WATER (ACCESS, TRANSPORT, STORAGE)

WATER IN MIGRANT SLUMS – PART 1

**Introduction**
Current Status
Need assessment

**Understanding the problem**
Typical Areas targeted
Out comes of need assessment

**CASE STUDY 1: Lingrajpuram**
Area Profile - Water scenario
Need assessment specific to Lingrajpuram
Out comes of need assessment and problem understanding
Possible approaches
Market Research (water transport and water models)
Community Feedback (co-design)
Concepts:
> Cart/wheel barrow type model
> Ergonomic Model for individuals to carry
> Business model entrepreneur / community run

**CASE STUDY 2: Tubrahalli**
Area Profile
Problem Identification
Preliminary Investigation
Survey & Existing Models
Conclusion of the problems faced
Community Model Vs Entrepreneurship Model
Community Meeting 1
Community Meeting 2

WATER AS A SMALL SCALE BUSINESS IN LOW INCOME HOUSEHOLDS – PART 2

**Introduction**
Current Status

**Understanding the problem**
About the business
Results of detailed water surveys
Out comes of need assessment

**The Water business system (tannery road)**

**Market Research**
Community Feedback + co-design

**Concepts**
> Cart/wheel barrow type model
> Complete vehicle modification
> Add on's / Value add's for cycle/ mounting techniques/ pots
> group run business/ systemic change
PART 1 – WATER IN MIGRANT SLUMS
Current Scenario

One of the main issues identified through UCL community approach has been ‘water’. Water access, transport, purification, storage, drainage, cost etc. are pressing issues in slums, low income households and small scale businesses.

Urban migrant labor slums are perhaps the worst hit/most ignored when it comes to water. The lack of water/water sources around all migrant settlements –is primarily due to temporary nature, informal status and elusive ownership issues that prevail. These are typically daily wage laborers who:

- Have no access to Cauvery drinking water through govt.
- Cannot afford to buy water from the cycle wallahs (small scale water businessmen)
- Have no fixed source of water, rely on irregular BBMP/private water tankers, BBMP/private taps
- Generally struggle with collection and transport of water for daily use

This document- part1 mainly understands the issue of water access and transport at an individual household level for a tent home.

Need Assessment

We conducted our need assessment through the following:

- Observations
- Conversation
- Immersive study

Women and children of Kodigehalli slum line up near a water tank
Through Conversations..

How long have they been staying there?
What are the problems faced, in terms of water?
Water is used for?

<table>
<thead>
<tr>
<th>For?</th>
<th>How often?</th>
<th>How much pots/litres?</th>
<th>We get enough for this purpose / need x amount more specifically for this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bathing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Washing</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Cooking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drinking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleaning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>... any others?</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

How many pots do they use each day?

SOURCE
Where do they get the water from?
How often do they get the supply? (days and timings)
How far is it?
Is it paid for? (monthly or daily basis?)
How much per pot?
Type of Water? Do they do anything to purify the water for drinking?
If yes What do they do? And why? If no, why not?
Would they pay if purified water was available at the IEC? If yes.. how much/ liter?
Will they be willing to pay if source of water is closer to home?

TRANSPORT
What do they carry water in?
How often do they have to repair/ replace it?
How do they carry it?
How often do they go to fill water?
Who does it in the family?

While talking to a family / group – We specifically asked-

<table>
<thead>
<tr>
<th>How often do you go?</th>
<th>How long do you take per trip?</th>
<th>Disadvantages of doing this activity?</th>
<th>Other comments about transporting water</th>
</tr>
</thead>
<tbody>
<tr>
<td>women</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>children</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>men</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Health issues due to transportation?
How difficult and annoying is it on a scale of 1-10?

STORAGE
What do they use to store the water?
Is water left stagnant or open?

- Observations
  Just spending time in the community at different times during the day, observing activities surrounding water by building rapport with people.

- Conversation
  Apart from basic and financial information we took the information above as guidelines for our water based interactions and interviews

- Immersive study
  We carried water with women/ children and men, from their water sources, analyzed pathways/ distances/ shortcuts, we have a tent of our own among one of the slums in which we store water/ bhingis (pots) and carried out various demos, interactive sessions and activities to get feedback and engage people in brainstorming for solutions.
Typical Areas Targeted

We conducted our need assessment in 6 slums (Marthahalli, Girinagar Lingarajpuram, Banashankari, Krishnappa Gardens, Yelahanka, Kothnur) across Bangalore with over 50-60 people overall to understand the need and nuances of the issue.

Each of these slums had similar profiles:

1. Tent Type homes made of casuarina poles, tarpoulin sheets, and other upcycled/found materials.
2. Migrant Families from Northern dry parts of the state.
3. Settled here from anywhere between 8-30 years.
4. Average size of the family: 5
5. Work mostly in the construction field on daily wages.
6. Single room homes
7. Open toilets and no drainages
8. Use kerosene as source for lighting (Rs 250/month)
9. Use Firewood as cooking source (Rs 800- Rs 1000/month)
10. Water source is typically 0.5km-3km away and is either paid (Rs20/week) or free.
11. Average income per household is anywhere between Rs 6,000- Rs 15,000.
12. Their major expenses include groceries, firewood and kerosene and mobile charging.
13. In a few slums NGO’s run educational activities, apart from which opportunities for children in these communities are non-existent.
14. They do not have access to any credit source or recognized identification.
15. Expenditure on health related issues are anywhere between Rs200-Rs1000 per month.
16. They travel back to their villages once/twice a year for about 1 week or two.
UNDERSTANDING THE PROBLEM

ACTIVITY
- Carrying pot to fill
- Walking to nearest source or cycling
- Collecting water
- Carrying heavy weights
- Storing water
- Using it for various purposes

ENVIRONMENT
- Uneven narrow roads
- Irregular availability of water
- Hostile tap owners and crowds
- BBMP tankers
- Unhygienic
- Stagnant water

INTERACTION
- Other users
- Water business people
- Private households
- Government
- BBMP staff/ local leaders
- NGOs

OBJECTS
- Cycles
- Plastic pots
- Ropes
- Hooks
- Electric tape
- Plastic sheets
- Pipes and taps
- Tanks
- 20 liter bottles

A,E,I,O,U Analysis
Problems faced by the community

**No identity, no water**
Most of the **migrant laborers** who are not under any contractor have a tough time sourcing water. They have to **fight** with the private connection owners to let them take water. They grab any opportunity to source water.

**Erratic Timings**
Due to unreliable and difficult sources - where some places women go at 3am to avoid conflicts, others even during mid day are required to stand a line (which occupies most or the time).

**Painful ergonomics**
Men and women have been carrying these pots full of water for ages but it is awfully hard to carry them. Children start carrying these pots from the age of 5.

**Number of trips**
In one go one person can carry maximum of 2 pots. **Daily requirement** of a family of four is **10-15 pots**. That means if there is just one person sourcing the water, they need to make **6 trips everyday**.
Excerpts from the conversations

“We have to walk two three kilometers for the paid water and the free water is farther away, but we prefer going there, we cant afford Rs.2 for each pot.” - Krishnappa Garden.

“Water is used for everything, which is why there is no option but to bear the burden. Doesn’t matter how we feel” - Pai Layout

“Three or four days in a month we don’t end up getting water, those days we end up buying Drinking water and making do with how much we have.” - Hosker halli

“We end up making 2-3 trips a day, whoever is free goes and brings back two filled pots, we need at least 20 pots a day” - Thubrahalli

“We cant afford to pay more that Rs.20 a month for water, we tried fixing the current free supply of water through pipes but the people around are just too lazy and don’t care” - Idka Mohalla.

Outcomes and Insights

The information below was collected across 23 slums areas in Bangalore, both notified and informal.

Water is mostly collected either for free or Rs20-Rs50 per week, with the source being 1-3km away through taps or tankers that are by and large unreliable.

An average family of 4-6 members needs anywhere between 12-20 pots per day. (1pot=15/18 liters)
**Profile**

<table>
<thead>
<tr>
<th>Name of location</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lingarajpuram</td>
<td>Slum / Low Income / Midway</td>
</tr>
</tbody>
</table>

**Address + Landmarks/ nature of space**

Henurdepo, kacharkanhalli, lingarajpuram Bangalore. (Land once belonged to a lake)

<table>
<thead>
<tr>
<th>Total number of households</th>
<th>300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total population</td>
<td>1000-1200</td>
</tr>
</tbody>
</table>

**Infants (0-3):**

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Infants</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 15</td>
<td>100</td>
</tr>
<tr>
<td>15-30</td>
<td>200</td>
</tr>
<tr>
<td>30-50</td>
<td>300</td>
</tr>
<tr>
<td>50+</td>
<td>50</td>
</tr>
</tbody>
</table>

| Time it existed: | 12-15 years |
| Land Type and details: | half km far from Lingarajpuram toll gate, near a temple |

**People staying:** Locals/migrants (mention from which areas?)- different districts of Karnataka

<table>
<thead>
<tr>
<th>Land owner Link (if any):</th>
<th>Local Land</th>
</tr>
</thead>
<tbody>
<tr>
<td>it’s an encroached/govt land</td>
<td></td>
</tr>
</tbody>
</table>

**Type of Households?** Tents

<table>
<thead>
<tr>
<th>Size/ space details?</th>
<th>12/15 sq ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of rooms:</td>
<td>1</td>
</tr>
<tr>
<td>Wall</td>
<td>No</td>
</tr>
<tr>
<td>Roof</td>
<td>Palthin covered</td>
</tr>
<tr>
<td>Floor</td>
<td>Cement</td>
</tr>
</tbody>
</table>

**Toilet / Sanitation**

<table>
<thead>
<tr>
<th>Bath area</th>
<th>Private</th>
<th>Common</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piped into dwelling</td>
<td>Public tap/ stand tap</td>
<td>Tanker</td>
</tr>
<tr>
<td>No toilet/ open</td>
<td>Here</td>
<td>Here/ There</td>
</tr>
<tr>
<td>Basic Drains (yes/no)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Water Source:** paid/free proximity? 0.5-1 km

<table>
<thead>
<tr>
<th>Water Source Type?</th>
<th>Amr?</th>
<th>Other Gadgets</th>
<th>Lighting</th>
<th>Mobile Charging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piped into dwelling</td>
<td></td>
<td>Kerosene Rs1000/month</td>
<td>free at work place</td>
<td></td>
</tr>
</tbody>
</table>

**Energy Source Type?**

<table>
<thead>
<tr>
<th>Energy Source Type?</th>
<th>Others Gadgets</th>
<th>Amt?</th>
<th>Kerosene Rs1000/month</th>
<th>Amt?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lighting</td>
<td>Kerosene Rs1000/month</td>
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<td></td>
<td></td>
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**Mobile Charging Free at work place**

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<th>Amt?</th>
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<th>Amt?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kerosene Rs1000/month</td>
<td></td>
</tr>
</tbody>
</table>

**Cooking: Type of Fuel** Firewood

<table>
<thead>
<tr>
<th>Cost:</th>
<th>300/ month</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Cost:</th>
<th>300-700/ month</th>
</tr>
</thead>
</table>

**Education Literacy Level**

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>200 literacy, few 10th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grades</td>
<td>Gollapudi school near the slum</td>
</tr>
</tbody>
</table>

**Children** Basic Reading writing, some are below 5th class

<table>
<thead>
<tr>
<th>Barriers</th>
<th>&gt;no support from parents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&gt;interest level low</td>
</tr>
</tbody>
</table>

**Type of professions?**

<table>
<thead>
<tr>
<th>Daily wage</th>
<th>Per piece rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor/ construction</td>
<td>Small businesses</td>
</tr>
</tbody>
</table>

**Average income (per household)**

<table>
<thead>
<tr>
<th>Men-200-250</th>
<th>Women-150</th>
<th>Total: 10,000/ month/ household</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>Energy</td>
<td>Groceries 1000-1500</td>
</tr>
</tbody>
</table>

**Major Expenditures**

<table>
<thead>
<tr>
<th>Health Problems (significant)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever, Cold, Cough</td>
</tr>
</tbody>
</table>

**Health:**

<table>
<thead>
<tr>
<th>Expenditure on health</th>
<th>150-200</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Most common illnesses</th>
<th>Nil</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Fever, Cold, Cough</th>
<th>Nil</th>
</tr>
</thead>
</table>
300 household in Lingrajpuram (Kachrakanhalli) on a land that once belonged to a lake have been settled in a cluster since 2006. Various occupations like contractors, laborers, cleaners, gardening etc are common here. A temple trust next to the land informally ‘allows’ the people to occupy the space. Families here are from different parts of Karnataka, hence speak mixed languages. They use kerosene and firewood as their main source of energy and fuel. Their main issues apart from energy include things like identity, water and sanitation. They use open areas as toilets and build secluded areas for bathing. The income per family is between 7,000-10,000 on an average. Every family has about 6-8 members.

The area is particularly difficult to access and understand due to heavy political influences. The environment is threatening for an outsider and takes sometime to get used to.

Local elements run the community and dictate terms and conditions although they may not own the land. The community is often seen as a vote bank and hence becomes very vulnerable in local political party disagreements. Apart from the basic problems of energy, water, sanitation there have also been social issues like domestic violence and child abuse that has been observed at various instances. Inspite of the issues, community members are

There were no other NGO’s working there when SELCO Foundation entered. Currently through the upcoming energy centres two NGO’s will be running various activities like – day care centre, evening tuitions, alcoholic anonymous etc. Efforts to get to the community have been ongoing. The Energy centre schedule to begin in May 2013 will provide access to solar home lighting systems, mobile charging and other energy services which typically enhance partner services.

Inspite day care and livelihood opportunities- the scope for impact and development remain dim as one of the biggest issues faced in Lingrajpuram is of water.

“I cant go and work because I have to take care of my children and make 6 trips each day in search of water, each of these trips take between 45min to an hour”

Water here, is connected to almost every other area of concern. However like every issue UCL began with getting to know the community and spending time with the families.

During the first step of the need assessments, conversation surrounding water would last for hours. The community does not complain or need in any way, but are open to change and discussion.

We also conducted a interactive session with 10 people (mix of men and women) from the community during which we:

> tried to understand the issues in a prioritized way (ie what are more pressing issues than others )
> Get feedback through which we can guage perceptions and assumptions

Through different activities.

“Body aches are a part of life.. Its no big deal”
Entry Point - How Was the Problem Identified?

Water was identified as a problem through conversations while profiling Lingrajpuram.
Understanding the Problem

We spoke to a sample set of 35 families during the conversations exercise. A few of the outcomes specific to Lingarajpuram are below:

- "We each take turns every day to have a bath, I get mine once a week, if I’m lucky twice”

Each family uses an average of 10-12 pots a day. There are specific fixed timings (once a week) for when they are get to collect drinking water (tap water), on other days they walk around 1km at least and collect water from different construction sites, apartments etc.

"We allocate specific colors for drinkable and non drinkable water. Its generally kept together, but everyone in the family knows the colors they can drink from.”
Online and Market Research - Community perceptions and feedback

**Product: Hippo Rollers**
Can accommodate more water and makes it easy to transport

Community Feedback
-- This will not work as it is broad and we take really narrow lanes and paths to collect water.

-- The tank will not roll like this, it is bound to get damaged considering the terrain within the slum itself. Once its been on our path way it will not survive very long

-- if we take something this fancy people may not allow us to fill from their source

**Product: Trolley**
Can accommodate more water and makes it easy to transport

Community Feedback
-- This is ok but we cannot afford the trolley.

-- Bisleri canisters are hard to source, specially ones with covers. Can we have the option of stacking our pots on it?

-- Something like a wheel barrow may also work. But it remains to be seen if it will create any issues at water sources.

**Product: Water backpack**
Can accommodate less water but is comfortable to carry

Community Feedback
-- Backpacks like this cannot hold the amount we can carry in one go (2 pots)

-- Better than backpacks are the shoulder sticks we men use, if we can get something that distributes the weight on the shoulders it may work

-- The backpack also looks expensive, we cannot afford paying for things which are for convenience sake.
Understanding the Problem

Design Brief after community feedback and interactions:

- Reduce number of trips (by increasing water capacity) (priority for them)
- Reduce stress on the body and work on ergonomics (priority for us)
- Work on products which are narrower and easily navigable
- Look at financing models/ affordable materials for the device
- The transport mechanism can also affect the source, so be aware of that
- If we can make 1-2 trips in a day instead of 5-6 it will make a huge difference
- Pots are made to be kept on the hip and head- where as men use pots mostly on their shoulders- this is very uncomfortable
- Willingness to pay for a better transport mechanism will have to be seen
- Willingness to pay if an entrepreneur delivers water to their door stop was spilt between some who said they are more than willing and some who said come what may they would not be able to pay
- Getting a tanker as a group and filling up right near your homes was not acceptable as they said people cannot coordinate and manage crowds

Concept 1

Rent a cart: Bisleri barrow
A modified small wheel barrow which can accommodate up to 4-5 bisleri 20l bottles. Changes were made to make more sturdy and maintain a better balance.

- The barrow was cut (niches) on either sides to fit in the neck of the bisleri can
- Straps are give to maintain the positions
- Extra length and castor wheels (360) provided at the back for better navigation in narrow lanes when they lift it, Front replaces for a stronger wheel for more flexibility and balance
- This is a push/pull trolley system
Community Feedback
A few people from the community tried the cart:
We could only test it at a time when very few people were home
Water was not available during the testing

People seemed to be open to it and wanted to know how much it was. The
next plan is to keep it at the energy centre for rent at Rs 3 per use to
gauge if people really need such a product.

People approved of it in terms of navigability and sturdiness and tested it
around there area.

Next Steps:
> To make it available as a rental
> To test and monitor it while people use it to get water
> To continue to get feedback and develop it

Costing and Usage
The prototype cost was Rs 3000
If 10 people use per day, for Rs 3 per use the cost will be recovered soon
It could also be used as a part time business for a small scale
entrepreneur
All damage and replacement costs will be taken care of through the rental
fee as well

Impact
This can reduce number of trips from 5/6 to 1/2
The burden of carrying the water and going through body aches is
lessened due to an easier pull or push mechanism
The rental makes it easily accessible and can filter out people who really
need it
If people can work instead of collecting water they can earn more and
afford to pay for the 3rupees per trip
The whole thing will be available as a set so they don’t have to source
bisleri bottles with covers
Rent a cart: Tank Trolley
The first bisleri barrow was designed so that they would not have too much trouble at the source while collecting and can fill bisleri bottles with without any objections.
A tank type model like this would make it easier to fill and unload/offload the water.

> A tap was added to an existing medium sized tank along with a trolley
> The trolley is an existing luggage trolley that has been modified to fit the tank and strap it in place
> Currently existing wheels have been used, however the wheels will need to be replaced by stronger, thicker ones
> This works only with a push mechanism
> Filling and offloading water would be done with a pipe that comes along with the tank trolley
This was a rough prototype with existing parts to see if it would work conceptually.

Costing and Usage
The prototype cost was around Rs 2000
If 10 people use per day, for Rs 3 per use the cost will be recovered soon
It could also be used as a part time business for a small scale entrepreneur.

The impact potential is same as the bisleri barrow.

Challenges (for Bisleri barrow + Tank trolley)
The reactions towards this type of a product at the source is still to be seen
In case of damages or misplacement (weak points are the tap and the Bisleri covers) these will be difficult to service/replace immediately
The rental model could be misused and will have to be based on trust or a refundable deposit.
Concept 2

Shoulder Supported water carrier
A contraption that would help carry double the amount of water in trip with ease

> To test the concept initially we used metal and developed the basic shape of the model
> The final prototype will need to developed in cloth/softer lighter materials
> Initially we worked on the idea that they can used the existing pots
> Pots can be easily hooked onto the device which sits snug on your shoulders
> The first prototype is only for the purpose of explaining the concept and getting feedback from the users

> Ergonomically this was not a strong prototype as a few pain points were identified in the first test- the foam added good support and comfort

1st test and community feedback
Make the 'u' shape that fits on the shoulder more flexible
It is difficult to walk fast in this as the pots obstruct the movement of hands and legs (if we use pots in this way- we try and keep them away from the body so we can walk easily)
Make the string adjustable

Next steps
> To incorporate user feedback and work on 2nd round of prototyping
> To develop an alternate water carrier which fits around the body, a leather bag or a tarp holder (something that can replace pots and carry a lot more water.)
CASE STUDY 2: TUBRAHALLI
<table>
<thead>
<tr>
<th>Profile</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kundanhalli gate, Tubrahalli</td>
<td>Slum / Low Income / Midway</td>
</tr>
<tr>
<td><strong>Landmarks/ nature of space</strong></td>
<td></td>
</tr>
<tr>
<td>Open Land surrounded by apartments</td>
<td></td>
</tr>
<tr>
<td><strong>Total number of households</strong></td>
<td>150</td>
</tr>
<tr>
<td><strong>Average size of families</strong></td>
<td>5-6</td>
</tr>
<tr>
<td><strong>Infants (0-3)</strong>:</td>
<td>150</td>
</tr>
<tr>
<td><strong>&lt; 15</strong>:</td>
<td>100</td>
</tr>
<tr>
<td><strong>15-30</strong>:</td>
<td>350</td>
</tr>
<tr>
<td><strong>30-50</strong>:</td>
<td>350</td>
</tr>
<tr>
<td><strong>50+</strong>:</td>
<td>150</td>
</tr>
<tr>
<td><strong>Time its existed</strong>:</td>
<td>15 years</td>
</tr>
<tr>
<td><strong>People staying</strong>: Locals/ migrants (mention from which areas?)- Gulbarga, khedgaon, deodurga and A.P.</td>
<td></td>
</tr>
<tr>
<td><strong>Land owner Link (if any)</strong>: nursappa stays near the slum</td>
<td></td>
</tr>
<tr>
<td><strong>Households</strong>: Leased &amp; Rented</td>
<td>Owned</td>
</tr>
<tr>
<td><strong>Amt?</strong></td>
<td><strong>Rent? Rs 200</strong></td>
</tr>
<tr>
<td><strong>On a scale of 1-10 how temporary/ permanent?</strong></td>
<td>7 (10 months in Blore, 2 months in Village)</td>
</tr>
<tr>
<td><strong>Type of Households? Tents</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Size/ space details?</strong></td>
<td>12/15 sq. ft</td>
</tr>
<tr>
<td><strong>Wall</strong></td>
<td>No</td>
</tr>
<tr>
<td><strong>Roof</strong></td>
<td>Palithin covered</td>
</tr>
<tr>
<td><strong>Floor</strong></td>
<td>Cement</td>
</tr>
<tr>
<td><strong>Toilet / Sanitation</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Bath area</strong></td>
<td>Private</td>
</tr>
<tr>
<td><strong>Common</strong></td>
<td></td>
</tr>
<tr>
<td><strong>No toilet/ open</strong></td>
<td>Basic Drains (yes/no)</td>
</tr>
<tr>
<td><strong>Water Source</strong>: paid/ free proximity? Half km</td>
<td>Piped into dwelling</td>
</tr>
<tr>
<td><strong>Public tap/ private tap</strong></td>
<td>Tanker</td>
</tr>
<tr>
<td><strong>Drinking water? no</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Energy Source</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Type?</strong></td>
<td>Lighting</td>
</tr>
<tr>
<td><strong>Kerosene Rs200/ month</strong></td>
<td>Mobile Charging</td>
</tr>
<tr>
<td><strong>Close by shop/ workplace</strong></td>
<td>Rs 5/charge or free at workplace</td>
</tr>
<tr>
<td><strong>Needs (if any)</strong></td>
<td>water with in their community</td>
</tr>
<tr>
<td><strong>Cooking: Type of Fuel- Firewood Cost: 300/ month</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Type of food</strong>: Roti, Rice, Curry, Sambar, Sabji</td>
<td></td>
</tr>
<tr>
<td><strong>Cost: 6000-7000/ month</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Literacy Level</strong>: Opportunity schools are in 1 km distance from the slum</td>
<td>Adults most-0 literacy, few- bellow 10th</td>
</tr>
<tr>
<td><strong>Children</strong></td>
<td>Basic Reading writing, some are bellow 5th class</td>
</tr>
<tr>
<td><strong>Barriers</strong></td>
<td>&gt;financial issues in family</td>
</tr>
<tr>
<td><strong>&gt;no support from parents</strong></td>
<td>&gt;interest level low</td>
</tr>
<tr>
<td><strong>Type of professions? Specific jobs (predominant)</strong></td>
<td>Daily wage</td>
</tr>
<tr>
<td><strong>Labor/ construction</strong></td>
<td>Salaried</td>
</tr>
<tr>
<td><strong>Per piece rate</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Small businesses</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Average income (per household)</strong></td>
<td>Men-200-250</td>
</tr>
<tr>
<td><strong>Women- 150</strong></td>
<td>Total: 10,000- 12,000/ household</td>
</tr>
<tr>
<td><strong>Major Expenditures</strong></td>
<td>Rent 200</td>
</tr>
<tr>
<td><strong>Health: Expenditure on health</strong></td>
<td>150-200</td>
</tr>
<tr>
<td><strong>Most common illnesses</strong></td>
<td>Fever, Cold, Cough</td>
</tr>
</tbody>
</table>
Tubrahalli is a temporary settlement consisting of Kaccha houses—built using a few hollow blocks, mud, wooden poles and tarpaulin sheet/flex banners. Even for these houses they pay a rent of 200–400 based on the surface area their house occupy. Location of the community can be pointed as open space behind Shriram Samruddi Apartment on Varthur Main Road in Bangalore (near Kundalahalli Gate). Most of the members in this community are migrants from north Karnataka (Districts like Gulbarga, Yadgir, Raichur, Bellary) who have come here in search of jobs that can add to their income source and this has probably helped them in below ways—

1. Clear loans (Cause of loan seem to be marriages/health issues/natural disasters leading no income through agriculture)

2. To support Agriculture activities in their native place (to buy seeds, fertilizers, etc)

3. Some back home have huge families while little land. So migration add to the income generation of whole family while other take care of land in native place

4. Most make sure to tune their work time here, with agriculture season - to grow some crops which require less human intervention and they would make very short visits during sowing, maintenance time and for harvesting and they continue to work in Bangalore as well. Even in this case it is added income source.

Most men work as Construction labourers (helpers), Carpenters, Tile laying workers, masons, Security Guards, Office boys, showroom sales men and others. Men working in construction related work get a daily payment of Rs 350 to 500 based on their experience and expertise. Payments happen on weekly basis. Also such men are observed as those who are without any literacy or very less education (Primary education). While Security Guards and other office related workers get a monthly payment of around Rs 7000–10000. These men seem to have an education of at least high school till 12th standard (second PU). We did come across some youngsters who are doing some correspondence degree courses as well.

Women work as construction helpers as well. They get a payment of 200–250 again based on their strength. Some women work as house maids in nearby apartments. They get a monthly payment of 800–1500 per month per house. Each work in minimum of 3 – 4 houses. There are a few women who go to offices /malls for housekeeping. Their approximate monthly salary seem to be Rs 6000. Pregnant women go to work as well till the 6th month of their pregnancy. Mothers with young children (less than 3 years) avoid going to work unless they have elder children or aged parents to look after the small kids. Some women do carry their children to the work place as well.

Schooling of children aged between 6 – 14 seems to be good, as most are enrolled in nearby government primary and high schools. Also there is a good chunk of children aged between 6 – 12 who are not attending government schools due to reasons like—taking care of home, lack of interest, taking care of siblings, helping mother, etc—many such children are enrolled in Tent School run by GMRVF and SSA. There are quite a few teenage girls who have discontinued their studies and are assisting their mothers/taking care of home independently. A good chunk of boys aged between 15 to 17 are working just like their adults (any of the jobs mentioned above for men).

Part of this community uses an Energy center (Run by SELCO Foundation) which provides Lanterns for 60 houses of this community at a cost of Rs 5 per day (Rs 150 per month). Those families who are not using lanterns use kerosene lamps for lighting and they spend anywhere between Rs 150–200 per month.

To add a point on expenditure a family of 5(2 Adults + 3 kids) spend around Rs 1500 per week on Cooking materials and Rs 150 per week on firewood. Mobile Charging happens in their workplace (free) or in nearby shops at Rs 5 per charging. Also there are expenses like travelling to their native(Rs 500 per person for each travel), On an average we can say Rs 50 per month per person hospital expenditure (need to validate this), hospital deliveries of pregnant
women costs them Rs 5000 to 8000 while there are still lot many cases of home deliveries happening as well, house modification costs them approximately Rs 600 per year (on sheet mostly) [many are good in reusing flex banners and other materials]. Open defecation is prevalent as there are no sanitation facilities. For bathing most have built a small area covered by tarpaulin again, just outside their houses. The slum has migrant workers pre-dominantly from North Karnataka and across all religions. We at Urban Community Labs during the formation of the Lab had decided that first few months the approach would be the community approach. The community approach can be a relative term but the basic understanding was that no solution would be offered to the community or an indicator to any problem of theirs. The idea being that if they understand the genesis of their problems and come together to solve the problems then there will be ownership, long term solutions and less dependency on multiple NGO’s/ governmental bodies.

**Entry Point - How Was the Problem Identified?**

Providing service of a Doctor weekly once in the Tent School was used as an entry point to establish trust and engage with the community. Idea was -- Once we get a rapport with the community we would make more regular visits to understand their lives much better and to find out how can we add value in their lives just by empowering them From the inception of UCL one thing was very clear that the Community Wing would not identify the problems and solve on behalf of the community. The problem had to be identified and presented by the community and there should be willingness to solve the problems.

**The Approach – Community engagement**

Community participation in its purest form probably means deep listening to the community and letting them guide our next course of action, all along believing that we cannot and should not give them what they do not feel the need for This approach needs to begin with a great sense of respect for the community and their reasons even if we do not fully relate to it or understand it It also means that we may need to let go of wanting to "help" or “give” or “save” people and instead letting them learn and develop the confidence to face their challenges themselves This might mean that we consciously take the brick bats for not hand-holding or giving ready-made (read “forced”) solutions even when we see problems which we feel we should step in and solve on their behalf. However, in case of emergency issues, we might need to step in and help without waiting to “empower” them as the patient might not be in a position to help himself/herself The approach requires us to be involved closely with the community. Only then, will we fully understand the problems that we are trying to address. A distant view will only give us a superficial understanding leading to wrong or short term solutions.
The first form of community engagement was the weekly doctor service provided by Doctors for Seva, this gave us an opportunity to interact with the community as healthcare was a much needed intervention in the area. There was a greater dominance of women and children who availed the free medical services. As the patients waited for the doctors intervention, it provided us with an opportunity to build a rapport with the women and understand their problems both health related and domestic issues faced. Though the patients came for the generic cold, cough, stomach pain, eye issues but there was a constant complain of body ache and a similar problems was observed in the young children living in the community. One of the 'probable reasons' we thought for these body aches is “Water Transportation” because those women who complained of body aches did carry a lot of water from long distance. Thus we shifted our focus on understanding water accessibility as an issue.

The Observations were:
Body Pain at various joints of women waist, shoulders etc.;
Collection of Water: The residents do not have any water facility which means there is no borewell, no piping or water tank. The water has to be collected from the closest government water tank which is approximately 1km-1.5km.
The other way is to get the water from water tractors and water tanks.
Body pain for children
The problem of water transportation was pre-dominantly faced by women
Most men acknowledged it as a problem but not a serious one. It seemed like a minor physical strain and a part and parcel of life which they did not seem to mind. The idea of a convenient setting enthused them but was difficult to gauge the extent.
Also from a UCL perspective it was very important note that an 'Entry Point' is very important which gives the Lab a reason to enter the community multiple times to build a rapport. The down side to this could be if the service is free like in the case of Medical services the community might expect the same as it was observed with some residents.

There are two groups who access water differently. 1- through their employer, 2- through unreliable sources.
### Groups with the Maestri (Water Access 1)

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-60 households (number may vary based on travel to native etc.)</td>
</tr>
<tr>
<td>These groups are formed based on the working profile and the water is arranged by the maestri</td>
</tr>
<tr>
<td>The Maestri arranges for the water once in 2 days. The size of tanker is generally 3000 liters</td>
</tr>
<tr>
<td>There is no storage mechanism (except for a few households)</td>
</tr>
</tbody>
</table>

**Water Access 1:**
There are 3 to 4 groups (each group having 10 – 12 households) who buy water through water suppliers at a price of Rs 300 for 3000 liters (each group ordered for their separate water tankers). This money is paid by the manager of this group (this is not deducted from their salaries/payments). They would order for these tankers once in two days. Other than storing in their houses (in the form of buckets, pots, etc.), some groups built a cement tank of their own (near to their houses) which is also filled by tanker water. This cement tank is largely unused for the past 3 months was used scarcely and was between Rs 2000 – 3000. Some had tried using Syntex tanks for water storage but they had started leaking and were left unused after that which indicates maintenance is an issue and the groups are reluctant to get it fixed. However, none of these groups used this water for drinking as they didn’t trust the source of this water. One more reason for getting water tank built by these groups is – some of these groups do go away for a work in relatively faraway place (to stay back or sometimes involves early morning travels and late arrival) and they don’t want their families to have water shortage when men from the houses have gone for work.

### Individual Households (Water Access 2)

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approximately 90-110 households collect the water individually</td>
</tr>
<tr>
<td>The water is collected from a government water tank, which has a bore well-constructed which is 1km-1.5km, with recent construction around the slum the distance is approximately 2.5km-3 km.</td>
</tr>
<tr>
<td>The collection timings for most of the households is 3.00 a.m - 7.00 a.m. Generally it’s the men who collect the water at this time of the day</td>
</tr>
<tr>
<td>The reason for such erratic timing is that of social conflicts with the people residing near the water tank who feel a strong sense of ownership to the tank and do not allow ‘outsiders’</td>
</tr>
<tr>
<td>Children or women collect water during the noon or evening</td>
</tr>
<tr>
<td>At any time a person can only carry 2 buckets/pots which vary in size. It could be anywhere between 10litres to 15litres</td>
</tr>
</tbody>
</table>

**Water Access 2:**
Other households have 3 water sources:
A public tank which is around 1km away.
Any nearby house/apartment those are willing to provide water. They used this option when the 1 option fails. (500 – 800 metres)
When both the above options fail they do go to households/public tank in nearby village called Tubrahalli (1 to 1.5 km)
Men, Women and Children – everybody carried water from these sources. Even the groups which buy water do use these water sources for drinking water. Other than distance and thereby burden of load, other issues in accessing water from these sources were:
To avoid any altercations with the local residents/owners most got water in odd hours like 3 am, 4 am, etc.
The community has a minimal influence on accessing water whiles the local residents near to tank or owners of houses/apartments had a strong say in letting these people access water.
Women would undergo some harassments at times as well
Children many a times skip classes to get water.
Water availability depended a lot on power as well (especially in public tanker)
There is always a question over availability as well owing various reason mentioned which did cause considerable strain (though we might not accept it and might say they have accepted it, But lot of their decisions are related to instability/volatility in their existence)
Considerable time of 1 to 2 hr is spent on this to get on an average 10 pots. During some peak traffic time, they may lose one hour in getting 2 pots of water.
Even pregnant women and mother with young children also carried water from long distance

Major problems faced

During casual interactions asking people what issues they face here, there were answers saying "Apart from water, there is no other issue". This made it seem like the community would not be ready for any other intervention or to even think of any other until water got out of their minds

While talking about Sanitation, hygiene and hence need for toilets, again Water came up as a big reason why they said toilets won't work until water problem was sorted out

People from low-income homes near the public water tap creating conflicts and abusing those from slums who come to collect water at the same place. In some cases, it felt unsafe for women/girls to go collect water due to harassment from other men near the public tap

Paths taken by community members to access water
Entrepreneur Model | Community Model
--- | ---
Excessive Dependence on an individual for basic necessity like water | No Dependence on individual, it will be a community decision
During Water Scarcity could lead to exploitation | Getting a consistent group to stick together is a challenge in this community
Ease in Decision Making since it’s a business model | Multiple decision makers will require excessive co-ordination
The cost will increase if the entrepreneur has to make profits. | Will only increase if cost of buying tanker goes up.

Community Meetings and Identifying Potential Natural Leaders:

Community model – the approach we tried was a time consuming process as it required us to understand the dynamics of the community the internal conflicts, the natural leaders, the forced leaders, the opinion makers, the religious tension etc.;

< This was our understanding of the models

Although we were open to an Entrepreneur model the community approach was the first push made. Decisions on the type of model can be taken only through community meets. Our efforts to have a community meet with a good gathering failed several times. But we did realize soon that this particular community needed a real incentive to come to community meet (as it wasn’t a part of their culture). Thus it requires a real push or a topic of their real interest to have such meetings. This made us to think was water not such an important issue for them? It is an important issue but they are used to their routine and most of them are not thus enthusiastic to solve it with vigor. Only a few old men/women, single mothers, women who are physically weak – were interested in getting this issue resolved. We did conduct two meetings with a good gathering and discussed the various possibilities to resolve the issues around water accessibility. Though they understood the possibility of community model there was some amount of reluctance in coming together and making some decisions. There were lots of inhibitions among themselves in taking initiatives. We decided we will get the tanker ourselves for a few days and once they see the possibility perhaps they will come together strongly and make the community model work. We got water tanker for two days and the community availed water as well. In the community meet held after this, the enthusiasm was better among community. But still there were same inhibitions present. Added to this a person who holds a relatively stronger opinion played spoil sport by insisting only entrepreneur model will work and community model can't work. As of now we have left there as we want to see is there a way we can make sure people come together to try community model.

To look at this as entrepreneur model v/s community model would be very wrong. Any model would work as long as it is well accepted by the community and people should voice their opinions strongly in such decisions around model. It should be a participatory process and active citizenship.
Learning’s from the approach

I. To build cohesion among a good group is quite difficult to ensure community model works. Time and again we hear from the people of the same community that – “people here are not ready to work together. It is difficult to get money from them”

II. The above point may be contested based on the available groups who are sourcing water through common tank. But they are knit together by a dependency on a common a manager (maestri). Unless such a reason exists it is hard, but not impossible, to get the community work together.

III. There is a good amount of risk involved if we let one person from the community carry out various business/tasks related to community. That person starts becoming a single point of contact for various organizations coming in and many of his/her personal ideas start getting floated instead of getting clear picture of community of opinion.

IV. There are good amount of leaders available within the community. This is reflected in the fact that they took initiatives like getting voter id cards to the community members and conducting various festivals like kannada rajyotsava, ganesha festival and others.

V. However it takes time to groom them and make them think better on the lines of community development. Though some of them might come together for a short term, it is difficult to find a person who can consistently put together certain for the sake of community. Where and how will they find the time in between continuous days of work? Their main purpose of being in urban place is to earn money!

VI. If not one person it is possible to make them take a collective responsibility. This would require intense and continuous engagement from us.

Pilots (to gauge feasibility of community / entrepreneur model):

First day:
1. Water tanker person came in at 7 15 after waiting for more than an hour on that day and in spite of committing on previous day he had not shown up as well.
2. Though the community was informed earlier, we had to go once again to inform them and after about ten minutes they slowly started coming.
3. Over a period of 1 hour 30 minutes 152 pots of water were collected by 28 different families. Approximately 10 pots of water was lost due to wastage and 30 were left unused in the tanker as he couldn’t wait further.
4. Cost of this tanker was 300 rupees and it has 4500 liters of water. He is the same guy who supplies water maestri groups in this community.

Second day:
1. A different tanker had to be called as the previous guy was not ready to wait that long. Even this guy came at 7 45 am though he had committed for 6 30 AM
2. People came on their own and 28 families collected 185 pots of water and approximately 20 pots of water was lost as wastage.
3. Cost of this tanker was 400 rupees and it had 5000 liters of water.
Next Steps (Lingrajpuram and Tubrahalli)

Two different approaches were initiated in similar slum communities: Both approaches were driven by community responses and needs. Both case studies have follow up work to determine which approach we can replicate for which type of community.

Lingrajpuram Conclusions

1. Co designing as a approach is also a time consuming processes which takes multiple efforts and may be inconclusive at times

2. As of now there has been sufficient interest from people to take the concepts/ project forward

3. The barriers are not the community or the approach but the elements around the lingrajpuram community that are self proclaimed local leaders

Tubrahalli Conclusions

1. Tanker people will not wait unless there is a storage mechanism and they are not going to maintain appropriate time.

2. As of now we have paid the money and when we did refer we are going to charge them for water there was willingness to pay among community. Some came forward to pay then and there.

3. Going by the current experience we can say for entrepreneur model we may have to charge at least 2 rupees per pot ( considering first day costing). If it has to be community model then not more than 10 people group would do well as each house would require 10 pots per day at least and they can tanker once in 3 days. Also each group will have to build the storage space.

4. The barriers are not willingness to pay/ what type of business/community model- but the key lies in ownership- who will take responsibility and for what reasons.
PART 2: WATER AS A SMALL SCALE BUSINESS
“Water transporters” are men deliver pots of water to underserved business, households and small institutes. The sell water on a per pot basis and earn their livelihood. We identified over 50 of these businessmen in this area itself. Many have been doing this to decades and have educated their children, bought homes, and run households through this business over the years.

The area covered is a radius of 6-7 km. The business is fairly straightforward:
- He invests in a cycle and 12 pots
- He fills the water at a far away free source
- Carries it to the customers who pay Rs3-4 per pot
- Does this until he makes between 200-300 per day

The business was identified during profiling and community engagement in Tannery road (a low income household area which was once the biggest slum in Asia)

While observing- What prompted us to understand this business further was the effort we saw it needed and the struggle that men (mostly older) faced just while loading and transporting.

Through observations and initial conversations:
- Pain points identified
  - Have to pull cycles with up to 200kgs of load over long distances
  - Sell it for petty rates, sometimes even on credit
  - A lot of them are too old, they resort to water delivery thinking it’s the only way of earning their livelihood.
  - Cars and autos ram into their cycles leaving them with heavy repair expenses

Basic features:
- Accessing Water- Finding a reliable source they can fill from every day
- Work Timings- Because people in the area around the tap fill during the day, they have to make sure the don’t disrupt the locality schedule and work around that
- Loading and offloading is laborious task that cannot be avoided
- They usually have fixed routes and fixed customers (a minimum number per day) everyday
- They cannot use the cycle as a cycle once its loaded it becomes a push cart (they only buy a cycle because of its resale value)
A,E,I,O,U Analysis

**ACTIVITY**
- Filling water
- Loading pots
- Pushing cycle
- Managing traffic
- Delivery
- Cycle back
- Repeat.

**ENVIRONMENT**
- Uneven narrow roads
- Public tap areas
- Heavy traffic

**INTERACTION**
- Hotel owners
- Residents
- Co workers
- Tap owners
- Government officials
- Hardware shop
- Cycle shops
- Repair shops

**OBJECTS**
- Cycles
- Plastic pots
- Ropes
- Hooks
- Electric tape
- Plastic sheets
- Pipes and taps
Excerpts from the conversations

“We set our prices according to the distance. It starts from Rs. 3-4 per pot over a distance of 1-2 kms and goes up to Rs.7-8 over 7-8 kms. “

“The reckless auto drivers just ram into us and the pots break instantly. They are neither apologetic nor helpful, leaving us with the repair expenses. We wish the containers were more sturdy”

“We need to take the water up two floors at times to empty the pots into the tanks because the owners refuse to do it”

“Most of us have permanent customers. We receive a call from them and we go and deliver. “

“There are times when the consumers don’t have money at all to pay. We have also given it for free at times. During other times we also give water on credit.”

“Pain is inevitable, we have to do something to earn our livelihood.”

Problems faced by the community

Up to 200 kg weight
Pulling a weight of up to 200 kg for a distance of 5-10 kms. This posture causes chest pain and breathlessness. Weakening knees, shoulders and legs.

Regular intake of pain killers
Navigating through traffic + bumpy, unsteady roads
They have to navigate through busy roads and narrow lanes, therefore a cycle occupying minimum space seems like the most feasible option despite of the discomfort.

Uncertain repair costs
The plastic pots need to be replaced every two months. The cost of a new pot is between Rs. 50-70 depending on the quality.
The business - Financials

Total investment: Rs 3000 (approx)
2000 (cycle)
600 (Rs 50 x12 pots)
300 (Rope, plastic, tape, elastic, hooks)

Recurring costs
Rs 300-400/ month (for wheel repairs/ pot replacements/ small fixing and mending)

Total earning
They make 5-6 trips
Approximate 30-40 rupees per trip

They sell each pot for Rs2,3 or 4 depending on distance and customer

“This business has no future, I don’t know when it can shut down- tomorrow even or after 10 years- we cannot say”

“We don’t keep an account on doctors and pain killers bill, many of us have met with accidents – and have had to undergo surgeries/operations also .. But these things cannot come in the way... we have to earn for a living”
<table>
<thead>
<tr>
<th>Product: Aquaduct</th>
<th>Product: Storage cycles</th>
<th>Product: Jaldooth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can accommodate more water and makes it easy to transport</td>
<td>Can accommodate more water and makes it easy to transport</td>
<td>Purified drinking water on a rikshaw</td>
</tr>
</tbody>
</table>

Community Feedback:
- It looks very expensive and it doesn’t look like it can hold too many liters, I will not be able to hang more bingis also on this.
- It does look comfortable, but that’s not a priority.
- If we know how much it was and we can try it, we will consider it.

Community Feedback:
- This is too broad and we can’t navigate through traffic. Maximum 2-2.5 feet width is navigable.
- These type of cycles are very difficult to ride, not meant to up slope and down slope - they don’t do very well when time is an issue for us.
- There will be more repair cost and resale value is less.

Community Feedback:
- People will not pay more for clean drinking water. Everyone drinks the tap water we provide.
- This is a big business investment and if people start getting water supply we will have nothing left.
Understanding the Problem

Design Brief after community feedback and interactions:

> Reduce number of trips (by increasing water capacity) (priority for them)
> Reduce stress on the body and work on ergonomics (priority for us)
> Work on products which are narrower and easily navigable
> Look at financing models/affordable materials for the device
> Make carrying, loading and offloading easier
> Preferably has to have a good resale value whenever they decide to discontinue

Concept 1

Transporter
An added fitting for a cycle that can hold more than 300l of water (1.5 times what they currently carry
> This 2.5 feet extension is made to fit on an existing bicycle
> Easy to pull/push and ride as and how needed

Community feedback and Next steps
Locally build a prototype and get a transporter to use it and then give feedback (they aren’t able to commit with a sketch but they say it looks positive)
There may be a resistance shifting to cans (but this trade off has a huge benefit of stackability)