UNHCR Handpump Apron Design

Tools and Guidance for Refugee Settings
UNHCR Standardized Designs for Refugee Settings
Post Emergency Handpump Apron with Drainage

FOREWORD
These post emergency handpump apron designs form part of UNHCR’s series of Standardized WASH Design Guidelines for Refugee Settings which are the result of an extensive review process with WASH actors active in refugee settings. It is recognized that the Standardized WASH Designs will require continuous review and amendment in response to changes in engineering best-practice and feedback from the field. Therefore further review will be managed by a Technical Review Committee which will meet regularly to discuss issues related to the use of the design and an annual review will be reported back to the WASH community. More urgent amendments will be reported as, and when, required. Note that this tapstand is based on a design shared by OXFAM GB.
NOTES

1. Handpump to be positioned centrally with spout exactly 50cm above concrete surface.
2. Concrete surface to be finished with non-slip (lightly brushed) surface with 1% slope to soakage pit.
3. Soakage pit dimensions to be determined by on-site soil infiltration test (see Appendix 20 of Engineering in Emergencies. Alternatively refer to the table of typical soil infiltration rates on page 213 of the UNHCR WASH Manual).
NOTES
1. Mass concrete footings 1:3:6 (min 240kg/m3 cement dosage). Slab concrete 1:2:4 (min 320kg/m3 cement dosage).
2. 15cm compacted hardcore layer to be covered with 1mm sand blinding before pouring concrete.
3. Slab reinforcement to consist of high tensile mild steel 6mm weld mesh 20cm x 20cm positioned 3cm above compacted hardcore.
1. Area of 6m x 3m to be cleared and perfectly leveled.

   Ensure apron is positioned centrally around handpump casing.

   Corner posts 10cm above ground and exactly the same level. This level will become the upper edge of the apron lip.

2. Excavate the 30cm wide footing to a level 55cm below the top of the posts. Excavate the slab area and drainage channel trench to a level 35cm below the top of the posts. Excavate a 70cm x 70cm handpump anchor hole to a level 70cm below the top of the posts.
The depth of the infiltration pit should be calculated based on the site soil infiltration capacity following the procedure in Appendix 20 of Engineering in Emergencies. Alternatively refer to the table of typical soil infiltration rates on page 213 of the UNHCR WASH Manual.

ENSURE EXTERNAL WOODEN SHUTTERING IS PERFECTLY SQUARE AND LEVEL (PERFORM A 3-4-5 TRIANGLE CHECK IN EACH CORNER)

Add 15cm of crushed and compacted hardcore material covered with sand blinding prior to laying concrete.
5. 0.50 m$^3$ footing concrete 20cm thick (1:3:6 cement dosage 240 kg/m$^3$)  
0.18 m$^3$ concrete anchor 35cm thick (1:3:6 cement dosage 240 kg/m$^3$)

6. Internal shuttering depth 5cm to create apron curb

High tensile mild steel 6mm weld mesh 20cm x 20cm positioned 3cm above compacted hardcore.
1.1 m³ concrete 15 cm thick slab with 20 cm thick side curbs (1:2:4 cement dosage 320 kg/m³).

1% slope towards soak pit with non-slip brushed finish.
9. Ensure slab is kept damp and out of direct sunlight for at least 7 days.

10. Handpump spout should be exactly 50cm above concrete slab level.

11. Adapt design to include optional disability ramp if required.
## BILL OF QUANTITIES

<table>
<thead>
<tr>
<th>Description</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wooden Posts (65cm x 5cm x 5cm)</td>
<td>15 pcs</td>
</tr>
<tr>
<td>Wooden Planks (4m x 20cm x 2.5cm)</td>
<td>4 pcs</td>
</tr>
<tr>
<td>Wooden Planks (4m x 5cm x 2.5cm)</td>
<td>5 pcs</td>
</tr>
<tr>
<td>Nails (6cm Galvanized)</td>
<td>1 kg</td>
</tr>
<tr>
<td>High Tensile Steel Weld-Mesh Ø6mm 20cm x 20cm</td>
<td>10 m²</td>
</tr>
<tr>
<td>Plastic Sheeting</td>
<td>10 m²</td>
</tr>
<tr>
<td>Complete Handpump Assembly</td>
<td>1 pc</td>
</tr>
<tr>
<td>Coarse Sand</td>
<td>0.9 m³</td>
</tr>
<tr>
<td>Coarse Gravel (6mm – 10mm)</td>
<td>1.5 m³</td>
</tr>
<tr>
<td>Cement (50kg sacks)</td>
<td>10 sacks</td>
</tr>
<tr>
<td>Compacted Hardcore Sub-Base</td>
<td>1.5 m³</td>
</tr>
</tbody>
</table>
Bill of Quantities

1. Wooden Posts (pc) 5cm x 5cm x 65cm
   x15

2. Wooden Planks (pc) 2.5cm x 20cm x 4m
   x4

3. Wooden Planks (pc) 2.5cm x 5cm x 4m
   x5

4. Nails 6cm (kg)
   x1

5. Steel Weld-Mesh 6mmØ x 20cm x 20cm
   x10m²

6. Plastic Sheeting
   x10m²

7. Handpump Assembly and Fittings (pc)
   x1

8. Cement 50kg (sacks)
   x10

9. Sand (m³)
   x0.9

10. Gravel (m³)
    x1.5

11. Compacted Hardcore Sub-Base (m³)
    x1.5
SPECIFICATIONS FOR CONSTRUCTION OF WATER SUPPLY RELATED INFRASTRUCTURE IN REFUGEE SETTINGS

300 SCOPE

300.1 These design guidelines specifically define the quality of materials and workmanship to be used when constructing water supply related infrastructure in refugee settings. A description of principles of water supply programmes in refugee settings, in addition to technical options and their advantages and disadvantages, can be found in the UNHCR WASH Manual.

301 SITE SELECTION

301.1 A basic requirement is that the site selected for water supply related infrastructure is free from the risk of high winds, flooding, subsidence, or erosion.

302 PREVENTION OF SURFACE OR GROUNDWATER CONTAMINATION

302.1 UNHCR and WASH actors must ensure that all water supply related infrastructure including treatment systems and soakaway systems do not contaminate surface water or shallow groundwater sources. Risks are generally low and related to contamination from water treatment chemicals, water treatment by-products and sludges and contamination from wastewater.

302.2 All tapstands, or other water collection and usage points, should be equipped with adequately designed soakage systems located at least 30 metres away from groundwater sources. The bottom of any pit or soakaway must be at least 1.5m above the highest average groundwater table level. These distances should be increased for fissured rocks and limestone.

302.3 In some situations temporary groundwater contamination from on-site soakage systems may not be of immediate concern if the groundwater is non-potable. An example of this can be found in areas where groundwater is heavily saline beyond drinking water health limits of 1,500μS/cm². In all cases, local legislation should be respected.

303 SPECIFICATIONS OF COMMON CONSTRUCTION MATERIALS

303.1 Gravel used for constructing concrete footings and slabs must be clean and free from mud, dust and plant material. UNHCR and WASH actors must ensure that only aggregates between 6mm and 10mm are used to prevent inter granular crack propagation across load bearing concrete structures (e.g. tapstand floor slabs, water reservoir roof slabs, and columns used in reinforced concrete water towers) and to ensure an adequate covering of steel reinforcement bars.

303.2 Sand used for water supply related concrete works should be coarse (no fines), clean and free from mud, dust and plant material.
303.3 Water should be non-saline and free from organic matter.

303.4 Cement must be fresh (manufactured in the last three months) dry, and should be stored in a safe, dry, place at least 15cm off the ground. Mass concrete footings should be cast with a 1:3:6 concrete mixture with a minimum cement dosage of 240 kg/m³. Concrete slabs and drainage channels should be cast as single continuous structures using a 1:2:4 concrete mixture with a minimum cement dosage of 320 kg/m³. Care should be taken to ensure that concrete mixtures are not over watered (bucket slump test should show no greater than ¼ reduction in the slump height). Cast concrete works should be immediately covered with plastic sheeting, straw, cement bags, sacking or leaves to keep the concrete moist and cool during the full curing period. The concrete should be cured with frequent watering at least twice daily for at least 10 days before use.

303.5 Reinforcement bars should be free from rust and of the correct type and size for concrete construction work (typically a characteristic yield stress of at least 210 N/mm²). Steel reinforcement should be placed as per the designs (to ensure the bars function correctly in tension) with at least 12mm concrete covering under every bar.

304 SOAKAGE PIT SIZING BASED ON SOIL INFILTRATION RATES

304.1 Soakage pits for WASH infrastructure should be sized according to the expected daily wastewater production rates, the local soil infiltration capacity, and the type of wastewater that will be generated. Soil infiltration capacities should be determined locally based on the procedure in Appendix 20 of Engineering in Emergencies. Alternatively refer to the table of typical soil infiltration rates on page 213 of the UNHCR WASH Manual. Soil infiltration rates should be adjusted to take into account whether the soakage pit will be used to dispose of relatively clean or contaminated wastewater. To ensure longevity, all soakage pit that are likely to be used to dispose of wastewater containing grease (e.g. from washing of cooking utensils) should be equipped with a grease trap.

305 WATER COLLECTION POINTS FREE FROM STANDING WATER

305.1 All water collection areas including tapstands, handpump aprons, hand dug well aprons, and showering and laundring points should be equipped with a non-slip concrete apron that has a gentle 1% slope to ensure that it is kept free from standing water. The 1% slope should be in the direction of the wastewater disposal system. There should be no standing water at any point in the conveyance and disposal mechanisms.

306 NON-SLIP SURFACE FINISHES AT WATER COLLECTION POINTS

306.1 All WASH programmes must ensure that users (in particularly the elderly, infirm, pregnant women etc.) are adequately protected from risks of slipping at water collection areas including tapstands, handpump aprons, hand dug well aprons, and showering and laundring points. All concrete
surfaces that are designated for walking on should be given a light non-slip surface finish (typically through the light application of a wetted stiff brush or other suitable light concrete surface stippling tool) approximately 40 minutes after concrete placement. The surface finish should be sufficient to prevent slipping but should not be too rough that it hinders the ability to keep the surface clean and well drained.

307 UNHCR STANDARD DESIGNS FOR WATER SUPPLY

307.1 The following drawings should be used in conjunction with these technical design guidelines.

<table>
<thead>
<tr>
<th>D-30/2015a</th>
<th>Tapstand Design with Drainage – EMERGENCY</th>
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</thead>
<tbody>
<tr>
<td>D-31/2015a</td>
<td>Tapstand Design with Drainage – POST EMERGENCY</td>
</tr>
<tr>
<td>D-32/2015a</td>
<td>Handpump Apron Design with Drainage</td>
</tr>
<tr>
<td>D-33/2015a</td>
<td>Hand Dug Well Design with Drainage</td>
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<tr>
<td>D-34/2015a</td>
<td>Generic Spring Design with Drainage</td>
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<tr>
<td>D-35/2015a</td>
<td>Raised Water Bladder Design - EMERGENCY</td>
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<tr>
<td>D-36/2015a</td>
<td>Raised Metallic Water Reservoir Design - EMERGENCY</td>
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<tr>
<td>D-37/2015a</td>
<td>Stone Masonry Water Reservoir Design – POST EMERGENCY</td>
</tr>
<tr>
<td>D-37/2015a</td>
<td>Brick Masonry Water Reservoir Design – POST EMERGENCY</td>
</tr>
</tbody>
</table>
USEFUL REFERENCES

Emergency water supply
- Lambert, R., and Davis, J. (2002), 'Engineering in emergencies 2nd Ed.', Register of Engineers for Disaster Relief (RedR), London.

Surface water
- WEDC (2012), ‘Intakes from rivers: WEDC trial course unit’. WEDC, Loughborough University, UK. http://wedc.lboro.ac.uk/resources/units/EWS_Unit_5_Surface_Water_Intakes.pdf
- USAID (1984), 'Constructing intakes for streams and rivers', USAID, Washington USA.
Spring captures


Hand dug wells

Hand drilled wells


Hand drilled wells

Machine drilled wells


Rainwater harvesting


Water network design

D-32/2015a

- Reed, B. and Shaw, R. (1989), 'Emergency water supply: WEDC technical brief #44', WEDC, Loughborough University, UK. [http://www.lboro.ac.uk/well/resources/technical-briefs/44-emergency-water-supply.pdf](http://www.lboro.ac.uk/well/resources/technical-briefs/44-emergency-water-supply.pdf)

Motorized water pumping
Handpumps


Water storage


