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Institute for the Advanced Study  
of Sustainability



**Water & Urban  
Initiative**

# Water quality modeling to assess Ciliwung River pollution in Jakarta, Indonesia

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(UNU-IAS Postdoctoral Fellow)

March 14, 2016

# Background

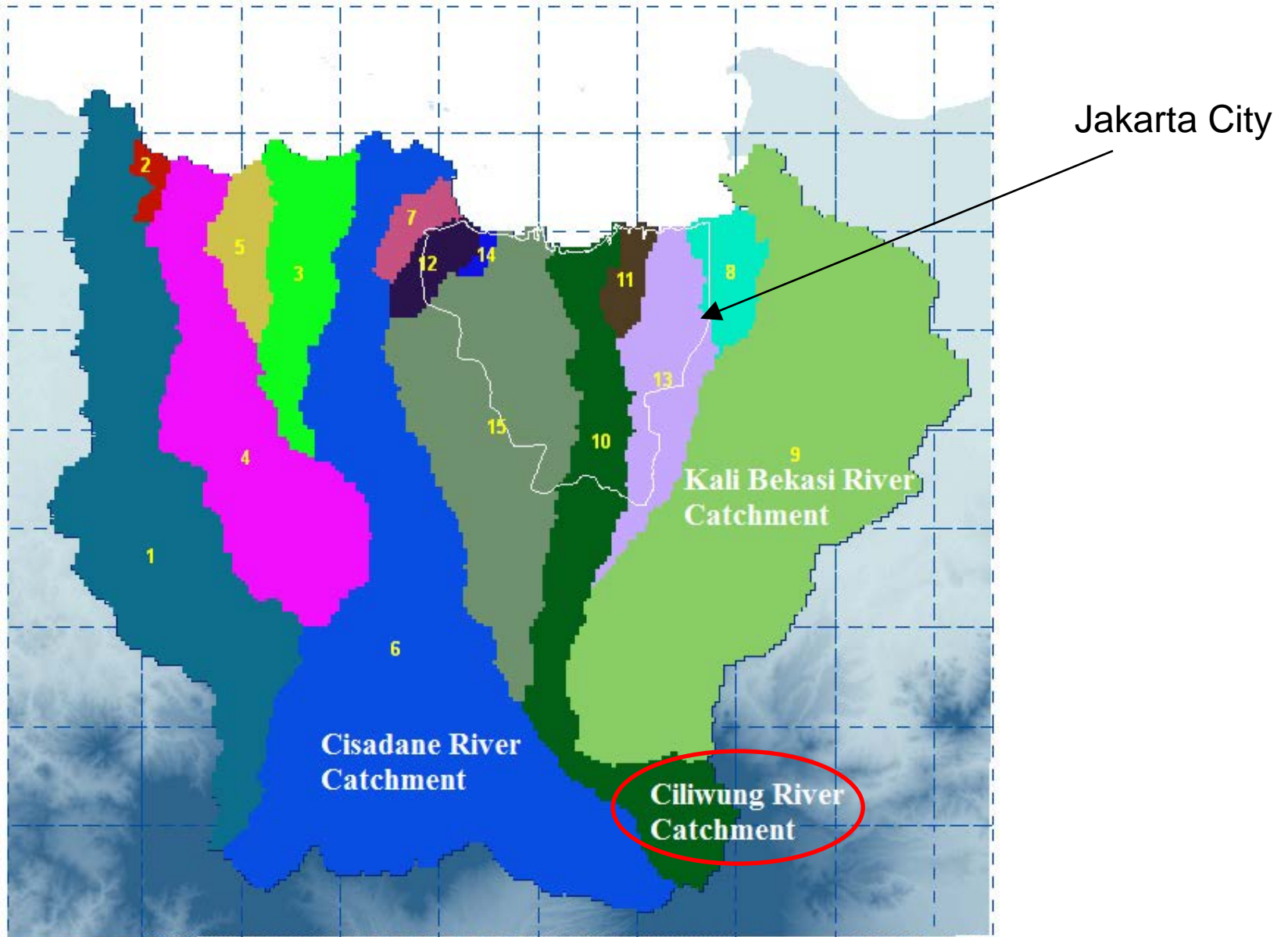
- Sources of pollution of surface water crossing Jakarta:
  - Water from households, commercial buildings
  - Discharges from industries
  - Pesticide and fertilizer run-off from agricultural land
  - Solid waste
  - Fecal matter from overflowing or leaking septic tanks
- Ciliwung River catchment is the biggest river intersecting the Jakarta Province.
- This research work was focused on Ciliwung River catchment in Jakarta to study the current trend of changes in the level of water quality parameters along the river using WEAP (Water Evaluation And Planning) model.

# Background



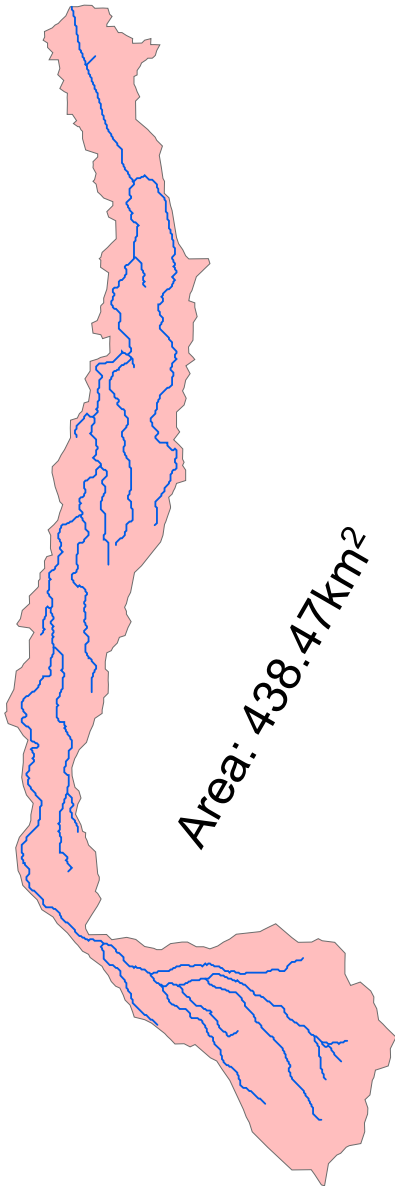
- Highly flexible hydrologic-water quality model and largely used for integrated water resources planning and management.
- GIS-based, graphical drag & drop interface
- Mass balance equations are the foundation of WEAP model
- Scenario management capabilities

# Study Area



River Catchments in the Jabodetabek Region

# Study Area



Ciliwung River West Canal

Sebelum Pintu Air Manggarai WQ Stn

WWTP covered area = 13.93km<sup>2</sup>

Intake PAM Condet WQ Stn

0km<sup>2</sup>

Sugutamu Gauging Stn

Kp Kelapa Gauging Stn

km<sup>2</sup>

Total: 389.77km<sup>2</sup>

km<sup>2</sup>

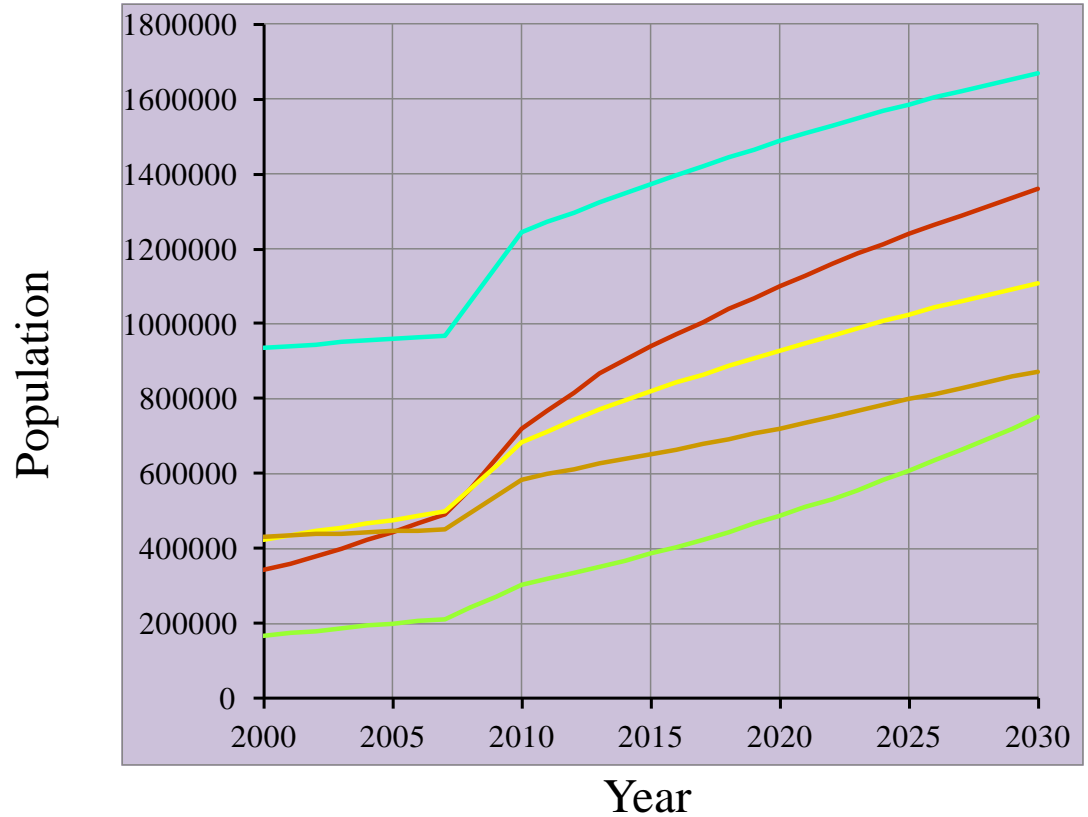
Katulampa Gauging Stn

152.63km<sup>2</sup>

**Ciliwung River Catchment**

# Study Area

## Population



CA5

CA4

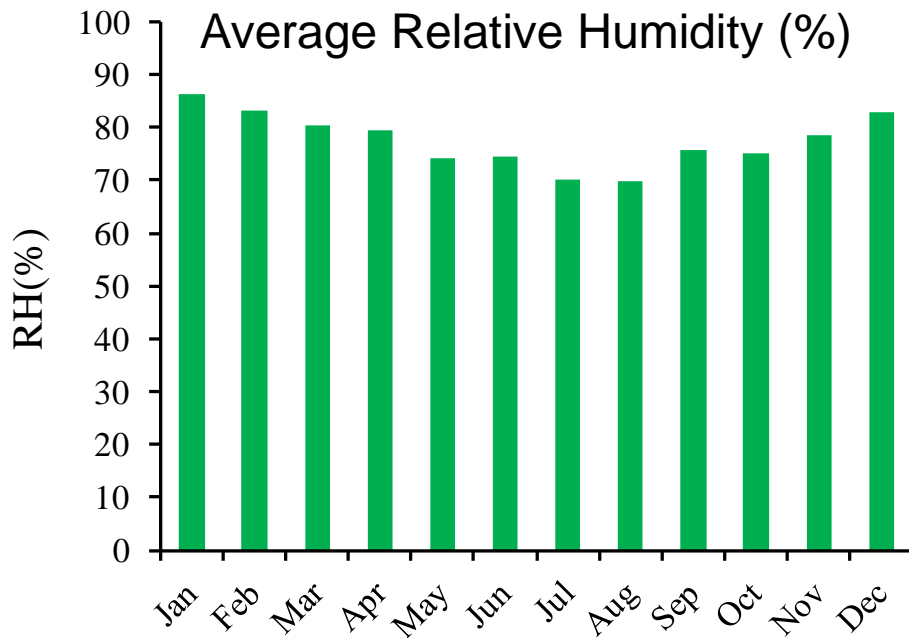
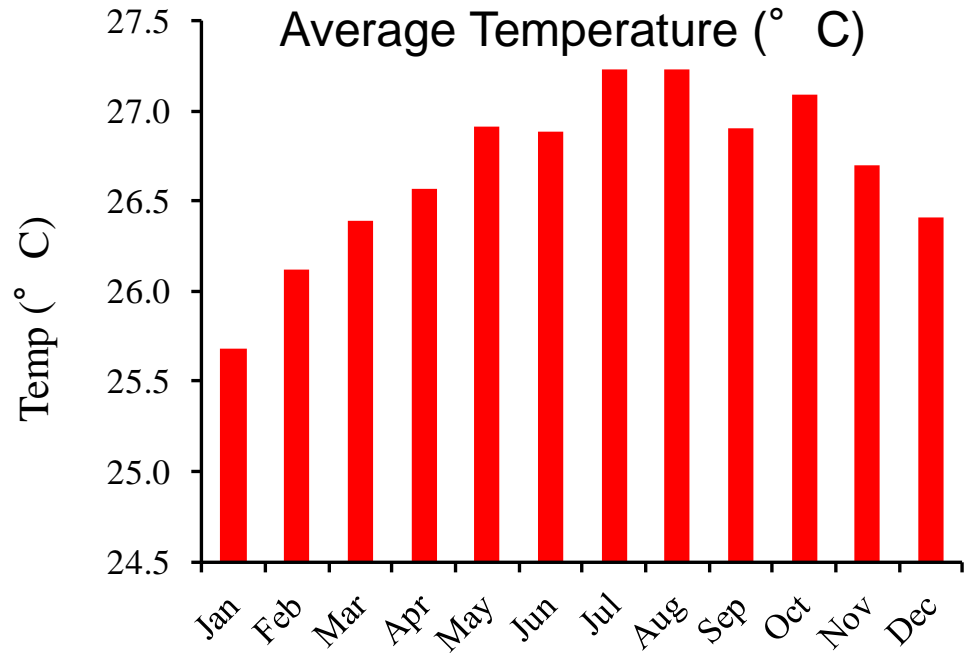
CA3

CA2

CA1

Year	CA1	CA2	CA3	CA4	CA5
2000	167,081	341,593	424,851	431,276	937,694
2007	212,372	491,636	499,155	449,467	966,153
2010	301,390	719,690	683,279	584,649	1,244,221
2015	386,463	938,731	819,270	652,527	1,373,714
2020	487,259	1,100,199	928,130	721,519	1,487,356
2030	752,479	1,358,621	1,108,621	873,167	1,667,095

# Meteorological Data



Max = 27.23° C  
Min = 25.68° C

Max = 86.34%  
Min = 69.71%

# WEAP interface

WEAP: Ciliwung\_River\_Basin

Area Edit View Schematic General Advance

Schematic

- River (1)
- Diversion
- Reservoir
- Groundwater (4)
- Other Supply
- Demand Site (4)
- Catchment (4)
- Runoff/Infiltration (4)
- Transmission Link (4)
- Wastewater Treatment Plant (1)
- Return Flow (6)
- Run of River Hydro
- Flow Requirement
- Streamflow Gauge (5)

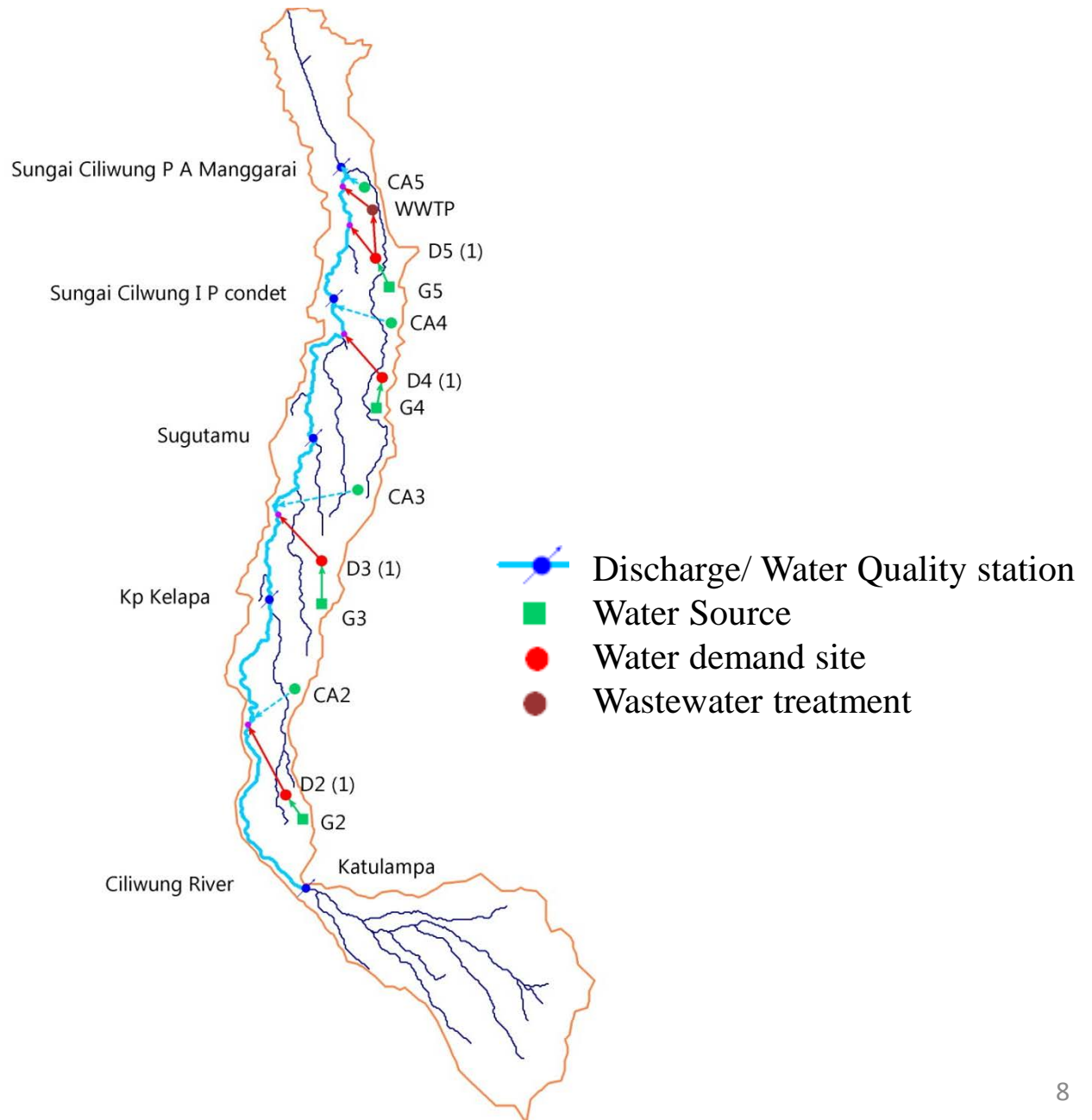
Data

Results

Scenario Explorer

Notes

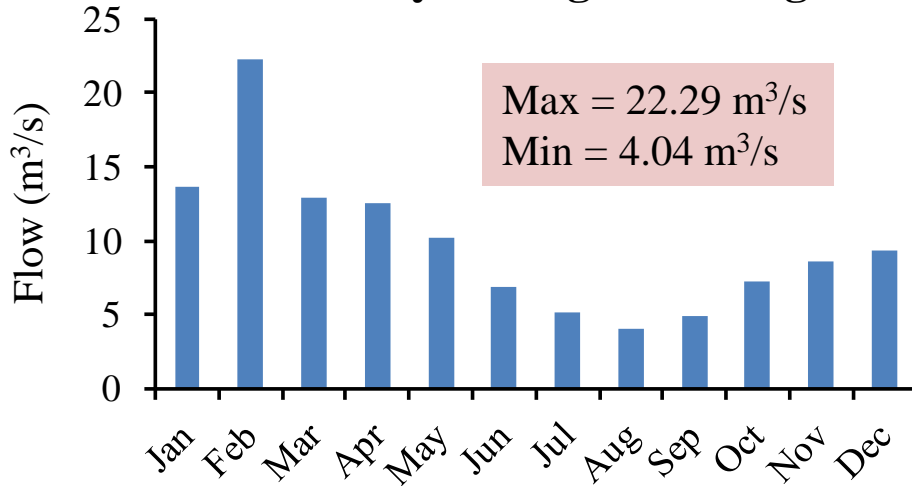
- CW\_Basin\_Boundary
- Ciliwung\_River
- Major Rivers
- Cities



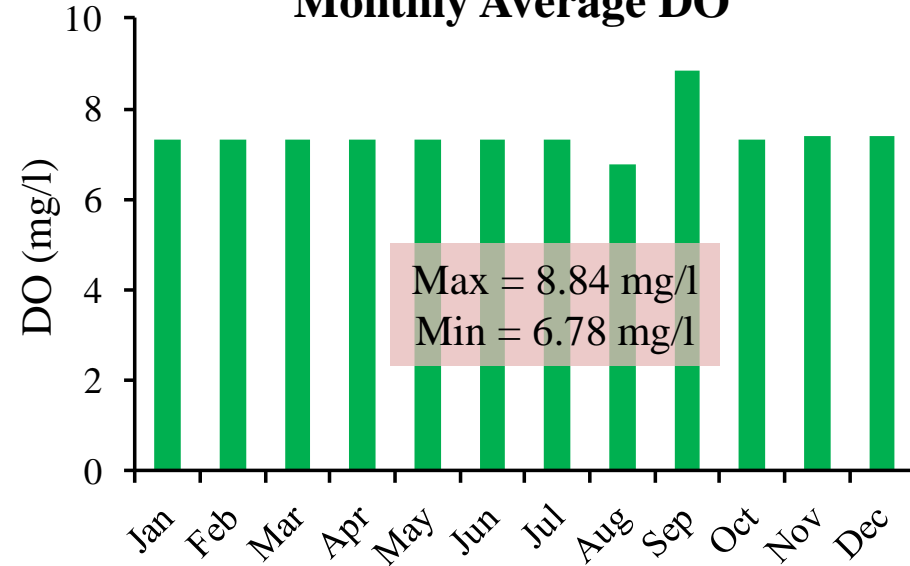


# Head In-flow Conditions

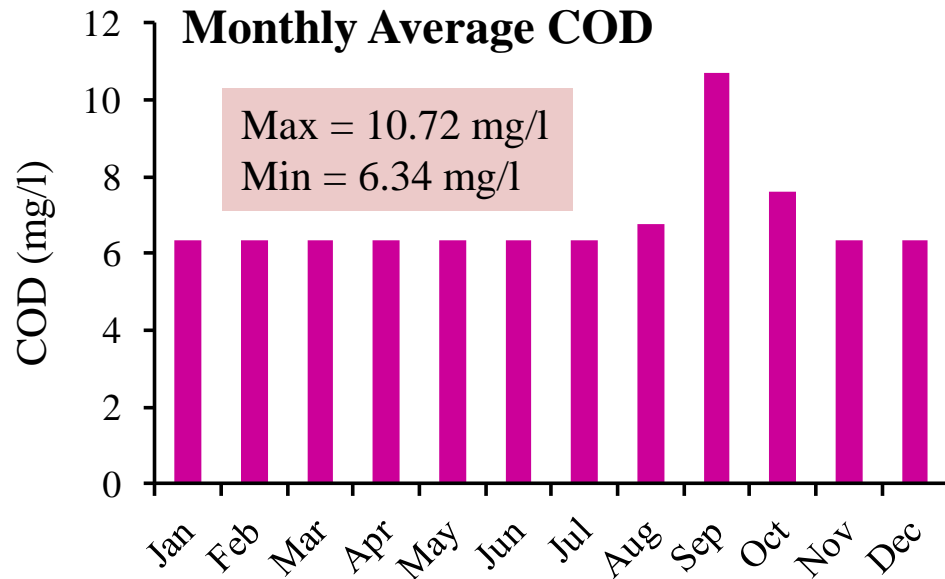
## Monthly Average Discharge



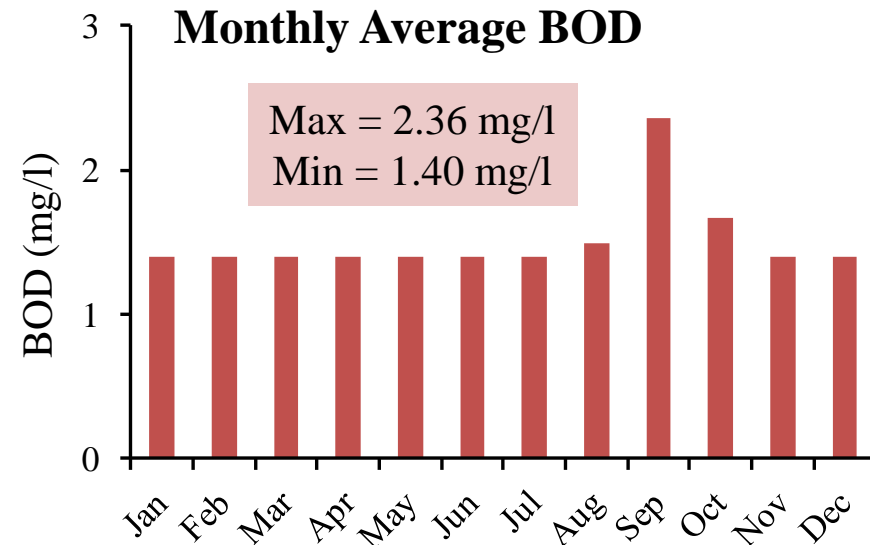
## Monthly Average DO



## Monthly Average COD

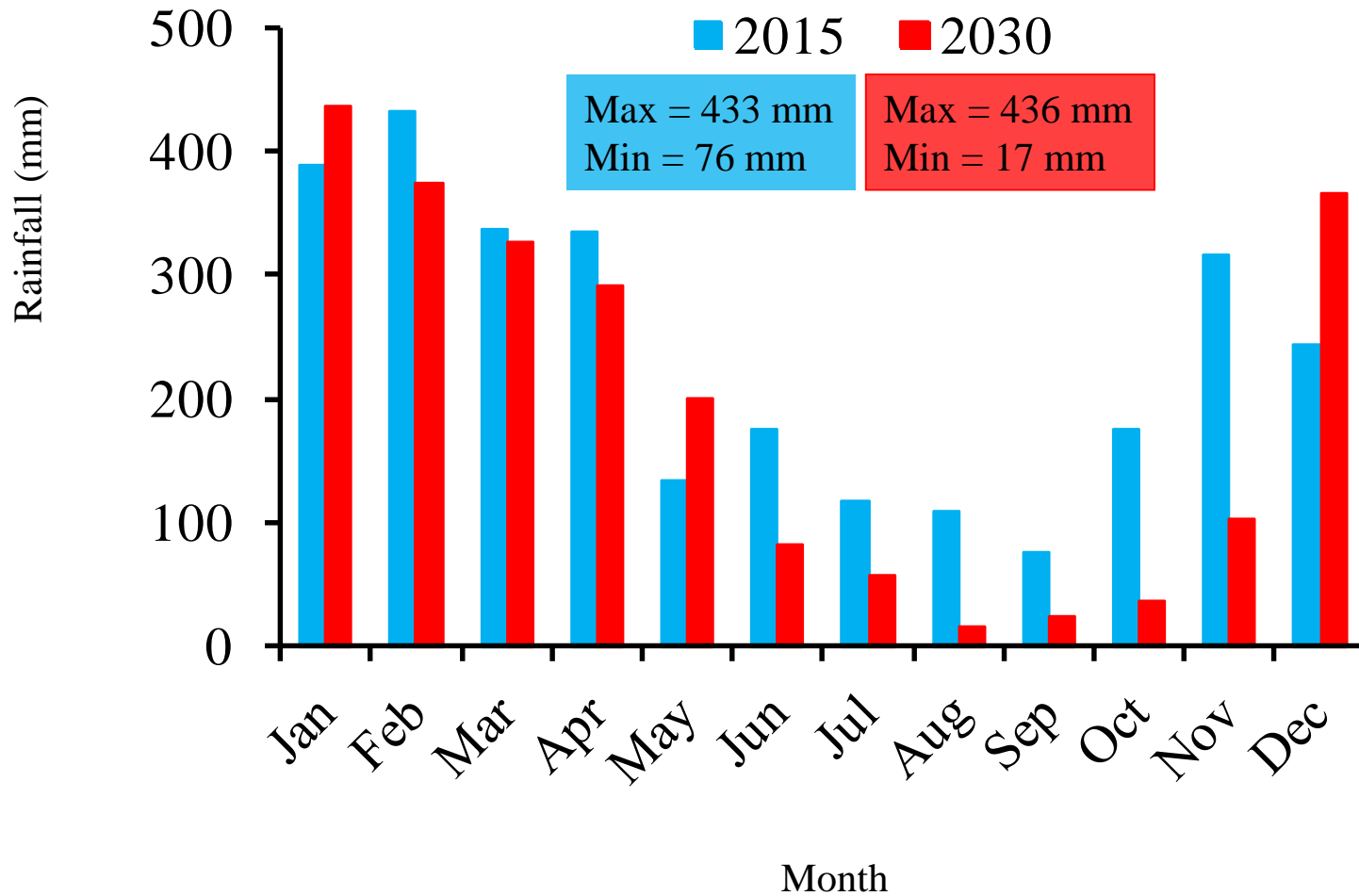


## Monthly Average BOD



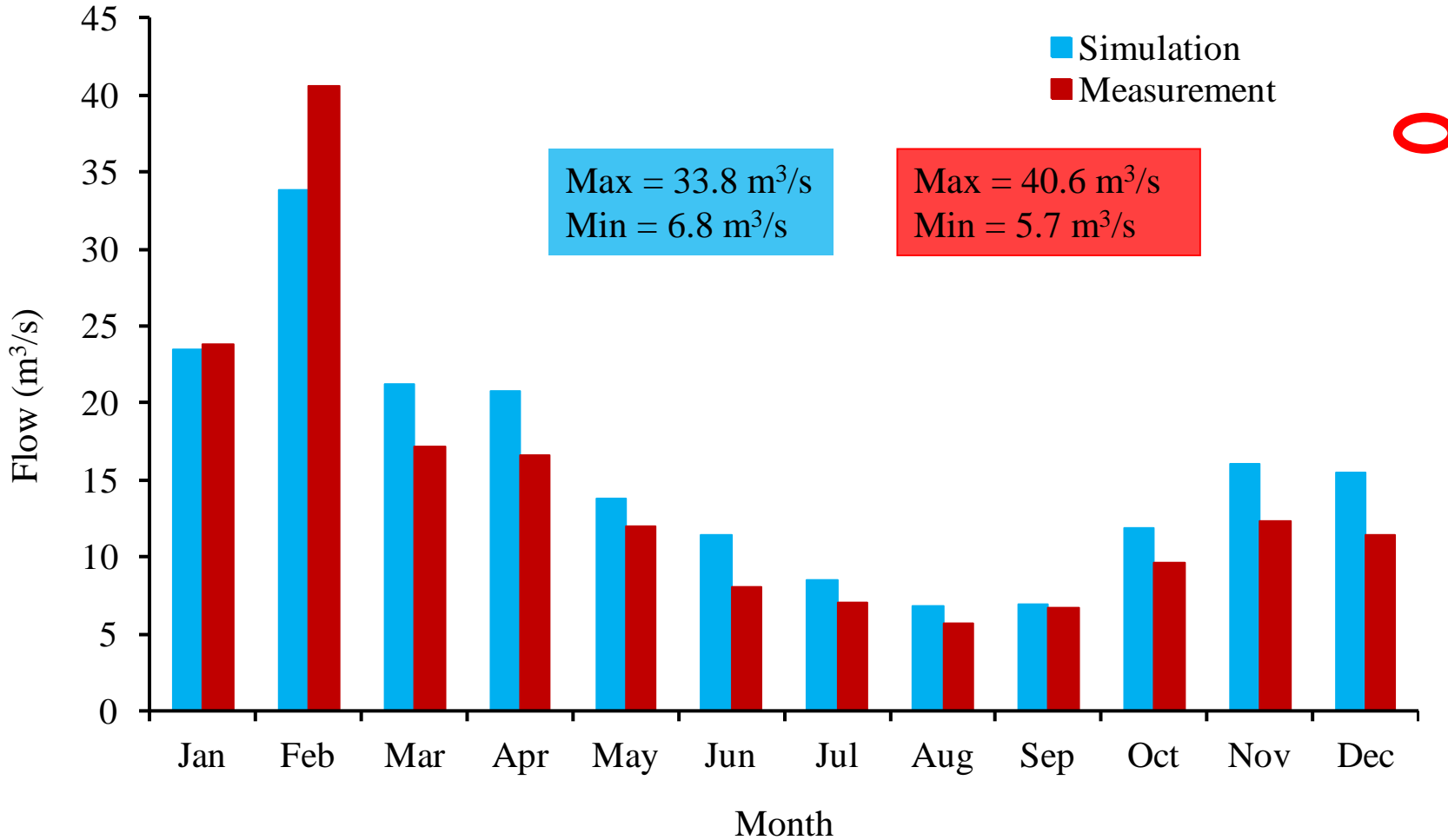
WQ parameters were approximated as per the data presented in  
“[http://hywr.kuciv.kyoto-u.ac.jp/ihp/riverCatalogue/Vol\\_05/3\\_Indonesia-11.pdf](http://hywr.kuciv.kyoto-u.ac.jp/ihp/riverCatalogue/Vol_05/3_Indonesia-11.pdf)”

# Rainfall Conditions



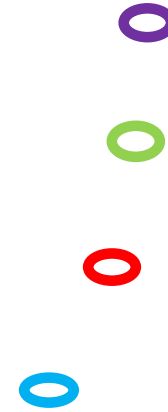
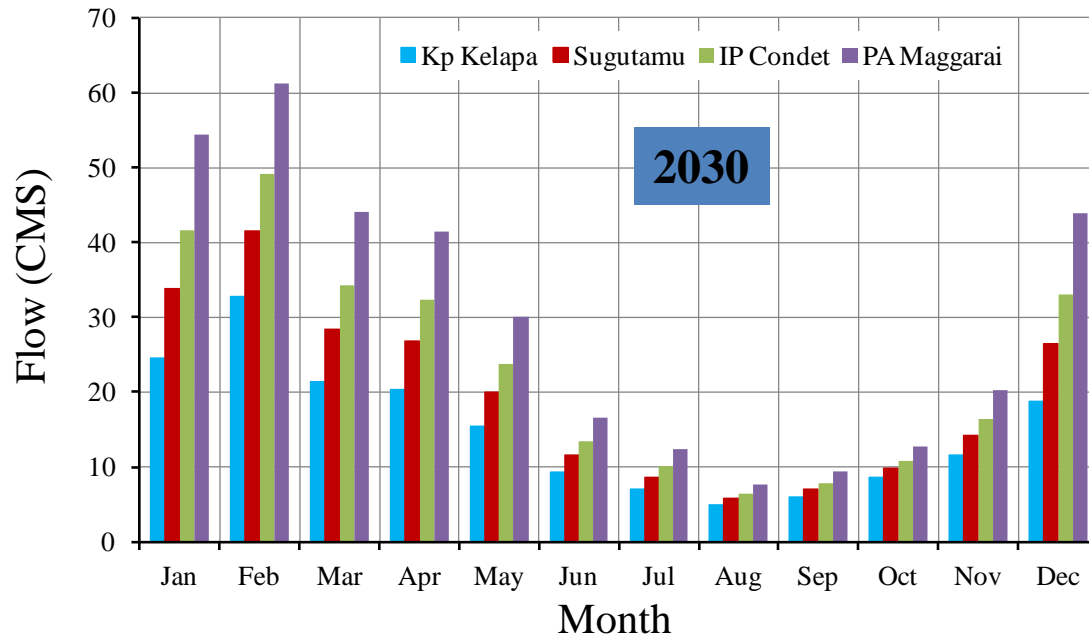
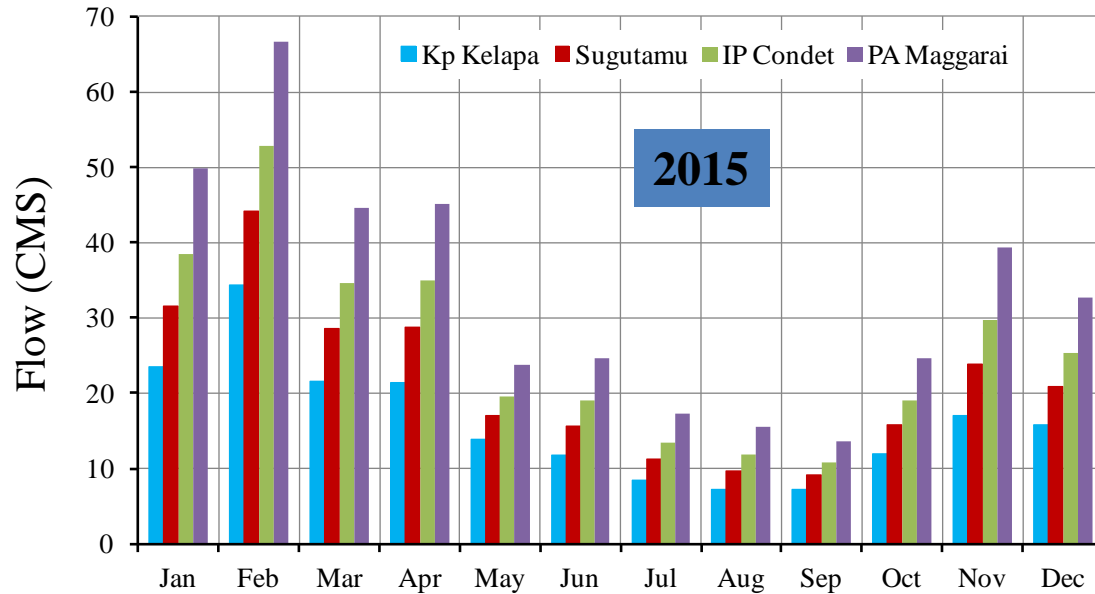
# Results

## Average monthly discharge at Kp Kelapa station (2000-2007)



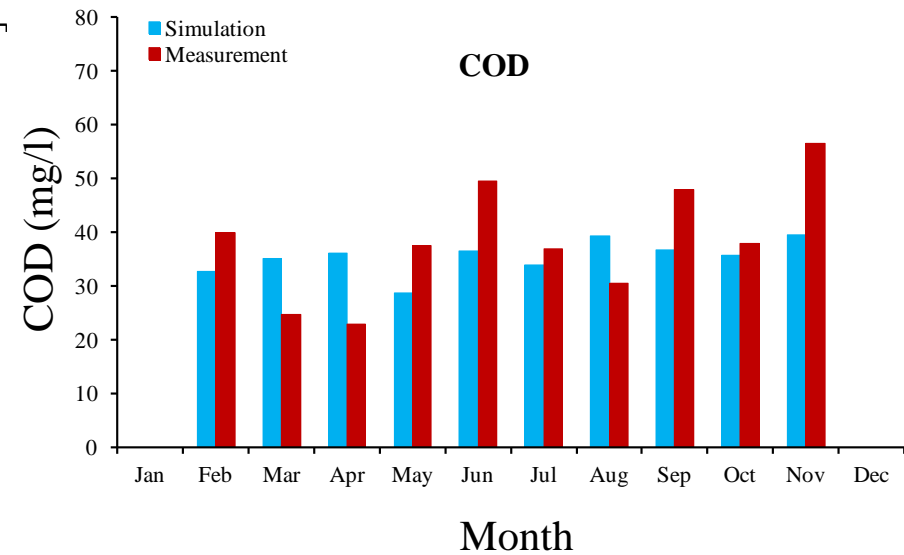
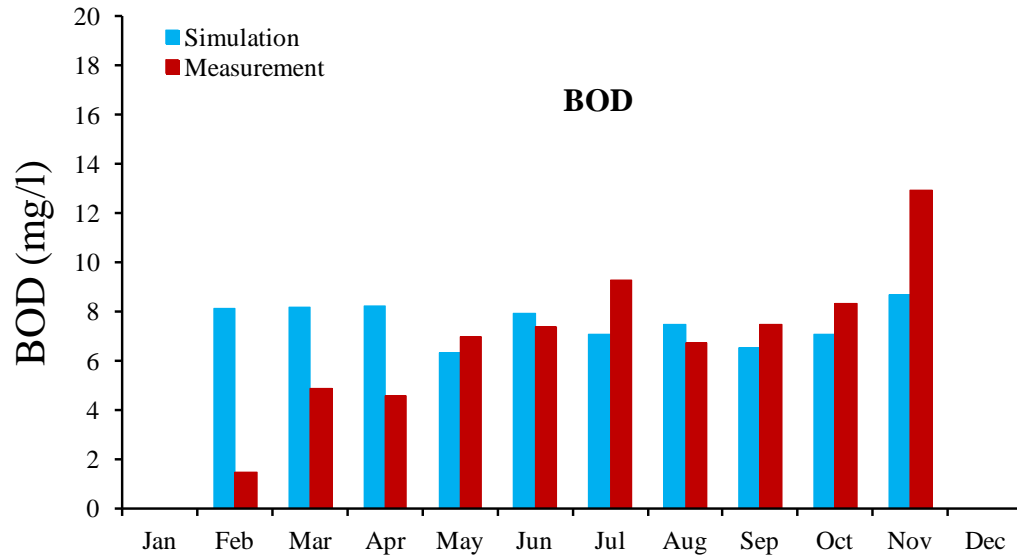
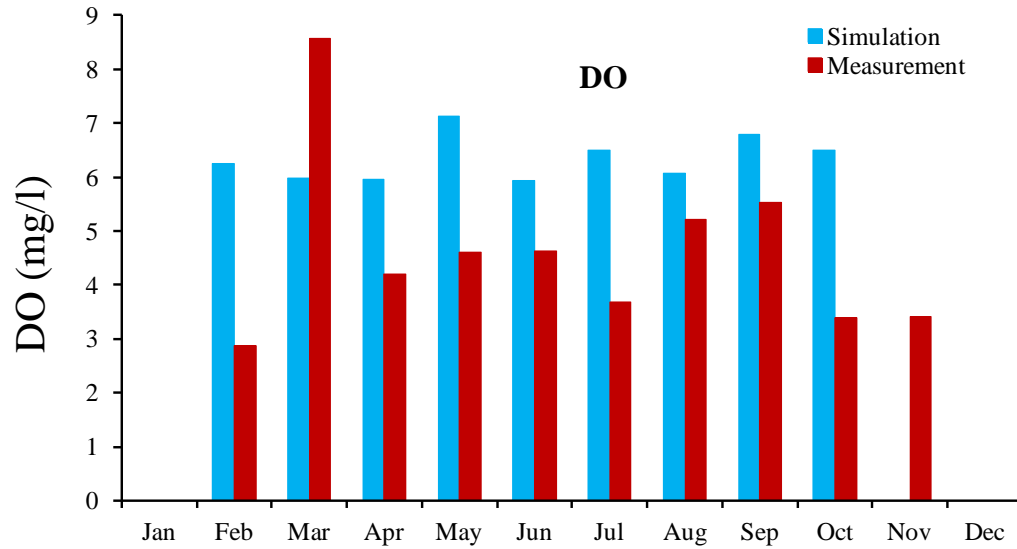
# Results

## Discharge at different stations (simulation)



# Results

## Water quality parameters at Intake PAM Condet (2008-2014)

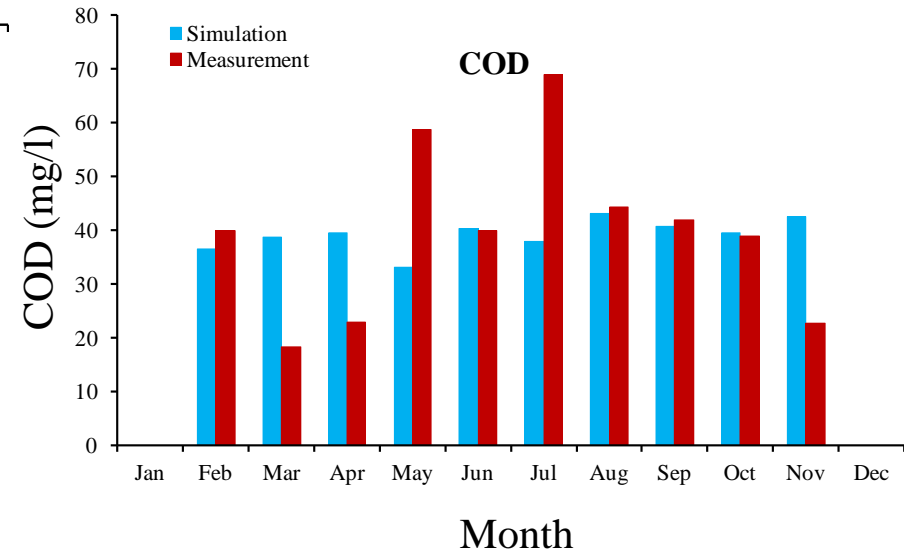
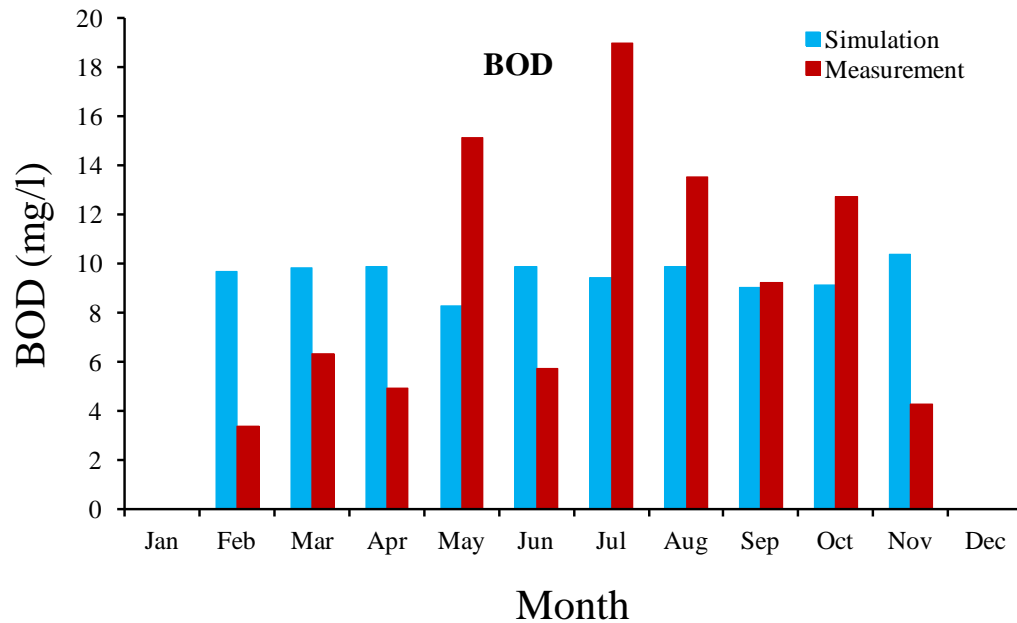
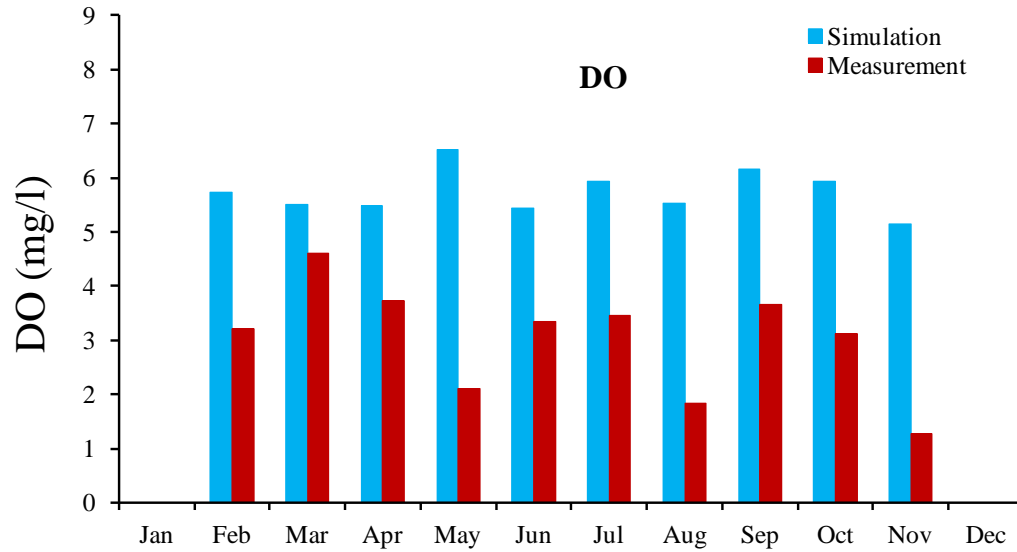


Month

# Results

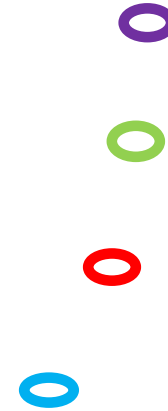
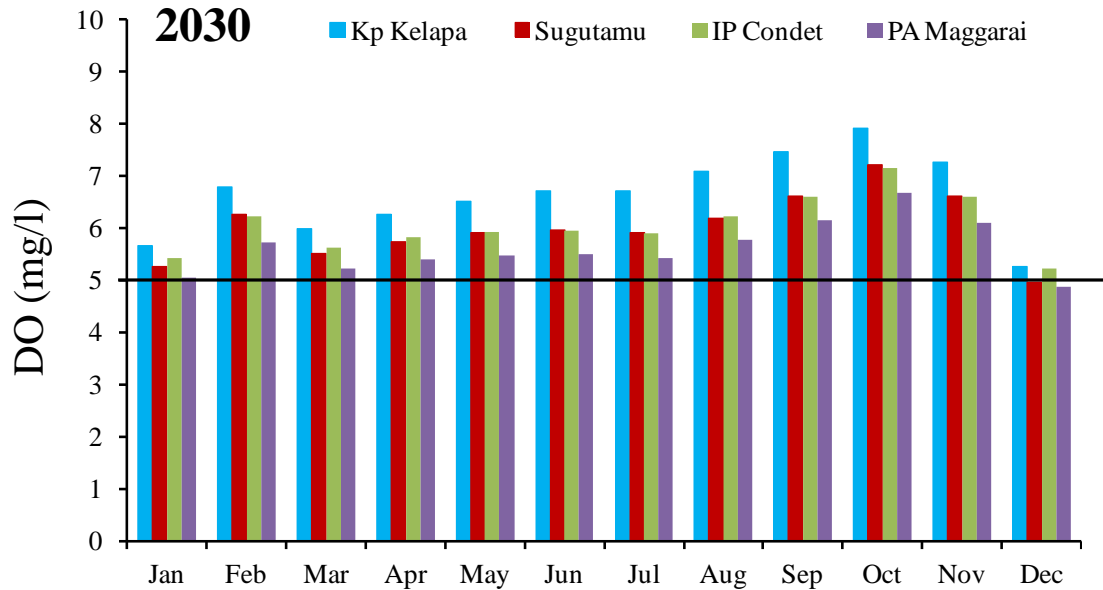
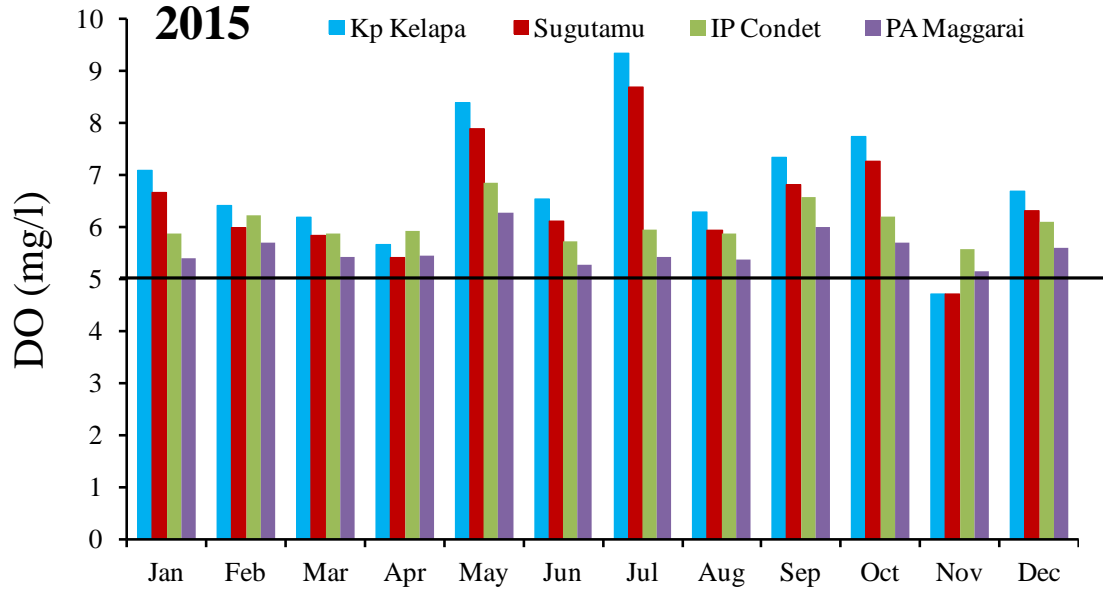


## Water quality parameters at Sebelum Pintu Air Manggarai (2008-2014)



# Results

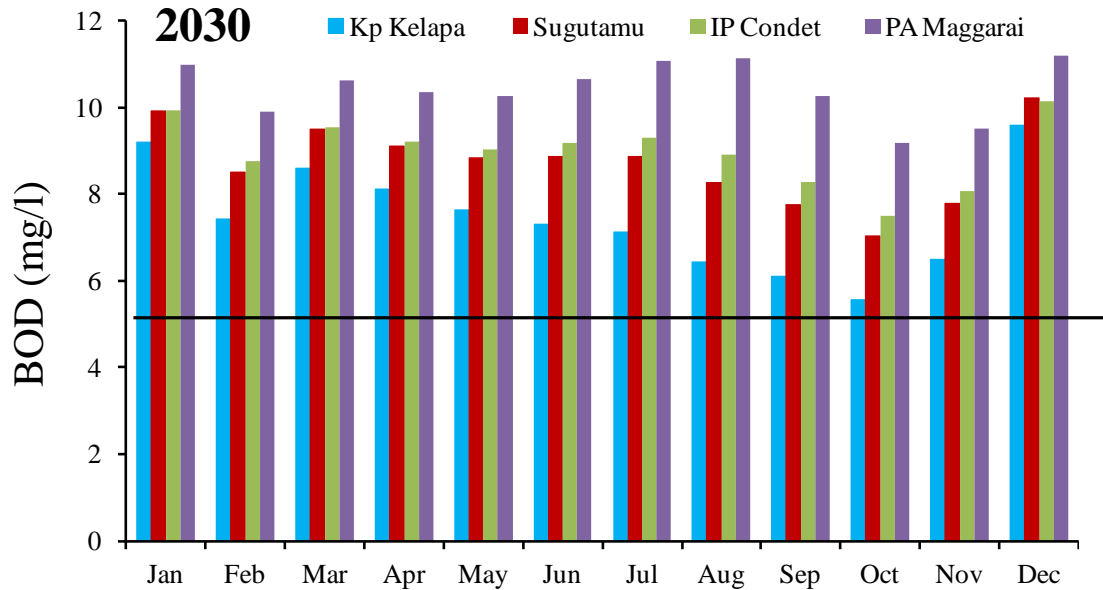
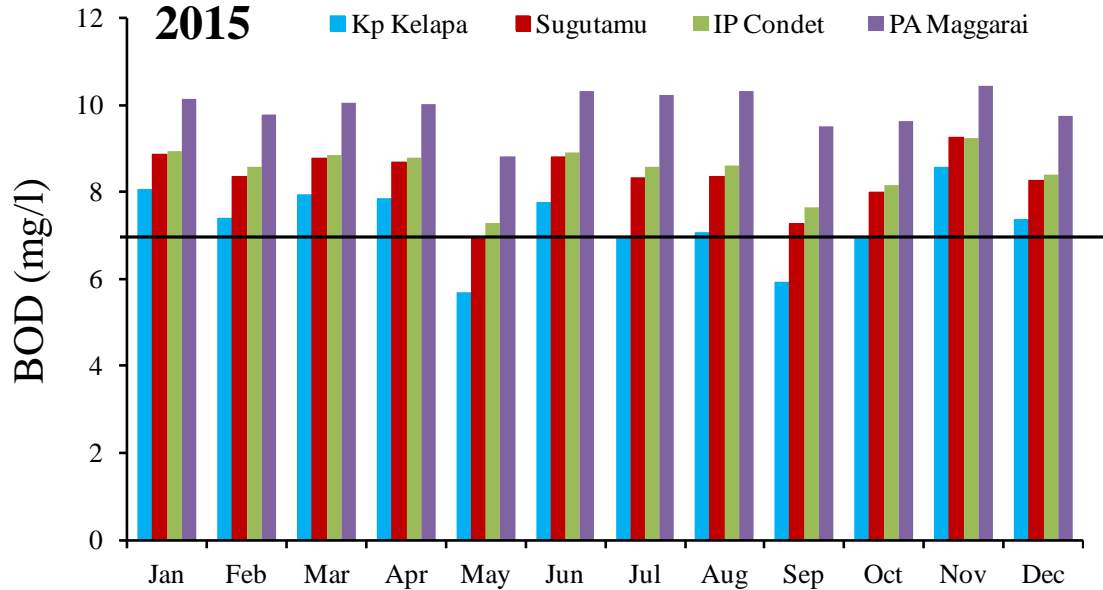
## DO at different stations (simulation)



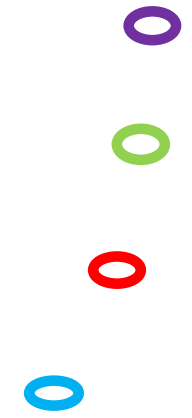
DO < 5mg/l considered as not suitable for aquatic life

# Results

## BOD at different stations (simulation)



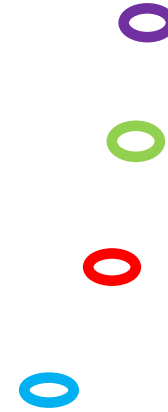
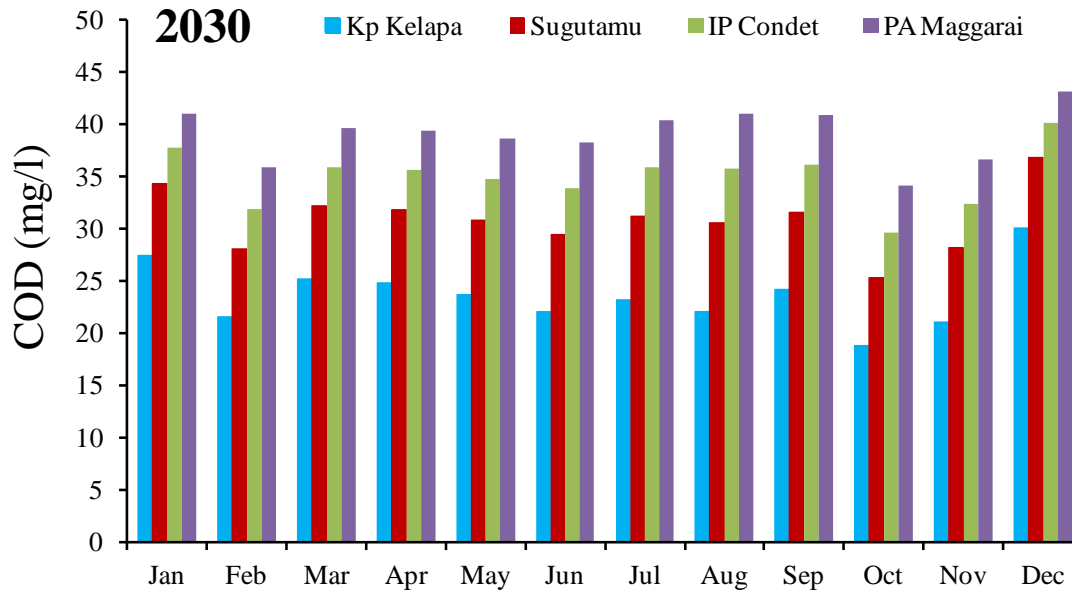
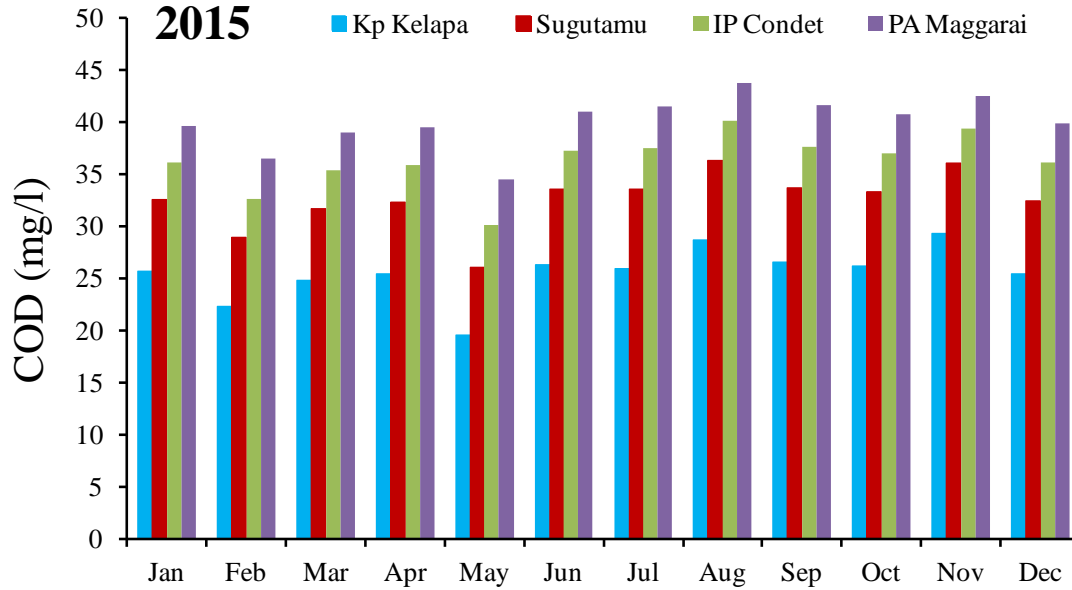
BOD > 7mg/l considered as not suitable for aquatic life





# Results

## COD at different stations (simulation)



- The simulation results show that the pollution level of the Ciliwung River is high and not suitable for aquatic life.
- Alternative baseline scenarios can examine vulnerability of water qualities to different demographic, technological, & climatological/hydrological futures.

*THANK YOU VERY MUCH FOR YOUR KIND  
ATTENTION!*