DECENTRALIZED URBAN SANITATION
a proposal for Savda Ghevra resettlement colony, Delhi

A Project in partnership between Centre for Urban and Region Excellence (CURE) and Julia King (PhD Candidate and Architect, Architecture for Rapid Change and Scarce Resources (ARCSR), London Metropolitan University)
As part of wider research to promote the implementation of low cost infrastructural interventions in Savda Ghevra (SG), a resettlement colony located on the western fringe of Delhi [Figure], this project looks at sanitation improvements and the design criteria behind a decentralised communal sanitation proposal.

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1 Since the 1990’s the prevalent strategy for dealing with illegal/squatter settlements by the Government of Delhi has been a “three-pronged strategy”: relocation to resettlement colonies, in-situ up gradation and slum improvement which is seen as an interim measure. The relocation to resettlement colonies in the rural-urban fringe of Delhi is financial viable for the state because of soaring land prices in the capital following aggressive regeneration on the back of the Commonwealth Games in 2010 and other ‘beautification’ projects. The cost benefit to the state is at the expense of those relocated households who face little to no civic amenities, the cost for rebuilding their homes, the acquisition of the lease, income loss, and additional travel costs.
INTRODUCTION
Settlement Characteristics

When fully occupied, SG will most likely be the biggest resettlement colony in Delhi; home to more than 20,000 families relocated from slums in the city centre and on city's development corridors. There are currently about 8500 families with 42,500 people living in plots allocated by the Municipal Corporation of Delhi (MCD). The resettlement of Savda Ghevra does not involve housing but simple relocation on plots allocated on the basis of eligibility; 18 square meters to squatter families who could prove, on the basis of their ration and voter card, to have lived in Delhi pre-1990, and 12.5 square meters to families possessing ration cards post January 1990 up to December 1998. The plots are arranged linearly and are contiguous on three sides with neighbouring properties resulting in an urbanity of regularity in contrast to the spontaneous traditional development associated with illegal slums. [Image top and bottom]. These patterns are a response in part to the landscape and established ways of building but also a response to existing infrastructure and physical boundaries.

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INTRODUCTION
Local Construction Types

In Savda Ghevra (SG) although the state has granted land titles\(^3\) which has encouraged the investment into building homes the use of good quality construction only represents 12% of the housing stock and 95% of homes are single storey\(^4\). Houses made of concrete and load-bearing brick walls are classified as pucca; if the walls are brick but the roof is corrugated sheeting the house is classified as semi-pucca; and houses with both temporary materials for walls and roof are classified as kucha. [Figure] Pucca houses have rudimentary plumbing fixtures with most washing occurring in the street or ‘wet rooms’ which are used for bathing and washing clothes and utensils.

<table>
<thead>
<tr>
<th>KUCHCHA 1 STOREY</th>
<th>KUCHCHA 1 STOREY</th>
<th>KUCHCHA 1 STOREY</th>
<th>PUKKA 1 STOREY</th>
<th>PUKKA 1.5 STOREY</th>
<th>PUKKA 2 STOREY</th>
<th>PUKKA 2.5 STOREY</th>
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<td>Estimated cost</td>
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<td>1500 - 2000 Rs.</td>
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<td>45 - 50,000 Rs.</td>
<td>100,000 Rs.</td>
<td>130,000 Rs.</td>
<td>150,000 Rs.</td>
<td>200,000 Rs.</td>
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<tr>
<td>A cheap basic shelter using mainly reclaimed and low cost materials.</td>
<td>A basic dry brick structure and CGI roof. A bamboo structure can be seen in front which is a type of outdoor toilet.</td>
<td>This house has been plastered which adds cost and also has sturdy door and window grill. The CGI roof means you can not put anything on the roof such as outdoor sleeping during the summer months and a water tank.</td>
<td>This house marks the transition stage where the roof is capable of taking another floor. Many houses at this stage have put staircases in place for the next stage.</td>
<td>This house has not put a toilet in their home preferring to use the ground floor as a shop and the 1st floor as their living space. A typical addition now would be to include a toilet on the 1st floor and live on a second floor.</td>
<td>This house has done a typical 1st floor toilet with a cesspit underneath the ground floor shop. As space will be tight with washing, cooking and sleeping happening on the 1st floor they will be looking to add soon.</td>
<td>Reaching the upper spectrum of incremental development this house offers enough living, work and sanitation (toilet).</td>
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</tbody>
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Figure (top) Typical Stages of Incremental Housing Source: Julia King (2010)

\(^3\) The land titles have been allocated on a ten year lease – based on resident and local NGO interviews the length of the lease is not a worry to local residents as there has never been a precedent for the state revoking a lease from a resettlement colony.

\(^4\) CURE report. “Sanjha Prayas: Bhagidari with the Poor” 2010
The plots are arranged along a 3 to 4m wide street or gali with open an concrete drainage channel which runs along either side of the streets in front of the houses. [Figure and Image]

These drains are intended to move sullage (grey water) which is all household waste except waste water from toilets (blackwater). However, this is compromised by the high rate of open defecation on site and the increased practice of private cesspits and septic tanks that discharge into these drains. There is currently no provision for piped water to the houses with most of the population relying on tanked water for drinking stored within the home. Water is mostly hand carried into the home but there are sufficient amounts for pour-flushing systems. The MCD has provided 23 community hand pumps which serve approximately 20% of the population’s general purpose needs. The pumped water is not used for drinking it unsafe.
During community consultation in March 2010 with CURE (Centre for Urban and Regional Excellence), a Development NGO that works in SG to improve access to basic services, the provision of toilets was the item of most concern to a group of 30+ members of ‘A Block’ from a list of concerns including: water, transport, jobs, health, education, ration cards, roads, drainage, and waste. This report presents a decentralized sanitation project in SG based on the need for improvement in the area.

6 18 housing blocks fit within the site grid and are arranged in either north/south or east/west rows. Smaller roads bound the blocks and narrow streets 4m wide divide the rows of houses. Across the whole of the site approximately 20% of the plots are either built upon or under construction. Blocks A, B, C and M are largely built. Blocks D, G, H, L and N are partly built and Blocks E, F, I, J, K, P, O, R, and S remain un-built.
In the case of Savda Ghevra any conventional sewerage is out of the question as there is no infrastructure for this and the cost would be too high in any case. When considering the low-cost options Savda Ghevra poses an interesting challenge in terms of future proofing as it is currently on the outskirts of the city immediately surrounded by fields [Image 5]. The result is something that from the outside looks peri-urban but within the boundaries of settled blocks has a high urban density ratio (168 people / hectare). Furthermore because of its locality close to a metro station (Mundka, 7km away) which will be extended to serve further housing projected in the area, Savda Ghevra, in the very near future will become engulfed by a city which is urbanizing rapidly. This has already been incorporate into the Delhi Masterplan for 2021 [Figure 5].

This means that any intervention now needs to be able to accommodate rapid urban change with scarce resources. This change is to a large extent determined by the MCD masterplan for the area.
Another important feature of Savda Ghevra is that the housing stock is not uniform. Housing in SG is developing over time, incrementally, meaning that the retrofitting of services requires a careful diagnostic survey of the existing fabric followed by ‘conservative surgery’ which maintains the familiar physical fabric with its emerging cultural capital whilst at the same time bringing the emancipatory benefits of internal sanitation. The key factor which governs the choice of internal sanitation method is the [debilitating] size of the residential plots: either 18 sq m or 12.5 sqm which are in most cases 100% occupied. These plot sizes are both too small to contain, within that plot space, any form of effluent treatment in the form of a latrine, pit, or tank. This means that although individual internal toilets (which is the deserved aspiration for the residents of SG) can be provided, the treatment of the effluent must be outside the plot boundary and therefore most appropriately communal.
Individual toilets with effluent treated collectively

Affordable and replicable throughout the site

Future proof in regards to the MCD masterplan

Managed, built and run by the community

Use local labour, skills, materials where possible

Develop urban model for low cost decentralized sanitation systems

Encourage ownership and promote health living environment

Provide simple buildable instructions
We are working with A Block to the north of the site. Although there is currently lots of empty space the only space that in the long term will remain empty are the many parks scattered around the site. In the example of Block A there are three parks that can be used.
The following pages highlight the key features of the site. This page shows the storm drains (2ft w x 2ft d) which run around the perimeter of A Block and connect at the two corners with the nullah north of the block.
PILOT PROJECT

The Site: Small street drains

The larger storm drains are fed by incomplete small drains that run along both sides of the galis. As part of the project it is important to integrate greywater removal by either incorporating it into a new system or repair and extend the existing open drain channels.
As mentioned the location for treating the effluent is proposed as the park spaces. For the pilot project we propose to demonstrate how this would work with the park at the centre of the site which address certain complexities in other areas - thus making the scheme replicable.
This diagram outlines the basic components of the project into 4 stages: the house, the intermediary chamber between septic tank and house, the septic tank and finally a disposal system. Because of the high water table in the area and the lack of any drains in the area which we can connect into the effluent will run through (3) a root zone (DEWAT). The design incorporates a UFA filter for secondary treatment of the septic tank effluent. It is a submerged filter with stone grit media where effluent from septic tank is introduced from the bottom. The microbial growth/plants are retained on the stone media for efficient digestion of effluent. About 70% B.O.D. (Biological oxygen demand) of the incoming effluent is reduced through UFA filter. The outgoing effluent is clear and free from bad smell. This secondary treatment has a little sludge production and low per capita operational cost. The outlet from the DEWAT can be re-use for a variety of purposes including construction and irrigation.
Toilets shall be supported in all households. These shall include both new constructions and retrofitting of existing systems based on housing conditions.

Because we are retrofitting new sanitation systems to houses which are already built and where no two houses are alike, some challenging design issues have been raised. However, understanding housing as a platform of transformation enables the problem to be addressed from the viewpoint of an incremental process in which the intervention of the occupant may enhance the property, the city itself and potentially the state’s investments. So the delivery of a common infrastructure serves as a catalyst for investments in the home (house upgrades) centred on the toilet facility.

As part of CURE’s livelihood project to engage with labourers and contractors, the team will assist in the many possible upgrade options — connecting local contractors to beneficiaries. Working together with local contractors the team has identified opportunities for cost reduction such as sharing columns which maintains overall concepts of ownership but reduces the cost of pucca construction by 30%. 

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**PILOT PROJECT**

**Project Components:** (1) Household Toilets and upgrades

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**FIRST FLOOR PLAN**

**GROUND FLOOR PLAN**

- Black water is taken down straight to the ground with maximum two houses sharing one down pipe, discharge into inspection chamber and run into septic tank with another inspection chamber, integrate outflow 10m near the surface water drains.

- Proposed Added Upgrade Structure

**PROPOSED FLOOR PLANS FOR TYPICAL UPGRADE**
Simplified sewerage shall be provided using small-diameter sewers laid at shallow depths which our desk top survey has found to be a viable solution. Small drainage with localized treatment has the advantage that they are suitable for incremental development. These shall be combined with a communal septic tank to treat the effluent – an intermediate technology which can provide an off-plot/on-site system capable of being plugged into conventional sewerage once the city expands its infrastructure to reach the settlement. The following diagrams explain the technical design process:

Step 1
Survey existing housing, A Block, Savda Ghevra resettlement colony.
PILOT PROJECT
Project Components: (2) Sewers an Septic Tank

Step 2
Identification of houses that need and want to upgrade house to incorporate a toilet.
PILOT PROJECT
Project Components: (2) Sewers and Septic Tank

STEP 3
Identify free spaces in accordance with the MCD masterplan: park spaces.
PILOT PROJECT

Project Components: (2) Sewers and Septic Tank

Community Management
A team comprised of members of the community is being established and trained to prepare contracts who will be responsible for the supervision and general maintenance.

Sanitation Call Centre
We would like to pilot and test a call centre to support decentralized sanitation projects in the Delhi region.

Step 4
Identify through community mobilization members who can form part of the management team.
Step 5
Design and implement decentralized sanitation pilot project for up to 300 units.
PILOT PROJECT

Project Components: (2) Sewers and Septic Tank

**Building Centre**
Each sanitation cluster would have a building centre which would be run by the management team and be used to disseminate information and have building workshops.

**Financing Models**
In order to assist in the financing a Savings Group and Toilet Revolving Fund is set up to lend money at zero interest.

**House Upgrades**
In order to assist in upgrades to have a WCI a core house is being designed which reduces the cost when a whole new house is needed. In addition we are running building workshops on service upgrades such as load bearing roofs.

**Step 6**
Sanitation infrastructure triggers NGO-led housing upgrades depending on individual needs.
PILOT PROJECT
Project Components: (2) Future Opportunities

Water Filtration
The sanitation sector is traditionally seen as an engineering issue often resulting in strategies that collapse shortly after they begin to operate.

Composting
To close the waste loop it is proposed that the sludge removed from the septic tank can be used in an activity already up and running on site.

Waste Collection
Imagining each cluster with waste collection as part of a holistic strategy to maintain a clean and healthy environment.

Livelihood Projects
Linking sanitation with livelihood schemes such as though construction, management, waste collection and composting.

Water Kiosk
The water kiosk would hold, store, and clean water to be distributed in the block. It is proposed to develop and push alternative sustainable water supplies in line with the proposed sanitation upgrades.

Step 7
Expand the infrastructure to include the whole block and incorporate tertiary treatment facilities.
DEWATS is based on a set of treatment principles - the selection of which has been determined by their reliability, longevity, tolerance towards inflow fluctuation, and most importantly, because these treatment principles dispense with the need for sophisticated control and maintenance. The DEWAT is based on sedimentation and primary treatment (septic tank) and secondary treatment (reed bed) for the effluent. Septic Tanks take wastewater of settleable solids, especially domestic. The advantage of such a system is that it is simple, durable, requires little space because of being underground. The reed bed in combination with a gravel filter is suitable for domestic wastewater where suspended solids have been removed by pre-treatment (septic tank). The principal advantage is that this can be cheap in constriction and there is no nuisance of odour. There is potential in the future to reuse sludge from the septic tank which needs to be removed annually; although the sludge contains pathogens when handled properly it is a valuable fertiliser.
A Sanitation committee comprised of members of the community is being established and trained to prepare contracts. The Sanitation committee will also be responsible for implementation supervision and general maintenance such as manhole inspections. It shall also be responsible for community advocacy, contributing to the plan and design, implementing the project through contractor identification and financial disbursements, designing an O&M plan and initiating collection systems.

Toilet Savings Groups shall be set up for those families who do not have enough funds, to help them save up for the toilet. These women shall be linked to CURE’s livelihoods initiative to enable them to build up savings for the home toilet.

By involving the community and not imposing upon them our ideas means that while there is greater ownership locally, there is also a constant adjustment that must be inbuilt into the design process and which may requires real time modifications and changes to ideas and proposals. It is hoped that through such participatory project management processes, other emancipatory benefits will be felt by the community as a collective vision or aspiration takes precedence over individual needs.
PILOT PROJECT

Project Components: (5) Access to Finance

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PILOT PROJECT
Implementation Plan

The pilot project is ready to be implemented and the team are currently looking for the funding to make this project a reality. The team has taken great care to ensure the pilot is affordable and replicable so that more clusters can develop. It is hoped that the outcomes and lessons learned from this process will serve as a model for similar applications in other resettlement and upgrading schemes throughout urban India.

Work is also currently on-going in creating guidelines for large scale master plans for both medium sized cities and new urban development and the team is seeking partner organizations to further develop and test this model.