

അമൃത വാർത്താപ്രതിക

ലകം 4



അമൃത
Atal Mission for Rejuvenation
and Urban Transformation

“നഗരങ്ങളുടെ മുഖ്യായ മാറ്റിയ അമൃതപദ്ധതി”

“5870 കോടിയുടെ പദ്ധതികൾ”

“3293 കോടി സംസ്ഥാന സർക്കാരിന്റെയും
നഗരസഭകളുടെയും വിഹിതം”

എന്റെ കേരളം, അമൃത സ്റ്റാളുകൾ...



അമൃത്‌വാർത്താ പത്രിക

ജൂൺ 2025 | പുസ്തകം 4 | ലക്കം 4



തദ്ദേശസ്വയംഭരണ വകുപ്പ് കേരള സർക്കാർ

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സുര൜് ഷാജി ഐ.എ.എസ്
മിഷൻ ഡയറക്ടർ

എഡിറ്റർ
മുരളി കെ.ചുമകുഞ്ചിൻ
എൻവിയോൺമെന്റ് എക്പ്രസ് കം
പ്രൈഡേം ജിയോളജിസ്ട്

അസിസ്റ്റന്റ് എഡിറ്റർ
സാവിയോ സജി ഇ.ആർ.



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എഡിറ്ററിയൽ

അമൃത് 1 അതിന്റെ അവസാന ഘട്ടത്തിലെയും കടക്കുമ്പോൾ കുടുതൽ കൂത്യുതയോടെ വൃക്തതയോടെ അമൃത് നേരം ഘട്ടം കുടുതൽ പ്രവൃത്തികൾ അവാർഡ് ചെയ്ത് പുരോഗമിക്കാൻ സാധിക്കേണ്ട എന്ന് ആശങ്കിക്കുന്നു. അമൃത് 2 -10 ഘട്ടം 125 കോടി രൂപ കേന്ദ്ര വിഹിതമായി അനുവദിച്ചു. അതിനോടൊപ്പം സംസ്ഥാന വിഹിതവും ചേർന്ന് 275 കോടി രൂപ അനുവദിച്ചു ലഭിച്ചു കഴിഞ്ഞു. ഈ ശരിയായി വിനിയോഗിക്കാൻ എല്ലാവരും ശ്രദ്ധിക്കേണ്ടതാണ്. എന്നാൽ മാത്രമേ അടുത്ത ഗധു നേടിയെടുക്കാൻ സാധിക്കുകയുള്ളൂ.

ഹരിത നഗരം പദ്ധതിയുടെ ഭാഗമായി എൻ.എച്ച്.ജി. അംഗങ്ങളെ ഉപയോഗിച്ച് വൃക്ഷം പ്രവർത്തനങ്ങൾക്ക് തുടക്കം കുറിക്കുവാൻ സാധിക്കുമെന്ന് പ്രതീക്ഷിക്കുന്നു. തെരേഞ്ഞെടുത്ത നഗര പ്രദേശങ്ങളിൽ നമുക്ക് ഇതിനായി കൈകൊർക്കാം. ഭൂമിയെ പച്ച പൂതപ്പിച്ച് നഗരങ്ങളെ ഹരിതാഭ്യർഥക്കാൻ ഇതിലൂടെ നമുക്ക് സാധിക്കേണ്ടും. ഇതിലൂടെ നടുന്ന വൃക്ഷം പ്രവർത്തകൾ അമൃത് മിത്ര പദ്ധതി തിലുടെ പരിചരണം നൽകാൻ തീരുമാനിച്ചിട്ടുണ്ട്. വർഷം മുഴുവൻ ഇതിന്റെ സംരക്ഷണം നമുക്ക് സംജ്ഞാതമാക്കുമെന്ന് പ്രതീക്ഷിക്കുന്നു.

ജർ ഹി അമൃത് പദ്ധതിയുടെ ആദ്യ ഗധുവായി 5.25 കോടി രൂപ നമുക്ക് ലഭിച്ചു. ഈ ഫണ്ട് ഉപയോഗിച്ച് കേരളത്തിലെ നഗര പ്രദേശങ്ങളിലെ 15 എൻ.റി.പി. പ്ലാറ്റ്‌ഫോർമ് നവീകരിക്കുന്നതിന് കൂത്യുമായ പ്ലാനിംഗിലൂടെ സാധിക്കേണ്ട എവരെയും ആർമ്പുത്തുന്നു.

കേരളത്തിനും പ്രത്യേകിച്ച് അമൃത് കേരളയ്ക്കും എററു അഭിമാനമുള്ള രേഖയിൽ ഇ-ഗവേണ്ടിന് അവാർഡ് സിൽവർ കാറ്റഗറി വിഭാഗത്തിൽ ദ്രോഡ് മിഷൻ മാനേജ്മെന്റ് തയ്യാറാക്കിയ പ്രോജക്ട് മോണിറ്ററിംഗ് സിസ്റ്റത്തിനും വാട്ടർ കൂളിറ്റ് മോണിറ്ററിംഗ് ആണ് ഇൻഫർമേഷൻ സിസ്റ്റം ആപ്പിനും ലഭിച്ചു എന്നുള്ളത് എററു ചാതിതാർത്ഥ്യത്തോടെ അറിയിക്കുന്നു. അതോടൊപ്പം ഇതിനുള്ള പൂർണ്ണ പിന്തും തന്ന കേന്ദ്ര സർക്കാരിനും സംസ്ഥാന സർക്കാരിനും ഒപ്പം പ്രവർത്തിച്ച എല്ലാ സഹപ്രവർത്തകർക്കും നൽകി അറിയിക്കുന്നു. തുടർന്നും ഇത്തരത്തിലുള്ള നേട്ടങ്ങൾ നേടിയെടുക്കാൻ കഴിയും എന്നും ആശങ്കിക്കുന്നു.

മിഷൻ ഡയറക്ടർ

(സ്വകാര്യ പിതാമഹത്തിന് മാത്രം)



ചാലക്കുടി നഗരസഭയിൽ നടന്ന അമൃത മിത്ര പദ്ധതിയുടെ ഉദ്ഘാടന ചടങ്ങ്

അമൃത്‌വാർത്താ പ്രതിക ഉള്ളടക്കം

ജൂൺ 2025



5 അമൃത് 1.0

8 “വിമെൻ ഫോർ ടൈസ്, ടൈസ് ഫോർ വിമെൻ” ക്യാമ്പയിൻ

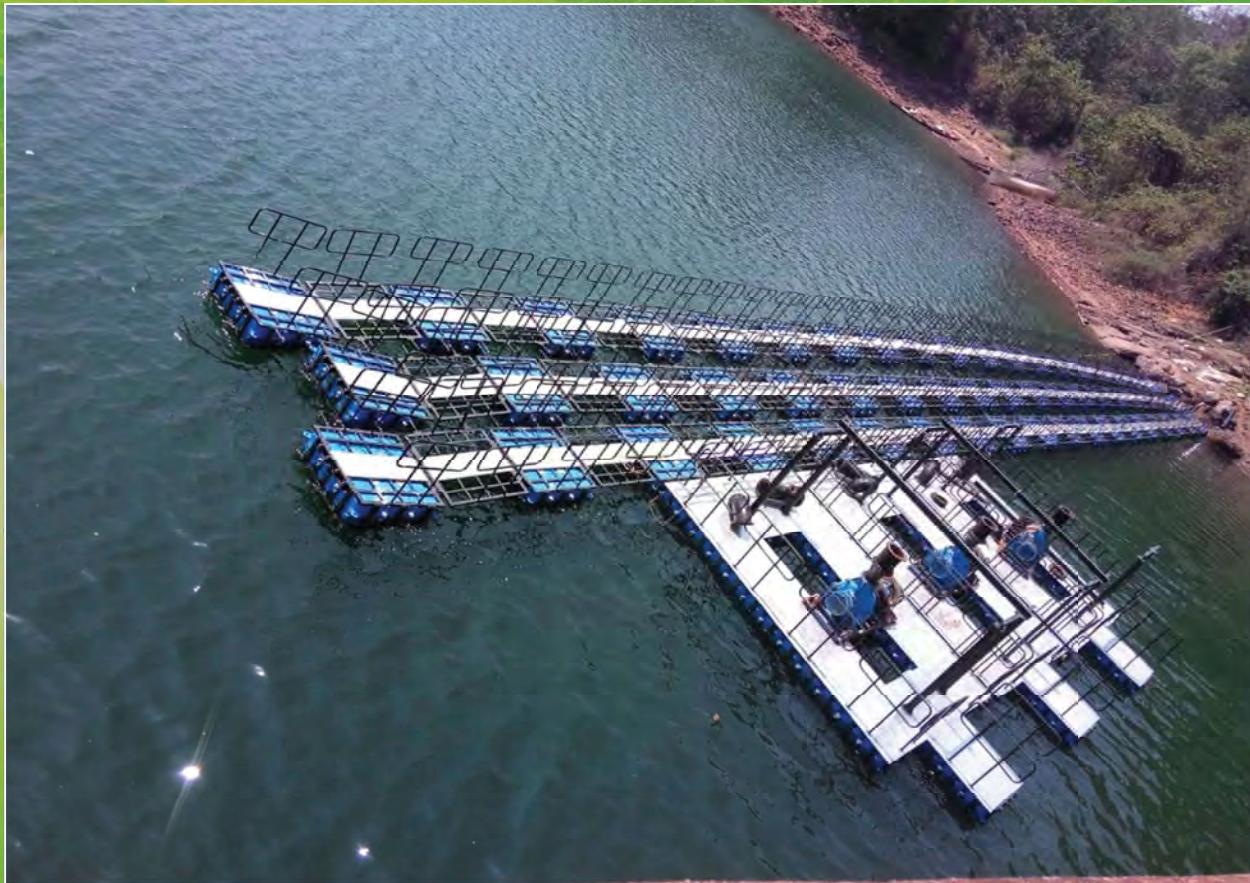
10 Decentralized Wastewater Treatment Systems (DEWATS): A Sustainable Approach for Kerala and Beyond

14 ‘ട്രിക് ഫ്രോ ടാപ്പ്’ മേഖലാ ശിൽപ്പരാല്

15 Article on Scientific Closure or Safe Re-use of Abandoned/defunct Bore Wells for Groundwater Recharge Measures and to Prevent Child Tragedies.



അമൃത് 2.0 പദ്ധതിയിലൂൾപ്പെടുത്തി നവീകരിച്ച ഇൻട്രി മുനിസിപ്പാലിറ്റിയിലെ കുഴുനിൽക്കേ അമൈലക്കുളം



തൃശ്ശൂർ പിച്ചിയിലെ മംഗലാട്ടിംഗ് റൂൾ ടെക് പദ്ധിംഗ് സംവിധാനം

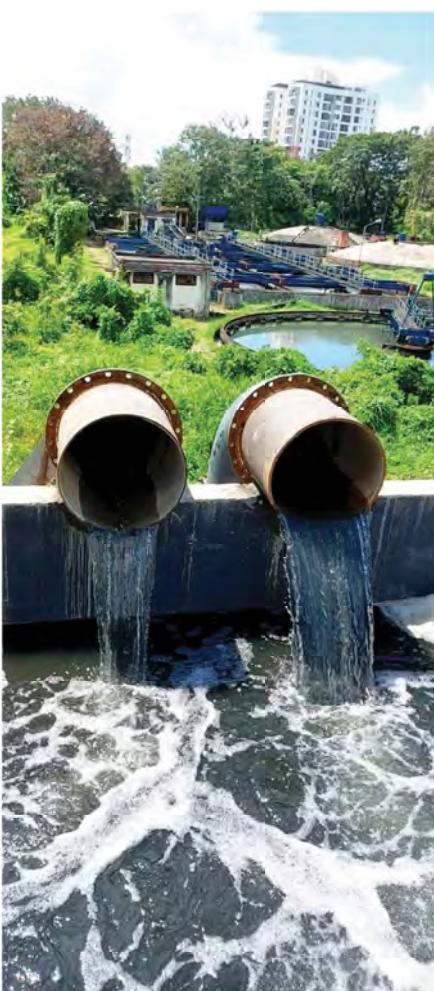


തിരുവനന്തപുരം അരുവിക്കരയിലെ ജല ശുശ്വരരണ പ്ലാൻ

അമൃത് 1.0

പദ്ധതി നിർവ്വഹണം

പുർണ്ണതയിലേയ്ക്ക്



എലംകുളം 5 റ്റം.എൽ.ഡി.
എസ്.റി.പി.

സംസ്ഥാനത്തെ 9 അമൃത് നഗരങ്ങളിൽ നടപ്പാക്കി വരുന്ന അമൃത് 1.0 പദ്ധതി പുർണ്ണതയിലേയ്ക്ക് എത്തുന്നു. ആകെ അംഗീകാരം ലഭിച്ച 1108 പദ്ധതികളിൽ 1044 പദ്ധതി കൾ പുർത്തെക്കിട്ടും. ശേഷിക്കുന്ന 64 പദ്ധതികൾ നിർവ്വഹണത്തിന്റെ വിവിധ ഘട്ടങ്ങളിലാണ്. ആകെ പദ്ധതി തുകയായ 2357.69 കോടി രൂപയുടെ 95.19% തുകയായ 2250.50 കോടി രൂപ പദ്ധതിയ്ക്കായി ചെലവഴിച്ചു. പുർത്തെക്കാണുള്ള പദ്ധതികളുടെ നിർവ്വഹണം തരിതഗതിയിൽ പൂരാഗമിക്കുന്നു.

രാജ്യത്തെ പാവപ്പെട്ടവരുടെയും പിന്നാക്ക ജനവിഭാഗങ്ങളുടെയും ജീവിതനിലവാരം മെച്ചപ്പെടുത്തുന്നതിനും നഗരങ്ങളിലെ അടിസ്ഥാന ഭാരതീക സൗകര്യങ്ങളും സേവനങ്ങളും പ്രത്യേകിച്ച് ശുശ്രാവ വിതരണം, ദ്രവമാലിന്യ സംസ്കരണം, നഗര ഗതാഗതം തുടങ്ങിയ മേഖലകളിൽ നൽകുന്നതിനായി കേന്ദ്ര-സംസ്ഥാന സർക്കാരുകൾ സംയുക്തമായി ആവിഷ്കരിച്ച് നടപ്പിലാക്കുന്ന പദ്ധതിയായ അമൃത് (അംഗൾ മിഷൻ ഹോർ റജ്യവിനേഷൻ ആൽസ് അർബൻ ട്രാൻസ്‌ഫർമേഷൻ). കേരളത്തിലെ ആർ കോർപ്പറേഷനുകളും ആലപ്പുഴ, പാലക്കാട്, ശുരുവായൂർ മുനിസിപ്പാലിറ്റികളിലുമാണ് നടപ്പിലാക്കിയത്. എല്ലാ വീടുകളിലും ശുശ്രാവ വിതരണത്തിനായുള്ള പെപ്പ് കണക്ഷൻ എത്തിക്കുക എന്നതാണ് പദ്ധതിയുടെ പ്രധാന ലക്ഷ്യം. ദ്രവമാലിന്യ സംസ്കരണം, പാർക്കുകളുടെ വികസനം, നോൺ മോട്ടോറേറേറ്റർ ഗതാഗത സംവിധാനങ്ങൾക്കുള്ള സൗകര്യങ്ങൾ ഒരുക്കുക എന്നിവയും പദ്ധതി ലക്ഷ്യമിട്ടും.

2015 ഏപ്രിൽബർ 1 ന് ആരംഭിച്ച പദ്ധതിയ്ക്ക് 5 വർഷമായിരുന്നു കാലാവധി. നില വിൽ 2025 ഡിസംബർ 31 വരെ കാലാവധി ദിർഘമിച്ചിട്ടും. കേന്ദ്രവിഹിതം 50% സംസ്ഥാനവിഹിതം 30% തദ്ദേശ സ്ഥാപന വിഹിതം 20% എന്ന അനുപാതത്തിലാണ് പദ്ധതിയുടെ ധന വിനിയോഗം.

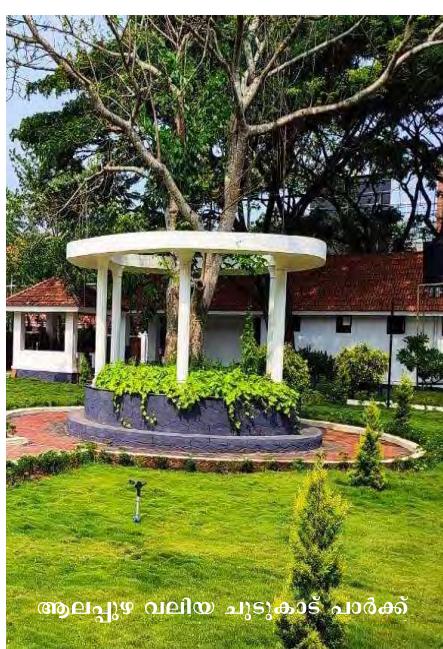


മലവ്യുച ജലസുഖകരണ പ്ലാറ്റ്

അമൃത് പരിപ്പ് കരണാബദ്ദ നടപ്പിലാക്കിയത്തിന് പദ്ധതി തുകയ്ക്ക് പുറമെ സംസ്ഥാനത്തിന് 59.82 കോടി രൂപ ഇൻസൈൻസിവായി ലഭിച്ചു. ഇതിൽ സംസ്ഥാനത്തിന് 7-10 റാങ്കാംഗ് ലഭിച്ചത്.

കാര്യഗ്രാമി വികസനത്തിന്റെ ഭാഗമായി 2493 പേരുകൾ പരിശീലനം നൽകിയിട്ടുണ്ട്. ഇന്ത്യയിൽ ആദ്യമായി ജപ്പാനുടെ ടച്ചൻ വഴിയുള്ള ധനവിനിയോഗം സാധ്യമാക്കിയത് അമൃത് കേരള മിഷനാണ്.





“വിമെൻ ഫോർ ട്രീസ്, ട്രീസ് ഫോർ വിമെൻ” ക്രാന്റിന്



കേന്ദ്രവിഷയുടെ പദ്ധതിയായ അമൃത് പദ്ധതിയുടെ ഭാഗമായ അമൃത് മിത്ര പദ്ധതി തിൽ ഉൾപ്പെടുത്തി നടപ്പിലാക്കുന്ന “വിമെൻ ഫോർ ട്രീസ്, ട്രീസ് ഫോർ വിമെൻ” ക്രാന്റിന് മുന്നോടിയായി മരങ്ങൾ നടുന്നതിന് ആവശ്യമായ സമലഞ്ചൾ സന്ദർശിച്ചു.

തദ്ദേശ സ്വയംഭരണ വകുപ്പും അമൃത് മിഷനും കേന്ദ്ര വേദന നഗരകാര്യ മന്ത്രാലയവും സംയുക്തമായാണ് പദ്ധതി നടപ്പിലാക്കുന്നത്. കേരളത്തിലെ 93 നഗരസഭകളിലായി 2500 വൃക്ഷങ്ങൾക്കും നട്ട പരിപാലനം നടത്തുന്നതിനാണ് പദ്ധതി വിഭാഗം ചെയ്തിട്ടുള്ളത്. കുടുംബശ്രീ അയൽക്കൂടങ്ങൾ മുവേനയാൾ പദ്ധതി നടപ്പിലാക്കുന്നത്. മേൽ 21,22,23 തീയതികളിലായാണ് സ്ഥലങ്ങൾ സന്ദർശിച്ച് വൃക്ഷങ്ങൾക്ക് നടേണ്ട ഇടങ്ങൾ നിശ്ചയിച്ചത്.

കുടുംബശ്രീ മുവേന സ്ക്രീകൾക്ക് തൊഴിൽ നൽകുന്നതിനായി നടപ്പിലാക്കിയ പദ്ധതിയാണ് അമൃത് മിത്ര പദ്ധതി. ജലത്തിന്റെ ശുശ്നനിലവാര പരിശോധന, ജലശുദ്ധികരണ ശാലകൾ, മലിനജല സംസ്കരണ പ്ലാറ്റുകൾ, വന്തു നികുതി പിരിക്കൽ, വാട്ടർ ചാർജ്ജുകൾ പിരിക്കുക തുടങ്ങിയ മേഖലകളിലായി 38 കോടി രൂപയുടെ തൊഴിലവസരങ്ങളാണ് അമൃത് മിത്ര പദ്ധതിയിലൂടെ കേരളത്തിൽ നടപ്പിലാക്കുന്നത്. 2500 കുടുംബശ്രീ പ്രവർത്തകരാണ് പദ്ധതി പ്രകാരം തൊഴിൽ നൽകുന്നത്. അമൃത് മിത്രയിലെ പ്രത്യേക പദ്ധതിയാണ് വൃക്ഷങ്ങൾക്ക് പരിപാലനം ഉൾപ്പെടുത്തിയിരിക്കുന്നത്.



ജൂൺ 4 നകത്ത് വൃക്ഷഭരതകൾ സംഭരിച്ച് ജൂൺ 5 മുതൽ ആഗസ്റ്റ് 30 വരെയാണ് വൃക്ഷഭരതകൾ നടപ്പിന്. ജലാശയ അർബനീസ്കൂളുകൾ, അശുപ്തികൾ, പൊതുമേഖലാ സ്ഥാപനങ്ങൾ തുടങ്ങിയ ഇടങ്ങളിൽ വൃക്ഷഭരതകൾ നടപ്പിച്ചിപ്പിച്ച് കൂടുംബവർഗ്ഗി പ്രവർത്തകൾ വഴി പരിപാലനം നടത്തുകയും പരിപാലനം പൂർണ്ണമായും 2 വർഷത്തേക്കാളും ഉപഗ്രഹങ്ങൾ വഴി നിരീക്ഷിക്കുകയും ചെയ്യും. വൃക്ഷങ്ങൾ പരിപാലി ക്കുന്ന സ്റ്റൈകൾക്ക് അധികം മിത്ര പദ്ധതിയിലൂടെപൂർത്തി വേതനം നൽകും. ആയിരത്തിലധികം സ്ഥലങ്ങളാണ് കേരളത്തിലെ നഗരസഭകളിൽ വൃക്ഷഭരത നടപ്പിനായി കണ്ണം തിയിട്ടുള്ളത്. സ്ഥല സന്ദർശനം നടത്തിയ കൂടുംബവർഗ്ഗി പ്രവർത്തകർക്ക് തദ്ദേശ സ്ഥാപനങ്ങൾ വഴി സാർ, യൂണിഫോം, വാട്ടർ ബോട്ടിൽ എന്നിവ വിതരണം ചെയ്തു. ജൂലൈ ഒന്ന് മുതൽ അബ്ദവരെ സോഷ്യൽ ഫോറസ്റ്റ് വകുപ്പ് മുഖ്യമന്ത്രി കൂടുംബവർഗ്ഗി പ്രവർത്തകർക്ക് വൃക്ഷഭരതത്തെ പരിപാലനത്തിന് പരിശീലനം നൽകും.



കൊല്ലം കോർപ്പറേഷൻ



കൊച്ചി കോർപ്പറേഷൻ



നിലേശ്വരം മുനിസിപ്പാലിറ്റി



എറുമാനുർ മുനിസിപ്പാലിറ്റി



കുത്താട്ടകുളം മുനിസിപ്പാലിറ്റി



വർക്കല മുനിസിപ്പാലിറ്റി



പുതല്ലൂർ മുനിസിപ്പാലിറ്റി



പാലക്കാട് മുനിസിപ്പാലിറ്റി



Decentralized Wastewater Treatment Systems (DEWATS): A Sustainable Approach for Kerala and Beyond

1. Introduction

India's urban growth and dense population patterns, particularly in states like Kerala, create complex challenges for traditional centralized wastewater treatment. These systems demand large-scale infrastructure, significant land acquisition, frequent pumping, and high operational costs. Kerala's unique geography—featuring a high water table, narrow roads, and fragmented settlements—renders centralized solutions inefficient and often impractical. Furthermore, the socio-environmental impact of routing urban sewage through rural areas has spurred community opposition.

Decentralized Wastewater Treatment Systems (DEWATS) offer a sustainable alternative. By processing wastewater near its source, DEWATS avoids costly infrastructure, minimizes environmental risks, and enables resource recovery. This paper presents an overview of DEWATS technology, components, design considerations, performance, and application across Kerala.



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2. The DEWATS Approach

DEWATS are locally managed systems that rely on passive biological processes with minimal mechanization. They prioritize gravity flow, low energy requirements, and scalability, making them ideal for settings ranging from individual households to institutions and small communities.

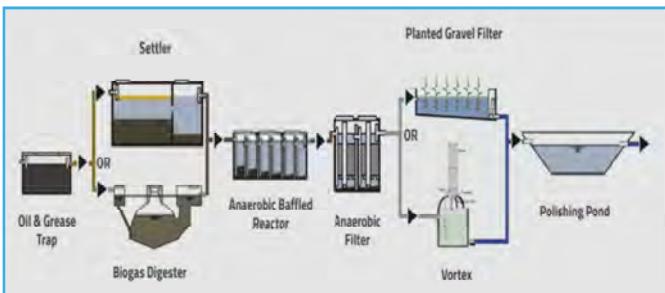
Key advantages include:

- Minimal energy and maintenance requirements
- Adaptability to terrain and settlement patterns
- Lower operational costs and land acquisition needs
- Flexibility for phased urban development

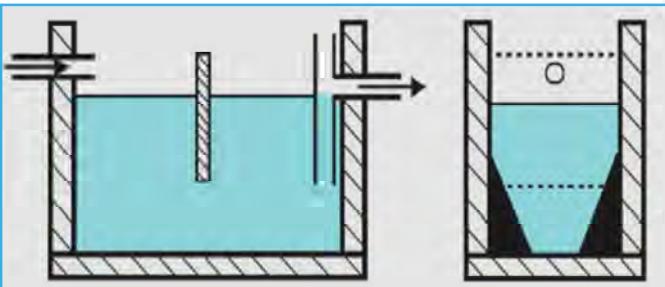
Enhanced water reuse, sludge management, and public health benefits.

3. Core Components of a DEWATS System

Each DEWATS installation is context-specific but typically includes the following five stages:

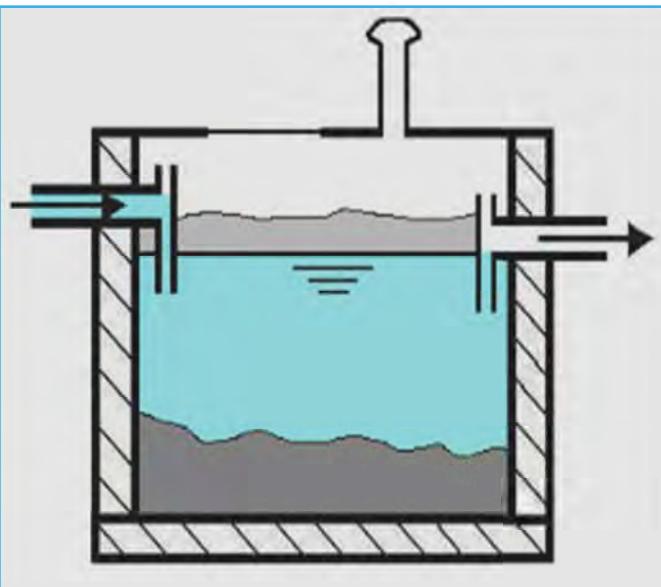


3.1 Oil and Grease Trap



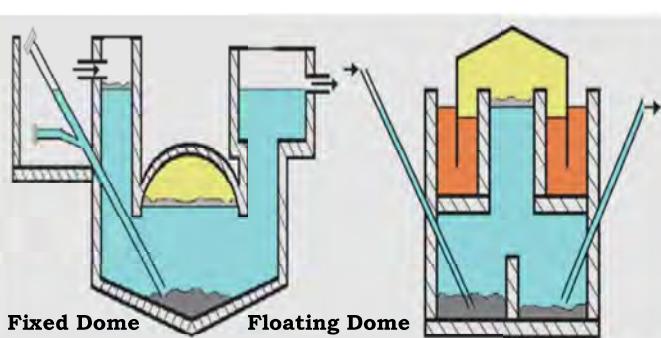
Grease traps are needed based on raw wastewater characteristics. They're usually unnecessary for domestic wastewater if a settler follows, but essential in places like canteens with high fat/oil content. Their function is to separate grease and oil via flotation, not to sediment organic matter—hence, short retention times of a few minutes. Baffle walls reduce turbulence and retain floating matter; a conical base ensures higher flow velocity to prevent fine particle sedimentation. A T-pipe blocks scum from entering downstream. Grease must be manually removed weekly. Blackwater should not pass through grease traps to avoid odor; in combined systems, traps must be decentralized and connected upstream of the settler.

3.2 .1 Settlers: Settlers are essential in DEWATS as primary treatment units due to their low cost, durability, and minimal maintenance needs. Unlike septic tanks, settlers are designed mainly for sedimentation of inorganic solids, with limited biological activity, making sludge accumulation slower.



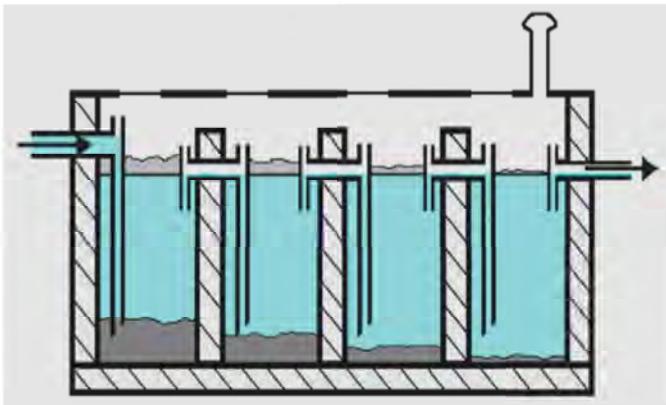
They are ideal for domestic or similar wastewater with settleable solids. In DEWATS, settlers replace septic tanks and serve only as pre-treatment before secondary modules like anaerobic baffled reactors. Scum and sludge must be removed periodically to maintain efficiency. Settlers offer ~25% BOD removal but do not treat pathogens or nutrients. Hydraulic Retention Time is 1.5H - 2.5 H

3.2.2 Biogas Digester (alternative to settler):



Biogas settlers are used in DEWATS for strong wastewater (high BOD), especially in Community-Based Sanitation (CBS) systems. They combine sedimentation with anaerobic digestion to reduce BOD by 40–50%, outperforming regular settlers. With a short HRT (12–24 hours), they serve as pre-treatment while capturing biogas for energy use and odour control. Settled sludge is digested and must be removed every 1–2 years.

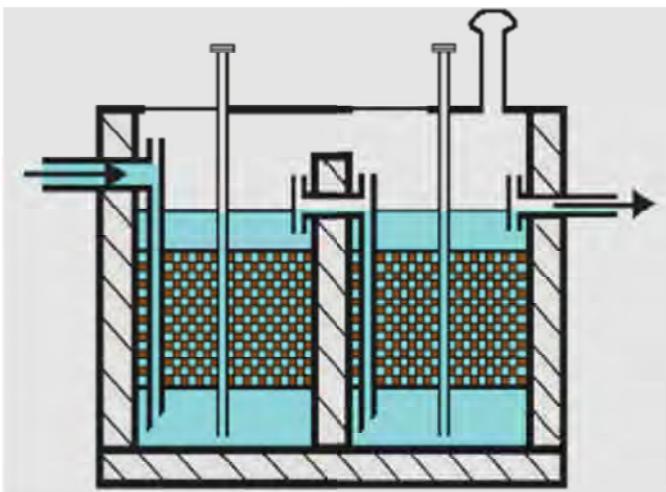
3.3 Anaerobic Baffled Reactor (ABR). Anaerobic Baffle Reactors (ABRs), also known as baffled septic tanks, combine septic tank, fluidised bed, and UASB technologies. They use anaerobic biological processes to treat high-strength wastewater by removing organic matter and stabilizing sludge.



Wastewater flows upward through at least four chambers, guided by baffles or pipes from the top of one chamber to the bottom of the next. In each chamber, it passes through active sludge, enabling contact with microorganisms that break down pollutants. Easily degradable substances are treated in the first chambers; more resistant matter is processed downstream. Hydraulic Retention Time is 2 to 3 Days

- ◆ BOD removal: 75%–85%
- ◆ Desludging: Required every 2–3 years

3.4 Anaerobic Filter (AF)

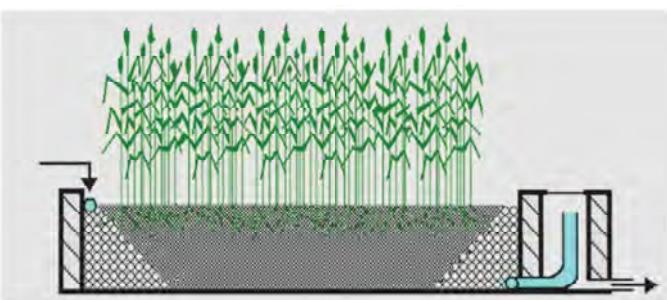


Anaerobic Filters (AF), also known as Fixed Bed or Fixed Film Reactors, are secondary treatment units used after settlers or Anaerobic Baffle Reactors (ABR) to enhance overall system performance. They treat dissolved and non-settleable solids through anaerobic digestion, along with some sedimentation and sludge stabilization.

AFs contain filter media like gravel, rocks, slag, or plastic pieces, which offer a large surface area for bacterial growth. As wastewater flows through the media, it comes into close contact with the biofilm, enabling efficient breakdown of organic matter in short retention times. Most bacteria are fixed on the filter material and reactor walls, while some remain suspended.

Over time, filters may clog, reducing efficiency. This requires cleaning by back-flushing or removing and washing the filter media. AFs are typically designed as up-flow systems to prevent biomass washout, although down-flow designs make cleaning easier. Equal wastewater distribution across the filter is critical for optimal performance. Hydraulic Retention Time is 0.5 to 1.5 Day. Overall BOD removal (ABR + AF): Up to 90%.

3.5.1 Horizontal Planted Gravel Filter (HPGF)



Horizontal Planted Gravel Filters (HPGF), also known as subsurface flow wetlands or root zone treatment systems, are a type of constructed wetland commonly used in DEWATS for tertiary treatment. They are designed for pre-treated domestic or industrial wastewater with BOD levels below 50 mg/L, primarily to reduce odour and improve effluent quality.

Wastewater flows horizontally beneath the surface through a planted gravel bed. The system operates in three zones: aerobic (top), anoxic (middle), and anaerobic (bottom). Oxygen is supplied via plant roots and surface gas exchange. The plants help filter pollutants, absorb nutrients, and reduce pathogens through natural processes.

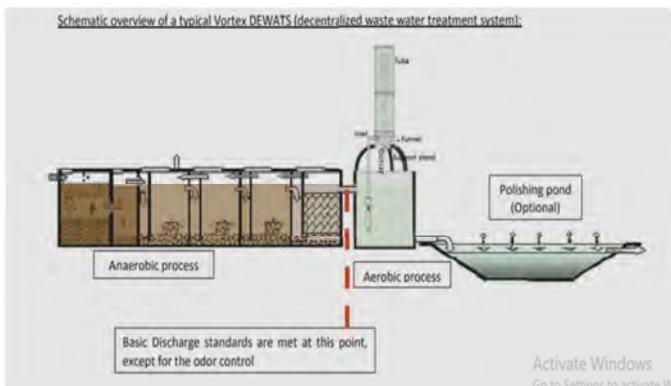
OR

3.5.2 Vortex : The Vortex is an advanced post-treatment module designed to improve the quality of anaerobically treated wastewater by increasing dissolved oxygen levels and removing residual nutrients like nitrogen and phosphorus.

Treated water enters the Vortex chamber, where a spiral flow pattern promotes natural aeration. This vortex-induced circulation enhances air-water contact, allowing ambient air to diffuse into the water without mechanical aerators.

The increased oxygen supports aerobic microorganisms that further degrade organic matter and assimilate nutrients, reducing BOD, COD, and residual ammonia or nitrate. The vortex action also helps mitigate odors by stripping volatile compounds, which are then vented or treated.

Compared to traditional options like planted gravel filters (PGFs), the Vortex offers a low-maintenance, energy-efficient alternative that requires less space and no vegetation management—ideal for compact or retrofitted installations.



3.6 Polishing Pond

A shallow open pond that further improves effluent quality through:

- ◆ Pathogen removal via natural UV radiation
- ◆ Aesthetic enhancement and final oxygenation

Often optional, but recommended for higher reuse applications or sensitive environments.

4. Suitability and Contextual Application

Best suited for:

- ◆ Residential colonies
- ◆ Hospitals, schools, and hostels
- ◆ Small industries and hotels
- ◆ Peri-urban and rural settlements

Key Benefits:

- ◆ Operates without electricity
- ◆ Uses local materials and labour
- ◆ Reduces land acquisition costs compared to centralized systems
- ◆ Easy operation and maintenance
- ◆ Encourages community participation and ownership

Limitations:

- ◆ Performance drops in cold climates
- ◆ Requires land availability
- ◆ May need post-treatment for reuse or environmental discharge

5. Operation and Maintenance (O&M)

Routine activities include:

- ◆ Visual inspections
- ◆ Checking for blockages and flow issues
- ◆ Ensuring covers are secure
- ◆ Desludging tanks every 2–3 years
- ◆ Maintaining vegetation in PGF

O&M is designed to be simple, requiring trained local personnel rather than technical experts.

6. Conclusion and Way Forward

DEWATS offers a sustainable, adaptable, and cost-effective alternative to centralized wastewater treatment. It is particularly well-suited to Kerala's topography and socio-political context, offering both environmental resilience and public health benefits.

Recommendations:

- ◆ Include DEWATS in urban planning and housing policies
- ◆ Promote integration with rainwater harvesting and greywater reuse
- ◆ Encourage private-public partnerships
- ◆ Train local stakeholders for O&M
- ◆ Implement performance-based subsidies

Future Research Areas:

- ◆ Integration with IoT-based monitoring
- ◆ Sludge valorisation through composting or biogas
- ◆ Development of hybrid DEWATS-centralized systems for flexible urban applications
- ◆ Research on plant varieties and microbial interactions in PGFs

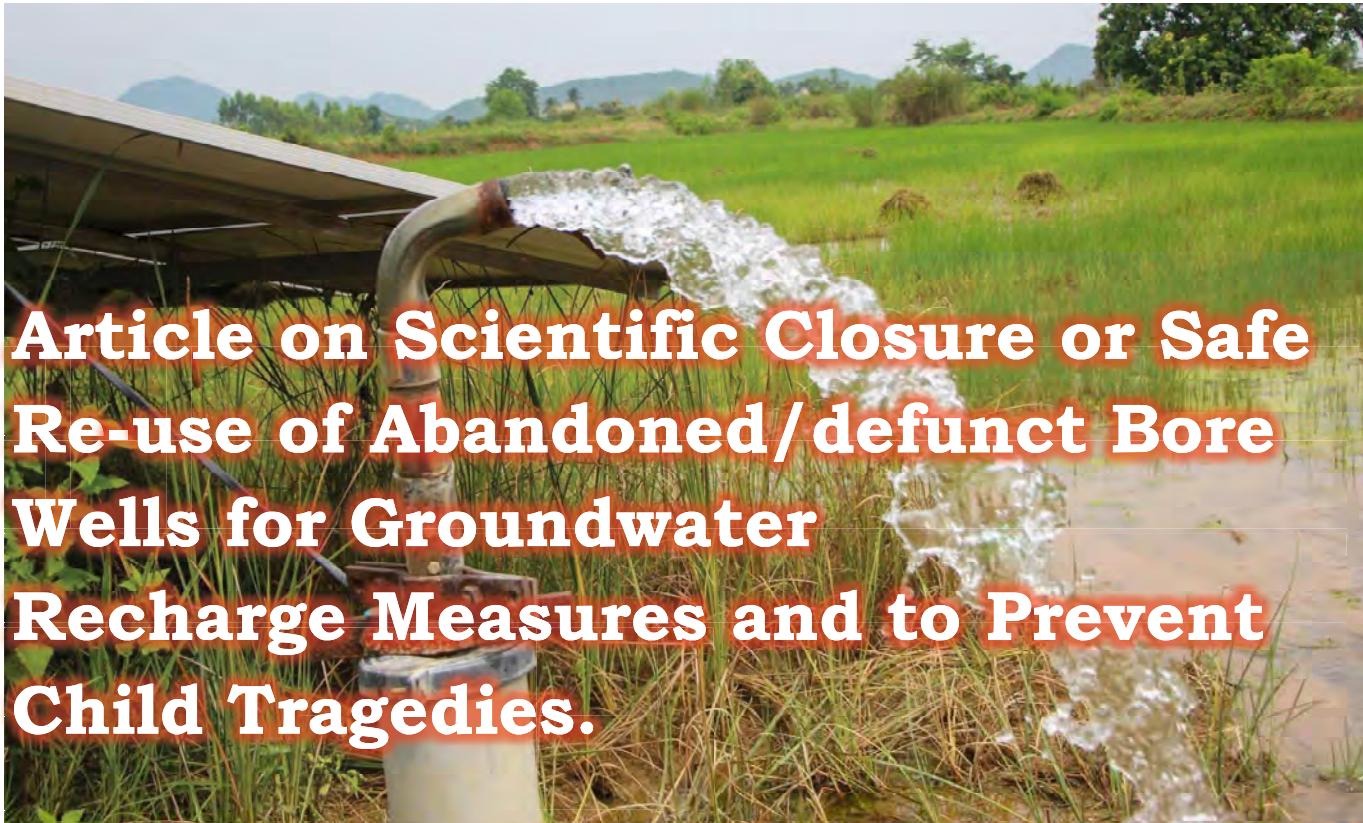
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കേന്ദ്ര വൈന നഗരകാര്യ മന്ത്രാലയം അമൃത് പദ്ധതിയുമായി ബന്ധപ്പെട്ട് '24 x 7 ഡ്രൈക്സ് ഫ്രോം ടാപ്പ്' എന്ന വിഷയത്തിൽ മേഖലാ ശിൽപ്പശാല സംഘടിപ്പിച്ചു. ഉത്തർ പ്രദേശിലെ അയോധ്യയിൽ വച്ച് നടത്തിയ ശിൽപ്പശാലയിൽ അമൃത് കേരളയിലെയും കേരള ജല അതോറിറ്റിയിലെയും ഉദ്യോഗസ്ഥർ പങ്കെടുത്തു. കേന്ദ്ര അമൃത് മിഷൻ ഡയറക്ടറും സെക്രട്ടറിയുമായ ശ്രീമതി ഡി. താര എസ്.എ.എൻ. ശിൽപ്പശാല ഉദ്ഘാടനം ചെയ്തു. വിവിധ മുനിസിപ്പൽ കോർപ്പറേഷനുകളിൽ നടപ്പിലാക്കിയ 24 x 7 'ഡ്രൈക്സ് ഫ്രോം ടാപ്പ്' മാതൃകകൾ ശിൽപ്പശാലയിൽ അവതരിപ്പിച്ചു. കേരളം മൂലമേഖലയിൽ നടത്തിയ പരിഷ്കരണങ്ങളായ ജല ഗുണനിലവാരം ഉറപ്പ് വരുത്തൽ, ഗാർഹിക കണക്കനുകൾ, കോറ്റ് ഓഫ് സ്ഥാർക്ക് മീറ്റിംഗ്സ്, മെറ്റീരിയലൈകളുടെ തിരഞ്ഞെടുപ്പ് തുടങ്ങിയവ ശിൽപ്പശാലയിൽ അവതരിപ്പിച്ചു. അടുത്ത രൈ വർഷത്തിനുള്ളിൽ ഒരു നഗര തദ്ദേശ സ്ഥാപനരെമ്പിലും പുർണ്ണമായും 24 x 7 'ഡ്രൈക്സ് ഫ്രോം ടാപ്പ്' സംവിധാനത്തിലേയ്ക്ക് മാറ്റുമെന്ന നിർദ്ദേശം മിഷൻ ഡയറക്ടർ മുന്നോട്ട് വയ്ക്കുകയും സംസ്ഥാന പ്രതിനിധികൾ അത് അംഗീകരിക്കുകയും ചെയ്തു.





Article on Scientific Closure or Safe Re-use of Abandoned/defunct Bore Wells for Groundwater Recharge Measures and to Prevent Child Tragedies.



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Introduction: -

In recent years, India has witnessed several tragic incidents where children have fallen into abandoned bore wells, often resulting in loss of life or prolonged and difficult rescue operations. These accidents highlight the urgent need for a systematic approach to identifying, managing, and either closing of the defunct borewell or repurposing such bore wells. Abandoned bore wells pose a significant threat not only to public safety but also to the environment, particularly in regions with unregulated groundwater extraction.

To address this dual concern, a scientific and policy-driven approach is essential. The first priority must be the safe and permanent closure of all defunct bore wells to prevent accidents. This involves sealing the wells with proper materials like clay, concrete, or bentonite, and marking them very clearly. Alongside closure, there lies also an opportunity for utilizing abandoned bore wells for groundwater recharge. **When suitably retrofitted and maintained, these structures can be used to harvest rainwater and enhance aquifer recharge, contributing to water sustainability in water-stressed regions.**

Thus, integrating disaster risk reduction with groundwater management offers a holistic and responsible pathway forward—one that addresses immediate human safety while also supporting long-term ecological resilience.

Frightening facts:

India has experienced several tragic incidents involving children falling into abandoned borewells, often leading to fatalities. These borewells, typically left open after water depletion, pose significant risks, especially in rural areas where they are common. Here's an overview:

- ◆ Fatehveer Singh (2019, Punjab): A 2-year-old was trapped in a 150-foot borewell for over 109 hours but was declared dead upon retrieval. He fell while playing near an uncovered borewell.

- ◆ Sujith Wilson (2019, Tamil Nadu): This 2-year-old died after being trapped in a borewell for 82 hours. His body was found decomposed, sparking public outrage over safety negligence.
- ◆ Mahi Upadhyaya (2012, Haryana): A 4-year-old fell into a 68-foot borewell and succumbed after being trapped for over 40 hours, despite extensive rescue efforts
- ◆ Chinnari (2017, Telangana): An 18-month-old girl fell into an abandoned borewell. Despite a two-day rescue operation, she could not be saved.
- ◆ Roshan (2018, Madhya Pradesh): In a rare successful rescue, a 4-year-old boy was saved after 35 hours in a 150-foot borewell... There are so many such cases are reported in various regions of India.

Since 2009, over 40 children have fallen into borewells in India, with rescue operations succeeding in only **30% of cases**. Despite Supreme Court guidelines to cap abandoned wells, enforcement remains inconsistent. States like Tamil Nadu, Haryana, and Gujarat report the highest incidences. The prevalence of these accidents highlights the urgent need for stricter regulations, better enforcement, and awareness to prevent such tragedies. Abandoned borewells in India have caused numerous tragic accidents, often involving children falling into these deep, narrow shafts. These incidents frequently result in fatalities due to the depth and confined space, making rescue operations extremely challenging.



A two-and-a-half-year-old girl child, who fell into a 300-foot borewell in Madhya Pradesh's Sehore district, was pulled out after a 55-hour operation. However, she had passed away.



A Two-Year-Old Girl, Ankita Falls into Borewell in Dausa, Rajasthan and are rescued after 7 Hours.....



A 3-Year-Old, Who Fell into Borewell in Telangana, Dies



The following are the brief elaboration of the disaster and preventive measures which are to be followed:

Scale of the Problem:

More than 40 incidents of children falling into borewells have been reported since 2009. A majority of these victims were under the age of 10. The Regions affected are States like Tamil Nadu, Gujarat, Haryana, and Punjab report the highest number of such incidents due to the widespread practice of digging borewells for water. The National Disaster Response Force (NDRF) and local teams often undertake complex rescue operations and challenges but ends up in failure to a maximum of 70%. The Underlying Causes and negligence cited are that many borewells are left open after becoming defunct, with little to no enforcement of sealing them properly. Even though The Supreme Court mandated capping abandoned borewells in 2010, but implementation has been inconsistent in many states of India. There lies an Unmonitored Practices by statute authorities that many borewells are dug illegally without proper authorization or oversight, increasing the risks and scale of disaster.

Broader Implications:

The proliferation of borewells highlights India's severe water scarcity issues and the lack of alternative water sources in many rural areas of concern. The Social and Legal Impact over the High-profile cases often trigger public outcry and legal scrutiny, but systemic changes remain limited.

Preventive Measures:

Efforts to mitigate this disaster include awareness campaigns, stricter regulations, technological solutions like borewell capping devices, and local monitoring systems. However, enforcement remains a challenge, requiring coordinated efforts between government bodies and communities.

1. How to plug/Decommission an abandoned/Defunct bore well to Prevent Kids and animals falling in to the abandoned bore wells and prevent the Contamination of aquifers and Productive wells close by?

Why De-commissioning a Defunct/failed Bore wells?



Decommissioning of a defunct/failed borewell

Well decommissioning is a process which seeks to restore the hydro-geological characteristics of the area to its original state prior to well construction and to prevent the possibility of the abandoned well acting as a conduit for contaminants movement from the surface or the cross contamination of aquifers and also to prevent kids and animals falling in to it.

- ◆ It ensures the safety of those in the vicinity of the bore well.
- ◆ It prevents surface water infiltration and vertical movement of polluted or contaminated water into an aquifer and contamination of the Groundwater quality regime of the area.
- ◆ Proper decommissioning will conserve aquifer yield and hydraulic head as well as groundwater quality aspects.
- ◆ Prevents falls of Animals and even small Kids in to the bore wells as is the case of regular happening in India.

Goals for Well Decommissioning:

The goal of decommissioning a bore/tube well is to restore the hydro-geological properties of the site. There are five pertinent goals relevant to it.

- ◆ The first and far most fact is to maintain the safety of the kids and animals close by to the open defunct bore wells.
- ◆ The second fact is to prevent vertical movement of water in the vadose zone. This prevents surface water from rapidly moving downwards and bypassing attenuation processes.
- ◆ The Third fact is the restoration of aquitards. This is similar to the first goal in that it seeks to prevent the vertical flow of water.
- ◆ The fourth goal is to maintain the flow of water through the aquifer system.
- ◆ The fifth Goal is to find the possibilities of conversion of defunct bore wells in to “Artificial recharge systems”

This is frequently less of a concern as the well itself is a point of impact for the aquifer which usually extends some distance in both cardinal directions and as such the single point impact should be minimal on the overall conditions of the aquifer. In some formations, such as highly fractured bedrock, fluid-based grouts may flow deep in to the aquifer and have impacts on the aquifer performance.

Appropriate Sealant Material for Bore well Decommissioning:

In theory, decommissioning of wells indicates a manner that reflects the original hydro-geological state involves mimicking the layers of strata that existed previously. In most cases, the key focus is on preventing the unwanted movement of polluted or contaminant water in a vertical direction. As mentioned above, the localized impediment of aquifers is of less concern. This can be done by focusing on filling the inside of the casing up with an impermeable material. The materials to be considered are natural clay materials and cuttings from new wells, bentonite high solids grouts, bentonite chips and pellets, neat cement concrete, and mixtures of sand and cement or bentonite grouts.

The various appropriate sealant material which can be used for scientific closure of bore wells are as detailed below:

(A) A non-toxic, commercially available material or mixture of materials, including

- (i). Bentonite clay,
- (ii). Bentonite clay and water mixture,
- (iii). Bentonite clay and sand and water mixture,
- (iv). Neat cement grout,
- (v). Sand cement grout, and
- (vi). Concrete grout, or

(B) A non-toxic material or mixture of materials that has a lower permeability than the Surrounding geologic formation to be sealed.

Cement grouts and bentonite high solids grouts are products that can be mixed into a slurry and pumped into a well using a tremie pipe which fills the well from the bottom -up (lifting the pipe during the process) ensuring that the entire space is filled and that any water in the well is pushed upwards and out of the well as the grout fills it. Both require specialized equipment for mixing and pumping. The concerns with using cement-based grout are that there are concerns of contraction when drying and also concerns with it as not bonding to casing walls.

More recent researches are done as part of many Grouts Study have indicated that cement-based grouts were more effective than bentonite clay-based products in sealing the annular space in wells, particularly when the cement was mixed with a small percentage of sand. Contraction and cracking concerns were less of a concern if added with sand mixture. Also, various tests conducted by adding bentonite grout to the cement mix (a common practice in the industry) resulted in the sealant being less effective. Bentonite grout slurries, which had previously been lauded as more effective as it remained more malleable and was suspected of bonding to casing better, was proved to be far less effective than cement-based grouts as moisture was wicked away by the vadose zone materials. The bentonite grouts (of various solid contents) contracted more than the cement due to this wicking action and thus, created voids, and also failed to bond to the casing.

However, Bentonite grout may fair significantly better in decommissioning operations inside of the casing because it will stay hydrated much longer as opposed to the materials that are in direct contact with the vadose zone. However, in many decommissioning approaches, there are efforts to ensure the annulus is filled through removing or puncturing the casing. This would open up the problem of moisture being wicked away by the vadose zone materials. Various Experimental studies have suggested that bentonite products with very high levels of solids, such as a mixture of **sand to bentonite of ratio of 4: 1, may be effective. Bentonite Chips and pellets are inexpensive for grouting wells as no equipment is needed for their installation. They are a viable and low-cost option when the goal is to fill the space inside the casing or when filling a hole that the casing has been removed from.**

Processes Involved in Decommissioning of the Bore well/Tube well:

Step-1	Remove all pumping equipment and casing if any, from the defunct well. Thoroughly flush out the well using a high-pressure air compressor.
Step -2	Measure the total depth and the diameter of the abandoned well and the non-pumping static water level. If possible, compare these figures with the information sheet on the original drilling report. Confirm whether the well is open to its original depth.
Step-3	Use these figures to decide which plugging material is appropriate and how much you will need. Whether or not the casing can be successfully pulled out will also determine which material to be used and what method is appropriate for placing the sealant into the well. If the casing cannot be removed, choose a slurry that can be pumped under pressure into the well so that any space around the outside of the casing will also get filled in due to high compressive pressure during sealing process.
Step-4	If possible, remove the well casing thoroughly or
Step-5	Disinfect the bore well. The water in the well must be flushed and cleaned of foreign materials, then disinfect with 200mg of chlorine per litre of water in the well needs to be worked out thoroughly.
Step-6	Place the plugging material into the well. It must be introduced at the bottom of the well and placed progressively upwards to ground surface. The only exception to this rule is when the plugging material being used is a bentonite pellet that has been designed and manufactured for pouring into the well from the ground surface. Using bentonite and cement grout we should be able to inject the grout from the base of the borehole to the surface using a tremie pipe in conjunction with a Putzmeister pressure grouting unit, this ensures all gaps are filled with fast setting grout, removing all contaminant's; boreholes are then capped with concrete, tarmac or turf (as per existing surroundings) at the surface.
Step-7	If the casing was not able to be removed, dig around it and cut it off a minimum of 0.5 m (20 in.) below the ground surface (see the enclosed figure), Cutting Off the Casing and Mounding the area with the Clay).
Step-8	Backfill and mound this portion of the hole with material appropriate for intended use of the land (i.e., clay) (see Figure Depicting below the Cutting Off the Casing and Mounding of the Clay material).
Step-9	Establish clear soil binding vegetation above the mound for increasing stability of the land surface.

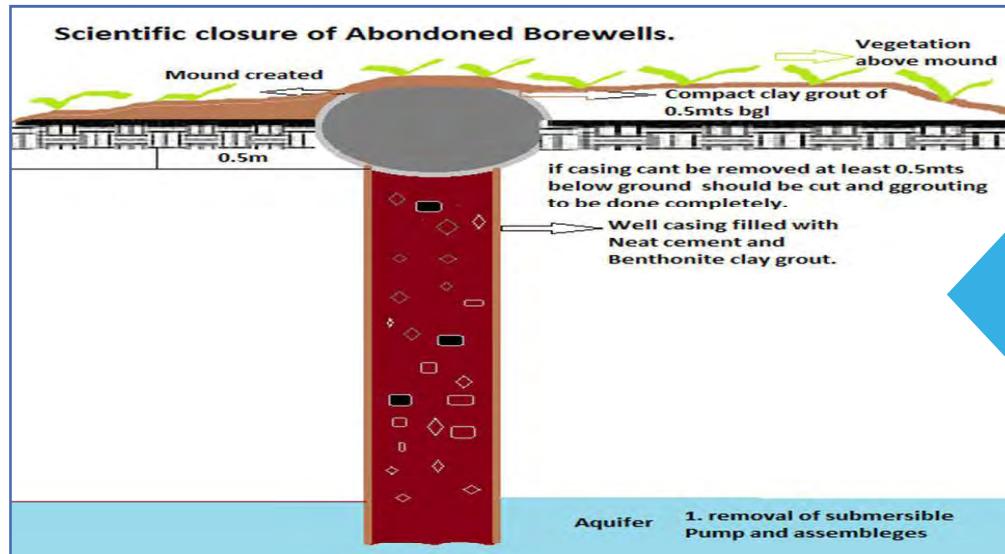


Figure depicting the cutting-off the Casing on top and Mounding of the Clay material as grout, followed by soil and vegetation growth as total scientific closure of abandoned bore well:(ref: Murali Kochu Krishnan's Published document in India water Portal).

Option of converting Abandoned/defunct bore/tube well to Artificial/induced recharge structures to enhance Groundwater regime of the Region:

Abandoned bore wells, if structurally stable and can be scientifically repurposed, offer a valuable opportunity to support Managed Aquifer Recharge (MAR) systems in India. With increasing stress on groundwater resources due to over-extraction, declining water tables, and irregular rainfall patterns, artificial or induced recharge has emerged as a critical strategy for ground water sustainability. Utilizing abandoned bore wells as recharge shafts can significantly contribute to the effort of Enhancing groundwater regime of the region.

The Rainwater or surplus surface water is directed into these defunct bore wells after pre-treatment to remove silt and contaminants. This allows for direct infiltration into deeper aquifers, reducing surface runoff and enhancing groundwater storage, particularly in hard rock or semi-arid regions where natural recharge is limited. Moreover, using already-drilled structures reduces the cost and effort compared to creating new recharge wells.

However, scientific assessment of each bore well is essential before it is integrated into a recharge system. Factors like casing condition, depth, geological formation, and contamination risks must be evaluated. Filters, desilting chambers, and proper maintenance protocols are also required to ensure recharge efficiency and water quality protection.

By repurposing abandoned bore wells into recharge structures, India can turn a public safety hazard into a strategic asset for sustainable water management, aligning with broader climate resilience and groundwater conservation goals.

Converting abandoned borewells into rainwater harvesting (RWH) structures is an excellent way to address groundwater depletion and improve water conservation. Here's an elaboration of how this can be achieved:

Steps to Convert Abandoned Borewells for RWH

- ◆ Assess the Borewell Condition.
- ◆ Inspect the borewell for structural integrity.
- ◆ Check for blockages or contamination.
- ◆ Ensure the borewell does not connect to sewage or other pollutants.
- ◆ Initially Clean the Borewell by good compressor pump to remove any debris, silt, or stagnant water. Flush the borewell thoroughly to ensure it is ready to receive clean rainwater.

Installation of a Filter System

Gravel Filter: Create a layer of gravel or pebbles at the borewell's inlet to filter large particles.

Sand Filter: Place a sand layer to filter finer particles.

Charcoal or Advanced Filter: Add activated charcoal or other filtration media to remove impurities and pathogens.

Connect Rainwater Collection System:

- ◆ Direct rainwater from rooftops or other catchment areas to the borewell via pipes. Insert a perforated PVC pipe into the bore well to guide filtered water into the well.
- ◆ Use first-flush diverters to ensure that initial rainfall (which may contain dust and debris) is discarded.
- ◆ Gravel packing to be done Surrounding the pipe to improve filtration and prevent clogging.
- ◆ Install a silt trap to prevent sediment entry.
- ◆ Ensure Overflow Management.
- ◆ Design an overflow mechanism to divert excess water to another storage system or a nearby recharge pit.
- ◆ Direct water from rooftops using gutters and downpipes to the pre-filtration chamber.
- ◆ Collect rainwater from paved or unpaved surfaces, ensuring that the water is free from oil, dirt, or chemical contamination.
- ◆ Test the water periodically to ensure it remains free of contaminants.

Safety Measures

- ◆ Seal the borewell with a perforated cap to prevent accidental falls and entry of unwanted materials.
- ◆ Periodically inspect the borewell for clogging or structural issues.
- ◆ Ensure that water entering the bore well is adequately filtered to prevent clogging or groundwater pollution.

Community Awareness and Permissions

- ◆ Inform the local community and local department and obtain necessary permissions if the borewell is in a shared or public area.
- ◆ Educate people about the benefits of RWH using borewells.
- ◆ Advantages of Using Abandoned Borewells for RWH are:

(Cost-Effective: Utilizing existing infrastructure, reducing the need for new construction.

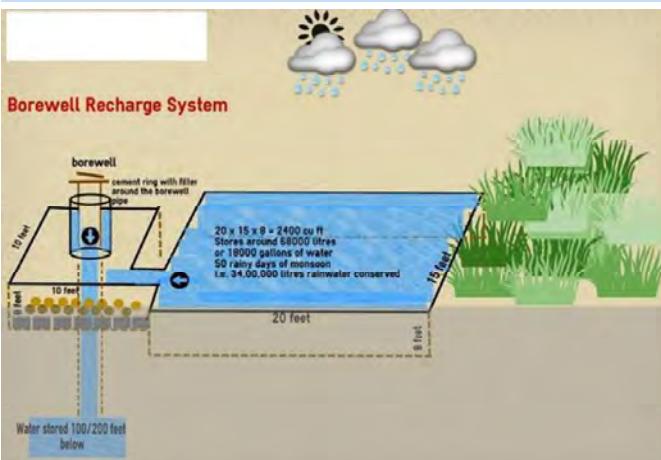
Improves Groundwater Recharge: Channels rainwater directly into aquifers, replenishing water tables.

Minimizes Water Wastage: Collects and utilizes rainwater that would otherwise run off.

Eco-Friendly approaches: Promotes sustainable water management practices).

Envisaged Challenges and Solutions

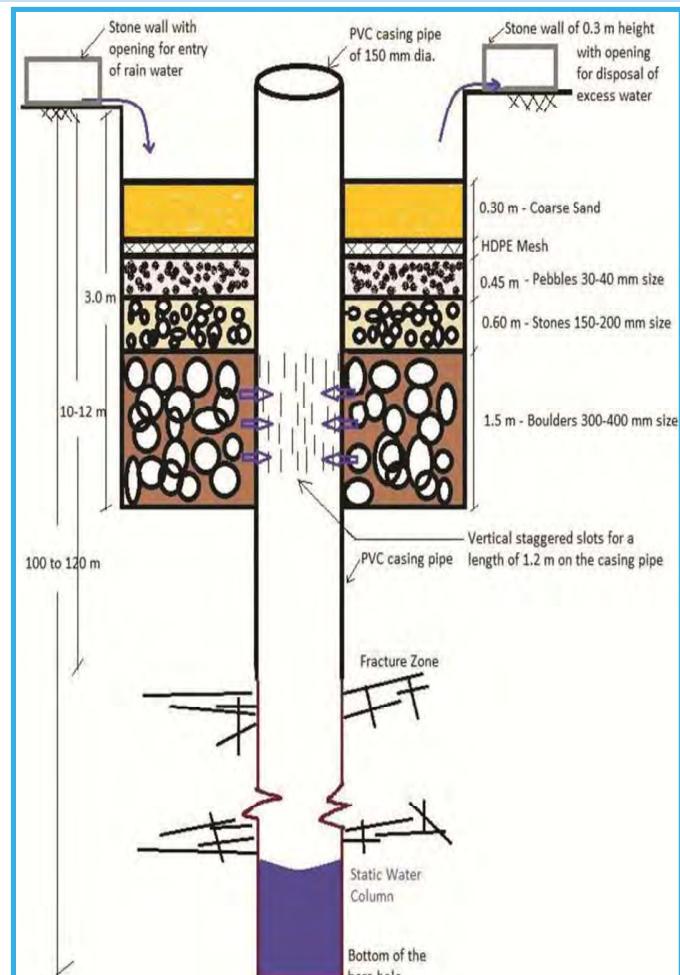
Prevention of Borewell contamination	: Use multi-layer filtration systems.
Limited catchment area	: Enhance rooftop or surface collection systems.
Structural weakness in borewell	: Reinforce or seal parts of the borewell.
Community resistance	: Raise awareness of long-term benefits and involve locals.
Benefits:	
Groundwater recharge	: Helps replenish aquifers.
Prevents waterlogging	: Effective management of rainwater runoff.
Sustainable reuse	: Provides a way to utilize non-functional bore wells.
Precautions	: <ul style="list-style-type: none"> Proper site evaluation to avoid contamination or ineffective recharge Thoroughly clean and disinfect the borewell before use to prevent pollutants from entering the aquifer, Multi-stage filtration system to remove silt, debris, and contaminants from collected rainwater entering in to bore well as recharge. Properly seal any collapsed or deep unused sections to prevent vertical leakage or accidents. Schedule a periodic check to ensure recharge efficiency and structural safety/integrity of the defunct or abandoned borewell selected for recharge.



Defunct Bore well Utilized for artificial recharge measures.



Cement Rings and filtering media around the Defunct bore well utilized for Recharge measures....



Disposition of Filtering Media details and utilization of defunct Bore well for groundwater recharge measures.



Defunct Borewells Re-furbished as recharge wells

Honorable Supreme Court guide lines to prevent fatal accidents involving children's falling in to abandoned bore/tube wells: -

The Supreme Court of India has issued comprehensive guidelines to prevent fatal accidents involving children falling into abandoned borewells and tubewells ensuring safe construction practices. These guidelines mandate that all states take **preventive measures, including fencing, steel covers, and proper filling of abandoned borewells**. These directives, first established in 2010 and **later reinforced, mandate specific safety measures and assign responsibilities to various stakeholders**.

Mandatory Notification: Landowners must inform local authorities (e.g., District Collector, Sarpanch) at least 15 days prior to constructing a borewell or tubewell.

Registration of Drilling Agencies: All drilling agencies—governmental, semi-governmental, or private—must register with the district administration.

Safety Measures During Construction:

Fencing: Erect barbed wire fencing or another suitable barrier around the well during construction.

Signage: Installation of a signboard near the well displaying the complete addresses of both the drilling agency and the well owner.

Platform Construction: Building of a cement or concrete platform **measuring 0.50×0.50×0.60 meters (0.30 meters above ground level and 0.30 meters below) around the well casing**.

Well Capping: Cap the well assembly by welding a steel plate or by providing a strong cap fixed to the casing pipe with bolts and nuts.

Post-Construction Measures:

Pump Repairs: Ensure that the tube well is not left uncovered during pump repairs.

Filling Mud Pits: Fill mud pits and channels after completion of works.

Restoration: Restore ground conditions to their original state upon completion of drilling operations.

Abandoned Borewells:

Filling: Fill abandoned borewells with clay, sand, boulders, pebbles, drill cuttings, etc., from bottom to ground level.

Certification: Obtain a certificate from the concerned department confirming that the abandoned borewell has been properly filled.

Monitoring and Enforcement:

District-Level Oversight: District Collectors are empowered to verify compliance with these guidelines and maintain records of borewells and tubewells in their jurisdiction.

Village and Urban Monitoring: In rural areas, monitoring is to be conducted through Village Sarpanch and the Agriculture Department. In urban areas, Junior Engineers and executives from the Ground Water/Public Health/Municipal Corporation departments are responsible.

Enforcement Challenges: Despite these clear directives, enforcement has been inconsistent across various states. **A Recent incident, such as the tragic case of a three-year-old girl, Chetna, who fell into a 150-foot-deep borewell in Rajasthan in December 2024, highlight the ongoing risks and the need for stricter adherence to safety protocols.**

In some regions, civil society organizations have criticized local authorities for their lax implementation of the guidelines, often citing negligence and lack of accountability.



Safe Closure of De-funct Bore/Tube Well

Safety Equipment Recommendations:

To enhance safety around borewells and prevent accidents, The following products are worth considering like:

Safety Nets	: Installing safety nets can prevent accidental falls into open borewells.
Manhole Covers	: Using heavy-duty covers can securely seal borewells when not in use.
Pump Covers	: Protective covers for pumps can prevent unauthorized access and potential hazards.
Safety Gates	: Adjustable safety gates can restrict access to borewell areas, especially for children.
Hydraulic Borewell Machines	: Utilizing advanced machinery can ensure proper sealing and maintenance of borewells.

Implementing these measures, along with strict adherence to the Supreme Court's guidelines, can significantly reduce the risk of accidents involving borewells.

The district authority in- charge should Maintain records of both functional and defunct borewells, overseen by the agriculture department in rural areas and municipal engineering or public health departments in urban regions.

Concluding Remarks

The issue of abandoned bore wells poses a significant threat to public safety and environmental sustainability. Incidents of children and animals falling into unsealed or improperly closed bore wells have been repeatedly reported, often resulting in tragic loss of life. In light of these dangers, the Supreme Court of India has emphasized the urgent need for scientific closure of such bore wells and their possible repurposing for groundwater recharge wherever feasible.

Scientific closure refers to the systematic and technically sound sealing of bore wells that are no longer in use, in accordance with established safety protocols and environmental standards. This process typically includes proper capping, backfilling with inert materials, and marking the location for future reference. Such measures not only prevent accidents but also reduce the risk of groundwater contamination due to surface pollutants entering through open boreholes.

Where conditions permit, abandoned bore wells can be ingeniously converted into recharge structures, contributing to the replenishment of depleting groundwater reserves. This dual-purpose approach offers a sustainable solution—enhancing water security while simultaneously addressing safety concerns. However, this requires a thorough site-specific feasibility assessment by hydrogeologists to ensure technical viability and long-term effectiveness.

State and local authorities must strictly enforce the guidelines laid down by the Supreme Court, including mandatory registration of drilling activities, geotagging of bore wells, and regular monitoring. Public awareness and community participation are also critical in ensuring these structures are not neglected or misused.

In conclusion, **the scientific closure or responsible utilization of abandoned bore wells must be prioritized as both a public safety and environmental conservation measure. Effective implementation of the Supreme Court's directives will go a long way in preventing avoidable tragedies and ensuring a more resilient and sustainable groundwater management framework for future generations.**

*"Seal the past, secure the future—
Let no well become a well of sorrow.
Where water once flowed, let life return.
Close with care, or recharge with purpose.
Safety and Sustainability must go hand in hand."*

“വിജോന്ന് ഫോർ ട്രീസ്, ട്രീസ് ഫോർ വിജോന്ന്” ക്രാന്റയിൽ

പയ്യന്തുർ മുനിസിപ്പാലിറ്റി



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പിരവം മുനിസിപ്പാലിറ്റി







**“വിശദ ഹോർ ട്രീസ്,
ട്രീസ് ഹോർ വിശദ”**