Design Concept of the facilities to manage river or to occupy the River space

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- Names of the river
- Dike, inspection passage, super levee
- Revetment, gabion, riprap
- Groundsill
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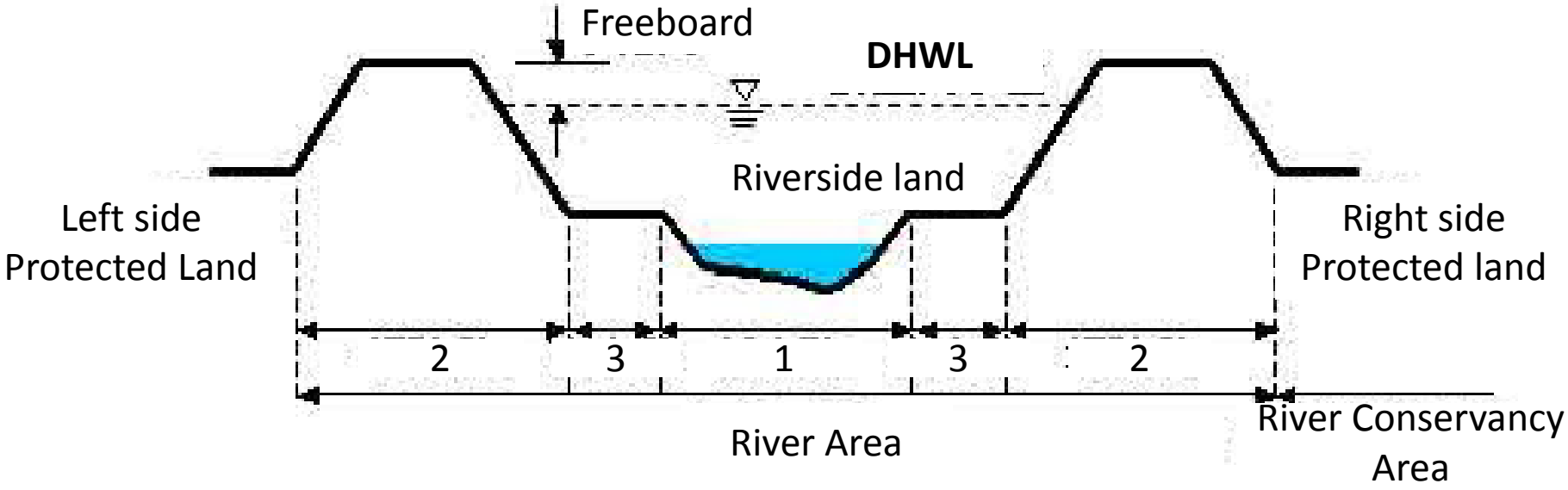
- Weir
- Bridge

Reference

- Ministry of Land Infrastructure Transport and Tourism Ordinance for Structural Standards of River Administration Facilities (STRUCTURAL RULES), Japan
- River and Dam Technical Standards, Japan

Names of the river



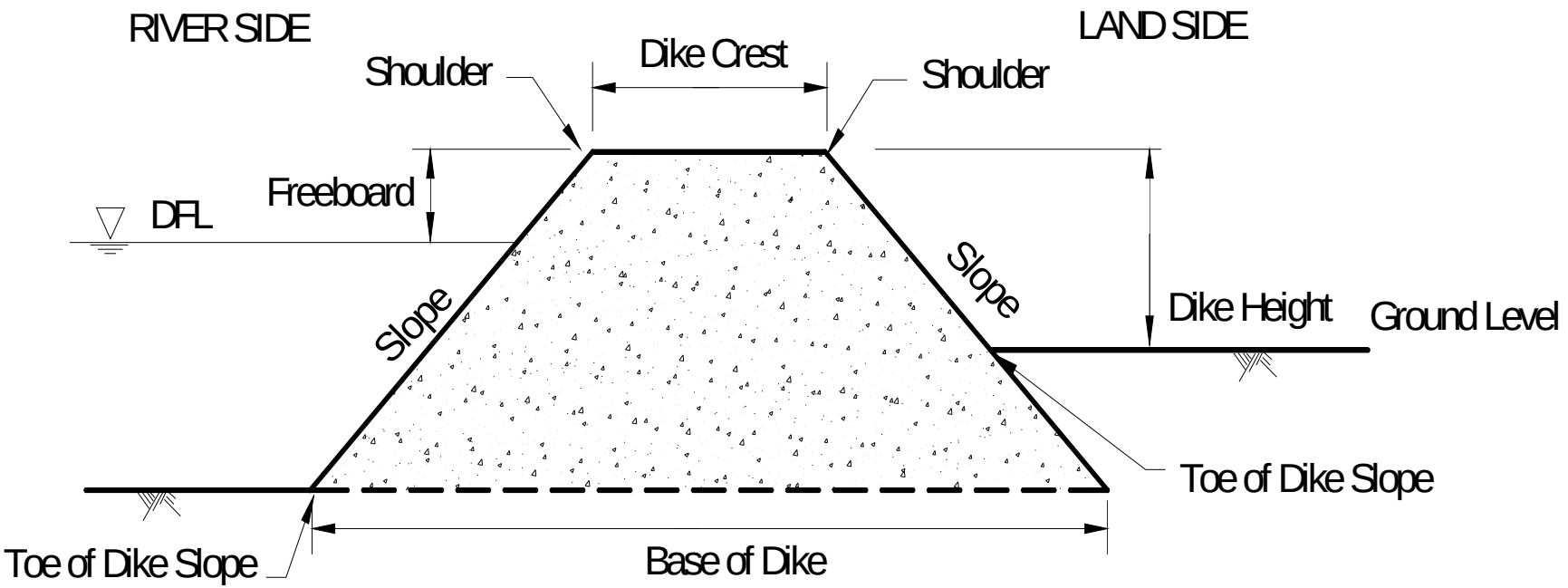
1	**Low water bed, Low-flow Channel**
2	Base of Dike
3	High water bed, River terrace

Koisegawa, Yasato, Ibaraki,
Japan

Ooya River, Chikusei, Ibaraki, Japan

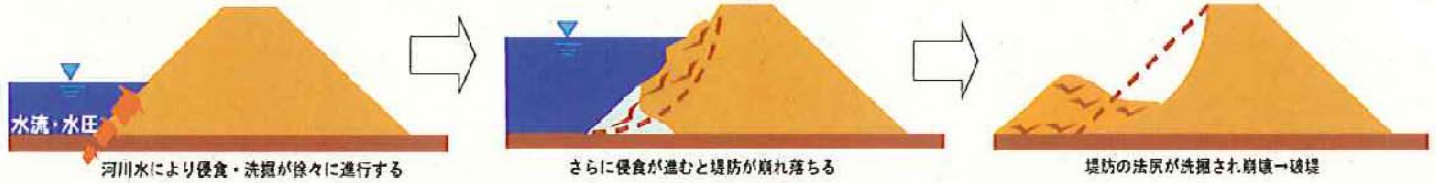
Dike

- A dike is an embankment or levee constructed along the banks of a stream, river, lake or other body of water for the purpose of protecting from overflowing floodwater by confining the stream flow in the regular channel. River improvement should be planned with non-diked river if possible to have efficient drainage conveyance.



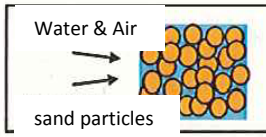
Parts of Dike

1

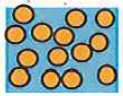


There is a possibility that, by the force of stream during flood, the bank and river front will be scrapped and those will be collapsed.

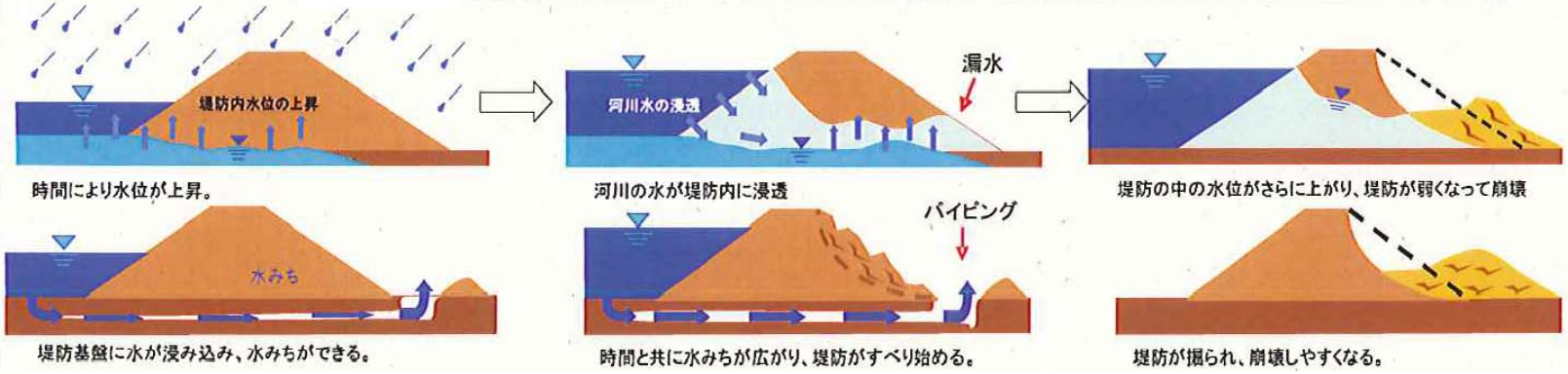
2



Bank is stable from the friction between sand particles and water



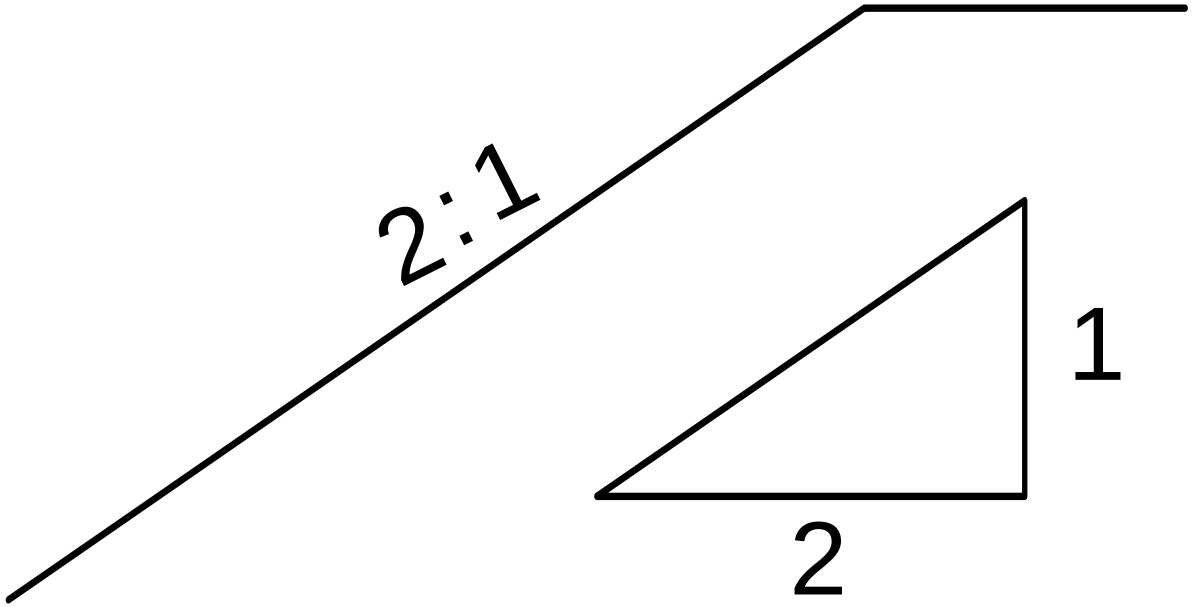
When water% is increased, the bank becomes unstable, because the density of sand is declined. Through infiltration, sand will run out with water.



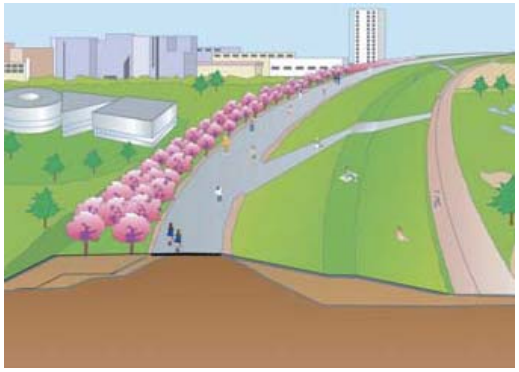
During the flood, even if the water level is bellow the bank top, there is a possibility that, owing to the infiltration of river water into the bank and weakening it, then the bank will be collapsed.

3

Because a bank is made by earth, there is a possibility that once river flow over topped from the bank, it will scrape against the earth, then the bank will be collapsed.



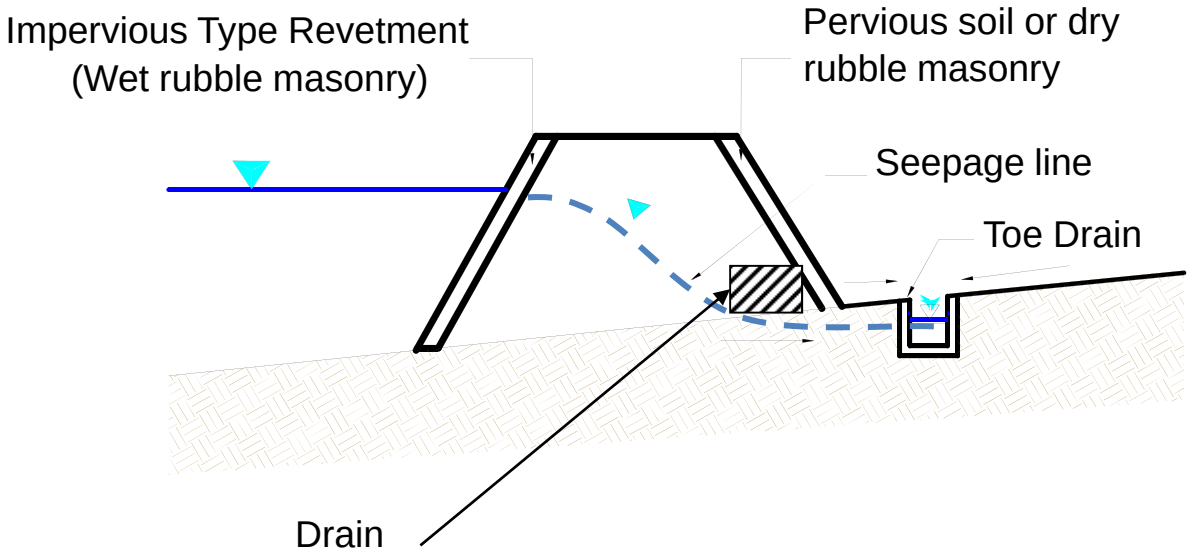
Minimum Slope of Dike



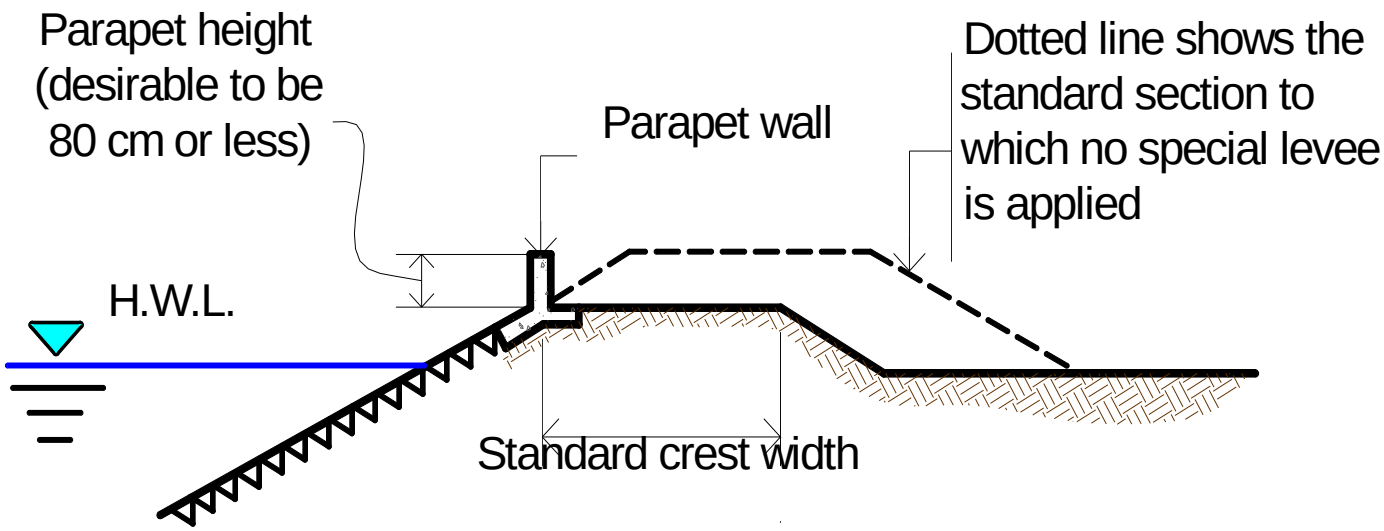
Mild Slope Levee at
Shinanogawa in Nagaoka City

Design flood discharge Q (m^3/s)	**Freeboard (m)**
Less than 200	0.6
200 and up to 500	0.8
500 and up to 2,000	1.0
2,000 and up to 5,000	1.2
5,000 and up to 10,000	1.5
10,000 and over	2.0

Design flood discharge, Q (m^3/sec)	Crest Width (m)
Less than 500	3
500 and up to 2,000	4
2,000 and up to 5,000	5
5,000 and up to 10,000	6
10,000 and over	7

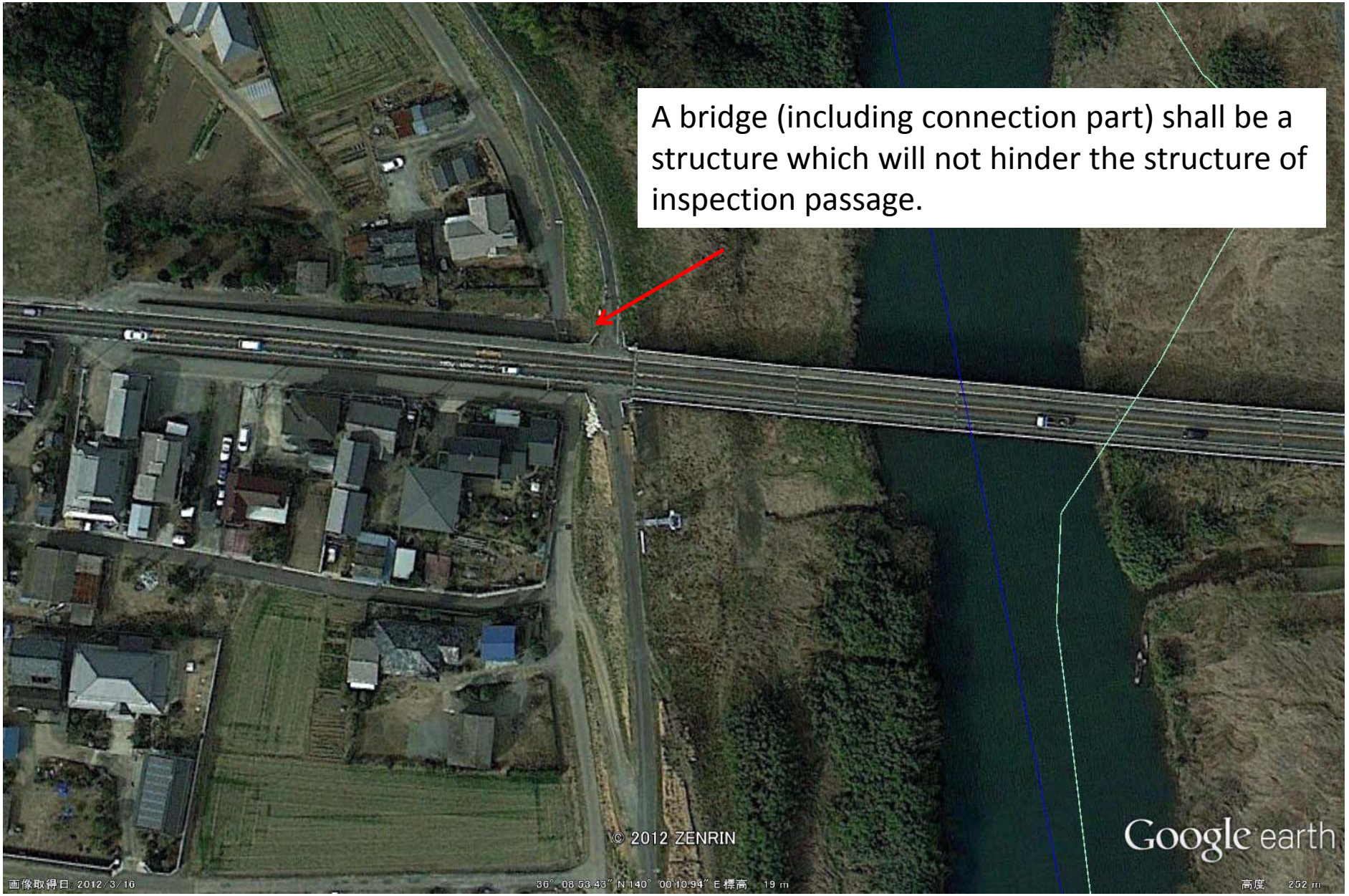


Dike: Example of Countermeasure Against Seepage



Parapet Wall (Example)

Gogyo River, Chikusei city, Ibaraki, Japan 2013 Sep. 7th


A bridge (including connection part) shall be a structure which will not hinder the structure of inspection passage.
© 2012 ZENRIN
Google earth
画像取得日: 2012/3/16
36° 08'53.43" N 140° 00'10.94" E 標高 19 m
高度 252 m

Water pipe bridge at Kokai River
2013 Sep. 7th

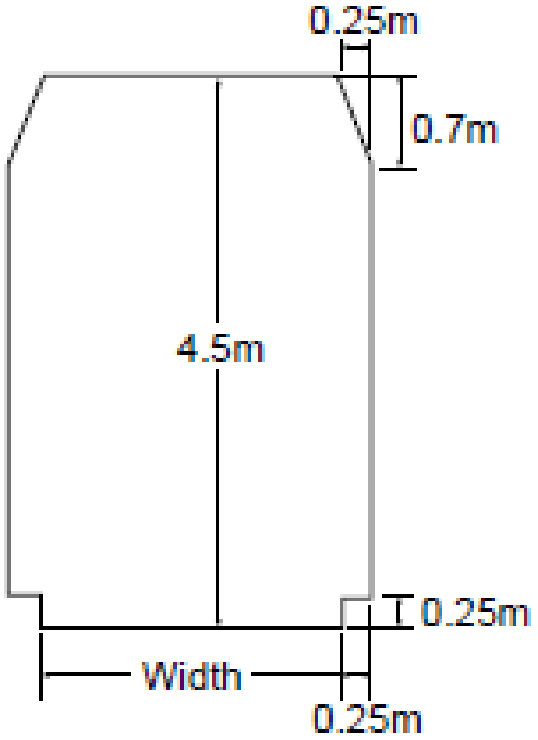
(Inspection passage)

Article 15.

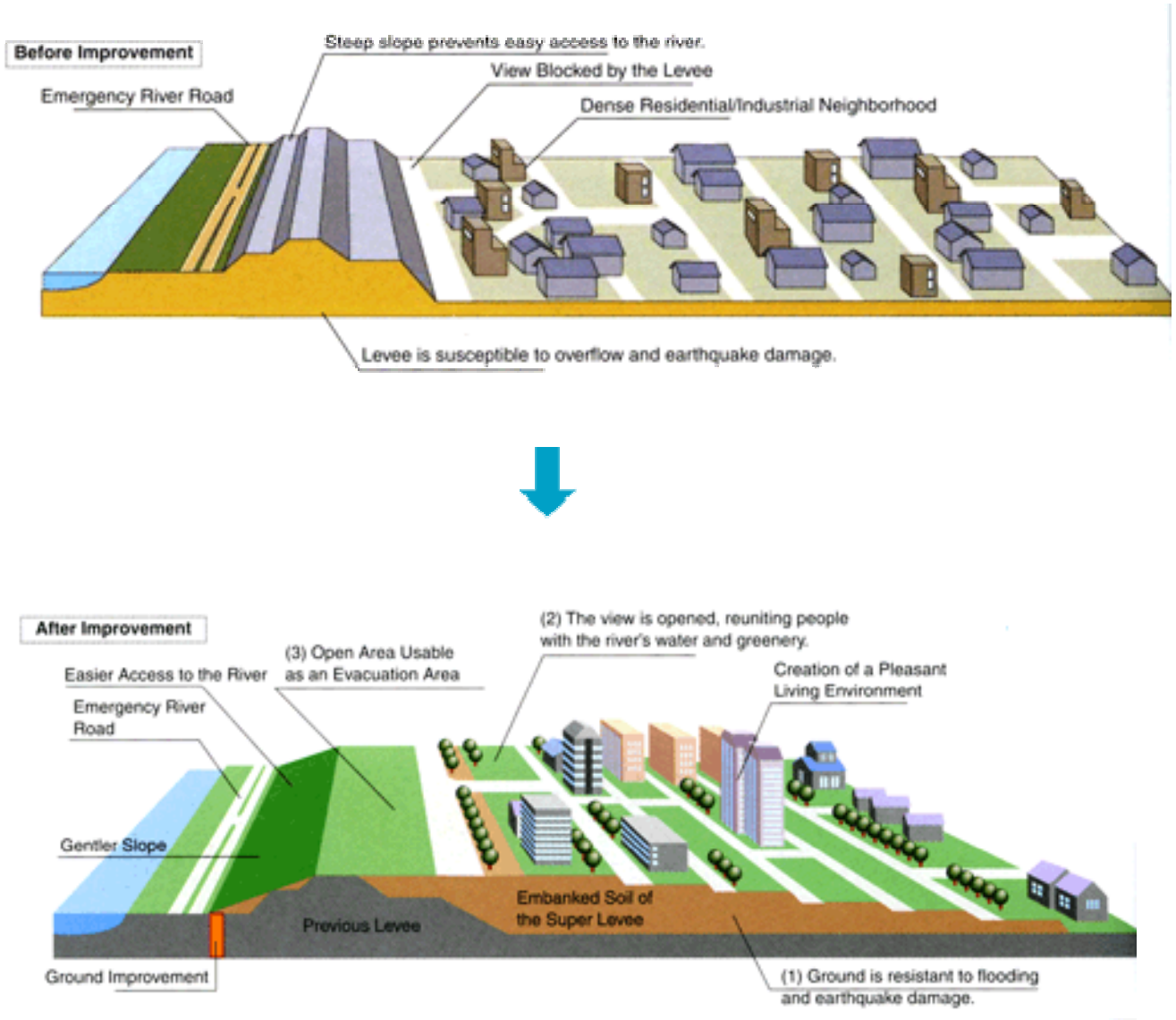
Inspection passage stipulated in Article 27 of the Structural Ordinance shall be built as provided by the following items. This shall not apply, however, in case there is a proper passage substituting for the inspection passage, in case all or major part of the levee are formed by structure of concrete, steel sheet piles or materials similar thereto or in a section in which the difference between the height of levee and the ground height on the landside of levee is less than 0.6m.

(1) The width shall take a proper value more than 3m and less than the crown width of levee.

(2) The construction gage is as shown below.



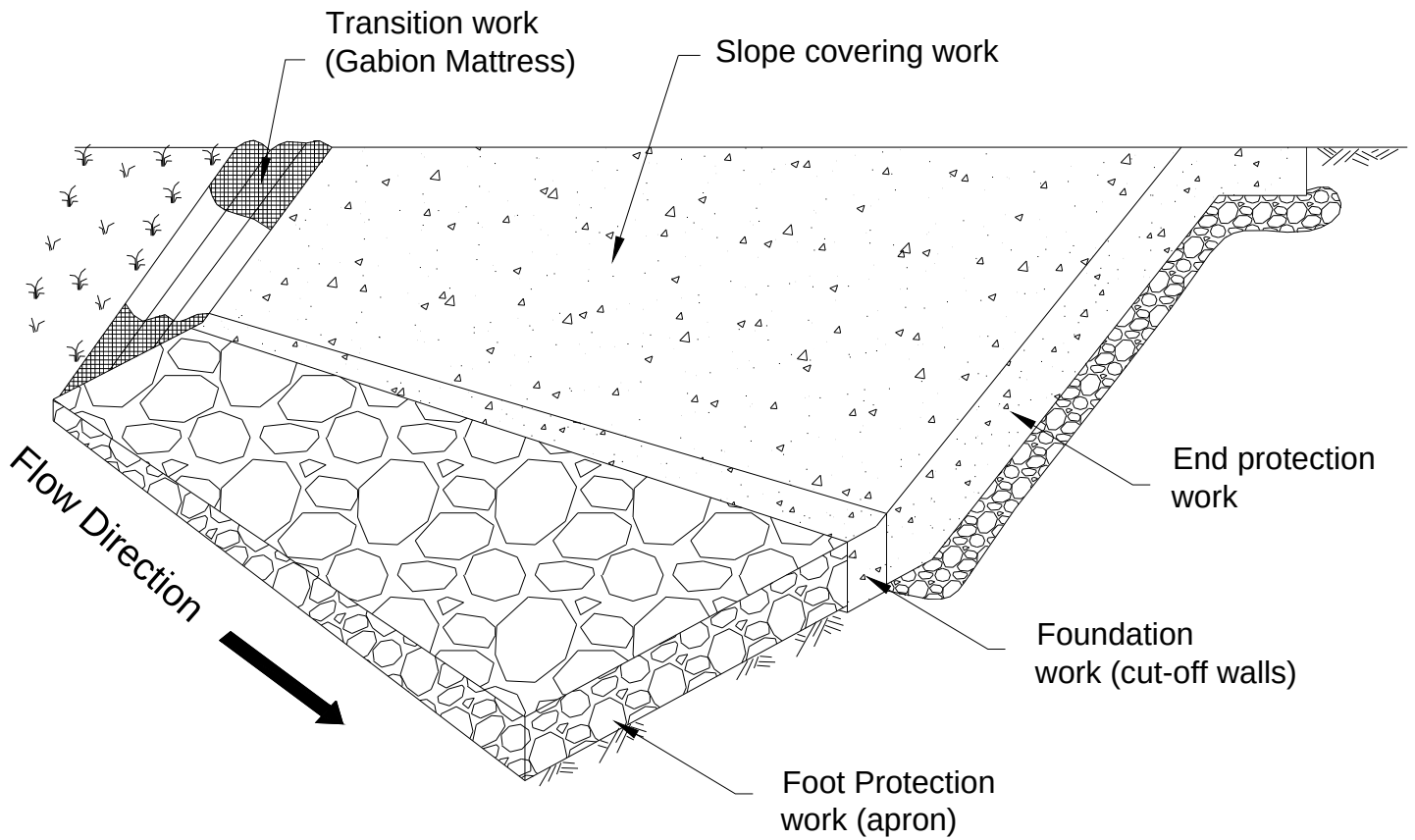

Metro Manila
Tullahan River
Image © 2012 DigitalGlobe


Before Improvement
Steep slope prevents easy access to the river.
View Blocked by the Levee
Emergency River Road
Dense Residential/Industrial Neighborhood
Levee is susceptible to overflow and earthquake damage.
After Improvement
(2) The view is opened, reuniting people with the river's water and greenery.
(3) Open Area Usable as an Evacuation Area
Easier Access to the River
Creation of a Pleasant Living Environment
Emergency River Road
Gentler Slope
Embanked Soil of the Super Levee
Previous Levee
Ground Improvement
(1) Ground is resistant to flooding and earthquake damage.

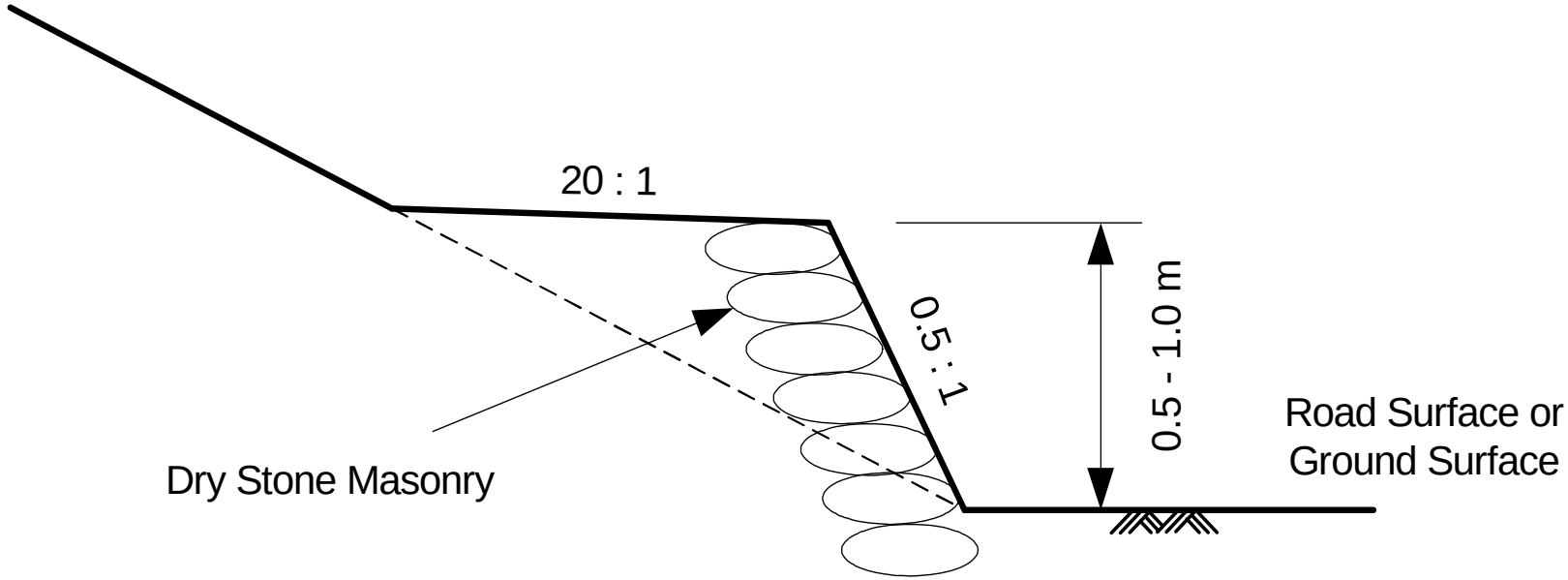
Super Levee

Revetment

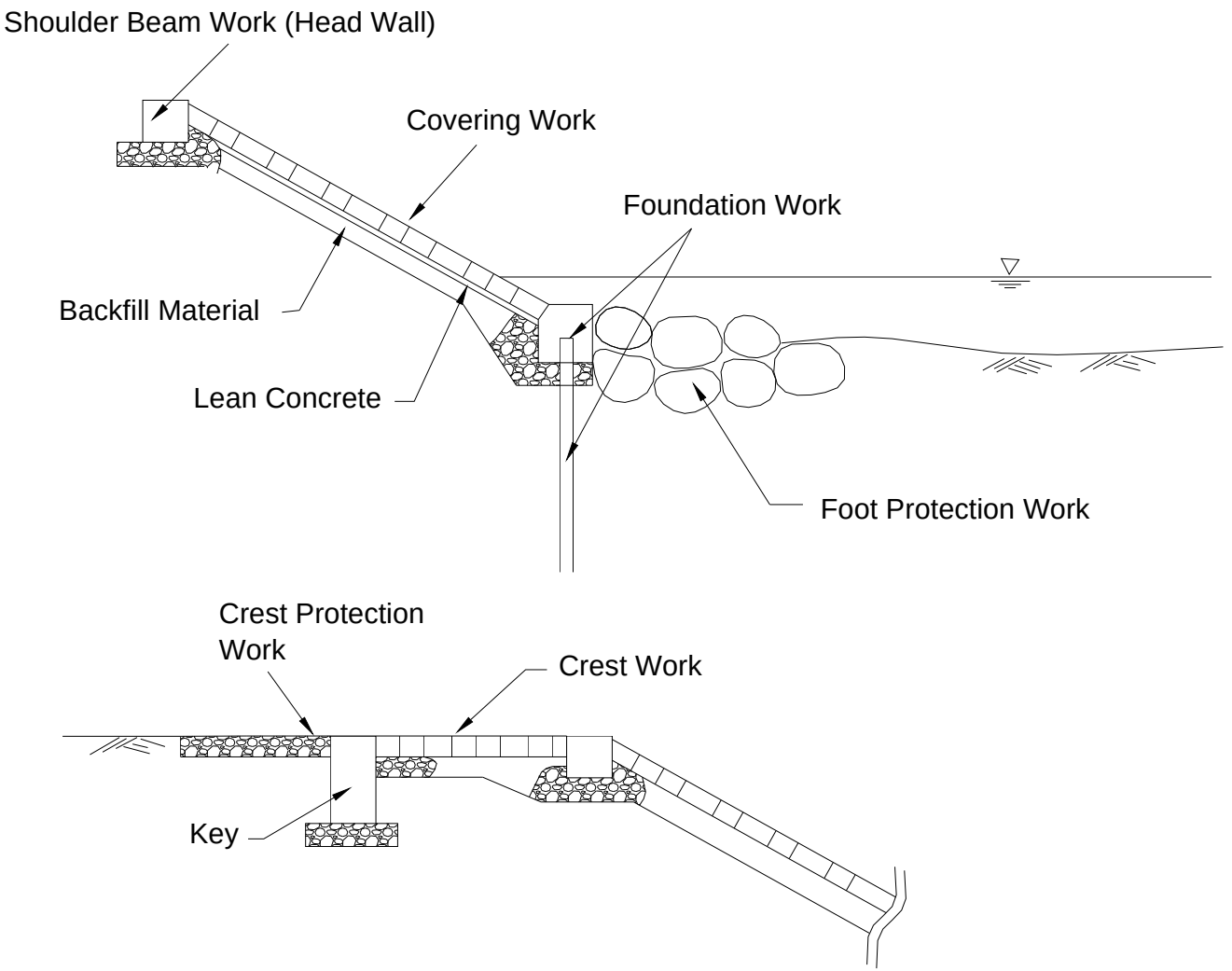
- Function of revetment is to protect the collapse of riverbank due to erosion, scouring and/or riverbed degradation.



Components of Revetment



Toe Protection work



Components of Revetment

- **Gabions** (from Italian *gabbione* meaning "big cage"; from Italian *gabbia* and Latin *cavea* meaning "cage") are cages, cylinders, or boxes filled with rocks, concrete or sometimes sand and soil that are used in civil engineering, road building, and military applications. For erosion control caged riprap is used. For dams or foundation construction, cylindrical metal structures are used. In a military context, earth or sand-filled gabions are used to protect artillery crews from enemy fire.
- (From Wikipedia, the free encyclopedia)

- **Riprap**—also known as **rip rap**, **rubble**, **shot rock**, **rock armour** or **Rip-rap**—is rock or other material used to armor shorelines, streambeds, bridge abutments, pilings and other shoreline structures against scour, water or ice erosion.
- It is made from a variety of rock types, commonly granite or limestone, and occasionally concrete rubble from building and paving demolition. It can be used on any waterway or water containment where there is potential for water erosion.
- From Wikipedia, the free encyclopedia


6月15日 起点側

Spur Dike

- A spur dike is a river structure with the following functions :

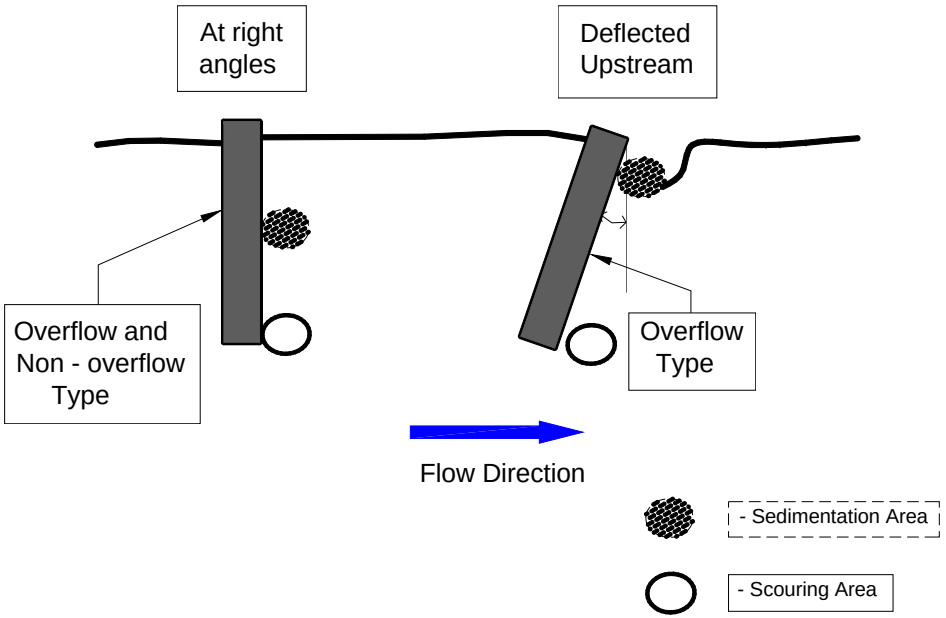
  1) To increase as the flow roughness and to reduce the flow velocity around the riverbank.

  2) To redirect river flow away from the riverbank.

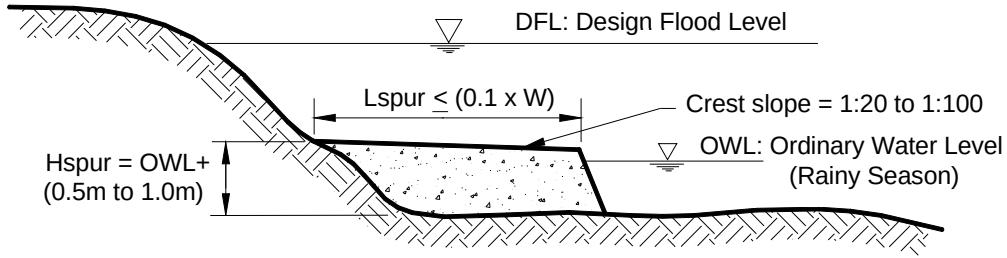
- Based on the above functions, the spur dikes are installed with the following purposes:

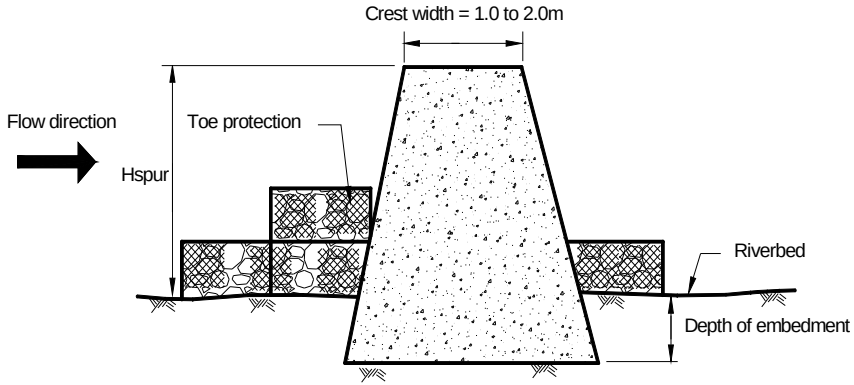
  1) To prevent bank erosion and damage to revetment.

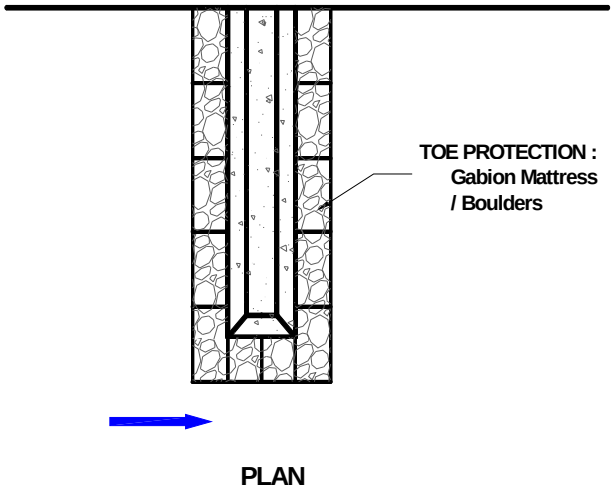
  2) To deepen water depth for navigation.


At right angles
Deflected Upstream
Overflow and Non - overflow Type
Overflow Type
Flow Direction
- Sedimentation Area
- Scouring Area

Dimensions of Spur Dike (Low Crest Type)

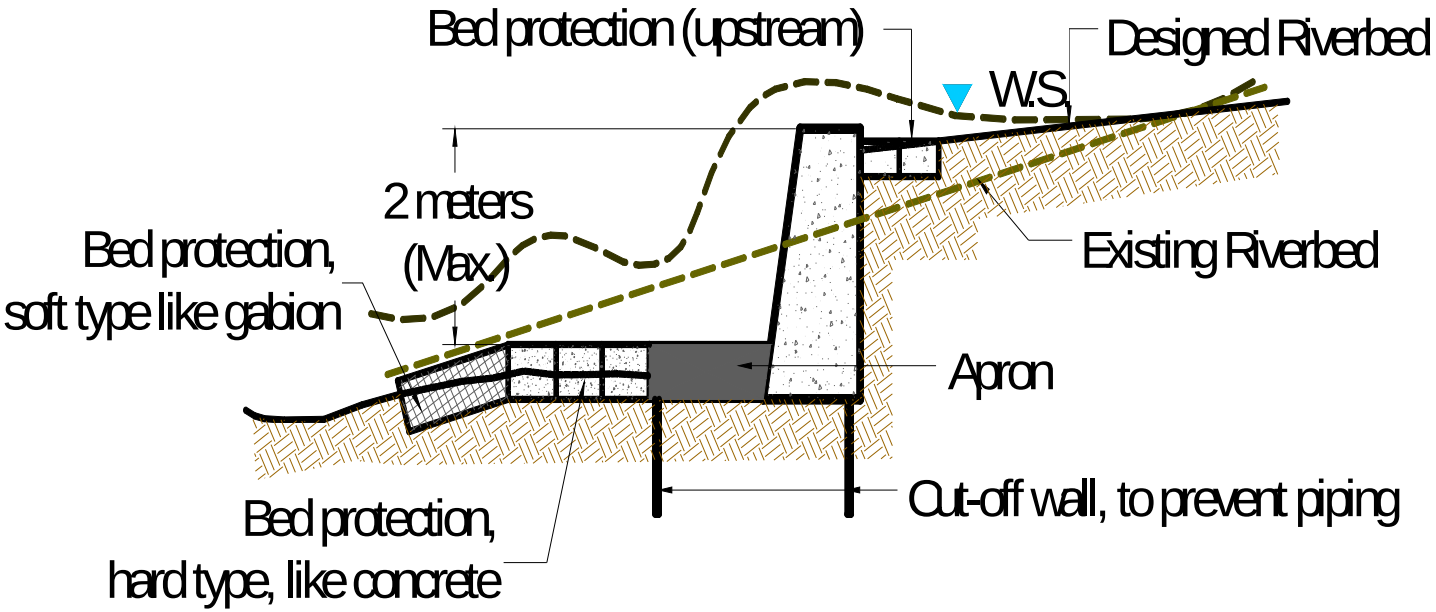




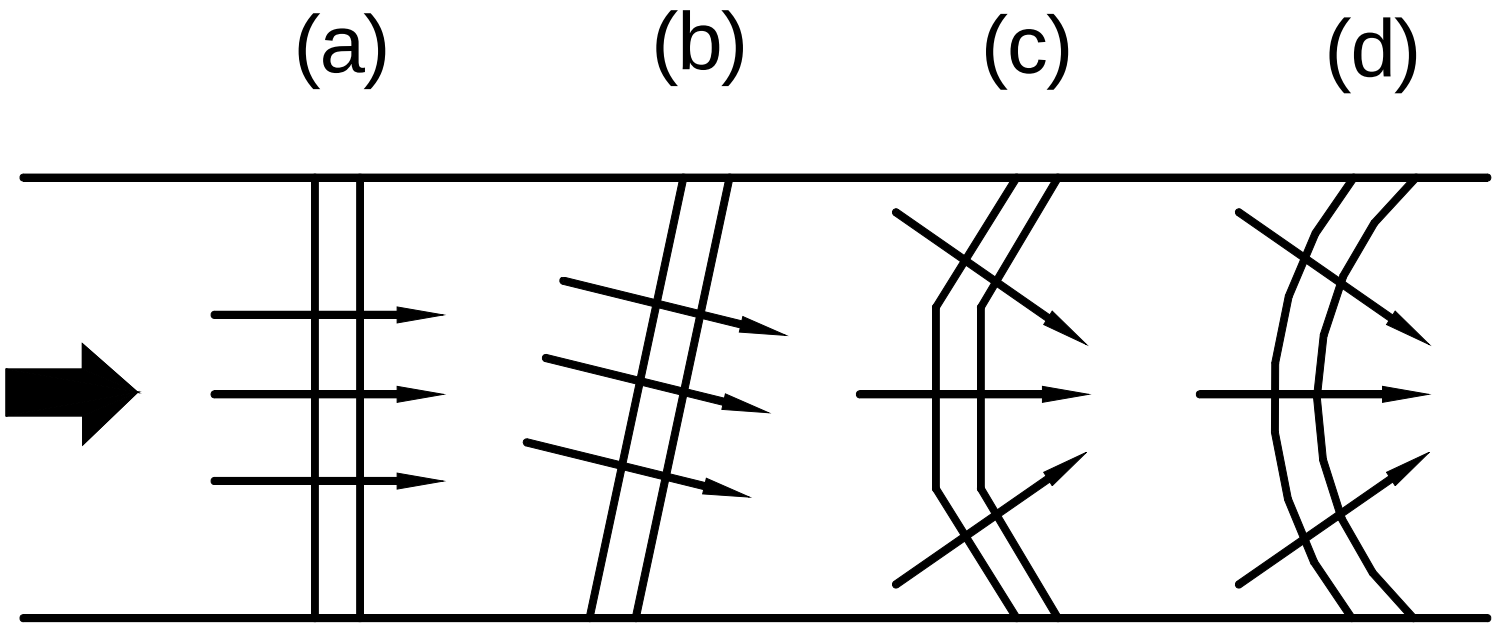


GROUNDSILL

- A groundsill is a river structure to prevent the riverbed degradation, to stabilize the riverbed and to maintain the longitudinal and cross-sectional profiles.


Bed protection (upstream)
Designed Riverbed
W.S.
2 meters
(Max.)
Bed protection,
soft type like gabion
Existing Riverbed
Apron
Cut-off wall, to prevent piping
Bed protection,
hard type, like concrete

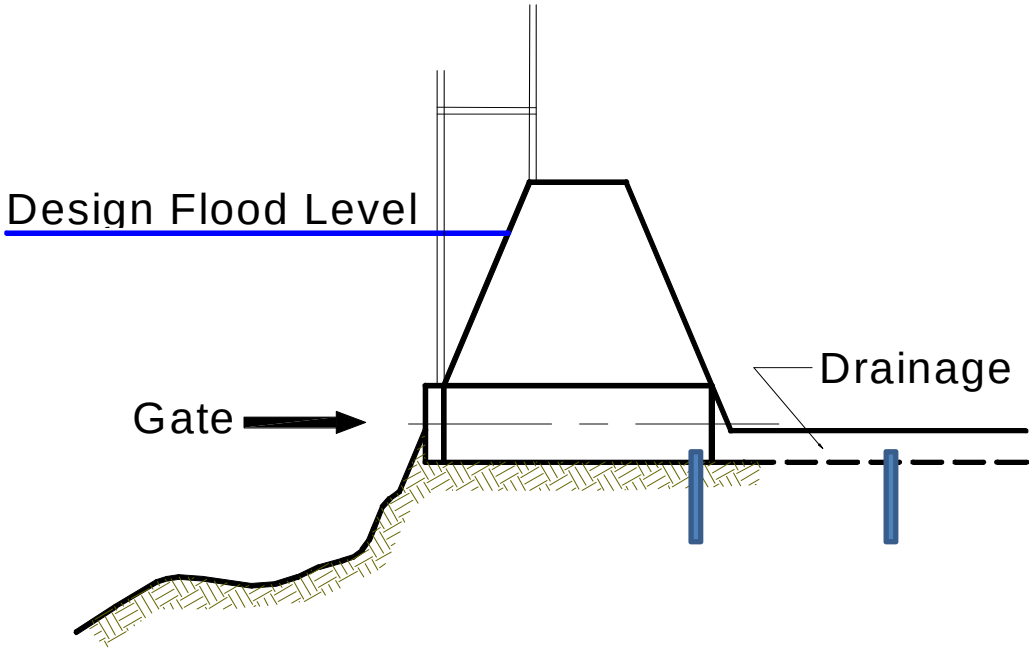
GROUNDSILL



Plane Forms of Ground Sills and Flow Direction

Sluice Way

- Sluiceway is a structure that connects the culvert passing through the dikes and its gate. Sluiceway is categorized into two (2) types according to its purpose: one is to drain the inland water into river, and the other is to draw the water (as an intake structure) from the river for irrigation use or some other purposes.



Sluiceway for Drainage

Kokai River from MLIT office

Situation of Damage on 1986 Year Flood

Direct damages from flood was as follows, inundation area : approximately 4,300 hectare, flooded houses : approximately 4,500 and the total amount of suffering flood : 40 billion yen.

The sinkage around the sluiceway (river side slope)

Increase in leakage water at wing-wall of the sluiceway (land side slope)

①Levee Crevasse at Hontoyota site in Jyousou City at about 9:58 a.m., on 6th of August 1986, over sixty-meter-long dike located at Hontoyota site was collapsed.

After the spread of sinkage, whole dike started collapsing

Dike crevasse became wider to 60m.

— 4 —

WEIR

- a barrier across a river designed to alter the flow characteristics. In most cases, weirs take the form of a barrier, smaller than most conventional dams, across a river that causes water to pool behind the structure and allows water to flow over the top. Weirs are commonly used to alter the flow regime of the river, prevent flooding, measure discharge and help render a river navigable.
- The weir is classified into an intake weir, diversion weir, tide weir, etc., and it is further classified into fixed weirs, and movable weirs according to the weir's intended purpose.

- (1) Weir is a structure which safeguards the action of water flow at a level *equal* to or lower than the design high-water level (or the design high-tide level in case of the high-tide section).
- (2) The flow of flood at a water level equal to or lower than the design high-water level and the adjacent river bank and the structure of river facilities should not be hindered by the weir.
- (3) It shall be designed in consideration of prevention of scour in river bed which connects to the weir.

Aoki Weir

Photos in 2013 Sep 10

Location	Sakuragawa City, Ibaraki, Japan
Name of river	Sakura
Beneficial area	61 ha
Height of the weir	5 m
Manager of Facility	Yamato & Sakura Water Supply Association
Length of the weir	19 m
Style of the weir	Semi Fixed Weir (Steel Slide Gate)
Construction year	1998

Hojo Weir

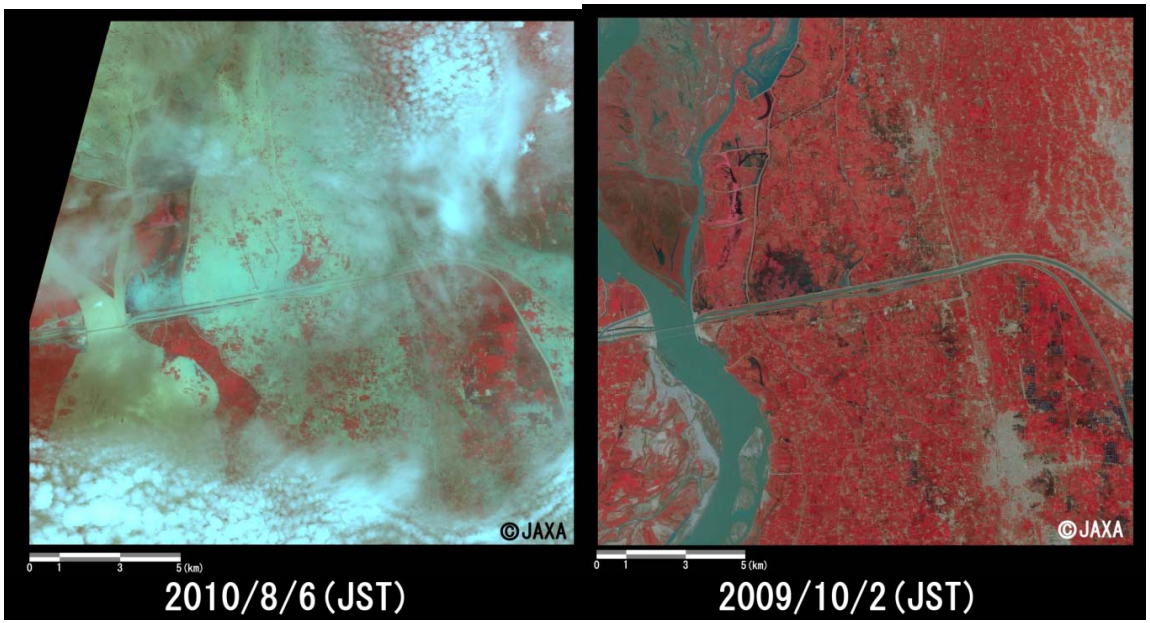
Photo in 2013 Sep 10

2013 Oct. 19

Location	Tsukuba City
Name of river	Sakura
Beneficial area	231.8 ha
Height of the weir	3.1 m
Manager of Facility	Tsukuba City Land Improvement Organization
Length of the weir	36.3 m
Style of the weir	Inflatable Rubber Weir
Construction year	1999

Design flood discharge (m^3/sec)	Span length (m)
Less than 500	15
500 and up to 2,000	20
2,000 and up to 4,000	30
4,000 and over	40

The Impact of structures within the river on flood flow.



Taunsa Barrage in Pakistan

Completed in 1958, rehabilitation from 2003 to suply irrigation for 8000km^2. 65 Gates (including rocks) Width 1325m

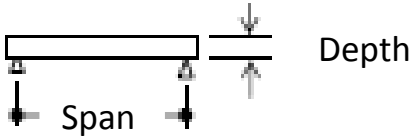
1. Review the infrastructures within the river
2. Width of Natural river and flow discharge volume
3. The level of river water upstream and downstream of the structure.
4. Erosion and Accretion in the vicinity of the structure
5. Emergency discharge release
6. Identify the issues of designing structures within the river

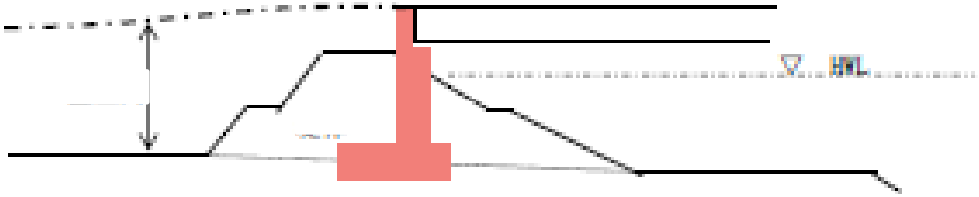
Bridge

- A structure built to span a river for the purpose of providing passage over it.
- (1) Abutment and pier to be built within the river area shall be a structure which will be safe against the action of river flow at a water level equal to or lower than the design water level (or the design high tide level in a high tide section).
- (2) Abutment and pier shall not disturb the flood flow at a water level equal to or lower than the design high water level.
- (3) They shall not severely hinder the structure of adjacent river banks and facilities.
- (4) And they shall be designed in consideration of prevention of scour in river bed adjoining the abutment or the pier.

Abutment

Usually, depth ratio is 1/(18-20).
Be careful for high banking in soft ground

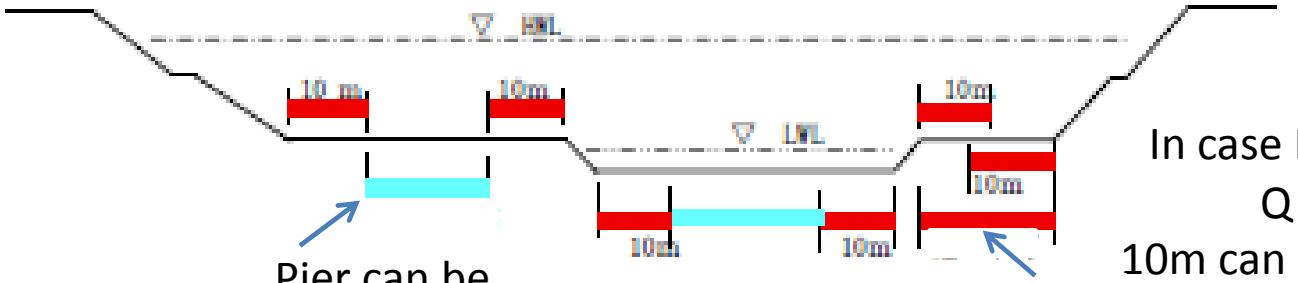




Bridge at Koise Gawa, Yasato, Ishioka City
Ibaraki Prefecture, Japan

Pier

Position of Piers

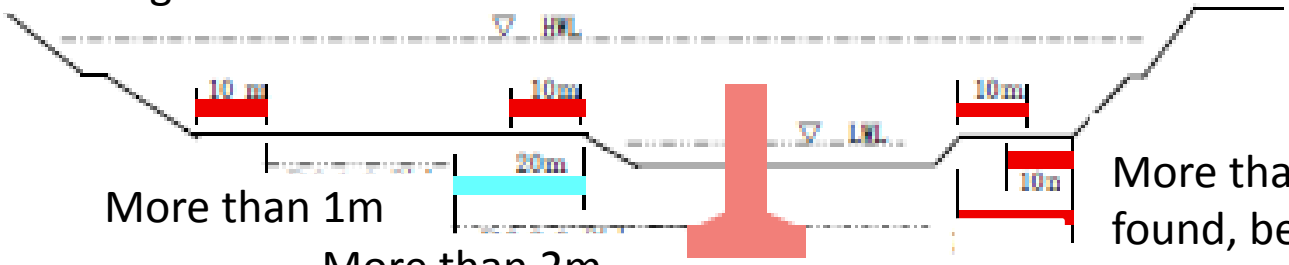


Pier can be positioned

Pier cannot be positioned

In case Design Discharge
$Q \leqq 500\ m^3/s$
10m can be reduced to 5 m

Depth of footing



More than 1m

More than 2m

More than 2m score is found, below the planned level or deepest score level

Disturbance Ratio of the piers of Bridge:

The ratio of total width of the piers to the width of the river. In order to minimize the disturbance of the flow discharge, in general, the ratio should be less than 5%.

Width of the river is the length of design high water level (DHWL) at the right angle of the flow between the banks. Width of the pier is the pier width, which is right angle of the flow at the height of DHWL. In order to minimize the disturbance of the flow discharge, in general the ratio should be less than 5%. Even in the worst case, under the condition of the structural safety, the ratio should be less than 6% in general bridge and 8% in Shinkansen railway bridge and Highway Bridge.

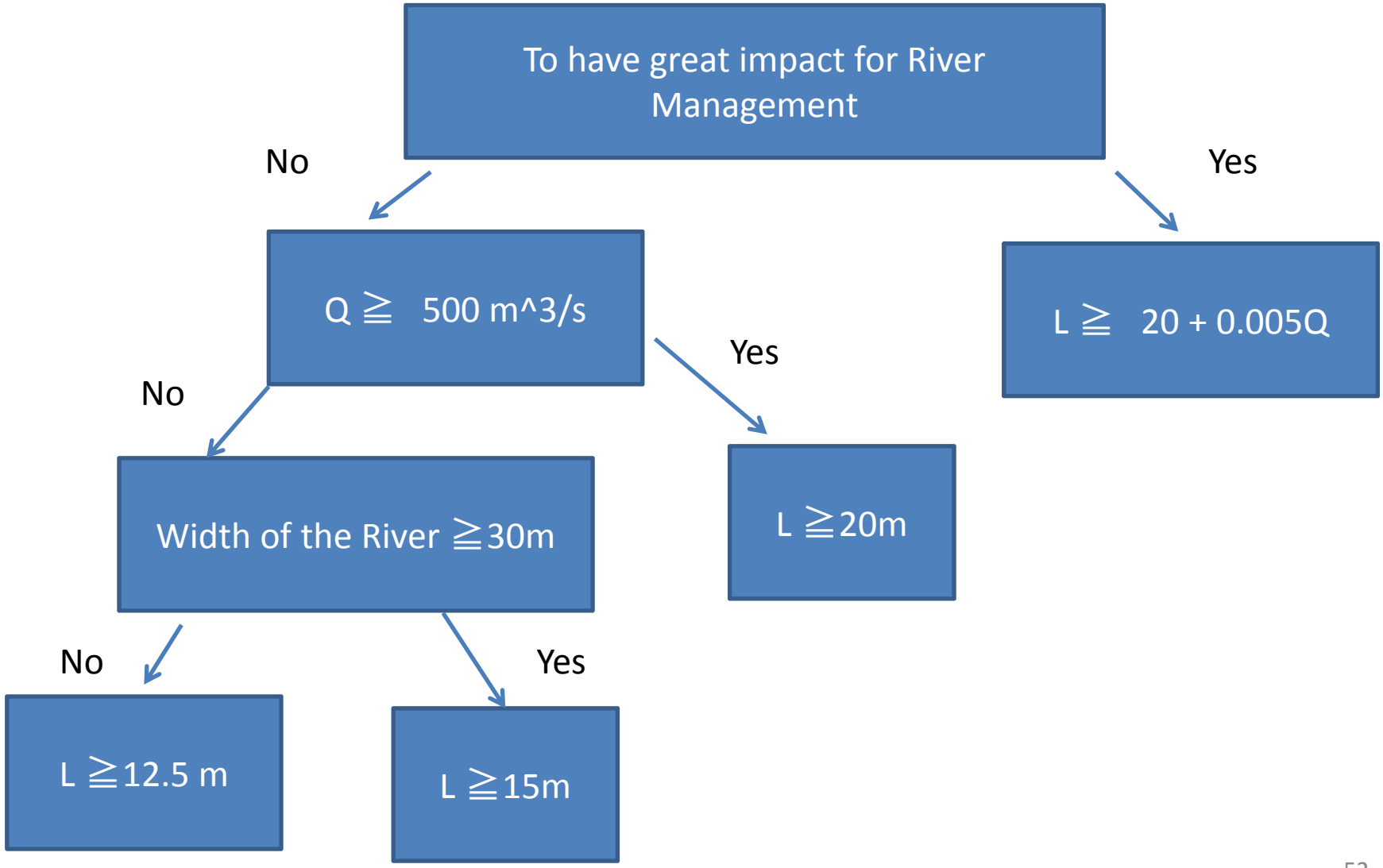
Ooya River, Chikusei City

Gogyo River, Chikusei City

Bridge Piers/Trestles within river area hinders water movement during flooding.

Ikarashi R. after 2011 Flood

L : Length between the piers or abutment (Between front of the Abutment to middle of the pier or between middle of the piers)



Jamuna Bridge in Bangladesh

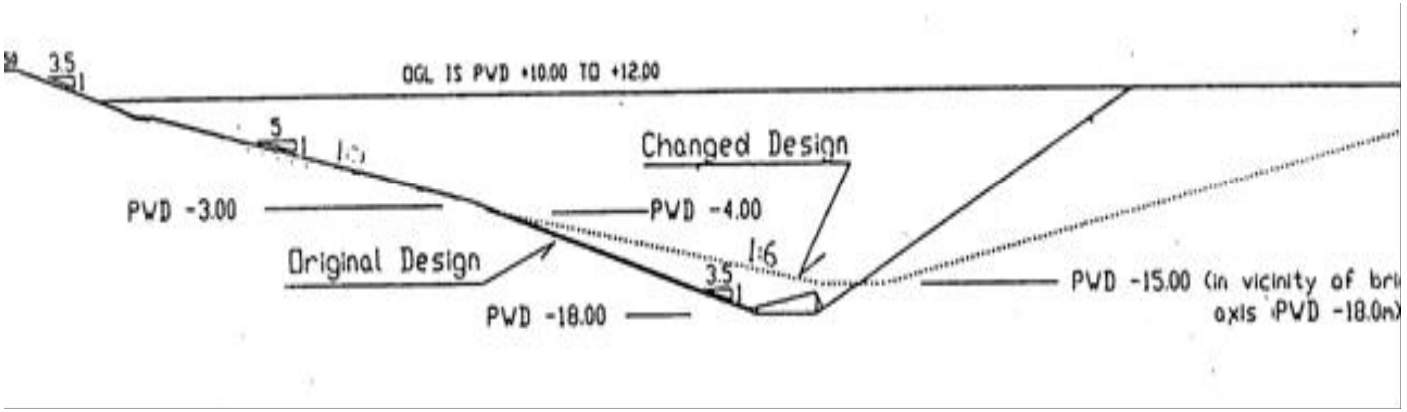
Opened in June 1998.

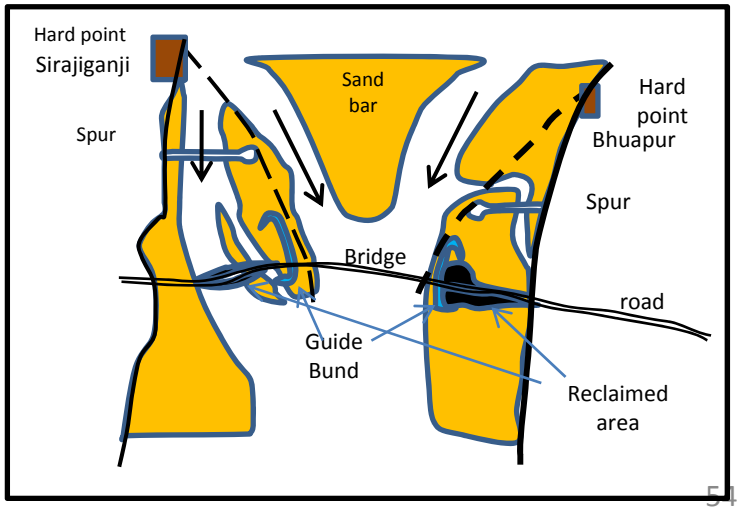
75 chars and 70,000 inhabitants within a span of 10kms of the Bridge site both up and down stream

40,000 m3/s : bankful
91,000 m3/s : 1 /1 O0

Main Bridge	4.8 km
East Guide Bund	3.07 km
West Guide Bund	3.26 km

During Construction, Changed the design of Guide bund Slope at Jamuna Bridge in Bangladesh





Thank for your attention

Please refer
http://whrm-kamoto.com/top.html
Philippines: Design Standard Guideline