Water Related Disaster/Risk Management in Sri Lanka

By Sudharma Elakanda,Mahaweli Authority of Sri Lanka

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Where we are ....?


Manila
Philippine
Sri Lanka
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Background

- Sri Lanka is an Island which is situated in the Indian ocean.
- Its total Land Area is 65610 sq km.
- Administratively
  - Provinces
  - Districts
  - Divisional sectariate division
  - Garmaniladari divisions.
- Demography
  - Population is 19 million
  - Annual population growth rate is 1.5
- Topography
  - Hill country
  - Low country
  - Coastal zone

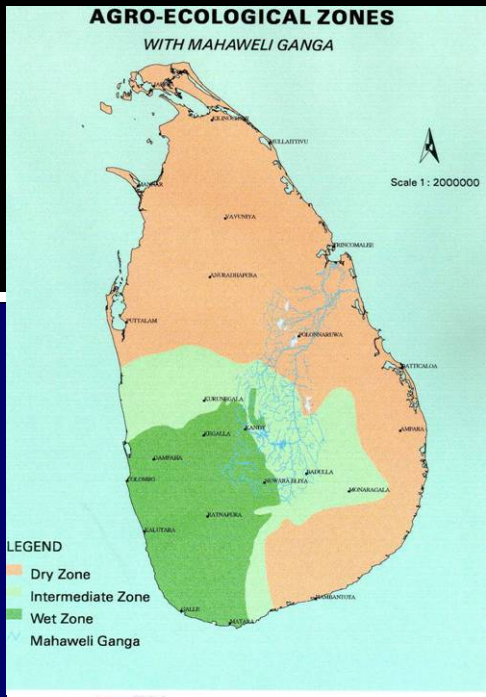
Background

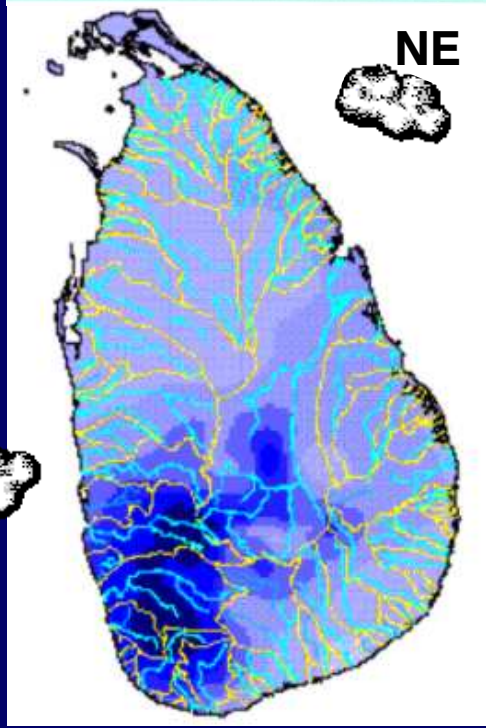
- Climatically
  - Wet zone
  - Intermediate zone
  - Dry zone

- Sri Lanka receives rainfall from two monsoons
  - *South-west (May to September)*
  - *North-East (December to February)*

- Mean annual rainfall varies from 900mm – 5500mm.
- Total annual rainfall is approximately 127 billion m^3
- Annual water resources per capita- 2300m^3

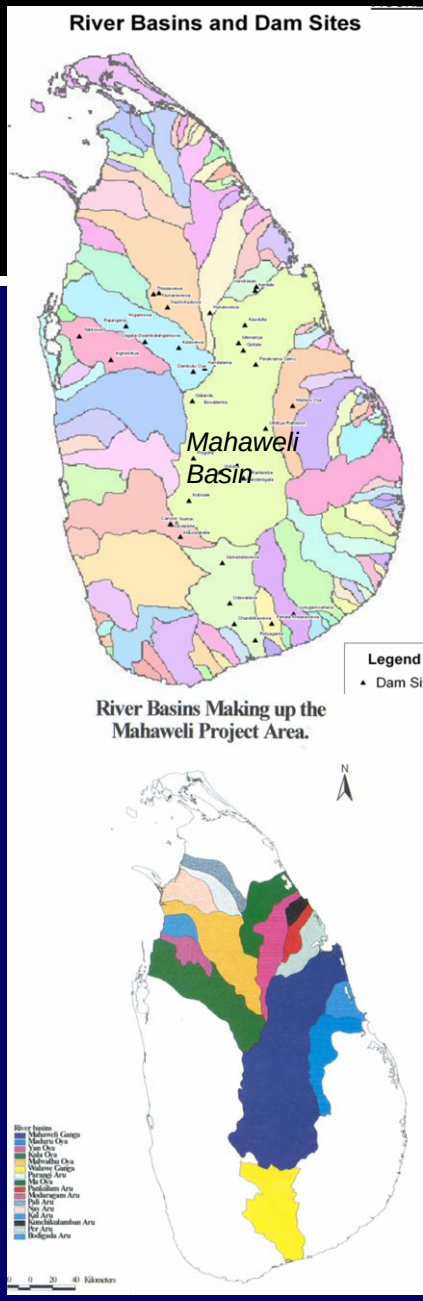
- At sea level temperature ranges from 25˚ to 28˚ C while it varies from 12˚ to 16˚ C in hill country





Background

- 103 River Basins in Sri Lanka
- 17 River Basins>1000sqkm
- Mahaweli River Basin is the Largest, 10327 Sq.km.
- Two main sub basins of Mahaweli Basin. Namely:
  - Upper Mahaweli Basin – lies on hill country, wet zone.
  - Lower Mahaweli Basin – lies on low country, dry zone.
- 14 river basins belongs to Mahaweli development project area



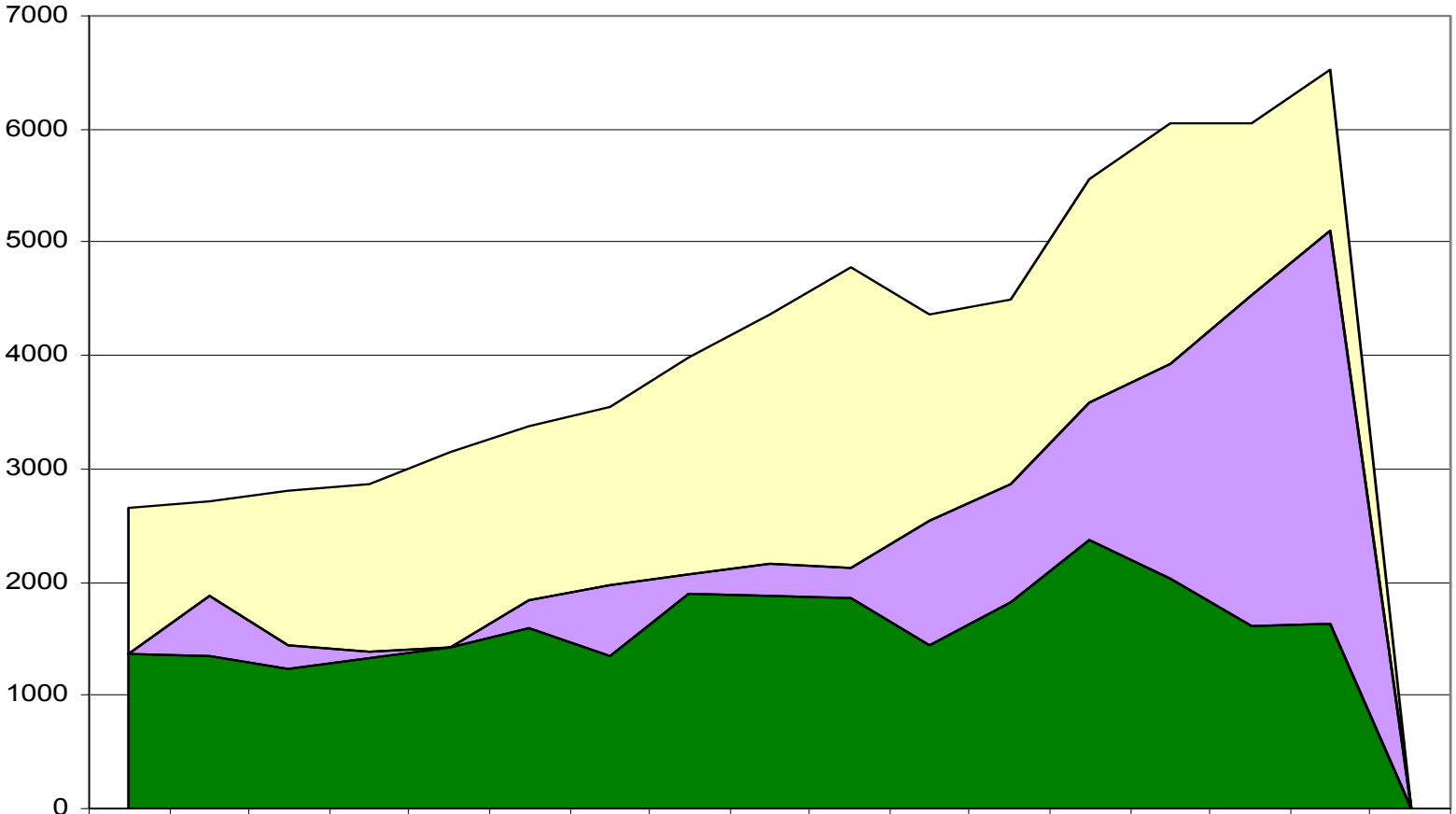
The Mahaweli Authority of Sri Lanka (MASL)

The Mahaweli Ganga Development Programme is the largest multi-purpose, integrated rural development programme ever undertaken in Sri Lanka .

Main objectives :

- Agriculture development – 900,000 Acers
- Hydro-power generation – 1270GWh
- Re-settlement
- Livelihood Development of Village Communities
- Enterprise Development in Mahaweli Areas

Mahaweli Contribution to the Power Sector



	86	87	88	89	90	81	92	93	94	95	96	97	98	99	00	01	02
Mahaweli Hydro	1278	826	1367	1471	1718	1529	1559	1905	2207	2661	1808	1620	1980	2116	1518	1409	
Thermal Power	8	530	202	57	5	260	640	183	275	269	1110	1051	1218	1895	2925	3476	
Non Mahaweli - Hydro	1367	1352	1231	1331	1427	1587	1341	1891	1882	1856	1439	1821	2362	2032	1606	1636	

Year

The Water

- **Constructive Part of the Water**
  - Irrigation , Food Production
  - Domestic Use
  - Hydro Power Production
  - Industrial use
- **Destructive Part of Water**
  - Flood/Flash Floods
  - Water Pollution/Health Hazards
  - Land Slides
  - Tsunami
  - Droughts

Level of Attention

- Public attention was totally on constructive part of the Water, because of the various benefits.
- Very less attention was on destructive part of the Water until recent time.

Sri Lanka is not a Disaster Prone Country until Recently

- Sri Lanka was Badly affected by the Tsunami in December 26, 2004.
- It was an Eye Opener for the people of the Entire Country.
- To face this challenge GOSL has taken action to pass a Parliamentary Act and Establish a separate Ministry to handle this important aspect in 2005.

9.0 Earthquake December 26, 2004

- Sri Lanka was Badly affected by the Tsunami in December 26, 2004.
- After the Tsunami catastrophe in December 2004, geologist warn that Sri Lanka is now more vulnerable to earthquakes and other natural calamities.
- Country is now not far away from the newly formed hyperactive plate boundary, thus requiring grater vigilance in construction and maintenance of projects of this nature.
- To face this challenge GOSL has taken action to pass a Parliamentary Act and Establish a separate Ministry to handle this important aspect in 2005.

Legal Framework

According to this Act the Ministry of Disaster Relief Services that was formed under the Gazette No. 1422/22, dated on 08th December 2005

- Sri Lanka Disaster Management Act No 13 of 2005. This act has provision for establishment of the
  - National Council for Disaster Management
  - The Disaster Management Center
  - Appointment of the Technical Advisory Committee
  - Preparation of Disaster Management Plan
  - Declaration of a State of Disaster
  - The award of compensation and matters connected therewith or incidental there to.

Functions of the Disaster Management Center .....

Through countrywide ministries, departments and public corporations, Provincial Councils and local authority administration; and district, division and Grama Niladhari administration; to enforce, coordinate and monitor activities related to,

- Hazard Mapping and Risk Assessment.
- Long-term disaster mitigation.
- Forecasting, early warning and information dissemination.
- Preparedness to respond to disasters when they occur.
- Emergency Operations Management.
- Management of the post-disaster activities after a disaster.

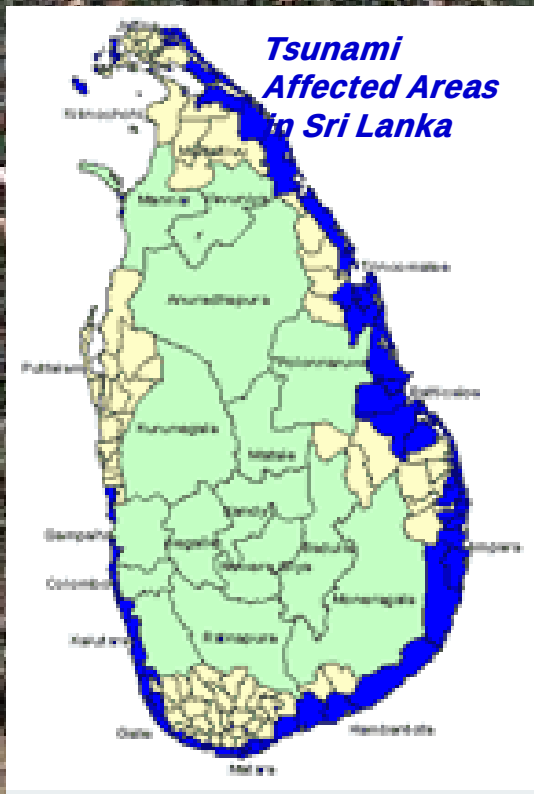
Recent Disasters in Sri Lanka

- Tsunami on 26th December 2004
- Drought 2004
- Flood and Landslide 17th May 2003
- Drought, 2001
- Cyclone, 26th December 2000
- Kantalai Dam Failure-1986

Tsunami on 26th December 2004

- Deaths - 30,920
- Missing - 5,620
- Injured - 15,196
- Displaced Persons - 392,048
- Displaced Families - 84,031
- Affected Families - 201,901
- Completely Damage Houses - 78,199
- Partially Damage Houses - 40,911
- Fishing Boats Lost - 15300
- The waves struck with huge force and swept inland as far as 5 kilometers.

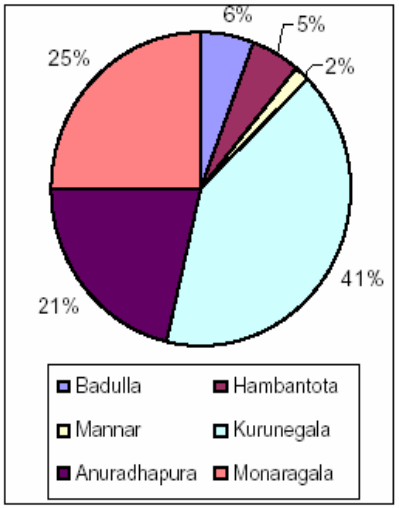
Satellite image at Kalutara Beach



Drought 2004 in Sri Lanka

July, August and September

The significant loss caused up to now is the failure of the paddy crop in Maha season as reported by the District Secretaries of the seven drought affected Districts mentioned above. The chena cultivation and highland crops in these Districts too have been severely affected according to the reports received

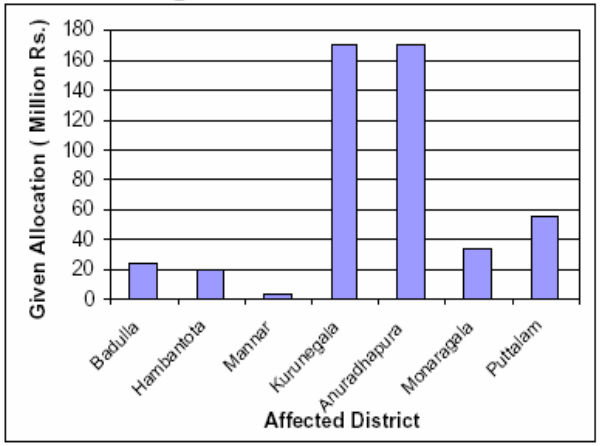


Crop Damages by Districts

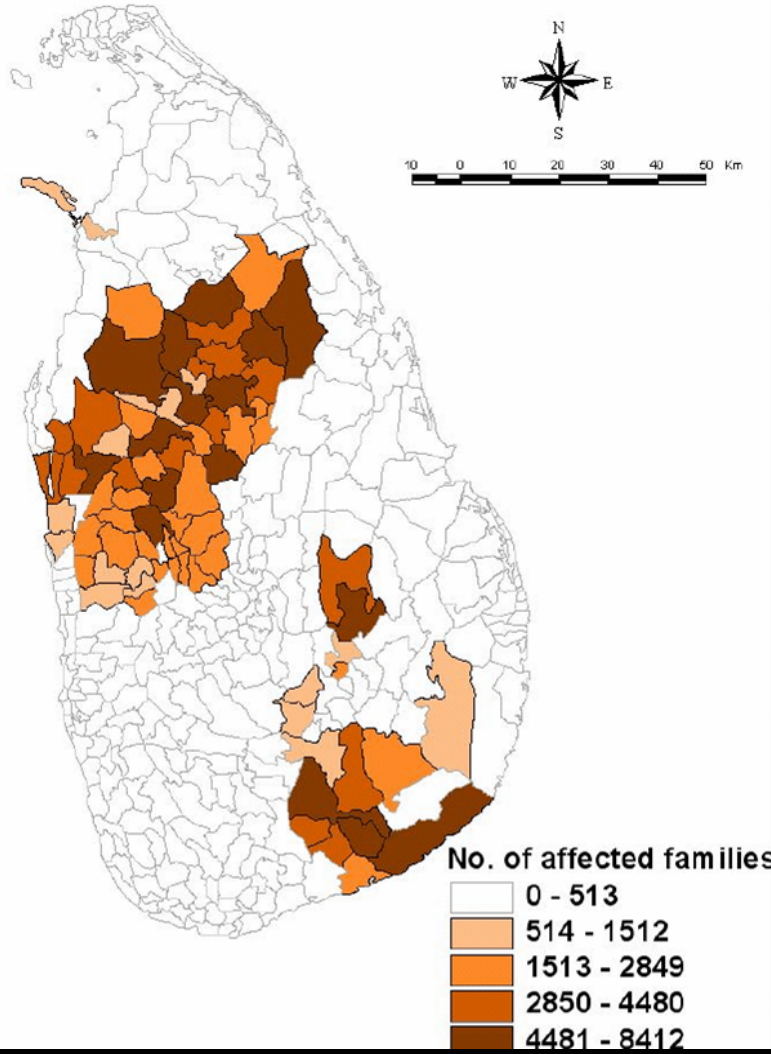
District	Crop Damaged (ha)
Badulla	3,087.00
Hambantota	2,809.70
Mannar	792.20
Kurunegala	21,561.00
Anuradhapura	11,272.00
Monaragala	13,130.00
Puttalam	N.A.
Total	**52,651.90**

Given Allocation for Drought – 2004

District	Given allocation (Million Rs.)
Badulla	25
Hambantota	20
Mannar	3
Kurunegala	170
Anuradhapura	170
Monaragala	33
Puttalam	56
Total	**477**



Spatial Distribution of Drought 2004



Water Related Disasters

Example : Dam Failures in Sri Lanka

1. The Kantale tank bund breached in 1986 resulting in a massive dam disaster;

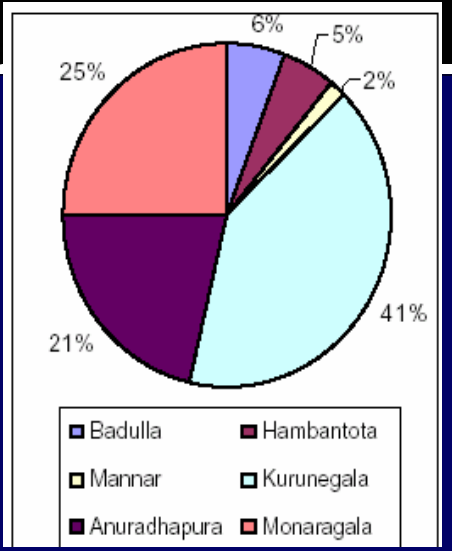
    - killing 127 people,
    - affecting 10864 residents,
    - destroying 1200 houses and substantially damaging agriculture,
    - commercial and public infrastructure sector.

The cost to the Government's relief, rehabilitation, and re-housing expenditures for the affected downstream residents was about three times the cost of all the rebuilding the breached section (Rs186 M).

MASL Activities for Drought Mitigation

1. Small tank & irrigation system improvement - Cascade Based development (Mahagalkadawala Cascade)

Droughts in 2004 (July,, August & September



2. Rainwater Harvesting & Homestead Development

"Pathaha" Construction

Pond Construction for Agriculture

Ferro Cement Tank For Drinking Water

3. Land use & Environmental Management

Deforestation for Chena Cultivation

- Establish Forest Plantation nursery
- Introduce Soil Conservation Measures

Water Pollution of KOB

Mainly due to Agro chemicals & Industrial Waste disposal into water system

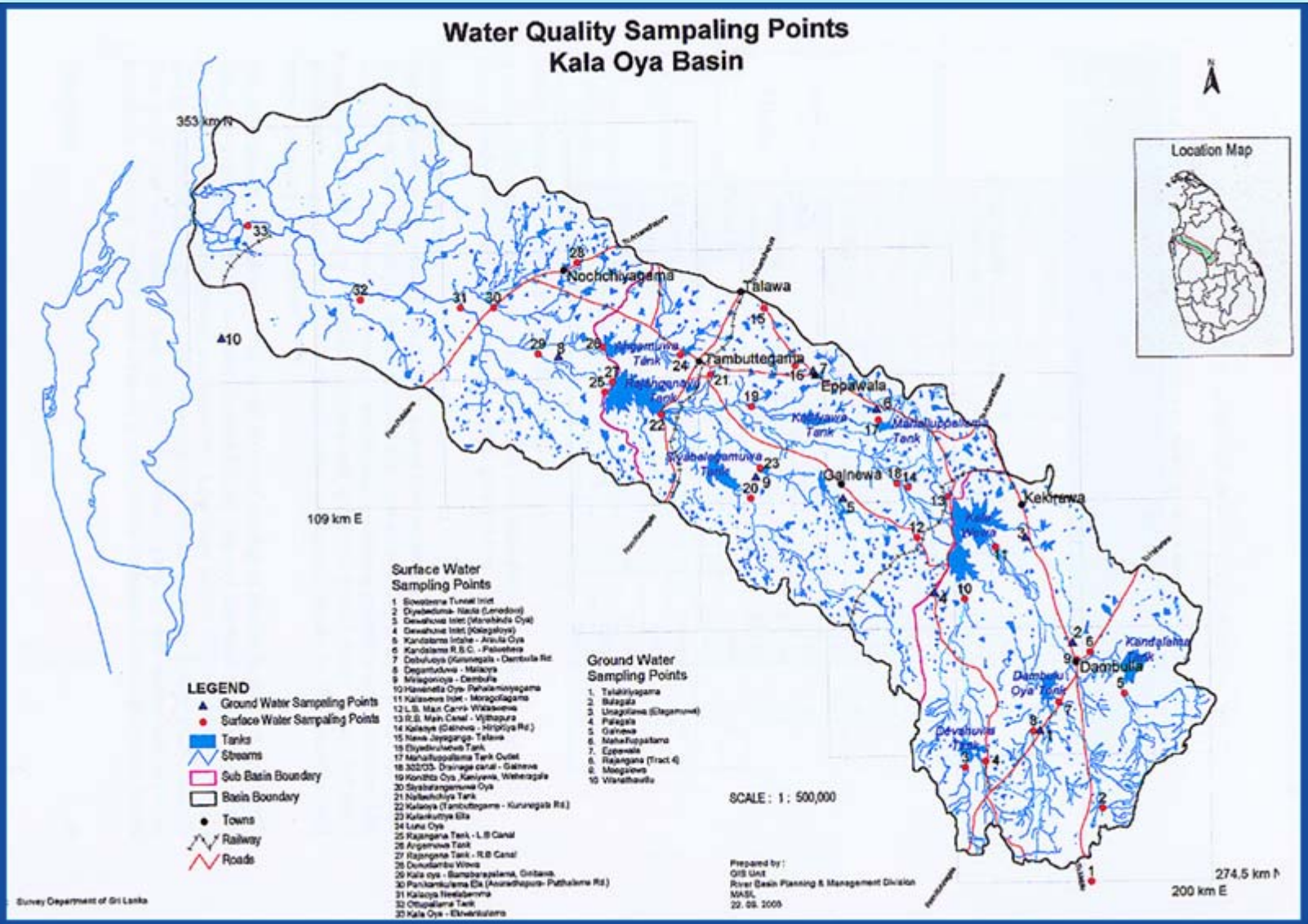
Diseases

- Fluoride accumulation on Teeth
- Kidney Diseases

  Statistics from the Provincial Directorate of Health Services reveal that in 2003 just over 1,300 patients with chronic kidney disease received treatment in the worst-hit North Central Province, with almost 200 patients dying of renal failure that year. Today the situation has been aggravated and report 4000 kidney patients per/yr
- Eye Diseases (catrack)

Water quality Management of KOB

- Established water quality Laboratory



Water Quality Parameter for water Quality Assessment in KOBO

- *Turbidity NTU*
- *Conductivity*
- *DO*
- *BOD*
- *Alkalinity*
- *Boron (as B) mg dm^{-3}*
- *Calcium (Ca) mg dm^{-3}*
- *Cloride (Cl) mg dm^{-3}*
- *Chromium (Cr(VI)) mg dm^{-3}*
- *Copper (Cu) mg dm^{-3}*
- *Fluoride (F) mg dm^{-3}*
- *PH*
- *Iron (Fe) mg dm^{-3}*
- *Lead (Pb) mg dm^{-3}*
- *Magnesium (Mg) mg dm^{-3}*
- *Manganese (Mn) mg dm^{-3}*
- *Nitrate (NO3) mg dm^{-3}*
- *S odium (Na) mg/L*
- *Potassium (P) mg/L*
- *Sulphate (So_4) mg dm^{-3}*
- *Zinc (Zn) mg dm^{-3}*

Landslides in Upper Mahaweli Catchment

- Vegetable Cultivation on steep slope
- Deforestation
- Home development on steep slope due to increase Population density
- Infrastructure development

MASL Mitigation Activities on Landslides

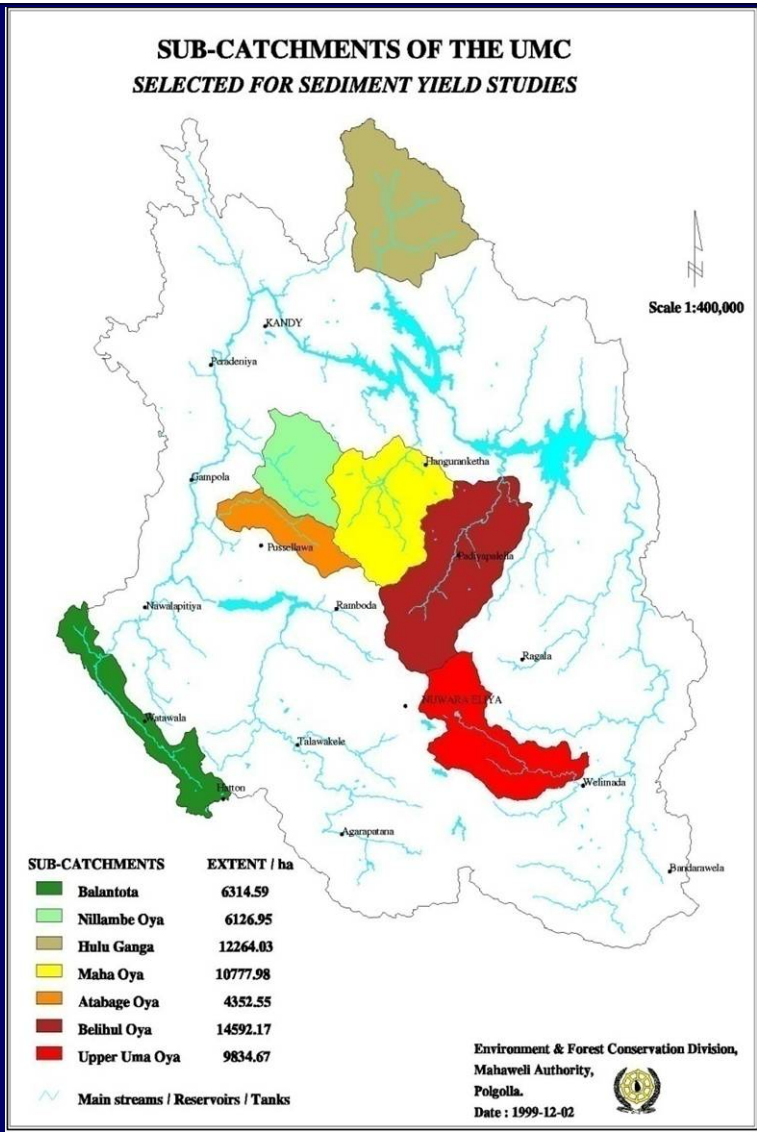
1. Identification/adoption/development of suitable conservation measures

SALT

Stone Bunds

2. Promotion/ involving local people and affected parties in conservation activities

3. Post implementation impact monitoring



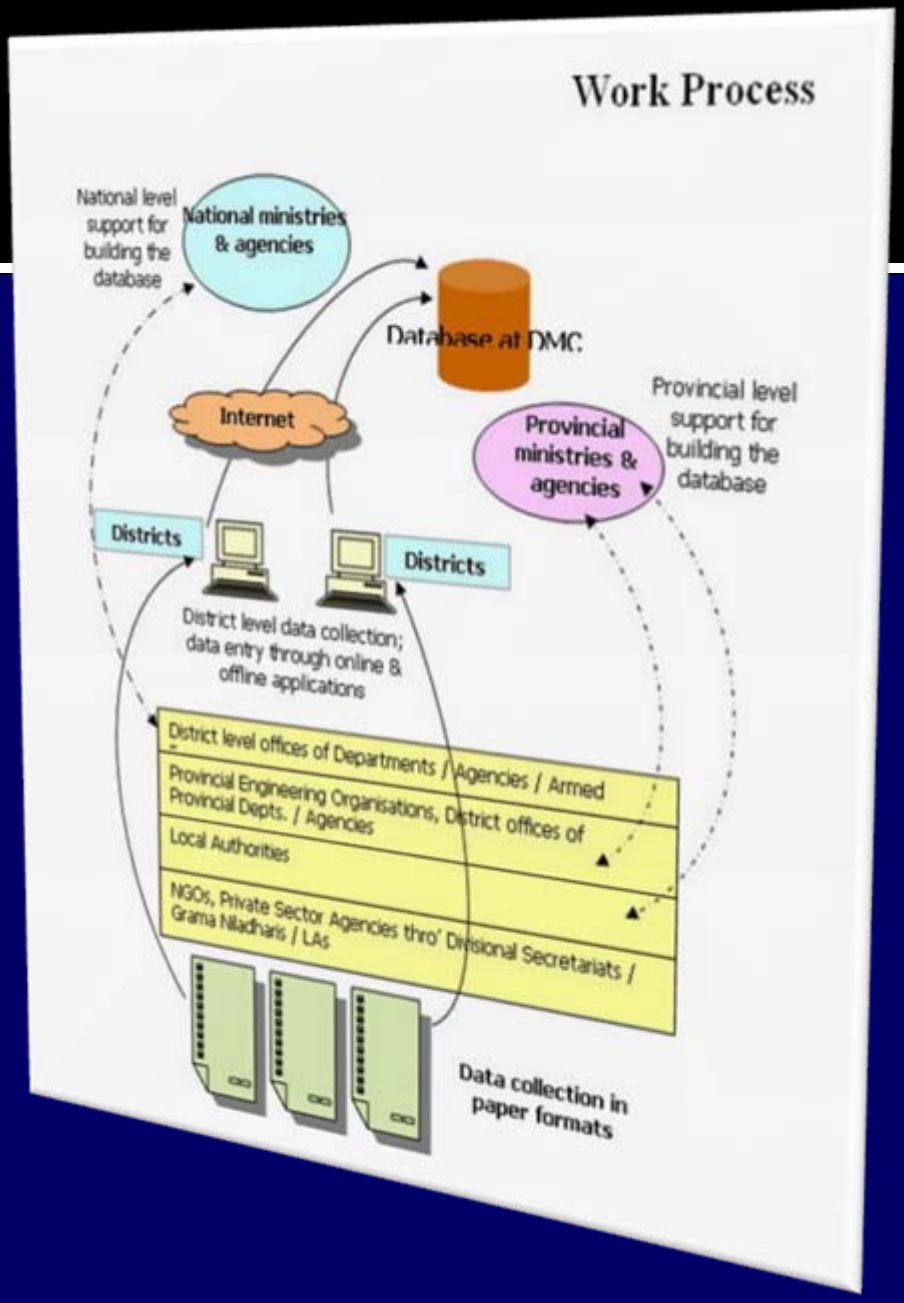
4. Awareness creation campaign & School Environmental Education programmes

5. Community forestry & fire hazards prevention programmes

• Information Management

- DMC is in the process of developing a database of resources to maintain information on the availability and locations of the resources needed for response activities in emergencies after a disaster.

- This database will include details of Equipment (equipments used in emergency response, e.g. Cutters, excavators etc.), details of **Skilled human resources** (people with various skills & expertise in emergency operations) and details of **Critical Supplies** (consumable items which requires very frequent updates, e.g. Medicines)



- Conducting awareness programmes to making awareness Officials, General public and school children in relation to Hazards, Risk and Vulnerability of Disaster Management

School Training Programme

Leadership Training Programme

Volunteer Training Programme

MASL's Key Intervention for Disaster Risk Management in Sri Lanka.

- Initiate Dam Safety & Water Resources Planning Project to address major challenges faced by the Water Sector in Sri Lanka.

Objectives of DSWRP Project

"Improve the development and management of water resources within the country, reduce water induced hazards to public, and enhance effectiveness of water related investments"

Identify Risk

Challenges Faced by Water Sector .....

Multiple signs of Aging Over 350 Large/Medium Dams, Headworks and Trans-Basin Canals of the country are now visible and they are suffering from various structural deficiencies and shortcomings in operation and monitoring of such facilities which affect largely on Public Safety.

DSWRP Project (Dam Safety & Water Resource Planning) of Sri Lanka will address this Challenge which might lead to huge water related Disasters having significant threat to the public safety

Reasons for Dam Failures

1. Overtopping

- Inadequate Spillway Design
- Debris Blockage of Spillway
- Settlement of Dam Crest
- Unusual Storm

2. Foundation Defects

- Differential Settlement
- Sliding and Slope Instability
- High Uplift Pressures
- Uncontrolled Foundation Seepage

Evidence of slope failures

Huruluwewa

Leakage – Castlereigh

3. Piping and Seepage

- Internal Erosion through Dam Caused by Seepage-"Piping"
- Seepage and Erosion along Hydraulic Structures Such as Outlet
- Conduits or Spillways, or Leakage through Animal Burrows

Less Common Cause for Dam Failure ....

During Earthquakes:

- Development of high pore pressure
- Possible liquefaction of saturated layers

The result of these can be excessive settlement or deformation of the embankment.

Dam Safety & Water Resource Planning Project (DSWRPP)

Project Component

1. Dam Safety & Operational Efficiency Improvement
2. Upgrade and Modernize current Hydro-Meteorological Information System (HMIS)
3. Multi Sectoral Water Resources Planning

Dam Safety & Operational Efficiency Improvement - Component 1

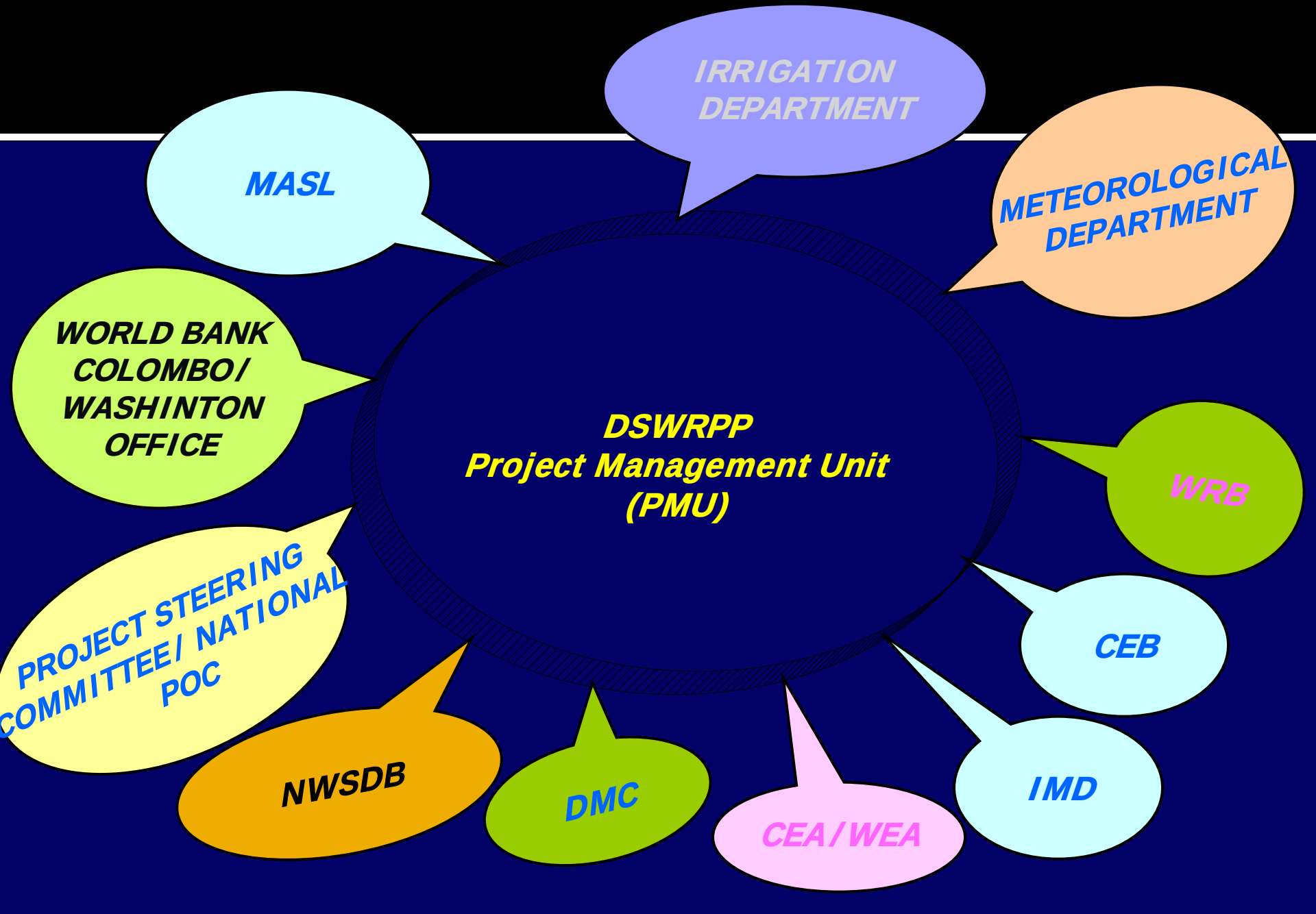
Analize & Evaluate Risks

- During the preparation of DSWRPP project , Risk Indexes were calculated of all 80 Large Dams using the widely accepted method namely Portfolio Risk Assessment (PRA).
- All 80 Dams were ranked according to their hazard and risk levels to identify and prioritize dams required urgent attention and to undertake remedial actions.
- According to the risk analysis following activities will be undertaken:

Treat Risks

- 32 Large Dams of the country identified as high risk to the public safety , will be fully rehabilitated.
- 80 Large Dams (including above 32 Dams) will be provided Basic Safety Facilities .
- Critical issues of Senanayaka Samudraya, Samanalawewa, Polgolla Tunnel, Minipe Trans basin canal and Victoria Dam will be studied and make recommendation for remedial actions
- Training Staff for Institutional strengthening of dam owning organizations

Institutional Mechanism



Locations of 32 High Risk Dams

Dams under Mahaweli Authority - 11

- Bowatenna
- Polgolla
- Victoria
- Randenigala
- Rantambe
- Kotmale
- Kalawewa
- Kandalama
- Dambulu Oya
- Maduru Oya
- Chandrikawewa

Dams under Ceylon Electricity Board - 04

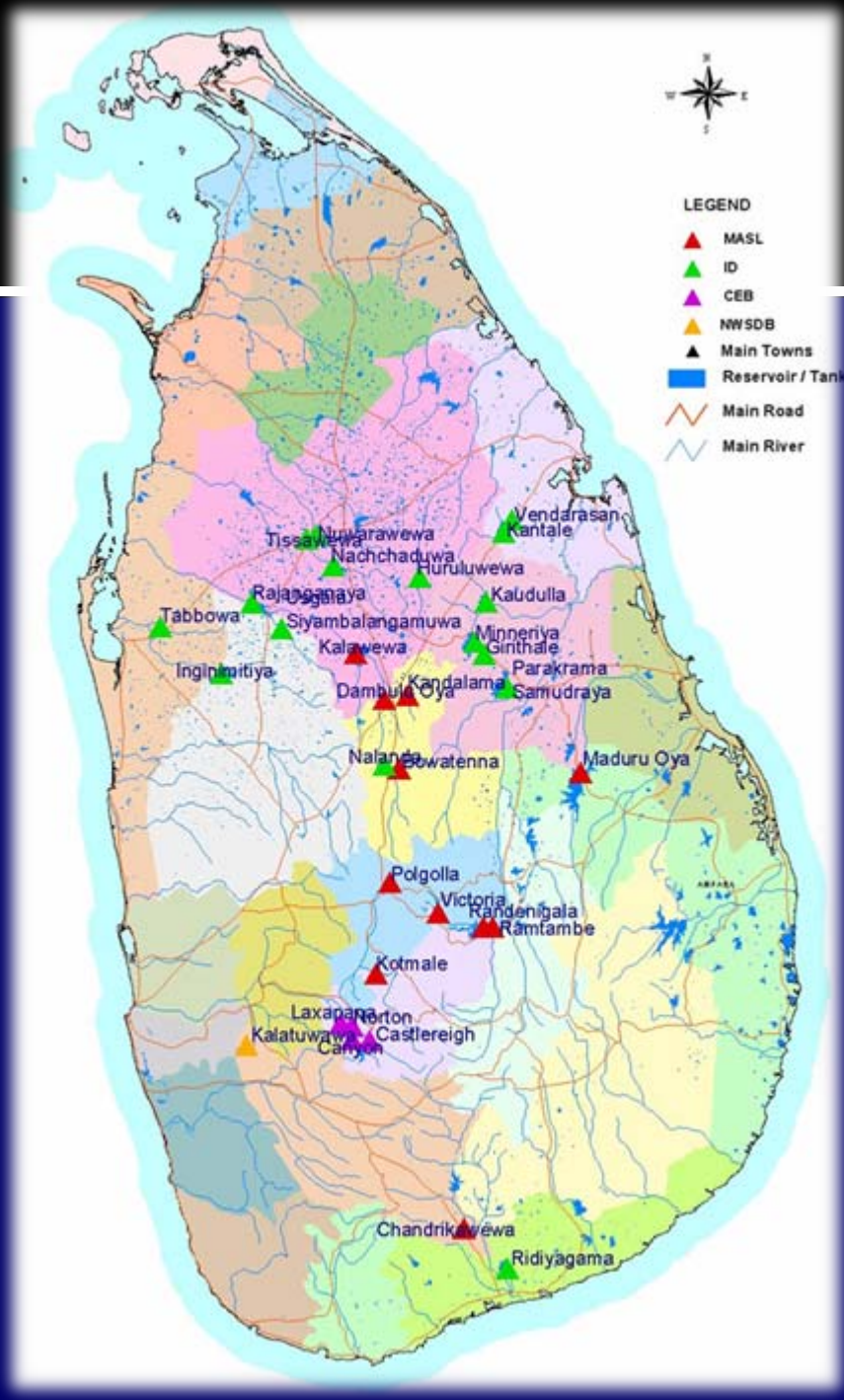
- Canyon
- Castlereigh
- Laxapana
- Norton

Dams under Irrigation Department - 1 6

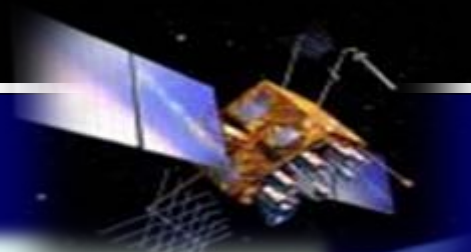
- Parakrama Samudra
- Minneriya
- Giritale
- Kaudula
- Kantale
- Nachchaduwa
- Huruluwewa
- Rajangana
- Nuwarawewa
- Tissawewa
- Vendrasan
- Inginimitiya
- Ridiyagama
- Tabbowa
- Nalanda
- Usgala - Siyambalangamuwa

Dams under Water Supply & Drainage Board - 01

- Kalatuwawa



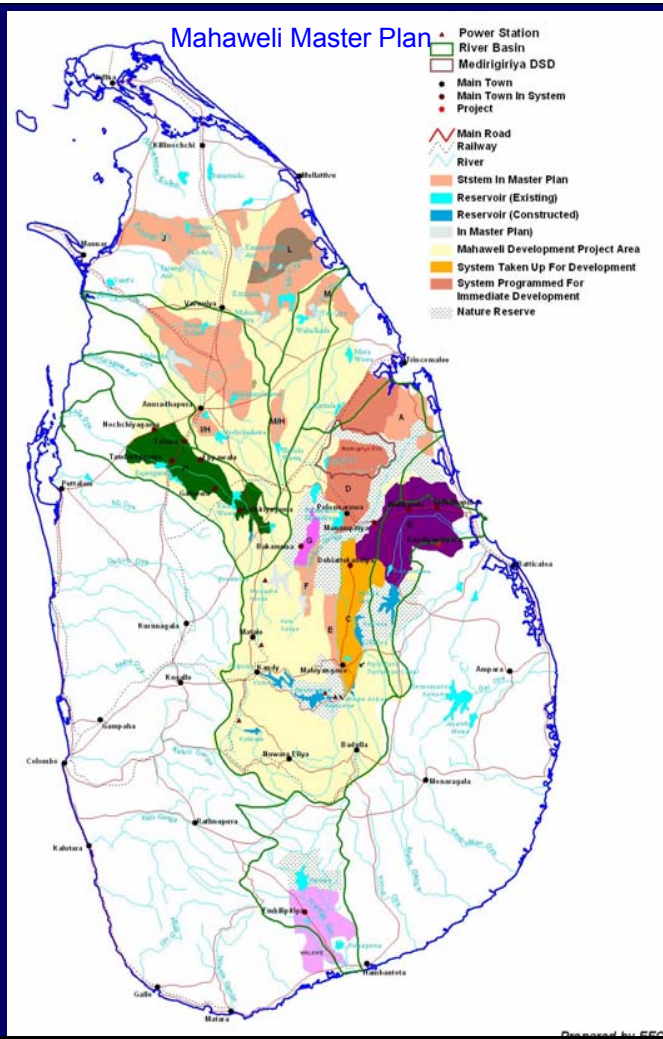
Upgrade and Modernize current Hydro-Meteorological Information System (HMIS) Component -2



- Upgrade & Modernize 50 Hydro- meteorological stations
- Modernize and establish Data Bank at Irrigation Department
- Improve Flood Protection Procedure, Tools and Training
- Establish Ground Water Monitoring System

Multi Sectoral Water Resources Planning - Component 3

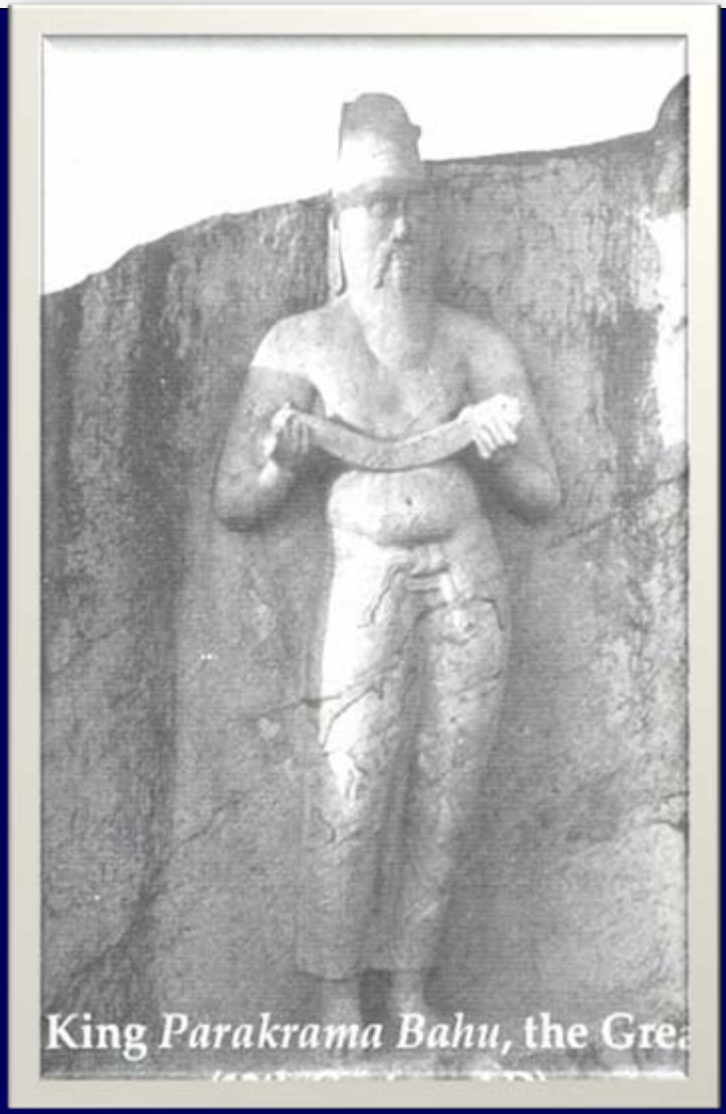
- Preparation of National Water Use Master Plan
- Update Mahaweli Water Resources Development Plan
- Preparation of Mundeni-Aru River Basin Development Plan



Action taken by DSWRPP for Mitigation of Environment Impacts

- The project has developed an Environmental Assessment & Management Framework (EAMF) to be used for Environmental assessment of each dam to be rehabilitated under the project.
- This framework was submitted to the CEA & got the clearance. The same document was published in the Newspapers for the public opinions & finalized.
- This EAMF is currently being used to prepare Environmental Assessment of each dam.
- Four EAs have already been completed for 4 Dams , including Tabbowa & Inginimitiya.

Water and Wisdom



The Sri Lankan knew the wisdom of the words of their mediaeval king, **Parakrama Bahu** the Great, who declared that

> *"not a single drop of water received from rain should be allowed to escape into the sea without being utilized for human benefit".*

Randenigala Spillway

Thank You for your Attention

"Disaster prevention & management should not be a effort only of the governments but it should be a join effort and responsibility of each one of us of the entire world"