水利署協助地方政府提升防災能力

Central - Local Governments Co-operation in Water Disaster Mitigation Affairs

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Outline

Review Water Disasters on Taiwan

Flood

- Typhoons & Heavy Rainfalls
- Land subsidence

Water Scarcity

- Drought
- High-Density Sediment Flow

Enhance Central-Local Governments Co-operation

Preparedness

- Inundation Area Flood Control Project
- Flood Control Facilities Maintain

Response

- Disaster Information Exchange
- Portable Pumping Machine Support

Introduction

Water Disaster Mitigation is a Persistently and Seriously Issue in Taiwan

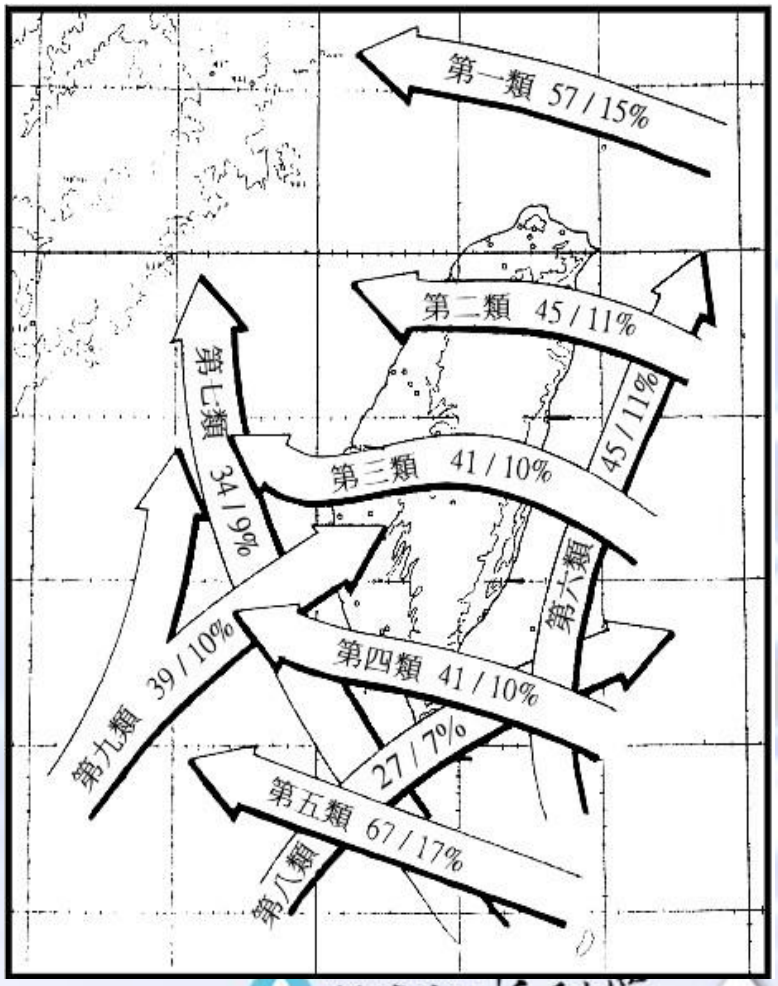
Time	Typhoon	Crisis Situation	Time	Typhoon	Crisis Situation
1996.07	HERB	Flood occurred in Keelung Creek （Rueifang Township、Sijhih City）and Tahan Creek（Panciao City）	2004.07	MINDULLE	● Huge debris flow occurred in Tachia Creek ● Gate Damage in Liyutan Reservoir ● Water scarcity occurred in Taichung City
1997.08	WINNIE	Flood occurred in Keelung River			
1998.10	ZEB	Flood occurred in Keelung River	2004.08	AERE	Water scarcity in Taoyuan due to heavy sediment in water
1998.10	BABS	Flood occurred in Keelung River	2004.10	NOCK-TEN	Start Using YuanSanZi Diversion Tunnel
1999.09		921 earthquake			
2000.10	XANGSANE	Flood occurred in Keelung River	2004.12	NANEMADOL	First Typhoon visiting Taiwan in December
2001.07	TRAMI	Flood occurred in Tainan City and	2005.6.12		● Spring Monsoon ● Flood occurred in Southern west coast
2001.07	TORAJI	Huge debris flow occurred in Choshui Creek	2005.07	HAITANG	● Heavy sediment in Kaoping Creek, Water scarcity in Kaoshun City ● Flood occurred in Southern west coast
2001.09	NARI	Flood occurred in Taipei MRT And all around the Taiwan			
2002,2003		Serious Drought	2005.08	MATSA	Taoyuan water scarcity due to heavy sediment in water

Review Water Disasters on Taiwan

Flood

- **Typhoons & Heavy Rainfalls**
- Land subsidence

1. Taiwan Located on the Typhoon's Track of Western Pacific.
2. Averaged 3.37 typhoons per year will influence Taiwan.
3. Averaged 1.82 typhoons per year will cause damages.
4. Typhoons induce 17.4 billion loss per year. That is almost equal to 0.33% of national GDP.



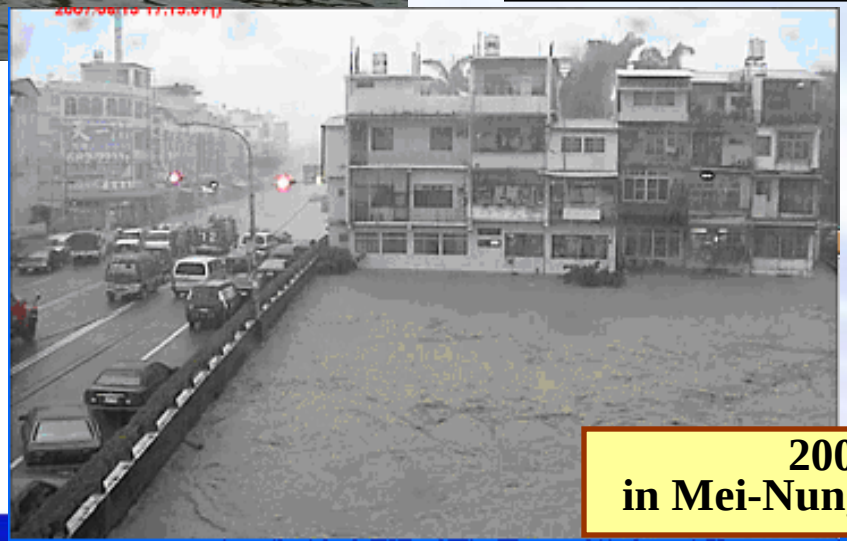
Typhoons, Spring monsoon and Summer storm often damage agriculture productions and result uncomfortable living.

2007 Spring Summer Storm in Sih-hu township, Yun-lin County

Agricultural Disasters Estimated Loss

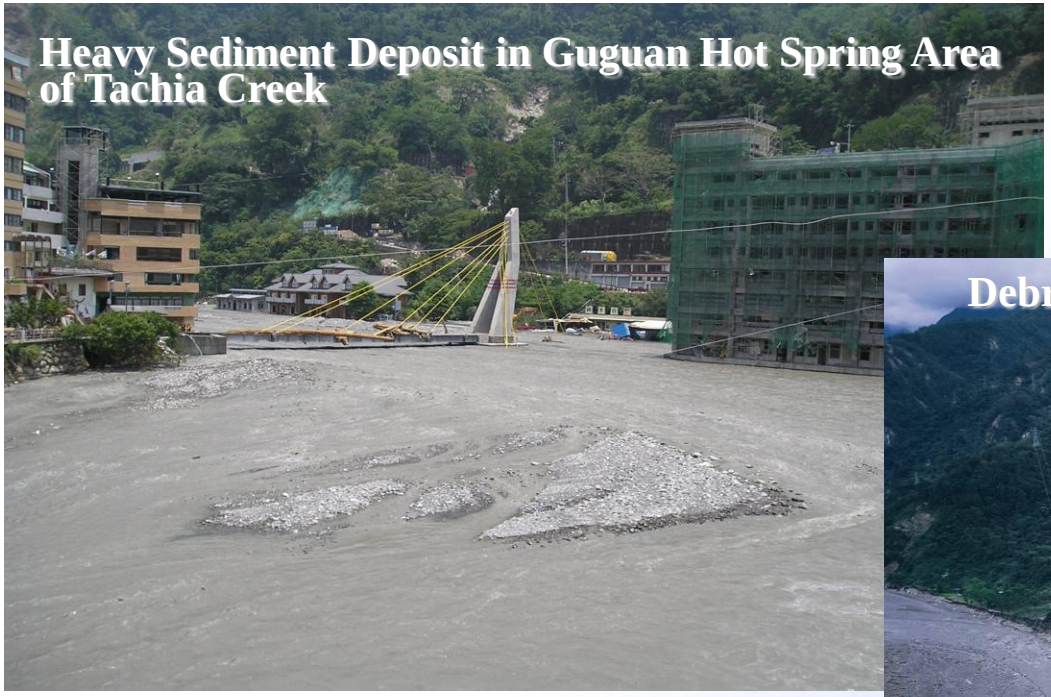
Unit: billion NT$

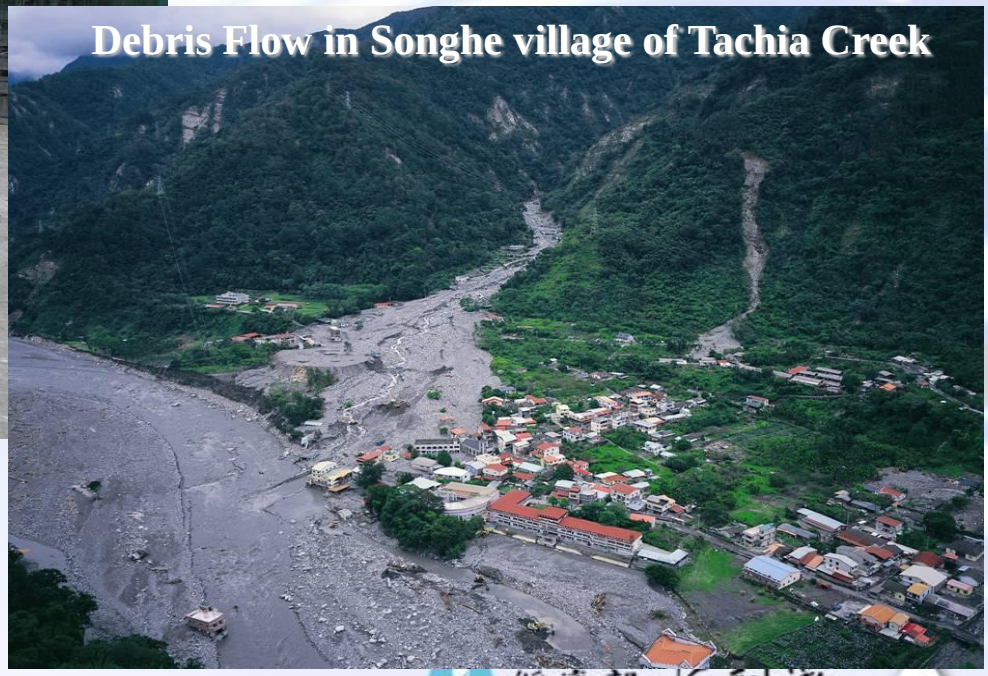
Year	Typhoon	Spring Monsoon	Summer Storm	Sum
2006	0.831	2.360	0.000	3.191
2005	12.586	5.285	0.000	17.871
2004	11.226	0.000	0.059	11.285
2003	3.135	0.058	0.000	3.193
2002	0.164	0.060	0.001	0.225
2001	14.510	0.138	0.031	14.679
2000	12.062	1.149	0.385	13.596
1999	1.989	0.000	1.285	3.274



2007 Typhoon SEPAT in Mei-Nung Town, Kao-hsiung County

- Typhoons, Spring monsoon and Summer storm occasional bring serious land slides and debris flow in mountain area.
- In 2001, more than 200 people died or disappeared in Typhoon Toriji which induced huge landslides and debris flows.


Heavy Sediment Deposit in Guguan Hot Spring Area of Tachia Creek


Debris Flow in Songhe village of Tachia Creek

Flood

- Typhoons & Heavy Rainfalls
- **Land subsidence**

1. Over usage of groundwater cause land subsidence

2. Land subsidence reduce functions of drainage system

Land subsidence in Southern west coast

- **Range**
  - ✓ Southwest coast, from the south bank of Wu creek to Pingtung county
  - ✓ Lanyang plain coast
- In 1996,the subsidence area was 1616 km2.

  Currently the subsiding area is about 803km2.
- **In 2007, the maximum accumulated subsidence is 3.24m in Pingtung County.**

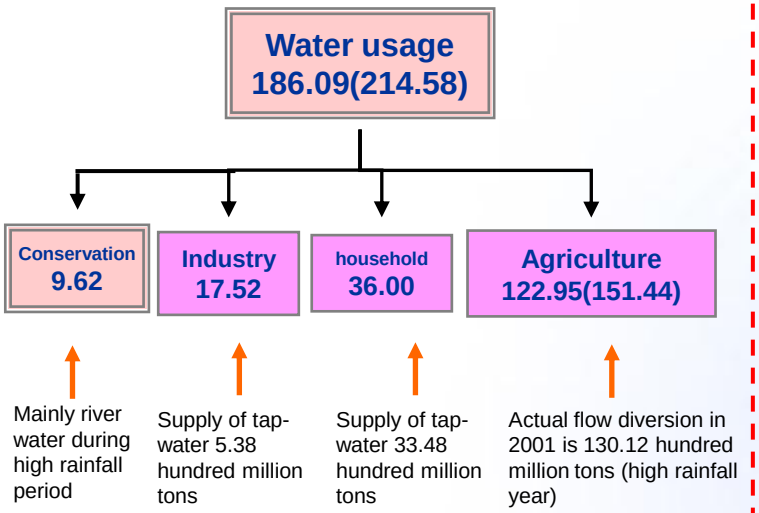
  The most severe subsiding area is in Erlin, Changhua counties with annual subsidence of 8.4cm and Huwei of Yunlin county with more than 8.2cm annual subsidence.

Water Scarcity

- **Drought**
- High-Density Sediment Flow

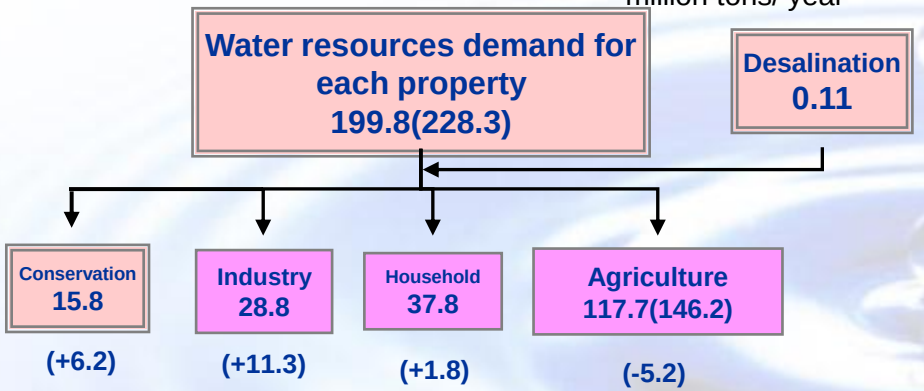
Water consumption of each property keeps increasing

The situation in the fair rainfall year 2001



Assumed fair rainfall year 2021

Unit：hundred million tons/ year



Needed q'ty of natural water resources

=186 hundred million tons

Needed amount of natural water resources

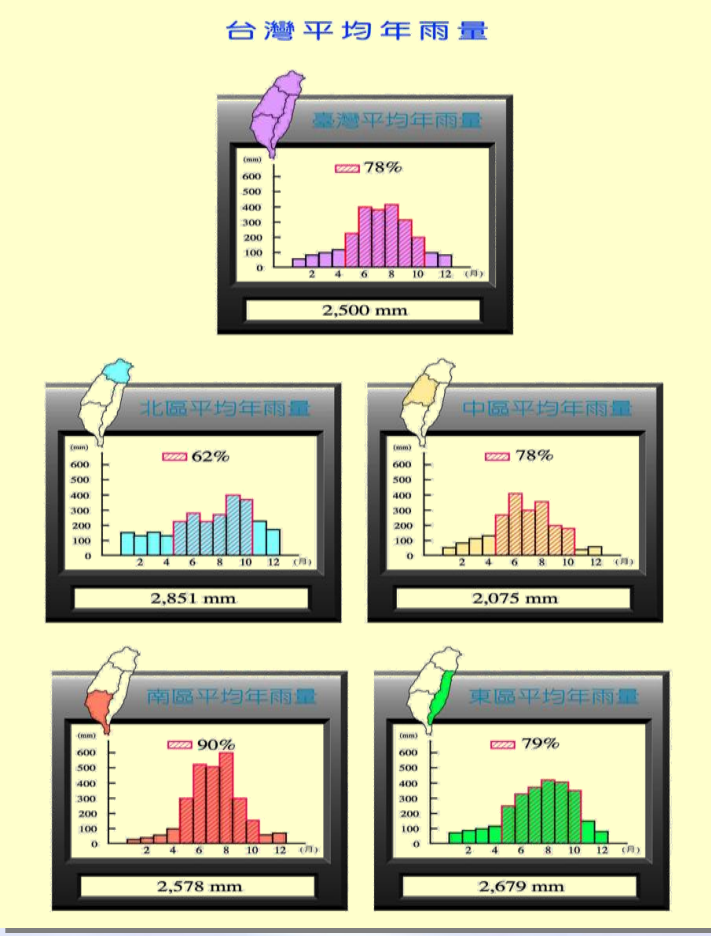
=200 hundred million tons

經濟部水利署

Note: 1.Parentheses are the irrigation water not for Irrigation Association and Taiwan Sugar Farm
2.During high rainfall year and season, water for agriculture includes river water. It has the functions of production, ecology and living. The amount is temporarily not listed.

High fluctuation of rainfall means High risk water supply

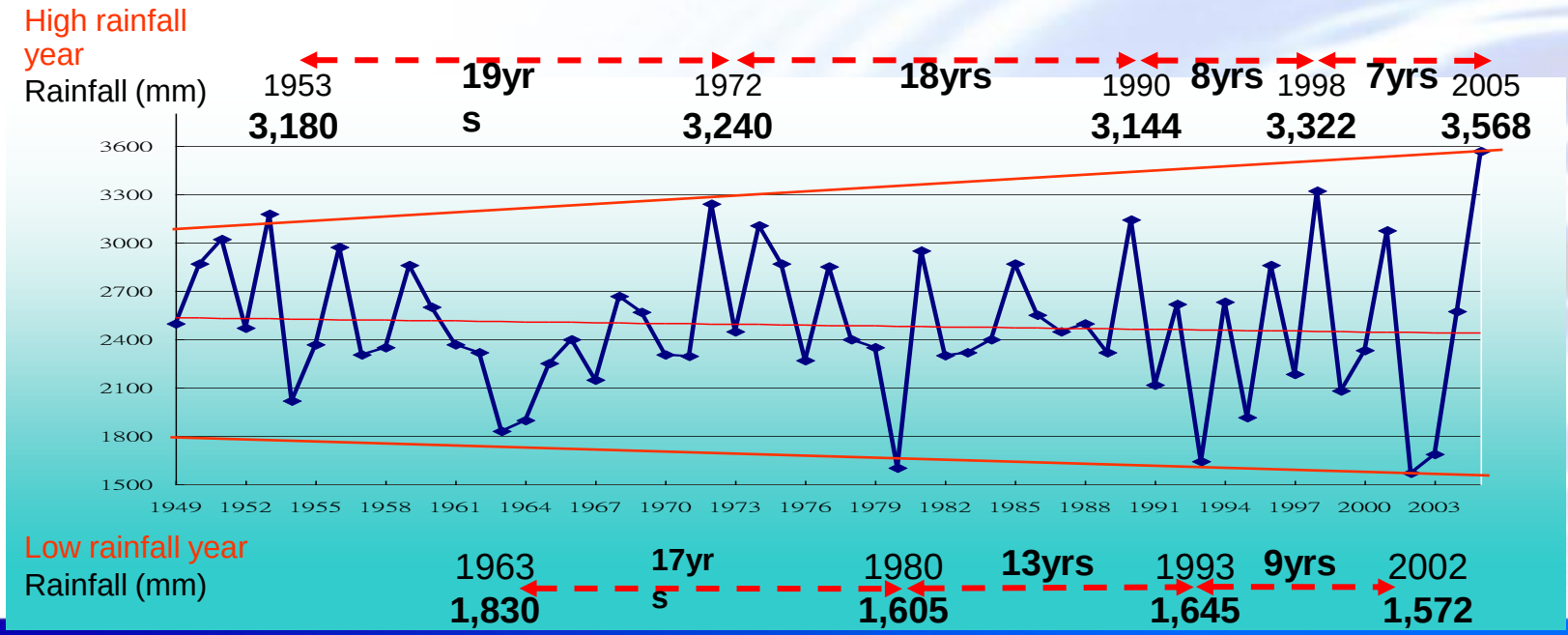
- **Uneven space distribution**
  - Over 8,000mm in the highest mountain area
    Less than1,200mm in the lowest plain
- **Uneven time distribution**
  - Rate of seasonal fluctuations during high and low reasons in the south is 9：1
  - A difference of 1,500mm rainfall between high and low flow years



Usable rainfall is limited, especially in the south with only 10% rainfall during low flows

Global Change Impacts become more obviously

														O612	O911	
Floods											Nari			Nock-Ten	Longwang	
				Doug				Babs		Bilis	Toraji			Aere	Mastsa	
				Caitlin		Herb		Zeb		Zangsane	Trami			Mindulle	Haitang	O609
Year	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
	North	South	North	North		North						North	North	North		
Droughts	Central		Central	Central										Central		
Impacted area	South		South	South										South		
	East		East	East										(H1 of 2004)		



Water Scarcity

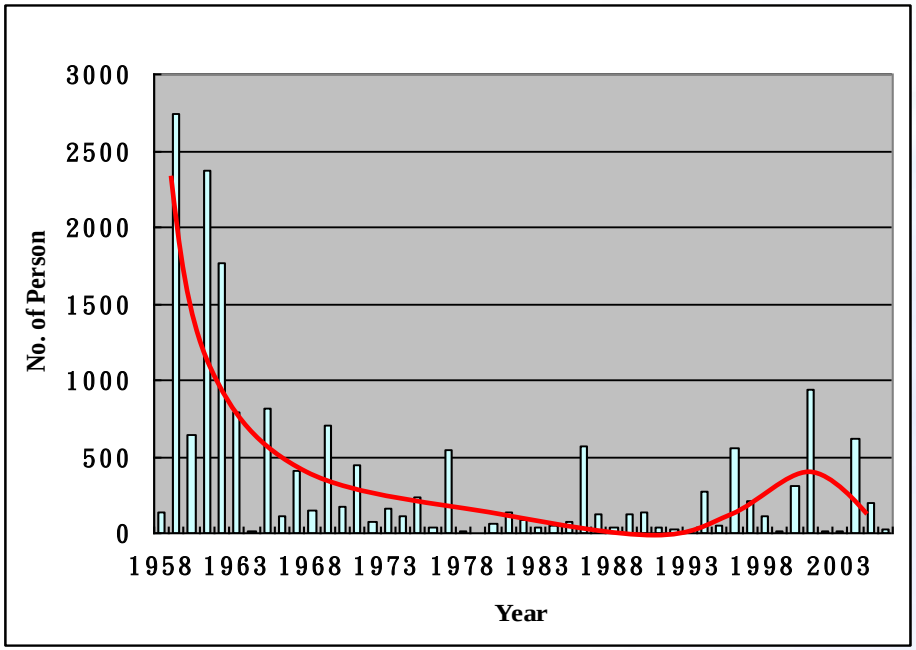
- Drought
- **High-Density Sediment Flow**

High turbidity during typhoons affects water supply

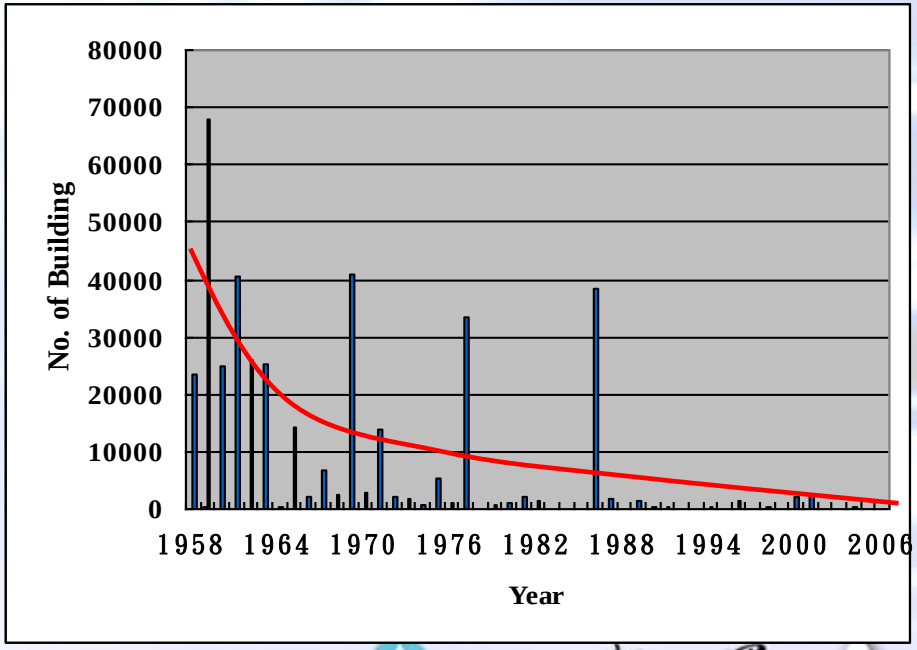
- Water resources in Taiwan include 3 main parts: rivers, reservoirs and groundwater and surface runoff occupies 77%. After 921 earthquake in 1999, the soil erosion problem became more severe. When a typhoon and heavy rain comes, it causes rising turbidity, and affects water supply.
- In 2004, Elly typhoon caused rising turbidity of Shimen reservoir and interrupted water supply for almost 30 days.

Central-Local Governments Co-operation

1. With well developed flood control facilities and disaster response system, the loss of water disaster loss is decreasing in Taiwan.
2. Central – Local governments closely co-operation is the key for success.
3. Co-operation issues include: Inundation Area Flood Control; Flood Control Facilities Maintain; Disaster Information Exchange; Portable Pumping Machine Support



Lift loss

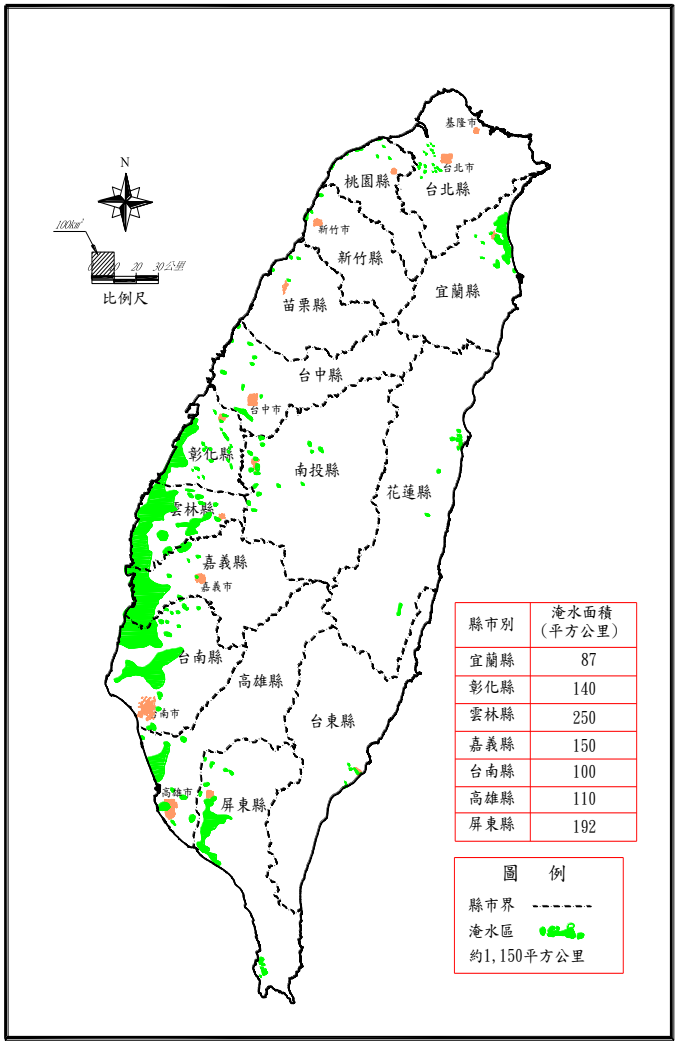


House Damage

Preparedness

- **Inundation Area Flood Control Project**
- Flood Control Facilities Maintain

1. IAFCP project will cost 116 billion NT$ and aim for protect 600km2 area & 2.5 million people.
2. Raise the Protection Level:
   - River： 50 years return period flood
   - Regional Drainage System: 25 years return period flood
   - Urban Drainage System: 5 years return period flood



縣市別	淹水面積（平方公里）
宜蘭縣	87
彰化縣	140
雲林縣	250
嘉義縣	150
台南縣	100
高雄縣	110
屏東縣	192

2006~2007	2008~2010	2011~2013
First Stage 30.9 billion NT$	Second Stage 44.5 billion NT$	Third Stage 40.6 billion NT$

The Investment of the first stage project of IAFCP

Unit: billion NT$

Item	2006	2007	Summary
Riverbed Digging Programs	1.500	-	1.500
Integration Watershed Management Planning	0.855	0.523	1.378
New Waterway Regulation Projects	10.042	15.355	25.397
Emergency Reconstructions	1.250	1.440	2.690
Summary	**13.647**	**17.318**	**30.965**

Results of the first stage project of IAFCP

- Riverbed Digging – **digging 1,868km long channel (about 6 million m^3 soil).**
- Integration Watershed Management Planning — **154 projects.**
- New Waterway Regulation — **1,112 projects (472 projects have been completed，154 km^2 area was protected) .**
- Emergency Reconstructions --- **reconstructed 108 km regional drainage channel and 1.5 km urban drainage channel, renew 4 pumping stations.**

台南市六塊寮排水及新寮支線清疏工程(前、後)

台東縣利嘉大南橋下游右岸堤防新建工程(前、後)

Preparedness

- Inundation Area Flood Control Project
- **Flood Control Facilities Maintain**

- Check local government's flood control facilities (including dikes, gates, pumping stations, tunnels etc.) and provide necessary maintain assistances before May 1st every year.
- Establish flood control facilities management system and exchange information periodically.

序號	項次	水系	工程名稱	預定完工日期	缺口地理位置（鄉鎮、村落）	防汛缺口相片、樁號、長度	汛期因應措施
01-0036-010-01	1	淡水河	無		七堵區友納溪匯流口	 【基隆河】無（基隆河友納溪匯流口長約 200 公尺）【1 處】	因該區無住戶，洪水發生時僅阻斷道路通行，對其他河段影響甚微，故以非工程措施管制人車通行方式因應，本局另於 96 年 3 月 19 日水十工字第 0960200179O 號函知基隆市政府，請預先妥擬管制及緊急應變措施，並於道路出入口設置相關警告標誌及替代道路說明，汛期時配合淡水河流域防洪指揮中心作業，於必要時管制人車通行。【查報人員：第十河川局工務課林益生 聯絡電話：02-8966987060212、0931135602】
01-0036-010-02	2	淡水河	無		七堵區楊梅坑溪匯流口	 【基隆河】無（支流楊梅坑溪匯流口長約 200 公尺）【1 處】	因該區無住戶，洪水發生時僅阻斷道路通行，對其他河段影響甚微，故以非工程措施管制人車通行方式因應，本局另於 96 年 3 月 19 日水十工字第 0960200179O 號函知基隆市政府，請預先妥擬管制及緊急應變措施，並於道路出入口設置相關警告標誌及替代道路說明，汛期時配合淡水河流域防洪指揮中心作業，於必要時管制人車通行。【查報人員：第十河川局工務課林益生 聯絡電話：02-8966987060212、0931135602】

Response

- **Disaster Information Exchange**
- Portable Pumping Machine Support

- Establish Water Disaster Information platform. Exchange river elevation, potential inundation area prediction, coastal disaster monitoring information.
- Disaster information is useful for local government decision making.

海岸預警

- 已完成雲嘉南高屏等海岸地區
- 可提供海堤高程資訊
- 可預測6小時水位資訊

淹水潛勢

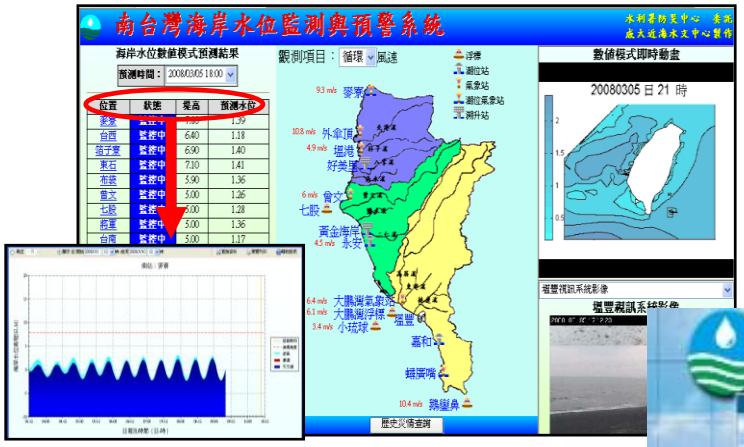
- 已更新台中、南投、高雄及屏東等縣市之淹水潛勢圖

水位預警

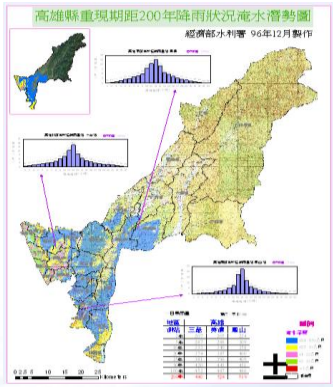
- 已完成淡水河、濁水溪及烏溪流域之洪水預警系統
- 可預測1～6小時水情資訊

淹水監測

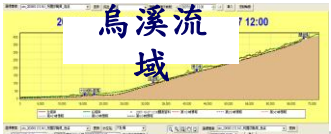
- 即時影像監視站：92-96共新建75處、旁收14站
- 移動式水位計：95-96共新建15處27座站

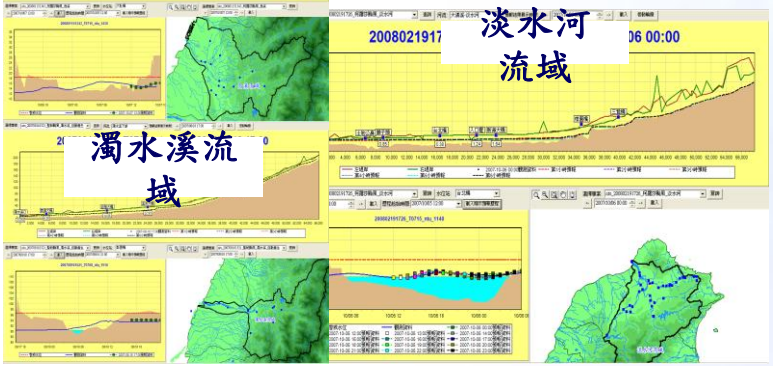

南台灣海岸水位監測與預警系統
海岸水位數值模式預測結果
觀測項目：
數值模式即時動畫
20080305 日 21 時
歷史災情查詢


屏東縣600毫米日降雨量之淹水潛勢圖


高雄縣重現期距200年降雨狀況淹水潛勢圖
經濟部水利署 96年12月製作


經濟部水利署
災害緊急應變系統
使用者認證


烏溪流域


淡水河流域
濁水溪流域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Response

- Disaster Information Exchange
- **Portable Pumping Machine Support**

420 portable pumping machines provided by Central Government have been distributed to county governments in inundation area.

77 WRA's portable pumping machines have been distributed to its branches and would be operated under county governments' requests.

總計控留77部

Portable Pumping Machines Reduce the inundation situations

- 2007 operation hours (WRA)
  - 18,200 hours.
- Financial support
  - 2.64 million NT$
  - 159 portable pumping machines.
- WRA,s portable pumping machines are ready to go in 10 minutes if local Governments ask help.


聖帕颱風後0820豪大雨(雲林地區)


聖帕颱風後0820豪大雨(羌園地區)