

Gravity Pit Sand Desalinator (GPSD) - Full System Document

Abstract

The Gravity Pit Sand Desalinator (GPSD) is a zero-electricity, low-cost water pre-filtration system designed to operate in coastal or arid environments. It uses natural slope, ultrafine sand, and layered structure design to remove salts and impurities from water sources before final purification. This document serves as a full survival-engineering guide for deployment, maintenance, and local adaptation.

1. System Overview

Principle: Passive gravity-fed filtration through ultrafine sand layers

Target Use: Coastal villages, refugee camps, drought zones, off-grid setups

Core Materials: Local sand, digging tools, gravel or mesh layer for drainage, optional flow diverters

2. System Design & Flow

- **Trench Depth:**
 - Standard use: 1.5–2.0 meters
 - Extended scale: up to 3–5 meters for high-throughput designs
 - Experimental extreme scale: up to 20 meters possible with engineered containment and reinforced slope
- **Sand Layers:**
 - Top: Fine dry sand (5–10 cm)
 - Middle: Ultrafine filter-grade sand (30–60 cm)
 - Bottom: Coarse sand or fine gravel (15 cm)
- **Drainage:** Side slope or central collection pipe (gravity exit)
- **Flow Direction:** Entry at top grade, gravity pulls water through sand stack
- **Crystallization Layer:** Monitor salt collection in top 15 cm

⚠ Extreme depths (5m–20m) require engineered safety measures, bracing, and vertical shaft protocols. These are provided here as conceptual ceiling for larger institutions.

3. Construction Guidelines

A. Tools

- Shovel, trenching spade, or earthmover
- Waterproof sheet (optional liner)
- Local containers or tanks
- Cloth mesh (to prevent sand migration)

B. Steps

1. **Select location:** Slightly sloped terrain or dug channel.
2. **Excavate trench:** 1.5–5 m preferred, up to 20 m in engineered deployments
3. **Layer installation** (bottom to top):
 - Coarse gravel
 - Ultrafine sand
 - Dry sand
4. **Install catchment or outlet**
5. **Cover to reduce evaporation (wood, tarps)**

4. Scenario-Based Deployment

Scenario	Depth	Target	Notes
Desert Village	1.5–2.0 m	Group filtration trench	Coastal
Camp	1.0–1.5 m	Rapid modular setup	Emergency Post-Flood
Schoolyard or Educational Use	1.0 m	Transparent casing for demo	
Remote Farm Ridge	2.0–3.0 m	Slope-fed trench for brine stripping	
Research-scale Desalination	5–20 m	Layered shafts, salt yield, institutional-grade	

5. Maintenance & Recovery

- **Weekly:** Check flow rate, inspect surface clogging
- **Monthly:** Remove top 5 cm layer if salt crystallization visible
- **Bi-Annually:** Replace ultrafine sand core
- **Avoid:** Contamination by waste water or soaps



6. Known Issues & Limitations

- Does not produce potable water directly (requires final treatment)
 - May clog in clay soils or algae-heavy sources
 - Evaporation losses if uncovered
 - Salt removal is passive, not active (harvest surface crust)
-

7. License & Use

This guide and system design are released under [CC BY 4.0](#).

You may: - Copy, distribute, and use the design - Modify and build upon it, even commercially

You must: - Attribute the original creator: Jean-Francis Kuoch



8. Support & Contact

Ko-fi donations: <https://ko-fi.com/jeanfranciskuoch>

Version: 1.1

Last Updated: May 2025