DRAFT

Master Plan

National Capital Integrated Coastal Development

KEMENTERIAN KOORDINATOR BIDANG PEREKONOMIAN
REPUBLIK INDONESIA

National Capital Integrated Coastal Development
Pembangunan Terpadu Pesisir Ibukota Negara

NCICD
PTPN

Colophon

The Master Plan of the National Capital Integrated Coastal Development is a joint project by Government of Indonesia and the Government of The Netherlands.

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Executing agency is The Coordinating Ministry for Economic Affairs, Indonesia

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Master Plan

National Capital Integrated Coastal Development

Coordinating Ministry for Economic Affairs | Special Capital Region of Jakarta | National Development Planning Agency | Ministry of Public Works | Government of the Netherlands

KEMENTERIAN KOORDINATOR BIDANG PEREKONOMIAN
REPUBLIK INDONESIA

Kementerian PPN/ Bappenas

National Capital Integrated Coastal Development
Pembangunan Terpadu Pesisir Ibukota Negara
NCICD PTPIN

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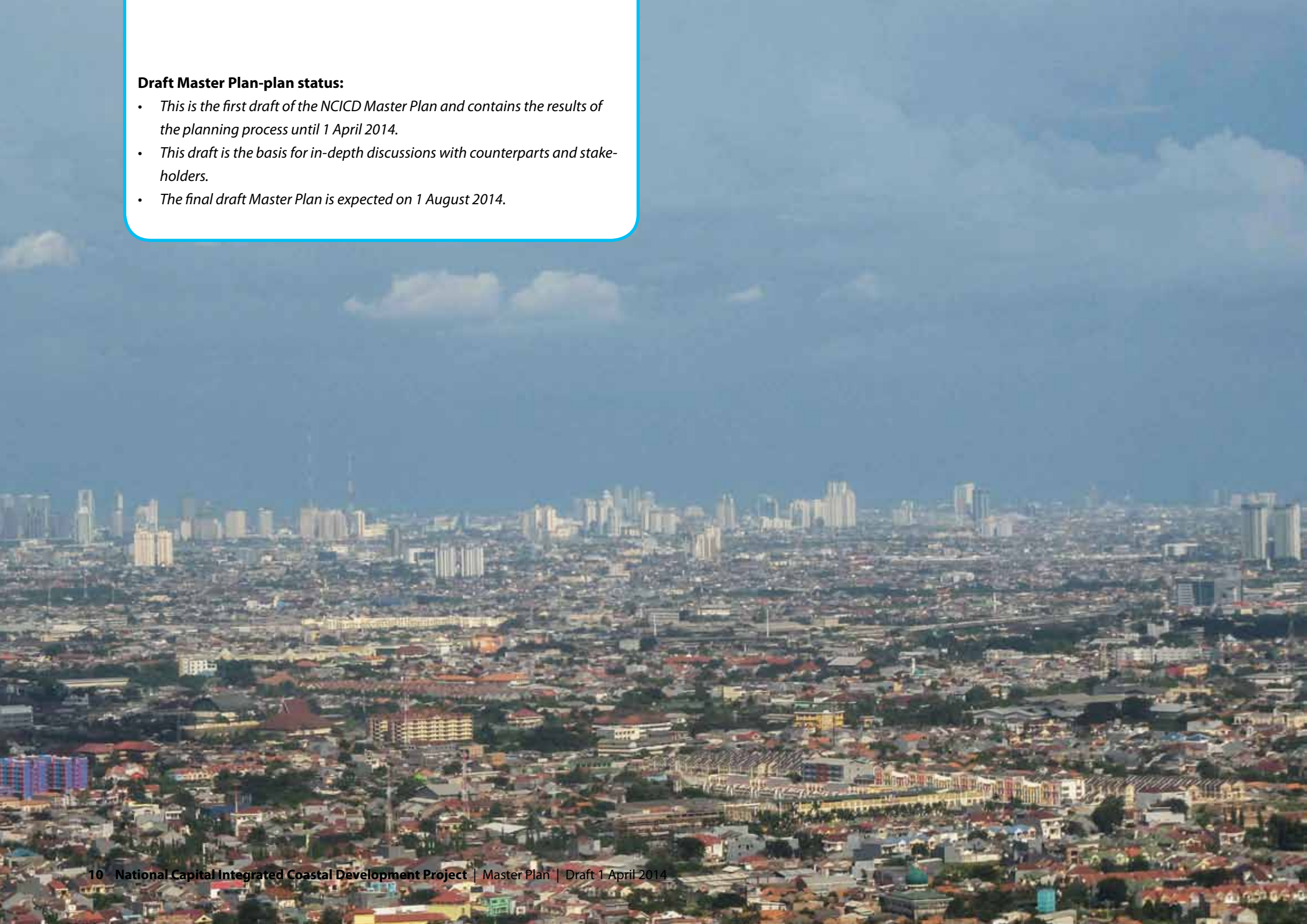
index

0 PREFACE

Draft Master Plan-plan status:

- *This is the first draft of the NCICD Master Plan and contains the results of the planning process until 1 April 2014.*
- *This draft is the basis for in-depth discussions with counterparts and stake-holders.*
- *The final draft Master Plan is expected on 1 August 2014.*

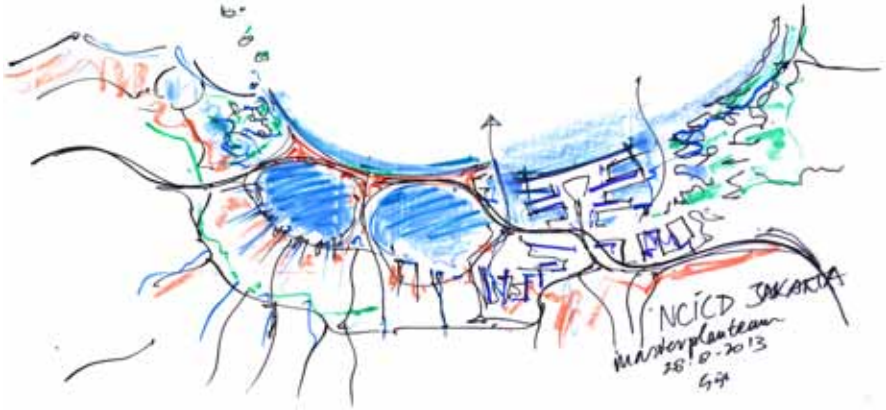


This is the Master Plan for the Integrated Coastal Development of the National Capital Jakarta. The plan aims to provide a solution for long term protection of Greater Jakarta against flooding from the sea. But this plan provides much more than that. It creates new space to the National Capital, by expanding seaward in a planned matter. It helps to solve the current connectivity problems of West-Java and Banten and addresses many of the current environmental problems.

The same sea that is now a threat will be used in many ways to benefit the National Capital, and the country as a whole. JJakarta Bay provides room for a new city district that accommodates over 1.5 million people from all income classes and a National Tangerang-Bekasi Highway that connects the provinces Jakarta, West-Java and Banten. The bay is also used to expand the port and strengthen the existing fisheries, thus stimulating economic growth. The bay will be converted into a large waduk (retention lake). It contributes to alleviate the urban floods and river floods which have affected the National Capital for so long, and will also serve as a sustainable source for drinking water for the citizens of Jakarta.

PROVIDE A SAFE ENVIRONMENT FOR THE PEOPLE OF JAKARTA TO SURVIVE, LIVE AND THRIVE. CREATE AN ENDURING, SUSTAINABLE FOUNDATION TO BUILD THE FUTURE OF THE CITY. RISE TO THE CHALLENGE OF THE WATER FROM THE SEA AND THE RIVERS.

The shape of the Great Garuda was chosen as iconic design for the planned coastal defence and land reclamations. The Garuda will protect the city and will bring safety and prosperity to the National Capital. It will offer Greater Jakarta a new image clearly visible and recognizable from the sky. A capital ready for the 21st century. To be proud of and to be enjoyed by all.



The Master Plan was developed under direct guidance of the Coordinating Ministry of Economic Affairs, National Development Planning Agency, Ministry of Public Works and the Special Capital Region of Jakarta and is the result of the long term cooperation between the governments of Indonesia and the Netherlands in the field of water management.

This Master Plan is an important step towards implementation. It provides a worked-out, well founded development and implementation model for the new city. It is a strong framework and starting point for feasibility studies on various components and detailed designs. It provides also a good basis for funding and contracting stages.

INTRODUCTION

1.1.
2007: A different flood

The 10 million inhabitants of the Jakarta metropolitan area (Indonesia) are used to flooding in the rainy season. Sedimentation and waste accumulation, combined with peak river discharges, create occasional floods in the 13 rivers and canals flowing through the low lying urban delta. Street flooding caused by heavy rainfall is a more common event, as the city struggles to keep the urban drainage system in pace with urbanization. However, in November 2007 North Jakarta was hit by a different flood. A high tide over-topped the sea wall on several locations and sea water was rushing through the streets creating high waters up to 1,5 metres deep for several days.

This flooding from the sea confirmed what some researchers already had been warning for: North Jakarta is subsiding at a staggering speed of 7,5 centimetres per year on average. In some parts subsidence rates even go up to 17 centimetres per year. Large parts of the city, including the coastal defences, are subsiding further and further below sea level.

In 2008 the existing sea wall was reinforced, but due to the subsidence this sea wall is already at a critically low level. Overtopping at high tide is expected within the coming years.

FACTS:

- *In November 2007, North Jakarta was hit by the first major flood from the sea. Land subsidence in North Jakarta is the underlying cause of this flooding. The average rate of subsidence is 7,5 centimetres per year, but in some coastal areas a subsidence rate of 17 centimetres per year has been measured.*
- *The 2007 floods caused an estimated damage of $544 million. Moreover, 76 people were killed and over 590,000 refugees were registered. In the same year a flood from the sea took place.*
- *Large scale deep ground water extractions are most likely the major cause for this land subsidence.*
- *In 2008 a sea wall was created, but due to the subsidence this sea wall is already at a critically low level. Overtopping at high tide is expected within the coming years.*

1.2.
Main goal

For several years Indonesia and the Netherlands have been working together to reduce and prevent floods in the National Capital of Indonesia. This collaboration resulted in the Jakarta Coastal Defence Strategy (JCDS) in 2011. Bilateral cooperation is continued in the National Capital Integrated Coastal Development (NCICD) project.

The JCDS project and the first phases of the NCICD project concluded that:

- strengthening the existing seawalls and upgrading the drainage pumping capacity can no longer provide sufficient protection for the long term. Moreover, space in Jakarta is too limited to create the required large storage basins. An offshore solution for flood protection has become inevitable to protect the city against floods from the sea and rivers in the coastal zone.

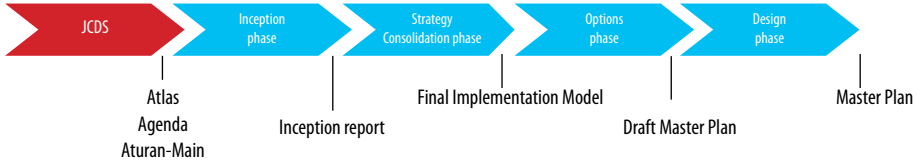
- an offshore solution offers many opportunities for the development of the coastal zone and to contribute to the socio-economic development of the National Capital of Indonesia as laid down in the MP3EI plan.

The main goal of the NCICD Master Plan is therefore to offer Jakarta long term protection against flooding from the sea and rivers in the coastal area, and at the same time facilitate socio-economic development.

Realising this goal requires an integrated planning approach. This Master Plan is therefore a Master Plan for both flood protection and for coastal development.

1.3.
From JCDS to Master Plan

This draft Master Plan of the National Capital Integrated Coastal Development (NCICD) project contains the results of the planning process in the period January 2013 - March 2014.



The NCICD project follows the Jakarta Coastal Defence Strategy project that resulted in a strategy for flood protection. In the Strategy Consolidation phase of the NCICD project, assumptions underpinning the Strategic Direction and design aspects of the Strategic Direction were researched. Conclusions from this additional research led to an optimised version of the JCDS: the Final Implementation Model (FIM).

FURTHER READING:

- *JCDS reports (2011): Atlas, Agenda, Aturan Main*

This draft Master Plan was developed on the foundation of the FIM. Further research into spatial aspects, engineering of solutions, financial and economic aspects and environmental impacts was done to further substantiate the choices made in this Master Plan.

The Master Plan is not the final planning stage. After approval, detailed designs and feasibility studies for components will have to be prepared, either by the Indonesian government or by private investors. Also funding and contracting procedures will require additional planning or revision of existing plans. This will be further elaborated in the final draft Master Plan.

THE MASTER PLAN

2.1.
Purpose of this master plan

This Draft Master Plan was developed as a basis for stakeholder and political consultation regarding the direction of development. Based on this process the final draft Master Plan will be finalised before 1 August 2014.

The purpose of the Master Plan is threefold:

- provide a worked-out long term flood safety model which also provides excellent socio-economic opportunities for the National Capital;
- provide a design for urban development with underlying business cases as development framework;
- provide a road map for implementation.

The Master Plan is the second step in a series of decision making steps which started with the Jakarta Coastal Defence Strategy. By adopting the Master Plan, the Government of Indonesia, the Special Capital Region of Jakarta and the Provinces of West Java and Banten establish it as the framework for further spatial, institutional and financial planning and commit to further elaboration. Next steps include adjustment of existing plans and execution of impact- and feasible studies, which will provide further information for final investment decisions.

Considering the urgency, the Government of Indonesia and the Special Capital Region of Jakarta should jointly decide on the rapid execution of the Phase A measures. Recommended is that groundbreaking will take place in July 2014.

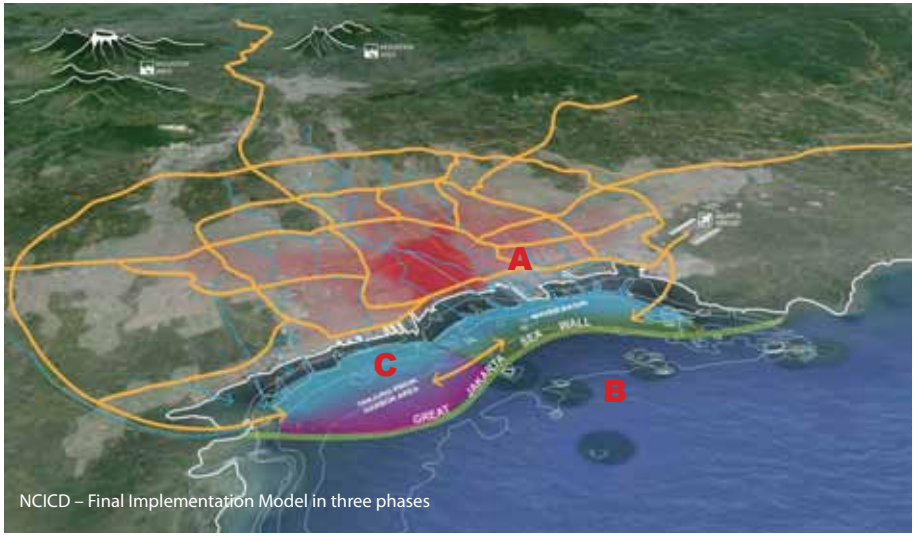
2.2.
Scope

The Master Plan focuses on the design and functioning of the flood risk solutions incorporated in an integral design for socio-economic urban development. The designs include the sea defences and the seaward development of the city. This Master Plan specifically deals with floods from the sea. Urban floods due to heavy rain in the city or river floods are outside the scope of this Master Plan.

The plan focuses on the coastal zone of Jakarta Bay and encompasses territory of the provinces Jakarta, Banten and West Java. It comprises developments on and adjacent to the existing sea- and river defences in the coastal zone, and off shore protection measures and urban development.

Measures are designed to be able to deal with conditions up to 2080.

The Master Plan includes plans and conceptual designs for three phases: phase A comprises the existing sea defences, phase B the outer sea wall and land reclamations, and phase C the long term development in the east of Jakarta Bay. Phase C has only been worked out in sketch designs as this development is far into the future and contains many uncertainties.



NCICD – Final Implementation Model in three phases

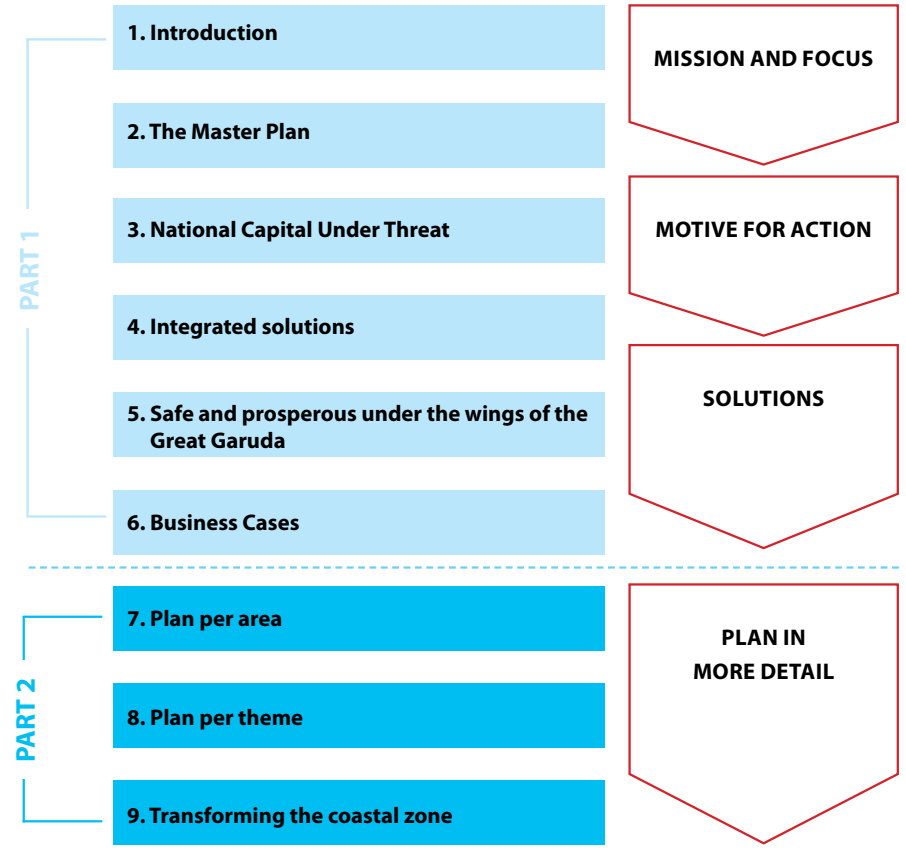
Supporting measures as improving the water quality in the city and providing piped water supply to reduce ground water extractions and subsidence, are considered in the Master Plan. Existing plans were evaluated and information from stakeholders was obtained and incorporated. Additional design of systems, planning and cost calculations, however, are not part of this Master Plan.

2.3.
Composition of the report

This Master Plan is divided in two parts. Part 1 describes the flood risks, urban challenges and the solutions at headlines. Part two goes into more detail on the plans per theme and per subarea. The structure of the Master Plan is shown in the figure on the right.

The Master Plan is based on many underlying analyses, calculations and further elaborations. These are bundled in six separate reports:

1. Engineering report
2. Upgrading existing sea defences
3. Spatial planning & urban design
4. Financial and economic study
5. Strategic environmental assessment building blocks
6. Implementation plan has been separately reported.



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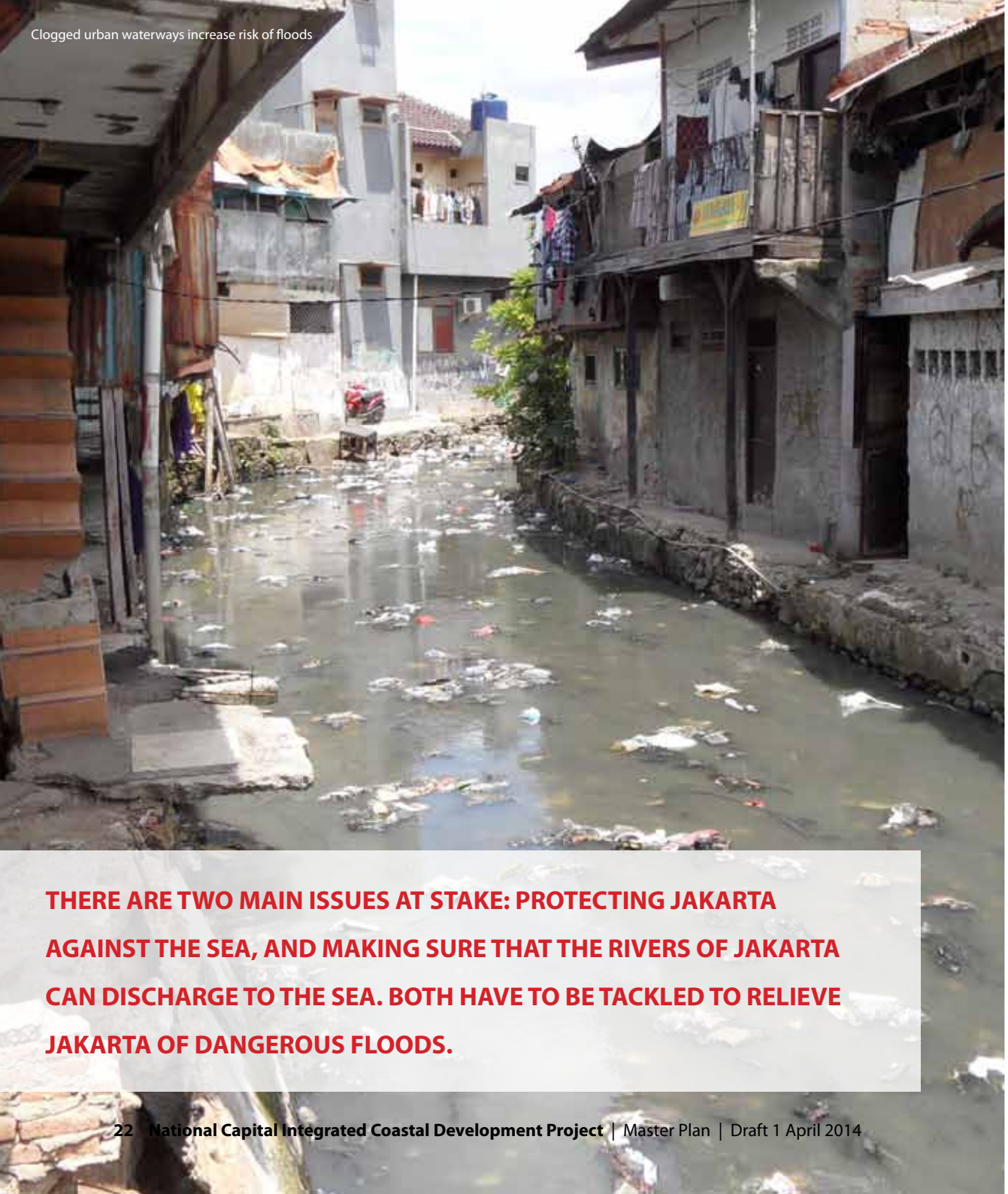
NATIONAL CAPITAL UNDER THREAT



Clogged urban waterways increase risk of floods

Inadequate constructions lead to risks

THERE ARE TWO MAIN ISSUES AT STAKE: PROTECTING JAKARTA AGAINST THE SEA, AND MAKING SURE THAT THE RIVERS OF JAKARTA CAN DISCHARGE TO THE SEA. BOTH HAVE TO BE TACKLED TO RELIEVE JAKARTA OF DANGEROUS FLOODS.

3.1.
Floods: the reason behind this Master Plan

Jakarta currently experiences three types of floods. The first type of flood is the result of insufficient water storage whereby heavy rains overwhelm inadequate drains. As excessive rainfall in the city flows towards the low lying coastal zone, this area is especially vulnerable for this type of floods. A second type of flooding comes from rivers or canals as a result of high discharges upstream. At many places the capacity of the water system cannot cope with peak demands. River dikes in many places are not high or strong enough and rivers, streams and pumps become clogged with sediment and garbage. As a result rivers overflow. The third type of flooding comes from the sea when sea dikes, and river dikes in the coastal area, are not high or strong enough. When the sea is at its highest, these dikes overflow, and sea water floods the city as happened in 2007.

This Master Plan aims to protect against this third type of floods. In the current situation floods of this kind are imminent as the flood defences of Jakarta are inadequate: preliminary surveys from 2013 indicate that currently over 40% of the coastal flood defences is not able to withstand the highest high water spring level (HHWS)[1].

Because of the ongoing subsidence in Jakarta's coastal zone, flood risks increase. Tackling of this issue is becoming increasingly difficult:

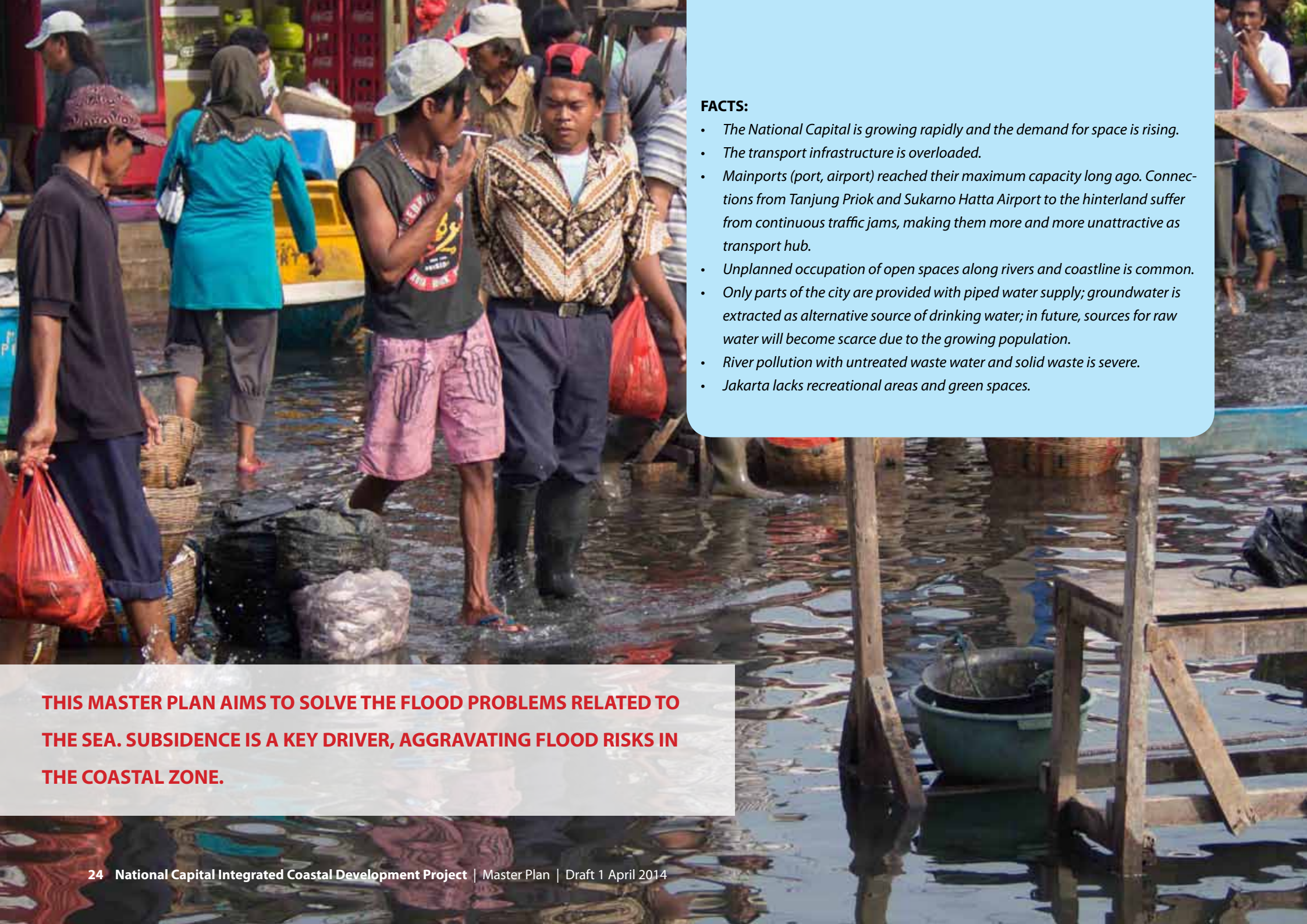
- due to severe subsidence, sea water levels will be between 3 to 5 metres above street level in 2050.
- as rivers and canals subside with the land levels, it becomes increasingly difficult to discharge excess water under gravity into the sea. Already, the polders of Jakarta make use of large pumps. In the near future, large scale drainage pumps with major pumping lakes with a total size of thousands of hectares will be needed to discharge the water of all other rivers, including the large Banjir Canals.

FACTS:

- *The sea defences are currently inadequate. Immediate risk is that due to subsidence the sea level will become higher than the defence: they will overtop during high tides in the coming years.*
- *Immediate action is required. Phase A of the Master Plan therefore includes raising the existing sea dikes. Also the dikes along the main rivers that are in open connections to the sea will be raised. This solves flooding problems until 2022. During this period, measures must be taken to reduce land subsidence.*
- *It is likely, however, that the process of subsidence will continue in a high rate for some years. Around 2025, over 10% of West Jakarta has subsided below the critical level of 2,5 m below the Highest High Water Spring level (HHWS). In areas below this level, casualties are likely to increase significantly in case of a flood, as fleeing to roofs will become more and more impossible.*
- *But ongoing subsidence leads to a second problem: also rivers subside which reduces their capacity to discharge water into the sea.*
- *When heavy rains will fall over Jakarta, peak river discharges have to be transported to the sea.*
- *Eventually river dikes will overtop or break and the river and sea water will flood the coastal zone which by than will be 3 to 5 metres below sea level.*
- *Damage and loss of life will be of dramatic magnitudes...*
- *A robust, sustainable solution is required.*

If no measures are taken, a large part of the coastal zone is under threat of permanent inundation. In this area, the lives of 4,5 million people are at stake. Material damage due to permanent inundation is calculated at $103 billion for loss of land and buildings only; the damage to the economy will be even greater. In addition, frequent flooding could cause reputation damage, leave of economic activities and an increase in insurance fees.

[1] The highest high water spring level is the highest level that spring tide reaches in a cycle of 18 years



FACTS:

- *The National Capital is growing rapidly and the demand for space is rising.*
- *The transport infrastructure is overloaded.*
- *Mainports (port, airport) reached their maximum capacity long ago. Connections from Tanjung Priok and Sukarno Hatta Airport to the hinterland suffer from continuous traffic jams, making them more and more unattractive as transport hub.*
- *Unplanned occupation of open spaces along rivers and coastline is common.*
- *Only parts of the city are provided with piped water supply; groundwater is extracted as alternative source of drinking water; in future, sources for raw water will become scarce due to the growing population.*
- *River pollution with untreated waste water and solid waste is severe.*
- *Jakarta lacks recreational areas and green spaces.*

THIS MASTER PLAN AIMS TO SOLVE THE FLOOD PROBLEMS RELATED TO THE SEA. SUBSIDENCE IS A KEY DRIVER, AGGRAVATING FLOOD RISKS IN THE COASTAL ZONE.

FURTHER READING:
The B.1 Engineering Report and the underlying technical reports describe the situation regarding flood safety in more detail

3.2.
Urban challenges

Jakarta has grown far beyond its administrative borders. But especially in the functioning of the city, boundaries are being surpassed. The coastal zone is facing serious challenges.

The road system of the city is at times paralysed by heavy traffic. Travelling times for commuters are stretching because of distance and especially because of heavy traffic. Not only growth in numbers, but also an increase in car-ownership leads to more cars on the road. In the period 2002-2010, car ownership has increased from 17 to 25%, and the ownership of mopeds increased from 34 to 72%. Road infrastructure and especially public transport infrastructure haven't kept up with the cities growth and this is putting a serious strain on the economic growth of Jakarta. In example, several links in the ring road system are missing and the MRT-project has not yet been completed. Also growth in the east-west corridor of western Java as a whole is affected as access to the port of Tanjung Priok and the Sukarno-Hatta airport is seriously affected by traffic. Traffic under normal conditions is bad, when floods occur traffic comes to a grinding standstill.

Another pressing issue is the availability of space for development as a whole. The metropolitan area of the city is still growing rapidly and space for as well residential as business related real estate development is limited and increasingly expensive. Growth takes mainly place in Bogor, Depok, Tangerang and Bekasi, making it a multi centred city often referred to as Jabodetabek.

The main ports of Jakarta are reaching their maximum capacity. Improvement of hinterland connections and extra space for future development of airports and harbours are required to streamline economic development according to the goals of the Master Plan for the Acceleration and Expansion of Indonesia Economic Development (MP3EI).

As a consequence of a process of uncontrolled densification, many open spaces have turned into slums that lack proper roads, drainage and water supply facilities. Informal settlements have developed along the water's edge around retention basins (waduks), the rivers and the coastline and are in a dilapidated state. Floods currently hamper the development of these areas. With a growing economy and increased income per family, the availability of sufficient low-cost housing is key to further development of the growing population.

The city struggles to supply clean water to its citizens and companies. Providing clean water is one of the key factors for economic development. Only part of the city is served with piped water supply. In addition many legal and illegal ground water pumps are installed, being the main cause for land subsidence. DKI Jakarta therefore aims at full coverage of piped water supply in 2030 which will be an enormous challenge. Additional sources for raw water of about 7 m3/s in 2030 are essential, as the availability from current sources will not be able to meet future demands.

Also considering the living environment Jakarta has reached boundaries. Pollution of rivers by industry and households, garbage dumping and smog are pressing issues. Most of the existing retention ponds have been polluted by human, industrial and commercial waste and garbage. They often clog the drainage system, they form a very untidy sight with a bad smell and pose a health hazard. Black waters are disposed directly into rivers and the bay. In the slums, where even basic facilities are lacking, this leads to very unhealthy situations.

JAKARTA IS A THRIVING METROPOLIS, BUT FACES SERIOUS GROWTH CHALLENGES

Jakarta has an enormous lack of outdoor recreation possibilities: pleasant outdoor environments are limited. The availability of green space in the city has decreased from over thirty percent in the 1960's to around 10 percent now. The only notable preserved nature area is Muara Angke mangrove and the only notable recreation area is Ancol. The waterfront of Jakarta is now dominated by slums, fishing communities and gated communities. Creating a public and attractive waterfront is important for the appearance of the city as well as for the quality of life that the city can offer its citizens and visitors for leisure and business. Thereby green and parks contribute to the economy of the city as well.

FURTHER READING:

- *The JCDS Atlas report provides a detailed urban analysis of the National Capital.*
- *For more detailed information on traffic see report B3b Transport System. In this report the current situation, trends and the directions towards relieving the traffic situation are worked out.*
- *For more information on expected demands for real estate see Report B4 Financial and Economic Study.*
- *The situation regarding slums and social housing is worked out in the C5.3 report on Social, Environmental and spatial impacts.*
- *Water quality issues are analysed in report C5.1.*

IV

INTEGRATED SOLUTIONS

TEN AMBITIONS FOR URBAN DEVELOPMENT:

1. *protect Jakarta's coastal zone against flooding from the sea;*
2. *provide new space for seaward growth of Jakarta and thereby generate revenues for the flood management measures;*
3. *create a new, attractive waterfront city overlooking Jakarta Bay;*
4. *provide housing and employment for all economic classes in order to decrease disparity between rich and poor;*
5. *improve connectivity, by establishing missing links in the public transport and road infrastructure (the Tangerang-Bekasi Highway);*
6. *improve the conditions for marine economic sectors, like fisheries and ports;*
7. *provide a healthy and pleasant living environment for Jakarta's citizens and visitors as an important factor for attracting foreign investment by improving water quality, waste management, environmental conditions and by providing green space for recreation;*
8. *contribute to solving the pressing raw water supply issues of the National Capital;*
9. *be leading regarding sustainable design in Indonesia by developing sustainable systems related to the water cycle, transportation and power supply;*
10. *be truly Indonesian in its design, reflecting Indonesian culture as a symbol for the National Capital.*

The problems in the National Capital are deeply interrelated and need to be solved applying an integrated approach. This holds for both strategic urban development issues, as well as solving practical problems like providing alternative housing for the low-income residents living on the sea walls when current sea walls are strengthened. At the same time, an integrated approach offers opportunities, finding synergy between solutions for social issues.

4.1.
Mission

The mission of this Master Plan is to integrate flood safety solutions with urban development, thus solving urban problems and at the same time generating revenues to finance flood protection. This Master Plan therefore is more than a flood management plan. It aims to be a catalyst for development of the coastal zone. The urgent need for a sea wall for flood protection provides the anchoring point for such an integrated plan. But what kind of urban development is envisioned? Ten main ambitions for urban development are presented in the boxon the opposite page.

4.2.
Approach

So in the approach of the Master Plan, developing a solution for the flood safety problem is the central goal of this Master Plan. Flooding needs to be solved urgently and therefore is the catalyst for other developments. As a foundation for the Master Plan, the best hydraulic solution for the flooding problem has been developed, including short term (no-regret) as well as long term solutions.

But at the same time, the hydraulic solutions are combined with land reclamations, toll roads and port expansion. These combinations contribute both to the urban development ambitions of the coastal zone, as to generating revenues to

finance flood protection measures. Investment opportunities have been optimised to create maximum revenues, balancing possible revenues and market absorption of real estate.

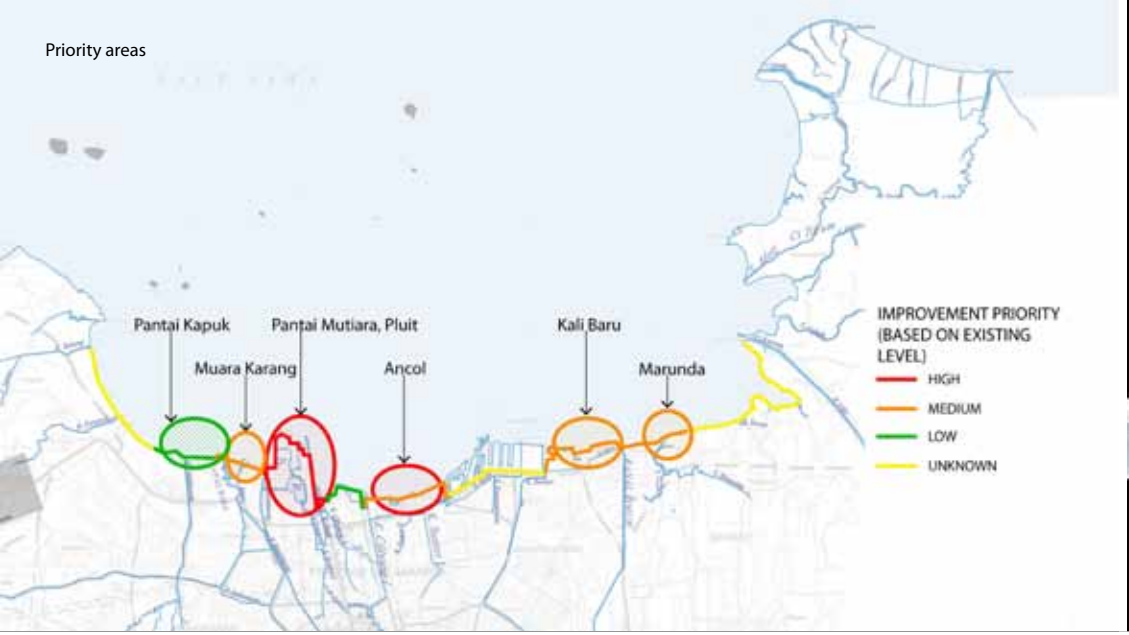
4.3.
Short term no regret measures

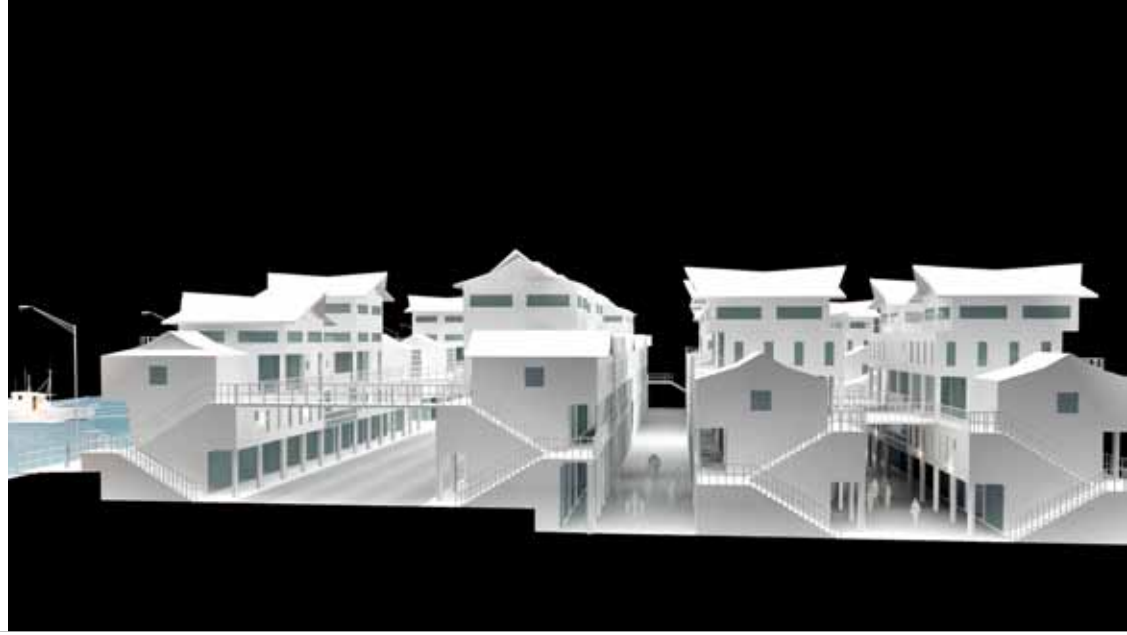
Short term actions for flood defence are urgent. Sea defences will overtop in the coming years and there is no time to lose. The measures mentioned below are urgent no-regret measures.

Reinforce current defences

Implementing sustainable solutions will require considerable more time than available. Therefore the current sea and river defences have to be strengthened and heightened by at least 1,5 meters to provide time. As subsidence slowly

Priority areas



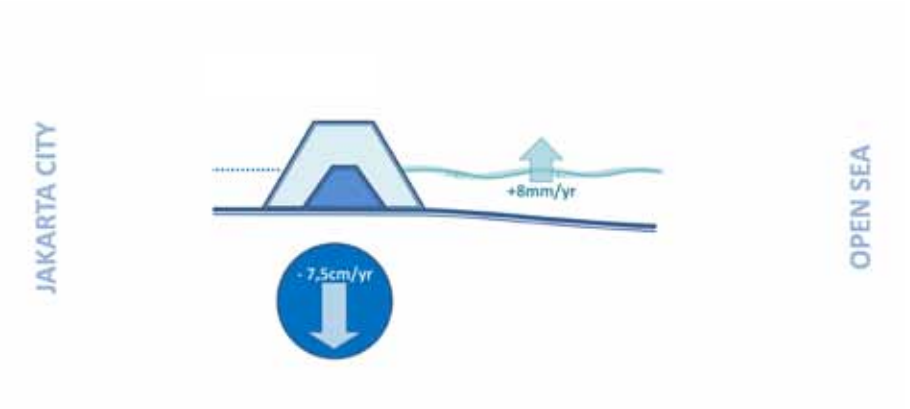


lowers the flood defences, this provides protection until 2022, allowing time to develop more robust solutions.

Action is most urgent near Pluit, Pantai Mutiara and along Ancol. At these locations protection levels are so low that overflow may occur under normal yearly conditions already. Given the critical situation, preliminary designs have been made during the development of this Master Plan. For this purpose, Northern Jakarta and its surroundings has been divided in a system of 7 dike rings that protect the area within from inundation . [1]

For 5 rivers and canals [2] , Dinas Pekerjaan Umum (public works of the City of Jakarta) is already preparing the construction of new pumping stations that will closed them off from Jakarta Bay: water will no longer flow under gravity but will be pumped out to the bay. Closing off these rivers significantly reduces the length of river embankments that needs to strengthened. While these embankments are situated in dense urban areas, this also reduces the number of people that needs to be resettled. For this reason, this measure is also recommended for the Kali Grogol, Kanal Ancol and Kali Sunter.

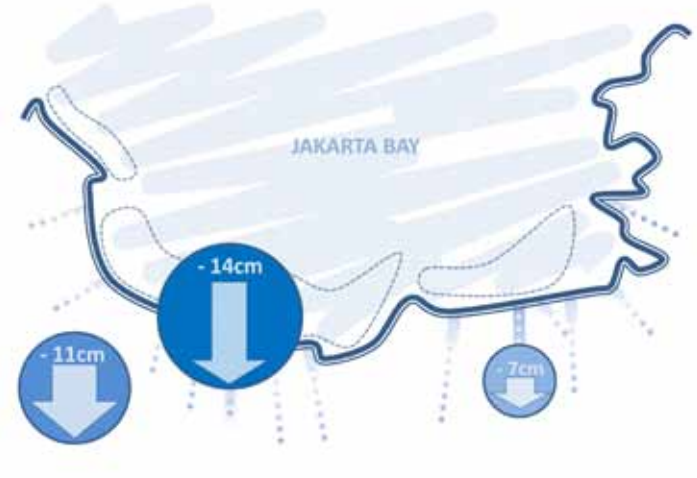
Implementation of dike reinforcement will start in 2014. At many locations, the available space for dike improvements is limited. Therefore designs were made that are integrated in the dense urban environment. Where possible, functions will be combined with or on these dikes.



Phase A (2015)

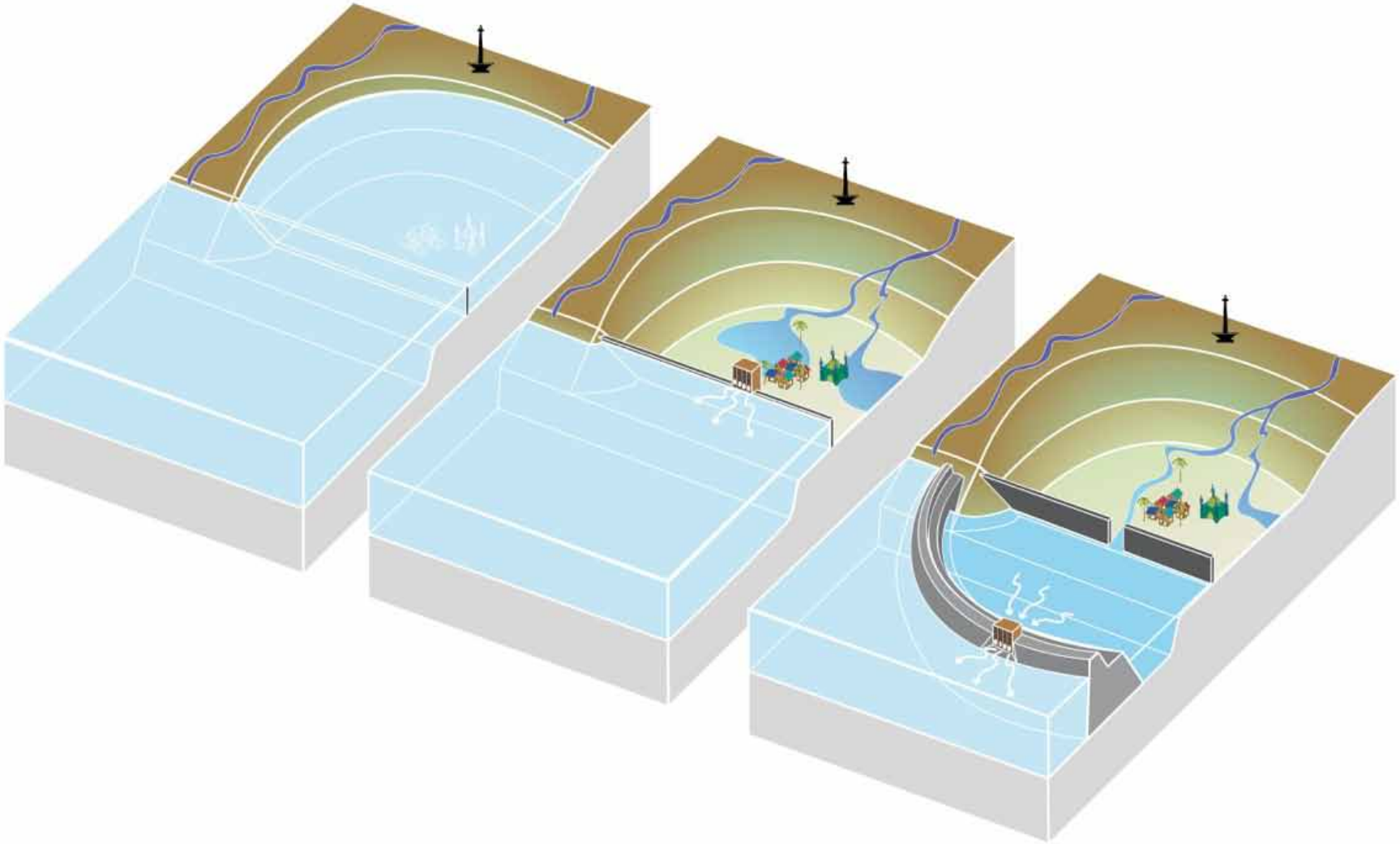
Slow down subsidence through piped water supply

At the same time, in any scenario it is essential to stop the cause of increasing flood risks, and reduce subsidence. In all of the coastal zone subsidence is severe. In the central and western part of Jakarta bay subsidence currently amounts on average 7,5 cm per year. Towards the east of the coastal zone, subsidence is less: around 3 cm per year.



[1] A ring dike is a closed system of measures (i.e. dikes, higher grounds, gates, etc.) to protect the area within from inundation.

[2] Kali Kamal, Kali Angke, Kali Muara Karang, Ciliwung and Kali Sentiong



Three principal solutions: a. abandon The National Capital, b. onshore protection by high dikes and large city waduks and c. offshore sea wall with large offshore waduk

FURTHER READING:

- *Technical report C1.5 Ground water & subsidence evaluates the subsidence problem.*

Subsidence, to a large extent, is caused by ground water extractions, which must be stopped and replaced by piped water supply. Not stopping subsidence means that Jakarta's coastal zone is subsiding deeper and deeper below sea level, making solutions for the flooding problems increasingly difficult and expensive. Stopping subsidence successfully or slowing it down significantly is enormously beneficial: significant reduction of subsidence before 2020 can postpone investments for long term solutions, or make this unnecessary altogether. This will probably not be feasible anymore for the western part of Jakarta, but it is for the eastern part. However, the challenge is big as also this area is quickly urbanising making an increase in groundwater use likely. To regularly assess the need for high investments in long term measures, subsidence should be thoroughly monitored.

Improve water quality

Currently the rivers and the Bay of Jakarta have serious water quality problems. Concentrations of oxygen are low due to heavy pollution with organic material and human waste, resulting in toxic situations for fish and other aquatic species. Concentrations of nutrients and heavy metals surpass standards by far. The smell of untreated waste water covers large parts of Jakarta. Unhygienic situations are common in the small streets of the kampongs. Improving the water quality is pressing and prerequisite to create an attractive, healthy and viable waterfront city. It is also conditional for using urban water as source for raw water. Therefore a integral water quality improvement program should be started, comprising waste water treatment, solid waste management, dredging and non structural measures. Acceleration of the existing sanitation Master Plan is required to meet the national ambition of full sanitation coverage in 2020.

Additional hydraulic measures

Additional upstream measures help alleviate flood risks in the coastal area: diversion of water coming to Jakarta, improving the city drainage system (allowing better through flow), adding more retention to the system and improving the drainage pumping capacity.

4.4.
Principal long term solutions

If subsidence is not stopped in time, additional solutions are required to offer flood safety to the citizens of North Jakarta. Three principal long term solutions have been considered: abandoning North Jakarta, onshore dike reinforcement and an offshore solution.

Abandoning North Jakarta

One line of thought could be to abandon North Jakarta. This would only be a viable option if the benefits of coastal protection wouldn't outweigh the costs or if no feasible technical solution would be available. Economic study shows that abandoning the zone at risk of flooding would mean that 4,5 million people would have to be reallocated and that USD 103 billion worth of land and real estate in an already densely populated metropolitan area would be lost.

Abandoning North Jakarta is therefore not considered a desirable nor a viable option, as the invested capital and the number of inhabitants simply is too large. The avoided material damage of USD 103 billion justifies a considerable investment in flood safety.

Onshore solution

An onshore solution signifies protecting the city with a huge sea wall on the

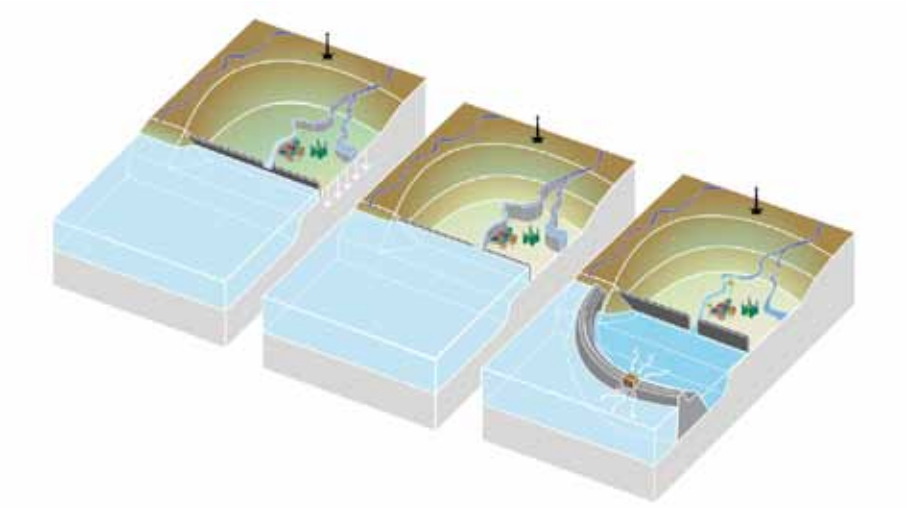
current coast line and adjoining equally high river dikes. The polders in the coastal zone will become increasingly deep. High dikes along the rivers, far inland, and the sea (up to 7 meters in the long term) will be necessary to keep the water from flowing into the polders. All crossings of rivers will have to be elevated up to several meters high, requiring space for long and high access roads. In addition, around 10 thousand hectares of retention ponds and a large pumping capacity will be required to keep the polders free from flooding.

Implementing this option means drastic measures in the existing densely populated city. Building these dikes and retention ponds requires displacing many people. Because of subsidence, the amount of land needed for retention would increase in time. In 50 years time, only a 50 metres wide sea wall will separate North Jakarta from the 5 metres higher sea. If this dike does break, consequences will be disastrous. It is unlikely that in that situation evacuation is possible and the casualty risk is high. In addition, thousands of hectares of retention ponds and a large pumping capacity will be required to keep the polders free from flooding.

Offshore solution

An offshore solution consists of a outer sea wall in the Bay of Jakarta, creating the required huge pumping lake (giant waduk) offshore. By combining the sea wall with land reclamations, a robust and unbreakable sea defence can be made. The retention lake behind the dike will have a lowered water level which facilitates free discharge of rivers. Pumping installations keep the water level in the lake sufficiently low. However, this alternative poses new challenges. To realise an acceptable water quality in the giant waduk, pollution in the rivers has to be reduced with approximately 75%. The implementation of a sewage collection and treatment system in Jakarta's coastal zone needs to be accelerated considerably, requiring immediate action.

The giant waduk decreases the necessity for more waduks in the city. This option provides solid protection up to 2080, which provides time to reduce subsidence. In addition, this solution offers socio-economic development opportunities in line with the goals of the MP3EI as the dike can be combined with urban development. The dike and land reclamations make closure of the second and third ring roads around Jakarta possible. The giant waduk offers an additional source for raw water and opportunities for further harbour development are created. This solution requires a large investment, but can be financed through combination with the development of a waterfront city. This waterfront city will become the appealing water front that Jakarta deserves.



Implementation model

The offshore solution is the most robust solution. In addition this solution offers many possibilities to create added value for the city and funding through land reclamations.

The implementation model is phased: the reinforcement of the current coastline will start already in 2014. The closure of the bay is divided in two phases (phases B and C).

BASED ON THESE CONSIDERATIONS, THE OFF-SHORE ALTERNATIVE IS CHOSEN AS THE BASIS FOR FURTHER DESIGN. THIS MEANS DESIGNING AN OUTER SEA WALL AS A LONG TERM SOLUTION, INTEGRATED WITH A LARGE RETENTION RESEVOIR IN A REVITALISATION OF THE COASTAL ZONE

FACTS:

- *the offshore solution means closing off part of the bay of Jakarta with an offshore outer sea wall in Jakarta Bay;*
- *this sea wall protects against flooding from the sea and creates a large retention basin (minimum 7.500 ha);*
- *the water level in the lake is allowed to fluctuate by 2,5 metres to temporarily store river water and urban drainage water;*
- *around 2030 the giant waduk can even in the dry season of a dry year provide a raw water supply of 12 m3/s, assuming that waste water in Jakarta is effectively treated;*
- *the water in the retention basin will be kept at a low level using huge pumping stations with a capacity of around 730 m3/second: the biggest in the world;*
- *by lowering the water level in the retention lake, rivers are enabled to discharge to the lake under gravity, even after 2025 when sea water level is well above land levels;*
- *the implementation consists of three main phases. Phase A is the strengthening of the current sea wall and river dikes, necessary to keep Jakarta save for the following years. Phase B consists of closing the western part of the bay with an outer sea wall. In the western part of Jakarta subsidence is highest, making closing off the western part of the bay most necessary. Closing off the eastern part of the bay (phase C) will only be necessary in case efforts to slow down or stop subsidence in the east are unsuccessful. This will be a long term development that should be started depending on monitoring results.*

As subsidence is largest in the western part of the coastal zone, this area needs to be closed off first. Flood risks will become unacceptable in this area around 2025 as over 10% of the area west of Tanjung Priok harbour will be subside below the critical level of 2,5 meters below the highest high water spring level (HHWS). This level is chosen as a threshold value as with inundations of 2,5 meters even 'vertical evacuation' to roofs and first floors of houses becomes increasingly difficult, rapidly increasing the casualty risk. From this moment the western part of the outer sea wall need to be closed.

In the eastern part of the coastal zone subsidence is lower. The critical level will be reached beyond 2040, providing more time before closing off the bay becomes necessary and to reduce subsidence.

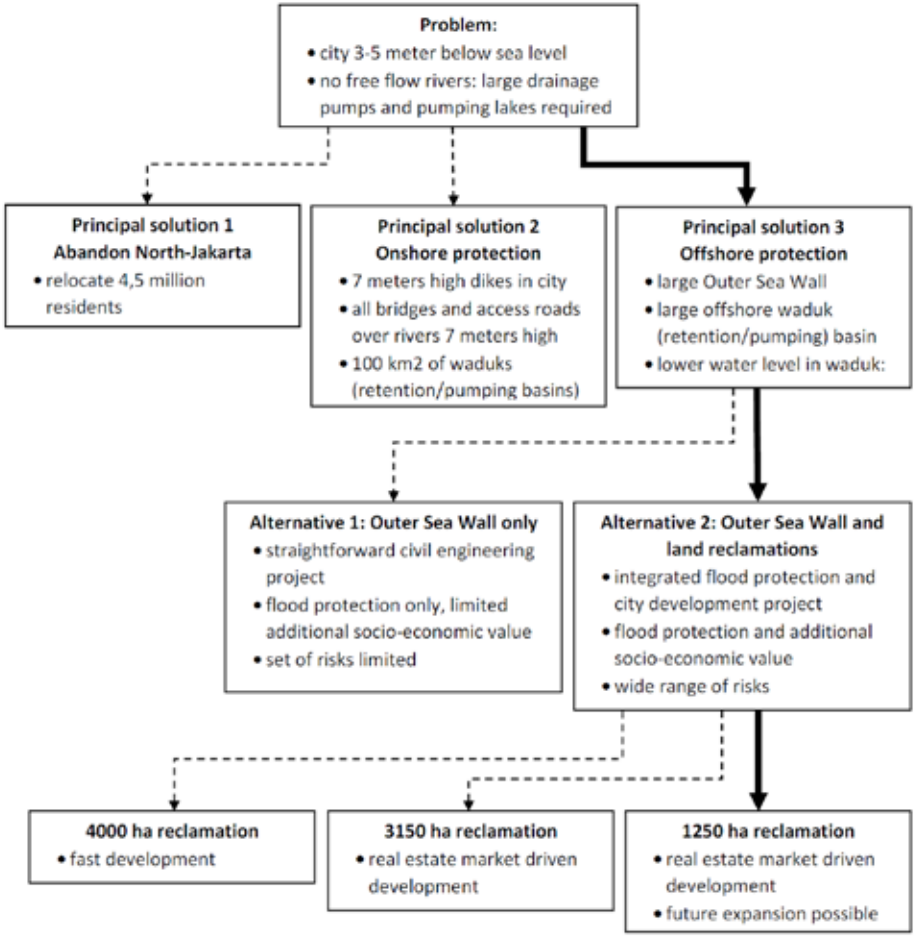
FURTHER READING:

- *Report B4. Financial and economic study*
- *Report C1.1 (Final Implementation Model) evaluates principal solutions and alternatives*
- *The hydraulic solution is worked out in B1. Engineering report*

4.5.
Spatial alternatives

With the offshore solution as a basis, several alternatives and options have been investigated regarding the combination of coastal protection measures and opportunities for spatial development (see figure on the next page). The basic and reference alternative aims just to protect the coastal zone against flooding, consisting off the outer sea dike including pumps and sluices and a toll road connecting east and west. Total costs for this alternative have been calculated at

minus $ 12 billion. Other alternatives focus on generating revenues to close this financial gap. They differ especially in the size of land reclamations and therefore opportunities for urban expansion. Alternatives of 1.250, 3.150 and 4.000 hectares have been studied and will be evaluated in the following chapter.
A strong wish of Indonesian government is to develop the flood defences in an integrated and cost neutral programme. The economic growth and the urban expansion of Jakarta provides opportunities to indeed do so and make combinations with the development of real estate, toll roads and harbour expansion. The 'outer sea wall only' alternative does not comply with this starting point as this project hardly generates any revenues.



Principal solutions, alternatives and options

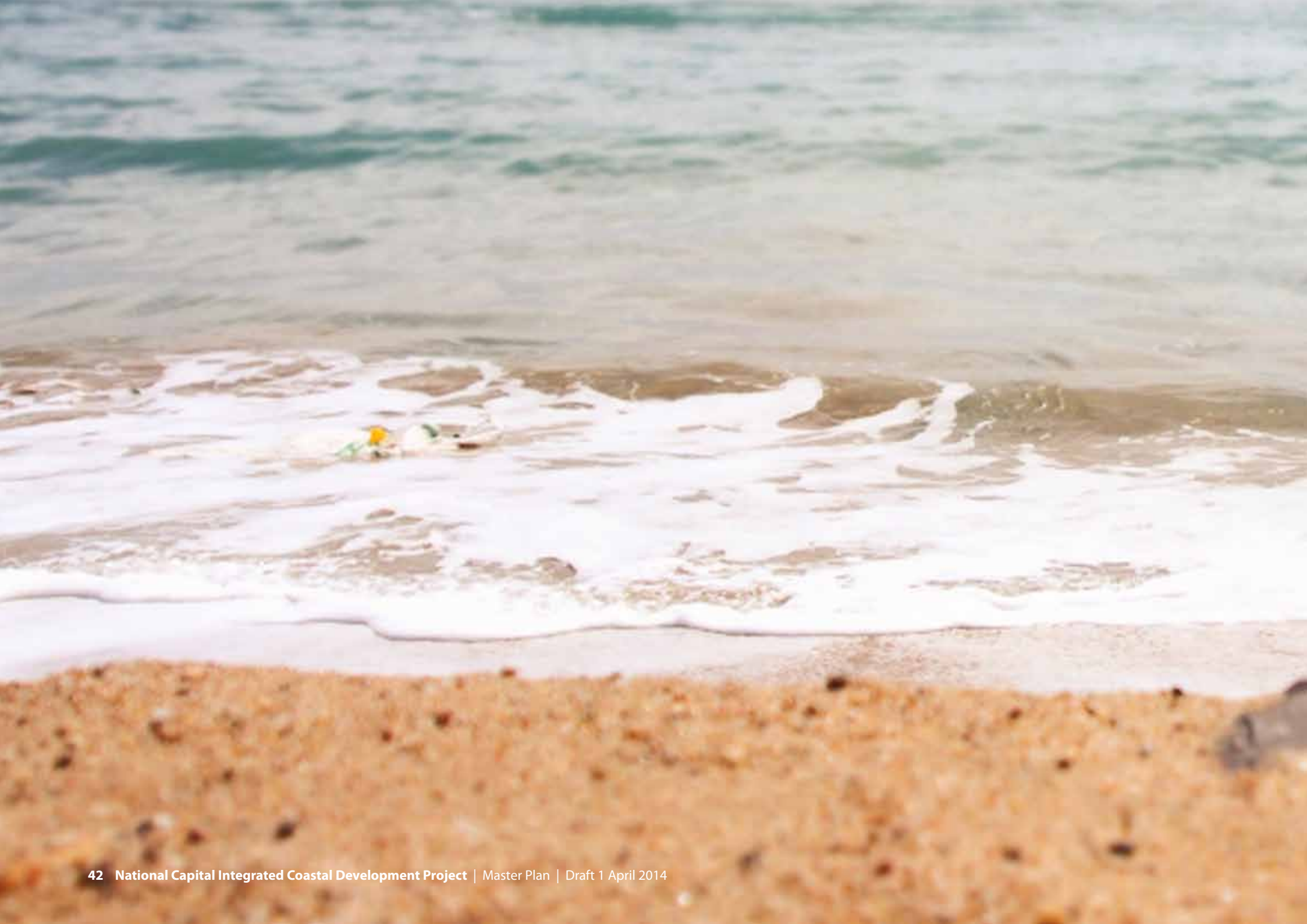
Preferred development: create a Waterfront City with a flexible approach

Building a city on the outer sea wall offers an enormous potential to solve multiple urban problems, and at the same time generate financial means. However, developing the sea wall already is a mega-project in all respects, let alone combining it with large scale land reclamations. Managing risks is of key importance. The two top risks influencing the business case are related to sand availability and economic growth. The development of the sea dike and the land reclamations in deep water (up to 18 metres) require large amounts of sand. The estimated sand reserves within a reasonable distance of the city are around 300 million m3. This is based on interviews with market experts. Further surveys are necessary to proof whether more sand is available. Another risk is the general economy: economic growth might cool down for a period of time and demand for real estate (especially offices) in such a period might be lower than now assumed. A lower demand for offices will have a negative impact on the financial return.

A flexible model is the best model to mitigate the main risks in the project. From this perspective, a model of 1.250 hectares of land reclamation is preferred which has the potential to be extended up to 4.000 hectares or more when the economic situation so allows. Depending on sand availability and market uptake of real estate the size of the project can later be amended to this maximum. The 1.250 ha alternative will therefore be the basis for further elaboration in the next chapter.

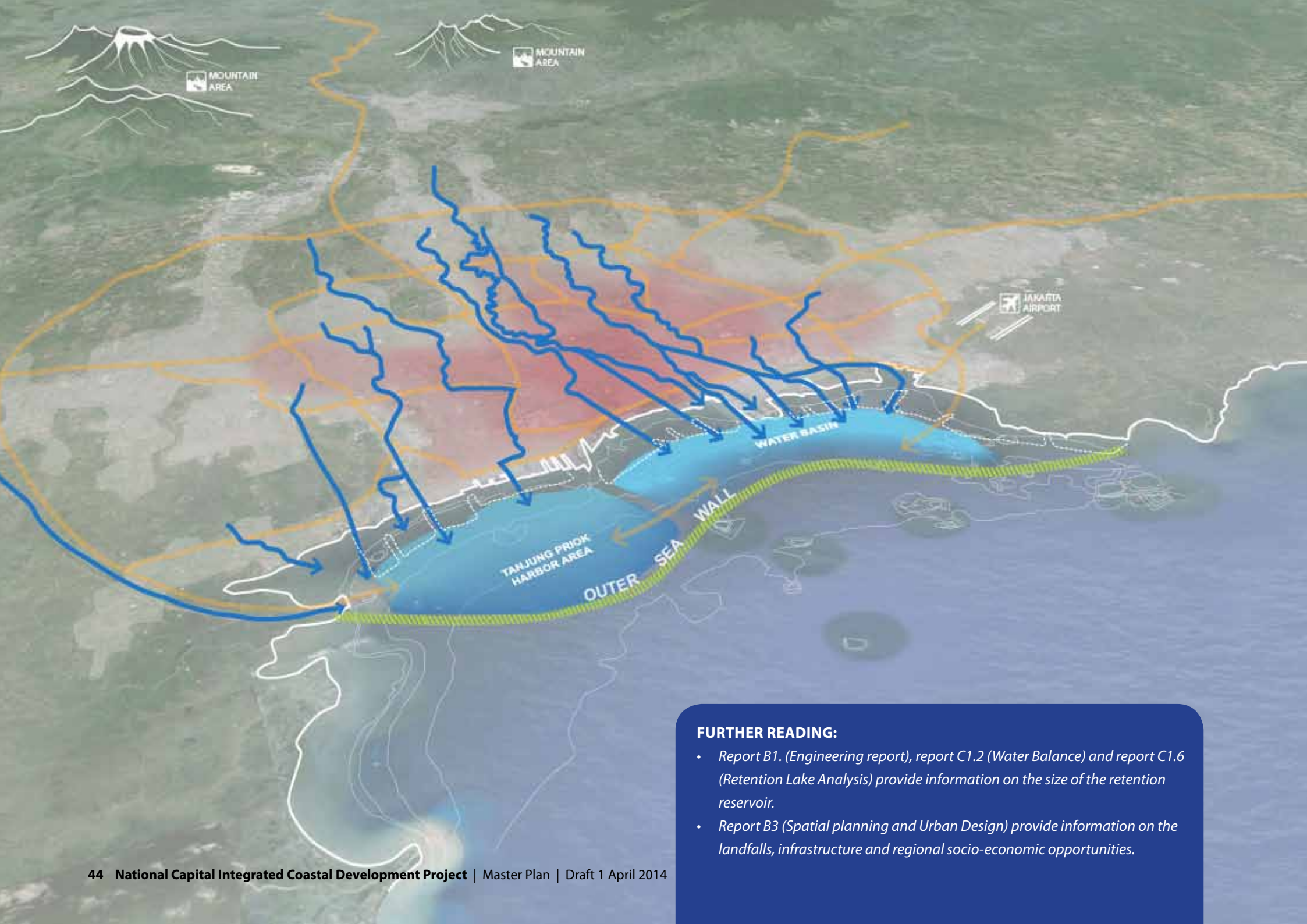
FACTS PREFERRED DEVELOPMENT

- *The estimated sand stock is 300 million m3. This amount of sand for construction purposes is assumed as a maximum in the business case, the design offers space for further development if more sand is available.*
- *The design integrates the spatial and socio-economic ambitions of the city.*
- *Phase A: improvement of the existing dike on the shore. Planning of work 2014-2018*
- *Phase B: construction of the outer sea wall including 1.250 ha land reclamation . Planning of the work 2018-2022.*
- *Completion of the missing northern links in the second and third ring road of Jakarta. Realisation of National Toll Road between Tangerang and Bekasi (2x4 lanes)*
- *Realisations of MRT between the city centre and new land reclamations, total length 11 km.*



V

SAFE AND PROSPEROUS UNDER THE WINGS OF THE GREAT GARUDA



FURTHER READING:

- *Report B1. (Engineering report), report C1.2 (Water Balance) and report C1.6 (Retention Lake Analysis) provide information on the size of the retention reservoir.*
- *Report B3 (Spatial planning and Urban Design) provide information on the landfalls, infrastructure and regional socio-economic opportunities.*

The final implementation model and the preferred development of a waterfront city of 1.250 ha are elaborated in a spatial design. The design strives to develop a waterfront city with a maximum added value considering the ten spatial ambitions described in chapter four.

This chapter focuses on the spatial design of the phase B development of the waterfront city. In addition it provides a vista on developments in phase C resulting in a development framework for Northern Jakarta. The design for short term measures of phase A is worked out in more detail in report B2. *"Upgrading existing sea defences".* For the locations Pluit and Kali Baru pilot designs have been made that serve as examples of how reinforcement of the existing dike and spatial planning can be combined.

5.1.
Sea Dike alignment

Starting point for the spatial design are the hydraulic and infrastructural boundary conditions for the alignment of the outer sea wall The alignment depends on the following conditions:

Size of the basin

The main reason for developing the outer sea wall far offshore is the necessity of creating a giant waduk. The required size of the waduk is mainly determined by the required capacity to buffer peak discharges of rivers and canals. It should also be large enough to act as raw water source for water supply. In addition, the lake should be large enough to create a robust system, in which natural attenuation and re-aeration processes contribute to an acceptable water quality. Based on these three arguments, the minimal required size is calculated at 7.500 ha.

Bathymetry and bay

As can be seen on the maps, the alignment for the outer sea wall follows the convex contours of the sea bed: to minimise costs by avoiding the deepest waters as much as possible and to connect to the natural shape of the coastline of North Java.

Land falls

The dike meets the land at Tanjung Priok Harbour. This important harbour should remain easily accessible from the sea. In the west the landfall is determined by the mouth of Kosambi river. This river remains in open connection to the sea, so that no additional water storage is required for this river.

Infrastructure development

Along the outer sea wall a long distance Tangerang-Bekasi Highway (toll) will be developed, as well as roads for local connections. These roads provide the missing links in as well the current east west connection (Trans Java Toll road) as in the current system of outer ring roads of Jakarta. The toll road essentially connects Tangerang and Bekasi, and the shorter the connection, the better.

Closure of the eastern part of Jakarta Bay can be postponed, or may still be avoided. The east west infrastructure connection however, is already required on a shorter term. For the eastern part of the bay, the design therefore includes a road connection. This connection does not necessarily follow the trajectory of a future sea dike: it is optimised from an infrastructure perspective.

THE GREAT GARUDA WILL BE THE PRIME LOCATION FOR INVESTORS. FOR NEW RESIDENTS IT WILL BE A NEW, MODERN PLACE TO LIVE AND FOR JAKARTA RESIDENTS THE PLACE TO ESCAPE THE CROWDED CITY WITHOUT TRAVELLING FOR HOURS AND SPEND SOME TIME ON THE WATER FRONT WITH CLEAN SEA WATER AND A FRESH BREEZE.

5.2.
Concept for spatial development: The Great Garuda

In addition to the alignment of the sea dike, two other factors are vital to the development of the spatial concept.

1. *Connectivity:* the dike will accommodate a new district of the city. Up to 1,5 million people will live and work here in future. High quality infrastructure should connect the new offshore district to the primary north-south development axis that defines Jakarta. By directly connecting the dike to the current city centre, Jakarta's the central axis is extended: this spine will be the catalyst for urban regeneration.

2. *Top real estate location with an iconic design:* the dike accommodates highly desirable real estate development. It accommodates a new Central Business District for Jakarta and a new spectacular beach front. However, the reclamations are located in deep water and cost recovery is a major challenge. Only a new iconic waterfront city with high quality development, would attract major investors. At the same time plenty room for middle- and low-income housing will be created, thus making a city for all residents.

Combining the natural convex contour lines of Jakarta Bay with rational concave infrastructural connections create wing-like shapes. In the centre, these shapes are connected to the central city axis. Soon, these shapes were associated with the national symbol of Indonesia: the Garuda. The outer sea wall was transformed into the Great Garuda.

This is more than just an ornament or a landmark. The Great Garuda protects the National Capital of Indonesia against the sea. It is also the first image of Indonesia which foreigners and Indonesian expats will see when landing over the Bay of Jakarta. It is shaped to provide space for growth and connectivity.

FACTS:

- *The basic design of the Great Garuda is 1.250 ha in size, offering 650.000 people a place to live and 350.000 people a place to work.*
- *Additional land reclamations can be developed in shallow waters in the giant waduk when demand for real estate allows so.*
- *15% of the Great Garuda is reserved for the new Central Business District (CBD) and 30% for social housing.*
- *In total 23,7 million m2 of real estate will be realised, of which over 61% for housing, 35% for retail and offices and 4% for industry.*
- *Priority will be given to create sustainable facilities for fishing communities who will have to be relocated from the current coastline. New fishing ports will be located on the wingtips of the Great Garuda, being close to the current fishing grounds.*
- *The new CBD will have an MRT connection to the existing city centre with a length of 11,2 kilometres.*
- *A Tangerang – Bekasi Highway with a total length of 43 kilometres and 2x4 lanes will span Jakarta Bay and pass the Great Garuda. Under the CBD, an underpass with a length of 2 kilometres will be created. It passes the sea-lane towards Tanjung Priok with an enormous iconic bridge with a clearance of 70 meters.*

THE BASIC DESIGN IS 1250 HECTARES, ALLOWING PLENTY ROOM FOR FUTURE LAND RECLAMATIONS

POISED IN THE MIDDLE OF THE GREAT WING-SHAPED SEA WALL WILL BE A NEW CENTRAL CITY AREA, POSITIONED AS A NATURAL EXTENSION OF THE CENTRAL SPINE AREA OF JAKARTA, IT WILL PROVIDE A SPECTACULAR AND WARM WELCOME TO ALL WHO COME TO THE NATION'S CAPITAL.

5.3.
Urban design

In these initial 3D impressions, the potential of the Great Garuda to become a new face of Jakarta is clearly shown. The central area located on an extension of the city axis, has the highest density and building heights. It also enjoys a large civic space at the heart of this new city district. In our vision for the Great Garuda we place the green network as one of the core spatial arrangement criteria. The green-spaces of the Great Garuda include a large city level park, urban block parks, grand avenues, waterfront boulevards, mangroves and wetlands, nature reserves and the city street network.

In order to generate maximum revenues and boost the attraction of major investors, it is highly recommended to embrace the Garuda as the new national government seat and relocate the most important governmental and civic functions to this location. In order to grow, the CBD needs anchor tenants and in this the government can play an important role to stimulate growth in the new CBD. In doing this, land in the city currently occupied by these functions would become available for redevelopment.

The CBD requires state of the art infrastructure. The design completes the northern part of the two outer ring roads of Jakarta and more local connections to the main land are established. A high speed rail connects the CBD with the airport and other parts of Java. An MRT line connects the CBD with the current city centre to assure interaction.

The wings of the Garuda host a new double city waterfront that on one side opens up to the sea and on the other side to the fresh water lagoon. At the sea there are long stretches of new beach created whilst on the lagoon side urban

FORMED BY THE LAWS OF NATURE, FLOW AND EFFICIENCY, THIS ELEGANT FOIL-SHAPED WATERFRONT CITY RESEMBLES A GREAT BIRD, AN EAGLE SPREADING ITS GREAT WINGS TO PROTECT THE PEOPLE OF JAKARTA, THE NATIONAL CAPITAL.

THE NATIONAL SYMBOL, BELOVED BY EVERYONE, COMES TO THE RESCUE OF THE NATIONAL CAPITAL, GUARDING ITS' PEOPLE FROM DROWNING AND PROVIDING A GRAND PERSPECTIVE OR THE FUTURE OF INDONESIA.

wharfs, jetties, and waterside office, commercial, leisure and residential developments are created. Creating sufficient residential neighbourhoods and a mix of working and living in the CBD is essential for its functioning.

On each wing there are many smaller urban blocks each separated by green buffers. The main roads pass through green corridors and at the outer extents of both wings, there are parks and locations for habitat development.

The east side of the Bay for now will be dominated by current activities. Tanjung Priok will have space for further development and remains connected to the sea. New is the Tangerang-Bekasi Highway connecting the Garuda with the West Java province, thereby establishing a missing link in the east-west connection in Java. In future the decision might have to be taken on closure of the eastern part of the bay. In addition preliminary plans for airport development and possibly further harbour developments exist. For now, these plans are indicatively drawn in: decisions will have to be taken later on.

The retention basis itself will have several functions as well. It provides leisure opportunities: for example for boating, swimming and fishing. In addition the lake provides opportunities for commercial fresh water fishing. Water management of the lake will be tuned to also provide raw water supply to the city, thereby alleviating the current pressure on water supply. In a dry year, the west lake can guarantee a reliable water supply of 12 m3/s in the dry season, assuming that waste water is effectively treated in future. A good water quality is a vital condition for all these developments.

FURTHER READING:

- *Reference to the spatial design report*
- *Reference to the planning context report*
- *Reference to the SEA*

5.4.
Relations with the current coastal zone

The effects of the development on the existing city will be considerable. The primary effect in the coastal zone will be that increased safety levels will offer incentives for investment. It offers the inhabitants of kampongs and residential neighbourhoods the assurance to invest in their properties and land prices will rise. In addition some specific coastal functions require attention in further design.

Land reclamations

The development of the plan will mostly be complimentary to the current and planned land reclamations. These are developed as mid- to high-end mixed-use urban villages. Where they are currently situated at the sea, they will be situated at a lake site in the future. The plan offers the residents of these islands many facilities that are currently not catered for as the Great Garuda considers all aspects of city life: providing civic amenities such as hospitals, schools and governmental functions. In addition the Great Garuda is likely to attract some of the best major businesses from the country, region and across the world, providing work opportunities for inhabitants.

Resettlements

Most of the settlements along rivers and coasts are a result of employment opportunities and economic activities for settlements in the coastal zone. A lot of the slum areas are located near the economic activities like Tanjung Priok. For dike construction, resettlements will be necessary, impacting the current situation and especially the social structure and cohesion in these neighbourhoods. Resettlement can provide an opportunity to revitalise settlements in the existing city, construct liveable dikes and counter illegal housing. [Reference to pilots] On the Garuda space will be reserved for social housing. Careful study is necessary to implement social housing in a proper manner, tuning into the current life style in which social interaction revolves around streets and public spaces in the neighbourhood. Getting it wrong leads to social isolation and may trap neighbourhoods in a downward spiral.

Fishing activities

All along the coast of Jakarta Bay and within the bay itself are many small and medium sized fishing ports, harbours, markets, processing and storage facilities, fish farms, seaweed farms and associated communities. They are a source of employment both directly and indirectly (repairs, parts, servicing of boats and equipment plus the community shops and services for workers and their families) and the centre of the communities that have grown up around them.

The nature of fishing behind the new dike will change from salt water to brackish or sweet water. This requires a challenging transition for some maritime industries that needs to be carefully considered. The plan offers opportunities to do so. In future, there is as well a possibility to utilise the lagoon for closed water fishing and farming as to develop new fishing port facilities and associated community neighbourhoods on the outer wing tips of the Great Garuda.


UOB

VI

BUSINESS CASES

FACTS:

- *Financing the flood protection by land reclamations and other sources of revenues is one of the principles in this project.*
- *To assess the potential of these revenues, business cases have been developed.*
- *Business cases provide insight in the overall financial aspects of this project, including aspects like costs, revenues, interest rates, return on investments and planning of components.*
- *The business case of the NCICD-project is complex and wide ranging as the business case essentially concerns building a new, large size city.*
- *Although the business cases in this Master Plan have been developed using current Indonesian costs and revenues, the outcomes should be used with care as they also contain long term predictions with some degree of uncertainties.*
- *The business cases in this Master Plan could change significantly when designs and timing of components are changed.*

6.1.
Introduction

Financing flood protection with urban development and other sources of revenues, preferably developed by private enterprises, is one of the project principles. This principle, however appealing from a public budget perspective, transforms a straightforward civil engineering project into a challenging integrated urban development with a complex financing structure. The size of the urban development (a large city) with all its different components contributes to this complexity.

In order to assess the financial feasibility of such undertaking, business cases were made. Business cases provide insight in the overall result of financial aspects like costs, revenues, interest rates and return on investments. It also provides information on the commercial viability of a project (would private investors and developers be able to make a profit) and the need for public financing for less profitable components.

Also other valuable financial information can be derived for business cases, like the impact of time on the finances (faster/slower development), the impact of fluctuating interest rates and changing real estate prices.

The business cases in the NCICD project were based on the best available information, like:

- actual Indonesian costs of construction and materials, derived from current land reclamations and recently completed civil engineering projects.
- actual market information on real estate prices in Jakarta and market predictions by major Jakarta based real estate companies
- information from toll road companies and feasibility studies on public transport systems

Despite this information, the business cases should always be used with some care, as the long term predictions on economy, costs and real estate values do have a degree of uncertainty. Also, the way the project is actually implemented will have a significant impact on the business case. Changes in design and timing of costly components will influence the business case. For instance changing the current mix of offices, retail, high-end and social housing will have a large impact.

6.2.
A feasible plan

For each of the alternatives a business case was developed, built up of the business cases for the major urban and civil engineering components. In this chapter, however, we focus on the business case for the preferred alternative: the 1.250 ha alternative.

The 1.250 hectares alternative is a financially sound development with a positive net present value of about 3 billion dollar. This means that if one would add up all future costs, revenues and other costs (like interest rates) and translate this into current value, the project would result into a positive outcome. This preferred alternative is the result of several iterations: also larger alternatives of 3.150 and 4.000 hectares (with different designs and construction schemes) have been calculated but proved to represent a negative net present value. Also the required upfront investments of the 1.250 alternative are considerably lower than in other alternatives. In addition, the preferred alternative can be realized with existing resources (eg. availability of sand), and has limited risks regarding economic developments.

THE GREAT GARUDA IS ADAPTIVE IN ITS DESIGN, ADDITIONAL DEVELOPMENT TO 4000 HA IS FEASIBLE

ASSUMPTIONS BUSINESS CASE :

- *The defined starting year is 2014. All prices are calculated to prices in the year 2014.*
- *The period up to 2050 was chosen for the business case as all main investments are expected to have taken place in that period, and as the investments and revenues after 2050 only have a small influence on total revenues.*
- *For GDP growth a real growth figure has been assumed of about 6% on a yearly basis in the period until 2015. In the period 2009-2013 real growth was 6,2 per year (period 2004-2008 6,5%).*
- *Due to the present economic boom an inflation rate of 10% is used until 2017. Afterwards, a somewhat more moderate long term inflation percentage is assumed of 7,0% yearly until 2050. This is in line with more moderate economic growth expectations.*
- *Regarding the long term of this project (till 2050) we have assumed a yearly nominal increase of 9% for all revenue prices. For the first years (continuation of current upswing) we have assumed an average increase per year of 20% (2015) and for later years 12,5% for the period 2016-2017.*
- *1% of the total construction cost are used for annual operating & maintenance costs, with the exception of the ship locks in the outer sea wall, the pipeline relocation and the cable crossing over the outer sea wall. For these components 4% is assumed. For the land reclamations 0,5% is used.*

The 1.250 hectares alternative could be the starting point of a larger development. The design is adaptive and could be developed into a waterfront city of 4.000 hectares when additional sand reserves are discovered and demand for real estate remains high.

The business case consists of four components: (1) flood protection, (2) land reclamation and real estate development, (3) transportation and (4) harbour development. In addition a special component is defined regarding the functioning of the retention lake and necessary pre-conditions. The business case includes phase A (upgrading the current sea defences) and phase B (the Great Garuda consisting of the Outer Sea Wall, land reclamations and the offshore Tangerang – Bekasi highway). Phase C (the long term development in the East Lagoon) for now includes too many uncertainties to include in the business case.

6.3.
Key factors

Choices in design and volume have a significant impact on the outcomes of the business case and have been optimised in the 1.250 ha alternative. The main factors of influence are:

Spatial design

A major factor in the business case is the location of the land reclamations. The outer sea wall needs to be developed far offshore, in deep water as there is a need for a large retention lake (waduk) and fresh water reservoir, therefore creating substantial costs for sand, rock and sheet piles. As large quantities are required (300 million m3 sand and 9,5 million m3 rock), small price changes have a large impact. Revenues are mainly derived from real estate developments on land reclamations. Where these are planned in deeper water, profits are lower. In the plan therefore a balance is sought between developing a seaside waterfront far offshore and developments in more shallow water (the tail of the Great Garuda). Where possible, land reclamations are located on shallows in Jakarta Bay.

Development pace

To counterbalance large upfront investments, revenues should be created as soon as possible. Starting developments in shallow water closer to the current coastline allows generating profits early. Assumed is a (realistic and feasible) real estate development of 50 ha/year.

Description	Start year	Period	End year
1 Flood protection	**2014**	**9**	**2022**
Stage A	2014	3	2016
Sea wall Garuda	2018	5	2022
2 Transport	**2018**	**11**	**2028**
City Toll road	2018	6	2023
National Toll road	2025	4	2028
Underpass + intersection	2019	4	2022
Bridges	2020	4	2023
MRT	2022	4	2025
3 Land reclamation	**2016**	**25**	**2040**
Reclamation	2016	25	2040
Selling land for real estate development	2017	24	2040
4 Port development	**2030**	**21**	**2050**
Tanjung Priok port (reclamation, etc)	2030	10	2039
5 Specials	**2018**	**33**	**2050**
Operating costs lagoon, employment, energy	2018	33	2050
Business case	**2014**	**37**	**2050**

Investments in the MRT will start in 2022 when the urban development has generated sufficient need for public transport, thus minimizing losses. The port will be developed after 2030, when the current port extension has been completed and operates, avoiding risk of empty quay. The total development time of the complete project will be 25 years, the sea wall closed in 2022.

Real estate program

The volume and composition of the real estate program in relation to the footprint (the size of the building plot) is an important factor in the business case. A high density development on a small footprint (in other words: high rise buildings), generates relatively high revenues. In the business case, the CBD is a high density development generating extremely high profits. On only 200 ha a total amount of 11 million m2 offices, housing and retail will be developed. This is 55% of the total real estate program and generates 84% of the total revenues.

Infrastructure

The infrastructure has been fine tuned to the forecasted transportation demands. In this business case a sober, functional design has been included, using existing land reclamations as much as possible to avoid costs of offshore, elevated roads. The east offshore connection with a high clearance bridge (over de approach channel for Tanjung Priok port) is very expensive (25% of the total infrastructure costs), but considered essential to complete the Tangerang-Bekasi highway. The highway east of this bridge is foreseen on piles.

6.4.
Nominal costs and revenues of main components

Flood protection

Flood protection is divided in phase A and phase B measures. Phase A consists of the short term development of in total six dike rings in the current city for which

dike reinforcements and installation of pumping stations is required. The total costs of phase A are $ 1.9 billion.

Phase B flood protection includes the development of the outer sea wall, including pumping station, jetties at the wings, locks, pipeline relocation, cable crossings and mangrove restoration. The total costs are $ 4.8 billion.
No direct income is expected from flood protection measures. However, flood protection leads to significant income for the government as increased safety leads to higher property, profit and income taxes. These secondary revenues are not included directly in the business case, but an indicative calculation has been made of economic effects for employment, taxes and added economic value of the total development.

Land reclamation	1.080	ha
Buildable	**45,0%**	
Total ground floor	4.860.000	sqm

Real estate	Buildable land	Relative	Land price / sqm	Total revenues
Housing		**69,3%**		**7.207.100.945**
1 Housing (CBD)	425.250	8,8%	12.215	5.194.343.700
2 Housing (high)	243.000	5,0%	2.791	678.174.120
3 Housing (middle)	1.727.325	35,5%	720	1.243.907.189
4 Housing (low)	972.000	20,0%	93	90.675.936
Office		**14,8%**		**11.393.565.300**
5 Office (CBD)	425.250	8,8%	24.570	10.448.392.500
6 Office (high)	291.600	6,0%	3.241	945.172.800
Retail		**4,0%**		**3.869.673.750**
7 Retail (prime)	70.875	1,5%	47.210	3.346.008.750
8 Retail (high)	121.500	2,5%	4.310	523.665.000
Industry		**12,0%**		**163.296.000**
9 Industry	583.200	12,0%	280	163.296.000
10 …	0	0,0%		0
Total	**4.860.000**	**100,000%**	**4.657**	**22.633.635.995**

Transport
The transportation component consists of the Tangerang-Bekasi highway, city (toll) roads, bridges and a metro or light rail (MRT) from Jakarta mainland into the new land reclamation. Total costs of transport elements are $ 5.0 billion.

Infrastructure not specifically developed for the Great Garuda, like the freight railway or trans-Java high speed rail, are not part of the business case. The development of the high speed rail is however accommodated by reserving the necessary space.

Transportation generates income through toll-revenues and the sale of MRT tickets through estimates are included in the business case. Total nominal revenues amount to about $4,4 billion.

Land reclamations
The total size of the land reclamations, flood protection and infrastructure in the design and business case is 1.250 ha, of which 1.080 ha concerns land reclamations. According to practice and regulations, 45% of this area is buildable. Costs of all the land reclamations are $ 7.0 billion. This is not including the construction of the outer sea wall. In addition to the land reclamation costs, extra costs for land development and nature compensation are calculated.

The main source of funding is the sale of land. 45% of the total area will be covered with buildings, 55% will be used for infrastructure and public green and recreation areas. The new Central Business District will cover 44% of the buildable area, 8% is reserved for high-end housing, 30% for middle-class housing and 17% for low-cost housing. The next table summarizes the total revenues per real estate type.

LIVING AND WORKING ON THE GREAT GARUDA

- *45% of the total area of the Great Garuda will be built, 55% is for infrastructure and public green and recreation areas*
- *The new Central Business District will cover 44% of the buildable area, 8% is reserved for high-end housing, 30% for middle-class housing and 17% for low-cost housing.*
- *In total 650.000 inhabitants will live and 300.000 will work on the Garuda*

Port development
Tanjung Priok port will expand in the next decades. In the business case the port is considered to be an autonomous development until 2030 (thus not part of the NCICD business case). Forecasts of container volumes predict that there is room for a total area of 400 hectares in the period 2030-2050. Costs for developing this land for container terminals are $1.6 billion . Additional port Infrastructure is not included in these costs calculations.

In the business case, the port generates income by the sale of developed land and ship call duties. Income generated for the port authority by sales of land and ship call duties can amount to $2,4 billion nominal. Costs and revenues for commercial operators have not been calculated because of lack of information.

Other costs
For all components of the business case also 1% maintenance costs have been included in the business case, with some exceptions. For locks, pipelines and cable crossings 4% is used, and for the land reclamations 0,5 % is used. The operation costs of the large waduk (reservoir) are included in the business case.

An important condition for the development of the bay is the improvement (by 75%) of the water quality. Costs for measures to improve the water quality are

part of existing dredging programs, solid waste management programs and the JICA sanitation master plan, and are therefore not included in the business case. These efforts need to be speeded up to facilitate the execution of the plan. In addition, priority should be given to sanitation improvements in the western side of the coastal zone.

6.5. Results

The financial result is a combination of all the costs needed to realize the flood protection and the revenues from toll, MRT, land sales and generated port income. The revenues are used to finance the (upfront) investment costs.

Overall there the components land reclamation and port expansion are profitable and the components flood protection and transportation are loss making. Over time, the sum of revenues are higher than the total costs, resulting in a positive business case.

It is important to consider that all business case calculations are so far without any financing costs (payments for debt and equity servicing). The figures below provide more insight in the cash-flow pattern in time.

	Area	Nominal development cost	Nominal maintence costs	Nominal revenue	NPV-result
1	Flood protection	(6.736.490.331)	(2.345.026.691)	-	(10.303.118.244)
2	Transport	(5.039.992.267)	(1.159.198.221)	4.407.087.360	(968.518.230)
3	Land reclamation	(8.929.487.585)	(1.026.855.310)	22.633.635.995	13.495.418.969
4	Port	(829.400.000)	(99.528.000)	2.369.600.000	1.357.007.500
5	Specials (operation lagoon)		(292.195.200)	-	(222.626.363)
	Total	*(21.535.370.183)*	*(4.922.803.422)*	*29.410.323.355*	*3.358.163.631*

Looking at the cash flows shows that until 2022 upfront investments are required with a maximum of 1.7 billion dollar on a yearly basis. After 2022 the revenues from the land sales ensure that there is financial sound cash flow, enabling the business case to end positive.

The initial investment costs are acceptable. Given the amount of medium term revenues, private investors will be interested to participate in this project.

6.6.
Economic effects

In addition to the cash flows of the Business Case the total development creates additional economic effects that are highly beneficial to the city. Indicative calculations have been made to for the economic effects of the components flood protection and land reclamations.

Water safety benefits for avoided damage in the risk area are $ 103 billion for loss of land and buildings and an additional $ 110 billion for economic activities up to 2020. In addition, land values and real estate prices will increase. The benefits for the government in terms of (prevention of foregone) tax income due to flood protection has been calculated on $ 5.1 billion for the period 2016-2020.

Up to 2020, due to the flood protection, direct employment of 935.000 persons and an additional indirect employment of 600.000 persons is saved in the risk area. The secured income tax for this employment has been calculated on $ 2.45 billion for the period 2016 – 2020.

The land reclamation and urban development on the Great Garuda will create employment and enormous added value for the city. The land reclamation will provide structurally over 550.000 new jobs. During construction of the Great Garuda, an additional 4.250 temporary jobs are generated on average. The added value of this employment for economy sums up to $ 64 billion (!) for the period up to 2040.

6.7.
Risk profile

Key risks regarding the NCICD-development and the measures that can be taken to manage these risks are mentioned below.

- **Development duration:** the plan has a long time horizon (longer than usual for private developers) and requires pre-financing large upfront investments.

  Mitigation: developments can be split up in manageable parts (e.g. Outer Sea Wall in 5 years, land reclamations in sizes of 50 ha./ year)

- **Availability of sand:** the plan needs a substantial amount of sand (in total 300 million m3), especially for land development in deep sea areas. Due to the sand need also for the existing reclamations the sand capacity on locations might not be sufficient or sand has to be transported from different places at much higher sand prices.

  Mitigation: the design of the Garuda (including outer sea wall and land reclamations is based upon the known estimated sand reserves of 300 million m3.

- **Cost risks:** development costs might be substantially larger in case of higher sand prices. Timing of purchase of sand and the capacity of the industry are crucial factors in this respect.

FURTHER READING:

For further reading regarding the business cases see report:

- *Spatial- economic report Business Case NCICD B4*

Mitigation: all kind of contingencies are built in within the current calculations, special focus must be at buying and building at the right time.

- **Market risks:** economic growth and demand for real estate (especially offices) might be lower than now assumed. A lower demand for offices (or less relocation of government offices to CBD) will have a negative effect on the revenues and financial return.

  Mitigation: the Garuda development has a market uptake comparable to the average current uptake. Governmental guarantees of moving governmental offices to the new CBD is necessary. The design of the Garuda is flexible, allowing for slowing down and acceleration based on the actual economic situation.

- **Revenue prices:** real estate prices and land prices might be lower than expected (especially in case of an economic downturn or more moderate than expected economic growth)

  Mitigation: selling land must be planned in economic stable times. Especially the CBD must be sold in economic good times.

- **Financing**: debt and equity rates might be higher than expected

  Mitigation: market validations on conditions of banks/ private parties to facilitate loans.

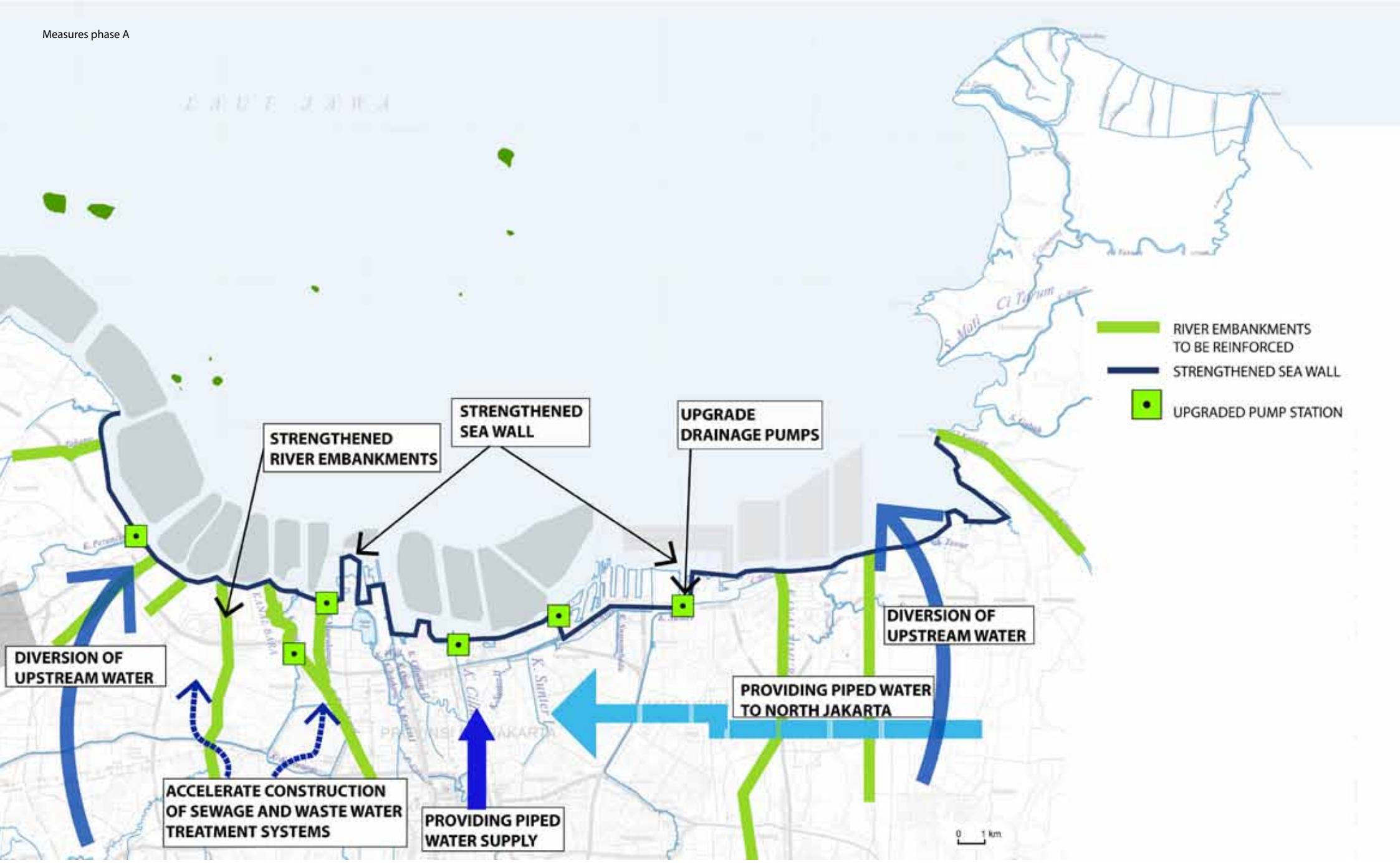
- **Sanitation measures might not be finalized before 2017:** a polluted lagoon might result having a negative impact on the real estate values.

  Measures: strong focus on the planning to be realized on time, first steps in an integrated water quality improvement program have been taken.


UNITED

VII

THE PLAN PER THEME


RIVER EMBANKMENTS TO BE REINFORCED
STRENGTHENED SEA WALL
UPGRADED PUMP STATION
STRENGTHENED RIVER EMBANKMENTS
STRENGTHENED SEA WALL
UPGRADE DRAINAGE PUMPS
DIVERSION OF UPSTREAM WATER
DIVERSION OF UPSTREAM WATER
PROVIDING PIPED WATER TO NORTH JAKARTA
ACCELERATE CONSTRUCTION OF SEWAGE AND WASTE WATER TREATMENT SYSTEMS
PROVIDING PIPED WATER SUPPLY
0 1 km

In this chapter the master plan is described in more detail, explaining the rationale by theme.

7.1.
Flood safety

NCICD will provide flood safety for Northern Jakarta both on short and long term. Three phases are distinguished in the development of flood safety infrastructure.

Phase A

Upgrading the current coastal defence is the high priority measure. This set of high priority measures includes 1) slowing down the land subsidence (by providing alternatives for ground water extractions), 2) strengthening and heightening sea walls, 3) upgrading the urban drainage system and 4) preventing upstream river water entering the low-lying Jakarta area. Also accelerating the water sanitation is part of phase A.

Sea wall sections in Pluit and Ancol are under immediate threat, implementation therefore starts already in 2014. The design levels for these sections take current subsidence rates into account, and will provide safety until 2022. If the implementation of long term measures is delayed, the dike profile offers sufficient basis to further increase the dike height providing additional safety for another 5-10 years.

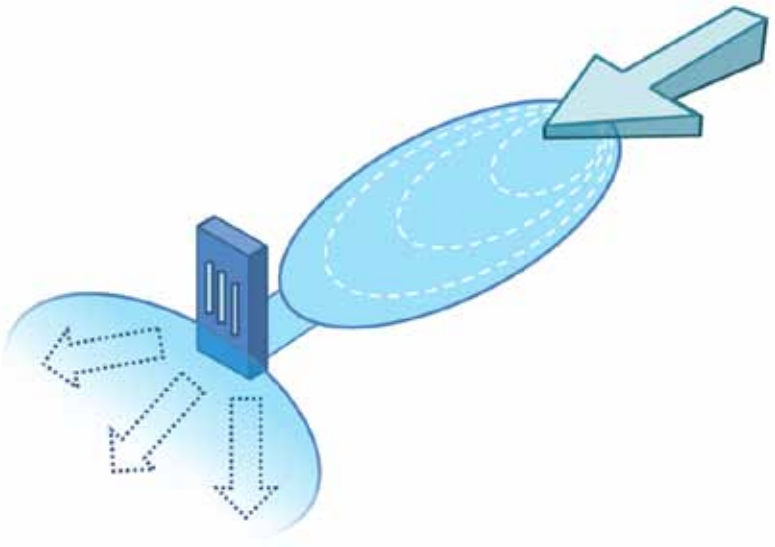
Implementing the phase A dike in the densely populated coastal zone, with buildings against and on top of the sea wall, requires detailed urban planning and careful socio-economic solutions and community involvement. Several dike typologies have been developed to meet local requirement: basic dikes, reduced dikes, green dikes, inland dikes and beach dikes. In addition dikes with land reclamations have been developed, thus providing a wide range of options..

In chapter 8 case studies for locations at Pluit and Kali Baru show how kampongs and slum areas could be upgraded in combination with flood protection. This upgrading could be an excellent opportunity for coastal revitalisation.

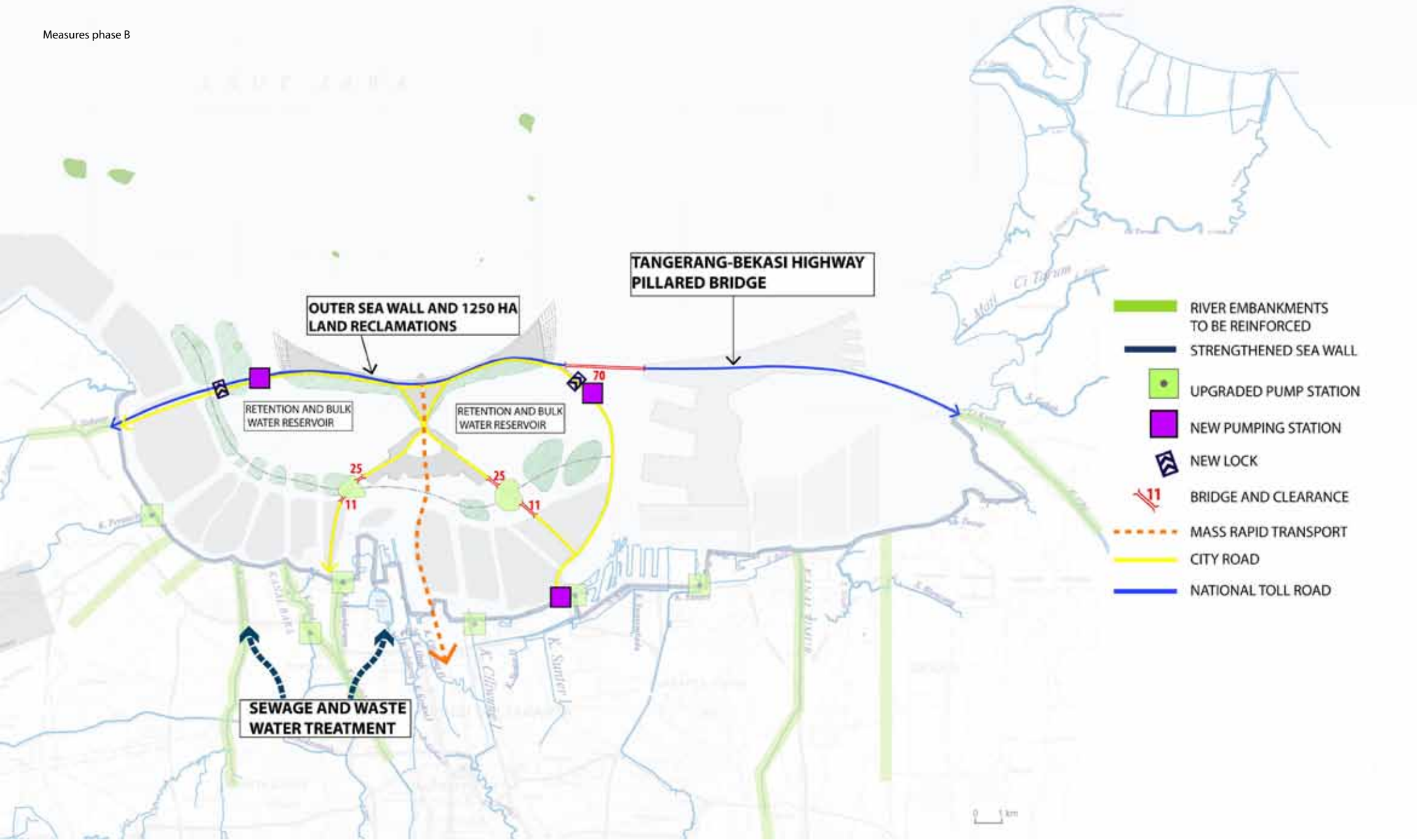
THE WIDE RANGE OF CONCEPTUAL DESIGNS FOR DIKES PROVIDE AN EXCELLENT TAILOR MADE OPPORTUNITY TO REVITALIZE THE COASTAL ZONE.

Phase B

It is unlikely that subsidence will be slowed down in the foreseeable future as it will take time to develop and implement alternatives for ground water extractions. Sea water levels will rise, canals and rivers will gradually stop flowing under gravity into the sea. Large drainage pumps are needed, especially in central Jakarta where subsidence rates are high. Pumping stations require pumping lakes to temporarily store peak river discharges.



Drainage pump and pumping lake to absorb peaks in rivers

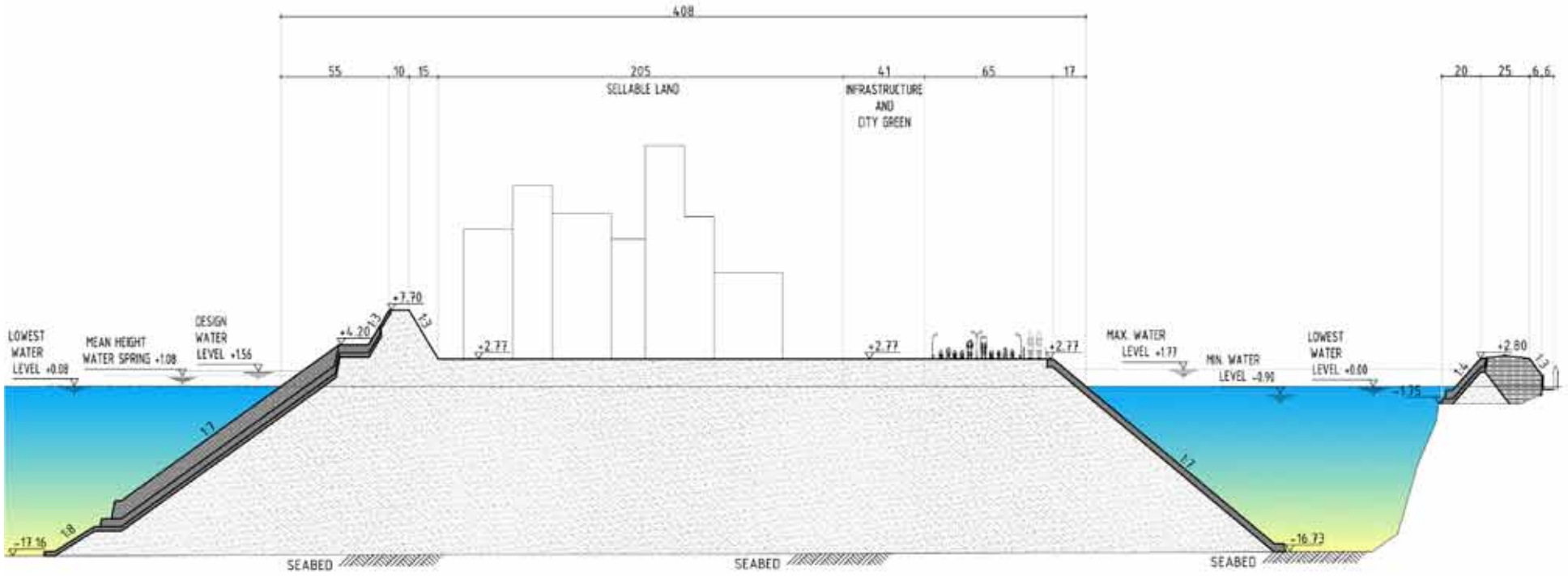

TANGERANG-BEKASI HIGHWAY
PILLARED BRIDGE
OUTER SEA WALL AND 1250 HA
LAND RECLAMATIONS
RETENTION AND BULK
WATER RESERVOIR
RETENTION AND BULK
WATER RESERVOIR
70
25
11
25
11
SEWAGE AND WASTE
WATER TREATMENT
RIVER EMBANKMENTS
TO BE REINFORCED
STRENGTHENED SEA WALL
UPGRADED PUMP STATION
NEW PUMPING STATION
NEW LOCK
11
BRIDGE AND CLEARANCE
MASS RAPID TRANSPORT
CITY ROAD
NATIONAL TOLL ROAD

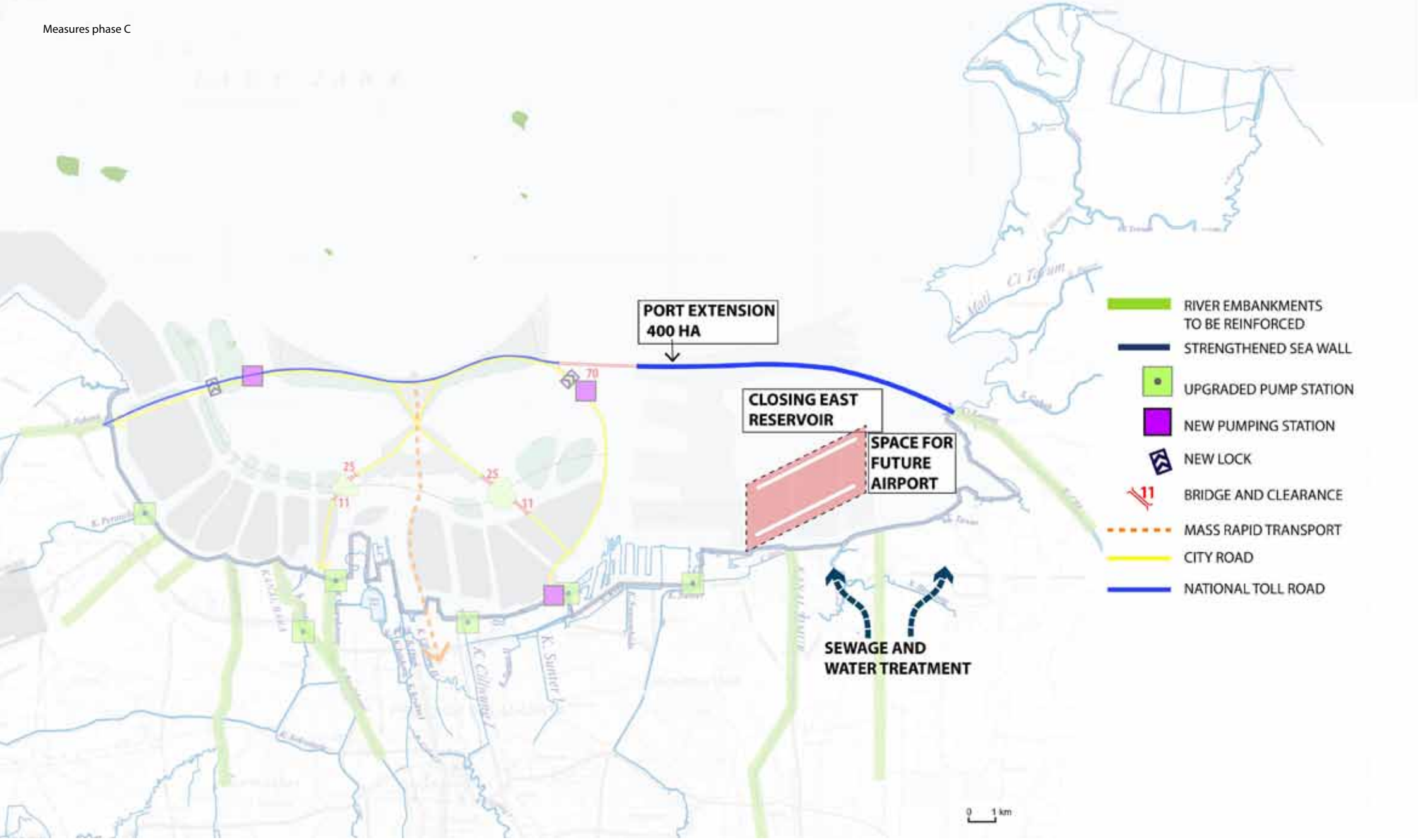
The need for large storage lakes (waduks) is one of the main reasons for creating the offshore waduk, rather than seeking room for such storage lakes in the city of Jakarta. The location of the outer sea (phase B) wall is mainly determined by the required storage capacity of the giant waduk between current coastline and sea wall. It provides sufficient room for future expansion of the land reclamation and storage capacity for bulk water supply.

Lack of data has made it difficult to statistically determine the moment when rivers will stop flowing and when flood risks become unacceptable. For most rivers and canals this will be sometime between 2015 and 2030, depending on the local subsidence rate, the river profile and river level in respect to the sea level.
Given this uncertainty, a closing data of 2022 was chosen. Around 2022 sea water levels will be around 3-4 meters above street level, which is a critical level as many houses in poor areas are below this height and 'vertical' evacuation will not provide safety against floods anymore. The current sea wall and the many rivers open to the sea would provide a safety risk, requiring a more robust and shorter Outer Sea Wall. By 2022 also many rivers and canals will not be flowing freely to the sea, thus requiring pumps and pumping lakes either onshore or offshore.

From this perspective, there is a difference between the eastern and western part of Jakarta. As subsidence is higher in the western part, measures are more urgent there. The western part of the bay needs to be closed between 2022 and 2028. For the eastern part, closure can be postponed until 2040, or even further if subsidence can be slowed down in the coming years.

The cross section through the land reclamation




PORT EXTENSION
400 HA
CLOSING EAST
RESERVOIR
SPACE FOR
FUTURE
AIRPORT
SEWAGE AND
WATER TREATMENT
RIVER EMBANKMENTS
TO BE REINFORCED
STRENGTHENED SEA WALL
UPGRADED PUMP STATION
NEW PUMPING STATION
NEW LOCK
BRIDGE AND CLEARANCE
MASS RAPID TRANSPORT
CITY ROAD
NATIONAL TOLL ROAD
0 1 km

The NCICD program significantly increases the flood safety of Northern Jakarta. As required in decree 121-2012 of the Governor of Jakarta, the design of the outer sea wall will be based on an extreme event that statistically occurs only once in 1,000 years. For design of the embankments along rivers and the giant waduk, a safety standard of once in 100 to 200 years is used.
The urban drainage water and water from upstream rivers will flow into the giant waduk. To keep the water level in this reservoir low and meet the safety standards in the rivers, the largest pumping station in the world is required with a pumping capacity of 730 m3/s. This is taking into account a fluctuation of 2,5 meters above the minimum water level in the waduk and a waduk size of at least 75 square kilometres.

FURTHER READING:
- *B1 – engineering report*
- *B2 – upgrading existing sea defences*

Phase C
For the eastern part of the Bay an adaptive approach is chosen. The subsidence is still relatively low and the main rivers can still flow freely. At this moment it is not possible to determine whether an outer sea wall will be necessary, or can still be avoided. In addition, the design requirements regarding the size and combinations with functions on the long term depend on economic development of this region. In a later point in time decisions for this area will have to be taken.

FACTS OUTER SEA WALL
- *The outer sea wall is an impressive structure that will be 25 kilometres in length and, at the deepest point, it will be 24 metres high of which 7,7 metres will be above sea level (+ 7,7 LWS-2012).*
- *At its widest, the base of the dike will be 380 metres wide.*
- *The outer slopes of the dike will be designed at a slope of approximately 1:7 because of geotechnical stability and wave run up.*
- *To protect the inner and outer slopes of the sea wall an armour layer of rock will be applied. Sheet piling will be applied at inner slopes in combination with urban development.*
- *The outer sea wall will be closed in 2022.*
- *The construction time of the sea wall, the pumping station and the toll road is estimated at 4-6 years*
- *The outer sea wall will provide protection up to 2080 (at a land subsidence rate of 2,5 cm/year under the Outer Sea Wall and sea level rise of 0,08 cm/year).*

7.2.
Social aspects

A project of the magnitude as proposed in this master plan has considerable positive and negative social impacts. Main effects are related to employment, the development of communities in the coastal zone and the impacts on fishery and related communities.

Employment
The increase in water safety generates several positive economic effects. As described in chapter 6, damage in the coastal zone is avoided ($ 103 billion) and economic activities are secured ($110 billion up to 2020). This is important to the economy, but especially important to the families of the directly and indirectly

employed. Up to 2020, direct employment of 935.000 persons and an additional indirect employment of 600.000 persons is saved as their working spaces are protected from flood risks. These jobs will be lost if no coastal protection measures are taken.

In addition, extra jobs are created. The land reclamation will provide structurally over 550.000 new jobs. During construction of the Great Garuda, an additional 4.250 temporary jobs are generated on average.

Communities: development and re-location

The coastal zone of Jakarta includes a broad social range in housing:

- Low income areas: slum areas, squatters and low-income settlements on the riverbanks and kampungs;
- High-end and middle class housing: elite residential/real estate (Pantai Mutiara), middle class housing and future land reclamations.

Many riverbanks and waduks are typically occupied by (semi-) illegal low-income occupants as these were the only available areas for squatters.
Many slum areas are located near the economic activities like Tanjung Priok. The total population living in the slums in the Jakarta coastal zone amounts to just under 1,5 million: about 6.5 % of the total population. Some high-end residential areas are built for the sea view and direct connection to the sea. This is also the case for the planned land reclamations.

The phase A sea wall strengthening will provide protection to all of the coastal communities, but will also have direct and major impacts on some of the coastal communities. The current sea defence is an integral part of neighbourhoods. Houses are built on top of the sea wall, in some parts the sea wall goes straight through residential areas and slums. Activities like shipyards and ship-breaking yards rely on a direct connection to the sea that might be disrupted by the development of a dike. Reducing the impact on these communities and economic activities is of paramount socio-economic importance.

Starting point for the conceptual design of phase A is to limit relocations due to dike reinforcement as much as possible. This is firstly achieved by disconnecting rivers and canals from the Jakarta Bay allowing lower, controlled water levels behind the drainage pumps significantly reducing the required dike improvement lengths and relocations. In addition, the impact of phase A is further reduced by constructing seawall improvements on the seaward side of the existing sea wall.
Chapter 8 furthermore provides an example of how dike improvement can go hand in hand with urban re-vitalisation. In addition to renewal of existing neighbourhoods, the Great Garuda area offers space for social housing and re-location. 17% of the Great Garuda is reserved for social housing.
The outer sea wall in phase B will guarantee the flood safety level in the current coastal zone. This creates a better investment climate in the National Capital for mid-end and high-end housing. The overall value of the area will increase and the

area around the retention lakes and rivers will become more attractive (also due to the sanitation programme). A lock in the outer sea wall will be built to provide for a connection to the sea. Nevertheless the direct connection and sea view of the existing real estate and future land reclamations to the sea and sea view will be lost.

Fisheries and fishing communities

All along the coast of Jakarta Bay and within the bay itself lie many small and medium sized fishing ports, landing areas, harbours, markets, processing and storage facilities, fish farms, seaweed farms and communities depending on these facilities. There is great diversity in the quality and standard of the facilities but regardless of whether they are formally organised or apparently chaotic, whether they are hi-tech or traditional, the maritime industries are an important source of employment both directly and indirectly (repairs, parts, servicing of boats and equipment plus the community shops and services for workers and their families) and the centre of the communities that have grown up around them.
The number of fishermen and vessels decreased in recent years. In 2012 12,000 active fisherman were reported. The fish production fluctuates per year, but an upward trend is registered. The statistics indicate a scale enlargement as production per vessel, per fisherman and per processing unit is increasing. The amount of cultivation farmers decreased (1,500 in 2012) since the cultivation of green mussels has been forbidden by DKI Jakarta due to the bad water quality in the Bay of Jakarta.

The autonomous development of the fishery sector is uncertain. Because of recent investments in new facilities and infrastructure, the productivity of fisheries in the Bay of Jakarta could increase. On the other hand fishing activities are negatively affected by the construction of the permitted land reclamations in Jakarta Bay.

The Garuda and sea wall will block direct access to the fishing ports. Also existing fishing grounds and salt water aquaculture will disappear in the fresh water retention lake. Considering the importance of the fishery sector to the communities they support, great care has to be taken of taking measures to mitigate effects of the closure of the bay.

Mitigation measures and long term opportunities can compensate for the impact. A lock will be included in the outer sea wall to facilitate the passage from the docks to the fishing grounds. Due to increased shipping times this is not seen as an ideal solution for daily sea-going fishermen.

Located at the outer tips of both the west and east wings of the Great Garuda new fishing ports and fishing communities are planned to re-locate current communities. These will be primarily designed with and for the people who will use them for work and living but will most likely also draw some interest for visitors. This can be interesting for fishing communities as they can sell their produce directly from markets or temporary and permanent shops, stalls, restaurants and food stands.

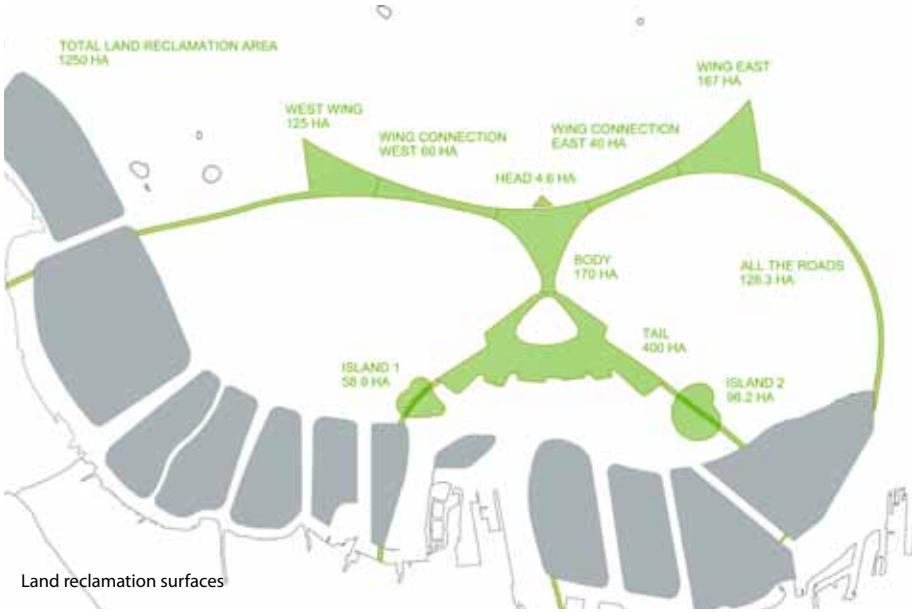
On the long term the fresh water retention lake could provide new alternatives for fishermen and cultivation farmers if water quality is sufficient.

7.3.
Land reclamation

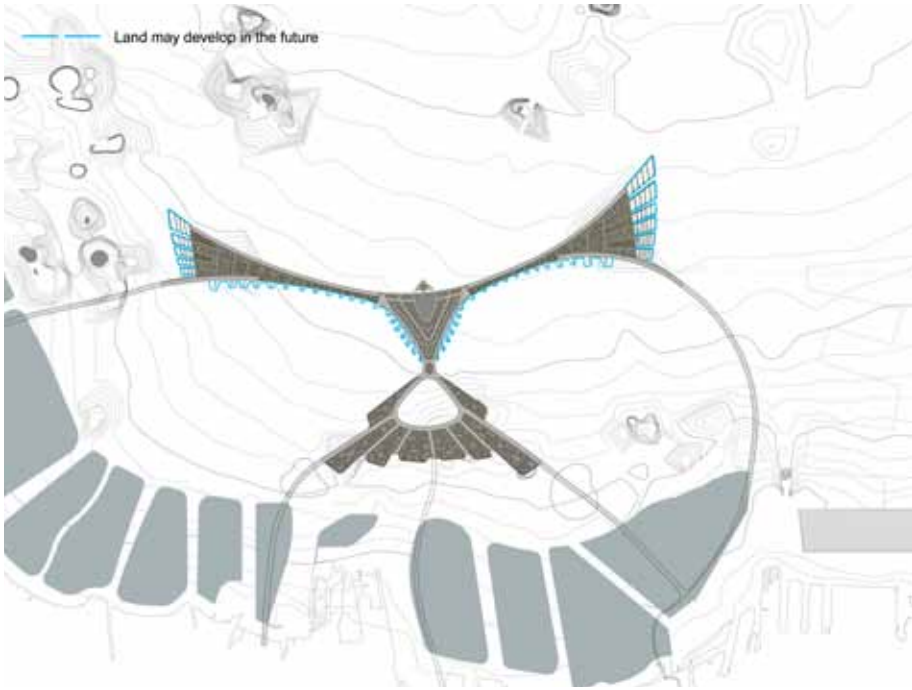
Closing the outer sea wall before 2022 will be one of the most challenging hydraulic civil works that has been carried out worldwide. No less than 90 million m3 will be needed for the outer sea wall alone. An additional 210 million m3 will be used for land reclamations, creating a total area of 1.250 ha for infrastructure and urban development.

Actual construction pace and final size of the Garuda should be tuned to the speed of market uptake of real estate. Depending on sand availability and economic development, the size of the Great Garuda can be increased to 3.000 or even 4.000 ha. The wings of the Garuda design can be further extended and also inside the lake there is still capacity for further development. If market uptake slows down, the building of the Garuda can be phased to avoid large upfront investments.

The availability of sand is highly uncertain. Surveys in the near future are therefore required. To reduce risks the design is based on the estimated available sand volume of 300 million m3. It is also possible to use alternative materials like solid waste from Jakarta or stabilised sludge. However, this can only contribute a few percent of the total required volumes, or will lead to relatively high costs.



Land reclamation surfaces



Reclamation of the tail of the Garuda will start as soon as possible, preferably in 2018, to generate incomes from real estate as soon as possible. At the same time, implementation of the outer sea wall will start from the landfalls towards the head of the Garuda.

As soon as the outer sea wall has been closed, the water level in the retention lake will be pumped down to -0,90 m LWS-2012 in the rainy season to immediately increase the water storage and decrease flood risks. During peak discharges from the rivers, the water level can increase 2,5 m, offering a storage capacity of almost 200 million m3 of water.

FACTS LAND RECLAMATION

- *In total 1.250 ha of land will be created. The design is flexible and can be enlarged up to 3.000 or even 4.000 hectares if sand is available.*
- *In m3 of sand, the 1.250 ha variant is comparable to a Palm Island in Dubai or the Maasvlakte 2 in the Netherlands.*
- *The land reclamations at the inside of the sea wall will have a surface level of + 3,77 m LWS-2012.*
- *Sand will need to be brought from far away, from borrow areas located in West Java and South Sumatra at a distance of 48 up to 173 km.*
- *To complete this enormous project in time, a large part of the worldwide dredging capacity is needed.*

Impacts on underwater infrastructure

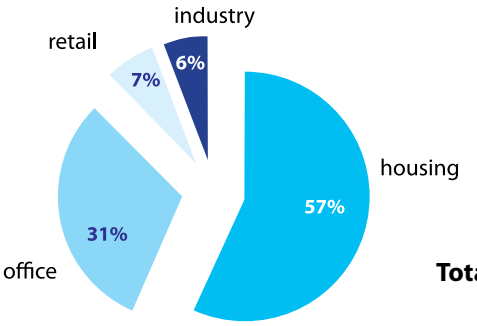
Power plants and infrastructure for communication and energy (e.g. LNG pipelines and internet cables) are situated along the current coastline. The development of the dike and retention lake will require the relocation of all this infrastructure for two reasons. First, the temperature in the lake will become too high for the power plants to function efficiently. Second, the communication and energy infrastructure will otherwise be buried and damaged by the creation of the dike and reclamation.

7.4.
Business and residential

The real estate program consists of a complete city district including all relevant functions and social groups. It is build up around the idea of creating a new Central Business District (CBD) and the housing and retail facilities to support it.

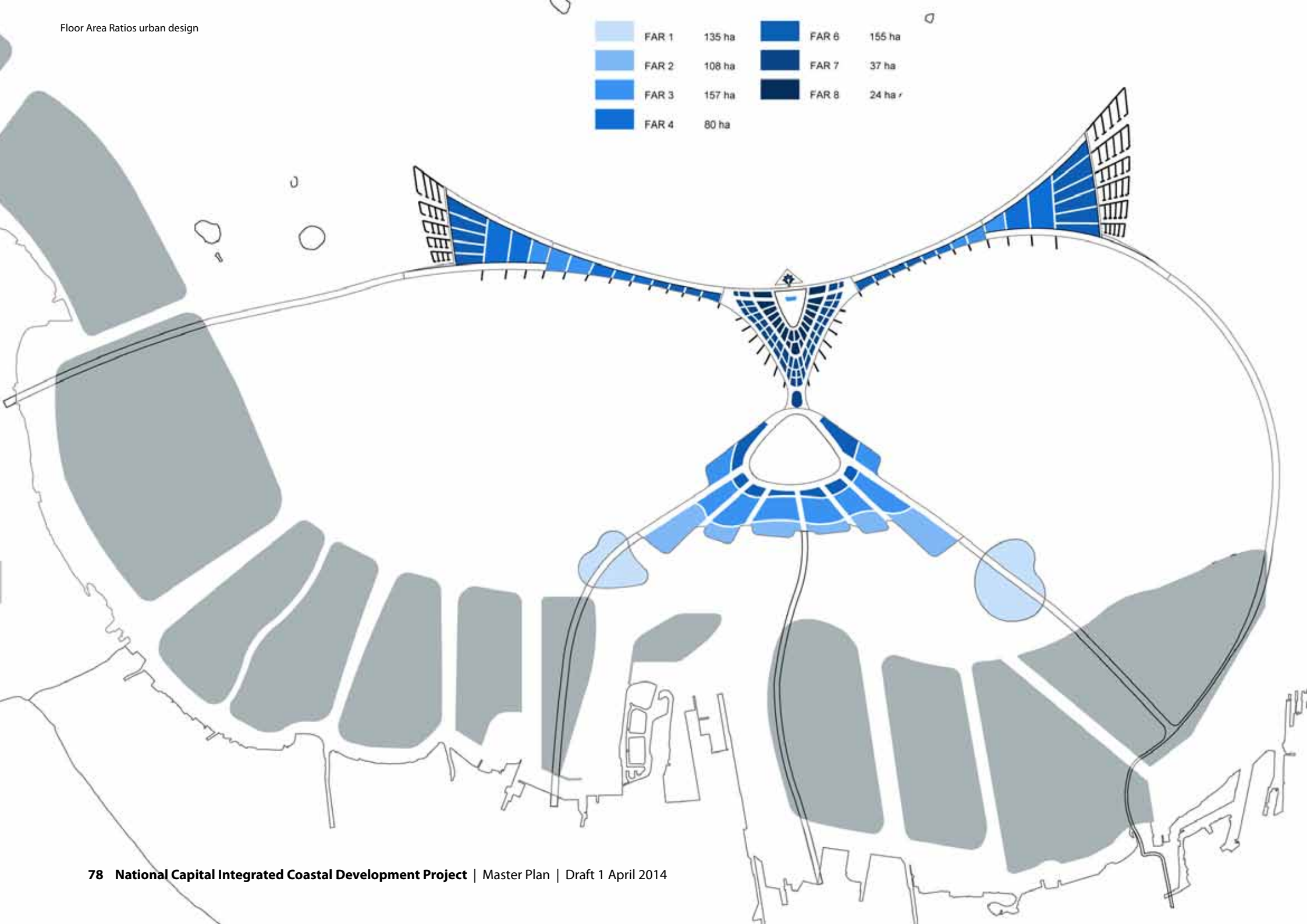
The Great Garuda will therefore be a relatively high density urban area. This is necessary to make the development financially viable, at the same time it is desirable in order to create critical mass required for a thriving, diverse and dynamic urban area.

In planning the densities the potential land-uses, functions, activities, neighbourhood creation, and the character of streets and spaces is taken into account just as the visual and physical connections and associations. Attention is paid to the skyline and to the logic of the sequence of urban nodes.



Total program mix

About 45% of the total land of the Garuda can be build on. In the business case a conservative estimate of 486 ha of ground floor is calculated. More than half of the total real estate program consists of housing, one third of offices and the rest of industry and retail.


FAR 1 135 ha
FAR 2 108 ha
FAR 3 157 ha
FAR 4 80 ha
FAR 6 155 ha
FAR 7 37 ha
FAR 8 24 ha

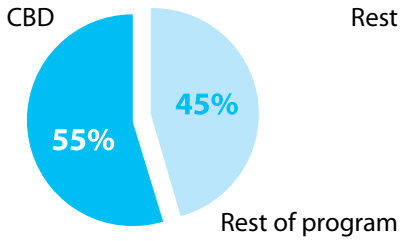
FURTHER READING:

- *B4 – financial and economic study*

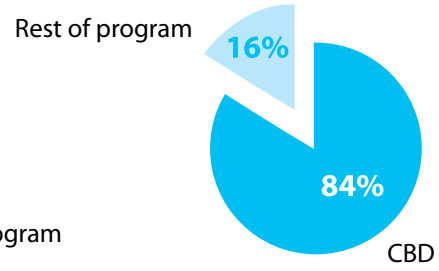
Central Business District

The CBD is financially the most important area of the program. Looking at the total amount of square metres real estate the CBD is 55% of the total program (in m2 Gross Floor Area, GFA). However looking at the revenues, the CBD contributes 84% of the total revenues.

CBD: % of m2 GFA



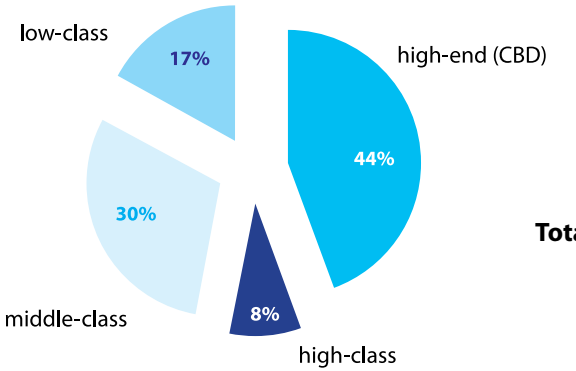
CBD: % of revenues



The CBD consist of the following functions: high-end housing, office and prime retail. A total amount of 11 mln. M2 GFA The layout of the CBD is a dense area, with a Floor Space Index of approximately 12. In order to function optimal it needs a net buildable area of 92 ha. or a gross area of 205 ha. The spatial constellation of the CBD is worked out in chapter 8.

Housing

The housing element of the design is best reflected by the following diagram showing the spread of the program across housing categories in this master plan.

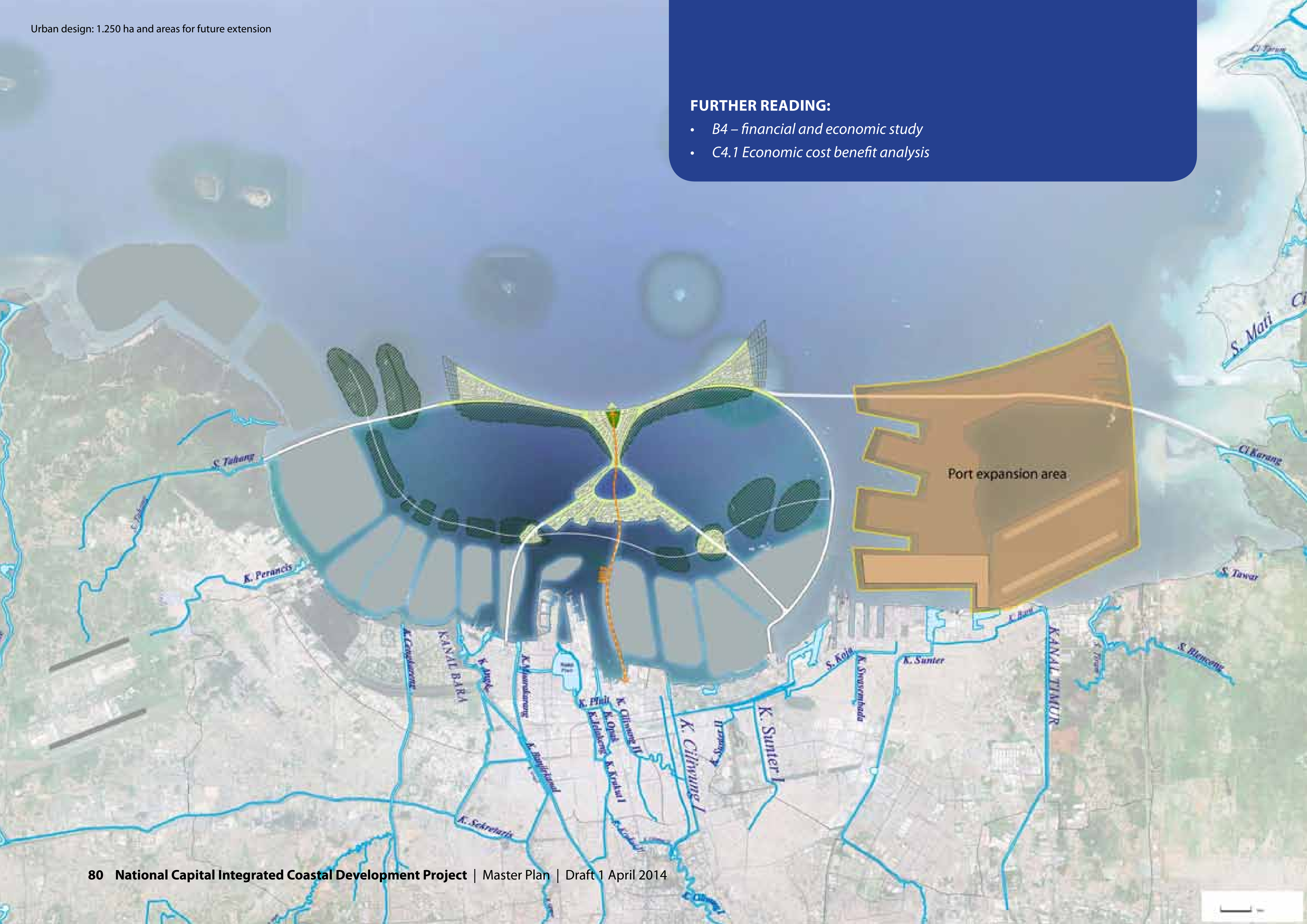


Total housing mix

We made a mixed design of high-end and high-class housing, middle class and low-class. This functional mix makes it possible to grow further (in terms of housing) within the new urban area, besides it makes a social mix of lower, middle and upper-class.

High end apartments are located within the CBD, whereas the high class residential areas are located beneath the wings of the Garuda. Other neighbourhoods are more mixed with lower income housing mainly situated around the maritime communities and middle income housing in the rest of the wings.

Urban design: 1.250 ha and areas for future extension



FURTHER READING:

- *B4 – financial and economic study*
- *C4.1 Economic cost benefit analysis*

7.5.
Main ports

Port development

Tanjung Priok is the most important (main-)port of Indonesia and an essential economic driver for Jakarta. In addition, this port has an important role for the whole west Java corridor development and specifically for the Bekasi industrial area.

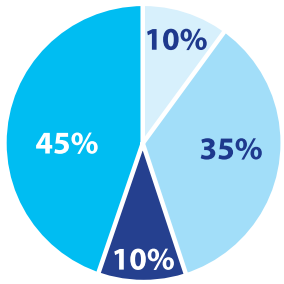
Currently (2013) the container traffic in Tanjung Priok is around 7 million TEU. For 2030 the container traffic forecast for Tanjung Priok is 18 million TEU; at an annual growth rate for the period 2008-2030 of 7.4%. The container terminals are operating at maximum capacity and there is a strong need for capacity expansion.
The Indonesian economy is growing fast with rates of 5-6% annually and is expected to grow further with rates of 6 to-7% in the coming decades. Currently the port is a bottleneck for economic growth in the region as capacity is insufficient, hinterland connections are poor and congested and logistics service providers perform poorly. In addition, subsidence is lowering the quays, which will require investments. These factors raise costs and therefore sincerely affect the position of the port in a region with stiff competition.

Port development is in principle a autonomous development. Port extension plans are already launched until 2030 and these are not part of the business case of the master plan. The master plan contributes significantly to the port development by easing traffic congestion and thereby boost port activities. Additional expansions of the ports are also foreseen after 2030. These can be combined with other developments in the eastern part of the bay.

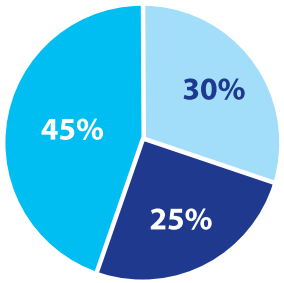
It can go without saying, that keeping an open connection to the sea is essential for its functioning. The bridge of the Tangerang-Bekasi highway in the master plan will have a 70 metres clearance to provide this open access.

The port of Sunda Kelapa will be closed off from the sea by the development of the outer sea wall. Locks in the outer sea will continue to provide access to the sea for Sunda Kelapa, fishing ports, as well for recreational boats and yachts.

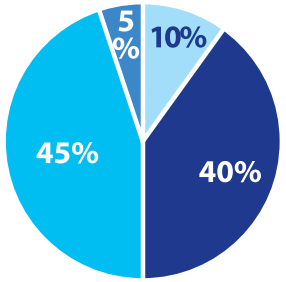
Modal split 2030 inside Garuda

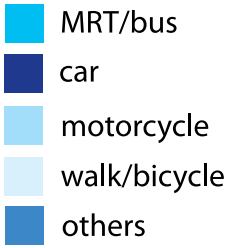


Modal split 2030 inside Jakarta



Modal split 2030 outside Jakarta





FACTS ON THE ROAD NETWORK

- *Based on rough calculations (no forecast model is available), the 650.000 inhabitants of the Garuda and 350.000 people who work on the Garuda result in an amount of 1,2 million trips per day.*
- *Based on traffic forecasts the capacity of roads will be as follows:*
  - *Tengerang-Bekasi highway will be a 2 x 4 lane road in the east and a 2 x 3 lane road in the west.*
  - *The outer ring Road 2 will be a 2x3 lane road.*
  - *The two connections from the Garuda to the mainland will be 2 x 2 + 2 x 4 lane roads.*
- *The bridge over the harbour entrance of Tanjung Priok will have a clearance of 70 metres.*

Main road network

Airport development

At the request of DKI Jakarta, an area is reserved in the Master Plan for the development of a new international airport. To avoid interference with the flight paths and approaches of the current (Soekarno-Hatta) airport, only locations far west (in the Tangerang district) or in the east part of Jakarta Bay will be potentially suitable. The eastern part of the bay is sufficiently large to accommodate an airport, however, specific airport studies will have to be performed to assess feasibility related to flight paths and (environmental) impacts.

7.6. Mobility and infrastructure

The city of Jakarta has been facing major traffic problems for years. The urban transport systems haven't kept up with the growing demand for mobility resulting in congestion. The congestion is caused not only by growth of the numbers of travellers, but also by an increase in car-ownership.

Traffic jams are wide spread, and as mentioned in the MP3EI: they have a negative impact on economic development. In addition it creates side effects such as noise and air pollution, which are for an important part caused by the great numbers of motorcycles.

To reduce traffic congestion, two major developments have to take place. First a modal shift has to take place: from cars and motorcycles to use of public transportation. Second, the infrastructure in the city needs to be upgraded: as well for public transportation as for road transport. These are two major points of attention in the spatial design of the master plan.

The design of the sea dike and Garuda include the completion of the ring roads in the north of Jakarta, it provide a route for the Tangerang-Bekasi Highway and High Speed Railway and includes facilities for public transport (MRT and busses).

Modality shift

Policies for mobility strive for a shift towards an increased use of public transportation. According to history however, the policy for 2030 (60% by public transport) is very ambitious. Therefore we used a modal split of maximum 45% travel by public transport (MRT and bus) to determine the need for capacity of the road network. Based on the available information and discussions with stakeholders, we come to the following assumptions about the modal split for the people working and living on the Garuda.

Because of the difference in travel distances, we have used different values for the trips made on the Garuda (inside the Garuda), the trips between the city of Jakarta and the Garuda (inside Jakarta) and trips to and from destinations outside Jakarta (outside Jakarta). These modal splits are used in the design of the road and public transport networks.

Design main road network

The current main road network in Jakarta consists of the Jakarta Inner Ring Road, the Outer Ring 1 and a number of radial connections across the city. The Jakarta Inner Ring Road is surrounding the central city and is a complete ring. The Outer Ring 1 is still incomplete, there are links missing at the west and the north-east. Both rings share the toll road along the coast of Jakarta. Plans exist to complete the missing road sections in Outer Ring 1. In addition plans exist to realize a second outer ring and a toll road along the coast westwards.

The design of the Garuda includes the following additions to the road network:

- The Outer Ring 2 is situated on the Outer Sea Wall, thereby completing the now missing northern connection.
- The Tangerang-Bekasi Highway (toll-road) is situated on the Outer Sea Wall. In this eastern part of the bay this road is build on stilts.
- The current Outer Ring 1 will be completed with a new road on the Garuda and the planned land reclamations. At the east side, near Tanjung Priok, the Outer Ring uses a part of the toll road which is already under construction.
- City (toll) roads connect the Garuda with the planned land reclamations and the city of Jakarta. These roads also are connections between the Jakarta Inner Road and the Outer Ring Roads.

These roads will serve to connect the Great Garuda to the city and to the east and the west. Just as important, these additions to the road network will drastically reduce the high traffic load on the current coast road. The provinces of Banten and West Java will be much better connected to Jakarta and the harbour of Tanjung Priok an also Sukarno-Hatta airport.

Design public transport network

To accommodate a shift towards greater use of public transport, a high quality public transportation network is designed for the Great Garuda. This network consists of:

- The sea wall provides a route for a High Speed train, as part of the High Speed railway along the north coast of Java (Cilegon - Banyuwangi).
- a freight railway in the east of the coastal zone to connect Tanjung Priok with the hinterland;
- a light rail (MRT) to connect the CBD with the central city. This connection is an extension of the South-North corridor in the city of Jakarta.
- an optional MRT-connection via the planned land reclamations along the coast to directly connect the CBD of the Garuda with the airport

The alignment of the freight railway can be partly combined with the high speed rail in the eastern coastal zone. The bridge at Tanjung Priok has a vertical clearance of approximately 70 m. When the High Speed train is using this bridge, gradients are required of approximately 7000 m. For that reason, a route south of Tanjung Priok was chosen.

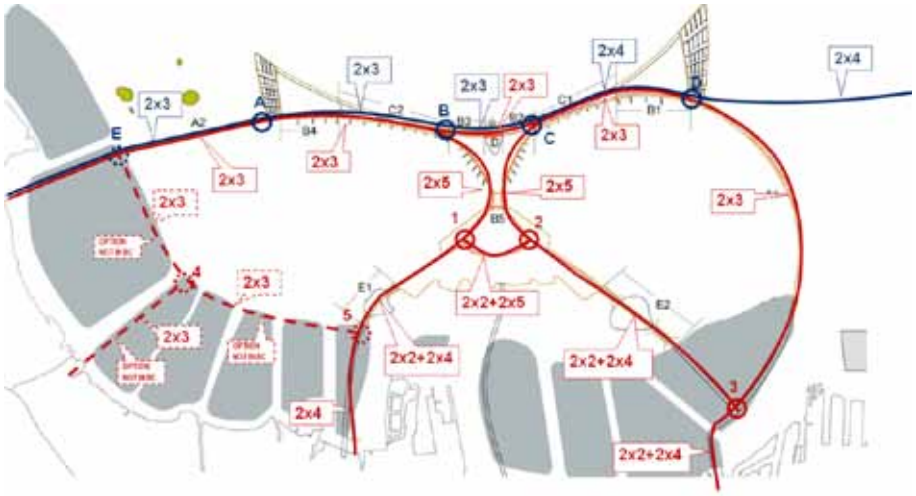
Mobility on the Garuda

Bus routes along the main roads of the Garuda, in combination with the MRT form the main form of public transport inside the Garuda, accommodating 45% of traffic. The buses mainly drive on separate bus lanes, only in quiet streets they will make use of car lanes. In this way, a dense network is created for public transport by bus.

The green structures on the Garuda in combination with relatively short distances due to the high density development make that about 10% of traffic consists of pedestrians and bicycles.

The remaining traffic on the Garuda consists of cars and motorcycles. On the Garuda the Tangerang –Bekasi highway, ring road two and local roads together form the primary traffic and public transport arteries: Great Garuda Grand Avenues. They connect this development with the rest of the city and form part of the primary east-west Jakarta connections. In these roles they become important

Main public transportation network



Road profiles main road network

FURTHER READING:

- *B3a – spatial planning & urban design*
- *B3b – Transport system analysis*
- *B3c – Tangerang-Bekasi analysis*

and challenging to design. They must be capable of providing sufficient capacity for great numbers of passengers and vehicles, but must not become a barrier between the different development areas. The road corridors will be lined by large trees and will thus become strong landscape elements forming an impressive green corridor.

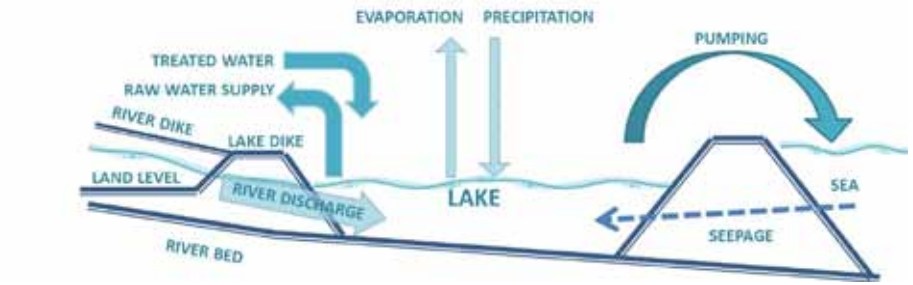
THE RETENTION BASIN DOES NOT ONLY ABSORB THE FLOOD WATER, IT IS ALSO A SOURCE FOR DRINKING WATER. CLEANING THE RIVERS AND CANALAS IN JAKARTA, HOWEVER, IS A PRECONDITION

7.7.
Water Management

The main components of the designed water system of the coastal zone consists of polder systems in north Jakarta, the rivers and canals that flow into the retention basin, the retention basin itself and the water management system on the Garuda itself.

Polder management

In total seven polders will be established in phase A. To create hydraulic manageable units, several dike rings were developed. To keep the land within these polders dry, waduk's and drainage pumps are required to pump out rain water and inflowing upstream water. Most polders will discharge their water into the retention lake behind the Outer Sea Wall. The Lower Sunter and Ancol Pumps will be adjusted so that they can discharge their water directly to the sea at Tanjung Priok.



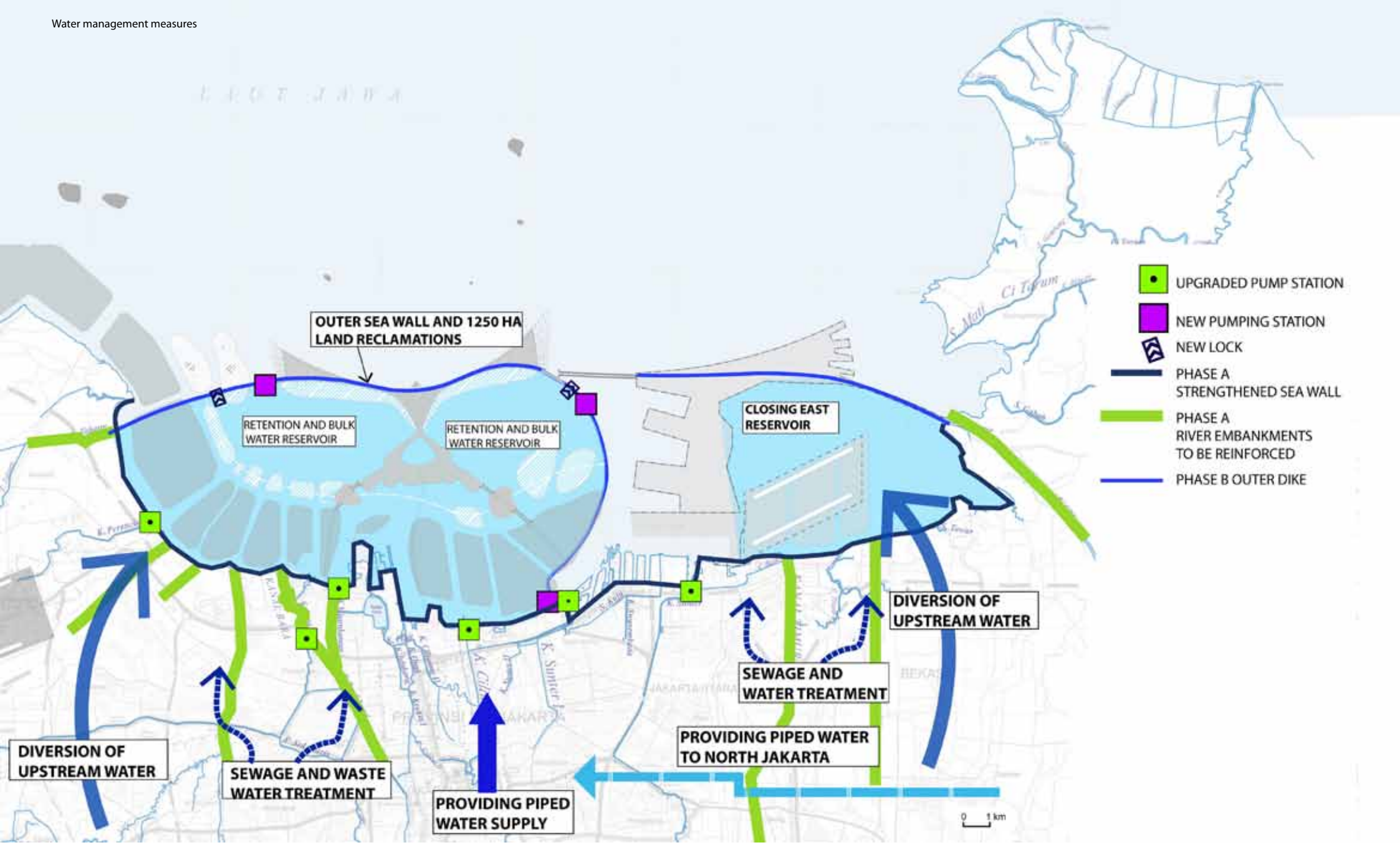
Cross section retention lake including in and out flow

Rivers

7 rivers and canals in western Jakarta will discharge into the giant waduk (the retention reservoir behind the Outer Sea Wall), including the Cengkareng Drain and Banjir Kanal Barat. After closing the bay, the water level will be lowered by 1,5 meter to -0,90 LWS-2012 in the dry season. This minimum level is determined based on the current depths of the rivers and the bay. Lowering the water level will immediately improve the river discharge during floods.

Retention basin

The retention basin of in total 75km2 serves as a giant waduk: it temporarily stores river water discharged into it before this water is pumped out. The water level in the retention basin can fluctuate 2,5 metres, creating storage space. The largest pumping station in the world is installed to maintain the water levels within the established boundaries.


OUTER SEA WALL AND 1250 HA LAND RECLAMATIONS
RETENTION AND BULK WATER RESERVOIR
RETENTION AND BULK WATER RESERVOIR
CLOSING EAST RESERVOIR
DIVERSION OF UPSTREAM WATER
SEWAGE AND WATER TREATMENT
PROVIDING PIPED WATER TO NORTH JAKARTA
DIVERSION OF UPSTREAM WATER
SEWAGE AND WASTE WATER TREATMENT
PROVIDING PIPED WATER SUPPLY
UPGRADED PUMP STATION
NEW PUMPING STATION
NEW LOCK
PHASE A STRENGTHENED SEA WALL
PHASE A RIVER EMBANKMENTS TO BE REINFORCED
PHASE B OUTER DIKE
0 1 km

The water level in the retention lake can, in time, be lowered to facilitate river discharge when the rivers subside further. This leads to a higher head difference between the water level in the retention lake and the sea. The total acceptable head difference over the outer sea wall however, is finite.

Supplying quality drinking water to Jakarta's population is currently a challenging task. Piped water supply and distribution is reaches only a small amount of the population. The retention basin might, over time, become a source of raw water supply. For this purpose, the operational level needs to be increased during the dry season to +0,65 m LWS-2012 in order not to surpass the minimum water level. In a dry year, the giant waduk can guarantee a reliable water supply of 12 m3/s in the dry season, adding up to 30 m3/s in the wet season. By combining this source of bulk water with other sources (including sustainable use of ground water), the National Capital can be provided with sufficient piped water year round.

The current water quality of the urban water is very poor and needs to be improved for the retention basin to function properly. This is further described under the environmental aspects in section 7.9.

Water management on the Great Garuda

Designing a complete urban area provides the opportunity to establish a state-of-the-art and sustainable water system on the Garuda. Rather than considering only engineering solutions, a combined approach of natural and man-made elements is most suitable to develop a robust water management system combined with high-quality environments.

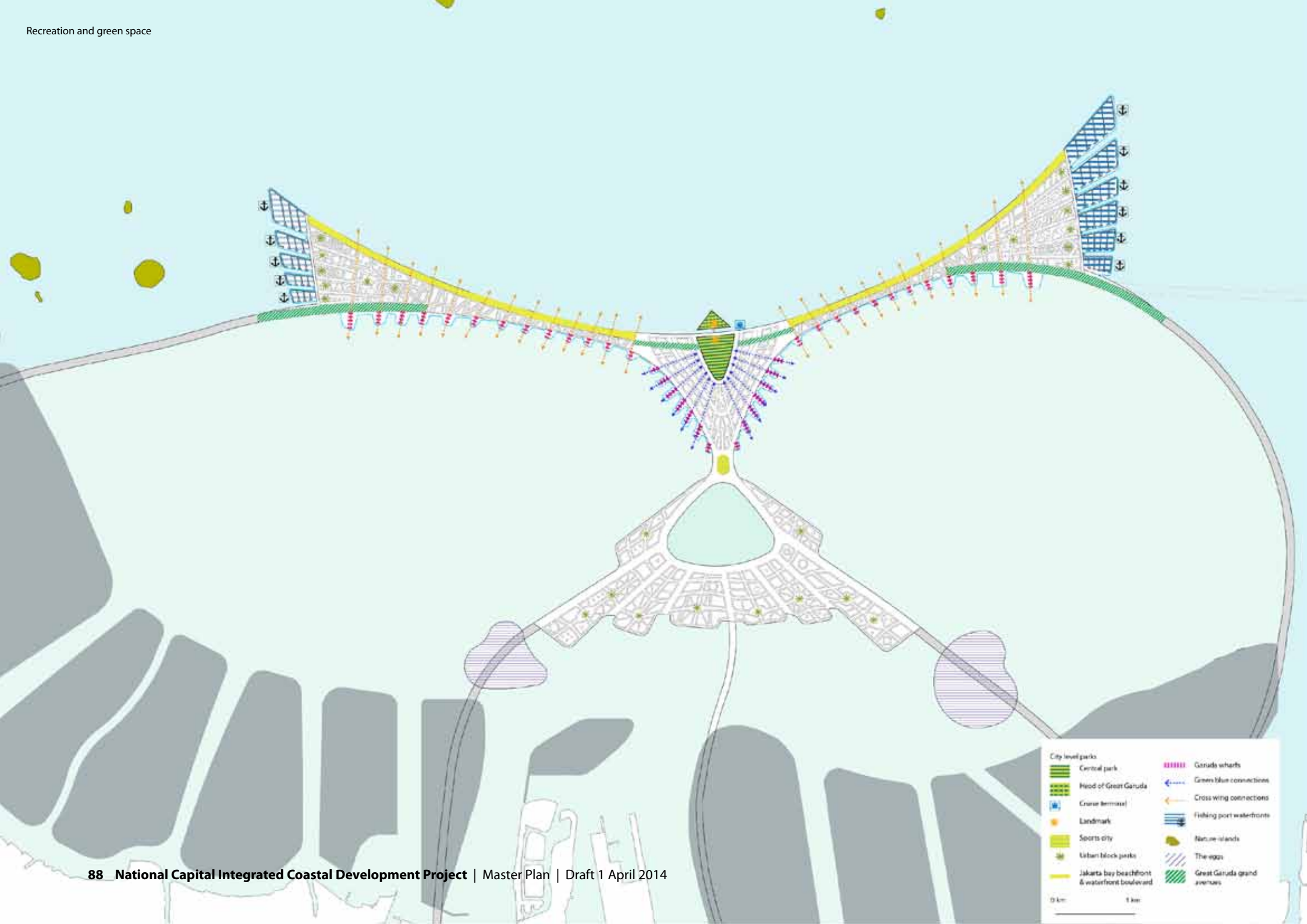
All waste water on the Garuda will be collected and treated. Runoff from roads will be filtrated before it reaches surface water, or will be collected and treated as well. A separate system is designed for rainwater. This relatively clean water is not mixed with sewer water: it is used as a supply for surface water streams on the Garuda and feeds into the parks, green zones and mangrove areas. This water as much as possible flows under gravity to, eventually, the retention lake or the sea. Roadside catchments and drainage swales, water attenuation ponds and extensive permeable surfaces can be integrated into the design and the benefits of green roofs and other techniques to slow down rain water run-off should be promoted.
An issue regarding water management in the Garuda is the salt water seepage of up to 3 m3/s, which will occur through the outer sea wall. As this is relatively high, it may be considered to create a polder in the Garuda, and catch salt water seepage in a drainage system.

THIS PARK WILL BE A LANDMARK LANDSCAPE AND WILL FUNCTION NOT ONLY AS A PRIMARY OPEN SPACE FOR THE GREAT GARUDA POPULATION, BUT ALSO AS A DESTINATION FOR THE CITIZENS OF JAKARTA.

7.8.
Recreation and green-space

The incredible pace of urbanisation in Jakarta has resulted in enormous pressures on the city's green infrastructure (both recreational and natural). Open spaces have been consumed by both legal and illegal development and the quality and safety of open spaces is not consistently good.

Many people do not have access to open spaces for recreation, leisure, health and well-being. Studies across the world have shown that quality and plentiful urban green results in urban populations that are physically and mentally healthier as well as more productive in work and education. The proximity of urban green contributes considerably to the attractiveness of the central business district.


City level parks
Central park
Head of Great Garuda
Cruise terminal
Landmark
Sports city
Urban block parks
Jakarta bay beachfront & waterfront boulevard
Garuda wharfs
Green blue connections
Cross wing connections
Fishing port waterfronts
Narrow islands
The eggs
Great Garuda grand avenues
0 km
1 km

The design of the Great Garuda places the green network as a core criterion for spatial arrangement. The green-spaces of the Great Garuda have a hierarchy and include a large city level park, urban block parks, grand avenues, waterfront boulevards, mangroves and wetlands, nature reserves and the city street network.

Central Park

The Central Park is the largest primary open space alongside the waterfronts and open waters. Located at the heart of the Great Garuda this parks is a large-scale multi-functional open space. It will become a focal point for the surrounding urban developments and will include a great diversity of functions, amenities and activities.

This park, as an integrated urban element, not only has a major physical value but also provides opportunities for financial value and returns to be realised. In many cities property values directly overlooking and in close proximity to high-quality open spaces, command amongst the highest in the city. So whilst it may appear to be a great extravagance creating such a large open space on costly land created in the sea, the civic benefits and direct and indirect increased land- and property-values are believed to compensate for this.

Standing in the area of highest density development and surrounded by the tallest buildings on the Great Garuda, this park will become a vital part of the urban fabric and a vibrant open space suitable for big outdoor activities and celebrations.

Museums, concert hall and the like would be appropriate elements to be considered for inclusion within an iconic building or building cluster within the park. Other smaller restaurant, gallery and café / bar pavilions could also be dotted throughout the park in order to further promote its popularity and extend hours of activity and use.

Garuda City Square

The Garuda City Square is located immediately to the south of the central park. This is a formal open space in the centre of this city district. It is a location for formal civic events and can also accommodate sculptural and artistic installations and performances. The MRT line passes through the square and there is an integrated public transport stop with opportunities to park (underground car parking), store bicycles and gain information about public transport routes, events etc.

Urban Block Parks

In addition to the functions of the larger parks, the urban block parks provide easy access local open spaces that can be specifically tailored to the character and needs of their immediate populations and built functions.

Jakarta Bay Urban Beachfront and Waterfront Boulevard

A prime waterfront real-estate location for large hotels and large-scale recreation / mass-tourism functions, the Jakarta Bay New Urban Beachfront and Waterfront Boulevard is the main publicly accessible new leisure destination. As the name suggests this is a place designed to attract visitors from a wider catchment area. The beach park will include pavilions, kiosks, beach festivals, outdoor performance spaces, piers, jetties and other sea-side activities.

The waterfront park

Closer to the outer east and west edges of the wings, the waterfront park is a green strip alongside the waterfront. This is a semi-natural waterside and includes mangroves, boardwalks and river-taxi pontoons and mooring locations. It is a relaxed landscape with little formal program and it is intended to be a counterpoint to the intense waterside typologies found closer to the head of the Great Garuda.

City Piers and Garuda Wharfs West and East

Located on the watersides surrounding the main body of the Great Garuda and on the southern edges of both wings, are areas of lower height developments with waterside leisure, entertainment and marina activities. The landscape design will be heavily influenced by marina styles and should consider ways to incorporate traditional fishing port and harbour architecture in a contemporary way. References such as Clarke Wharf in Singapore can be considered.

Mangroves, Wetlands and Nature Islands

As well as recreation and leisure landscapes, we also propose that certain areas become places for nature with minimal human disruption and access. The creation of the lagoon will result in many different habitat typologies developing from fresh and brackish water within the lagoon to tidally influenced salt water maritime conditions outside of the sea dike. We therefore consider various locations for the enhancement of existing habitats and natural areas, as well as the developments of new nature zones. Mangrove Park and Discovery Centre is located at the western tip of the Great Garuda western wing. The intention of this park is to re-establish large areas of mangrove forest and wetland and to create an educative and recreational program to allow people to learn about the importance of mangroves and to enjoy the tranquillity of the wetland park. Boardwalks extend throughout the series of mangrove islands and at the discovery centre it is possible to hire boats, take a water-taxi, and engage in a range of informative and fun activities.

THE IMPACTS OF THE PROJECT ARE SIGNIFICANT, BOTH POSITIVE AND NEGATIVE. MITIGATION OF ADVERSE IMPACTS IS ESSENTIAL

7.9.
Environmental impacts

Closing the bay has significant environmental impacts. Initially, these effects will be negative as the current environmental system will change significantly. The design is aimed at creating new opportunities for the development of environmental qualities. A better environmental quality is even a requirement for the success the urban development.

Mangroves

The last true mangrove areas of Jakarta Bay can be found around Pantai Indah Kapuk area. Mangrove covers in total 320 ha of which 180 ha is protected. The mangroves currently suffer from several external forces including, low water quality, solid waste, illegal cutting and most notably subsidence. Given the current subsidence rates, it is very likely that the mangroves will submerge, resulting in oxygen depletion and subsequently to the complete degradation of the forest. Closing the bay will result in an accelerated degradation of the mangrove forest. The bay will change into a fresh water basin with different hydraulic conditions, making it impossible for mangroves to outcompete less saline tolerant species. The remaining brackish water mangrove area in North Jakarta will transform into a fresh water habitat.

In order to mitigate the loss in mangrove area, several possibilities have been analysed. The goal is to create a true estuarine system with intertidal conditions, a size of at least 180 ha and the potential to provide the same ecosystem services the current mangrove area is able to provide. The locations with the most potential for mangrove development are in the east side of the bay just north of the mouth of the Sungai Bekasi, in-between the feathers of the Garuda or along the western side of the seawall and western reclamations.

The phase B design incorporates the development of mangroves in the western wing of the Garuda. The development of a mangrove park and discovery centre is proposed here. At this location nature education, mangrove restoration and city recreation can be combined in an interesting mix.

Mitigating loss of mangrove habitat can further focus on strengthening mangrove areas in the region. In the eastern part of the bay opportunities are identified integration in the design of phase C is a possibility. Considering the uncertainties of spatial development and long term flood defence requirements this design will have to be develop at a later stage.

Water quality

Jakarta lacks effective waste water treatment, leading to exceptionally high loads of human waste, organic materials and nutrients in Jakarta's rivers. Over 95% of urban water is classified as highly polluted. The low chemical quality has already led to the prohibition of mussel farming near Tanjung Priok port.
If no measures are taken, the water quality of the retention basin will become extremely bad. Organic material will cause oxygen depletion leading to mass starvation of aquatic species. High nutrients will cause excessive bloom of algae or water hyacinth. Therefore, priority needs to be given to a water quality improvement program that focuses on acceleration of sanitation in western Jakarta, solid waste management, dredging and awareness programs. In addition, it might be needed to dredge the current top layer of the bay, as organic material might be piled up here.

The closure of the bay makes cleaning of rivers imperative. It creates the necessary momentum to implement sanitation measures and therefore has a positive impact on water quality. This in addition has positive effects on living conditions along the rivers and the coastline. In addition, the outer sea wall contains the pollutants in the bay, dramatically improving the water quality outside the basin. This has a positive effect on marine ecosystems and possibly increases productivity for fisheries. For instance the pollution of the valuable Thousand Islands is reduced, thus contributing to protection of coral reefs and sea grass areas.

Marine life

The ecology of the freshwater and estuarine system is heavily impacted by pollution and low oxygen concentrations. Several migratory fish species and three species of eel can be found in the Jakarta Bay. Populations of all three eel species however, are severely depressed.

Closing off the bay will turn the bay of Jakarta into a fresh water retention lake, which has a large impact on the ecological situation of the Jakarta Bay. As a result, sedentary marine species of fish and benthos will die out. Larger reef fish and pelagic species however, will try to migrate towards better suited habitats at seaward locations. They can be aided by giving them time to find a way out along the shifting saline gradient. Disappearance of marine species will take place over several months giving euryhaline species time to dominate the food chain and consume cadavers of disappearing species. Sudden massive mortality is therefore not likely to show.

In the freshwater state there is a diversity of tolerant fish species that disperse over the retention lake quickly, especially when the waters entering the lake are of sufficient quality. Many freshwater species are also interesting target species for fisheries and aquaculture. To prevent the disappearance of migrating fish species and estuarine life, estuarine habitats can be created outside the dam, along the south west coast (this can be combined with mangrove developments) and ship locks and pumping stations can be adapted to allow for fish migration.

VIII

THE PLAN PER AREA

1. Construction of dike
2. Construction of road

PS Pumpstation

Road + dike combined

3. Construction of new land and housing behind dike and relocation of residents adjacent to Pluit Reservoir
5. New shipyard
6. Piers connecting the urban area to the water
7. New market related to fishing industry

8. Re-vegetated area adjacent to reservoir
9. New urban parkland
10. Upgrading of existing urban areas

In this chapter the designs are worked out per phase and per location to show how different themes combined contribute to a safe and revitalised coastal zone. Where chapter 7 focussed on themes and technical design, this chapter focuses on the integration of themes and the urban design.

8.1.
Phase A: dikes-an opportunity for coastal revitalisation

Phase A consists of the reinforcement of the dikes along rivers and the coast as described in chapter 7. In total seven dike rings have been designed to create hydraulic units which will protect the coastal zone until the closure of the Outer Sea Wall. However, most of the surface area of Jakarta is developed and most waterfronts are flanked by important road and infrastructure corridors or dense developments, both legal and illegal.

Making room for strengthened flood defence structures requires large land acquisitions and relocations. Considering integrated solutions combining dikes and walls with infrastructure, buildings and facilities is therefore key to ensure optimal use of valuable and limited space.

In technical report B2 six concepts for the technical designs of dikes are presented. These concepts should be worked out per location. In some places as a rather technical solutions, in others in combination with infrastructure or as part of an urban development concept.

Using the right concepts, dikes could add value to coastal communities. Coastal protection becomes the catalyst for development and revitalisation. To show how this can work in practice, the locations Pluit and Kali Baru are chosen as pilot locations. Here the location Pluit is shown as an example as its situation is typical for some densely populated locations along the coast line.

Current situation Pluit

The coastal zone in Pluit faces many challenges. Subsidence levels are high as well as the risk of floods. There is a complex, dense mix of land-uses and extensive informal and illegal land occupation and development. Pluit fulfils an important function in the city water system. A large pumping station with a large waduk is situated here. The location chosen as a pilot is the area between the Waduk Pluit and the sea.

Around the north-east part of Waduk Pluit, illegal settlements have developed on the banks. This is not a desirable situation from environmental, hydraulic and living environment point of view.

In the current situation, the settlements and businesses here have a strong relation with the sea. Fishermen rely on the proximity to their boats and activities like ship repair and ship demolition depend on direct access from the sea. Lack of space for the development of the dike is a very important issue here.

Development strategy

The focus in this pilot is creating space for redevelopment of the coastal zone using the reinforcement of the dike as a catalyst. Concepts to combine the dike with roads, buildings, marine facilities and environmental improvements were explored.

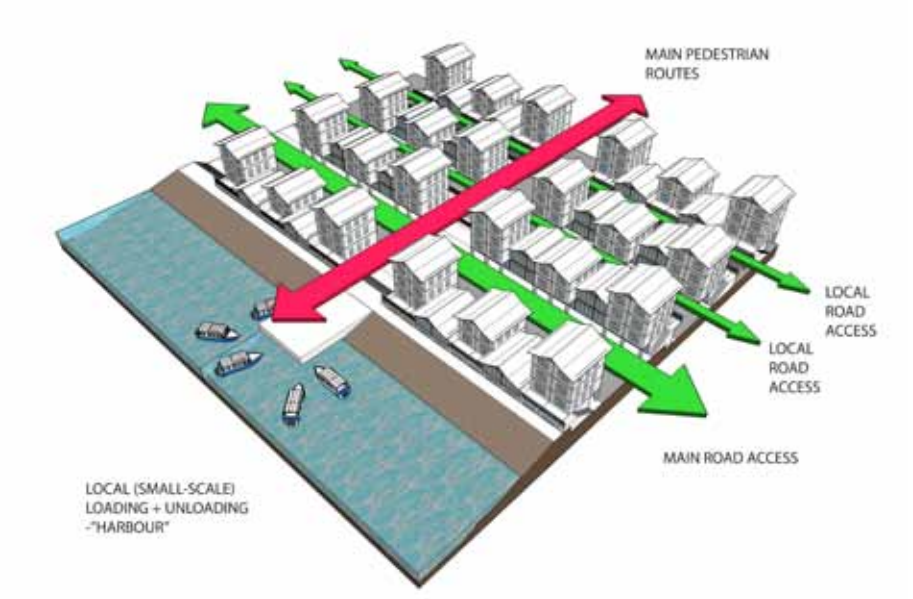
In Pluit the new sea wall is designed offshore of the current sea wall, thus creating additional land in the shallow waters between the old and the new sea defences. This newly created land provides the opportunity to build new affordable social housing for the coastal residents now living in poor conditions. The figure on the previous page shows the development steps.

- Step 1 is to construct the offshore sea dike to achieve the necessary flood safety standards. Temporary piers may also be made to allow those who currently

rely on direct water access to continue to have this. A wide dike is developed along the west side of the inlet. To the east the dike re-joins the current land and will be combined with road infrastructure.

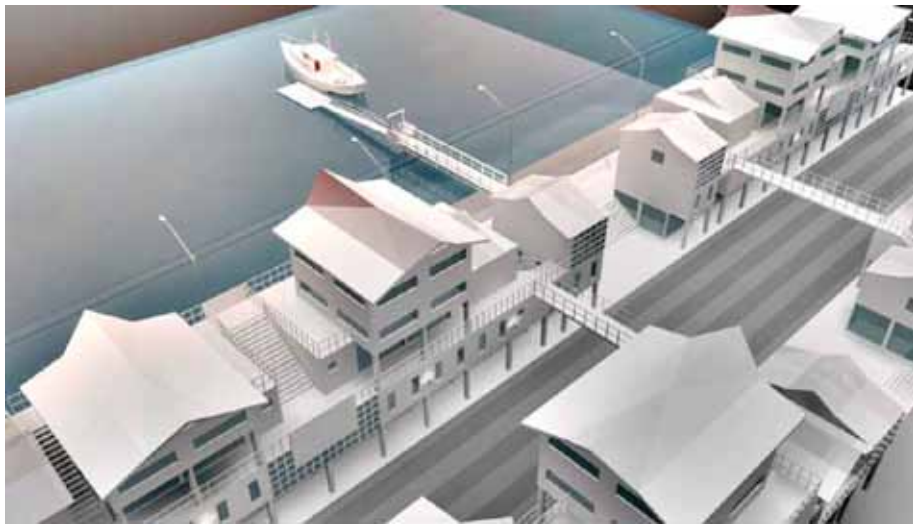
- Step 2 refers to the subsequent road and infrastructure improvements.
- In step 3 new land is created behind the new dike. This is an essential step in the transformation process whereby a new urban village will be made. The local community, currently living in poor conditions, can relocate here. Redevelopment, by relocating close by is considered the best way for redevelopment, preferred over relocation to locations far away.
- Once new building are constructed, residents can be re-located, land cleared and the next row of development can take place (step 4).
- Steps 5 and 6 are the creation of permanent new slipways and mooring piers / docks.
- Step 7 shows the opportunity to create a market, storage and processing area for fishing related activities and functions.
- Once the illegal / informal areas along the north east edge of waduk Pluit have been relocated it is possible to undertake environmental improvements whereby suitable waterside habitats and open spaces for recreation are created (8).
- Step 9 refers to the establishment of a compact but valuable public open green space for the new community around which civic functions such as schools, health care etc. may be focused.
- The final step is then step 10, where the last stage of urban renewal is undertaken.

In terms of overall urban design concept, the key relationships between open spaces and the people who use them are carefully taken into account. Open spaces are considered important for all kinds of domestic and employment related activities. With this aspect as a fundamental design and planning consideration, the north-south alignment is the most appropriate for pedestrian and non-car



routes. Running perpendicular to the sea edge (east-west) are therefore the vehicular routes. This arrangement allows strong connectivity to be established between the primary employment location of the coast edge (fishing and fishing related industries) and the heart of the new urban village where the workers and their families will live and run businesses.

STRENGTHENING THE SEA WALL IS AN EXCELLENT OPPORTUNITY TO REVITALISE THE COASTLINE. AN INTEGRATED APPROACH IS REQUIRED IN WHICH FLOOD PROTECTION AND URBAN DEVELOPMENT GO HAND-IN-HAND



In the Spatial planning & urban design book, this concept has been worked out as well on the building level.

Conclusion

The coastline of Jakarta is densely populated and used for a multitude of purposes. Developing the Phase A sea defence will have an impact on the land use and communities. Integrated urban designs aimed at both flood protection and revitalising local communities will reduce disruption, increase acceptance and add socio-economic value to the design. The Pluit pilot provides a concept which also could be used as a model for other populated areas. Also other conceptual designs for different situations on the coastline have been developed and are presented in technical reports B2 and B3.

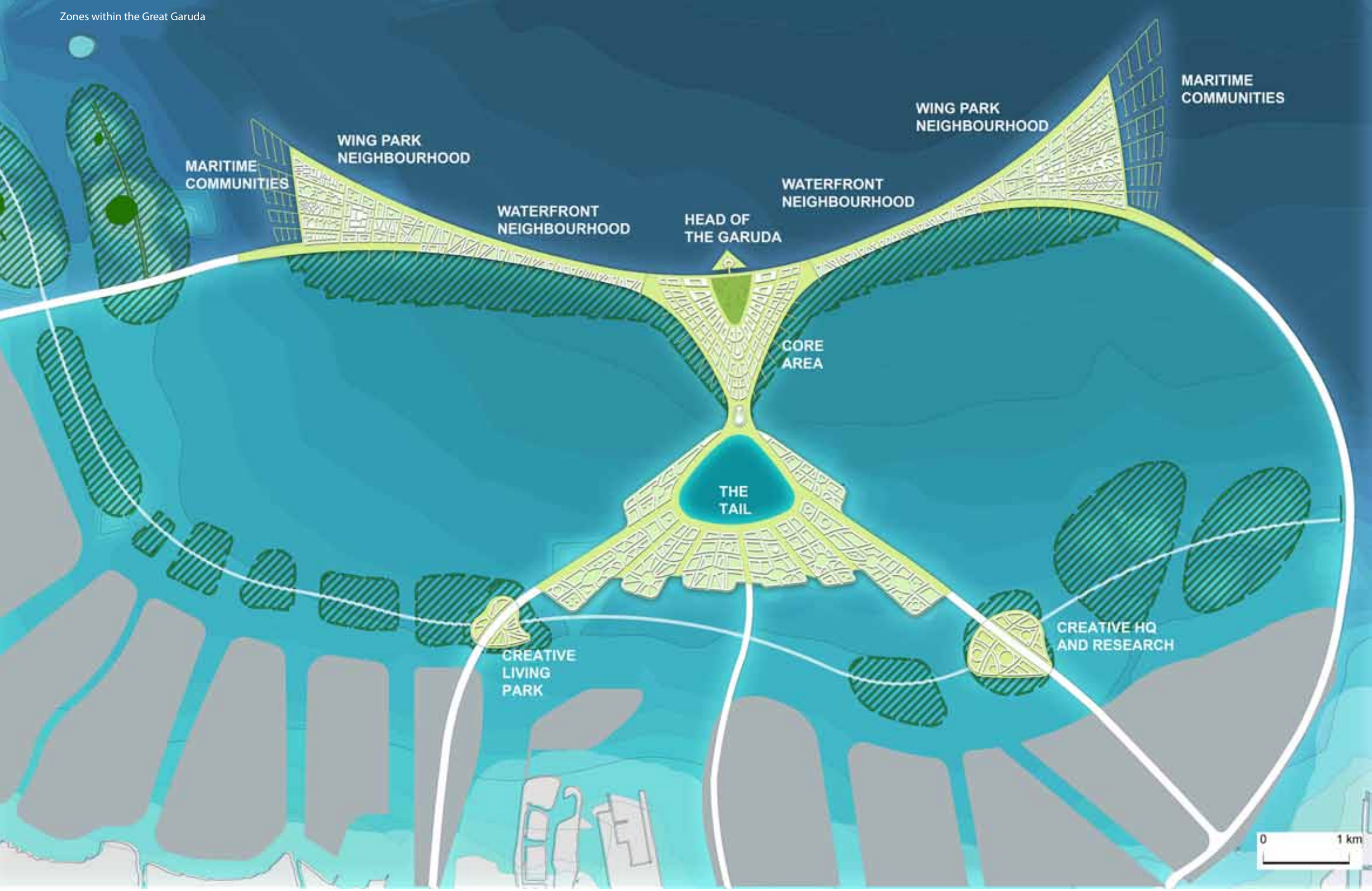
FURTHER READING:

- *B3a – Spatial planning & urban design*
- *B2c – Evaluation report*
- *B2d – Dike ring D conceptual design*

8.2.
Phase B: the Great Garuda

The main structures that define the shape of phase B are: the outer sea wall alignment, the central city axis, connections and the iconic design of the Garuda. Within the area of the Garuda itself, the density distribution, the green space strategy and the road structure are main elements in the design. In this section specific areas and neighbourhoods of the Garuda are presented in more detail, showing their characteristics and possibilities and focussing on the urban design.

Zones within the Great Garuda



The Great Garuda Core Area

The core area of the Garuda predominantly features commercial developments with retail, leisure and cultural and entertainment components. Also the administrative centre of Jakarta will relocate to this core area of the Garuda. The general programming is intended to create active streets so that each commercial tower includes publicly accessible functions at the lower levels. This can include shopping malls, cafés, restaurants, bars, clubs, galleries etc.

A lively and genuinely mixed-use city has the capacity to support a rich array of cultural and entertainment facilities. Some of these will be specific locations and buildings, others may be seasonal events that are able to reach a wide and broad audience. In designing the city an important consideration is which locations are most suitable for cultural and entertainment clusters. For instance in London, the culture and entertainment centre West End is located between busy shopping streets, creative and culturally diverse Soho and the important commercial and administrative parts of the city. The non-building specific activities are also of great importance to the cultural development of a city. Open air events are able to provide big-scale, popular activities for the city and enhance a feeling of civic pride. It is important to plan spaces that can accommodate such events.

A public cultural complex in the core area can include many different functions. In some cities it is the museum, library of an integrated theatre, music, performance

BODY AND HEAD OF THE GREAT GARUDA, THE CENTRAL BUSINESS DISTRICT

and/or sport building. In other cities it is a part of town where many cultural and public facilities are located in close proximity. The most important factor is that it should be a mix of paid entry facilities and functions, and free, publicly accessible facilities and functions. This is necessary to ensure viability on all levels.

The Waterfront Downtown Areas

These downtown areas are the main mixed-use urban areas with a strong mix of commercial, retail and residential functions. Located between the heart of the Great Garuda and the City Piers, they are the ultimate high-urban living areas with a mix of residential unit sizes but almost exclusively apartment typologies. In these developments the mix-of use is considered to be a vertical mix rather than horizontal. This means that each building should have the potential to include various different uses and functions.

Cities are melting-pots of ideas, cultural exchanges and commercial activity. Offices bring in many people each day on their commute to and from home. This footfall provides the basis from which commercial and retail developments can grow. The shops attract people both during and outside of office hours so that the city experiences prolonged periods of high levels of activity. However, when resi-

dential developments are missing or too small in commercial areas or city cores, there is a tendency for the city core to die-out in the evenings and weekends. The addition and integration of large numbers of residential developments reinforces the viability and vitality of the city core and allows enhanced levels of commercial and retail activity plus extended hours of footfall and therefore encourages the development of civic facilities such as art galleries. Large office concentrations attract large numbers of transient populations; those visiting the city for work, business and conferences etc. Cultural and social activities and amenities draw in people from outside the city to visit and stay. People in the city core often live smaller than those in the suburbs, so visiting friends and family need places to stay. Each of these factors contribute to the attraction of the city core for hotel, restaurant, café and bar development.

Parking in this city district must be carefully planned. The program is dense and population numbers high therefore it is necessary to include basement or embedded multi-level parking facilities. These should be regularly located throughout the district but should be designed in such a way that they do not negatively impact upon the overall urban picture. It is not desirable to have extensive inactive facades that are associated with old-fashioned multi-level parking garages. Instead, parking garages should be clad with other functions so that they integrate into the city fabric and provide easy access and adequate parking to support all of the planned city functions.

Head of the Garuda

The head of the Great Garuda is shown as a prominent open space and civic icon location. It is the primary visual element when viewing the new Jakarta Waterfront from the sea. Surrounded on all sides by water, this location will be highly visible and should be designed so that it becomes the strongest image of the Great Garuda waterfront. As the 'head' is located in the deepest waters of the Great Garuda, its construction requires careful planning. Steep dike walls combined with retaining walls can be applied and in parts floating techniques may also be applied in order to further enhance the maritime experience.

A key design objective is to maximise the feeling of being at sea and standing at the gateway to the city but also at the gateway to the thousand islands. It will showcase the culture and heritage of Indonesia and Jakarta whilst combining this with innovative and progressive design. As the primary location for arrivals from the sea it should adopt a breath-taking and memorable design. However, it is also the pinnacle of the new Capital City location which is a city for everyone and therefore the designs and access to this area should carefully blend exclusivity with inclusivity; a place for all where everyone feels special and proud.

The Tail

The base of the tail of the Great Garuda is a location where main road and public transport infrastructure routes come together. Here the creation of a large inner lake park is proposed that will be the focal point for the surrounding tail-feather islands and the main connection between existing Jakarta and the Great Garuda. At the northern end of the inner lake, where the tail joins the body, there is a development location that benefits from excellent connectivity and that is particularly suitable for city scale sport, leisure and entertainment facilities. It is a location that people can easily reach but there is also sufficient space between this area and nearby residential and office areas that potential noise and crowd disruption will not be a negative impact on these areas.

THE TAIL; RESIDENTIAL MIXED-USE AND SPORT, LEISURE & ENTERTAINMENT

Waterfront Neighbourhoods

The Waterfront Neighbourhoods are medium-high rise, mostly residential neighbourhoods located on the connecting parts of each wing. These neighbourhoods mark a transition from ultra-urban to mid-urban city living. There is an intention to create mixed-use urban blocks with vertically mixed functions around the block perimeter and north-south aligned residential buildings set within the blocks in garden courtyards. These blocks are developed above the main road highway connection so that through traffic is not impeded by local traffic and residential areas do not suffer the effects of traffic pollution.

LIVING ON THE WINGS OF THE GARUDA; WATERFRONT NEIGHBOURHOODS AND MARITIME COMMUNITIES

Garuda Wing Park Neighbourhoods

These neighbourhoods are mid-density, primarily residential areas where green is a dominant feature. Closer to the heart of the Great Garuda, the neighbourhoods are set within park landscapes and, with proximity to the outer edges of these districts, the character is increasingly dominated by buffer planting and mangrove planting areas. The neighbourhoods also include large recreation parks through which water collection streams meander. The building heights are generally higher around the central zones and become lower to the edges. Some higher accent buildings mark key sight lines out to sea and back to the main land.

Wing Tips: Maritime Communities

Located at the outer tips of both the west and east wings of the Great Garuda new fishing ports and communities are located. These will be primarily designed with and for the people who will use them for work and living but will most likely also draw some interest for visitors. It can be interesting for fishing communities to

have opportunities to sell their produce directly from markets or temporary and permanent shops, stalls, restaurants and food stands.

The role of the Great Garuda in the development of the fishing industry is to provide new opportunities. Salt water fishing industries can benefit from improved facilities both for their industrial needs and for the quality of residences and community amenities such as schools, healthcare and administration facilities. There is in the future the possibility to utilise the lagoon for closed water fishing and farming and to develop new fishing port facilities on the Garuda.

New communities and urban areas will need to be developed with respect to the way in which the people who will live there, are used to using their neighbourhoods. Many of the traditional existing fishing community areas are dense, complex labyrinths where functions and activities merge with each other. There are extremely high levels of street activity and the boundaries between work place and living space are blurred. People in these areas often rely heavily on their immediate support circle for childcare, social life etc. It will therefore be important

to carefully consider how the new neighbourhoods can foster this spirit of community and provide architectural solutions that are appropriate.

Whilst the ambition on the Great Garuda will be to provide higher density developments priority in these areas is not to disconnect people from the streets and spaces of the neighbourhood. Across the world there are examples of schemes where low-quality dense low-rise housing has been replaced by multi-level apartment accommodation in the name of progress. In some cases this has resulted in communities who were once focussed around the street, feeling disconnected from each other and unfamiliar in their new situation. In the worst cases this change has produce negative social situations where nobody feels responsible for the area in which they live and anti-social behaviour has risen. The importance of neighbourhood pride, civic ownership and community is thus a vitally important ingredient when considering the architectural typologies for the new fishing / maritime community areas.

Creative Living Park

Great Garuda Creative Living Park is an area created on a near-shore archipelago island between the new developments and the former coast line of Jakarta. This location explores the relationships between old and new and the challenges of creating new land in the sea. It is a pioneering landscape. The location makes it very appealing for a number of functions as it benefits from proximity to residential and business functions of all types. Here a creative living park is proposed where innovative architectural design and business creativity can have a prominent place in the total new development area.

THE EGGS: CREATIVE LIVING AND WORKING ON A NEAR SHORE ARCHIPELAGO ISLAND

The concept for creative working space applies a principle once common throughout traditional cities; live and work on the same premises. The principle is that the residential building has a work space integrated into it. In some cases

this is a shop or workshop on the ground floor. In some cases it may be an office on one or more floors but in all cases living space is generally located above the working areas. To create this kind of environment specific planning and permitting requirements will have to be applied. In addition architectural competitions or small commissions can be used to allow many small architectural practices to design individual houses within a row or complex and create the specific creative neighbourhood as envisaged. In order to promote the attractiveness and viability of such live-work units it is essential to plan their location in the overall masterplan, very carefully.

Typical uses of live-work units are in residential support services and small business support services. In terms of residential support services functions such as child day care, offices for household cleaning companies, hair-dressers, small scale beauty services, dentists and doctors' practices etc can be considered. These do not require locations within large rows of retail activities as they are generally essential or day-to-day services that people will choose due to the proximity to their house. They are generally small units and are found scattered throughout residential areas. Short-term parking facilities are important for such businesses but they require few other specific elements. Small business support services include financial advisors, solicitors, legal advisors, print and courier services, print-shops and day-to-day stationary supplies, web-design and maintenance companies etc. These functions have some benefit from clustering and prominent locations so may be located on main thorough-fares and in residential areas close to larger business and commercial areas. Other groups attracted to live-work units are start-up entrepreneurs and research practices. These benefit from ease of interaction with larger commercial, office and institutional facilities and should be located in close proximity to these.

Creative Headquarters & Research Centres

Whilst the creative office location is a thriving mix of many companies of all sizes, the creative headquarters or research centre tends to be a large single company development dedicated to the progressive design and development parts of a company. Located between the existing city and Great Garuda, this area is one of the islands in the new near-shore archipelago and is also adjacent to the industrial hub of Tanjung Priok. The large scale creative HQ / research centre should be a showcase for innovative and environmentally responsible architecture.

Connecting to the context of current city and the sea

The relationship between the Great Garuda and other planned and on-going off shore land developments is complimentary. The Great Garuda is developed as an integral part of the Jakarta Metropolis and considers not only its role and relationship with regards to the existing city, but also to the many planned and on-going land reclamation projects in Jakarta Bay. Many of these plans promote themselves as mid- to high-end residential mixed-use urban villages and are seen as high quality, safe and flood free locations for those who can afford to live there. The future residents of these islands will have many of their daily needs catered for within each island but larger scale facilities and amenities are not always included in the programming of these developments.

At the Great Garuda all aspects of city life and the requirements of the urban population are considered thereby providing civic amenities such as hospitals, schools and governmental functions. The Great Garuda is also likely to attract some of the best major businesses from the country, region and across the world to locate there. Many of the people who come to work may choose or want to live on some of the planned island developments and likewise those who can afford to live at the planned islands may also want to work at these companies. Whilst the islands offer secluded oasis developments, they do not perhaps provide the city waterfront that the Great Garuda intends to deliver. So also in terms of water-

front typologies there is increased diversity created for leisure, nature, industry, recreation and city branding.

A new city-a sustainable city

This new, modern city provides excellent opportunities to create a really sustainable city in terms of energy use and efficient (re-)use of water. By integrating energy-saving and energy-producing elements (solar panels) in the designs it should be possible to create an energy-neutral city. Re-introducing traditional natural cooling techniques are driven by the cool sea breeze, is an important element of this ambition. The location next to the Java sea will also create outdoor living and working opportunities. Smart 'cool' designs are required.

Phase C

FURTHER READING:

- *B3a – spatial planning & urban design*

8.3.
Phase C

Phase C consists of several long term developments on the east side of Jakarta Bay. Closure of this part of the Bay is anticipated in case subsidence in east Jakarta cannot be stopped. The east dike section with the Tangerang Bekasi Highway provides a good starting point for this closing.

Sufficient space is available in the bay to accommodate the extension of the mainport Tanjung Priok and an airport, but additional studies will have to show whether this airport is feasible. Port extensions up to 2050 are included in the phase C design.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IX

TRANSFORMING THE COASTAL ZONE
[THE DEVELOPMENT STRATEGY]


KEMPINSKI

NOTE:

Note: the implementation strategy is still under development. Implementation aspects like construction stages, involvement of the private sector, financing strategies and organisational structure will be worked out in the coming months by the PMU support team in collaboration with the Indonesian government and the Master Plan team.

In this chapter we will now focus on some important implementation principles.

THE PROBLEM OF SCARCITY OF RELIABLE DATA WAS SOLVED BY DEVELOPING ROBUST DESIGNS AND ADAPTIVE STRATEGIES

9.1.
Adaptive development

The scope of the Master Plan project did not include generating primary data. Most of the data was extracted from existing studies and combined with data and experiences from previous projects (land reclamations). A technical survey was carried out to measure the heights of the current sea wall.

As (reliable) data in Indonesia is scarce and not easily accessible, many uncertainties emerged during the plan process. When possible, alternative models or compatible international data was used, but for some topics a large degree of uncertainty still exists. The strategy in dealing with these remaining uncertainties consists of two elements:

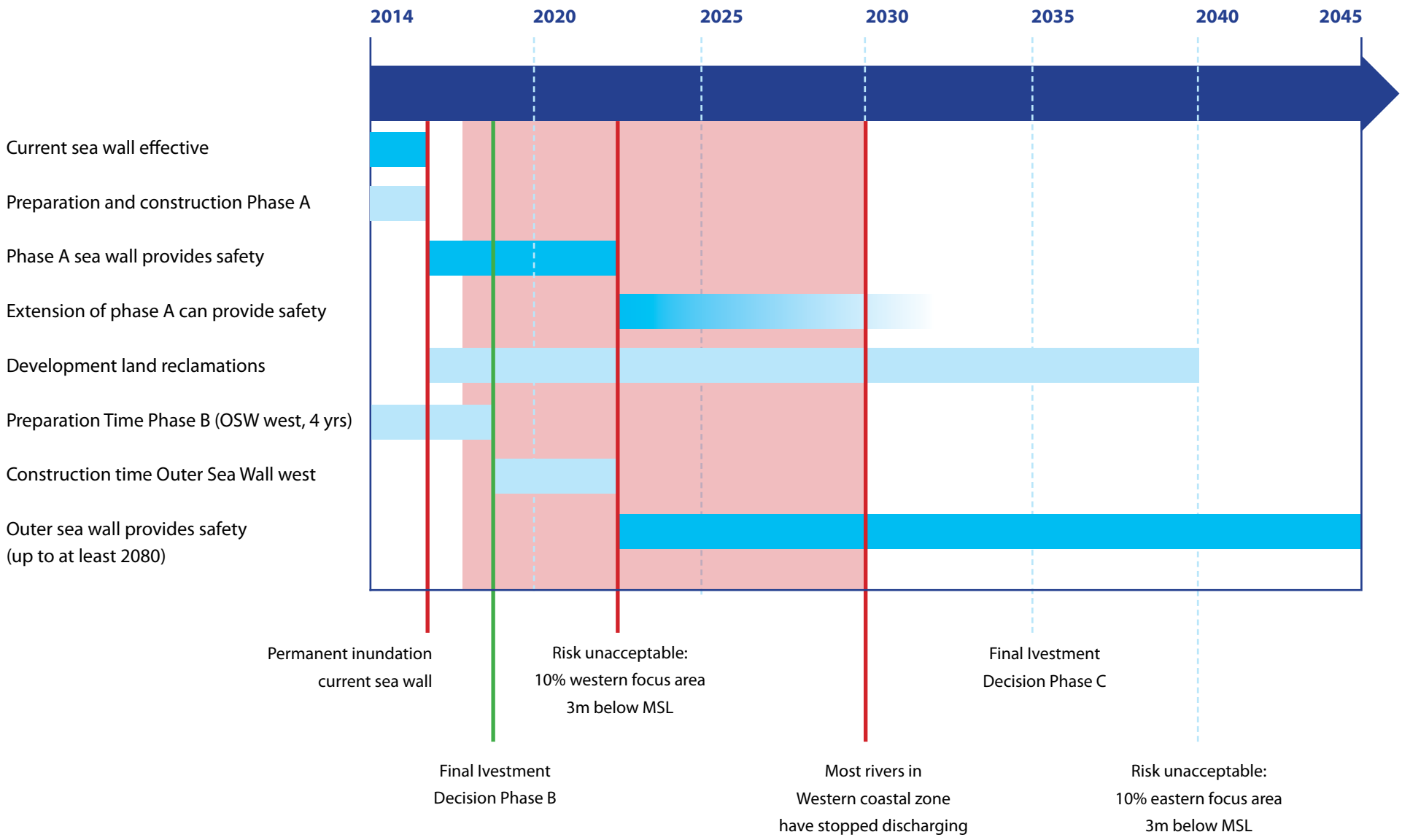
- **robust designs**. Example: when designing sea dikes, uncertainties on land subsidence, wave run-up and tidal anomalies emerged. By taking a conservative approach, risks of underestimating possible impacts were limited.
- **adaptive strategies.** There is still plenty of room in the strategy for adaptation. The timing of the Outer Sea Wall, for instance, can be revised depending on new developments (in land subsidence, economy). Another example: although the size of the reservoir is designed on the best available expertise on river discharges and predictions of (future) rain fall events, still a degree of uncertainty remains. In our analysis we concluded that system adaptation by adding additional drainage pumps is easy and cost-effective.

9.2.
Uncertainties and risk management

Regarding the uncertainties the picture is very diverse, even within topics. Some examples:
Cost calculations: civil engineering cost calculations are largely based on actual costs in current land reclamations works and are therefore quite accurate. The main uncertainty within these cost calculations is the future cost of sand and rock (due to the expected pressure on these markets). The situation regarding uncertainties in some other major topics is as follows:

- **Business case:** real estate prices are based on the current market prices and recent markets developments in Jakarta and therefore accurate. The prediction of the future market prices (necessary to complete the business case), however, is to some extend speculative as no reliable long term economic prediction can be made.
- **Hydraulics:** reliable discharge data are scarce and the discharge calculations were prepared based on rain fall data in the catchment area and discharge models. The size of the reservoir was based on these calculations. However, it is unknown how much of the upstream water in the future will be diverted around the city in the future and how climate change will influence the inflow.

Phasing of project implementation in relation to flood risks



- **Sea bed conditions:** the offshore geological composition under the Great Garuda is unknown and no detailed prediction can be made on compaction and settling of the Great Garuda. Assumptions had to be made.

Uncertainties lead to financial risks. Some uncertainties/risks could be minimized by generating new primary data (additional field research), but many uncertainties related to future developments will remain.

Mega projects as the NCICD are inherently full of risks. The size of the project, the complexity and duration create various technical, financial and organisational risks. The top three of risks are:

- Uncertain mid- and long term economic development. A temporary cool-down of the growth of the economy could have an impact on real estate prices and consequently the business case and, in the worst case, the speed of realisation of the Great Garuda.
- Availability of sand. There is a huge demand of sand for land reclamations, but there are only limited source areas. The price of sand and the costs of transportation could easily rise as sand will have to be brought in from distant source areas.
- Water quality. The efforts to clean-up the urban drainage water by construction of sewerage and waste water treatment systems must to be accelerated significantly. However, this is not an easy task in the densely populated city. If the water quality does not improve, the water quality in the reservoir will be poor, affecting both the residents and the market potential of the Great Garuda and obstructing the use of the reservoir as raw water supply source.

Risk management is one of the most important aspects in managing such projects. Each risk requires its own approach: many technical risks can be minimized by research, financial risks by sharing benefits and risks or by seeking the right contracting strategy.

Phase A-no regret measures

Slowing down land subsidence will benefit the whole project and safety of the National Capital. It creates more construction time in Phase A and Phase B. Additional bulk water sources should therefore be developed, piped water should be provided and ground water extractions should be reduced.

Also the current sea defences need to be strengthened as soon as possible. Overtopping during high waters is expected in a few years' time and sea walls are often below the design height.

Water sanitation programmes should be accelerated significantly. This will not only improve the current and future water quality in the bay/reservoir, but also benefit the residents of Jakarta

Phase B

As soon as the Master Plan is approved, preparation for building phase B (the western Outer Sea Wall), should commence. Preparation (feasibility studies, design and planning, contracting and permitting) could take up to 4 years implying that actual construction could start around 2018. This is also the year of the Final Investment Decision, as the construction time is 4-6 years (to allow closure in 2022).

Any private development of land reclamations including the Outer Sea Wall should take the hydraulic condition (closure of the Outer Sea wall in 2022) as deadline into the planning.

Phase C

Phase C is not indicated in figure ##. At this moment it is not possible to determine whether it is necessary to close the eastern part of the bay and when this will be necessary.