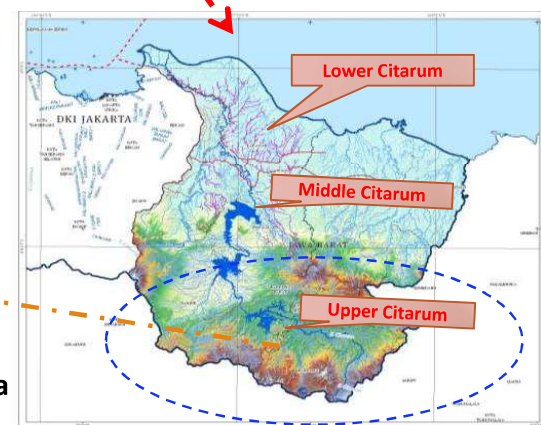
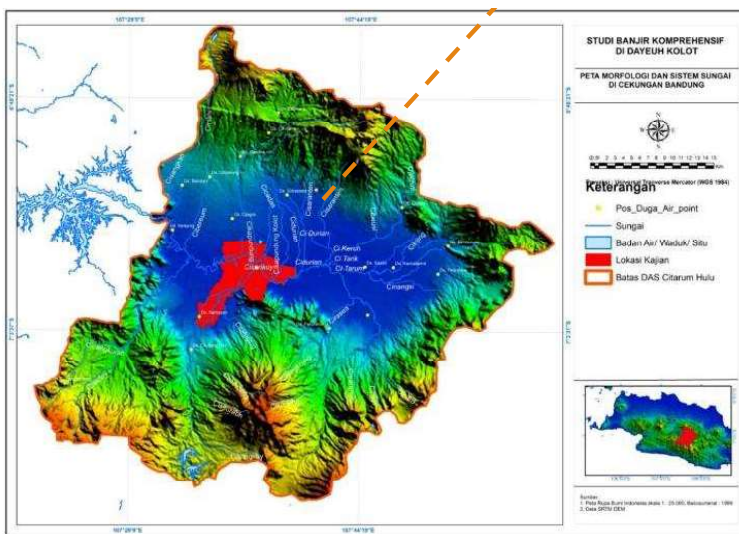


## Water Nexus Analysis for Citarum River Restoration Program in West Java, Indonesia

MSB Kusuma  
Faculty of Civil and Environmental Engineering

### Case Study : Upper Citarum River

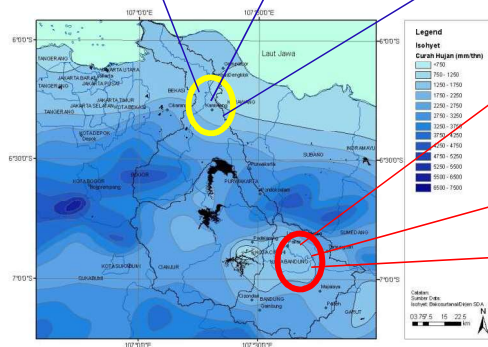
Natural Flood Plain surrounding by Mountains



Foccus of Presentation Upper Citarum River Basin, West Java  
Indonesia, (BBWSC & BAPPENAS, 2012 )



One weeks flooded in Jatiasih, Bekasi due to dike breach of Citarum River downstream of Jatiluhur Reservoir in 2013



Three weeks flooded in Dayeuh Kolot, previously natural flood plain area of upstream Jatiluhur Reservoir, 2013



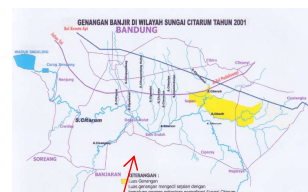
Kusuma, MSB, et.al, Water Res Eng, FCEE, ITB



1986 Before normalization



1994 Partial normalization



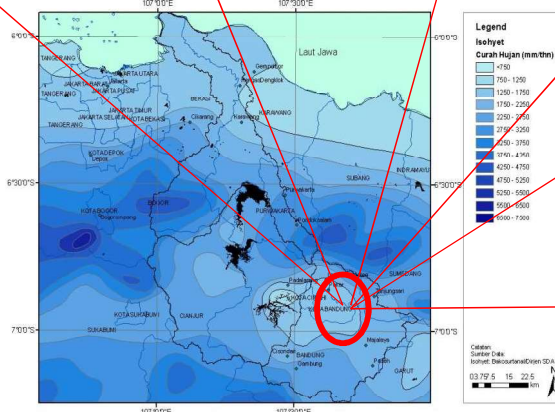
2001 Nearly final normalization



2003 Final normalization

Engineering solution is only a short term as there is socio engineering solution required for the following problem :

- Erosion and sedimentation
- Solid waste
- Land use change
- Water supply/allocation



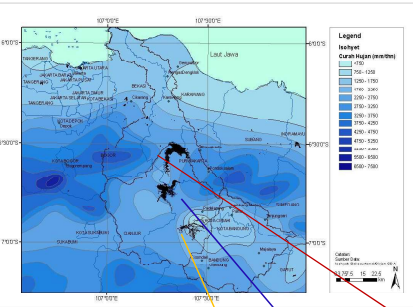
2005 After normalization



2010 After normalization

Kusuma, MSB, et.al, Water Res Eng, FCEE, ITB





Average annual sedimentation rate  
8 million m<sup>3</sup>/year → flood in rainy season  
and water scarcity in the dry season (ASER  
2008, BPLHD)



**Jatiluhur Dam during drought event in 2013, Source: voaindonesia.com**



**Jatiluhur Dam during flood event in 2010, Source:**  
nasional.news.viva.co.id



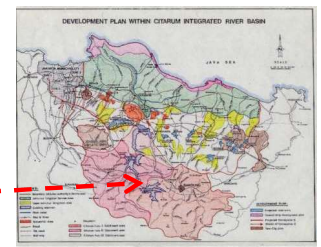
**Saguling, 1984, IndoPower**



**Cirata (1988, PT PJB)**

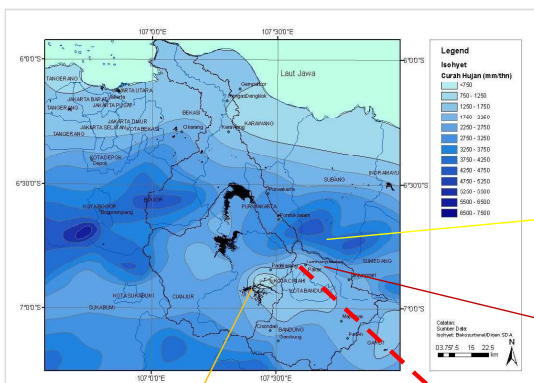


Jatiluhur 1967, POJ



### Three Cascade Reservoir of Citarum River (Flood, Irrigation, Power, Raw Water and Aqua Culture)

► Kusuma, MSB, et.al, Water Res Eng, FCEE, ITB



Ciwidey, upstream area, MSB Kusuma, 2005



Watershed degradation in neglasari area (BBWSC, 2013)



555 000 m<sup>3</sup>/year of solid waste (BBWSC, 2013). Batujajar Bridge - Photo: The Sun, 2009



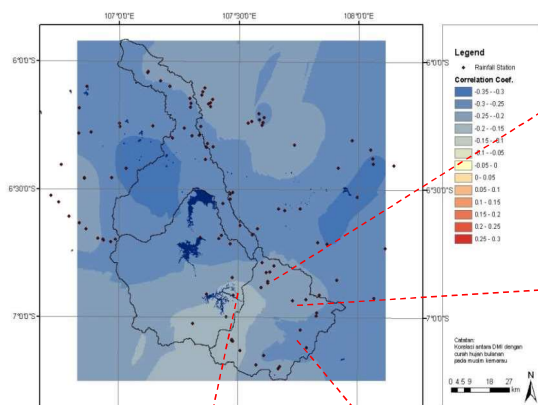
Industrial and domestic waste, upstream and downstream, BBWSC



190 Tons /day of organic Waste, BPLHD,2009

► Kusuma, MSB, et.al, Water Res Eng, FCEE, ITB

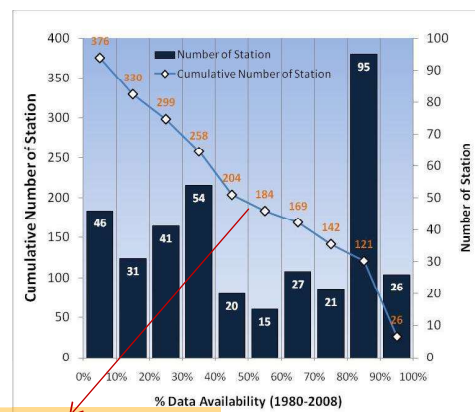




Discharge Station at Nanjung



Rainfall Station at Cicalengka



Data Availability <50%  
(192stations)

Data Availability >70%  
(142 stations)

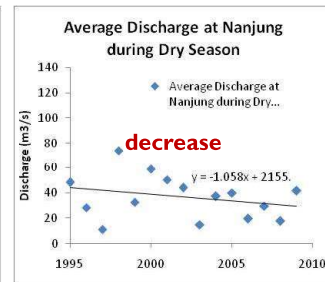
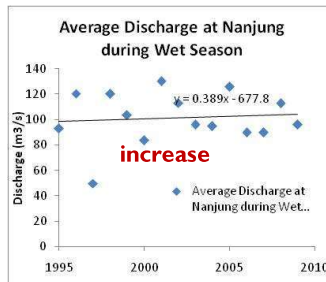
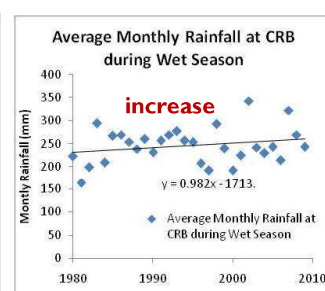
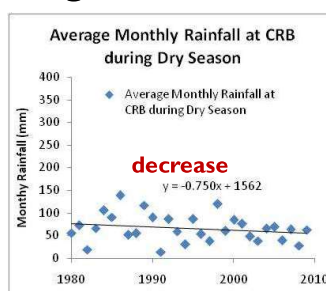
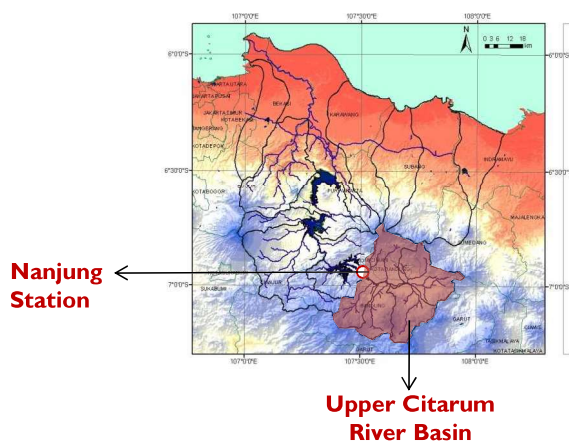
Data Availability >90%  
(26stations)

Data observation ; varies from one station to another. From **376 rainfall stations**, 26 stations (6.9%) has very good data record with data availability more than 90%, 142 stations (37.8%) have relatively good data records with data availability more than 70% and 192 stations (51.2%) have bad data records with data availability less than 50%.

► Kusuma, MSB, et.al, Water Res Eng, FCEE, ITB

### Climate Change: Rainfall and river discharge trend

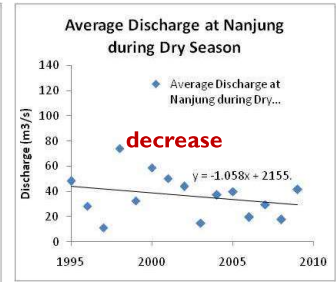
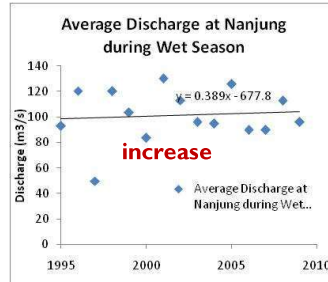
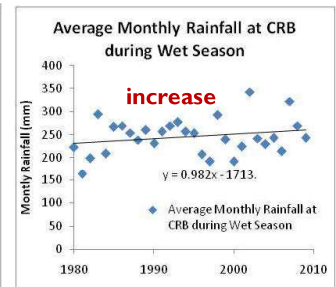
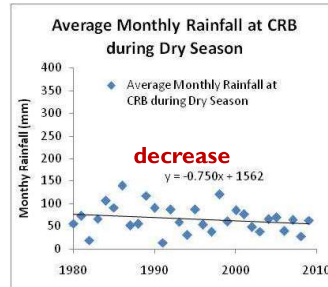
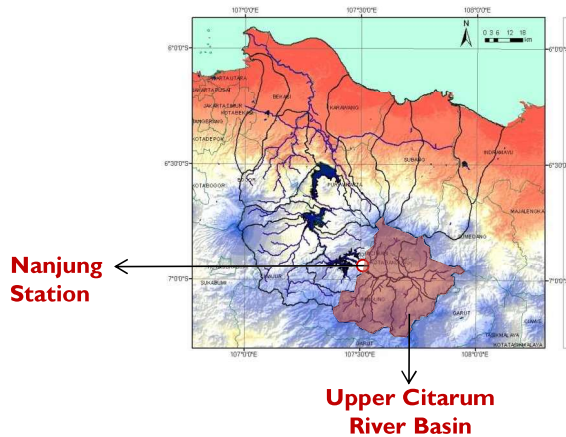
- Trend of increase in average rainfall and discharge during wet season, and decrease in dry season within the last few decades: (Case Study of Upper Citarum River Basin)



► Kusuma, MSB, et.al, Water Res Eng, FCEE, ITB

## Climate Change: Rainfall and river discharge trend

- ▶ Trend of increase in average rainfall and discharge during wet season, and decrease in dry season within the last few decades: (Case Study of Upper Citarum River Basin)



▶ Kusuma, MSB, et.al, Water Res Eng, FCEE, ITB

9

## Existing Condition : Current Floods November 11-13, 2018



*Inundation due to floods on 11-13 November 2018 :*

- Depth : 0.5 – 1 m
- Duration : 1 d- 4d and more (occurring..)
- Area on going identification



# Existing Condition : Puting Beliung (Mini Tornado) November 11-Jan 2019.

Jumat, 11 Januari 2019 20:18 WIB

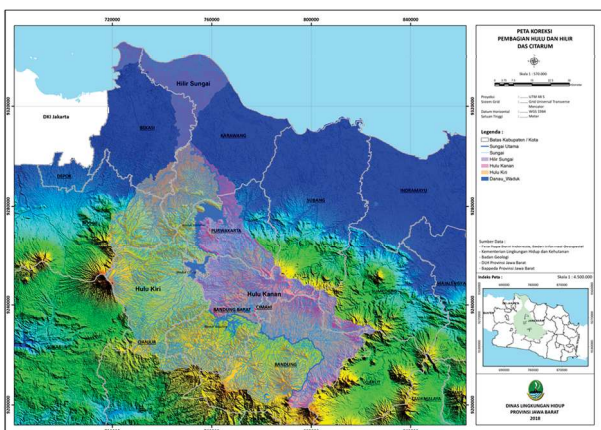


**11-01-2019 :**  
*Mini Tornado? Duration 15-30 minute, Area on going identification*



TRIBUNNEWS.COM - Video detik-detik angin puting beliung

## Land Cover and Water USE in Upper Citarum River Basin (2006-2013)

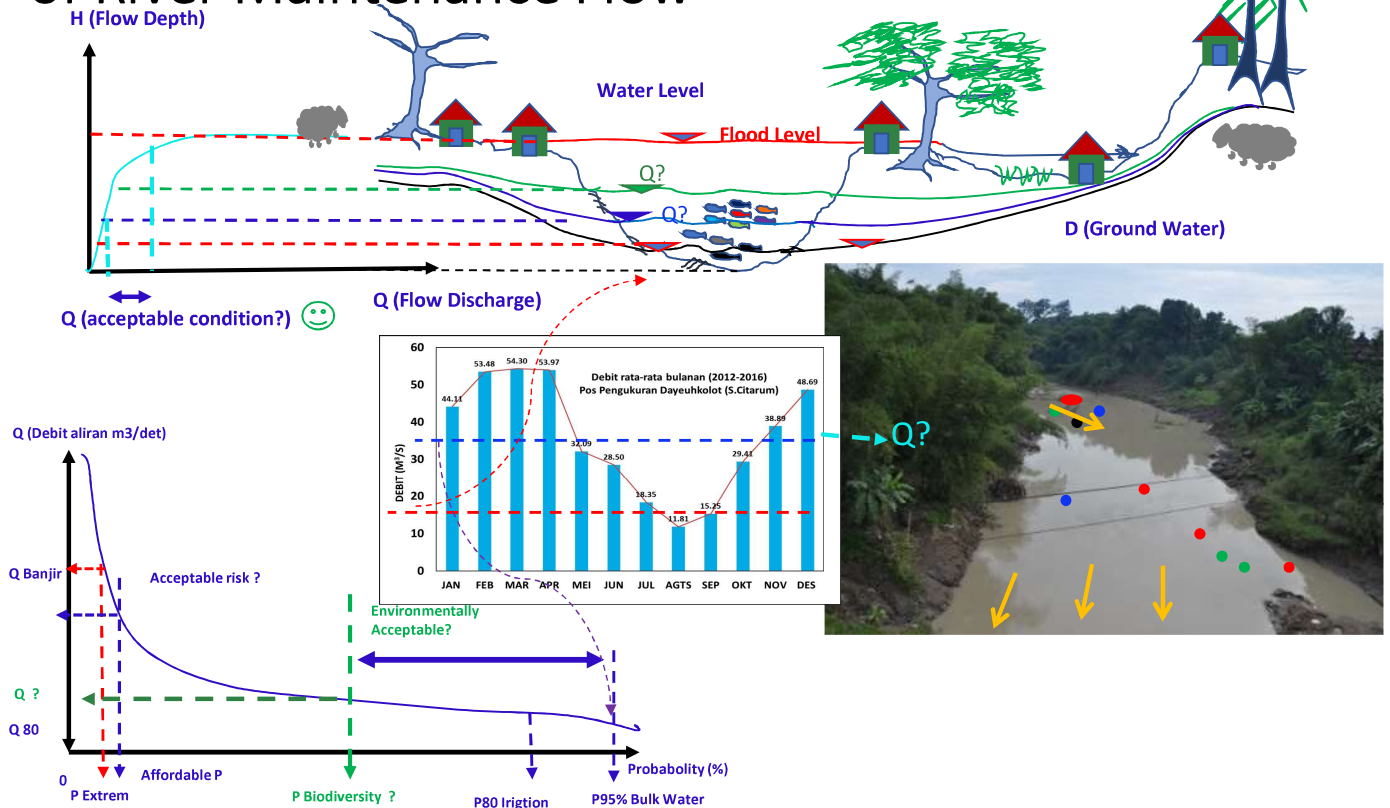


No	Land Cover Type	Area (Km <sup>2</sup> )				
		2006	2009	2011	2012	2013
1	Rice fields	24.54%	24.54%	24.54%	24.54%	24.54%
2	Dryland Agriculture	22.87%	22.76%	22.74%	22.74%	22.74%
3	Settlement	19.89%	19.91%	19.92%	19.92%	19.92%
4	Mixed dry land agriculture	11.08%	11.08%	11.08%	11.08%	11.08%
5	Plantation	10.19%	10.34%	10.46%	10.46%	10.46%
6	Secondary Forest	6.97%	6.97%	6.94%	6.94%	6.94%
7	Plantation	2.28%	2.32%	2.43%	2.43%	2.43%
8	Open Land	0.74%	0.56%	0.35%	0.38%	0.38%
9	Shrubs	0.71%	0.79%	0.80%	0.80%	0.80%
10	Primary dryland forest	0.47%	0.47%	0.47%	0.47%	0.47%
11	Body of water	0.15%	0.15%	0.15%	0.12%	0.12%
12	Airport	0.11%	0.11%	0.11%	0.11%	0.11%
Total		100.00%	100.00%	100.00%	100.00%	100.00%

No	Water Use	Percentage
1	Irrigation	86.70%
2	Bulk Water	6%
3	Industry	2%
4	Municipal	0.30%
5	Maintenance	5%

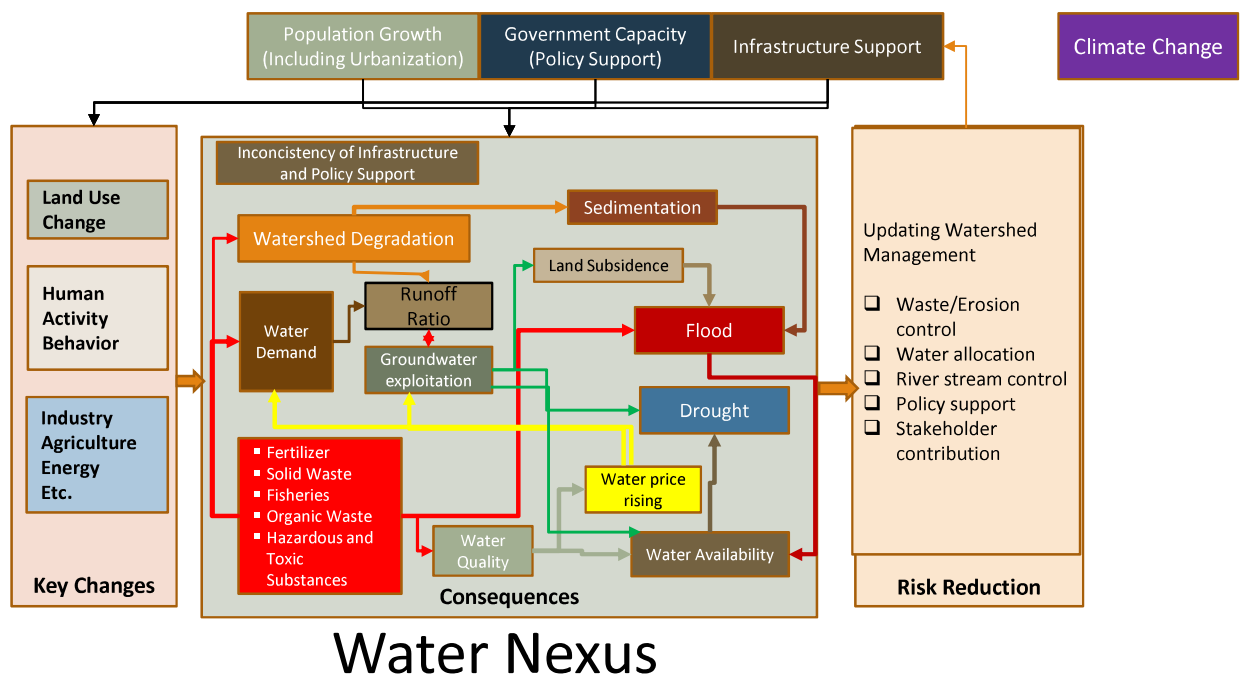
Source : BBWSC  
 Rencana Pengelolaan Sumber Daya Air Wilayah Sungai Citarum

# Updating River Management : Basic Concept of River Maintenance Flow



Basic Concept : Conservation (Collings, 1972, Bovee, 1982 Swanson et al., 1993, Palau, 1994; Tharme & King, 1998, Palau & Alcázar, 2012) & Disaster ( Harkunti et al 2008, msbadrik 2011)

## Updating : River Function, Water Nexus and Restoration



# River Function, Water Nexus and Restoration

---

## Water Nexus Key Parameter

- Water allocation for each activity
- Area allocation of each land use
- Appropriate ground water level range
- Standard Threshold of river water quality
- Erosion and suspended sediment rate threshold
- Solid waste restriction
- Acceptable flood and drought
- Population density and growth

# River Function, Water Nexus and Restoration

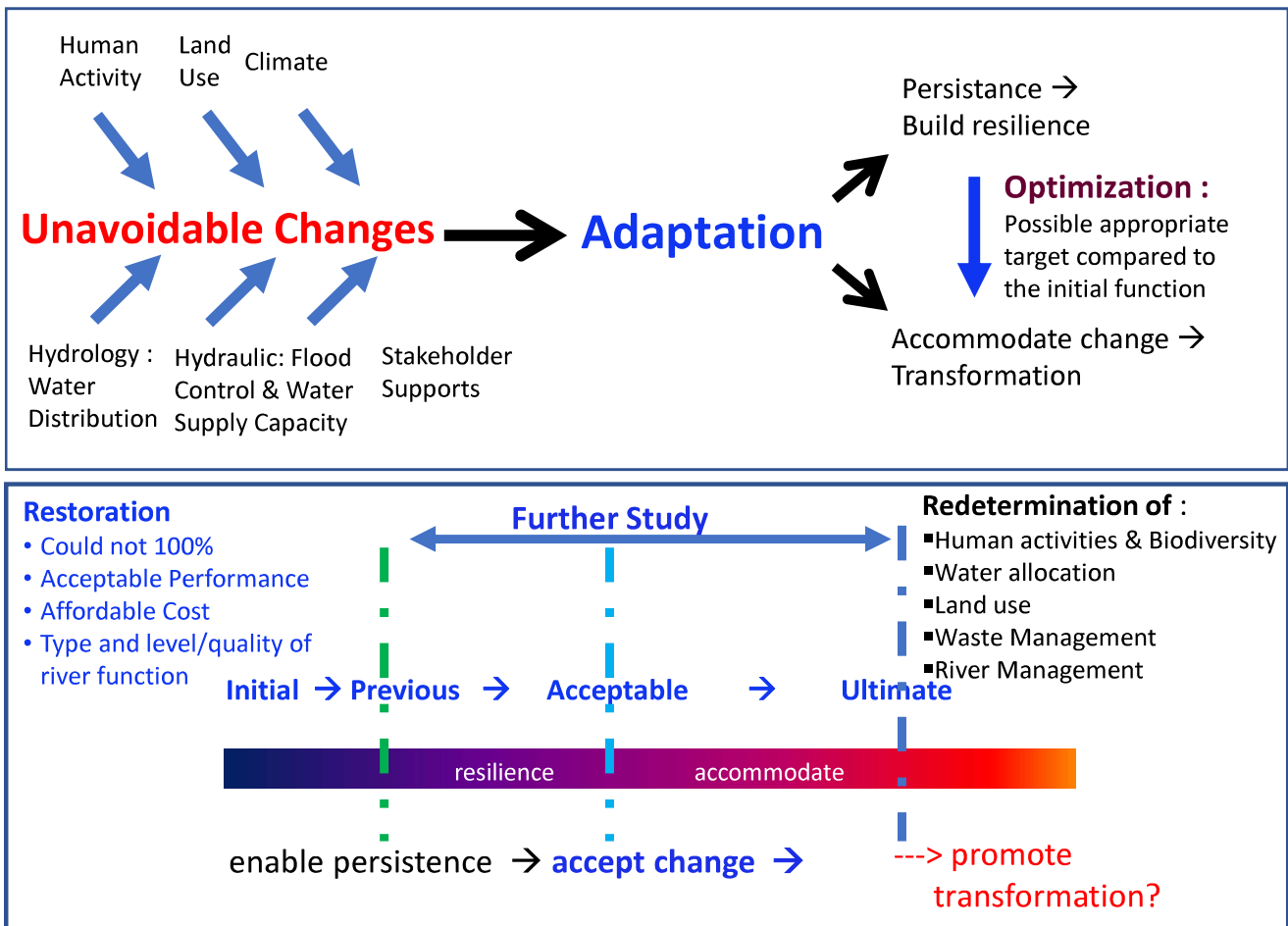
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## Restoration

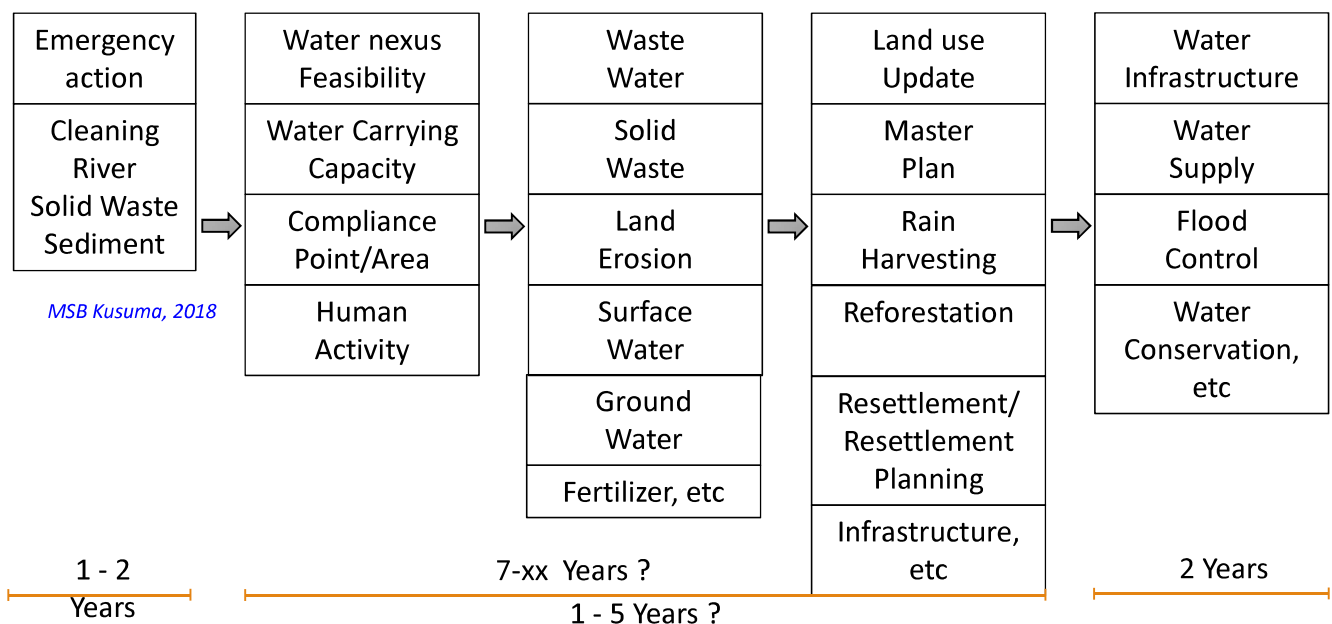
- Possible appropriate target compared to the initial function
- Type and level/quality of river function
- Redetermination of :
  - Ecosystem
  - Human activities
  - Water balance/allocation
  - Key parameter threshold
  - Land use
  - River Management System



# River Management Strategy : Restoration and Adaptation ?



## Watershed Management for River Restoration Staging Effort



# River Function, Water Nexus and Restoration



**Government mobilized army to clean Citarum River**

## Watershed Management for River Restoration Staging Effort



PRESIDEN  
REPUBLIK INDONESIA

PERATURAN PRESIDEN REPUBLIK INDONESIA

NOMOR 15 TAHUN 2018

TENTANG

PERCEPATAN PENGENDALIAN PENCEMARAN DAN KERUSAKAN

DAERAH ALIRAN SUNGAI CITARUM

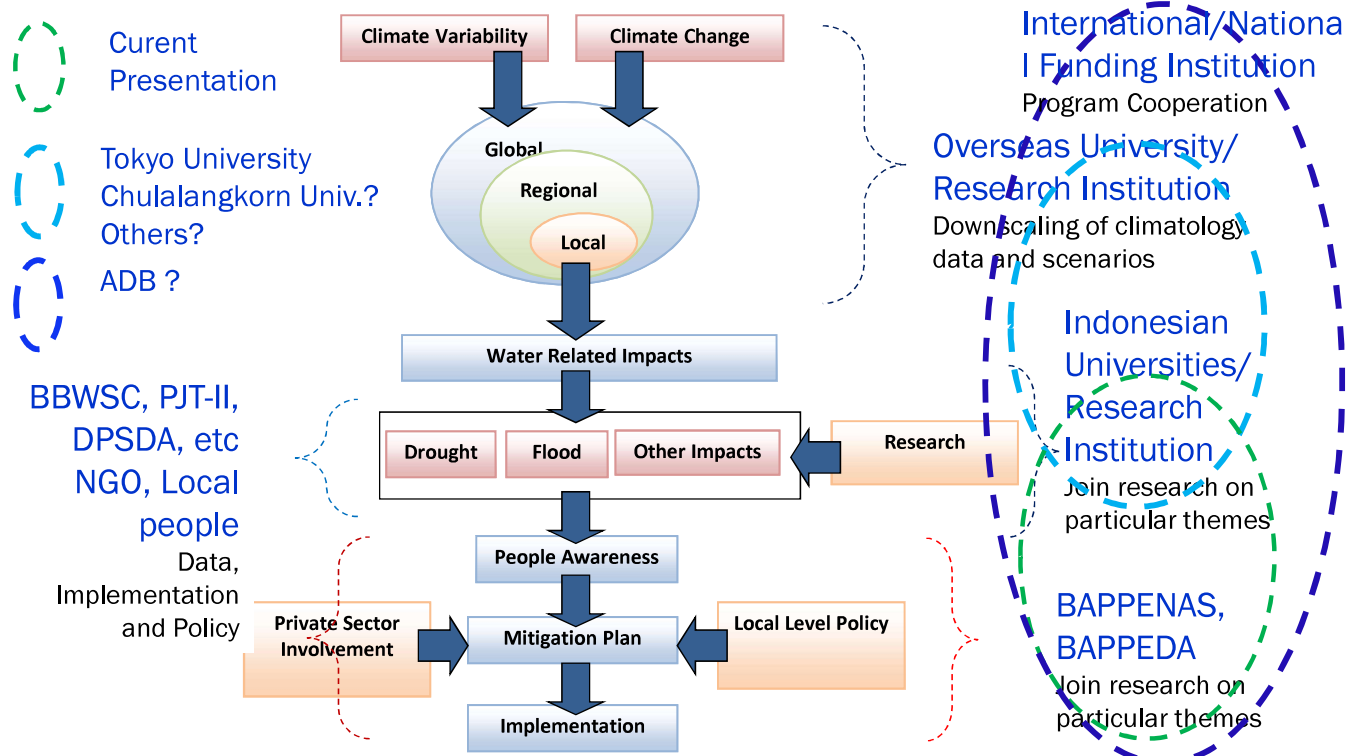
DENGAN RAHMAT TUHAN YANG MAHA ESA

PRESIDEN REPUBLIK INDONESIA,

*Presidential Decree for  
Citarum :*

- Emergency*
- Updating problem an potential solution*
- Addressing Improvement Policy for Current River Management*





► Kusuma, MSB, et.al, Water Res Eng, FCEE, ITB

Thank You  
Abrigado  
Terimah kasih