JICA ISSUE-BASED TRAINING

Environment Conservation Technology for Road Maintenance

FY2025

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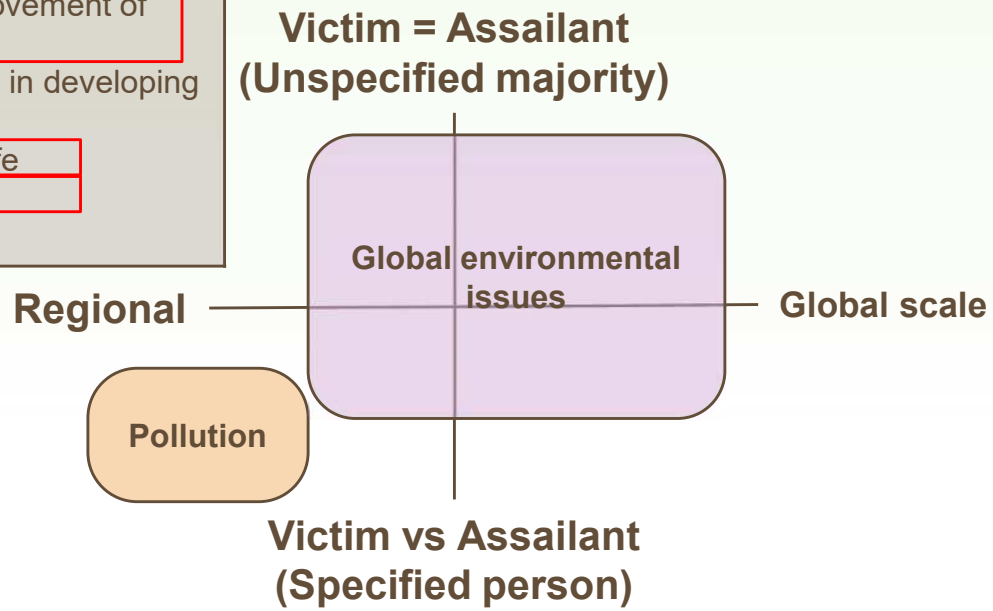
Contents of Today's Session (Table of Contents)

Comparison of pollution problems and global environmental problems

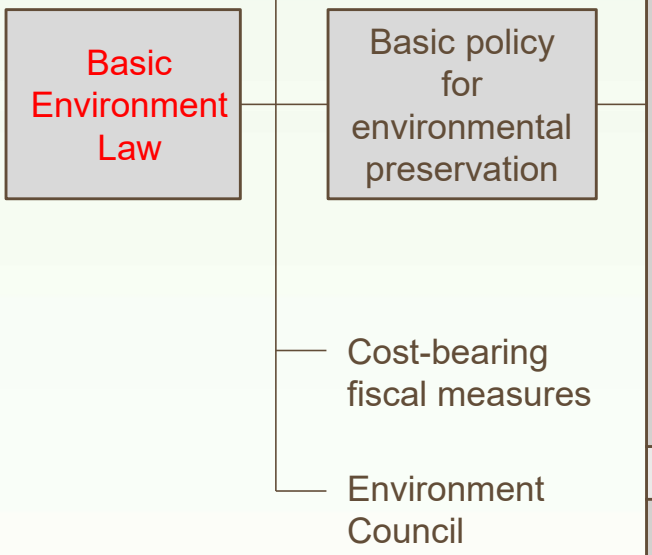
Comparison target	Pollution problem	Global environmental issues
(1) Regionality	Restricted to specific areas	Global impact
(2) Injury and damage relationship	Victims and assailants are identified	Victims and assailants are not identified (Unspecified majority)
(3) Environmental quality	Environmental quality is specified ・Air pollution ・Water pollution ・Soil contamination ・Noise ・Vibration ・Ground subsidence ・Offensive odor (Seven typical types of environmental pollution)	Each of these issues are related to each other ・Global warming ・Ozone layer depletion ・Acid deposition ・Marine pollution ・Transboundary movement of hazardous waste ・Pollution problems in developing countries ・Reduction in wildlife ・Deforestation ・Desertification

In the road maintenance business, what Should be addressed mainly in terms of environmental problems?



From the text of "Environmental Regeneration Doctor"

Environment Legal System of Japan



Formulation of environmental basic plan and regional environmental pollution control program		
Setting environmental quality standard		
Promotion of Environmental Impact Assessment		Environmental Impact Assessment Act
Framework and regulation to prevent disruption of environmental preservation	Air pollution	Air Pollution Control Act⇒Regulations by Emission Standards
	Water pollution	Water Pollution Control Act⇒Regulations by Emission Standards
	Soil contamination	Soil Contamination Countermeasures Act
	Noise	Noise Regulation Act
	Vibration	Vibration Regulation Act
	Ground subsidence	Industrial Water Act, Restriction on the Pumping of Groundwater (Building Water Act) Act
	Offensive odor	Offensive Odor Control Act
	Chemicals	PRTR Act*, Act Concerning Special Measures Against Dioxins
	Waste recycling	Fundamental Act for Establishing a Sound Material-Cycle Society, Waste Management and Public Cleansing Law, Construction Recycling Act
	Land usage	National Land Use Planning Act, City Planning Act, Building Standard Act
	Natural environment	Nature Conservation Act , Basic Acton Biodiversity, Act for the Promotion of Nature Restoration
Economic measures to prevent disruption of environmental preservation		
Maintenance of facilities for environmental protection		Sewerage Act
Promotion of use of products that reduce environmental load		Green Purchasing Act
Environmental education, environmental conservation activities		Environmental education promotion act
Dispute resolution and relief for victims		Act Concerning the Settlement of Environmental Pollution Disputes
Global environmental conservation, international cooperation		Act on Promotion of Measures to Cope with Global Warming, Freon Emission Control Act

* Act Concerning Reporting, etc. of Releases to the Environment of Specific Chemical Substances and Promoting Improvements in Their Management

Environmental quality standard and emission standard

End-of-pipe regulation

Apply drainage standards to outlet from workplaces
⇒ Penalties if the standards are exceeded

Environmental standards are applied to rivers, lakes, and oceans
(Target values without any penalty even if it is exceeded)

Two different conservation target criteria (for water quality)

① Objectives for protection of human health

- 27 "Harmful substances" other than heavy metals such as cadmium and volatile organic compounds such as trichlorethylene
- Uniform standard value across Japan

② Purpose of conserving living environment

- Water quality items for water supply, fisheries, industrial water and natural environment conservation based on the usage of water areas by humans

- pH, BOD (biochemical oxygen demand: index of organic contamination), SS (suspended solids), DO (dissolved oxygen), and total coliform

- Baseline value varies depending on the catchment area
  ⇒ Depending on the catchment area, a criteria which is more stringent than the uniform standard values is applied.

Legislation related to waste and recycling system

Fundamental Act to form a material-cycle society

Fundamental Act for Establishing a Sound Material-Cycle Society

Recycling promotion act

Act for promotion of effective use of resources

Regulatory act for the proper disposal of waste

Waste Management Act

Promotion of recycling according to the individual characteristics and regulatory act

Construction Recycling Act

Main acts for waste treatment and resource recycling

① Waste Management and Public Cleansing Act (Enacted in 1970)

- Municipality handles and regulates the emission control and proper treatment of "Industrial waste" discharged by business operators and "General waste" discharged by individuals
- In construction, the waste disposer (Construction contractor) bears the responsibility of processing the industrial waste and not the company placing the ordering
- The processing responsibility of industrial waste is to ensure reuse and weight reduction and proper traceability using controlled documents to prevent illegal dumping

② Construction Recycling Act (Enacted in 2000)

- Act which specifies the following “Specific construction material" and makes sorting and recycling mandatory for construction work that is equal to or above a certain scale (for example, dismantling: 80 m², new construction: 500 m²)

“Specified construction materials:” Concrete, iron, wood, asphalt concrete

Main acts for soil contamination

○ Soil Contamination Countermeasure Act (enacted in 2003)

- Soil survey of land where there is a possibility of soil contamination is mandatory
- When there is a risk of damage to human health by the contaminated soil, measures such as removal of contamination and blocking the route of intake by people is mandatory
- Target pollutants includes 27 "Harmful substances" other than heavy metals such as cadmium and volatile organic compounds such as trichlorethylene

Acts for noise and vibration

① Noise Regulation Act (Enacted in1968)

- Acts and regulations for noise from factories and construction
- As for noises associated with construction work such as pile drivers, rock drilling machine, concrete plant, heavy machineries, standard value (85 dB) is set for the site boundary and working hours are set for the work site .

② Vibration Regulation Act (Enacted in 1976)

- Regulations for vibration business activities from factories and construction work
- As for vibrations associated with construction work such as crushing using pile drivers, steel balls, and breakers, standard value (75 dB) is set for the site boundary and working hours are set for the work site.

Ideas of responding in construction fields?

① Low noise and low vibration of sources: To use machines with low noise and low vibration structure

② Blocking propagation routes: To install soundproof walls, vibration-proof structures, etc.

Main acts on global warming

○ Global warming countermeasures promotion act (domestic law) (Enacted in 1998)

- Act to our country and local governments to promote reduction of greenhouse gas emissions, including legislative activities such as the formulation of plans against global warming and so on
- Although there are no direct restrictions based upon the law regarding construction business, we are trying to reduce CO_2 emissions directly or indirectly involved in construction.

Ideas of responding in construction fields?

① Method of transporting materials
② Fuel reduction for vehicles and machinery
③ Energy-saving in construction methods or means
④ Energy saving of facilities such as field office and so on
⑤ Greening, green procurement, education, etc.

Main acts concerning biodiversity conservation

① Act for the Promotion of Nature Restoration (Enacted 2002)

- Act aimed at restoring a natural environment damaged in the past
- Construction companies participate in multi-natured revitalization projects for natural river development, biotopes, etc.

② Three Acts on Landscape and Greening (Enacted and revised in 2004)

- Act for establishing the framework for conservation and creation of urban greening
- The construction industry takes urban greening into consideration as a project designer and builder

③ Biodiversity Basic Act (Enacted in 2008)

- Act aimed at the comprehensive conservation of wildlife species and natural environment
- To establish basic principles for the conservation and sustainable use of biodiversity, the nation has to formulate a national biodiversity strategy and regulate the obligation of municipalities to formulate the regional biodiversity strategy
- The construction industry takes into account regional ecosystem conservation in construction and business operations

§ 2　Examples of environmental initiatives

What to do in environmental response？

① Measures against construction wastewater
② Measures against waste
③ Measures against noise and vibration
④ Ecosystem conservation measures
⑤ Measures against natural soil contamination
⑥ Measures to prevent global warming

§ 2 Examples of Environmental Initiatives

1. Measures to prevent water pollution
2. Measures against waste and byproduct
3. Measures to prevent soil contamination
4. Measures for biodiversity and ecosystem conservation

(1) Measures to prevent water pollution

Water quality items to consider in construction wastewater treatment ?

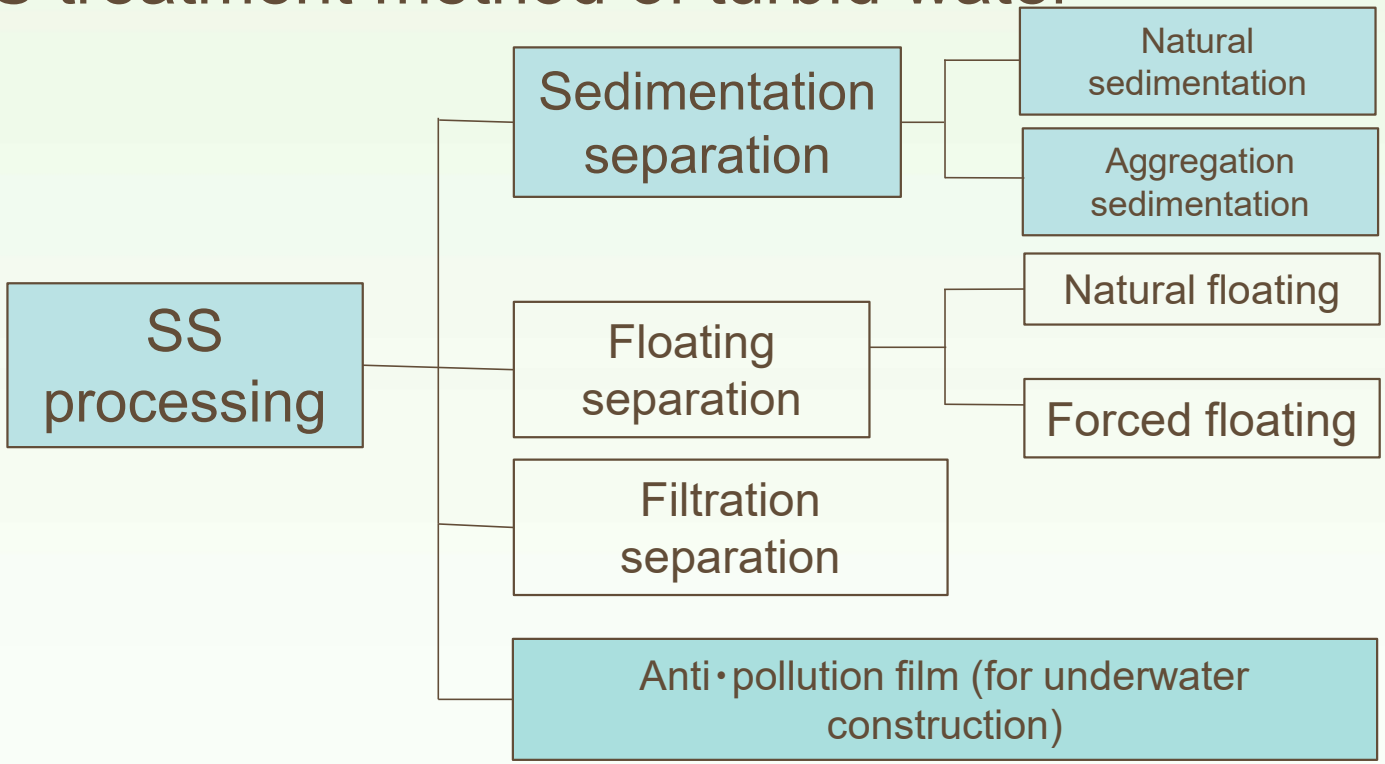
① Turbidity (SS: Suspended Solids)
- SS concentration: Hundreds - tens of thousands of mg/l
- Although Japan's uniform effluent standard is 200mg/l, more strict standard is set per basin.

② pH
- Concrete construction where strong alkaline cement is used
- Neutralization treatment with acid and carbon dioxide

③ Organic substances, heavy metals, etc.
- When using organic chemical solutions
- When heavy metals are in stratum

(1) Construction wastewater treatment

■ SS treatment method of turbid water



- The most common treatment is by sedimentation pond and sedimentation separator (thickeners)
- If the effluent standard is stringent, filtration separation may be performed after sedimentation separation
- In the case of large volume treatment or small sites, aggregation sedimentation treatment using coagulant is performed

(1) Construction wastewater treatment

■ Natural sedimentation treatment

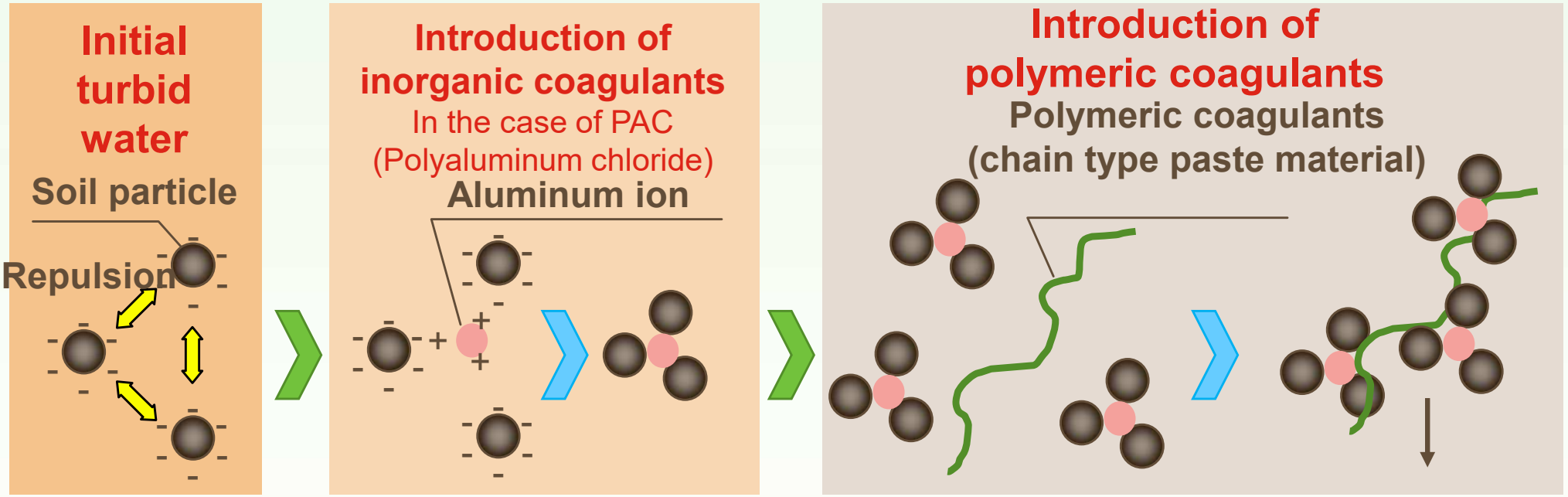
From neolite website

- SS is precipitated in the sedimentation pond and the supernatant water is discharged.
- A large sedimentation pond is required for fine particles to precipitate and reduce turbidity of supernatant water.

(1) Construction wastewater treatment

■ Aggregation sedimentation treatment

・ Sedimentation rate is speeded up by increasing the apparent particle size.



Fine soil particles charged to the anion repel and do not settle.

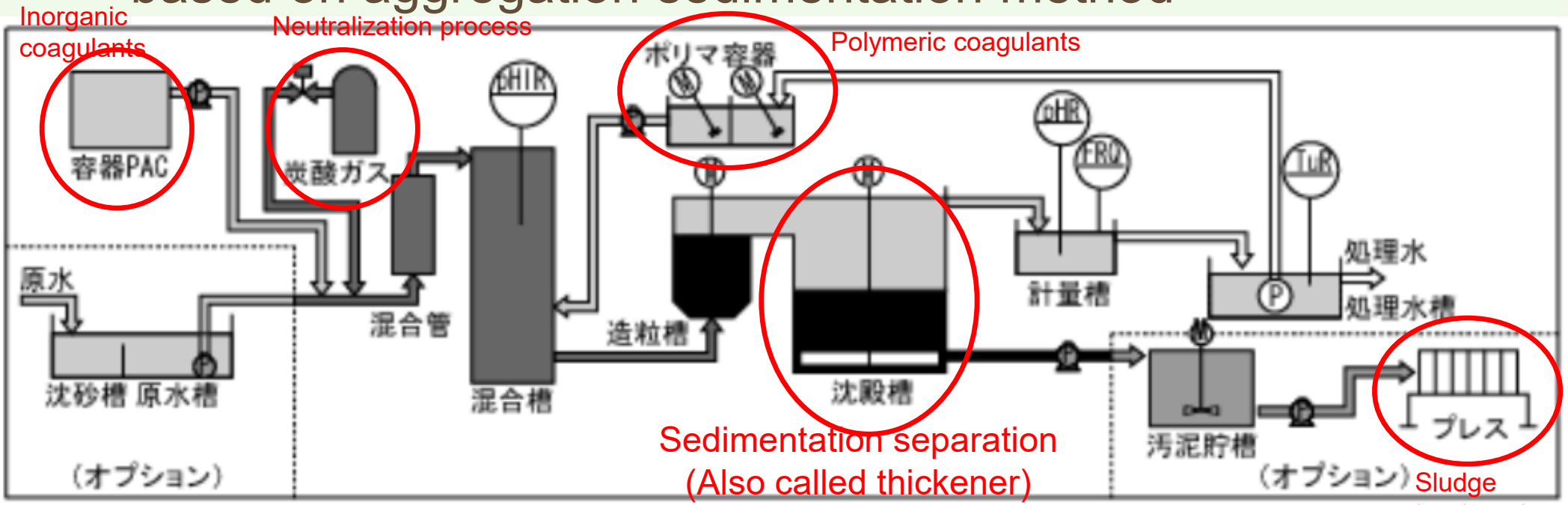
Soil particles become ready for bonding as they are electrically neutralized by the aluminum cations contained in the PAC.

When polymeric coagulant paste is added, large flocs are formed and sedimentation process is speeded up.

1. Measures to Prevent Water Pollution

(1) Construction wastewater treatment

- General construction turbid water processing system based on aggregation sedimentation method



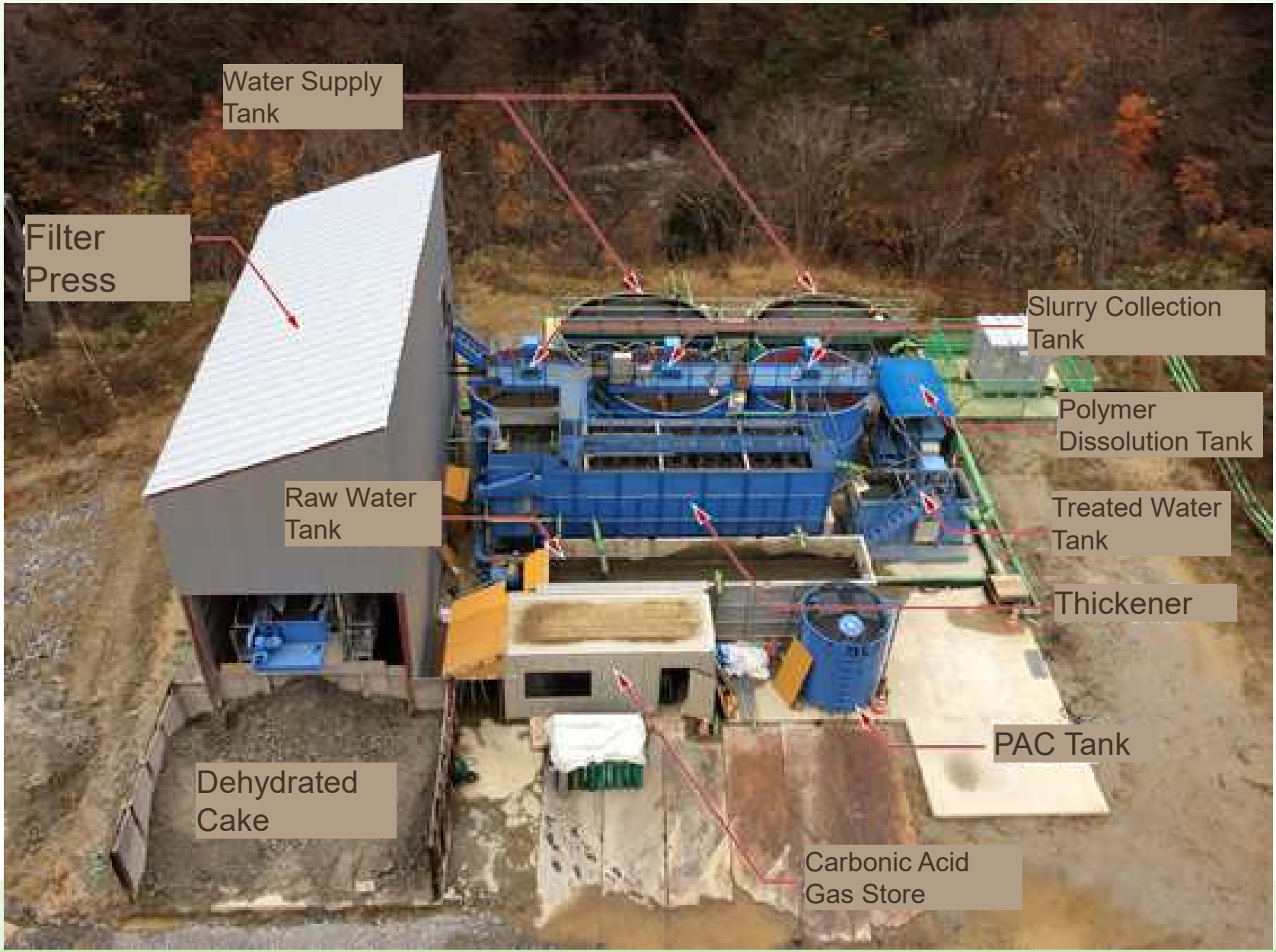
From Actio website

- Using aggregation settling effect, high sedimentation rate can be obtained
- SS can be reduced from 1,000 to 5,000 mg/l to 25 mg/l or less
- Amount of treated water is about 10 to 100 m^3/h

1. Measures to Prevent Water Pollution

(1) Treatment of construction muddy water

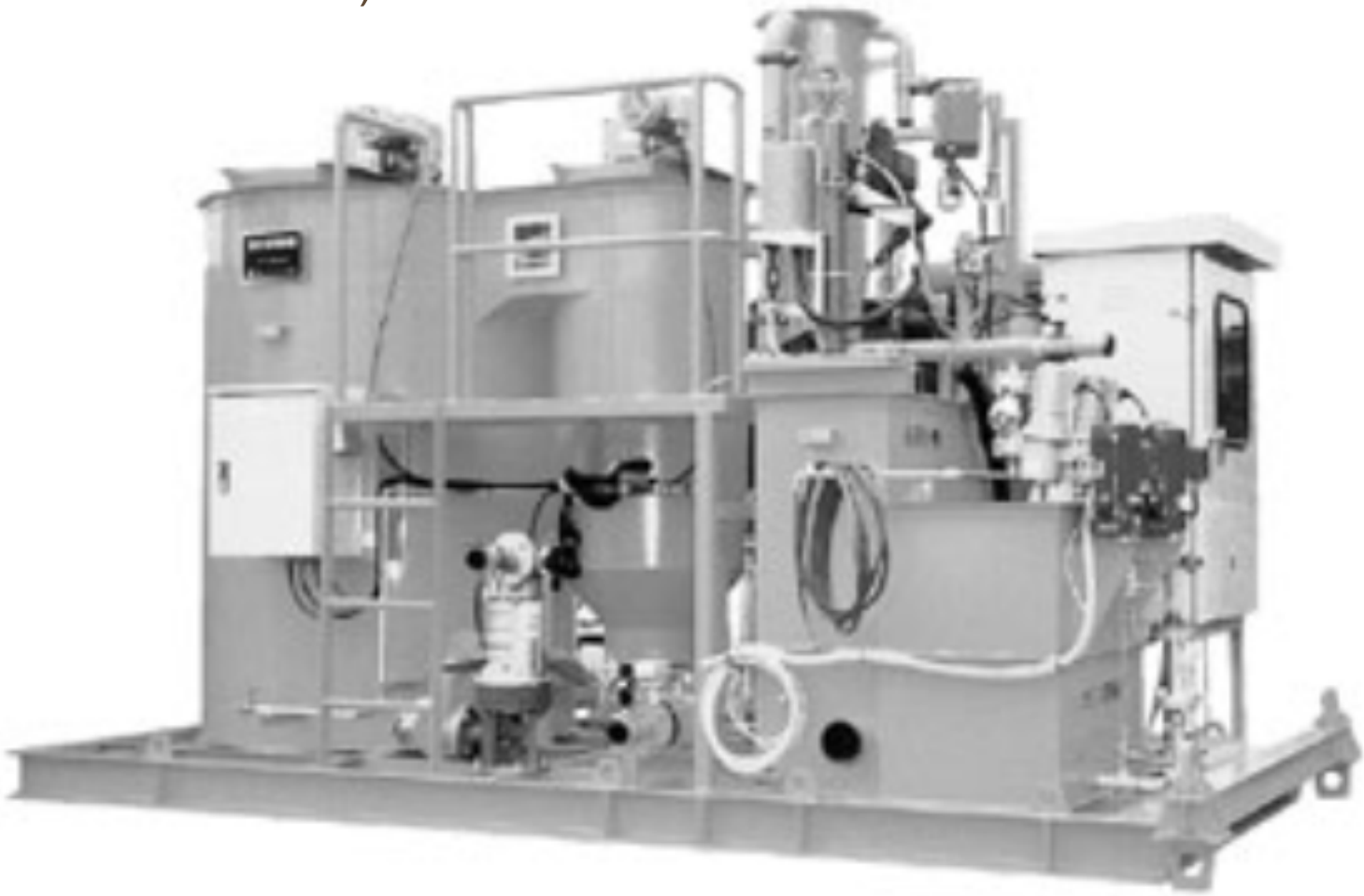
- Turbid water treatment equipment of aggregation sedimentation type (Large size model: 100 m^3/h scale)



From Kasabori dam Website

(1) Construction wastewater treatment

- Turbid water treatment equipment of aggregation sedimentation type (Compact model: 10 m^3/h scale)

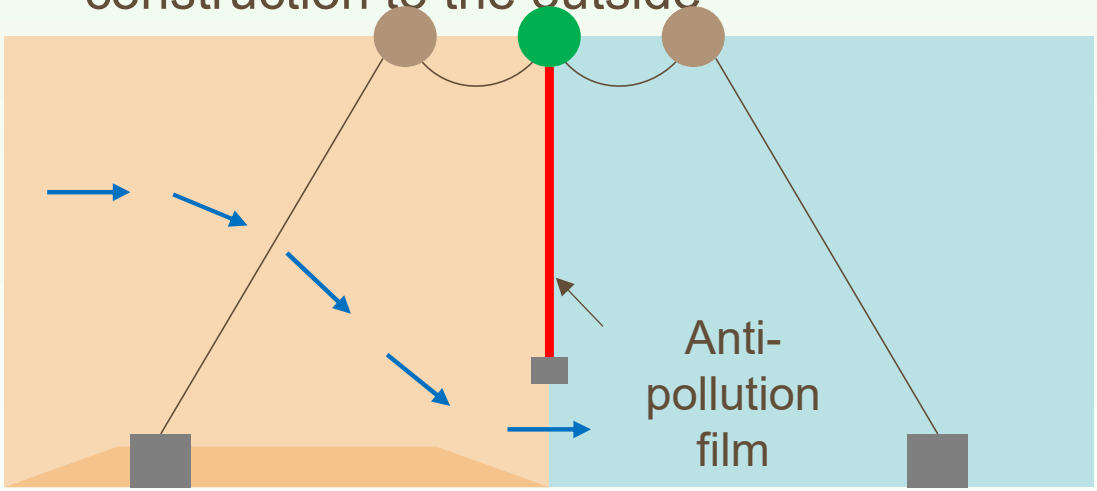


From Actio website

(2) Prevention turbid diffusion at construction sites in in-water areas

■ Anti-pollution film

・A film extending from the water surface into the water to prevent diffusion of turbid water generated by the underwater construction to the outside



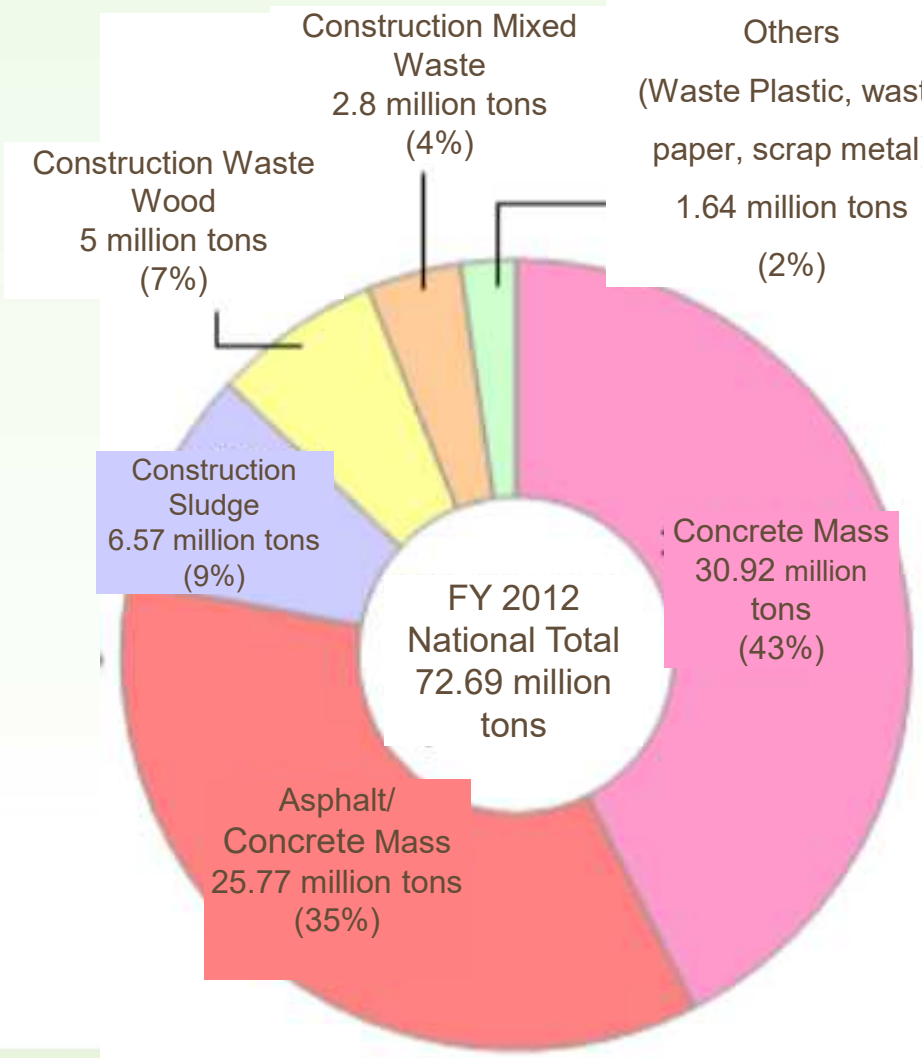
From the Website of Taiyotent Hokuriku

・Since the film barrier does not extend to the bottom of the water, complete shielding is not obtained.
・Polyester fabric is generally used as the membrane material
・SS are expected to precipitate by flowing down just before the film boundary
・Flow rate is 0.5 m/s or less

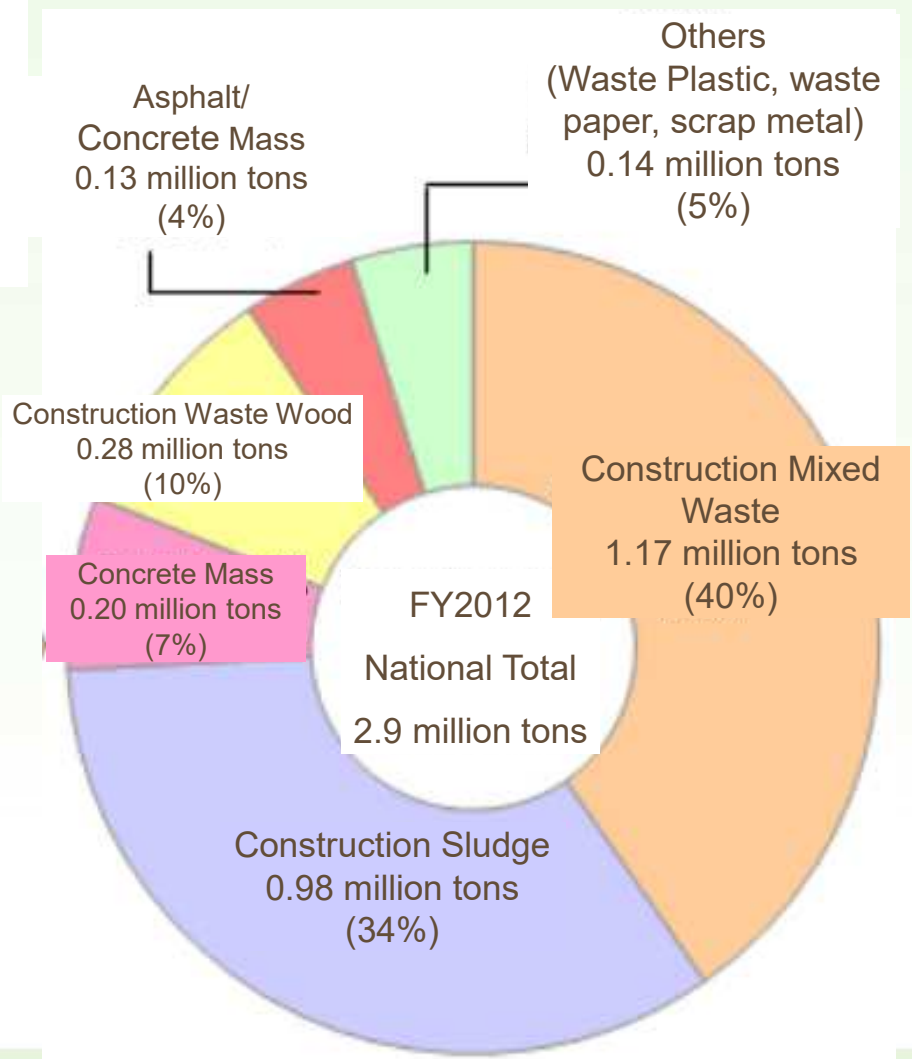
2. Measures against waste and byproduct

Emissions and final disposal amount of construction waste in Japan

- The final disposal volume was 2.90 million tons compared to 72.69 million tons in 2012.
- Most of the discharged concrete, asphalt, etc. are recycled, but construction mixed waste, construction sludge, construction waste wood are disposed without recycling.



Emission amount of construction waste



Final disposal volume of construction waste

2. Measures against waste and byproduct

(1) Construction sludge

- Example of dehydration and aggregation process of construction sludge

Dehydrated cake of construction sludge

Modifier are added and mixed using tractor

Difficult for plants to grow without aggregation

Plants can grow because of aggregation

2. Measures against waste and byproduct

(2) Construction waste wood

- Examples of utilizing trees cut from the sites as a spraying material for greening of slopes

Cut trees

Trees are chipped using a tab grinder

Composting fine grain chips

Composted chips

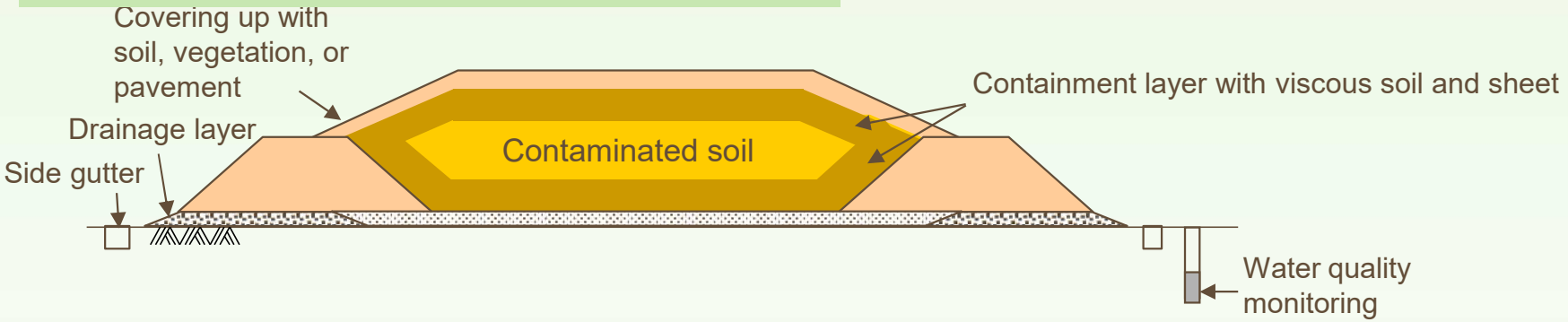
Sprayed by mixing with seeds, etc.

Spraying status and post spraying greening status.

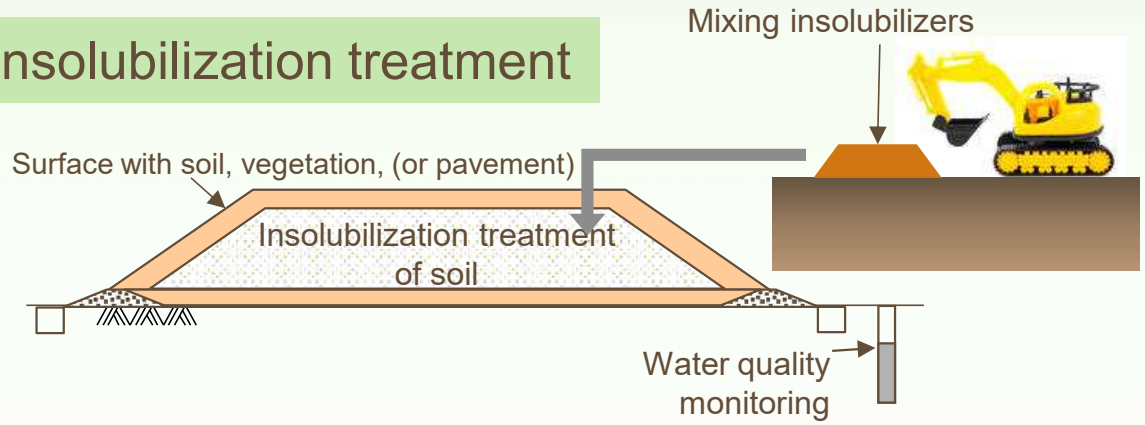
3. Measures to prevent soil contamination

Methods to deal when excavated contaminated soil is used for raising

(1) Containment of contaminated soil



(2) Insolubilization treatment



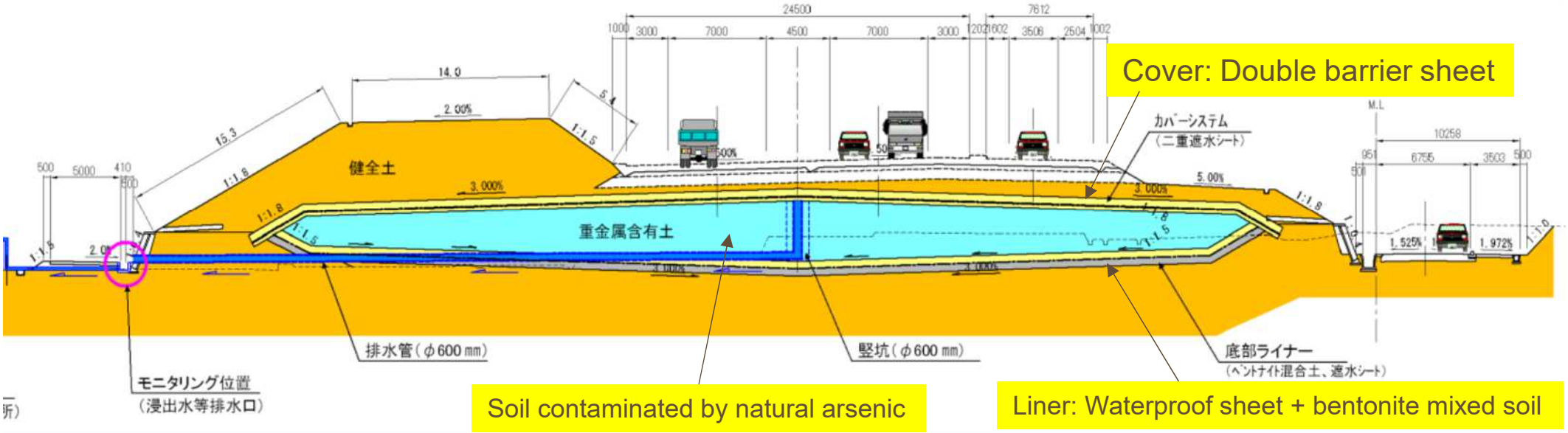
3. Measures to prevent soil contamination

(1) Example of containment of contaminated soil

Liner construction with bentonite mixed soil

Arsenic wastewater treatment facility

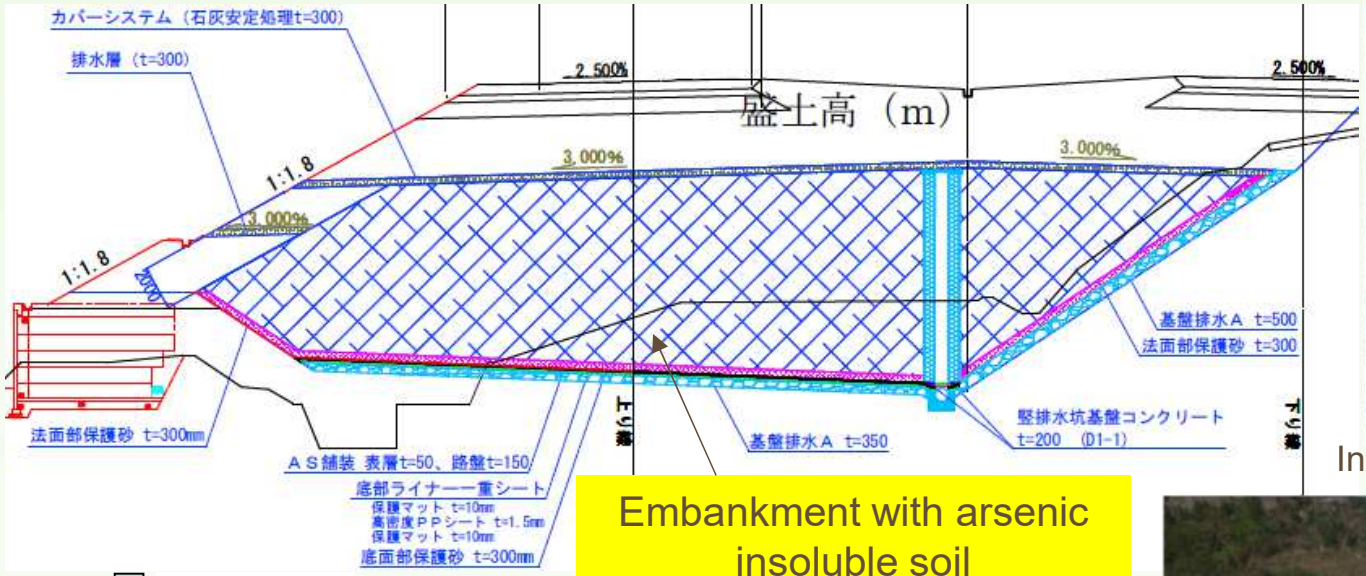
Rupture test of waterproof sheet



From the 24th Chubu Geotechnical Symposium, 2012, “Measures for heavy metal-containing soil in the new Tomei Expressway embankment construction project”, Yamawaki et al.

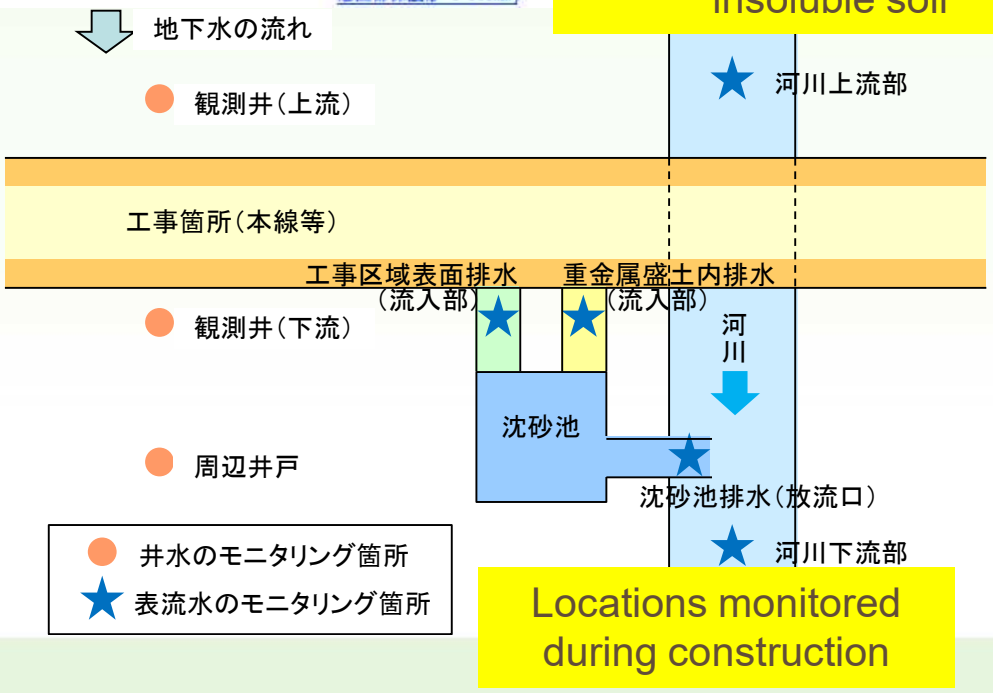
3. Measures to prevent soil contamination

(3) Example of insolubilization treatment of contaminated soil



Embankment with arsenic insoluble soil

Insolubilization test using cement type solidifier



Locations monitored during construction

Embankment construction status with insoluble soil

From the 24th Chubu Geotechnical Symposium, 2012, “Measures for heavy metal-containing soil in the new Tomei Expressway embankment construction project”, Yamawaki et al.

4. Measures for biodiversity and ecosystem conservation

Basic concept of ecosystem conservation support in development

If development activities are expected to impact the natural environment, minimize the impact of development activities through methods mentioned below.

① Avoidance: Do not develop the target area
② Minimization: Minimize the area of development and severity of expected impacts
③ Alternative: Restore nature that is lost by at another location (Alternative includes the concept of "Net loss" which makes the overall loss to the ecosystem zero or "Net gain" to make it more than zero)

* As a principle, follow the order of Avoidance → Minimization → Alternative

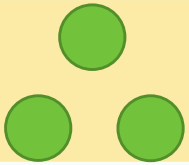
Basic approach to living space

Which is preferable?

① Size of habitat space

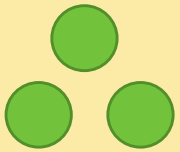

② Cohesion in same area


③ Proximity when distributed

④ Shape when dispersed

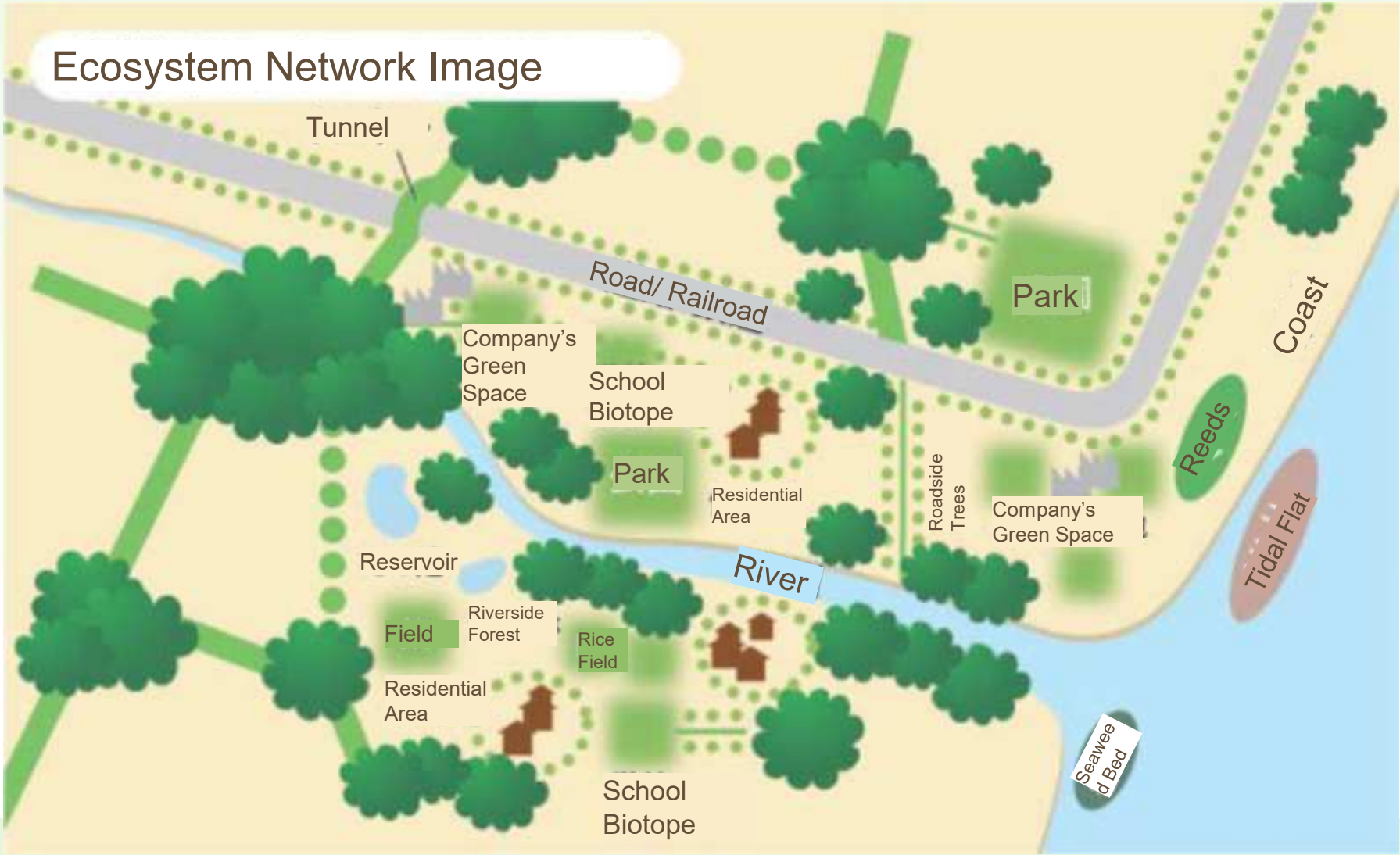

⑤ Yes or No concerning path

4. Measures for biodiversity and ecosystem conservation

What is ecosystem network?

A network of ecosystems connected by various spaces where wildlife inhabits and grows (Forests, farmlands, green spaces in urban areas, watersides, rivers, oceans, wetlands, marshes, tidal flats, seaweed beds, and coral reefs, etc.)



From Aichi nature conservation strategy (Aichi Prefecture Environment Department, March 2009)

4. Measures for biodiversity and ecosystem conservation

Prepared by materials from Japan Federation of Construction Contractors

(1) Examples of construction work in mountains and suburbs - ①

- Minimized impact caused by noise, vibration, lighting, and other effects of construction to environments for living organisms.
- Secured moving paths without dividing animals' behavioral spheres.

Earth color painting on construction machinery and temporary equipment

To prevent light diffusion by hood louvers and avoid death of insects by adopting less insect-inducing lamp

To avoid division of small animal habitats and secure moving routes for crossing roads

Road crossing passage

4. Measures for biodiversity and ecosystem conservation

Prepared by materials from Japan Federation of Construction Contractors

(1) Example of construction work in mountains and suburbs - ②

- Constructed a biotope to ensure growth space for organisms
- Transplanted rare species of plants that were discovered and educated construction workers to pay attention to the rare species

Created a biotope for fireflies as an alternative measure of construction

Transplantation of rare species of plants found

Draw attention using signboards for rare species

Environmental education using the Red Data Book

4. Measures to Protect Biodiversity and Ecosystem

Prepared by materials from Japan Federation of Construction Contractors

(2) Examples of slope greening

■ Slope greening to restore native species of plants

The local ecosystem was maintained by spraying the natural topsoil of the site to be used as the base material for greening on the new slope that was constructed, restoring plants of the native species and preventing impact of non-native species.

Spraying status of natural topsoil

Transplant status of native seedlings

Status of slope one year after construction

4. Measures to Protect Biodiversity and Ecosystem

Prepared by materials from Japan Federation of Construction Contractors

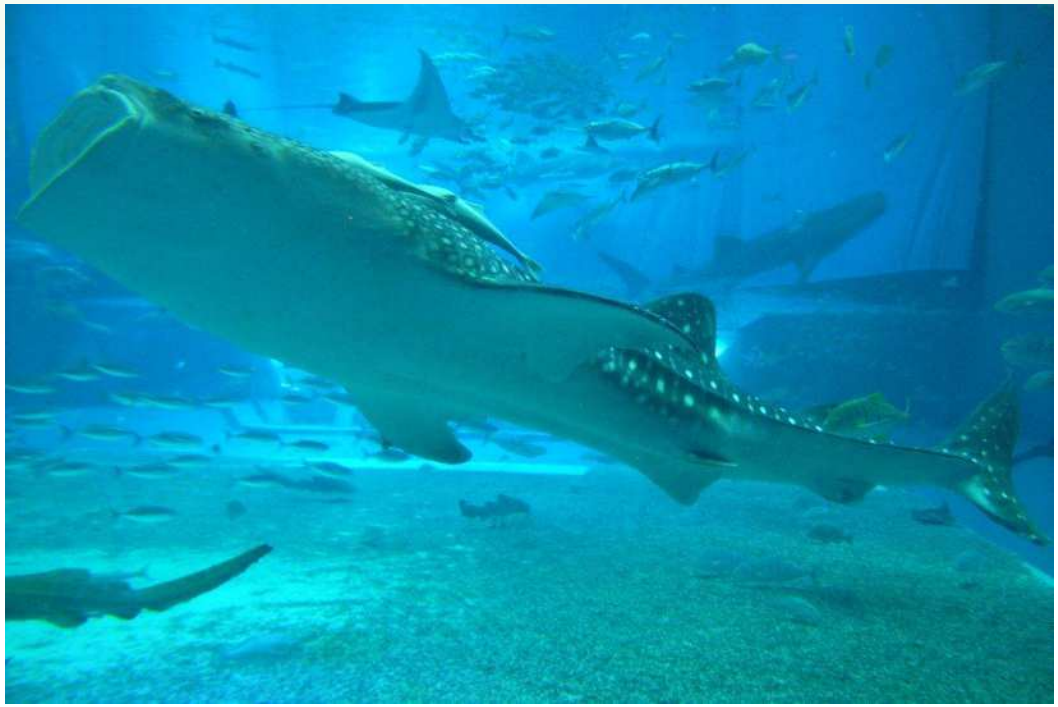
(3) Examples of water area

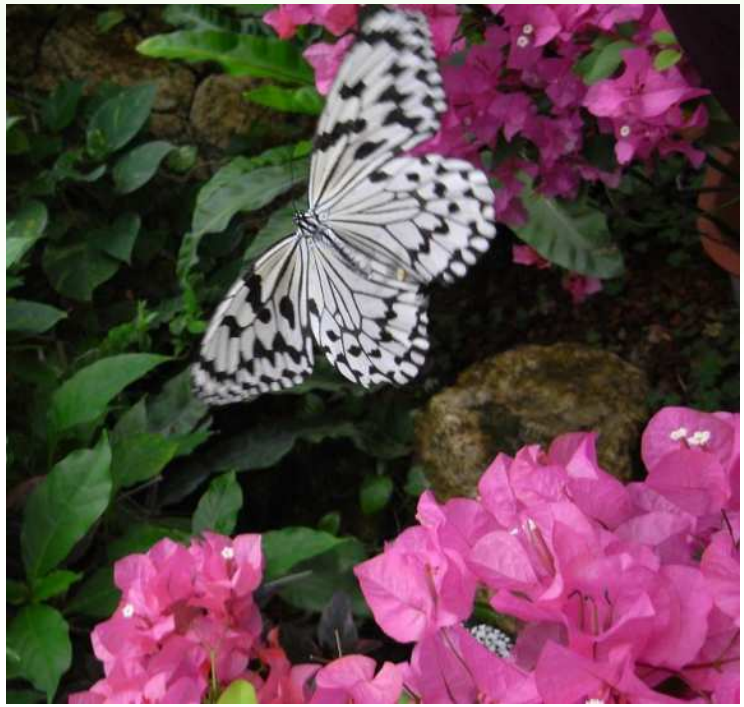
■ Construction of vegetation floating islands

- Aquatic plants are planted on buoyant structural materials by installing vegetation base materials and artificial floating islands are created. In addition to providing habitat for organisms, it is expected to purify water.

Example of demonstration experiment of brackish water

Wild birds nesting on the floating islands





Thank you very much for your kind attention.