WASH Flood Response and Recovery in Kerala - 2018 - 2019

SOP For Cleaning and Retrofitting of Dugwells

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Standard Operating Procedure for Rehabilitation of Dug Wells After Floods

The aim of this document is to explain the field level procedures in repairs and retrofitting of wells. The floods of 2018 due to South West monsoon, caused a very great havoc in 13 districts of Kerala by inundating all the Dug Wells, Borewells and Septic tanks. The flood water mixed with faecal sludge and black water of the flooded septic tanks contaminated the wells causing health hazards.

UNICEF and the Government of Kerala associated with Gramalaya started the relief works in 5 most affected districts of Kerala. The local Panchayat authorities and the State Government authorities assisted the team in assessing the damages caused to the wells and septic tanks of the villages in Alappuzha, Ernakulam, Pathanamthitta, Thrissur and Wayanad. A project was arrived to repair and retrofit the wells and the septic tanks contaminated by the floods and to create models of the method of cleaning and repairing the wells and the septic tanks.

Rehabilitating of Wells:

When the wells are flooded, faecal waste and dead animals may be found in the well water. Dewatering and desilting of the wells and disinfecting them is very much important to make the water safe for drinking. If the wells are dug deep to increase the water level and repaired, we have to disinfect the well to make it safe drinking water.
Open Dug wells:

If the wells are contaminated and filled with flood water alone, cleaning and disinfecting them is sufficient. The inner walls of the well and the excess water drain should be kept clean.

The surrounding of the well is to be properly maintained and protected from being contaminated water by the regular use during non-disaster periods.

For Retrofitting and Rehabilitation of Dug Wells the detailed Standard Operating Procedures are given below:

Step 1: Survey of affected Dug Wells:

- The dug wells in the flood affected area should be surveyed for the details as given in the survey format.
- The pre and post flood scenario of the wells and water level and damages caused by the floods should be recorded in the survey format.
- The cross-sectional drawing of the wells should be drawn with respect to some temporary bench mark established at site.
- The damages to the rings placed inside and to the parapet wall and other damages are also to be noted in the survey format.

Step 2: Observations of the Dugwells:

- Turbidity in the wells have been increased due to the floods up to 29.60 NTU (allowable is 1.0 NTU).
- In some areas of Alappuzha district iron content up to 8.50mg/litre(allowable is 1.0mg/litre) in water is found.
- Coliform is present in most of the areas.
- In some of the wells in Pathanamthitta district E-coli is present.
- The pH value is as low as pH 3.80 in some of the wells in Pathanamthitta district.
- Kerala people tend to treat the water drawn from the dug well is pure and sacred.
- The septic tank out let is situated close to the dug well.
## Survey Format for Dug Wells

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Particulars</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Name of the Block</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Name of the Gram Panchayat</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Name of the Village</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Name of the Beneficiary</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Address of the Beneficiary</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>GPS Co-Ordinates</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Location of TBM (Temporary Bench Mark)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Total Depth of the well from ground level</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Depth of Current Water-level below the Ground level</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Height of the Parapet wall from ground-level</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Diameter of the well</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Whether the dug well water meant for drinking purpose emanating foul smell after the flood</td>
<td>Yes ☐  No ☐</td>
</tr>
<tr>
<td>13</td>
<td>Did the water level raise or low after the flood?</td>
<td>Yes ☐  No ☐</td>
</tr>
<tr>
<td>14</td>
<td>Is Motor Pump fitted in the well?</td>
<td>Yes ☐  No ☐</td>
</tr>
<tr>
<td>15</td>
<td>Is Well water Used Before Flood?</td>
<td>Yes ☐  No ☐</td>
</tr>
<tr>
<td>16</td>
<td>Is Well water in Usage After Flood?</td>
<td>Yes ☐  No ☐</td>
</tr>
<tr>
<td>17</td>
<td>Is the Well Abandoned?</td>
<td>Yes ☐  No ☐</td>
</tr>
<tr>
<td>18</td>
<td>Whether the well water polluted</td>
<td>Yes ☐  No ☐</td>
</tr>
<tr>
<td>19</td>
<td>Is Well water used for Drinking?</td>
<td>Yes ☐  No ☐</td>
</tr>
<tr>
<td>20</td>
<td>Is Well water used for Domestic purpose?</td>
<td>Yes ☐  No ☐</td>
</tr>
<tr>
<td>22</td>
<td>Whether the well is chlorinated or not?</td>
<td>Yes ☐  No ☐</td>
</tr>
<tr>
<td>23</td>
<td>If yes, Specify how many times the well was Chlorinated?</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>What type of Chlorination and when it was done?</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Who has carried the chlorination?</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>What is the present condition of water?</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Whether the well needs desilting?</td>
<td>Yes ☐  No ☐</td>
</tr>
<tr>
<td>28</td>
<td>Did the taste of water change after Flood?</td>
<td>Yes ☐  No ☐</td>
</tr>
<tr>
<td>29</td>
<td>How many members using the well water?</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Did the well covered? If yes, what type of material used?</td>
<td>Yes ☐  No ☐</td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Particulars</td>
<td>Details</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------------------------------------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>31</td>
<td>Beneficiary is willing for field test?</td>
<td>Yes ☐ □ No ☐ □</td>
</tr>
<tr>
<td>32</td>
<td>Did the water sample collected for tests? If yes, when?</td>
<td>Yes ☐ □ No ☐ □</td>
</tr>
<tr>
<td>33</td>
<td>Distance between Dug well and toilet septic tank soak pit</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Is there risk of any other toilet tank soak pit near well?</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>If yes, distance between them</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Is there any other risk of contamination near by area?</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>If yes, give the details</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Is there is any structural damage to the well?</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>If yes, give the details</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Did the house hold have any other water supply?</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Risk Assessment</td>
<td>Very High ☐ □ High ☐ □</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medium ☐ □ Low ☐ □</td>
</tr>
<tr>
<td>42</td>
<td>Is the well selected for the project demonstration?</td>
<td>Yes ☐ □ No ☐ □</td>
</tr>
<tr>
<td>a</td>
<td>If yes, give the details for selection</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>If No, give the details for non selection</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Any other details</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Whether rough hand sketch of the household surveyed (Map) attached</td>
<td>Yes ☐ □ No ☐ □</td>
</tr>
<tr>
<td>45</td>
<td>Did Photo of the well attached?</td>
<td>Yes ☐ □ No ☐ □</td>
</tr>
</tbody>
</table>

Note: The format is based on WHO Guidelines for Drinking Water Quality(Second Edition) Volume 3

Name of the District Coordinator: Signature:
Name of the Verifying Officer: Signature:
Step 3: Personal Safety Equipments:

- Necessary care should be taken while working inside the well. While repairing and maintaining the wells the following measures are to be taken.
- Carbon Monoxide gas will be emanated from the pumps operated in Diesel and Petrol. Other poisonous gases may also be emanated from inside the well.
- While cleaning the inner walls, attack of Chlorine gas may be faced. Using preventive equipments is a must.
- The labour engaged inside the well may face danger of drowning by fast water secreting. Hence the labour should go into the well tying a rope around his waist.
- Helmet should be worn to avoid accidents by things falling down from the surface or collapsing of inner walls.
  - Equipments like weak and worn out Buckets, Ladders and Ropes

Step 4: Dewatering & Cleaning the Dug wells:

- The depth of the water level before the floods and at present level is to be noted from the beneficiaries of the well.
- The labours engaged in cleaning the wells should have necessary equipment and also should possess sufficient training in the field.
- Before cleaning the well, the path of the drain, the status of the walls of the well and necessary equipments should be kept ready.
- The contaminated water should be pumped out of the well.
- The water drained from the well should be disposed through proper drainage or in a low lying place than the well.
- The well has to be thoroughly cleaned by desludging and removing the wastes and debris thoroughly.
- The inner walls of the well have to be repaired and the height of the wall can be raised a few lines as per necessity.
- 5 m.gms of Chlorine per litre of water is to used to clean the walls of the well.
- Drain the water completely and wait till the well retrieves water fully.
- Always repair and maintain the cover of the well and water lifting equipments
Step 5: Procedures of removing solid things from the wells while repairing:

Big sized buckets can be used to drain the water out. Using pulleys and rope are also a procedure followed for draining the water. Using ropes and pulleys may not be helpful for deeper wells which have to be cleaned till the bottom fast.

Common submersible pumps can be used for draining water. When using submersible electric motor pump, precaution should be taken to ensure no damages to the electrical wires to avoid electrocution.

After dewatering and completely emptying the well, the debris have to removed by using the chain pulley method.

Step 6: Cleaning the inner walls of the well:

- Long handled strong and sturdy brushes can be used with 200 grams per litre Chlorine solution, to clean the inner walls of the well. Cleaning of the wells can be done from outside if the wells are shallow.
- While working inside the well, Helmet, face mask, goggles and gloves have to be used to avoid harmful gas emitted by Chlorine. The Chlorine solution should remain on the walls for a minimum of 30 minutes before cleaning.
- The repairing of the inner walls and the parapet wall can be undertaken after dewatering.

Step 7: Repairing and Improving the Structures:

The factors contaminating the well after repairing and disinfecting, should be avoided. The parapet wall, the flow path of water into the well, the pumps and water fetching equipment are to kept clean. Cover or net to keep the well protected from falling of leaves have to be repaired and the well is to be kept clean and hygiene.

Find out the cracks in the inside walls of the well particularly near the surface. The seepage of dirty water from the surface and contaminating the well could be avoided by plastering all the cracks. The sides of the cracks have to be scraped and then plastered with cement and sand mortar.
Step 8: Estimation of water in well:

- Before chlorination the water quantity in the well has to be calculated to arrive at the quantity of bleaching powder needed for the chlorination.
- First measure the diameter of the well and then divide the dia by two to get the radius of the well.
- Measure the depth of the water in the well by lowering a rope slowly with a weight at the bottom and just touch the bottom of the well.
- Lift the rope to surface and measure the depth of water from the wet portion of the rope.
- The formula for calculating the volume is \( V = \pi r^2 \) where \( \pi \approx 22/7 \) or 3.14 and \( r \) = radius of the well.

Step 9: Disinfecting procedure in the well:

- After the well gets retrieved with full water, as per WHO guidelines mix Chlorine according to the capacity of water in the well at 2.50 grams per 1000 litres of water. If the water is found more contaminated, increase Chlorine addition at the rate of 5.00 grams per 1000 litres of water.
- For preparing the chlorine solution mix the required amount of bleaching powder in plastic mug with water and make it a paste.
- The prepared paste has to be mixed with water in a non-metallic container with a glass rod or stick. The prepared solution should be allowed to settle down for 30 minutes.
- The Chlorine solution should be well mixed in the well water. The water should be drained using pumps, only after allowing the Chlorine solution to remain at least for a minimum of 12 hours.
- While Chlorinating the well the turbidity NTU should be less than 20 counts. pH should be not less than 6.50 and not to exceed 8.50 units.
- If pH is found less than 6.50, hydrated lime solution can be added to enhance pH.
- If the turbidity is found more than 5NTU, Poly Aluminium Chloride can be added at 30 grams per 1000 litres of water taking into account the level of water of the well.
- Allow the solution to remain in the well for a minimum of 12 hours and drain the water completely.
- Chlorine sedimentation should be measured after the well retrieves its full water level.
- Repeat draining the water till the Chlorine sedimentation level reaches less than 0.05 M.gms.
• **Step 10:** Best practices for good health and safe living:

  - Diesel or Petrol pumps or its accessories should not be lowered into the well. It should be ensured that the smoke of the pumps, kept even outside the well, should not enter into the well, because, Carbon Monoxide gas is heavier than air and may tend to travel towards the bottom of the well. The labours working in the well may suffocate or even cause death.
  - The labours engaged in cleaning, repairing and disinfecting the wells, should have obtained sufficient training about the dangers in these activities.
  - The labours getting into the well must compulsorily wear Helmets and safety belts.
  - In the absence of a parapet wall around the well all things should be kept at a safe distance of minimum of 2 metres from the well.
  - To operate the crane or the lifting equipment, there should be a person available at all times at the top of the well, while men are working inside the well.
  - The well should be kept aerated.
  - Smoking and carrying lit lamps should not be taken inside the well. The lamp will go off if Carbon Monoxide gas is found in the well. In this situation, a big thick branch of a tree should be used to exile the gas found inside the well.
Step 11: Things to be taken care of:

Special care should be given to the wells in which animals or human dead bodies are found from the floods.

- Water bodies of the areas affected by Cholera with decayed corpses will spread more infection.
- General human dead bodies will not cause harm to the water bodies. But, faecal waste and the human dead bodies of infectious diseases will cause more contamination to the water bodies.
- Water bodies will be more contaminated by Cryptosporidia, Campilobacter and Listeria gerns present in the decayed human corpses lying for a longer period.
- The black water from the septic tanks found within 10 metres, extra care is to be taken to arrest seeping of black water from entering the well.

Step 12: After water sample tests:

- After the treatment of the well water with chlorination and PAC addition the water sample to be tested.
- If the tests reveal the presence of E-coli and coliform in the well water, the water should be used only after proper disinfection treatment.
- For disinfection of water any method can be used and we found silver ionization method is more effective and user friendly.
- The surrounding areas may be strengthened to prevent the incursion of contaminated water from septic tank/sewers, etc.

Step 13: Recommendations:

In the areas where most of the wells are affected, the strategy could be to focus and disinfect most safe sources of water first and facilitate community use that water, till others are cleaned, disinfected and made functional.

Periodical disinfection of the dug wells have to be scheduled to reduce the contamination.

To disinfect the water by boiling of both piped and open well water should be rolling boil of water for 1 min or keeping water covered and then allowing it to cool slowly after boiling can add an extra margin of safety.

The overhead water tanks also to be cleaned and disinfected periodically once in 6 months. Store the bleaching power/chlorine tablets or powder in closed containers and shall not be exposed to sun light.

All wells need not be de-watered when water table/flood level is high and soil is sandy and easily permeable.

Periodic water quality testing for biological (may be twice in a year) and chemical parameters once in an year or two) is to be done to ensure safe drinking water.

If the pH is below 6.5 lime may be added to enhance the pH value.
Do not add bleaching powder directly in to the well, prepare chlorine solution for chlorination of wells.
Do not allow anyone to use the well during the cleaning process.

It is advisable to test residual chlorine (free residual chlorine-FRC) by pool tester to ensure presence of residual chlorine. Residual of chlorine is important to ensure safety of the water.

Enteric viruses are inactivated by the maintenance of a disinfectant residual of at least 0.5 mg/litre free chlorine for a minimum of 30 minutes in waters with a turbidity of less than 1 NTU and a pH of less than 8.0.

Some of the dug wells contain E coli which can be removed only with water purifiers working in Silver Ionization process or any other methods.

The septic tanks or the leach pits are to be placed at a safe distance of 15 meters from the dug wells to avoid filtration of black water causing contamination.

People should be educated about the good practices and safe distance between a well and septic tank.

A Dug well hygiene Management campaign should be imparted at State level to reach every household.

Onsite toilet technology training to be provided to the masons to ensure the right construction method.

Turbidity can be measured by using turbidity tube, turbidity meter or other simple techniques.

When turbidity is high and water table is also high (flood yet to recede fully) settling and decanting, boiling and thereafter chlorination at domestic level is most effective for safe drinking water.

GP should take the lead in water quality monitoring and surveillance.
References:


Acknowledgements:

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