REFLOW THE KAMPUNG
An integrated purification system to manage the water and waste flows in the Kampungs in Bandung
The growth of the earth’s urban population and areas continues as a major demographic trend; it is projected that 70 % of the world’s population will live in urban areas by 2050 (UN Habitat, 2011).
Intro

I  Context  

I  Research  

I  Design  

I  Conclusion
Around 1.2 billion people, or almost one-fifth of the world’s population, live in areas of physical scarcity, and 500 million people are approaching this situation (UN-Water, 2007).
In this urban area’s one-sixth of the population, live in physical water and 500 million people are approaching this situation. Two-thirds of the world’s population could be living under water stressed conditions (UN-Water, 2007).
If we continue dealing with plastic in the same way, there will be in 2050 in terms of weight are more plastic in the sea than fish (WNF, 2016)
CONTEXT
INDONESIA
- 250 million people
- more than 17,000 islands
- Jakarta capital city

JAVA
- Area 132,000 km²
- 143 million people
- In West Java, 1.3 million people are employees in the textile industry
LOCATION

BANDUNG
- 3rd largest city by population
- 2nd largest metropolitan area
- 8.6 million people

CIGONDEWAH KALER
- 21230 people
- 12 RW's
- Divide in several RT
LOCATION

RW 02/12 IN CIQONDEWAH

RW 12  1358 people
RW 02  1788 people
THE KAMPUNG IS A DISTRICT FOR THE TRADITIONAL INDONESIAN COMMUNITIES WHICH AROSE WITHOUT A PLAN FOR INFRASTRUCTURE AND BUILT ENVIRONMENT (Colombijn, 2010).
KAMPUNG
KAMPUNG
INTRODUCTION

Bandung city has a population of 21,894 people and generates 2.575.478 kg of waste per year. Bandung restricts the area to 167.67 km² with 15,000 people per km².

Cigondewah has a population of 8,199,892 people and generates 8.199,892 kg of waste per year. Cigondewah restricts the area to 233.565 km² with 35,000 people per km².

KAMPUNG WASTE FLOW BANDUNG

1. Textile Waste
2. Organic Waste
3. Plastic Waste
4. Toxic Waste
5. Factories
6. Paper Waste

BANDUNG CITY

- Population: 21,894
- Area: 167.67 km²
- Density: 15,000 p/km²

CIGONDWEH

- Population: 8,199,892
- Area: 233.565 km²
- Density: 35,000 p/km²
PROBLEM STATEMENT

HIGH DENSITY IN THE KAMPUNG
PROBLEM STATEMENT

POLLUTED RIVERS
PROBLEM STATEMENT

BAD SANITATION
PROBLEM STATEMENT

WASTE DUMPED EVERYWHERE
HOW CAN A **COMMUNITY BUILDING** IN THE KAMPUNG REFLOW THE **WATER** AND **WASTE CYCLES** TO **IMPROVE** THE LIVING QUALITIES FOR THE RESIDENTS IN BANDUNG, INDONESIA?
TECNICAL RESEARCH QUESTION

HOW TO IMPROVE THE WATER QUALITY IN THE KAMPUNG BY MANAGING ALL THE WATER FLOWS WITH A PURIFICATION SYSTEM WHERE WASTE MANAGEMENT IS INTEGRATED?
FIELD RESEARCH

WATER FLOWS

[Map and images related to water flows]
FIELD RESEARCH

WASTE FLOWS
WATER PURIFICATION SYSTEMS

1. ANAEROBIC BAFFLES REACTOR

2. ANAEROBIC FILTER

3. PLANT FILTER / FISH POND
FLOW PRINCIPAL

REFLOW THE KAMPUNG

Locals

Drinking Water

Public Building

Household Waste

Intro

Context

Research

Design

Conclusion
**DRINKWATER**

**Rainwater collection**
- 2500mm/year
- 6,85mm/day
- 1,2L drinking water * 3146 people = 3775L/day
- Roof 3775/6,85 = 550m²

**Drinkingwater filter**
- Filtering 3775L/day
- 1,8m²/day
- 2,5m x 2m = 5m²
- Height 2m
- Retention time 24 hours

**Distribute**
In gallons 5L or 10L
Distribution/collection space 12m²

**SANITATION**

**SHOWER**
- Showers for max. 1890 people
- 4 showers men/4 women
- Total space = 14m²

**WASHING BINS**
- Maximum 1890 residents
- Washing bins men, women 5
- Total 18m²
- Area combined with showers

**TOILETS**
- Toilets for 2560 people
- 12 toilets: 5 men, 5 women
- Total 20m²

**WATER COLLECTION**
- Water collection for 1 week
- Closed system
- 15m³ = 15,000L
- 18m²

**WATER TREATMENT**

**TRASH SKIMMER**
- Trashes skimmer for all the river water
- Machine 7 meters long
- Width of the river

**ANAEROBIC TREATMENT**
- Baffled reactor 138m³/day
- 6.6m x 10m
- Retention time 24 hours
- Anaerobic filter
  - 42m² (6m x 7m)
- Retention time

**PLANT/FISH POND**
- Planted gravel filter
- Depth 1.5m above ground
- 15m x 23m = 351m²
- Fish pond
- Depth 2 meter
- 10m x 14m = 140m²

**HOUSEHOLD WASTE**

**WASTE COLLECTION POINT**
- Collection area for the household waste
- 20m² needed
- It will immediately be processed and bring to the waste separation

**WASTE SEPARATION**
- Waste separate in three categories: organic, recyclables and others
- Storage space
- 28m² for all categories
- Total 54m²

**BIOGAS REACTOR**
- Organic waste = 772kg/day
- 300kg/m³
- Total 18m³
DESIGN
CONCEPT

RAINWATER COLLECTION
CONCEPT

CLEAN WATER IN / WASTE OUT
CONCEPT
LANDSCAPE PLAN
LANDSCAPE PLAN
PLANTS AS AN ARCHITECTURAL ELEMENT
LANDSCAPE PLAN
FLOW SCHEME
ROOF

DETAIL BAMBOO NODE
ROOF

DETAIL BAMBOO NODE
ROOF

DETAIL TOP CONSTRUCTION, BAMBOO / MEMBRANE

[Diagram of roof detail with numbered parts: 1, 2, 3, 4, 5, 6, 7, 8]
STEELPLATE ROOF

BAMBOO ROOF STRUCTURE
main beams Ø70mm, sub beams Ø50mm, h.o.h. 400mm

STONE BRICK 400x200x200mm,
2x square cutouts 100x100mm filled with concrete

BRIICK WALL, different patterns

STEEL REINFORCEMENT,
steelpipes 10mm thickness

CONCRETE FOUNDATION
Poured concrete ring 300mm thickness

CONCRETE FLOOR
Poured concrete 200mm thickness
Bamboo is strong, light, flexible, renewable and reduces CO2. Both local and modern techniques can be used.

The strongest was a composite of natural fibres and resin. Bamboo pavilion prototypes showed that the design can be made. Joining two bamboo stems without using nails, screws or bolts will provide the needed friction. It will also make the joints more durable, so the construction will last longer.

Material Design & Research
By J.J. (Jaap) Overal

Tests on bamboo were developed and tested to determine their strength.

Bamboo (longitudinal)
Bamboo (transverse)
Wood

Strength of the joints:
BAMBOO HEMP ROPE
BAMBOO SISAL ROPE

Structure analysis showed local forces and deformations.

Prototype showed that the design can be made. As a final recommendation it is advised to use rope to make the joints and improve these with resin. The resin will provide the needed friction. It will also make the joint more durable, so the construction will last longer.

The entire structure was tested by analyzing it in a configuration that did not exceed the maximum levels. The prototype showed that the design can be made.

Summary
Bamboo pavilion
Location
Resort in Pejaten, Bali (Indonesia)

Building Technology
Graduation specialization:
Material Science
Structural Mechanics

Mentors:
First Mentor: Dipl. -Ing. F. (Florian) Heinzelmann
Second Mentor: dr. ir. F.A. (Fred) Veer
Third Mentor: Dipl. -Ing. F. (Florian) Heinzelmann

Final design configuration showed local forces and deformations.

Tests on bamboo

Maximum stress between 100 - 160 MPa

Bending strength:
Young's modulus (GPa)
Tensile strength (MPa)

Prototype showed that the design can be made.

Load case:
Weight + wind load

GA the

Mentors: Sponsors:
- BRICKS REFER TO FORMAL INDUSTRY IN THE RW02/12 KAMPUNG
- BRICKS OUT OF REUSED MATERIALS
- BRICK PATTERNS GIVES EACH MODULE OWN IDENTITY
STONE PATTERN sanitation facilities
PRESSED WASTE BRICKS waste facilities
PLASTIC BOTTLES IN CEMENT WALL waste facilities
STONE PATTERN drinking water facilities
- CLIMATE DESIGN MODULES
- NATURAL VENTILATION
- OPEN BRICK PATTERN
- WINDOWS
CONCLUSION
BENEFITS

REPLICABLE

WATER DEMAND

SAME COSTS

MANAGED BY COMMUNITY

BUILD BY COMMUNITY

CLOSED WATERFLOW
THANK YOU FOR YOUR ATTENTION!

QUESTIONS?