Application of RiverWare to Low-Flow Management in the Yasu River Basin

By

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I. Introduction

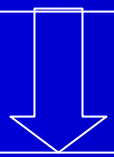
- Significance and Necessity of Low-Flow Management

Change in land use

Increase of water use

Climate change

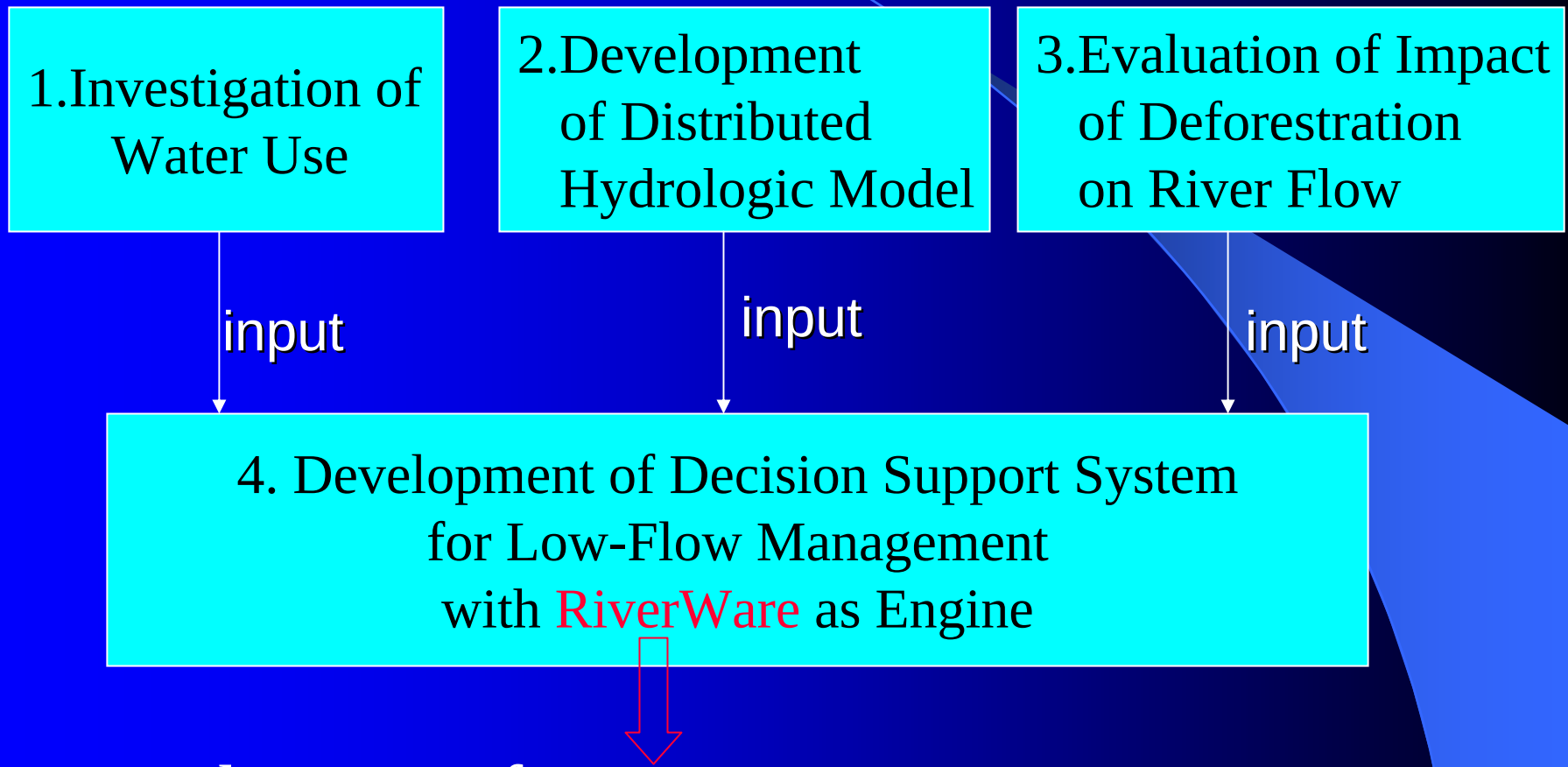
Deforestration



Flood: increase of frequency and scale

Low-flow: minimum flow not satisfied

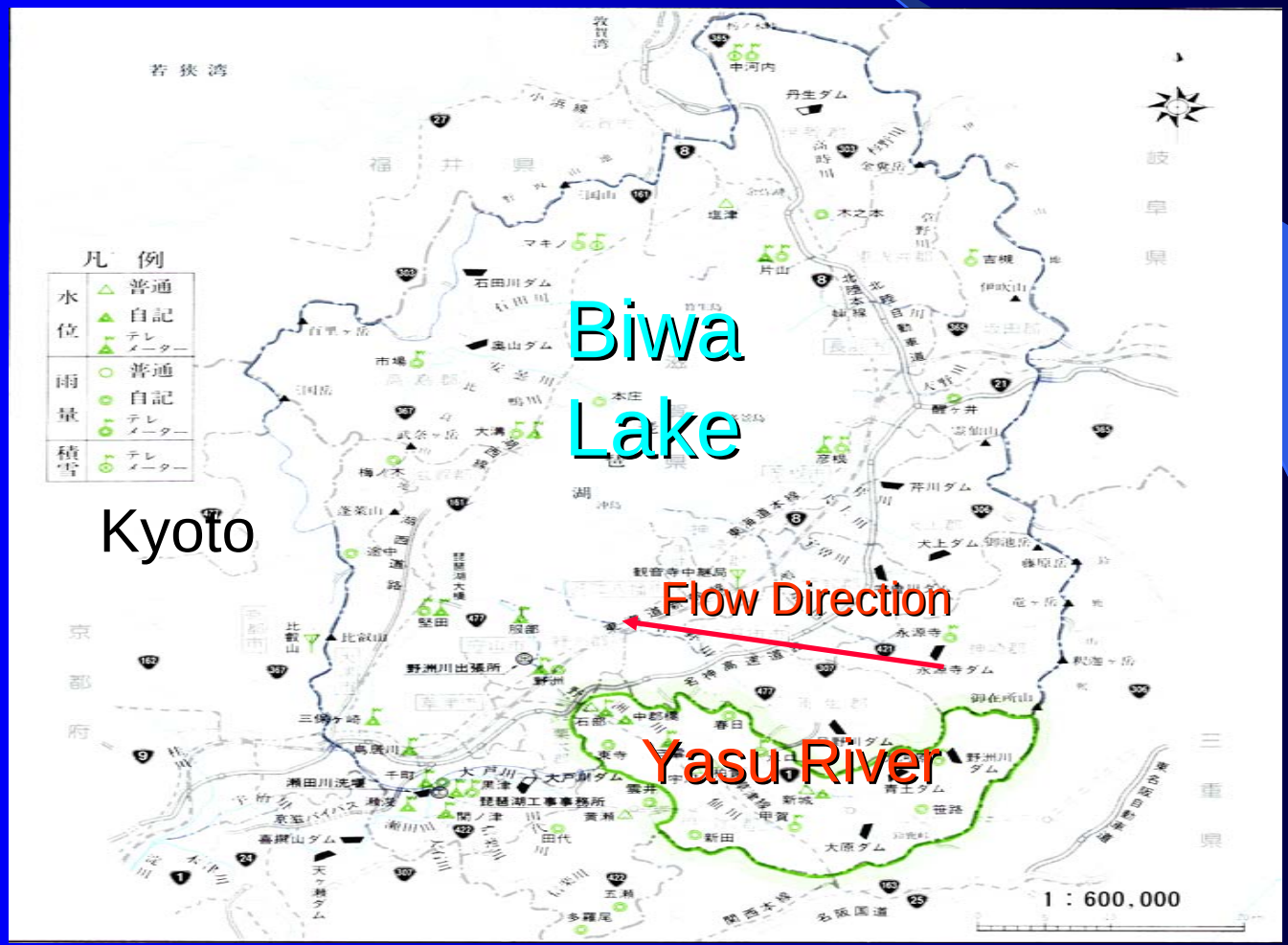
- Development of a Decision Support System for Yasu River Low-Flow Management



- Application of RiverWare to Yasu River Low-Flow Management

II. Outline of the Yasu River Basin

Location of Yasu River Basin



Yasu River Basin

Yasu River Dam

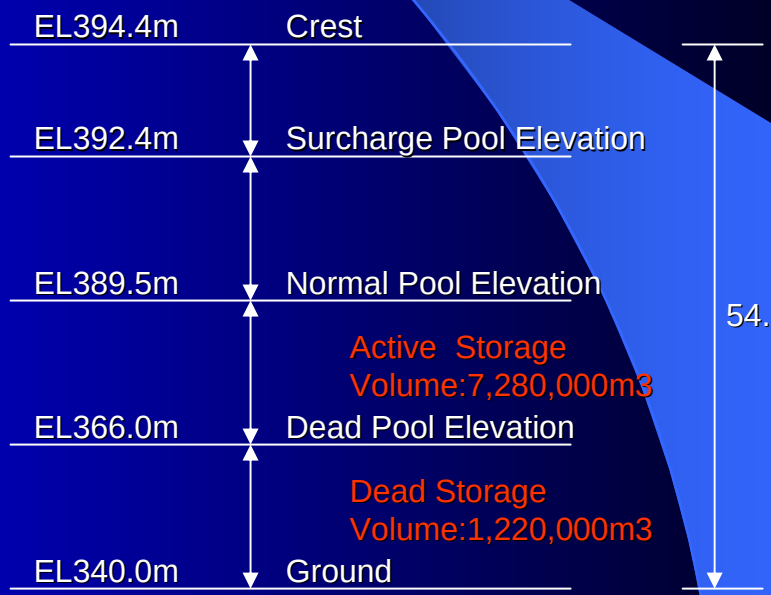
Yasu River Dam

Construction: completed in 1951

Type: gravity concrete dam

Catchment Area:32.45 km2

Purposes: water supply



Odsuchi Dam

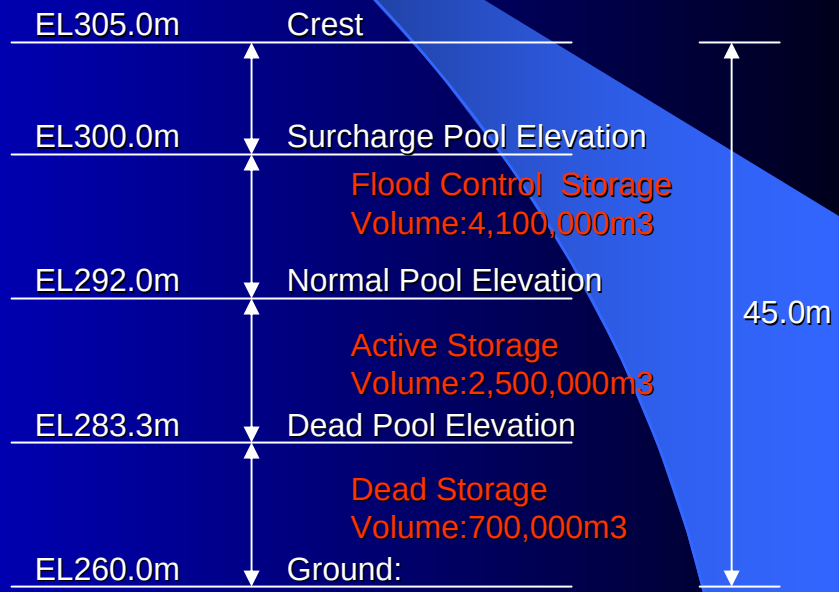
Odsuchi Dam

Construction: completed in 1987

Type: rockfill dam

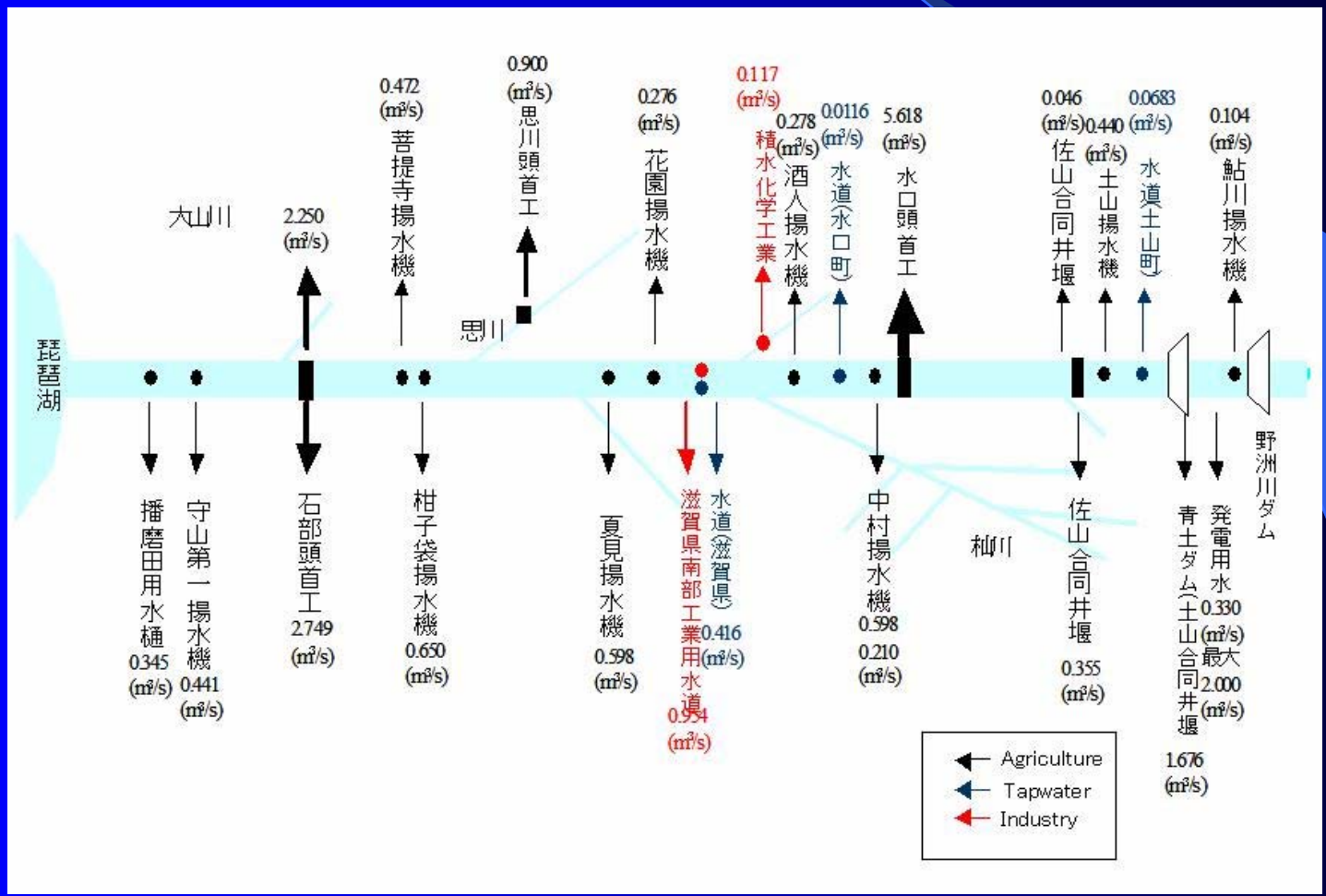
Catchment area:54.3 km2

Purposes: water supply and flood control



III. Low-Flow Management Issues in Yasu River Basin

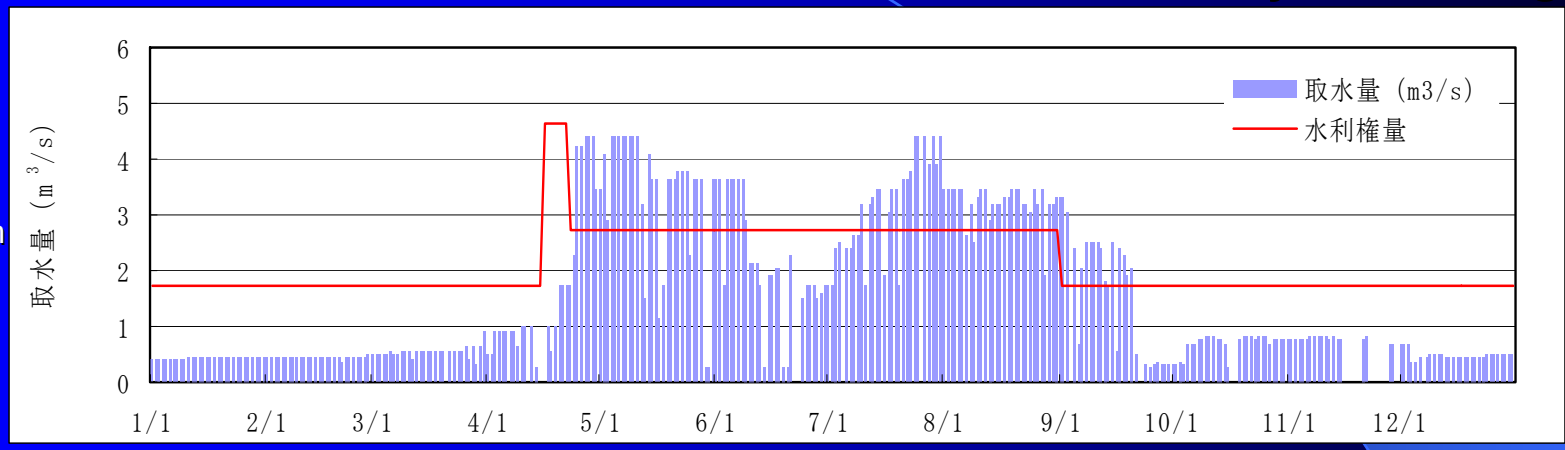
(1) Allowable diversion flow by water right



(2) Reported Diversion flow at Ishibe weir

Year 1998, Left Bank

Reported
Determined by water right

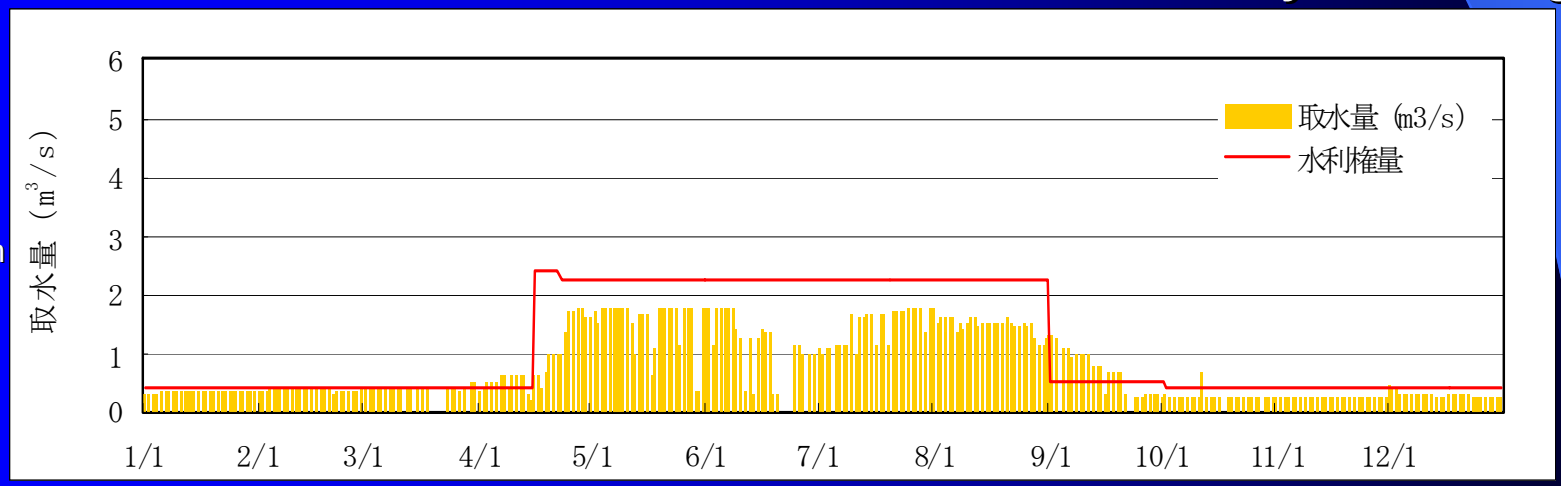


Diversion Flow

Month/Date

Year 1998, Right Bank

Reported
Determined by water right



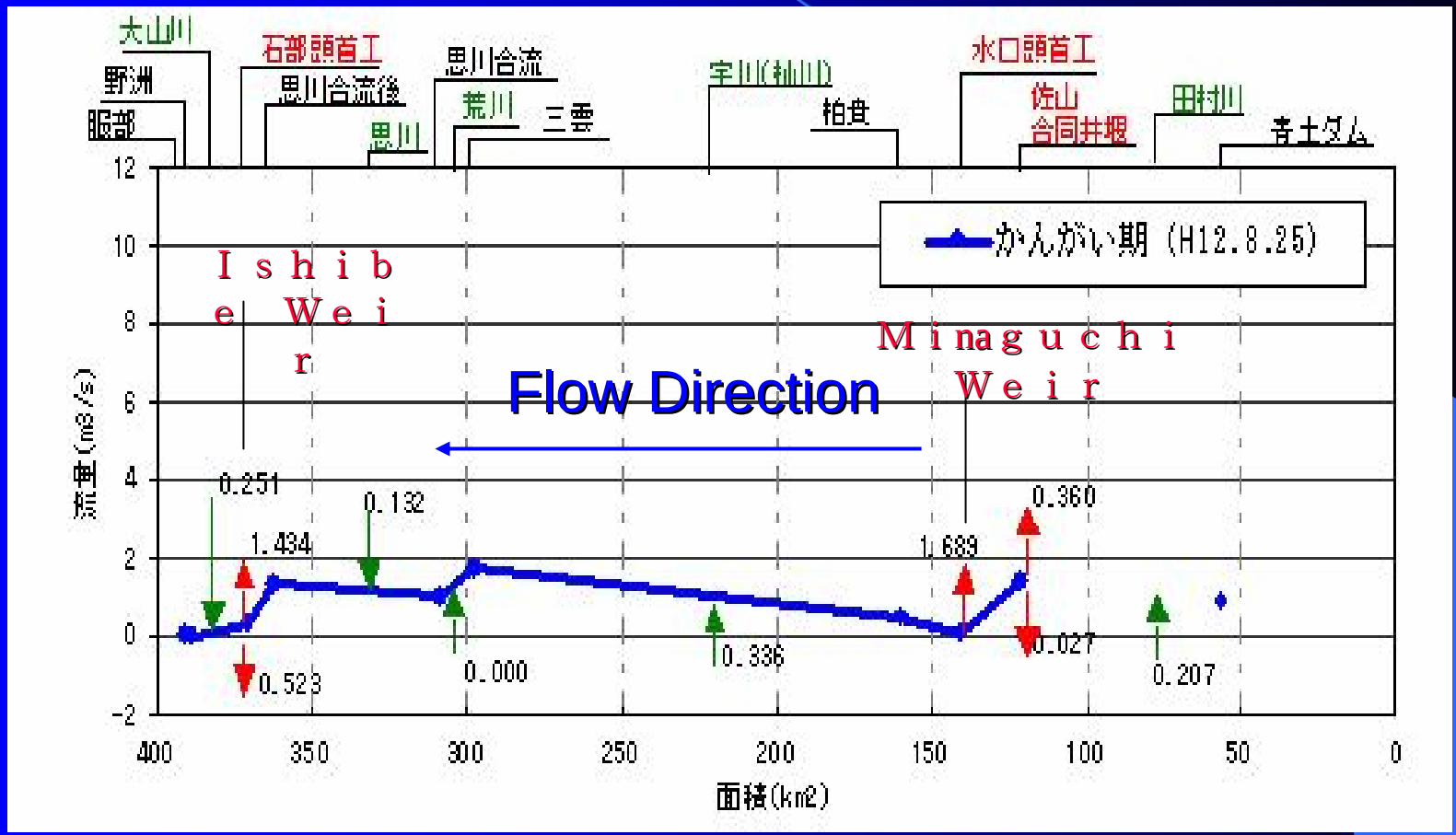
Diversion Flow

Month/Date

(3) Longitudinal Change of River Flow

Observed on August 25, 2000

River Flow (m3/s)



Catchment Area (km2)

(4) Reservoirs' Operation

1) Yasu River Reservoir

It is under the jurisdiction of the Ministry of Agriculture, Forestry and Fishery of Japan and operated only for agricultural water use

2) Odsuchi Reservoir

It is under the jurisdiction of the Shiga Prefecture of Japan and operated for industrial, municipal and environmental water use

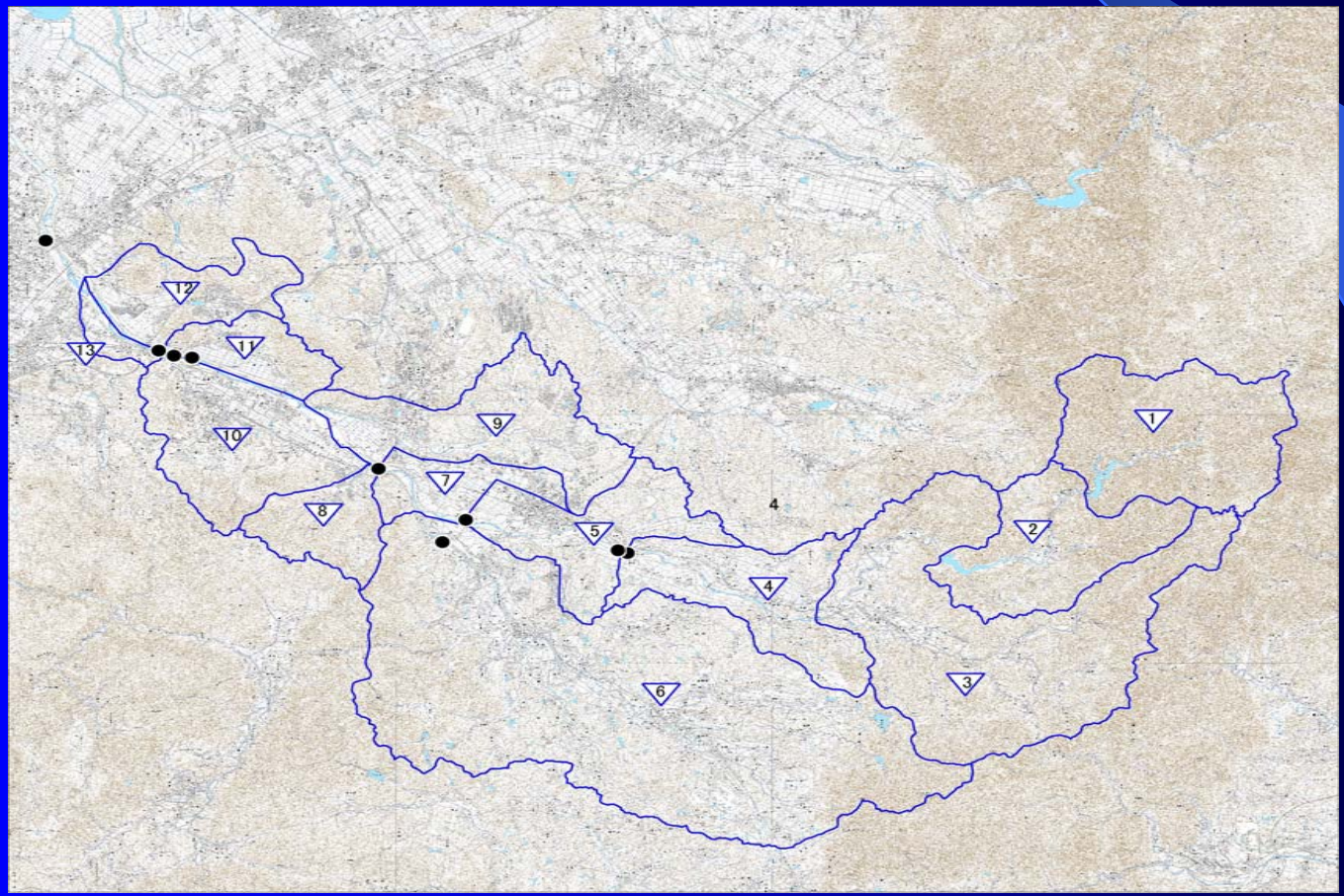
Different operation policies in the two agencies make it difficult to operate the two reservoirs as a reservoir system.

(5) Possible reason of the low-flow being too small

- Too much water is diverted for agriculture
- Reservoirs do not work efficiently and effectively
- Impact of deforestration on river low-flow
- Impact of groundwater on river low-flow

IV. RiverWare Model for the Low-flow Management

Sub-basin | RiverWare Model | Operation Rule



(1) Verification of Reservoirs' Operation Rule

Computational conditions

a) Reservoirs:historic daily inflows (1993-2000, 8 years)

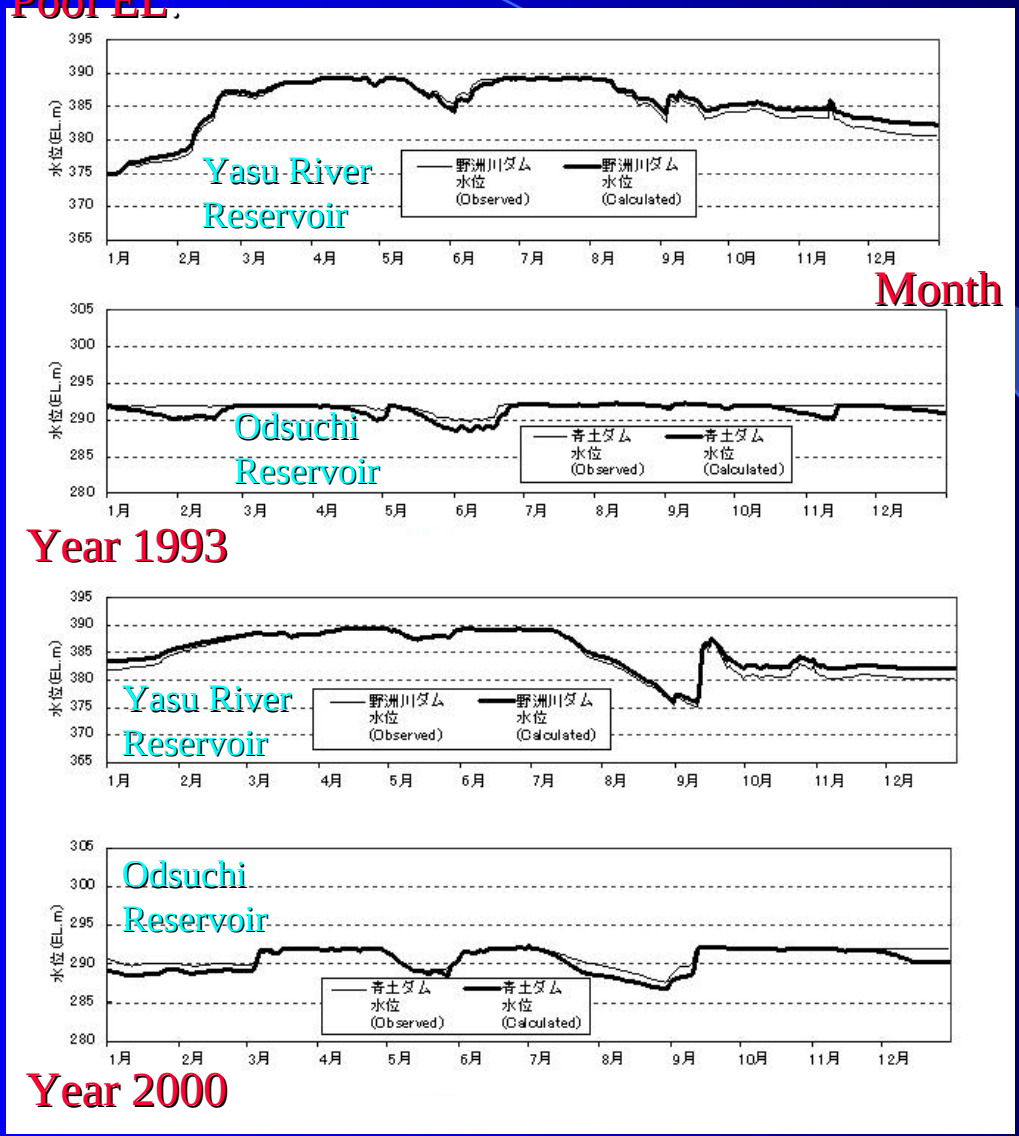
b) Operation policy: current reservoir operation rules

c) Runoff of sub-basins: observed daily flows (1993-2000, 8 years)

d) Diversion flows: reported diversion flows (1993-2000, 8 years)

e) Timestep: daily

Computational results



(2) Simulation of Allowable or Maximum Diversion Flow

Computational conditions:

a) Reservoirs:observed daily inflows (1991-2000, 10 years)

b) Operation policy: current reservoir operation rules

c) Runoff of sub-basins: observed daily flows (1991-2000, 10 years)

d) Diversion flows

Case1: diversion flow = max divers. flow by water right

Case2: diversion flow = (max divers. flow by water right)*(2/3)

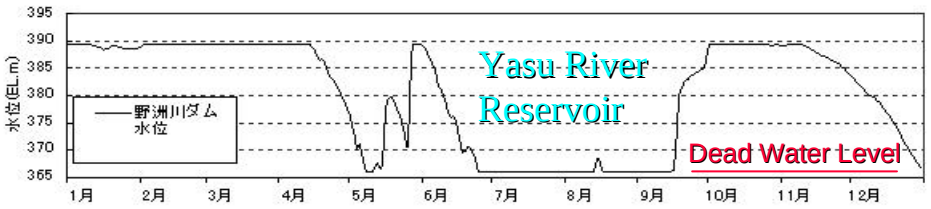
Case3: diversion flow = (max divers. flow by water right)*(1/2)

e) Timestep: daily

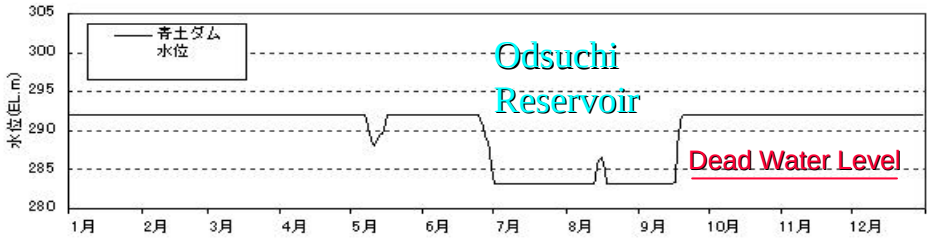
Computational results

Case 1: diversion flow = max diversion flow by water right

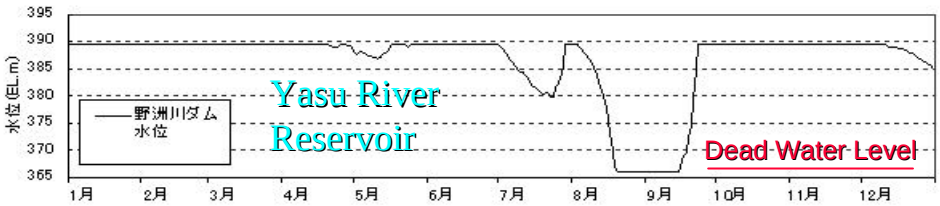
Pool EL.

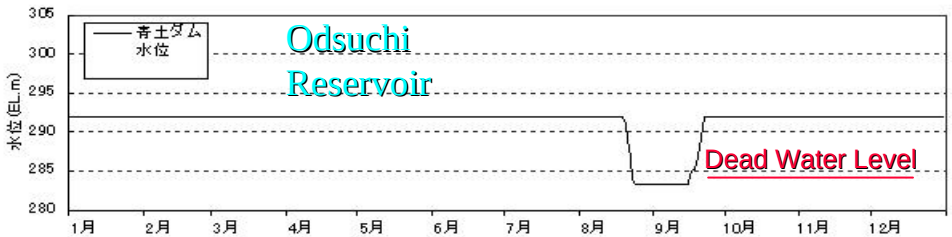


Month



Year 1994 (Low-flow Year)

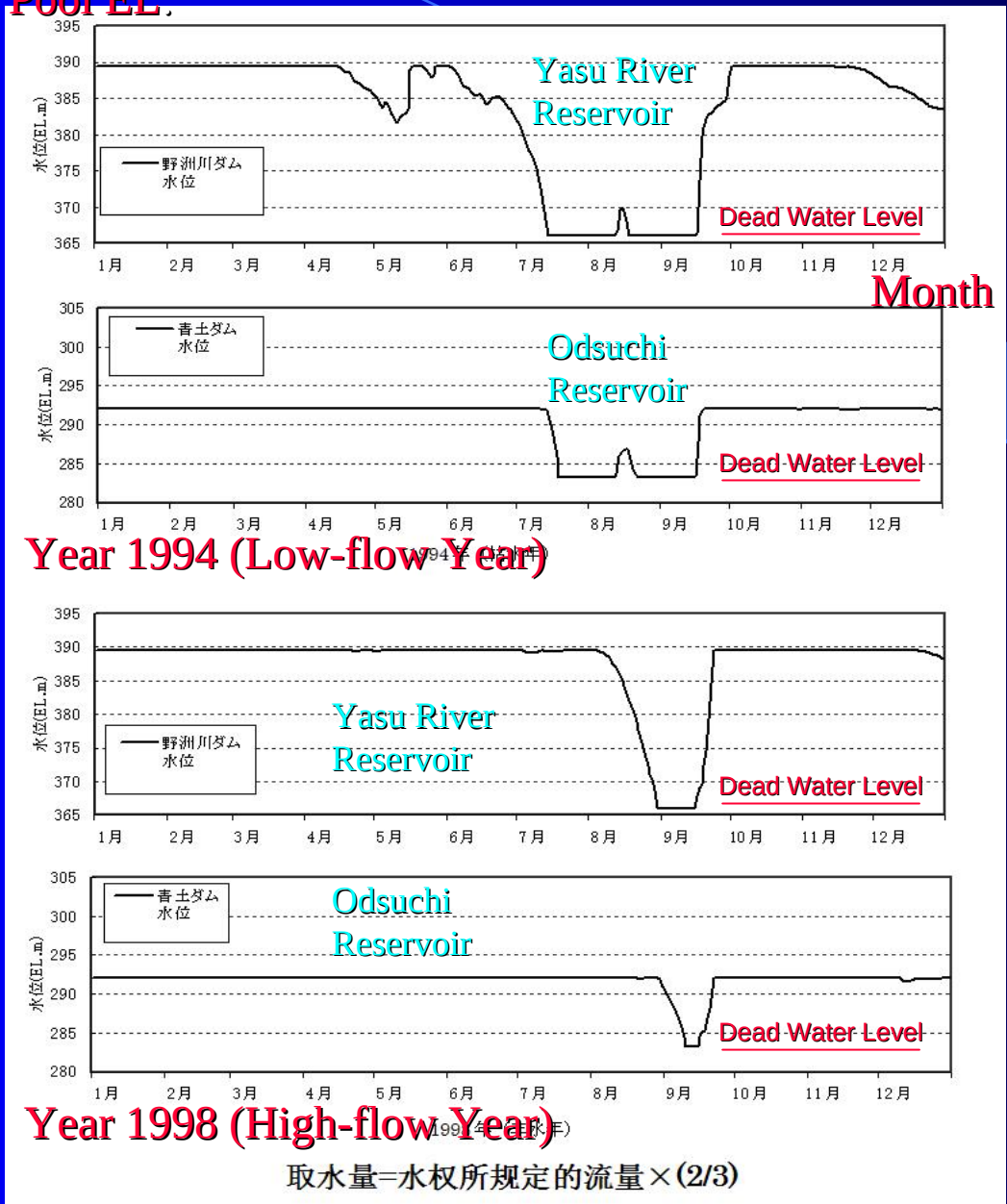




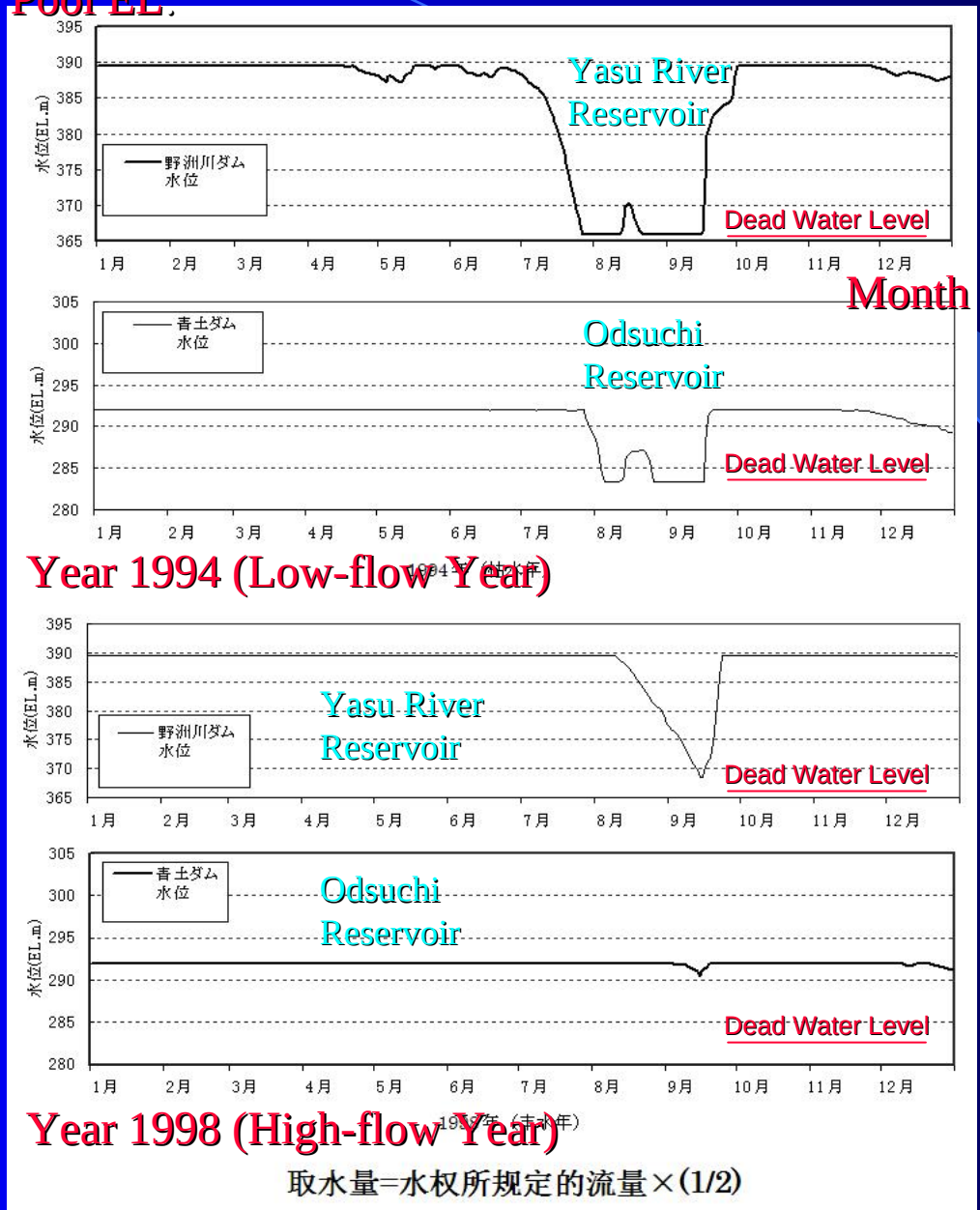
Year 1998 (High-flow Year)

取水量=水权所规定的流量

Case2: diversion flow = (max diversion flow by water right)*(2/3)



Case3: diversion flow = (max diversion flow by water right)*(1/2)



V. Enhancement of RiverWare to Meet the Needs of River Basins in Japan

1. Embedding rainfall-runoff models in RiverWare

2. Making more timesteps selectable such as 10 minutes and 5 days

3. Allowing users to add site-specific models to RiverWare

4. Possibility of Japanese version of Riverware

— END —

Thank you !

Basic Information of Yasu River

Length of Mainstream: 65km

Catchment Area: 378 km2

(Mountainous Area:82%, Plain Area: 18%

Average Annual Precipitation: Mountainous Area 1,900-2,200mm

Plain Area 1,400-1,700 mm

Population: 220,000