1. Introduction

There are two standard sizes of PSF, the PSF-500 (large) for approximately 500 users and the PSF-300 (small) for up to 300 users. If the pond water is very turbid, the PSF-500 may be required even for user groups less than 300. However, which size, large or small, will be constructed, will be decided following the implementation guideline of PSF prior to taking up actual construction. Also, in this guideline the roles of DPHE and beneficiaries have been described.

There are separate designs for the two PSF’s and the quantity of materials required for their construction are also different. Materials will be supplied from DPHE stock and some from special procurement by DPHE, Executive Engineer. All the materials and tools (please see para 2.1, 2.2 and 2.3) required must be collected and stored at the construction site before starting of the construction. The quality of the materials must be checked during collection/procurement. Necessary tools and equipment (same for both sizes) must be available also at the time of construction. DPHE will provide free of charge the tools and equipment (for 5 PSF – one set required). The SAE of the Department of Public Health Engineering will engage trained local mason and labor for the construction of pond sand filter and he will also inspect the work frequently. The beneficiaries will participate in the construction work, through carrying of materials and providing some labor. For details regarding the role and participation of the beneficiaries please see the implementation guideline and specification.

At the start of the construction, the storage chamber cover slab, pre-filter chamber top and bottom slab and channel should be cast at the very beginning to allow sufficient time for curing and hardening.

The pond and site/location selection criteria for PSF is shown at Appendix 2.

2. Materials for Pond Sand Filter

2.1 Materials required for Large Pond Sand Filter (PSF-500, for 300-500 users)

<table>
<thead>
<tr>
<th>Items</th>
<th>Specification</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. From DPHE store stock</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Cement</td>
<td>50 kg per bad</td>
<td>22 bags</td>
</tr>
<tr>
<td>2. CGI Sheet</td>
<td>6’ x 26 swg</td>
<td>3 nos.</td>
</tr>
<tr>
<td>3. Galv wire mesh</td>
<td>½”</td>
<td>25 sft.</td>
</tr>
<tr>
<td>4. Handpump No.6</td>
<td>each</td>
<td>1 no.</td>
</tr>
<tr>
<td>5. PVC pipe</td>
<td>1-1/2”</td>
<td>as required</td>
</tr>
<tr>
<td>Item Description</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-------------------</td>
<td></td>
</tr>
<tr>
<td>GI pipe 1-1/2”</td>
<td>1 no. 5’ one end threaded</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 no. 2’-6” both end threaded</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 nos. 1’-6” one end threaded</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 no. 1’-2” one end threaded</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 no. 0’-10” one end threaded</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 no. 1’-2” no thread</td>
<td></td>
</tr>
<tr>
<td>PVC strainer 1-1/2”</td>
<td>3 rft.</td>
<td></td>
</tr>
<tr>
<td>Solvent cement 50 gm tube</td>
<td>½ tube</td>
<td></td>
</tr>
<tr>
<td>MS rod/MS wire 1/8”</td>
<td>No. 10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MS wire 75 rft.</td>
<td></td>
</tr>
<tr>
<td>MS rod 3/8”</td>
<td>2 rft</td>
<td></td>
</tr>
<tr>
<td>PVC adaptor</td>
<td>if required</td>
<td></td>
</tr>
<tr>
<td>PVC spigot</td>
<td>if required</td>
<td></td>
</tr>
<tr>
<td>PVC coupling</td>
<td>if required</td>
<td></td>
</tr>
<tr>
<td>PVC end cap</td>
<td>2 nos.</td>
<td></td>
</tr>
<tr>
<td>Pipe wrench (14”)</td>
<td>1 no.</td>
<td></td>
</tr>
<tr>
<td>Slide wrench (12”)</td>
<td>1 no.</td>
<td></td>
</tr>
<tr>
<td>1st class bricks</td>
<td>1700 nos.</td>
<td></td>
</tr>
<tr>
<td>1st class picked bricks</td>
<td>675 nos.</td>
<td></td>
</tr>
<tr>
<td>(for making khoa)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local sand (FM=1.0)</td>
<td>25 cft.</td>
<td></td>
</tr>
<tr>
<td>Masonry sand (FM&gt;1.4)</td>
<td>125 cft.</td>
<td></td>
</tr>
<tr>
<td>Sylhet sand (D10=.25-.35 mm)</td>
<td>90 cft.</td>
<td></td>
</tr>
<tr>
<td>Hose pipe 1-3/4”</td>
<td>2 ft.</td>
<td></td>
</tr>
<tr>
<td>Jubilee clip 2-1/2”</td>
<td>2 nos.</td>
<td></td>
</tr>
<tr>
<td>GI cap 1-1/2”</td>
<td>3 nos.</td>
<td></td>
</tr>
<tr>
<td>PVC elbow 1-1/2”</td>
<td>4/5 nos.</td>
<td></td>
</tr>
<tr>
<td>Reducer 1-1/2” x ½”</td>
<td>2 nos.</td>
<td></td>
</tr>
<tr>
<td>Manhole cover 22”</td>
<td>1 no.</td>
<td></td>
</tr>
<tr>
<td>with locking device</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timber to size as specified</td>
<td>0.75 cft. [2”x2”x5’-10” – 3 nos.] [2”x1”x6’-3” – 3 nos.</td>
<td></td>
</tr>
<tr>
<td>Hinge &amp; Bolt (Hash kol) locally made</td>
<td>2 pairs</td>
<td></td>
</tr>
<tr>
<td>Nails 1½” &amp; 2”</td>
<td>0.25 kg.</td>
<td></td>
</tr>
<tr>
<td>Small size water jar (kolsi) clay made</td>
<td>1 no.</td>
<td></td>
</tr>
<tr>
<td>Tap (urban type) ½” size</td>
<td>2 nos.</td>
<td></td>
</tr>
<tr>
<td>Padlock &amp; Keys</td>
<td>2 nos.</td>
<td></td>
</tr>
<tr>
<td>Local made chain and</td>
<td>1 pair</td>
<td></td>
</tr>
<tr>
<td>hook or staple and hasp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coal tar paint or equivalent</td>
<td>1 kg.</td>
<td></td>
</tr>
<tr>
<td>Bamboo full length</td>
<td>2 nos.</td>
<td></td>
</tr>
</tbody>
</table>
### Materials required for small Pond Sand Filter (PSF-300, for less than 300 users)

<table>
<thead>
<tr>
<th>Items</th>
<th>Specification</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. From DPHE store stock</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Cement</td>
<td>50 kg per bad</td>
<td>11 bags</td>
</tr>
<tr>
<td>2. CGI Sheet</td>
<td>6’ x 26 swg</td>
<td>1.5 nos.</td>
</tr>
<tr>
<td>3. Handpump No.6</td>
<td>each</td>
<td>1 no.</td>
</tr>
<tr>
<td>4. PVC pipe</td>
<td>1-1/2”</td>
<td>as required</td>
</tr>
<tr>
<td>5. GI pipe</td>
<td>1-1/2”</td>
<td>1 no. 2-6” both end threaded</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 no. 1’-6” one end threaded</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 nos. 1’-2” one end threaded</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 no. 0’-10” one end threaded</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 no. 0’-10” one end threaded</td>
</tr>
<tr>
<td>6. PVC strainer</td>
<td>1-1/2”</td>
<td>3 rft.</td>
</tr>
<tr>
<td>7. Solvent cement</td>
<td>50 gm tube</td>
<td>½ tube</td>
</tr>
<tr>
<td>8. MS rod/MS wire</td>
<td>1/8”</td>
<td>No. 10</td>
</tr>
<tr>
<td></td>
<td>MS wire</td>
<td>75 rft.</td>
</tr>
<tr>
<td>9. MS rod</td>
<td>3/8”</td>
<td>2 rft</td>
</tr>
<tr>
<td>10. Wire mesh</td>
<td>½”</td>
<td>9 sft.</td>
</tr>
<tr>
<td>11. PVC adaptor</td>
<td>-</td>
<td>if required</td>
</tr>
<tr>
<td>12. PVC spigot</td>
<td>-</td>
<td>if required</td>
</tr>
<tr>
<td>13. PVC coupling</td>
<td>-</td>
<td>if required</td>
</tr>
<tr>
<td>14. PVC end cap</td>
<td>each</td>
<td>2 nos.</td>
</tr>
<tr>
<td>15. Pipe wrench (14”)</td>
<td>each</td>
<td>1 no.</td>
</tr>
<tr>
<td>16. Slide wrench (12”)</td>
<td>each</td>
<td>1 no.</td>
</tr>
<tr>
<td><strong>B. From special procurement</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. 1st class bricks</td>
<td>-</td>
<td>950 nos.</td>
</tr>
<tr>
<td>2. 1st class picked bricks</td>
<td></td>
<td>315 nos.</td>
</tr>
<tr>
<td>(for making khoa)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Local sand</td>
<td>(FM=1.0)</td>
<td>15 cft.</td>
</tr>
<tr>
<td>4. Masonry sand</td>
<td>(FM&gt;1.4)</td>
<td>55 cft.</td>
</tr>
<tr>
<td>5. Sylhet sand</td>
<td>(D10=.25-.35 mm)</td>
<td>50 cft.</td>
</tr>
<tr>
<td>6. Hose pipe</td>
<td>1-3/4”</td>
<td>2 ft.</td>
</tr>
<tr>
<td>7. Jubilee clip</td>
<td>2-1/2”</td>
<td>2 nos.</td>
</tr>
<tr>
<td>8. GI cap</td>
<td>1-1/2”</td>
<td>3 nos.</td>
</tr>
<tr>
<td>9. PVC elbow</td>
<td>1-1/2”</td>
<td>4/5 nos.</td>
</tr>
<tr>
<td>10. Reducer</td>
<td>1-1/2” x ½”</td>
<td>1 nos.</td>
</tr>
<tr>
<td>11. Manhole cover</td>
<td>22”</td>
<td>1 no.</td>
</tr>
<tr>
<td>with locking device</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Timber to size</td>
<td>as specified</td>
<td>0.31 cft. [1”x2”x4’-6” – 5 nos.</td>
</tr>
<tr>
<td>13. Hinge &amp; Bolt</td>
<td>(Hash kol) locally made</td>
<td>2 pairs</td>
</tr>
<tr>
<td>14. Nails</td>
<td>1½” &amp; 2”</td>
<td>0.25 kg.</td>
</tr>
<tr>
<td>15. Small size water jar</td>
<td>(kolsi) clay made</td>
<td>1 no.</td>
</tr>
<tr>
<td>16. Tap (urban type)</td>
<td>½” size</td>
<td>1 nos.</td>
</tr>
<tr>
<td>17. Padlock &amp; Keys</td>
<td></td>
<td>2 nos.</td>
</tr>
<tr>
<td>18. Local made chain and</td>
<td></td>
<td>1 pair</td>
</tr>
</tbody>
</table>
hook or staple and hasp
19. Coal tar paint or equivalent 1 kg.
20. Bamboo full length 2 nos.

2.3 Tools and Equipment from DPHE store (for 5 PSF – one set required)
(same for Large and Small plant)

<table>
<thead>
<tr>
<th>Items</th>
<th>Specification</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sieve</td>
<td>½” dia 2’-6” x 3’</td>
<td>1 no. for khoa</td>
</tr>
<tr>
<td>2. Sieve</td>
<td>¼” dia 2’-6” x 3’</td>
<td>1 no. for khoa and sand</td>
</tr>
<tr>
<td>3. Sieve (1 mm)</td>
<td>1/25” dia 2’-6” x 3’</td>
<td>1 no. for sand</td>
</tr>
<tr>
<td>4. Sieve (0.5 mm)</td>
<td>1/50” dia 1’-6” x 2’</td>
<td>1 no. for cement</td>
</tr>
<tr>
<td>5. Hand saw</td>
<td>each</td>
<td>1 no.</td>
</tr>
<tr>
<td>6. Hand drill</td>
<td>each</td>
<td>1 no.</td>
</tr>
<tr>
<td>7. Bucket</td>
<td>each</td>
<td>2 nos.</td>
</tr>
<tr>
<td>8. Karai</td>
<td>each</td>
<td>3 nos.</td>
</tr>
</tbody>
</table>

3. Constriction of Pond Sand Filter (common for both size)

(a) PSF-500 : Large Plant  
(b) PSF-300 : Small Plant

3.1 Foundation and Floor

3.1.1 Preparation
- The bricks for soling and wall must be adequately soaked before use.
- The khoa, sand and cement must be sieved.
- The sieved khoa and sand must be washed to remove dust and foreign materials.

3.1.2 Procedure
- Choose a fairly level and well drained site for PSF near the pond.
- Mark out the foundation using wooden pegs and string (Fig. 1a/1b)
- Excavate the foundation uniformly to a depth of 9”. Remove the soil and keep aside. (The floor of the excavation must be leveled off and compacted by tamping).
- Set up the pipe work at the base of the pump (Fig. 1a/1b- section, A-A)
- Fill the bottom of the foundation with 2” layer of local sand with proper compaction.
- Place 3” brick soiling for main filter chamber, storage chamber and raised platform (shaded area in Fig. 2a/2b) (The joint between each brick should be filled with sand).
- Prepare cement concrete with a ratio of 1:2:4 (cement concrete must be used within half and hour after water mixing).
Figure I a, Lay out of Foundation (Large Plant)
Figure Ib, Lay out of foundation (Small Plant)
Space for pipe work

PLAN

connected to pond

SECTION A-A

SECTION B-B

Fig. 2b, Floor and Pipe work (Small)
• Pour a layer of 4” cement concrete (1:2:4) on the top of brick soling (shaded area in Fig. 2a/2b) for main filter chamber, storage chamber and raised platform.
• Pour a layer of 2” cement concrete (1:2:4) directly on the remaining portion of sand layer (must be saturated with water before placing of concrete) (unshaded area in Fig. 2a/2b) for user’s platform.
• Construct the cornice of the user’s platform (18) as 5” brick wall (Fig. 4a/4b).

3.1.3 Notes on Construction
• Concrete must be thoroughly compacted after placing (pouring).
• The slope of platform (approximately 1:50) must be towards the drainage outlet.
• Before starting brick work, allow the concrete to set for about 2 days, keeping it wet and covered with jute sacking or banana leaves to prevent drying (curing 12 hours after casting).
• The space shown in Fig. 2a/2b must be left empty for pipe work. After pipe work the space must be filled up with 3” brick soling and 4” cement concrete.

3.2 Brick work in Walls and Raised Platform

3.2.1 Preparation
• Before putting down the first brick layer.
  – roughen and clean the surface of concrete floor,
  – apply cement grouting (1:1) on the roughened surface and place pipings 12, 15 and 16 on the floor as shown in Fig. 3a/3b (see next para for details)
  – apply mortar (mix ratio 1:2)
• Construct the first brick layer as shown in Figure 3a/3b.
• The collection pipe from Filter chamber to storage chamber (12), Filter chamber wash out (15) and storage chamber washout (16) must be placed in the first layer of brick work as shown in Fig. 3a/3b and in Fig. 7a/7b – Section, B-B.
  (a mortar mix ratio 1:1 must be used around each pipe) details of pipe wash out pipes are shown in Fig. 9
• Bricks should be thoroughly cleaned and soaked in water before placing them on the mortar bed.
• The sand and cement must be sieved before mixing.
Figure 3a, First course of Brick Wall (Large)

Figure 4a, First 30" height (Large)
Figure 3b, First course of Brick Wall (Small)

Figure 4b, First 42" height (Small)
4. Procedure (Specific for Large Plant PSF-500)

4.1 Construct 10” brick wall for the filter chamber (FC), 5” brick wall for storage chamber (SC) and pre-filter chamber (PFC), up to a height of 30” on concrete floor (see shaded area in Fig. 4a).

4.2 The two outlet pipes (14) should be embedded into the masonry work of the storage chamber at the height of 19” from the platform top as shown in Fig. 4(a) and in Fig. 7a, Section B-B. Details of Water Tap and Stop Cock are shown in Fig. 10.

4.3 After construction of the brick work up to first 30” height, only the four corners of the filter chamber should be constructed as 10” wall and the rest of the wall from 30” to 47” height of the filter chamber (FC), storage chamber (SC) and pre-filter chamber (PFC) should be constructed as 5” wall (see shaded area in Fig. 5a).

4.4 At heights (within storage chamber (SC) and filter chamber (FC) shown in Fig. 4a and Fig. 7a, Section, B-B and C-C, set the stepping bricks (3” height and 10” width) directly into the walls (with varied projection) as detailed below:

<table>
<thead>
<tr>
<th>Steps</th>
<th>Filter chamber (2)</th>
<th>Storage chamber (13)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>12” (from floor)</td>
<td>12” (from floor)</td>
</tr>
<tr>
<td>2nd</td>
<td>27” (from floor)</td>
<td>27” (from floor)</td>
</tr>
<tr>
<td>3rd</td>
<td>42” (from floor)</td>
<td>42” (from floor)</td>
</tr>
</tbody>
</table>

4.5 Construct 35” height, 5” brick work for raised platform (6) on the concrete floor (see Fig. 7a).

4.6 Construct directly on the ground 5” brick wall for foot steps (9) to raised platform as shown in Fig. 4a and 7b.

4.7 Fill up and compact the space below the PFC and raised platform (upto 35”) and foot steps with sand or soil.

4.8 Construct above the compacted soil/sand the 5” brick wall (26) to support the pre-filter chamber as shown in Fig. 5a and 7a. upto 12” height. Fill and compact the space in the PFC chamber from 35” to 47” with soil/sand.

4.9 Place the pre-filter chamber bottom slab (1-1/2” thick) at the height of 47” from the floor as shown in Fig. 6a and Fig. 7a, Section A-A.

4.10 Place the connection pipes (27) from pre-filter chamber to filter chamber and pre-filter chamber without pipe (17) on the PFC bottom slab as shown in Fig. 6a.

4.11 Construct the remaining portion (47” to 60” height) of PFC, SC and FC as mentioned in 4.3.
Figure 5a, From 30" to 60" height (Large)

Fig. 6a, Pre-Filter Chamber Slab at 47" height (Large)
Figure 5b, From 42" to 54" height (Small)

Fig. 6b, Pre-Filter Chamber Slab at 42" height (Small)
4.12 Cast a rectangular concrete block 10”x10”x12” (10) around the rise pipe supporting the hand-pump as shown in Fig. 5a and Fig. 7a, Section, A-A.

4.13 Cast 1” thick concrete slab (1:3:6) on each step (9) and on the top of raised platform (6).

4.14 Embed two bolts (5) into the two corners of the main filter chamber as shown in Fig. 7a, plan.

4.15 Embed the hook/hasp 929) to the top of the wall of the main filter chamber as shown in Fig. 7a, Section A-A.

4.16 The space between the filter chamber washout pipe (15) and the pre-filter chamber wall in large plant should be filled with 2-1/2” cement mortar (1.6) [shaded area ///// in Fig. 3a] to avoid any water logging there.

4.17 Details of construction are shown in Fig. 7a.
Figure 7a, Details of Pond Sand Filter

Large
SECTION B-B

SECTION C-C

(to be filled with mortar)

Figure 7a, Details of Pond Sand Filter. (large)
SECTION D-D
(Figure 7a)
5. Procedure (Specific for Small Plant PSF-300)

5.1 For the First 42” height construct 5” brick wall for the filter chamber (FC) and storage chamber (SC) on the concrete floor (see shaded area in Fig. 4b).

5.2 The outlet pipe (14) should be embedded into the masonry work of the storage chamber at the height of 19” from the top of platform as shown in Fig. 4b and in Fig. 7b, Section B-B. Details of water tap and stop cock is shown in Fig. 10.

5.3 At heights (with PC and SC) shown in Fig. 4b and Fig. 7b, Section B-B and C-C, set the stepping bricks (3” height and 10” width) directly into the walls as described below:

<table>
<thead>
<tr>
<th>Steps</th>
<th>Filter chamber (2)</th>
<th>Storage chamber (13)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>12” (from floor)</td>
<td>12” (from floor)</td>
</tr>
<tr>
<td>2nd</td>
<td>33” (from floor)</td>
<td>33” (from floor)</td>
</tr>
</tbody>
</table>

5.4 Place the pre-filter chamber bottom slab (1-1/2”) at a height of 42” from the floor as shown in Fig. 6b and Fig. 7b Section A-A.

5.5 Place the connection pipes (27) from PFC to FC and pre-filter chamber washout pipe (17) on the bottom slab (Fig. 6b).

5.6 Construct 31” high, 5” brick work for raised platform (6) on the concrete floor (Fig. 7b).

5.7 Construct directly on the ground 5” brick wall for foot steps (9) to raised platform as shown in Fig. 4b and 7b.

5.8 Fill up and compact the space below the raised platform and foot step with sand or soil.

5.9 Cast a rectangular concrete block (10) around the rise pipe supporting the handpump as shown in Fig. 5b and Fig. 7b, Section A-A.

5.10 Cast 1” thick concrete slab (1:3’6) on each step (9) and on the top of raised platform (6).

5.11 Embed two bolts (5) into the two corners of the main filter chamber as shown in Fig. 7b plan.

5.12 Embed the hook, hasp 929) to the top of the wall of the main filter chamber as shown in Fig. 7b (plan).

5.13 Details of construction are shown in Fig. 7b.
SECTION A-A

Figure 7b, Details of Pond Sand Filter (Small)
Figure 7b, Details of Pond Sand Filter. (Small)
6. Notes on Construction

- The mortar should be mixed on a clean platform.
- To ensure wall is waterproof, joints must be carefully filled with mortar, eliminating all gaps and voids.
- The mortar thickness between brick layers should be 10 mm (approx. ½”).
- Joints should be scraped down approximately 10 mm deep and filled with fresh mortar.
- For the first two layers of brick work the mortar mix ratio should be 1:2 after that 1:4.
- Bricks should be laid in patterns that do not result in a straight line joint vertically (see Fig. 8).
- The walls should be built evenly so the weight is distributed uniformly on the foundation.
- After the mortar is set the masonry should be covered and watered regularly for curing.
- The bolt should be L-shaped.

6.1. Plastering

6.1.1 Preparation

- Bricks should be completely cleaned and dampened before putting down the first coat of plaster.
- The mortar for plastering should be mixed on a clean platform and the mix itself should be without any impurities.

Figure 8, Brick Work Details
Figure 9, Details of Washout Pipes

Figure 10, Details of Water Tap and Stop Cock

Figure 11, Details of Ferro-Cement Channel
6.1.2 Procedure

- The inside wall of all the chambers is given two coats of plaster. The first coat is spatter-dash, using a rough plaster of 1:3 mix ratio. This coat is not trowel led smooth, but left bumpy and irregular to provide a rough surface for the next coat to adhere to. The thickness of this coat is ½”.
- The second coat is a 1:2 mortar mix ratio trowel led smooth and clean. The thickness of this coat is ¼”.
- After the second coat a neat smooth cement finish is applied.
- The outside wall of all the chambers, raised platform and steps are given only one coat of 1:4 plaster, ½” thick. This coat is trowel led, smooth clean.
- The cement finish for the outside wall extends only 1ft. up from foundation level, except in the platform area where it extends 3 ft.
- The bottom of the filter chamber should be plastered as shown in Fig. 16.

6.1.3 Notes on Plastering

- The plastering of the inside wall is started first.
- The plaster must firmly be applied and properly compacted to make sure that there is a good bond between bricks and plaster.
- The first coat should be left for 24 hours before applying the second coat.
- After finishing the second coat the cement finish must be applied straight way. The mixture for the cement finish is 1 part cement with 1 part water (1:1).
- Care must be taken for proper curing of the plaster.

6.2 Construction of SC Cover Slab and PFC Ferro-cement Slab
(to be cast at the very beginning)

6.2.1 Storage Chamber Cover Slab

- Level a part of the ground.
- Layout the dimensions as shown in the Fig. 12a/12b and make a framework with bricks.
- Lay cement bags on the ground to minimize soaking of the mortar into the soil.
- Place the vent pipe as shown in the Fig. 12a/12b-Section, A-A.
- Blank off the area where the manhole will be, using a circular object like a bucket.
- Place the first layer of concrete (mix ratio 1:3:6) ½” thick and compact properly.
- Place the No. 10 MS wire/1/8” MS rod as shown in the Fig. 12a/12b.
- Place the manhole frame.
- Place the final layer of concrete (1:3:6) 1” thick and smooth its surface.
- Cover the slab for 24 hours.
- After curing place the slab over the storage tank and seal the gaps between slab and storage chamber with a mortar of mix ratio 1:3.
- Fix the manhole cover.
- Make sure that the manhole is situated over the steps in the storage chamber.
Figure 12a, Details of Storage Chamber Cover Slab

Top cover

FERRO-CEMENT (1:3) SLAB FOR PCC

Chicken wire mesh (2-layers)

Proportion of mix: 1:3

FERRO-CEMENT SLAB SECTION A - A

Figure 13a, Pre-Filter Chamber Slab (Large)

(Top A Bottom)
Figure 12b, Details of Storage Chamber Cover Slab (Small)

Figure 13b, Pre-Filter Chamber Slab (Small)
6.2.2 Ferro-Cement Pre-Filter Chamber Bottom Slab and Channel
(to be cast at the very beginning)

- The same procedure should be followed except, cement mortar (mix ratio 1:3) should be used in place of concrete in three layers as shown in Fig. 13a/13b.
- Over the first ½” layer of mortar, place the first layer of ½” wire mesh.
- Place the second layer of mortar (1:3) ½” thick and compact.
- Place the second layer of ½” wire mesh as shown in Fig. 13a/13b Section, A-A.
- Place the final layer of mortar ½” thick and smooth its surface.
- Cover the slab for 24 hours.
- After 24 hours, remove the covers and frame work and cure the slab for at least 7 days.
- After curing place the slab in position when the construction of the filter chamber has reached the specified height (47” for large plant and 42” for small plant)
- Support the free corner of the slab by bricks or bamboo (small PSF)
- Install pipe work as shown in Fig. 6a/6b.
- Complete the brick work, leaving a gap in the wall for fixing the ferro-cement channel (8).

6.2.3 In the same way construct a PFC top cover slab 24”x32”, Fig. 13(a), Top Cover.

6.2.4 Ferro-cement Channel should be constructed as shown in Fig. 11 (to be cast in the very beginning).

6.3 Construction of Lid

- Cut all the wood to the sizes shown in the Fig. 14.
- Make the framework of lid as shown in the Fig. 14.
- Fix the hinges corresponding the bolts (5) and staple (28) to the frame.
- Fix the CGI sheets to the frame.
- Place the lid over the filter chamber and fix the hinges with the anchor bolts (5).
Figure 74, Details of Filter Chamber Lid.
6.4. Connecting Pond to Sand Filter and Installation of Intake Pipe

6.4.1 Preparation

- Collect information regarding the maximum and minimum depth of water level in the pond.

6.4.2 Procedure

- Make out trench from the foot of the filter (near the base of hand pump) to the bank of pond (following the shortest distance as shown in Fig. 1a/1b).
- Dig the trench.
- The depth of trench near the bank of pond should be about 4 ft. (depending on the depth of minimum water level) and its width 2 ft.
- The slope of trench should be towards the filter (100:1). This slope makes it easier to pump water from the pond to the filter and also ensures there is always water in the pipe, eliminating the need for priming.
- The bottom of the trench must be leveled and cleaned to make sure that the PVC pipe will not be damaged.
- 1-1/2" PVC pipe is used to connect the pond water to the hand pump.
- The PVC pipe is extended up to the middle of the pond.
- In the middle of the pond a 3ft. length of 1-1/2” PVC inlet filter (tubewell screen) with end cap is connected to the PVC pipe, using an adaptor if necessary as shown in the Fig. 15.
- A sealed clay pot is used in the pond to keep the PVC inlet filter floating as shown in the Fig. 15.
- A wooden or bamboo structure is used to keep the PVC inlet pipe in a fixed position.
- A 2 ft. length of flexible hose pipe is fitted about 10 ft. from the edge of the pond to enable the pipe to move up and down easily as the water level varies.
- The hose pipe is connected to the PVC pipe again, which continues up to the foot of the sand filter. An intermediate support to the PVC pipe is to be provided between the edge of the pond and hose pipe to prevent sogginess/damage.
- A PVC elbow is fitted at the foot of the pipework and the PVC pipe connected to a GI pipe (Fig. 2a/2b-Section, A-A).
- The hand pump is set on the GI pipe.

6.4.3 Installation Notes

- The end of PVC pipe should float 2 ft. below the water level.
- The PVC pipes should be joined with solvent cement, except the joint between the inlet screen filter and the PVC pipe. This joint should be a push-fit to enable easy removal of the screen for cleaning.
- The hose pipe should be under water to prevent damage by heat or animals.
- The PVC pipe should be pushed inside the hose pipes, and secured with two jubilee clips on the hose pipe.
- The pipe should be supported inside the pond as shown in Fig. 15.
- The GI pipe must be cut to the required length and trenched, if necessary.
- PVC pipe can be joined to GI pipe by PVC threaded socket adopter.
Figure 15. Details of Intake and Pond - Sand Filter Connection
7. Filter Media

7.1. Preparation of Filter Media (sizes and grading, sieving)

- The filter khoa should be graded into the following sizes:
  
  - 1/8” to 1/4’’ - 4” height
  - 1/4’’ to 1/2” - 4” height
  - ½” to 1 - 4” height

  For grading the khoa, first use the ½” sieve; the retained khoa will be used for the layer of particle size > 1/2. Then use the ¼” sieve; the retained portion will be used for the ½” to ½” layer; the passing portion will be used for the layer of particle size < 1/4”.

- The filter sand should be graded to an effective size of 0.2 mm to 0.35 mm. For grading the sand, use the ¼” sieve to separate the larger particles. Then use the 1/25” sieve to separate the smaller particles. The remaining sand will have the required effective size of 0.2 to 0.35 mm.

7.2. Preparation of Filter Chamber

- Before placing the filter media the main filter chamber and storage chamber should be thoroughly washed.

- Make a brick tunnel (4) in front of the connection pipe (12) as shown in the Fig. 7a/7b and in the Fig. 16. The brick should be washed before putting them into the chamber.

7.3. Placing of Filter Media

- Wash the ½” to 1” sizes khoa and place it in the bottom of the filter chamber to a depth of 4”.

- Then wash and place the ¼” to ½” and 1/8” to ¼” sizes khoa respectively in the same manner in layers of 4” each as shown in Fig. 16.

- Then wash the filter sand as follows:
  
  - Wash the platform.
  - Place a moderate amount of sand on the platform.
  - Close the platform drain.
  - Pour plenty of water onto the sand and mix.
  - Drain the dirty water.
  - Repeat until the sand is completely clean.

- Place the sand carefully to a depth 18” on the top of the khoa layer.

- Place 7” layer of ¼” khoa in the pre-filter chamber.

- Place sufficient amount of coconut fiber over the khoa layer in PFC as shown in Fig. 7a/7b.

- Excess sand should be left with beneficiaries.
Brick Tunnel Shrouded with Graded Khoa

Filter Bed

Figure 16, Details Filter Bed and Brick Tunnel
8. Operation, Cleaning and Maintenance of PSF

8.1. Operation Procedure
- After the filter media is placed open the washout pipe of the filter chamber to drain accumulated water. Then close the washout.
- Place bricks on top of the sand under the pre-filter chamber to reduce disturbance and securing of the sand under impact of water.
- Pump water until the filtered water enter the storage chamber.
- After some time filtered water will pass through the washout pipe of the storage chamber.
- The initial filtered water should be drained through the washout pipe of the storage chamber.
- Close the washout pipe of the storage chamber. The water level in the storage chamber will rise to the level of the outlet pipe.
- Draw water from the storage chamber by opening the tap.

8.2. Precautions and Regulations
- The lid and manhole should be kept closed at all times except when cleaning the PSF.
- Pump every time you draw the water.
- The taps should always be closed to prevent wastage of water.
- No one should be allowed to disturb the sand bed.
- Nothing should be dropped into the filter chamber or storage chamber.
- The PSF lid should be shut gently to avoid damage.
- Always keep the manhole under lock and key to prevent the people from going into the storage tank.
- PSF should be used for as many purposes as possible.

8.3. Cleaning of PSF
Due to clogging of the top layer of sand by impurities, the filtration rate will gradually drop and the flow rate through the outlet pipe will also be too low, the top sand layer must be cleaned at that time. Caretaker family should be trained to clean the PSF.

The cleaning procedure of Main Filter Chamber is as follows:
- Stop pumping and open the lid.
- Open the FC washout pipe and let the water drop below sand level.
- Scrap 3” of sand from the top of the filter bed.
- Wash this sand on the platform and place the clean sand back into the filter.
- Close the FC washout pipe.
- Clean dust and insects from inside the tank and lid.
- Wash the platform and platform drain.
- Close the lid and start pumping.

Note: It is quite possible for 2 persons to clean the PSF in under 45 minutes.
- Periodically it may be necessary to add new sand (Sylhet Sand) to replenish the lost sand in order to maintain the sand level.
- It will take a few days for the PSF to reach its desired performance.
8.4. **Cleaning of Storage Chamber**
- Open the storage chamber washout pipe.
- Open the manhole, enter the storage chamber and clean the walls and floor.
- Close the manhole and SC washout pipe.

8.5. **Cleaning of Pre-Filter Chamber**
- Open the washout of the pre-filter chamber.
- Take all the khoa out and clean the khoa on the platform.
- Clean inside of pre-filter chamber.
- Close the washout.
- Put the clean khoa back into the pre-filter chamber.

8.6. **Cleaning of PVC Screen**
- Take the PVC screen out of the pond.
- Clean the outside of the screen with a brush or cloth.
- Clean the inside of strainer using a cloth wrapped on a stick.
- Wash the screen with water.
- Put the screen back in its original position.

8.7. **Maintenance of PSF**
If the PSF has been properly constructed, the only items likely to need replacement and repair are the movable parts, i.e. the lid and hose pipe. The repair of the lid should be within the competence of any local carpenter. The hose pipe may be replaced as and when needed.

The pump handle fulcrum pins should be oiled regularly with any type of oil (mustard oil works well). This will prevent the handle from wearing out fast and make pumping easy.
Appendix-1

List of Items and Various parts of a Pond Sand Filter

1. Filter Chamber (FC)
2. Step Down to FC
3. Pre-Filter Chamber (PFC)
4. Brick Tunnel
5. MS Hinge Anchor Bolt
6. Raised Platform
7. Handpump
8. Ferro-cement Channel
9. Brick Foot Step to Pump
10. Concrete Block
11. Storage Chamber (SC)
12. Collection Pipe (FC to SC)
13. Step down to SC
14. Delivery Pipe and CI Tap
15. FC Washout Pipe
16. SC Washout Pipe
17. PFC Washout Pipe
18. Platform
19. ½” Dia. PVC Vent Pipe (Perforated)
20. Manhole
21. Pitcher Seat
22. Fixed SC Cover
23. Lid for Filter Chamber
24. Graded Sand Bed (0.2-0.35mm)
25. Graded Khoa (1-½”, ½”-¼”, ¼”-1/8” in 4” layers, fine above coarse)
26. PFC Support Wall (large)
27. Connection Pipe (PFC to FC)
28. Chain (1/4” MS) or Staple
29. Hook/Hasp (1/4” MS)
30. Bricks to stop displacing of sand
Appendix-2

Basic Requirement of a Pond for Construction of a PSF

Selection of a proper pond meeting the following requirements is very important and the key to proper construction, operation and maintenance:

a) The pond must be large enough to ensure that it will not dry out in the dry season.

b) The salinity of the pond water must not exceed 600 ppm at any time of the year.

c) The iron content of the pond water must not exceed 5 ppm at any time of the year.

d) While the location of the PSF should be close to a family to ensure its security, it must be freely accessible to the public.

e) The beneficiaries must complete an application form to build a PSF and must be willing to participate and contribute in the construction and take complete responsibility for operation and routine maintenance.
B. General Guideline for River Sand Filter*

* Draft prepared by Dhaka Community Hospital
A. Existing Water Resource Survey

− Collection of record (number, location, present situation) of arsenic safe water resources in the area.
− Collecting reports of household drinking and cooking water use.

B. Site Selection

Site is selected considering factors stated below:
1. Distance of river form RSF site.
2. River water level at dry season (should be at least 15-20’ deep).
3. Taste and color of river water at dry season.
4. Highest flood level of the project area.
5. Information on stability of riverbank.
6. Type of land use and industrial development of surrounding area.

C. RSF Configuration

1. Length : 11’6”
   Width : 10’
   Height : 5’2’’ (above GL)
   Number of Chamber : 6

2. A waste pipe is connected with every chamber

D. RSF Chamber Information (Fig. 1)

<table>
<thead>
<tr>
<th>Chamber No.</th>
<th>Length</th>
<th>Width</th>
<th>Height</th>
<th>Material Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3’</td>
<td>3’8”</td>
<td>1’8”</td>
<td>1.5” brick chip</td>
</tr>
<tr>
<td>2</td>
<td>2’6”</td>
<td>3’8”</td>
<td>1’8”</td>
<td>1” brick chip</td>
</tr>
<tr>
<td>3</td>
<td>2’6”</td>
<td>3’8”</td>
<td>1’8”</td>
<td>3/4” brick chip</td>
</tr>
<tr>
<td>4</td>
<td>2’11”</td>
<td>3’8”</td>
<td>1’8”</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>6’7”</td>
<td>6’1”</td>
<td>5’2”</td>
<td>3” brick chip, Sylhet Sand and White Sand</td>
</tr>
<tr>
<td>6</td>
<td>4’4”</td>
<td>6’1”</td>
<td>5’2”</td>
<td>Treated Fresh, Water Reserve and 3500 liters</td>
</tr>
</tbody>
</table>

1. From 4th chamber water is supplied to 5th chamber through flow pipe.
2. Filtered water is stored in 6th chamber. Its capacity is 3500 litre.

E. Construction

1. 1’ foundation below GL. This consists of 5” brick soling and above it 4” concrete casting. 1” plastering above concrete casting.
2. Above foundation 10” brick wall is provided up to 42” height and from this point 5” brick wall is provided up to 20” height.
Figure 1 Chambers of the RSF
3. 2000-liter capacity overhead tank is installed beside RSF at 16’ height above GL.
4. Four 10”x10” pillar is constructed to hold the tank. Each pillar has 15”x15” RCC foundation below GL up to 2’.
5. Water is supplied through ¾” PVC pipe from the tank to tap point.
6. 22”x22” platform with drainage line is constructed at tap point.
7. ½” GI pipe is connected with tap.

**F. Water Flow Pattern**

1. Water is supplied to 1st chamber from the river through 1” PVC pipe. A 1HP electric pump is used to raise water.
2. Water passes through chamber 1, 2 and 3 horizontally and reaches to chamber 4.
3. From Chamber 4 water is supplied to chamber 5 through flow pipe.
4. Water then passes to 5th chamber where it is filtered by slow sand filtration and then passes to 6th chamber.
5. A ½” HP electric pump is used to raise water from 6th chamber to overhead tank.
6. ¾” PVC pipe is used to supply water from tank to tap point.

**G. Maintenance**

RSF filtering materials are cleaned at one monthly interval. Top 6” material from each chamber is taken out from the chamber, washed with clean water, sun dried and then put into the respective chambers.

**H. Water Quality**

15 water parameters are tested in the laboratory three times a year. These were: pH, color, turbidity, carbon dioxide, alkalinity, hardness, iron, manganese, chloride, fluoride, nitrate-nitrogen, total dissolved solids, total coliform, faecal coliform and arsenic. Water samples are collected from the source, chambers and point.