

6th EWA / JSWA / WEF Joint Conference  
„The Resilience of the Water Sector“  
15-18 May 2018, Munich, Germany



# Restoration of Sendai Sewerage Service from the Great East Japan Earthquake and Disaster- prevention Measures for the Future

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City of Sendai, Japan  
May-16, 2018



# Overview of Sendai city

- Population: Over 1,000,000
- Political and economic center of Tohoku
- Green Modern City



**Sendai City**

## Sendai Wastewater Utility (SWU)

- A part of Sendai City
  - 118 years, 3rd oldest service in JPN
  - Service area: 19,000 hectares
  - Sewer and channel: over 4,500 km
  - 5 WWTPs, Minami-Gamo (MGWWTP), biggest
-

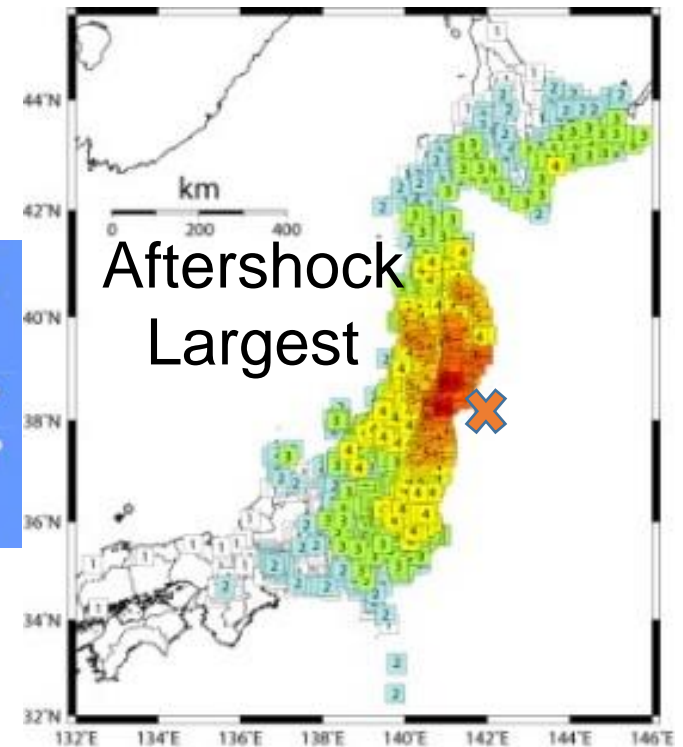
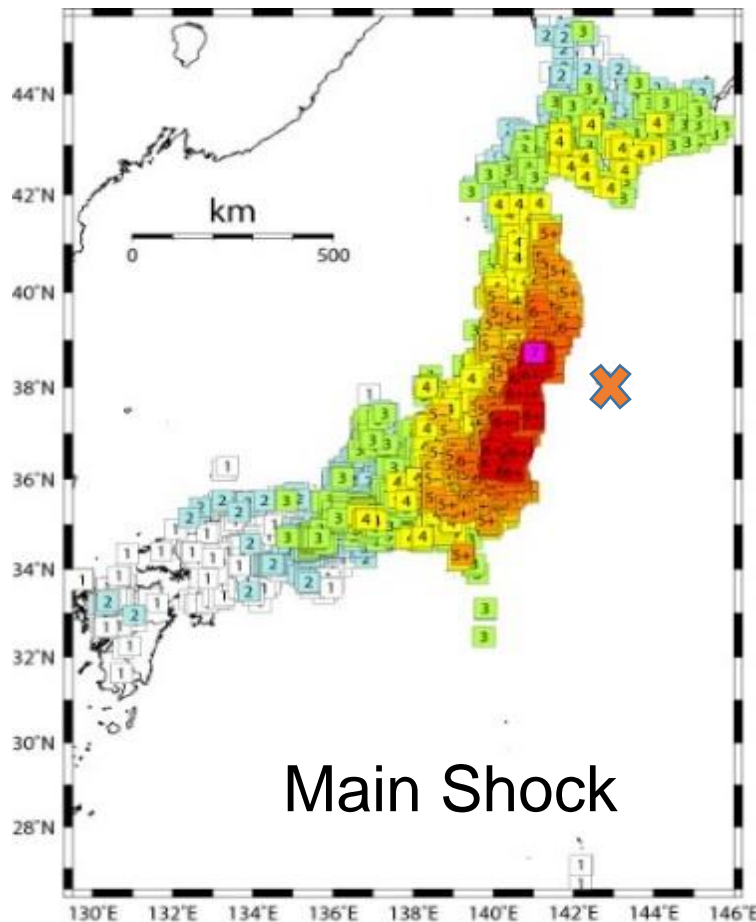
# Outline of the Great East Japan Earthquake

- 11<sup>th</sup> March 2011
- Magnitude 9.0
- Epicenter: Sanriku offshore
- Killed: 19,630



**Source:** Fire Disaster Management Agency  
<http://www.fdma.go.jp/bn/higaihou/pdf/jishin/157.pdf>

# Main shock and largest aftershock



Source: Japan Meteorological Agency web site

# Damaged Sewerage Facilities in SWU

- Sewer
  - 102km / 4,578km, damaged/total SWU asset
- Pumping stations and WWTPs
  - 98place / 330place
- Money lost
  - 650 million dollars, 590 M\$ just for MGWWTP!



# Sewers damaged by earthquake



Manhole lifted by liquefaction



PVC pipe collapsed



# Pumps destroyed by quake and tsunami



Inclined building by quake



Inside of PS





## Three priorities of immediate response

1. Securing toilet for citizens
2. Maintaining sanitation
3. Preventing pollution



- SWU continued sewer service even after the quake.



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# Newly Built MGWWTP (Cap 400,000m<sup>3</sup>/day )



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# Tsunami hit MGWWTP

[https://www.youtube.com/watch?v=Lf\\_kukC7UUQ](https://www.youtube.com/watch?v=Lf_kukC7UUQ)



The moment of tsunami

From 4 story admini. bld.

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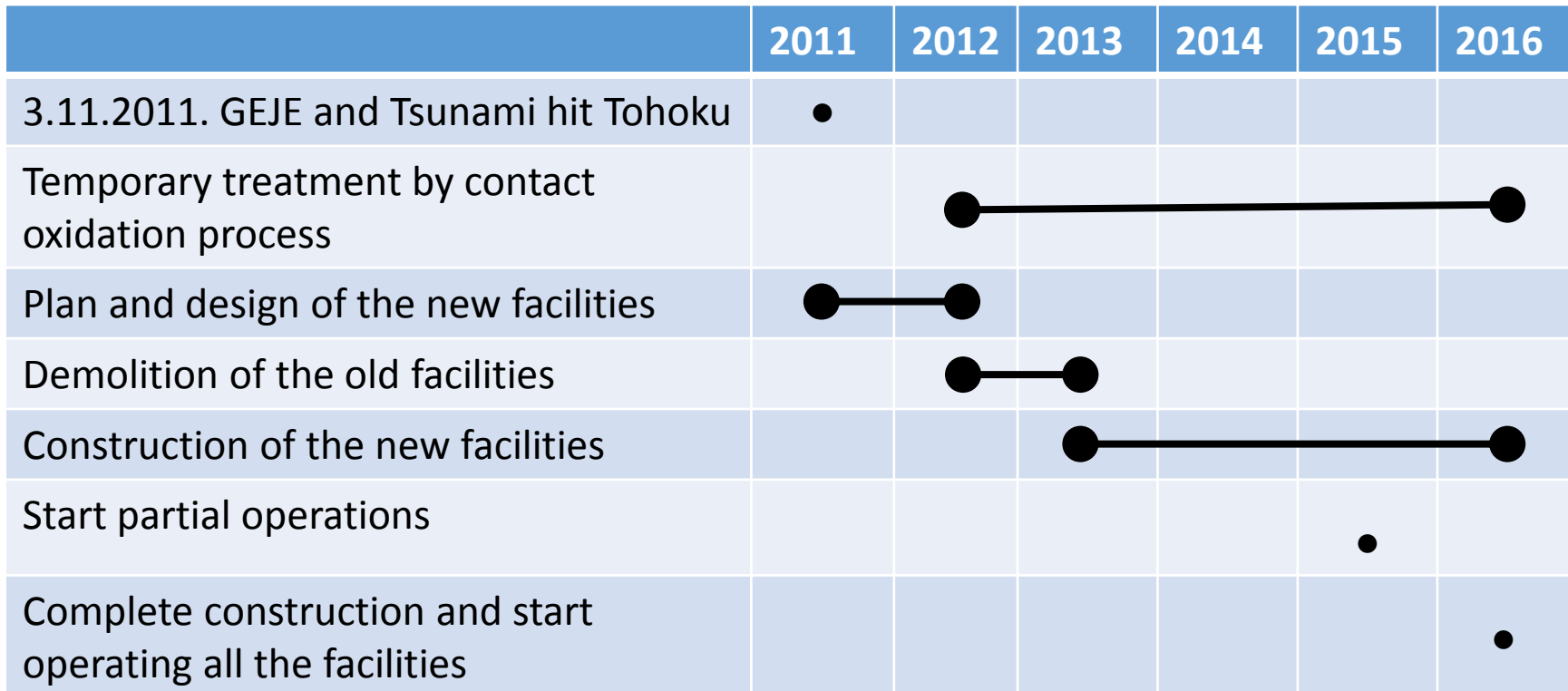
## Damages by Tsunami



PS building's wall, yielded

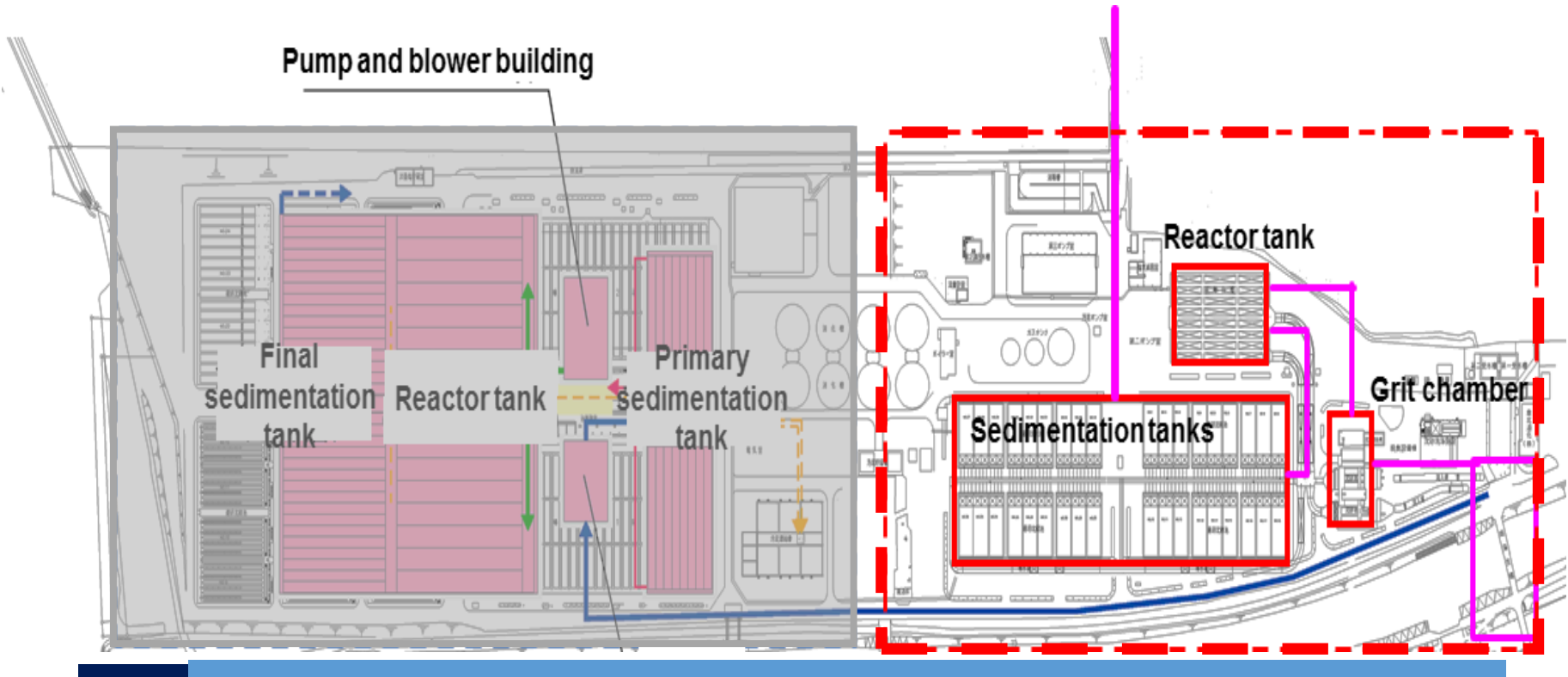
Primary sedimentation tank

# Recovery project

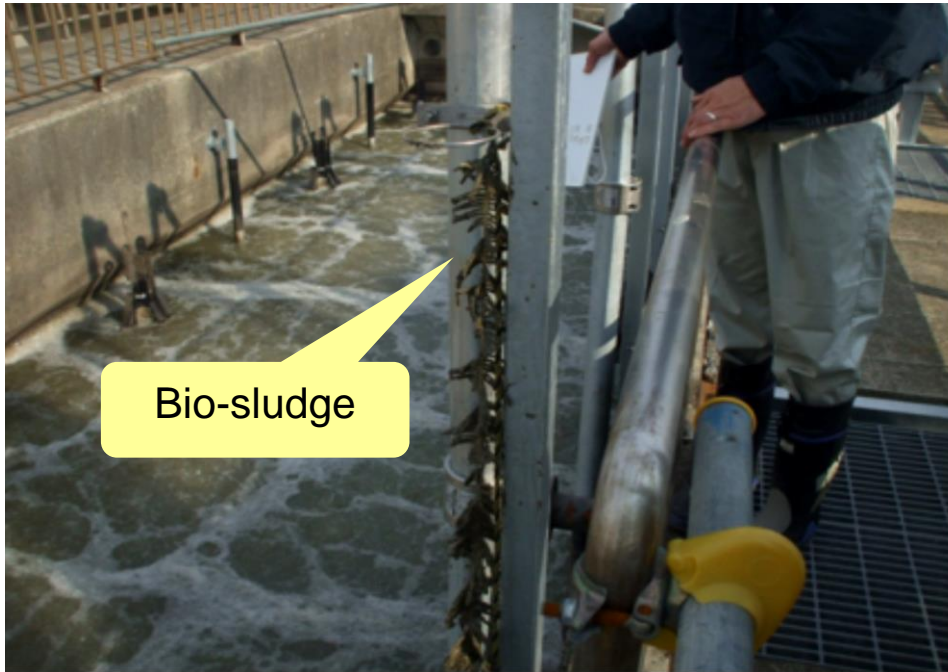


# The temporary wastewater treatment facilities

- Existing pre-aeration tanks were converted to temp reactor

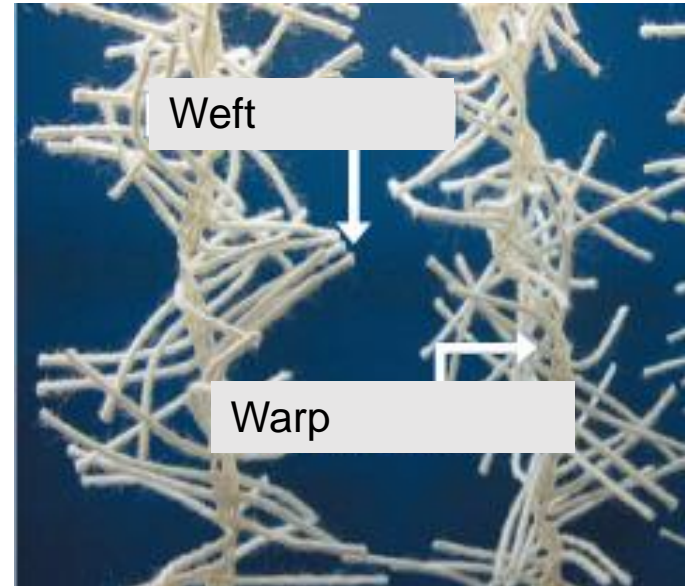


# Contact oxidation process with fiber media



Bio-sludge

State of fiber media with biofilm attached

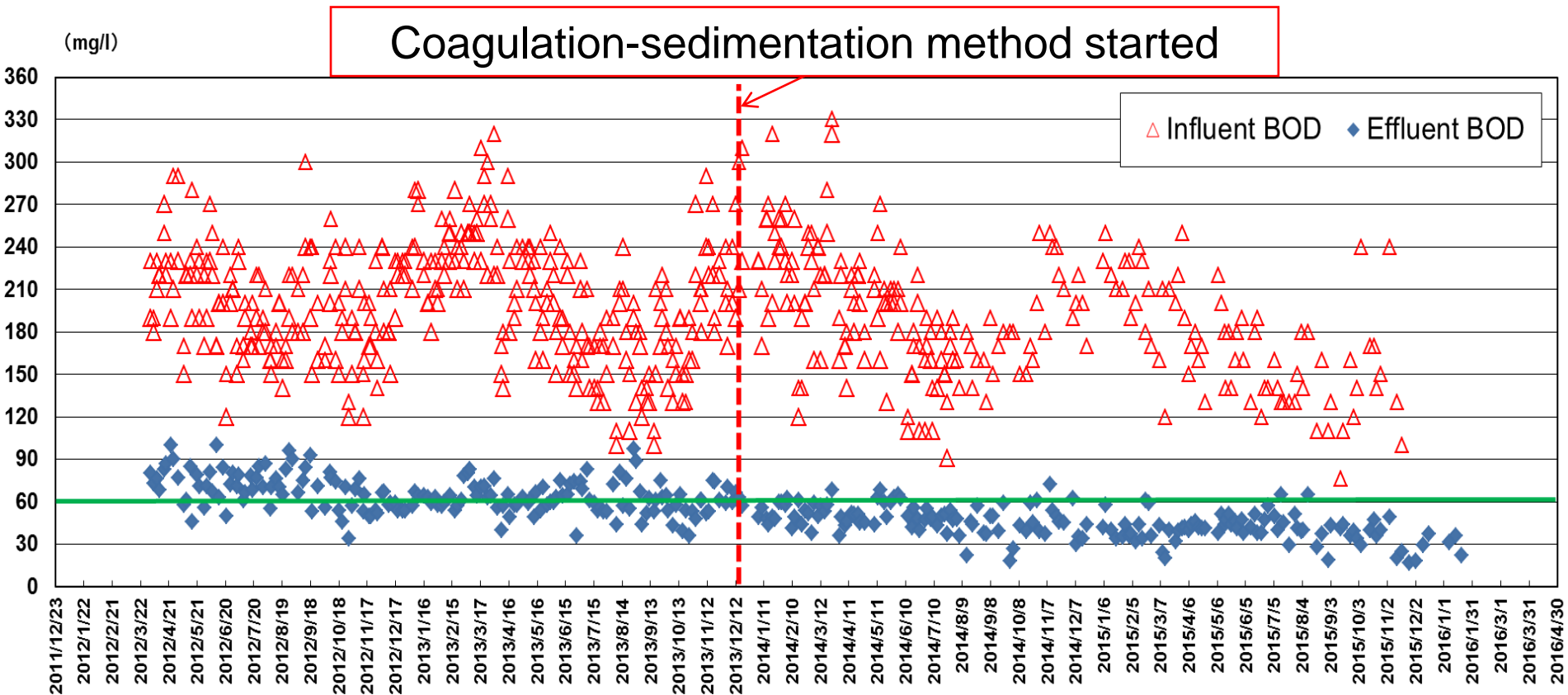


Weft: Acrylic yarn with excellent  
adhesion of sludge

Warp: Polyester-based yarn that does  
not easily adhere sludge

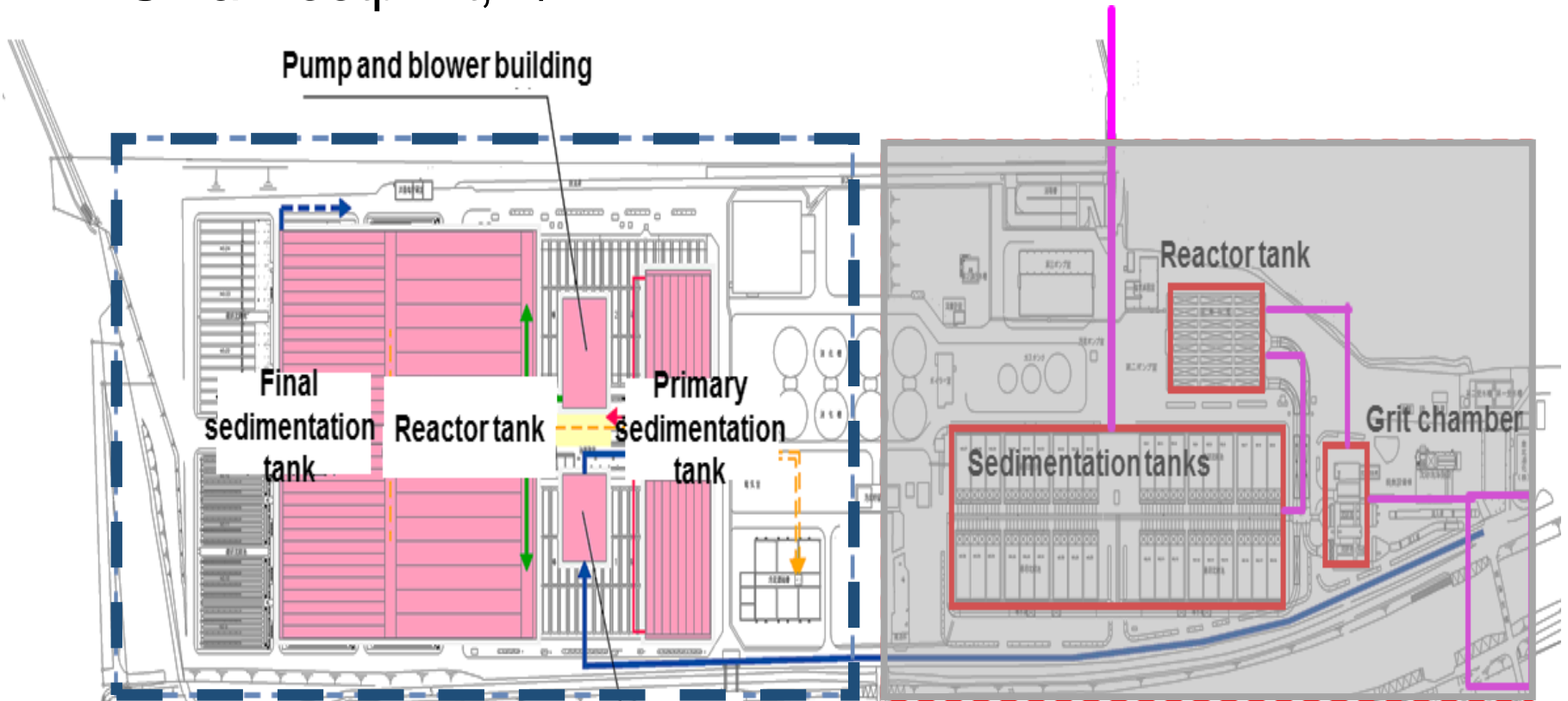


# Influent and effluent of BOD



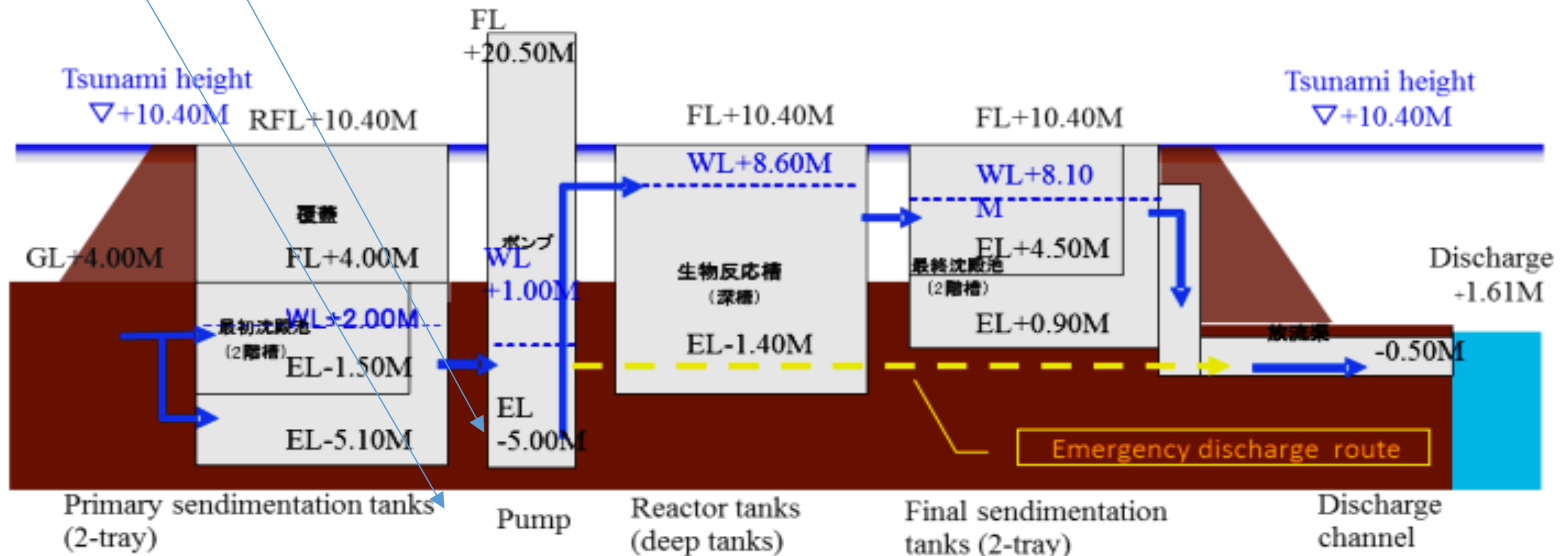
# New MGWWTP

- Small footprint, 1/2



# Measures against earthquake and tsunami

- Embankment for tsunami protection
- Emergency gravity discharge route with no power



# Environmentally friendly system

- Solar power
  - Capacity: 630kW
  - Output: 560MWh/year
- Small hydropower
  - Capacity: 109kW
  - Output: 800MWh/year
- The solar system alone powers a discharge primary treatment in case of emergency



# Lessons learned through the GEJE and Tsunami

- Life is top priority, must be clearly stated in BCP.
- Importance of temporary treatment during restoration.
- Should be rebuilt with disaster resistance and environmentally friendly with concept of “build back better”.



We appreciate your support from the world.



Jozenji-street in Sendai



Sendai Tanabata festival

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# Thank you for your attention!

-SWU shares our experience globally.

