance is being provided from the central government. A decentralisation process has been started recently with the aim of giving local governments more power to take financial decisions on projects. This will assure more local

knowledge will be included but it will still require capacity development at the lower levels of governance.

A lack of easily available structured information on all issues discussed above has been encountered. There is information and knowledgeable personnel, but often it's not written or digitally available, spread over several departments and authorities and not of the needed quality. To develop solid plans and to take decisions about the best approaches regarding the issues at hand good information and monitoring is required to come up with the most cost effective solutions. An effort to develop a shared information system is recommended. Also it must be clear who is responsible to gather what kind of information (quantity and quality).

On waste water treatment and flood management, responsibilities are not clearly defined. Regarding flooding, this is of importance for the islands. Waste water management is an issue that will need to be developed in time. A first priority must be given to drinking water supply, latrines and drainage.

From a financial perspective the local municipality should be and are allowed to collaborate in public private partnerships and can grant concessions. Via such arrangements the municipality could mobilize private finance with which to fund new investments. In the future, when decentralization legislation is enacted, it is expected they can also obtain loans from external financial parties.

However the ease with which finance could be raised via these routes depends on:
(1) the degree to which the central government continues to underwrite financial liabilities taken on by local governments (or not), and
(2) the degree to which decentralization provides local governments with robust sources of revenue which allow it to take on multi-year financial obligations of their own accord.
Stakeholders in the Angolan financial sector indicate willingness to loan to government, but also express caution against expecting too much from local government financing capacity in the short- to medium term.

3.5 Socio-economic location specific

The municipality of Soyo, whose capital has the same name, is located in the extreme Northwest of the province of Zaire and has a surface of 5,572 km2. It is bordered to the north by the border with the Democratic Republic of Congo (river frontier); to the South with the municipality of Tomboco; to the East with the municipality of Noqui and to the West by the Atlantic Ocean. Its economic potential, based on oil and port exploration, gives it the status of Economic Capital of the Province. The municipality is divided into 5 communes and about 79 villages distributed in the 4 communes (except the headquarters commune). According to data from the 2014 Census, the municipality of Soyo is the most inhabited in the province of Zaire, with 227 175 residents. The population of Soyo is mainly belonging to the ethnic group "mussolongo", of "the Bakongo" ethnic group. A large number of migrant workers have come to Soyo to find employment in the construction of the Angola LNG plant. Some informants have informed the DRR mission that migrants to Soyo significantly exceed the resident population. With the completion of most of the Angola LNG construction unemployment is on the increase. Some of the under-employed have sought alternative livelihoods in traditional sectors such as artisanal fishing and informal trading.

3.5.1 The Islands

In the municipality of Soyo there are about 100 Islands along the seafront and river, of which 24 islands are inhabited. On the islands visited, the populations affirmed that these localities have

been inhabited for more than 20 years. Due to the reduction of formal jobs in the city of Soyo an increasing number of people are seeking employment in artisanal fishing in the island settlements. These small villages are growing in a disorganizedway , without urban planning. Traditional leadership structures (Sobas) are rooted in these areas. Sobas are interested in continuing to play the role of facilitator in the intervention of local development projects and can be engaged as key stakeholders in plans to improve the sanitation in the settlements where they are influential actors



Figure 9 Islands of Soyo

Artisanal fishing is the main economic activity that most professionally characterizes the families living on the islands. It is clear, however, that family farming (peasantry) is, along with artisanal fishing, a basic activity for families. Women are mainly involved in agricultural production. There is a sharp division of labor between men and women. Men are engaged in fishing while women do the processing (drying and smoking) of the fish. Women are the group with the most connections in the communities, with great power of family influence, in the religious groups and on the markets where they constitute important networks of social relation.

Most small artisanal fishermen fish with dugout canoes, traditionally built from the natural local forest trees. With the progressive reduction of good quality trees in areas surrounding communities, canoes are either made of low quality tree trunks, which greatly reduces their time of use, or are made from good quality trunks in more distant areas, which aggravates their costs. Some small artisanal fishing entrepreneurs, with some economic capacity, have larger, mostly flat boats, vessels equipped with outboard engines. The vessels are built locally in small semi-artisanal yards. The engines are purchased on the local market, or in neighboring countries Rowing canoes make short fishing trips of only a few hours possible, so they do not use any cold-fish conservation equipment during fishing activity. The fishing gear most used by small fishermen is gillnetting and line fishing. The fishing equipment used including nets, line, hooks, buoys, etc. are mainly acquired in the informal market, and of uncertain quality and conditions. The conservation of fish in the form of dryoing or freezing is a necessity on fishing journeys of long duration, which last two, three and more days. Upon return from fishing, fishermen sell fresh fish on the beaches. With the exception of some catches which have been pre ordered by merchants or buyers, fish are usually sold to fishmongers who resell it to retail. These fishmongers are usually the wives of fishermen or other women who are engaged in the marketing of fish.



Figure 10 Drying fish

On the landing beaches closest to the urban centers, particularly in the city of Soyo, most of the fish of greater commercial value are sold fresh. Some, of lower quality fish, are marketed through street vending. The remaining part and the fish of less commercial value are processed for conservation. The most commonly used forms of preservation are smoking, salting or just drying. Even the high-quality fish that is landed at sites that are a long distance from the markets in Soyo risk spoiling in the time it takes to get it to the city, therefore it has to be processed and conserved before it can be transported for sale in the urban markets.

The main factors affecting the development of artisanal fisheries, which have been identified in the course of observation and informal conversations with small-scale artisanal fishers, are at the level of: degradation of natural fisheries resources; difficulties and costs of access to capture materials; the lack of associative spirit among fishermen (cooperatives, community groups, interest groups) that favor a strong tradition of family groups; the difficulties of movement of people and of the goods of commercialization given the dependence of the river transport that connects the fishing villages to the commercial centers; the poor repair and maintenance capacity of the flat-blades and the motors that move them.

As a general finding, it should be noted here that because the quantities of fish caught are now relatively low, the shortcomings and constraints associated with the conservation and commercialization of fish are not, at present, basic limiting factors. The little fish caught by the small artisanal fishermen is marketed without major difficulties.
However, in spite of the reduction in the level of their share of the global economy, the traditional importance of fishing as a way of life for most of the families living on the islands has been underlined in almost all communities.

Community health
Obviously, the problem described in 3.3.1 has a negative impact on the public and community health of island residents. In all communities malaria is the main disease, affecting the entire population, particularly children and pregnant women. In addition cholera, other pathologies such as acute diarrheal diseases (DDA) and typhoid fever have been reported.

Regarding the causes, the lack of water and / or poor water quality were mentioned in all the communities "because they consume improper water from the river and cacimbas (wells). Communities also complain of lack of electrical energy and basic sanitation, and defecation is mainly in the open air.

3.5.2 The city of Soyo

The city of Soyo is economically dynamic, because of the oil industry; there is investment in infrastructure and social services made by the Provincial Government and oil industry partners reaching a level of accessibility higher than other municipalities in Zaire province.

Subsistence family farming is the main activity carried out in rural Soyo communities. Even the inhabitants of peri-urban areas continue to involve themselves in agricultural practice. As complementary activities, communities carry out small-scale fishing and small-animal breeding, micro-industries and informal trade.
However, it is important to consider that the city of Soyo is one of the great attractors of people, especially young people, who come in search of job opportunities, both from the interior of the province and from Luanda, due to the great concentration of companies related to the oil industry in recent years and with the opening of the academic institutes of the middle and higher levels. The population of the peri-urban neighborhoods of Soyo city, despite having invested financial resources for the construction and improvement of their homes, face very serious difficulties relation to sanitation and the environment, and especially due to the constant flooding due to amongst others deficiency of drainage mechanisms. This scenario places the inhabitants in less appropriate situation for quality housing. The disorganized growth of these neighborhoods and little control by the authorities could incentivize authorities to take mitigating measures, including resettlement. At present, it is difficult to predict possible socio-economic impacts on people and goods, as the exact nature, size and location of housing and mitigation actions are not fully understood. If imminent this will require close collaboration between the various stakeholders (government, local authorities, community leaders, technical services, population, etc.) starting at the site identification stage so that social and environmental aspects are taken into account in the design of technical studies.

In peri-urban neighborhoods of the city of Soyo where there are no piped water distribution systems or where systems are broken down, the populations are supplied with water from alternative sources. A small part of peri-urban communities get water from public standposts, but most of them have as alternative sources the traditional manually excavated wells, and river-water distributed and sold through private cistern trucks. The quality of water in most wells is not good for human consumption and is only used for washing by many families. In general, there are few health education programs warning of the dangers of consuming untreated water to ensure that the water consumed is treated, either from the source or at the home.



Figure 11 Local well with nearby latrine (this well in Nona was not used for drinking water purposes, it was confirmed that in this area drinking water is available from tanks/stand posts)

In spite of the fact that the capacity for the local municipality to manage the distribution of water at the community level is weak, the national programme for "community water management" MoGeCA that addresses this shortcoming has not been implemented in Soyo. At the community level, no community-based organizational forms (water groups or committees or caretakers) have been created, no grassroots work was carried out at the level of social mobilization, in order to enable beneficiary communities to manage and maintain the few water systems that have been provided by the municipal authorities. A key recommendation of the DDR mission is to implement the MoGeCA community management model in Soyo.
There exists a potential in Soyo to develop the capacities of community organizations. Traditional village solidarity exists in the older communities where "sobas" or customary leaders still exist. Both traditional authorities, other community and religious leaders and women's organizations can be engaged in community mobilization around environmental issues. Angola's demography, characterized by a large number of youth provides the opportunity of engaging young people in environmentally related projects through the extensive school network engaging teachers, as development actors, who can play an important role in supporting community organizing processes.

Community health
The populations of the peri-urban districts visited consider poor access to basic services, flooding and poor drainage as the factors that influences their public and community health. In these neighborhoods, malaria is the main disease, affecting the entire population, particularly children

and pregnant women. In addition to malaria, cholera other pathologies such as acute diarrheal diseases (DDA) and typhoid fever are serious concerns.
Regarding the causes, the lack of water and / or their poor quality were mentioned in some communities "because some families consume improper water from wells". Lack of basic sanitation was also mentioned (outdoor defecation).
There is a poor response of health centers and clinics, both in the prevention and treatment of major diseases and in care, particularly in maternal and child care. The general impoverishment of families has also been referred to as a factor which, in general terms, contributes to the deterioration of health conditions.

3.6 Financial setting

3.6.1 Public sector funding of capital investment projects

Economic and fiscal context hampered by focus on oil/gas, with positive outlook after election
The Angolan economy can be characterized as focused on the petroleum industry (which today constitutes >90% of the value of Angolan exports, with diamond exports making up the lion's share of the remainder). This focus has resulted in a reliance on oil and gas exports (production share sales and dividend payments from joint ventures) for foreign exchange reserves. A real non-oil economy has not developed sufficiently. For this reason domestic consumption, boosted by revenue from oil and gas proceeds, requires substantial quantities of imported goods. Domestic price levels are therewith highly dependent on the exchange rate between the Angolan kwanza and the US dollar.

Against this background, the oil price crunch of 2014 and onward led to a substantial drop in foreign exchange revenue and reserves, and therefore to:

- increasing the officially reported government debt-to-GDP ratio of up to 60-70% by 2017;[2]

- increasing pressure to (gradually) abandon the artificially high peg of the kwanza to the dollar and as a result increased price inflation[3] which hit 30% by end 2017; and

- substantial haircuts to government spending (most of which has historically been funded from petroleum-linked revenue) during the several past years.

[2] The split between domestic and foreign currency government debt is 50/50, however domestic debt is mostly indexed to the kwanza-USD exchange rate, meaning domestic debt 'behaves' like foreign exchange debt
[3] An artificially high peg above market rates (by a factor ~2, before 2018), requires the Central Bank to expend foreign currency in order to maintain it

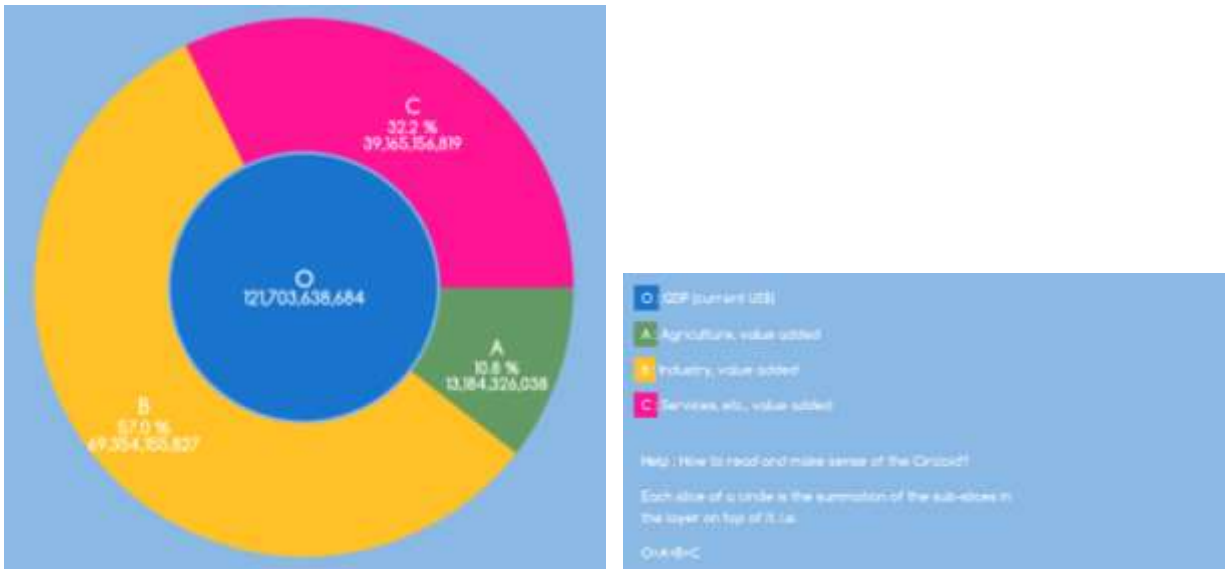


Figure 12 GDP composition based on recent World Bank Development Indicators (aggregated by mecometer.com)

In 2017 elections took place. In the run-up to these elections substantial government spending pushed up private sector credit, spending and prices. Following the 2017 election, the new government has begun taking steps to normalize the economic situation, as the IMF concludes in the notes of its most recent mission to Luanda: *"The Angolan economy is experiencing a mild economic recovery. The new administration is rightly focused on restoring macroeconomic stability and improving governance. Also, the more benign outlook for oil prices opens a window of opportunity to strengthen macroeconomic policies and give new impetus to structural reforms, allowing Angola to realize its full potential."*

As local governments do not avail of their own revenue streams, all regional and provincial investment projects are funded via the central Ministry of Finance (although decision-making for smaller projects, as indicated above, is devolved). Local governments currently cannot borrow or invest.

Economic/fiscal context adversely impact creditworthiness and country risk perceptions
The general assessment of government creditworthiness and country risk reflects these fiscal and macroeconomic circumstances:

- International credit rating agencies' current assessment of the creditworthiness of the Angolan state (with respect to issuance of foreign currency government debt is B for Fitch, B3 for Moody's, B- for S&P, implying substantial uncertainties and meaning Angolan government debt is considered high-yield and high-risk by international investors.

Agency	Rating	Outlook	Date
Moody's	**B3**	stable	Apr 28 2018
Fitch	**B**	stable	Apr 25 2018
Moody's	**B2**	under review	Feb 07 2018
Moody's	**B2**	stable	Oct 20 2017
S&P	**B-**	stable	Aug 11 2017
Fitch	**B**	negative	Sep 23 2016
S&P	**B**	negative	Aug 12 2016
Moody's	**B1**	negative	Apr 29 2016
TE	**41**	stable	Apr 16 2016

Fitch	**B+**	negative	Mar 25 2016
Moody's	**Ba2**	negative watch	Mar 04 2016
S&P	**B**	stable	Feb 12 2016

Table 6 Recent rating changes by the various rating agencies (as summarized by tradingeconomics.com)

- Export credit agencies (ECA), for offering export finance insurance coverage, follow the central OECD country risk assessment which classifies Angola under category '6' as high risk.

Credit ratings of government debt has recently improved. For the foreseeable future however, these ratings means that government borrowing from external sources is expensive: ~8-10% for debt raised from international bond investors) an for ECA-insured debt, whilst attractively priced (~4% all-in) constrained by strict ECA ceilings.

Conclusion: best short-term potential for public sector finance in bilateral/multilateral funding
In this context, the national government's short-term ability and policy drive to invest substantially in new capital investment projects most likely will be restrained and selective[4]:

- The potential of funding from government revenue funds or from external sovereign finance (such as the specifically marked "Infrastructure bonds" recently issued by several Sub-Sahara governments) is hampered by fiscal adjustments set in motion by the new government, as well as by the adverse impact of recent economic turbulence on credit risk assessments used by international investors;

- Because Angola no longer has the HIPC classification (per the 'Heavily Indebted Poor Countries' initiative of World Bank/IMF), interest-free loans and grant funding to the Angola government from bilateral and multilateral partners are in principle not available.

- Therefore, in the short term, for public financing of projects such as considered in this report for Soyo and the region there will probably be a general preference for using funds from bilateral and multilateral partner institutions – which would offer loans at concessional terms (i.e. at favorable terms and conditions compared to commercial terms) to central government.

As it was not possible to hold a meeting with Ministry of Finance officials this was not confirmed explicitly – although bilateral/multilateral parties generally expressed a keen interest in financing projects if properly structured projects are proposed (and most of them have recently increased their focus on infrastructure investments).

Government's own funds / sovereign borrowing	HPIC funding	Bilateral/multilateral funds
Moderate/limited	None	Strong

Table 7 General potential of public sector finance sources for Soyo projects, summary

In recent years, substantial investments in public/urban infrastructure have been funded from oil-backed loans provided by China's Exim bank. In principle, these are not different from international loans provided to Angola (directly to central government or to SOEs (State-Owned Enterprises) arranged and secured by oil revenues in the past. However terms and conditions on

[4] This is a deduction based on publicly available information, as no meetings with the Finance ministry were held

Exim Bank oil-backed loans are reported to be more favorable (lower interest costs, longer grace and maturity periods, etc.) – whilst typically requiring procurement of Chinese contractors.

3.6.2 Private sector financial context

We have reviewed five modes of private financing of capital projects: debt finance, investment finance, trade finance and microfinance and CSR funding.

Debt finance
In the past, abundant availability of foreign exchange currency has reportedly led to relatively inefficient lending by domestic banks and SOEs. For domestic banks (and, eventually, for *Sonangol* as a lender of last resort) this has resulted in a significant share of the private sector credit portfolio comprising Non-Performing Loans (i.e. loans where the borrower has defaulted on repayment and/or interest obligations; according to World Bank data for the period up to and including 2015, there was a 15% Non-Performing-Loan rate - and rising).

In these circumstances and given scarcity of kwanza liquidity, kwanza-denominated domestic credit is available mostly for government borrowing. It is available only in limited supply and at strict terms and conditions for non-government, private sector borrowers – typically requiring substantial collateral or other recourse (i.e. there does not seem to be a market for unsecured consumer loans).

International financing institutions provide foreign currency loans to private sector or SOEs only under the condition of either collateral or explicit government guarantee, or export credit insurance provided by official bilateral partner ECAs (which in turn require government guarantee). A notable exception applies to the (mostly SOE/state-owned) oil and gas sector which in the past has obtained international finance via oil-backed loans, i.e. on the back of its foreign exchange revenue stream.

Investment finance
For private “equity” investments in capital projects, the real estate sector is a good illustration of what has happened during the years of high oil and gas prices: a significant number of properties have either been build and left vacant, or have seen construction activity halted halfway– leaving the property unfinished. While the result of this is most visible across the skyline of Luanda, the inflow of capital and private sector activity linked to the realization of the LNG Terminal has also “produced” a comparable situation in Soyo.

Angola does have a track record of being the single largest recipient of Foreign Direct Investments (FDI) in Sub-Saharan Africa. Whilst most of its FDI in the past has been linked to the oil and gas sector, Angola is rich in other natural resources and the potential of other economic sectors is strong. With the new government’s policy of diversification and developing the non-oil economy, investments in other sectors such as fishing hubs like the one in and around Soyo should increase. Government-supported public infrastructure and service projects should be the first to benefit from such a trend.

Trade/ECA finance
Trade (export) finance for procurement of goods from sellers abroad by buyers in Angola is available on the basis of insurance coverage provided by an Export Credit Agency. The potential of funding capital projects from export credit insurance-covered finance is determined by:

- *ECA capacity to insure*; due to the high OECD risk classification currently applied for Angola, ECA ceilings are relatively strict and ECAs cautious;

- *Position of local buyers of exported product*: private or (semi)public, e.g. local government, meaning there needs to be a properly structured export proposition;

- *Central government willingness and capacity to issue* the required counter guarantees to the ECA (commercial bank issuance of guarantees to private parties is not probable unless a strong security package is provided).

Assuming the Soyo projects proposed in this report are developed, we expect that the main constraint for ECA financing will be on the third determinant (the availability of counter-guarantees to backstop default on the ECA-covered loan).

Microfinance and peer-to-peer finance
Microfinance is available under specific programs in Angola. In a typical microfinance format, individuals group together in order to establish a microfinance group which borrows for small business loans from a microfinance credit institution, such as KixiCredito (one of the micro-credit institutions operating in Soyo). Limited ticket size, relatively high rates and short repayment periods mean that microfinance is well-suited for smaller, community-driven improvement projects. Other small-ticket finance is peer-to-peer finance between individuals, e.g. house owners-builders borrowing the funds for house construction from family members. KixiCredito has developed a micro-loan product called KixiCasa for financing incremental housing to build houses in stages or for making improvements on existing homes.

CSR funding
Per its contractual obligations, ALNG has a USD 3m annual budget for CSR projects in Soyo and Zaire province. This budget has already been allocated for the period 2018-2019 but budgeting is ongoing for the subsequent years. ALNG has confirmed it will consider any plans put forward by the government with respect to water management and sanitation improvements. Cofinancing by them is also an option. For projects to be considered a clear benefit to the population is required.

Conclusion: private finance constrained
The current potential of private finance for investments is constrained: debt finance is mostly available to government and/or on the basis of securitization of future oil and gas revenues. Private investments and FDI have strong potential if economic and fiscal stabilization continues, and the potential of export finance depends on well-structured procurement and security provided by (sovereign) counter-guarantees.

Debt finance	Investment finance	Trade/ECA finance	Microfinance/P2P
Limited potential	Limited potential, with positive outlook	Moderate potential (depending on buyer and counter-guarantee)	Available for small individual and/or community-level solutions

Table 8 General potential of private sector finance sources for Soyo projects, summary

4 RECOMMENDATIONS ON MEASURES

4.1 Introduction

In this chapter our recommendations from a technical, socio economical, institutional and financial perspective are summarized. We separated the islands and the city of Soyo as these are two different challenges.

4.2 Technical location specific

4.2.1 The Islands

The main observed challenges at the Islands as described in paragraph 3.3.1 (see Figure 4) for which mitigating measures (if any) could be developed are Potable Water, Sanitation, Inundations, Phreatic water levels, Drainage and Urban Planning. Each defined challenge will be discussed briefly.

Potable Water
As was mentioned by the interviewed locals on the islands health was the main issue of concern. The situation regarding health at the islands can be explained by the combination of the observed issues, therefor the improvement of the health circumstances needs to be a combination of (technical) mitigating measures for all of these defined challenges.
It starts with proper potable water. Proper potable water could be brought to the islands from remote reservoirs by tubes. The distances, the terrain and the number of islands with preferred discharge points make such a solution not very cost effective. The distribution by means of transport from remote reservoirs or production facilities is a much better solution, but it requires permanent and costly transport facilities as well as local storage facilities. It is a 'never ending solution' as the costly transport must be continuous and it makes potable water also relatively expensive.



Figure 13 Example of a solar power driven potable water facility (www.appliedmembranes.com).

The installation of solar powered drinking water installations requires almost only the investment for the purchase of the installations itself. The resulting quality is extremely good. As the system is self-powering it is a good and workable solution for the potable water challenge.
It must be questioned whether all the separate islands should be provided with such facilities, just the few main islands scattered through the region, or just one major island. In the last option reference is made to the already present potable water storage facility on the main island. The

potable water over there is provided by the municipality. Probably only the people living on this main island and maybe the few surrounding smaller islands get the potable water from this storage, but the other island hardly make any use of this facility as it was claimed to be a too long distance.
It must also be questioned that when smaller islands will be facilitated with potable water most probably more people will come and live on the islands. That could be an undesirable side effect.

It is therefore concluded that the installation of a solar powered potable water installation on one or two locations on the main and/or bigger islands would be the best solution.

Sanitation
With the use of good potable water the infection of drinking and cooking water by improper sanitation on the islands is prevented for the biggest part, but a risk remains.
Septic tanks may resolve the issue, but they require regular cleaning and this is difficult in these remote area's which are difficult to access from the water for larger cleaning vessels.
Latrines are another option. The proper function of a latrine depends on the infiltration of its waste water into the subsoil which in itself has a natural cleaning ability. But as the present latrines are placed just above phreatic water levels no infiltration will take place. The waste products spread with every inundation and affect the surrounding waters. A proper and local applicable solution will be to create an elevated area on the island on which the latrines are positioned. The level should be well above high water level so waste water can easily infiltrate.
These elevated areas should be big enough for the infiltrated water to clean itself in a natural way.

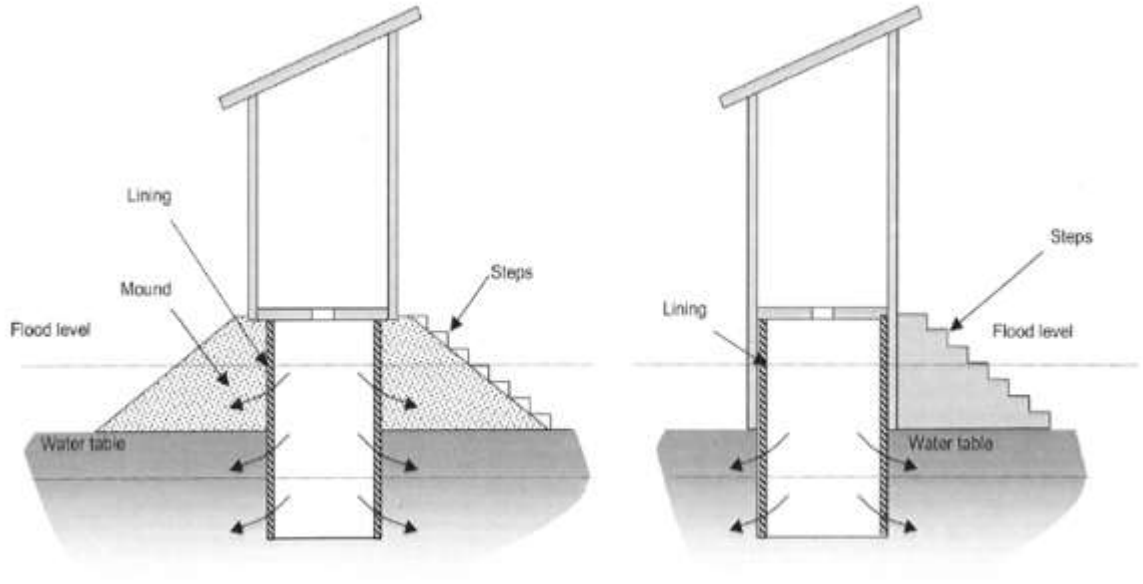


Figure 14 Types of raised pit latrine (On-site sanitation in areas with a high groundwater table, Sarah Parry-Jones, 1999,)

When elevated areas are being erected on the islands the sides will be under the attack of erosion by high water levels. A simple and local solution might be a pole wall surrounding the elevated area's in which branches from the trees are woven. On the inside geotextile is proposed to prevent sand from the inside to wash out. This geotextile is not available on the islands, but is not expensive.

Inundations
The regular inundations at the combination of high river levels due to the rainy season and high tides only may be prevented by relevelling the complete islands to a level above the highest water levels. This requires a lot of sand which most probably must be dredged by costly industrial equipment, it requires the houses and other facilities to be removed temporally and introduces a new issue: shore and scour protection. With building the houses and other facilities on poles the local people have created themselves a cost effective, workable and livable solution.

High Phreatic water levels
The high phreatic water levels on the islands fluctuate most probably around the mean water level. Surface runoff facilities or subsurface drainage will have hardly any influence. Only levelling up an area will create a deeper phreatic water level.

Drainage
As is mentioned under the previous item any surface runoff facility or subsurface drainage will have hardly an effect on the present phreatic water levels on the islands. Only when larger higher areas are levelled up by sand suppletion, the accumulation of phreatic water in this elevated areas should be prevented by installation of subsurface drainage by (horizontal) drains. Standstill water in little pools on the islands should be prevented by a surface drainage system (little open gutters. Also the refreshing of the standstill waters in the mangroves behind the islands could be improved by smaller discharge canals through the islands.

Urban Planning
Proper urban planning includes and integrates all the previously mentioned challenges and their solutions.
Improving the living conditions could result in an increase of the population on the islands as more people will potentially move there. This would be an unwanted side effect. Nevertheless the fishermen will stay on the islands in any case as their fishing grounds are nearby and only improved circumstances regarding livelihood could change this. As a minimum the potable water and sanitation issue must be resolved and this is applicable for all the islands. When the potable water issue is resolved and the contamination from the latrines is controlled by increasing their elevation, the impact of inundations, drainage and high phreatic water levels on the healthy living conditions will be reduced.

4.2.2 Nona

The main observed challenges in the Soyo suburb Nona as described in paragraph 3.3.2 (see Figure 6) for which mitigating measures shall be developed are Inundations, High Phreatic Water Levels, Run off Drainage and Urban Planning. Due to the expansion of the city newcomers were looking for places to build accommodations. Logically they ended up on the edges of the present suburb. The subsoil here is not sandy anymore as it is previous mangrove area containing layers of compressive soils. Each defined challenge are being discussed briefly

Inundations
The inundations at the edges of the Soyo suburb Nona are caused by the following causes:
- Poor drainage of surface runoff from the higher grounds;
- Inundation during high river water levels in the rainy season in combination with high (spring) tides.
- Consolidation of the subsoil due to the gravity forces of elevation by sand fills and construction of houses/ infrastructure.

Consolidation is an irreversible process. Over the years the average top level will lower resulting in more frequent inundations of the areas areas near the river side and less infiltration. More frequent inundations over the years were confirmed by the locals.

The inundations of the lower edges of the Soyo suburb Nona could be prevented by the following measures:

1. Levelling up by sand fill of the complete area at the edge of the suburb. Inundations due to high tides from the rives side are prevented. Also due to the sand fill the infiltration capacity increasesd. A major disadvantage that one need to mitigate is however that – expecting the houses will not be raised, but remain on the lower levels – the houses itself now inundate more frequently due to the surface runoff of precipitation water. Unless sufficient drainage is installed more pools with standstill water will be created. Solving the problem of the tidal inundations this way creates other major issues if not done properly;
2. Levelling up by sand fill op the complete area including the houses. This would require the houses to be demolished and removed before the sand fill is applied. As the inhabitants of these to be removed houses will have to live somewhere else it is more logical to elevate a presently unoccupied area and relocate the households of these inundation-affected houses towards this new area.
3. Create a dike on the outside (on the edge of the river) of these lower grounds on the edge of the suburb. This also prevents the inundations from the river side. Natural runoff of precipitation could however become blocked this way. A drainage system must be installed and it is expected that also pumps are required to discharge the superfluous during high river water levels.
4. It is advised to build each new house in these low lying areas on a higher level – on a mound. Inundations form the river side will be prevented and surface runoff from the precipitation water will pass outside these newly build houses. Impact on existing houses needs to be evaluated.

It may be concluded that levelling up an existing (part of a) suburb is not feasible due to the high costs of temporary relocation, demolition and rebuilding. Once temporary relocated the inhabitants could probably better stay there permanently. The most feasible solution for this part of the suburb with inundation problems is installing a drainage system and in order to keep the floods from the high tides out, a dike on the outside shall be created. When doing that a larger area could be covered creating space for new houses. Without dike it is recommended to build new houses on mounds above high-water levels. It is also recommended to stop further expansion into the (previous) mangrove area's if better locations can be identified and prepared for city expansions.

High Phreatic water levels

Due to the high phreatic water levels infiltration of rainfall is limited and runoff increases. The infiltration capacity is even worsened due to the rather impermeable compressive soils underneath the sandy top layer. Where the sandy top layer has a substantial thickness – say minimal 0,5 meters – subsurface drainage tubes with connection to lower grounds/open water can be implemented. The phreatic water level around these drainage pipes will be lower. In larger areas that will be elevated or reclaimed this type of drainage also should be implemented. A lower phreatic water level will improve the infiltration capacity in the raining season and partly reduce the surface runoff issues.

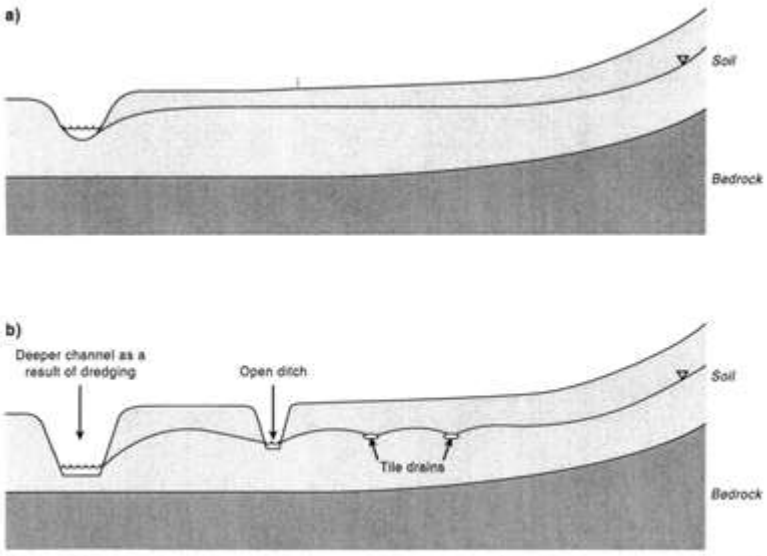


Figure 12 A schematic diagram showing the impact of land drainage on water-table height.

Figure 15 Influence of subsurface drainage on the phreatic water tables. (Source)



Figure 16 Subsurface drainage (http://www.trekkertreknieuwwehl.nl/drainage-aanleggen)

Drainage

Not only the described subsurface drainage of these lower areas should be improved, also the drainage of surface runoff should be improved. There were no gutters or ditches for natural runoff observed. The type end location of these measures for controlling surface runoff should be calculated and decided between urban planners and engineers.

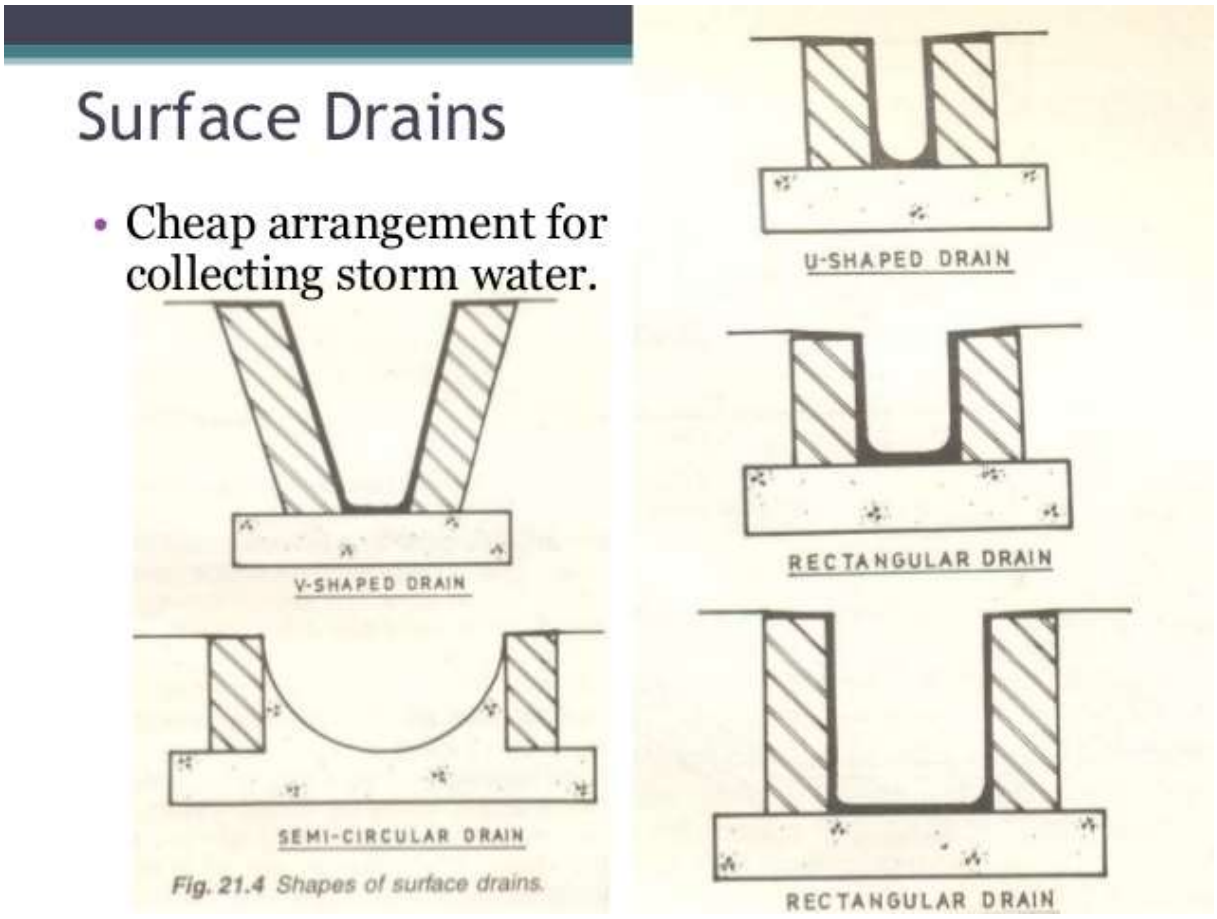


Figure 17 Types of surface drains/gutters for collection of surface runoff (Source)

Once implemented the system of gutters and/or ditches for controlling and discharging the surface runoff should be maintained and cleaned at all the time. This aspect – preventive maintenance – is also considered a main point of concern as it is not part of the present culture. Reference is made to the oldest democratic organizations in the Netherlands that were based on organizing and controlling the maintenance of the water discharge system (water regulatory authority). Controlling the water systems in the Netherlands is part of culture; it will take time before a certain level of awareness can be achieved in Soyo.

Urban Planning
The lack of urban planning contributed to uncontrolled construction of houses in the lower areas on the edges of the Soyo suburb Nona and contributed to the inundations, accumulation of precipitation, high phreatic water levels, poor drainage and consolidation issues. Introduction of integrated urban planning taking account of these technical issues shall improve the quality of the living circumstances.

4.2.3 NkunguyaNyenguele

The main observed challenges in the Soyo suburb Nkungu ya Nyenguele as described in paragraph 3.3.2 (see Figure 7) for which mitigating measures shall be developed are High Phreatic Water Levels, Drainage and Urban Planning. Rainfall gets trapped inside the suburb causing high phreatic water levels, long term stagnant water and subsequently development of standstill water borne diseases. Each defined challenge is being discussed briefly.

High phreatic water levels.
The high phreatic water levels are caused by rainfall getting trapped inside the suburb due to lack of (surface) drainage. The infiltration capacity gets minimized as the subsoil is saturated and pools are borne. Also the infiltrated water has nowhere to go as is not drained by subsurface drains. The situation in Nkungu ya Nyenguele has probably become worse since the elevation and improvement of the main road between the suburb and the river. Natural runoff was further blocked. No run off measures like gutters or ditches were noticed. Not even alongside the main road. Recommendations for the control of the phreatic water levels are described in the next paragraph about drainage.

Drainage
As described above the water related problems in the Soyo suburb Nkungu ya Nyenguele are mainly caused by lack of drainage, more specifically drainage of surface runoff as well as drainage of the subsoil/ groundwater.
The drainage of surface runoff by gutters and ditches makes precipitation to flow naturally to lower points and finally into the river. The drainage of the subsurface by drains, at a depth of say 1-1,5 meters below surface, drain the subsoil over time and lower the phreatic levels. These subsurface drains may discharge into the gutters and/or ditches implemented for discharge of runoff. The subsurface drains have several advantages. Once the phreatic levels under roads are lowered to at least one meter below ground level, the forces of (heavy) traffic are distributed better and roads suffer less. This is also the case for sand roads. The high phreatic water levels cause little pools and passing traffic make these pools bigger. Another advantage of a lower phreatic water level is the restoration of the natural infiltration capacity of the subsoil. Part of the precipitation will infiltrate and reduces surface runoff. The capacity of a layer of one meter dry sand is about 300 mm of water. This is a substantial quantity. Infiltrate capacity however is lower than the intensity of tropical showers, so anyhow a combination of surface and subsoil drainage is required.
The terrain of the suburbs is not flat. Naturally the suburbs have several deceptions – lower parts. Water accumulates in these lower sections. Due to the urbanisation and infrastructural works (main roads) the natural runoff gets blocked more and more, causing long term standstill waters. For natural runoff through ditches and gutters a certain slope is required. Although this slope is relatively small (about 2%), over 1000 meters the level difference is 2 meters. It might be the case that in some parts of the suburbs the required height difference for the natural runoff may not be reached. This is the case for instance when a deception is trapped between higher grounds. In that case the mechanical discharge through pumps of superfluous precipitation water is required. Underground tubes for gravity flow make it possible to overcome more height difference than open gutters but are not recommended as long as maintenance (these tubes will get filled with sediments) is not optimized.

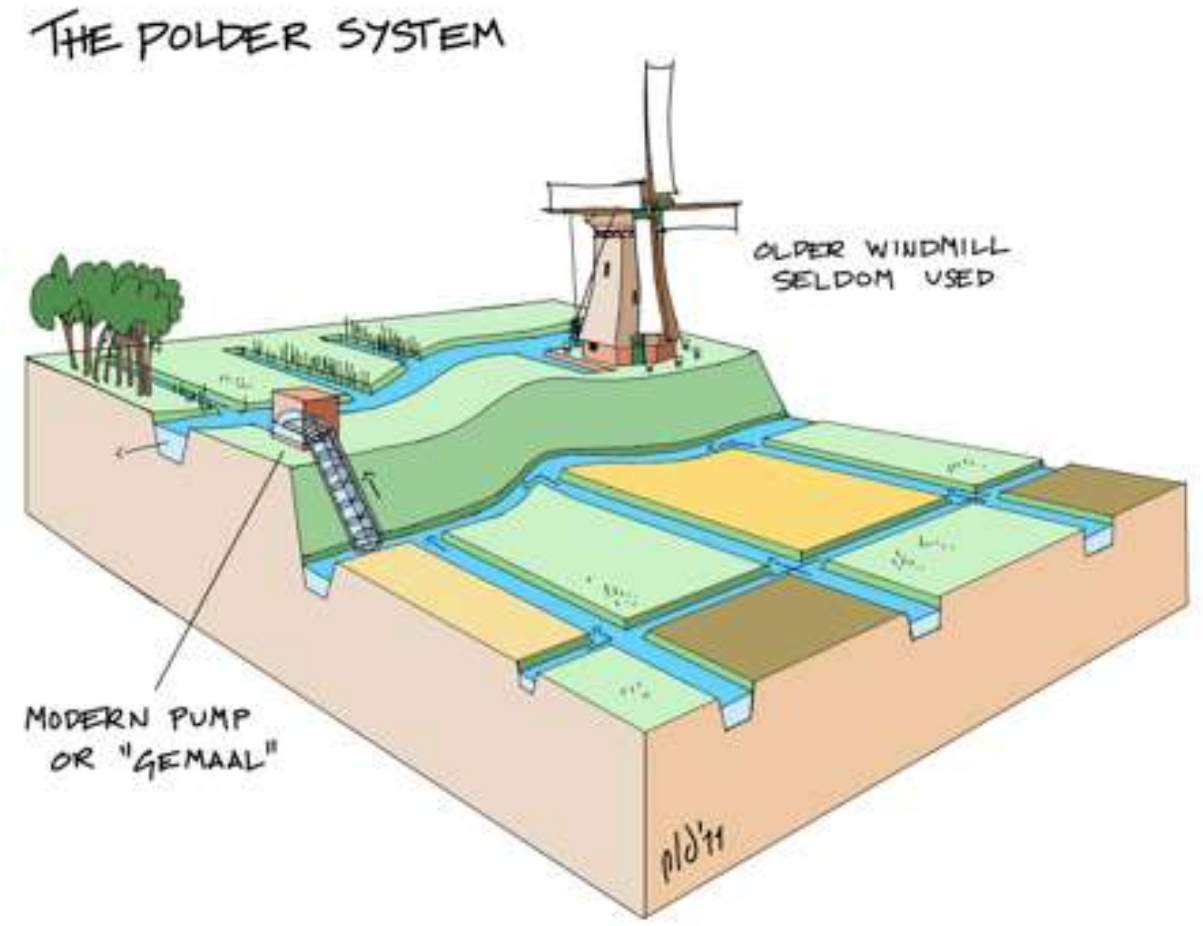


Figure 18 Example of a complete drainage system in a "polder"(https://br.pinterest.com/pin/326440672964732506/)

The principle of drainage system is explained through Figure 18. In the subsurface drainage collects the infiltrated precipitation and transports it (horizontally) to the gutters and ditches on the sides. The open water diches transport the water towards the lowest point in the area. When the level of the river (at the left) is lower than the water level at the right side water discharges through a discharge sluice (that closes when the river level gets too high). When the outside river level is higher high mechanical discharge through pumps is required.

The ditches in Figure 18 also might be gutters for instance alongside a road. In Figure 18 the water in the ditches stands still in the dry season. As no standstill water is allowed in the gutters (to prevent mosquito borne diseases) there should be a slope in the gutters of at least 2%. In next **Fout! Verwijzingsbron niet gevonden.** the proper functioning of such a system is shown. It is the system at the LNG-plant in Soyo. The water collected in the subsurface drains discharges in the gutters. Surface runoff (from the road for example) gets in to the gutters and these gutters function as a storm water gutter. Due to the slope the water flows naturally to the lower point and gets either naturally discharged to open water or via pumps.



Figure 19 A gutter at the LNG-plant in Soyo with little outlets from the subsurface drains behind it (some indicated by red arrows)

Preferably at the lowest point in the area a collection and pump unit is installed that may discharge trough a pipe or elevated higher gutter that transports the water to the point where natural runoff may take over. As for energy consumption, efficiency, sensitivity for debris and easy maintenance an Archimedes' spiral wheel pump unit may have preference over more sophisticated pump systems.



Figure 20 Example of a "Archimedes" spiral wheel pump (Source).

Urban Planning
In the Soyo suburb Nkungu ya Nyenguele houses are situated along unpaved streets. It is suggested to combine the existing infrastructural system and accurate information on the level of the terrains with the management of water in the new planning initiatives. This way the high phreatic water levels and the local drainage may be controlled permanently, the pools including its consequences will be history.

4.2.4 Paróquia

The main observed challenges in the Soyo suburb Paróquia as described in paragraph 3.3.2 (see Figure 8) for which mitigating measures shall be developed are High Phreatic water levels, Drainage and Urban Planning. The situation in Paróquia is comparable to the situation in the Soyo suburb Nkungu ya Nyenguele. Each defined challenge is being discussed briefly.

High phreatic water levels.
The high phreatic water levels are caused by the precipitation getting trapped inside the suburb. The high phreatic water level was witnessed in a local water well. The infiltration capacity of the subsoil drops as it gets saturated and pools are borne. As the infiltrated precipitation has nowhere to go as the area is not drained, levels rise. The situation in Paróquia has worsened since the elevation and improvement of the main road at the south (about 1,5 meters above ground level) and the construction of the airstrips of the airfield on the northern side (also at a higher level). The natural runoff was further blocked by these developments. No compensating measures like gutters or ditches have been witnessed, not even alongside the main road. The high phreatic water level only can be reduced and controlled by subsurface drainage.

Drainage
The situation and solution regarding drainage is quite similar to the situation in the Soyo suburb Nkungu ya Nyenguele which has been described in the previous paragraph. The only difference is the presence of a gutter under the main road and unfinished discharge channel downstream. The level of the road crossing is too high preventing discharge out of the area in a natural way. The discharge channel constructed is blocked downstream by absence of a discharge structure allowing water to flow out. The same structure should prevent high tide to flow in.



Figure 21 Check valve (small scale example) (www.beuker-bkl.com)

We recommend at least finalizing and cleaning up the current discharge channel that passes the main road (including the missing outlet and if needed depending on the water levels at the discharge point with a check valve or similar type of structure). The area we visited could not discharge to the above mentioned gutter because of its low level. Subsurface drainage and a gutter system in this area may collect superfluous water and transport it to just upstream from the gutter/road crossing. A pump system like the “Archimedes” spiral wheel can bring the water to the higher level after which it discharges through the gutter. Before implementing this solution it should be checked based on an elevation map if this is the easiest discharge direction.

Urban Planning
In the Soyo suburb Paróquia houses are situated along unpaved streets. It is suggested to combine the existing infrastructural system and accurate information on the level of the terrains with the management of water in the new planning initiatives. This way the high phreatic water levels and the local drainage may be controlled permanently, the pools including its consequences will be history.

4.3 Integrated solutions

4.3.1 Integrated drainage study

The technical measures to the locally observed water related issues are proposed, however it should be understood that only three local sites in the city of Soyo were visited and studied. It is expected that more similar sites with the same water related issues are present in the city of Soyo and they might be interconnected. This has been confirmed by the local authorities, but the quantity and magnitude could not be estimated. It can be expected that the problems in the suburbs are not limited to these three sites. The absence of a drainage system is common.

If indeed the problems are city wide preferably the locally to be implemented measures on water management and control should be part of a larger system. One cannot solve the problem on one site and leave the consequences to the other side of the road as has been witnessed on the sides of the main roads. It is proposed to launch a water management study for the city of Soyo. The surface levels all over the city should be investigated and measured carefully as well as a

complete inventory of the quantity and magnitude of the water related issues should be conducted. There should be a relation between the measured terrain deceptions and inventoried problem areas. Also the present water discharge facilities/ water infrastructure including its dimensions should be inventoried to include them in the total solution.
This information together with the local precipitation information shall be studied, resulting in an integral water management plan containing suggestions for subsurface drains, culverts, pumping stations, local elevations of terrain and discharge channels. Even locally voluntary relocations could be considered. Logically the result of the study also should contain a timeframe and the community should be involved.

4.3.2 Reclamations/ Elevations

On Wednesday 2nd of May the local office of Boskalis was visited. It became clear that the required sand for the LNG-terminal-reclamation was capital dredged from the navigation channel and from win-locations off coast. The ongoing dredging at the moment is only maintenance dredging of the navigation channel and port. The material dredged is only extremely fine silt and had no value for any reclamation/ elevation. The dredged material/silt is dumped off shore in waters over 200 meters deep.

Just offshore the city of Soyo a Chinese grab-dredger has been dredging for the ferry harbor. The available sand has been brought to shore for various smaller reclamation projects. At the time of the visit also this dredging project was finished.

Anyhow, in the offshore vicinity of Soyo and Congo delta there are vast quantities of good reclamation material available. In case new dredging initiatives are considered the authorities should evaluate if the material to be dredged could be used on land to reduce flood and drainage issues. Attention must be paid to the hydrological, environmental and morphological effects of such dredging projects.

Levelling up in existing urban areas is not expected to be an easy implementable solution. When levelling up a certain local urban area, this area will have less water related issues (like the new roads), but will pass on their problems to the neighboring sites. Also it is expected that in urban areas the housed will not be demolished and rebuilt on higher (levelled) grounds. Therefor the lowest parts will be the parts where people live. It has been witnessed that large sites and houses next to the higher new main roads now have a semi-permanent water issue as the properties were under water. Proper levelling up of an urban area (including real estate) is therefore an extremely expensive solution. The installation of a drainage for superfluous water is expected to be a lot easier and cheaper. And the result will be the same.

Only the elevation of larger areas that are currently not occupied for future urban development with dredged sand (like the LNG-terminal site) is a good suggestion. In these planned extensions the growth of the city can be absorbed and people, who currently live under very harsh circumstances (that can’t be solved easily technically) could be relocated if they are willing to.

4.3.3 Potable Water

It is recommended that the "Community Water Management Program" MoGeCA should be implemented through the municipal public standpost network in urban and peri-urban areas of Soyo. Community self-management of local water systems is an effective way of preventing vandalism and neglect and of keeping standposts running and maintained in a sustainable way. The weak capacity of public-utility operators and local authorities in Angolan municipalities meant that management strategies had to be developed that involved consumers in implementing and

maintaining basic services. Affordability and willingness-to-pay studies in several provinces demonstrated that low-income households were prepared to pay for a public water supply service if it was reliable and if the price was lower than that charged by private water vendors. Local residents generally assume that piped water from the public grid has been treated and that the quality is superior to the water sold by the bucket on the informal market. A model was developed to provide a community service at a price affordable to consumers. The costs of the water and the standpost maintenance are covered, and revenues for the municipality encourage it to provide a continuous supply to the standposts. The Angolan government has adopted a policy to remove subsidies and accept the principal of cost recovery for basic services such as water.

Under the MoGeCA model[5], water committees are formed to at each standpost to collect revenue, oversee operations and maintenance, monitor and register the number of days of water flow, and ensure that records of all payments and expenses are kept. Committees are accountable to residents and water consumers. Each committee manages its own finances and deals with conflict, including enforcement of the prohibition of illegal connections. Urban district-based associations or federations of water committees are developed through which committees involved in managing standposts share their experiences and work together in seeking better services from local government authorities. The development of associations of local consumer groups provides the legal framework necessary for their registration with municipal administrations, and trains and supports community residents to help them reach their potential as consumer-managers of water services. They make fair payments for services provided, look after their community's investment, and put pressure on utility suppliers to be accountable for the performance of their roles.

4.4 Institutional

As mentioned before between the different governmental levels (from municipality to province to central government) sectoral connections exist. Depending on scale and size of projects, projects are being planned and funded on a higher level. At exactly what level or moment an initiative becomes someone else's responsibility did not became completely clear during the one week mission but a risk of gaps or overlap in responsibilities when all levels are being involved exists. It is to be recommended to study this further as it will be important to have clear definition of responsibilities during all steps of the project cycle (so including preventive maintenance and operation).

The main objective of the mission was the improvement of the health condition of the population of Soyo. To start on the islands the focus should be on potable water and latrines and in the city of Soyo on drainage (of runoff and groundwater).

For the future water management should become an important criterion in the urban plans to be developed by the city. What we mean by this is that in the development of locations/neighborhoods all water aspects should be planned and integrated with the other functions in advance.

It was mentioned that for the more complex projects experts from the national authorities support the local authorities. Especially as more responsibilities will be moved towards the municipalities capacity building on water management is needed.

[5]ref: Cain, A. (2018) *Informal water markets and community management in peri-urban Luanda,* Angola, Water International, https://doi.org/10.1080/02508060.2018.1434958

Maintenance is an element that needs more attention. With maintenance we refer to preventive maintenance and cleaning and not just repairing water infrastructure when in fails. By preventing failure infrastructure will last longer and will cost less over time. Sufficient budgets need to be dedicated to this. In Figure 22 an example is shown of a recently constructed discharge channel which is will not function according to specifications due to a lack of maintenance e.



Figure 22 Discharge channel in Soyo

A mentioned earlier to develop solid plans and decide about the best approach regarding the issues at hand good information and monitoring would help a lot to come up with the most cost effective solutions. An effort to develop a shared information system would be recommended. Also it will need to be clear who is responsible to gather what kind of information (quantity and quality). At the moment this is not arrange efficiently.

On waste water treatment and flood management responsibilities are not clear. Regarding flooding this is of importance for the islands. To implement flood measures it needs to be clear who to involve. Regarding waste water this is something that will need to be developed in time and is for now a bit less urgent.

As we understood, forthcoming decentralization should devolve some degree of decision-making and more financial autonomy from central government to local authorities. It will fall to the local authorities to ensure that integrated water and sanitation planning is done whilst fully considering and raising the necessary budgetary resources and financial planning. Part of the decentralization will be for local governments to institute their own revenue stream through

selected local taxes. It is recommended to investigate the feasibility of putting in place a local water & sanitation levy per household (both practical feasibility and affordability to levees).

Revenue from such income streams can be used to budget both capital costs of the measures proposed in this report and in any forthcoming integrated water and sanitation plan (the local government may borrow to fund such capital costs, against part the future revenue from e.g. a water and sanitation tax), as well as the management and maintenance of physical assets and equipment. It may also enable the local government to engage a private contractor to implement and manage (some of) the proposed solutions. Proceeds from such income streams may also be allocated towards MoGeCa activities – requiring a close partnership between local government collecting those revenues and (potentially together with MoGeCa) setting plans, and MoGeCa-driven implementation.

4.5 Socio-economic

In general, we tried to develop suggestions (for socioeconomic solutions) based on the actor-centered approach[6], here the term “actor” understood as active local participants as well as external institutions such a central government and foreign and national private sector companies involved in Soyo.
Therefore, the suggested actions should be framed in a Community Development Plan of the Municipality of Soyo, which, obviously, should be implemented by the Municipal Administration and always in partnership with other institutions such as local civil society actors and commercial companies. The Municipality has the opportunity to propose social and development projects for approval in the annual budget cycle for inclusion in the national state budget.

The Municipal Administration of Soyo has created a "Consultative Council" (CAC) which is the potential space for participatory governance, where local authorities have the opportunity to consult and become increasingly accountable to society. Consultative Councils are regulated by national legislation and are transitional institutions that will eventually be replaced by formally elected Municipal governments in the next several years. Consultative Councils today only have an advisory role and are obliged to contribute to the decision-making process in drawing up local development plans and annual budgets. Although it is the prerogative of the local Administrator to designate the participants to the Consultative Council; civil society organizations have advocated for holding broadly community based forums to be used to elect representatives to the Consultative Councils. In addition to local administration, other representatives of sectors of society in the municipality, such as the traditional authorities, the private sector, churches, civil society organizations and others are members of the Consultative Councils. It is within the framework of the Consultative Council that a Community Development Plan should be discussed and eventually approved.

4.5.1 The Islands

The people living on the islands who were contacted (men and women) recognize that the island plays the role of fishing place, and the distance from their original residences in the city have turned the island into residential villages. As a result, there has been a great openness in communities to seek combined solutions that include, on the one hand, improving basic service conditions (access to safe water and sanitation) and, on the other hand the production, processing and marketing of fish. The importance of paying more attention to the return of children to the schools available in Soyo city was emphasized.

[6] *Norman Long,* s.d

Recommendations

- To promote creation and the effective existence of associative organizations of fishermen (cooperatives, community associations) capable of providing their members with technical, organizational and marketing support services, which are legitimized and recognized.
- The distribution of vessels should be conditional upon requests made by fishermen's organizations and only following a positive assessment of the technical and economic feasibility, on a case-by-case basis, in relation to the investment to be made.
- Need to encourage more opportunities for women, especially for small businesses. For women to be more involved in society, it is important to have basic services in place in their communities (drinking water, sanitation, health services, education, energy, etc.).
- Promote, in the context of environmental improvement actions, training activities in community management of social infrastructures for water, sanitation and hygiene; include small businesses. The improvement of the hygiene for the sale of fish in the informal markets will make a significant contribution to the livelihoods of women who are involved in this sector. Women's enterprises can be upgraded through introducing appropriate technologies for fish conservation through drying, smoking or freezing.

4.5.2 The city of Soyo

Among the populations of the peri-urban neighborhoods of the city of Soyo we find the most disadvantaged, who often earn a share of their livelihood from a variety of labor services provided or small informal activities. In order to ensure that the most disadvantaged are not left worse off than before any action suggested in the context of the future suggested projects, if needed appropriate and affordable livelihood replacement options should be discussed and implemented and the solutions should fit in the local reality to be sustainable.

In the urban planning improvements proposed for peri-urban risk areas in the DRR report a participatory rapid diagnosis (DRP) is recommended in order to identify the priorities and preferences of the target group. At that point in time local communities will have the opportunity to identify potentially vulnerable groups. These groups may include people who will receive the least benefit from compensation activities because of their social position (women, young people and the elderly). They may also include households that will have unexpectedly high social or economic costs, such as loss of property or access to a source of income or other resource. Mitigation strategies such as financial or in-kind compensation should be negotiated and agreed for those who may be displaced or otherwise affected negatively by the development proposals.

Usually, in urban and peri-urban areas there are no sobas or their power is diluted by the growth of the city, there are neighborhood coordinators and commissions of residents. Neighborhood co-ordinations and committees of residents are the governing bodies in these areas, up to a point functioning as sobas at the same time serving as government bodies. These commissions of residents can be very powerful in some areas. Residents commissions are usually consulted by new migrants to the city and by Government institutions when they want to implement a new local project regarding the availability of land.

Despite current and ongoing investments in the municipality in the water sector, the current state of drinking water supply and sanitation, with an emphasis on peri-urban and rural populations is still worrying. In this context, any investment in this sector at the municipality level, with priority for peri-urban and rural communities, is justified and recommended.

Suggestions for possible technical interventions in the water and sanitation sector were presented in section 4.2 of this report; therefore, additionally we present suggestions for socio-economic solutions aimed at ensuring the sustainability impact of these actions:

- An in-depth analysis of the technical solutions to be chosen (advantages and disadvantages) is recommended, involving the beneficiary communities before deciding on the type of investment to be made and the system to be installed in a given locality. Except in places where more sophisticated systems are justified, priority must be given to adaptable, low-cost technologies that are easily controllable by the community.
- It is also recommended that the companies contracted to install water systems, involve the communities in this process, because the consultation will increase the sense of responsibility in relation to the investment.
- Whatever the investments in terms of water infrastructures, the work of Social Mobilization should be the backbone of the whole process, in order to guarantee not only the sustainability of the systems, but also the sustainability of projects in general.
- The Social Mobilization work should be based on the Community Water Management Model (MoGeCA) outlined in 4.3.3: This model is appropriate as a component of public systems based on the distribution of water through standposts and local systems based on wells. The water committees are organized on a water-point basis and grouped into "associations" that are linked through distribution networks to the supply system. The committees and associations have been proven to provide excellent forums for the public service provider and to engage communities in other activities related to sanitation, public education and social mobilization. Included in the approach are: a) Health Education - to ensure that communities can deal positively with water and basic sanitation; b) Community organization - to establish systems for the organization and management of water systems at the community level that allow cost recovery at water points to mitigate the risks inherent in sustainability; (c) specific training and trainings - in order to increase the capacity (empowerment) of communities to manage their own processes of development, management, maintenance and repair of simple water systems such as hand pumps; d) Participation as a fundamental principle in all processes - to ensure that communities participate in the most important decisions on the problems that affect them (accountability).
- At the level of the institutions involved in water management, the challenge will be to institutionalize Social Mobilization services in order to ensure the continuity of the social processes initiated during the implementation of projects in this sector. The MoGeCA model is promoted country-wide by the National Water Directorate (DNA) and can be supported by NGO's who have experience with this in the country.

4.6 Way forward, approach towards implementation of measures

4.6.1 The islands

For the islands it was recommended to search for the best mix of locally applied solutions and more centralized in combination with improvement of the working conditions. Potable water and latrines could be arranged on every island (centralisation means less costs) but topography in combination with the potential for elevations and willingness of people to move will be decisive on what the best mix of solutions will be.

This means that a study is needed to identify the best locations for improved living circumstances. Questions that need to be included (not limited):

- Which islands have best conditions regarding flooding (topography/ amount of m^2 above water level)?
- On which islands could most people be housed and how many?
- Is nearby dredging material available, where and how much?

- Could this be brought to the islands and at what costs?
- What are the distances to the fishing grounds?

The above technical study should be accompanied by a social study:

- Under what conditions would people be willing to move (including distance to livelihood)?
- How to deal with the leadership structures (Sobas)?
- How can the working circumstances best be improved?
- To what side effects would improved living circumstances on the island lead (immigration to the island?)?
- What existing potentialities can be included in the solution?

Once the above study has been conducted one can decide what to implement where.

Some of the islands might have less bad conditions than the islands visited and already be quite sizable regarding population. If the municipality already is aware of some and is convinced these will have to be maintained, the proposed measures can be implemented already on these islands: water treatment based on solar energy, elevated latrines and strategic elevations.

4.6.2 Soyo City

For the city of Soyo three parallel lines of thinking were proposed.

The elaboration of the risk study to determine the dimensions of the drainage/flood problem needs to be the first step. As a result of this step isolated problems will be identified for which local technical solutions can be elaborated. For the other identified areas at risk a drainage plan needs to be elaborated after which integrated solutions should be implemented.

Also from this moment one the city should search for the locations with best natural conditions for city extensions (at reasonable distance to the city, so working in the city and using the services of the city is feasible). Costs of development of the locations with the best potential should be estimated (elevations (if needed) + infrastructure). Once terrain has been made suitable for living newcomers and people living at harsh conditions in the city or the islands could be moved (not forced) here.

4.7 Funding the proposed solutions

We highlight potential funding solutions for the proposed solutions for the Islands and Soyo, below.

4.7.1 Funding/financing of solutions islands

For the islands the proposed measures concerned the following types of interventions:

- Solar powered potable water installation;
- Elevated latrines;
- Leveling up areas to deal with high phreatic water levels; and
- Surface drainage system and smaller gutters.

These are mostly solutions that are funded from (central or local) government budgets. Whilst potable water offtake and usage of shared latrines could be a basis for per-volume or per-use user charging, we do not expect this to be sufficient to enable some form of private finance of the capital investments needed. Moreover, with the exception of the solar-powered potable water installation the proposed solutions all represent relatively simple technical concepts and

(especially on the islands) of small scale – making it less likely that export credit insurance-covered financing could be raised.

As mentioned above, it is recommended to investigate the feasibility of putting in place an area-specific or town-wide water and sanitation levy for funding improvements such as the ones recommended above. However due to the peripheral location of the islands, enforcement and collection of such a levy from island households may be challenging. Moreover central government may still seek bilateral or multilateral loans to fund or co-fund (alongside a budgetary contribution from its own resources) a program of potable water assets, sanitation assets, area leveling and drainage.

On a larger scale, it is not uncommon to use DBFM-type (Design-Build-Finance-Maintain) or BOT-type (Build-Operate-Transfer) contracts whereby private parties implement substantial treatment and infrastructure assets, raise the project finance needed to fund the investments, and repay those investments from user charges, government subsidies or a combination of both. However, due to the inherent complexity of raising substantial amounts of project finance, this is only feasible in relatively low-risk environments for relatively large-scale projects – which does not apply to the solutions proposed here.

On the smaller scale that these proposed interventions will most likely represent, microfinance solutions (community-based, pooled finance from microfinance institutions and repayment of small improvements to local infrastructure and sanitation facilities) may pose a relevant direction to explore. Communities or groups undertaking microfinance for interventions where user charges is possible (e.g. latrines) may consider to do so whilst putting in place a user fee to reduce their direct burden of repayment and avoid free-rider problems.

Studies
The recommended studies (as referred to in 4.6.1) are necessary and may be funded from prospective bilateral or multilateral partners with an interest in supporting government investments into specific interventions down the road.

4.7.2 Funding/financing of local solutions Soyo

For Soyo the proposed measures concerned the following types of interventions:

- Subsurface drainage tubes to deal with high phreatic water levels
- System of gutters and/or ditches for controlling and discharging the surface runoff

The analysis of funding options as provided for the island-specific solutions above, by and large, also applies for the funding/finance potential of these solutions for the urban areas of Soyo – hence we reference the analysis provided for the islands above.

Although some potential for small micro-financed solutions exists, most of the proposed interventions need to be realized using central or local government budget – potentially with the added financial support of a new local government household levy earmarked for covering the costs of implementing and maintaining water and sanitation (infra)structures. The imposition of such a levy appears more feasible in the Soyo urban area where governance, administration and enforcement are presumably more effective than in the more remote islands.

Together with this another notable difference, the larger size and/or the larger number of the interventions in the urban areas, may help to create enough scale and structure to implement a program of interventions. Such a more sizeable program, supported by a water management and

sanitation master plan, would make it more feasible to secure the involvement of bilateral or multilateral funders interested in creating a certain scale of impact.

Studies
The recommended studies (as referred to in 4.6.2, and 4.3) are necessary and may be funded from prospective bilateral or multilateral partners with an interest in supporting government investments into specific interventions down the road.

4.7.3 Funding/financing of sustainable urban development Soyo

Third we review a proposed urban development concept whereby:

- A new area of the city is developed from scratch;
- This new area is developed according to best practice and standards for water management and sanitation;

The area combines social housing and commercial property development, potentially enabling cross-subsidizing from commercial development toward social housing.

In the figure below we provide a brief overview of the economics of the proposed urban development – whereby the central question is whether commercial property development:

- Creates surplus value which can be captured and used for supporting social housing development; or
- Breaks even or is not financially viable on its own, and therefore cannot support an additional social housing component.

Of course the answer to these questions depends on the viability of commercial property planning (will there be sufficient demand? is it will planned and marketed? are costs of building within reasonable bandwidths? etc.) and on the proportion between commercial property and social housing – as expressed in ground area hectares/acres or in floor area in square meters.

General observations about the property markets in Soyo suggest that the market is quite saturated – after having gone through a period of substantial construction activity surrounding the implementation of the LNG terminal infrastructure. At this point in time and based on these impressions, it therefore seems that it is unlikely for a commercial-social hybrid urban development to be feasible without the support of additional government subsidies (in fact it appears that even on a standalone basis the market is too saturated to support the addition of more commercial property to the existing stock).

Hence the concept of funding social housing ambitions, and possibly realization of water and sanitation infrastructure according to a new best-practice standard, from commercial property seems unlikely to succeed without government support (funded from local or central government's own resources and/or from loans extended to government by bilateral or multilateral partners).

It would take a substantial upswing in economic activity and property market activity in Soyo for this analysis to change. Figures estimated for cost of development and rental/purchase price levels for social and commercial housing suggest that in this case urban development projects are more likely to result in financial surpluses.

Preparation cost per sqm	**50**	**kz**	
Construction cost per sqm	18,000	kz	
Land lease price per sqm	50,000	kz	* urban center
Land lease price per sqm	8,000	kz	* urban peripheral
Land lease price per sqm	700	kz	* other
Cheap/social housing purchase cost per sqm	37,500	kz	
Expensive housing purchase cost per sqm	125,000	kz	
Cheap/social housing rental cost per sqm	12,000	kz	
Expensive housing purchase cost per sqm	150,000	kz	

Table 9 – Housing development cost and revenue metrics (source: Soyo municipality)

A larger scale development of the kind described above needs to be preceded by a careful review of projected costs, revenues and hence of the corresponding expected financial/economic balance of the project.

In addition such a new development needs to be properly structured in order to make sure the financial costs and benefits are realized in the most efficient way possible, and broadly in line with expectations and projections. This is particularly important in case of a project which aims to undertake a new type of urban development without – as far as we are aware – any precedent in Angola to date.

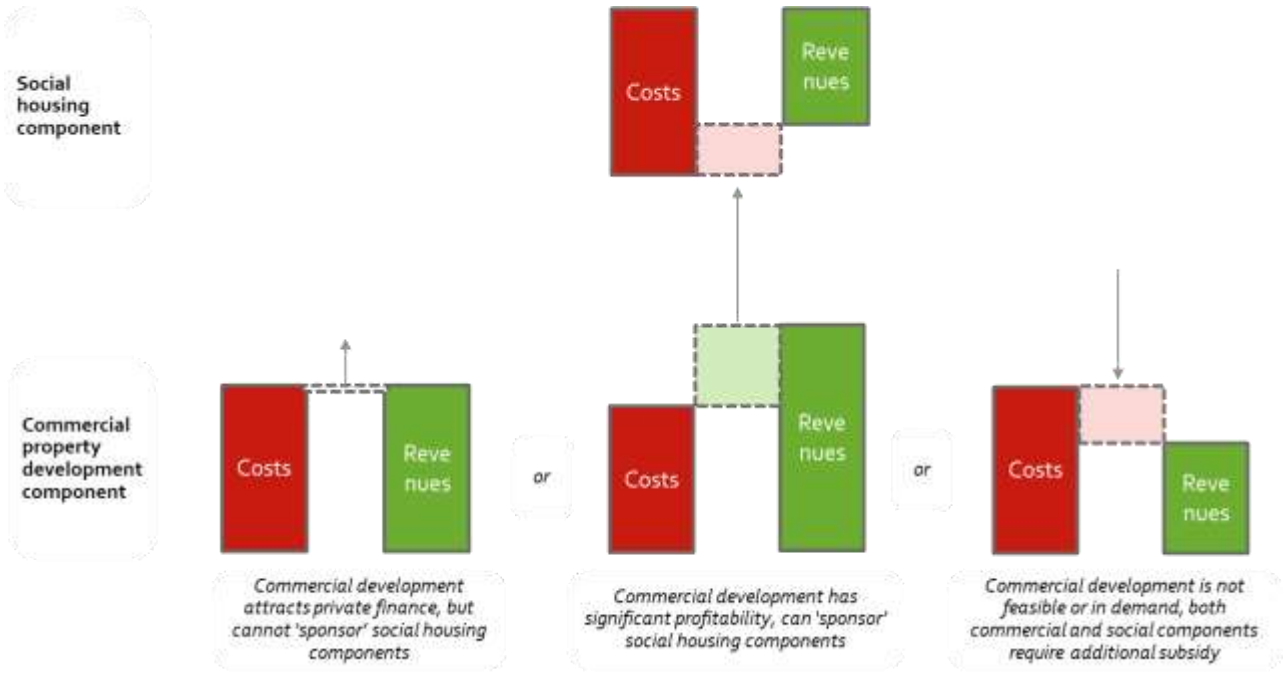


Figure 23 Housing and property development structuring

In order to undertake such structuring, such that it can be made part of a contractual structure and a market/tender strategy, three core questions (in addition to many others) need to be answered:

- What will be the scope of the (local) government?
- What will be the scope of private partner or partners (and to what extend it is a private party required to invest capital at risk, and/or to attract financing from third parties)?
- Which parties carry specific risks:

- With respect to the general successful realization of scope by all parties (what happens if respective parties do not meet fulfill their obligations under contractual agreement(s)); and
- Most specifically with respect to demand and pricing (i.e. property-market related) risk: who carries the consequences if demand and pricing do not materialize as projected?

The schematic below demonstrates three potential structures, and highlights how important especially the approach and strategy to demand and pricing risk will be

	(Local) government scope	***Private partner(s) scope***	***Demand/ pricing risk***
Integrated and fully private	*Gives land and development rights concession to private partner (following competitive tender and financial bidding for concession fees / royalties)*	*Develops land according to prescribed standards, develops and markets property (prescribed social housing and 'free' scope) as build-to-let or build-to-sell.*	*With private partner (will costs and risks be earned back from sufficient revenues?)*
Integrated and joint public-private	*Government enters into a joint venture with private partner selected via competitive tender, joint venture undertakes full prescribed 'social' scope and 'free' scope of land development and property development.*		*Nearly all risks shared according to participation in the JV (government always retains reputation and 'residual' risk)*
Government undertakes land development, private partner undertakes property development	*Develops the land according to prescribed standards and gives development rights concession to private partner through competitive tender and financial bidding for concession fees / royalties*	*Develops and markets property (prescribed social housing and 'free' scope) as build-to-let or build-to-sell.*	*Partly with government (will concession fees/ royalties cover land development costs) and partly with private partner (will costs and risks be earned back from sufficient revenues?)*

Table 10 Urban development structuring options

Utilities (energy, sanitation) development structuring

In case of a larger urban development, it may become interesting to develop larger-scale utility assets (energy supply, wastewater treatment and potable water supply, waste collection, etc.). Private finance for such utilties may be raised to (partially) fund investments in such assets through the various contractual structures that were highlighted in previous sections of this report:

- the BOT or operating concession (includes the private party taking revenue risk), O&M (Operations and Maintenance) contracts and management contracts,
- more integrated DBFM contracts wherein the private party is paid for the availability and quality of the asset, and
- joint ventures (based on shared equity) whereby public and private parties jointly undertake and manage a project or programme and jointly share in investments, operating and maintenance costs, revenue and upside and downside.

ANNEX A – DRR-TEAM

Dutch Risk Reduction Team: reducing the risk of water related disasters
Many countries around the world face severe water threats. Often, these countries are in urgent need of expert advice on how to prevent a disaster or how to recover from a calamity. For instance, when a country has been struck by severe flooding and the first emergency relief workers have gone, the need for advice on how to build a sustainable and safer water future arises. To meet these needs with a swift response, the Dutch government has initiated the Dutch Risk Reduction Team (DRR-Team). This team of experts advises governments on how to resolve urgent water issues related to flood risks, water pollution and water supply, to prevent disasters or to rebuild after water related disasters. With climate change and a fast growing world population, water issues are becoming more urgent. As a country renowned for its' expertise on water and delta management, the Netherlands feels a responsibility to share its' knowledge worldwide. That is just what the DRR-Team does; sharing expertise with governments to come up with the best possible approach/solutions for tackling urgent water issues. Because of the unique cooperation between government and sector, the best experts can be fielded quickly. The Dutch government offers a specific number of advisory missions each year.

Advice for all water issues
The Netherlands has brought its best water experts together in the Dutch Risk Reduction Team. It consists of high level advisors supported by a broad base of technical experts who can provide top quality and tailor-made expertise to governments that are confronted with severe and urgent water challenges. The Dutch are experts in adapting to water in a changing world; from delta management to water technology, from urban planning to governance, public private partnerships and financial engineering.

How does the DRR-Team work?
Governments that have to deal with an urgent water issue are encouraged to contact the Dutch embassy in their region. The embassy will liaise quickly with the Dutch government. Interventions will only take place after a request from a central government has been received by the Dutch government, and after a recent calamity or to prevent a threatening disaster. The DRR-Team does not focus on emergency relief, but on sustainable solutions. If the decision to respond to the request is made, relevant Dutch experts will be rapidly fielded to the area that is under pressure. Together with the government and local experts, the situation will be assessed and analyzed after which the team will come up with a set of recommendations. For example, advice on technical interventions including immediate measures and long term sustainable solutions, advice on governance and advice on financing options. The DRR-Team enables a foreign government to take action on the basis of sound advice and expertise.

ANNEX B – TEAM MEMBERS

For the Disaster Risk ReductionMission on Flood Risk Management, ecological solutions, Improve the health conditions of the population (Expert advice on flooding and sanitation in Soyomunicipality) the following experts went toAngola:

Rutger Perdon:
Over 15 years of experience in the water sector in several positions as a consultant and project manager on water projects in the Netherlands, Mexico, Costa Rica, Guatemala, Colombia, Paraguay, Brazil, Peru, Ecuador, Portugal, Serbia, China, The Philippines, Indonesia, Sudan, Nigeria, Israel and the US. He worked mainly in the field of integrated water management including coasts, flood management and urban water especially related to urban planning, water fronts and climate change adaptation. Besides his technical expertise he is specialised in project and process management, governance, stakeholder management and business development.

Peter Vercouteren:
Over 30 years work experience in the field of Design, Construction and Project Management of large infrastructural works, especially Marine Structures, Coastal Defence systems and Sub-soil Infrastructure. Tasks and responsibilities vary from Infrastructure Planning and Development, Feasibility Studies, Design Management and Coordination, Contracting and Contract Management to Construction Supervision and Site Management.

Koen van Baekel:
Koen is financial advisor with RebelGroup in the field of infrastructure and public investment finance – working on funding and finance strategies, financial analysis and structuring as well as tender implementation across investment sectors from water and sanitation, energy and utilities, agriculture and irrigation/water security, transport infrastructure and public transport. He has substantial experience in both developed markets and emerging markets

Afonso Cupi Baptista:
Manager of the Water and Sanitation Program of the NGO Development Workshop Angola (DW). Professor and collaborator at the Jean Piaget University of Angola. He has a wide experience of more than 15 years of work in Development Projects and Socio - Community Participation in the Angolan context. Former UN official in Angola in the World Food Program (WFP) and technical expert of the Ministry of Agriculture and Rural Development. Specialist in Social Mobilization and Community Management of Water and Sanitation. Specialist in Participatory Budgeting - Public Policies of Inclusion, Participation and Social Mobilization.

Allan Cain:
An architect and urban planner and Executive Director co-founder of the NGO Development Workshop. He is a specialist in urban development, water & sanitation, settlements upgrading and microfinance. During his more than thirty-five years' experience in developing countries, he has carried out projects for community construction, school planning, and popular participation programmes. He also, has developed programmes in community-based development involving participation of local residents and the strengthening of civil society institutions

ANNEX C – MISSION PROGRAMME

DAY	ACTIVITY	PARTICIPANTS
30-4	Visit 2 islands in the Delta	Several representatives municipality of Soyo
	Meeting to further discuss in depth the situation at the islands. Also discussed program and context of the next day	Several representatives municipality of Soyo
1-5	Site visits in Soyo	Several representatives municipality of Soyo
2-5	Meeting with Royal Boskalis Westminster	Several representatives Royal Boskalis Westminster
	Meeting with Angola LNG	Several representatives Angola LNG & municipality of Soyo
	Preparing debrief	-
3-5	Debrief	Several representatives municipality of Soyo
	Meeting	Country Director Commerzbank
	Meeting	Director Special Credits BAI Bank
4-5	Debrief	Vice Governor Zaire
	Meeting	Chief Economist African Development Bank
	Meeting	Angola LNG Luanda