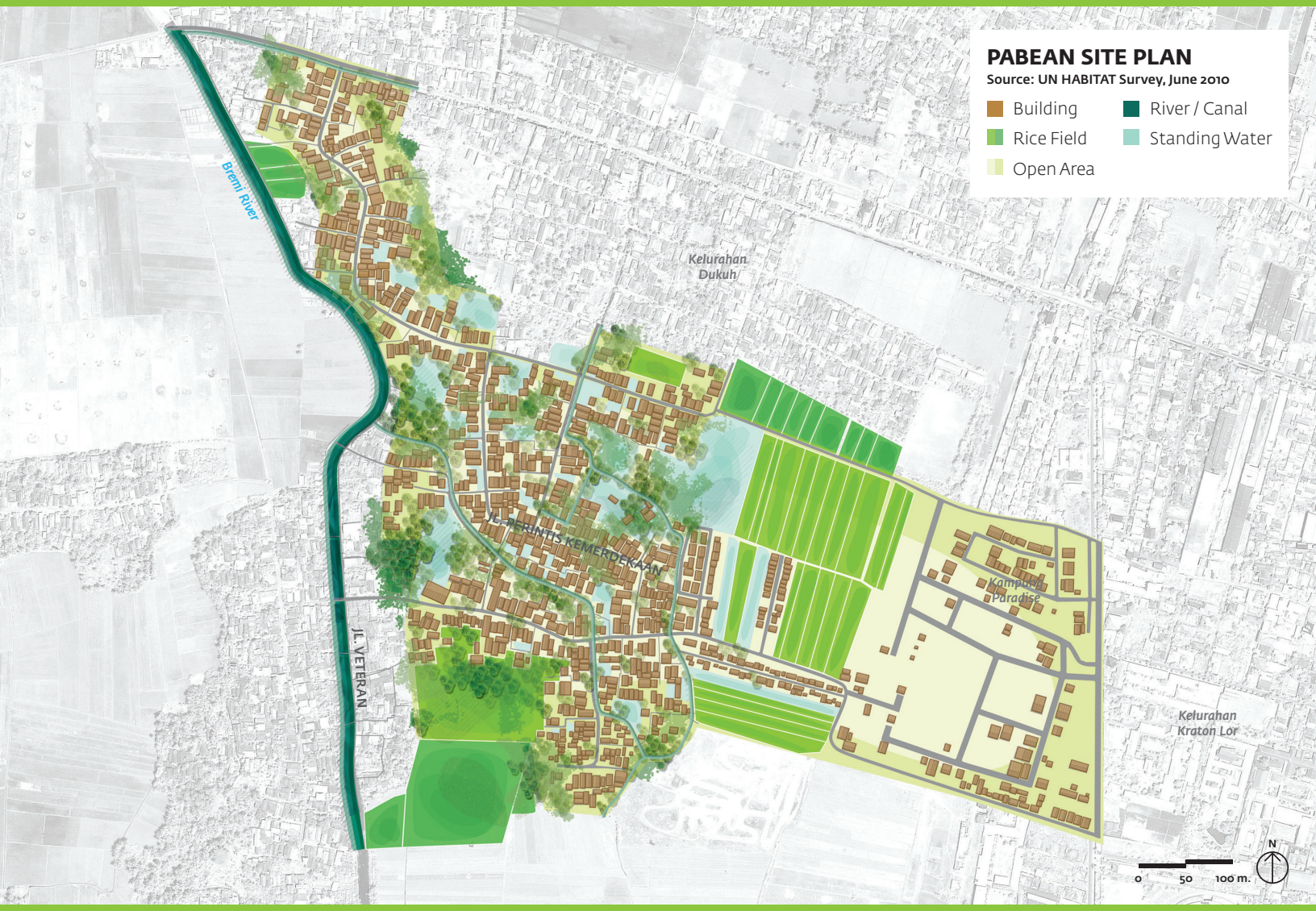
COLORED WATER

ASSESSMENT OF CLIMATE CHANGE VULNERABILTY IN KELURAHAN PABEAN PEKALONGAN, CENTRAL JAVA

WATER RUNS IN MANY COLORS IN PABEAN. The water on the street is red, yellow, and green. It washes away dyes from Pabean's batik factories. The Bremi river is brown with sediment from the Dieng Mountains – as well as from contamination. Blue water flows from public standpipes. Fresh and pure, it is pumped from artesian wells into standpipes. These different waters eventually flow together, draining into the ocean a kilometer away. Water from the ocean is also making its way back to Pabean, as the sea-level rises.

This report is named "Colored Water" because water reminds us that assessing climate change vulnerability means paying attention to interdependence. Water is needed for batik production, but floods stop these activities, bringing health risks and lost livelihood. Water also creates contradiction. Batik dyes pollute groundwater, but are they not quite beautiful too, on fabrics in the sun? This assessment seeks to understand these interdependencies, but "Colored Water" also expresses a basic fact of life: the people here get wet, the ground is saturated, streets are soaked – for many reasons.



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This study is sponsored by **UN HABITAT** in Jakarta, Indonesia.

PAK KHOIRUL BASYARI

Batik Day-Laborer, 45 Years Old

"What we know about the climate change is that we can no longer predict the season, rainy or dry. We need help from the government to anticipate the tidal flood. We can do nothing because it is caused by water from the sea."

1

2

3

Many Kinds of Climate Change Impacts

1) Almost every available space in Pabean is used for batik production, which is impacted by climate change – here workers carry dyed fabric to a drying area; 2) Circulation is commonly disrupted by standing water on Jalan Perintis Kemerdekaan; 3) Residents are exposed to contamination from "helicopter toilets" when the Bremi river floods.

EXECUTIVE SUMMARY

"COLORED WATER" DESCRIBES HOW URBAN COMMUNITIES experience and respond to climate change in Pabean, a dense neighborhood in Pekalongan, Central Java. This assessment identifies and analyzes the groups of people, physical areas, urban systems, and cultural and economic sectors in Pabean that are most vulnerable to climate change. The purpose of this assessment is to inform a city-scale climate change resilience strategy for Pekalongan that is being developed for UH HABITAT's Climate Change Cities Initiative by P5 (Pusat Pelayanan Perencanaan Pembangunan Partisipatif / Center for Participatory Development Planning Services) in 2010 – 2011.

WHY DID WE SELECT PABEAN FOR STUDY?

Pabean is the only urban area to be studied at the neighborhood-scale as part of the Pekalongan initiative. For this reason, Pabean was selected because its characteristics reflect conditions in other Pekalongan neighborhoods where climate change is having an impact. The selection criteria included:

- Elevation and proximity to coast – Pabean is low-lying and 1.75 km from the sea, and so floods several times a year.
- Poverty – Two-thirds of families in Pabean are in poverty, and the urban poor are usually more vulnerable to climate change hazards and less likely to have a voice in urban planning decisions.
- Localized economy – The batik sector employs 75% of working adults in Pabean, mostly in home industries.
- Level of community organization – Community leaders and residents manage neighborhood services, such as a drinking-water distribution system, so there is potential to observe evidence of "adaptive capacity" (locally initiated activities to mitigate impacts of climate change).

In most respects, these conditions are extreme in Pabean. The poverty rate, for example, is very high compared to other Indonesian cities. Pabean was chosen for its similarities with other urban neighborhoods. Yet at the same time, the severe conditions found here cast the impacts of climate change into even starker relief. The tough lessons of Pabean should therefore resonate strongly when they are extrapolated to the city-scale.

SUMMARY OF FINDINGS

Climate change is having observable impacts on residents and urban systems in Pabean and the poor are especially vulnerable. How can the statistics, interviews, maps, and urban design analysis in this assessment lead to strategies to address these impacts? An assessment, after all, necessarily stops short of offering solutions.

This summary frames the assessment findings as a series of four thematic questions. After analyzing the situation and neighborhood, these are the questions we found ourselves asking over and over – what needs to be resolved in order to arrive at solutions? From our perspective, developing strategies that focus on family resources, land use regulation, the batik sector, and the drainage system is central to addressing future climate change impacts.

STUDY AREA SELECTION CRITERIA

1. Low-lying elevation and proximity to the coast
2. High poverty
3. Localized economic activities such as batik production
4. High level of community organization

These four questions are intended – in a way – to be creatively provocative for the P5 planning team. The thematic questions can facilitate the transition from assessment to strategy development by providing direction to understand the problems in Pabean and identifying lines of enquiry that promise to lead to effective solutions:

1. **How much help from outside do Pabean residents need in order to mitigate the impacts of climate change?**

   The fundamental unit of climate change impact is the family. When batik factories close due to floods, for example, everyone in the family is affected because income is lost. Families have no savings and live on daily income, so there is little to no capacity to prepare for or adapt to the floods. When we asked what families do to prepare for floods, we heard the same answer again and again: "We do nothing." The anecdotal evidence suggests the adaptive capacity for the more severe impacts of climate change in the future just does not exist at the family level.

   This is not to be overly pessimistic since there have already been several neighborhood level responses to climate change. In east Pabean, there are new footpaths sponsored by the World Bank slum upgrading program (PNPM) that reduce localized flooding. The Pabean community also manages a drinking water distribution service. Yet even so, is there local capacity to address the neighborhood-wide issues that families feel they can "do nothing" about – such as health, flooding, and livelihoods?

   Our question is whether there are climate impacts that are truly beyond the resources of local capacity? The local drainage system, for example, needs to be comprehensively reconstructed, which requires significant outside resources. At the same time, there may be problems that require a mix of local capacity and outside resources. We think a useful metric to keep in mind while developing strategies is the family – can a family address this issue with their own resources? If not, does the strategy increase their capacity to do so?

2. **How can climate change mitigation help to address other problems like rapid urbanization?**

   Climate change is not the only problem facing Pabean. Rapid urbanization also has visible impacts in the neighborhood and these are closely linked to the effects of climate change. Transitions in land use, for example, appear to increase localized flooding. The agricultural fields surrounding Pabean are incrementally being developed as housing. Currently, the amount of developed land and agricultural land is roughly equal in Pabean – about 20% each. When land is filled for development, the irrigation water is simply pumped into the next field over, increasing the overall potential for flooding.

   Since there will be demand for new housing in the long-term, climate change impacts, such as increased flooding from heavy rainfall, may be more severe as a result of

the current development pattern. Addressing climate change in Pabean means addressing rapid urbanization. The opportunity therefore exists to formulate land use policy and development regulations around the issue of climate change.

3. **Do the risks of having a specialized batik economy increase or decrease with the onset of climate change?**

High risks come with a specialized economy like the batik sector, which employs 75% of Pabean's adults. A resilient economy, after all, is characterized by many diverse employment opportunities, rather than a single sector. Climate impacts on a single sector – from both short-term variability in weather events and slow onset change – affect everybody. If there is either flooding or a downturn in the market, no one is working. Batik production relies on natural resources – water for dyeing, wood for fuel, predictable weather and sunlight for drying – and these processes can easily be disrupted.

At the same time, the batik sector has significant untapped value. A batik-producing neighborhood like Pabean could become a tourist destination, which could raise incomes for all families. The quality of batik produced in Pabean could also rise to a new level, fetching higher prices at the market.

Our question is how to open up that value without increasing the climate change risks to which a specialized economic sector like batik is exposed. We found some manufactures on the path to adaptation – they are trying out new production methods and redesigning their manufacturing spaces. These are first steps towards a resilience strategy for this important sector.

4. **Is it the water system or the approach to fixing the water system that is broken?**

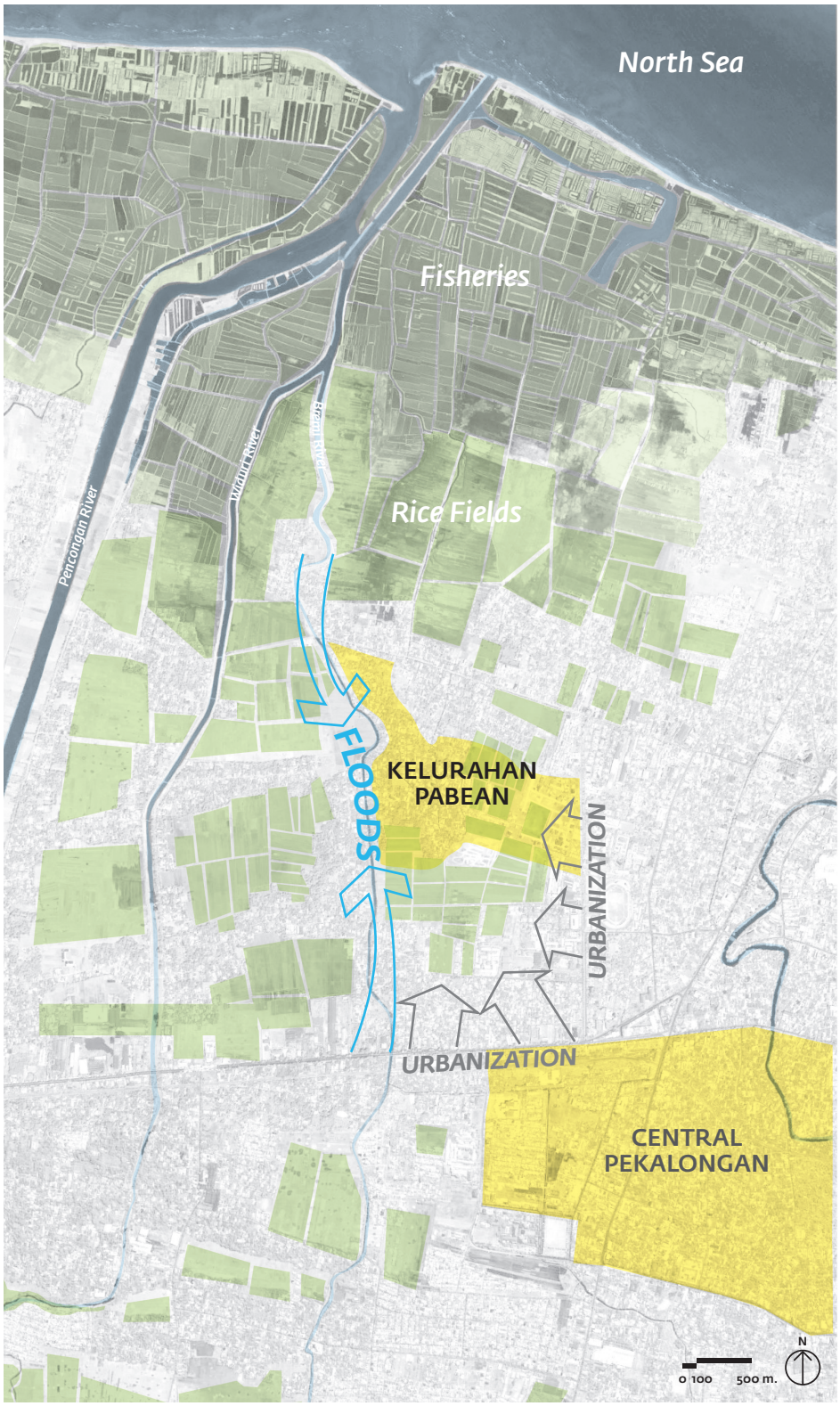
The impacts of climate change are both complex and severe because many natural and constructed water systems intersect in low-lying Pabean. These include the North Sea coastal system, the Bremi river and Sengkaran watershed, urban drainage canals, and agricultural field irrigation. While floods are caused by the interaction of rising tidal water and increasing peak river flow, waterlogging results from Pabean's non-functioning drainage system. Floods and drainage issues are at the root of a range of other problems – from health risks to drinking water contamination to physical circulation to economic activity.

Our question is whether efforts up to this point to address drainage in the neighborhood have actually made the situation worse? We observed several areas where street drains have been replaced and sidewalks redesigned to reduce flooding. However, it does not appear these piecemeal strategies are coordinated with one another. In some instances, the improvements do not physically link up with the existing drainage system. So, the new drains brim with water just as much as the existing ones do.

The problems of the drainage system require a comprehensive engineering solution implemented in a coordinated manner. This is actually an opportunity, since sustainable storm- and waste-water management infrastructure can be introduced in Pabean as the system is reconstructed. It may be, however, that the technical or financial resources to implement such upgrades do not exist in local government – which may explain why the problem is being addressed incrementally.

A common tension in each of these thematic questions is capacity – what capacity exists at the neighborhood level and what exists in city government to respond to climate change impacts? Negotiating these two scales of capacity is a key task and challenge of developing strategies for resilience.

Evidence of adaptive capacity at the neighborhood level is both a reason for optimism and source material for city-wide strategies. Despite many climate change-related obstacles, the batik sector in Pabean thrives. The community has also successfully implemented government-sponsored infrastructure and water projects. These instances of adaptive capacity are captured in the following analysis of three types of vulnerability. They should be studied for their potential to be scaled up as city-wide strategies and integrated into the management of city-scale urban systems.



Exposure to Both Human and Natural Pressures

Pabean is located about a kilometer from central Pekalongan – the connection to the center is important for economic activity and accessing services. Yet central Pekalongan is also expanding due to rapid urbanization, so the fields surrounding Pabean are being developed. At the same time, coastal inundation and high river peak flows create floods several times a year.

PHYSICAL CONTEXT

LOCATION

PEKALONGAN IS A COASTAL CITY WHERE MANY neighborhoods are located either on or in close proximity to the ocean. Pabean is located 1.75 km from the North Sea coast. It is also adjacent to the Bremi river, though the official neighborhood boundary in the west is about 50 meters inland from the riverbank. Flooding occurs from both the river and coastal inundation – known locally as "*rob*."

The neighborhood is surrounded on the east and south by rice fields, though the urban center is near. The Pekalongan train station is 1 km (0.6 mile) away; the commercial center is 1.6 km (1 mile) away. A busy corridor of commercial activities is located just east of Pabean – it includes a new gated housing development called Kampung Paradise, Muhammadiyah High School, a stadium, and businesses. On Pabean's northern boundary across from Kelurahan Dukuh, there is an additional developed area mixed with agricultural fields, similar in scale and density to Pabean.

Jalan Perintis Kemerdekaan connects to two primary roads that lead to the city center. Despite its proximity to the city center, Pabean is physically isolated. Jalan Perintis Kemerdekaan is paved, but narrow and not graded, so heavy rainfall causes flooding. Even so, it is an important connection because it provides residents and traders with access to employment centers and the batik market in central Pekalongan.

LAND USES

Land uses in Pabean are transitioning from agricultural to residential, which indicates the area is rapidly urbanizing. The conversion of agricultural land to housing has relevance for future impacts of climate change. Whereas 26% of land is agricultural, 19% is occupied by buildings, most of which are residential. The current pattern of development incrementally fills-in rice fields with housing. Along the east end of Jalan Perintis Kemerdekaan, there are two instances of single rice fields that have been developed with long rows of attached housing on either side of an access road. Kampung Paradise, a gated development to the east, is an example of larger-scale development on multiple fields. The implication

PABEAN BASELINE STATISTICS

(Source: UN Habitat Survey, June 2010; Pekalongan Municipal Data)

Pekalongan Pop.	247,973
Pabean Pop.	3,883
# Families	1,152
Average HH size	3.37
% Poverty	65%
Dependency Ratio	0.67
% Female-headed HH	13%
% Land Tenure	68%
Ratio HH to Homes	1.33

Top Occupations

Farmers – 5% Traders – 15%
Laborers – 5% Batik Workers – 75%

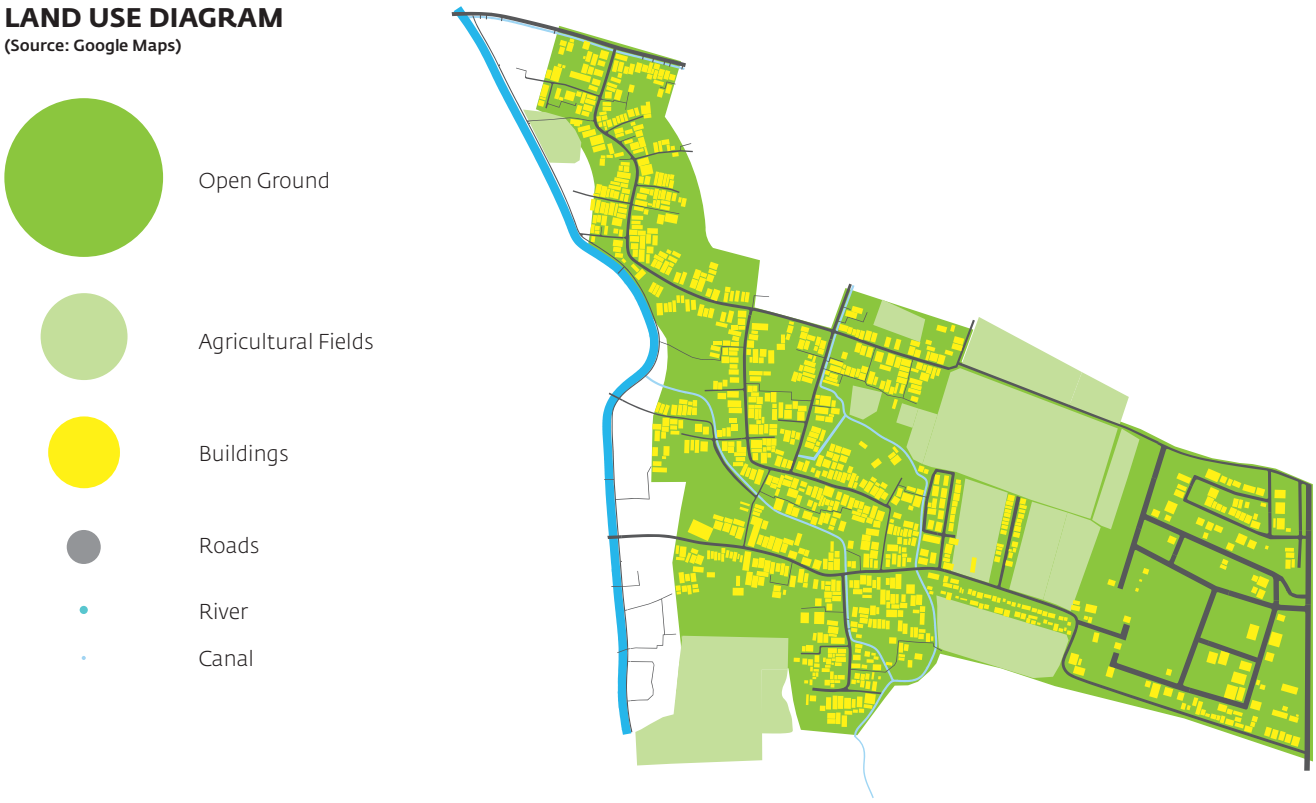
PABEAN LAND USES

Source: Google Earth

	Hectares	Acres	% of Total Area
OPEN GROUND	19.4	47.9	41.5%
AGRICULTURAL FIELDS	12.4	30.6	26.4%
BUILDINGS	8.7	21.5	18.5%
ROADS	4.4	10.9	9.5%
RIVER	1.3	3.2	2.8%
CANAL	0.5	1.2	1.1%
TOTAL AREA	46.8	115.6	100%

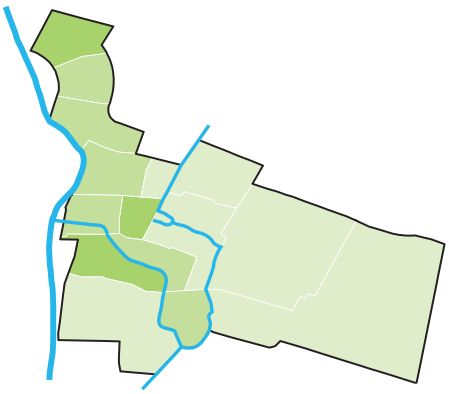
LAND USE DIAGRAM

(Source: Google Maps)



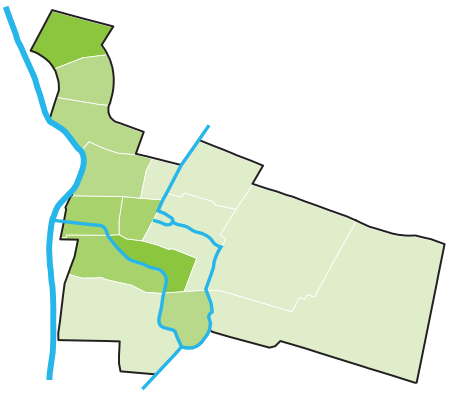
More Development, Less Land to Live On

There is about the same amount of agricultural land in Pabean as there is built space, 26% and 19% respectively. Rice fields are incrementally being developed as housing, which is indirectly increasing population density. When land is developed, standing water increases in the neighborhood, which reduces the amount of habitable area in Pabean. So more people live on less land.



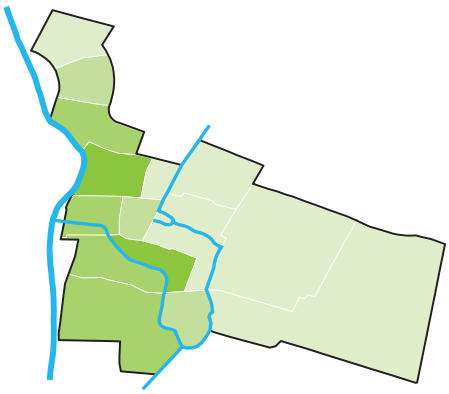
EXISTING POPULATION DENSITY
(PEOPLE / HECTARE)

- 18 – 100
- 100 – 200
- 200 – 300
- 300 – 400



"EFFECTIVE" POPULATION DENSITY
(PEOPLE / HECTARE)

- 18 – 100
- 100 – 200
- 200 – 300
- 300 – 600



POPULATION DENSITY DELTA
(DIFFERENCE BETWEEN EXISTING AND "EFFECTIVE" POPULATION DENSITY – PEOPLE / HECTARE)

- 0 – 10
- 10 – 25
- 25 – 50
- 50 – 433

of this development pattern increased storm-water runoff into adjacent areas and increased flooding.

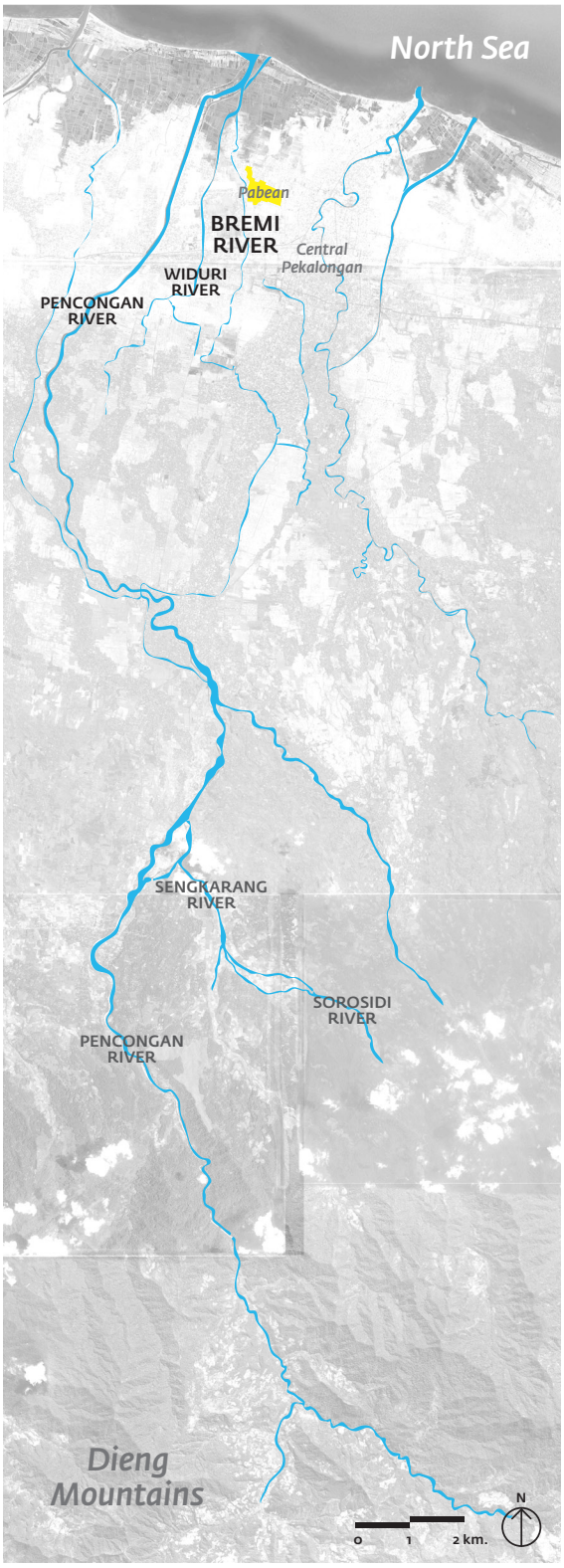
Pabean is a compact settlement with high population density. However, the conventional measure of density – dividing the population by the land area – is misleading because so much land in Pabean is inundated with water. In the RTs nearest the river, population density ranges between 100 and 200 people per hectare. The overall neighborhood density is 80 people per hectare. But when the inundated areas are factored out of the land area, the "effective" population density is much higher.

Most "open ground" in Pabean, which includes the space between buildings and undeveloped lots, has standing water or is waterlogged. When inundated areas are factored out, population density increases by 25 to 100 people per hectare. In general, this means that water inundation increases the densities at which people are living. High density, in turn, creates health risks and puts pressure on public infrastructure and services.

BUILDING TYPES AND USES

The built fabric of Pabean is primarily residential. Housing construction is simple and inexpensive. Housing in Pabean is usually confined masonry construction, which consists of a poured concrete frame filled in with bricks. Roofs are wood frames with clay tiles. Home batik industry production is commonly located in the back of residential structures or in rear buildings of vernacular bamboo construction.

Confined masonry houses are generally sturdy in the context of short-term flooding. Residents are more impacted by the long-term costs of either flood-proofing ones home or addressing subsidence. On the one hand, there are rare instances of new construction on built-up land, elevated above the flood line. This is an expensive option out of reach for most residents. On the other hand, long-term waterlogging makes older houses subside, creating damage to housing that is also expensive to mitigate. The negative climate change impacts to housing in Pabean, therefore, are likely to occur over time in the long-run.



Where Two Ecological Systems Connect

Pabean is located at the intersection of two regional ecosystems – The Sengkaran watershed and the North Sea coastal environment. Climate change impacts both systems. Rivers flood more frequently due to higher levels of runoff from the Dieng Mountains. Coastal inundation is increasing because of sea-level rise. Since Pabean is low-lying, floods are common.

CLIMATE CONTEXT

REGIONAL AND LOCAL ECOSYSTEMS

THE BREMI RIVER, PART OF THE SENGKARAN WATERSHED, IS the key ecosystems in Pabean. The Bremi is a third order stream in a watershed system that flows from the Dieng Mountains to the North Sea. Upstream from Pabean, the Bremi River is utilized for irrigation along its course. Downstream, it flows into the Widuri River, which flows into the Pencongan River, which drains into the sea. The Bremi is controlled by a manually operated sluice gate at Pabean's northern boundary. The river is polluted – rubbish is dumped in it and people use it for sanitation.

Other relevant regional ecosystems are the coffee-wood forests of Kalimantan. Though well over 500 km away, these forests supply wood fuel for the batik industry. A typical factory in Pabean uses a cord of wood every two months. Batik also accesses an international market for chemical dyes, which come from China and Germany as well as domestically from Indonesia.

Climate hazards that will affect the river ecosystem include increased precipitation, unpredictable seasons, increased frequency and intensity of river floods, and increased coastal flooding. Coastal flooding, in particular, makes Pabean vulnerable to waterlogging (saturation of the ground) and salinization (contamination of groundwater and soil with salt). Impacts of these hazards range from temporary displacement and property damage to contaminated drinking water and loss of agricultural and commercial productivity.

BUILT INFRASTRUCTURE

Built infrastructures in Pabean serving residents include the drainage system and piped water system (PDAM) as well as social infrastructure, which consists of a health clinic.

BASIC CLIMATE STATISTICS

(Source: See Endnotes)

Average Temperature	
Dry Season	31.6 ° C
Rainy Season	26 ° C
Rainfall	
Annual Raifall	124 cm
Average Rainfall per Event	2.798 mm
Dry Season Montly Average (Mar. to Aug.)	3.9 cm
Rainy Season Montly Average (Sept. to Feb.)	16.9 cm
# Hazard Events / Year (Flood and Wind)	185

The batik sector is supported by a system of production and exchange facilities that are, for the most part, self-built by residents.

The drainage system consists of two large canals and street drains. Overall, the system is under-maintained and lacks

Interrelated Hazards and Efforts to Adapt

1) In some places in Pabean, the water-filled streets and canal are indistinguishable; 2) Water in the street drains has a deep blue shade from waste-water contaminated with batik dye; 3) One resident has adapted to floods by constructing his home on more than 30 cm of landfill; 4) While most residents are batik workers, some still find livelihood in nearby rice fields.

capacity to effectively manage storm-water and flooding. The system is polluted by rubbish dumping, disposal of sanitary waste, and waste-water from industrial activity, including batik production. Capacity of both the canals and street drains is significantly reduced by sedimentation. In many locations, street drains have been filled in by residents, which creates disconnections within the system – water literally has no where to flow. While the Department of Public Works is responsible for maintaining the canals, street drains are maintained by the community through *gotong royong*.

The distributed water systems consist of piped water (PDAM) and standpipes in each RT with artesian wells. The artesian wells are an example of an urban system managed locally by neighborhood government. Artesian wells are deep bore wells that penetrate the water table to a depth of 125 m. underground. About 75 families share each standpipe for drinking water.

There is one health center in RW 1 / RT 1. The health center is small with only two rooms and two nurse staff. Anecdotally, residents said there is little information available on water- and flood-related diseases. Many residents suffer from diseases related to poor sanitation and flooding.

POTENTIAL HAZARDS

Increased Flooding

Pabean is a low-lying area at high risk from flooding. Flood levels from the Bremi river fall slowly after a heavy rain event, especially since coastal tides are increasingly inundating further inland. Anecdotally, residents said floods occur two to three times a year and last from three to six days. Residents anecdotally said flood water rises to 30 cm and comes at least 100 m. from the river. (Many residents who live further inland also reported flooding.) The drainage system has no pumps, so water recedes naturally. Residents also said that floods are both new and becoming more frequent and prolonged – one resident said that 10 years ago, there were no floods. In the future, both increasing frequency and intensity of storms and sea-level rise will increase the impact of floods on Pabean.

Direct impacts include reduced physical circulation within the neighborhood and damage to property and homes. Floods also increase diseases such as skin problems like eczema and *dompo*, fever, and diarrhea, especially among children.

Flooding also causes indirect impacts to economic activities, including agriculture and home industry. When fields flood, crops are damaged and harvest and transport to market is delayed. Home industry, including batik, usually close for several days at a time during and after floods, which reduces the number of productive days in the year. Decline in these sectors increases poverty.

Sea-level Rise

Proximity to the coast makes Pabean vulnerable to rising sea-levels and coastal inundation – known locally as "*rob*." Rising seawater flows upstream to flood the low-lying areas, creating barriers to physical circulation and infiltrating wells. Sea-level rise from climate change will lengthen the duration of floods.

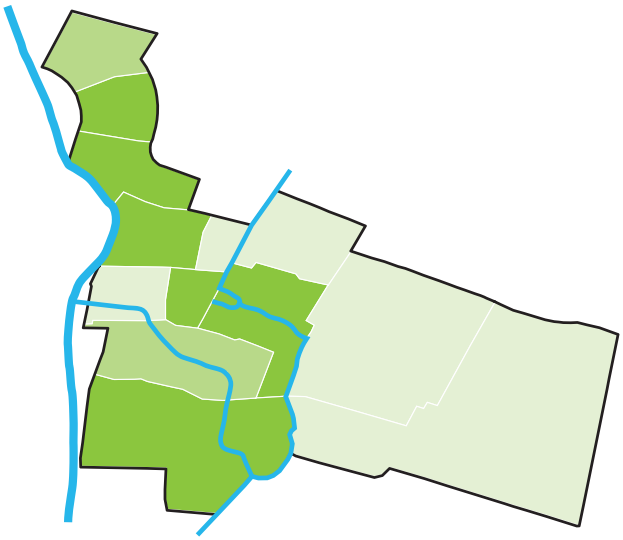
Direct impacts include waterlogging and salinization of private wells and agricultural fields. Salinization contaminates drinking water and reduces agricultural productivity.

Sea-level rise indirectly impacts drinking water from artesian wells by shifting users of private wells to the standpipe system. Sea-level rise also prevents upstream water flow, which compounds problems caused by local flooding. These floods also increase exposure to disease.

Waste-water from Batik Factories

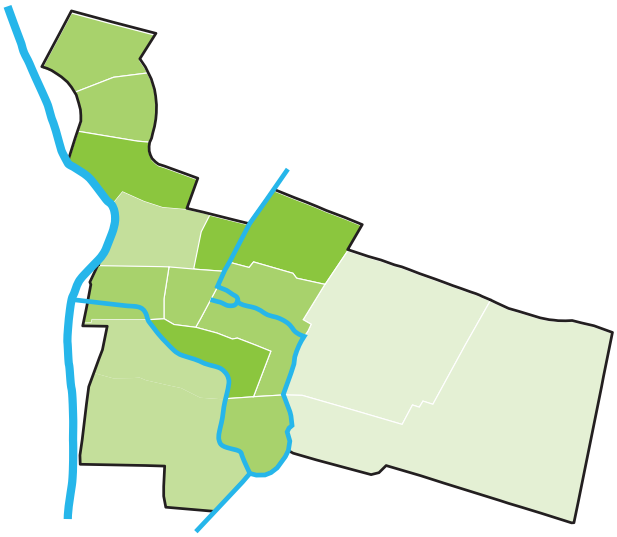
The use of chemical dyes for batik production creates health hazards for community residents. Dyes are routinely dumped into the local drainage system and the river. Often, dyes sit in pools of standing water or clogged drains. Dye also seeps into the ground and infiltrates well water. In the future, increased flooding will further expose residents to batik factory waste-water.

Direct impacts include discoloration of well water and odor, which was demonstrated by residents. A public health worker also anecdotally said there is high incidence of allergies, especially among children, and attributed these illnesses to contaminated water.



% YOUTH NOT IN SCHOOL
(AGE 7 to 18)

0 – 10
10 – 22
22 – 56



% HOUSEHOLDS IN POVERTY
(Based on Municipal Data)

0 – 50
50 – 66
66 – 75
75 – 100

Batik, Livelihood for 75% of Pabean Adults

1) Batik is produced at a range of scales in Pabean and with different levels of quality; some batik is produced by painting dye directly on fabric; 2) High-skilled workers include stampers, who apply wax to fabric before it is dyed; 3) Fabric is dried on bamboo racks constructed in empty lots, hanging centimeters above waterlogged land.

PAK YEDI

Batik Day-Laborer, 43 Years Old

"If the rain falls for three days in a week, we aren't working. If I'm not working, I can be a *becak* driver or I just stay at home. When my house floods, I can just clean the water and mud out of the house."

VULNERABILITY 1 – BATIK SECTOR

WALKING THROUGH PABEAN, IT IS EASY TO HAVE THE impression that every conceivable space is being used for batik production – from houses and roofs to streets and vacant lots. The batik sector is the primary activity in Pabean's economy – 75% of working-adults are employed in this sector. Batik is a localized economic activity, which provides residents with access to employment opportunities. Yet at the same time, economic activity in Pabean is highly specialized, lacking the kind of diversity that makes groups resilient to sudden changes in the market. Moreover, the poverty rate in Pabean is 66%, and reaches higher than 75% in many RT. Even though residents benefit from the advantages of proximity to work, their incomes from batik are not bringing them out of poverty.

Batik is produced at a range of scales in Pabean, but most residents are employed in medium-sized workshops with 10 to 25 laborers. Batik production involves several sequential stages, including motif design, application of wax and dyes, extraction of wax, and drying. The most specialized task is wax application. Workers who are skilled at this stage are trained from youth and have highly developed abilities. Lower skilled workers use pattern stamps to apply wax and create batiks that have lower value. Production is almost entirely manual and the process uses significant resources. Inputs include natural and chemical dyes from Indonesia, China, and Germany, water from private wells for dyeing and washing, and slow burning coffee-wood from Kalimantan for boiling water.

Batik also supports other economic activity in Pabean. Many people open *warung* ("small food shops") in the front areas of their home. These serve and are patronized by batik workers in the area.

> Batik is a localized and accessible economic activity, but also highly specialized, lacking the diversity that makes groups resilient to sudden changes in the market.

Rainfall and floods related to climate change are adversely impacting the batik sector by reducing productivity and disrupting trade. These direct impacts could be mitigated through improved drainage and development of production processes that do not rely on predictable weather. The indirect impacts of climate change, which primarily effect

family incomes, could be mitigated through diversification of workforce skills and the overall economy to create more employment options. At the same time, batik contributes significantly to Pekalongan's urban economy, so this role deserves consideration.

HAZARDS

Batik production is effected by variation in rainfall, flooding, and sea-level rise.

Variation in rainfall ranges from too little rain in the dry season to too much in the rainy season – either outcome affects production. Too little rain disrupts the dyeing and washing stage of production since there is less water available in private wells. Too much rain disrupts the drying stage since batik fabrics are usually hung on bamboo racks outdoors. Similarly, unpredictable rain may disrupt or prolong the drying stage.

Both floods from heavy rains and sea-level rise disrupt production. Pabean floods at least two to three times a year for three to six days at time. When Pabean floods, all production stops. When the floods recede, land becomes waterlogged, which also disrupts production.

VULNERABILITY

Vulnerable groups include batik workers, low-skilled workers, children of workers, women, traders, and factory owners.

Batik workers have specialized skills, so when the sector is disrupted they have difficultly shifting into other sectors. Some find informal employment as *becah* drivers or laborers, but residents said anecdotally that most do not work at all. The children of workers often leave school early to enter the batik industry and acquire production skills. Not completing their education exposes children in the long-term to social and economic vulnerabilities.

Women are vulnerable since they are usually responsible for securing water for the family. Batik sector-related impacts on water resources increases the time women commit to this task.

Lastly, traders and factory owners typically have higher incomes than workers, but floods and rains disrupt their work as well.

DIRECT IMPACTS

Direct impacts from unpredictable rainfall and flooding include reduced productivity, disrupted physical circulation, and damaged equipment. Obstructed roads is a significant issue since there are only three access points into the neighborhood. Delays in arrival of inputs and delivery of finished product interrupts production cycles – which means lost work and lost family income.

Both families of batik workers and batik factory owners are making do at the margins – climate change-related disruption of production can easily create a crisis.

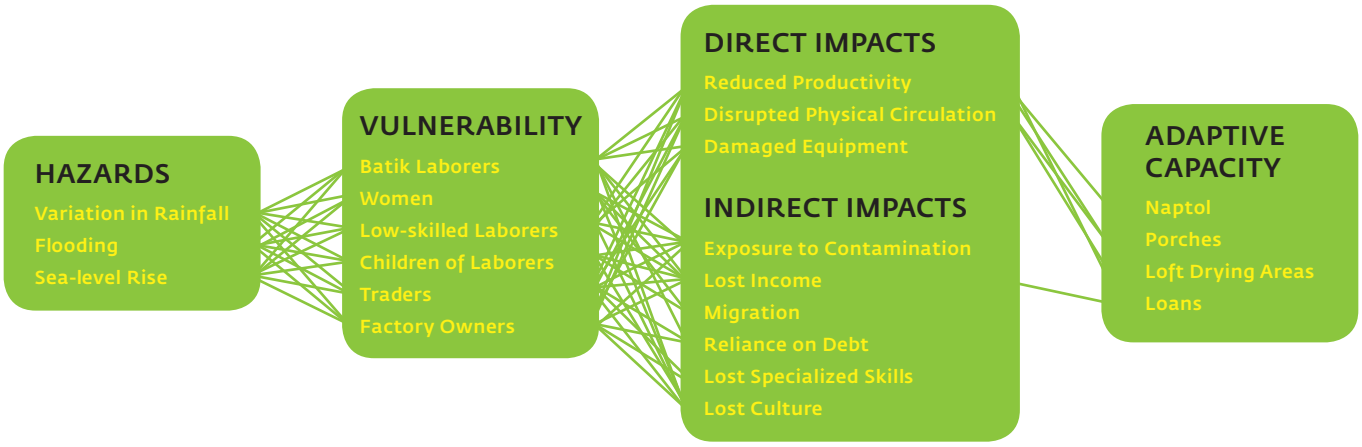
Anecdotally, residents described a range of daily wages for workers, including a low of 10,000 Rp. for women and from 25,000 to 40,000 Rp. for men. At the high end, a laborer working six days a week earns about 12.5 million Rp. annually (about US $1,400). If floods disrupt 15 days of work, the worker loses 600,000 Rp., about 0.05% of total income. This may not seem like a lot, but families typically have no savings.

Disruption of factory production can also quickly overwhelm an owner with costs. Anecdotally we heard that a small factory produces about 50 *kodi* ("batch") of batik per week. Each *kodi* sells for 40,000 Rp., so a factory takes in about 2 million Rp. weekly. Dye and materials cost about 800,000 Rp., wood another 125,000 Rp, and, if there are four workers earning 40,000 Rp., wages are 960,000 Rp. Expenses are therefore up to 95% of weekly income, so not meeting the 50 *kodi* quota will rapidly plunge the owner into the red. One resident who works in a very small shop, for example, said in May and July 2010 their output decreased from 12 to six *kodi* because of unpredictable rains.

INDIRECT IMPACTS

Direct impacts from hazards include exposure to contamination, lost income, migration, reliance on debt, lost specialized skills, and lost culture. Loss of income, in particular, creates many indirect impacts. These include children leaving school to support family income, increased reliance on debt by both families and factory owners, and increased potential for migration to other production centers such as Bali. It is also possible that migration could increase

VULNERABILITY 1 CONCEPT DIAGRAM
BATIK SECTOR



family income, if remittances are higher than wages that could be earned at home in Pekalongan.

Waterlogged land and standing water from floods exposes residents to water contaminated by dyes and water-borne disease. Children are especially vulnerable to skin and eye disease. Irritation of the eye and skin – as well as dye-stained feet – was observed on many children in Pabean.

Lastly, there is the important threat of lost culture. The City of Pekalongan is identified as a center of batik production in Indonesia and residents in Pabean take great pride in their craft. For the batik industry to decline in Pekalongan would mean the loss of the city's identity and heritage.

ADAPTIVE CAPACITY

Signs of adaptive capacity in Pabean include modifications to the batik production process and diversification of local economy.

Batik producers are adapting, in particular, to the increased unpredictability of rain. They are using naptol, for example, a chemical dye that does not require direct heat from sunlight to dry. Batik producers are also adapting the physical structure of work spaces. Porches added to houses create outdoor, but sheltered drying areas. In addition, second-storey loft spaces are being used for drying.

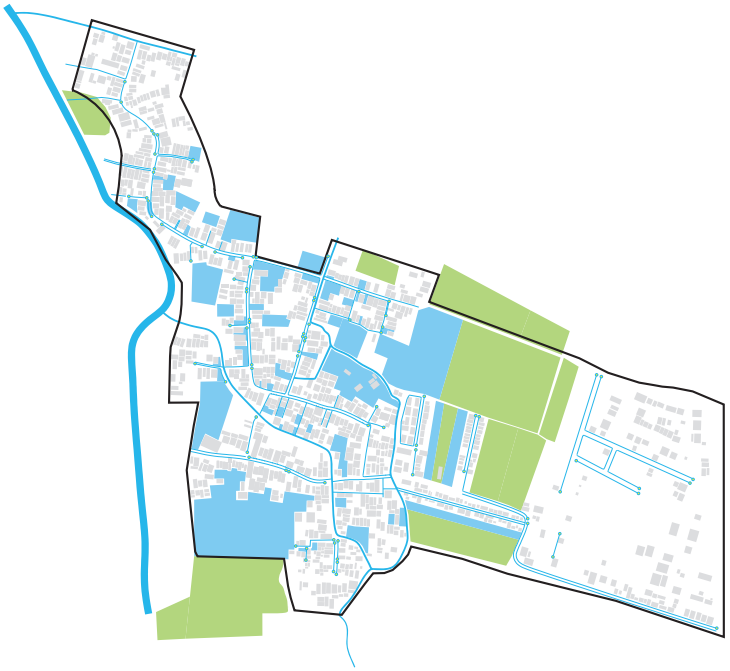
The strong scent of *terasi* ("shrimp paste") on some streets in Pabean indicates the location of new small enterprises. Owners of these enterprises anecdotally said they began producing *terasi* as an alternative to employment in the batik sector.

As resourceful as these expressions of adaptive capacity are, these activities may not be enough to address climate change impacts in the future. Yet batik is an important sector in Pekalongan, so the long-term stability of the urban economy depends upon resilience at the local level.

DRAINAGE SYSTEM DIAGRAM

Source: UN HABITAT Site Observation, July 2010

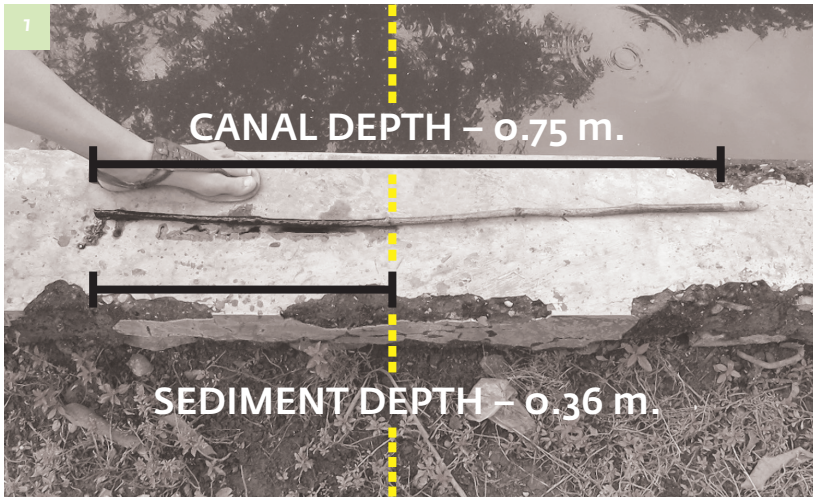
- River
- Canal
- Street Drain
- Standing Water
- Rice Field
- Neighborhood Boundary
- "Dead End" (where street drains stop without connecting to another drain, the canals, or the river)



STANDING WATER AND DRAINAGE SYSTEM RT ANALYSIS

Source: UN HABITAT Survey, June 2010

	PABEAN	RW 1			RW 2			RW 3				RW 4			
	Total / Average	1	2	3	1	2	3	1	2	3	4	1	2	3	4
INUNDATED AREA (Hectares)	7	0	0.09	0.43	0.66	0.2	0.06	0.16	1.13	0.18	1.42	0.18	1.94	0.28	0.25
% of TOTAL AREA	15%	0%	6%	20%	32%	14%	6%	5%	75%	6%	18%	11%	37%	14%	2%
# OF "DEAD ENDS" IN DRAINS	90	2	7	9	7	3	7	9	1	8	7	0	13	4	13



Brimming with Water

The highest levels of standing water are in RW / RT 3 / 2, 4 / 2, and 2 / 1 (above table); 1) A spot measurement of the drainage canals showed that 48% of the depth is filled with sediment and rubbish, which reduces capacity by more than half; 2) The lack of maintenance is compounded by the use of the canal for "helicopter toilets" – outdoor sanitation.

PAK IDI

Migrant, 39 Years Old

"When the rainy season comes you might not be able to use your shoes due to the water covering up all the streets in Pabean."

VULNERABILITY 2 – DRAINAGE SYSTEM

VISITORS TO PABEAN STEP OVER POOLS OF STANDING WATER and scramble from porch to porch to avoid flooded roads – otherwise, they risk covering their shoes in mud. Residents, on the other hand, wear rubber boots and go barefoot since for them, water always finds a way into spaces for work and living. Pabean is low-lying, so water naturally accumulates here, but the persistent presence of standing water results from a non-functioning drainage system. The clogged canals and drains in Pabean bring prolonged floods, contaminated water, and water-borne disease, and so the drainage system is a significant source of vulnerability.

The drainage system has three key components, all of which are overburdened and lack capacity to drain storm- and flood-water.

Most water eventually drains into the Bremi river, which is now subject to increased flooding due to heavy rains and sea-level rise. There are two canals in Pabean, which wend in a northwest direction from the rice fields in the south. One canal remains south of Jalan Perintis Kemerdekaan and empties into the Bremi. The other canal heads north into Kelurahan Dukuh, where it joins another canal that flows into the Bremi. Lastly, most streets are equipped with drains, which should flow into the canals. However, many of the drains are either filled in, clogged with sediment, or not connected with the rest of the system. The disjointed, piecemeal condition of the street drains is one significant issue with the drainage resulting from lack of maintenance. The second issue is sedimentation in the canals.

Sediment is an example of how lack of maintenance reduces drainage system capacity. Using spot measurements, the depth of the canals is 0.75 m. The potential capacity of the two canals is 3.9 million liters. Spot measurements showed that there is 0.36 m of sediment clogging the canal, which makes the effective capacity about 2 million – 50% of potential capacity. (This assumes the sediment depth is even throughout both canals.) An average rainfall event pours about 1.3 million liters of water on Pabean – about half the amount of water in an Olympic size swimming pool. While the effective capacity of the canals could handle this volume, an increase in the amount of rainfall – a storm twice the volume of an average event, for example – could easily overwhelm the system.

Clearing sediment from canals would immediately double the capacity of the system to handle storm-water, bringing the system back to its intended capacity. Moreover, other systems could contribute to storm-water management. Rainwater harvesting from roofs of all buildings in Pabean, for example, would capture 20% of rainfall in an average event.

DRAINAGE SYSTEM CAPACITY ANALYSIS

Source: UN HABITAT Survey, July 2010

	Area (m^2)	Depth (m)	Volume (liters)	% Total Drainage System Volume
EXISTING CANAL CAPACITY	5,200	0.75	3.9 million	100%
"EFFECTIVE" CANAL CAPACITY	5,200	0.39	2.028 million	52%
Rainfall Events				
AVERAGE RAIN EVENT	468,000	0.002798	1.31 million	65%
AVERAGE RAIN EVENT x 2	468,000	0.0045	2.11 million	104%
Comparative Statistics				*% Total Average Rain Event*
OLYMPIC-SIZE POOL	–	–	2.5 million	191%
ROOF-HARVESTING CAPACITY	86,800	–	242,866	19%

The impact of climate change on residents and urban systems is multiplied by the lack of a functioning drainage system. Direct impacts include lost productivity, disrupted physical circulation, and increased health risks. All of these direct impacts could be mitigated through better storm- and waste-water management. The community has proven ability to access and implement government-funded infrastructure upgrading projects. Yet at the same time, there appears to be lack of awareness about how piecemeal activities – such as filling in a drain in front of ones home – contribute to the neighborhood-scale problem.

HAZARDS

The drainage system is affected by flooding, sea-level rise, variation in rainfall, and subsidence. Chemical dyes from batik are also a hazard since residents are exposed to them for prolonged periods when they do not drain away.

Floods, sea-level rise, and increased intensity of rain events all overwhelm the drainage system, leading to localized flooding, on-going standing water, and waterlogging. Waste-water from batik industry mixes with standing water and exposes residents to health risks. Children especially are vulnerable to skin diseases such as eczema since they walk barefoot on neighborhood streets.

VULNERABILITY

Vulnerable areas include low-elevation areas with standing water, areas where street drains are disconnected, and areas near the canal. The people who live and work in these areas are also vulnerable.

Standing water occurs on both streets and undeveloped land. Because the drainage system does not have pumps, water drains slowly from low-lying areas. Lots that are not developed are nearly always flooded with water. A significant area of standing water is located in RW 3 / RT 3 in the area where the east canal forks. (The termination point of the spur of canal originating at the fork could not be located.) Another area of standing water is in RW 2 / RT 2 where water blocks Jalan Perintis Kemerdekaan and floods adjacent lots.

Disconnected street drains are located throughout the neighborhood. Drains are filled in by residents when houses are constructed, to expand the front yard area, or to create a land bridge between the street and front yard. The drains along Jalan Perintis Kemerdekaan in RWs 1 and 2 have many disconnections. So do the drains on the dense and narrow backstreets of RW 3 / RT 3.

Lastly, residents living in all areas along the canal are vulnerable to health risks. Many households have constructed "helicopter toilets" in the canal, either because home drainage systems do not work or for lack of space in the home. With floods and heavy rains, houses are exposed to water contaminated with human waste.

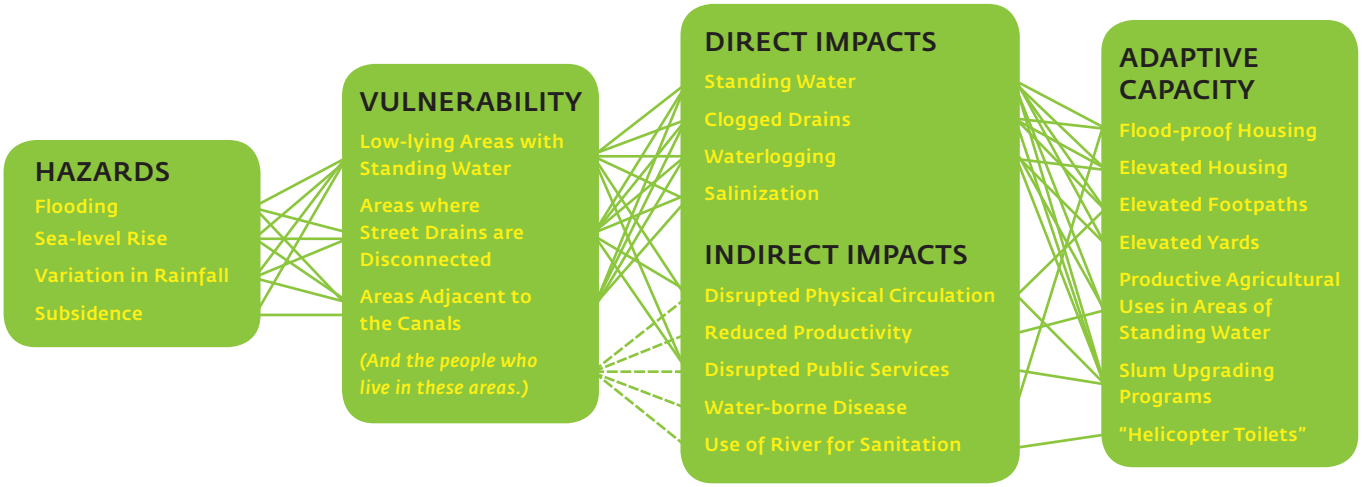
DIRECT IMPACTS

The conditions resulting from lack of maintenance of the drainage system – standing water, clogged drains, waterlogging – combine with climate change impacts to disrupt physical circulation, expose residents to contaminated water and odor, and salinize groundwater and soil.

INDIRECT IMPACTS

Direct impacts have immediate indirect implications for the local economy. One resident – Pak Nasir – anecdotally said people cannot reach the city center when streets are flooded, which disrupts trade. Another resident – Pak Basri – anecdotally said soil quality has declined as a result of salinization, reducing agricultural productivity. He added

VULNERABILITY 2 CONCEPT DIAGRAM
DRAINAGE SYSTEM



that he has not harvested rice from his field since 1998 due to the salinization.

Other indirect impacts effect services and public health. Residents build "helicopter toilets" with bamboo and plastic tarps in the canals as an alternative to private sanitation. While some families lack space at home for private sanitation because of high density, waterlogging makes household drainage systems back up. One resident – Pak Mulyono – anecdotally said even though his family has a private toilet, they use the river since doing so distances waste from home. These uses expose all residents to water-borne disease.

Dengue and malaria, in particular, are health risks that are increased by standing water. A public health worker anecdotally said standing water causes many infections in children. Eczema, for example, is caused when children walk barefoot in contaminated water.

ADAPTIVE CAPACITY

Signs of adaptive capacity to drainage system issues abound in Pabean and range in scale from individual initiative to government collaboration. However, income level is an important factor for individual capacity to adapt – many individuals observed implementing adaptive strategies were of higher income.

First of all, neighborhood leadership has already work with government and the World Bank to implement a sidewalk elevation program through PNPM. These programs also repaired street drains in one area. However, the community may not have adequate information about the potential for participatory budgeting to improve neighborhood conditions. Moreover, though these initiatives are positive, they are also piecemeal. The grant programs do not address drainage issues comprehensively.

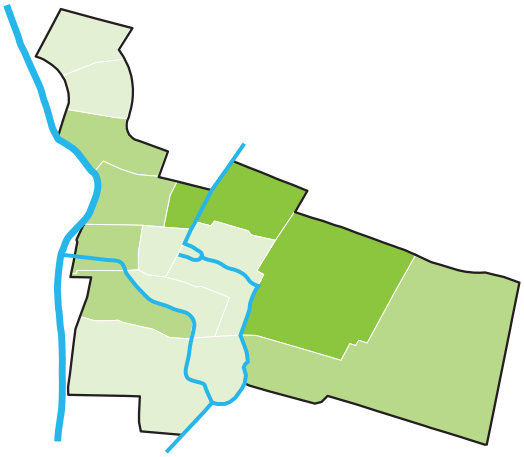
Residents are also implementing many physical adaptation strategies to their homes and on their properties. Some residents are "flood-proofing" their homes using sand bags and salvaged bricks and rubble, creating small levees to prevent flood waters from entering. Others are elevating both footpaths and front yards using land fill. The most successful example of physical adaptation observed in Pabean was an elevated house in RW 2 / RT 1. Before constructing the home, the owner elevated the lot by 30 cm. using land fill from another part of the neighborhood. These adaptations are possible only with financial resources.

Households are also making use of standing water by growing vegetables and banana trees, farming fish, and creating bamboo structures for storage over the water. These activities, however, create resources for home use and likely do not contribute significantly to family income.

Other strategies are less instructive forms of adaptation. "Helicopter toilets," for example, are a response to lack of proper sanitation. But this strategy for coping with waterlogging creates health risks of its own.

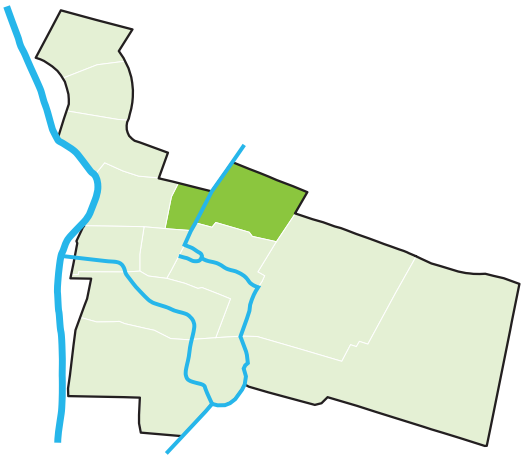
% HH with PDAM

0 – 38
38 – 75
75 – 100



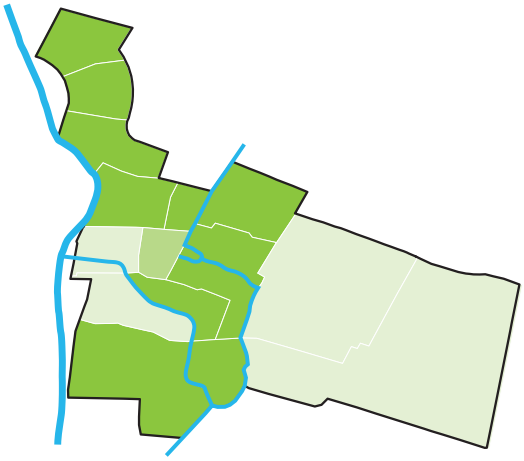
% HH with PUBLIC WELLS

0 – 9
9 – 50
50 – 91



% HH with PRIVATE WELLS

0 – 25
25 – 55
55 – 100



Low Levels of Water Service

Access to PDAM is very low in the older areas of settlement in Pabean; high access to PDAM in east Pabean is located mostly in Kampung Paradise, the new gated housing development. At the same time, drinking water from private wells is contaminated by batik dyes and salinization. So residents have developed a locally-managed drinking water system using an artesian well.

IBU RIYANTI

Mother, 25 Years Old

"If the rain falls for one night, it will flood for three days. Because the climate is changing so often, many children get sick – they have flu, cough, and fever when the flood comes."

VULNERABILITY 3 – DRINKING WATER SYSTEM

A RESIDENT POURS A GLASS OF WATER FROM THE PRIVATE well in her yard. She points out the color and gestures to indicate the odor. Few Pabean residents drink well water anymore. Instead, it is used for domestic washing and in batik production. PDAM is an option for only a few, since service reaches as low as 5% of households in many RT. Climate change puts drinking water at risk since it reduces the number of potential sources in the world a community can draw upon for water. In Pabean, the sources are already limited.

Pabean has developed an effective artesian well system to supply water and meet community needs. Drinking water comes from an artesian bore well within the community connected to standpipes that are shared by about 75 families in each RT. Residents pay a monthly fee of 3,000 Rupiah. However, service is available only twice daily for one hour (between 6:00 and 7:00 and 17:00 and 18:00). This neighborhood-scale system is a promising sign of adaptation. But securing water for all residents in Pekalongan will require city level management to link with local communities and ensure quality service and affordable pricing.

Though the artesian wells work adequately, vulnerability to climate change results from the drinking water system relying on only a single source. If the artesian wells are compromised, residents will have to divert family income to purchase water from another source or drink contaminated water from private wells. Moreover, PDAM service in older areas of settlement in Pabean is extremely low. The drinking water system could be made more resilient if multiple sources for drinking water were available to residents.

HAZARDS

The drinking water system is affected by flooding, sea-level rise, variation in rainfall, and coastal inundation.

While floods contaminate private well water, variation in rainfall is especially a threat to the artesian well system. If there is too little rain, the water reservoir fails to recharge, reducing water supply. When this occurs, residents must purchase water or use the private wells. However, water from private wells is often salty and polluted with batik dyes.

VULNERABILITY

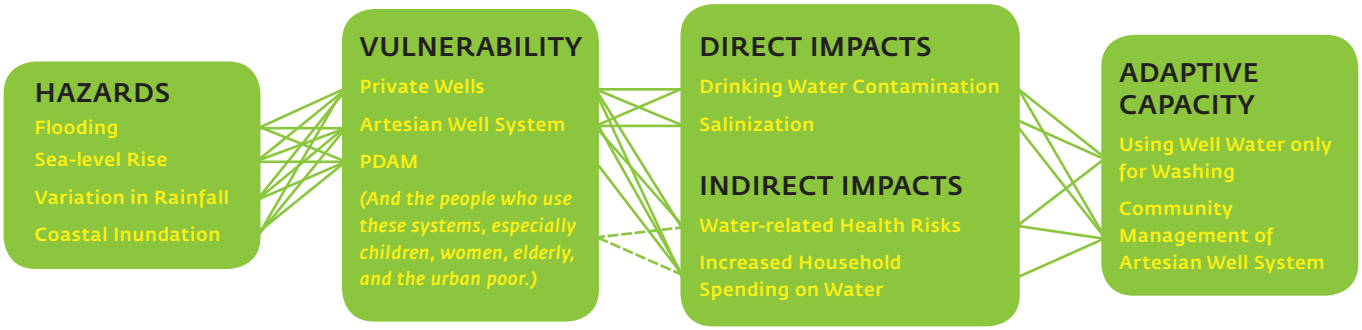
Vulnerable components of the drinking water system are private wells and the artesian wells. All people who rely on these systems are also vulnerable to climate change impacts, but especially women, children, the elderly, and the urban poor.

The wells are vulnerable to both salinization, which results from flooding and coastal inundation, and overuse when there is too little rain. Workers in batik factories anecdotally said that if private wells run dry because there is too little

Going Further to Access Drinking Water

1) Jerry cans are located near a standpipe for the artesian well system; residents can collect water only for one hour during the morning and evening; 2) In the dry season, some batik factories use water from public wells and PDAM because private wells run out of water; 3) Youth help carry water home; 4) A resident indicates the tint and smell of private well water.

VULNERABILITY 3 CONCEPT DIAGRAM
DRINKING WATER SYSTEM



rain, water will be taken from the artesian well system. They said there is usually not enough water during the dry season. In addition, the neighborhood-managed water system is exposed to steep increases in demand from residents who use private wells.

PDAM is not exposed to the same kind of vulnerability as the other drinking water sources. Yet PDAM could be an important tool for adding redundancy to the system – which means having an alternative source of drinking water if wells are not available. PDAM is available to less than 10% of households in seven RTs in north and central Pabean. Increasing PDAM service would require coordination between municipal and neighborhood government as well as regional management of water resources.

Everyone is affected when water is scarce, but women and the urban poor are especially vulnerable. Women are also vulnerable since they are usually responsible securing water for the family. Batik sector-related impacts on water resources increase the time women must commit to this task. If water is scarce, the urban poor may not have income to purchase clean water from other sources.

DIRECT IMPACTS

Direct impacts from floods and variation in rainfall include drinking water contamination and salinization. Contamination could occur from sedimentation and waste-water from batik dyes and chemicals. Salinization reduces quality of drinking water.

INDIRECT IMPACTS

Indirect impacts include water-related health risks and increased household spending on water.

Untreated water from private wells may cause diarrhea and typhus as well as increased risk of infant mortality. Public health professionals anecdotally said allergies are an issue because batik dyes have infiltrated water sources. Children and the elderly are especially vulnerable to these health risks.

If artesian well water is depleted or contaminated, then households may have to divert income to purchase water from another source.

ADAPTIVE CAPACITY

Local management of the artesian well system is a strong expression of adaptive capacity. The private well system became contaminated and so residents sought and found an alternative source of drinking water. Moreover, information about drinking water safety is widely distributed in Pabean, since most residents now use private wells only for batik and cleaning.

However, Pabean now relies on a single source for drinking water, which is vulnerable to climate change. Its disruption could result in increased health risks and economic challenges for residents. The drinking water system needs to be expanded and the local capacity for management is a resource to incorporate into city-scale strategies.

Community Voices for the Next Stage of Planning

1) Batik workers in Pabean are the heart of Pekolongan's economy, so future growth will depend on adaptation of the batik sector to climate change; 2) Many residents are testing out ideas of their own for adaptation, such as elevating footpaths; 3) Other residents show how Pekalongan can become resilient – for example, by securing food from diverse sources.

RECOMMENDATIONS FOR NEXT STEPS

THE FOLLOWING IDEAS ARE RECOMMENDATIONS INTENDED for the P5 planning team on how to incorporate the lessons of "Colored Water" to city-scale planning.

BENCHMARKING

The statistics collected for "Colored Water" can be used for making comparisons to other neighborhoods and districts in Pekalongan. Which indicators measure higher or lower in other areas of Pekalongan? In what ways is Pabean similar to other neighborhoods and therefore instructive in terms of managing the built environment? Conversely, are there indicators – such as poverty – that are different, making Pabean a "cautionary tale" about how other neighborhoods may develop in the future? There may be indicators, such as PDAM access, deserving of wider survey and mapping with Geographic Information Systems in order to understand city-scale patterns and gaps in access.

CONNECTING

This report presents several detailed cases of how urban sectors and systems – such as drainage – are working in Pabean. A next step is to consider the ways in which existing systems can integrate with city-scale systems. Which economic activities and infrastructures in Pabean work well and should be extended to the rest of Pekalongan? How can improvements to city-scale systems help to address problems with sectors and systems within Pabean?

SCALING UP

There is much evidence of adaptive capacity to climate change in Pabean. Ideally, the best strategies for adaptation in Pabean can be models for the city. For example, the artesian well system, which is locally managed, effectively offers drinking water service at a low price as climate change compromises other systems.

REACHING OUT

The analysis presented here relies extensively on interactions with the community – both interviews and focus group discussions. If local constituents are mobilized and their voices included in the planning process, they will become advocates for ideas proposed by strategies for resilience. Community organizations are quite strong in Pabean, and the Mayor of Pekalongan and his staff are recognized for good governance and participatory leadership. Moreover, technical officers for PNPM are a resource for implementation, but the short-term nature of PNPM projects may make the officers less mindful of long-term climate change impacts. These three groups of constituents are good starting points for creating advocates for the plan both among residents and with local government.

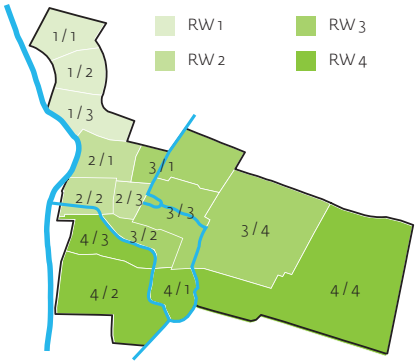
ANNEX 1 – STATISTICS AND THEMATIC MAPS

COLLECTED STATISTICS

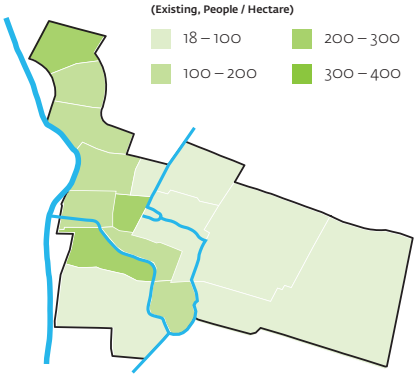
Source: UN HABITAT Survey, June 2010, Pekalongan Municipal Poverty Data

	PABEAN	RW 1			RW 2			RW 3				RW 4			
	Total / Average	1	2	3	1	2	3	1	2	3	4	1	2	3	4
TOTAL HOUSEHOLDS (HH)	1,152	106	107	70	107	61	72	82	60	76	57	92	80	116	66
TOTAL FEMALE HH	148	7	9	8	11	19	11	20	3	14	2	13	14	15	2
TOTAL POPULATION	3,883	575	268	270	235	279	245	104	220	313	155	212	330	435	242
AREA (Hectares)	48.2	1.95	1.58	2.11	2.06	1.47	0.93	3.28	1.51	3.16	7.93	1.6	5.26	2.08	13.3
EXISTING POPULATION DENSITY (People / Hectare)	80.6	295	169	128	114	190	263	31.7	146	99.1	19.5	132	62.7	210	18.3
"EFFECTIVE" POPULATION DENSITY (People / Hectare)	81.6	1.95	1.58	2.11	2.06	1.47	0.93	3.28	1.51	3.16	7.93	1.6	5.26	2.08	13.3
AGE 0 – 6	484	35	41	25	19	30	25	45	36	39	35	43	42	40	29
AGE 7 – 18	829	100	101	86	57	56	45	45	25	85	18	52	59	50	50
AGE 18 – 65	2,219	435	108	152	143	185	6	26	156	172	96	91	218	320	163
AGE 65+	182	5	18	7	16	8	0	40	3	17	6	26	11	25	0
DEPENDENCY RATIO	0.66	0.32	1.48	0.78	0.64	0.51	55	5	0.41	0.82	0.61	1.33	0.51	0.36	0.48
TOTAL YOUTH OUT OF SCHOOL	179	17	32	36	21	4	0	0	3	23	0	18	15	10	0
% YOUTH OUT OF SCHOOL	22%	17%	32%	42%	37%	7%	56%	0%	12%	27%	0%	35%	25%	20%	0%
TOTAL HH WITH PDAM	441	8	7	48	65	44	0	82	0	0	57	1	0	85	44
% HH WITH PDAM	38%	8%	7%	69%	61%	72%	2%	100%	0%	0%	100%	1%	0%	73%	67%
TOTAL HH WITH PUBLIC WELLS	101	0	0	1	0	0	25	75	0	0	0	0	0	0	0
% HH WITH PUBLIC WELLS	9%	0%	0%	1%	0%	0%	0%	91%	0%	0%	0%	0%	0%	0%	0%
TOTAL HH WITH PRIVATE WELLS	635	87	73	48	65	0	0	82	60	55	2	78	70	0	15
% HH WITH PRIVATE WELLS	55%	82%	68%	69%	61%	0%	55%	100%	100%	72%	4%	85%	88%	0%	23%
TOTAL HH WITH PUBLIC WC	90	0	50	1	0	1	0	0	0	0	0	18	20	0	0
% HH WITH PUBLIC WC	8%	0%	47%	1%	0%	2%	0%	0%	0%	0%	0%	20%	25%	0%	0%
TOTAL HH WITH PRIVATE WC	365	45	30	15	30	10	0	25	40	10	57	11	15	11	66
% HH WITH PRIVATE WC	32%	42%	28%	21%	28%	16%	0%	30%	67%	13%	100%	12%	19%	9%	100%
RUBBISH COLLECTIONS / WEEK	0.57	2	3	0	0	0	0	0	0	0	2	0	0	0	1
FREQUENCY OF MEETINGS	1.71	0	6	2	0	0	5	0	4	0	1	2	0	4	0
# OF COMMUNITY ORGANIZATIONS	34	5	3	3	4	4	0	4	2	4	0	1	1	3	0
# HH IN POVERTY	751	77	78	54	66	41	52	82	60	54	0	64	47	76	0
% HH IN POVERTY	65%	73%	73%	77%	62%	67%	72%	100%	100%	71%	0%	70%	59%	66%	0%
TOTAL HOUSES	87	80	48	65	44	0	75	50	55	57	63	62	85	92	863
TOTAL HH WITH LAND TENURE	42	50	35	65	40	0	5	45	55	57	17	5	85	N / A	501
% HH WITH LAND TENURE	58%	48%	63%	73%	100%	91%	0%	70%	90%	100%	100%	27%	80%	100%	N / A
RATIO HH TO HOMES	1.22	1.34	1.46	1.65	1.39	0	1.09	1.2	1.38	1	1.46	1.29	1.36	0.72	1.33

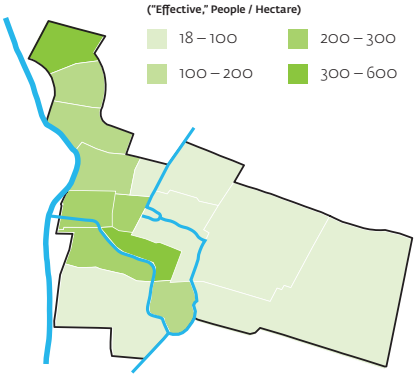
RW / RT ID #s



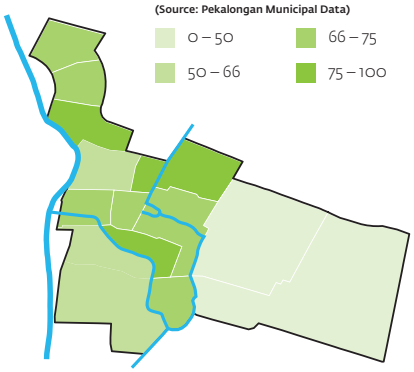
POPULATION DENSITY
(Existing, People / Hectare)



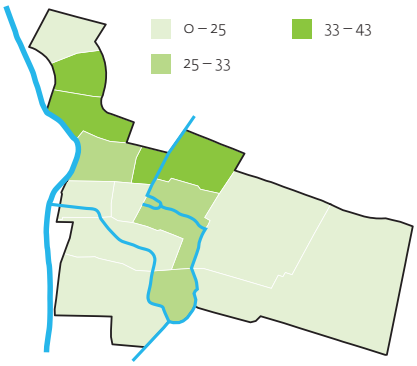
POPULATION DENSITY
("Effective," People / Hectare)



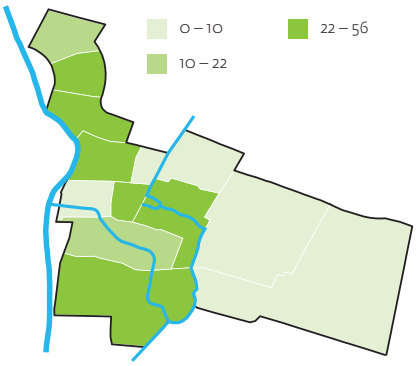
POVERTY
(Source: Pekalongan Municipal Data)



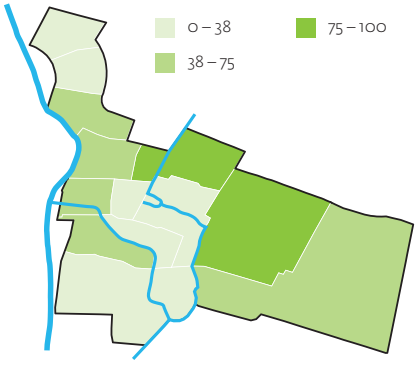
% AGE 7 to 18



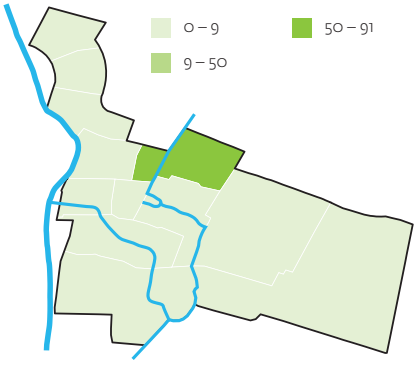
% YOUTH OUT OF SCHOOL



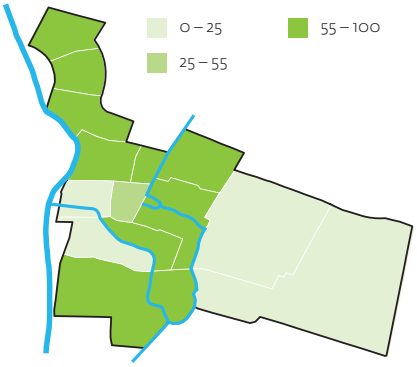
% HH with PDAM



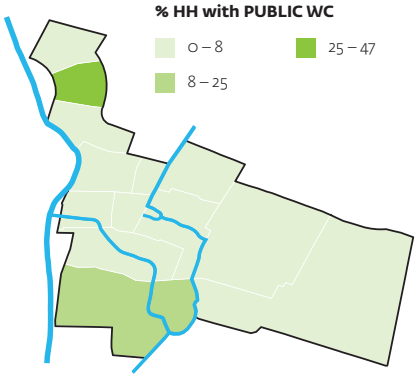
% HH with PUBLIC WELLS



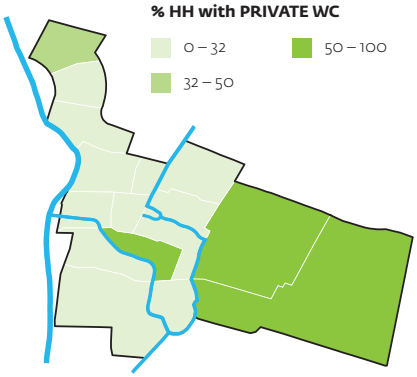
% HH with PRIVATE WELLS



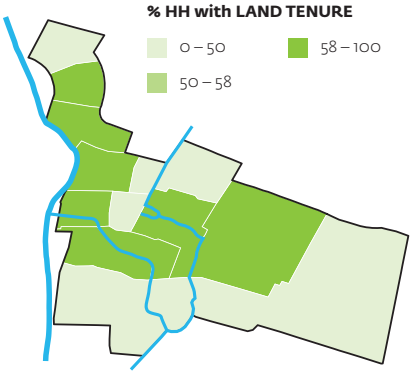
% HH with PUBLIC WC



% HH with PRIVATE WC



% HH with LAND TENURE



ANNEX 2 – FOCUS GROUP DISCUSSION NOTES

19 JULY 2010
PAK KARTONO'S HOUSE
RW 3 / RT 1

What do you know about tidal flooding?

PAK YAHYA: The main cause is that the river in the west of Pabean (Bremi river) has been widened to make the water flow to the sea, but it doesn't make any change because the sea now is higher that the river itself. The water gate doesn't work; it cannot protect the neighborhood from high tidal wave. There is no official person to monitor and control the water gate.

PAK MULYONO: The water flows from southern areas in the city is much bigger that the capacity the river can cope with. And there are three gates, but only two which actually work, but the gate is much lower that the sea-level itself.

The Pabean village is just a simply water end area, where water from other several areas in the city go through. When the sea-level is higher, the water stop flowing and become flood in Pabean area which can stay several days. The sedimentation in the Bremi river also decreases capacity of the river to retain water.

When do the tidal floods happen in the village?

PAK NASHIR: The tidal flood have come since 2002 in Pabean. It is caused by normalisation of the river to add up into three rivers in Pabean which lead to tidal flood regularly every full moon.

MR. YAHYA : Now Pabean is getting worse than before.

Why does the tidal flood happen? Is that something natural? How the do people here know about the tidal flood?

PAK DIRMAN: We really need people who are responsible to monitor the water gate.

The flood is also natural phenomena since it is also affected by earth gravitation. From what I can see from the TV, the ice pole is melt and it is because the sea water is higher than usual.

PAK MULYONO: The iceberg in north polar is melting (global warming). I just notice this from television.

The house composition in Pabean is also very dense, where there is not enough land available for absorbing rain water and water from the sea.

The people said: "They can do nothing, only to raise up their houses."

The house of Pak Kartono has been rise up twice, it has been one meter higher than the original one, the window now is just the same level with the ground.

What has been done by the resident to anticipate the flood?

PAK MULYONO: Making the water gate in the river, raising up the house, raising up the pavement.

Are there any impacts to the batik activities?

PAK MULYONO: When the flood come there are production, because people can not dry the batik in the street that is flooded.

PAK NASIR: We cannot go out to the city to take and sell batik because the street is flooded.

Does your income decrease because of flood?

PAK DAMARI AND PAK YAHYA: In May and June, our income decrease very significant from 12 *kodi* finished to only 6 *kodi* finished (50%).

What about farmers in this village?

PAK BASARI: When we spread out the seed in the farm, all are gone swept away by water in the farm. We cannot grow rice recently. The quality of soil also disrupted.

PAK NASHIR: Morning and afternoon, all farms are flooded.

If you don't grow rice, then what you do instead?

PAK NASIR: We work in the city as informal workers such as pedicap driver, parking man, and worker in construction. We do anything what we can do to survive.

PAK BASARI: We did not harvest any rice since 1998.

What is the impact of flood on health conditions?

Eczema and other skin deseases, fever, *kaki gajah*, and diarrhea.

What you do to cure your sickness?

PAK MULYONO: *Puskesmas* provide only generic medicine, if it not better, we are recommended to go to the hospital in the city. Medicine for *kaki gajah* is free in *Puskesmas*.

There is no information from *Puskesmas* to the people about how to deal with deseases caused by flood. Only information about *kaki gajah*, but it is limited and without coming house by house.

What about your private well, is it impacted?

PAK YAHYA: Yes, we cannot drink from water in the well. Toilet is usually in the river, but we also used well water for our sanitation.

PAK NASHIR: Our well is colored and smelly. The batik dye polluted the well water.

Where do you get clean water?

PAK YAHYA: We take from the pipe water provided by the neighborhood. It is only available in the morning and afternoon betwee 6:00 and 7:00 a.m. and 4:00 and 5:00 p.m.

Do you have PDAM?

PAK YAHYA: Pipe water can go into the houses, but we have to pay for the installation. It is below the general cost in the city. But now, we can not add new installation from PDAM.

We prefer to use water pipe from the neighborhood government that we can take from the water pipe in every RT. We have only to pay 3,000 Rp. per house per month.

Is there any water tank to catch rain water?

No.

Do you use your private toilet?

PAK MULYONO: Although we have private toilet, we prefer to use the river. It is more comfortable.

What about land title?

PAK YAHYA: We don't have time and money to make certificate. Big block of land still have one certificate. So many houses in one land have only certificate. Our land is still legal since we inherit the land from our parents, but we haven't spilt them into each house's certificate.

Do you have saving groups?

PAK MULYONO: We have BKM (*Badan Keswadayaan Masyarakat*) supported by PNPM / World bank. They provide loan to the people, and they organise themselves for the loan.

PAK NASHIR: I want to question back, how to anticipate the flood from the sea?

In every RT people are usually gathered together to discuss proposal to then *musrenbang*. But we found that our proposal does not meet the city level program so they often are neglected by the government. We often raise to the city to improve our drainage, but the government give another program which is house renovation. People here need the drainage improvement.

ENDNOTES

Page 9 – Pabean Baseline Statistics

http://population.mongabay.com/population/indonesia/1631766/pekalongan

Top occupations data from interviews.

Page 13 – Regional and Local Ecosystems

http://www.dephut.go.id/files/stat_pemalijratuno7.pdf

Page 13 – Basic Climate Statistics

http://weather.uk.msn.com/local.aspx?wealocations=wc:IDXX0040&q=Pekalongan%2C+IDN&src=rss

Page 13 – Basic Climate Statistics Continued

http://www.springerlink.com/content/n6776p3527rul186/

http://weather.uk.msn.com/local.aspx?wealocations=wc:IDXX0040&q=Pekalongan%2C+IDN&src=rss

http://www.pekalongankab.go.id/web/images/stories/DDA%202008%20Ind%20Ver.pdf

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COLORED WATER

AUGUST 2010