PML and South Chennai Lakes

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Organisation of the talk

- Studies conducted by IITM in South Chennai –
  - Past (2013-14) funded by Department of E&F

    Water Quality in PML – Impact of dumpsite and WWTP

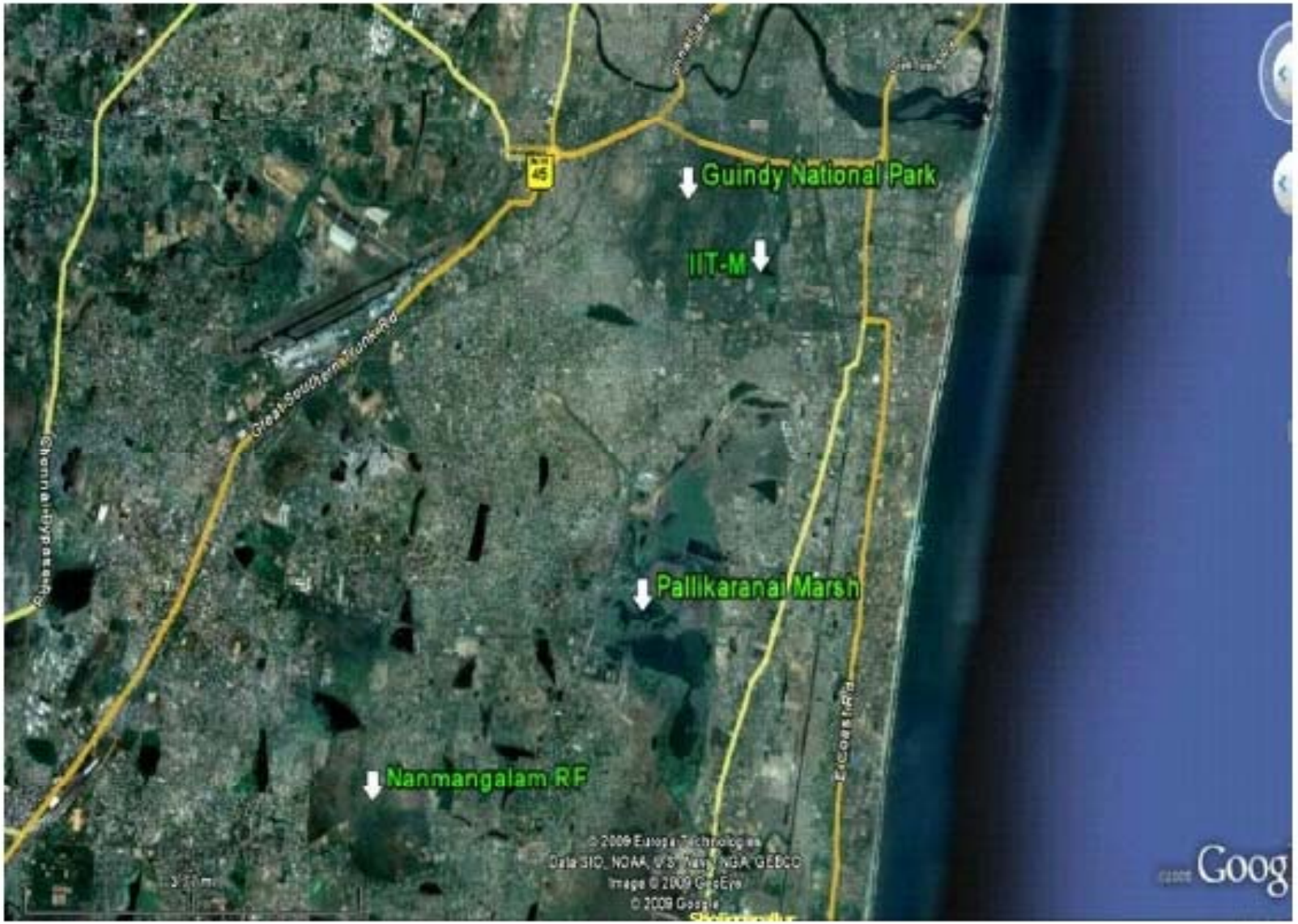
    Remediation Strategies
  - Current (2015-16) funded by DST through IGCS

    Hydrological Studies of PML and Lakes -

    Hydrogeological studies (ongoing)

- What did we do?
- What did we understand?
- What do we suggest?

Location of PML and lake systems between Adyar and Palar basins




Pallikaranai, Tamil Nadu, India
Image © 2010 TerraMetrics
Image © 2010 GeoEye
©2009 Google
Imagery Date: Apr 21, 2009
12°56'47.20" N 80°13'25.33" E elev 0 m
Eye alt 8.07 km

Past Studies on Pollution levels in PML

Pollution of the PML

Leachate

Solid waste landfill

Pallikaranai Water Samples Collection and Velocity Measurement Points

Adaptive management plan

Remediation and Restoration Strategies

1. Prevention of pollution sources
    1. Dumpsite removed or revamped - Isolation or treatment of leachate.
    2. Alternative disposal of Wastewater treated and untreated
2. Aggressive Remediation of critically polluted zones
3. Increasing water retention capacity feeding drainage channels and linkages

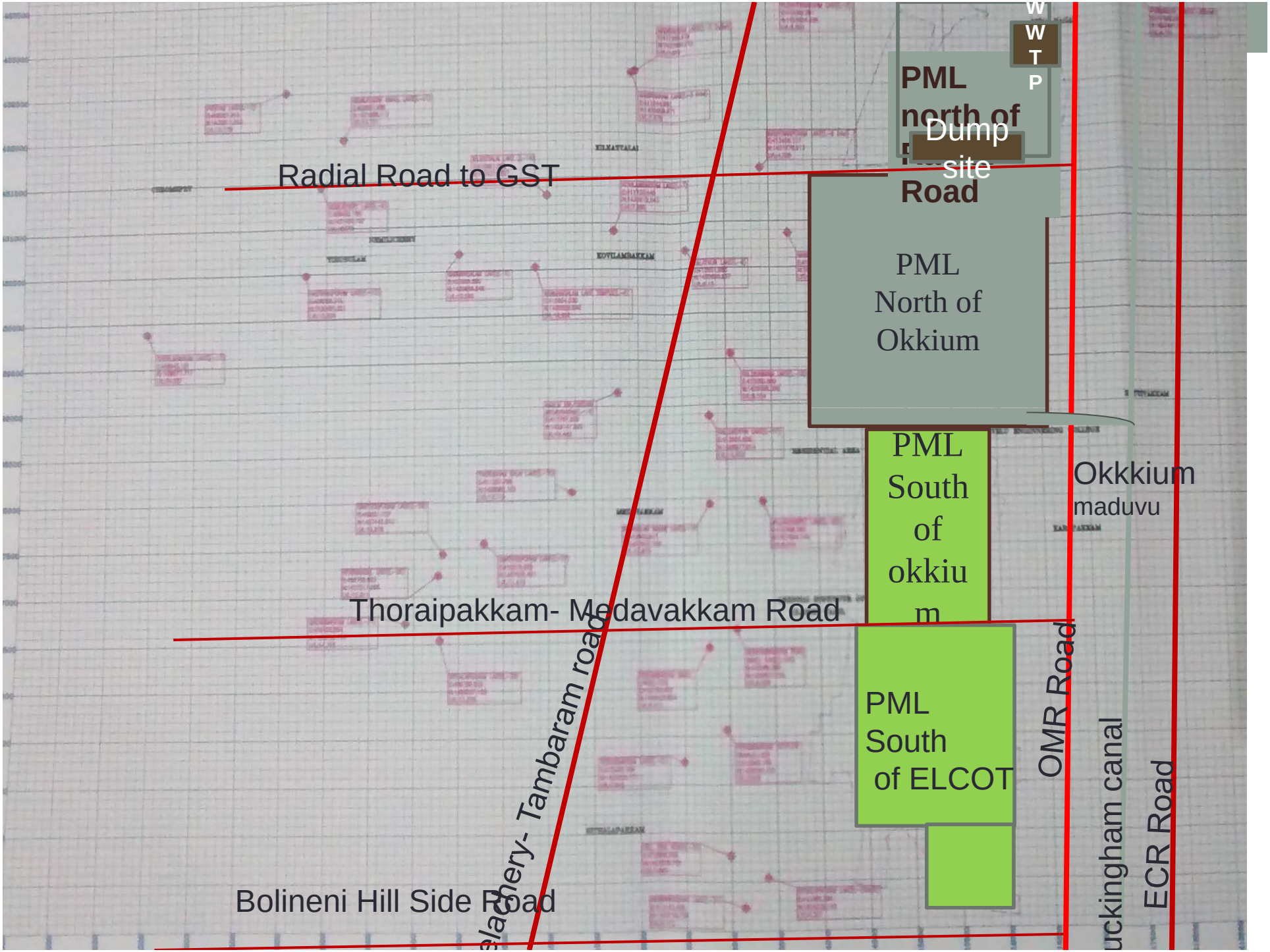
Current Studies

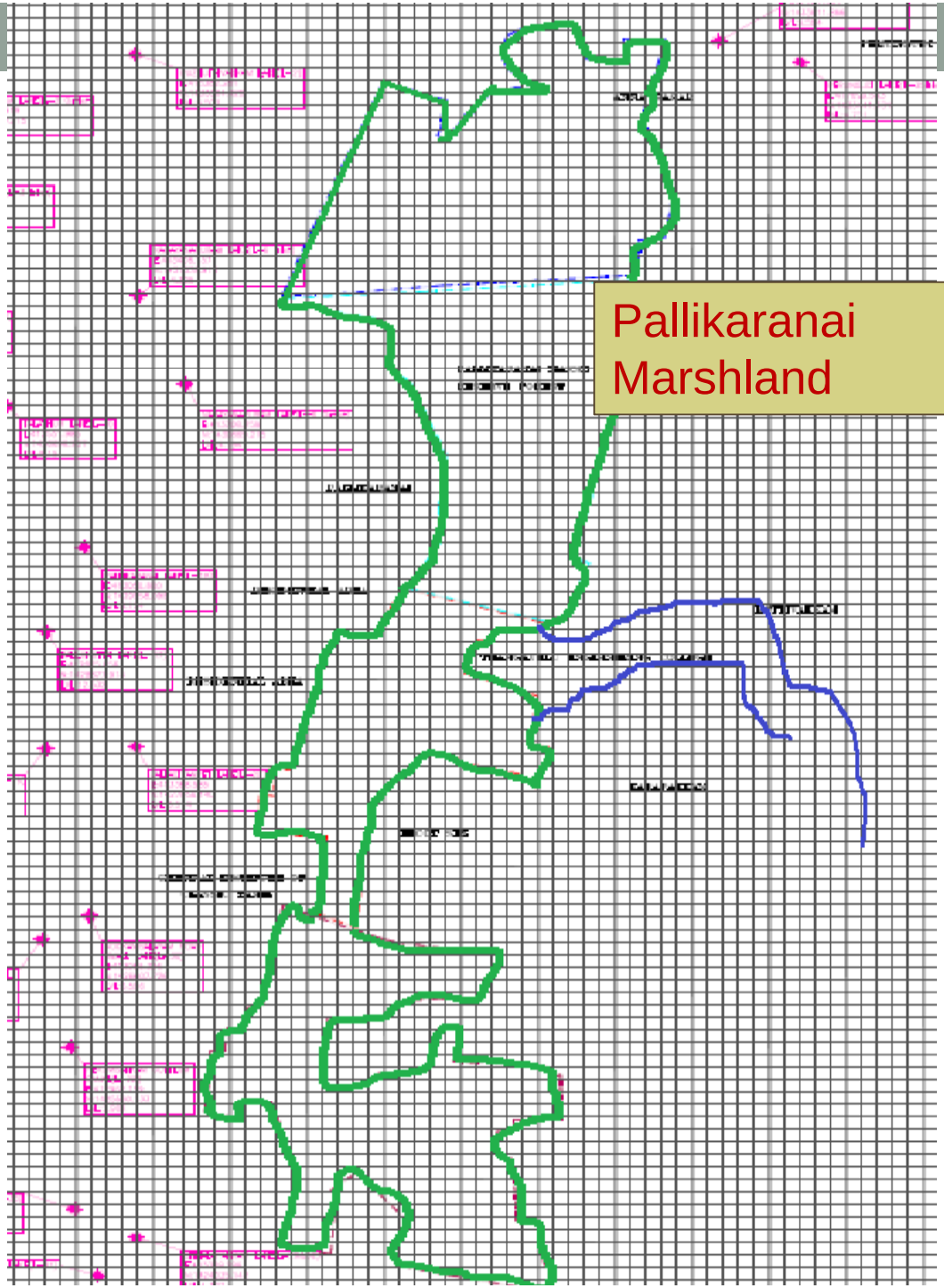
Objectives:

- Identifying locations of inflows and ouflows into and out of the marshland
- Reestablishing connectivity to the lakes
- Restoring the functionality of southern part of the dry marshland
- Restoring the lakes and improving their functionality
- Understanding the hydrogeology to establish connectivity through subsurface

What we have done?

- Reconnaissance survey of Pallikaranai marshland(PML)and lakes surrounding it
- Frequent measurement of water quality and depth at okkiyum maduvu and culvert in radial road
- Identification of inflows and outflows in the marshland and lakes
- Topographic survey was done to get the reduced levels /contours of the terrain of Marshland and surrounding areas
- Water levels and water quality monitoring in open wells around Pallikaranai marshland
- Post Flood scenario


W
W
T
P
PML
north of
Dump
site
Road
Radial Road to GST
PML
North of
Okkium
PML
South
of
okkiu
m
Okkkium
maduvu
Thoraipakkam- Medavakkam Road
PML
South
of ELCOT
OMR Road
uckingham canal
ECR Road
Bolineni Hill Side Road
lachery- Tambaram road

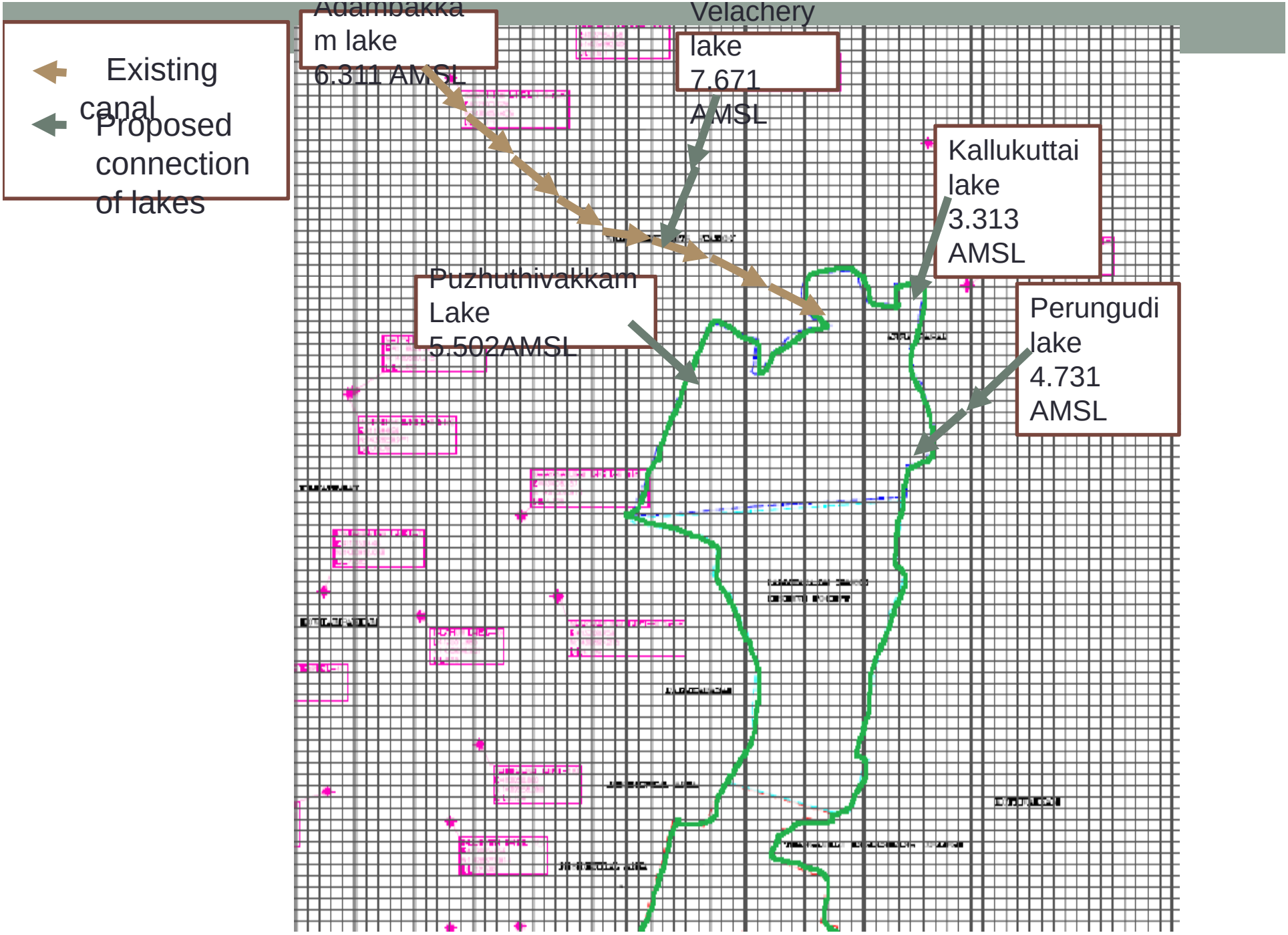

Pallikaranai
Marshland

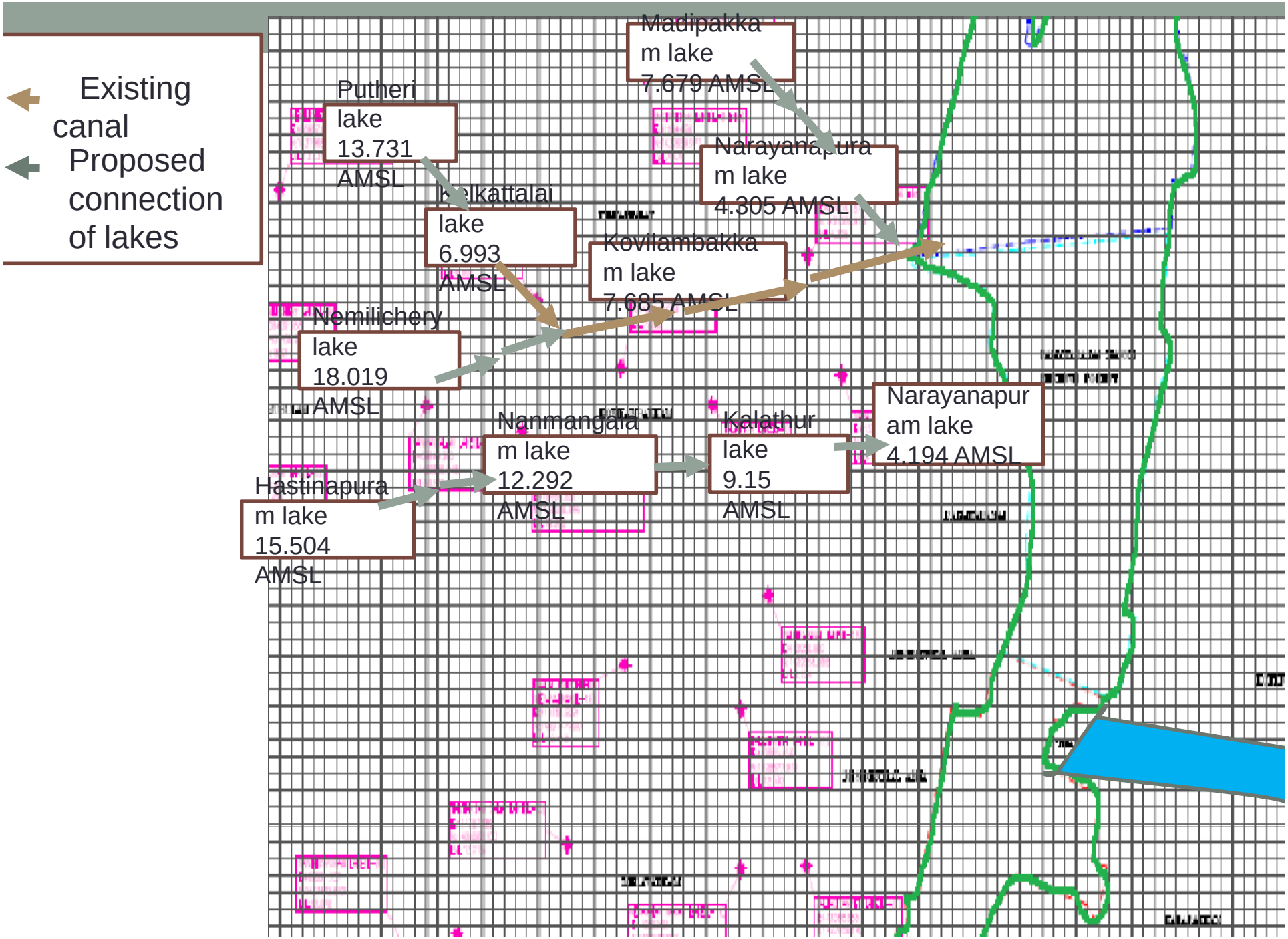
What we learnt from our Studies

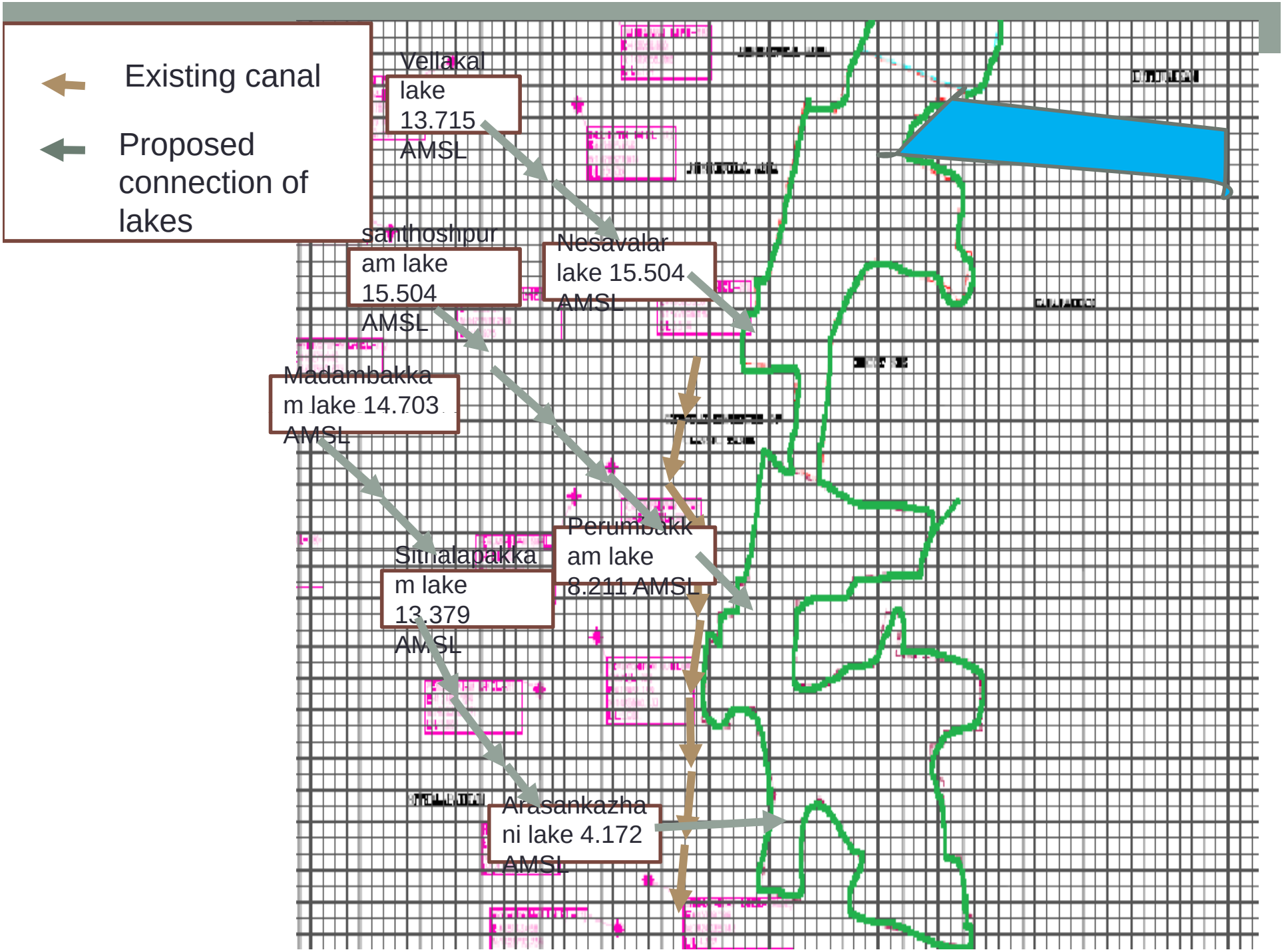
- Most of pollution load coming into PML was from Dumpsite and wastewater treatment plant
- High concentrations of BOD, COD , and TDS
- Toxic heavy metals and organics through surface and subsurface flow from dumpsite leachate

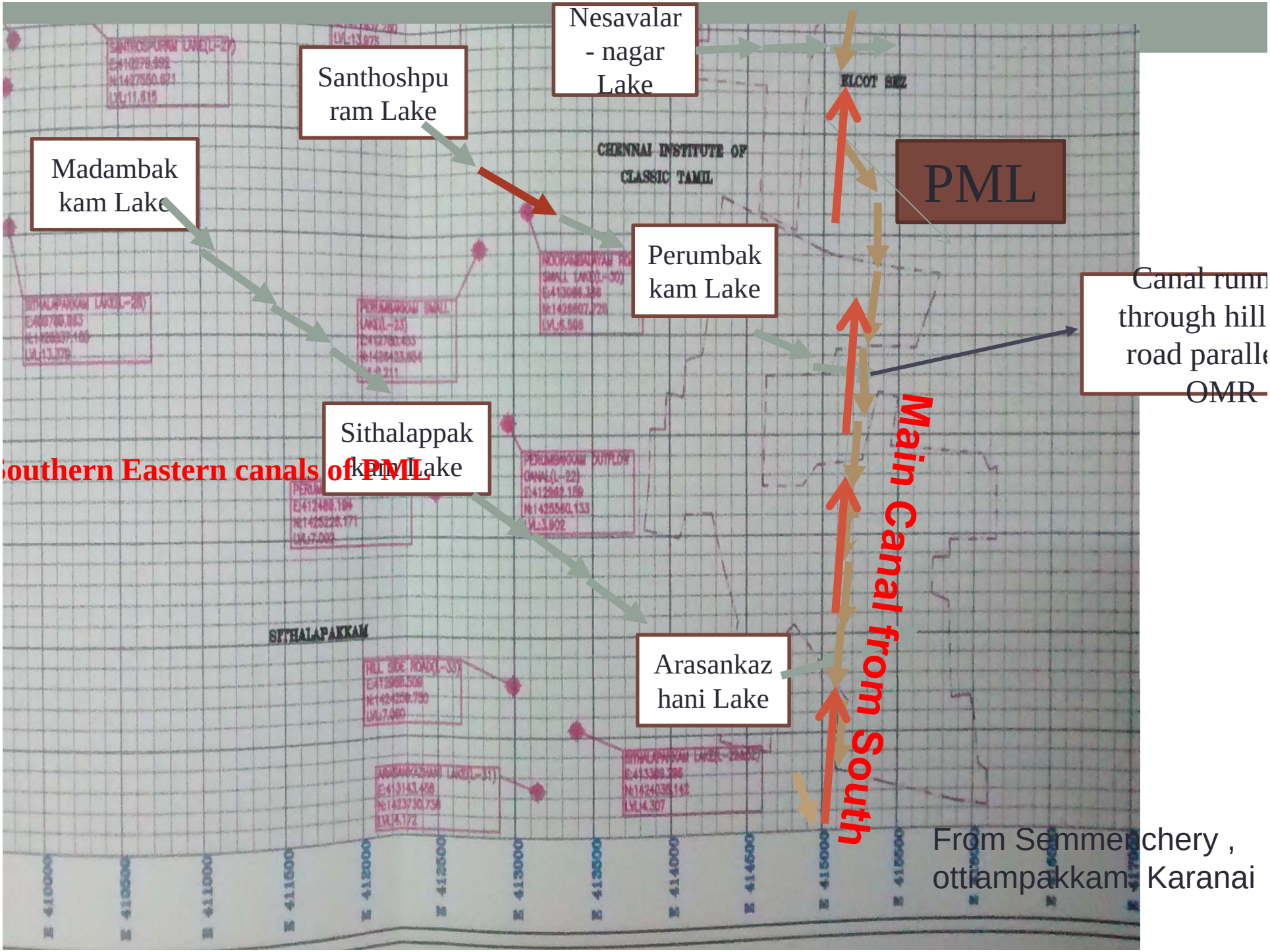
What we learnt?

- Connectivity between lakes are poor or completely lost.
- Cascading lake structure altered due to dredging, elevating bunds and loss of canals
- Connectivity to PML is poor and often only wastewater flows reach PML
- Groundwater severely contaminated due to solid waste in dumpsites and around lakes and canals
- Groundwater withdrawn in large quantities through wells in lakes.


Existing canal
Proposed connection of lakes
Adambakkam lake 6.311 AMSL
Velachery lake 7.671 AMSL
Kallukuttai lake 3.313 AMSL
Puzhuthivakkam Lake 5.502AMSL
Perungudi lake 4.731 AMSL


Existing canal
Proposed connection of lakes
Madipakkam lake 7.679 AMSL
Putheri lake 13.731 AMSL
Narayanapuram lake 4.305 AMSL
Kelkattalai lake 6.993 AMSL
Kovilambakkam lake 7.685 AMSL
Nemilichery lake 18.019 AMSL
Narayanapuram lake 4.194 AMSL
Nanmangala m lake 12.292 AMSL
Kalathur lake 9.15 AMSL
Hastinapuram lake 15.504 AMSL


Existing canal
Proposed connection of lakes
Vellakal lake 13.715 AMSL
santhoshpuram lake 15.504 AMSL
Nesavalar lake 15.504 AMSL
Madambakkam lake 14.703 AMSL
Sirnalapakkam lake 13.379 AMSL
Perumbakkam lake 8.211 AMSL
Arasankazhani lake 4.172 AMSL


Nesavalar - nagar Lake
Santhoshpuram Lake
Madambakkam Lake
Perumbakkam Lake
Sithalappakkam Lake
Arasankazhani Lake
PML
Canal runn through hill road paralle OMR
Main Canal from South
Southern Eastern canals of PML
From Semmencherry , ottiampakkam, Karanai
CHENNAI INSTITUTE OF CLASSIC TAMIL
SITHALAPAKKAM

What we learnt from our PML Studies

- Five inflows coming from culverts on eastern side but with poor interconnectivity to upstream lakes

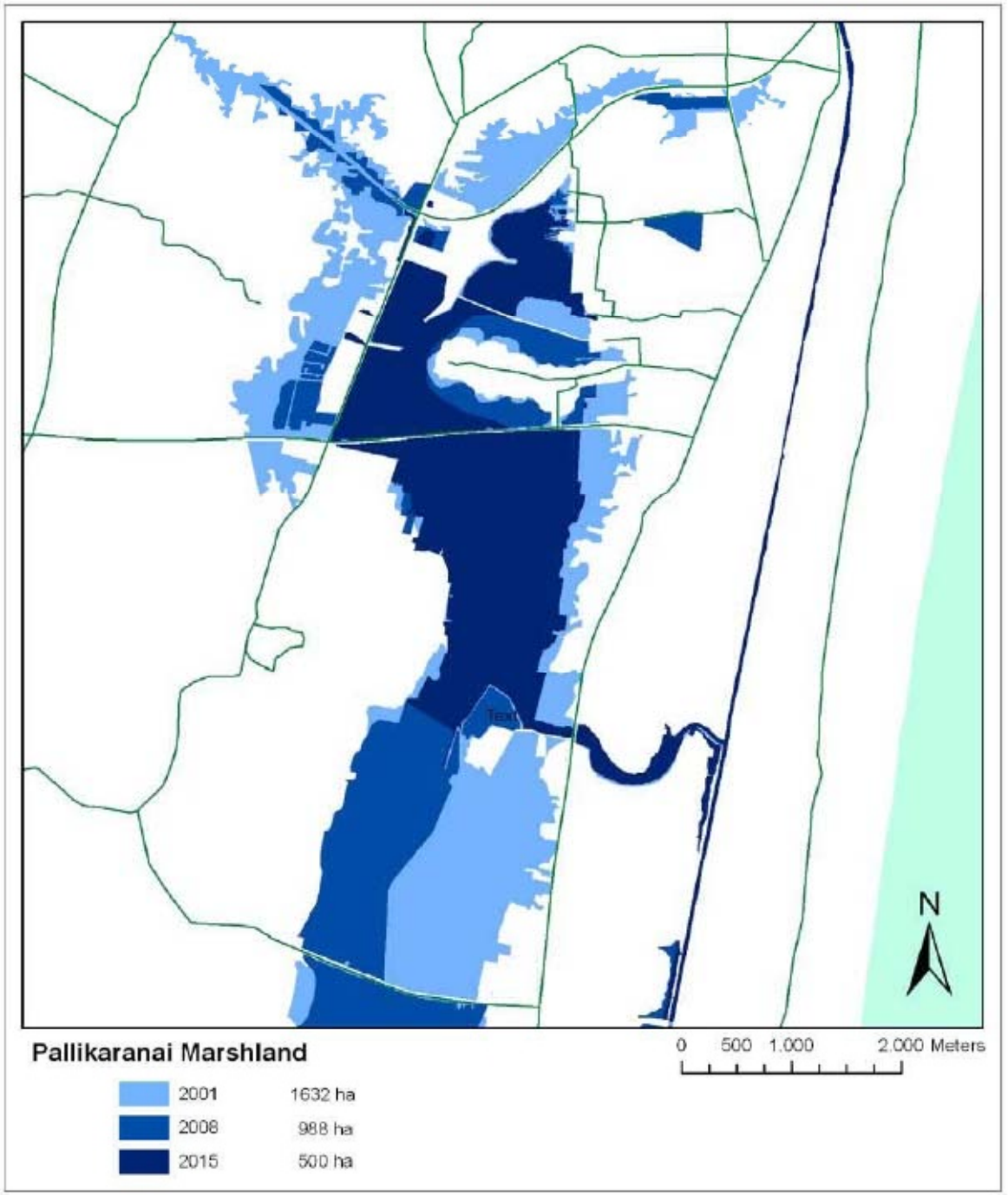
- 15 culverts on radial road mostly carrying sewage and leachate
- One long canal from South to north bringing water from lakes Semmencheri and Mampakkam
- One uncontrolled outflow –Okkium Maduvu to Buckingham canal

  Evident from recent flood event 12 -15 ft of water reduced to zero in few days
- No outflow from Buckingham canal except the river mouths
- Ground water surface water connectivity is high

Water Retentior Capacity

Currently,900 ha
90,000cum

Can be increased to
300,000cum



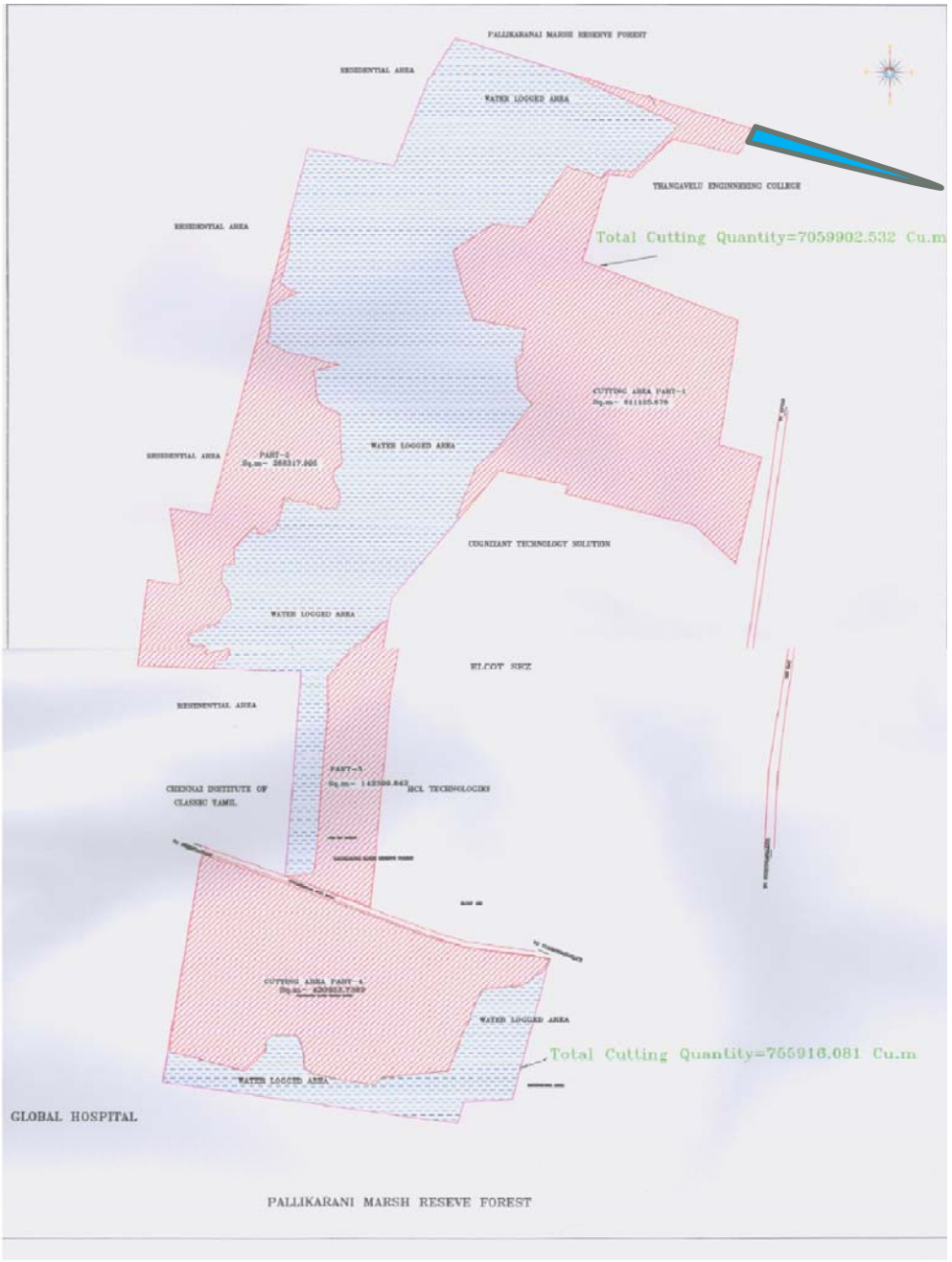
Dredging PML

Increasing water Spread Area in PML

Based on the survey,1.5 to 3 Million cum volume of water

5 times the water spread area

More birds/ biodiversity
More GW recharge
Less runoff




Maariyamman Temple Lake
Semmancheri
Richmond Ave
Juhu Beach Rd
Karl Marx Ave
49
Buckingam canal
Bay View St
Gandhi Nagar Main Rd
Control Sluices
Kanathur Reddikuppam
49A
Temple Lake
Navallur
Maya St
PA Rd
Rajaram Rd
Devi Palanisamy St
© 2016 Google
Image © 2016 CNES / Astrium
Google earth
2002
Imagery Date: 1/4/2016 12°51'10.60" N 80°13'57.74" E elev 1 m eye alt 5.13 km

SOUTH CHENNAI LAKES

Studies conducted by IITM

Objectives of the study

- Devise Management plants for Lakes to improve their functionality as
  - Decentralized water Source
  - Ground Water Recharge
  - Water Retention and Flood Mitigation
  - Promote recreation spots and tourism

Ranganathapuram Lake (near Medavakkam) B and A

Nemmelicheri - Narrow outflow canals

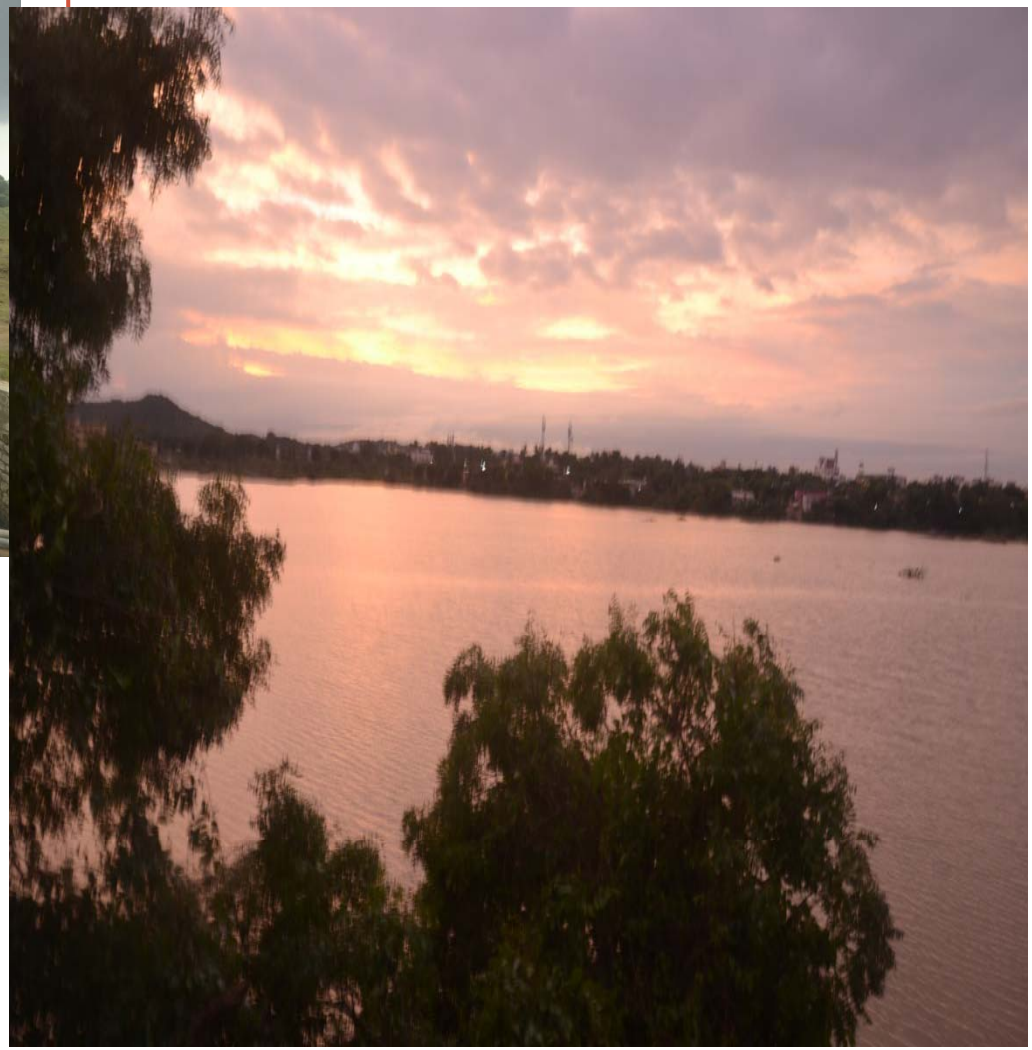
Narayanapuram lake – Need for culverts

Channel outside lake from Keelkatalai lake to PML

South side of Nara lake Old pump house for w/s

Sittalapakkam lake (B and A)

Vellakal lake
Near Nanmangalam forest
(Bad policy)



Jalladianpet lake

Eutrophication

Nesavalar Nagar outflow to Jalladianpet lake

Solid Waste dumped in canals

Roads dividing Lakes – No culverts

What we learnt from Lake studies

From the topographic survey conducted around the PML the following inferences are made

- The slope is towards the marshland

  i.e. Elevation of the lakes are decreasing towards the marshland in Northern as well as western part.

- All the lake bunds have been elevated and lakes dredged which have made the cascading design nonexisiting anymore.
- Each lake is a subcatchment .
- During flood event the emergency outlets should be connected to a downstream water body.
- Lake bunds around the PML are at a higher elevation than PML
- South Canal connected to a large no of lakes and flows North into the city

What needs to be Done with respective to sustainability and functionality

- Engineering Interventions in surface water bodies PML and lakes
  - Dredging canals,
  - Dredging PML
  - Establishing lost connectivity between lakes and PML
  - Reversing flow directions
  - Protection of lakes and canals
  - Construction of weirs in outlet and inlet of lakes
  - Sluice gates should be employed in Okkium maduvu
  - Reservoir Bathymetry studies can help us to understand not only the depth variation but also the sediment deposition

Engineering inerventions for ground water

- Pumping of groundwater has to be accounted and regularized
- . Permeable reactive barrier walls or other treatment strategies can be employed to remediate the leachate which is percolating from the dumpsite.
- Soil lithology can determine the recharge depth as well as the infiltration capacity of the soil
- Hydrogeological study and pumping test should be done to determine the aquifer storativity and transmissivity.
- Ground water Recharge structures within PML /Lakes to establish subsurface connectivity.

What needs to be done with respect to Flood control

- Reallignment of South canal to flow out of the city
- More canals should be made in the southern part of marshland which connects to BC
- Establish connectivity to BC at the ECR link Road
- Establish connectivity between BC and Bay of Bengal
- Construction of alternative connections to Buckingham canal

What do we need to Design - Data and models

- Missing crucial data
  - – Year round Flows in and out of lakes, bathimetry, sediment load
    - To design canals, control structures
    - To determine dredging depths
    - To determine mass loads of pollution

- Systematic hydrological studies
- Flow Measurements into and out of marshland/lakes
- Topography from DEM
- Hydrogeological Investigations
- Pilot scale studies on PRB to protect PML /GW from leachate heavy metals

THANK YOU