



GROUND RULES: DESIGN FOR CONTINUAL CRISIS

Edited by Studio Unité

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STUDIO INTRODUCTION

SPRING 2010

Columbia University: Graduate School of Architecture
Preservation and Planning

Ground Rules: Professor Alice Chun

Tim Bell

Irene Brisson

Mason Edge

Nathaniel Felder

Ji Hye Ham

Cristina Handal

Dionysis Kaltis

Starr Law

Stefana Simic

Andrea Sreshta

Anna Stork

Marlisa Wise

Students in their second year Masters of Architecture program researched and investigated a variety of health and safety concerns facing Haiti historically as well as in the immediate aftermath of the January earthquake. Each student project addresses a specific aspect of the Haitian environment such as water, energy, annual hurricanes, soil depletion, erosion, and deforestation. We have developed preliminary designs of systems and strategies that could be locally deployed and evolved to mitigate these serious threats in the short and long term.

While our research is specifically focused on the complex economic, political and environmental conditions in Haiti, the rigorous understanding of this unique situation elucidates universal concerns facing communities exposed to natural disasters, developing urban and rural societies and effective sustainable strategies for nations of all development statuses.

HISTORY OF CRISIS



POLITICAL INSTABILITY

The materials for housing must integrate agriculture and commerce, to insure jobs. Innovative solutions for infrastructure must bind alternative energy, communication, sanitation and rainwater collection networks. We are intensely committed to providing well researched and documented information about Haiti's culture, from religion, and social environment, to political and ecological tensions. This research prefaces the designs for Haiti, to create more responsive and strategic opportunities for land remediation, civic constitution, and social economy.

SOCIOECONOMIC DISASTER



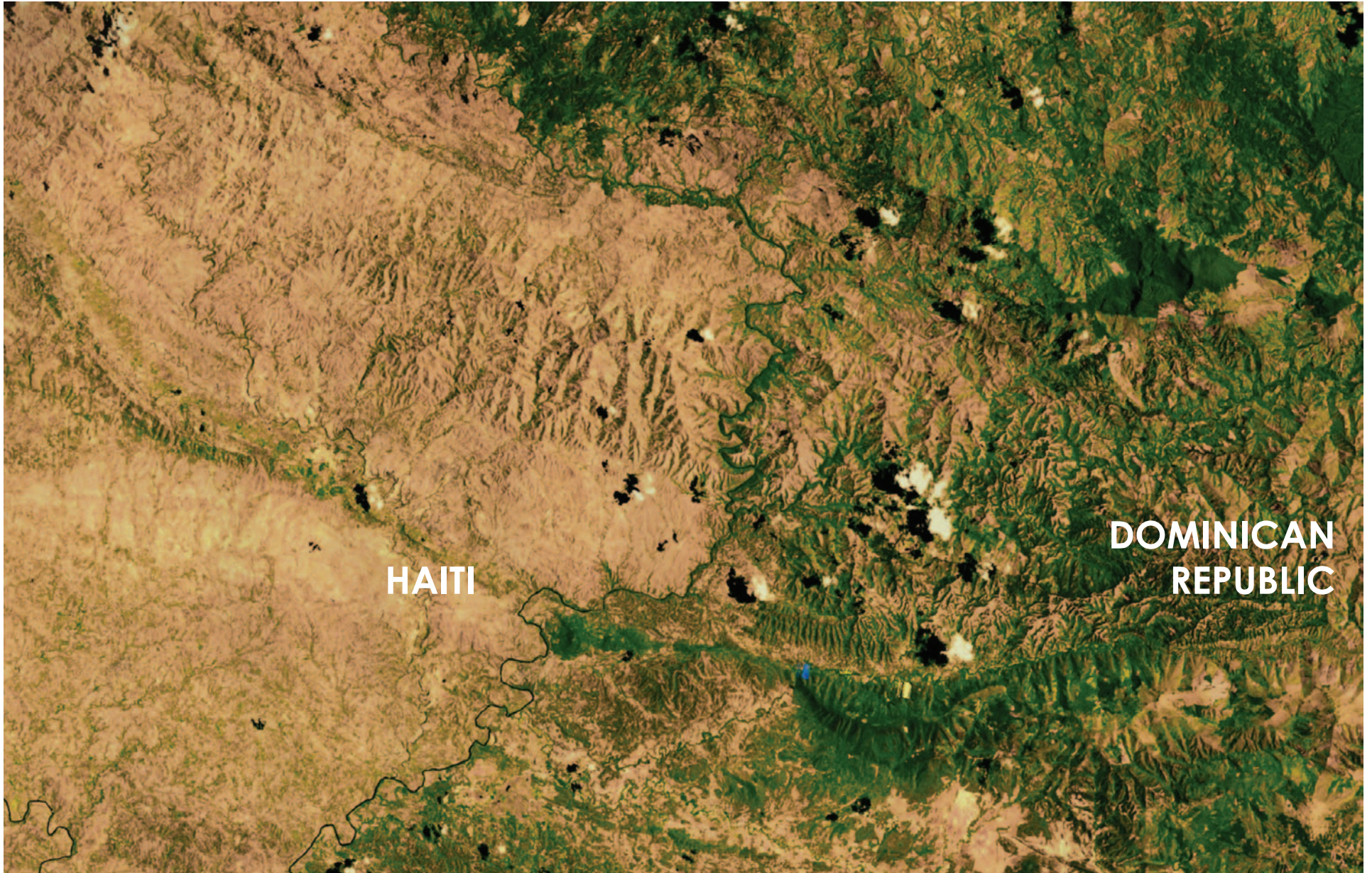
JACMEL, HAITI

STRUCTURAL FAILURE

Mindful of the value of indigenous knowledge and expertise, it is key for architects to respect traditional values and ways of working and take these as a starting point for meeting new challenges using realistic resources and working directly with local stakeholders – families, communities, and local organizations. In order to effectively integrate and represent the knowledge of local stakeholders it is key to establish personal connections and a close dialogue between professional practice, cutting edge technical expertise, vernacular craftsmanship, and local customs.

A particular skill set of the architect is the creative synthesis of policy, technical considerations and design concepts to develop both realistic and idealistic proposals and interventions in the built environment. We believe that the development of research documentation using the graphic representation of architecture will allow us to disseminate knowledge in an accessible and useful form to international and local designers that will be key players in the long, slow process of rebuilding a nation.

ARCHITECTURAL DISASTER

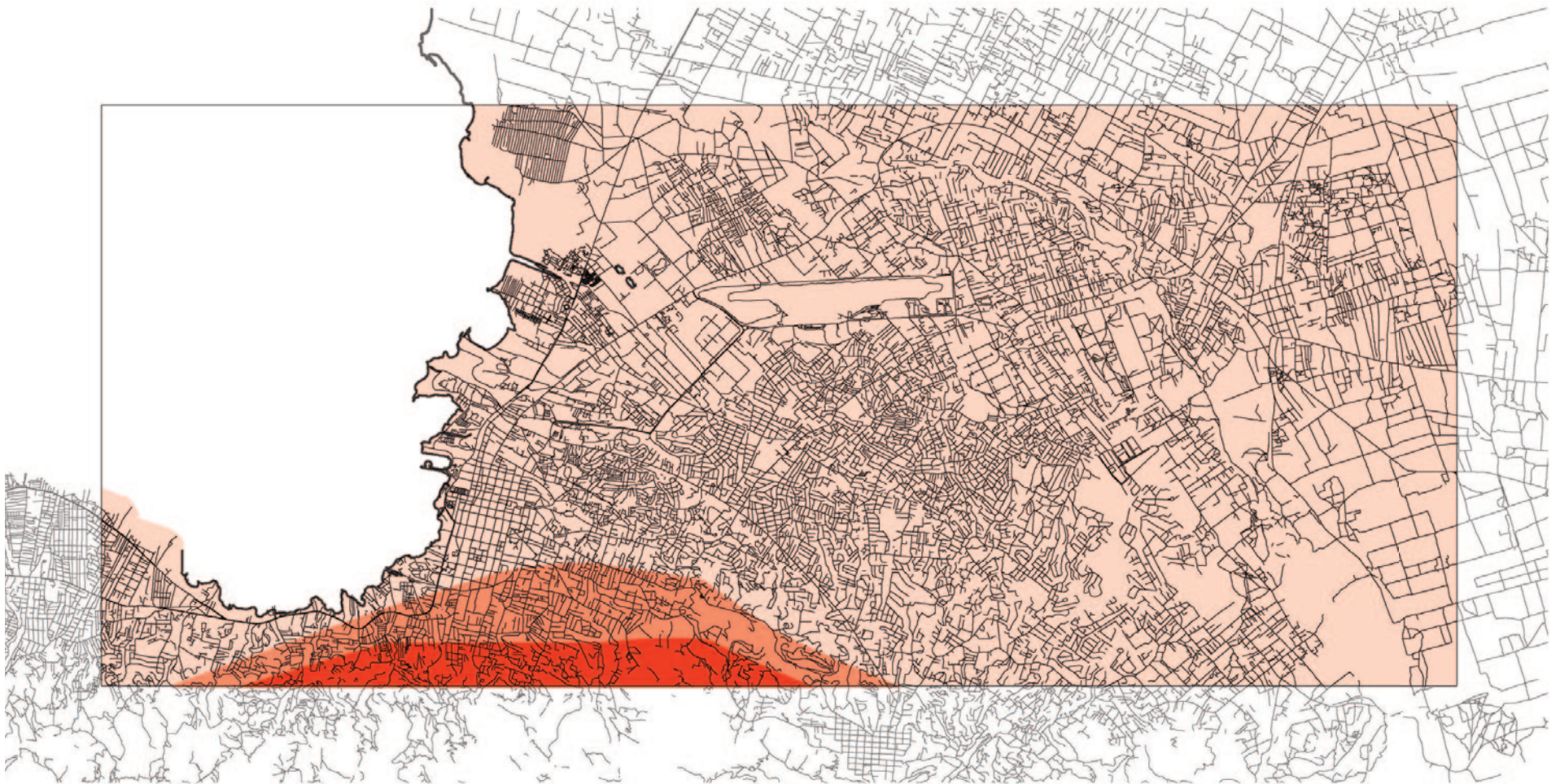


HAITI

DOMINICAN
REPUBLIC

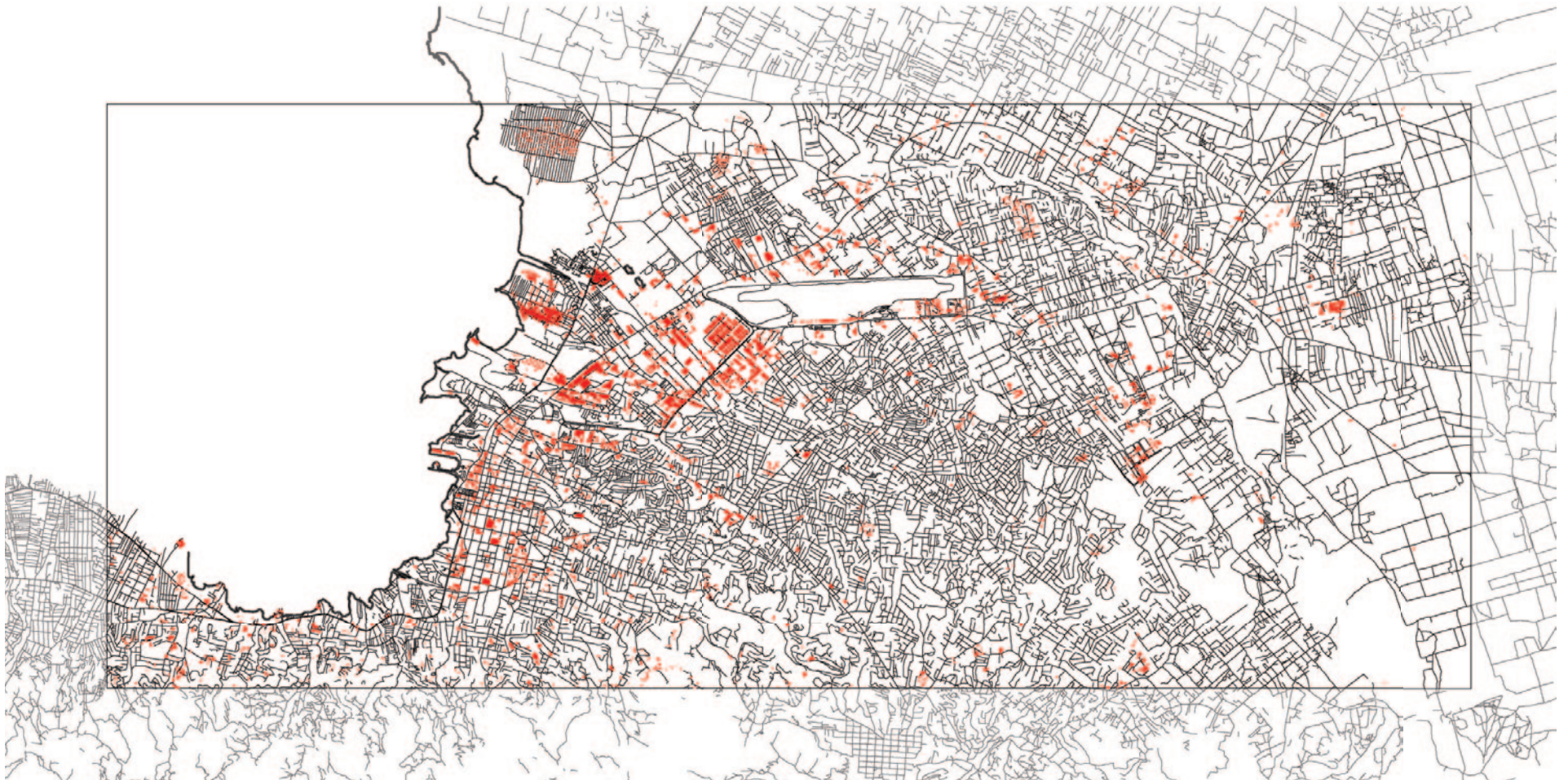
DEFORESTATION

7.0 magnitude earthquake strikes southern Haiti



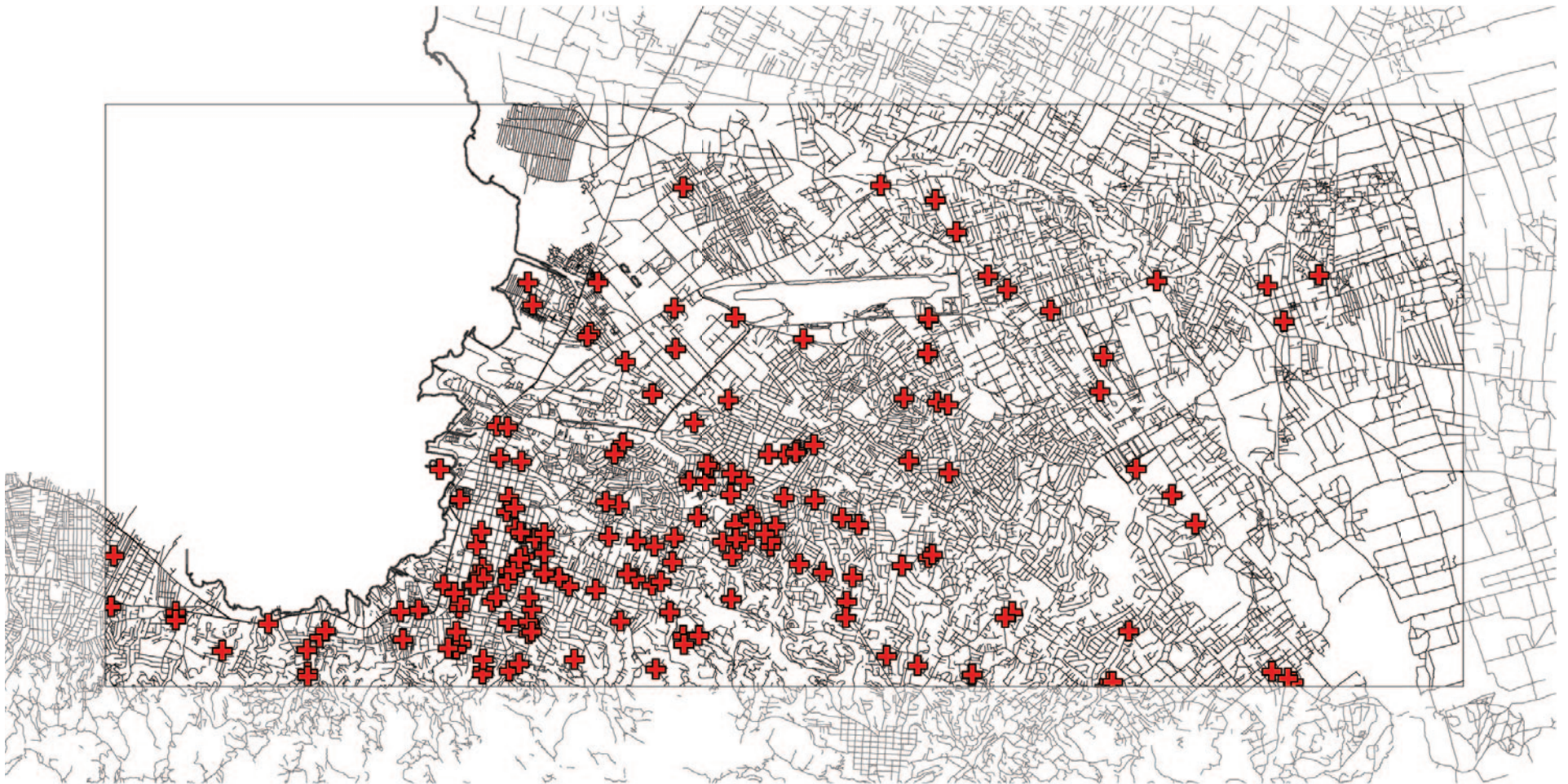
Earthquake magnitude in Port-au-Prince

Where did the city collapse?



Building damages in Port-au-Prince as of February 14, 2010

What is the disaster response?



Relief centers in Port-au-Prince as of February 14, 2010

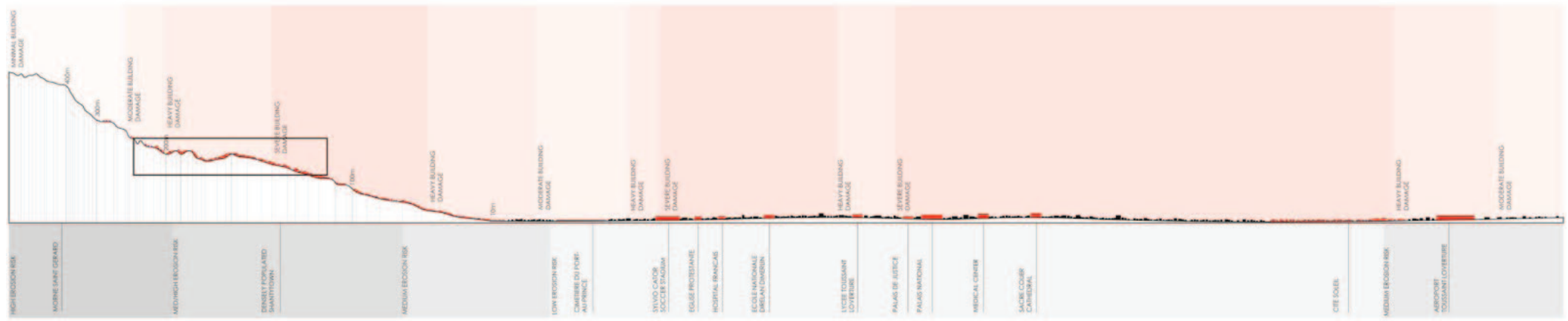
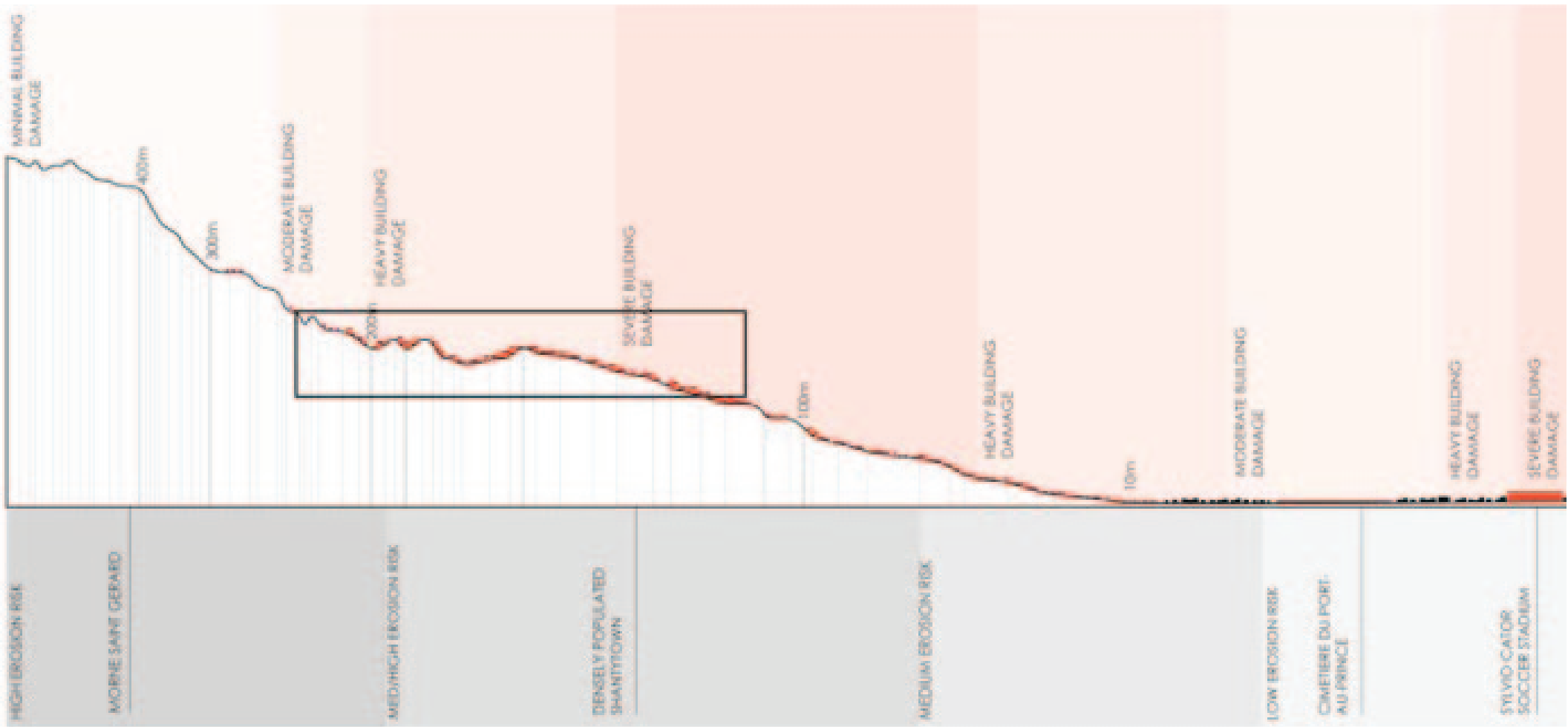
Where are the survivors?



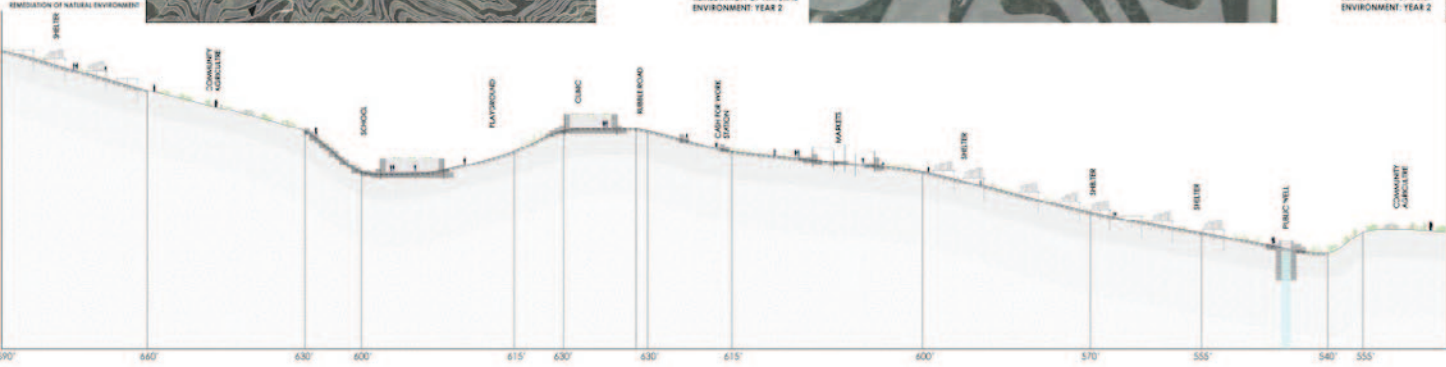
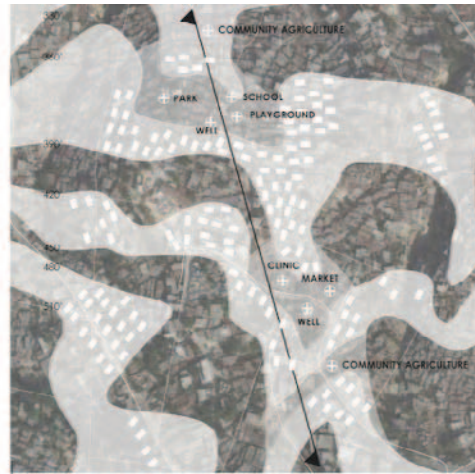
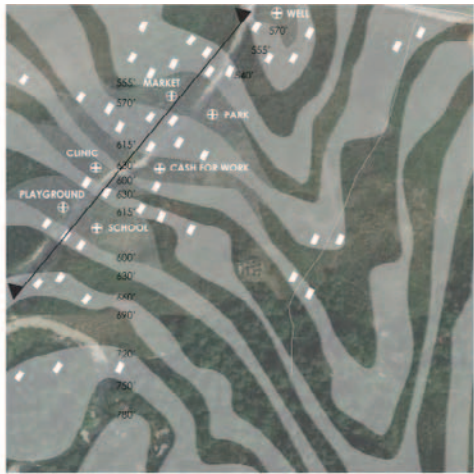
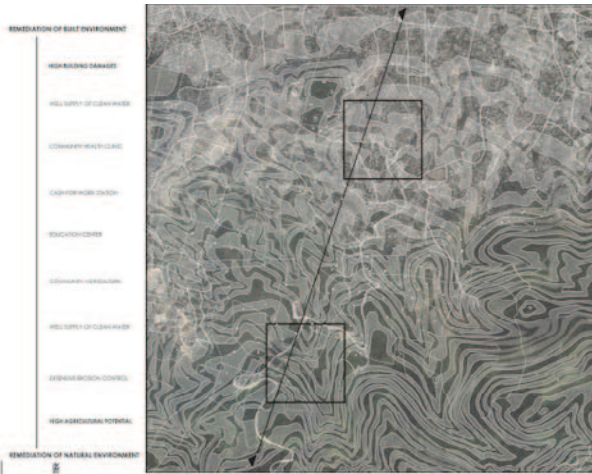
Tent settlements in Port-au-Prince as of February 14, 2010

What happens during the rainy season?

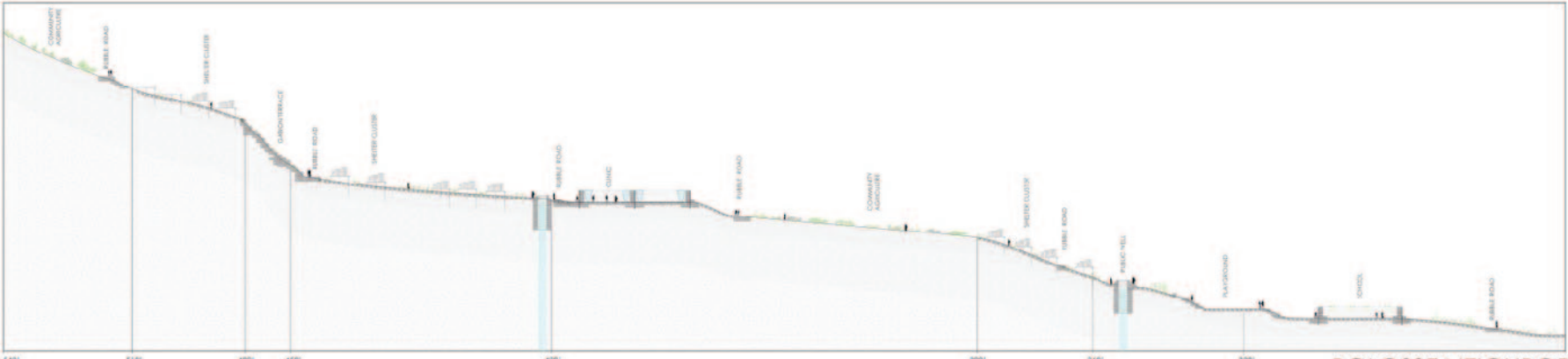




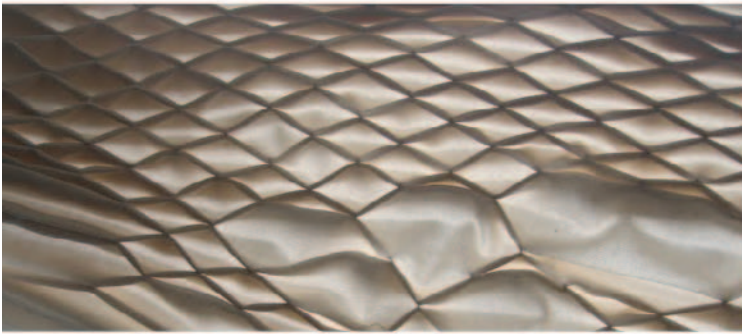
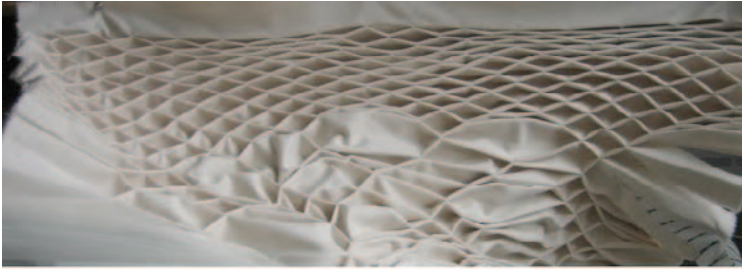
STRATEGY_LAND



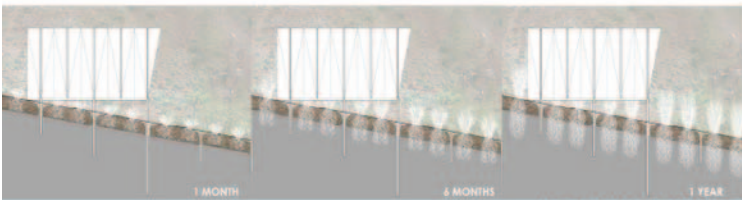
BOLOSSE NEIGHBORHOOD
RURAL REGENERATION STRATEGY



BOLOSSE NEIGHBORHOOD
URBAN REGENERATION STRATEGY



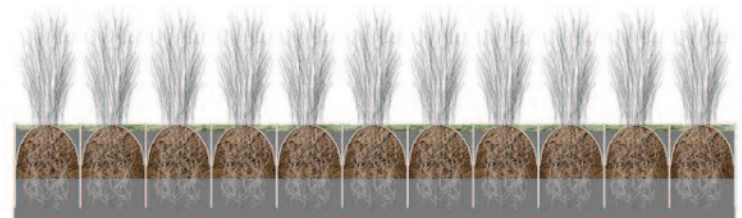
FABRIC SMOCKING STUDIES



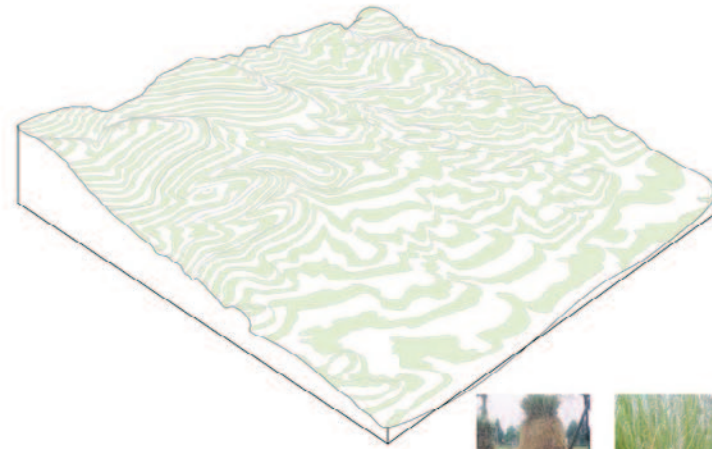
ARTIFICIAL ROOT SYSTEM ALLOWS FOR REMEDIATION BY NATURAL GROWTH



BIODEGRADABLE FABRIC ANCHORS INTO SOIL BY BAMBOO POLES



MARLISA WISE & JI-HYE HAM



ARTIFICIAL ROOT SYSTEM ALLOWS FOR HEALING OF DAMAGED HILL COMMUNITIES



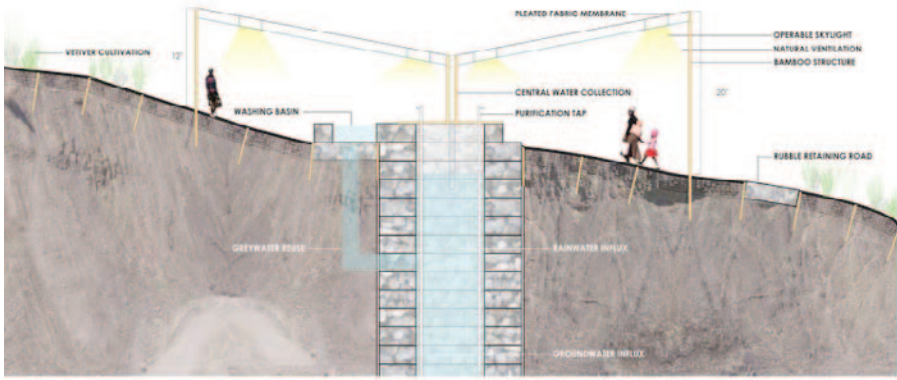
VEGETER ROOT RETAINS SOIL IN CONTOUR



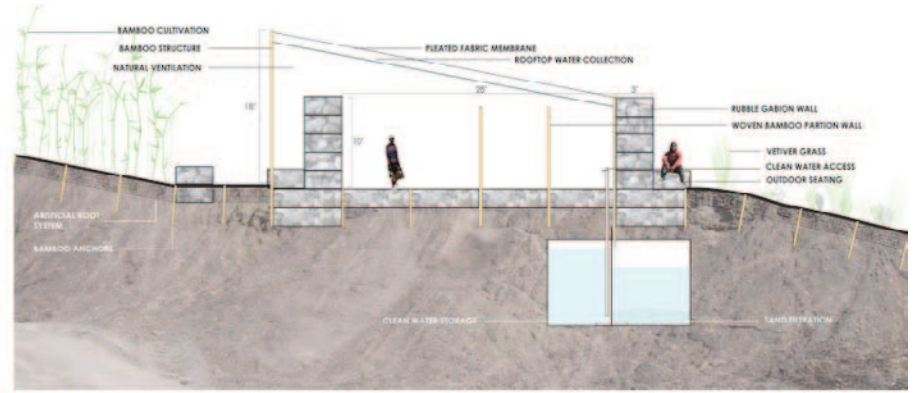
REMEDIAED SOIL PROMOTES AGRICULTURE



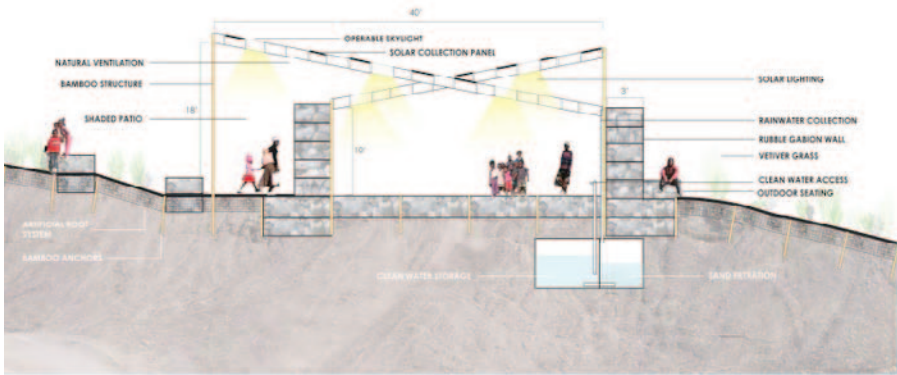
LANDSCAPE REMEDIATION



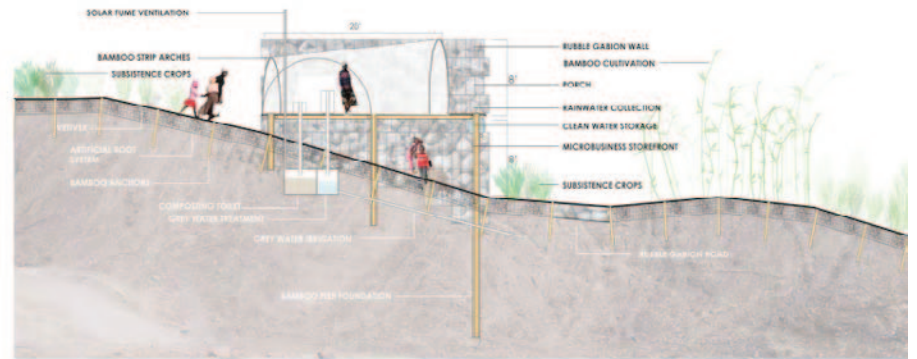
PUBLIC WELL



CLINIC

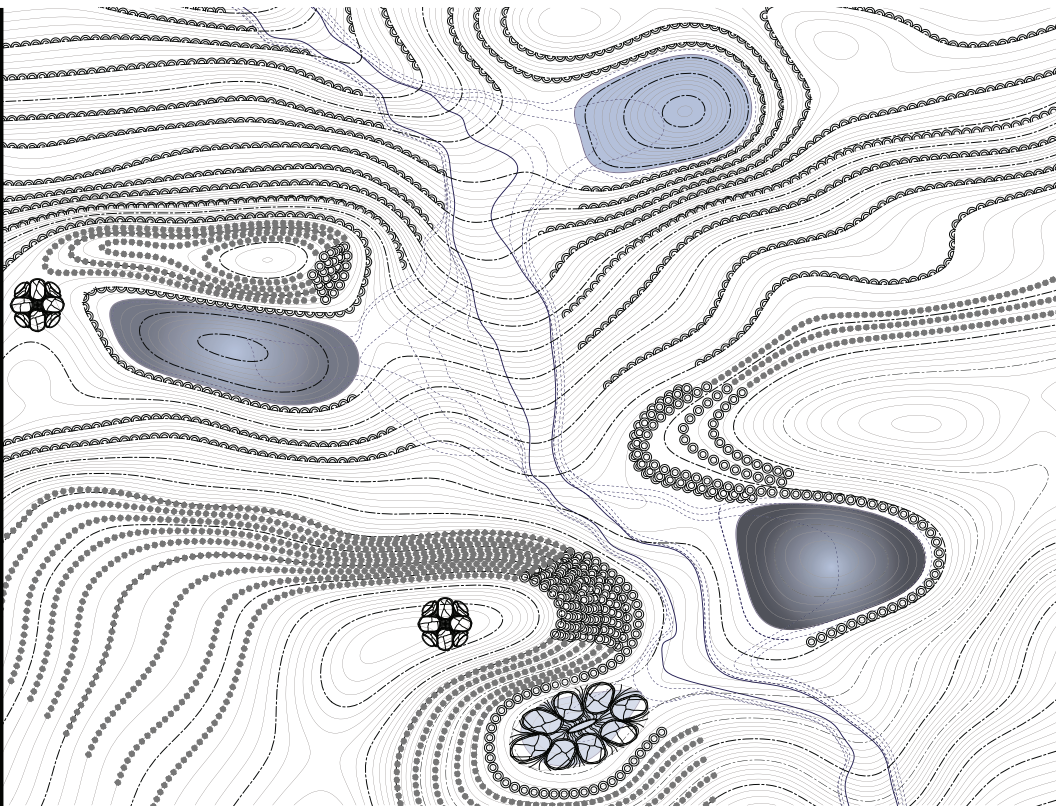
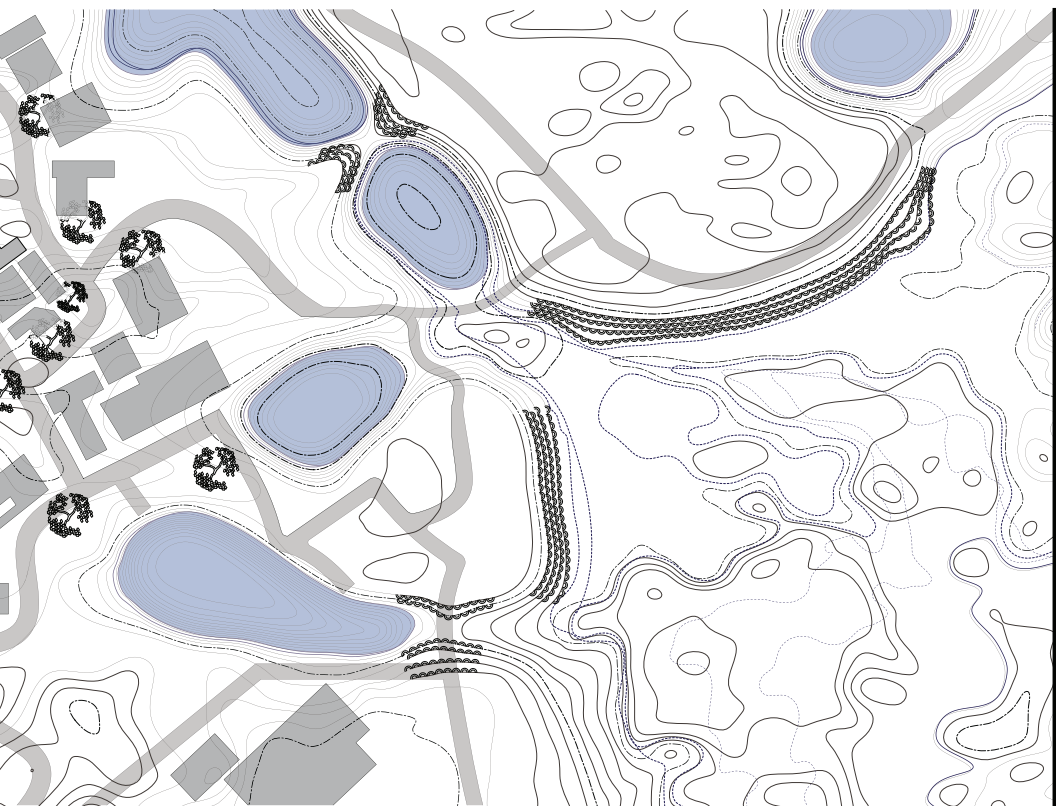
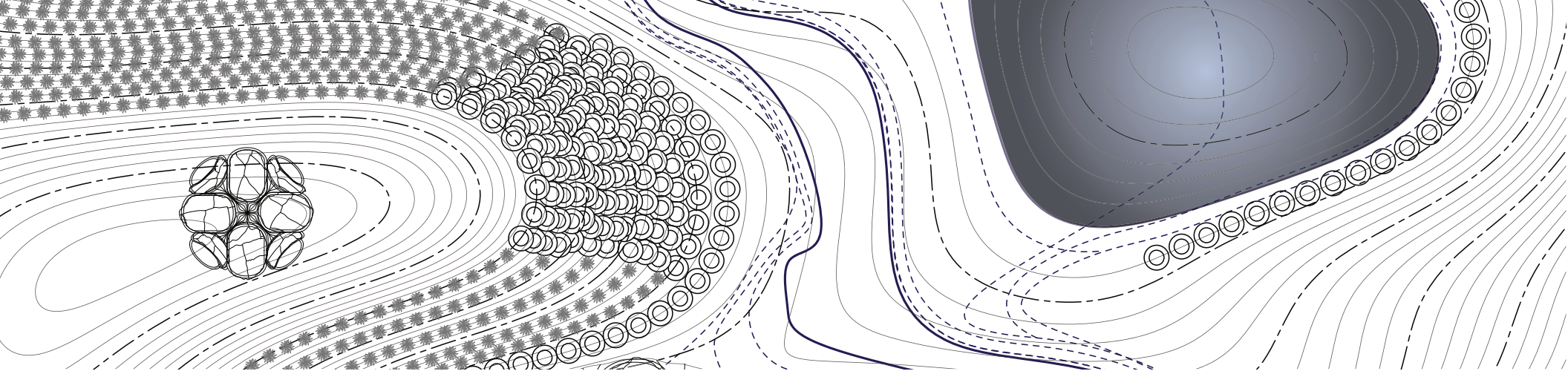


SCHOOL



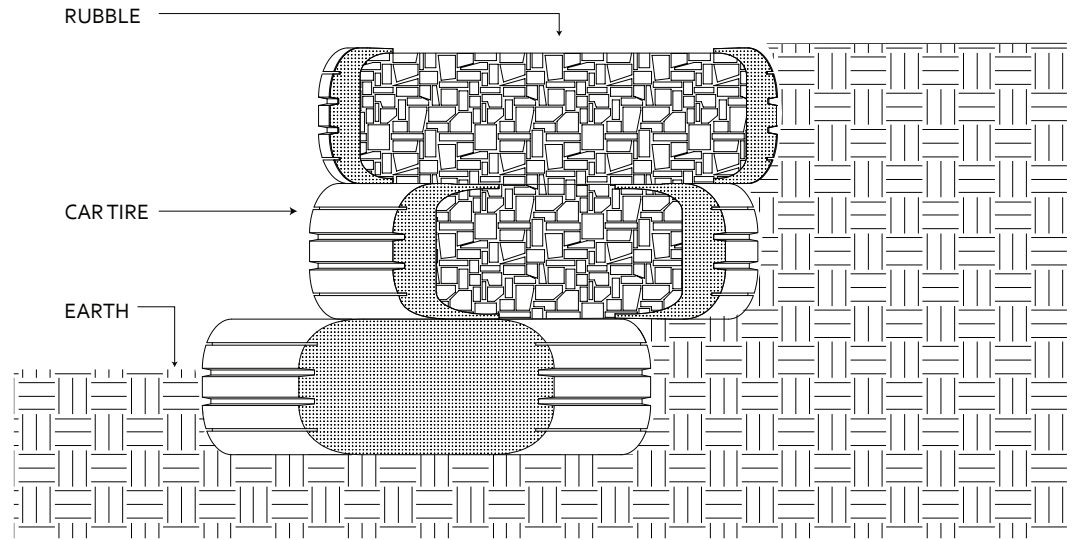
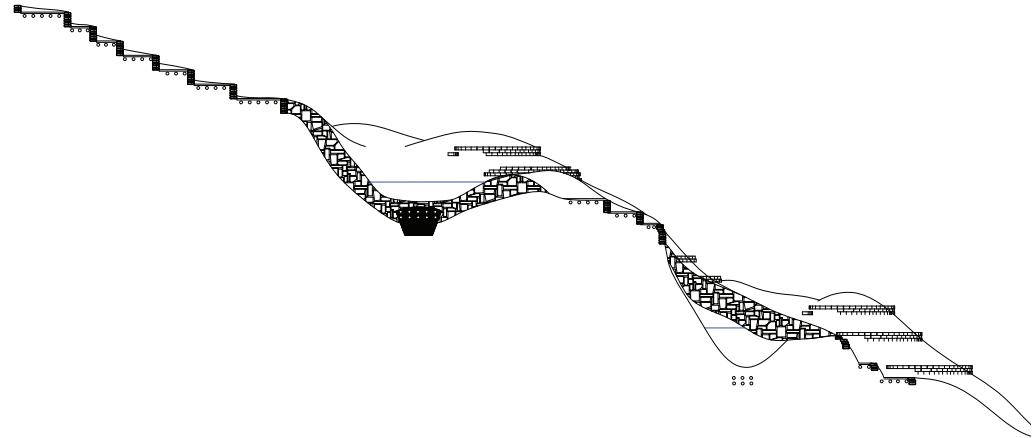
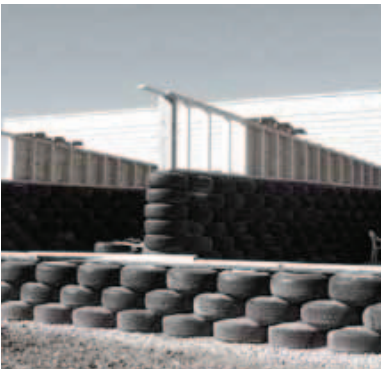
SHELTER

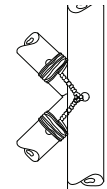
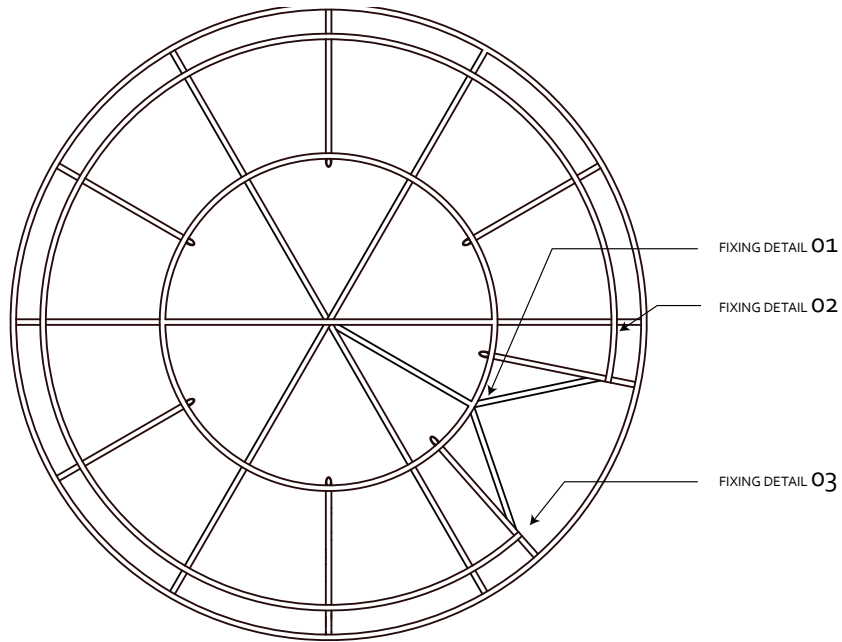




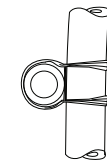
STEFANA SIMIC

LANDSCAPE REMEDIATION

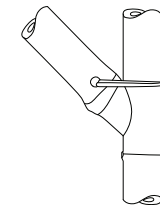




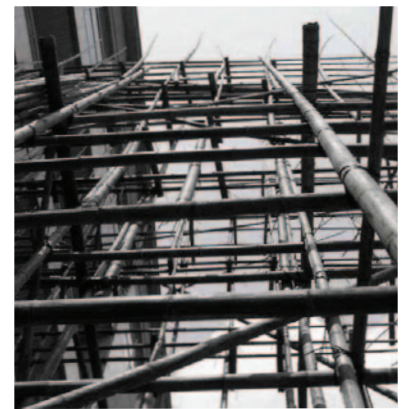
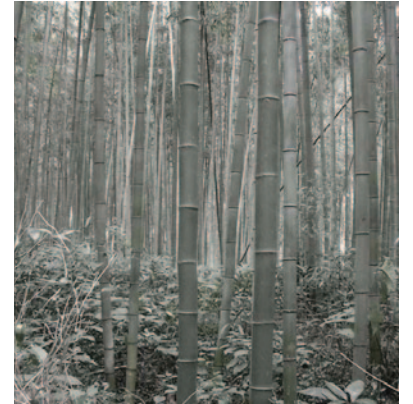
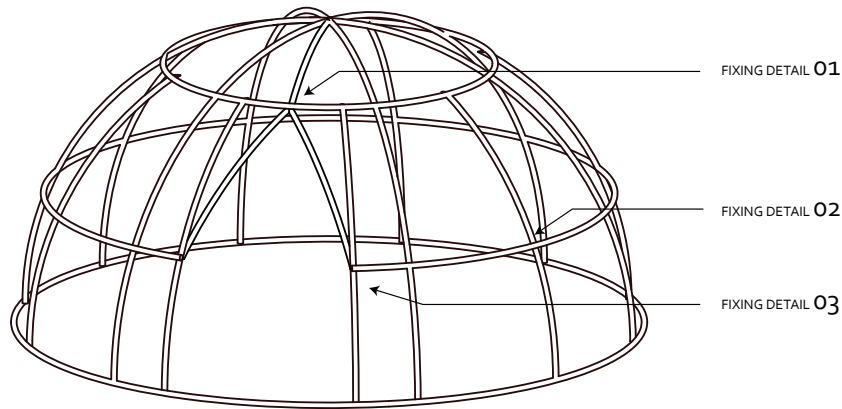
DETAIL 01



DETAIL 02



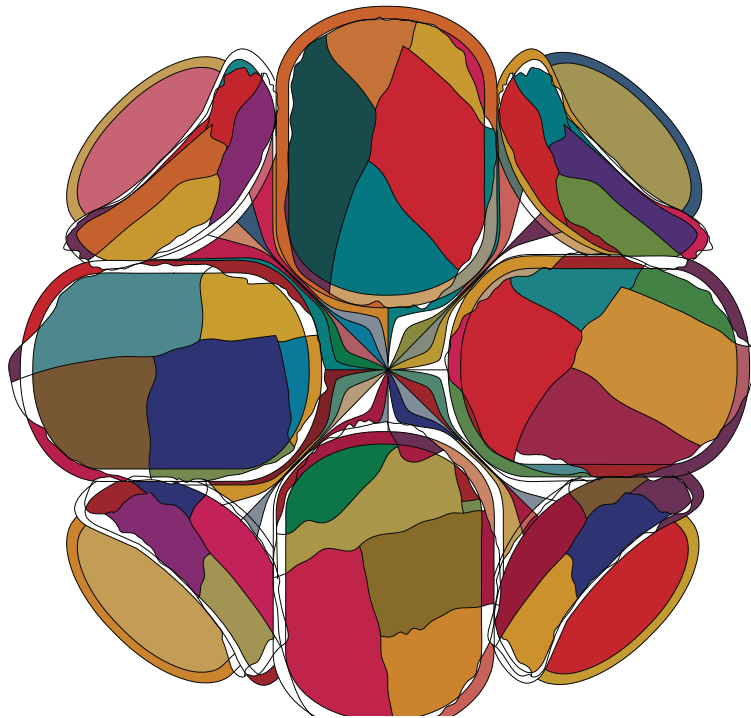
DETAIL 03







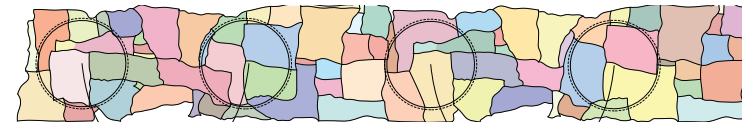
PATTERN



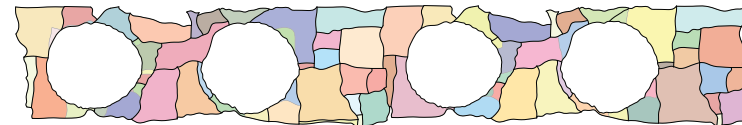
INSTRUCTIONS

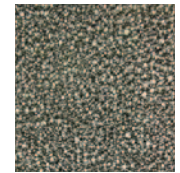
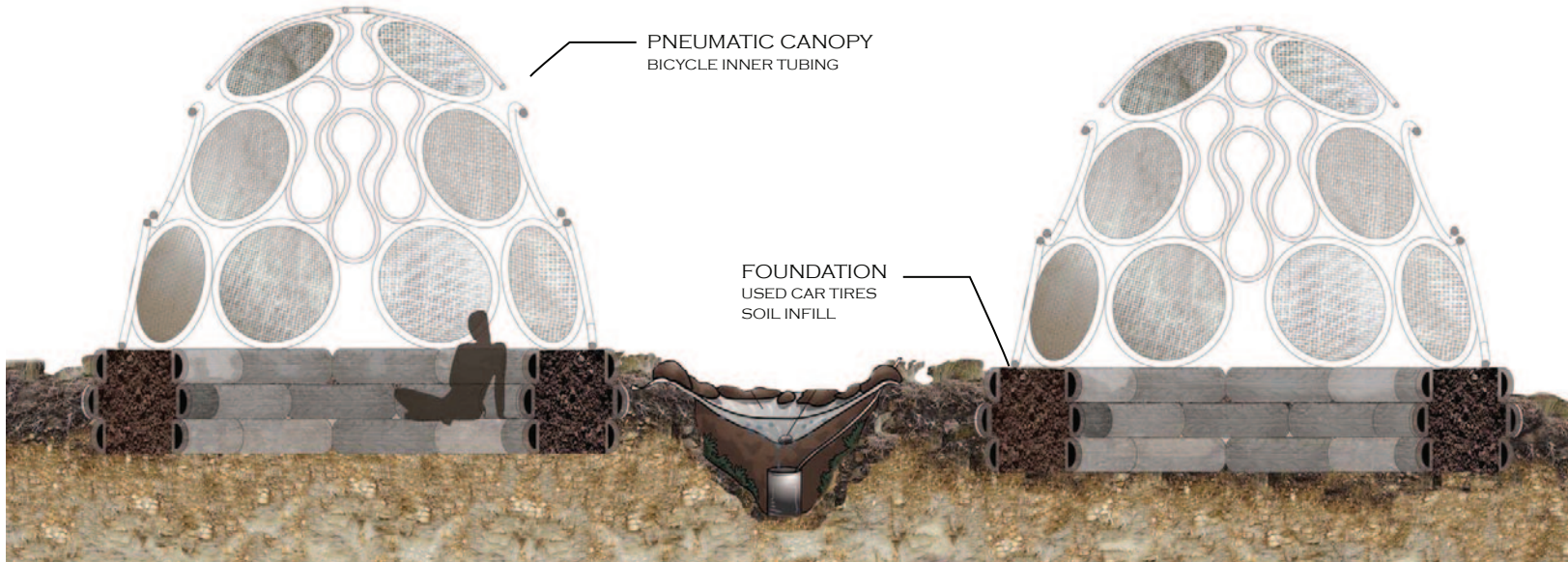


QUILT

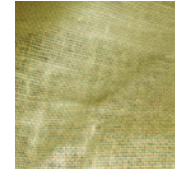


CIRCLE POUCH FOR INSERTION OF INNER TUBE





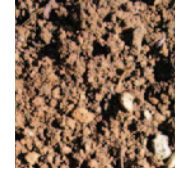
CARBON



LINEN



GRASS



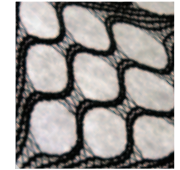
SOIL



BIKE

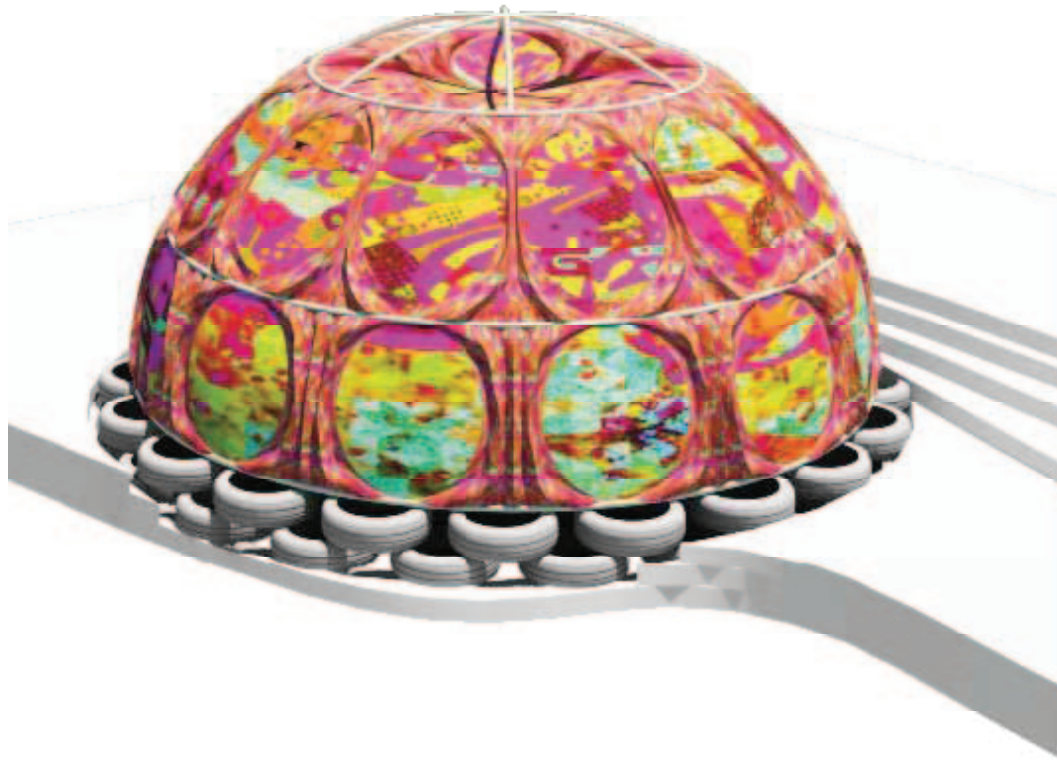


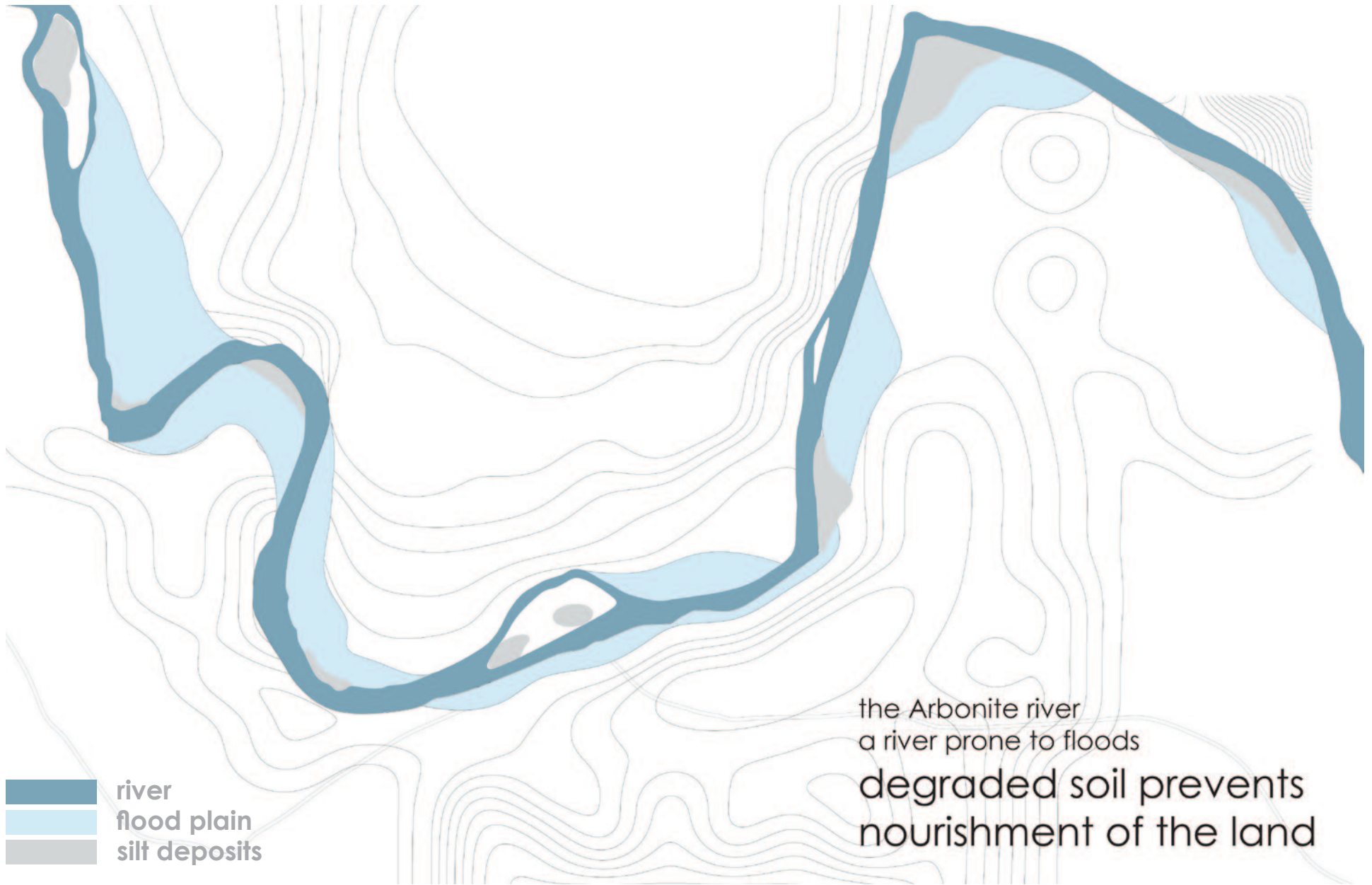
CAR



WEAVE





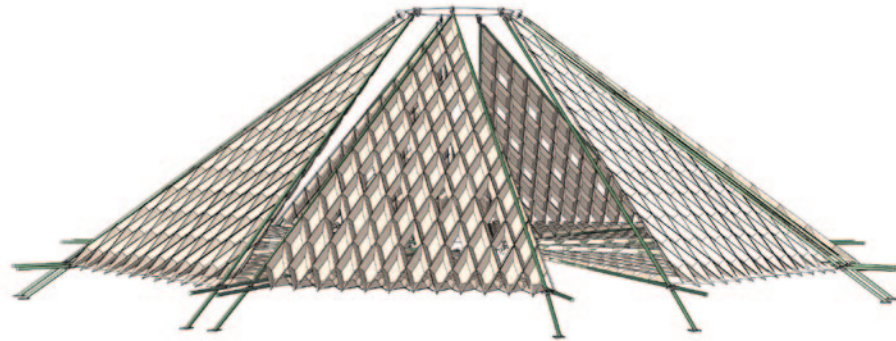


river
flood plain
silt deposits

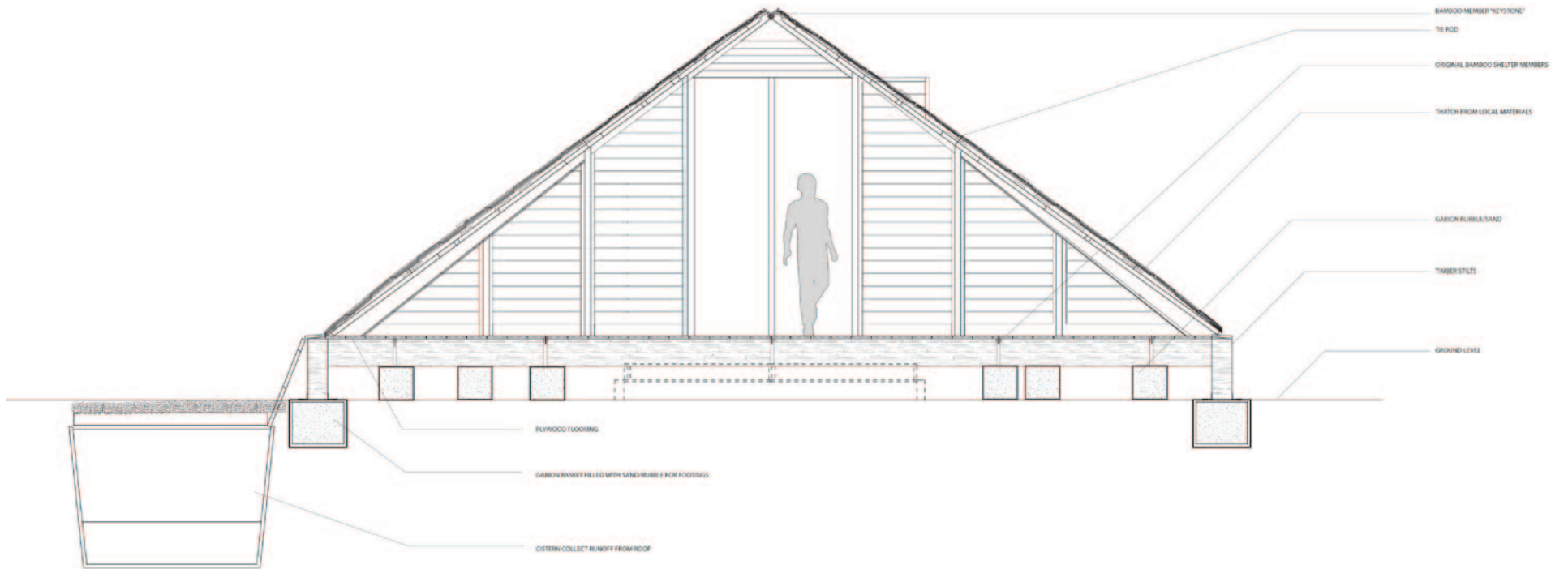
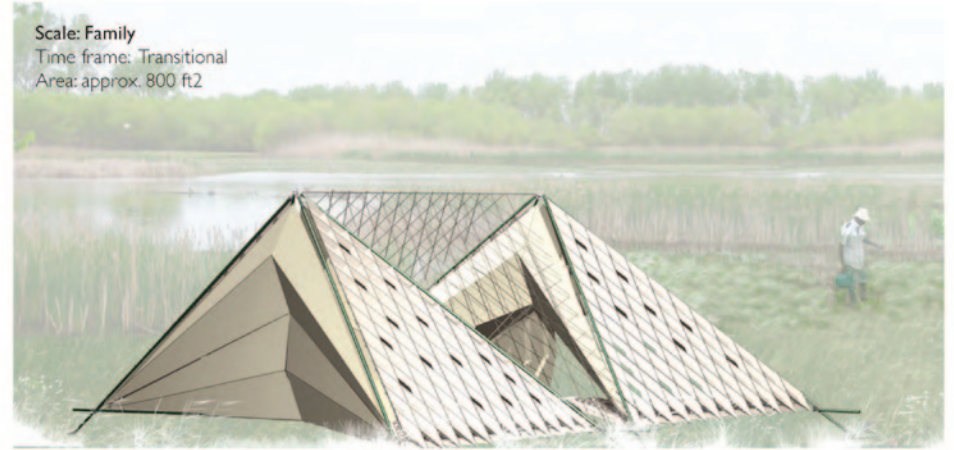


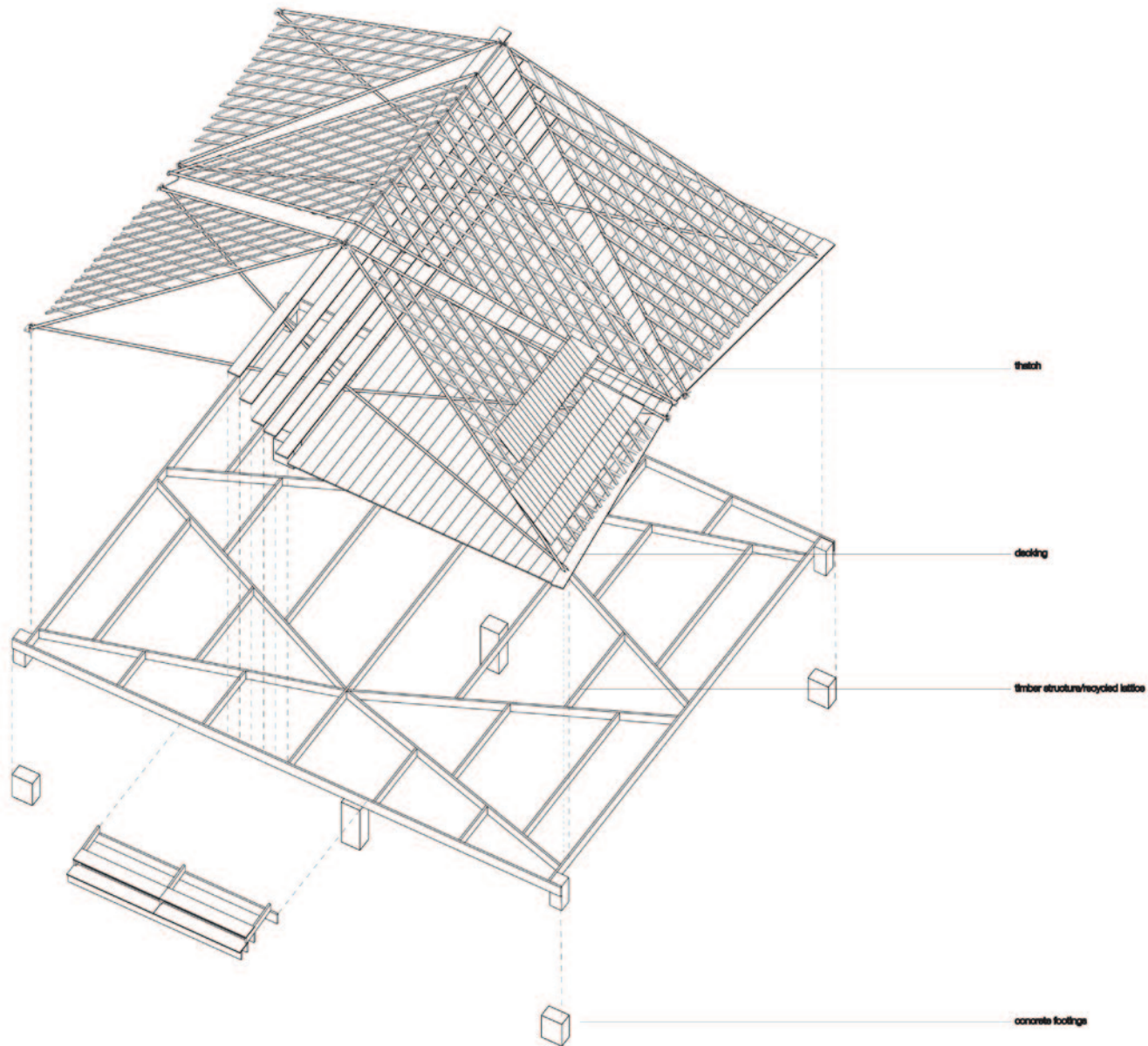
STARR LAW

HOUSING

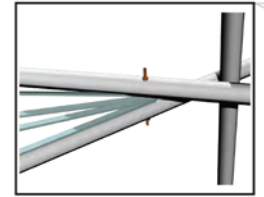


Scale: Family
 Time frame: Transitional
 Area: approx. 800 ft2

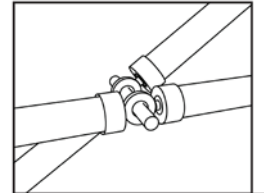




CONNECTIONS



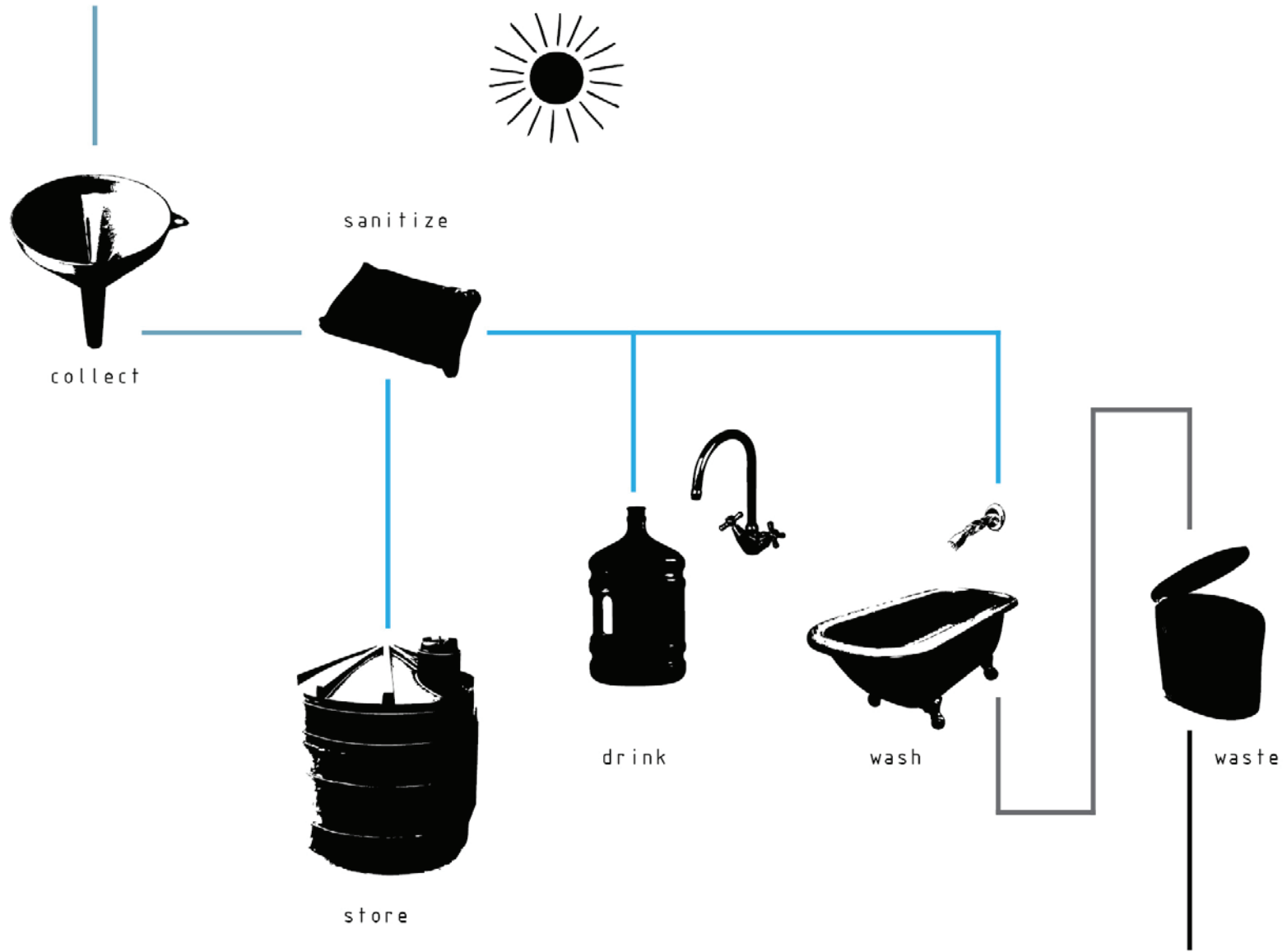
fanning connection, pivots in X direction



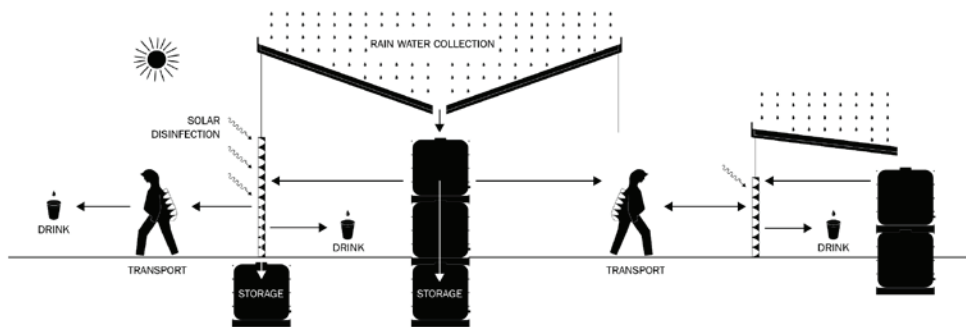
pivoting connection in Y direction



STRATEGY_WATER



POINT OF SOURCE PURIFICATION RAINWATER HARVESTING

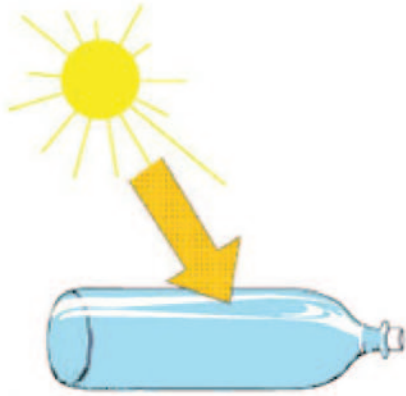


Annual Rainfall (in.)	Collection Area (ft ²)	Annual Volume Available (gal)	Daily Volume Available (gal)	Daily Volume Available (l)
52 in	100	2,593 gal	7 gal	27 l
52 in	200	5,186 gal	14 gal	54 l
52 in	500	12,966 gal	36 gal	134 l
52 in	1,000	25,932 gal	71 gal	269 l
52 in	2,000	51,865 gal	142 gal	538 l

rainwater available per roof area



- Reduction of burdens of the poor: less time spent in collecting water (particularly women and children)
- Reduction in water-related diseases as quality is usually better than water from traditional sources; impact is less sick days, savings on medical expenses and time for more economic activities
- Improved health status as excess rainwater used for vegetable and crop growing gives improved diet;
- Less back problems and growth reduction particularly among children and women as transportation of heavy loads over long distances is reduced
- Improved economic and health status from the income from vegetable and other crops, and other economic activities using excess rainwater
- More time for education and personal development, particularly for young girls as time saved is now used for school attendance or homework



Inactivation of microorganisms by UV-A-radiation and thermal treatment

Sodis concept



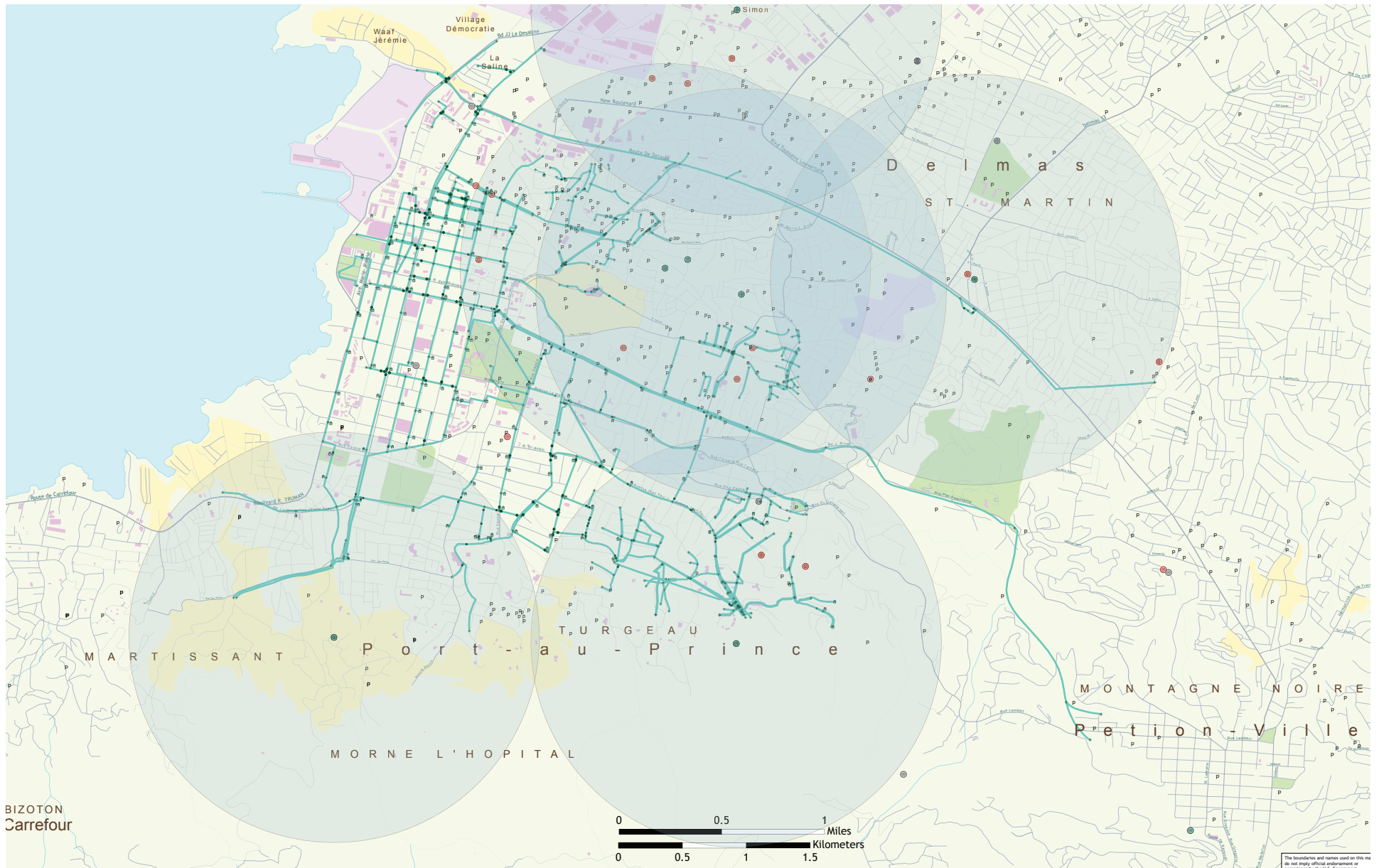
Aquapak



Sodis training Indonesia



Eric Olsen's Solar Water Disinfecting Tarpaulin



Functioning wells, 1 week after earthquake
 1 mile access radius
 (USAID reporting)



Pre-earthquake sanitation services reached only 17% of Haitians

Access to drinking water was only available for 63% of Haitians

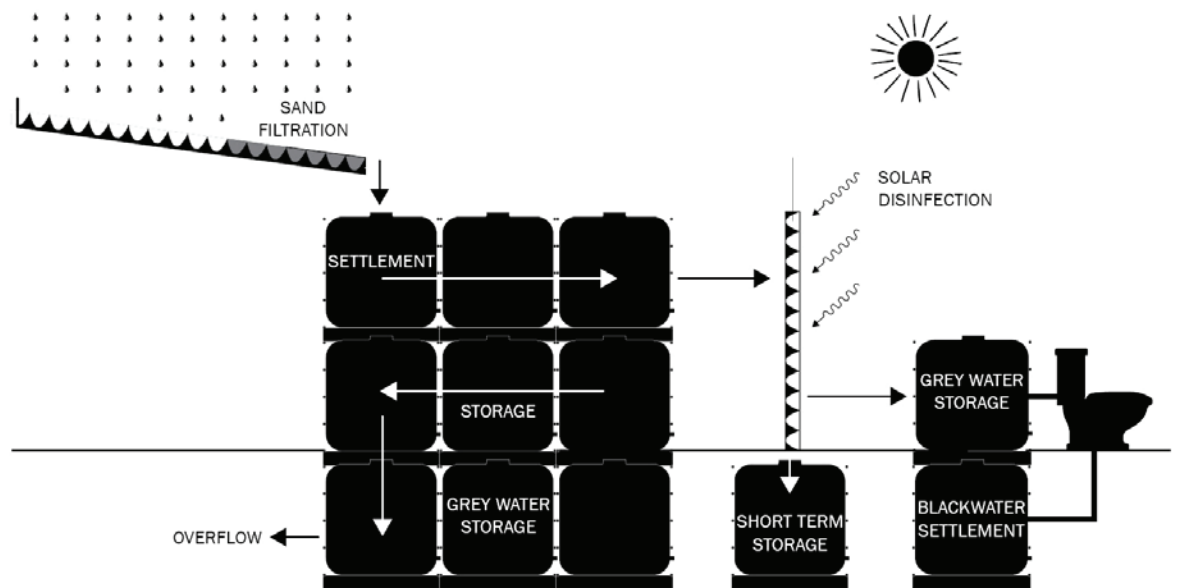
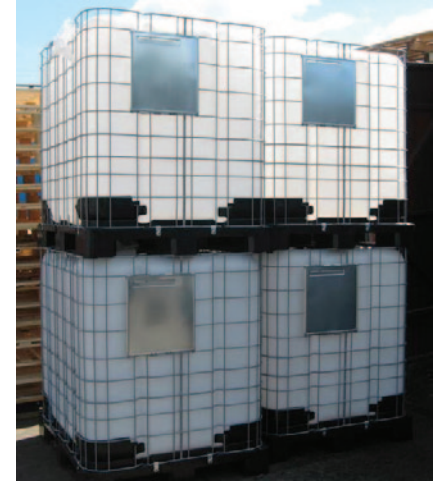
Piped drinking water was accessible only to a small proportion of Port au Prince inhabitants. The vast majority of the population drank bottled water before the earthquake."

"Women and children throughout the world spend as many hours carrying water as if the entire population of California spent an full year working 40 hours a week, just carrying water."

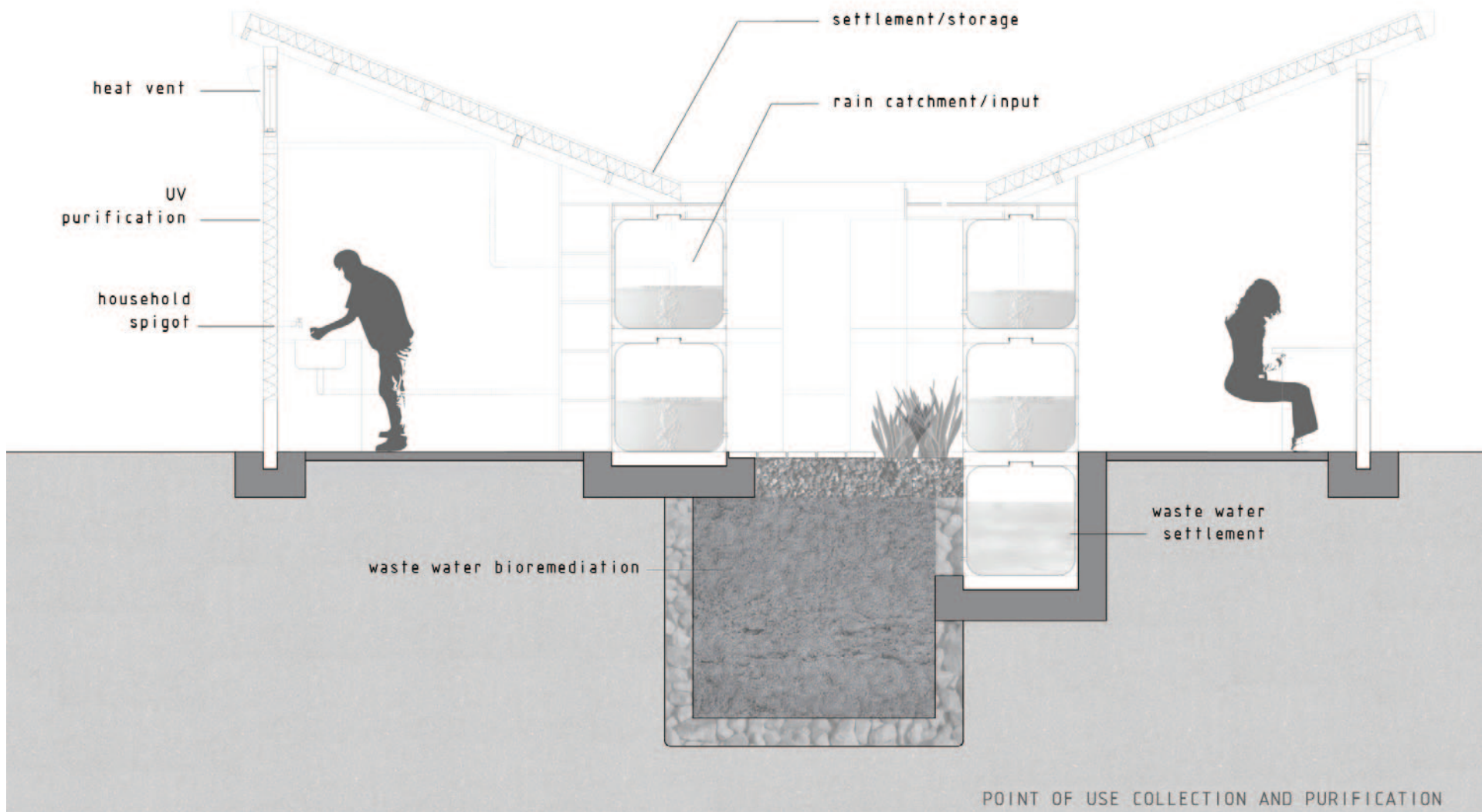
Prof. Amy Smith, MIT.

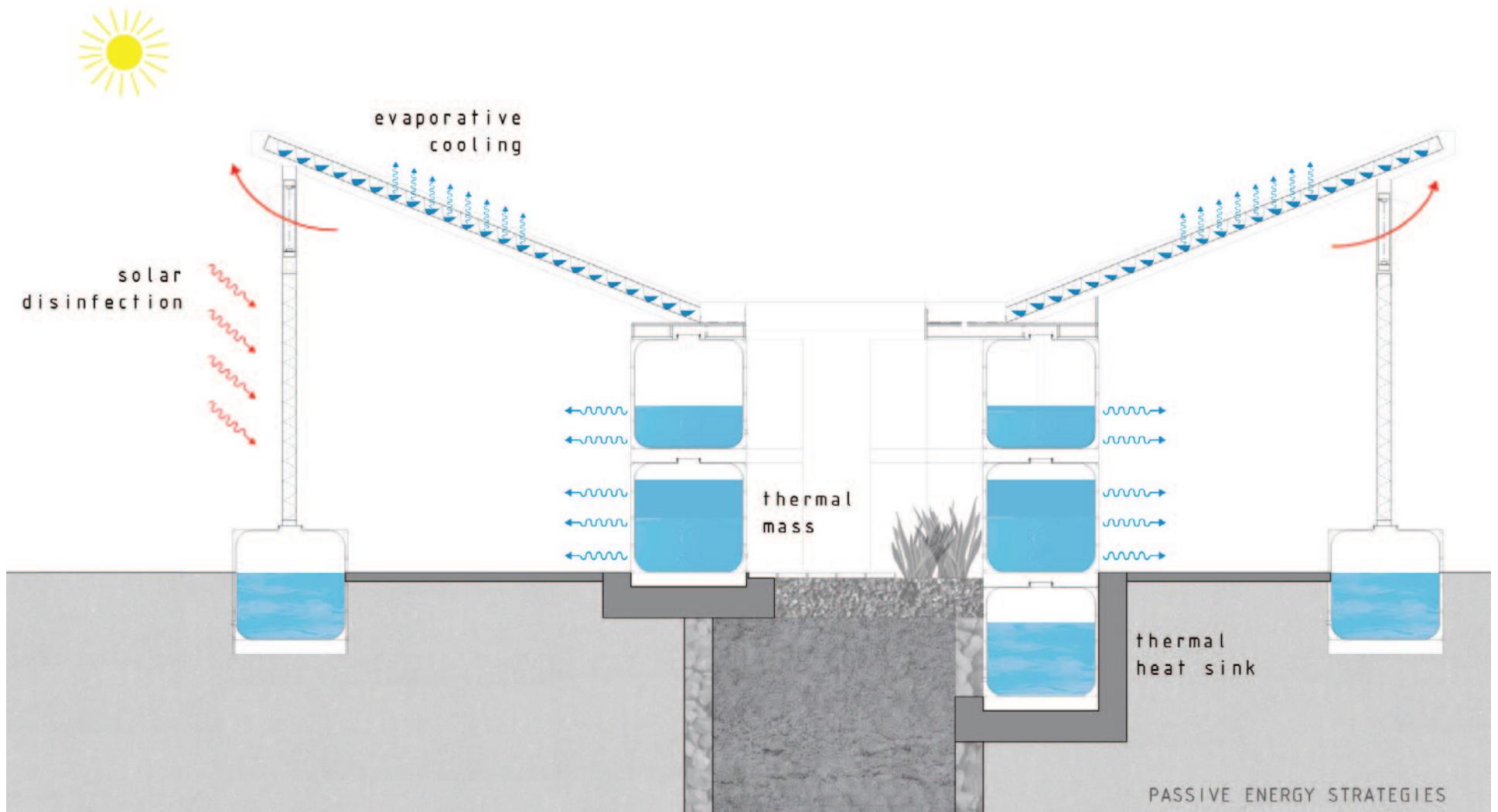
1 in 8 people in the world do not have access to safe drinking water

1.4 million children die from water-borne disease annually



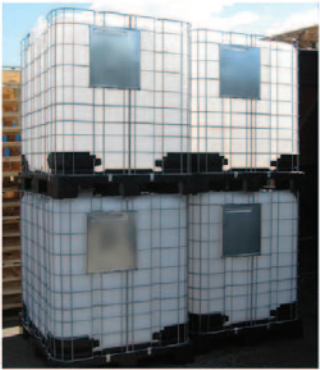
WATER STORAGE



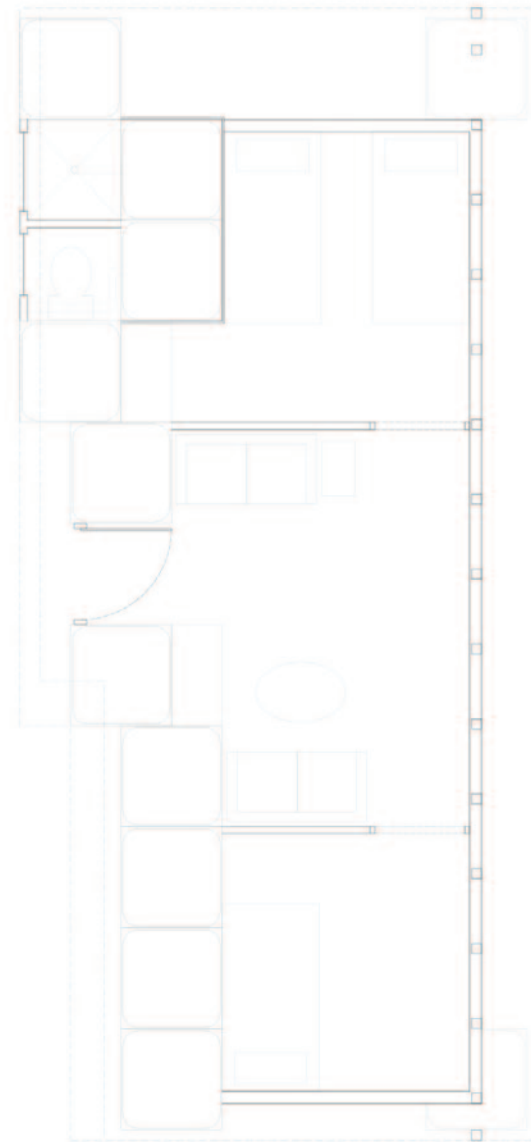
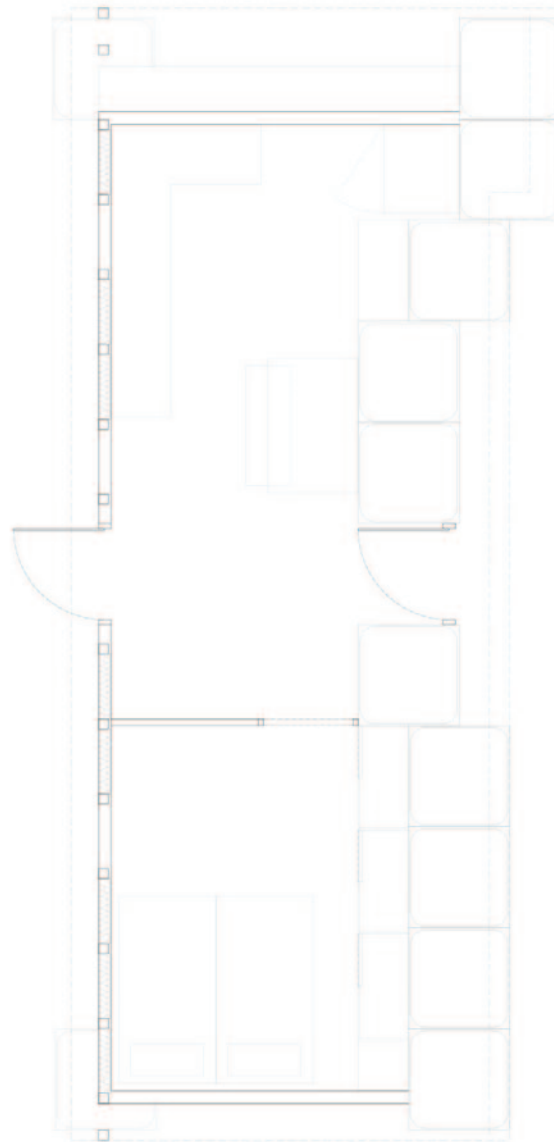




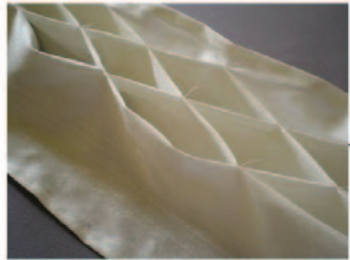
gabion filtration wall



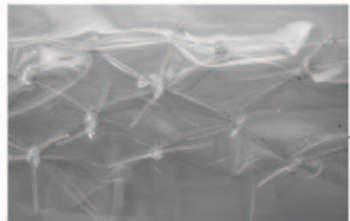
1000 l. IBC tanks



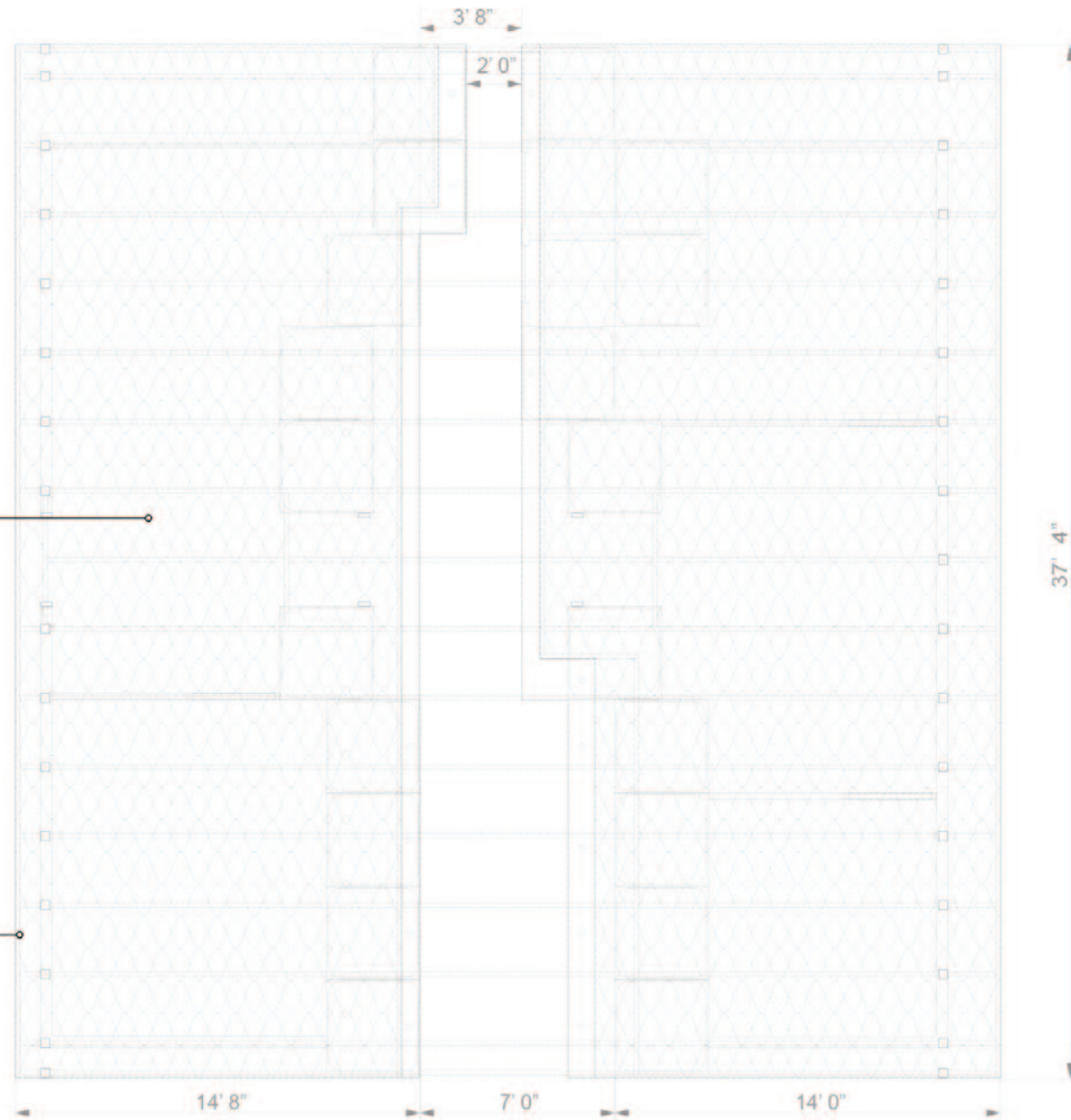
1,000 SF SHELTER OPTION



textile smocking w/resin (roof)
collection
evaporative cooling
filtration



clear vinyl smocking (wall)
aeration
stiffening
baffling



SAMPLE ROOF OPTION



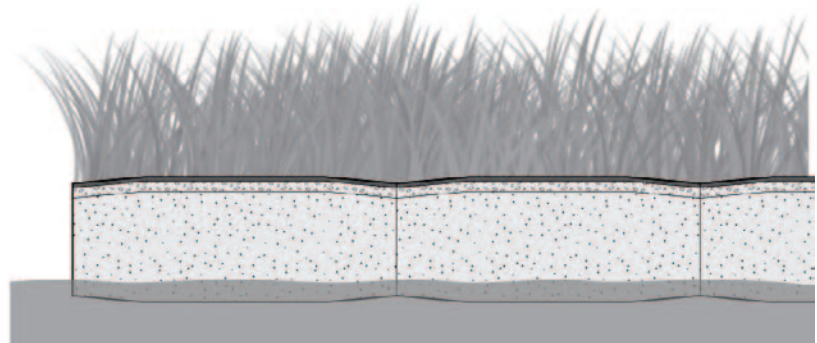
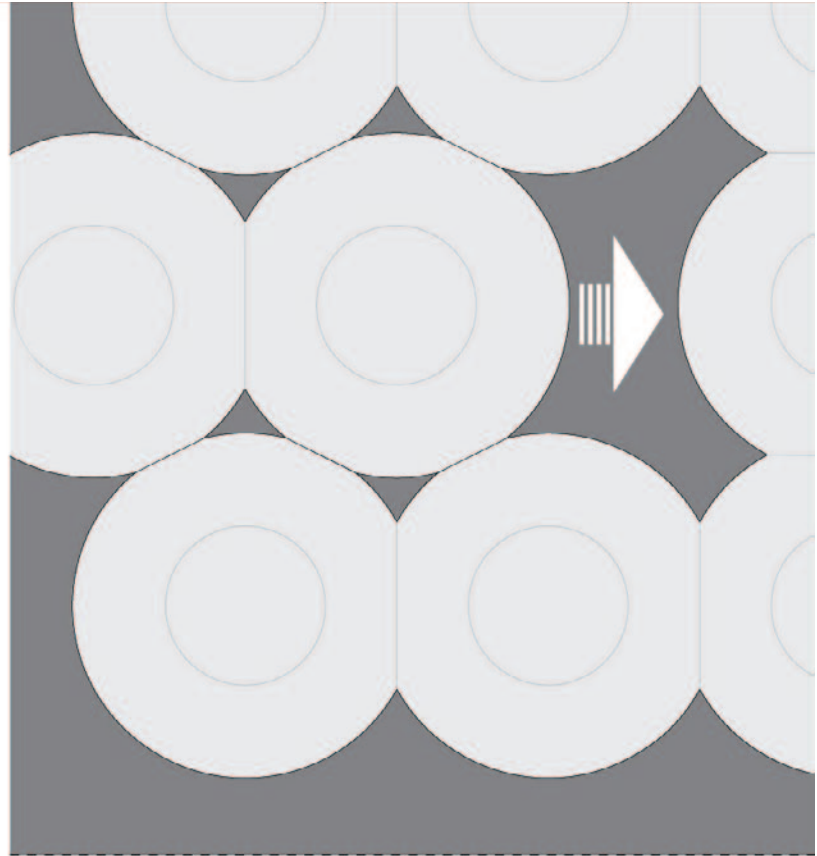
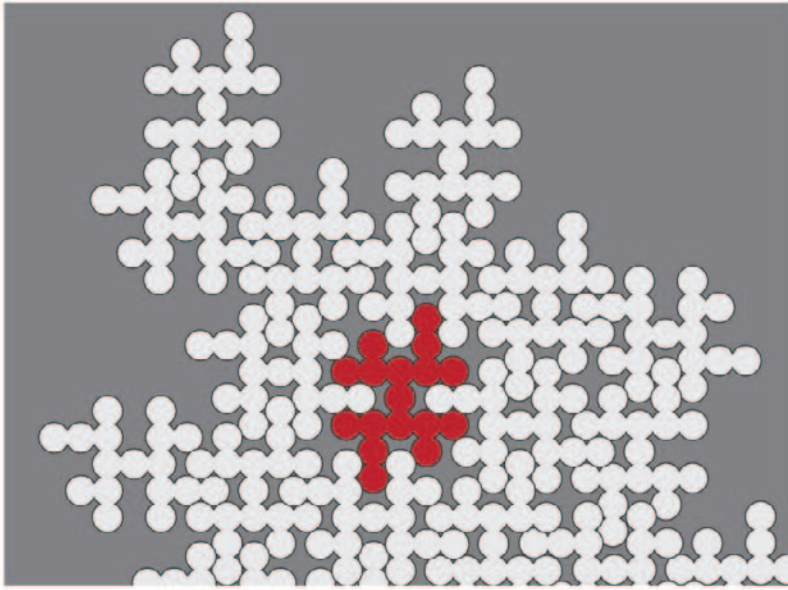
MASON EDGE

WATER REMEDIATION



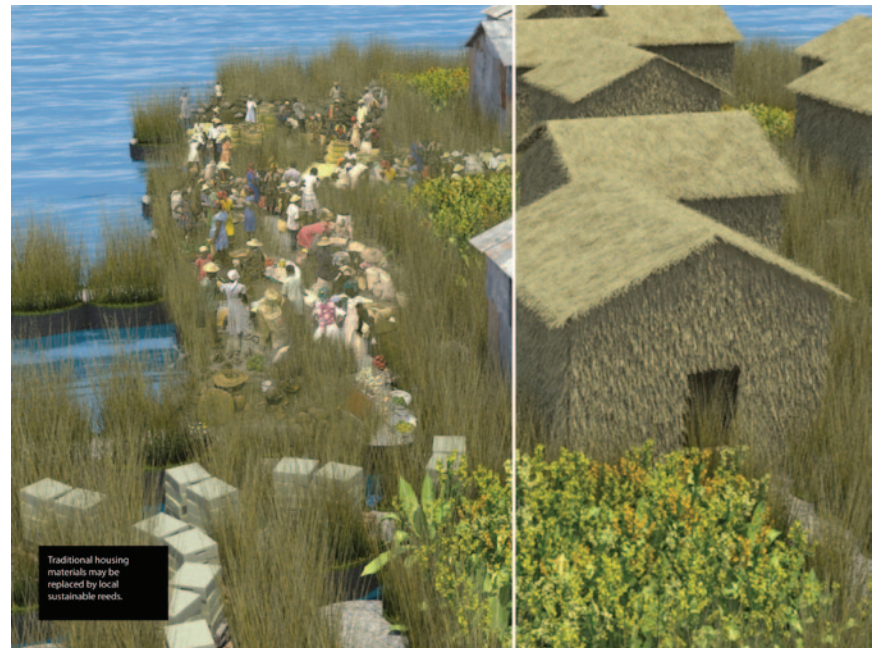
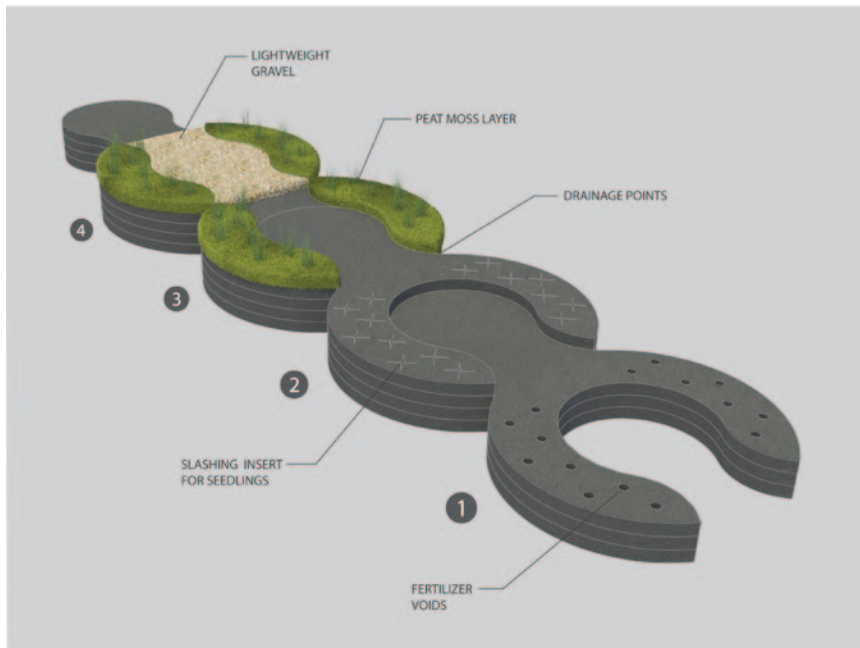
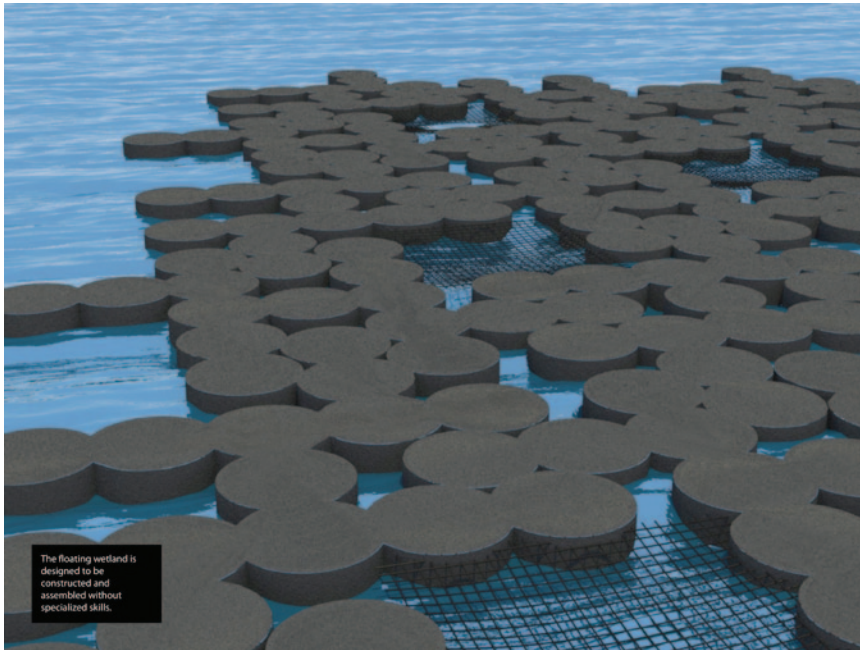
MASON EDGE

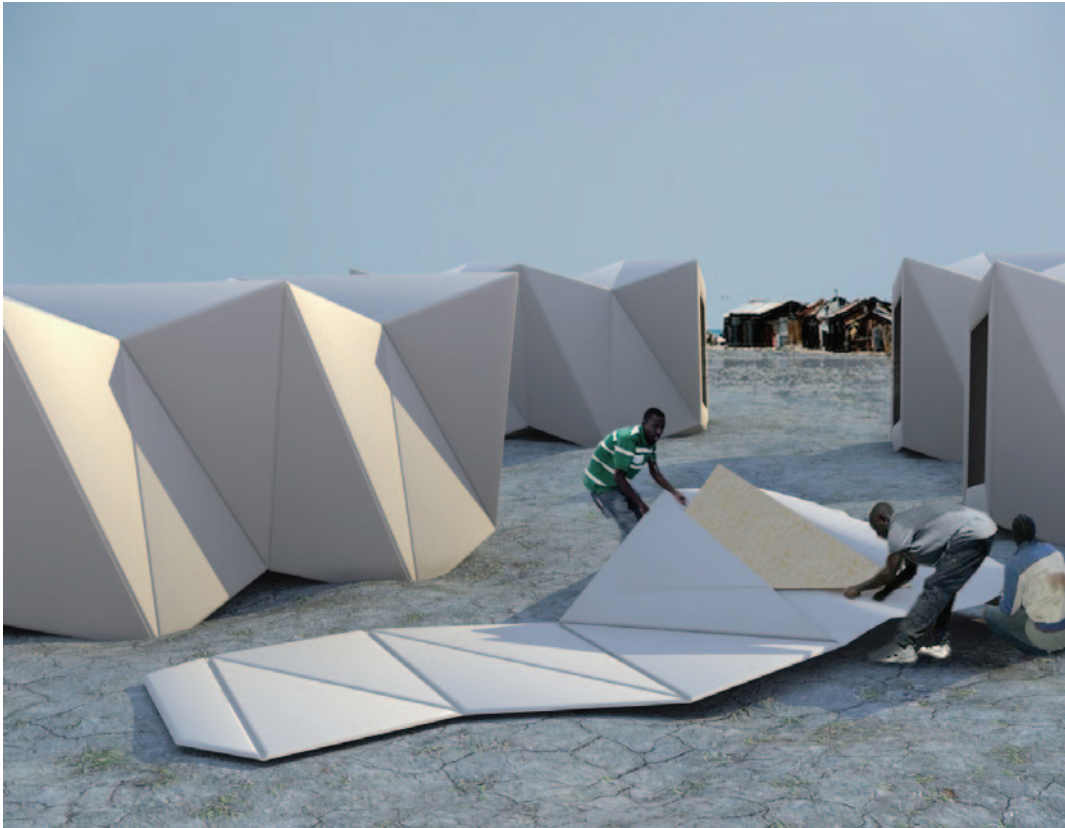
LAND REMEDIATION



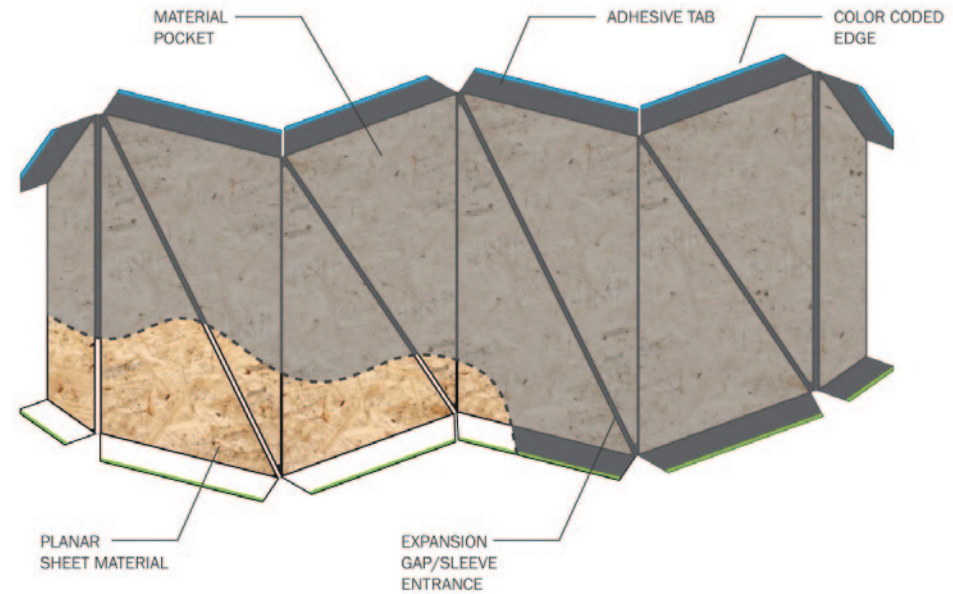
MASON EDGE

WATER REMEDIATION

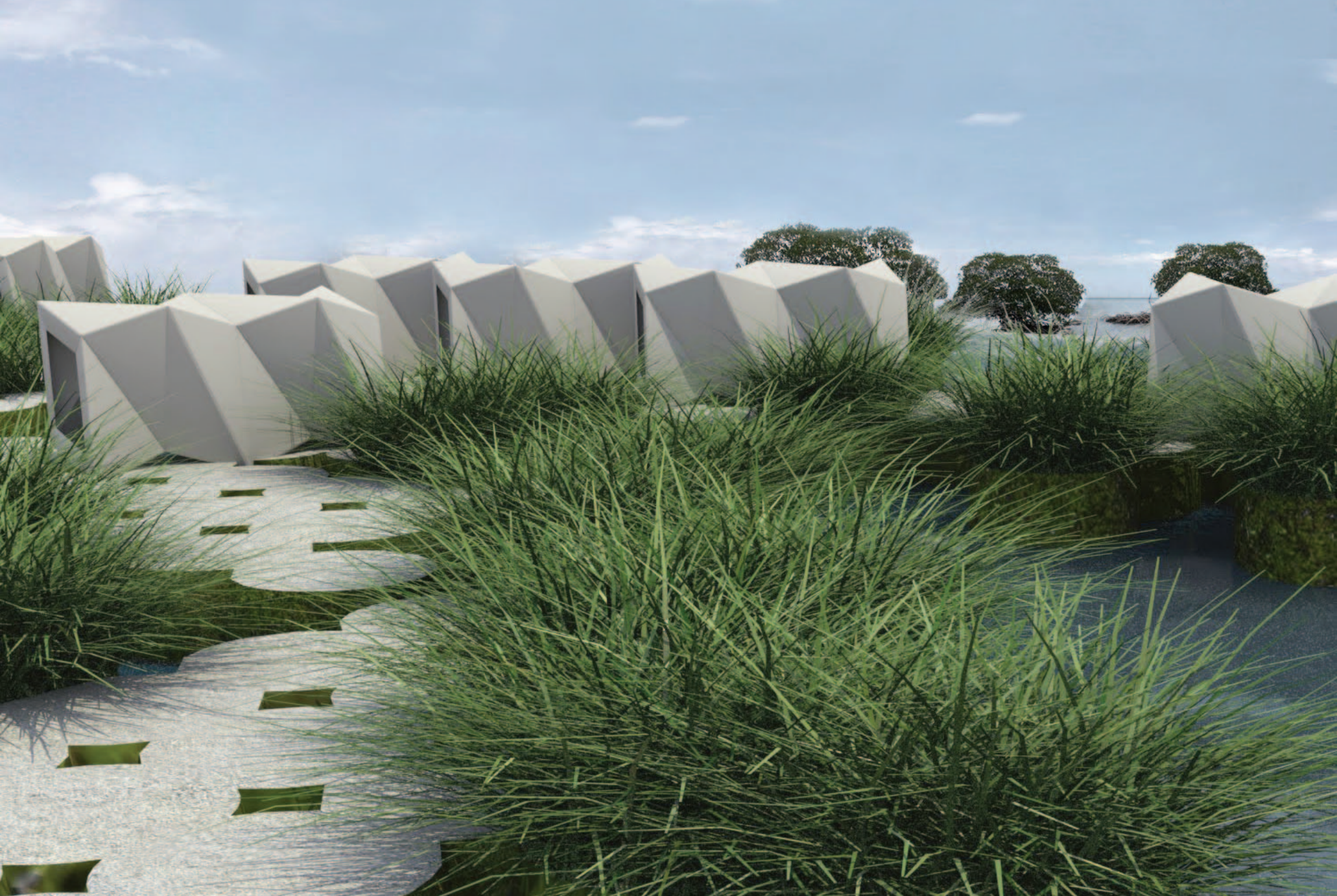




MASON EDGE



HOUSING



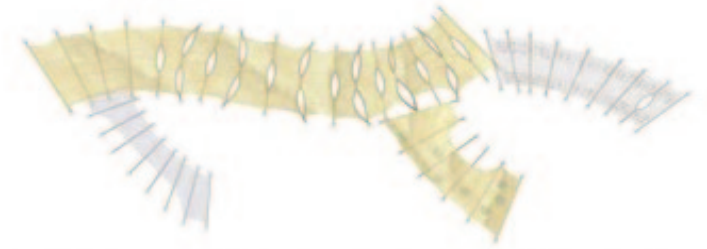
MASON EDGE

HOUSING/REMEDIATION

STRATEGY_TEXTILES

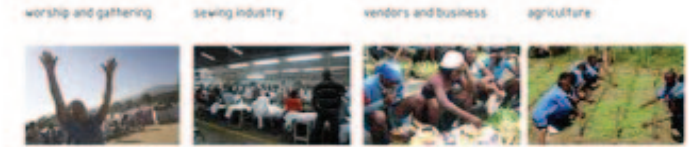
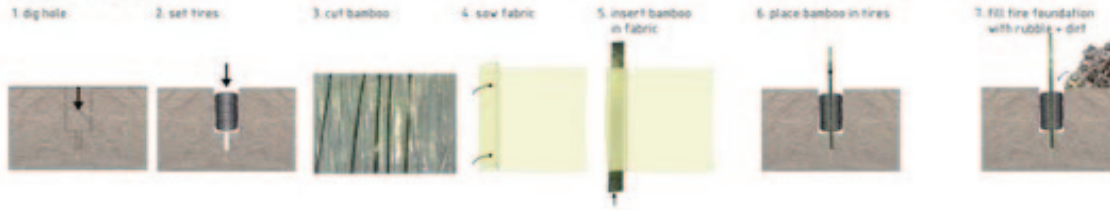


We see these garments as prototypes that lend their structure and tectonics to a larger architectural intervention. This intervention is meant to take place in any of the existing tent cities of Port-au-Prince. As an example we have placed it in Petionville which is currently the largest tent city housing with around 50,000 inhabitants. Since the quake, urban rhythms have resumed resulting in the emergence of informal economies and businesses, which vary from food and electronics vendors to cell phone charging services and even beauty treatments. This surge of microeconomic activity is not only crucial for Haiti as a whole but for improving life in these fragile new communities.



Petionville, Port-au-Prince

Deployment Diagrams



A flexible system to be used by the community to construct urban spaces such as a Market, a Greenhouse, a Place of Worship or even individual dwellings. The system borrowed from our garments is a skin and bones system. The boning provides a frame for the fabric and allows it to expand and become voluminous. We selected sustainable and recycled materials that are native to Haiti; namely bamboo, car tires, rubble, and local textiles. Bamboo as the structural element is known for its tensile characteristics and fast growing rate and is already being grown locally by various organizations in a reforestation effort. Car tires and the concrete rubble from the destroyed structures are used as foundations. Finally, fabrics from the local textile industry as well as clothing donations can be used as a skin for the structure.



babyBag

The babyBag gives the parent the gear to take care of the baby's basic needs in situations of distress. With the babyBag, the child can be carried comfortably in the front part, freeing the parents' hands for other activities. The back part of the bag is used as a backpack for storing their belongings, as a tub for bathing, a table for changing and a bed for sleeping.

Carry



adjustable straps on sides

Change



Bathe

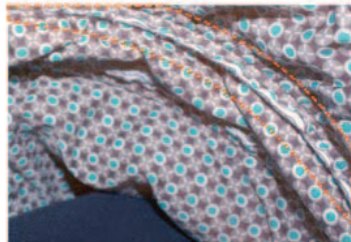
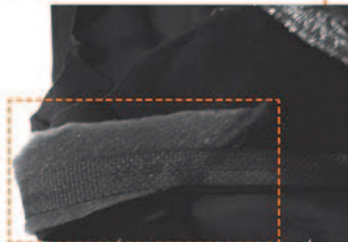


Sleep



padded straps

pocket for battery



interior lining and boning structure

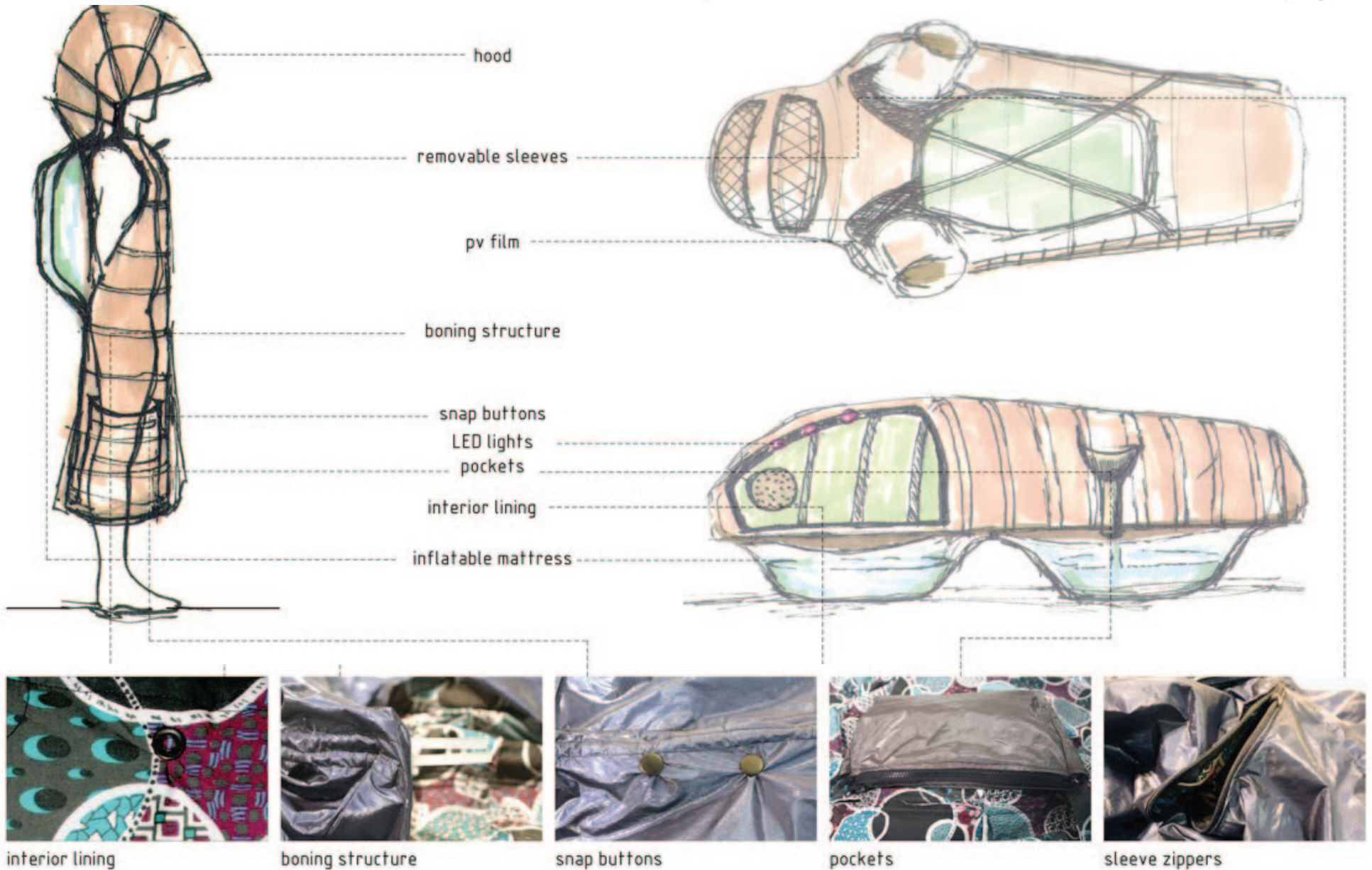
interior wiring for LED lights

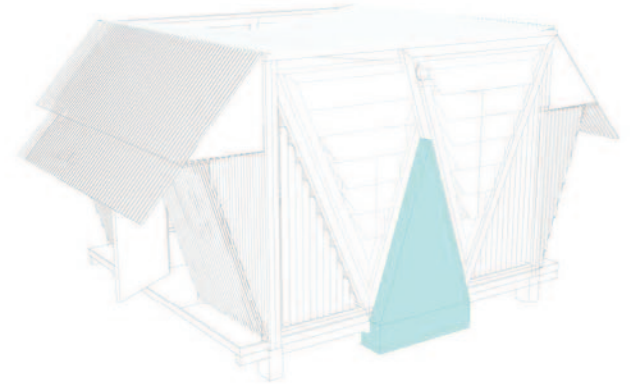
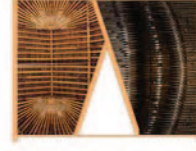
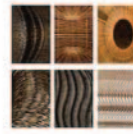
velcro to remove rear compartment



rainCoat

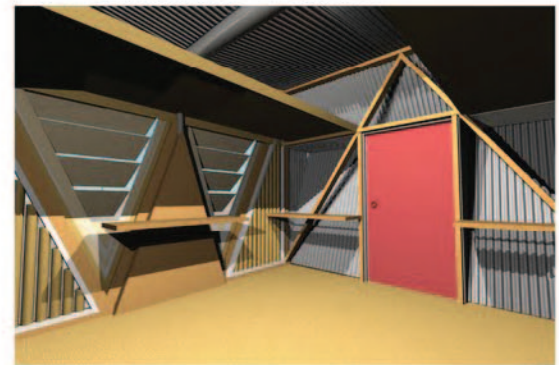
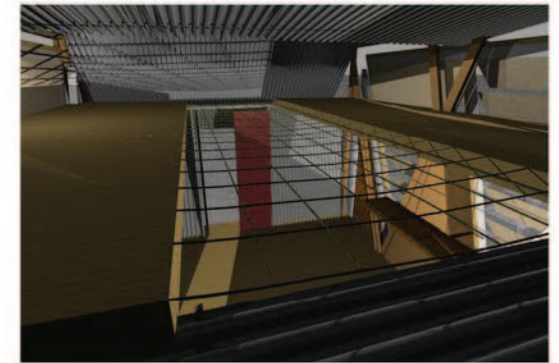
The rainCoat is a waterproof jacket for the nomadic refugee. It protects from the rain, contains multiple pockets that have different functions crucial for post-disaster survival, and inflates as a bed for sleeping.

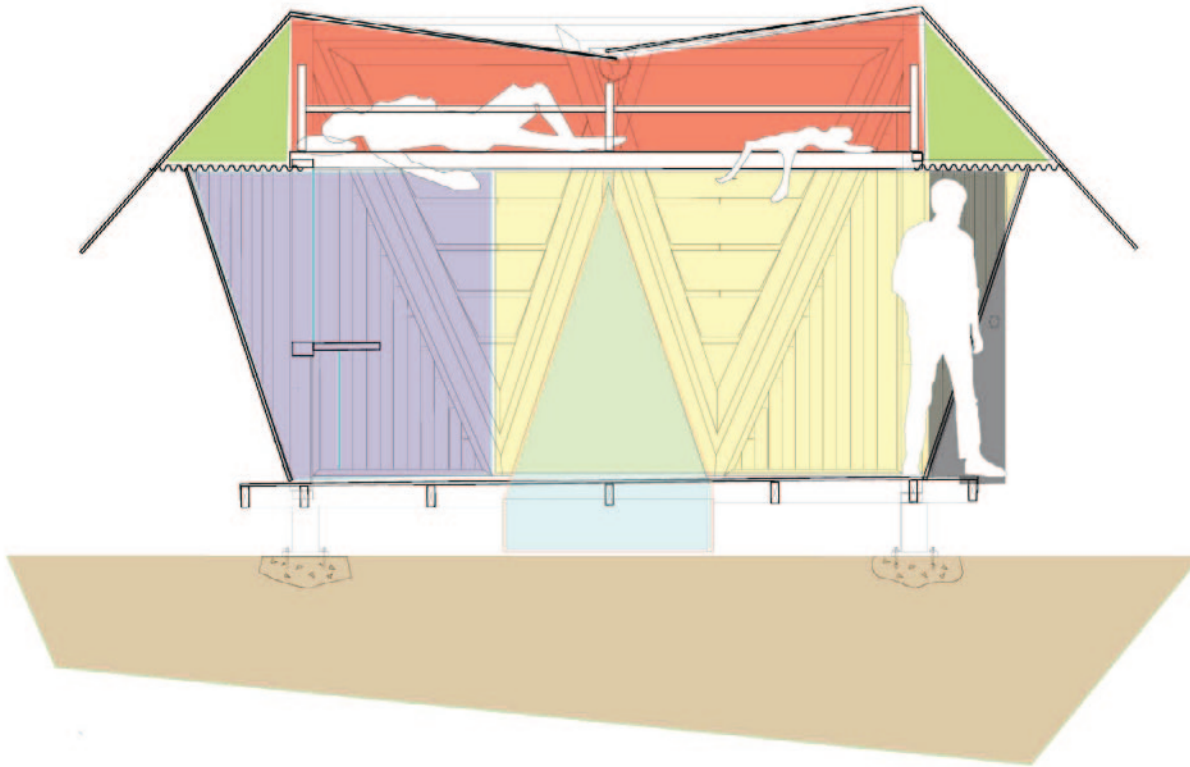




Panel Iterations
Iterative suggestions using local materials and practices and expressive influences.

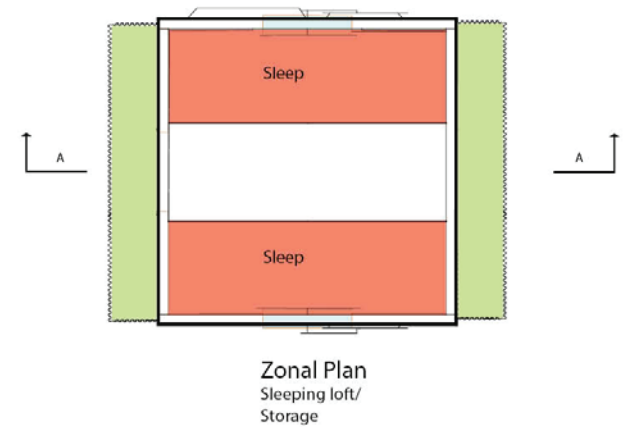
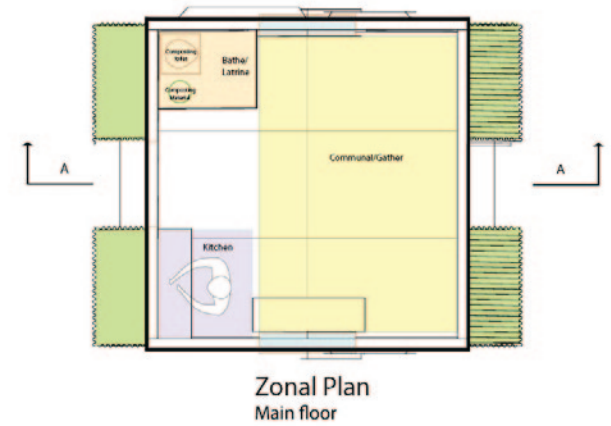
This version is suggestive of possible micro-business involvement in Bamboo processing and weaving.

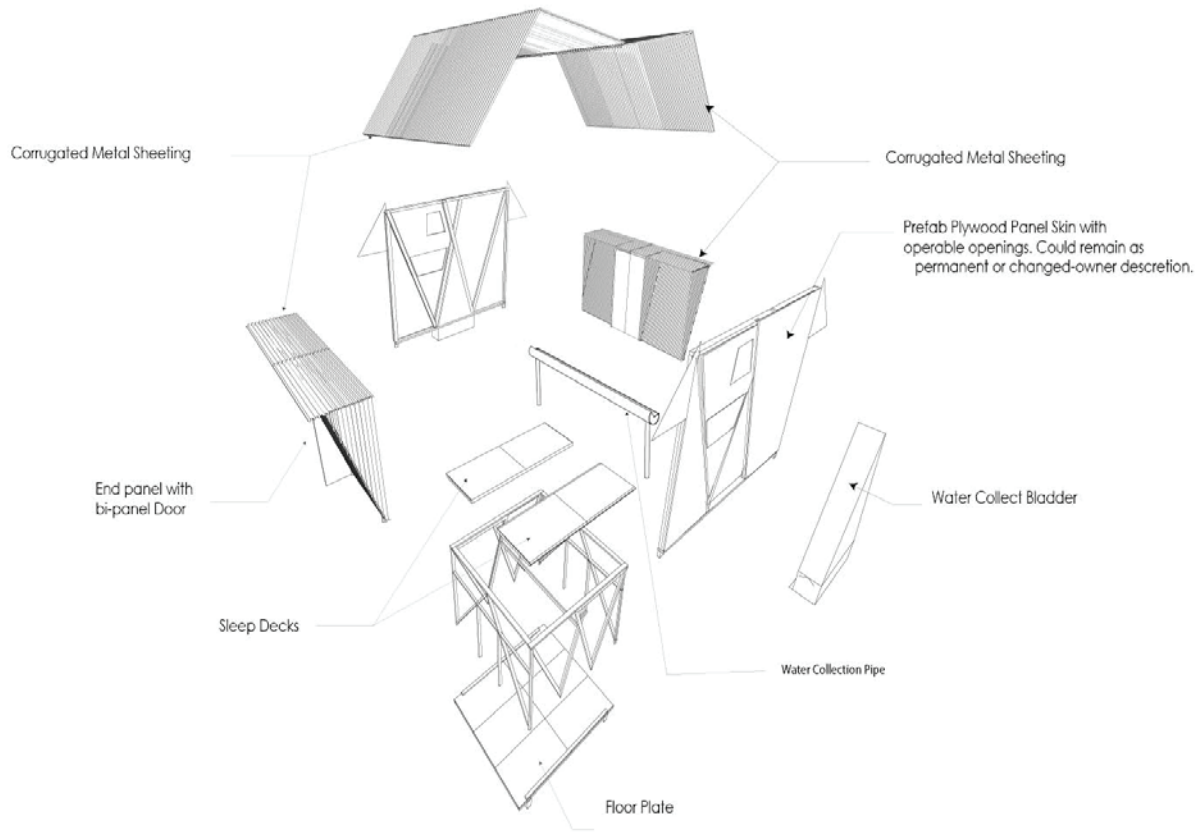




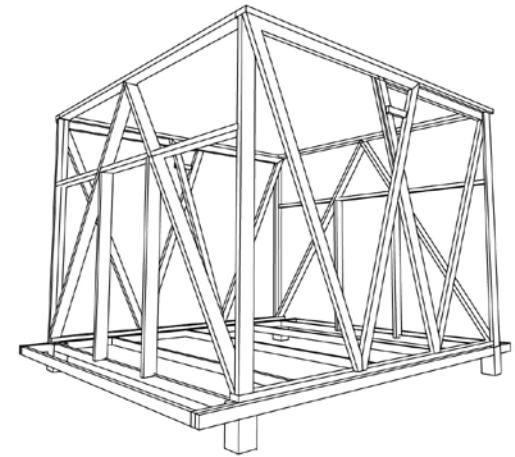
Zonal Section A-A
 Shelter is held to concrete footings by bolts which allow for unbolting and moving structure.

- Sleeping
- Kitchen
- Communal/Gather
- Storage
- Water Collection
- Bathe/Latrine



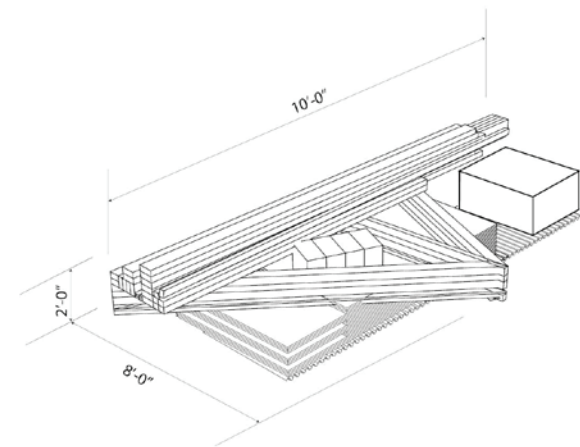


Prefab and Pre-cut components designed for onsite assembly.



Structure to Withstand Typical Natural Events such as hurricanes and earthquakes

Structure to provide a basic level of physical protection from intruders to lessen vulnerability



Flat Pack for Transport
16 to a 40' Shipping Container

STRATEGY_ENERGY



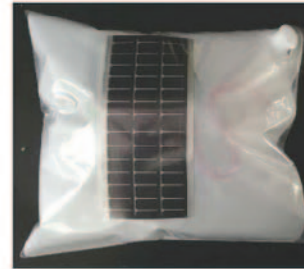
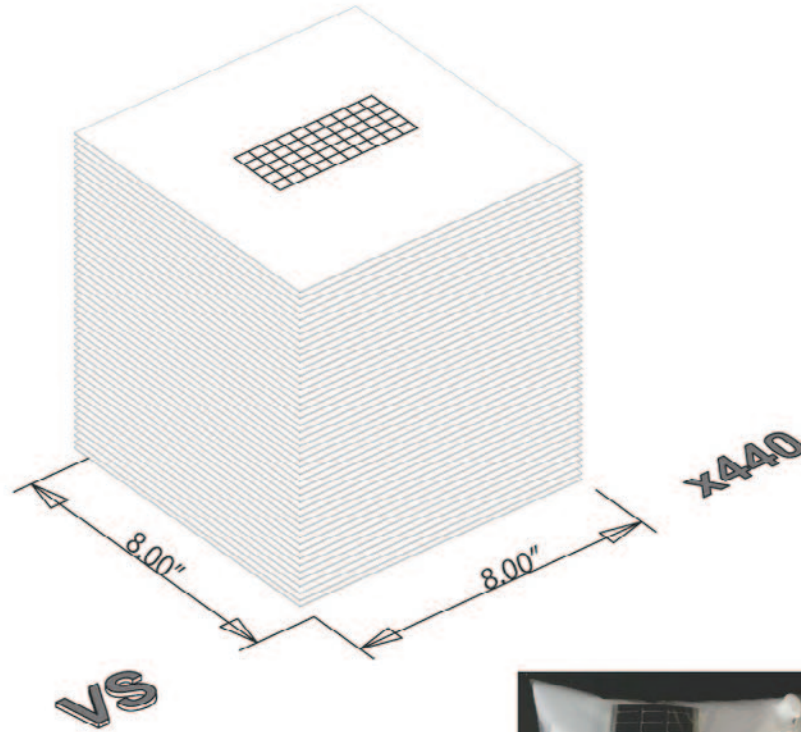
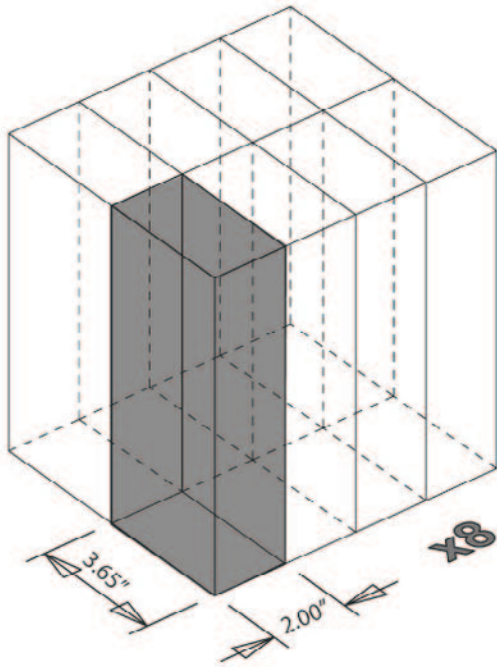
THE SOLAR LIGHT PILLOW PROVIDES A LOW-COST, SUSTAINABLE SOURCE OF LIGHT IN SITUATIONS WHERE THERE IS NO ACCESS TO AN ELECTRICAL GRID. THE LIGHT PILLOW IS DISTRIBUTED IN DISASTER RELIEF MUCH AS FOOD AID AND WATER ARE PROVIDED AS BASIC PROVISIONS. INFLATING THE LIGHT PILLOW ALLOWS THE LIGHT TO DIFFUSE, CREATING A LANTERN-LIKE EFFECT.

THE LIGHT PILLOW

DAYTIME CHARGING/NIGHTTIME USE

ANDREA SRESHTA & ANNA STORK

ENERGY



WHILE IT IS NECESSARY IN SOME SITUATIONS TO HAVE A HIGHER-GRADE, MORE DURABLE FLASHLIGHT, THE LIGHT PILLOW PROVIDES LIGHT IN MORE INFORMAL SETTINGS, SUCH AS THAT OF LIGHT FOR READING AND NIGHTTIME SAFETY. FOR EVERY 8 OF THE 'BOGO' FLASHLIGHT THAT IS SHIPPED, IT IS POSSIBLE TO STACK AND SHIP ROUGHLY 400 INDIVIDUAL LIGHT PILLOW.

THE LIGHT PILLOW

HOW DOES IT STACK UP?



THE SOLAR TREE IS A BAMBOO FRAME THAT CONTAINS SOLAR PANELS AND EMBEDDED LED LIGHTING. DUE TO THE LACK OF AN ELECTRIC GRID IN MANY PARTS OF HAITI, THERE IS OFTEN NO NIGHTTIME STREET LIGHT FOR SAFETY AND TO ALLOW FOR THE CONTINUATION OF ACTIVITIES AFTER SUNDOWN. THE SOLAR TREE PROVIDES SHADE IN THE DAYTIME, AND LIGHT AT NIGHT.

THE SOLAR TREE

URBAN INFRASTRUCTURE FOR LIGHT AND SHADE

ANDREA SRESHTA & ANNA STORK

ENERGY



1 IN 3 PERSONS IN HAITI HAS A CELL PHONE. WITHOUT ACCESS TO A GRID FOR CHARGING, MANY HAITIANS USE AD-HOC CHARGING SERVICES PROVIDED AT THE STREET-SIDE MARKETPLACE. THESE CHARGERS TYPICALLY RUN OFF OF DIESEL GENERATORS. THE SOLAR UMBRELLA REPLACES THE USE OF GENERATORS THROUGH THE USE OF SOLAR PANELS FOR INDIVIDUAL PHONE CHARGING.

THE SOLAR UMBRELLA

CELLULAR PHONE CHARGING FOR THE INFORMAL MARKETPLACE

ANDREA SRESHTA & ANNA STORK

ENERGY



ROUGHLY 70% OF HAITIANS HAVE NO ACCESS TO STABLE ELECTRICITY. THE ISSUES OF POWER GENERATION AND DISTRIBUTION OF ELECTRICITY ON A LARGE SCALE MUST BE ADDRESSED IN THE REBUILDING PROCESS. THE USE OF SOLAR COLLECTION AS A WAY TO GENERATE ELECTRICITY IS GEOGRAPHICALLY APPROPRIATE IN THE TROPICS. THE SOLAR TREE TOWER PROVIDES ONE MECHANISM FOR INSERTING LARGE-SCALE SOLAR COLLECTION TO CONTRIBUTE TO POWER COLLECTION AND GENERATION.

THE SOLAR TREE TOWER

LARGE-SCALE INFRASTRUCTURE FOR SOLAR ENERGY COLLECTION

ANDREA SRESHTA & ANNA STORK

ENERGY



THE LARGE-SCALE ARRAY WOULD BE SITED IN AN UNINHABITED COASTAL ZONE. THE STRUCTURES ARE AMPHIBIOUS, ALLOWING THEM TO BE ANCHORED DURING TIMES OF HURRICANES AND FLOODING SIMILAR TO THAT OF OFFSHORE OIL RIGS. THE ABILITY TO ANCHOR THE STRUCTURE ON EITHER LAND OR WATER ALLOWS FOR THE MODULE TO GROW IN DIFFERENT DIRECTIONS WITHIN COASTAL ZONES.

THE SOLAR TREE TOWER

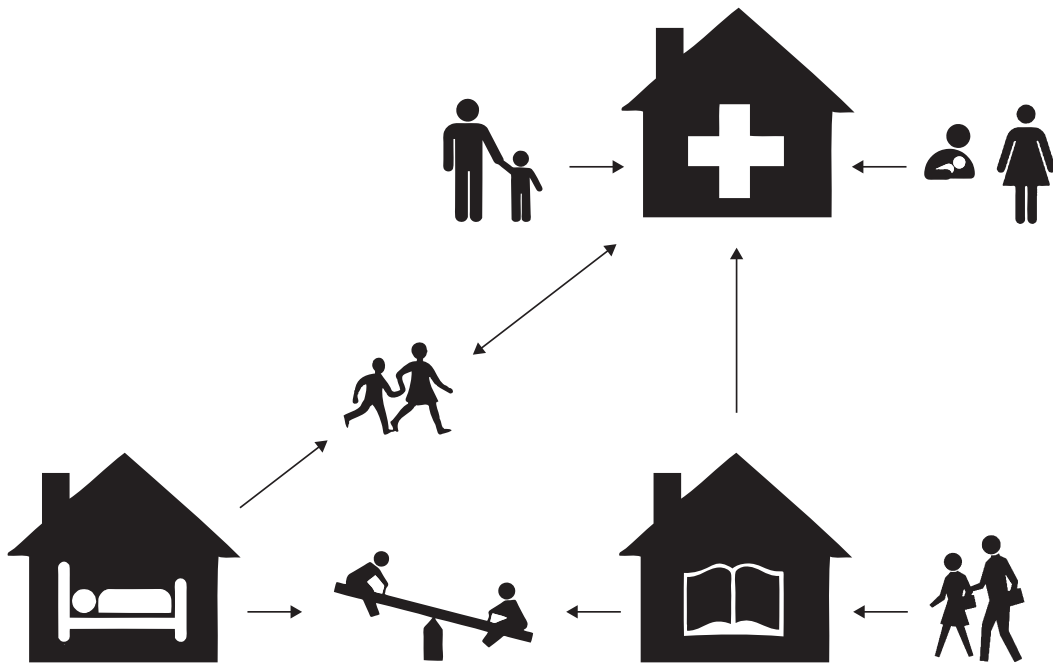
LARGE-SCALE INFRASTRUCTURE FOR SOLAR ENERGY COLLECTION

ANDREA SRESHTA & ANNA STORK

ENERGY

VILLAGE TOURNESOL

JACMEL, HAITI



Village Tournesol in Jacmel, Haiti will be a safe haven for women and children affected by the recent earthquake and other natural disasters Haiti can potentially face.

The village encompasses the construction of various buildings within the surrounding rural areas of the city of Jacmel.

The village will provide

- 30 individual permanent shelters for underserved women with children

- Orphanage serving 200 orphans and street children

- Primary school serving 300 children from the local community

- Maternal and Infant Health clinic with pharmacy



Design Objectives

- Intimacy and community

- Natural Ventilation

- Natural Daylight

- Solar orientation

- Views

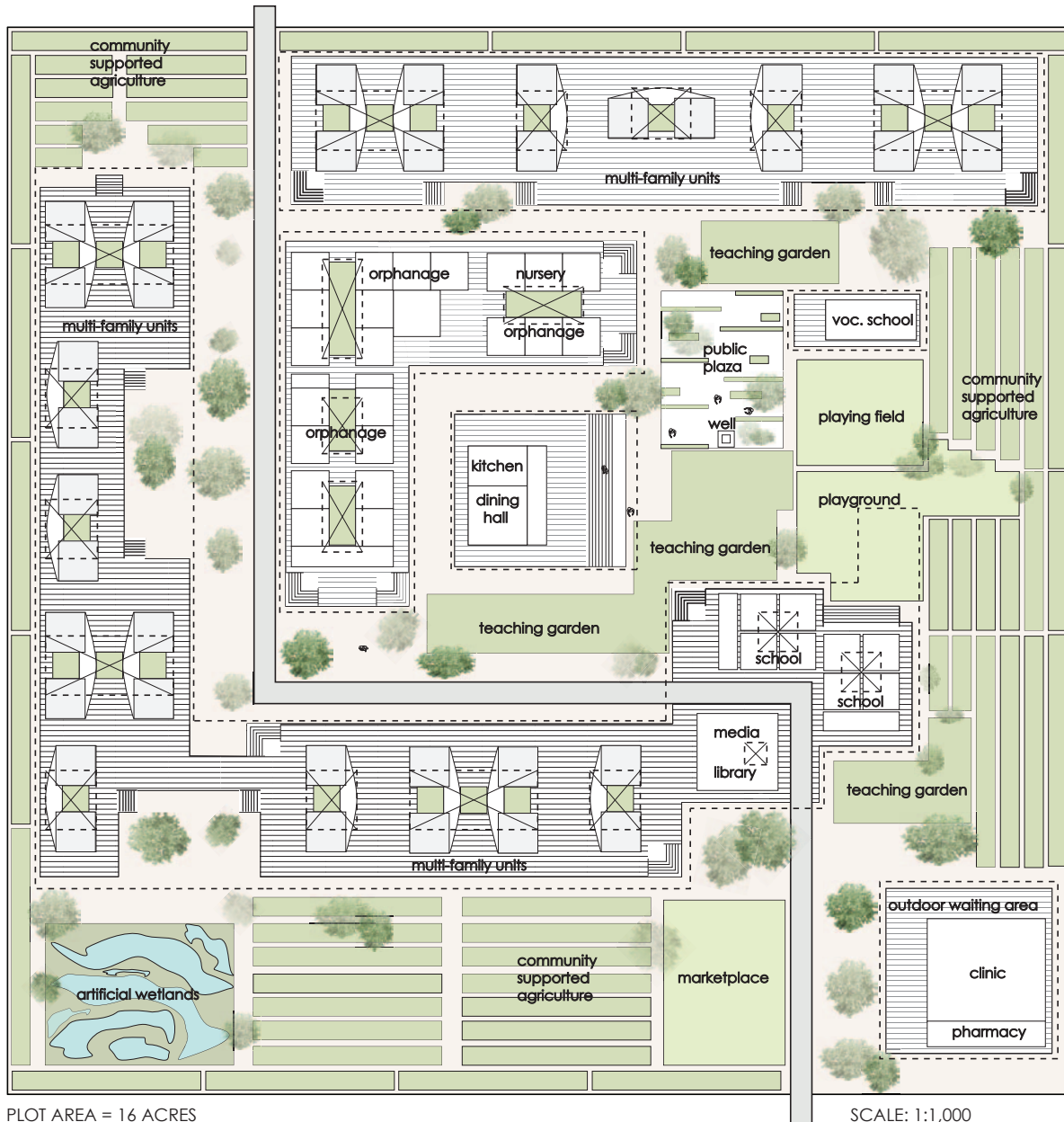
- Rainwater Collection

- Landscaping for water collection & drainage

- Garden for food production & education

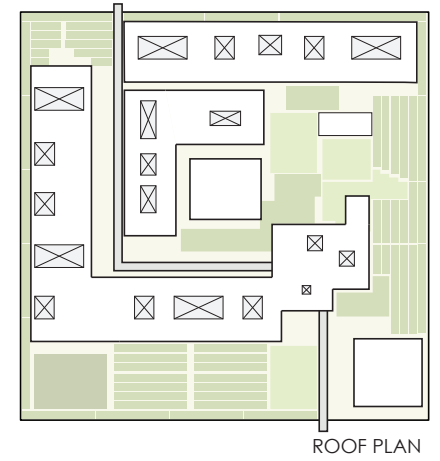
- Reuse of Materials

OBJECTIVES



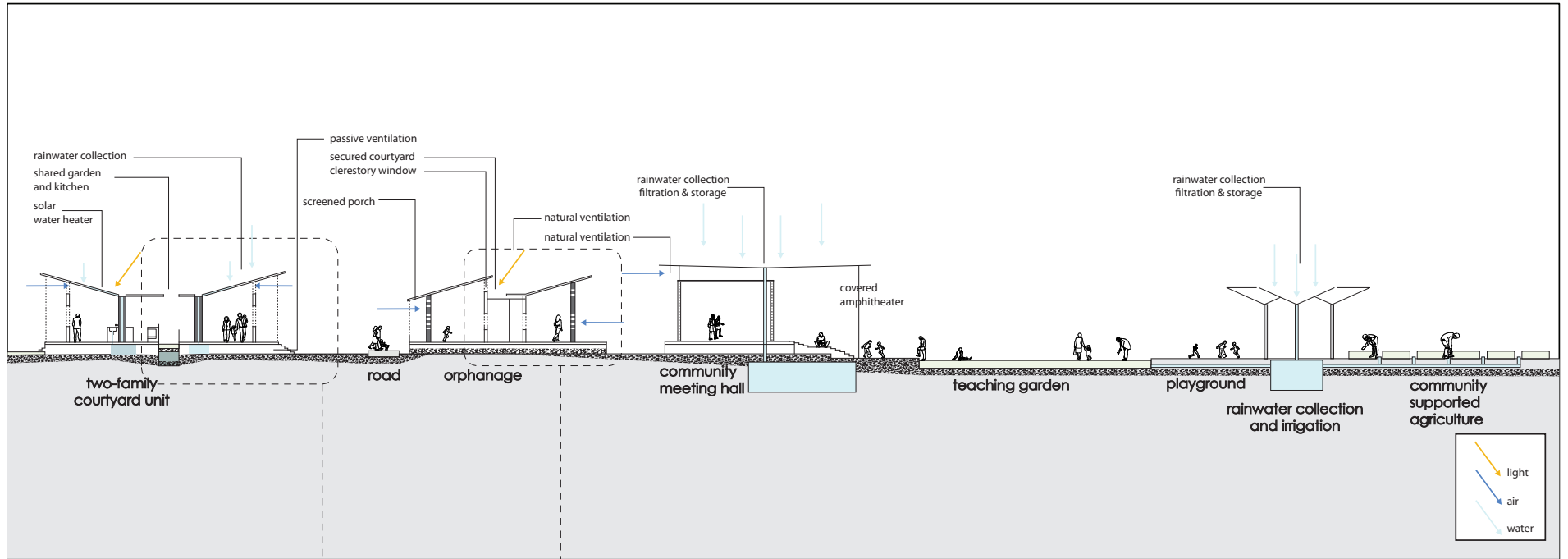
PLOT AREA = 16 ACRES

SCALE: 1:1,000

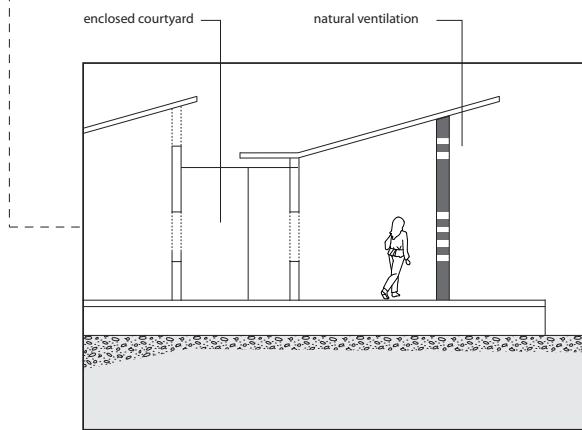
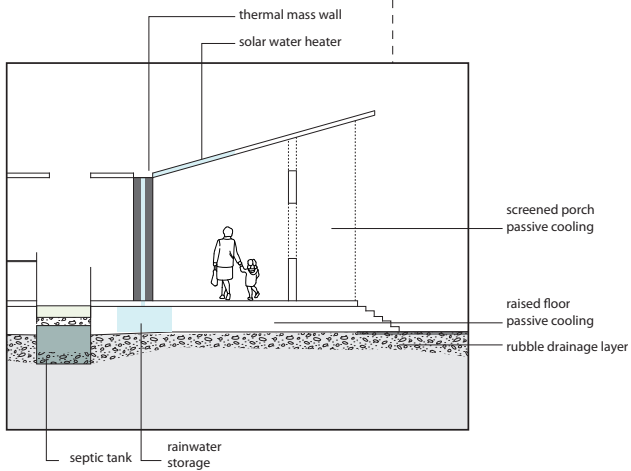


ROOF PLAN

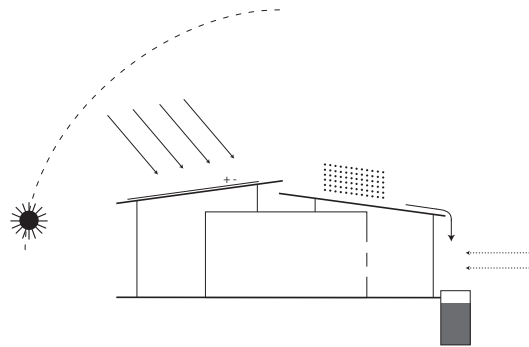
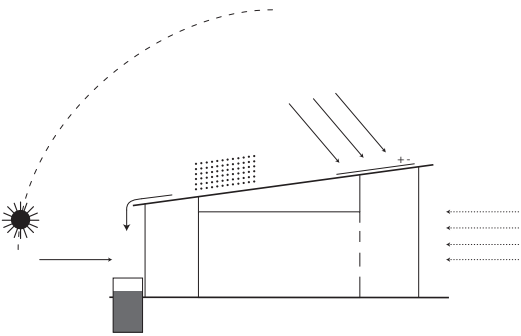
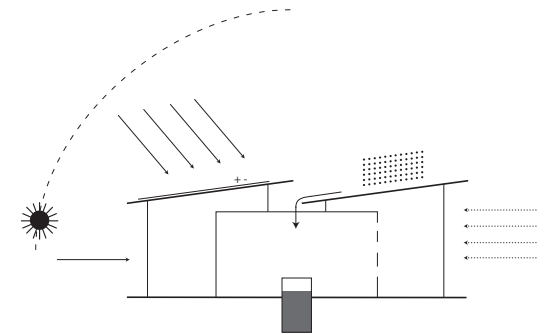
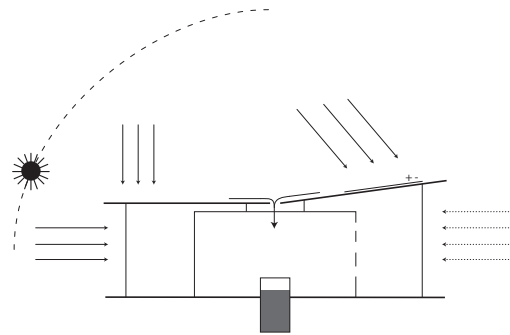
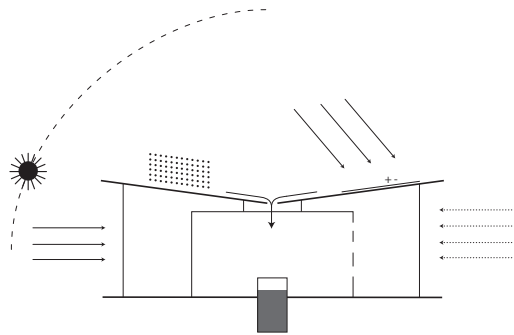
MASTERPLAN



SITE AREA = 16 ACRES (64,700 SQ. M.)

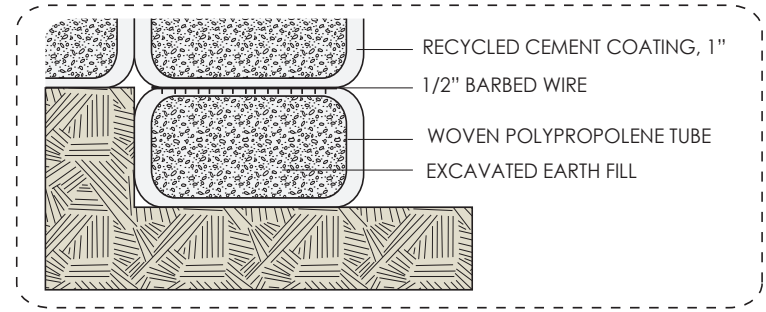
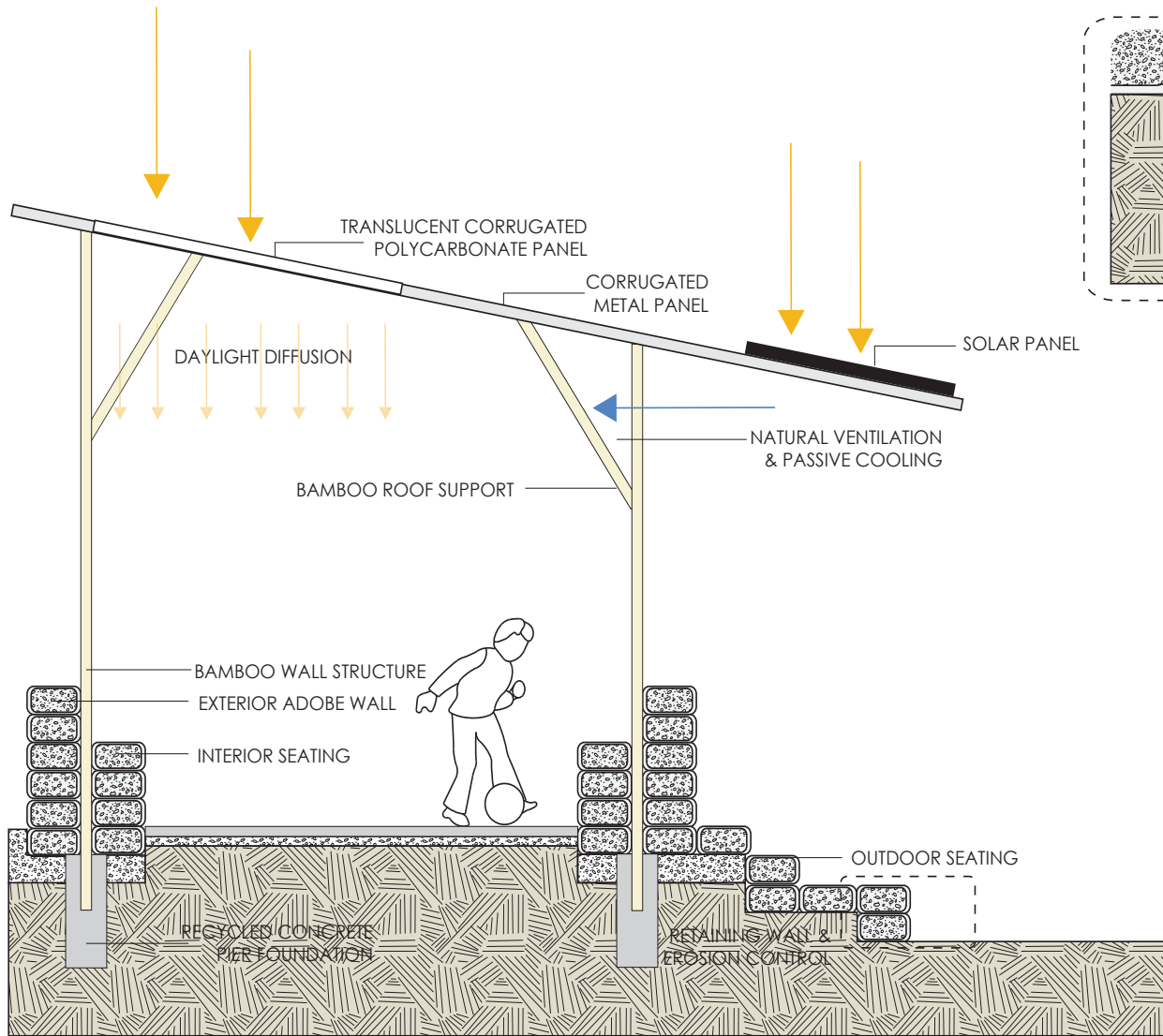


SITE SECTION



- ←..... INDIRECT DAYLIGHT
- ←..... DIRECT DAYLIGHT
- +— SOLAR PANEL
- ▒ RAIN CATCHMENT
- WATER RESERVOIR

PASSIVE STRATEGIES

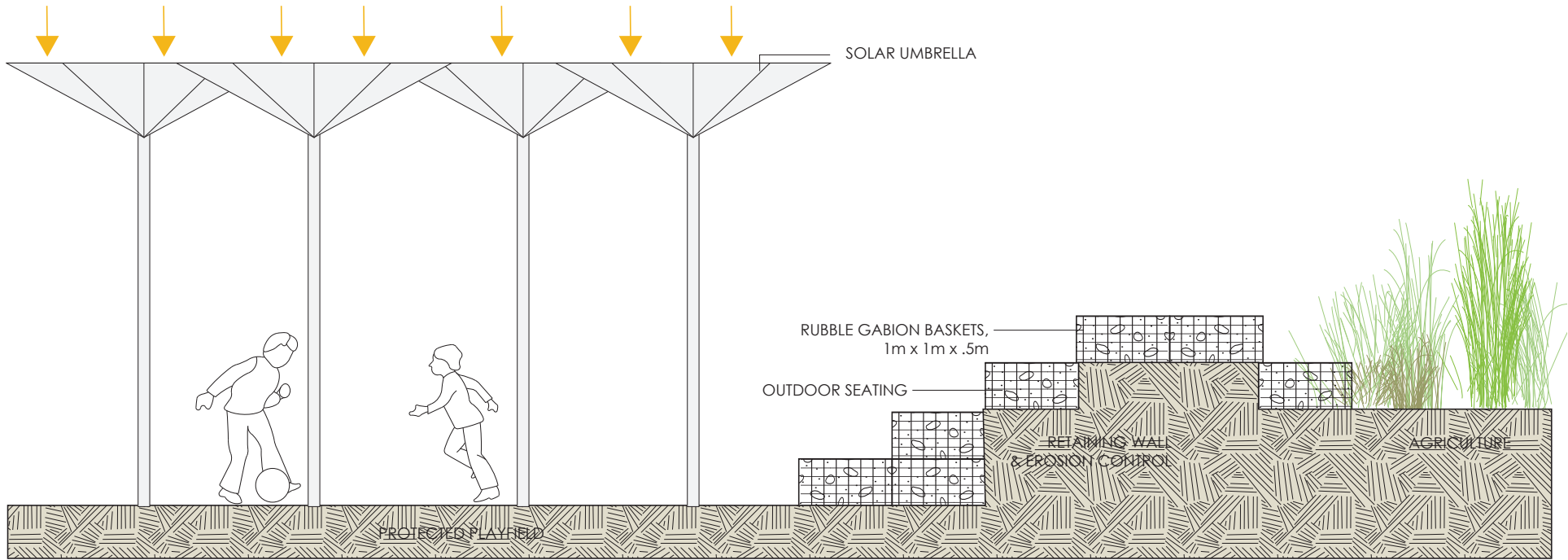


ADOBE SITE WALL SECTION

SCALE: 2" = 1'

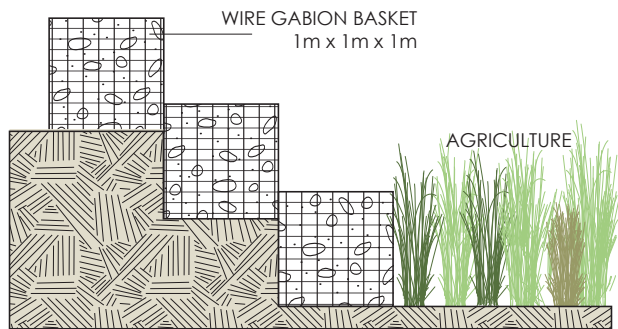
ADOBE BUILDING WALL SECTION

SCALE: 1/2" = 1'



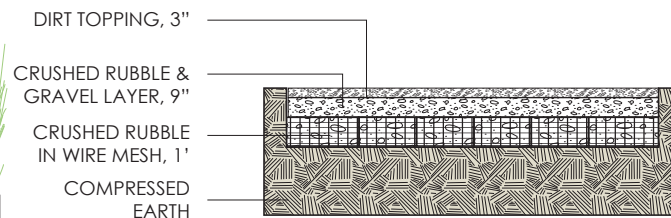
PLAYGROUND SECTION

SCALE: 1/2" = 1'



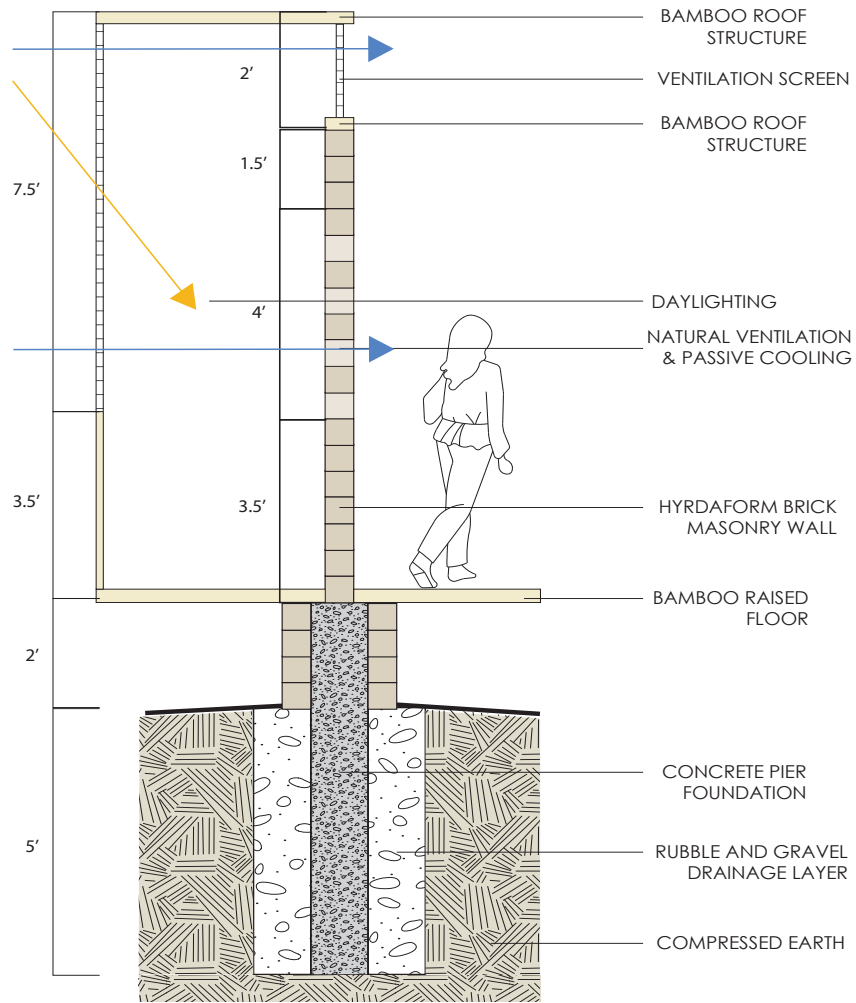
GABION SITE WALL SECTION

SCALE: 1/2" = 1'



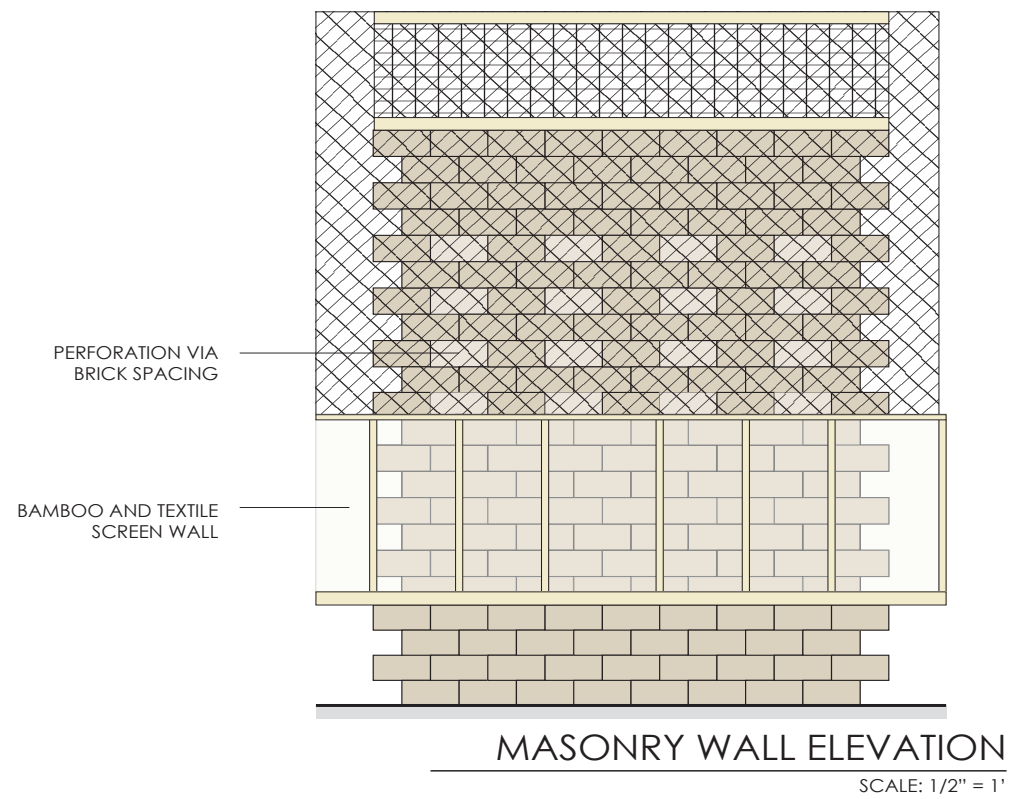
ROAD DRAINAGE SECTION

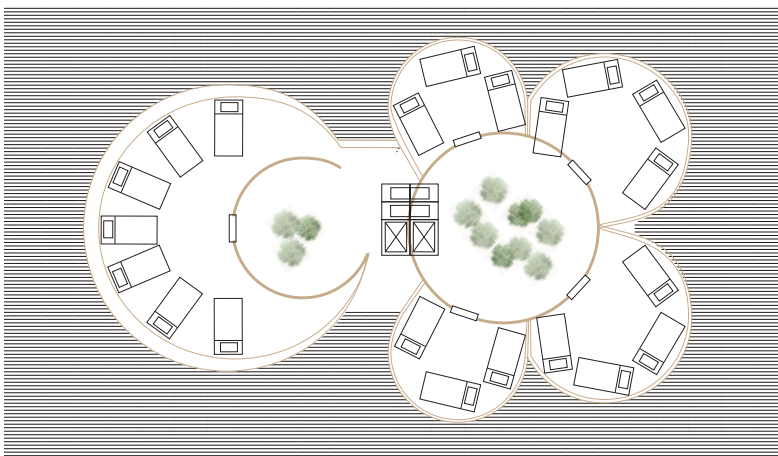
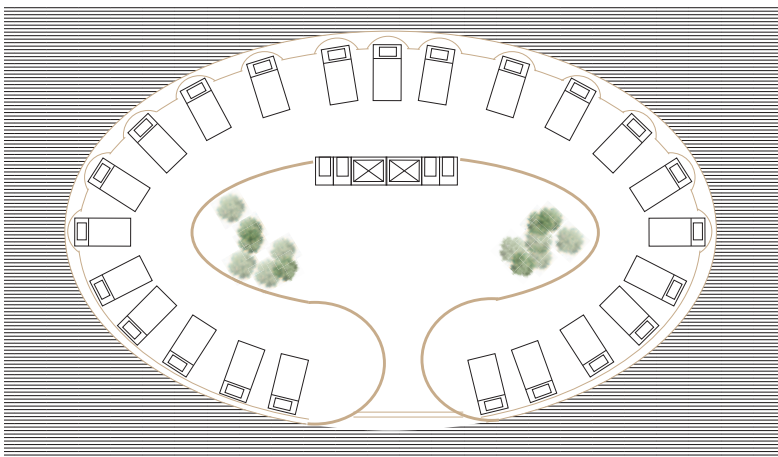
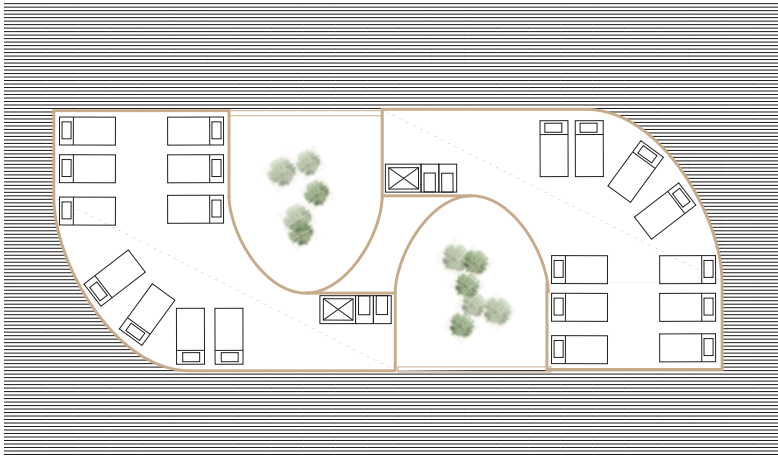
SCALE: 1/4" = 1'



MASONRY BUILDING WALL SECTION

SCALE: 1/2" = 1'



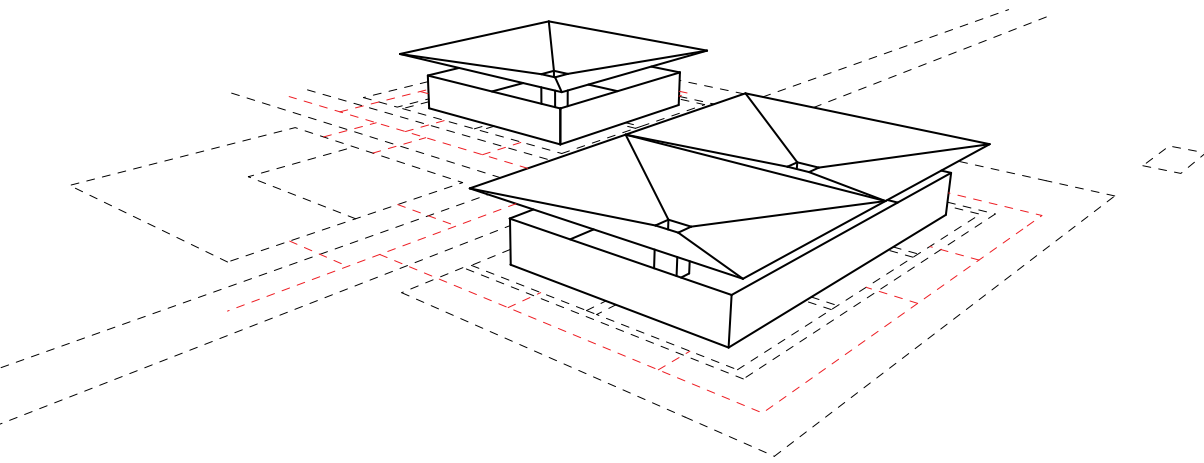


EARTH BAG CONSTRUCTION

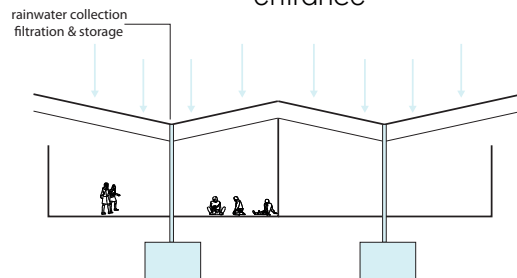
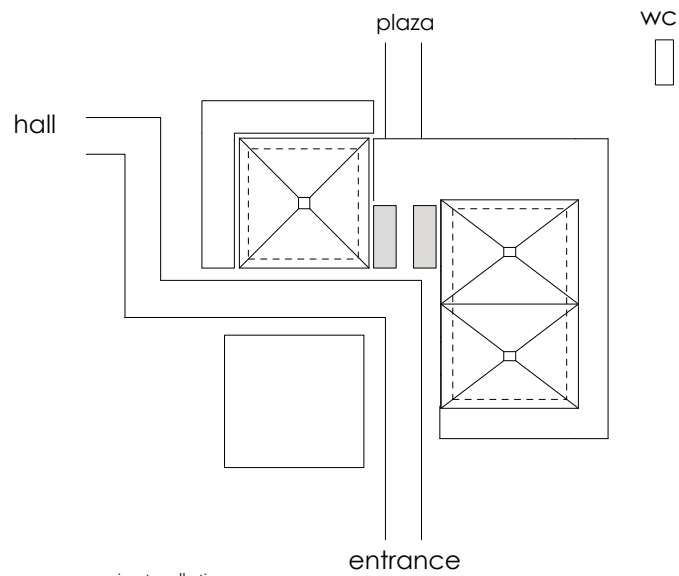


ORPHANAGE UNITS

VILLAGE TOURNESOL
EDUCATION



RECYCLED BILLBOARD ROOF PROTOTYPE



RECYCLED BILLBOARD WEARABLES

SCHOOL

VILLAGE TOURNESOL
HEALTHCARE



Maternal & Infant Health Clinic

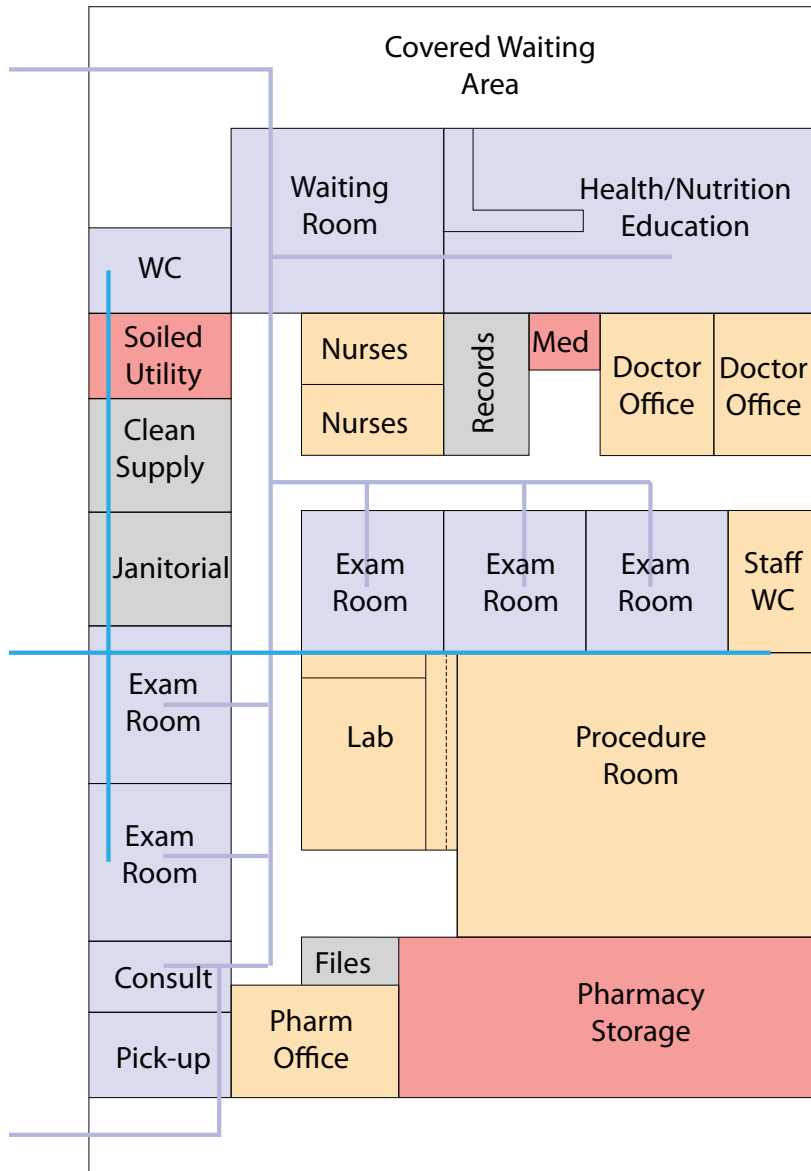
The 4 examination rooms, each of 10 m² will allow the Maternal & Health Clinic to welcome 80 patients per day. The clinic also includes a counseling room of 10 m², a procedure room of 40 m², 2 nurse intake stations of 5 m², a waiting area of 40 m², a lab facility, and a pharmacy with consultation space.

Services

- Free check-ups from skilled professionals
- A safe environment for clients to openly discuss their health concerns
- Health counselling
- Community education: sanitation, family planning, nutrition, breast feeding, immunization
- Health education for school children and parents
- Special support for the elderly, poor and disabled;
- Distribute low cost medication with necessary education
- Access to for basic laboratory testing
- Treatment of female health issues

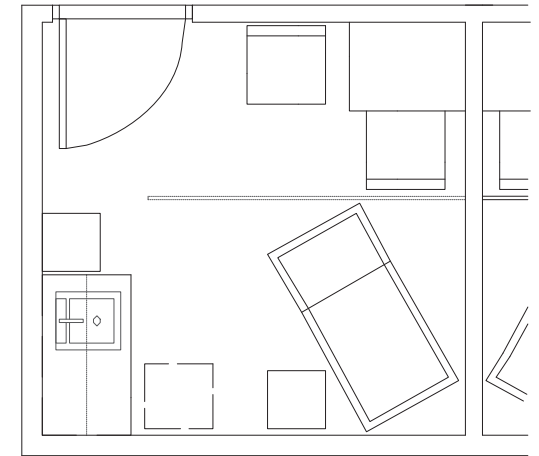
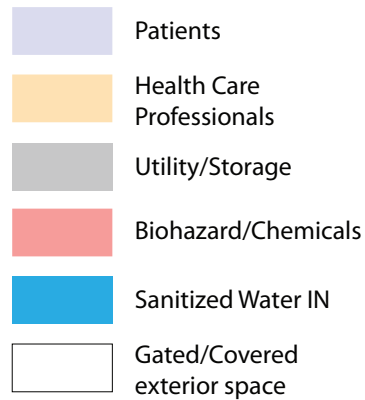


HEALTH CLINIC



PROGRAM DIAGRAM

NOT TO SCALE



EXAM ROOM LAYOUT

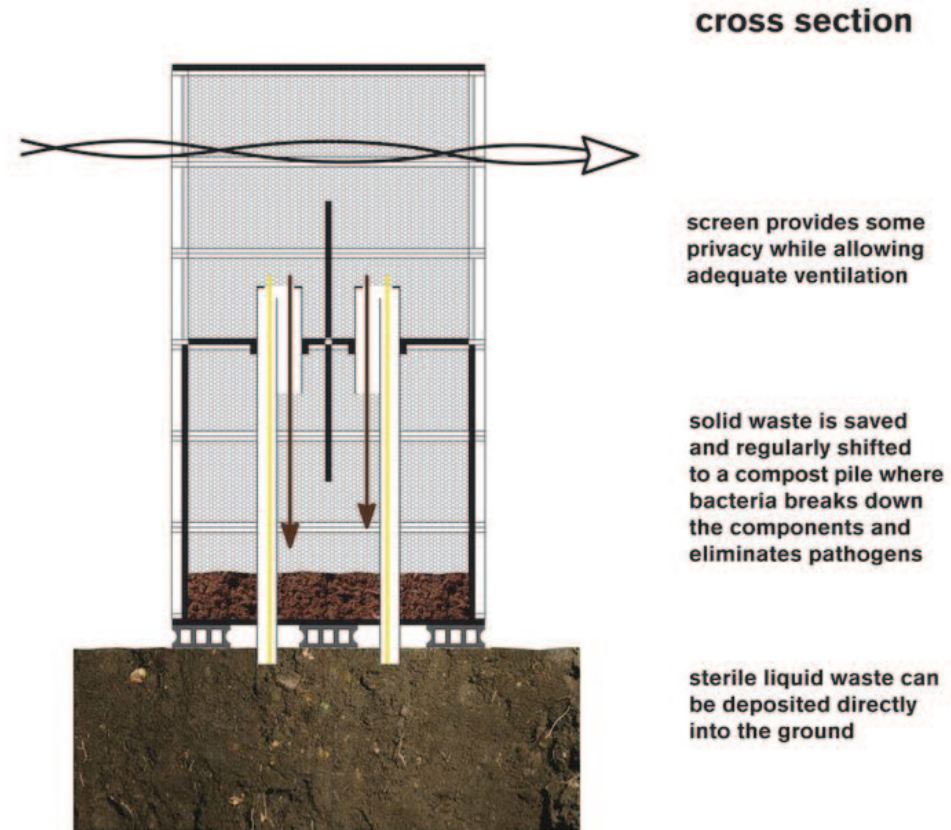
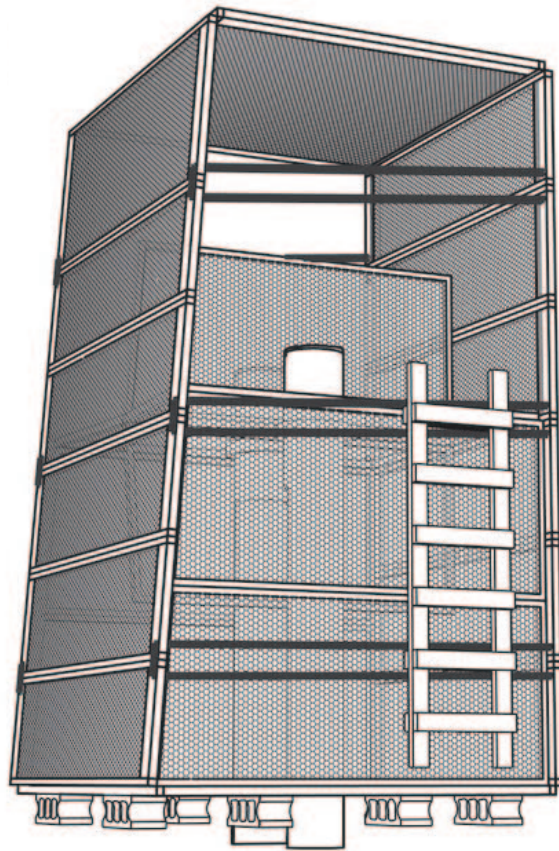
NOT TO SCALE

PROGRAM	FT ²	M ²
Exam Rooms	535	50
Procedure Room	450	42
Nurse Intake Stations	106	10
Waiting Area	322	30
Education Room (with teaching kitchen)	645	60
Lab Facilities	214	20
Supply/Utility Rooms	258	24
Doctors Office	180	17
Pharmacy Storage	322	30
Pharmacy Office	90	8
Pharmacy Consult	53	5
Lavatories	106	10
Medical Records	53	5
TOTAL CLINIC AREA	2243	208

HEALTH CLINIC

VILLAGE TOURNESOL

SANITATION



compost process

toilet divider separates liquid and solid waste



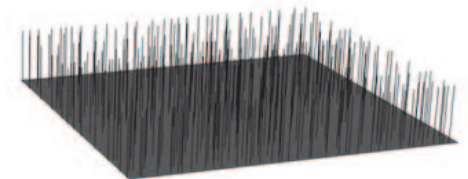
Currently, only 16% of rural Haitians and 50% of those in cities have access to adequate sanitation facilities. Simultaneously poor soil fertility has limited agricultural output and led to migration of rural populations to urban centers.

fertilizer produced

407 ft³



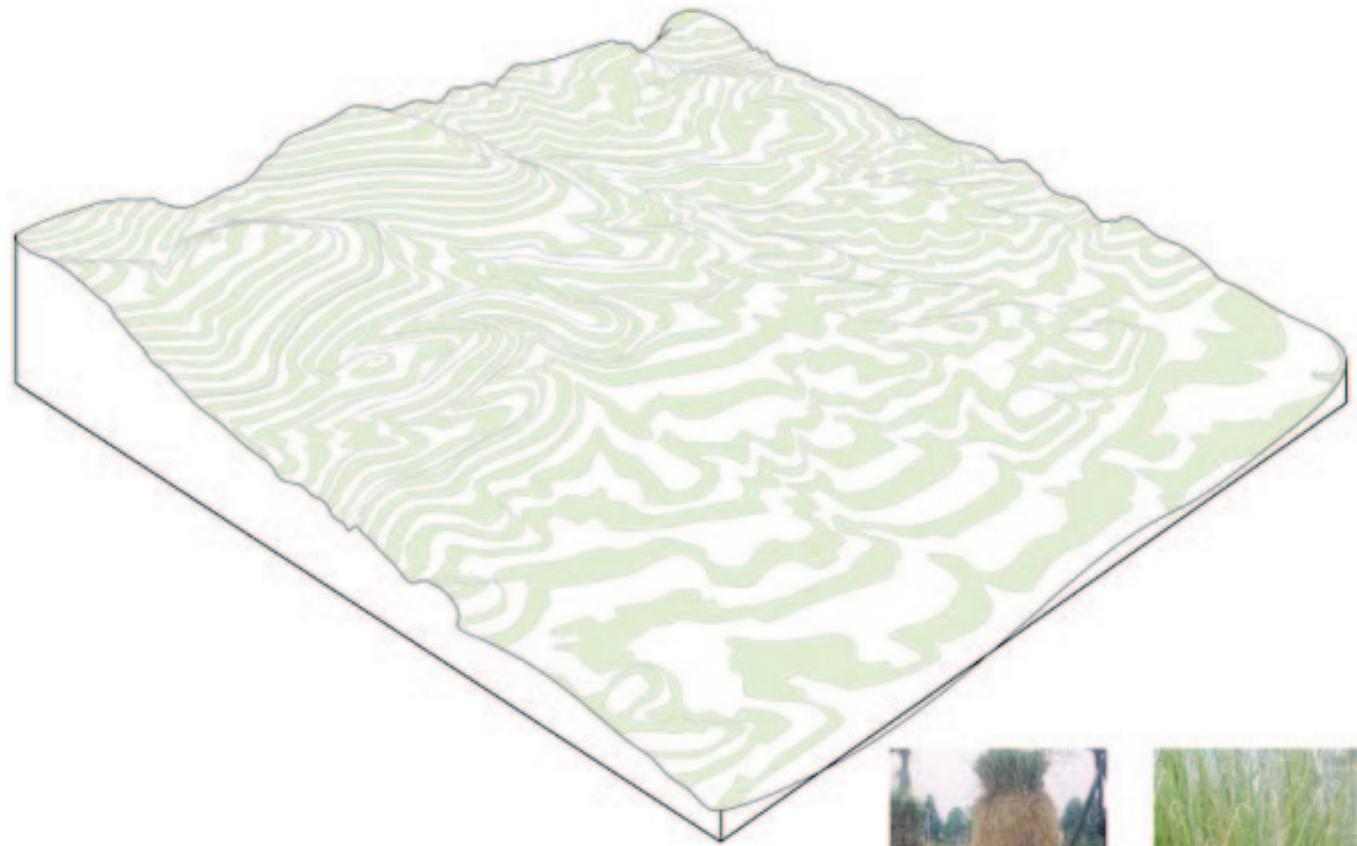
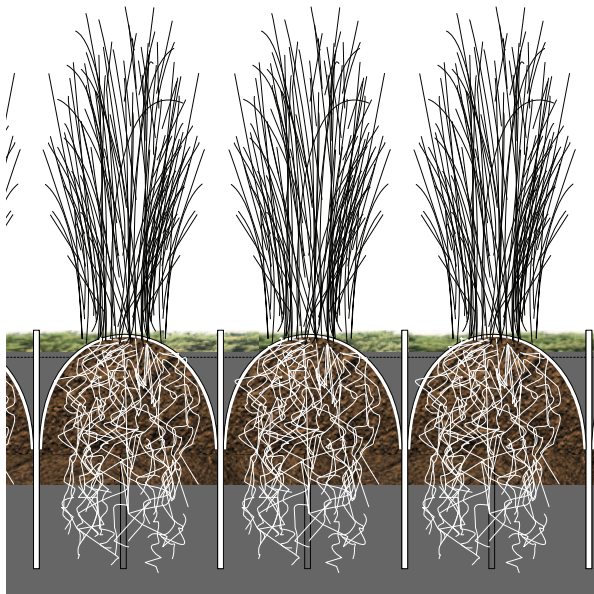
2,442 ft²



Most Haitian farmers do not have access to nor can afford commercial fertilizer. However, one full pop up composting toilet can produce four hundred seven cubic feet of fertilizer and cover two thousand four hundred forty two square feet.

COMPOSTING TOILET

VILLAGE TOURNESOL
AGRICULTURE



ARTIFICIAL ROOT SYSTEM ALLOWS FOR HEALING OF DAMAGED HILL COMMUNITIES



VETIVER ROOT RETAINS SOIL IN CONTOURS



REMEDIATED SOIL PROMOTES AGRICULTURE

LANDSCAPE REMEDIATION & CULTIVATION