

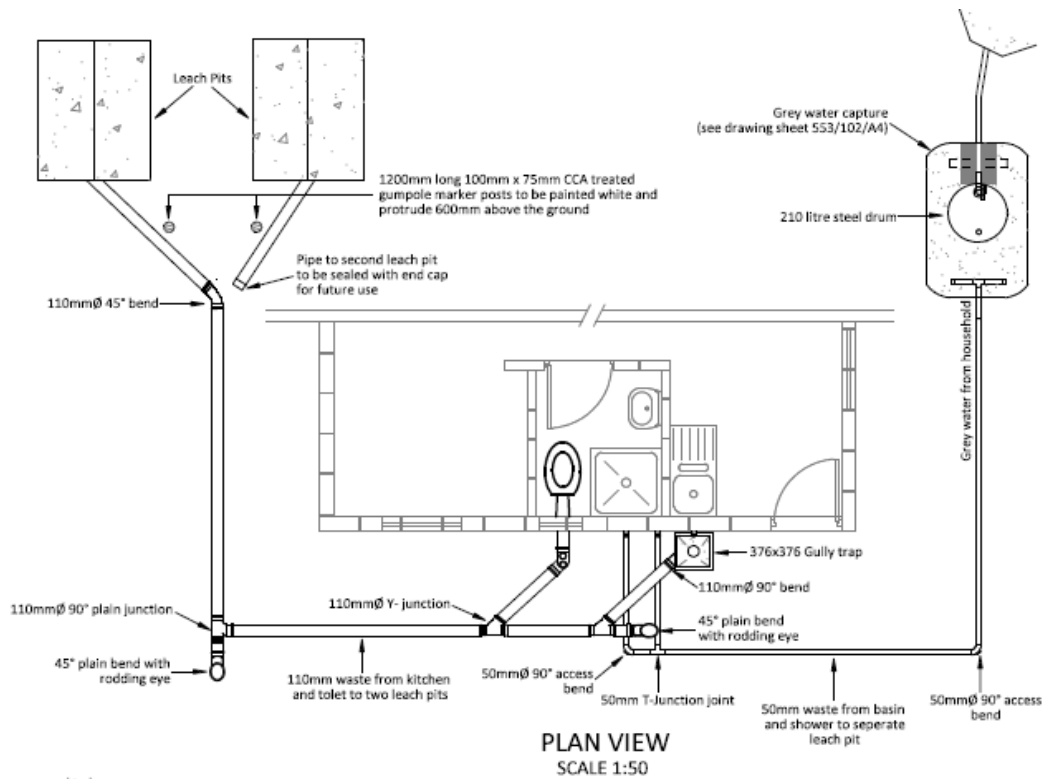


Demonstration and Scaled up Implementation of Pour Flush Sanitation in South Africa

Report to the
WATER RESEARCH COMMISSION

by

PARTNERS IN DEVELOPMENT



WRC Report No. 2203/1/18
ISBN 978-1-4312-0011-8

June 2018

Obtainable from:

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Printed in the Republic of South Africa

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1. INTRODUCTION

In 2012, the eThekweni Municipality agreed to specify the Pour Flush system developed by the WRC for its Oakford Priory Housing Project, which is located approximately 5 km north west of Verulam (**Figure 1**). The project is different from the usual RDP type housing projects in that the average plot size is 500 m² rather than 200 m², which will allow the owners to conduct small scale agriculture on their properties (**Figure 2** and **Figure 3**). The water supply in the area is severely constrained and eThekweni was accordingly not willing to approve waterborne sanitation for the development. However, they were also not willing to approve *Ventilated Improved Pit* (VIP) latrine construction, as eThekweni is no longer in favour of the VIP due to its onerous maintenance requirements. Whereas eThekweni has for ten years been specifying the *Urine Diversion Double-Vault toilets* (UDDT) for its rural areas, these toilets are not universally popular and their maintenance requirements have proven to be not that different to VIPs. Oakford is a prestige project and there is an opportunity to use a sanitation system which can be installed within the houses and which is closer to the universally aspired to waterborne sanitation, without the high water demand associated with that option.

There is a considerable amount of bureaucracy involved with housing projects and the actual start of construction was much delayed, not commencing until the beginning of 2015.

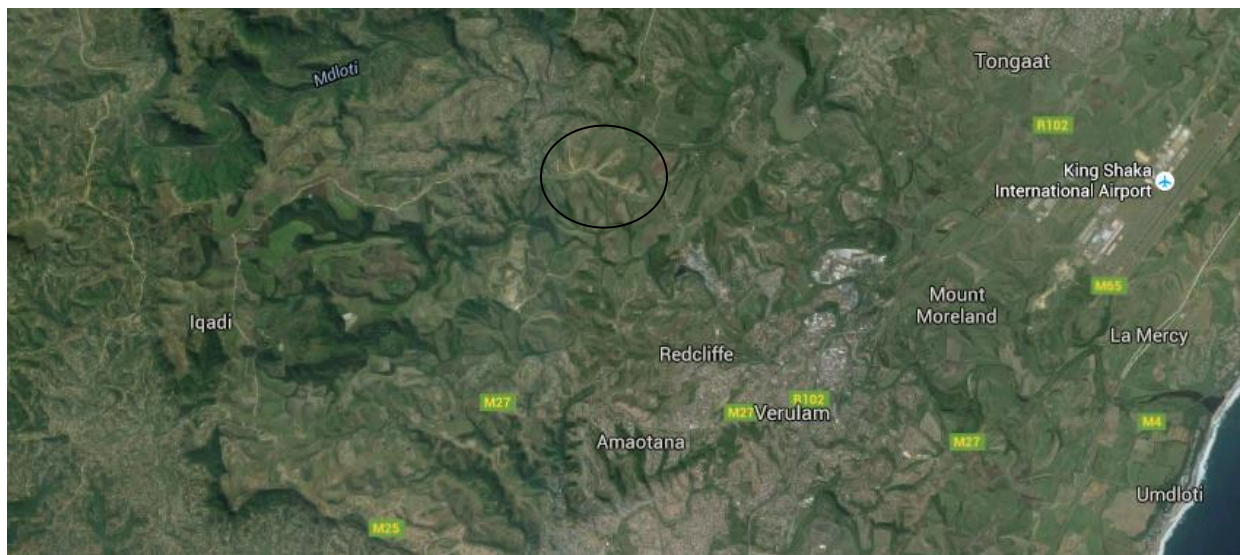


Figure 1: Location of Oakford Priory Housing Project (circled) 5 km northwest of Verulam and 10 km due west of the King Shaka International Airport.



Figure 2: The Oakford Priors Housing Project (circled) is approximately 3 km south west of the Hazelmere Dam. To the west lies the community of Osindisweni. Some of the families who will move to this new development will be relocated from the area immediately around the Hazelmere Dam, which is currently being raised.



Figure 3: The Oakford Project comprises some 690 sites with an average size of 500 m² each.

2. STATUS OF THE HOUSING PROJECT

Two of the specific causes of the delay in the commencement of the housing project were the need to get the Environmental Management Plan approved by the Department of Environmental Affairs, and the need to get a Water Use License approved by the Department of Water Affairs and Sanitation. The need for approval from the Provincial Department of Housing also held up progress. *Partners in Development* (PID) has assisted eThekweni in meeting with the representatives of all of these departments and in making various submissions.

The approvals were eventually forthcoming and work on the civils contract commenced in January 2015. In April 2015, four demonstration houses were completed by the civils contractor and PID installed Pour Flush toilets in these houses.

On 3 November 2015, the construction of houses finally commenced (**Figure 4** and **Figure 5**). In February 2016 work was held up again when inspectors of the *National Home Builders Registration Council* (NHBRC) became involved in the project. They were unfamiliar with the Pour Flush system and several meetings were required to satisfy them that the system was acceptable.

PID's work on the demonstration of the first 90 units was completed in June 2016. eThekweni aimed to complete the sanitation for the other 600 homes from its project budget.

Apart from the large number of institutions involved other challenges experienced to date have included the following:

- The stipulated minimum wage for the site is relatively high at R200 per day. Labour must be recruited from the local community and a number of work stoppages were experienced in the early stages until task rates had been agreed.
- The ground conditions are for many of the sites particularly hard (see **Figure 6** and **Figure 7**, for example). Progress excavating this material by hand has been very slow and rock breaking equipment has had to be hired at times.
- The site is inaccessible whenever there is rain and this has regularly caused delays with the deliveries of materials.



Figure 4: Housing under construction at Oakford.



Figure 5: A view of the first set of houses nearing completion.



Figure 6: Ground conditions at some sites have been particularly difficult.



Figure 7: Bedding and blanketing material has had to be imported from commercial sources to protect the pipes.

3. DESIGN PREFERENCES

The eThekweni municipality specified that the Pour Flush toilets should be constructed inside the homes. **Figure 8** shows an extract from the approved plan, which is included in full in **Appendix 1**.

The Pour Flush toilets at Oakford Priory are installed inside the home. In reality, the leach pits are generally not located close to the houses as the backs of the houses are mostly located on deep cuts due to the slope of the land. The leach pits are located to the side and the front, requiring long lengths of sewers and trenching (estimated at 30 metres in total per site).

eThekweni have further specified that they want the greywater collected separately and that it must be possible for users to collect and recycle their greywater. PID therefore had to develop a design for a greywater collection and recycling system, which is shown in **Figure 9** (the full design is included in **Appendix 1**).

Photographs of the installed system can be viewed in **Figures 10-13**.

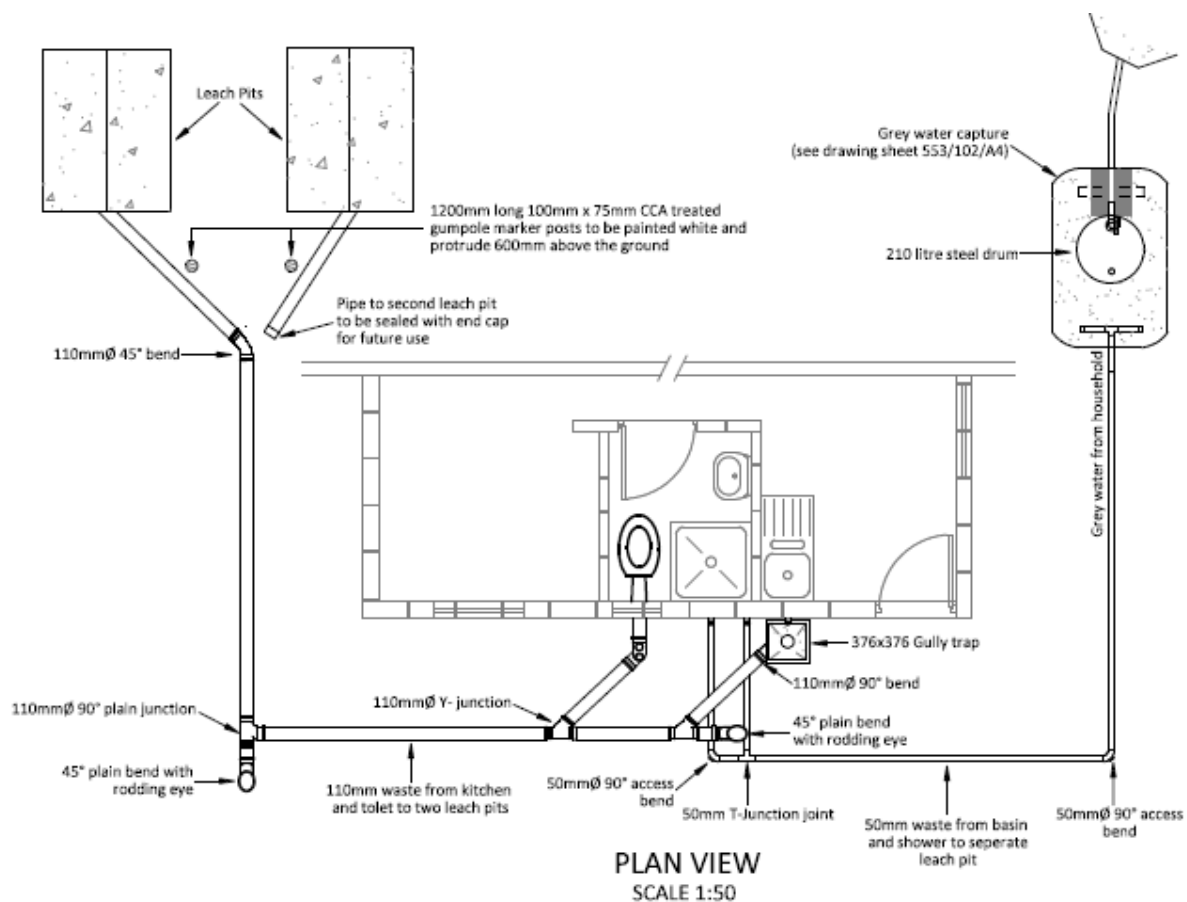


Figure 8: The approved sanitation plan for the Oakford houses.

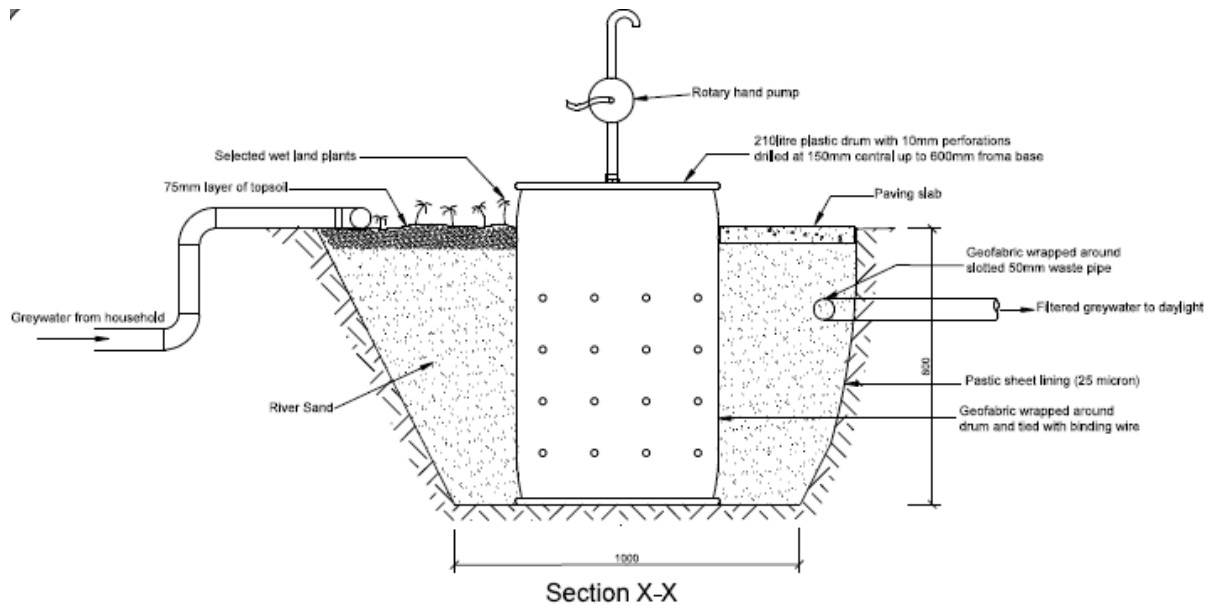


Figure 9: The greywater collection and recycling system developed for Oakford.



Figure 10: A view of leach pits under construction at one of the Oakford houses.



Figure 11: A greywater recycling system under construction in the foreground. In the background a stand is being constructed for a rainwater harvesting tank.



Figure 12: A view of a Pour Flush toilet in a bath room in one of the Oakford houses.



Figure 13. The greywater collection tank with handpump fitted for extraction of flushing water. The water is filtered through sand and geofabric before it enters the collection drum.

4. COSTS

Oakford is a high cost environment due to high labour costs and difficult ground conditions. The final cost for the Pour Flush toilet, sewers, waste pipe and greywater recycling per site came to more than R16 000 per site, or R1.5 million for the 90 demonstration units completed. The eThekweni municipality will fund the balance of the Pour Flush sanitation costs (i.e. for the other 600 units) from their project budget.

5. USER SURVEY

The first homes were only occupied in December 2016 so it has not been possible until recently to gauge user response. Between the completion of PID's work and the occupation of the houses, eThekweni's Housing section took it upon themselves to add cisterns to every toilet, so this became a low flush toilet rather than a Pour Flush toilet (Figure 14).



Figure 14: Pour Flush system retrofitted with cistern by the eThekweni Housing Department. The cistern installation was in response to pressure brought to bear on them by community representatives who did not fully understand the cistern-less Pour Flush system (to reduce water leaks). The homeowner tiled the bathroom which shows a sense of ownership.

A summary of the user survey for the first 22 occupants is included in **Appendix 2** and the data is attached.

The response to the toilets is positive, with all toilets in use. There have been some problems with small leaks around the cistern installations as these were not done very professionally.

With the use of cisterns, it is not possible to determine the water consumption per house or per person.

All the toilets surveyed were in use. Piped water is not yet available to this community and users have to fetch their water from a communal tank which is filled by the municipality.

A summary of the results is presented below:

- Eight of the 22 homes surveyed reported that they had had some problems with their toilets, all related to the cistern installations. The other 14 had not had problems.
- 100% of respondents reported that they use toilet paper for anal cleansing.
- 100% of respondents described their toilets as safe, nice looking, easy to keep clean and nice smelling.
- Of the 22 families surveyed, one indicated that one family member, an uncle, preferred to go to the toilet outside. He does not feel comfortable using the toilet inside. One family (the same family) reported that their mother preferred to use a bucket at night rather than the toilet as she is not well.
- No families reported that any family member was too young to use the toilet, and no families reported that they had a disabled member who was unable to use the toilet, although one did comment that a hand rail for their grandmother would be useful.
- A third of respondents noted some problems with the greywater disposal, where sometimes the water was taking too long to soak in, or where there was a noticeable smell.
- Three respondents (15%) indicated that they would prefer a porcelain toilet to a plastic toilet.
- One respondent indicated that she would prefer a VIP toilet, saying she was not sure what she would do when the Pour Flush pit fills up. This perhaps does not make sense, as a VIP pit will also fill up, but perhaps this user likes to be able to see how full the pit is.
- Half of the respondents indicated that they use greywater to flush, usually from a 20 litre wash basin.
- Toilet paper was present in 90% of the bathrooms inspected, as was soap. The water bucket was present in all but one bathroom, and the toilet brush in all but two.
- The pedestal, cistern and seat cover were in good condition in all homes inspected. 90% of seats and 80% of pans were found to be clean, with the balance a bit soiled.

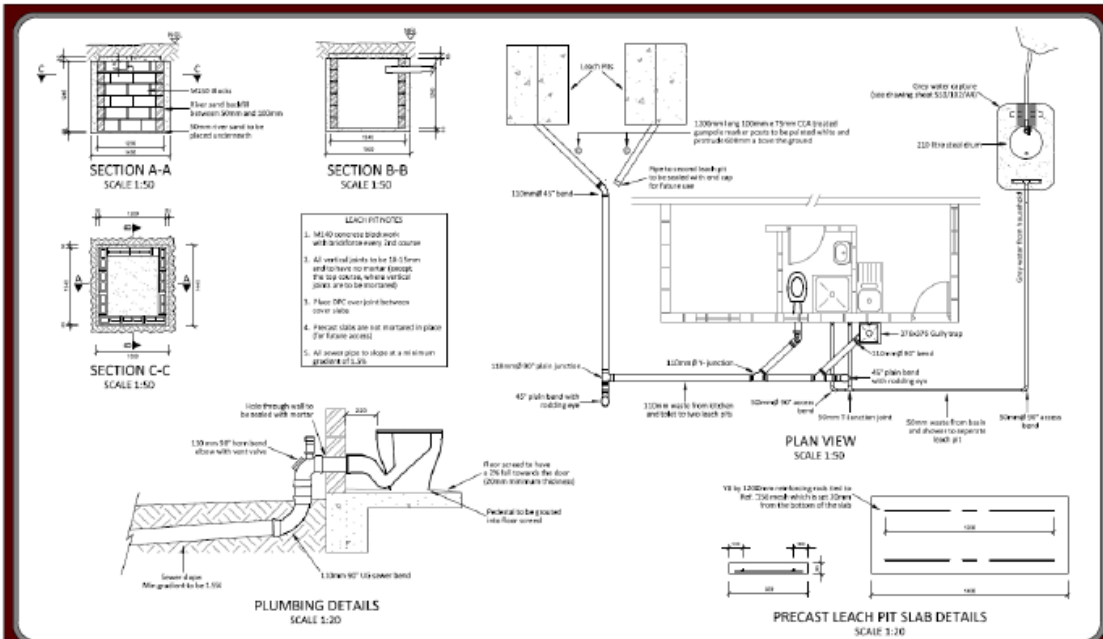
6. DISSEMINATION OF INFORMATION

The implementation of this project has required more than 10 meetings with various eThekweni Municipal bodies, including Housing, Water and senior management, as well as others such as consultants, contractors and the National Home Builders Registration Council (NHBRC). All of these meetings have served to disseminate the Pour Flush / low flush concept.

Apart from these meetings during the project period presentations were made on Pour Flush at the following workshops, conferences and symposiums:

25-27 September 2013	WRC Innovation Symposium, CSIR, Pretoria
28 May 2014	WISA, Nelspruit
May 2015	WRC Sanitation Symposium, Durban
September 2015	Department of Housing, eThekweni
May 2016	WISA, Durban

APPENDIX 1: TYPICAL DESIGN DETAILS



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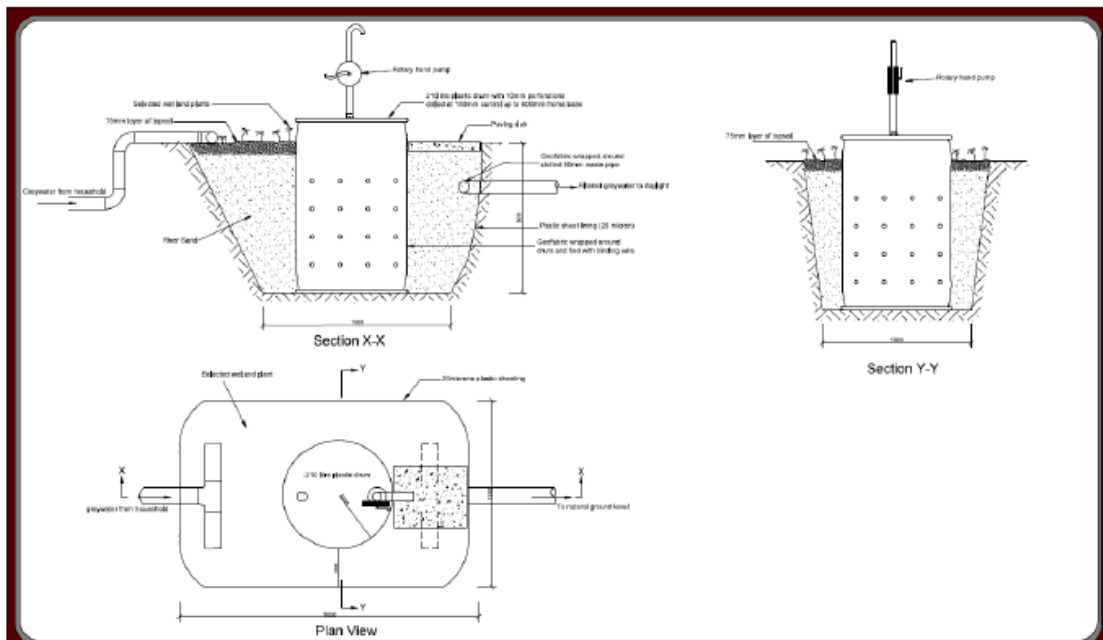
WATER RESEARCH COMMISSION

ETHERWINI METROPOLITAN MUNICIPALITY

PROJECT
Oakford Priory Housing Project

DESCRIPTION
Pour Flush Toilet and Leach Pit Details

NO.	DATE	DESCRIPTION	BY	CHKD	APPD
DESIGNED	DAS	26/09/2015			
DRAWN	DAS	26/09/2015			
SCALE	AS SHOWN				
NO.	1	OF	1		
REVISION					
DATE					
PROJECT NO.	553/102/A3				



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WATER RESEARCH COMMISSION

ETHERWINI METROPOLITAN MUNICIPALITY

PROJECT
Oakford Priory Housing Project

DESCRIPTION
Greywater Disposal and Re-use System Details

NO.	DATE	DESCRIPTION	BY	CHKD	APPD
DESIGNED	DAS	26/09/2015			
DRAWN	SM	26/09/2015			
SCALE	1:15				
NO.	1	OF	1		
REVISION					
DATE					
PROJECT NO.	999/102/A3				

APPENDIX 2: USER SURVEY

POUR FLUSH HOUSEHOLDER INTERVIEW			
1. Interviewer:		2. Date:	
3. Age of person interviewed:		4. Male / Female	
5. Family name:		6. Address/GPS:	
7. How many people live in the home fulltime:		8. How many part time	
A. Experience with the toilet			
9. Is the toilet in use: Yes/No If No, why not?			
10. Does the water supply work reliably?			
11. What do you do when the water supply is not working?			
12. How much water do you use per day for flushing?			
13. Is there anything you like about the toilet?			
<div style="display: flex; justify-content: space-between; align-items: flex-start;"> Safer for small kids Safe from collapse Less smell More clean Other: : _____ </div>			
14. Have you had any problems with your toilets? Yes / No. If yes, what's wrong?			
15. What do you use for wiping?			
<div style="display: flex; justify-content: space-between; align-items: flex-start;"> Toilet paper News paper </div>			
16. Have you had water splashing back during flushing? Yes / No. If Yes, what is happening			
17. How often does it happen?			
18. Is there anything you don't like about the toilet?			
19. Is there any leaking of water or wet floor during flushing? Yes / No. If Yes, Where?			
20. Do you have any problem(s) with your cistern? Yes / No. If yes where?			
21. Is it safe to use your toilet? Yes / No. If No, why			

<p>22. Please say YES for any of the following words that describe your toilet (circle the letter of any to which they answer YES)</p> <p>a. Dangerous Y / N If Y, reason: _____ e. Smells bad</p> <p>b. Safe Y / N If Y, reason: _____ f. Smells nice</p> <p>c. Not looking nice If Y, reason: _____ g. Easy to keep clean</p> <p>d. Looks nice h. Gets dirty easily</p>	
<p>23. Is there anyone in the family who CHOOSES NOT to use the toilet? Y / N If yes, how many people? _____ Who, and why (for each one)?</p> <p>24. Is there anyone who doesn't use the toilet at night? Y / N If yes, who, and why (for each one)?</p> <p>25. Is there anyone not in nappies who is too young for the toilet? Y / N If yes, where do they go?</p> <p>26. Is there anyone disabled who can't use the toilet? Y / N If yes, where do they go?</p> <p>27. Is there anyone in the family who isn't ALLOWED to the toilet? Y / N If yes, how many people? _____ Who, and why (for each one)?</p>	
<p>28. Have you had any leaks outside or always wet ground? Yes or No? If yes, where?</p> <p>29. Do you have any problem(s) with your pump for grey water?</p>	
<p>30. Have you felt any bad smell outside? Yes or No? If yes, where?</p>	
<p>31. Observe any damage of pipes and other issues related to plumbing (PID):</p> <p>Other comments:</p>	
<p>32. Is there anything that you don't like about this toilet? Yes / No If yes, what?</p> <p>33. Would you prefer a VIP toilet? Yes / No.</p> <p>34. Are there any improvements you would recommend for this toilet?</p> <p>35. How often does your water supply not work? _____</p> <p>36. Do you ever not use the toilet because of water shortage? Yes / No If yes, what do you do?</p>	
<p>37. Do you ever use grey water to flush? Y / N</p> <p>38. From where do you get the grey water?</p>	

39. Do you have any problems with your pump?

40. Where do you dispose of your greywater (from washing dishes, clothes and bathing)?
 Pour into the new toilet Pour in the yard Pour on the vegetables

41. Where do you dispose of rubbish?
 burn bury throw in dump Municipal collection Other: _____

42. Does any child in your house use nappies? Y / N If yes, DISPOSABLE or CLOTH (circle)?

43. If disposable, where do you dispose?
 Old toilet burn bury throw in dump Municipal collection Other: _____

Inspection		House number:
Item	Condition	Are these items present
Pedestal	Good , Damaged	Toilet paper
Cistern	Good, Damaged	Soap
Seat cover	Good, Damaged	Water bucket
Seat	Clean A bit Dirty Very Dirty	Toilet brush
Inside pedestal	Clean A bit dirty Very Dirty	
Any other comments:		

RESULTS FOR FIRST 22 HOMES

		Yes	No
9.	Is the toilet in use: Yes/ No If no why not?	22	0
10.	Does your water work reliably	22	0
14.	Have you had any problems with your toilet? Yes / No	8	14
22.	Please say YES for any of the following words that describe your toilet		
a.	Dangerous Y/N	0	22
b.	Safe Y/N	22	0
c.	Not looking nice		
d.	Looks nice	22	0
e.	Smells bad		
f.	Smells nice	22	0
g.	Easy to keep clean	22	0
h.	Gets dirty easily		
23.	Is there anyone in the family who chooses not to use the toilet? Y / N	1	21
24.	Is there anyone who does not use the toilet at night? Y / N	1	21
25.	Is there anyone not in nappies who is too young for the toilet? Y / N	0	22
26.	Is there anyone disabled who can't use the toilet? Y / N	0	22
28.	Have you had any leaks outside or always wet ground? Yes or No	7	15
30.	Have you felt any bad smell outside? Yes / No	8	14
32.	Is there anything that you don't like about this toilet? Yes / No	3	19
33.	Would you prefer a VIP toilet? Yes / No	1	21
37.	Do you ever use grey water to flush? Y / N	11	11
	Are these items present?		
	Toilet paper	20	2
	Soap	19	3
	Water bucket	21	1
	Toilet brush	20	2

	Condition			
	Good	Clean	A bit dirty	Very dirty
Inspection				
Pedestal	22	0	0	0
Cistern	20	0	0	0
Seat cover	22	0	0	0
Seat		19	3	0
Inside pedestal		17	5	0