

ജനുവരി 2026



പുറം 10

അമൃത വാർത്താപത്രിക





നീലേശ്വരം മുനിസിപ്പാലിറ്റിയിൽ അമൃത് പദ്ധതിയിൽ ഉൾപ്പെടുത്തി നവീകരിച്ച പാലായി കുളം



കോഴിക്കോട് നഗരസഭയിൽ അമൃത് പദ്ധതിയിൽ ഉൾപ്പെടുത്തി നവീകരിച്ച നീലി ചിറ

അമൃത് വാർത്താ പത്രിക

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എഡിറ്റോറിയൽ



അമൃത് പദ്ധതിയുമായി ബന്ധപ്പെട്ട് കഴിഞ്ഞുപോയ വർഷം ഒട്ടേറെ നാഴികക്കല്ലുകൾ കൈവരിക്കുവാനും ദേശീയ തലത്തിൽ വിവിധങ്ങളായ അംഗീകാരങ്ങൾ നേടിയെടുക്കുവാനും നമുക്ക് സാധിച്ചു. അമൃത് 1.0 യിലെ പദ്ധതികളെല്ലാം തന്നെ പൂർത്തീകരിക്കുവാൻ സാധിച്ചു എന്നത് വലിയ നേട്ടം തന്നെയാണ്. ഈ നേട്ടങ്ങൾ കൈവരിക്കാനായി പരിശ്രമിച്ച എല്ലാവരെയും അഭിനന്ദിക്കുന്നു. പൂർത്തിയായ പദ്ധതികളുടെ പൂർത്തീകരണ രേഖകൾ തയ്യാറാക്കി പോർട്ടലിൽ അപ് ലോഡ് ചെയ്യാനുള്ള നഗരസഭകൾ അത് എത്രയും വേഗം പൂർത്തിയാക്കണമെന്ന് അറിയിക്കുന്നു.

ജലസ്രോതസ്സുകളുടെ സംരക്ഷണവും ജലവിതരണ സംവിധാനങ്ങളും പഠിക്കുവാനായി പോയ കേന്ദ്ര സർക്കാരിന്റെ ഉന്നതതല സംഘത്തിലെ ഒരംഗമായി ഇസ്രായേൽ സന്ദർശിച്ചു. അവിടുത്തെ പൊതു സംവിധാനങ്ങളുടെ പരിപാലനവും ആധുനികവൽക്കരണവും ആരെയും അതിശയിപ്പിക്കുന്ന ഒന്നായിരുന്നു. ജലസ്രോതസ്സുകളുടെ സംരക്ഷണവും, നദികളുടെ സംരക്ഷണവും ജലത്തിന്റെ പുനരുപയോഗ സംവിധാനങ്ങളും നമ്മുടെ സംസ്ഥാനത്തിനും മാതൃകയാക്കാവുന്നതാണ്.

അമൃത് 2.0 പദ്ധതി പ്രവർത്തനങ്ങൾ സംസ്ഥാനത്തെ എല്ലാ നഗരസഭകളിലും നടന്നുവരികയാണ്. അമൃത് 1.0 കഴിഞ്ഞ ഒരു ദശാബ്ദക്കാലമായി സംസ്ഥാനത്തെ 9 നഗരസഭകളിൽ വളരെ കാര്യക്ഷമമായി നടത്തി അതുവഴി പൂർത്തീകരിച്ച പദ്ധതികൾ ജനക്ഷേമകരമായിരിക്കുന്നതും പ്രദേശത്തെ മുഖ്യമായ മാറ്റിയതിനും നാം സാക്ഷികളാണ്. അത്തരത്തിൽ അമൃത് 2.0 പദ്ധതികളും വളരെ നന്നായി പൂർത്തീകരിക്കുവാൻ ഈ വർഷത്തിൽ നമുക്ക് സാധിക്കട്ടെ. അമൃത് 2.0 പദ്ധതിയുടെ അനുബന്ധമായി ഒട്ടേറെ നഗര പരിഷ്ക്കരണ നടപടികളും പരിപാടികളും നടന്നു വരുന്നുണ്ട്. അതിൽ പ്രധാനപ്പെട്ട പരിപാടിയായ അമൃത് മിത്ര പദ്ധതി മിക്ക നഗരസഭകളിലും തുടർ പ്രവർത്തനങ്ങളുമായി വളരെ നല്ല രീതിയിൽ മുന്നോട്ട് പോകുന്നുണ്ട്.

നമ്മുടെ തദ്ദേശ സ്ഥാപനങ്ങളിലെല്ലാം പുതിയ ഭരണ സമിതികൾ നിലവിൽ വന്നു കഴിഞ്ഞു. പുതിയ തദ്ദേശ അദ്ധ്യക്ഷന്മാർക്കും സ്റ്റാൻഡിംഗ് കൗൺസിൽ ചെയർമാന്മാർക്കും കൗൺസിലർമാർക്കും അമൃത് മിഷന്റെ ആശംസകൾ അറിയിക്കുന്നു. അമൃത് 2.0 പദ്ധതികൾ സമയബന്ധിതമായി പൂർത്തീകരിക്കുന്നതിന് നിങ്ങളോരോരുത്തരുടെയും സഹായസഹകരണങ്ങൾ അത്യാവശ്യമാണ്. തുടർന്നും നമ്മുടെ നഗരങ്ങളെ ജലദ്രവ്യമുള്ള നഗരങ്ങളാക്കുന്നതിനുള്ള പ്രവർത്തനങ്ങൾക്ക് ആവശ്യമായ പിന്തുണ നൽകണമെന്ന് അഭ്യർത്ഥിക്കുന്നു.

മിഷൻ ഡയറക്ടർ



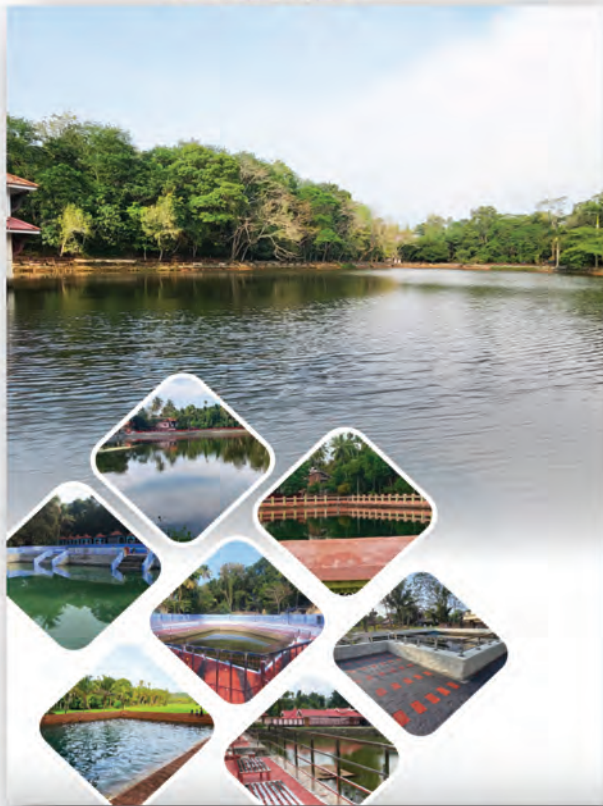
ഏറ്റുമാനൂർ മുനിസിപ്പാലിറ്റിയിൽ വാർഡ് 2 ൽ അമൃത് പദ്ധതിയിൽ ഉൾപ്പെടുത്തി നവീകരിച്ച കുടിവെള്ളത്തിനായുള്ള കുളം



ഏലൂർ മുനിസിപ്പാലിറ്റിയിൽ അമൃത് പദ്ധതിയിൽ ഉൾപ്പെടുത്തി നവീകരിച്ച നാരാണത്ത് അമ്പല കുളം

അമൃത് വാർത്താ പത്രിക ഉള്ളടക്കം

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5 അമൃത് 1.0

7 Report Towards the Israel Study Tour and field Exposure visits carried out from 29th November to 5th of December, 2025 on Urban Water Management Practices

24 “Paper Cups: The Eco-Mirage Poisoning Your Brew with Micro plastics unveiling Health and Environmental Risks for Communities”

30 Brief Note Towards the Credit Enhancement Initiative Guidelines promulgated by MoHUA under AMRUT 2.0.



അമൃത് 2.0 പദ്ധതിയിൽ ഉൾപ്പെടുത്തി നവീകരിച്ച കണ്ണൂരിലെ വലിയ കുളം

പ്രധാനമന്ത്രിയുടെ ഉപദേഷ്ടാവ് ശ്രീ തരുൺ കപൂർ കൊച്ചി കോർപ്പറേഷൻ സന്ദർശിച്ചു



അമൃത് 1.0

പദ്ധതി നിർവ്വഹണം

പൂർണ്ണതയിലേയ്ക്ക്

സംസ്ഥാനത്തെ 9 അമൃത് നഗരങ്ങളിൽ നടപ്പാക്കി വരുന്ന അമൃത് 1.0 പദ്ധതി പൂർണ്ണതയിലേയ്ക്ക് എത്തുന്നു. ആകെ അംഗീകാരം ലഭിച്ച 1106 പദ്ധതികളിൽ 1063 പദ്ധതികൾ പൂർത്തീകരിച്ചു. ശേഷിക്കുന്ന 43 പദ്ധതികൾ നിർവ്വഹണത്തിന്റെ വിവിധ ഘട്ടങ്ങളിലാണ്. ആകെ പദ്ധതി തുകയായ 2357.69 കോടി രൂപയുടെ 96% തുകയായ 2232 കോടി രൂപ പദ്ധതിയ്ക്കായി ചെലവഴിച്ചു. പൂർത്തീകരിക്കാനുള്ള പദ്ധതികളുടെ നിർവ്വഹണം ത്വരിതഗതിയിൽ പുരോഗമിക്കുന്നു.

രാജ്യത്തെ പാവപ്പെട്ടവരുടെയും പിന്നാക്ക ജനവിഭാഗങ്ങളുടെയും ജീവിതനിലവാരം മെച്ചപ്പെടുത്തുന്നതിനും നഗരങ്ങളിലെ അടിസ്ഥാന ഭൗതിക സൗകര്യങ്ങളും സേവനങ്ങളും പ്രത്യേകിച്ച് ശുദ്ധജല വിതരണം, ദ്രവമാലിന്യ സംസ്കരണം, നഗര ഗതാഗതം തുടങ്ങിയ മേഖലകളിൽ നൽകുന്നതിനായി കേന്ദ്ര-സംസ്ഥാന സർക്കാരുകൾ സംയുക്തമായി ആവിഷ്കരിച്ച് നടപ്പിലാക്കുന്ന പദ്ധതിയായ അമൃത് (അടൽ മിഷൻ ഫോർ റിജ്യൂവിനേഷൻ ആന്റ് അർബൻ ട്രാൻസ്ഫർമേഷൻ). കേരളത്തിലെ ആറ് കോർപ്പറേഷനുകളും ആലപ്പുഴ, പാലക്കാട്, ഗുരുവായൂർ മുനിസിപ്പാലിറ്റികളിലുമാണ് നടപ്പിലാക്കിയത്. എല്ലാ വീടുകളിലും ശുദ്ധജല വിതരണത്തിനായുള്ള പൈപ്പ് കണക്ഷൻ എത്തിക്കുക എന്നതാണ് പദ്ധതിയുടെ പ്രഥമ ലക്ഷ്യം. ദ്രവമാലിന്യ സംസ്കരണം, പാർക്കുകളുടെ വികസനം, നോൺ മോട്ടോറൈസ്ഡ് ഗതാഗത സംവിധാനങ്ങൾക്കുള്ള സൗകര്യങ്ങൾ ഒരുക്കുക എന്നിവയും പദ്ധതി ലക്ഷ്യമിട്ടു.

2015 സെപ്റ്റംബർ 1 ന് ആരംഭിച്ച പദ്ധതിയ്ക്ക് 5 വർഷമായിരുന്നു കാലാവധി. നിലവിൽ 2025 ഡിസംബർ 31 വരെ കാലാവധി ദീർഘിപ്പിച്ചു. കേന്ദ്രവിഹിതം 50% സംസ്ഥാനവിഹിതം 30% തദ്ദേശ സ്ഥാപന വിഹിതം 20% എന്ന അനുപാതത്തിലാണ് പദ്ധതിയുടെ ധന വിനിയോഗം.



തൃശ്ശൂർ കോർപ്പറേഷൻ - ആകാശപാത



തൃശ്ശൂർ പിച്ച്യിലെ ഫ്ലോട്ടിംഗ് ഇൻ ടേക് പമ്പിംഗ് സംവിധാനം



തിരുവനന്തപുരം അരുവിക്കരയിലെ ജല ശുദ്ധീകരണ പ്ലാന്റ്



ഫുട്പാത്ത് ബ്രിഡ്ജ്, കൊല്ലം കോർപ്പറേഷൻ



ആലപ്പുഴ വലിയ ചുടുക്കാട് പാർക്ക്



എലക്ട്രോ എസ്.റ്റി.പി., കൊച്ചി കോർപ്പറേഷൻ



Introduction:

Israel's Global Water Management Leadership:

"Transforming Scarcity into Surplus":

Context: Despite 60% desert coverage, low rainfall (<500 mm/year), and recurring droughts, Israel has turned chronic water scarcity into a global model of abundance and innovation by 2025.

Desalination Excellence: With five advanced reverse osmosis plants (notably Sorek: 150 MCM/year, Hadera: 127 MCM/year), Israel generates over 80% of its drinking water from seawater desalination. Integration of energy recovery and renewables makes this cost-effective and eco-friendly.



Suraj Shaji IAS.,
Mission Director,
AMRUT, Kerala



Figure: 1- Majestic Desalination Plant at Sorek



Figure: 1A filtration Methodology in Sorek desalination Plant.

Wastewater Recycling Leadership: Nearly 90% of wastewater is treated and reused, primarily in agriculture, far surpassing countries like Spain (17%). The Shafdan plant treats 97 MGD with secondary and tertiary processes, producing high-quality effluent.

Soil Aquifer Treatment (SAT): Pioneered since the 1970s, SAT uses natural dune filtration to polish effluent and recharge aquifers, yielding nearly potable water for irrigation with minimal energy usage.

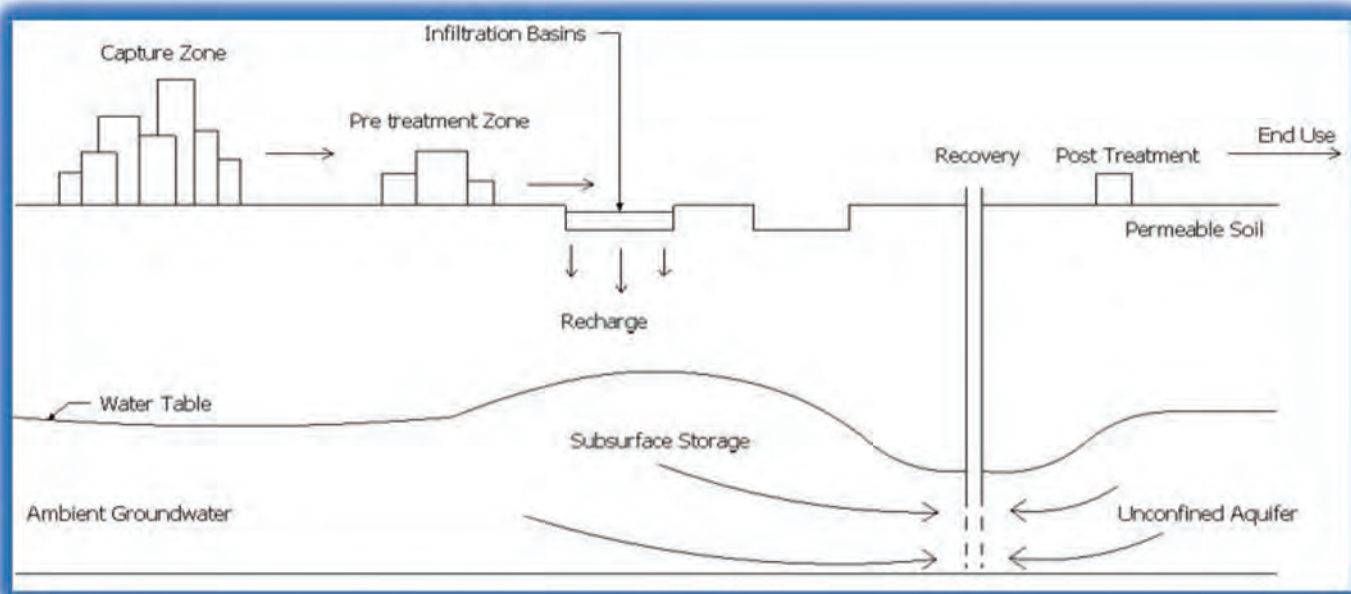


Figure :2 Design and Construction Principles of Soil Aquifer Treatment

Drip Irrigation Innovation: Invented in the 1950s-60s, drip irrigation delivers water directly to roots, achieving approx. 100% efficiency. Covering 75% of crops, it reduces water use by up to 70%, boosts yields, and supports sustainable agriculture in arid zones.



Figure:3“Gravity flow-based Drip Irrigation system and Precision Farming Practices”

Precision Farming Practices:

Precision farming practices in Israel include the use of advanced technologies like IoT sensors, drones, and automated machinery to optimize resource use and increase crop yields. Drip irrigation, a pioneering Israeli innovation, is widely adopted to precisely deliver water and nutrients, saving significant amounts of water. **Variable rate technology (VRT)** is employed to customize fertilizer and pesticide applications based on real-time data from soil and crop sensors. Farmers use AI and machine learning for monitoring and decision-making to enhance productivity while minimizing environmental impact. These integrated systems contribute to sustainable agriculture by improving efficiency and reducing waste in Israel's arid and resource-limited conditions.



Figure:4 - Precision Farming Technology

Policy & Infrastructure: The 1959 Water Law nationalized water resources; the Israel Water Authority (2007) regulates water use, promotes full-cost pricing, and enforces treatment and reuse quotas. The National Water Carrier (completed 1964) remains core infrastructure, distributing freshwater and desalinated water across regions.

Historical Challenges: Water shortages post-1948, droughts in the 1980s-2000s, aquifer depletion, and seawater intrusion drove innovation and reforms.

Current Status (2025): Israel produces 20% more water than needed, with desalination and recycling supplying half the country's demand. Per capita use has declined due to efficiency measures. Ongoing investments include new desalination plants, expanded reuse schemes, AI smart meters, and enhanced aquifer storage.

Global Impact: Israel exports water technology and expertise worldwide, setting standards in innovative engineering, environmental sustainability, and integrated water resource management. Israel's water sector combines security, governance, economics, and hydrological science into a single, integrated model. The five presentations together show how Israel moves from threat and scarcity to resilience and long-term security through coherent laws, institutions, technology, and tariffs.

Water sector Key Players in Israel:

The water sector consists of multiple operational and regulatory entities responsible for production, conveyance, local distribution, sewage collection, treatment, and effluent reuse.

The Key Players:

Mekorot (National Water Company), Local municipalities, regional municipalities, Municipal corporations, Joint municipal associations, Cooperative associations, Desalination plant operators, Private entities. These actors together manage the entire supply chain—from raw water production and conveyance to sewage treatment and effluent reclamation.

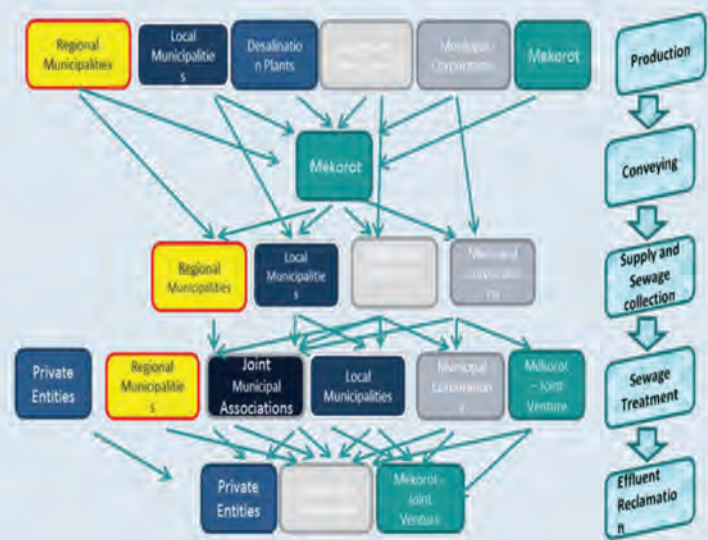


Figure:5 Water Sector Key Players

2. Integrated Context and Threat Environment:

- ◆ Across all the presentations carried out by experts, the introduction frames Israel as a water-scarce, geopolitically exposed country that treats water as a public good managed by the State. This core principle appears consistently:
- ◆ Water is legally public property (Water Law 1959) and centrally regulated by the Israel Water Authority (IWA).
- ◆ Natural resources cover only about half of total demand; the rest comes from desalination and reclaimed wastewater.
- ◆ Water infrastructure is exposed to terror, cyber-attacks, missile strikes, earthquakes, and climate change.
- ◆ The unified challenge put forth in all the presentations made by experts looks in to as how to sustain reliable, safe, and affordable water service under chronic resource deficit, security threats, and increasing climate variability.

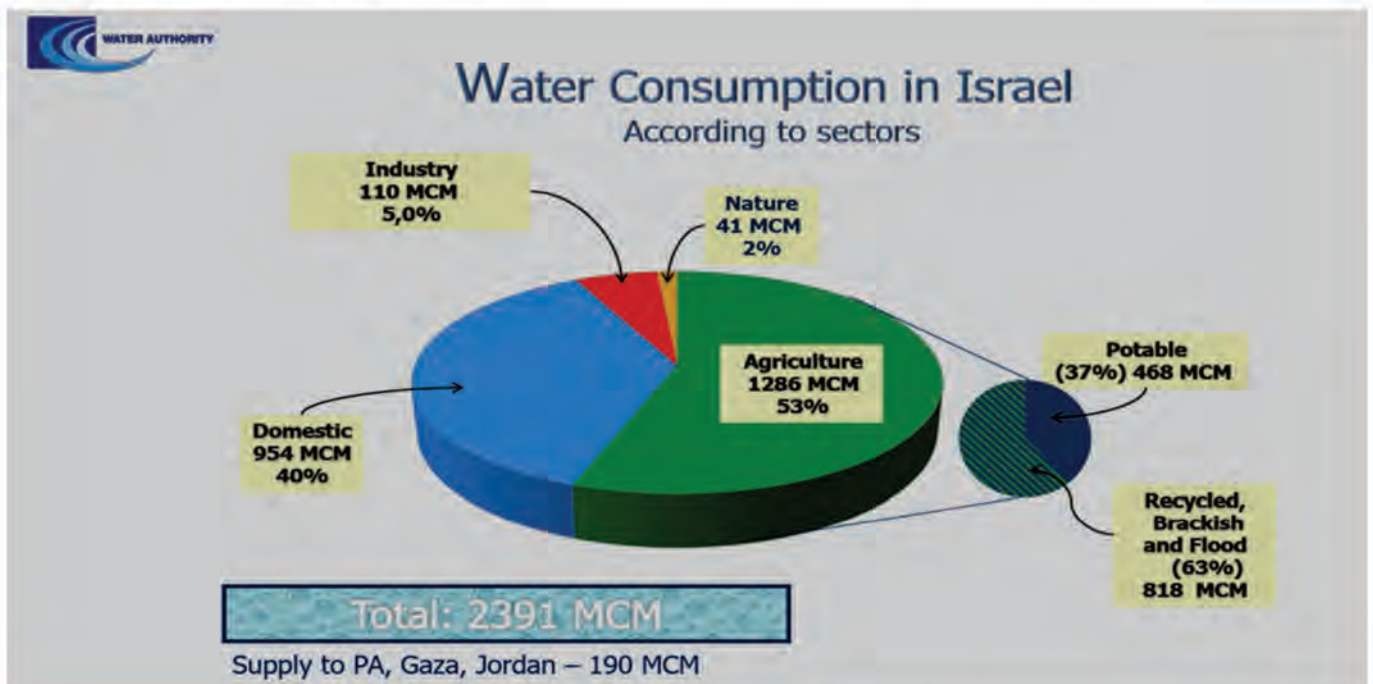


Figure:6 Water Consumption Patterns in Israel

3. Governance, Responsibility, and Regulatory Framework:

All governance-related aspects converge to one strong, professional, central regulator with clear laws and strict enforcement.



Figure:7 -Water Governance Frame work

Common elements expressed:

Single “one-stop” Water Authority.

- ◆ Consolidates previously fragmented responsibilities (nine ministries before 2007).
- ◆ Plans, develops, preserves, regulates, and manages all water resources and services.
- ◆ Uses a Water Authority Council/Board with representation from key ministries and public members, but operates on professional—not political—criteria.



Figure: 8 - Water Authority council as Single one stop entity

Legal framework:

- ◆ Water Law (1959): Water is public property; extraction and supply need permits.
- ◆ Water Measurement Law (1955): Mandatory universal metering.
- ◆ Water Drillings Control Law (1955): Permits for drilling and well closure.
- ◆ Water & Sewage Corporations Law (2001): Professional local utilities with engineering and service standards and economic tariffs.

Regulatory style:

- ◆ “Tough and demanding” regulation: strict security, operational and backup requirements.
- ◆ Mandatory security & emergency officers in utilities.
- ◆ Mandatory drills (cyber, contamination, power failure, earthquake).

It is very clear that a “holistic, centralized, professional management” and “strong regulation” as the backbone of resilience.

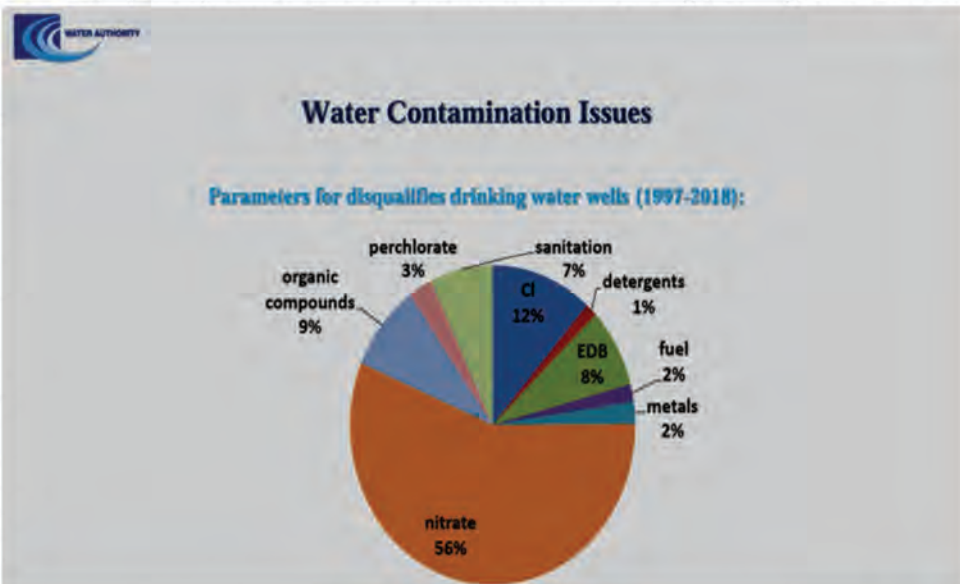


Figure:9 Various Parameters that disqualify Drinking water wells

4. Water Resources Integration and Long-Term Hydrological Management:

The “Water Resources” and “Long-Term Management” describes the same integrated resource strategy from two angles: **system architecture and hydrological science**.



Figure:10 Water Resource Pillar

Water Governance Pillar

Resource mix and integration:

Natural resources: Approx 42–60% of total (mainly groundwater and the Sea of Galilee).

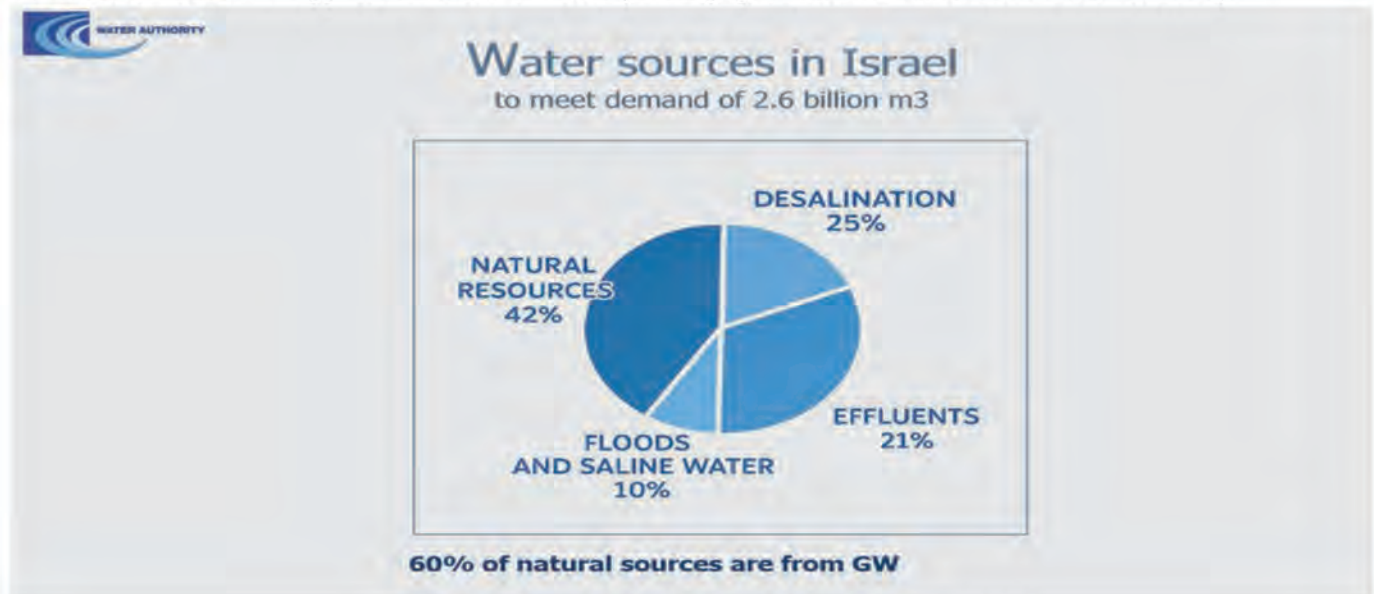


Figure:11 Water resources Mix and integration Israel

Manufactured resources: desalinated seawater (Approx 25%) and reclaimed wastewater (approx 20–23%), plus flood and saline water (approx 10%).

National Water Grid and National Carrier physically integrate basins and enable blending based on quality, cost, and availability.

Groundwater centrality and basin-based management

- ♦ About 60% of natural resources are groundwater.
- ♦ Recharge quantified for each hydro-geological basin; comprehensive monitoring of levels and quality water balance and water auditing.
- ♦ Mandatory metering since **the 1950s supports basin-scale water balances and numerical models**.

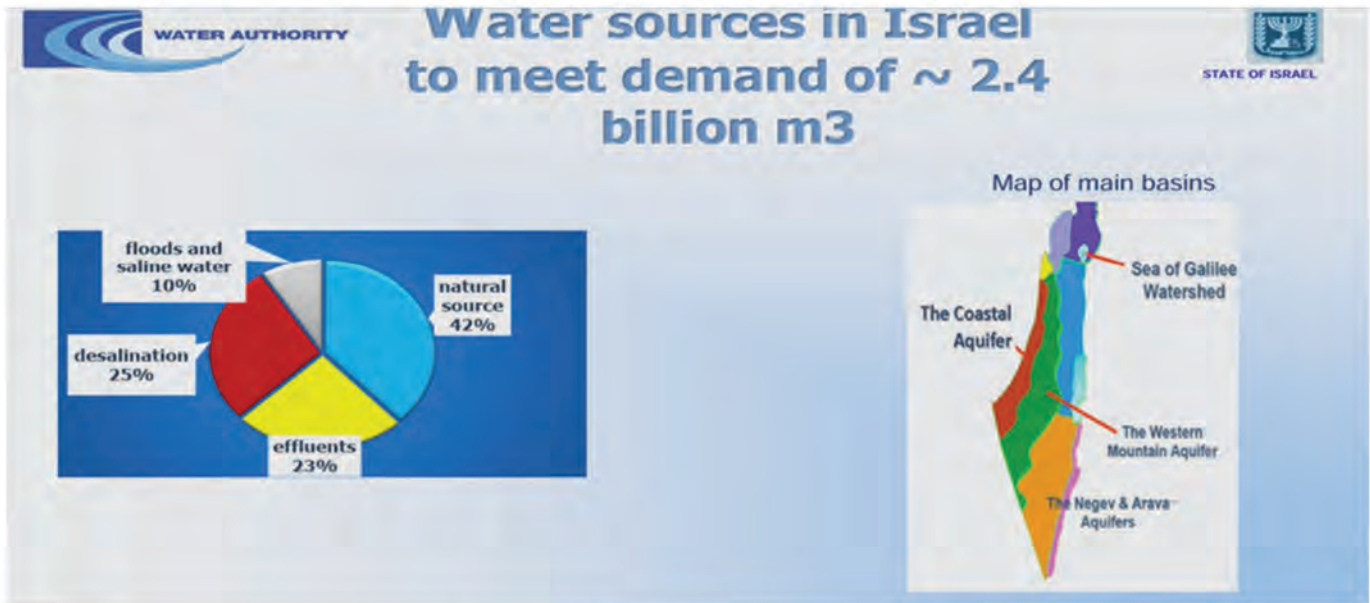


Figure:12 Water resource Mix and Integration

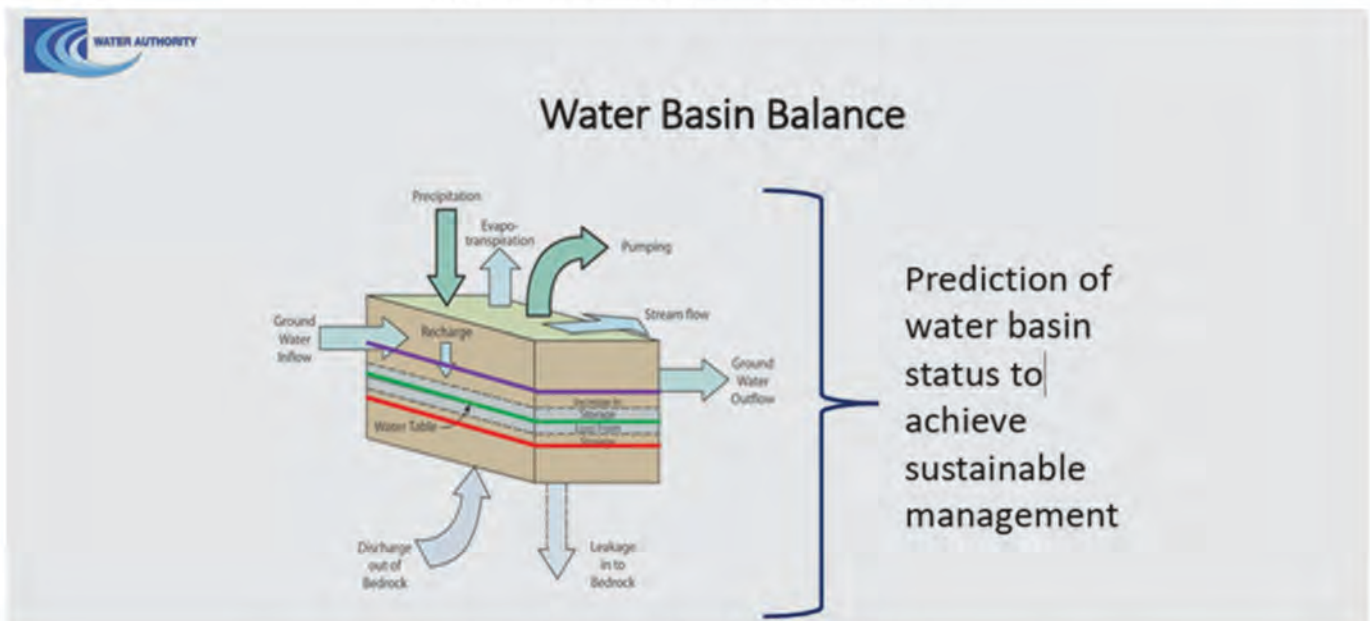


Figure:13 Water Basin Balance detailing.

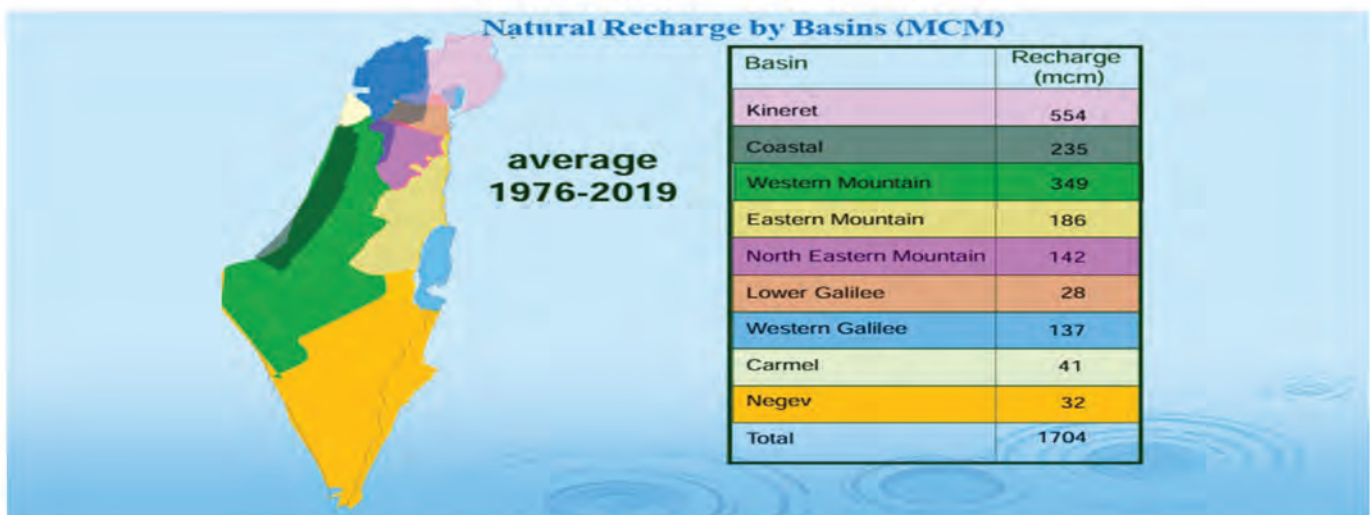


Figure:14 Geo specific Natural recharge Basin in Million cubic metre

Operational levels and Climate adaptation:

- ♦ Red, green, and purple lines define safe operating ranges in aquifers, guarding against seawater intrusion and environmental damage.
- ♦ Climate change scenarios (rainfall decline, recharge reduction) are factored into models, leading to more desalination, reuse, and artificial recharge where possible.

The hydrology reports bring forth that science-based strategy integrating monitoring, modelling, and manufactured water” is the technical foundation for the **IWSM and tariff policies described in the various experts’ presentations.**

5. Security, Emergency Management, and Cyber Preparedness:

The security-focused detailing extends **governance and hydrology into operational resilience under shocks.**

Common cross-links:

Threat spectrum:

Terrorism and contamination; missile attacks on tanks, lines, and plants; cyberattacks; earthquakes; global-type crises (Flint, Charleston) as cautionary examples.

Multi-layered protection:

- ♦ **Physical security:** cameras, access control, hardened structures, patrols.
- ♦ Real-time water quality monitoring, including biological sensors (e.g., electric fish).



Figure: 15 Bio sensor Based water Quality Monitoring system

- ♦ **Cyber defence:** dedicated Water SOC linked to national SOC ecosystem.



Figure:16 Water SOC linked to national SOC ecosystem

Backup and redundancy:

- ♦ Mandatory generators and diesel storage.



Figure:17. Mandatory back-up generators and Diesel Storage for pumping system.

- ♦ Redundant pumping and SCADA systems; manual operation capability for key assets.
- ♦ Low-tech options (manual pumps, gravity systems, mobile tanks) for digital/energy failures.

Manual ability and knowledge retention



Figure: 18. Manual operational ability and knowledge base

Emergency methodology:

- ♦ **Clear priorities:** short-term life-saving supply (tankers, bottled water), rapid repair and bypass solutions, public information and evacuation. if needed.
- ♦ Pre-identified distribution hubs (schools, supermarkets, public grounds) and sanitation contingencies (mobile units, bypass systems).

Security related details and conclusions reinforce the same idea as the regulatory and tariff chapters: resilience by design, through standards, drills, and redundancy financed by cost-reflective tariffs.

6. Economic and Tariff Framework:

The economics related aspect translate governance and hydrological strategy into pricing tools that shape behaviour and fund infrastructure.

Shared principles:

Full cost recovery:

- ♦ Tariffs must cover desalination, bulk conveyance, local distribution, sewage treatment, energy, O&M, and capital costs.
- ♦ Tariff revenue is the primary funding source, ensuring financial independence from annual political budgets.
- ♦ Uniform and fair tariffs
- ♦ Same price nationwide for equivalent service, regardless of local cost differences (e.g., Jerusalem vs. Tel Aviv).

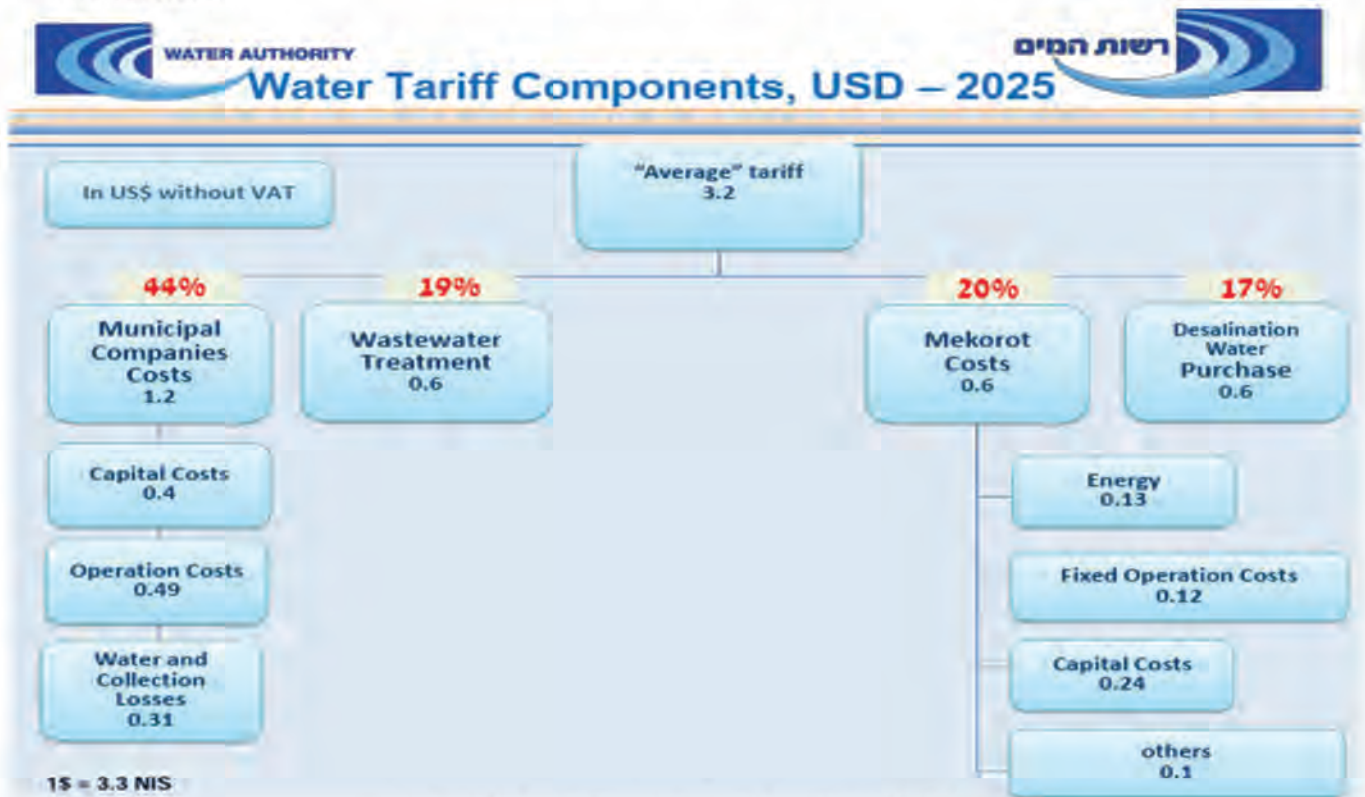


Figure:19 Various Water Tariff component and Out lay

Progressive and sector-specific pricing:

- ♦ Households: two-block tariff (low price for basic needs; lesser than 3.5 m³/person/month with VAT: 2.5 dollar/cubic metre and higher price above 3.5 m³/person/month with VAT of 4.6 dollar/cubic metre) to protect basic consumption and penalize excess.
- ♦ Agriculture: differentiated tariffs for potable vs. reclaimed water, with a strategic shift from hidden water subsidies to transparent direct support, while keeping effluent reuse central.
- ♦ Tariff levels sit in a mid-range globally but reflect high treatment and desalination standards.

Water Tariffs – Household, 2025

Two-block tariff system (water+ sanitation + vat)

- Below 3.5 m³/person/month - the rate is - 2.5 \$/m³
- Above 3.5 m³/person/month - the rate is - 4.6 \$/m³

- ❖ Progressive pricing
- ❖ Encouraging conservation
- ❖ Cost recovery

1\$ = 3.3 NIS



Figure:20 - Household level Water Tariff

Demand management and efficiency:

- ♦ Tariffs, universal metering, quotas (for agriculture), and performance norms drive conservation and NRW reduction.
- ♦ Long-term trends show stable or reduced per-capita demand thanks to technology, pricing, and awareness.

The IWSM, governance, and tariff reports all conclude that economic tools are integral to sustainability—aligning user incentives with hydrological limits and security investments.

7. Data, Monitoring, and Information Flows:

- ♦ Across governance, hydrology, and tariffs, data appears as the unifying operational asset:
- ♦ Every well, pump, and plant is metered, with digital data flows to the Water Authority.
- ♦ National databases track demand by sector, NRW, aquifer levels, salinity, contamination types, and treatment performance.
- ♦ SOC's and emergency systems rely on real-time operational and cyber telemetry.
- ♦ Models and tariff reviews both depend on long-term time series of rainfall, recharge, consumption, and costs.

This tight integration of data supports the “professional, non-political” character of decision-making highlighted the core values.

8. International Experience and Transferable Lessons:

The security and governance reports highlight Israel's external engagements (e.g., Bahamas humanitarian missions) as proof of exportable know-how. All conclusions converge on several transferable principles:

- ♦ Centralized but multi-stakeholder regulation with strong legal backing.
- ♦ **Integrated management of all sources (natural and manufactured) through a national grid.**
- ♦ Mandatory metering, basin-based hydrological modelling, and clear operational thresholds.
- ♦ Strict security and emergency regulation, enforced through drills, officers, and backup standards.
- ♦ Cost-reflective, uniform tariffs that fund infrastructure and encourage conservation.
- ♦ High reliance on wastewater reuse and desalination to offset climate and natural deficits.

9. Integrated Comparative Conclusion:

Comparing the introductions, chapter details, and conclusions across all five reports shows a consistent, mutually reinforcing architecture:

- ♦ The Water Security & Cyber report explains how the sector is protected against acute shocks.
- ♦ The IWSM Model and Governance & Data Flow reports explain how institutions, laws, and planning organize the whole system.
- ♦ The Tariff Framework report explains how money flows sustain infrastructure, security, and quality.
- ♦ The Long-Term Management report explains how hydrology and climate science shape sustainable extraction and source diversification.

Together, they describe a single integrated model in which:

- ♦ **Water is public, centrally managed, and fully measured.**
- ♦ Natural and manufactured sources are planned and operated as one unified system.
- ♦ Governance is strong, professional, and data-driven.
- ♦ Security and emergency preparedness are embedded in regulation and financed through tariffs.
- ♦ Tariffs ensure economic sustainability, fairness, and conservation.
- ♦ Long-term hydrological and climate realities guide all strategic decisions.

This well-developed framework allows Israel to transform structural scarcity and high security risk into a managed condition of water security and resilience.

10. Kishon River basin-based rejuvenation and Basin wide Management Study:

Kishon River rejuvenation and upkeep follow a basin-scale, nature-based development approaches integrating pollution control, ecological restoration, and community uses, aligned with Israeli water law, River Authorities' guidelines, and Mediterranean basin climate constraints.

A Kishon River Water Plan includes:

Mapping of all inflows (industrial, municipal, stormwater, agricultural, baseflow) and set quantitative water quality and ecological flow targets.

Prioritization of pollution load reduction at source (industrial pre-treatment, sewer separation, stricter discharge consents) and interception/treatment of polluted baseflows.

Allocating treated wastewater and stormwater for reuse where possible, reserving higher-quality flows for river baseflow and estuarine health.

Integrating flood risk management (widened sections, floodplain reconnection, setback levees) with ecological corridors and public access.

Water quality monitoring array and index:

- ♦ **Establishing a tiered network:** upstream reference sites, midstream industrial/urban impact zones, downstream/estuary and salt marsh.
- ♦ **Parameters:** physico-chemical (temperature, pH, EC, DO, turbidity), nutrients (N, P species), organic load (BOD, COD, TOC), salinity (chloride, sulfate), metals (e.g., Hg, Cd, Pb, Cr, Ni, Zn), organics (PAHs, VOCs), PFAS, microbiological indicators (E. coli, total coliforms).
- ♦ Develop a Kishon Water Quality Index (KWQI) aggregating sub-indices (oxygen regime, eutrophication, salinity, toxicity, microbiology) with class thresholds for "bad-poor-moderate-good-high" ecological status.

Online water quality monitoring system:

- ♦ Installation of continuous multiparameter sondes at critical locations (industrial zone, major WWTP outfalls, upstream reference, estuary) with telemetry to a central SCADA or river basin dashboard.
- ♦ Real-time parameters: level/flow, pH, EC/salinity, DO, turbidity, temperature, chlorophyll-a, NH₄+4+, NO₃-3-, ORP; coupled with automatic samplers triggered during events (spills, high turbidity, storm peaks).
- ♦ Implement alarm thresholds and decision rules for regulatory action, emergency response, and adaptive operation of WWTPs and industrial discharge systems.

Biological monitoring using macroinvertebrates:

- ♦ Using a standardized biotic index (e.g., adapted BMWP/ASPT or Mediterranean River Macroinvertebrate Index) capturing community composition, EPT richness, and tolerance scores.
- ♦ Sample riffle/pool habitats seasonally, integrating with fish, periphyton, and riparian vegetation monitoring to reflect cumulative and long-term condition beyond spot chemistry.
- ♦ Include official ecological status classes and restoration targets based on macroinvertebrate metrics.

Typical socio-ecohydrological cross-section of Kishon:

River corridor: low-flow thalweg, vegetated benches, connected floodplain or terraced berms, with variable salinity toward the estuary.

Ecohydrology: gradient from freshwater/low-salinity reaches supporting fish and macroinvertebrates to brackish estuarine/salt-marsh habitats with halophytes, birds, and nursery grounds for marine biota.

Socio-use zones: walking/biking paths, controlled recreation (angling, boating where safe), education areas, and conserved “quiet zones” for biodiversity; integrated with flood storage and groundwater-surface water interaction.

Current recommended standards of drinking water in ppb (order of magnitude, WHO-type benchmarks):

- Nitrate (as $\text{NO}_3\text{-3-}$): $50 \text{ mg/L} \approx 50,000 \text{ ppb}$.
- Lead: $10 \text{ }\mu\text{g/L} \approx 10 \text{ ppb}$.
- Arsenic: $10 \text{ }\mu\text{g/L} \approx 10 \text{ ppb}$.
- Cadmium: $3\text{--}5 \text{ }\mu\text{g/L} \approx 3\text{--}5 \text{ ppb}$.
- Mercury: $1 \text{ }\mu\text{g/L} \approx 1 \text{ ppb}$.
- Chromium (total): $50 \text{ }\mu\text{g/L} \approx 50 \text{ ppb}$.
- Benzene: $1\text{--}10 \text{ }\mu\text{g/L} \approx 1\text{--}10 \text{ ppb}$.

PFOA, PFOS (indicative): low single-digit to $<100 \text{ ng/L}$ ($0.001\text{--}0.1 \text{ ppb}$), with many jurisdictions now aiming at combined PFAS in the ng/L range; national standards should be consulted for precise regulatory values.

PFAS in industrial discharge:

Likely sources: fluorochemical production, metal plating, textiles, paper, firefighting foam, electronics, and some chemical parks along the lower Kishon.

Actions: mandatory PFAS inventories, substitution of PFAS where feasible, on-site advanced treatment (GAC, ion-exchange, high-pressure membranes, high-temperature destruction for residuals), and strict, progressively tightening discharge limits in ng/L to low $\mu\text{g/L}$ range.

continuous surveillance: routine PFAS monitoring in industrial effluents, Kishon water, sediments, fish tissue, and groundwater, with a risk-based approach to hot-spot remediation.

Fishes in the Kishon:

Historically: native Mediterranean freshwater and euryhaline species (e.g., cyprinids, tilapias, mullets, grey mullet species, eels), with heavy pressure from pollution, flow alteration, and habitat simplification.

Current strategy: restore water quality and habitat heterogeneity, manage invasive species, and re-establish longitudinal connectivity to support resilient fish communities and estuarine nursery functions.

Salt marsh of Kishon and its management:

Functions: key Mediterranean coastal wetland providing nursery habitat, bird feeding/roosting areas, carbon storage, nutrient removal, and a buffer against coastal flooding and sea-level rise.

Threats: industrial encroachment, contaminated sediments, altered salinity/flooding regimes, and fragmentation.

Management: protect remaining salt marsh with clear zoning; remove or cap contaminated sediments where feasible; re-establish semi-natural tidal/freshwater inflow regimes; control invasive plants; create boardwalks and hides for low-impact recreation and education; integrate the salt marsh as a flagship component of the Kishon River Park and basin-scale restoration plan.

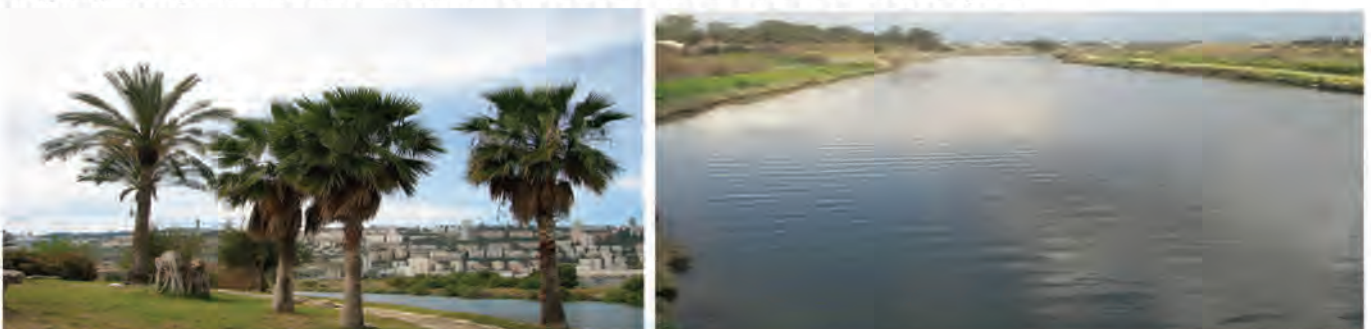


Figure:21 Integrated Kishon River rejuvenation and Basin Management

Israel's model can be adapted to Kerala state by **focusing on governance integration, hydrology-based planning, security/emergency readiness, and tariff/efficiency reforms as part of Key Learning from Israel Studies:**

Key Learnings for Kerala State:

1. Governance and Institutional Setup:

- ◆ Move toward a functional “one-stop” water regulator at state level (or de facto through coordination), integrating KWA, Irrigation, LSGD, Groundwater, Pollution Control Board, and KSDMA around a single basin-wise planning and data framework, similar to Israel's central Water Authority.
- ◆ Use the proposed River Basin / River Conservation Authorities in Kerala as the anchor for integrated river-basin management and disaster-resilient planning (Periyar, Bharathapuzha, Chaliyar, Chaliyar-Kallayi, etc.).
- ◆ Create a professional technical council (hydrology, economics, urban planning, DRR, environment) that clears major water investments, analogous to Israel's professional Water Council, but nested within Kerala's decentralized governance context.

2. Hydrology, Sources, and Data Systems:

Establish full metering and telemetry for bulk sources (intakes, WTPs, major wells, zonal meters) and progressively at consumer level in cities like Kochi, Kozhikode, Thrissur, and Palakkad, mirroring Israel's universal measurement approach.

Shift from “scheme-by-scheme” planning to basin and aquifer budgets: define sustainable yields, ecological flows, and “red/green” operational levels for key aquifers in Palakkad gap, midlands, and coastal sand aquifers (Aluva, Kochi, Kozhikode), similar to Israel's basin-wise recharge and operational lines.

Integrate natural and “manufactured” water:

- ◆ Aggressively scale treated sewage reuse for irrigation/industry using your STP promotion ideas (centralized + decentralized) in urban fringes.
- ◆ Pilot “urban reuse belts” like Shafdan analogues for Kochi and Thrissur, pairing STPs with agriculture/landscaping demand, as Israel does with reclaimed wastewater.

3. Security, Emergency and Disaster Management

For Kerala's multi-hazard context (floods, landslides, coastal hazards), adapt Israel's security-emergency logic to water:

- ◆ Mandate a designated “Water Security & Emergency Officer” in each major utility division (KWA circles, major municipalities), aligned with KSDMA's virtual cadre concept.
- ◆ Prepare district-level “Water Emergency Plans” that pre-identify alternative sources (wells, ponds, interconnections), tanker routes, and public distribution points for flood, drought, and contamination events, similar to Israel's distribution station concepts.

Strengthen cyber and operational continuity gradually:

- ◆ Begin with basic cyber hygiene for SCADA and billing systems, offline/manual operating protocols, and generator requirements at major headworks and STPs.
- ◆ Integrate water utilities into the state EOC/DEOC information flow as a sector “cell,” akin to a simpler Water SOC.



Figure:22- Bank protection Measures and Permeable pavements along Kison River

4. Tariffs, NRW, and Efficiency:

Use Israel-style economic logic without copying tariff levels:

- ♦ Move toward transparent, cost-reflective urban tariffs with lifeline “first block” for basic needs, higher block for high use; ring-fence revenues for O&M, NRW reduction, and security/emergency investments.
- ♦ Make NRW reduction a central financial strategy (district metered areas, active leak control, pressure management) in Kochi, Thrissur, Kozhikode, and Palakkad; current NRW in Kochi is high and directly erodes KWA finances and resilience.
- ♦ For agriculture, gradually rationalize canal and lift-irrigation allocations in Palakkad and Kole areas using measured deliveries and volumetric pricing combined with targeted subsidies, parallel to Israel’s quota-cum-tariff system.

5. Decentralization, Community and Technology:

Embed Israel’s “professional central regulator” within Kerala’s strong local self-government framework:

- ♦ Panchayats and municipalities manage local sources, ponds, and decentralized STPs under state-set technical and security standards, with performance-based grants for NRW, quality, and reuse, as emerging in decentralized governance literature for Kerala.
- ♦ Use your mobile STP exhibition vehicle concept as an Israeli-style “extension and education” tool:
- ♦ Demonstrate wastewater reuse, flood-resilient sanitation, and decentralized treatment in flood-prone wards of Kochi/CIAL, Periyar islands, Palakkad town, and Kozhikode coastal wards, echoing Israel’s emphasis on awareness and R&D-practice linkage.

6. Practical Phased Roadmap for Kerala:

1. Phase 1 – Diagnostics & Pilots (1–3 years)

- ♦ Basin-wise water audits (Periyar, Bharathapuzha, Chaliyar etc) and NRW baselines in Kochi, Thrissur, Kozhikode, Palakkad.
- ♦ Pilot full metering + DMAs + reuse belts in 1–2 cities.
- ♦ Notify minimum emergency standards (backup power, alternate sources, emergency chlorination, manual operation) for KWA schemes in high-risk districts.

2. Phase 2 – Institutionalization (3–7 years)

- ♦ Establish a Kerala Water Resources Authority/River Basin Authority with legal backing and technical cells, aligned with KSDMA and LSGD.
- ♦ Formalize tariff principles (lifeline+ increasing blocks; earmarked funds for NRW, security, and reuse).
- ♦ Roll out district-level Water Emergency Plans and training for water-sector “virtual cadre” officers.

3. Phase 3 – Advanced Integration (7–15 years)

- ♦ State-wide supervisory control, integrated data platform (sources–networks–quality–finance–disaster data).
- ♦ Large-scale wastewater reuse for agriculture/industry, especially in Palakkad, Thrissur, and Kochi corridors.
- ♦ Progressive movement toward basin-wise caps and operational lines for all key aquifers and rivers, analogous to Israel’s long-term hydrological management.

Key learnings suitable for Kerala River rejuvenation and basin management from the Kishon river basin model study includes the following:

1. Basin-Scale Integrated Planning:

- ♦ Map all inflows (industrial, municipal, stormwater, agricultural, baseflow) and systematically set water quality and ecological flow targets.
- ♦ Prioritize pollutant load reduction at the source with stronger regulatory controls (industrial pre-treatment, sewer separation) before reliance on end-of-pipe treatment.
- ♦ Reuse treated wastewater and stormwater strategically to augment river baseflows and downstream ecological health, especially important in water-stressed climates like Kerala’s.



2. Multi-Parameter Water Quality Monitoring & Indexing:

- ◆ Implement a tiered water quality monitoring network covering upstream reference sites, pollutant impact zones, and estuarine/salt marsh areas, capturing detailed physico-chemical, nutrient, metal, organic, PFAS, and microbiological parameters.
- ◆ Develop a composite Water Quality Index similar to KWQI to simplify complex data into actionable river health status categories for stakeholders and regulators.
- ◆ Deploy online continuous monitoring sondes with telemetry and real-time data dashboards, enabling adaptive management and rapid response to pollution events.

3. Ecological and Biological Monitoring:

- ◆ Use macroinvertebrate-based biotic indices adapted to local river ecology for long-term ecological condition assessment beyond spot chemical tests.
- ◆ Integrate fish, periphyton, and riparian vegetation monitoring to track ecosystem recovery and biodiversity restoration comprehensively.
- ◆ Set ecological condition and restoration targets based on biological metrics, improving community engagement and ecosystem resilience.

4. Flood Risk and River Corridor Management:

- ◆ Combine flood risk reduction infrastructure (floodplain reconnection, setback levees) with ecological corridor design and public recreational access, maximizing social and environmental benefits.
- ◆ Maintain a socio-ecohydrological perspective considering river salinity gradients at the confluence points, habitat zonation, and multifunctional socio-use zones (education, recreation, conservation).

5. Addressing Emerging Contaminants like PFAS:

- ◆ Identify likely PFAS industrial sources and enforce strict discharge controls with progressive tightening of limits in the ng/L to low µg/L range, alongside mandatory inventories and substitution policies.
- ◆ Apply advanced treatment technologies (GAC, ion exchange, membranes) specific to PFAS removal and continuous surveillance in water, sediments, and biota for risk-based management.

6. Habitat Restoration and Biodiversity Enhancement:

- ◆ Restore water quality and physical habitat heterogeneity to support native and euryhaline fish species, while managing invasive species to enhance ecological connectivity and nursery habitats.
- ◆ Protect and restore coastal wetlands (salt marshes) for their key ecological services, including carbon sequestration and flood buffering, integrating them into river basin park frameworks.



Empowering India's Water Leaders: Senior level Officers from India Mastering Advanced Water Management Techniques in Israel.

7. Community and Stakeholder Integration:

- ♦ Promote controlled public recreational uses (walking, biking, angling, boating) and education zones to strengthen community stewardship of river health. Promote bio- swales, permeable non concer-tized walk way etc
- ♦ Use “quiet zones” to balance biodiversity conservation with socio-economic use.

For Kerala's rivers, this integrated Kishon-style approach will encourage holistic rejuvenation by combining strong pollution controls, water reuse, adaptive real-time monitoring, ecological restoration, and community engagement, all tailored to local socio-ecological and climatic conditions.

Conclusion:

The study of Israel's integrated water resource management, sewerage systems, and river rejuvenation offers valuable insights into sustainable, basin-scale approaches that prioritize pollution control at the source, ecological restoration, and adaptive real-time monitoring. Israel's emphasis on circular water use, advanced treatment technologies, and community-inclusive river corridor management provides a robust model for addressing complex urban water challenges under climatic constraints. Adopting such nature-based and multi-disciplinary frameworks can significantly enhance river health, water security, and resilience in Kerala state.

“Israel's successful water management paradigm clearly indicates that effective river and water resource management demands a holistic, science-driven, and community-engaged strategy that balances environmental integrity with socio-economic needs. For Kerala, adopting this approach means integrating advanced pollution control, real-time monitoring, and nature-based solutions tailored to the region's unique monsoon-driven hydrology, densely populated catchments, and rich biodiversity. Emphasizing wastewater reuse, floodplain restoration, and inclusive stakeholder participation can strengthen Kerala's River rejuvenation efforts while enhancing climate resilience and sustainable water security.

“Paper Cups: The Eco-Mirage Poisoning Your Brew with Microplastics unveiling Health and Environmental Risks for Communities”

Introduction:

Paper cups dominate India's 22–25-billion-unit market (IMARC 2022–2028), especially in Kerala's tea-stall culture and most of the private and Government offices. Marketed as biodegradable alternatives to plastic, but there hidden a dirty secret. It is to mention that, a thin polyethylene (PE) lining (20–80 μm) that prevent leaks but degrade under hot liquids (**85–90°C**). IIT Kharagpur's landmark 2020 study in *Environmental Science & Technology* reveals a single 100 ml cup releases approximately 25,000 microplastics (10–1000 μm) particles per 100 milli liter of hot liquid in 15 minutes. Thus, equalling to 75,000 particles daily for three-cup of beverage users daily and affecting their health portfolio. “Nano plastics” (<1 μm), phthalates, styrene, heavy metals (Cr, Pb, Ni), and ions leach alongside, entering waterways and water bodies and also pollute the environment by bio-accumulation of contaminants in soil. With the market reaching 23.2 billion units in 2025 and projected to hit 29 billion by 2033, urgent policy action is essential, particularly in high-consumption regions like Kerala. Hence, the above demands an urgent scrutiny and through scientific study.



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Figure:1- Coffee/Tea in paper cup? It's serving 25,000 microplastics too! It's time to sip smarter.....

Composition and Leaching Mechanisms: Heat Triggers the Nightmare:

Paper cups consist of 90–95% cellulose pulp coated with a thin (20–80 µm) polyethylene (PE) layer to prevent leakage, alongside additives like wax or PLA in some variants. Hot liquids trigger thermal softening, mechanical shedding from stirring, and chemical migration enhanced by acidity, releasing microplastics (10–1000 µm) and nanoplastics (<1 µm).

Key Release Triggers:

- ♦ **Thermal Softening:** At 85–90°C, PE deforms, shedding irregular particles (56–126 µm, confirmed by SEM (*Scanning Electron Microscopy*), / (FTIR. *Fourier-Transform Infrared Spectroscopy*)
- ♦ **Mechanical Stress:** Stirring or shaking spikes release to 73,840 particles (weekly estimate).
- ♦ **Chemical Factors:** Acidic coffee/tea boosts migration; reuse retains 80–90% contamination.

Quantified Data from Research Studies carried out by IIT Kharagpur:

GC-MS (Gas Chromatography-Mass Spectrometry) and ICP-OES (Inductively Coupled Plasma Optical Emission Spectrometry) related scientific study confirm toxins exceed safe thresholds; plastic cups leach more, **but paper's "green" label mentioning in cups is quite deceiving.**

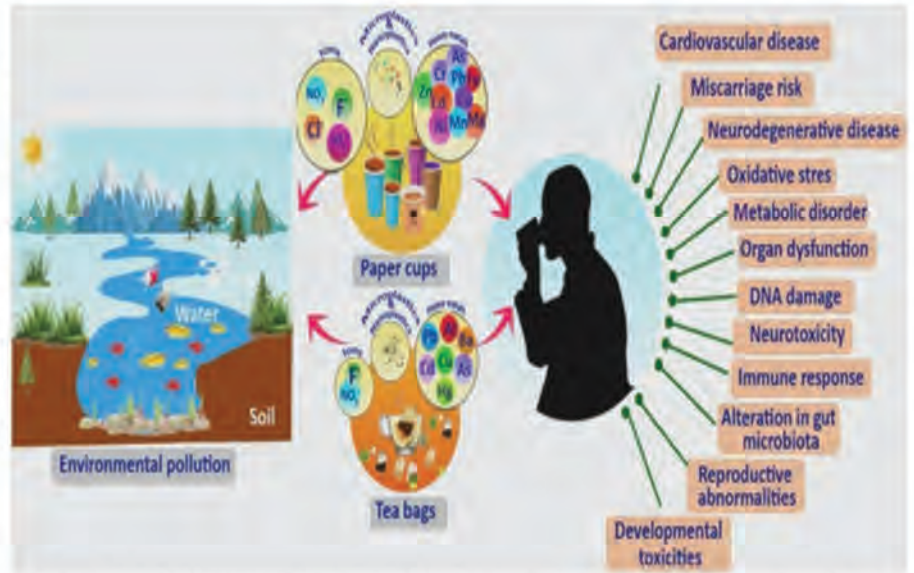


Figure:2- "Environmental and Health Impacts of Micro plastics coated Paper cups"

Condition	MPs per 100 ml (15 min)	Contaminants
Hot Water (85–90°C)	25,000	Phthalates (DEHP, DEHA), styrene, BPA
With Shaking	Up to 73,840	Heavy metals (Pb, Cr, Ni), nitrite
Annual (Weekly User)	37,613–89,294	BHT, vinyl chloride

Table:1. Quantified Data from Research Studies carried out by IIT Kharagpur

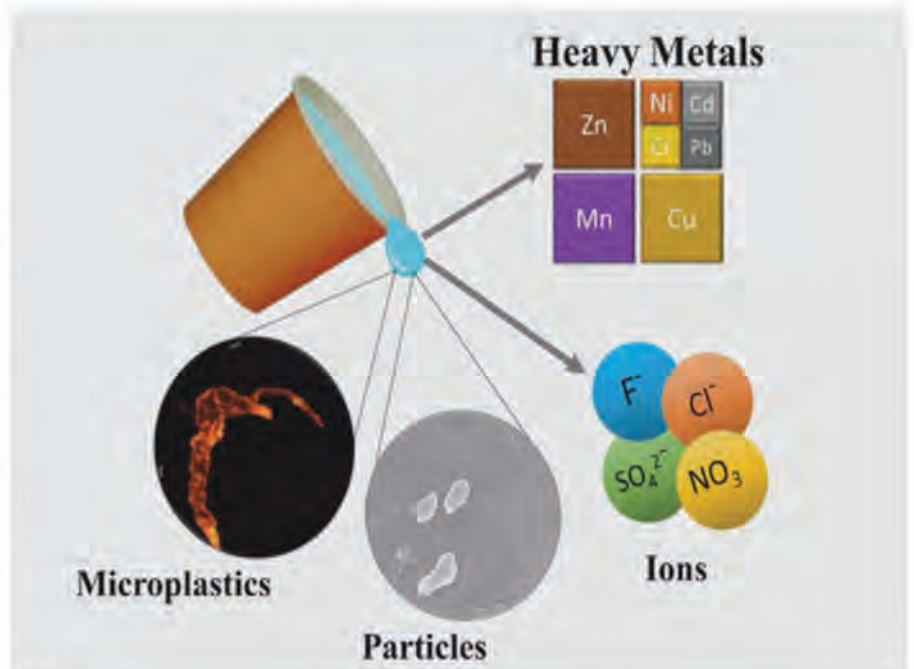


Figure:3- Heavy Metals and Microplastics Spread in Paper cups

Key Quantification Data:

Study/Source	Conditions	MPs Released (per 100 ml, 15 min)	Particle Size/Shape
IIT Kharagpur (2020)	85–90°C hot water	25,000 (10–1000 µm)	Irregular, 56–126 µm
Multi-batch (90 cups)	95°C, 20 min	675–5,984/L (PE/PP/PS)	<20 µm, HDPE dominant
Routine User Model	3 cups/day	75,000/day; 657–876M/year	2–5 µm
Weekly Exposure	Hot beverages	37,613–89,294 particles	N/A

Table:2:- Key Quantification Data

Detected Contaminants (via GC-MS, ICP-OES):

Category	Compounds	Sources Confirmed
Polymers	HDPE, PP, PS, nylon, polycarbonate	All clusters
Phthalates	Diethyl phthalate, DEHA	80% docs
Chemicals	Styrene, vinyl chloride, BPA, BHT, benzotriazole	Scientific/Health
Metals/Ions	Cr, Cd, Pb, Ni, nitrite, chloride, fluoride	70% docs

Table: 4 Various contaminants detected. (Source IIT Kharagpur)



Factors Enhancing Release:

- ♦ Temperature: >85°C increases by 10x vs. cold (4°C).
- ♦ Time/Duration: Peaks at 15–20 min; shaking/stirring worsens.
- ♦ pH/Acidity: Carbonated/acidic drinks boost from PE cups.
- ♦ Reuse: Second use retains 80–90% initial release.

Matters of Prime Concern: Health and Environmental Toll:

Health Risks: Ingested Microplastics disrupt gut microbiota, cause inflammation, leaky gut, and IBS (irritable bowel syndrome -like symptoms). Nano plastics cross into blood, accumulating in liver, kidneys, brain—triggering oxidative stress, endocrine disruption (hormone mimicry via phthalates/BPA), infertility, diabetes, and cancer links (styrene). Vulnerable groups—Kerala's children, pregnant women, office members of Private and public/Government, Railways distribute Hot beverages in microplastic coated paper cups and a largest polluter of environment which faces amplified risks. **weekly users ingest credit-card-sized plastic annually (AS per the micro plastics related study report of Shri. M.G. Rajamanickam IAS during his Cornell Humphrey Fellowship study at USA).** The micro plastics acts as toxin vectors, bioaccumulating via food chains and affects the Human Health drastically.

The various Health related Impacts Analysis are as detailed Below:

Health Impacts of Ingested Microplastics: -

Gastrointestinal Effects:

- ♦ Irritation of intestinal lining
- ♦ Disruption of gut microbiota
- ♦ Potential inflammatory responses

Cellular and Systemic Effects:

Nano plastics may:

- ♦ Enters bloodstream
- ♦ Accumulating in organs such as liver, kidneys, and brain
- ♦ Causes **oxidative stress and cellular damage**

Endocrine Disruption:

Plastic coatings often contain chemicals such as:

- ♦ Bisphenol-like compounds
- ♦ Phthalates

These substances can:

- ♦ Phthalates/styrene mimic hormones, linked to thyroid issues, reproductive problems, diabetes, cancer
- ♦ Affect thyroid function
- ♦ Impact reproductive health and fertility

Chemical Leaching from Wax and Plastic Coatings:

Hot beverages accelerate the migration of:

- ♦ **Plasticizers**
- ♦ **Stabilizers**
- ♦ **Heavy metals (trace levels from inks and adhesives)**

The Long-term exposure may lead to:

- ♦ Liver and kidney toxicity
- ♦ Increased risk of metabolic disorders
- ♦ Potential carcinogenic effects (still under investigation)

Thermal Degradation and Toxic By-Products:

At elevated temperatures:

- ♦ Plastic linings undergo partial degradation
- ♦ Formation of **volatile organic compounds (VOCs)**

Possible effects include:

- ♦ Headaches and nausea (short-term)
- ♦ Cumulative toxic burden with repeated exposure

Direct Ingestion Risks (Clustered from Health Assessments):

- ♦ **Gastrointestinal:** Gut irritation, dysbiosis, inflammation, leaky gut; linked to IBS/IBD.
- ♦ **Endocrine/Reproductive:** Phthalates/BPA disrupt hormones; infertility, obesity, thyroid issues.
- ♦ **Systemic/Chronic:** Nano plastics cross blood-brain barrier; oxidative stress, cancer (styrene), diabetes, neurotoxicity.
- ♦ **Acute /Short-Term Symptoms:** VOCs (volatile organic compounds) cause headaches/nausea.

Vulnerable Populations:

Certain groups face higher risks:

- ♦ **Children and adolescents** (developing systems)
- ♦ **Pregnant women** (foetal exposure)
- ♦ **People with digestive or hormonal disorders**
- ♦ **Daily consumers of takeaway beverages**

Comparative Lifecycle Metrics:

Material	CO ₂ /Cup	Decomposition	MP Pollution Risk	Recycling Rate
PE-Lined Paper	110g	Decades (lining)	High	<1%
Polystyrene	33g	500 years	High	Low
PP/PET Plastic	10–30g	Centuries	Very High	Low
Reusables (Steel/Glass)	20–100 uses offset	Indefinite (reusable)	None	High

Table :5:- Comparative life cycle matrix of Contaminants (Source: IIT Kharagpur)

Detected Contaminants:

Category	Examples	Health/Environmental Effects
Microplastics	HDPE, PP, PS (2-5 µm)	Gut inflammation, microbiome disruption, bioaccumulation
Phthalates	Diethyl phthalate, DEHA	Endocrine disruption, hormone interference
Other Chemicals	Styrene, vinyl chloride, BPA, BHT	Carcinogenic, reproductive toxicity
Heavy Metals	Cr, Cd, Pd, Ni	Neurotoxicity, cancer risk
Ions/Organics	Nitrite, chloride, naphthalene	Oxidative stress, cellular damage

Table:6 :- Detected Contaminants (Source data: IIT Kharagpur)

Environmental Impacts of Single-Use Paper Cups:

Single-use paper cups, despite "green" labelling, pose severe environmental threats due to their plastic (PE) linings, which prevent recycling and true biodegradability. Globally, production fells 6.5 million trees yearly, demanding high water and energy inputs, while in India, this exacerbates deforestation.

Lifecycle and Disposal Issues:

Non-Recyclable: PE coating defies pulping/separation; 90%+ end in landfills or incinerators, persisting decades.

Landfill Fallout: Clog sites, emit methane (potent GHG), and leach microplastics into soil.

Water Pollution: Degraded cups contaminate rivers, oceans (e.g., Kerala's flood-prone waterways), entering food chains and threatening biodiversity/seafood safety.

Comparative Footprint Analysis:

Material	CO2 per Cup	Decomposition Time	Recycling Rate
Paper (lined)	Appox 110g	Decades (lining)	<1%
Polystyrene	Appox 33g	500 years	Low
Plastic (PP/PET)	10-30g	Centuries	Low

Table :7:- comparative foot print analysis (Source: IIT Kharagpur)

Wildlife ingestion and marine pollution exacerbate biodiversity loss.

Comparative Risks:

Material	Health Risk	Hot Suitability	Recyclability
Coated Paper	High	Poor (>15 min)	<1%
Stainless Steel	Very Low	Excellent	High
Glass/Ceramic	Very Low	Excellent	High

Table:8:- comparative Risks analysis

Suggestions and Recommendations: From Awareness to Action:

Individual Steps:

- ♦ Switch to reusable steel/glass/ceramic mugs; carry for takeaways (BYOC (customers who bring their own cup) (BYOC) discounts like Starbucks).
- ♦ Do not leave hot drinks in disposable cups for over 15 minutes, as heat can degrade coatings and release chemicals. Avoid reheating them in microwaves, since plastic linings, wax, or glue may melt, leach toxins, or cause burns.

Institutional Measures:

- ♦ Total Ban of microplastics coated paper cups in Kerala government and private/corporate offices/events; installing dishwashers for re-usables.

- ♦ Promote kulhads (clay cups) for all meetings/gatherings and in railways, in offices. Etc

Further to which promotion of various activities like:

1. Regulatory Bans and Standards:

Phase out PE-lined disposable cups by 2028 under extended Plastic Waste Management Rules; mandate industrial-grade compostable PLA coatings with FSC certification. Immediate bans in government offices, events, and public spaces.

2. Economic Incentives:

Introduce ₹1-2/cup levy on single-use disposables to fund reusable infrastructure; provide subsidies and vendor discounts (e.g., BYOC rewards) for steel/glass/ceramic alternatives, modelled on Starbucks.

3. Mandatory Labelling and Awareness:

Require clear microplastics/chemical risk warnings on all disposable cup packaging; launch targeted campaigns through tea stalls, offices, and all programmes of central and state leveraging Webex stakeholder engagement.

4. Infrastructure Development:

Expand industrial composting facilities for PLA; install dishwashing stations in public spaces; deploy GIS-monitored wastewater micro plastics tracking systems, prioritizing the flood-prone Rivers and water bodies of Kerala to have control on micro plastics contamination.

5. Research and Monitoring:

Fund IIT-Kerala baseline studies on local exposure; develop low-cost detection kits (FTIR/GC-MS/SEM); implement annual supplier audits and WHO-aligned microplastics monitoring protocols with public KPIs.

6. Local Integration and Cultural Solutions:

Advocating and integrating mandates for reusable beverage containers into Kerala's state urban water missions to promote sustainability. It proposes reviving traditional kulhads—biodegradable clay cups rooted in ancient Indian culture—as flood-resilient, eco-friendly alternatives to disposables for serving tea and coffee in Kerala's local culture

Way Forward: Implementation Framework- A Phased Shift to Safety:

Short-Term (2026): Launch pilot bans on PE-lined paper cups in Thiruvananthapuram government offices and events; roll out public awareness campaigns via state health drives and WebEx stakeholder meetings; develop GIS apps for tracking MP hotspots in wastewater and rivers.

Medium-Term (2027–28): Implement national ₹1–2/cup levy to fund reusables; mandate 50% reusable adoption in cafes and quick-service restaurants (QSRs); integrate reusable policies into Kerala missions; accelerate R&D on enzyme-degradable coatings and low-cost detection kits.

Long-Term (2030+): Enforce zero single-use disposable cup policy nationwide; build circular economies with MP-free supply chains; track KPIs including 50% river based microplastic reduction, 70% reusable adoption rate, and compostable PLA infrastructure expansion. Collaborate with experts on Micro plastics Management for scalable models.

it advocates a scientifically proven switch from single-use disposable cups to reusables in beverage service (like India's chai/kappi culture). Reusables have higher initial CO₂ emissions from manufacturing, but these are offset after roughly 20 uses—via fewer cups produced overall and less waste disposal yielding net environmental gains over disposables lifecycle.

Environmental Safeguards

The shift curbs plastic pollution (microplastics in waterways), prevents chemical leaching from cup linings into drinks (e.g., avoiding >15-min hot exposure in disposables), and cuts long-term CO₂ from virgin material production and landfilling/incineration. This protects ecosystems (e.g., Kerala's flood-prone rivers) and vulnerable groups like urban poor exposed to contaminated water sources.

Public Health & Cultural Benefits:

It safeguards health by reducing toxin exposure from reheated disposables, while preserving convenient, traditional tea/coffee rituals—pairing with BYOC incentives (e.g., Starbucks' 10-percent discount) or revived kulhads (biodegradable clay cups). No convenience loss; instead, it embeds reusables into daily habits.

Urban Water Management Link:

In Kerala's context (AMRUT missions, flood resilience), it integrates reusable mandates into state policies, reducing plastic waste in stormwater systems, easing wastewater treatment burdens, and aligning with watershed rejuvenation—promoting blue-green infrastructure without compromising cultural practices.

Conclusion:

Scientific evidence unmasks wax- and microplastic-coated paper cups as trojan horses, releasing 25,000+ particles alongside nano plastics and chemical contaminants per hot serving—posing under-recognized risks of gut irritation, endocrine disruption, cumulative toxicity, and Kerala's flood-vulnerable water security. With India's market surging

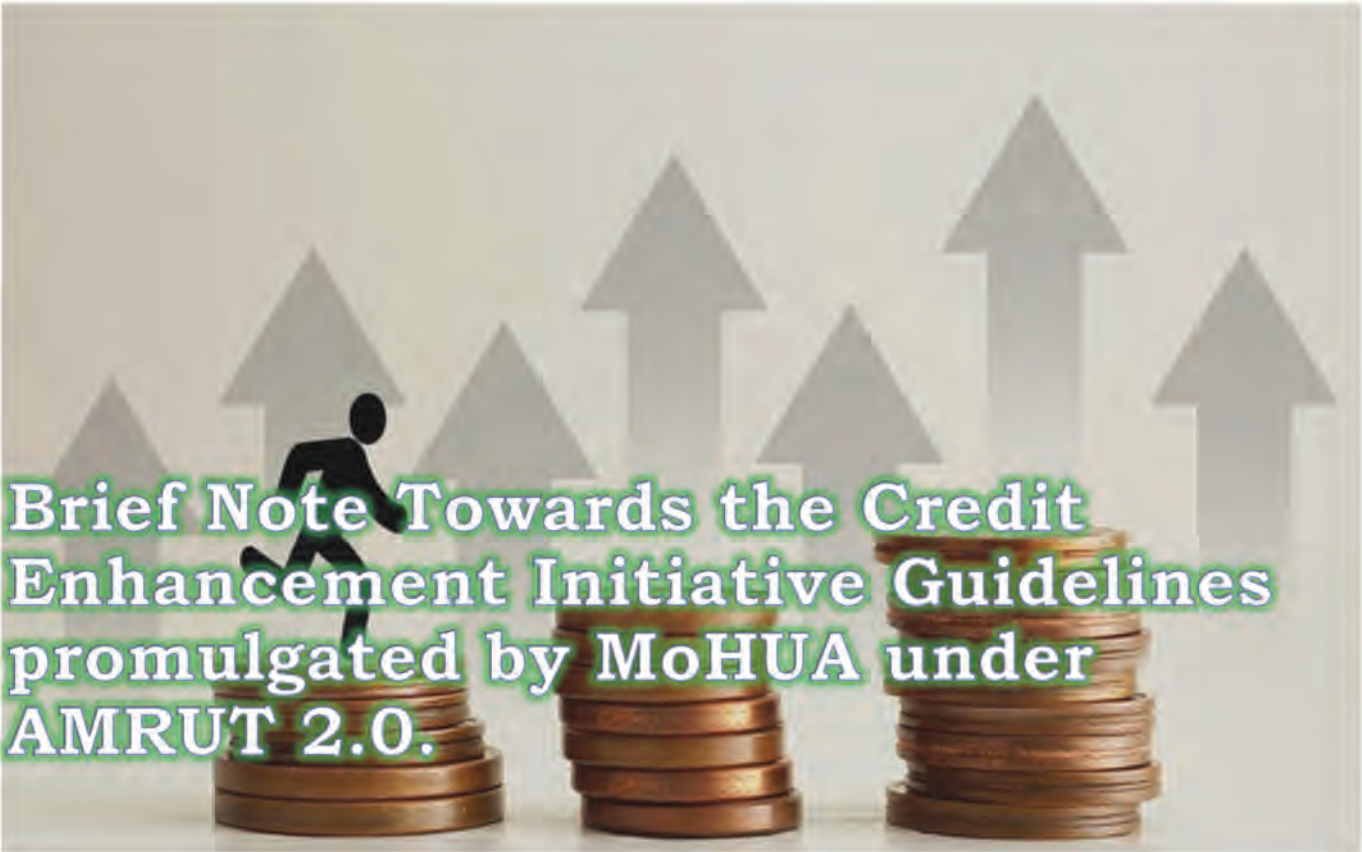
to 29 billion units by 2033, regular chai/coffee consumption amplifies irreversible ecological damage and public health crises. Transitioning to zero-leach reusables, which offset CO₂ after 20 uses, demands immediate regulatory bans, incentives, and oversight to safeguard biodiversity, urban resilience, and India's cherished beverage culture. Hence, transitioning to **safe, reusable alternatives** and strengthening regulatory oversight are essential steps to protect public health and sustainability.

“Heat turns the micro plastic-coated Paper cup into a culprit, brewing plastics and chemicals into every sip and slowly stealing health and Environment over time.”- Murali Kochukrishnan.

DOES THIS BOTHER YOU TOO???



Switch to Safe Reusable Alternatives



Brief Note Towards the Credit Enhancement Initiative Guidelines promulgated by MoHUA under AMRUT 2.0.

1. Introduction

The Ministry of Housing and Urban Affairs (MoHUA), Government of India, under the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) 2.0, has issued detailed guidelines for the **Credit Enhancement Initiative** in October 2025. The initiative has been designed to improve access to institutional finance for smaller Urban Local Bodies (ULBs), particularly those with populations below one lakh, which often face constraints in raising market-based funds for urban infrastructure development.

2. Background and Rationale

India's rapid urbanisation requires sustained investment in water supply, sanitation, sewerage, and allied urban infrastructure. Smaller cities, however, often lack adequate financial capacity, credit history, and institutional readiness to access loans from banks and financial institutions. To address this gap, MoHUA has introduced a **Credit Guarantee Fund (CGF)** of ₹300 crore as a risk-mitigation mechanism for lenders, thereby encouraging institutional lending to eligible ULBs. In addition, ₹25 crore has been earmarked under AMRUT 2.0 reforms for capacity building of ULBs in financial management, project structuring, and credit readiness.

3. Objectives of the Initiative

The key objectives of the Credit Enhancement Initiative are: - To enhance the creditworthiness of ULBs and enable them to access formal institutional finance for urban infrastructure projects. - To promote a culture of self-financing and responsible borrowing through market-based mechanisms. - To help ULBs build a credible repayment track record, facilitating future access to direct market borrowings without credit guarantees. - To strengthen financial discipline and long-term sustainability of urban infrastructure investments.



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4. Eligibility Criteria

4.1 Eligible Agencies

All Urban Local Bodies, including Municipal Councils, Town Panchayats, and any specialised agencies designated by the State Government or ULB, are eligible under this initiative, subject to the condition that the city population is less than one lakh as per AMRUT 2.0 projections for the year 2021.

4.2 Eligible Projects

Each ULB can initially propose **one project** under the initiative.

A maximum of **five projects per State/UT** can be taken up, with provision for reallocation in case of non-participation.

Projects must be **distinct** and not financed under any other Centrally Sponsored Scheme.

Eligible sectors include water supply, sanitation and sewerage, rejuvenation of water bodies, green spaces, other urban infrastructure services, and Public-Private Partnership (PPP) projects.

All projects must be **bankable**, with a maximum project duration not exceeding **10 years**.

5. Project Approval Process

The approval process follows a structured pathway: **1. Project Formulation** by the ULB in consultation with a lending institution, including loan structure and repayment mechanism. **2. State-Level Approval** by the State-Level Nodal Agency (SLNA) / State High Powered Steering Committee (SHPSC) under AMRUT 2.0. **3. In-principle Loan Sanction** by the lending institution through the designated MoHUA platform. **4. Final Approval by MoHUA** through the Project Approval Committee chaired by the National Mission Director, AMRUT 2.0. **5. Execution of Tripartite Agreement** among the lending institution, State Urban Development Department, and the ULB within two weeks. **6. Issuance of Credit Guarantee Letter** by HUDCO upon MoHUA approval.

6. Eligible Lending Institutions

Nationalised Banks and Non-Banking Financial Companies (NBFCs) are eligible to extend loans to ULBs or designated agencies under this initiative. HUDCO may also act as a lending institution in addition to its role as Credit Guarantee Fund manager.

7. Credit Guarantee Fund – Operational Framework

7.1 Fund Structure

Total CGF corpus: **₹300 crore**.

Operated by **HUDCO** as the Nodal Agency and Implementation Partner.

Interest accrued on the fund is reinvested into the corpus.

7.2 Extent of Finance and Guarantee

Loan assistance up to **80% of project cost**, extendable to 85% in exceptional cases.

Credit guarantee cover up to **60% of the loan amount or ₹5 crore**, whichever is lower.

No State Government guarantee is required.

7.3 Invocation of Guarantee

Guarantee is triggered if repayment default exceeds **60 days**.

CGF support can be drawn for a maximum of **two quarters per financial year** to prevent the account from becoming a Non-Performing Asset (NPA).

Amount drawn from CGF must be refunded if the ULB regularises repayments.

8. Illustrative Financial Scenarios

The guidelines provide multiple scenarios illustrating loan repayment and default situations for a ₹10 crore loan over five years at 8.9% interest, including: - **Scenario 1:** No default – full repayment without CGF usage. - **Scenario 2:** Default during implementation with project discontinuation. - **Scenario 3:** Default during implementation with project continuation. - **Scenario 4:** Default after two years post-completion. - **Scenario 5:** Default after three years post-completion.

These scenarios demonstrate how the CGF mitigates lender risk while ensuring project continuity and accountability of ULBs.

9. Implementation, Monitoring and Governance

A **Credit Guarantee Manager** will oversee fund administration, claims, and MIS reporting.

Lending institutions are responsible for project appraisal, monitoring, and recovery as per their policies.

An **Independent Review and Monitoring Agency (IRMA)** will periodically assess scheme performance.

Monthly MIS reports will be submitted to MoHUA detailing fund utilisation, repayments, defaults, and balances.

Any policy modifications will be undertaken only with MoHUA approval.

10. Project Completion and Reporting

ULBs are required to complete projects within the approved cost and timeline and submit completion reports upon project closure. Successful implementation and disciplined repayment will enhance the ULB's eligibility for future projects with reduced guarantee coverage.

11. Conclusion

The Credit Enhancement Initiative under AMRUT 2.0 is a significant reform-oriented intervention aimed at integrating smaller ULBs into formal credit markets. By combining partial credit guarantees with capacity building and structured monitoring, the initiative promotes financial discipline, improves bankability of urban infrastructure projects, and supports sustainable urban development in smaller cities across India.



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Progress

AMRUT 1 & AMRUT 2.0

AMRUT 1

Phase I of the Atal Mission for Rejuvenation & Urban Transformation

Outlay: 2357 Cr.

Central Assistance: 1161.2 Cr.



Total Projects: 1106 Nos.

Water Supply: 216 Nos., Sewerage: 151 Nos., Drainage: 535 Nos.
Urban Transport: 126 Nos., Parks & Green Spaces: 78 Nos.



Awarded: 1106 Nos.



Completed: 1063 Nos.



Expenditure: 2232 Cr.



Completion: 96%

AMRUT 2.0

Phase II of the Atal Mission for Rejuvenation & Urban Transformation

Outlay: 3515 Cr.

Central Assistance: 1374 Cr.



Total Projects: 737 Nos.

Water Supply: 248 Nos., Sewerage: 45 Nos.
Waterbody Rejuvenation: 371 Nos., Parks & Green Spaces: 73 Nos.



Awarded: 539 Nos.



Completed: 132 Nos.



Expenditure: 625 Cr.



Completion: 20%



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