Implementation by Nagoya City

Measures to make Horikawa River Limpid

Summary meeting for the 28th stage

Nagoya City

Greenification & PublicWorks Bureau River Plannning Div.

Waterworks and Sewerage Bureau Sewerage Plannning Div.

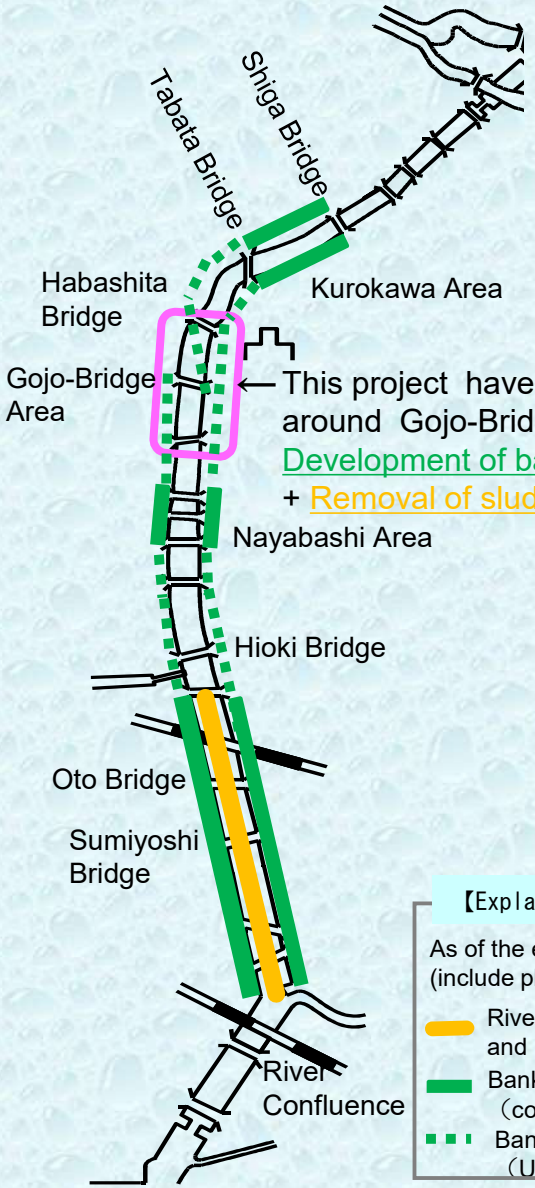
Environment Bureau Local environmental measures Div.

Implementation by
Nagoya city
Greenification & PublicWorks Bureau

Initiatives for clarification of *Horikawa* River

-①Removal of Sludge-

◆Removal of Sludge in Horikawa River



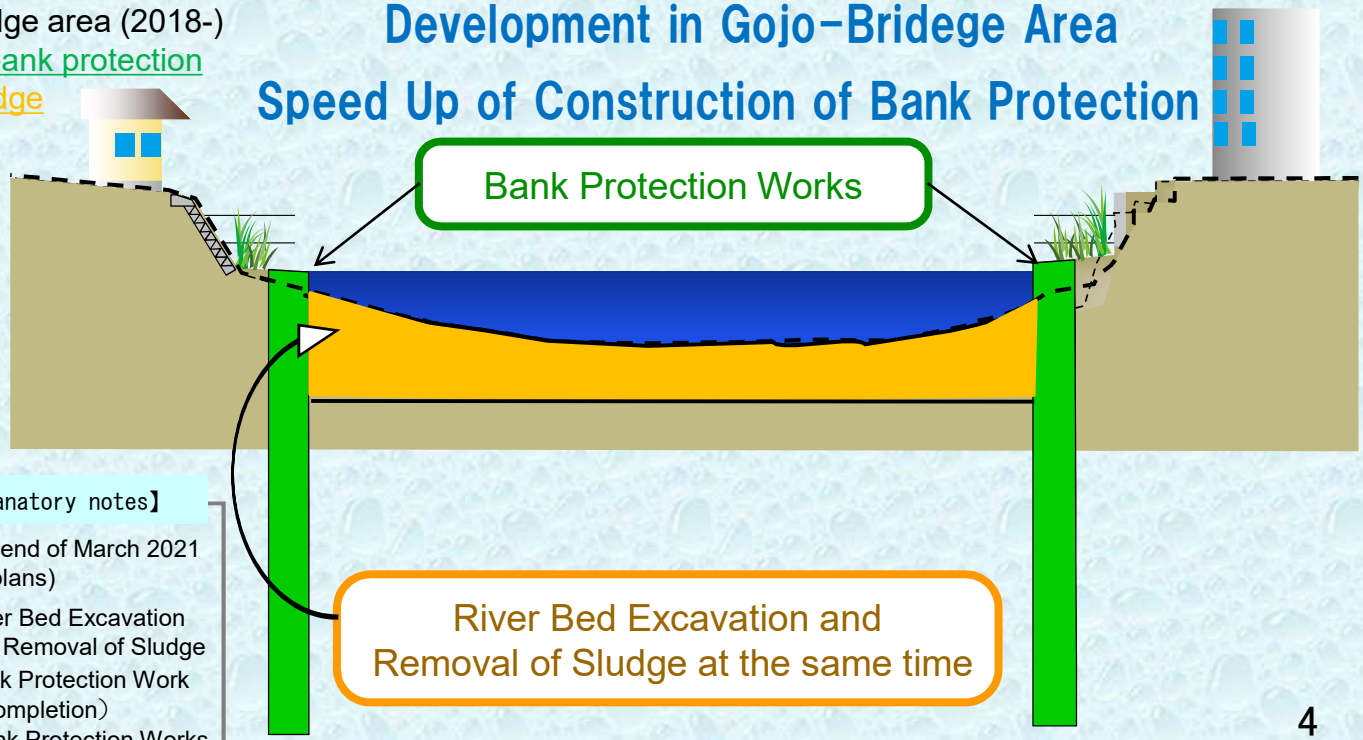
- **Development of Bank Protection in River management project**

- **After Bank Protection Works, River bed Excavation and removal of sludge are implemented at the same time**

⇒Development from downstream+

Development in Gojo-Bridege Area

Speed Up of Construction of Bank Protection



◆Removal of Sludge in Horikawa River②

Improvement work of Bank Protection

Before improvement work

After improvement work

(Upstream of Tenmacho Bridge)

Removal of Sludge

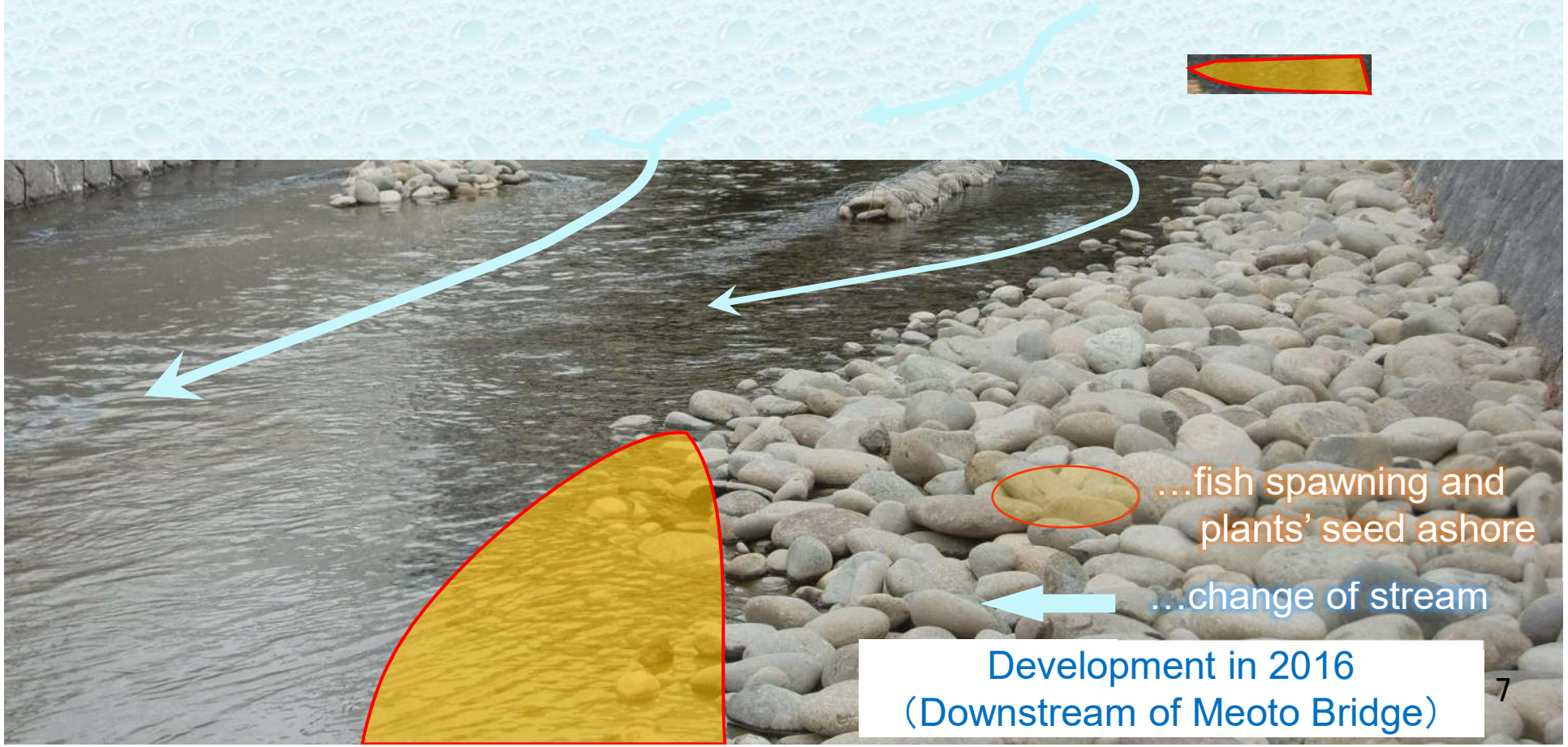
(Downstream of Sumiyoshi Bridge)

Initiatives for clarification of *Horikawa* River

-②Developments of Shallows and Depths-

◆Developments of Shallows and Depths

Setting wooden piles and ripraps generates variable stream on the river for enforcing river's self-purification function and creating habitats with growth of plants.



Development in 2016
(Downstream of Meoto Bridge)

◆Developments of Shallows and Depths

Installed in 2010

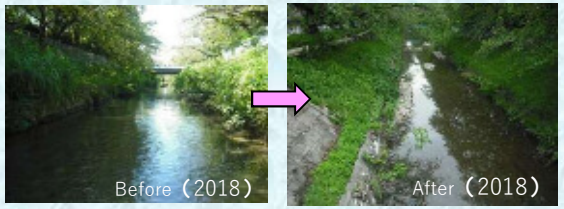
Installed in 2012

Installed in 2013

Installed in 2015 (Downstream of Ruriko Bridge)

Installed in 2016 (Downstream of Meoto Bridge)

Installed in 2018 (Upstream of Kizune-Bridge)



Some of the creatures seen in the upstream of Horikawa River

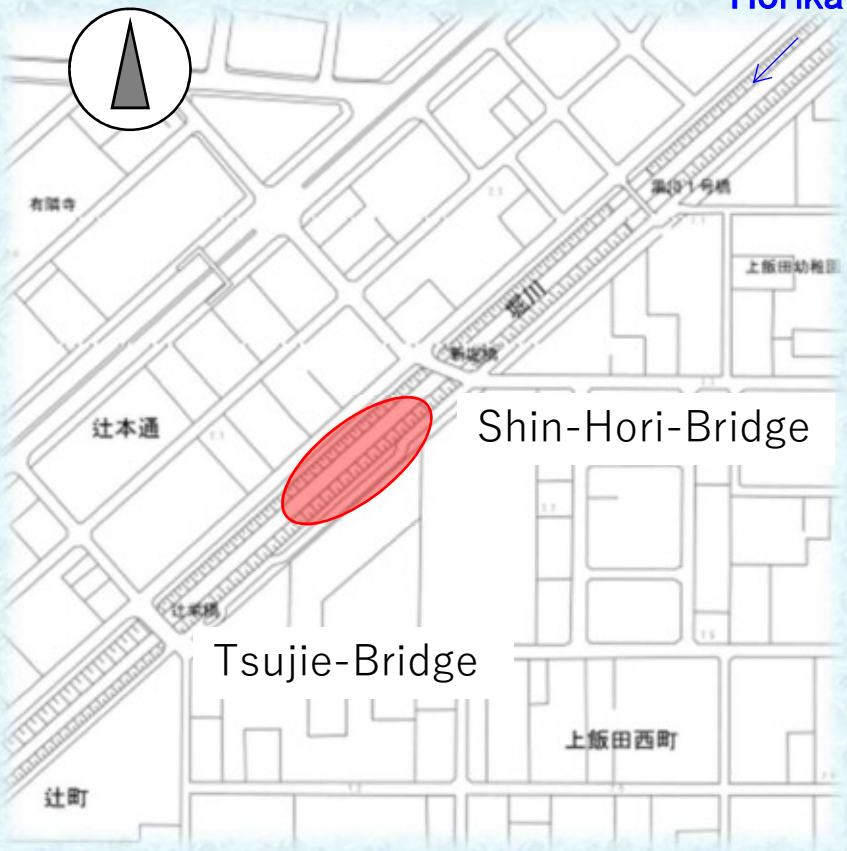
◆Improvement

- Variety and amount of fish have increased. (example pale chub)
- Benthos have increased. (example shrimp)
- Plants have grow up more.

◆Developments of Shallows and Depths

A development project was completed in Downstream of Shin-Hori-Bridge in Kita Ward, March 2021

MAP



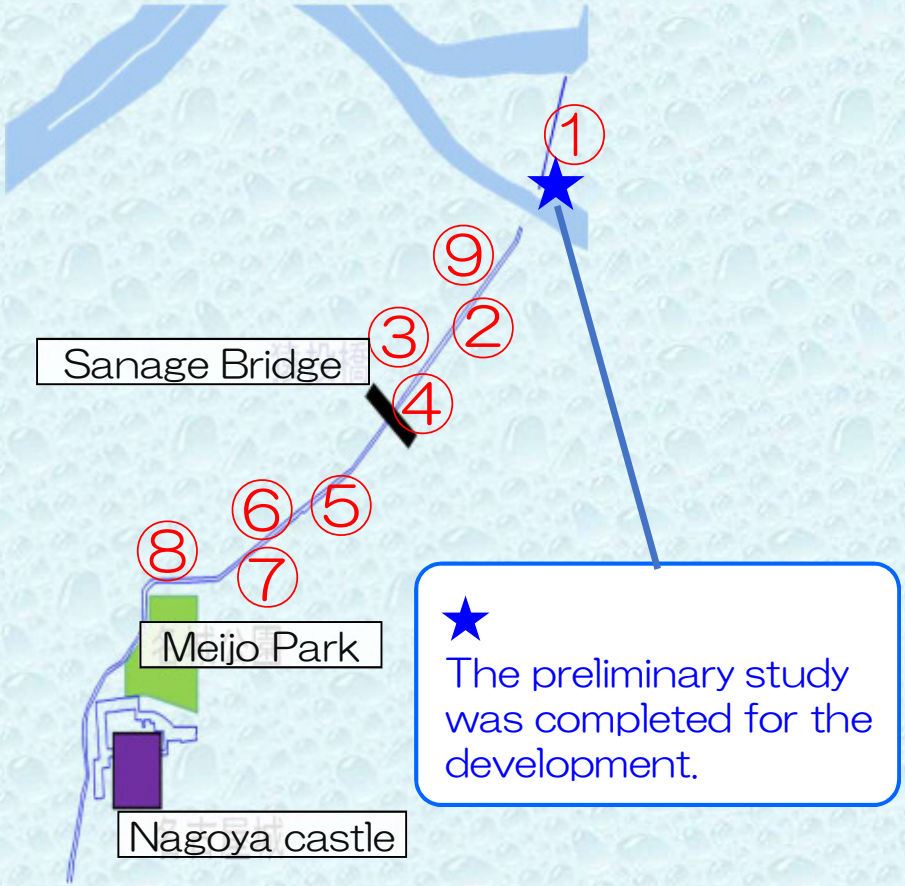
condition

Initiatives for clarification of *Horikawa* River

-③ Use of shallow groundwater -

◆Use of shallow groundwater

We are studying for the extension of this facility in Moriyama ward in FY2020.
(★ in the following map)



※The facilities discharge shallow groundwater into the Horikawa River.

① Mar.2013

Uprsteam of Seko Bridge
0.01m³/s

② Oct.2004.

Tsujei Bridge
0.01m³/s

③ Nov.2005

Kizune Bridge
0.01m³/s

④ Mar.2014.

Sanege Bridge
0.01m³/s

⑤ Mar.2015

Shiga Bridge
0.01m³/s

⑥ Mar.2008

Shimizu spring water
0.0005m³/s

⑦ Mar.2018

Kinjo Bridge
0.01m³/s

⑧ Mar.2016

Nakatsuchido Bridge
0.01m³/s

⑨ Mar.2021

Kurokawa First Bridge
0.01m³/s

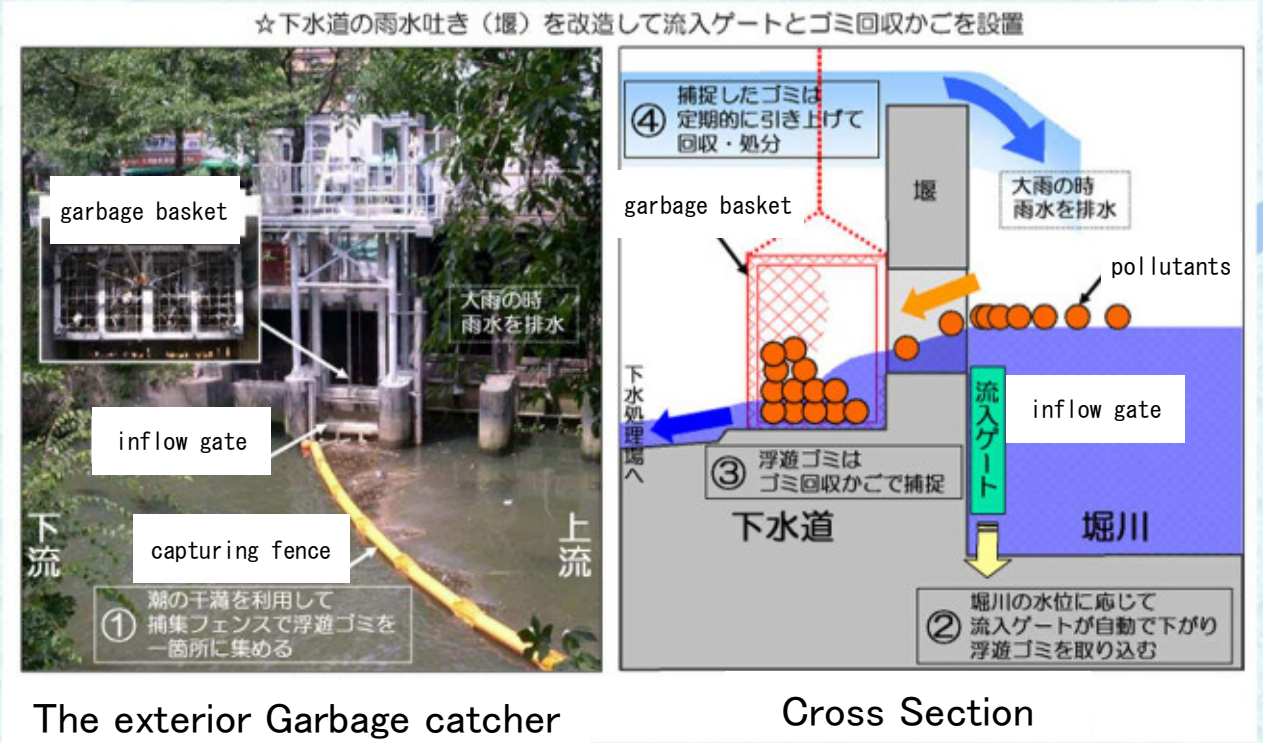
※②③④
The wells are broken.
⇒We are studying to repair

Initiatives for clarification of *Horikawa* River

-④Change of collected pollutants -

Removal of inflow of pollutants

◆Garbage catcher （Near Johoku Bridge） since 2006



The exterior Garbage catcher　　Cross Section

Removal of pollutants

Cleaning by NAGOYA *Seiko-kai* (Public interest incorporated association for cleaning Nagoya Ports)

Removal of floating garbage

2 Cleaning by Seiko-kai Part2

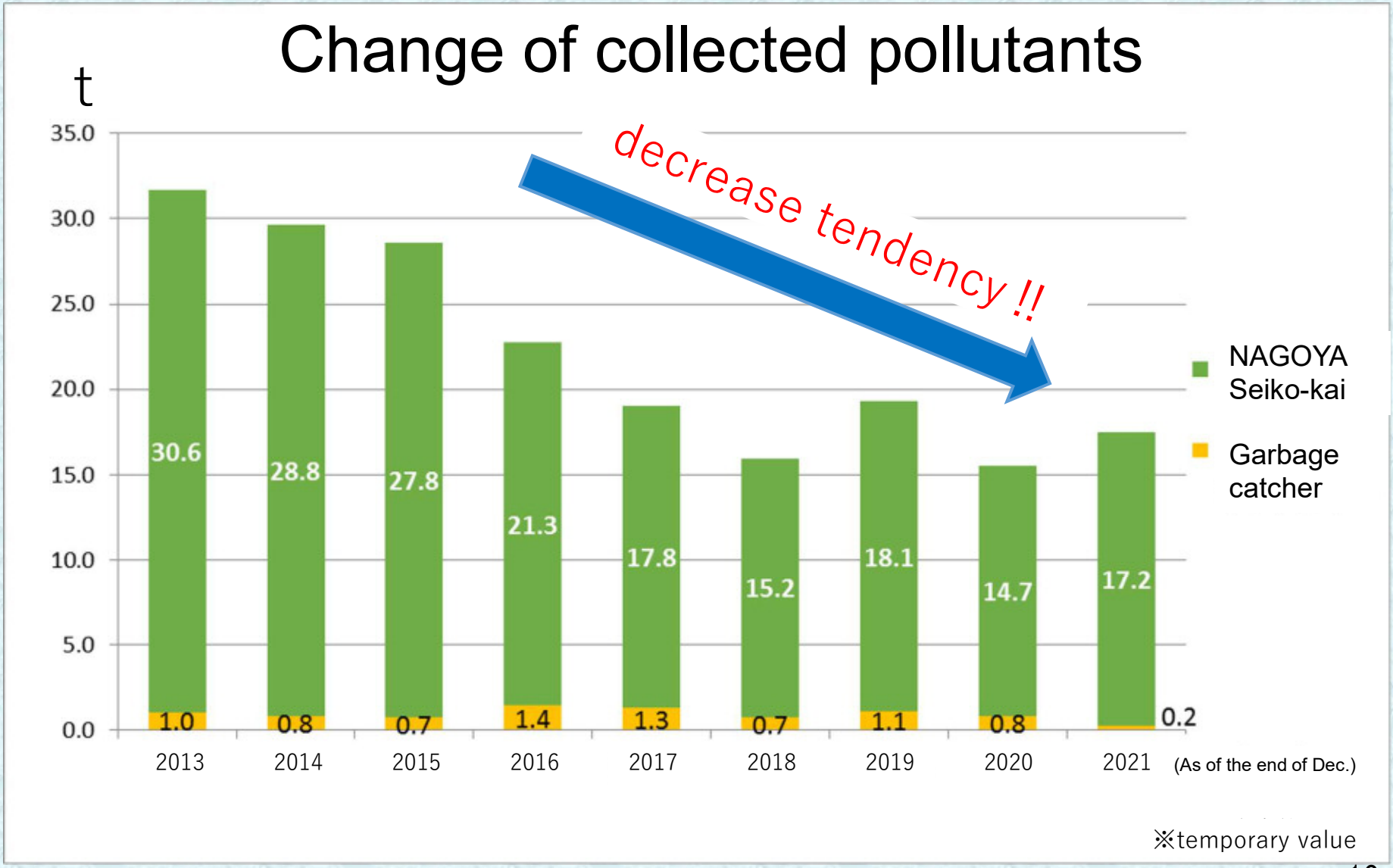
We consulted with Nagoya Port Authority that has jurisdiction over Seiko-kai !

We communicated the area where floating garbage gathers where citizens reported at the last summary meeting for the 27th stage, and requested efficient cleaning.

(Nagoya city)
The floating garbage gathers around the recessed area of Shin-Horikawa River, for example Mukaida Bridge. As with Horikawa River, please clean efficiently, such as collecting the garbage at ebb tide.

(Nagoya Port Authority)
We have acknowledged.
We will communicate Seiko-kai, and try to collect garbage as much as possible.

Collection of pollutants



Initiatives for clarification of *Shin-Horikawa* River

■Survey and study for improvement of water environment of the Shin-Horikawa River (2020)

For improvement the water environment of the Shin-Horikawa River, we verified and evaluated the effectiveness of various water purification measures in consideration of experts opinions, and formulated future purification policies.

List of experts

Name	Belong to		Specialized field
Kenji Daito	Daido University	Professor	Environmental Geotechnics, Sedimentology
Akihiro Tominaga	Nagoya Institute of Technology	Professor	River Engineering Hydraulics
Naoki Matsuo	Chubu University	Professor emeritus	River Engineering Environmental Hydraulics
Akihiko Yagi	Aichi Institute of Technology	Visiting professor	Limnology
Naoko Yoshida	Nagoya Institute of Technology	Associate Professor	Environmental Microbiology

Future policy for improving the water environment of Shin-Horikawa River

① Installing **separate sewer system** that reduces the pollution load as wide as possible

② Working on measures simultaneously that will be effective immediately

ex**. installing rainwater reservoirs**

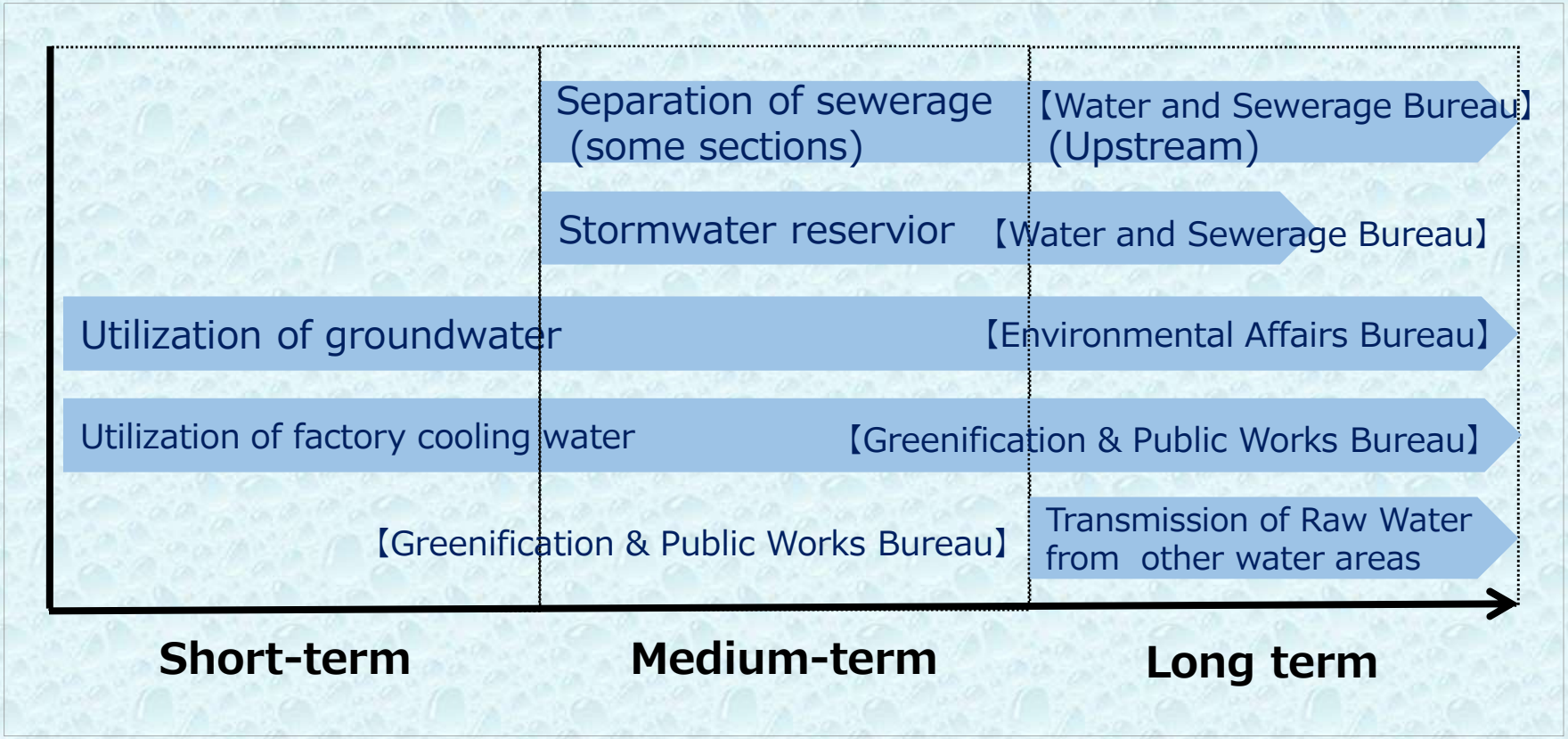
③ **Discharging groundwater and factory cooling water** that supplies oxygen for the bottom of the river**.**

Checking the result of ①, ② and ③ continuously

④ **Water conveyance from the other basin** according to the improvement of water quality at the intake place

■Survey and examination for improving the water environment of the Shin-Horikawa River (FY.2020)

<Assumed schedule>



Short term : 1 to 5 years
Medium term: 5 to 10 years
Long term : 10 years or more

■Cooperation with Nagoya Chamber of Commerce and Industry (**2020 plan**)

○To make prosperity of Shin-Horikawa River together with companies on the river

・Experience event of boarding (know the present)

is scheduled in May 2021 for companies along the river

・Exchanging opinions about the future (talk about the future)

Industry-Government-Academia-Private started discussion about the future.

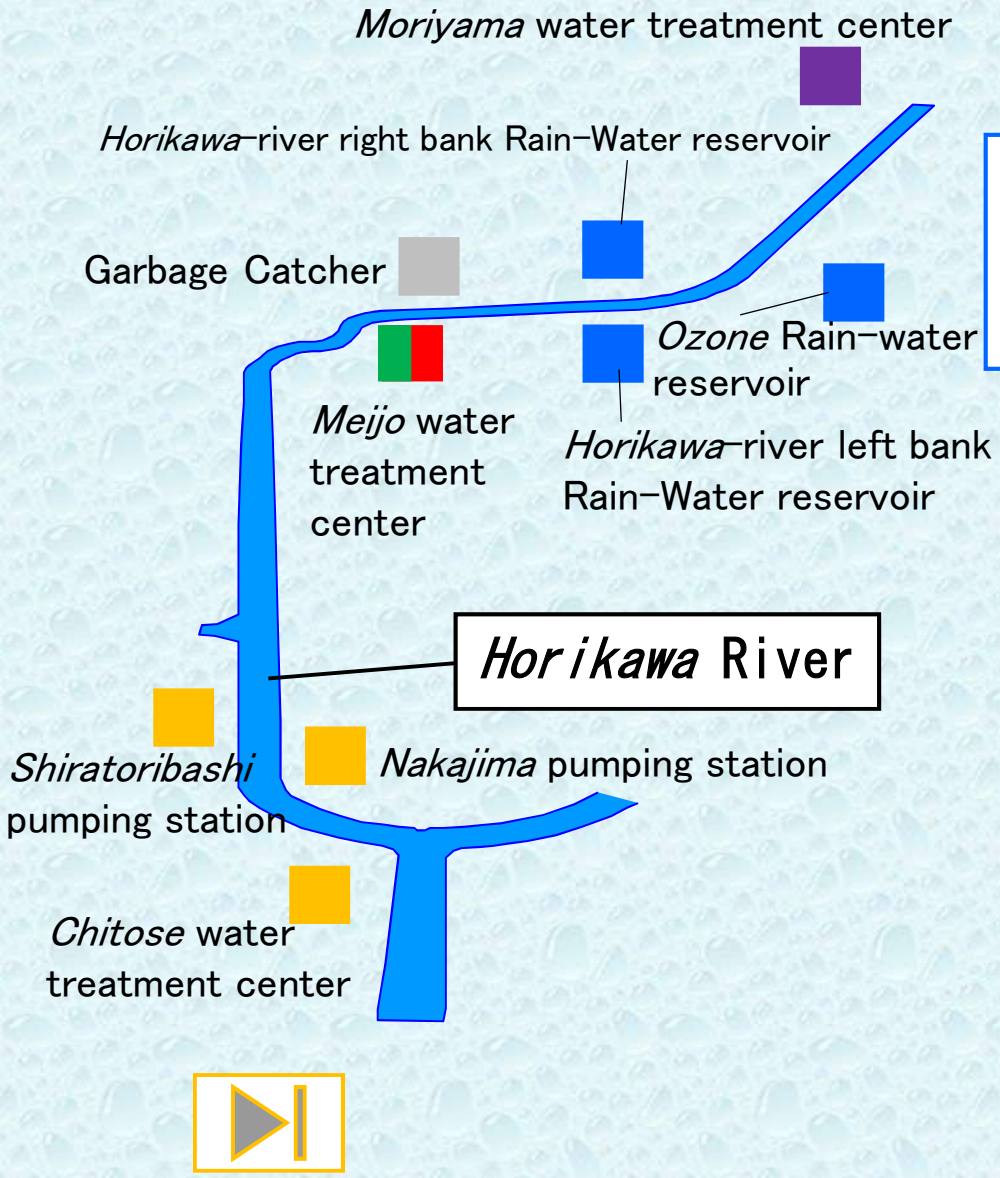
First meeting was held in August 2020.

Second meeting is sceduled in March 2021.

Implementation by Nagoya City Waterworks and Sewerage Bureau

Initiatives for clarification of *Horikawa* River

Initiatives for clarihication of *Horikawa* River



Advanced wastewater treatment
Meijo water treatment center (disk filter)

Advanced facilities of primary treatment
Meijo water treatment center

Rain Water reservoir for pollution control
Ozone Rain-water reservoir
Horikawa-river right bank Rain-Water reservoir
Horikawa-river left bank Rain-Water reservoir

Set of Garbage removel facilities

Shrinkage of Rainwater screen slit
Shiratoribashi pumping station
Nakajima pumping station
Chitose water treatment center

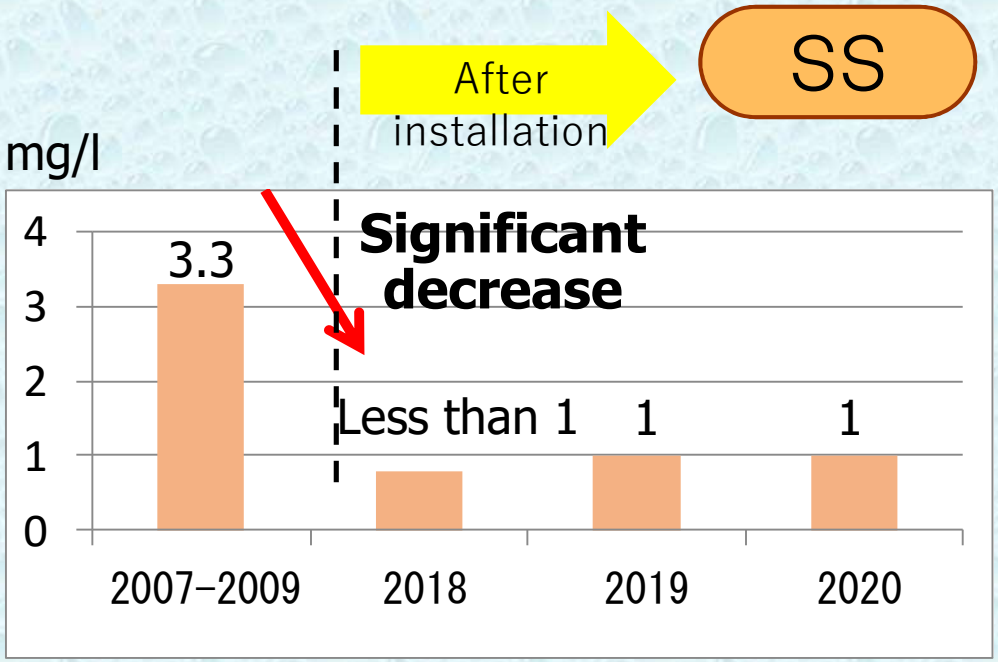
Reclaimed wastewater supply
Moriyama water treatment center

Garbage Catcher(Corporation with Greenification & PublicWorks Bureau)

Advenced wastewater treatment

◆*Meijo* water treatment center

(wastewater treatment capacity：50,000m3/day)



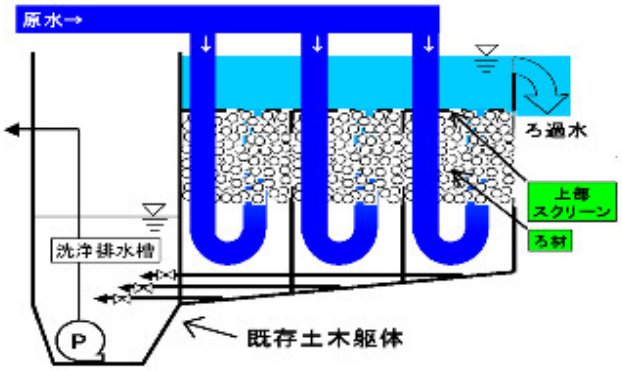
Minute Suspended Solids(SS) in treated water are removed more by the filtration devices (disk filter)

■Advanced Facilities of primary treatment (Improvement of combined sewer system)

We changed the primary treatment of rain water from Settling treatment to Filtration treatment , remodeled the part of existing first settling basin and installed advanced facilities of primary treatment in the water treatment centers.

◆ ***Mejjo*** **Water Treatment Center** (primary treatment capacity 99,400m3/day)

- Started operation in 2019



Treatment flow

Special filteration materilal

※Left figure is Tenma Water Treatment Center

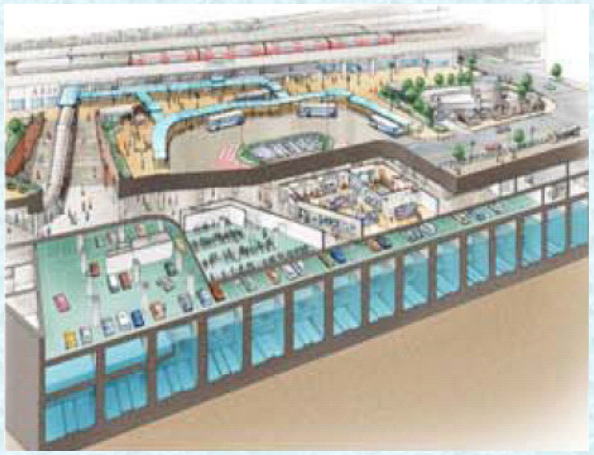
◆Removal Rate of BOD 20%–30%

➡50%–60% Improvement!

■Rain-water Reservior for pollution controll (Improvement of combined sewer system)

We construct rainwater storage facilities to reduce pollution load for *Horikawa* River in rainy weather by storing high polluted first flush rainwater temporarily.

Ozone rain water Reservoir for pollution control



Started operation in 2006

(12,000m^3)

Horikawa-river right bank Rainwater Reservoir for pollution control

Started operation in 2010

(13,000m^3)

Horikawa-river left bank Rainwater Reservoir for pollution control

Started operation in 2019

(14,000m^3)

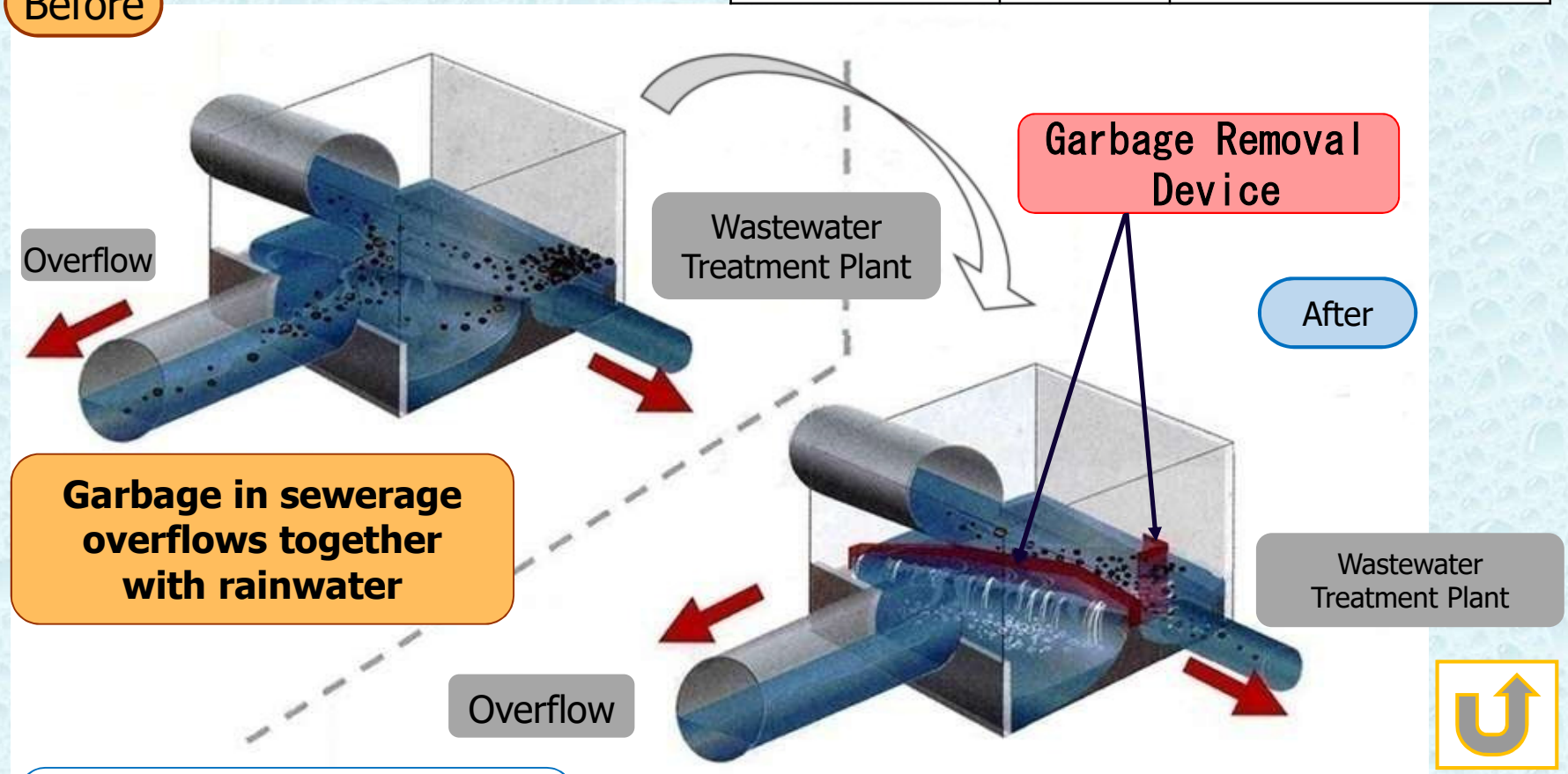
Removal and Reduction of inflow of pollutants

◆Improvement of combined sewer system
(Installation of Garbage Removal Device)

The number of installation of
Garbage Removal Device (end of FY2019)

Total Plan	Installed	Future plan to install
127	115	12

Before



■Shrinkage of Rainwater screen slit (Improvement of combined sewer system)

Rainwater screens are the facility to remove comparatively big garbage, and installed in water treatment centers and pumping station.
More garbage is removed by shrinkage of rainwater screen.

◆ *Shiratoribashi* pumping station
Nakajima pumping station
Chitose water treatment center

◆Rainwater screen slit

40mm → 25mm

◆Prevention of inflow of pollutants

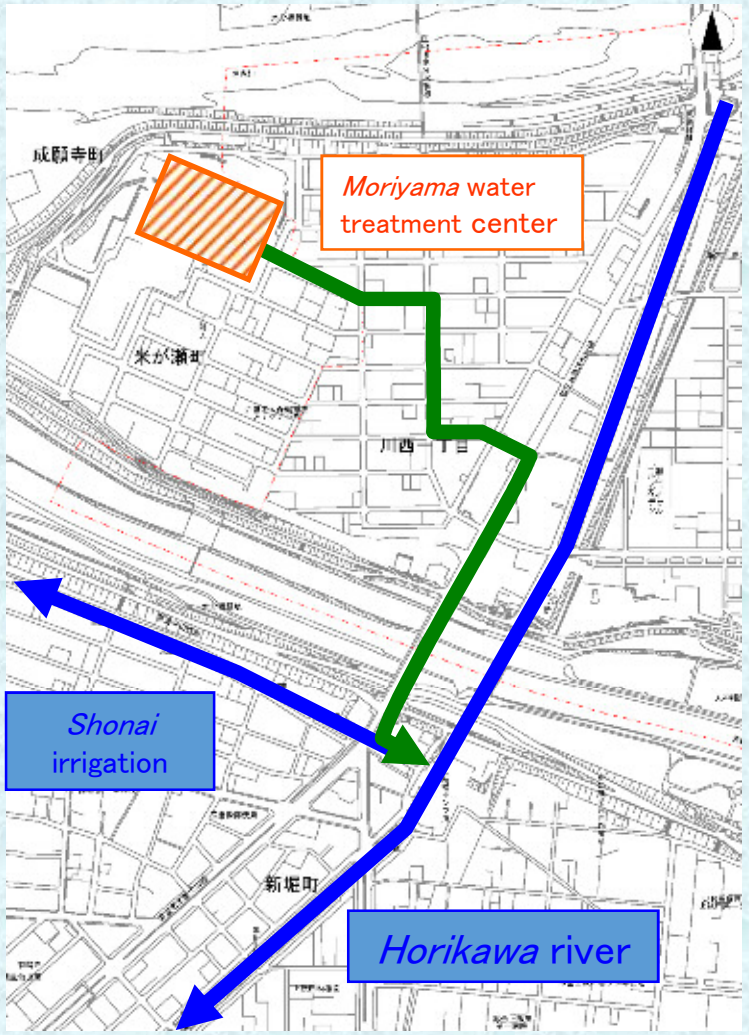
Supply of reclaimed wastewater

Moriyama water treatment center supply reclaimed water treated by membrane filtration to *Horikawa* river.

Water supply :Up to 4,000m3/day(0.046m3/s)

Flat membrane unit aerobic tank

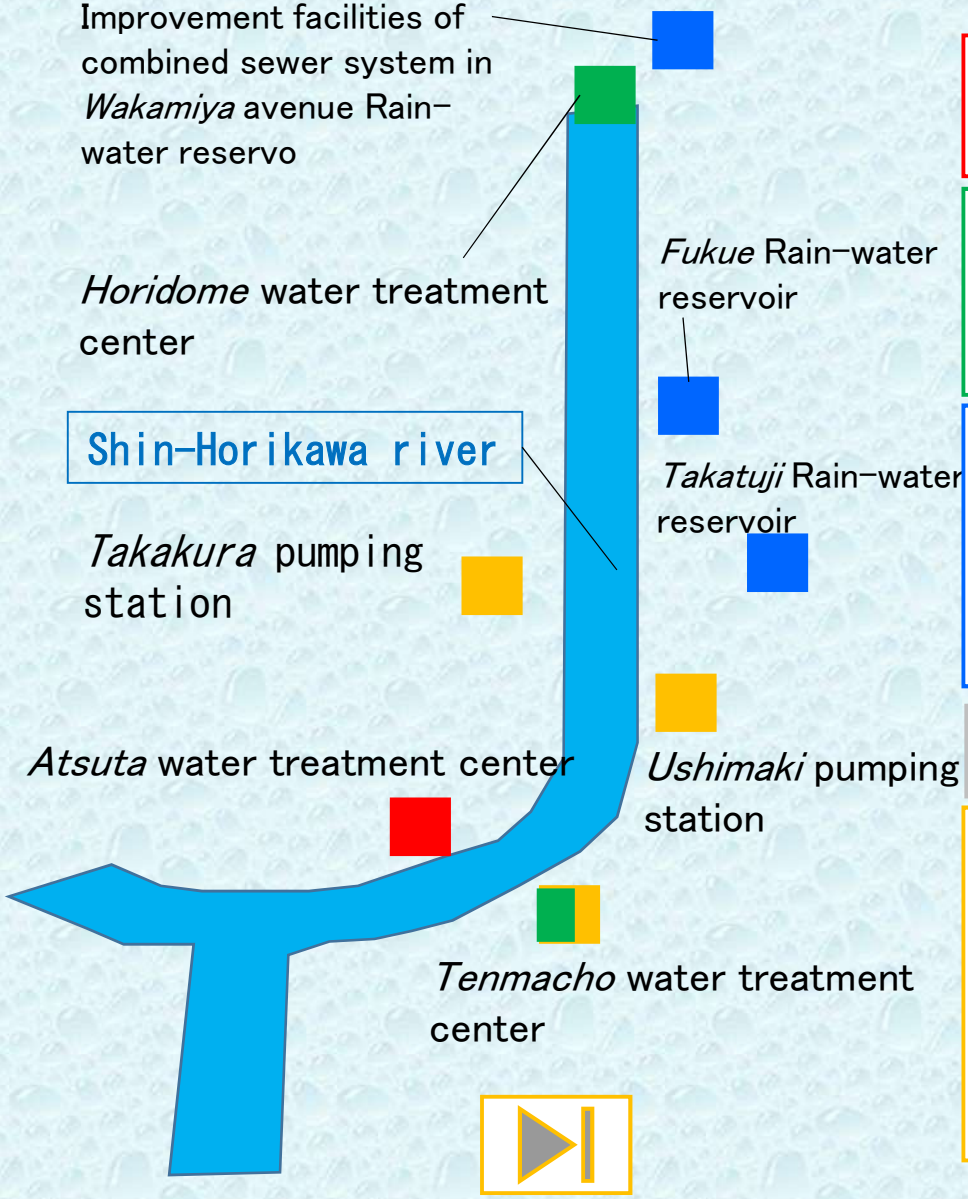
Flat membrane unit



※Watering period is almost irrigation period(April～October)
(Except the period for Shonai irrigation channel(November～March))

Initiatives for clarification of *Shin-Horikawa* River

Initiatives for clarification of *Shin-Horikawa* River



Advanced wastewater treatment
Atsuta water treatment center (AO method)

Advanced facilities of primary treatment
Horidome water treatment center
Tenmacho water treatment center

Rain-water reservoir for pollution control
Wakamiya avenue Rain-water reservoir
Fukue Rain-water reservoir
Takatuji Rain-water reservoir

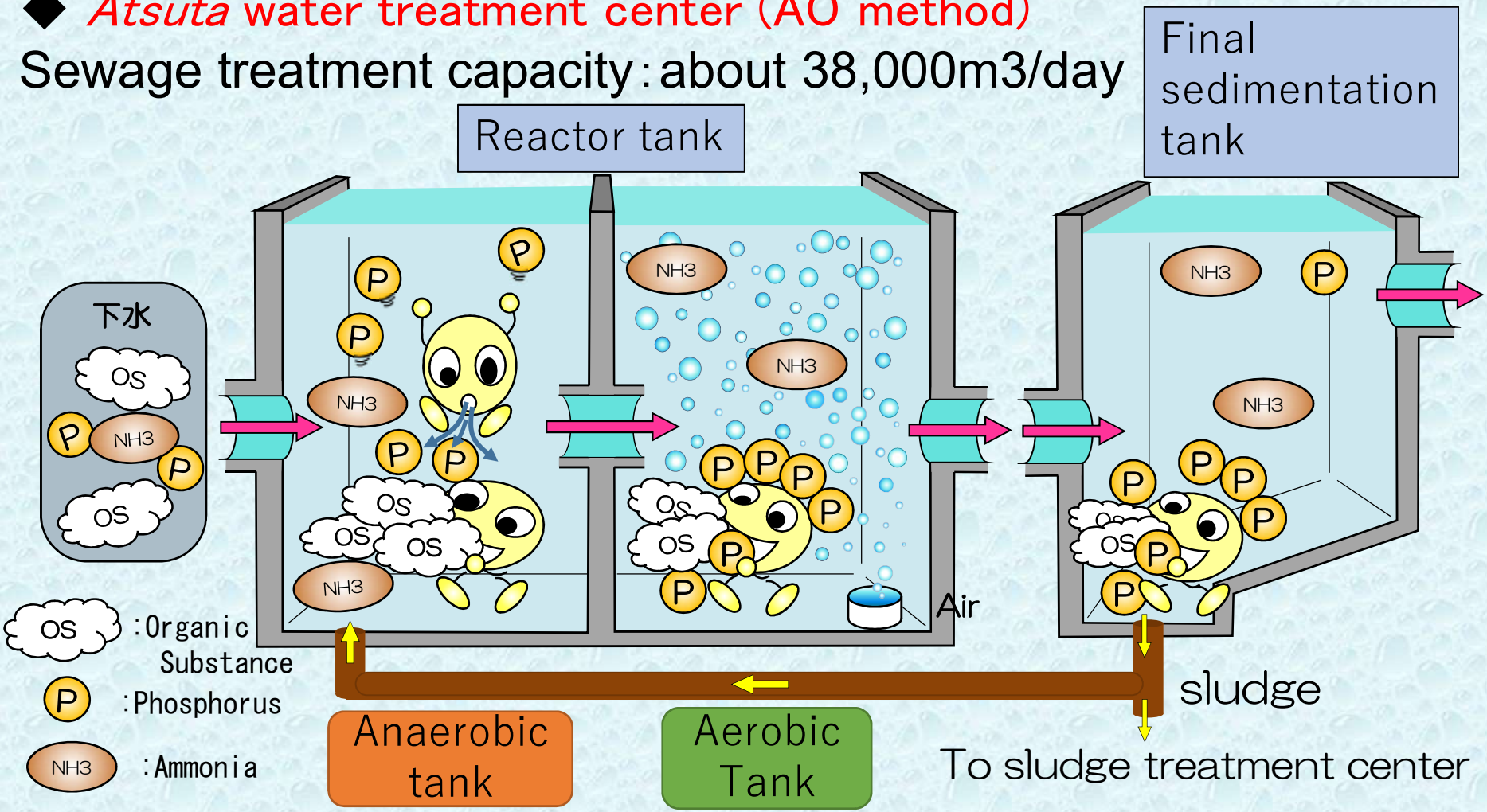
Set of Garbage removel facilities

Shrinkage of Rainwater screen slit
Takakura pumping station
Ushimaki pumping station
Tenmacho water treatment center (under installing)

Advenced wastewater treatment

◆ *Atsuta* water treatment center (AO method)

Sewage treatment capacity：about 38,000m3/day



The process can remove nitrogen and phosphorus which causes eutrophication more than normal conventional activated sludge process.

■Advanced Facilities of primary treatment (Improvement of combined sewer system)

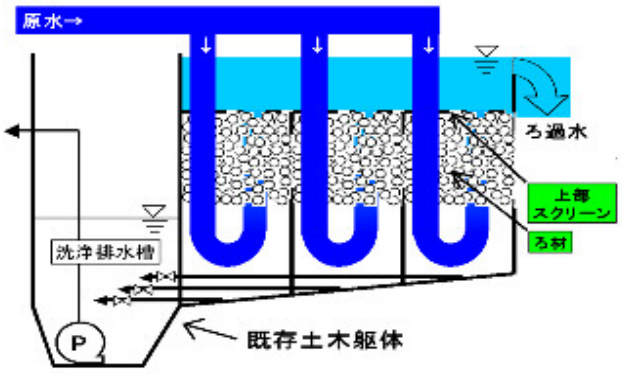
We changed the primary treatment of rain water from Settling treatment to Filtration treatment , remodeled the part of existing first settling basin and installed advanced facilities of primary treatment in the water treatment centers.

◆ *Tenmacho* Water Treatment Center (treatment capacity 168,000m3/day)

- Started operation in 2011

◆ *Horidome* Water Treatment Center (treatment capacity 277,200m3/day)

- Started operation in 2018



Treatment flow

Special filteration materilal

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◆Removal Rate of BOD 20%–30%

➡50%–60% Improvement!

Rain-water Reservior for pollution controll (Improvement of combined sewer system)

We construct rainwater storage facilities to reduce pollution load for *Shin-Horikawa* River in rainy weather by storing high polluted first flush rainwater temporarily.

Takatuji Rain-water reservoir

Started operation in 1987

(30,000m^3)

Fukue Rain-water reservoir

Started operation in 1999

(26,000m^3)

Improvement facilities of combined sewer system in *Wakamiya* avenue Rain-water reservoir

Started operation in 2002

(19,000m^3)

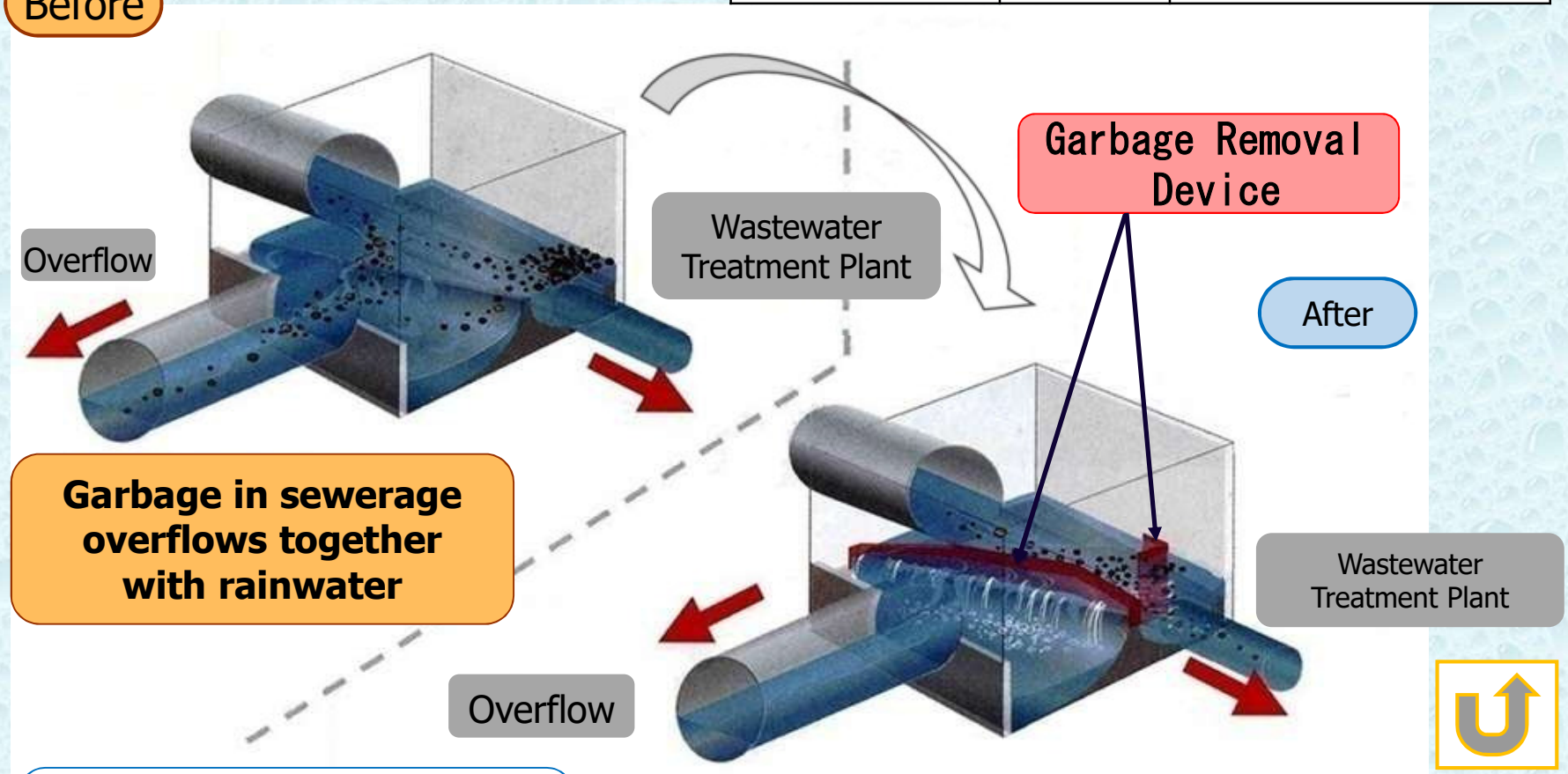
Removal and Reduction of inflow of pollutants

◆Improvement of combined sewer system
(Installation of Garbage Removal Device)

The number of installation of
Garbage Removal Device (end of FY2019)

Total Plan	Installed	Future plan to install
45	45	completion

Before



■Shrinkage of Rainwater screen slit (Improvement of combined sewer system)

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More garbage is removed by shrinkage of rainwater screen.

◆ *Takakura* pumping station
Ushimaki pumping station
Tenmacho water treatment center
(under installing)

◆Rainwater screen slit

40mm → 25mm

◆Prevention of inflow of pollutants

Additional initiatives for clarification

Further water clarification In the upper and middle area of Horikawa and upstream area of Shin-Horikawa

Subject

Further water clarification in the upper and middle area of Horikawa and upstream area of Shin-Horikawa is needed in terms of contribution to town development in the city center.

Concept of countermeasures

We will promote effective measures as soon as possible, such as the construction of rainwater trunk sewer.

In parallel with this, we are also working on the examination and implementation of the early realization of separate sewerage system, by limiting the area and so on.

Urban development using the waterfront(Horikawa)

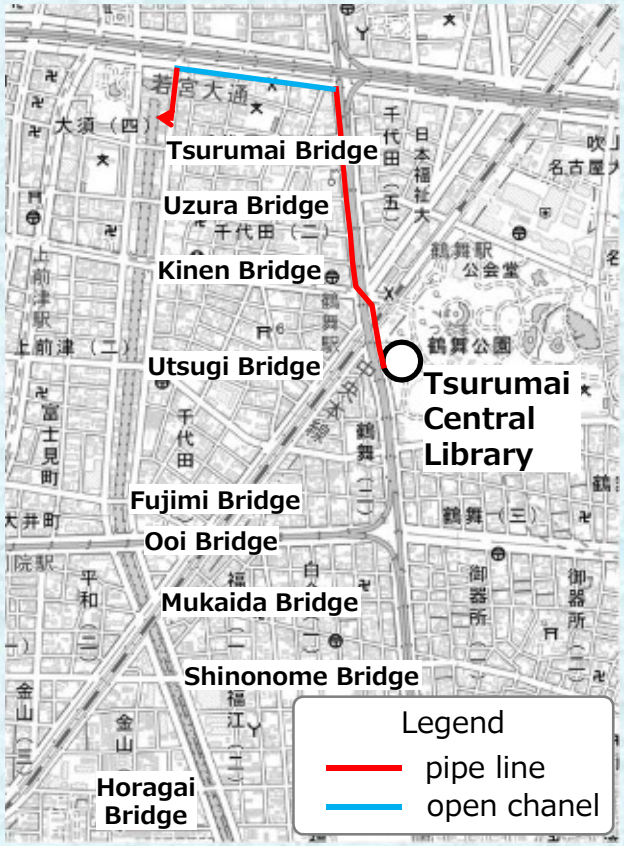
Implementation by Nagoya City Environment Bureau

■Examination of using ground water in Shin-Horikawa (FY2020)

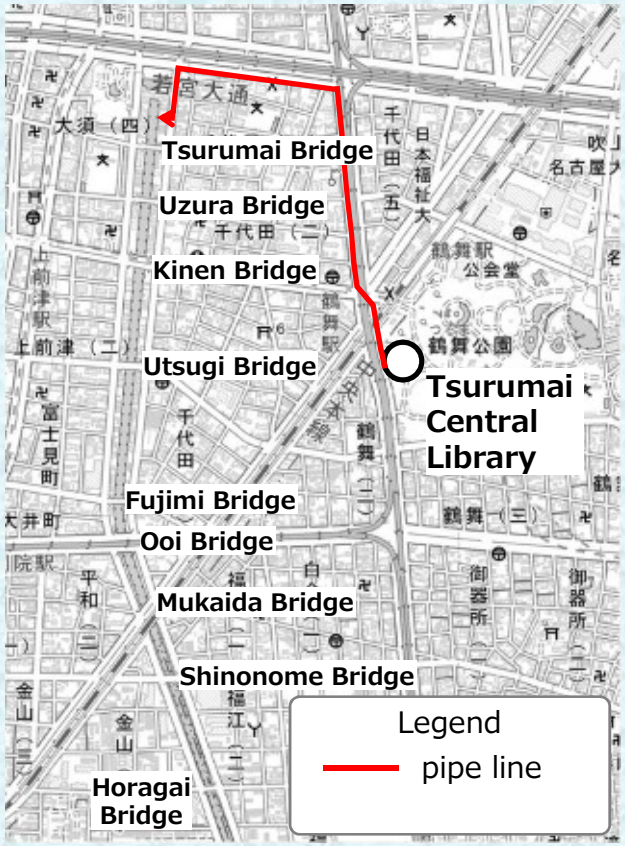
Water source		Spring water from Tsuruma Central library			Well	
Water supply		0.005m³/s			Per a well 0.01m³/s	Per a well 0.0016m³/s
Water conveyance plan		A	B	C	D	E
Overview		● The new pipelines and open channels are developed. ● Water are Discharged from a riverside land.	● The new pipelines are developed. ● Water are Discharged from a riverside land.	● The new water pipes are developed in the existing sewage pipelines. ● Water are Discharged from the storm overflow chamber	● The new well which is 200mm in diameter are developed on a river side land , and water are discharged.	● The new well which is 50mm in diameter are developed on a river side land , and water are discharged.
Effects of improvement water quality		Volume : medium Discharge to low rise : Possible	Volume : medium Discharge to low rise : Possible	Volume : medium Discharge to low rise : Impossible	Volume : large Discharge to low rise : Possible	Volume : small Discharge to low rise : Possible
Effects of enlightenment for citizens		The wide waterside park can be developed.	Development of the waterside park is difficult.	The Waterside park can not be developed.	The waterside park can be developed.	The waterside park can be developed.
Construction・Maintenance		● We need a detail study about construction method to cross the main road and underground structures. ● The open channels need periodic cleaning.	● We need a detail study about construction method to cross the main road and underground structures.	● The construction work in combined sewage pipelines is difficult. ● The water pipes need periodic cleaning.	● The construction work in small area is difficult. ● The well and waterside park need periodic cleaning. ● We need monitoring about ground water level.	● The construction work in small area is possible. ● The well and waterside park need periodic cleaning.
Rough cost (million yen)	Construction	109	103	41	21	6
	Maintenance (10years)	24	3	20	17	4
Judgement		△	△	△	◎	○

Study on groundwater utilization in Sinhorikawa (2020 fiscal year)

Water conveyance Plan A



Water conveyance Plan B



Water conveyance Plan C

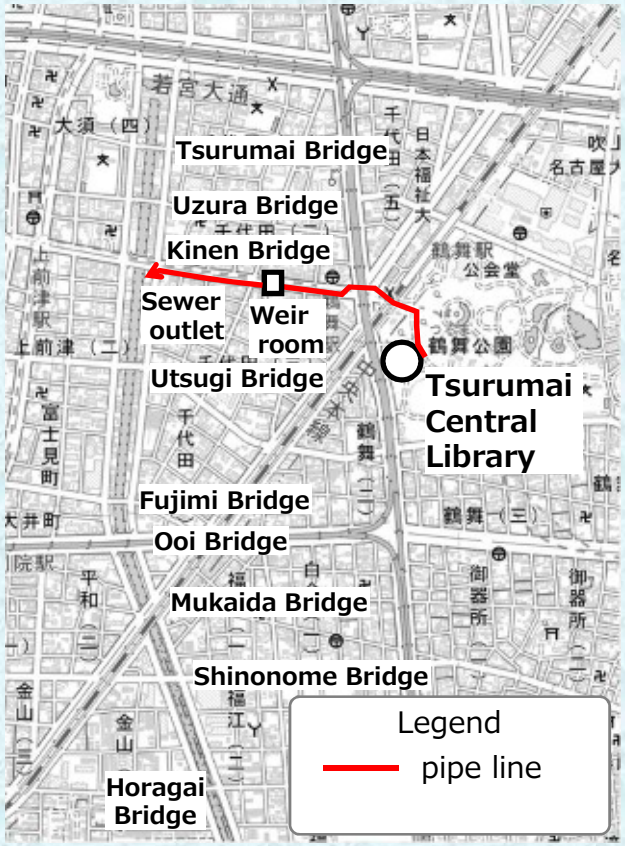


Image of groundwater use (Water conveyance Plan D,E)

Discharging groundwater from bottom layer is expected to improve water quality
< main effects >
- Improvement of dissolved oxygen concentration in the bottom layer.
- Reduction of stratification.
(Difference in salinity between surface and bottom layers)

Hydrophilic space

High Water Level
Tokyo Peil 1.20m

Treated water (+untreated water)

Groundwater flow

Seawater coming in at high tide

Low Water Level
Tokyo Peil -1.37m

Seawater is always stagnant

River bed

Well P