行政院所屬各機關因公出國人員出國報告書

（出國類別：出席國際會議）

出　席

「第三屆世界水資源論壇」

(The 3rd World Water Forum)

出國報告書

出國人員：經濟部水利署 黃署長金山等 32 人

出國地點：日本

出國期間：中華民國 92 年 3 月 16 日至 3 月 24 日

報告日期：中華民國 92 年 4 月

系統識別號:C09201624

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頁數: 80　含附件: 否

報告名稱:

出席「第三屆世界水資源論壇」出國報告書

主辦機關:

經濟部水利署

聯絡人／電話:

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出國人員:

黃金山　經濟部水利署　署長
陳弘卣　經濟部水利署　副總工程司
謝勝彥　經濟部水利署　水利規劃試驗所　所長
馮德榮　經濟部水利署　科長
林惠芬　經濟部水利署　副工程司

出國類別: 其他

出國地區: 日本

出國期間: 民國 92 年 03 月 16 日 -民國 92 年 03 月 24 日

報告日期: 民國 92 年 05 月 08 日

分類號/目: G5／水利工程　G5／水利工程

關鍵詞: 第三屆世界水資源論壇,地下水,防洪

內容摘要: 「世界水資源論壇」係由世界水資源委員會（World Water Council）主辦，每三年辦理一次，爲全世界重要水資源會議之一，第三屆訂於2003年3月16日至23日在日本京都舉辦（前二屆分別於1997年、2000年假摩洛哥馬拉喀及荷蘭海牙舉行），辦理多項座談會、討論會、展示活動，並彙整各項成果，提報部長級會議討論，最後簽署宣言，且另研提「世界水資源行動方案」，作爲未來三年全球水資源政策，俾憑協助各國推展各項水資源事務。經濟部水利署爲嚮應參與國際活動的政策，自2001年起即積極規劃參與第三屆世界水資源論壇，包括架設「第三屆世界水資源論壇」中文網站，以都市防洪爲題，開闢於網站上供國人討論，並即時翻譯大會重要訊息；擔任「水之聲伙伴」（Water Voice Partner）負責蒐集台灣地區各界人士針對水的議題上網所提供的意見，譯成英文，轉送論壇秘書處彙整。此外，極力爭取於第三屆世界水資源論壇由經濟部水利署主辦二場座談會，發表台灣的經驗與國際人士交流，經於2002年9月獲該論壇秘書處同意主辦「都市防洪」與「地下水管理與地層下陷防治」二場座談會，均以本署黃署長金山爲議題召集人。自2002年九月確認台灣將主辦兩場座談會後，經濟部水利署即廣徵各方意見，並將座談會主軸定爲「台灣經驗分享」。爲鼓勵國人參與，水利署亦組團廣邀各界參與，除將台灣水利界成果展現於國際舞台上，亦藉此機會與世界各地專家互動，觀摩他國成就。

出國人員名單

經濟部水利署組團前往日本京都及大阪參加第三屆世界水資源論壇，其中除六篇論文發表者及負責本活動之工作人員外，行政院永續發展委員會委員於幼華教授、王鑫教授及時報文教基金會余範英董事長擔任顧問隨團指導，再者，行政院國科會、水利會及相關研究、私人機構派員參與，總共 32 人，另外國內媒體中國時報、台視、中天、公共電視及 Taipei Times 均派員赴日採訪大會各項活動及我國主辦座談會實況。水利署組團人員名單如下：

序號	姓名	服務單位/職稱	出國期間
1	黃金山(領隊)	經濟部水利署 署長	3/16-3/21
2	余範英(顧問)	時報文教基金會 董事長	3/16-3/21
3	於幼華(顧問)	台大環工所 教授	3/16-3/21
4	王鑫(顧問)	台大地理系 教授	3/16-3/21
5	陳弘凷	經濟部水利署 副總工程司	3/16-3/24
6	謝勝彥	經濟部水利署水利規劃試驗所 所長	3/16-3/21
7	馮德榮	經濟部水利署綜合企劃組 科長	3/16-3/21
8	林惠芬	經濟部水利署綜合企劃組 副工程司	3/16-3/21
9	朱文生	能邦科技顧問股份有限公司 博士	3/16-3/21
10	黃煌煇	國立成功大學水公試驗所 主任	3/16-3/21
11	宋長虹	國立成功大學地層下陷防治服務團博士	3/16-3/21
12	李天浩	國立台灣大學土木系 教授	3/16-3/21
13	李鴻源	國立台灣大學土木系 教授	3/16-3/21
14	龔誠山	中興工程顧問公司 協理	3/14-3-21
15	倪佩君	淡江大學水資源管理與政策研究中心執行長	3/16-3/21

序號	姓名	服務單位/職稱	出國期間
16	潘明祥	行政院九二一震災災後重建推動委員會 大地工程處 處長	3/16-3/21
17	陳禮仁	國立成功大學防災研究中心 顧問	3/16-3/21
18	李錦郎	新竹農田水利會 總幹事	3/16-3/21
19	徐金錫	嘉南農田水利會 會長	3/16-3/20
20	莊文南	黎明工程顧問公司 組長	3/16-3/21
21	魯立雄	中華顧問工程公司 計畫經理	3/16-3/21
22	梁文盛	巨廷工程顧問(股)公司 副董事長	3/16-3/21
23	單信瑜	國際水利環境學院 副院長	3/16-3/21
24	鄺孟憶	國際水利環境學院 行政組長	3/16-3/21
25	陳淑美	行政院國科會 研究員	3/16-3/21
26	商能洲	台大環境工程學研究所 研究助理	3/16-3/21
27	蕭登元	台大環境工程學研究所研究助理	3/16-3/21
28	徐鼎昌	駐日本代表處 秘書	-
29	許　瑞	中華顧問工程司 董事長	3/16-3/23
30	林東泰	中華顧問工程司 副總經理	3/16-3/23
31	林茂佟	中華顧問公程司 工程師	3/16-3/23
32	許少華	逢甲大學 副教授	3/16-3/23

目　　錄

附件：

一、 第三屆世界水資源論壇中文網站

二、 台灣地區水之聲

三、 水博覽會宣傳海報

四、「都市防洪」會議資料

五、「地層下陷防治」會議資料

六、 京都部長宣言（英文全文）

七、 京都部長宣言（全文中文翻譯）

八、 水行動方案概要(英文)

九、 相關報導

- 淡江大學水資源管理與政策研究中心網站報導
- Taipei Times 報導
- 中國時報專題報導

十、 活動照片

壹、緣 起

「世界水資源論壇」係由世界水資源委員會（World Water Council）主辦，每三年辦理一次，為全世界重要水資源會議之一，第三屆訂於2003年3月16日至23日在日本京都舉辦（前二屆分別於1997年、2000年假摩洛哥馬拉喀及荷蘭海牙舉行），辦理多項座談會、討論會、展示活動，並彙整各項成果，提報部長級會議討論，最後簽署宣言，且另研提「世界水資源行動方案」，作為未來三年全球水資源政策，俾憑協助各國推展各項水資源事務。

經濟部水利署為響應參與國際活動的政策，自2001年起即積極規劃參與第三屆世界水資源論壇，包括架設「第三屆世界水資源論壇」中文網站，以都市防洪為題，開闢於網站上供國人討論，並即時翻譯大會重要訊息；擔任「水之聲伙伴」（Water Voice Partner）負責蒐集台灣地區各界人士針對水的議題上網所提供的意見，譯成英文，轉送論壇秘書處彙整。

此外，極力爭取於第三屆世界水資源論壇由經濟部水利署主辦二場座談會，發表台灣的經驗與國際人士交流，經於2002年9月獲該論壇秘書處同意主辦「都市防洪」與「地下水管理與地層下陷防治」二場座談會，均以本署黃署長金山為議題召集人。

自2002年九月確認台灣將主辦兩場座談會後，經濟部水利署即廣徵各方意見，並將座談會主軸定為「台灣經驗分享」。為鼓勵國人參與，水利署亦組團廣邀各界參與，除將台灣水利界成果展現於國際舞台上，亦藉此機會與世界各地專家互動，觀摩他國成就。

貳、行 程

日期	時 間	活動	地點/說明
3月16日	上午	台北－大阪	
(星期日)	下午	大會報到	大阪、京都會場
3月17日	上午	參與大會各項活動	京都國際會議中心
(星期一)	下午	洪水組召集人會議	
3月18日	上午	參加洪水組開幕式	京都國際會議中心
(星期二)	下午	水利署「都市防洪」座談會	
3月19日	上午	水利署「地層下陷防治」座談會	大阪國際會議中心
(星期三)	下午	地下水組閉幕	
3月20日 (星期四)	全天	參觀琵琶湖流域綜合管理局	Shiga
3月21日	全天	大阪－台北	團員返台
(星期五)		參與水之聲頒獎典禮	陳副總工程司弘由
3月22日 (星期六)	全天	參與大會各項活動 旁聽部長級會議	京都國際會議中心
3月23日 (星期日)	全天	參與大會各項活動 旁聽部長級會議	京都國際會議中心
3月24日 (星期一)		大阪－台北	陳副總工程司弘由 返台

參、世界水資源論壇概要

一、世界水資源論壇宗旨

世界水資源委員會（World Water Council）於 1996 年在法國馬賽（Marseilles）成立，定位為國際水資源政策智庫。其成員包括 300 多個來自世界各地非政府組織（NGO）、政府機關、民間團體、世界銀行、聯合國相關組織等，經濟部水利署為團體會員之一。該委員會成立宗旨如下：

1.謀求各層級決策人士達成政策共識。

2.建置平台供研討全球、區域性及地區性重要水資源議題。

3.界定國家及國際水資源管理需求。

4.擬訂水資源整合經營管理策略，協助各國落實水資源永續發展措施。

5.促進以和平互助方式運用跨國河川流域水資源。

為增進瞭解全球水資源議題，進而擬訂水資源管理策略，協助世界各國處理水資源課題，該委員會乃籌辦「世界水資源論壇」，藉由全球各國合作達成下列目標：

1.提高水資源議題的政治重要程度。

2.經由各方面研討，研提共同宣言或策略建議，以協助解決 21 世紀全球各國水資源課題。

3.推動共同研究計畫，探討水資源整體經營管理對策。

4.促進各國政府落實執行水資源管理措施。

二、歷屆水資源論壇成果

1997 年於摩洛哥馬拉喀（Marrakech）舉辦第一屆世界水資源論壇，會議結果提出「21 世紀水資源、生活及環境願景」報告。第二屆世界水資源論壇則於 2000 年 3 月假荷蘭海牙（Hague）舉行，來自 156 國家共約 5,500 人參與，另有 120 個國家主管水資源部長或相關機關首長出席部長級會議，與會代表一致同意通過「海牙聲明」－期望 21 世紀，不分老弱婦孺、世界上每個角落的人享有安全的用水。第二屆結論海牙宣言內容摘錄如下：

1.符合基本需求：確保民眾安全、充足、衛生的用水，同時賦予參與水資源管理權力（尤其是婦女）。

2.確保糧食供應：應有效利用、調配水資源，以確保糧食供應無虞。

3.保護生態系統：透過永續水資源管理方法，確保生態系統之完整。

4.分享水資源：透過永續河川管理手段，建立水資源共享、和平管理機制。

5.危機管理：提供洪水、乾旱、污染或其他水資源相關災害之危機處理能力。

6.重視水資源價值：水資源管理方式必須反應出水的經濟、社會、環境及文化價值；更進一步，必須透過制定水價機制，充分反應供水之成本。

7.智慧管理水資源：明智之水資源經營管理，必須將公眾利益充分納入考量。

三、第三屆世界水資源論壇籌備過程

第三屆世界水資源論壇由日本政府籌辦，於本（2003）年3月16日至23日假日本京都、大阪、滋賀三地同時舉行。其主要預期成果二項，完成「世界水資源行動方案」（World Water Action Report）與「部長宣言」（Ministerial Declaration）。其中第一項乃延續第二屆世界水資源論壇成果，並將其轉換為行動方案。另依例在部長級會議後共同提出「部長宣言」，作為未來三年全球水資源政策，俾憑協助各國推展水資源管理事宜。

本屆世界水資源論壇舉辦方式以下列三大類別進行：

(一)一般參與者

1.虛擬水會議（Virtual Forum）：

首先，向論壇秘書處申請同意後，選擇特定議題，於網站上開闢討論園地，供人上網參與研討，網站主持人再將研討意見提送秘書處，於三月論壇舉行時辦理座談會，其結論提送部長級會議討論。

2.水之聲伙伴計畫（Water Voice Partnership Project）：

經向論壇秘書處註冊後，由水之聲伙伴利用各種途徑蒐集一般民眾對水的意見，提送秘書處彙整，於三月論壇舉行時辦理小組會議，其重要意見提報部長級會議討論。

3.區域性會議（Regional Conference）與議題座談會（Session）：

均由全球各民間或政府單位選擇議題向論壇秘書處申請，經劃分亞洲、美洲…及不同課題，指定一單位策劃會議內容，再於三月論壇舉行時辦理各

區域及議題座談會，其結論將提送部長級會議研討。

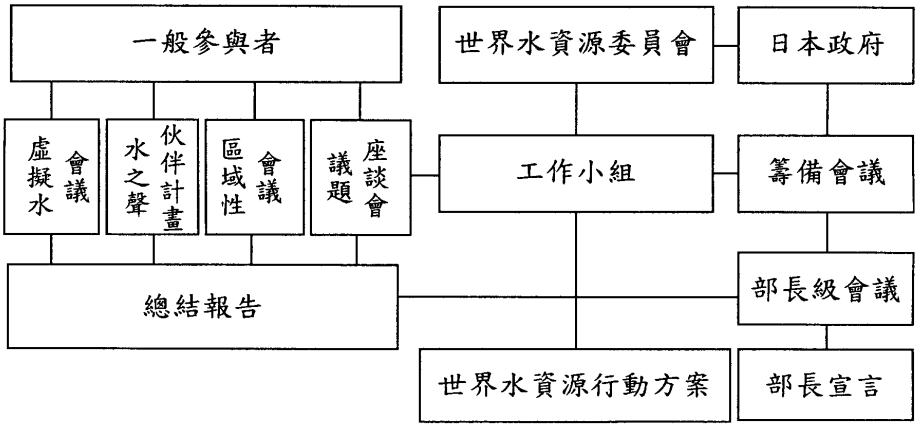
(二)世界水資源委員會

世界水資源委員會成立一工作小組（Water Action Unit），透過各項研討會研擬「世界水資源行動方案」草案，於三月論壇舉行時討論定案。

(三)日本政府

主辦國日本負責召開部長級會議，自 2000 年第二屆世界水資源論壇舉辦後，日本政府即透過一系列研討活動，規劃會議內容及草擬部長宣言草案，於三月論壇舉辦時彙整「虛擬水會議」、「水之聲伙伴計畫」、「區域性會議」及「議題座談會」所獲得討論成果，一併提送部長級會議討論後，確定 2003 年京都宣言。

上述三大類論壇舉辦方式之關聯圖示意如下：



四、第三屆世界水資源論壇議程

三月	16 日 星期日	17 日 星期一	18 日 星期二	19 日 星期三	20 日 星期四	21 日 星期五	22 日 星期六	23 日 星期日	
舉辦地點 (Venue)	京都 (Kyoto)	京都 (Kyoto)	京都 (Kyoto)	京都 (Kyoto)	京都 (Kyoto)	京都 (Kyoto)	京都 (Kyoto)	京都 (Kyoto)	
	京都國際會議廳, 京都寶 池王子飯店 Kyoto International Conference Hall, Kyoto Takaragaike Prince Hotel		大阪 (Osaka) Grand Cube Osaka	大阪 (Osaka)	滋賀 (Shiga) Biwako hall, Otsu Prince Hotel	滋賀 (Kyoto)			
議題發表(Issue)		水資源,食物與環境 Water, Food, and Environment			整體水資源管理與流域管理 Integrated Water Resources management (IWRM) and Basin Management (Shiga)		其它議題 Other Sessions	其它議題 Other Sessions	論壇 Forum
	水資源與氣候 Water and Climate		水資源與管理 Water and Governance						
		和平水資源 Water for Peace		農業,食物與水資源 Agriculture, Food, and Water					
	水補給,公共衛生,衛生與水污染 Water Supply, Sanitation, Hygiene, and Water Pollution		水資源與城市(大阪) Water and Cities (Osaka)			水資源基礎建設資金 Financing Water Infrastructure			
	水資源與文化之差異 Water and Culture Diversity		水資源與資訊 Water and Information (Osaka)						
			地下水(大阪)Groundwater (Osaka)		水,教育與能力建構 Water, Education, and Capacity Building				
	水資源與能源 Water and Energy		洪水 Floods						
		水資源,自然與環境 Water, nature, and Environment		水與貧窮 Water and Poverty					
	其它議題 Other Sessions	其它議題 Other Sessions	其它議題 Other Sessions	其它議題 Other Sessions	其它議題 Other Sessions	其它議題 Other Sessions			
主題(Topics)			公民營合作關係 Public-Private Partnership (Osaka)		水壩與永續發展 Dams and Sustainable Development				
特別節目 (Special programs)						水資源與國會議員 Water and Parliamentarians	世界水資源評估 World Water Assessment Programs		
	世界水資源行動 World Water Actions					部長級會議 (水資源,食物與農業) Ministers Meeting on "Water, Food, and Agriculture" (Shiga)			
主要團體(Major groups)				首席執行小組 CEO Panel (Osaka)					
		水資源記者小組 Water Journalists Panel		聯合小組 Union Panel (Osaka)	兒童世界水資源論壇 Children's World Water Forum				
		性別與水資源小組 Gender and Water Panel	青年世界水資源論壇 Youth World Water Forum	科學,科技與管理小組 Science, Technology, and Management Panel		水資源發展之友小組 Water Development Partners Panel			
區域議題討論 (Regional Days)		非洲地區 Day of Africa	亞洲及太平洋地區 Day of Asia and Pacific	美國地區 Day of the Americas	中東及地中海地區 Day of the Middle East and the Mediterranean	歐洲地區 Day of Europe			

大會議程(續)

三月	16 日 星期日	17 日 星期一	18 日 星期二	19 日 星期三	20 日 星期四	21 日 星期五	22 日 星期六	23 日 星期日	
典禮-京都 (Ceremonies)	開幕典禮 pening Ceremony							閉幕典禮 Closing ceremony	
	頒獎典禮 Award Ceremony for King Hassan II Great World Water Prize	頒獎典禮 (水資源記者競賽) Award Ceremony for Water Journalists Competition			第三屆世界水資源論壇紀念森林 3rd World Water Forum Memorial Forest (Shiga)	頒獎典禮(水之聲訊息獎) Award Ceremony for Water Voices messenger Prize			
招待中心 (Stakeholder Center)	參加人員發表及會議場地 On-site presentation and meeting space for participants								
記者室 (Press Center)						論壇參與者與部長之對談 Dialogue between Forum Participants and Ministers			
部長級會議 (Ministerial Conference)				高級官方會議 Senior Officials Meeting			部長級會議 Ministerial Conference		部長級會議 Ministerial Conference
京都						京都慶祝活動 Kyoto Festival			水資源博覽會與慶祝活動 Water Fair and Festival "Mizu-En"
滋賀				滋賀慶祝活動 Shiga Festival					
大阪			水資源博覽會 Water EXPO						
琵琶湖與淀川流域 Lake Biwa and the Yodo River Basin Area	流域地區慶祝活動 Festival in the basin area								
流域地區 Basinwide Events	流域地區慶祝節目 Events in the basin area								

肆、經濟部水利署參與第三屆世界水資源論壇過程

一、爭取主辦專題座談會

為能積極參與國際水資源交流，經濟部水利署自 2001 年起即積極參與大會各項活動，並辦理三項活動如次：

1.架設「第三屆世界水資源論壇」中文網站：

於水利署與淡江大學水資源管理與政策研究中心網站架設「第三屆世界水資源論壇」中文網頁（如附件一），即時翻譯大會重要訊息，並以「都市防洪」為題，供國人討論。

2.水之聲伙伴計畫：

於 2002 年初向論壇秘書處註冊，不設定議題，同樣於水利署與淡江大學水資源管理與政策研究中心網站供民眾發表意見，總計選擇 20 則譯成英文提送論壇秘書處彙辦（附件二）。

3.辦理議題座談會：

水利署自 2001 年起即規劃並向論壇秘書處申辦二場座談會，議題分別為「都市防洪(Flood Mitigation in Urban Areas)」及「地下水與地層下陷防治(Groundwater and Related Land Disasters)」，均以水利署黃署長金山為議題召集人。然受限於我國特殊外交處境，論壇秘書處建議我方改以非政府組織與會，經與中國土木水利工程學會協商同意水利署以其學會之水資源工程委員會名義與會，並於 2002 年九月獲大會正式通知申辦成功。

自確認將於大會中主辦兩場座談會後，水利署即號召水利從業人員參與，並討論如何利用此一難得機會向世界宣揚我水利方面之成就、分享台灣經驗。經多次協商後，確定以「台灣經驗分享」為主軸辦理兩場座談會。

二、專題座談會辦理成果

水利署此次主辦之兩場座談會以「都市防洪(Flood Mitigation in Urban Areas) 」(見附件四)及「地層下陷防治（Groundwater and Related Land Disaster）」(見附件五)為題分別商請台大水工所、成大水工所、能邦公司及中興工程顧問公司協助，會議議程及議題重點內容如下：

(一)都市防洪座談會議程(三月十八日)

時間	主題	講者
14:30 ~ 15:00	大台北地區防洪策略	黃金山博士 經濟部水利署署長
15:00 ~ 15:25	都市防洪決策系統	李天浩教授 台大土木系
15:25 ~ 15:40	實例探討: 基隆河整治經驗	李鴻源教授 台大土木系
15:40 ~ 15:50	結論	

都市防洪座談會以大台北地區防洪經驗為例，介紹我自民國六十年開始之大台北防洪計畫，主要工程為興建及加高堤防(堤防設計採 200 年洪水頻率為保護目標)，開闢二重疏洪道，以分洪方法疏解洪流，區內排水及跨河橋樑亦配合改善。然而分析當前都會區淹水的原因又包含：氣候變遷雨量改變、都市化效應流量增加、抽水站失靈、無法正確掌握降雨以及洪水預警準確度等，因此針對大台北

地區防洪問題，於工程方法上已重新評估洪峰流量、加強排水系統、改善建築物結構等；非工程防洪建設方面，將針對洪水平原的管理、水文氣象資訊系統的改善、防災教育訓練及資料庫建置等進行檢討。

討論時，與會專家對於我國能以200年洪水頻率之高標準作為堤防設計準則甚表驚訝，亦對我淡水河防洪決策支援系統之整體洪水預報系統模式高度肯定。與會專家對於近年來因氣候變遷造成之極端洪水事件亦提出所屬國家之案例，並一致認為傳統之工程方法已不足以應付此變化，非傳統工法，特別是洪水平原的管理，為都市防洪必須採取的途徑。

(二)地層下陷防治座談會議程(三月十九日)

時間	主題	講者
08:45～09:15	開幕致詞及背景介紹	黃金山博士 經濟部水利署署長
09:15～09:45	台灣地下水管理	黃煌煇主任 成大水工所
09:45～10:00	休息	
10:00～10:30	台灣地下水監測網	龔程山博士 中興工程顧問公司
10:30～11:00	台灣地區地層下陷防治	朱文生博士 能邦科技公司
11:00～11:30	討論	

地層下陷防治議題首先介紹台灣西南沿海地區因地下水超抽造成之地層下陷、海水入侵及水質惡化等災情。為防止災情惡化，水利署自 1995 年起推動第一階段五年

期之地層下陷防治方案，主要工作包括建立地下水觀測站網以掌握地下水補注量、抽取量及水質狀況；加強地下水管理推動水權制度，並加強教育宣導，提高一般民眾對此問題之警覺。經過第一階段的努力，地層下陷狀況已獲明顯改善，第二階段另一個五年防治方案亦已展開。

在與現場專家互動時，各國專家對我歷年努力表示肯定，亦對我自第一階段所學習到之經驗，及兩階段防治方案之重點轉移表達高度興趣。回應與會人員之提問，我國代表表示防止地層下陷唯一途徑為不超抽，而不超抽需有精確資料及監測系統作為管理之依據，這個部分我國仍需再加強；另外鼓勵農漁民減少抽取地下水，光靠宣導效果有限，政府補助亦無法徹底解決此問題。我國第二階段防治方案除延續第一階段計畫，亦加強輔導高用水量農漁民轉業。目前委請產業專家評估可行之轉業類別，俟評估成果成熟後將加強對地層下陷地區民眾之宣導，並輔導其轉業，以徹底解決地下水超抽問題。

伍、第三屆世界水資源論壇主要成果

本屆論壇籌備會由日本皇太子德仁擔任榮譽主席、前首相橋本龍太郎及世界水資源協會總裁 Dr. Mahmound Abu-Zeid(現任埃及水資源與灌溉部部長)共同擔任主席。此次會議雖在英美聯軍對伊拉克開戰的陰影下舉行，仍吸引了一百七十個國家、四十三個國際組織，包括非政府組織、政府官員、學者等二萬四千多人參加，而水所引發的國際衝突及可能帶來的和平契機亦成為此次論壇關注的焦點。

一、京都部長宣言

本屆論壇延續聯合國 2003 國際淡水年及約翰尼斯堡永續發展高峰會結論以提供安全用水為討論主軸，在八天會議期間，針對 38 個主題共舉辦了 351 場專題會議，討論主題整理如下表。

水與貧窮	(Water and Poverty)
水與和平	(Water for Peace)
水與管理權	(Water and Governance)
水資源綜合管理與集水區管理	(Integrated Water Resources Management and Basin Management)
水、糧食與環境	(Water, Food and Environment)
水與氣候	(Water and Climate)
水與都市	(Water and Cities)
農業、糧食與水	(Agriculture, Food and Water)
給水、公共衛生、保健與水污染	(Water Supply, Sanitation, Hygiene, and Water Pollution)
洪水	(Floods)

水與能源	(Water and Energy)
水與文化多樣性	(Water and Cultural Diversity)
地下水	(Groundwater)
水與資訊	(Water and Information)
水設施之資金籌措	(Financing Water Infrastructure)
水與運輸	(Water and Transport)
水、教育與能力建構	(Water, Education and Capacity Building)
其他分組	(Other Sessions)

在為期八天的會議中，前六天由各分組舉行論壇，彙整共識。後兩天則是官方部長級會議，進一步以官方單位之立場，檢測各分組結論之可行性，確定此次會議結論，並由各國部長簽署京都宣言，作為未來三年全球水資源政策。宣言內容摘述如下(完整英文宣言如附件六，及中文翻譯版如附件七)：

1.基本方針：

- 水是永續發展的驅動力量，能保護環境的完整，根除貧困和饑餓，是維護人類健康和福址不可缺少之物。
- 提昇水議題層級有全球一致之急迫性，每個國家皆有付諸行動之責任，國際社會及各國和地方的組織皆應支持這項決議。各國中央政府應授權地方政府及各社區來積極推動，不分富貧，不分男女。
- 水資源計畫應以公開研討方式由各國及國際組織以分享資訊及促進彼此的合作為前提來承辦

有關水資源的事項。

2.水資源管理及利益分享：

- 為在 2005 年前達成水資源綜合管理及提昇用水效率，我們將提供工具及其他特殊協助與開發中國家，特別是低度開發國家；同時，強調跨國合作－特別是跨國界流域－解決水資源問題的重要性。
- 提倡並鼓勵全球氣候變遷汲水循環之預測及監測研究；我們將致力於發展及應用非傳統水資源，如海水淡化、水回收和雨水儲蓄利用。

3.安全的飲用水及公共衛生：

- 在 2015 年前達成將全世界無法享有安全用水與無法擁有基礎公共衛生設備之人口比例減半之目標。
- 鼓勵生活飲用水和基本公共衛生設施的科技發展研究。

4.水與糧食生產及農村發展：

透過有效率及公正分配的用水以及管理，改善農業用水效率；推動地區性社區發展，為農村地區的貧戶增加工作機會及收入以根絕貧窮。

5.水污染防治與生態保育：

- 建立適當的立法體制以確保水資源永續利用及水污染防治。
- 有計畫地推動綠化、森林永續管理、濕地復育與生物多樣化保存，以保護及永續利用水資源，以及防治水污染。

6.災害減低與風險管理：

- 加強工程結構如水庫以及堤防等全面性的方法；另發展非工程方法如土地使用管理，建立災害預警系統、風險管理系統。
- 建立可全球適用之資料分享系統，加強提供相關資料、資訊、知識及經驗，並相互合作將天然災害之災情減至最低。

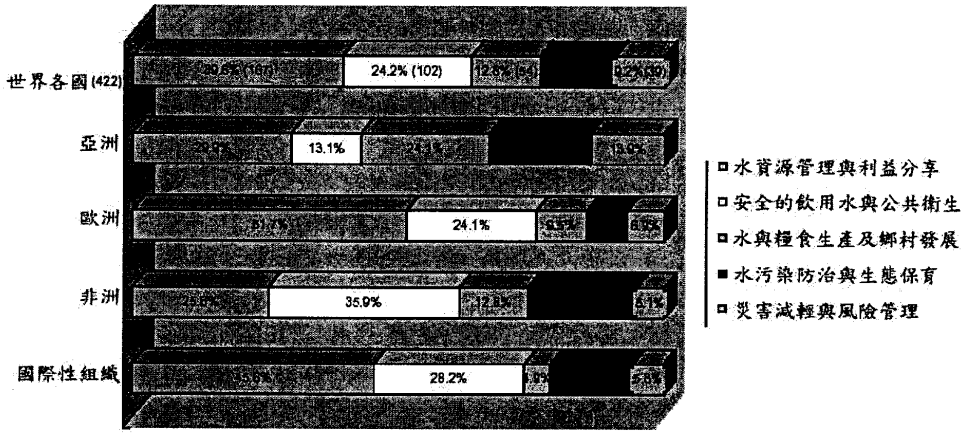
二、水行動方案

世界水資源協會(World Water Council, WWC)自第二屆世界水資源論壇各國簽署海牙宣言後，致力於追蹤各國後續推動狀況，及世界水資源情勢。水行動方案(Water Action)即為此追蹤過程之報告，並將整理後結論送至「第三屆世界水資源論壇」部長會議討論，提醒世人目前最迫切之水議題。(英文原文請參見附件八)

(一)總述

- ■來自三十六個國家及十六個國際性組織，共計提出422個水行動方案(至2003年3月10日止)。
- ■整體而言，多數的行動方案中均與「水資源管理與利益分享」及「安全的飲用水及公共衛生」等議題相關。
- ■就地區性而言，亞洲地區國家相較於其他地區較多關注於「水與糧食生產及鄉村發展」與「災害減輕與風險管理」等議題。
- ■歐洲地區國家提出多數有關「水資源管理及利益分享」之行動方案。
- ■非洲地區國家提出多數有關「安全的飲用水及公共衛生」之行動方案。
- ■國際性組織所提之行動方案與歐洲地區國家之行動方案趨勢類似。

世界各地區水行動方案趨勢統計圖示如下：



(二)、水行動方案內容摘錄

1.政府部門與地方相關單位應共同體認水資源開發與消弭貧窮之重要性，藉由整合水、衛生、能源、健康、農業及生物多樣化等部門之相關水資源策略與重大計畫以達成此目的。

2.政府部門與地方相關單位應提高對於水資源開發案之投資。

3.國際金融機構應優先資助對水資源有迫切需求之國家，如前面所提之政府及地方部門雙方之贊助單位亦應將建設水資源之責任列入優先考量。

4.政府部門及國際金融機構應採取適當的方法以為相關水資源公共基礎建設籌措資金。

5.國際機構應深入了解水之效益及改良之水資源管理方法，同時擴展民眾對於以上這兩個觀點的認知。

6.提供水資源服務者應加強其服務內容之品質與效率，同時作好經營及維護等工作。

7.聯合國應將水資源對於永續發展所扮演之重要角色納入其正準備「永續發展之時代教育(Decade of Education for Sustainable Development)」的宣言中。

8.對於經地方分權後及因任務性編制之新成立水資源機構，政府應加強提昇該組織之能力建構。

9.不論是政府部門、工業、農業單位及一般民眾等，均應在日常生活中致力於污染之消弭，並確保執行任何開發案不增加環境污染。

10.社區組織、非政府組織、私部門及公部門、地方單位與國家政府等，應共同合作以做好最佳的水資源管理，因為水是大家共有的事業。

11.國際機構應促進跨國流域之聯合水資源管理。

12.水資源管理者應同時與氣象及水資源科學家們共同合作，以發展適當方法來適應氣候變遷並降低因洪水及乾旱等災害所帶給人類的苦難。

13.國際機構應建置全球追蹤系統，掌握水資源情勢、水部門的行動以及邁向千禧年水資源發展目標之進展。

三、水博覽會

除上述大會議程外，三個會場京都、大阪、滋賀亦分別以不同主題辦理水博覽會。京都以水與文化(Spirit of Water)為主題將博覽會分為四大類，第一類是在國際會議中心針對與會學者專家辦理的專業性攤位式展示說明會，由各國代表親自說明該國政府或學術團體、民間團體之任務、內容及成果，這是推銷自己的場所。第二類是在植物園辦理的水與文化/水與文明展，由日本和法國共同承辦，內容以東西方「水的神話、信仰、生活」為主。第三類是在市中心辦理的遊藝性博覽會，鼓勵遊藝活動與商業娛樂活動，民眾是主要的賓客，「寓教於樂」是這項活動的特色。第四類是在京都文化博物館辦理之「水名畫展」，展出各國與水相關之名畫，以日本畫家作品為主（宣傳海報如附件三）。

大阪辦理的展示展覽及博覽會場在西南灣區(Osaka Bay)的國際展覽中心，共有四個展場以水產業為主軸，展覽內容偏重科學、技術性等。場地寬廣、設計良好，專業人士說明及展示十分認真。

滋賀大津市的展覽以「水與自然」為主題，偏重一般民眾的參與。大津市瀕臨琵琶湖，湖畔有琵琶湖水利博物館，展示集水區管理、水庫管理各層面的題材。

陸、結論與建議

一、結論

(一) 此次會議中討論議題甚廣，其中全球一致之水問題整理如下：

1.全球暖化、氣候變遷、乾旱及洪水發生頻繁。

2.經濟發展及工業化造成水資源污染，以致可用水源日益減少。

3.都市化及人口集中，造成河川洪峰流量增加，災害不斷。

4.人口增加造成總需水量增加，而由於水源不足，超量抽取地下水，造成地層下陷、海水入侵等災害。

5.農業、工業及民生用水各標的互相爭水的糾紛層出不窮。

6.海水上升後海岸地區排水困難及潮浪災害的增加。

7.水資源的經營、保育、開發、淨化及輸送成本提高，用水成本不斷增加。

除了上述全球共同的水問題台灣都有之外，台灣尚有以下獨特的問題：

1.台灣已高度發展卻未有完善的污水收集及處理系統。

2.台灣工業化程度已甚高，但農業用水卻仍佔總用水量 74% 。

3.台灣高度依賴工業，卻無工業用水法、工業用水專用水源及供水系統。

4.自來水水價偏低，無法反映供水成本；未收取農業用水水費，造成依賴政府大幅度補貼各項標的用水成本。

(二)綜整上述問題，今後台灣水資源管理應朝以下方向努力：

1.建立完善廢、污水回收系統，加強廢污水回收利用。

2.水源開發多元化，講求經濟效益。

3.強化農業、工業用水調配機制，整合現有供水系統，且加強地面與地下水聯合運用，提昇水資源調配效率。

4.研訂工業用水法、專用水源及供水系統。

5.推動公平合理的水價調整機制，充分反應供水成本與水的經濟價值。

6.結合水文及大氣科學，以加強長短程定量降雨預報的準確性與可靠度。

7.落實相關法令執行，加強水資源保育。

8.引進國外經驗，發展本土化水資源科技，提高水資源施政成效。

(三)我國此次限於非聯合國成員無法以官方身分與會，但成功以非政府組織(NGO)方式突破外交困境主辦兩場座談會，誠屬不易。主辦之經濟部水利署及參予專家會前詳密之籌劃、準備，在會場上獲熱烈迴響，成功將我水利界努力成果呈現於國際舞台上。

我方參與本屆論壇兩年多，所提結論獲認同並納入部長宣言項目如下：

1.黃金山署長去(2002)年參加於帛琉舉辦之水資源永續發展會前會中所提，重視非傳統水源開發如廢水回收、雨水貯留系統、海水淡化等方法，為21世紀重要之替代水源。

2.我國主辦之都市防洪座談會中強調洪水平原管理、洪災預測及風險管理之重要性。

3.我國主辦之地層下陷防治組座談會強調我國地下水監測資料收集、分享、應用於減災之重要性。

二、建議

第四屆世界水源論壇定於 2006 年在加拿大蒙特婁（Montreal）舉行，為延續本次第三屆世界水資源論壇呈現台灣經驗成果，我國應積極籌劃參與。未來籌辦方向以爭取與美國、日本、新加坡、荷蘭等國對口單位合作，幾項可行議題包括：

1.水與環境（合作國家：荷蘭、日本、美國）

2.替代水源的開發（合作國家：新加坡、日本、美國）

3.都市防洪（合作國家：日本）

4.地下水管理（合作國家：荷蘭）

經由本次參與會議經驗，深信我國水資源政策工作方向及其成果，與水資源先進國家相較並不遜色。未來，應增加與各產、官、學、研等相關單位之互動，並鼓勵更多我國非政府組織單位積極參與該會，以彰顯台灣水資源發展之成效，除彌補以官方單位之身分參與會議可能受到之限制外，亦可擴展與國際社會交流之機會，讓台灣的水資源管理與發展更臻完善。

附件一

「第三屆世界水資源論壇」

「中文網站」

一、網站功能

第三屆世界水資源論壇(The 3rd World Water Forum-WWF3)中文網站(http://www.water.tku.edu.tw/wwf3/)自民國九十一年五月起提供有關大會相關資訊服務，本網站介紹世界水資源協會成立宗旨、辦理世界論壇之目的，同時，配合本次論壇之召開，提供重要大會新訊(Newsletter)、蒐集台灣水之聲及摘錄各國水之聲(Water Voice)與辦理虛擬水會議(Virtual Water Forum)以提供專題討論等。

本網站共包含下列五個單元：

(1)會議簡介

(2)大會新訊

(3)水之聲

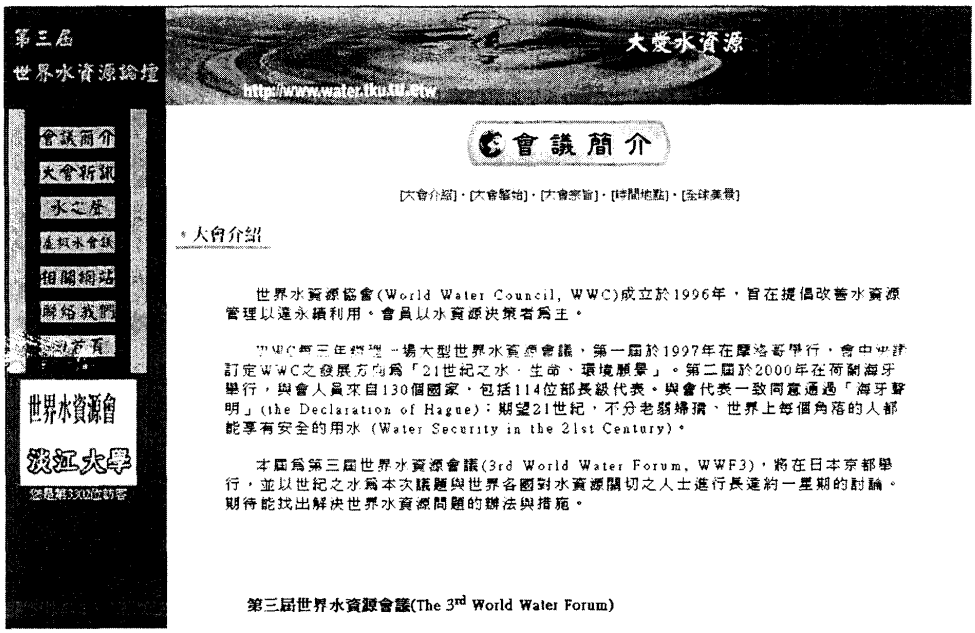
(4)虛擬水會議

(5)相關網站

第三屆世界水資源論壇於2003年3月16日~23日於日本京都、大阪及茲賀等地舉行，台灣代表團參予大會會議期間(3月16日~21日)，WWF3中文網站並同時刊載由水利署率領之專家學者們在日本京都與大版會場所舉行之「都市防洪」及「地層下陷防治」二場專題會議之特別報導。

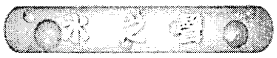
二、單元內容

(一)會議簡介



(二)大會新訊

(三)水之聲



主題	作者	日期
1. 1j	不	2003/3/20
2. 水資源	好人	2003/3/20
3. WATER	郁茹	2003/2/11
4. 我們要感謝河	(lisa)英文	2003/1/16
5. 日常家庭設備怎省水的配備	陳嬿渝	2003/1/16
6. 要愛物河水	許智琪	2002/12/20
7. 好好的喜歡我們全佈的河川	許森煌	2002/12/20
8. 好好愛護河川	許流慧	2002/12/20
9. 哼.....	謝佳蓉	2002/12/20
10.請好好保護河川	朕偉	2002/12/20
11.請大家愛物河川	許智琪	2002/12/20
12.不要在污染河水	許智琪	2002/12/20
13.水	謝佳蓉	2002/11/26
14.節約用水之	李施道	2002/11/13
15.請問有誰知道何謂Off farm&On farm的口？	星之海	2002/10/28
16.水世界在林逸	李政道	2002/10/21
17.想問...	很想生氣的人	2002/8/14
18.節約用水的推廣	小陳	2002/8/5

[單元簡介]・[台灣水之聲]・[世界水之聲]

世界水之聲

更新日期：2002/12/18
水之聲案件：17853
水之聲信差：1897
水之聲夥伴：162

世界各國的案例介紹

[2003/1/3]

宏都拉斯水之聲

安全的飲用水是發展的關鍵，在宏都拉斯西方，有許多村落居民識字率很低，六成以上的居民不能讀書，因此有許多改善教育的計畫策劃中，事實上，絕大多數的居民因爲不潔的飲用水引起腹瀉及胃腸的毛病，導致無法正常上課，因此改善現有飲用水的清潔才是關鍵。

	主題	日期
1.	宏都拉斯水之聲	2003/1/3
2.	泰國曼谷水之聲	2002/9/27
3.	非洲水之聲	2002/9/24
4.	日本年青的水之聲	2002/8/26

(四)虛擬水會議

http://www.water.tku.edu.tw

虛擬水會議

[單元簡介]、[會議主題]、[世界水會議]

=>討論區議題選單 =>地下水與地層下陷

發表新主題

第1頁/共1頁

討論主題	作者	最後更新	回應	人氣
1. 問題研析	jerry	2002/8/26	1	57
2. 何謂地層下陷??	jerry	2002/8/26	3	123
3. 水資源	簡爭	2002/6/13	2	118
4. 防治策略	jerry	2002/6/10	1	61

台灣地區因經濟蓬勃發展，各標的用水需求總量急速增加，由於地表水源供應不足，而地下水在成本低廉、取用便利、水質水量穩定、施工容易等因素之下，導致一般民眾及業者大量抽取地下水使用，超限利用的結果，導致嚴重的地層下陷。

在近幾年努力推動地層下陷防治之下，地層下陷的情形，已經逐年趨緩，只有少部分區域，仍然持續下陷。現今的研究課題朝著1.地面水與地下水聯合運用原則。2.有效管制地下水超抽問題。3.如何增加地下水補注及其他替代水源。4.地下水資訊及監測系統的建置。四個方向去研究，希望能借由地下水去控制減緩地層下陷的速率。

各項研究報告，認定養殖業超抽地下水為引起地層下陷之最大禍首，但是在傳統農業不敵市場經濟的壓迫；沿海漁業資源因工業廢水污染日漸枯竭之下，要使養殖戶放棄生產工具而轉業之可能性並不大。沿海淡水養殖大量抽取地下水，會造成海水入侵及地層下陷問題；沿海海水養殖會因鹽水入滲加重土地鹽化的程度，政府該禁止養殖業在沿海地區養殖，又或是鼓勵業者以外海方式養殖呢?

另外，是否處理養殖業超抽地下水的問題之後，地層下陷就可以獲得根本的解決，又或是該從集水區地下水源頭補注去著手?

虛擬水會議

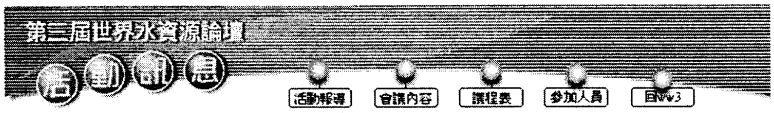
[單元簡介]、[會議主題]、[世界水會議]

世界會議室

更新日期：2002/12/20
參與討論人次：4895人
主題會議室：161個

會議主題	新增日期
1. 河川生態工法	2002/10/4
2. 海水淡化—未來供水新選擇	2002/9/27
3. 公共衛生廢水處理	2002/9/19
4. 氣候變遷下安全的流域開發	2002/8/26
5. 都市鄉村之用水與公共衛生	2002/8/7
6. 國際洪水組織	2002/7/22
7. 巴基斯坦的水質	2002/6/14
8. 國際非利益團體組織共同聲援保護湖泊	2002/6/10
9. 重視民生安全-水資源、環境衛生與保健	2002/6/7
10. 水的資訊與挑戰	2002/5/31
11. 人們對於水資源及衛生環境的價值觀	2002/5/31
12. 化衝突為聯合-邁向和平共享水資源	2002/5/31
13. 世界水資源行動方案	

(五)會議即時報導-專題會議



專題討論會議

經濟部水利署為積極擴增國際資訊交流，本次世界水資源論壇會議期間，特於大會籌設之專題會議單元中申請獲准召開「都市防洪」及「地層下陷防治」等二單元之專題討論會議，期藉由此項會議邀請世界各國水資源專家共同研討，以促進治水管理之經驗交流。茲將專題會議議程規劃說明如下：

a.「都市防洪」(Flood Mitigation in Urban Areas)

(a)舉辦日期：2003年3月18日

(b)舉辦地點：日本京都國際會議館ROOM K

(c)會議召集人：經濟部水利署 黃署長金山

(d)議程規劃如下表：

時間規劃	議題	報告人
14:30~15:00	大台北都市防洪策略	黃金山（經濟部水利署署長）
15:00~15:25	都市防洪決策支援系統	李天浩（台灣大學土木系教授）
15:25~15:50	基隆河整治經驗	李鴻源（台灣大學土木系教授）

b.「地層下陷防治」(Groundwater and Related Land Disasters)

(a)舉辦日期：2003年3月19日

(b)舉辦地點：日本大阪國際會議中心 R1102

(c)會議召集人：經濟部水利署 黃署長金山

附件二

「台灣地區水之聲」

一、水之聲訊息收集

為積極推廣國內「水之聲」與「虛擬水會議」收集國內意見及經驗，製作活動海報，寄送國內相關單位張貼，期獲取台灣水之聲訊息。

附件 2-1

說出你的水之聲吧！

我們也期待您成為水之聲的信差

如果您不介意將您的姓名或 E-MAIL 留在我們的網站上，您可留下您的資料

姓名：_____ E-MAIL：_____

關於您：

☐兒童 ☐成年人 ☐老年人

☐男性 ☐女性

關於您的工作：

☐農 ☐林 ☐漁 ☐非政府組織/團體

☐政 ☐研究人員/教師 ☐私人公司

☐公務人員 ☐家庭工作者 ☐學生 ☐其他

您所在的地區：_____

問題描述的建議：

1. 居住環境中所遇到的水問題
2. 周遭水環境所衍生的正負面問題
3. 您對問題改善的期待與建議
4. 每一則訊息字數約 300 字左右即可

郵寄地址：台北郵政 1-616 號信箱

網址：www.water.tku.edu.tw/wwf3

二、提報「水之聲」訊息：

本屆大會特設立「水之聲」計畫，旨在搜集世界各地民眾對於水資源的看法及意見。這個計畫主要目標是建立一個資料庫並搜集世界各地人民的意見及建議。其將會是一個很有用的工具，提供第三次世界水資源會議中各種活動的基本訊息。特彙整 WWF3 中文網站所蒐集之水之聲資訊及其他近期台灣相關水資源報導，共摘錄二十則主題並翻譯為英文提報大會「水之聲」網站，提供世界各國作經驗交流。

序號	**Title (水之聲標題)**	Title (水之聲標題)
1	水世界在林邊!!!	Lin-bian Water World!!!
2	與水爭地的後果!	Water Raging for Loss of its Land!!!
3	防洪與親水設施	Flood Prevention and Water Recreation Facilities
4	建立全島災害聯防網，提昇生活品質	Establishing an Island-wide Disaster Prevention Network for a Safety
5	都市防洪策略	Urban Flood Mitigation Strategy
6	洪災保險	Flood Insurance
7	規劃致洪區 建立耐災都市	Flood Retention Areas and Flood Resistant Cities
8	納莉颱風影響台北房價	Typhoon Nari Contributes to Estate Price Fluctuations in Ta
9	淨水器的必要	Necessity of Water Purifier
10	自來水水質	Water Quality
11	地下水資源合理利用	Reasonable Use of Groundwater Recourses
12	如何面對地下水超抽問題？	How to Attack the Problem of Excessive Pumping of Groundwater?
13	加強遏止地下水超抽，減輕地層下陷與提升地下水補注效果	Excessive Pumping Crackdown to Alleviate Subsidence and Enhance Groundwater Recharge Results
14	抽取地下水 應收「水權費」	Charging Water Right Fees for Groundwater Pumping
15	防治地層下陷人人有責	Ground Subsidence Prevention Is Everyone's Job

序號	Title (水之聲標題)	
16	水權制度	Water Rights System
17	制定合理水價	Toward Reasonable Water Pricing System
18	開闢多元化水源	Diversifying Water Sources
19	釜底抽薪 解決缺水之夢魘	Solving Water Shortage
20	台灣是缺水地區	Taiwan – Facing Water Scarcity

各則水之聲之中文及英文翻譯內容如下：

序號：**1**

Keywords: Floods

Messenger Name	Jin Jiang Lin
"Water Voice" collection date	October 10, 2002
Country / Region / Area	Taiwan / Pingtong
Voice Sender's Age	Adult
Voice Sender's Gender	Male
Voice Sender's Occupation	Public officer

Title：水世界在林邊!

林邊鄉三面臨水,平常即有三分之一的土地低於海平面.每逢農曆初一及十五前後那些天,淹水面積更為擴張,嚴重影響民眾生活起居.且境內擁有乙座自來水水源地;但在淹水的陰影下,使林邊人對水域產生恐懼感;因此連帶影響了對臨近水域的親和感.

近來在一些社區營造人士的帶動下,親水活動及相關設施對居民產生無形的影響;民眾在不知不覺中亦會投入相關活動及環境改造工作,這是大家始料所未及的!希望能多一些人來認識林邊!了解林邊!共同營造一優質的林邊水世界

Lin-bian, an area surrounded by water on three sides with one-third of its land normally below sea level, is under constant threat of floods with the most severe ones happening during the period from a few days before till after the first and the fifteenth day of each lunar month, causing great inconveniences, even damages to the lives of local residents and the tap water source in this area. Living in the shadow of floods has heightened the fear of water bodies among locals and distorted their relationship with natural waters.

Thanks to recent efforts of community reconstruction advocates, Lin-bian residents are now starting to participate in water activities and relevant environmental re-engineering projects in their hometown. The success of these projects is far beyond expectation! It is hoped that more people will visit the place, learn about it, and join the effort to create a beautiful, high-quality water world of Lin-bian.

序號：**2**

Keywords: Urbanization

Messenger Name	Jin Jiang Lin
"Water Voice" collection date	Jun 25, 2002
Country / Region / Area	Taiwan / Taipei
Voice Sender's Age	Adult
Voice Sender's Gender	Male
Voice Sender's Occupation	Student

Title：與水爭地的後果!!!

淹水 對於老一代的人來說 是很難得發生的；隨著時代的變遷，都市的發展造成空地使用的需求增加，因此將建築物建造在河川的行水區上，如今，可見河川附近矗立起一棟棟的建物。然而，一場大雨過後，民眾則要紛紛收拾著淹水退去後留下的淤泥。這原本屬於水流通的路，被人們佔用了。遇到了大雨來襲，增加的流量無法經由原先的水路向下宣洩時，自然就會四處漫流，造成淹水了。其實，人為的開發雖然帶來了許多便利，但前提是必須要尊重大自然，考慮到自然的法則，才能跟大環境和平的相處。

Flood was a rare event for older generations. As the times change and the demand for land rises due to urbanization, many buildings are now invading river waterways. Today, riverside buildings are commonplace, and the residents of these buildings are getting used to the routines of cleaning up the mud and dirt left behind by the floodwater after every heavy rain. The original watercourses are now occupied. During torrential rains, the quickly increasing rainfall has nowhere else to go but to run off the course and flood into local residences. It is true that economic development has brought us many conveniences, but it should never have been done at the expense of nature. It is only when we learn to respect the laws of nature will we be able to live peacefully together with the natural environment.

序號：**3**

Keywords: Floods

Messenger Name	Jin Jiang Lin
"Water Voice" collection date	May 28, 2002
Country / Region / Area	Taiwan /Taipei
Voice Sender's Age	Adult
Voice Sender's Gender	Male
Voice Sender's Occupation	Public Officer

Title： 防洪與親水設施

綠堤防，在日本又稱為「高規格堤防」或「超級堤防」（super dike），係指將整個堤內土地拉高至堤頂，使施設的堤防在遭遇超過計畫洪水位時，雖遭受洪水溢流而不致於潰決的堤防。其兼顧都市開發及災害避難所的設置，為可達到防洪、防災、都市景觀及配合都市計畫的河堤構造物。綠堤防其堤後緩坡之土地，稱為「超級堤防特別區域」，可供一般都市計畫使用，除可興建公寓大廈、辦公大樓及工廠設置地點外，亦可將水岸生活空間綠美化，提供民眾休閒遊憩與觀賞之用。

台灣河川的水文特性、地質狀況、河川周遭環境與河堤的需求情形均與日本極為相似，而台灣地區臨河岸地區的地形，多數經沖積形成往河域方向傾斜，傳統興建的堤防，往往將濱岸土地圍成一盆地，洪水雖不易氾濫，但市區積水卻不易排出，為解決排水不良及積水成災的弊病，參酌日本結合防洪、景觀與建築的綠堤防成功之案例，將來可考慮引進綠堤防。

Green dike is also called the "high-standard dike" or "super dike" in Japan, referring to the dike form in which the entire dike area is lifted to the dike top level, so that in the event that floodwater goes beyond the planned flood level the water will only overflow but the dike will not burst. The dike also encompasses the needs of urban development and the construction of disaster shelters, making it a multi-functional dike structure that not only alleviates floods and disasters, but also enhances urban landscape and coordinates urban planning. The gentle back slope of these green dikes is called the "super dike special zone" and can be used for general urban planning including the construction of residential/office buildings and manufacturing plants or for waterfront landscaping for recreational or viewing purposes, which will increase the living spaces of local residents.

There is great similarity in hydrological features, geological conditions, river surroundings, and dike requirements between the rivers of Taiwan and those of Japan. Also, most of the river coasts in Taiwan are slanting

towards the valley due to alleviation. With conventional dikes, which tend to enclose riverside areas and turn them into basins where floodwaters can be effectively contained but on the flip side the extra water in the city will not be easily drained. To improve flood drainage and prevent flood damages, the Japanese super dike projects that successfully integrate flood control, landscaping, and architecture concepts may be the best examples that we can learn after.

序號：**4**

Keywords: Floods

Messenger Name	Jin Jiang Lin
"Water Voice" collection date	March 21, 2002
Country / Region / Area	Taiwan / Taipei
Voice Sender's Age	Adult
Voice Sender's Gender	Male
Voice Sender's Occupation	Public officer

Title：建立全島災害聯防網，提昇生活品質

洪澇災害防治是預警、搶（防）救及事後處理3項程序所顯合而成的連續發生事件。各項程序間倘能做到「0時差」的要求，災害損失就可以降低至最小程度。其中特別是預警工作—「多一分預前準備，少一分災後損失」。應建構完整的基本資料蒐集體系，透過通訊及資訊網，以最快的時間提供預警發布。單單僅藉由政府的力量，欲建立完善的、機動性強的防災體系，仍屬不足。唯有透過學校、民間業者（保全、通訊、資訊、新聞媒體）、及社區成立守望相助組織，並藉助尖端資訊及通訊科技，透過國家資訊基礎建設(NII)，佈建全島災害預警聯防網，形成「4合1」的力量，方為可成。

Flood and waterlog mitigation consists of three continuous stages of pre-warning, rescue, and post-event treatment, and when relevant tasks at each stage are performed at "zero time lag", the damages can be reduced to minimum. This is particularly true with the pre-warning stage since "with each additional preparation effort made, the damage of the disaster is reduced a little." Therefore, it is necessary to establish a comprehensive basic data collection mechanism and to issue pre-warnings as early as possible through communications and information networks. Government's effort alone is not enough to guarantee a disaster prevention system that is sound and of high mobility. The involvement of schools, private sectors (security, communications, information, press and media), and mutual-help organizations at local communities, the use of leading-edge information and communications technologies, and the construction of the National Information Infrastructure (NII) are all necessary ingredients of a powerful disaster pre-warning and prevention network.

序號：**5**

Keywords: Floods

Messenger Name	Jin Jiang Lin
"Water Voice" collection date	May 2, 2002
Country / Region / Area	Taiwan / Taipei
Voice Sender's Age	Adult
Voice Sender's Gender	Male
Voice Sender's Occupation	Researcher

Title : 都市防洪策略

在都市地區，與水爭地的情況甚為嚴重，因此都市外圍必須築起混凝土防洪牆，而且都市雨水下水道也得依賴抽水站才能排往河川。都市的雨水下水道及抽水站等排水設施，因為雨水下水道容易淤積、沉陷，使功能喪失，導致淹水。另外，抽水站若操作不當或維修不妥，也會導致水量積湧，無法即時宣洩，而造成都市積水。

過去的都市防洪觀念，都希望把自家的雨水盡速往鄰地排出，因此所有住家大樓都把自家基地墊高，或者設置緊急馬達以排除積水，造成都市公共排水設施莫大的負擔。每到大雨，永遠有低窪人家匯集眾人之雨水而淹水。事實上，這種不考慮土地保水、滲透、貯留的排水觀念，是一種很不生態的都市防洪計畫。現在歐美最新的生態防洪對策，常規定建築及社區基地必須保有滲透、貯留雨水的能力，以吸收部分洪水量，而達到軟性防洪的目的。

Excessive exploitation on the waterfront in urban areas is becoming an issue of great concern. Many cities are surrounded by concrete walls to prevent flood damages and rely totally on pump stations to help divert water from the rainfall drains into river channels. However, urban rainfall drains and pump stations are highly susceptible to heavy rains because these gutters can easily silt up or subside during rains and pump stations if wrongly operated or poorly maintained will cause the water level to rise too quickly in rain. Either situation can easily turn into a flood.

The old urban flood prevention concept is to allow the water in the premise of one's home to drain into adjacent areas. As a result, people would raise the foundation of their house or install an emergency motor to drain the floodwater out of their homes. This however could greatly increase the burden of public drainage facilities in urban cities. Hence, when there is a rain, there is a flooded lowland housing. Such a drainage concept that disregards the roles of soil in water conservation, diffusion, and storage is not ecological friendly at all. The most recent flood prevention strategy in

the U.S. and Europe is to require the foundations of buildings and residential communities to perform the function of rainwater infiltration into ground and storage in order to absorb certain amount of floodwater as an alternative measure for flood control.

序號：**6**

Keywords: Floods

Messenger Name	Jin Jiang Lin
"Water Voice" collection date	January 24, 2002
Country / Region / Area	Taiwan / Taipei
Voice Sender's Age	Adult
Voice Sender's Gender	Female
Voice Sender's Occupation	Researcher

Title ： 洪災保險

台灣地區發展的歷程當中，曾經歷大小不同的環境災害，造成生命、財產上的巨額損失，而國內災害管理系統尚未建構完全，建築法令又缺乏災害防治相關規範，因此災害的防治、補償、與救助，政府皆扮演重要的角色。但基於風險分攤、資源分配效率與公平而言，政府不應承擔所有環境災害的損失，而可透過公私合作的災害保險制度，解決政府的財政壓力，並穩定社會經濟生活，達到災害損失降低的目的。

Throughout the course of development, Taiwan has undergone many natural disasters and suffered huge losses in human lives and properties as a result. However, since the domestic disaster management system is yet to mature, with the Construction Code lacking relevant regulations on disaster prevention, the Government has always played a major role in the disaster control, compensation, and rescue. From the standpoint of risk sharing and resource allocation efficiency, and in term of fairness, the Government should not bear the burden of all the losses from natural disasters. Therefore, some form of public-private cooperation is desirable for the establishment of a disaster insurance system to help release the Government of some financial pressure, and to enhance social and economic stability and reduce damages and losses from natural disasters.

序號：7

Keywords: Floods

Messenger Name	Jin Jiang Lin
"Water Voice" collection date	September 20, 2001
Country / Region / Area	Taiwan / Taipei
Voice Sender's Age	Adult
Voice Sender's Gender	Male
Voice Sender's Occupation	Professor

Title：規劃致洪區 建立耐災都市

大台北都會區遭遇到多數居民生平僅見的水災，光是築堤防堵不足以防災，政府與民眾除應有非工程的防災觀念外，更須建立耐災城市的都市發展思維。例如，民眾應有洪災保險的觀念，透過保險分散自己的風險，政府則應強化土地分區利用，減低高危險地區的使用。都市規畫應有防災思考，考慮到都市水災發生的可能性，規畫每一段的滯洪區，以分流、滯洪，分散危機的方式，將洪峰分散在河川的中下游各段，減少洪水的逕流量，就能減輕都市型水災的發生。另一方面，應從國土規畫的根源做起，將脆弱、敏感地區分隔開來，列為限制開發區，避免人與水爭，水侵犯人的機率就會減低。

The Taipei metropolitan area just suffered a flood that for many of its residents was the worst they had ever seen in their entire life. Building dikes is no longer sufficient for prevention of future floods. Hence, the Government and the public should both develop the concepts of non-structural flood control and flood resistant city development. For example, the people should understand how to use insurance policies to divert flood risks, while the Government should strengthen zoned land use to reduce the use of high-risk lands. In urban planning, flood prevention concepts and measures should be incorporated, which should include planning for flood retention areas for each land section taking into account its probability of flood occurrence, and using diversion and retention methods to allow flood peaks to spread over various midstream and downstream sections to reduce the amount of stream flow and minimize the occurrences of urban floods. Also, to tackle flood problem at its root, the National Land Plan should designate venerable, sensitive lands as development restriction area to avoid excessive exploitation and to reduce the likelihood of water disasters.

序號：**8**

"Water Voice"

Keywords: Floods

Messenger Name	Jin Jiang Lin
"Water Voice" collection date	October 8, 2001
Country / Region / Area	Taiwan / Taipei
Voice Sender's Age	Adult
Voice Sender's Gender	Male
Voice Sender's Occupation	Other

Title ： 納莉颱風影響台北房價

淹水問題為這次納莉颱風給大台北地區帶來的最大傷害，它也正是影響大台北房價波動的主要因素。以往建商推銷的景觀住宅，強調臨河風景視野佳，然而，它的價格都會受到這次臨河地區災情嚴重而下滑。尤其原本強調可以看到河岸風景的第一排住宅，也都會大受影響。因此，現在已經有些建商將訴求由原先的景觀轉為防水防洪措施，因此在這段時間會加強建築物的機電設備、防洪措施。

Flood problem is the biggest damage Typhoon Nari has created to the Taipei Metropolis in its wake, and is also the main contributor to the price fluctuations of Taipei housing. Many of the riverside estates overlooking the river landscape that developers had been actively promoting saw the biggest drop in prices, especially the first row of the houses with a panoramic river view. Therefore, many developers are now shifting their focus of promotion from previous river views to flood prevention measures. It is expected that at least for the time being real estate developers will continue to strengthen the electrical and mechanical equipment as well as flood control measures of various buildings.

序號：**9**

"Water Voice"

Keywords: Sanitation

Messenger Name	Jin Jiang Lin
"Water Voice" collection date	Jun 12, 2002
Country / Region / Area	Taiwan / Taipei
Voice Sender's Age	Adult
Voice Sender's Gender	Male
Voice Sender's Occupation	Other

Title：淨水器的必要

今年台灣面臨數十年來少見的大旱，河川多呈現乾涸現象，水庫供水不足，中央政府為此成立抗旱小組應變。從水資源的管理來看，天氣的變化無常對水資源管理構成極大的困難；而從水質的角度來看，更是有不良的後果。在正常的降雨情形下，河川的水質不會產生特別的變化。但洪水或乾旱的發生，水質便會受到相當程度之影響。在限水的時期，因自來水的水壓降低、分區分時的間歇供水，對水管的衛生造成不良影響，水質會呈現較混濁的現象。此時淨水器成為大眾最佳水質的保障，是民眾抗旱的良方。

Taiwan suffered its worst drought in decades this year (2002), with many rivers drying up and serious reservoir storage insufficiency. The Central Government even established a Drought Control Taskforce in response. Drastic climate changes are not only a serious threat to the management of water resources but also bear negative effects on the quality of water. With normal precipitation, the water quality in rivers can stay rather consistent. Floods and droughts however can exert significant impact on water quality. For instance, water rationing during drought seasons can cause tap water pressure to drop and the intermittent water supply rationed by region and by time slot can adversely affect water hygiene in the pipeline, raising turbidity levels in water. Hence, water purifier is necessary to ensure the best water quality and help guard against droughts.

序號：**10**

"Water Voice"

Keywords: Sanitation

Messenger Name	Jin Jiang Lin
"Water Voice" collection date	Jun 7, 2002
Country / Region / Area	Taiwan / Kaoshiung
Voice Sender's Age	Adult
Voice Sender's Gender	Male
Voice Sender's Occupation	Researcher

Title：自來水水質

台灣南部地區的自來水水質一直為民眾所擔憂，水質問題，不外乎水源，水處理以及輸送儲水設備所影響，政府目前積極改善水源水質，並加強水處理過程之改善，然而在用戶端之水管及水塔改善卻鞭長莫及，容易功虧一簣，因此吾人建議，加強補助用戶端之淨水設施，自來水廠只要維持目前效能與水質即可，其他水質改善經費應投入用戶端之設備，以收立即之功效。

Tap water quality has always been a matter of great concern among people in Southern Taiwan. Water quality depends on a variety of factors, most notably water source, treatment measures, and transmission/storage facilities. The Government is actively working to improve water source quality and treatment procedure. However, water pipelines and water towers at user end are often not to be easily controlled by the Government because of their high complexity, yet they constitute a major factor to the result of water quality improvement. Therefore, some sort of subsidies for user-end purification equipment is desirable. In other words, water supply corporations will only need to maintain its current operation performance and water quality, while the extra water improvement funding should be used for user-end equipment installation in order to achieve immediate results.

序號：**11**

"Water Voice"

Keywords: Groundwater

Messenger Name	Jin Jiang Lin
"Water Voice" collection date	Jun 10, 2002
Country / Region / Area	Taiwan / Taipei
Voice Sender's Age	Adult
Voice Sender's Gender	Male
Voice Sender's Occupation	Other

Title ： 地下水資源合理利用

地層下陷與地下水之間有著絕對的關係，地下水資源合理使用，是防治地層下陷的根本之道。台灣水資源的調配，應以引用河川水為主，並將豐水期多餘的水儲存至枯水期使用，即以水庫或是地下水的方式儲存，到枯水期時先運用水庫的水，再搭配地下水，這種地表水與地下水聯合運用的模式是台灣應行的水資源運用方式。

Land subsidence problems are tied to groundwater. In other words, reasonable use of groundwater is the fundamental way to prevent ground from further subsiding. Water resources in Taiwan should be mainly drawn from river waters, and the extra water from the wet season should be stored either in reservoirs or in the form of groundwater for use in dry season. During dry season, water should first be drawn from reservoirs and then from groundwater supplies. Such conjunction use of surface water and groundwater is the most ideal mode of water use in Taiwan.

序號：**12**

"Water Voice"

Keywords: Groundwater

Messenger Name	Jin Jiang Lin
"Water Voice" collection date	August 23, 2002
Country / Region / Area	Taiwan / Yunlin
Voice Sender's Age	Adult
Voice Sender's Gender	Male
Voice Sender's Occupation	Researcher

Title ： 如何面對地下水超抽問題？

與其靠經驗或運氣來決定抽取地下水是否超量，當然不如有完善的地下水文資料。若是能建立一地區地下水的「安全出水量」，並據以擬定管制措施，則地下水的抽取可以是很安全的。當然，這就得靠長期的相關監測及研究資料才能建立起來，在這一方面，我們還有許多可改善的空間。地下水文資料一旦建立，接下來就是管制措施。一口井該鑿多深？最大出水量該限制在多少？井與井之間的距離該有多遠？不同季節的出水量該如何調度？需不需要設立停抽季？諸如此類的標準都有必要加以明定。

Depending on experience or luck to decide whether groundwater is being pumped excessively is definitely not as reliable as if we have complete hydrological data on groundwater. If we can establish a safe amount of groundwater extraction for each region and develop corresponding regulation measures, pumping groundwater can still be a safe activity. However, this will rely on long-term monitoring and survey to gather all the relevant data. After establishing the hydrological databank, we will need to formulate relevant regulations to specify the appropriate well depth, extraction amount limit, well-to-well distance, seasonal extraction amount adjustment measures, whether to declare pumping suspension period, etc.

序號：**13**

"Water Voice"

Keywords: Groundwater

Messenger Name	Jin Jiang Lin
"Water Voice" collection date	February 28, 2002
Country / Region / Area	Taiwan / Taipei
Voice Sender's Age	Adult
Voice Sender's Gender	Male
Voice Sender's Occupation	Researcher

Title：加強遏止地下水超抽，減輕地層下陷與提升地下水補注效果

濁水溪沖積扇蘊藏之地下水資源，其含水層可自地表到地下二〇〇公尺。本區抽用之地下水除自來水公司之地下水井有抽用記錄外，尚有水利會之水井與非法水井所抽用地下水量未進行記錄與管制，建議應針對區內地下水井進行普查，並加裝管制計量器，但是對於天然補注量較大之地區(如扇頂區)之實際補注效用與範圍應加確認，並規劃(限制)最大抽取量，善加利用可資使用之地下水最大量。而對於已經發生下陷地區，應嚴格管制地下水之抽用，並於地下水豐沛地區設置潛堰，作為地下水庫以供緊急備水及地下水補注用。

The alluvial fan of the Choshui River contains an aquifer that stretches from ground surface to 200m below ground. Except the groundwater wells of water supply corporations that have extraction records, water wells of irrigation association and illegal wells do not have any records on water pumping. Hence, it is important to conduct a general census on well number in the region and to install monitoring meters. For regions that receive relatively large amount of natural recharging water (e.g. the fan top), the recharge effectiveness and scope should be verified and a maximal extraction amount should be specified for control in order to make the utmost use of the maximal available groundwater resources. For currently subsiding regions, groundwater pumping should be strictly controlled. For regions with abundant groundwater supply, immerse weirs should be constructed as underground reservoirs for emergency water use and groundwater recharge.

序號：**14**

"Water Voice"

Keywords: Groundwater

Messenger Name	Jin Jiang Lin
"Water Voice" collection date	May 17, 2002
Country / Region / Area	Taiwan / Taipei
Voice Sender's Age	Adult
Voice Sender's Gender	Male
Voice Sender's Occupation	Other

Title：抽取地下水 應收「水權費」

地下水因為開發容易，取用方便，且供水品質策穩定，處理費用低廉，因此常被大量的抽取開發引用。但過度開發的結果，易導致地層下陷，而使得排水不良、海水倒灌、海水入侵、地下水鹽化等問題相繼出現，危害居住及農、漁業環境。

台灣南部地區易發生季節性乾旱加上地下水超抽嚴重，據估計，抽取地下水高達七億立方公尺，超抽情況嚴重，將來水可能比石油更珍貴。地下水超抽結果造成水源日漸枯竭，大家一定要好好珍惜水源。現今，抽取地下水並未收取水權費，建議未來應該依申請口徑、抽取量，支付一定的水權費，依據使用者付費精神，較合理也讓使用者較懂得珍惜水資源。

Due to easy exploitation and access, as well as stable quality and low treatment cost, large qualities of groundwater are being extracted for water supply, which however can easily lead to ground subsidence, causing drainage problems, sea inundation and invasion, and groundwater salination and threatening the living as well as farming and fishing environment.

The southern part of Taiwan is highly susceptible to seasonal droughts. The excessive groundwater pumping further worsens the situation. According to statistics, the amount of groundwater extracted has reached as much as 700 million m3. If the trend continues, water might become a more scarce resource than petroleum some day. To prevent excessive groundwater pumping from depleting precious water sources, we need to do more to conserve and preserve all existing water sources. One way to achieve the goal is to charge water right fees according to caliber of pipe and extraction amount of water. The principle of "User pays" is not only more economically plausible, but will make users more aware of the need to conserve water resources.

序號：**15**

"Water Voice"

Keywords: Groundwater

Messenger Name	Jin Jiang Lin
"Water Voice" collection date	December 25, 2001
Country / Region / Area	Taiwan / Changhua
Voice Sender's Age	Child
Voice Sender's Gender	Female
Voice Sender's Occupation	Student

Title：防治地層下陷人人有責

我的家鄉位於沿海地區，屬於地層嚴重下陷現象的縣市，更緊臨嚴重地層下陷的彰化縣大城鄉。雖然種了很多花、樹木，當豪雨過後就會看見花圃又凹陷了一處，再不然就是樹根露出地面，因為土壤不見了。曾聽說有些地區因地層下陷使得二樓變一樓，而鄰近的大城鄉西港村也因養殖文蛤、漁類而超抽地下水造成地層下陷以致海水倒灌釀成災情，聽起來不禁令人擔心！

首先我們要配合政府地下水管制政策不再過度開發，不過份抽取地下水、多種些樹木、善用水土資源等來防治。做學生的要向家人、鄰居告知地層下陷的可怕性以及鼓勵他們攜手做防治工作。要改變觀念千萬別為了眼前的利益與方便，而造成後代子孫的無窮的傷害與不安，愛護大自然才能有美好的未來。

My hometown is located in the coastal region of Taiwan. It suffers from severe ground subsidence and adjoins Tacheng, Changhua County, which is also seriously subsiding town. Despite all the flowers and trees we have planted in our home vicinity, ever time when there are a torrential rain, some part of our flower nursery would sink into the ground or the tree roots would become exposed because of the loss of soil. We heard about that some buildings are already one-floor sunk into the ground due to subsidence and that the Hsigang village of our neighboring Tacheng town had experienced some serious sea inundations due to subsidence because the villagers had been excessively pumping groundwater for their fishery farms. All these stories have kept our town residents very worried.

To prevent us from further worrying and suffering, we need to comply

with government groundwater control policies and regulations and to stop excessive exploitation of groundwater, to plant more trees, and to make more sensible use of water and soil. Students can help by telling their family and neighbors about the serious consequences of ground subsidence and by encouraging them to help with relevant prevention and control efforts. We all have to start thinking in longer term instead of acting for immediate benefit and convenience because if we don't, our offspring will have to live with the terrible consequences. To love and care for the nature is the only way we can ensure a beautiful and bright future for many generations to come.

序號：**16**

Keywords: Water Polices

Messenger Name	
"Water Voice" collection date	December 31, 2001
Country / Region / Area	Taiwan / Taipei
Voice Sender's Age	Adult
Voice Sender's Gender	Male
Voice Sender's Occupation	Professor

Title ： 水權制度

目前台灣的水權擁有者並不能自由處置其所取得之水權，因此類似搭排費、渠道借用費等名目，取代了交易價格之事實，可見水權擁有者之主權不完善，使得水資源之交易成本偏高，無法使水資源達到更有效率及公平之應用。所以，如何重新定義水權，以滿足經濟社會之需求，有必要深入探討，建立一使社會大眾有共同認知與肯定的水權制度。

At present, the owners of water rights are not allowed to trade their rights freely. Hence, open trading prices are not available; instead, water rights owners charge construction fees, channel use fees and the like as a way to trade their rights. This shows that the water rights owners do not enjoy complete autonomy, which has resulted in unreasonable high transaction cost for water trading affairs, and has compromised the efficiency and fairness in water use. Therefore, it is important that water rights should be redefined and a widely recognized and accepted water rights system be established in order to meet both social and economic demands.

序號：**17**

"Water Voice"

Keywords: Water Polices

Messenger Name	
"Water Voice" collection date	May 22, 2002
Country / Region / Area	Taiwan / Taipei
Voice Sender's Age	Adult
Voice Sender's Gender	Male
Voice Sender's Occupation	Professor

Title ： 制定合理水價

水價合理的調昇為水資源永續經營的當務之急，目前台灣自來水價格僅能勉強支付日常管理及維護成本，遑論反映水源開發、保育、淨水過程、供水管線等其他成本，且統一水價亦無考量豐枯水季、用水量大小的公平性問題。水資源的使用應由使用者付費，民生與工業供水系統亦須分開，以利區隔成本，並建立合理的水價機制。

Reasonably increasing water prices is a pressing need for the sustainability of water resources. The current tap water price in Taiwan can barely cover the overheads and maintenance cost of the water supply corporation, not to mention water source development, conservation, purification, pipeline, and other costs. Also, current uniform pricing regardless of seasonal changes in water supply and the differences in water use amount is not necessarily a fair pricing system. The cost of water use should be borne by the user, and the household and industrial water should have separate supply systems so that a deferential pricing policy can be employed and a more reasonable water pricing mechanism can be established.

序號：**18**

"Water Voice"

Keywords: Drought

Messenger Name	
"Water Voice" collection date	May 22, 2002
Country / Region / Area	Taiwan / Taipei
Voice Sender's Age	Adult
Voice Sender's Gender	Male
Voice Sender's Occupation	Public officer

Title ： 開闢多元化水源

台灣愈趨嚴重的循環性乾旱及其所凸顯的水資源不足，解決水荒需多管齊下，並在合理考量開發成本下實施，包括重新探討水庫規劃缺水忍耐之標準，調整台灣農業經營用水，同時評估水庫興建與海水淡化之發展，適度增闢水源，提高供水的安全度。

The deteriorating cyclical droughts in Taiwan highlight the seriousness of the water shortage problem on the island. To solve this problem, multiple measures have to be adopted simultaneously and the development cost has to be taken into consideration whenever feasible. In other words, we need to review current water shortage tolerance levels in reservoir planning, adjust water use measures for agricultural operations, evaluate the feasibility of reservoir construction and seawater desalination projects, and develop new water sources appropriately in order to increase water supply safety.

序號：**19**

"Water Voice"

Keywords: Drought

Messenger Name	
"Water Voice" collection date	September 27, 2002
Country / Region / Area	Taiwan / Taipei
Voice Sender's Age	Adult
Voice Sender's Gender	Male
Voice Sender's Occupation	Professor

Title ： 釜底抽薪 解決缺水之夢魘

今年台灣北部地區之水荒，造成經濟與社會的衝擊，但目前所看到的各種措施，包括農地停耕、區域調水及減壓供水等皆只是應急。
台灣地區未來水庫的開發因對環境的影響大及成本高，不易獲得認同，故新水源再開發已極有限。既然新水源開發不易，海水淡化成本又高；因此，如何能創造低成本的水資源以應需求，英考量從節約用水及回收再利用、合理水價、開發第二水資源、移用農業用水供民生或工業利用等四大策略。

The drought occurred in Northern Taiwan this year had a great impact on both the economy and the society. However, many measures taken in response including farmland fallow, transferring water from other region , and supplying water at lower pressure are only good as temporary resort.
Since new reservoir projects will not likely to be approved because of their relatively large environmental impact and high cost, water resources left for further development are extremely limited. In addition to difficulty in developing new water sources, seawater desalination cost is very high. Therefore, in order to create low-cost water resources to meet water demand, we suggest the application of four concurrent strategies of water conservation, water recycling and reuse, reasonable water pricing policy, development of alternative water resources, and transfer of agricultural water for civil and industrial use.

序號：**20**

"Water Voice"

Keywords: Drought

Messenger Name	
"Water Voice" collection date	September 27, 2002
Country / Region / Area	Taiwan / Taipei
Voice Sender's Age	Adult
Voice Sender's Gender	Male
Voice Sender's Occupation	Other

Title ： 台灣是缺水地區

台灣每年的降雨量雖十分充沛，但由於地狹人稠、山坡陡峻，以及颱風豪雨雨勢急促，大部分的降雨皆迅速流入海洋。因此，每人每年實際可分配到的降雨量甚少，只及世界平均值的八分之一(33, 975 立方公尺/人/年)。此外，台灣的降雨量在地域、季節的分布極不平均，更容易造成地區性、季節性的乾旱。未來，由於經濟發展、人口成長、以及新水源（如建造水庫）的開發成本增加，缺水的問題將愈發嚴重。

Despite large amount of total annual precipitation in Taiwan, because the island has limited land with high density of population, and has steep hills and mountains with typhoons and torrential rains that always come and go rapidly, most of the rainfall ends up in the ocean. Hence, the actual precipitation per year per capita is only one-eighth of the world average (33,975 m3/capita/yr). In addition, the regional and seasonal distribution of rainfall in Taiwan is highly uneven, which can easily cause regional or seasonal drought. For future, as the economy develops, the population grows, and the cost for new water source (e.g. building reservoir) increases, the water shortage problem is expected to exacerbate.

附件三

水博覽會宣傳海報

Water and Cities

Community building taking into account symbiosis with the nature and water circulation
Industrial technologies involving water

Water and Lifestyle

Water and daily living
Water-related products and services that support comfortable and safe living

Water Plaza

Children's art
Water Art Contest
Fire engines and amphibious cars
Viva!! "Water & Vehicles"
Ship models meet together
The Wharf of Model Ship
Let's drink varied water!
Water Tasting Booth

Water Topics

Water issues at home and abroad, and measures to solve them

Let's think about···

Water, Lifestyle and the Future

The 3rd World Water Forum

WaterEXPO

Water, Cities, Industry and the Future — Water Creation and the Future —

March 18[Tue] ~ March 22[Sat], 2003

Intex Osaka

Nanko-Kita, Suminoe-ku, Osaka, Japan

10:00 ~ 17:00
(Please enter by 16:30.)

Organized by:Water EXPO Committee and Nihon Keizai Shimbun, Inc.

Supported by: Ministry of Foreign Affairs / Ministry of Education, Culture, Sports, Science and Technology / Ministry of Health, Labor and Welfare / Ministry of Agriculture, Forestry and Fisheries / Ministry of Economy, Trade and Industry / Ministry of Land, Infrastructure and Transport / Ministry of Environment / Shiga Prefecture / Kyoto Prefecture / Osaka Prefecture / Nara Prefecture / Wakayama Prefecture / Otsu City / Kyoto City / Osaka City / Kansai Council (in random order)

Cooperated by: Television Osaka, Inc.

Admission Free

Special Exhibition
Water Supply Fair

Daily living and water supply
— Living surrounded by safe and reliable water —

Water circulation and roles of water supply
Up-to-date technologies for water supply system that support urban functions

Organized by
The 6th Water Technology Symposium Committee

Special Exhibition
Sewage System Fair

Water circulation and roles of sewage system
Up-to-date technologies for sewage system that support urban functions

Organized by
Sewage System Fair Committee

[Inquiries]
Tel : 03-5777-8600
E-mail : info@water-expo.jp

http://www.water-expo.jp/

Exhibitions

Let's think about… Water, Lifestyle and the Future

The 3rd World Water Forum

Water EXPO

Water Topics

The corner introduces a wide range of water issues and solving measures.

Major exhibitors: International organizations, government and municipal offices, universities / institutes, NGOs / NPOs, etc.

Special Exhibition **Water Supply Fair**

Daily living and water supply

–Living surrounded by safe and reliable water–

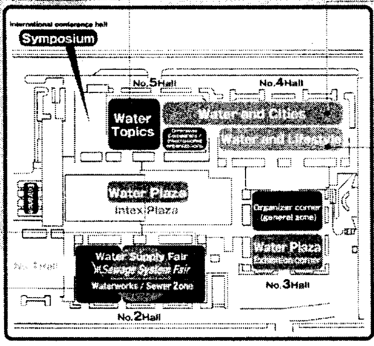
Organized by The 6th Water Technology Symposium Committee

The fair presents water circulation and roles of water supply, as well as up-to-date technologies for water supply that support urban functions.

Major exhibitors: Water supply and distribution systems, Water purification systems, Business management (Outsourcing and PFI) and others

Vendor forum

The special booth is provided for exhibitors to promote their products and businesses. They are expected to advertise their selected products. For details, visit the Web site.



Water and Cities

The corner introduces technologies and products for community building, which help realize water circulation systems needed for a city to live with the nature.

Major exhibitors: River improvement technology, Greening technology, Agricultural and forestry technology, Water treatment technology, Sludge processing technology, Industrial technologies using water, and Others

Water and Lifestyle

The corner introduces water-related products and technologies that support comfortable and safe living.

Major exhibitors: Products and services related to foods/drinks, household appliances, housing equipment, daily necessities, medicines and environments

Water Plaza

Visitors can enjoy various events and exhibitions, while thinking about relationships between water and daily living, daily necessities, medicines and environments

Special Exhibition *Sewage System Fair* Organized by Sewage System Fair Committee

The fair presents water circulation and roles of sewage system, as well as up-to-date technologies for sewage system that support urban functions.

Major exhibitors: Design and measurement, Construction, Ducting materials, Sewage processing, Maintenance management, Waste water facilities and others

Special Lectures and International Symposiums

[Venue] International Conference Hall, Intex Osaka

Tadao Ando

Programs (expected)

*Japanese-English simultaneous translation provided except for March 22

Ⓐ March 18 (Tue.) 13:30 - 16:00

Special lecture: "Building Cities of Water, Green and Flower"

by **Tadao Ando**, Architect

Ⓑ March 19 (Wed.) 13:30 - 16:00

Symposium: **"Effective Use of Water and New Infrastructure"**

Keynote lecture: Prof. Yoshio Tsukio Ph. D of the University of Tokyo

Panel discussion

Panelists: Yoshio Matsuda, Chairman of the Board, Foundation for Riverfront Improvement and Restoration

Naotake Okubo, President & Representative of Sekisui Chemical Co., Ltd.

Takeo Obayashi, Vice Chairman of Obayashi Corporation.

Hidenobu Jinnai, Professor of Hosei University

Coordinator: Yoshinori Morino, Chief Researcher of Japan Center for Economic Research

Ⓒ March 20 (Thu.) 13:30 - 16:00

Symposium: **"Business Opportunities Involving Water"**

Key lecture: Gérard Mohr, COO of Vivendi Water

Panel discussion

Panelists: Yoichiro Furuse, Representative Director of the Board Executive Vice President & CAO Administration & Finance, Corporate Strategy of Sanyo Electric Co., Ltd.

Shigeo Mizutani, CEO President of Japan Water Corporation

Yoshihiro Ogawa, President of P.T. Kurita Indonesia

Prof. Dr. Kenichi Nakagami, Professor of Ritsumeikan Asia Pacific University

Coordinator: Shuichi Saito, Senior Editor & Editor, Economic News Department, Editorial Bureau, Osaka Head Office, Nihon Keizai Shimbun, Inc.

Ⓓ March 21 (Fri., national holiday) 11:00 - 12:00

Lecture: **"Global Water Crisis and Human Future"**

by **Koichiro Matsuura**, Director-General of UNESCO

Ⓔ March 21 (Fri., national holiday) 13:30 - 16:30

Symposium: **"Water and Global Environmental Conservation, and Japan's Roles"**

Key lecture: Michiko Imai, Mountaineer and Doctor of Medical Science

Presentation: Dr. Kati Myllymäki, President of World Medical Association

Panel discussion

Panelists: Daijiro Hashimoto, Governor of Kochi Prefecture

Toshio Koike, Professor of the University of Tokyo

[illegible] Hainan, Professor of Shanghai Jiao Tong University

[illegible] Hatakeyama, Representative of the "Association Adoring the Woods of Oysters."

Coordinator: [illegible] Tochigi, senior staff writer, Economic commentary Department, [illegible] Nihon Keizai Shimbun, Inc.

Michiko Imai

Ⓕ March 22 (Sat.) 14:00 - 15:00

Lecture: "World [illegible] Sommelier [illegible] Water"

by Shinya Tasaki, Sommelier at the Hotel Seiyo Ginza

Shinya Tasaki

Application

[illegible] or fax the lectures or symposiums [illegible] occupation (place of work) to the [illegible] date: March 4 (Tue.) If more-than-[illegible] be mailed to attendance chosen by [illegible] basis. Admission order cards will [illegible] International Conference Hall on Intex Osaka [illegible]

[illegible] (Tel: 03-5281-1573, Fax: 03-5281-1561)

● [illegible] changed.

[illegible] subsicized by the Foundation of River & Watershed [illegible]

Water Plaza full of various events

Enjoy events and think about water.

Held everyday

Water Tasting Booth

Visitors can taste water from various places that changes from day to day.

The Wharf of Model Ship Ship models meet together

Water Art Contest: People's art

Viva!! "Water & Vehicles"

Fire engines and other cars meet together.

"Higashi-hi (wooden duct)" of "Sayamaike" (Sayama pond)

Let's look at an artifact of Japan's oldest reservoir unearthed in Osaka Prefecture.

Coelacanth Robot created by cutting-edge technologies

Liquid Sculpture Water interactive art

Held on specified days

Water Experiments Room Prior registration necessary **and Mini-Aquarium Workshop** Admission ticket necessary **(March 21 - 22)**

* To apply for Water Experiments, please send a return postcard with all applicants' names, addresses, telephone numbers, dates and time desired, school names and grades to the Steering Secretariat. Deadline date: Applications should be postmarked not later than March 10 (Mon.). Attendance will be chosen from applicants on a first-come-first-served basis. Steering Secretariat: Kyodo Building 4F, 3-9-2 Kanda-Ogawamachi, Chiyoda-ku, Tokyo 101-0052, Japan

Tour of Sail Training Ship "Akogare" for free (March 18 - 20)

Concert by Osaka Prefectural Police Headquarters' Band (March 18)

Drill Performance by Osaka Municipal Fire Department's Band (March 21)

Walking Competition (March 21) Prior registration necessary

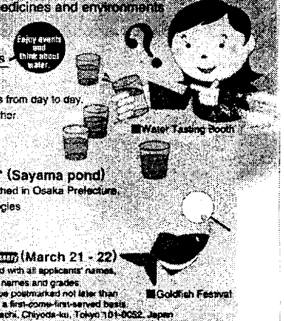
* For inquiry about Walking Competition, please call the Osaka Prefecture Walking Association (06-4396-6240) on Monday, Tuesday, Thursday and Friday between 10:00-17:00

Experience of Getting Aboard Amphibious Vehicles Admission ticket necessary **(March 21)**

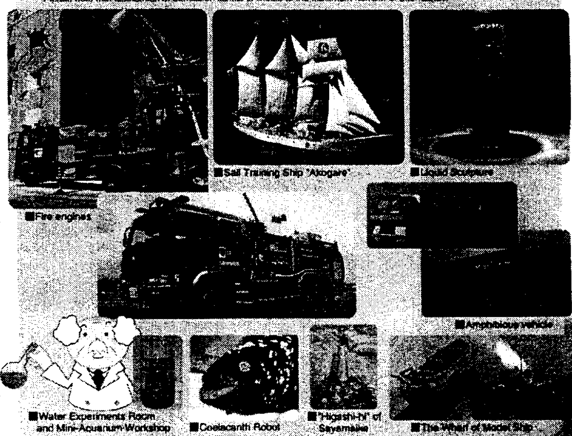
Visitors can enjoy more events and exhibition booths, including Water Commedy on Stage by Yoshimoto Kogyo's performers.

* For more information, please access the Web site or Phone Call, both shown below.

* Admission tickets will be available at the secretariat office of Intex Osaka No. 3 Hall from 10:00 am on the day of the event. Please note that distribution of admission tickets is limited to the maximum number of attendance.



■Water Tasting Booth ■Goldfish Festival



■Fire engines ■Sail Training Ship "Akogare" ■Liquid Sculpture ■Amphibious vehicle ■Water Experiments Room and Mini-Aquarium Workshop ■Coelacanth Robot ■"Higashi-hi" of Sayamaike ■The Wharf of Model Ship

Access to Venue

Intex Osaka

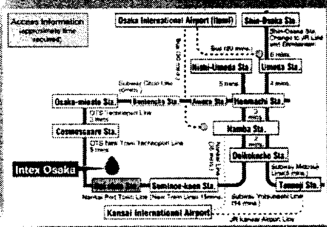
1-5-102 Nanko-kita, Suminoe-ku, Osaka

● From Subway Chuo Line
- At "Cosmosquare Sta." By "OTS Technoport Line", change to New Tram Line to "Nakafuto Sta.". 5 mins. by walk
- Take "OTS Technoport Line" to "Cosmosquare Sta." 10 mins. by walk

● From Subway Yotsubashi Line
- At "Suminoe-koen Sta." by Subway Yotsubashi Line, change to New Tram Line to "Nakafuto Sta." 5 mins by walk

● Limousine Bus

Direct connection between Kansai International Airport and Hyatt Regency Osaka (Fee 1,500 yen)

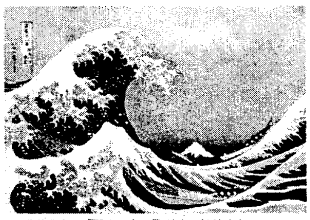


Inquiries

For the latest information: ………… **http://www.water-expo.jp**

Inquiries: ………………………… Call at 03-5777-8600 [illegible]

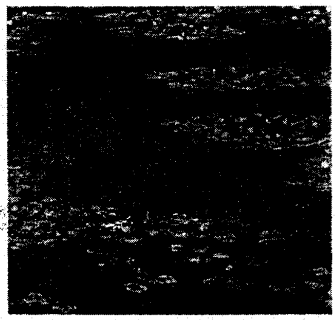
* This leaflet includes some plans unfixed, and contents are subject to [illegible]



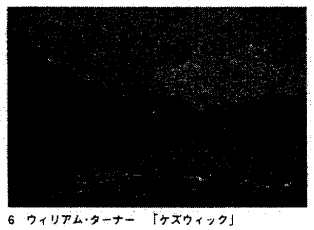
8　葛飾北斎　「富嶽三十六景 神奈川沖浪裏」
平木浮世絵美術館 蔵

10　葛飾北斎
「諸国滝廻り 木曽路ノ奥阿弥陀ヶ瀧」
太田記念美術館 蔵

9　葛飾北斎　「富嶽三十六景 甲州石班澤」
太田記念美術館 蔵

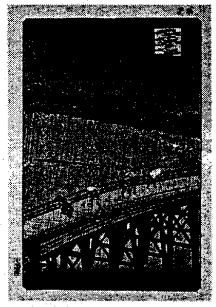


7　クロード・モネ　「睡蓮」　アサヒビール大山崎山荘美術館 蔵



6　ウィリアム・ターナー　「ケズウィック」

11　歌川広重　「東海道五十三次 庄野」



13　歌川広重
「名所江戸百景 大はしあたけの夕立」
平木浮世絵美術館 蔵

12　歌川広重　「近江八景 唐崎夜雨」
大津市歴史博物館 蔵

14　喜多川歌麿
「橋下男女歌合」（重要美術品）
平木浮世絵美術館 蔵
※この作品は、3月23日（日）までの展示。

開催

和洋古今の水の名品展

モネ、ターナー、北斎、広重、大観、応挙、栖鳳、
松園、福田平八郎など 14点

Japan and the West
Classic and Modern Masterworks with Water

平成15年
2月28日[金]
～3月30日[日]

休館日：月曜日

午前10時～午後7時30分（入場は7時まで）
3階美術・工芸展示室

主催　京都府、京都文化博物館
後援　第3回世界水フォーラム推進京都実行委員会
入場料　一　般 500(400)円、大高生 400(320)円、
中小生 300(240)円
（ ）内は20名様以上の団体料金

THE MUSEUM OF KYOTO
京都文化博物館
〒604-8183　京都市中京区三条高倉
TEL 075-222-0888　FAX 075-222-0889
URL http://web.kyoto-inet.or.jp/org/bunpaku/

Water Scenes of Kyoto

— Paintings from the Kyoto Prefecture Collection

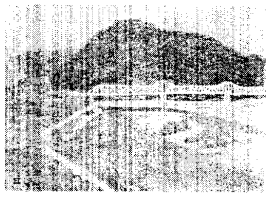
第3回世界水フォーラム 開催記念

ふるさとの水と名画展

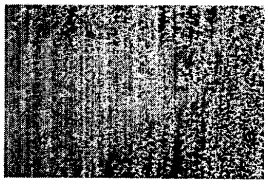
京都府所蔵絵画から

【出品目録】

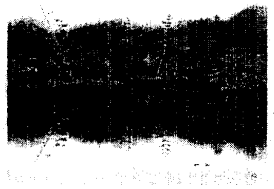
Ⅲ-13 林 功一 「嵐山遠月」



Ⅲ-9 [illegible] 「笠置」

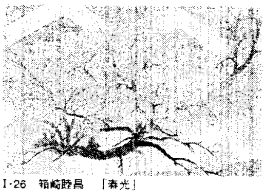


Ⅱ-6 鹿見喜陌 「気」

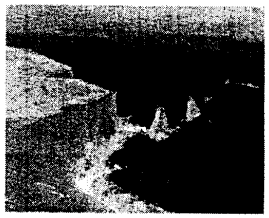


Ⅲ-17 武藤 彰 「醍醐寺」

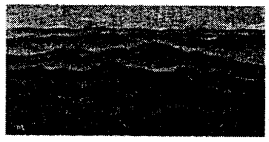
Ⅱ-12 正井和行 「蛍」



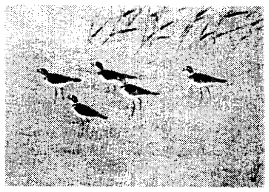
I-26 箱崎睦昌 「春光」



I-19 田中 岑 「丹後の海」



Ⅲ-7 下保 昭 「北山連峰」



Ⅱ-3 上村淳之 「千鳥」

Ⅲ-5 上原 卓 「宇治川」

I-21 堂本印象 「苔寺」

京都画壇の精華66点

平成15年
2月28日[金]
～3月30日[日]
休館日：月曜日

京都文化博物館

第3回
世界水フォーラム開催記念

ふるさとの水と名画展

―京都府所蔵絵画から―

和洋古今の水の名品展

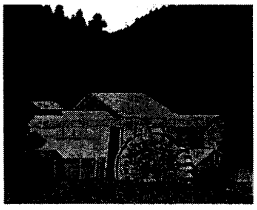
I-12　堤原緋佐子　「鴨川の夕涼み」

I-1　池田遙邨　「大文字の送り火」

I-9　岡崎忠雄　「蕭満」

I-2　磯田又一郎　「京の家並みと橋丁」

I-3　猪田青以　「木屋町と高瀬川」



I-5　宇田裕彦　「貴船の水車（宋宛）」

第3回世界水フォーラム開催記念
「ふるさとの水と名画展―京都府所蔵絵画から―」
開催によせて

京都府知事
山田啓二

本展は、第3回世界水フォーラムの開催を記念して、古くから水とのかかわりを大切にし、水の文化を育んできたここ京都の地において「水」をテーマとした名画展を開催するとともに、日本と西洋の著名画家による「水」の情景を描いた珠玉の名品を紹介する「和洋古今の水の名品展」を併せて開催するものであります。

これらを通して、「京都らしさ」を再発見し、人と水・自然との共生について関心を深めていただくことは誠に意義深いものでございまして、是非とも多くの方々に御覧いただくことを期待しております。

本展開催に当たり、関係の皆様方に心から感謝いたしますとともに、この展覧会が「世界水フォーラム」に少しでも貢献できることを願っております。

開催趣旨

「21世紀の人と自然」を考えるとき、いのちの根源である「水」がますます重要な要素になっていることに気づきます。

人が生きるという営みは、環境と深く関わり、芸術活動においても「水」をモチーフとする作品が数多く制作されてきました。

このたび「第3回世界水フォーラム」が京都を中心に開催（3/16～3/23）されるのを記念して、京都府所蔵絵画から「水」にまつわる作品を展覧し、「ふるさとの水と名画展」を開催します。

これは、京都の自然や風景、生命感あふれる動植物をテーマにし、京都を創作の拠点として活躍する画家たちが制作した「京の百景」（昭和48年）、「京の四季」（昭和61年）、「いのち賛歌」（平成4年）の作品群の中から、66点を紹介するものです。

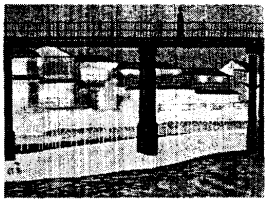
また、各所蔵家・機関の御協力を得て、日本と西洋の著名画家による水の名作14点を紹介する「和洋古今の水の名品展」を併せて開催します。

それぞれの作品に表現された「水」に親しむことにより、人と水・自然との共存について関心を深めていただければ幸いです。

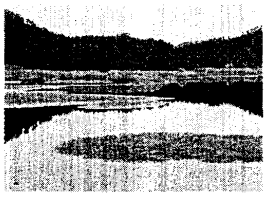
I-6　大日established世子　「三条大橋」

I-7　大野俊明　「二条城緑雨」

I-8　大淵陽一　「沼北の雪」



I-11 小野竹喬 「鴨川夜景」

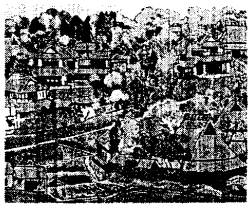


I-13 川島 浩 「深泥池」

I-17 佐々木邦彦 「大江山連峰」

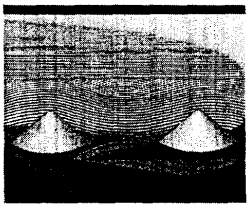
I 水のいのち／水と人のいとなみ

私たち人間をはじめ、地球上のすべての生命は「水」によってそのいのちを育まれてきました。雨、雪、川、池、海など、水はさまざまに姿を変えます。人々の暮らしは、まさにそれらの水とともにあります。



I-16 小松 均 「八瀬」

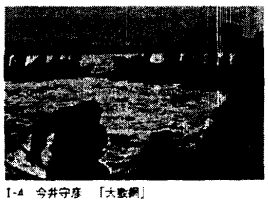
No.	作家名	作品名	備考
1	池田 遙邨	大文字の送り火	京の百景
2	磯田又一郎	京の家並みと横丁	〃
3	猪田 青以	木屋町と高瀬川	〃
4	今井 守彦	大敷網	〃
5	宇田 裕彦	貴船の水車（未完）	京の四季
6	大日躬世子	三条大橋	京の百景
7	大野 俊明	二条城緑雨	京の四季
8	大淵 陽一	洛北の雪	〃
9	岡崎 忠雄	蒲蒲	いのち賛歌
10	奥村 厚一	奈具海岸	京の百景
11	小野 竹喬	鴨川夜景	〃
12	梶原緋佐子	鴨川の夕涼み	〃
13	川島 浩	深泥池	〃



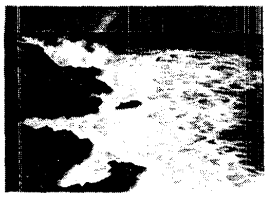
I-15 小牧源太郎 「大仙院の石庭（盛砂）」

I-31 三尾公三 「蜷蜿野幻想」

I-20 西田寒次 「木津川（The Ground）」



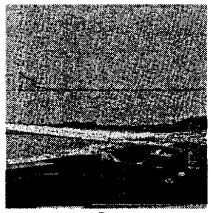
I-4 今井守彦 「大敷網」



I-10 奥村厚一 「奈具海岸」

I-18　澤　宏朝　「丹後立岩」

I-14　久保嶺爾　「春山」

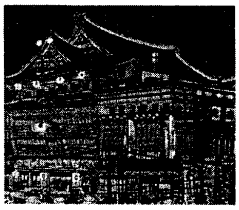


I-23　中野庸二「YŪHIGAURA (Play Beach)」

I-29　広本　進　「空也の滝」

I-22　中井浩一　「芹生の流れ」

I-25　丹羽尚子　「下鴨神社三井社」

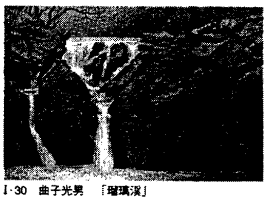


I-28　樋口富麻呂　「南座顔見世」

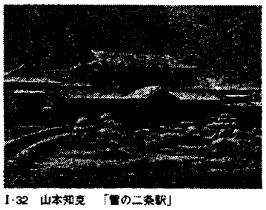
I-24　西野陽一　「猿橋」

I-27　橋本房男　「早春譜（中書島の外輪船）」

No.	作家名	作品名	備考
14	久保　嶺爾	春山	いのち賛歌
15	小牧源太郎	大仙院の石庭（盛砂）	京の四季
16	小松　均	八瀬	京の百景
17	佐々木邦彦	大江山連峰	〃
18	澤　宏朝	丹後立岩	〃
19	田中　岑	丹後の海	京の四季
20	鶴田　憲次	木津川（The Ground）	〃
21	堂本　印象	苔寺	京の百景
22	中井　浩一	芹生の流れ	京の四季
23	中野　庸二	YŪHIGAURA（Play Beach）	〃
24	西野　陽一	猿橋	いのち賛歌
25	丹羽　尚子	下鴨神社三井社	京の四季
26	箱崎　睦昌	春光	〃
27	橋本　房男	早春譜（中書島の外輪船）	〃
28	樋口富麻呂	南座顔見世	京の百景
29	広本　進	空也の滝	京の四季
30	曲子　光男	瑠璃渓	京の百景
31	三尾　公三	嵯峨野幻想	京の四季
32	山本　知克	雪の二条駅	〃



I-30　曲子光男　「瑠璃渓」



I-32　山本知克　「雪の二条駅」

Ⅱ-7　竹内浩一　「忘人」

Ⅱ-8　中野嘉之　「白鷺」

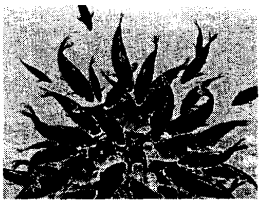
Ⅱ-1　磯部冠城　「金魚」

Ⅱ-2　伊東俊平　「冠島」

Ⅱ　水辺のいきもの

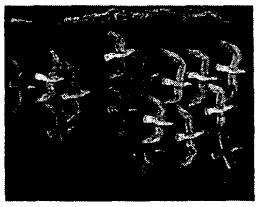
人は水辺に憩い、水辺のいきものたちを慈しんできました。いま、地球の環境は著しい変化の中にあります。水辺のいきものたちの生息環境も変化し、多くの種が危機にさらされています。

No	作家名	作品名	備考
1	磯部　冠城	金魚	いのち賛歌
2	伊東　俊平	冠島	京の四季
3	上村　淳之	千鳥	〃
4	大沼　憲昭	求餌図	いのち賛歌
5	北野　治男	丹頂	〃
6	鹿見　喜昭	気	〃
7	竹内　浩一	忘人	〃
8	中野　嘉之	白鷺	〃
9	西内　利夫	冠島（あおみずなぎどり）	京の百景
10	八田　　哲	朝の川	いのち賛歌
11	本多　功身	末枯どき	〃
12	正井　和子	蛍	〃
13	三谷　青子	魚	〃
14	村田　茂樹	大山椒魚・芦生	〃
15	吉村　和敏	島に帰る（オオミズナギドリ）	京の四季



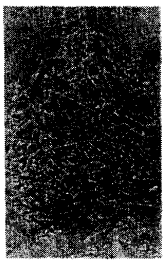
Ⅱ-4　大沼憲昭　「求餌図」

Ⅱ-5　北野治男　「丹頂」

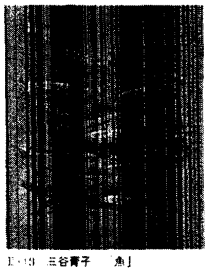


Ⅱ-15　吉村和敏　「島に帰る（オオミズナギドリ）」

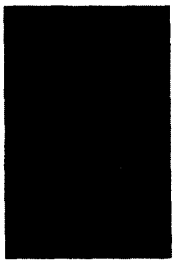
Ⅱ-10　八田　哲　「朝の川」



Ⅱ-11　本多功身　「末枯どき」

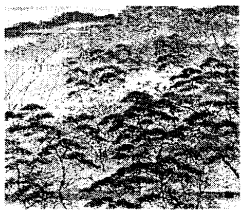


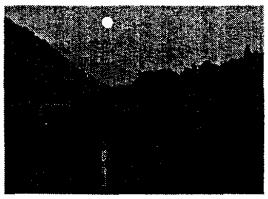
Ⅱ-13　三谷青子　「魚」



Ⅱ-14　村田茂樹「大山椒魚・芦生」

Ⅱ-9　西内利夫「冠島（あおみずなぎどり）」


Ⅲ-6　宇田荻邨　「嵐山」


Ⅲ-12　濱田昇児　「大野渓谷」

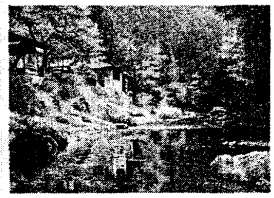

Ⅲ-1　麻田辨自　「梅尾」

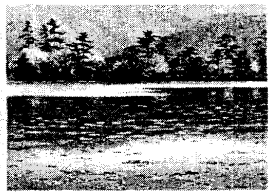

Ⅲ-9　岸田蒼坪　「長岡天神（つつじ）」

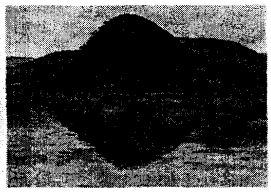
Ⅲ　山紫水明

日に映えた山が紫に見え、澄んだ水が明かな私たちのふるさと。古くから山紫水明といわれてきた京都は、日本人のこころのふるさとでもあります。その美しい自然は、水とともに四季折々に姿を変えます。

No.	作家名	作品名	備考
1	麻田　辨自	梅尾	京の百景
2	芦田　芳生	清滝川	京の四季
3	岩倉　寿	笠置	京の百景
4	岩澤　重夫	北山春霞	いのち賛歌
5	上原　卓	宇治川	京の百景
6	宇田　荻邨	嵐山	〃
7	下保　昭	北山連峰	〃
8	河合　健二	修学院離宮	京の四季
9	岸田　蒼坪	長岡天神（つつじ）	京の百景
10	国府　克	丹後松島	〃
11	堂本　元次	大澤池	〃
12	濱田　昇児	大野渓谷	京の四季
13	林　潤一	嵐山渡月	〃
14	藤田　孝正	桂川	〃
15	水野　深草	浄瑠璃寺	京の百景
16	三輪　晃久	修学院離宮	〃
17	武藤　彰	龍安寺	〃
18	山岸　純	広沢の池	京の四季
19	山添　耕治	桂川の愛宕山	〃


Ⅲ-2　芦田芳生　「清滝川」


Ⅲ-11　堂本元次　「大澤池」


Ⅲ-18　山岸　純　「広沢の池」


Ⅲ-14　藤田孝正　「桂川」

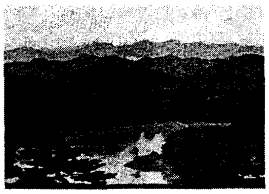

Ⅲ-10　国府　克　「丹後松島」


Ⅲ-4　岩澤重夫　「北山春霞」


Ⅲ-16　三輪晃久　「修学院離宮」


Ⅲ-19　山添耕治　「桂川の愛宕山」


Ⅲ-15　水野深草　「浄瑠璃寺」

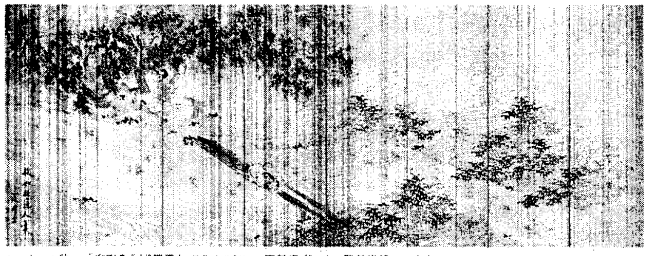

Ⅲ-8　河合健二　「修学院離宮」

特集

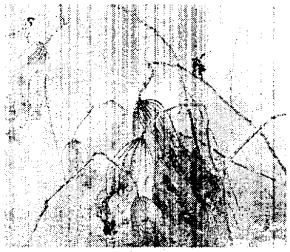
和洋古今の水の名品展

Japan and the West
— Classic and Modern Masterworks with Water

多くの画家が「水」を描き、幾多の名作が生み出され、人々に親しまれてきました。
ここでは、各所蔵家や機関の御協力を得て、日本と西洋の著名画家による水の傑作14点を紹介。



1 池 大雅 「柳下童子図屏風」 重要文化財 京都府蔵 泊大雅美術館コレクション

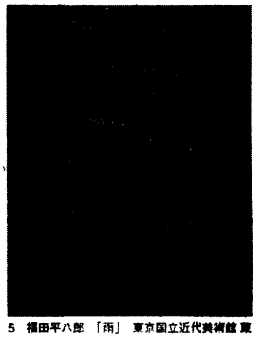


3 竹内栖鳳 「しぐるる池」 西芳寺 蔵

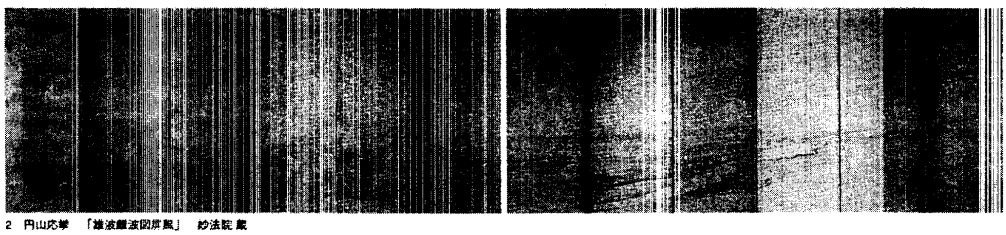
No.	作家名	作品名	制作時期	所蔵
1	池　大雅	柳下童子図屏風（重要文化財）	江戸中期	京都府蔵 泊大雅美術館コレクション
2	円山　応挙	雄波雌波図屏風	江戸中期	妙法院
3	竹内　栖鳳	しぐるる池	昭和16年	西芳寺
4	上村　松園	凝気楼	明治33年頃	
5	福田平八郎	雨	昭和28年	東京国立近代美術館
6	ウィリアム・ターナー	ケズウィック（水彩）	1801年	
7	クロード・モネ	睡蓮	1907年	アサヒビール大山崎山荘美術館
8	葛飾　北斎	冨嶽三十六景 神奈川沖浪裏	江戸後期	平木浮世絵美術館
9	葛飾　北斎	冨嶽三十六景 甲州石班澤	江戸後期	太田記念美術館
10	葛飾　北斎	諸国滝廻り 木曽路ノ奥阿弥陀ヶ滝	江戸後期	太田記念美術館
11	歌川　広重	東海道五十三次 庄野	江戸後期	
12	歌川　広重	近江八景 唐崎夜雨	江戸後期	大津市歴史博物館
13	歌川　広重	名所江戸百景 大はしあたけの夕立	江戸後期	平木浮世絵美術館
14	喜多川歌麿	橋下男女魚釣（重要美術品）	江戸中期	平木浮世絵美術館

※作品No.14は、3月23日（日）までの展示

4 上村松園 「凝気楼」



5 福田平八郎 「雨」 東京国立近代美術館 蔵



2 円山応挙 「雄波雌波図屏風」 妙法院 蔵

附件四

「都市防洪」會議資料

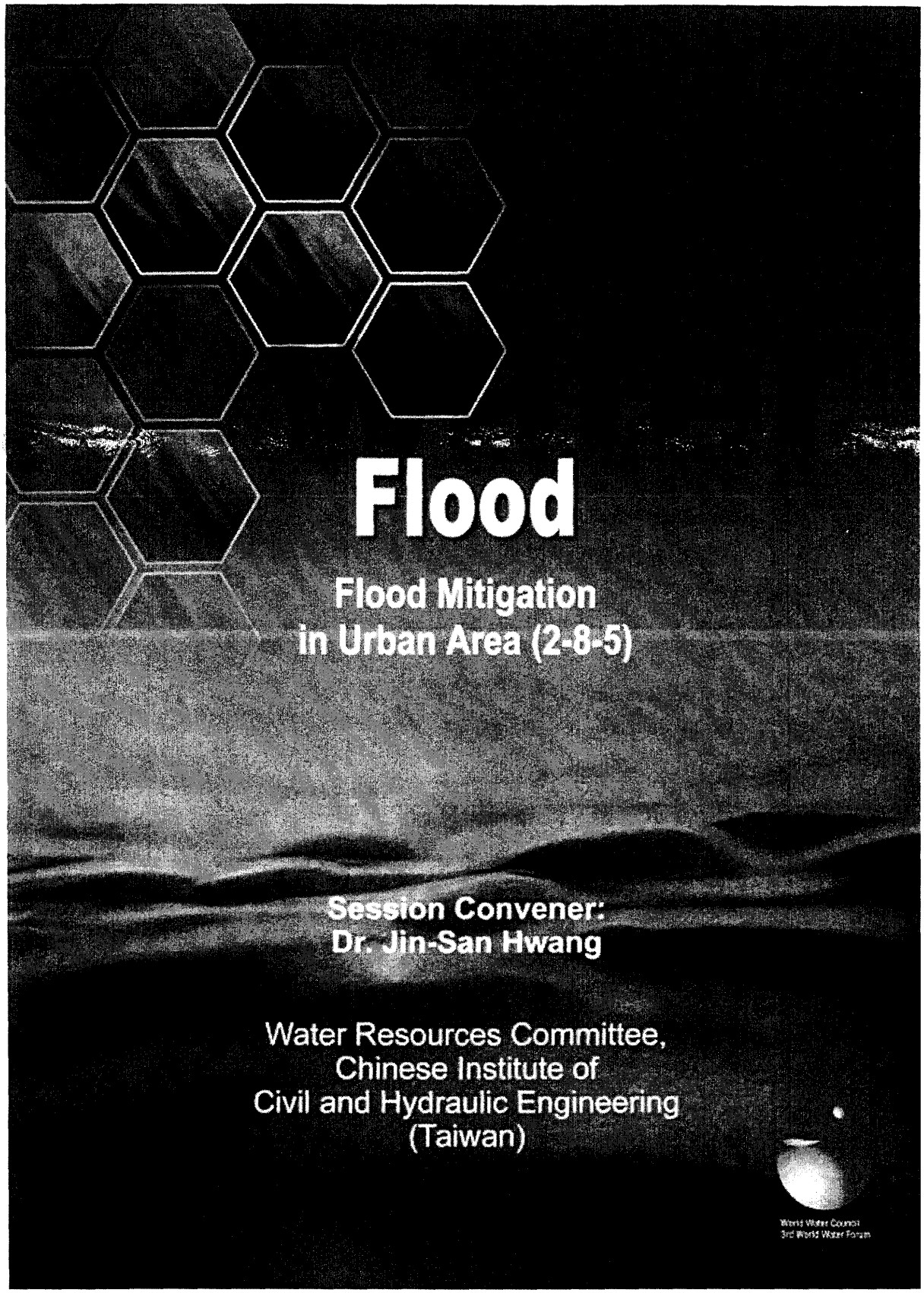

Flood
Flood Mitigation
in Urban Area (2-8-5)
Session Convener:
Dr. Jin-San Hwang
Water Resources Committee,
Chinese Institute of
Civil and Hydraulic Engineering
(Taiwan)
World Water Council
3rd World Water Forum

Table of Contents

Case Studies, Taipei Taiwan

Flood Mitigation Strategies for for Taipei Metropolitan

Dr. Jing-San Hwang,
Director General, Water Resources Agency

Decision-Support System for Urban Flood Mitigation

Dr. Tim Hau Lee,
Associate Professor, National Taiwan University

A Case Study :The Keelung River Experience

Hong-Yuan Lee,
Professor, National Taiwan University

Taiwan

Flood Mitigation Strategies for for Taipei Metropolitan

Jing-San Hwang, Ph.D.
Director General,
Water Resources Agency
Ministry of Economic Affairs
Taiwan

Content

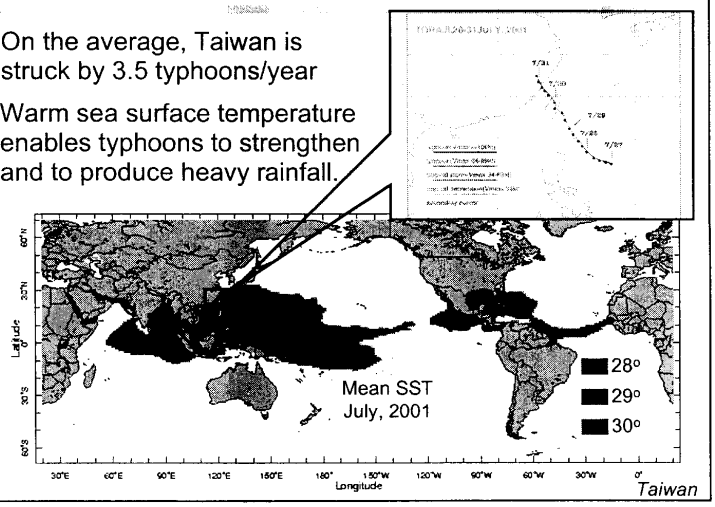
- Hydrometeorology challenges for Taiwan
- Hydrology and geomorphology condition of Tanshui River Watershed and Taipei Basin
- Flood Mitigation Project for Taipei
- Current issues and their remedies

Taiwan

Hydrometeorology Challenges

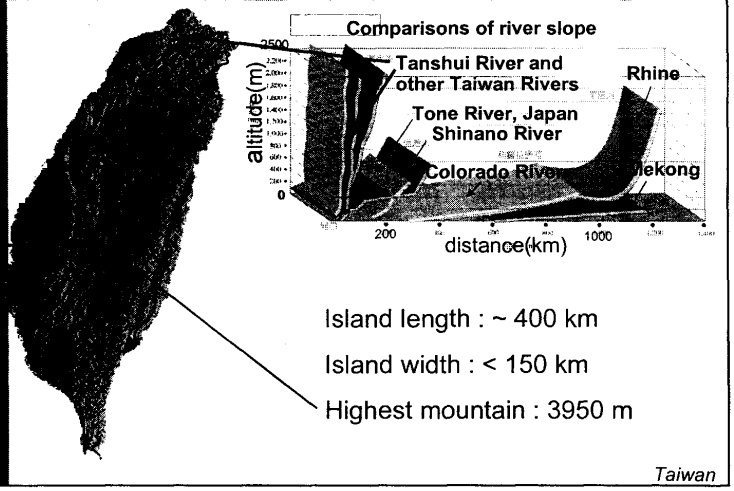
On the average, Taiwan is struck by 3.5 typhoons/year

Warm sea surface temperature enables typhoons to strengthen and to produce heavy rainfall.



Taiwan

Topography and River Slope



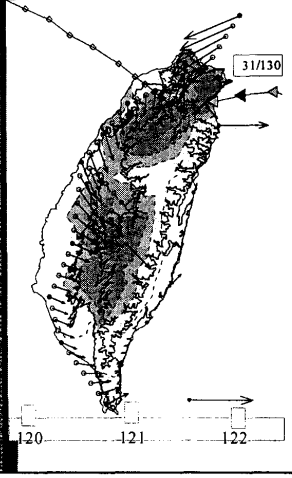
Island length : ~ 400 km

Island width : < 150 km

Highest mountain : 3950 m

Taiwan

Orographic Enhancement of Typhoon Rainfall



Strong wind/high Froude number over-mountain airflow induces heavy rainfall on the windward side

without orographic enhancement, typhoon rainfall intensity:
i ~ 20 mm/hr

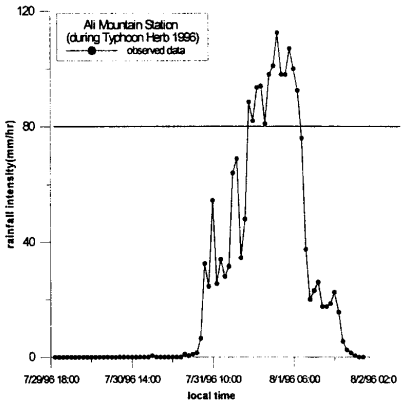
With orographic enhancement :
i ~ 50 mm/hr

Heavy rainfall and steep terrain causes flash flood and debris flow in the upstream valleys as well as inundation in the downstream alluvial plain

Taiwan

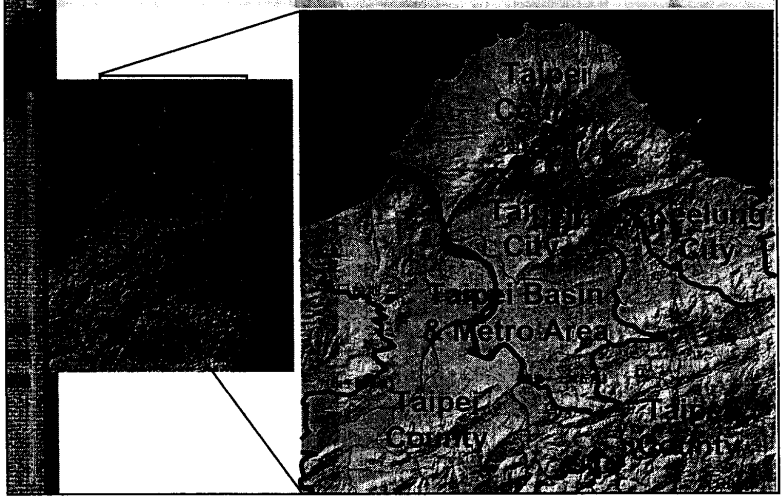
Orographic Enhancement of Typhoon Rainfall

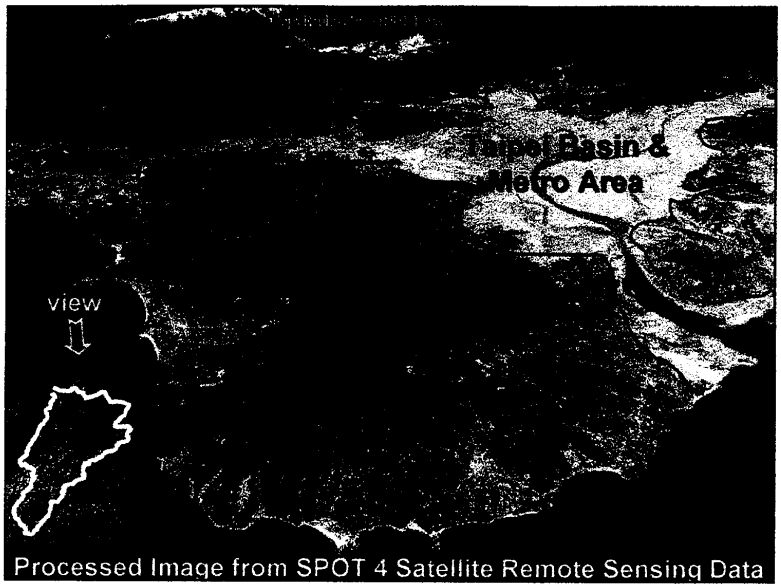
- During Typhoon Herb, Ali Mountain Station recorded hourly rainfall intensity was continuously greater than 80 mm/hr for 13 hours.
- Maximum 24-hour rainfall is 1748mm, which is about 94% of the world record.

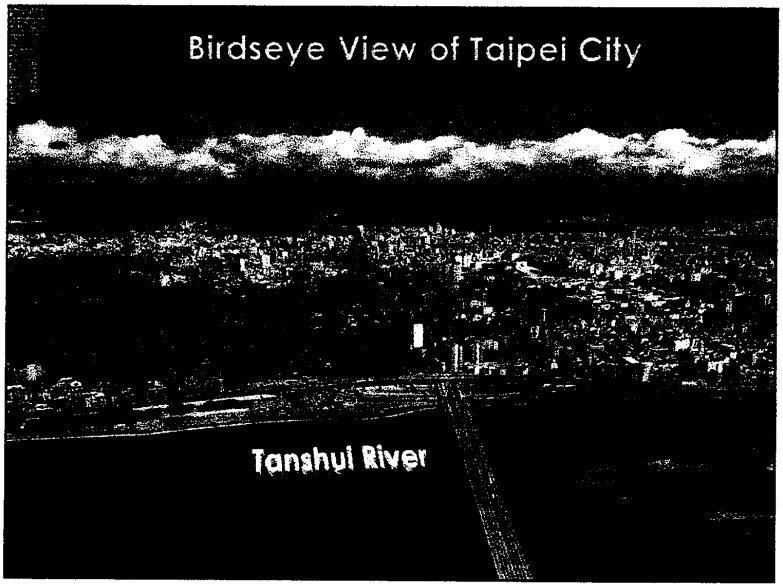


Taiwan

Tanshui River Watershed & Taipei Basin

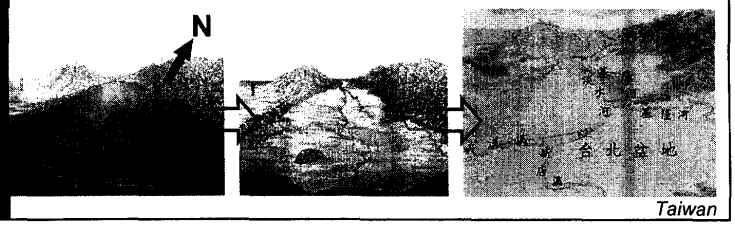



Taipei Basin &
Metro Area
view
Processed Image from SPOT 4 Satellite Remote Sensing Data


Birdseye View of Taipei City
Tanshui River

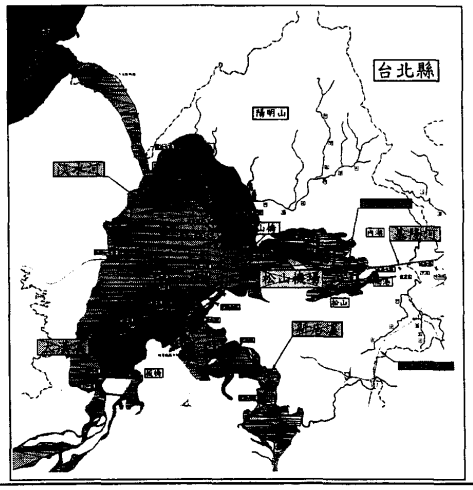
Hydrology and Geomorphology Condition

- Taipei basin was a lake till A.D.1700.
- Main part of Taipei Metro is located 0-20m (area ~240km^2) above mean sea level, which is ~ 9% of Tanshui River watershed (2,726 km^2), and 5 km^2 is below mean sea level.
- Storm water collected at upper Tanshui River Basin will flow through Taipei Metropolitan area.
- Due to historical settlement, the rivers are narrow.



Taiwan

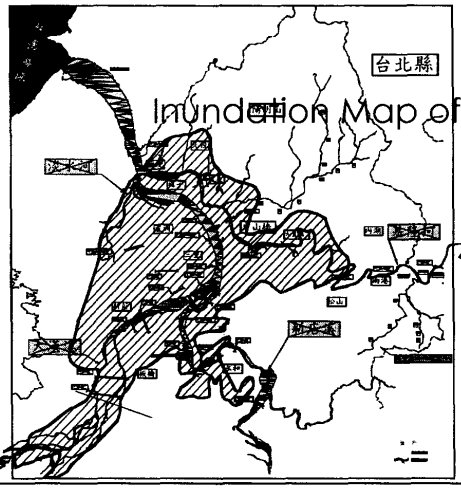
Map of 1932 Inundation



Inundated area = 102.16 km^2

Taiwan

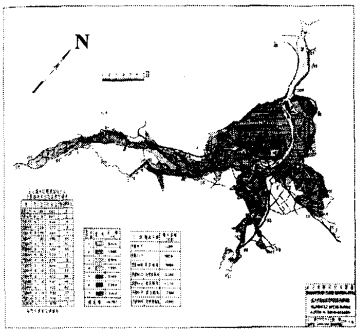
Inundation Map of Typhoon Gloria, 1963



Inundated area = 145.82 km^2

Taiwan

Inundation Area of Some Major Floods Before The Tanshui River Flood Mitigation Project

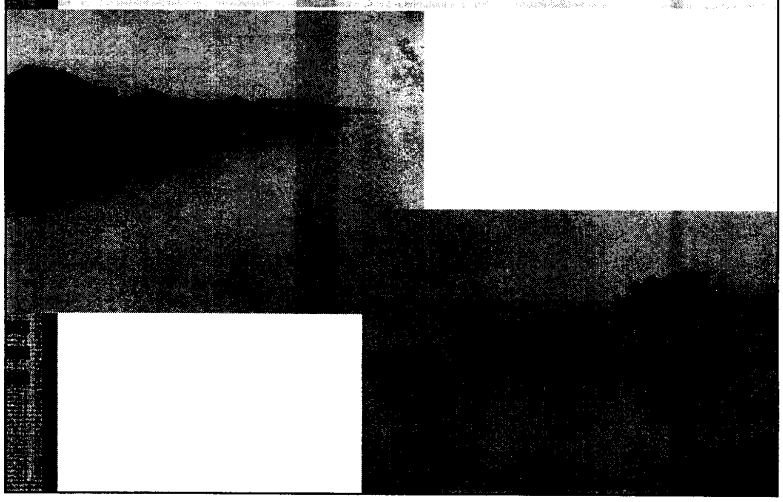


Year	Typhoon	Inundated Area km^2
1920		132.81
1932		102.16
1958	Billie	75.68
1961	Pamela	111.42
1962	Amy	107.12
1962	Opal	78.32
1963	Gloria	145.82

# of occurrence of the above 7 inundations	1	2	3	4	5	6	7	total
area (hectares)	3420	1660	2010	1880	3010	2360	4410	18750

Taiwan

1925 Inundation Near Taipei Bridge



Phases of Taipei Flood Mitigation Project

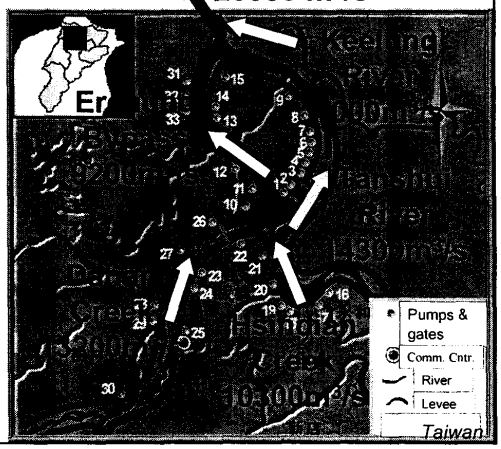
- Planning, Experimenting and Revision
  1960-1970
- Implementation of The Flood Mitigation Project for Taipei
  1970-1996
- Continuing Project – Keelung River
  1997-

Taiwan

Flood Mitigation Project for Taipei (1/9)

Designed Flow **25000 m³/s**

- Based on hydrological data before 1970
- Utilized 200-year return period flood stage + 1.5m freeboard (equivalent to 500 yr return period)



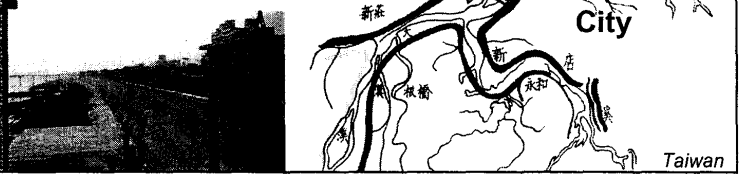
Flood Mitigation Project for Taipei (2/9)

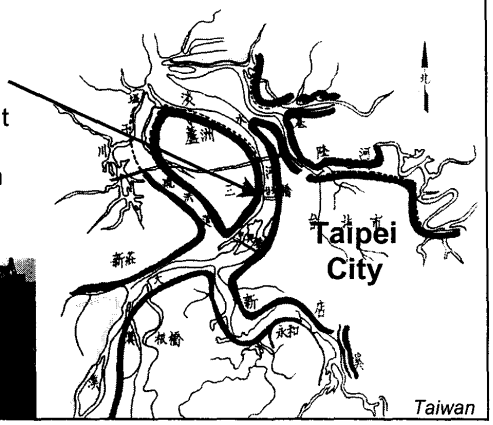
1. Raise Embankments

- Levee height at Taipei Bridge is raised to 10m above m.s.l.

Length of newly built or raised:

- Taipei City 98 km
- Taipei County 96km





Flood Mitigation Project for Taipei (3/9)

2. Construct Erchung Flood Bypass Channel:

- To overcome the narrow cross-section problem near Taipei Bridge.

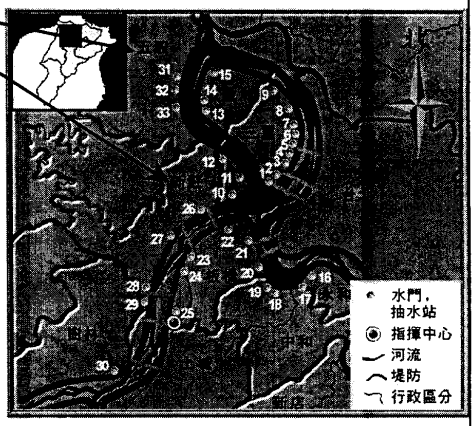
Flood Mitigation Project for Taipei (4/9)

3. Landfill

- To elevate the surface of low land for 136.8 hectares.

4. Dredging

- To enhance the efficiency of channel flow.



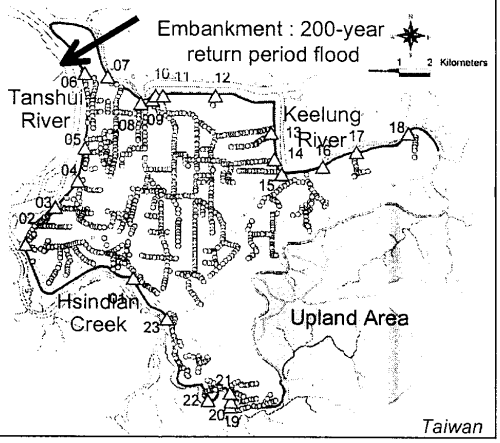
Taiwan

Flood Mitigation Project for Taipei (5/9)

5. Develop Urban Drainage System

- Storm sewer design utilizes 5 year return period rainfall ~78.8 mm/hr.
- Pumping station design utilizes typhoon rainfall ~45 mm/hr.

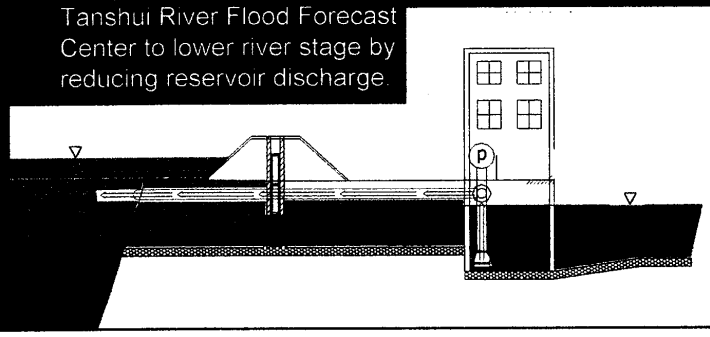
△ Pumping Station
o Manhole
River
— Levee
Upland Watershed Building Block



Flood Mitigation Project for Taipei (6/9)

Operation Rules of Pumps and Gates

- Inside water level > river stage : open gate (+ pumping)
- Inside water level < river stage : close gate + pumping
- Pumps are operated locally but can be helped by The Tanshui River Flood Forecast Center to lower river stage by reducing reservoir discharge.

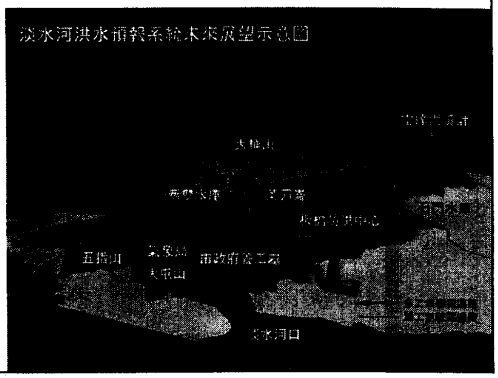


Yu-chen Pumping Station at Keelung River (7/9)

Flood Mitigation Project for Taipei (8/9)

6. Develop Flood Forecasting System and Flood Mitigation Decision Support System

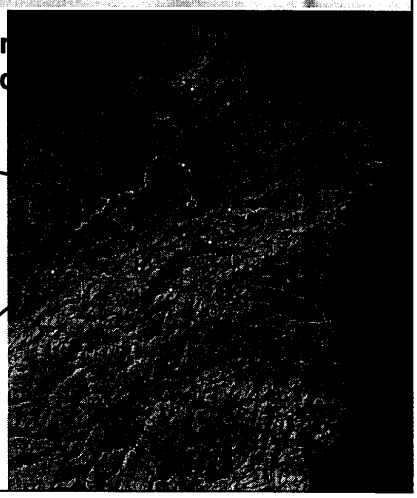
- To issue warning for lowland area
- To support operation of 2 reservoirs.
- To assist the operation of gates and pumps



Flood Mitigation Project for Taipei (9/9)

7. Optimize Reservoir Operation for Flood Peak Reduction

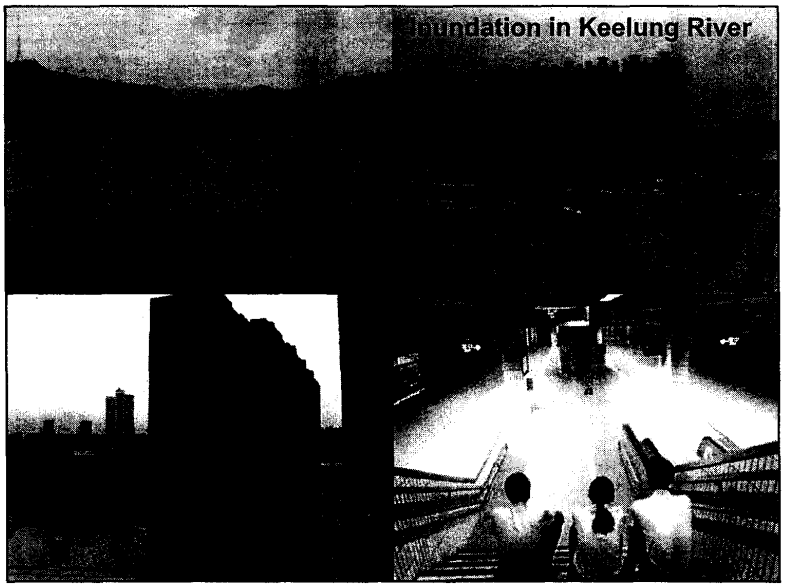
- Feitsui Reservoir, storage capacity ~ 400 million m^3, travel time of flood peak to Taipei Bridge ~1.5hr,
- Shihmen Reservoir, storage capacity ~ 250 million m^3, travel time of flood peak to Taipei Bridge ~ 3.0hr



Current Issues

1. **Increase in annual rainfall and decrease in the number of rainy days**
2. **Runoff increases due to urbanization effect**
3. **Failure of pumping stations**
4. **Building design does not have inundation consideration**
5. **Lack of accurate quantitative precipitation forecast**
6. **Ineffective flood warning dissemination**
7. **Lack of public awareness**
8. **Urban development in unprotected area (mid-Keelung River valley)**

Taiwan



Remedies

1. Revaluate the Designed Peak Discharge
2. Enhance the Functions of Drainage Systems
3. Improve Buildings' and Underground Structures' Ability to Reduce Inundation Damages
4. Proper Land Use to Increase Flood Retention Capability
5. Improve Flood Warning Dissemination System, Planning and Training
6. Encourage community involvement

Taiwan

Decision-Support System for Urban Flood Mitigation

Tim Hau Lee[1], Ming-Shi Hsu[2], and Hong-Yuan Lee[1]

[1] Department of Civil Engineering,

[2] Department of Bio-Environmental System Engineering,

[1,2] Hydrotech Research Institute

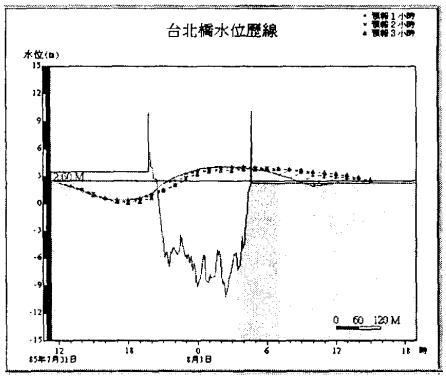
National Taiwan University, Taiwan

Content

- Flood Forecast Model (FFM) and Flood Mitigation (FM) DSS for Tanshui River
- Urban Inundation DSS for Taipei City
- Application of FFM and FMDSS during Typhoon Nari, 2001
- Future Prospects

Objectives of Flood Forecast Model

- To provide 6-hr lead-time hourly water level elevation forecasts at designated locations during typhoons

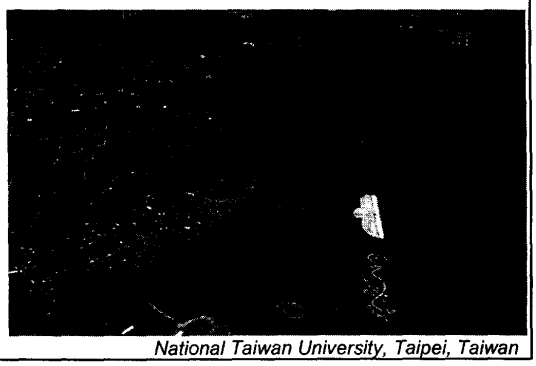


- To automate hydrological and meteorological data processing
- To display data through a graphical user interface (GUI)
- To develop a DSS based on operation needs

National Taiwan University, Taipei, Taiwan

Objectives of the FM ADSS

- Evacuate cars & people in the flood plain
- Issue warning and evacuate people in the lowland area for levee-overrunning flood
- Support operation of 2 u/s reservoirs and operation of gates /pumps



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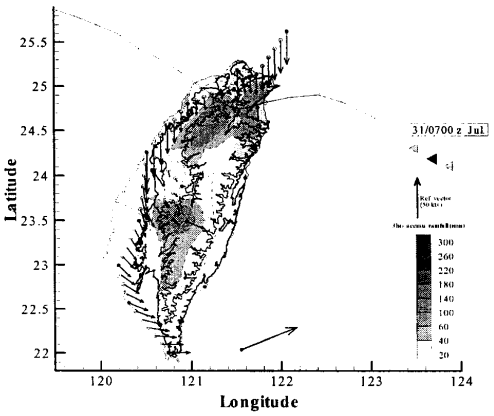
Rainfall Forecast Model

- Climatologic Typhoon QPF (CTQPF) Model based on phase-lock relationship between historical location of typhoon center, typhoon strength and station rainfall data, 0-24 hr lead-time
- Radar Extrapolation QPF Model by TREC (Tracking Radar Echo by Correlation),1 to 2 hr forecast lead-time
- Subjective analysis based on weather maps, NWP model output, typhoon track forecast, satellite and radar images, etc.

National Taiwan University, Taipei, Taiwan

Typhoon-Terrain Interaction

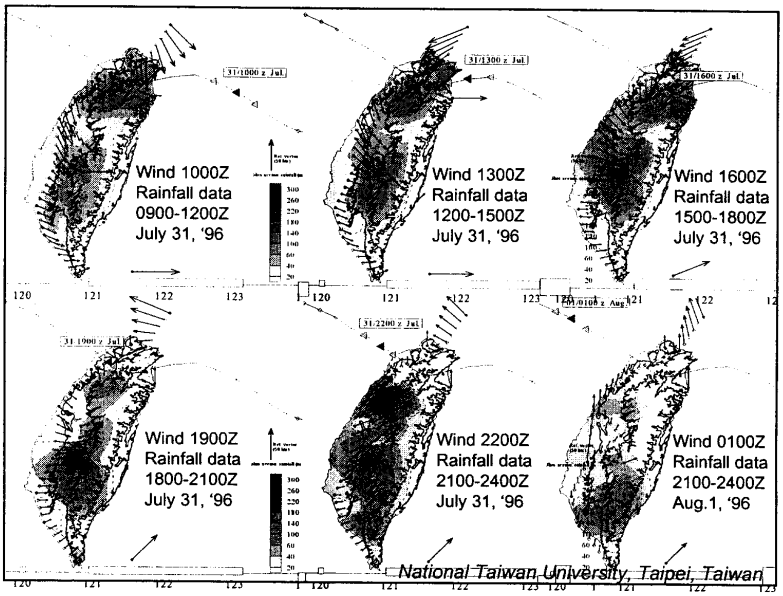


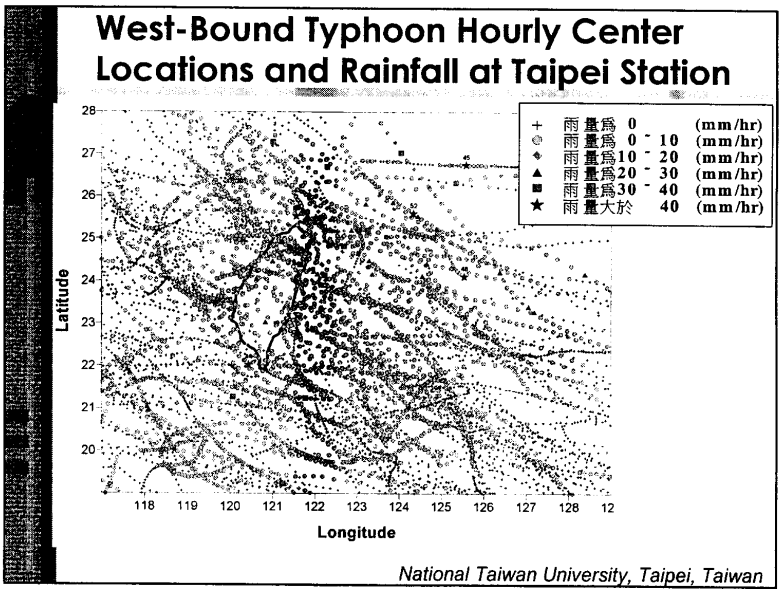
Wind data
0700Z July 31, 1996

Rainfall data
0600-0900Z

Contours :
100-meter
1000-meter

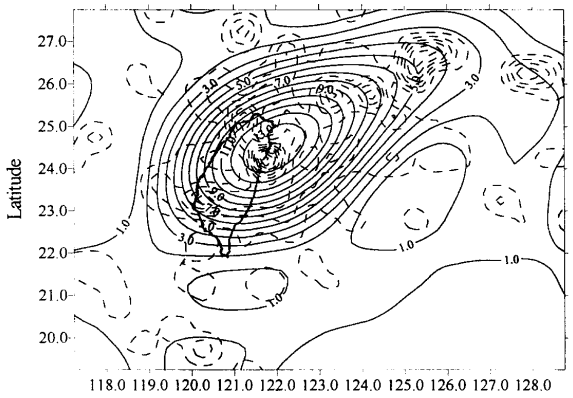
National Taiwan University, Taipei, Taiwan


Wind 1000Z
Rainfall data
0900-1200Z
July 31, '96
Wind 1300Z
Rainfall data
1200-1500Z
July 31, '96
Wind 1600Z
Rainfall data
1500-1800Z
July 31, '96
Wind 1900Z
Rainfall data
1800-2100Z
July 31, '96
Wind 2200Z
Rainfall data
2100-2400Z
July 31, '96
Wind 0100Z
Rainfall data
2100-2400Z
Aug.1, '96
National Taiwan University, Taipei, Taiwan


West-Bound Typhoon Hourly Center Locations and Rainfall at Taipei Station
雨量爲 0 (mm/hr)
雨量爲 0 - 10 (mm/hr)
雨量爲10 - 20 (mm/hr)
雨量爲20 - 30 (mm/hr)
雨量爲30 - 40 (mm/hr)
雨量大於 40 (mm/hr)
Latitude
28
27
26
25
24
23
22
21
20
118 119 120 121 122 123 124 125 126 127 128
Longitude
National Taiwan University, Taipei, Taiwan

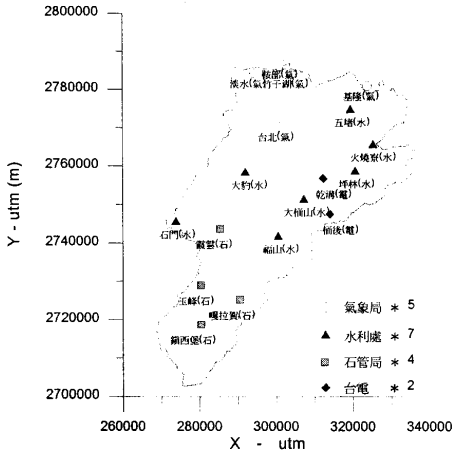
West-Bound Typhoon Hourly Center Locations and Rainfall at Taipei Station

Data are fitted to a double Fourier function



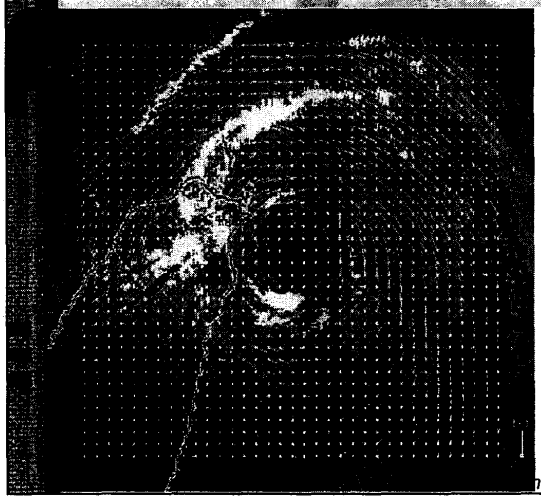
National Taiwan University, Taipei, Taiwan

18 Climatologic Typhoon QPF Stations



National Taiwan University, Taipei, Taiwan

Radar Extrapolation QPF Model by TREC with Adaptations to Typhoon

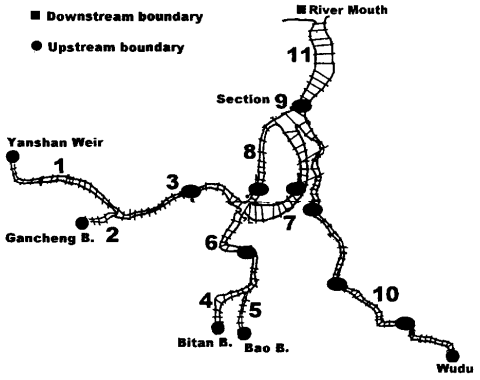


Field of rain cell advection velocity estimated from 12:03 & 12:09pm Wufegnshan radar data during Typhoon Herb 7/31/1996

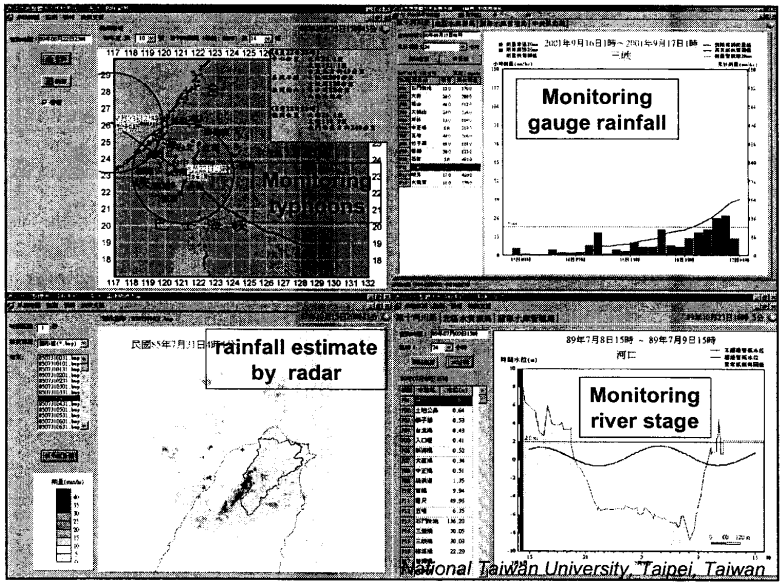
n University, Taipei, Taiwan

Real-time Feedback Using Kalman Filter

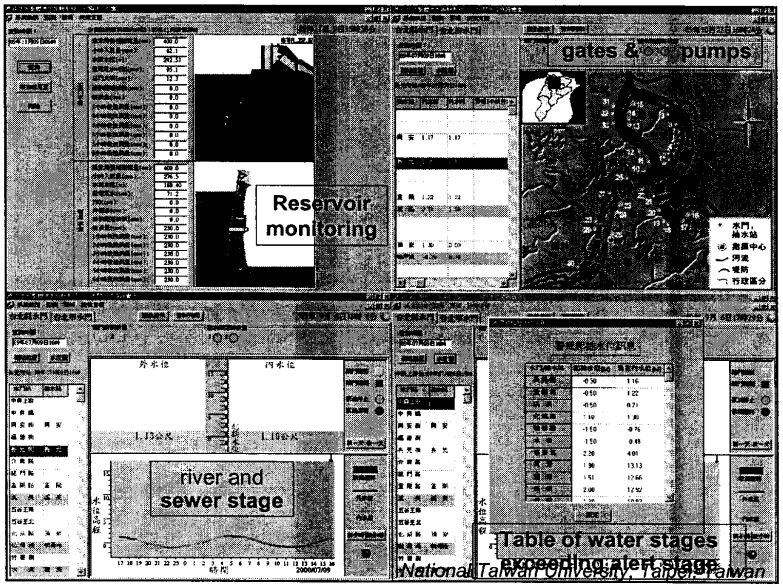
Runoff feedback at u/s boundaries
Stage feedback at interior stations



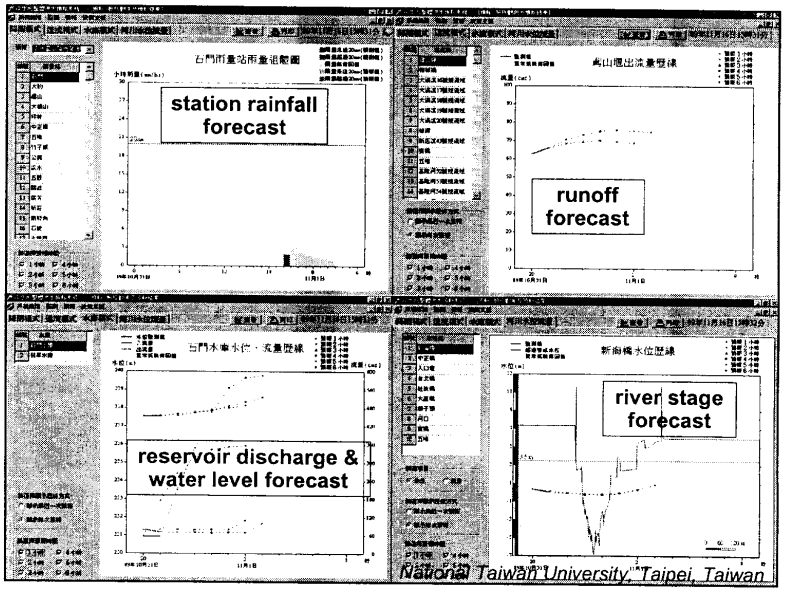
National Taiwan University, Taipei, Taiwan

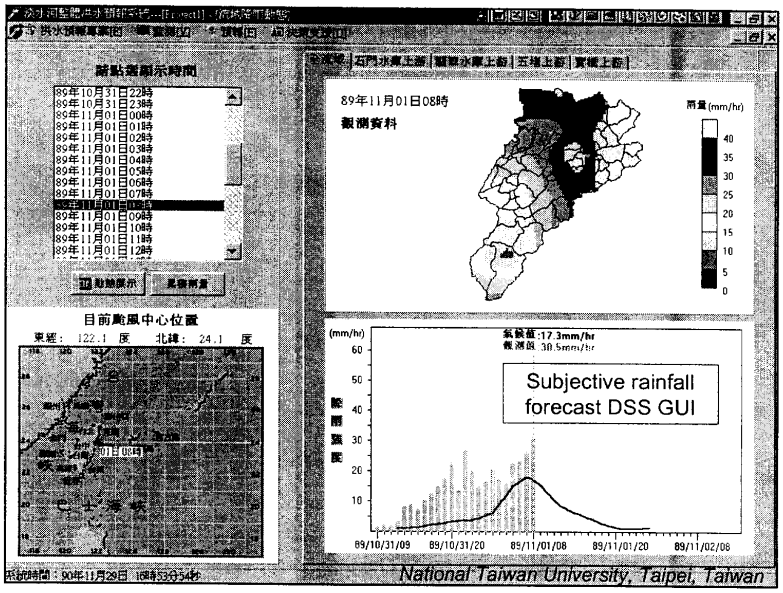


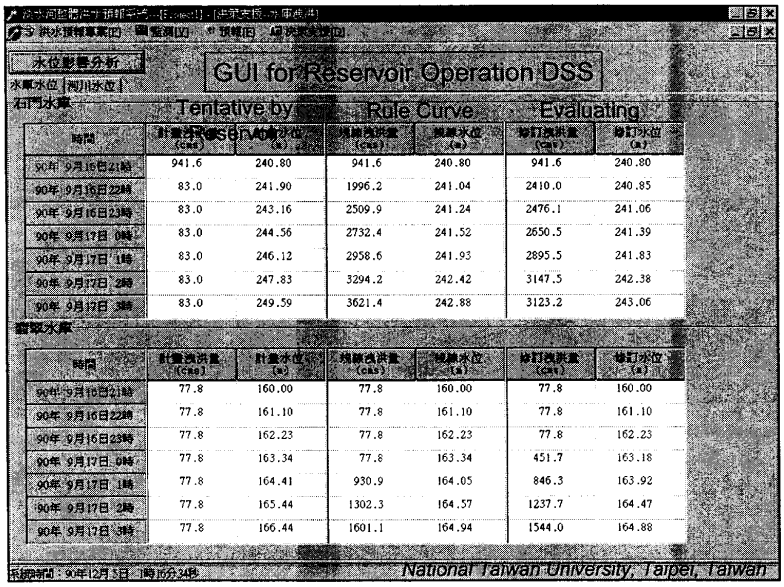
National Taiwan University, Taipei, Taiwan

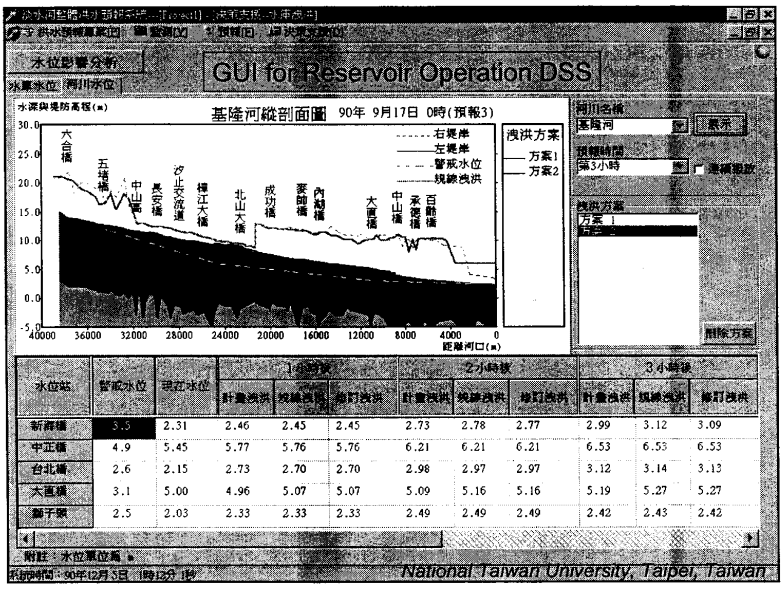


National Taiwan University, Taipei, Taiwan


station rainfall forecast
runoff forecast
reservoir discharge & water level forecast
river stage forecast
National Taiwan University, Taipei, Taiwan


89年11月01日08時
報測資料
雨量(mm/hr)
Subjective rainfall forecast DSS GUI
National Taiwan University, Taipei, Taiwan

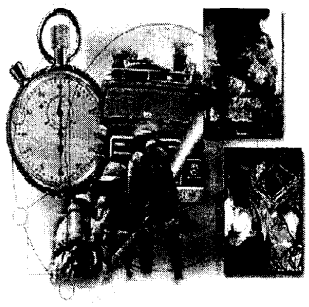

GUI for Reservoir Operation DSS
Tentative by Rule Curve Evaluating
National Taiwan University, Taipei, Taiwan


GUI for Reservoir Operation DSS
基隆河縱剖面圖 90年 9月17日 0時(預報3)
National Taiwan University, Taipei, Taiwan

台北市災害防救決策支援系統
Taipei City Natural Hazard Mitigation DSS

颱洪決策支援系統
Typhoon DSS

震災決策支援系統
Earthquake DSS



離開

台北市防災計畫辦公室
國科會防災國家型科技計畫辦公室
National Taiwan University, Taipei, Taiwan

颱洪決策支援系統
Typhoon & Flooding Decision Support System

颱風資訊
Typhoon Info

水情資訊
Hydrologic Info

災情展示資訊
Inundation Info

災害潛勢資訊
Potential Disastrous Area Info

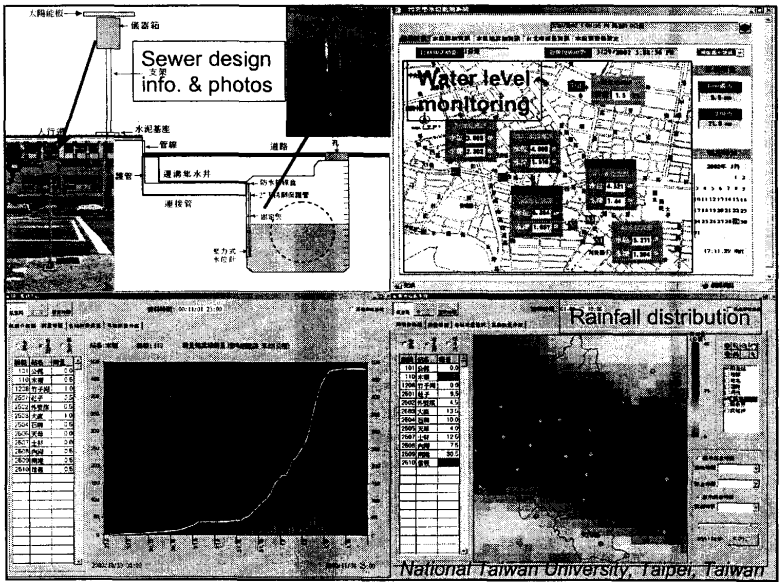
雨量站
Rain gauges
水位站
Sewer Stage
Stage at Pumps

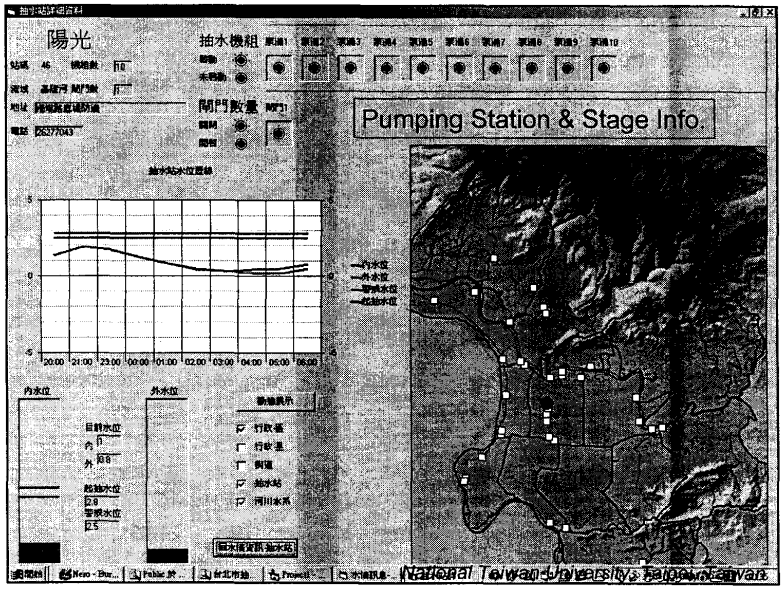
疏散門
Gates

淹水潛勢
Potential Inundation

坡地潛勢
Potential Slope land Disaster

回主系統


Sewer design info. & photos
Water level monitoring
Rainfall distribution
National Taiwan University, Taipei, Taiwan


陽光
抽水機組
開門數量
Pumping Station & Stage Info.
National Taiwan University, Taipei, Taiwan

Potential Inundation Map

- For urban area, 6-hr lead-time and 24-hr lead-time typhoon rainfall forecasts are used with Potential Inundation Maps (PIM) to assess whether an area is endangered.
- PIMs are generated numerically using DTM data, with different rainfall and pump failure scenarios.
- For the following reasons,
  - lack of site-specific, time-specific, and accurate QPF,
  - lack of high resolution (gate size~250m), horizontal scanning radar observed rainfall, and
  - real-time coupled simulation of sewer flow and 2-D overland flow/inundation model is too time consuming.

  The above combination is the optimal solution currently available.

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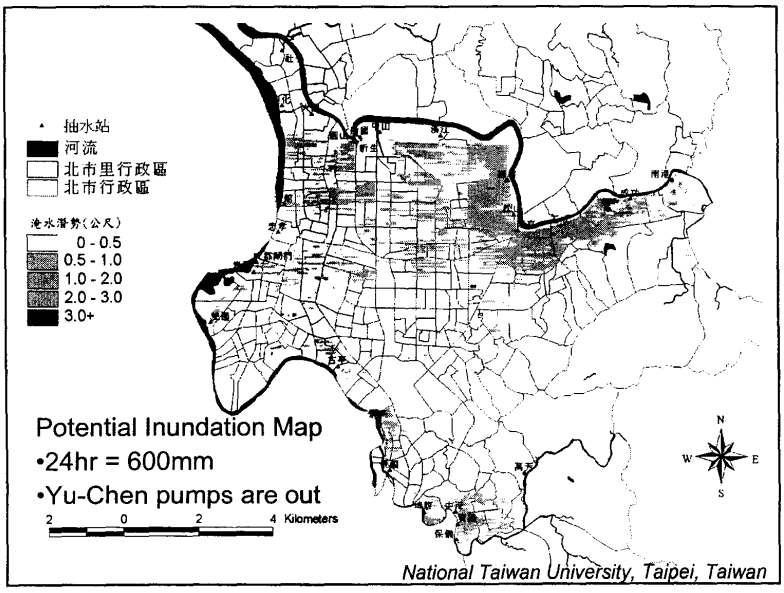
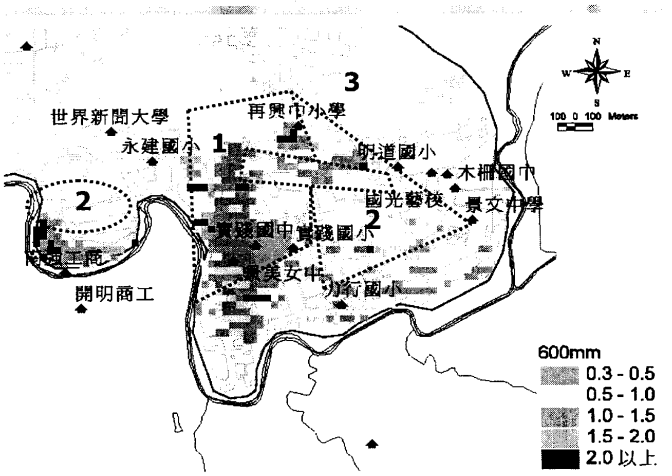


Potential Inundation Depths

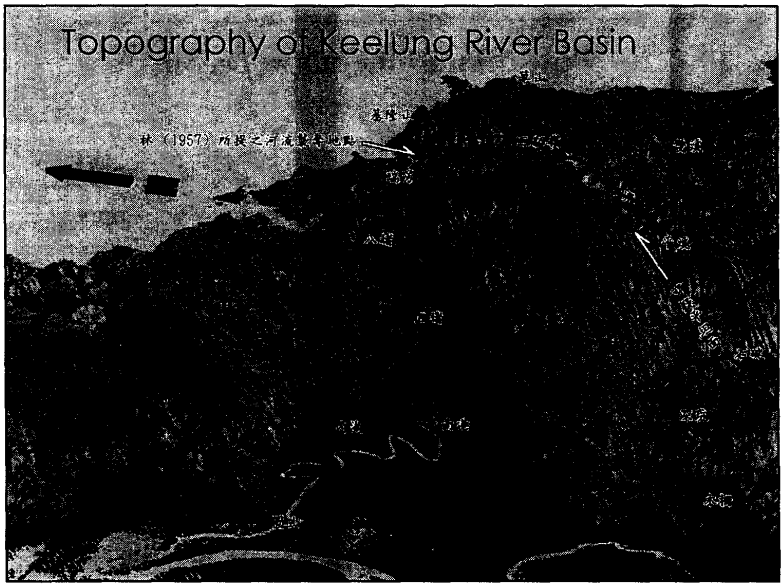


National Taiwan University, Taipei, Taiwan

Application of FFM and FMDSS
during Typhoon Nari, 2001

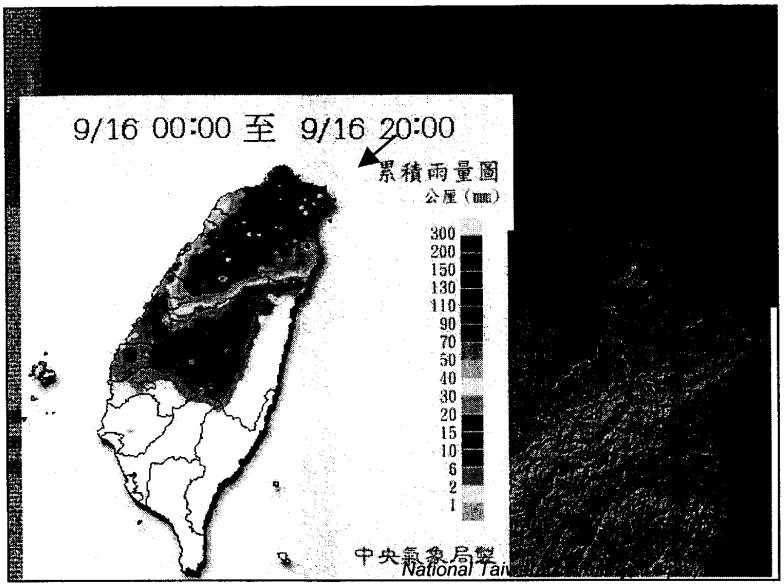
20:30 Sep. 16, 2001 Warning Issue # 1

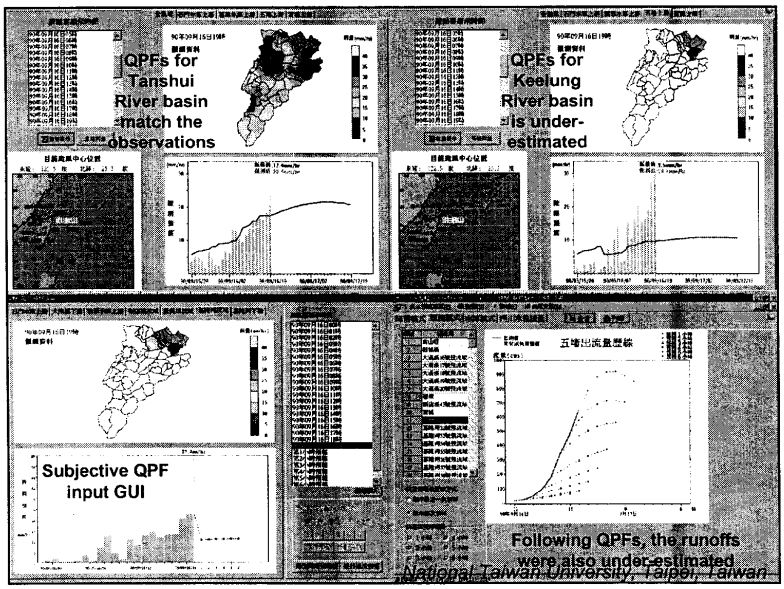
National Taiwan University, Taipei, Taiwan

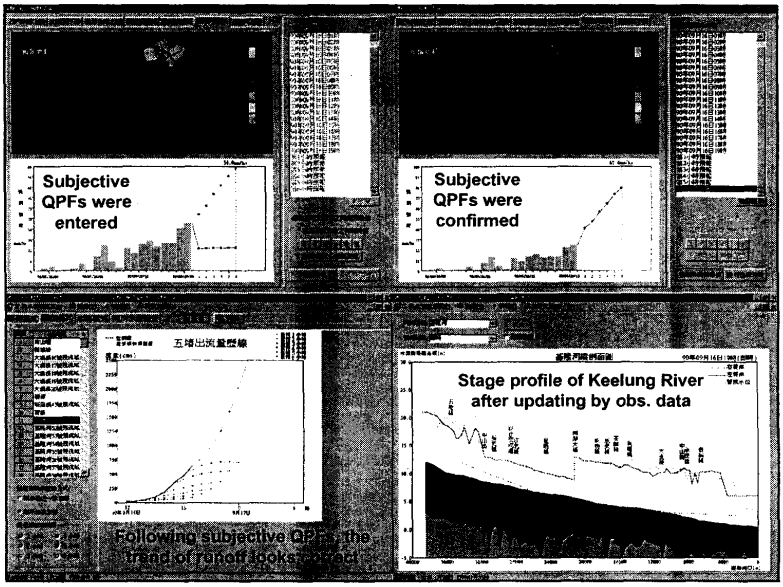


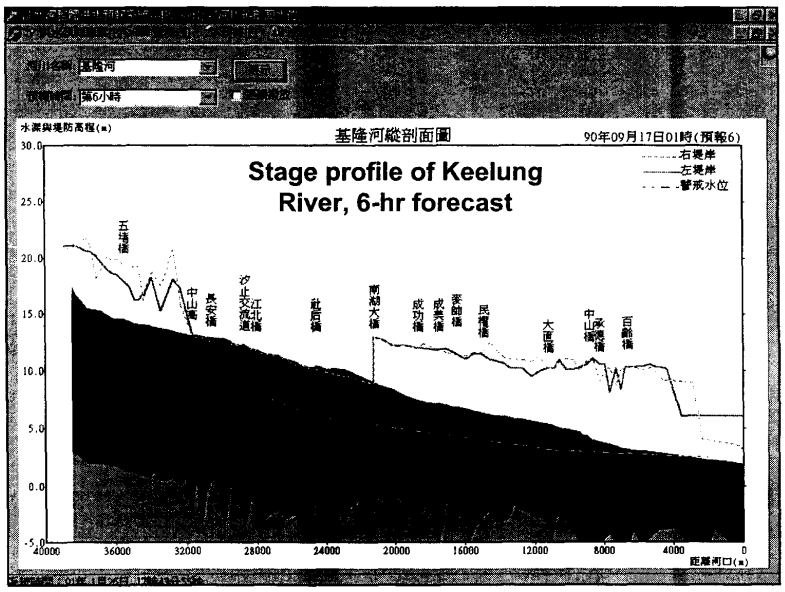
Track of Typhoon Nari

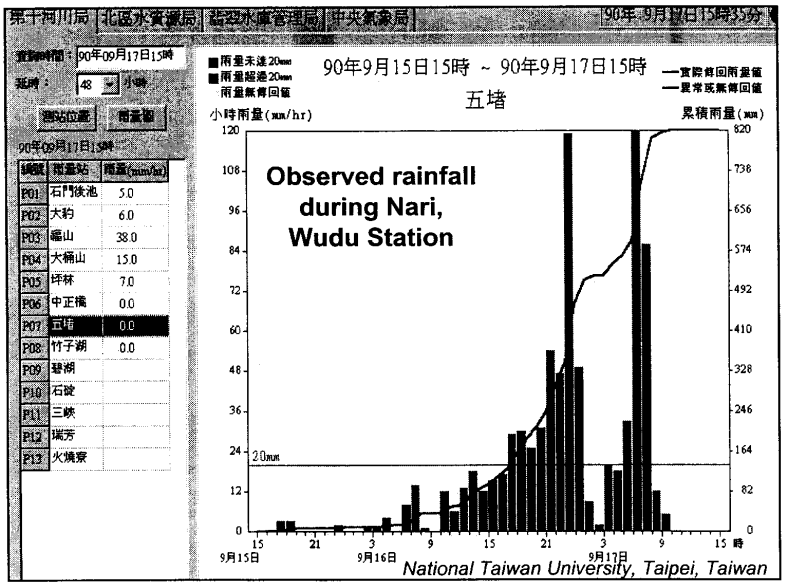
- Typhoon Nari moved from NE toward SW and land-fell at the NE corner of Taiwan at about 23:00, Sep.16, 2001.
- No recorded typhoon ever hits Taiwan from this route since 1896. The climatology typhoon QPF model did poorly.

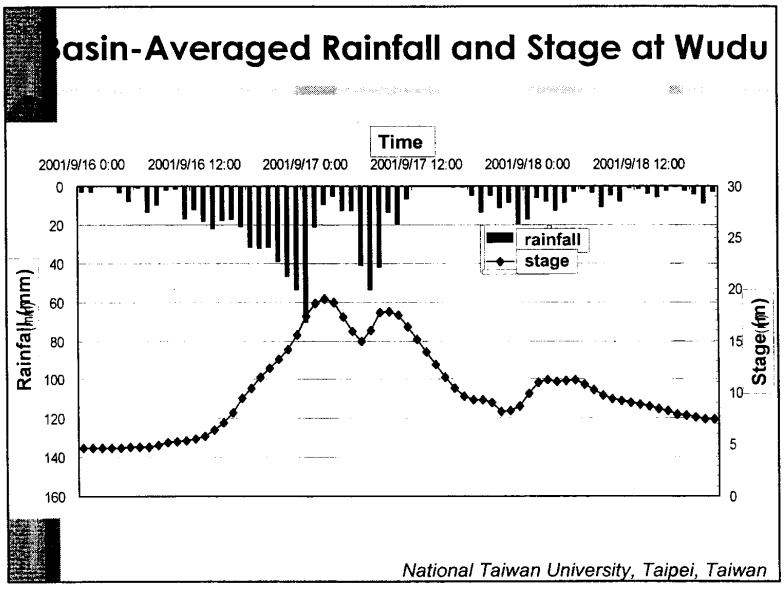

9/16 00:00 至 9/16 20:00
累積雨量圖
公厘（mm）
300
200
150
130
110
90
70
50
40
30
20
15
10
6
2
1
中央氣象局製
National Tai


QPFs for Tanshui River basin match the observations
QPFs for Keelung River basin is under-estimated
Subjective QPF input GUI
Following QPFs, the runoffs were also under-estimated
National Taiwan University, Taipei, Taiwan

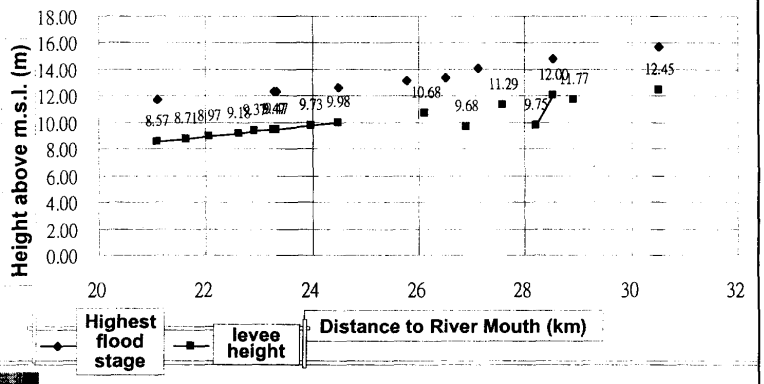

Subjective QPFs were entered
Subjective QPFs were confirmed
五堵出流量歷線
Stage profile of Keelung River after updating by obs. data
Following subjective QPFs, the trend of runoff looks correct


基隆河縱剖面圖
90年09月17日01時(預報6)
Stage profile of Keelung River, 6-hr forecast
右堤岸
左堤岸
警戒水位
五堵橋
中山橋
長安橋
汐止大橋
江北橋
社后橋
南湖大橋
成功橋
麥帥橋
成美橋
民權橋
大直橋
中山橋
承德橋
百齡橋
距基河口(m)


90年9月15日15時 ~ 90年9月17日15時
五堵
Observed rainfall during Nari, Wudu Station
小時雨量(mm/hr)
累積雨量(mm)
20mm
9月15日
9月16日
9月17日
National Taiwan University, Taipei, Taiwan


asin-Averaged Rainfall and Stage at Wudu
Time
2001/9/16 0:00
2001/9/16 12:00
2001/9/17 0:00
2001/9/17 12:00
2001/9/18 0:00
2001/9/18 12:00
rainfall
stage
Rainfall(mm)
Stage(m)
National Taiwan University, Taipei, Taiwan

Water Marks of Highest Flood Stages



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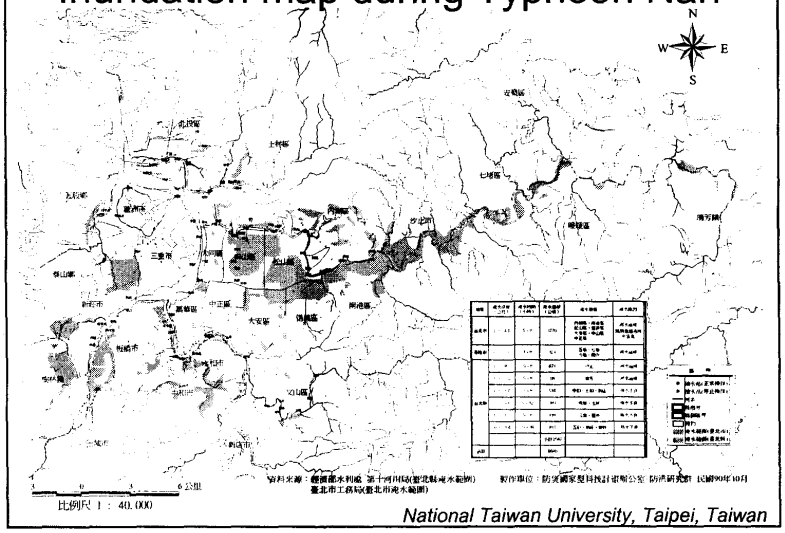
Inundation map during Typhoon Nari



National Taiwan University, Taipei, Taiwan

Inundation and Mitigation Actions

- The 10 year return-period levee of mid-Keelung River was overrun between 10:30pm to 10:50pm.
- Disaster Mitigation Center of the Central Government ask the Taipei City, Taipei Prefecture and Keelung City to enforce evacuation in potential inundation area.
- 20,000 people were evacuated.
- Nobody was drown in this area during this incident.

National Taiwan University, Taipei, Taiwan

Future Prospects

- Improves accuracy of Typhoon Rainfall Observation
  - Introduction of Quantitative Precipitation Estimate and Segregation Using Multiple Sensors (QPESUMS) products by CWB (Taiwan) and NSSL/NOAA (USA)
- Develops 12hr lead-time QPF
  - with CWB (Taiwan) and FSL/NOAA (USA)
  - Assimilating radar observation of typhoon Doppler wind data into very high resolution (~1km) mesoscale NWP model for warm starting

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Future Prospects

- Applies more versatile flood forecast model
  - Flood Early Warning System (FEWS) + Sobek (WLIDelft) for Tanshui River and other rivers
- Employs advanced information technologies
  - Development under a Grid Computing architecture with web based and GIS based GUI as well as internet database
  - Implementing web-based 3-D display of radar data, VR display of stage forecast & inundation information.

A Case Study : The Keelung River Experience

Hong-Yuan Lee[1], Tim Hau Lee[1], and Ming-Shi Hsu[2]

[1] Department of Civil Engineering,

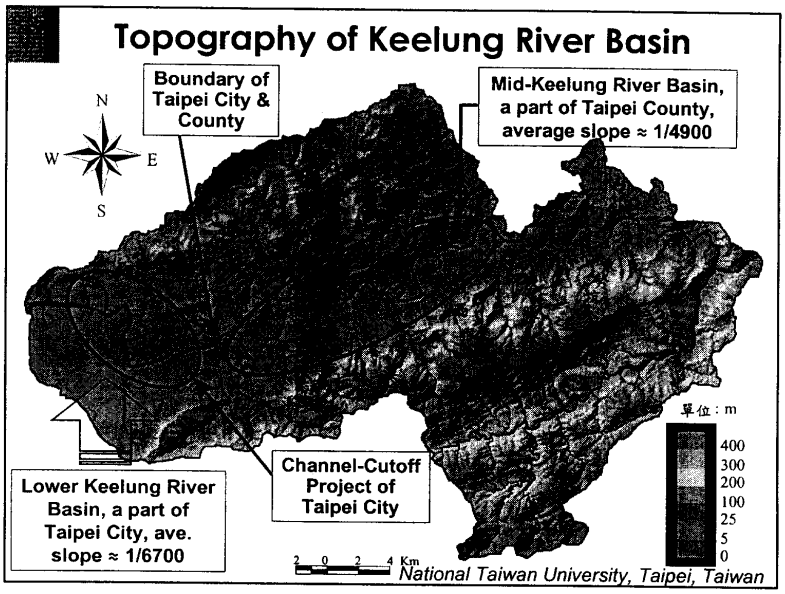
[2] Department of Bio-Environmental System Engineering,

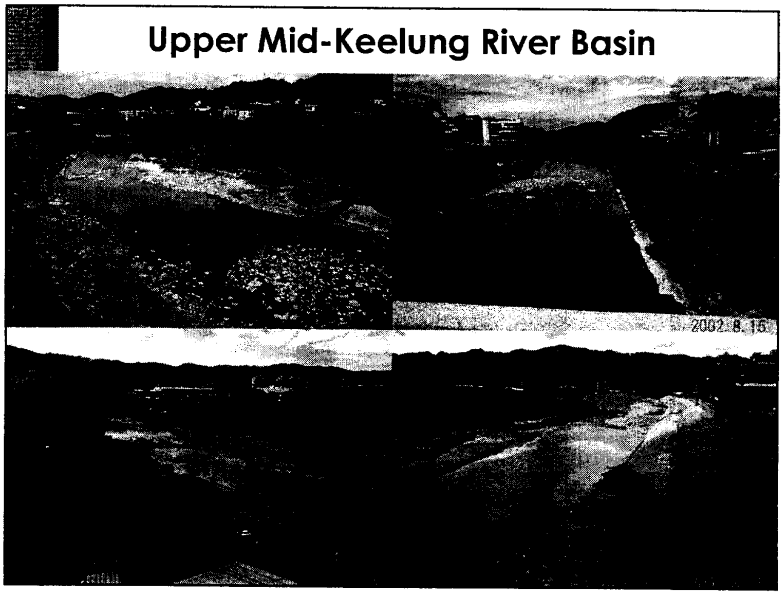
[1,2] Hydrotech Research Institute

National Taiwan University, Taiwan

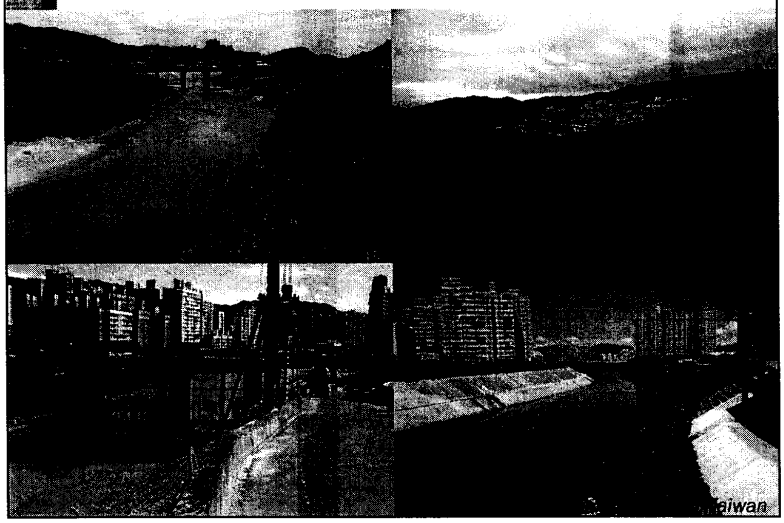
Content

- Background of Mid- and Lower Keelung River Basin
- A Short History of Flood Events and Mitigation Countermeasures
- The Integrated Flood Mitigation Project
- What are the lessons learnt ?

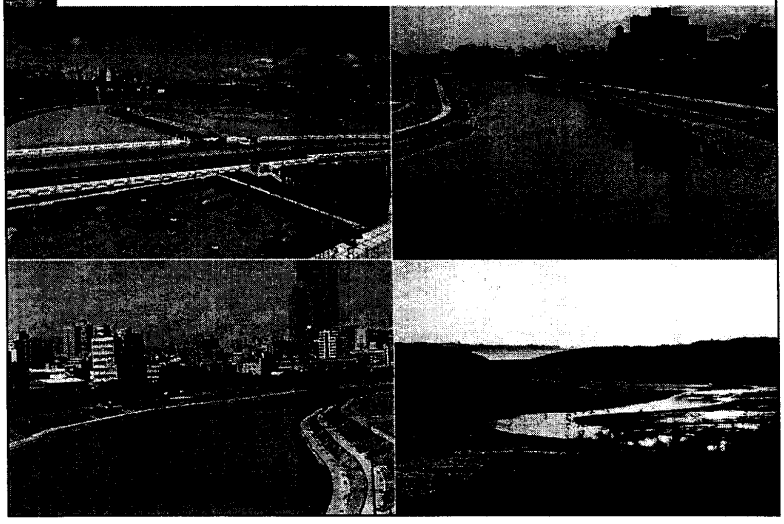

Topography of Keelung River Basin
Boundary of Taipei City & County
Mid-Keelung River Basin, a part of Taipei County, average slope ≈ 1/4900
N
W
E
S
單位：m
400
300
200
100
25
5
0
Channel-Cutoff Project of Taipei City
Lower Keelung River Basin, a part of Taipei City, ave. slope ≈ 1/6700
2 0 2 4 Km
National Taiwan University, Taipei, Taiwan


Upper Mid-Keelung River Basin
2002.8.15

Lower Mid-Keelung River Basin

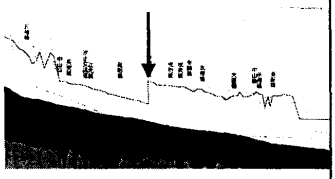


The Lower Keelung River & Taipei City



Floods & Structural Mitigation Projects

- 1971 "Taipei Integrated Flood Mitigation Project" is only up to the Taipei City-County boundary. Mid-Keelung River Basin was not included in the project.



- Due to rapid development in mid-Keelung River Basin, the Provincial Government completed the Preliminary Mitigation Plan in August 1985.
- Taipei City started the channel-cutoff project study in 1985 and completed the construction in 1996. Since then, Taipei City is protected against 200-year flood.

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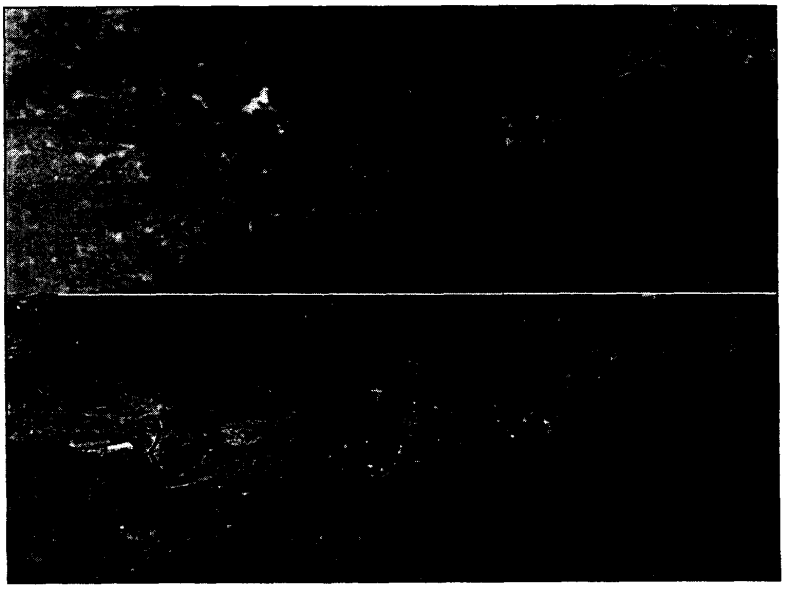
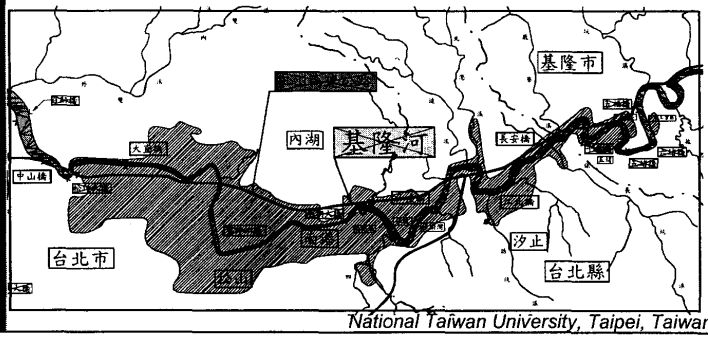


Recent Floods & Mitigation Projects

- Typhoon Lynn at Oct. 25~26, 1987 accompanied by the northeasterly monsoon, together they brought heavy rainfall and caused serious inundation along the Keelung River, both Taipei City and County.



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Recent Floods & Mitigation Projects

- After Typhoon Lynn, the Preliminary Mitigation Plan was reexamined and revised in July 1988.
- According to the "Fundamental Flood Mitigation Plan", the river training boundary was announced in 1992.
- The announced river training boundary conflicted the existing urban development plan of Hsichih Town and Keelung City.
- The local governments had difficulties to change the corresponding urban development plan and resolve the land acquisition procedures for levee construction.
- The Provincial Government started the "initial phase of the project" in May 1997. It includes bottlenecks widening, levee building and channel dredging. With those countermeasures, 10-year return-period flood is able to be contained in the channel.

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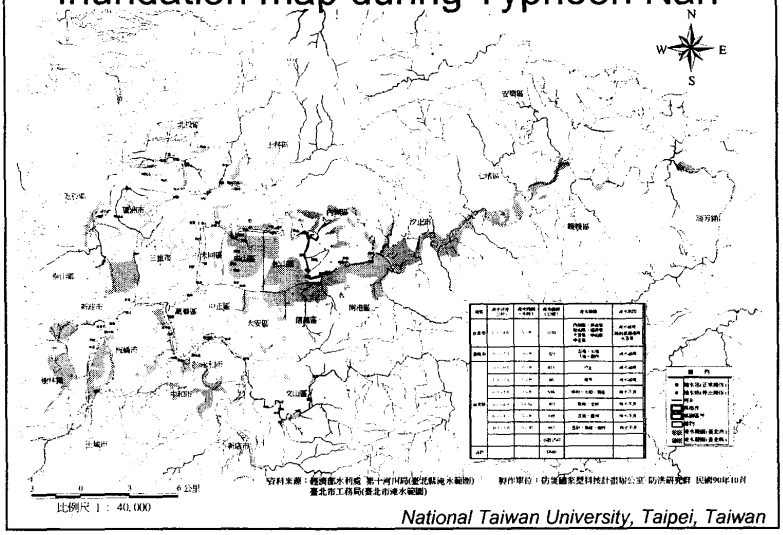
Major Floods in Keelung River

Typhoon & Date	Wudu Station			Inundation	
	3-day Rainfall (mm)	Highest Hourly Rainfall (mm)	Highest Stage (m)	Area (ha)	Max. Depth (m)
Lynn Oct. 24, 1987	847	79	16.92	916	~3.0
Zeb Oct. 15, 1998	614	57	16.02	345	~2.0
Babs Oct. 25, 1998		37	16.13	338	~1.8
Xangsane Oct. 31, 2000	752	49	17.98	553	~3.0
Nari Sep.16, 2001	972	120	19.14	6,640*	~4.0

* Inundation area of the whole Tanshui River Basin

National Taiwan University, Taipei, Taiwan

Inundation map during Typhoon Nari



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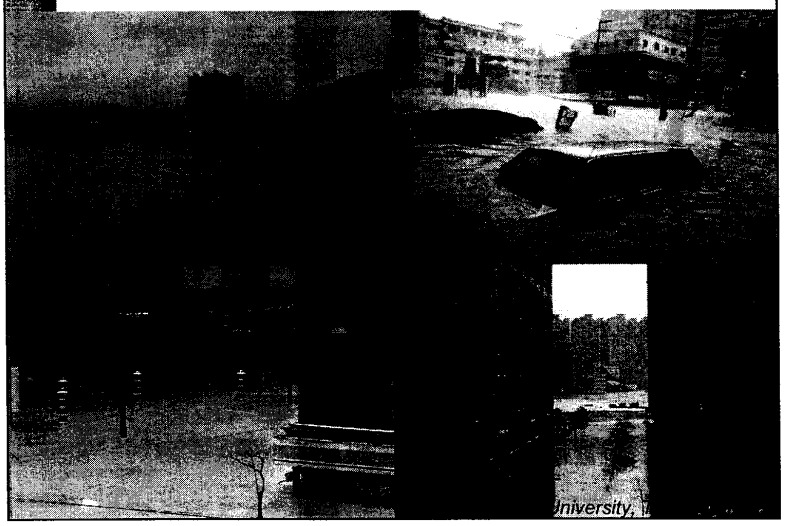
Inundation at Mid-Keelung River Basin

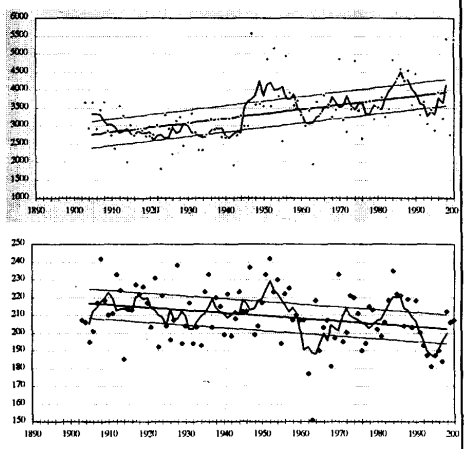


Recent Floods & Mitigation Projects

- After Typhoon Zeb and Babs in Oct. 1998, the Executive Yuan demanded to speed up the "initial phase of the project".
- Raising the levee height to 200-year flood proposed by the "Fundamental Flood Mitigation Plan" is not a favorable solution due to:
  - The heights of the levee is something people cannot bear their sights of.
  - The flood peak is amplified due to increased rainfall and urbanization effect.

Climate Change in Keelung Rainfall Station

- Record period: 1903-2000
- Annual rainfall amount increases 1185 mm in 98 years.
- The number of rainy days decreases 14.6 days in 98 years



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Recent Floods & Mitigation Projects

- The flood plain is highly developed, it is difficult and costly to acquire more land.
- All the existing bridges must be elevated or reconstructed, the backwater levees of subsidiaries must be built, highways and railroads crossing the subsidiary levees have to be elevated too.
- The benefit/cost ratio is too low, while the budget and the construction difficulties are too high.

Other alternatives must be applied in conjunction with the Fundamental Plan.

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Changes in Flood Peaks

Return Period	Analyzed Year	Station Discharge (m^3/s)			
		River Mouth 485 km^2	Grand Hotel 382 km^2	Wudu 181 km^2	Yuan-Shan-Tse 90 km^2
200 years	1970	4000	3200	2300	1000
	1988	4180	3170	2630	1090
	1998	4110	3110	2260	1070
	2001	5200	3950	2730	1620
	2002	5790	4690	2960	1780
10 years	1970	2610	2120	1470	620
	1988	2770	2150	1650	680
	1998	2570	2010	1450	690
	2001	3300	2590	1750	1040
	2002	3460	2760	1810	1080

National Taiwan University, Taipei, Taiwan

Recent Floods & Mitigation Projects

- The draft of "Integrated Flood Mitigation Plan for Keelung River" was prepared at April 2000.
- The following alternatives were investigated:

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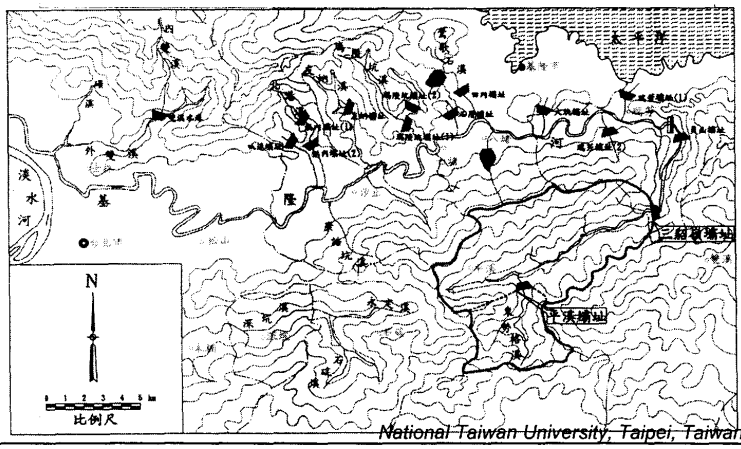
Flood Mitigation Reservoirs

Possible Reservoir/Detention Pond Sites



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Highland Water Interception & Diversions

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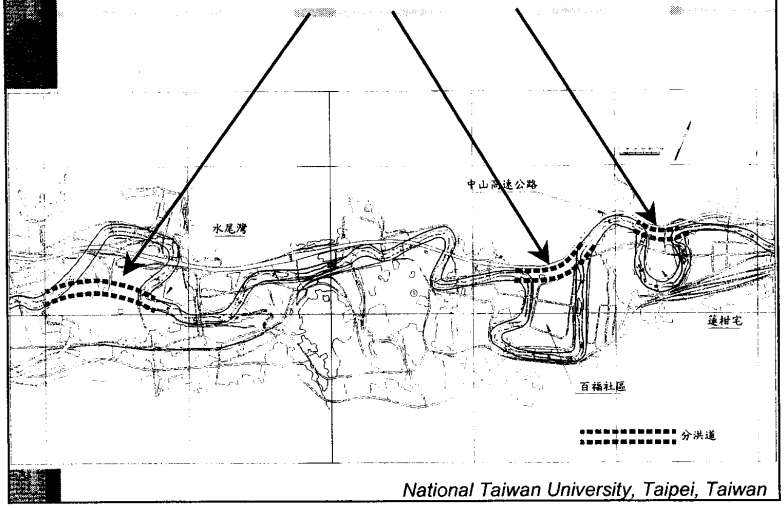
Channel Cutoffs



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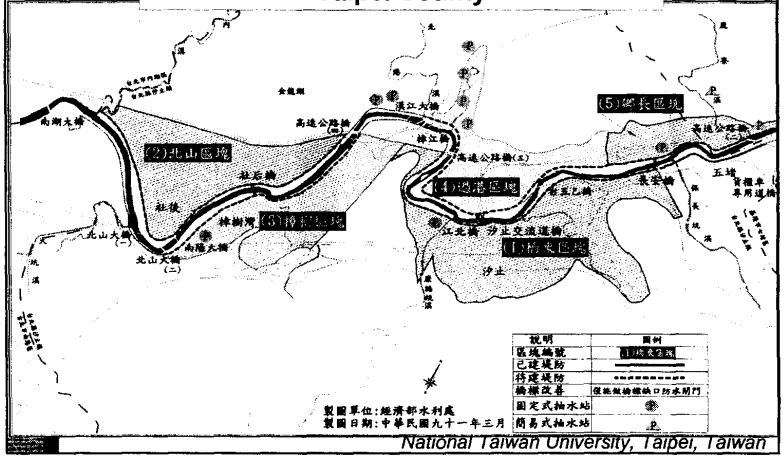
Flood Storage in the Flood Plain

University, Taipei, Taiwan

The Concept of Flood-Control-Blocks

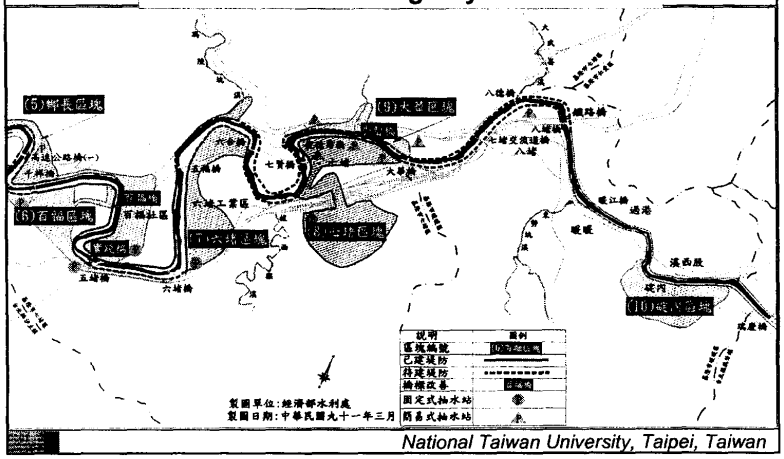
Taipei County



National Taiwan University, Taipei, Taiwan

The Concept of Flood-Control-Blocks

Keelung City



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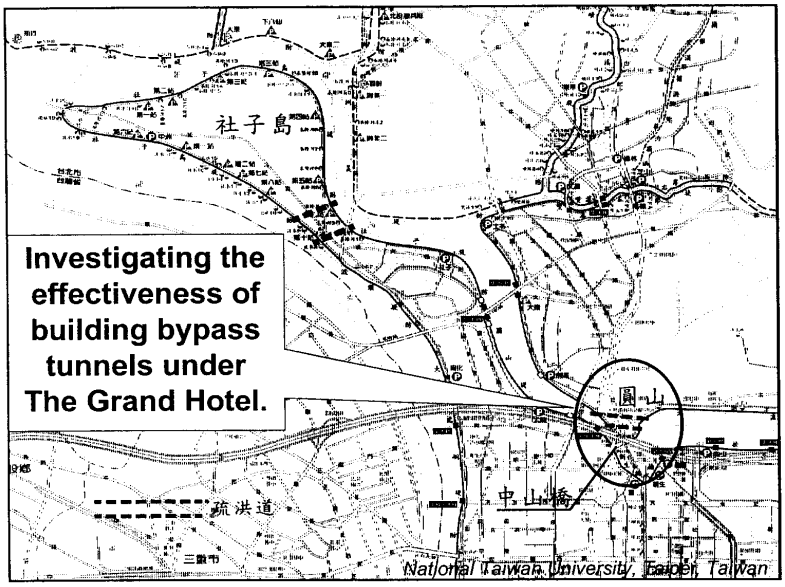
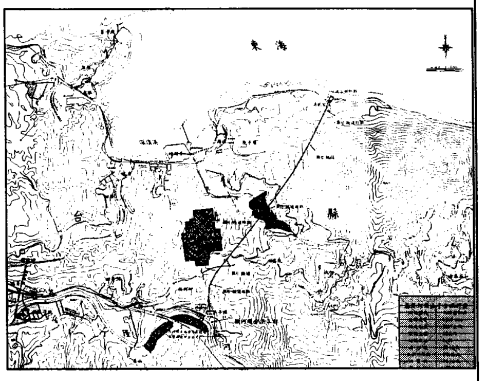


Yuan-Shan-Tse Diversion Plan

- The Yuan-Shan-Tse Diversion Tunnel was approved In June 2000.
- It can reduce the stages of the 200-year flood by ~1.5 meters.
- It does not cause any disturbances to the local society activities.



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Integrated Flood Mitigation Plan

Structural Mitigation Endeavors (Jul. 2002~Jun. 2008)

- The Yuan-Shan-Tse Diversion Tunnel (on going)
- Levee constructions, main channel and subsidiaries
- Building the urban drainage system
- Elevate the heights of bridges (25 in main stream and 6 in subsidiaries)
- Watershed management
- Retention storage plan (6 sites, 44 hectares, retention storage $=1.32\times10^6$ m^3)
- Yuan Mountain bypass tunnels (under investigation)
- Highland water interception and diversion plan (in the stage of feasibility study)

Integrated Flood Mitigation Plan

The Non-Structural Measures:

- Short term:
  - Flood plain zoning. The target area: 771-hectare inundation area of typhoon Xangsane.
  - Improve the hydrological and meteorological information system, accuracy of flood forecasts and effectiveness of warning dissemination
  - Develop mitigation action plan, provide training and education, prepare the needed resources.
  - Establish fundamental database for the purpose of hazard mitigation.

Integrated Flood Mitigation Project

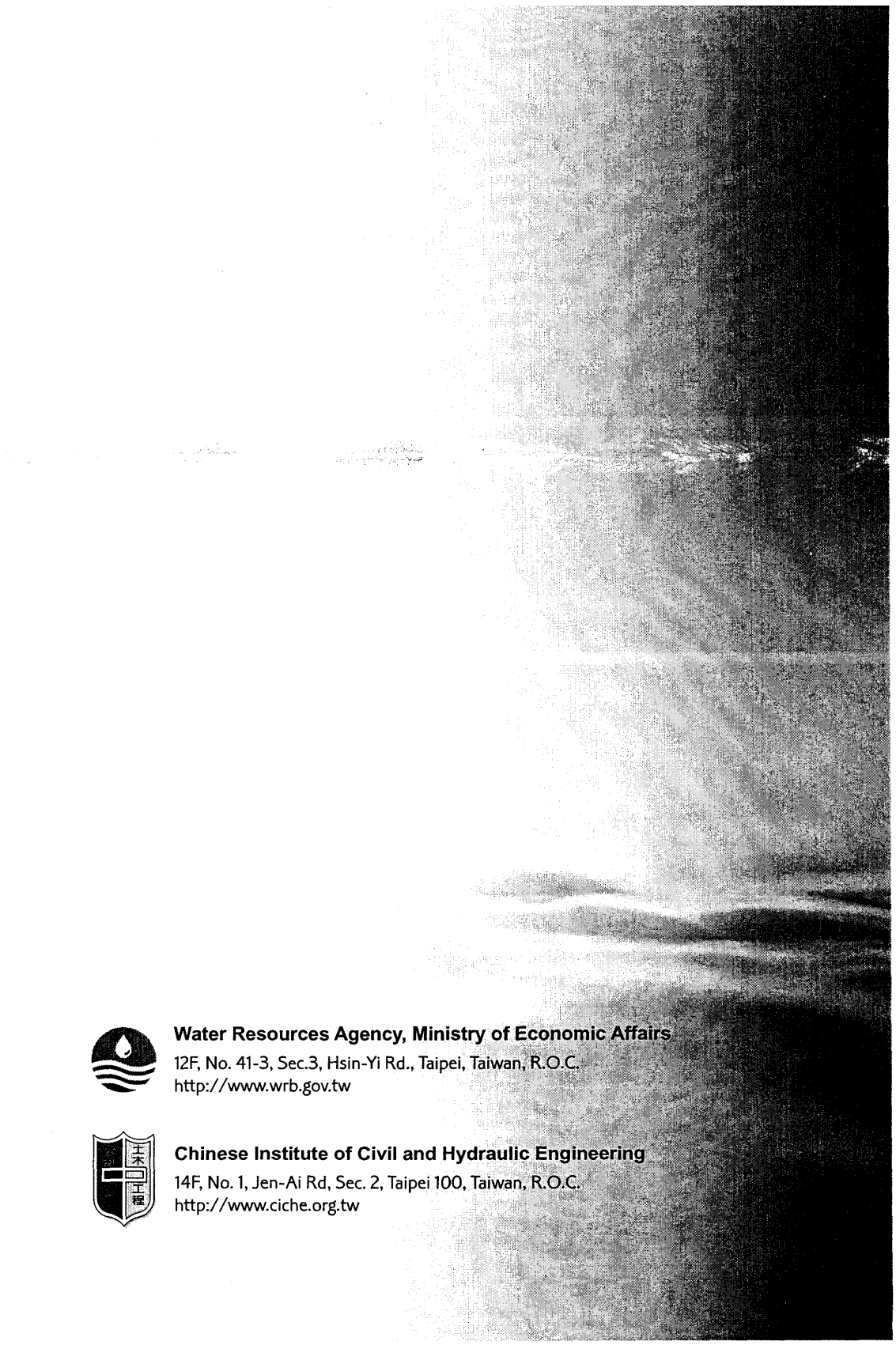
- Long term: (from the viewpoint of sustainable environment)
  - Limit 1st floor usage of major buildings in the potential inundation area.
  - Revise city zoning plan to gradually reduce the development intensity on flood plain.
  - Enforce permeable surface development as well as rain water storage and usage in construction code.

What are the lessons learnt ?

- Institutional problems:
  - In policy making procedure, the say of our water agency is relatively weak.
  - Lack of communication and consultation among government agencies, as well as lagging flood zoning behind the urban development, the land purchasing budget of Keelung River Project is over 50%.
- Without urban planning tied in with the flood plain control, the water resources officers and hydraulic engineers can not solve the flood mitigation problem alone.

What are the lessons learnt ?

- Accomplishment of structural measures in the first phase of Tanshui River Flood Mitigation Project has its background.
- Nonstructural measures are critical to the success of Keelung River Flood Mitigation Project.
- Engineers and planners in the 21st Century face new challenges in their designs of flood control measures.



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Chinese Institute of Civil and Hydraulic Engineering
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http://www.ciche.org.tw

附件五

「地層下陷防治」會議資料

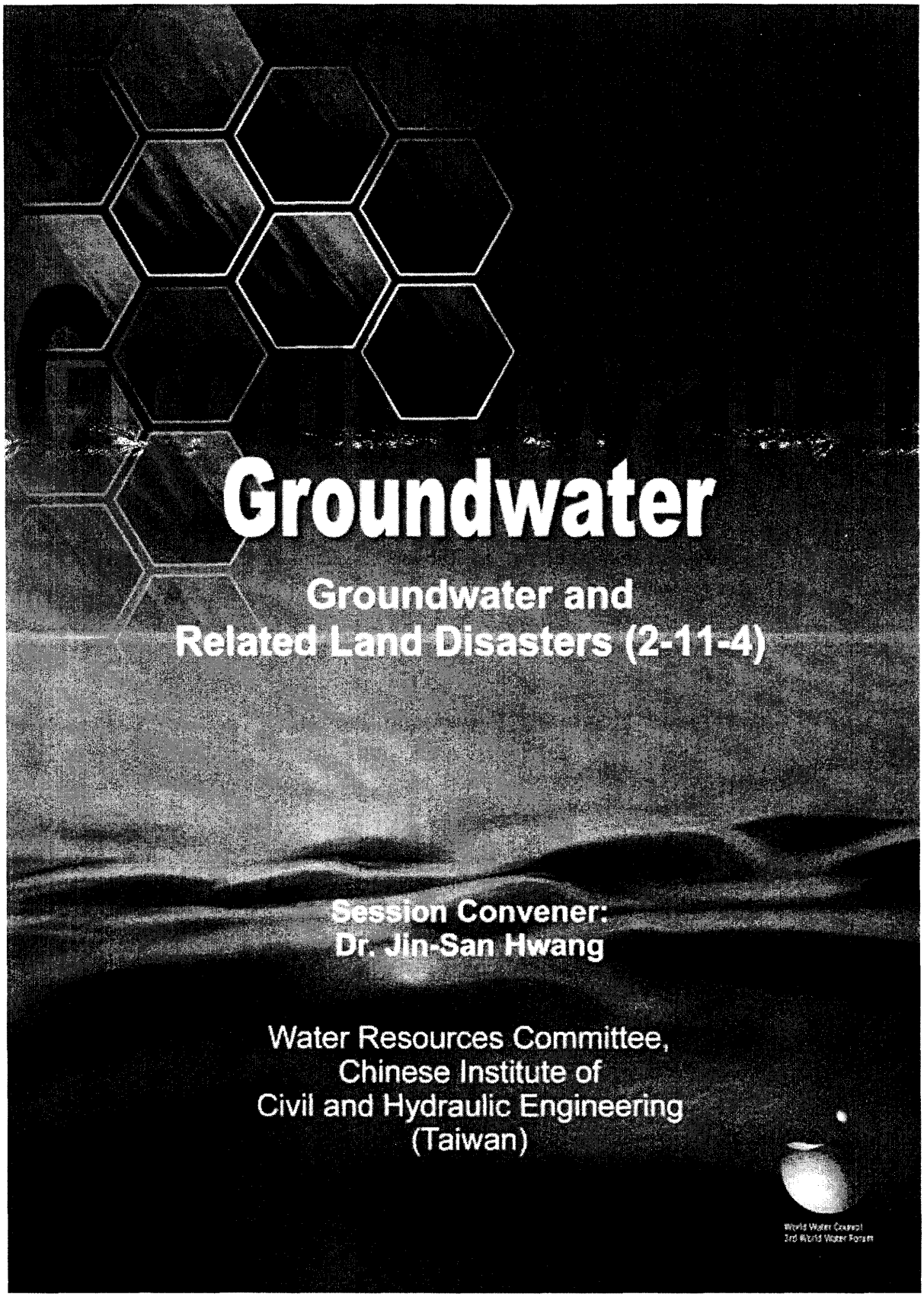

Groundwater
Groundwater and
Related Land Disasters (2-11-4)
Session Convener:
Dr. Jin-San Hwang
Water Resources Committee,
Chinese Institute of
Civil and Hydraulic Engineering
(Taiwan)
World Water Council
3rd World Water Forum

Table of Contents

Opening Remarks

Rapid popolution and industrial growth have significantly increased the water demand in Taiwan over the last several decades. Due to steep terrain and insufficient regulatory capacity, more than 80% of our annual runoff is lost to the surrounding ocean each year (Fig. 1). Reliability of surface water diversion, which accounts for 42% of our total annual water supply, is limited by uneven seasonal distribution of precipitation (and runoff). On the other hand, the easier access and lower development cost have led to excessive groundwater exploration in most of our coastal aquifers (Fig. 2) since the 1970's.

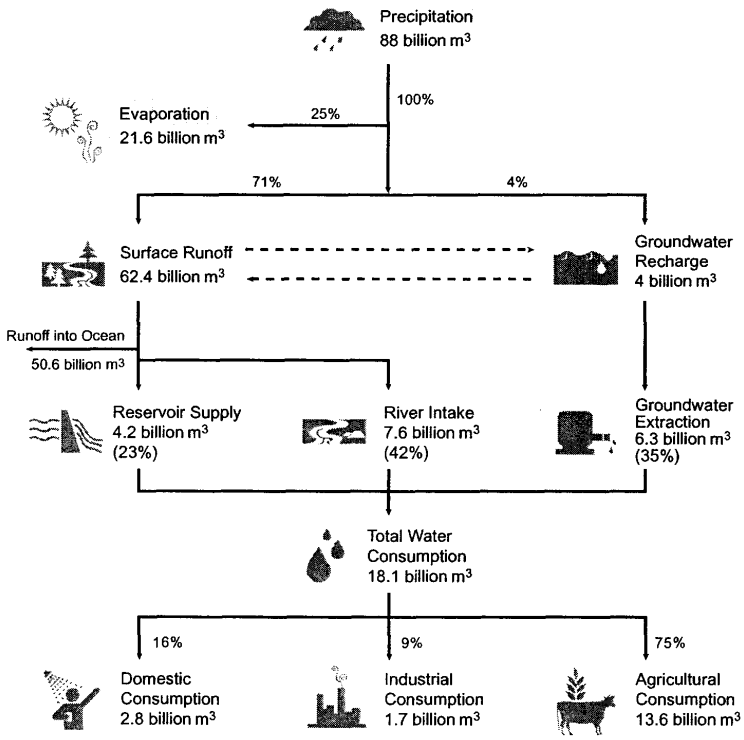


Fig.1 Annual Water Resource Utilization (Averaged between 1990 and 2000)

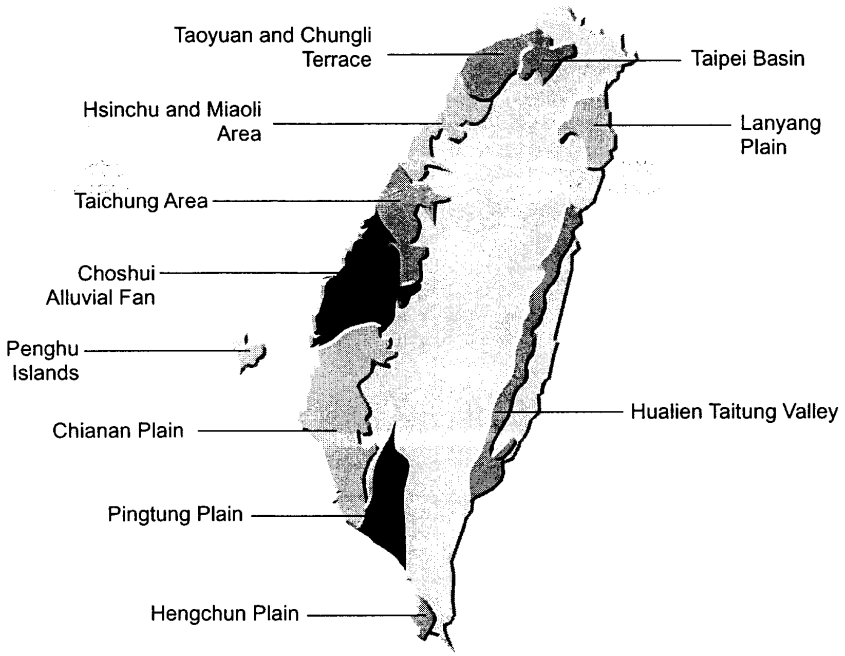


Fig.2 Taiwan's Groundwater Aquifers

Excessive groundwater development not only reduced the yield of the aquifers but also induced severe land subsidence problem in Taiwan. The latest survey showed that 17% of Taiwan's coastal plain, which covers an area of more than 1,890 km^2, was affected by land subsidence due to groundwater overdraft (Fig. 3). Some severely affected land subsidence areas have suffered enormous losses from properties damages, flooding, and infrastructure failures (Fig. 4).

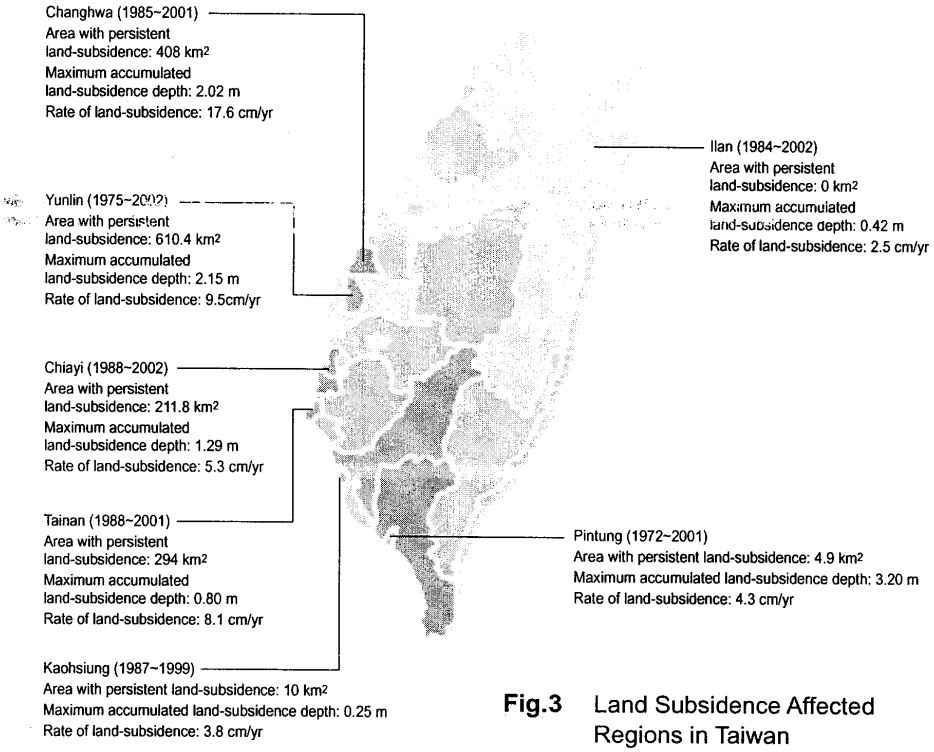


Fig.3 Land Subsidence Affected Regions in Taiwan

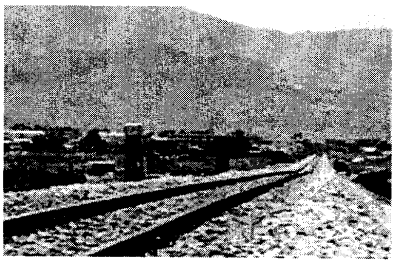


Fig.4
Railroad Failure Due to Land Subsidence near Jiadong, Pingtung County

Taiwan's government initiated a comprehensive program to better manage our groundwater resources and land subsidence problem in the 1990's. The program included the establishment of:

- an islandwide groundwater and land subsidence monitoring network (Fig. 5) to collect baseline hydrogeoiogic and land subsidence data (Fig. 6) for research and development of better management policies (Fig. 7)

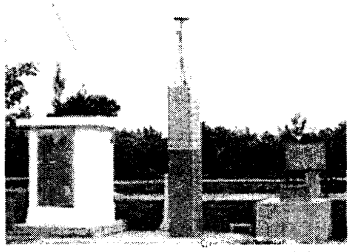


Fig.5 GIS Equipped Subsidence Monitoring Station, Yunlin County

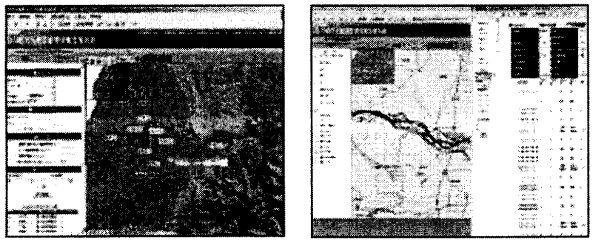


Fig.7 Groundwater Management Decision Support System

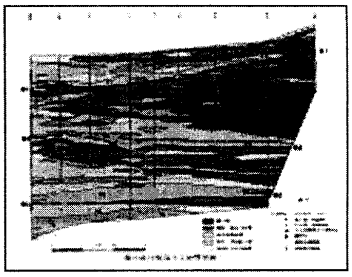


Fig.6 Geologic Profile of Choshui Alluvial Fan

- strictly enforced groundwater pumpage restriction zones in which all existing and new pumping wells are monitored and controlled (Fig. 8)

- new flood control pump stations and heightened floodwalls to prevent lowland flooding (Fig. 9)

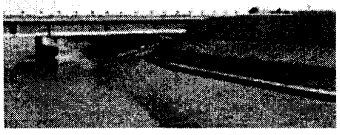


Fig.9 Heightened Floodwall in Changhwa County

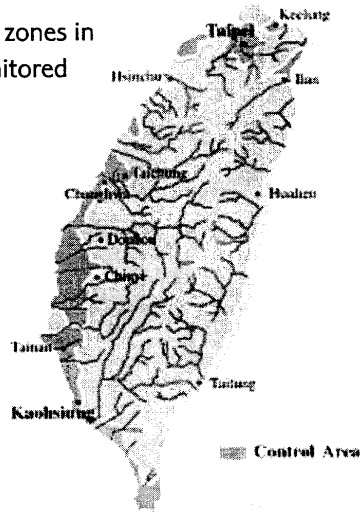


Fig.8 Groundwater Pumpage Restriction Zones in Taiwan

- revised landuse policies to discourage developments whose water supplies rely mainly on groundwater

- plans for conjunctive use of surface and ground water and other alternative water supplies to supplement groundwater withdrawal (Fig. 10)

- programs to assist residents and industries to adapt to groundwater management policies

- regularly held land subsidence prevention training seminars for professionals and citizens (Fig. 11)

Fig.10 Aquifer Storage and Recovery (ASR) Demonstration Site, Pingtung County

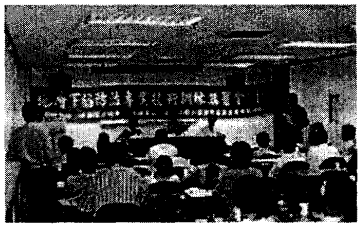


Fig.11 Land Subsidence Prevention Training Seminar

Session Introduction

This session is to introduce the challenges in managing groundwater resources and associated land subsidence problem in Taiwan. Our work are organized in three separate papers respectively entitled:

- Groundwater Management in Taiwan
- Groundwater Monitoring Network in Taiwan
- Land Subsidence Prevention in Taiwan

As a responsible member of the global community, we are committed to sustainable use of our water resources and exchange of our knowledge and experience with the rest of the world. We are honored to have the opportunity to present our work in this Third World Water Forum and we look forward to your participation and valuable comments.

Groundwater Management in Taiwan

Introduction

The island of Taiwan, shaped roughly like a tobacco leaf, has an area of 36,000km^2 and receives an average annual rainfall of 2,510mm. Based on the hydrogeological conditions, the coastal plain of Taiwan can be classified into nine groundwater subregions (Fig. 1), with an average annual groundwater recharge of 4.0 billion m^3.

There were only some seventy machine-drilled wells in Taiwan before 1945. At the turn of the 21st century, the number of wells reached 250,000 with an annual pumpage of 5.67 billion m^3.

Past Challenges

Groundwater management in Taiwan had faced several challenges before the 1990's:

- insufficient groundwater pumpage and recharge data,
- ineffective groundwater management policies,
- uncontrolled water right, and
- persistent decline of groundwater table and groundwater contamination.

The uncontrolled development of groundwater had led to undesirable economic damages due to saline water intrusion, land subsidence, and contamination.

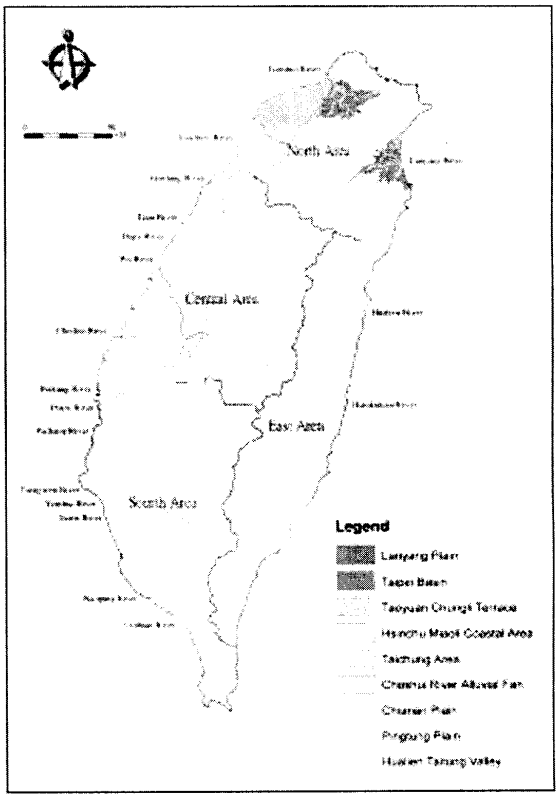


Fig.1 Taiwan and Its Groundwater Subregions

Groundwater Management Plans

To improve groundwater management, Taiwan's Water Resources Agency (WRA) had studied and prepared new policies and plans to achieve sustainable use of our groundwater in the 1990's. These plans include:

- establishment of a coordinated management framework,
- installation of an islandwide groundwater monitoring network,
- enforcement of new management policies,
- development of a groundwater management decision support system, and
- conjunctive use of surface and ground water.

The contents of these plans are briefly introduced here.

Establishment of a Coordinated Management Framework

According to our Water Law, while the local government is in charge of detecting and penalizing illegal use of groundwater, the central government is to study, enact and amend related policies. WRA promoted the "Rational Water Right Implementation Plan" in 1995, and helped 23 local governments to effectively manage their groundwater resources. In addition, WRA and Environmental Protection Administration (EPA) have since revised related regulations to cope with management decisions, which included:

•promulgating a "Groundwater Control Guidelines" to limit applications for new wells and regulate groundwater usages,

•delineating a "Severe Subsidence Area Map" and coordinate with land use policies to alter industrial developments and reduce groundwater consumption in subsidence affected areas (Fig. 2),

•revising the "Regulations for Well Drilling Industry" to promote the growth of the industry and related professionals, and

•establishing a "Regulations for Alleviation of Soil and Groundwater Contamination" to manage groundwater contamination.

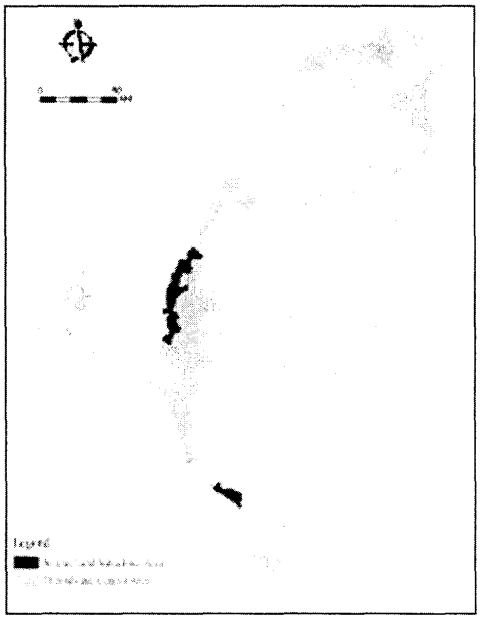


Fig.2 Severe Land Sebsidence and Groundwater Control Area

Installation of an Islandwide Groundwater Monitoring Network

To obtain sufficient baseline data of our aquifers and groundwater resources, four monitoring network installation plans, which included modernization and installation of existing hydrologic stations (Fig. 3), groundwater observation wells (Fig. 4), land subsidence monitoring stations (Fig. 5), and groundwater quality monitoring wells (Fig. 6), were initiated in 1992. The purposes of these projects are to integrate hydrologic, hydrogeologic, water quality, and terrain elevation data to improve the understanding of our groundwater resources. Details of these projects are presented in a separate paper in this session.

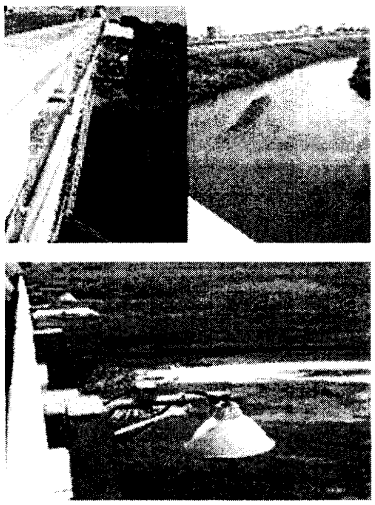


Fig.3 Modernization of Existing Hydrologic Station

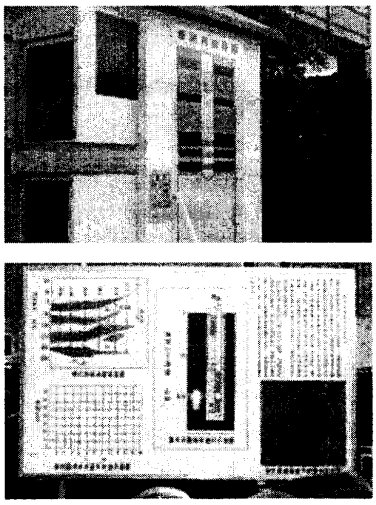


Fig.4 Groundwater Monitoring Wells

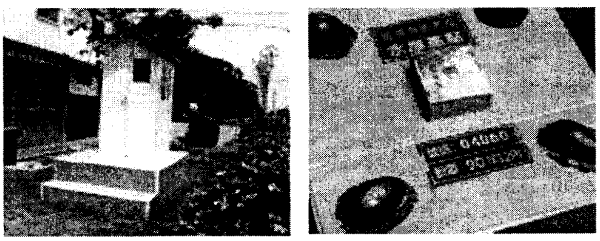


Fig.5 Land Subsidence Observation Station

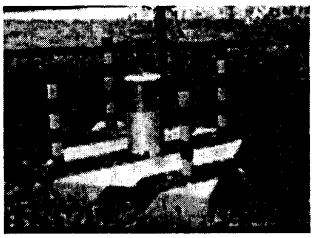


Fig.6 Groundwater Quality Monitoring Well

Enforcement of New Management Policies

The major tasks of enforcement of management policies include :

•Estimation of recharge: Estimated total groundwater recharge is 5.75 billion m^3 for wet years, 5.08 billion m^3 for average years, and 4.47 billion m^3 for dry years (Table 1). These latest recharge figures are used to define safe yields of our aquifers.

•Development of groundwater resources maps: A series of maps, including "Map of Groundwater Resources in Taiwan", and related atlas "Modulus Map of Groundwater" (Fig. 7), "Coefficient of Groundwater Flows" (Fig. 8), and "Coefficient of River Recharge" (Fig. 9) were developed for future investigations and research.

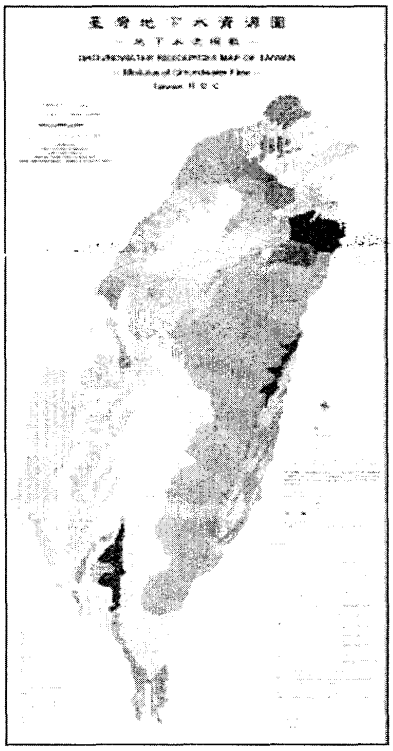


Fig.7 Groundwater Resources Map of Taiwan - Modulus of Groundwater Flow

Table 1 Estimated Groundwater Recharges in Taiwan

Groundwater Subregion \ Hydrologic year	Wet	Normal	Dry
Taipei Basin	66.2	51.0	45.0
Taoyuan Chungli Terrace	377.5	343.2	326.0
Hsinchu Miali Coastal Area	492.2	435.0	407.1
Taichung Area	578.2	555.4	545.9
Choshui River Alluvial Fan	1428.9	1380.7	1254.6
Chiana Plain	998.5	852.8	718.7
Pingtung Plain	964.3	777.8	582.1
Lanyang Plain	451.4	351.8	282.9
Hualien Taitung Valley	346.6	304.2	287.3
Hengchun Plain	47.2	24.7	19.7
Total	5751.0	5076.6	4469.3

Units:10^6m^3

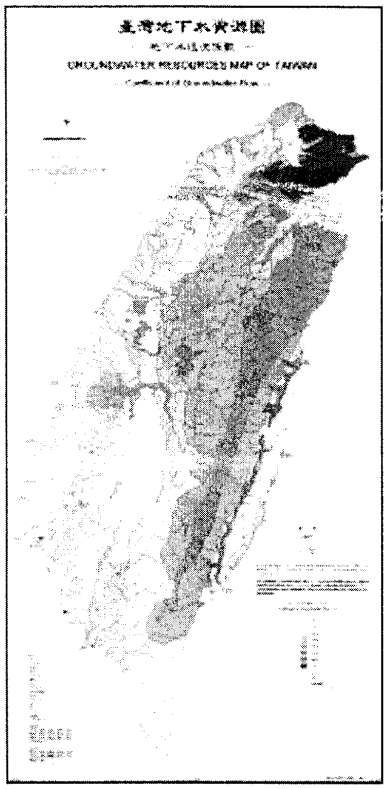


Fig.8 Groundwater Resources Map of Taiwan -Coefficient of Groundwater Flow

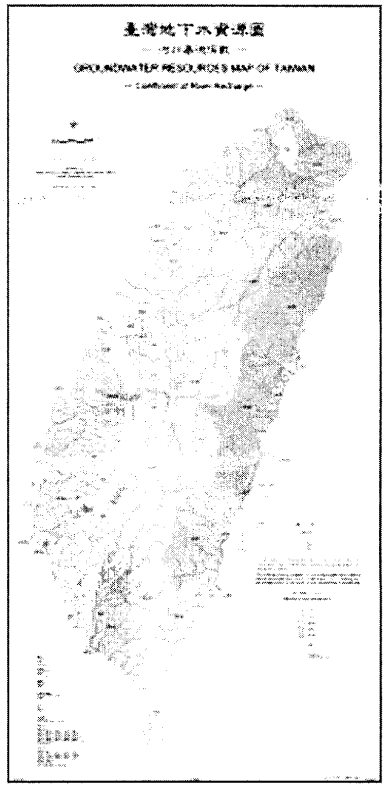


Fig.9 Groundwater Resources Map of Taiwan -Coefficient of River Recharge

• Investigation of hot spring resources: Located between Eurasia and Philippine Sea plates, Taiwan has abundant hot spring resources (Fig.10). WRA has promoted a four-year project named "Investigation and Exploitation of Hot Spring Resources in Taiwan", under the guidelines of "Management of Hot Spring Resources Exploitation" to control hot spring water right and to establish a hot spring database for more effective management of the resources.

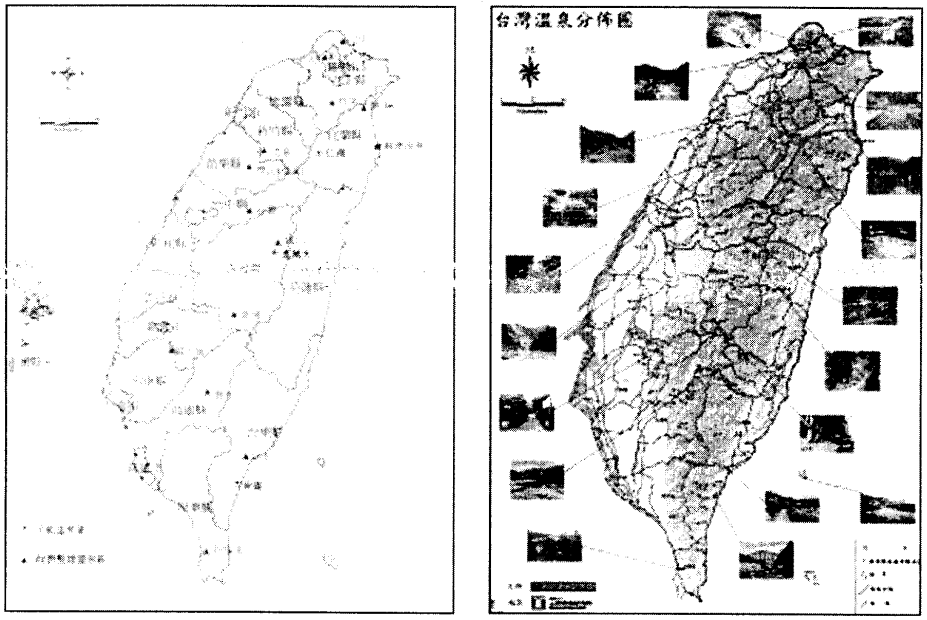


Fig.10 Hot Spring Resources in Taiwan

• Verification of water well information: Better control of water well information leads to successful water well management. In order to establish a complete database of groundwater wells and their pumpage records, WRA completed a "National Water Well Verification" project in 2000, which set the guidelines for water well verification in each of the subregions in successive stages.

• Metering of groundwater: Metering water usage is essential to effective water right management practices including water right registration, permit approval, and water tariff collection.

Development of Ground Water Management Decision Support Systems

To improve water managers' analytical capabilities, a two-phase project to establish an integrated groundwater management decision support system was implemented in 1996. The first stage of the project (1996-2000) was to establish a water right information and management support system to expedite water right registrations and improve data management and analysis capabilities (Fig.11).

The second stage of the project (2001-2005) is to complete a management decision support system for decision makers to obtain better information and feedbacks from management policies (Fig. 12).

Conjunctive Use of Surface and Ground Water

To manage our water resources between wet and dry seasons with distinctive hydrologic variability, plans for conjunctive use of surface and ground water in Choshui Alluvial Fan and Pingtung Plain have been developed. The primary principles of the plans are

- to encourage efficient use of surface water and to increase groundwater storage in wet season, and
- to supplement surface water supplies with appropriate withdrawal of groundwater in dry season.

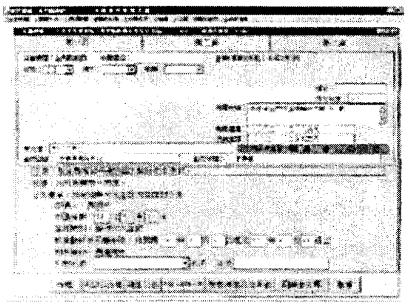


Fig.11 Water Right Management System—Query Results

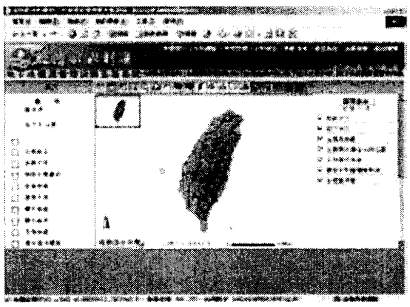


Fig.12 Management Decision Support System—Geologic Information Query

Concluding Remarks

We live on an island where average natural groundwater recharge to our coastal aquifers is about 4 billion m^3 per year. While it is better controlled now, we still use in excess of 5 billion m^3 of groundwater each year to support our agriculture, industries, and domestic consumption. Through the implementation of more effective plans and enforcement policies, and the investments in building more intelligent knowledge base and advanced analytical tools, our groundwater resources will be better managed and preserved in this century.

Groundwater Monitoring Network in Taiwan

Background

Groundwater is an important water resource in Taiwan. Due to uneven seasonal distribution of precipitation, groundwater is used as supplemental water supply during dry season. Excessive withdrawal of groundwater leads to serious problems of groundwater contamination, land subsidence, and seawater intrusion which impose immense land and property damages. Insufficient data has been a major limitation in our groundwater management. Therefore, installation of an effective groundwater monitoring system is imperative in Taiwan. This paper introduces the implementation of a comprehensive monitoring network and its preliminary accomplishments.

Project Objectives

The objectives of this project are to

- obtain long term hydrogeologic and groundwater quality data,
- conduct hydrogeology and groundwater related research for the better understanding of our aquifers,
- establish a groundwater resources information and decision support system to facilitate data utilization and information sharing in groundwater management,
- institute new guidelines for groundwater utilization and conservation.

Project Tasks

The project consists of six major tasks:

(1) Geological and Hydrogeological Survey and Investigation

(2) Installation, Operation and Maintenance of Monitoring Wells

(3) Groundwater Quality Sampling and Analysis

(4) Groundwater Related Research and Studies

(5) Development of Groundwater Management Decision Support System

(6) Public Education

The monitoring network was to be implemented from 1992 to 2008 in three stages as shown in Table 1.

Table 1 Groundwater Monitoring Network Implementation Plan

Stages	Groundwater Zone	Hydrogeology Investigation Station		Groundwater Monitoring Well		Pumping Test Well	
		Planned	Accomplished	Planned	Accomplished	Planned	Accomplished
First Stage 1992-1998	Choshui Alluvial Fan	81	93	188	188	56	51
	Pingtung Plain	60	52	148	127	27	23
	Subtotal	141	145	332	315	83	74
Second Stage 1999-2003	South part of Chianan Plain	100	49	212	111	40	24
	Lanyang Plain	22	14	40	19	8	6
	Hsinchu-Miaoli Coastal Area	48	29	85	36	17	8
	Penghu islands	13	0	25	0	6	0
	Subtotal	183	92	362	166	71	38
Third Stage 2004-2008	Taipei Basin	27	0	46	0	10	0
	Taoyuan-Chungli Terrace	42	0	85	0	16	0
	Taichung Area	47	0	57	0	13	0
	Hualien-Taitung Valley	68	0	88	0	18	0
	Hengchun Plain	9	0	20	0	4	0
	Subtotal	193	0	296	0	61	0
Total		517	237	990	481	215	112

Preliminary Accomplishments

Geological and Hydrogeological Survey and Investigation

The Hydrogeological investigation wells were placed about 5 km apart and reached 250 to 300 m depths. The core samples were photographed and well logs, sediment distribution, geological ages, and chemical compositions were recorded. Geological column (Fig. 1), cross sections (Fig. 2) and fence diagrams (Fig. 3) of main aquifers were constructed.

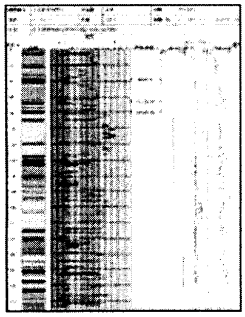


Fig.1 Geological Column

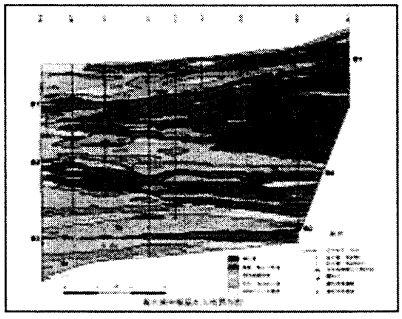


Fig.2 Geological Profile of Choshui Alluvial Fan

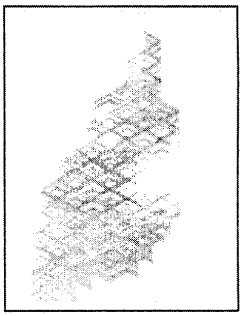


Fig.3 Fence Diagram of Choshui Alluvial Fan

Installation, Operation and Maintenance of Monitoring Wells

By 2001, 186 hydrogeological survey stations and 481 groundwater monitoring wells had been installed in Choshui Alluvial Fan, Chianan Plain, Pingtung Plain, Lanyang Plain, and Hsinchu-Miaoli Area (Fig. 4). Twenty seven percent of the wells are shallow wells (depth less than 60m) and the others are deep wells (depth over 60m). Pumping tests were performed to determine transmissivities and storage coefficients of the aquifers. A typical groundwater monitoring station is shown in Fig.5.

Well camera was used to examine inclination of well casing and broken perforated pipes (Fig. 6). Well water quality was analyzed to detect well corrosion potential. Latest data collection technologies have been applied to all monitoring wells (Figs. 7 and 8).

Fig.4 Groundwater Monitoring Network in Taiwan

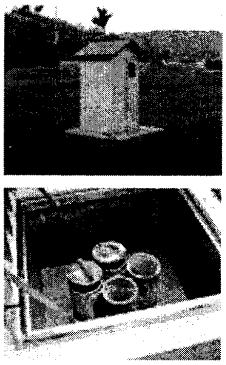


Fig.5 Typical Groundwater Monitoring Station

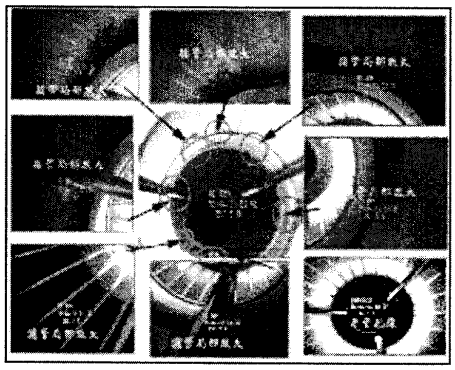


Fig.6 Photo Images of Well Body

Fig.7 Groundwater Table Data Download to PDA

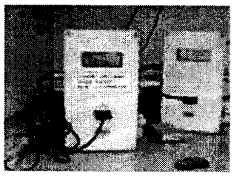


Fig.8 Use of GSM for Data Transfer

Groundwater Quality Sampling and Analysis

Groundwater quality data were taken from monitoring wells which, together with those gathered from groundwater quality monitoring network installed by our Environmental Protection Administration, can not only delineate the extent of groundwater pollution but also set up an early warning system for all groundwater users(Fig. 9).

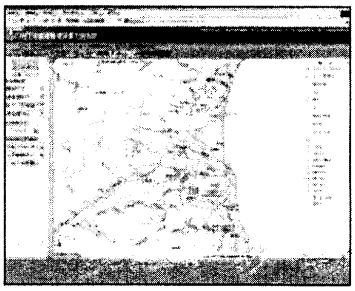


Fig.9 Groundwater Quality Warning Map of Lanyang Plain

Groundwater Related Research and Studies

The availability of more and better hydrogeological data has enabled several key groundwater related research and studies which were otherwise difficult to realize.

These studies include thorough investigations of existing wells (Fig. 10), development of several complex simulation models, building of an islandwide groundwater database (Fig. 11), management of hot spring resources (Fig. 12), a valuable tourism attraction in Taiwan, and more accurate estimation of groundwater pumpages and natural recharges.

Fig.10 Well Investigation

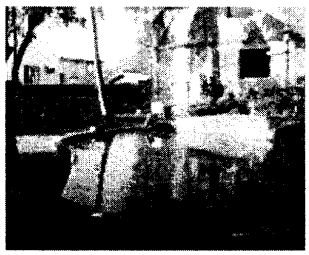


Fig.12 Hot Spring Resources in Taiwan

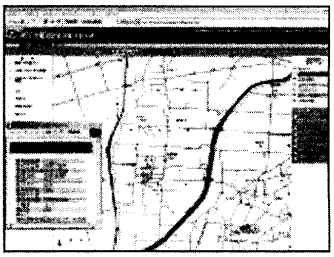


Fig.11 Groundwater Database

Concluding Remarks

The installation and maintenance of a modern groundwater monitoring network have facilitated valuable hydrogeological data which were previously unavailable to decision makers, managers, and researchers. By 2008, Taiwan will have completed one of the most comprehensive regional groundwater monitoring network in the world. We are proud to have the opportunity to share our plan and experience with the world water resources community.

Land Subsidence Prevention in Taiwan

Background

Land subsidence due to overdraft of groundwater has been observed in many parts of the world. In Taiwan, due to its relatively low development cost, groundwater has been the main source of water supply for most aquacultural and coastal industries since the 1970's.

The overdraft of groundwater had caused serious land subsidence in the coastal areas (Figs. 1 and 2) which in turn had resulted in extensive economical losses from frequent floodings (Fig. 3) and other infrastructure failures. Total subsidence affected area due to groundwater overdraft in Taiwan had at one point in time exceeded 1,890 km^2.

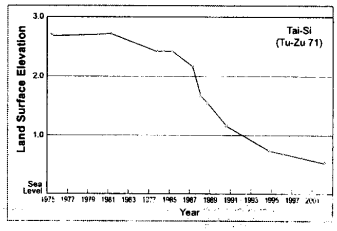


Fig.1 Land Surface Elevation Variation at Tai-Si (Tu-Zu71) Station in Yun-Lin County

Recognizing the severity of the situation, Taiwan's government initiated a five-year Land Subsidence Prevention and Reclamation Plan (LSPRP, or the Plan) in 1995 to remediate land subsidence problem in seven counties and municipalities. LSPRP was extended for another five years in 2001 to comprise numerous strategic and administrative objectives and tasks, including the division of manpower and responsibility between central and local governments. The contents and preliminary achievements of the Plan are introduced in this paper.

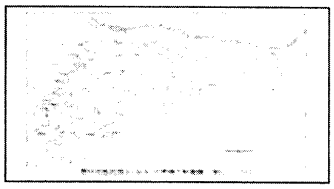


Fig.2 Accumulated Land Subsidence from 1992 to 2002 in Yun-Lin County

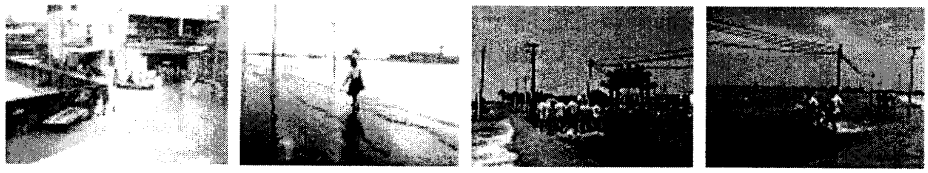


Fig.3 Coastal Flooding during Typhoon Season

Objectives

LSPRP's main objectives are: (1) to alleviate land subsidence problems from groundwater overdraft and (2) to develop improved landuse and water resources plans in subsidence affected areas to minimize further economic and social losses.

Principles

The Plan has been executed under the following three guiding principles:

(1) The Plan shall coordinate with applicable county and/or municipal development plans.

(2) The Plan shall strike a balance between ecological conservation and economic development and in accordance with rational water resources utilization plan.

(3) Public eduation and law enforcement shall both be emphasized to maintain current living conditions of the citizens.

Implementation Strategies

LSPRP's implementation contains five general topics. Their strategies and tasks are briefly presented below.

Landuse Planning in Subsidence Affected Areas

The main work is to develop new landuse policies and measures for all subsidence affected areas. These policies and measures are to clearly delineate areas where specific developments are permitted (or prohibited).

The task also includes the assessment and development of guidelines and technologies to reclaim subsidence affected areas for specific landuse purpose.

Aquaculture Production Control and Water Management

One of the key strategies of this task is to restrict water consumption of aquacultural industries through production control. Specific targets and measures include setting an annual production cap of 270,000 tons for domestic market only, reducing fishpond area from 52,000 to 22,000 hectares, converting fishponds to recreational facilities (Fig. 4), adopting alternative harvesting methods to replace inland fishponds (Fig. 5), and revising aquacultural practices such as raising premature stocks instead of adult fish.

For water conservation, annual water demand target for the entire aquacultural industry is limited to 700 million cubic meters, and all groundwater from subsidence affected areas are to be supplied only from public wells managed by producers' own associations. All illegal or unregistered private wells are to be capped.

The task also includes the development and promotion of water reuse technologies (Fig. 6) and salt-water aquacultures (Fig. 7) to reduce the industries' reliance on fresh groundwater.

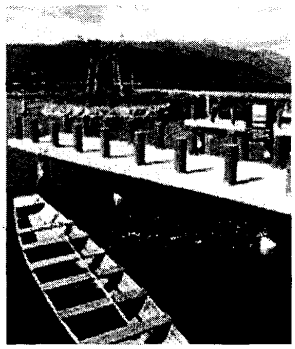


Fig.4 Conversion of Fishpond to Recreational Facility in I-Lan County

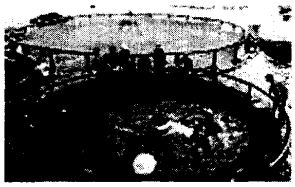


Fig.5 Seanet Harvesting Method to Replace Fishponds

Fig.6 Development of Water Reuse Technologies in Aquaculture Production Zone in Yun-Lin County

Fig.7 Ta-Wen Salt Water Supply Factory in I-Lan County

Industrial Water Management and Development

In order to increase efficiency of industrial water consumption, this task sets a goal of 5% increase in industrial water reuse each year. A team named "Industrial Water Use Task Force" was set up to guide coastal industries to implement effective water conservation measures, including the establishment of standards for rational water use in factories and review of water use plans for major factories.

This task also includes planning and implementing new surface or alternative water supply systems (Fig. 8) to provide stable water supplies to coastal industries.

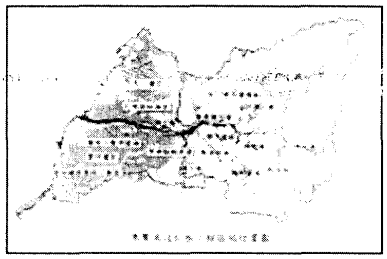


Fig.8 Chi-Chi Dam and It's Water Distribution System

Monitoring and Enforcement

Comprehensive surveys of coastal regions' hydrogeology, land subsidence, and existing wells have been executed in this task. The surveyed information are used to develop control and enforcement guidelines. Although established in phases, our groundwater and soil monitoring networks have been significantly strengthened by this task.

Several unsuitable and outdated groundwater related laws have been or are to be amended in this task. To enforce the laws, electricity cutoff has been used as a soft deterrent to illegal fishponds and wells (Fig. 9) in the transition period. Guidelines for groundwater metering practice and tariff are to be implemented. Groundwater recharge areas (Fig. 10) are delineated and controlled from surveyed data, and plans for conjunctive use of surface and ground water resources are developed to prevent overuse of groundwater in coastal areas.

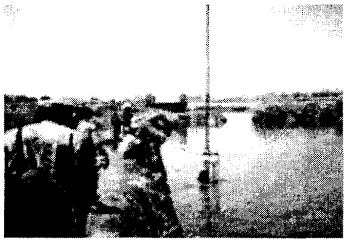


Fig.9 Dismantling Illegal Wells in I-Lan County

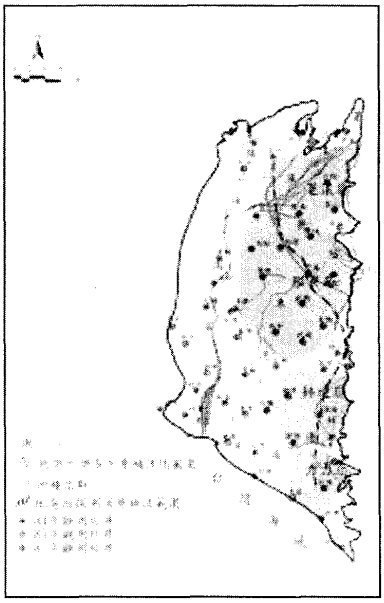


Fig.10 Groundwater Recharge Zones in Ping-tung Plain

Public Education

Strengthening public education is a major task of the Plan. This work includes publication of educational materials for land subsidence prevention and reclamation (Fig. 11), and periodically holding public hearings, training courses, and seminars to encourage public participation in the Plan (Fig. 12).

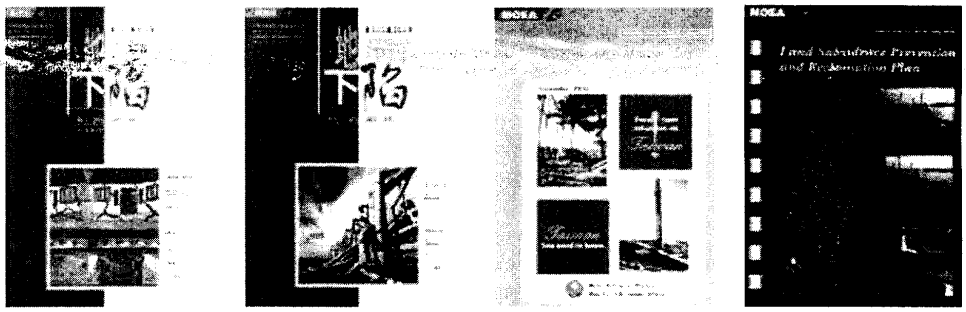


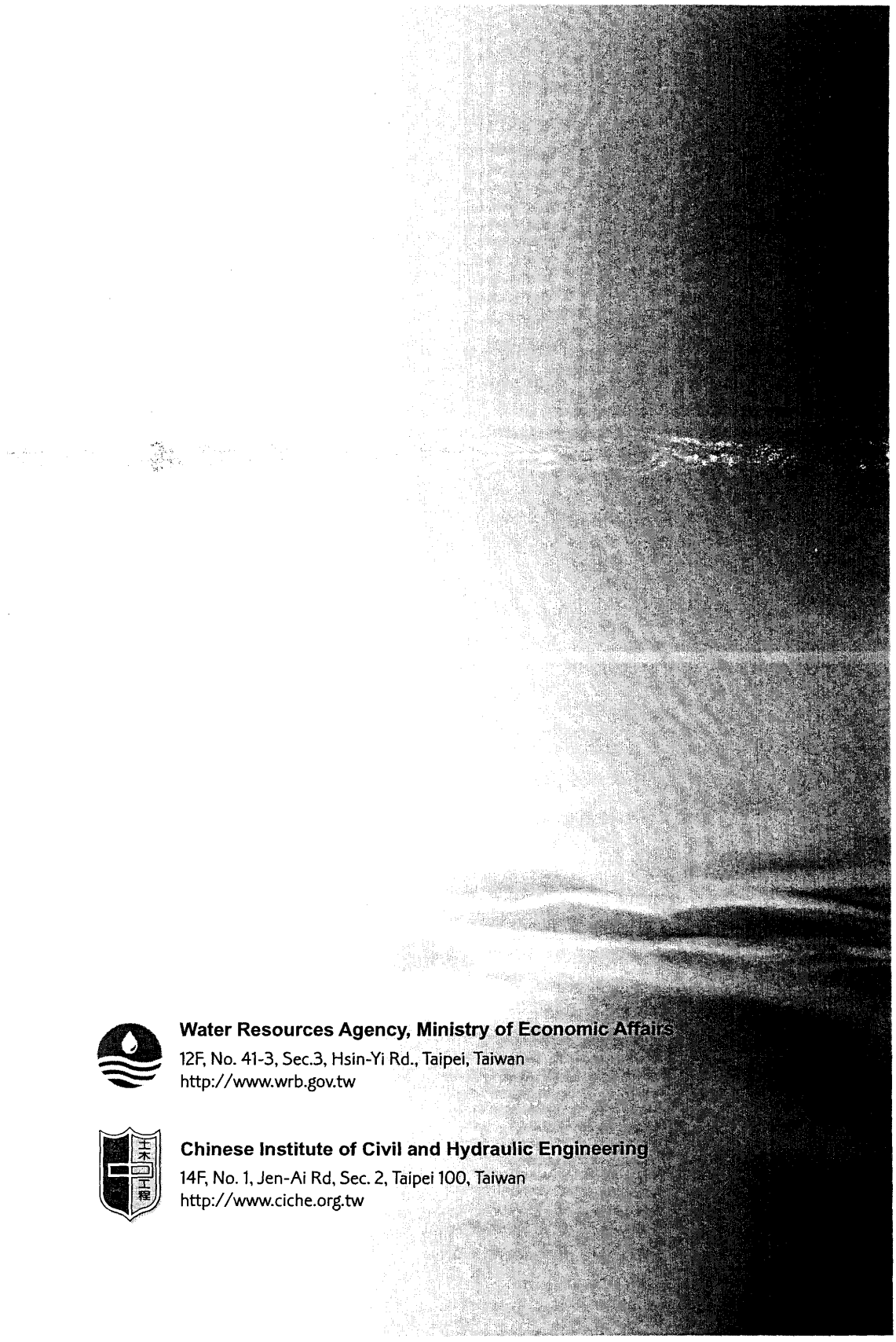
Fig.11 Publications of Land Subsidence Prevention and Reclamation

Closing Remarks

By the end of the first phase of the Plan (the year 2000), groundwater withdrawal in Taiwan had significantly reduced from 7.1 to 5.67 billion m^3/year. Aquacultural use of groundwater had reduced from 2.4 to 1.14 billion m^3/year. Groundwater levels had risen up and seawater intrusion had been repelled in some coastal regions. Land area where subsidence rate exceeds 3 cm/year had been reduced from 1,616 to 920 km^2.

Fig.12 Public Education,Training Sessions, Public Hearings, and Technical Seminars for Land Subsidence Prevention and Reclamation

Although our land subsidence problem has been controlled, much work still lies ahead. The second phase of LSPRP, extended for another five years in 2001, is focusing on preserving and enhancing land value and living quality of the citizens in all land subsidence affected regions.



Water Resources Agency, Ministry of Economic Affairs
12F, No. 41-3, Sec.3, Hsin-Yi Rd., Taipei, Taiwan
http://www.wrb.gov.tw

Chinese Institute of Civil and Hydraulic Engineering
14F, No. 1, Jen-Ai Rd, Sec. 2, Taipei 100, Taiwan
http://www.ciche.org.tw

附件六

「京都部長宣言」

（英文全文）

Ministerial Declaration
--- Message from the Lake Biwa and Yodo River Basin---

23 March 2003

We, the Ministers and Heads of Delegation, assembled in Kyoto, Japan on 22-23 March 2003, on the occasion of the 3rd World Water Forum. Building upon the outcomes of the Monterrey Conference on Financing for Development, the World Summit on Sustainable Development (WSSD), and the United Nations Secretary General's Water, Energy, Health, Agriculture and Biodiversity (WEHAB) initiative as well as other water-related events, we assert our common resolve to implement the appropriate recommendations in order to achieve the internationally agreed targets and goals including the United Nations Millennium Development Goals (MDGs).

Taking note of the thematic and regional statements and recommendations from the 3rd World Water Forum, we declare the following:

[General Policy]

1. Water is a driving force for sustainable development including environmental integrity, and the eradication of poverty and hunger, indispensable for human health and welfare. Prioritizing water issues is an urgent global requirement. Each country has the primary responsibility to act. The international community as well as international and regional organizations should support this. Empowerment of local authorities and communities should be promoted by governments with due regard to the poor and gender.

2. Whilst efforts being undertaken so far on water resources development and management should be continued and strengthened, we recognize that good governance, capacity building and financing are of the utmost importance to succeed in our efforts. In this context, we will promote integrated water resources management.

3. In managing water, we should ensure good governance with a stronger focus on household and neighborhood community-based approaches by addressing equity in sharing benefits, with due regard to pro-poor and gender perspectives in water policies. We should further promote the participation of all stakeholders, and ensure transparency and

accountability in all actions.

4. We are committed, in the long term, to fortify the capacity of the people and institutions with technical and other assistance from the international community. This must include, among others, their ability to measure and monitor performance, to share innovative approaches, best practices, information, knowledge and experiences relevant to local conditions.

5. Addressing the financial needs is a task for all of us. We must act to create an environment conducive to facilitating investment. We should identify priorities on water issues and reflect them accordingly in our national development plans/sustainable development strategies including Poverty Reduction Strategy Papers (PRSPs). Funds should be raised by adopting cost recovery approaches which suit local climatic, environmental and social conditions and the "polluter-pays" principle, with due consideration to the poor. All sources of financing, both public and private, national and international, must be mobilized and used in the most efficient and effective way. We take note of the report of the World Panel on Financing Water Infrastructure.

6. We should explore the full range of financing arrangements including private sector participation in line with our national policies and priorities. We will identify and develop new mechanisms of public-private partnerships for the different actors involved, while ensuring the necessary public control and legal frameworks to protect the public interests, with a particular emphasis on protecting the interests of the poor.

7. As water situations differ from region to region, we will support established regional and sub-regional efforts such as the vision of the African Ministerial Conference on Water (AMCOW) to facilitate the New Partnership for Africa's Development (NEPAD) and the Central American Integration System (SICA), and the implementation of the program of action in favor of Least Developed Countries (LDCs). Recognizing the uniquely fragile nature of water resources in small island developing states, we support specific programs of collaboration such as the Caribbean Pacific Joint Program for Action on Water and Climate in Small Island Countries.

8. We reaffirm the necessity for countries to better coordinate monitoring and assessment systems at local, basin and national levels, with development of relevant national indicators where appropriate. We call

upon the United Nations, inter alia through the Commission on Sustainable Development, to take a leading role and cooperate with other organizations involved in the water sector to work in a transparent and cooperative way. We welcome the willingness of the Organization for Economic Cooperation and Development and other organizations to periodically inform the international community of aid activities in water-related areas. Ways to track progress on water issues may be usefully explored on the basis of existing facilities and relying upon information from countries and relevant UN agencies, regional development banks and other stakeholders, including civil society organizations.

9. We welcome the proposal to establish a new network of websites to follow up the Portfolio of Water Actions that will publicize actions planned and taken on water-related issues by countries and international organizations in order to share information and promote cooperation.

[Water Resources Management and Benefit Sharing]

10. As we aim to develop integrated water resources management and water efficiency plans by 2005, we will assist developing countries, particularly the least developed countries, and countries with economies in transition, by providing tools and further required assistance. In this context, among others, we encourage regional development banks to take a facilitating role. To this end, we invite all stakeholders, including private donors and civil society organizations, concerned to participate in this process.

11. Recognizing that cooperation between riparian states on transboundary and/or boundary watercourses contributes to sustainable water management and mutual benefits, we encourage all those states to promote such cooperation.

12. We will further encourage scientific research on predicting and monitoring the global water cycle, including the effect of climate change, and develop information systems that will enable the sharing of such valuable data worldwide.

13. We will promote measures for reducing losses from distribution systems and other water demand management measures as a cost-effective way of meeting demand.

14. We will endeavor to develop and deploy non-conventional water

resources by promoting innovative and environmentally sound technologies, such as the desalination of seawater, water recycling and water harvesting.

15. We recognize the role of hydropower as one of the renewable and clean energy sources, and that its potential should be realized in an environmentally sustainable and socially equitable manner .

[Safe Drinking Water and Sanitation]

16. Achieving the target established in the MDGs to halve the proportion of people without access to safe drinking water by 2015 and that established in the Plan of Implementation of the WSSD to halve the proportion of people without access to basic sanitation by 2015 requires an enormous amount of investment in water supply and sanitation. We call on each country to develop strategies to achieve these objectives. We will redouble our collective efforts to mobilize financial and technical resources, both public and private.

17. We will address water supply and sanitation in urban and rural areas in ways suitable for the respective local conditions and management capacities, with a view to achieving short-term improvement of water and sanitation services as well as cost-effective infrastructure investments and sound management and maintenance over time. In so doing, we will enhance poor people's access to safe drinking water and sanitation.

18. While basic hygiene practices starting from hand washing at the household level should be encouraged, intensified efforts should also be launched to promote technical breakthroughs, especially the development and practical applications of efficient and low-cost technologies tailored to daily life for the provision of safe drinking water and basic sanitation. We encourage studies for innovative technologies to be locally owned.

[Water for Food and Rural Development]

19. Water is essential for broad based agricultural production and rural development in order to improve food security and eradicate poverty. It should continuously contribute to a variety of roles including food production, economic growth and environmental sustainability. We are concerned with increasing pressure on the limited fresh water resources and on the environment. Noting that a diverse array of agricultural practices and agricultural economies has evolved in the world, we should make every effort to reduce unsustainable water management and improve the

efficiency of agricultural water use.

20. Through effective and equitable water use and management, and extending irrigation in areas of need, we will promote neighborhood community based development, which should result in income-generating activities and opportunities and contribute to poverty eradication in rural areas.

21. We encourage innovative and strategic investment, research and development and international cooperation for the progressive improvement of agricultural water management, by such means as demand-driven management including participatory irrigation management, rehabilitation and modernization of existing water facilities, water-harvesting, water-saving/drought-resistant crop varieties, water storage and dissemination of agricultural best practices.

22. Inland fisheries being a major source of food, freshwater fish production should be addressed through intensified efforts to improve water quality and quantity in rivers and protection or restoration of breeding areas.

[Water Pollution Prevention and Ecosystem Conservation]

23. We recognize the need to intensify water pollution prevention in order to reduce hazards to health and the environment and to protect ecosystems, including control of invasive species. We recognize traditional water knowledge and will promote the awareness of positive and negative impacts of human activities on watersheds for the entire water cycle through public information and education, including for children, in order to avoid pollution and unsustainable use of water resources.

24. To ensure a sustainable water supply of good quality, we should protect and use in a sustainable manner the ecosystems that naturally capture, filter, store, and release water, such as rivers, wetlands, forests, and soils.

25. We urge countries to review and, when necessary, to establish appropriate legislative frameworks for the protection and sustainable use of water resources and for water pollution prevention.

26. In view of the rapid degradation of watersheds and forests, we will concentrate our efforts to combat deforestation, desertification and land

degradation through programs to promote greening, sustainable forest management, the restoration of degraded lands and wetlands, and the conservation of biodiversity.

[Disaster Mitigation and Risk Management]

27. The growing severity of the impacts of floods and droughts highlights the need for a comprehensive approach that includes strengthened structural measures such as reservoirs and dikes and also non-structural measures such as land-use regulation and guidance, disaster forecasting and warning systems and national risk management systems, in harmony with the environment and different water uses, including inland waterway navigation.

28. We will cooperate to minimize damage caused by disasters through enhancing the sharing and exchange, where appropriate, of data, information, knowledge and experiences at the international level. We encourage the continuation of collaboration between scientists, water managers, and relevant stakeholders to reduce vulnerability and make the best prediction and forecasting tools available to water managers.

29. Finally, we thank the Government and people of Japan for hosting this Ministerial Conference and the Forum.

附件七

「京都部長宣言」

（全文中文翻譯）

部長宣言

---來自琵琶湖和淀川流域的訊息---

二〇〇三年三月二十三日

我們謹代表各國部長及代表團負責人，出席二〇〇三年三月二十二日至二十三日在日本京都所舉行之第三屆世界水資源論壇。依據蒙德勒財務發展開發會議 (Monterrey Conference on Financing for Development)、永續發展世界高峰會 (World Summit on Sustainable Development, WSSD)、以及聯合國水、能源、衛生、農業及生物多樣性(Water, Energy, Health, Agriculture and Biodiversity, WEHAB)及其他水資源相關事件之結論，我們在此發表共同宣言，將採取適切行動以達成國際共識及聯合國千禧發展計劃之目標 (Millennium Development Goals, MDGs)。

摘錄自第三屆世界水資源論壇主題(thematic)及區域性(regional)會議結論，我們發表以下宣言：

〔基本方針〕

1. 水是永續發展的驅動力量，能保護環境的完整，根除貧困和饑餓，是維護人類健康和福址不可缺少之物。因此，提昇水議題之層級為全球各國當務之急，每個國家皆有付諸行動之責任。國際社會及各國和地方的組織皆應支持這項決議。各國中央政府應授權地方政府及各社區來積極推動，不分富貧，不分男女。
2. 目前為止，應該持續加強對水資源發展及管理的問題所做的努力。我們了解良好的管理、能力的建構及資金的籌措等，皆為完

成這項使命之最重要的因素。在此任務下，我們將全力推動水資源綜合管理。

3. 為確保好的水資源管理，我們應將焦點放在每個家庭及社區，將改善貧戶以及性別觀點等問題納入水資源政策，以滿足公平的利益分享。我們應更進一步的邀請所有相關人員參與，以確保所有的行動過程透明且合理化。

4. 我們承諾將長期透過國際社會提供技術及其他協助，以確保個人及團體組織能擁有測量及監控的能力，以及分享有關區域性之創新方法、好的實施方案、資訊、知識和經驗。

5. 籌募資金對我們而言是項艱困的任務。我們應建立一個益於投資的環境，優先處理水資源問題，並適時地反映於國內發展計畫、永續發展策略及減少貧困策略報告書（Poverty Reduction Strategy Papers, PRSPs）中。資金應透過成本回收方式募集，並使之能符合當地氣候、環境及社會條件，兼顧“使用者付費”原則，適當考慮貧戶狀況。所有財務的來源，不論是來自公共或私人，國內或國際，皆需具有機動性且能做最有效率及效能的使用。本摘要來自資助水資源基本建設世界會議(World Panel on Financing Water Infrastructure)報告。

6. 我們應該仔細審查財務的配置情況，特別是私部門的參與是否與國內政策和重點議題具一致性。為確保一般民眾(特別是貧戶)的權益，我們將在公共管理及合法範疇下發展一個新的公私部門合作機制，以鼓勵各方參與。

7. 由於各地水資源狀況不同，我們支持建立區域性及次區域性團體，如非洲水資源部長級會議（Africa Ministerial Conference on Water, AMCOW），即是利用此種方式，形成新的非洲發展合作關

係；中美洲整合系統（Central American Integration System, SICA），及特別為低度開發國家所發展的計畫。另一方面，體認到開發中小型島國水資源環境脆弱，我們支持類似之合作計畫，例如加勒比海太平洋地區小型島嶼國家水資源與氣候相互結合的發展計畫。

8. 我們再次重申各國在建置區域性、流域性、全國性的監測系統及評估系統時需作更好的協調，並有必要發展適當的評估指標。除透過永續發展委員會之外，我們建請聯合國主導此計畫，以過程透明化的方式與其他水資源組織合作。我們歡迎經濟合作發展組織或相關組織定期通報國際社會對於水資源之援助活動。利用現存於各國、聯合國組織、區域發展銀行、用水團體之設備及資訊也許可追蹤水資源議題進展。

9. 為分享資訊及鼓勵合作，我們對於建立一個新的網站，用以追蹤後續的水行動(Water Action)表示歡迎。此舉將可替各國及國際組織廣為傳播其為水行動所規劃及採取之各項水相關議題活動。

〔水資源管理及利益共享〕

10. 為在 2005 年以前發展水資源綜合管理及用水效率計畫，我們針對開發中國家，特別是低度開發和經濟處於過渡期的國家，提供工具及滿足其需求之協助。在此情況下，我們鼓勵區域開發銀行擔任輔助角色。我們亦邀請私人捐款者和民間社會組織團體等，共同參與這項工作。

11. 臨河國家及以水道為界之國家間的合作，有助於水資源永續管理及雙方互惠利益，我們鼓勵所有符合這些條件的國家們能積極地合作。

12. 我們會鼓勵有關預測及監測全球水循環之研究，特別是氣候變遷的衝擊，並發展一套使全球均能分享此類資料之資訊系統。
13. 我們將推動降低配水系統之漏水損失，並以最具成本效益原則發展用水需求管理，以符用水需求。
14. 我們將致力發展及應用兼具創新及環保之非傳統水源開發技術，如海水淡化、廢水回收利用、及雨水貯集系統等。
15. 我們體認到水力發電是一種可再利用且乾淨之能源，其具有環境永續發展及社會公平分配原則的潛能。

〔安全的飲用水及公共衛生〕

16. 為達成聯合國千禧發展計畫目標(2015 年前讓全球無法取得安全飲用水的人口比例減半)及執行永續發展高峰會計畫(2015 年前讓全球無法達到基本衛生條件生活人口比例減半)，需投注龐大資金於給水及公共衛生方面。我們呼籲各國訂定計畫完成此目標。我們也會集合所有力量，機動地運用來自於公共或私人的捐款及技術。
17. 為解決城市及鄉村地區公共給水及衛生問題，我們將針對各地不同的情況及各地方政府的管理能力制定適宜之方法，以達到短期內改善給水及衛生設備，及建立長期符合成本效益之投資、健全管理維護的目標。並藉此提高窮人取得安全飲用水及公共衛生設備。
18. 在基本衛生保健的實行上，應該從居家層級之個人洗手習慣的養成開始做起，進而推動科技的突破，特別是發展有效率、低成本、可應用在日常生活的飲用水和基本公共設施的科技。我們也鼓勵發展具當地特色之新科技。

〔水與糧食生產及農村發展〕

19. 水為一般農產品及農村發展之基礎，用以提昇糧食供應安全並根絕貧窮。水應持續扮演糧食生產、促進經濟成長以及使環境永續再生的角色，但我們擔心這終究為有限的乾淨水源和環境日漸帶來的壓力。不同的農業實務及農業經濟方針已在世界各地形成，我們應該盡最大的力量減少無法永續利用的水資源管理，並且改善農業用水的效率。

20. 透過有效率及公正的分配及管理水資源，擴展地方所需之灌溉區域，我們將推動社區發展，期能為農村地區的貧戶帶來增加收入的機會並根絕貧窮。

21. 為積極改善農業用水管理，我們鼓勵創新及策略性的投資、研究發展、及國際合作。透過以需求為導向的管理改善農業用水管理，如灌溉管理納入參與者、現存水源設備的更新及現代化、雨水利用、各式省水或抗旱作物的栽種、水的儲存、及最佳農耕方法之宣導。

22. 內陸漁獲一直是食物的主要來源，我們應付出更多心力改善水質、水量、保護或維護漁業繁殖區以確保淡水魚的產量。

〔水污染防治與生態保育〕

23. 我們體認到加強水污染防治的迫切性，希望降低對健康以及環境之傷害，並期能保護生態環境，包括控制入侵物種破壞原生態環境。我們亦體認到大眾對水源知識的不足，將透過全民教育的方式，不分老少，使社會大眾了解到人類在河川流域上的活動對整個水循環所造成的正、負面影響。教育大眾的目的主要是防止民眾污染水資源以及防範水資源無法再利用。

24. 我們應保護且學習自然生態之自我涵養、過濾、蓄水、排水的機制，如河川、溼地、森林、及土壤之運作，以確保良好的水源得以永續利用。

25. 我們力促各國應重新檢討，且在必要的時候重新建立適當之立法體制，用以保護及永續利用水資源，以及防治水污染。

26. 有感於集水區及森林的快速流失，我們將集中精力對抗森林濫伐、沙漠化、土地流失等問題。透過有計畫地推動綠化、森林永續經營、流失土地及濕地的復育與生物多樣化保育來達成這項目標。

〔災害減低與風險管理〕

27. 水旱災的衝擊日益嚴重，凸顯整合工程及非工程方法之需要性。工程方法如加強水庫及堤防的結構強度；非工程方法如土地使用管理、天災預警系統、風險管理系統。並配合環境與不同的水資源利用相互協調，如內陸水道之導航。

28. 透過加強分享全球性適用之資料、資訊、知識及經驗，可相互合作將天然災害之災情減至最低。我們也鼓勵各國科學家、水資源決策者，及相關的人員和單位持續地合作，共同克服困難，並為水資源管理者建立一個最有效率的水資源預測工具。

最後，我們要感謝日本政府及人民主辦此次部長級會議及本屆世界水資源論壇。

附件八

「水行動方案概要」

（英文）

Regarding the Portfolio of Water Actions (PWA)

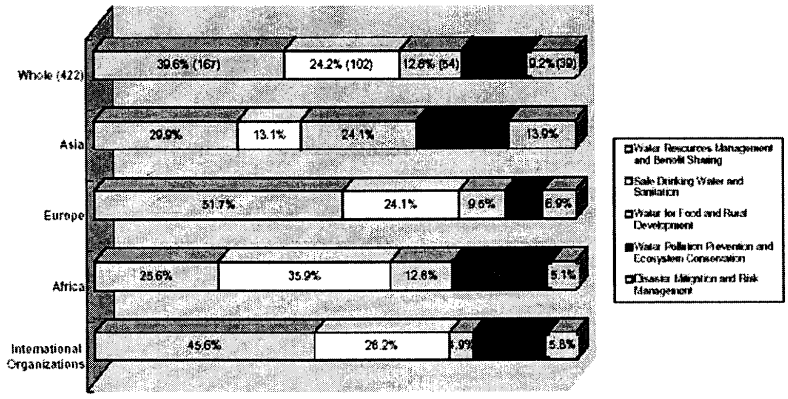
22 March 2003

Ministerial Conference

on the occasion of
the 3rd World Water Forum

- A total of 422 actions were submitted from 36 countries and 16 international organizations. (As of 10 March 2003)
- Overall, many of the actions involve "Water Resources Management and Benefit Sharing" and "Safe Drinking Water and Sanitation."
- Regionally, actions from Asia are more focused on "Water for Food and Rural Development" and "Disaster Mitigation and Risk Management" than other regions.
- Europe submitted many actions on "Water Resources Management and Benefit Sharing."
- Africa submitted many actions on "Safe Drinking Water and Sanitation."
- International organizations demonstrate a similar trend to Europe.

Theme / Region



附件 8-1

Draft STATEMENT World Water Actions		
Coordinators		Date: February 3, 2003
World Water Council	Mr. Francois GUERQUIN	f.guerquin@worldwatercouncil.org
Secretariat of the 3rd World Water Forum	Mr. Toshio Okazumi	okazumi@water-forum3.com
Liaison Officer in the secretariat of the 3rd World Water Forum	Mr. Toshio Okazumi	okazumi@water-forum3.com

ISSUES

Since The Hague, WWC is committed to participate to better information of what is happening in the water world. World Water Actions is a monitoring process designed to process such information to WWF3, to the Ministerial Conference, and should guide all stakeholders in committing to what are the most pressing issues in water.

ACTIONS

Our current contribution is the following, which is our input to the Ministerial Conference.

Many actions have been initiated. Many are ongoing. But many more are still needed to avert the looming water crisis and to realize a safe water world for all. And they are needed more urgently and at a faster pace than ever before.

Water is everybody's business. And everybody, as individuals, communities, private and public organizations, multinationals, governments, and international organizations, needs to take on responsibility for realizing a safe water world. There are vital actions for everyone, in all of these roles:

1. Governments and local authorities to acknowledge the importance of water to development and poverty reduction by mainstreamingwater in strategies and masterplans for all WEHABsectors
2. Governments and local authorities to increase investments for water development .
3. International financial institutions and bilateral donors to prioritize support to countries that face their responsibilities towards water, as stated above.
4. Governments and international financial institutions to adopt measures to attract financing for infrastructure
5. International institutions to deepen understanding and expand public awareness of the benefits of water and improved water management.
6. Service providers to improve the quality and efficiency of service provision, operation , and maintenance
7. The United Nations , in preparing the declaration for the Decade of Education for Sustainable Development, to take in account the important role of water in sustainable development.
8. Governments to focus on capacity building for the new institutions created by decentralization and their newly assigned roles and tasks.
9. Governments, industry, agriculture and people in their daily lives to contribute to eradicating existing pollution and ensuring that development doesn't result in increased pollution.
10. community organizations, NGOs, private and public sectors, local administrations and national governments, to work in partnership for the best of water management – because water is everybody's business.
11. International institutions to facilitate co-operation in the joint management of trans-boundary water systems.

12. Water managers, in collaboration with climate and water scientists, to develop ways to better adapt to climate variability and to reduce the human suffering caused by flood and droughts.
13. International institutions to establish a global monitoring system covering the state of water resources, the activities in the water sector, and progress towards the Millennium Development Goals.

WWC expects all participants to use this working document, criticize it if needed, but just hope that it will nurture the thinking and most importantly the decision-making.

For itself WWC will announce its commitments in WWF3, but will pursue efforts in much needed monitoring and elaboration of thinking around the benefits of water, to give all of us convincing arguments for more attention to water.

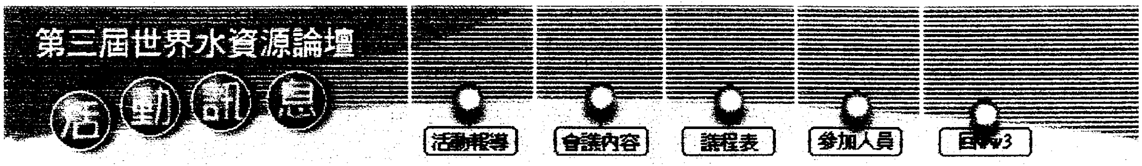
附件九

「相關報導」

- 淡江大學水資源管理與政策研究中心網站報導
- Taipei Times 報導
- 中國時報專題報導

淡江大學水資源管理與政策研究中心網站報導(一)

3 月 16~18 日



3月16日 | 3月17日 | 3月18日 | 3月19日 | 後續報導

3/17 日實況報導

第三屆世界水資源論壇3月18日由大會「洪水組」集合台灣、印度、巴西及荷蘭等國家之單位代表共同於京都國際會議館舉辦「都市防洪」之專題會議。經濟部水利署黃署長金山與台灣大學土木系李鴻源教授、李天浩教授等人將分別發表「都市防洪」之專題論文，會中首先將由各國代表說明重要工作主題，並以圓桌論壇方式(Global Round Table)進行議題討論。

會場實影

活動會場

活動介紹看板

網際網路服務中心

會議場景-水、糧食與環境

水利署代表與大會「洪水組」(IFNET)工作人員寒喧 (左 2, 3)

經濟部水利署黃署長金山活動剪影

經濟部水利署黃署長及專家學者等一行人於 3 月 16 日前往日本京都國際會議館(Kyoto International Conference Hall)參加第三屆世界水資源論壇，並將於 3 月 18 及 19 二日分別在京都及大阪主持召開「都市防洪」及「地層下陷防治」之專題會議。

3 月 17 日，水利署受日本河川整備中心之邀請參予「水與交通」之專題研討會議，並與河川整備中心進行交流聯誼。該中心丸岡昇部長曾於 2001 年受邀至台參與水利署舉辦之「綠堤防實施計畫之探討」，並於會中發表專題演講，雙方互動關係良好。

抵達大阪

與日本河川整備中心理事長松田方夫 (左 2)合影

「您可能不知道」-摘錄-大會新聞報導

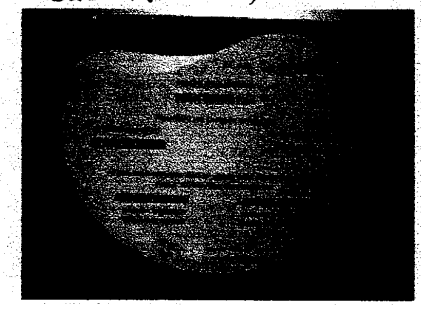
- 現今約有 10 億人口(佔世界人口數之四分之一)無法享用安全之供水。
- 現今約有 24 億人口(佔世界人口數之二分之一)缺乏適當之衛生設備。

- 每 15 秒就有一位孩童因飲用不乾淨的水引發疾病後不治。
- 有五分之一的開發中國家將在 2030 年面臨水資源缺乏問題，中東、非洲北部及部分的亞洲國家實已遭受缺水的困境及壓力。
- 在阿富汗國家中約有百分之七十五的人口無法飲用乾淨的水，該地區已經三年沒有下雨，每四個孩童當中就會有一位無法度過小生命的第五歲。
- 約有二分之一的世界人口每晚上必須忍受乾渴入睡，而在貧困地區中最窮苦的人們與該地較富有的人們相比，反而必須付出超出十至一百倍(如同兩者薪水比例一般)的價錢來買水。

這些令人怵目驚心的有關水的統計數字是第三屆世界水資源論壇公佈的一部份，身為地球公民，我們是不是都應該多關切一點『水』的問題？畢竟缺水的痛苦和不幸，很可能降臨在每一個人的身上。

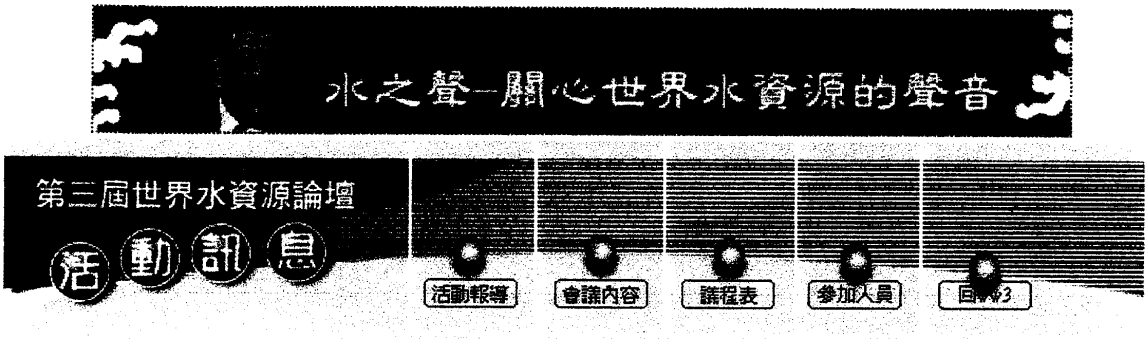
水與人口統計資料
發表日期 2003 年 3 月 17 日
資料統計:

●當前世界人口數: 6,256,978,474 (約 62.6 億)
●缺乏飲用水人口數: 1,220,260,297 (約 12.2 億,
佔世界人口總數比例: 19.5%)
●缺乏衛生設備人口數: 2,410,130,148 (約 24.1 億,
佔世界人口總數比例: 38.5%)
●若千禧年的水資源計畫能自 2000 年起就受到重視，
則當今缺乏飲用水及衛生設備的人口數可減低為:
-缺乏飲用水人口數: 1,097,209,038 (約 11.0 億,
佔世界人口總數比例: 17.5%)
-缺乏衛生設備人口數: 2,194,415,940 (約 21.9 億,
佔世界人口總數比例: 35.1%)



淡江大學水資源管理與政策研究中心網站報導(二)

3月25日



3月16日 | 3月17日 | 3月18日 | 3月19日 | 後續報導

配合第三屆世界水資源論壇召開(3/16~3/23)，日本河川整備中心發行了一本名為『水世紀的生活』特輯，其中報導『水之聲』網站，蒐集了來自世界各地的訊息，適切的反應大家對21世紀水資源問題關切的心聲。在台灣，這個網站的版主正是經濟部水利署副署長林襟江，在這位時刻關心全國水利事務的長者帶領之下，第三屆世界水資源論壇中，台灣的人民善盡了地球公民的責任和義務。以下為水利署林副署長所收集的台灣水之聲，並發表於世界水之聲論壇。

"Water Voice"

Messenger Name	Lin Jing-Jion
"Water Voice" collection date	Jun 12, 2002
Country / Region / Area	Taiwan / Taipei
Voice Sender's Age	Adult
Voice Sender's Gender	Male
Voice Sender's Occupation	Other

Title: Taiwan suffered its worst drought in decades this year (2002)

Taiwan suffered its worst drought in decades this year (2002), with many rivers drying up and serious reservoir storage insufficiency. The Central Government even established a Drought Control Taskforce in response. Drastic climate changes are not only a serious threat to the management of water resources but also bear negative effects on the quality of water. With normal precipitation, the water quality in rivers can stay rather consistent. Floods and droughts however can exert significant impact on water quality. For instance, water rationing during drought seasons can cause tap water pressure to drop and the intermittent water supply rationed by region and by time slot can adversely affect water hygiene in the pipeline, raising turbidity levels in water. Hence, water purifier is necessary to ensure the best water quality and help guard against droughts.

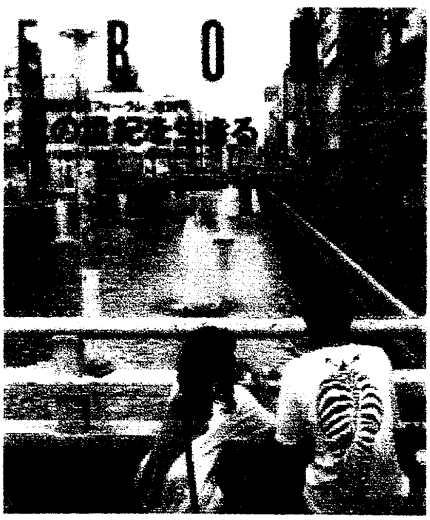
中文原文

水之聲信差	水利署副署長林襟江
水之聲訊息發表日期	2002 年 6 月 12 日
發表地點	第三屆世界水資源論壇中文網站
訊息發表人	冷若水/成人
發表人性別	男
發表人職別	其他

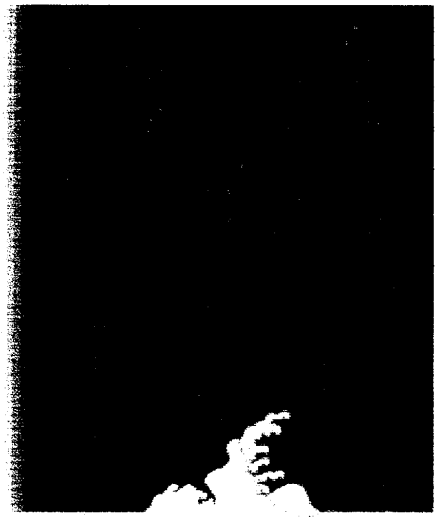
標題：淨水器的必要

今年台灣面臨數十年來少見的大旱，河川多呈現乾涸現象，水庫供水不足，中央政府為此成立抗旱小組應變。從水資源的管理來看，天氣的變化無常對水資源管理構成極大的困難；而從水質的角度來看，更是有不良的後果。在正常的降雨情形下，河川的水質不會產生特別的變化。但洪水或乾旱的發生，水質便會受到相當程度之影響。在限水的時期，因自來水的水壓降低、分區分時的間歇供水，對水管的衛生造成不良影響，水質會呈現較混濁的現象。此時淨水器成為大眾最佳水質的保障，是民眾抗旱的良方。

『水世紀的生活』特輯-封面及內文



封面



標示位置即報導台灣水之聲內容

TAIPEI TIMES

第一則

標題：**Taiwan on stage at water forum**

FLOOD PREVENTION: The 3rd World Water Forum in Kyoto continued as Taiwanese delegates shared their experiences of flooding with the global community

By Chiu Yu-Tzu
STAFF REPORTER IN KYOTO
Wednesday, Mar 19, 2003,Page 2

Taiwan gave the international community a lesson in tackling urban flooding yesterday as more than 170 countries gathered at the 3rd World Water Forum in the Japanese city of Kyoto.

The Water Resources Agency (WRA) presented three reports on flood mitigation in urban areas at the triennial international meeting, offering valuable suggestions taken from past experience.

WRA Director Hwang Jing-san (黃金山), leader of Taiwan's 30-strong delegation to the forum, said the flood mitigation strategy in Taipei deserved to be heard by a wider audience because it has been adopted by a national capital.

Lee Hong-yuan (李鴻源), a civil engineering professor at National Taiwan University, concluded at a session entitled "Flood Mitigation and Urban Areas" that Taipei's experience demonstrates that non-engineering strategies deserved further notice because people could not only rely on new technology to control water.

Lee said those strategies included building detention ponds (small dam created to hold back an excessive amount of rain fall in a short period of time), revising land-use regulations and establishing a sound flood-insurance system.

Lee said that Taipei has been victim to a series of floods since 1997. Lee said, however, that Typhoon Nari in 2001 exposed the country's shortcomings in flood prevention.

"We would like to share our know-how on flood-warning systems, but also hopefully learn about non-engineering strategies from others," Lee said.

Lee Tim-hau (李天浩) from the civil engineering department of NTU, said that improving the accuracy of typhoon predictions was an important goal.

"We believe that a transnational collaborative mechanism on rainfall precipitation is needed not only by Taiwan but also the Philippines and Vietnam," Lee said.

The WRA's presentation interested participants, especially those from nations with similar environmental problems to Taiwan.

F. L. Bussink from the Netherlands' Ministry of Transport, Public Works and Water Management, said in his country people were told to believe in engineering. Bussink added, however, that recent urban flooding in his country demonstrates that engineering is not a cure-all.

Bussink stressed the importance of reshaping old-fashioned engineering concepts and educating the public.

"All measures need political support. However, the government should tell people the truth," Bussink said.

DPP lawmaker Eugene Jao (趙永清), who attended the forum in Kyoto yesterday, said that Taiwan's active participation in the forum demonstrates the country's ambition to keep up with sustainable-development issues.

Hwang said that Taiwan is facing the same water challenges as others, such as increased flooding, water-supply shortages, ongoing development, worsening urbanization, over pumping of ground water and increased costs of maintaining water sources.

Hwang said, however, that participation in the forum was a good chance for Taiwan to review the problems that are unique to the country.

"For example, how could the sewer system in an industrialized country like Taiwan be so poor?" Hwang said.

In 2000, according to government statistics, the average sewer connection ratio in Taiwan was only 7.2 percent. Even in the Taipei metropolitan area, the ratio was only 48.

In Kaohsiung, the nation's second largest city, the ratio is 7.2 percent. In the rest of the country, the ratio is 0.6 percent.

第二則

標題：**Taiwan shares aquifer experience**

By Chiu Yu-Tzu
STAFF REPORTER
Thursday, Mar 20, 2003,Page 2

At a time when many countries in the world are facing challenges resulting from overuse of ground water, at the 3rd World Water Forum in Osaka yesterday Taiwan shared its experience in managing its aquifers effectively.

Taiwan's experience in controlling land subsidence caused by overuse of groundwater was reported in a session on Ground Water and Related Land Disasters.

Chu Wen-sen (朱文生), Executive-General of Environmental & Infrastructural Technologies (EIT), and Hwang Hweng-hwang (黃輝煌), head of Water Resources Agency's (WRA) Land-Subsidence Prevention and Reclamation Corps, jointly reported on the nation's experience in establishing 186 stations and 481 monitoring wells to study the properties of groundwater.

In the 1980s, Taiwan benefited from exporting seafood. But the aquaculture projects that produced the fish which resulted in the over-use of groundwater.

In the past decade, the government has spent NT$1 billion on rehabilitating land that was damaged by the disastrous overuse of groundwater.

Between the mid-1970s and the early 1990s, over-pumping along coastal areas by fisheries seriously depleted the nation's aquifers.

During that period, the nation consumed 7 billion cubic meters of groundwater annually but received an annual average rainfall of only 4 billion cubic meters.

By monitoring groundwater levels and revising land use and agricultural policies, the government has been able to limit the amount of groundwater pumped each year to about 5 billion cubic meters, Chu said.

Water Resources Agency Director Hwang Jing-san (黃金山) suggested at a wrap-up discussion that all levels of government

must work with the public to develop rational plans for use of land and water resources.

"In addition, proper management of groundwater and land subsidence depends on sufficient data, advanced analysis tools and commitments from both the government and the public," Hwang said.

In response to questions raised at the session, Hwang said that pursuing a better standard of living was not necessarily built on consuming more water.

Hwang stressed that ground water should not be used for development unless safety limits were set.

Representatives from India said their government has been trying to mitigate the impact of groundwater over-exploitation in Andhra Pradesh for years.

The delegates stressed the importance of the government engaging the public and educating them about the use of groundwater.

On March 22, World Fresh Water Day, a 10-day campaign will be launched in India to further prevent the depletion of groundwater.

The water forum is currently being held in the Lake Biwa and Yodo River Basin area that connects Kyoto, Shiga and Osaka.

Taiwan's delegation comprises 30 water resources experts and officials. As the forum gathers today in Shiga, the delegates will gather information pertaining to sustainable development.

Yesterday, participants from different areas of the world seemed to share the opinion that water policy makers now face a double challenge: More ecological disasters of the kind already experienced will increase the costs of using groundwater, while at the same time reduced yields will make it even harder to meet the rising demand for water.

Discussions at the forum suggest that water managers have to deal with a host of related issues: supply, quality, allocation, distribution, equity with respect to present and future generations, resource vulnerability and reliability, sustainable use, biological diversity, and ecological integrity.

第三則

標題：**Taiwan needs to recognize the real costs of water**

By Chiu Yu-Tzu
STAFF REPORTER
Friday, Mar 21, 2003,Page 6

Taiwan must adopt diverse and extraordinary measures to promote water conservation, including a water price hike, Water Resources Agency Director Hwang Jing-san (黃金山) said yesterday in Kyoto.

Taiwan's delegation to the Third World Water Forum will return to Taiwan today.

Before wrapping up five days of participation in the forum, Hwang said that a shortage of water resources remains a threat to Taiwan for the near future.

"We Taiwanese have indulged in wasting water that we pay extremely low prices to obtain," Hwang said.

According to Hwang, water prices in Japan are about three to four times those of water prices in Taiwan.

"If water prices reflected the real value of the water, users would not waste it," Hwang said.

The real cost of water should include the costs of ecological conservation, reducing the rate of water loss and other maintenance, Hwang said.

After paying a visit to Lake Biwa -- the largest lake in Japan and one of its most important fresh water resources -- in Shiga prefecture, Hwang said that Taiwan has the same ability to maintain and protect its water resources as Japan does.

"If our water resource management system could be less politicized, solving water-related issues would be easier," Hwang said.

DPP lawmaker Eugene Jao (趙永清), who observed the forum in Japan, said that Taiwan's involvement in the forum lays particular stress on the technological side of conservation.

"We should also have paid attention to social issues, such as capacity building," Jao said.

Capacity building refers to the sum of efforts to enhance and utilize people's skills and capabilities as well as institutions at the local, national and global levels, in an attempt to sustain development of water resources.

Jao said that promoting the innovation of technology in order to achieve goals such as water conservation, waste water recycling, rainwater harvesting remained essential to solving water shortage related problems.

Jao said that he would urge the Sustainable Development Committee (永續會) of the Legislative Yuan to discuss water issues, including establishing reasonable water prices and improving the effectiveness of water resources management.

Although Taiwan's delegation will not be able to join the Ministerial Conference on all occasions when the forum meets, Hwang said, the WRA would still keep the nation well informed with updated views shared by forum members worldwide.

Meeting under the shadow of the war in Iraq, the forum's members called for international cooperation in maintaining the limited water resources on the planet.

Dr. Mohmoud Abu-Zeid, the President of the World Water Council (WWC) warned of the negative impact being made by the war on the region's water resources, water-distribution systems and sanitation systems.

第四則

標題：**Water meet highlights isolation**

IRONY: At the World Water Forum, 182 countries came together to deal with common problems, but ended up showing that Taiwan is an island in more ways than one

By Chiu Yu-Tzu
STAFF REPORTER IN KYOTO
Tuesday, Mar 25, 2003,Page 6

Despite more than 100 new commitments on water made by the participants of the 3rd World Water Forum, which concluded on Sunday in Japan. Taiwan remains alienated from the international society in the water sector.

At the eight-day forum, 24,000 participants from 182 countries participated in 351 separate sessions on 38 interlocking themes dealing with water, especially on how to bring safe water and sanitation to the entire world.

The participants addressed methods of balancing humanity's increasing water supply needs. Also considered were techniques for improving the health and sanitation of available water as well as the use of water for food production, transportation, energy and environmental needs.

To address the problems related to water usage, most countries will require more effective governance of water resources while improving capacity and finding adequate financing to promote greater efficiency.

Taiwan's delegation to the forum reported on aspects of the nation's experience in controlling urban floods and conducting land subsidence mitigation at the forum's venues in Kyoto and Osaka last week. However, various legislators, local non-governmental organizations (NGOs) and academics said that Taiwan could have been more active in its involvment with the forum.

DPP lawmaker Eugene Jao (趙永清), who arranged a personal trip to Japan to observe the forum, said that the forum secretariat actually sent the Legislative Yuan an invitation to parliamentary sessions, but that the invitation was turned down by the Foreign and Overseas Chinese Affairs Committee. Jao said he had been unaware of the invitation until he arrived at the Kyoto International Conference Hall, where the forum was held on March 18.

"I was sorry to see the Legislative Yuan's limited awareness of global sustainable development," Jao said.

Jao said the negligence made Taiwan miss an opportunity to publicize it's efforts made in promoting sustainable development issues concerning water.

In addition, Jao said that he regretted seeing Taiwan's involvement in the forum lay particular stress on the technological side, rather than social issues.

As Taiwan could not join the ministerial conference held on Friday and Saturday, the delegation, composed of 30 water resources officials in addition to experts from universities and private enterprises, returned to Taiwan on Friday.

Although Water Resources Agency (WRA) director Hwang Jing-san (黃金山) said that the agency would still keep itself well informed of the updated views shared by forum members worldwide, local NGOs criticized the government's reluctance to learn new strategies to manage water resources from a social perspective.

Of the more than 100 commitments reached during the forum, the climate theme accounted for more than 20 commitments.

At the forum, attendants agreed that the "community level public participation is fundamental to achieving these goals" as well as the "common basic requirement for water is an opportunity for cooperation and peace."

"In the past, we've fully known that governmental water resources technocrats despise others with no civil and water conservancy engineering background," said Chang Cheng-yang (張正揚) of the Meinung People's Association (MPA, 美濃愛鄉協進會), a grass-roots organization that opposes the dam.

Chang argued that the WRA had never learned up-to-date theories on water resource management, such as concepts pertaining to capacity building.

At the forum, participants recognized that the need for capacity building, education and access to information for enhanced effectiveness in water management is unquestioned.

They also admitted that these critical elements of the water development process are often treated as an add-on to programs,

with scant regard to local capacity-building institutions, gender mainstreaming, cultural diversity and traditional knowledge or to long-term commitment.

Chang said the government's conservative attitude toward water resource management ironically made local NGOs focusing on water issues link themselves with their counterparts at an international level.

Next week, Chang said, MPA would publish the Chinese version of "Citizens' Guide to the World Commission on Dams," which was originally produced by the International Rivers Network (IRN) based in Berkley.

At the forum, IRN representatives said pseudo-solutions to existing problems pertaining to water could be driven by personal, institutional, corporate and political interests.

Aside from Taiwan's reporting its experience at the international forum, long-term unsolved problems deserved more attention, said Yeh Shin-cheng (葉欣誠), a water resources engineering expert at the National Kaohsiung Normal University.

"For example, the existence of unsolved problems pertaining to land subsidence can be attributed to local governments' reluctance to take legal actions to tackle illegal drilling and to close illegal wells," Yeh said.

Yeh said land subsidence mitigation was being used by local political factions to gain influencez. Political interference, Yeh said, hampers Taiwan from pursuing a sustainable future.

Water resources experts estimate that there have been about 40,000 illegal wells that over consume ground water.

報章名稱：中國時報 版次：21 日期：92/4/1 (二)

多元參與謀共識 共同解決水問題

～從世界水論壇看國內水問題系列五之一

呂理德

前言

受到氣候異常的影響，水不只在台灣動輒造成旱澇，也在全世界性各地造成相同的問題，因此由聯合國協助世界水資源協會，三月十六日至二十三日在日本京都、大阪、滋賀三地召開「第三屆世界水論壇」會議，為如何解決水的問題提出對策與交換各國心得。

這項水的國際會議幾乎涵括了所有有關水的議題，本報自即日起推出系列報導，從世界水資源會議看國內水問題，為台灣的水問題提出建言。

去年，北部地區面臨嚴重的缺水問題，今年，北部以及南部地區缺水危機又再度籠罩，北部地區隨時可能要進採取第二階段限制非民生用水措施。除了缺水問題外，台灣一遇暴雨則洪水成災，最近一、兩年的桃芝颱風，三小時內下了近五百公釐的暴雨；還美颱風為大高雄地區帶來四十年罕見的七二一大水災，打破了兩百年來的紀錄，納莉颱風讓台北的地下捷運系統成為「捷運河」。

旱災及洪水氾濫，似乎並不是台灣所特有的，而且有愈來愈嚴重的趨勢，因此今年的世界水論壇會議的舉行，也就更受世人所矚目。這項會議共計有來自世界各地一百七十個國家，四十三國國際組織，包括非政府組織（NGO）、政府官員及學者二萬四千餘人參加。

今年世界水論壇會議主題是「世紀之水」，由於今年是聯合國所訂定的國際淡水年，因此首先上場的是民間論壇會議，會議討論中心主軸以提供安全飲用水為主，討論主題包括：「水資源、食物與環境」、「水資源與氣候」、「和平與水資源」、「水資源管理」、「水資源與區域管理」、「水補給、公共衛生、與水污染」、「地下水」、「水資源與能源」、「資源基礎建設資金」、「洪水」、「水資源與城市」、「水資源、自然與環境」、「公民參合作關係」、「水與貧窮」、「水壩與永續發展」、「世界水資源評估」等議題，從大氣的環境變遷，公共衛生、農業用水與食物生產、各棟地用水之爭、水資源管理效率、水環境與自然環境以及水資源建設資金籌設等三十三個主題深入探討。

在為期八天的會議中，聯合國相關官員在會中表示，世界水資源需求量的成長幅度是人口成長率的三倍。在這次論壇中，與會代表達成的新承諾多達一百項，目標都是為了讓全世界享有安全的水資源與衛生設施。

大會同時在大阪及滋賀縣大津市舉行水資源博覽會等，展出水有關產業、水環教育以及水文化歷史。

世界水論壇會議重頭戲是部長級會議，從三月二十二日起至二十三日舉行，共計有有一〇一個國家部長與九個國際組織負責人參與。

由於水的供應或是保護除了必須結合住民及非政府組織NGO團體推動外，最後還都要靠政府的力量，因此世界水資源論會議，前五天先舉行NGO論壇，後兩天則是官方部長級會議以及國會議員水資源論壇上場，主辦單位也同時安排NGO代表與部長們進行一場對談，同時將NGO結論納入部長級會議中討論。

在為期兩天的部長級會議中，通過了部長宣言、水的行動計畫，會議主席日本外務省藤崎一郎議官指出，水的問題必須從基層做好治理工作，落實社區住民參與觀念，加強國際間水合作，同時注意公共利益，以及貧窮的水問題。在美、伊戰爭方面，與會部長們也認為，將對伊拉克伸出與水有關的援助，尤其是給難民的清潔飲用水，以及戰後有關水方面的重建相關工作。

從NGO論壇到國會議員論壇，再到部長級會議，以及數以千計的各式各樣水展覽、水文化凸顯，都顯示世界水資源會議主辦單位相當清楚，水的問題相當複雜，從上游的水源開發與保護，到下游的水利建設與防洪、各目的事業用水之爭，都不是單一政府力量所能解決，必須藉由民間力量、民間資金以及民意代表們支持，而當地原住民、婦女、小孩以及地方政府都可能必須扮演重要角色。世界水伙伴關係（GWP）會長卡爾森表示，在任何條件下，每一個人都有用水的權利，水的管理與分配權限，必須與原住民、婦女、年輕人、農民及貧窮人充份討論。

在部長會議中包括厄瓜多爾、秘魯、巴西、委內瑞拉、哥倫比亞、巴拉圭多數部長們最關心的課題是原住民，他們認為，原住民最清楚如何維護大自然，也最知道如何節約用水的。

台灣一旦發生水問題時，最常看到的是政府相關部門的意見與做法，至於民間聲音則相當微弱。但多元參與，才能共同解決水問題，不知道，台灣民眾有沒有這樣的認知？政府部門也做好了這樣準備嗎？

報章名稱：中國時報 版次：21 日期：97/4/2（三）

從世界水論壇看國內水問題系列五之二

水資源和平共享 全球關切議題

呂理德

水是戰略物質，為水而戰不斷在世界上發生。

全世界水資源中淡水只佔全部水資源二．五三%，其餘九七．四七%皆是海水；人類有可能利用的淡水包括河川、湖泊、人工水池、地下水等，共約有八千立方公里，每年可能再生總淡水量八%，一年平均蒸發量二六%，五四%成為逕流，其餘人滲到地下水，所以水雖很多，但多數卻不是人所能利用，各種搶水也就成為未來世紀最大一顆不定時炸彈。水的戰爭與和平將成為全球穩定與否的重要指標之一。

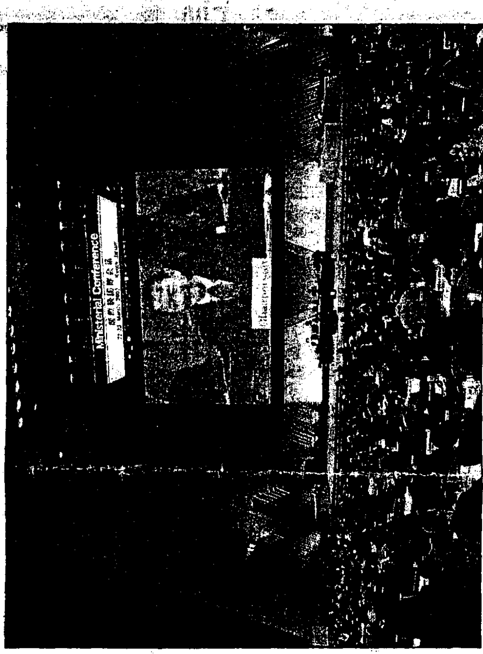
正當美、伊拉克戰事爆發之際，來自世界各地二萬四千名代表聚集在日本京都參加第三屆「世界水論壇會議」，共同關切另一個衝突的根源—水議題。

根據聯合國所公布的資料指出，隨著世界人口從六十億增加至八十億後，全世界至少有二百六十一個流域潛藏衝突危機，這些流域中有三分之一流域是涵蓋超過兩個國家以上的，有十九個流域是涵蓋超過五個或者以上的國家，其中多瑙河流經十八個國家，流經九至十一個國家河流的有剛果河、尼日河、尼羅河、萊茵河及三比西河，其它十二個河流分別是：梅克納河、 Lake Chad、塔里木河、Aral Sea，約旦河、庫拉河、湄公河、底格里斯河及幼發拉底河、，拉普拉塔河、湼曼河、以及維斯圖拉河，這些河至少也流經五至八個國家。

由於取水的利益問題，這些國家就常常發生爭執，因此第三次世界水論壇會議就明確表示，人口不斷增加，食物需求增加，相對就會增加水的需求量，也因此會導致用水失去平衡與永續發展。

農業專家說，為了解決貧窮問題，未來二十五年，每年農業灌溉用水必須增加十五至二五%農業用水，才能生產供應增加人口的糧食，然而隨著污染不斷增加，水資源卻愈來愈少。

過去五十年，至少有三十七件國際紛爭是因水而戰，至少有二百個條約因此而產生。為水而戰隨時隨地都在發生。



來自全球一百零二國家水利部長，聚集在日本京都為水的戰爭與和平提建言。（呂理德攝）

在第三屆世界水論壇部長會議中，玻利維亞農業部長李伯爾就很感慨的說，一百二十四年前，玻利維亞與智利發生內戰，結果玻利維亞戰敗，也因此喪失了水道而成為一個內陸國，沒有出海口，玻利維亞深深體認，二十一世紀的水是一個連結體，大家必須共同透過對話，共同解決發展的水問題，玻利維亞已經做好了這樣的準備。

李伯爾的發言獲得了在場尼泊爾水利部長加瓦利的支持，他說，河川航道及水資源等都必須由流域內人們共享，不是上游所獨占。

阿爾及利亞駐日本大使班德瑪也表示，在世界水論壇會議部長宣言中，有關水資源所引起的流域武裝衝突、國家生態保育等問題，以及國際合作面臨的障礙，應該具體表達出來，讓各國了解此一問題的嚴重。

事實上，美伊戰爭開打引發和平處理水的爭議呼聲。針對水不足，不應是戰爭，而應透過和平解決，因此前蘇聯總書記現任綠十字總會會長的戈巴契夫就呼籲設立水紛爭調停的機構。水的問題，並不只是不足問題，其分配與管理上也有問題，以俄羅斯而言，其水量雖充足，但卻遭受污染，應該從流域管理來看水資源合理化。像河川湖泊受到污染後，如何淨化是相當重要的。

隨著英美聯軍向伊拉克開戰後，在日本滋賀縣水論壇會場以水與和平為討論的重點也就更受外界重視，與會的NGO代表認為，水是人民賴以維生的東西，從一般市民為立場，英美聯軍不能破壞水的供應設施，或者水壩，一旦這些乾淨的水遭受破壞，平民老百姓的生命也立即會受到威脅，世界水資源會議會長默罕默德就說，無罪的老百姓是不應受到牽連的。水是和平的主幹，和平是人類開發管理不可或缺的因素。

國際教科文組織副執行長安德拉指出，戰爭最後輸的是人類。水不應是紛爭的源頭，應是知識、文化、和平 的淵源，解決水的紛爭，各個領域必須整合在一起，共同使用水源國家，必須以平等互惠原則來討論其用水問題，才不會有紛爭。

世界水資源會議會長默罕默德指出，改善水的問題，能改善世界和平與穩定，減少貧窮的人被犧牲。

在水論壇會場內，每一個人聚精會神地大談水戰爭與和平，議場外的大螢幕上，不時有美伊戰爭最新消息，會場外更有反戰人士，要求和平共享全球水資源，水資源真的是戰略物資，不是從天上掉下來的禮物，國人應該好好珍惜。

報章名稱：中國時報 版次：21 日期：92/4/3(四)

掌握水資源議題 拓展外交空間

呂理德

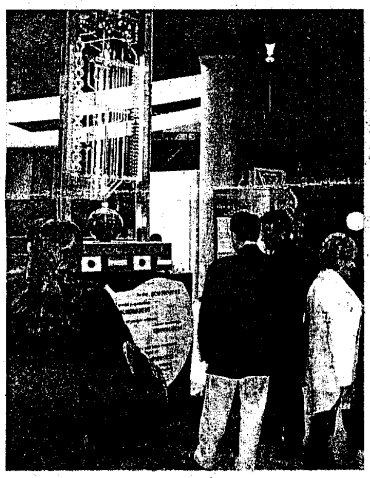
在全球一片水荒、水患聲中，水的問題已經成為世界最迫切的問題之一，聯合國也將今年定為國際淡水年。參與各重世界性水的會議與組織，拓展水外交工作，掌握第一手訊息，已是不容忽視課題，而第三次世界水論壇提供了不少這一方面值得國人參考借鏡地方。

在世界水論壇會議會場中，一個液晶顯示螢幕上顯示，全世界人口有六十二億五千七百八十六萬人，有十二億二千零三十三萬人缺乏安全飲用水，有二十四億一千零十六萬人生活在沒有衛生下水道設備環境中，每年有五百萬至七百萬人死於與水相關的疾病，其中五歲以下小孩人數超過二百二十萬人。這樣簡單數據說明了世界水的問題嚴重性。水問題已經不是地區性的問題，而是全球性的課題，而水的問題又可分為水太髒、水太多以及水太少等三個大問題。

隨著工業發展，全球每年產生污水量約一千五百立方公里，一天排放到水域的廢棄物二百萬公噸，一公升污水可以污染八公升的淡水，目前全世界受污染的水有一萬二千立方公里，開發中國家五〇%係利用污染水當水源。因上下道設備不足影響而發生腹瀉、住血吸虫病、腸內疾病，二〇〇〇年估計死亡人數有二百二十一萬三千人，而為瘧疾而死亡的人數有一百萬人，全世界有二十億以上，感染住血吸虫，這當中有三億人得到嚴重的疾病。

水太多與水太少問題都與氣候變遷問題有關。日本河川與水委員會秘書長菊地良介說，造成洪水的兩個主要原因是地球暖化以及人大量居住在都市。

聯合國資料顯示，一九二〇至一九四〇年，平均每年颱風三．五件，一九四四年至一九八〇年，每年平均五．五件，二〇〇〇年至二〇〇一年每年颱風件數增加至十三件。專家估計，二〇〇〇年，全世有二十%的人口，三十個國家面臨缺水的問題，但是到了二〇二五年，將有三〇%，二十三億人口，五十個家面臨缺水的問題。



第三屆世界水論壇會議中，以液晶螢幕顯示全球有十億人口喝不到乾淨的水。（呂理德攝）

一九七一至一九九五年，洪水影響十五億人，平均每年受影響人數達一億人。總共有三十一萬人因此而喪身。平每一場主要洪水，都會造成一千人以上死亡，以及十億美元以上損失。

一九九一至二〇〇〇年間，自然災害所造成災民每年有一億四千七百萬至二億一千一百萬人，十年間共有二千五百五十七件自然災害，造成六十六萬五千人死亡。這些自然災害中洪水佔五〇%，水疾病佔二八%，乾旱十一%。自然災害所造成的損失，在一九九一年是三百億美金，但一九九七年則已經高達七百億美金，實上損失可能是兩倍以上，九七%自然災害所造成的死亡在落後國家，從一九九六年開始，水的災害（包括水災及旱災）就增加一倍以上。

水的問題愈來愈嚴重，自然成為全球關切的話題，水的外交也就日益重要。台灣因為外交處境困難，無法成為聯合國或其相關組織的會員國，但世界水資源協會所主辦的世界水論壇會議，是世界水資源外交重要場合。

今年台灣成功突破外交困境，以中國土木水利工程學會名義登記參與世界水論壇會議，除了三十餘位代表順利取得大會的入場許可外，代表團同時在防洪組與地下水組兩場論壇座談會舉辦兩場有關防洪與地下水的民間論壇會議，由經濟部水利署長黃金山、台大土木系教授李鴻源、台大教授李天浩、成大水工所長黃煌輝、能邦科技公司執行長朱文生、中興工程顧問公司龔誠山、分別報告台灣相關的經驗與做法。

雖然台灣無法參加這一次部長級會議，但能在水資源論壇會議中，順利舉行兩場分組座談，向全世界介紹台灣經驗，這項外交突破相當難得。

朱文生就指出，今年活動有一些進展，三年後第四屆水論壇會議將在加拿大舉行，而加拿大對台灣不是很友好，因此水利署應早日籌劃參與事宜，建議與美國、日本、新加坡、荷蘭等較友好國家的對口單位開始共商議題，較容易成功。下屆會議可考慮的議題包括：水與環境（荷蘭、日本、美國）；替代水源的開發（新加坡、美國）；都市防洪（日本）；地下水管理（荷蘭）。

拓展外交向世人呈現台灣經驗，已是當前外交工作重點，但由於台灣不是聯合國會員國，因此包括聯合國大會、聯合國相關機構如世界衛生組織、聯合國教科文組織等都有實質困難，但近年來聯合國所支持的包括環境、水、永續發展等相關會議，不但有各國元首與部長與會，更是相關資訊交流重要場合，因此台灣應該吸取這一次會議的經驗，在這方面做更進一步突破，爭取以務實方式參與部長級會議，提升台灣的國際能見度。

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統一管理權責 解決漏水問題

水資源日益稀少，工業、農業與家庭生活用水的爭議也就不少，有效率的管理水資源，也就成為世界水論壇熱門話題。

農業專家說，為了解決貧窮問題，未來二十五年，全球每年農業灌溉用水必須增加十五至二五%農業用水，才能生產供應全球所增加人口的糧食。但環境保護專家說，相反的農業用水每年必須減少十%，以保護河川、湖泊、濕地，以滿足工業及人口增加的用水。

隨著工業發展，工業用水不斷增加，工業向農業搶水也就時有所聞。一九九五年全球工業用水量為七百二十五立方公里，二〇二五年工業用水量估計將增加至一千一百七〇立方公里，約占全球水資源二四%使用量，屆時農業用水只占三〇%，家庭生活用水占十一%，其中在高度發展國家，農業用水占三〇%，家庭用水占十一%，工業用水比率將占其總用水量的五九%；低度開發國家工業用水量則只占十%，農業用水占八二%，生活用水占八%。

工業與農業爭水 唯靠管理解決

台灣雖然號稱已進入開發國家，但農業用水比例高達七六%、生活用水十六%，工業用水只不過占九%左右，各種用水之爭，尤其是農業與工業用水之爭，幾乎可以說是年年上演。

世界水會議副會長威廉出，水應該相盡辦法到每一個人手裡，讓每一個人使用。聯合國援助開發總署烏馬蘭，水權利的分配是一件很困難的事情，每一機關的人都認為水是屬於自己的，但沒有一個機關會好好保護水資源。

如何解決這一場搶水戰爭？第三次世界水論壇會議與會各國代表普遍認為，要做好有效的水資源管理工作，統一的管理機關是必要的，而流域管理更是未來要走的一條路，而相關水的政策與法律的完備性，以及有效的執行都是必要的工作。

為了協助落後國家管理水資源，世界水論壇部長宣言中強調，將在二〇〇五年完成一個水資源管理與效率計畫。官方與民間形成一個伙伴關係，在二〇〇五年，制定統合水資源管理計畫，宣言中強調，水的設施資金如何取得，水壩與永續發展如何達成，也是未來重點工作。

除了用水之爭外，漏水量大也是另一個問題，目前台北市漏水率三七．三%，台灣省二三%，一天漏水量約一九七萬噸，相當於南部地區一天用水量，一年損失七十億元以上。

北市一天漏水 南部一天用水

在大阪水博覽會會場上，東京都水道局就展示二〇〇二年東京都漏水防止驚人成果，水道局官員說，在一九四五年，東京都漏水率高達八〇%，但到二〇〇一年漏水量已降至六．四%，漏水主要是地下自來水管線龜裂與腐蝕所造成。

這一位官員同時指出，由於東京都每天要取得六百二十三萬公噸原水，已經達到飽和，新的水源很難在尋覓，只有在減少漏水方面著手，這也是一九九二年東京漏水率已經只有十．二%，東京都仍積極投入漏水防止原因。他強調，漏水防止實在沒有其它的方法，只有加速更新汰換老舊水管，並且多加派人手四處巡找漏水地方。東京都水道局編制就有三百七十五名防止漏水作業職員。

反觀臺北自來水事業處，無費水率高達四二%，但水處自己承認的實際漏水率卻只有三十%，另水處表示過去四年（八十八年至九十一年），平均每年投資約六億五千萬元，已汰換老舊管線長度二七七公里，水處為改善漏水情況，水處計劃提出中長程汰換水管計畫，中程計劃自九十二年至九十五年止，將投入總工程費二十五億二千萬元，汰換管線二二〇公里，預期可降低漏水率四個百分點。另為改善長期漏水預計以三十年時間，平均每年以百分之二之比例，汰換管線三、七六一公里，完成後預期將可降低漏水率百分之二十，概估經費每年約需十五億元。

東京都水道局在世界水論壇上展示，如何將自來水漏水率從二次大戰後的百分之八十降至去年的百分之六．四。（呂理德攝）

台灣水價偏低 抓漏苦無經費

依照台北自來水事業處的計畫，第一個問題是經費仍無著落，第二個問題是整個計畫要長達三十年，而歸根究底還是錢的問題。經費從那裡來？

事實上，這筆費用應該來自水費，才符合受益者付原則，但台灣水價也太低，台灣省水價每度九元，台北市每度七點七元，鄰近日本為四十二元，德國六十六元，丹麥五十七元，比利時五十三元，荷蘭四十三元，法國四十二元，英國四十一元，美國十八元，南非十六元，加拿大十四元，台灣水價偏低的結果，不但不利於推動節約用水工作，對於自來水單位汰換老舊水管工作推展，也會造成嚴重的阻礙。

聯合國估計，全世界有十二億人口缺乏安全飲用水，二十四億人口沒有衛生下水道設備，每年有五百萬至七百萬人死於與水相關的疾病，聯合國預計在公元二〇一五年達到缺乏安全飲用水以及衛生下水道減半計畫，每天要有三十萬人新供水備，以及四十萬人新衛生下水道設備。這項減半計畫，預計在未來二十五年中每年必須投入一千八百億美元。

台灣污水下水道普及率只有十三%，台灣能做得到聯合國二〇一五年減半計畫嗎？

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呂理德

他山之石：日本人愛水愛得透徹

日本是一個愛水的民族。走在日本大街小巷，繁華景象可能與台北東區相仿，但卻四處都是小橋流水所營造出來的水文化城市卻是令人印象深刻。從日常生活中，可以看到一個愛水民族，如何與水生活在一起，創造出獨特的水文化。

為了展現日本人愛水的特質，第三屆水論壇會議，主辦單位也邀請所有與會者，從山科一直到琵琶湖紀念館附近，沿著琵琶湖疏水道乘坐特有日本小船，一覽這一條疏水道風光景色，沿途可以看見的是日本京都的古都風貌，兩岸楊柳扶疏，含苞待放的山櫻花。疏水道兩旁，不時有人散步，更可以見到垂釣的人，這樣如詩如畫的畫面，彷彿在電影畫面中似曾相識。

曾經在京都大學唸書的的蘭陽技術學院助理教授林獻山說，疏水道是引琵琶湖的水進入京都，然後流入高瀨川，一方面做為京都飲用用水，也同時有水力發電，河旁兩岸也是京都市民休閒場所。

談起琵琶湖，就是日本人的驕傲。第三屆水論壇會議另一個場地是琵琶湖所在地滋賀縣大津市是一個相當小的城市，但卻在這一次會議中大出風頭，因為他們有一座琵琶湖，這一座光湖面積就有六百七十四平方公里，河岸長約二百三十五公里，占有滋賀縣六分之一面積，湖的容量為二百七十五億立方公尺。台大土木系教授李鴻源說，這樣的數據可能無法來形容琵琶湖有多大，台灣一年用水量約一百八十億立方公尺，換句話說，一個琵琶湖，就可以提供台灣一年半所有農業、生活以及工業用水。

在日本關西地區，琵琶湖是他們大地賴以為生的母親，整個京都、大阪、神戶地區一千四百萬人用水都要依靠琵琶湖，走在琵琶湖岸邊，也可以發現，日本人是多麼善待她，清澈的水質，也沒有高聳的湖堤，讓人隨時可以親近她。

更令人驚訝的是，琵琶湖兩岸開發的壓力也相當大，有水上遊憩活動，四周圍交通便利，也有高聳的大樓，但是卻仍能讓琵琶湖保持她清淨的面貌，不會發臭變髒。

琵琶湖也曾經走過遭人污染破壞的日子，但是三、四０年前，日本人覺醒，積極投入整治工作，每年寒暑假並安排居住在京阪神附近的小朋支參觀並進行環境戶外教學活動，從小灌輸他們愛護環境與水資源，如今看到的是人與水和諧相處的景像。

這樣的景象在京都市中心的白川也可以見到。白川，是一條穿過京都市東山地區一條默默無名的小河，這樣的小河要是在台灣，多數不是一條黑龍江，就是被加蓋做停車場，或是高聳堤防所阻隔，但她的水卻是清澈見底，流水潺潺，河的兩岸也不見土堤防，甚至欄杆都沒有，居民門前種了一些小花，要澆花，隨手拿個取水桶到河邊取水，這樣與河親近的畫面實在令人羨慕。

去過京都的人，都知道一條位於銀閣寺與南禪寺附近不到六點一公里長的哲學之道，她並沒有什麼特別之處，只因為有一條小河道，河道兩旁盡是櫻花、楓樹，走在其中，令人心曠神怡，暫時可以忘去塵囂。

事實上，即使在高度工業化的大阪城，在走過公害經驗之後，目前雖然仍四處可見高聳的煙囪仍在，但河川及海洋也都已露出生機，不再有惡臭。

水的博覽會上，日本人更是將水展現得淋漓盡致。在大阪主展覽場會場上，除了有關水的科技與產業發展，呈現在與會者眼前，也有與生活相關的節水、儲水、自來水及污水下水道設備，各種與水有關包裝水、清酒、高科技生成水也都在之列，更有與水相關的文化。大津展覽會場則強調他們如何與琵琶湖共生的展覽。總之，整個會場讓人感覺到不但有傳統也有創新，更有震憾，讓人意想不到一個區區的水展覽會能做得如此活潑生動。

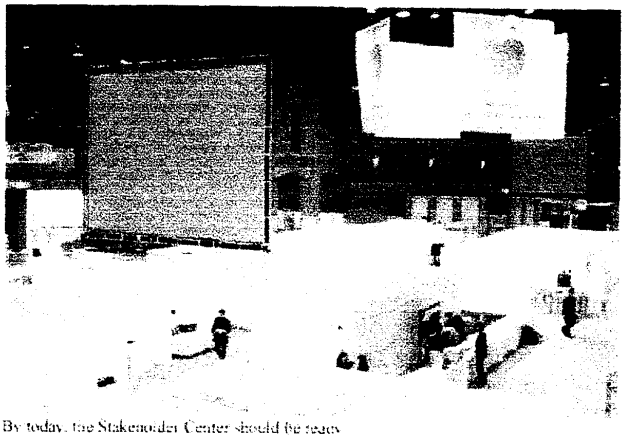
在京都水宣言中，日本人很自豪的說，從京都發展歷史，他們看到他們的祖先，無論是居住在小村落與森林中，抑或是居住在平原中，他們了解，一個富有豐富的水文化是離開不了他們的生活中，每一區域因為都有其不同水的歷史與文化，而這是每一區域所共有的，因此要解決這樣複雜而廣泛的水問題，每一區域首先要有共同合作並且具有長期視野及綜合性角度來解決水的問題。

從日本的經驗，台灣應該要好好思索如何對待河川的問題了。

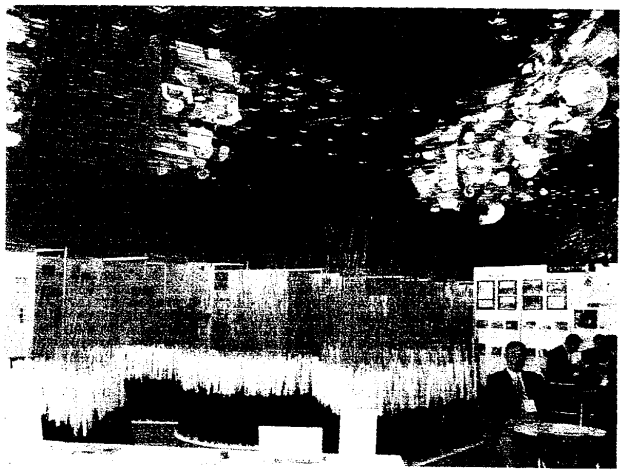
附件十

「活動照片」

照片一： 主辦單位於日本京都鴨川河上佈置歡迎大會標語



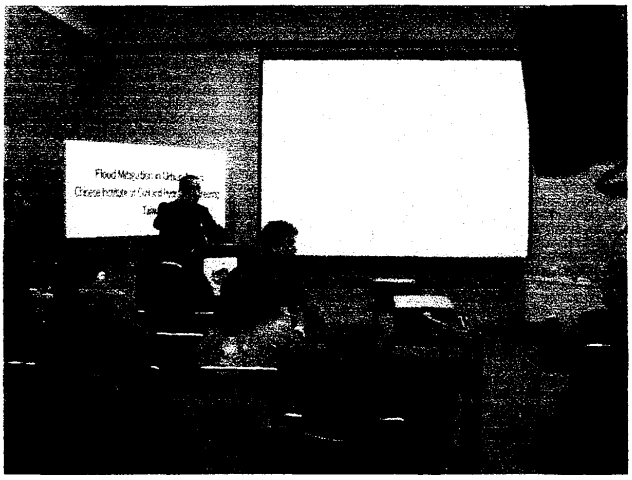
照片二：京都展示會場佈置



照片三：大阪展示會場佈置

照片四： 3/18 日大會洪水組開幕儀式

照片五： 3/18 日「都市防洪」專題座談會會場

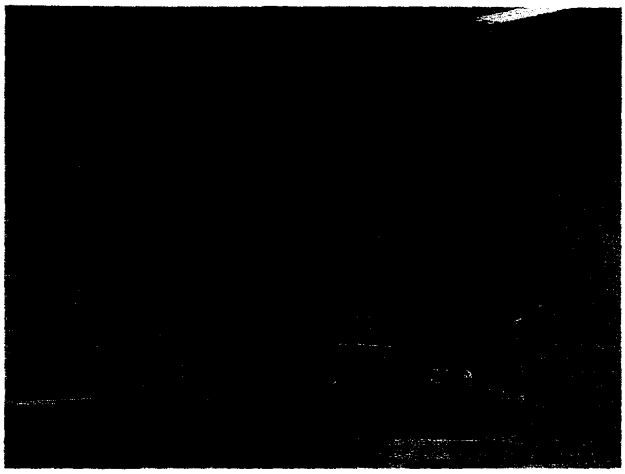


a. 黃署長金山專題報告

b. 李教授天浩專題報告

c. 李教授鴻源專題報告

照片六(a,b,c)： 3/18 日台灣發表「都市防洪」專題



a. 黃署長金山與黃主任煌輝回應專題討論

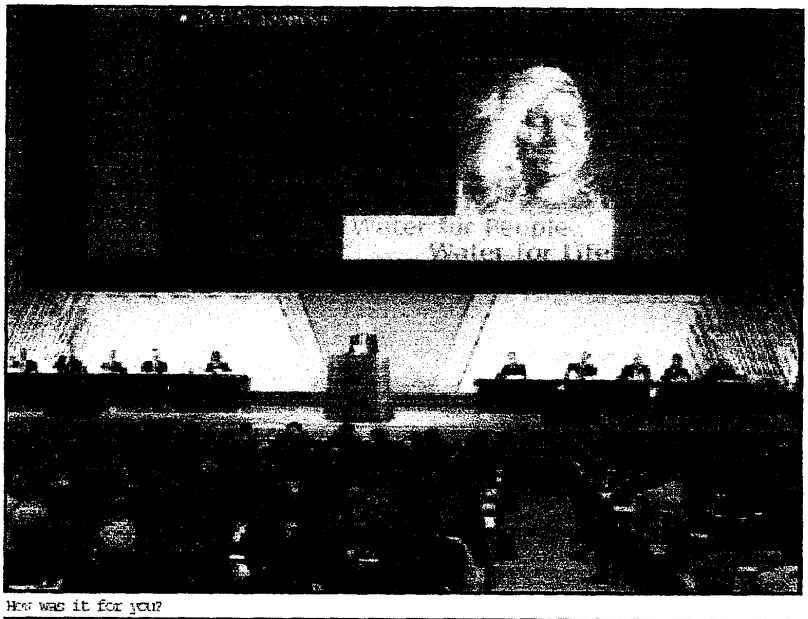
b. 龔博士誠山專題報告

c. 朱博士文生專題報告

照片七(a,b,c)： 3/19 日台灣發表「地層下陷防治」專題

照片八： **3/19** 日「地層下陷防治」專題座談會會場

照片九： **3/19** 日「地層下陷防治」專題會議結論撰寫



照片十： **3/21** 日 大會舉行結論會議會場

照片十一： 日本京都會場外觀

照片十二：參紡琵琶湖－左起：黃煌輝主任與隨團顧問
(於教授幼華、余董事長範英、趙委員永清)合影

照片十三：參紡琵琶湖－黃署長金山接受隨團記者訪問

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