Rejuvenation of Water Tanks for ecological and socio-economic resilience in Kumbakonam

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Introduction

- **Kumbakonam** is a **river-edge settlemen**t in Tamil Nadu, India.
- The town is bounded by two rivers, the **Cauvery River to the north and Arasalar River to the south.**
- With more than **188 temples** scattered throughout the area, it also serves as a religious center in the region.
- Kumbakonam contains several important **temple complexes, sacred water tanks, and hundreds of secondary shrines.**

Aim

- **Restoration and rejuvenation of tanks in Kumbakonam** by bringing back the glory of ancestral knowledge.

Objectives

- **Restoration methods to replenish the rivers and tanks** in Kumbakonam and in turn the groundwater.
- **Treatment of surface run-off** before it reaches the river and tanks and restore the drainage system.
- **Restore the micro-climate.**

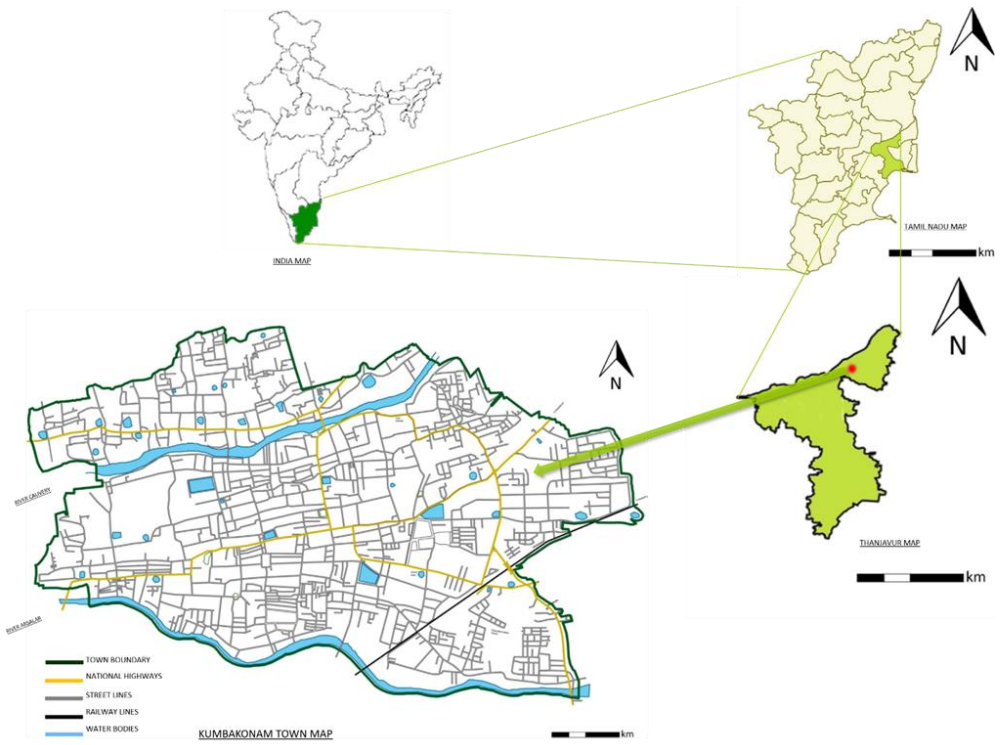
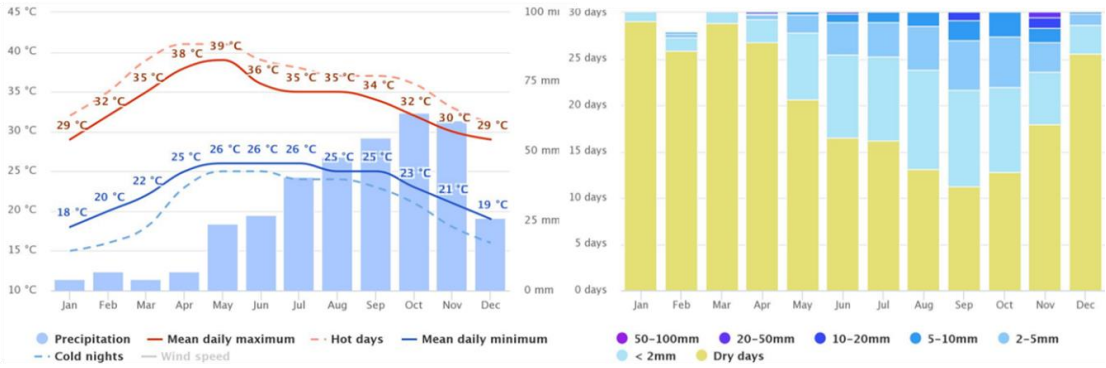


Fig 1: MAPS OF INDIA, TAMIL NADU, THANJAVUR AND KUMBAKONAM

Fig 2 & 3: Views of Temple tanks in Kumbakonam

Climate in Kumbakonam

- Kumbakonam has a **tropical climate**.
- The temperature here averages 28.7 °C. **Max temperature in summer: 40 °C; Min temperature: 20 °C.** The **average annual rainfall is 1048 mm**.



MAX TEMP: 28° - 40° C , MIN TEMP: 18° C – 20°C

MAJOR PRECIPITATION IN SEPTEMBER, LOWEST JAN - APRIL

Fig 4 & 5: Temperature and Precipitation levels

Maps of Kumbakonam

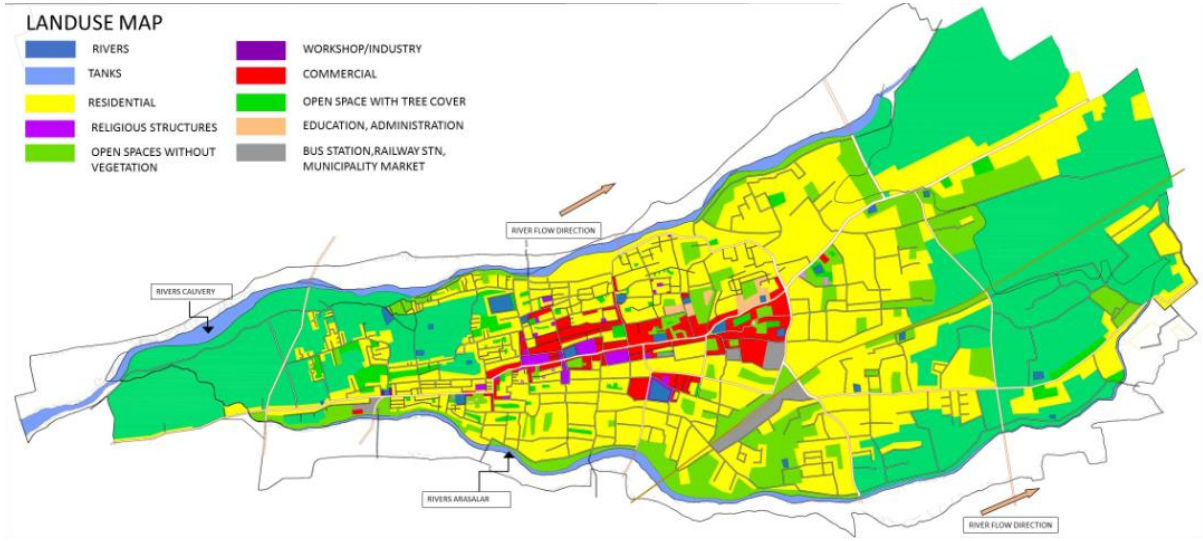


Fig 6: Land Use Map: mainly- residential – along the river & tanks indicating increased urbanization

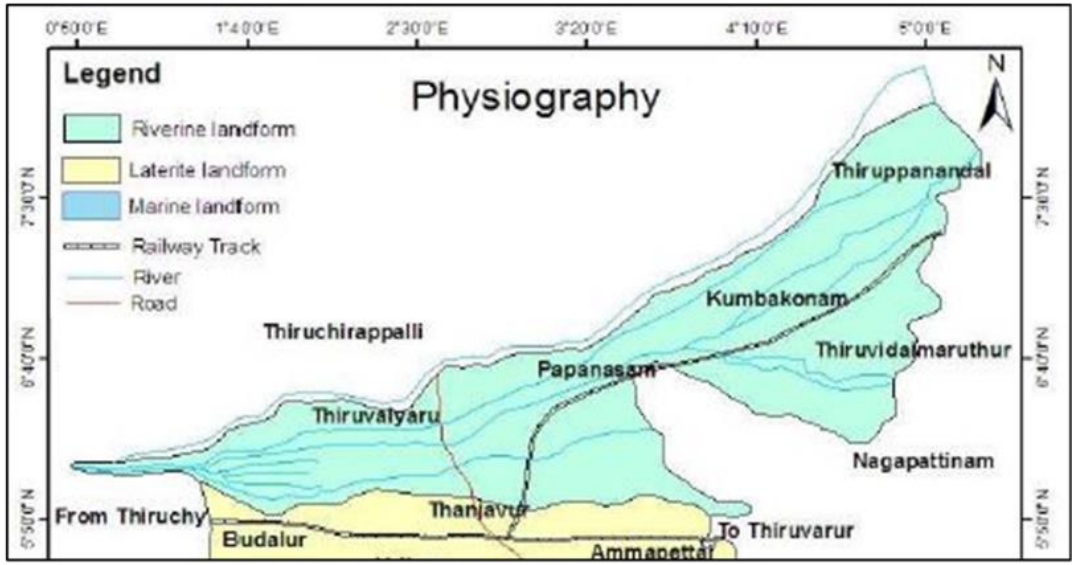


Fig 7: Physiography Map: riverine landform – slopes towards bay of Bengal indicating that the land has rich & fertile soil, suitable for agriculture.

(Thanjavur is the rice bowl of India)

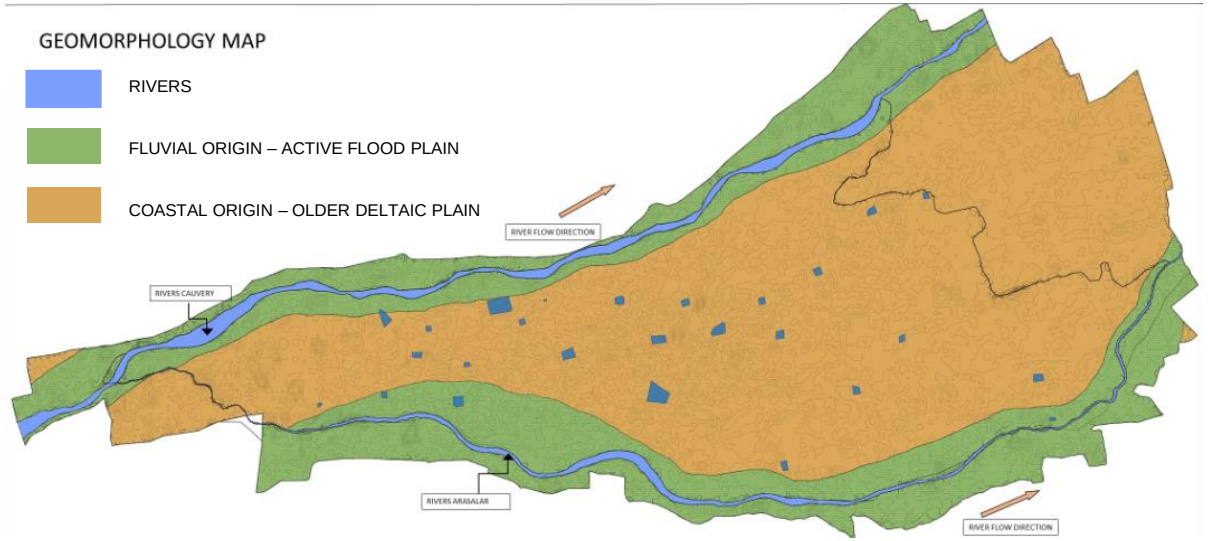


Fig 8: Geomorphology Map: alluvial and deltaic plains (Thanjavur is the rice bowl of India).

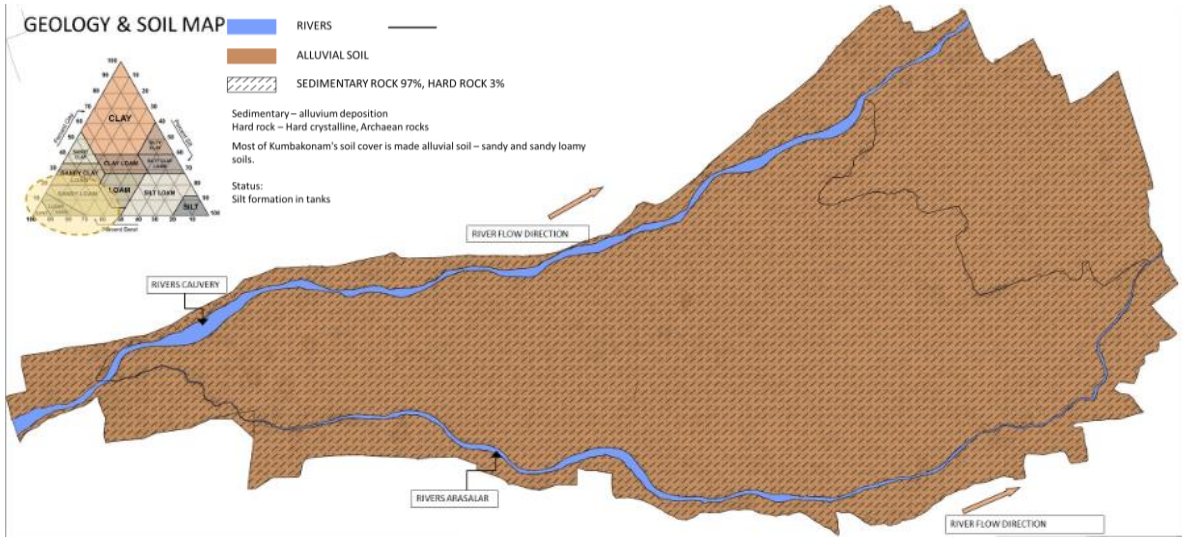


Fig 9: Geology & Soil Map: fluvial soil Indicating soil deposits and landforms created by the river (Cauvery)

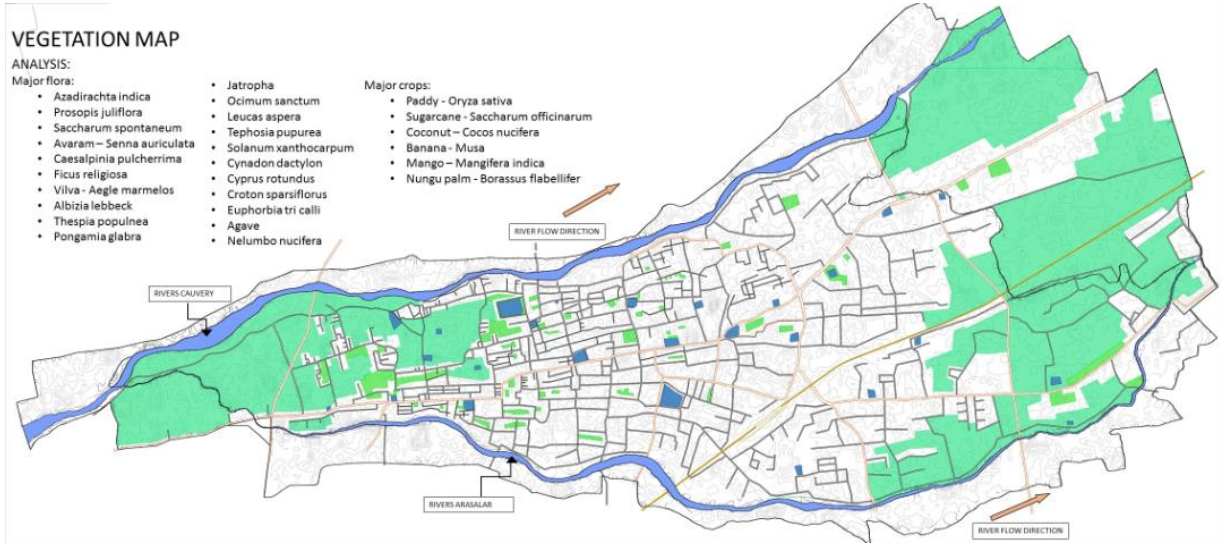


Fig 10: Vegetation Map

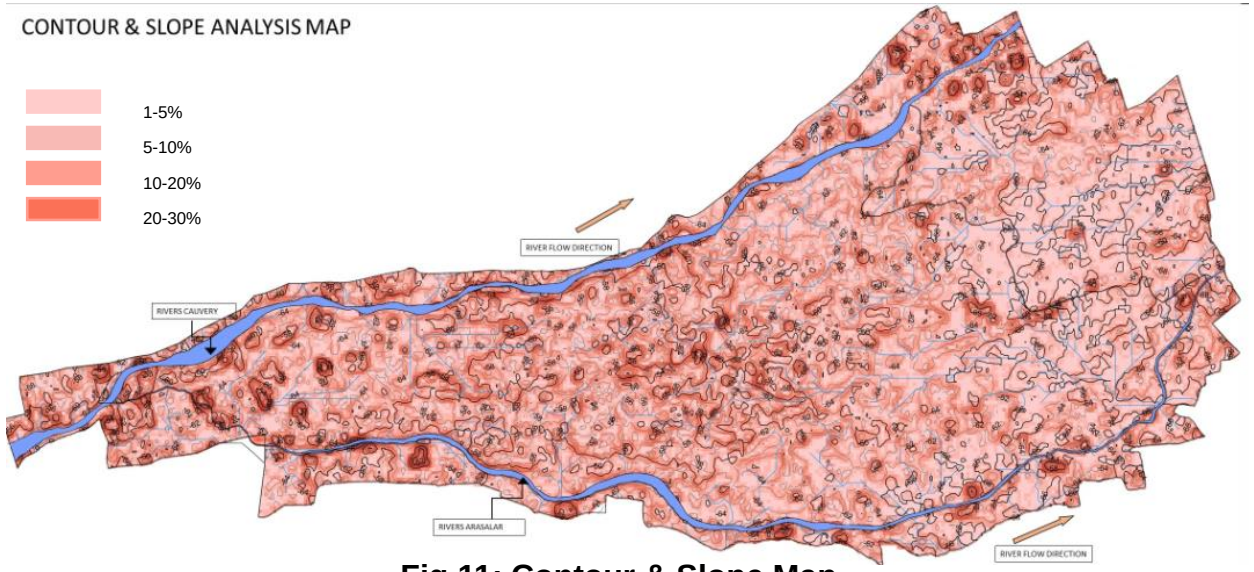


Fig 11: Contour & Slope Map

Historic, Cultural, Religious and Socio-Economic Heritage of Kumbakonam

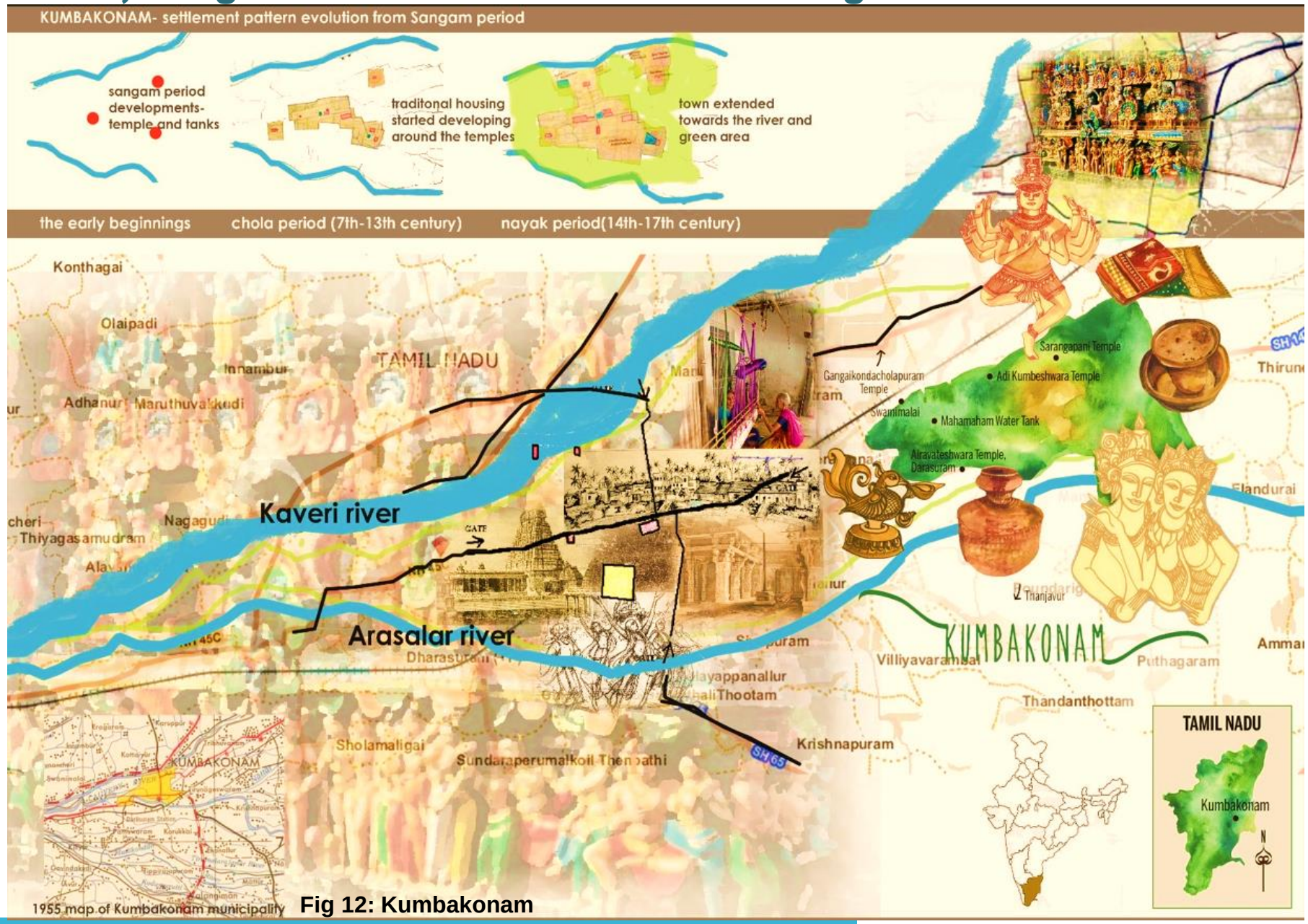


Fig 12: Kumbakonam

Historic, Cultural, Religious and Socio-Economic Heritage of Kumbakonam & Importance

Fig 13: Chola dynasty ruled the region during the medieval period, built several buildings with architectural values; several temple complexes and their sacred tanks, example: Mahamaham Tank (famous for its Mahamaham Festival)

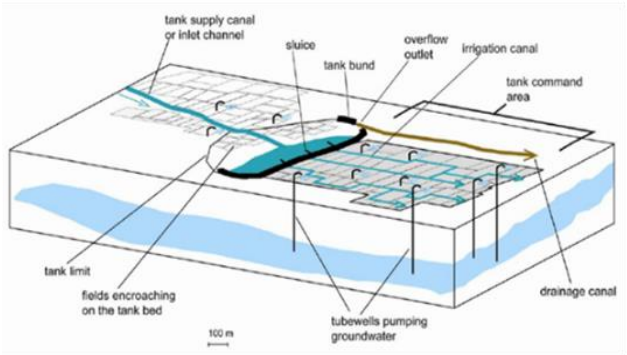
Fig 14: settlement along the rivers

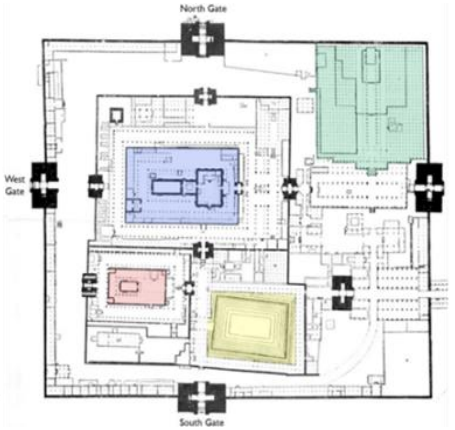
Fig 15: offering prayers in rivers/ tanks

Fig 16, 17 & 18: performing rituals, disposing items into rivers/ tanks

Tank Ecosystems

Fig 19: Image of Temple Tank





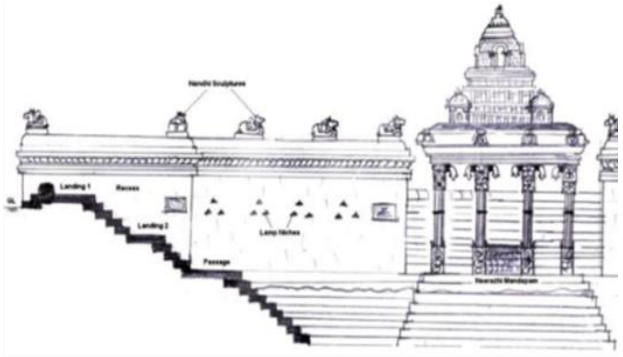


Fig 20: Structure & Design of Tanks

Sophisticated systems of drains, wells and tanks were built to conserve and utilize water; tank chains or tank cascades; square or rectangle in plan - embankment around the tanks is constructed by granite stones and act as retaining walls to keep the earth from silting the tank

Economic, Socio-cultural, And Ecologic Functions Of Water Tank Ecosystems

Fig 21: Abhishekham

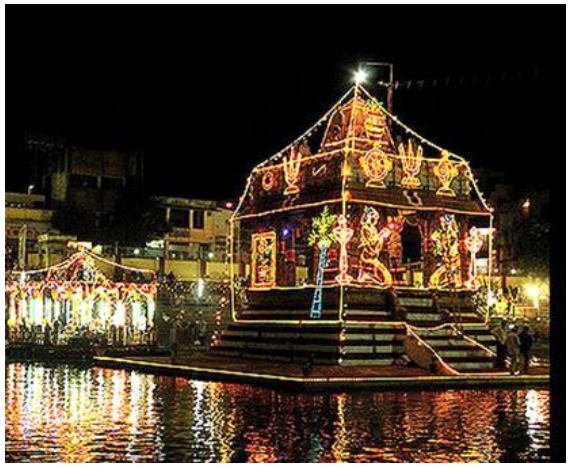


Fig 22: Theppam

Fig 23, 24 & 25 Water for agriculture and feeding cattle

Fig 26: Drinking

Importance

Traditionally tanks and temple tanks seem to have played three hydraulic roles:

- As a storage, which acted as **insurance against low rainfall periods** and also **recharges groundwater** in the surrounding area
- As a **flood control measures**, preventing soil erosion and wastage of runoff waters during the period of heavy rainfall
- As a device which was **crucial to the overall ecosystem**

Important focal point of this tradition settlement, but also in **controlling the micro climate** of the place helping to **maintain the hydrological balance** of the area.

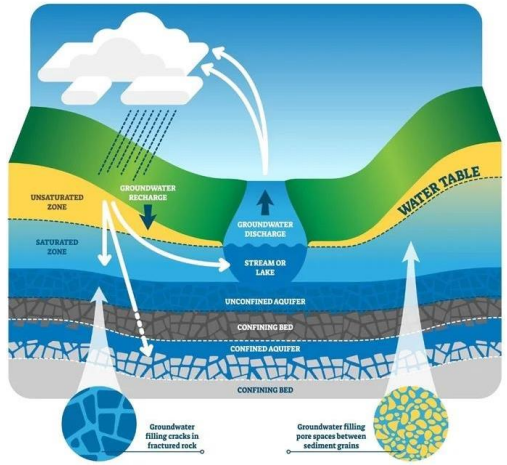


Fig 27: Groundwater recharge

Threats

- Most of the temple tanks were served by inlet systems in the olden days. The inlet systems are blocked and precious rainwater runs into sewers and reaches the sea.
- In recent years, due to mushrooming of commercial and residential apartments in the catchment areas, the inlet systems are compromised and precious rainwater runs into sewers and reaches the sea.
- Groundwater recharge has been reduced due to the increase in impervious surface from asphalting or concreting of roads and backyards.

Fig 28

Neglected, unmaintained tanks leading to growth of weeds & breeding grounds for various diseases. Prone to encreachment. Water rendered unfit for daily consumption

Fig 29

Encroachment of areas along river Cauvery & river Arsalar indicating the need for space to accommodate ever increasing population

Fig 30

Polluting the river as well as the banks

Fig 31

Polluting the river - washing clothes, toxic effluents discharged into the rivers from industries along the river

Threats

Fig 32

Neglected, unmaintained tanks leading to growth of weeds & breeding grounds for various diseases. Sanctity and value of temple tank and its landscape is lost

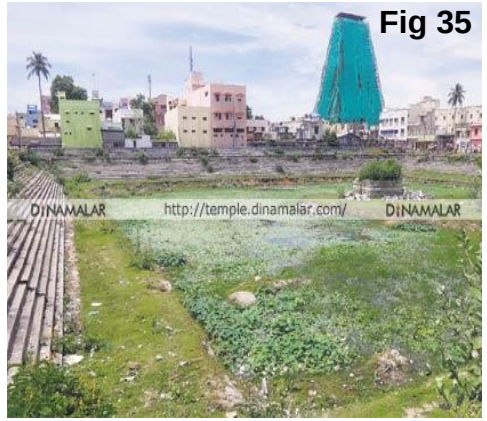
Fig 33

Encroachment of tanks which are neglected to accommodate the rapid urbaniation

Fig 34

Drying up of the tanks and temple ponds due to water scarcity – underground water extraction at alarming rates

Fig 35



Neglected, unmaintained tanks leading to growth of weeds & breeding grounds for various diseases. Prone to encroachment

Need for conservation and rejuvenation of the tanks & rivers

- It is important to restore methods to replenish the rivers and tanks in Kumbakonam and in turn the groundwater.
- To increase groundwater recharge and its availability
- Increase the storage capacity and increased quantities of water available for irrigation;
- Clean and better environment.
- Improve soil moisture regime and hence, improve water collection.
- Increase biodiversity and preservation of water and soil biota.
- To improve the micro-climate.

Fig 36

Hydrology map of study area

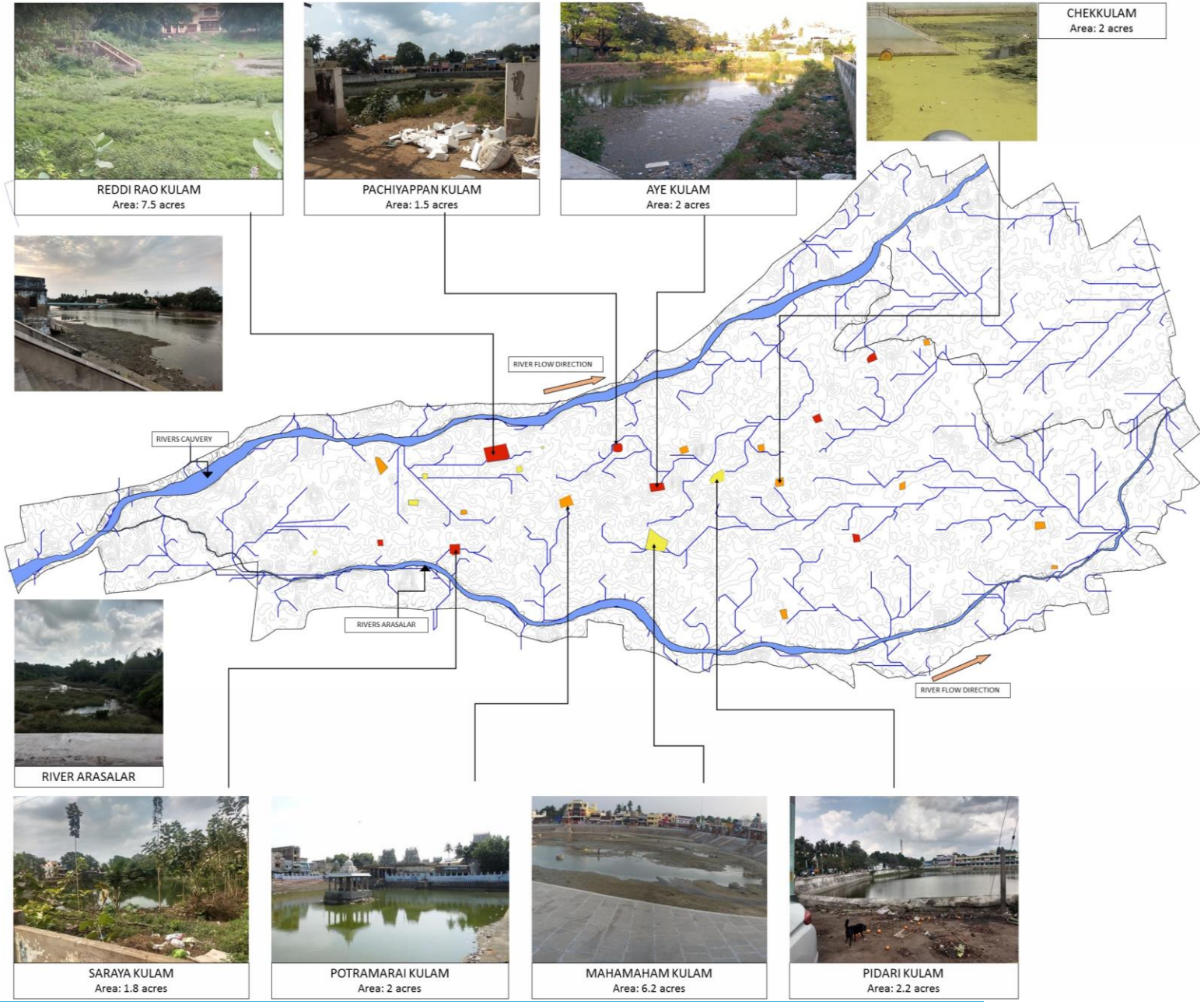


Fig 37: Hydrology map

LEGEND:

STREAMS RIVERS

STUDY AREA

- RIVER ARASALAR: It is a branch of river Cauvery which split into 5 different rivers when it enters into Tanjore district from Trichy. It has gentle slope towards east and southeast. Arasalar takes its course from Tiruvaiyaru of Tanjore, covers and travels through Kumbakonam and enters into the sea of Bay of Bengal at Karaikal. It is a seasonal river receiving water only during rains.
- RIVER CAUVERY: The part of the river travelling through Kumbakonam is a distributary from the main Cauvery river. It enters into the Sea of Bay of Bengal at Karaikal. Seasonal river receiving water only during rains.
- River basin – watershed : Cauvery river basin
- Drainage: From West to East and South-East

CLIMATE:

- Kumbakonam has a tropical climate.
- The temperature here averages 28.7 °C. Max temperature in summer: 40 °C; Min temperature: 20 °C
- The average annual rainfall is 1048 mm.
- Max temp: 28° - 40° C , Min temp: 18° c – 20°C
- Major precipitation in September, lowest Jan - April

AREA: 18.2 sqkm
No. of tanks in study area: 30
Level of pollution/ degradation of the tanks:

High level Medium level Low level

STATUS:

- Encroachment
- Mud lifting
- Water pollution
- Groundwater depletion
- Algal/weed growth
- Habitat Destruction
- Drying up of river

ISSUES:

- Posed by nature: rainfall may be more within the short period of duration – hence recharge is less, runoff is more.
- Caused by anthropogenic activities: intensive groundwater extraction, intensive surface water irrigation, growing urban complexes, industrial establishments- drastic depletion in groundwater resources.
- Caused by socio-economic condition: Land holdings differences-agitation among land holders.
- Administrative issues: No groundwater act in force - casual approach regarding recharging & management of groundwater.

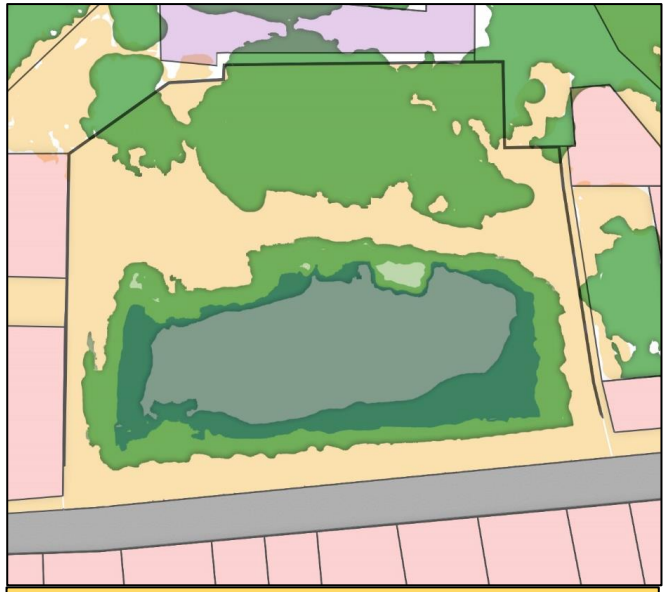
POLICIES, RECOMMENDATIONS:

- Regular assessment of groundwater quality, frame regulations and Acts and implementing the policies, rules and regulations.
- De-silting of existing tanks followed by percolation pond with recharge wells and recharge shafts.
- Implementation of roof – top rainwater harvesting.
- Recharge pits / Shafts / trenches of suitable design are ideal structures for rainwater harvesting in such areas.
- Water Level and quality measurements through wells,piezometers, DWLR with telemetry, ground water elevation.
- Metering watersupply to confirm contribution from groundwater.

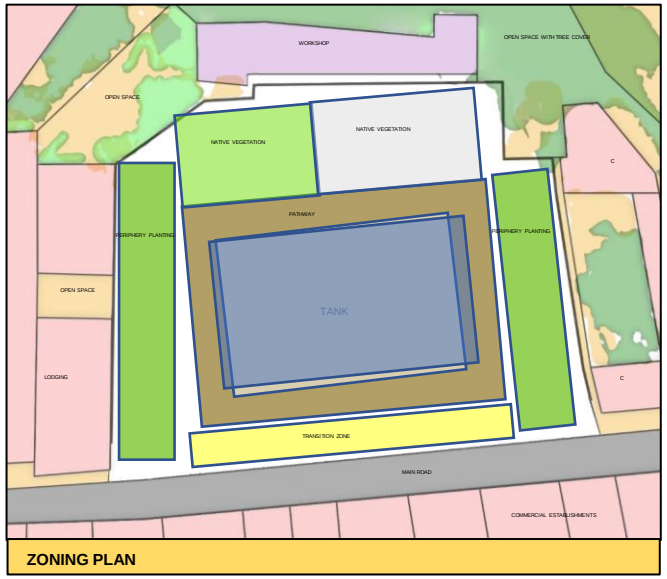
INFERENCE:

Hydrology map is critical information, which helps in understanding the water source for the river and tanks as well as the course of these water bodies.
Also helps in understanding and planning for future development.
Helps to design safety measures and rectify issues which are causing major damage.

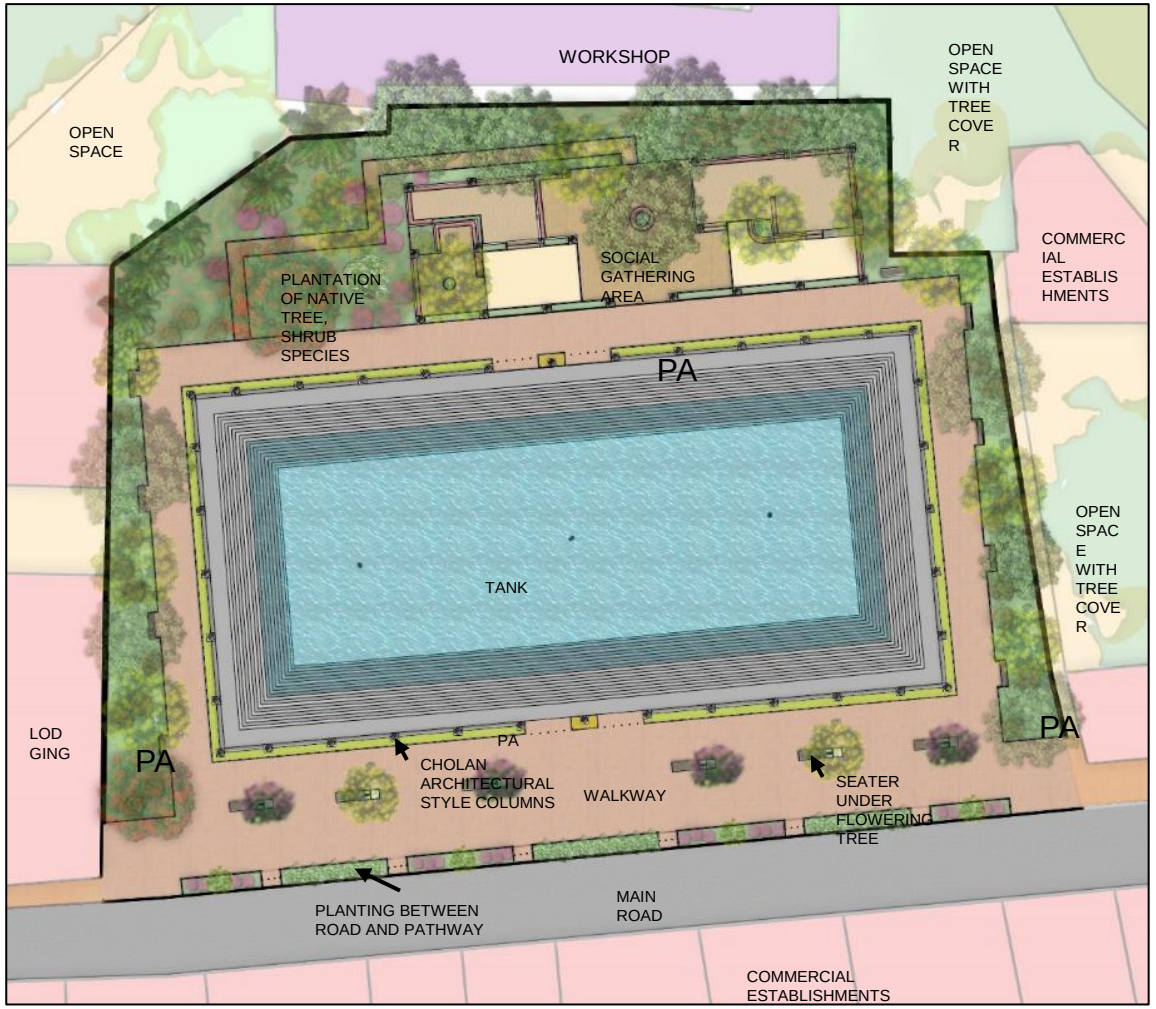
TANK TYPOLOGY: PUBLIC; NAME OF THE TANK: AYEKULAM



EXISTING CONDITIONS



ZONING PLAN



PLAN

WATER TANK AREA

PATHWAY

TRANSITION ZONE BETWEEN ROAD AND TANK

NATIVE SPP PLANTATION

PERIPHERY PLANTING

AREA: 9400 Sqm

LANDUSE IN THE REGION: COMMERCIAL - Hardware stores, hotels and lodging facilities

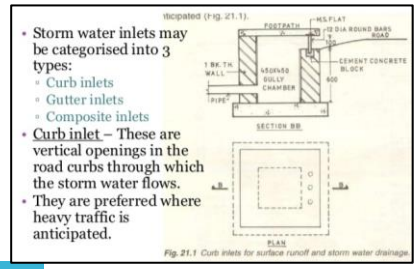
PRESENT CONDITIONS: Unused, soild waste dumping, stagnation of water, algal growth, encroachment - a taxi stand is on one of the sides of the tank.

.

Analysis:

- Issues:
  - The tank is being encroached upon by 15m from towards the road. It is usedas a taxi stand.
  - Waste disposal into the tanks is causing water and soil pollution.
  - No positive awareness about tank, Remains unnoticed and non maintained.

- Introducing fauna into water such as algae eating fishes to help keep the littoral ecosystem healthy.
- Introducing flora like lotus and lilies, visually, aesthetically pleasing ecologically beneficial.
- Rejuvenating and increasing social activity around the tanks will help generate revenue. Maintenance becomes mandatory.
- Aeration systems to regulate biological processes in the tank.
- Depicting the history of the region using Cholan style design and elements.



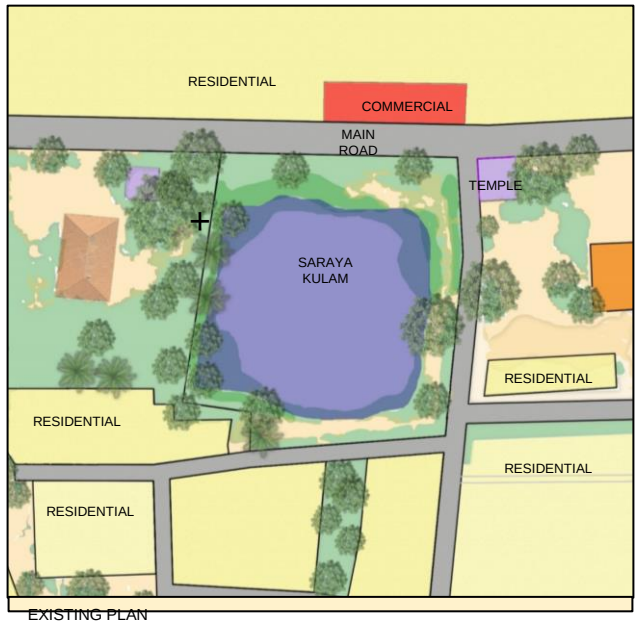
- Storm water inlets may be categorised into 3 types:
  - Curb inlets
  - Gutter inlets
  - Composite inlets
- Curb inlet – These are vertical openings in the road curbs through which the storm water flows.
- They are preferred where heavy traffic is anticipated.

Fig. 21.1 Curb inlets for surface runoff and storm water drainage

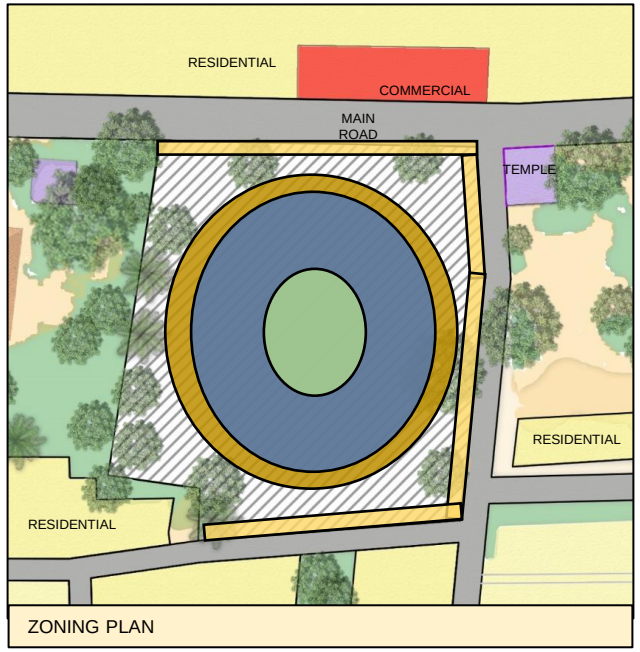
Fig 38: Inlet

Sl no.	Scientific name	Description
1	Senna auriculata	Avaram, yellow flowering, tall shrub-small tree
2	Aagle marmelos	Bilva tree
3	Prosopis cineraria	Vanni tree
4	Calophyllum inophyllum	Native tree
5	Wrightia tinctorial	White flowering
6	Azadirachta indica	Neem
7	Caesalpinia pulcherrima	Tall shrub
8	Jatropha	Shrub
9	Ocimum spp.	Shrubs, herbs
10	Catharanthus roseus	Periwinkle
11	Rosa	Button rose
12	Nelumbo	Lotus, lilies
13	Cynodon dactylon	Bermuda grass

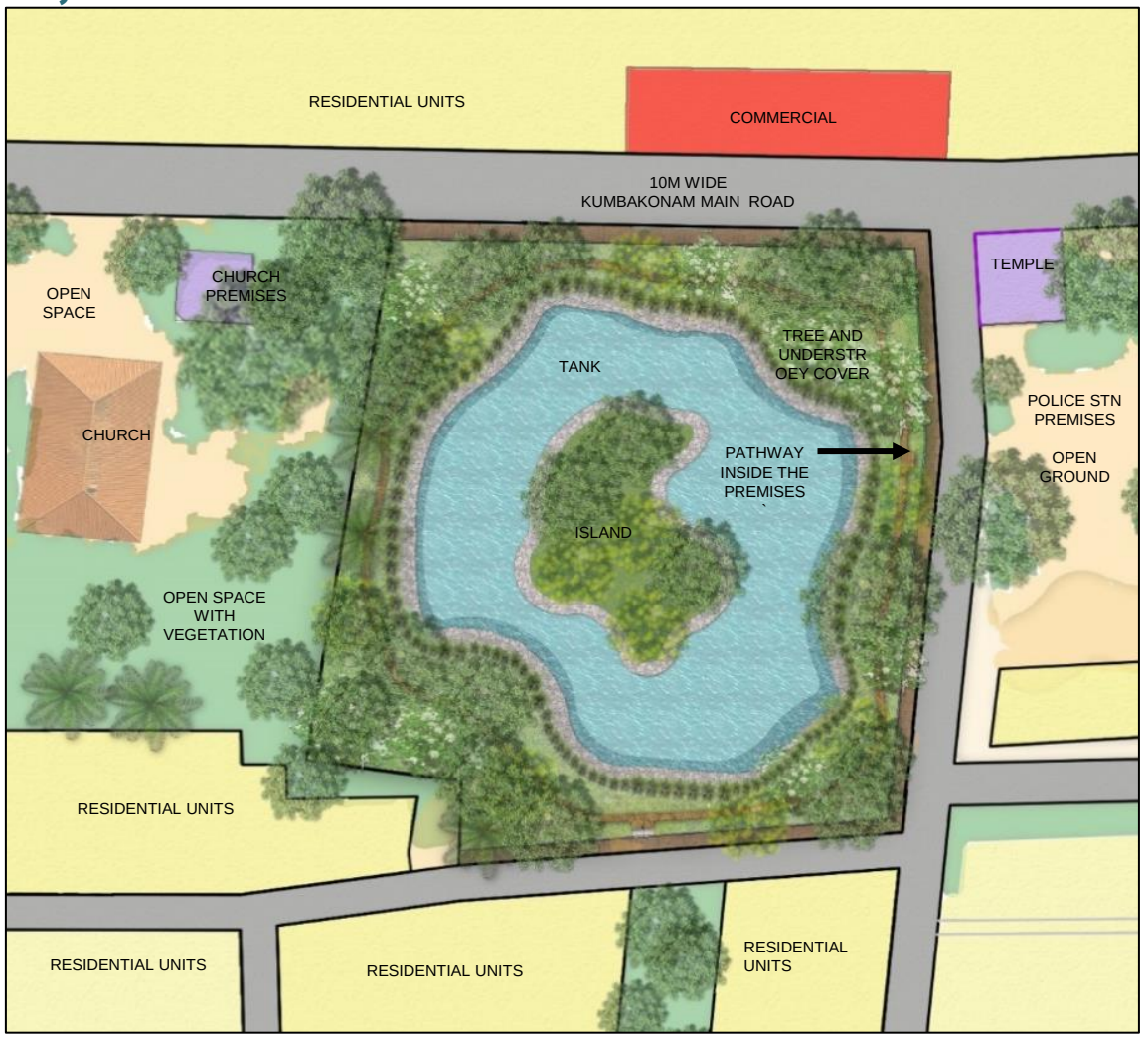
TANK TYPOLOGY: ECOLOGICAL; NAME OF THE TANK: SARAYA KULAM



EXISTING PLAN



ZONING PLAN



PLAN

Fig 39: Vetiver grass- intercept surface run-off, stone pitching for soil slope stabilization

Fig 40: Small island with native flora to attract fauna and migratory birds

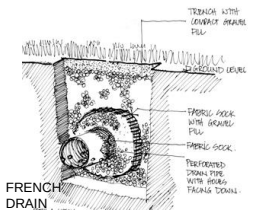


Fig 41: French drain

AREA: 5375 Sqm

LANDUSE IN THE REGION: Residential, small scale commercial stores along Kumbakonam main road residential use and river down south

PRESENT CONDITIONS: Unused, solid waste dumping, construction work halted since a long time, stagnation of water, algal growth, water pollution, no maintenance.

Analysis:

- Using stabilization methods with stone pitching and vetiver grass with 8% slope will help intercept surface run-off and the slope directs towards the water collection area.
- Introducing fauna into water such as ducks, algae eating fishes to help keep the littoral ecosystem healthy.
- Introducing native flora to increase the ecological health.
- By inviting migrating birds by planting native species and restore the ecological value of the area.

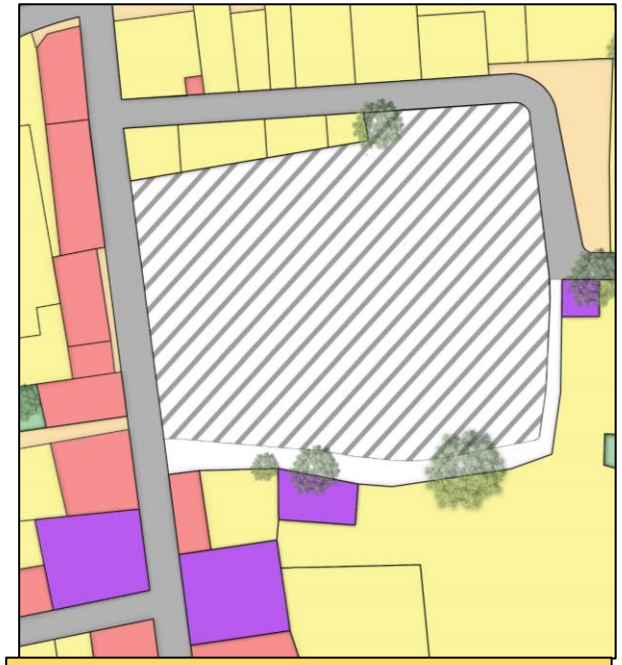
RECOMMENDATIONS:

- Regular assessment of groundwater quality, frame regulations and Acts and implementing the policies, rules and regulations.
- De-silting of existing tanks followed by percolation pond with recharge wells and recharge shafts.
- Recharge pits / Shafts / trenches of suitable design are ideal structures for rainwater harvesting in neighboring.
- Water Level and quality measurements through wells, piezometers, ground water elevation.
- Metering water supply in the neighborhood to confirm contribution from groundwater.

A	FLORA	
1	Senna auriculata	Avaram, yellow flowering, tall shrub-small tree
2	Aagle marmelos	Bilva tree
3	Prosopis cineraria	Vanni tree
4	Calophyllum inophyllum	Native tree
5	Wrightia tinctorial	White flowering
6	Azadirachta indica	Neem
7	Mimusops elengi	Fruiting tree
8	Caesalpinia pulcherrima	Tall shrub
9	Jatropha	Shrub
10	Ocimum spp.	Shrubs, herbs
11	Catharanthus roseus	Periwinkle
12	Rosa	Button rose
13	Nelumbo	Lotus, lilies
14	Cynodon dactylon	Bermuda grass
B	**FAUNA –** Native, Aves, Aquatic spp., Insects	
	Cattle egret, Little egret, Turtle, Algae eating fishes, Parrots, Ducks	

TANK TYPOLOGY: TEMPLE; NAME OF THE TANK: PACHIYAPPAN KULAM

EXISTING CONDITIONS



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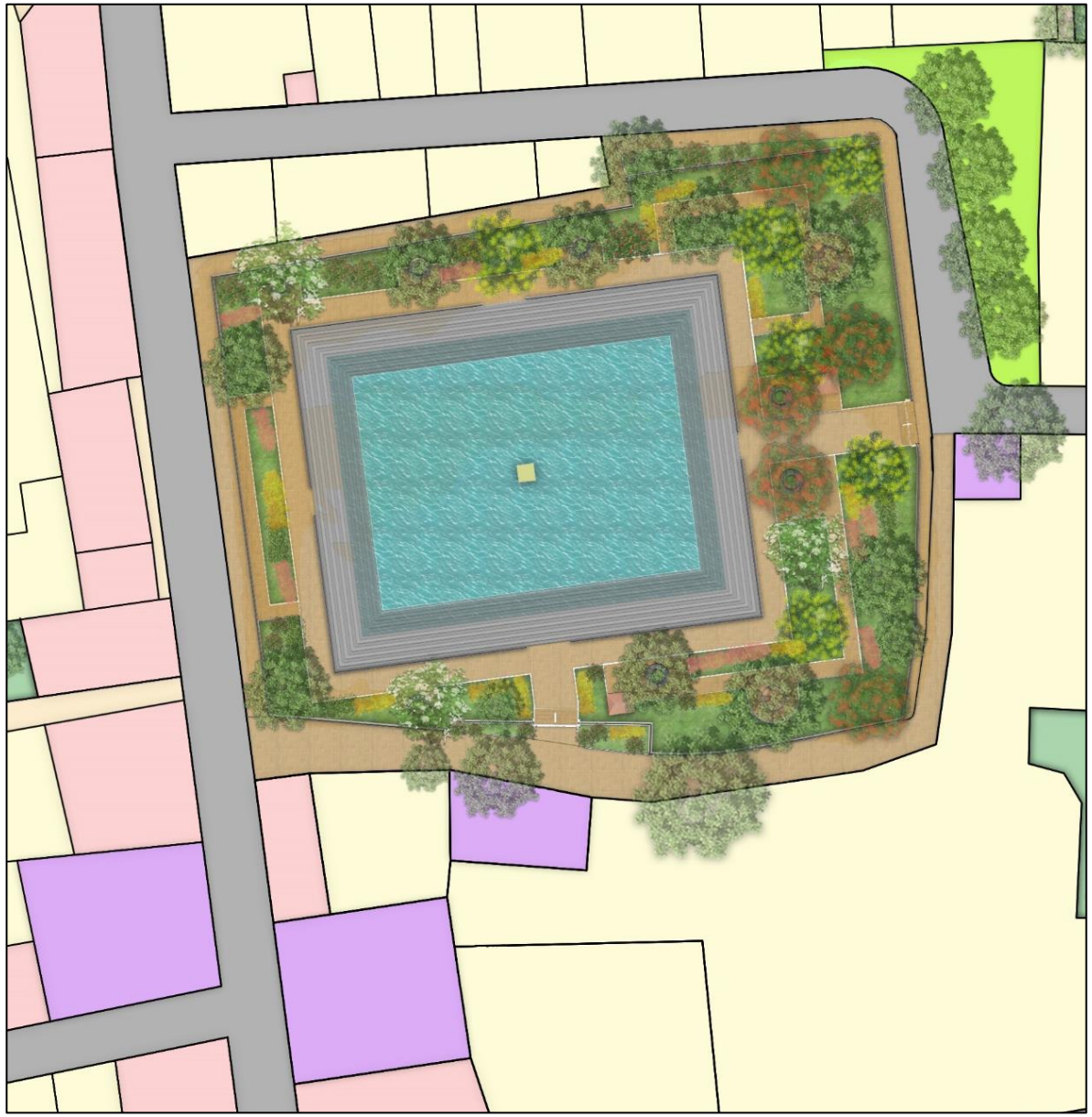


AREA: 1.5 acres

LANDUSE IN THE REGION: Religious- Temples, residences, commercial along Mutt road.

PRESENT CONDITIONS: HIGH LEVEL pollution/degradation.
Unused, garbage disposal site, Construction of walls around the tank, garbage & construction debris disposal, dry areas in tank- water channel blocked, excessive digging of borewells.

Analysis:

- Issues:
  - The tank is being is left unattended to after a brief construction activity.
  - Waste disposal into the tanks is causing water and soil pollution.
  - No positive awareness about tank, Remains unnoticed and non maintained.

- Introducing fauna into water such as algae eating fishes to help keep the lentic ecosystem healthy.
- Introducing flora like lotus and lilies, visually, aesthetically pleasing ecologically beneficial.
- Arranging, maintaining a separate area for disposal of offerings.
- Rejuvenating and increasing social activity around the tanks will help generate revenue. Maintenance becomes mandatory.
- Aeration systems to regulate biological processes in the tank.
- Depicting the history of the region using Cholan style design and elements.

Fig 42

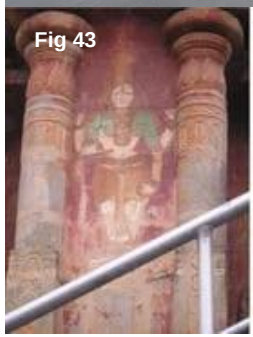


Fig 43

Suggestions

Develop clear definition of tanks, free-flowing rivers, barriers, reference areas

Consider network structure, connectivity

Incorporate meta- ecosystem thinking – restoration planning – macro level

Prioritize actions – obtain sufficient quantity/ quality of water collection, drainage network

Consider conflict areas with other legislative frameworks

Enhance awareness, stakeholder participation and citizen engagement

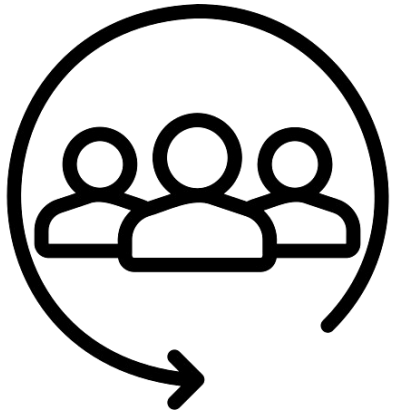
Fig 44

Suggestions

Rainwater collection

Sewage treatment

Regularly maintain and manage tanks



Community involvement

Student projects

Levy fine for polluting

Economic incentives for rain water conservation

Fig 45

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