YuanShanTze flood Diversion Project

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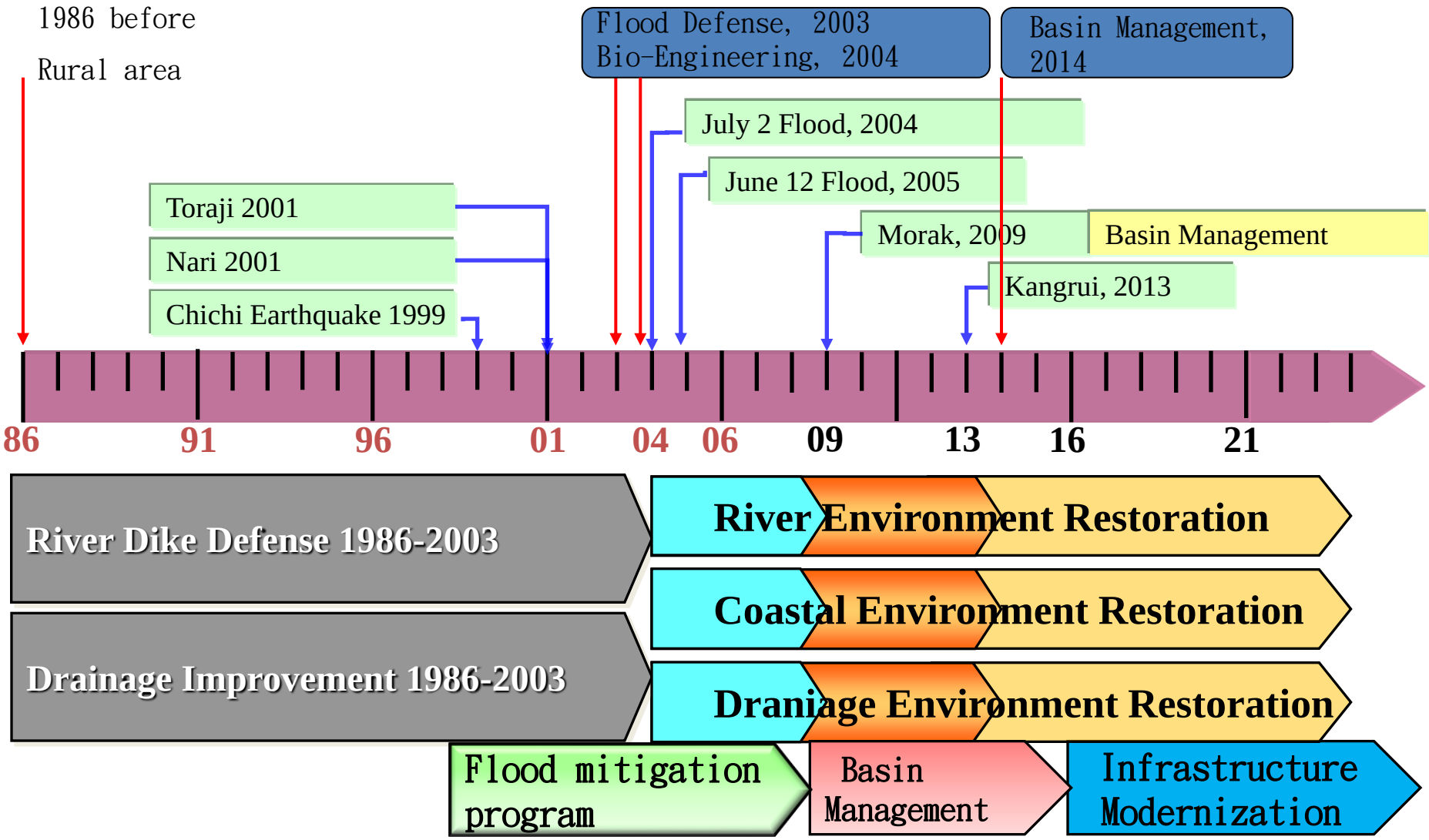
Water Resources Agency, MOEA, Taiwan

Flood Defense Policy



Basin Management-From Line to Space

Rural Stage

1.Escape
2.Inundation

Flood Control

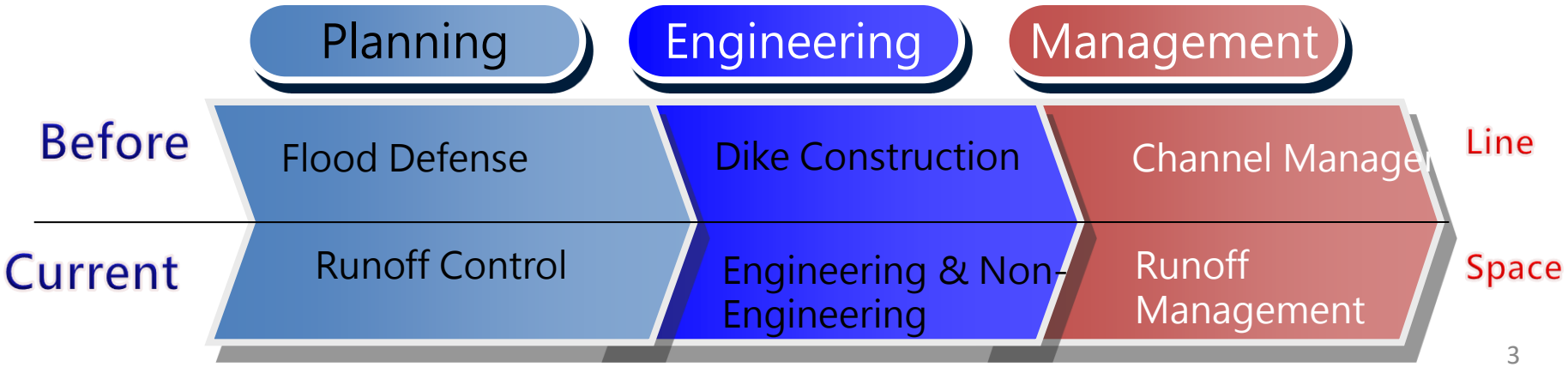
1.Channel Regulation
2.Land Use Over Development

Flood Defense

1.Flood Defense
2.Piroity to Real Estate Development
3. Channelization

Flood Management

1.People-Land-Water Harmonization
2.Basin Integration
3.Basin Water Environment Restoration
4.Runoff Control



Policy of Flood Defense for Tanshui River Downstream Area

Tanshui River Catchment

- 1998-2006 for Keelung River flood defense work
- YuanShanTze flood Diversion Work

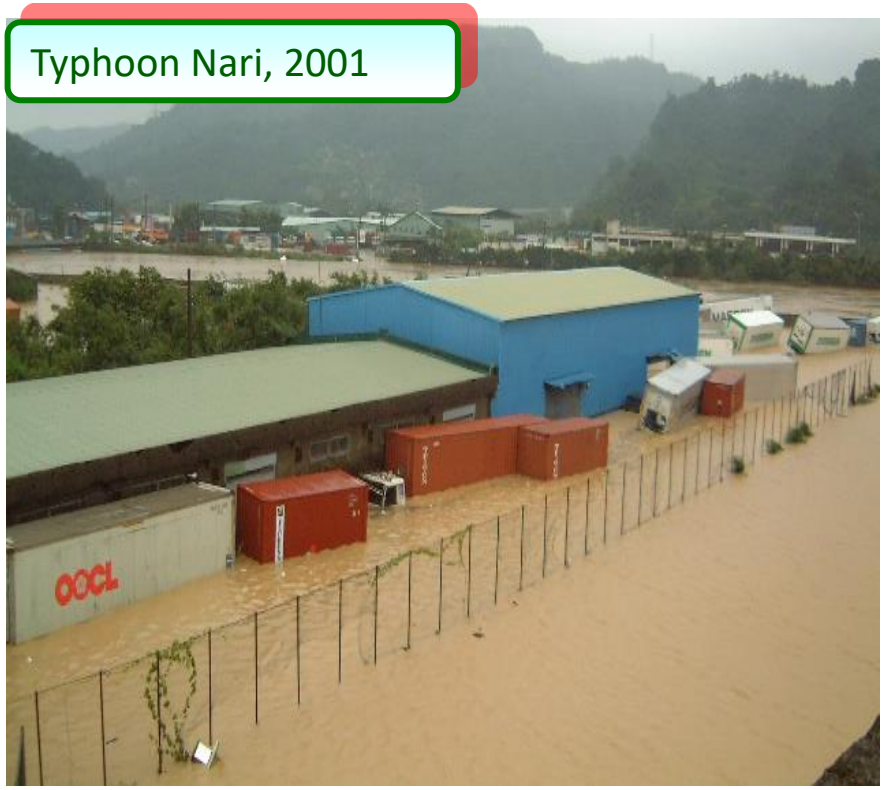
- Flood Defense Work, 1976-1999
- 200 years Flood Defense
- No over flow for 500 years flood

Keelung River Basin, 491 km^2, Main Stream 86.4 Km, one of Tributaries of Tanshui River

Flood characteristics of Keelung River

Heavy rainfall on the upstream area
Meandering at middle stream river valley area
Estuary river on the downstream area
Highly urban development on the middle and downstream river valley
River channel was narrowed by human development

Typhoon Nari, 2001

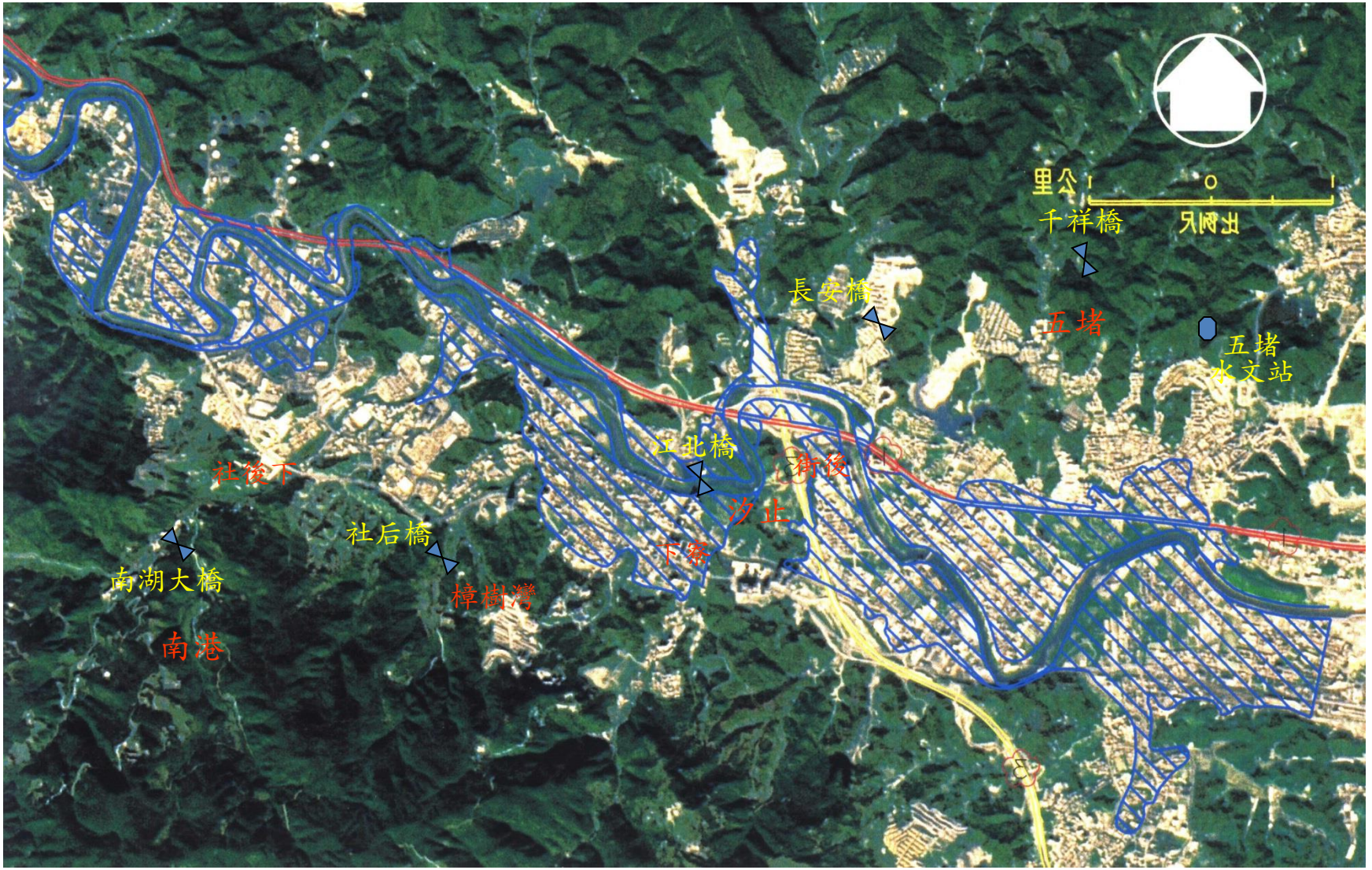


Typhoon Nari, 2001

Flood Disaster of Keelung river

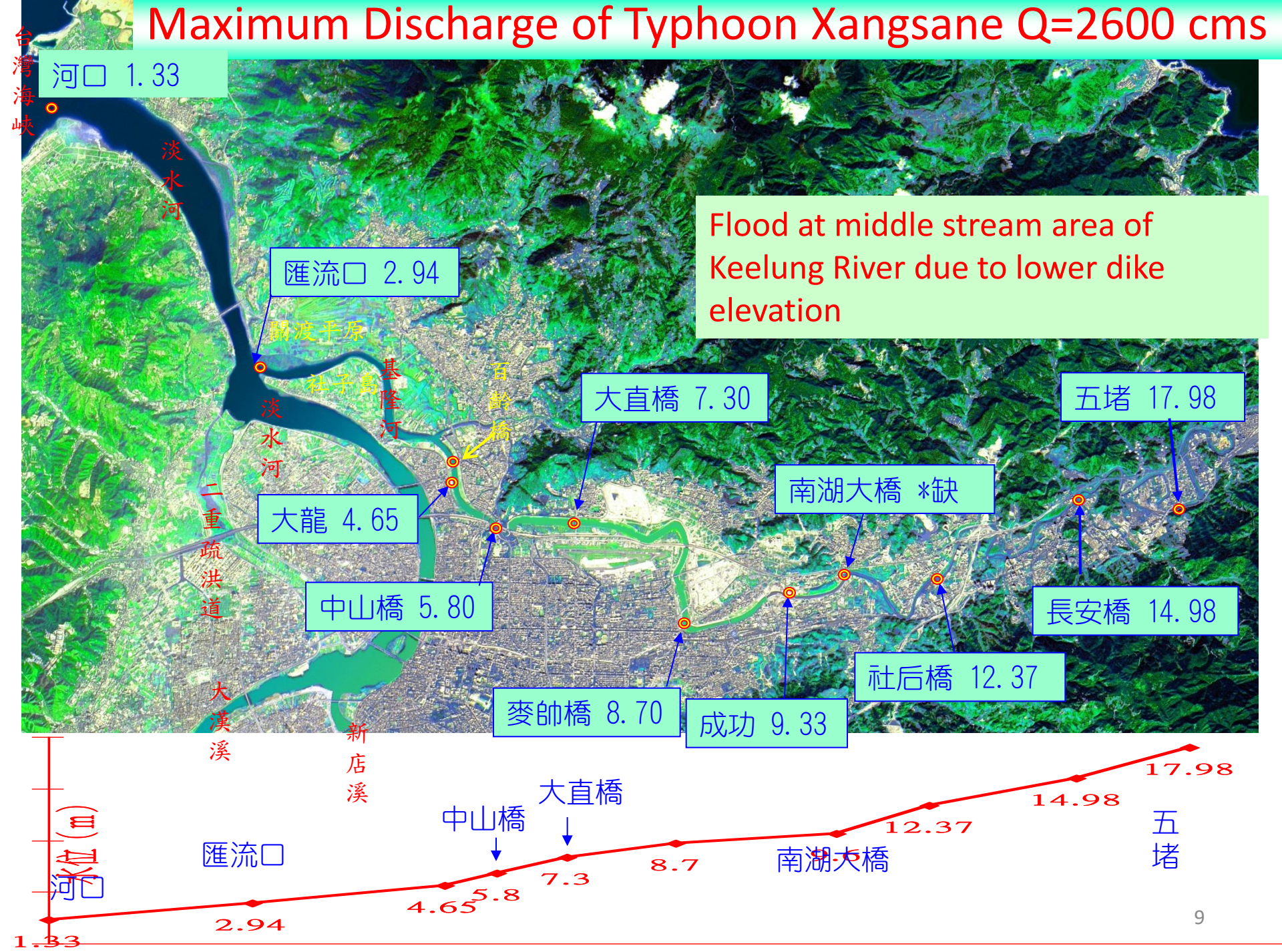
Typhoon Event	Lynen(87)	Ruibe(97)	Barbis(98)	Xangsane (00)	Nari(01)
Inundation Area(Ha)	1,322	636	624	699	4,710
Depth(m)	0.2~7.5	0.5~7.5	0.5~3.8	0.5~7.5	0.3~8.5
Death (Person)	21	0	0	59	64
Damage	US$ 30 billions				

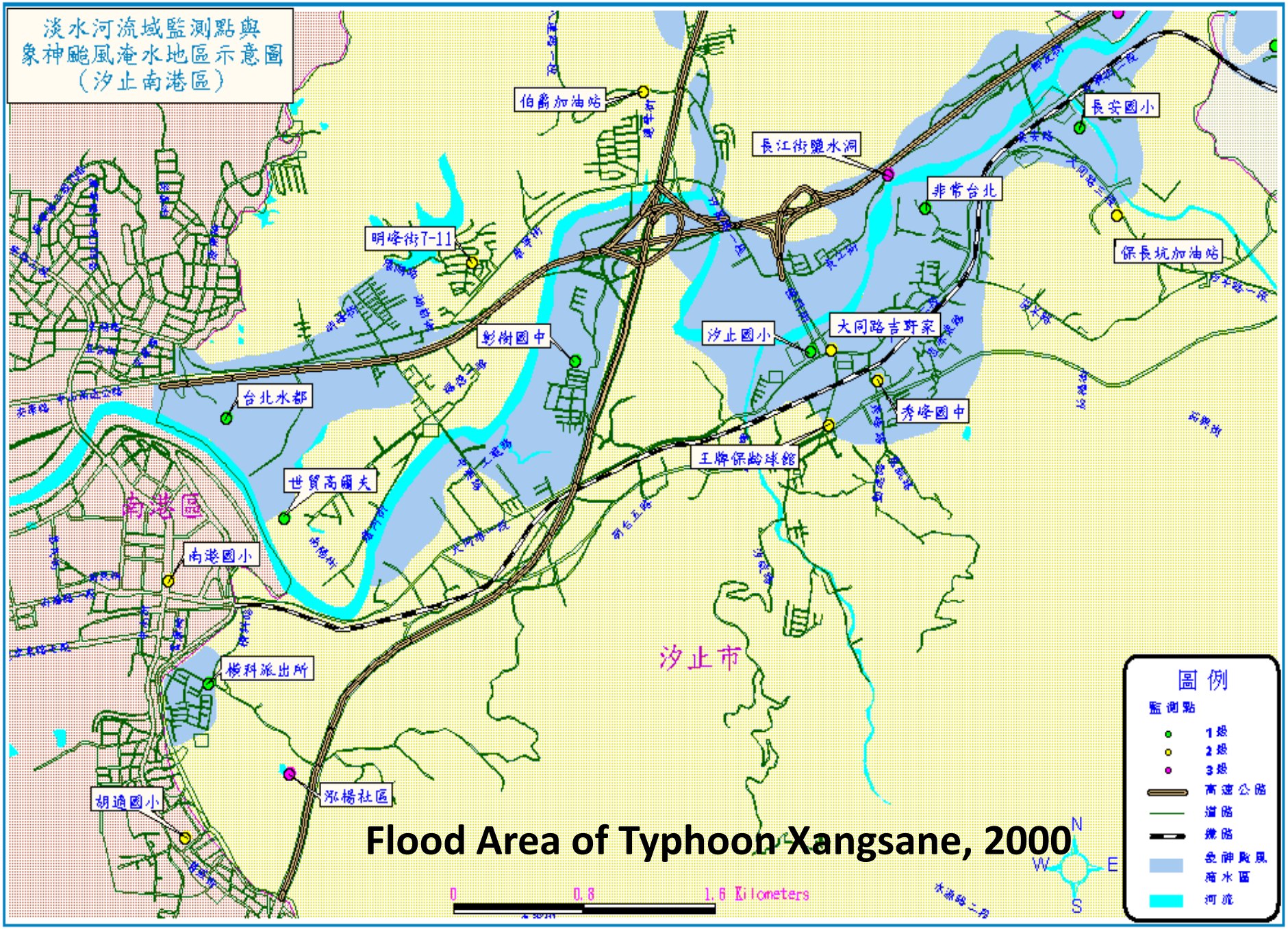
Typhoon Xangsane, 2000



Flood Area of Typhoon Ruibo and Barbis, 1998

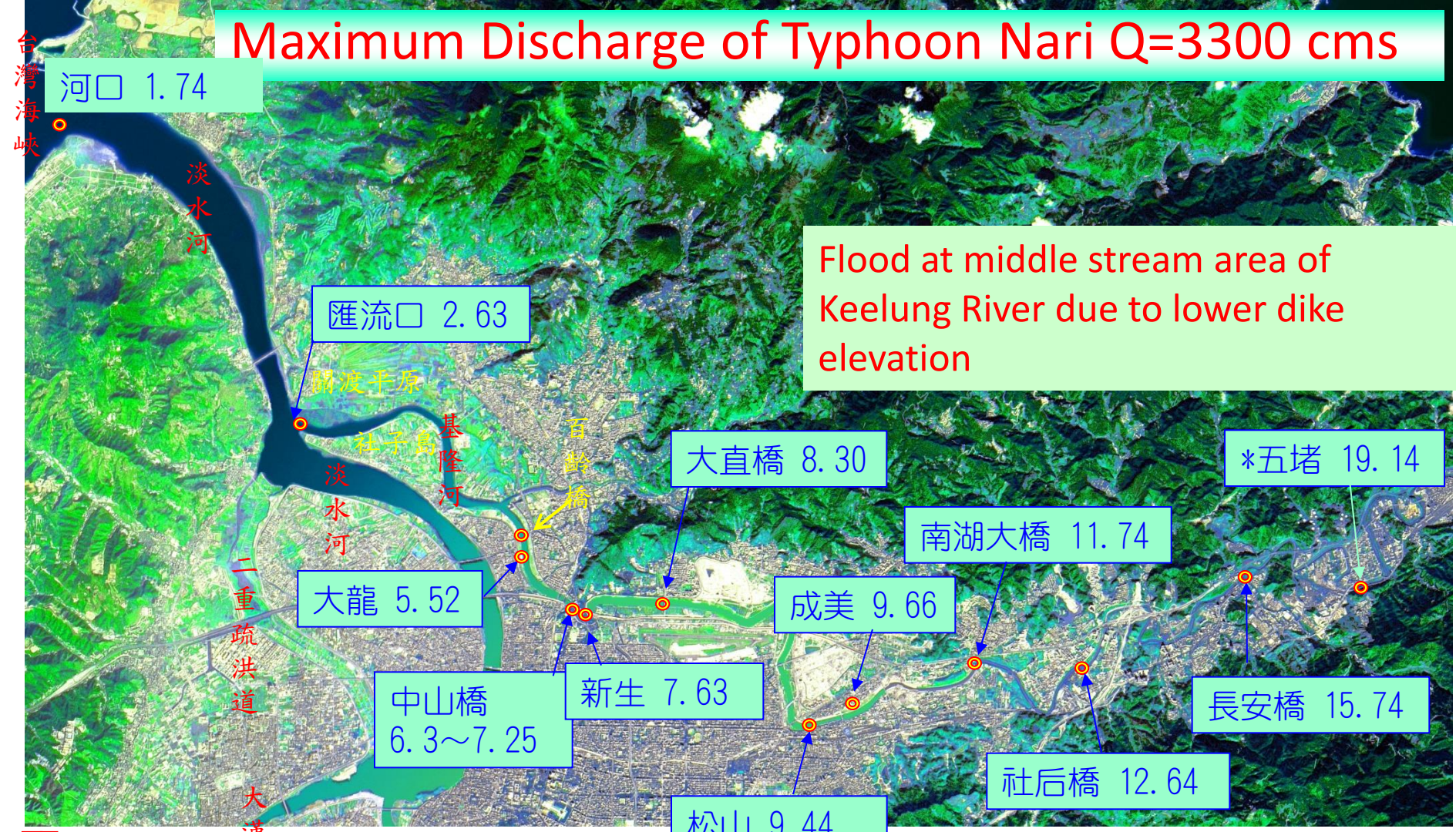
Maximum Discharge of Typhoon Xangsane Q=2600 cms





Flood Area of Typhoon Xangsane, 2000

Maximum Discharge of Typhoon Nari Q=3300 cms



Flood at middle stream area of Keelung River due to lower dike elevation

Badu Railway bridge

Wudu Railway station

Jiangbei Bridge, Xizhi

Xangsane Rd, Xizhi

Flood of Typhoon Nari on Keelung River


Qidu
五堵交流道


Xiwan Rd
Typhoon Nari
汐萬路


Jiangbei bridge
大同路


Nangang
環東大道

Flood Defense Work of Keelung River

Project Area: Nankang, Xizhi, Ruifang, Houdong, Pinxi Districts and Keelung, total length is 59.5 km.

Project contents:

- **YuanShanTze Diversion Work**
- **Dike Work**
- **Drainage and pump station on Tributaries**
- **Bridge modification work**
- **Yuanshan bottom neck improvement work**
- **Flood Warning system**

Dike improvement Work

Qidu, Dahua (Before)

Baifu (Before)

Qidu, Dahua (After)

Baifu (After)

Dike Improvement Work

Guogang (Before)

Guogang, Qiaodong (Before)

Guogang (After)

Guogang, Qiaodong (After)

Dike Improvement Work


Qiaodong (Before)

Beishan (Before)


Qiaodong (After)


Beishan (After)

YuanShanTze Diversion Work

Diversion Principle	Divert Q=1310 cms to East Sea from Q=1620 cms for 200 years flood. Downstream q=310 cms for Base flow.
Main Work	Entrance and Dissipation work 2.48 Km long Concrete Tunnel with 12 m diameters 3 check dams with 3 m height and 75 m width
Construction Period	Begin June 5, 2002, complete Oct 28, 2005.
Budget	US$ 2 billions

Layout


東海
N
W
E
S
0 250 500
M
深澳灣
無草山
出水口結構
二號分洪隧道
北35
九份溪
基隆山
九份溪過河段
一號分洪隧道
102
瑞芳
基
隆
九份
北35
進水口結構
102
防砂壩
河
貢山子分洪位置
索引圖
北37
新 北 市
介壽橋
侯硐

Geological Condition

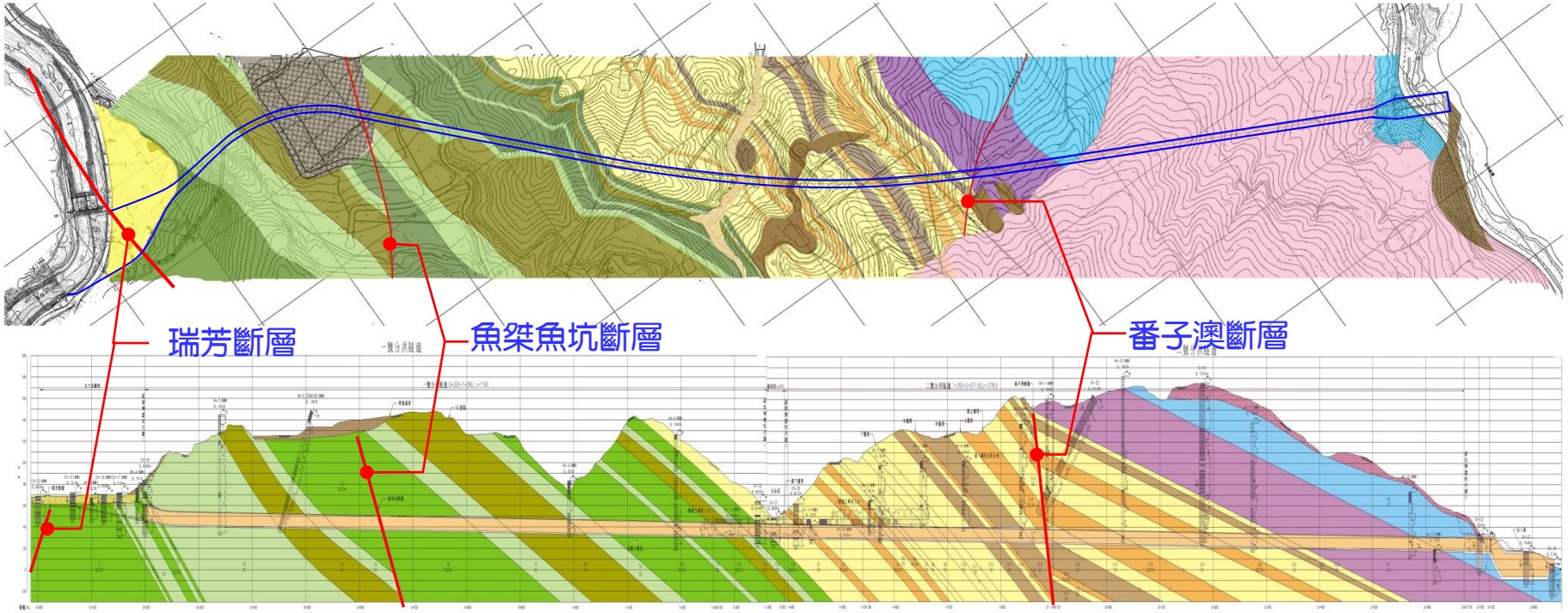


圖　例

崩積層	大寮層砂岩段	石底層砂岩段	南港層砂岩段	煤碴堆積
河階堆積層	大寮層砂頁岩互層段	石底層砂頁岩互層段	南港層砂頁岩互層段	回填土
火山碎屑堆積	大寮層頁岩段	石底層頁岩段	斷層線	

YuanShanTze flood Diversionphotographs of progress

Mar,2003-Before the tunnel excavation

Nov,2003-Lining of tunnel

May,2003-The tunnel excavation

May,2003-Completion of tunnel

YuanShanTze flood Diversionphotographs of progress

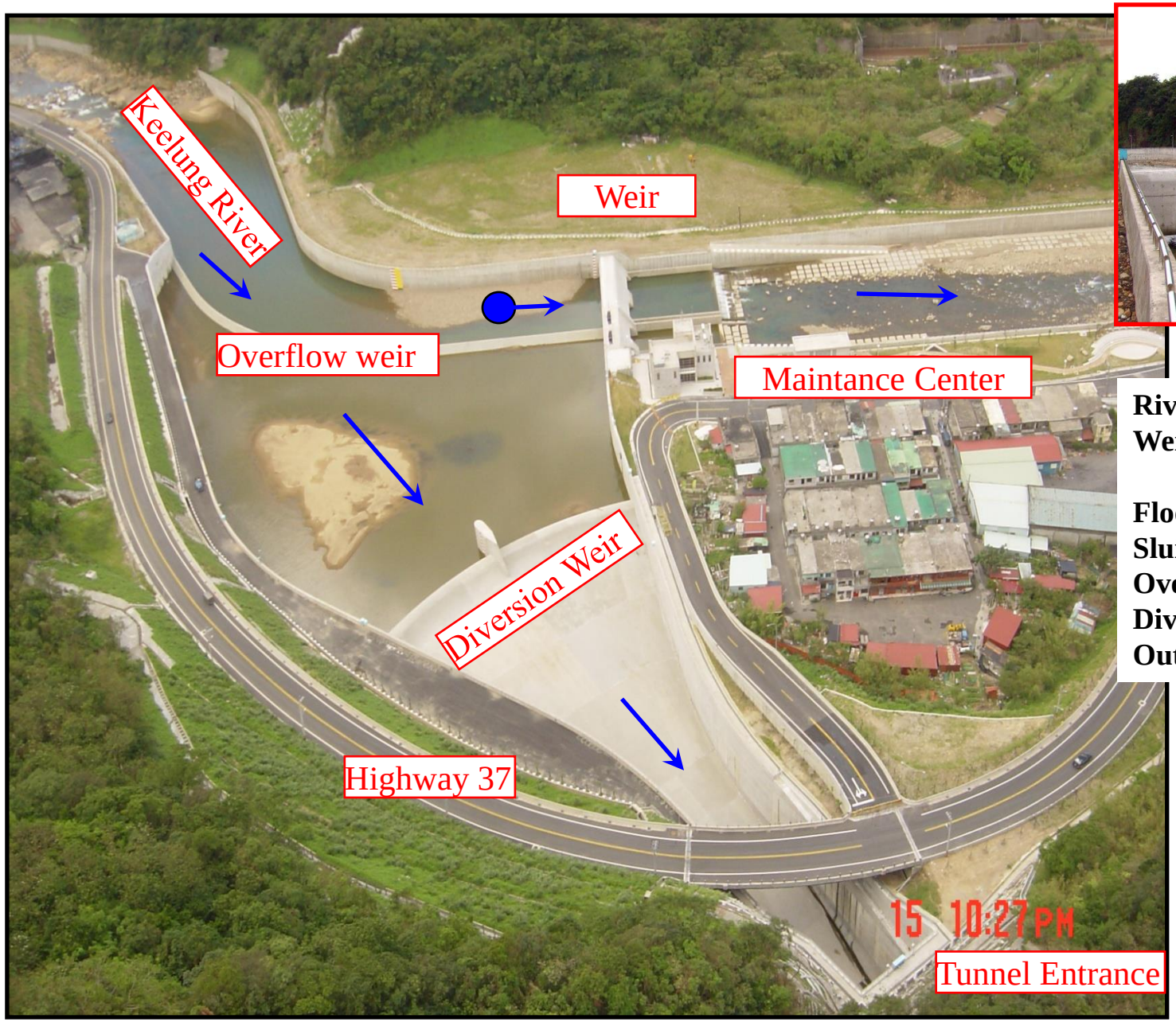
May,2005-Diversion Weir

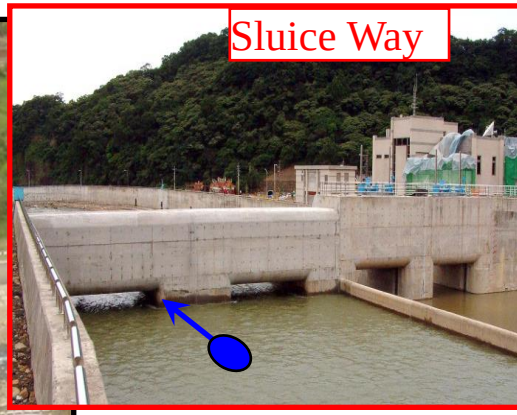
Jan,2005-Outlet Construction

Jan,2005 Completion of downstream weir

Jan,2005-Top of outlet

Bird View of YuanShanTze Diversion Work





River Bed	**EL=60.0M**
Weir	**H= 8.0M**
	L= 30.0M
Flood way	**8.0Mx2.5Mx2**
Sluice Way	**6.0Mx3.0Mx2**
Overflow weir	**EL=62.5M**
Diversion Weir	**EL=63.0**
Outlet	**EL=4.0M**

After Completion

Bird View of Entrance

Bird View of Outlet

Panoramic View of YuanShanTze Project

Management

One management Center with 3 personal Work

Flood operation

1.Automatic Overflow
2.Open Sluiceway for river flushing
3.Close Sluice way when water level to EL63.0 m, starting overflow
4.Open Sluice way for water level down to EL62.5 m, for flushing sand

Over flow, 2005


Over flow, Sep 01,2005

Typhoon Sula

Aug 1,2012 PM 2:30 water level 62.5M

Typhoon Sula

Aug 2,2012 AM6:30 water level 65.0M

Typhoon Sula

Aug 2,2012 AM6:30 water level 65.0M

Typhoon Sula

Aug 2,2012 AM6:30 water level 65.0M

Visiting Program

Feb 19,2016 Defense University

April 29,2016 Chungyuan University

May 26,2016 APEC Group

July 13,2016 Disaster Prevention Center

Social-Economic Benefit

The land price of Xizhi area was lower down and people migrated out of Xizhi due to serious flood from 1999 to 2005.

The flood is diminished after YuanShanTze diversion project.

The population of Xizhi area was 176,130 from 2002 to 2004. The population was increased to 196,028 after 2005.

The house price increase from 38,000/m^2 to 79,400/m^2 from 2005 to 2006.

Reduce Dike Construction Cost around US$ 1.5 Billions

Social-Economic Benefit

44 diversion events until 2017. Total diversion volume is 200 millions m^3. Reduce downstream flood hazard for 13 years.

Up to 1500 people visit YuanShanTze Work per year. Provide education to the ordinary people and young engineers.

The economic benefit: around US$ 1.6 Billions from reducing damage of downstream areas.

Thank you for your attention

Presenter：Dr. Kung Chen Shan

July 6, 2018

Water Resources Agency, MOEA,Taiwan