Outline of Ground Water Management in Japan

The NARBO Thematic Workshop on
Water Allocation and Water Rights

November 28 2006

Water Resources Policy Division, Land and Water Bureau

1 Government organizations related to groundwater use and its laws and ordinances

2 Groundwater use and ground subsidence

3 Measures taken in Nobi Plain

4 Others

Governments Related to Water in Japan

Ministry of Health, Labour and Welfare

Water Supply for Domestic Use, Quality Preservation of Water Source, etc.

Ministry of Agriculture, Forestry and Fisheries

Water Supply for Agricultural Use, Forest Development for Headwaters Conservations, etc.

Ministry of Economy, Trade and Industry

Water Supply for Industrial Use, Hydropower, etc.

Ministry of the Environment

Water Quality, Environmental Preservation, etc.

Ministry of Land, Infrastructure and Transport

Sewerage, River Improvement for Flood Control and Environment, Reservoir Area Development, Water Supply and Demand Planning, etc.

Affairs under Jurisdiction Defined in the Respective Ministry Establishment Laws

Ministry of Health, Labor and Welfare

- Domestic water supply

Ministry of Agriculture, Forestry and Fisheries

- Agricultural use of land, water and other resources
- Agricultural water use
- Land improvement projects (projects related to irrigation drainage, land readjustment, land reclamation, agricultural lands and the facilities necessary for their preservation and use, and maintenance / promotion of the use of agricultural land, such as restoration of agricultural facilities from disaster)
- Afforestation and flood control measures for forest land, construction / improvement of forest roads and other forest development

Ministry of Economy, Trade and Industry

- Assistance and supervision for industrial water system projects
- Planning, drafting and promotion of basic policy relating to power development

Affairs under Jurisdiction Defined in the Respective Ministry Establishment Laws

Ministry of the Environment

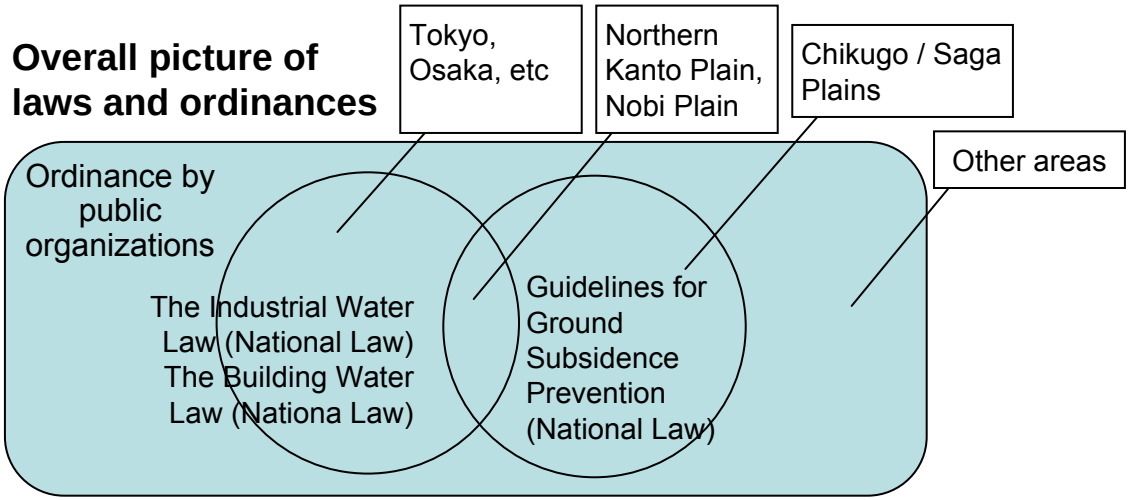
- Establishment of environmental standards
- Regulations to prevent pollution
- Treatment of excreta and wastewater using septic tanks
- Establishment and regulation of standards, guidelines, policy and plans relating to clerical procedures and projects (treatment of wastewater using sewer systems and other facilities, conservation of rivers, lakes and marshes, environmental impact assessments etc.) from the standpoint of environmental conservation

Ministry of Land, Infrastructure and Transport

- Planning, drafting and promotion of Basic Plan for Water Resource Development as well as other comprehensive and fundamental policies relating to water demand and supply
- Planning, drafting and promotion of measures for reservoir areas
- Sewer systems
- Management of rivers, streams and water surfaces (improvement, use, conservation etc.)
- Construction and management of facilities for the development and use of water resources
- Planning, drafting and promotion of policies relating to flood control and water use in river basins

Legal System related to Groundwater use in Japan

- There is no individually defined law concerning “groundwater” in Japan.
- Surface water, one of main water resources of river is governed under “The River Law”
- Regulations on pumping up groundwater/utilization is implemented in pursuant to The Industrial Water Law (1956) and the Law Concerning Regulation of Pumping-up Groundwater for Building Use (1962), to prevent ground subsidence. The regulations specifies restriction on pumping groundwater for industrial use as well as for air-conditioning of building (which requires permission from prefectural governors). However, these laws apply to only designated areas.
- Others ordinances were formulated in many prefectures and municipalities during period of 1960s-1970s, which regulates pumping-up of groundwater to prevent ground subsidence and other damages,as well as water quality conservation and an appropriate use.
- Prevention measures for ground subsidence were strongly required due to the frequent occurrence in various parts of Japan since 1970s. Through “promotion of subsidence prevention measures” by a conference of the cabinet members concerned in 1981,” the guideline of measures for preventing ground subsidence” was formulated for “The Nobi Plain, “ “The Chikugo /Saga Plains” and “The northern Kanto region” where the damage of ground subsidence was extensive and frequent.
- “Law” and “Ordinance” are subject to punishment but “Guidelines” are not subject to punishment. “National Law” supersedes “Ordinances” by public organizations



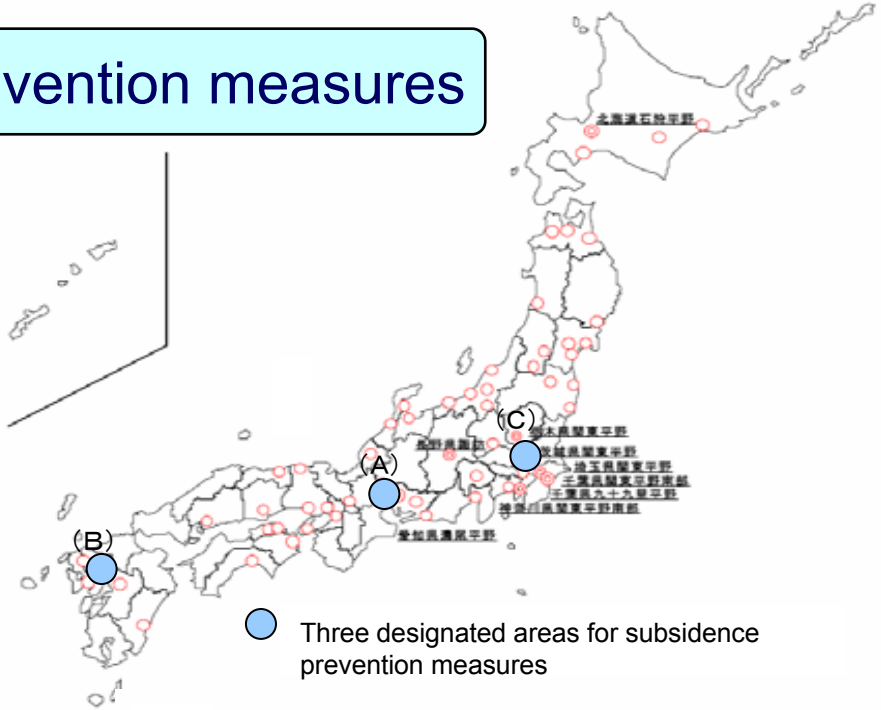
Outline of Laws concerning Groundwater Pumping Regulations

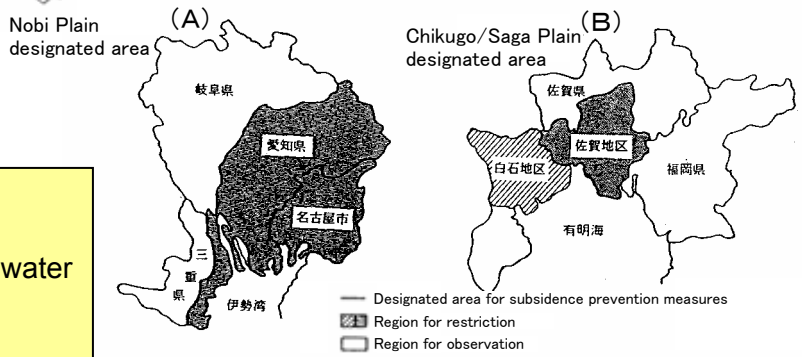
Laws	Year	Outline of Laws
Industrial Water Law	1956	・Those who intents to pump up groundwater for industrial use from wells within the areas designated by Government ordinance, are required to ask permission from prefectrual governor submitting location of strainer and cross-sectional area of discharge spout. ・Industry means manufacturing industry, electricity, gas and energy supply industries. ・The requirement specifies “designated areas,” that ground water level have been lowered and water resources have been contaminated by intrusion of salt water and polluted water or that “certain areas” where ground subsidence have occurred, due to the excessive pumping groundwater. The requirement regulates the rational use of groundwater for industrial purpose to conserve water and installation of water system for industrial use, or installation of water system to be completed within a year in those designated areas. This requirement applies to Tokyo, Miyagi, Fukushima, Saitama, Chiba, Kanagawa, Aichi, Osaka and Hyogo prefectures.
Law Concerning Regulation of Pumping-up Groundwater for Building Use (Building Water Law)	1962	・Those who intends to pump groundwater for building use, are required to ask permission from prefectural governor, submitting the location of strainer and cross-sectional area of discharge spout ・Water for pump-up groundwater for building use means groundwater for the use of air-conditioning, flush toilet and vehicle washer and so on. ・As for the requirement to designate areas, it specifies disaster prone-areas (tidal wave and flooding) due to ground subsidence caused by the pumping of groundwater.” (The designated areas: Tokyo, Saitama, Chiba and Osaka Prefectures)

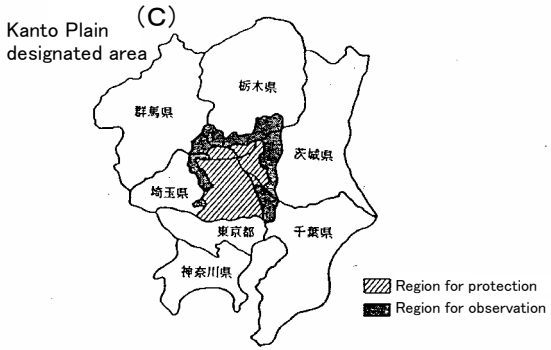
Outline of guidelines subsidence prevention measures

Overview of Guidelines for Ground Subsidence Prevention

	Nobi Plain (A)		Chikugo / Saga Plains (B)			Northern Kanto Plain (C)	
Name	Guidelines for Preventing Ground Subsidence, etc. at the Nobi Plain		Guidelines for Preventing Ground Subsidence, etc. at the Chikugo and Saga Plains			Guidelines for Preventing Ground Subsidence, etc. at the Northern Kanto Plain	
Date finalized	April 26, 1985		April 26, 1985			November 29, 1991	
Date partially revised	September 5, 1995		September 5, 1995				
Date for review	March 30, 2005		March 30, 2005			March 30, 2005	
Groundwater pumping quantity (region for restriction / protection) m3 / year				Saga	Shiraishi		
	Fiscal 1982	410 million	Fiscal 1982	7 million	12 million	Fiscal 1986	720 million
	Fiscal 2003	170 million	Fiscal 2003	4 million	2 million	Fiscal 2003	490 million
	Target quantity	270 million	Target quantity	6 million	3 million	Target quantity	480 million
Target region	Parts of Gifu, Aichi and Mie Prefectures		Parts of Fukuoka and Saga Prefectures			Parts of Ibaraki, Tochigi, Gunma, Saitama and Chiba Prefectures	
Notes	At the liaison conference of relevant government offices held on March 30, 2005 to discuss the Guidelines for Ground Subsidence Prevention, it was agreed that efforts to prevent ground subsidence based on the Guidelines would continue.						







Gist of The Guidelines

- The comprehensive measure should be promoted to prevent groundwater subsidence and control water quality for areas (the Nobi Plain, the Chikugo /Saga Plains and the northern Kanto Plain which are highly prone to groundwater subsidence and other damages.
- The target volume of groundwater pumping should be established.
- To control the pumping-up amount of groundwater; 1) “The Industrial Water Law”, “The Building Water Law ,” and “Ordinance concerning restriction on pumping-up groundwater should be fully functioned, 2)”projects for securing alternative water resources” and “projects for water resource development facilities and water supply facilities” should be implemented to shift of the use to surface water, and 3) Guidance should be strictly given to those pumping groundwater to save groundwater and encourage the rational use of groundwater.
- Monitoring and measurement on subsidence level, groundwater level and other damages should be carried out to to identify the status of ground subsidence

Promotion of Groundwater Measures

High-growth period

Occurrence of problems due to excessive pumping of groundwater

1956 – Industrial Water Law was enacted.

(Jurisdiction shared by the Ministry of Economy, Trade and Industry and the Ministry of Environment)

1962 – Building Water Law was enacted.

(Ministry of Environment)

1981

◎Move to enact a groundwater law focusing on subsidence prevention measures for ground hosting groundwater -> Failed to do so.

◎Promotion of subsidence prevention measures by a conference of the cabinet members concerned

1985 - 1991

◎Documentation of Outline of subsidence prevention measures

- ○Establishment of target groundwater collection
- ○Securing and development of alternative water sources and water supply facilities
- ○Prevention of damage from subsidence and recovery measures

Subsidence-prone areas subjected to the program

Promotion of measures by the governmental organs concerned in a comprehensive manner:

Cabinet secretariat, Ministry of Finance, Ministry of Health, Labour and Welfare, Ministry of Agriculture, Forestry and Fisheries, Ministry of Economy, Trade and Industry, Ministry of Land, Infrastructure and Transport, Ministry of Public Management, and Ministry of Environment

The Water Resources Department undertakes affairs for promoting the measures under “Outline”.

Groundwater Quality Measures

1970- Water Pollution Prevention Law was enacted.

1989- Amendment: Introduction of regulation on ground permeation of toxic water

1996- Amendment: Introduction of a system for ordering groundwater purification

2003- Soil Contamination Countermeasures Law

Ministry of Environment

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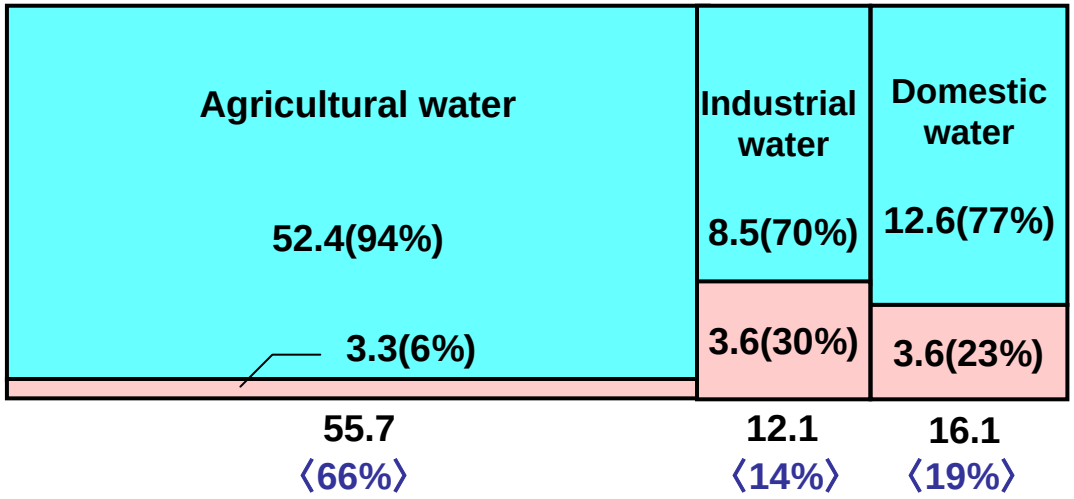
Water Use in Japan and Abroad

・The ratio of groundwater use accounts for approximately 13% in the world
・ The large portion of groundwater is used for industrial water

Current state in Japan

(In billion m^3/year)

Total 83.9



Surface water 73.4(87%)

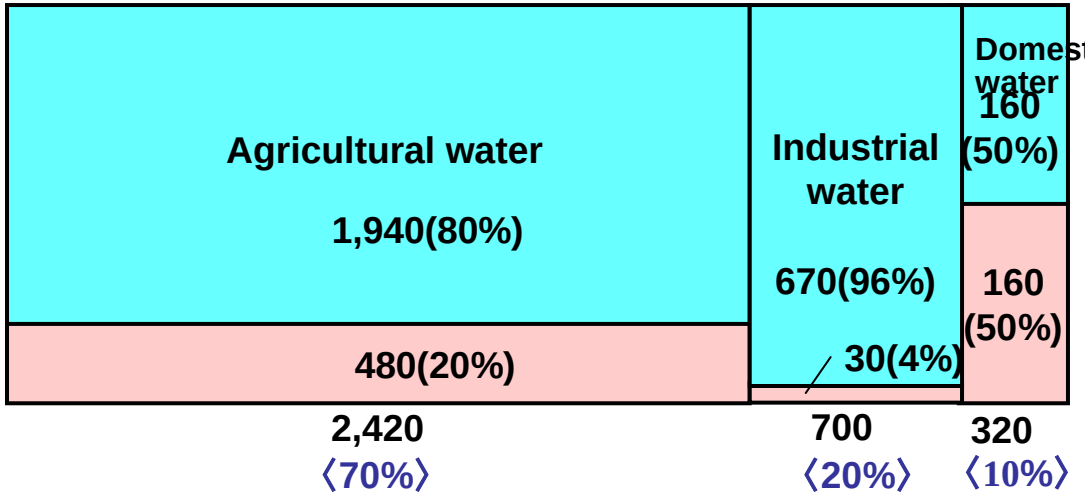
Groundwater 10.5(13%)

Source: "Water Resources in Japan 2006" from Water Resources Department, Ministry of Land Infrastructure and Transport

Current state in the world

(in billion m^3/year)

Total 3,440

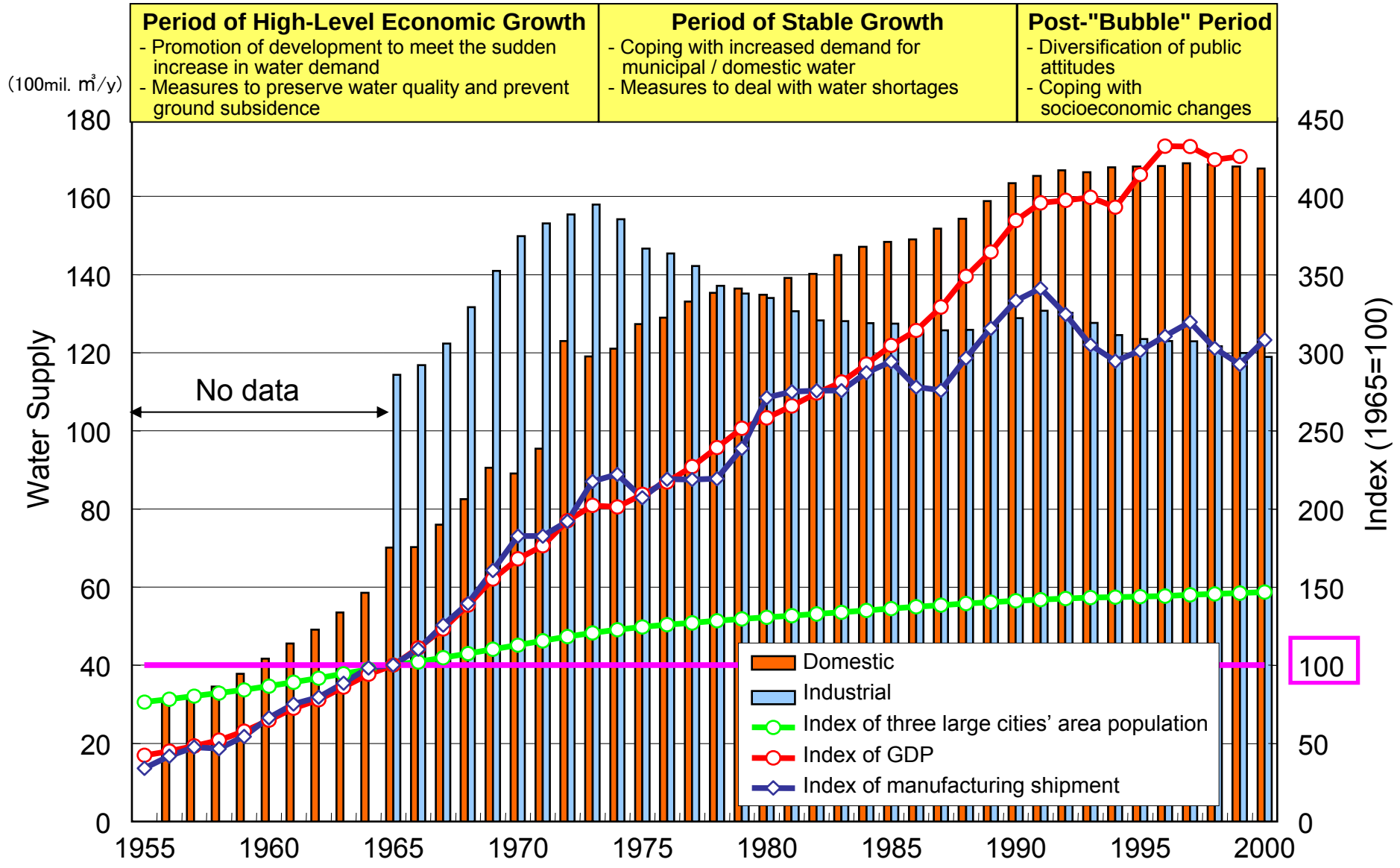


Surface water 2,770(81%)

Groundwater 670(19%)

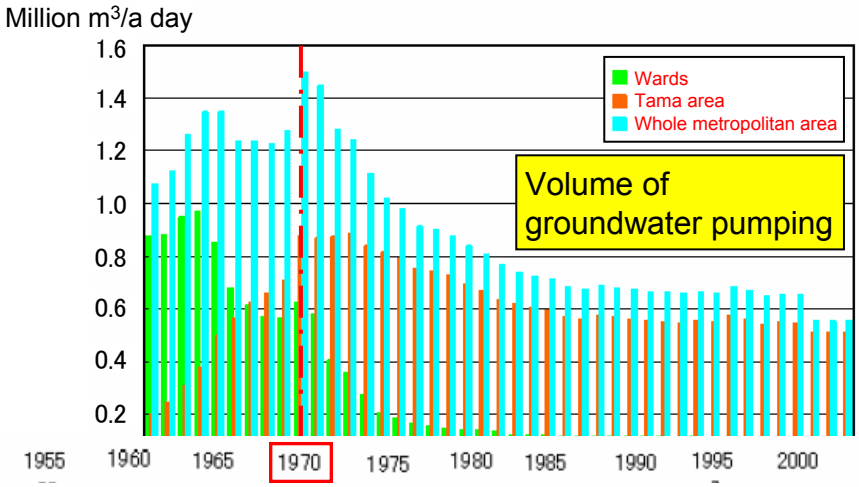
Source: I.A. Shiklomanov "Assessment of Water Resources and Water Availability in the World" from WMO, 1996

Development Phase and Water Supply



Note: the figures shown is the nationwide data in Japan
Three large cities area: Tokyo area (Saitama prefecture, Chiba prefecture, Tokyo metropolitan district, Kanagawa prefecture), Osaka area (Kyoto prefecture, Osaka prefecture, Hyogo prefecture), Nagoya areas (Aichi prefecture, Mie prefecture)
GDP figure is actual figure of base year 1990. The indexes including manufacturing shipments are actual figures recalculated after multiplied by general price index of base year 1990.
Sources: Water supply figure, industrial statistics, population census and an annual report of population estimate, annual reports on national income statistics and on national accounting

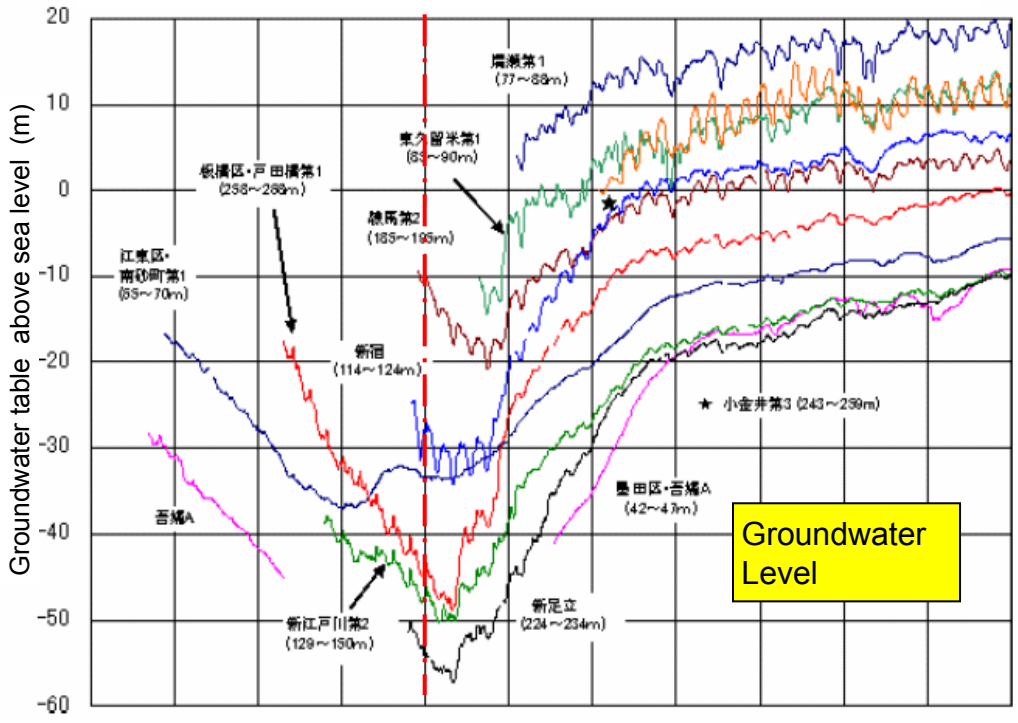
Volume of Pump-up Groundwater and Groundwater/ Subsidence Levels in Tokyo Metropolitan District

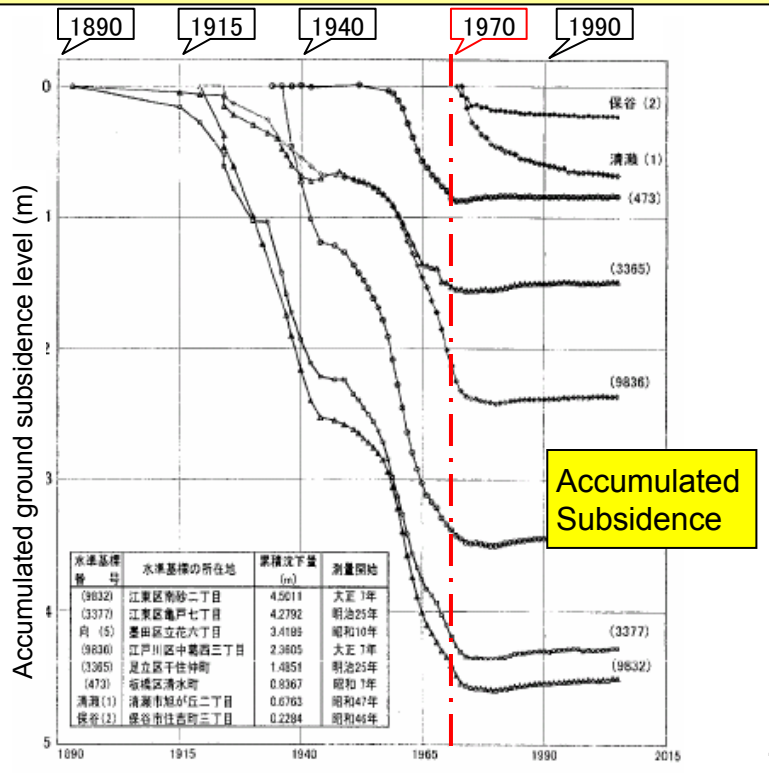


・The demand for groundwater use had been rapidly increased in the course of industrialization since 1900s.
・As a result, groundwater level was lowered and ground subsidence occurred. The highest subsidence was recorded at 4m

Water Restriction by Laws and Ordinances

・The volume of pumping groundwater was able to reduce considerably since 1970 at the peak. (Currently approximately 1/3 is reduced from 1970)
・As a result, groundwater level was raised up to 50m
・In recent years, ground subsidence seems to calm down.



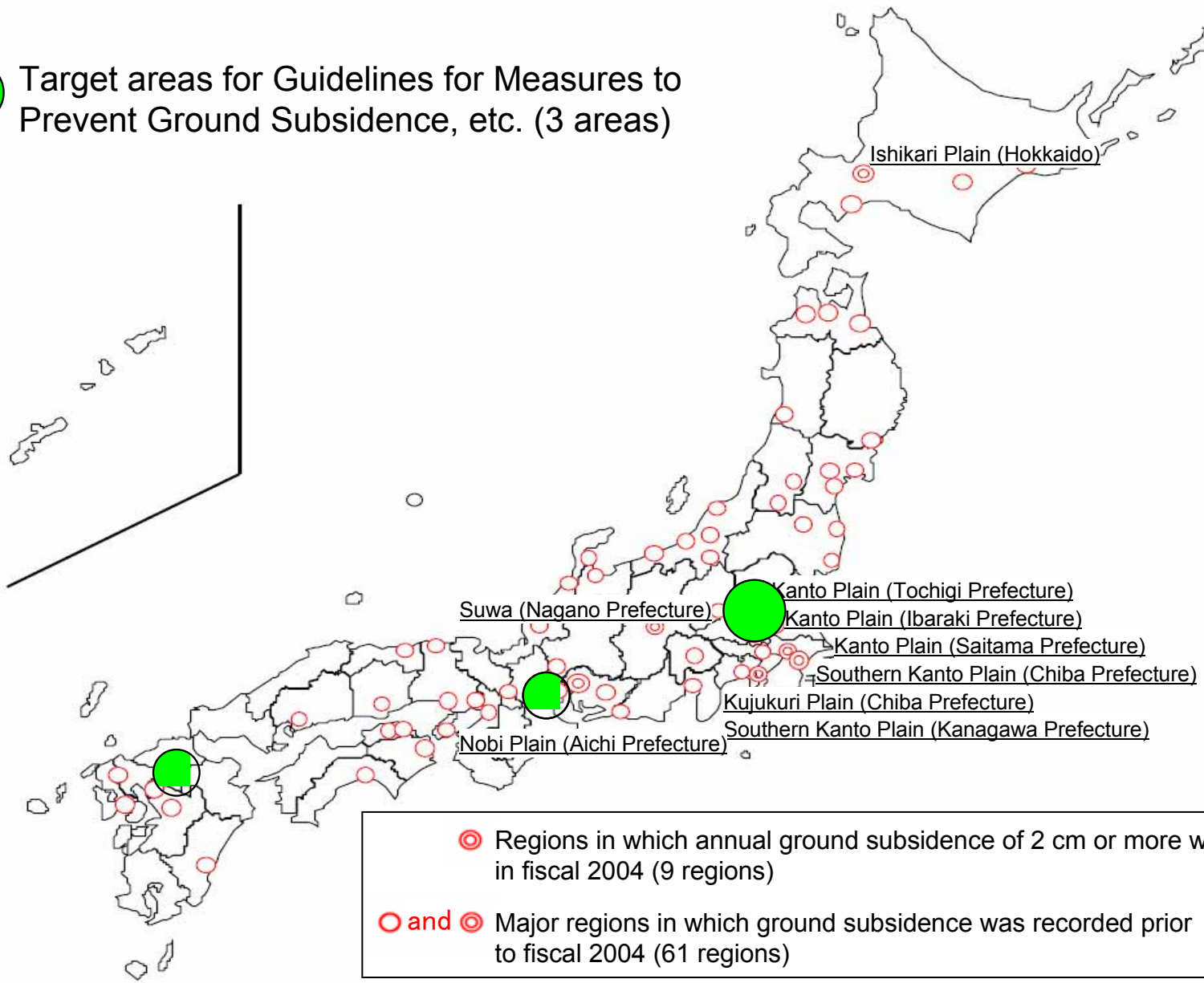


水準基標番号	水準基標の所在地	累積沈下量 (m)	測量開始
(9632)	江東区南砂二丁目	4.5011	大正 1年
(3377)	江東区亀戸七丁目	4.2792	明治25年
向 (5)	墨田区立花六丁目	3.4199	昭和10年
(9836)	江戸川区中葛西三丁目	2.3605	大正 7年
(3365)	足立区千住仲町	1.4851	明治25年
(473)	板橋区清水町	0.8367	昭和 1年
清瀬(1)	清瀬市旭が丘二丁目	0.6763	昭和47年
保谷(2)	保谷市住吉町三丁目	0.2284	昭和46年

Source: Website of Tokyo Metropolitan Government (http://www.metro.tokyo.jp/ENGLISH/index.htm)

Overview of Ground Subsidence Areas Nationwide

Target areas for Guidelines for Measures to Prevent Ground Subsidence, etc. (3 areas)

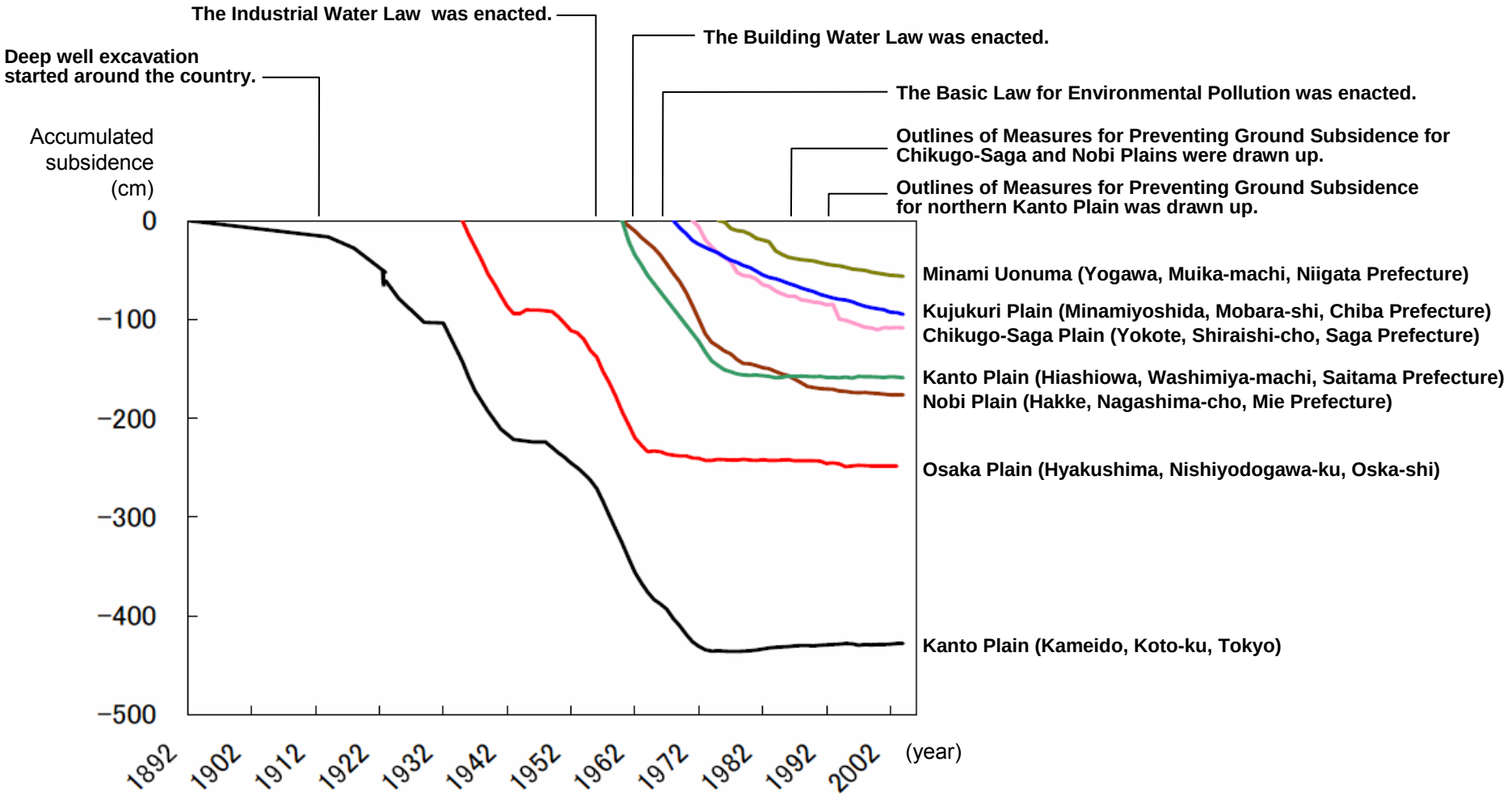


◎ Regions in which annual ground subsidence of 2 cm or more was recorded in fiscal 2004 (9 regions)

○ and ◎ Major regions in which ground subsidence was recorded prior to fiscal 2004 (61 regions)

Note: According to "Overview of Ground Subsidence Areas Nationwide" (Ministry of the Environment)

State of Subsidence

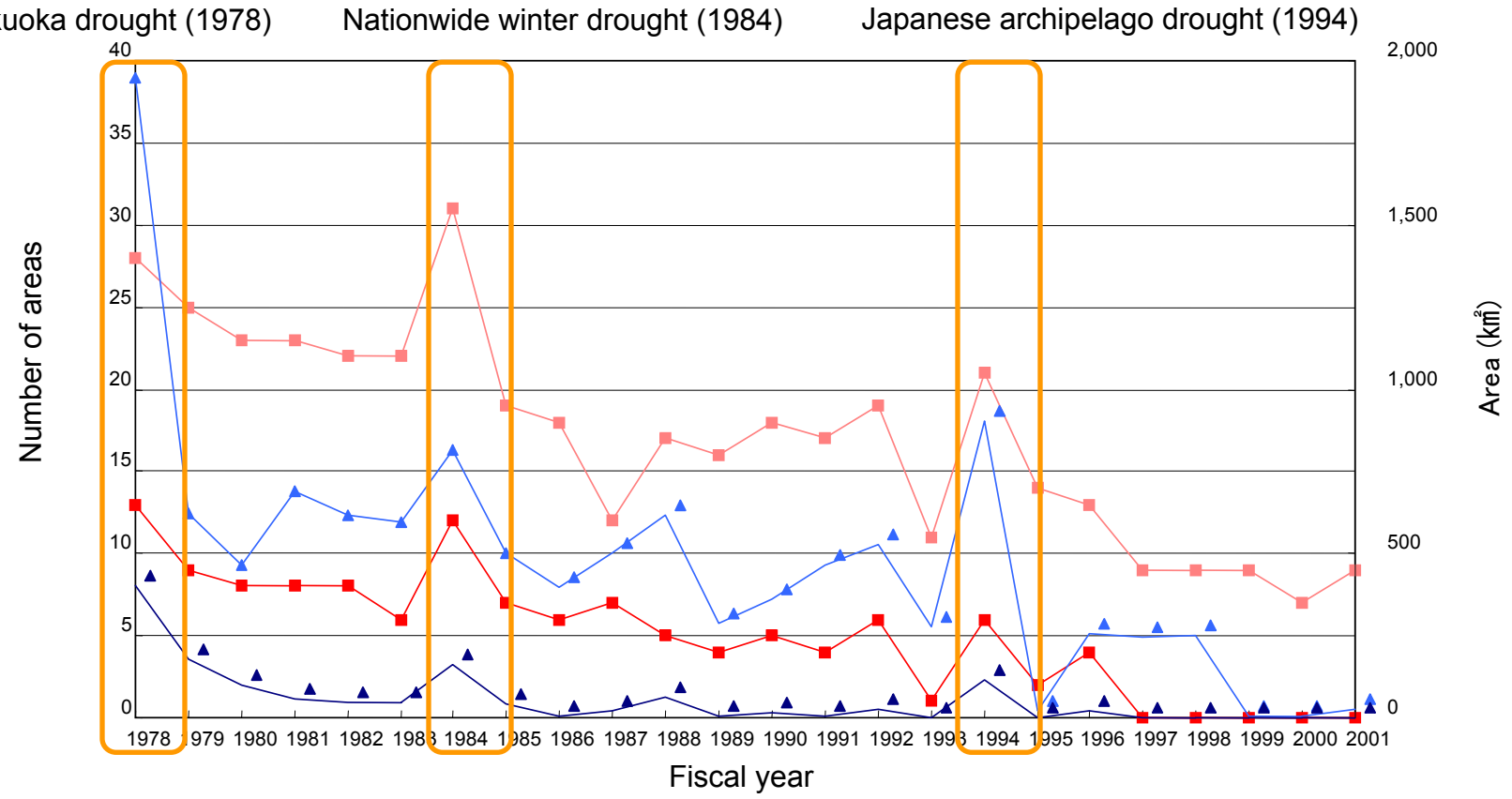


Source: Overview of Areas with Subsidence across Japan (Ministry of Environment, 2005)

Ground Subsidence During Drought Periods

Ground subsidence is generally subdued, but it occurs due to rapid groundwater collection during drought periods.

State of Subsidence across Japan



Source:1978 - 2000: "Outline of Areas with Land Subsidence Across the Country in Fiscal 2000", Soil Environment Division, Water Environment Department
2000 - 2001: "Outline of Areas with Land Subsidence Across the Country in Fiscal 2001", Soil Environment Division, Water Environment Department

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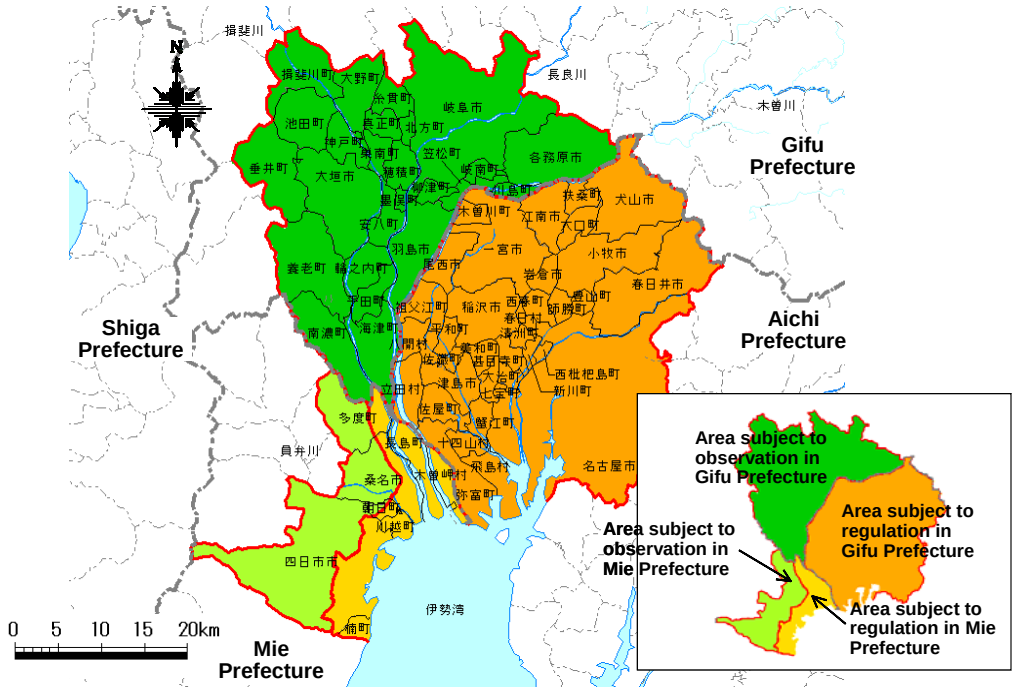
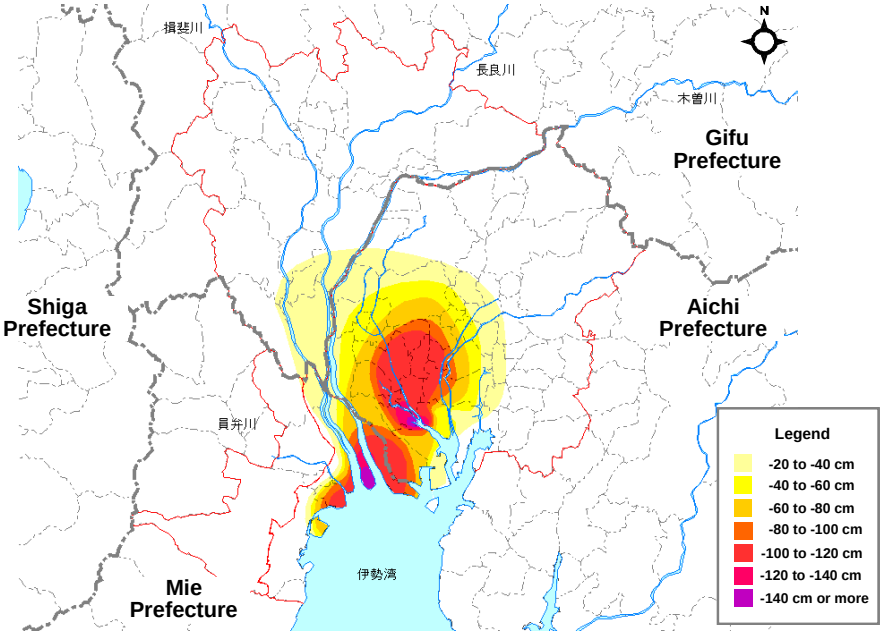
Outline of Guidelines for Preventing Ground Subsidence for Nobi Plain

- The Guidelines of Measures for Preventing Ground Subsidence for the Nobi Plan was established in 1985 at the Cabinet Meeting.
- Three targeted areas are designated for Aichi, Mie and Gifu Prefectures which covers 1,485㎢
- The greatest subsidence level was recorded at 160cm affecting 700㎢ around the areas since the first monitoring was initiated in 1961.
- Target volume of pumping water to restrict groundwater is established, and projects for water facilities development securing alternative water resources and measures for measuring and monitoring the status of ground subsidence are defined.
- In recent years, the pumping volume of groundwater was reduced less than the targeted volume and thus, ground subsidence appeared to be calm down.
- Constant measurement and monitoring for groundwater and ground subsidence is being carried out at 110 observation wells and at 1400 points.



Area subject



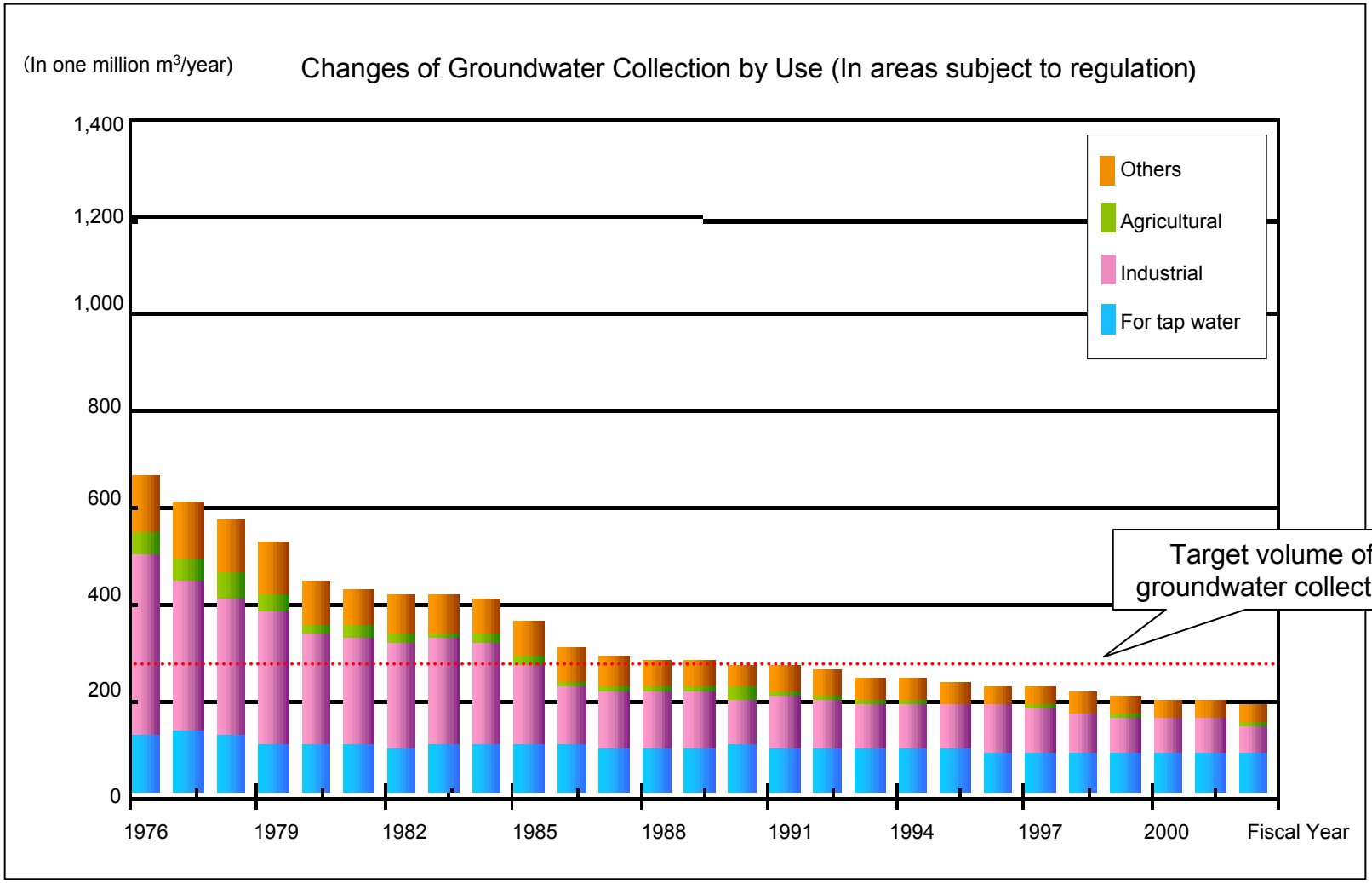
Contour map of accumulated subsidence

(February 1961 – November 2002)

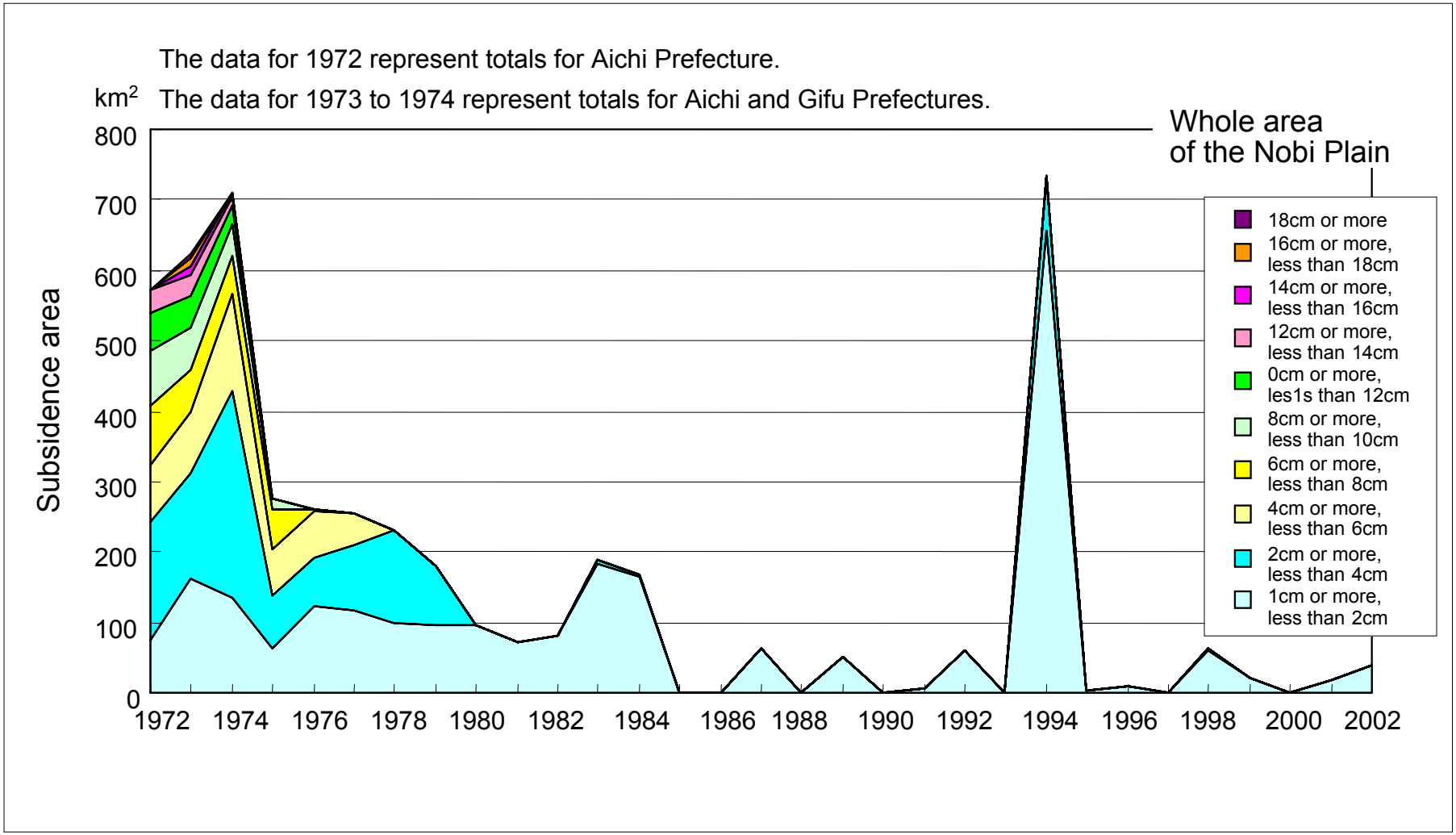
Laws Concerning Subsidence Prevention and Other Measures

	Industrial Water Law (Enforced on June 11, 1956)	Aichi Prefectural Ordinance Concerning Conservation of Living Environment for Residents	Mie Prefectural Ordinance Concerning Conservation of Living Environment for Residents	Nagoya Municipal Ordinance Concerning Environmental Conservation for Securing Health and Safety of Citizens	Gifu Prefecture (self-imposed regulation)
Progressions	(Aichi) June 17, 1960 - Area designation July 5, 1984 - Area designation (Mie) July 10, 1957 - Area designation July 1, 1963 - Area extension	October 1, 1971 Enforcement of Aichi Prefectural Ordinance for Pollution Prevention September 30, 1974 Pumping regulation April 1, 1976 Area extension October 1, 2003 – Transition to the new ordinance	April 21, 1972 Enforcement of the Mie Prefectural Ordinance for Pollution Prevention April 1, 1976 Area extension March 27, 2001 Transition to the new ordinance	January 8, 1973 Enforcement of the Nagoya Municipal Ordinance for Pollution Prevention November 16, 1974 Pumping regulation October 1, 2003 Transition to the new ordinance	June 3, 1974 Establishment of Nishino Area Council for Measures Related to Groundwater Use July 28, 2000 Area extension
Areas subject to regulation	(Aichi) Part of the Minami and Minato wards (ku) in the city of Nagoya and 21 municipalities including the city of Ichinomiya and other municipalities in the Owari region (Mie) Part of the city of Yokkaichi, Kusunoki-cho	First control area (the city of Inazawa and southward) Second control area (the city of Ichinomiya, etc.) Third control area (the city of Kasugai, etc.)	Area No.1 (Nagashima-cho, etc.) Area No. 2 (Part of the city of Yokkaichi, etc.)	The entire area of the city of Nagoya	Area A (The built-up area in the city of Ogaki) Area B' (Anpachi-cho, Wanouchi-mura, Hirata-cho, Sunomata-cho) Area B (The city of Ogaki, excluding Area A, Kaidu-cho, Yoro-cho, Nannou-cho) Area C (Godo-cho, Ikeda-cho, Ono-cho, Ibigawa-cho) Area D (Tarui-cho)
Contents of regulation – **Applicable industry type**	Industrial	All industries except for home use	All industries except for home use	Facilities excluding the following: Facilities for domestic use or those used under the Industrial Water Law, and facilities within watershed areas to which river laws are applicable	Industrial
Contents of regulation – **Standards for permission**	(Aichi) Minami-ku and others, Nagoya Cross-sectional area of the discharge spout / Location of the strainer 46 cm^2 or less: At 80 m or deeper Exceeding 46 cm^2: At 300 m or deeper Ichinomiya and others Cross-sectional area of the discharge spout / Location of the strainer Must be 19 cm^2 or less : No deeper than at 10 m or at 2,000 m or deeper (Mie) Cross-sectional area of the discharge spout / Location of the strainer 21 cm^2 or less : At 100 m or deeper 21 - 46 cm^2 : At 230 m or deeper	Location of the strainer: No deeper than at 10 m Cross-sectional area of the discharge spout: No greater than 19 cm^2 Rated output of the motor: No greater than 2.2 kw Total pump discharge per day: 350 m^3	Location of the strainer: No deeper than at 10 m Cross-sectional area of the discharge spout: No greater than 19 cm^2 Rated output of the motor: No greater than 2.2 kw Total pump discharge per day: 350 m^3	Location of the strainer: No deeper than at 10 m Cross-sectional area of the discharge spout: No greater than 19 cm^2 Rated output of the motor: No greater than 2.2 kw Total pump discharge per day: 350 m^3	(Water intake standards) For new facilities only Area / Water intake volume (m^3/day) / Pump spout diameter (mm) / Location of the strainer (m or deeper) Area A: Not permitted / - / - Area B': 1,000 / 80 / 100; 500 / 65 / 100 Area B: 1,000 / 80 / 70; 500 / 65 / 70 Area C: 1,000 / 80 / 30; 500 / 65 / 30 Area D: 1,000 / 80 / 25; 500 / 65 / 25
Contents of regulation – **Transitional handling of existing facilities**	Deemed permission under the conditions below: Aichi January 4, 1967 Minami and Minato wards, Nagoya February 1, 1986– 21 municipalities including Ichinomiya (with some areas excluded) Mie February 10, 1970 The permission standards applicable subsequently	Deemed permission under the conditions below: Groundwater use of no less than 350 m^3 per day for industrial, building, hot spring businesses, mining and industrial tap water is subject to 20% reduction of the total pump discharge after January 1, 1976 for the First control area and after April 1, 1977 for the Second control area.	Deemed permission under the conditions below: Groundwater use of no less than 350 m^3 per day in Area No. 1 is subject to 20% reduction of the total pump discharge after April 1, 1977, except for facilities with the strainer installed at no deeper than 10 m or groundwater use for agriculture, aquaculture and water supply services.	Deemed permission under the conditions below: Reporting is required within 30 days after being deemed as a pumping facility under the ordinance.	Area A: By March 1977, intake reduction is required by 30% of the pump discharge as of the reference date.
Additional requirements	Users of approved wells are required to report on the state of the well use.	Among existing wells, those with a pump having a discharge spout with a cross-sectional area of 19 cm^2 or more are subject to a reporting duty on the installation of a water meter and the pump discharge.	Facilities with a pump having a discharge spout with a cross-sectional area of 6 cm^2 (19 cm^2 for those installed before April 1, 1975) or more are subject to a reporting duty on the installation of a water meter and the pump discharge.	Pumping facilities are subject to a reporting duty on the water intake volume and water level-measurment.	Installation of a water meter and rationalization of water use

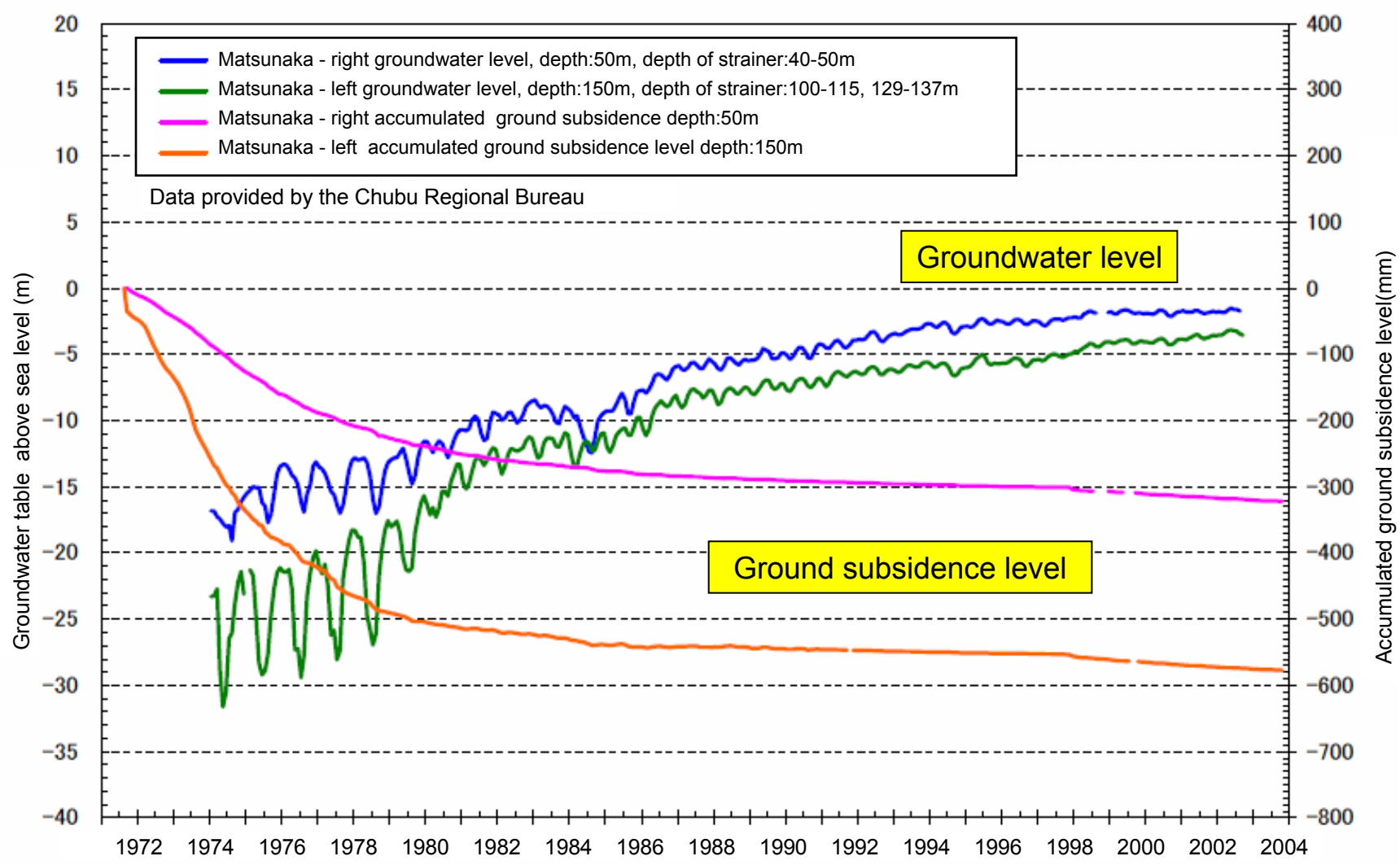
Changes of Groundwater Collection



Changes of Subsidence Area

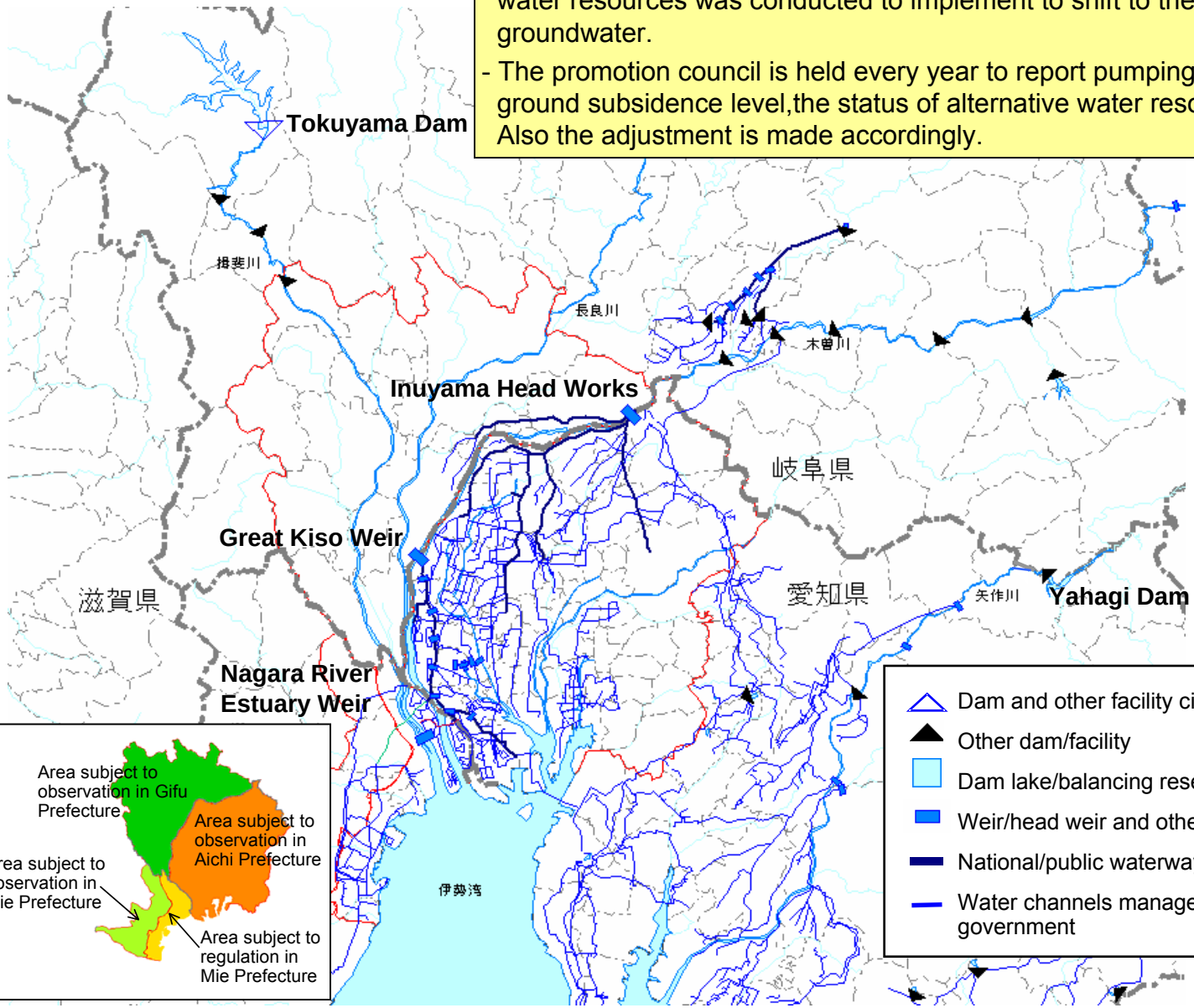


Changes of Groundwater Level and Ground Subsidence



Measures for Preventing Ground Subsidence

- Water resource development by dams and and canal projects to secure alternative water resources was conducted to implement to shift to the use of surface water from groundwater.
- The promotion council is held every year to report pumping volume of groundwater, ground subsidence level,the status of alternative water resources facilities and the like. Also the adjustment is made accordingly.



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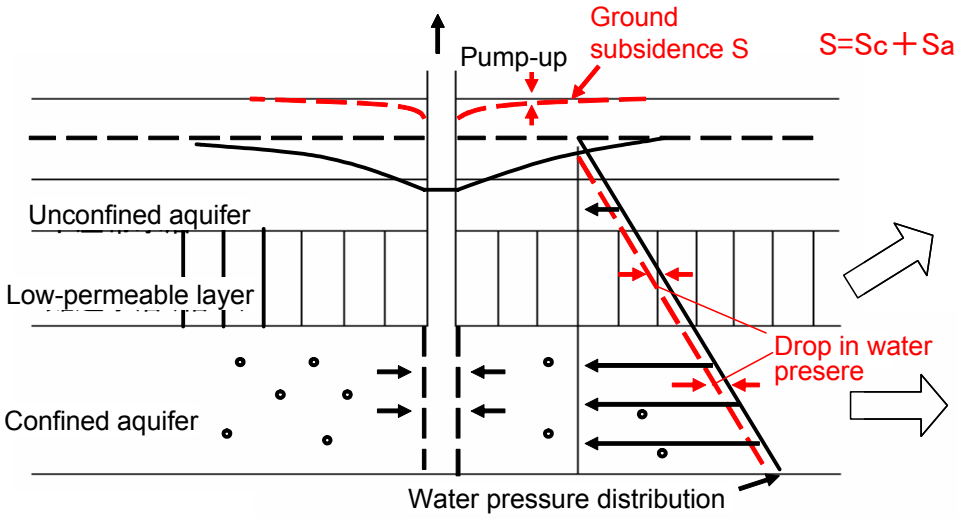
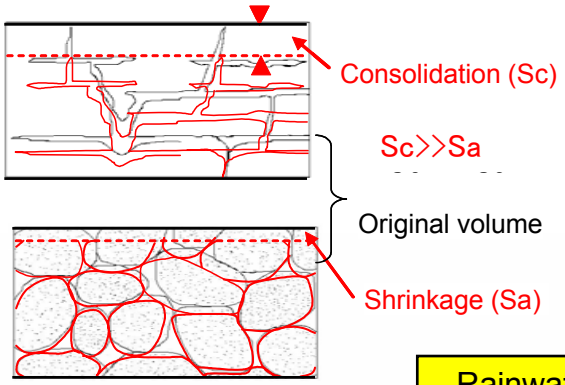
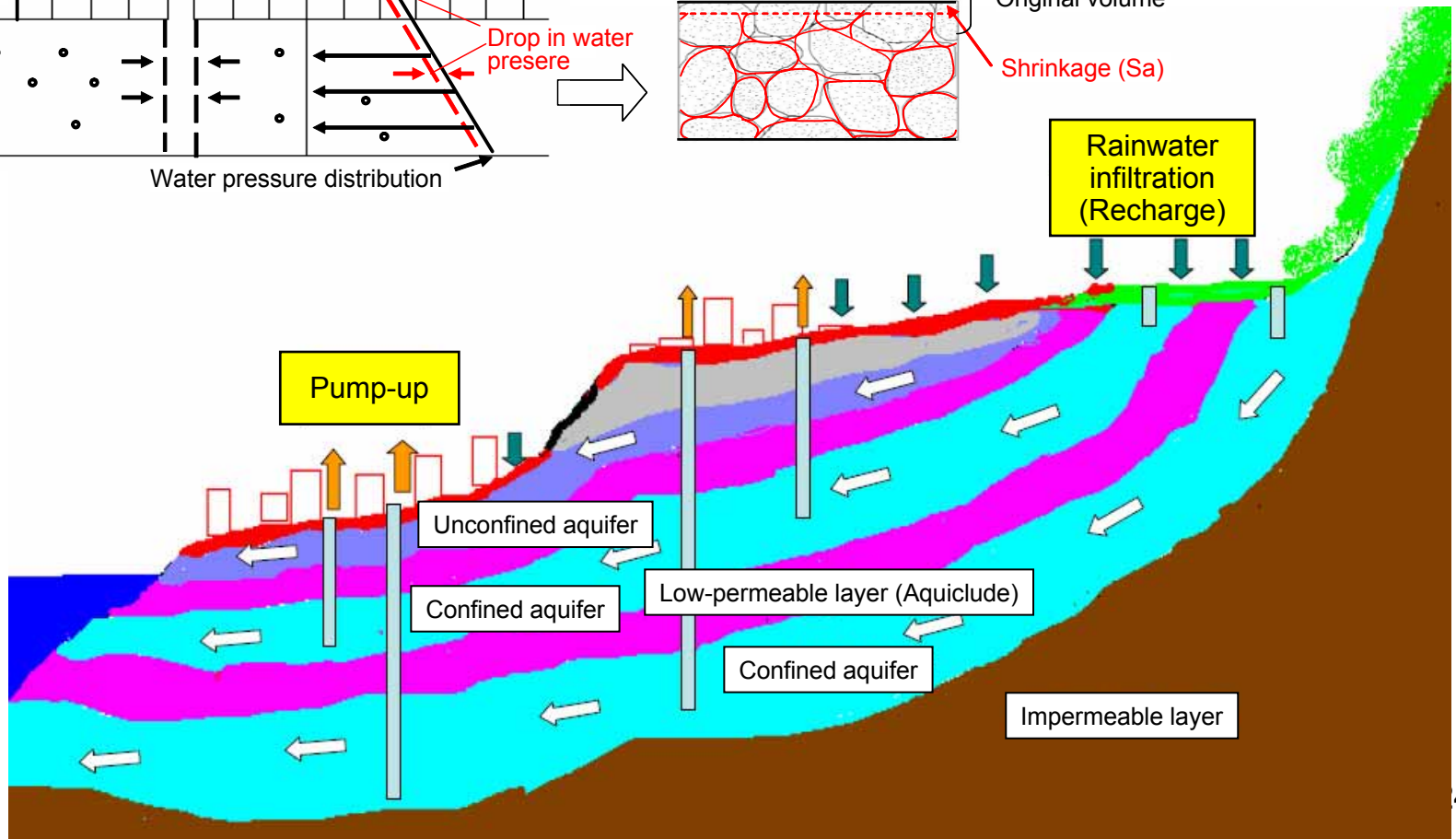
Other (1) Mechanism of Ground Subsidence

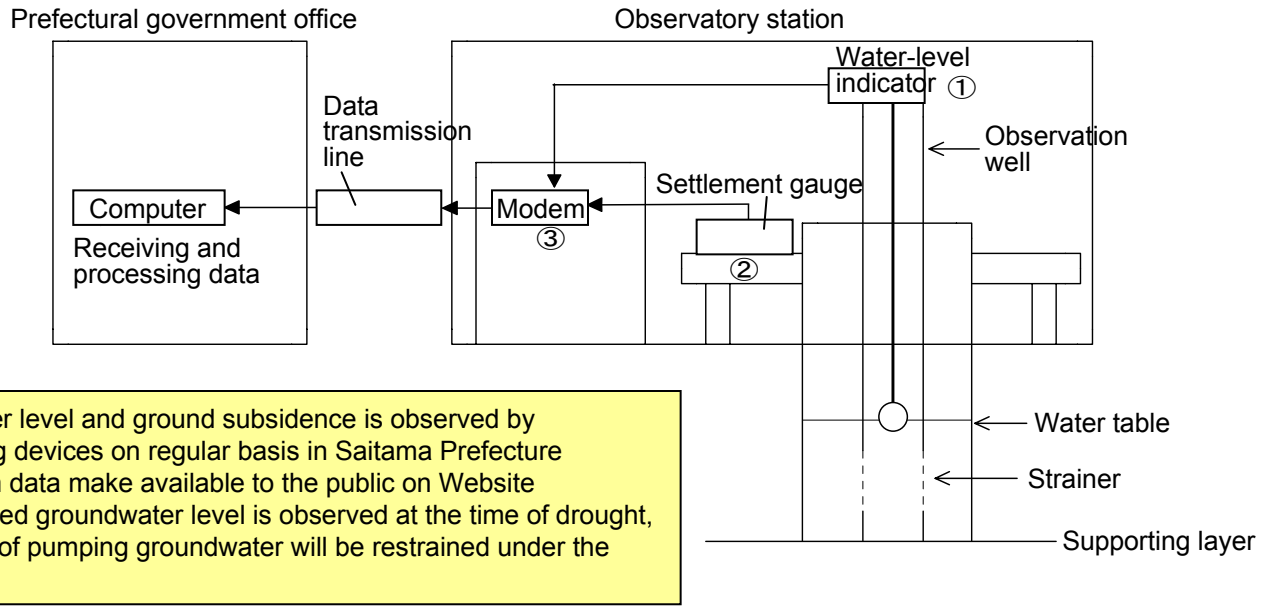
- Excessive pumping water from an confined aquifer puts the water under pressure and then, causes the consolidation (Sc)of low-permeable layer (eg. Clay strata). After shrinkage (Sa) of aquifer occured, surface layer sinks.（S=Sc+Sa）







Other (2) Groundwater Level Monitoring System in Saitama Prefecture



- Groundwater level and ground subsidence is observed by telemetering devices on regular basis in Saitama Prefecture
- Observation data make available to the public on Website
- When lowered groundwater level is observed at the time of drought, the volume of pumping groundwater will be restrained under the ordinance