

## MILESTONE RESEARCH & DEVELOPMENT

## SAND & SPACE

THE PROJECT THAT RESEARCH INTO TECHNOLOGIES AND SOLUTIONS FOR HABITAT BUILD WITH INTENTION TO MANAGE LIFE QUALITY OF SCIENTIST AND ASTRONAUTS BY USING ARCHITECTURE APPROACH ON CURRENT TECHNOLOGIES WITH SOLUTIONS FROM SPACE AGENCIES PLANS ON MARS MEDICAL. LATER WITH THE INFORMATION FROM BASE RESEARCH THE PROJECT SHIFT TO APPLY THOSE STRATEGIES AND APPROACHES TO HELP REFUGEE THAT STRUGGLES WITH POOR LIFE QUALITY AND HABITATS IN ZAFATARI.



### WHY SAND?

SAND IS EVERYWHERE ON MARS AND ALSO EARTH'S DESERT. AN UNLIMITED AMOUNT OF MATERIALS.

MARS'S GEOGRAPHY IS VERY SIMILAR TO EARTH'S DESERT AREA. LOCATION WHOLE PLANET MOSTLY COVERED WITH RED SAND. A DESERT BLOOM WITH EXTREME COLD WINTER, HOT DAY AND MARS'S ATMOSPHERE ALTHOUGH VERY THIN AND POOR FOR TRIP TO MARS TAKE OFF FOR THE LAUNCHER (SOUTH AFRICAN) AND THE PAYLOAD. IN ZAFATARI PEOPLE CANNOT BRING CONSTRUCTION MATERIALS TO MARS AND THE SOLUTION TO BUILD CONSTRUCTION BASE FROM LOCAL MATERIALS.

WITH CURRENT SITUATION OF SYRIA, MANY SYRIANS WERE FORCED TO MOVE OUT OF COUNTRY AND STAY IN JORDAN. ZAFATARI REFUGEE CAMP WITH LIMITED RESOURCES AND BUDGET CAMP REFUGEES WERE GIVEN FRAMING TIME. HOWEVER THE CONFLICT STILL CONTINUOUS LONGER THAN EXPECTED AND FRAMING TENT WERE RANDOM AND BE CONSIDERED AS TENT. WEATHER SAND AS MARS INSTEAD OF IMPORT IN MATERIALS. IN ZAFATARI MATERIALS IN THE DESERT CAUSE EVERYTHING POINT TO SAND.

## MARS

STRATEGIES THAT UNIVERSITY AND SPACE AGENCIES COMES UP TO MAKES HUMAN BE ABLE TO LIVE ON MARS



### SAND



### PARTICLES SIZES

**SLIT AND CLAY**  
ARE VERY SMALLER AND HAVE MORE SURFACE AREA BETWEEN EACH QUARTZ AND FINE CLAY. MANY THEM WILL ABLE TO STICK TO EACH OTHER FOR BUILDING THINGS SUCH AS CLAY HOUSE OR WALLS THIN BIGGER PARTICLES USE SAND.

**CONSTRUCTION SAND**  
BIG BOUNDER AND HAVE LESS SURFACE AREA. MAKES IT EASY TO STICK TOGETHER BY CONCRETE OR AGENT SO ITS BEST FIT FOR CONSTRUCTION.

**DESERT SAND**  
IN THE MIDDLE THAT IS TOO SMALL TO USE AS A FILLET AND TOO BIG TO STICK TOGETHER BY ITSELF. TO BE ABLE TO USE DESERT SAND AS CONSTRUCTION MATERIALS AND PROPER ENCLOSURE NEED TO BE CONSIDERED.

## ZAFATARI

OUTCOME OF USING MARS STRATEGIES AND INSPIRED BY TO HELP FIX CAMP CURRENT CONDITION.

### MATERIALS

## SAND

USING LOCAL MATERIAL TO CONSTRUCT HABITATS ON MARS DUE TO LIMITED PAYLOAD AND BUDGET SAVING.

### HABITATS

## CRYSTALLIZED SAND DOME

USING 3D PRINTER AND SOLAR ENERGY TO BUILD DOME FOR HABITATS AND BASE OPERATIONS

### FOOD

## LOCAL GROWN FOOD

TRAVELING TO MARS CAN BE VERY LONG, 6-9 MONTHS AND WAIT PERIOD OF 2 YEARS BETWEEN EACH RESTOCK. LOCAL GROWN FOOD IS NECESSARY AND SOME OF PLANTS HAVE BEEN TESTED TO PLANT ON MARS SOIL.

TESTED ON MARS SOIL  
- RADISHES - PEAS  
- RYE - TOMATOES

### FOOD & POWER

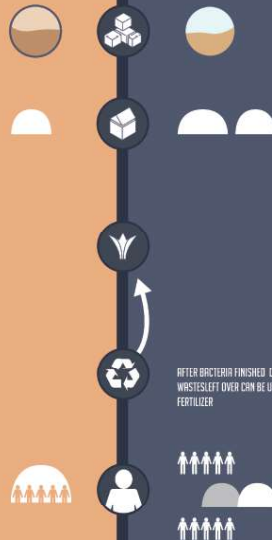
## HUMAN WASTE

MARS'S SAND STORM CAN BLOCK SUNLIGHT FOR LONG AMOUNT OF TIME, AND MAY CAUSE POWER OUTAGE. HUMAN WASTE COMBINE WITH BACTERIA CAN CREATE METHANE GAS FOR USE IN EMERGENCY SITUATION.

### COMMUNITIES

## PEOPLE INTERACTION IN ENCLOSED SPACE

NEED PUT PEOPLE TOGETHER TO RESEARCH AND STUDY ON HOW THEY CAN COOPERATE AND EMOTIONAL EFFECT WHEN PUT ON SAME TASK IN REMOTE LOCATION.



## SAND

UNLIMITED MATERIAL THAT NEVER TO BE UTILIZED  
HELP ORGANIZATION BUDGET ON OVERALL CAMP MAINTENANCE COST

## SANDBAGS DOME

INSTEAD OF USING 3D PRINTING HABITATS CAN BE USING LONG SANDBAGS TUBES WHICH FASTER, EASIER AND MORE COST EFFICIENT

## HYDROPONICS

FOOD IN ZAFATARI ARE 100% DISTRIBUTED BY UNHCR. LOCALS ARE DESPERATELY TRY TO PLANT THEIR OWN FOOD WITHOUT CORRECT CONDITION. HYDROPONICS STYLE AND TESTED PLANT WILL HELP LOCAL ABLE TO GROW AND FEED THEMSELVES.

## FOOD & HUMAN WASTE

EVERYDAY LARGE AMOUNT OF NATURAL GAS WERE USED TO COOK MEALS FOR REFUGEES. THAT THE GAS COST CAN BE REDUCE BY PRODUCE METHANE GAS FROM TONS OF WET FOOD WASTE AND HUMAN WASTE PRODUCE BY 80,000 PEOPLE EVERYDAY

## CREATING COMMUNITIES

LET PEOPLE CREATE THEIR OWN COMMUNITIES  
LET GROUP OF FAMILIES TOGETHER  
BUILD THEIR OWN SAND DOME HABITATS AND NEIGHBORHOOD.

## SAND ARCHITECTURE + URBAN PLANNING FOR

## ZAFATARI



ZAFATARI (ARABIC: زفطاري) IS A REFUGEE CAMP IN JORDAN, LOCATED 11 KILOMETRES EAST OF MA'RAQ, WHICH IS GRADUALLY EVOLVING INTO A PERMANENT SETTLEMENT. IT WAS FIRST OPENED ON JULY 28, 2012 TO HOST SYRIANS FLEEING THE VIOLENCE IN THE ONGOING SYRIAN CIVIL WAR THAT ERUPTED IN 2011.



### DISTRICTS



TOTAL AREA : 5.3 SQUARE KILOMETERS

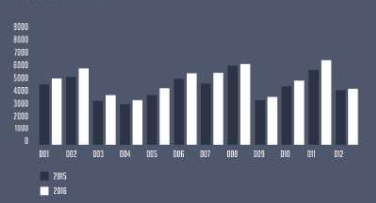
48701 REFUGEES HAVE PASSED THROUGH CAMP

80146 PERSONS OF CONCERN IN 2017 (SYRIAN REFUGEES)

45684 ARE UNDER 24 (57%)

9137 ARE UNDER 5

### DISTRICTS POPULATION



DATA FROM UNICEF REACH REPORT : ZAFATARI CAMP POPULATION COUNT  
UNHCR UNABLE TO COUNT EACH DISTRICT NUMBER IN 2017

## ZAFATARI

LOOK UP



CAMP ESTABLISH IN 2012 WITH 1 DISTRICT NOW EXPAND TO TOTAL OF 12 DISTRICT



FIRST TWO ON CAMP REFUGEES HABITATS: UNHCR PROVIDED FABRIC TENT FOR CAMP REFUGEES TO LIVE IN.



PEOPLE USE EVERY AVAILABLE MATERIAL AND SPACE TO MEET THEIR NEEDS.



WATER DISTRIBUTION POINT, A CONCRETE WITH TWO TAP FAR LESS THAN ENOUGH



THE CONFLICT IS LONGER THAN ANYONE EXPECTED ALSO SURPASS THE FABRIC TENT EXPECTED DURATION OF USES (1-2 YEARS)



TWO TYPES OF HABITATS FOR REFUGEES A ZINC PLATED BUNGALOW



EVEN THE NEW TYPES OF HABITATS IT STILL TOO HOT FOR DESERT CLIMATE. PEOPLE DESPERATELY USED OLD FABRIC FROM TENT TO COVER THE ROOF.



FLAT LAND WITHOUT ANY SEWER, FLASH FLOOD ALWAYS HAPPEN EVERYTIME IT RAINS

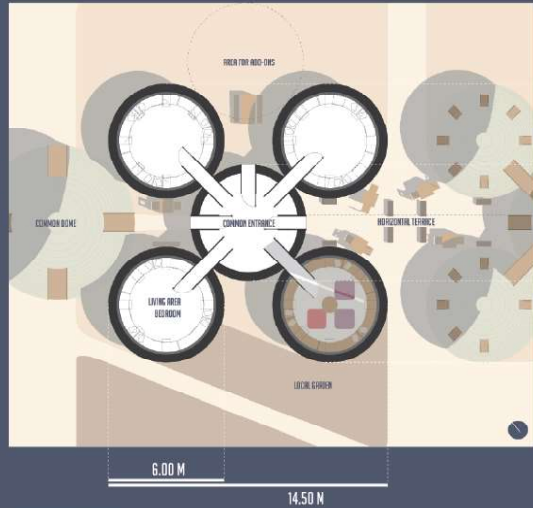


HARSH WINTER TIME WITH SNOW DAMAGING THE WORK OUT TENT.



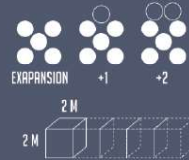
## LIVING DOME PLAN AND AXON

ZAATARI  
PROJECT



### SPECIFICATION

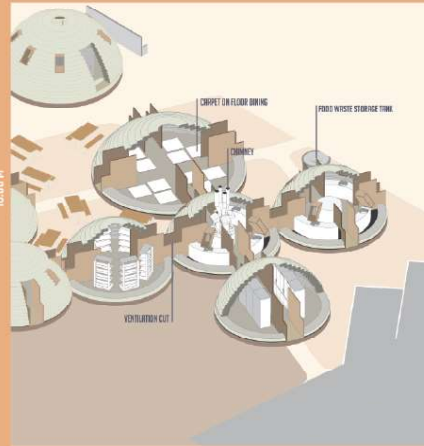
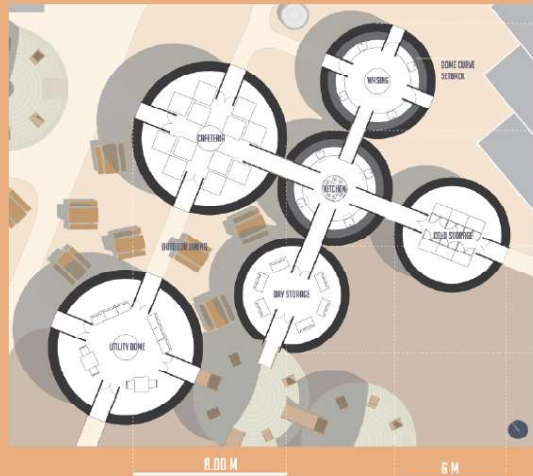
CAPACITY	6 PERSONS
AREA (1 DOME)	28 SQ. M
TOTAL AREA	112 SQ. M
SAND REQUIRED	8 CUBIC M
1 DOME	40 CUBIC M
TOTAL	



## LIVING DOME

PURPOSED LIVING AREA FOR CAMP REFUGEES WITH MORE ORGANIZED PLAN AND MORE PRIVACY IN EACH DOME. HOWEVER STILL ENCOURAGE PEOPLE TO LIVE TOGETHER BY INCREASING OUTDOOR ACTIVITIES AREA. EACH LIVING DOME CAN HOLD 1 FAMILY OR UP TO 6 PERSONS.

## KITCHEN & CAFETERIA SCALE 1:100



### SPECIFICATION

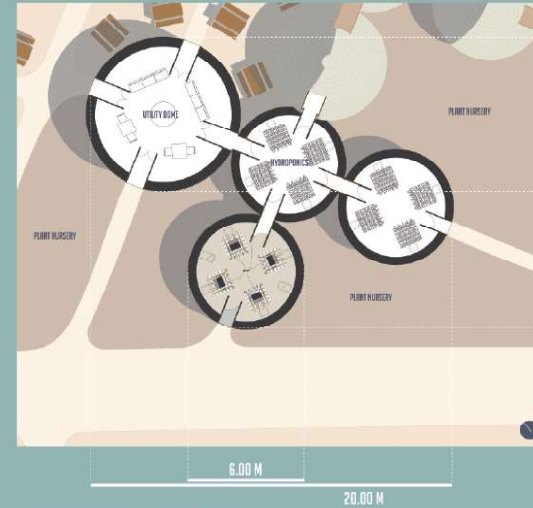
KITCHEN (1 DOME)		STORAGE (2 DOME)	
RADIUS	3 M	RADIUS	3 M
STOVE	4 UNIT	FRIDGE (540 LITERS)	6 UNIT
SINK	4+ UNIT	STANDARD SHELF	6 UNIT
WASHING (1 DOME)		CAFETERIA (1 DOME)	
RADIUS	3 M	RADIUS	4 M
SINK	4+ UNIT	INDOOR CAPACITY	80 PERSON

## KITCHEN & CAFETERIA

NEW FOOD DISTRIBUTION POINT FOR THE AREA, INCREASING TOTAL FOOD OUTPUT PER DAY AND STORAGE. ADD INDOOR / OUTDOOR CAFETERIA AND NEW COMMON AREA FOR NEIGHBORHOOD. NEW KITCHEN CAN SUPPORT FOR 300+ PEOPLE PER DAY. ALSO INTRODUCING FOODWASTE STORAGE TANK TO GENERATE GAS FOR COOKING PURPOSE.

## HYDROPONICS & NURSERY PLAN AND AXON

ZAATARI  
PROJECT



### SPECIFICATION

HYDROPONICS (3 DOME)	
CAPACITY	4 UNIT
DOME RADIUS	3 M
UTILITY DOME (1 DOME)	
DOME RADIUS	4 M
TOTAL AREA	50 SQ. M

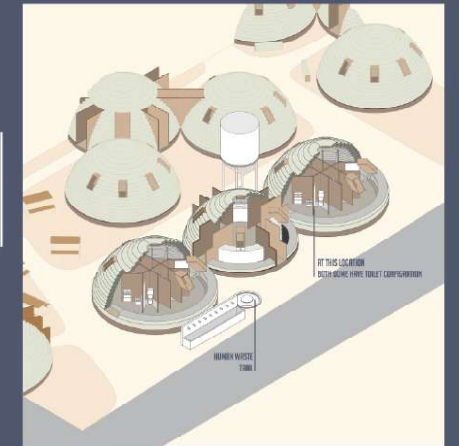
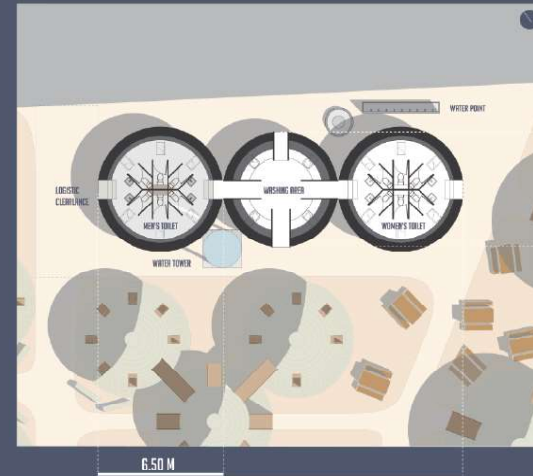


DIY HYDROPONICS UNIT  
5 PVC 6" TUBES  
WOODEN STAND  
PUMP AND RESERVOIR  
1 UNIT ABLE TO GROW  
25 PLANTS.

## HYDROPONICS & NURSERY

NEW CAMP AREA PLANNING ALLOW MORE SPACE TO BE UTILIZED OTHER THAN SLEEPING PLACES. HYDROPONICS DOME ALLOW CAMP REFUGEES TO LOCALLY GROW PLANT FOR THEMSELVES AND ALSO TO BE AN ORPHANAGE FOR PLANT BEFORE FACING HARSH DESERT ENVIRONMENT.

## WATER POINT SCALE 1:100



### SPECIFICATION

WASHING (1 DOME)		SHOWER (-)	
RADIUS	3 M	RADIUS	3.25 M
SINK	4+ UNIT	SHOWER UNIT	UP TO 6 UNIT
TOILET (2 DOME)		SINK	4 UNIT
RADIUS	3.25 M	WATER DISTRIBUTION	
SINK	4 UNIT	TAP	9 UNIT
TOILET	6 UNIT	WATERTOWER	
		USE FOR BOTH TOILET AND KITCHEN AREA	

## NEW WATER POINT

REDESIGN OF CURRENT WATER POINT AREA, WHICH ONLY HAVE ONE UP TO 4 TAP, ADDING MORE WATER DISTRIBUTION AREA AND RESTROOM DOME, WHICH CAN BE CONFIG FOR TOILET OR SHOWER AREA. ALSO INTRODUCING HUMAN WASTE STORAGE TANK WHICH LATER CAN BE USE AS A COOKING GAS.



## ORGANIZATION MAP

ZAATARI  
REFUGEE CAMP

- WAREHOUSE
- DISTRIBUTION POINTS
- HOUSEHOLD
- RECYCLING FACILITIES
- HEALTH FACILITIES
- RECREATION
- COMMUNITY OFFICE
- YOUTH CENTRES
- COMMUNITY CENTER
- REGISTRATION
- WATER FACILITIES
- KINDERGARTEN
- CHILD AND FAMILY CENTERS
- SCHOOLS
- SECURITY OFFICES
- OFFICES
- BLOCKS
- DISTRICTS

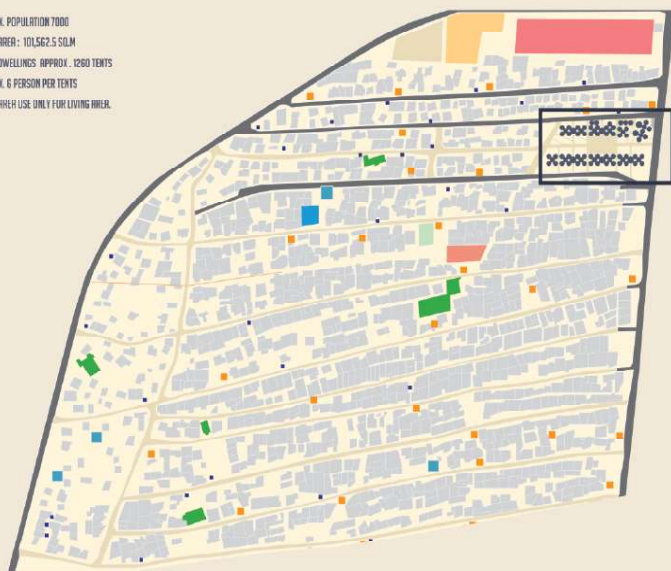


500 M 1000 M 1500 M

## DISTRICT 01 ORGANIZATION MAP

- HEALTH FACILITIES
- MOSQUES
- YOUTH CENTRES
- COMMUNITY CENTER
- WATER POINT
- WASH CENTER
- CHILD AND FAMILY CENTERS
- SCHOOLS
- OFFICES
- KITCHEN
- WAREHOUSE
- TENTS

APPROX. POPULATION 7000  
TOTAL AREA: 101,562.5 SQM  
TOTAL DWELLINGS: APPROX. 1200 TENTS  
APPROX. 6 PERSON PER TENT  
>80% HIGH USE ONLY FOR LIVING AREA.



100 M 200 M 300 M

SITE VISIT



HYDROPONIC CHECK UP



LUNCH TIME



EVENING DINER



NIGHT AT THE COMMONS

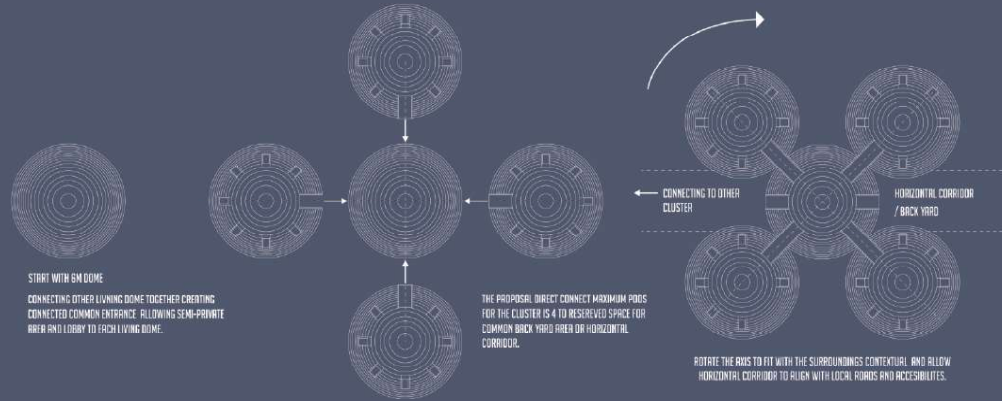


LIGHTS OUT

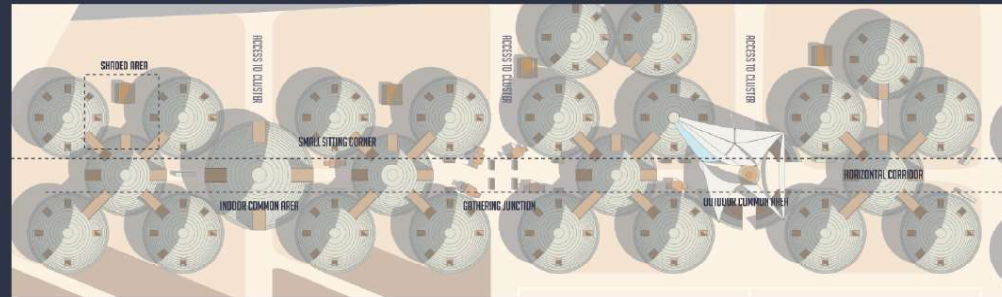




## SAND DOME & LIVING CLUSTER PLANNING



## NIEGHBORHOOD PLANNING

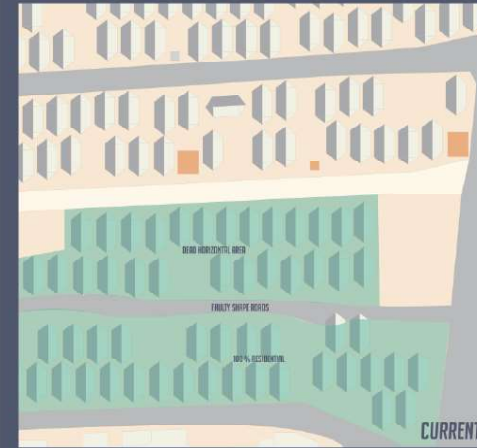


## SUGGESTED PLANNING



## DISTRICT 1 NIEGHBORHOOD UPDATE

ZATARI  
ESTABLISHED 1974



### ZONING

MOST OF AREA UTILIZED FOR TENT USE ONLY (RESIDENTIAL), NO COMMUNITIES AREA AND FEW OF INFRASTRUCTURE AND LIFE SUPPORT FACILITIES. NO LOCAL ACTIVITIES.

APPROX. 55 TENTS IN PROPOSE AREA.  
APPROX. 275 PERSONS.

### CONNECTION

VERY FEW VERTICAL CONNECTION PEOPLE NEED TO TAKE A BIG DETOUR BEFORE ACCESS THEIR LOCATION. EMPTY HORIZONTAL AREA BETWEEN THE TENTS ARE DEAD NOBODY USE IT.

RCI RAITO



RESIDENTIAL  
COMMUNITIES  
INFRASTRUCTURE



### ZONING

CURRENT AREA HAS BEEN REDESIGN AND ORGANIZED WITH INTRODUCTION OF NEW FACILITIES AND INFRASTRUCTURE. MORE RESIDENTIAL CAPACITY WITH NEW FACILITIES.

C1+C2  
51 RESIDENTIAL DOME UP TO 65 (ADD-ONS)  
CAPACITY OF 306 UPTO 390-  
(1 DOME, 6 PERSONS)

### NEW ACCESS

ENTRANCE OF RESIDENTIAL UNIT CAN BE ACCESS FROM VERTICAL WALK WAY WITH NEW HORIZONTAL ROAD TO MAXIMIZED AREA UTILIZATION. THE DEAD AREA CHANGED TO BECOME HORIZONTAL BACK YARD FOR RESIDENCE TO USE.

RCI RAITO

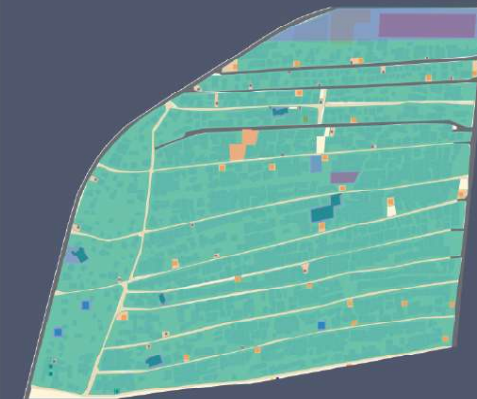


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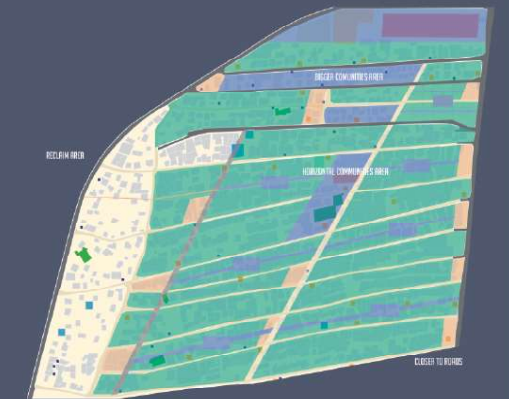
## DISTRICT 1 DISTRICT RE-ORGANIZATION



### ZONING

SAME STORY IN BIGGER SCALE TENTS WERE DISTRIBUTED FIRST THEN FACILITIES AND INFRASTRUCTURE. WATER POINT, TOILET, AND KITCHEN WERE SCATTERED AROUND THE AREA. DISTRICT 1 IS THE OLDEST AND HIGHEST DENSITY DISTRICT IN ZATARI.

VERY FEW VERTICAL ACCESS THOUGH OUT THE TENTS AREA, SO PEOPLE DIDN'T GATHER AND DO ACTIVITIES TOGETHER MUCH TO GO FROM ONE LOCATION TO OTHER A VERY BIG DETOUR NEED TO BE TAKEN.



### UPDATED

THE NODE DESIGN ABLE TO EXPAND AND REPEATS FROM THE TOP LEFT CORNER OF C1 AND C2 USE SAME STRATEGY WITH COMMUNITY AREA SURROUNDED BY RESIDENTIAL AREA IN THE MIDDLE HORIZONTAL LINE CONNECTING TO BIGGER COMMUNITY AREA.

EXPECTING 2X CAPACITY AREA CAN UTILIZE FOR MORE COMMUNITIES AREA OR SHRINK DOWN WASTE DISTRICT AREA AND WITH THE INFRASTRUCTURE AND FACILITIES MORE ORGANIZED AND CLOSER TO MAIN ROAD FOR BETTER LOGISTIC.