5th World Water Forum
4 countries collaborative research on risk based flood management

Risk based Flood Management for adapting to Climate Change

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Contents of presentation

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Recent change on Climate

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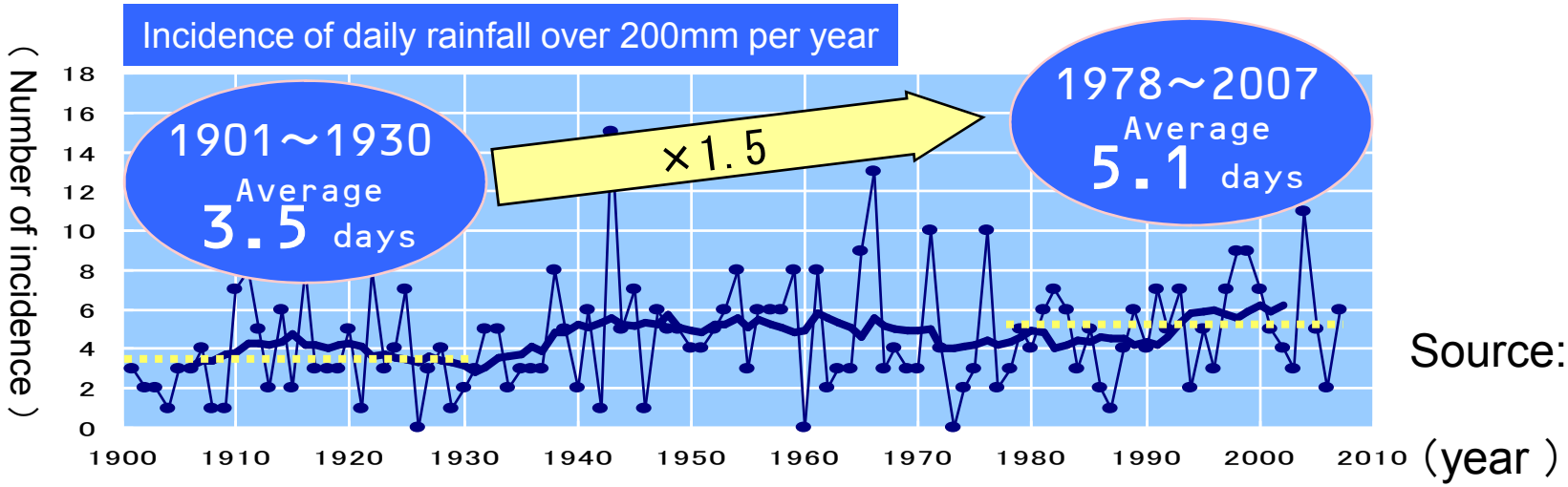
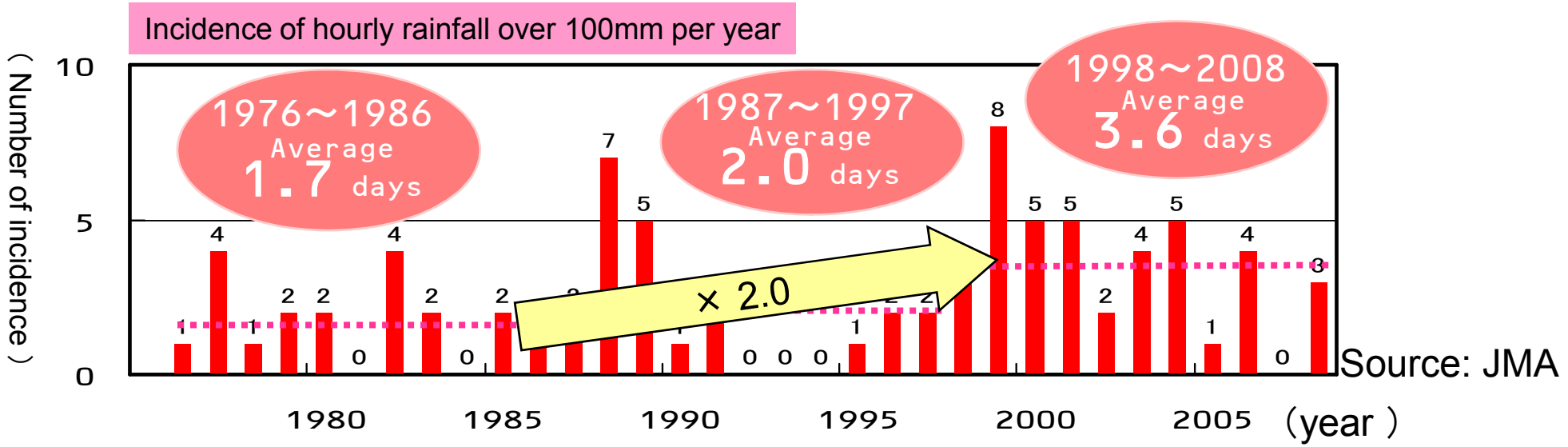
Daily rainfall over 200mm is significantly increasing



Source: JMA

Hourly rainfall over 100mm is increasing



Source: JMA

Review impacts on water related disaster

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Large volumes of greenhouse gas emissions cause CO_2 concentration in the air to rise and increase heat absorption, resulting in temperature rise.

Melting of glaciers, ice caps and ice sheets

Thermal expansion of sea water

Change in evapotranspiration

More intense typhoon

Precipitation increase

More frequent heavy rains and droughts

Increase of river flow

More frequent high tides and coastal erosions

More frequent floods

More serious debris flow

Projection of future Climate

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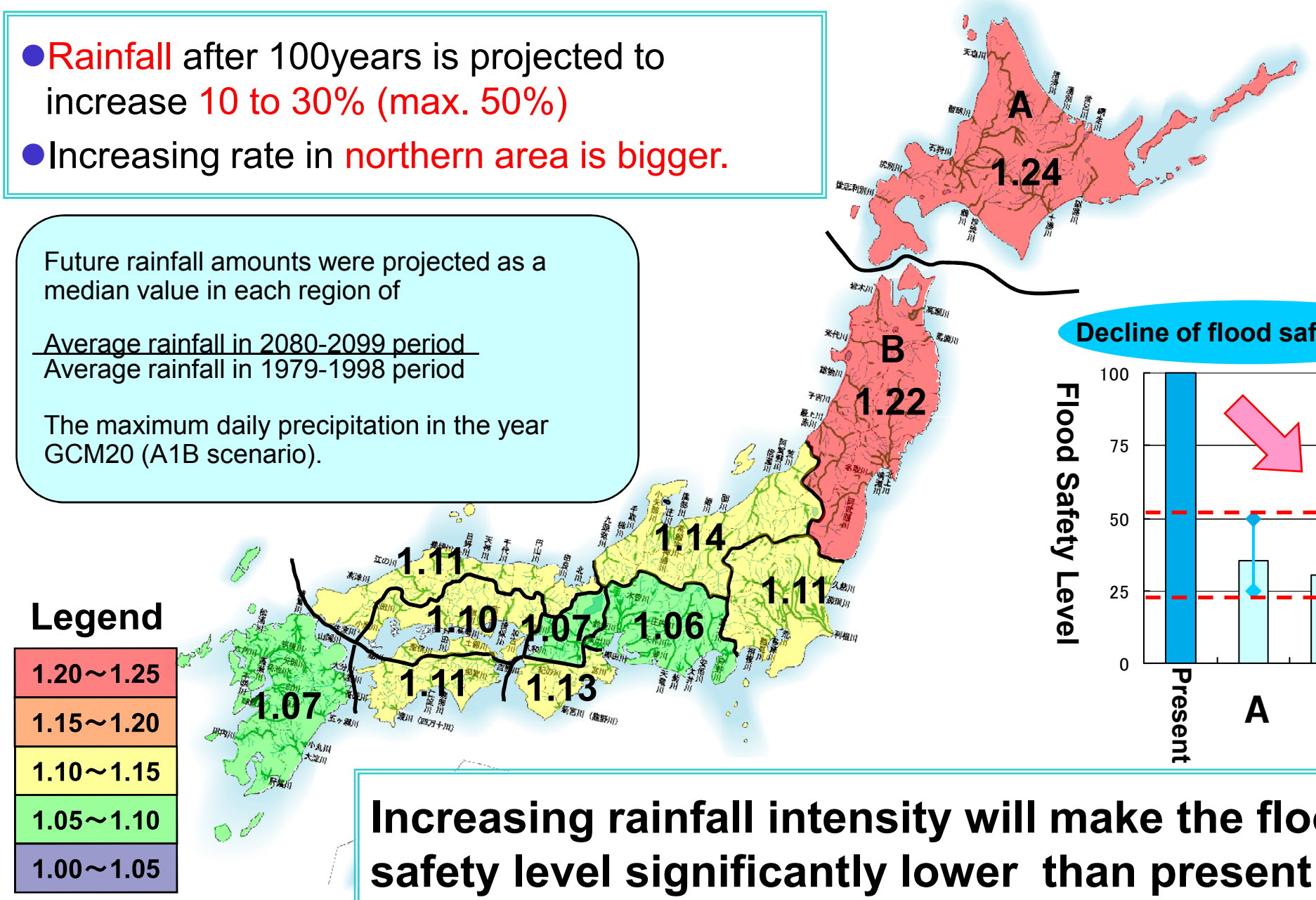
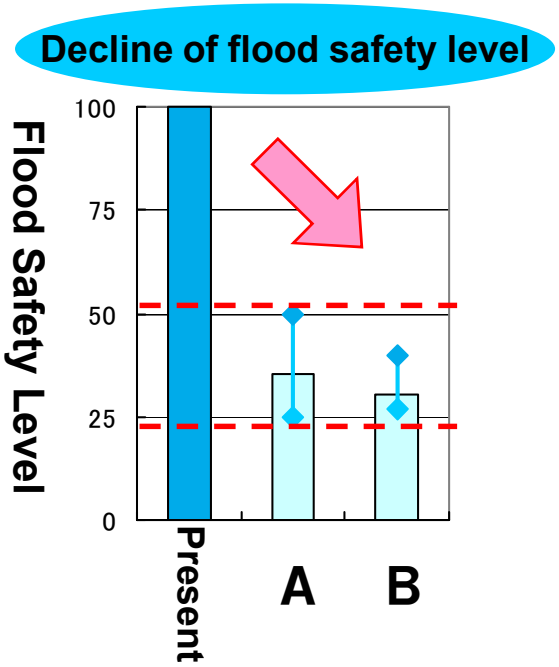
- Rainfall after 100years is projected to increase 10 to 30% (max. 50%)
- Increasing rate in northern area is bigger.

Future rainfall amounts were projected as a median value in each region of

$$\frac{\text{Average rainfall in 2080-2099 period}}{\text{Average rainfall in 1979-1998 period}}$$

The maximum daily precipitation in the year GCM20 (A1B scenario).





Increasing rainfall intensity will make the flood safety level significantly lower than present

Basic Concept for tackling in increasing risks

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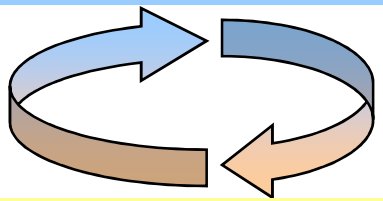
Configuration of counter-measures for climate change

- Mitigation Measures



- Adaptation Measures
  - Facility
    Ex) Dike, Dam, Discharge, Infiltration trench, …
  - Regional Development
    Ex) Land use regulation, Building restriction, Circle levee, …
  - Crisis Management
    Ex) Flood Hazard Map, Real-time information, TEC-Force, …
  - Monitoring
    Ex) River Information, Planning, Revision of plan, …

- Multiple measures
- Effective& Efficient Adaptation Programme
  - Risk Assessment -

Basic concept for tackling in increasing risks

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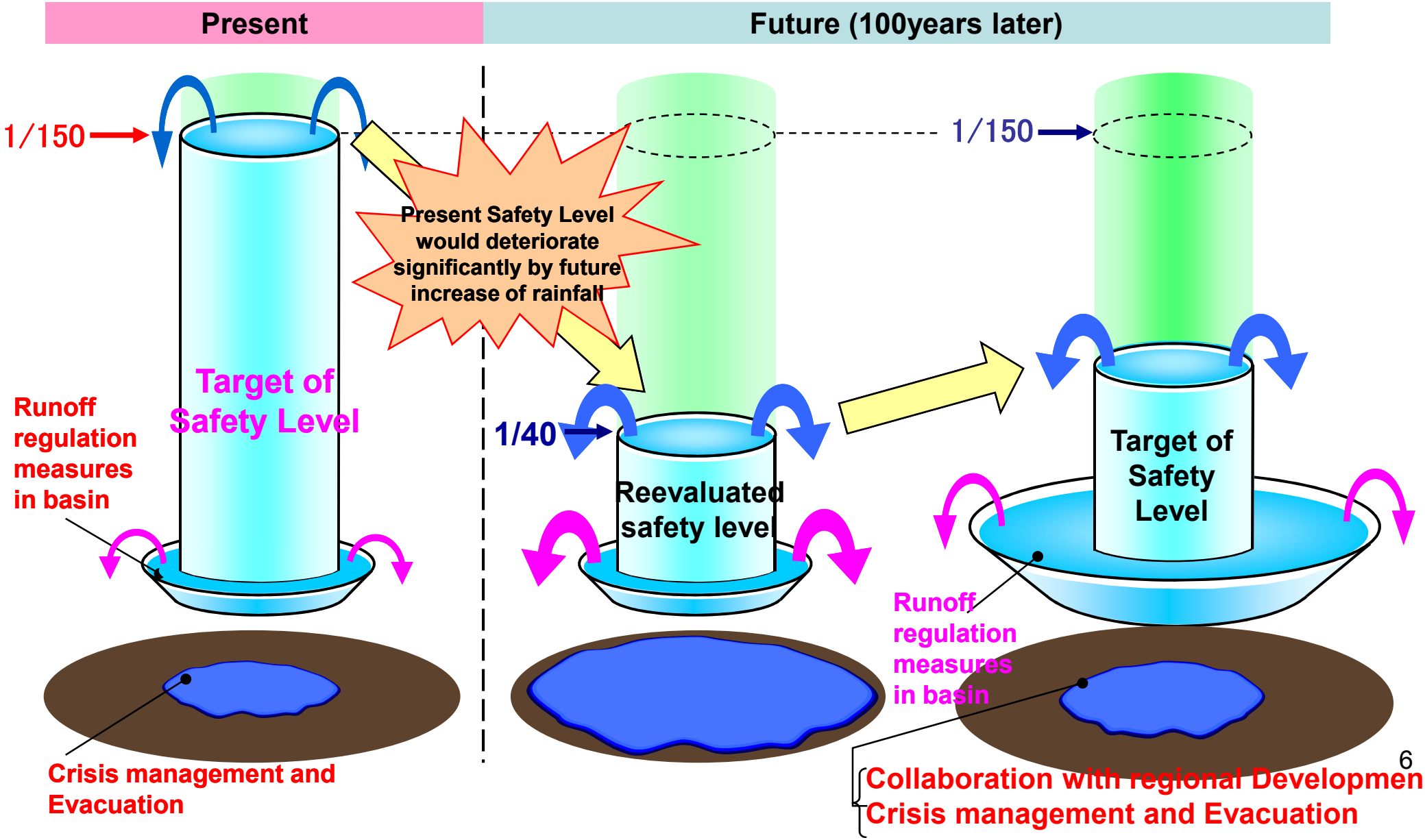
- Multiple measures in flood management -



Challenge new flood management program based on risk assessment

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■Human Damage

- Number of casualties
- Number of stranded people
  - Number of social welfare facility resident and hospital patient
- Number of person be emergently evacuated
  - Number of social welfare facility resident and hospital patient
- Number of evacuating center resident

■Physical damage

- Number of flooded houses
- Lifeline damage (electric power, communication, gas supply, water supply, water treatment)
- Transportation infrastructure damage (Road, Railway, Harbor)
- Amount of flood disposal
- Number of flooded cars

■Damage in life style

- Population who suffer from lifeline damage (electric power, communication, gas supply, water supply, water treatment)
- Population who suffer from transportation infrastructure damage (Road, Railway, Harbor)

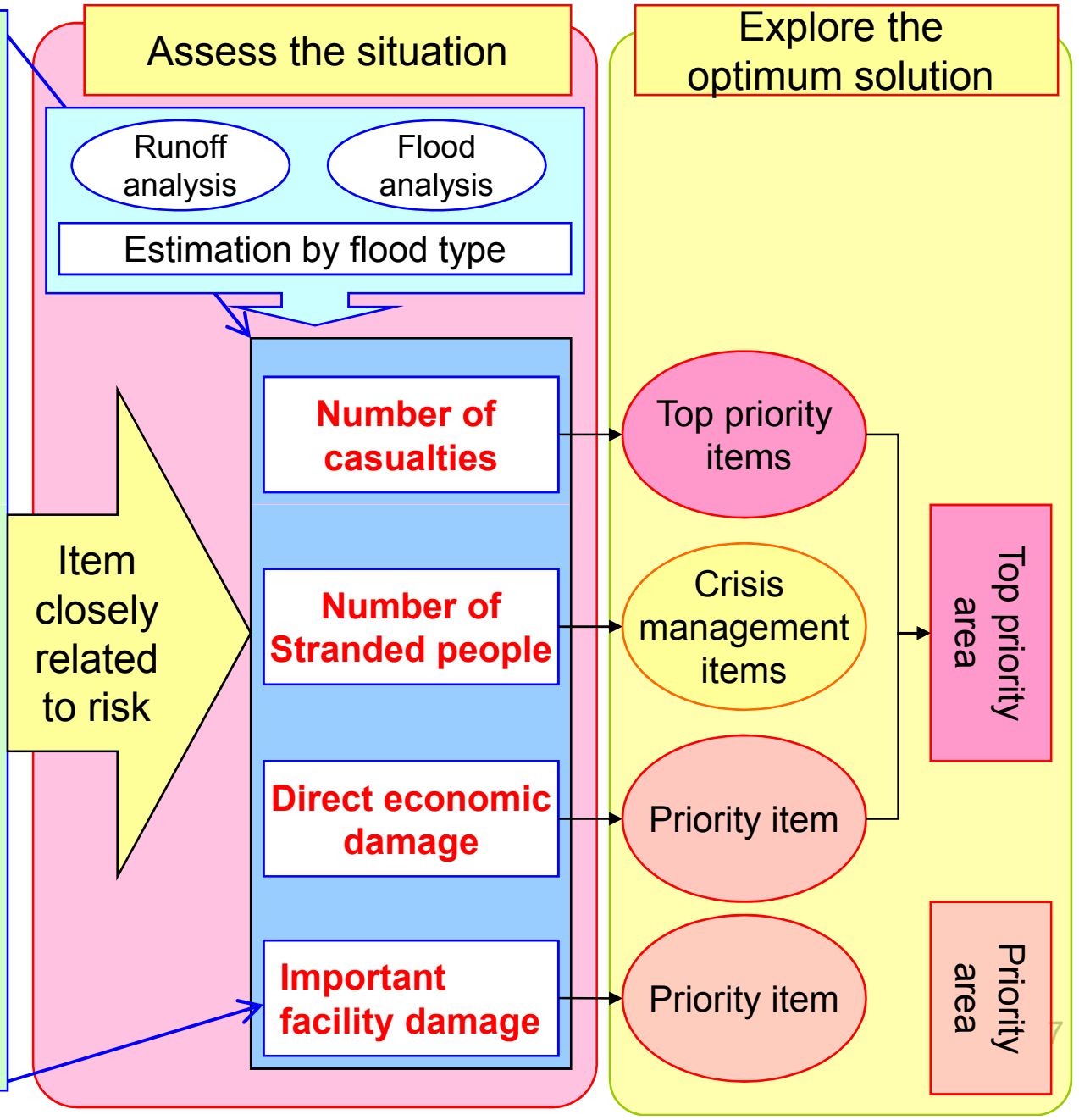
■Economic damage

＜Direct Damage＞

- Building Damage (Residence, Office)
- Asset Damage (household goods, depreciated asset, stock)
- Lifeline damage (electric power, communication, gas supply, water supply, water treatment)
- Transportation infrastructure damage (Road, Railway, Harbor)
- Public civil infrastructure damage

＜Indirect Damage＞

- Impact cased by stranded people and severed logistics
- Spread effect of economic damage (damaged area, outside, domestic and international)



Challenge to new flood management program based on risk assessment

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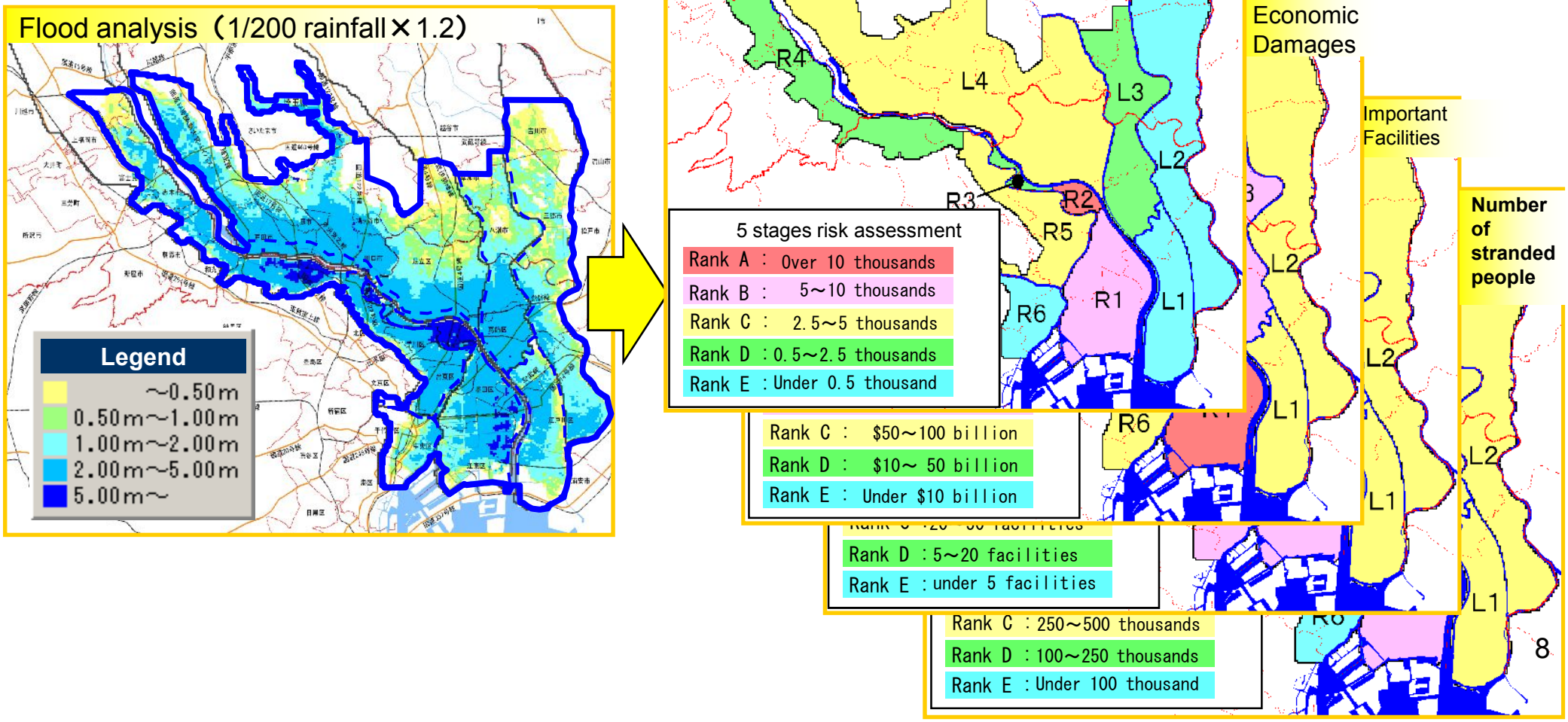
Risk Map: When implementing a risk assessment, we take into consideration the increasing future climate change, and carry out analysis of floods of various magnitudes that may occur at different precipitations.



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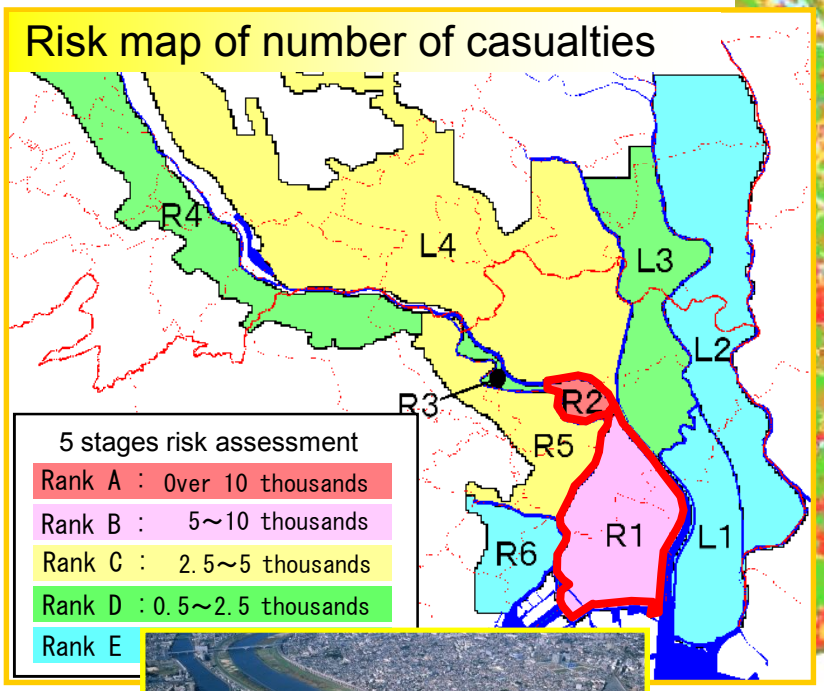
Target: “Zero Casualties”

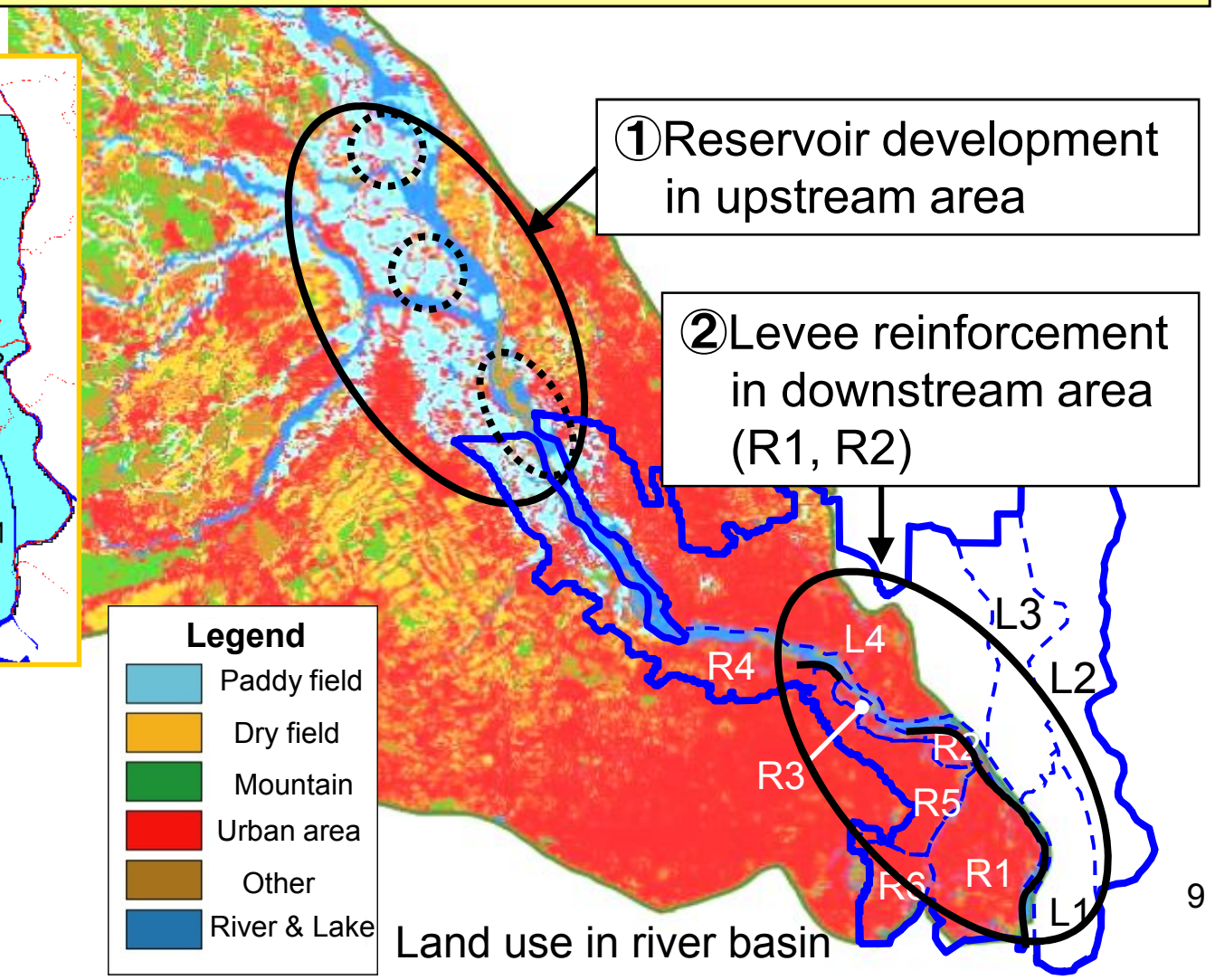
■There is a risk of a substantial number of casualties in R2 and R1



Urbanization in downstream area

①Reservoir development in upstream area

②Levee reinforcement in downstream area (R1, R2)

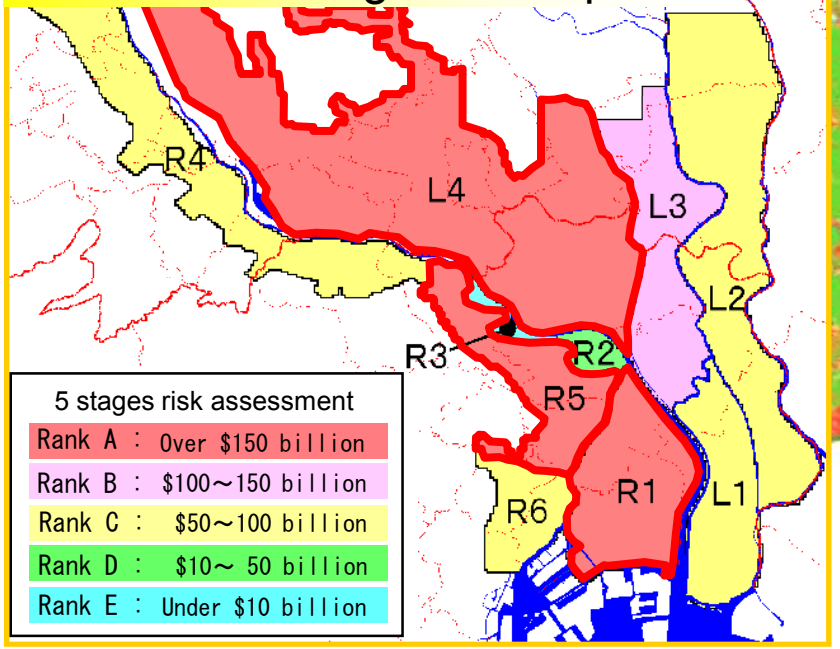


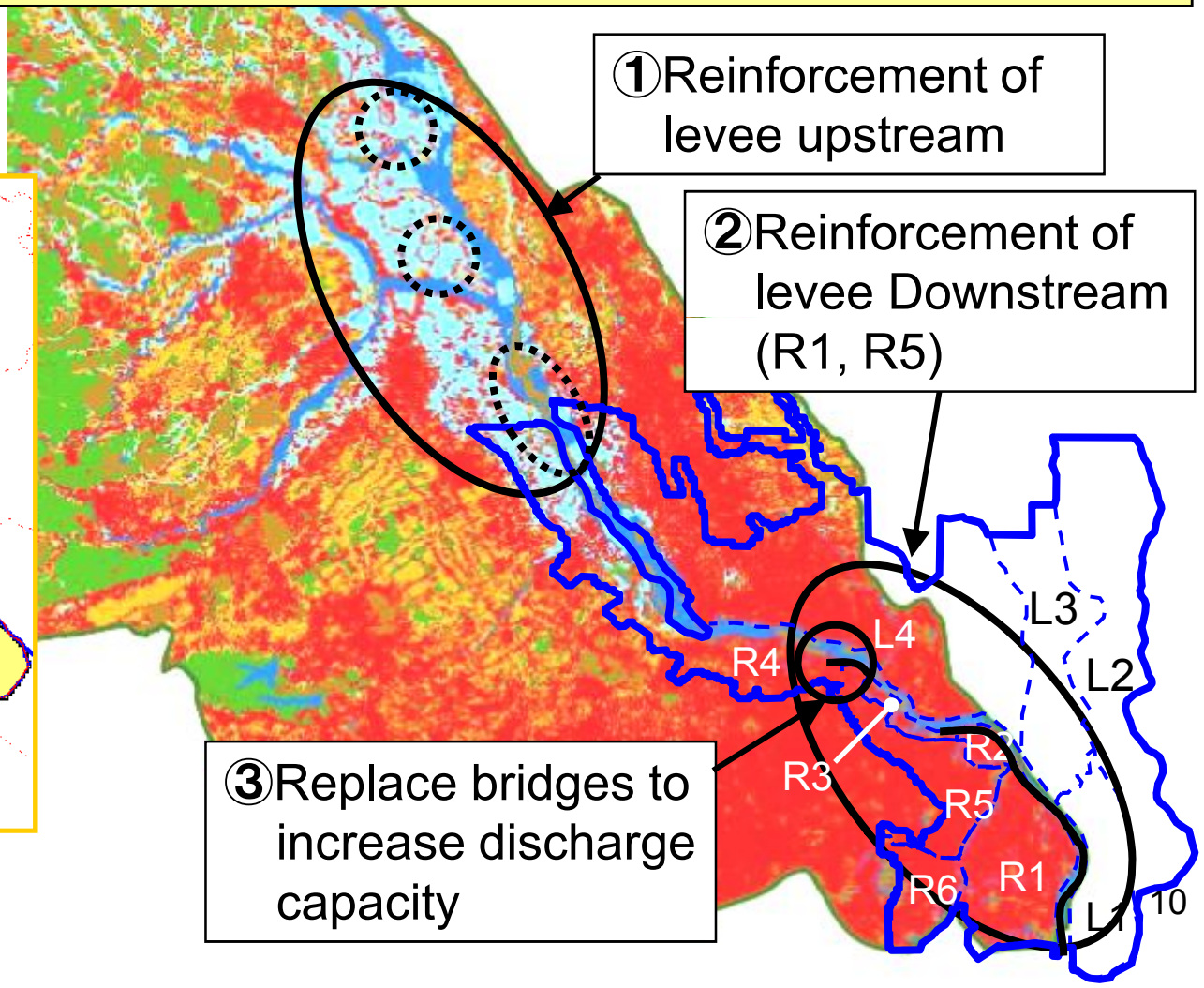
Land use in river basin

Target: “Minimizing economic damage”

■Since there is concentration of assets in the lower drainage area, the economic damage would be considerable particularly in R1, R5 and L4 zones.

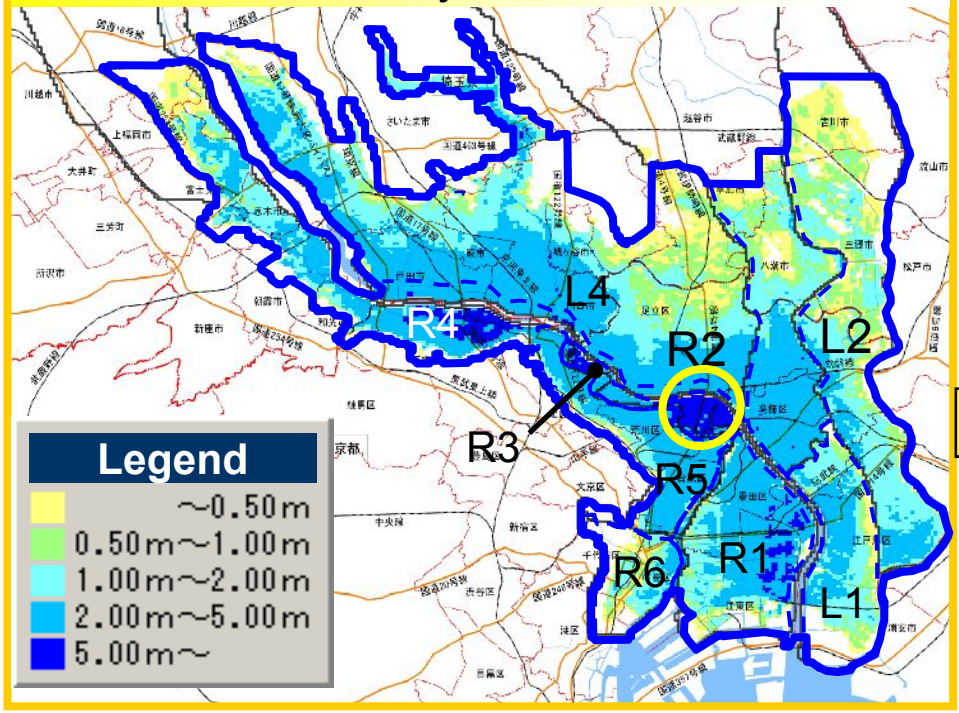
Economic damage risk map





Evaluation of program

Result of flood analysis（1/200rainfall ×1.2）

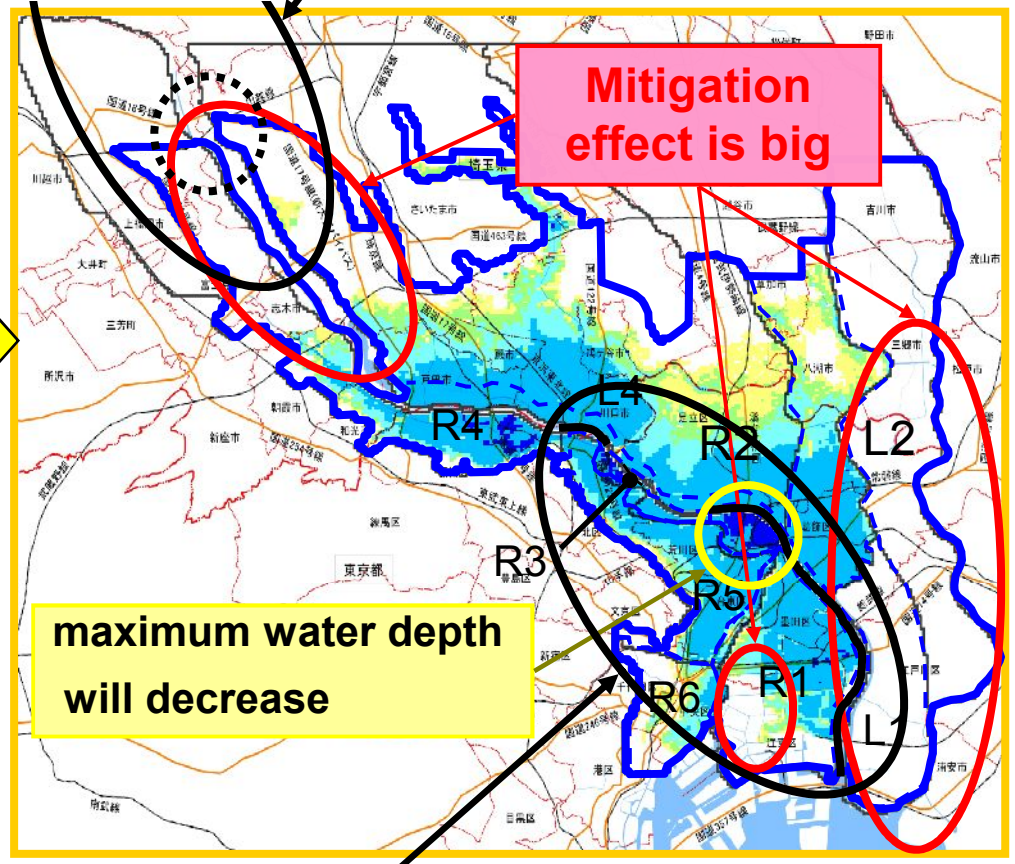


Priority of adaptation measures

1 Zero Casualties
2 Minimizing economic damage

⇒Reinforcement of levee
⇒Development of new reservoir

1 Development of reservoir upstream



2 Reinforcement of levee (R1, R5)

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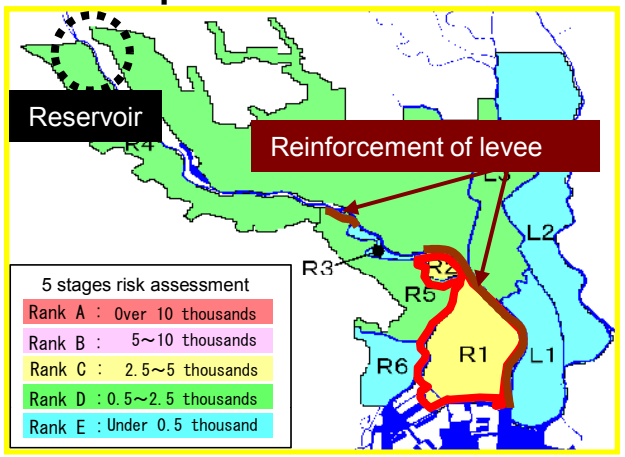
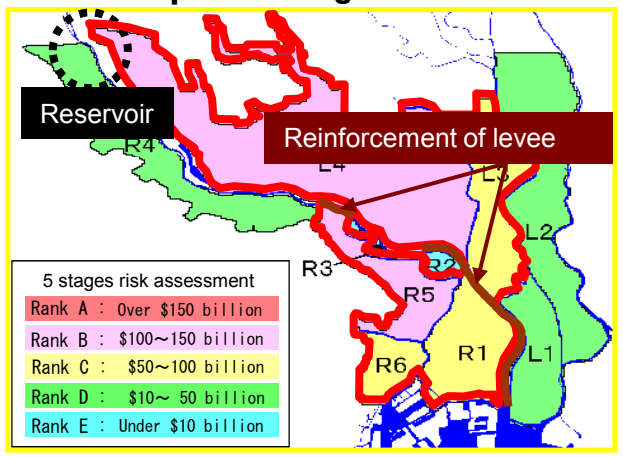
➢Time oriented ROAD MAP

Risk map of Casualties



Risk map of Damage



Example of Road map

	Block	Present: Death	Present: Damages	Structural Measures	Program (1～10 years)	Program (11～30 years)	After 30 years: Death	After 30 years: Damages	Non structural Measures
Right bank	R1			Levee			○	○	Hazard map Land use information
				New Reservoir					
	R2			Levee			○		Hazard map Land use information
				New Reservoir					
				New pump station					
	R3			New Reservoir					
	R4			New Reservoir					Hazard map
				New pump station					
	R5			Levee				○	Hazard map Land use information
				New Reservoir					
				New Bridge					
	R6			New Bridge				○	
Left bank	L1			New Reservoir					Hazard Map
	L2			New Reservoir					
	L3			New Reservoir				○	Hazard map Land use Information
	L4			New Reservoir				○	

○ : The zones requiring particular attention to non-structural measures

Ex. Hazard map, land use regulation, disaster information structure.

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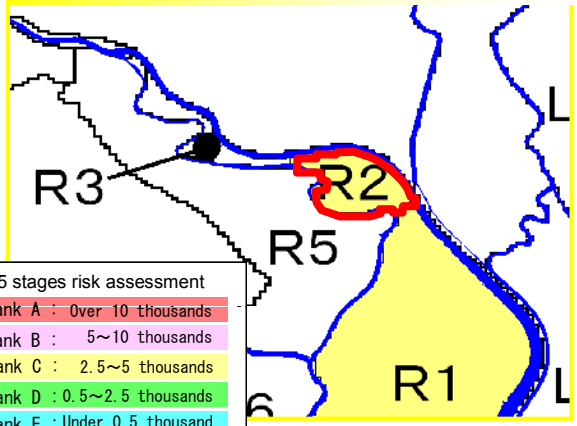
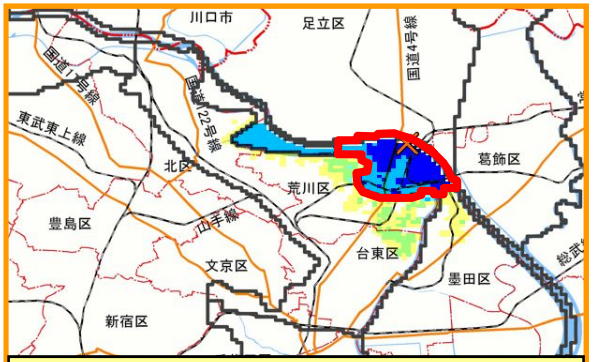
➢When structural measures are not enough to eliminate the hazards, we may concentrate non-structural measures

Number of Casualties :R2



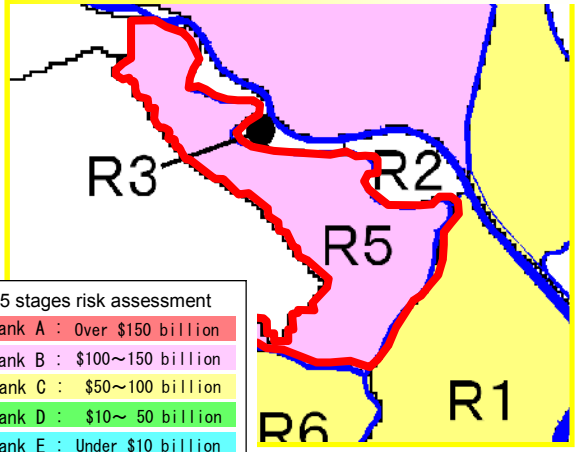
5 stages risk assessment

Rank A :	Over 10 thousands
Rank B :	5～10 thousands
Rank C :	2.5～5 thousands
Rank D :	0.5～2.5 thousands
Rank E :	Under 0.5 thousand



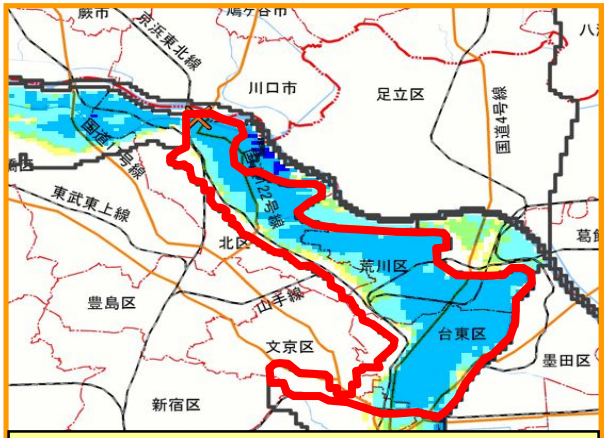
Determining concrete measures by considering the types of anticipated flooding

Damage amount R5



5 stages risk assessment

Rank A :	Over $150 billion
Rank B :	$100～150 billion
Rank C :	$50～100 billion
Rank D :	$10～ 50 billion
Rank E :	Under $10 billion



Determining concrete measures by considering the types of anticipated flooding

○Emergency navigation of resident

- ➢preparation and distribution of hazard maps
- ➢Communication system establishment
- ➢Evacuation training

○Measurement not to be cumulated more

- ➢preparation and distribution of hazard maps
- ➢Land use regulation and navigation
- ➢Obligating raised floor structure and water proof structure

Conclusion

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Shift to the risk based flood management

1) Change flood control target from secure of necessary river flow to disaster risk in basin for various size of possible floods

2) Introduction of flood risk assessment as basic procedure in flood management program

3) Clear prioritizing each measures and risk allocation put into the time-oriented road map

4) Strengthen non-structure measures for areas which still remains problems

5) Monitoring, Regularly review, Adaptive response


Thank you for your attention