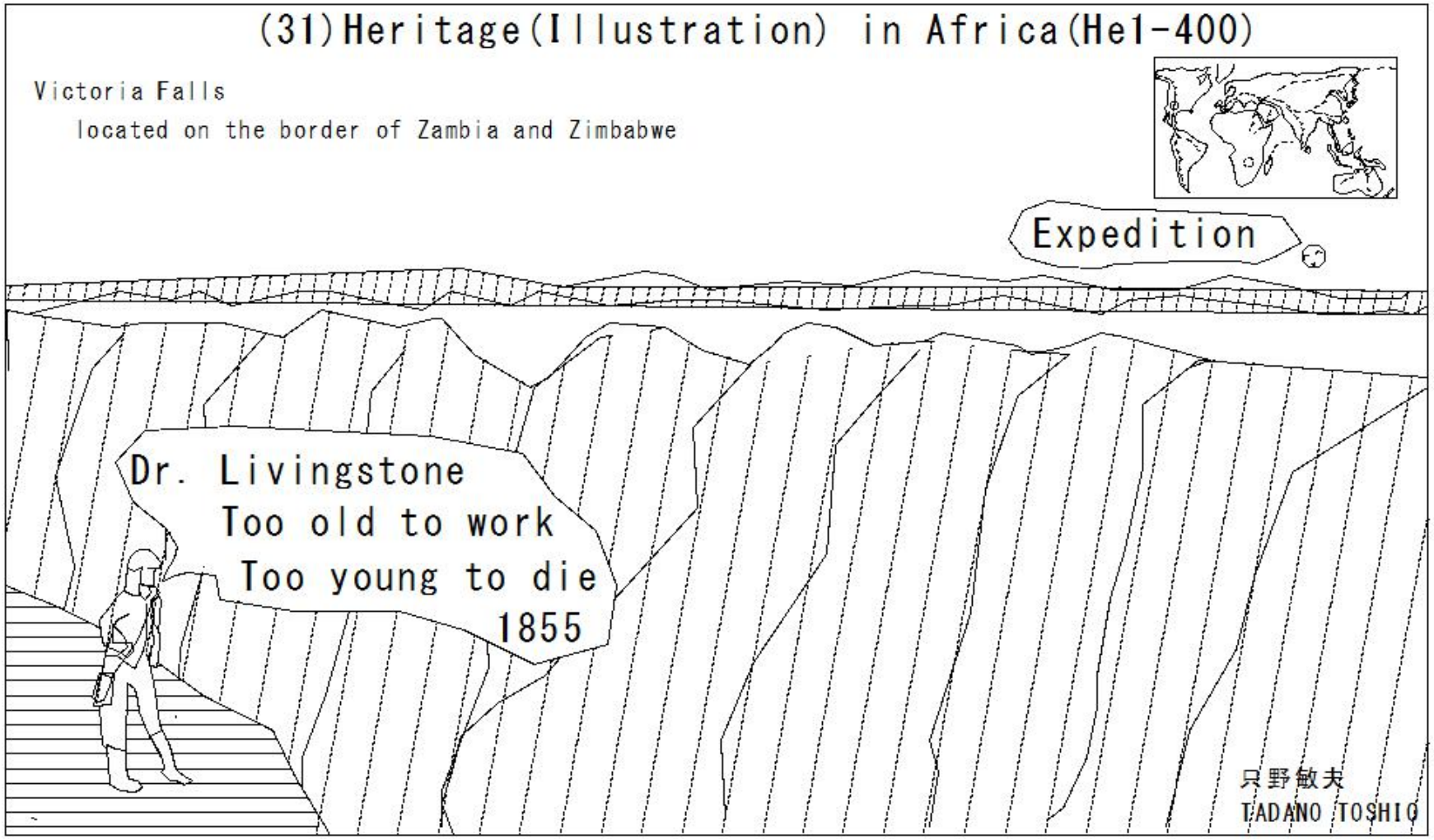
(31)Heritage(Illustration) in Africa(He1-400)



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	① The Foundation of Water and Land Resources	①gricultural and Rural Development Information Center
2	②政宗公時代からの 北上川改修工事とその意義	②NPO法人あぐりねっと21 （宮城大学名誉教授）加藤 徹
	② The Kitakami River Improvement Project and its Significance since the Time of Date Masamune	② NPO AgriNet21 (Professor Emeritus, Miyagi University) Toru Kato
3	③北上川の概要と歴史	③北上川下流河川事務所
	③ An Overview and History of the Kitakami River	③ Kitakami River Lower Reach River Office
4	④北上川・鳴瀬川の改修の歴史	④北上川下流河川事務所
	④ History of the Improvement Projects of the Kitakami and Naruse Rivers	④ Kitakami River Lower Reach River Office
5	⑤みやぎの治水事業 迫川改修80周年～	⑤宮城県 土木部 河川課
	⑤ Flood Control Projects in Miyagi Prefecture: 80th Anniversary of the Hasama River Improvement Project	⑤ Miyagi Prefecture, Civil Engineering Department, River Management Section
6	⑥迫川の変遷	⑥宮城県東部土木事務所登米地域事務所
	⑥ Changes in the Hasama River	⑥ Miyagi Prefecture Eastern Civil Engineering Office, Tomei Regional Office
7	⑦迫川の概要と改修事業	⑦宮城県公式ウェブサイト
	⑦ An Overview and History of the Sakikawa River Improvement Project	⑦ Miyagi Prefecture Official Website
8	⑧野蒜築港跡のびるちっこうあと	⑧松島市教育委員会、野蒜築港ファンクラブ
	⑧ Nobiru Port Ruins	⑧ Matsushima City Board of Education, Nobiru Port Construction Fan Club
9	⑨貞山運河	⑨宮城県土木部河川課
	⑨ Teizan Canal	⑨ Miyagi Prefecture Civil Engineering Department, River Management Section
10	⑩「東北地方の近代土木遺産と土木の偉人を調べよう」	⑩東北大学 創造工学研修（2013年度）
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11	⑪四ツ谷用水再発見事業	⑪仙台市環境局環境共生課
	⑪ The Yotsuya Irrigation Canal Rediscovery Project	⑪ Sendai City Environmental Bureau, Environmental Coexistence Section
12	⑫世界農業遺産「大崎耕土」～内川水物語	⑫宮城県　北部地方振興事務所
	⑫ "Osaki Agricultural Heritage" - The Story of Uchikawa Water	⑫ Miyagi Prefecture Northern Regional Development Office
13	⑬内川［宮城県大崎市］	⑬大崎土地改良区
	⑬ Uchikawa River [Osaki City, Miyagi Prefecture]	⑬Osaki Land Improvement District
14	⑭内川・大堰	⑭宮城県北部地方振興事務所
	⑭ Uchikawa River and the Great Weir	⑭ Miyagi Prefecture Northern Regional Development Office
15	⑮世界農業遺産「大崎耕土」～南原穴堰水物語	⑮北部地方振興事務所　農業農村整備部
	⑮ "Osaki Agricultural Heritage" - The Story of Minamihara Anaseki Weir Water	⑮ Northern Regional Development Office, Agricultural and Rural Infrastructure Department
16	⑯世界農業遺産　大崎耕土を調べよう！	⑯大崎地域世界農業遺産推進協議会
	⑯ Let's Explore the "Osaki Agricultural Heritage"!	⑯ Osaki Region World Heritage of Traditional Agricultural Systems Promotion Council

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(He23) River-Crossing Waterway	River-Crossing Waterway
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(He30) Paddy Field Drainage, Underdrainage	Paddy Field Drainage, Underdrainage
(He31) Paddy Field Drainage, Underdrainage	Paddy Field Drainage, Underdrainage
(He32) Paddy Field Drainage, Underdrainage	Paddy Field Drainage, Underdrainage
(He33) Paddy Field Drainage, Culverts	Paddy Field Drainage, Culverts
(He34) Paddy Field Drainage, Culvert	Paddy Field Drainage, Culverts

(He35) Paddy Field Drainage, Culvert	Paddy Field Drainage, Culverts
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(He61) Tsubogaricho	Tsubogaricho
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(He199) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)	Yotsuya Irrigation Canal
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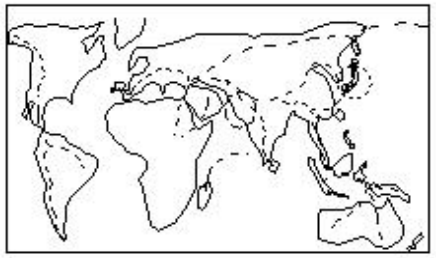
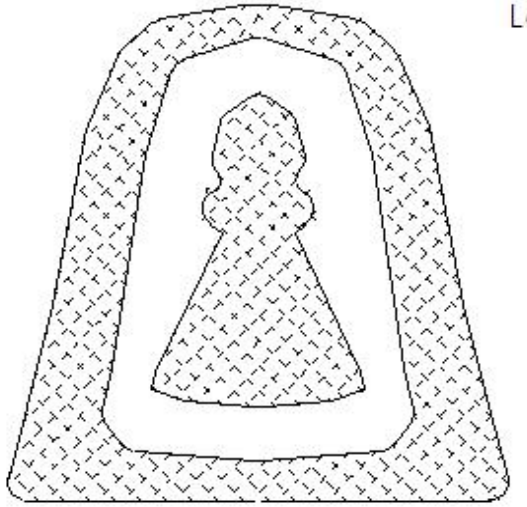
(He1) Ancient tomb

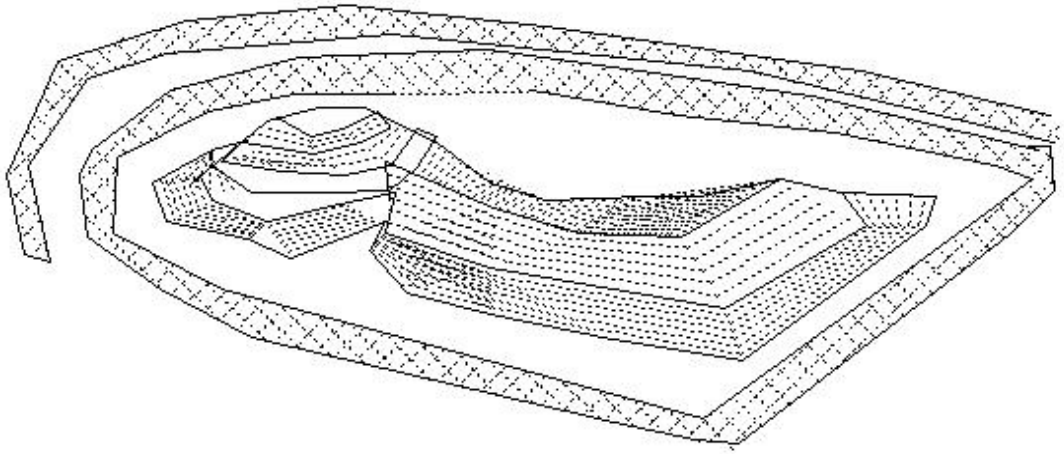
(He1) Ancient tomb



① Mid-Ancient tomb Period (around the 5th century)
② Earth transportation and embankment
③ Determining direction, distance, angle, etc.
④ Introduction of iron tools, etc.
⑤ Calculation of earthwork volume and labor volume, etc.
⑥ Technology introduced from the continent and Korea
⑦ The Oyama Ancient tomb burial mound is approximately 480 meters long and 30 meters high.

The Oyama Ancient tomb
Length: 480m, Height: 30m





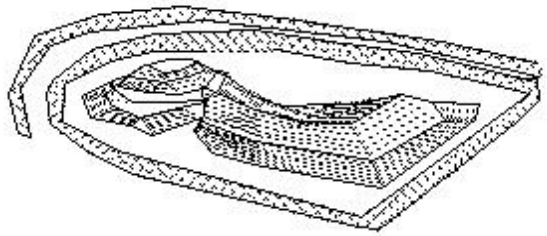
(He2) Ancient tomb

(He2) Ancient tomb

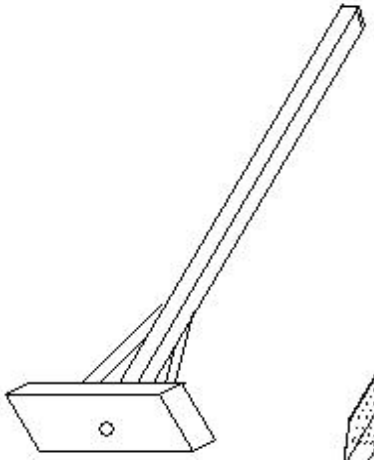
Construction Tools

① Hoe and plow were used for excavation.
② In addition to wooden tools, iron tools were also used.
③ Use (Mokko)a loader or a hoist to transport the soil.
④ A sled was used to transport the sarcophagus.

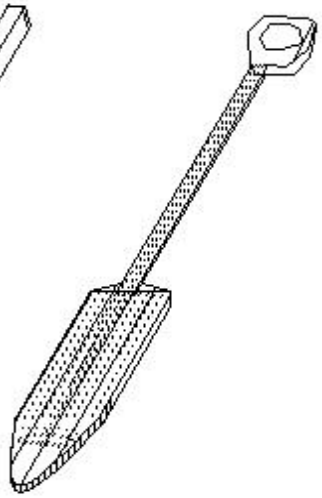
Ancient tomb



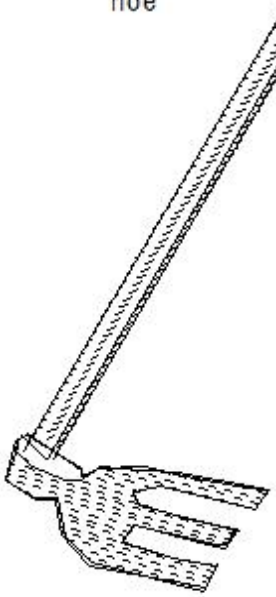
Horizontal ruler



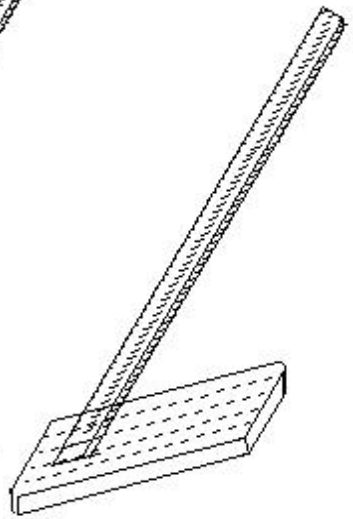
plow



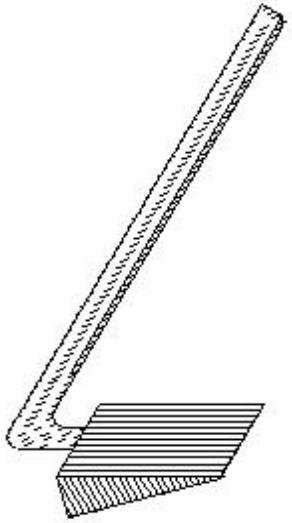
hoe



hoe



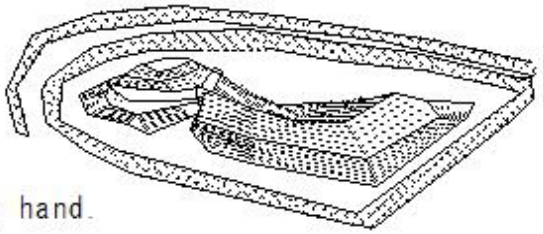
hoe



(He3) Ancient tomb

(He3) Ancient tomb

Ancient tomb



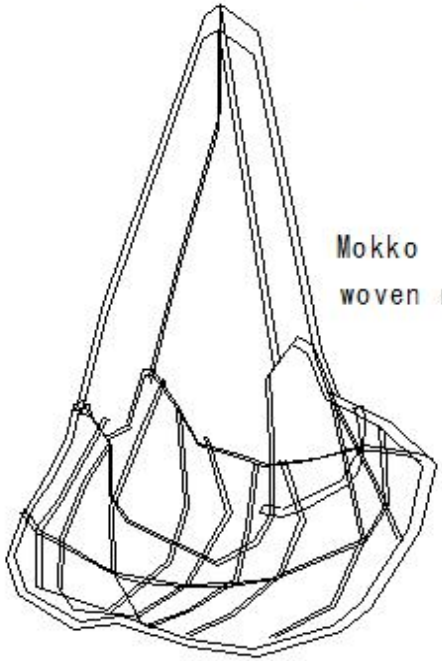
Construction Tools

③Use (Mokko)a loader or a hoist to transport the soil.

Earth-transporting tool

① Made from woven rope, bamboo, or vines

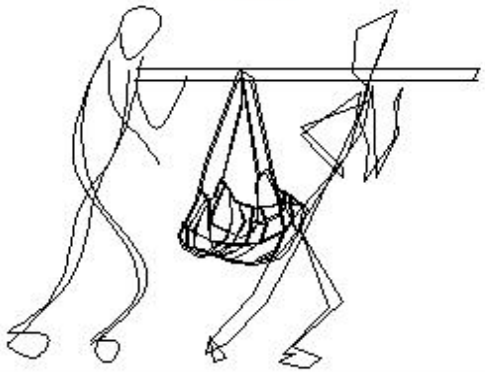
② Used by people to carry on their shoulders, on their backs, or by hand.



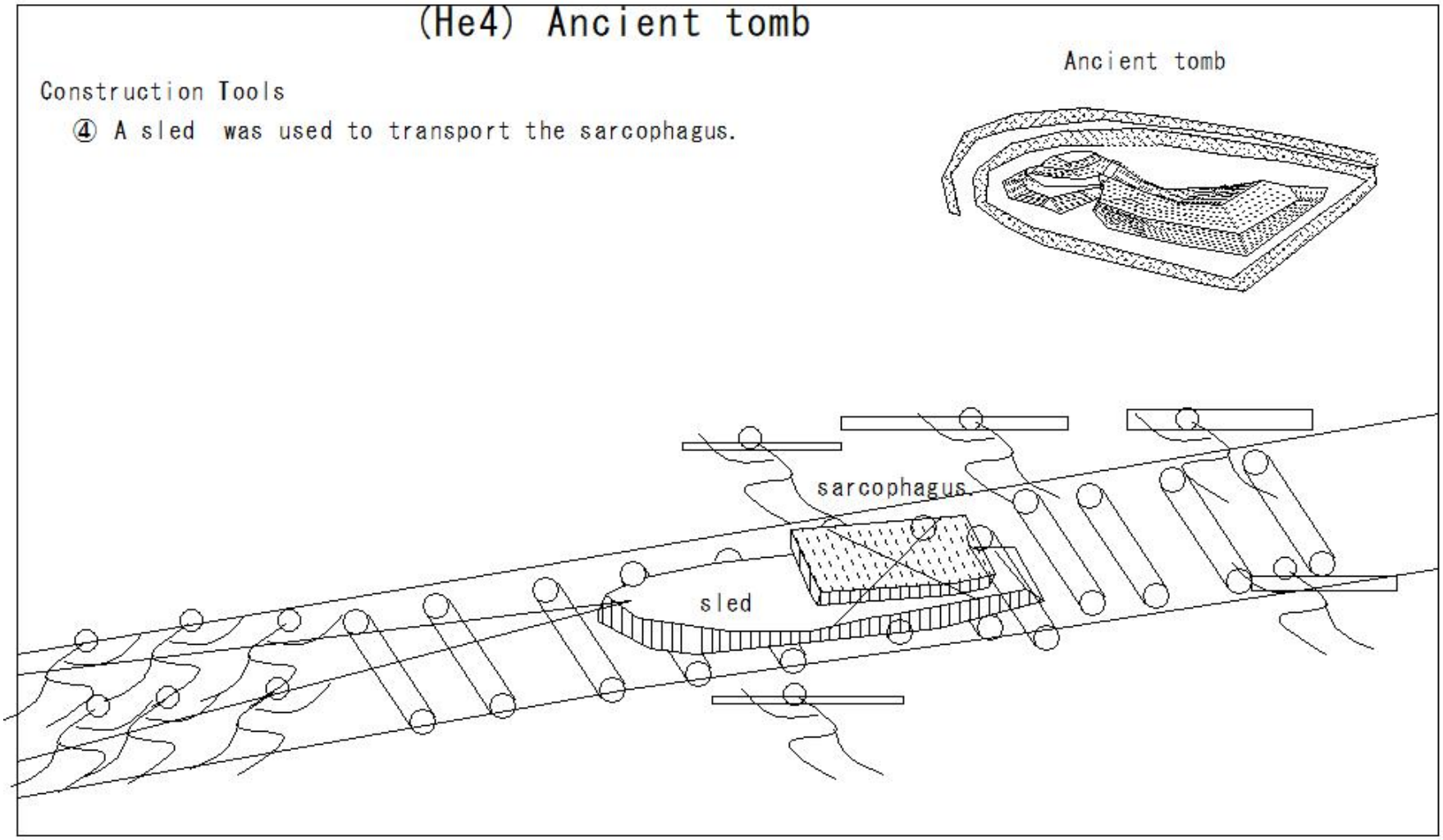
Mokko

woven rope, bamboo, or vines

Mokko



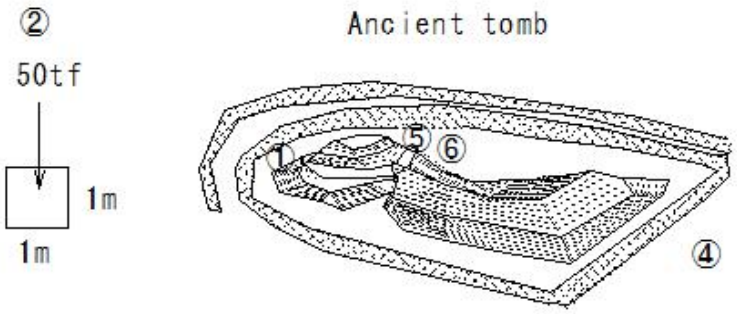
(He4) Ancient tomb



(He5) Ancient tomb

Design Technology

① The Oyama Ancient tomb reaches a maximum height of 30 meters.
② The load on the ground from the fill exceeds 50 tons per square meter.
③ This is the same load as placing a 12- to 30-story reinforced concrete building directly on the ground.
④ A geologically sound location was selected.
⑤ To support the enormous weight, the mound is raised in three tiers.
⑥ The angle of each tier is within the angle of repose of the soil.

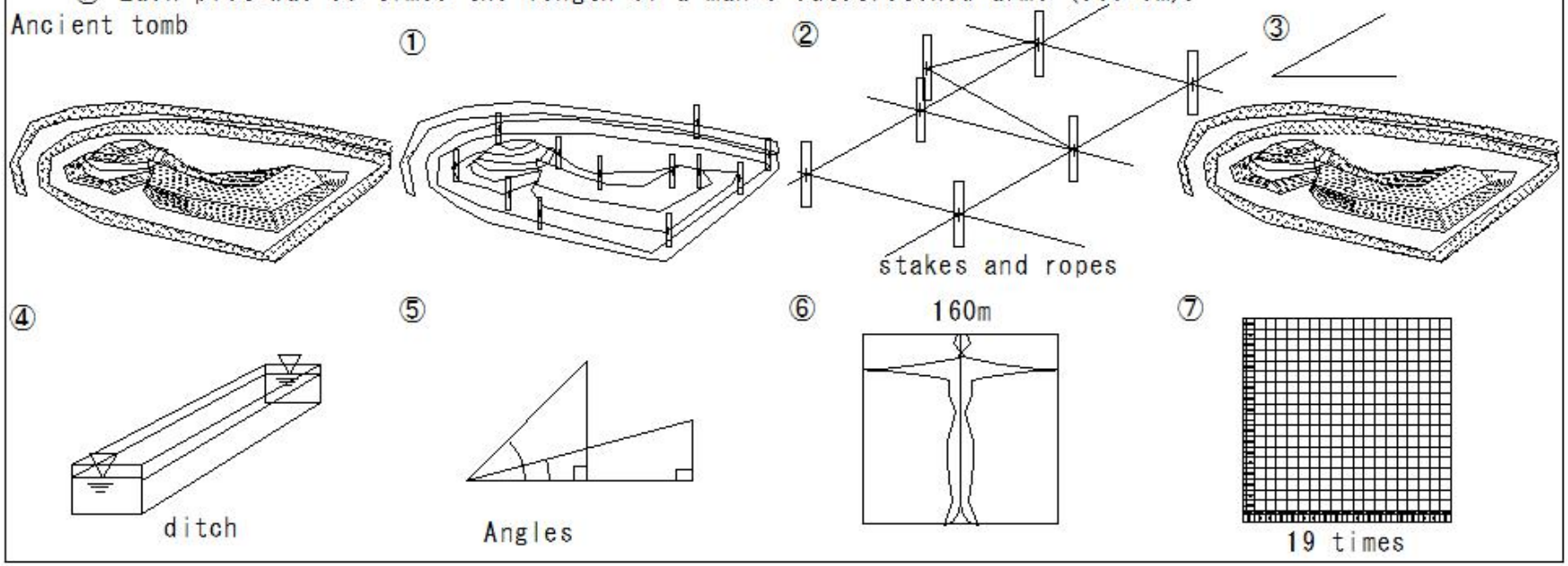


(He6) Ancient tomb

(H6) Ancient tomb

Surveying Techniques

① The outline was actually drawn on the ground.
② The squares were divided using stakes and ropes.
③ Ancient tomb are three-dimensional structures consisting of horizontal and sloped surfaces.
④ The horizontal surface was determined by filling a ditch or wooden tank with water.
⑤ Angles were calculated using a triangle with a base and height.
⑥ The unit of length was based on the length of an adult's outstretched arms (fathom).
⑦ Each plot was 19 times the length of a man's outstretched arms (160 cm).



(He7) Ancient tomb

(He7) Ancient tomb

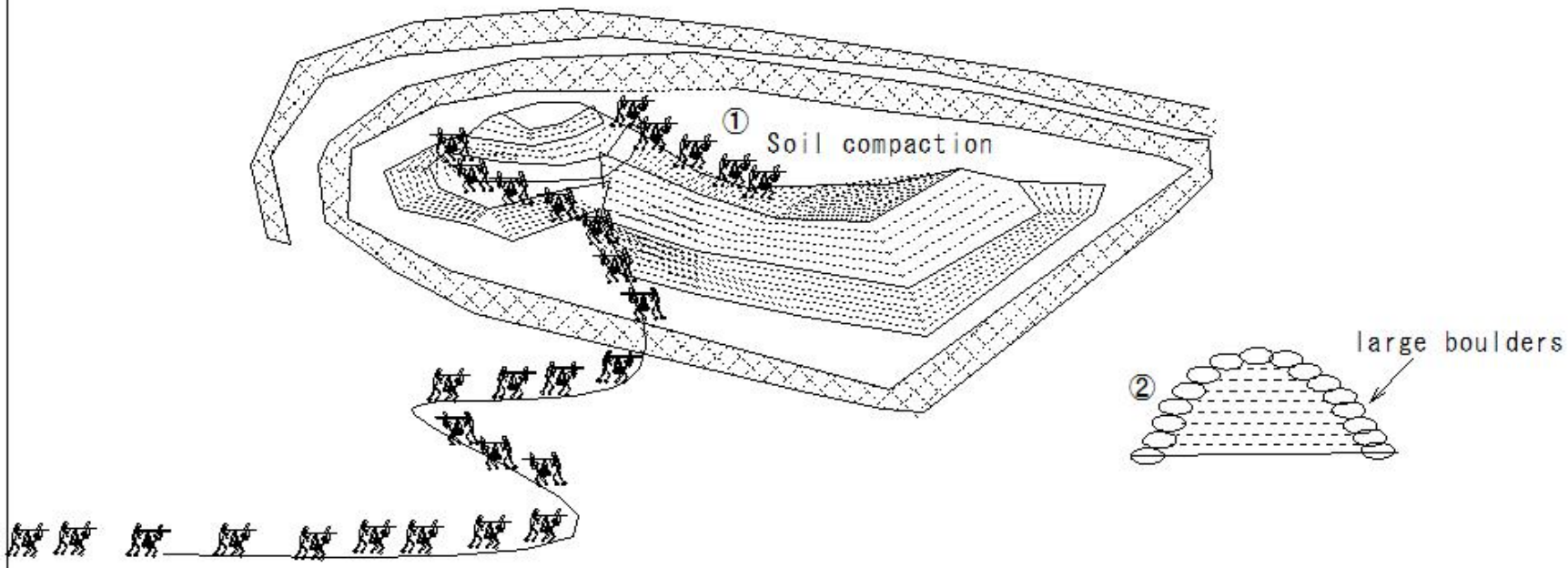
Slope Protection

Oyama Ancient tomb

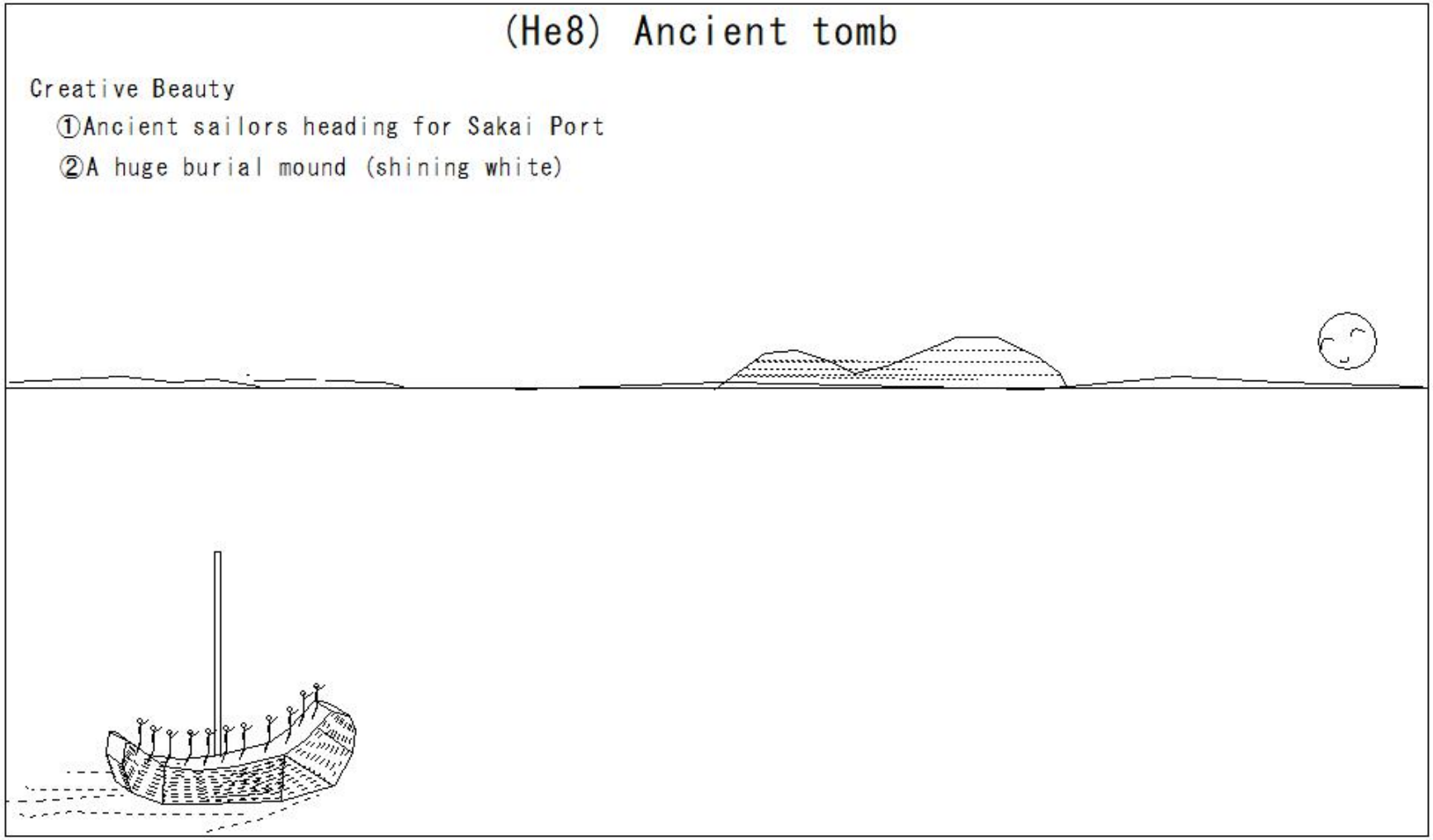
① Soil compaction: The mounding took place over a long period of time.

② The slope was covered with large boulders the size of a cat or dog's head.

Ancient tomb



(He8) Ancient tomb

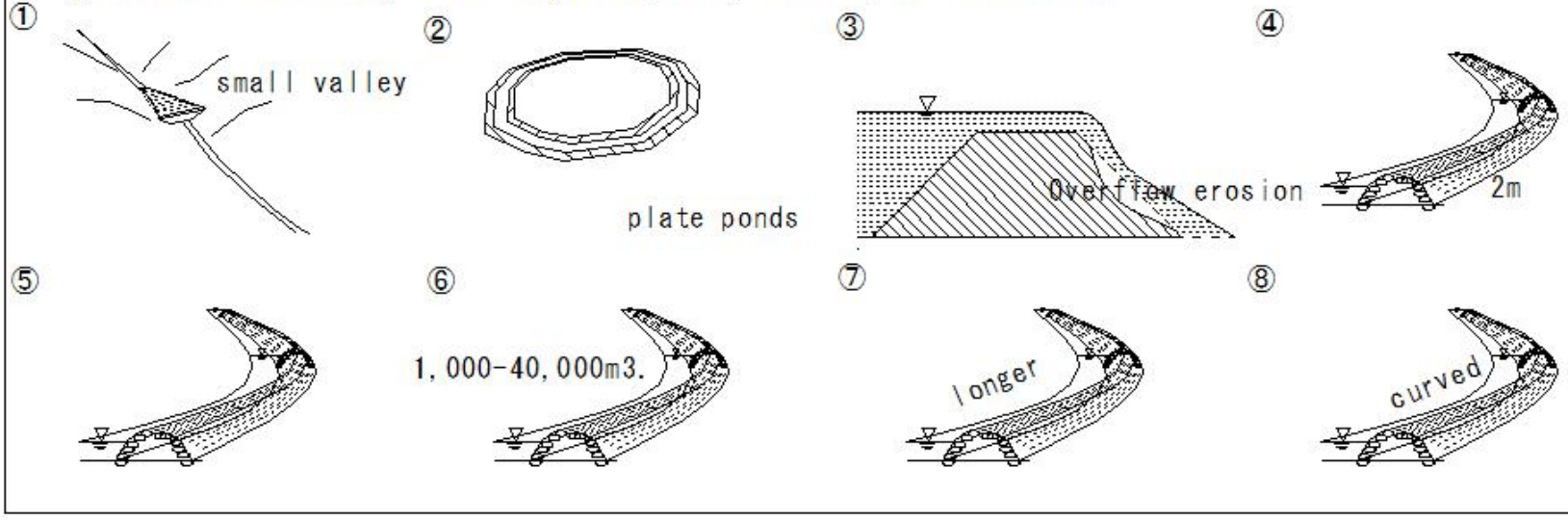


(He) Ancient tomb

(He9) Reservoir

Construction of reservoir

① Created by damming a small valley or stream.
② Built on flat ground, these so-called "saraike" ponds (plate ponds).
③ Reservoirs built in ancient times have been renovated many times throughout their long history.
④ The dam height is less than 2m.
⑤ The dam length is 100-250m.
⑥ The water storage capacity is 1,000-40,000m3.
⑦ The dam length is longer than the dam height.
⑧ The dam is curved, with many being two-, three-, or four-sided.



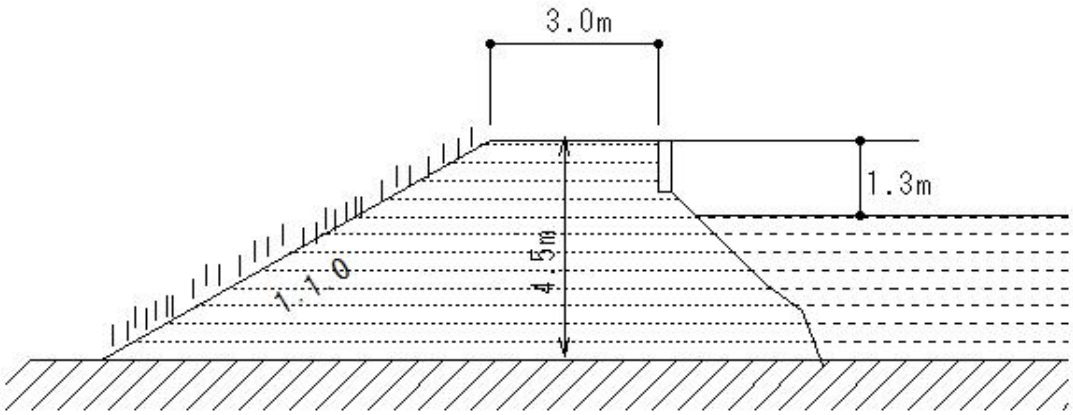
(He10) Reservoir

(He10) Reservoir

Pond Construction

Pond Structure

Ancient Ponds



(He11) Reservoir

(H11) Reservoir

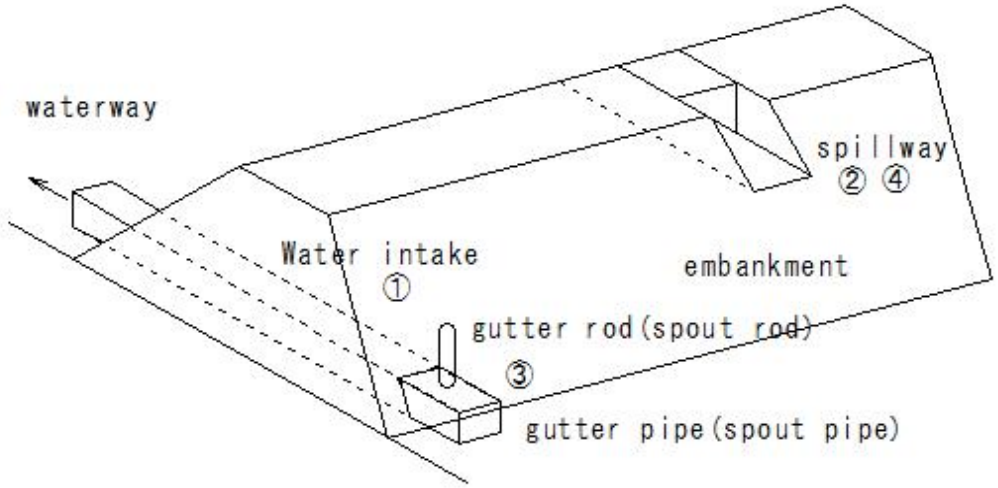
History of Water Intake Facilities and Spillway

① Water intake facilities for taking in water

② Spillway for releasing water when the river is full

③ The water intake facilities are made by cutting a pine log in half lengthwise, digging a groove in one side of the log, and then stacking the two logs together to form a "spout pipe" that is then plugged with a "spout rod."

④ The spillway is built by digging an embankment at one end of the levee.



(He12) Reservoir

(H12) Reservoir

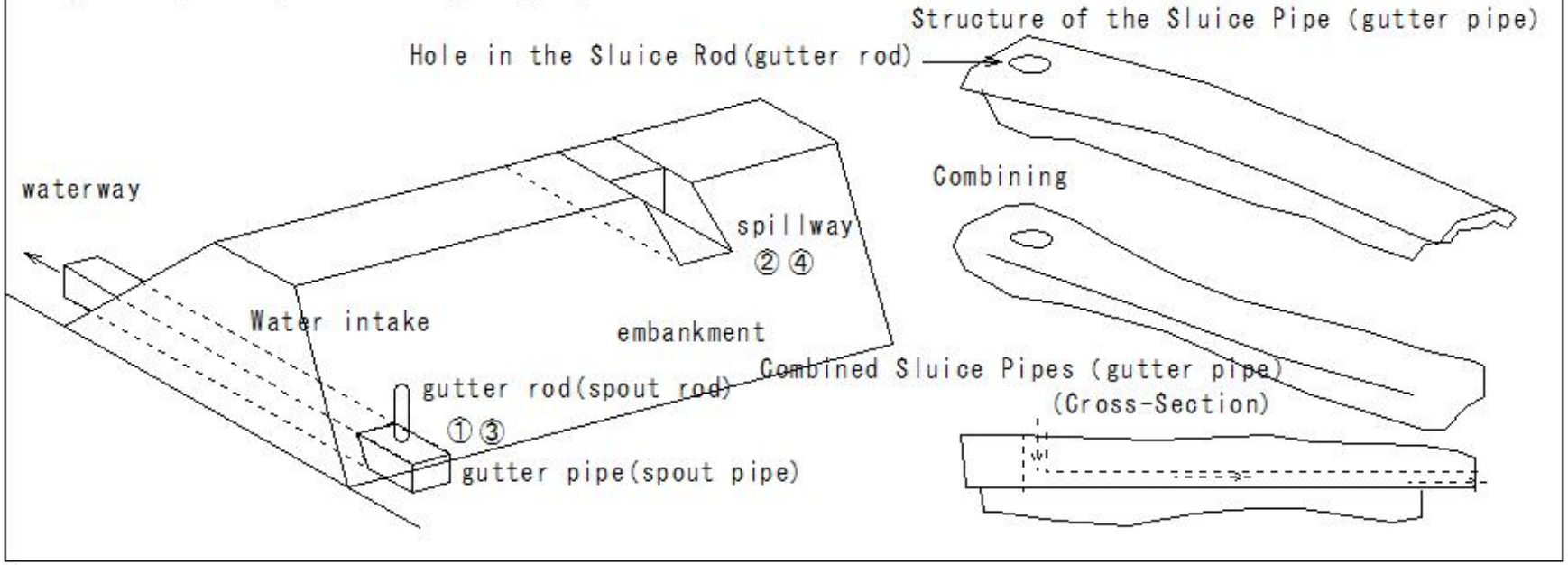
History of Water Intake Facilities and Spillway

① Water intake facilities for taking in water

② Spillway for releasing water when the river is full

③ The water intake facilities are made by cutting a pine log in half lengthwise, digging a groove in one side of the log, and then stacking the two logs together to form a "spout pipe" that is then plugged with a "spout rod."

④ The spillway is built by digging an embankment at one end of the levee.

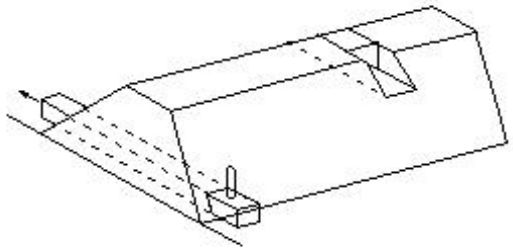


(He13) Reservoir

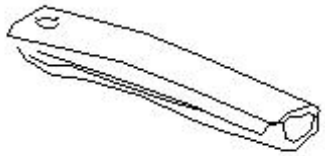
(H13) Reservoir

History of Water Intake Facilities and Spillways

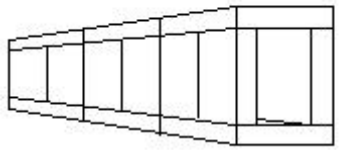
① Wooden culverts are prone to rot.
② To prevent this, a water reservoir was installed at the very end of the culvert.
③ Measures were taken to prevent rot, such as keeping the culvert constantly submerged.
④ Instead of rotting wood,
⑤ Stone was also used after 1854.
⑥ However, the problem of water leakage from joints remained.
⑦ The fundamental solution was the introduction of reinforced concrete pipes.



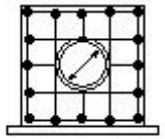
Combining



① Wooden culverts



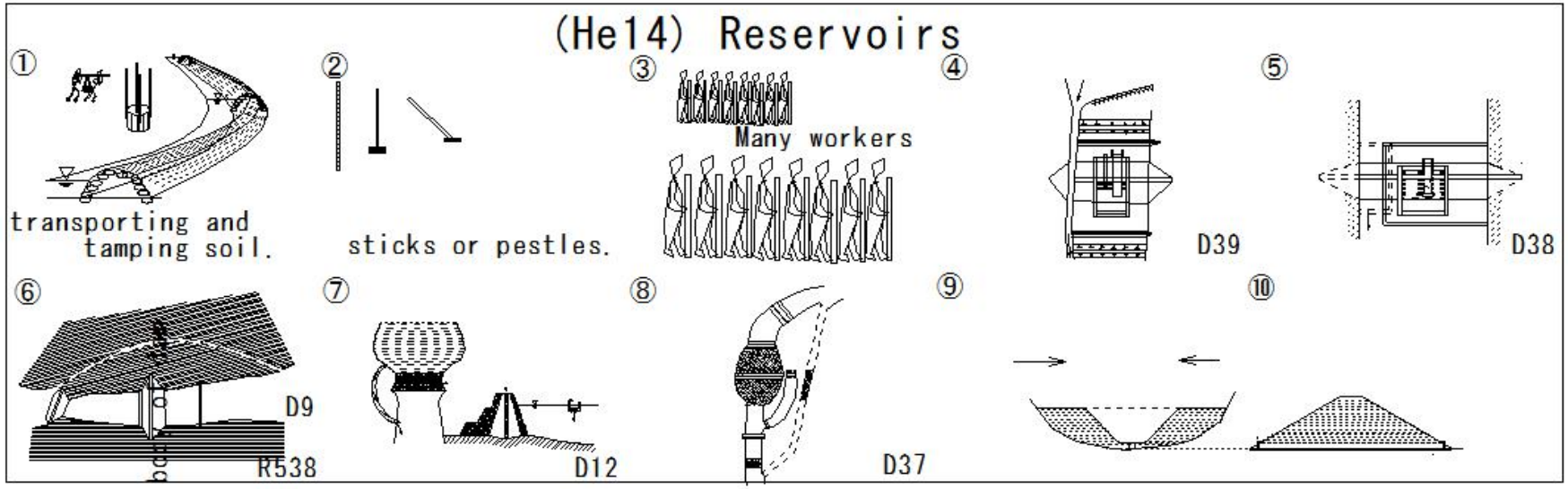
⑤ Stone gutter



⑦ Reinforced concrete pipes.

(He14) Reservoirs

(H14) Reservoirs
History of Water Intake Facilities and Spillways
Construction of Embankments
① Embankments are constructed by transporting and tamping soil.
② In the past, tamping embankments was done with sticks or pestles.
③ Many workers were forced to move back and forth, stomping the soil with their feet.
④ The greatest challenge in embankment construction was flood control during construction.
⑤ Many construction failures were due to this.
⑥ Even today, when building large dams, temporary drainage channels are installed prior to the main construction.
⑦ While it is possible to divert floodwaters or remove them with a "bottom drain" in small reservoirs or basins,
⑧ this was nearly impossible in large reservoirs that dam the main stream of a river.
⑨ The middle section was left as a water supply until the end, and then closed off all at once.
⑩ The center of a levee, built in a short period of time, was always a weak point and often led to its collapse.



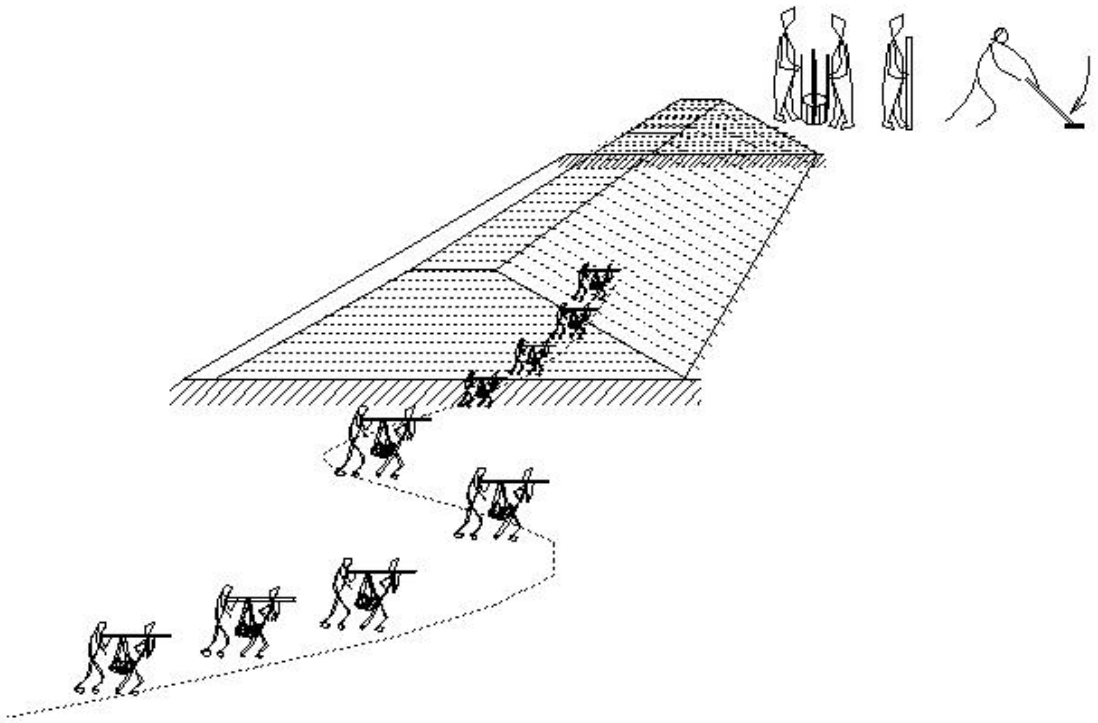
(He15) Reservoir

(He15) Reservoir

History of Water Intake Facilities and Spillways

Construction of Embankments

① Embankments are constructed by transporting and tamping soil.



(He16) Reservoir

(He16) Reservoir

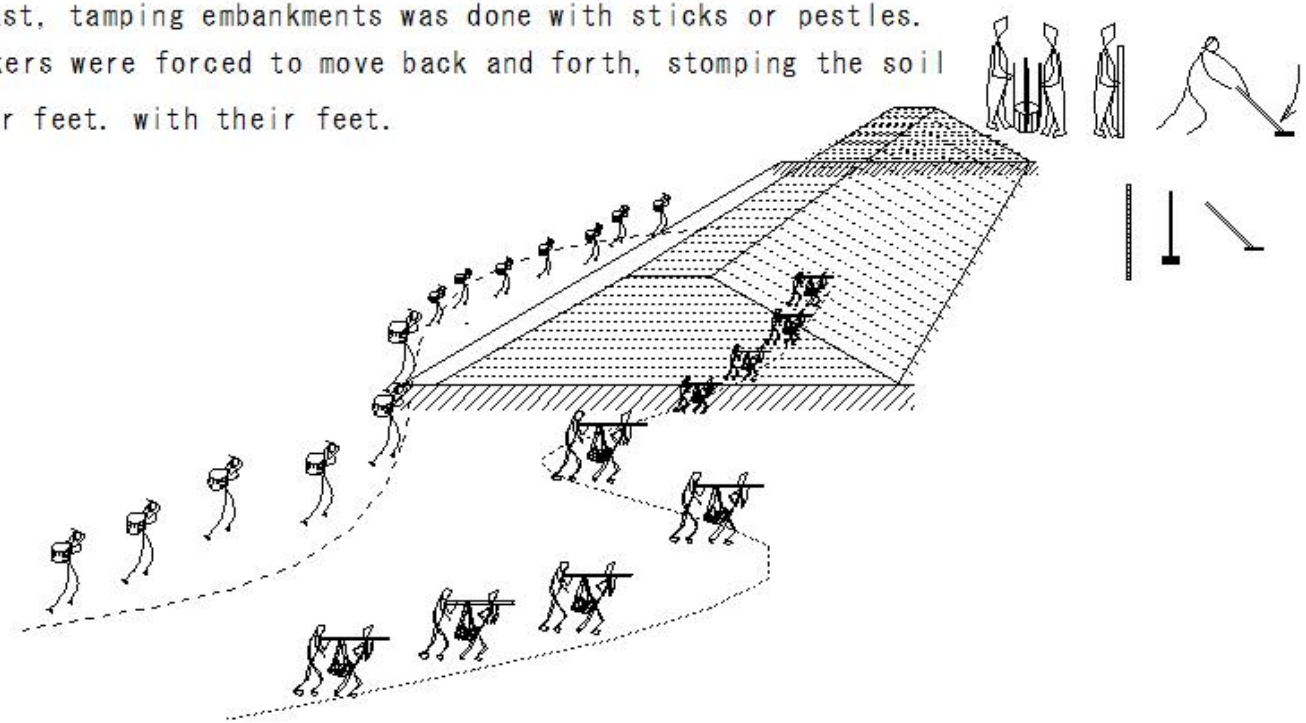
History of Water Intake Facilities and Spillways

Construction of Embankments

① Embankments are constructed by transporting and tamping soil.

② In the past, tamping embankments was done with sticks or pestles.

③ Many workers were forced to move back and forth, stomping the soil with their feet. with their feet.



(He17)Stone Bridge

(He17)Stone Bridge

Tsujun Bridge, a Stone Arch Bridge

Stone Bridge Technology

① The Tsujun Bridge was built in Nagahara, Yabe Town, Kamimashiki District, Kumamoto Prefecture

② Built between 1852 and 1854

③ Originally planned and designed by Yasunosuke Fuda

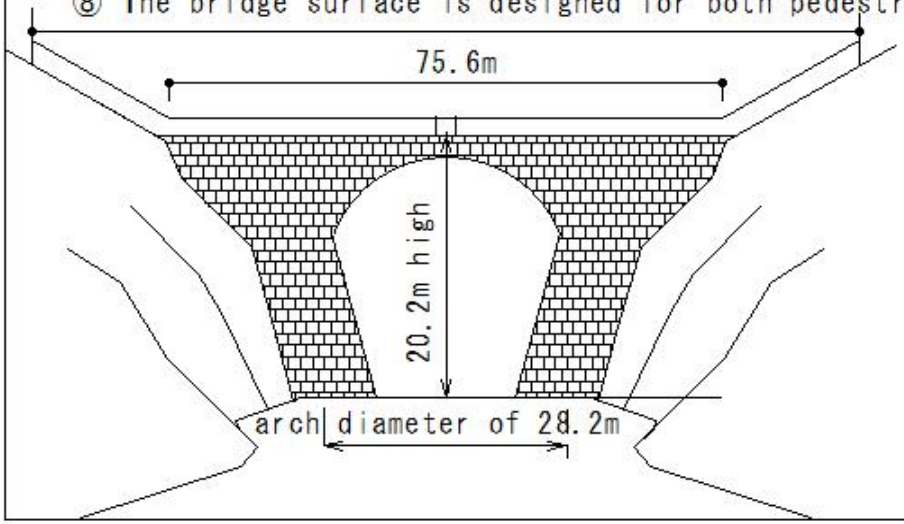
④ Stonemason Kangoro Hashimoto

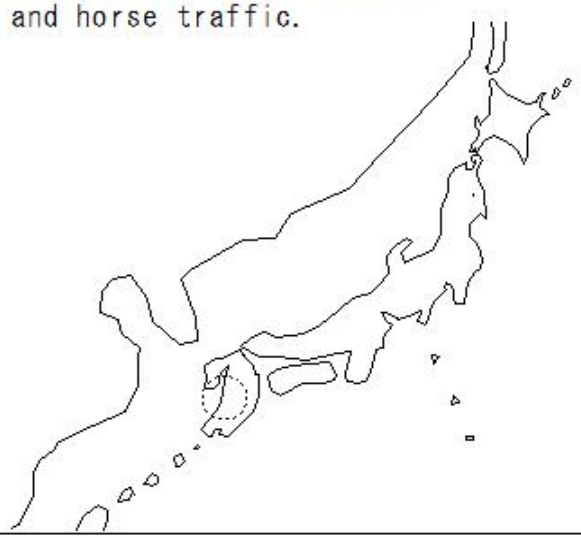
⑤ The bridge is 75.6m long, 6.3m wide, 20.2m high, with an arch diameter of 28.2m

⑥ A single-arch eyeglass bridge

⑦ Three siphon water pipes (with a water flow rate of 15,000m3/day) are buried,

⑧ The bridge surface is designed for both pedestrian and horse traffic.





(He18)Stone Bridge

(He18)Stone Bridge

Tsujun Bridge, a Stone Arch Bridge

Stone Bridge Technology

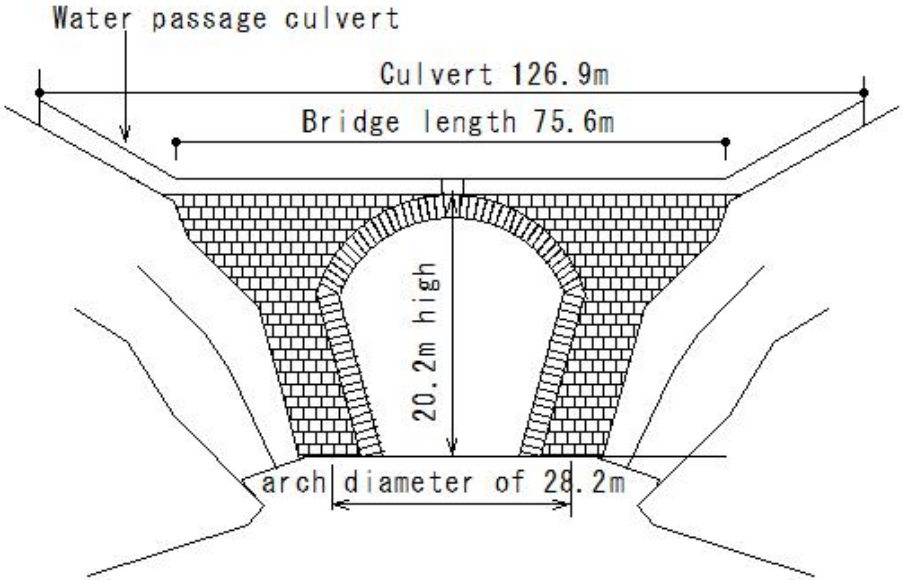
Combined arch bridge and siphon technology

① 29m above the riverbed

② To cross the waterway, an arch bridge and a siphon were used in combination

③ Various simulation experiments were conducted on the arch diameter and siphon height

④ Drop of 7.6m, rise of 5.9m



(He19)Stone Bridge

(He19)Stone Bridge

Tsujun Bridge, a Stone Arch Bridge

Stone Bridge Technology

Water-Resistant and Earthquake-Resistant Design

① The water pipes are able to withstand tremendous water pressure.

② High-quality stone is cut straight-grained.

③ A 30cm square water hole is dug in the center, and the blocks are connected.

④ To prevent water leakage from the joints,

⑤ grooves are cut into the stone surface.

⑥ A special plaster made from a mixture of soil, sand, shell ash, salt, and pine needle juice is then filled and hardened.

⑦ Wooden pipes carved out of pine logs are fitted into each water pipe in four places.

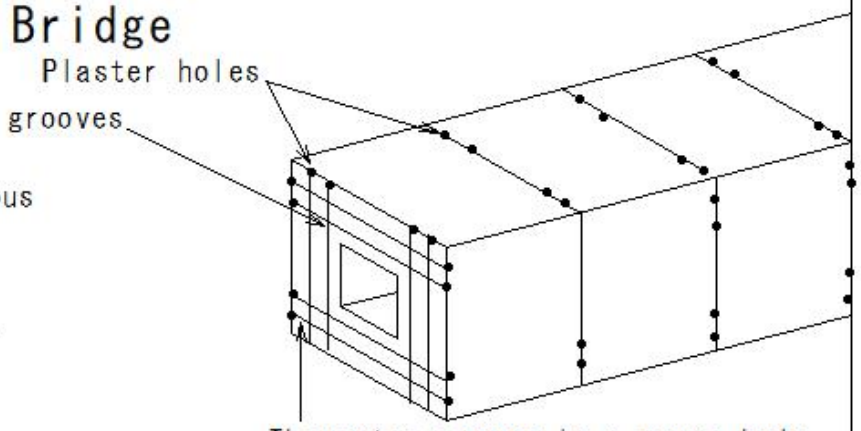
⑧ They serve as buffers against earthquakes and other damage.

⑨ The water flow rate of each of the three water pipes can be individually adjusted.

⑩ A water outlet in the center of the bridge allows sediment and other debris to be expelled from the pipes.

⑪ The slope and curve of the siphon drop and upwelling sections prevent direct water pressure from being applied to the bridge.

⑫ The design was achieved through repeated detailed studies using models.



The outer grooves are spare holes for when water is passed through.

(He20)Stone Bridge

(He20) Stone Bridge

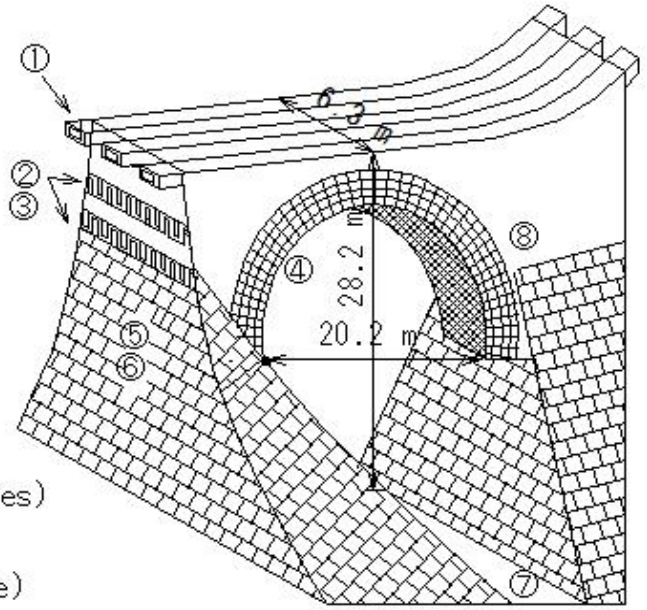
Tsujun Bridge, a Stone Arch Bridge

Stone Bridge Technology

Construction Techniques

① To build an arch bridge, first shoring is erected.
② Cut stones are placed on both sides of the shoring,
③ to create the most important part of an arch bridge, the shoring.
④ These shoring stones are 90 cm thick.
⑤ Uneven stones called chain stones are placed between the shoring stones to strengthen the side stone walls.
⑥ To further strengthen the bridge,
⑦ stone sheath walls, modeled after those of Kumamoto Castle, are erected.
⑧ The bases of the shoring stones are wrapped and reinforced.

Water flow rate (15,000 m3/day)



① Coming from intake
② Chain stone
③ (Hanging stones are used at the edge of the ring stone)
④ Ring stone
⑤ Cross section
⑥ Backing stones (all square stones)
⑦ Base is large bedrock
⑧ Cut stone wall

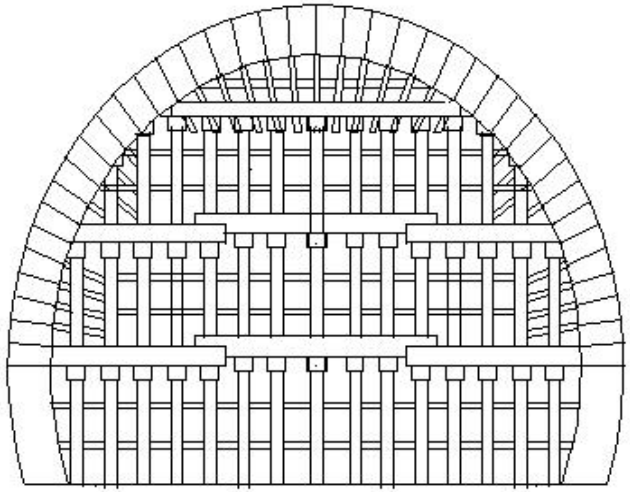
(He21)Stone Bridge

(He21) Stone Bridge

Tsujun Bridge, a Stone Arch Bridge

Stone Bridge Technology

Construction Techniques



Shoring Design Drawing: Wooden framework (shoring) used in the construction of the arch bridge.

(He22) River-Crossing Waterway

(He22) River-Crossing Waterway

River-Crossing Waterway

Siphon Technology Used Since Ancient Times

① Siphons are used when a waterway is interrupted by a river or valley.

② A vertical U-shaped detour is used to transport water.

③ A siphon called Batou is located on the Momonogawa River, upstream of the Matsuura River, which flows through northwestern Saga Prefecture.

④ Designed by Hyogo Narutomi.

⑤ Built in 1611.

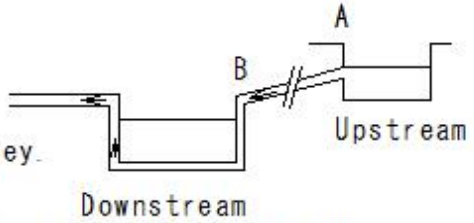
⑥ The Momonogawa area is located higher than the Matsuura River, making it impossible to extract water.

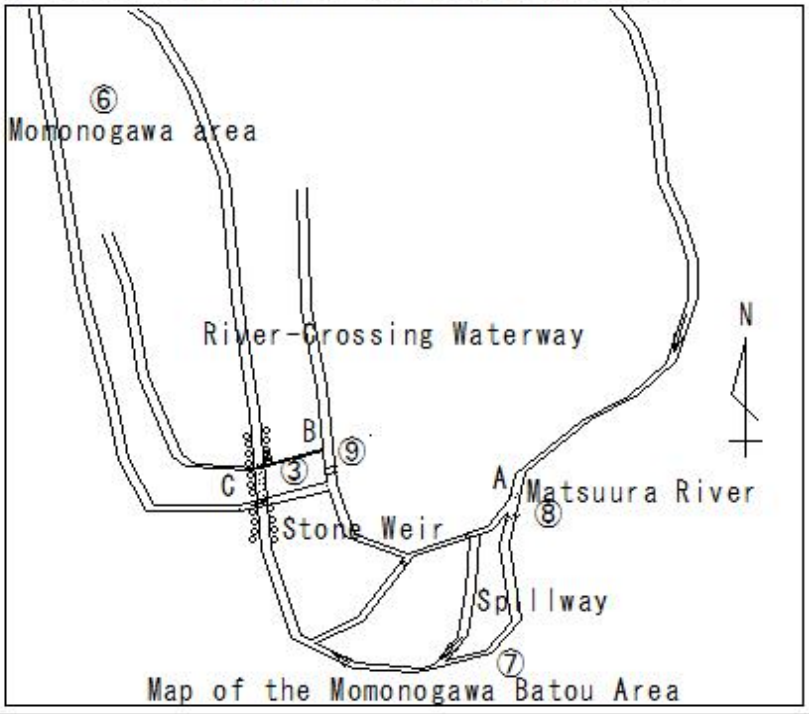
⑦ Utilizing the topography of the Matsuura River, which curves upstream,

⑧ A weir (a dam) was located upstream on the opposite bank, and the water taken from this was channeled across the Matsuura River via a siphon across the river.

⑨ Two siphons, one large and one small, were installed side by side, each serving two settlements with different irrigation areas.

Cross-section of the Momono River near Batou



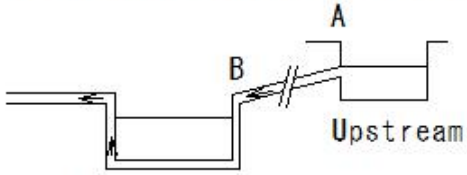


Map of the Momonogawa Batou Area

(He23) River-Crossing Waterway

(He23) River-Crossing Waterway

Cross-section of the Momono River near Batou



River-Crossing Waterway

Siphon Technology Used Since Ancient Times

Structure of the Siphon

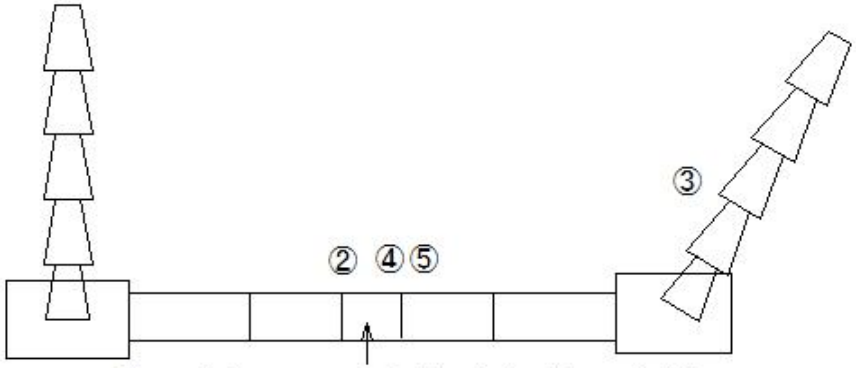
① The siphon section was replaced with a concrete pipe in 1928.

② Until then, a system consisting of about 50 connected buckets was used for a long time.

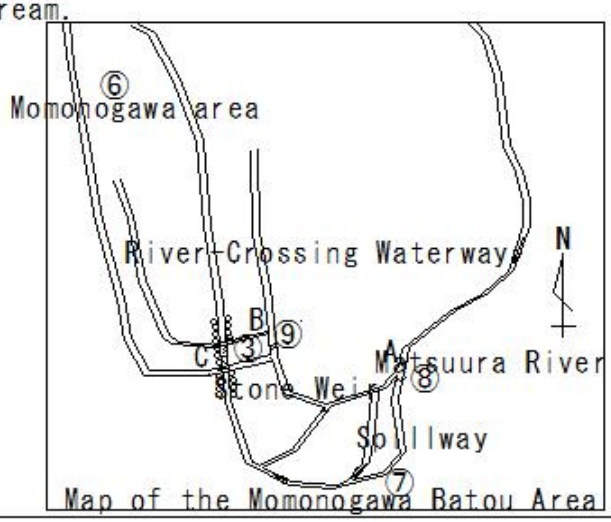
③ The upstream rising section of the siphon section is twice as long as the downstream rising section.

④ The siphon section, laid on the riverbed, is covered with sturdy stone paving to protect it from the flowing water.

⑤ The river washes over this stone paving as it flows downstream.

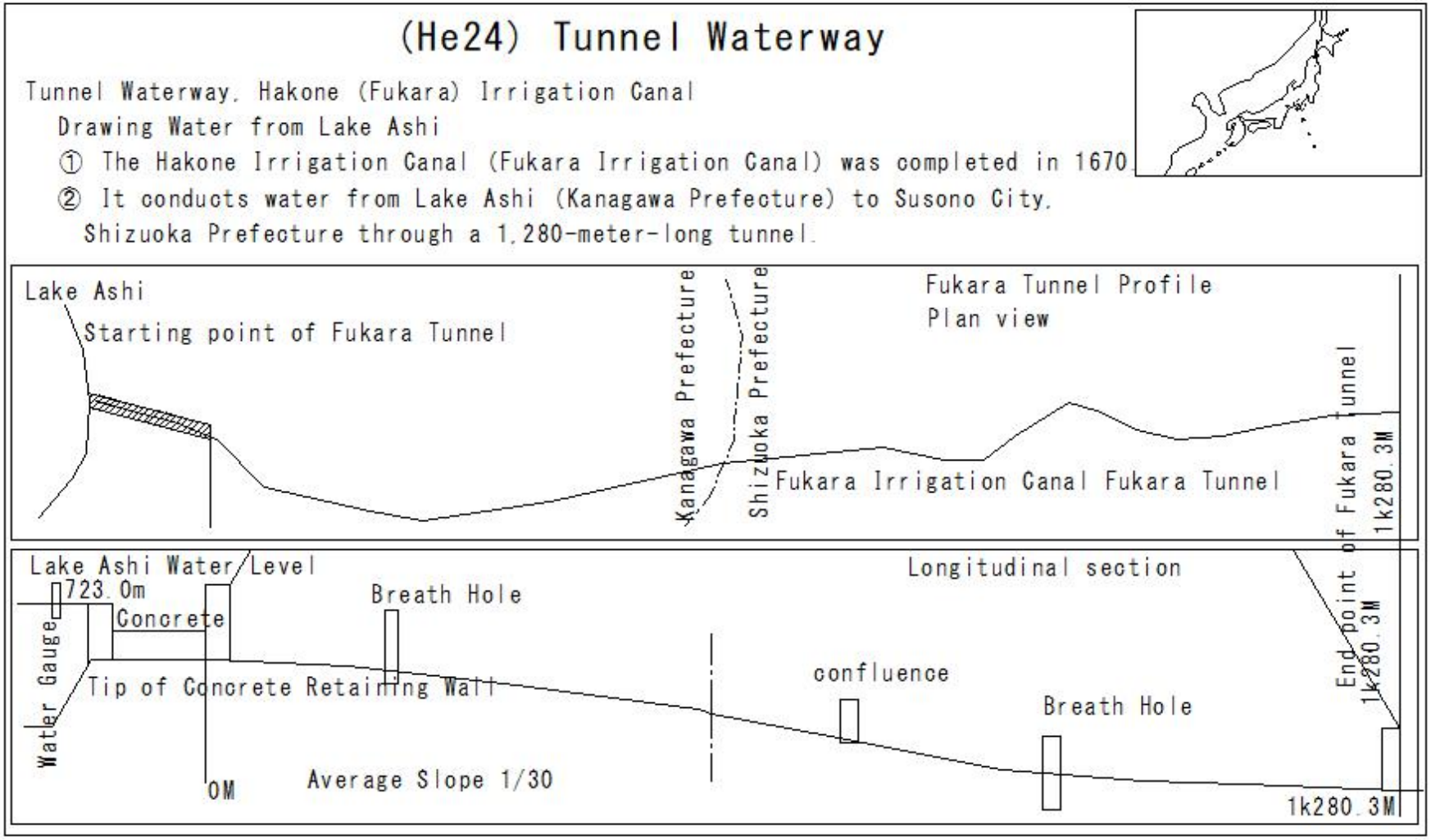


Structure of the Siphon



Map of the Momonogawa Batou Area

(He24) Tunnel Waterway



(He25) Tunnel Waterway

(He25) Tunnel Waterway

Tunnel Waterway, Hakone (Fukara) Irrigation Canal

Surveying Technique

① Construction began in 1666 by excavating both entrances from the Lake Ashi and Fukara sides.

② Construction surveys were conducted using Kojiri Pass, which overlooks both entrances, as a reference point to determine the elevation difference between Lake Ashi and the Fukara side and the overall gradient.

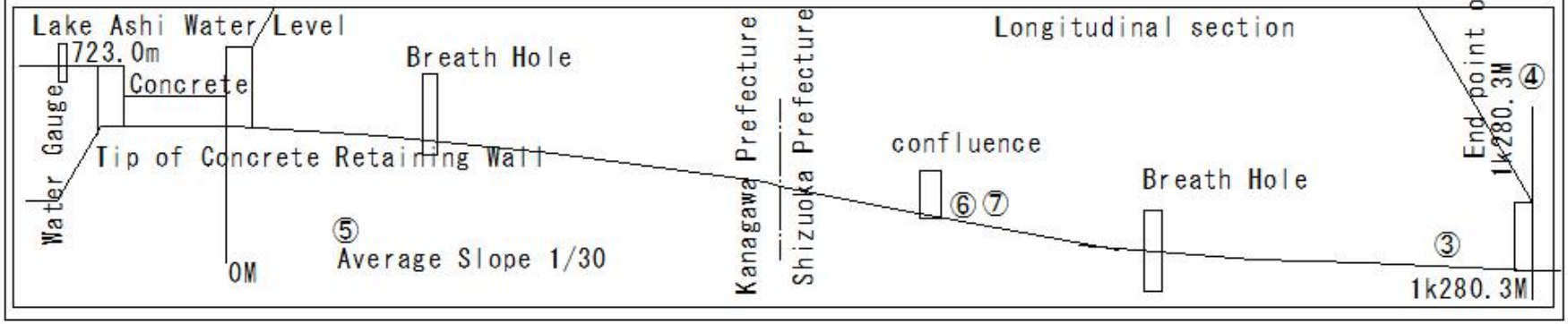
③ Based on the total drop of 10m between both entrances and the total length of 1,280m,

④ The total length of 1,280m,

⑤ The tunnel gradient was estimated to be 1/130.

⑥ Currently, a drop of approximately 1m is observed in the center of the tunnel.

⑦ It is unclear whether this is due to construction error or calculation.



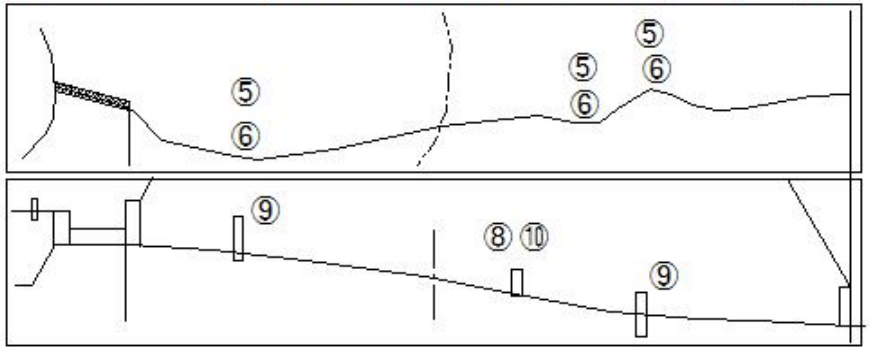
(He26) Tunnel Waterway

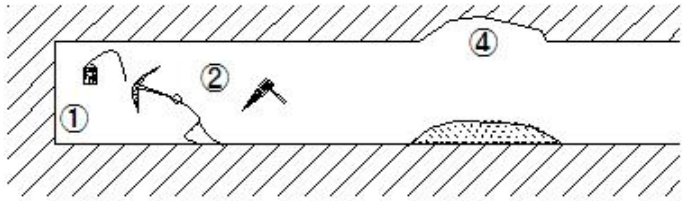
(He26) Tunnel Waterway

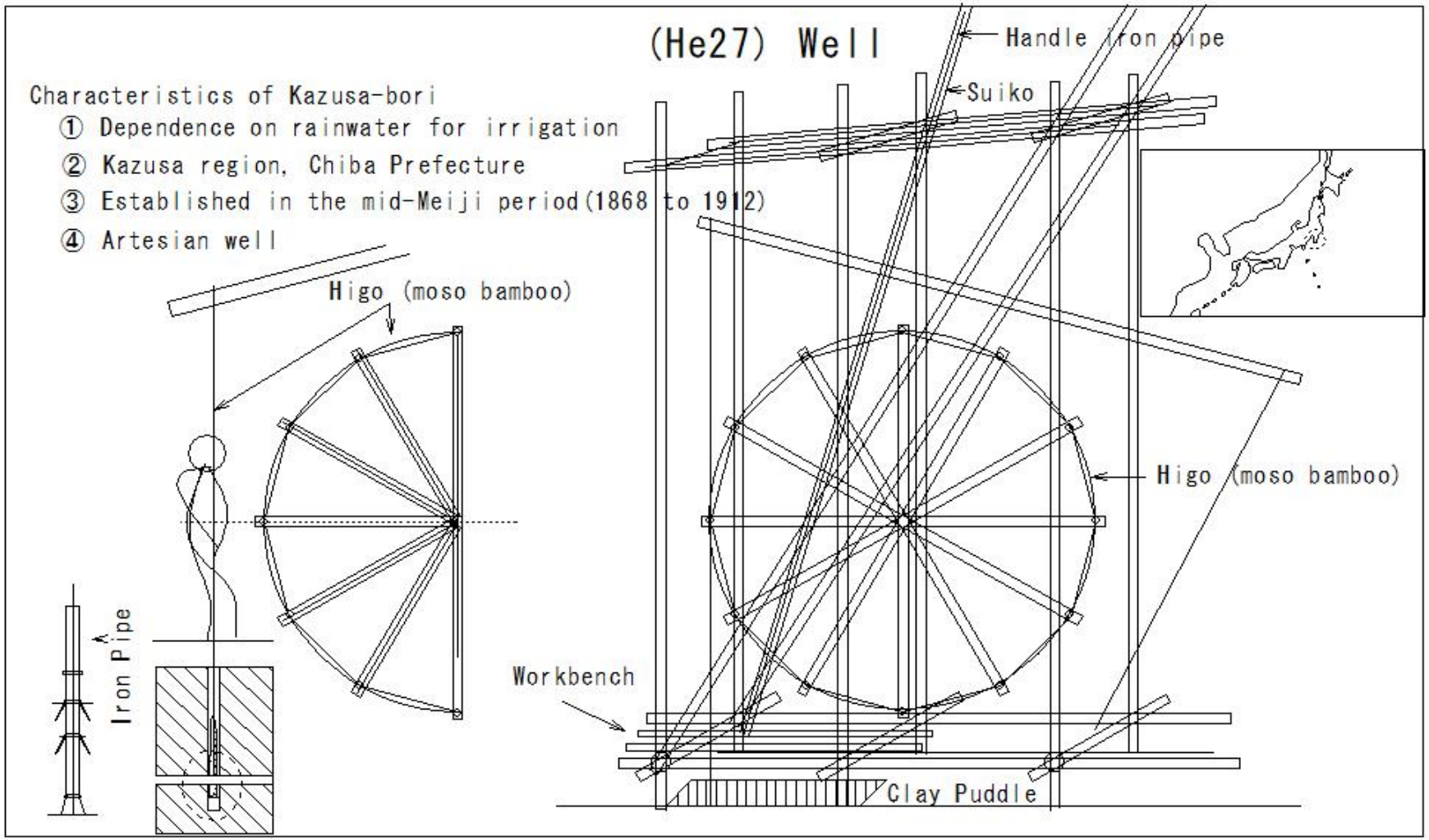
Tunnel Waterway, Hakone (Fukara) Irrigation Canal

Excavation Technique

① The excavation direction was apparently checked daily at the excavation site using lanterns.
② Pickaxes and chisels were the primary excavation tools.
③ The geology was dominated by tuff.
④ The construction involved faults, fractured zones, landslides, and springs.
⑤ The route snakes in plan view.
⑥ Excavation was carried out while avoiding hard rock.
⑦ Excavation was carried out while making corrections.
⑧ The tunnel has a drop in the center.
⑨ A vertical shaft, likely for ventilation, located approximately 150 meters from both entrances.
⑩ In 1670, the tunnels were joined below Kojiri Pass.
⑪ It took four years and a total of 834,000 people.






(He27) Well
Handle iron pipe
Suiko
Characteristics of Kazusa-bori
① Dependence on rainwater for irrigation
② Kazusa region, Chiba Prefecture
③ Established in the mid-Meiji period(1868 to 1912)
④ Artesian well
Higo (moso bamboo)
Higo (moso bamboo)
Iron Pipe
Workbench
Clay Puddle

(He28) Well

Characteristics of Kazusa-bori

① An artesian well is made by digging a narrow hole in the ground from above ground using an iron rod or other tool.

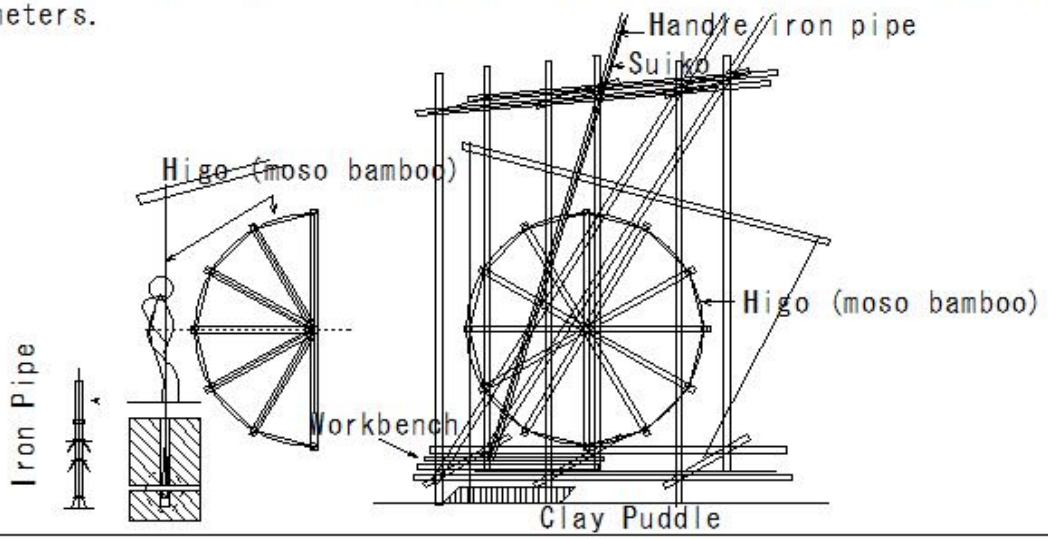
② It allows groundwater to flow naturally.

③ A distinctive feature of Kazusa-bori is the use of small pieces of bamboo called Higo (moso bamboo) to connect the digging tool, which gets longer as the digging progresses.

④ Kazusa-bori's use of Higo (moso bamboo) makes it lightweight.

⑤ Furthermore, the highly elastic Higo (moso bamboo) can be rolled up.

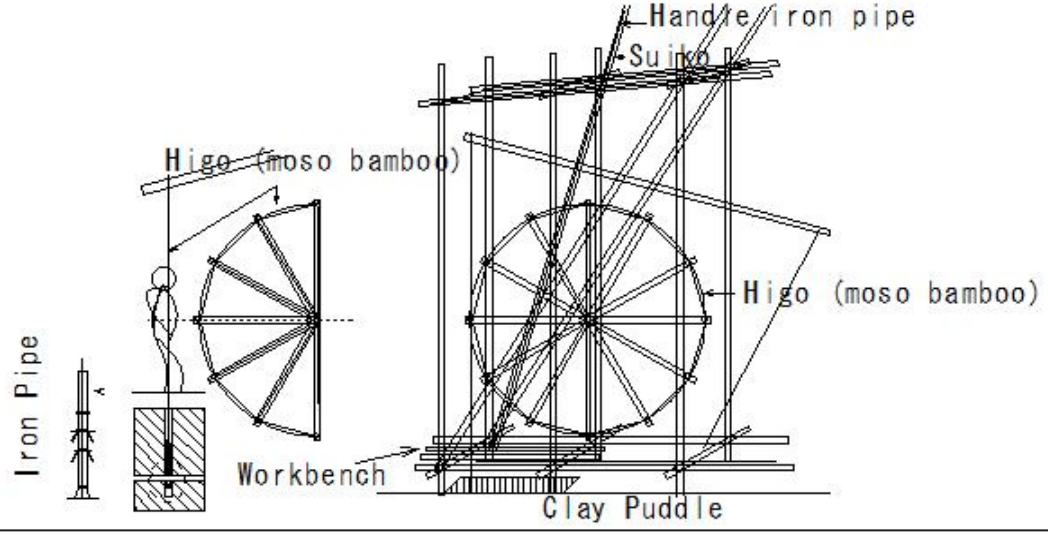
⑥ This leads to significant labor savings, allowing two to three people to dig a depth of over over 400-500 meters.



(He29) Well

Characteristics of Kazusa-bori

① Drilling using an iron pipe
② Repeated dredging of the excavated waste using a Suiko
③ Clay water is injected during drilling.
④ The clay water in the hole is pressurized and forms a film of fine particles on the wall as it seeps through the wall into the strata, protecting the hole wall.
⑤ This floats the excavated waste, enhancing the effectiveness of dredging.
⑥ This technique is similar to modern boring techniques.
⑦ Once the well is dug, a bamboo trough is inserted to protect it.



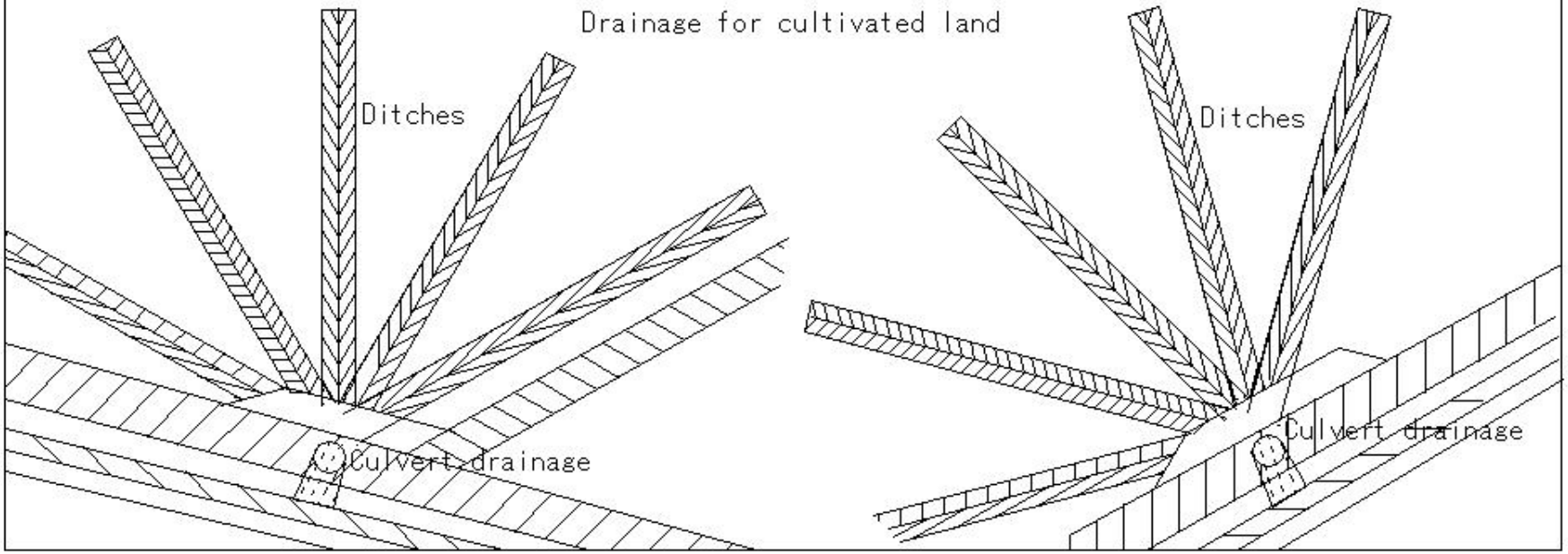
(He30) Paddy Field Drainage, Underdrainage

Underdrainage in the Edo Period(1603 - 1868)

① Drainage of cultivated land is one of the most important agricultural techniques for promoting crop growth.

② From around the end of the Edo period(1603 -1868), underdrainage techniques, in which underground trenches were dug to drain water, became widespread.

③ Underdrainage at that time had many drawbacks, such as water not being able to drain if the field had unevenness, and had to be constructed for each paddy field or by individuals.



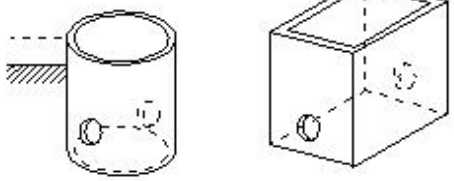
(He31) Paddy Field Drainage, Underdrainage

Paddy Field Drainage and Underdrainage

Tomita Jinpei

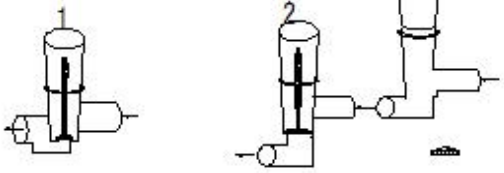
① Tomita Jinpei was born in Toride Village, Kikuchi County, Kumamoto Prefecture.
② In the land price survey that served as the basis for the land tax reform,
③ he noticed that drainage conditions led to differences in land price grades,
④ and worked to establish underdrainage technology to promote drainage of cultivated land.
⑤ In 1884 (Meiji 17), he invented the retention well.
⑥ He enabled free flooding and drainage of paddy fields, creating the basis for today's simplified drainage system.
⑦ Furthermore, in 1903 (Meiji 36), he invented the water gate clay pipe, which allowed for free regulation of groundwater drainage and
⑧ allowed for drainage over an even wider area.

Structure of a well



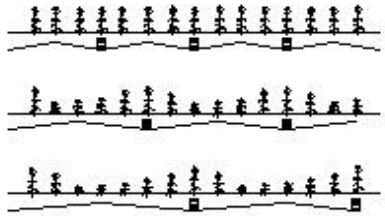
He32

Water lockt clay pipe



He33

Culvert drainage



He34

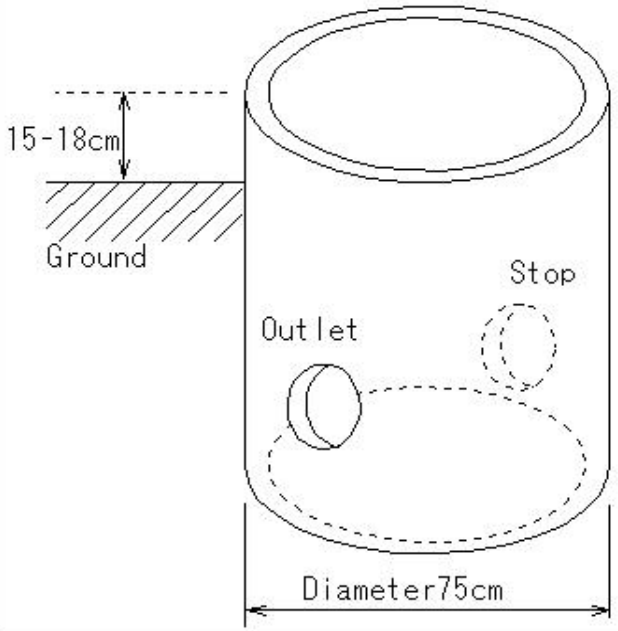
(He32) Paddy Field Drainage, Underdrainage

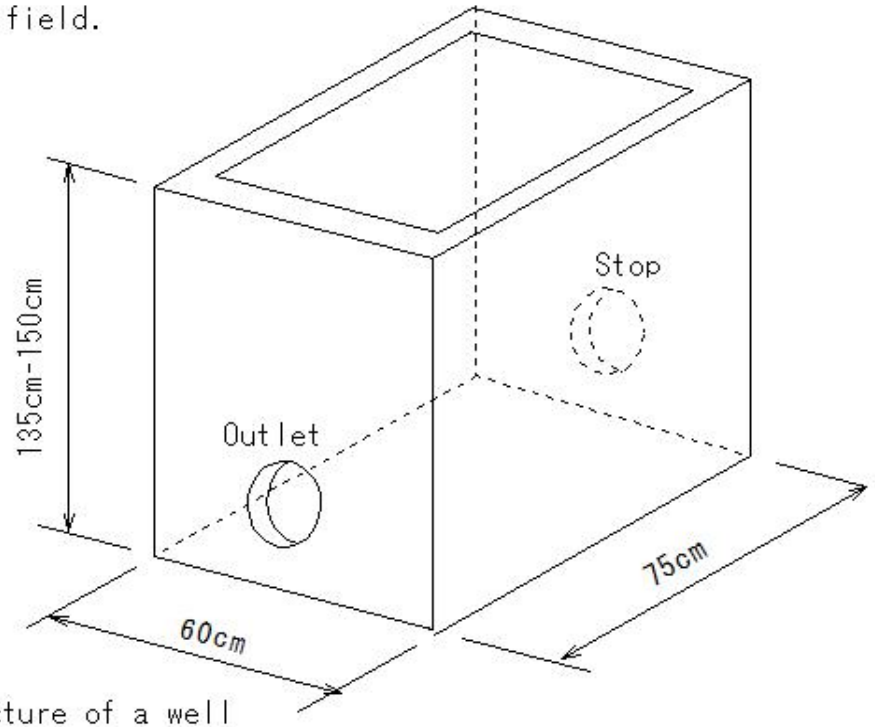
Paddy field drainage, culvert

Tomita Jinbei

Structure of a well

A trough is placed between the stop and outlet to drain water, and both ends are plugged to store water in the paddy field.





Structure of a well

(He33) Paddy Field Drainage, Culverts

Rice Field Drainage, Culverts

Tomita-Style Water lockt clay pipe

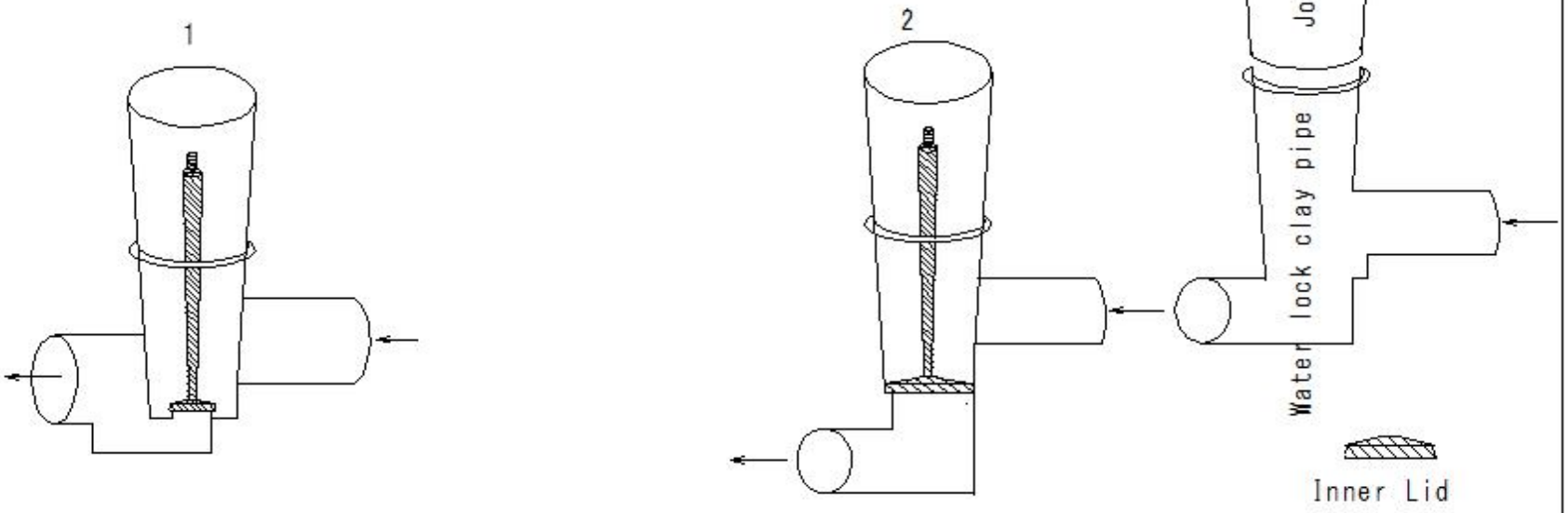
1. Flatland Water lock

   Used for backflow drainage and areas with no elevation difference

2. Standard Water lock

   Used for areas with an elevation difference of 4-5 sun (13.2-16.5 cm) or more

3. Structure of Water lock clay pipe



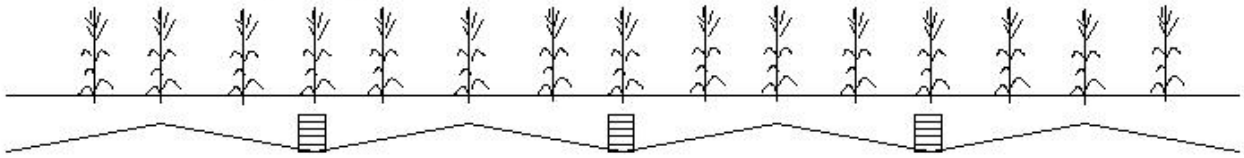
(He34) Paddy Field Drainage, Culvert

Rice Field Drainage, Culvert

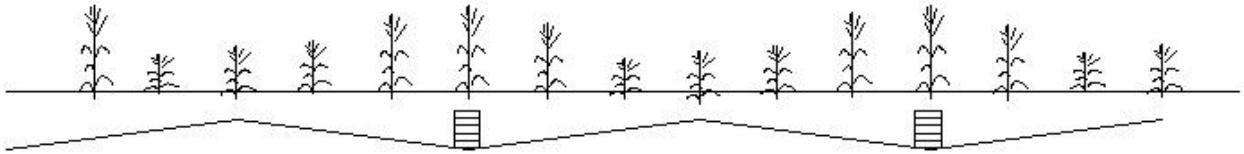
Tomita-style culvert drainage

Cross-Section of Drainage Area

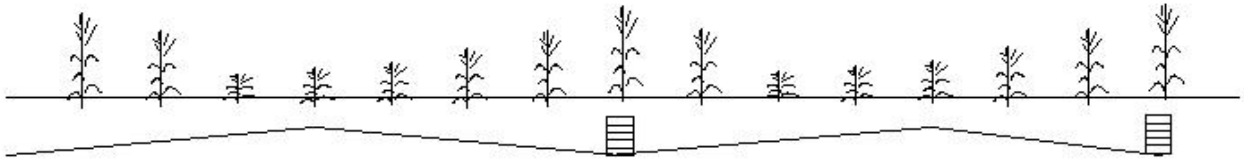
① Culvert with 7.2m spacing



② Culvert with 10.8m spacing



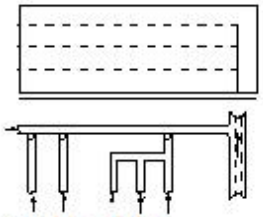
② Culvert with 14.4m spacing



(He35) Paddy Field Drainage, Culvert

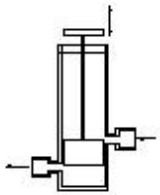
Rice Field Drainage, Culvert

Water lock water gate



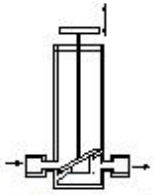
Water lock

I2



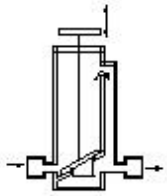
water gate

I119



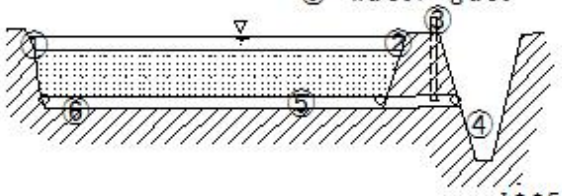
water gate

I120



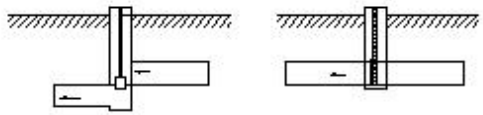
I121

③ Water gate



I285

Relief well(Water gate)



I537

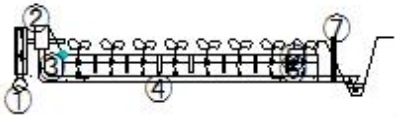
⑫ Water level adjustment sluice

⑦Water level adjustment sluice

Water gates

I943

I1230



I1233

(He36) Reclamation

Creating Farmland, Reclamation

Sea Reclamation and Lake Reclamation

① There are two types of reclamation: sea surface reclamation and lake reclamation.

② Sea surface reclamation, which involves enclosing coastal tidal flats or the sea surface with levees, was often carried out in the inland seas of western Japan, where large tidal ranges expose vast tidal flats at low tide.

③ Lake reclamation, which involves removing inland water from lakes and ponds, was primarily carried out in eastern Japan, where there are many lagoons.

(He37) Reclamation

(He37) Reclamation

Creating Farmland, Land Reclamation

Sea Reclamation and Lake Reclamation

Development of Levee Construction

○Until the Early Edo(1603 - 1868) Period

①Sea reclamation took place in areas with significant land mass near the mean high tide level of spring tides.

②Levees were made of stacked sumo rings.

③Bamboo baskets filled with soil.

④Pine log stakes were driven into the ground at regular intervals, with bamboo or bamboo woven into the core to form the levee, and then piled up with soil.

○From the Mid-Edo Period

⑤The area covered up to the mean high tide level of neap tides.

⑥The surface of the levees began to be protected with masonry.

○By the end of the Taisho Period (Taisho Period (1912-1926)).

⑦Deepwater levees were constructed, and their surfaces were protected with concrete blocks.

○After the end of the war (1945).

⑧The sand pump method was used for the rear embankment.

○From the mid-1950s (1955-1964).

⑨Gentle slope embankments paved with asphalt began to appear.

(He38) Reclamation

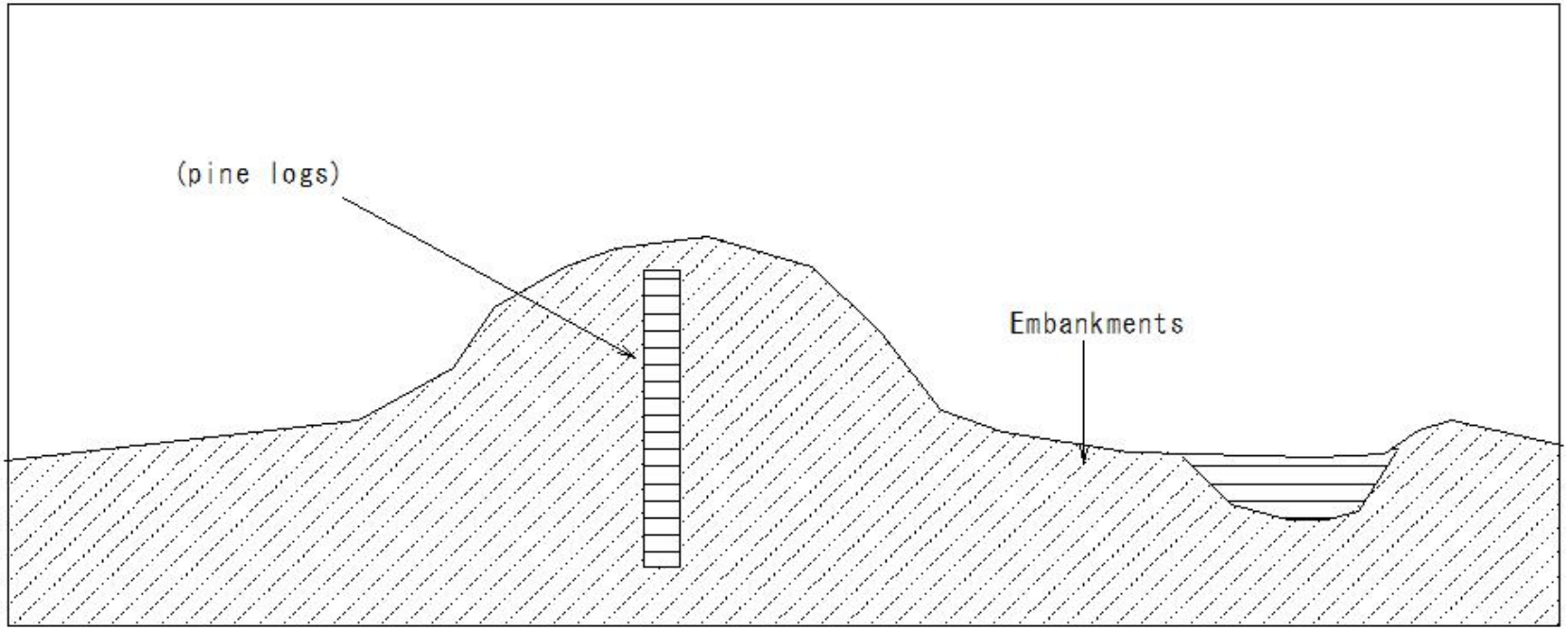
(He38) Reclamation

Creating Farmland, Reclamation

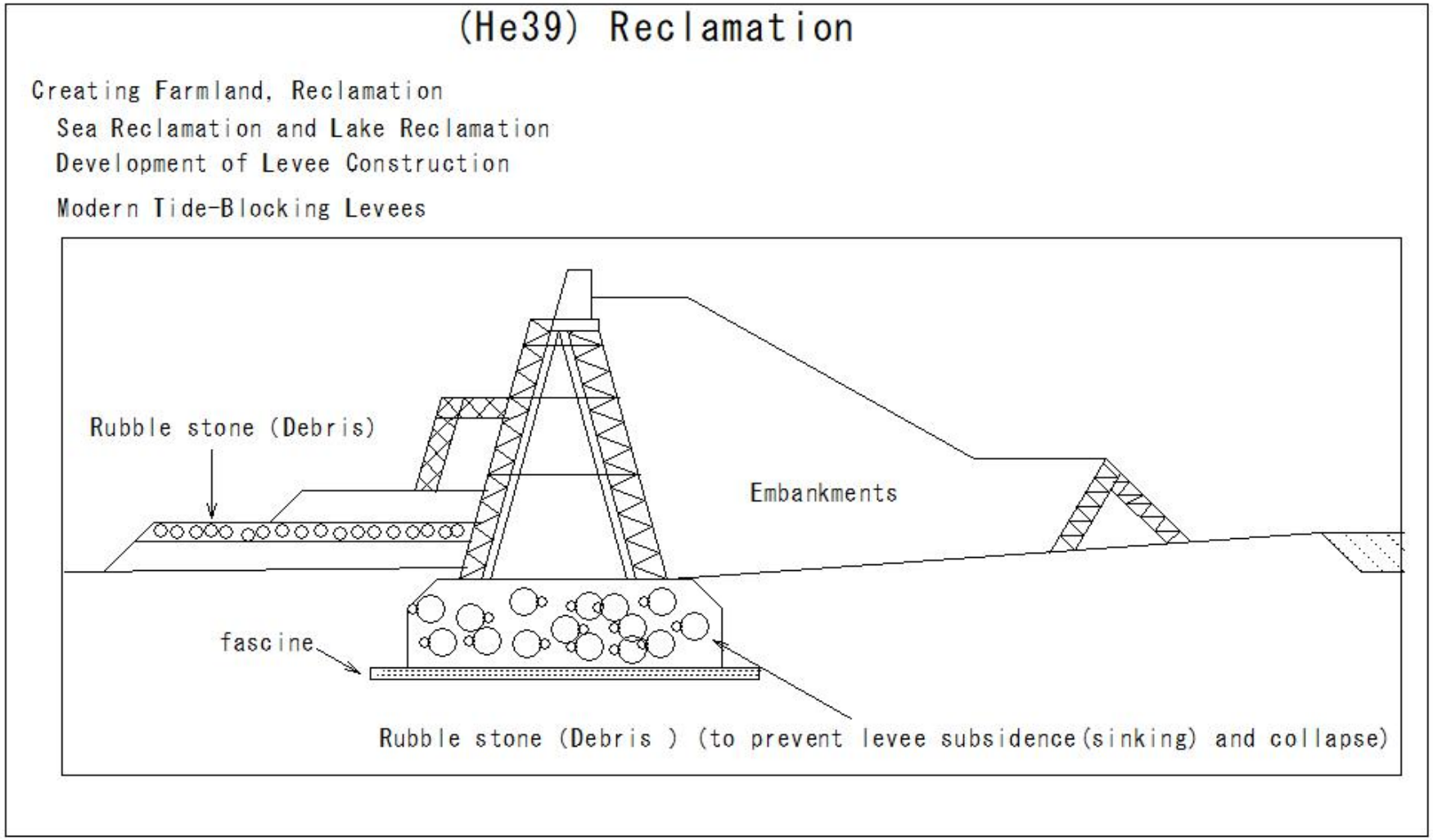
Sea Reclamation and Lake Reclamation

Development of Levee Construction

Edo Period(1603 - 1868) Reclamation Levees



(He39) Reclamation



(He40) Reclamation

(He40) Reclamation

Creating Farmland, Reclamation

Sea Level Reclamation and Lake Reclamation

Drainage Methods

① From the mid-Edo period (1603-1868), when reclamation projects extended to tidal flats below sea level, tidal stop works became necessary.

② A tidal stop work involves creating a tidal entrance/exit in a dike and then quickly closing it off at low tide as the final step in embankment construction.

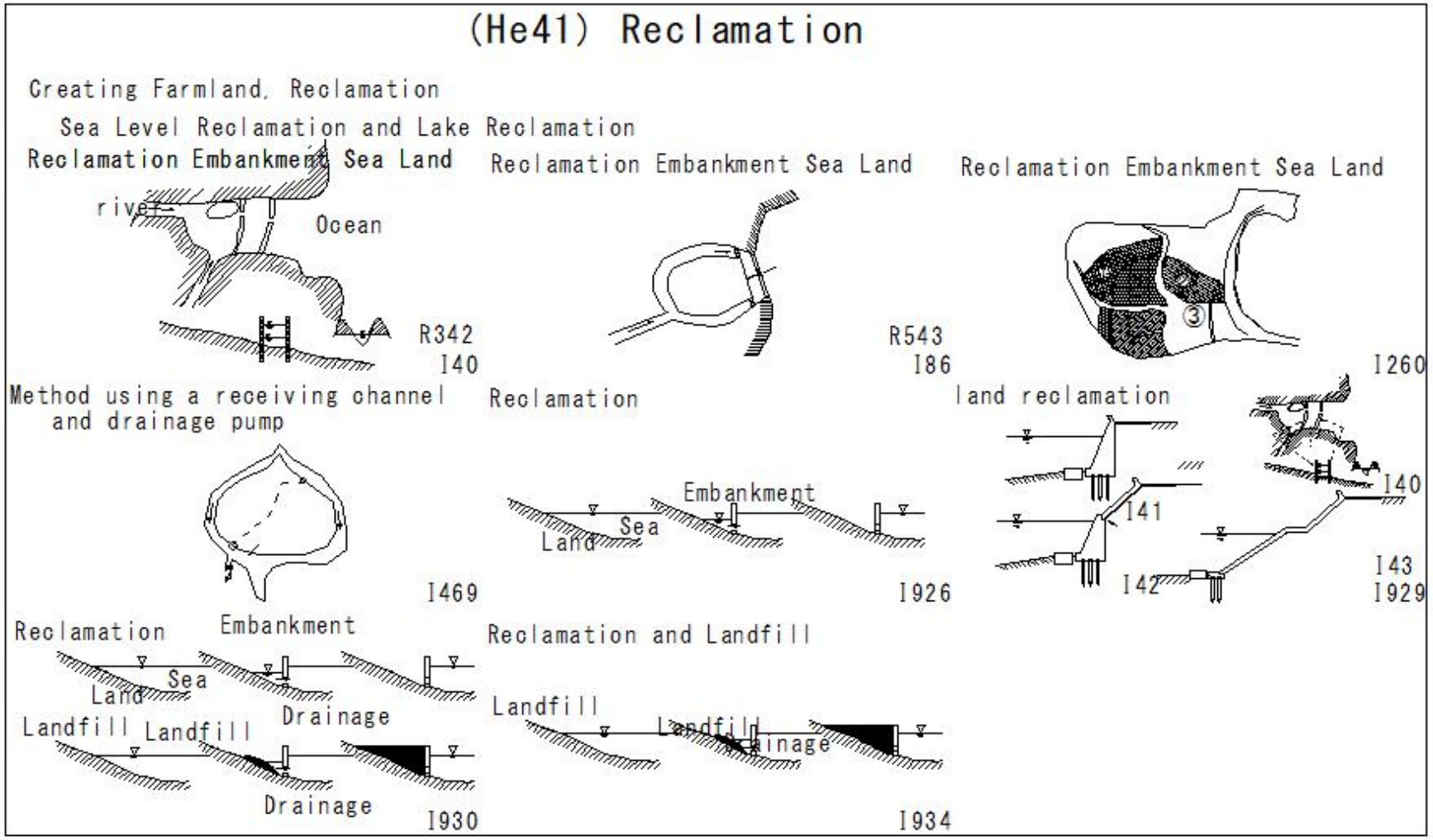
③ In case of embankments were built near the mean high tide level of neap tides, this was relatively easy and quick, using materials such as sumo rings stacked on top of each other.

④ From the late Meiji period (1868-1912), as the project expanded to sea level, square timbers were inserted between the supports to create a corner stop.

⑤ Meanwhile, for lake and marsh reclamation projects, natural drainage methods were used, such as digging canals, until the mid-Meiji period (1868-1912).

⑥ From the late Meiji period (1868?1912), mechanical drainage methods using drainage pumps were adopted.

(He41) Reclamation



(He42) Reclamation

(He42) Reclamation

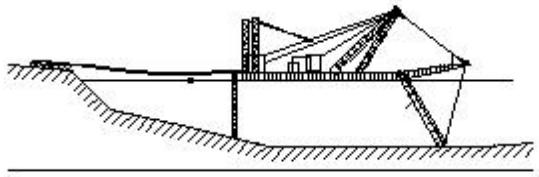
Creating Farmland, Reclamation

Sea Level Reclamation and Lake Reclamation

Reclamation Embankment Sea Land

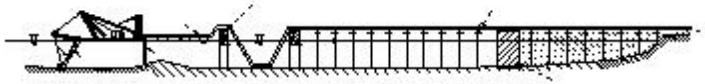
A pump dredger excavating a drainage channel

・Pump dredger



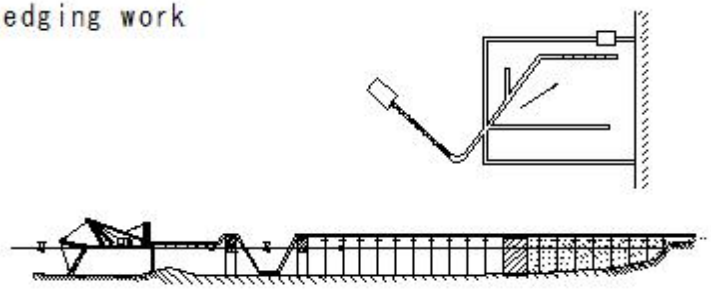
PC70

・Dredging work(Direct Landfill)



PC79

・Dredging work



PC87

(He43) Making a Map

(He43) Making a Map

Making a Map

Creating a Map of Japan

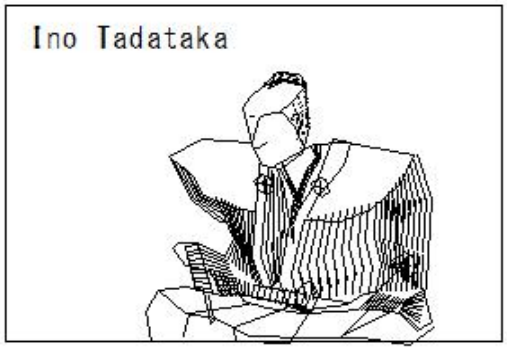
① Ino Tadataka was born in Oseki Village, Yamabe County, Kazusa Province (Kujukuri Town, Sanbu County, Chiba Prefecture) during the mid-Edo period (1603-1868).

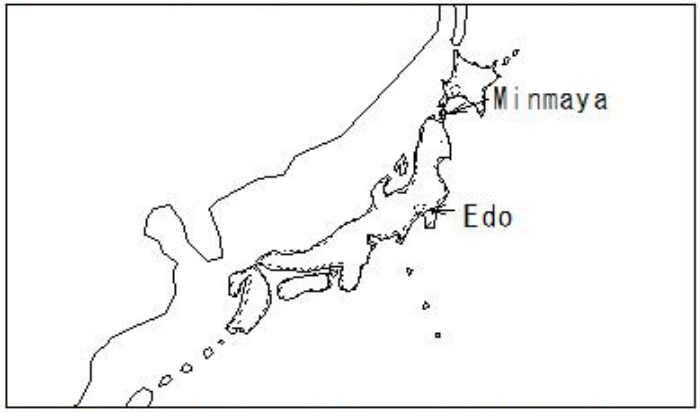
② He began his surveys in Izu and eventually expanded to Kyushu and its surrounding islands. After 17 years, he completed the entire survey of Japan in 1816 (Bunka13) at the age of 72.

③ Based on this survey, he began creating a map of Japan. Takahashi Kageyasu completed it in 1821 (Bunsei 4), three years after his death, and presented it to the

④This map, known as the "Complete Map of the Great Japanese Coast" or "Ino Map," was the first accurate map of the entire country of Japan.

⑤The "Ino Map" was produced in three versions: large (1:36,000), medium (1:216,000), and small (1:432,000).





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(He44) Making a Map

(He44) Making a Map

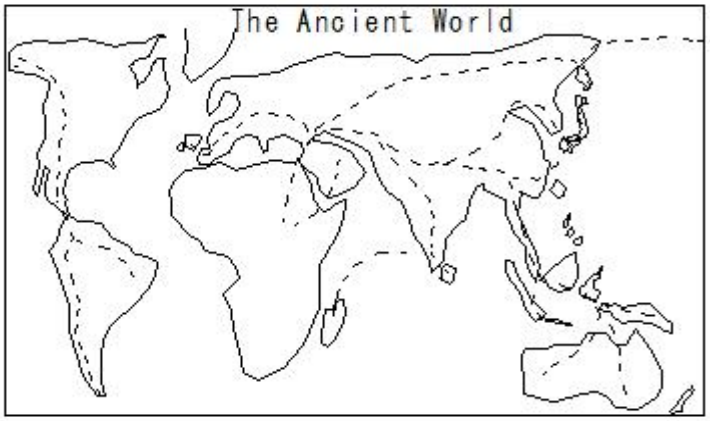
Making a Map

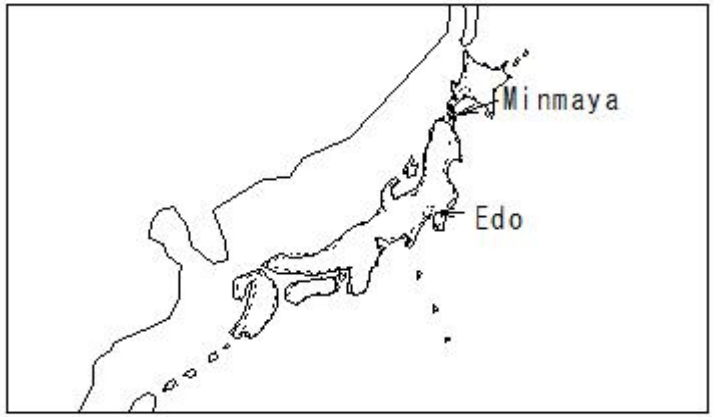
Creating a Map of Japan

Precise Surveying Techniques

① To confirm the length of the meridian, Tadataka planned to measure it all the way to Ezo (Hokkaido). Starting in 1800, he walked from Edo to Ezo over 180 days.

② From his measurements between Edo and Minnaya on the Tsugaru Peninsula, he determined that the length of one degree of the meridian was 28 ri 2 bu (110.85 km), which is roughly the same as the current calculation of 111 km, demonstrating the astonishingly precise measurements.





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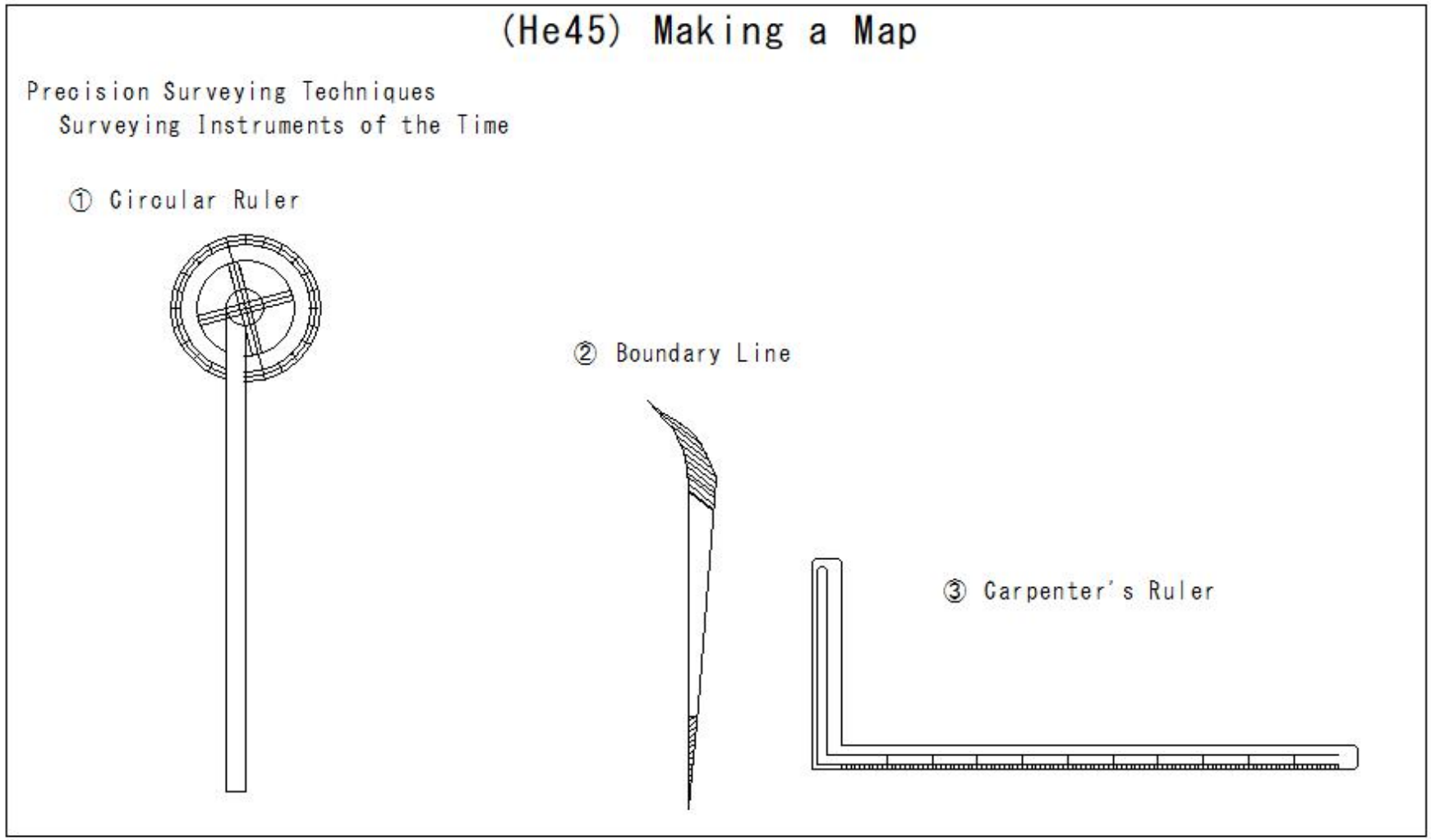
(He45) Making a Map

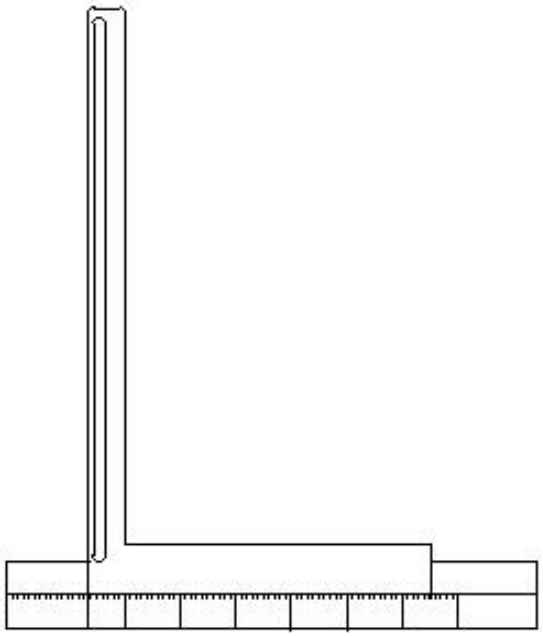


(He46) Making a Map

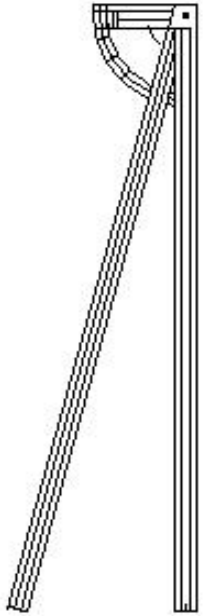
(He46) Making a Map

Precision Surveying Techniques
Surveying Instruments of the Time

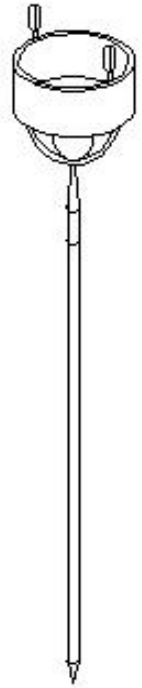
④ Parallelogram



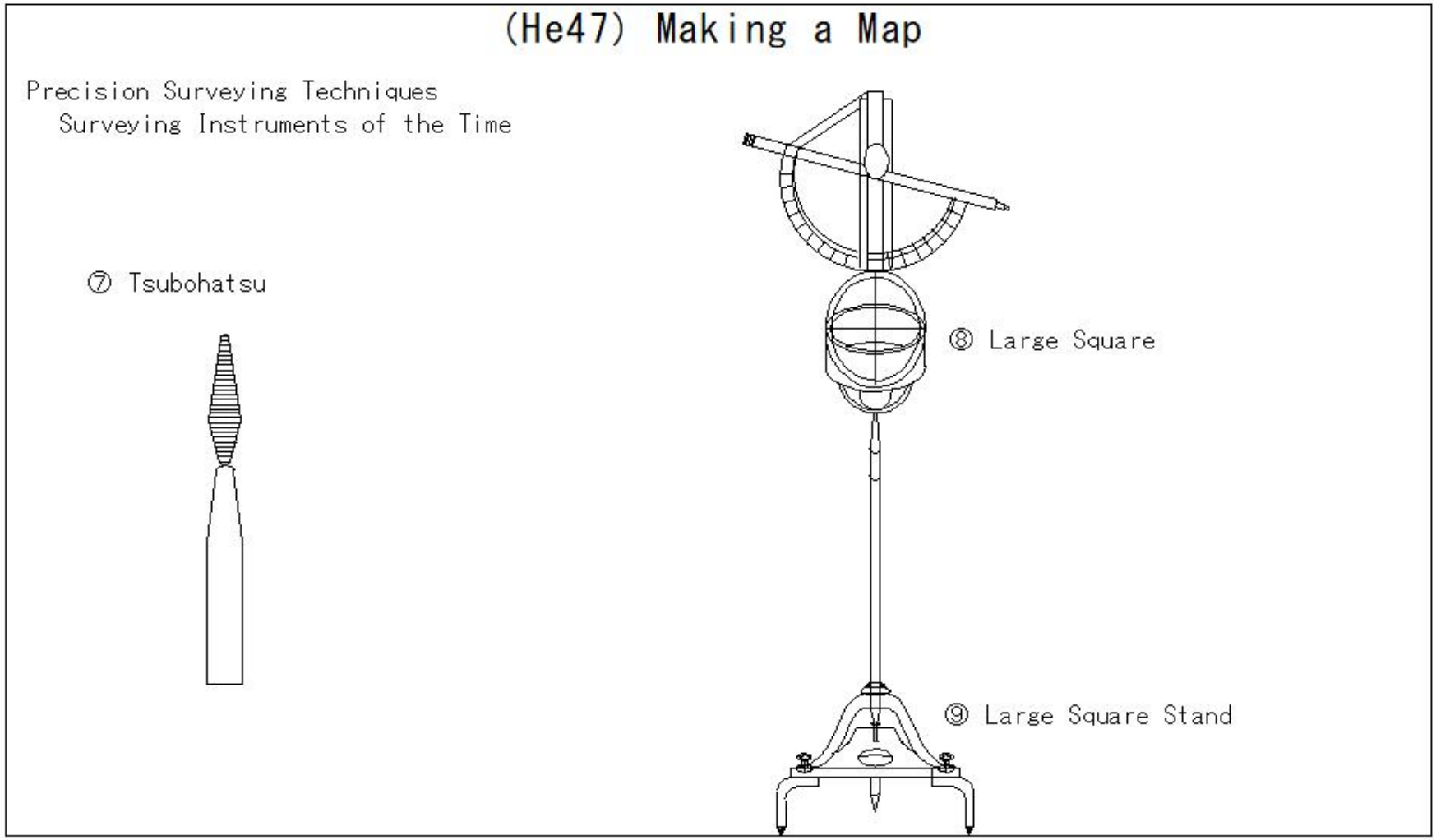
⑤ Octagonal Ruler



⑥ Small Square



(He47) Making a Map



(He48) Making a Map

(He48)Measuring Land, Land Survey

Measuring Land, Land Survey

Nationwide Standards

① Land surveys are used to calculate cultivated land. An important purpose is not just to measure its area, but also to determine the amount of tax and labor based on that area.

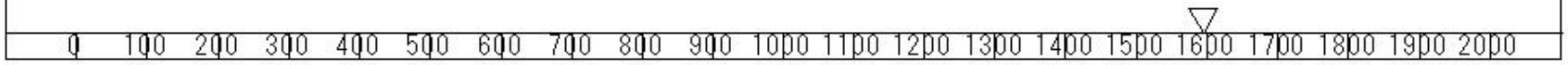
② A famous example of land surveying is the so-called "Taiko Land Survey" conducted by Toyotomi Hideyoshi in 1594 and 1595.

③ This survey appears to have unified standards nationwide and implemented stricter measures than previous surveys.

④ To standardize measurements, 1 ken (approximately 1.8 m) was set at 6 shaku 3 sun, and 1 tan (approximately 10 a) was set at 10 se = 300 bu, with the amount based on the Kyoto sho.

⑤ The classification of fields and their rank (upper rice paddies, middle rice paddies, etc.) was determined, and the standard productivity of the cultivated land was expressed in kokudaka (rice paddies). A fixed annual tax was then levied based on this.

1 a = 1 dam2 (square decameter) = 100 m2



(He49) Making a Map

(He49) Measuring Land, Land Survey

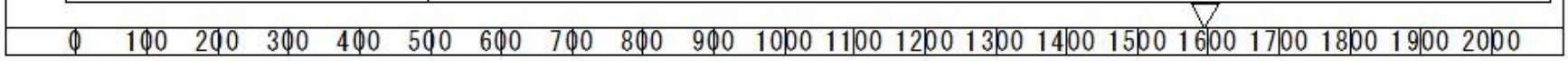
Measuring Land, Land Surveying
Nationally Unified Standards

Creating Registers

① The land survey ledger created during the land survey clearly listed the hamlet, grade, tan (approximately 100 acres), koku (approximately 100 koku), and cultivator for each parcel of land.

② It served as a forerunner of the basic cadastral register.

○Address of each parcel of land	
○Grade	
○Land area	
○Kokudaka (rice yield)	
○ Landowner are clearly indicated for each plot.	



(He50) Making a Map

(He50)Measuring Land, Land Survey

Measuring Land, Land Surveying

Surveying Techniques

① Land surveying involved the use of various tools, including a "small square instrument" to determine direction,

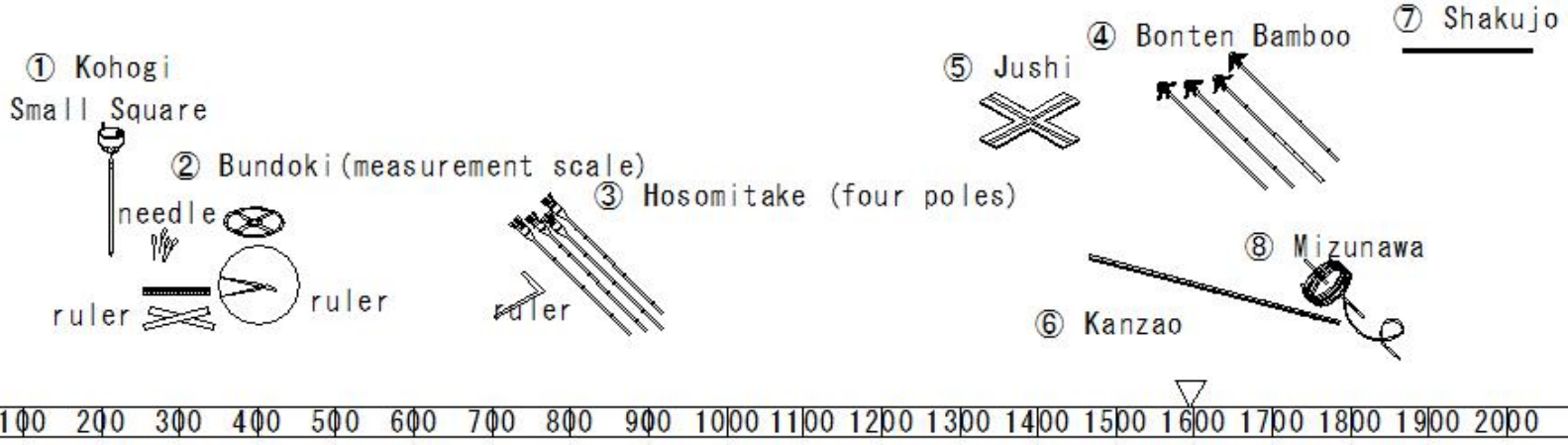
② "thin bamboo sticks" placed at the four corners of the plot as guideposts,

③ "mazao" (a square pole) and "shakujo" (a staff) as units of length.

④ The specific area was calculated by basically placing the area into a single rectangle.

⑤ For circular cultivated land, the area was calculated from the circumference or diameter of the circle.

⑥ To prevent measurements from exceeding the actual size due to slack in the rope, an error correction called "rope slack" was also used.



(He51) Making a Map

(He51)Measuring Land, Land Survey

Measuring Land, Land Surveying

Surveying Techniques

① Kohogi: A type of tool used in surveying during the Edo period to measure direction.

② Bundoki(measurement scale), needle, ruler, and ruler: Drafting tools.

③ Hosomitake (four poles): Bamboo poles with bundles of straw attached to the tops, set up at the four corners of the cultivated land to be surveyed as targets.

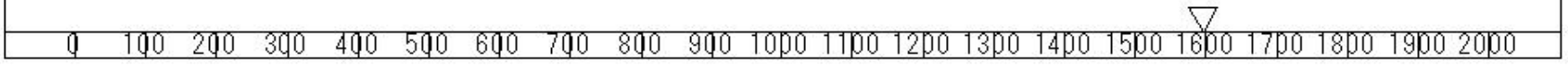
④ Bonten Bamboo: Four bamboo poles with paper strips attached to the ends, set up between each Hosomitake. They are used to measure the interior and exterior dimensions of land, and as targets for stretching ropes vertically and horizontally, through the three bamboo poles in front and behind.

⑤ Jushi: A method of measuring the area of land.

⑥ Kanzao: A bamboo pole used to measure length (especially one ken) in land surveying and construction.

⑦ Shakujo: Used to measure the length of land.

⑧ Mizunawa: Mizunawa is stretched vertically and horizontally to measure length.



(He52) Making a Map

(He52) Measuring Land, Land Survey

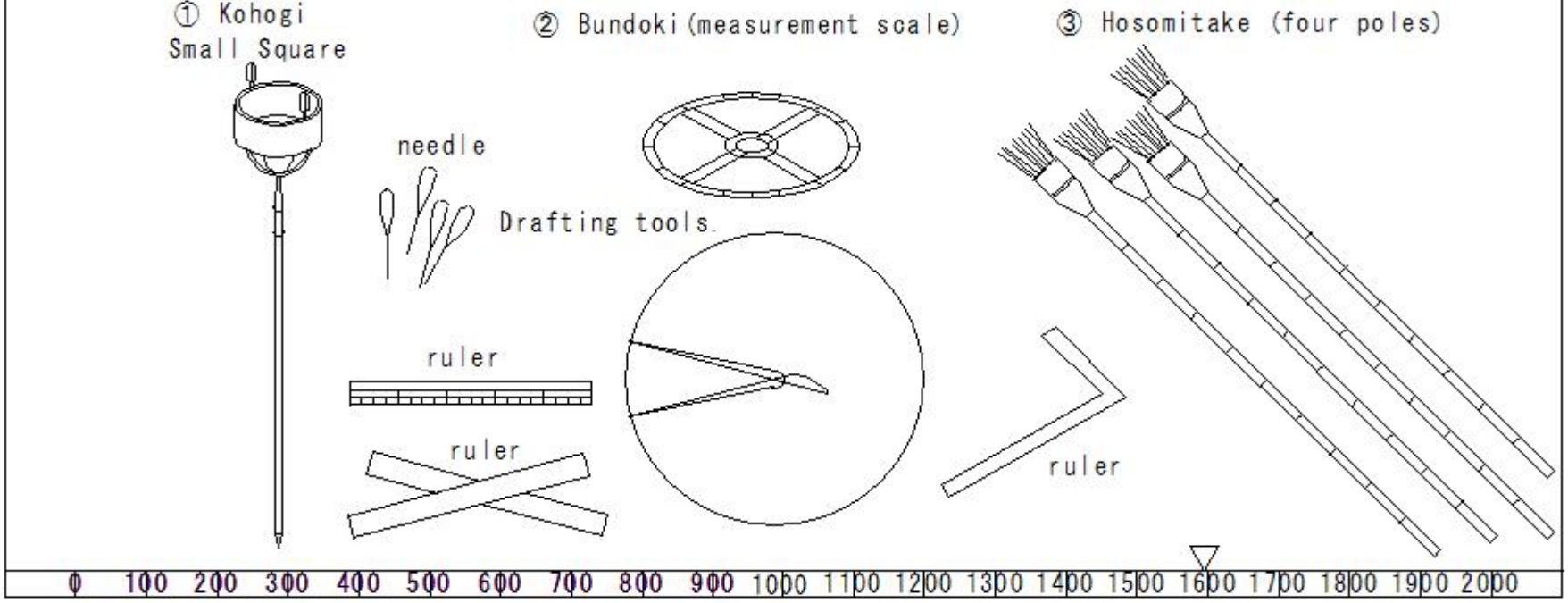
Measuring Land, Land Surveying

Surveying Techniques

① Kohogi: A type of tool used in surveying during the Edo period to measure direction.

② Bundoki (measurement scale), needle, ruler, and ruler: Drafting tools.

③ Hosomitake (four poles): Bamboo poles with bundles of straw attached to the tops, set up at the four corners of the cultivated land to be surveyed as targets.



(He53) Making a Map

(He53)Measuring Land, Land Survey

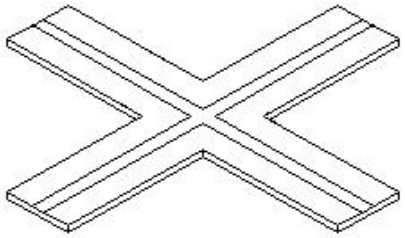
Measuring Land, Land Surveying

Surveying Techniques

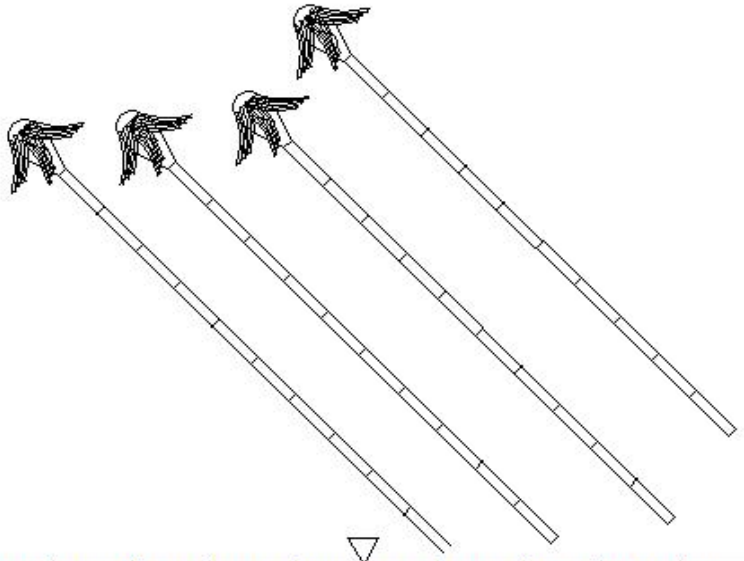
④ Bonten Bamboo: Four bamboo poles with paper strips attached to the ends, set up between each Hosomitake. They are used to measure the interior and exterior dimensions of land, and as targets for stretching ropes vertically and horizontally, through the three bamboo poles in front and behind.

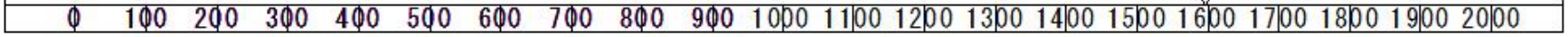
⑤ Jushi: A method of measuring the area of land.

⑤ Jushi



④ Bonten Bamboo





(He54) Making a Map

(He54) Measuring Land, Land Survey

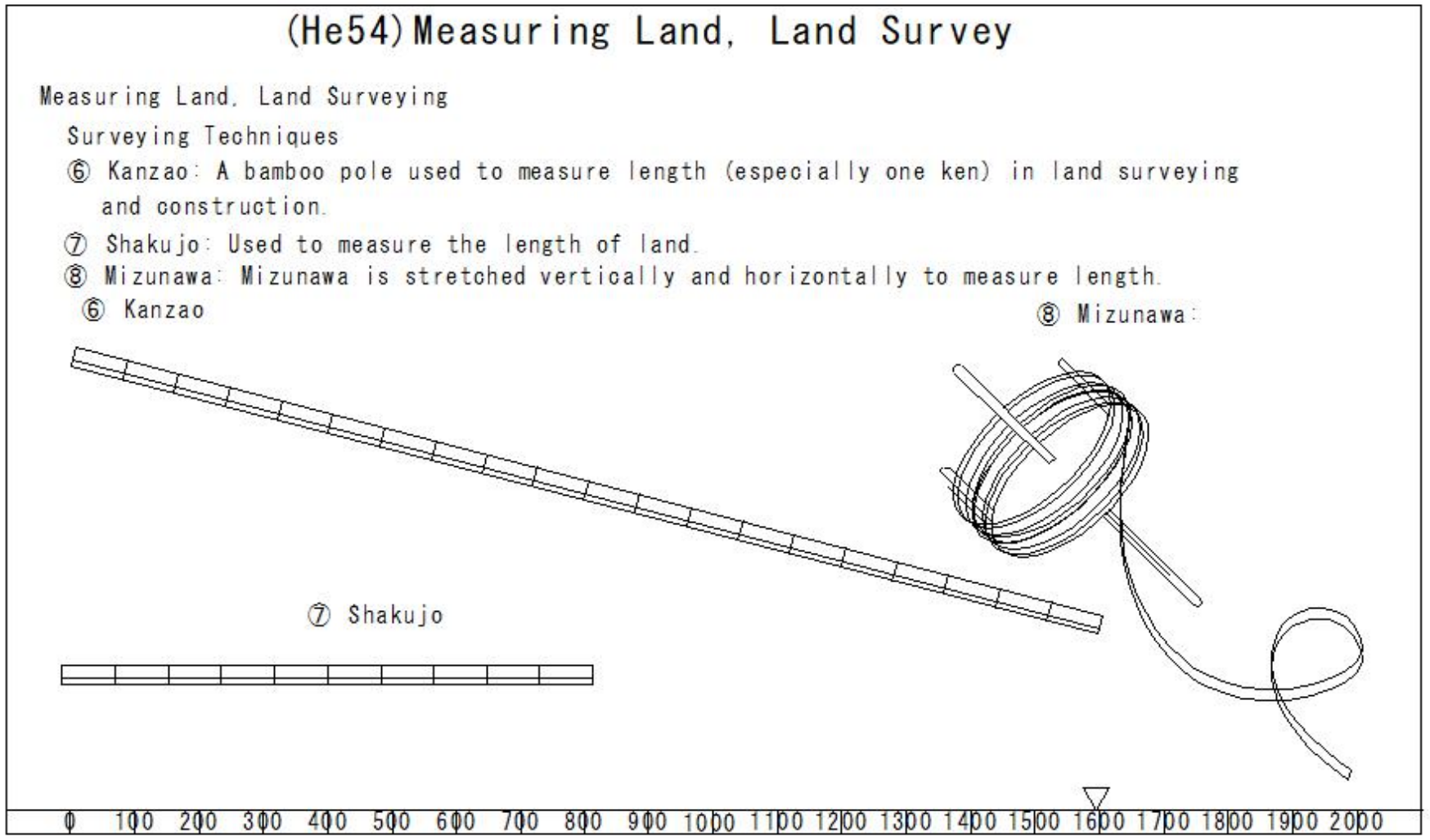
Measuring Land, Land Surveying

Surveying Techniques

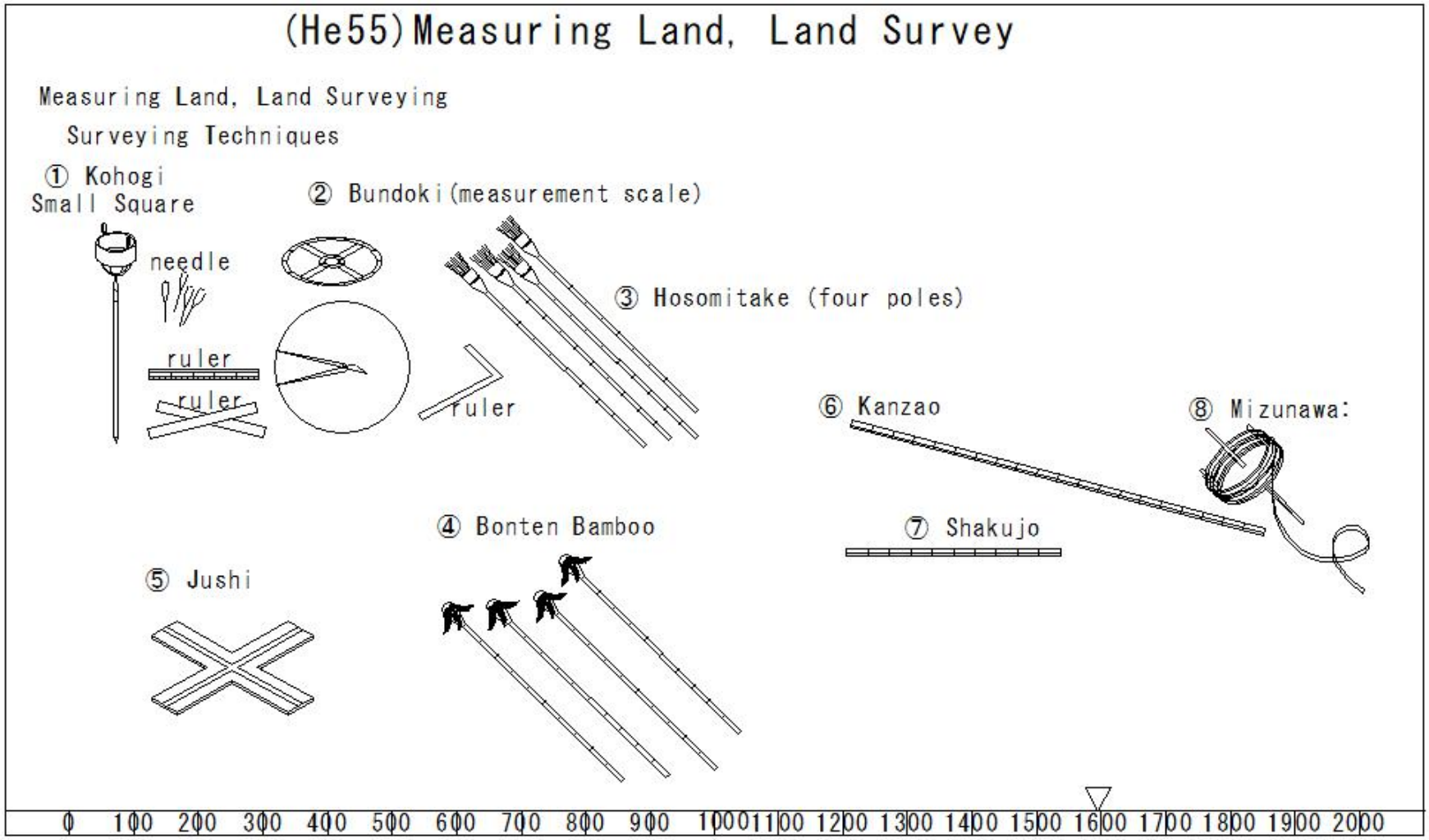
⑥ Kanzao: A bamboo pole used to measure length (especially one ken) in land surveying and construction.

⑦ Shakujo: Used to measure the length of land.

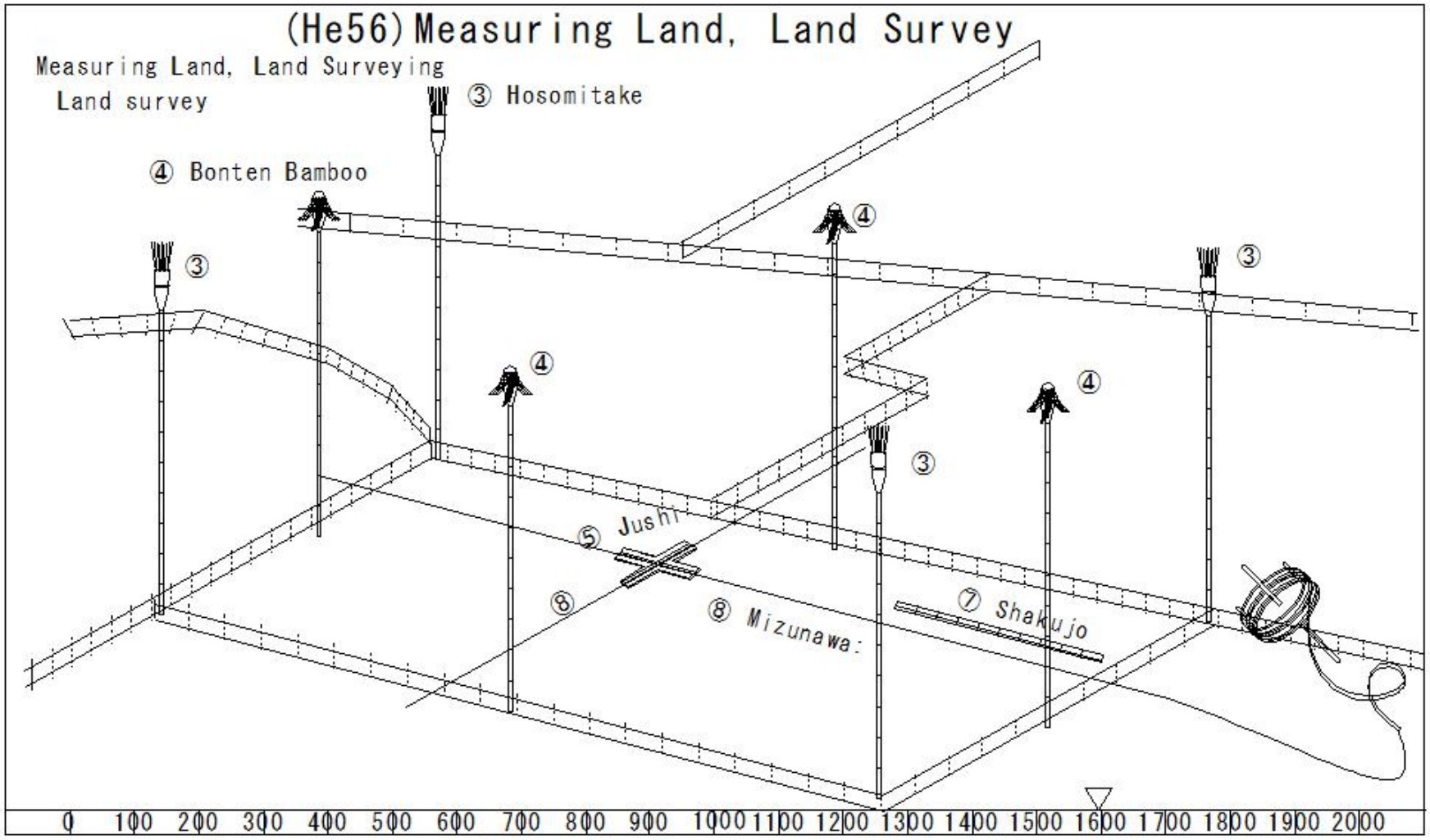
⑧ Mizunawa: Mizunawa is stretched vertically and horizontally to measure length.



(He55) Making a Map



(He56) Making a Map



(He57) Rural Planning

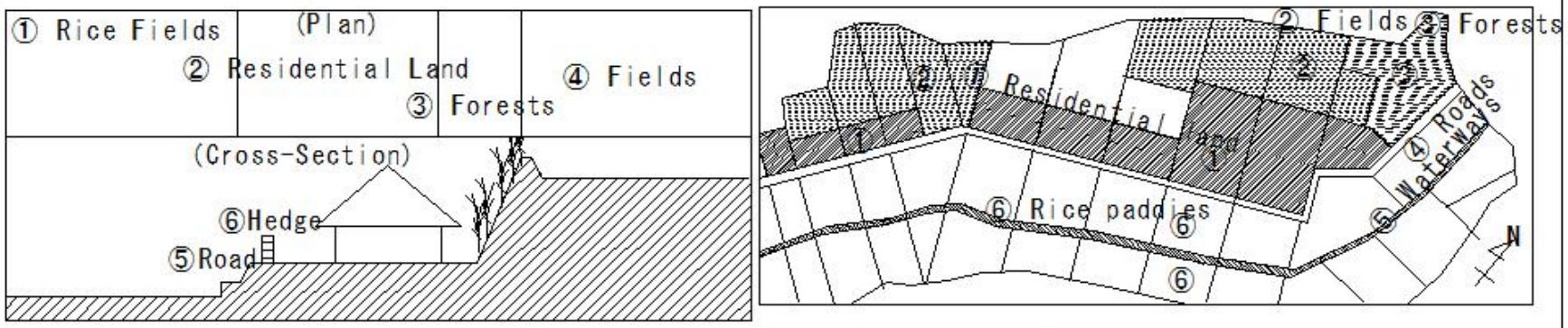
(He57) Rural Planning

Early Modern Rural Planning (1573-1868)

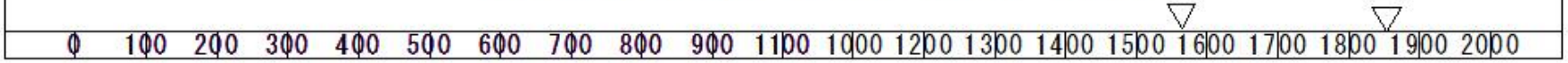
The Ideal Image of the Early Modern Rural Village

① The "Seiryo-ki," written at the end of the Middle Ages, states,
"The residences of the upper classes are surrounded by mountains,
② with rice paddies in front, a stream on the left, and fields on the right,
③ without many of the land belonging to the parents, they cannot cultivate as they wish."
④ This well-defined village structure, which follows the topography
from forests to rice paddies, is well-described.

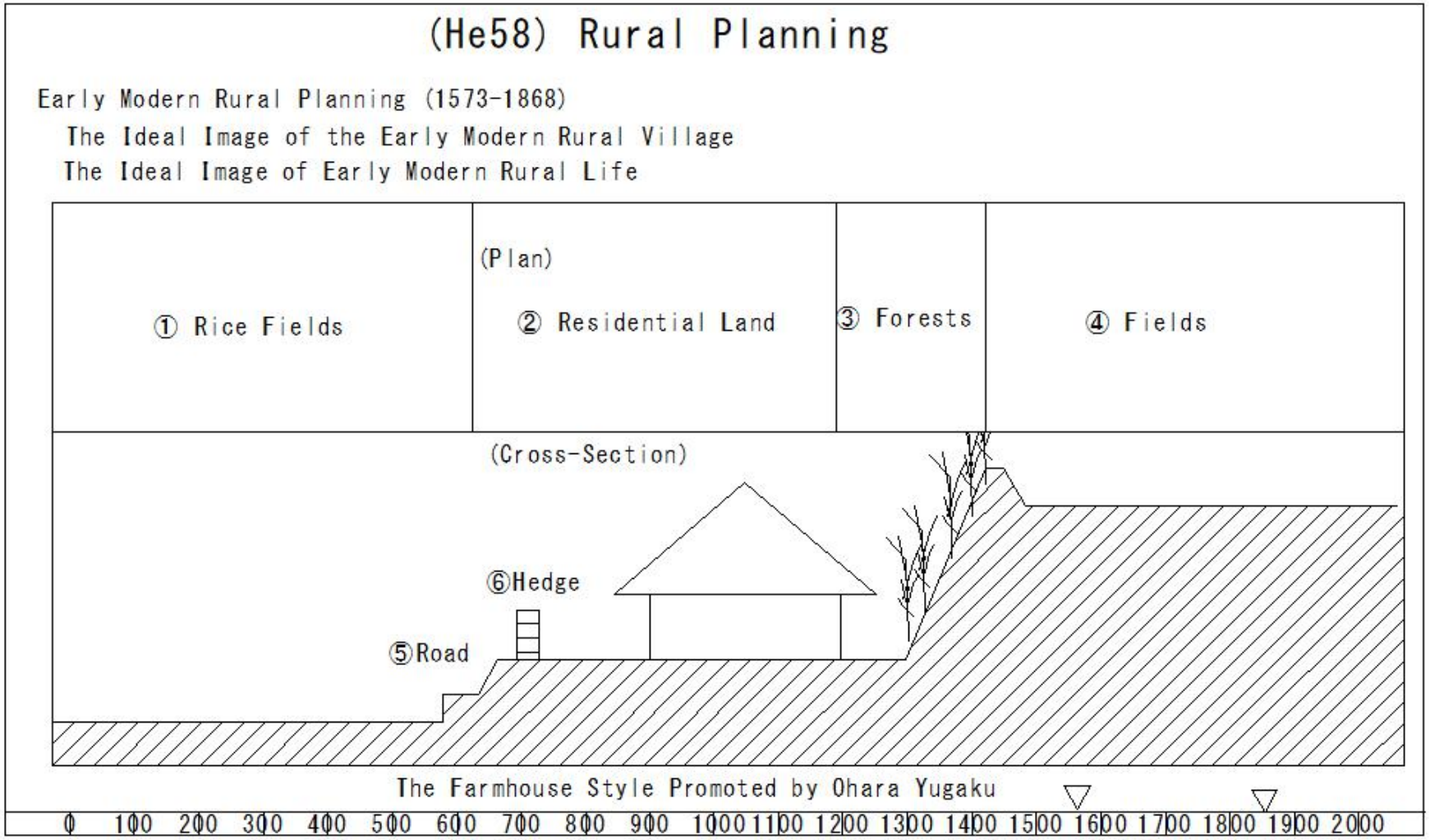
The Ideal Image of Early Modern Rural Life



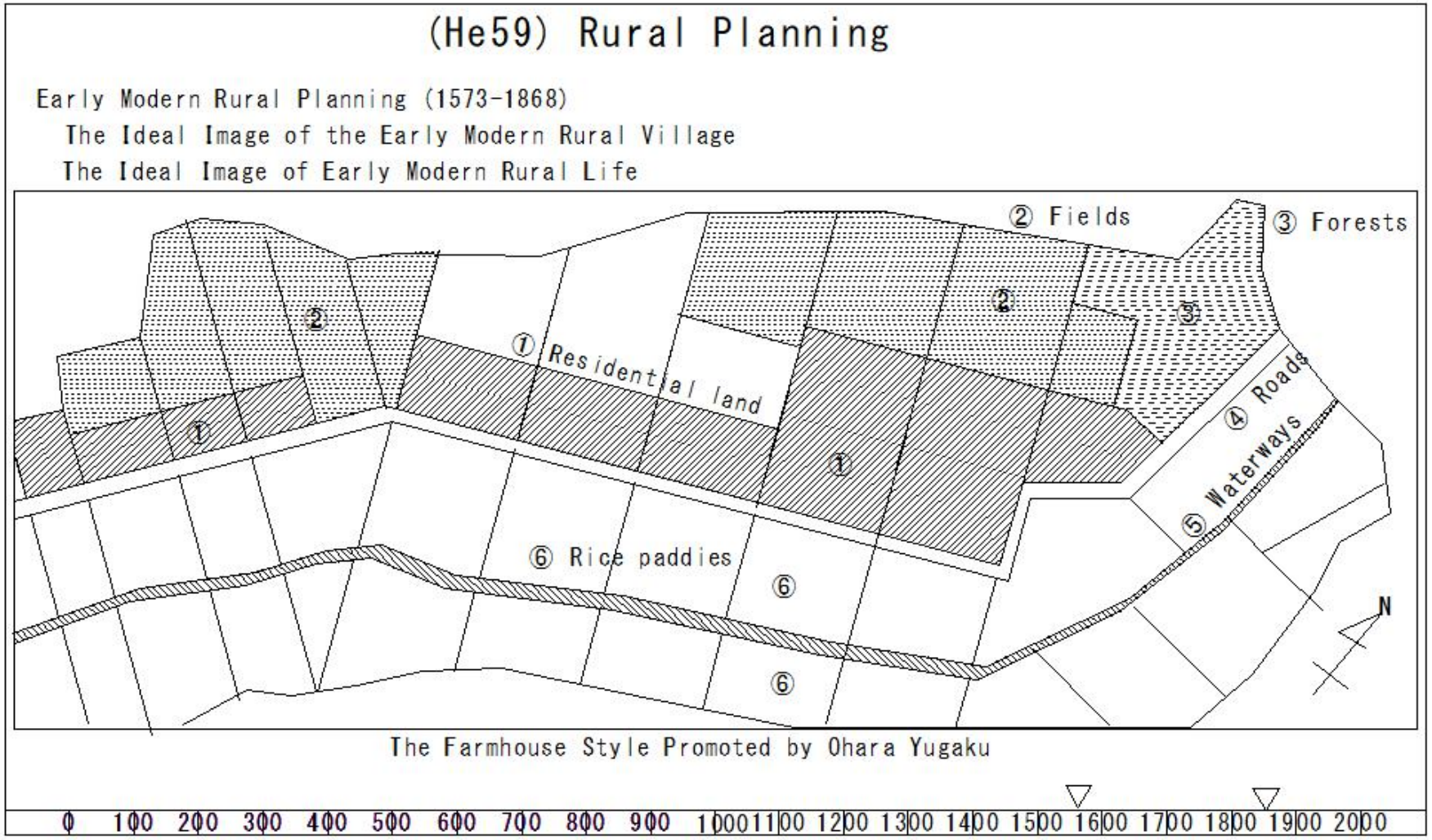
The Farmhouse Style Promoted by Ohara Yugaku



(He58) Rural Planning



(He59) Rural Planning



(He60) Tsubogaricho

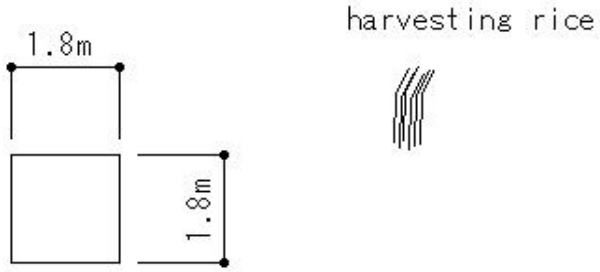
(He60) Tsubogaricho

Tsubokaricho

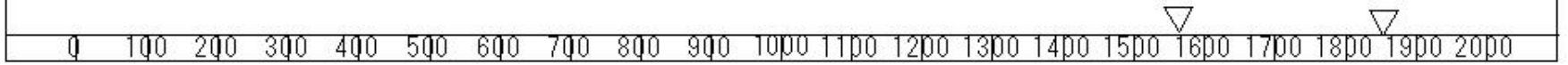
① "Tsubokari" is a method of harvesting rice in an area of 1 tsubo (1.8*1.8=3.3 m2) and using this as a basis to estimate the total yield.

② During the Edo period, it was used as a method of determining annual tax payments. After the Meiji Restoration, following the land tax reform, it was used to calculate rent payments between landlords and tenant farmers and to survey crop yields for allocation of supply.

③ Currently, it is only used to survey crop conditions.



area of 1 tsubo (1.8*1.8≒3.3 m2)



(He61) Tsubogaricho

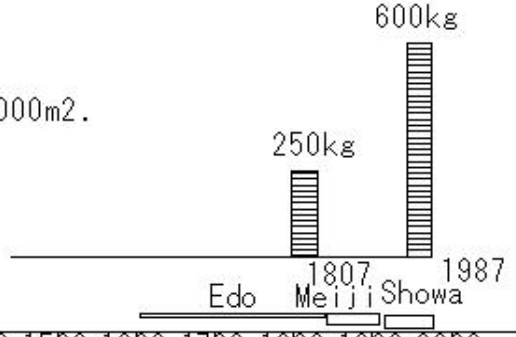
(He61) Tsubogaricho

Tsubokaricho

① This Tsubokaricho reveals trends in rice yields in the early modern and modern periods.
② The rice yield per 1 tsubo (approximately 3.5 square meters) has increased approximately 2.5 times over the past 180 years.
③ Based on the rice yield per 10 ares in 1987 (Showa 62), which was approximately 600 kg,
④ Approximately 180 years ago, during the Bunka era (1807), approximately 250 kg of rice was harvested.
⑤ Rice yields during the Edo period (1603-1868) were by no means low.
⑥ Since then, rice yields have gradually increased with the introduction of improved varieties and new cultivation techniques.
⑦ In terms of variety selection, indigenous varieties were used until the mid-Meiji period (1868-1912).
⑧ Improved varieties have been introduced since the early Showa period (1926-1989).
⑨ In recent years, field improvement has been carried out, eliminating the differences between fields and the yield gap.

1 tan = 10 ridges = 300 tsubo = approximately 10a = approximately 1,000m2.
The unit of land size (area) is "m2"

Rice bales (each bale weighs approximately 60 kilograms)



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(He62) Grid-Based Planning and Technology

(He62) Grid-Based Planning and Technology

Grid-Based Planning and Technology

① Plotting land and organizing its ownership and use, like Japan's grid system, has been widely adopted throughout history.

② In ancient Rome and its colonies, the centuria (centuries) were used. A square plot of land approximately 710m square was subdivided into 20x20 sections, and four of these were grouped together for land allocation.

③ The ancient Chinese systems of Qianmo and Jin-tian land divisions were similar.

④ More recently, the township system implemented in the United States (6 miles = approximately 9.7km square and its 36 equal sections)

⑤ The colonial divisions of Australia were implemented in accordance with British land policy.

⑥ Colonial divisions modeled on the township system are widespread in Hokkaido.

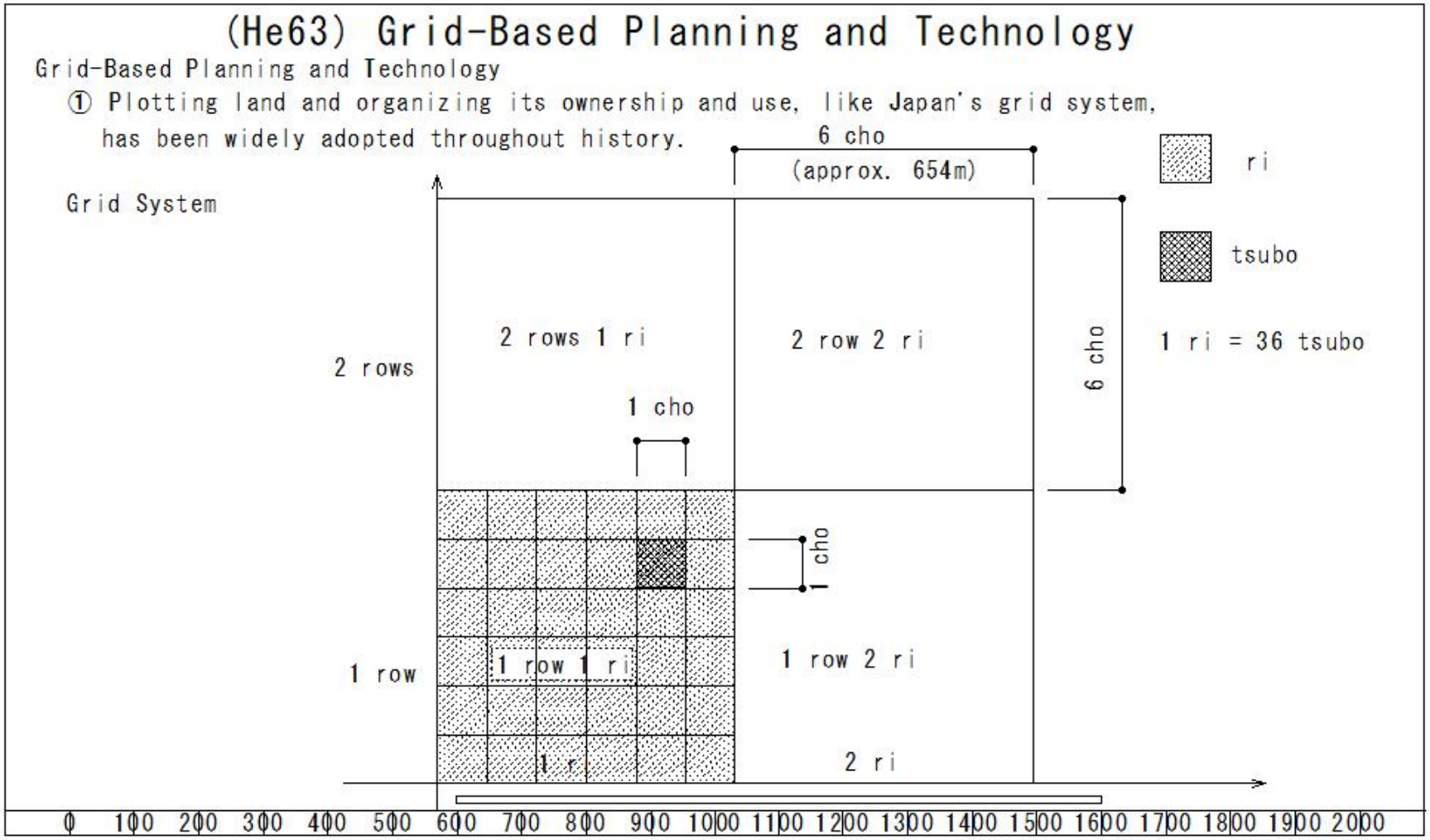
⑦These parcels were established as settlement and development progressed.

⑧The complexity and volume of land policy and parcel setting procedures increased.

⑨A need for regular, uniform parcels arose.

⑩These parcels formed an important framework for regulating disorderly settlement and developing orderly new villages in newly developed areas.

(He63) Grid Planning and Technology



(He64) Grid Planning and Technology

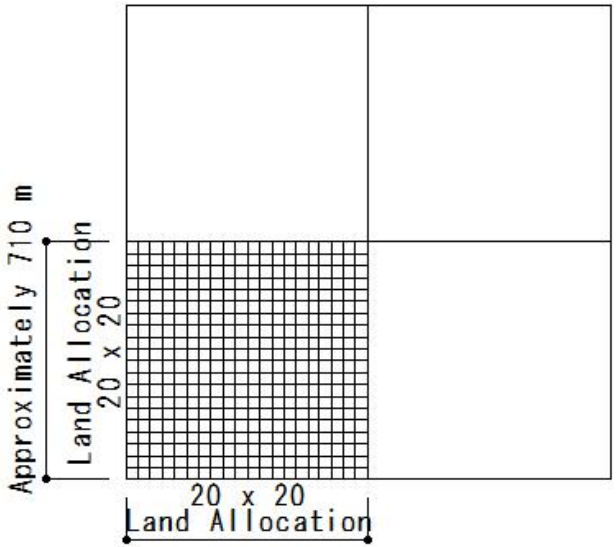
(He64) Grid-Based Planning and Technology

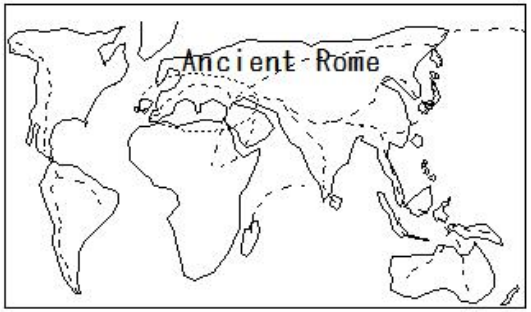
Grid-Based Planning and Technology

② In ancient Rome and its colonies, the centuria (centuries) were used. A square plot of land approximately 710m square was subdivided into 20x20 sections, and four of these were grouped together for land allocation.

Ancient Rome
Land Allocation

Centuria (Hundred-Year Fields) in the Colonies





753 BC - 476

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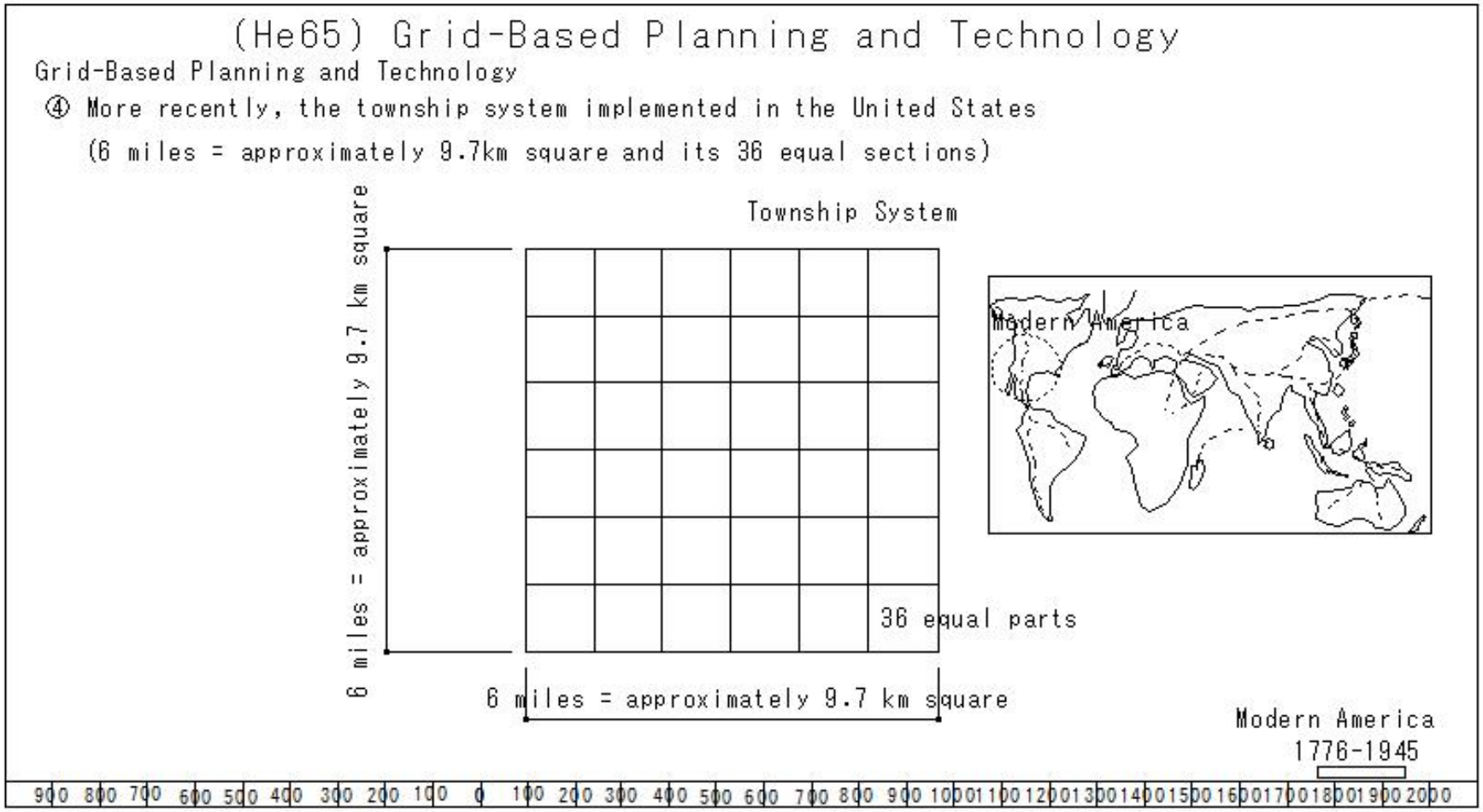
(He65) Grid Planning and Technology



(He66) Grid-Based Planning and Technology

(He66) Grid-Based Planning and Technology

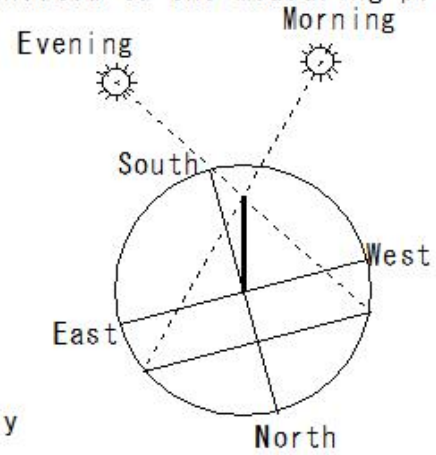
Grid-Based Planning and Technology

Orientation Method

① Ideally, grid divisions should be aligned in a straight line from east-west to north-south.

② Calendars and astronomical documents were introduced from China and Korea around the 6th century. Among them,

③ The Zhouli includes a method known as the "Nikki method," which involves erecting a measuring pole on the ground, drawing a circle around it, and marking the points where the shadows of the rising and setting sun intersect on the same circle. Connecting these two points yields the east-west line, which is then bisected and connected to the measuring pole to obtain the north-south line.



6th century

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(He67) Grid-Based Planning and Technology

(He67) Grid-Based Planning and Technology

Grid-Based Planning and Technology

Orientation Method

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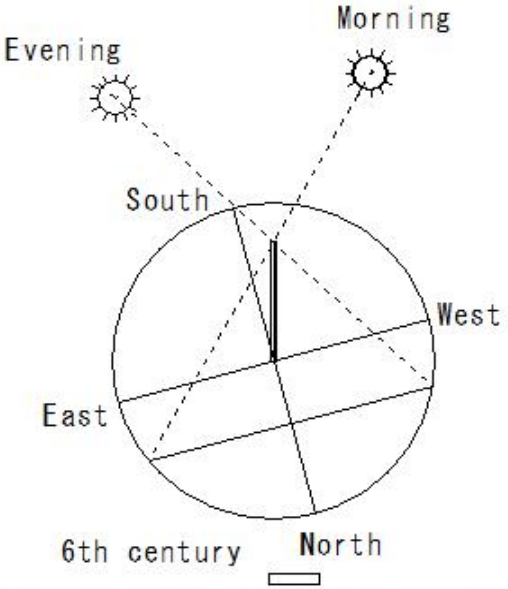

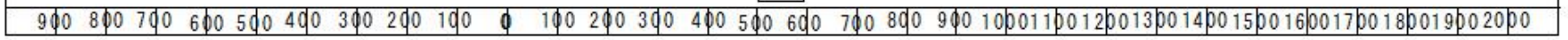

(He68) Civil Engineering Works

(He68) Civil Engineering Works

① Whether it was the construction of ancient tombs or the development of new rice fields, these were all done by hand using hoes, spades, and mokko.

② Because they were done by hand, there were naturally limitations on the scope and scale of the work

③ Construction projects such as digging waterways and building reservoirs were completed in a relatively short period of time by gathering a large number of people.

④ A scene of well digging is depicted in the "Taiman Mandala Engi" (written in the Kamakura period(1185～1333)), preserved at Taima Temple in Nara Prefecture.

⑤ This is thought to be a typical example of civil engineering work carried out in the development of manors, etc.

(He69) Civil Engineering Works

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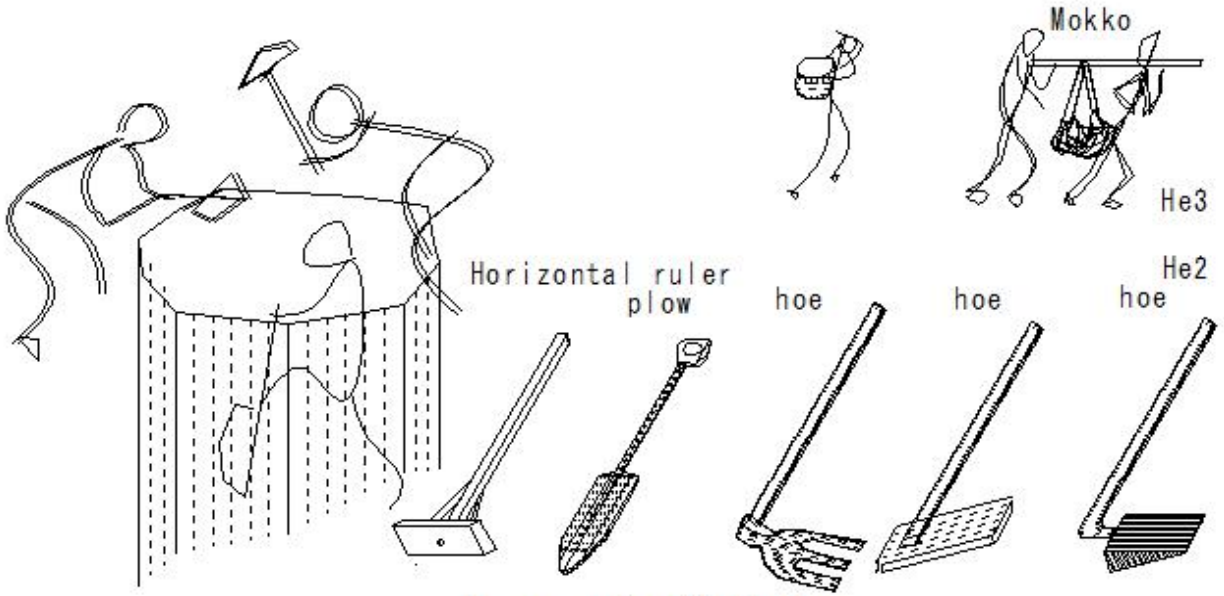

A scene of well digging
(1185～1333)

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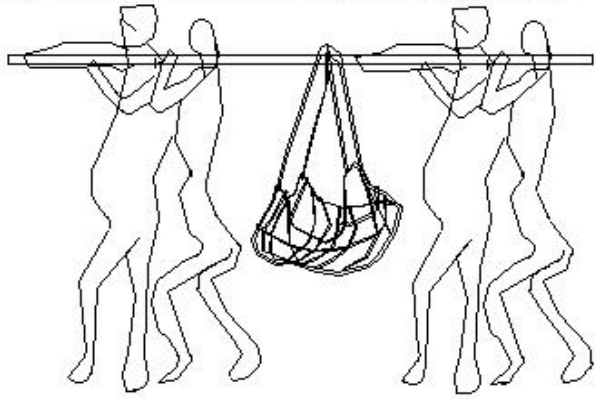
(He70) Civil Engineering Works

(He70) Civil Engineering Works

Kuro Kuwa Gumi (Black Hoe Group)

① Farmers were conscripted to carry out large-scale construction projects.
② Civil engineering specialists also emerged.
③ In the mid-modern period, with the establishment of civil engineering contractors, a group called the Kuro Kuwa Gumi (Black Hoe Group) emerged.
④ Kuro Kuwamono (Black Hoemen) excelled in using extra-large hoes and carrying soil. They excelled in working on flat land and were active in the development of new rice fields, such as the Inbanuma reclamation project.
⑤ During the Edo(1603-1868) period, those involved in civil engineering works were called Kuro Kuwa (Black Hoe) or Dokata (Dokata). Earth and sand were carried on

Kuro Kuwa (Black Hoe) or Dokata (Dokata).



Edo(1603 - 1868)

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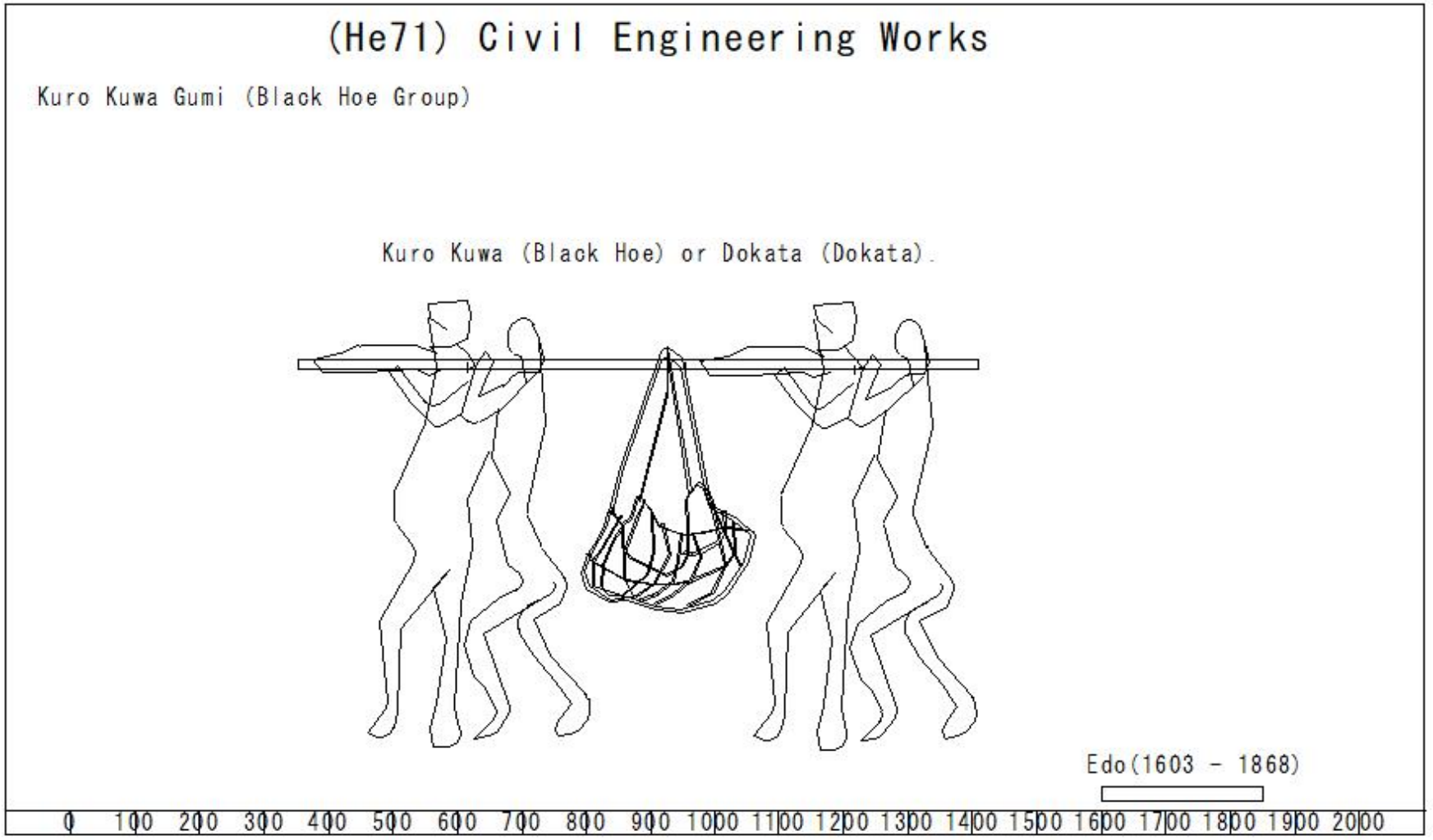
(He71) Civil Engineering Works



(He72) Civil Engineering Works

(He72) Civil Engineering Works

Civil Engineering Ships

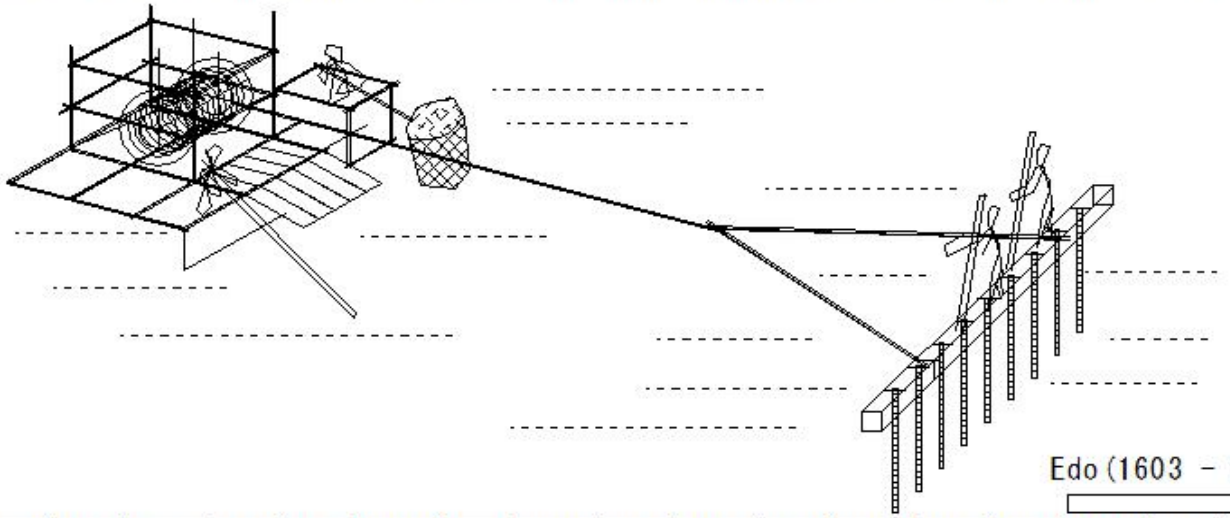
Civil Engineering Ships as Seen in "Nogu Benri-ron" (The Theory of Agricultural Tools Convenience)

Dredging

① Okura Nagatsune, in "The Convenient Use of Agricultural Tools,"

② introduces the civil engineering ship invented by Koraku Matsuemon as one that could be used for new rice paddy development, port construction, and coastal embankment construction.

③ This ship was used to dredge sediment from the riverbed. Sand was scooped up with a plank, lifted up by a ship equipped with a pulley, and loaded onto a sediment carrier attached to it.



Edo (1603 - 1868)

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(He73) Civil Engineering Works

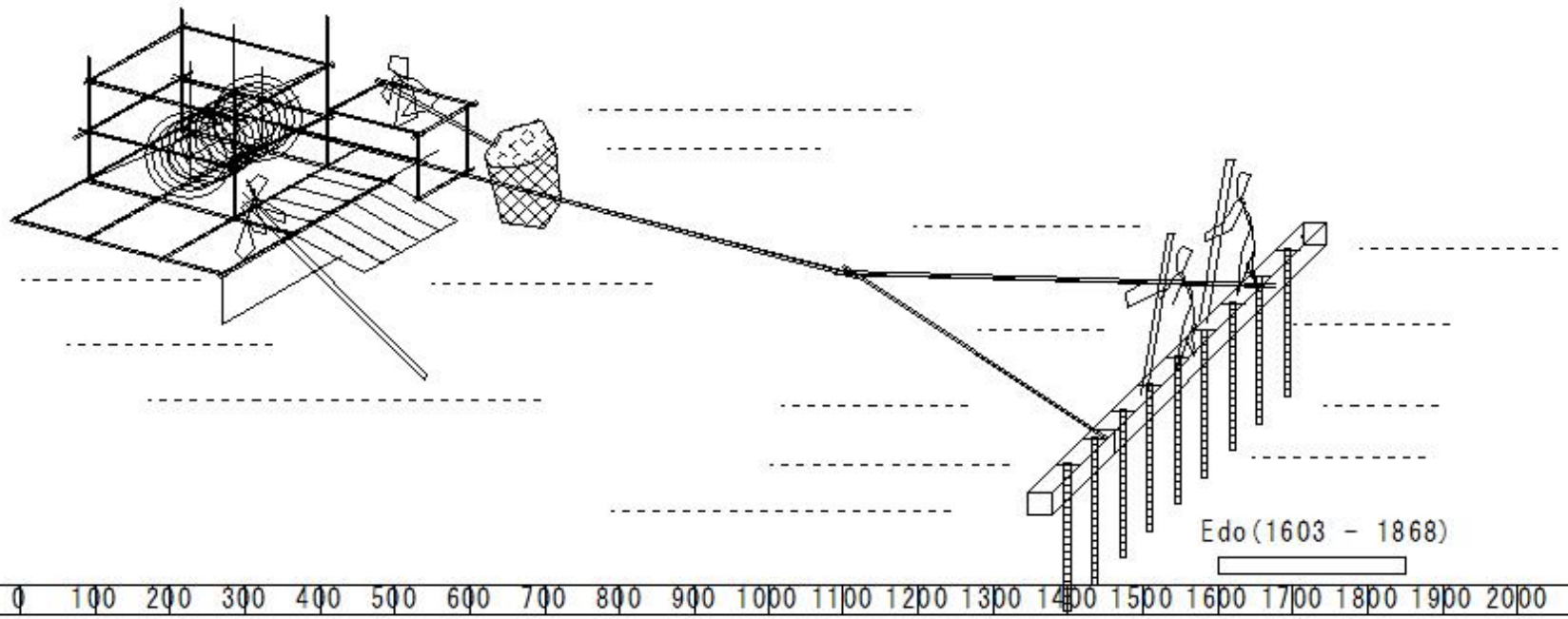
(He73) Civil Engineering Works

Civil Engineering Ships

Civil Engineering Ships as Seen in "Nogu Benri-ron" (The Theory of Agricultural Tools Convenience)

Dredging

③ This ship was used to dredge sediment from the riverbed. Sand was scooped up with a plank, lifted up by a ship equipped with a pulley, and loaded onto a sediment carrier attached to it.



(He74) Civil Engineering Works

(He74) Civil Engineering Works

Civil Engineering Ships

Civil Engineering Ships as Seen in "Nogu Benri-ron" (The Theory of Agricultural Tools Convenience)

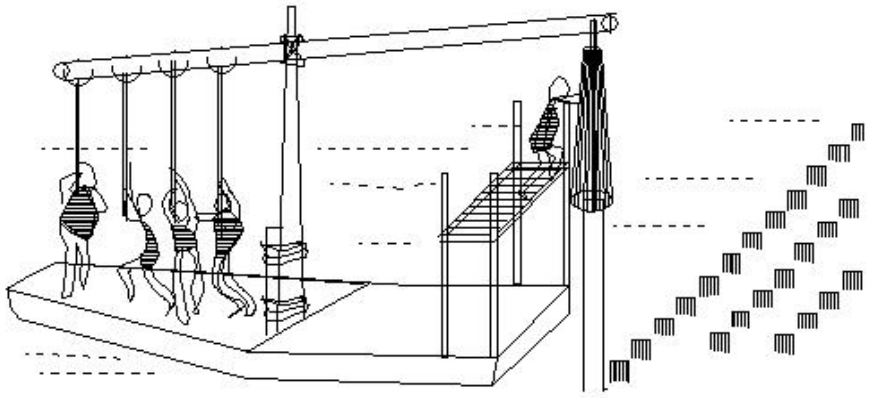
Pile Driving, Pile Pulling

① The principle of a lever is applied.

② The pile driving ship is 7 fathoms (approximately 12.6 m) long and 7 shaku (approximately 1.5 shaku) wide.

③ The pile driving section is lifted up and driven down.

④ The pile pulling ship, with its tip over 2 ken (approximately 3.6 m) long, clamps the tip of the pile puller between the piles and pulls them up.



Edo(1603 - 1868)

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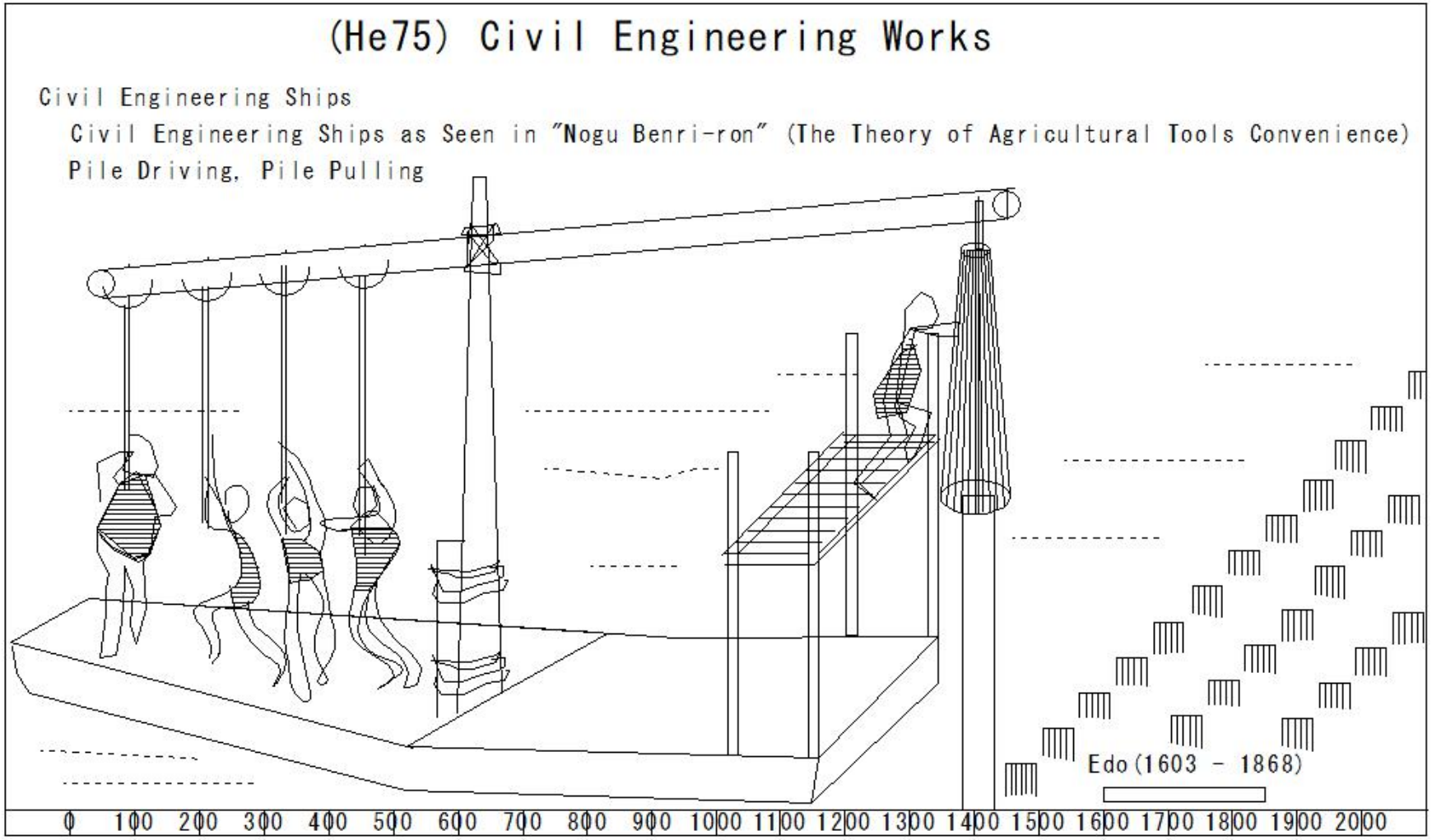
(He75) Civil Engineering Works



(He76) Civil Engineering Works

Civil Engineering Ships

Civil Engineering Ships as Seen in "Nogu Benri-ron" (The Theory of Agricultural Tools Convenience)

Transporting Megaliths

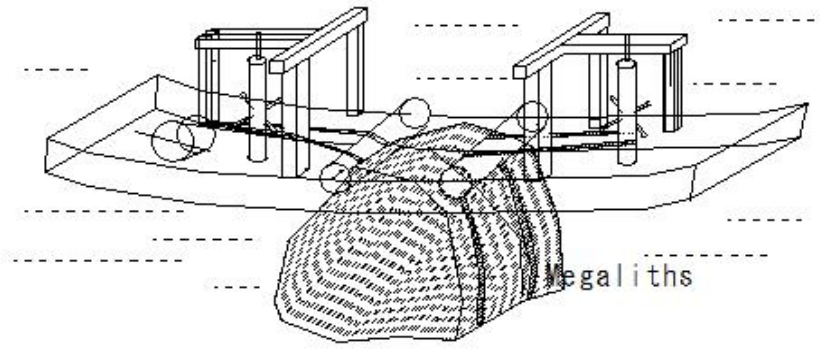
① When Koraku was 65 years old, he renovated the port of his hometown, Banshu Takasago (Hyogo Prefecture).

② He is said to have used stone fishing boats, stone boats, and pulley boats to stack large stones and build a sturdy stone wall.

③ Stone fishing boats, also known as bottomless boats, were over 7 fathoms 4 shaku long and 7 shaku wide, and it is said that one potter's wheel required four workers.

We can see that fathom = 6 feet = 1.82880 m = 6.0349 shaku. Also,

1 shaku = 1/3.3 meter ≒ 0.303 meters. 1 shaku = 10 sun = 100 bu. 0.303 meters



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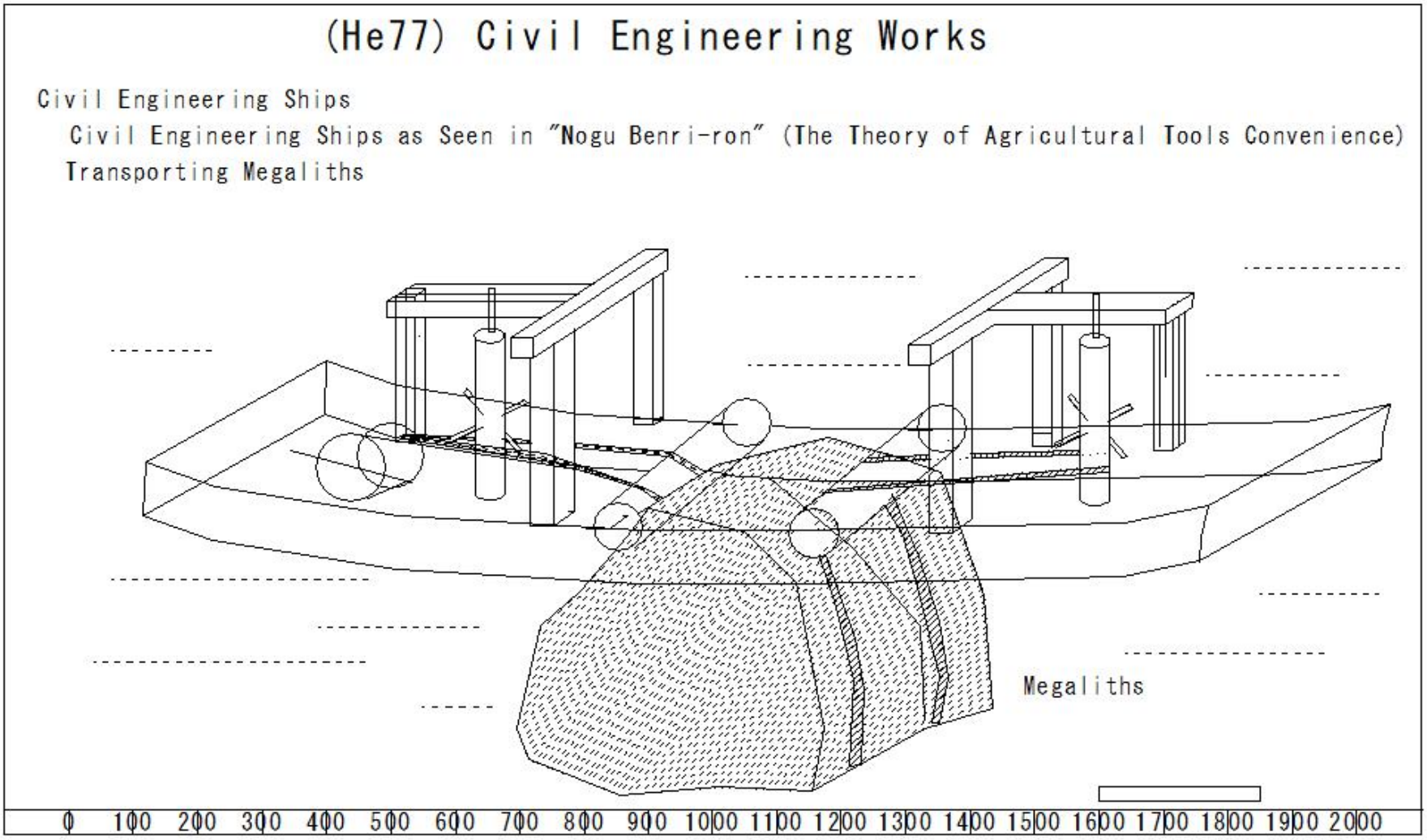
(He77) Civil Engineering Works



(He78) Kitakami River Improvement Projects

(He78) Kitakami River Improvement Projects

History of the Kitakami River

History of Flood Control Projects

① Full-scale flood control projects on the Kitakami River are thought to have begun after the feudal era.

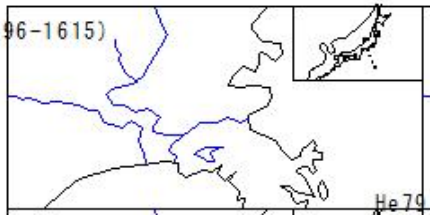
② Notable flood control projects include the river channel re-routing of the main Kitakami River carried out by Date Sagami Munenao during the Edo period,

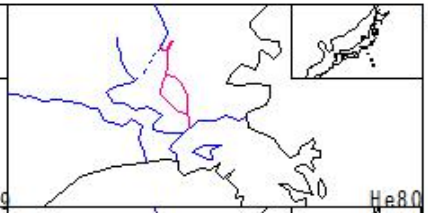
③ The subsequent river channel re-routing of the main Kitakami River (present-day Old Kitakami River), the Old Hasama River, and the Eai River, carried out by Date Masamune's vassal, Kawamura Magobei.

④ These river works dramatically reduced flood damage in the lower Kitakami River basin, spurring the development of new rice fields,

⑤ Established a water transportation network for transporting rice produced in the upper reaches to Edo.

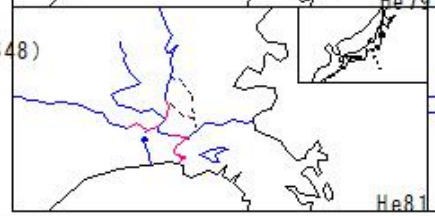
Before the Keicho Period (1596-1615)

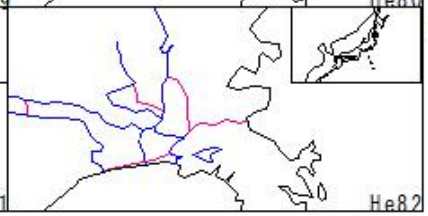




After construction by by Date Sagami Munenao Edo period (1603 - 1868)

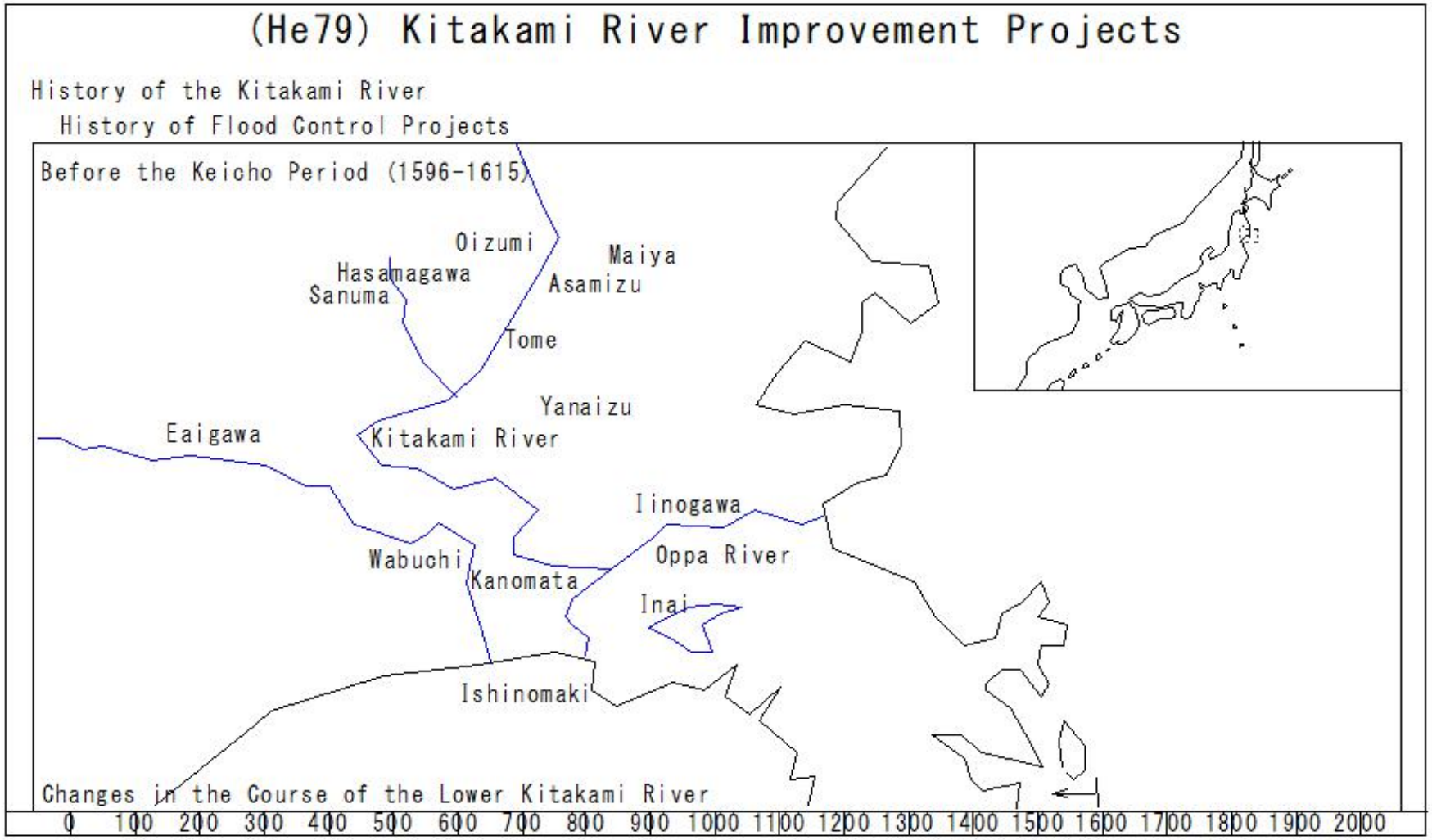
After the construction by Magobei Kawamura (1575-1648)



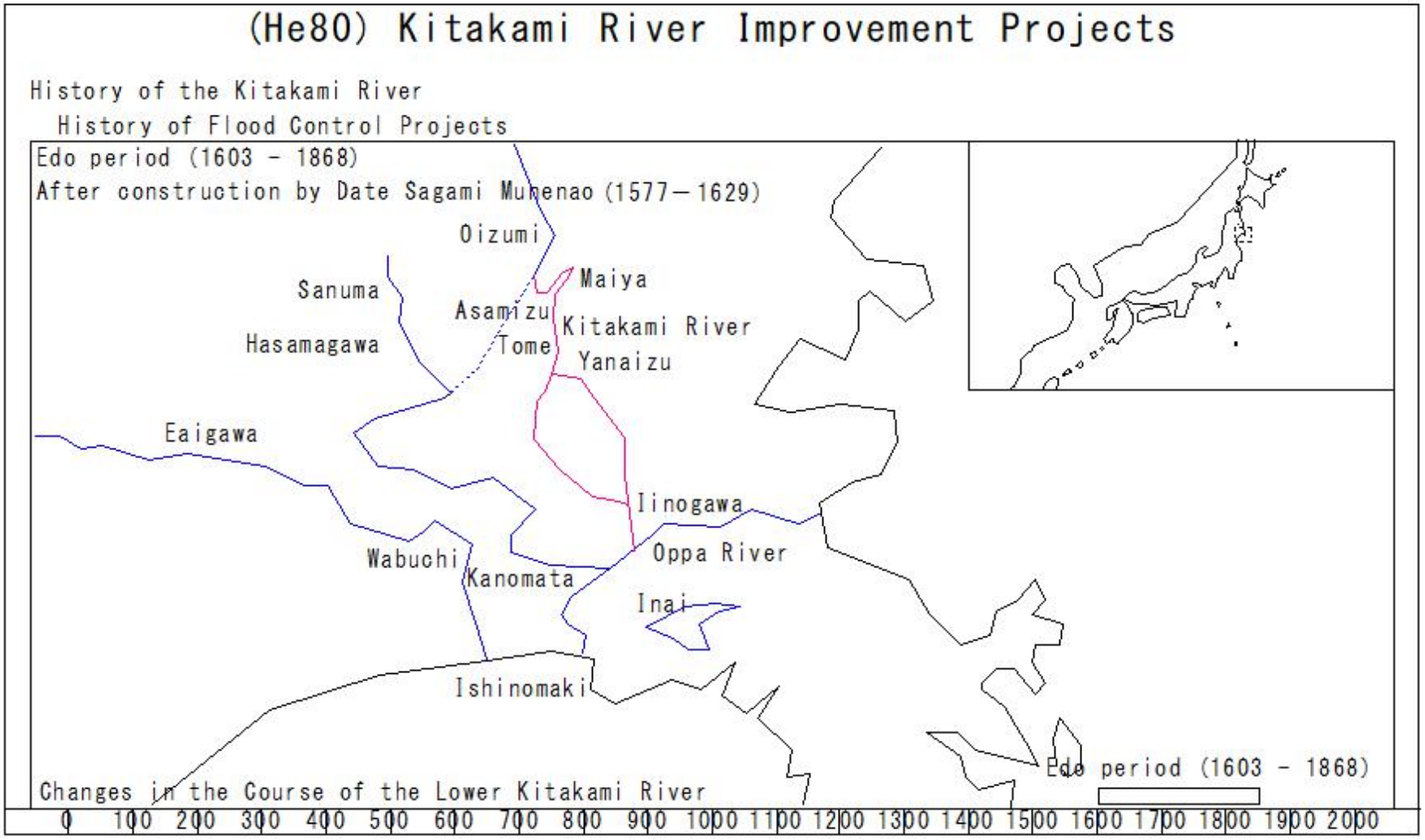


After the Meiji period (1868-1912)

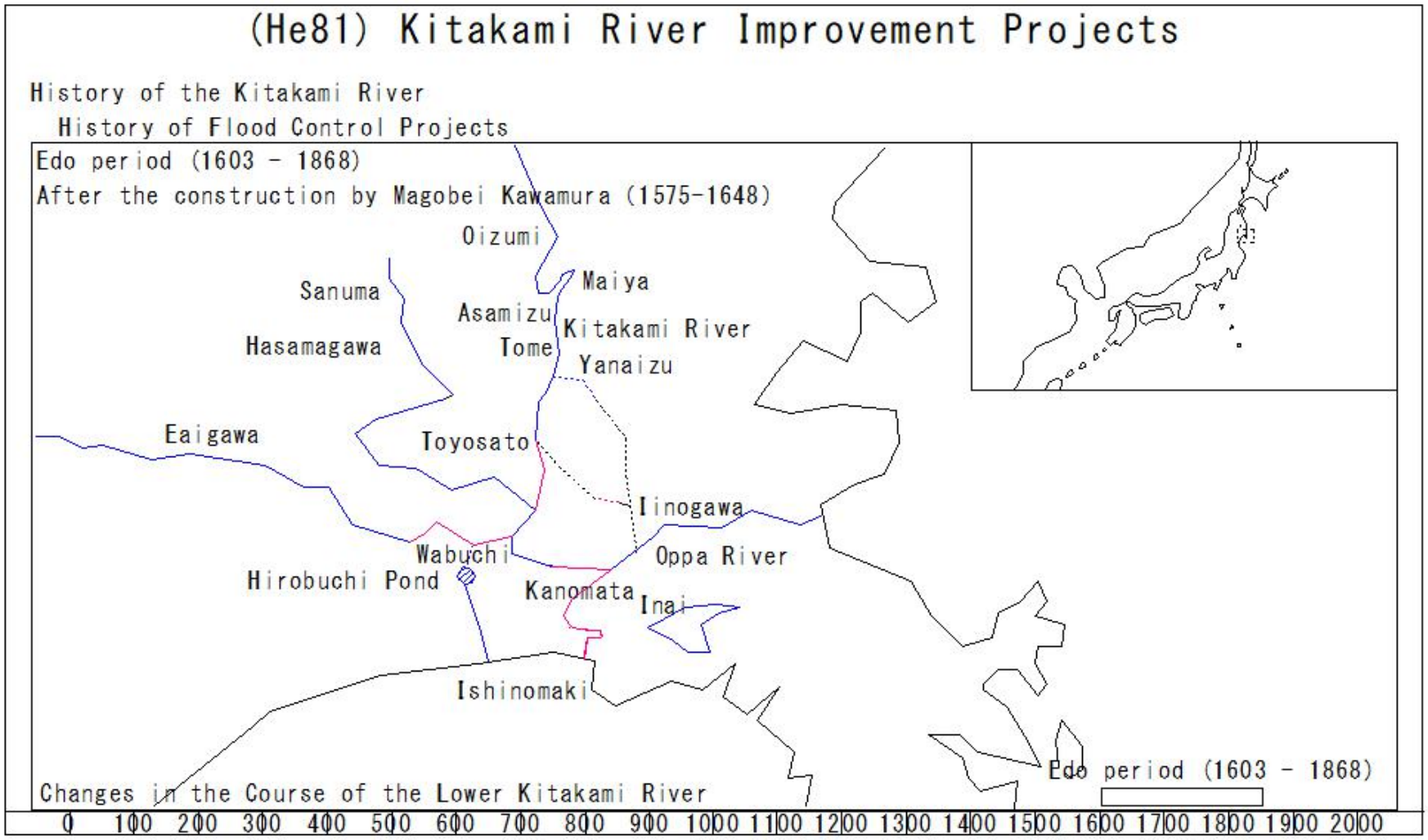
(He79) Kitakami River Improvement Projects



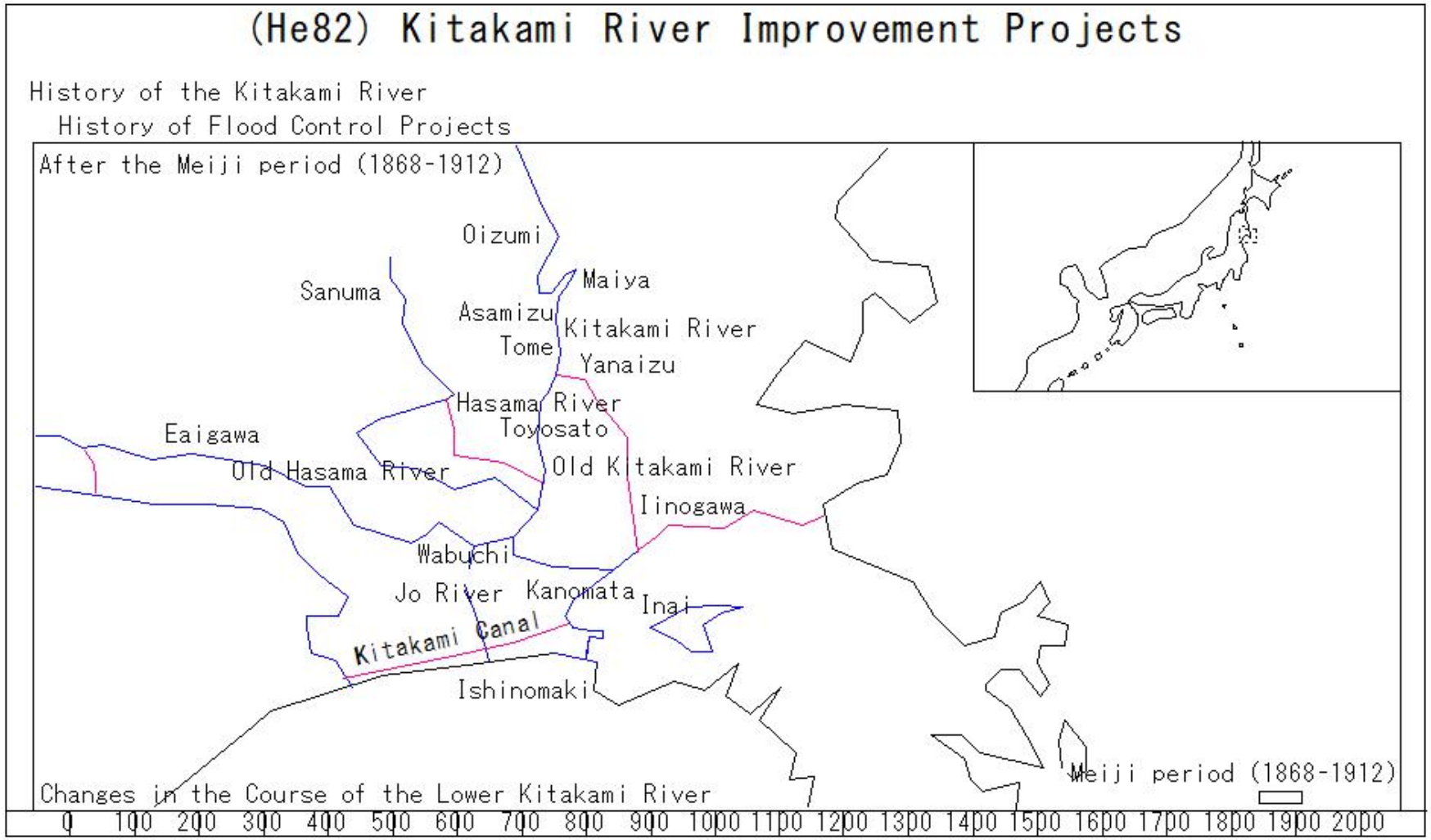
(He80) Kitakami River Improvement Projects



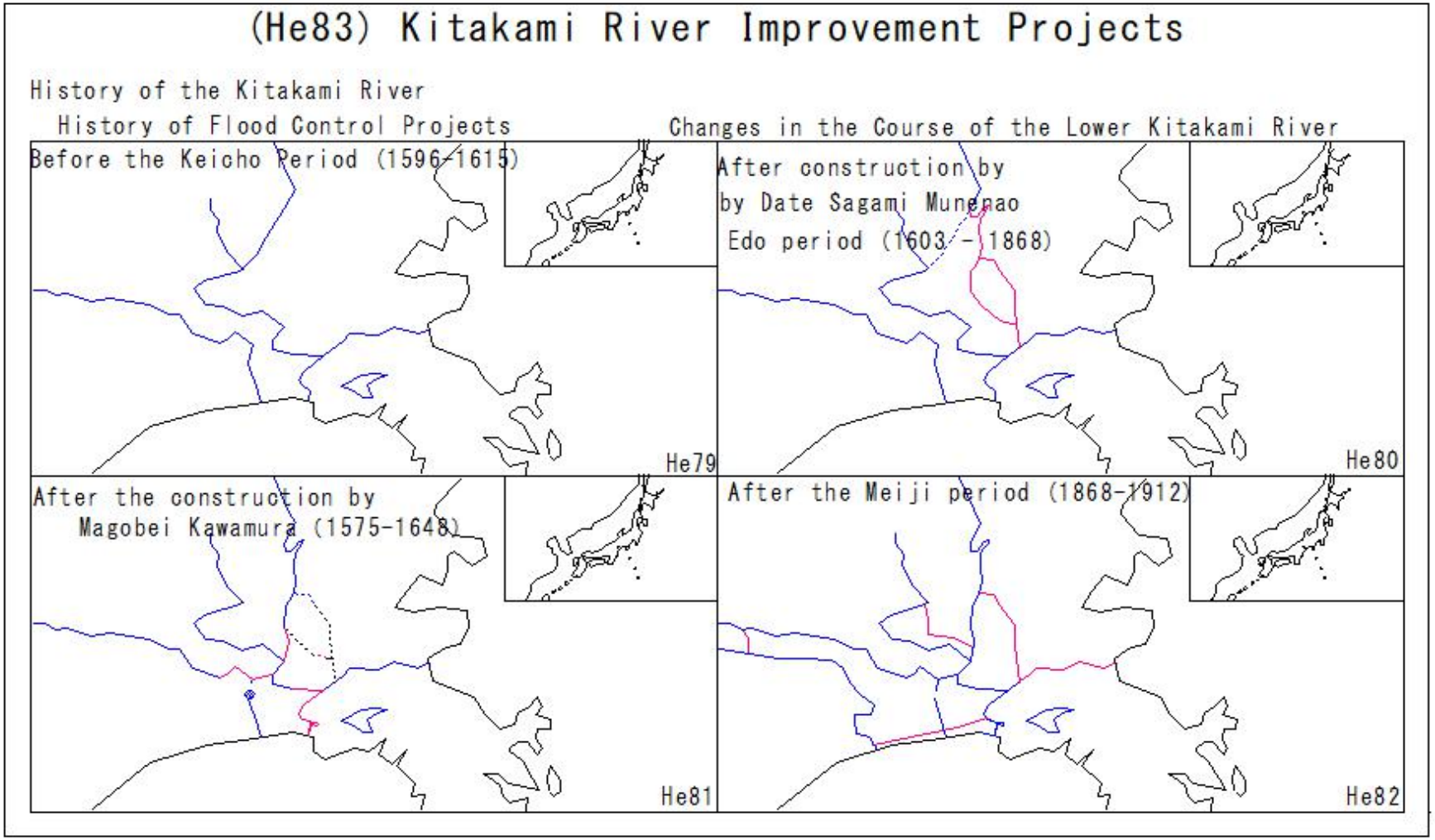
(He81) Kitakami River Improvement Projects



(He82) Kitakami River Improvement Projects



(He83) Kitakami River Improvement Projects



(He84) Kitakami River Improvement Projects

(He84) Kitakami River Improvement Projects

History of the Kitakami River

History of Flood Control Projects

① From the early to mid-Meiji period, low-water channel construction was primarily carried out to develop a waterway network, ensuring a shipping route between Ishinomaki, the river's mouth, and Morioka.

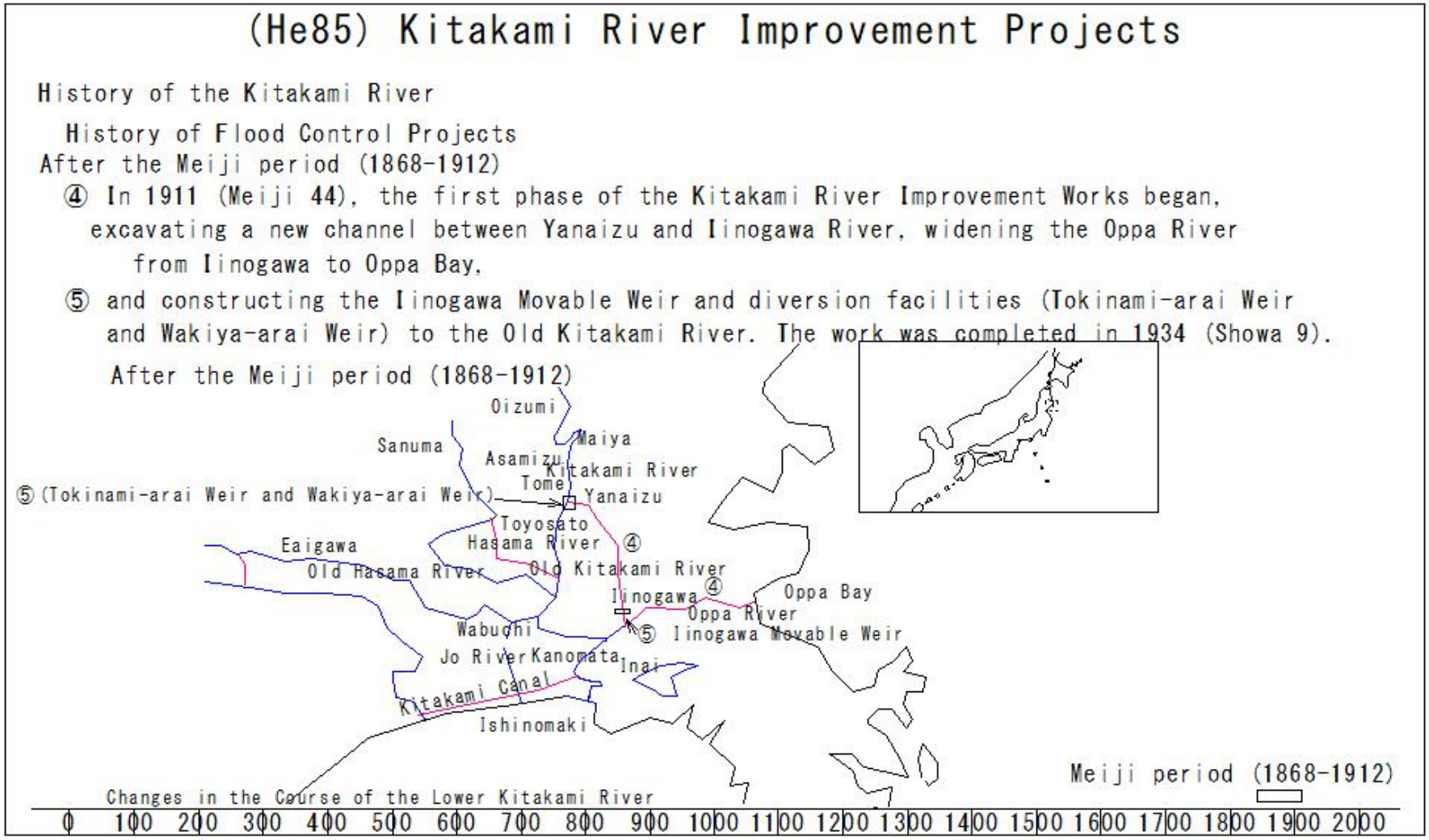
② As a result, the Kitakami River was utilized as a shipping route, with steamships operating from Ishinomaki to Ichinoseki City.

③ From the late Meiji period to the early Showa period, following the flood of 1910 (Meiji 43),

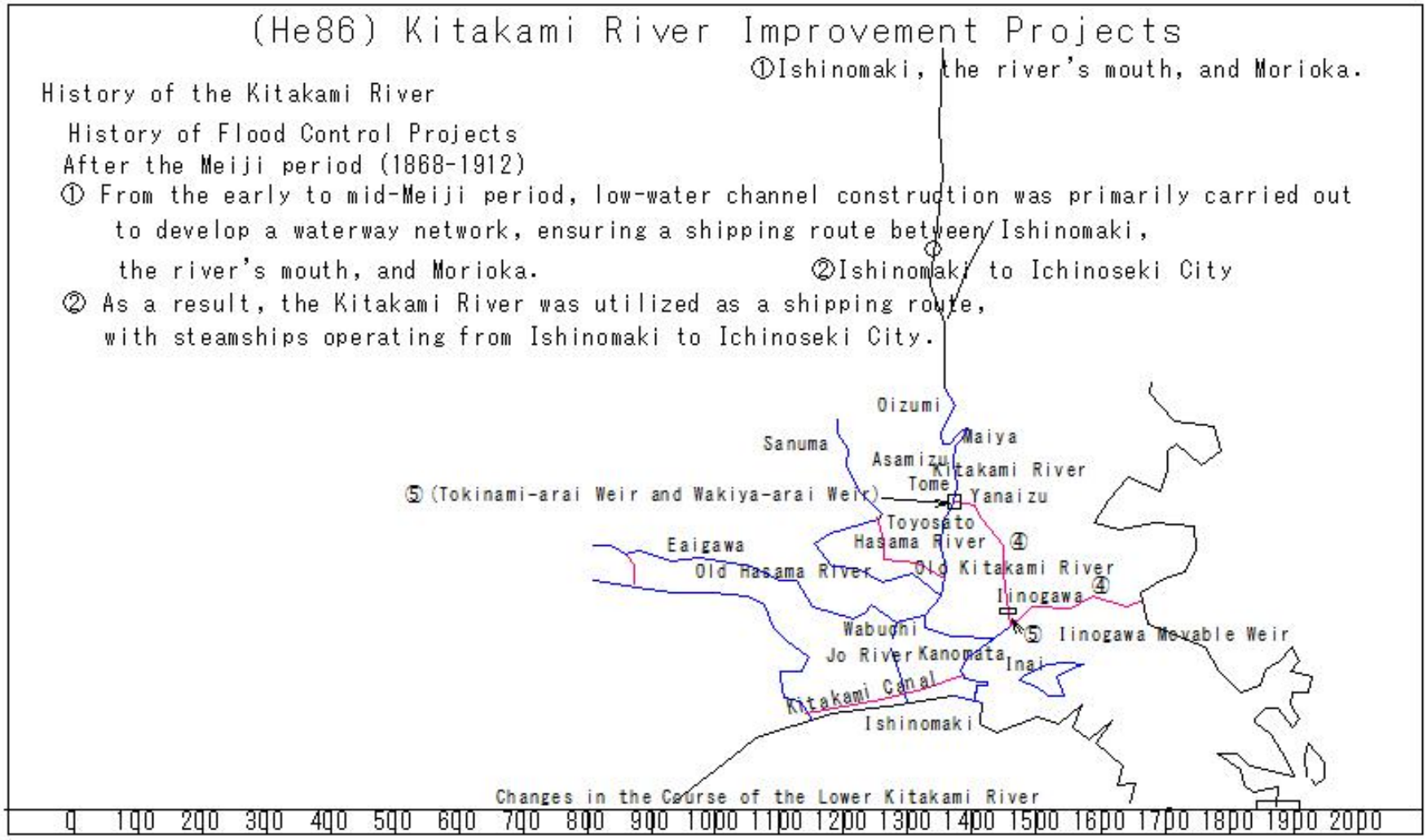
④ In 1911 (Meiji 44), the first phase of the Kitakami River Improvement Works began, excavating a new channel between Yanaizu and Iinogawa River, widening the Oinami River from Iinogawa to Oinami Bay,

⑤ and constructing the Iinogawa Movable Weir and diversion facilities (Tokinami-arai Weir and Wakiya-arai Weir) to the Old Kitakami River. The work was completed in 1934 (Showa 9).

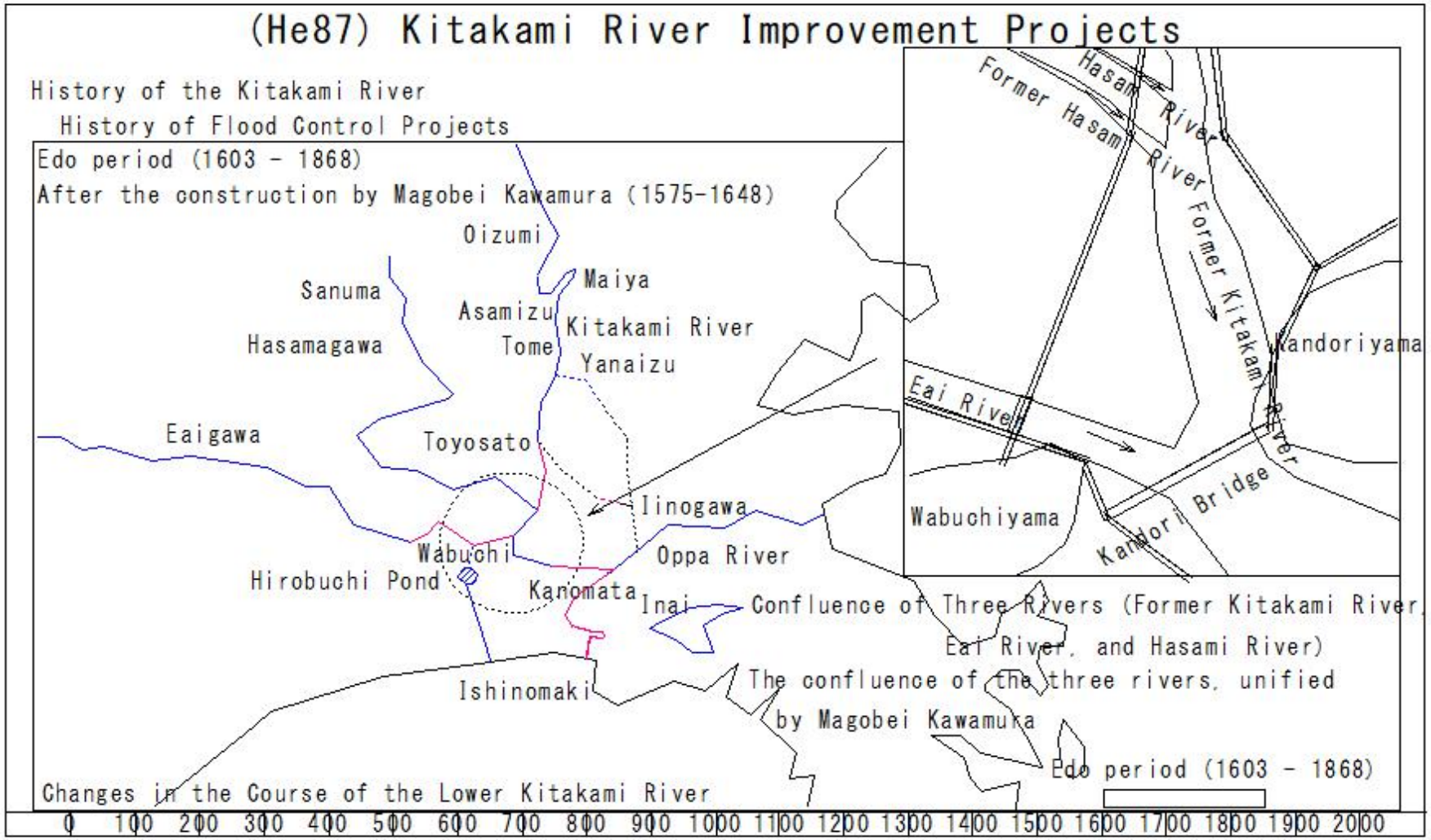
(He85) Kitakami River Improvement Projects



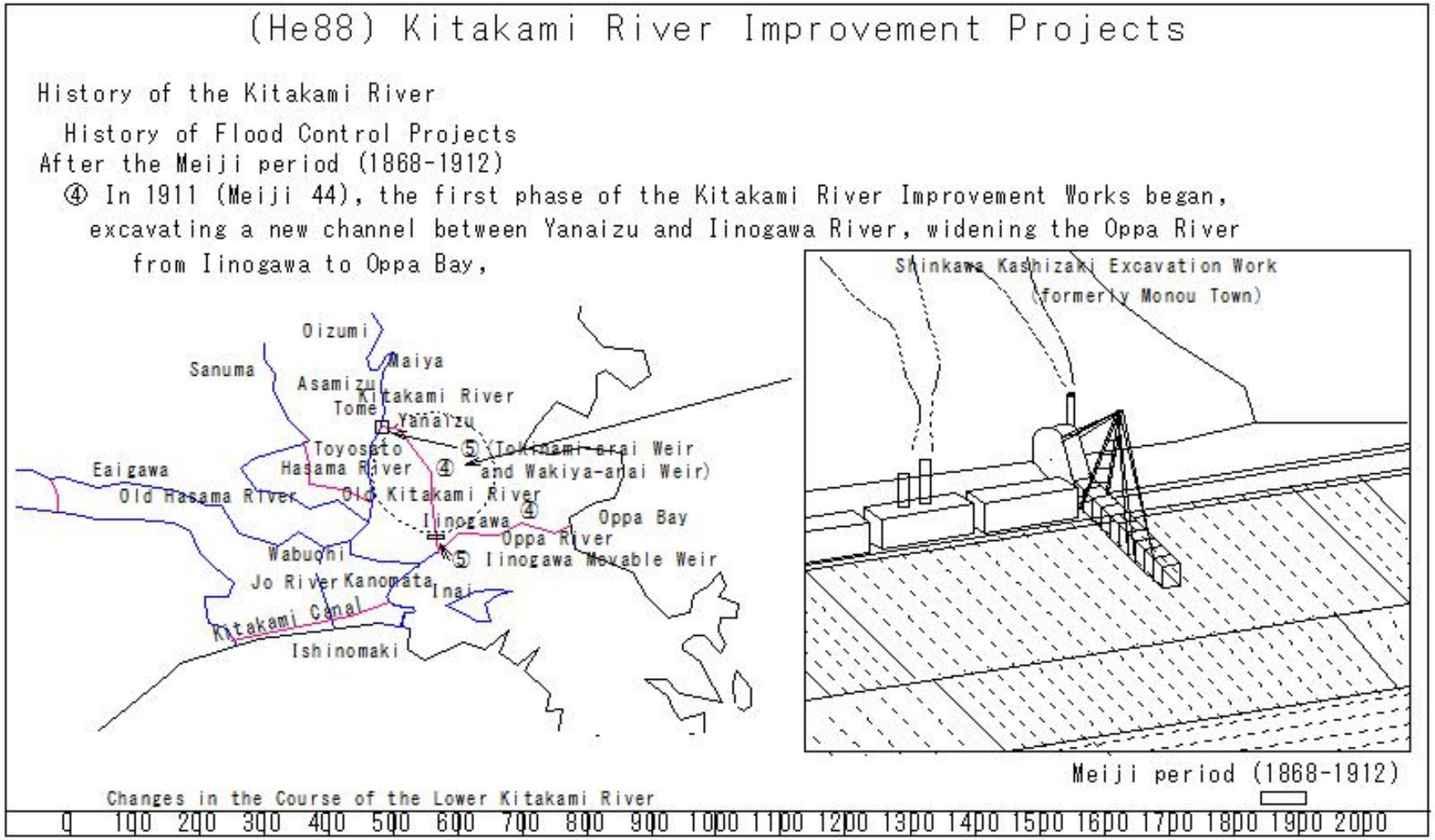
(He86) Kitakami River Improvement Projects



(He87) Kitakami River Improvement Projects



(He88) Kitakami River Improvement Projects



(He89) Kitakami River Improvement Projects

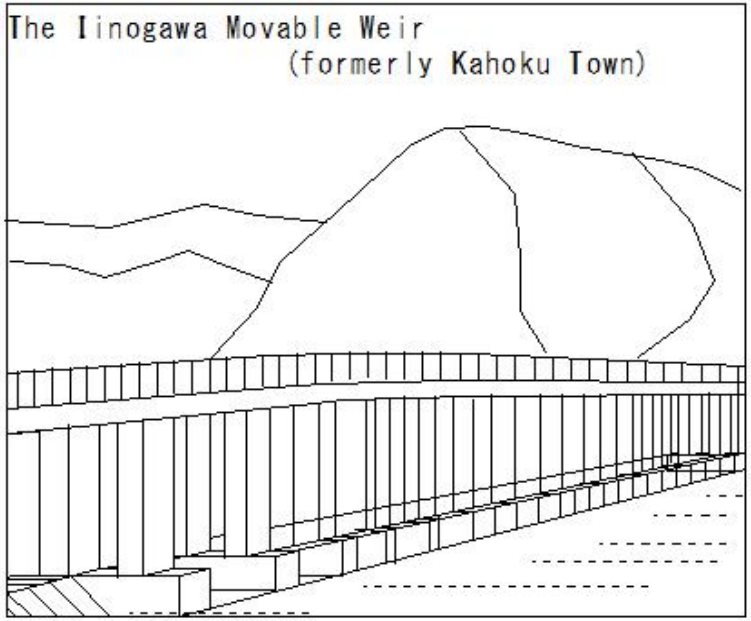
(He89) Kitakami River Improvement Projects

History of the Kitakami River

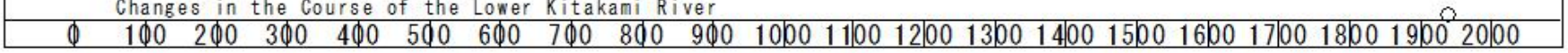
History of Flood Control Projects

After the Meiji period (1868-1912)

⑤ and constructing the Iinogawa Movable Weir and diversion facilities (Tokinami-arai Weir and Wakiya-arai Weir) to the Old Kitakami River. The work was completed in 1934 (Showa 9).



Changes in the Course of the Lower Kitakami River



(He90) Kitakami River Improvement Projects

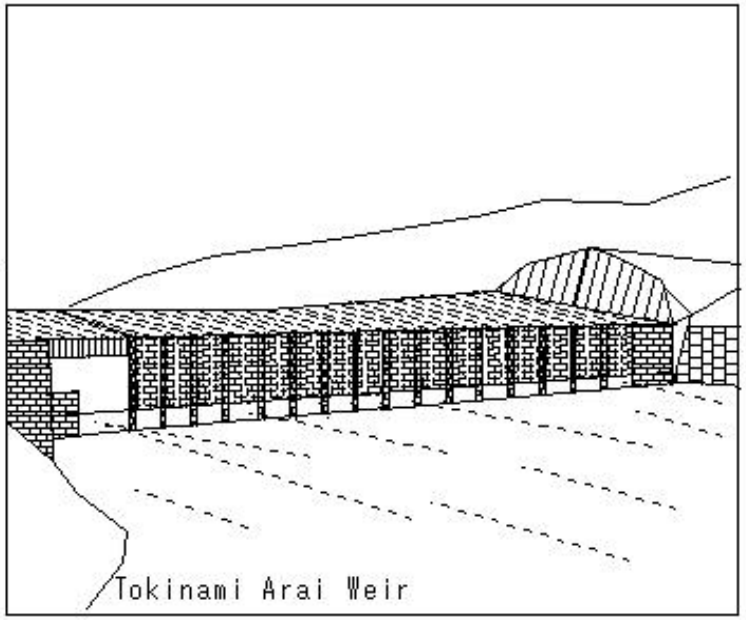
(He90) Kitakami River Improvement Projects

History of the Kitakami River

History of Flood Control Projects

After the Meiji period (1868-1912)

⑤Constructing the Iinogawa Movable Weir and diversion facilities (Tokinami-arai Weir and Wakiya-arai Weir) to the Old Kitakami River. The work was completed in 1934 (Showa 9).



Changes in the Course of the Lower Kitakami River

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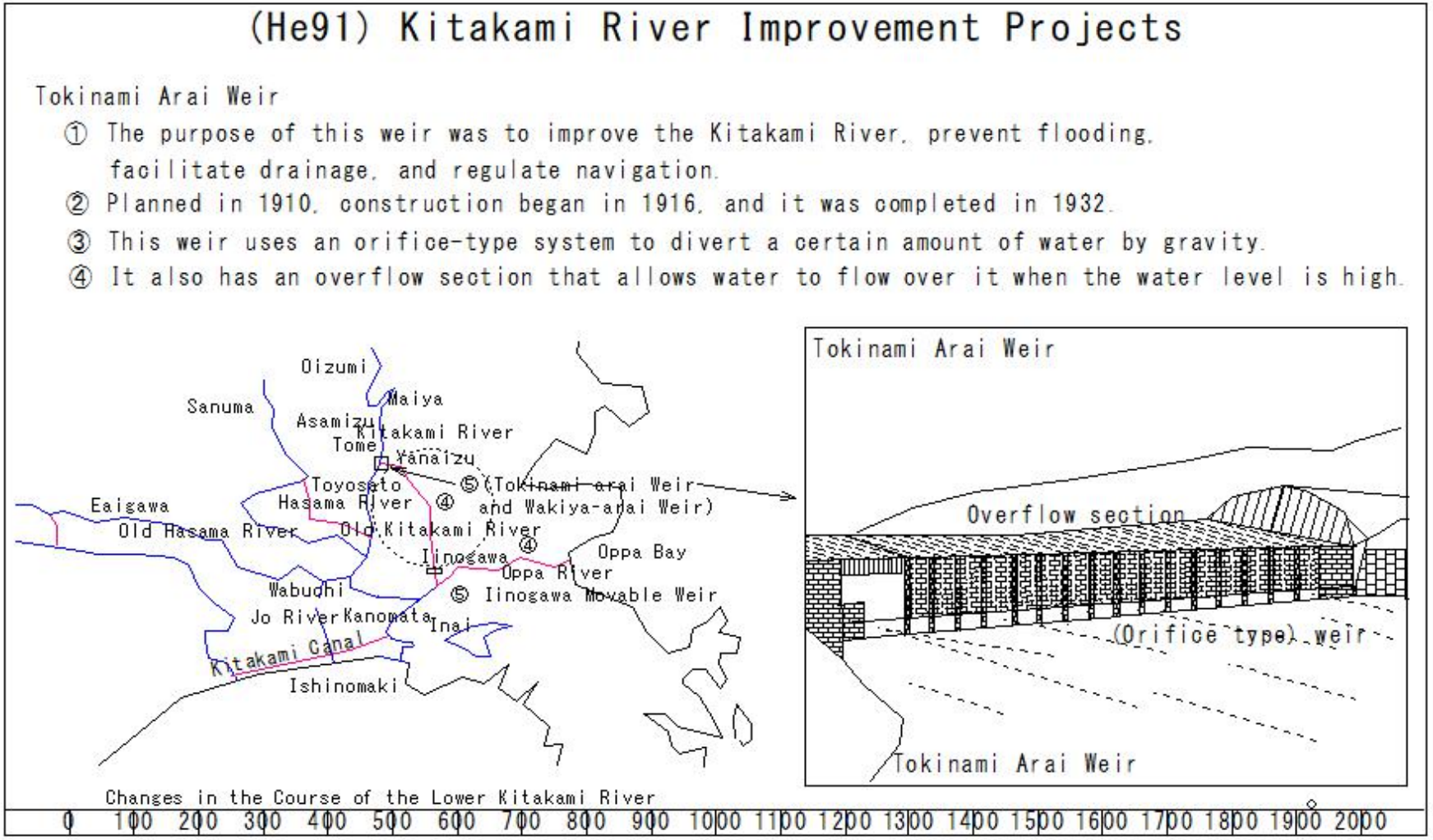
(He91) Kitakami River Improvement Projects



(He92) Kitakami River Improvement Projects

(He92) Kitakami River Improvement Projects

Tokinami Arai Weir

① This is a fixed weir. To divert a certain amount of water, a culvert runs underneath the weir. This is called an orifice structure.

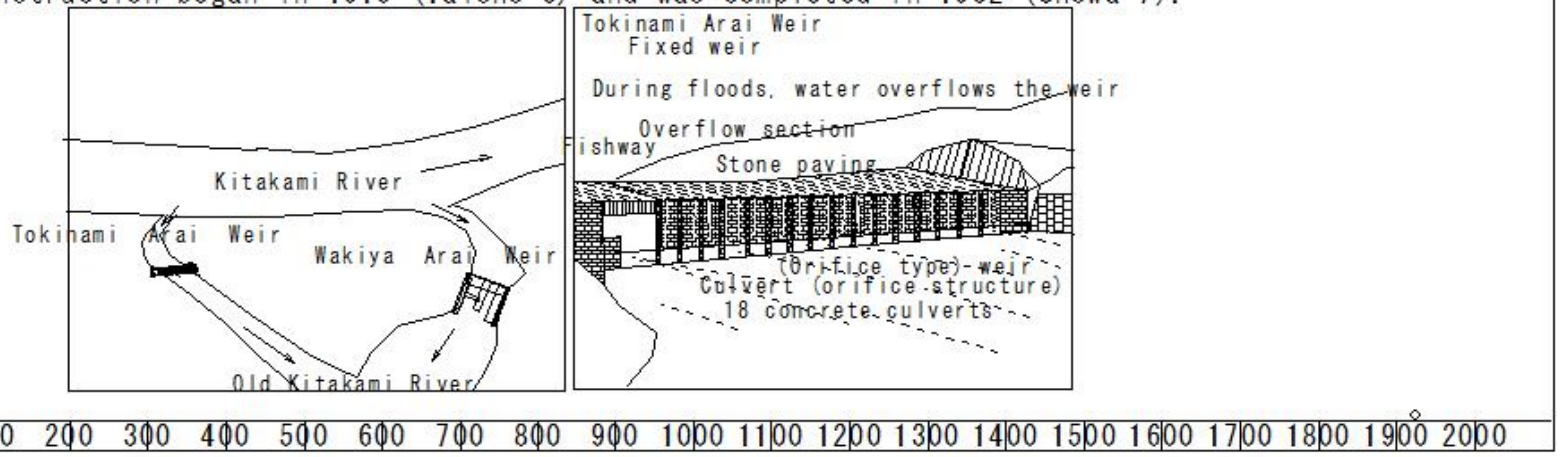
② The water passage consists of 18 concrete culverts, each 0.94 meters wide, 1.35 meters high, and 37 meters long.

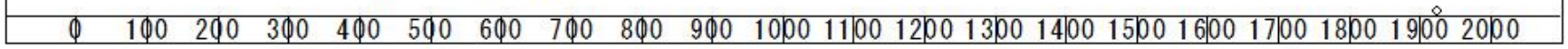
③ Stone paving is installed above this, and a fishway runs along the right bank.

④ Originally, a levee was planned to be built over the weir, but due to poor ground conditions, construction was canceled and the weir's size was reduced.

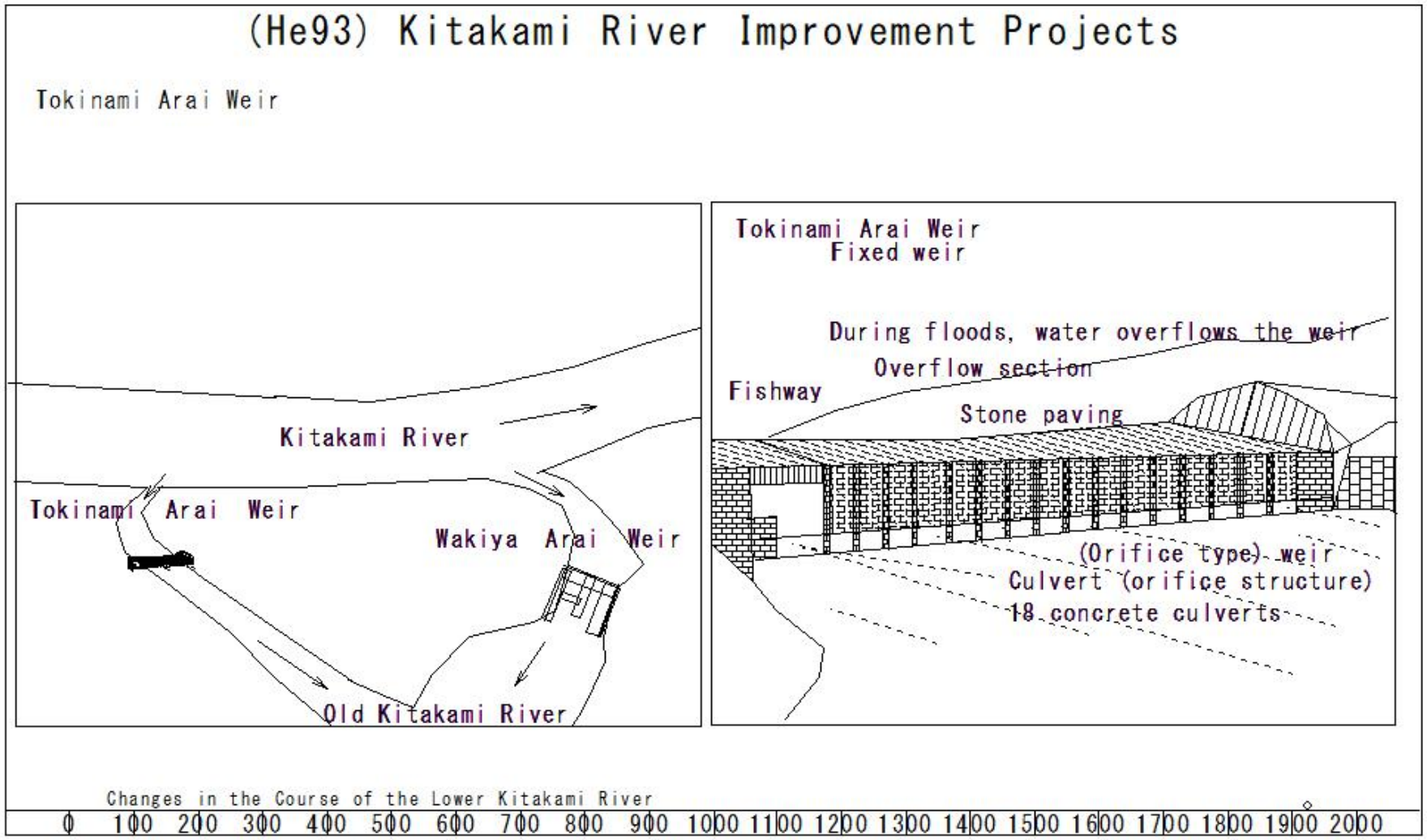
⑤ Under normal circumstances, a certain amount of water flows from the culvert into the Old Kitakami River. However, during floods, water overflows the weir.

⑥ Construction began in 1916 (Taisho 5) and was completed in 1932 (Showa 7).





(He93) Kitakami River Improvement Projects



(He94) Kitakami River Improvement Projects

(He94) Kitakami River Improvement Projects

History of the Kitakami River

History of Flood Control Projects

Wakiya Arai Weir

① A facility that separates the main Kitakami River from the Old Kitakami River.

② A fixed weir with an orifice structure that allows water to flow through holes in the arai weir.

③ It consists of six culverts, each 2.35 meters wide, 1.65 meters high, and 9 meters long.

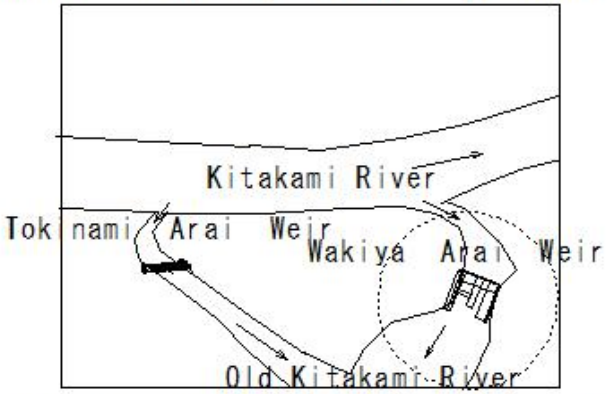
④ A fishway is provided on the right bank.

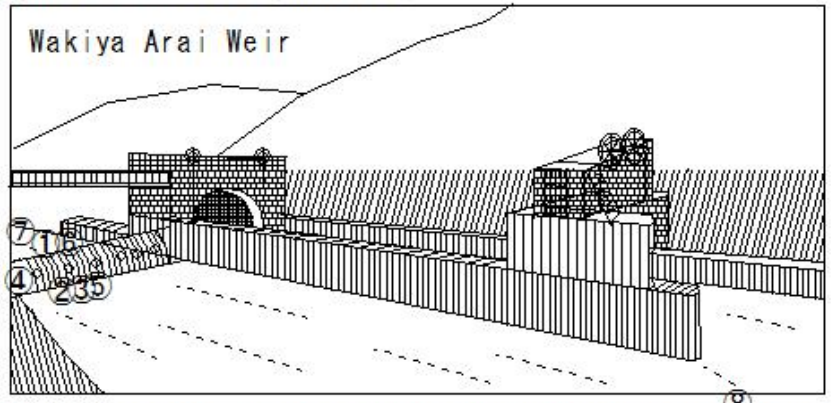
⑤ Under normal conditions, water is supplied to the Old Kitakami River through holes in the weir.

⑥ During floods, water overflows the weir.

⑦ This reduces the flow into the Old Kitakami River and mitigates backflow into tributaries.

⑧ Construction began in 1925 (Taisho 14) and completed in 1932 (Showa 7).





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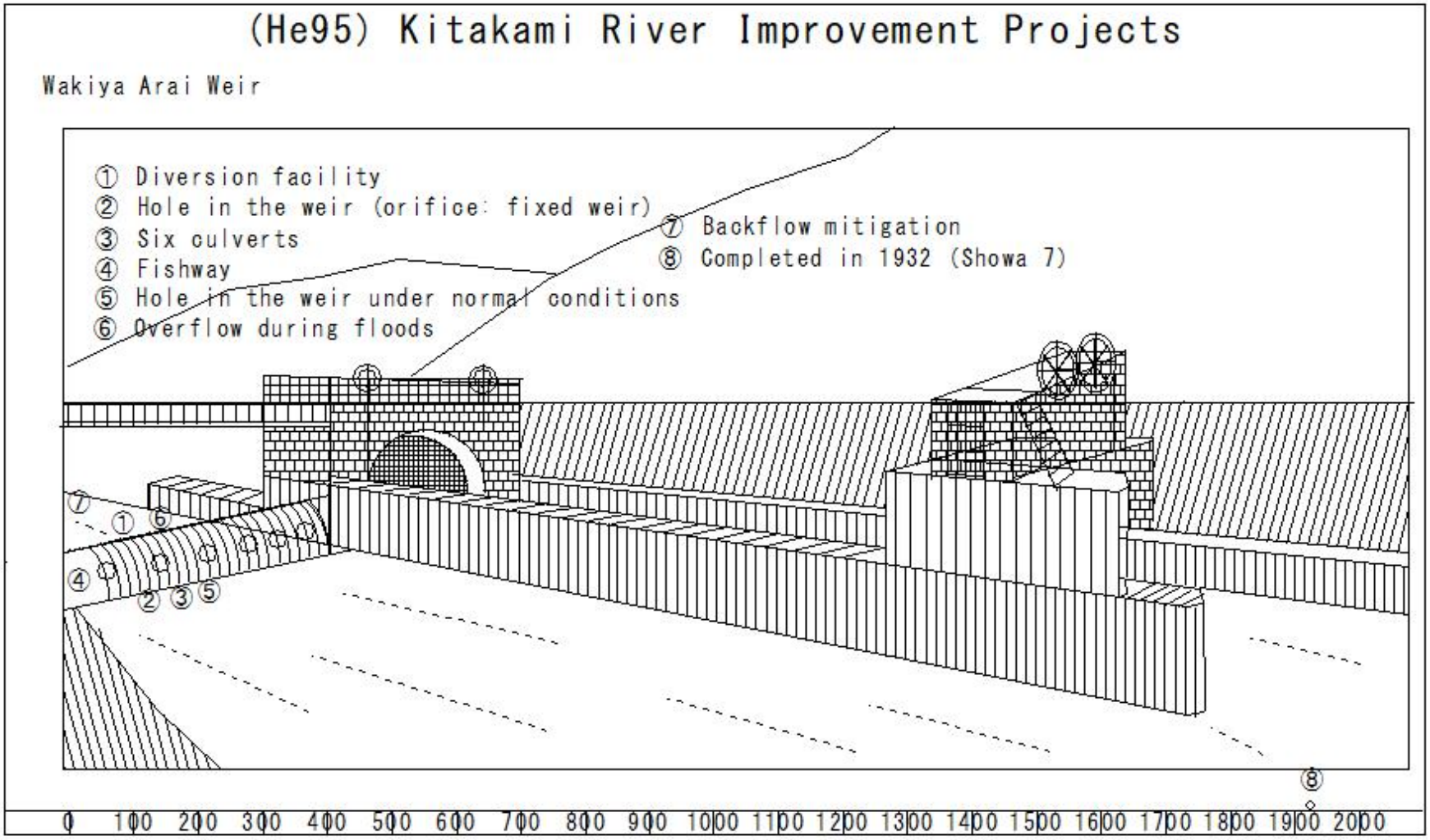
(He95) Kitakami River Improvement Projects



(He96) Kitakami River Improvement Projects

(He96) Kitakami River Improvement Projects

Wakiya Lock

① The diversion of the Kitakami River resulted in a difference in water level between the main Kitakami River and the Old Kitakami River.

② Wakiya Lock was built to allow ships to navigate this difference in water level.

③ It is located on the left bank of the Wakiya Arai Weir.

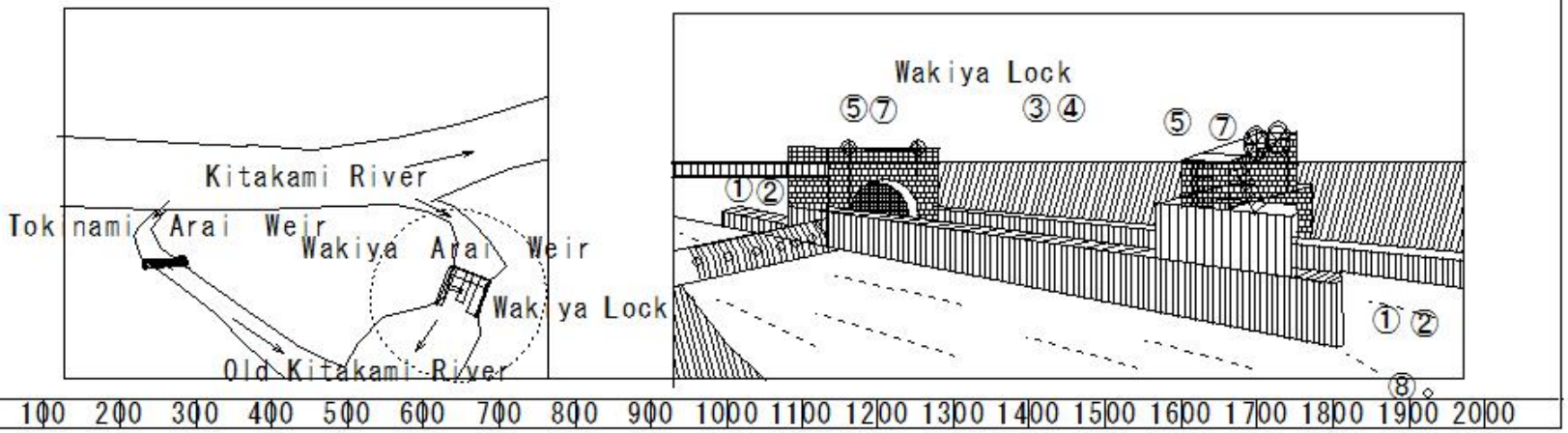
④ It is 73 meters long, and the lock chamber that regulates the water level is 46.6 meters long and 7.8 meters wide.

⑤ The gates are two-tiered, lift-up steel gates.

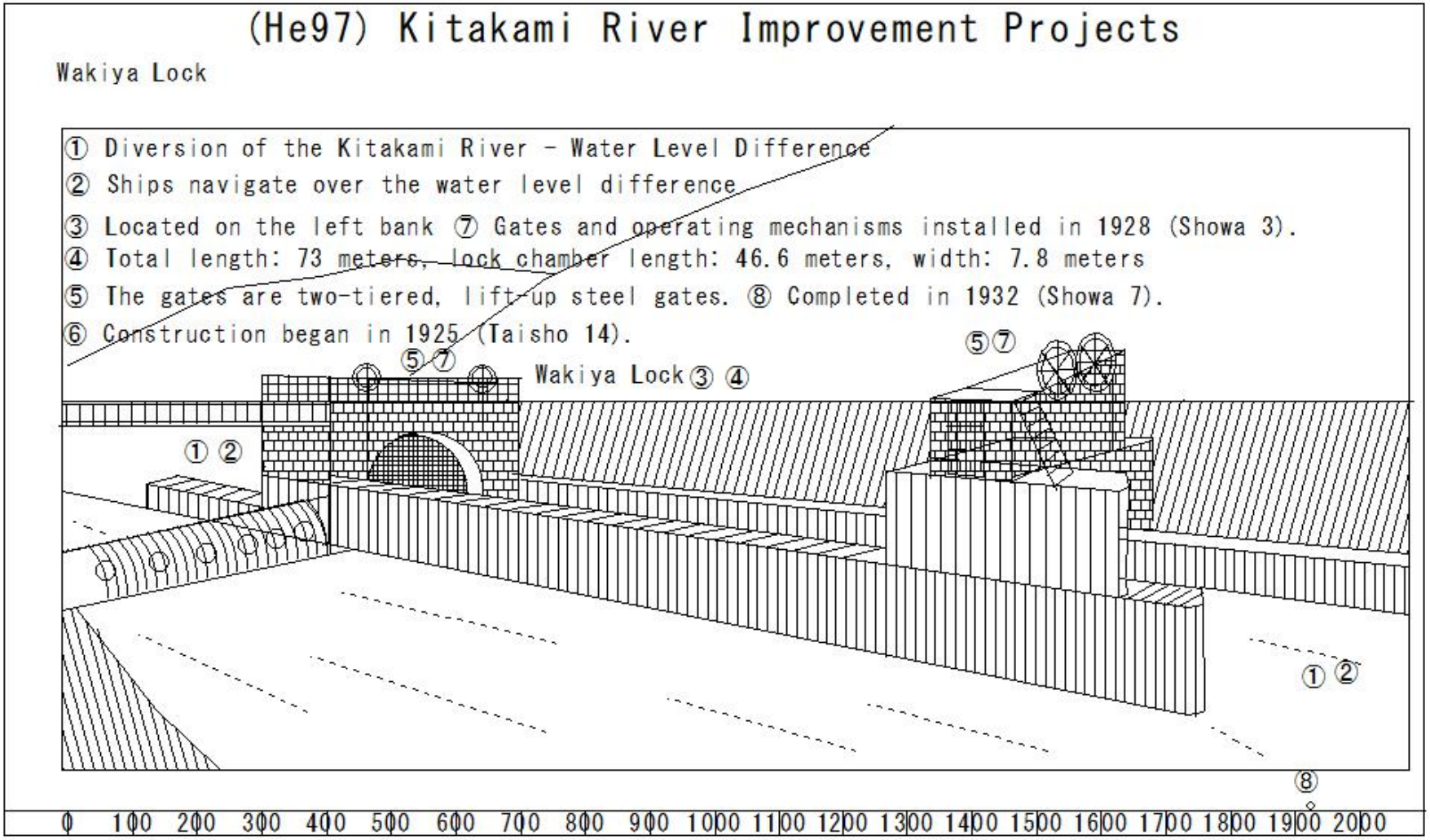
⑥ Construction began in 1925 (Taisho 14).

⑦ Gates and operating mechanisms installed in 1928 (Showa 3).

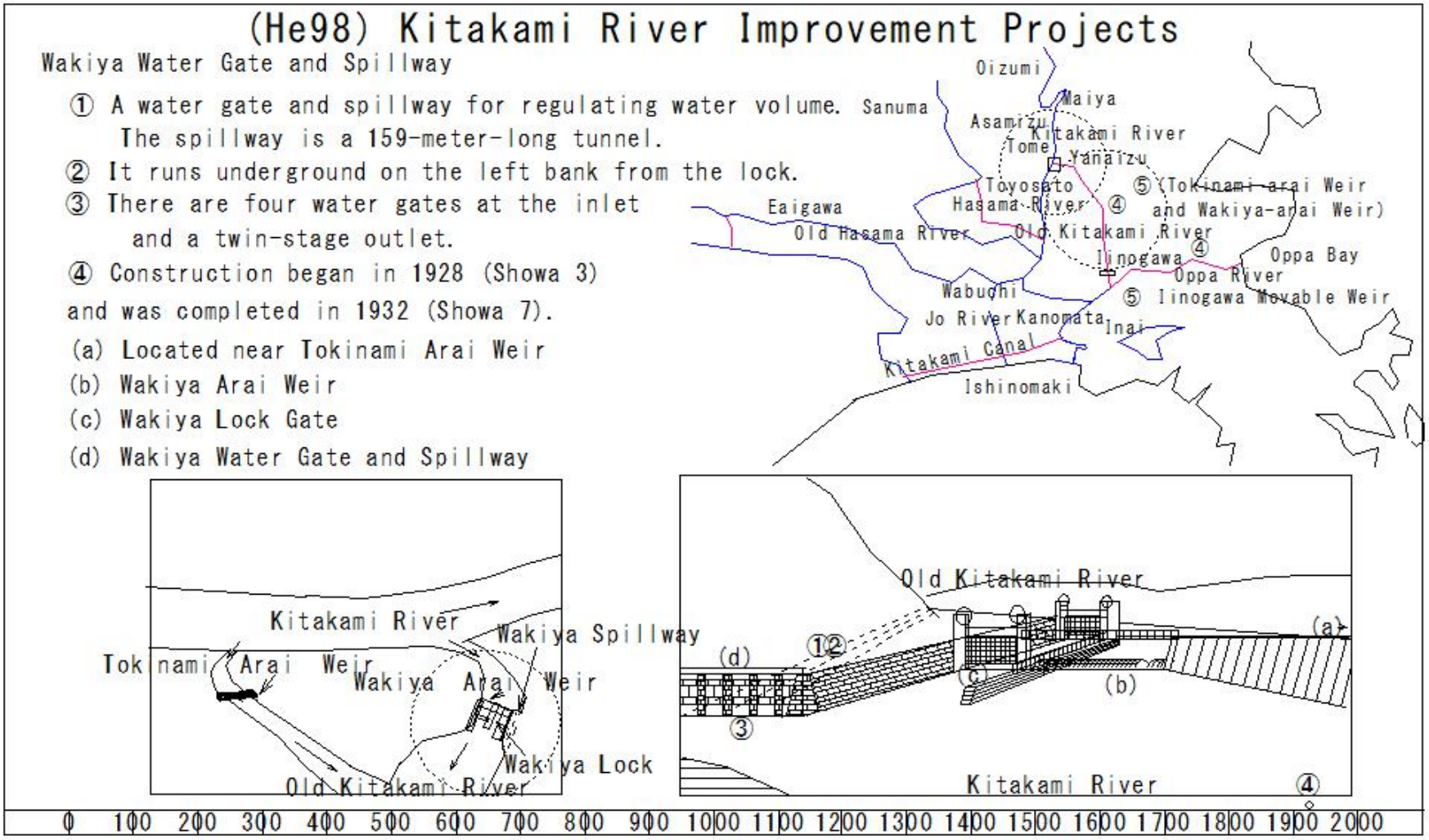
⑧ Completed in 1932 (Showa 7).



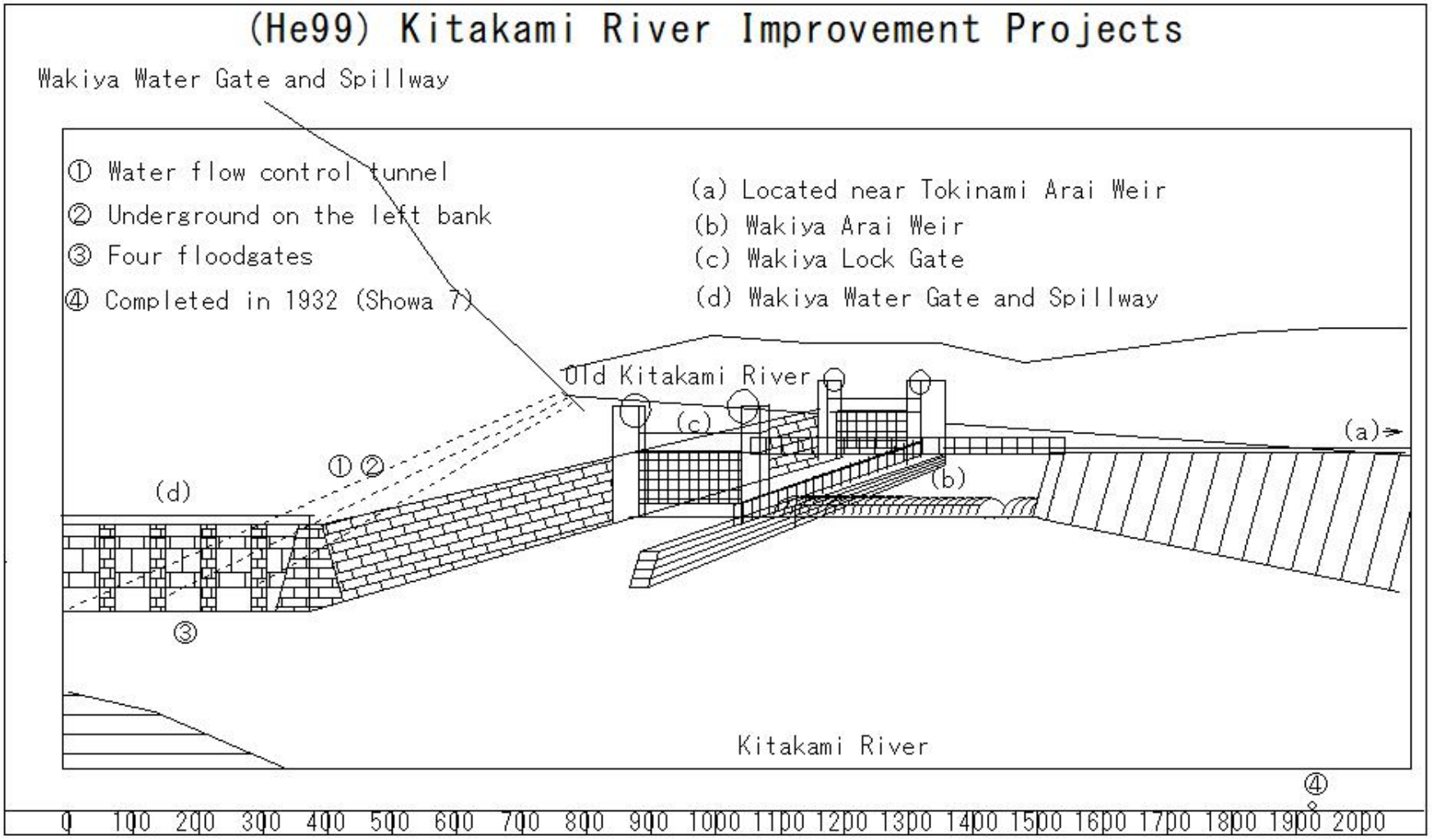
(He97) Kitakami River Improvement Projects



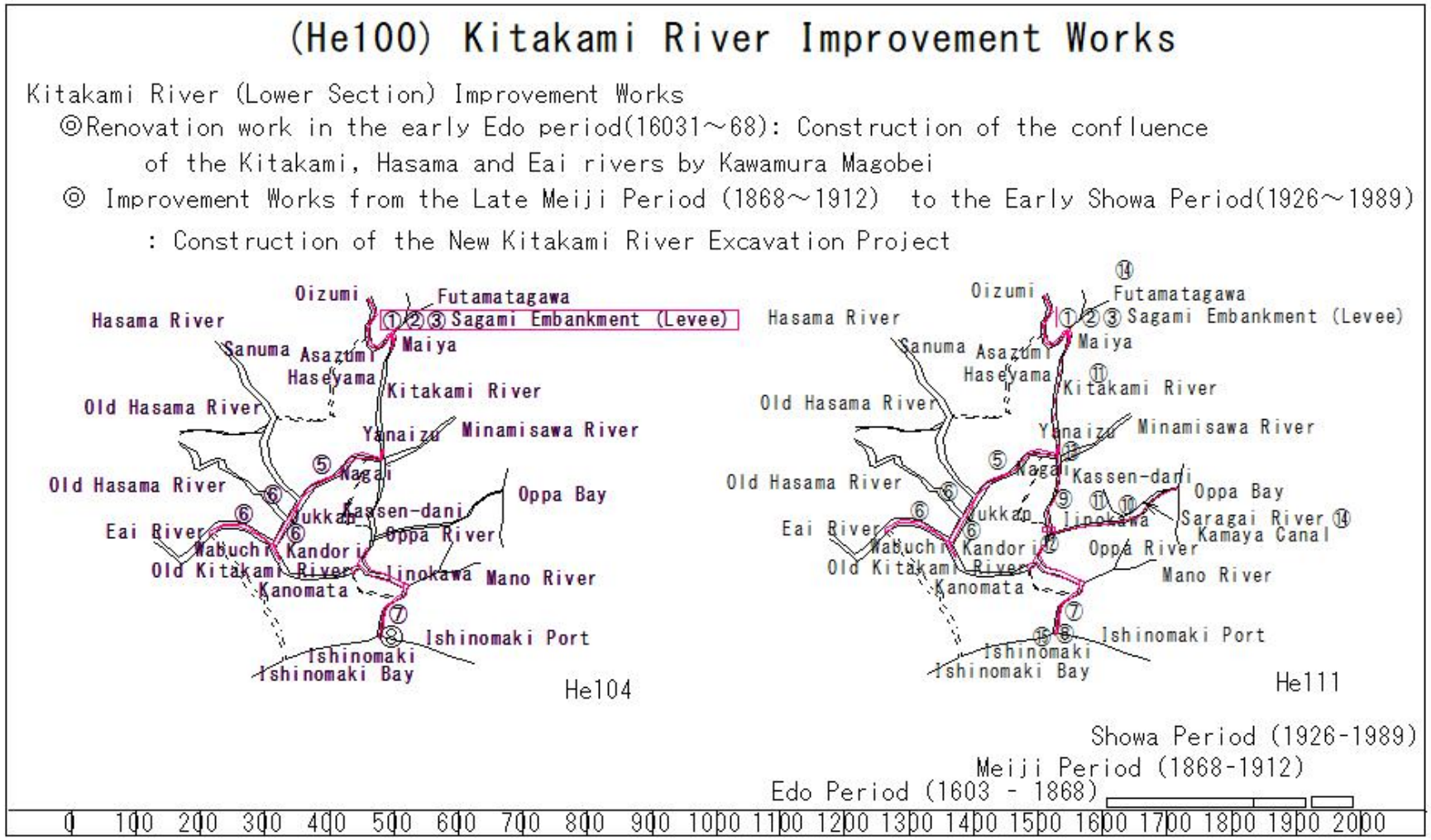
(He98) Kitakami River Improvement Projects



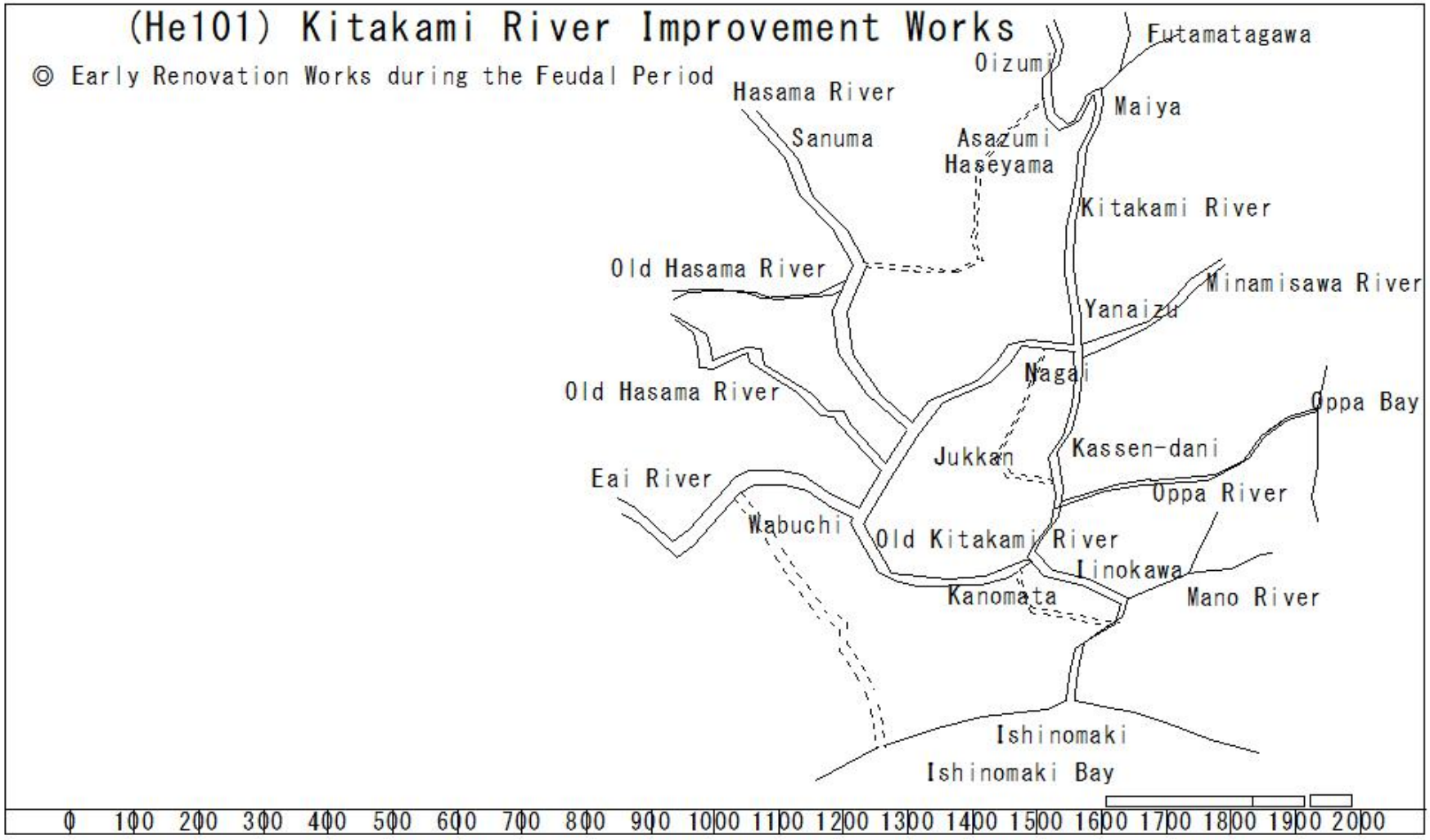
(He99) Kitakami River Improvement Projects



(He100) Kitakami River Improvement Projects



(He101) Kitakami River Improvement Projects



(He102) Kitakami River Improvement Projects

(He102) Kitakami River Improvement Works

◎ Early Renovation Works during the Feudal Period

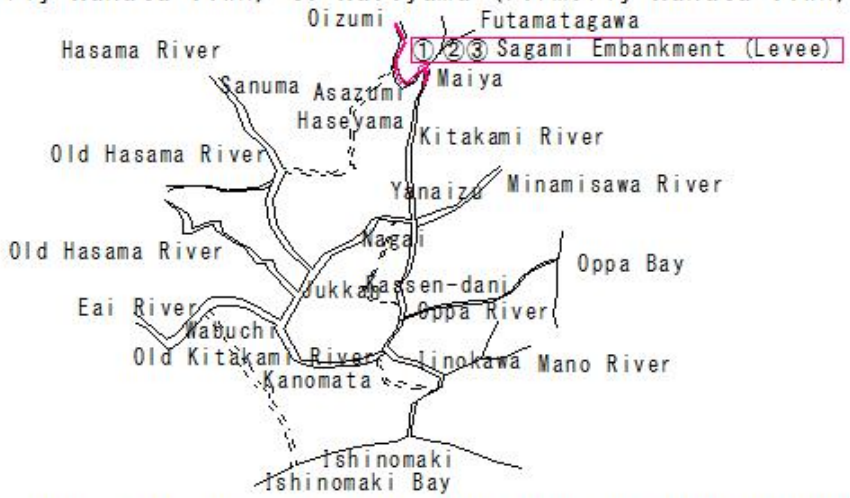
Renovation Works Overview

1. Construction of the Sagami Embankment (Levee)

① The first lord of Tome , Date (Shiraishi) Sagami no Kami Munenao, constructed the Sagami Embankment (Levee) between 1605 and 1608.

② Blocked the flow of the Kitakami River downstream to the Hasama River, diverted the Kitakami River to the Futamata River, and diverted all water from the upper reaches of the Kitakami River south toward Yanaizu (formerly Tsuyama Town).

③ Along with this change in course, construction of a levee (the "Sagami Embankment") from Oizumi (formerly Nakata Town) to Haseyama (formerly Nakata Town) was also carried out.



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(He103) Kitakami River Improvement Projects

(He103) Kitakami River Improvement Works

◎ Early Renovation Works during the Feudal Period

Renovation Works Overview

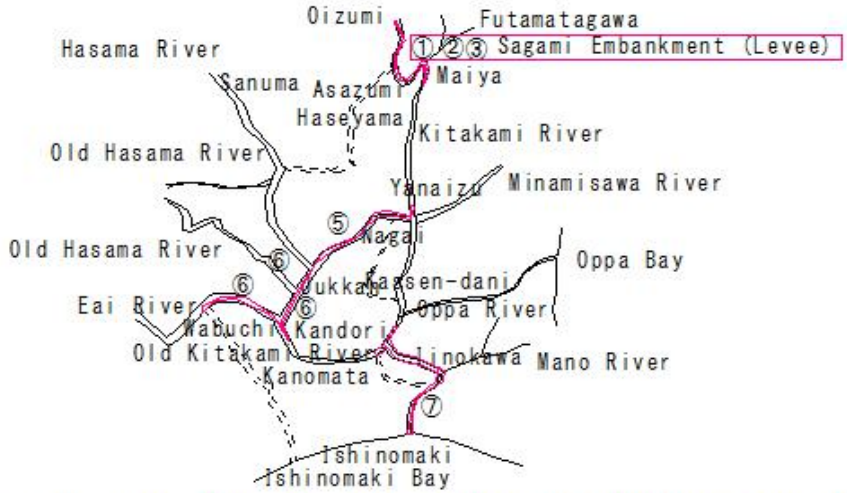
3. Confluence of the Kitakami, Eai, and Hasama Rivers

④ In 1616, Kawamura Magobei Shigeyoshi first merged the Eai and Hasama Rivers.

⑤ From 1623 to 1626, he improved the river channel of the Kitakami River between Yanaizu and Kandori(approximately 5.2 km).

⑥ The three rivers merged to join the Eai and Hasama Rivers. In addition,

⑦ At this time, the river channel from Kanomata to Ishinomaki was also improved by partially excavating a new channel.



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(He104) Kitakami River Improvement Projects

(He104) Kitakami River Improvement Works

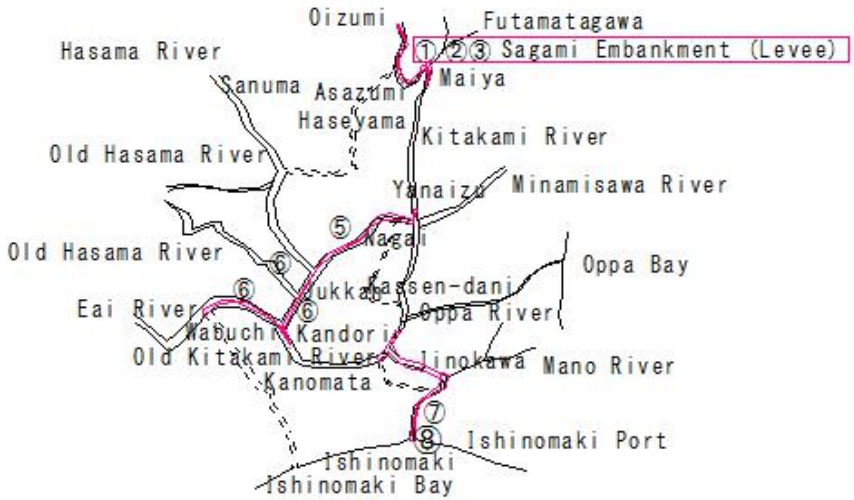
◎ Early Renovation Works during the Feudal Period

Renovation Works Overview

4. Opening of Ishinomaki Port

⑦ Kawamura Magobei Jukichi excavated the waterway between Kanomata and Ishinomaki,

⑧ opened Ishinomaki Port as a base for exports.



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(He105) Kitakami River Improvement Projects

(He105) Kitakami River Improvement Works

Overview of the Renovation Works from the Late Meiji Period to the Early Showa Period

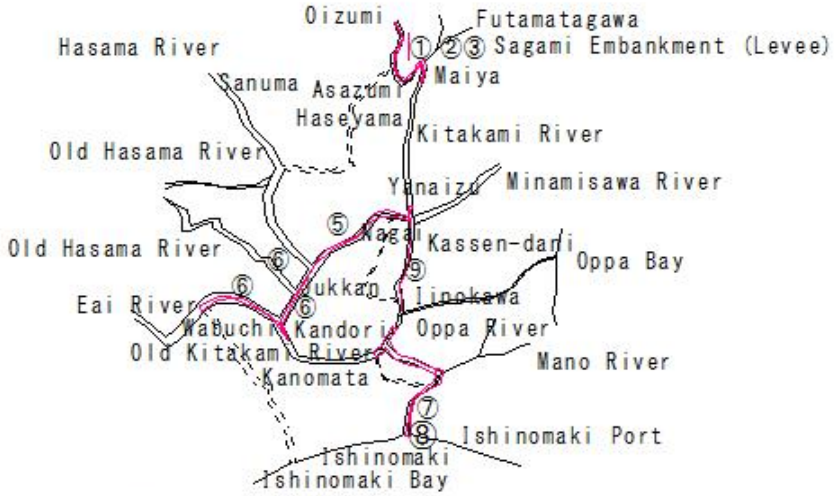
1. Purpose of the Renovation Works

The purposes of these renovation works were, first, to prevent flooding; second, to prevent backflow of the Kitakami River tributaries, the Hasama River and the Eai River, thereby eliminating flooding damage; and third, to improve the navigation channel.

2. Major Works

⑨ Excavation of the New Kitakami River

The excavation of the new river stretched from Yanaizu to the downstream Iinogawa (river width: 445 m at Yanaizu, 290-445 m at Kassenya). Work began in 1912 and was completed in 1925.



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(He106) Kitakami River Improvement Projects

(He106) Kitakami River Improvement Works

Overview of the Renovation Works from the Late Meiji Period to the Early Showa Period

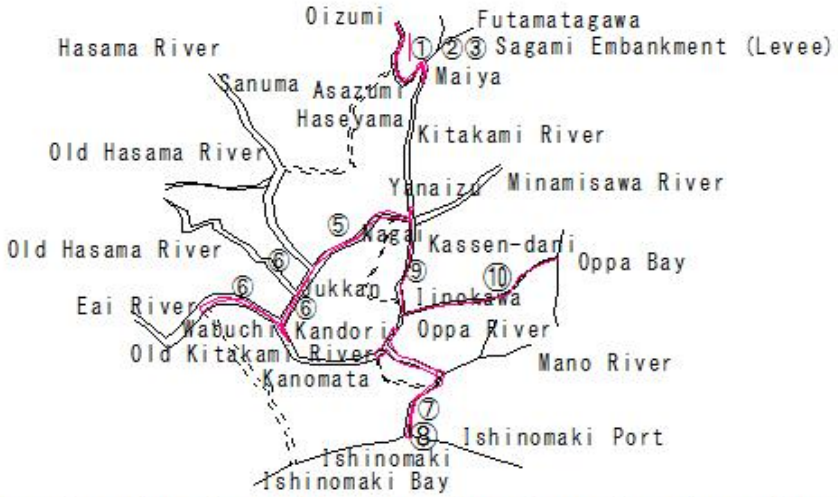
1. Purpose of the Renovation Works

The purposes of these renovation works were, first, to prevent flooding; second, to prevent backflow of the Kitakami River tributaries, the Hasama River and the Eai River, thereby eliminating flooding damage; and third, to improve the navigation channel.

2. Major Works

⑩ Dredging of the Former Oppa River and Other Areas

Dredging of the Former Oppa River stretched approximately 15 km from the Iinogawa point along the former Oppa River to its mouth. Construction began in 1912 and was completed in 1928.



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(He107) Kitakami River Improvement Projects

(He107) Kitakami River Improvement Works

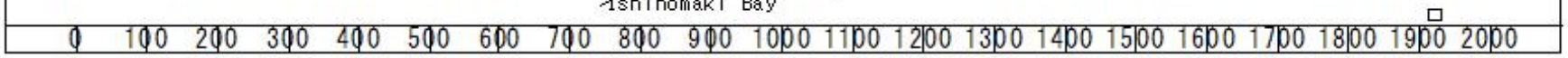
◎ Improvement Works from the Late Meiji Period (1868～1912) to the Early Showa Period(1926～1989):
Construction of the New Kitakami River Excavation Project

2. Major Works

⑪ Raising and Embankment Work

The raising work will cover approximately 23km of land, including the left bank from the Sagatate Embankment to the Ogushi Embankment, from the Iwate Prefecture border to Yanaizu, and the right bank from the Oizumi Embankment to the Tokinami Embankment.

Embankment work will begin with the Yokokawa Embankment on the right bank, and Nakano Jusanhama.



(He108) Kitakami River Improvement Projects

(He108) Kitakami River Improvement Works

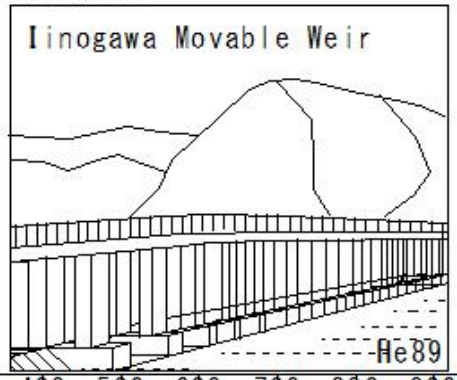
◎ Improvement Works from the Late Meiji Period (1868～1912) to the Early Showa Period(1926～1989):
Construction of the New Kitakami River Excavation Project 2. Major Works

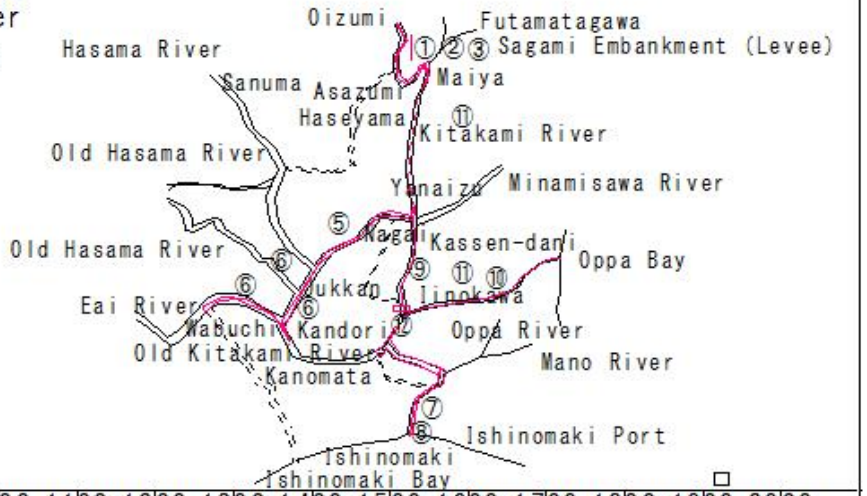
⑫ Construction of the Iinogawa Movable Weir

The Iinogawa Movable Weir, measuring 409 meters in width (16 of its 21 spans were rolling gates), was installed 14.8 kilometers from the river mouth in 1931. Upon its completion, the New Kitakami River began to allow water to flow through it.

Purposes of the Installation of the Iinogawa Movable Weir

1. Maintain the water level of the New Kitakami River downstream of Yanaizu and the Old Kitakami River, ensuring irrigation water
2. Facilitate navigation on the Old Kitakami River
3. Prevent the riverbed of the New Kitakami River from lowering and stabilize the river channel
4. Prevent salt intrusion





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(He109) Kitakami River Improvement Projects

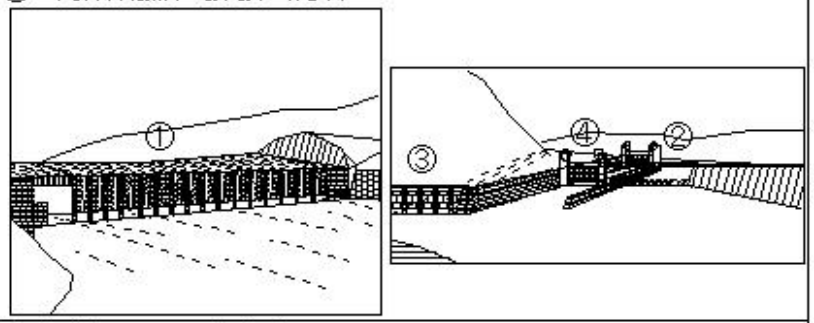
(He109) Kitakami River Improvement Works

◎ Improvement Works from the Late Meiji Period (1868～1912) to the Early Showa Period(1926～1989):
Construction of the New Kitakami River Excavation Project 2. Major Works

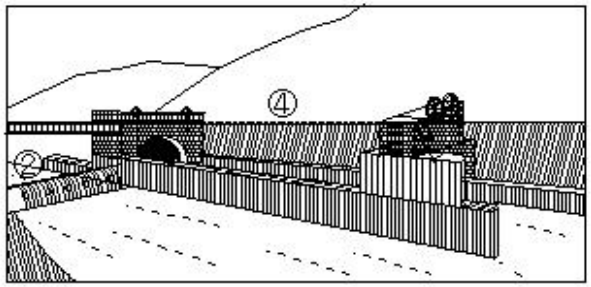
⑬ Installation of Diversion Facilities, etc.

In consideration of the objectives of the Kitakami River Improvement Project flood control, navigational channel development, and irrigation and drainage diversion facilities were installed.

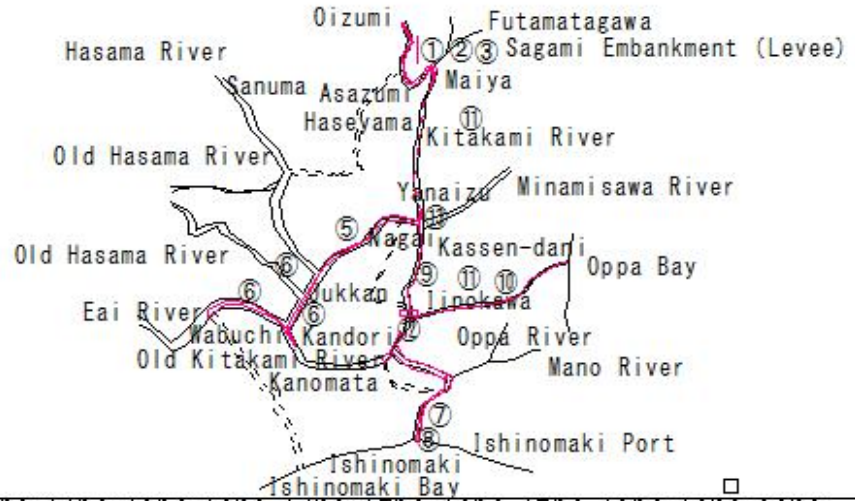
① Tokinami-arai Weir



② Wakiya-arai Weir



① Tokinami-arai Weir ③ Wakiya Water Gate
② Wakiya-arai Weir ④ Wakiya Lock Gate



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(He110) Kitakami River Improvement Projects

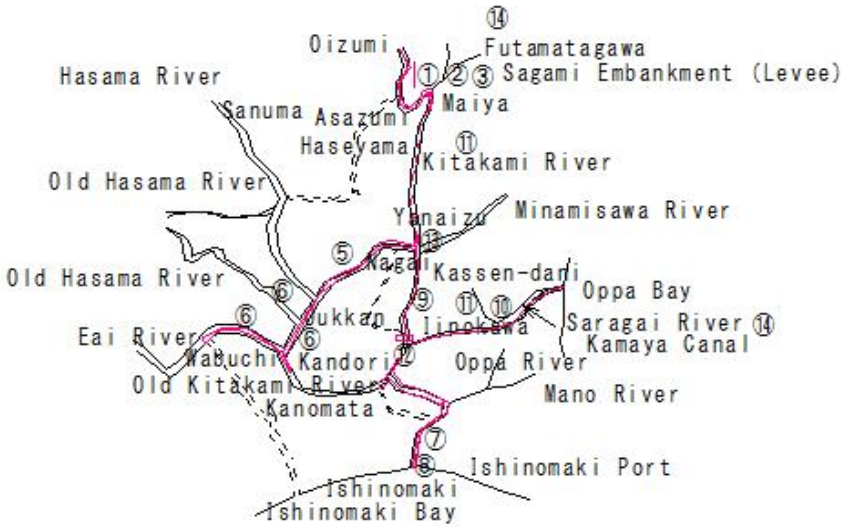
(He110) Kitakami River Improvement Works

◎ Improvement Works from the Late Meiji Period (1868～1912) to the Early Showa Period(1926～1989): Construction of the New Kitakami River Excavation Project 2. Major Works

⑭ Ancillary Works

① Irrigation canals, drainage channels, etc. that were blocked or affected by the excavation of the Shin Kitakami River were repaired as ancillary works.

② The Futamata Canal, Saragai River Canal, Kamaya Canal, etc., as well as their associated sluice gates, were also newly constructed.



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(He111) Kitakami River Improvement Projects

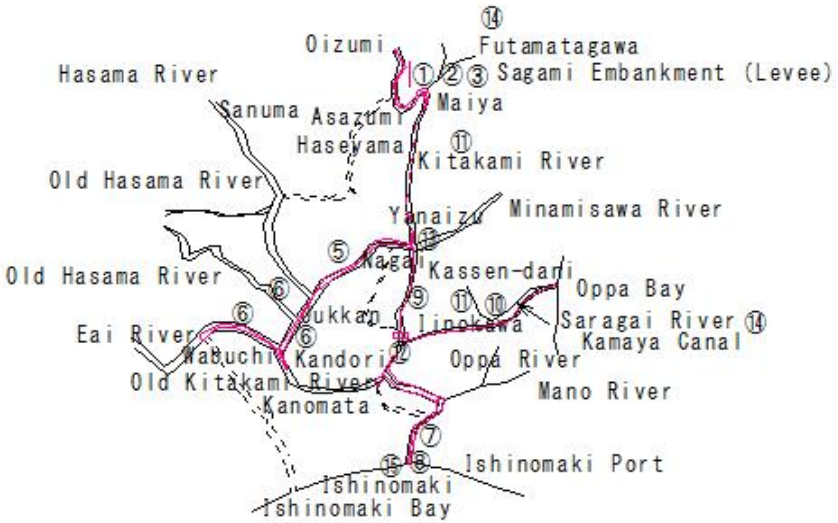
(He111) Kitakami River Improvement Works

◎ Improvement Works from the Late Meiji Period (1868～1912) to the Early Showa Period(1926～1989): Construction of the New Kitakami River Excavation Project 2. Major Works

⑮ Improvement of Ishinomaki Port

① To increase the water depth at the mouth of the Kitakami River and restore navigational conditions.

② Jetties were constructed on both sides of the river mouth.



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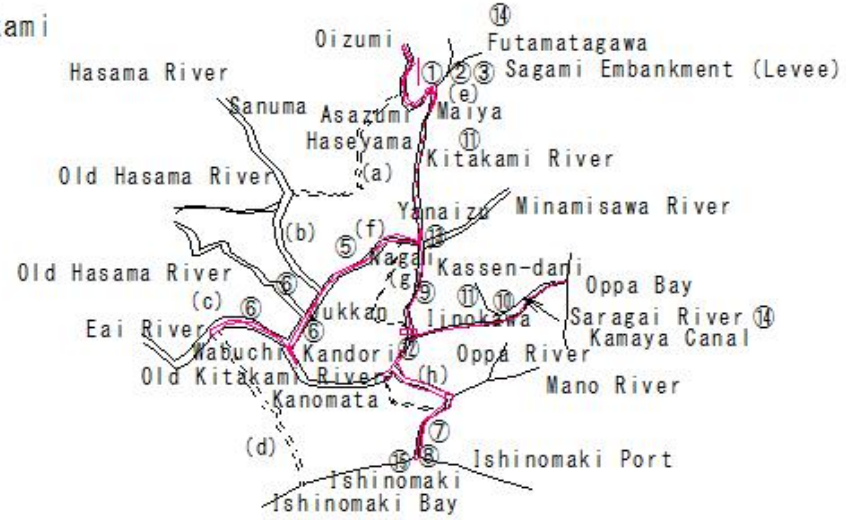
(He112) Kitakami River Improvement Projects

(He112) Kitakami River Improvement Works

(a) The ancient course of the Kitakami River
(b) The new Hasaka River, excavated during the Hasaka River Improvement Project (1932-1939)
(c) The river channel constructed by Kawamura Magobei (1616) to allow the Hasaka River to merge with the river
(d) The ancient course of the Eai River (Tamatsukuri River)
(e) The river channel constructed by Shiraishi Sagami Munenao (1605-1610)
(f) The river channel constructed by Kawamura Magobei (1623-26) to allow the three rivers (Kitakami, Hasaka, and Eai) to merge
(g) The river channel constructed during the Kitakami River Improvement Project (1911-1934)
(h) The river channel constructed by Kawamura Magobei (1623-1626)



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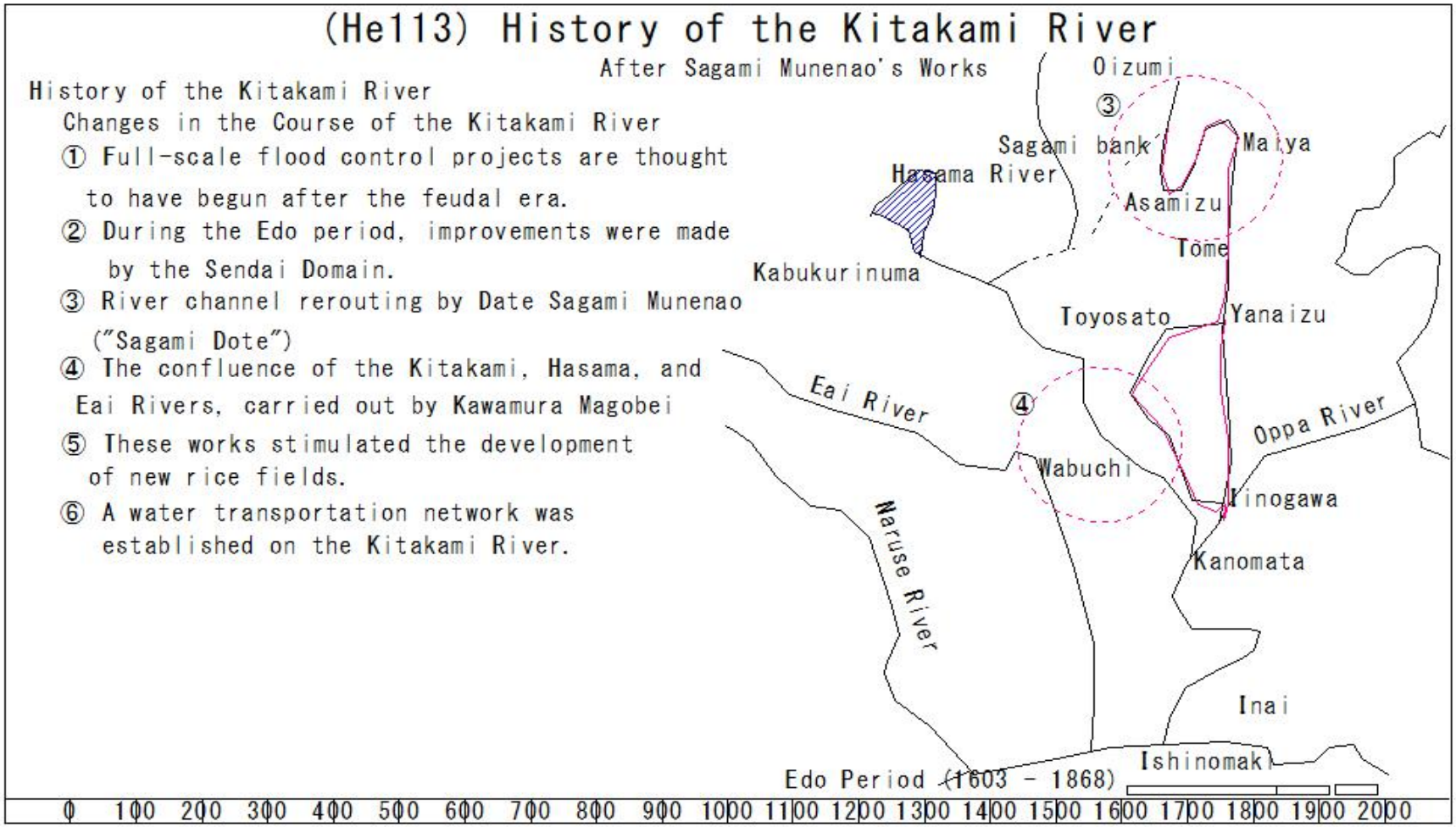
(He113) History of the Kitakami River



(He114) History of the Kitakami River

(He114) History of the Kitakami River

History of the Kitakami River

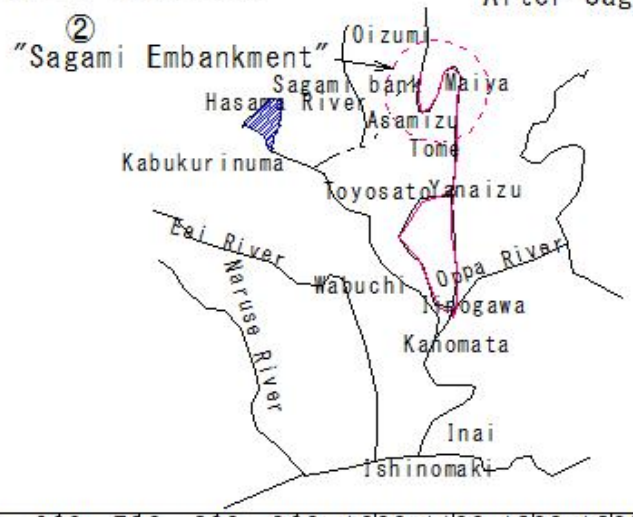
Changes in the Course of the Kitakami River
Primitive River and the Kitakami River in the Edo Period,

① Primitive rivers did not have a fixed channel like today, but instead had low-lying marshes spread across the plains.

② In 1605 (Keicho 10), Date Sagami Munenao, lord of Tome Castle, began construction of the "Sagami Embankment" to develop his territory and new rice fields.

③ Completed in 1610 (Keicho 15), the Kitakami River was choked at Asamizu in Nakata Town and diverted toward Maiya in Towa Town.

After Sagami Munenao's Works



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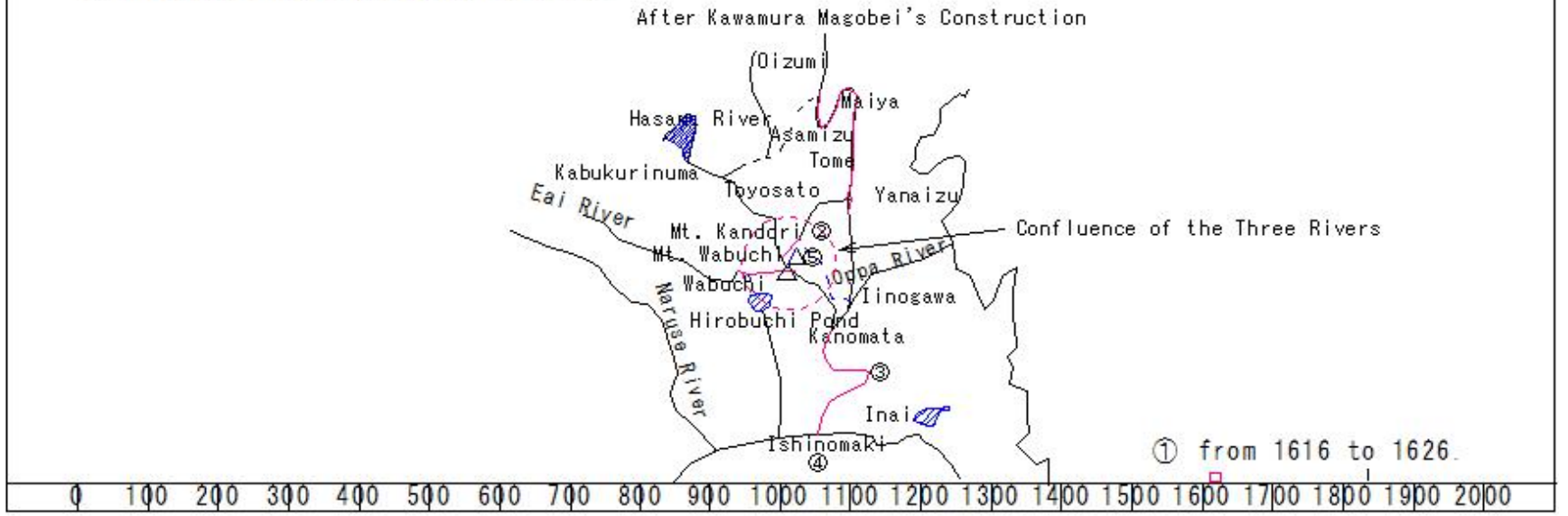
(He115) History of the Kitakami River

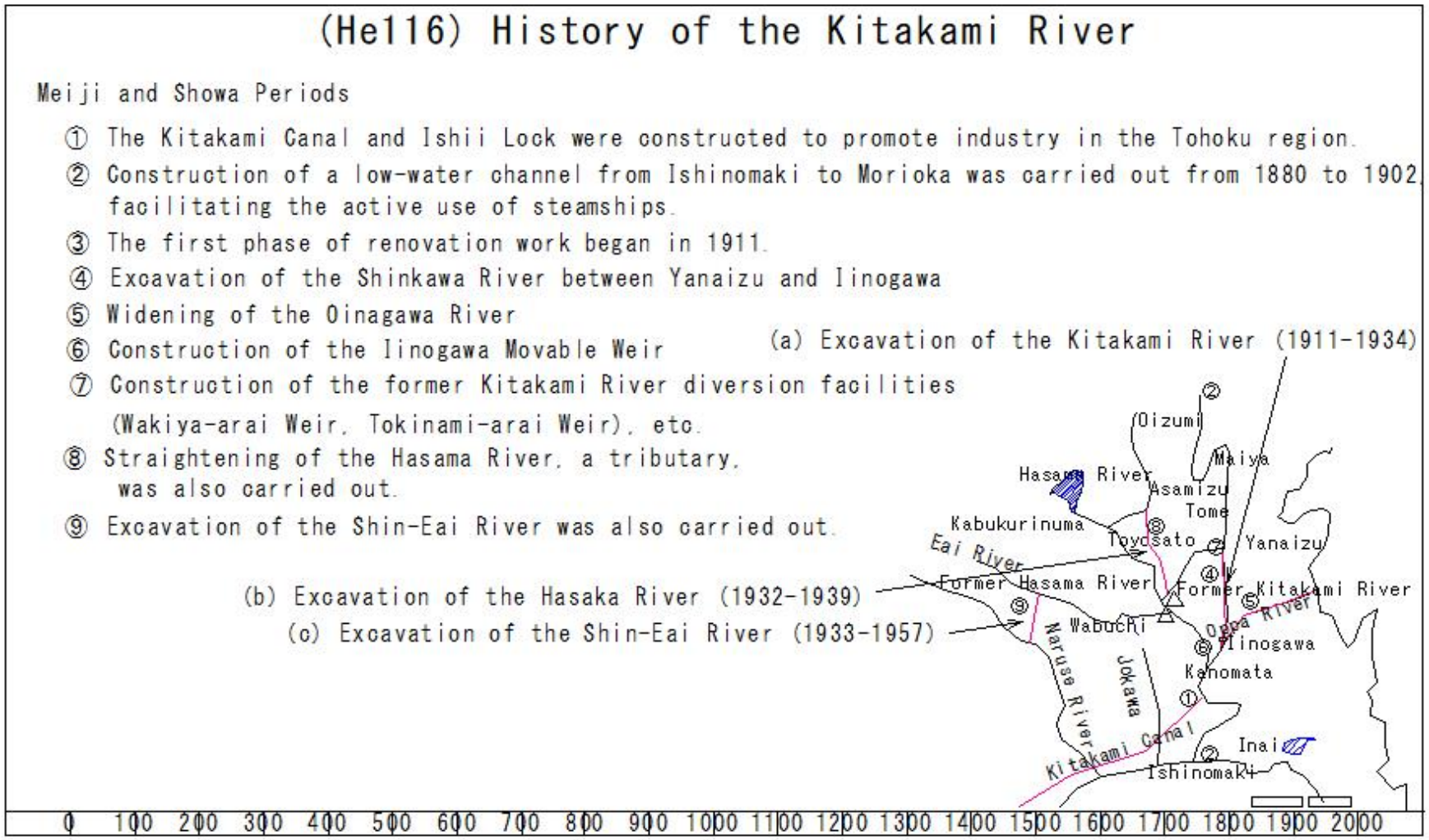
(He115) History of the Kitakami River

History of the Kitakami River

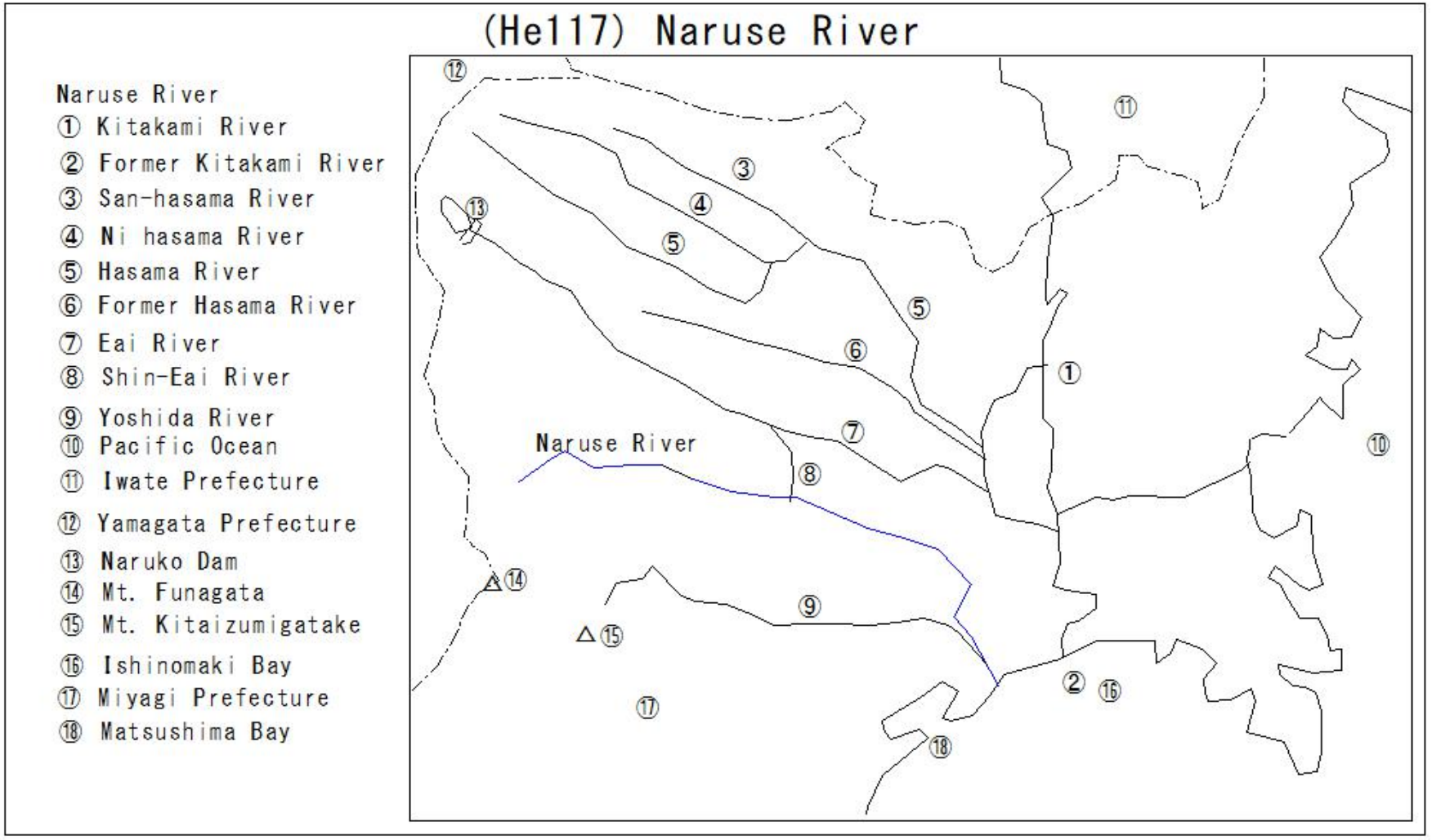
① Kawamura Magobei, a vassal of Date Masamune, worked from 1616 to 1626.
② He merged the Kitakami River, Hasama River, and Eai River between Mt. Wabuchi and Mt. Kandori
③ He excavated a channel from Kanomata to Ishinomaki to secure a shipping route.
④ Ishinomaki, at the river's mouth, became a collection point for rice shipped to Edo and prospered as a river port.
⑤ Floodwaters from the three rivers began to collect at the narrow Wabuchi section, and flooding became common upstream.



(He116) History of the Kitakami River



(He117) Naruse River



(He118) Naruse River

(He118) Naruse River

Naruse River

History of Flood Control on the Naruse River

①From around 1688, renovation work was carried out from Nenushi and Oyanagisakai in Nango Village to the river mouth, with the main focus being on straightening the river.

②Plans were made to reclaim Shinai Numa, which was a floodplain for the Yoshida River, and the Genroku Cave was excavated in 1697.

③In the Meiji era, in the hope of promoting the development of the Tohoku region, construction of a direct national sea route project centered on the Nobiru Port at the mouth of the Naruse River began in 1878 (Meiji 11).

④In 1890, the Kitakami River and Abukuma River were connected by the Touna Canal, Kitakami Canal, and Teizan Canal.

⑤Construction of the Nobiru port had to be halted due to disasters and financial problems.

⑥At the end of the Meiji period, a new Meiji tunnel was excavated to drain floodwaters around Shinai Marsh into Matsushima Bay.

⑦In 1916, Miyagi Prefecture came up with a grand plan to merge the Eai, Naruse, and Yoshida rivers and due to its importance, construction was made a national project from 1921 onwards.

⑧In the Showa era, excavation and construction of banks to separate the Tsuruta River basin from the Naruse River (1913-1926), and construction of back dikes to prevent floods from the Naruse River from flowing back into the Yoshida River (1925-1940)

⑨Installation of the Yoshida River Siphon, which crosses the Yoshida River overpass (1934)

⑩Furthermore, the excavation of the Shin-Eai River (1933-1957) was also carried out.

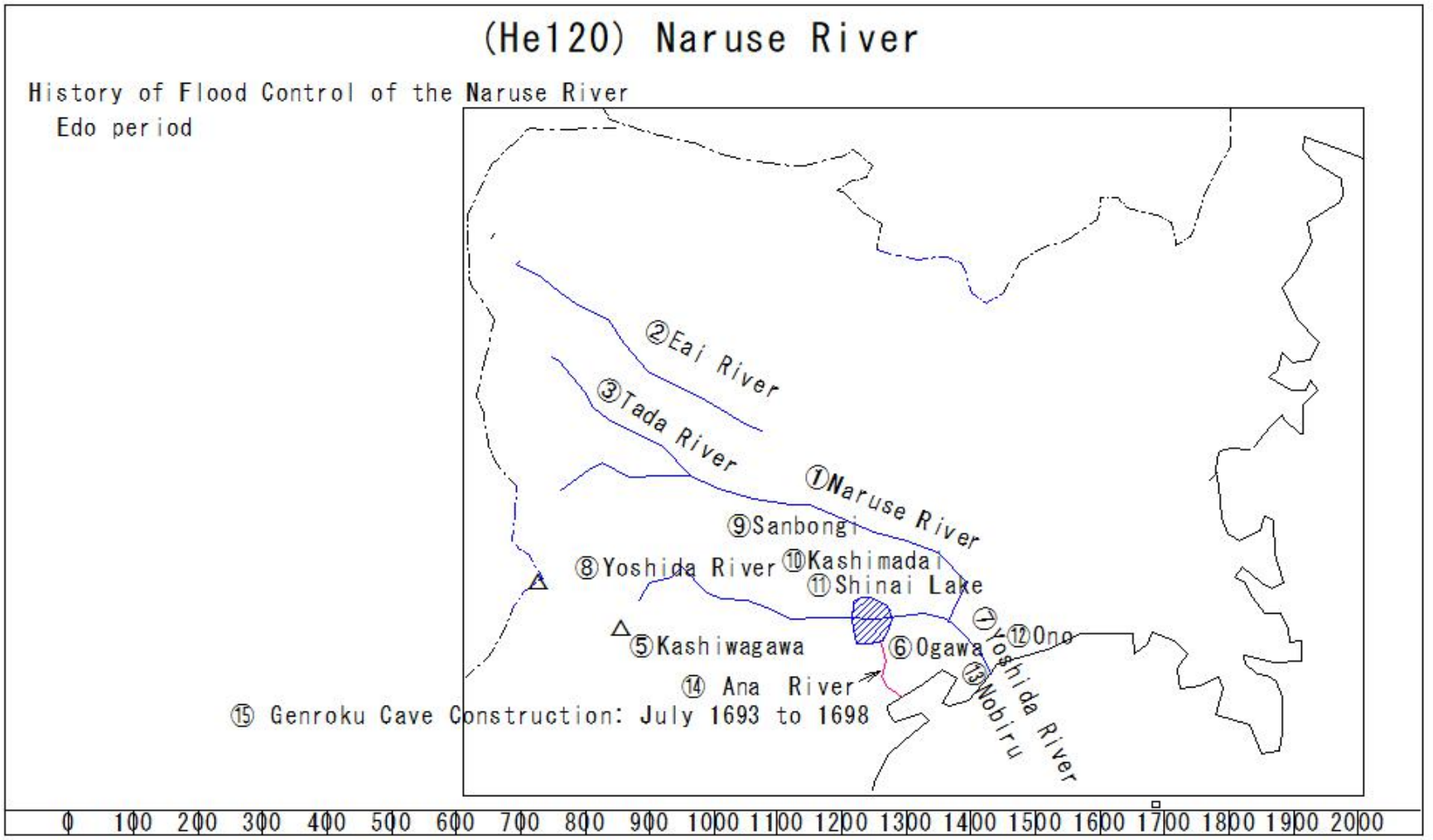
(He119) Naruse River

(He119) Naruse River

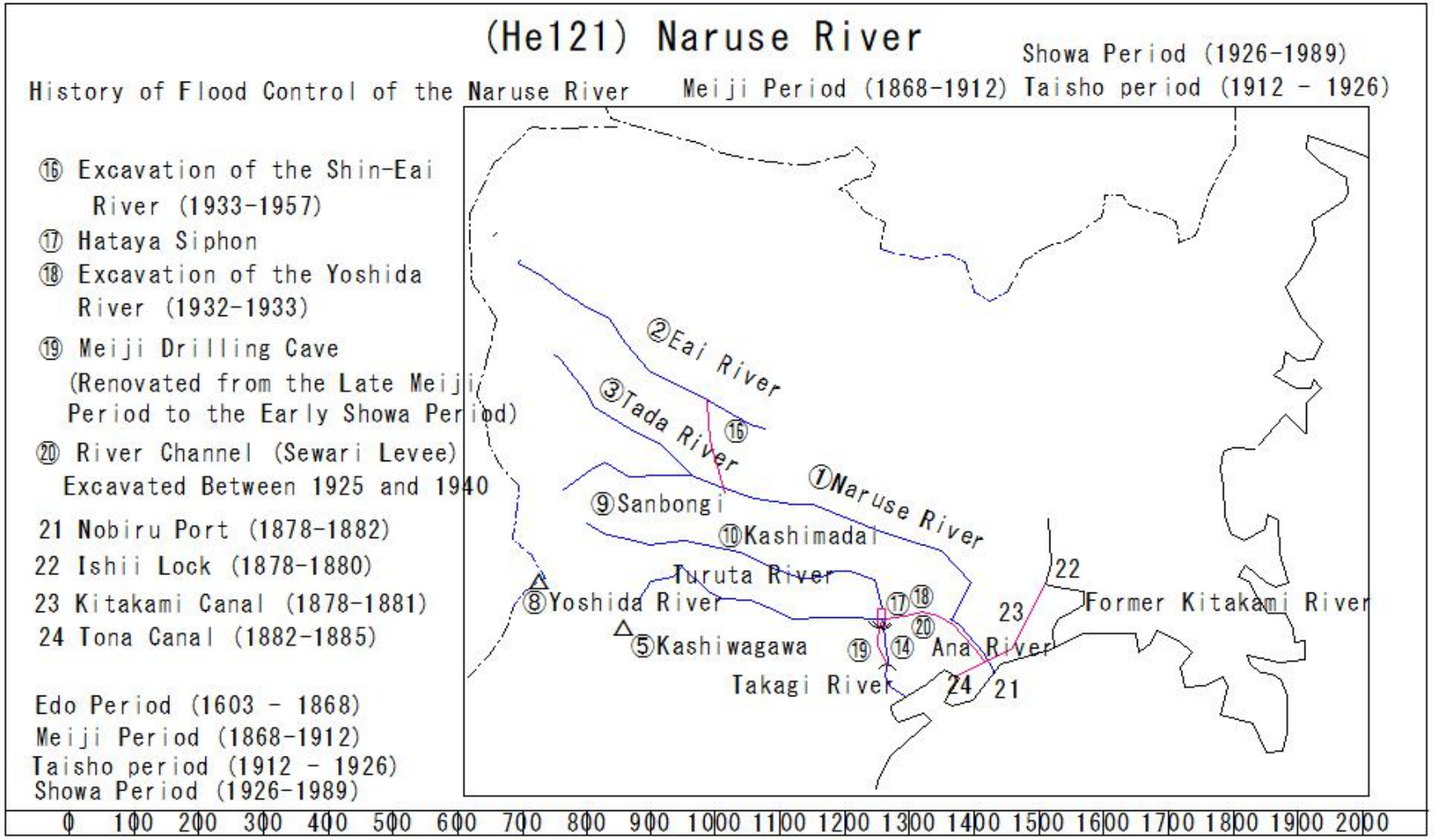
History of Flood Control of the Naruse River

Primitive River

(He120) Naruse River



(He121) Naruse River



(He122) Naruse River

(He122) Naruse River

Naruse River

History of Flood Control on the Naruse River

①From around 1688, renovation work was carried out from Nenushi and Oyanagisakai in Nango Village to the river mouth, with the main focus being on straightening the river.

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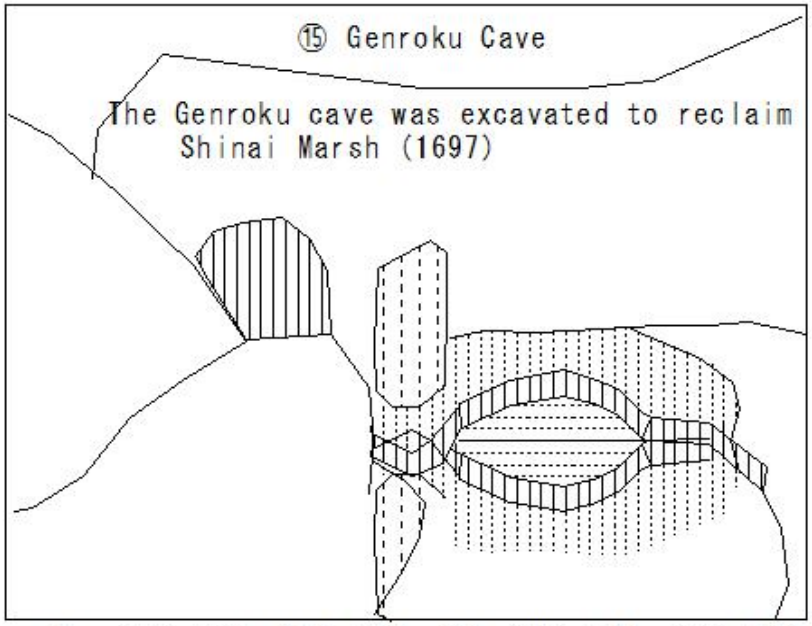

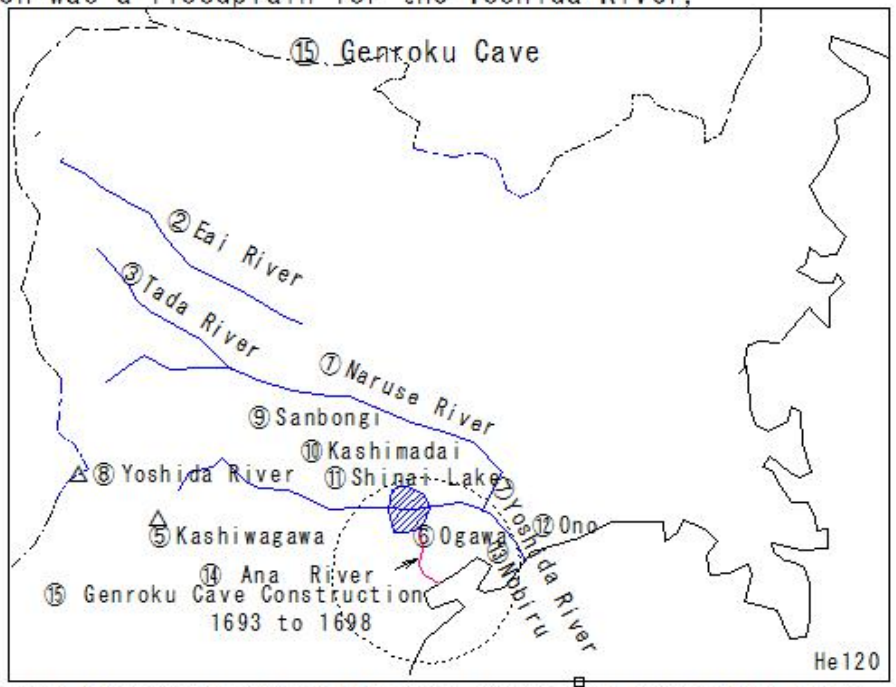

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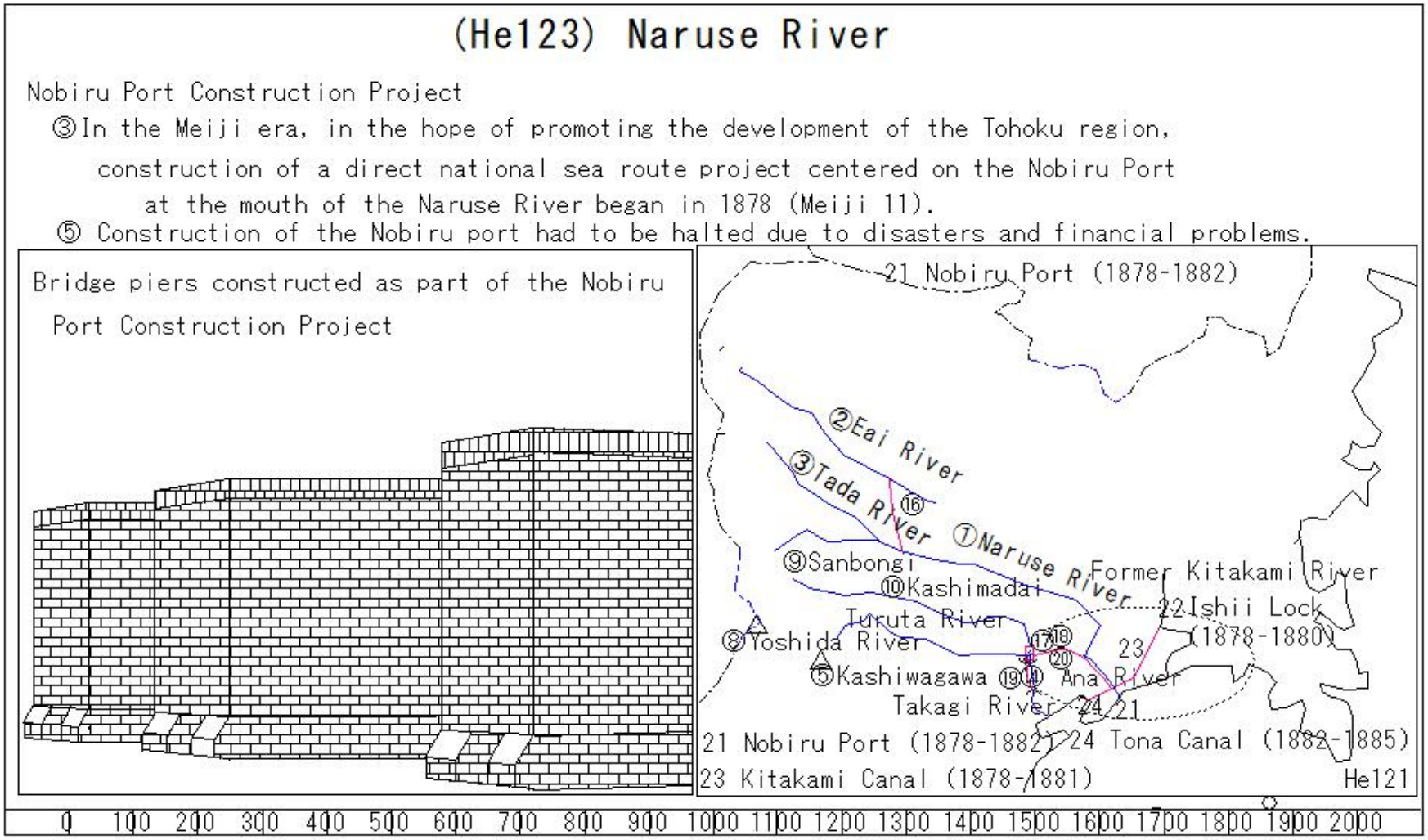
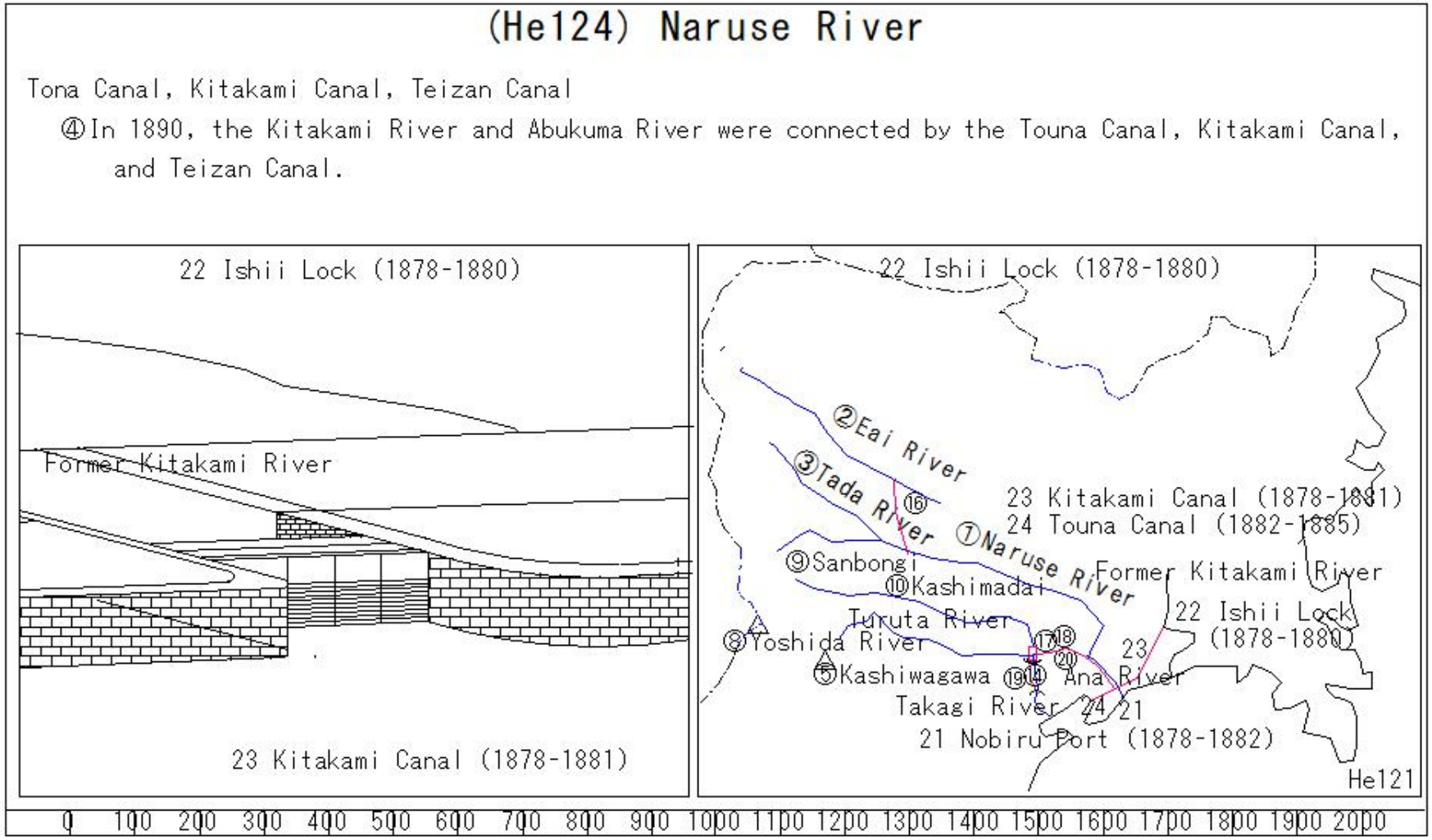
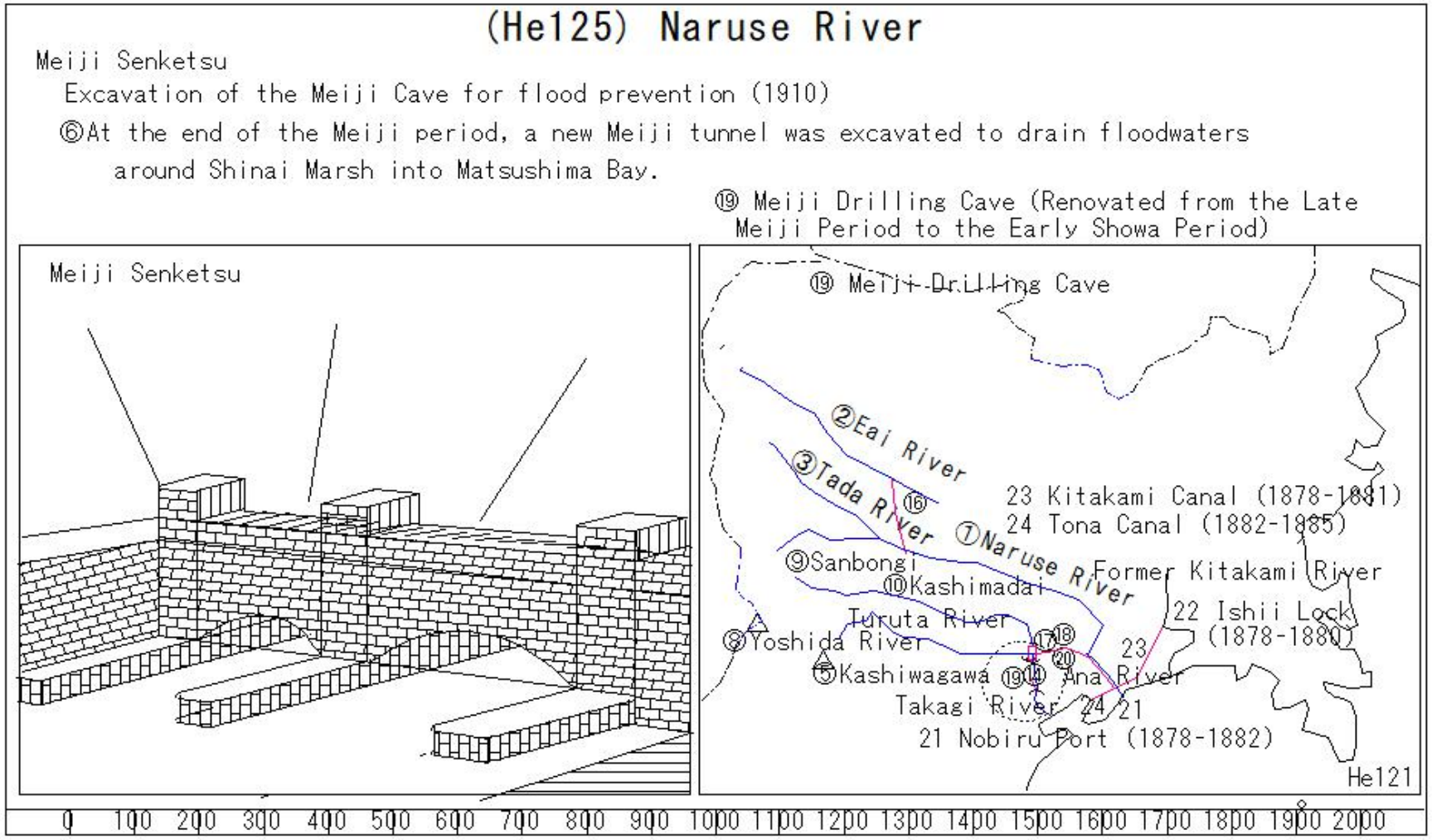
(He123) Naruse River



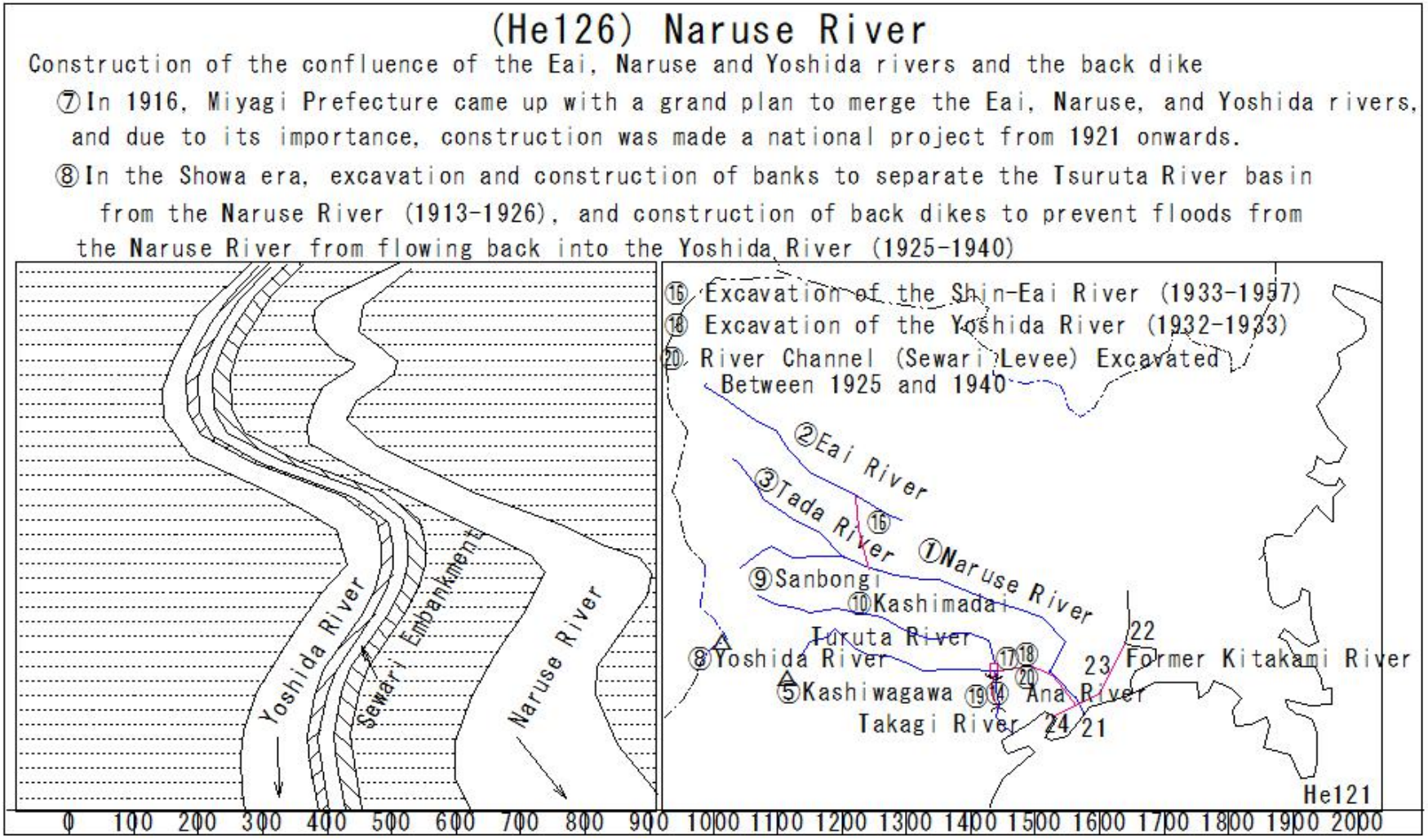
(He124) Naruse River



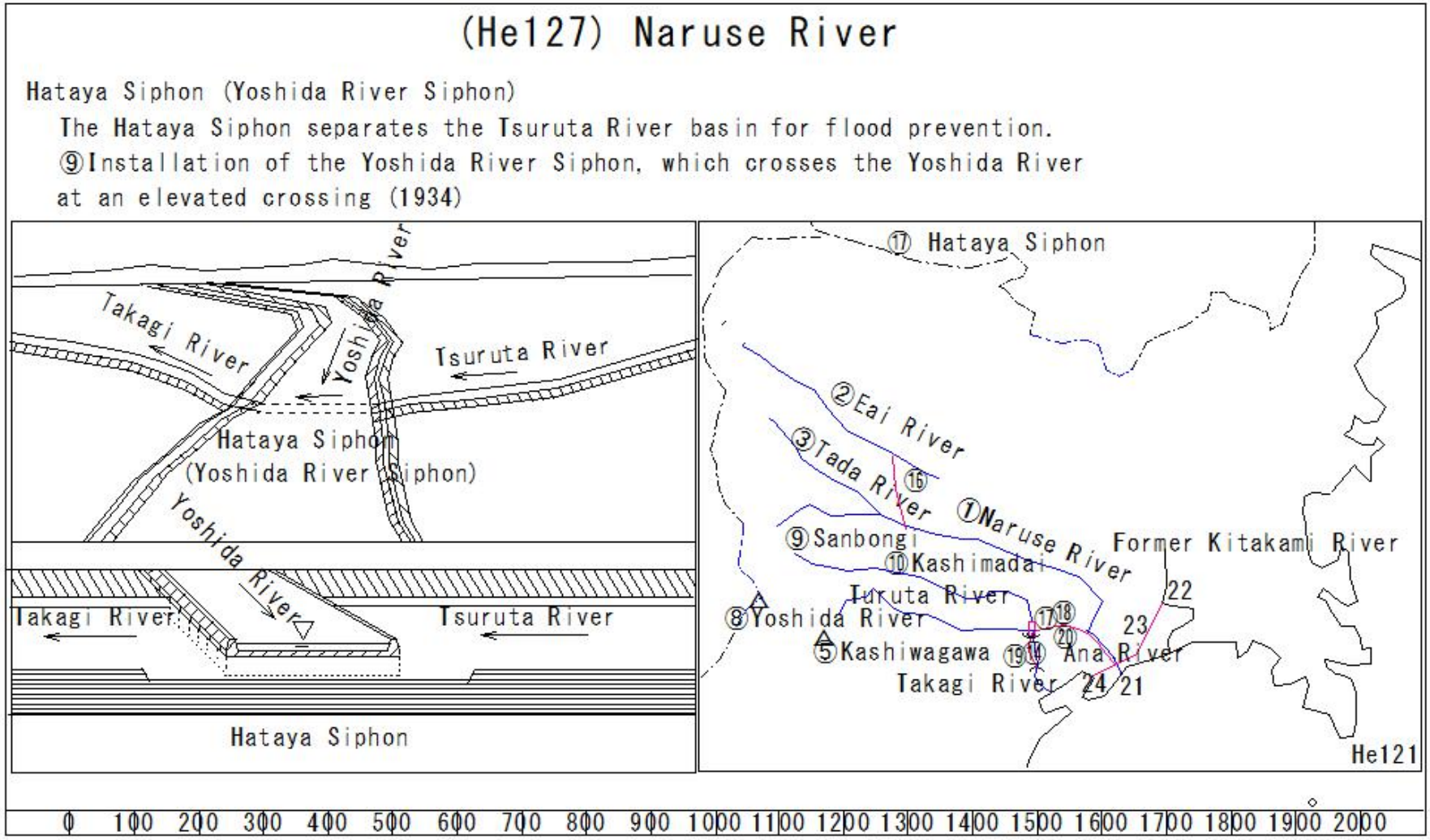
(He125) Naruse River



(He126) Naruse River



(He127) Naruse River



(He128) Naruse River

(He128) Naruse River

Separation of the Naruse River and Tsuruta River (Genroku Drilling Hole)

(Approximately 320 years ago)

①The Naruse River basin, with its low-lying terrain, has frequently suffered from flood damage. Since ancient times, measures such as river diversions and new river

②The Genroku Drilling Hole, which drains water into Matsushima Bay, was constructed in the flood-prone Shinai Marsh during the Edo period.

③The Genroku Drilling Hole, which began in 1693 (Genroku 6), included the construction of drainage ditches, the excavation of a ditch (Genroku Drilling Hole), and construction to prevent backflow of the Naruse River. It resulted in the development of 600 chobu (approximately 590 hectares) of new rice paddies.

○Changes in the Naruse River and Yoshida River Channels

Genroku Cave Overview

① Location: Matsushima Town, Miyagi County, Miyagi Prefecture
② River Name: Anakawa River, Takagi River System
③ Type: Two hand-dug tunnels
④ Specifications: Length 2,578m / Width 3.6m / Height 2.4m
⑤ Construction Start/Completion: 1693 (Genroku 6) / 1698 (Genroku 11)

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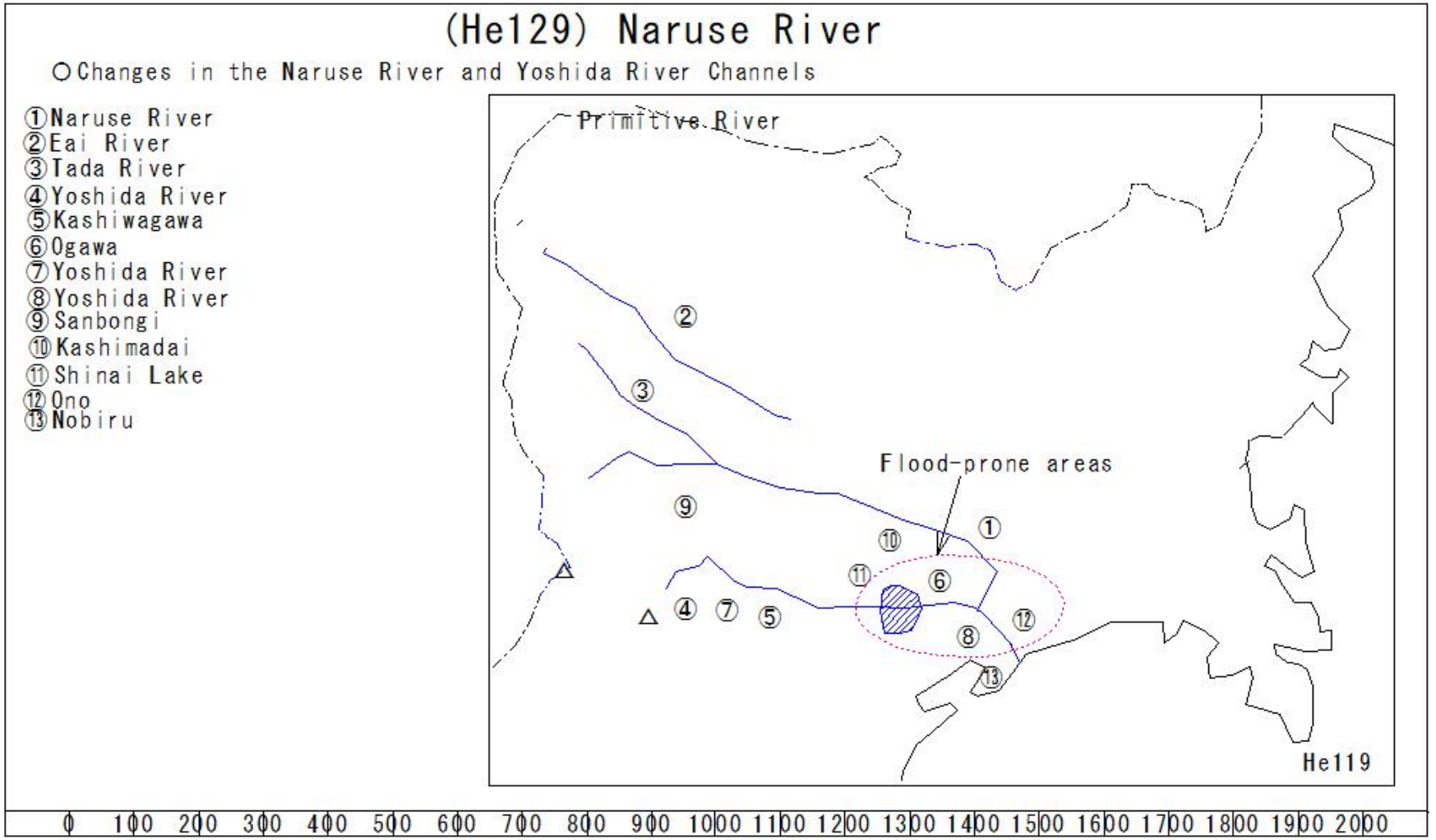
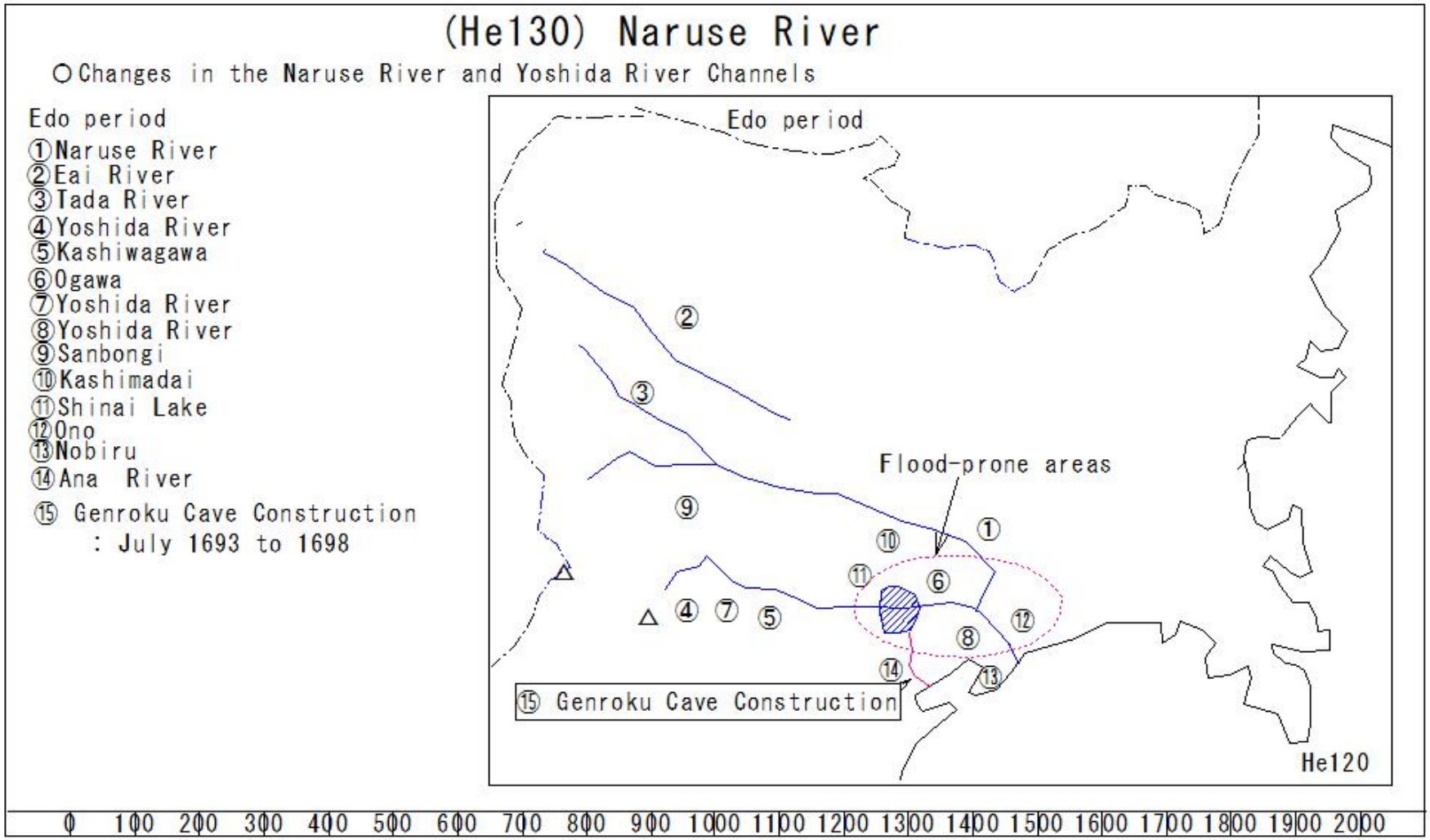
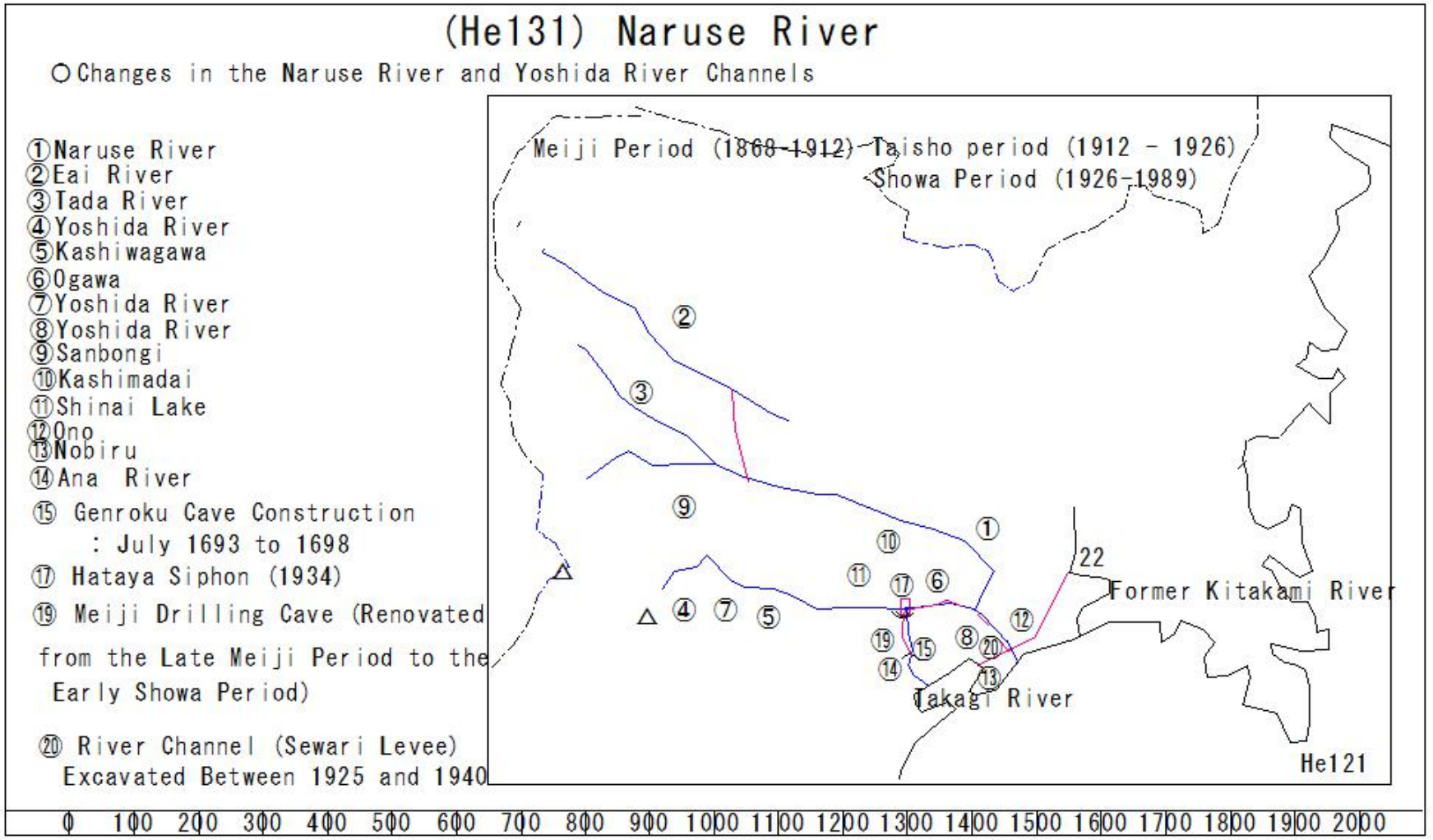
(He129) Naruse River



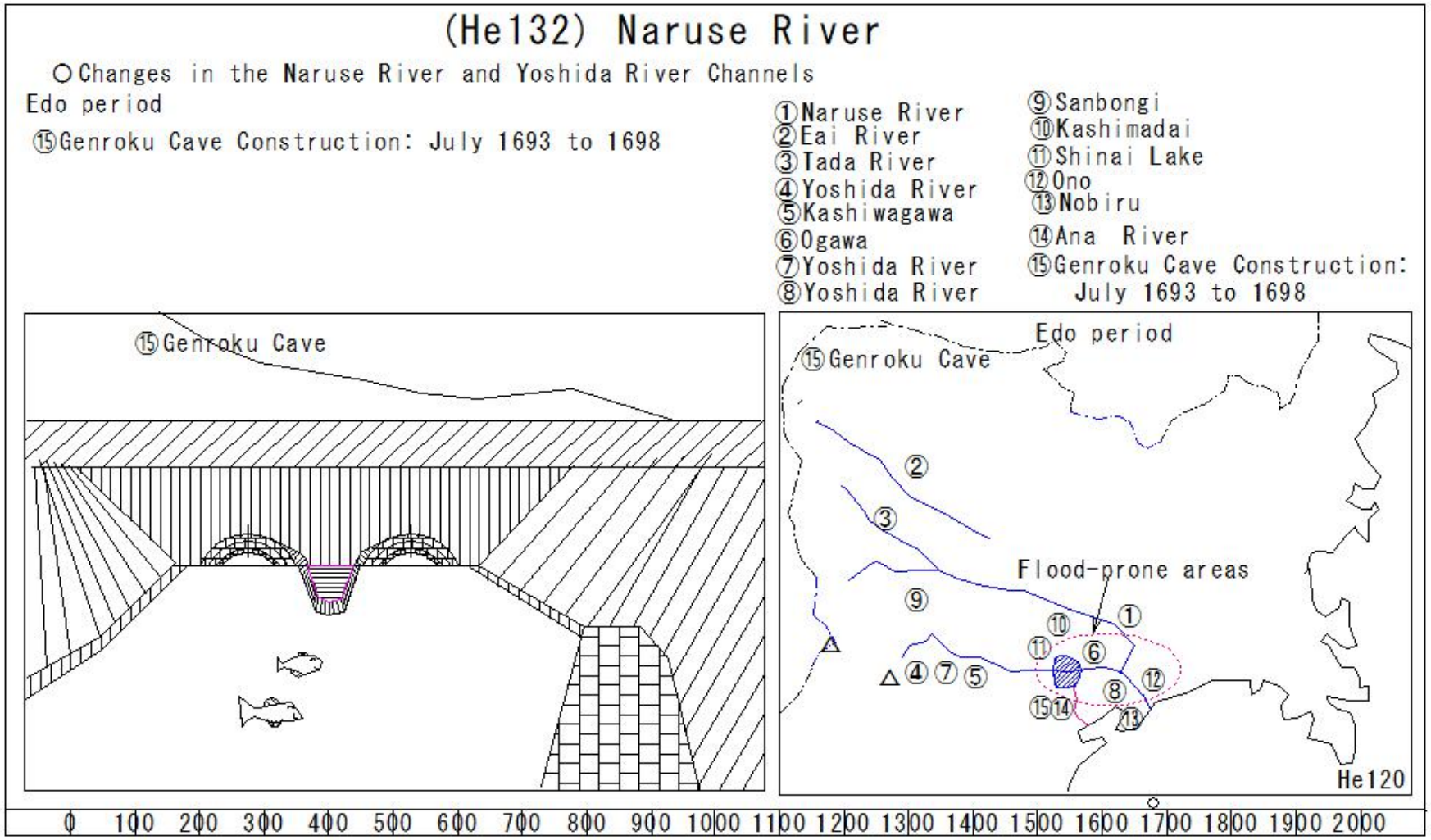
(He130) Naruse River



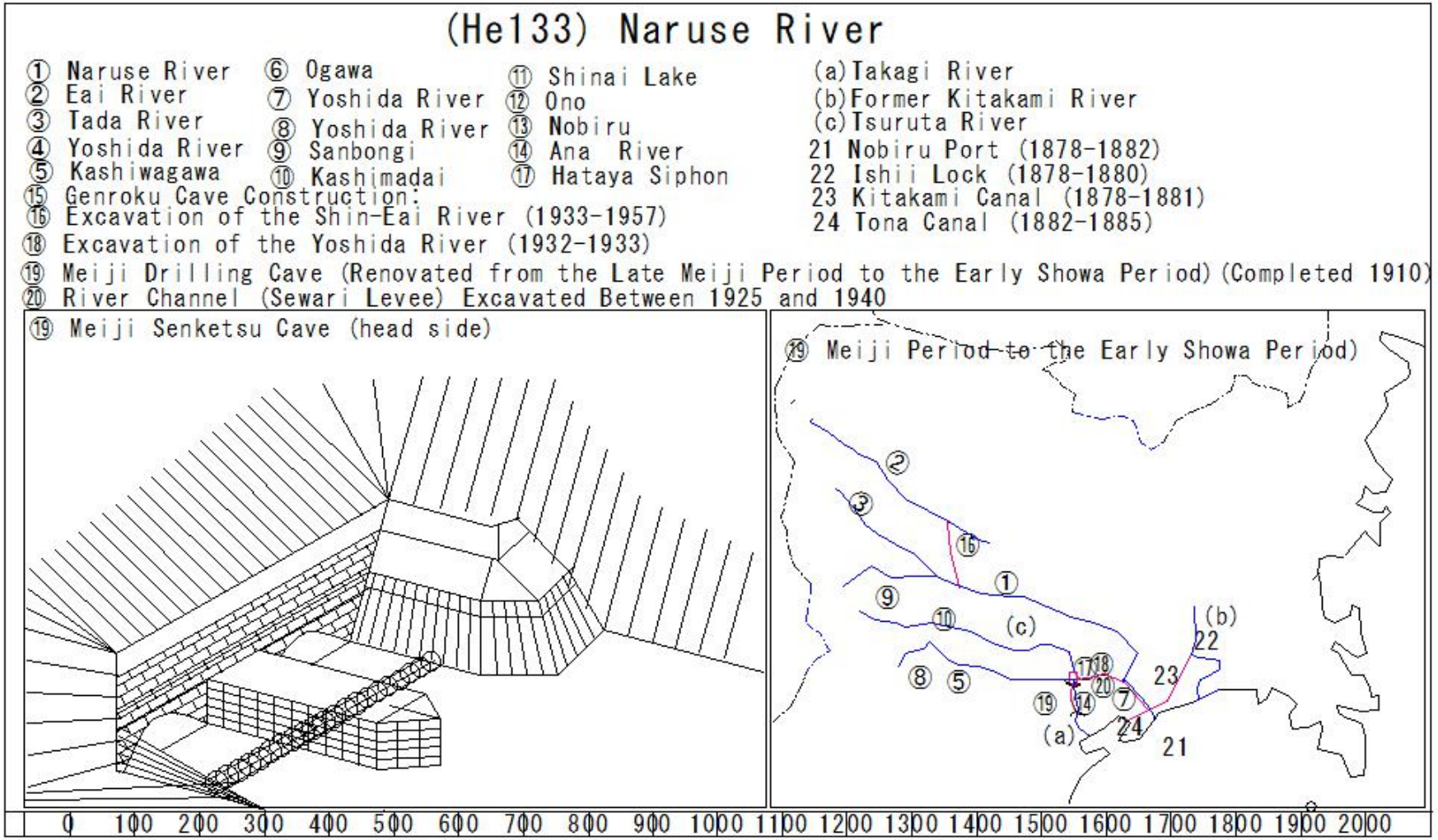
(He131) Naruse River



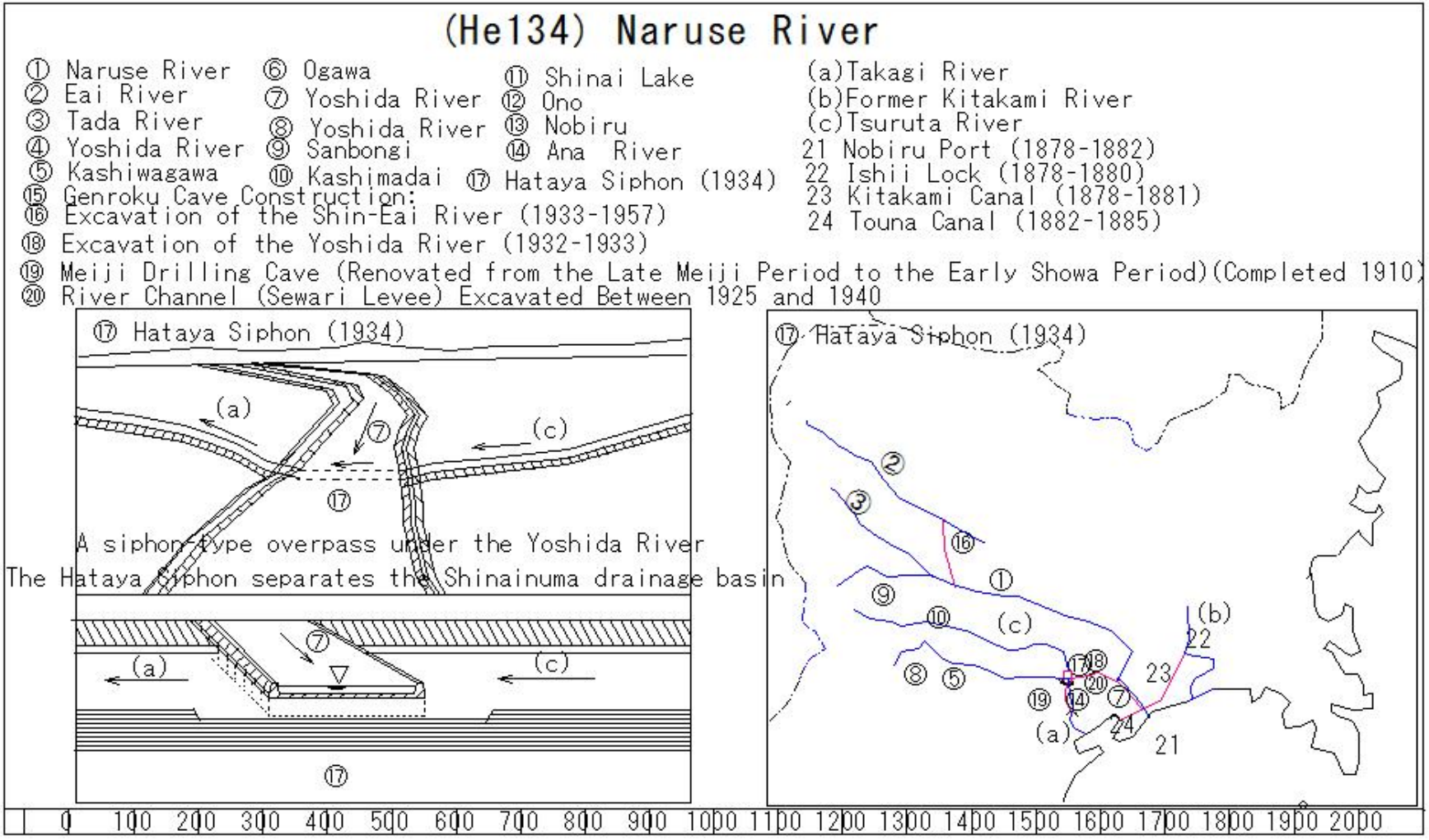
(He132) Naruse River



(He133) Naruse River



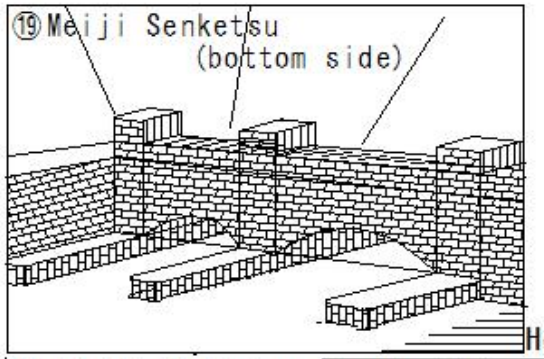
(He134) Naruse River



(He135) Naruse River

(He135) Naruse River

Kamata Sannosuke, who served as the mayor of Kashimadai village, excavated a new underground tunnel, the Meiji Underground Cave, from 1906 to 1910. With the completion of the Takagi River, which was created as a result, water was drained into Matsushima Bay.



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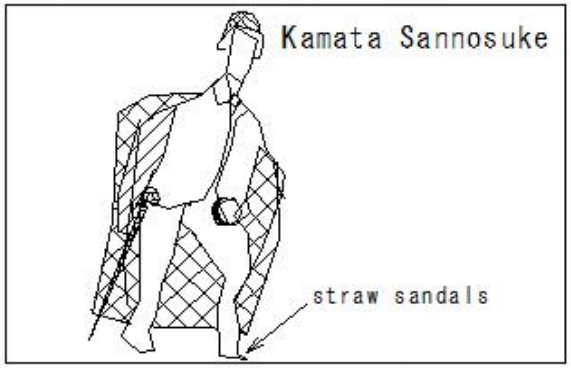

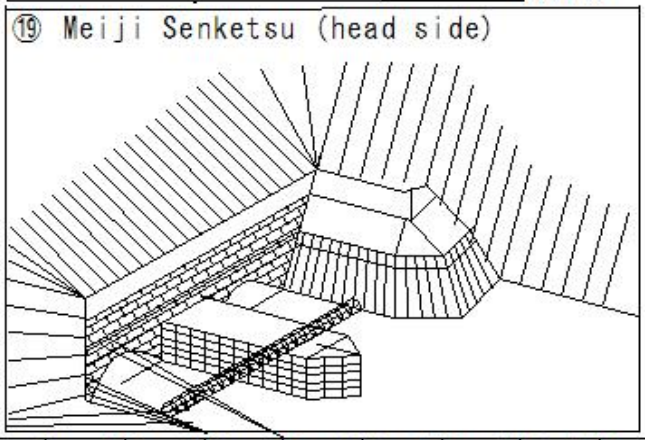

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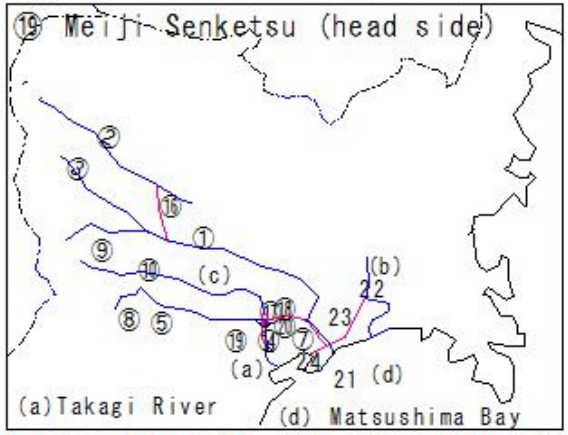


0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000

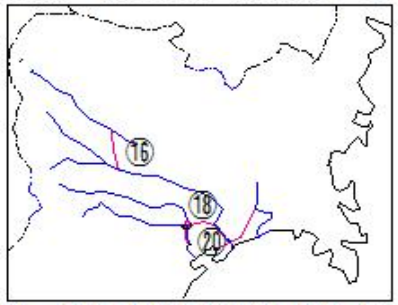
(He136) Naruse River

(He136) Naruse River

Naruse River, Shin-Eai River, and Yoshida River (Sewaritei (Sewari embankment))

1. The confluence of the Naruse River and its tributary, the Yoshida River, is a frequent flooding area, due in part to its topographical features. The Yoshida River's riverbed is lower than the Naruse River's, causing floodwaters to backflow into the Yoshida River. The Yoshida River, with its low-lying ground, frequently floods.
2. To prevent flooding caused by backflow from the Naruse River, a new river was excavated and a Sewaritei (Sewari embankment) was installed (1925-1941).
3. The Shin-Eai River was excavated to receive some of the floodwaters from the Eai River, part of the Kitakami River system (1933-1957).
4. These flood control measures led to the formation of a fertile and vast rice paddy area, and urban areas developed along the river.

⑯ Excavation of the Shin-Eai River (1933-1957)
⑱ Excavation of the Yoshida River (1932-1933)
⑳ River Channel (Sewari Levee) Excavated Between 1925 and 1940



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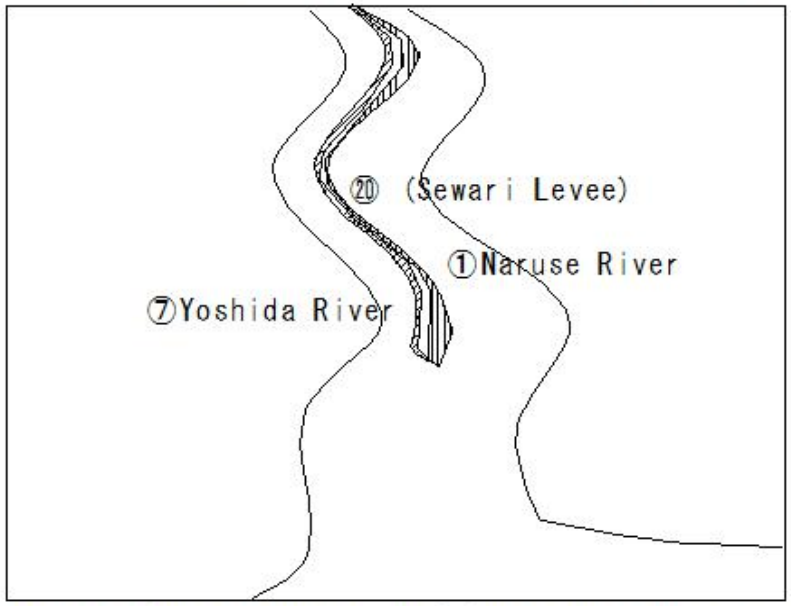
(He137) Naruse River

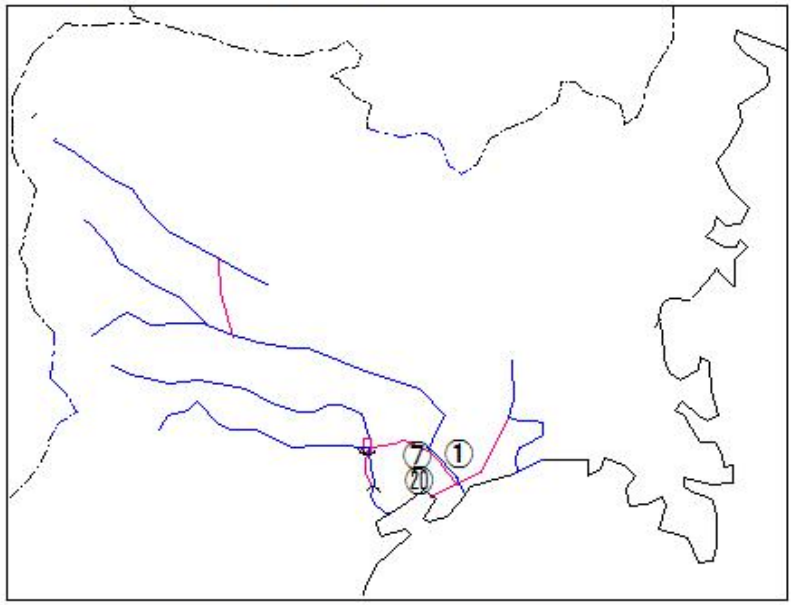
(He137) Naruse River

Naruse River, Shin-Eai River, and Yoshida River (Sewaritei (Sewari embankment))

2. To prevent flooding caused by backflow from the Naruse River, a new river was excavated and a Sewaritei (Sewari embankment) was installed (1925-1941).

⑳ River Channel (Sewari Levee) Excavated Between 1925 and 1940





Back dike (Sewari embankment)(upstream from the mouth of the river) to prevent backflow into the Yoshida River

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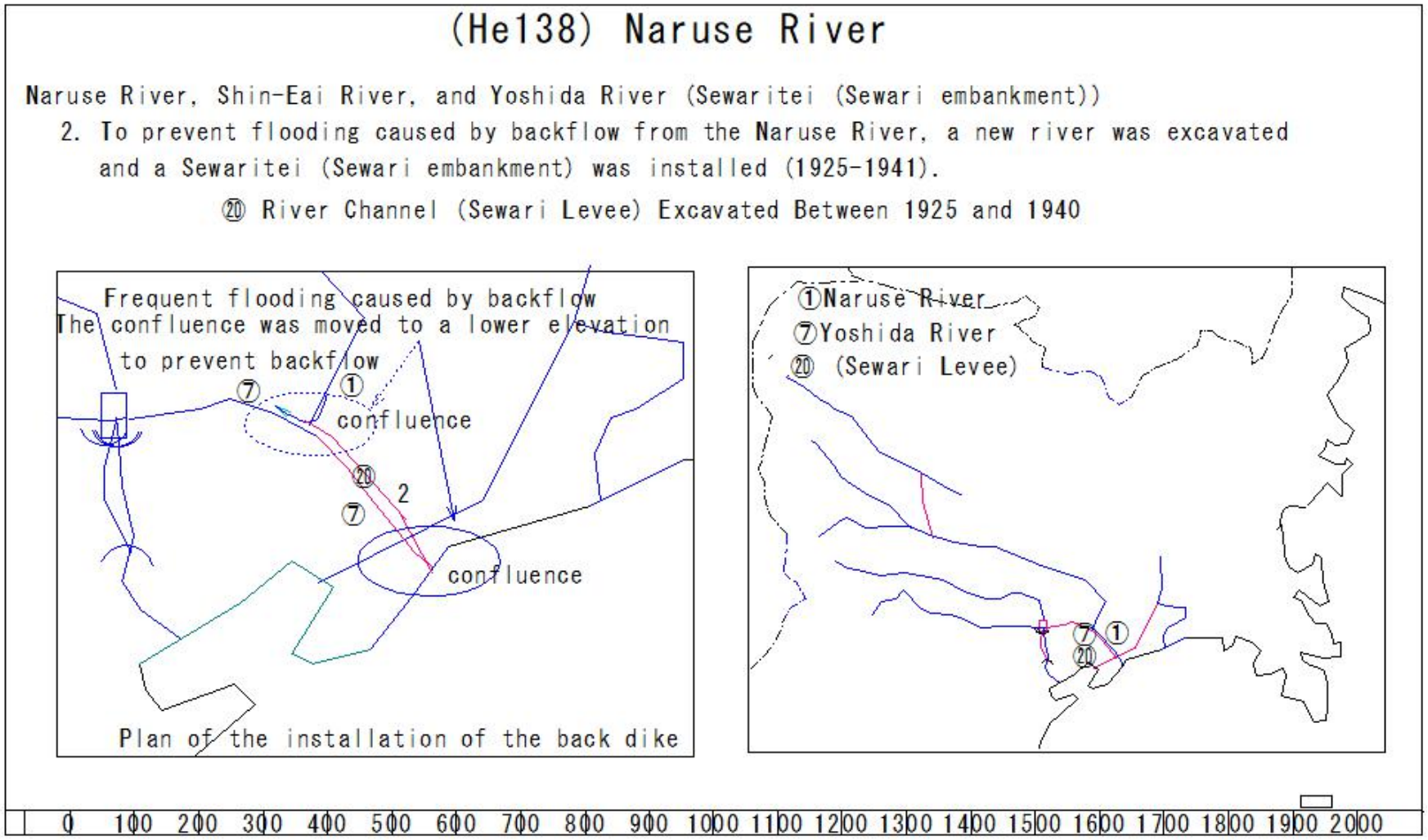
(He138) Naruse River



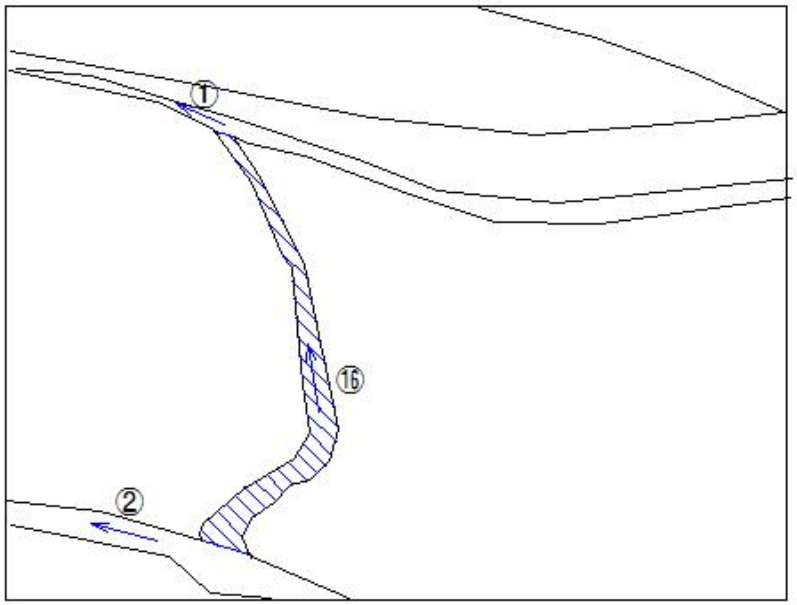
(He139) Naruse River

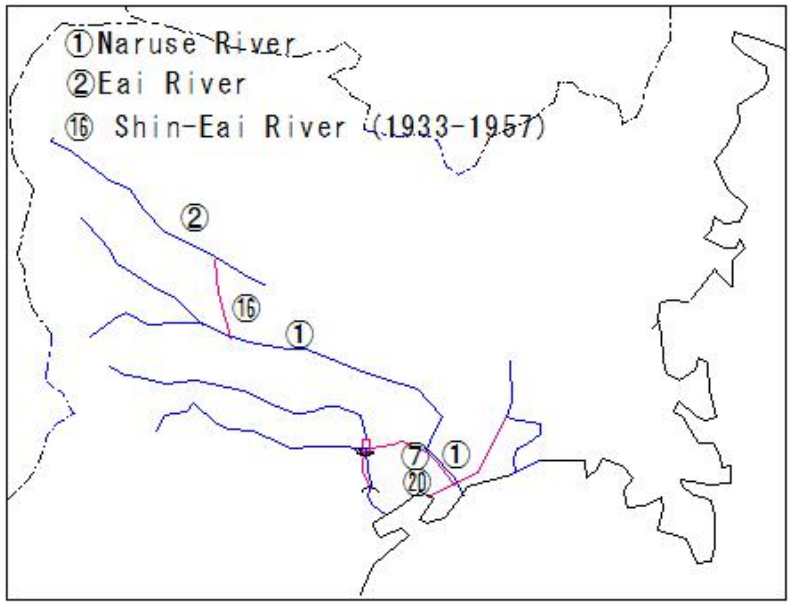
(He139) Naruse River

Naruse River, Shin-Eai River, and Yoshida River (Sewaritei (Sewari embankment))

3. The Shin-Eai River was excavated to receive some of the floodwaters from the Eai River, part of the Kitakami River system (1933-1957).

⑯ Excavation of the Shin-Eai River (1933-1957)





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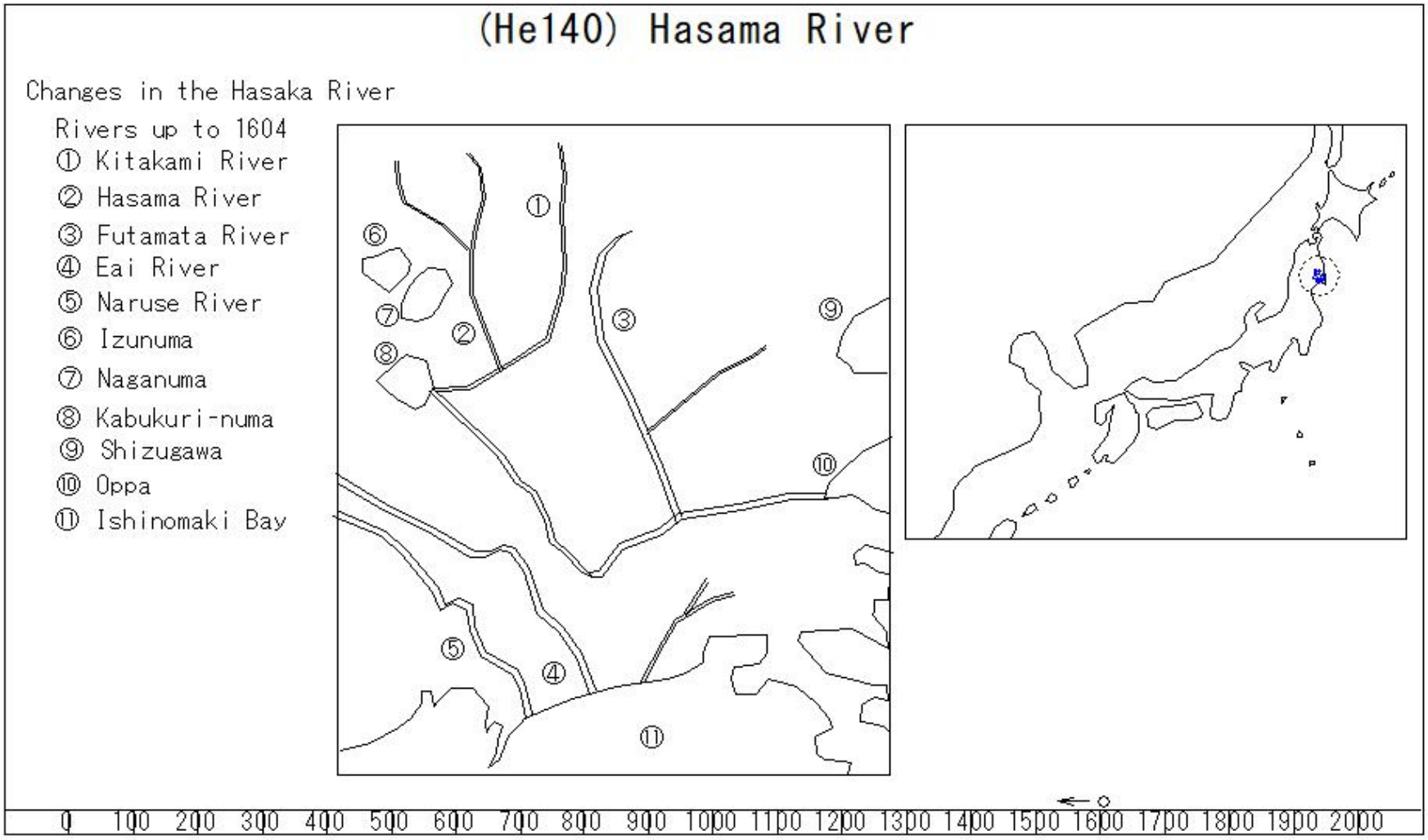
(He140) Hasama River



(He141) Hasama River

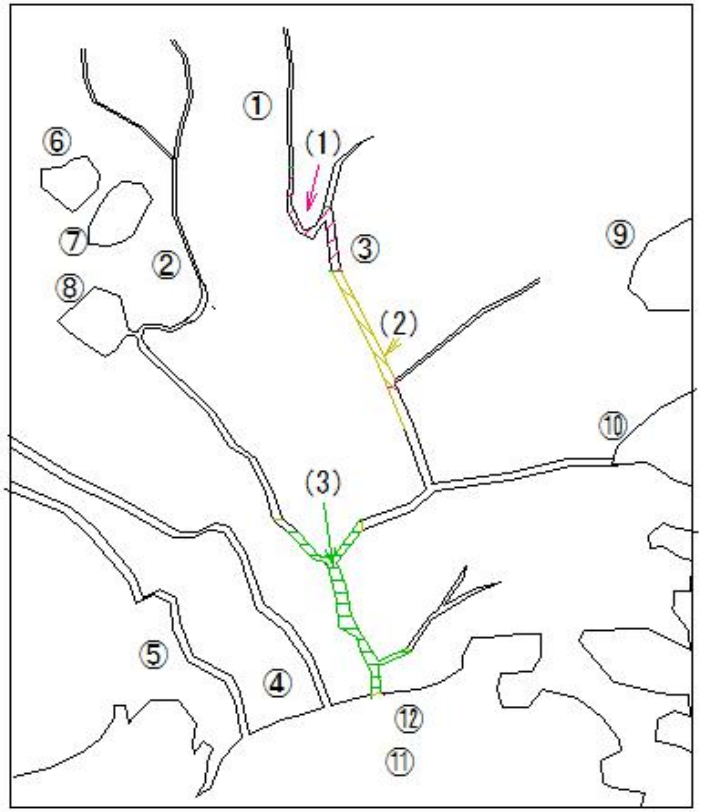
(He141) Hasama River

Changes in the Hasaka River

(1) From 1605 to 1608, the river was renovated by Munenao Shiraishi.

(2) From 1609 to 1610, the section between Tome and Yanaizu was renovated.

(3) The river course was changed to Ishinomaki, and the Hasama River became an independent river.



① Kitakami River
② Hasama River
③ Futamata River
④ Eai River
⑤ Naruse River
⑥ Izunuma
⑦ Naganuma
⑧ Kabukuri-numa
⑨ Shizugawa
⑩ Oppa
⑪ Ishinomaki Bay
⑫ Ishinomaki

0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000

(He142) Hasama River

(He142) Hasama River

Changes in the Hasaka River

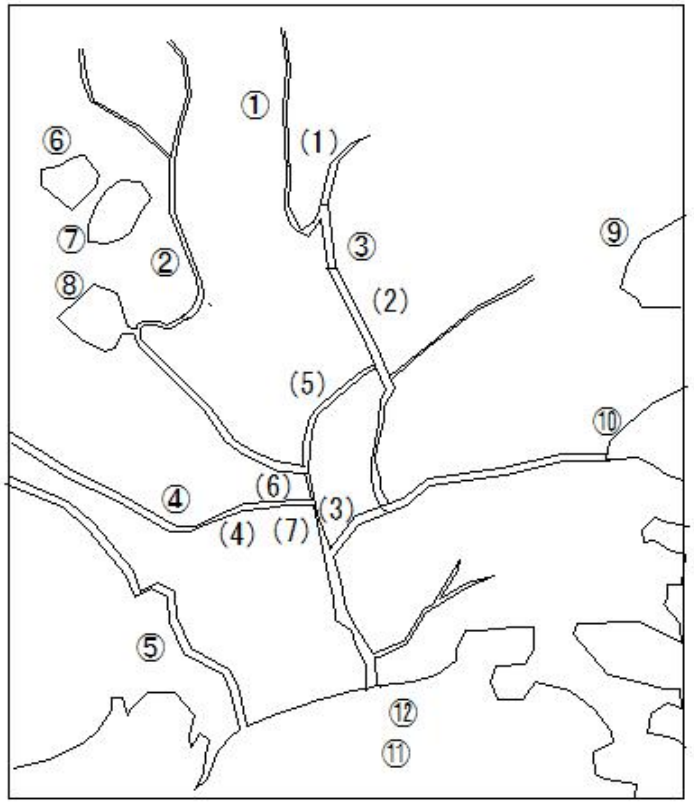
(4) 1617: Kawamura Magobei merged the Eai River and Hasama River.

(5) 1617-1620: Excavation of Inooka Tandai from Yanaizu led to the confluence of the Kitakami River and Hasama River.

(6) Excavation of the river channel to Mt. Kandori.

(7) 1621-1622: River channel widening work.

① Kitakami River
② Hasama River
③ Futamata River
④ Eai River
⑤ Naruse River
⑥ Izunuma
⑦ Naganuma
⑧ Kabukuri-numa
⑨ Shizugawa
⑩ Oppa
⑪ Ishinomaki Bay
⑫ Ishinomaki



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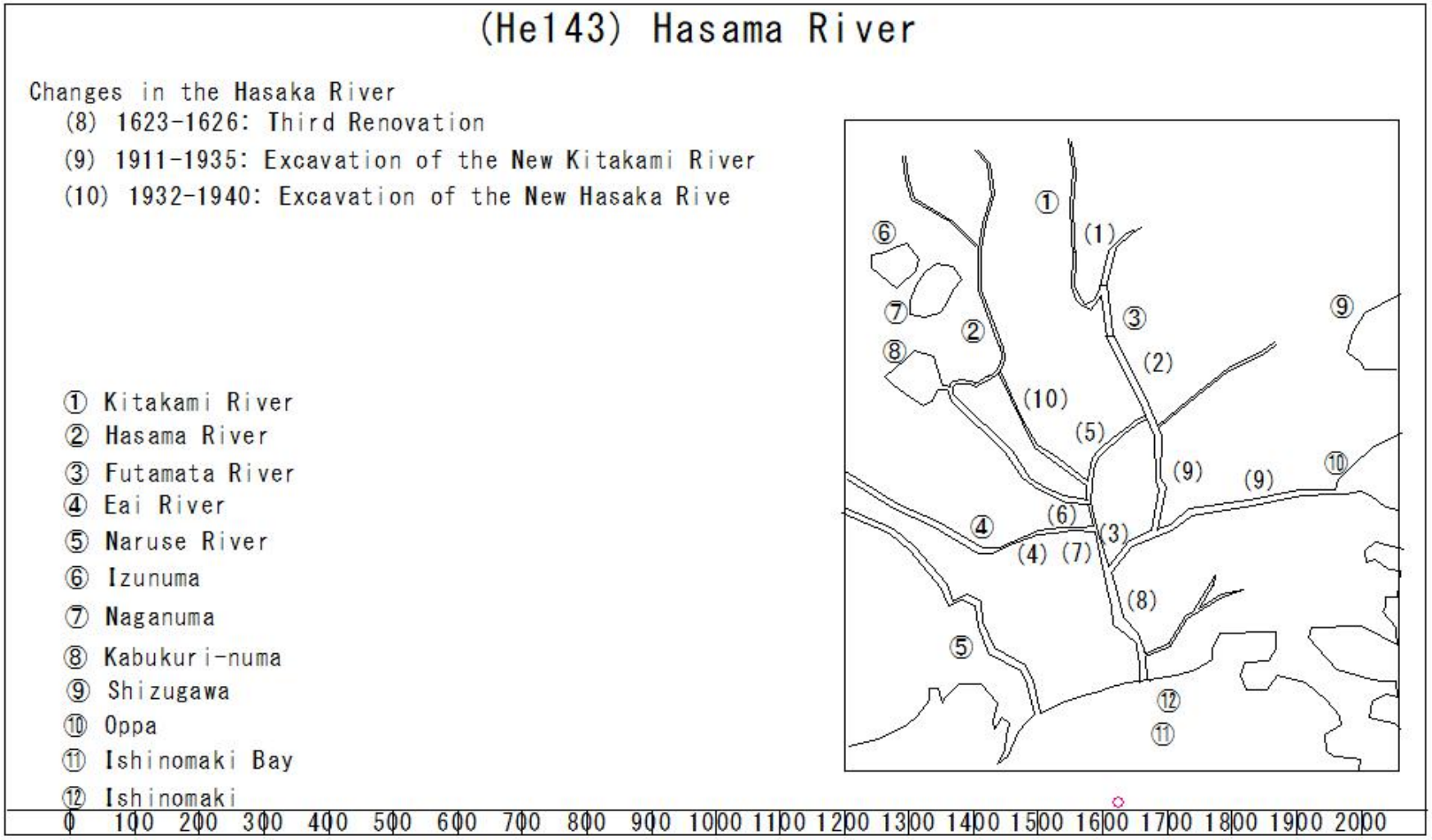
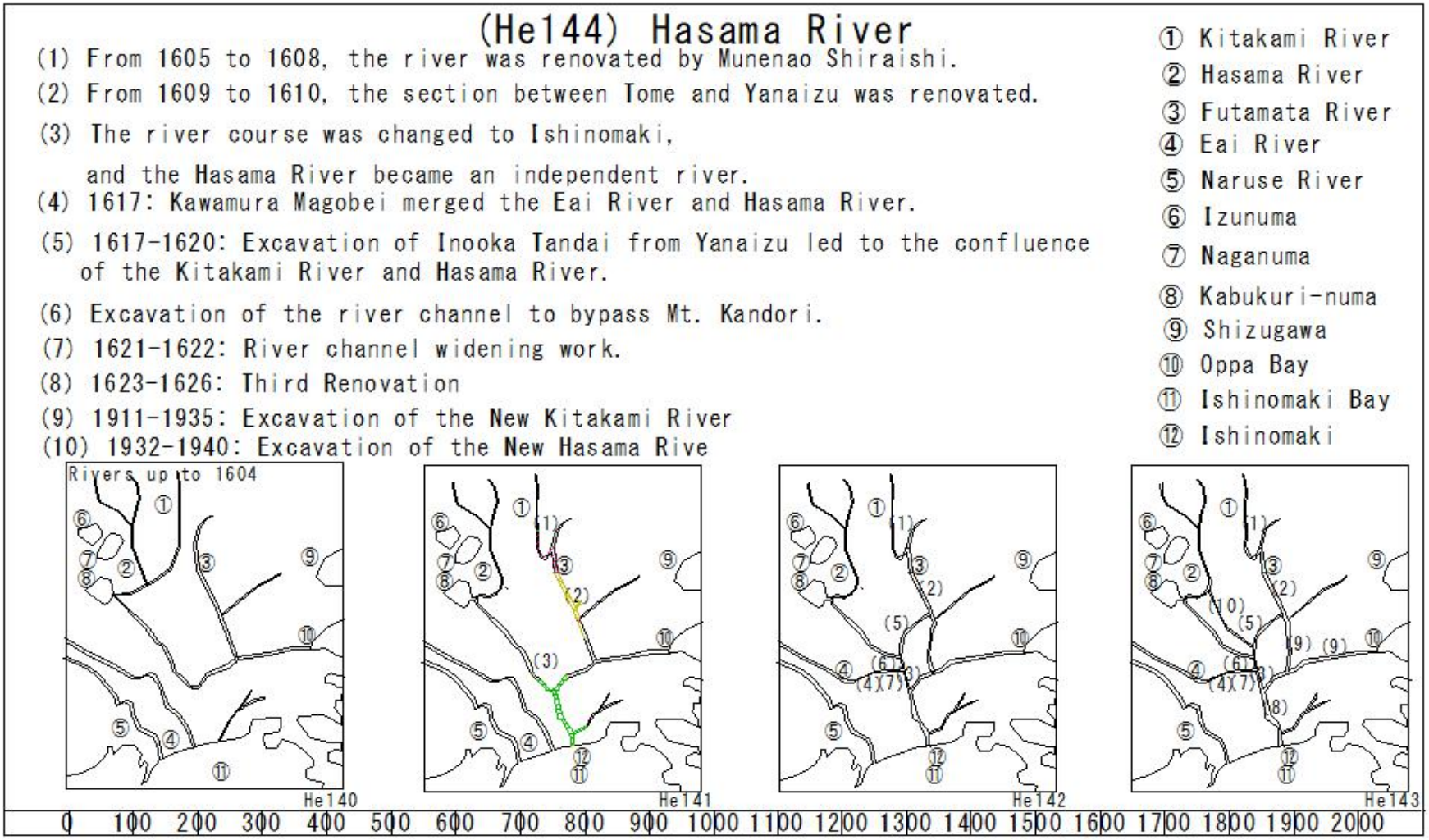
(He143) Hasama River



(He144) Hasama River



(He145) Hasama River

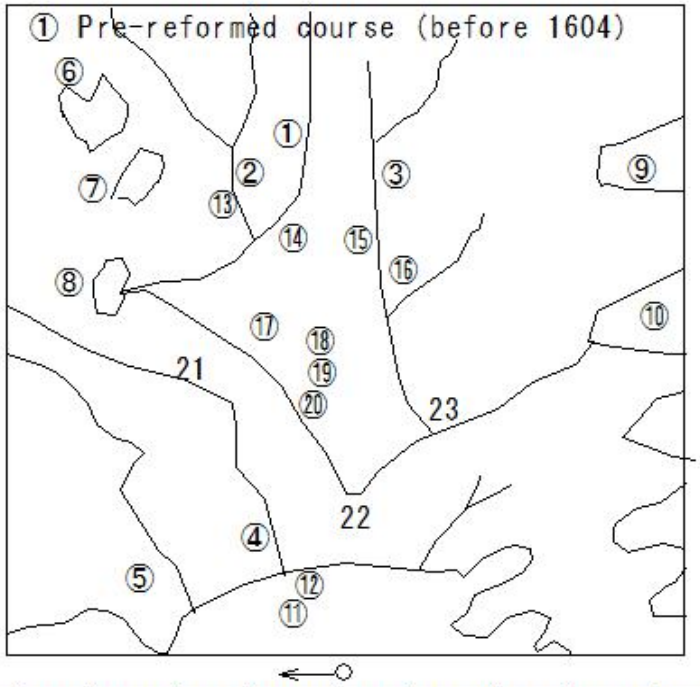
(He145) Hasama River

Changes in the Hasaka River

① Pre-reformed course (before 1604)

Before the Edo period, the Kitakami River meandered inland to the west before flowing into Oppa Bay.
The Eai River was an independent river.

① Kitakami River
② Hasama River
③ Futamata River
④ Eai River
⑤ Naruse River
⑥ Izunuma
⑦ Naganuma
⑧ Kabukuri-numa
⑨ Shizugawa
⑩ Oppa Bay
⑪ Ishinomaki Bay
⑫ Ishinomaki
⑬ Sanuma
⑭ Yoshida
⑮ Tome
⑯ Yanaizu
⑰ Toyosato
⑱ Terasaki
⑲ Nakatsuyama
⑳ Kandori
21 Wakuya
22 Kanomata
23 Iinogawa



0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000

(He146) Hasama River

(He146) Hasama River

② Renovations by Shiraishi Munenao (1605-1610)

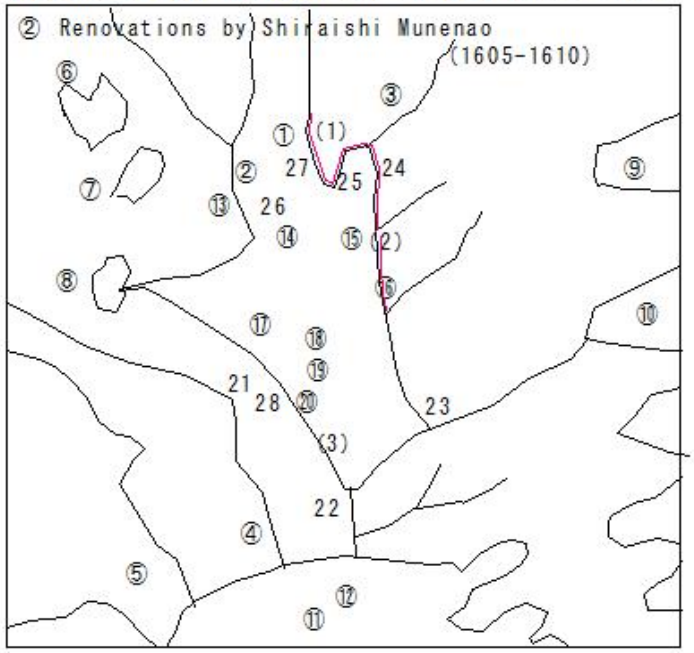
Shiraishi Munenao, a vassal of the Date clan, diverted the Kitakami River into the Futamata River and allowed it to flow south. This separated the Hasaka River from the Kitakami River.

(1) From 1605 to 1608, the river was renovated by Munenao Shiraishi.

(2) From 1609 to 1610, the section between Tome and Yanaizu was renovated.

(3) The river course was changed to Ishinomaki, and the Hasama River became an independent river.

① Kitakami River
② Hasama River
③ Futamata River
④ Eai River
⑤ Naruse River
⑥ Izunuma
⑦ Naganuma
⑧ Kabukuri-numa
⑨ Shizugawa
⑩ Oppa Bay
⑪ Ishinomaki Bay
⑫ Ishinomaki
⑬ Sanuma
⑭ Yoshida
⑮ Tome
⑯ Yanaizu
⑰ Toyosato
⑱ Terasaki
⑲ Nakatsuyama
⑳ Kandori
21 Wakuya
22 Kanomata
23 Iinogawa
24 Maiya
25 Asamizu
26 Mori
27 Sagami Embankment
28 Wabuchi



0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000

(He147) Hasama River

(He147) Hasama River

③ Kawamura Magobei's Renovations (1616-1622)

Kawamura Magobei, a retainer of the Date clan, excavated a river channel from Yanaizu to Kandori, merging the Hasama River with the Kitakami River. He also excavated the Eai River, merging them at Wabuchi.

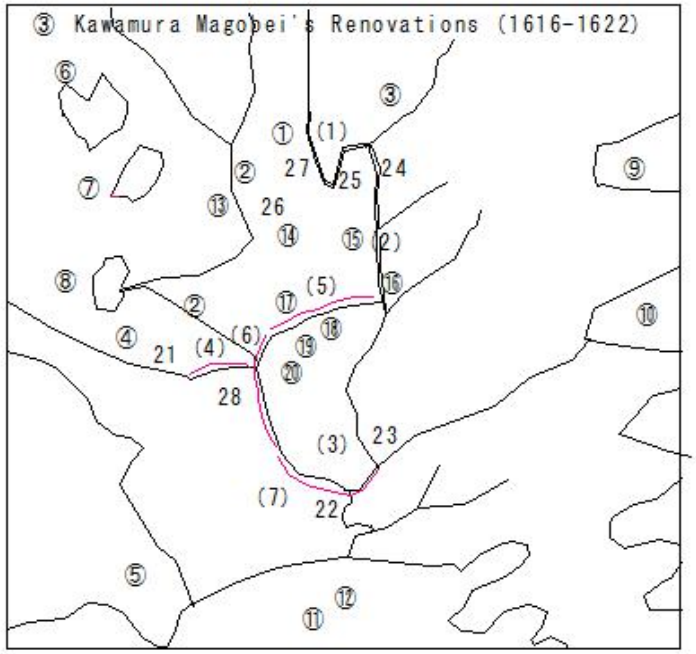
(4) 1617: Kawamura Magobei merged the Eai River and Hasama River.

(5) 1617-1620: Excavation of Inooka Tandai from Yanaizu led to the confluence of the Kitakami River and Hasama River.

(6) Excavation of the river channel to bypass Mt. Kandori.

(7) 1621-1622: River channel widening work.

① Kitakami River
② Hasama River
③ Futamata River
④ Eai River
⑤ Naruse River
⑥ Izunuma
⑦ Naganuma
⑧ Kabukuri-numa
⑨ Shizugawa
⑩ Oppa Bay
⑪ Ishinomaki Bay
⑫ Ishinomaki
⑬ Sanuma
⑭ Yoshida
⑮ Tome
⑯ Yanaizu
⑰ Toyosato
⑱ Terasaki
⑲ Nakatsuyama
⑳ Kandori
21 Wakuya
22 Kanomata
23 Iinogawa
24 Maiya
25 Asamizu
26 Mori
27 Sagami Embankment
28 Wabuchi



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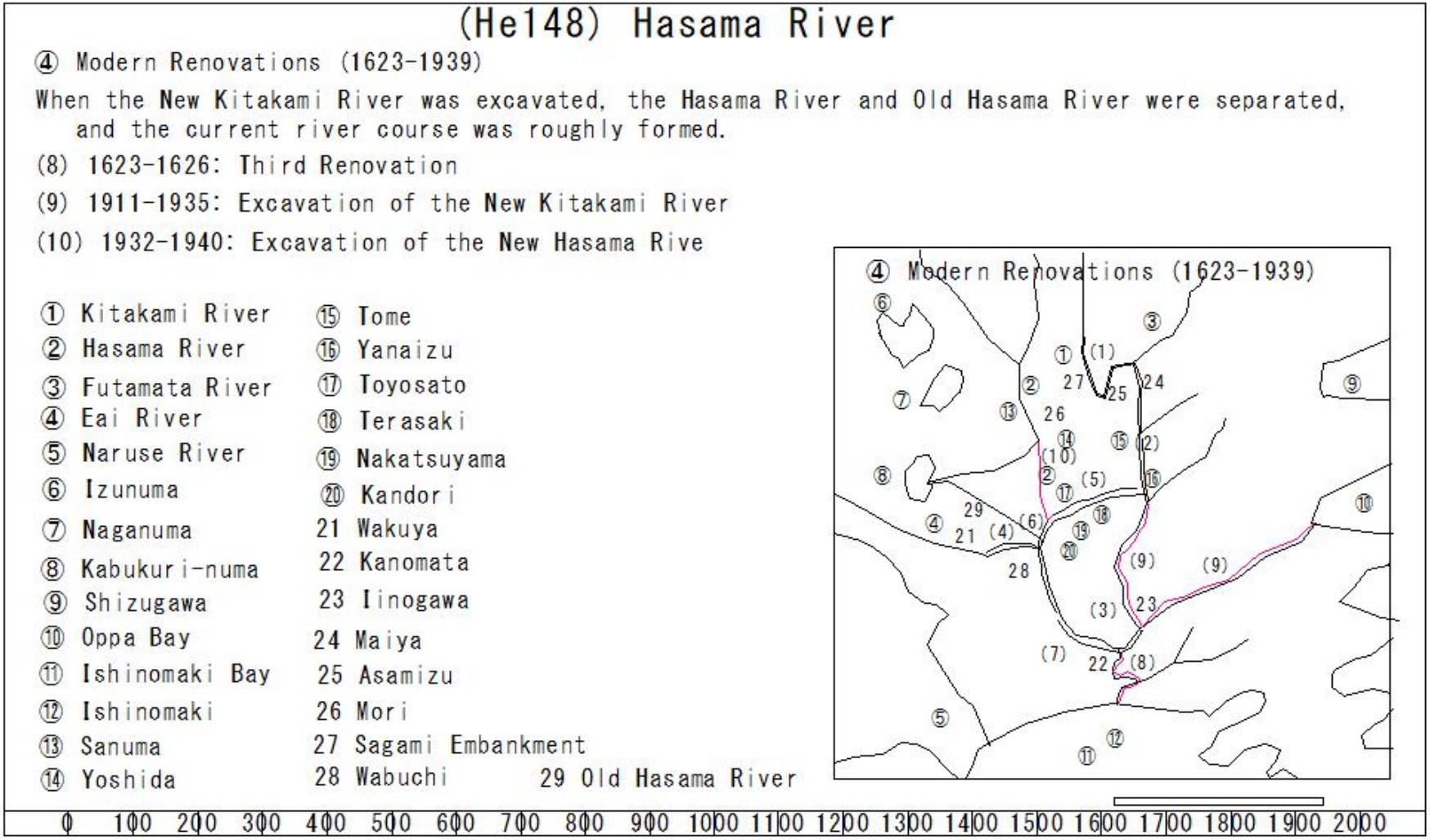
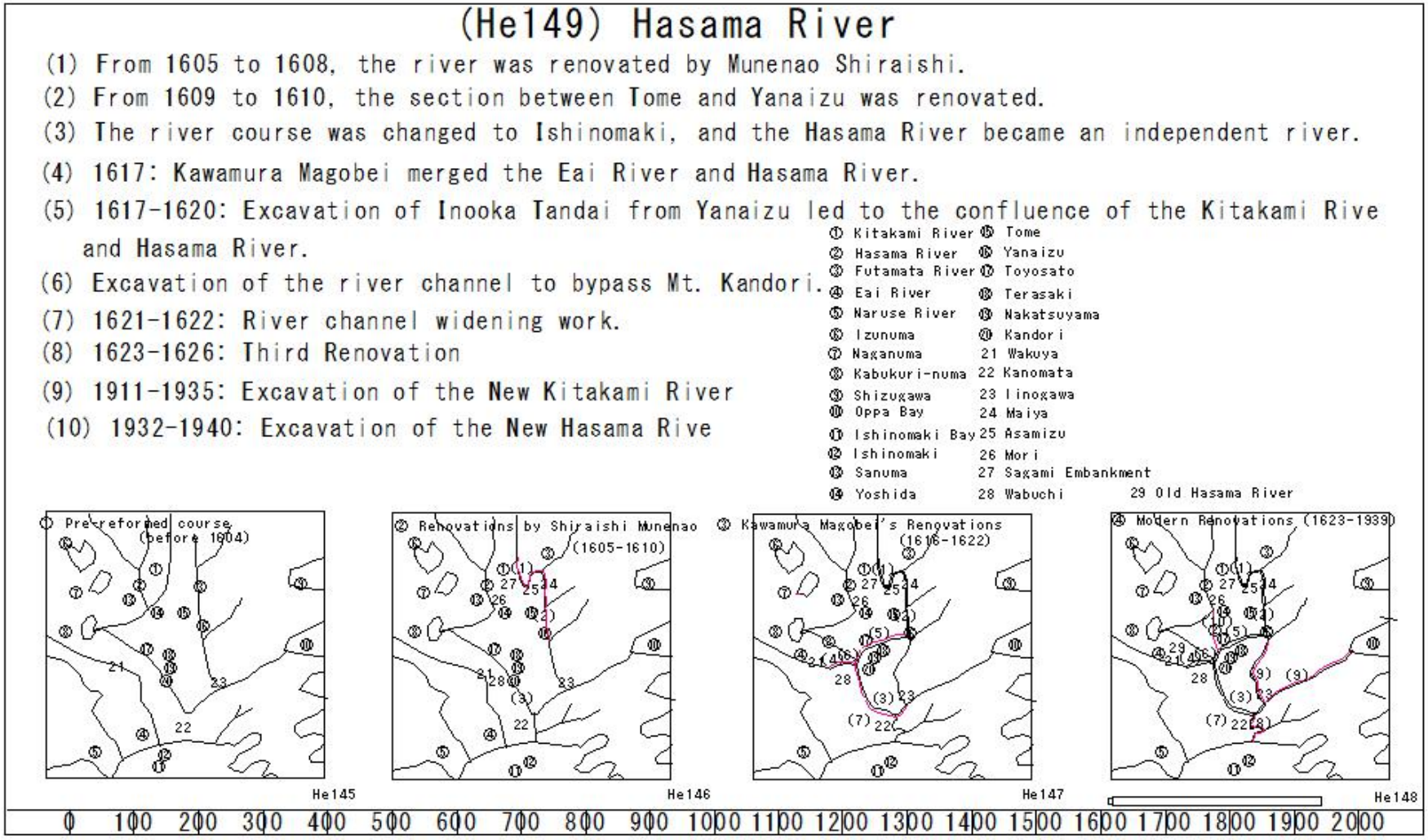
(He148) Hasama River



(He149) Hasama River



(He150) Hasama River

(He150) Hasama River

Hasama River New River Excavation Project - Major Renovation in 1932 -

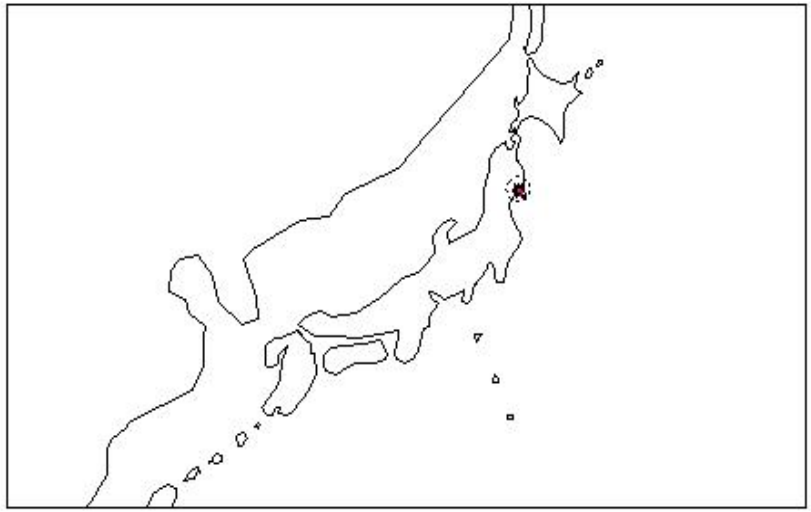
Yamayoshida Water Gate and Arai Weir

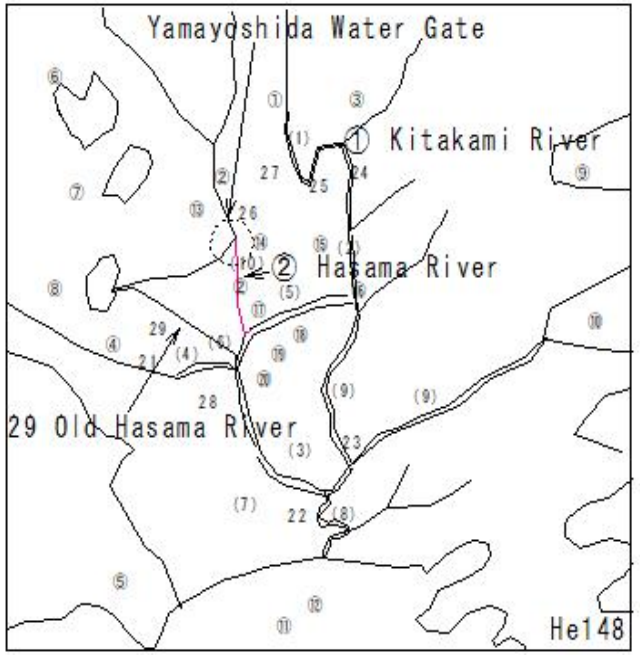
① The Yamayoshida Water Gate and Arai Weir were constructed in what is now Yamayoshida, Yoneyama-cho, Tome City.

② The Hasama River was branched off and a new river, 11.7 km long, was excavated.

③ It took eight years, from 1932 to 1939, to complete.

Yamayoshida Water Gate Completed in 1938





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(He151) Hasama River

(He151) Hasama River

Hasama River New River Excavation Project - Major Renovation in 1932 -

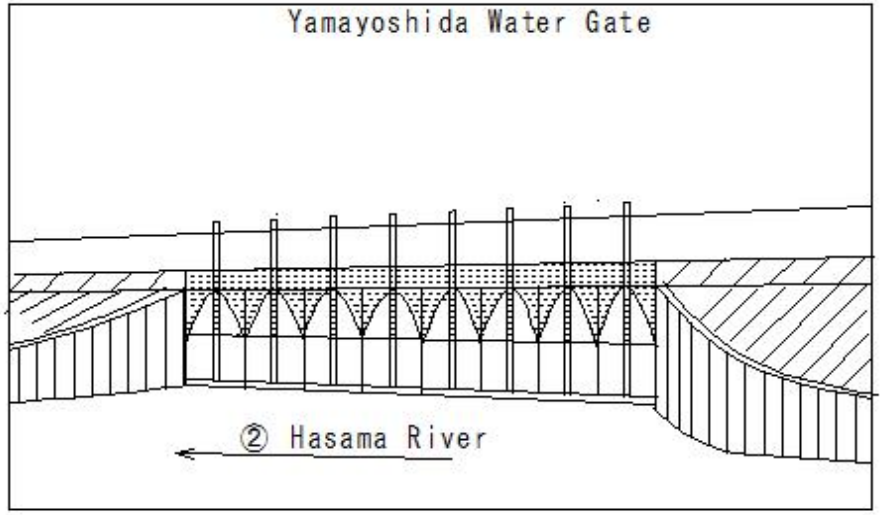
Yamayoshida Water Gate and Arai Weir

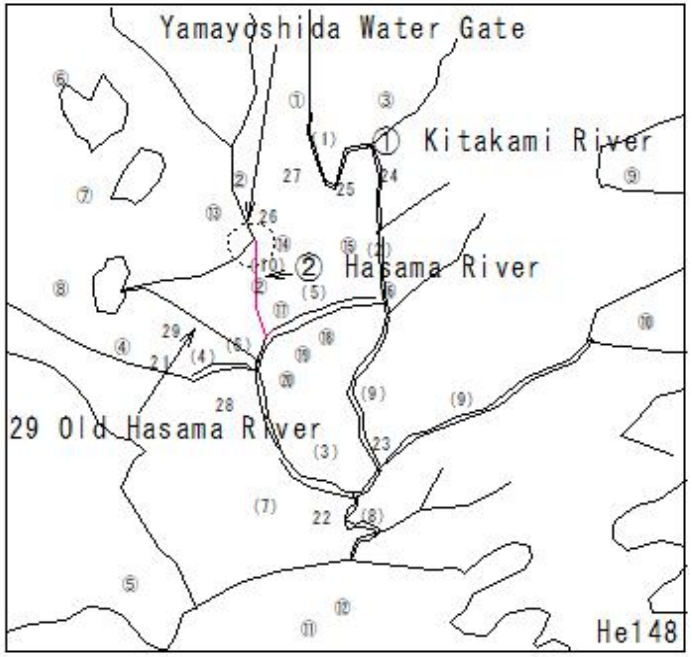
① The Yamayoshida Water Gate and Arai Weir were constructed in what is now Yamayoshida, Yoneyama-cho, Tome City.

② The Hasama River was branched off and a new river, 11.7 km long, was excavated.

③ It took eight years, from 1932 to 1939, to complete.

Yamayoshida Water Gate Completed in 1938





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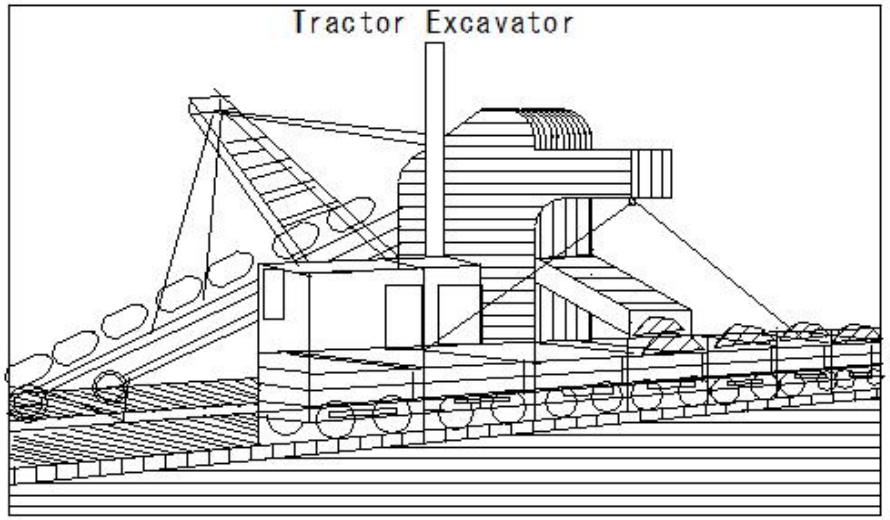
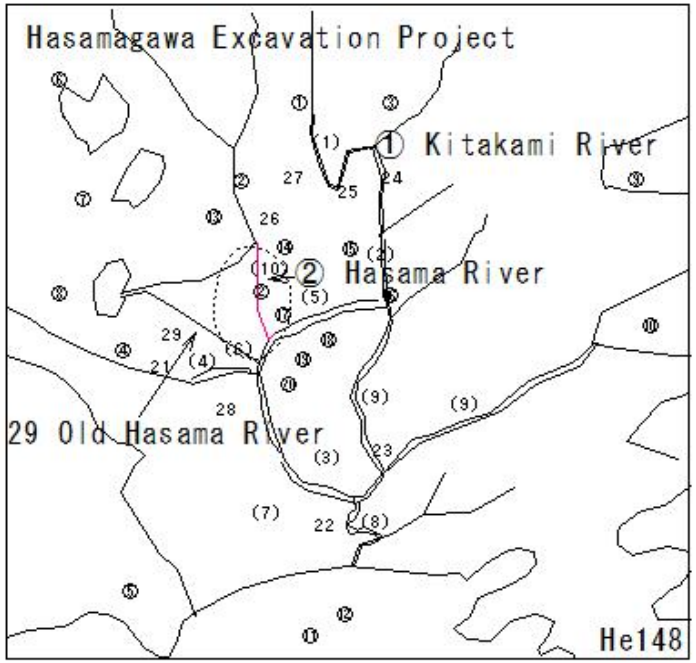
(He152) Hasama River

(He152) Hasama River

Hasama River New River Excavation Project - Major Renovation in 1932 -

Excavation and Transport Machinery from the Early Showa Period





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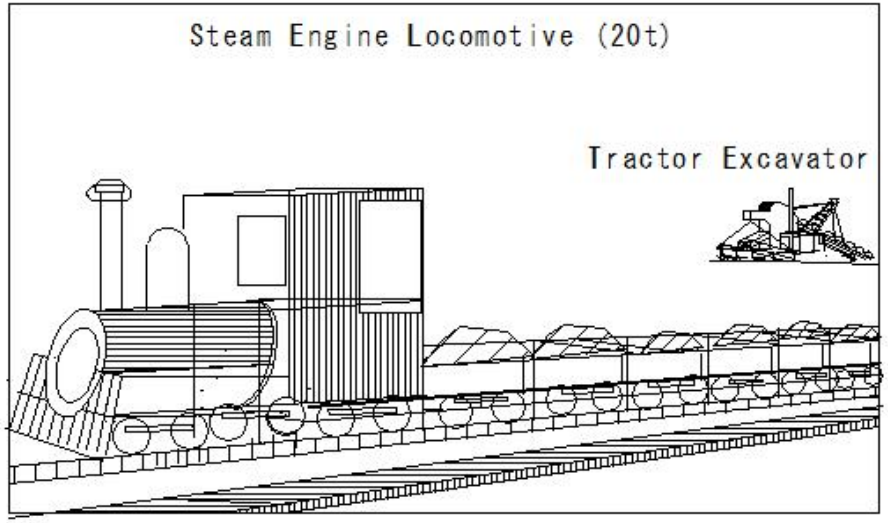
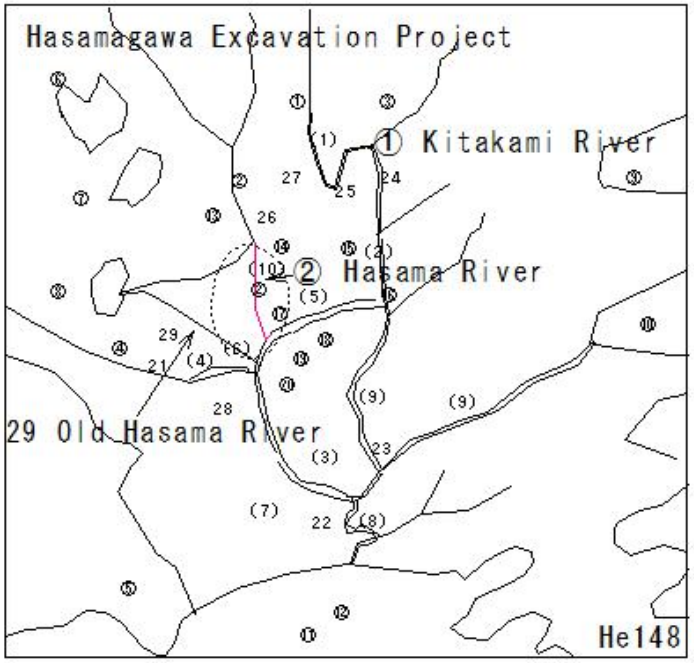
(He153) Hasama River

(He153) Hasama River

Hasama River New River Excavation Project - Major Renovation in 1932 -

Excavation and Transport Machinery from the Early Showa Period





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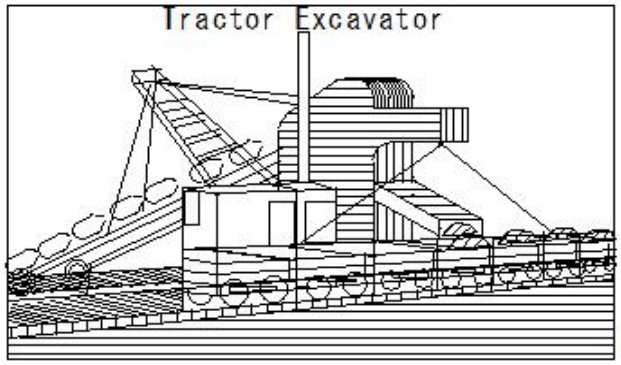
(He154) Hasama River

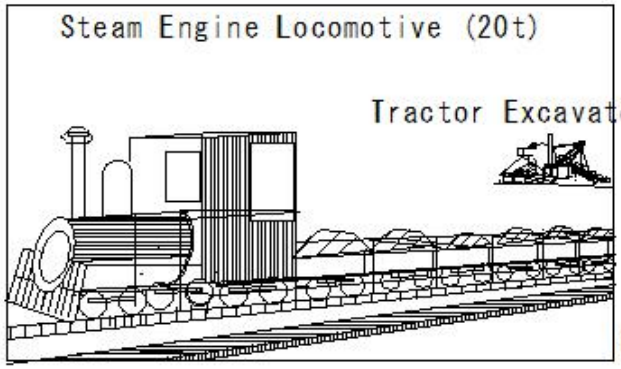
(He154) Hasama River

Hasama River New River Excavation Project - Major Renovation in 1932 -

Excavation and Transport Machinery from the Early Showa Period



He152



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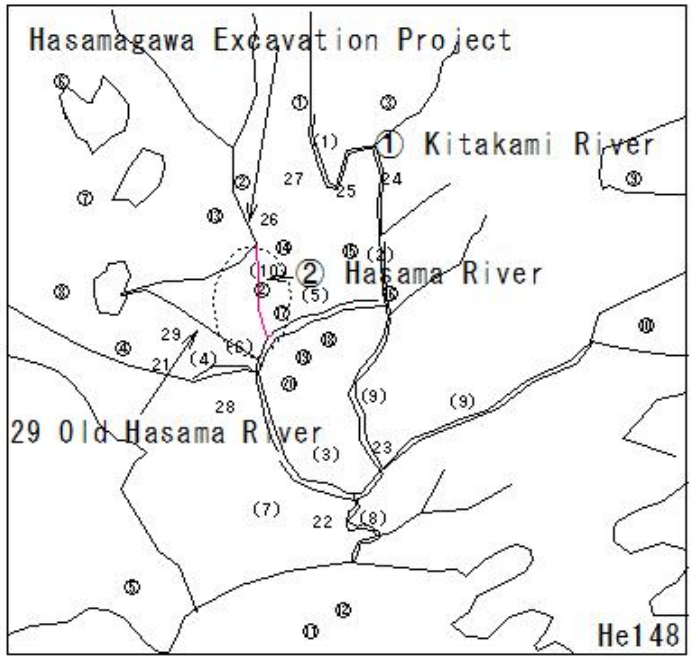


0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000

(He155) Hasama River

(He155) Hasamagawa

Retarding Basins in the Hasama River Basin

① Minamiyachi Retarding Basin (located on the border between Kurihara City and Tome City), together with Naganuma Dam, regulates floodwaters of the Hasama River.

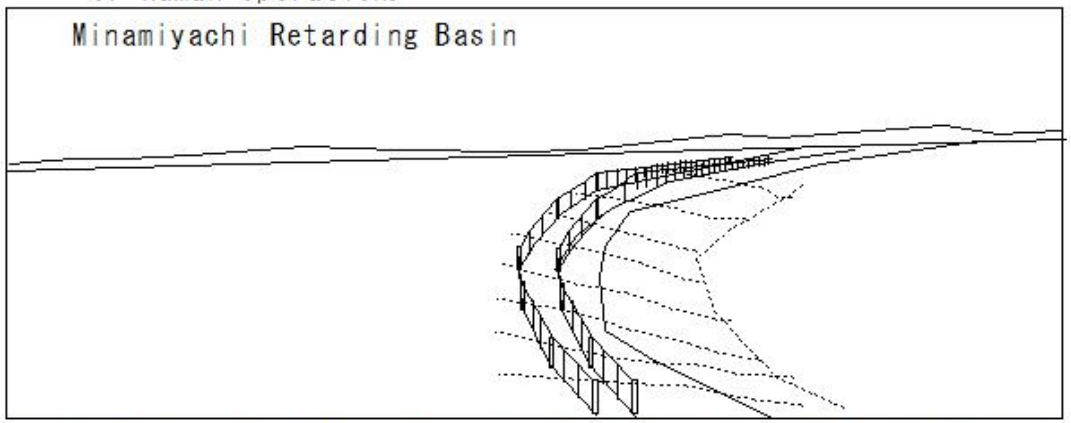
② Reduces flood damage downstream.

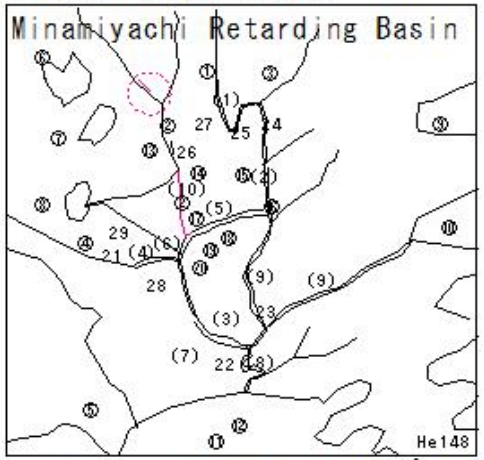
③ The inlet to the overflow levee of the retarding basin is equipped with 120 wooden gates, each 2.5m wide and 0.62m high.

④ Normally closed with weights.

⑤ In the event of a flood, the gates automatically tip over due to water pressure, allowing floodwaters to flow into the retarding basin.

⑥ This facility, built half a century ago (completed in 1956), requires no power source or human operation.





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(He156) Hasama River

(He156) Hasamagawa

Flood Retardation Basins in the Hasama River Basin

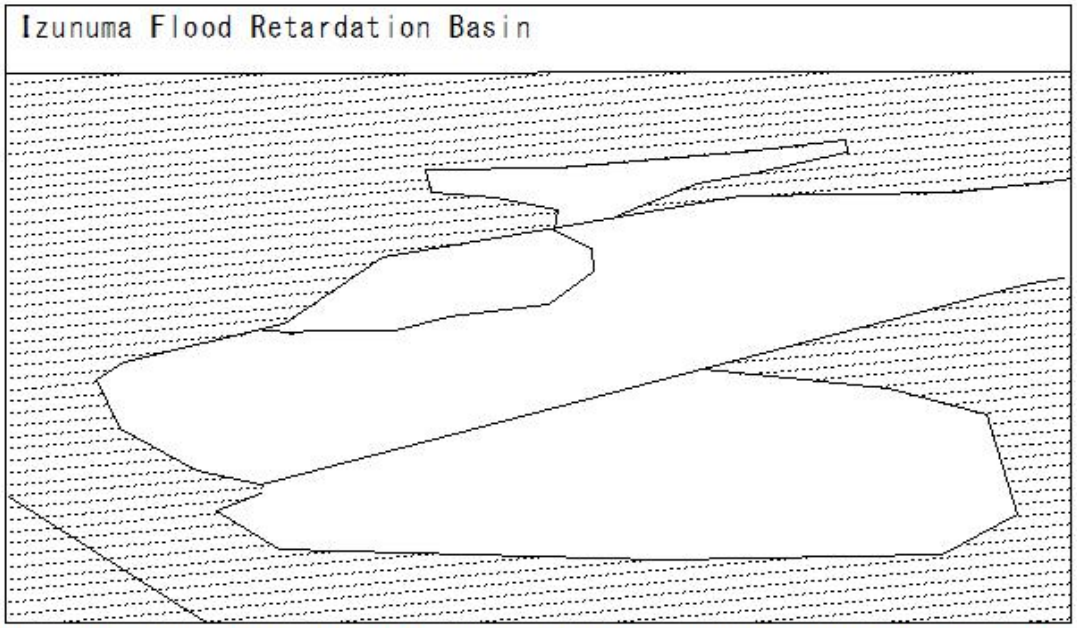
Izunuma Flood Retardation Basin

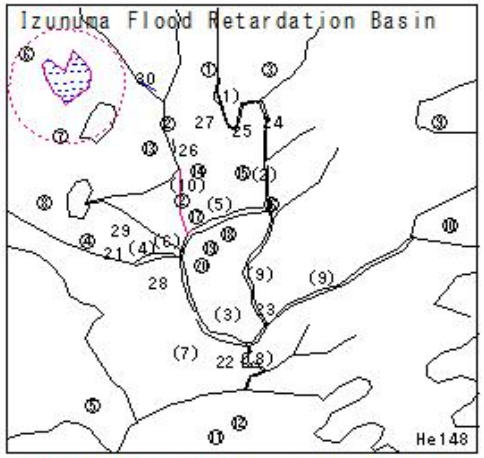
① Izunuma is maintained as a flood retarding basin by operating two floodgates.

② It stores floodwaters from the Arakawa and Ochibori Rivers

③ Protects surrounding residential and cultivated land from flooding.

⑥ Izunuma
⑦ Naganuma
⑧ Kabukuri-numa
30 Minamiyachi





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(He157) Hasama River

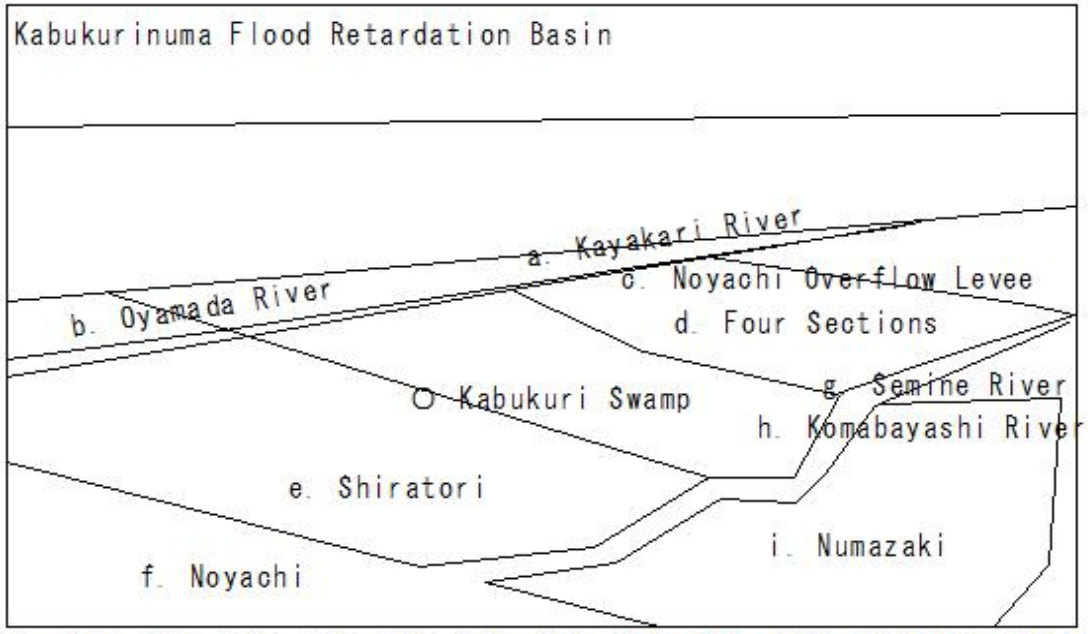
(He157) Hasamagawa

Flood Retardation Basins in the Hasama River Basin

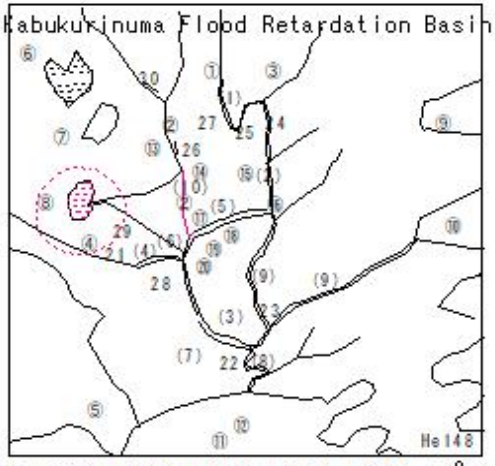
Kabukurinuma Flood Retardation Basin

① Utilizing the Kabukuri-numa natural retarding basin at the confluence of the Oyamada River, the Seminegawa River, and the Kayakari River, and developing the surrounding rice fields.

② Completed in March 2001



⑥ Izunuma
⑦ Naganuma
⑧ Kabukuri-numa
30 Minamiyachi



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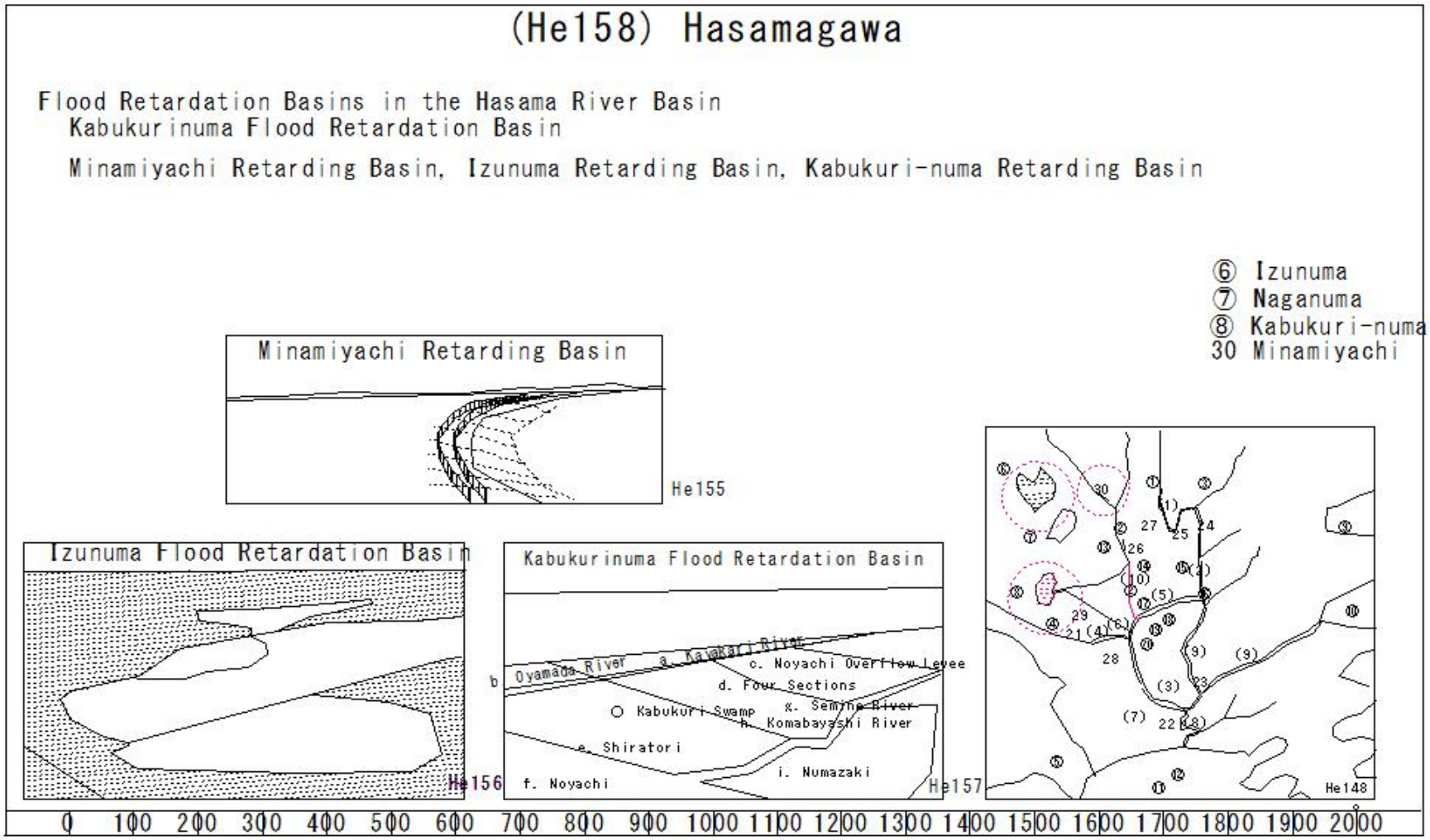
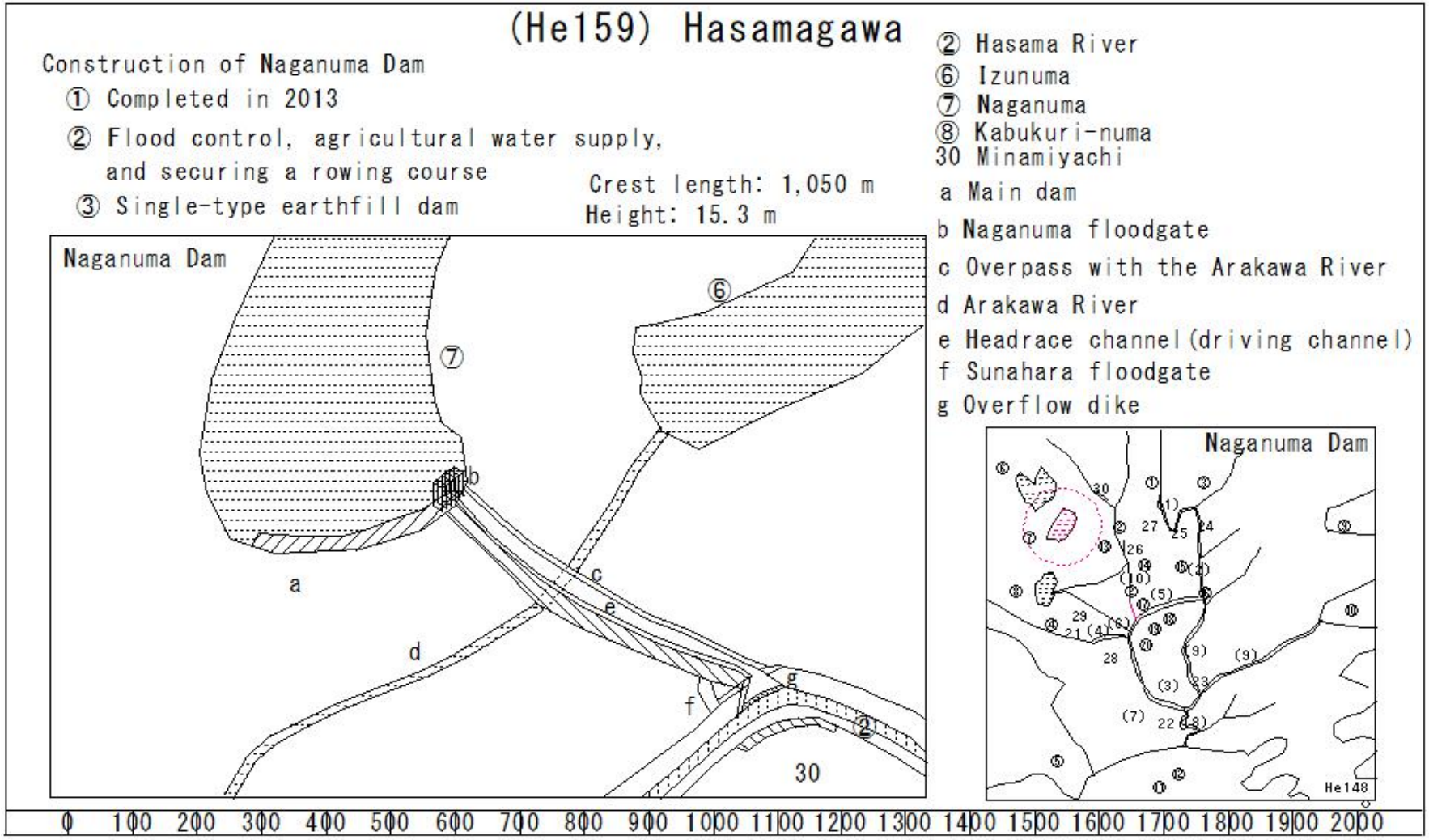
(He158) Hasama River



(He159) Hasama River



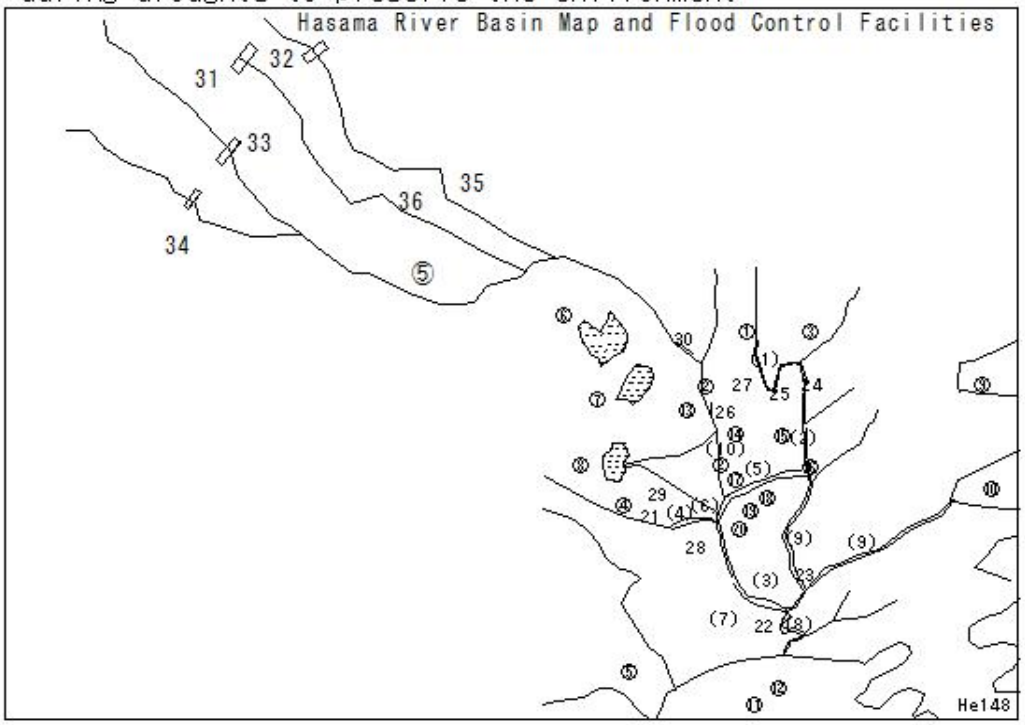
(He160) Hasama River

(He60) Hasamagawa

Dams in the Hasama River Basin

- ○ Securing water resources for drinking water and agricultural use, and hydroelectric power generation
- ○ Preventing and reducing flood damage by controlling floods during heavy rains
- ○ Preventing rivers from drying up during droughts to preserve the environment

31 Aratozawa Dam
32 Kurikoma Dam
33 Hanayama Dam
34 Oda Dam
⑥ Izunuma Retarding Basin
30 Minamiyachi Retarding Basin
⑦ Naganuma Dam
⑧ Kabukuri-numa Retarding Basin
35 San Hasama River
36 Ni Hasama River
⑤ Hasama River (Ichi Hasama River)
② Hasama River



0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000

(He161) Hasama River

(He161) Hasamagawa

Dams in the Hasama River Basin

Hanayama Dam

Purpose: Flood control, water supply and agricultural water supply, ensuring normal flow, power generation (output 1,500 kW)

○Type: Gravity concrete dam

Dam height: 48.5 m

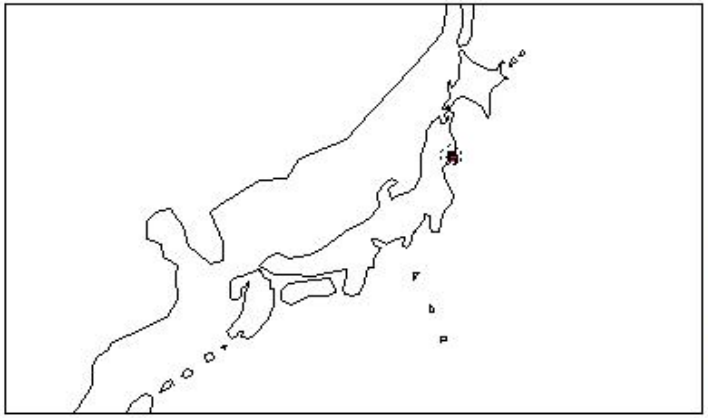
Crest length: 72.0 m

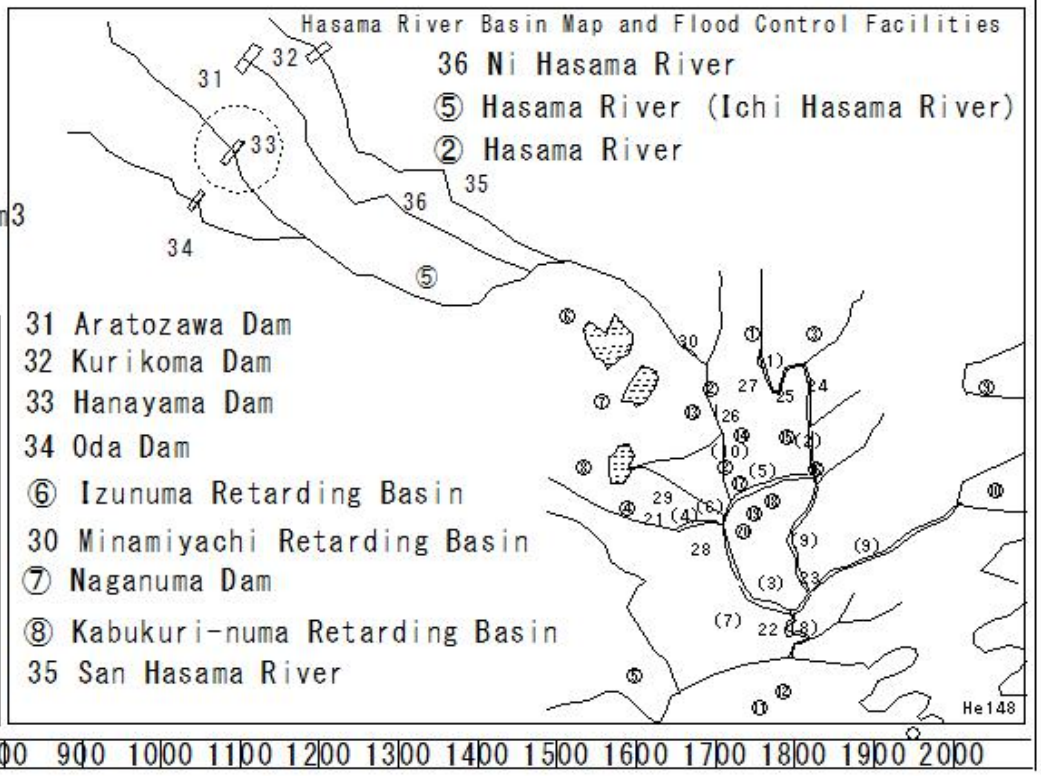
Catchment area: 126.9 km2

Reservoir area: 2.4 km2

Total storage capacity: 36.6 million m3

○Completed: 1957





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(He162) Hasama River

(He162) Hasamagawa

Dams in the Hasama River Basin

Hanayama Dam

Purpose: Flood control, water supply and agricultural water supply, ensuring normal flow, power generation (output 1,500 kW)

○Type: Gravity concrete dam

Dam height: 48.5 m

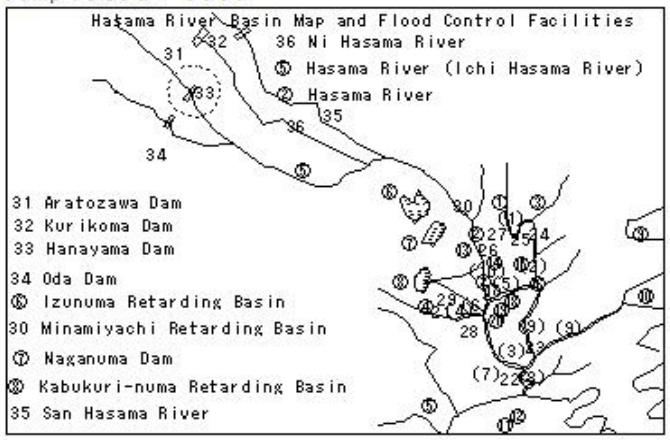
Crest length: 72.0 m

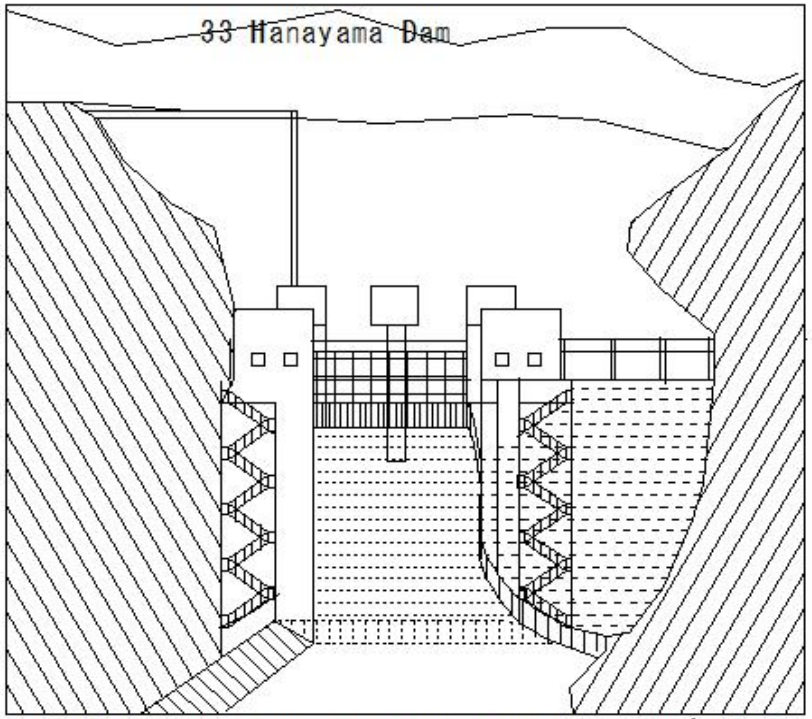
Catchment area: 126.9 km2

Reservoir area: 2.4 km2

Total storage capacity: 36.6 million m3

○Completed: 1957





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(He163) Hasama River

(He163) Hasamagawa

Dams in the Hasama River Basin

Kurikoma Dam

Purpose: Flood control, agricultural water supply, power generation (output 2,800 kW)

Type: Gravity concrete dam

Dam height: 57.2 m

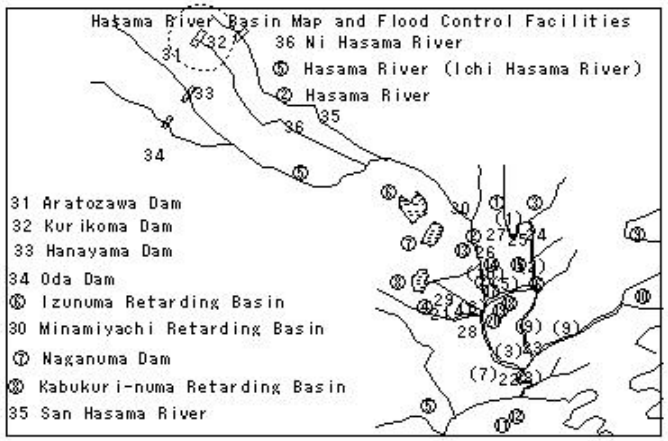
Crest length: 182.0 m

Catchment area: 53.0 km2

Reservoir area: 0.83 km2

Total storage capacity: 13,715,000 m3

Completed: 1961



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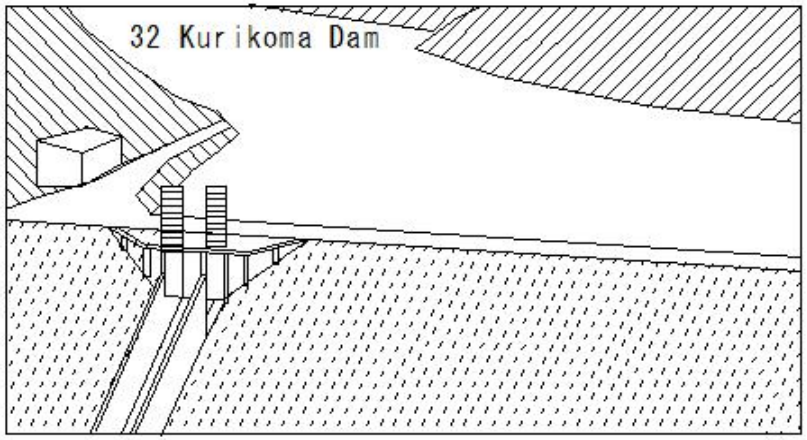

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(He164) Hasama River

(He164) Hasamagawa

Dams in the Hasama River Basin

Aratozawa Dam

Purpose: Flood control, agricultural water supply, power generation (1,000kW output)

Type: Central core rockfill dam

Dam height: 74.4m

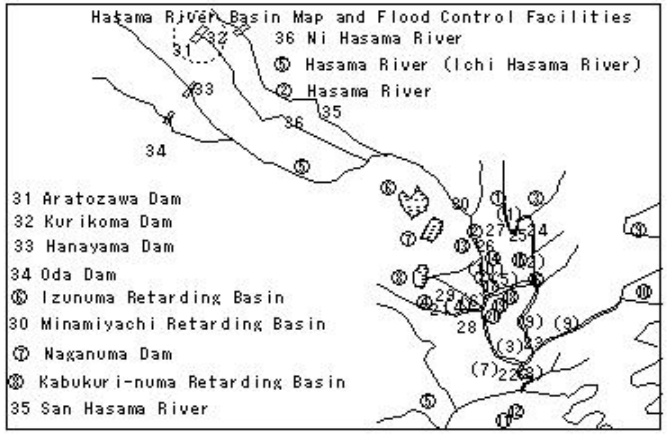
Crest length: 413.7m

Catchment area: 20.4km2

Reservoir area: 0.76km2

Total storage capacity: 14.13 million m3

Completed: 1998



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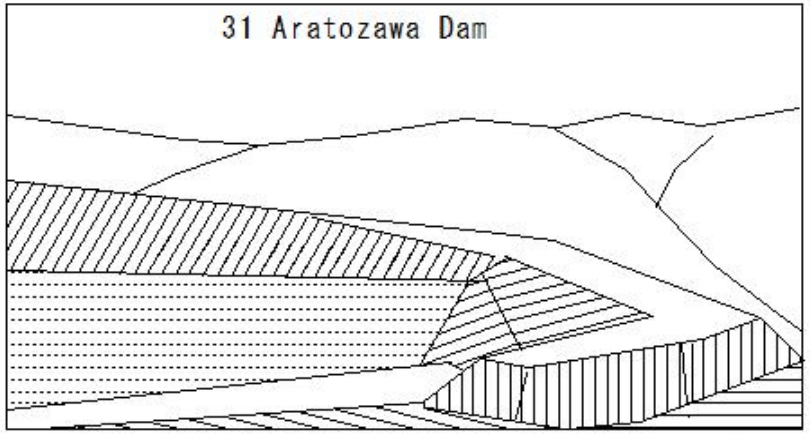

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(He165) Hasama River

(He165) Hasamagawa

Dams in the Hasama River Basin

Oda Dam

Purpose: Flood control, agricultural water supply

Type: Central core rockfill dam

Dam height: 43.5 m

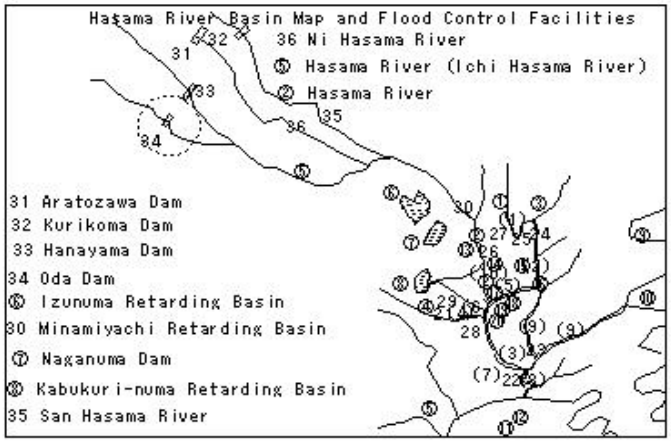
Crest length: 520.0 m

Catchment area: 23.4 km2

Reservoir area: 0.81 km2

Total storage capacity: 9.72 million m3

Completed: 2005



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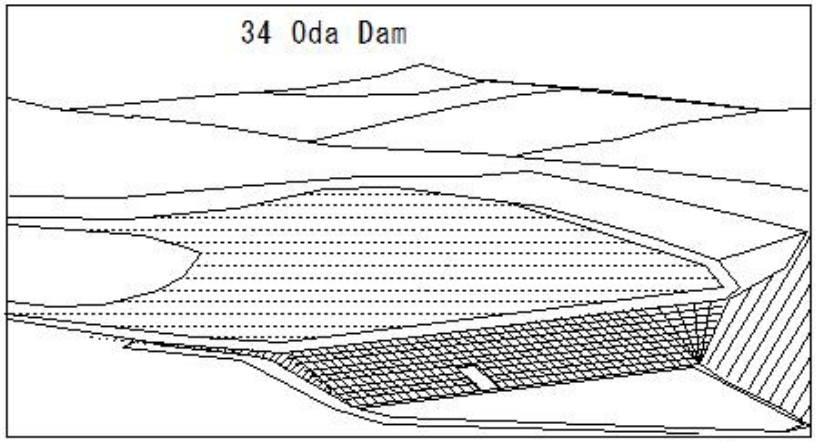

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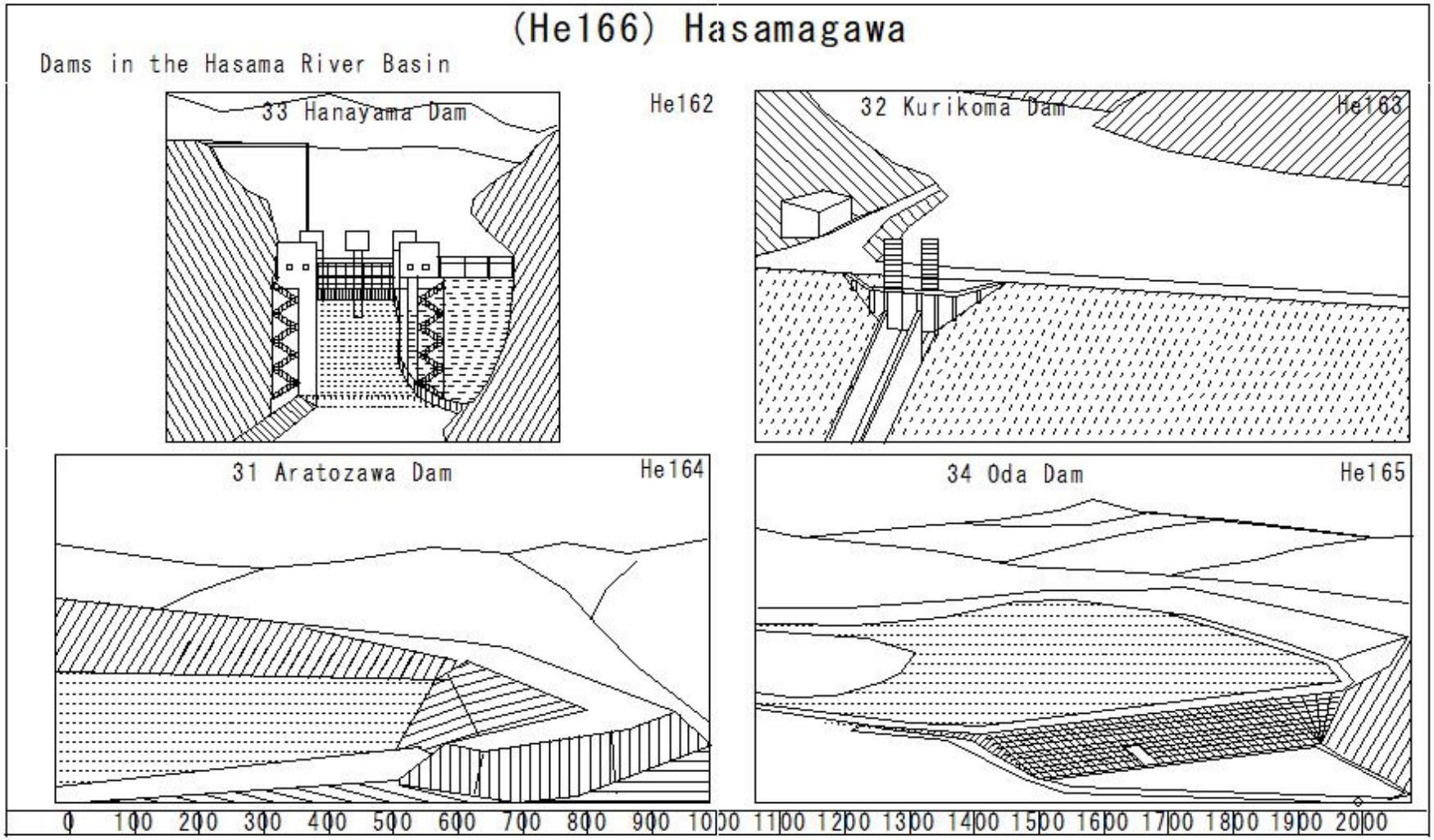
(He166) Hasama River



(He167) Hasama River

(He167) Hasamagawa

Geography and Basin Characteristics of the Hasama River ~Five Flood Control Issues~

The Hasam River basin's topography is uniquely unsuitable for flood control.

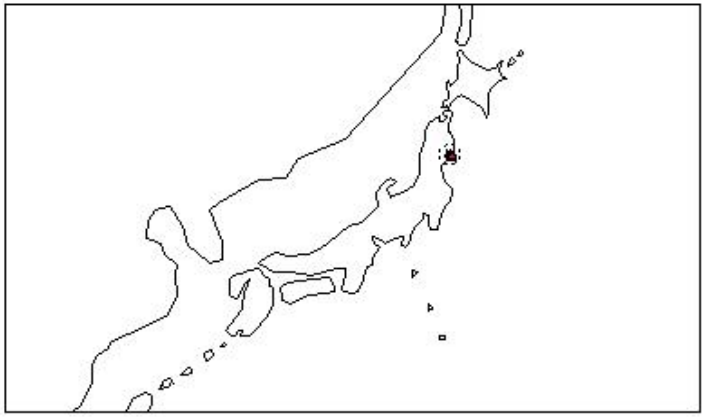
As a result, flood control measures have long been implemented based on the basin's characteristics.

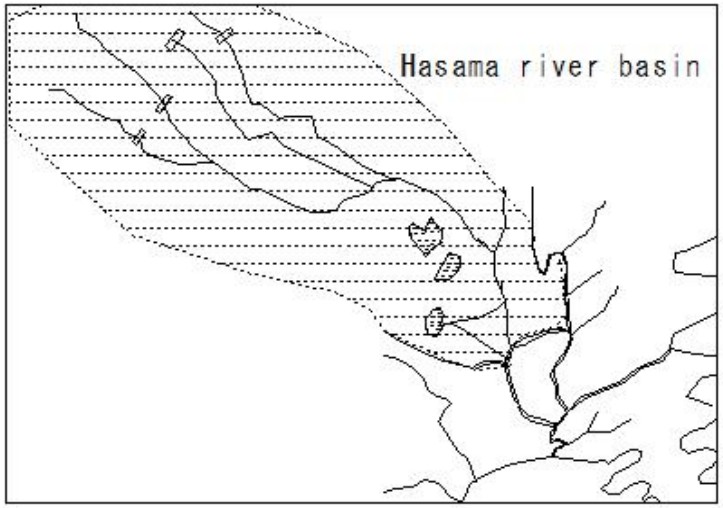
① The upper reaches are prone to rainfall.

② The middle and lower reaches flow through low-lying, gentle-gradient land.

The Hasama River originates by collecting rainwater from the southeastern slope of Mount Kurikoma, one of the rainiest areas in the prefecture.

From the middle to lower reaches, the gradient is extremely gentle, at 1:4000, making it difficult for floodwaters to flow downstream.





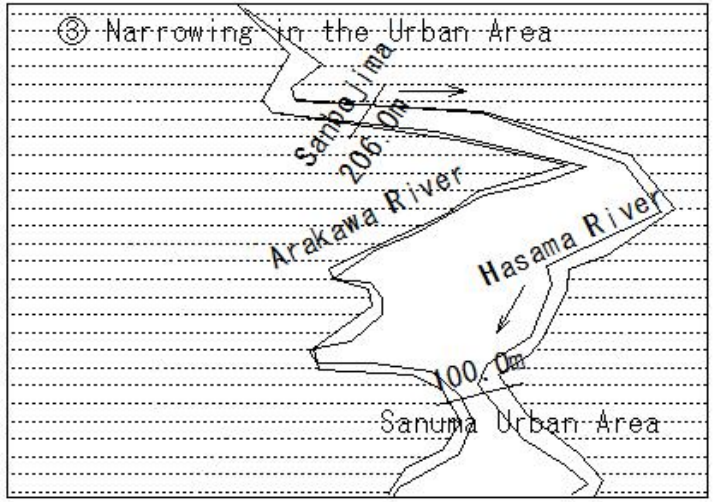
(He168) Hasama River

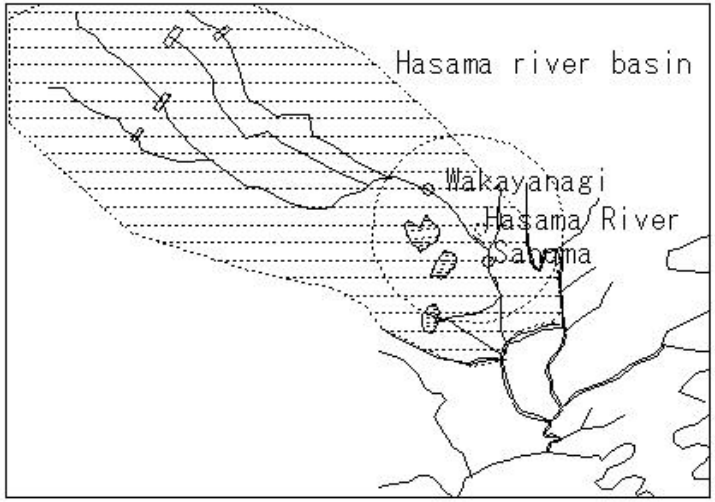
(He168) Hasamagawa

Geography and Basin Characteristics of the Hasama River ~Five Flood Control Issues~

③ Narrowing in the Urban Area

The Hasama River narrows between the urban areas of Wakayanagi and Sanuma (the river width is narrower upstream than downstream). This creates a bottleneck during floods, making the water level near the urban area more likely to rise.





(He169) Hasama River

(He169) Hasamagawa

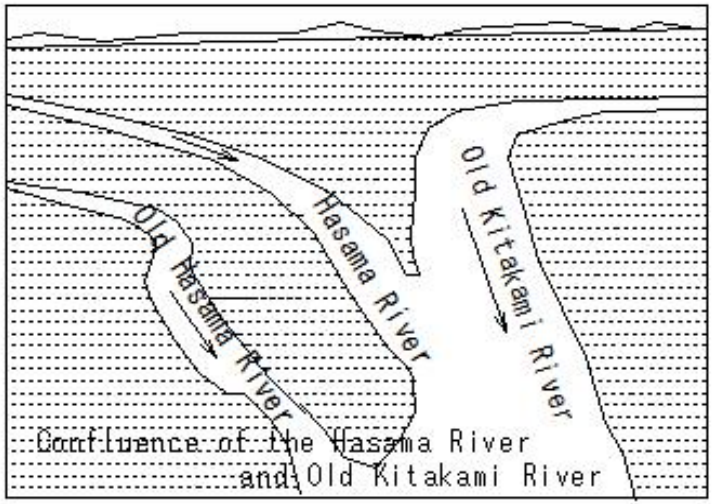
Geography and Basin Characteristics of the Hasama River ~Five Flood Control Issues~

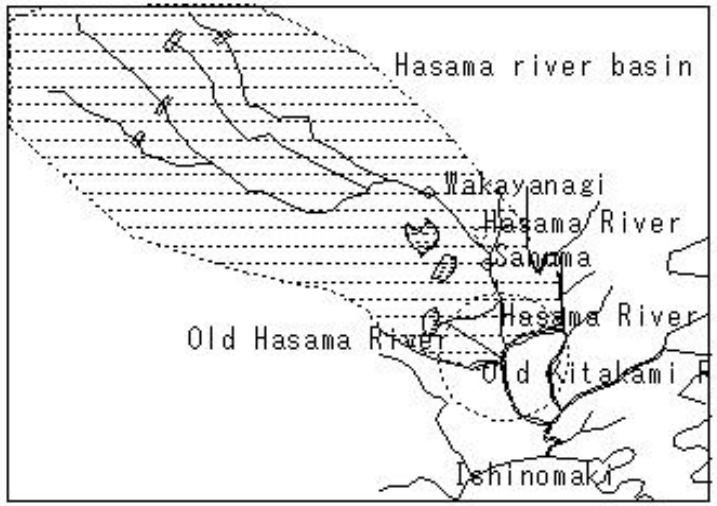
④ Affected by backwaters of the Old Kitakami River

⑤ Limited flood capacity downstream (Old Kitakami River)

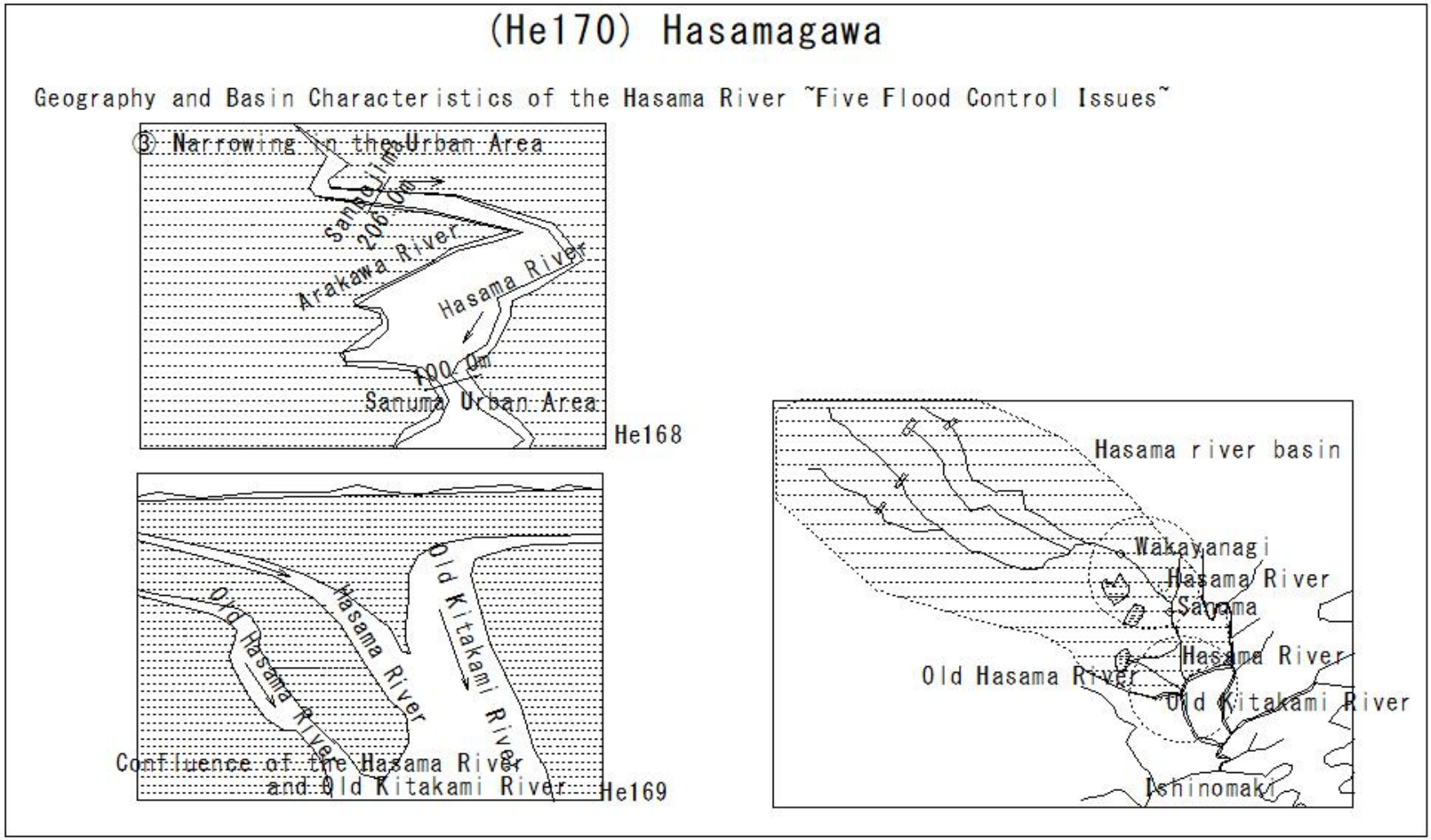
Because the middle and lower reaches of the Hasama River have an extremely gentle gradient, when the Old Kitakami River rises, floodwaters from the Old Kitakami River backflow into the Hasama River.

In addition, to prevent flood damage in Ishinomaki City downstream, there is a limit on the amount of floodwater flow from the Hasama River to the Old Kitakami River.





(He170) Hasama River



(He171) Nobiru Port Construction

(He171) Nobiru Port Construction

Nobiru Port Construction

① Planned as the Meiji government's most important base for the development of the Tohoku region, covering the area from present-day Higashimatsushima City in

② Japan's first modern Western-style port construction project (starting in 1878).

③ Site selection and design were handled by Dutch Chief Engineer of the Ministry of the Interior, Van Doorn.

④ A jetty was completed at the mouth of the Naruse River in 1882 and began operation.

⑤ Rough waves in the outer harbor made it difficult for large ships to anchor.

⑥ Unexpected sand drift made it impossible to maintain the water depth.

⑦ A typhoon in September 1884 destroyed part of the jetty.

⑧ The Nobiru Port Construction Project was canceled without starting construction on the outer harbor.

⑨ Valuable modern Western-style port facilities (jet remains, sewer system, brick bridge abutments, etc.) remain, demonstrating the civil engineering technology of the time.

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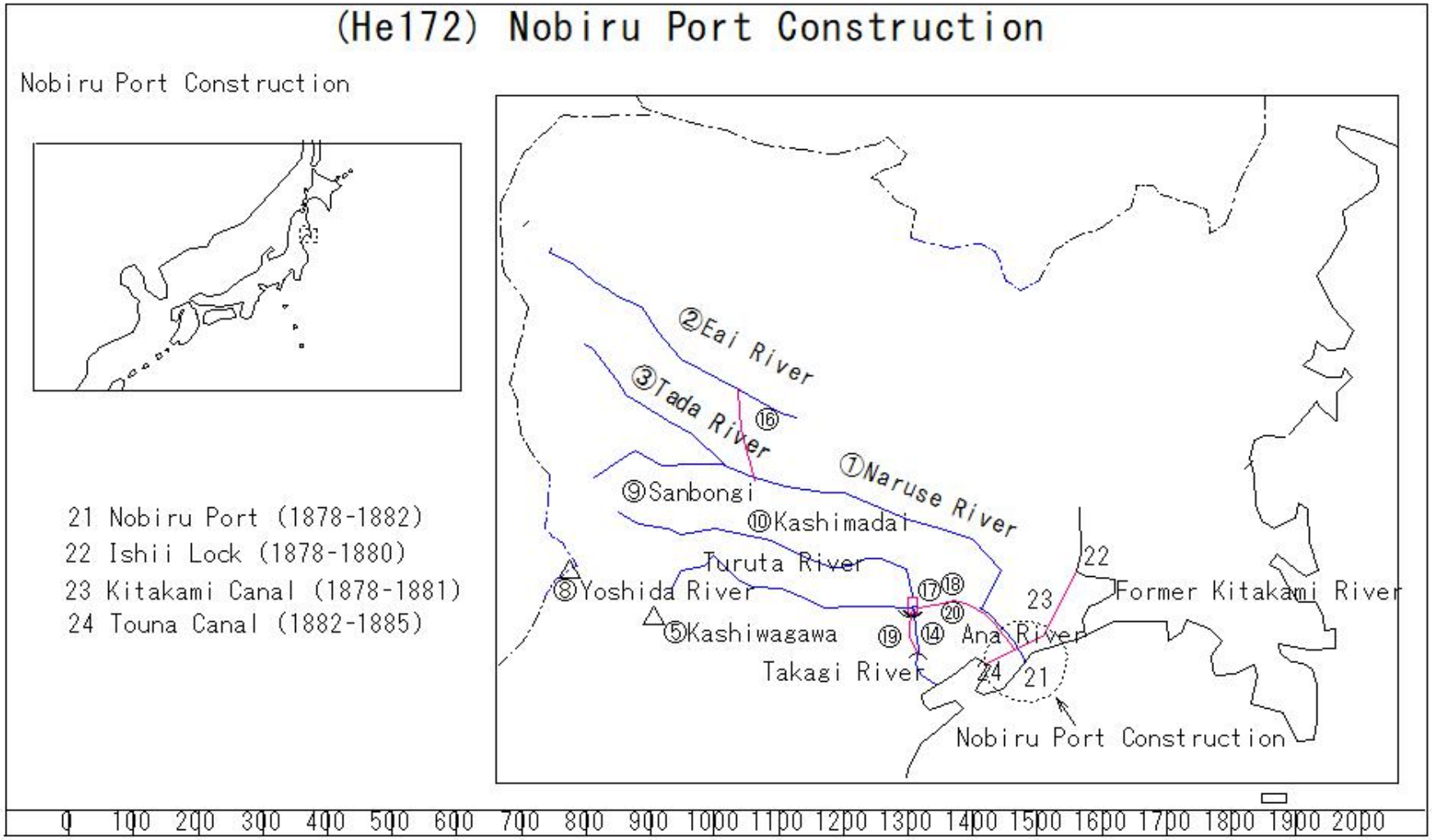
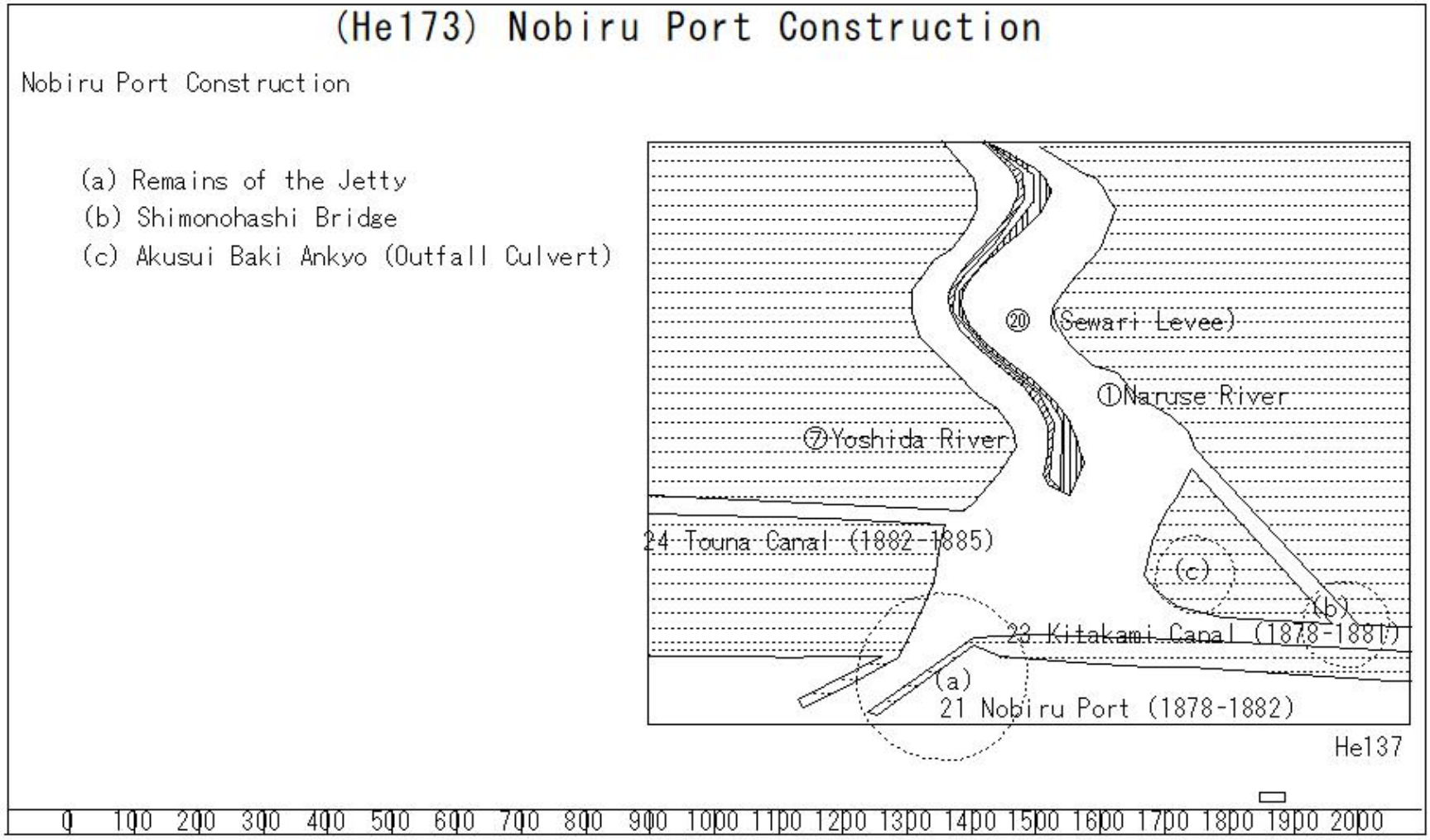
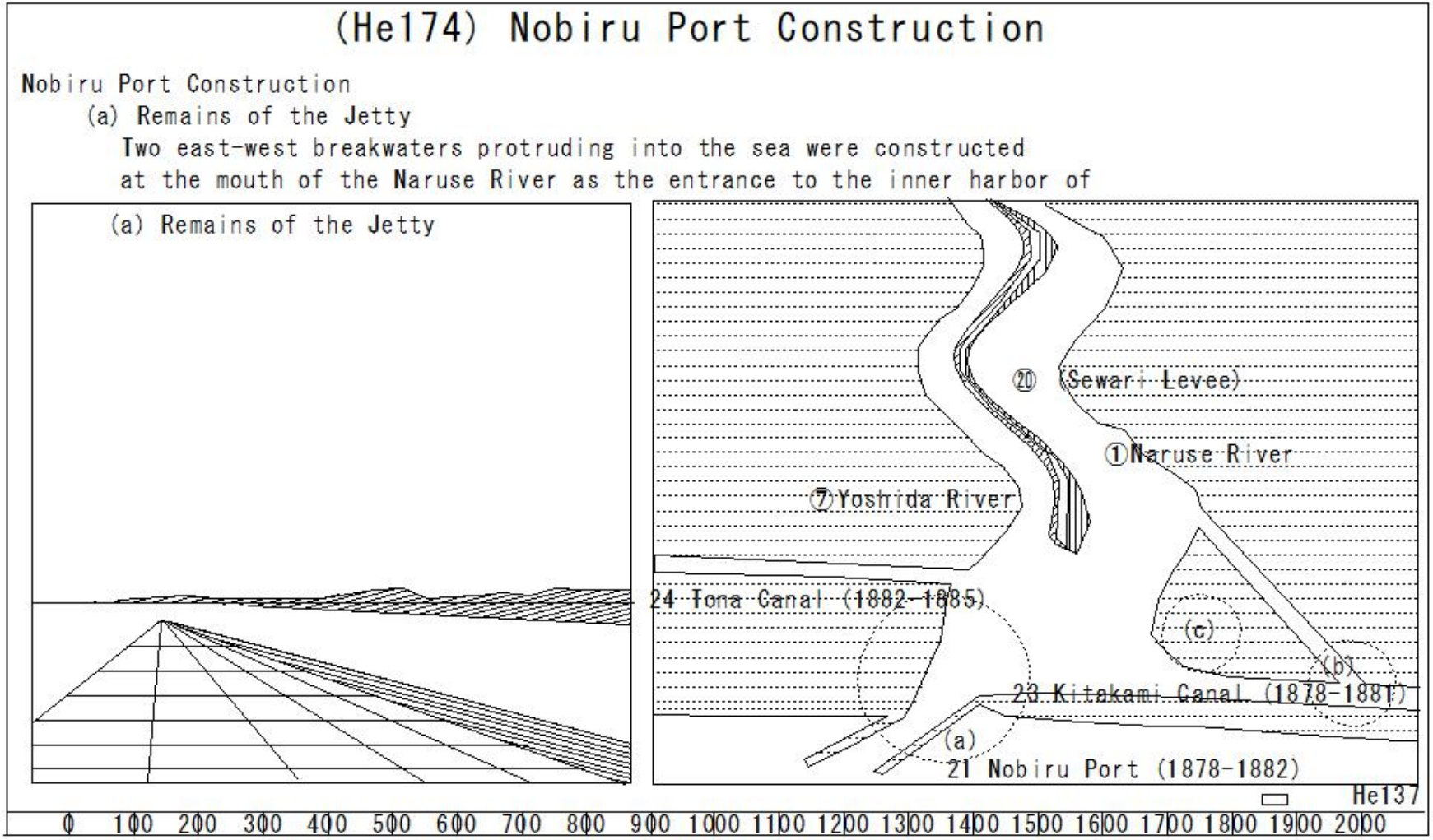
(He172) Nobiru Port Construction



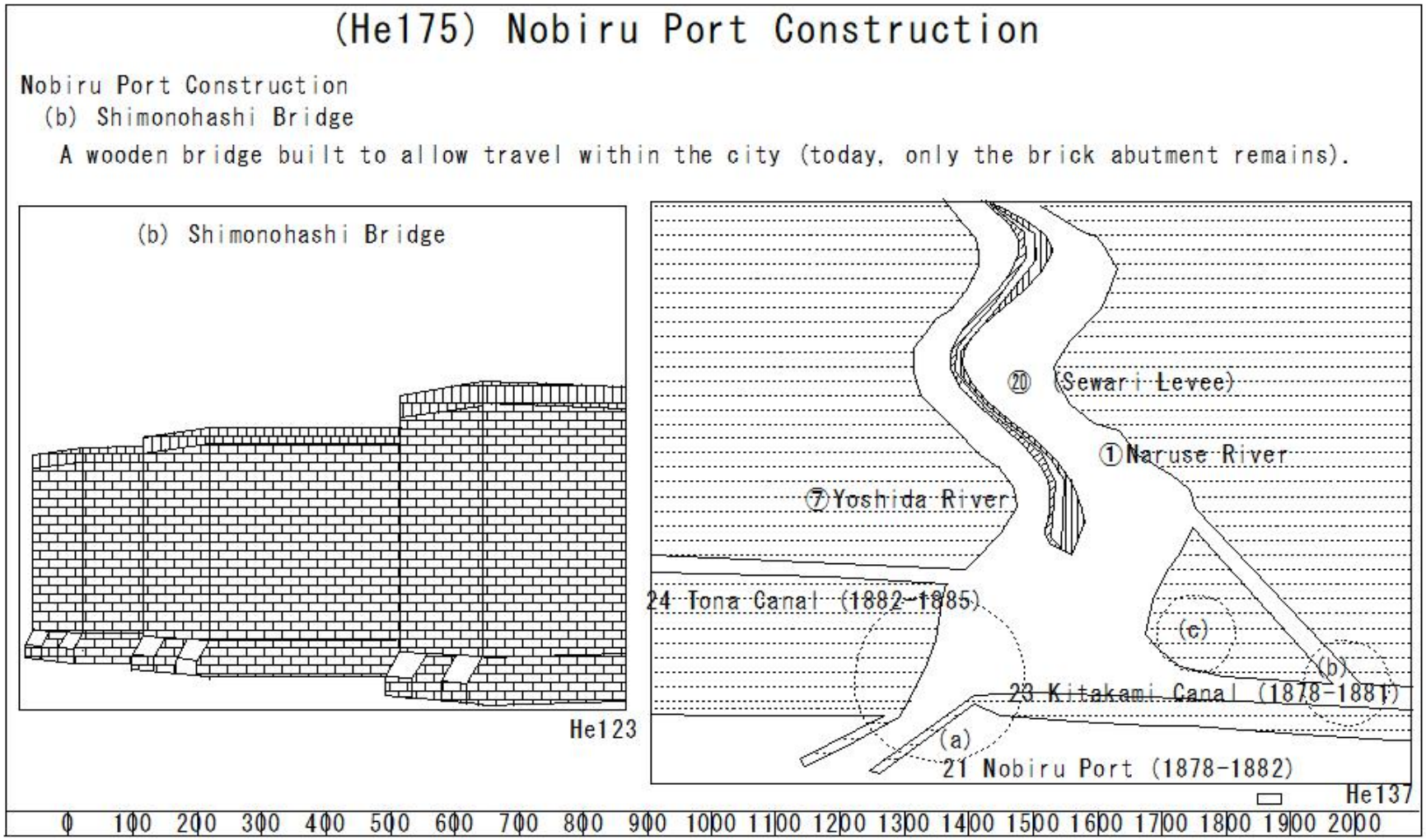
(He173) Nobiru Port Construction



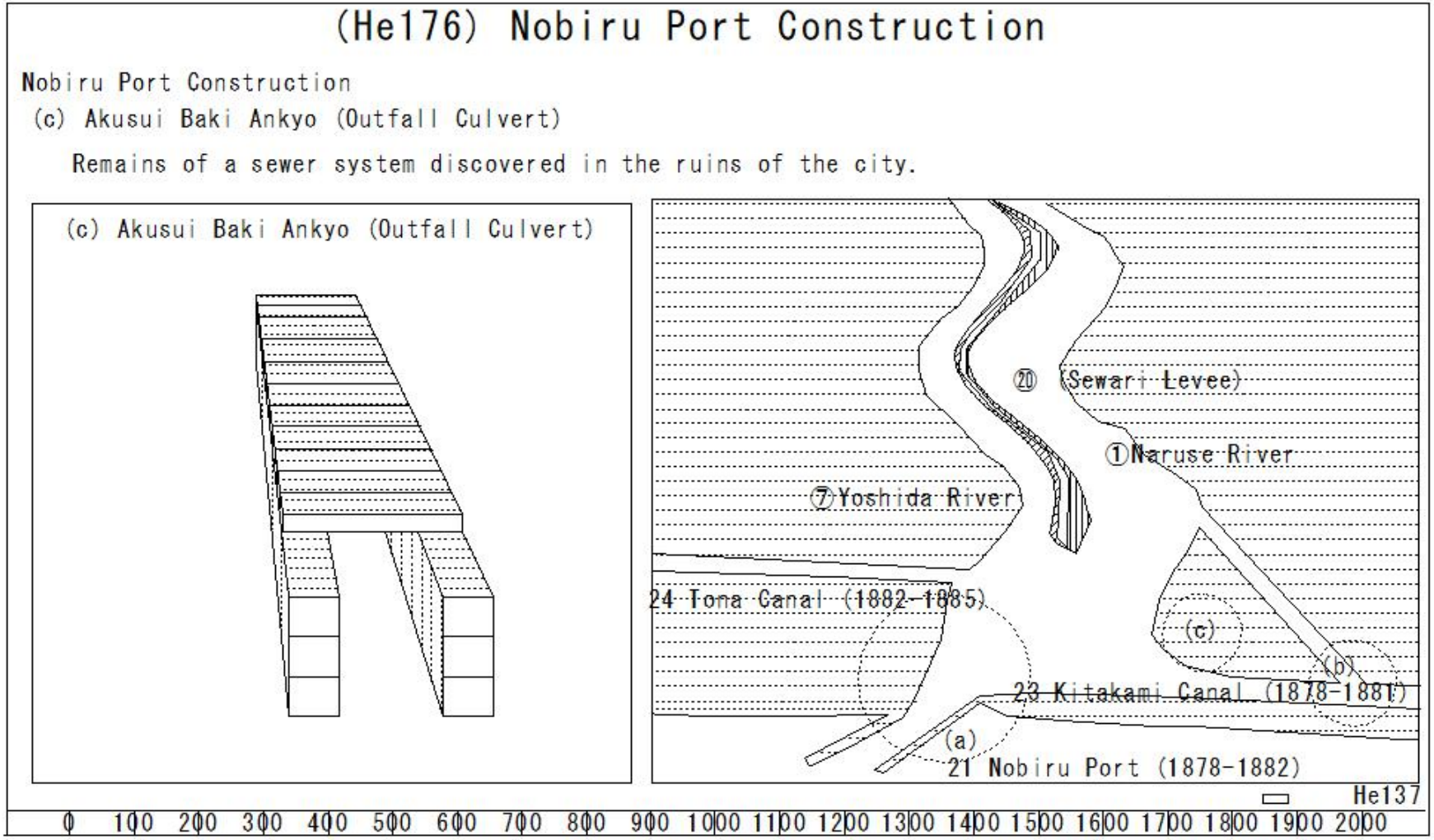
(He174) Nobiru Port Construction



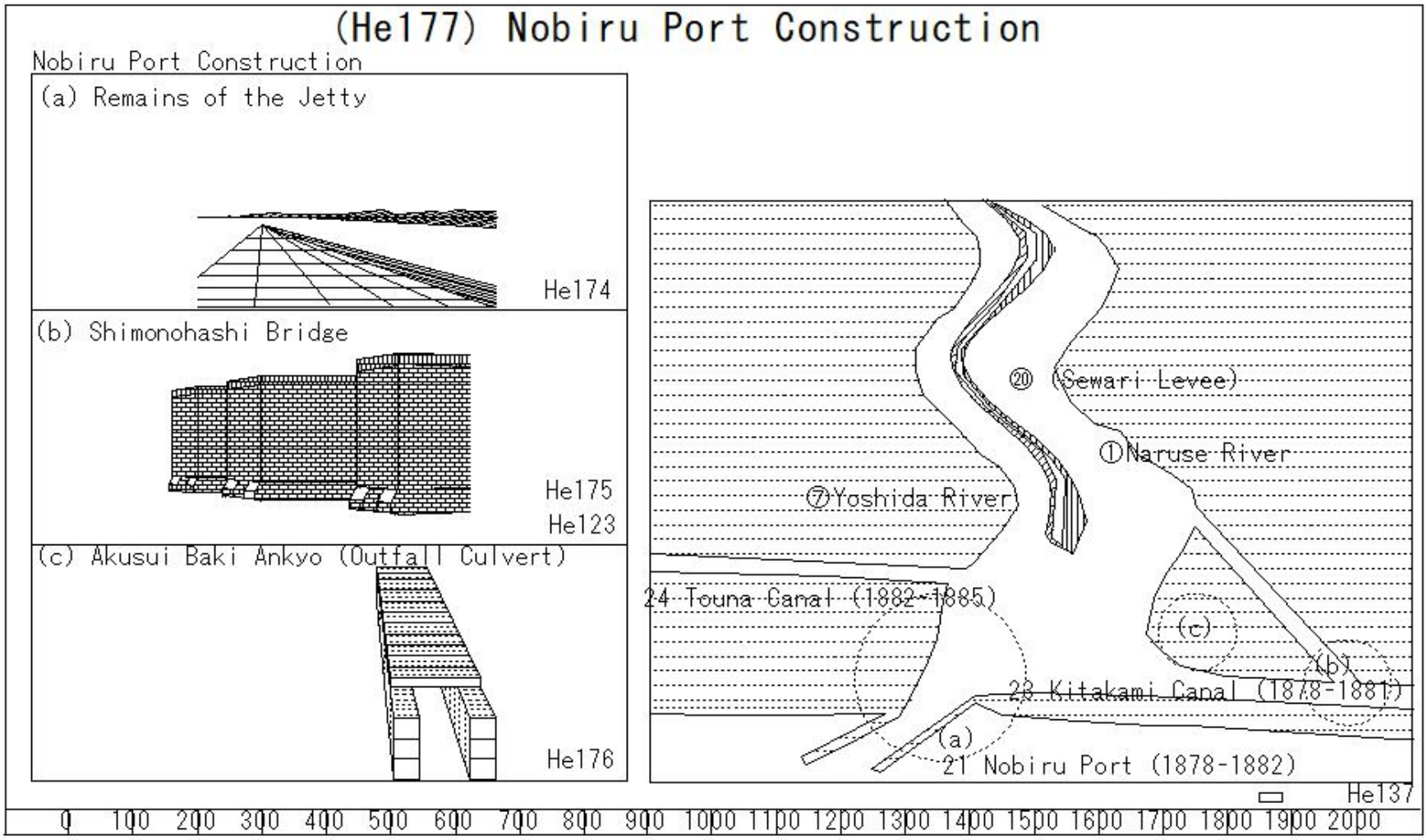
(He175) Nobiru Port Construction



(He176) Nobiru Port Construction



(He177) Nobiru Port Construction



(He178) Nobiru Port Construction

(He178) Nobiru Port Construction

Nobiru Port Construction

Major Projects in the Inner Port Area

① Construction of the East Jetty (191m) and West Jetty (236m)

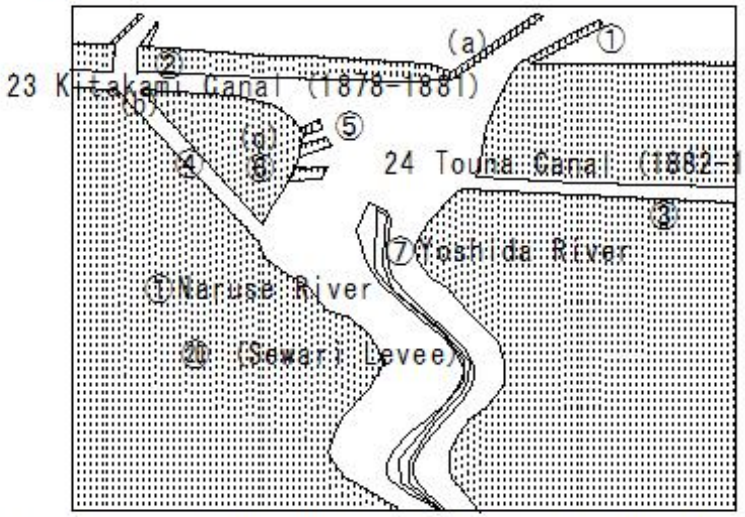
② Excavation of the Kitakami Canal (11.8km long) and installation of locks

③ Excavation of the Touna Canal (3.3km long)

④ Excavation of the Shin-Naruse River and installation of submerged breakwaters to divert the Naruse River

⑤ Dredging of the Inner Port Basin (3ha, 4.2m deep)

⑥ Creation of a new urban area by filling in the Naruse River delta (34.6ha)



(a) Remains of the Jetty

(b) Shimonohashi Bridge

(c) Akusui Baki Ankyo (Outfall Culvert)

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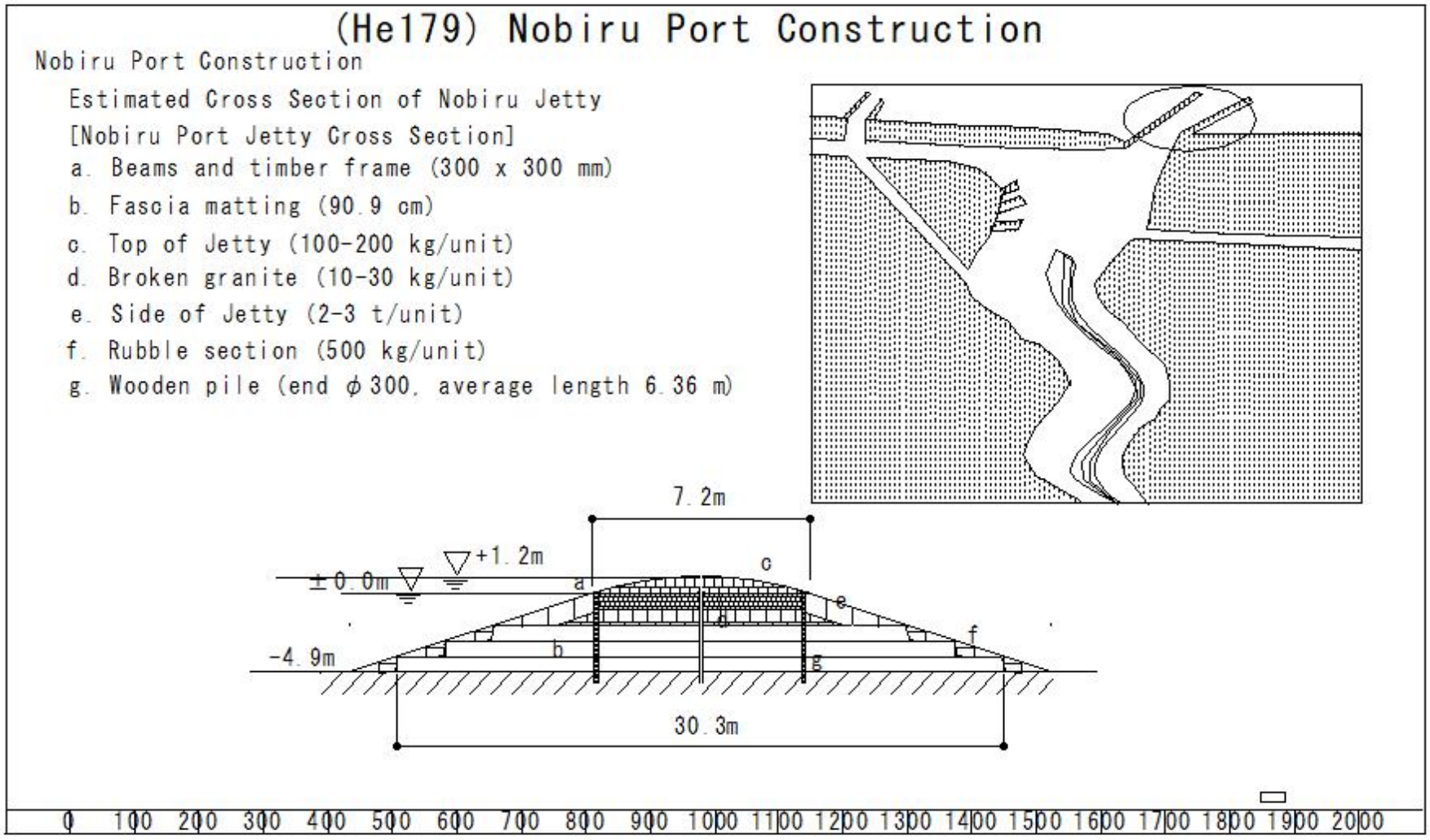
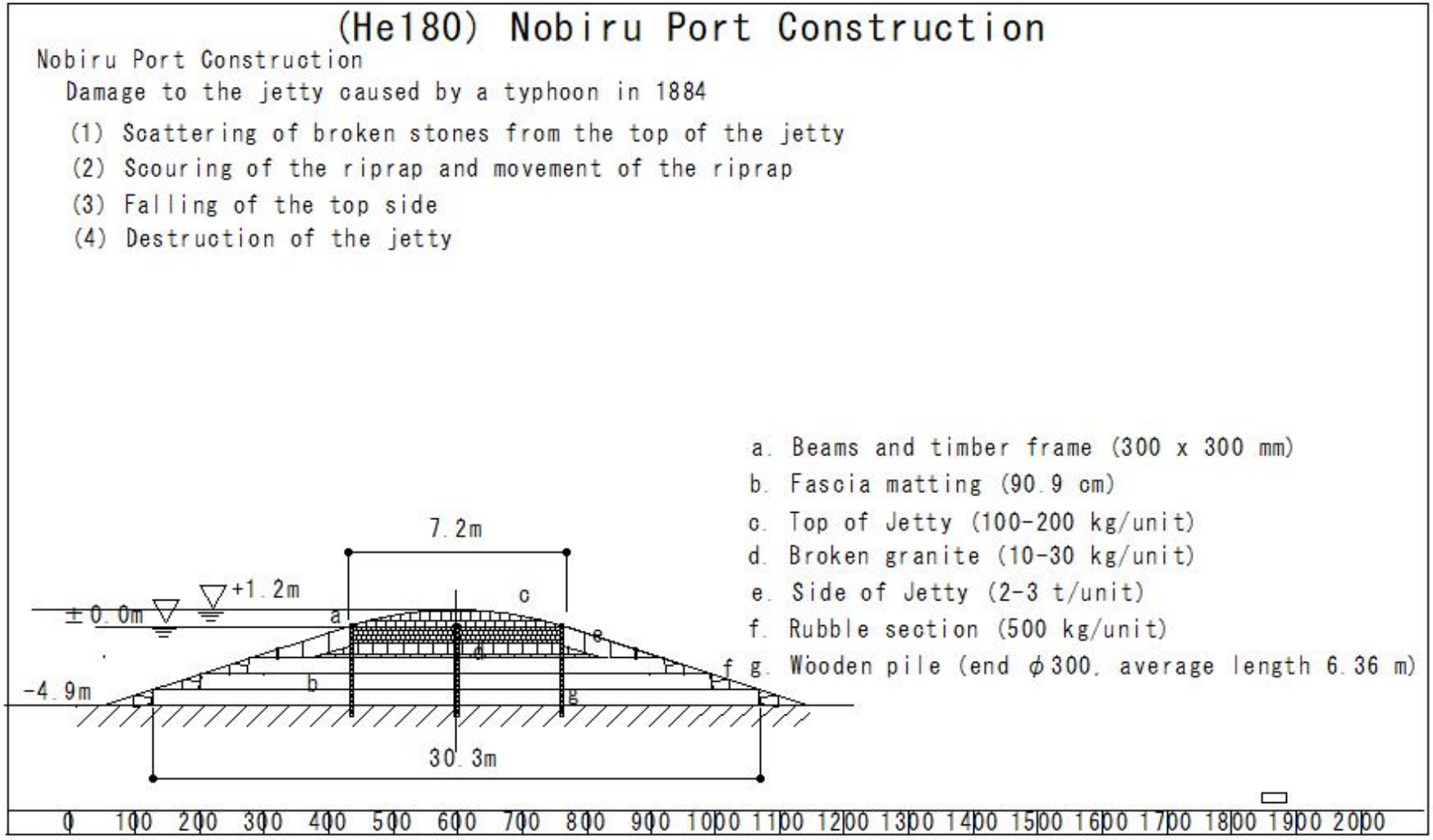
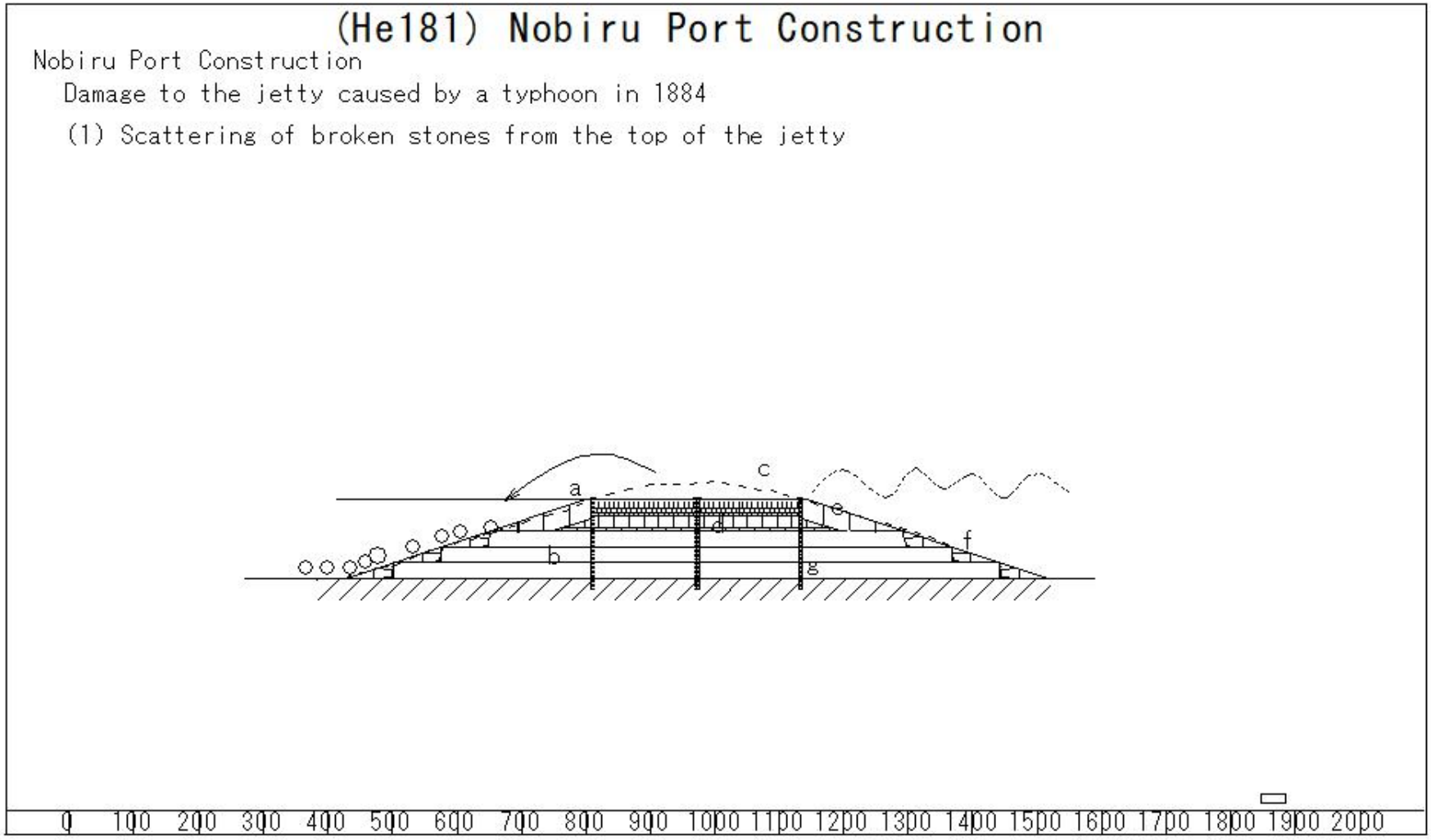
(He179) Nobiru Port Construction



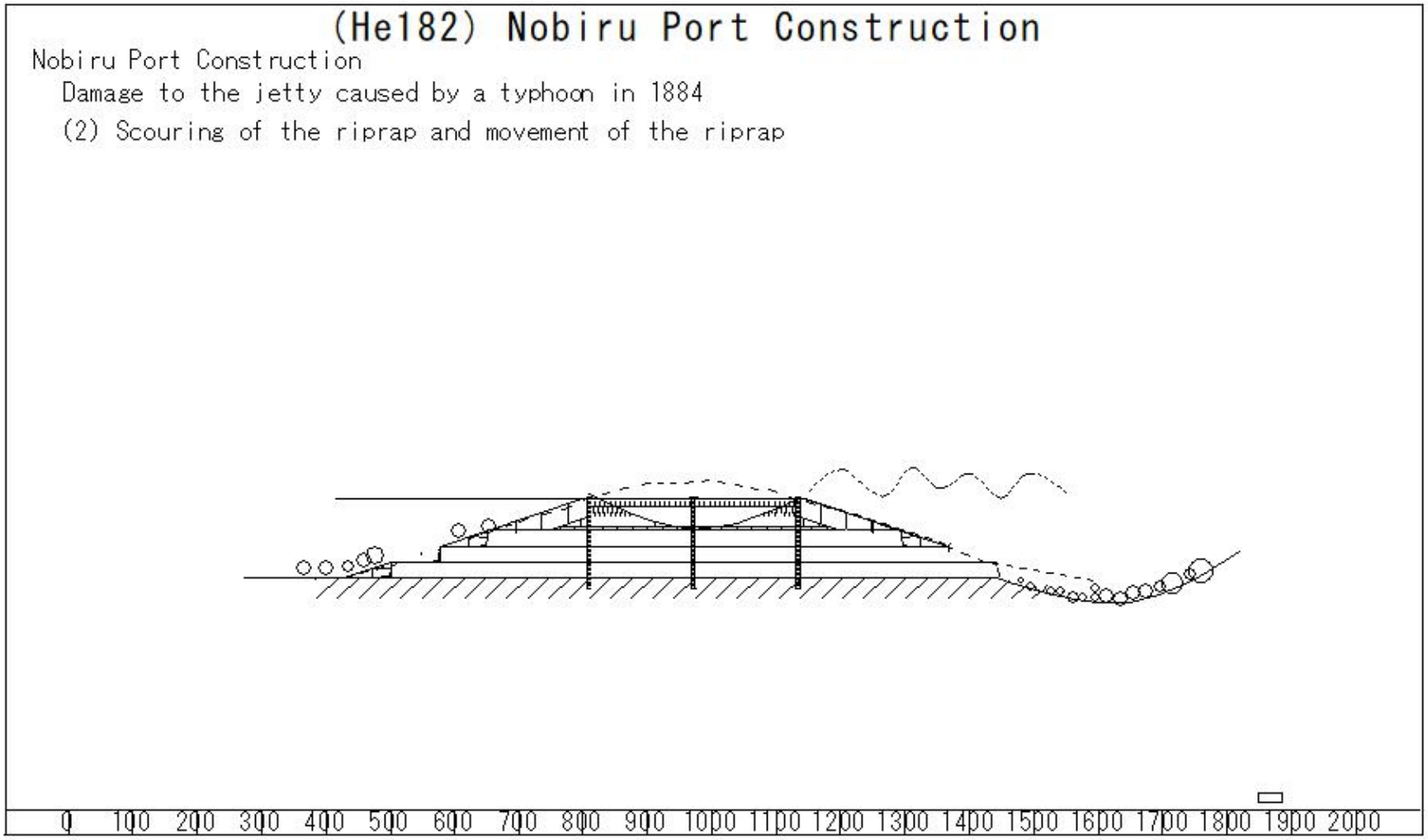
(He180) Nobiru Port Construction



(He181) Nobiru Port Construction



(He182) Nobiru Port Construction



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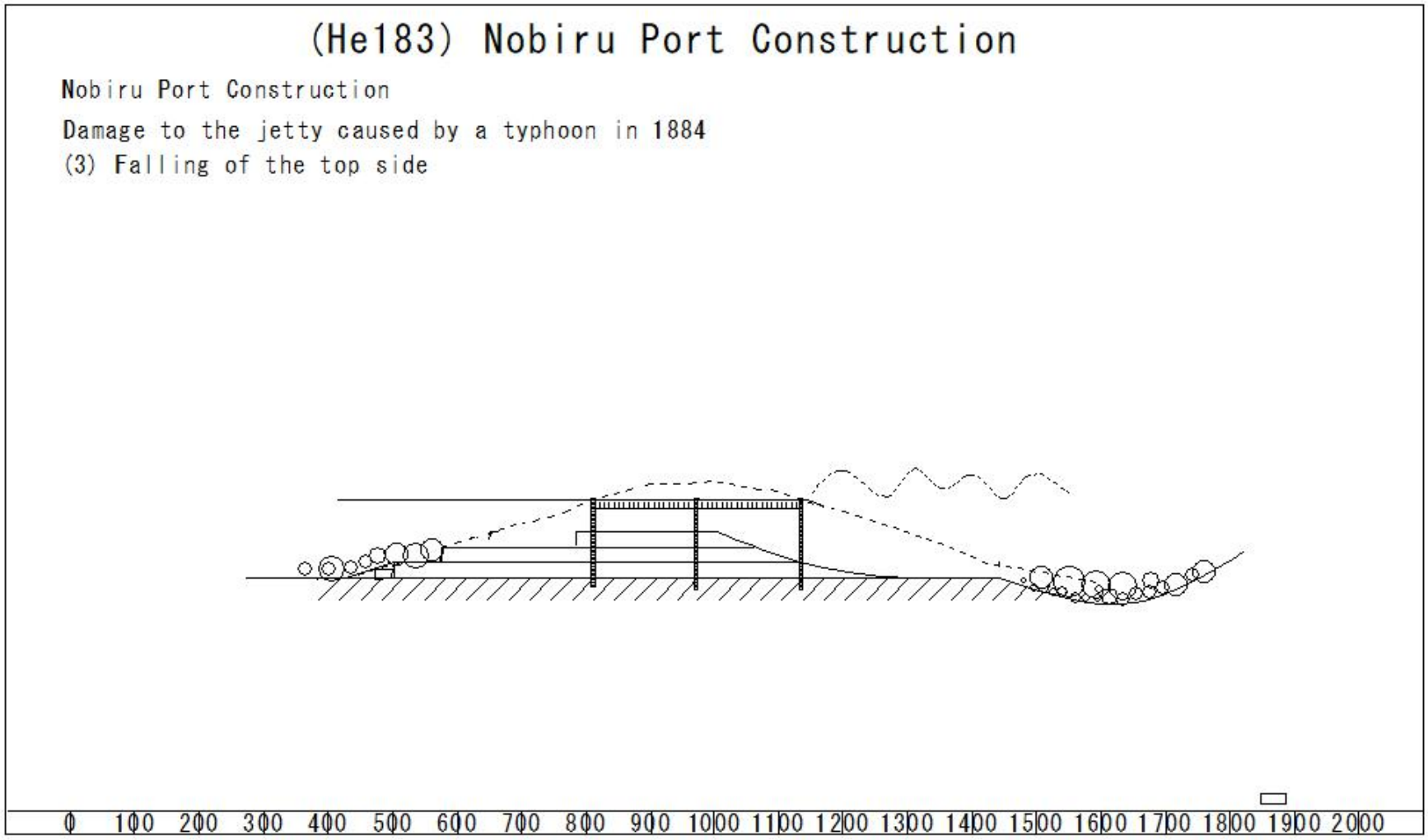
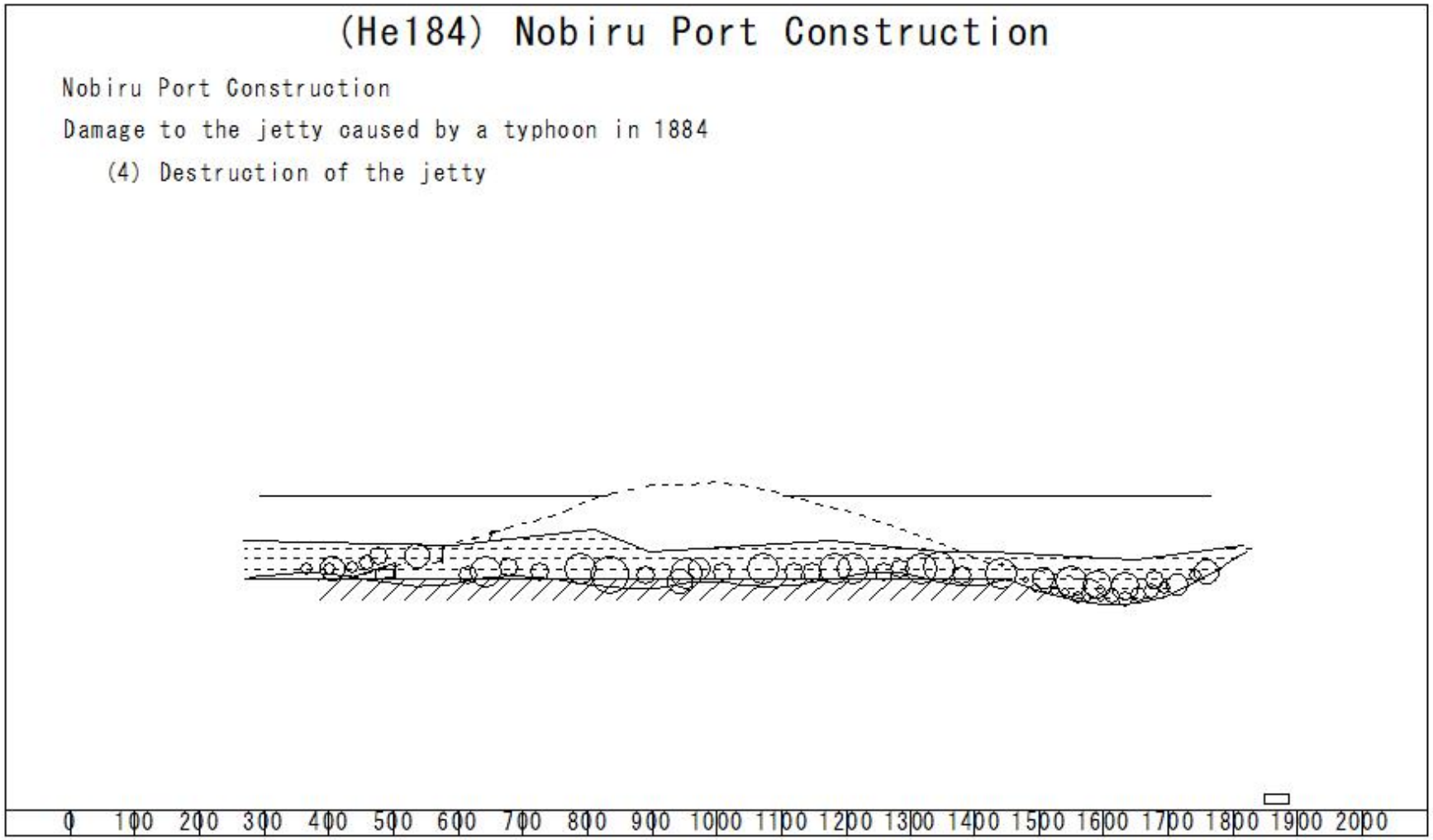
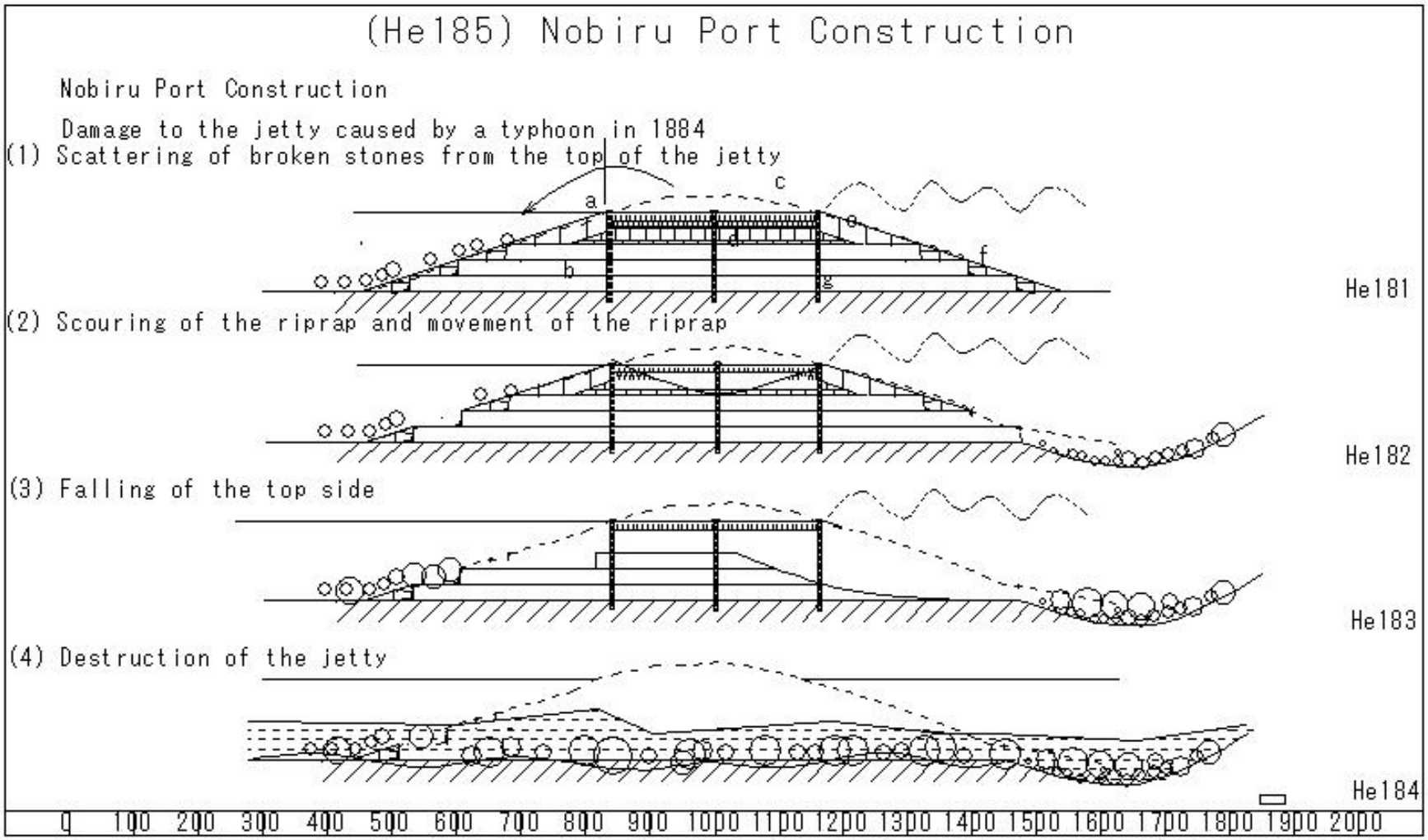


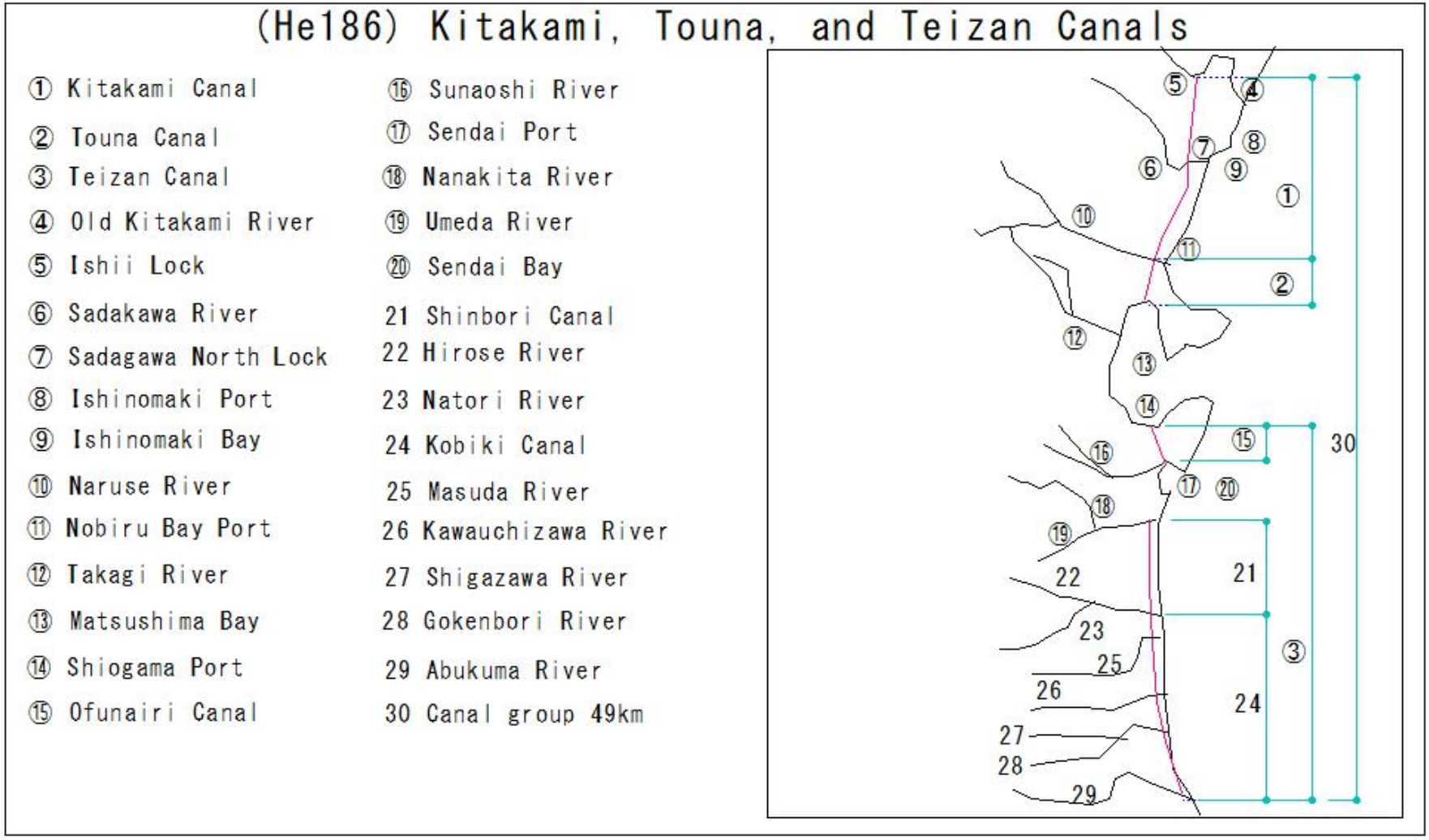
(He184) Nobiru Port Construction



(He185) Nobiru Port Construction



(He186) Kitakami, Touna, and Teizan Canals



(He187) Kitakami, Touna, and Teizan Canals

(He187) Kitakami, Touna, and Teizan Canals

The Kitakami Canal (Kitakami Canal)

① The Kitakami Canal is a 12.8-kilometer canal connecting the mouths of the Old Kitakami River and the Naruse River.

② It was excavated during the Meiji period as part of a related project to the Nobiru Port Construction Project.

③ It was expected to form a transportation artery from the Kitakami River through the Kitakami Canal, passing through Nobiru Port, the Touna Canal, and the Teizan Canal toward Sendai.

④ Ishii Lock, Japan's first modern lock, was located at the junction with the Kitakami River.

⑤ The wooden Nobiru Lock was installed at the confluence with the Shin-Naruse River.

⑥ The Omagari and Kama Locks were built at the intersection with the Sada River to prevent backflow and sediment inflow from the Sada River.

⑦ Construction of the Kitakami Canal began in 1878 (Meiji 11).

⑧The Kitakami Canal was completed the following year, in 1882 (Meiji 15).

⑨After that, the canal gradually fell into disuse due to the failure of the Nobiru Port construction project and

⑩the opening of the Tohoku Main Line.

⑪Despite the installation of locks, sediment continued to accumulate on the riverbed.

⑫By around 1891 (Meiji 24), steamships could only navigate freely at high tide.

⑬After floods in 1909 (Meiji 42) and 1910 (Meiji 43), steamship navigation became completely impossible.

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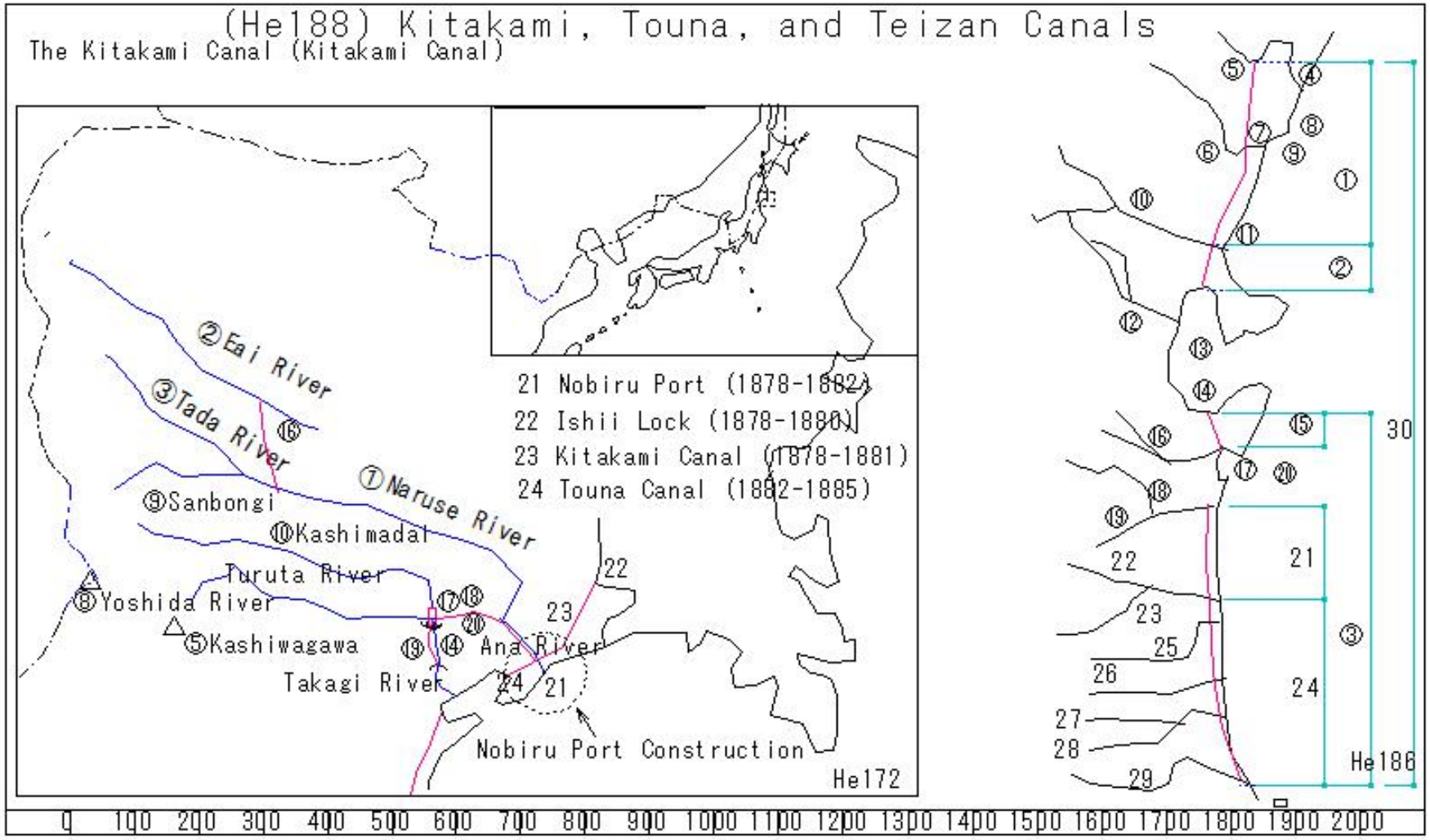
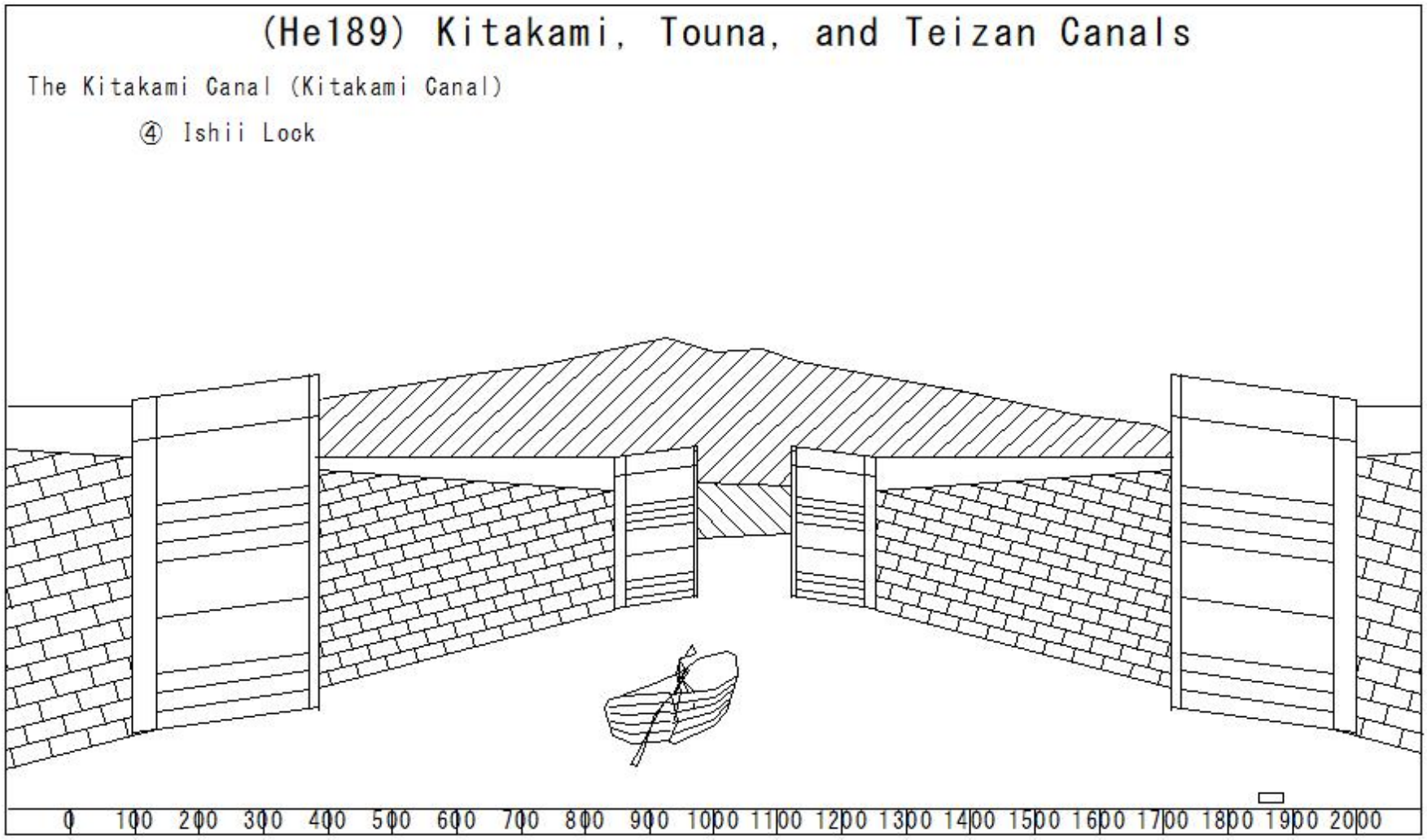
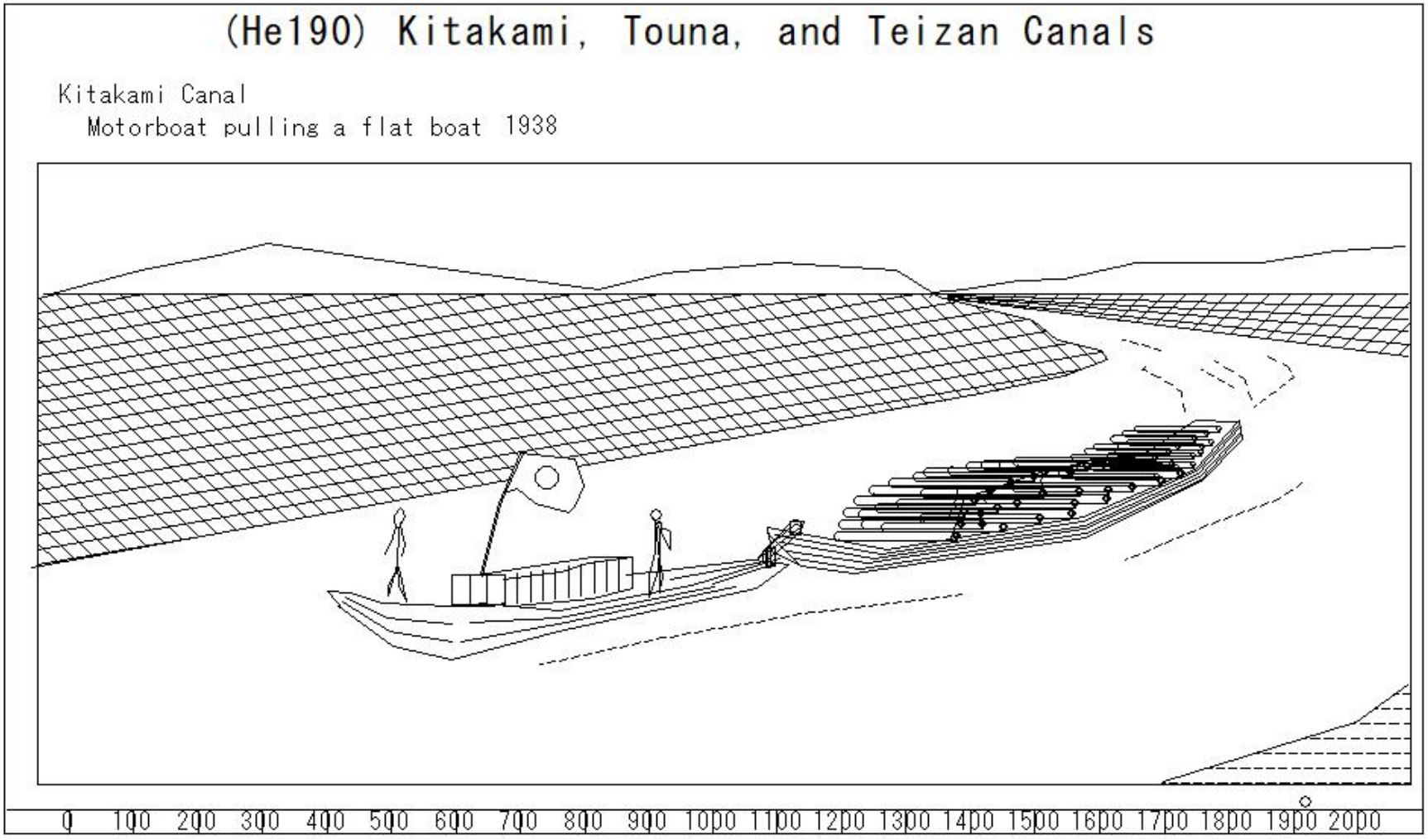
(He188) Kitakami, Touna, and Teizan Canals



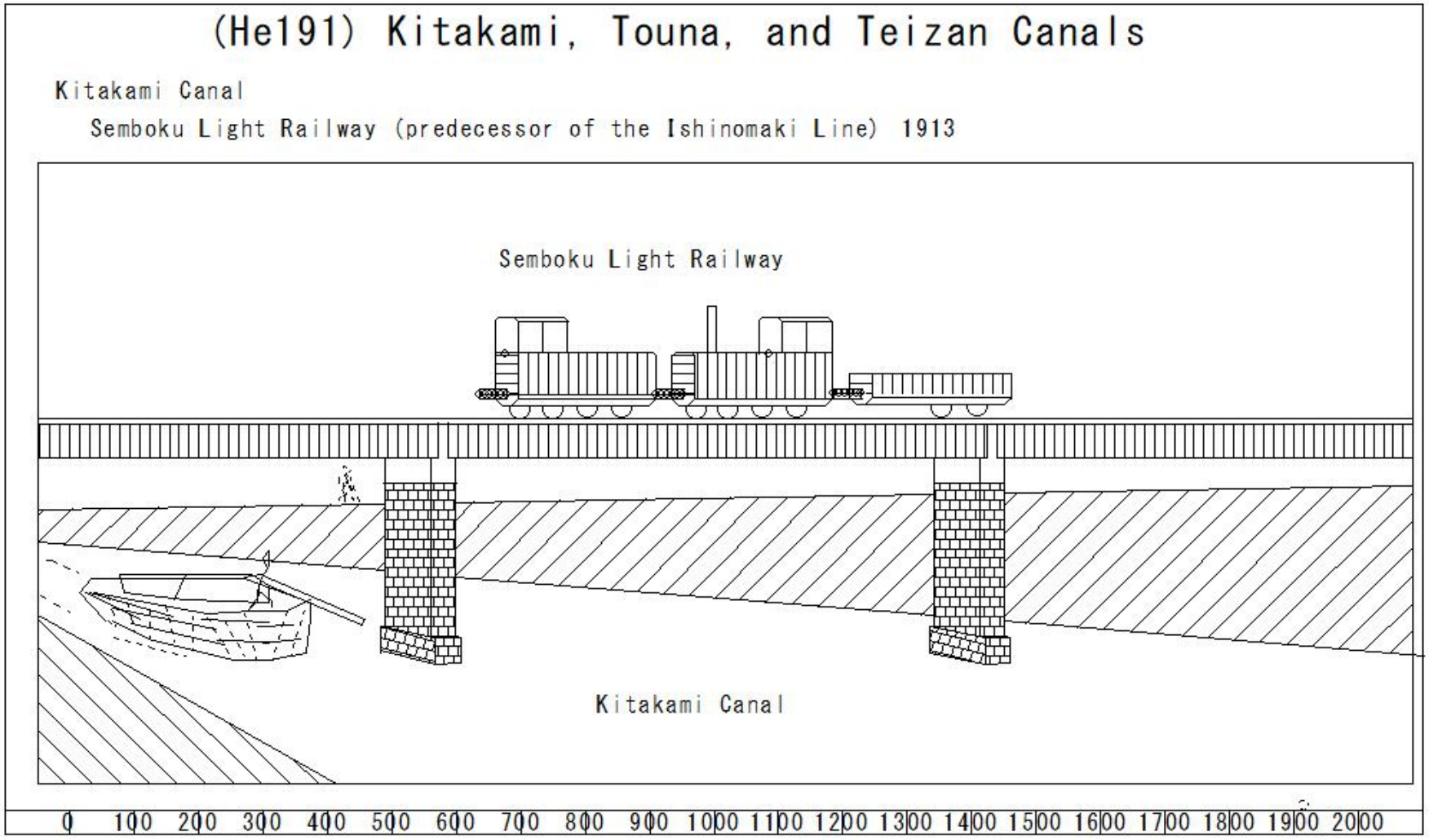
(He189) Kitakami, Touna, and Teizan Canals



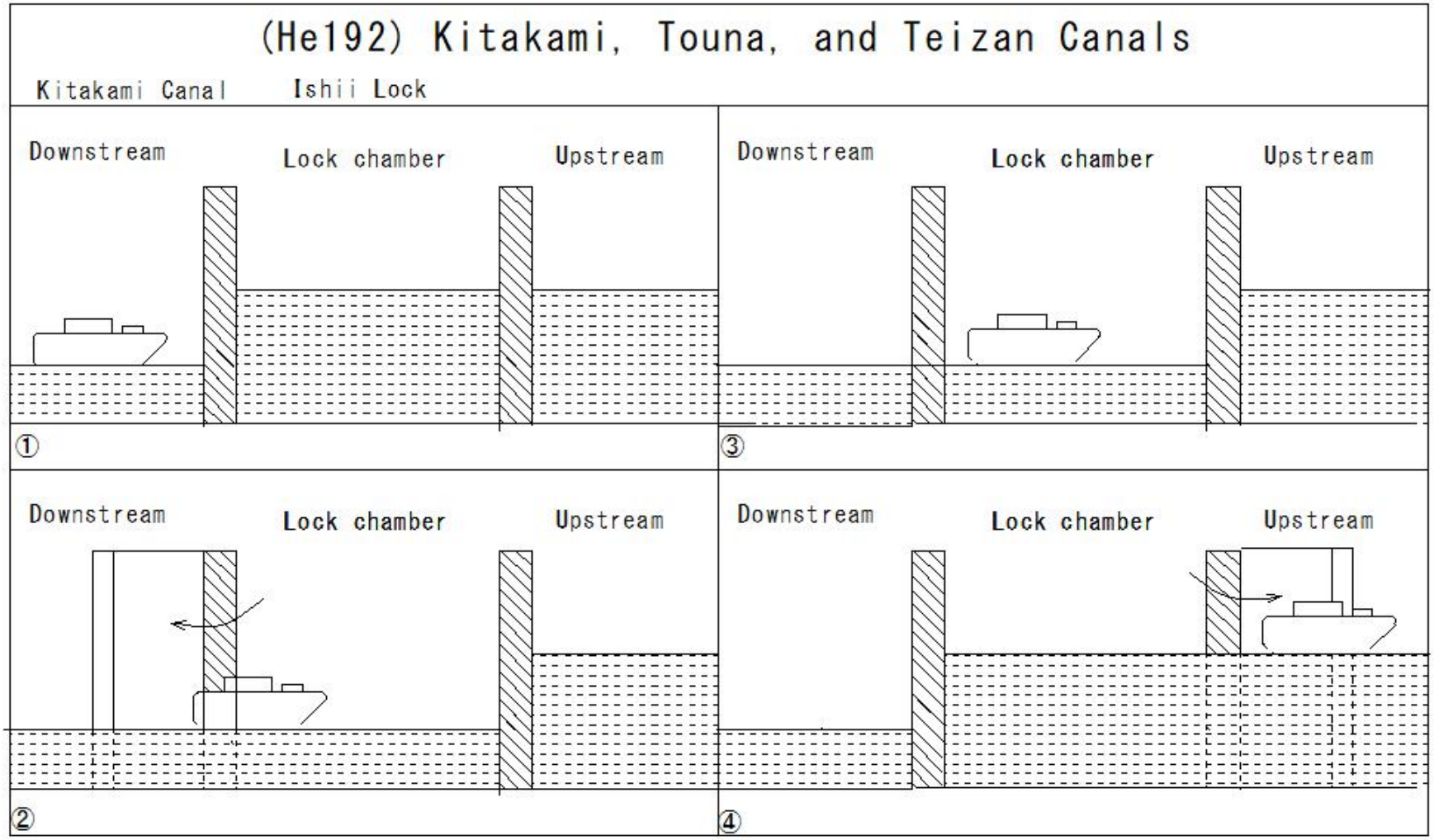
(He190) Kitakami, Touna, and Teizan Canals



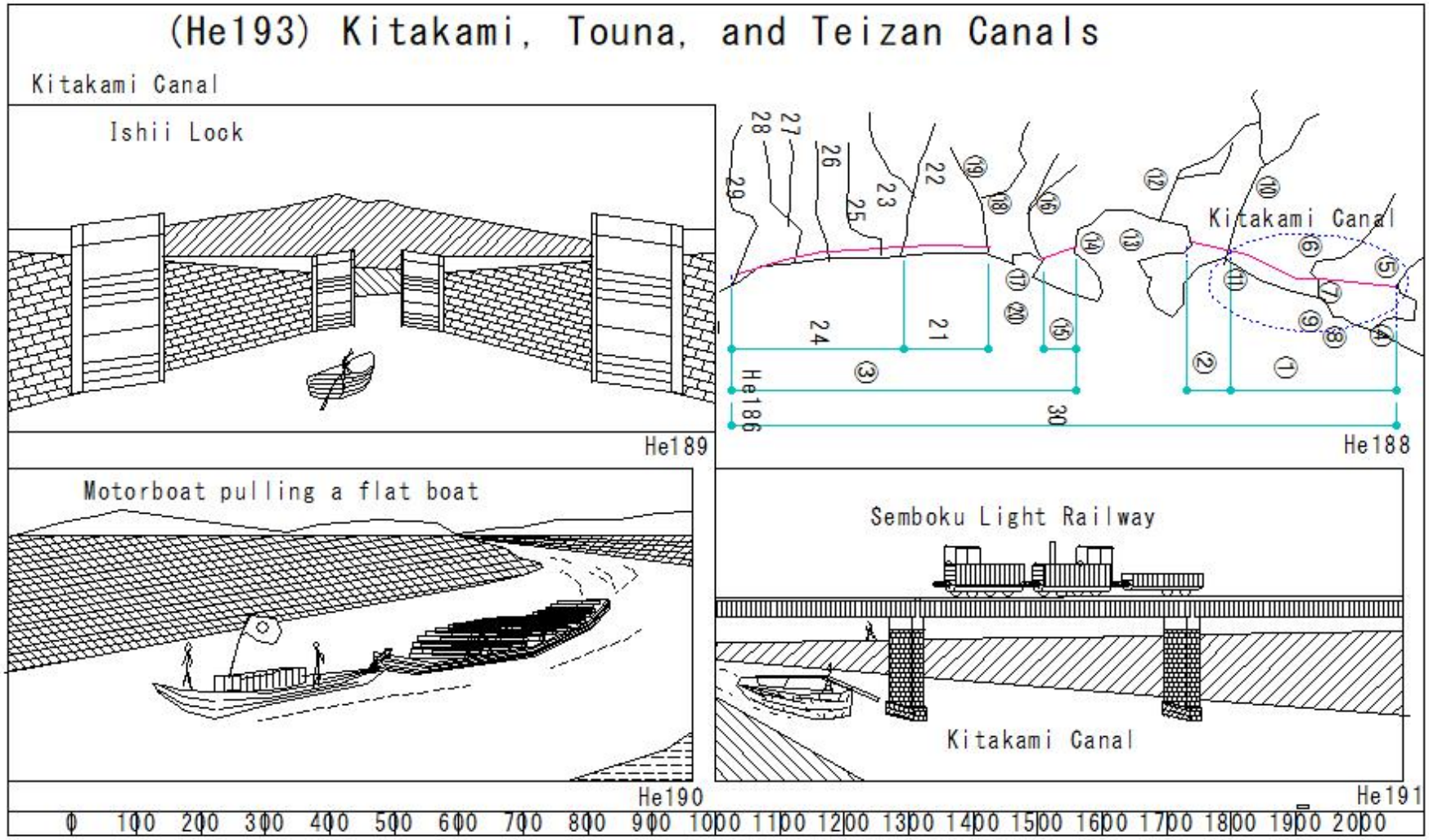
(He191) Kitakami, Touna, and Teizan Canals



(He192) Kitakami, Touna, and Teizan Canals



(He193) Kitakami, Touna, and Teizan Canals

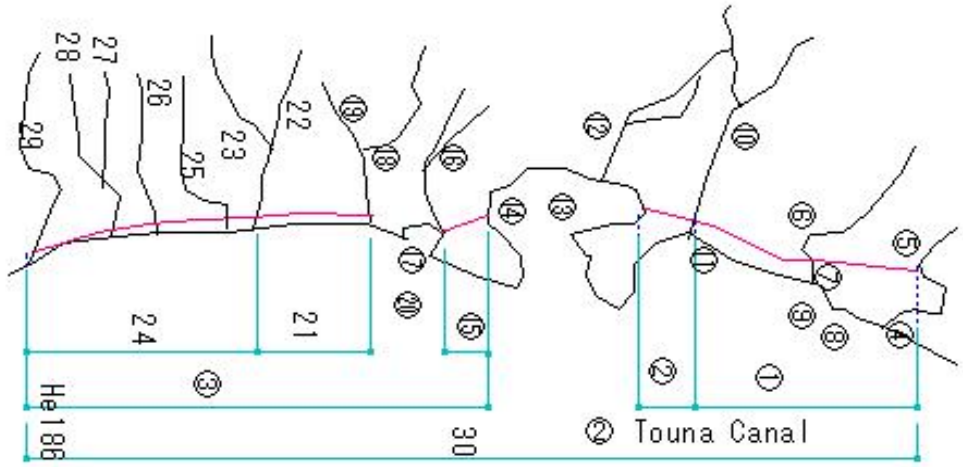


(He194) Kitakami, Touna, and Teizan Canals

(He194) Kitakami, Touna, and Teizan Canals

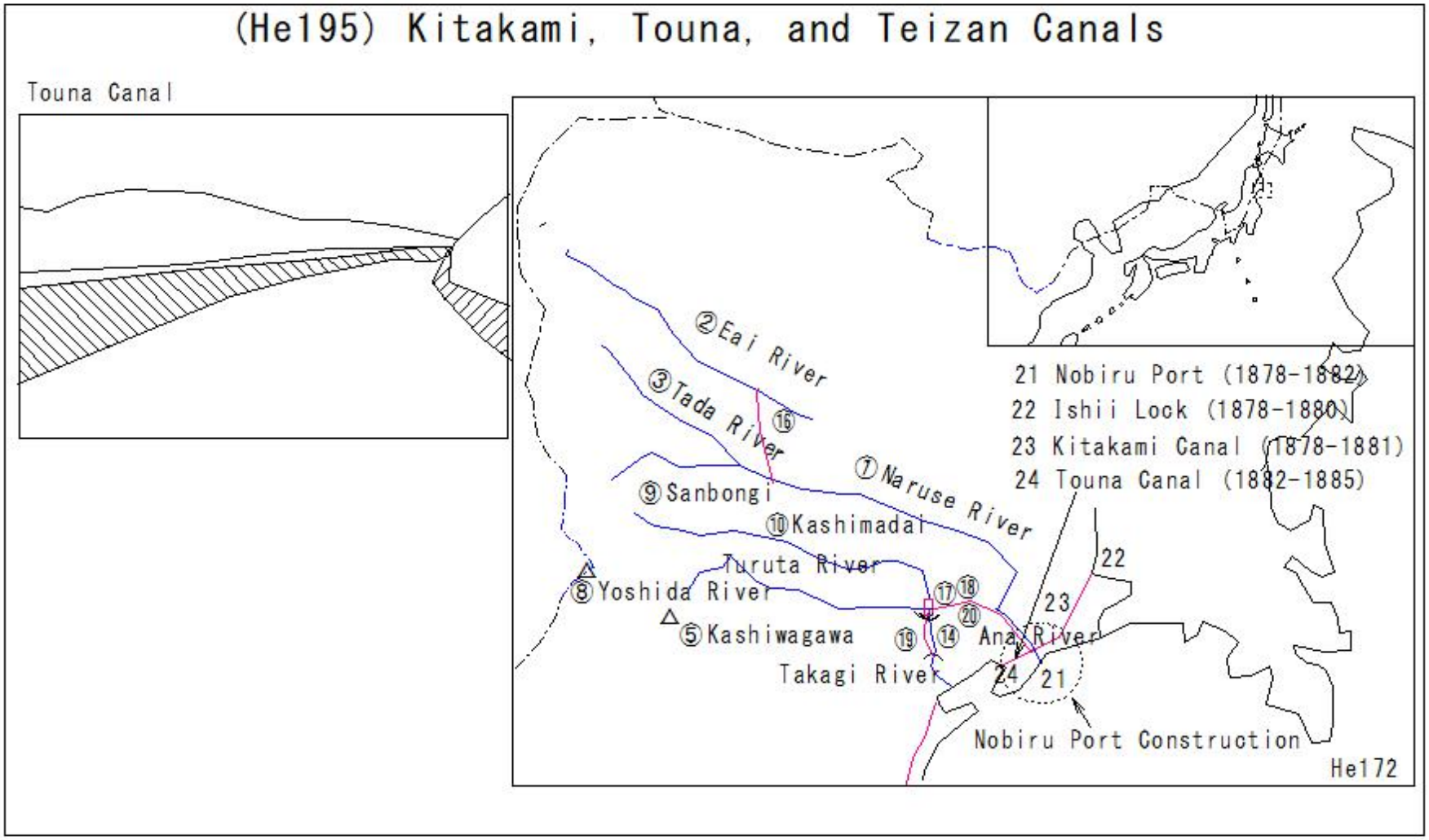
Touna Canal

① A canal connecting the Naruse River and Matsushima Bay, dug during the Meiji era.
② It was dug in conjunction with the Meiji government's construction of Nobiru Port.
③ The Kitakami Canal was completed in 1881.
④ The Touna Canal was completed in 1884.
⑤ The inner harbor was completed in 1882, and after its opening, it was temporarily bustling.
⑥ A typhoon in September 1882 destroyed the inner harbor's jetty.
⑦ Construction of the harbor was halted without completing the outer harbor.



He186

(He195) Kitakami, Touna, and Teizan Canals



(He196) Kitakami, Touna, and Teizan Canals

(He196) Kitakami, Touna, and Teizan Canals

Teizan Canal

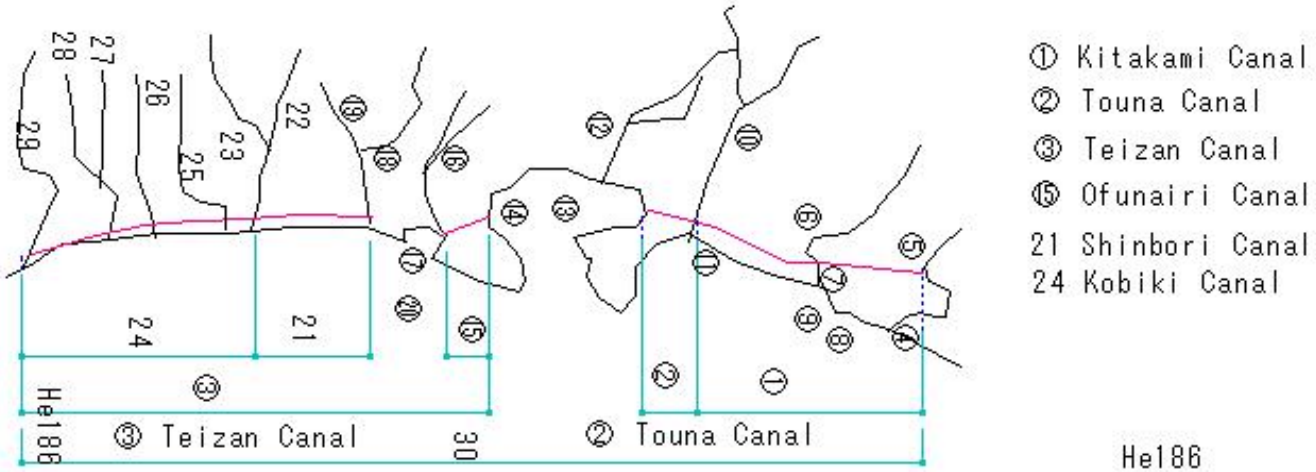
① Teizan Canal (collective term for Kibikibori, Shinbori, and Onofuneiribori) Teizan Canal (Shinbori) Meiji 3-8 (1870-1875) Length: 9.5 km

② The Touna Canal and Kitakami Canal connect the coast of Sendai Bay, stretching approximately 49 km from the Abukuma River to the former Kitakami River.

③ Originally intended for shipping.

④ Construction began by order of Date Masamune, lord of the Sendai domain.

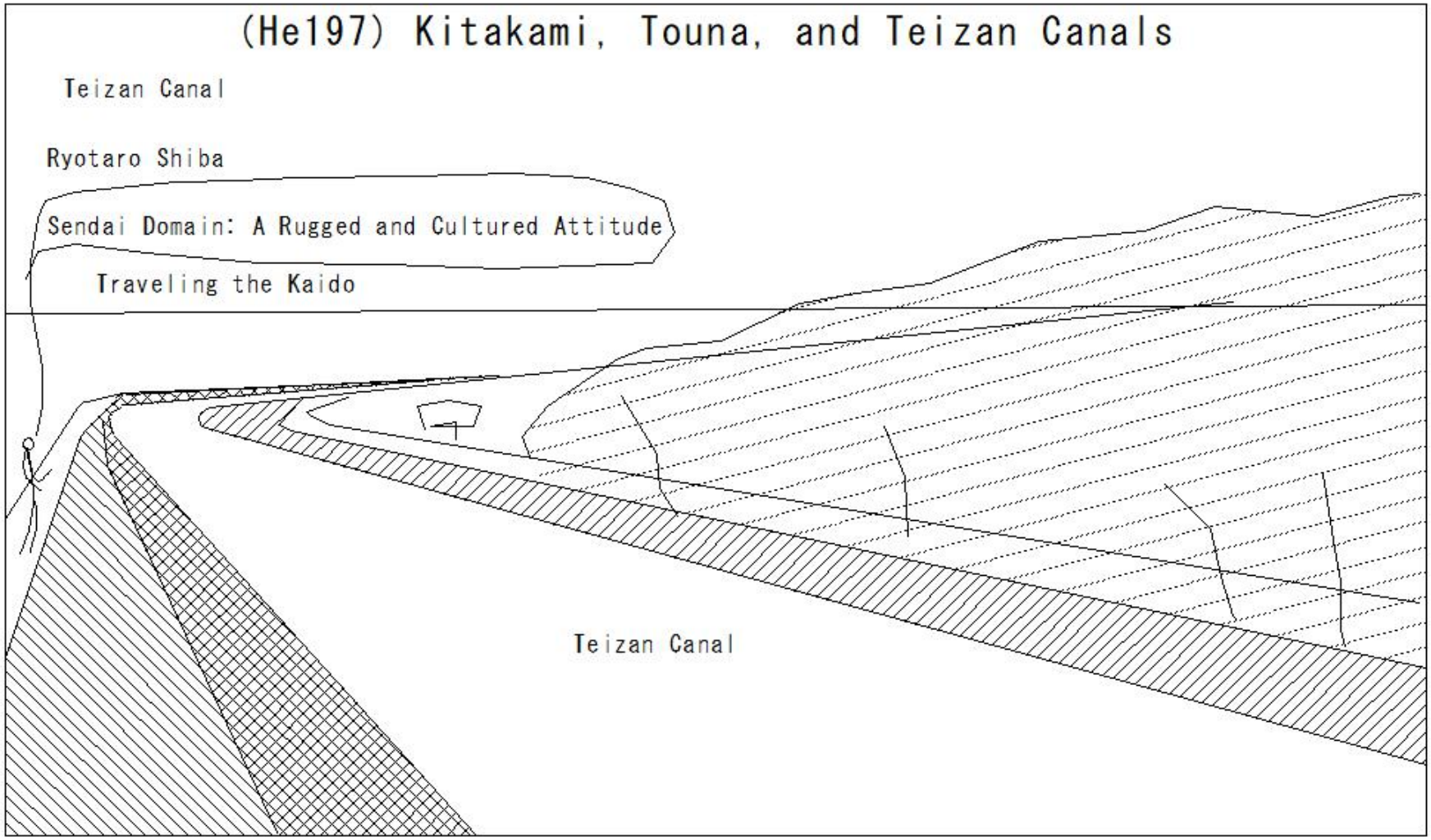
⑤ It was extended in connection with the Nobiru Port Construction Project, a Meiji government initiative to promote industry in the Tohoku region.



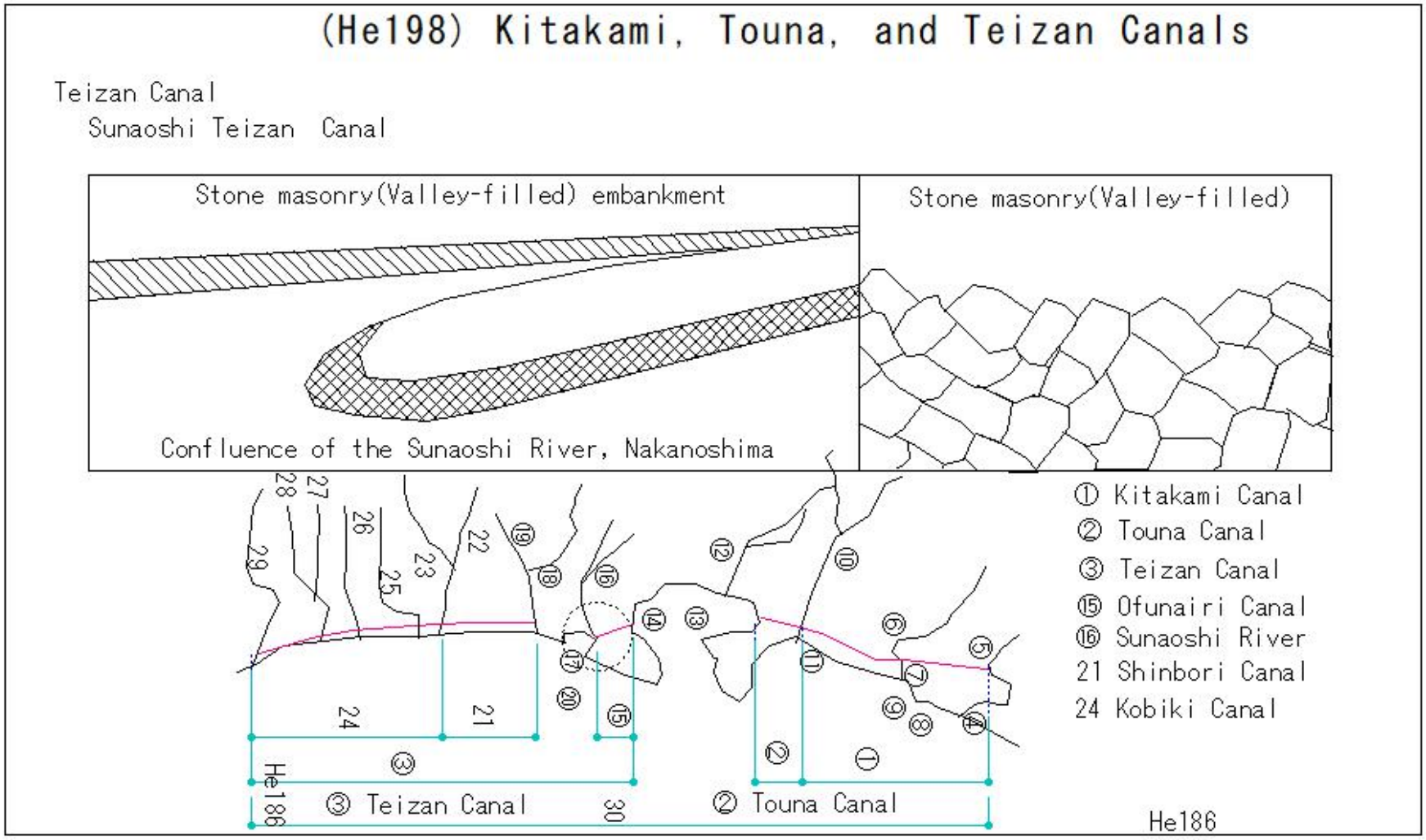
① Kitakami Canal
② Touna Canal
③ Teizan Canal
⑮ Ofunairi Canal
21 Shinbori Canal
24 Kobiki Canal

He186

(He197) Kitakami, Touna, and Teizan Canals



(He198) Kitakami, Touna, and Teizan Canals



(He199) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)

(He199) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)

Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)

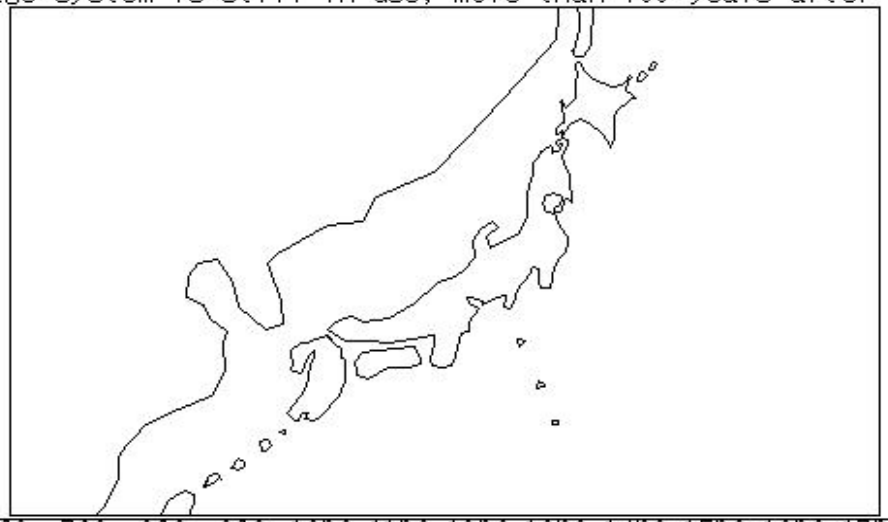
① Sendai City's sewerage system is said to have originated from the Yotsuya Irrigation Canal, built by order of Date Masamune in the early Edo period.

② Modern sewerage systems were launched in the Meiji period, making Sendai the third fastest in Japan after Tokyo and Osaka.

③ Brick sewerage systems built in the 1890s still remain in the city, and the need for wastewater treatment expanded the sewerage system after the war.

④ They remain an important part of the city's infrastructure.

⑤ Sendai City's brick sewerage system is still in use, more than 100 years after its completion in 1900.



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(He200) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)

(He200) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)

The Sendai City Brick Sewerage System uses a brick structure, which is rare for sewerage systems.

Sendai City's sewers are primarily shaped like three pipes: rectangular, oval, and horseshoe.

Their use is determined by factors such as depth, slope, and flow rate.

① Rectangular

Mainly used as storm drains, they discharge directly into rivers or the sea. Therefore, the water level is fixed, and they cannot be laid deep. This shape allows for a large flow rate.

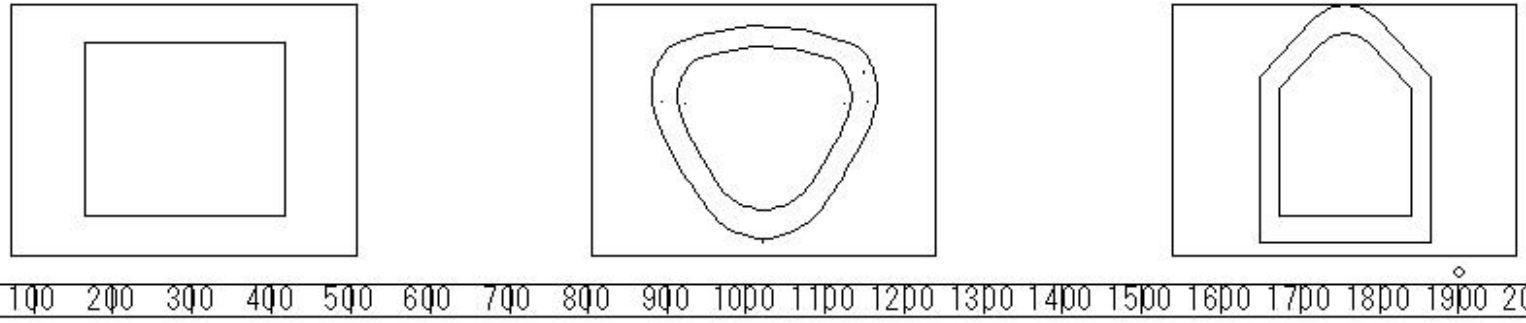
② Oval

They can maintain a high flow rate with a small slope, so solids are also carried along. They are used on flat ground where a slope is not possible. They are durable.

③ Horseshoe

They are tall enough for a person to enter, making them easy to maintain. They are durable. They were also featured in the movie "Golden Slumber."

① Rectangular ② Oval ③ Horseshoe



(He201) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)

(He201) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)

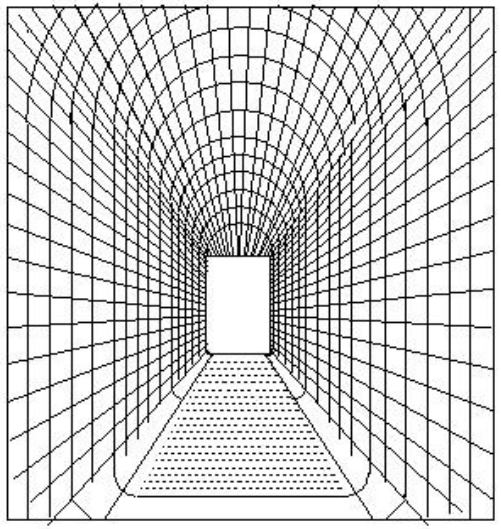
○Second phase construction

Brick sewer under Jozenji Street

① Horseshoe-shaped brick sewer (inner dimensions 900mm x 1530mm, length 189.4m) Construction began in 1900 and was completed in 1903.

② In addition to construction starting from the Hirose River outlet on the west side of Jozenji Street,

③ Excavation continued from the corner of Kokubuncho east toward the end of Kotodai, and excavation also continued from the middle, resulting in the completion of all construction.



Brick sewer under Jozenji Street

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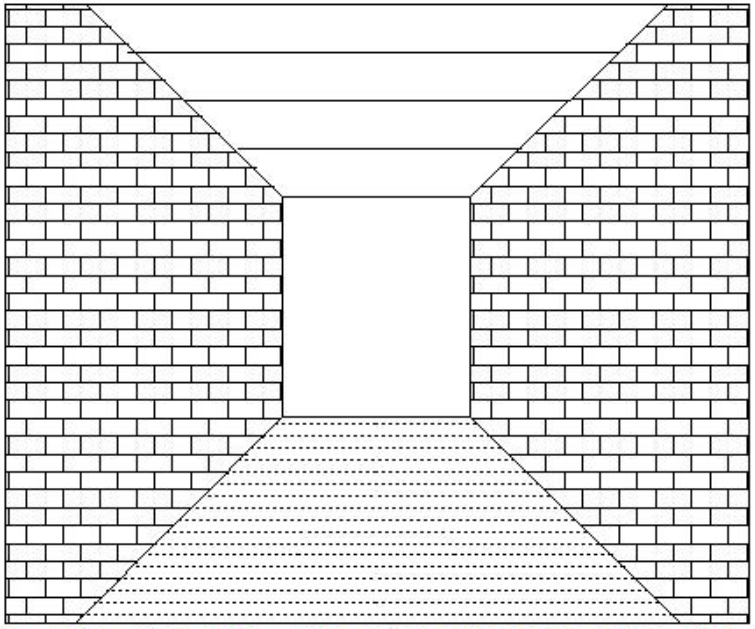
(He202) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)

(He202) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)

○ First Phase Construction

① The first brick sewerage system constructed in Sendai. Rectangular brick sewer (interior dimensions 660mm x 900mm, length 500.1m). Construction began in 1899 and was completed in 1900.

② Excavation began from the outlet of the Hirose River in front of Katahiracho Elementary School, and continued upstream through Kitsunekoji, Omachi, and Hosoyokocho, . completing a total length of 2,100m



Katahiracho Main Line
Rectangular brick sewer

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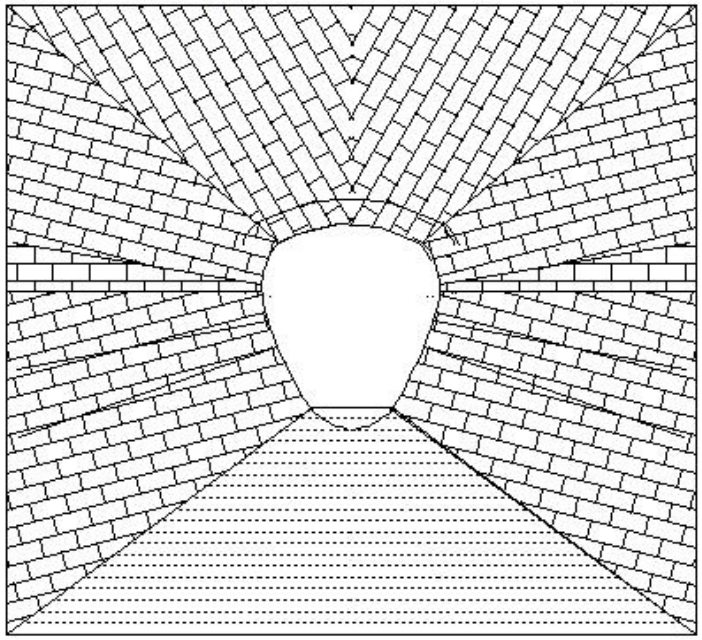
(He203) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)

(He203) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)

○ Third Phase Construction

① Egg-shaped brick sewer (inner dimensions 770mm x 1.120mm, length 290.91m) Started in 1903 and completed in 1904.

② Construction was temporarily halted in 1904 due to mobilization orders for the Russo-Japanese War and rain.



Fukuromachi Main Line
Egg-shaped brick sewer

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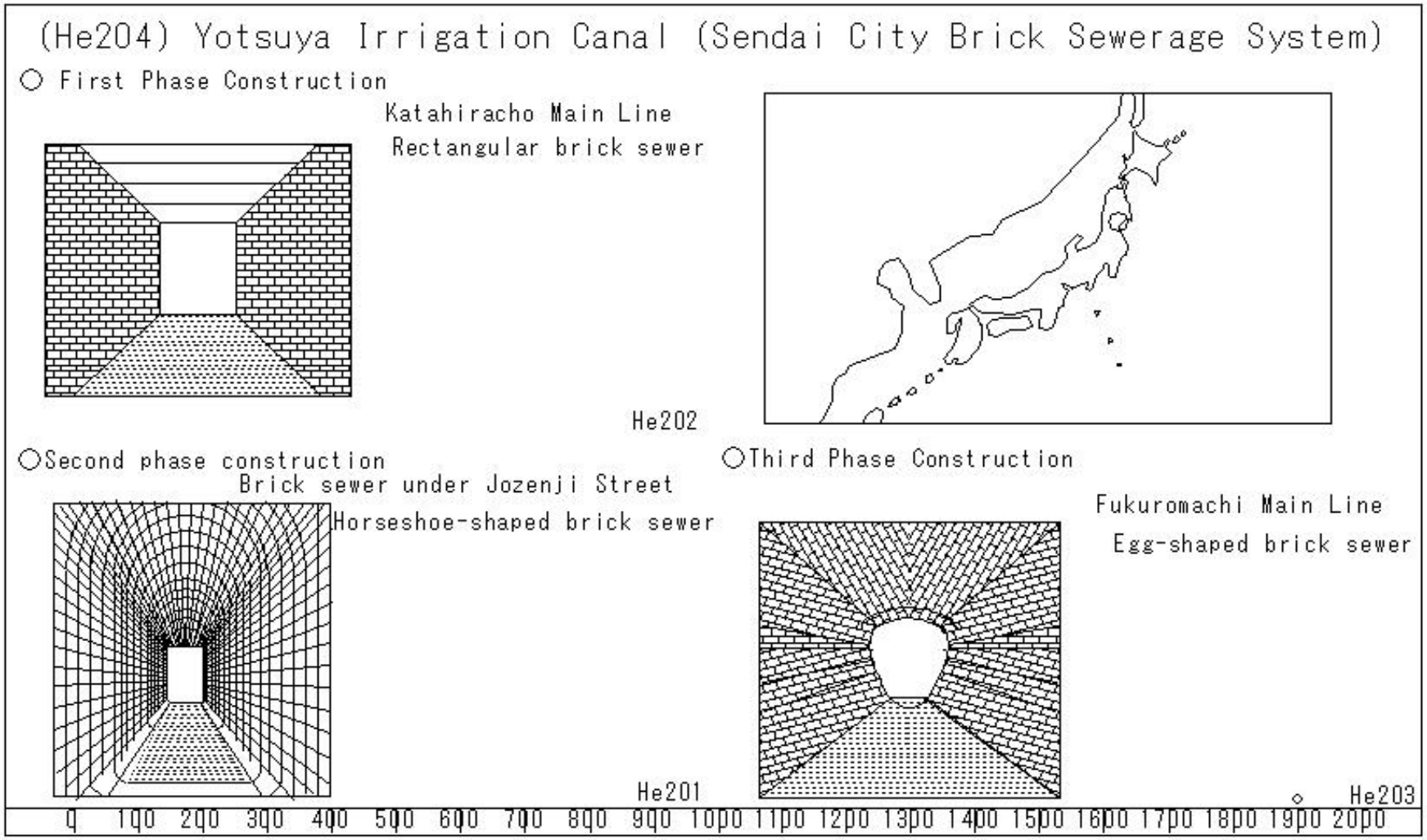
(He204) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)



(He205) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)

(He205) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)

The Yotsuya Irrigation Canal

① In 1601, Date Masamune began construction of his castle on the natural fortress of Mount Aoba, and also began construction of a castle town on the opposite bank of the Hirose River.

② This area was a river terrace formed by the river's course changes, and high cliffs prevented access to the town and made it impossible to transport water directly from the river to the town.

③ The artificial river (irrigation canal) that he ordered his vassal, Kawamura Magobei Jukichi*1, to build was the "Yotsuya Irrigation Canal."

④ The Hirose River was run upstream to Gorokumura, where a weir was erected to take water. The water was then passed through the valleys via tunnels*2 and culverts*3, and diverted into the castle town west of Yahatamachi as an open channel*4.

⑤ The main stream flowed east from Yahatamachi along Kitarokubancho, passing Miyamachi and flowing into the Umeda River, irrigating several hundred hectares of rice paddies downstream.

⑥ Tributaries branched off from this main stream at three locations: Kakuseiincho, Kimachi, and Torichomachi. Many more branches branched off, crisscrossing key

⑦ It replenished groundwater to supply well water, and also played an important role as a water source for firefighting within the city. It was also used as a drainage

⑧ In the upper reaches, it was used for industrial purposes such as operating waterwheels and dyeing textiles. It also served to irrigate roads in the summer and dump snow in the winter, while also cultivating trees within the city and creating a prosperous town.

(He206) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)

(He206) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)

*1 Born in 1575 (Tensho 3) in Abu, Nagato Province (present-day Hagi City, Yamaguchi Prefecture). He served the Mori clan, but in 1601 (Keicho 6), he was employed by the Date clan. He constructed a canal from the Kitakami River to Ishinomaki Port, built the Ishinomaki port, and constructed the Yotsuya Irrigation Canal and the Teizanbori Canal. He died in 1648 (Keian 1).

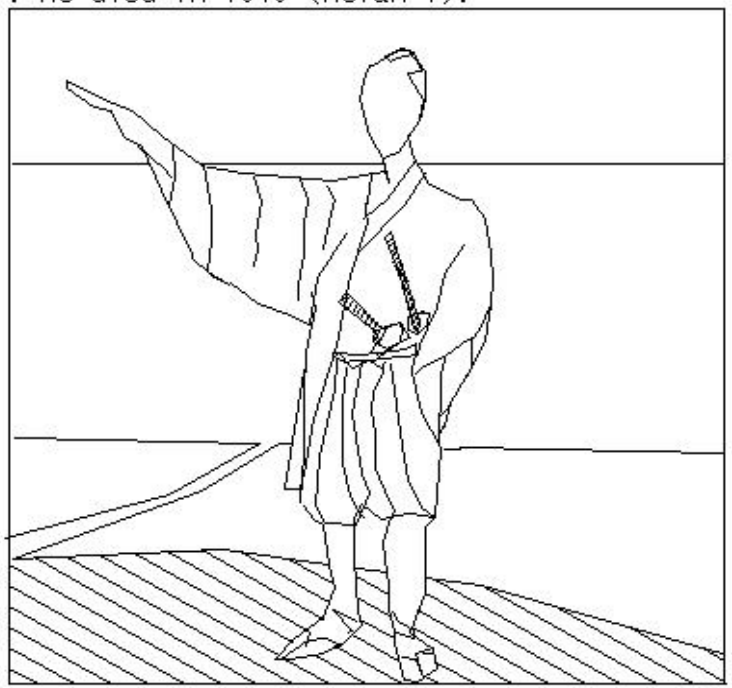
*2 Tunnel

*3 Aqueduct made of bamboo or wood

*4 Aqueduct with an open top

*5 Aqueduct buried underground

*6 Box-shaped aqueduct



He215

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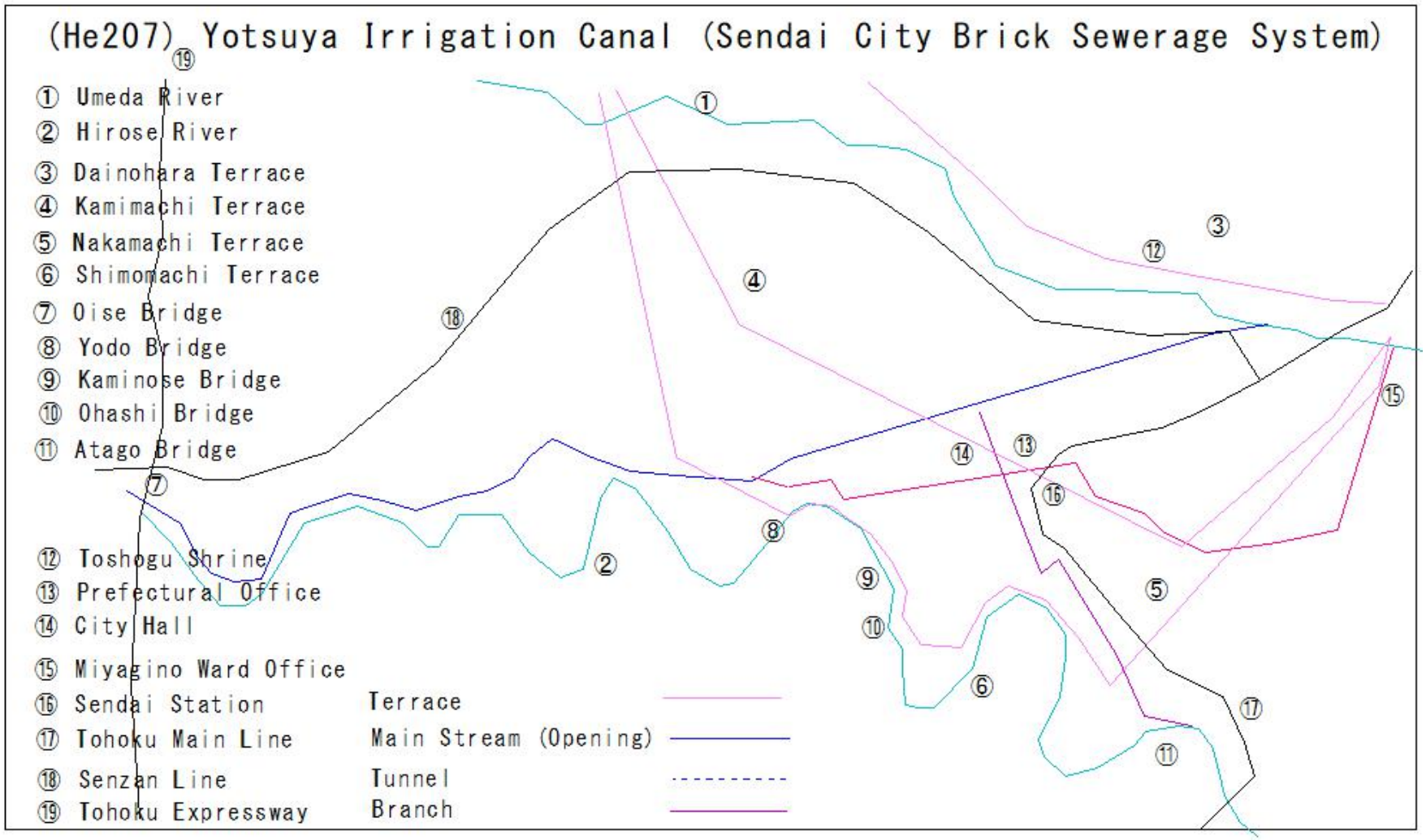
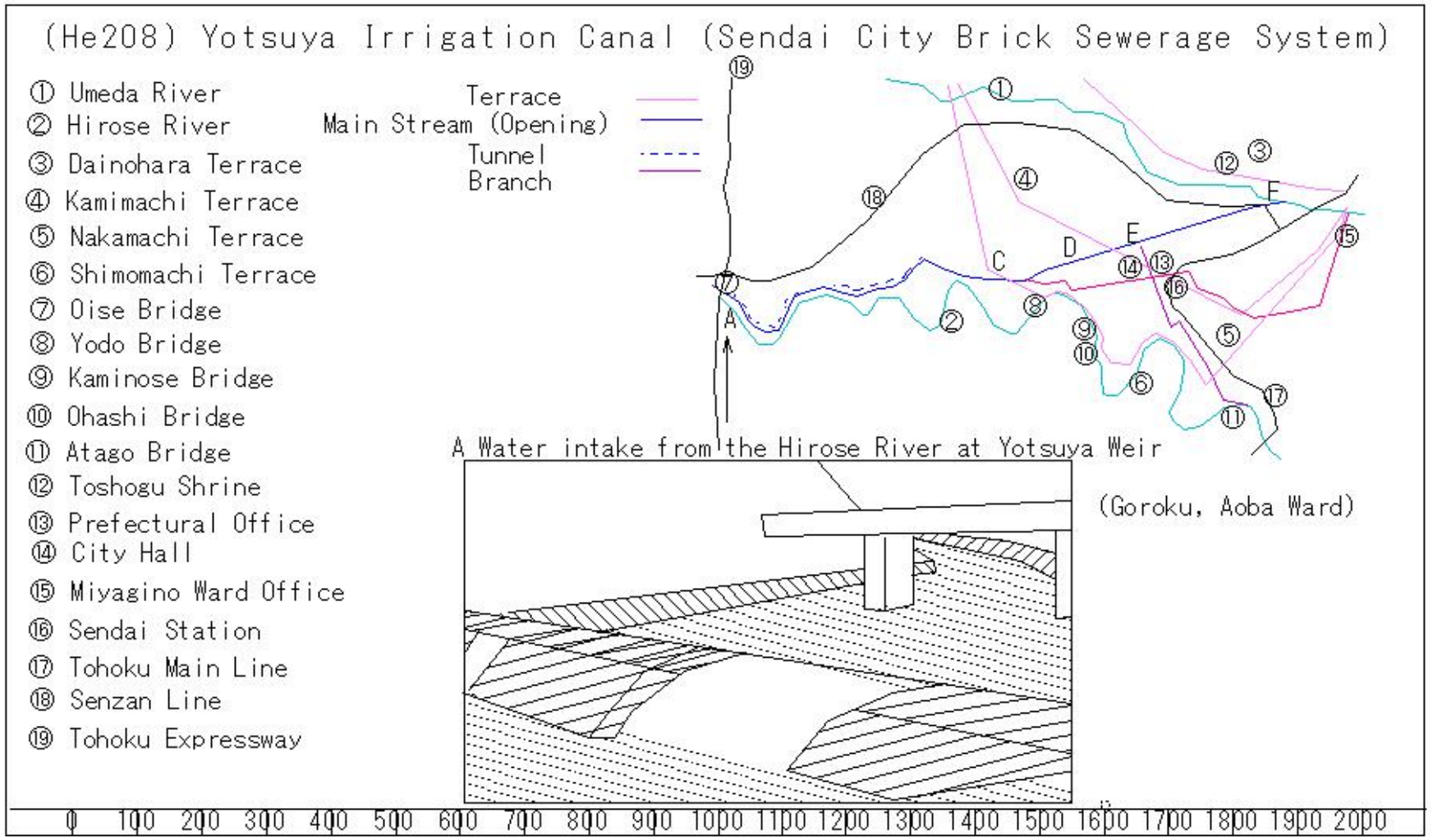
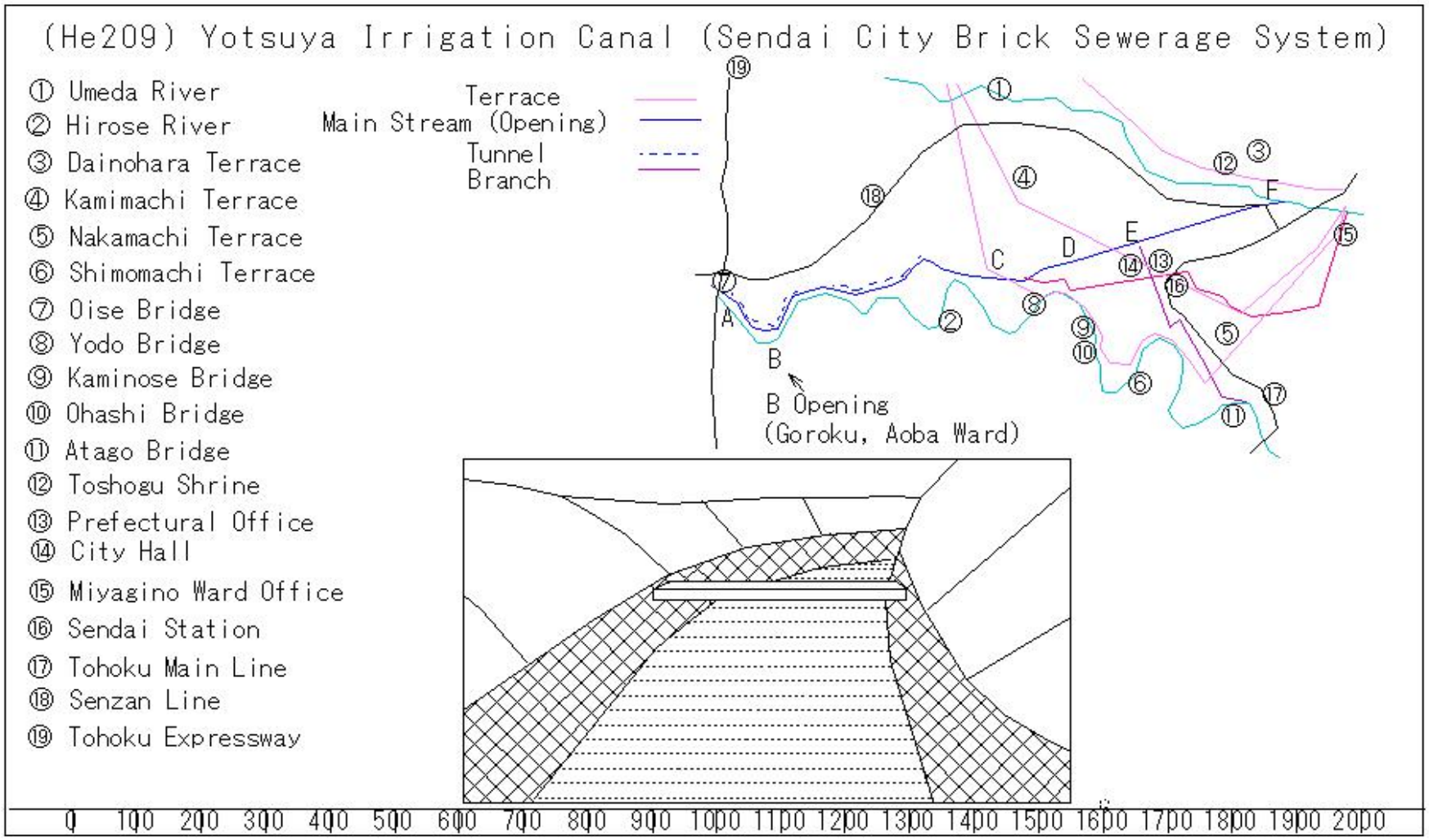
(He207) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)



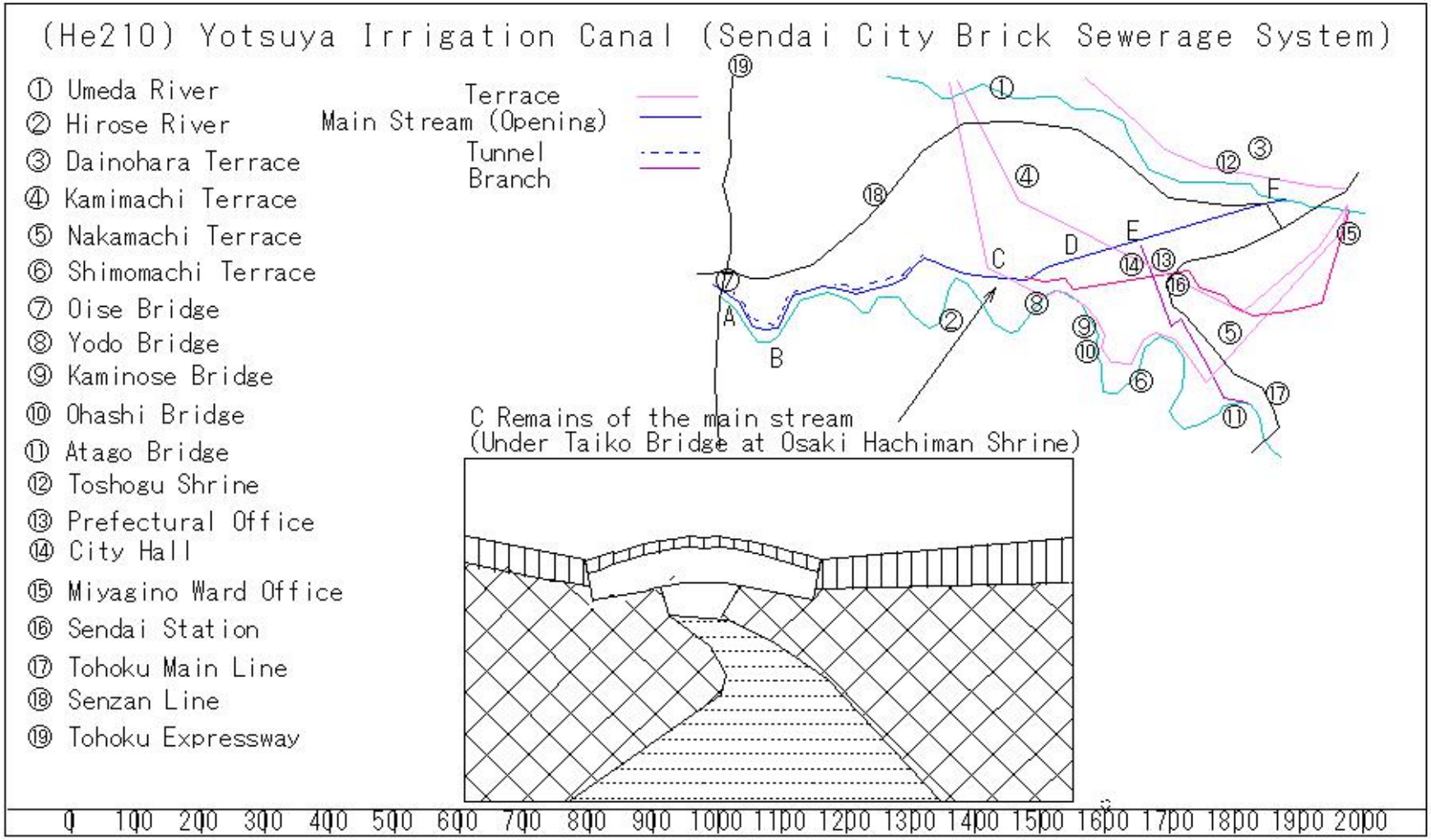
(He208) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)



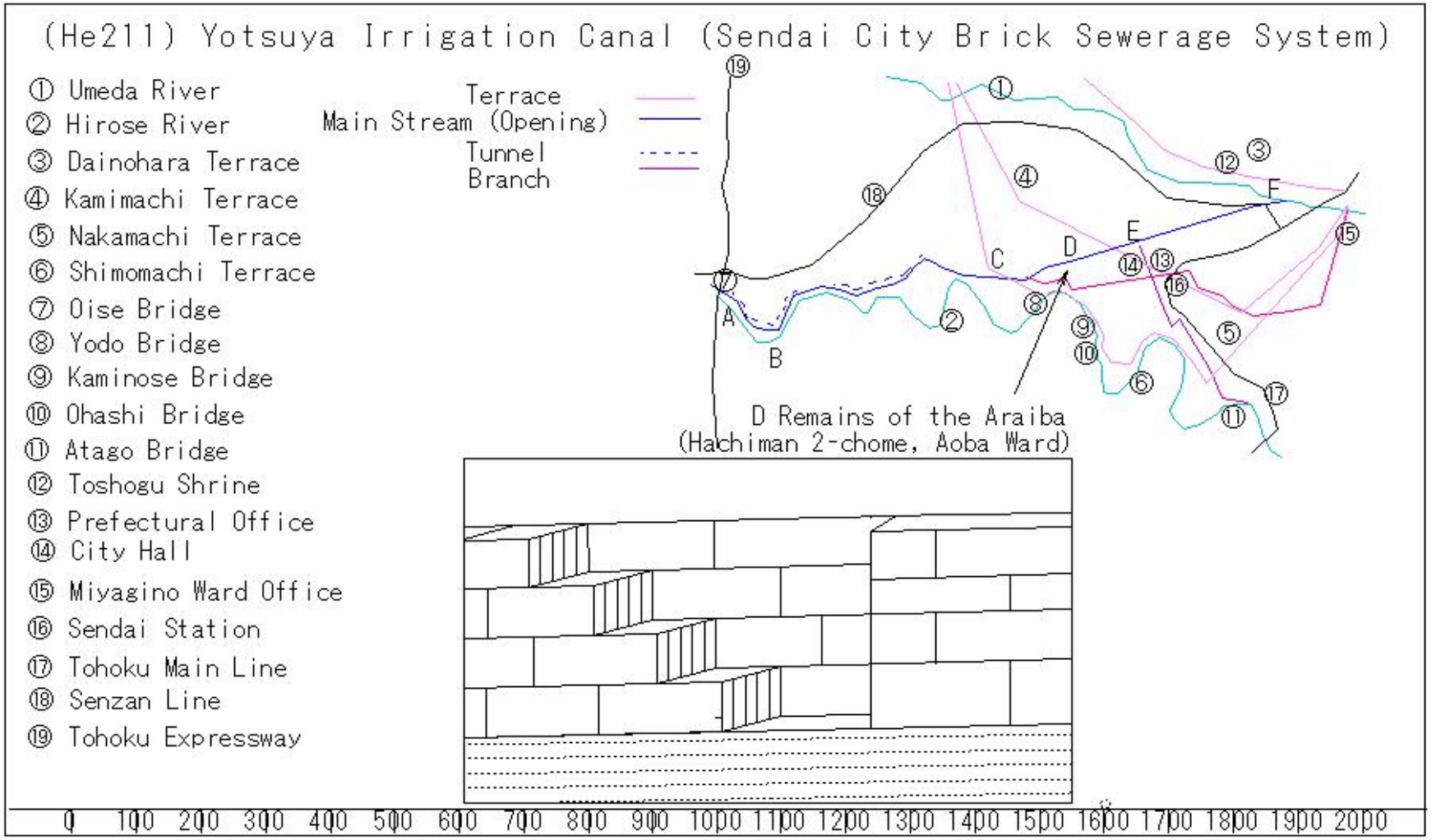
(He209) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)



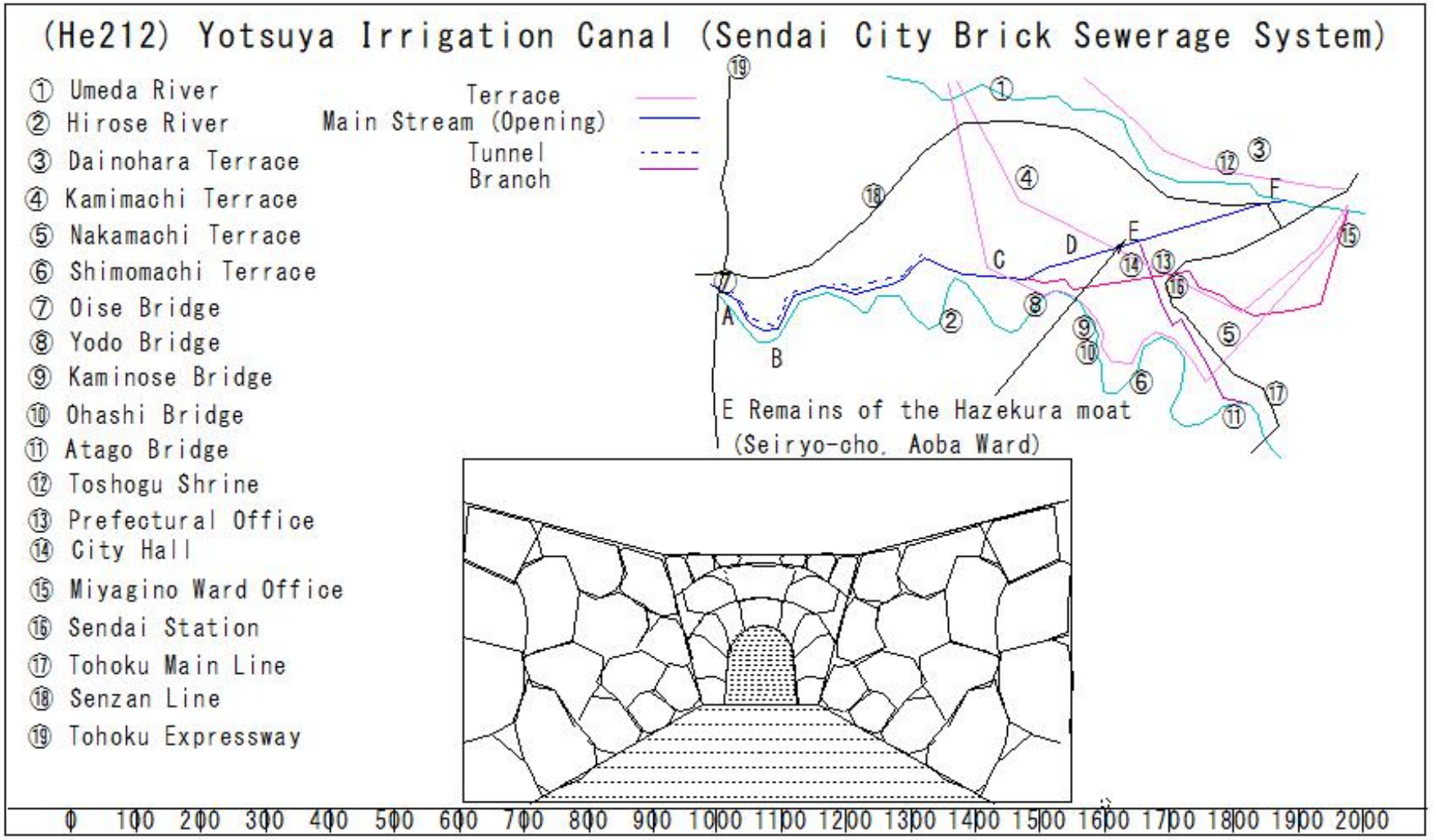
(He210) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)



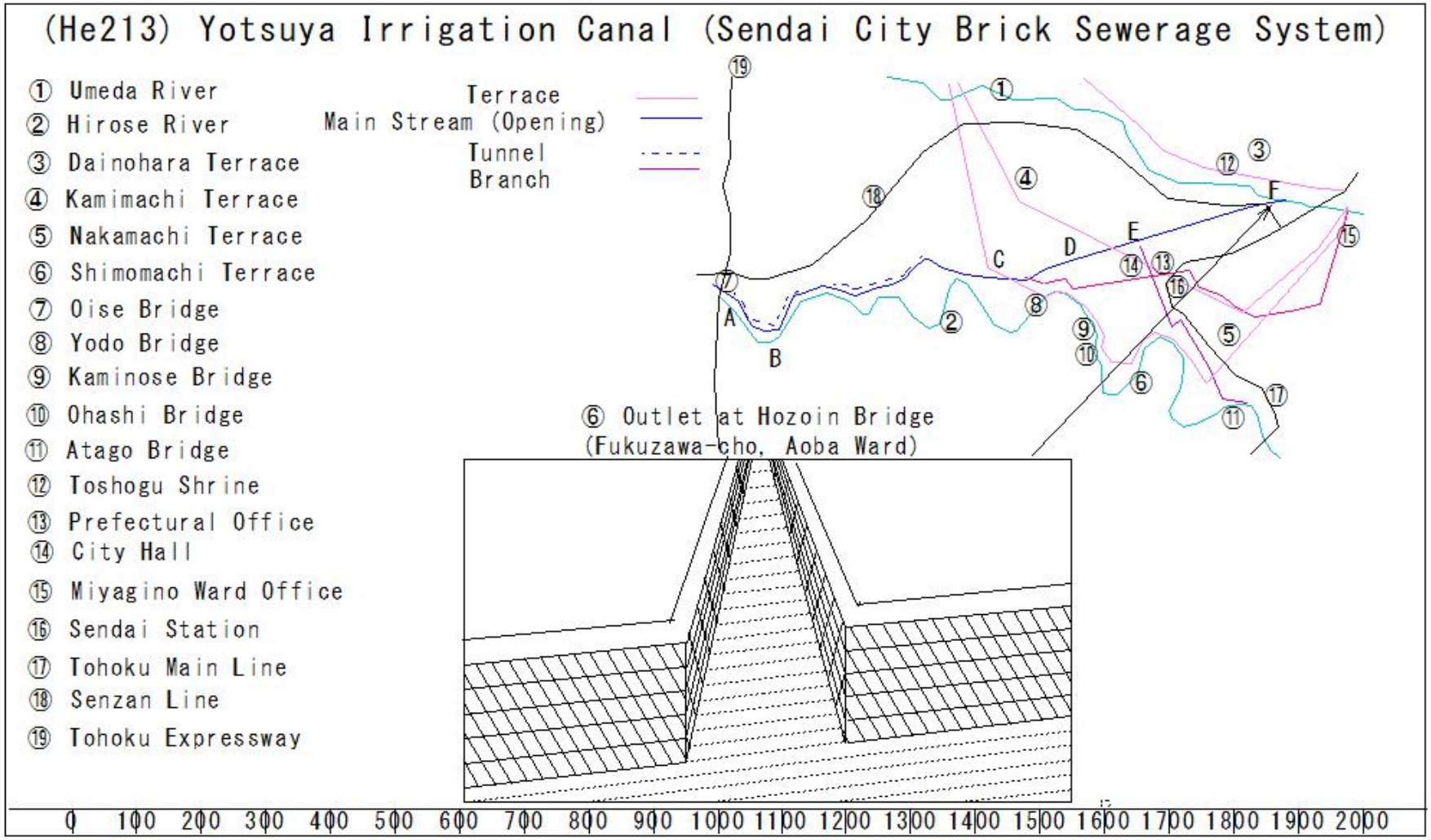
(He211) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)



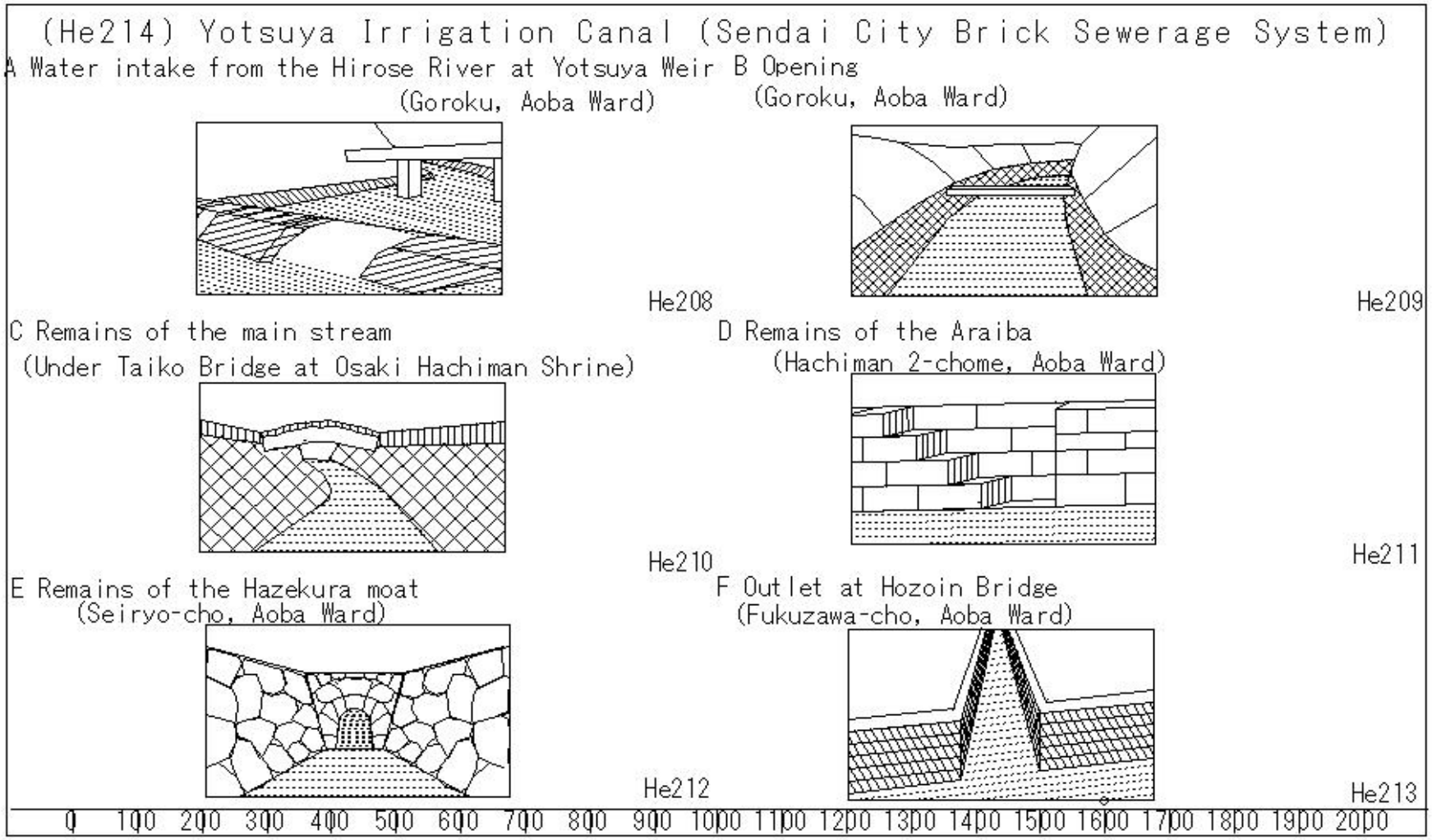
(He212) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)



(He213) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)



(He214) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)

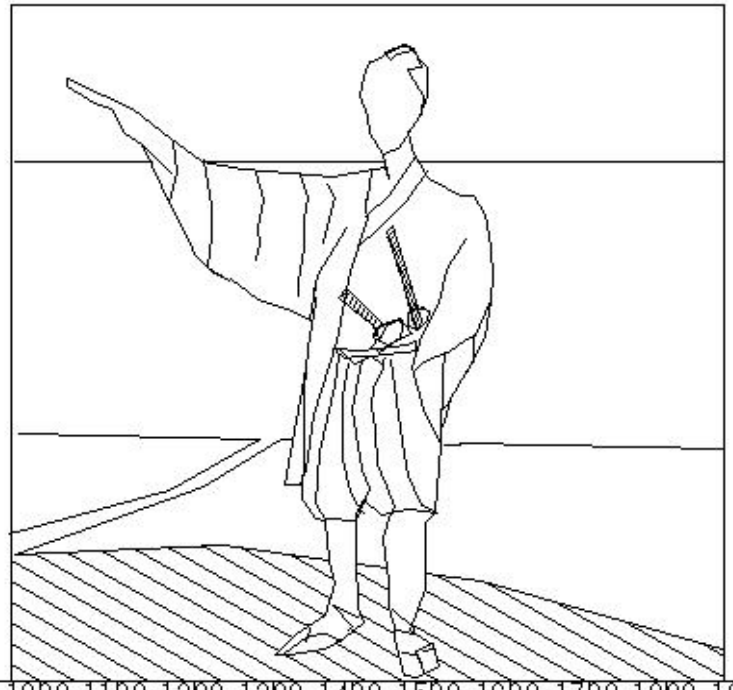


(He215) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)

(He215) Yotsuya Irrigation Canal (Sendai City Brick Sewerage System)

Kawamura Magobei

1. Waterway construction for a canal from the Kitakami River to Ishinomaki Port and river repairs.
2. Construction of Ishinomaki port and improvement of water transportation
3. The Yotsuya Weir was constructed to improve the irrigation channels around Sendai Castle.
4. The Teizanbori Moat was constructed to improve waterway transportation.
6. The Izuno Weir was constructed upstream of the Ichihasama River.



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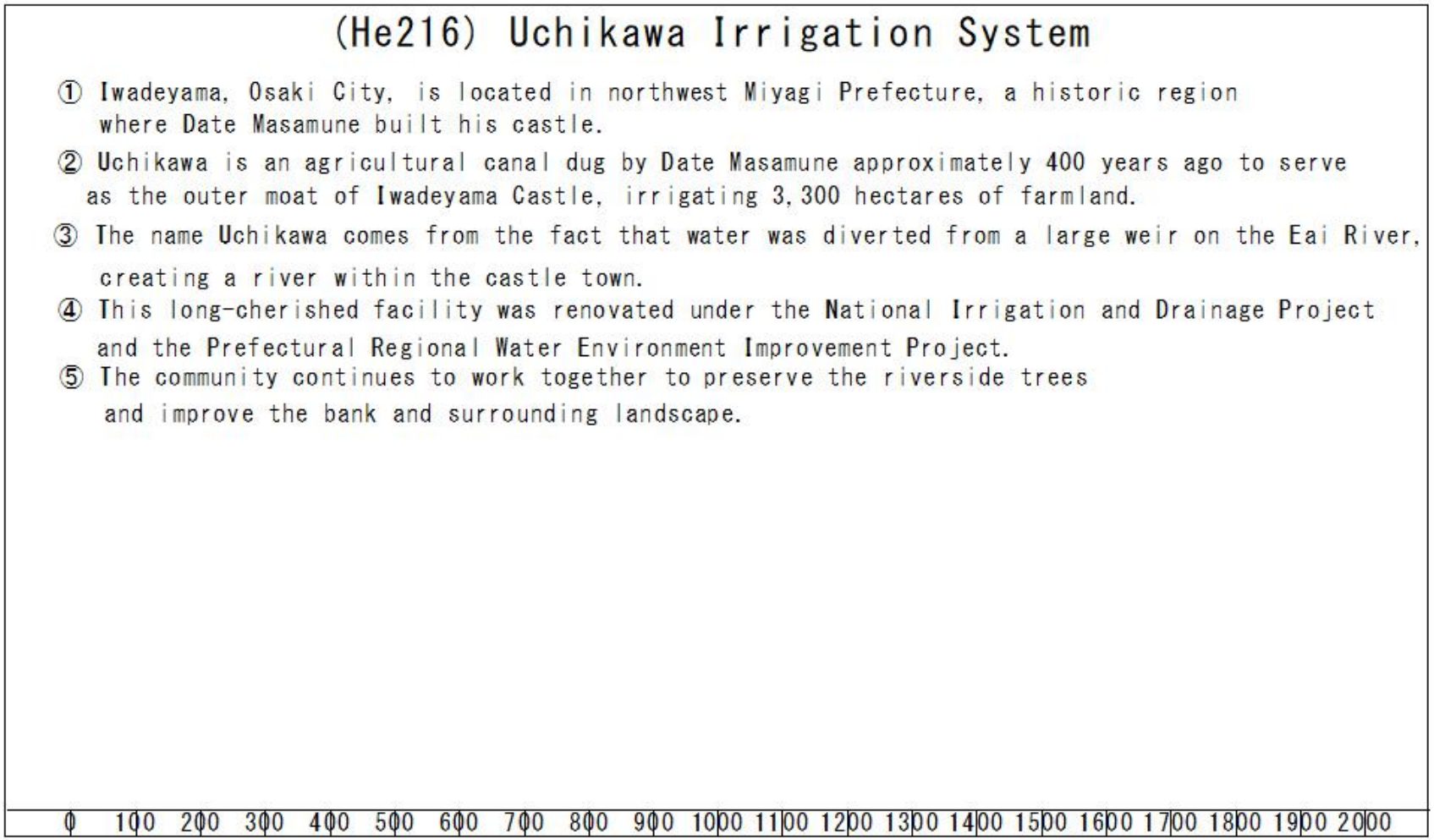
(He216) Uchikawa Irrigation System



(He217) Uchikawa Irrigation System

(He217) Uchikawa Irrigation System

①1591 Approximately 430 years ago, Date Masamune moved his castle from Yonezawa to Iwadeyama and ordered the development of the Uchikawa River. To draw sufficient water into the river, a large wooden weir measuring 14.4 meters in length and 9 meters in width was built.
Because it was so large for the time, it came to be called the "Great Weir."

② 1909 After the weir was built, it was destroyed every time a major flood occurred, necessitating laborious and expensive restoration work. Near the end of the Meiji era, in 1910 (Meiji 43), it was decided to relocate the weir upstream to a more stable flow on the Eai River. Subsequently, in 1922 (Taisho 11), the wooden weir was reconstructed with concrete.

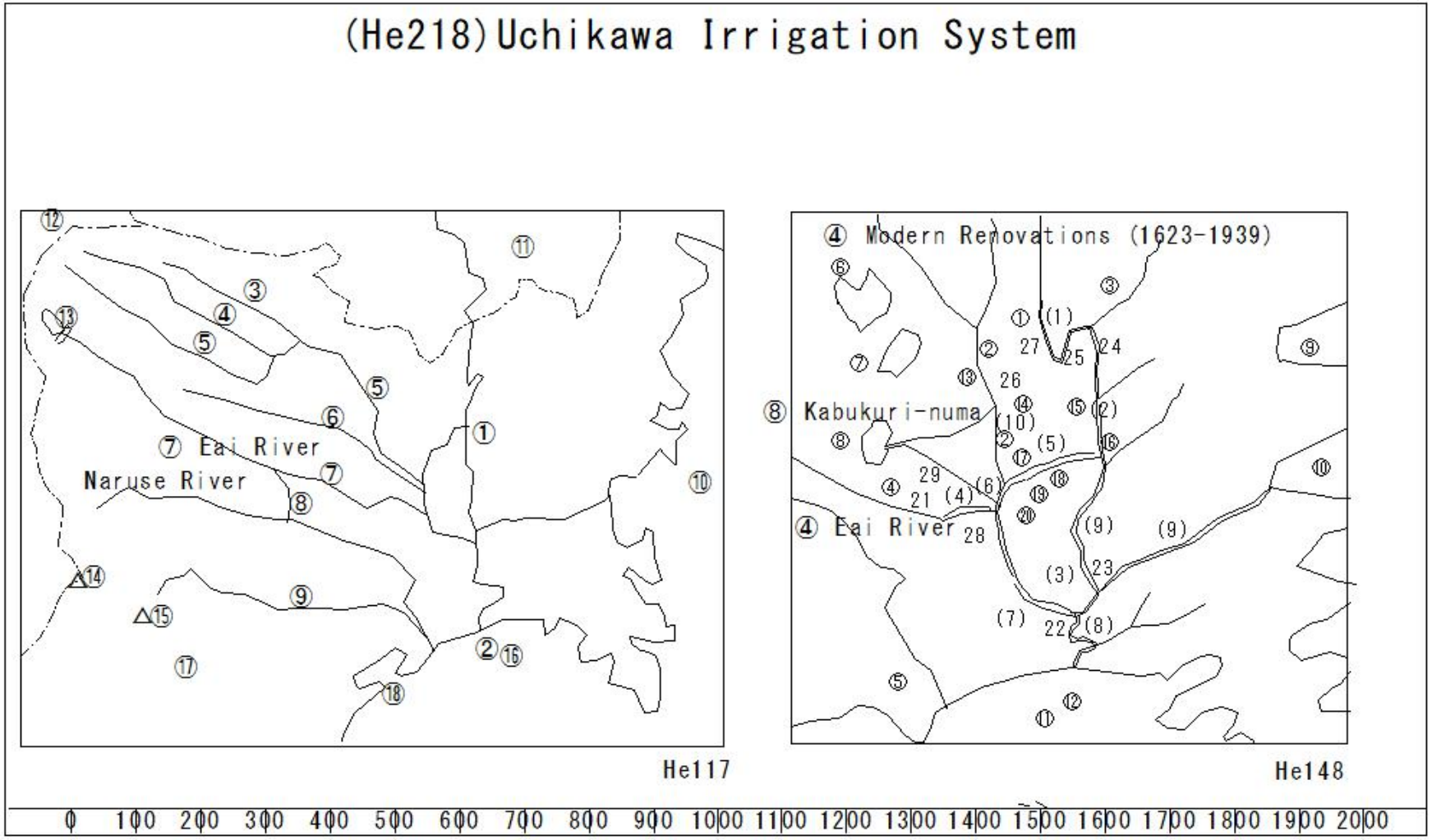
③ 1947～1948 Despite being constructed with sturdy concrete, the Great Weir suffered the brunt of unprecedented typhoons that struck Japan after the war. The 1947 (Showa 22) typhoon Kathleen and the 1948 (Showa 23) typhoon destroyed the weir and washed it away, completely halting water intake.

④ 1949-1951 After the typhoon washed away the Great Weir, farmers piled up sandbags and managed to regain water intake, but full restoration was not easy.
Disaster recovery work then began and was completed in 1951 (Showa 26).

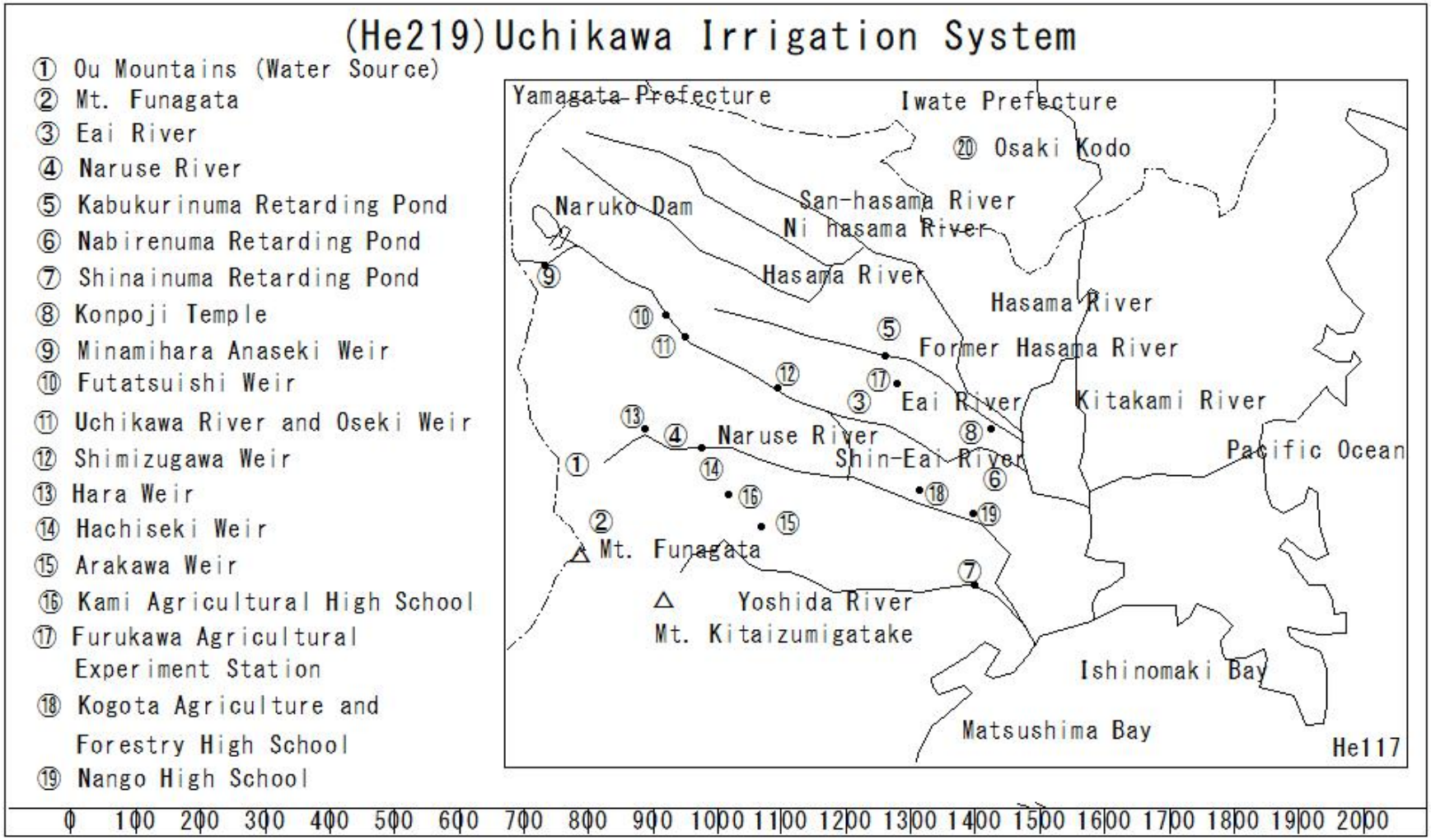
⑤ Due to the aging of the facility and the need to ensure proper sediment discharge, renovations were carried out through a special irrigation and drainage project, resulting in the current Oizumi Headworks.

⑥ 2005 Approximately 40 years later, cracks and missing concrete became noticeable. Beginning in 2003,the National Irrigation and Drainage Project removed 30 cm of the concrete from the Oizumi Headworks' surface and replaced it with new concrete, completing the repair work in 2005.
At the same time, a fishway was also renovated to make it easier for fish to ascend.

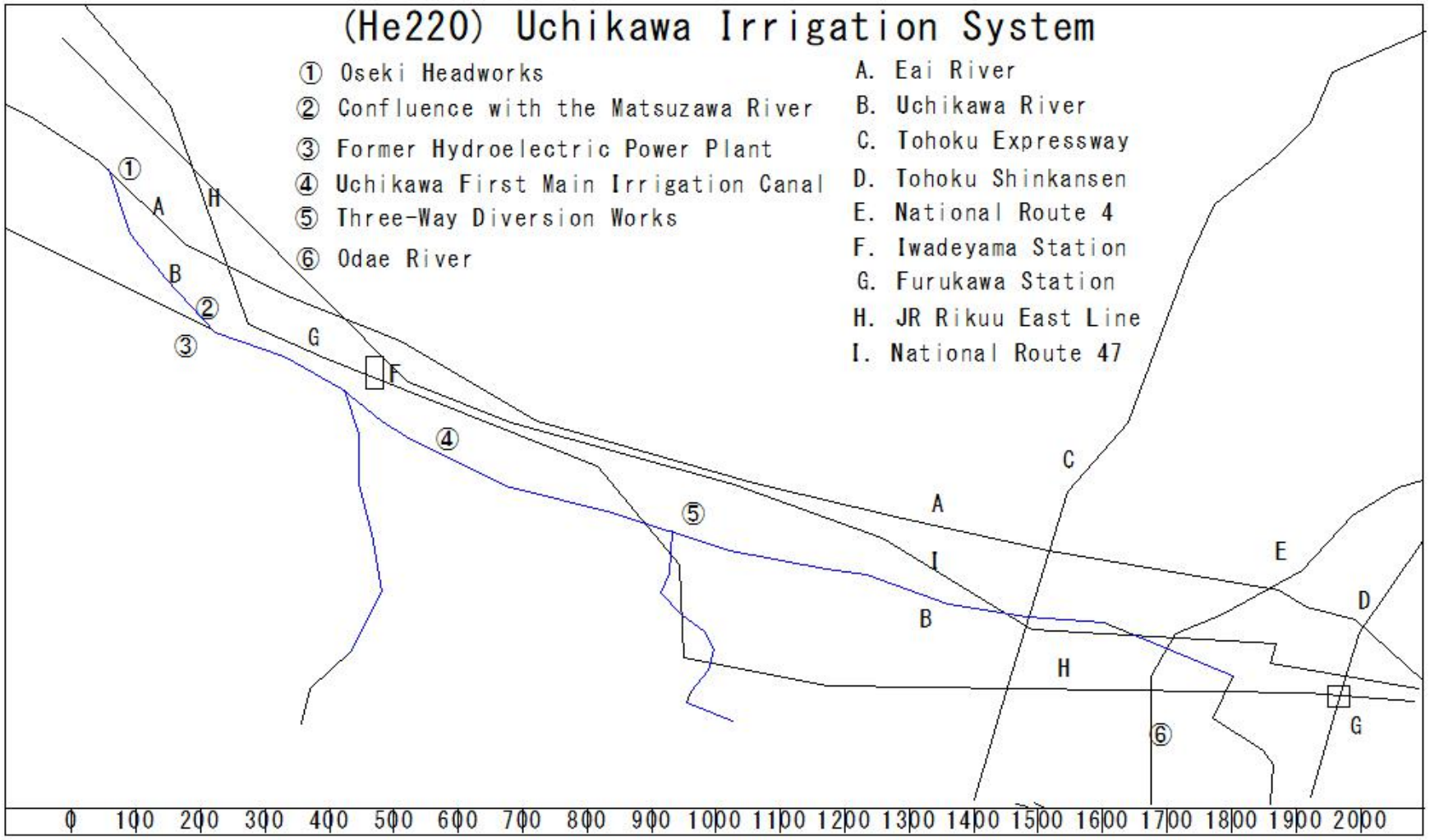
(He218) Uchikawa Irrigation System



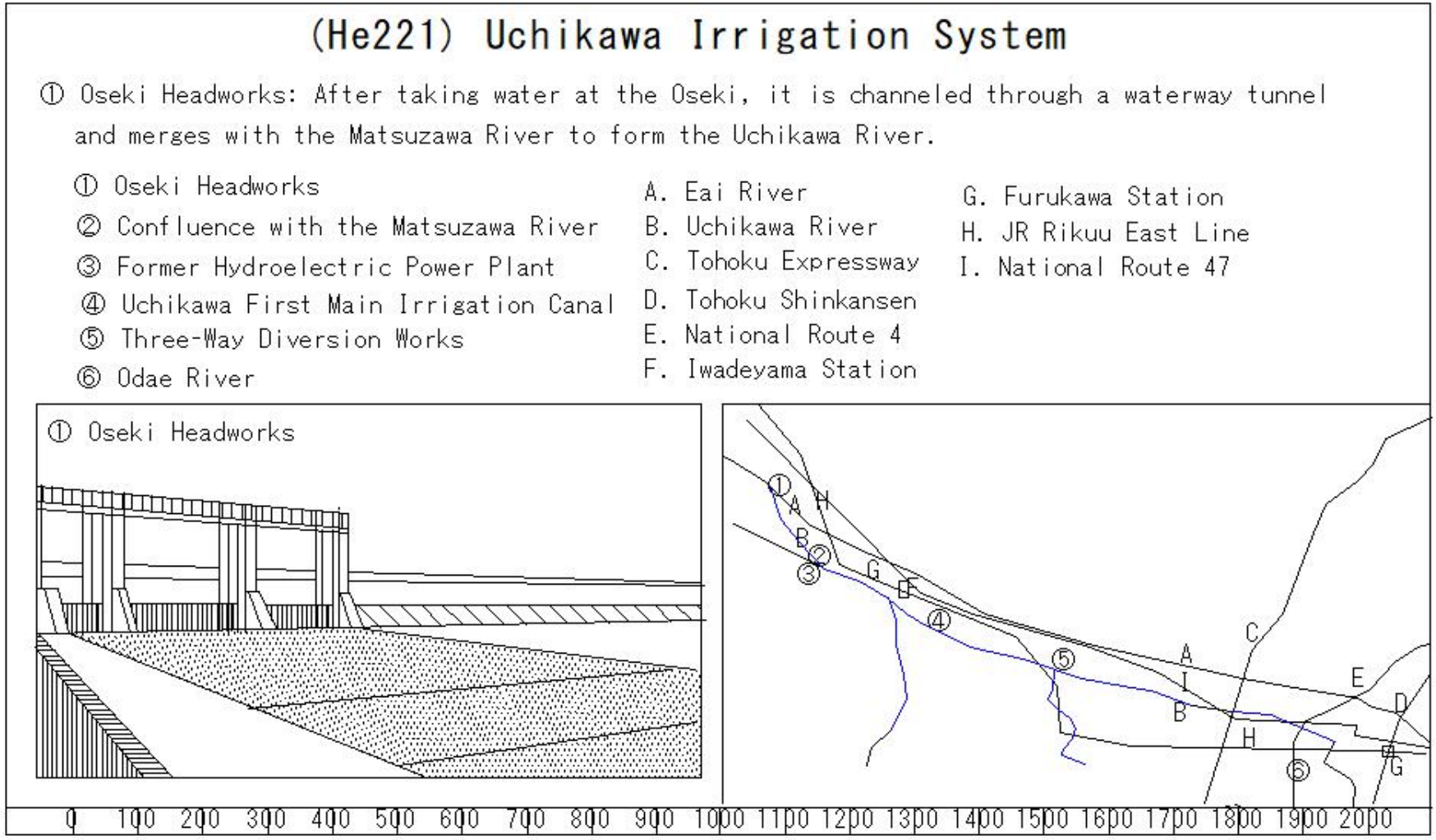
(He219) Uchikawa Irrigation System



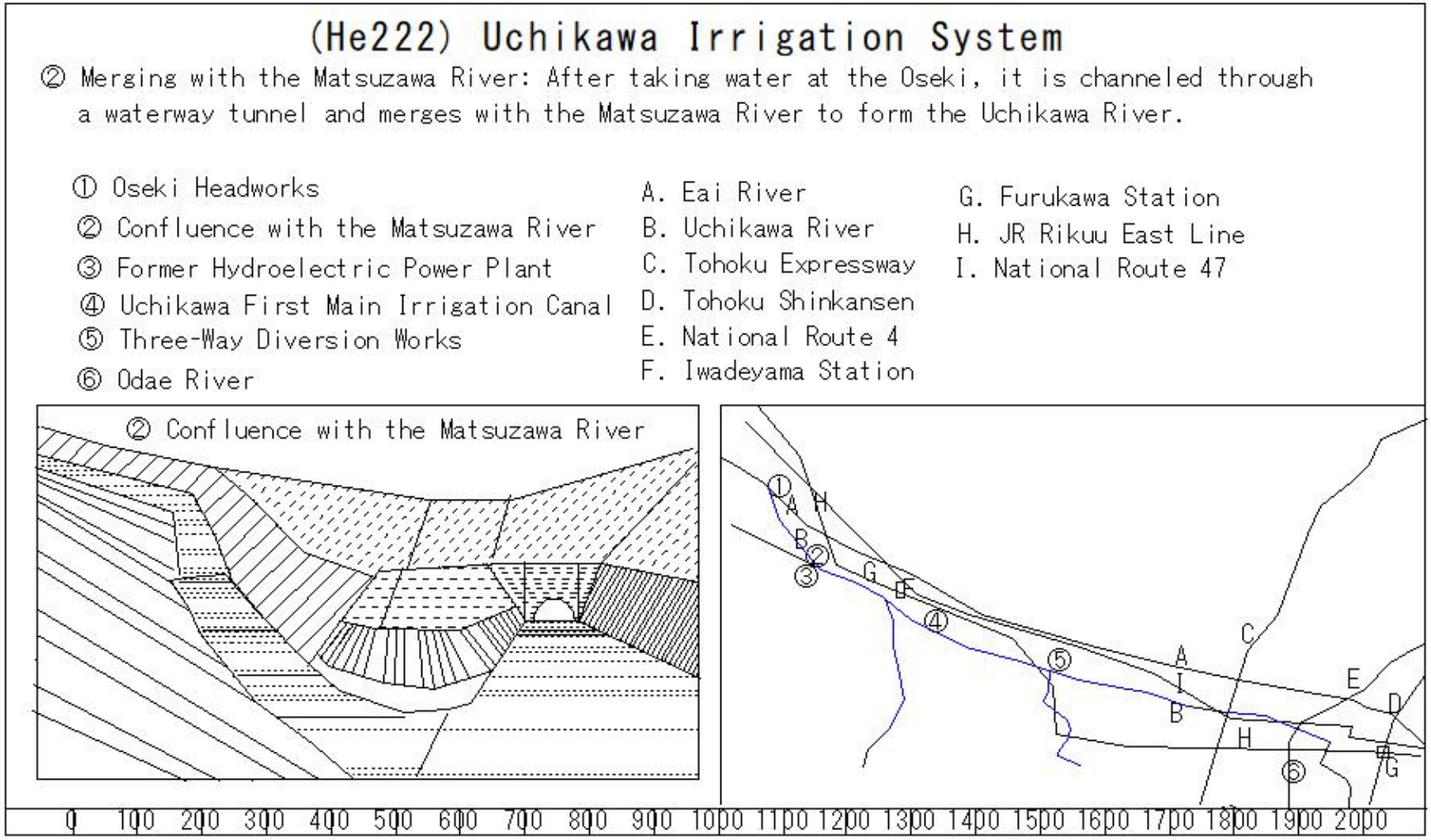
(He220) Uchikawa Irrigation System



(He221) Uchikawa Irrigation System



(He222) Uchikawa Irrigation System



(He223) Uchikawa Irrigation System

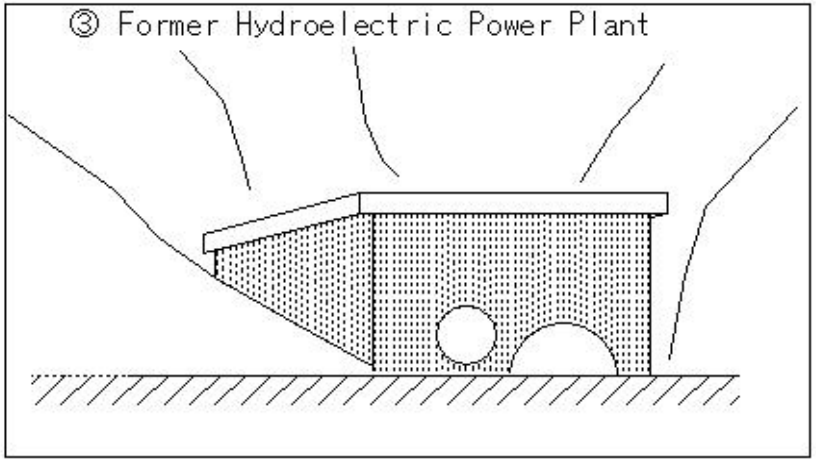
(He223) Uchikawa Irrigation System

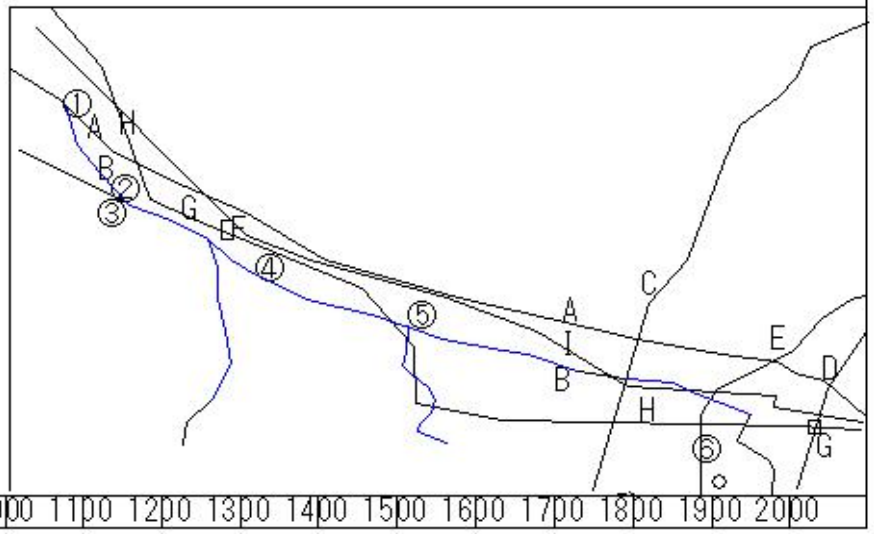
③ Former Hydroelectric Power Plant: This is the site of a hydroelectric power plant built in 1912 (Meiji 45).

① Oseki Headworks
② Confluence with the Matsuzawa River
③ Former Hydroelectric Power Plant
④ Uchikawa First Main Irrigation Canal
⑤ Three-Way Diversion Works
⑥ Odae River

A. Eai River
B. Uchikawa River
C. Tohoku Expressway
D. Tohoku Shinkansen
E. National Route 4
F. Iwadeyama Station

G. Furukawa Station
H. JR Rikuu East Line
I. National Route 47





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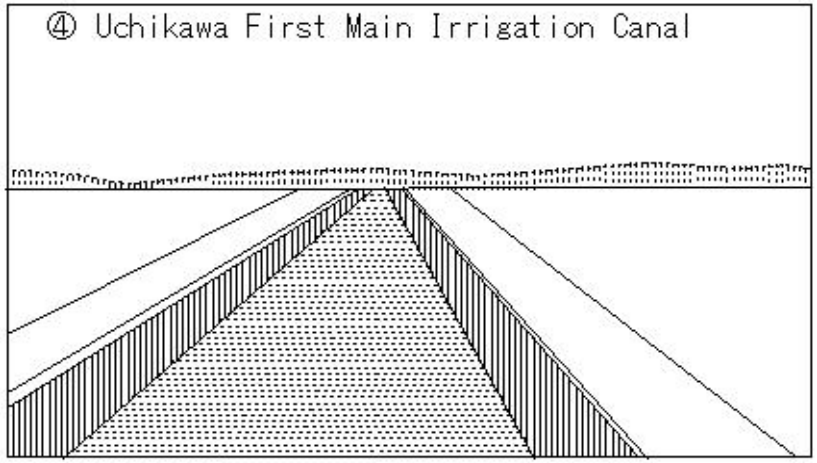
(He224) Uchikawa Irrigation System

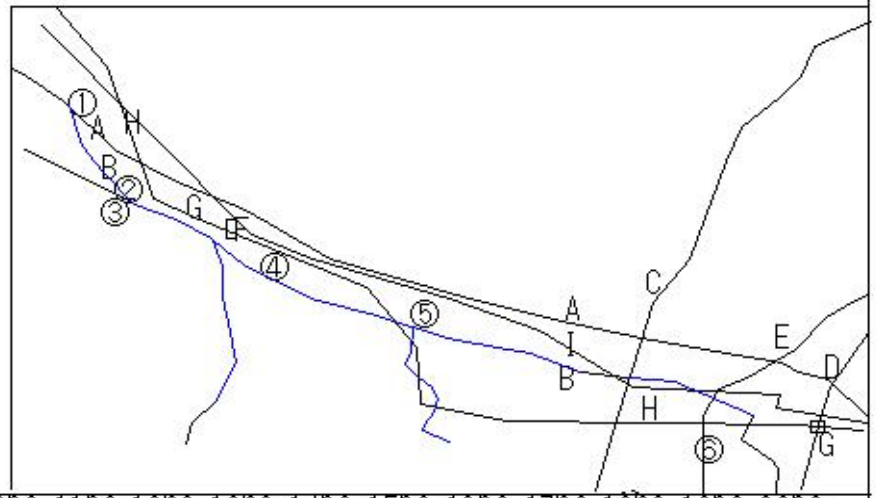
(He224) Uchikawa Irrigation System

④ Uchikawa First Main Irrigation Canal: This is the Uchikawa First Main Irrigation Canal, constructed as part of the national irrigation and drainage project for the Osaki Compared to the construction of the Iwadeyama City section, which takes into consideration history, landscape, and ecology, this concrete canal was constructed more economically.

① Oseki Headworks
② Confluence with the Matsuzawa River
③ Former Hydroelectric Power Plant
④ Uchikawa First Main Irrigation Canal
⑤ Three-Way Diversion Works
⑥ Odae River

A. Eai River
B. Uchikawa River
C. Tohoku Expressway
D. Tohoku Shinkansen
E. National Route 4
F. Iwadeyama Station
G. Furukawa Station
H. JR Rikuu East Line
I. National Route 47





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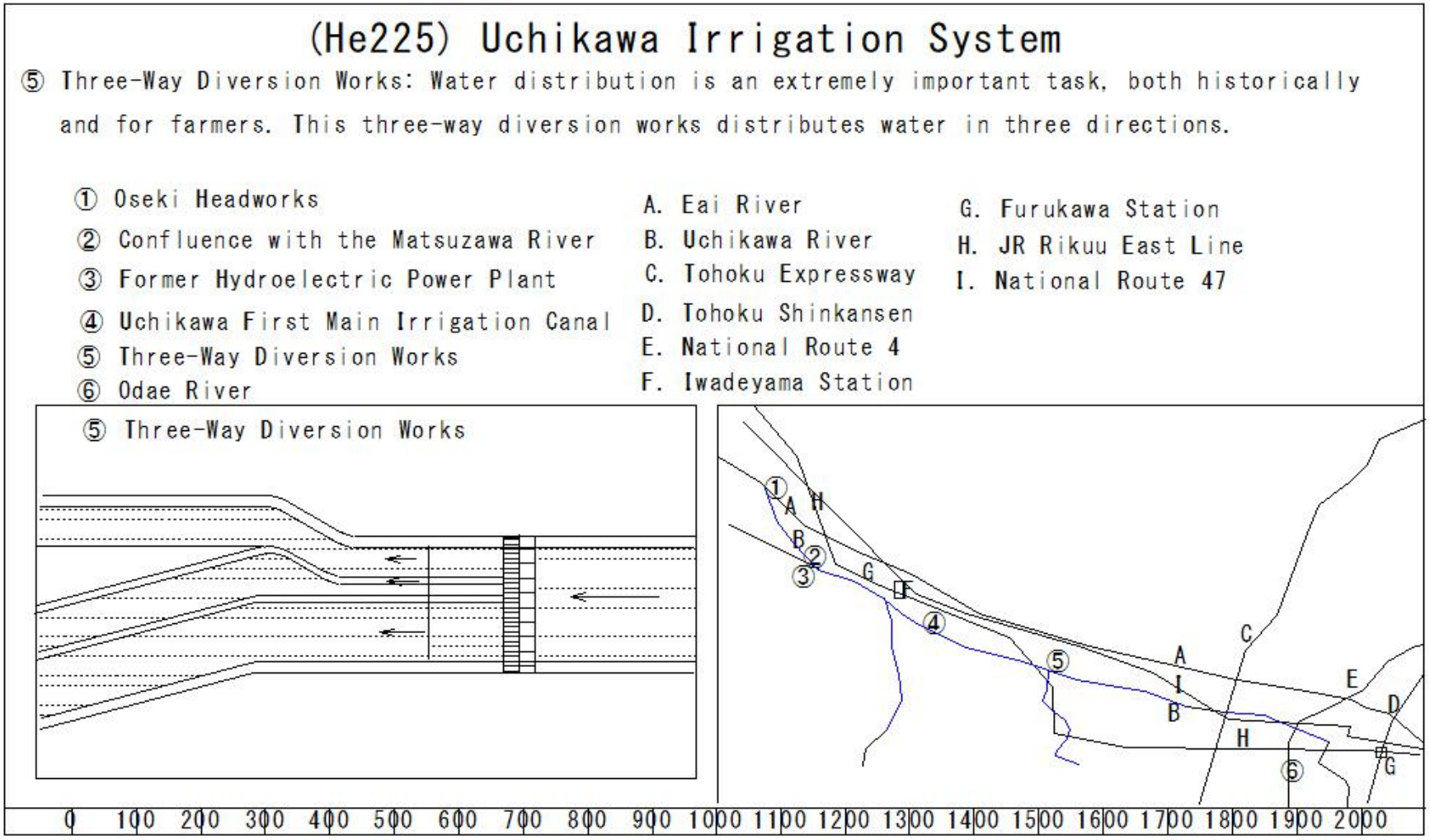
(He225) Uchikawa Irrigation System



(He226) Uchikawa Irrigation System

(He226) Uchikawa Irrigation System

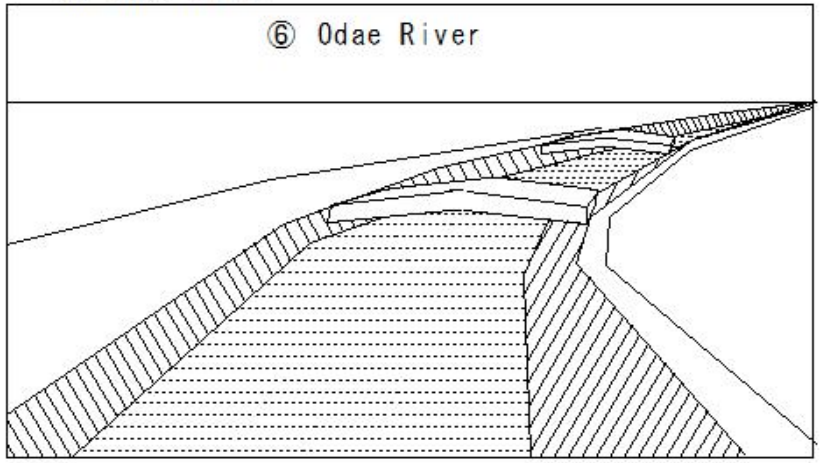
⑥ Odae River:The waters of the Uchikawa River flow into the Furukawa area of Osaki City and become the Ozaze River.

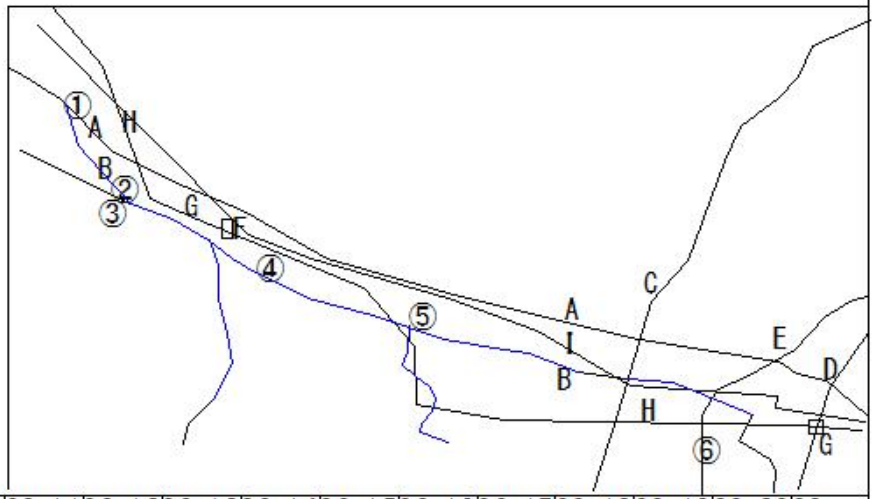
Around the Ozaze Bridge, you can feel the atmosphere of the Heian period.

① Oseki Headworks
② Confluence with the Matsuzawa River
③ Former Hydroelectric Power Plant
④ Uchikawa First Main Irrigation Canal
⑤ Three-Way Diversion Works
⑥ Odae River

A. Eai River
B. Uchikawa River
C. Tohoku Expressway
D. Tohoku Shinkansen
E. National Route 4
F. Iwadeyama Station

G. Furukawa Station
H. JR Rikuu East Line
I. National Route 47





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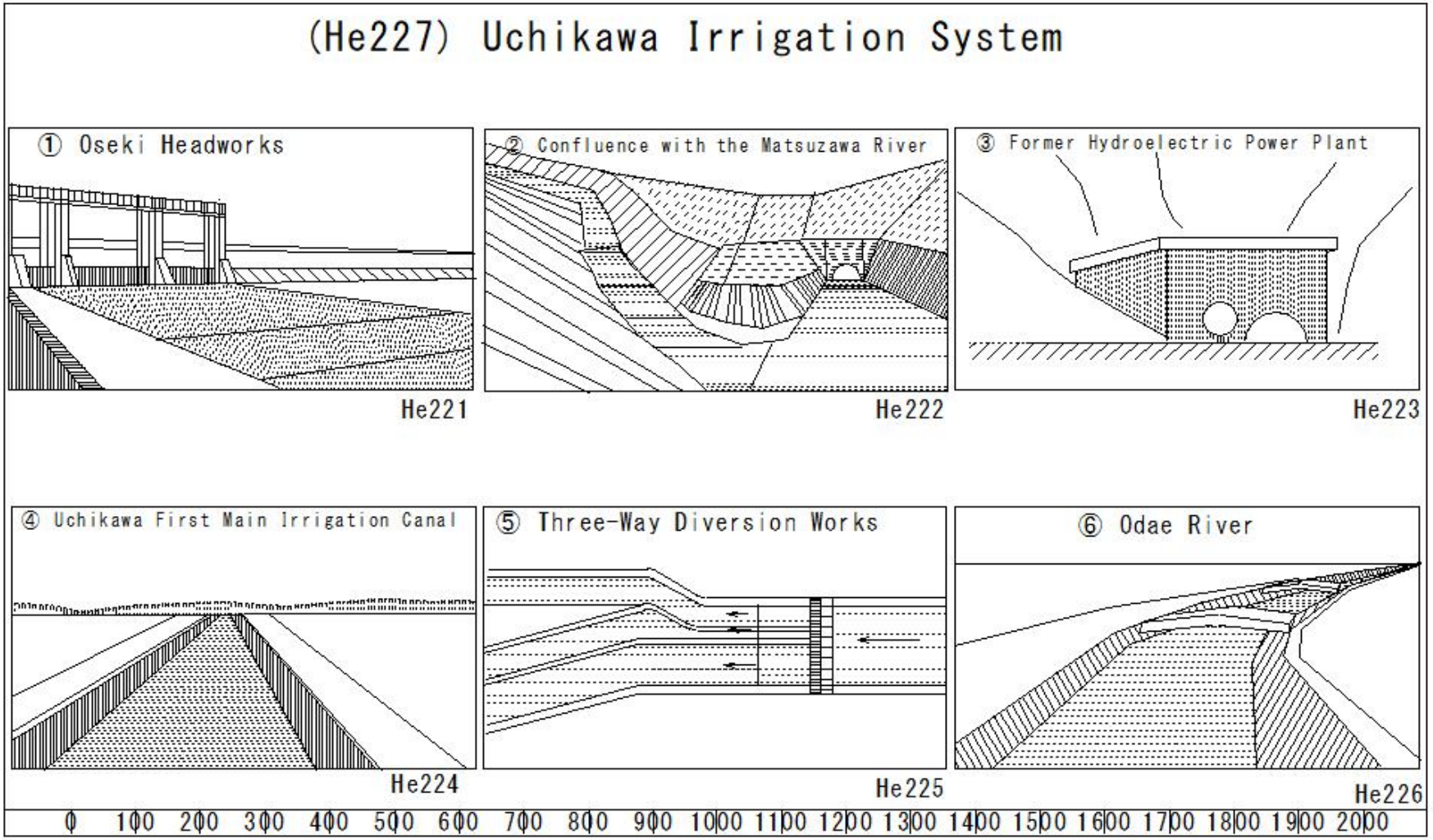
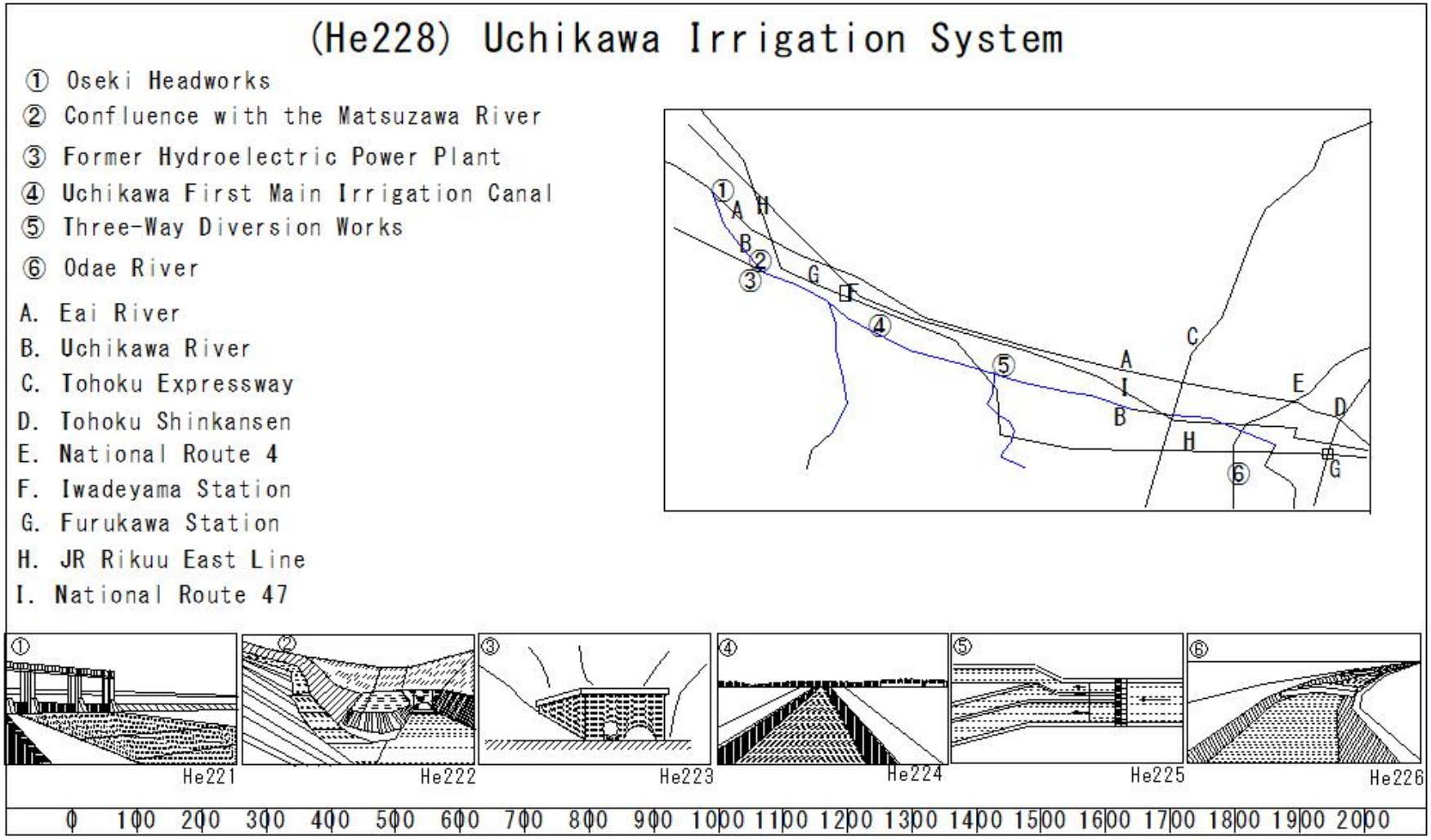
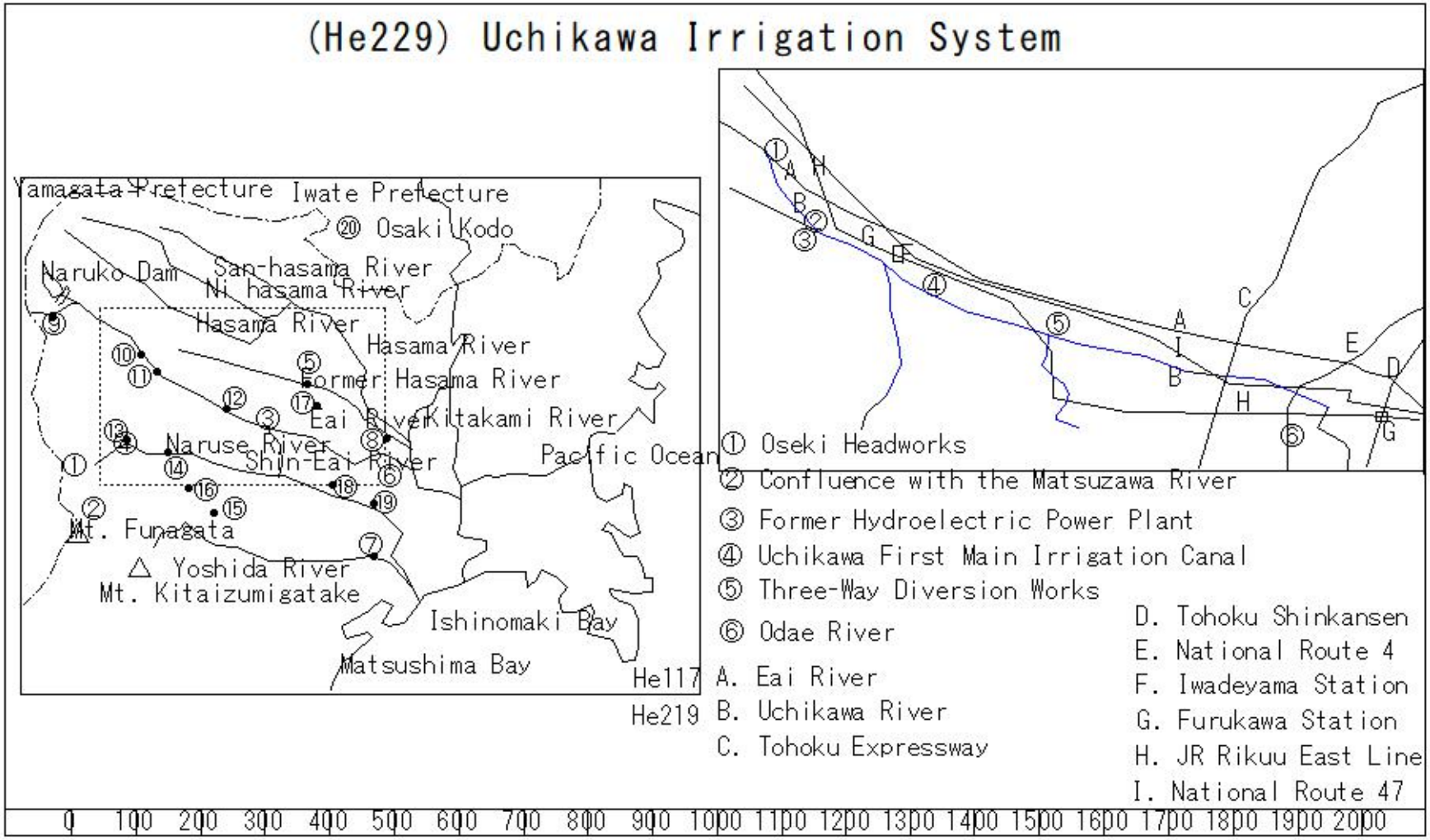
(He227) Uchikawa Irrigation System



(He228) Uchikawa Irrigation System



(He229) Uchikawa Irrigation System



(He230) Uchikawa Irrigation System

(He230) Uchikawa Irrigation System

A The Flow of the Uchikawa River

From the Yubikan (a building) to the Iwadeyama area, where the atmosphere of a castle town remains, the teeming Uchikawa River flows abundantly, exuding a historical atmosphere.

The Northern Regional Development Office, Agriculture and Rural Development Department website, features a water story that tells the history of ingenious water management facilities.

B Iwadeyama Castle and the Uchikawa River

Looking up at Iwadeyama Castle and the eastern lookout from the Uchikawa River, you can see that the terrain functions as a natural fortification, keeping enemies at bay.

C Ninokamae Bridge

The name Uchikawa comes from its location inside the first structure. The second structure was located to the south of this area, giving the bridge its name.

D Branch Waterway with Nishikigoi Carp

The Uchikawa River also serves as a place of relaxation for residents. It incorporates the abundant blessings of water into their lives and fosters beautiful scenery.

E Ushiarai-Fuchi Pocket Park

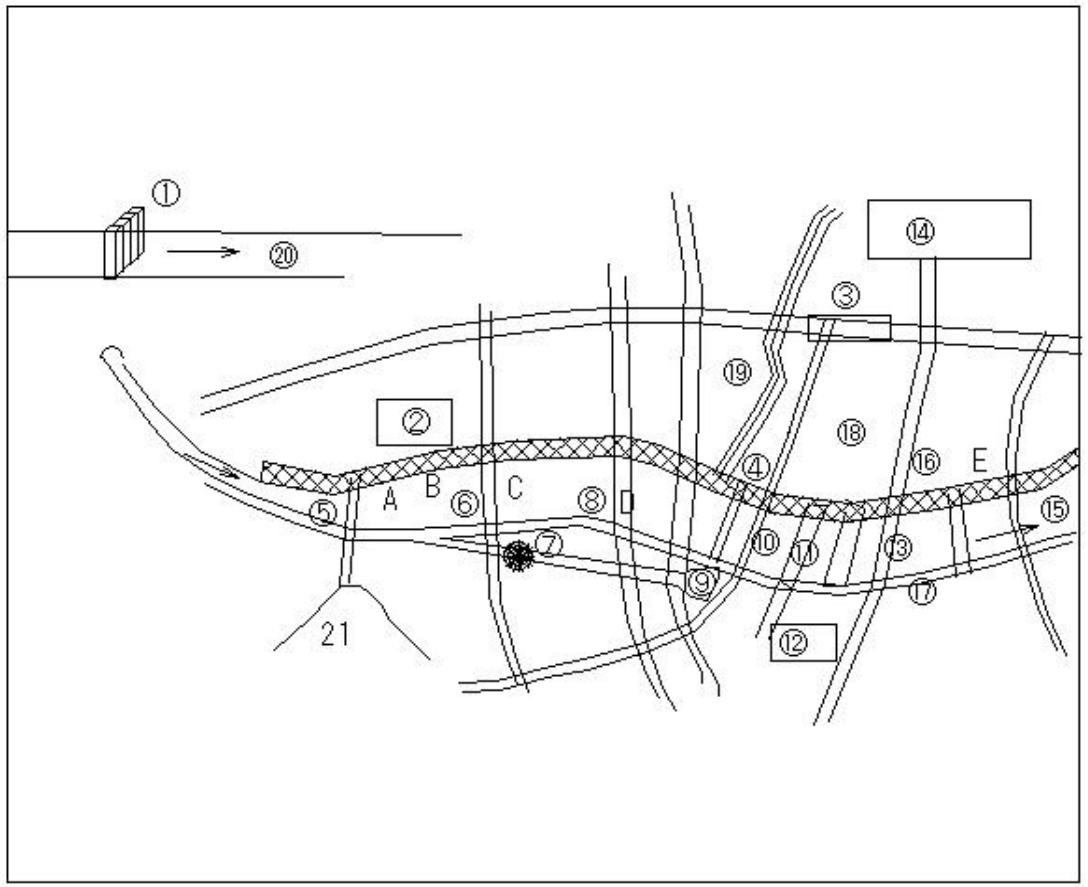
The Uchikawa River's waterway embankment is constructed with natural stone, respecting both history and the landscape. The surrounding area also features parks and promenades, befitting Masamune River.

(He231) Uchikawa Irrigation System

(He231) Uchikawa Irrigation System

Uchikawa District Water Environment Improvement Project Overall Concept Diagram

① Oseki Headworks
② Yubikan
③ Iwadeyama Station
④ Oarai Land Improvement District
⑤ Nakajima Bridge
⑥ Ninokamae Bridge
⑦ Todaura Waterwheel
⑧ Iwadeyama Bridge
⑨ Uchikawa Shinsui Square
⑩ Koimachi Bridge
⑪ Shiroyama Bridge
⑫ Raigoji Temple
⑬ Raigoji Bridge
⑭ Iwadeyama Town Hall
⑮ Uchikawa River
⑯ Ushiarai Pond
⑰ Promenade/Learning Path
⑱ Ushiarai Pond Pocket Park
⑲ Babbling Canal
⑳ Eai River
21 Iwadeyama Castle Ruins



(He232) Uchikawa Irrigation System

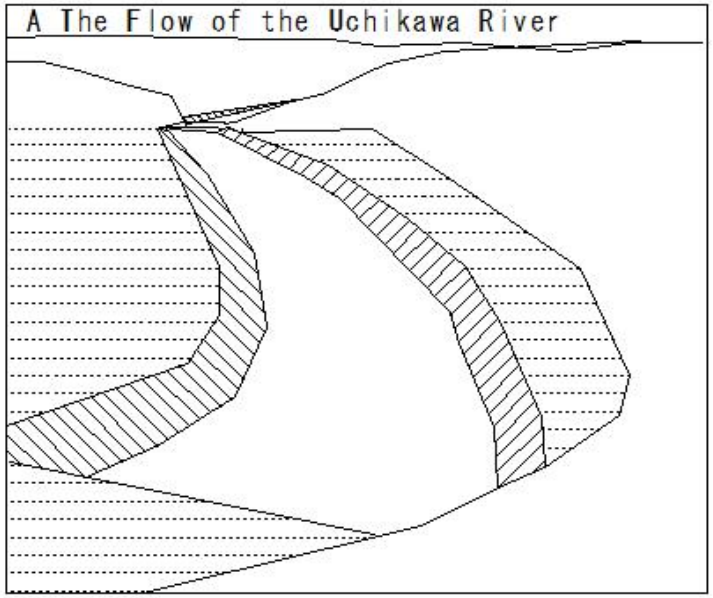
(He232) Uchikawa Irrigation System

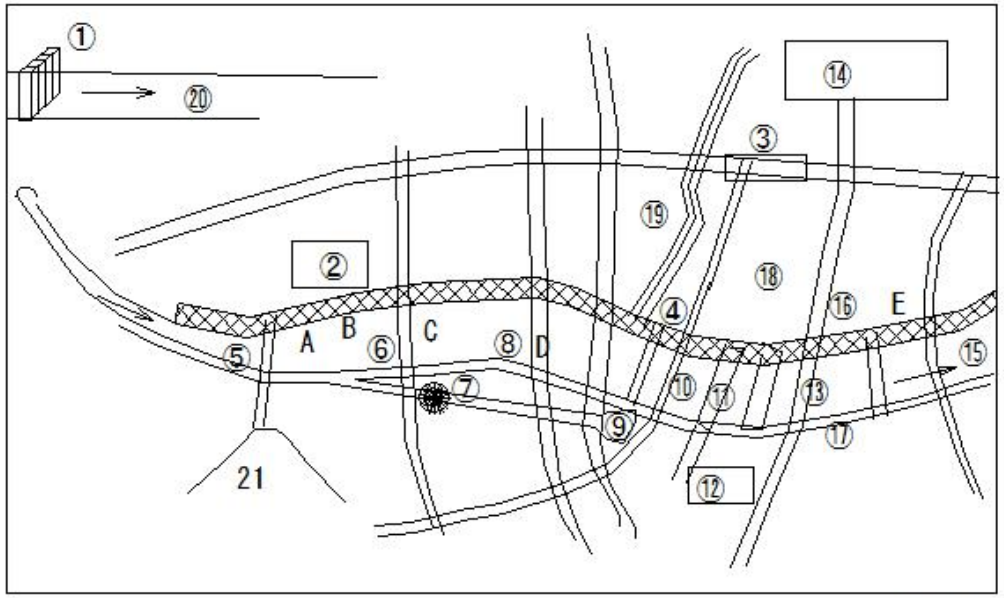
Uchikawa District Water Environment Improvement Project Overall Concept Diagram

A The Flow of the Uchikawa River

From the Yubikan (a building) to the Iwadeyama area, where the atmosphere of a castle town remains, the teeming Uchikawa River flows abundantly, exuding a historical atmosphere.

The Northern Regional Development Office, Agriculture and Rural Development Department website, features a water story that tells the history of ingenious water management facilities.





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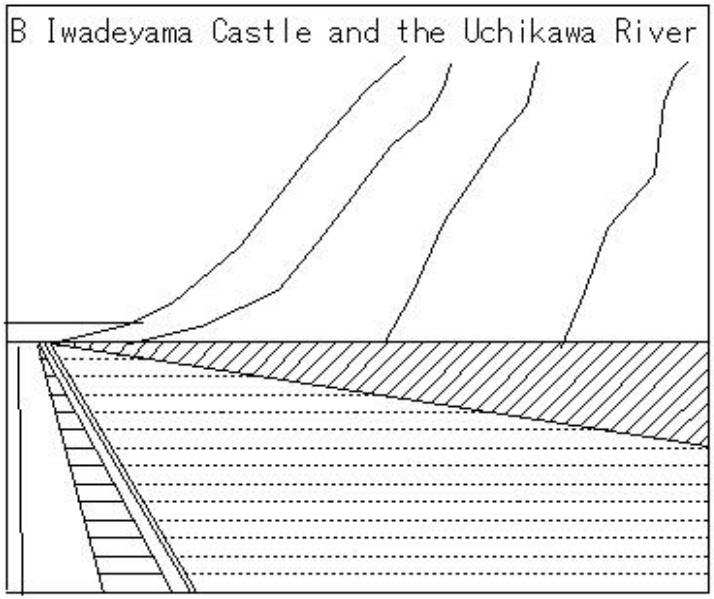
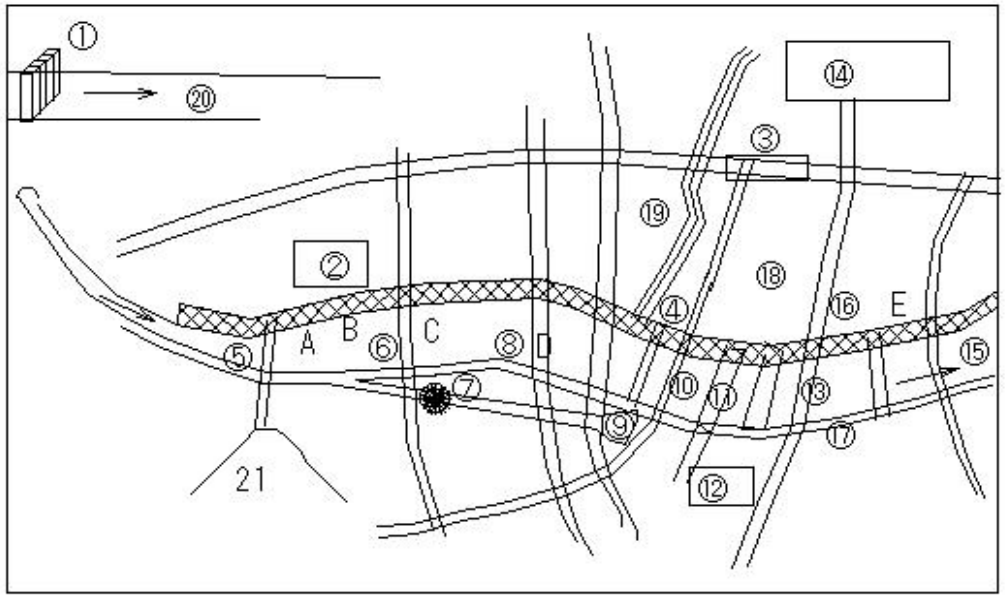
(He233) Uchikawa Irrigation System

(He233) Uchikawa Irrigation System

B Iwadeyama Castle and the Uchikawa River

Looking up at Iwadeyama Castle and the eastern lookout from the Uchikawa River, you can see that the terrain functions as a natural fortification, keeping enemies at bay.





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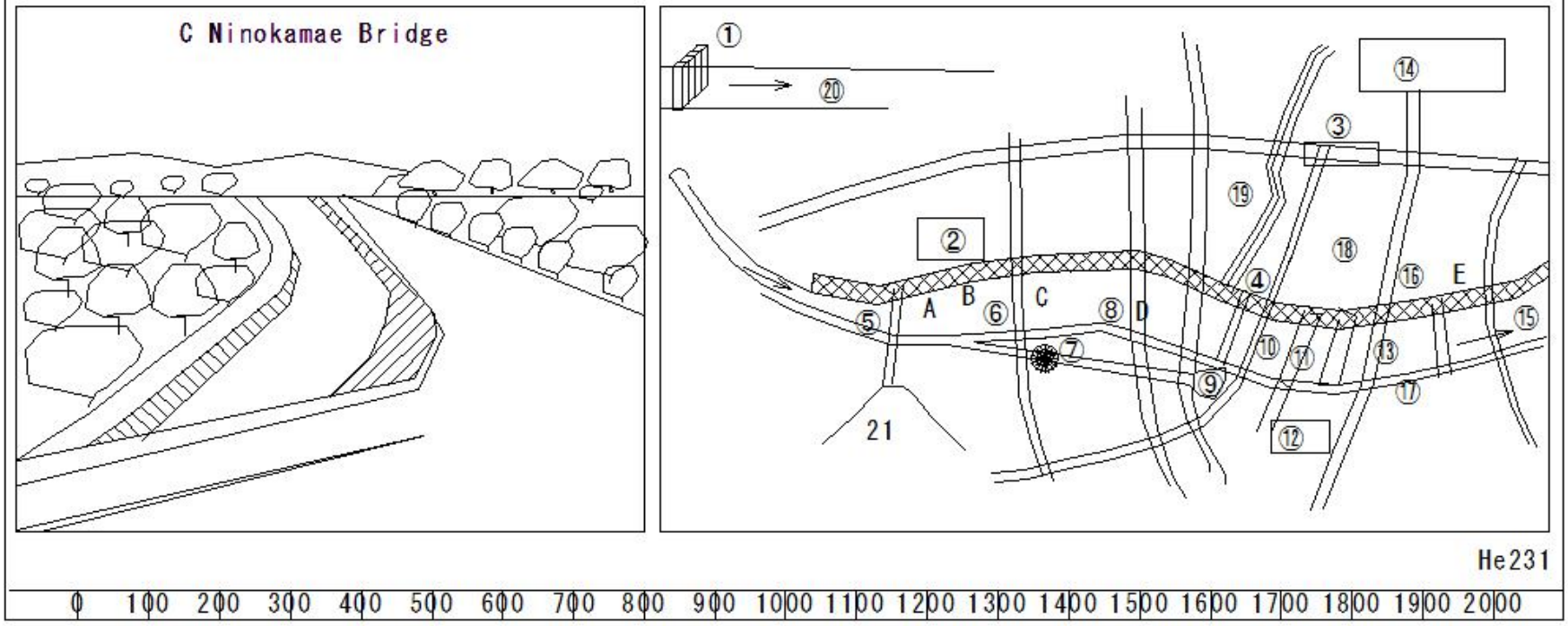
(He234)Uchikawa Irrigation System

(He234) Uchikawa Irrigation System

C Ninokamae Bridge

The name Uchikawa comes from its location inside the first structure. The second structure was located to the south of this area, giving the bridge its name.



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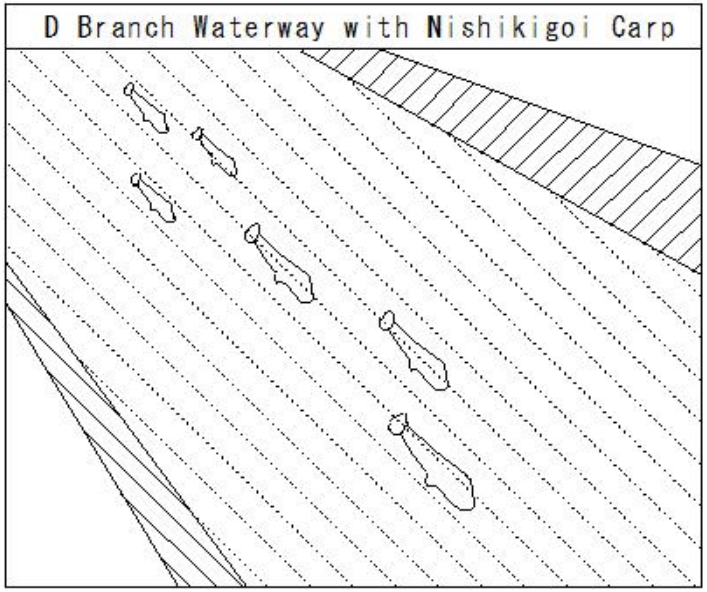
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000

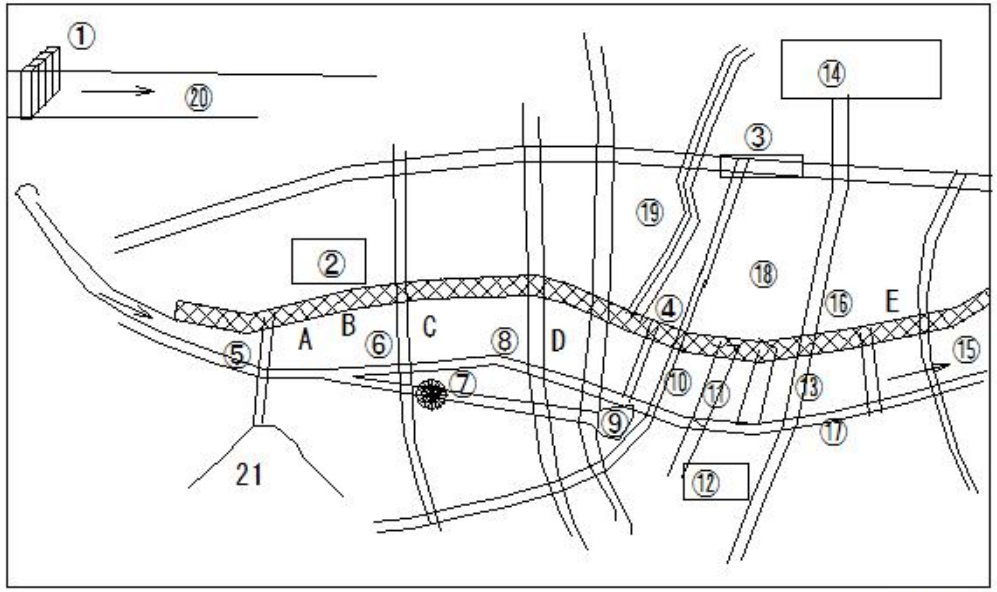
(He235)Uchikawa Irrigation System

(He235) Uchikawa Irrigation System

D Branch Waterway with Nishikigoi Carp

The Uchikawa River also serves as a place of relaxation for residents. It incorporates the abundant blessings of water into their lives and fosters beautiful scenery.





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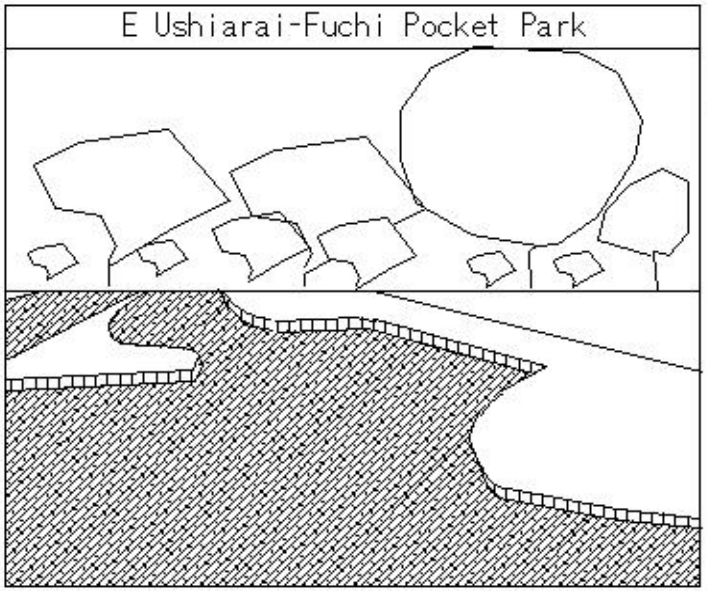
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000

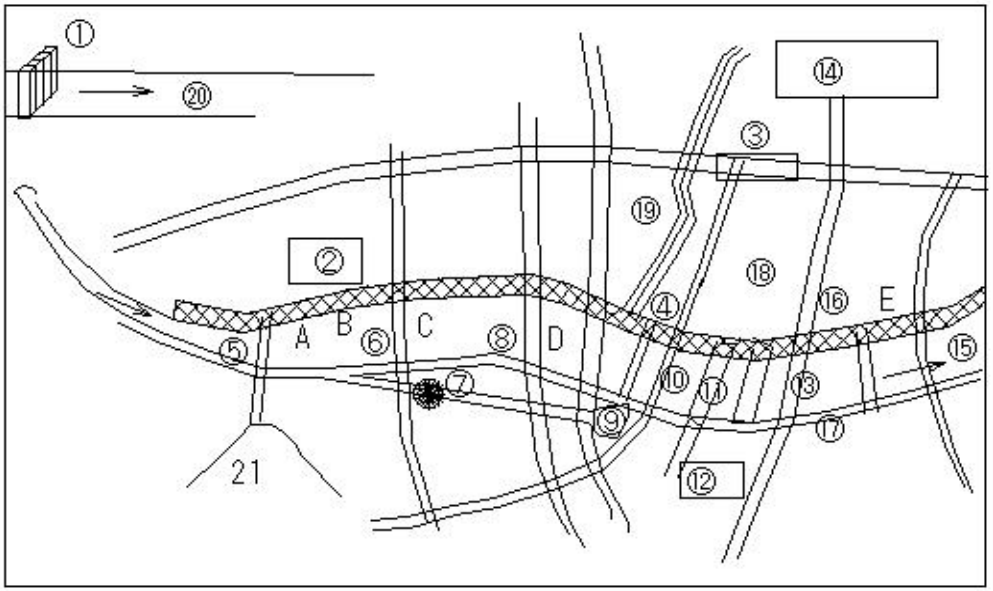
(He236)Uchikawa Irrigation System

(He236) Uchikawa Irrigation System

E Ushiarai-Fuchi Pocket Park

The Uchikawa River's waterway embankment is constructed with natural stone, respecting both history and the landscape. The surrounding area also features parks and promenades, befitting Masamune River.





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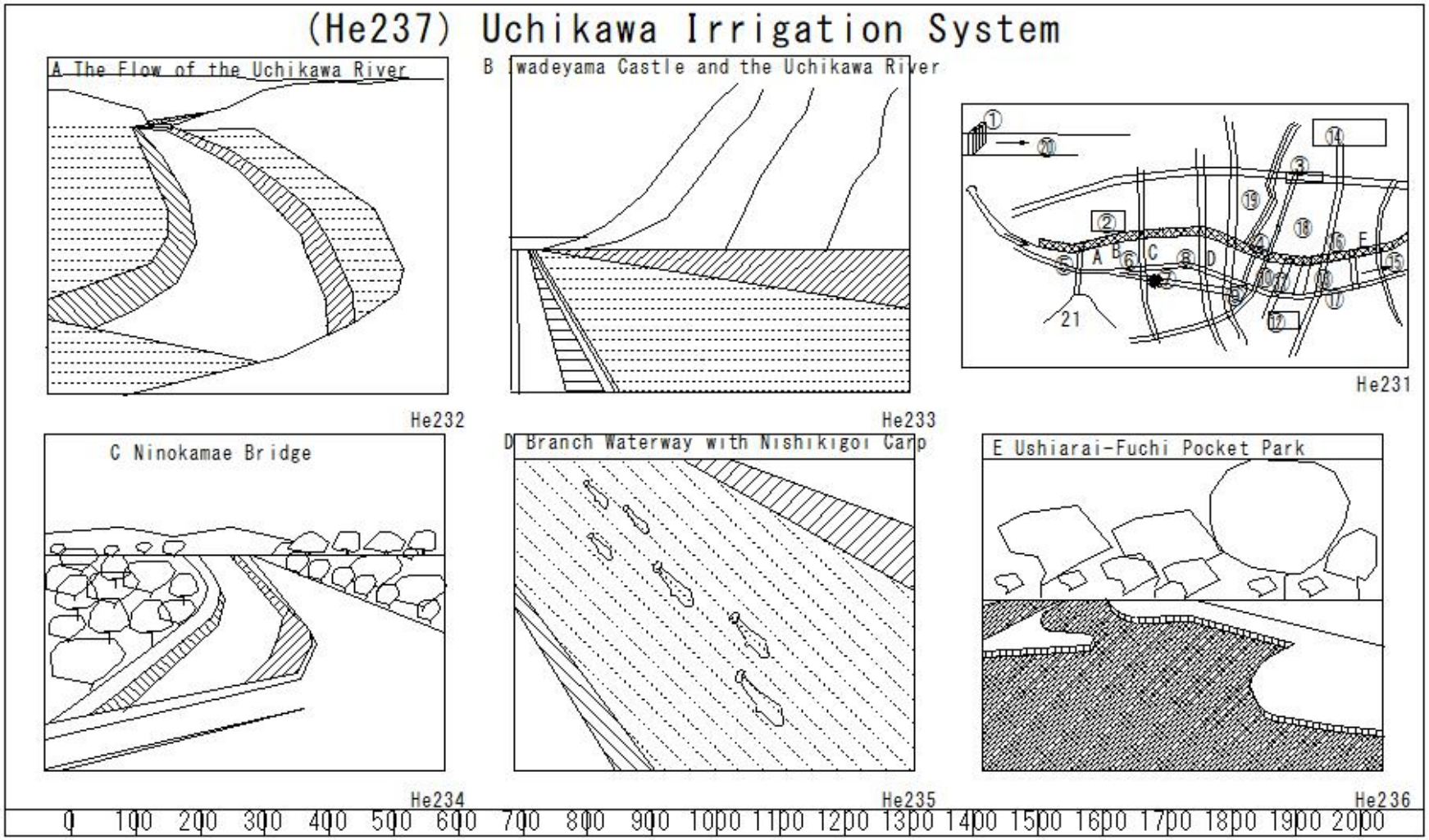
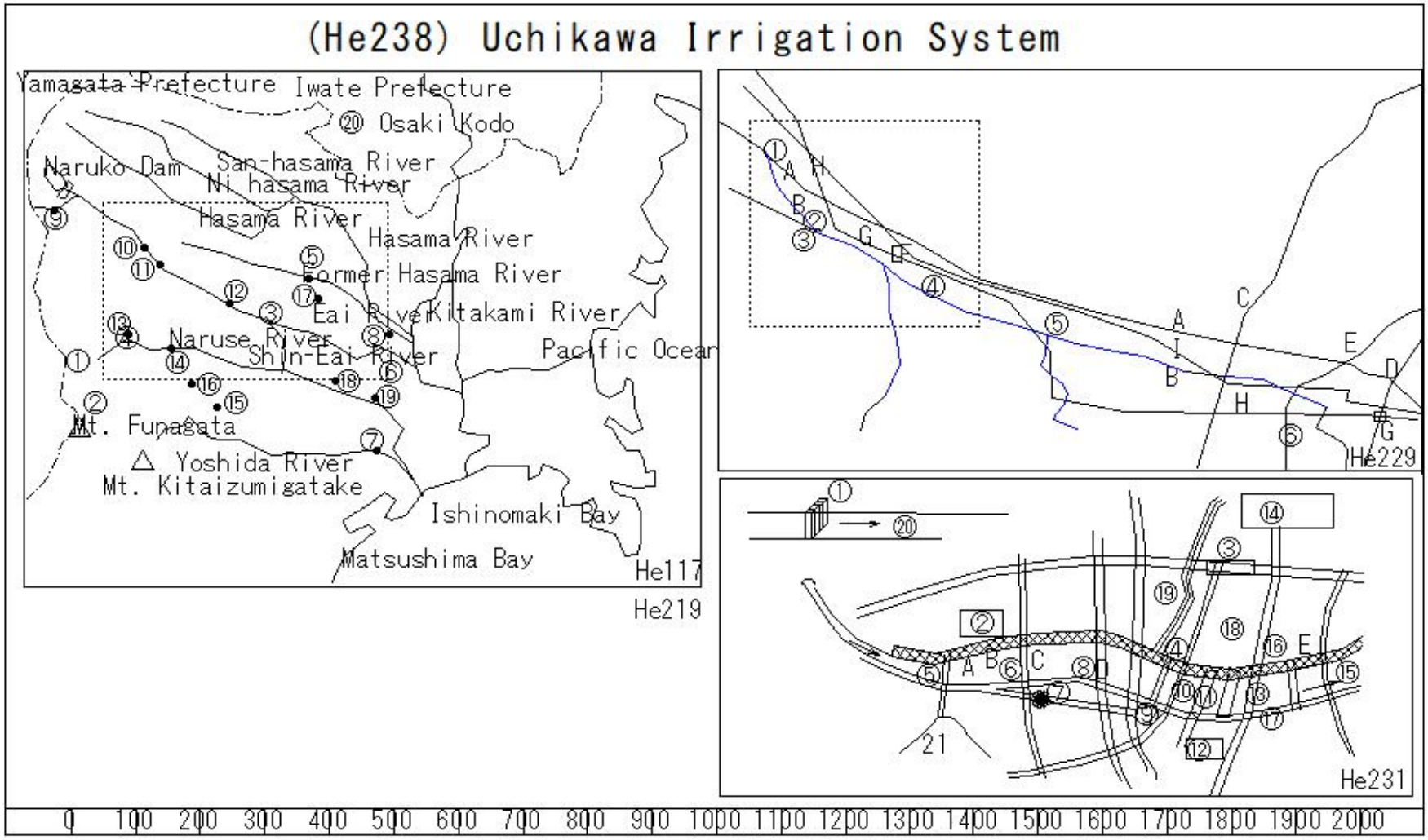
(He237)Uchikawa Irrigation System



(He238)Uchikawa Irrigation System

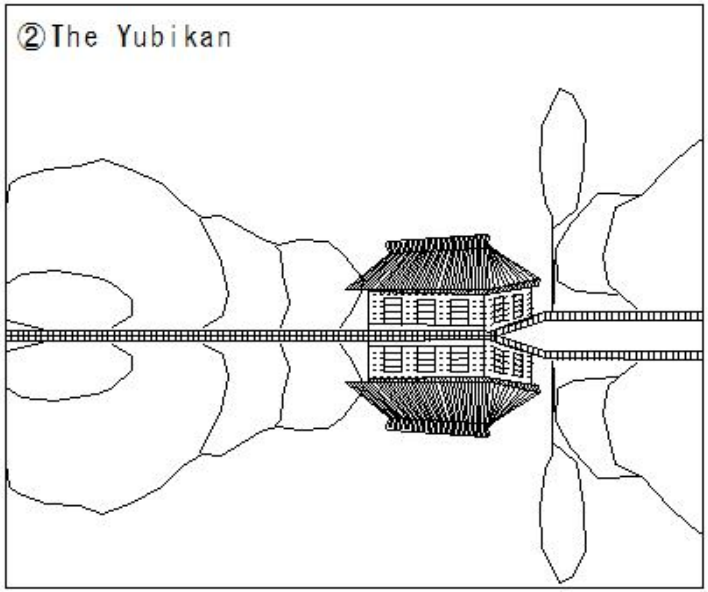


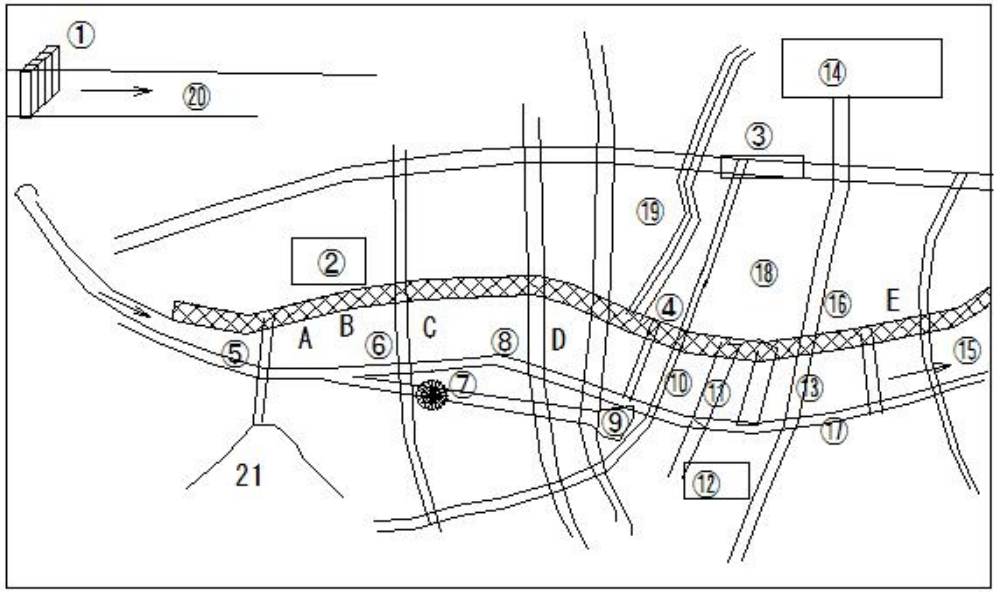
(He239)Uchikawa Irrigation System

(He239) Uchikawa Irrigation System

The Yubikan

The Yubikan is an Edo period structure located in what is now the city of Osaki, Miyagi Prefecture, Japan. It served as a han school for the Date clan of Sendai Domain, and is the oldest existing educational structure in Japan.





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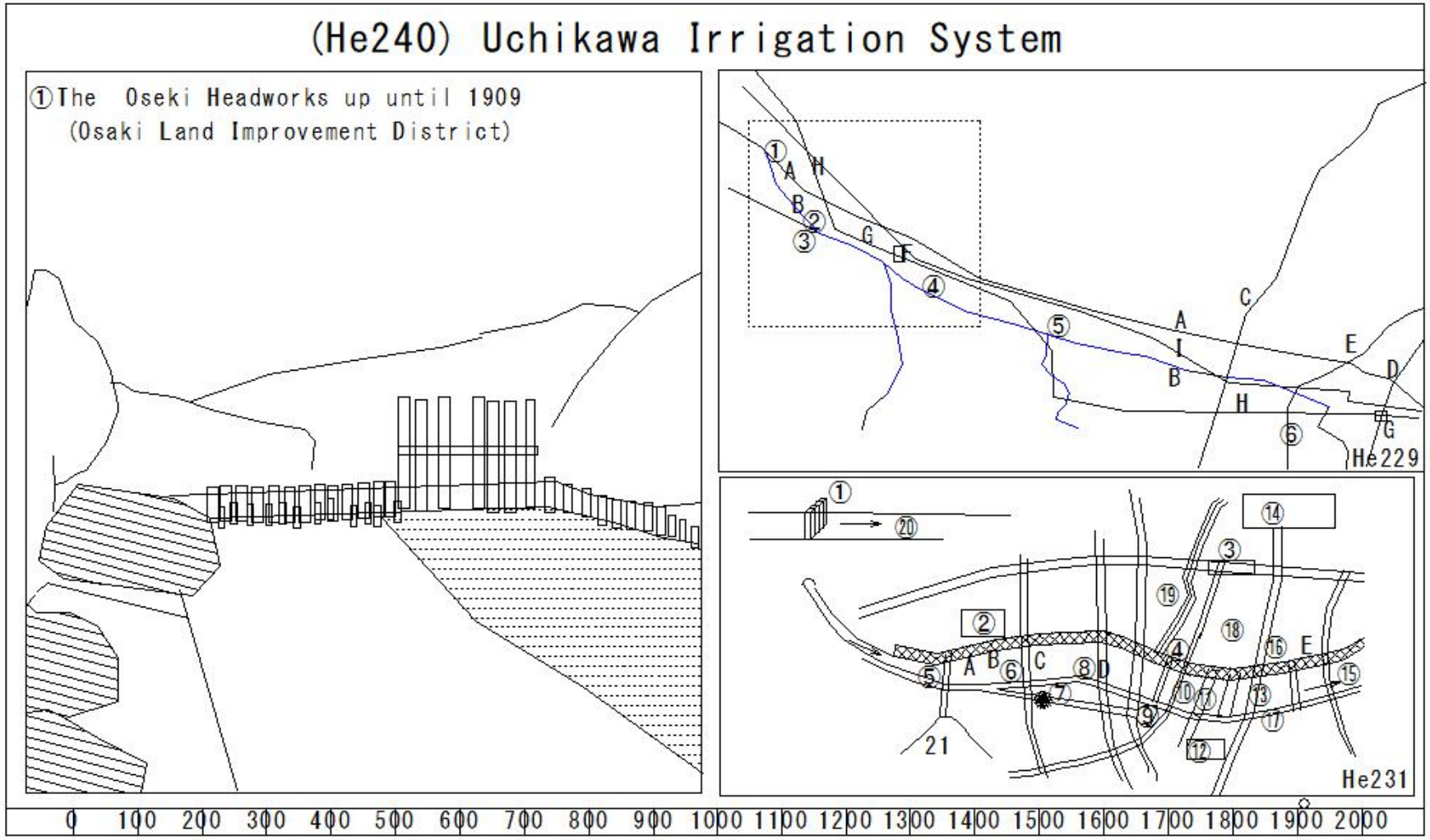
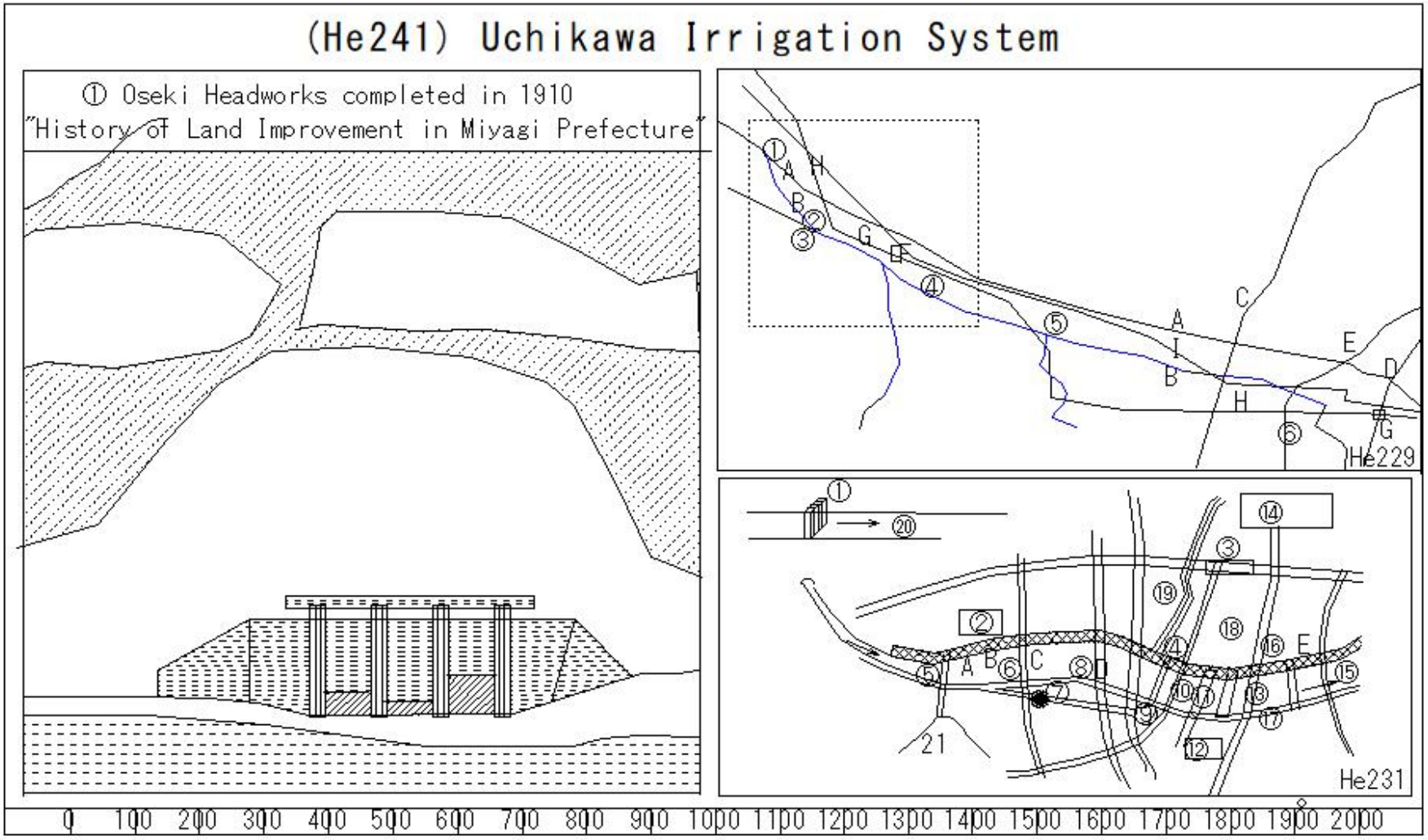
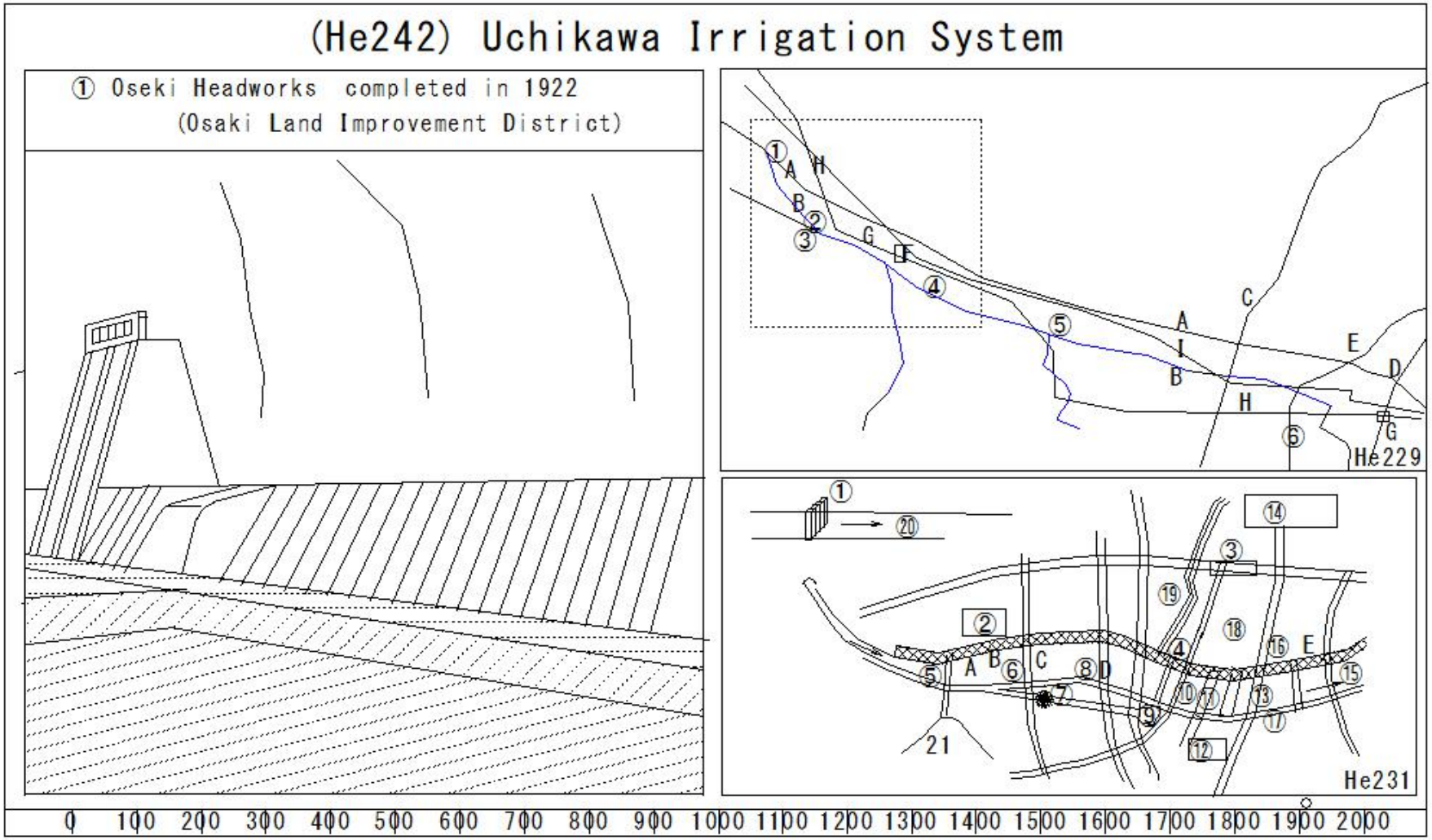
(He240)Uchikawa Irrigation System



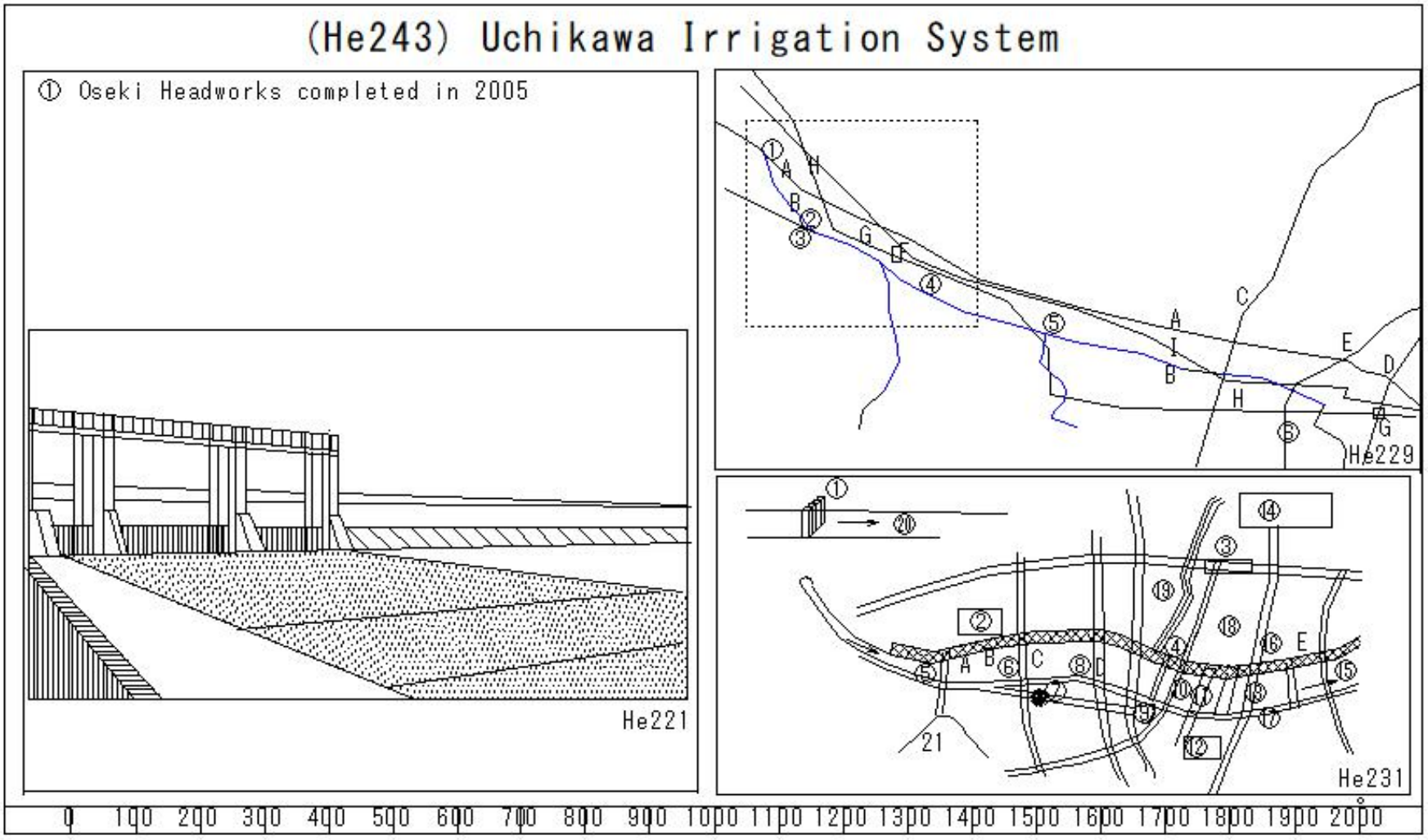
(He241)Uchikawa Irrigation System



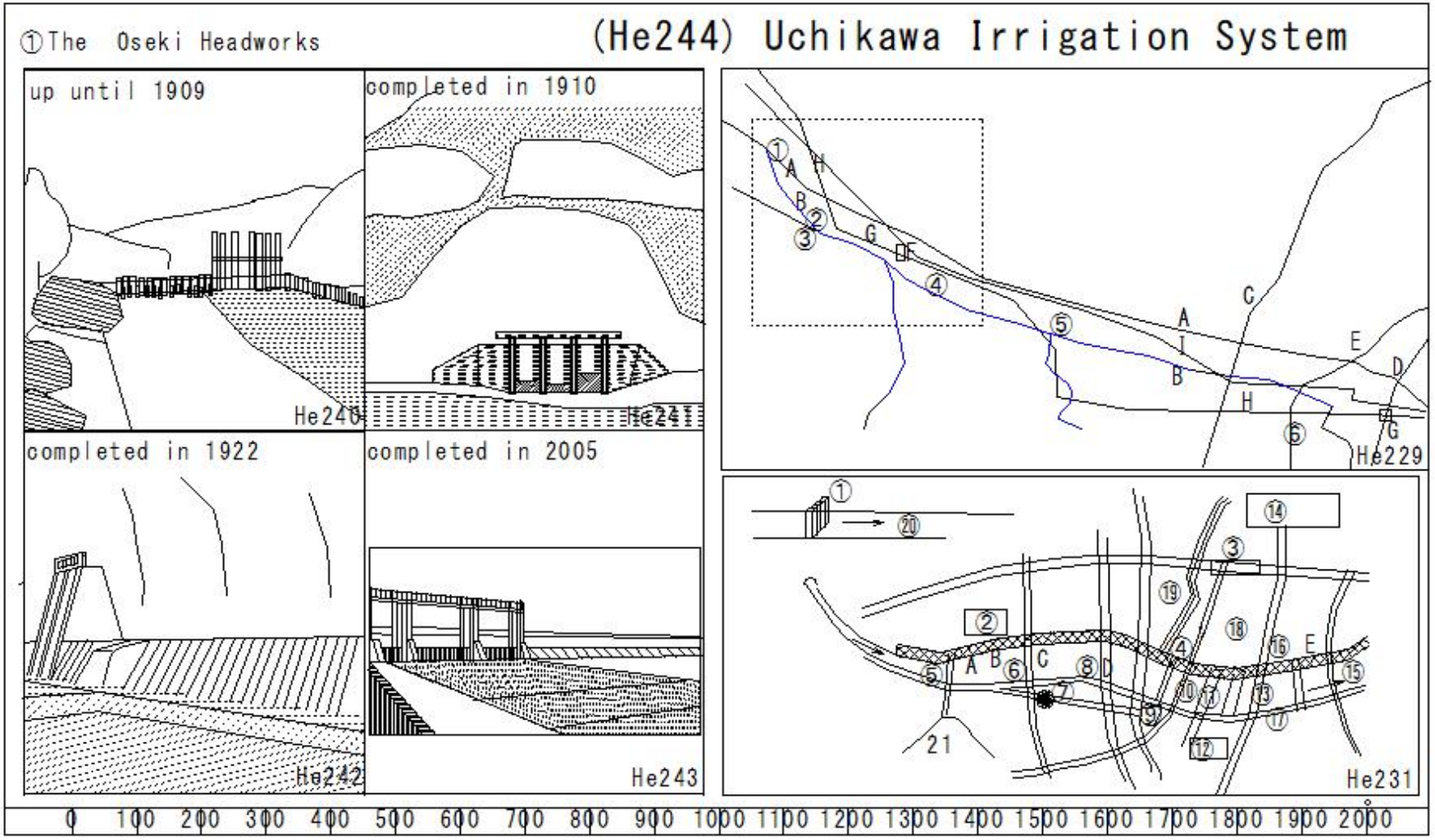
(He242)Uchikawa Irrigation System



(He243)Uchikawa Irrigation System



(He244)Uchikawa Irrigation System



(He245) Minamihara Anaseki

(He245) Minamihara Anaseki

(Tunnel Waterway)

① The Minamihara district, located further upstream from Naruko Onsen, is at a high elevation and separated from nearby rivers by mountains, making it difficult to transport water to rice fields.

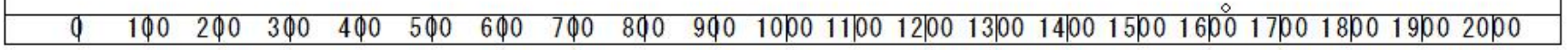
② To bring water from the river to such an area, people at the time came up with the idea of digging a tunnel for the waterway into the mountains.

③ Beginning in 1644, under the direction of government official Yusa Heizaemon Noritsugu, people diligently dug through the mountains by hand.

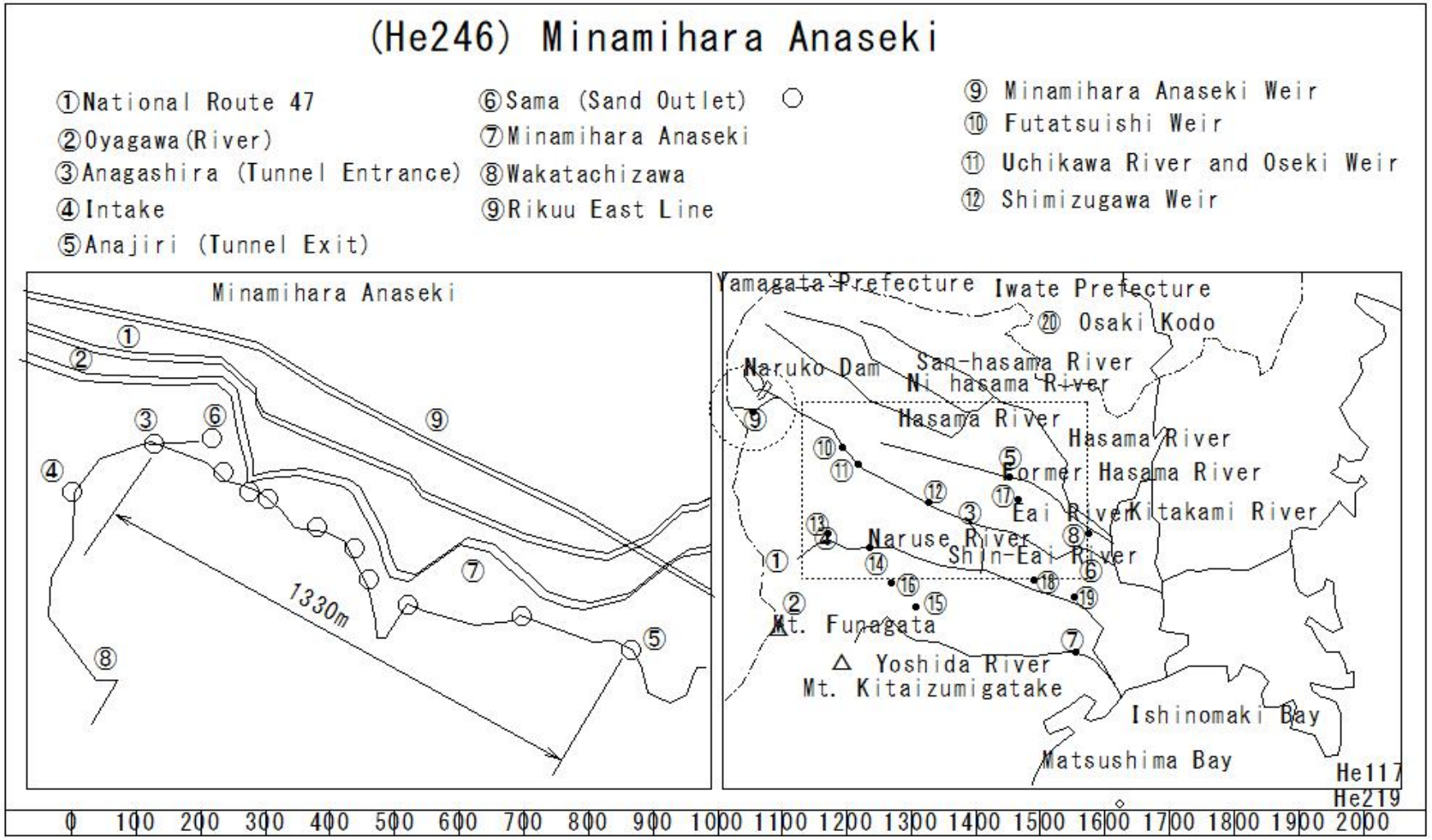
④This is Minamihara Anaseki. Its total length is 1,880 meters, with a 1,330-meter tunnel called Sukuriana.

⑤ There is a horizontal hole called "Sama" midway through the tunnel, which was used to drain soil and sand during cleaning.

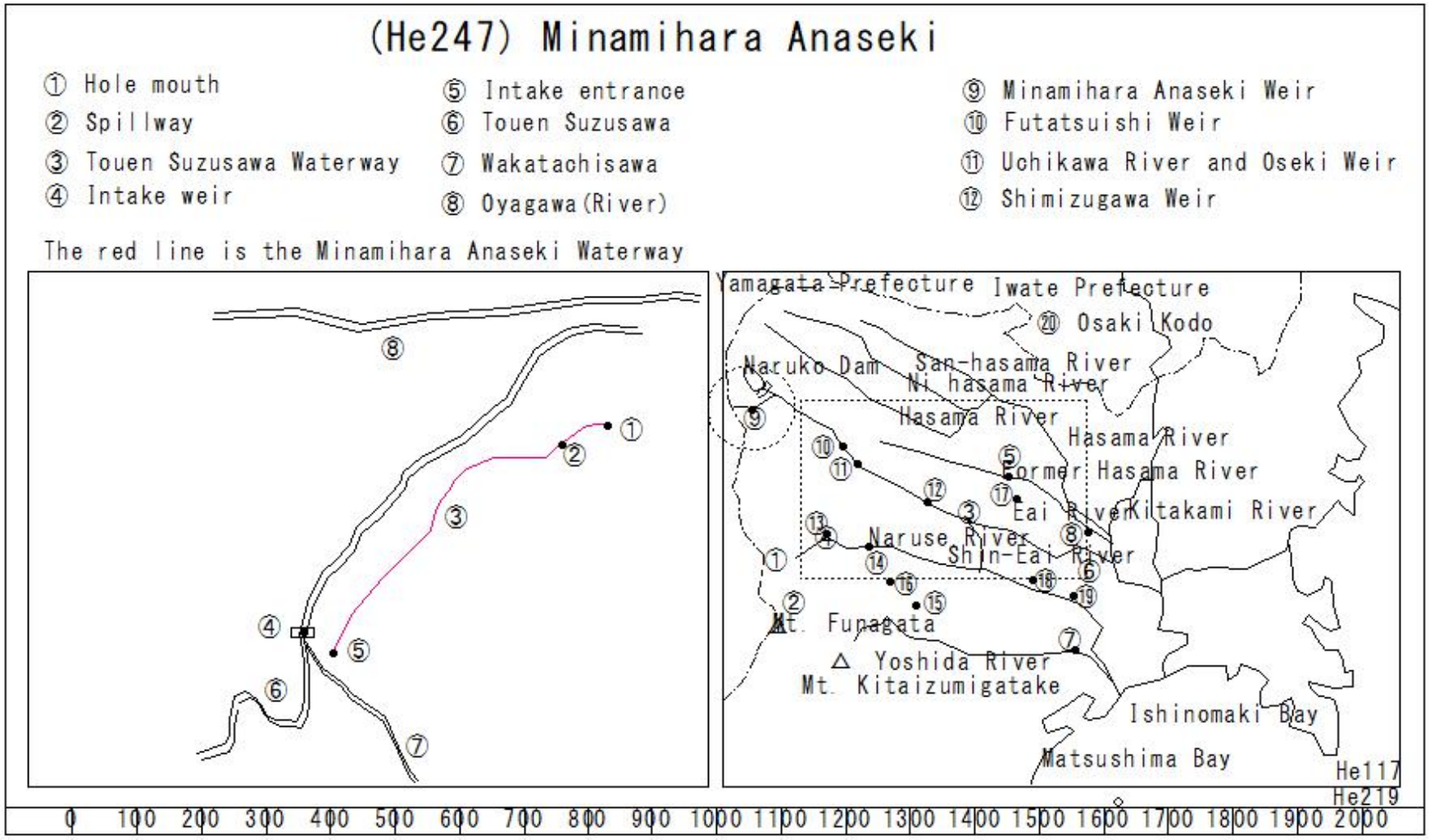
⑥ Even now, 370 years later, Minamihara Anaseki remains in much the same form as it did back then. It is used for agricultural and domestic purposes, irrigating 25 hectares of rice paddies in Minamihara village.



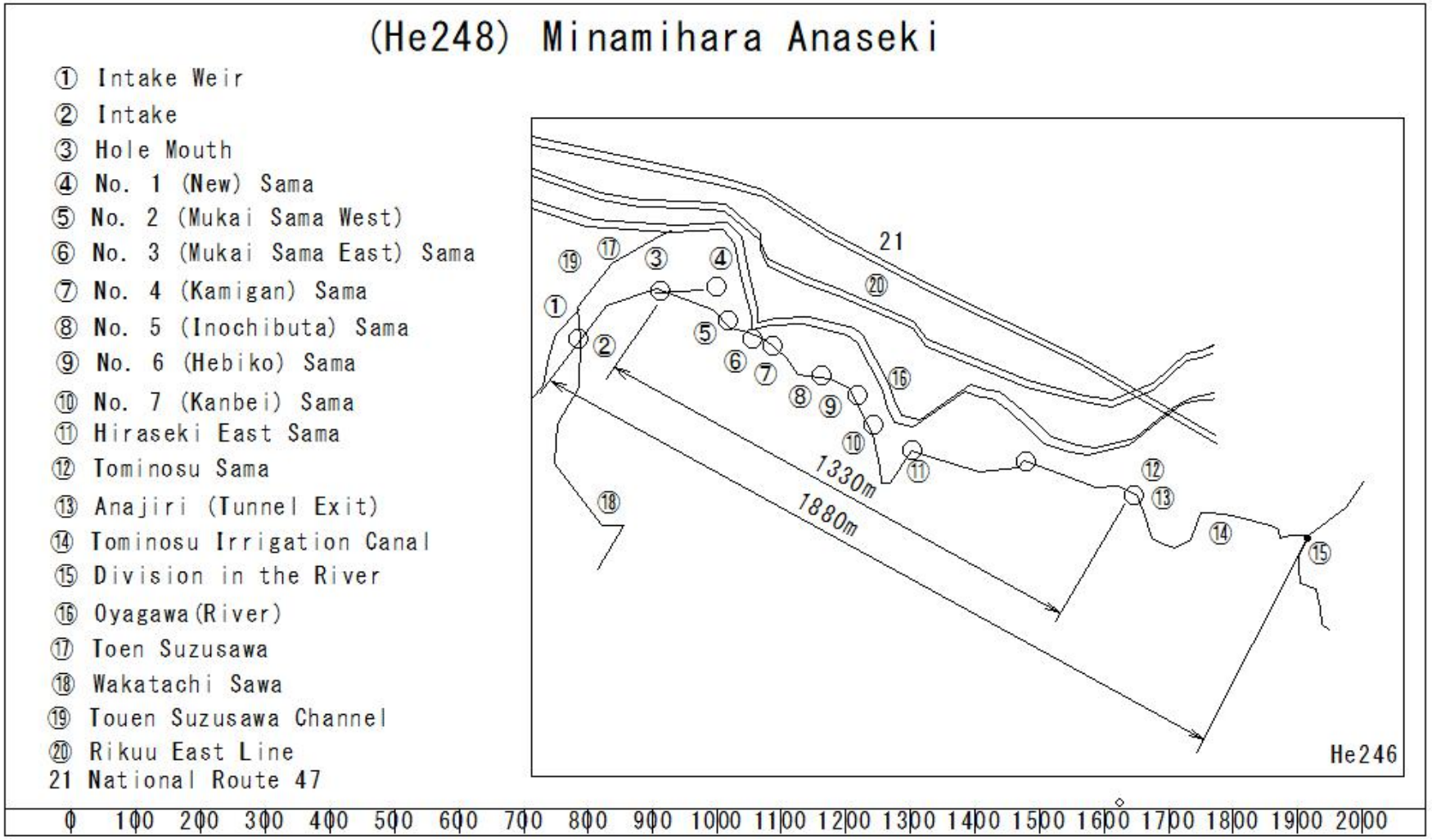
(He246) Minamihara Anaseki



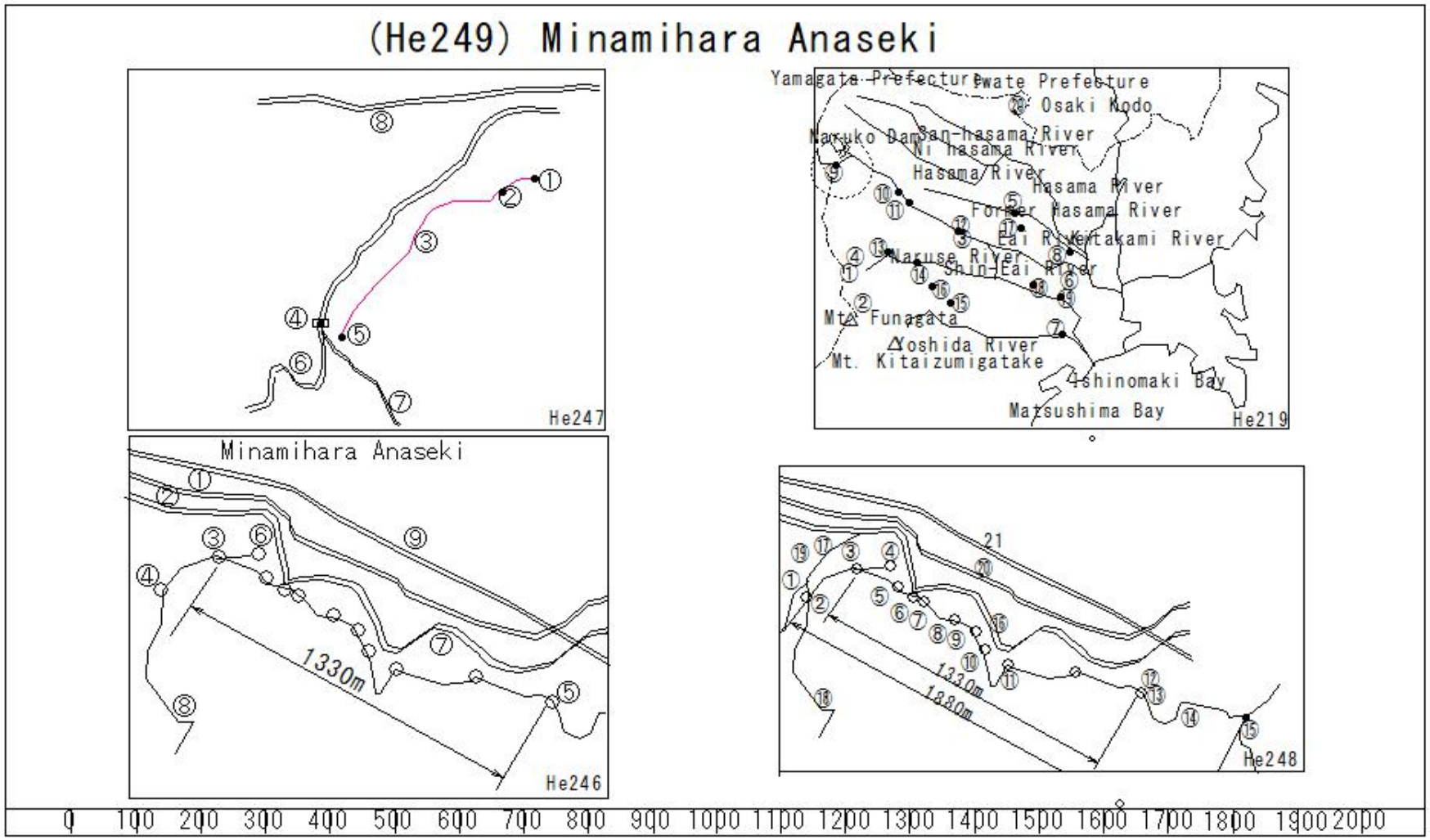
(He247) Minamihara Anaseki



(He248) Minamihara Anaseki



(He249) Minamihara Anaseki



(He250) Minamihara Anaseki

(He250) Minamihara Anaseki

Minamihara Anaseki Water Story "Technology"

A Minamihara Anaseki Topography and Geology: Sedimentary Slate

B Water Source: Toen Suzusawa and Wakatachizawa, tributaries of the Oyagawa River

C After water intake, an open channel runs from the intake to the anakuchi (the tunnel's beginning point)

D Anaseki (aqueduct tunnel) runs from the anakuchi (the tunnel's end)

E The water intake is located at an elevation of 287.4m, at the waterway's diversion point (wa The elevation is approximately 283m.

F The difference in elevation is 4-5m.

G The total length is 1,880m, with a gradient of approximately 1 in 500.

H At night, men with torches were stationed along the Oyagawa River and instructed to climb the southern cliff one by one. From Karuizawa on the opposite bank, they were instructed to "which number should climb up, which number should descend."

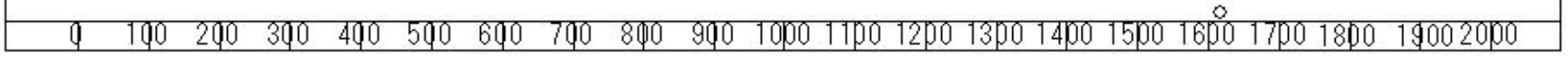
I Stakes were driven into the river at each point, lines were drawn between the points, and a survey map was created.

J This work appears to have taken many nights.

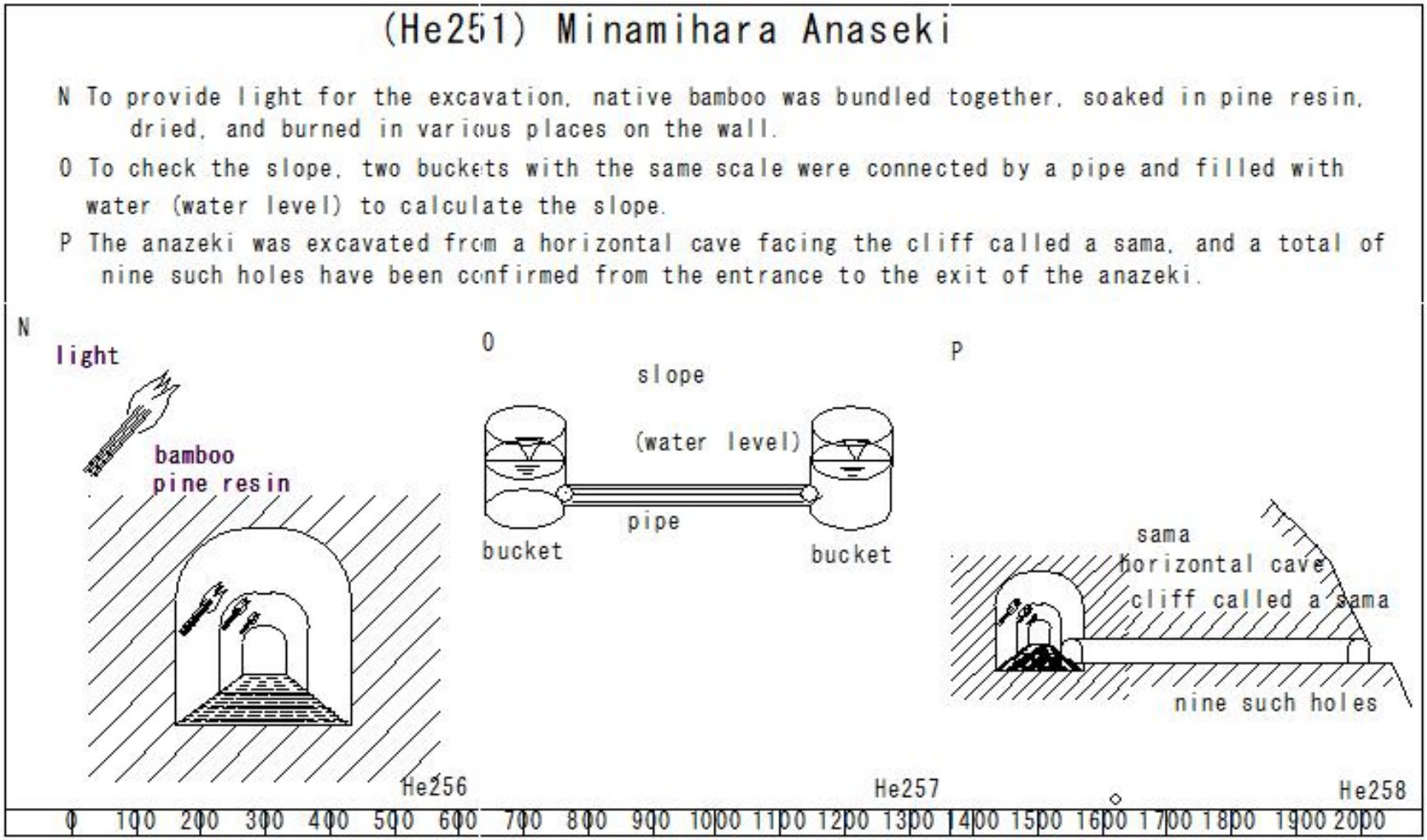
K As mentioned above, the excavation of the hole weir was mostly made of sedimentary slate (amaiwa).

L Because it was dug using a chisel, the interior walls have an uneven surface.

M It is 2.0m high and 1.5-2.0m wide, and its high moisture content would have made it easy to carve.



(He251) Minamihara Anaseki



(He252) Minamihara Anaseki

(He252) Minamihara Anaseki

Minamihara Anaseki Water Story "Technology"

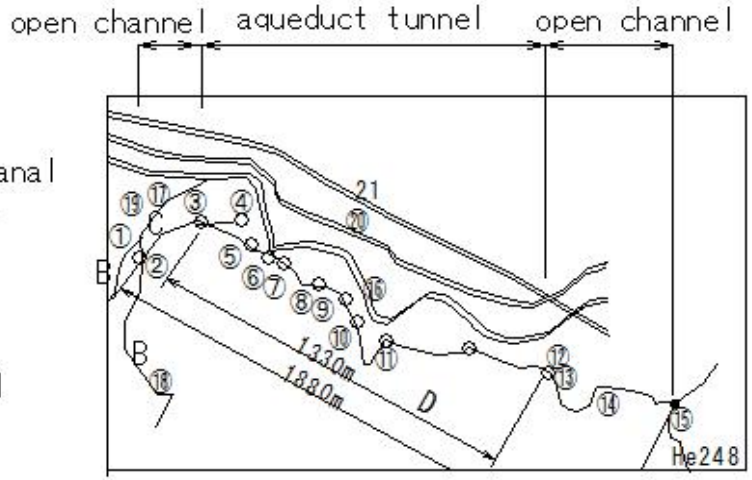
A Minamihara Anaseki Topography and Geology: Sedimentary Slate

B Water Source: Toen Suzusawa and Wakatachizawa, tributaries of the Oyagawa River

C After water intake, an open channel runs from the intake to the anakuchi (the tunnel's beginning point)

D Anaseki (aqueduct tunnel) runs from the anakuchi (the tunnel's end)

① Intake Weir
② Intake
③ Hole Mouth
④ No. 1 (New) Sama
⑤ No. 2 (Mukai Sama West)
⑥ No. 3 (Mukai Sama East) Sama
⑦ No. 4 (Kamigan) Sama
⑧ No. 5 (Inochibuta) Sama
⑨ No. 6 (Hebiko) Sama
⑩ No. 7 (Kanbei) Sama
⑪ Hiraseki East Sama
⑫ Tominosu Sama
⑬ Anajiri (Tunnel Exit)
⑭ Tominosu Irrigation Canal
⑮ Division in the River
⑯ Oyagawa(River)
⑰ Toen Suzusawa
⑱ Wakatachi Sawa
⑲ Touen Suzusawa Channel
⑳ Rikuu East Line
21 National Route 47



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(He253) Minamihara Anaseki

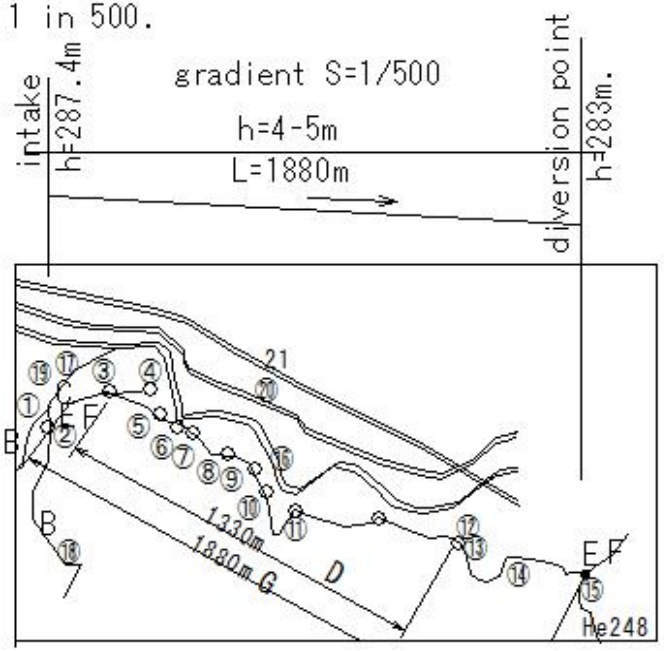
(He253) Minamihara Anaseki

Minamihara Anaseki Water Story "Technology"

E The water intake is located at an elevation of 287.4m, at the waterway's diversion point (The elevation is approximately 283m.

F The difference in elevation is 4-5m.

G The total length is 1,880m, with a gradient of approximately 1 in 500.



① Intake Weir
② Intake
③ Hole Mouth
④ No. 1 (New) Sama
⑤ No. 2 (Mukai Sama West)
⑥ No. 3 (Mukai Sama East) Sama
⑦ No. 4 (Kamigan) Sama
⑧ No. 5 (Inochibuta) Sama
⑨ No. 6 (Hebiko) Sama
⑩ No. 7 (Kanbei) Sama
⑪ Hiraseki East Sama
⑫ Tominosu Sama
⑬ Anajiri (Tunnel Exit)
⑭ Tominosu Irrigation Canal
⑮ Division in the River
⑯ Oyagawa(River)
⑰ Toen Suzusawa
⑱ Wakatachi Sawa
⑲ Touen Suzusawa Channel
⑳ Rikuu East Line
21 National Route 47

0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000

(He254) Minamihara Anaseki

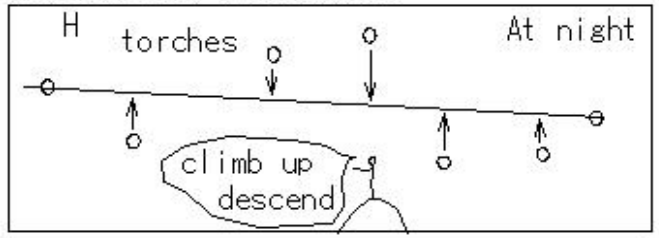
(He254) Minamihara Anaseki

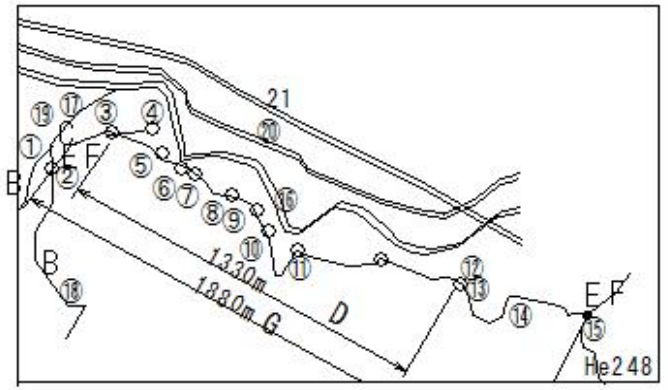
Minamihara Anaseki Water Story "Technology"

H At night, men with torches were stationed along the Oyagawa River and instructed to climb the southern cliff one by one. From Karuizawa on the opposite bank, they were instructed to "which number should climb up, which number should descend."

I Stakes were driven into the river at each point, lines were drawn between the points, and a survey map was created.

J This work appears to have taken many nights.





① Intake Weir
② Intake
③ Hole Mouth
④ No. 1 (New) Sama
⑤ No. 2 (Mukai Sama West)
⑥ No. 3 (Mukai Sama East) Sama
⑦ No. 4 (Kamigan) Sama
⑧ No. 5 (Inochibuta) Sama
⑨ No. 6 (Hebiko) Sama
⑩ No. 7 (Kanbei) Sama
⑪ Hiraseki East Sama
⑫ Tominosu Sama
⑬ Anajiri (Tunnel Exit)
⑭ Tominosu Irrigation Canal
⑮ Division in the River
⑯ Oyagawa(River)
⑰ Toen Suzusawa
⑱ Wakatachi Sawa
⑲ Touen Suzusawa Channel
⑳ Rikuu East Line
21 National Route 47

0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000

(He255) Minamihara Anaseki

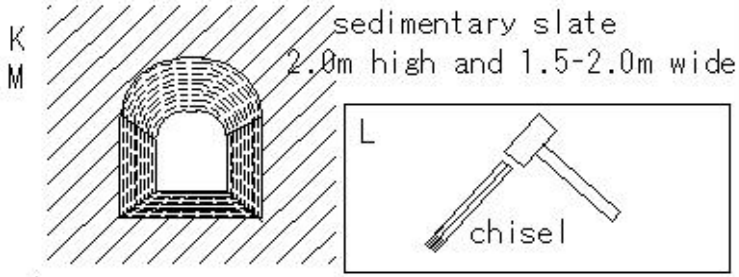
(He255) Minamihara Anaseki

Minamihara Anaseki Water Story "Technology"

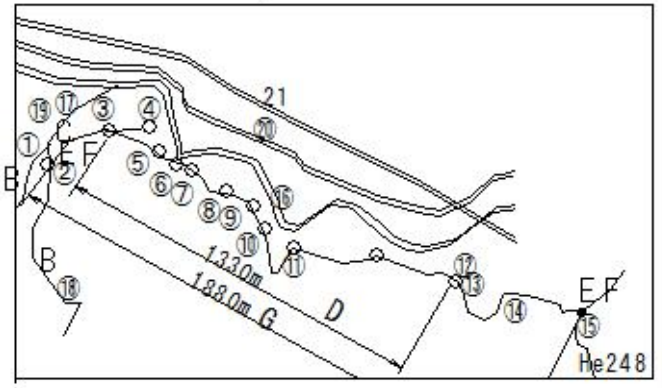
K As mentioned above, the excavation of the hole weir was mostly made of sedimentary slate (amaiwa).

L Because it was dug using a chisel, the interior walls have an uneven surface.

M It is 2.0m high and 1.5-2.0m wide, and its high moisture content would have made it easy to carve.



① Intake Weir
② Intake
③ Hole Mouth
④ No. 1 (New) Sama
⑤ No. 2 (Mukai Sama West)
⑥ No. 3 (Mukai Sama East) Sama
⑦ No. 4 (Kamigan) Sama
⑧ No. 5 (Inochibuta) Sama
⑨ No. 6 (Hebiko) Sama
⑩ No. 7 (Kanbei) Sama
⑪ Hiraseki East Sama
⑫ Tominosu Sama
⑬ Anajiri (Tunnel Exit)
⑭ Tominosu Irrigation Canal
⑮ Division in the River
⑯ Oyagawa(River)
⑰ Toen Suzusawa
⑱ Wakatachi Sawa
⑲ Touen Suzusawa Channel
⑳ Rikuu East Line
21 National Route 47



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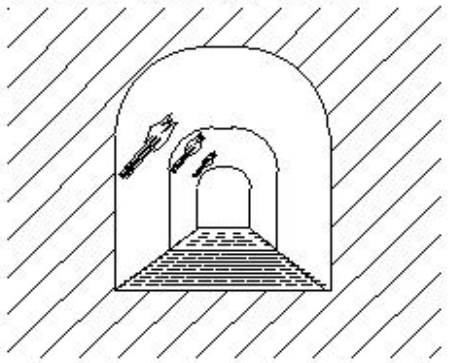
(He256) Minamihara Anaseki

(He256) Minamihara Anaseki

Minamihara Anaseki Water Story "Technology"

N To provide light for the excavation, native bamboo was bundled together, soaked in pine resin, dried, and burned in various places on the wall.



① Intake Weir
② Intake
③ Hole Mouth
④ No. 1 (New) Sama
⑤ No. 2 (Mukai Sama West)
⑥ No. 3 (Mukai Sama East) Sama
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⑧ No. 5 (Inochibuta) Sama
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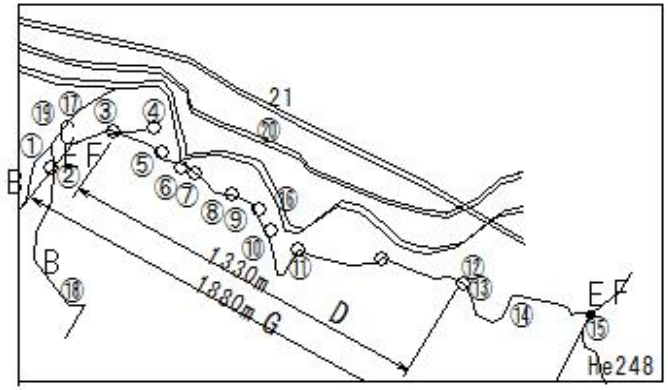
⑱ Wakatachi Sawa
⑲ Touen Suzusawa Channel
⑳ Rikuu East Line
21 National Route 47



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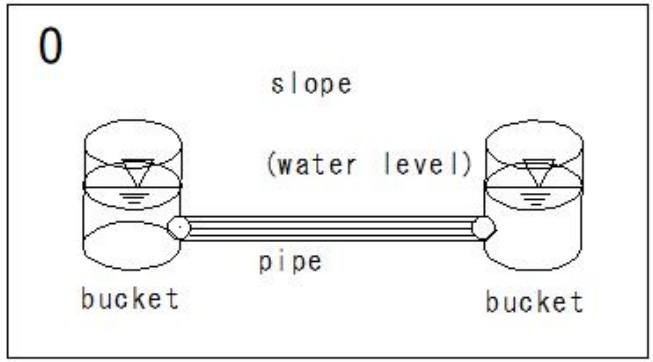
(He257) Minamihara Anaseki

(He257) Minamihara Anaseki

Minamihara Anaseki Water Story "Technology"

0 To check the slope, two buckets with the same scale were connected by a pipe and filled with water (water level) to calculate the slope.



① Intake Weir
② Intake
③ Hole Mouth
④ No. 1 (New) Sama
⑤ No. 2 (Mukai Sama West)
⑥ No. 3 (Mukai Sama East) Sama
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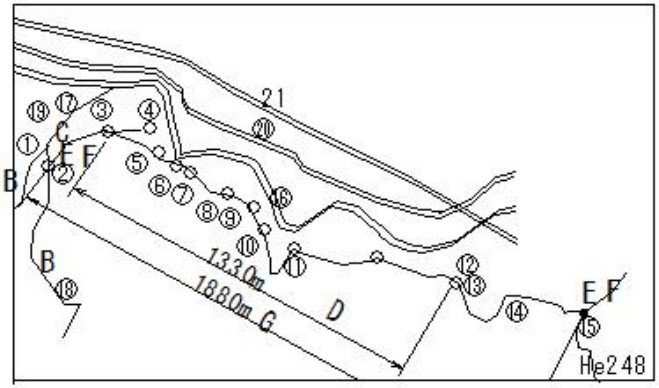
⑱ Wakatachi Sawa
⑲ Touen Suzusawa Channel
⑳ Rikuu East Line
21 National Route 47



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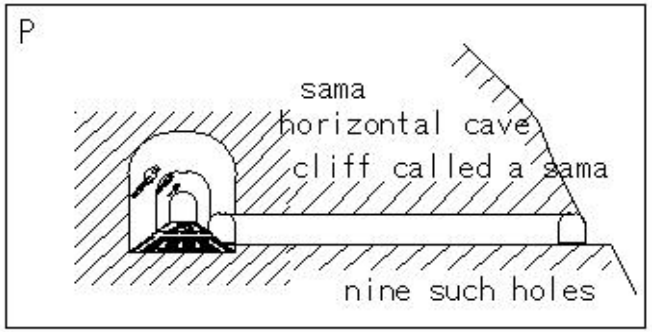
(He258) Minamihara Anaseki

(He258) Minamihara Anaseki

Minamihara Anaseki Water Story "Technology"

P The anazeki was excavated from a horizontal cave facing the cliff called a sama, and a total of nine such holes have been confirmed from the entrance to the exit of the anazeki.



① Intake Weir
② Intake
③ Hole Mouth
④ No. 1 (New) Sama
⑤ No. 2 (Mukai Sama West)
⑥ No. 3 (Mukai Sama East) Sama
⑦ No. 4 (Kamigan) Sama
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⑨ No. 6 (Hebiko) Sama
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⑰ Toen Suzusawa
⑱ Wakatachi Sawa
⑲ Touen Suzusawa Channel
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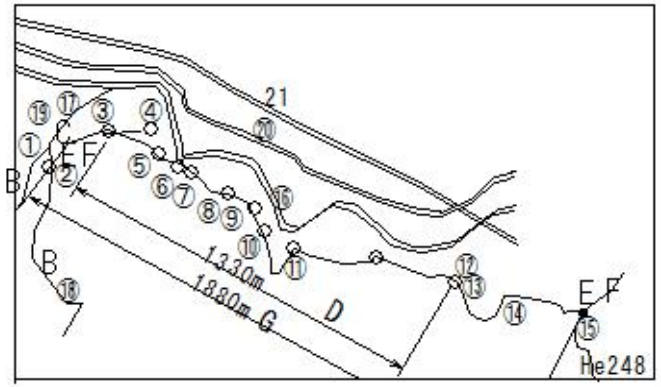
21 National Route 47



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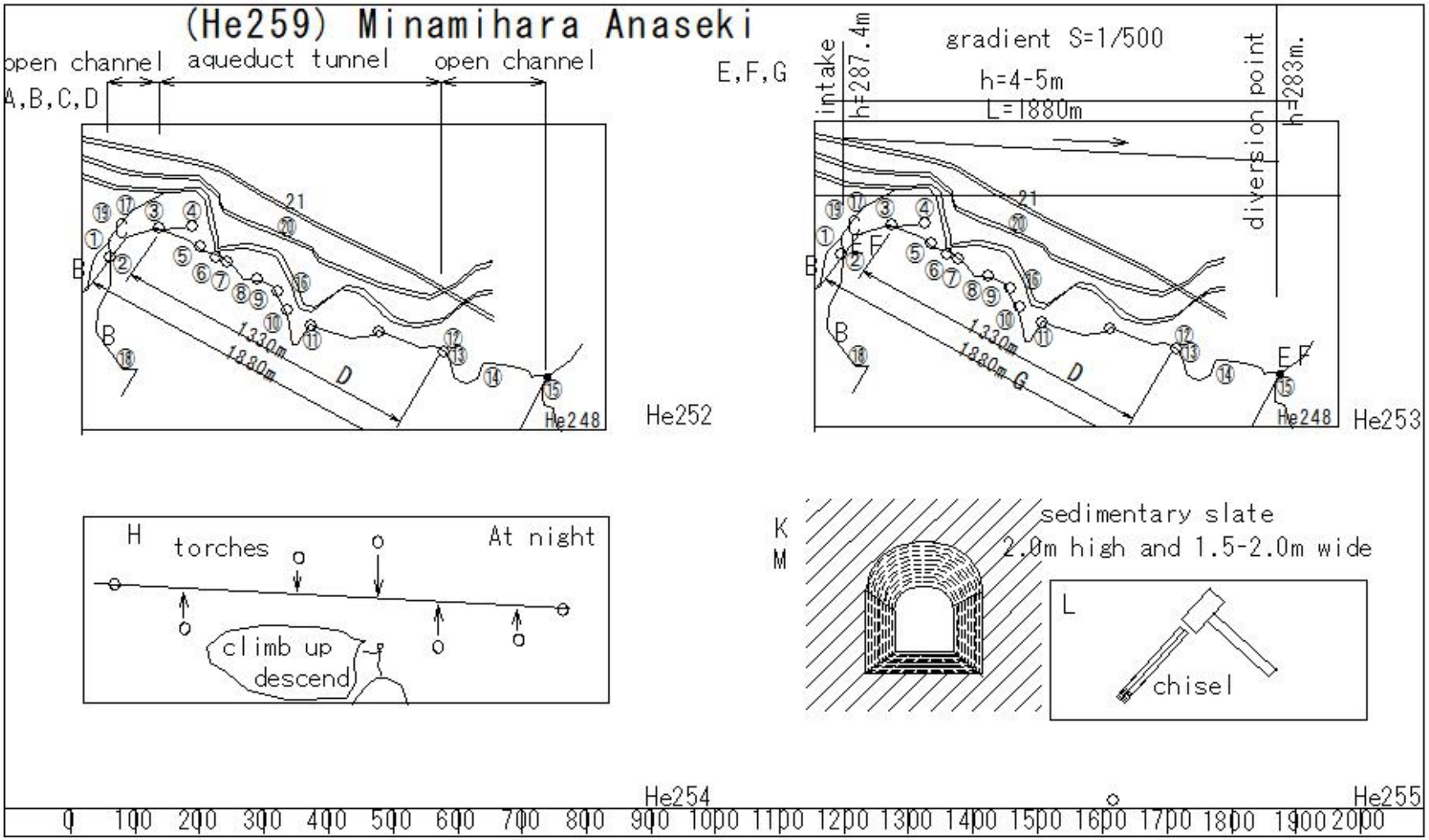
(He259) Minamihara Anaseki



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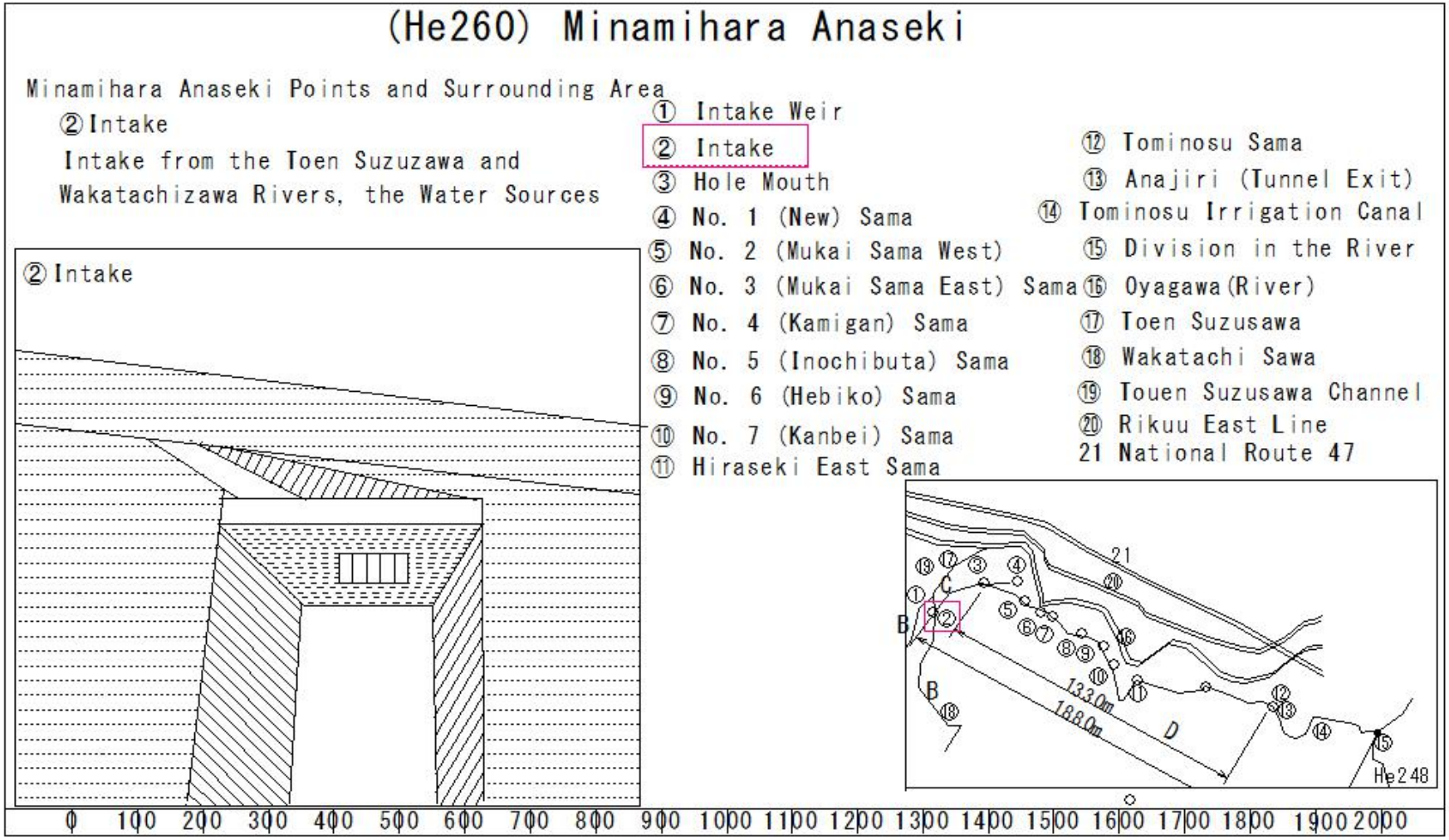

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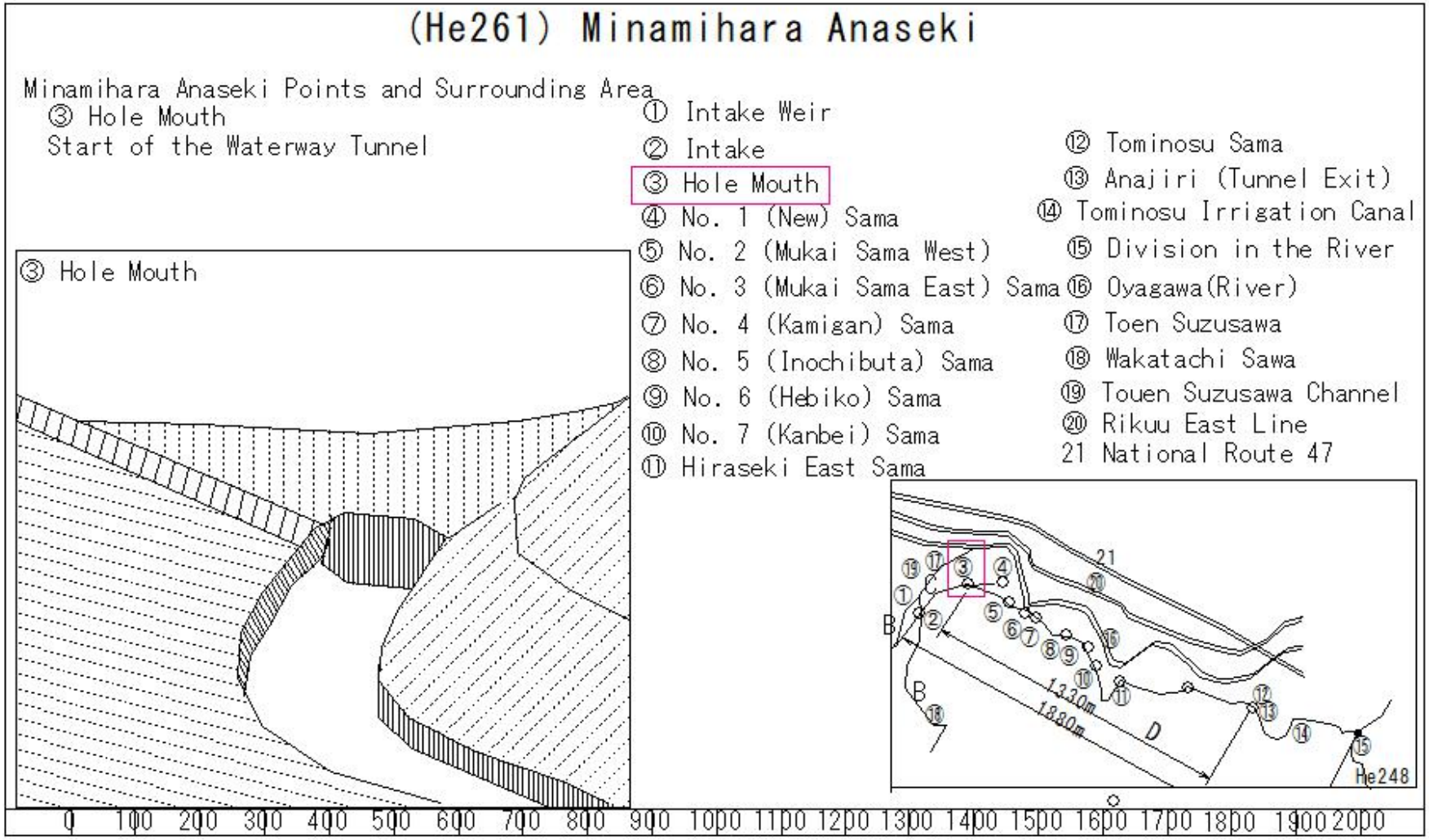

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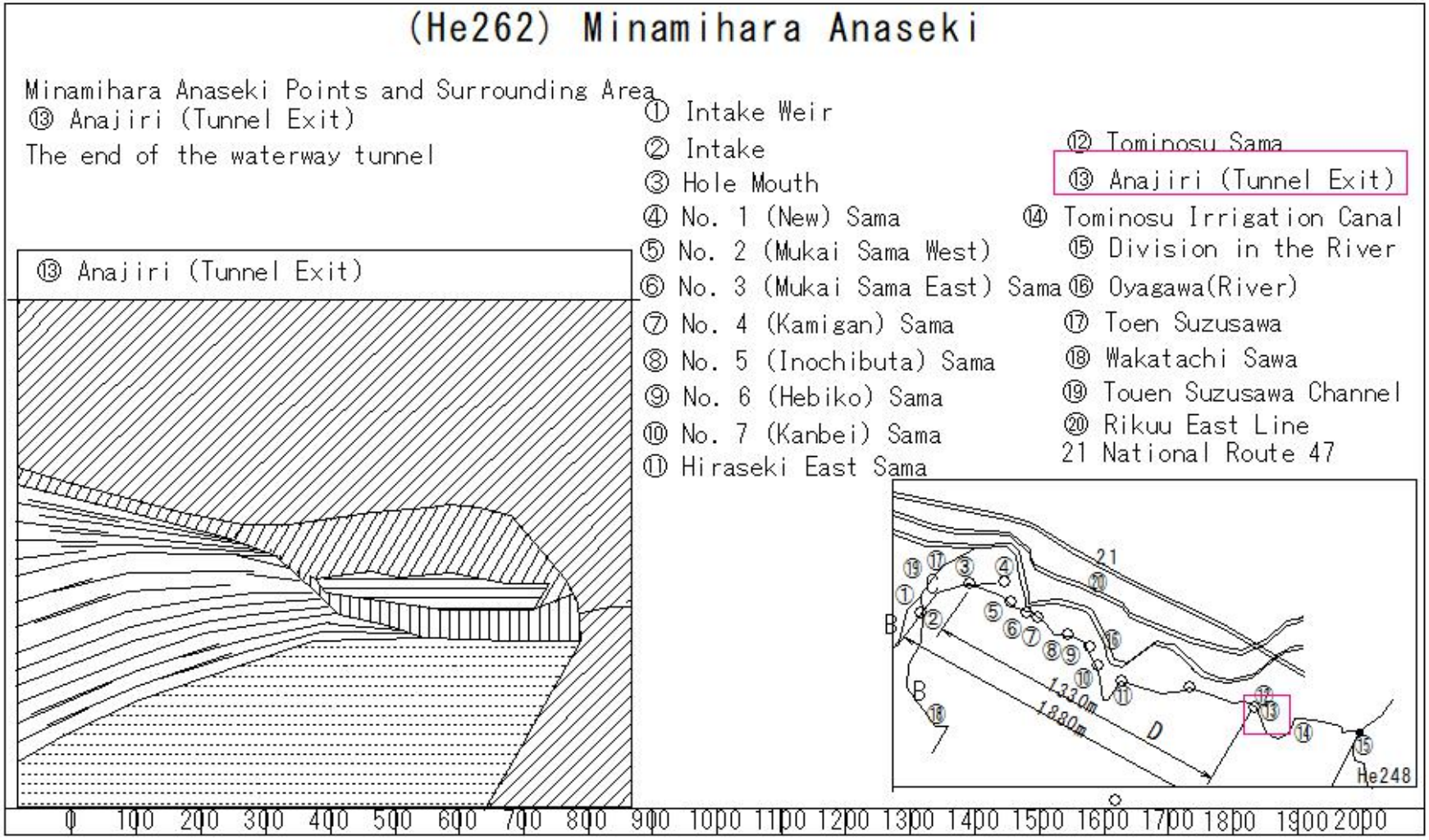
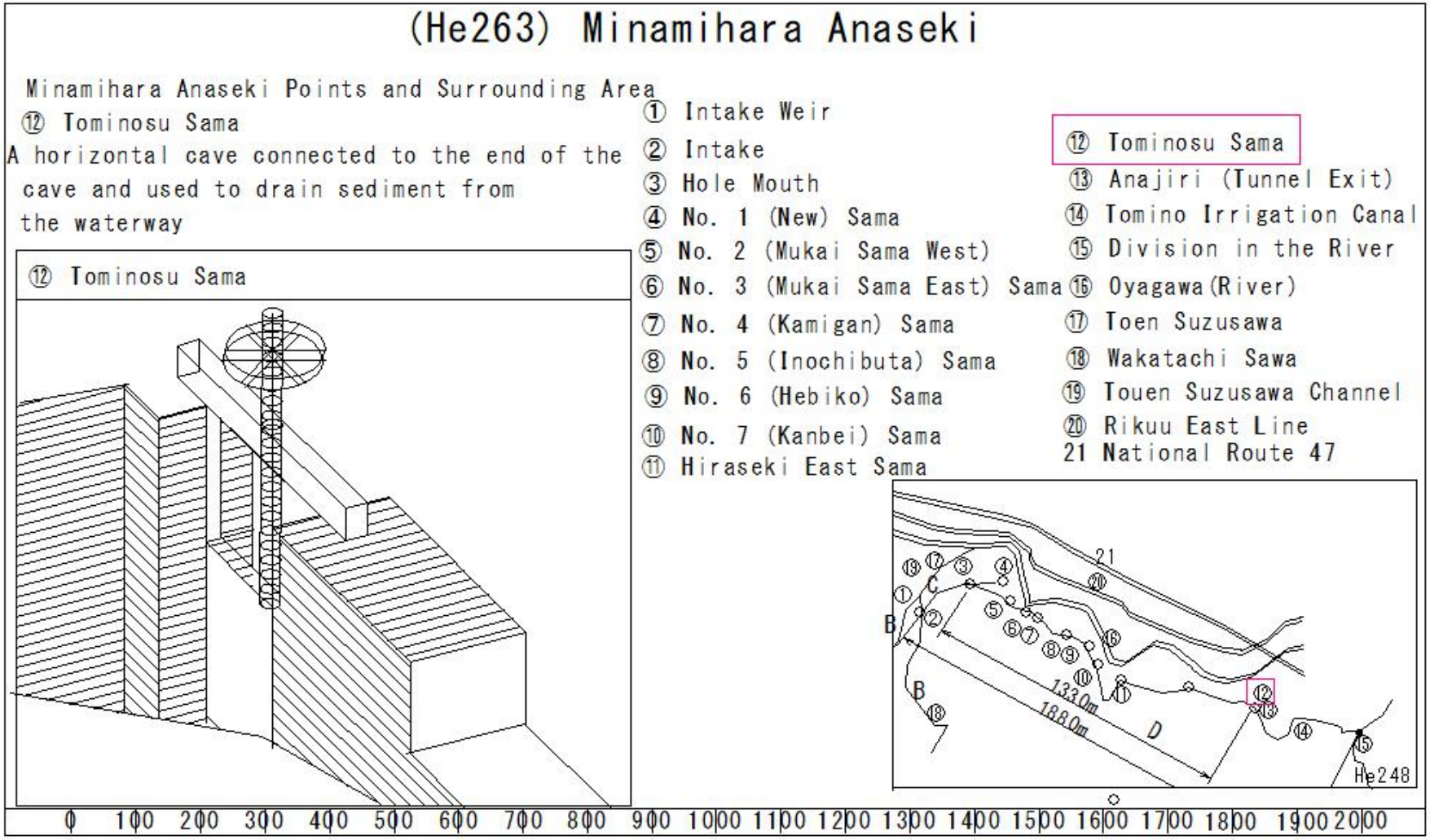


(He263) Minamihara Anaseki



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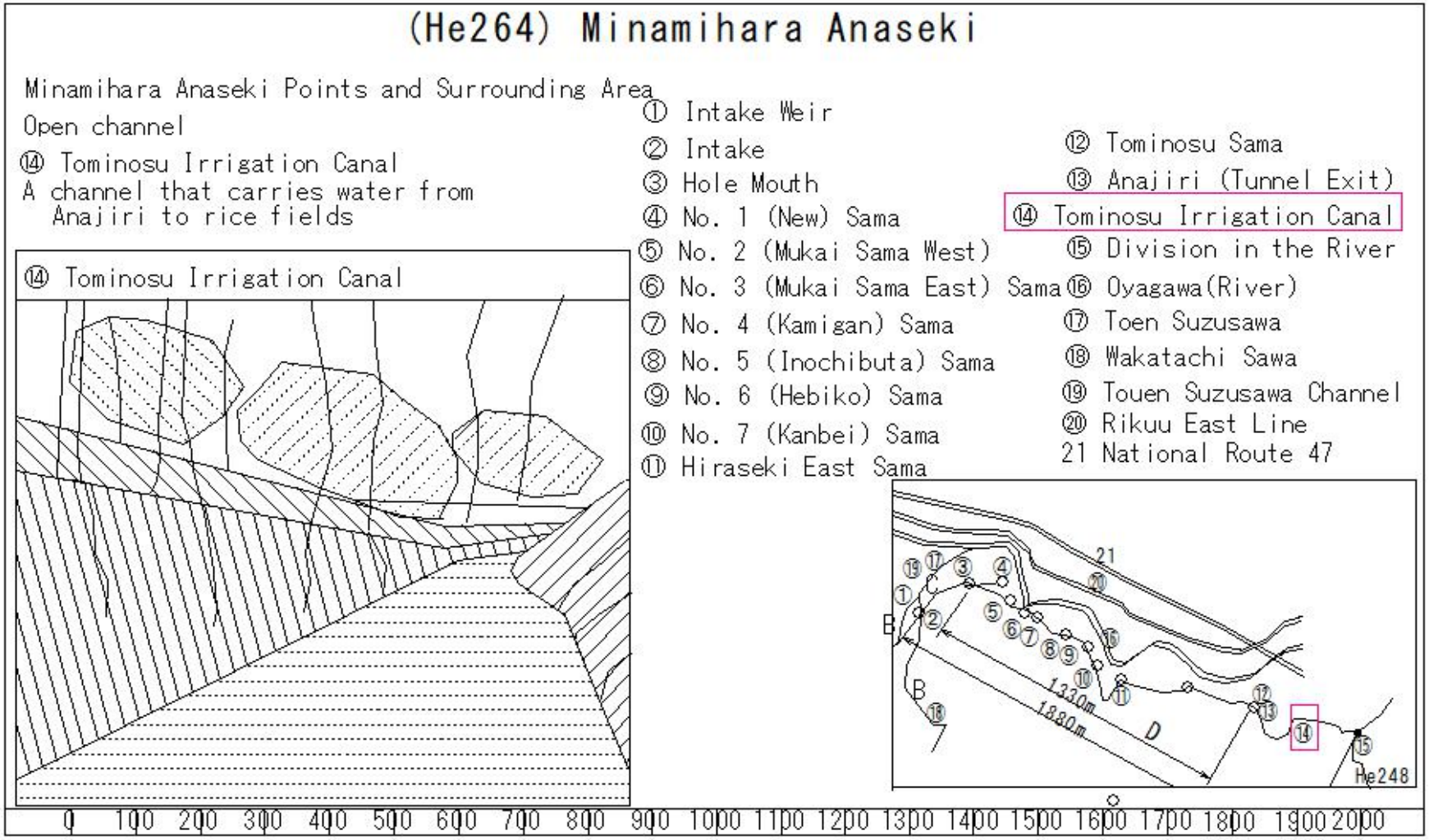

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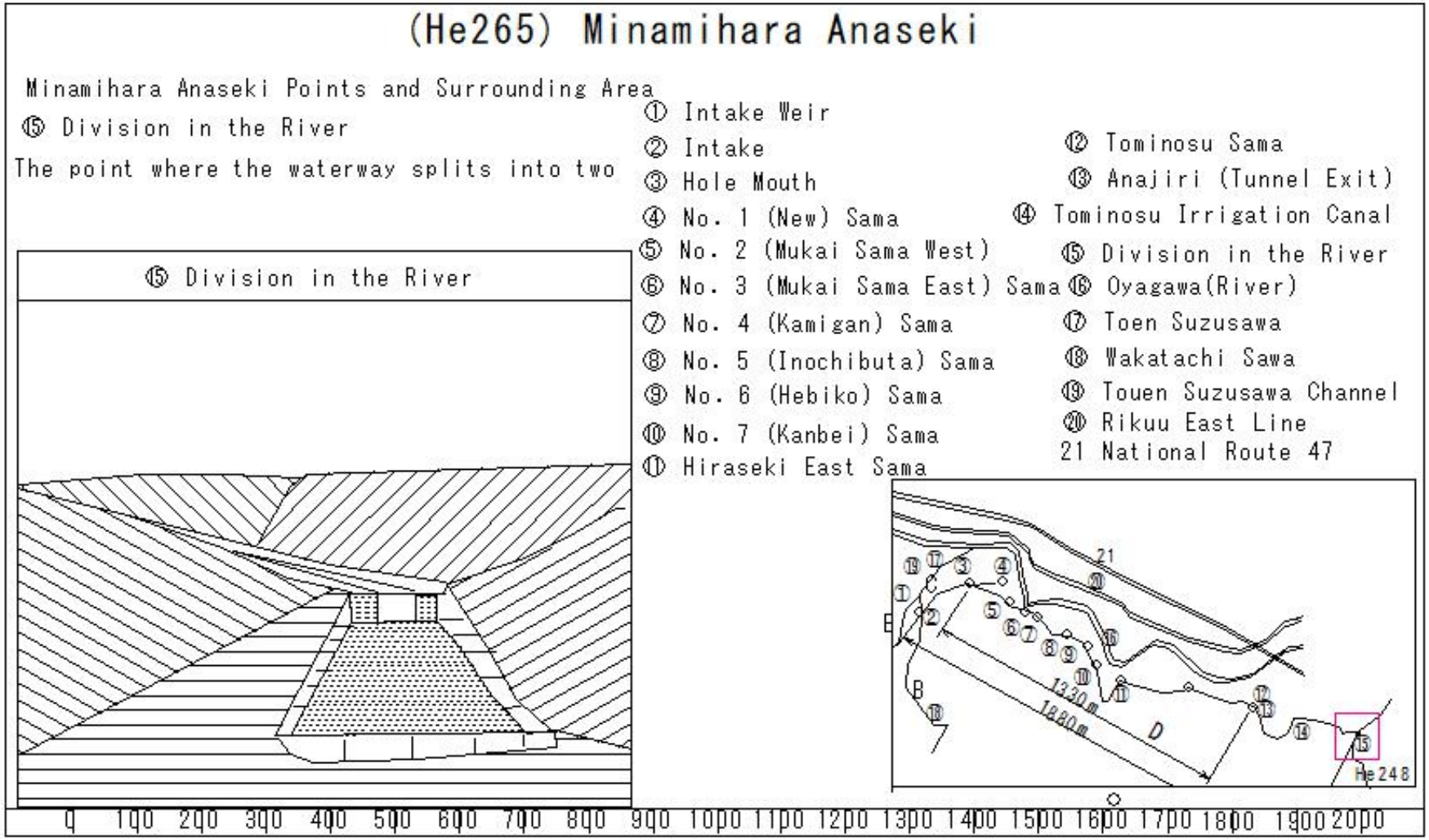

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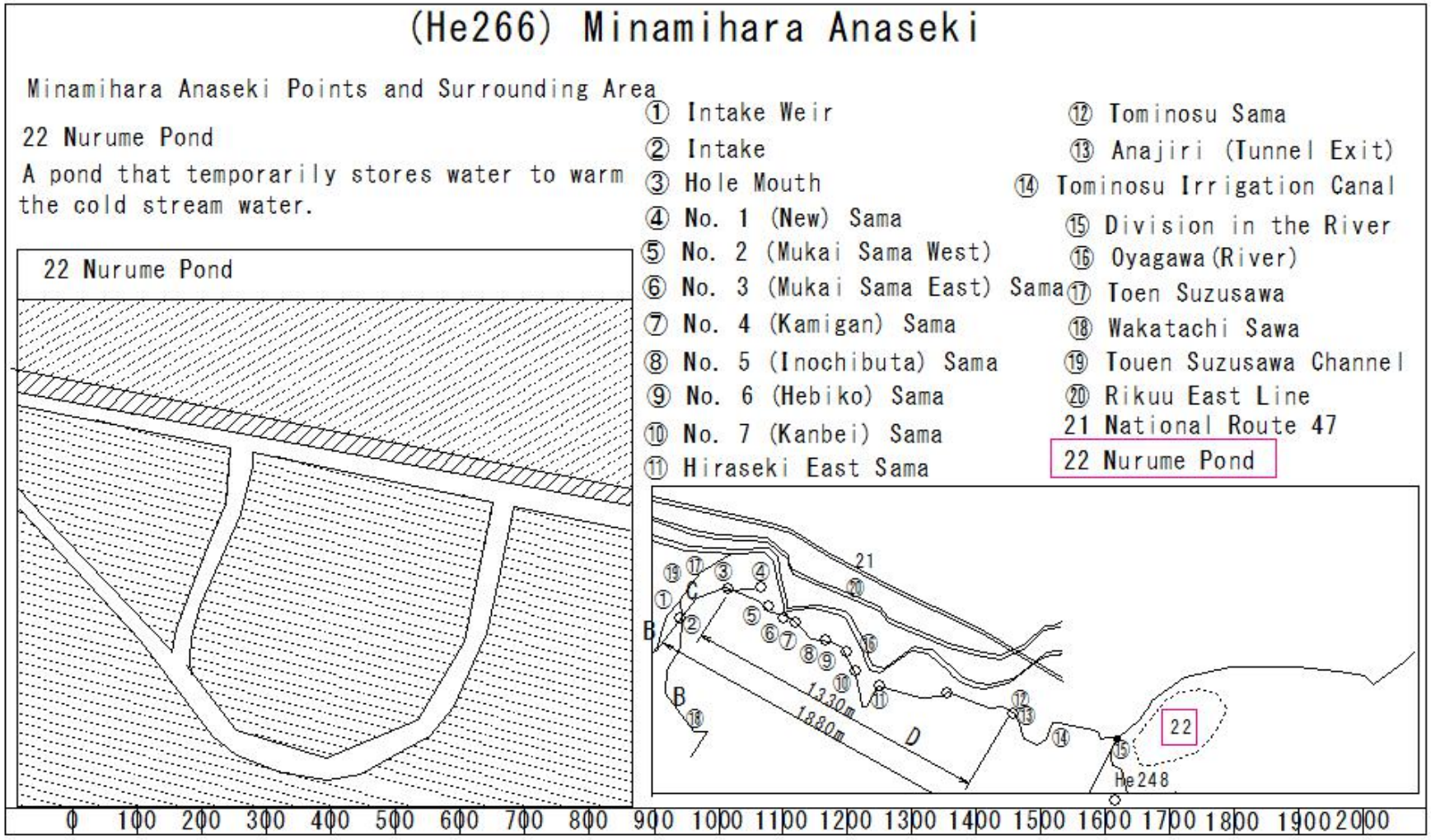

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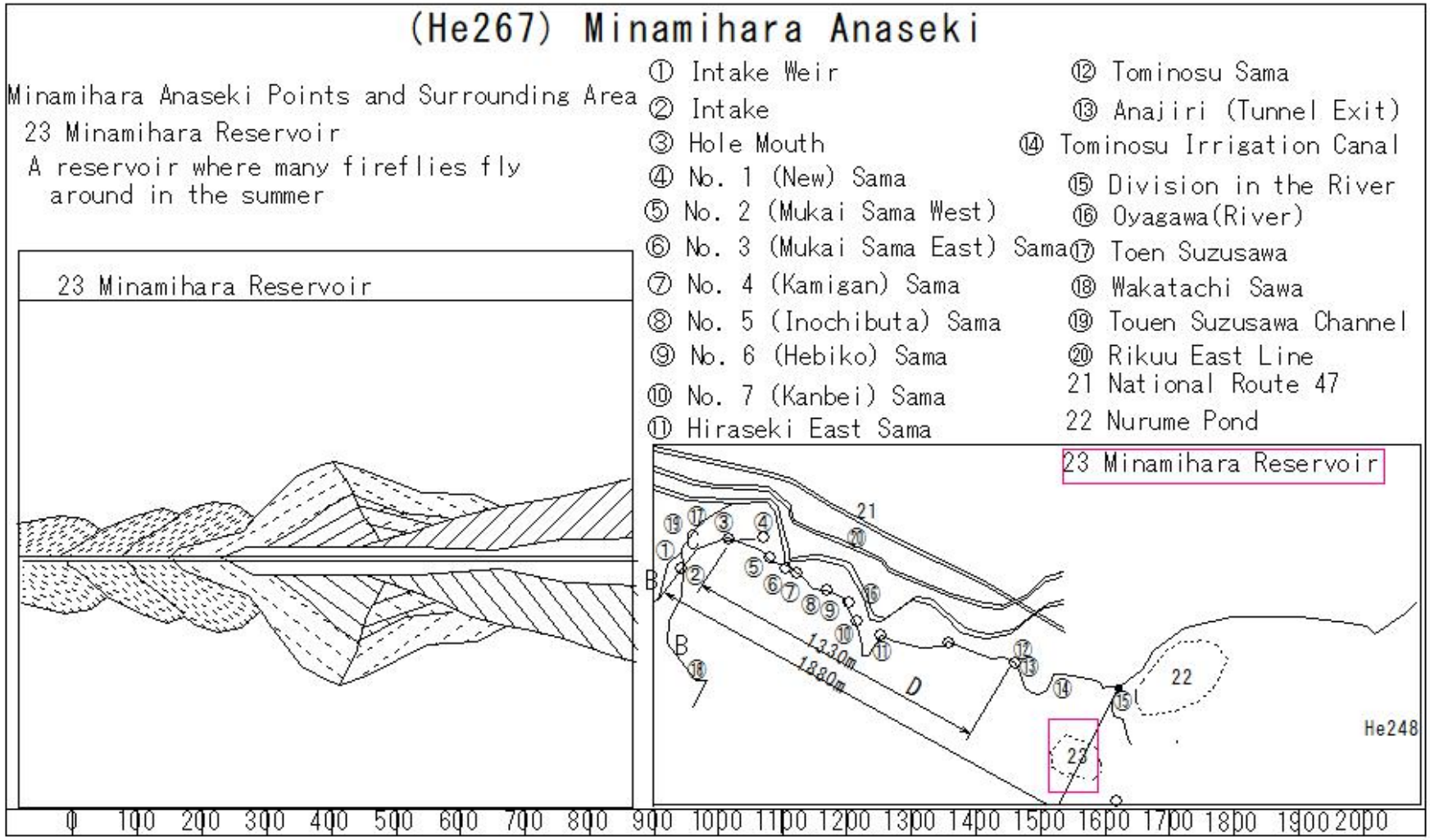

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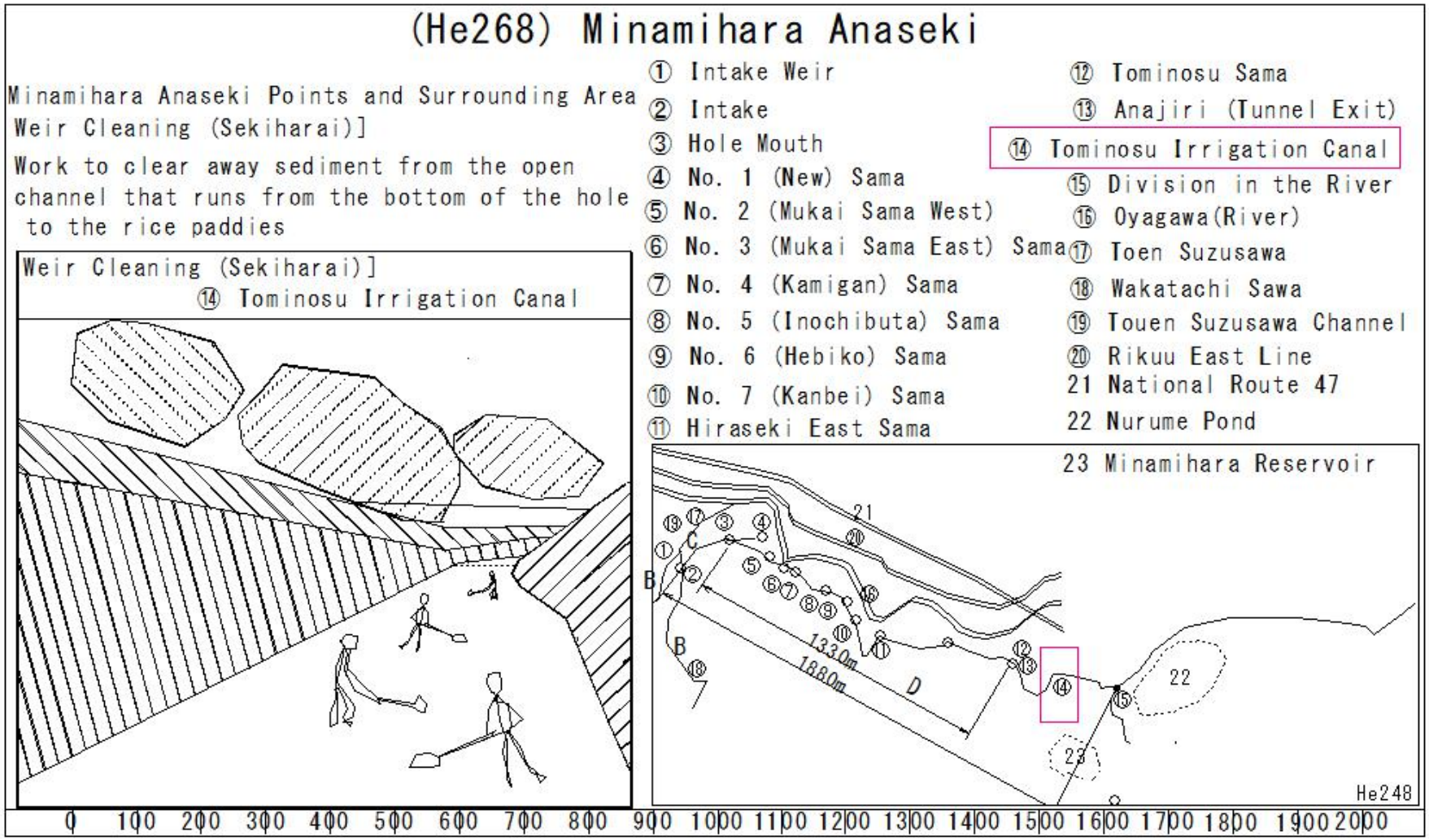

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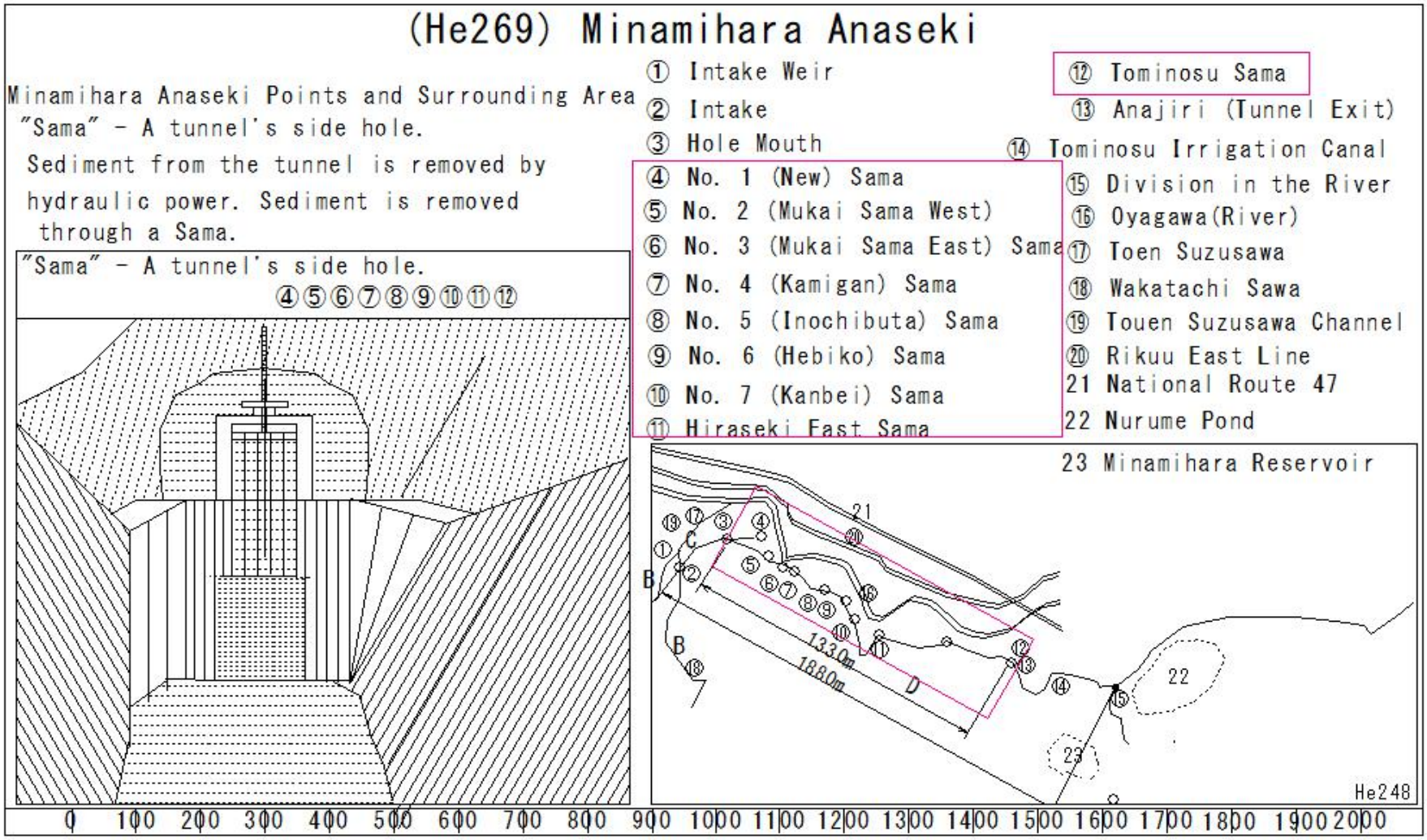

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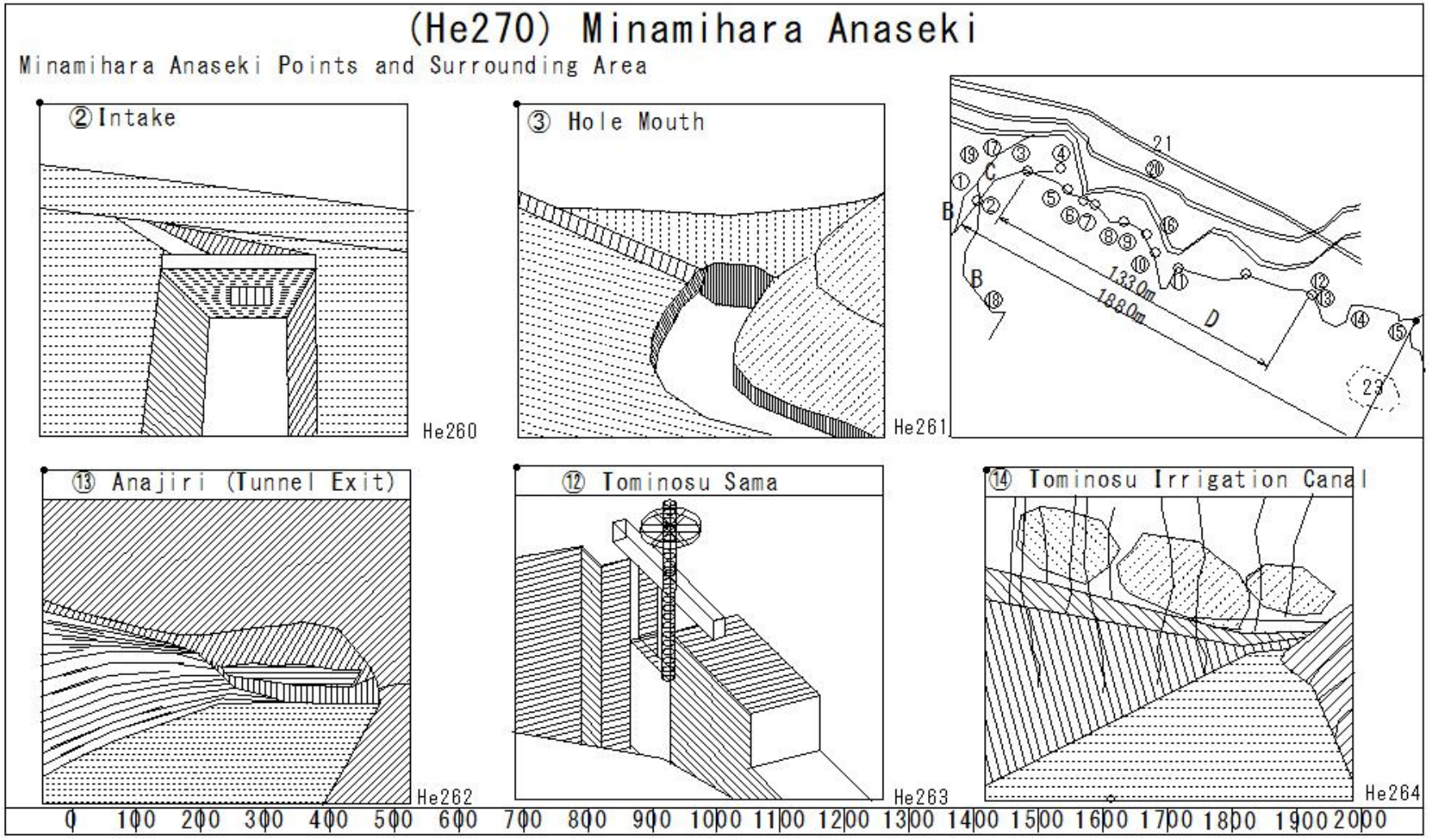

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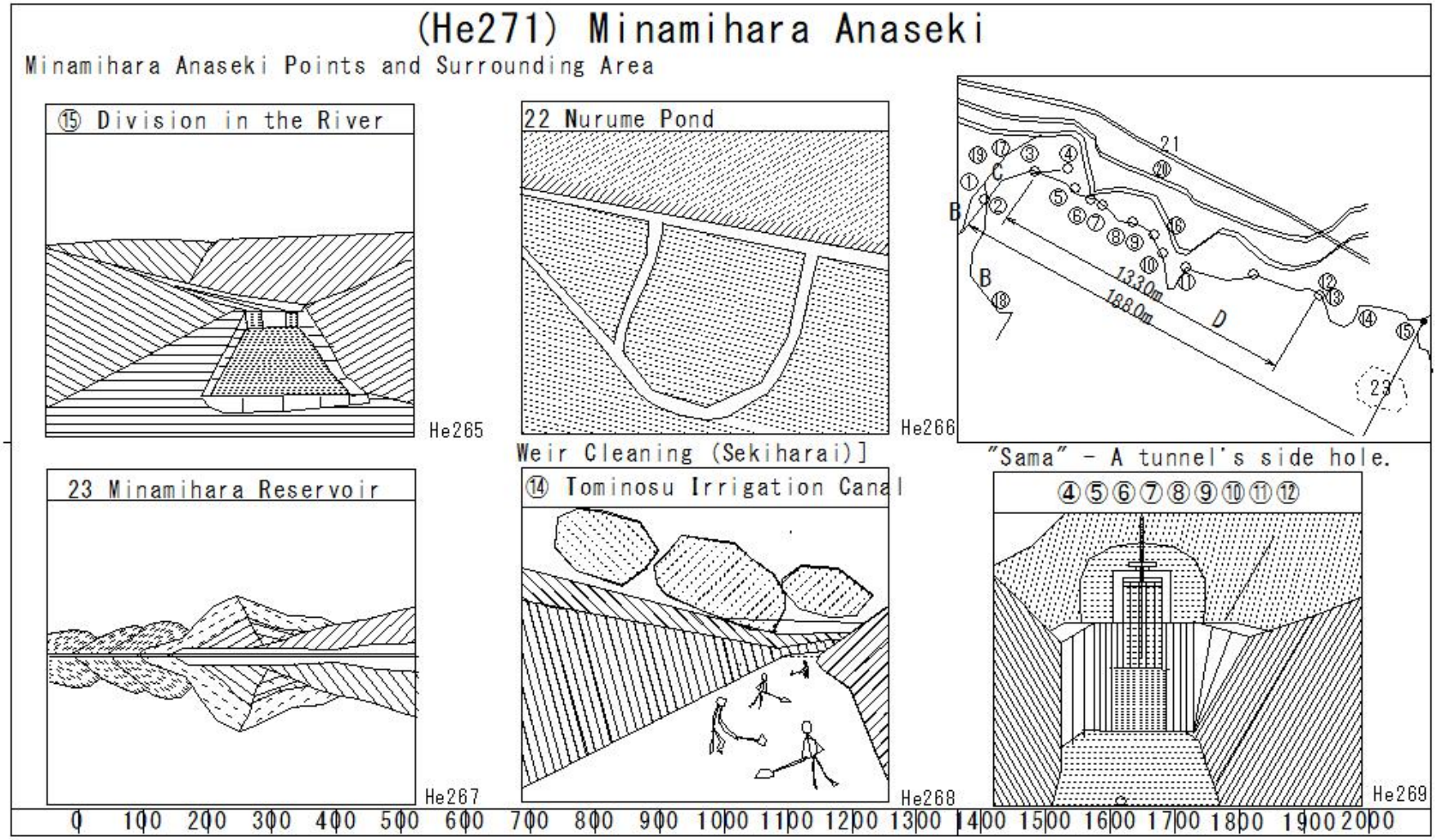


(He272) Osaki Kodo

(He272) Osaki Kodo

① The Osaki region has developed as a rice paddy farming area, utilizing the valleys and wetlands that stretch along the Eai and Naruse Rivers.

② Cold damage caused by the cold, humid seasonal winds known as "Yamase," which are unique to the Pacific coast of Tohoku,

③ droughts and floods caused by the changing topography from steep mountainous areas to gentler plains, plague the people.

④ Osaki Kodo is a land that has developed through various ingenuity and innovation in regulating water to maintain food and livelihoods in a harsh natural environment.

⑤ Key Points for Osaki Kodo's Designation as a Globally Important Agricultural Heritage System

⑥ An Ingenious Water Management System Supporting Agriculture

⑦ Paddy Field Agriculture in Coexistence with Diverse Biodiversity

⑧ Traditional Agricultural Culture Linked to Agriculture

⑨ A Rich Rural Landscape

⑩ The Food Culture Nurtured by Osaki Kodo

⑪ Securing food in a harsh environment requires wisdom and ingenuity suited to the region.

⑫ Osaki Kodo's water management system, which responds to cold weather damage and flooding, has been central to the development of

⑬ Symbiotic Relationships with Living Creatures, Agricultural Culture, Food Culture, and a Rich and Distinctive Landscape.

⑭ The overall "connection" among these elements was key to its designation as a Globally Important Agricultural Heritage System.

(He273) Osaki Kodo

⑮ An ingenious water management system supporting agriculture

⑯ Osaki Kodo has developed as a rice paddy farming region, utilizing the valleys and wetlands that stretch along the Eai River and Naruse River basins.

⑰ However, agriculture has faced significant challenges.

⑱ Cold damage caused by the Yamase seasonal wind

⑲ Floods and droughts caused by the terrain

⑳ To address these issues, approximately 1,300 water intake weirs*, tunnels and caverns*, irrigation and drainage channels, reservoirs, and retarding basins have been constructed along the Eai River and Naruse River basins that flow through Osaki Kodo since around the Edo period, and these systems remain in place to this day.

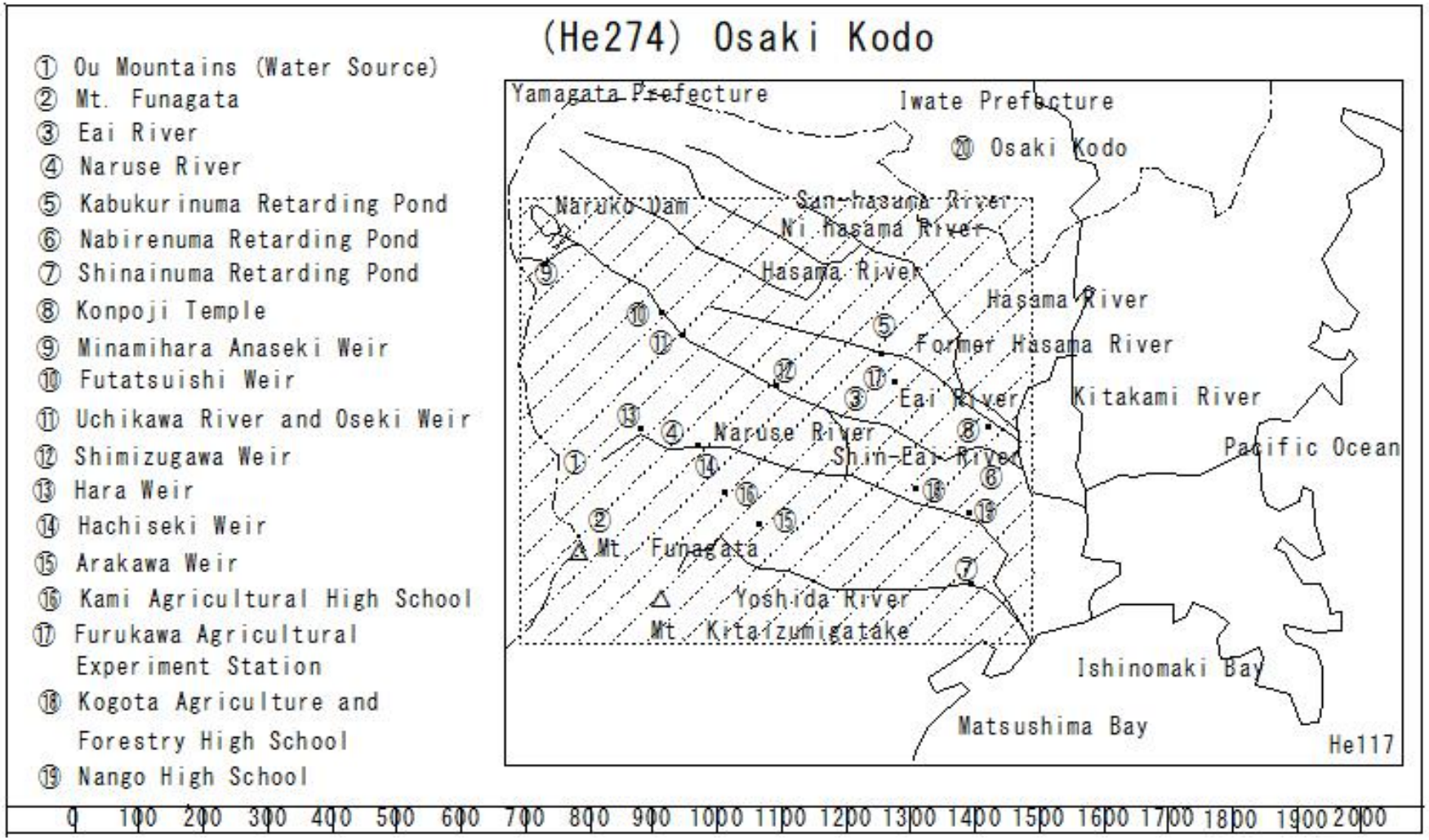
21 *Intake weir: A system for drawing water from rivers for agricultural use.

22 *Tunnel/borehole: A tunnel dug for water management.

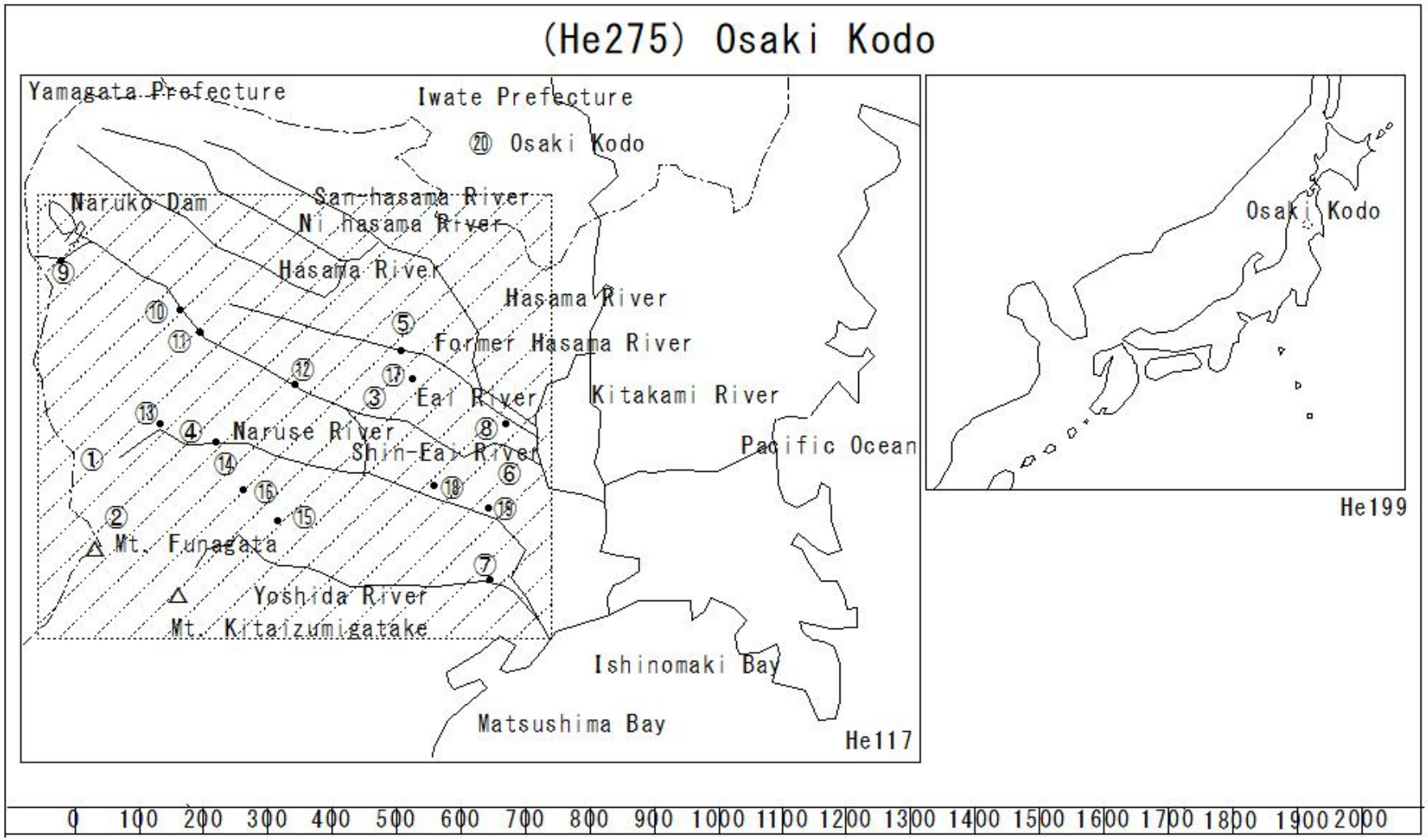
23 Year-round damage control measures.

24 These water adjustments are carried out through "contract associations," organizations that connect farmers with their local ties.

(He274) Osaki Kodo



(He275) Osaki Kodo



(He276) Osaki Kodo

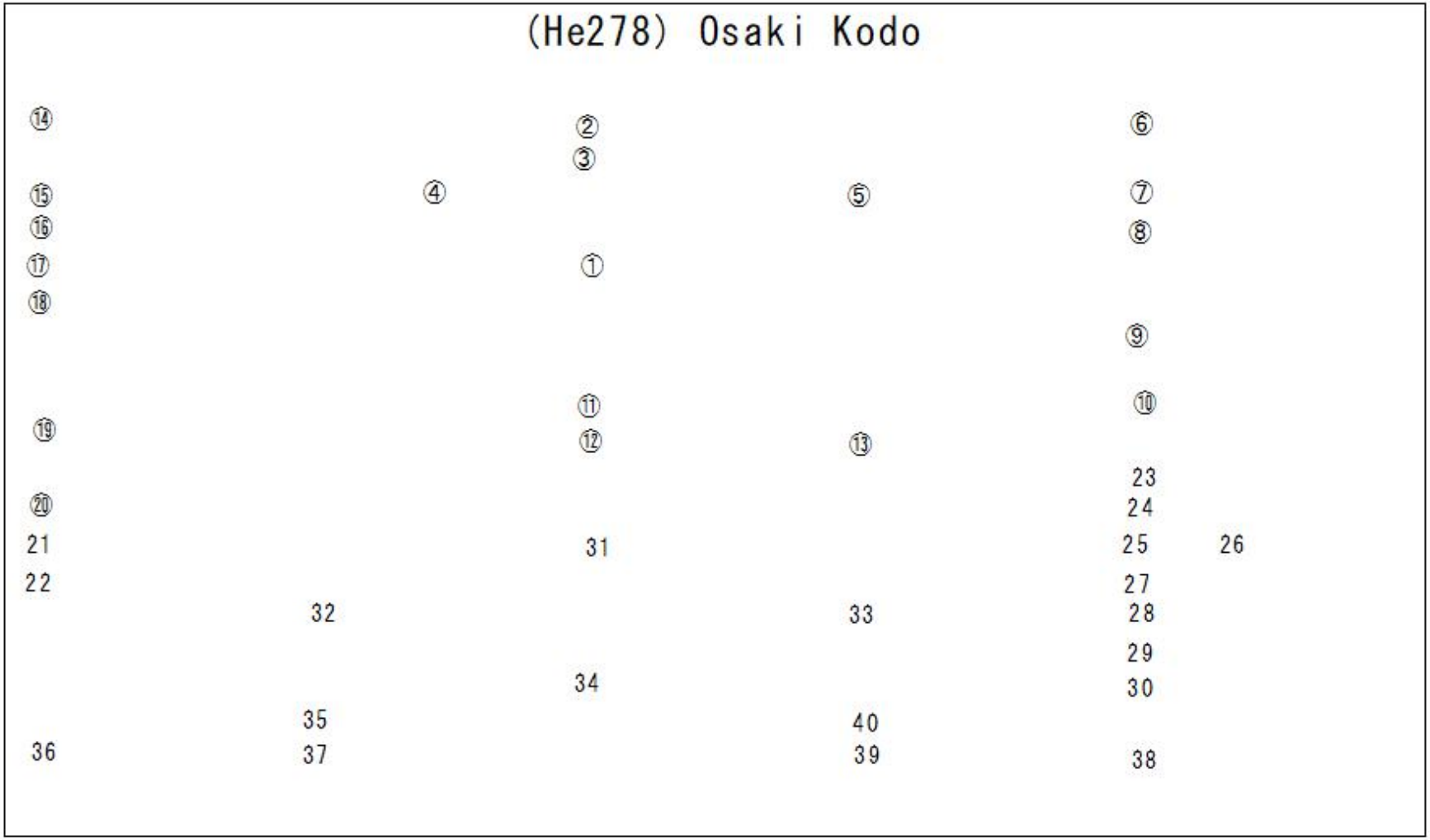
(He276) Osaki Kodo

① Traditional Water Management
② Skillful Water Management Foundation
③ Water Management Based on Contract Associations
④ Waterway Management
⑤ Tunnels and Holes
⑥ Flood Control
⑦ Water Management Using Retention Ponds
⑧ Paddy Fields
⑨ Natural Retention Ponds
⑩ Damage Mitigation
⑪ Cultivation Techniques to Overcome Yamase (Rice Storms)
⑫ Warm Water Channels
⑬ Deep Water Management and Daytime Water Withholding
⑭ Operation and Adjustment
⑮ Water Resource Allocation Adjustment
⑯ Repeated Water Use for Downstream Paddy Fields
⑰ Surplus Water
⑱ Farmer-Driven Allocation Adjustment to Enable Drought(Ban-sui) and Repeated Use of Irrigation Water
⑲ Stable Supply
⑳ A Rich Environment

(He277) Osaki Kodo

21 Household Forest (Igne)
22 Composed of multiple tree species, the floating forests above the rice paddies provide habitat for frogs, birds, and other species.
23 Pest control
24 Symbiotic relationship between biodiversity and agriculture
25 Native natural enemies
26 Pests
27 Predation and control
28 Pest control using natural enemies
29 Paddy field agriculture continues to support the wintering of Greater White-fronted Geese
30 Value creation through symbiosis with nature
31 Agricultural production that supports food and livelihoods
32 Osaki's Sasanishiki rice and the production of Hitomebore
33 Production of fermented foods such as sake, miso, and soy sauce
34 The landscape and traditional culture nurtured by Osaki Kodo and efforts to preserve them
35 Traditional agricultural culture nurtured by paddy field agriculture
36 Agricultural rituals praying for a good harvest
37 Traditional rice cake dishes
38 Nurturing the next generation to protect the agricultural system
39 Mutual support through communication and trust
40 Efforts to preserve agricultural systems

(He278) Osaki Kodo



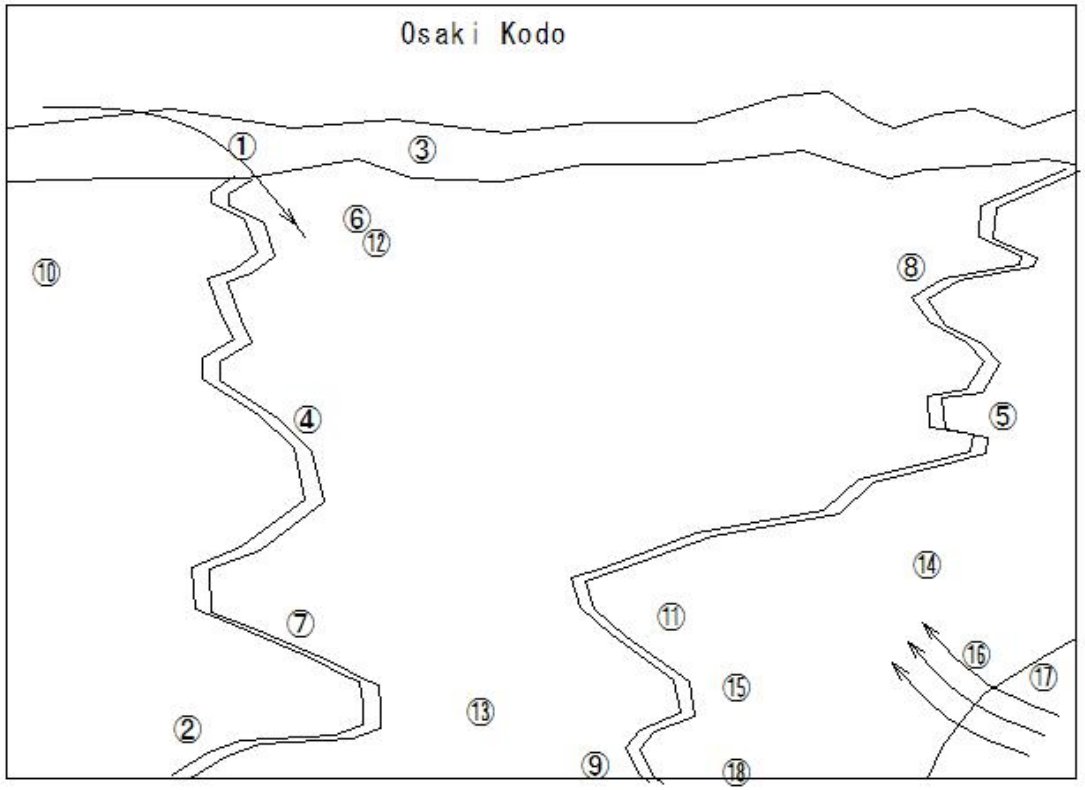
(He279) Osaki Kodo

(He279) Osaki Kodo

A Globally Recognized Agricultural Heritage

Osaki Kodo is a region that has developed into a widespread rice paddy farming area by clearing the floodplains of the Eai and Naruse Rivers.

① Northwesterly Wind
② Shinainuma Retarding Basin
③ Ou Mountains
④ Naruse River
⑤ Eai River
⑥ Kami Town
⑦ Naruse River
⑧ Osaki City
⑨ Misato Town
⑩ Shikama Town
⑪ Eai River
⑫ Kami Town
⑬ Nabirenuma Retarding Basin
⑭ Kitakami Highlands
⑮ Kabukuri-numa Retarding Basin
⑯ Yamase Wind
⑰ Pacific Ocean
⑱ Wakuya Town



(He280) Osaki Kodo

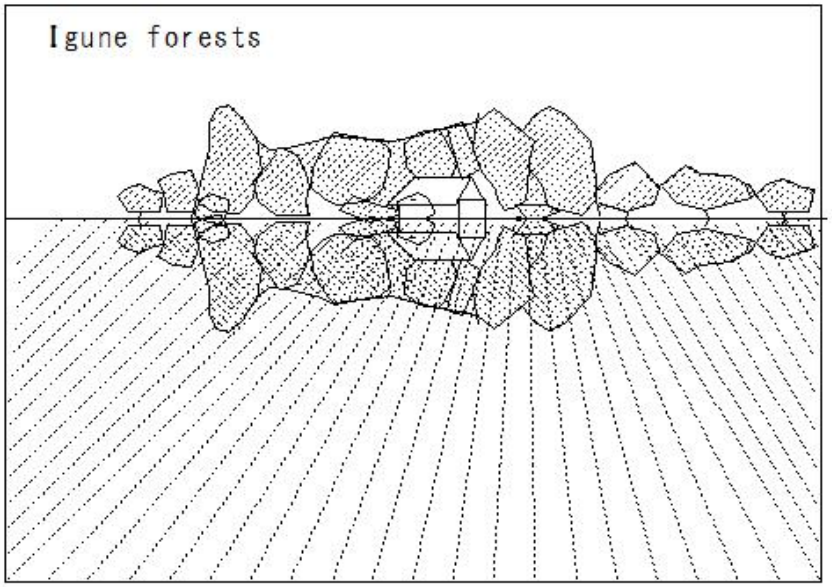
(He280) Osaki Kodo

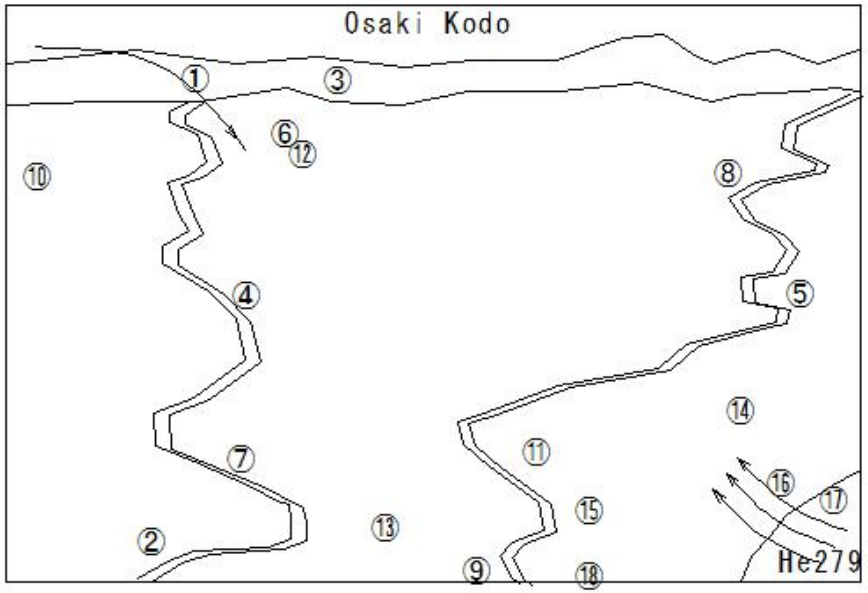
A Globally Recognized Agricultural Heritage

① Osaki Kodo faces harsh natural conditions for rice cultivation, including the monsoon wind "Yamase" during the rainy season, floods, and water shortages.

②Under such natural conditions, farmers have developed agriculture, centered on rice cultivation, through a variety of ingenuity and hardship, using a network of waterways to secure water for agricultural use and regulate water supply through drainage measures.

③In addition, the igune forests surrounding their homes have protected the farmers' lives from the northwesterly winter winds, snow, floods, and driftwood.





(He281) Osaki Kodo

(He281) Osaki Kodo

Ikune - the forests surrounding the estate that support our lives

The igune forests that stretch across the entire Osaki Kodo region are filled with the wisdom of our ancestors for approximately 400 years. They not only protect people's lives but also nurture many living creatures.

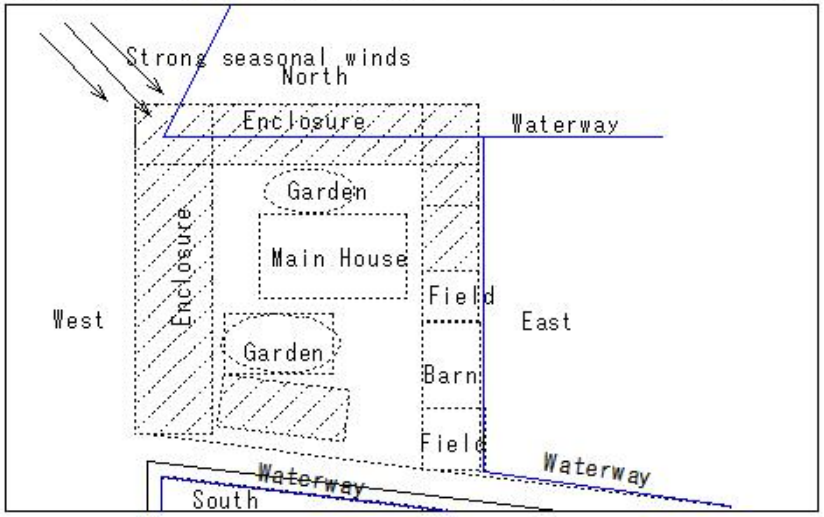
Ikune means "house" and "kune" means "boundary," meaning the boundary between estates.

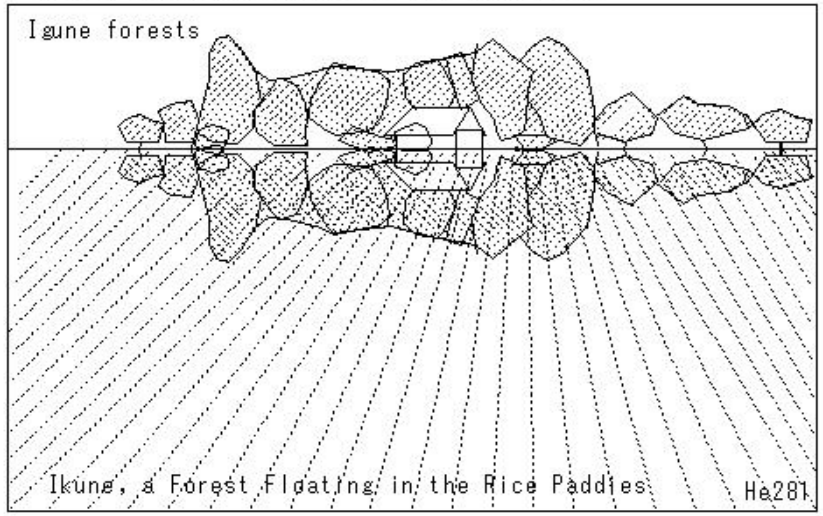
○Disaster Mitigation Wisdom: The densely packed trees in the enclosure protect the home from driftwood caused by strong seasonal winds and floods.

○Self-Sufficiency Wisdom: Fruit trees, medicinal herbs, and vegetables grown in the fields support livelihoods.

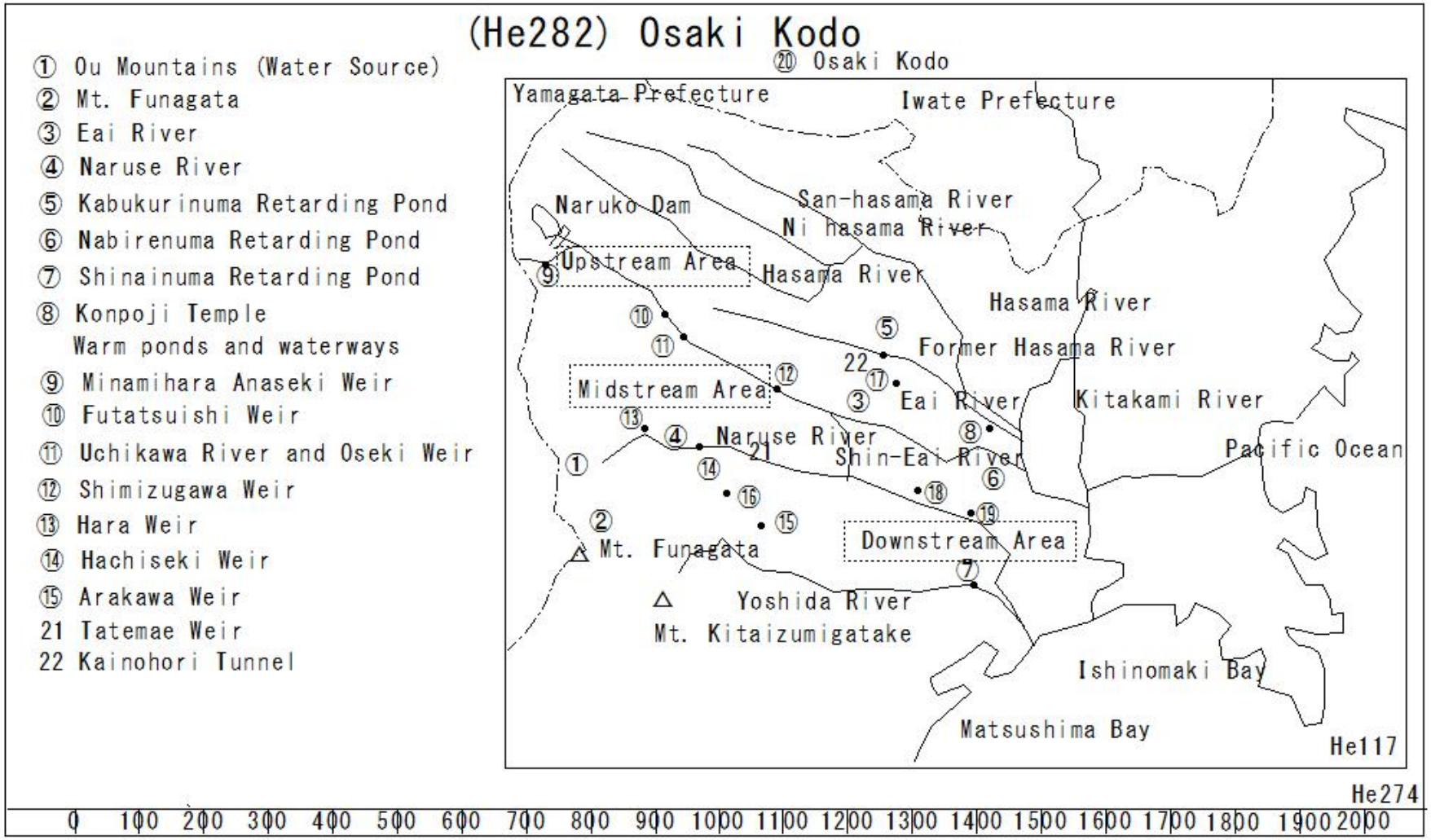
○Agricultural Wisdom: Careful water management and a location suitable for farming nurture rice plants like dragonflies and frogs.

Ikune has protected the livelihoods of farmers from northwesterly winter winds, snow, floods, and driftwood.





(He282) Osaki Kodo



(He283) Osaki Kodo

(He283) Osaki Kodo

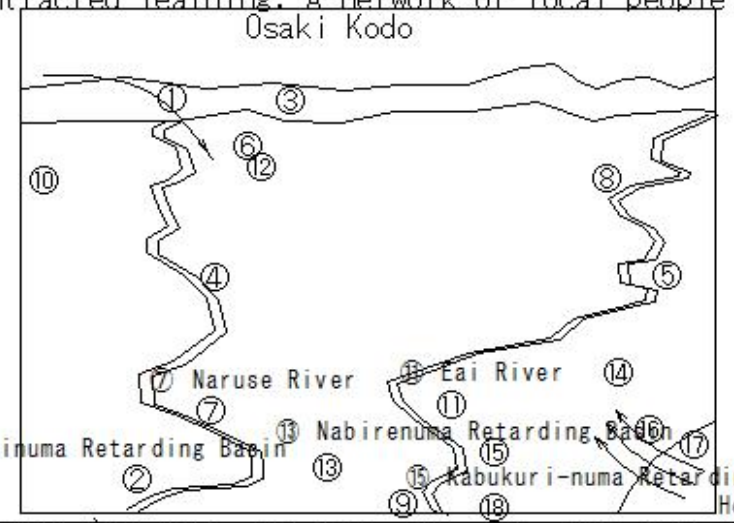
① Osaki Kodo is a region with mountain ranges to the west and gently flattening out toward the Pacific Ocean to the east.

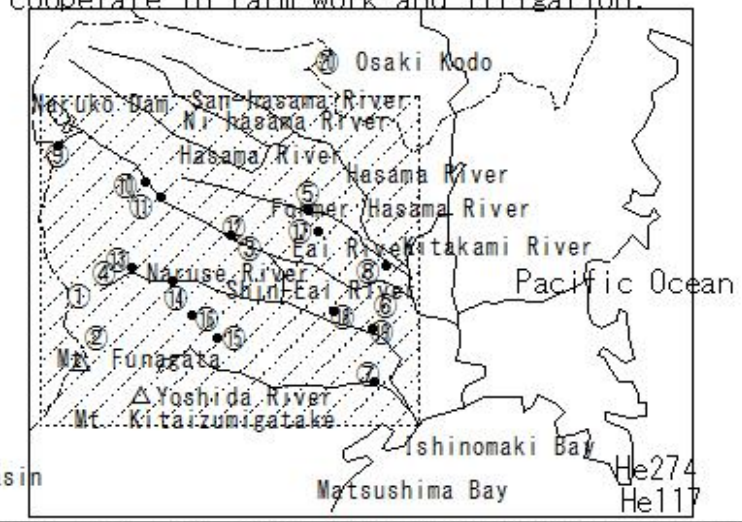
② Due to its unique topography, the region is subject to harsh natural conditions, including frequent water shortages (droughts), floods, and cold damage caused by the seasonal wind "Yamase."

③ Despite these challenges, the local people used their wisdom, ingenuity, and hard work to skillfully manage water, including obtaining it and devising countermeasures against floods, and developed a water management system.

④ This water management system, established by our ancestors, relies on mutual cooperation among farmers, and continues to support rice production in the region.

*1 Contracted learning: A network of local people who cooperate in farm work and irrigation.





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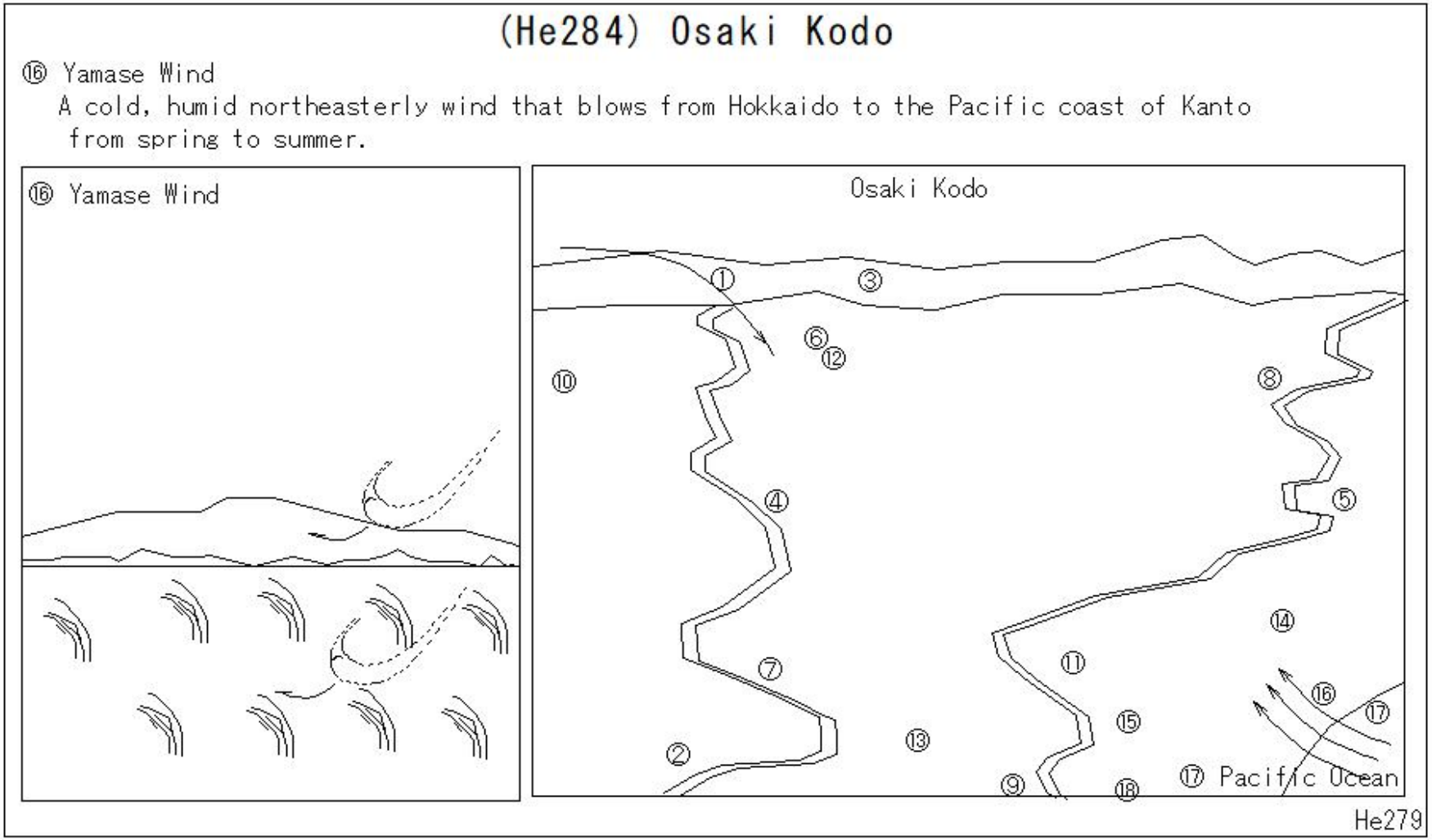

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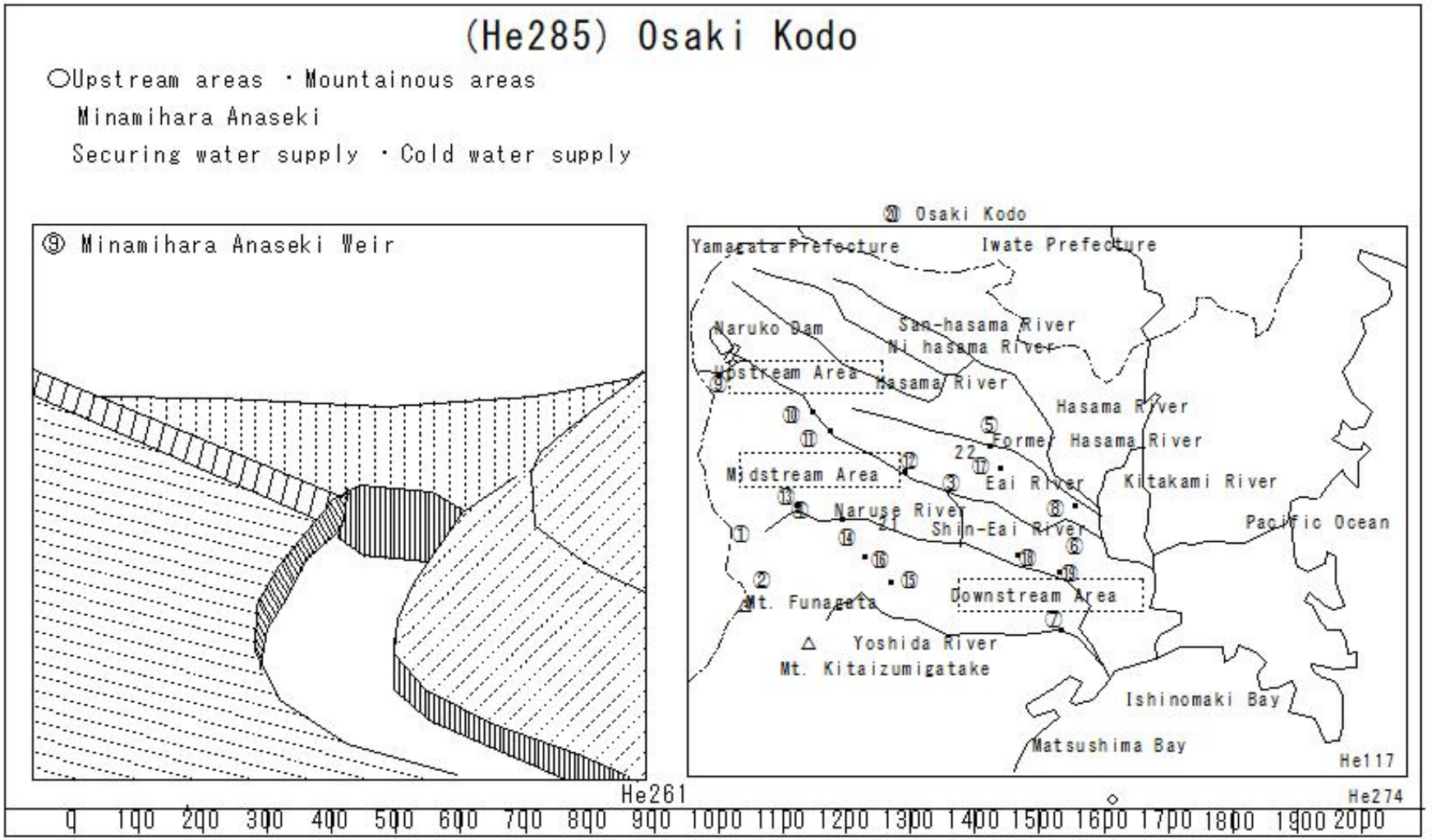

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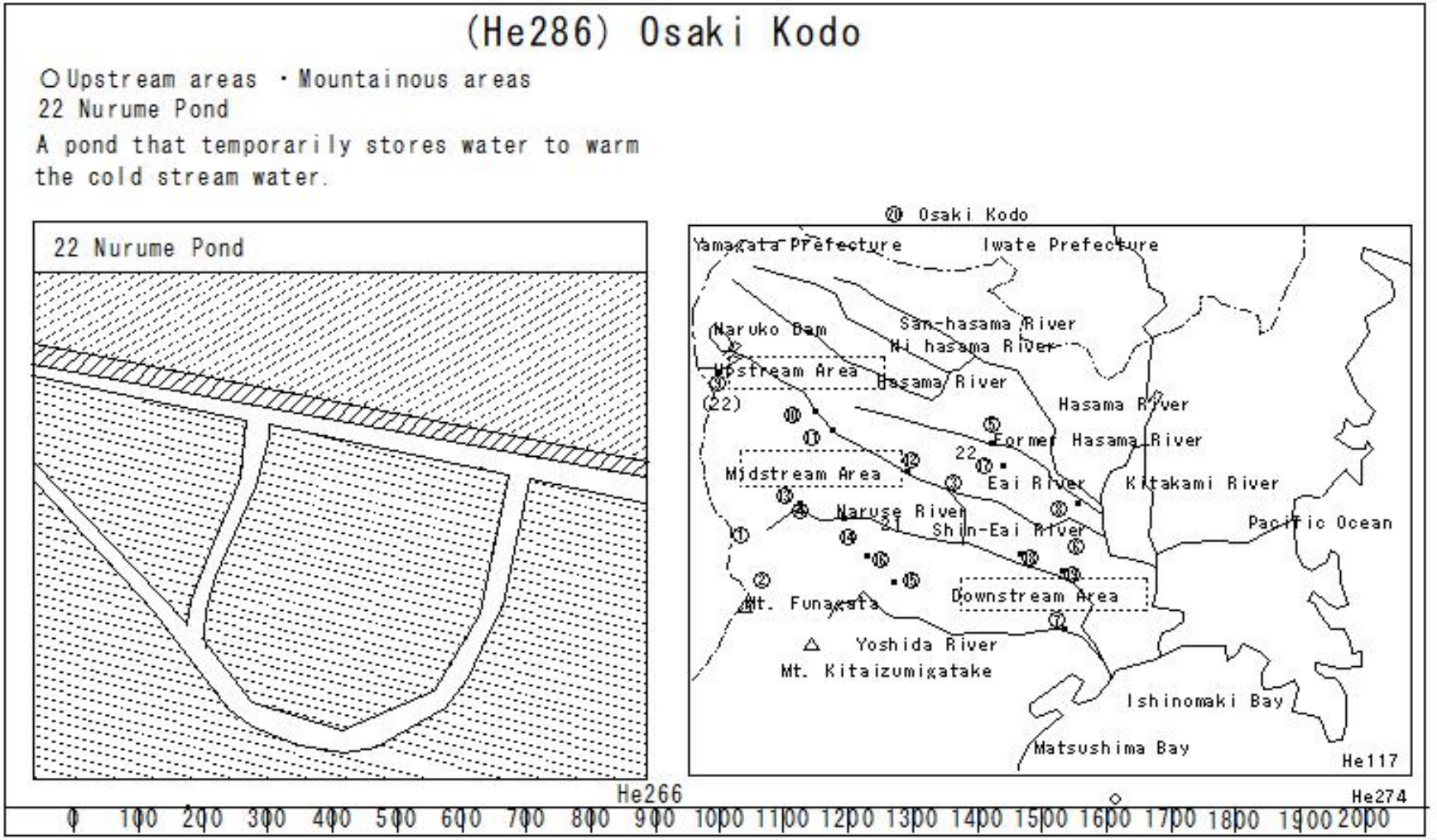
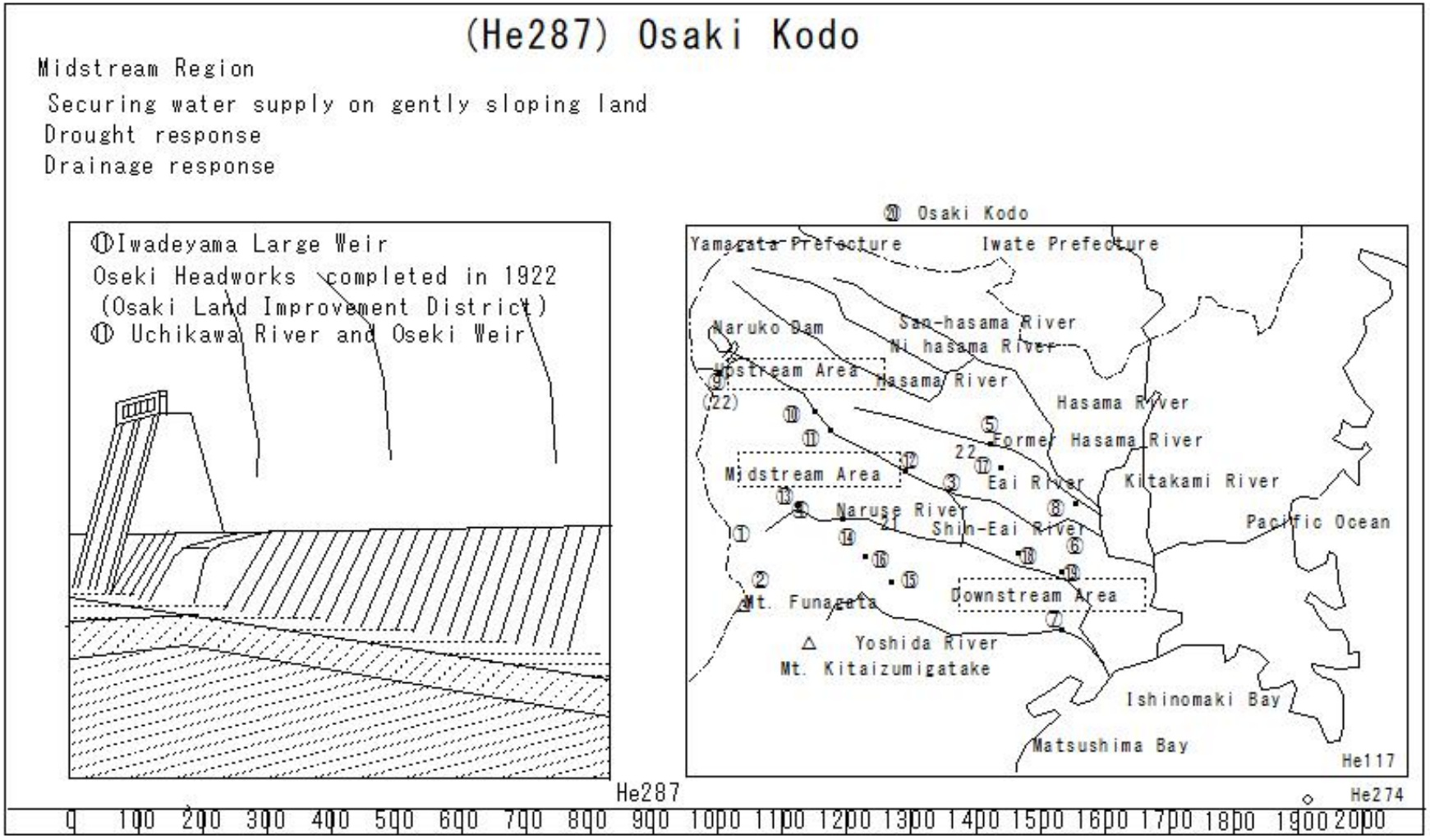


(He287) Osaki Kodo



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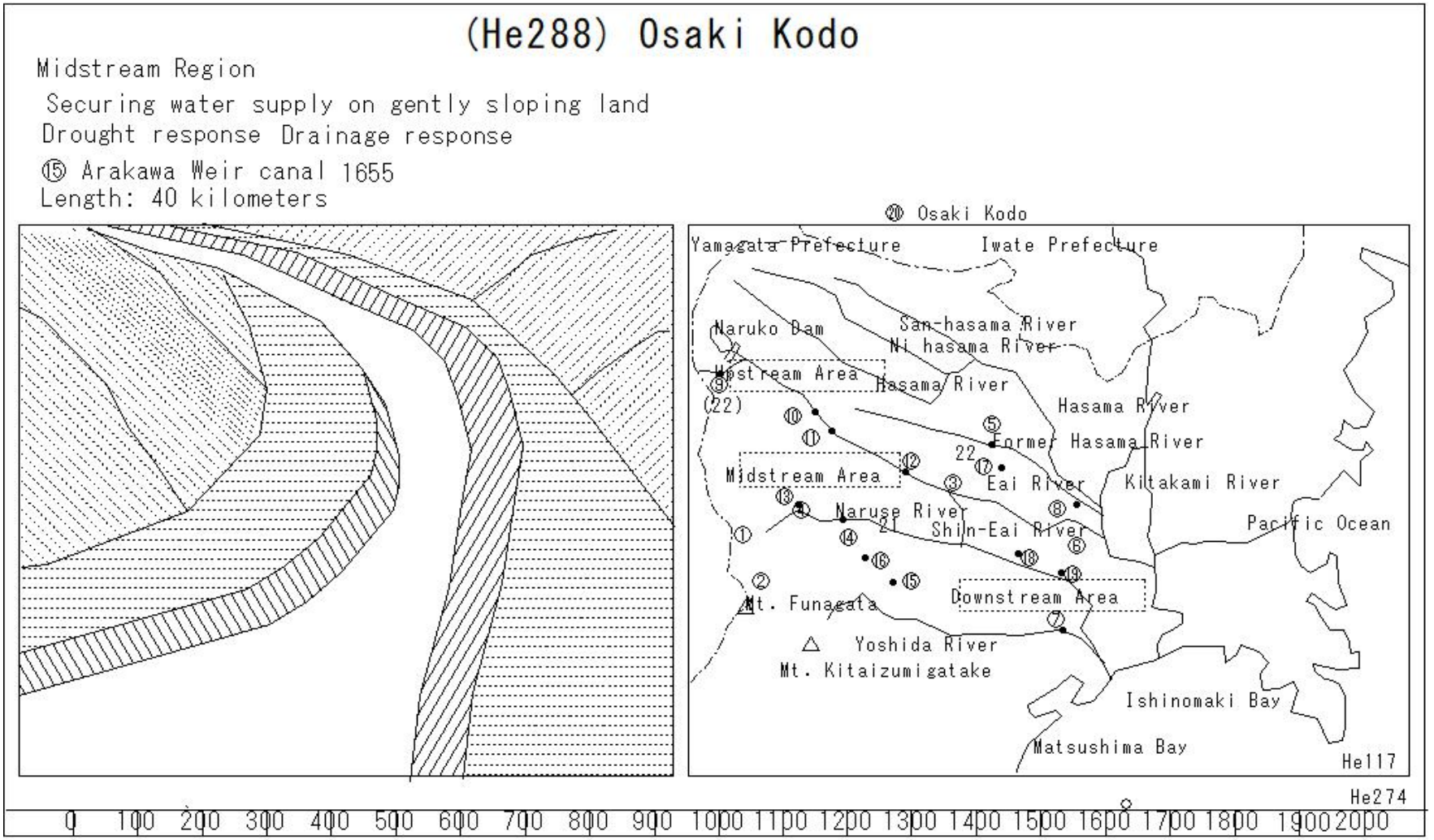

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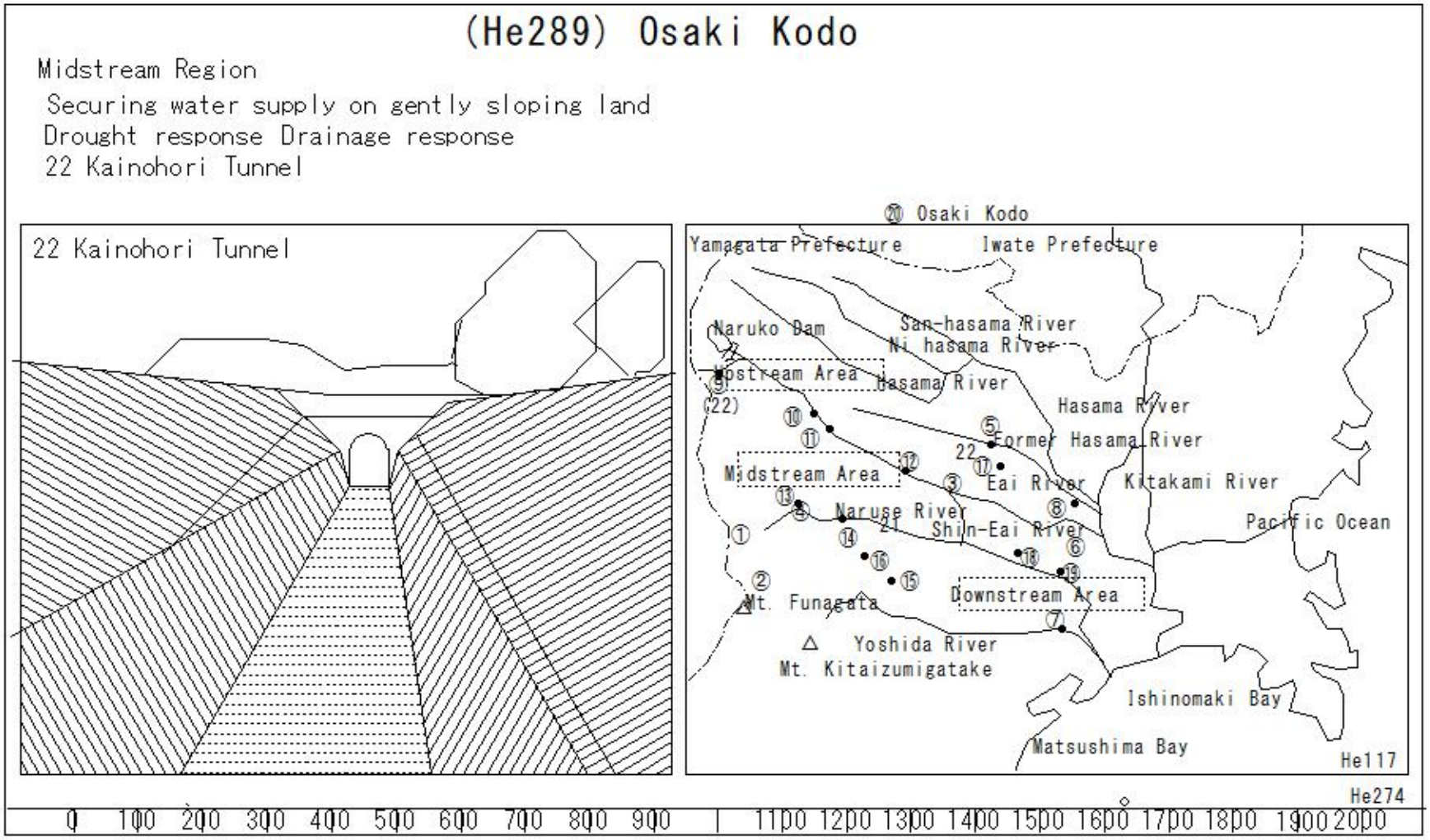

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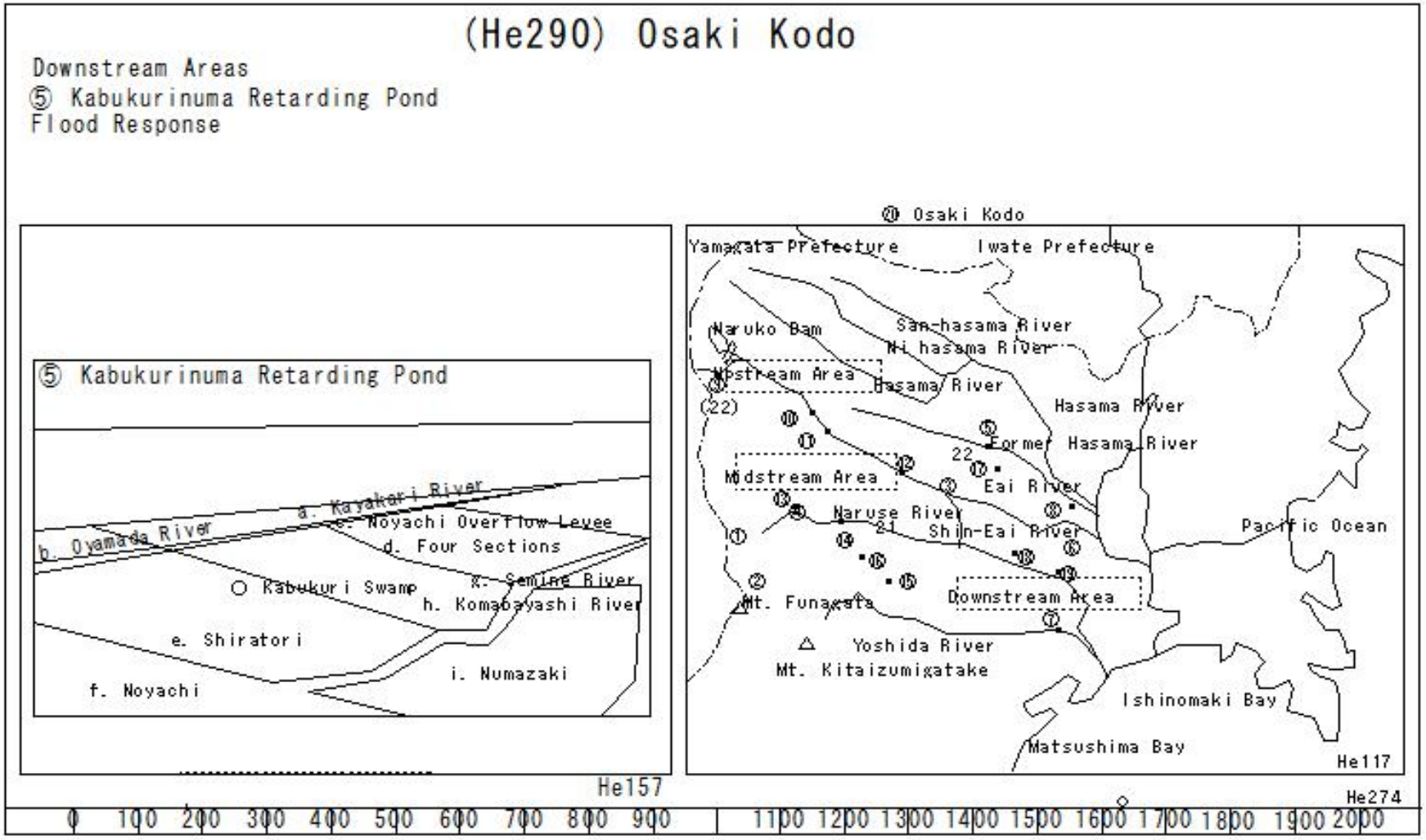

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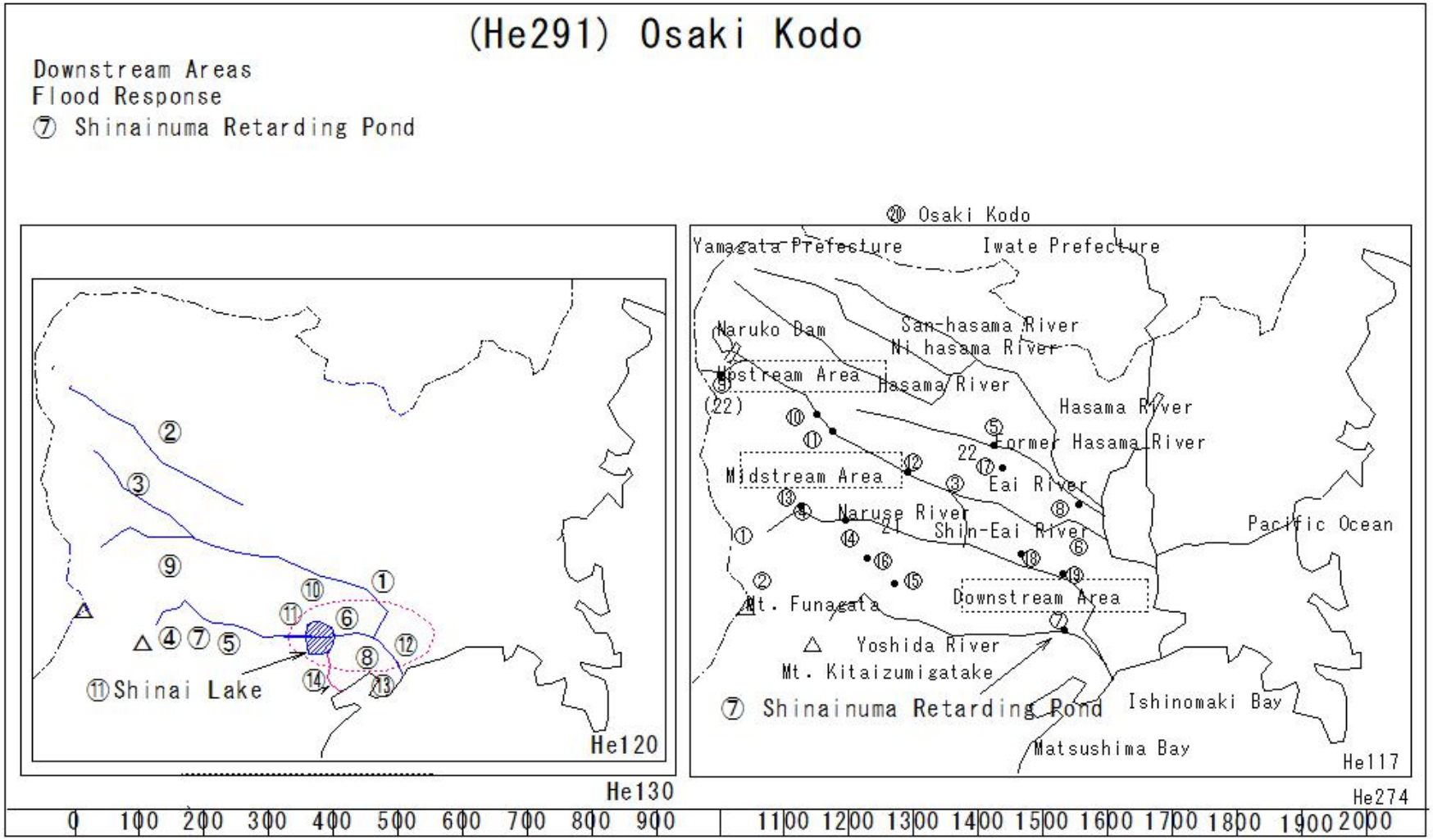


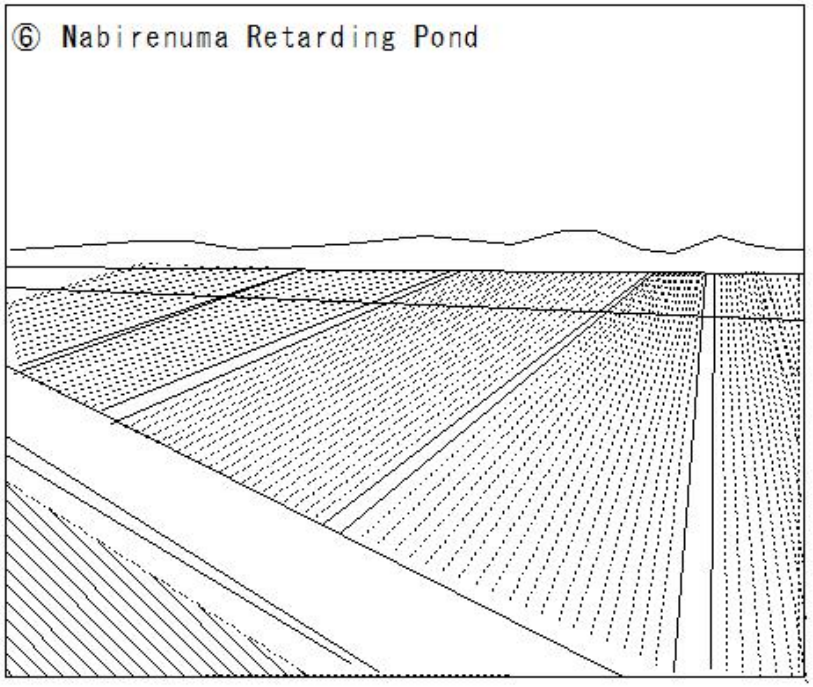
(He292) Osaki Kodo

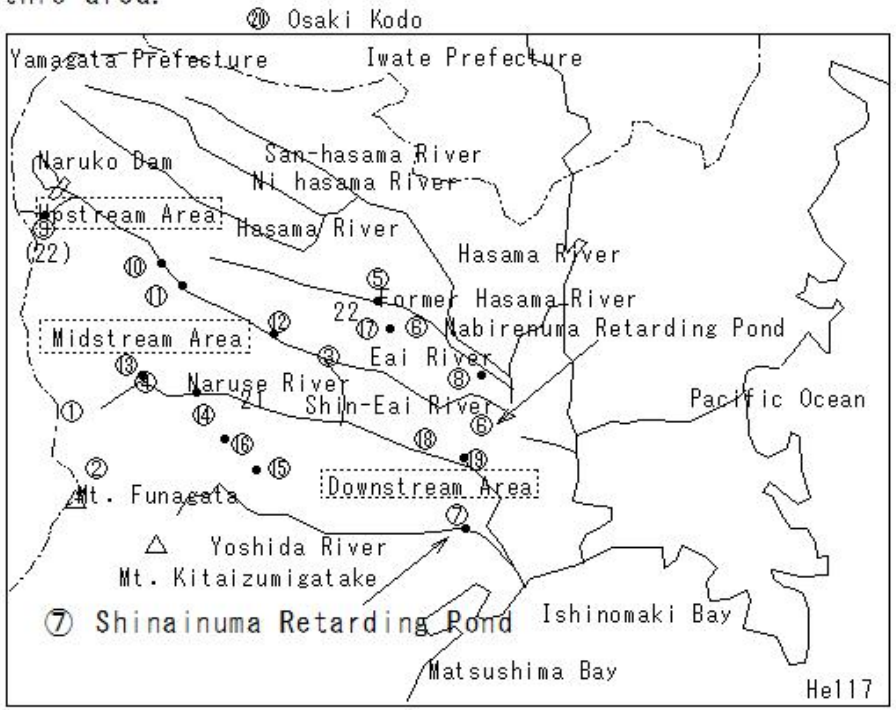
(He292) Osaki Kodo

Downstream Areas
Flood Response

⑥ Nabirenuma Retarding Pond

1. Nabirenuma flows into the Eai River, and when the river's water level rose, drainage became impossible, resulting in frequent flooding in this area.





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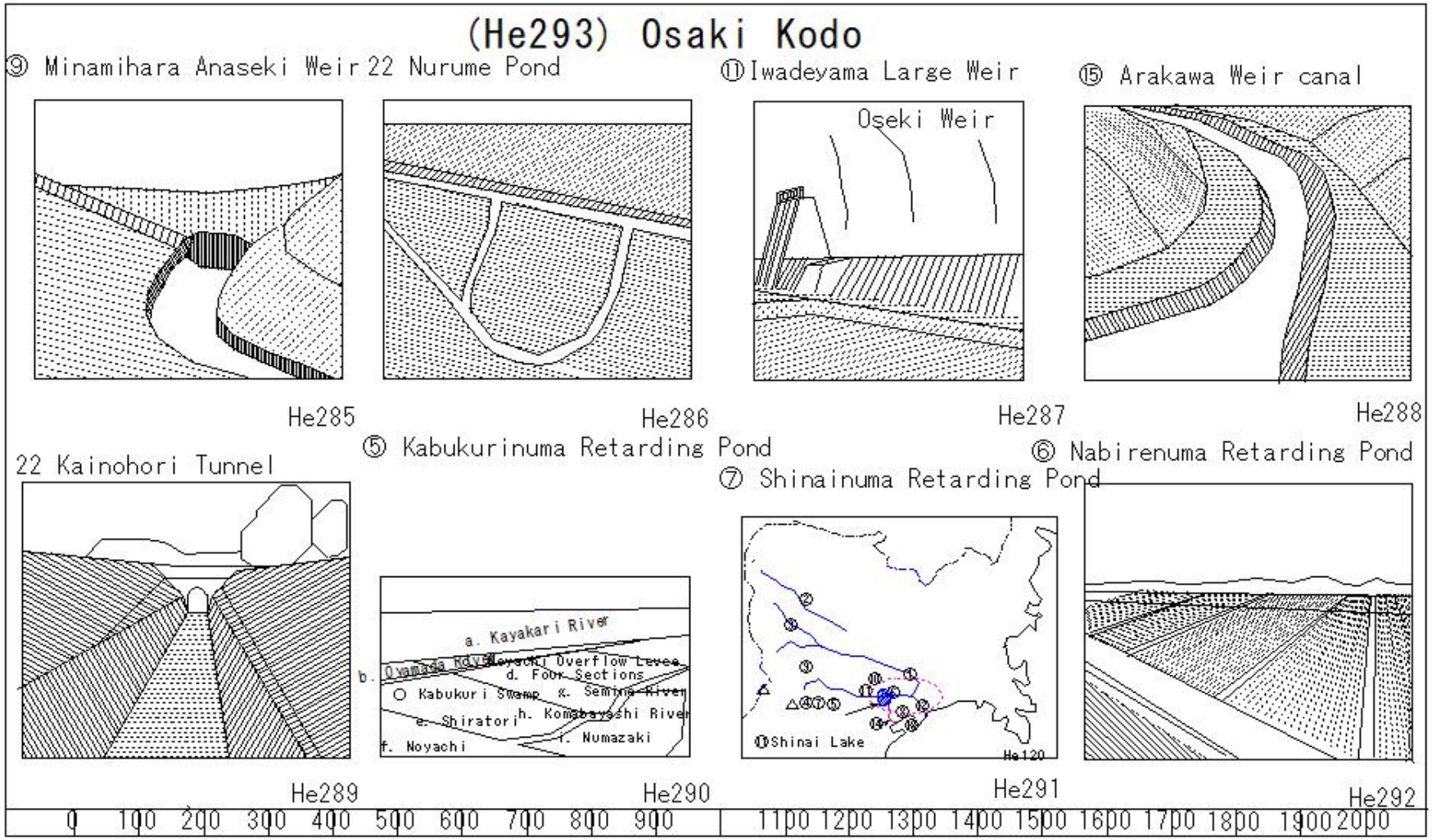
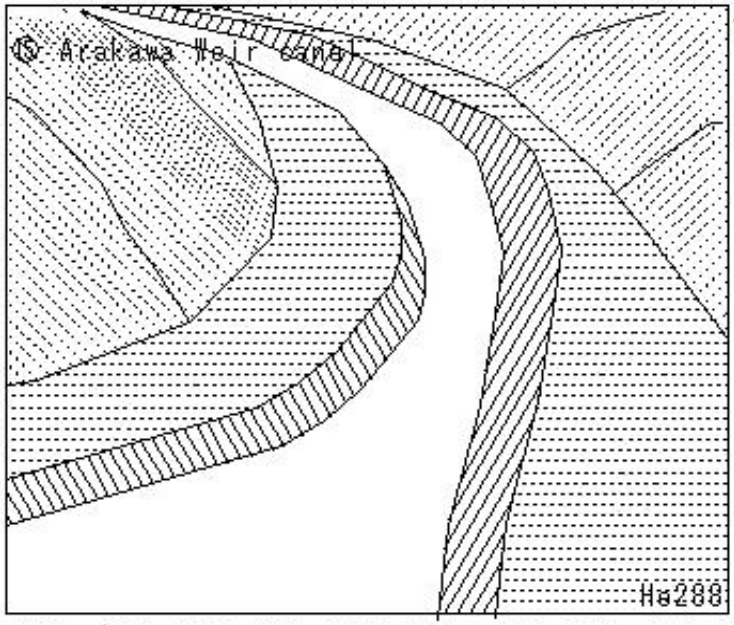


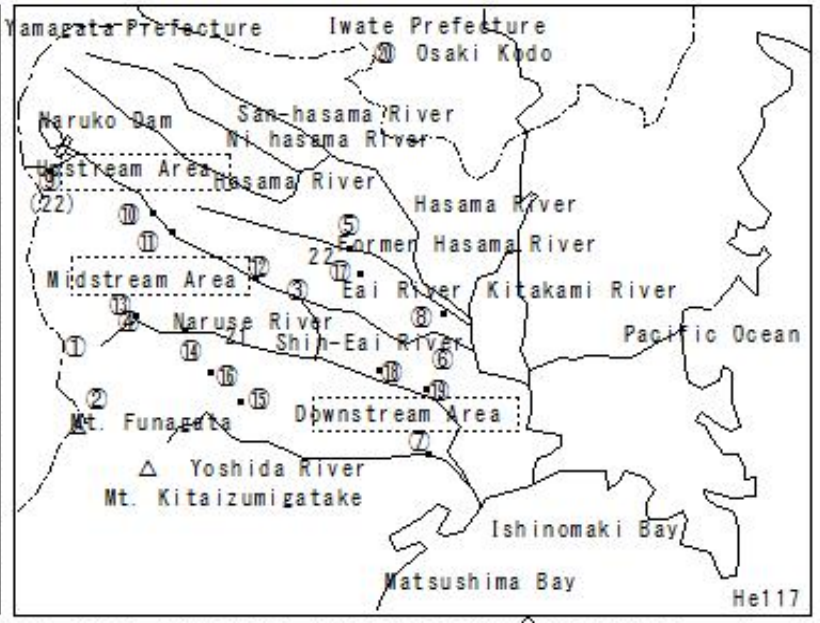
(He294) Osaki Kodo

(He294) Osaki Kodo

Arakawa Seki Irrigation Canal

① Located in an area where drawing water from a large river is difficult due to its topography.
② This 33km-long canal (with 12 tunnels and caverns) draws water from the Arakawa River (now the Hanakawa River), a tributary of the Naruse River, and flows through the hillside.
③ Excavated between 1646 and 1649,
④ The advanced irrigation technology combined with reservoirs is still in operation today.





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(He295) Osaki Kodo

⑮ Arakawa Weir canal

(He295) Osaki Kodo

① The Arakawa Weir Irrigation Canal, built in the 1600s and still in use today, is located on a mountainside.

② The Sanbongi area is a hilly region with fast-flowing rivers, making it difficult to secure water from the river.

③ Even securing water from reservoirs was difficult due to the limited forest behind it.

④ The Arakawa Weir was built between 1646 and 1649.

⑤ It was dug along the mountainside at a natural gradient from the Hana River, a tributary of the Naruse River, toward Matsuyama.

⑥ Kiemon Ogoe, who oversaw the excavation, is believed to have conceived an ingenious water management system for the entire Osaki Kodo basin in an era without detailed maps.

⑦ It is believed that he envisioned an ingenious water management system for the entire Osaki Kodo basin.

⑧ The total length was 33 km, with 12 tunnels dug into the hillside in the Sanbongi area and one in Shikama Town, totaling approximately 1,700 meters.

⑨ Large areas of lush bamboo grass and virgin forest were cut down.

⑩ When selecting the route for the irrigation canal to allow it to flow naturally,

⑪ it was said that the work involved nighttime observations by fire and messenger dispatches, and the decision was made while the route was being decided.

⑫ Wooden shovels were used for the excavation work.

⑬ The tunnel was dug from both sides after the entrance and exit were determined. Everyone was anxious about whether water would flow, but when it finally did, everyone rejoiced.

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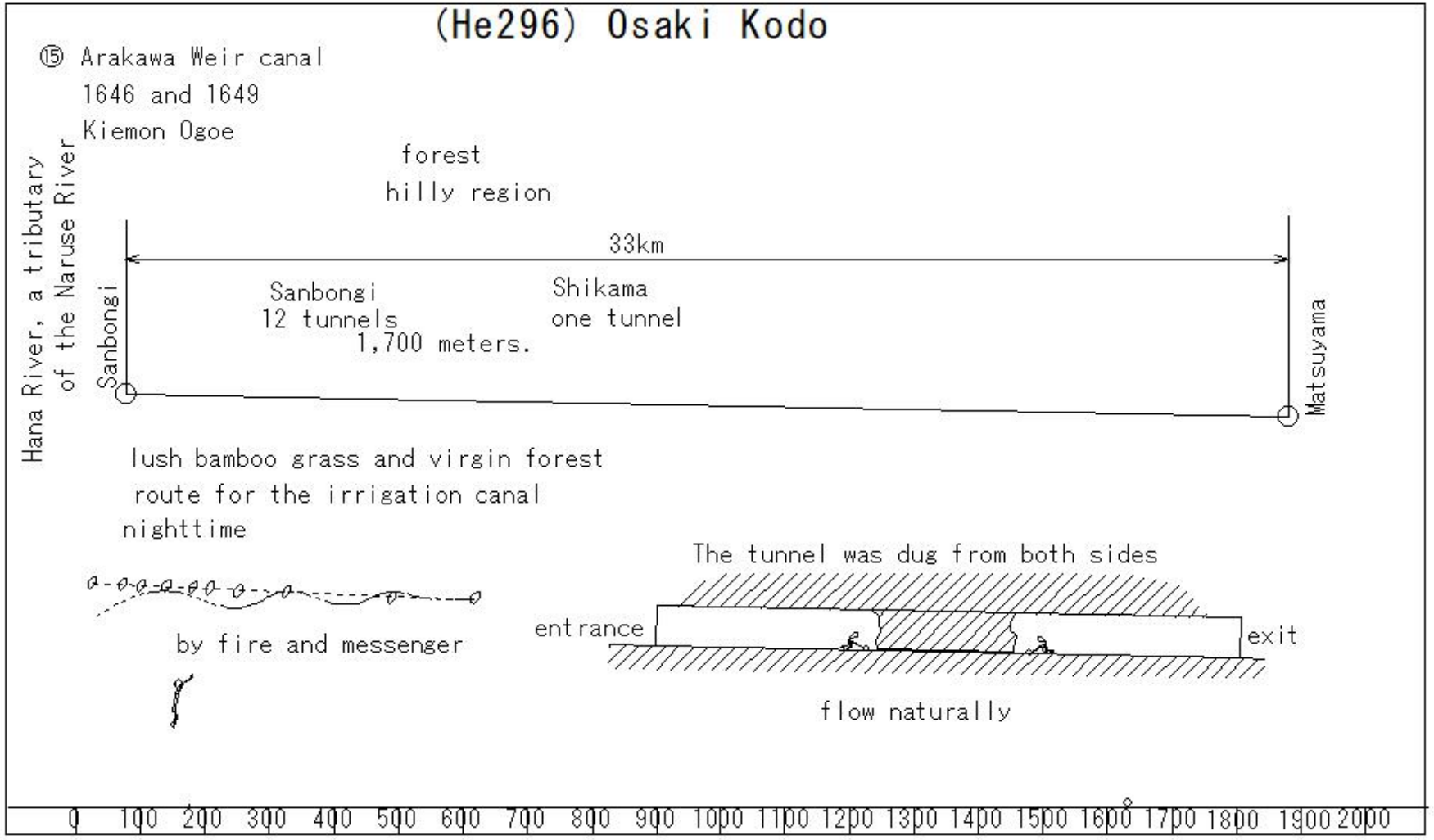
(He296) Osaki Kodo



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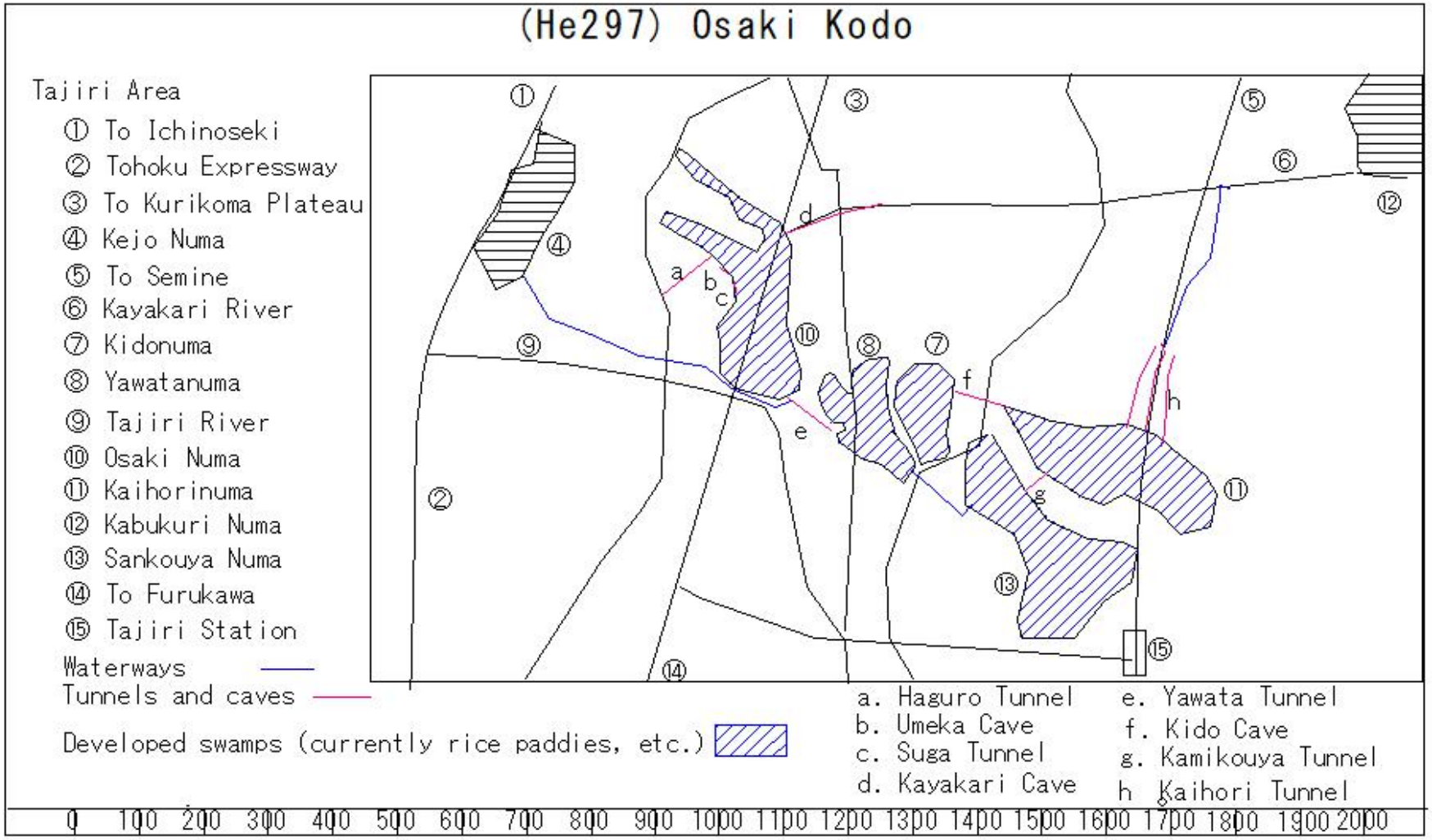

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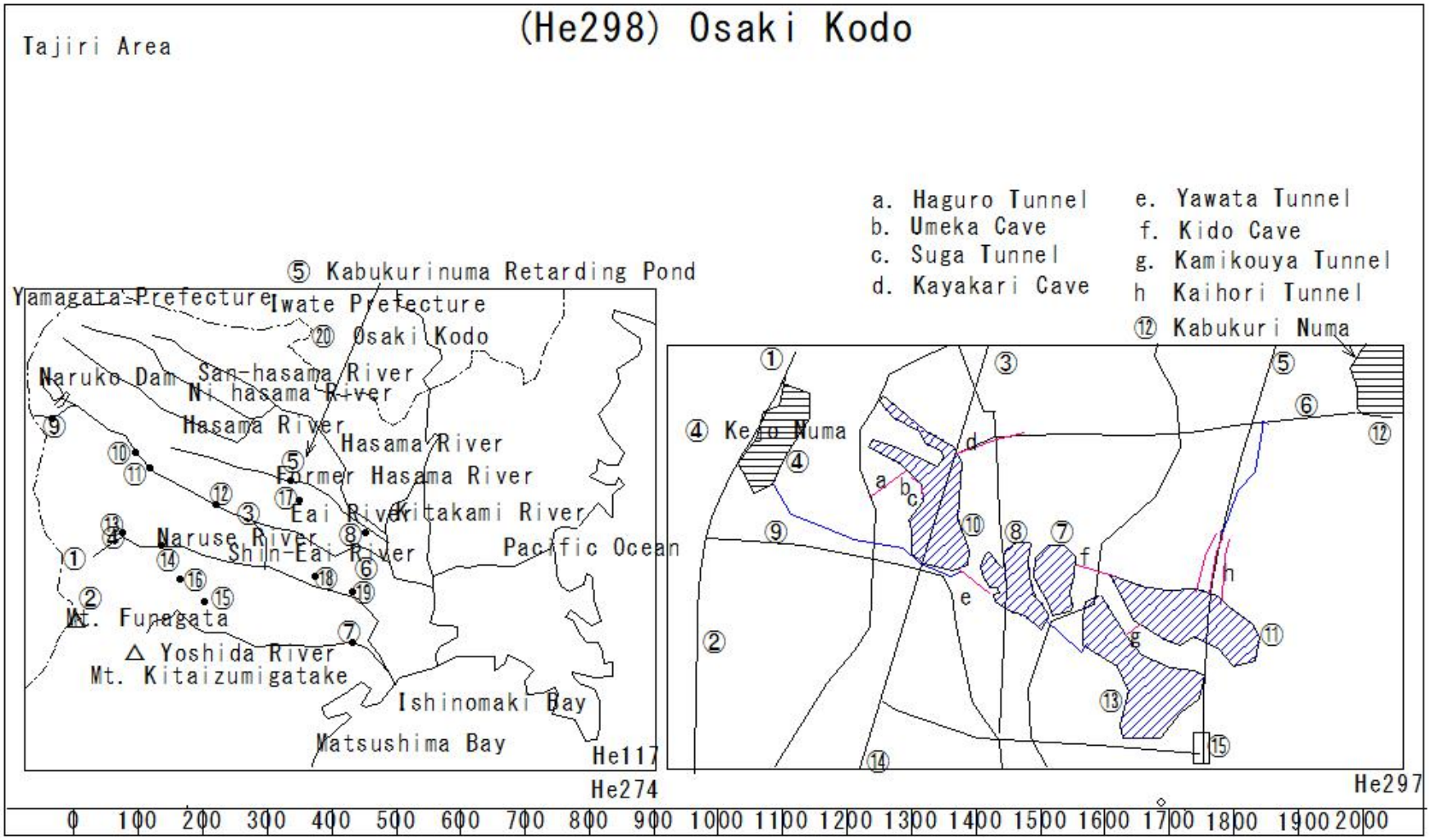

(He299) Osaki Kodo

Tajiri Area

(He299) Osaki Kodo

① Connection of Osaki Kodo's Water Management Infrastructure: "Wetland Water Management"
② The hilly areas in the northern part of the Furukawa and Tajiri regions were once dotted with swamps.
③ The hilly areas were uneven, making drainage poor and securing water difficult, making them difficult to use as rice paddies.
④ During the Edo period, Saga Fusatomo, a native of Kainohori, Numabe Village (present-day Tajiri), served as the northern magistrate of the Sendai Domain.
⑤ In 1635 (Kan'ei 12), in order to contribute to the local community,
⑥ he began work on improving the drainage system of the "Kainohori Swamp" and developed approximately 130 hectares of new rice fields.
⑦ A tunnel was built from the "Sankoyanuma" upstream to secure irrigation water for the new rice fields.
⑧ This ingenious approach killed two birds with one stone: draining the Sankouya Swamp and beginning the development of new rice fields.
⑨This process was repeated with the upstream swamps, and approximately 700 hectares of new rice fields were developed over the 55 years leading up to the development of Kaihorizaki Swamp.
⑩Saga's irrigation and drainage improvement project at Kaihori Swamp was an important milestone, marking the beginning of a major 55-year undertaking.
⑪In the local Kainohori area, a stone monument (erected in 1894) and a shrine (constructed in 1954) commemorate his achievements.
⑫The Osaki region has suffered from the triple hardships of floods, droughts, and cold weather damage caused by winds called "yamase" winds, but has overcome these challenges by combining various water management methods tailored to the unique geographical features.

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(He300) Osaki Kodo

(He300) Osaki Kodo

Tajiri Area

a Osaki Kodo: "Water Management in Wetlands"

b Furukawa and Tajiri Regions: Scattered Swamps

c Hilly Regions: Poor Drainage, Difficult to Secure Drainage and Water Supply

d Edo Period (Saga Fusatomo)

e Kan'ei 12 (1635)

f Irrigation and Drainage Improvement Project for "Kainohorinuma"

g Securing Irrigation Water for New Rice Fields by Constructing a Tunnel from "Sankoyanuma"

h Draining "Sankoyanuma" Marsh to Develop New Rice Fields

i 55 Years Until the Development of (Kaiborizaki Marsh)

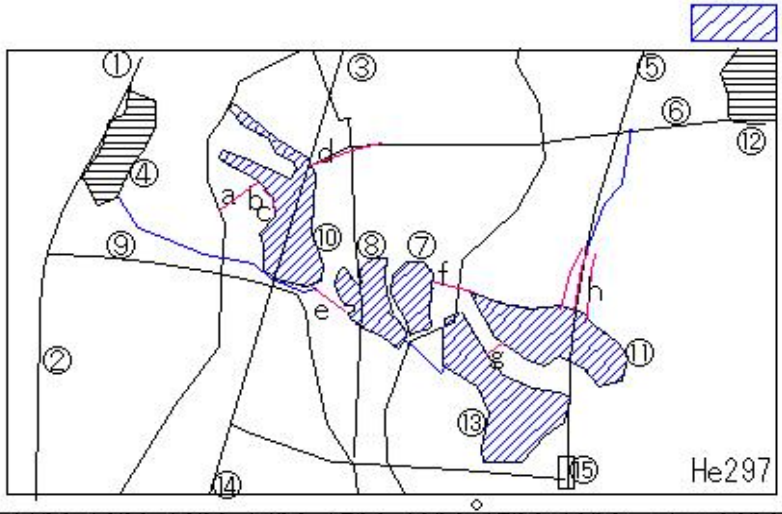
j Saga Clan's Irrigation and Drainage Improvement Project for Kaihorinuma

k The Osaki Region Experienced Floods, Droughts, and Cold Damage from "Yamase" Winds

l Combining Water Management Infrastructure

① To Ichinoseki
② Tohoku Expressway
③ To Kurikoma Plateau
④ Kejo Numa
⑤ To Semine
⑥ Kayakari River
⑦ Kidonuma
⑧ Yawatanuma
⑨ Tajiri River
⑩ Osaki Numa
⑪ Kaihorinuma
⑫ Kabukuri Numa
⑬ Sankouya Numa
⑭ To Furukawa
⑮ Tajiri Station

Waterways
Tunnels and caves
Developed swamps (currently rice paddies, etc.)



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(He301) Osaki Kodo

(He301) Osaki Kodo

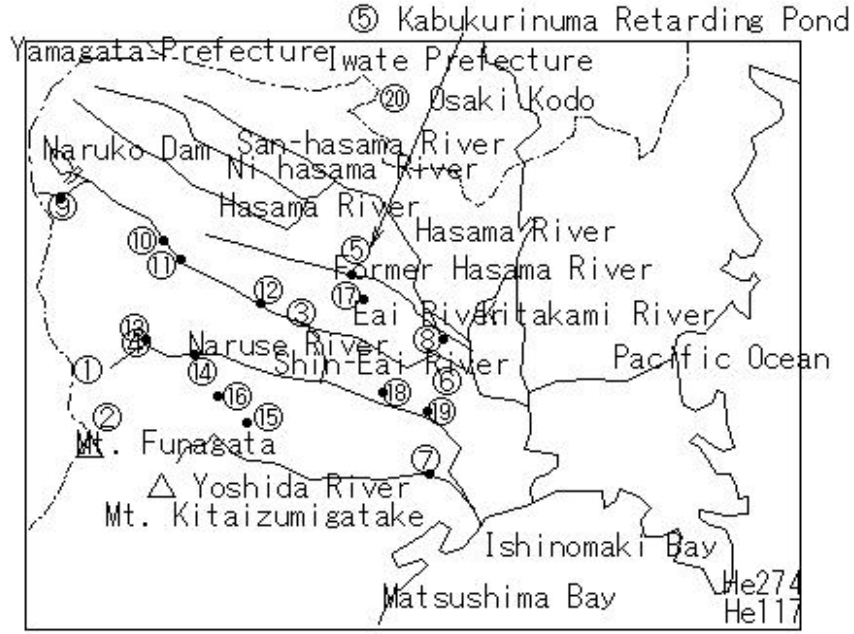
Tajiri Area Kayakari Cave

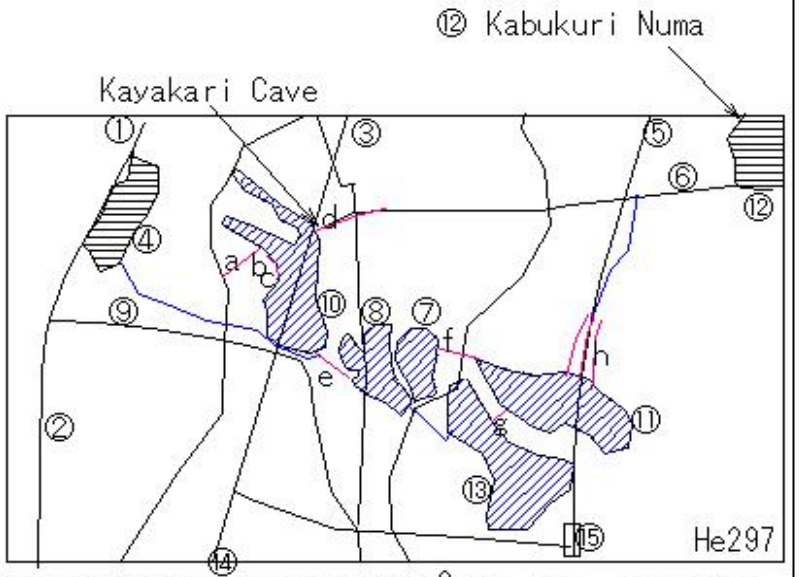
① The Kayakari Cave has its entrance at the northern end of the Komatsu district and its exit at the mouth of the Kayakari River on the east side.

② It is extremely long, with a total length of 1,121 meters.

③ Construction took place during the Kan'ei era (1624-1645).

a. Haguro Tunnel
b. Umeka Cave
c. Suga Tunnel
d. Kayakari Cave
e. Yawata Tunnel
f. Kido Cave
g. Kamikouya Tunnel
h Kaihori Tunnel





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(He302) Osaki Kodo

(He302) Osaki Kodo

Tajiri Area Kayakari Cave

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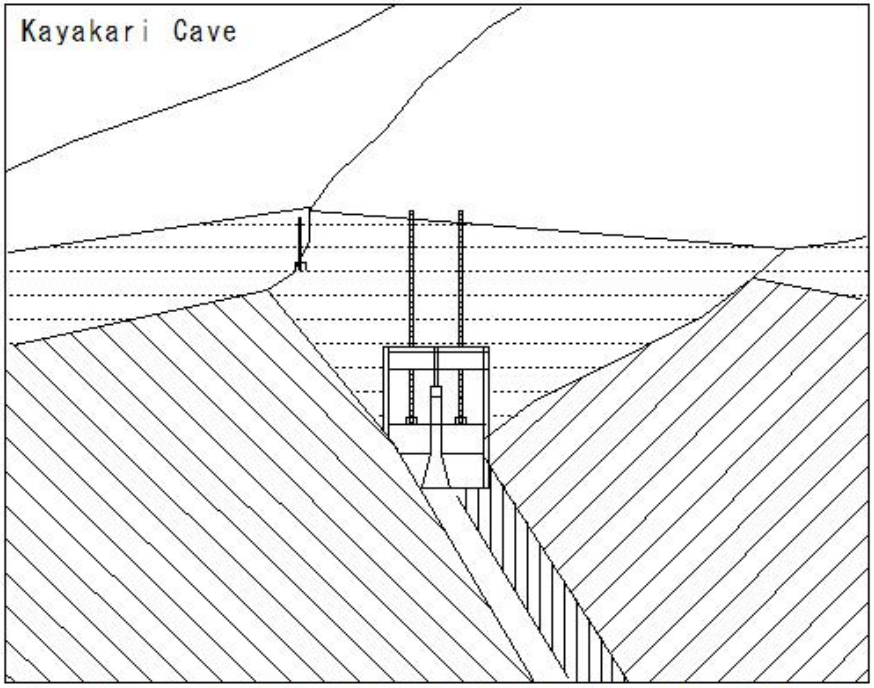
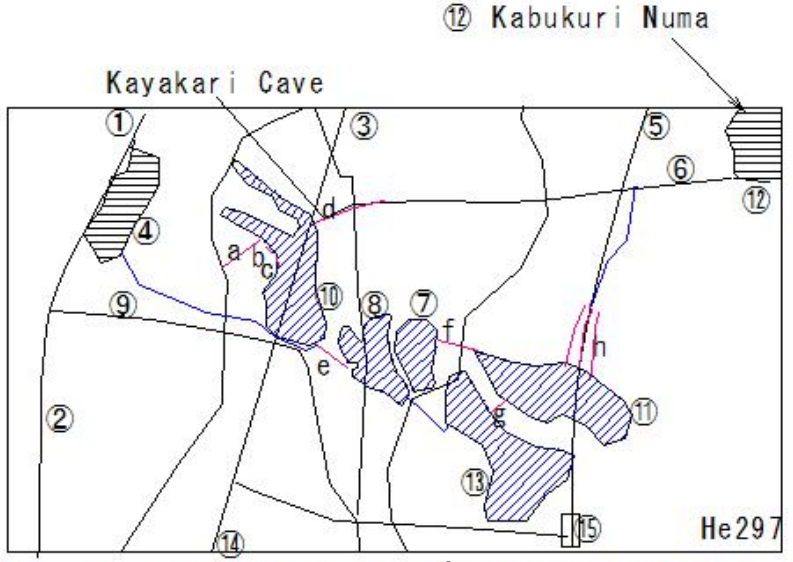
③ Construction took place during the Kan'ei era (1624-1645).

a. Haguro Tunnel
b. Umeka Cave
c. Suga Tunnel
d. Kayakari Cave
e. Yawata Tunnel
f. Kido Cave
g. Kamikouya Tunnel
h Kaihori Tunnel





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(He303) Osaki Kodo

(He303) Osaki Kodo

Tajiri Area Kayakari Cave

Construction Methods for Mine and Tunnel

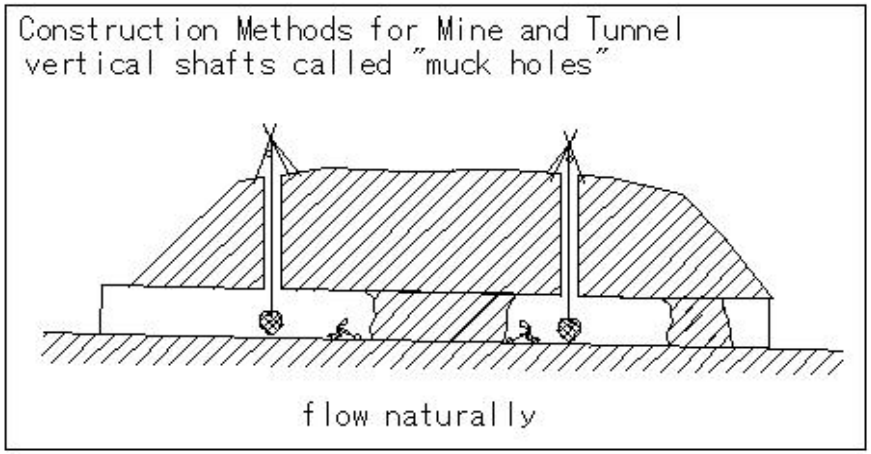
① Excavation work began with digging vertical shafts called "muck holes" (soil discharged from the tunnel) at intervals of several hundred meters.

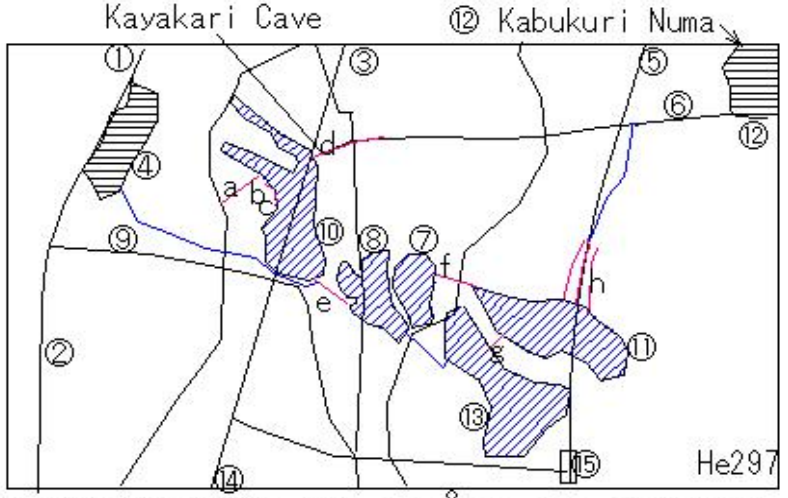
② The bottoms of these shafts were then excavated horizontally to connect them.

③ The muck holes were also used for discharging soil and for maintenance.

④ The remains of five muck holes remain in the Kayari Mine today.

a. Haguro Tunnel
b. Umeka Cave
c. Suga Tunnel
d. Kayakari Cave
e. Yawata Tunnel
f. Kido Cave
g. Kamikouya Tunnel
h Kaihori Tunnel





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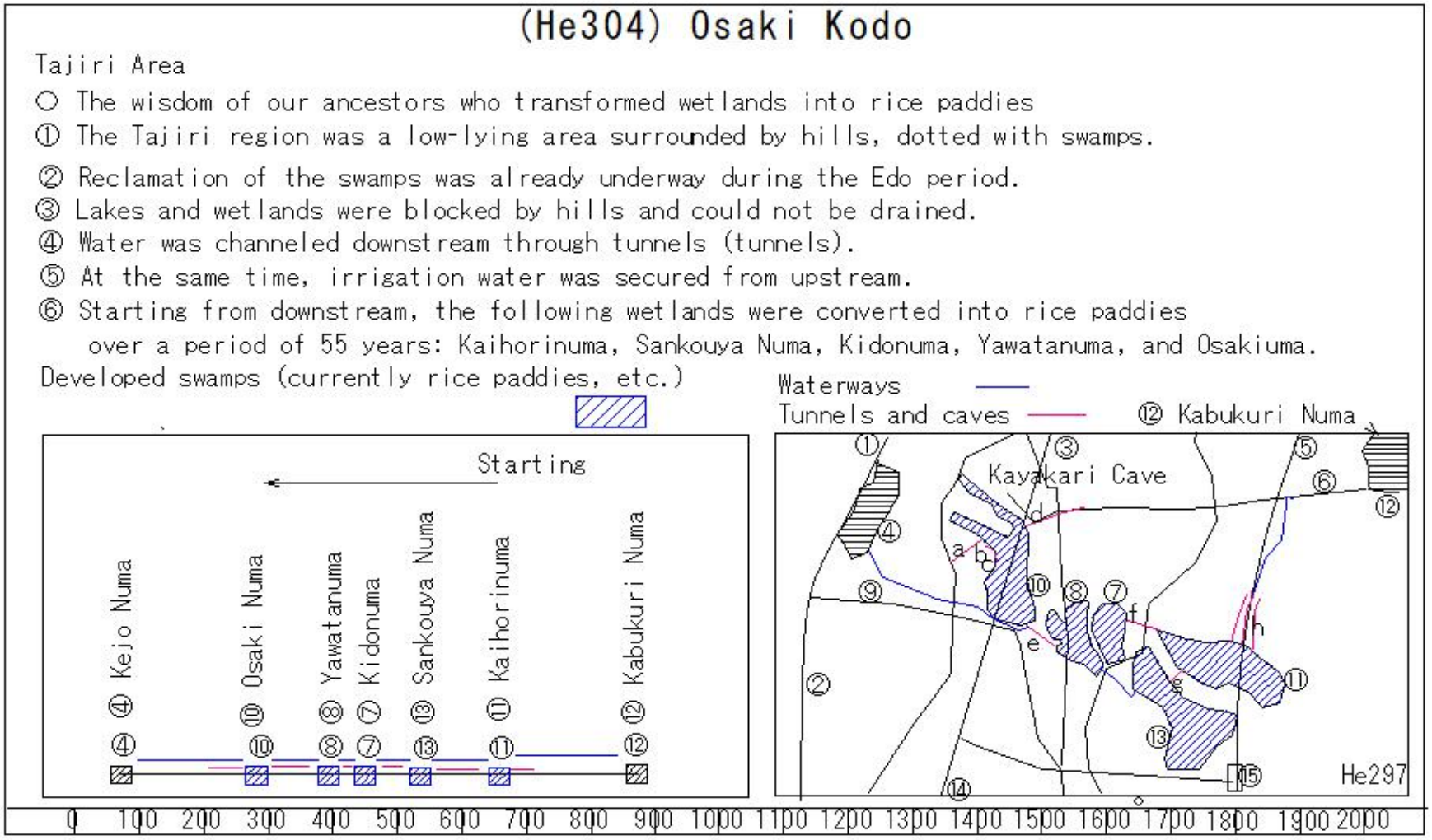

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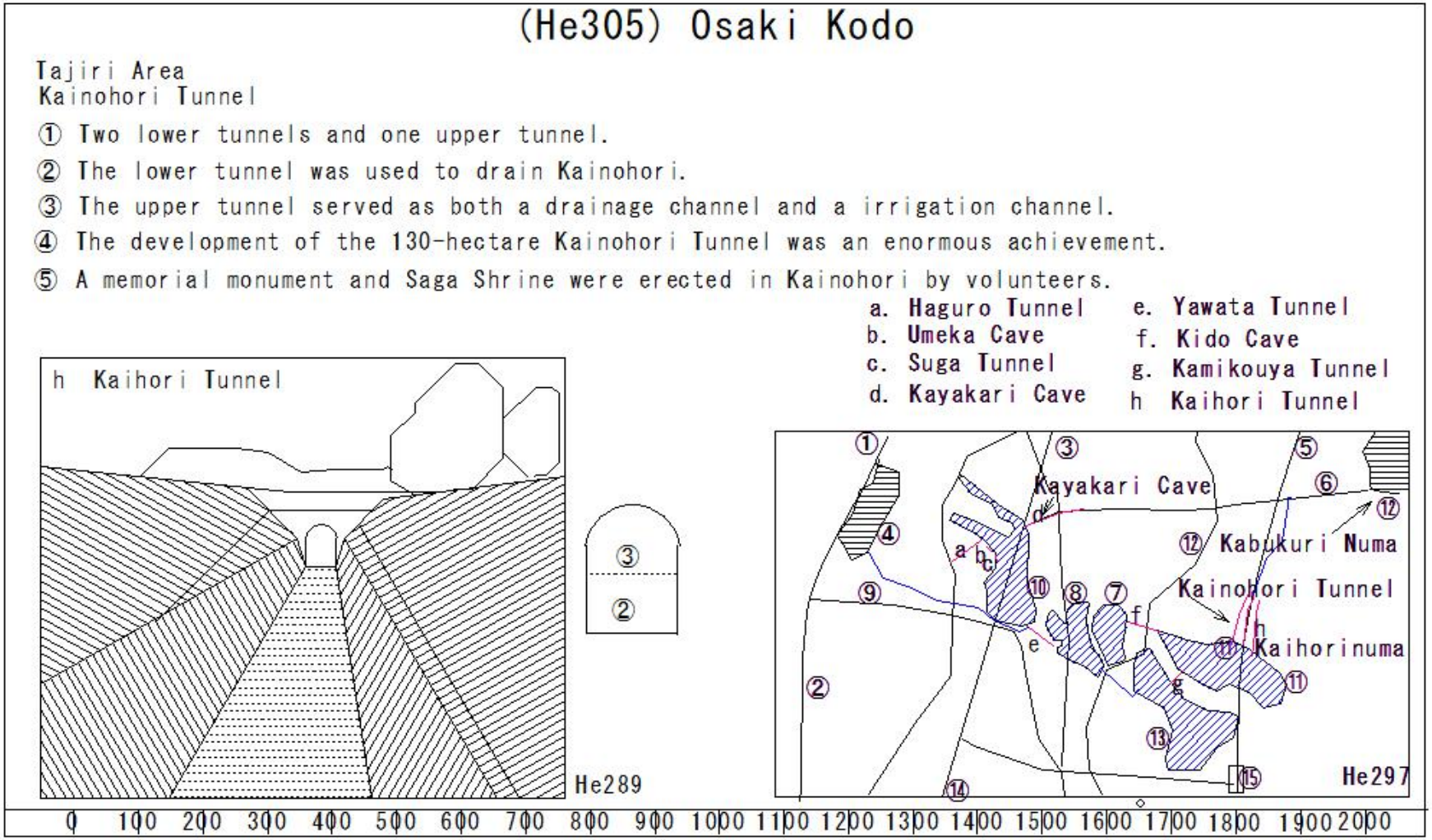


(He306) Osaki Kodo

(He306) Osaki Kodo

Tajiri Area

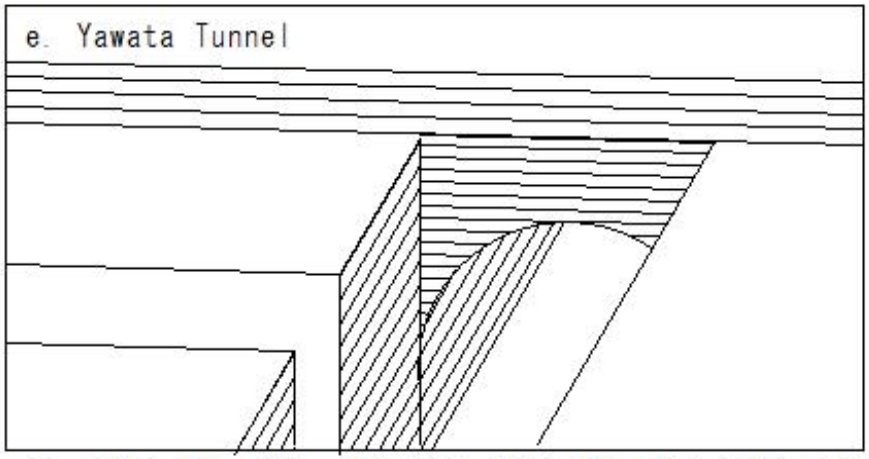
Yawata Tunnel

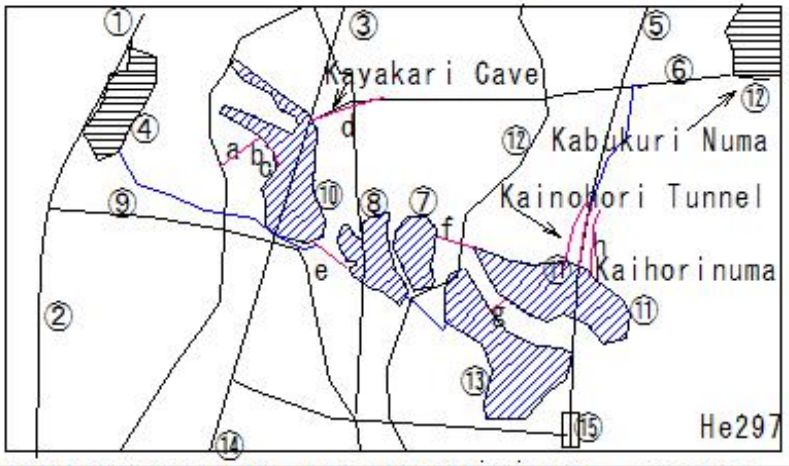
① This tunnel serves both water and drainage, and was excavated between 1688 and 1743 to supply irrigation water following the reclamation of Yawata Pond.

② This tunnel served as both a drainage and irrigation facility.

③ Along with the Kainohori Tunnel, it served as an important water management facility connecting large and small ponds for the development of new rice fields in the Tajiri region.

a. Haguro Tunnel
b. Umeka Cave
c. Suga Tunnel
d. Kayakari Cave
e. Yawata Tunnel
f. Kido Cave
g. Kamikouya Tunnel
h Kaihori Tunnel





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(He307) Osaki Kodo

(He307) Osaki Kodo

Tajiri Area

Hassundo

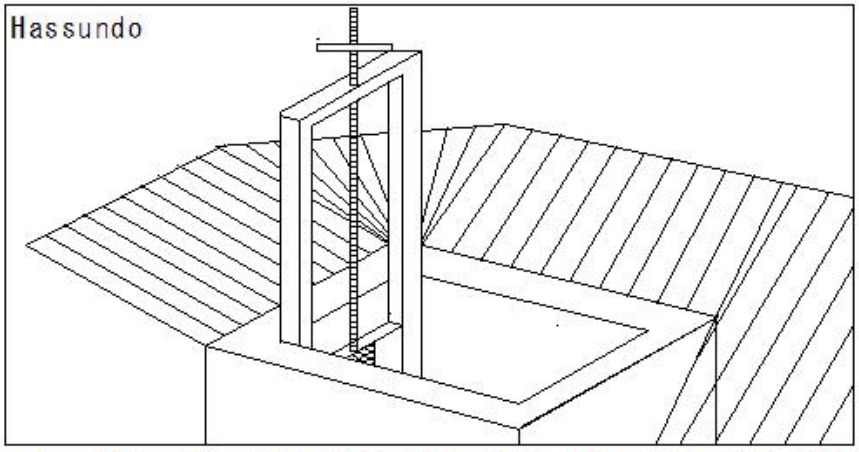
① A 24cm (8-inch) hole is installed at the boundary between the upstream and downstream sides of the drainage channel.

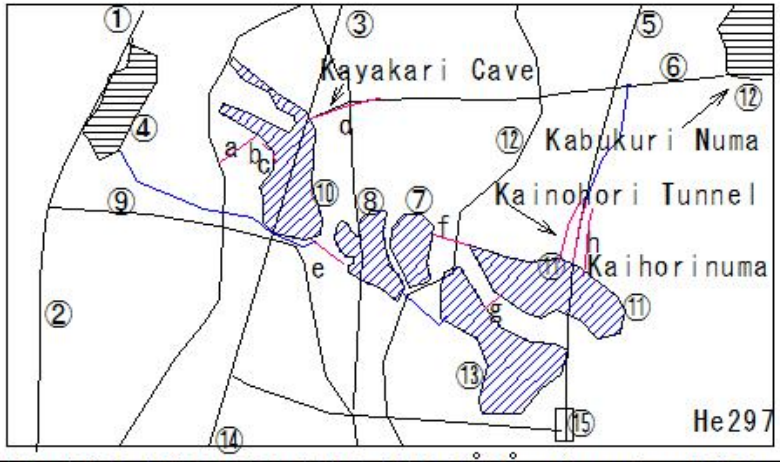
② A mechanism to limit the amount of water flowing downstream during floods.

③ During floods, the upstream area is also flooded, reducing flood damage in downstream areas.

④ The wisdom of water management that takes the entire region into consideration is passed down.

a. Haguro Tunnel
b. Umeka Cave
c. Suga Tunnel
d. Kayakari Cave
e. Yawata Tunnel
f. Kido Cave
g. Kamikouya Tunnel
h Kaihori Tunnel





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(He308) Osaki Kodo

(He308) Osaki Kodo

Tajiri Area

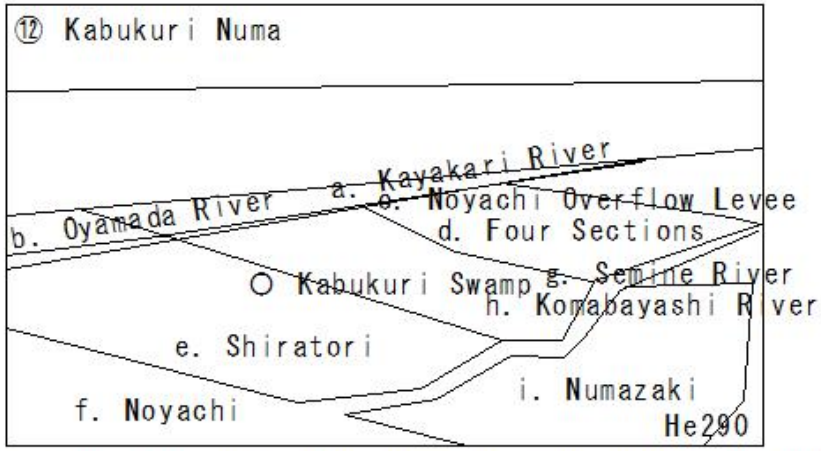
⑫ Kabukuri Numa

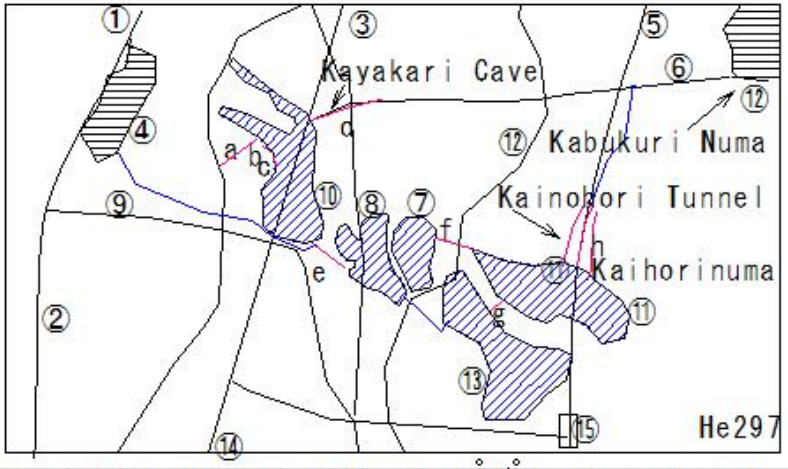
① A flood-control basin that regulates water levels during floods.

② It is off-limits to humans, it is the only area in the Tajiri region that has not been reclaimed.

③ It has become a wetland with a precious natural environment, even in eastern Japan.

a. Haguro Tunnel
b. Umeka Cave
c. Suga Tunnel
d. Kayakari Cave
e. Yawata Tunnel
f. Kido Cave
g. Kamikouya Tunnel
h Kaihori Tunnel





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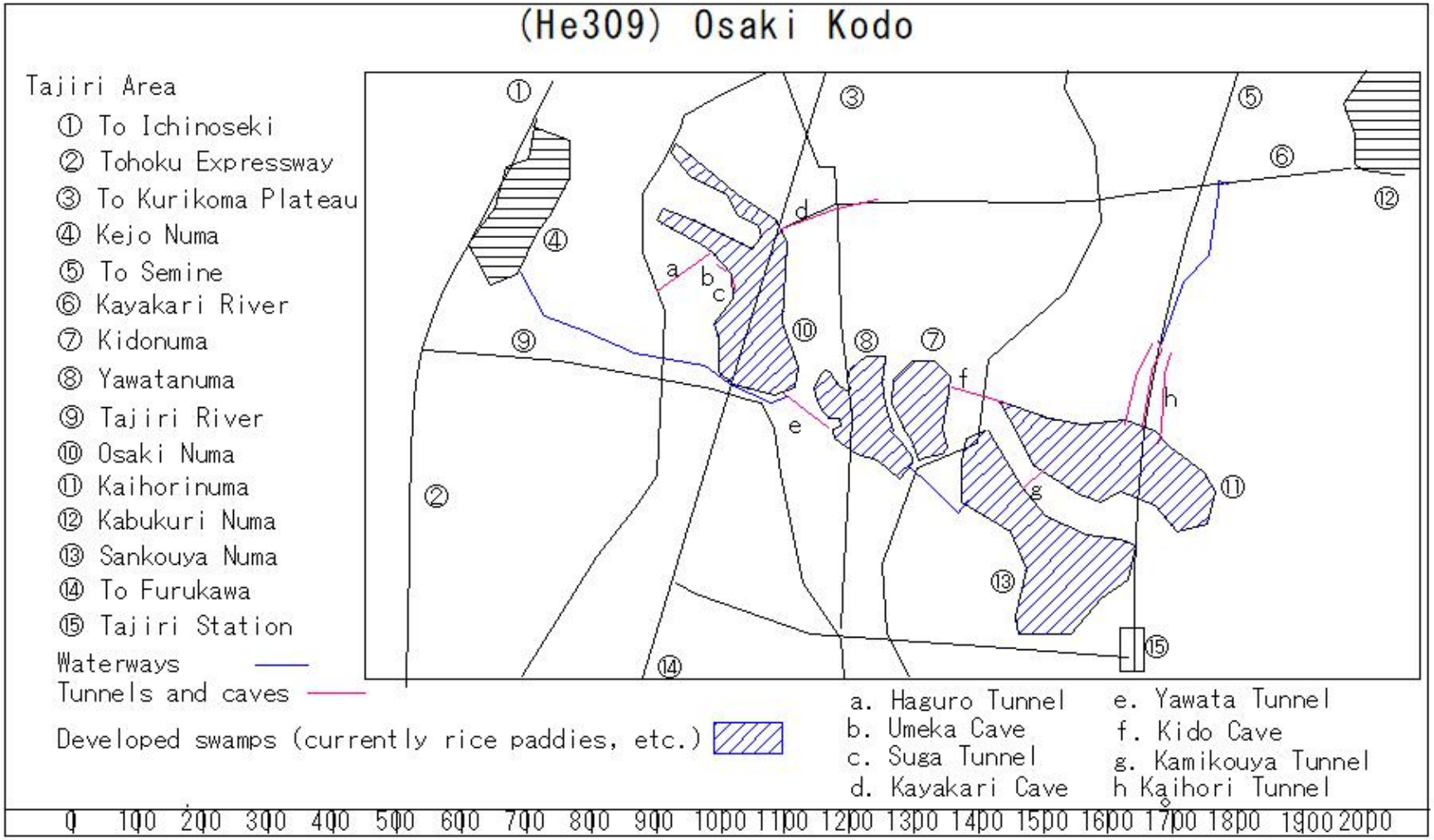
(He309) Osaki Kodo



(He310) Osaki Kodo

(He310) Osaki Kodo

Tajiri Area

① During the Edo period, two major routes drained the lakes and marshes in the Tajiri region, improving their irrigation systems and converting them into rice paddies.

② One route was "Kayakari Pond - Kabukuri Numa" (from Kejo Numa to Kayakari Cave - Kabukuri Numa).

③ The other route to the south was "Tajiri River - Yawata Tunnel, Kido Cave, Kamikouya Tunnel - Kainohori Tunnel - Kabukuri Numa."

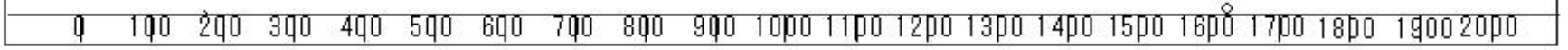
④ These routes were converted into new rice paddies and rice paddies starting downstream. These routes offer insight into the hardships of excavating them.

⑤ They are still in use today, with the Kayakari Pond being a massive 1,121m long tunnel, constructed by hand.

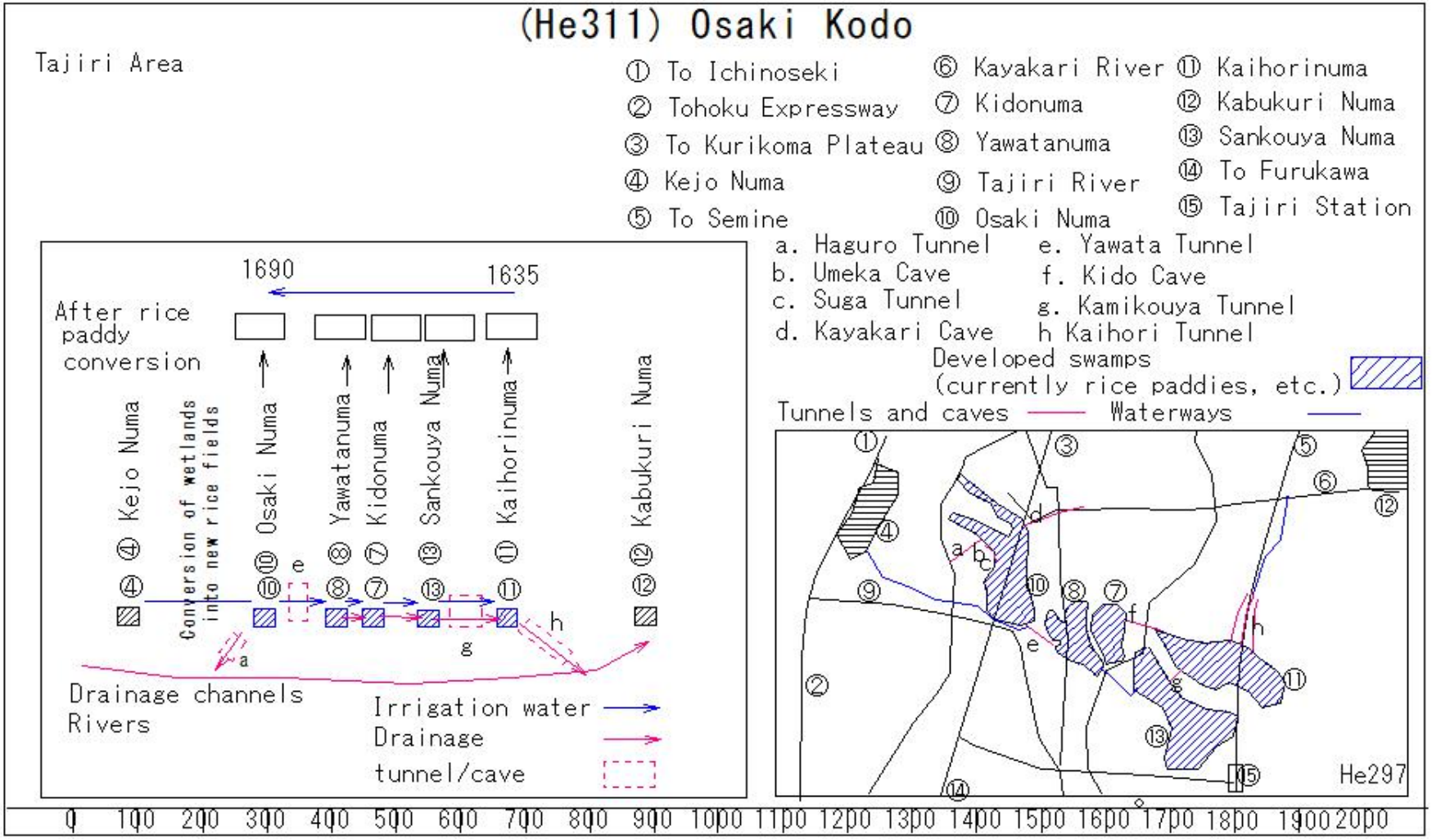
⑥ Kejo Numa and Kabukuri Numa are major migration sites for white-fronted geese, accounting for 90% of the geese migrating to Japan. The number of birds can exceed 100,000 at its peak.

⑦This is closely related to the fact that local farmers have provided a wintering environment for the geese by storing water in rice paddies during the winter, creating "winter rice paddies."

⑧It can be said that the geese chose this area because they rely on farmers who practice agriculture in harmony with nature.



(He311) Osaki Kodo



(He312) Osaki Kodo

(He312) Osaki Kodo

Tajiri Area

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② One route was "Kayakari Pond - Kabukuri Numa" (from Kejo Numa to Kayakari Cave - Kabukuri Numa).

③ The other route to the south was "Tajiri River - Yawata Tunnel, Kido Cave, Kamikouya Tunnel - Kainohori Tunnel - Kabukuri Numa."

○Two major routes

② ④→d→⑫

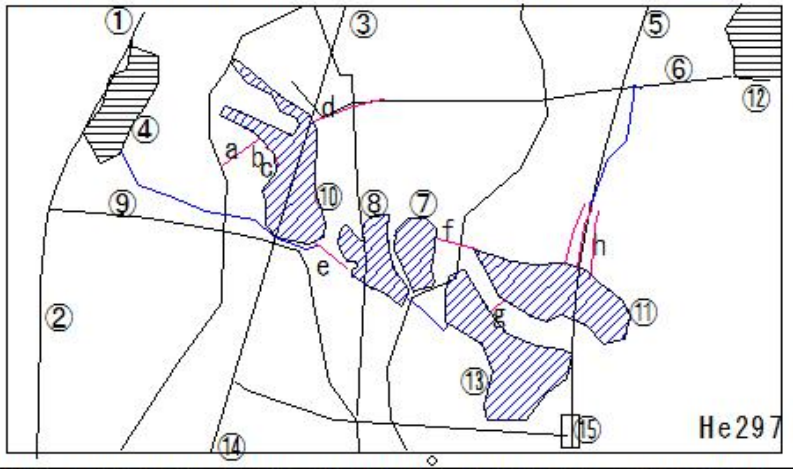
③ ⑨→e→f→g→h→⑫

a. Haguro Tunnel
b. Umeka Cave
c. Suga Tunnel
d. Kayakari Cave
e. Yawata Tunnel
f. Kido Cave
g. Kamikouya Tunnel
h Kaihori Tunnel

Developed swamps (currently rice paddies, etc.)

Tunnels and caves —— Waterways ——

① To Ichinoseki
② Tohoku Expressway
③ To Kurikoma Plateau
④ Kejo Numa
⑤ To Semine
⑥ Kayakari River
⑦ Kidonuma
⑧ Yawatanuma
⑨ Tajiri River
⑩ Osaki Numa
⑪ Kaihorinuma
⑫ Kabukuri Numa
⑬ Sankouya Numa
⑭ To Furukawa
⑮ Tajiri Station



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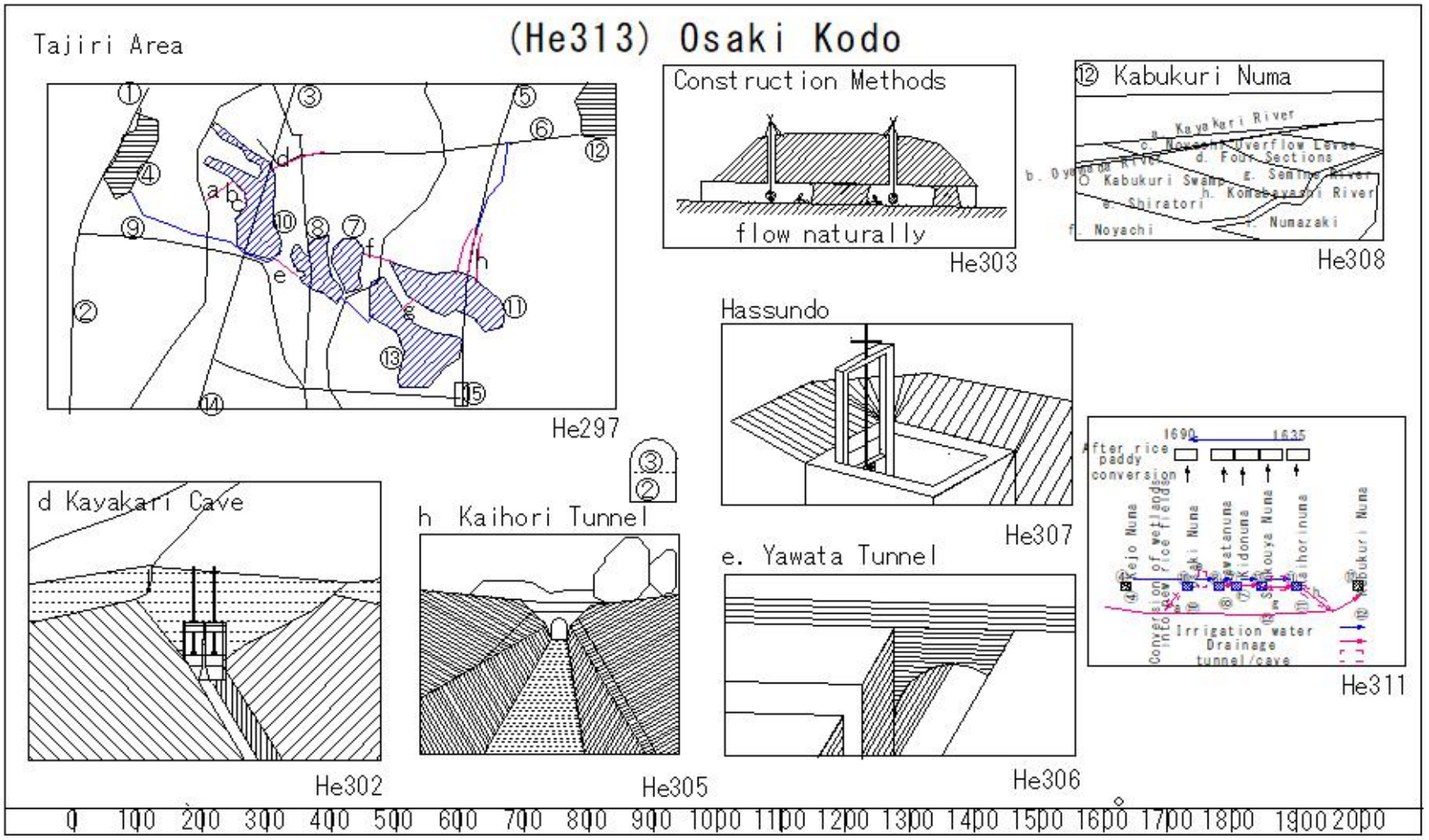
(He313) Osaki Kodo

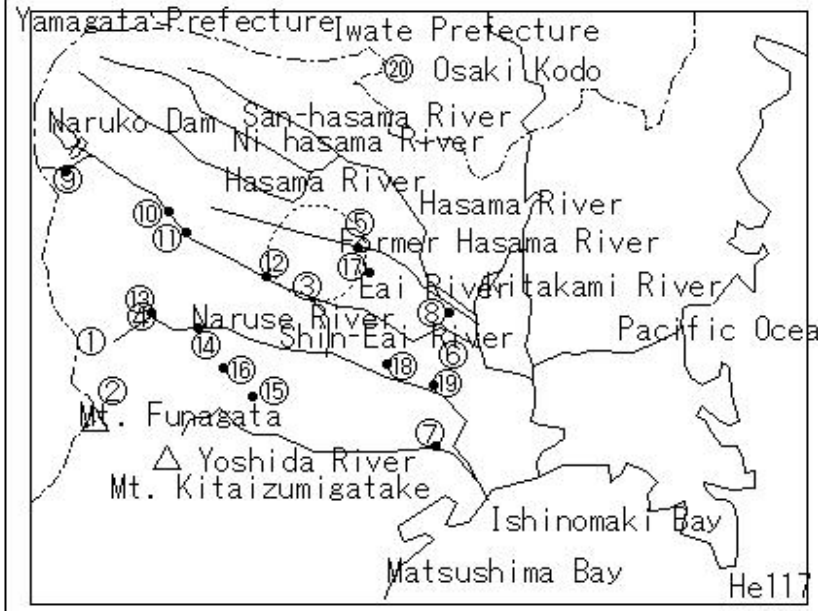


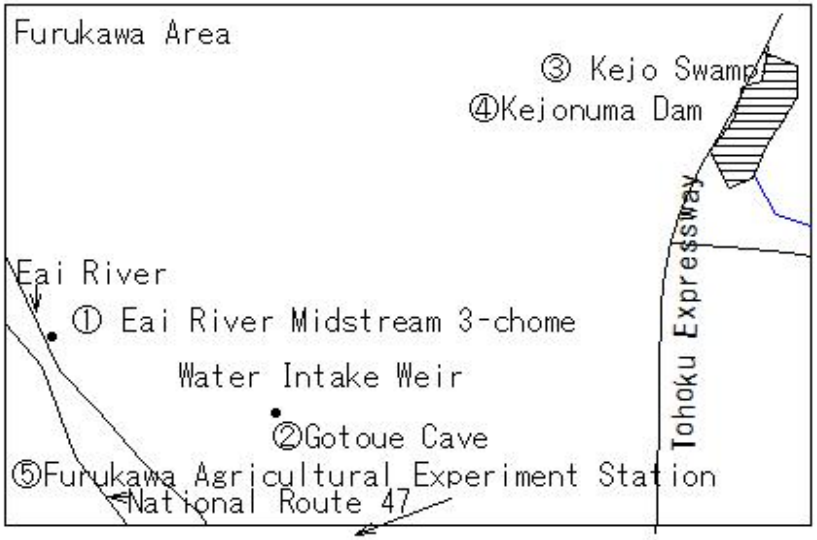
(He314) Osaki Kodo

(He314) Osaki Kodo

Furukawa Area

1. Water management using a network of waterways that allow natural flow on gently sloping land
2. Water is taken from the river and natural flow is used to irrigate the basin.
   Water volume is adjusted throughout the area using "bansui" (water supply).





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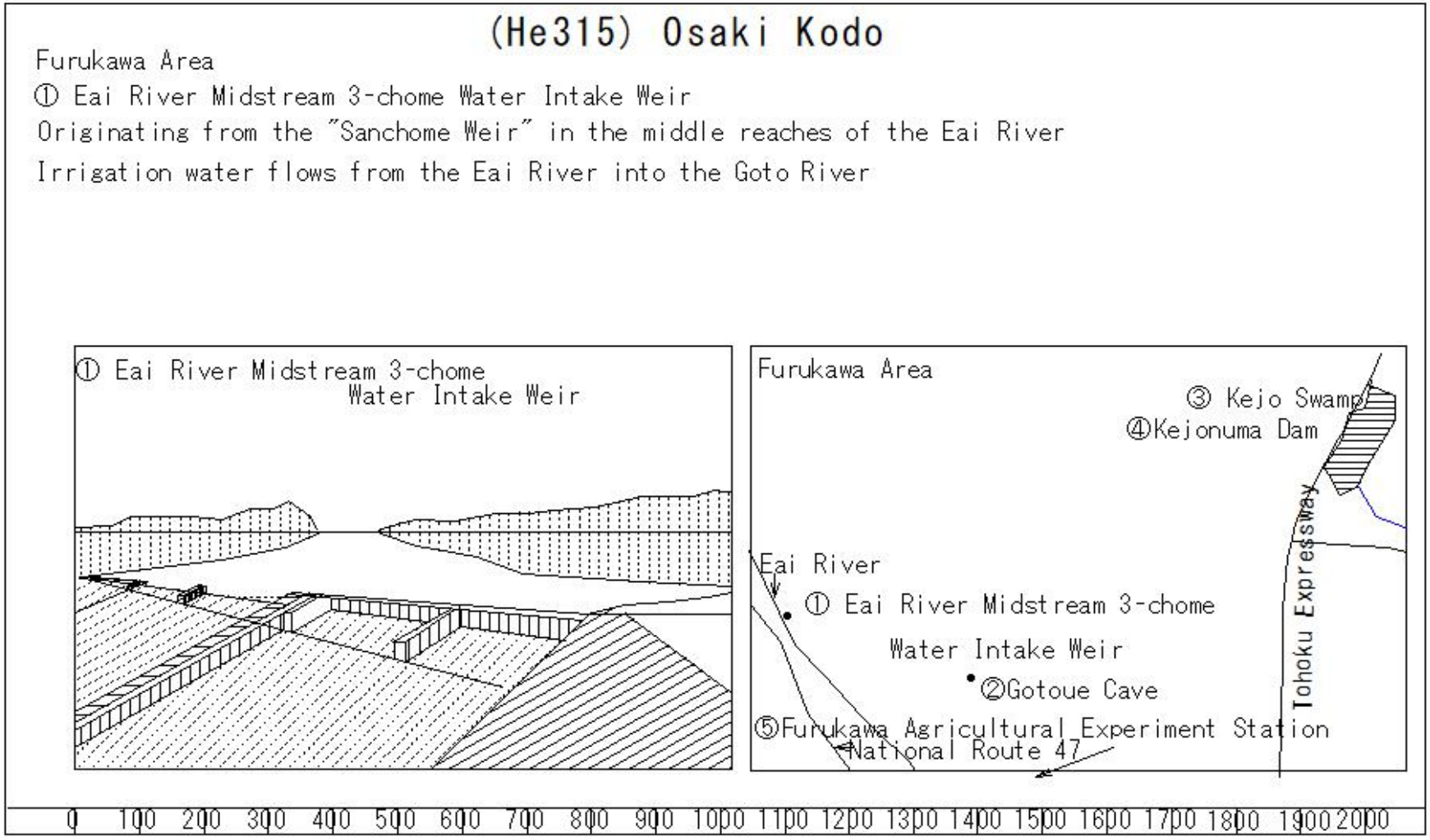

(He316) Osaki Kodo

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Furukawa Area

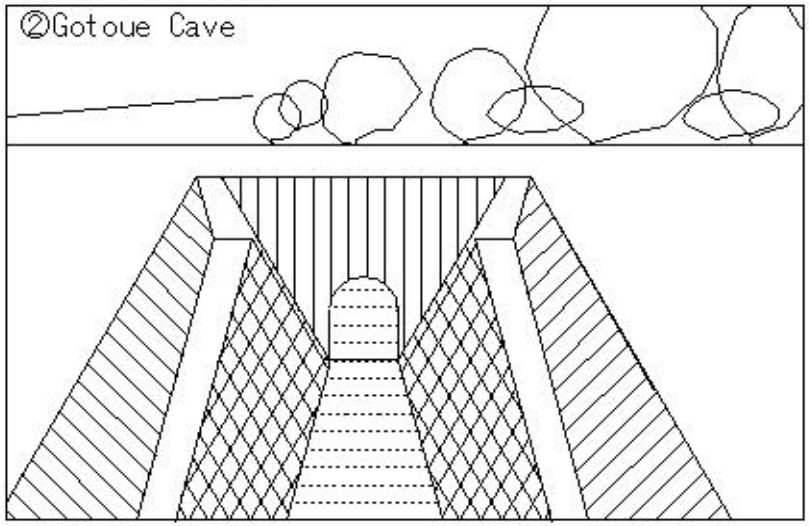
②Gotoue Cave

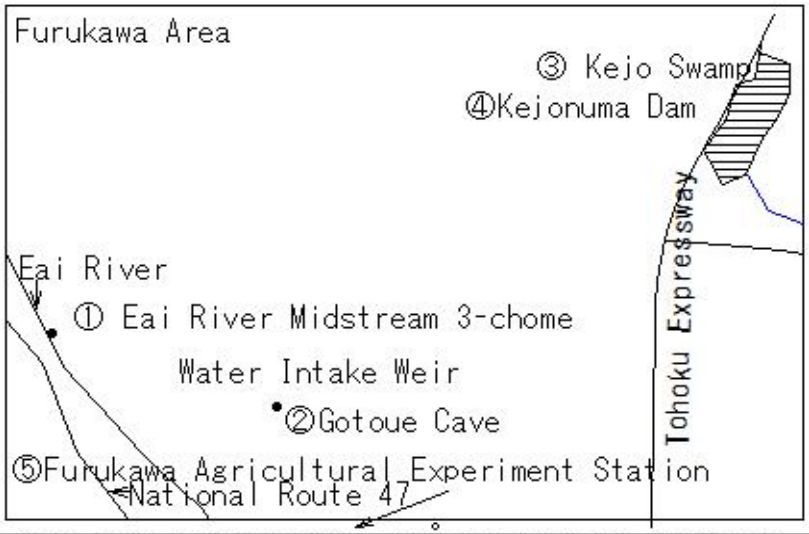
① Gotoue is an approximately 4km irrigation canal that runs from the 3-chome intake in the middle reaches of the Eai River to Minami-Kobayashi.

② Gotoue Cave is a cave that runs approximately 100m beneath the hill where Ryukoin Temple is located

③ The name "Gotoe" is said to have come from Goto Magobei Nobuyasu, who resided at Miyazawa Fortress during the Keicho era.

④ Gotoue Cave is believed to have been excavated around 1596 (Keicho 1) and is considered the oldest cave in the area.





(He317) Osaki Kodo

(He317) Osaki Kodo

Furukawa Area

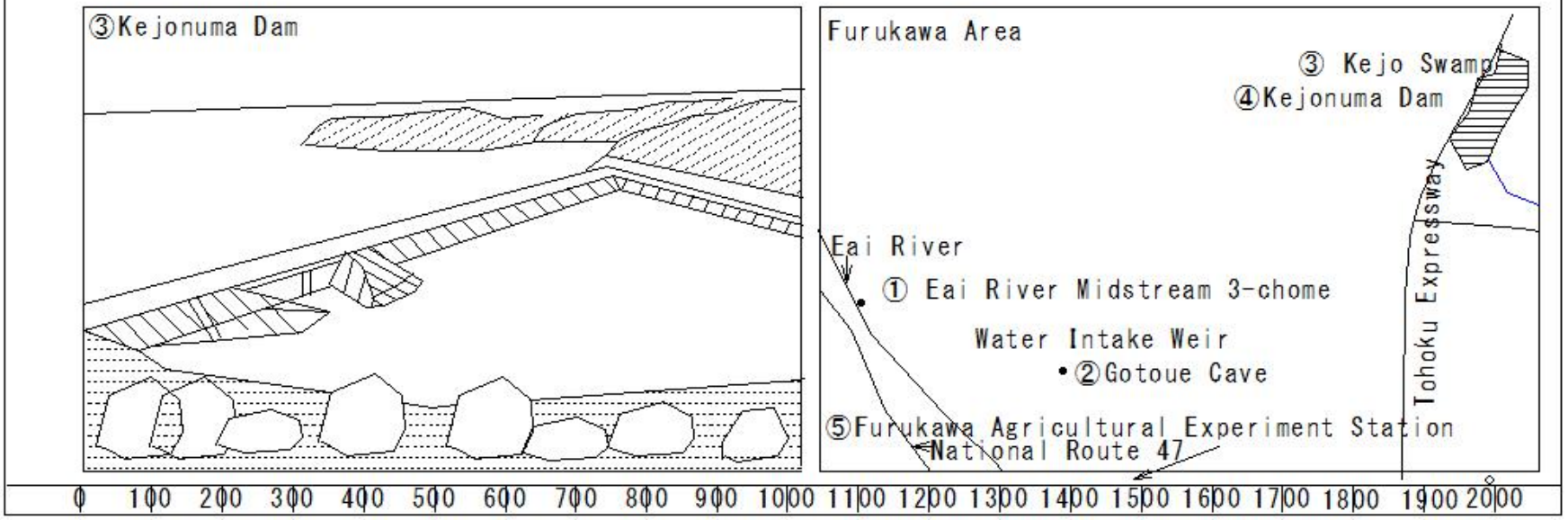
③Kejonuma Dam

① Originally a natural lake called Kejonuma

② It was converted into a reservoir and a standard earth dam.

③ A flood control dam for agricultural water supply.

④ Construction began in 1980 and was completed in March 1996.



(He318) Osaki Kodo

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Furukawa Area

③ Kejo Swamp

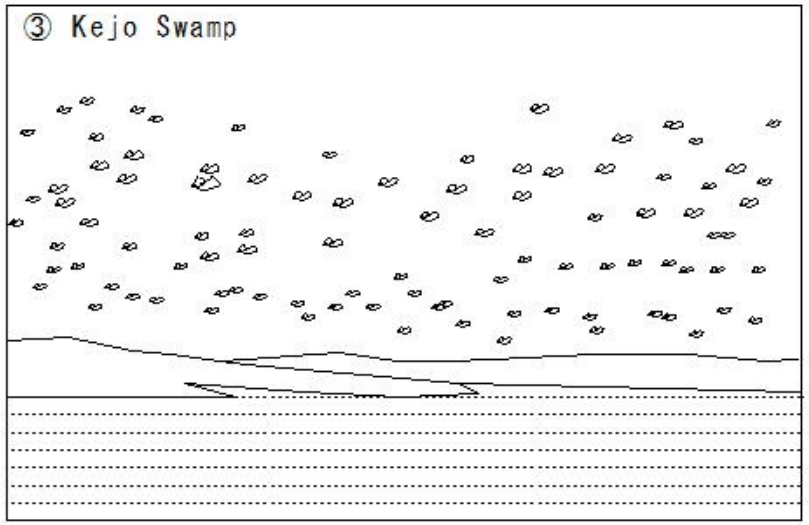
Ramsar Convention Wetland "Kejo Numa"

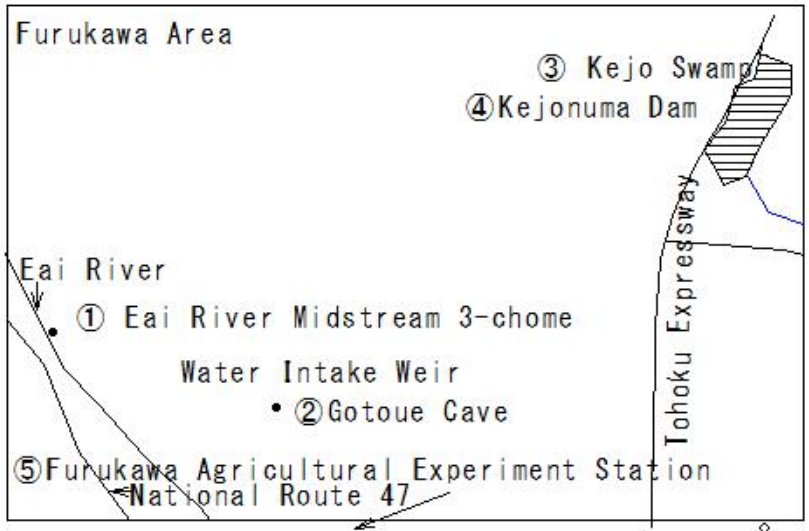
Biodiversity

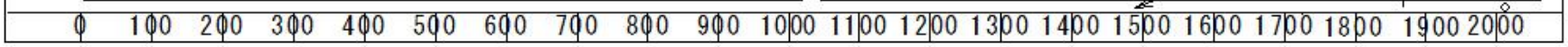
① Kejo Numa became a Ramsar Convention Wetland in October 2008.

② It is an important wintering ground for Anatidae, including Bean Geese, Greater White-fronted Geese, and Great Tit Geese. At peak times, the population exceeds

③ Seasonal flowers, such as Japanese irises and day lilies, can be seen in the surrounding area.







(He319) Osaki Kodo

(He319) Osaki Kodo

Furukawa Area

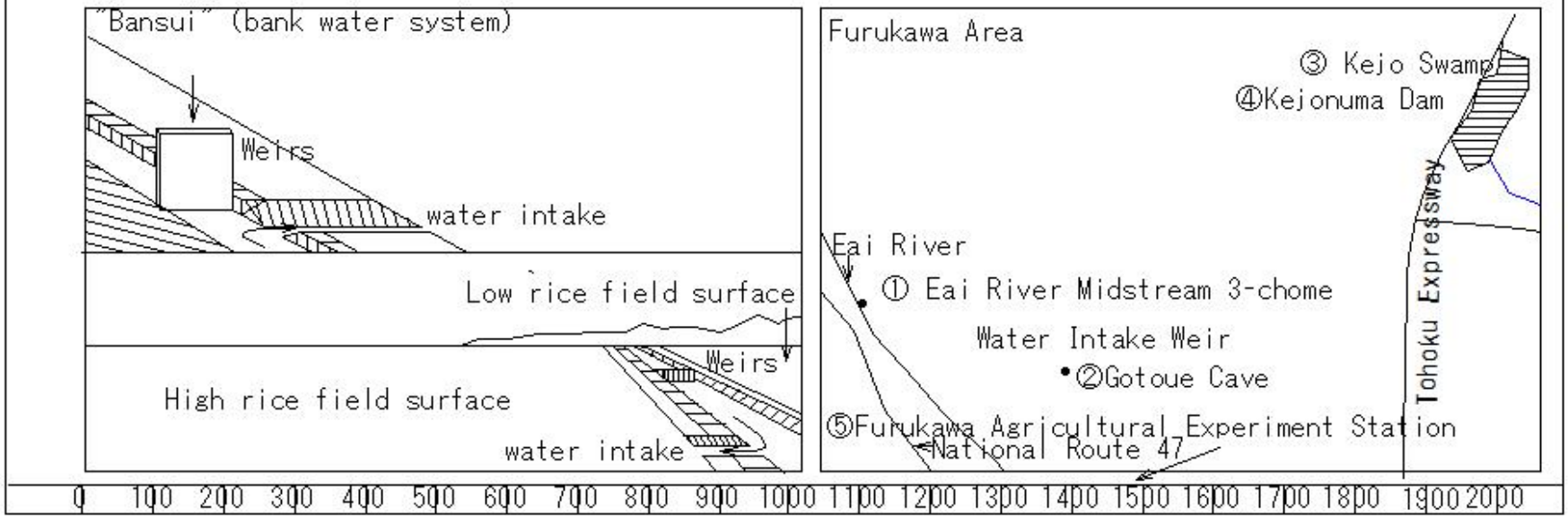
"Bansui" (bank water system)

① In gently sloping areas like the Furukawa River, it is necessary to adjust the amount of water used throughout the area.

② A rotational water distribution system called "bansui" (bank water system) has been used.

③ This system has ensured the water needed for agricultural operations throughout the region.

④ For rice paddies with varying elevations, weirs raise the water level in the irrigation channels and allow water to be diverted to the upstream paddies.



(He320) Osaki Kodo

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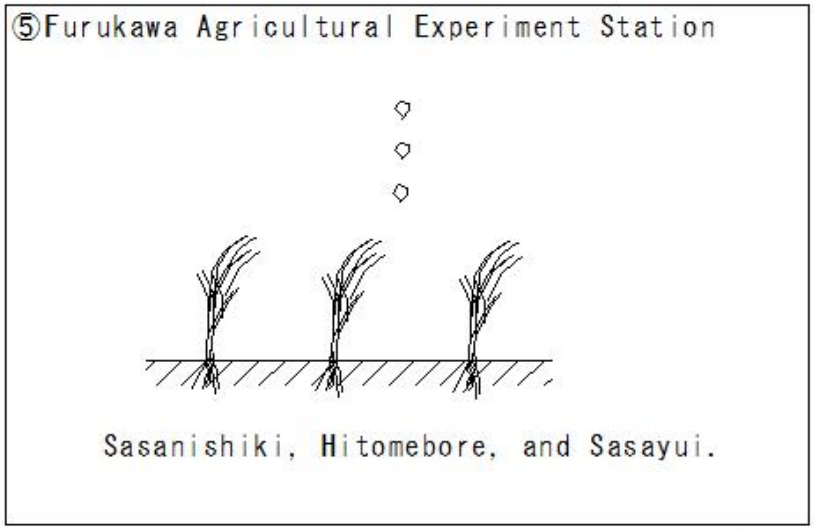
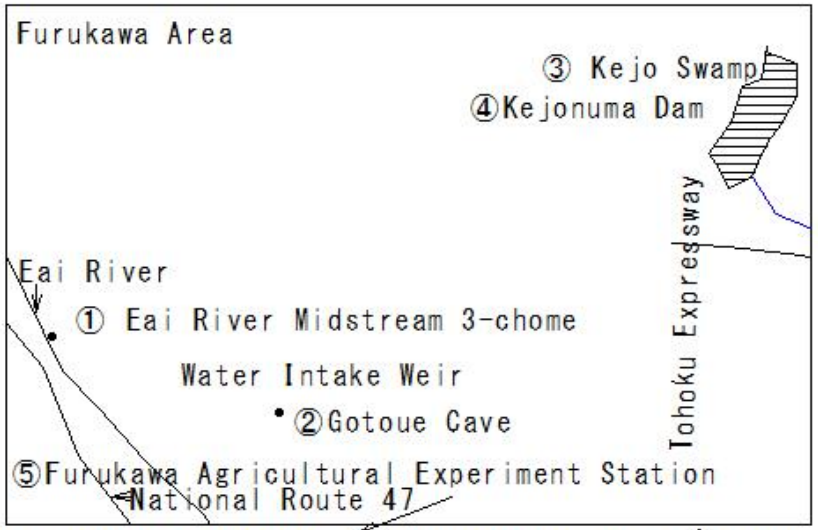
Furukawa Area

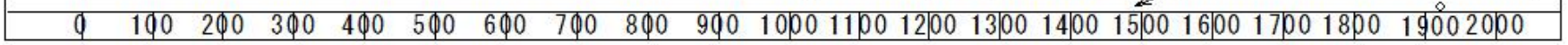
⑤Furukawa Agricultural Experiment Station

①Since its establishment in Furukawa-Suwa, Osaki City, as a branch of the Miyagi Prefectural Agricultural Experiment Station in 1921

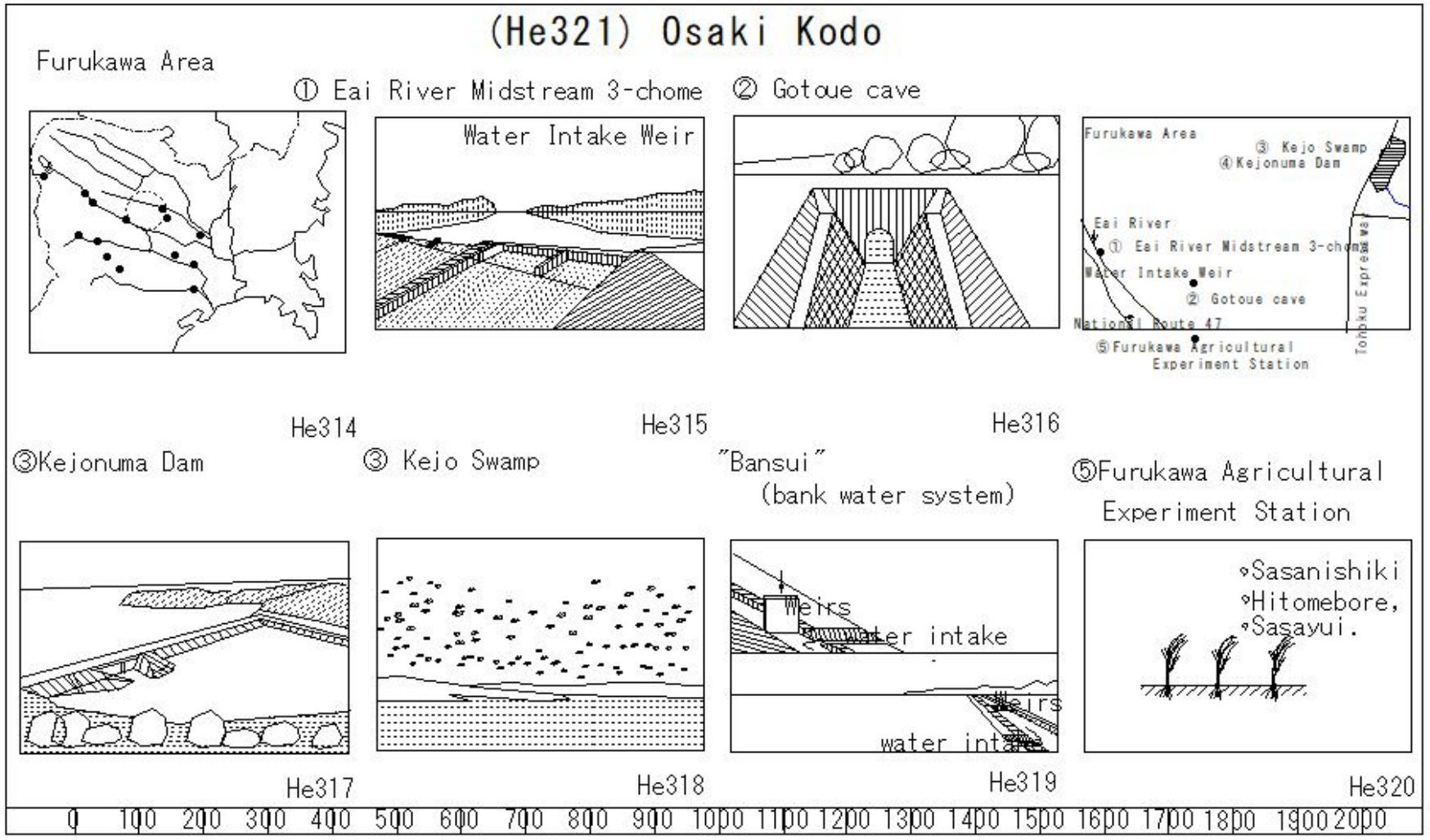
②It has produced Miyagi brand rice varieties such as Sasanishiki, Hitomebore, and Sasayui.







(He321) Osaki Kodo



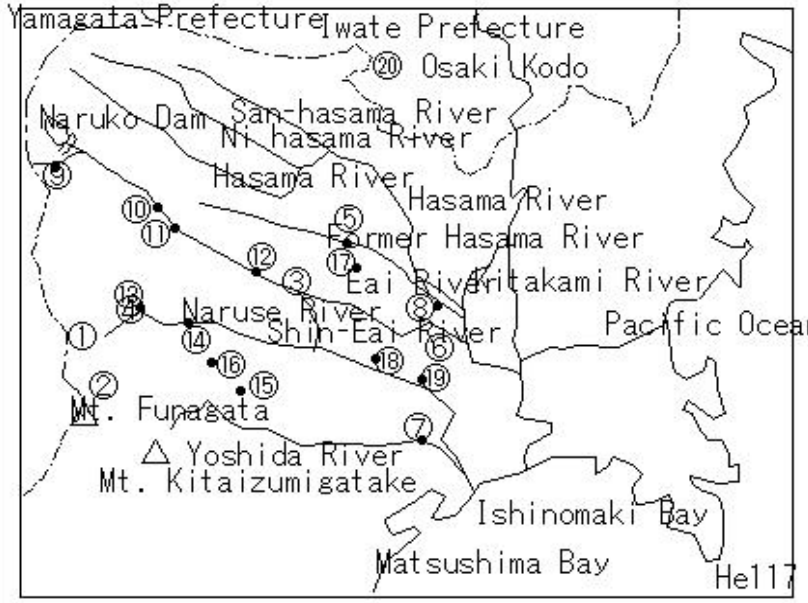
(He322) Osaki Kodo

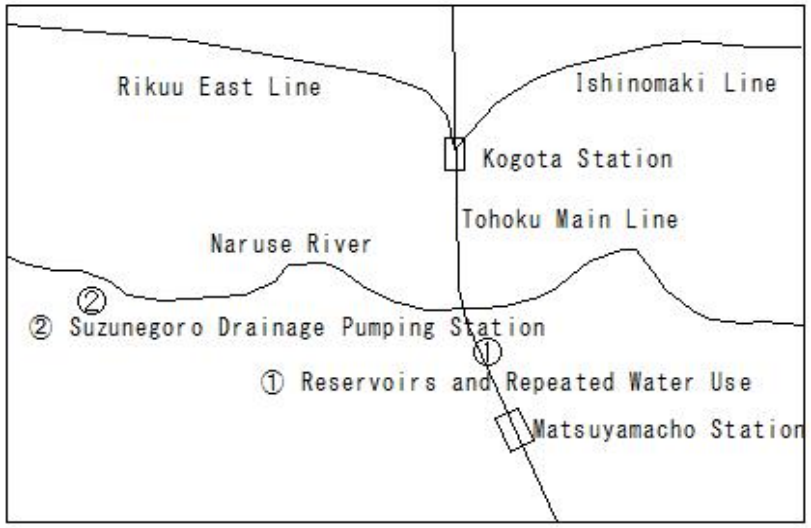
(He322) Osaki Kodo

Matsuyama Area

① During the Edo period, this area flourished as a castle town for the Moniwa clan, a senior retainer of the Date clan, who played a leading role in the development of new rice fields in the Sendai domain.

② The contributions of the local people who cultivated the barren land, often with its many valleys, near the main stream of the Naruse River, are significant.





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(He323) Osaki Kodo

(He323) Osaki Kodo

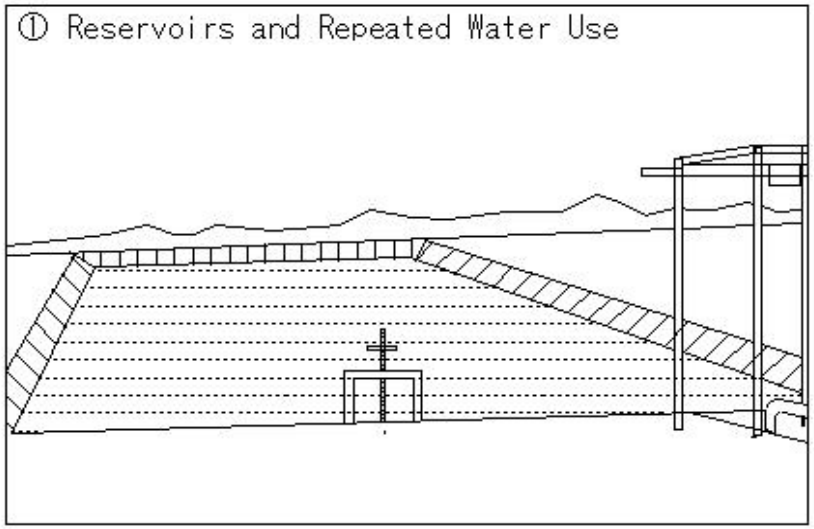
Matsuyama Area

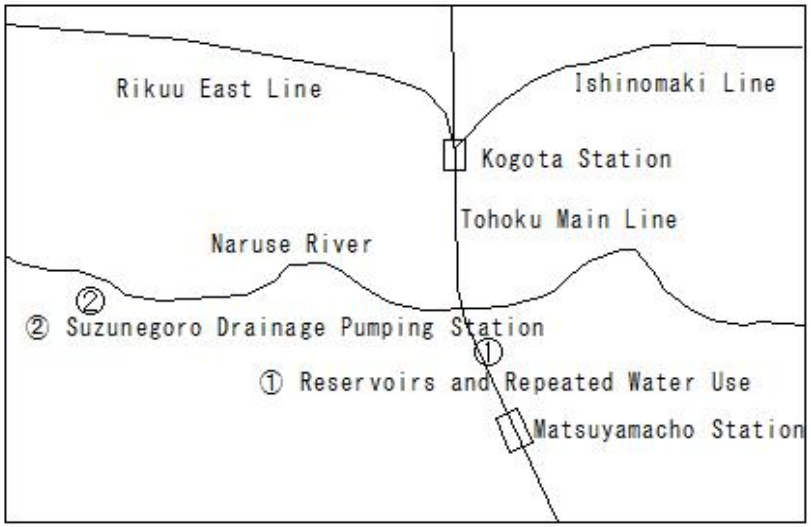
① Reservoirs and Repeated Water Use

① Numerous reservoirs have been constructed as a means of securing irrigation water in the midstream and downstream areas, where water shortages are common.

② There are 1,152 reservoirs throughout the Osaki Kodo area.

③ In addition to raising the water level in drainage channels for repeated use, skillful water management is also practiced to secure irrigation water.





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(He324) Osaki Kodo

(He324) Osaki Kodo

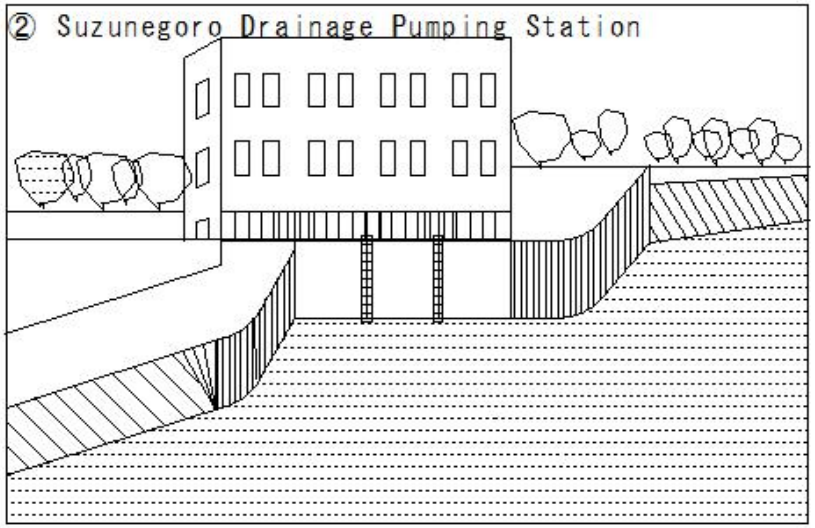
Matsuyama Area

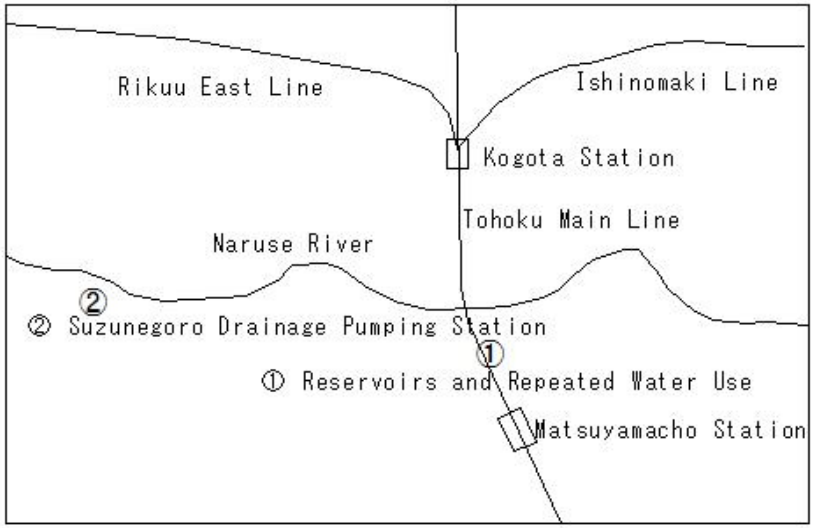
② Suzunegoro Drainage Pumping Station

Side Levee and Suzunegoro Drainage Pumping Station

① A side levee was constructed where the distance between the Naruse River levee and the mountain narrowed to hold back floodwaters and protect the town downstream. As a result, the area upstream of the levee was prone to flooding.

② However, with the completion of the Suzunegoro Drainage Pumping Station in 1989, the situation was greatly improved.





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(He325) Osaki Kodo

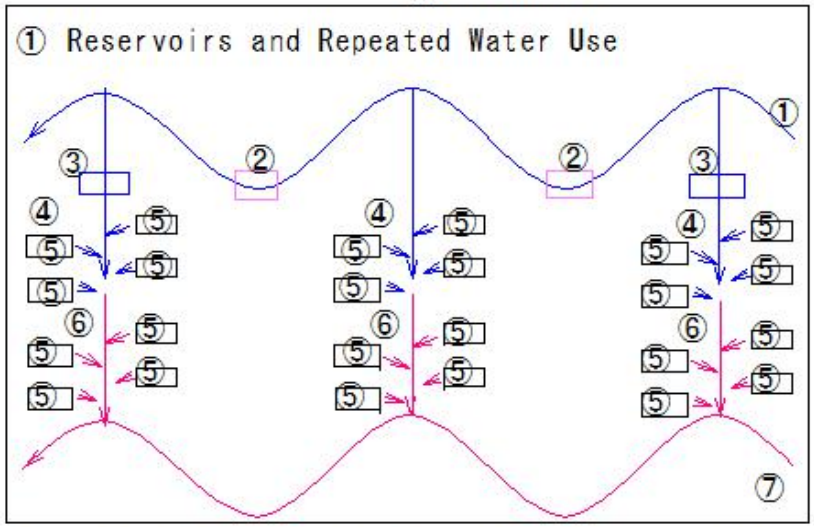
(He325) Osaki Kodo

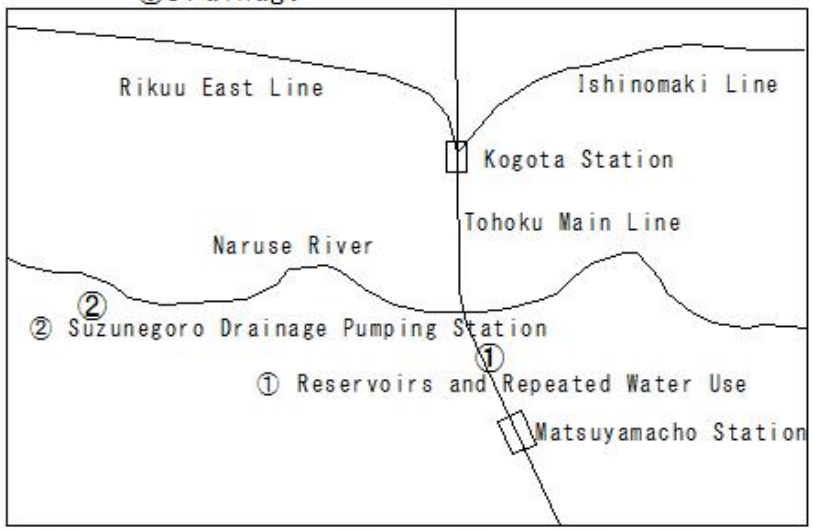
Matsuyama Area

① Reservoirs and Repeated Water Use

1. Reservoirs and Repeated Water Use: In the middle and lower reaches of the river, where available water levels are low, many reservoirs are built in the hilly areas, with 1,152 in total throughout the Osaki Kodo area.

2. Reservoirs are installed to dam up drainage channels, reusing the drainage water to ensure irrigation. ①Arakawa Weir Irrigation Channel ②Tunnels and Subterranean Holes ③Reservoirs ④Irrigation Water ⑤Rice Fields ⑥Drainage ⑦Drainage Channels





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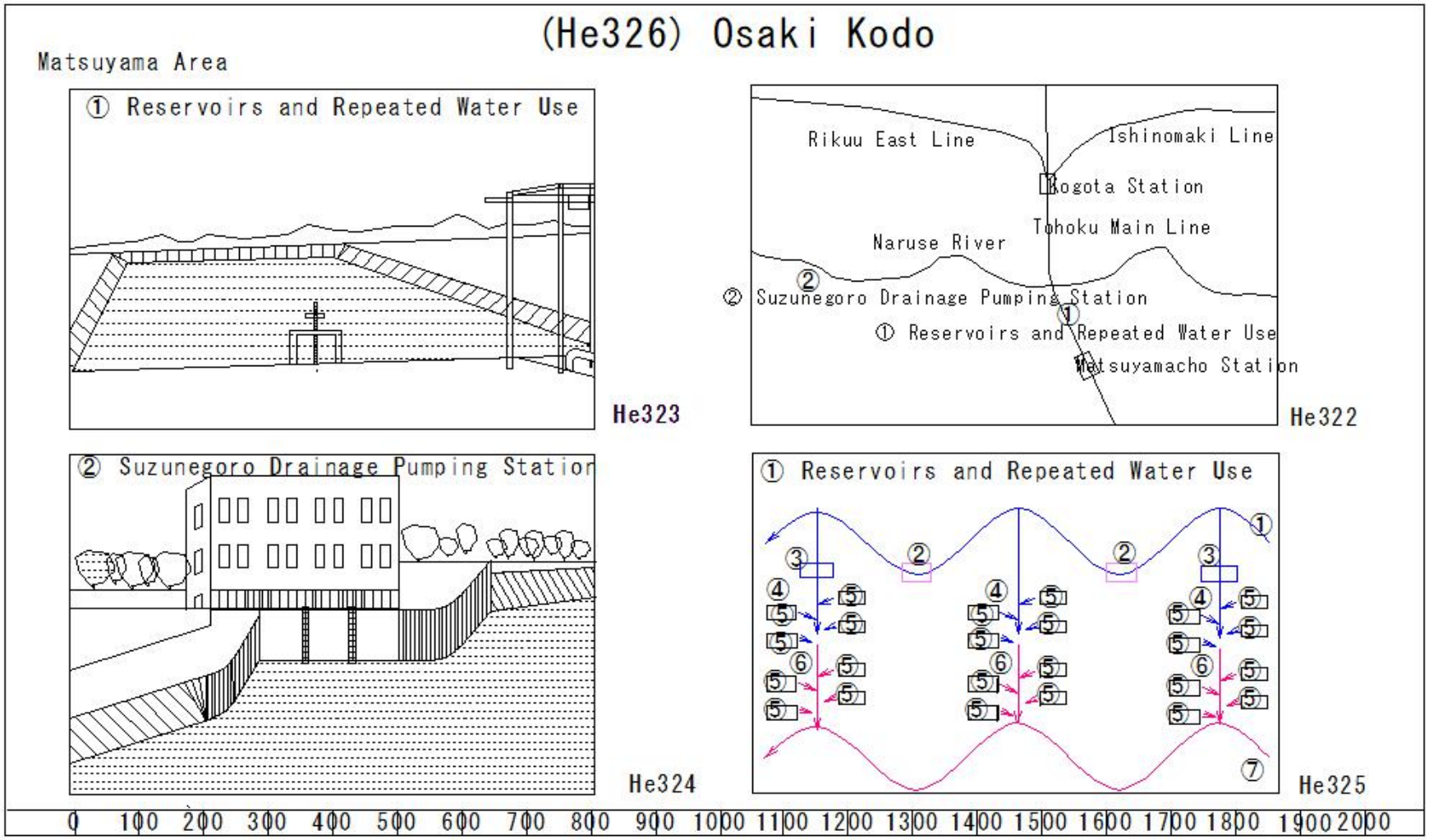
(He326) Osaki Kodo



(He327) Osaki Kodo

(He327) Osaki Kodo

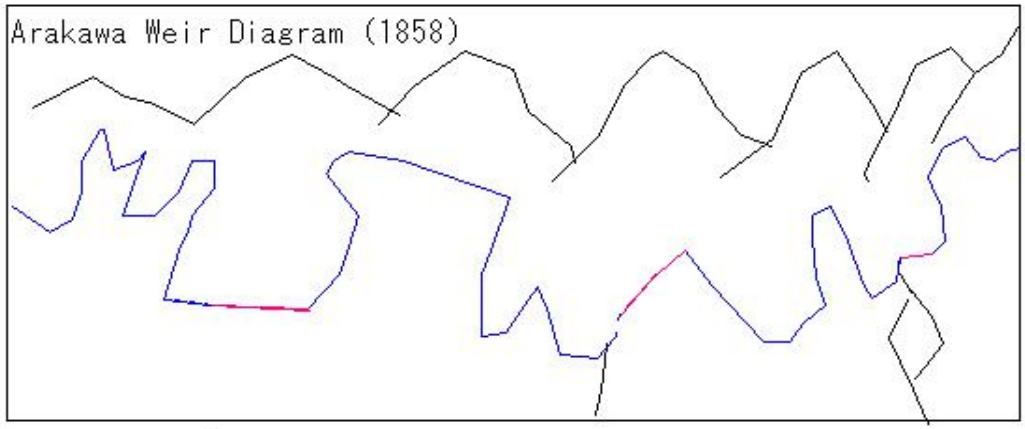
Matsuyama Area

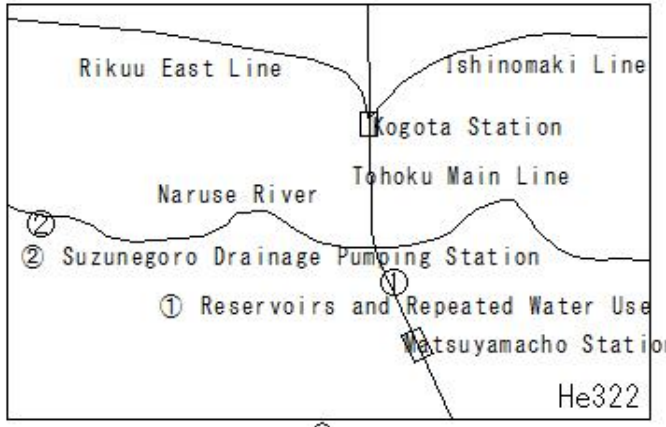
Matsuyama Region: 33km of Waterway

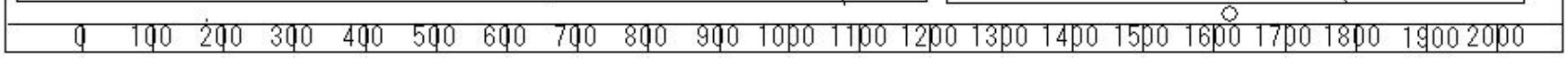
① Construction began in 1626 (the third year of the Kan'ei era) and took three years to complete, converging the Kitakami River, Hasama River, and Eai River.

② Water transportation, drainage, and irrigation functions were improved.

③ The Arakawa Weir, excavated by Maeda Kizaemon and Ogoe Kiemon between 1646 and 1649, ensured water access to the Matsuyama region.







(He328) Osaki Kodo

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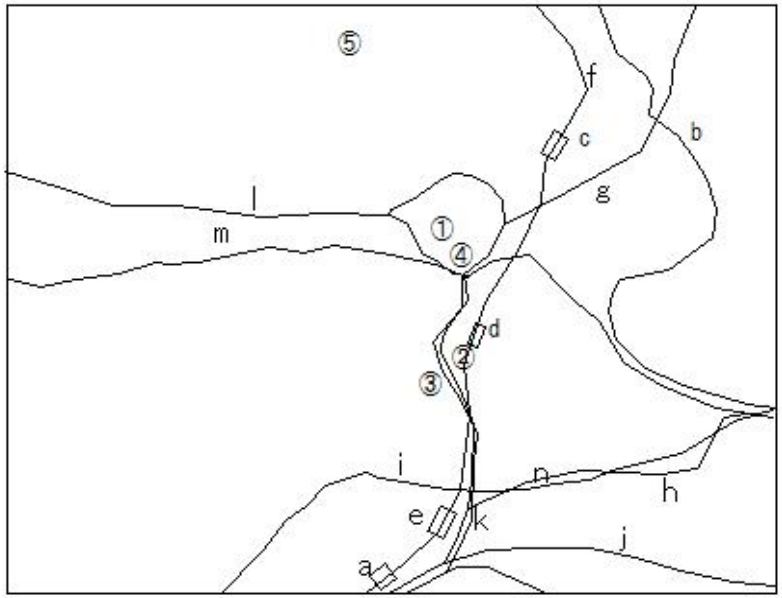
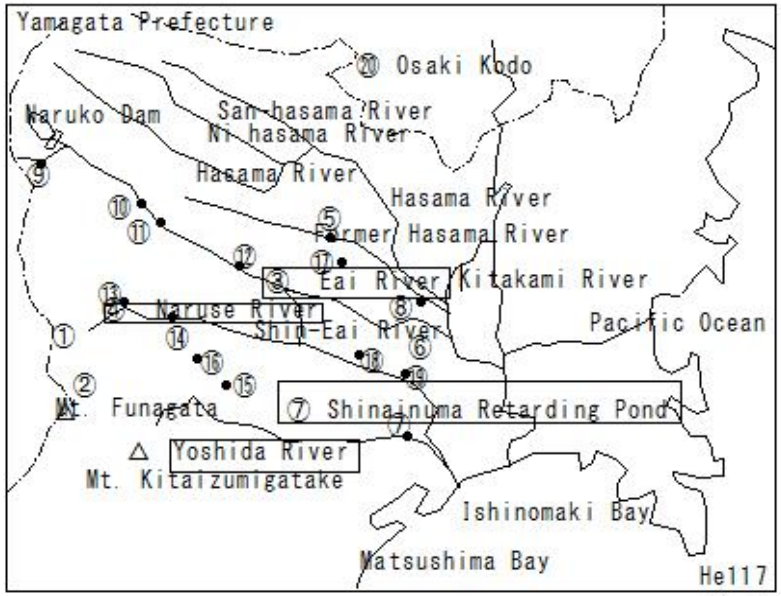
Kashimadai Area

① Shinainuma Retarding Basin
② Genroku Cave
③ Meiji Cave
④ Yoshida River Siphon
⑤ Katsurazawa Reservoir

a Matsushima Station
b Naruse River
c Kashimadai Station
d Shinainuma Station
e Atago Station
f Tohoku Main Line
g National Route 346
h National Route 45
i Sanriku Expressway
j Senseki Line
k Takagi River
l Tsuruta River
m Yoshida River





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(He329) Osaki Kodo

(He329) Osaki Kodo

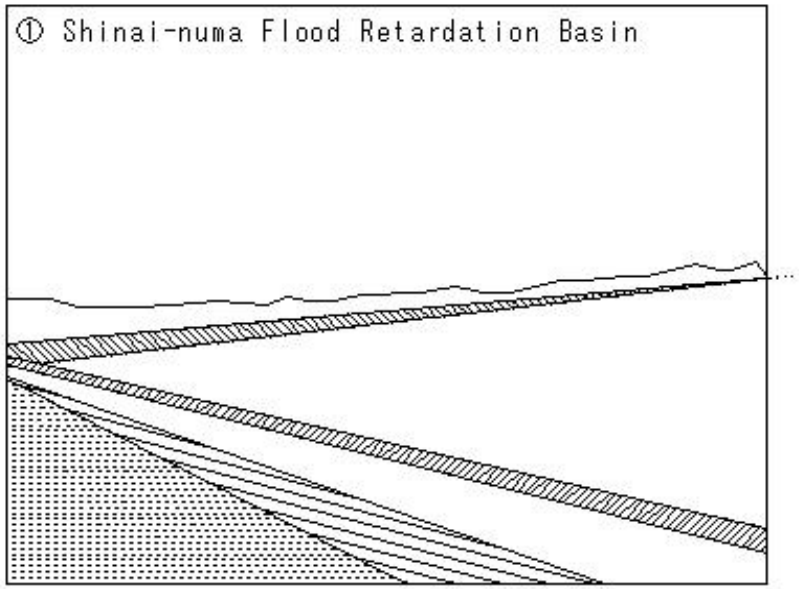
Kashimadai Area

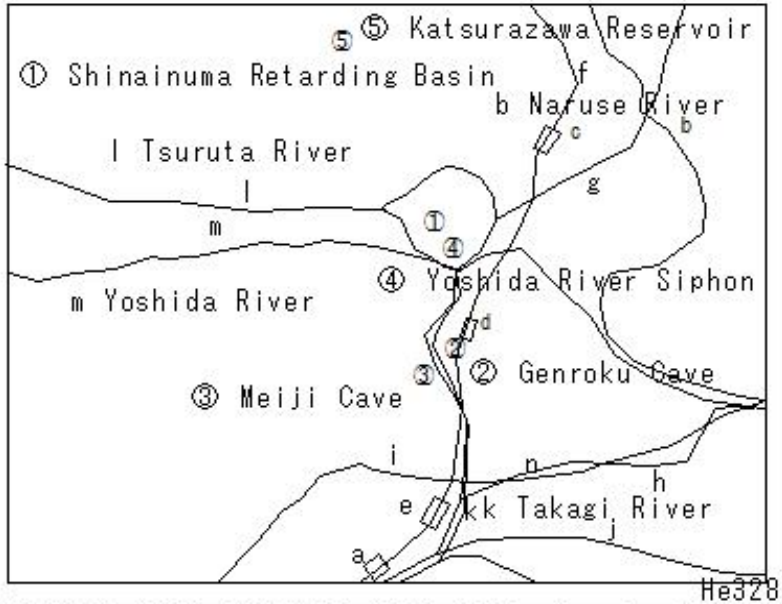
① Shinai-numa Flood Retardation Basin

① The flood-prone Shinai-numa swamp was reclaimed to allow agriculture to enjoy the benefits of the Osaki Kodo soil. While taking advantage of the rice paddy's relatively high tolerance for flooding during large-scale floods,

② Water from the river was temporarily stored in the paddy fields (372 hectares).

③ Damage to other paddy fields and villages was mitigated.





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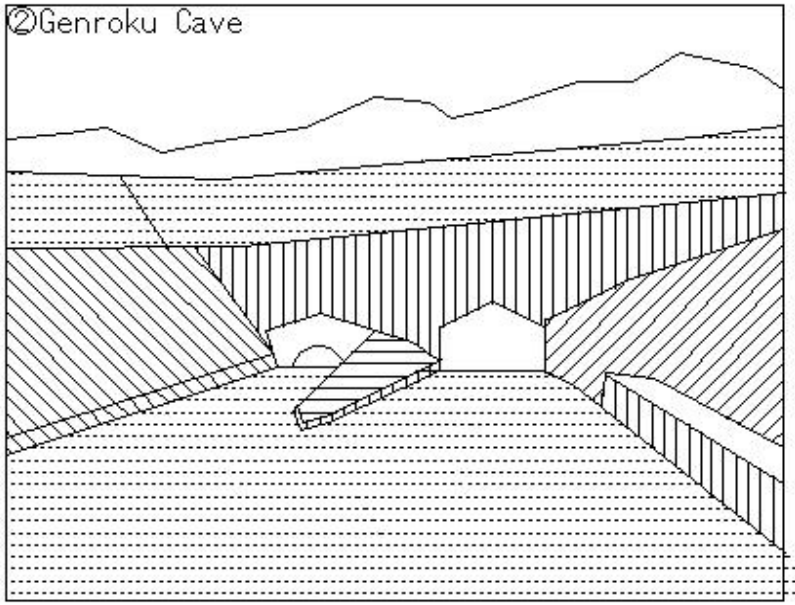
(He330) Osaki Kodo

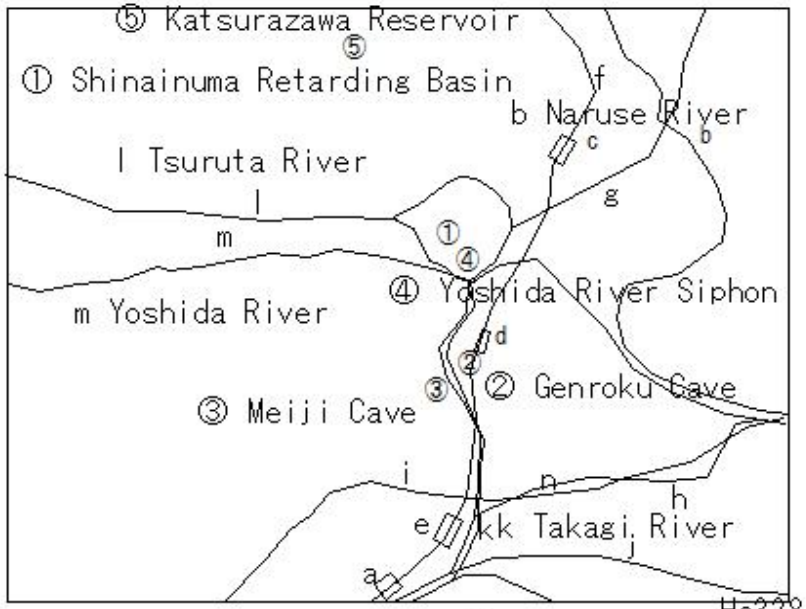
(He330) Osaki Kodo

Kashimadai Area
②Genroku Cave

① The distance from Shinai Swamp, which has long been plagued by flooding, to Matsushima Bay is 7.4 km, with an elevation difference of only 2 m.

② Starting in 1693 (Genroku 6), a difficult project took 11 years to dig two tunnels, each 2,578 m long, across the slight elevation difference, allowing the swamp's water to flow into Matsushima Bay.





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(He331) Osaki Kodo

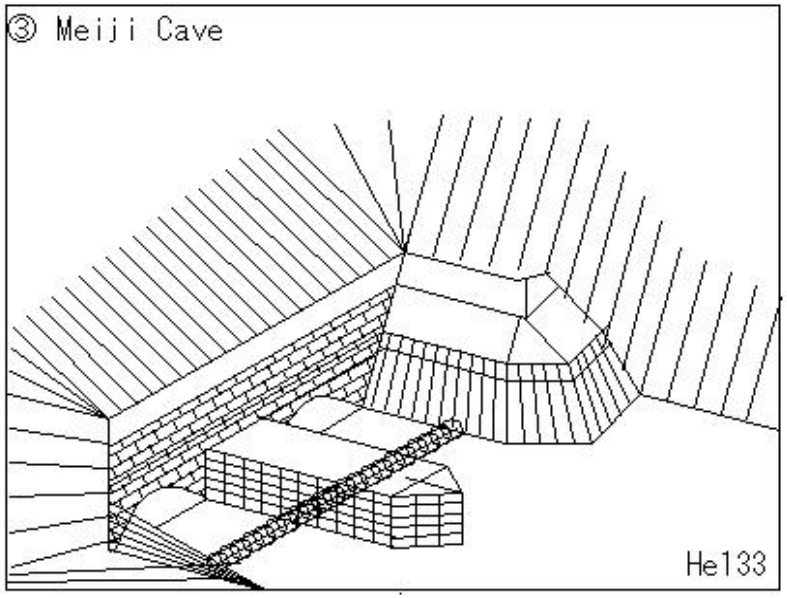
(He331) Osaki Kodo

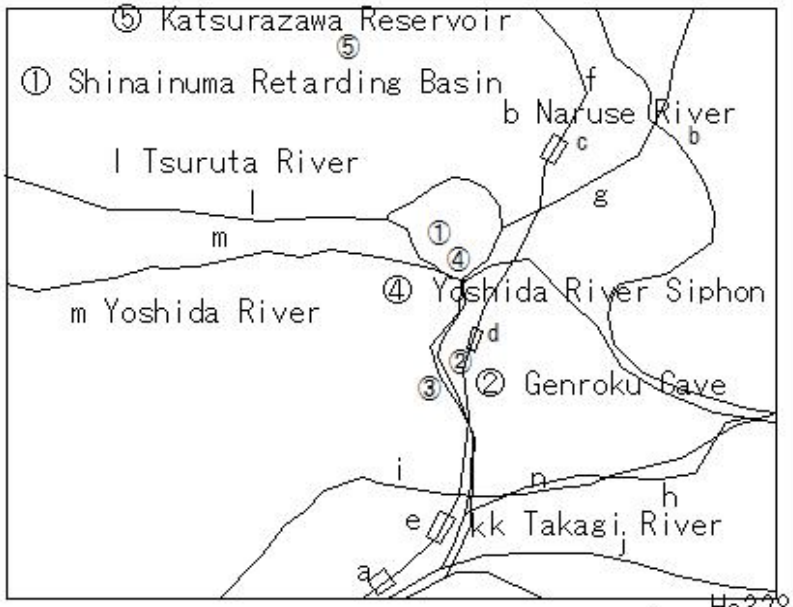
Kashimadai Area

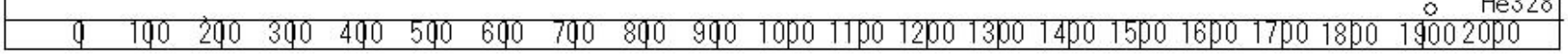
③ Meiji Cave

① After the Genroku cave was completed, the flow of the cave deteriorated over the years due to sediment and other factors, resulting in flooding every time there was heavy rain.

② Thanks to the efforts of Kamata Sannosuke, the mayor of Kashimadai Village, affectionately known as the "Waraji Village Mayor," a new cave was completed in 1910 (Meiji 43).







(He332) Osaki Kodo

Kashimadai Area

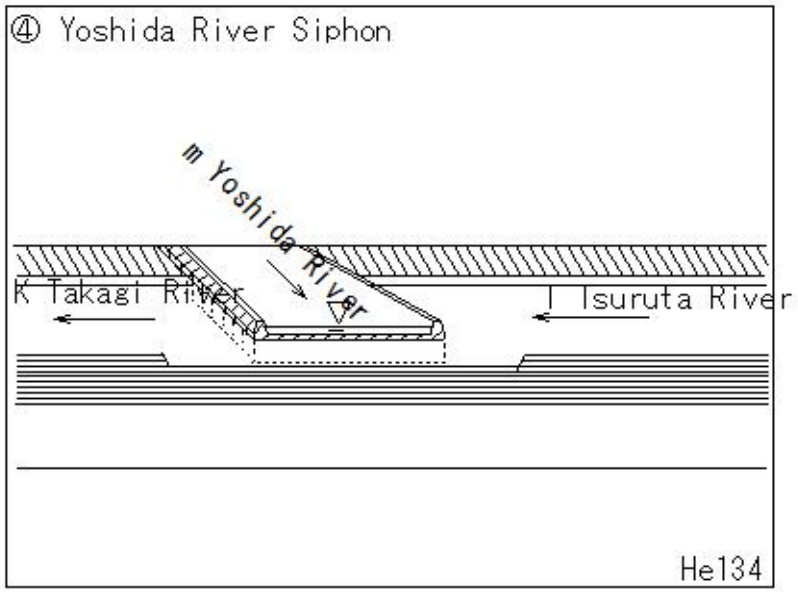
(He332) Osaki Kodo

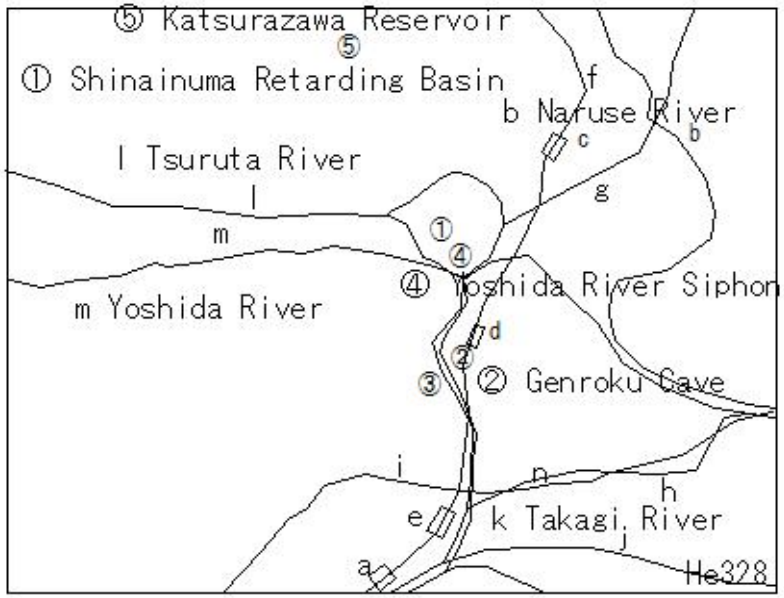
④ Yoshida River Siphon

① This river overpass, completed in 1940, drains the Tsuruta River, which flows through Shinai Lake, by diving it under the Yoshida River.

② After crossing the Yoshida River, the river changes its name to the Takajo River, connects to the Meiji Pit, and flows into Matsushima Bay.

③ In 1977, the completion of the massive reclamation project, which took approximately 200 years, was announced.





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(He333) Osaki Kodo

Kashimadai Area

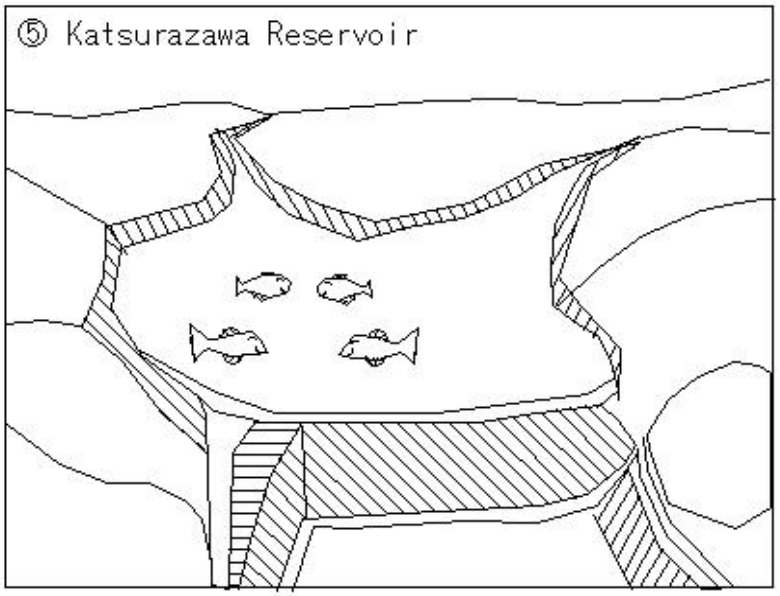
⑤ Katsurazawa Reservoir

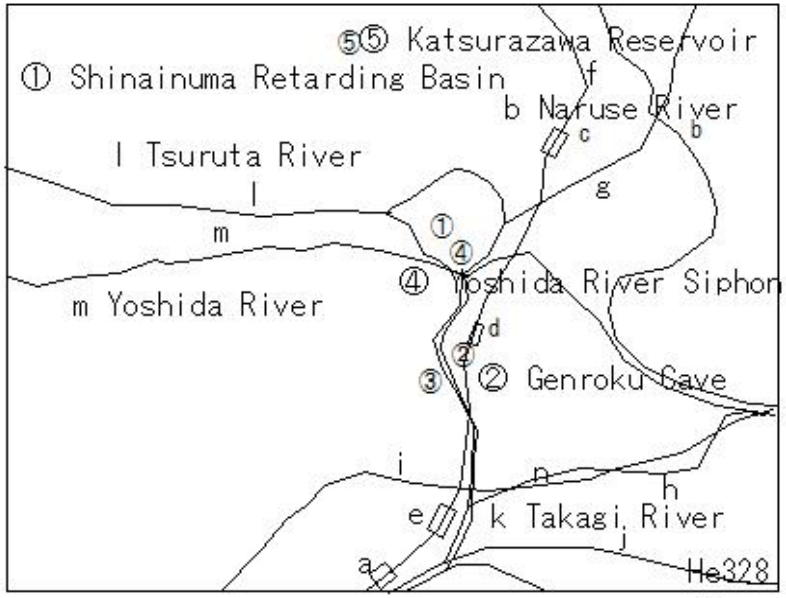
(He333) Osaki Kodo

① In 1993, the Japanese minnow, a carp species thought to be extinct, was discovered in this reservoir for the first time in 60 years.

② The Ministry of the Environment designated the "Group of Reservoirs Surrounding the Former Shinai Numa" as one of Japan's 500 Important Wetlands.

③ Activities such as draining the pond are carried out to maintain a healthy environment.





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(He334) Osaki Kodo

Kashimadai Area

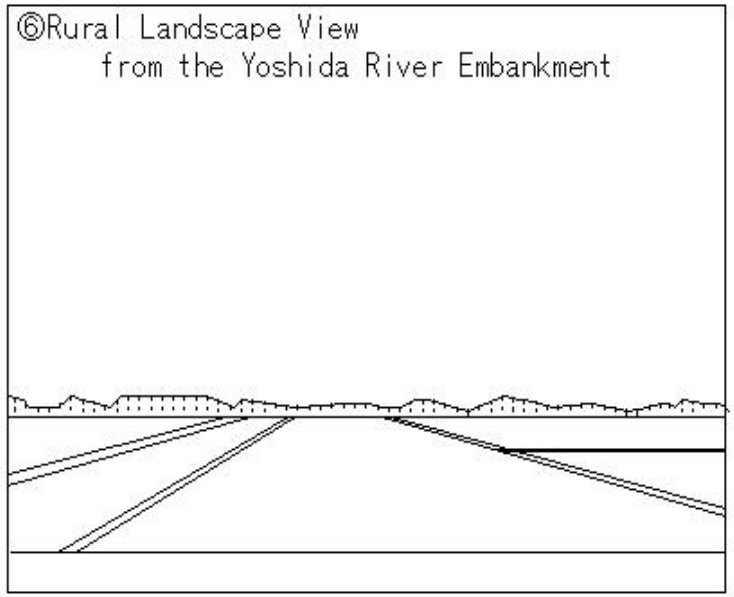
(He334) Osaki Kodo

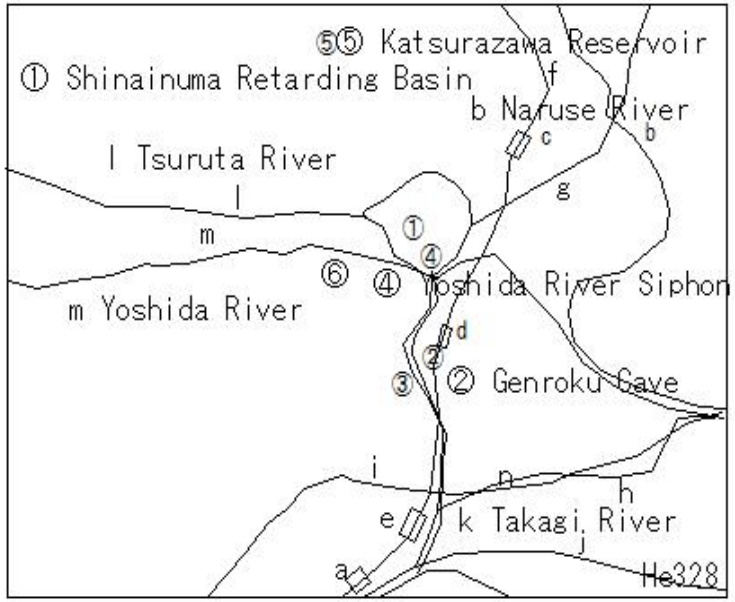
⑥Rural Landscape View from the Yoshida River Embankment

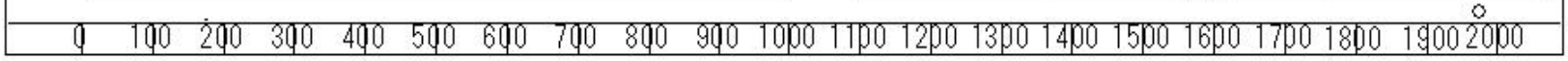
Landscape

① The terrain is flat, with a gradient of about 1:2500
(a difference in elevation of 1 meter per 2500 meters).

② The flood-prone Kashimadai area was reclaimed and drained through the painstaking efforts of our ancestors. Overcoming repeated floods, the area now offers a panoramic view of vast farmland as far as the eye can see.







(He335) Osaki Kodo

Kashimadai Area

(He335) Osaki Kodo

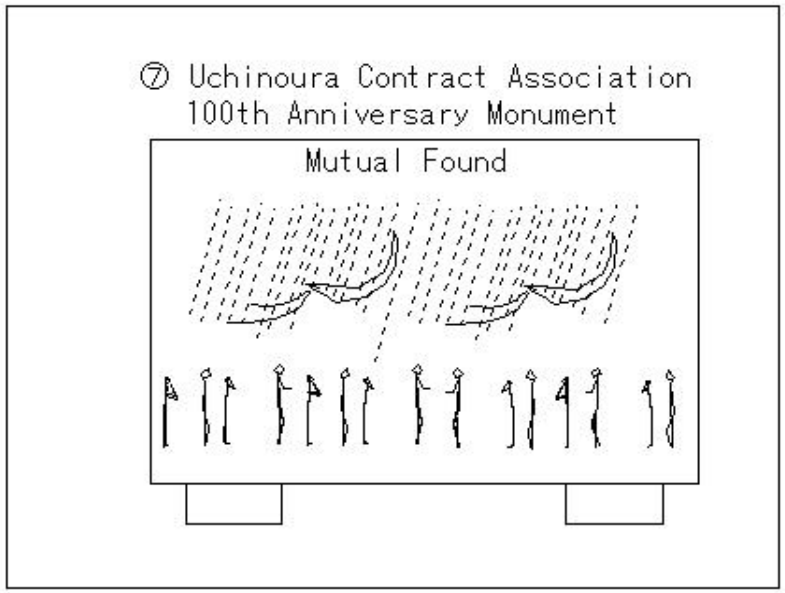
⑦ Uchinoura Contract Association 100th Anniversary Monument

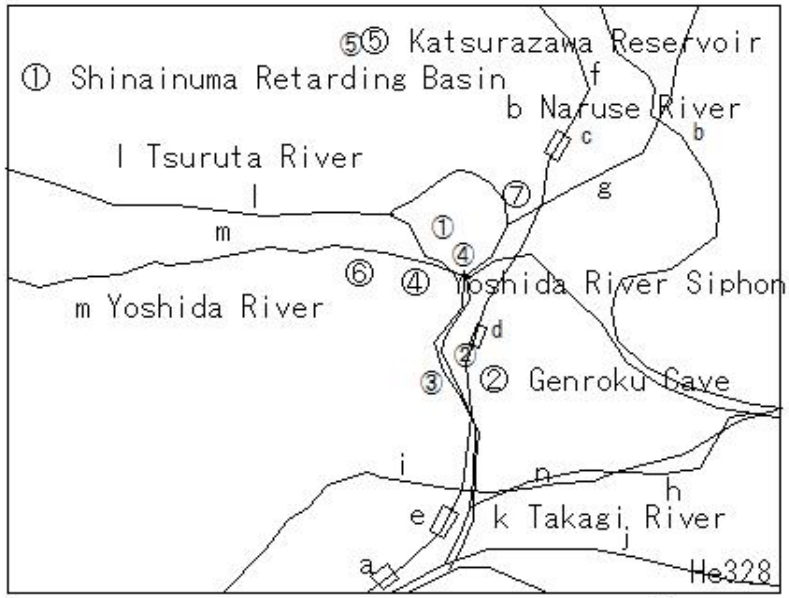
Traditional Agricultural Culture

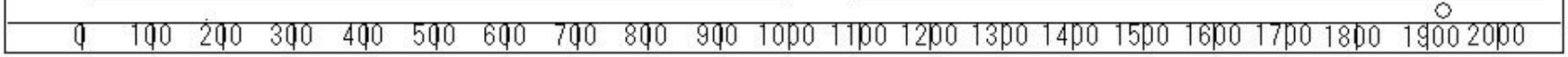
① Uchinoura Contract Association was founded in 1914.

② Despite repeated floods and poverty, the people cleared wasteland, worked together in agriculture, and supported each other in their daily lives to maintain the community.

③ This monument serves as a testament to that.







(He336) Osaki Kodo

Kashimadai Area

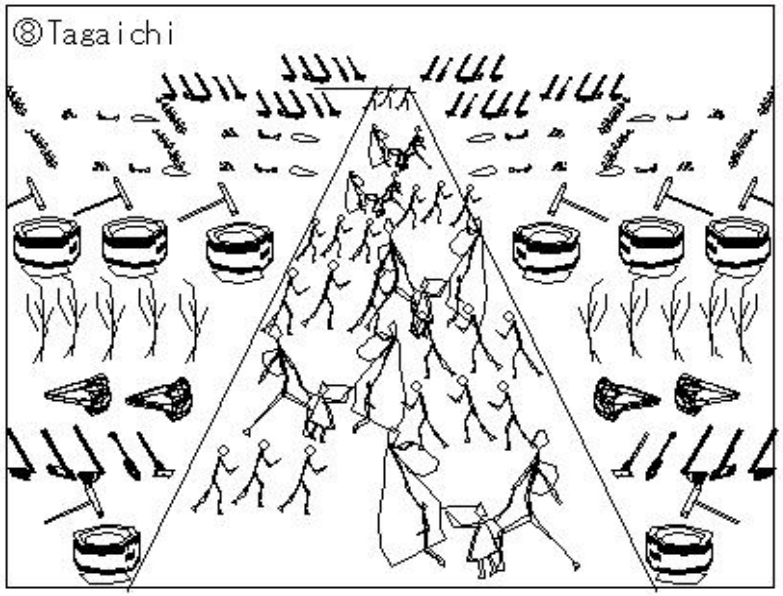
⑧Tagaichi

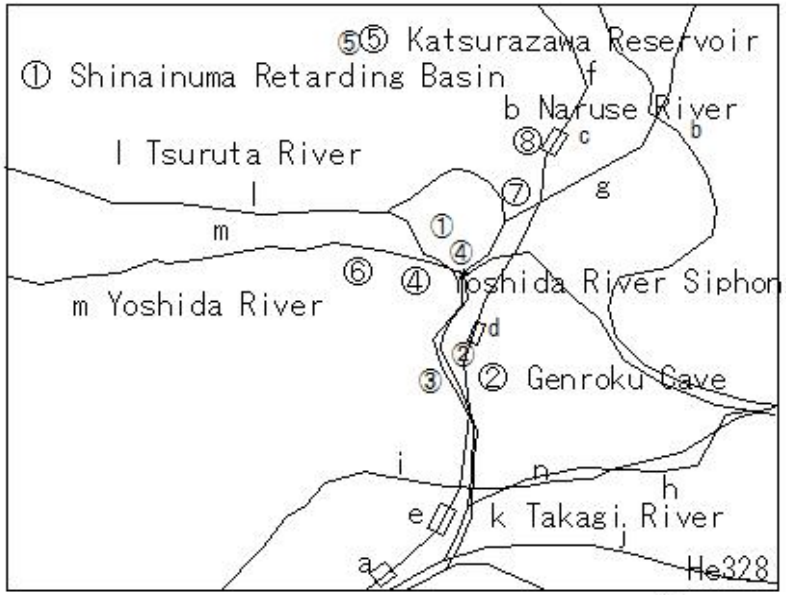
Traditional Agricultural Culture

(He336) Osaki Kodo

① In 1910, Mayor Sannosuke Kamata merged 14 village shrines into Kashimadai Shrine.
This market was established to promote the welfare of villagers by selling agricultural and processed goods produced by the villagers.

② This traditional market boasts one of the largest scales in the Tohoku region.





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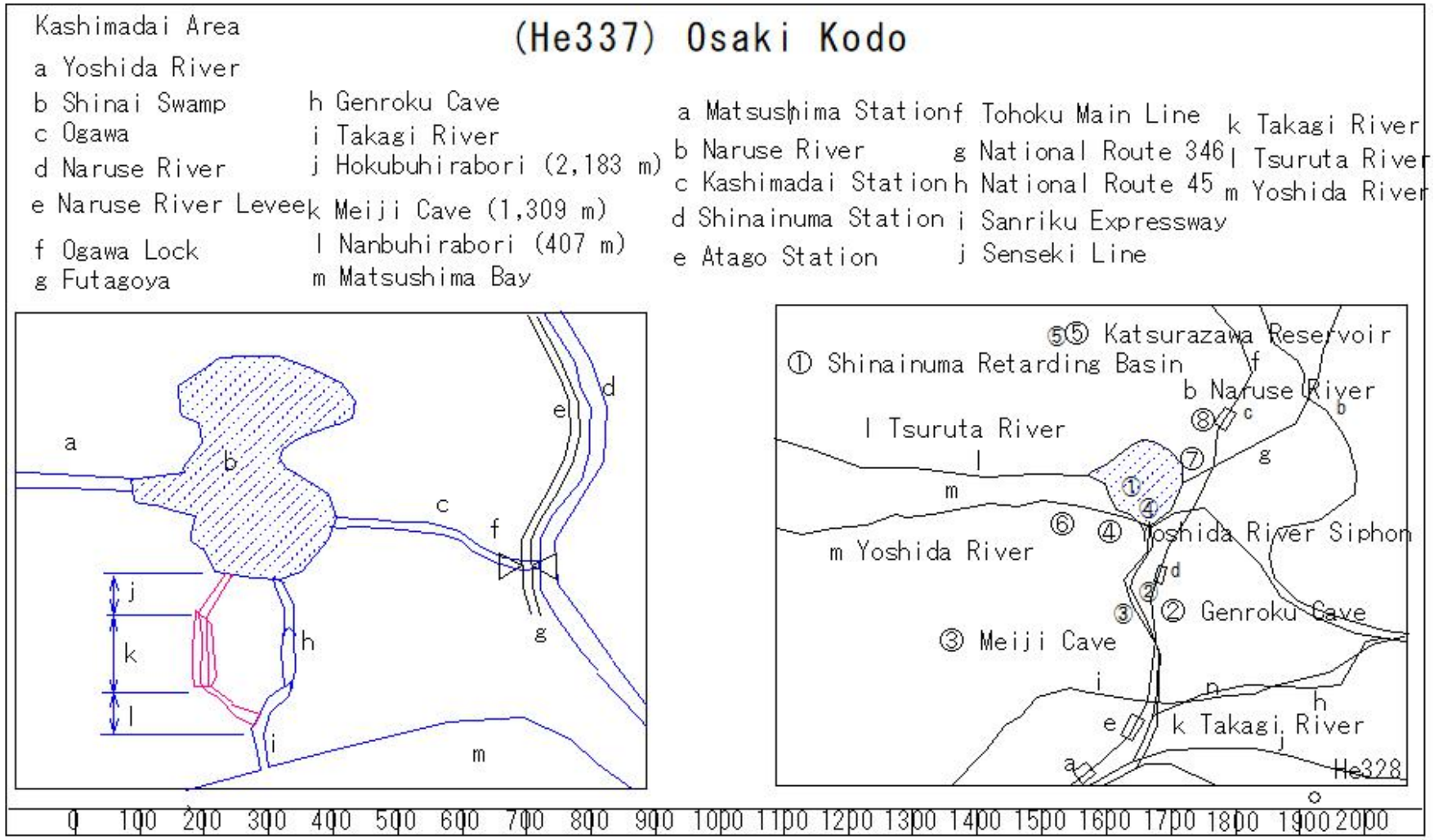
(He337) Osaki Kodo



(He338) Osaki Kodo

(He338) Osaki Kodo

Kashimadai Area

Genroku Drilling Hole

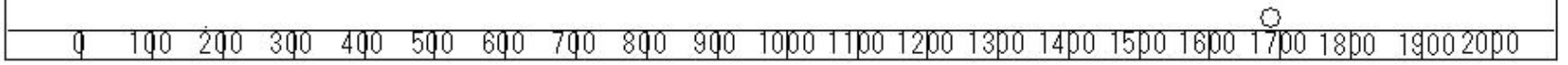
① The Genroku Drilling Hole is an artificial tunnel built to drain water from Shinai Lake into Matsushima Bay, prevent backflow of the Naruse River, eliminate flooding, and open up new rice paddies in Shinai Lake.

② Construction took place over five years, from 1693 (Genroku 6) to 1698 (Genroku 11) during the Edo period, resulting in many casualties.

③ The Tsuruzawa Tunnel (current location), also known as the "Drilling Hole," is a vertical hole dug using the Genroku Drilling Hole construction method.

④ The difference in slope between Shinai Lake and Matsushima Bay is only 4.59 meters. Furthermore, the tunnel's length of 2,578 meters made construction impossible with the technology of the time.

⑤ Therefore, it is believed that a vertical hole was first dug, and then a horizontal hole (drilling hole) was dug between the two vertical holes.



(He339) Osaki Kodo

Genroku Drilling Hole

(He339) Osaki Kodo

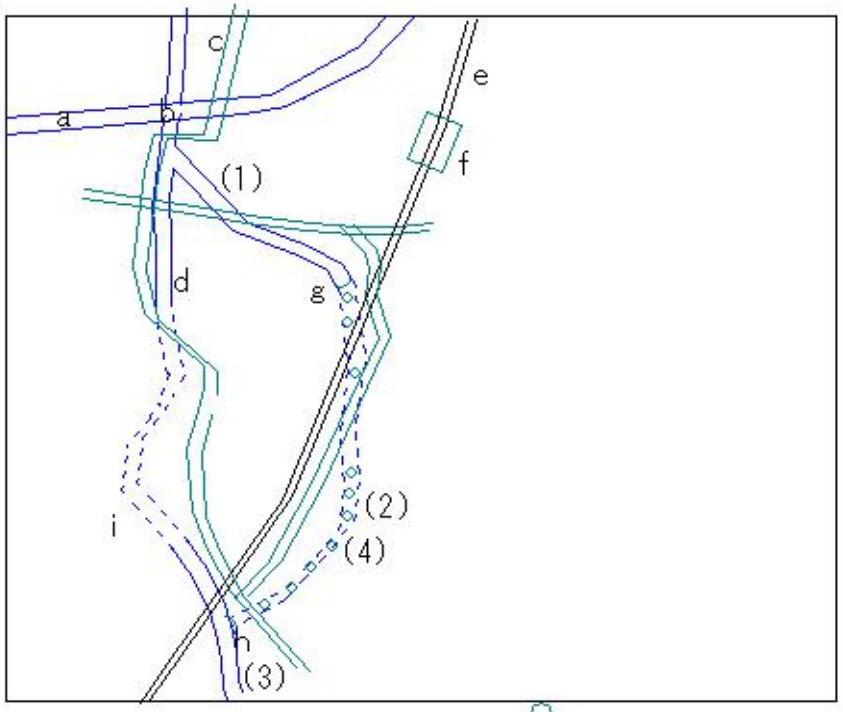
a Yoshida River
b Yoshida River Siphon
c R346
d Takagi River
e Tohoku Main Line
f Shinainuma Station
g Genroku Cave - Anagashira
h Genroku Cave - Anajiri
i Meiji Cave (1,309m)

(1) Northern Flat Moat
(from Shinainuma to Anagashira)
*Length: 1,754m *Width: 27m *Depth: 2m

(2) Cave (from Anagashiri to Anajiri)
*Length: 2,578m *Width: 3.6m *Height: 2.4m (2-section)

(3) Southern Flat Moat
(from Anajiri to Matsushima Bay)
*Length: 3,065m *Width: 18m *Depth: 2m

(4) Vertical Holes (Drop Holes): 10



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(He340) Osaki Kodo

(He340) Osaki Kodo

Kashimadai Area

Genroku Drilling Hole

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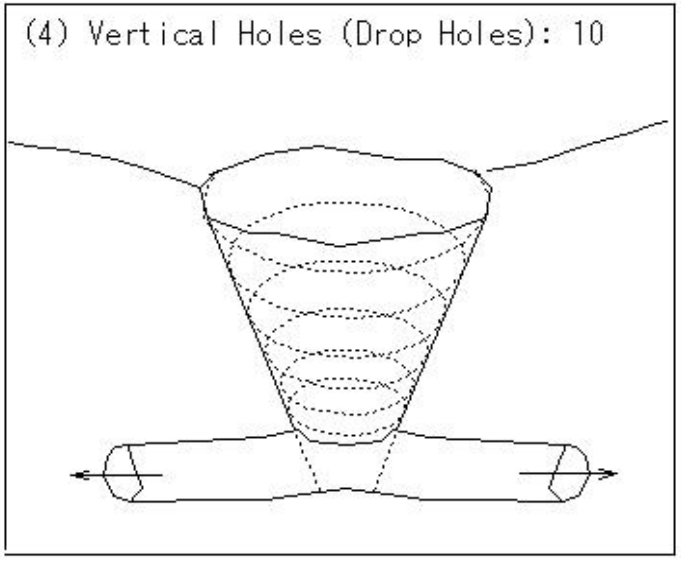

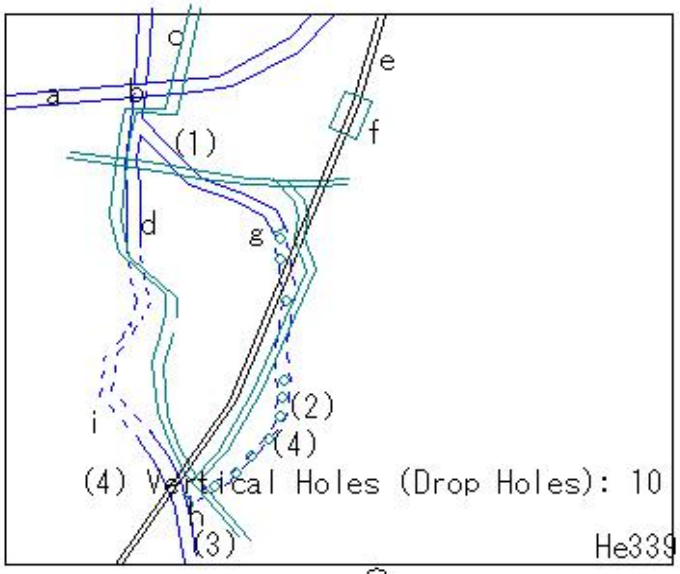

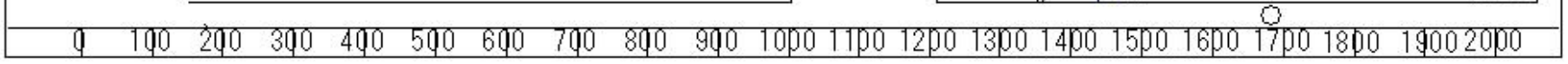

(He341) Osaki Kodo

(He341) Osaki Kodo

Kashimadai Area

Genroku Drilling Hole

③ The Tsuruzawa Tunnel (current location), also known as the "Drilling Hole," is a vertical hole dug using the Genroku Drilling Hole construction method.

④ The difference in slope between Shinai Lake and Matsushima Bay is only 4.59 meters. Furthermore, the tunnel's length of 2,578 meters made construction impossible with the technology of the time.

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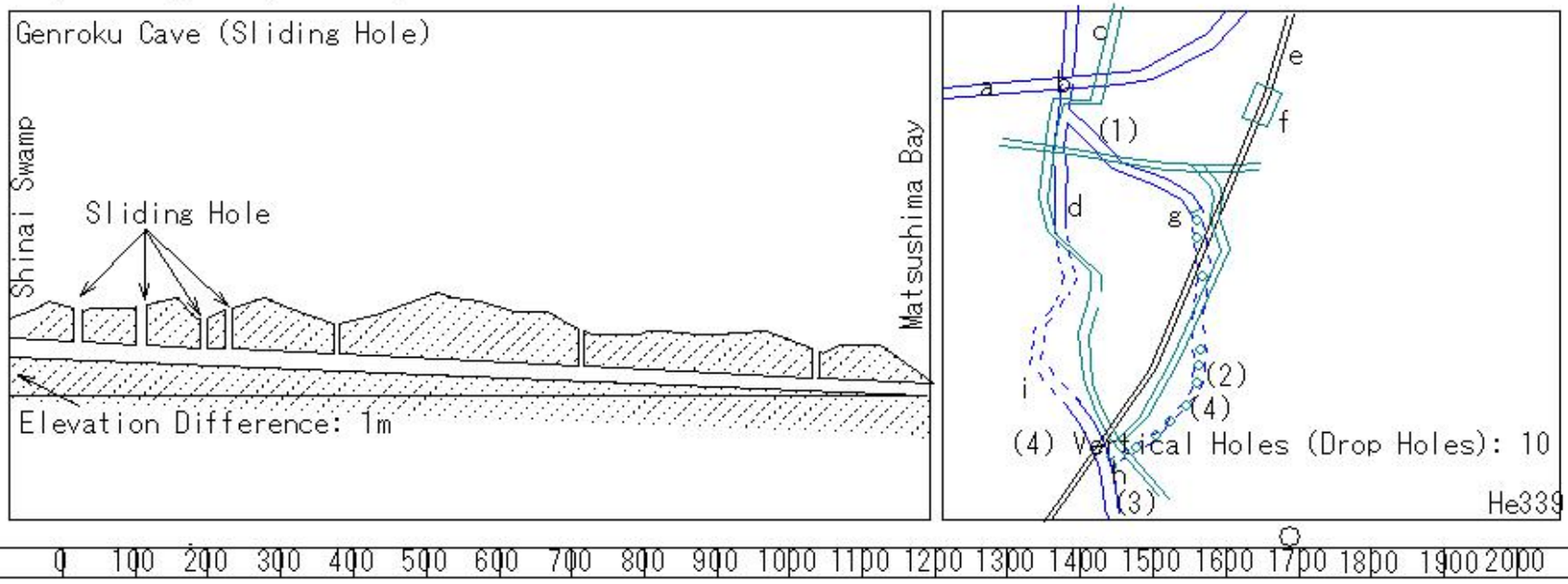
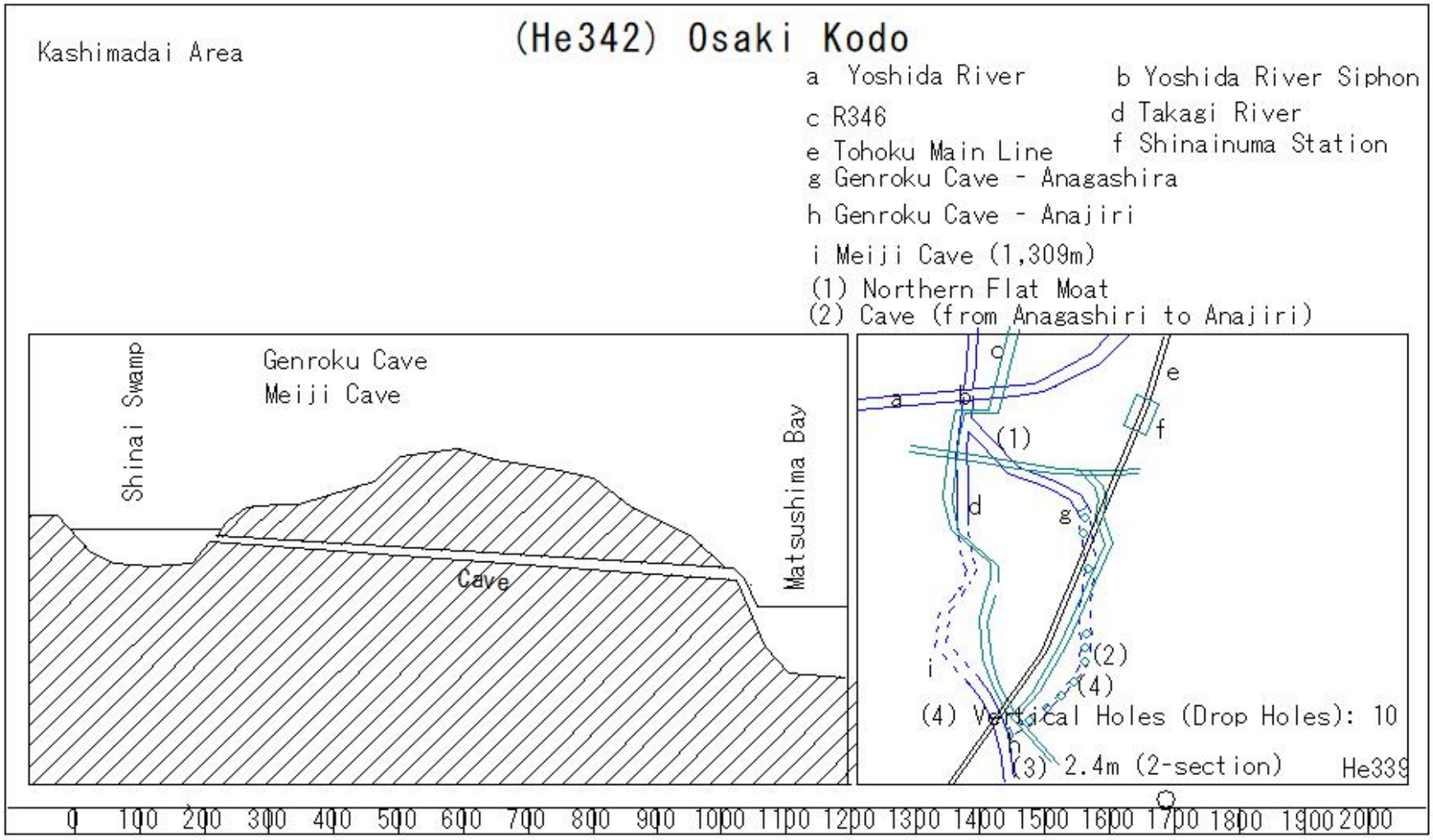


(He342) Osaki Kodo



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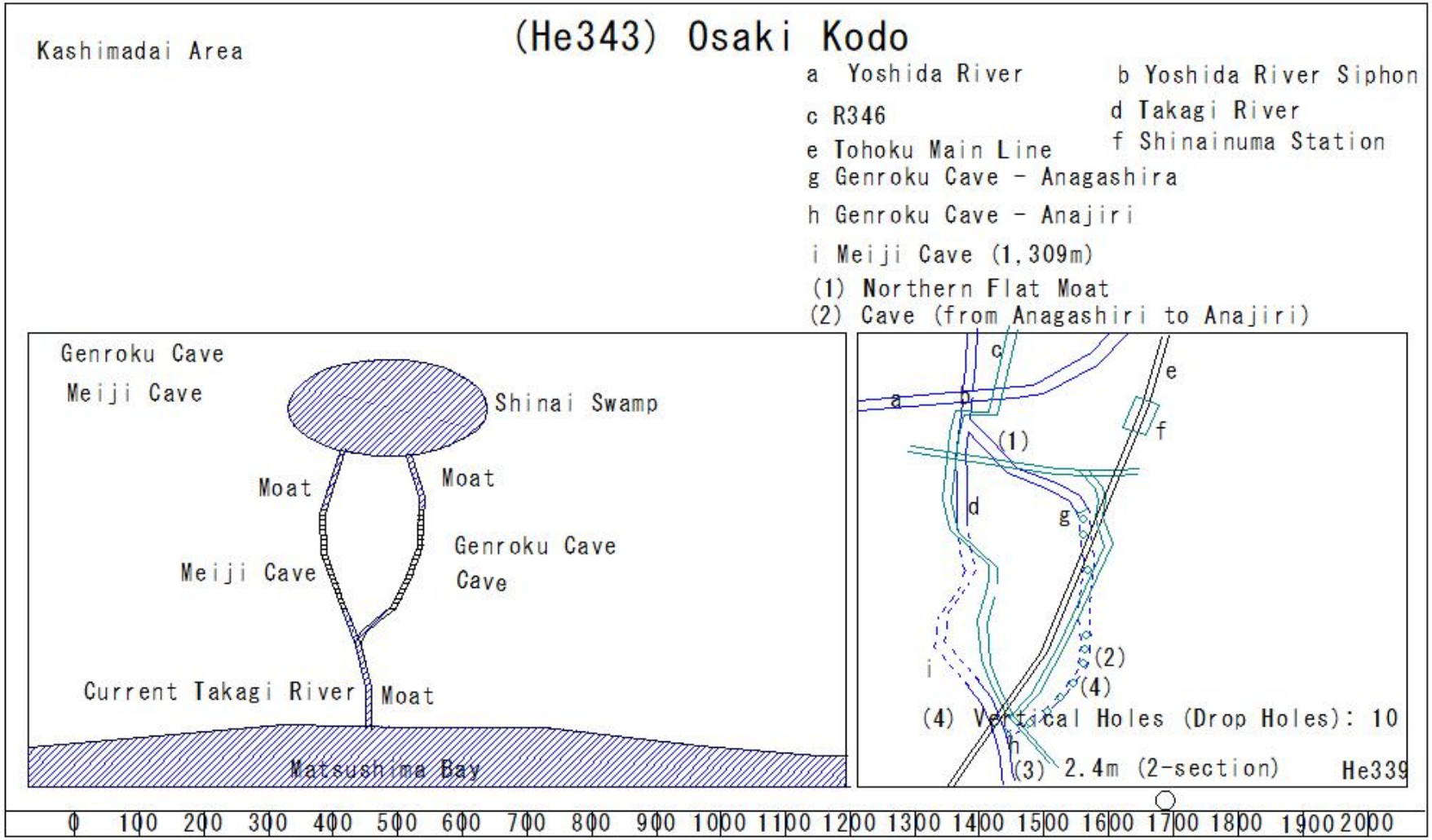

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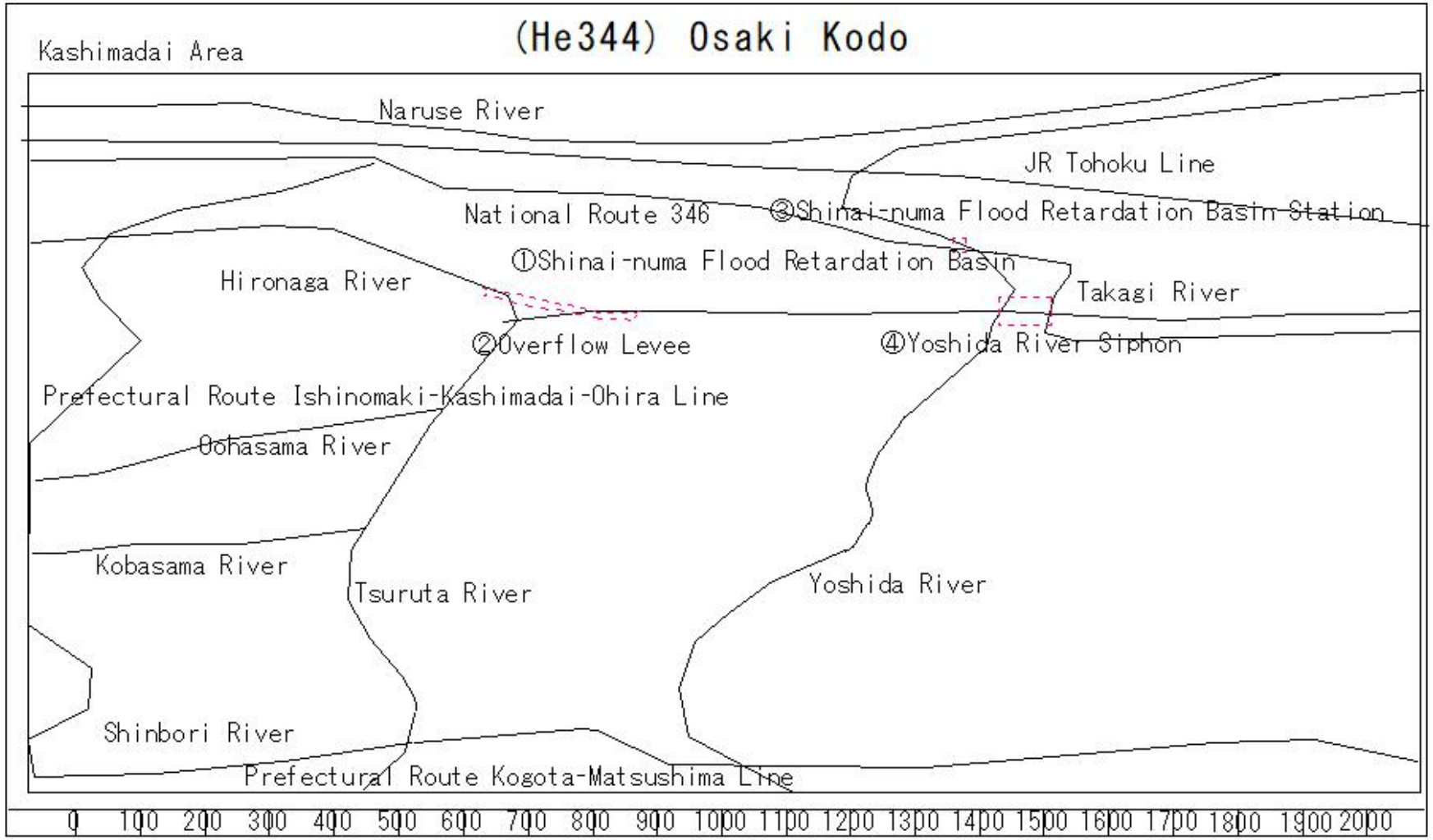

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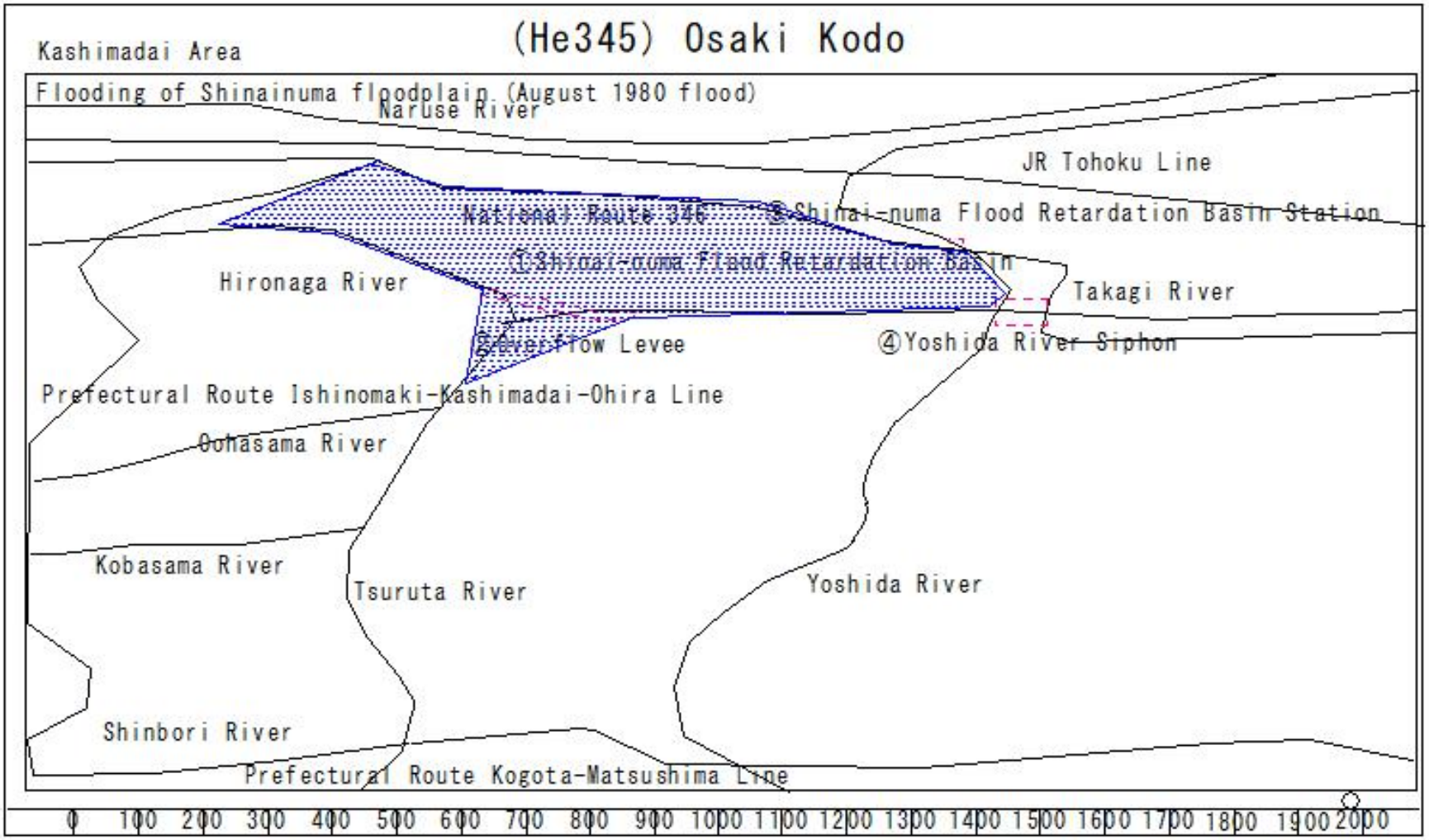

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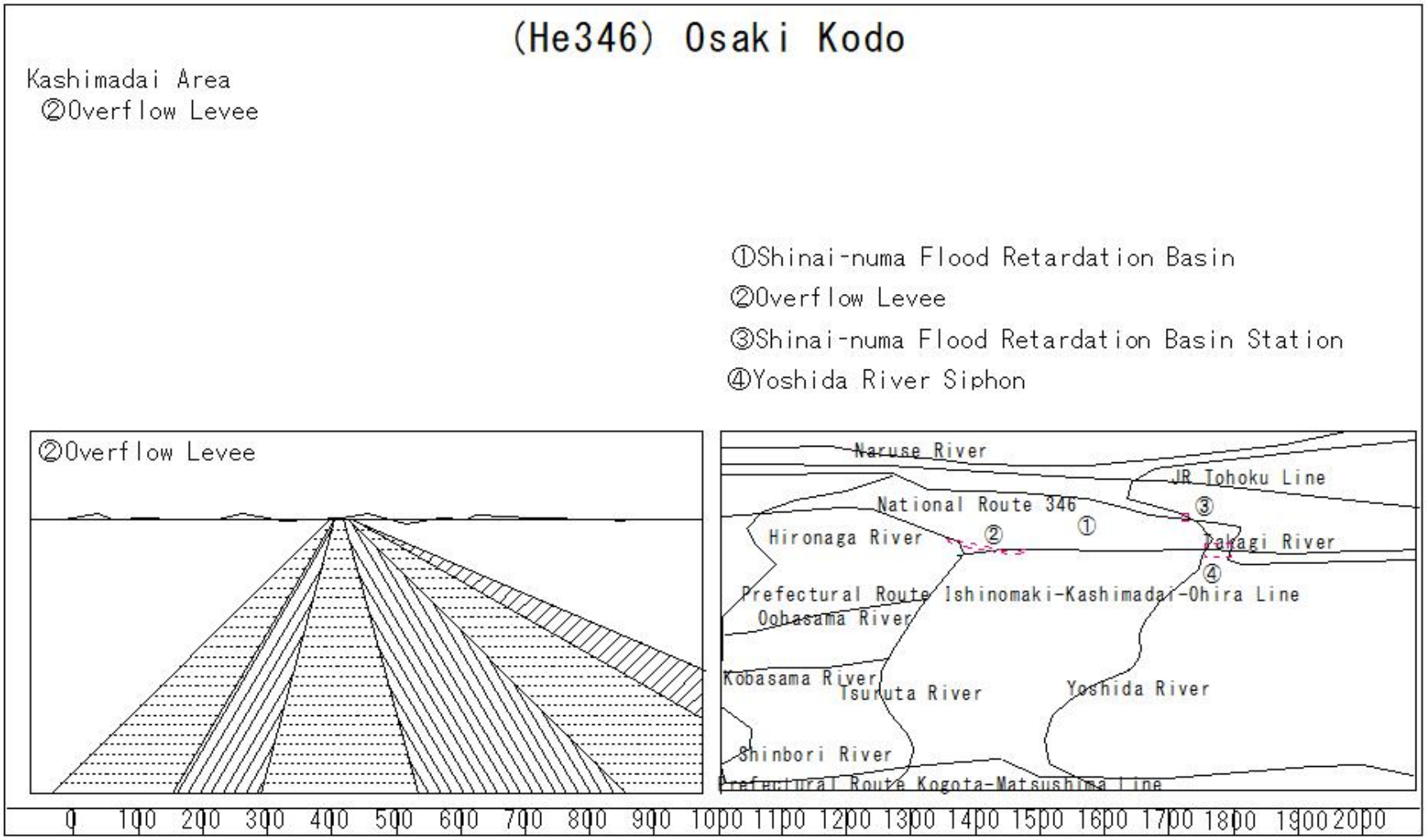

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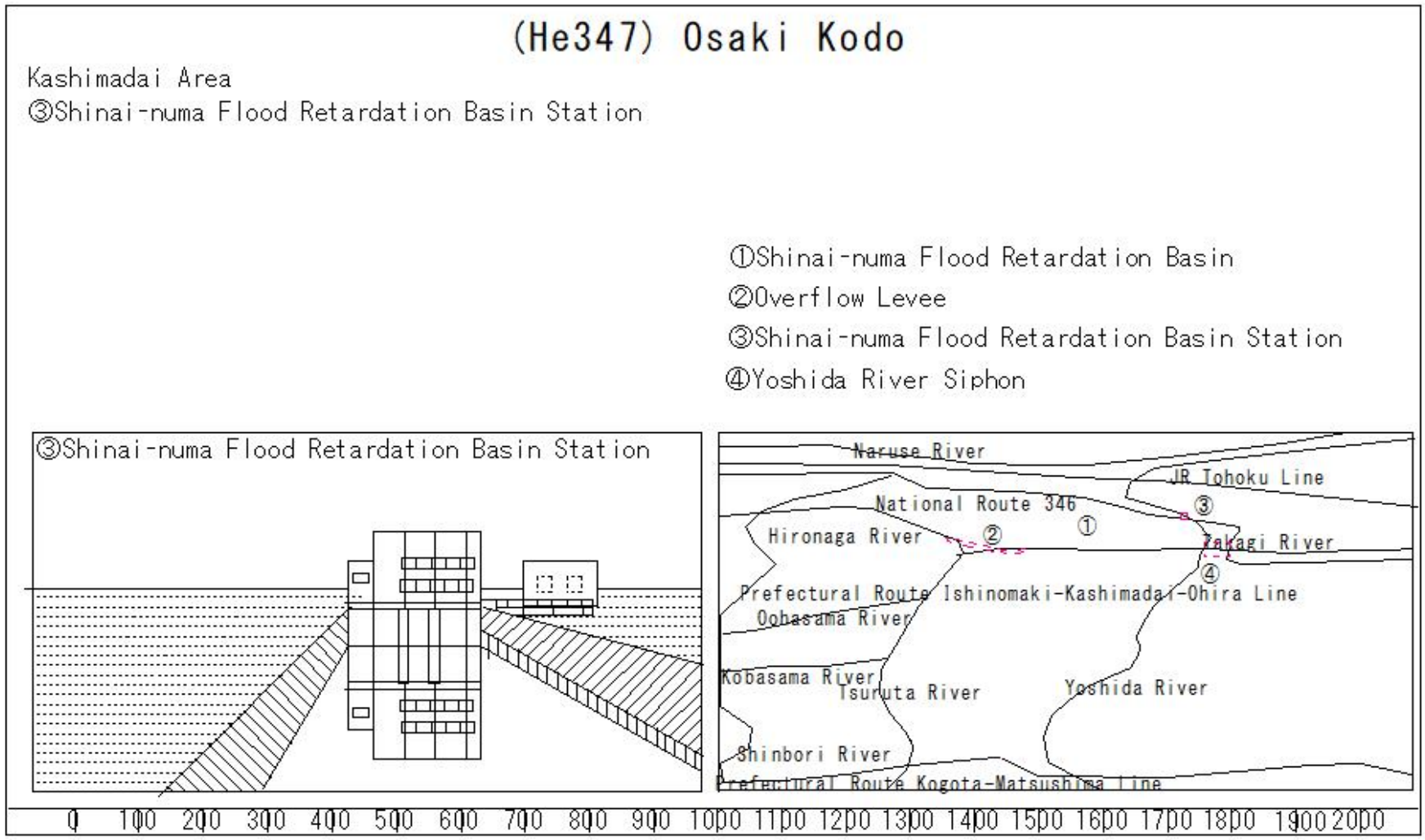

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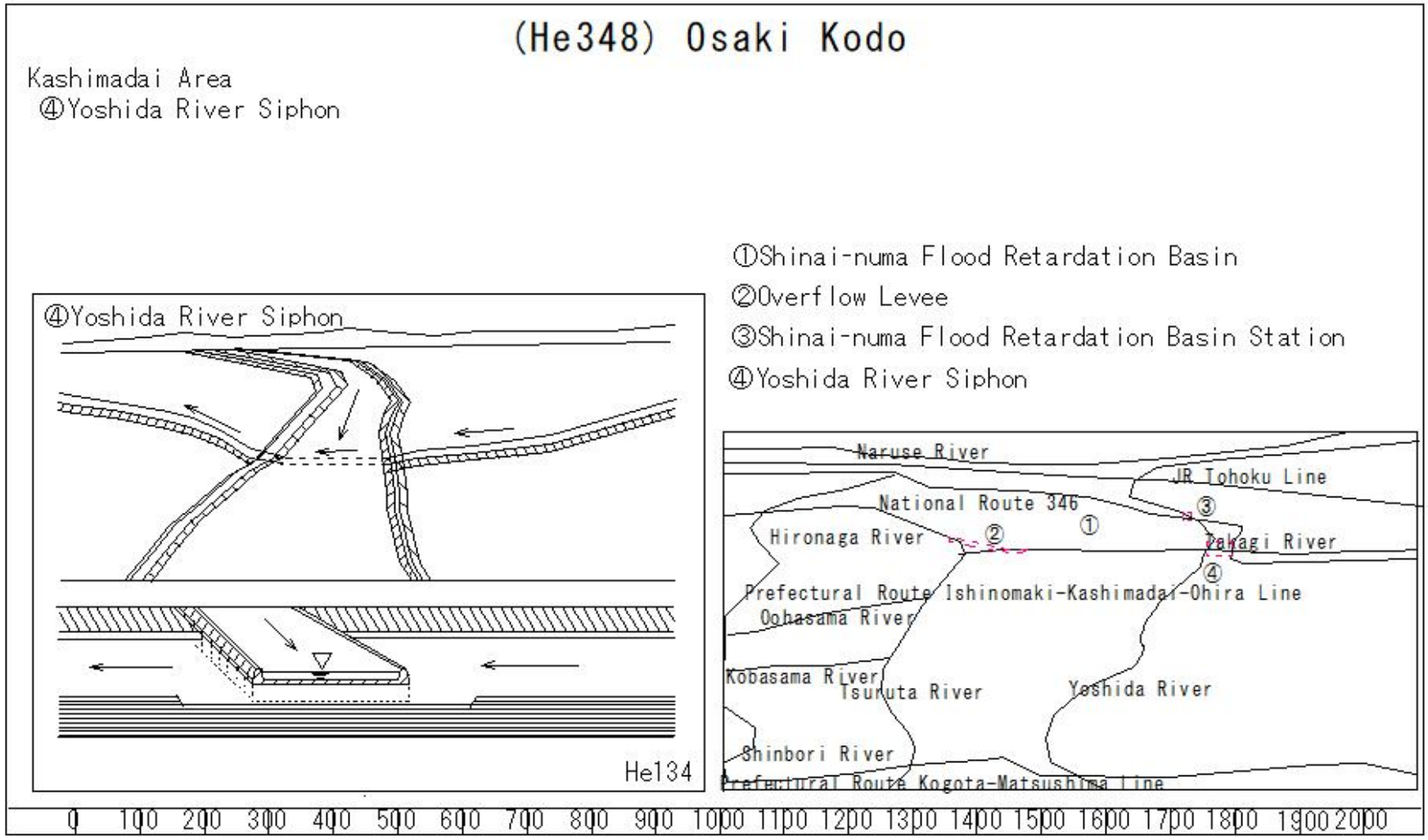

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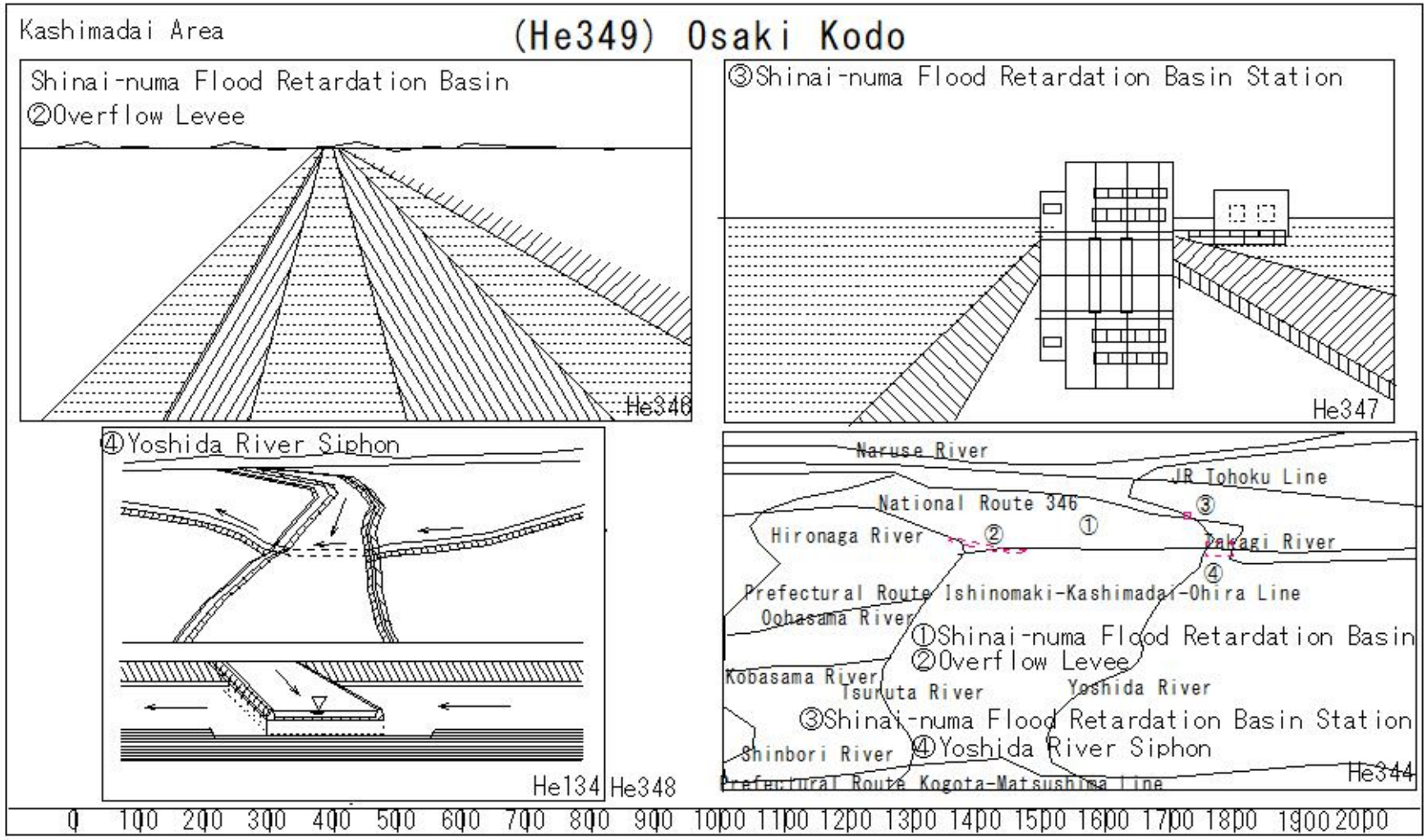

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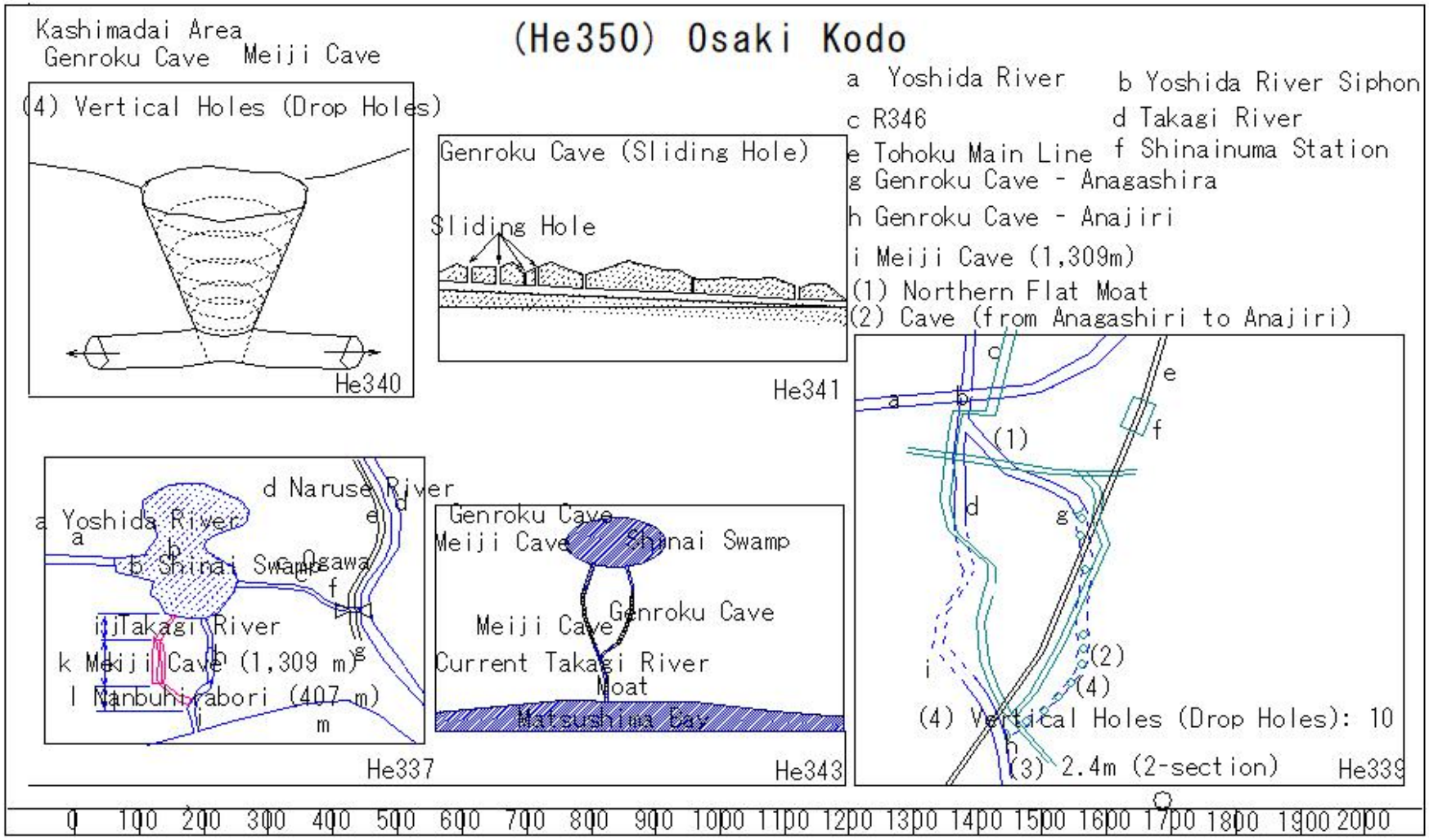

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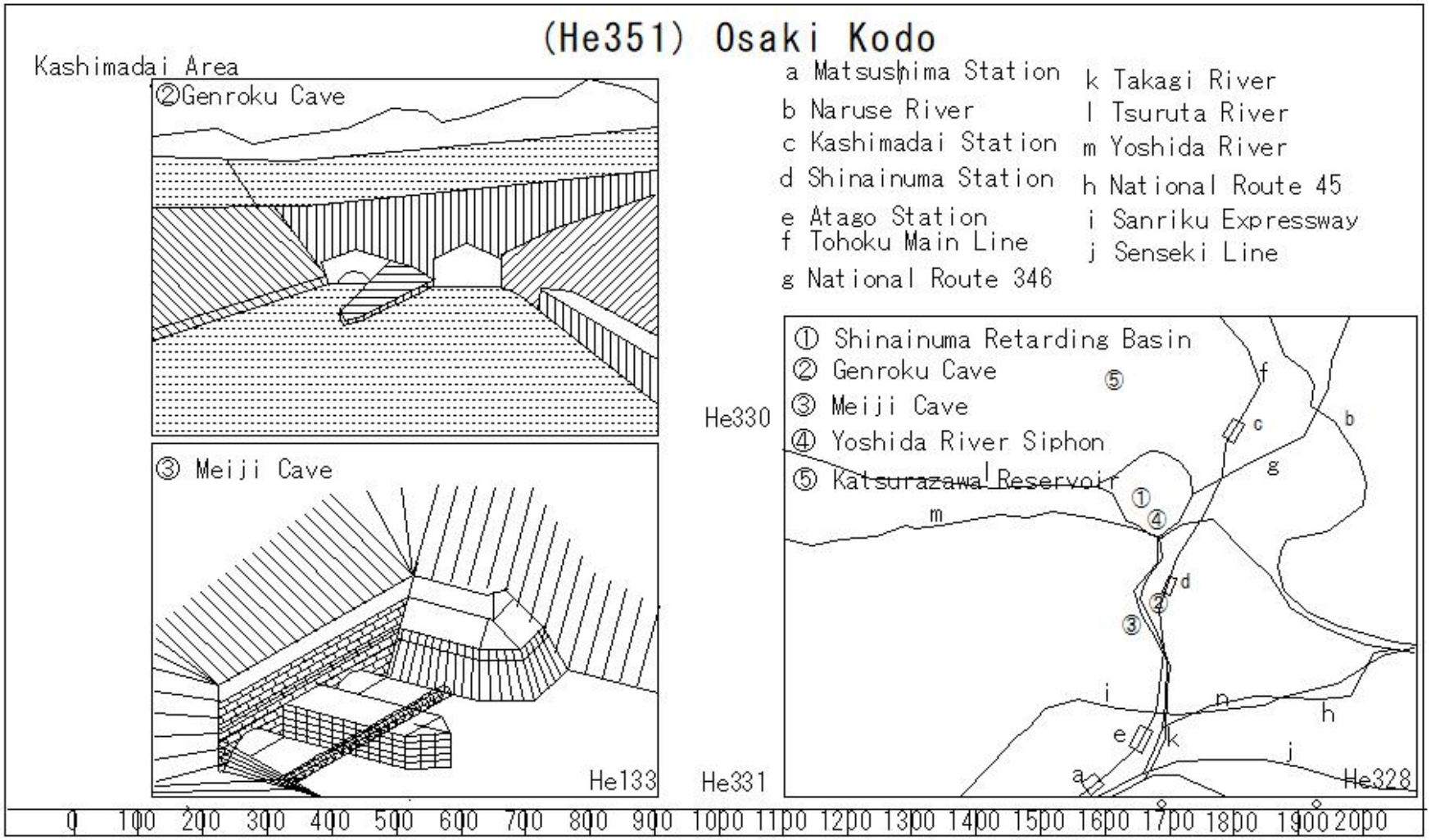

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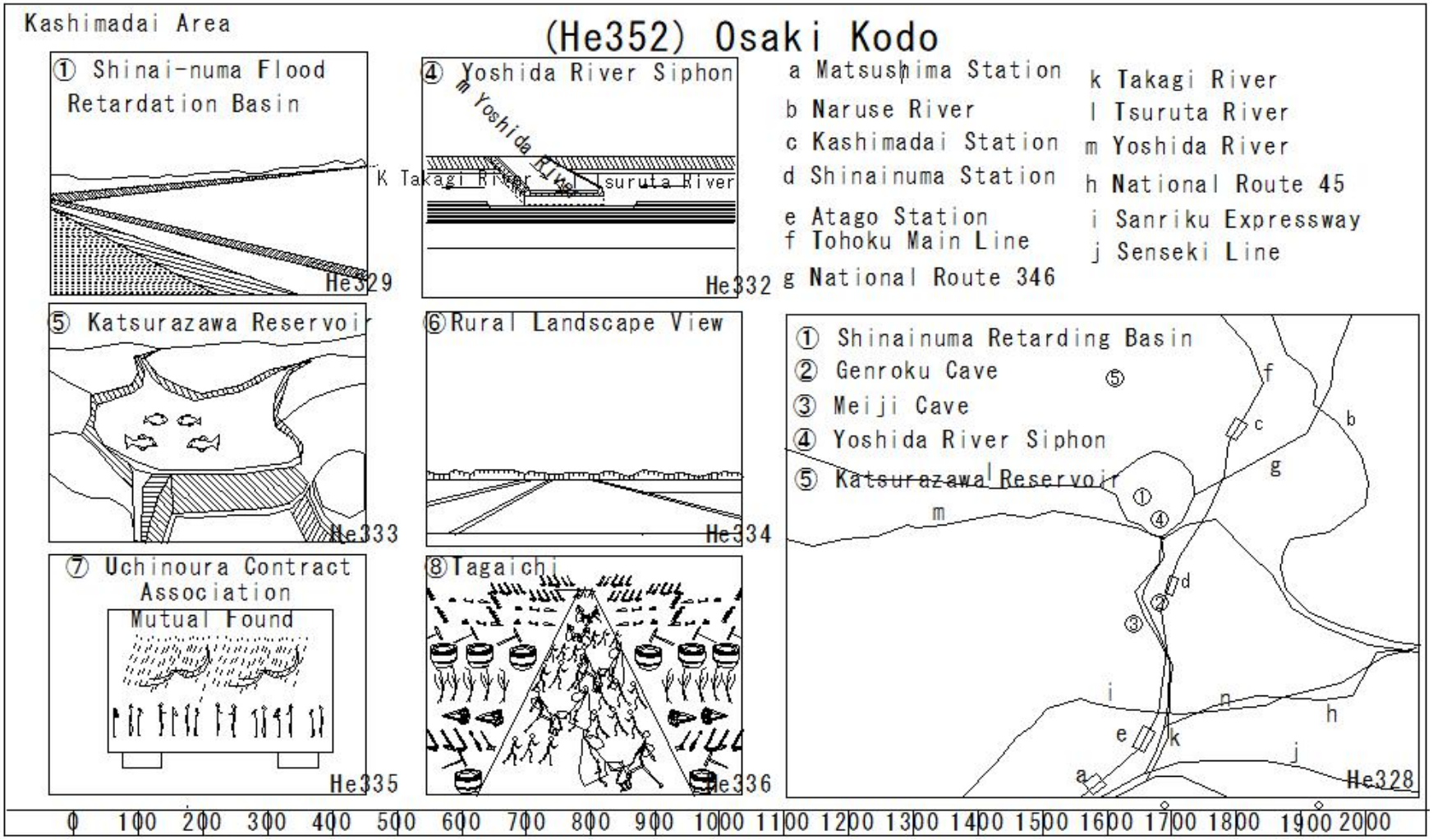


(He353) Osaki Kodo

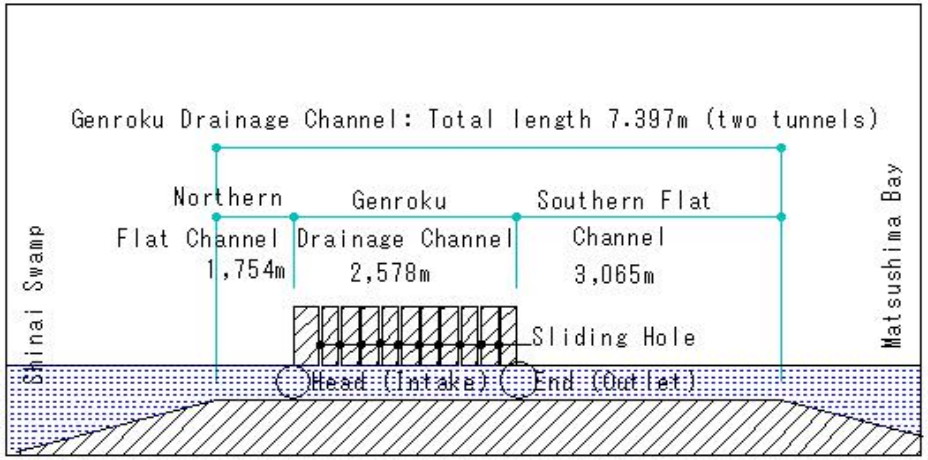
Kashimadai Area

(He353) Osaki Kodo

② Genroku Cave

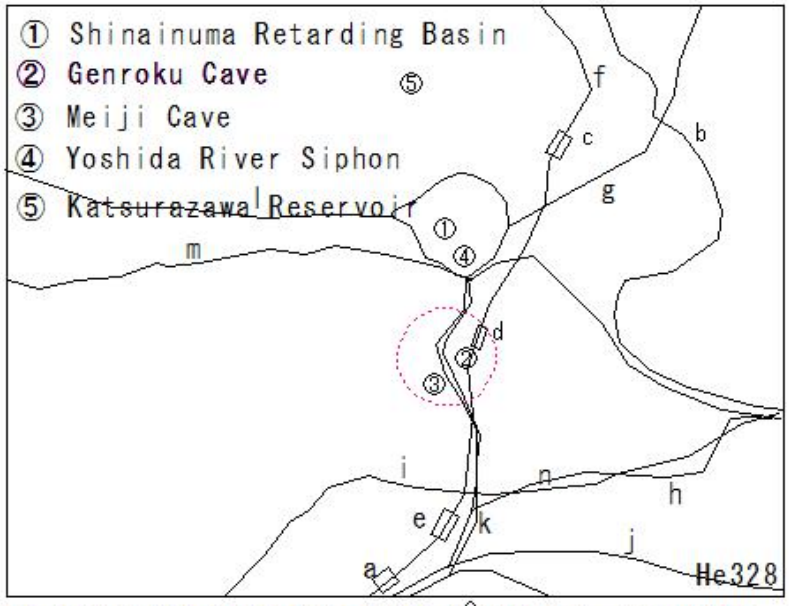
Groundbreaking in 1693 - Completion in 1698

Genroku Drainage Channel: Total length 7.397m (two tunnels)			
	Northern Flat Channel	Genroku Drainage Channel	Southern Flat Channel
Length	1,754m	2,578m	3,065m
Width	27～54m	3.6m	18m
Depth	2m	2.4m	1～2m



a Matsushima Station
b Naruse River
c Kashimadai Station
d Shinainuma Station
e Atago Station
f Tohoku Main Line
g National Route 346
k Takagi River
l Tsuruta River
m Yoshida River
h National Route 45
i Sanriku Expressway
j Senseki Line

① Shinainuma Retarding Basin
② Genroku Cave
③ Meiji Cave
④ Yoshida River Siphon
⑤ Katsurazawa Reservoir



0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000

(He354) Osaki Kodo

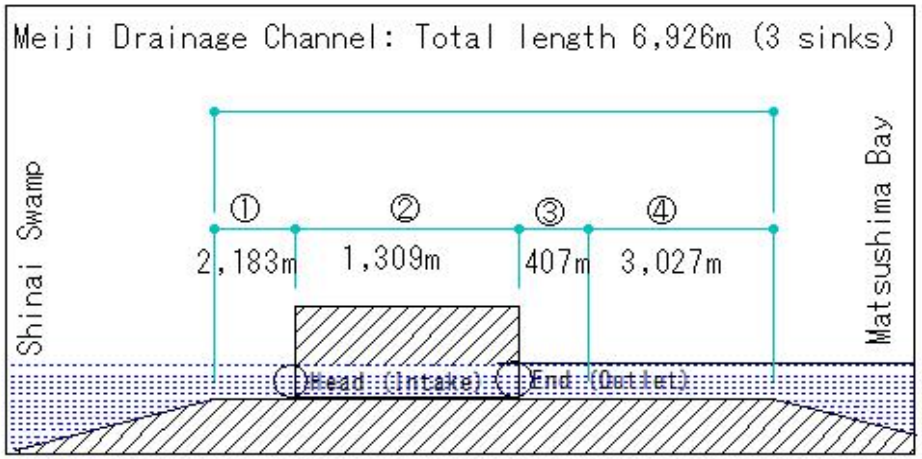
Kashimadai Area

(He354) Osaki Kodo

③ Meiji Cave

Construction started in 1906 and completed in 1910

Meiji Drainage Channel: Total length 6,926m (3 sinks)				
	①Northern Drainage Channel	②Meiji Drainage Channel	③Southern Drainage Channel	④Southern Flat Moat (Genroku)
Length	2,183m	1,309m	407m	3,027m
Width	15～18m	6m	20～40m	20～100m
Depth	4m	4m	4m	4m



a Matsushima Station
b Naruse River
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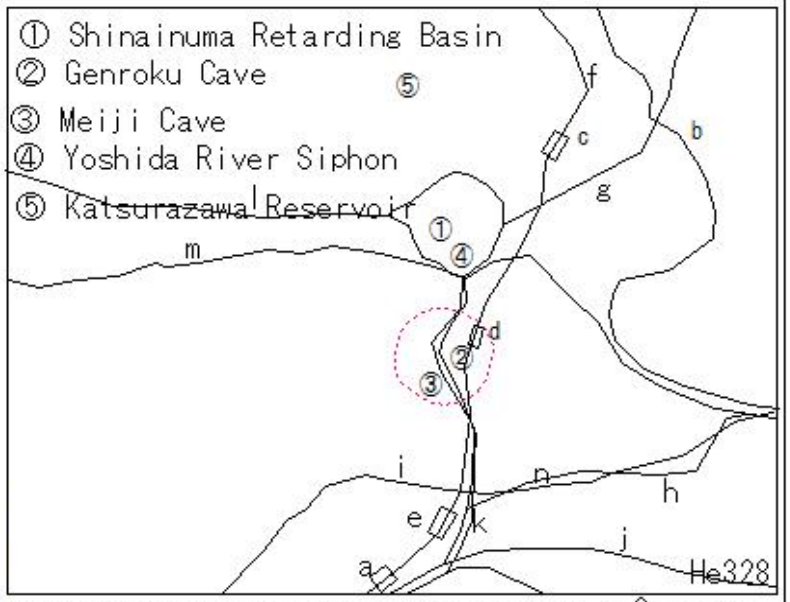
g National Route 346
k Takagi River
l Tsuruta River
m Yoshida River
h National Route 45
i Sanriku Expressway
j Senseki Line



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(He355) Osaki Kodo

Kashimadai Area

(He355) Osaki Kodo

② Genroku Cave

Groundbreaking in 1693 - Completion in 1698

Genroku Drainage Channel: Total length 7,397m (two tunnels)			
	Northern Flat Channel	Genroku Drainage Channel	Southern Flat Channel
Length	1,754m	2,578m	3,065m
Width	27～54m	3.6m	18m
Depth	2m	2.4m	1～2m

③ Meiji Cave

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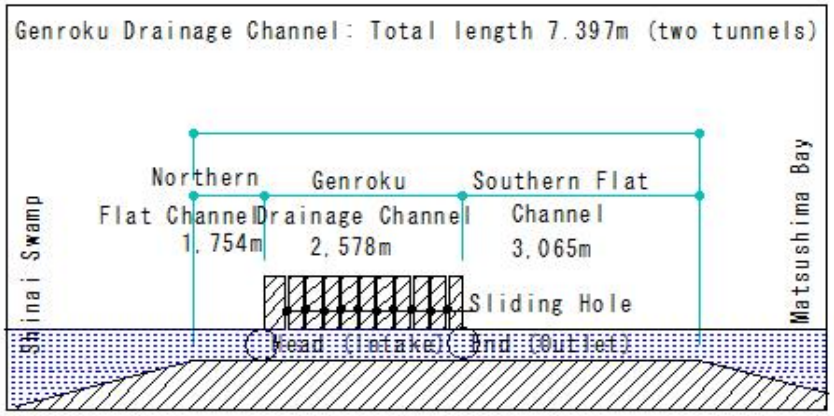
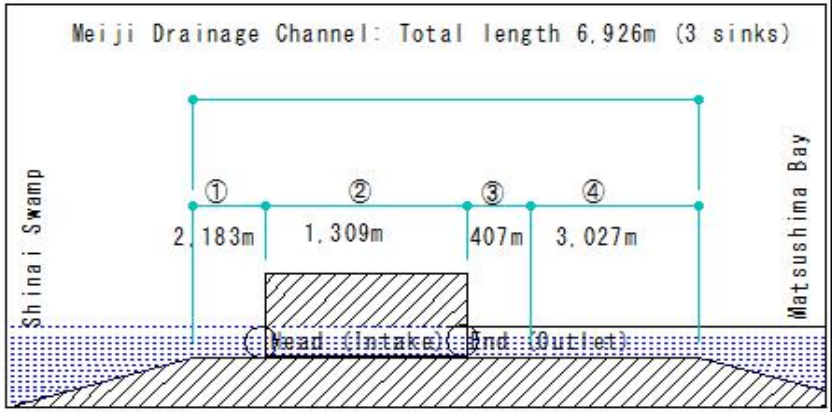
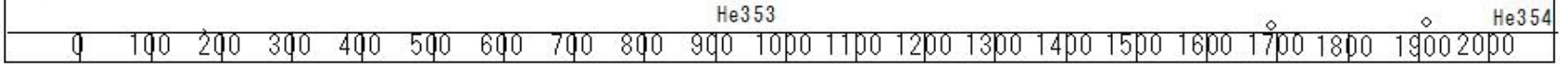
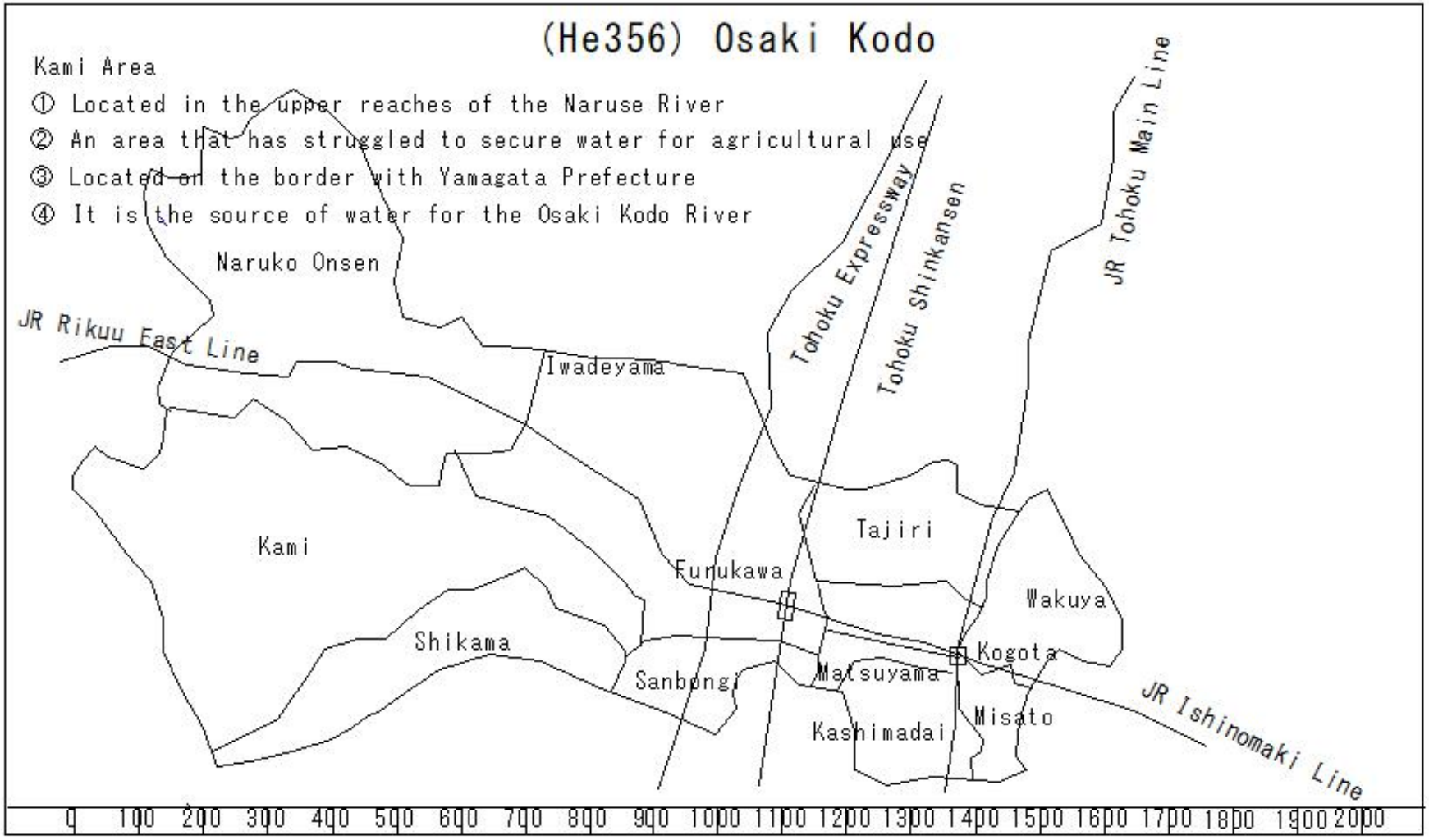


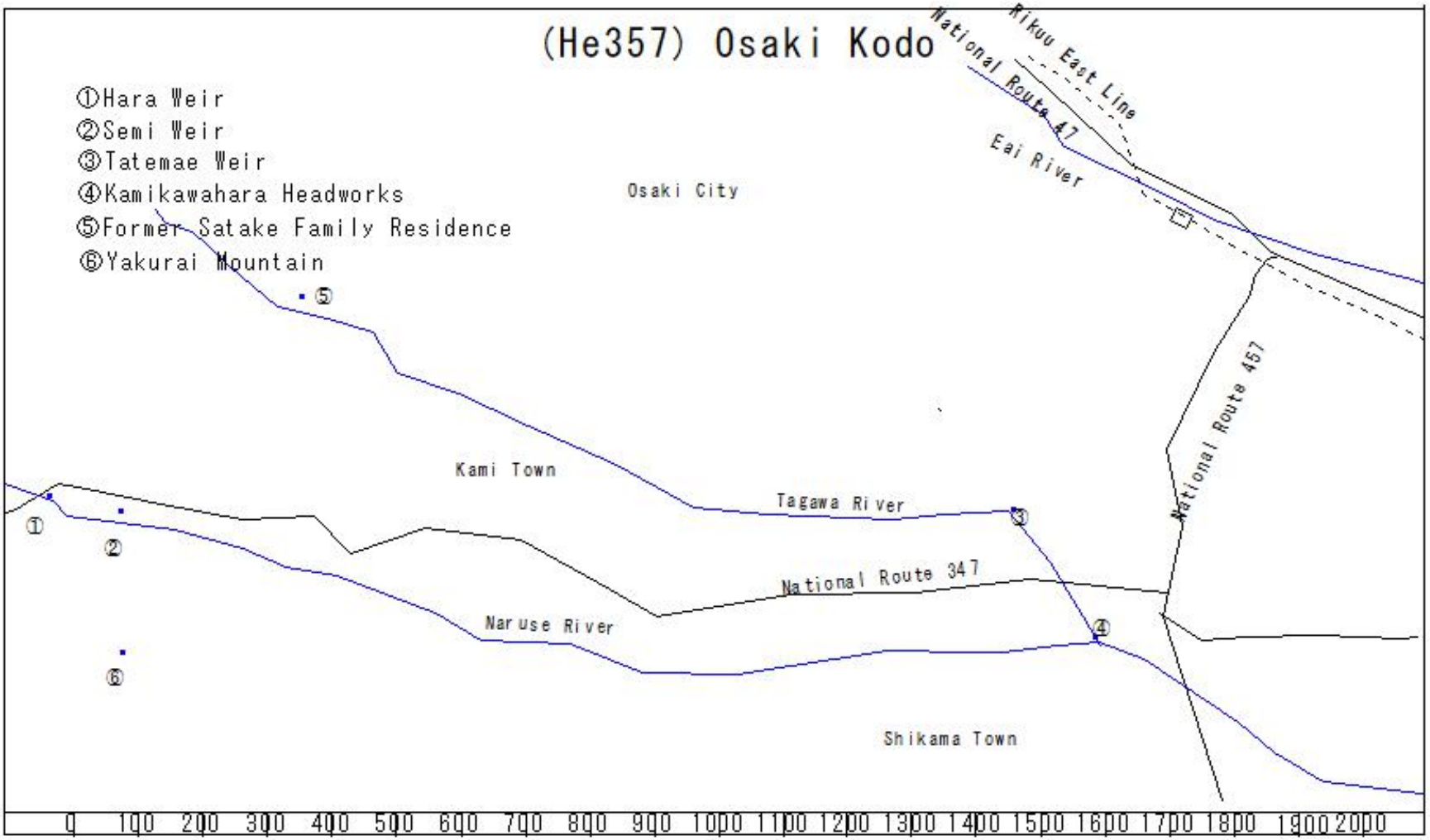




(He356) Osaki Kodo



(He357) Osaki Kodo



(He358) Osaki Kodo

(He358) Osaki Kodo

Kami Area

①Hara Weir

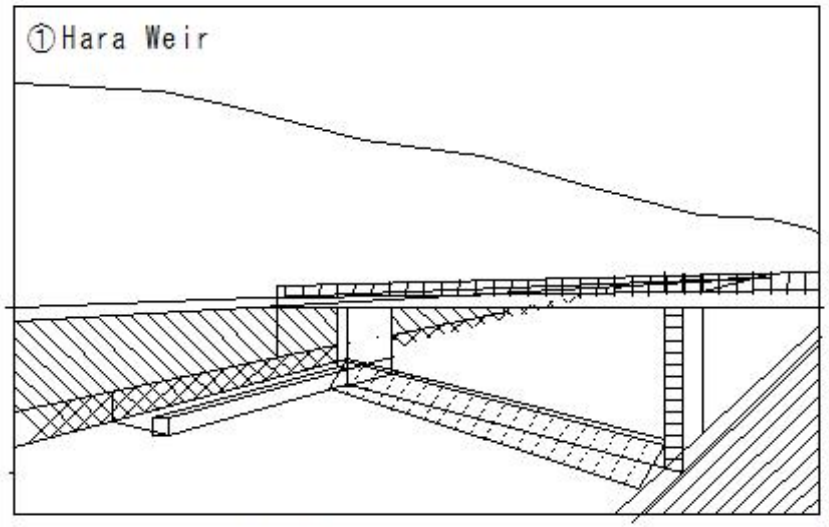
Ingenious Water Management Infrastructure

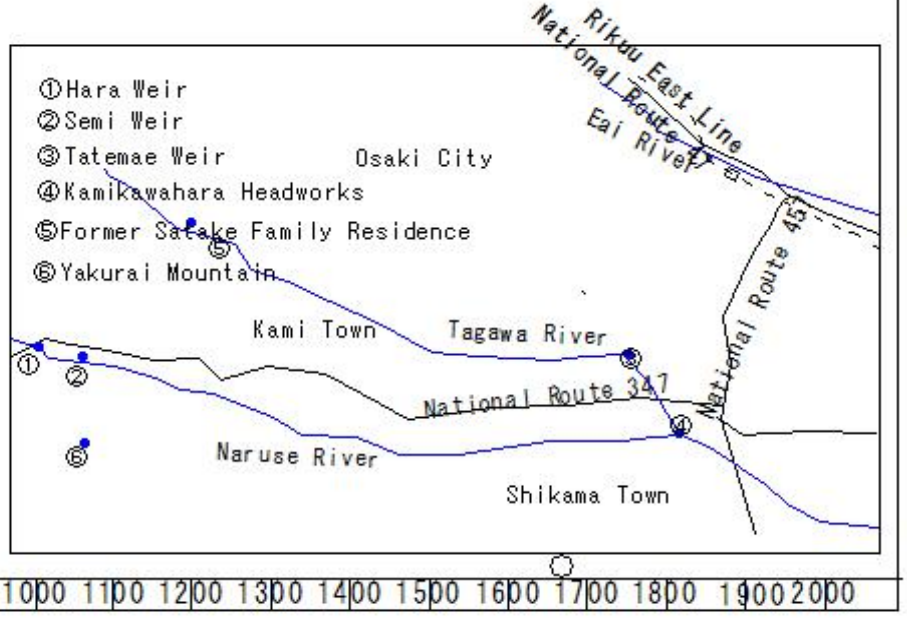
① This water intake weir was ordered by Lord Tsunamura, the fourth lord of the Date clan.

② It took approximately 10 years to build, starting in 1670.

③ A stone monument reads, "The weir transformed what was then a barren land into a fertile rice paddy field."

④ It irrigates the fields of the present-day Onoda area of Kami Town.





0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000

(He359) Osaki Kodo

(He359) Osaki Kodo

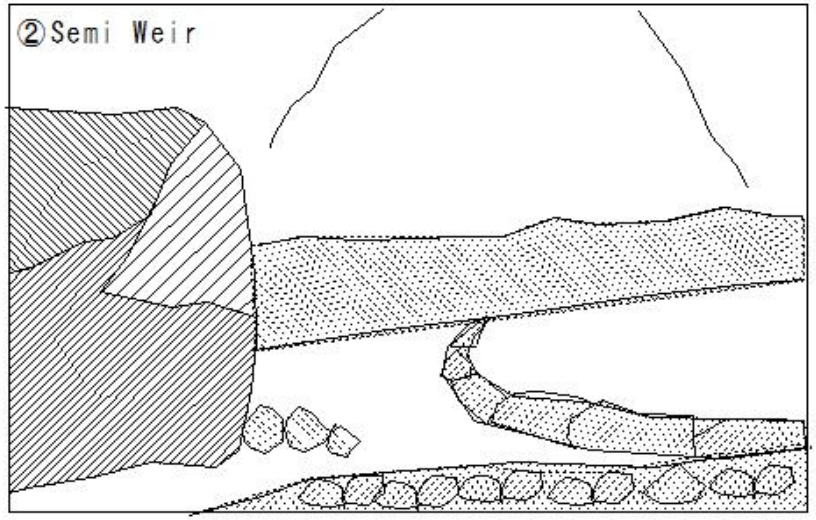
Kami Area

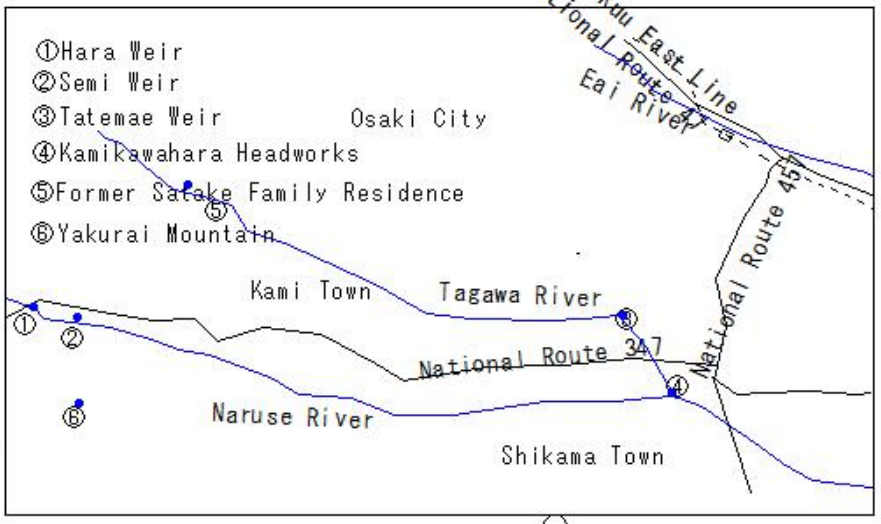
②Semi Weir

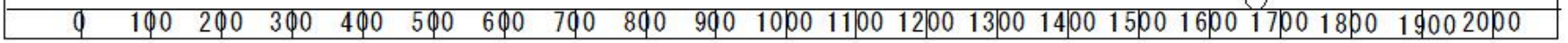
Ingenious Water Management Infrastructure

① This water intake weir was constructed over a period of approximately 10 years, beginning in 1660, by order of the Ishimoda clan, who ruled the Miyazaki region of present-day Kami Town.

② This difficult construction project took approximately 10 years.







(He360) Osaki Kodo

(He360) Osaki Kodo

Kami Area

③ Tatemae Weir

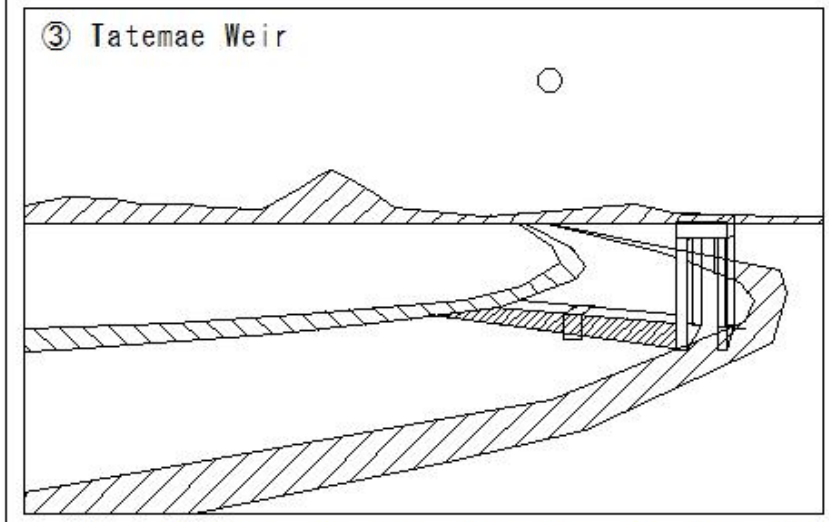
Ingenious Water Management Infrastructure

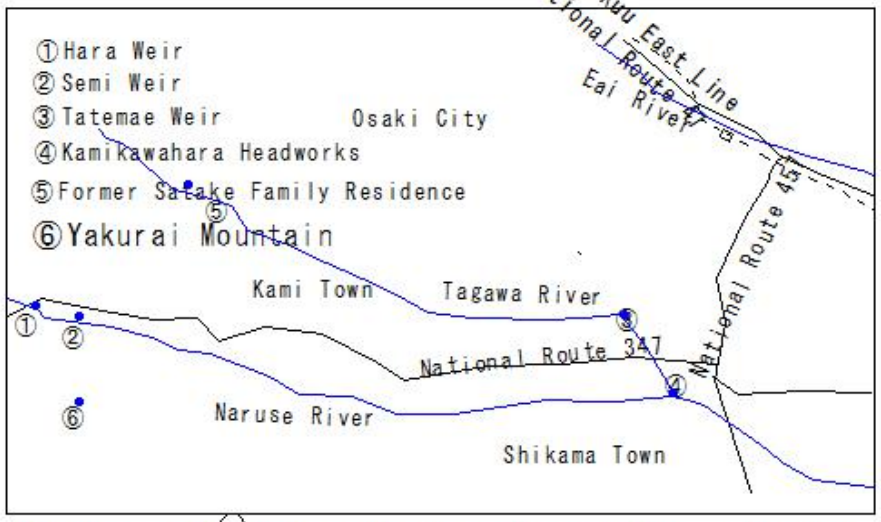
① A weir for irrigation water intake from the Tagawa River, a tributary of the Naruse River.

② Construction began in 1267 and took 12 years.

③ It irrigates the current Nakashinden area of Kami Town.

④ Water irrigated through the Semiseki Weir flows back into the Tagawa River and is reused as a water source for the Tatemae Weir.





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(He361) Osaki Kodo

(He361) Osaki Kodo

Kami Area

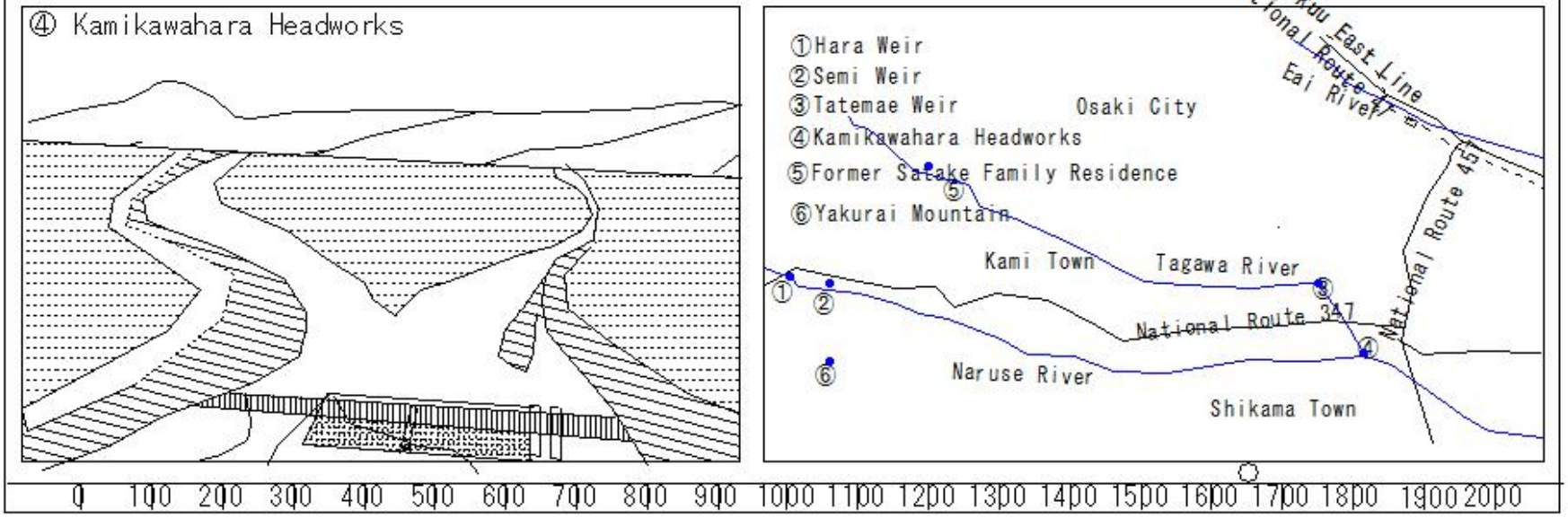
④ Kamikawahara Headworks

Ingenious Water Management Infrastructure

① Built in 1640 (Kan'ei 17).

② Originally located on the main stream of the Naruse River, it was relocated to the tributary, the Tagawa River, due to the enormous cost and manpower required for maintenance and repairs. Hence, it is also known as the Tagawa Weir.

③ Currently, it is maintained as the Kamikawahara Headworks at the confluence of the Naruse River and the Tagawa River.



(He362) Osaki Kodo

Kami Area

⑤Former Satake Residence

A testament to traditional agricultural culture

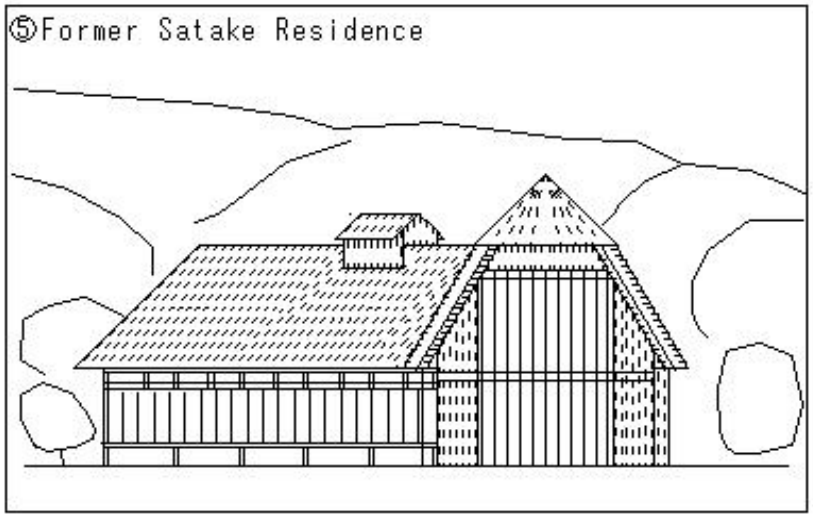
① It is believed to have been built in the late Edo period.

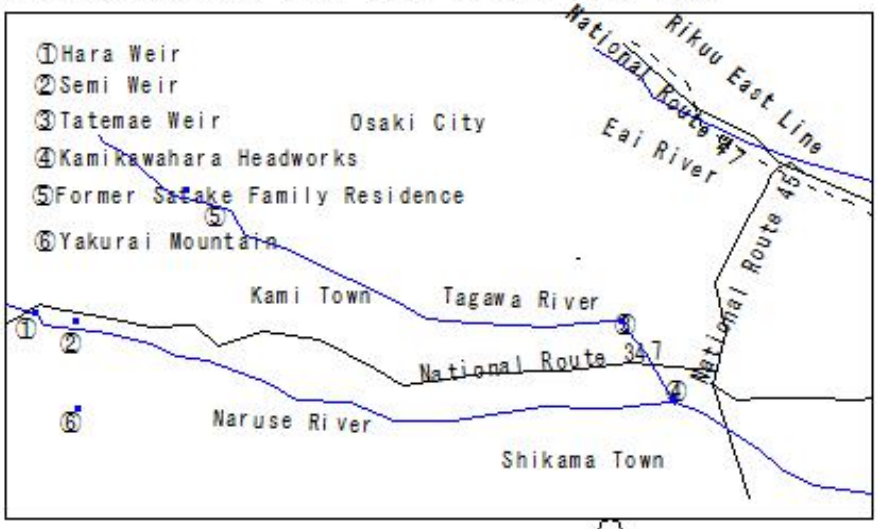
② The main building has a gable roof.

③ The layout of the main living area is a typical four-room structure with a central hall, common in Edo-period farmhouses in this region.

④ The interior is open to visitors.

⑤ This is a valuable historical building that offers insights into life during that era.





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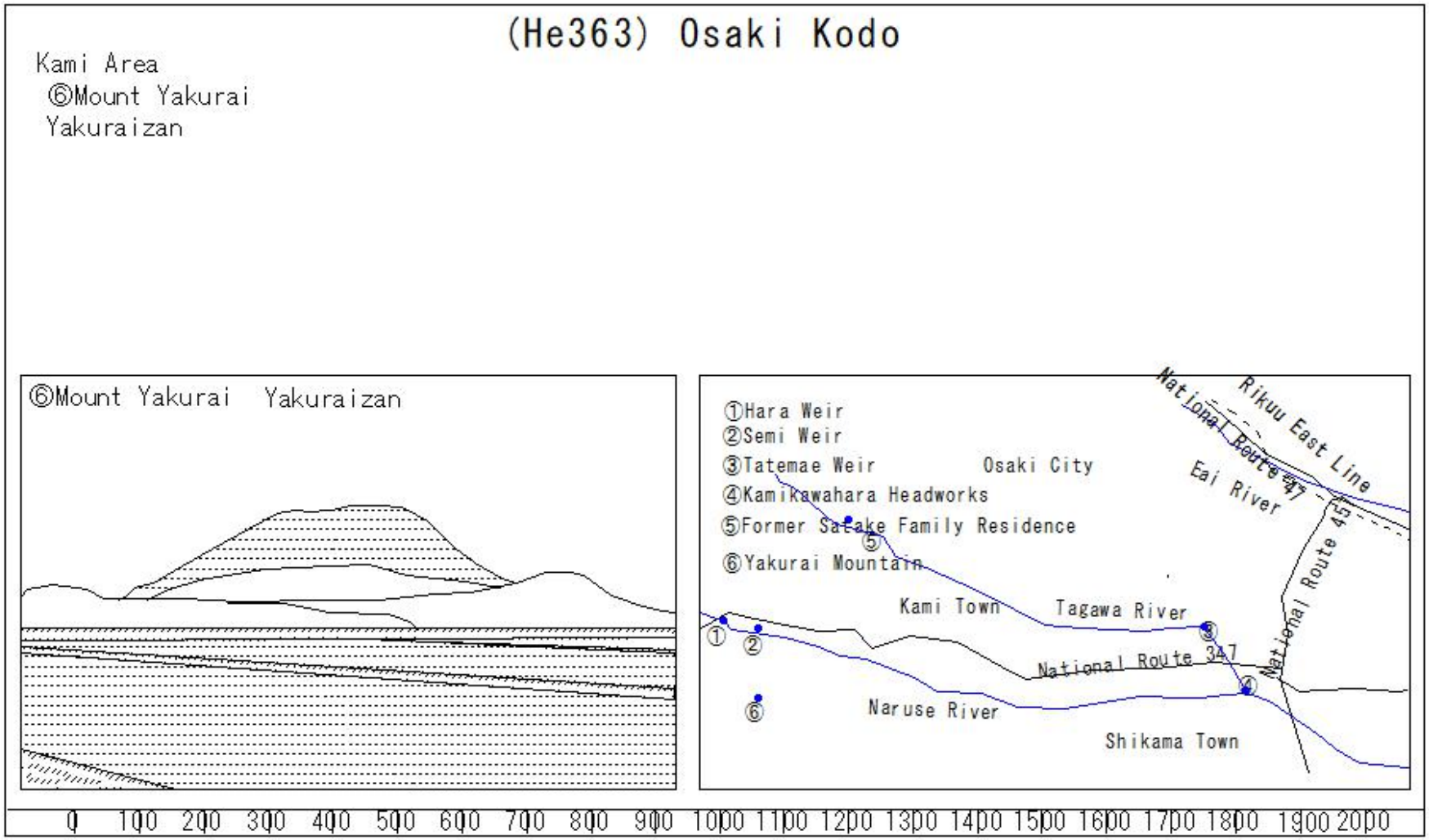
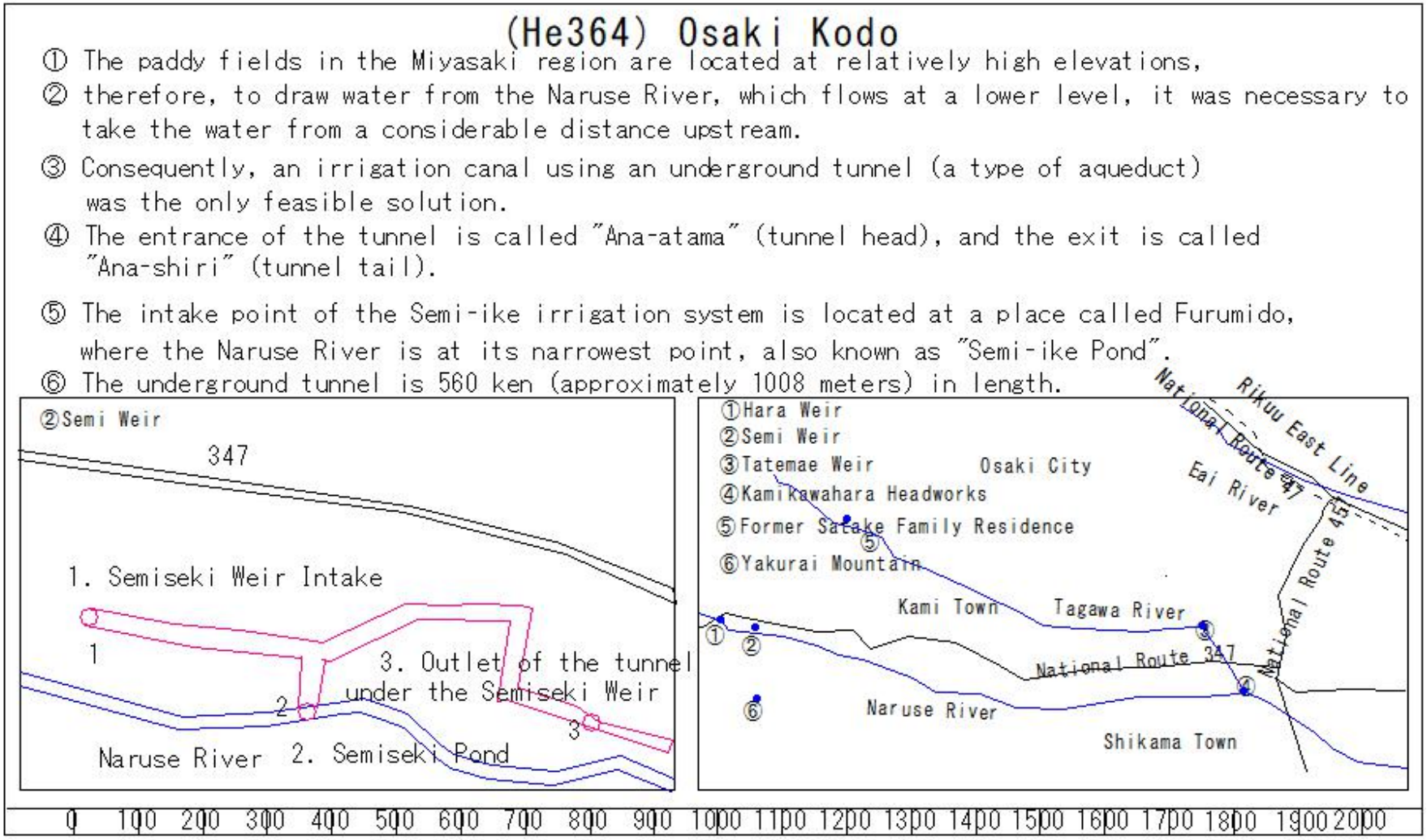
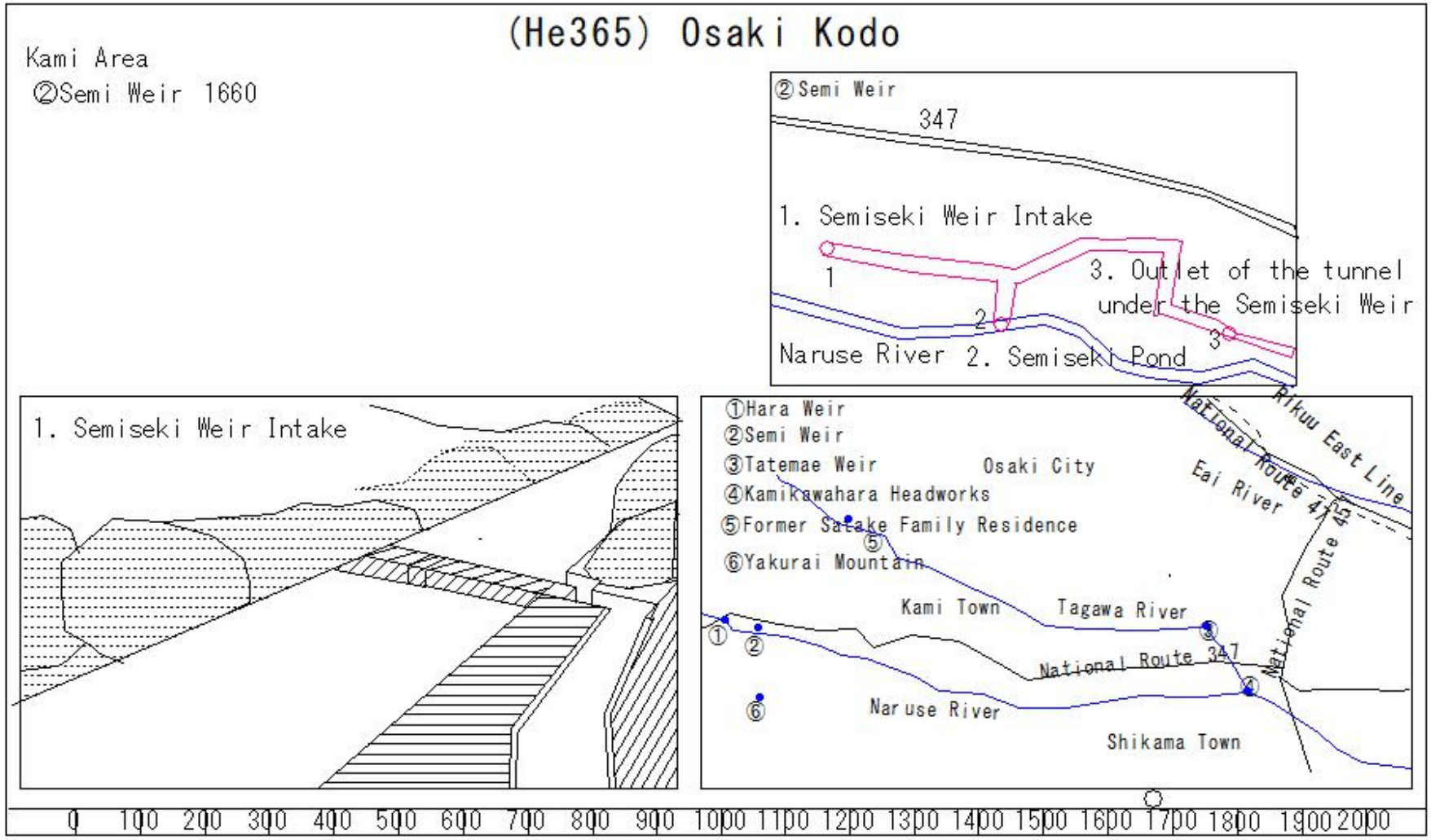
(He363) Osaki Kodo



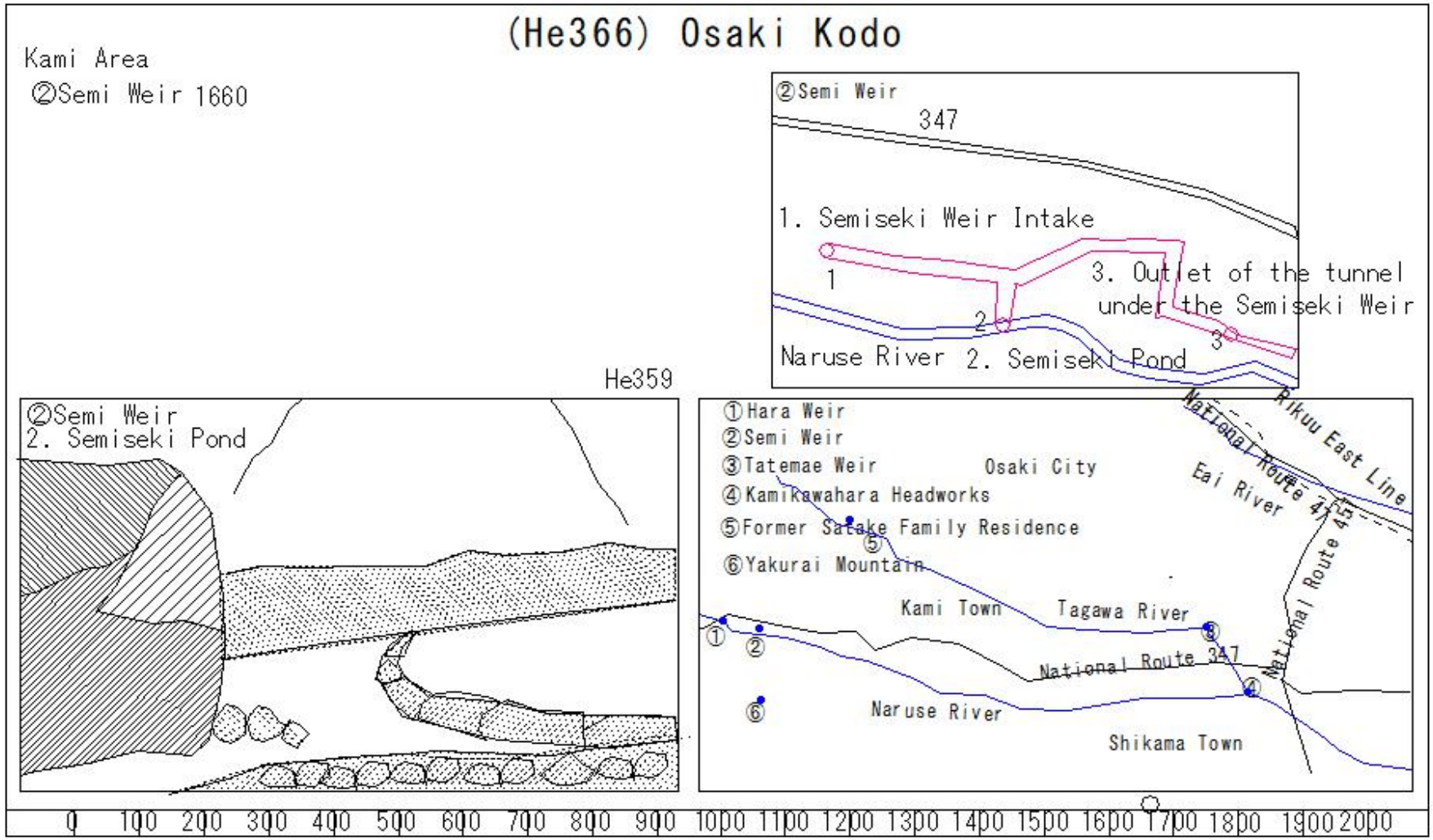
(He364) Osaki Kodo



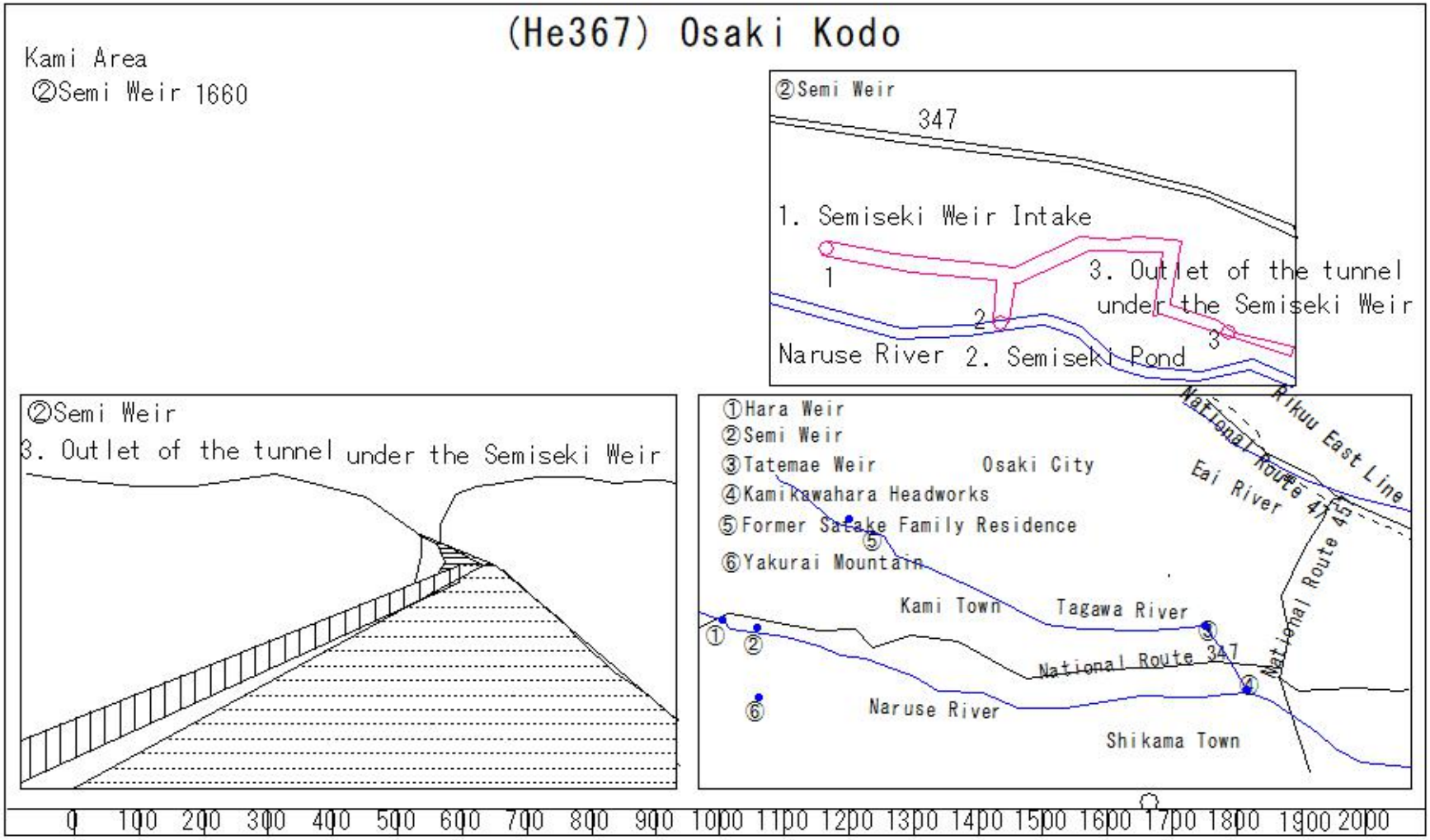
(He365) Osaki Kodo



(He366) Osaki Kodo



(He367) Osaki Kodo



(He368) Osaki Kodo

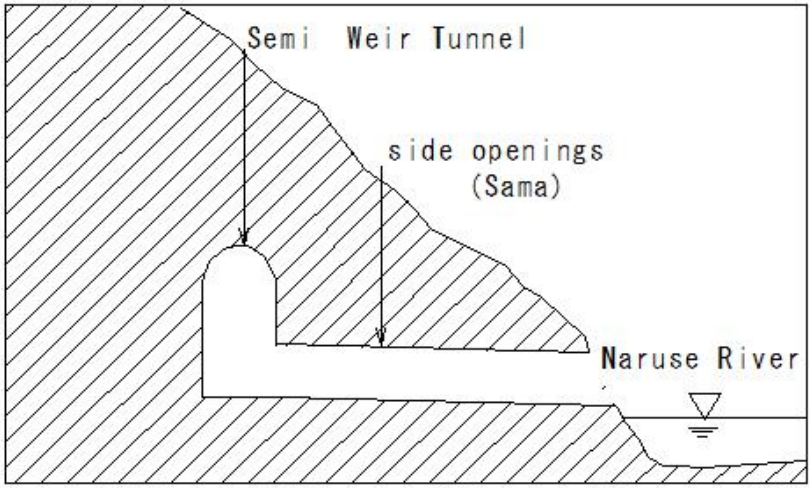
(He368) Osaki Kodo

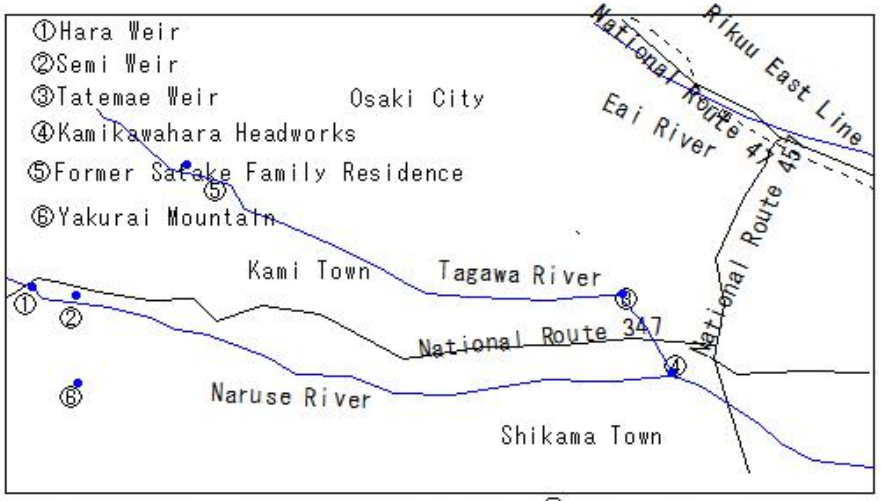
Kami Area

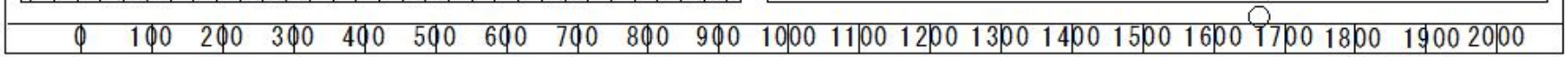
②Semi Weir 1660

① The Semi Weir Tunnel has several side openings facing the Naruse River. These openings are called "Sama"

② The construction method involved first digging the side openings (Sama) from the river side, then excavating outwards from each opening in both directions until they connected to form a a single tunnel.







(He369) Osaki Kodo

(He369) Osaki Kodo

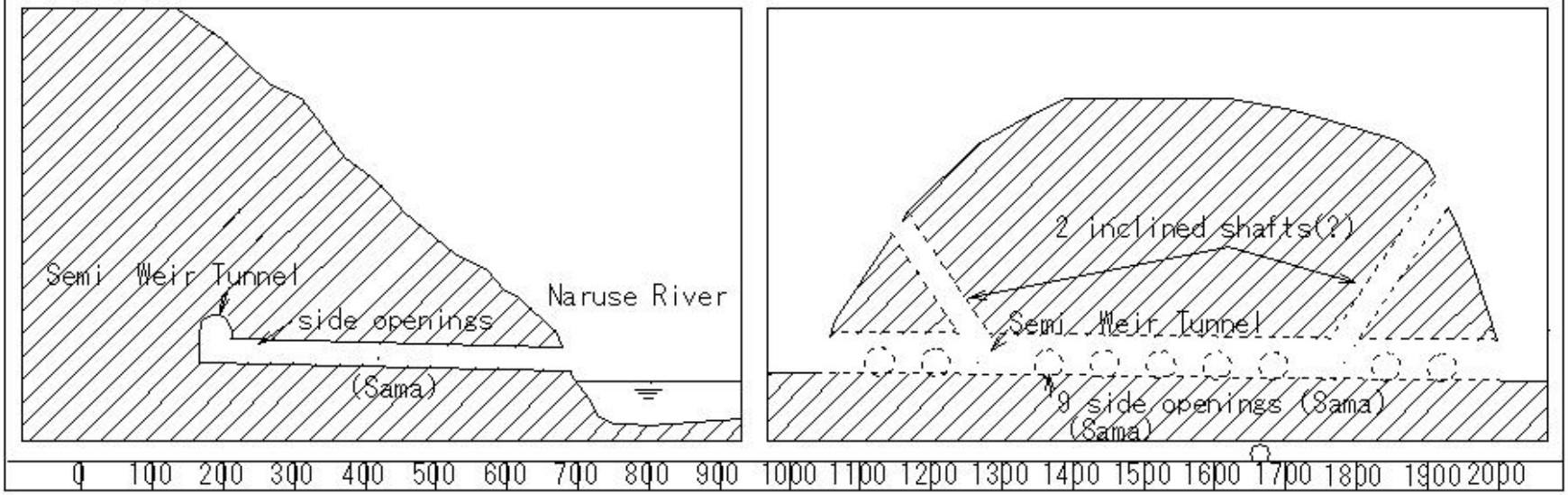
Kami Area

②Semi Weir 1660

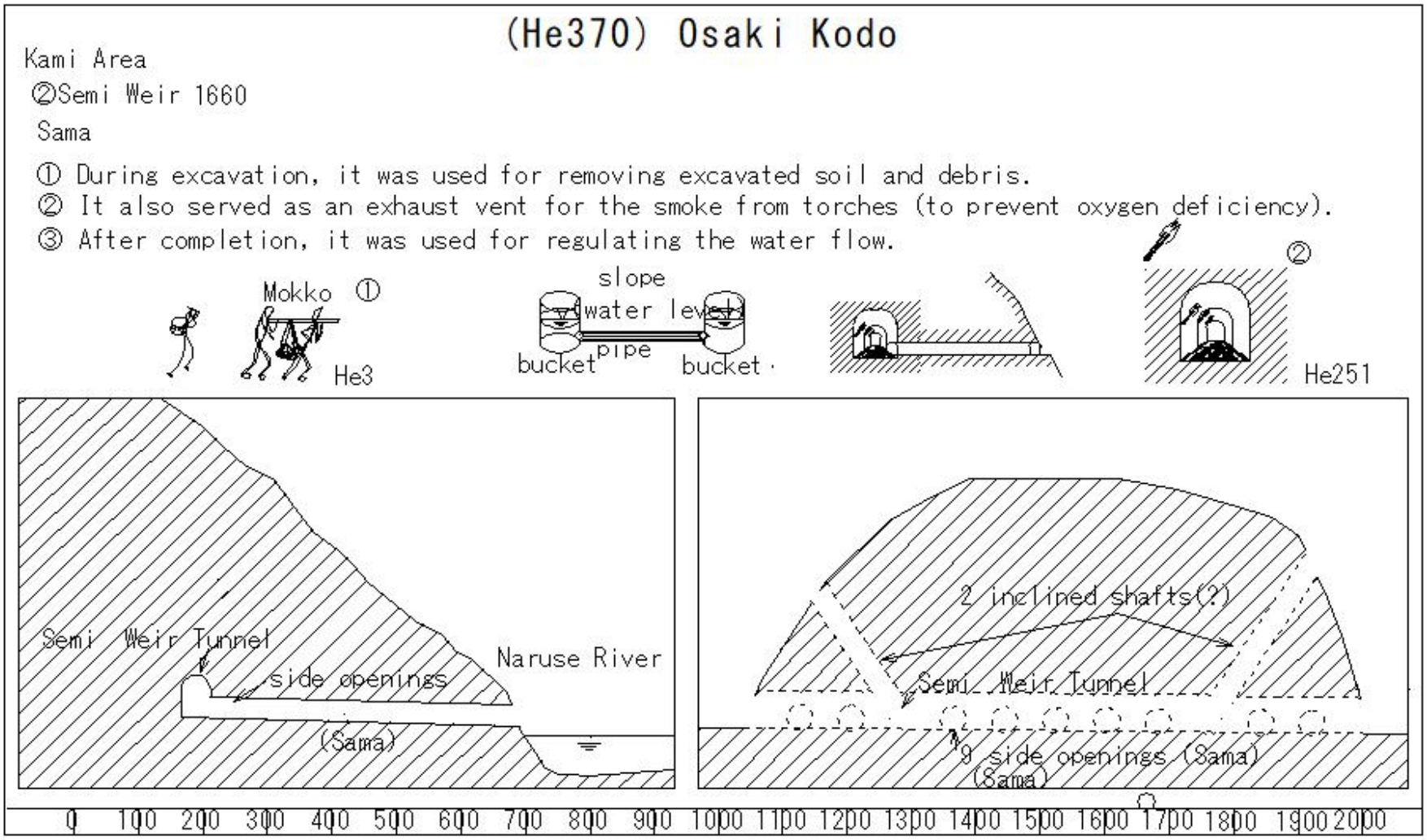
① The Semi Weir Tunnel has several side openings facing the Naruse River.
These openings are called "Sama"

② The construction method involved first digging the side openings (Sama) from the river side, then excavating outwards from each opening in both directions until they connected to form a a single tunnel.

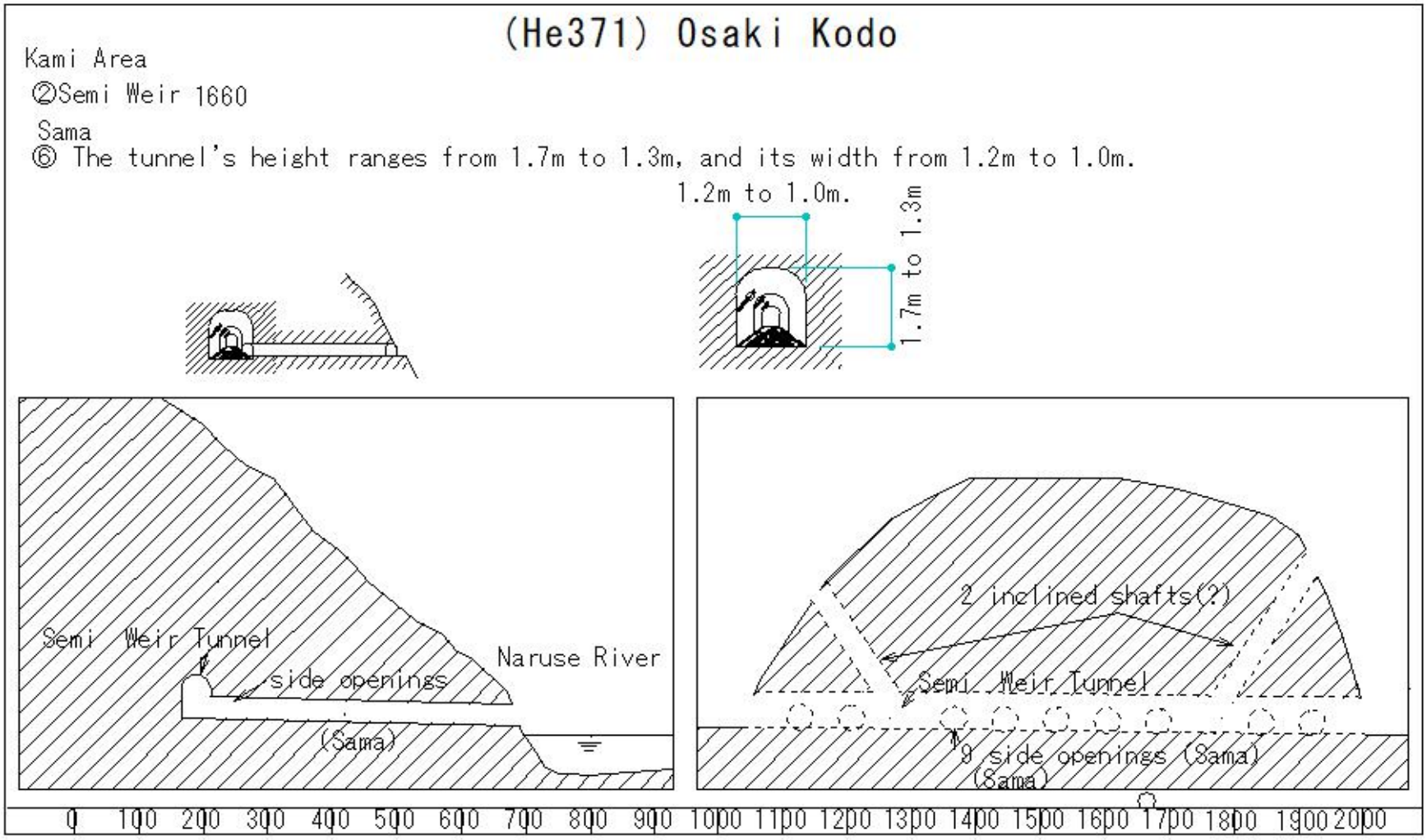
9 side openings (Sama) and 2 inclined shafts(?)



(He370) Osaki Kodo



(He371) Osaki Kodo



(He372) Osaki Kodo

(He372) Osaki Kodo

Kami Area

②Semi Weir1660

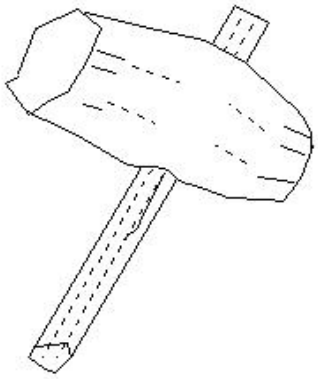
The tools used for digging directly into the rock involved first:

① Using a chisel and a hammer to chip away at the rock,

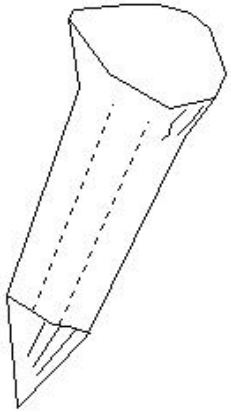
② Then using a shovel and a hoe to gather the loosened soil and debris,

③ Finally, transferring the soil and debris into a basket using a shoulder pole and carrying it out.

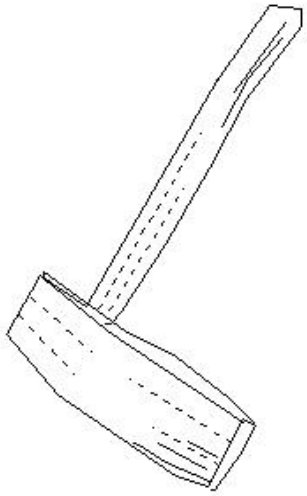
①Hammer (for stone carving)



②Stone chisel



③Hoe



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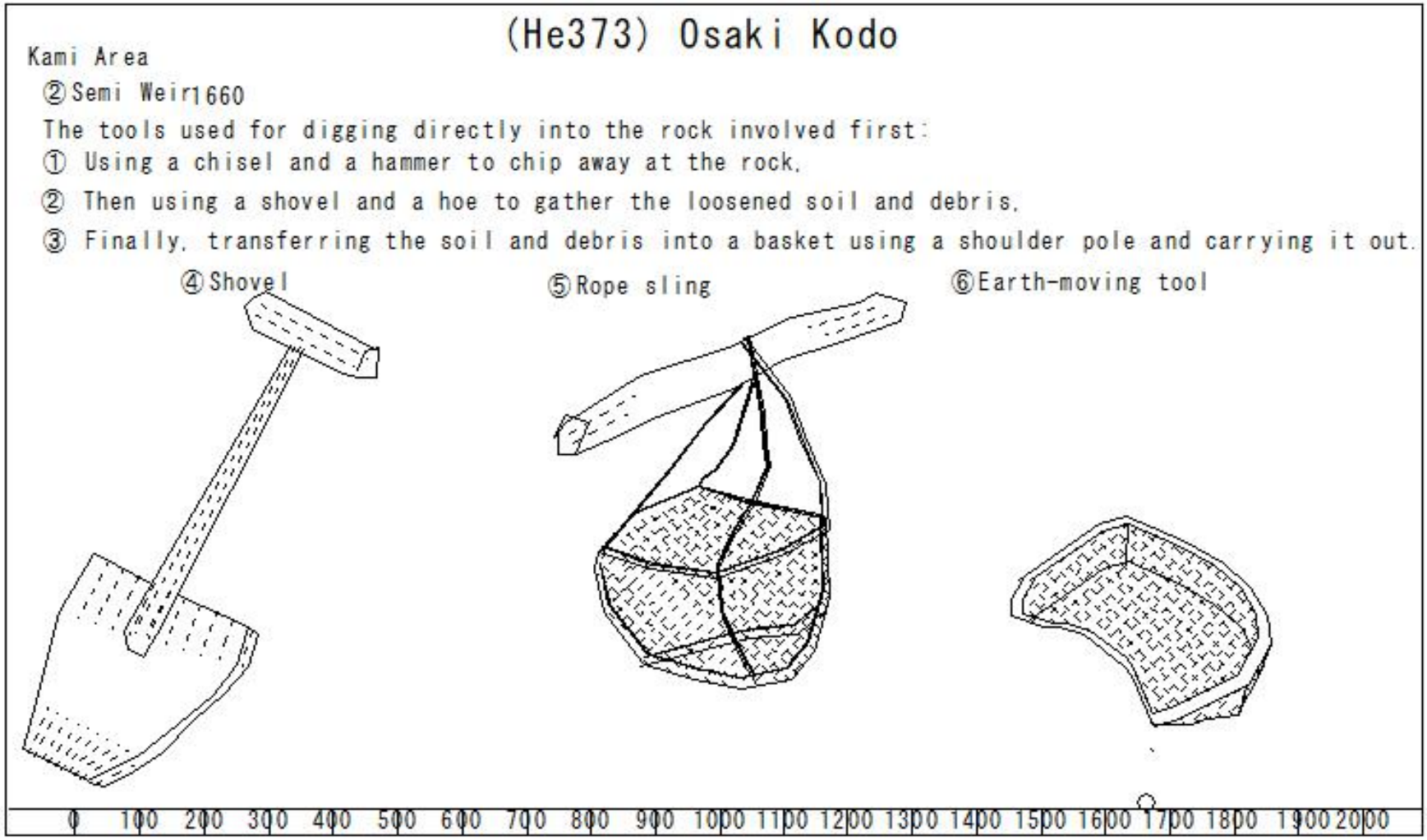
(He373) Osaki Kodo



(He374) Osaki Kodo

(He374) Osaki Kodo

Kami Area

②Semi Weir1660

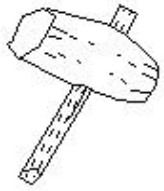
The tools used for digging directly into the rock involved first:

① Using a chisel and a hammer to chip away at the rock,

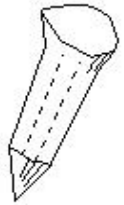
② Then using a shovel and a hoe to gather the loosened soil and debris,

③ Finally, transferring the soil and debris into a basket using a shoulder pole and carrying it out.

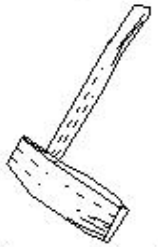
①Hammer (for stone carving)



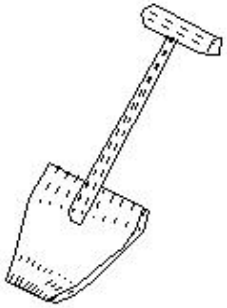
②Stone chisel



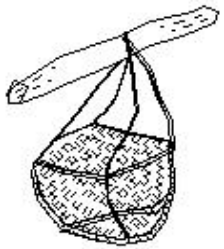
③Hoe



④Shovel



⑤Rope sling



⑥Earth-moving tool

He372

He373

0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000

(He375) Osaki Kodo

(He375) Osaki Kodo

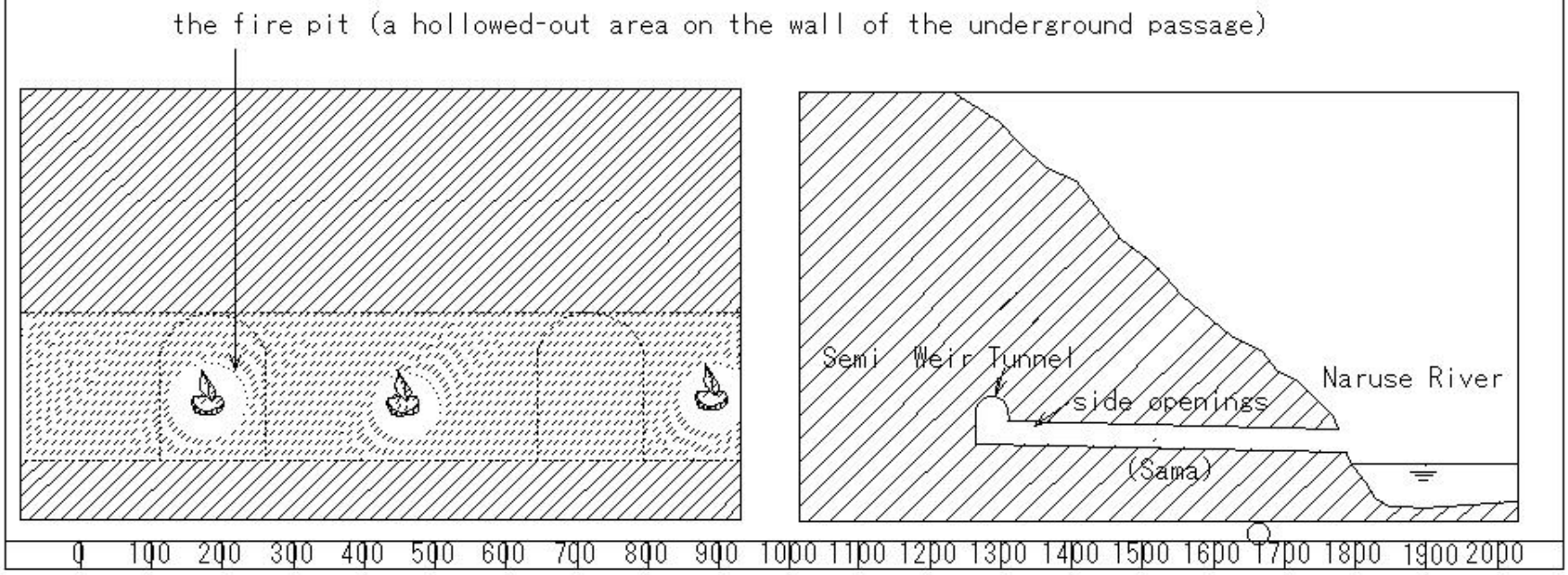
Kami Area

②Semi Weir 1660

① To survey the interior of the underground passage, torches were lit to illuminate the area.

② To measure the height of the water channel, a small indentation was carved into the wall of the passage and secured with clay.

③ A fire pit (a place to light a fire) was created, and oil was used to maintain the flame.



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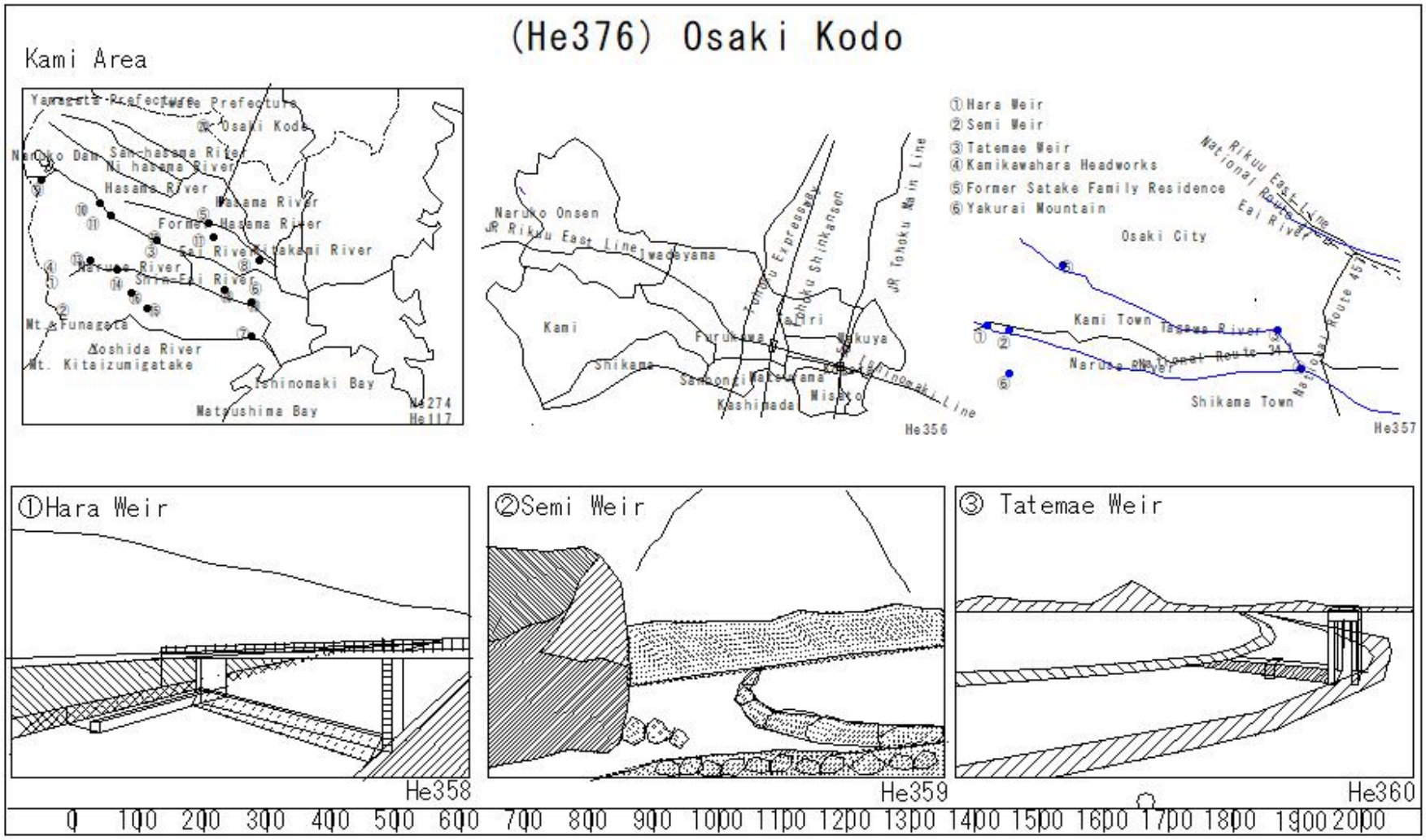

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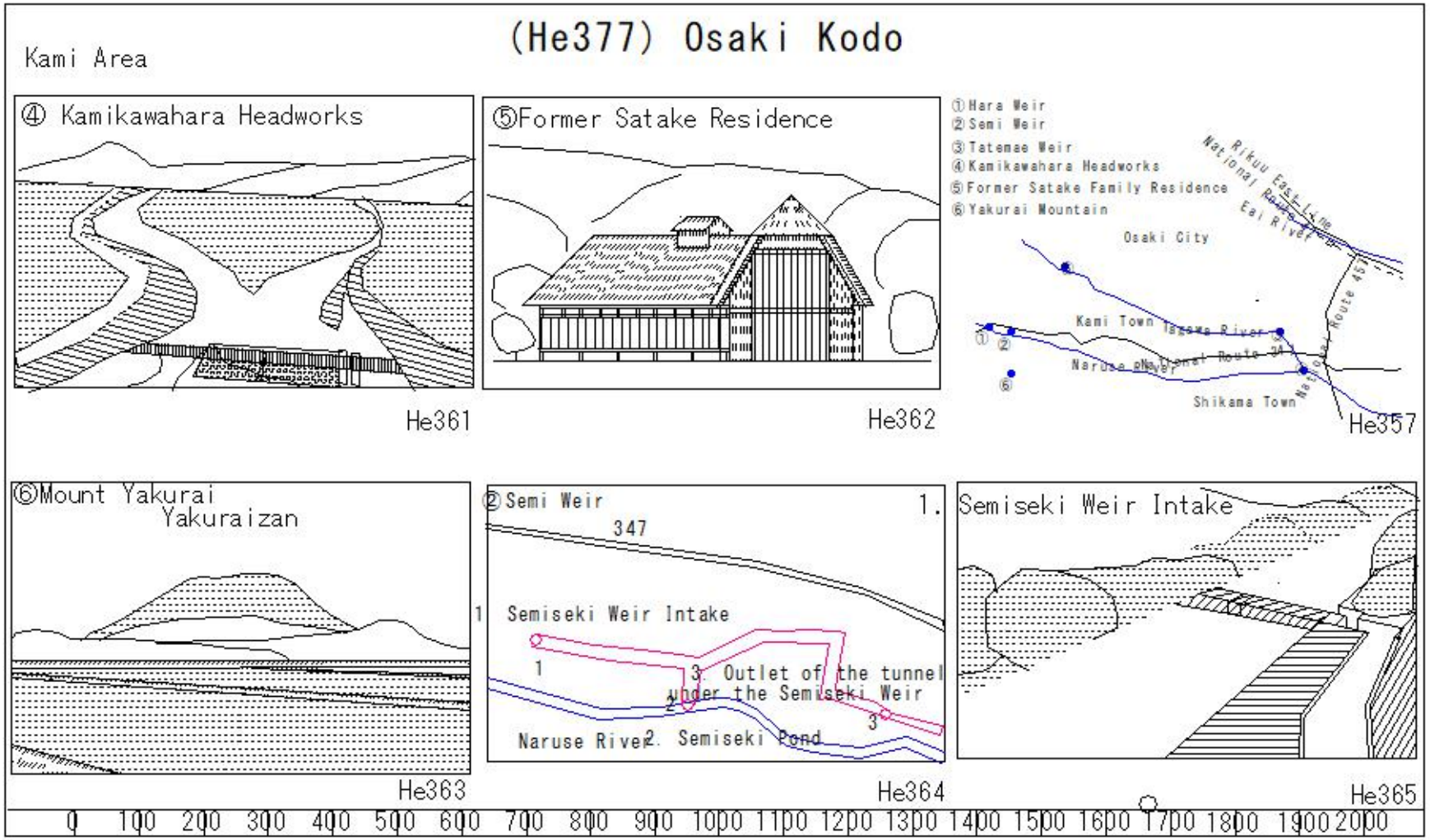
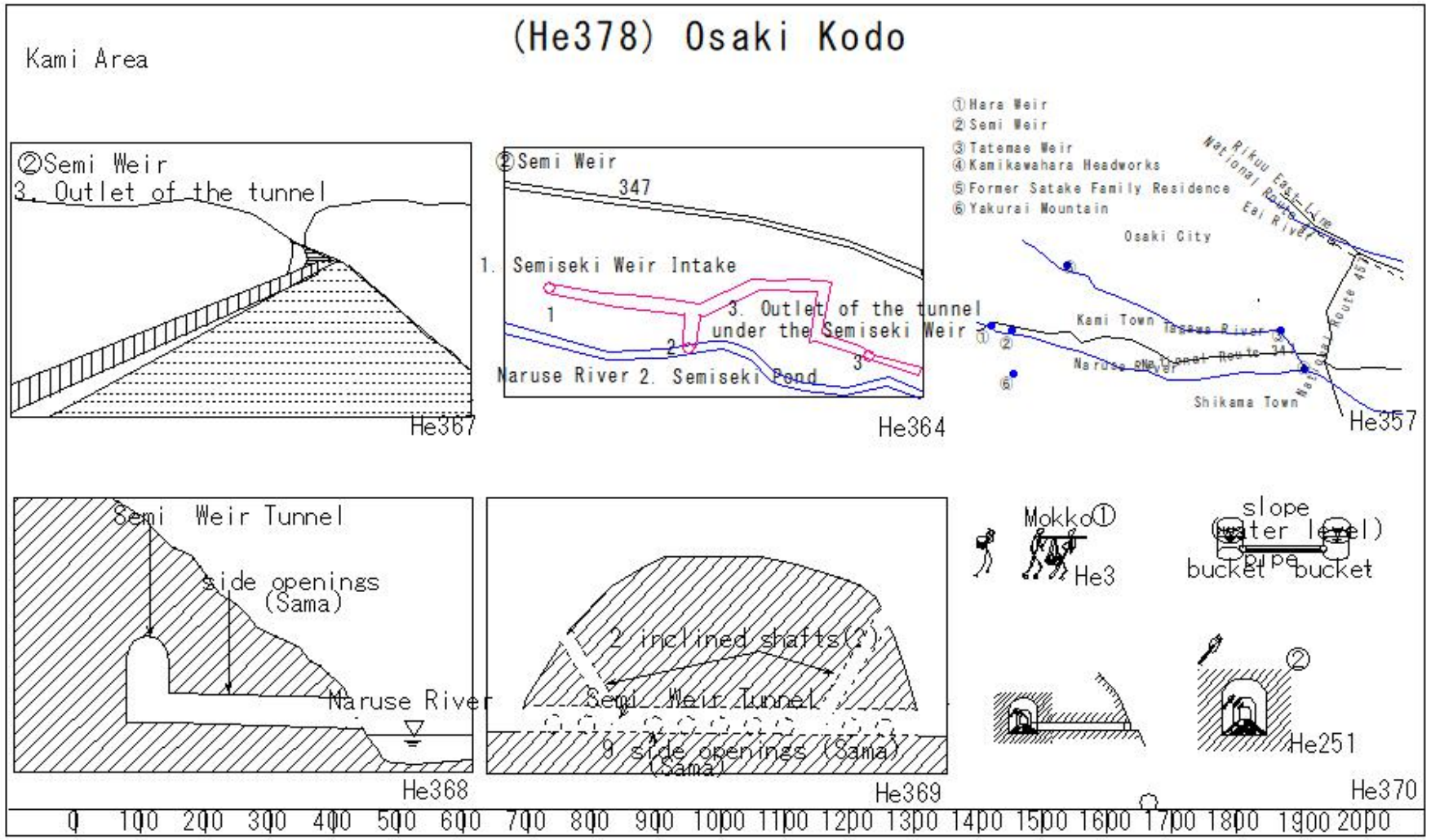


(He378) Osaki Kodo



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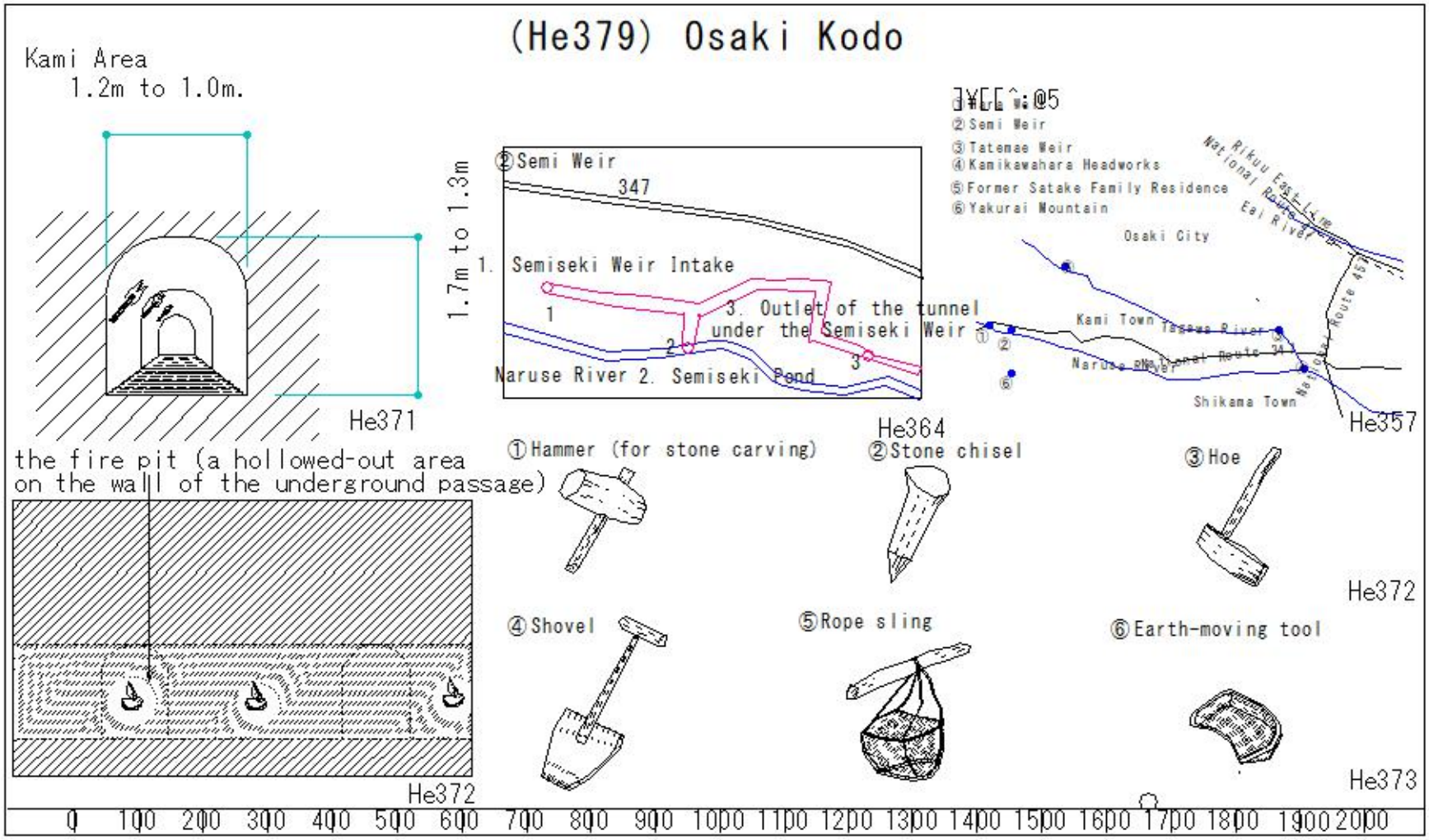

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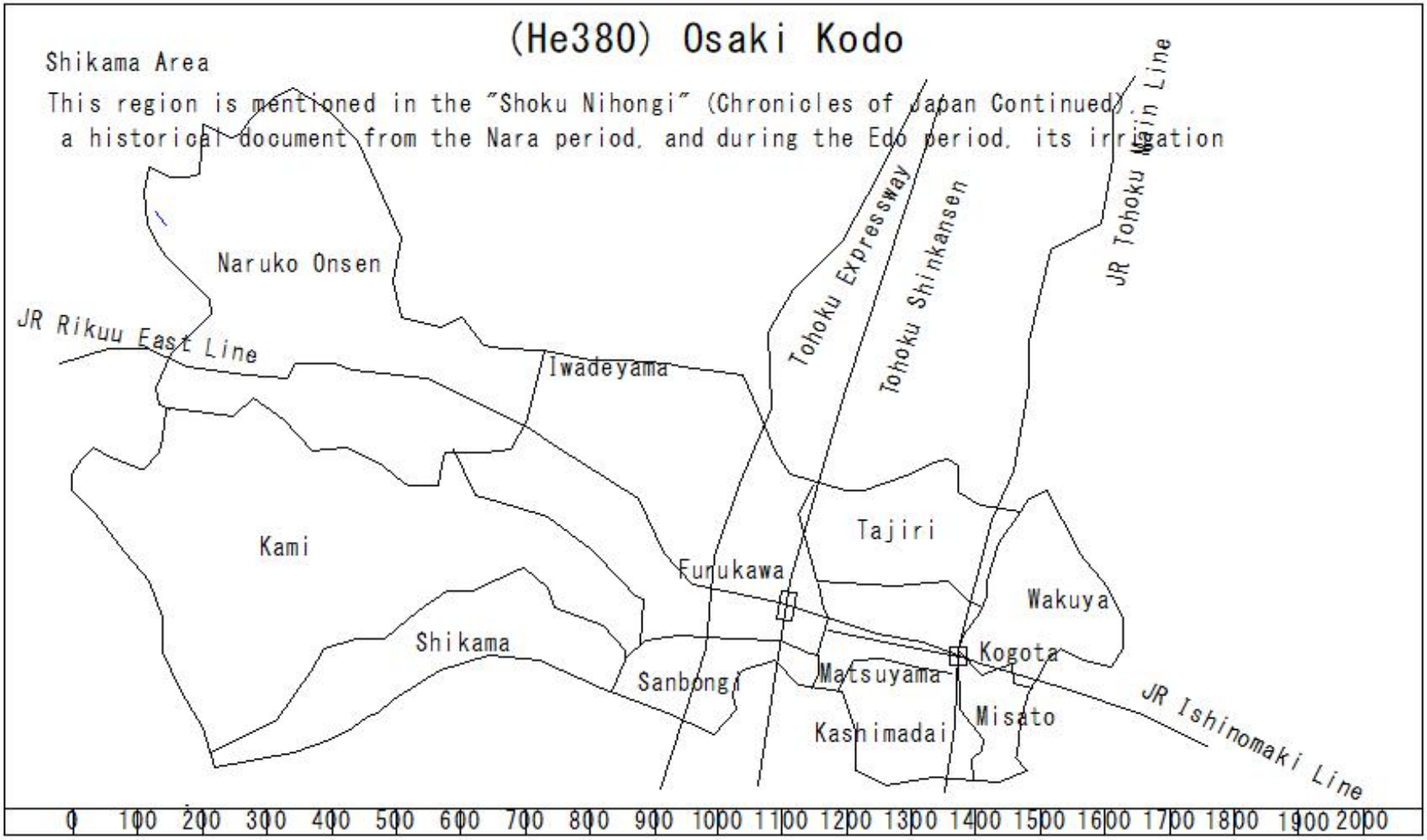

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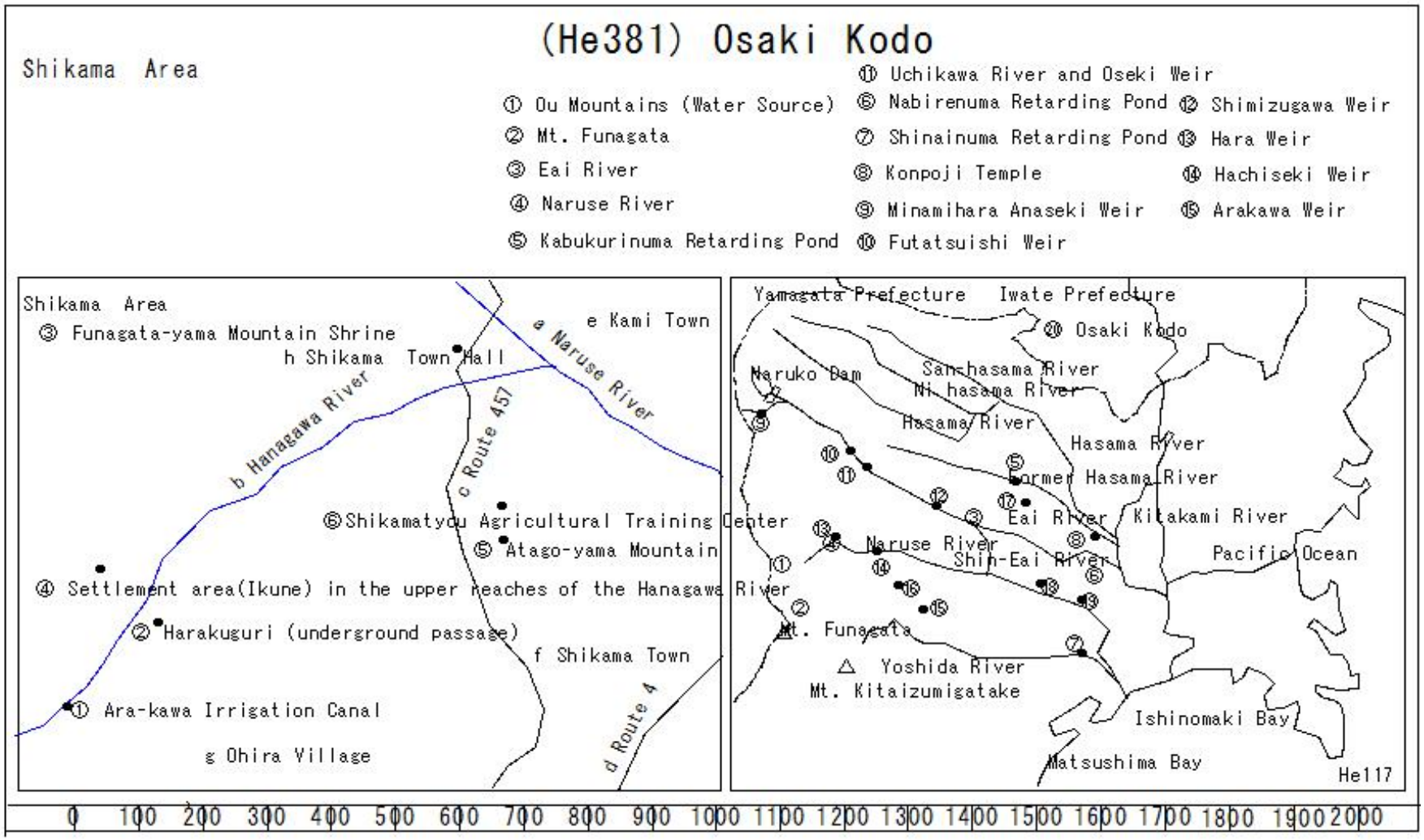


(He382) Osaki Kodo

(He382) Osaki Kodo

Shikama Area

① The current Hanagawa River was once a turbulent river called the Arakawa River.

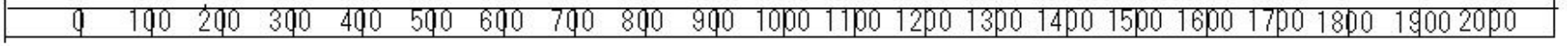
② The Arakawa Irrigation Canal was built to reclaim the marshy land to the south of the river and turn it into farmland.

③ It was constructed between 1646 and 1649.

④ It was dug along the natural slope of the hillside, extending from the Hanagawa River towards the Matsuyama area of Osaki City.

⑤ Okoshi Kiemon, who oversaw the construction, is believed to have conceived a sophisticated water management system for the entire Osaki agricultural region, even in an era without detailed maps.

⑥ This was a large-scale project, with a total length of 33 km, including 12 underground tunnels (13 in total for the entire Arakawa irrigation canal), totaling approximately 1,700 m in length.



(He383) Osaki Kodo

(He383) Osaki Kodo

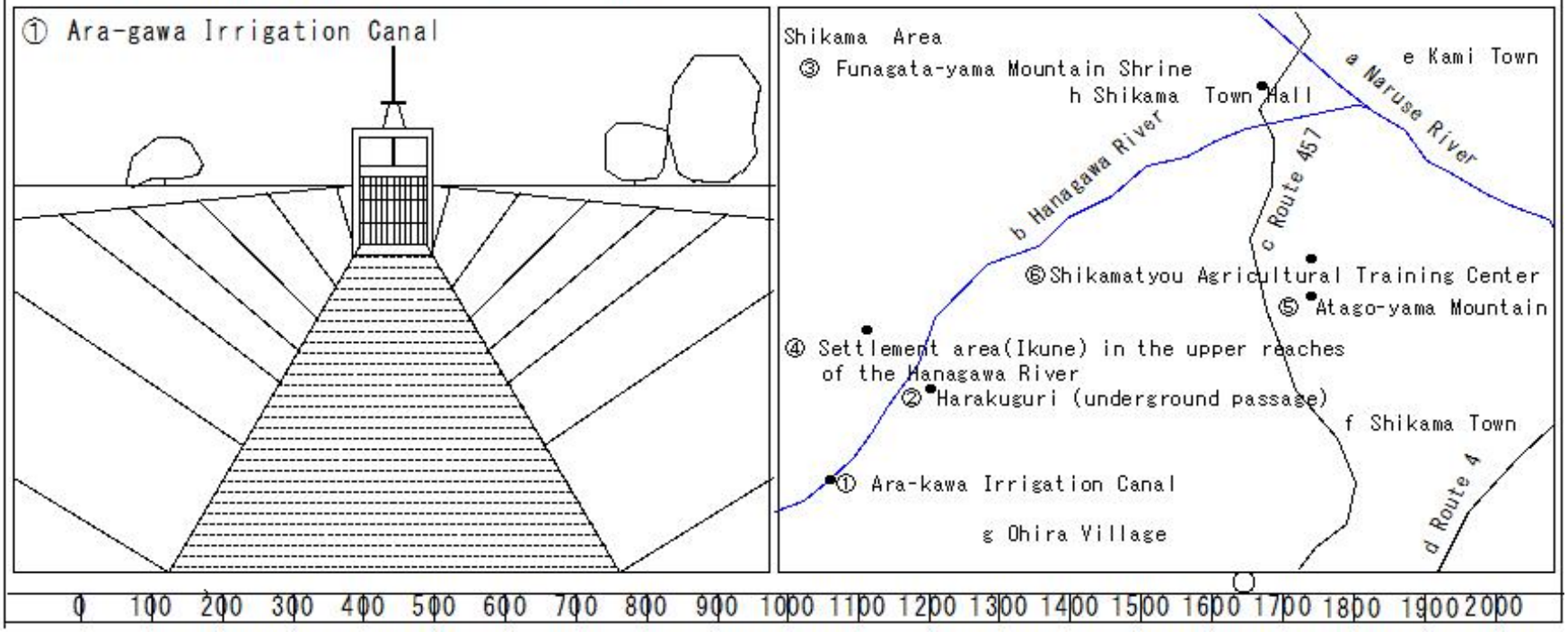
Shikama Area

① Ara-gawa Irrigation Canal

Built between 1646 and 1649 Total length: 33 km

Extending along the Arakawa River (now known as Hanagawa River) to Sanbongi, Osaki City

Features 12 underground tunnels (13 in total along the entire Arakawa irrigation canal), totaling approximately 1,700 m in length

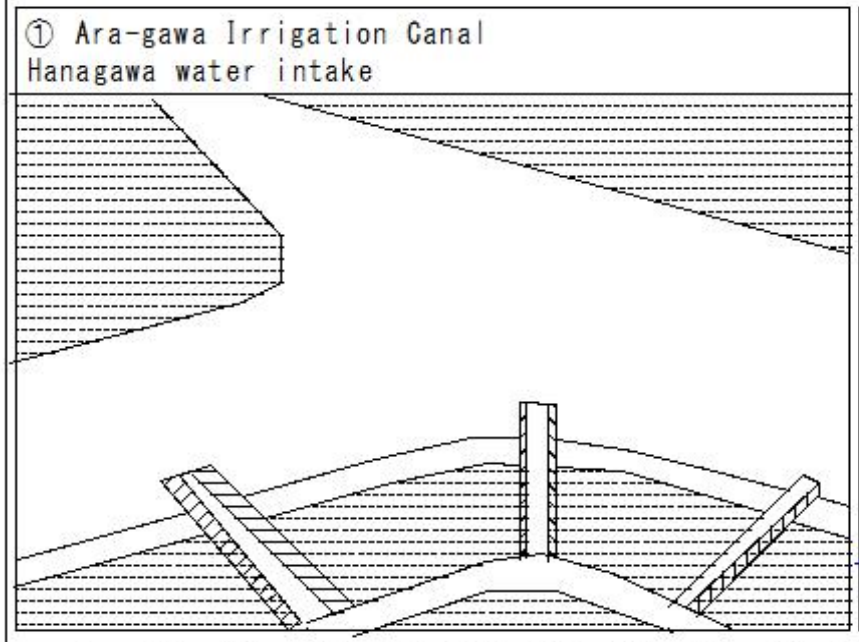


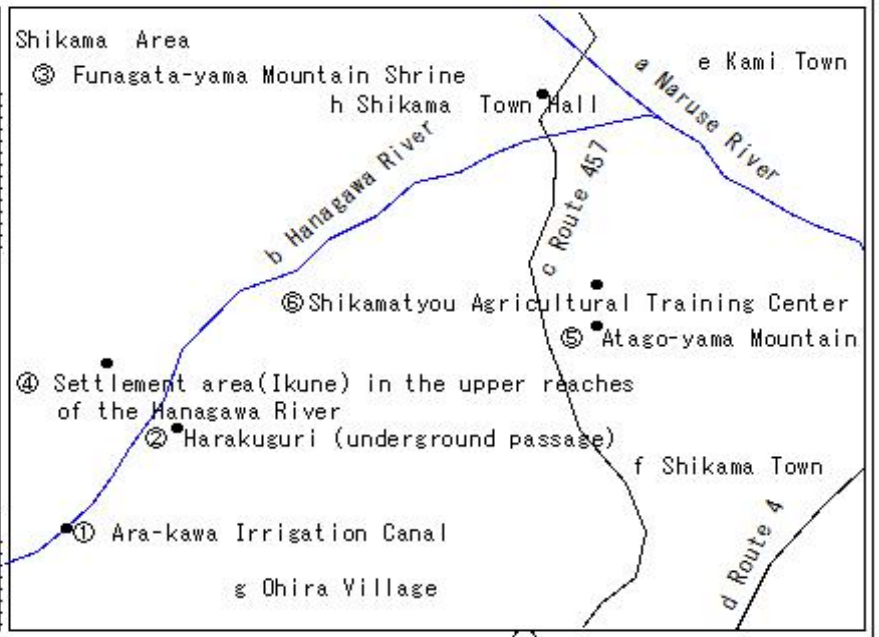
(He384) Osaki Kodo

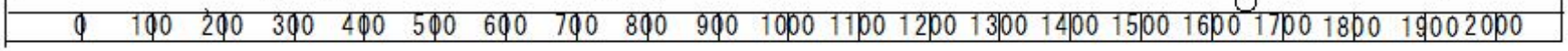
(He384) Osaki Kodo

Shikama Area

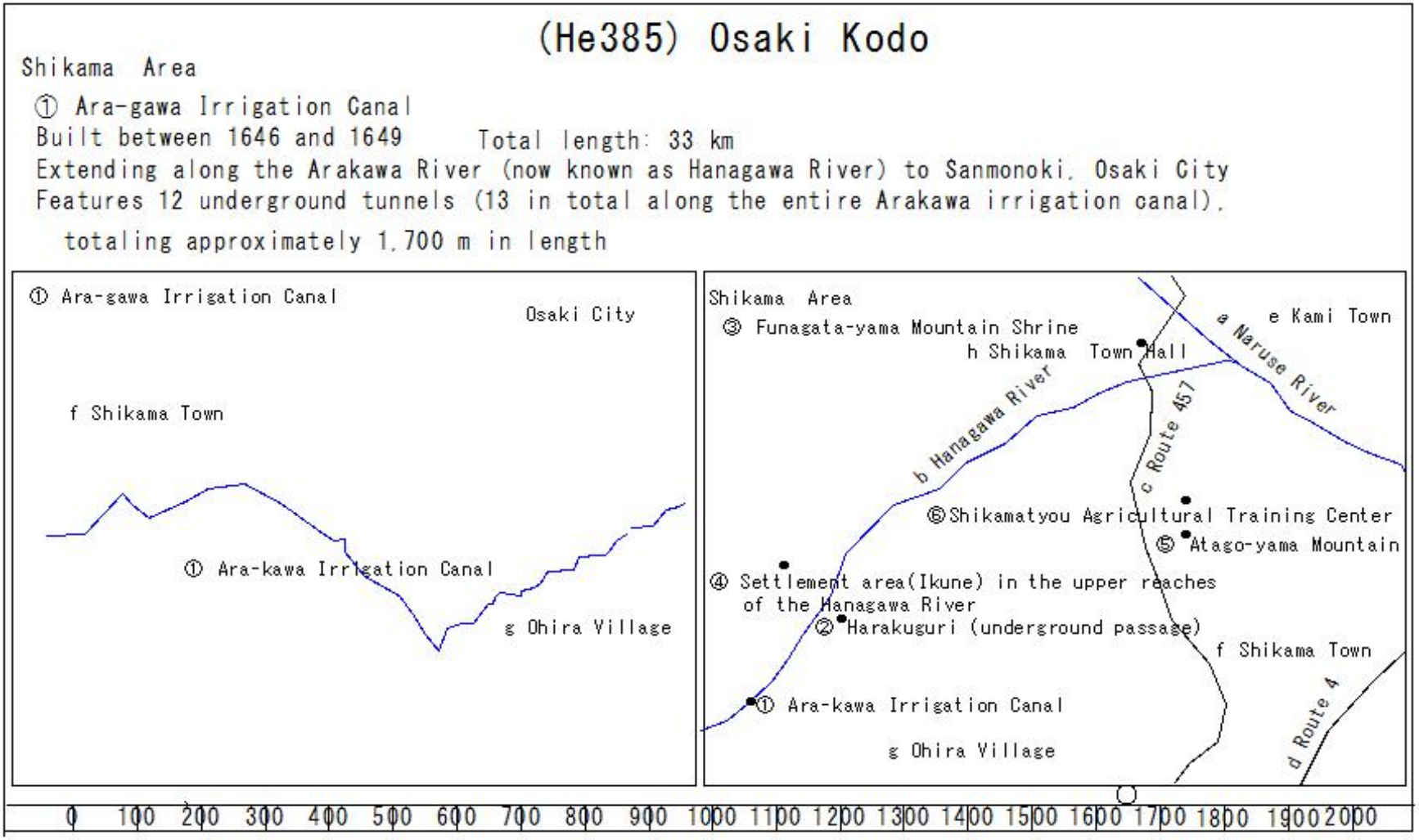
① Ara-gawa Irrigation Canal
Built between 1646 and 1649 Total length: 33 km
Extending along the Arakawa River (now known as Hanagawa River) to Sanmonoki, Osaki City
Features 12 underground tunnels (13 in total along the entire Arakawa irrigation canal),
totaling approximately 1,700 m in length







(He385) Osaki Kodo



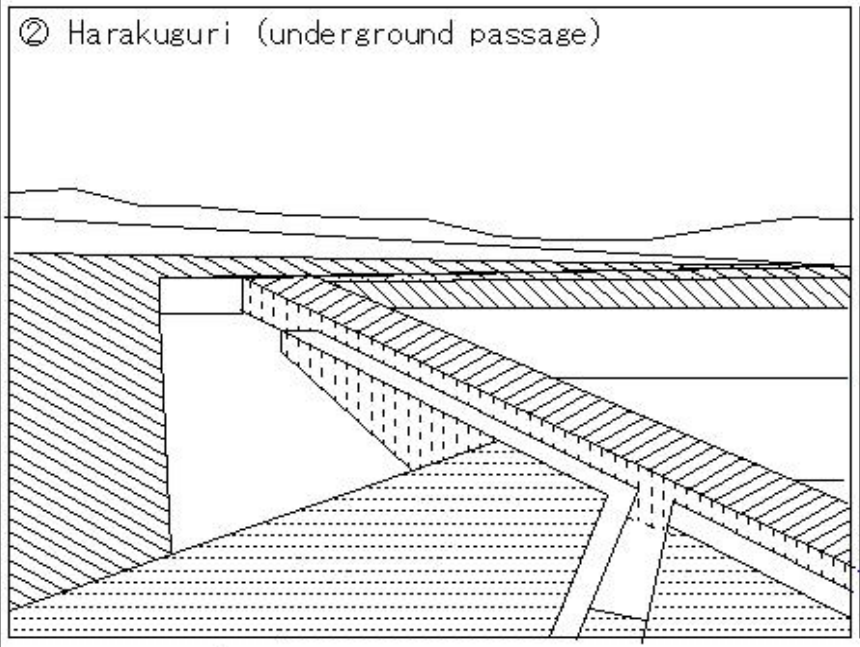
(He386) Osaki Kodo

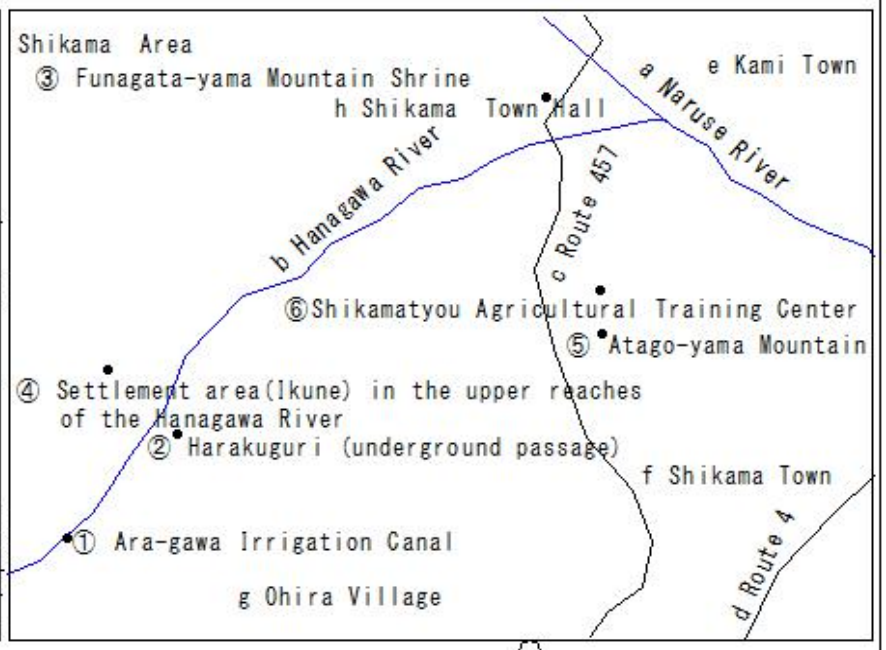
(He386) Osaki Kodo

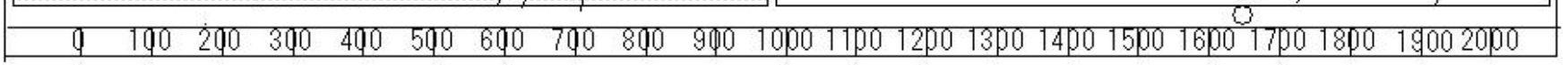
Shikama Area

② Harakuguri (underground passage)

1. This is a tunnel (aqueduct tunnel) located upstream of the 12 tunnels/underground passages along the Arakawa Irrigation Canal.
2. The tunnel makes a 90-degree turn, changes direction to the east, and extends towards a hilly area containing Paleolithic archaeological sites.







(He387) Osaki Kodo

Shikama Area

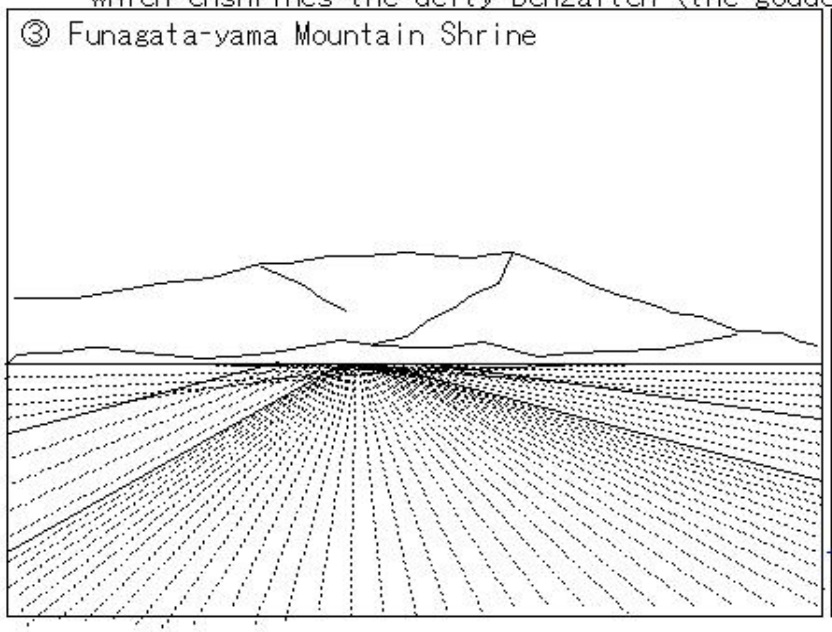
(He387) Osaki Kodo

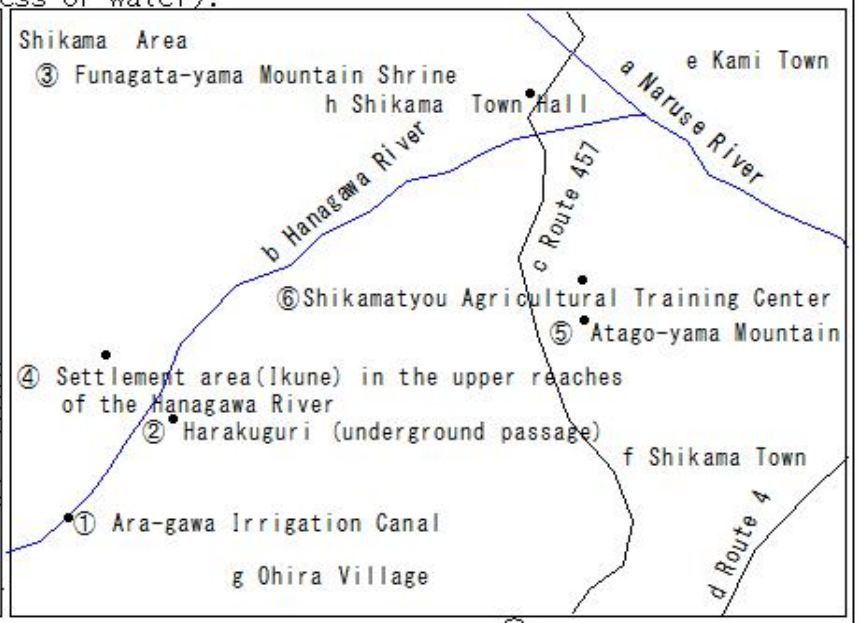
③ Funagata-yama Mountain Shrine

Mount Funagata Shrine and its Religious Significance Traditional Agricultural Culture

① Mount Funagata, located at the source of the Naruse River, has long been revered as a sacred mountain by the local community, where people worship mountain deities, water deities, and the deity of rice cultivation.

② At the summit of the mountain stands the Funagata-yama Gosh Shrine, which enshrines the deity Benzaiten (the goddess of water).





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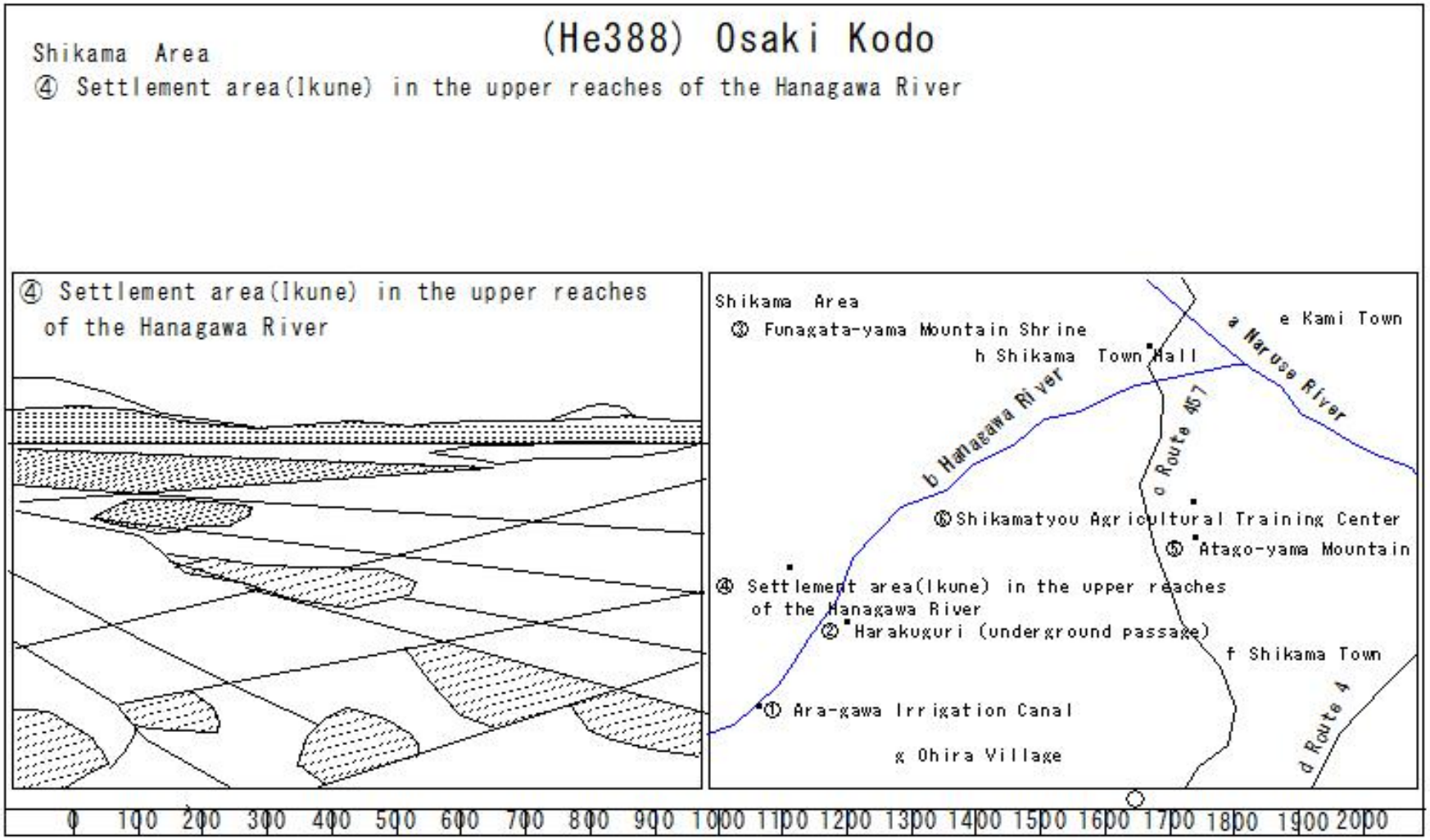
(He388) Osaki Kodo



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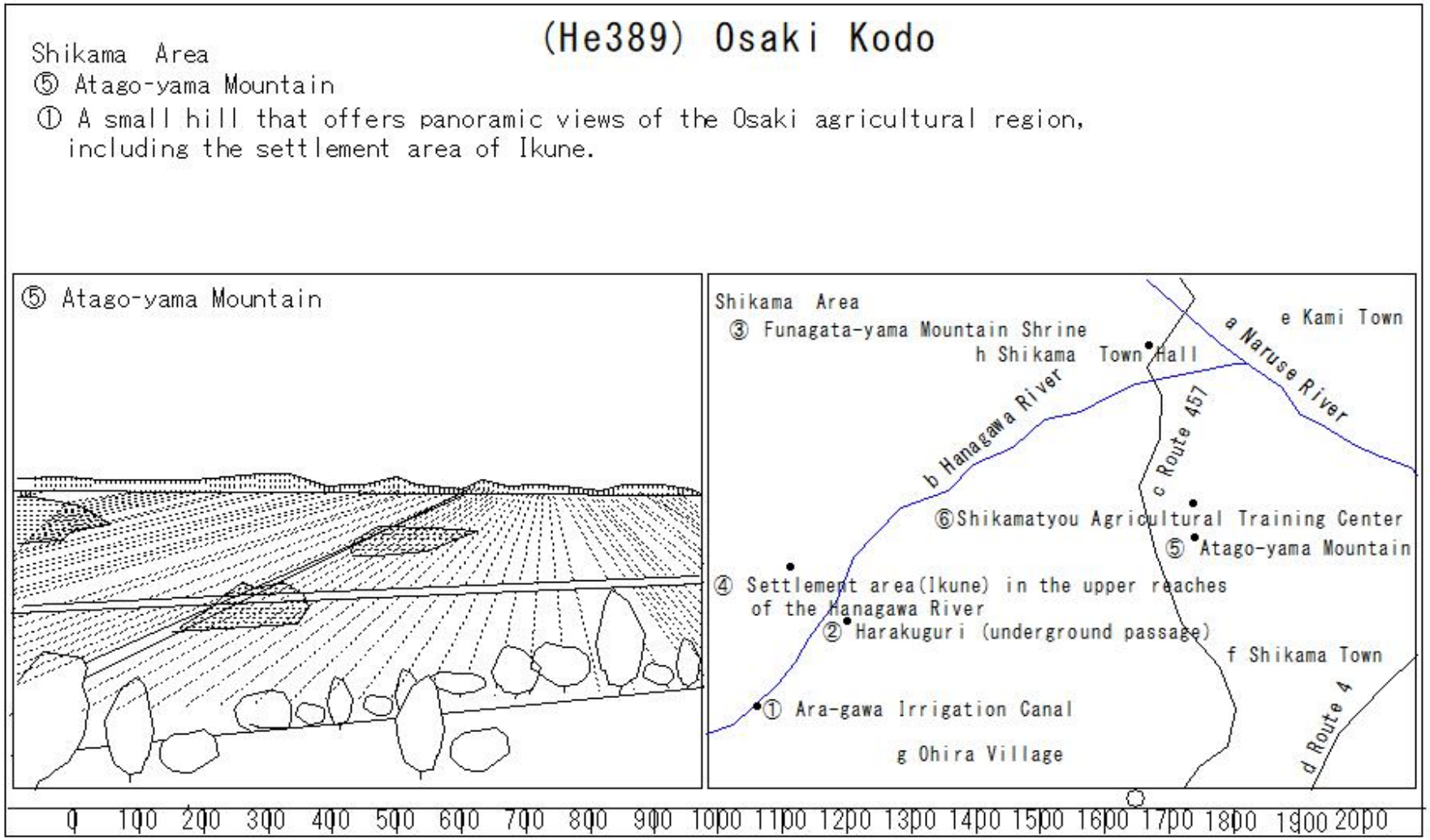

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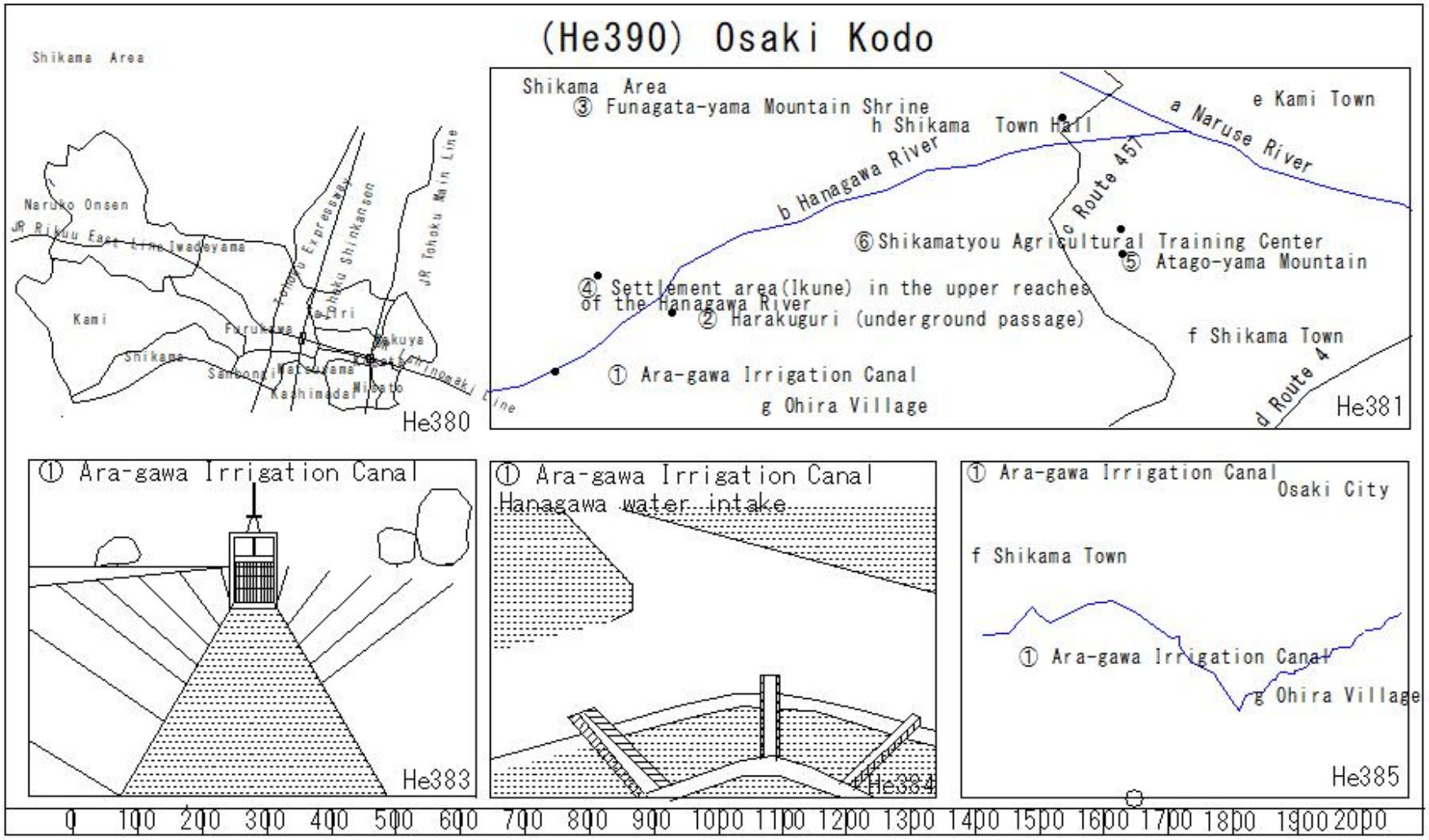

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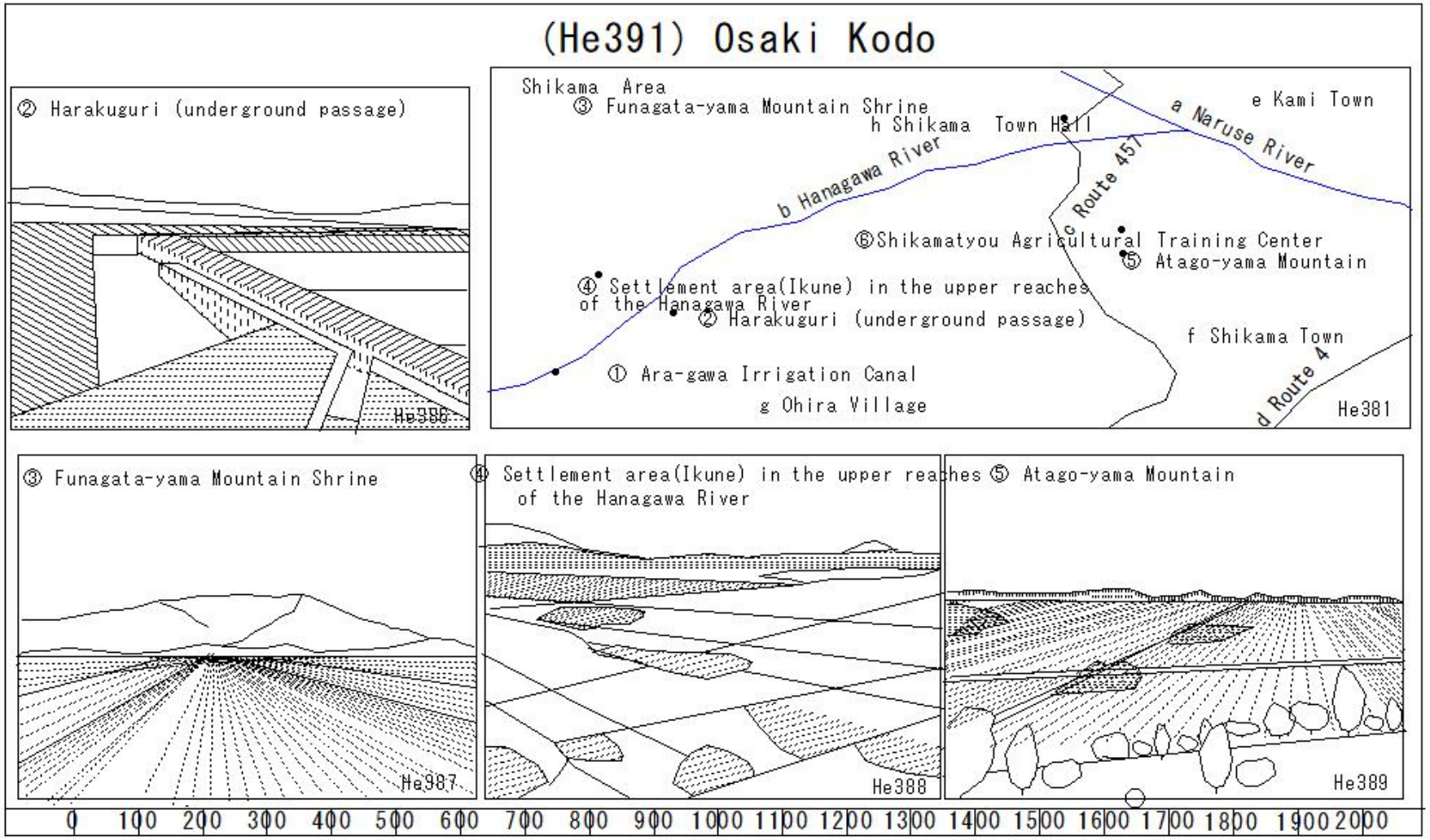

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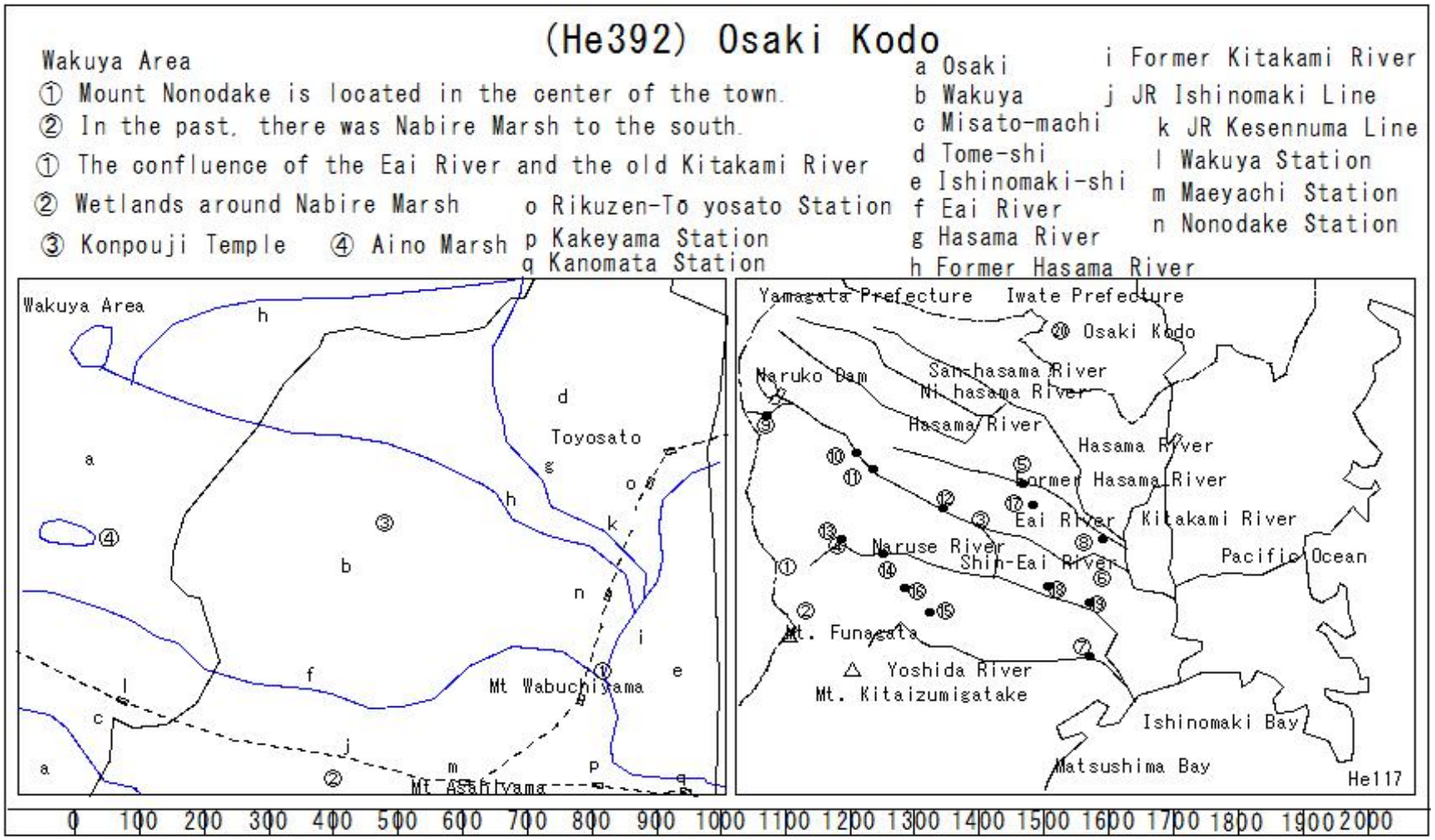

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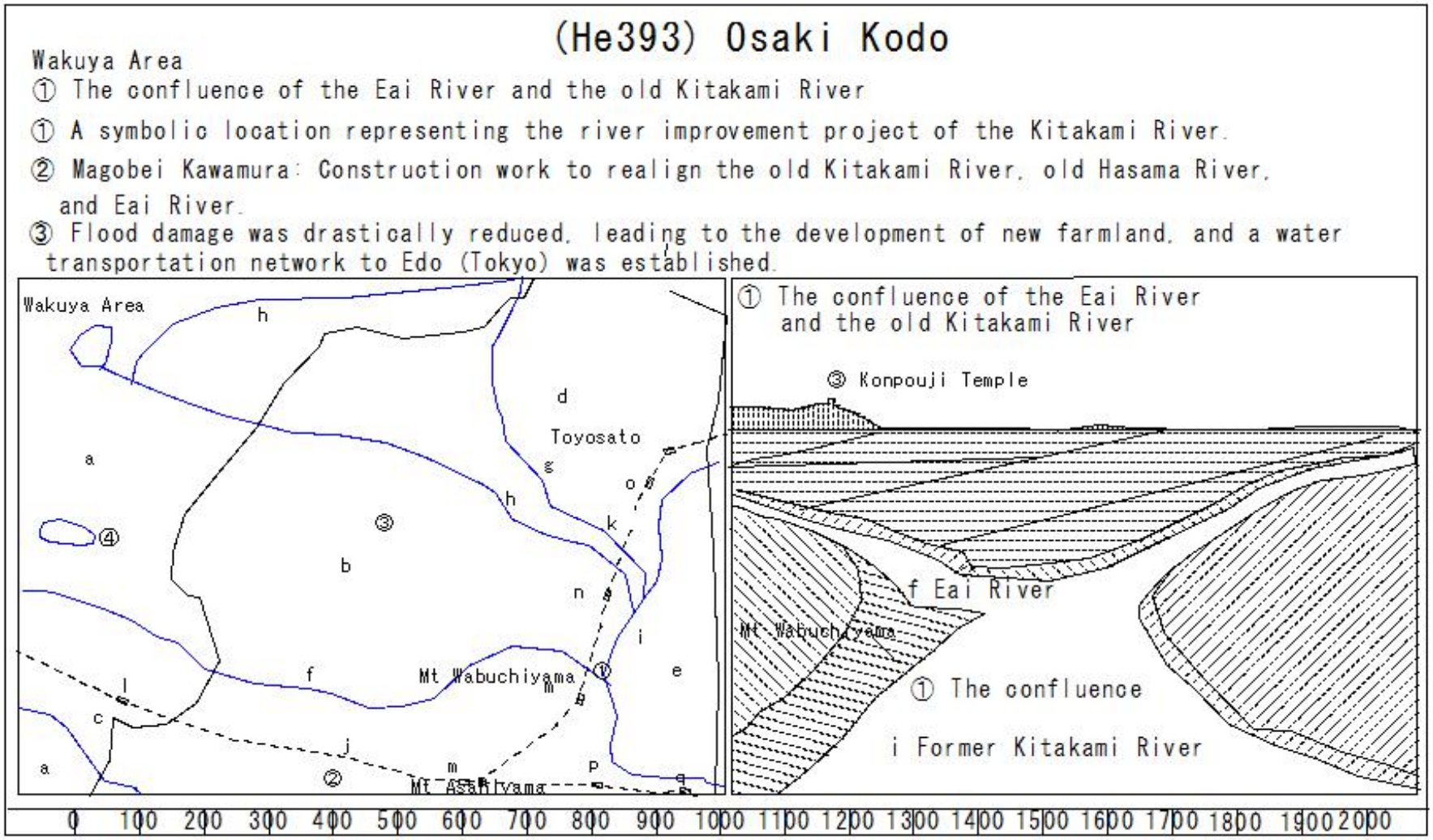
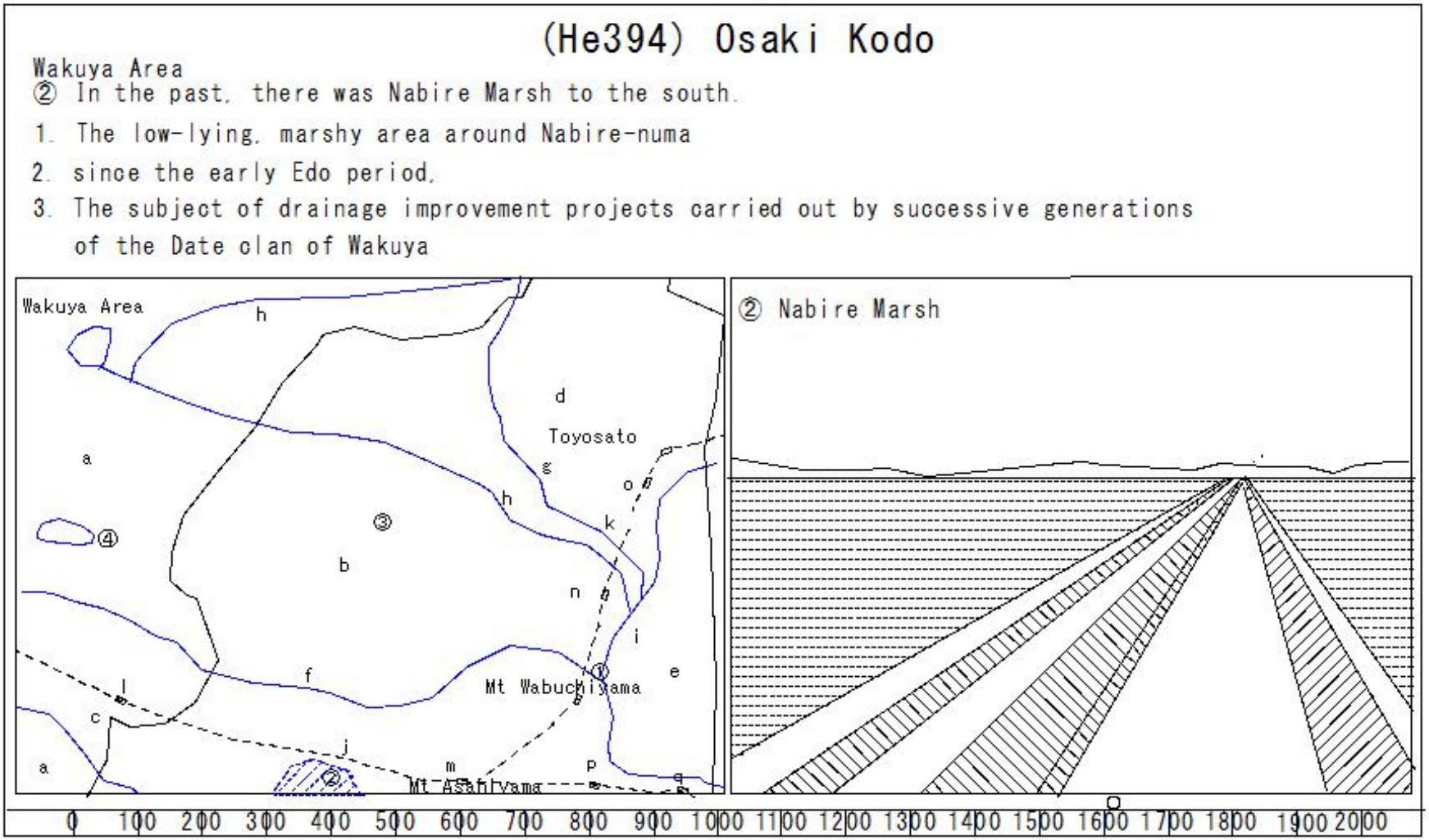


(He394) Osaki Kodo

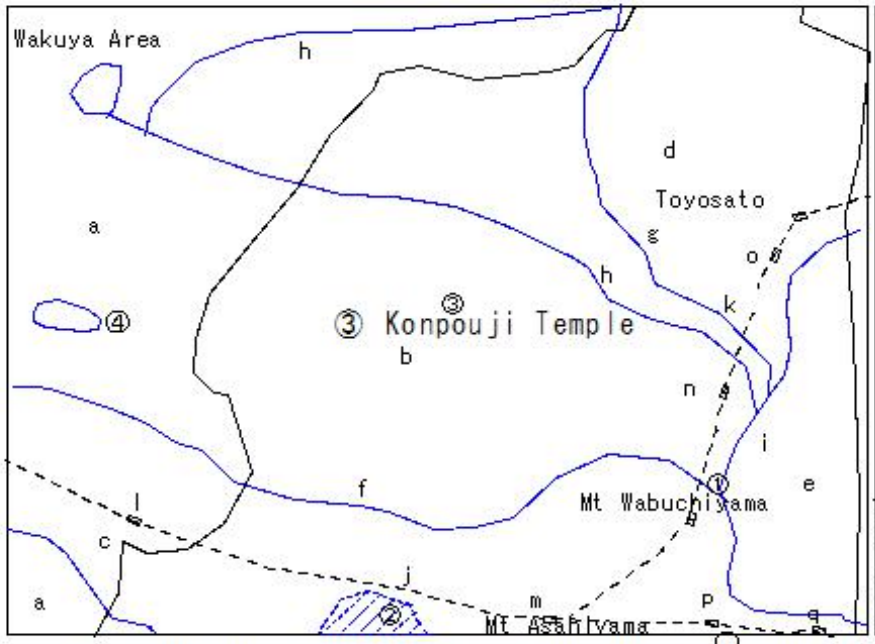


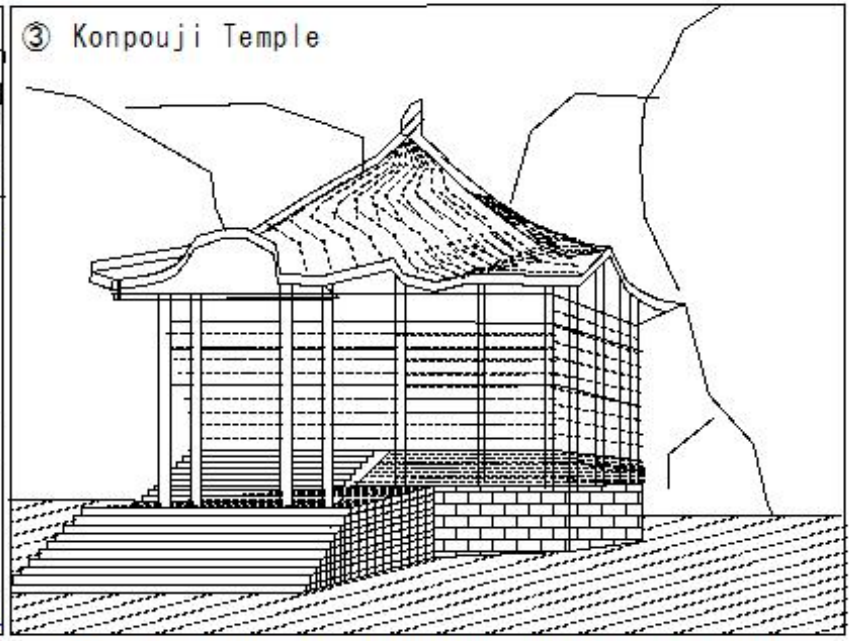
(He395) Osaki Kodo

(He395) Osaki Kodo

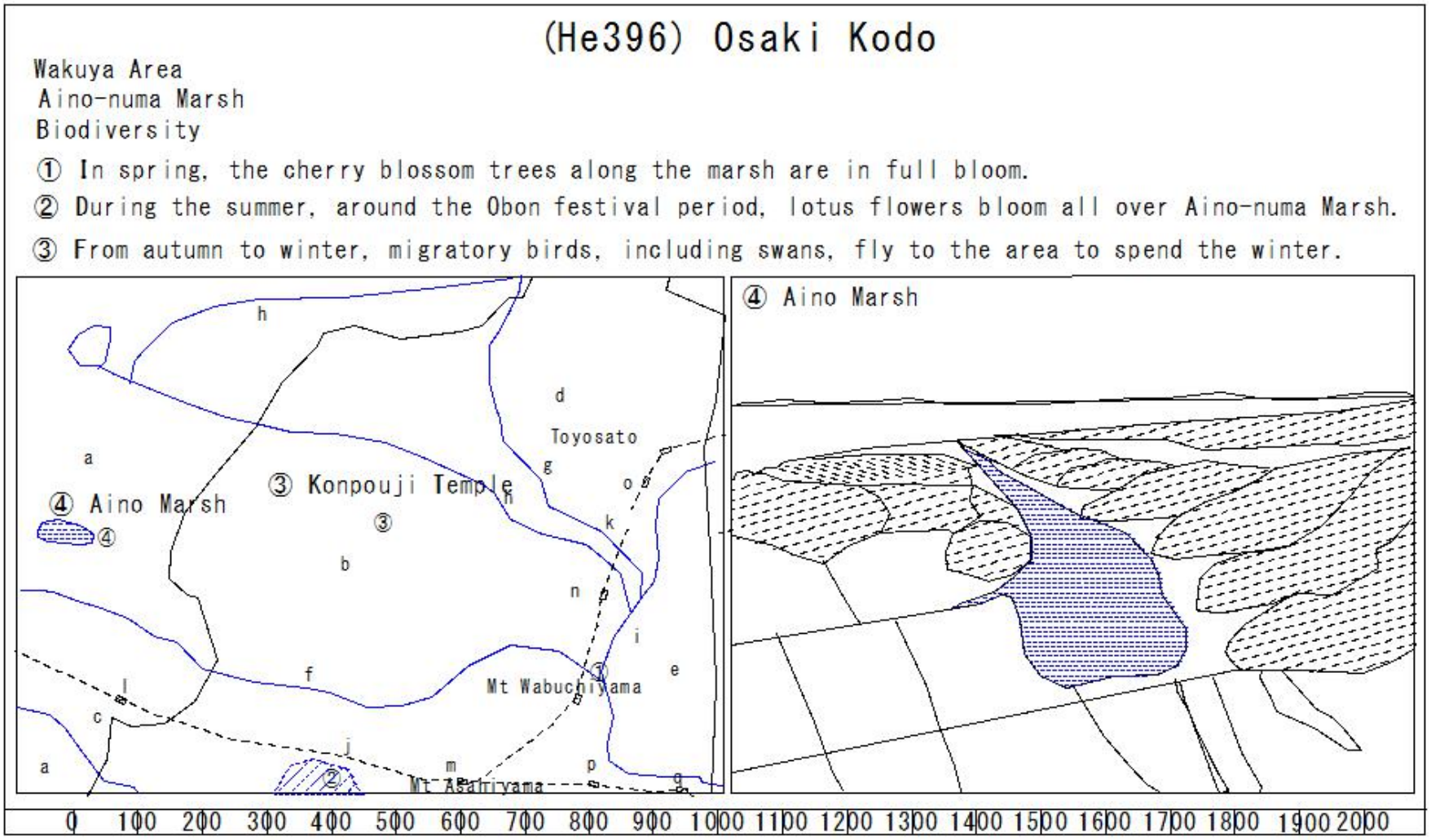
Wakuya Area

1. A sacred site where killing animals and entry by women were strictly prohibited from ancient times.
2. Founded in 807 AD (Daitō 2nd year) by Sakanoue no Tamuramaro.

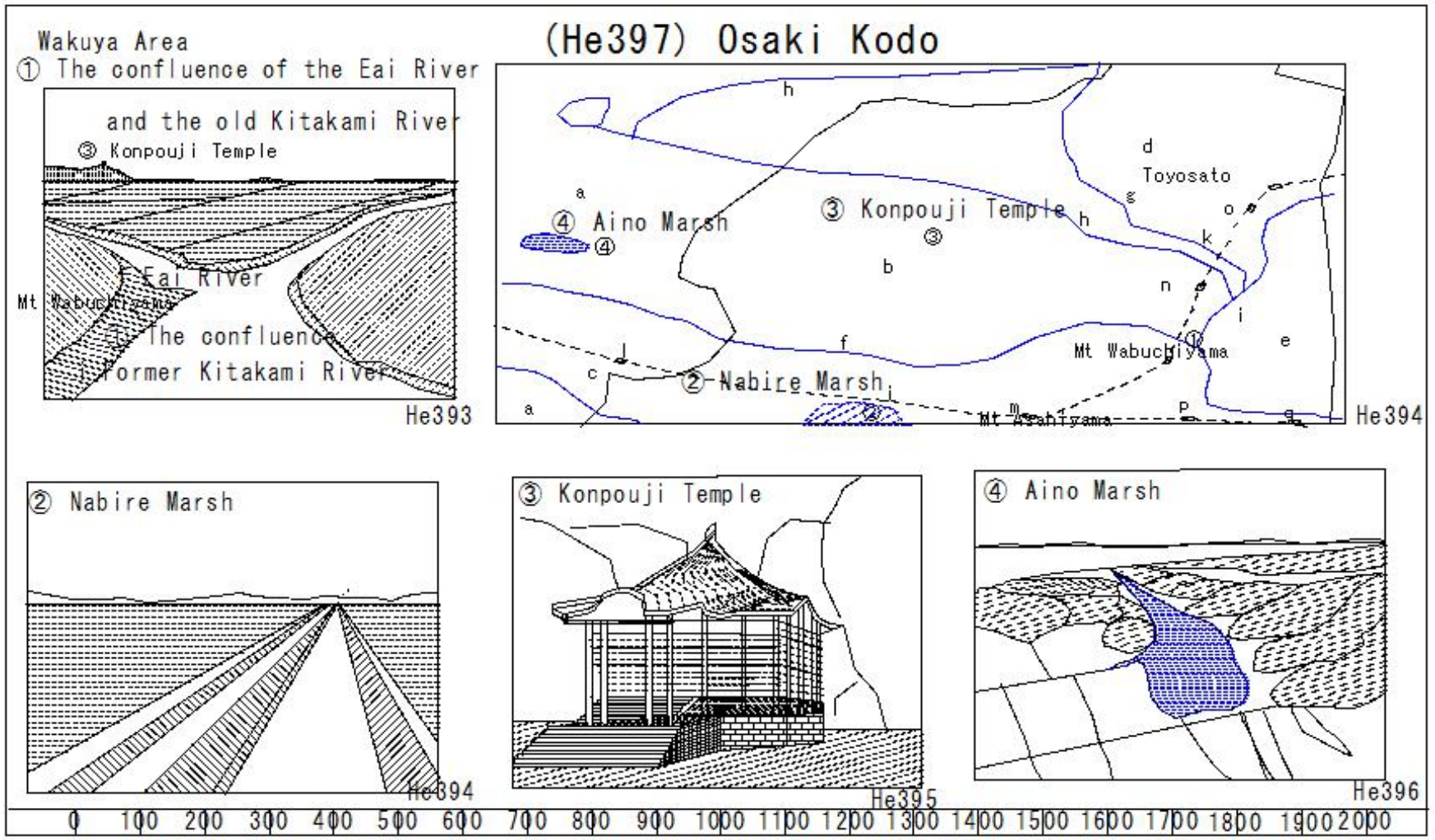




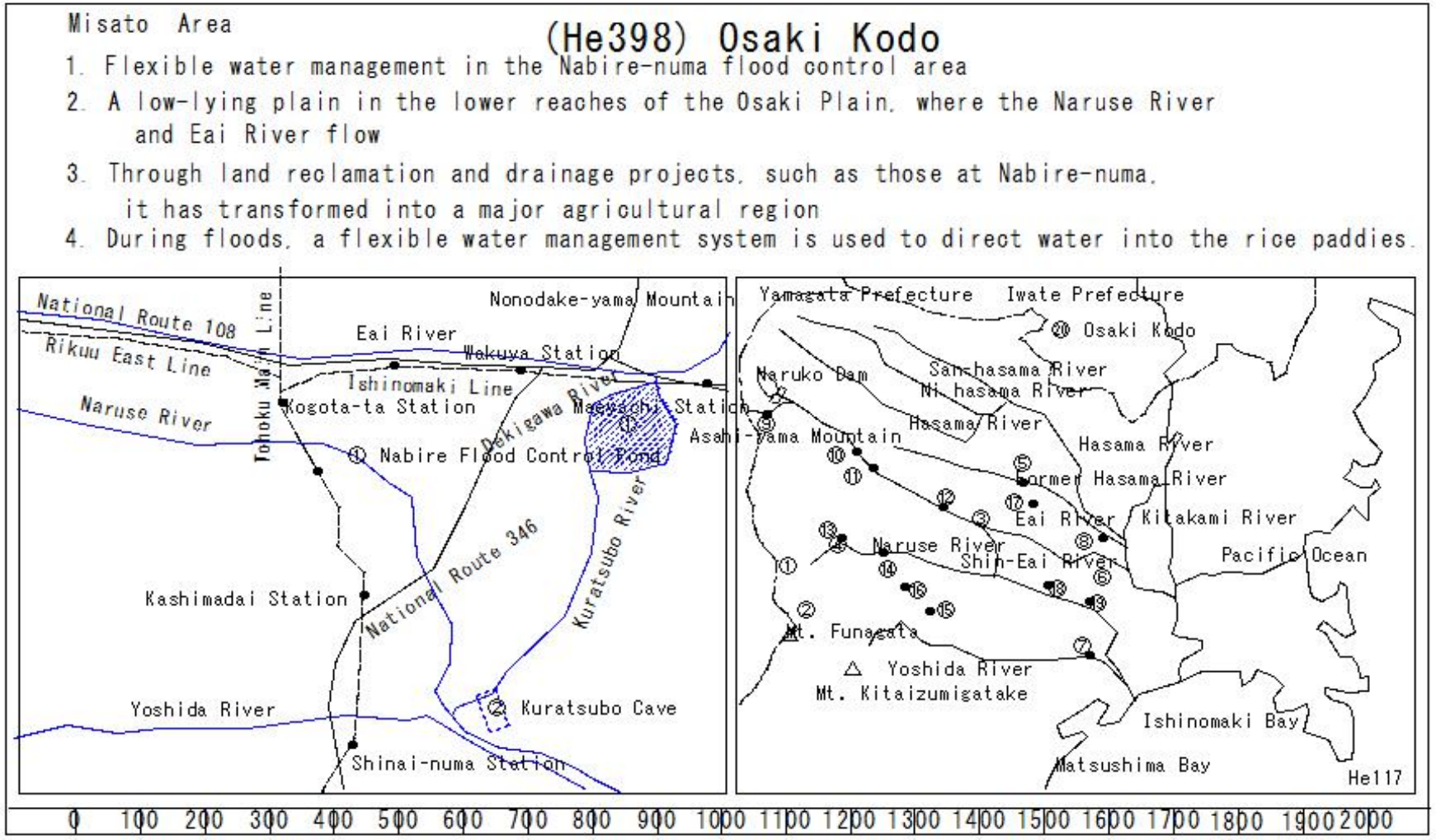
(He396) Osaki Kodo



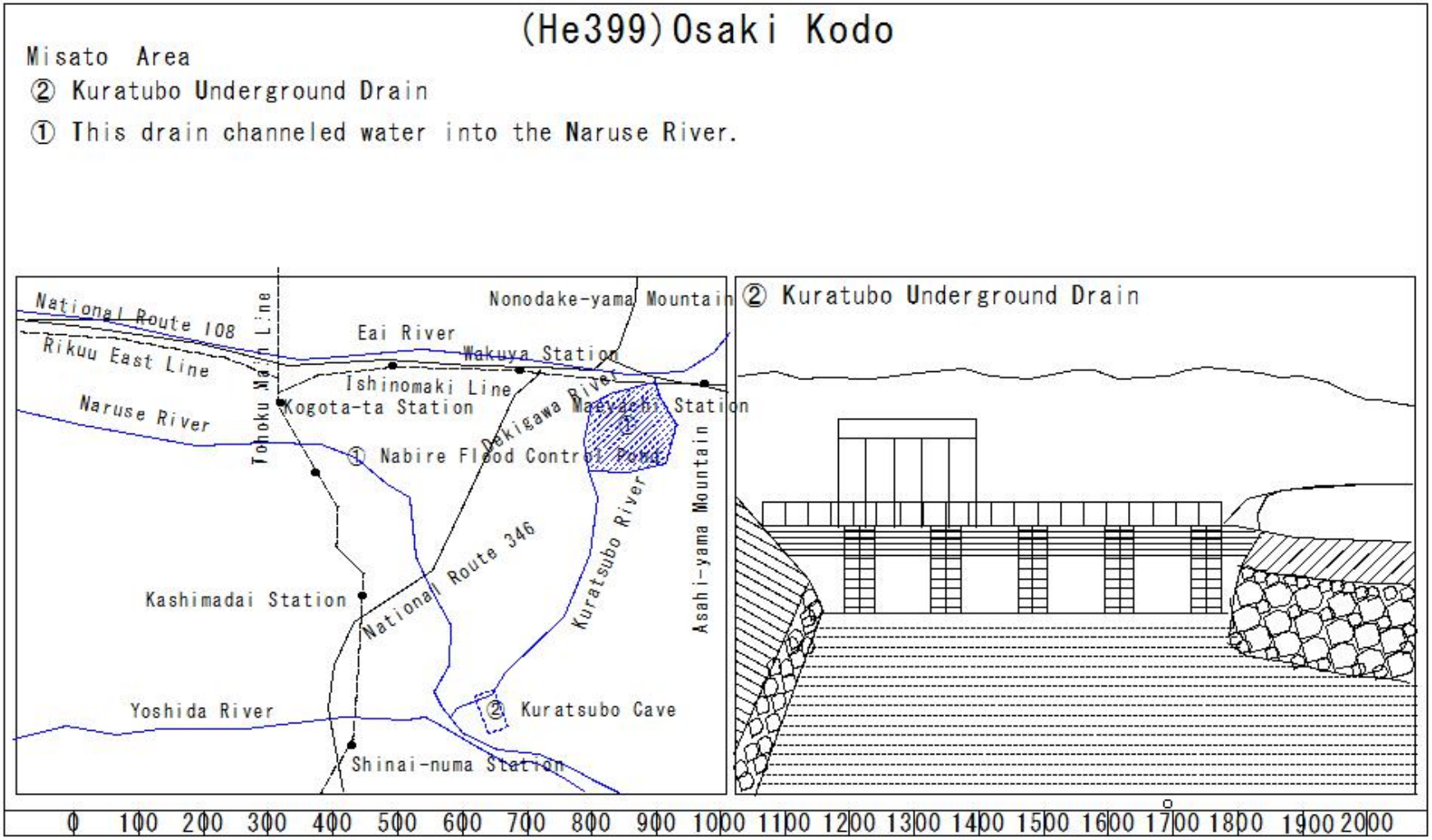
(He397) Osaki Kodo



(He398) Osaki Kodo



(He399) Osaki Kodo



(He400) Osaki Kodo