經濟部

行政院所屬各機關因公出國人員出國報告書

（出國類別：其他－出席國際會議）

「第20屆台美水資源技術合作年會及考察」

「The 20th AIT-TECRO Water Resources Program Annual Review Meeting」

出國報告書

出國人：經濟部水利署北區水資源局王瑋正工程司兼課長

出國地點：美國

出國期間：96 年 11 月 4 日至 11 月 15 日

報告日期：96 年 12 月 1 日

目　錄

摘　要

本次第 20 屆(2007 年)台美水資源技術合作年會，於 11 月 4 日啟程由台北前往美國洛杉磯後轉機至丹佛市，首日 11 月 5 日於丹佛市舉行「第 20 屆(2007 年)台美水資源技術合作年會」，並利用中午休息時間參觀美國墾務局技術支援中心（Technical Service Center, Bureau of Reclamation）及水資源研究試驗室(Water Resources Research Laboratory)。隔日 11 月 6 日參觀丹佛市水利工程設施並於傍晚前往新紐澳良(New Orlean)。11 月 7 及 8 日拜會美國工兵團(US Army Corps of Engineers)並考察 Katrina 風災復建工程，並於 8 日下午前往休士頓。11 月 9 日參訪 Harris County's 防洪計畫與管理(Harris County Food Control District)，11 月 10 參訪參訪聖安東尼奧河岸整治工程並於 11 日前往薩克滿多市。11 月 13 日考察石峽大壩(Stony Gorge Dam)水庫更新改善工程，旋即於 11 月 14 日由舊金山搭機返台並於 11 月 15 日抵達桃園國際機場。

壹、前言

我國於 1987 年起與美國內政部墾務局簽訂「中美水壩工程設計建造之技術支援」協議，該技術支援協議乃透過我北美事務協調會(CCNAA)與美方在台協會(AIT)簽署合作合約，依實際需要，函請美方內政部墾務局派遣相關專家協助。為擴展水資源技術合作之需要修訂為「台美水資源發展技術支援協議」，工作內容則另述明於各附錄案中，至今計簽署有附錄 1 至附錄 8，目前僅持續進行附錄 6 及附錄 8 合約。

為促進合作之實質效益，檢討合作計畫成果以及策劃年度工作計畫，依協議規定每年訂期舉辦年會，第一屆於 1988 年由我方召集，爾後此項年會輪流在中美兩地舉行。今（2007）年（第 20 屆年會）適輪由美方主辦。

本次第 20 屆(2007 年)台美水資源技術合作年會，我方代表團於 11 月 4 日由桃園機場啟程前往美國加州洛杉磯後轉機至科羅拉多州丹佛市，首日 11 月 5 日於丹佛市舉行「第 20 屆(2007 年)台美水資源技術合作年會」，並利用中午休息時間參觀美國墾務局技術支援中心（Technical Service Center, Bureau of Reclamation）及水資源研究試驗室(Water Resources Research Laboratory)。隔日 11 月 6 日參觀丹佛市水利工程設施並於傍晚前往路易斯安那州新紐澳良(New Orlean)。11 月 7 及 8 日拜會美國工兵團(US Army Corps of Engineers)並考察

Katrina 風災復建工程，並於 8 日下午前往休士頓。11 月 9 日參訪德州休士頓 Harris County 防洪管理局(Harris County Flood Control District)，11 月 10 參訪參訪聖安東尼奧河岸整治工程(另「赴美協商台美水資源發展技術協議」計畫，謝總工程司勝彥、陳所長弘凸及賴局長伯勳等 3 人奉命先行回台)並於 11 日前往加州薩克滿多市。11 月 13 日考察石峽大壩(Stony Gorge Dam)水庫更新改善工程，旋即於 11 月 14 日由舊金山搭機返台並於 11 月 15 日抵達桃園國際機場。

貳、雙方代表團成員

本次第 20 屆(2007 年)台美水資源技術合作年會，我方與會代表經濟部水利署謝總工程司勝彥、水利規劃試驗所陳所長弘凷、北區水資源局賴局長伯勳(「赴美協商台美水資源發展技術協議」計畫)及王瑋課長、國立成功大學詹錢登教授、私立逢甲大學許少華主任(教授)、財團法人台灣水利環境科技研究發展教育基金會游組長進裕、中興工程顧問公司劉建邦經理等人與會，共計 8 人。

美方則由墾務局技術服務中心 Michael Gabaldon(Acting Director)帶領水資源、地工、環境、壩工、工程施工、泥沙運移、數值模擬等各專業人員與會，年會安排於科羅拉多州丹佛市美國內政部墾務局技術支援中心 (Technical Service Center, Bureau of Reclamation) 舉行，由雙方團長共同主持，雙方代表團成員名單詳如表一、二及照片一、二所示。

表一　我方代表團成員名單

20th Annual AIT-TECRO Water Resources Program 2007 Annual Meeting
WRA delegation's proposed itinerary

Delegate list:

Name 姓名	Oganzation 所屬機關單位	Position 職稱
Hsieh, Sheng-Yen	Water Resources Agency	Chief Engineer
謝勝彥	經濟部水利署	總工程司
Chen,Hung-Kwai	Water Resources Planning Institute, Water Resources Agency	Director
陳弘凷	經濟部水利署水利規劃試驗所	所長
Lai, Bor-Hsun	Northern Region Water Resources Office, Water Resources Agency, MOEA	Director
賴伯勳	經濟部水利署北區水資源局	局長
Wang, Wei	Northern Region Water Resources Office, Water Resources Agency, MOEA	Chief of Planning Section
王瑋	經濟部水利署北區水資源局	課長
Hsu, Shao-Hua	Feng Chia University, Water Resources Engineering and Conservation	Professor
許少華	逢甲大學水利工程與資源保育學系	教授
Jan, Chyan-Deng	National Chung Kung University, Department of Hydraulic and Ocean Engineering	Professor
詹錢登	成功大學水利及海洋工程學系	教授
Liu, Chien-Pang	Sinotech Engineering Consultants, Inc	Technical Manager
劉建邦	財團法人中興工程顧問社	
Yu, Chin-Yu	Taiwan International Institute For Water Education	Division Head
游進裕	國際水利環境學院	教研組組長

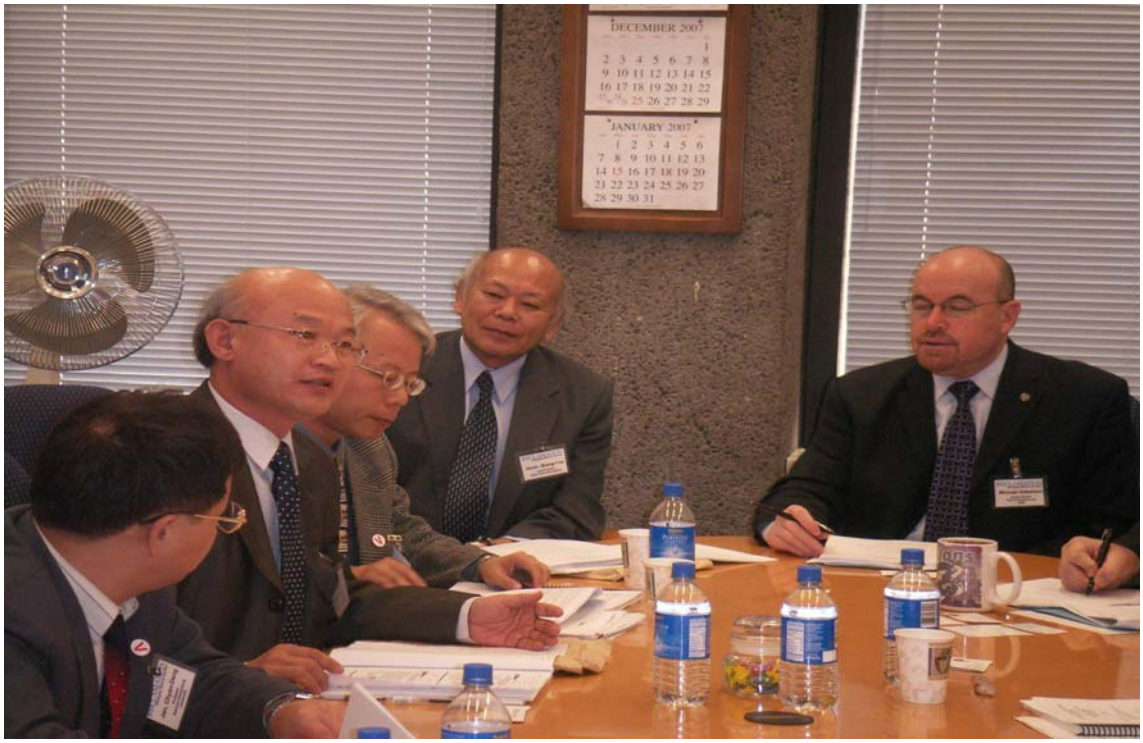
表二　美方代表團成員名單

20th Annual AIT-TECRO Water Resources Program 2007 Annual Meeting
RECLAMATION delegation's proposed itinerary

Delegation list：

Name	Organization	Position
Michael Gabaldon	Technical Resources, BOR	Acting Director
Lowell Pimley	TSC, BOR	Acting Director
Dick Ives	Native American and International Affairs Office	Director
Tom Hepler	BOR, TSC, Waterways and Concrete Dams Group	Hydraulic Structural Engineer
Blair Greimann	BOR, TSC, Sedimentation and River Hydraulics Group	Hydraulic Engineer
Tony Wahl	BOR, TSC, Water Resources Research Lab	Hydraulic Engineer
Barbara Mills-Bria	BOR, TSC, Structural Analysis Group	Structural Engineer
John Trojanowski	BOR, TSC, Waterways and Concrete Dams Group	Hydraulic Structural Engineer
Wayne Graham	BOR, TSC, Sedimentation and River Hydraulics Group	Hydraulic Engineer
Tim Randle	BOR, TSC, Sedimentation and River Hydraulics Group	Manager
Yong Lai	BOR, TSC, Sedimentation and River Hydraulics Group	Hydraulic Engineer

照片一台美雙方代表團成員於美國墾務局技術支援中心 682 會議室



照片二 我方代表(謝總工程司)於美國墾務局技術支援中心 682 會議室

參、年會會議及參訪內容

一、第二十屆台美水資源技術合作年會

(一)籌備過程：

我方與美方（美國內政部墾務局）於 1987 年簽訂「中美水壩工程設計建造之技術支援」協議，係針對當時興建的鯉魚潭、南化及牡丹等水庫工程之設計、施工等技術，請美方提供施工經驗、指導與諮詢。該技術支援協議乃透過我北美事務協調會(CCNAA)與美方在台協會(AIT)簽署合作合約，依實際需要支援項目，函請美方派遣相關專家協助。因合作內容皆屬水庫興建事宜為主，因此訂為「中美水壩工程設計建造之技術支援」協議。嗣後，為擴展雙方水資源技術合作之需要而修訂為「中美水資源發展技術支援協議」。於 1988 年雙方為促進合作之實質效益，並檢討合作計畫成果及策劃下年度工作計畫，依協議規定每年訂期舉辦年會，直至今(2007)年則屆滿 20 周年，特舉辦第 20 屆年會，適輪於美國由美方主辦。

(二)會議記事：

第 20 屆中美水資源技術合作年會（20th 2007 AIT-TECRO Water Resources Program Annual Review Meeting）於 2007 年 11 月 5 日星期一，於美國加州丹佛市墾務局技術支援中心 682 會議室舉行(Conference Room 682,Technical Service Center Bureau of Reclamation)(議程參見表三)，由雙方團長共同主持

表三　第 20 屆台美水資源技術合作年會議程

2007 年 11 月 05 日(星期一) 上午

時間	議程、主持人
8:30 a.m.	Welcome and Opening Remarks Michael Gabaldon, Acting Director, Technical Resources, BOR Sheng-Yen Hsien, Chief Engineer, WRA, Taiwan Lowell Pimley, Acting Director, TSC, BOR Dick Ives, Director, Native American and International Affairs Office
8:50 a.m.	2007 Project Progress Report: Appendix 6 Tom Hepler, BOR, TSC, Waterways and Concrete Dams Group
9:10 a.m.	2007 Project Progress Report: Appendix 8 Blair Greimann, BOR, TSC, Sedimentation and River Hydraulics Group
9:30 a.m.	Feedback Report on the 2007 Project Progress and Technical Support of BOR Chen Hung-Kwai, Director, Water Resources planning Institute, Liaison
9:50 a.m.	Discussion on the 2007 Project Progress Report Moderator-Dick Ives, Director, Native American and International Affairs Office
10:15 a.m.	Break
10:30 a.m.	Current or Future Needs : Taiwan WRA's Perspective Sheng-Yen Hsien, Director, Chief Engineer, WRA, Taiwan
11:00 a.m.	Discussion of 2008 Calendar Year Work Items Under both Appendix 6 and Appendix 8 Agreements
12:00 p.m.	Lunch organized by the BOR

表三　第 20 屆台美水資源技術合作年會議程(續)

2007 年 11 月 05 日(星期一) 下午

時間	議程、主持人
1:00 p.m.	“Embankment Protection Systems and Models for Predicting Erosion and Breach Due to Overtopping Flow” Tony Wahl, BOR, TSC, Water Resources Research Lab
1:30 p.m.	“Dynamic Analyses of Concrete Dams” Barbara Mills-Bria, BOR, TSC, Structural Analysis Group
2:00 p.m.	“Spillway Failures Under Hydrologic Loads” John Trojanowski, BOR, TSC, Waterways and Concrete Dams Group
2:30 p.m.	Break
2:45 p.m.	“Problem of high turbidity in reservoir and river during typhoon season and related research needs” HSU, Shao-Hua, Professor, Feng Chia University
3:15 p.m.	“Balin check dam collapse event in Taiwan” Liu Chien-Pang, Technical Manager, SINOTECH
3:45 p.m.	“Flood history in Colorado and approaches taken in the Denver metropolitan area to minimize flood damage” Wayne Graham, BOR, TSC, Sedimentation and River Hydraulics Group
4:15 p.m.	Technical Discussion Moderator: Tim Randle, Manager, TSC, BOR, Sedimentation and River Hydraulics Group
4:45 p.m.	Summary and Concluding Remarks Sheng-Yen Hsien, Chief Engineer, WRA, Taiwan Michael Gabaldon, Acting Director, Technical Resources, BOR
6:30 p.m.	Welcome Banquet, Hosted by BOR, Simms Landing, 11911 W 6th Avenue, Lakewood, Colorado, Yong Lai will provide transportation

會議，美方代表為墾務局技術支援中心主任 Michael Gabaldon（Acting Director, Technical Resources, BOR），我方代表則由經濟部水利署謝總工程司勝彥擔任。

會議首先由美方 Michael Gabaldon(Acting Director)介紹本次與會美方代表及表達歡迎我方代表團來訪之意，並說明美國對於水資源利用及管理課題是相當受到重視，並且研究利用不斷進步的科技與技術，在處理相關水資源的問題，期望藉由年會的召開，能使台美雙方在水資源的問題上的技術及知研究成果能相互交流。

緊接著由我方代表團團長謝總工程司勝彥代表我方致詞及介紹我方代表成員。

雙方團長致詞及介紹之後，隨即依年會議程由雙方團長共同主持相關計畫及各項報告之研討，首先由美國墾務局技術支援中心 Tom Hepler（BOR ,TSC,Waterways and Concrete Dams Group）及 Blair Greimann（BOR ,TSC,Sedimentation and River Hydraulics Group）分別針對第 6、8 號附錄之 2007 年工作成果(2007 Project Progress Report ：Appendix 6、8)進行相關介紹與簡報。美方代表於報告第 6、8 號附錄工作議題與成果之後，接著由水利規劃試驗所陳所長弘凷 Chen Hung-Kwai（Director,Water Resources Planning Institute）針對 2007 年美方給予我方相關計畫及技術支援所提供之協助、建議等相關課

題，做適當與必要之回應與說明。陳所長簡報後，接續討論2007 年美方所提工作報告(由 Dick Ives 簡報)；由美方進行簡報之後則由我方代表進行報告,針對目前及未來提出我國台灣目前所遇到的相關問題及需求，並進行雙方技術交流討論，並且針對 2008 年將進行的工作項目進行討論工作（詳照片三、四）。

因時程緊迫，美方人員利用中午休息時間帶領我方代表人員參觀美國墾務局 TSC 研究中心(Technical Service Center, Bureau of Reclamation, USBR)，該中心提供工程、研究、科學服務並從事於土木工程領域、環境工程領域、大地工程領域、基礎工程領域(水利、機械、機電工程)、水資源領域等相關之委託工作。各研究領域底下皆有優秀的研究團隊在進行各項研究工作。

水資源研究試驗室(WRRL)對於水工模型實作(照片五、六)、現場試驗、水資源、水力學和流體力學等問題上的技術，皆有所長,並實地的應用於各項開發工程與新興水資源的管理上。

下午議程首先則由水資源研究試驗室技術支援中心 Tony Wahl（Water Resources Research Laboratory ,TSC, BOR）,針對堤岸保護(Embankment Protection Systems and Models for Predicting Erosion and Breach Due to Overtopping Flow)課題進

照片三　美方代表(Tom Hepler)簡報

照片四　我方代表(陳所長弘凷)簡報

照片五 美國墾務局水資源研究試驗室(WRRL)模型製作

照片六　美國墾務局水資源研究試驗室(WRRL)以木材製作模型

行三十分鐘的簡報。後由墾務局技術支援中心 Barbara Mills-Bria（Structural Analysis Group）及 John Trojanowski (Waterways and Concrete Dams Group)針對混凝土壩動態分析（Dynamic Analyses of Concrete Dams）、水力荷重致溢洪道破壞(Spillway Failures Under Hydrologic Loads)等相關課題進行簡報介紹。接續由我方許少華教授(Hsu, Shao-Hua, Professor, Feng Chia University)及劉建邦經理(Liu Chien-Pang, Technical Manager, SINOTECH)分別提出颱風期間水庫高濁度原水沉降研究(Problem of high turbidity in reservoir and river during typhoon season and related research needs)及巴陵壩損壞事件探討(Balin check dam collapse event in Taiwan)等簡報。接著由 Wayne Graham(Sedimentation and River Hydraulics Group, TSC, BOR)針對丹佛都會區減少洪災損害（Flood history in Colorado and approaches taken in the Denver metropolitan area to minimize flood damage）課題進行簡報。

依議程完成簡報後，雙方進行技術研討與綜合討論，並將討論結果作成決議(詳附錄一)，俾供日後執行雙方技術合作之參考。

於年會結束後，由美方(墾務局)在 Simms Landing 宴請本次台美與會貴賓，共同慶祝本次年會圓滿成功並期許下一個 20 周年年會，餐敘當中，席間針對今日所談之議題討論互動熱烈，雙方與會人員相約明年在台灣再見。

(三)雙方合作記事：

1、第 6、8 號附錄記事(2007 年部份)

第 6 號附錄合作工作內容如下：

美方協助我方辦理之水資源工程技術指導與建議，其期末報告務必於今(2007)年 12 月中旬提出。

第 8 號附錄合作工作內容如下：

(1) 經雙方討論研商後，水利署採用之「岩盤沖刷預測(“Predicting Rock Scour)」期中報告於今(2007)年年底前完成，期末報告於明(2008)年 4 月底前提出。

(2) 墾務局於今(2007)年 12 月底赴台灣協助之行程後，提供推估河床岩盤沖刷所需之參數予水利署。

2、第 6、8 號附錄記事(2008 年部份)

第 6 號附錄合作工作內容如下：

於水利署提出工作需求後，墾務局將提供並予以技術協助：

(1) 請於 2008 年初協助及指導水利署北區水資源局(NRWRO)增設取水工工程。

(2) 2008 年請墾務局協助及指導水利署北區水資源局辦理石門水庫既有設施防淤功能改善計畫。

(3) 2008 年 11 月工作協助水利署中區水資源局(CRWRO)辦理湖山水庫技術支援及諮詢。

(4) 2008 年 11 月工作協助水利署南區水資源局(SRWRO)辦理曾文水庫越域引水工程技術支援及諮詢。

第 8 號附錄合作工作內容如下：

懇務局於 2008 年 1 月份提出明(2008)年工作範圍與內容並提供以下技術諮詢：

(1)大甲溪(Tachia River)河床穩定計畫。

(2)石門水庫異重流(density current)及浚渫(dredging)試驗計畫。

(3)濁水溪(Choshui River)整體性河川復育研究與規劃。

二、參觀丹佛市水利工程

2007 年 11 月 6 日由美國墾務局人員陪同參訪美國兵工團於 1965 年建造之 Chatfield 壩及拜會丹佛市都市排水與防洪局(Offices of the Urban Drainage and Flood Control District)。相關參訪內容如下（詳表四、照片七~十及附錄二）：

表四　參觀丹佛市水利設施行程表

2007 年 11 月 06 日(星期二)

時間	參訪內容
8:30 a.m.	Observe the Corps of Engineers Chatfield Dam, constructed after the 1965 South Platte River flood. Currently, there are studies ongoing to convert some flood storage to water supply storage.
10:00 a.m.	Offices of the Urban Drainage and Flood Control District. Meet with Kevin Stuart to learn about flash flood warning program in Denver area and on-site and other small flood storage reservoirs on tributaries to the more major rivers.
1:30 p.m.	Lunch
2:30 p.m.	Travel upstream along the Cherry Creek drainage. Observe Cherry Creek in the walled section and in the unwalled section upstream from Downing St. Continuing upstream, observe newly constructed flood storage reservoirs on Goldsmith Gulch, a tributary to Cherry Creek. Continue upstream to Cherry Creek Dam. Drive over dam and then observe the spillway that diverts floodwater completely around Denver. (The dam was completed in the early 1950's - the spillway has never been used).
4:30p.m.	Reuter-Hess Dam which is under construction.

照片七　Chatfield 壩遠景

照片八　我方參訪人員與美方陪同人員討論 Chatfield 壩營運管理情形

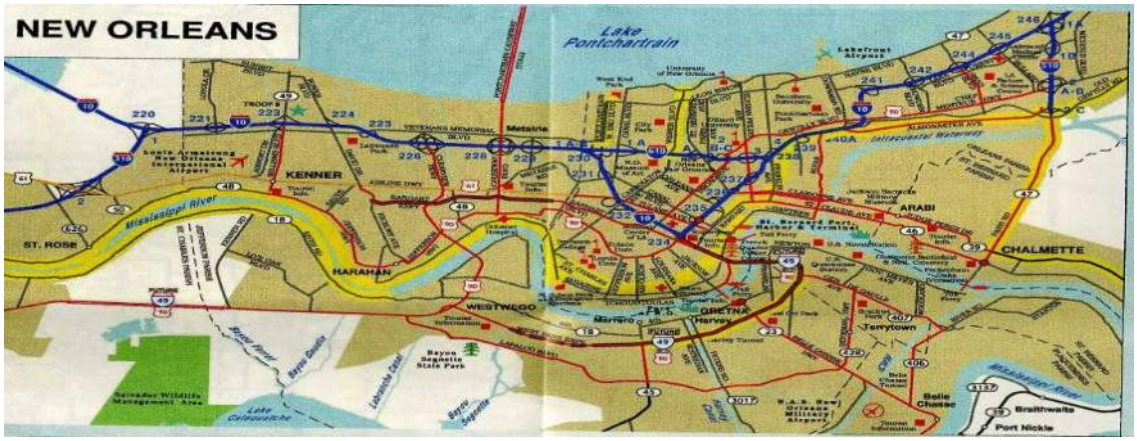
照片九　UDFCD 人員進行丹佛市都市排水與防洪簡報

照片 10 Reuter-Hess Dam 大壩加高工程（施工中）

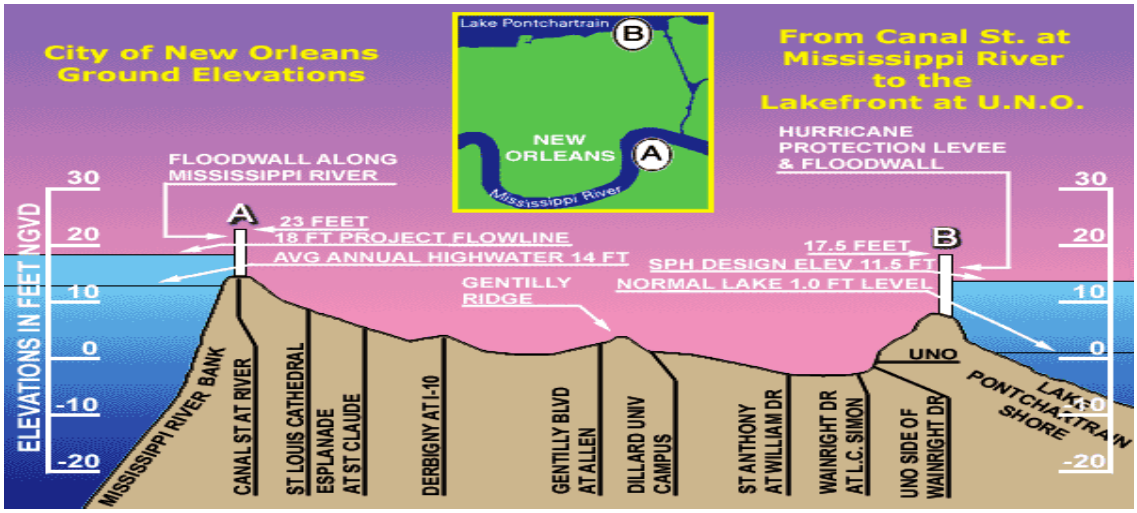
三、拜會美國工兵團及參觀新紐澳良市卡崔那風災復建工程

2007 年 11 月 7 日由美國工兵團(US Army Corps of Engineers)新紐澳良颶風防護局 (New Orleans Hurricane Protection Office)人員陪同參訪美國工兵團防護計畫及考察卡崔那風災復建工程。相關參訪內容如下(詳表五、照片十一~十四及附錄三):

新紐澳良俗稱「大快活」(BIG EASY),有美國南部最大港,人口約 45 萬人(2005 前),現約 25 萬人。地形宛如「大碗公」,大部份低於海平面。



新紐澳良重建計畫示意圖

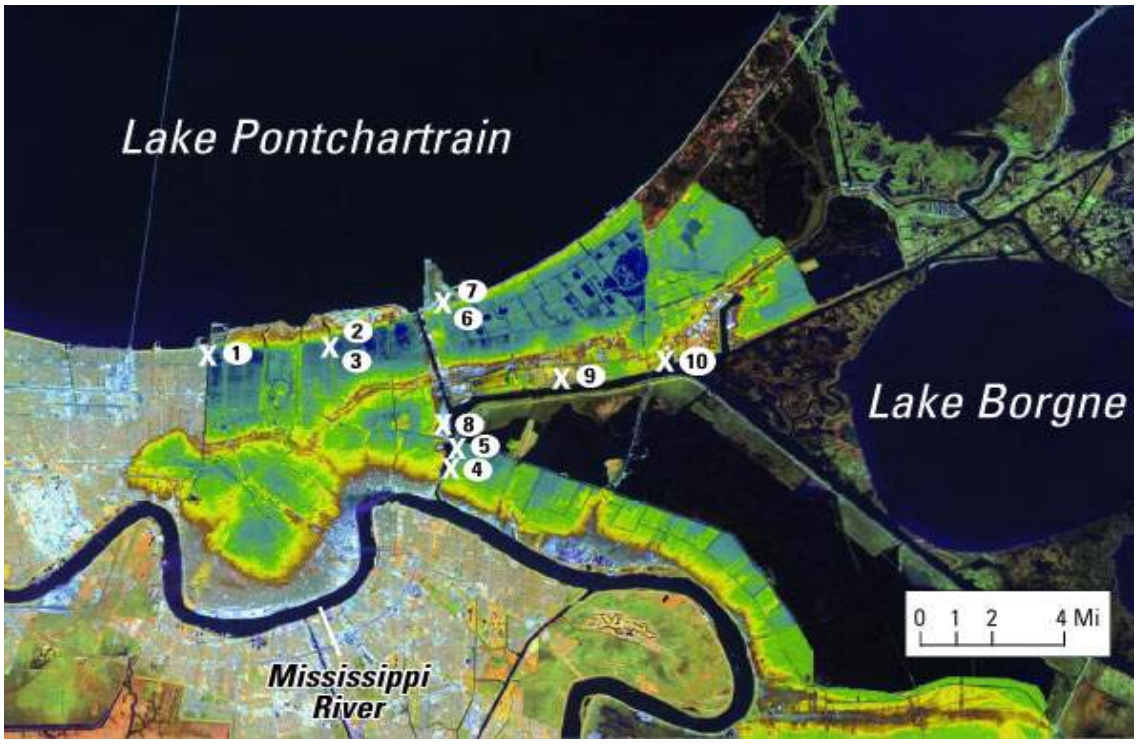


新紐澳良地面高程示意圖

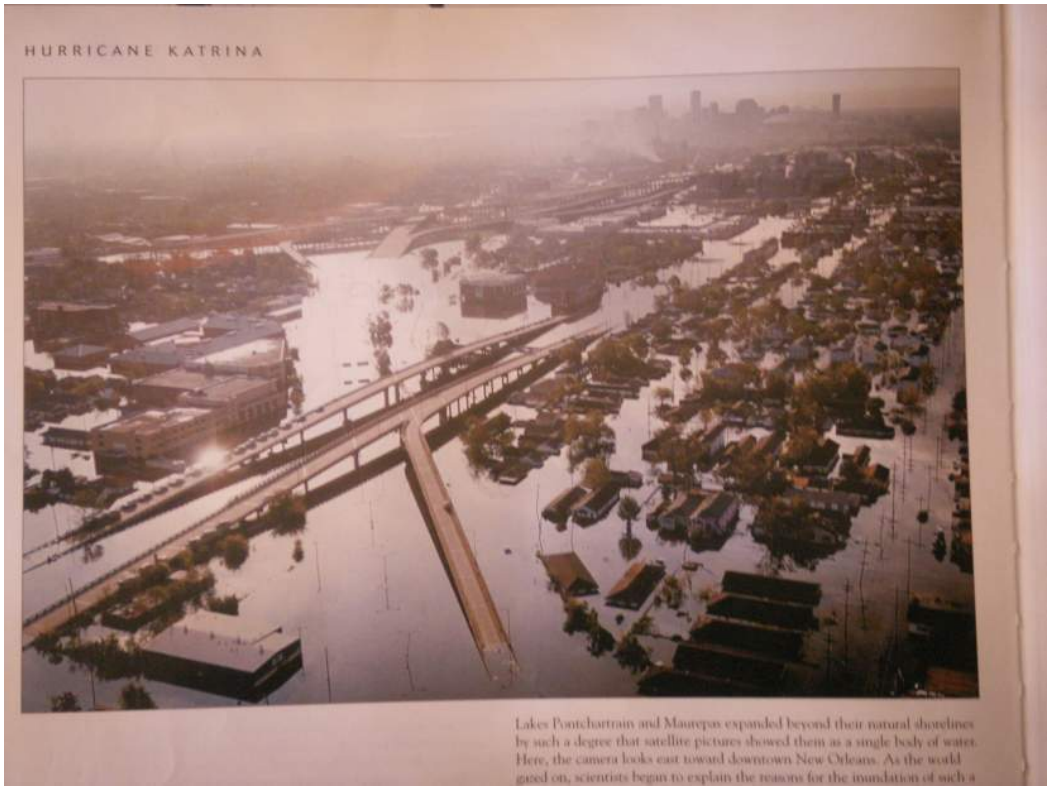
表五　參訪美國工兵團及考察卡崔那風災復建工程行程表

2007 年 11 月 07 日(星期三)

TIME	ACTION
08:15	Depart Omni RoyalOrleans
08:50	Arrive MVN
09:00	HPS Overview Brief
10:05	Site Visit(s) to: IHNC with drive through gth Ward MRGO via 510 Bridge London Avenue Canal Orleans Avenue Canal
Noon	Lunch at Deanie's
13:35	Site Visit(s) Continue 17th Street Canal
14:05	Harvey Canal and Cousins Pumping Station



新紐澳良市卡崔娜風災(Hurricane Katrina)淹水深度圖



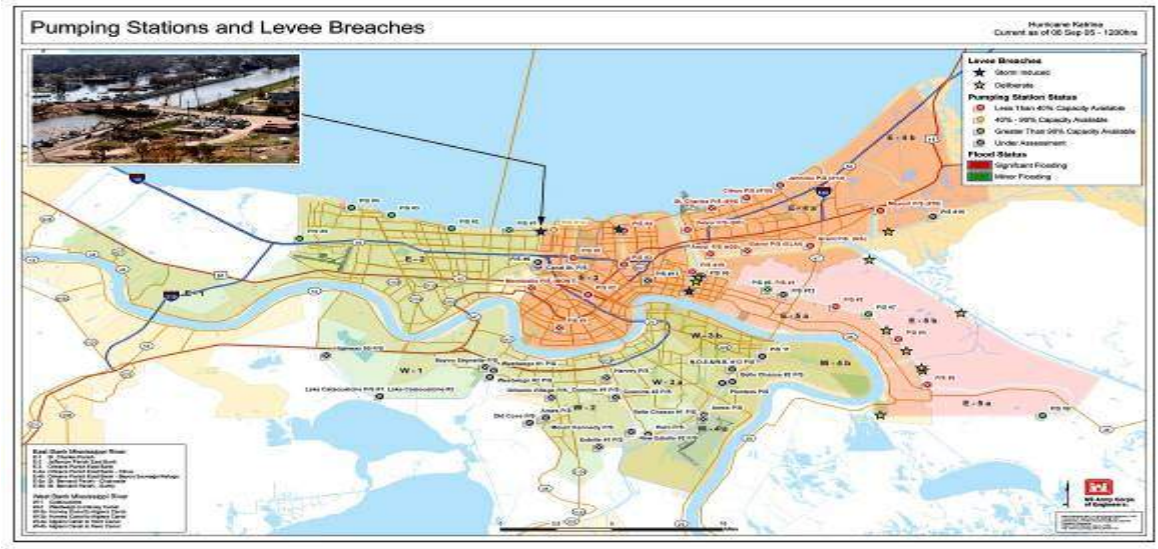
照片十一　新紐澳良市卡崔那風災淹水情形(翻拍)

照片十二　美國工兵團人員說明卡崔那風災復建工程

照片十三　卡崔那風災復建工程之一(抽水站工程)

照片十四　卡崔那風災復建工程之一(堤防復建)

新紐澳良市卡崔那風災(Hurricane Katrina)主要淹水原因有：一、颶風造成的湧浪太高(20’～27’)，而堤防一般只抵禦(9’～12’)。二、Lake Pontchartrain(龐洽翠恩湖)之水位受暴潮影響抬高，造成市區連接湖的運河破堤，故造成重大災難。三、部分區域則因內水積澇無法排出，而造成積水。



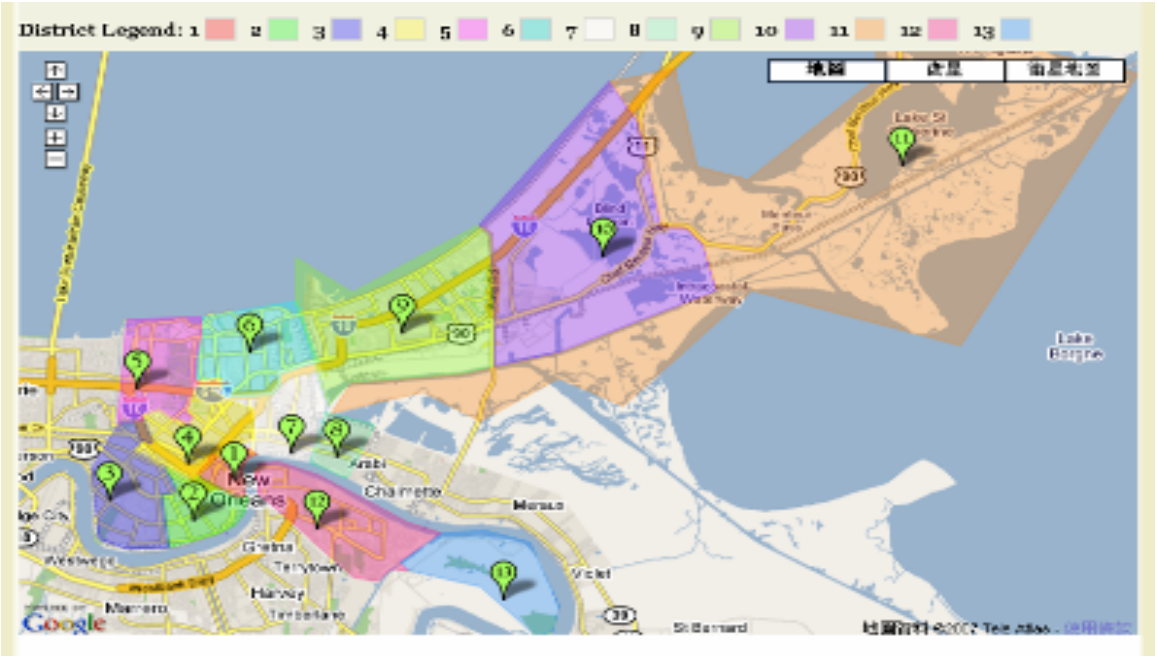
抽水站與破提位置示意圖

新紐澳良市淹水情形之一

美國颶風以風速作為分級，以 Katrina 颶風而言，風速為三級颶風，但湧浪已超過 5 級颶風。美國颶風分級標準如下：

Scale Number (Category)	Winds (mph)	Pressure (millibars)	Surge (feet)	Damage
3	111 – 130	945 – 964	9 to 12	Extensive
4	131 - 155	920 - 944	13 to 18	Extreme
5	> 155	< 920	> 18	Catastrophic
Katrina				
3	127	920	20 – 27	Catastrophic

重建區分成三部分：RE-BUILD、RE-DEVELOPMENT 及 RE-NEW。目前災區重建雖完成規劃，但缺乏資金支援，故進度仍嚴重落後。

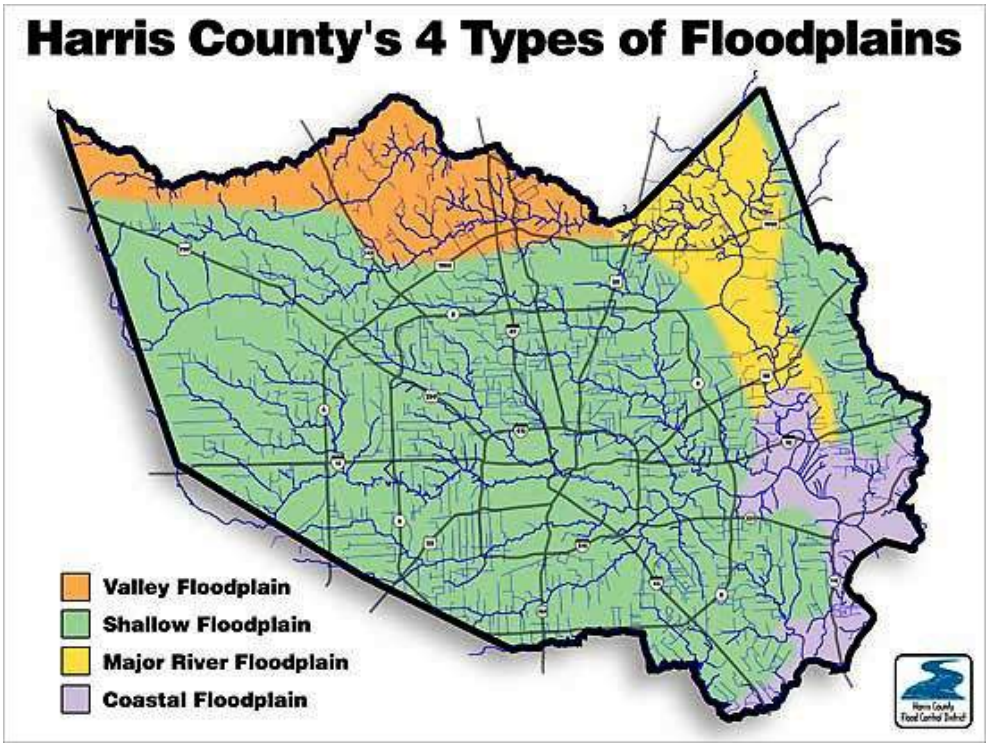


新紐澳良災害重建示意圖

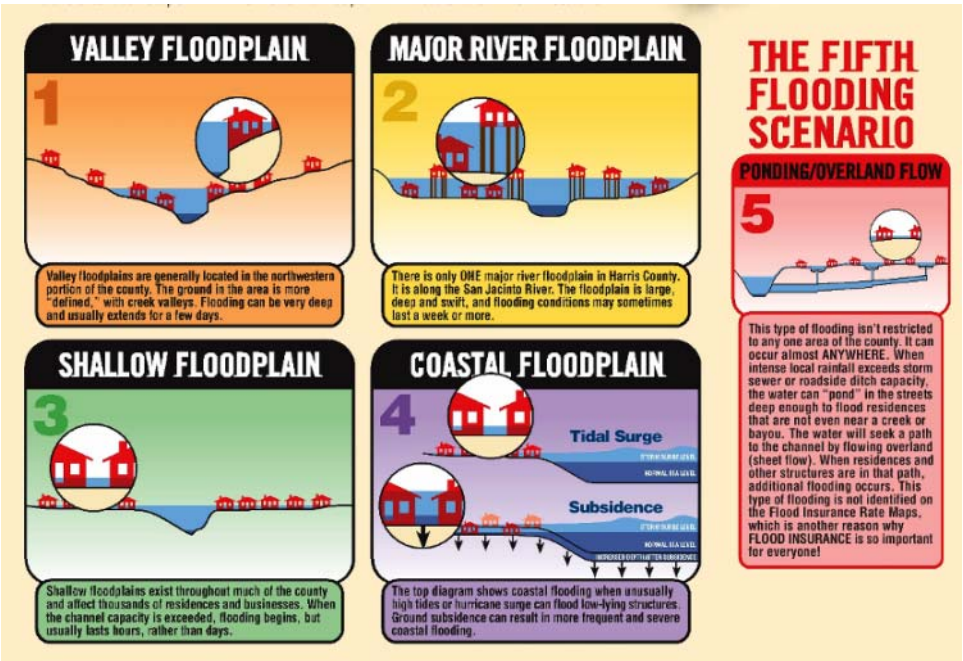
四、參訪 Harris County's 防洪管理局及聖安東尼奧河岸整治工程

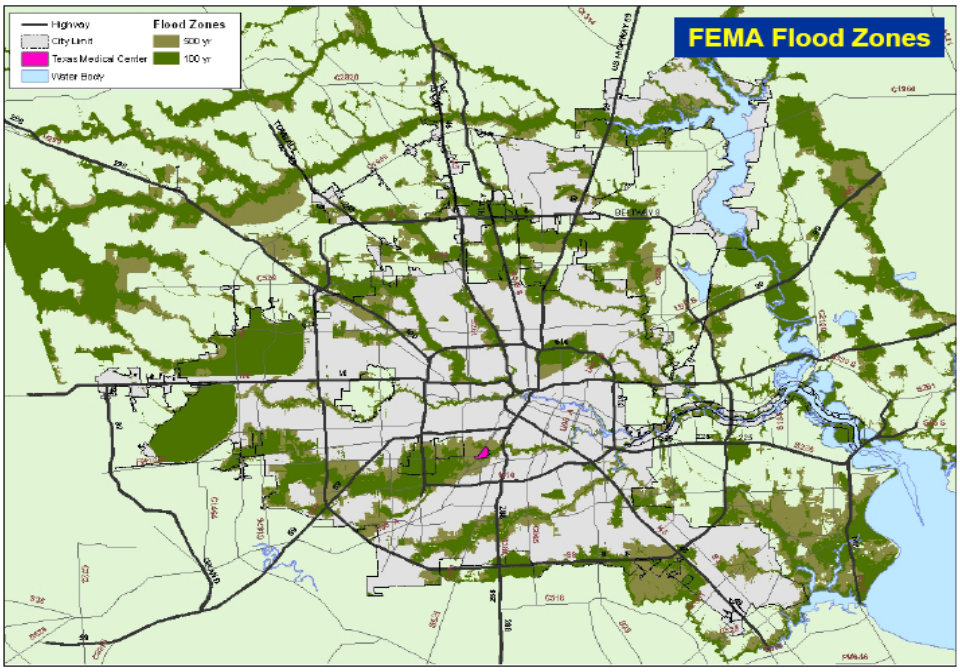
2007 年 11 月 9、10 日由駐休士頓台北經濟文化辦事處商務組安排參訪 Harris County's 防洪管理局(Harris County Flood Control District，HCFCD)及聖安東尼奧(San Antonio)河岸工程。11 月 9 日當日首先赴 HCFCD 聽取 Harris County 對洪水整治之簡報，隨後由 HCFCD 人員陪同參訪休士頓都會區緊急應變中心及滯洪池工程。相關參訪內容如下(詳表六、照片十五~十七及附錄四)：

排水系統分高地排水區、平地排水區、河川區及暴潮影響區。



休士頓平原排水系統(洪水平原型態)：





11 月 10 日赴聖安東尼奧參訪當地之河岸整治工程(River Walk)，經由河岸整治工程（詳照片十八）並結合觀光旅遊而成為繁榮地方之一成功案例。

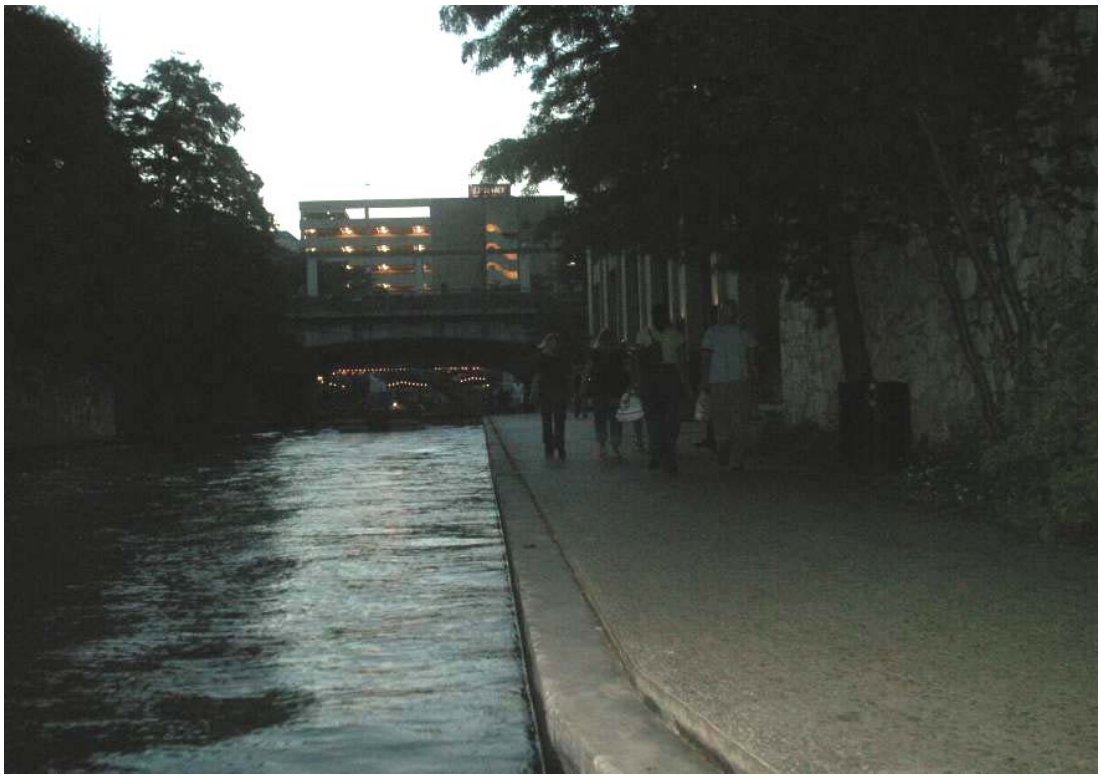
表六　考察 Harris County's 防洪管理局行程表

TIME	ACTION
07:45	出發赴 Harris County Flood Control District(HCFCD)
08:30	HCFCD 簡報 (Yeh Min Maa-Moderator) Conference Room 100 ● Gary Green:Welcome, HCFCD history and projects/funding (20min) ● Jacob Spenn: TSARP, LIDAR, Floodplain Regulations(30min) ● Break(10min) ● John Randolph: Buyout Program(20min) ● Jeff Lindner: Flood Watch and Information Program(30min) ● Break(10min) ● Question and answer session Break(30min)
11:00	轉赴休士頓都會區緊急應變中心 Houston Transtar
11:15	參訪 Houston Transtar
Noon	
13:30	考察參訪 Project Brays, Barker Reservoir
17:00	張濟群博士作美國水利管理簡報

照片十五　HCFCD 防洪管理局業務簡報

照片十六　滯洪池除防洪功能外亦為生物棲息地

照片十七　美國水利管理簡報(台北經濟文化辦事處商務組辦公室)



照片十八　聖安東尼奧河岸整治工程

五、考察石峽大壩(Stony Gorge Dam)安全工程

2007 年 11 月 13 日由美國墾務局人員陪同參訪石峽大壩，石峽大壩於 1928 年完工，位處石峽溪，於 East Park 壩下游約 18 英哩(mile)，另於 Fruitvu 西邊約 5 英哩。水庫蓄水量約 50,380 acre-feet，剩餘水源供應農業灌溉用水。石峽大壩是由 46 隔間(bays) 組成之扶壁式平板混凝土壩(a concrete slab and buttress structure)，其壩高(height)139 英呎(feet)、壩頂長(crest length)868 英呎，是早期 Ambursen 型式壩之一，石峽大壩之平板與扶壁支撐係用來幫助大壩防護地震力，其出水工(outlet works)是一直徑 50 英吋管線(出水能力為 1000 立方英呎/每秒)位於壩基(底)；其溢洪道閘門(3 道閘門，每道閘門 30*30 英呎)共可排放 30,000cfs。(詳照片十九~二十及附錄五)

1990 年代中期，位處加州海岸山脈逆斷層(buried trust fault)被視為可能於中央峽谷南部(southern portion of the Central Valley)誘發一地震。而石峽大壩又位處海岸山脈之東邊；經調查發現，可能逆斷層接近石峽大壩，因此以現有扶壁式平板混凝土壩不足以抵抗可能逆斷層所誘發之地震。

石峽大壩為防止入庫洪水量超過溢洪道洩洪能力時，溢流洪水沖蝕右壩基腳(toe)，已於大壩右壩基礎下游面增設一混凝土平板防止大壩基礎掏空，另亦於壩頂左壩上游面構築胸牆(parapet)。現正辦理扶壁式支撐之更新改善，並於支撐(buttress)與支撐之間構築連續壁(diaphragm wall)加勁大壩，防止地震之破壞。

照片十九　石峽大壩更新改善工程(溢洪道)

照片二十　石峽大壩更新改善工程(遠景)

肆、結論與建議

一、結論

(一)第 20 屆台美水資源技術合作年會，台(經濟部水利署)美(美國內政部墾務局)雙方已於今(2007)年 11 月 5 日假美國（加州丹佛市)隆重舉辦並圓滿完成。回顧過去 20 年合作成效，美方於施工技術、實務經驗上均給予我方莫大協助與建議，除此之外，本次代表團團員也深刻感受:「20 年來我方與美方已建立良好合作夥伴關係,經由美方大力協助與安排,使得我方代表團人員得以參訪美國重大工程,從中吸取該國寶貴經驗,回國後得以應用於我國水利工程建設。印證了，古聖先賢”他山之石，可以攻錯。”之古訓。

(二)「台美水資源發展技術支援協議」第 6 號附錄及第 8 號附錄皆有其重要性,台灣目前水資源工程以颱風期間挾帶大量洪水入庫致原水濁度飆高而影響淨水場功能為首要且亟需解決課題之一,因此石門水庫原水濁度、排淤(異重流)及浚渫等相關議題已優先考量；另湖山水庫與曾文水庫越域引水工程，亦為未來協助工作項目之一。

另台灣因河川坡陡、洪水流速急速等因素，使得河

床沖刷嚴重致河川之保護構造物毀損,因此河川河床(岩盤)沖刷研究、河川復育與滯洪池規劃設計亦是雙方合作之課題。

(三)目前為解決石門水庫原水濁度飆高問題，增設取水工工程及既有設施排淤功能改善工程(電廠防淤功能改善工程)已積極進行中，另新建排砂道及排洪隧道防淤功能改善工程規劃設計亦積極辦理委託工作中,俟工程施工或規劃設計等工作遇需協助時，再請美國墾務局提供人員及技術協助。

(四)「台美水資源發展技術支援協議」為目前『台美雙方』就水資源技術合作僅存之唯一官方協定,建議以後台美合作議題應透過美國墾務局官方管道進行實質交流與合作,於實務操作方面,除配合年會輪流派員互相實際從事公務考察,並請美方提供技術諮詢、建議供我方參考落實外,為走向國際化既定政策,經濟部水利署應派遣專業人員赴美接受相關專業課程訓練,除加強兩國雙邊情誼外,對於我國未來水利工程建設必可提供諸多實質幫助。

二、建議

(一)本次年會及參訪行程，事前均依實務需求並經過縝密規劃與安排,對我國水利工程決策與承辦人員規劃、設計、施工等技術之提升，應有莫大幫助及

助益。建議爾後經濟部水利署赴美參加台美會議人數，應以任務性質從寬、覈實派員與會，以符合提升水利工程規劃設計技能、工程技術需求。

(二)我國目前外交處境甚為艱困，台美會議得以維繫 20 年情誼，實屬不易，因此建議上級機關應繼續支持與肯定本合作計畫。另為延續本合作計畫與經驗傳承，建議參訪人員應邀請以往曾參加之團員或水利署退休高階人員參與。

(三)本次年會利用午休時間參觀墾務局水工試驗室，該試驗室之部分水工模型已改以木材製作。以木材為主要材料，其優點為具有方便拆卸與容易改變地形的優點，且更有環保概念，值得未來國內相關機關參考使用。

(四)美國腹地廣大且河川洪水流速較緩，因此其滯洪池之設置對洪水洪峰消減及防洪功效甚為成功，因此建議我方應對其成功案例審酌參考。目前國內正在推動綜合治水工作，滯洪池是為重要方法之一，本次觀察的滯洪池公園化，平常為休閒或生物棲息等功能，汛期則可發揮滯洪功能，為一多目標之滯洪池，此案例可為我國規劃設計滯洪池之參考。

(五)「第二十一屆（2008 年）台美水資源技術合作年

會」將輪流由我國舉辦，美方將針對我方所提附錄6及附錄8等工作內容提出詳細報告供我方參考，由於台美雙方地理、地質、水文、水理、人文及社會等環境條件有所差異，為利未來執行契合我方需求，我方應積極邀請相關產、官、學、研等專家學者，提供建議與資料，俾使本合作案順利執行，並收最大效益。

附錄一　年會決議

2007 Water Resources Program
The 20th AIT-TECRO Annual Review Meeting
Conclusions

The 2007 20th AIT-TECRO Annual Meeting was held on November 5, 2007 at the Technical Service Center, Bureau of Reclamation (Reclamation), in Denver, Colorado, USA. Delegates for the Water Resources Agency of Taiwan (WRA) and Bureau of Reclamation (Reclamation) discussed various issues related to the work accomplished in 2007, potential work items in 2008 under Appendix 6 and 8 Agreements, and other matters. The meeting has reached the following conclusions:

1. Conclusions about the 2007 work accomplishment:

   - Appendix 6

     - A final report from Reclamation will be delivered by mid-December based on Taiwan regional water resources offices' responses already received by Reclamation.

   - Appendix 8

     - After review and discussions, WRA adopted the midterm progress report of "Predicting Rock Scour" as the work accomplished in 2007. The final report will be delivered in April, 2008.

     - Reclamation will provide further details of needed parameters to estimate river rock scouring in Taiwan after the December trip.

2. 2008 Work items:

   - Appendix 6

     Reclamation will send technical team(s) to assist WRA regarding the following technical issues upon request:

     - Shihmen Reservoir intake work for NRWRO in early 2008.

     - Due to the recent typhoon impact, Reclamation suggestions about the current facility enhancement implementation for sediment sluice tunnel in Shihmen Reservoir for NRWRO will be in 2008.

- Husan Reservoir for CRWRO in November 2008
- Tsengwen Transbasin Works for SRWRO in November 2008

➢ Appendix 8

Reclamation is to provide technical consulting service in 2008 for the following:

- The riverbed stability project of Tachia River
- The density current and dredging experiment project of Shihmen Reservoir
- Overall river rehabilitation and restoration research and planning project in Choshui River

Reclamation will provide a proposal in January 2008 for the 2008 work scope.

SIGNATORIES

For WRA, TAIWAN	**For Reclamation, USA**
Mr. Sheng-Yen Hsien	Mr. Michael R. Gabaldon
Chief Engineer	Acting Director
Water Resources Agency	Technical Resources
Ministry of Economic Affairs	Bureau of Reclamation
	U.S. Department of the Interior

附錄二　丹佛市水利工程

Chatfield Dam & Lake

Chatfield Dam was the second of three dams built to protect the Denver region from floods. Located southwest of Denver on the South Platte River, construction of the dam was begun in 1967 and was completed in 1975. The dam measures approximately 13,136 feet in length with a maximum height of 147 feet from the streambed to the top of the dam.

Chatfield Lake is 2 miles long and has an average depth of 47 feet. The lake drains an area of approximately 3,018 square miles. The 1,479-surface-acre lake has a storage capacity of 27,046 acre-feet

The Dam

Type-Rolled Earth Fill

Height-147 feet

Length-13,136 feet

Width of Top-30 feet

Fill Quantity-14,650,000 cubic yards

The Spillway

Type-Ungated Chute

Capacity-188,000 cubic feet per second

The Outlet Works

Type-Circular 7 feet in diameter

Capacity-2,000 cubic feet per second

The Lake

Drainage above dam-3,018 square miles

Storage Capacity-355,000 acre feet

Surface Acres (max. pool)-4,822 acres

Surface Acres (multi-purpose pool)-1,479 acres

Maximum depth-47 feet

Length of multi-purpose pool 2 miles

Width of multi-purpose pool-1.5 miles

Capacity of multi-purpose pool-27,046

Cherry Creek Dam & Lake

Cherry Creek Dam was the first of the three dams to be built to protect the Denver region from catastrophic South Platte River floodwater that plagued the area for more than 100 years. Located at the southeast edge of Denver in Aurora, Colorado, construction of the dam was begun in 1948 and was completed in 1950.

Cherry Creek Lake is 1.5 miles long, has 8 miles of shoreline, and has a maximum depth of 26 feet. The lake drains a total area of approximately 385 square miles. The 880-surface acre lake has a storage capacity of 134,470 acre-feet of water.

The Dam

Type-Rolled Earth Fill

Height-141 feet

Length-14,300 feet

Width of Top-30 feet

Fill Quantity-13,000,000 cubic yards

The Spillway

Type- Open Channel

Canal-12,200 feet long by 55 feet wide

The Outlet Works

Type-3 conduits 679.5 feet

Concrete-31,500 cubic yards

The Lake

Drainage above dam-390 square miles

Storage Capacity-134,4700 acre feet

Surface Acres (max. pool)-2,630 acres

Surface Acres (multi-purpose pool)-850 acres

Maximum Length of Pool-3.25 miles

Shoreline at multi-purpose pool-8 miles

Capacity of multi-purpose pool-13,960 acre-feet

Bear Creek Dam & Lake

Bear Creek Dam was the last of three dams built to protect the Denver region from floods. Located on the southwest edge of suburban Lakewood at the confluence of Bear Creek and Turkey Creek, construction of the dam was authorized in 1968 and was completed in 1982. The dam was constructed in two segments including the main embankment and the south embankment.

Bear Creek Lake is less than 1 mile long and has an average depth of 48 feet. The lake drains an area of approximately 236 square miles. The multi-purpose pool measures 110-surface-acres and has a storage capacity of 2,000 acre-feet.

The Dam

Type: Rolled Earth Fill

Height:

Main Embankment 179.5 feet

South Embankment 65.0 feet

Length:

Main Embankment 5,300 feet

South Embankment 2,100 feet

Width of Top:

Main Embankment-30 feet

South Embankment-30 feet

Fill Quantity:

Main Embankment 11,345,000 cubic yards

South Embankment 770,000 cubic yards

The Spillway

Type: Earthen Cut

Capacity: 153,500 cfs

The Outlet Works

Type: Circular 7 ft in diameter

Capacity: 2,000 cfs

The Lake

Drainage above dam: 236 sq. miles

Storage Capacity: 78,000 ac-ft

Surface Acres (max. pool): 718 acres

Surface Acres (multi-purpose pool): 110 acres

Maximum depth: 48 feet

Length of multi-purpose pool: 0.5 miles

Width of multi-purpose pool: 0.4 miles

Capacity of multi-purpose pool: 2,000 ac-ft

Tri-Lakes Information Center

The Tri-Lakes Information Center is located on top of a hill overlooking Chatfield Lake. Here, visitors can learn about the Tri-Lakes and the surrounding area. Organized groups can take a field trip to the Chatfield Dam. The Information Center is staffed by Corps employees and is conveniently located near the C-470/Wadsworth interchange.

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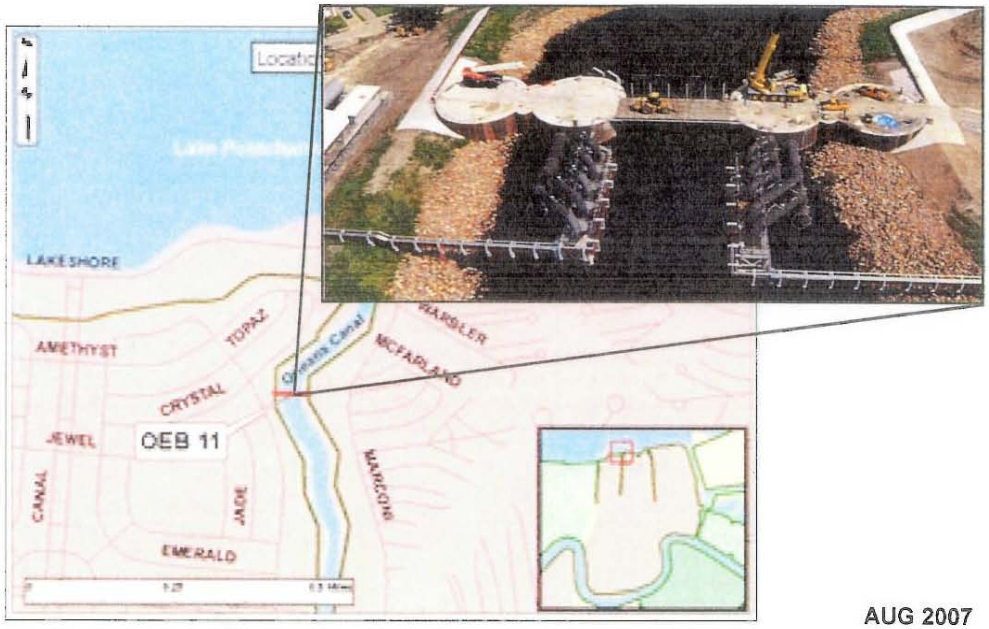
US Army Corps
of Engineers ®
Hurricane Protection Office

Orleans Outfall Canal

Project Fact Sheet

The Orleans Avenue Outfall Canal is located between the 17th St. and London Avenue Canals, and extends approximately 1.8 miles from Pumping Station #7 to Lake Pontchartrain. The project includes the construction of an interim gated flood control structure on the canal at Lake Pontchartrain. This structure has five panel gates that will be open under normal conditions and closed during rising Lake Pontchartrain surge from impending tropical storm activity. When the gates are closed, pumps will move water out of the drainage canal, around the closed gates and into Lake Pontchartrain.

- The structure has 10 temporary pumps with a current pumping capacity of 2,200 cubic feet per second. At this rate, the pumps could fill the average back yard swimming pool in about one second.
- The five massive gate panels are 35.5 feet tall and nearly 12 feet wide. They are supported by structures called jackets. The jackets are anchored to a depth of 110 feet.
- Rounded concrete cells, 46 feet in diameter, provide support for the pumps' discharge pipes and integrate the gated structure with the earthen levee. Anchoring the cells and providing support for the discharge pipe are H-piles that are driven more than 66 feet.



AUG 2007

New Orleans Hurricane Protection Office *Shaping Today, Securing Tomorrow*

US Army Corps
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Hurricane Protection Office

Orleans Outfall Canal

Project Fact Sheet

Stronger Protection for New Orleans

The U.S. Army Corps of Engineers' efforts to upgrade the flood and storm protection system will continue through 2010. The Corps will engineer, construct and improve storm flood protection infrastructure to a 100-year protection level. This work includes:

- Constructing permanent pump and flood gate structures to block storm surges from entering the 17th St., Orleans Avenue, and London Avenue Canals.
- Constructing the best engineering solution for providing the 100-year level of protection for the Inner Harbor Navigational Canal.
- Raising levees to the 100-year level protection.

The federal government has appropriated more than $7 billion to complete the work of restoring and improving the hurricane protection system. The work currently consists of more than 100 planned construction projects.

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New Orleans Hurricane Protection Office *Shaping Today, Securing Tomorrow*

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Hurricane Protection Office

17th Street Outfall Canal

Project Fact Sheet

The 17th St. Outfall Canal extends approximately 2.4 miles north from Pump Station #6 to Lake Pontchartrain. It is the boundary between Orleans and Jefferson Parishes, entities that share in the canal's management and maintenance.

- This interim gated closure structure is operational and can provide protection against storm surge. The structure is located at the outfall of 17th St. Canal at Lake Pontchartrain. To protect the canal, the structure includes a series of 11 panel gates that will be open under normal conditions and closed during impending storm surge due to tropical storm activity.
- Each gated panel is nearly 12 feet wide, 27 feet tall and more than 15 inches thick. Each panel weighs approximately 11 tons and are heavily reinforced for strength.
- Currently there are 18 temporary pumps and 14 portables on this site with the pumping capacity of 5,200 cubic feet per second. By mid-August 2007, the pumping system will be able to evacuate water at a rate of 7,600 cubic feet per second with the addition of 11 new direct drive pumps. That is the equivalent of filling an Olympic-sized swimming pool in less than 12 seconds.
- 17th St. Canal I-wall breach has been repaired with the construction of approximately 400 feet of new T-wall.
- With the new structure in place, the city has better protection than ever before. When storm surge threatens the safe water level in the canal, the gates will close to block the surge and pumps will evacuate the water through the structure into Lake Pontchartrain.

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17th Street Outfall Canal

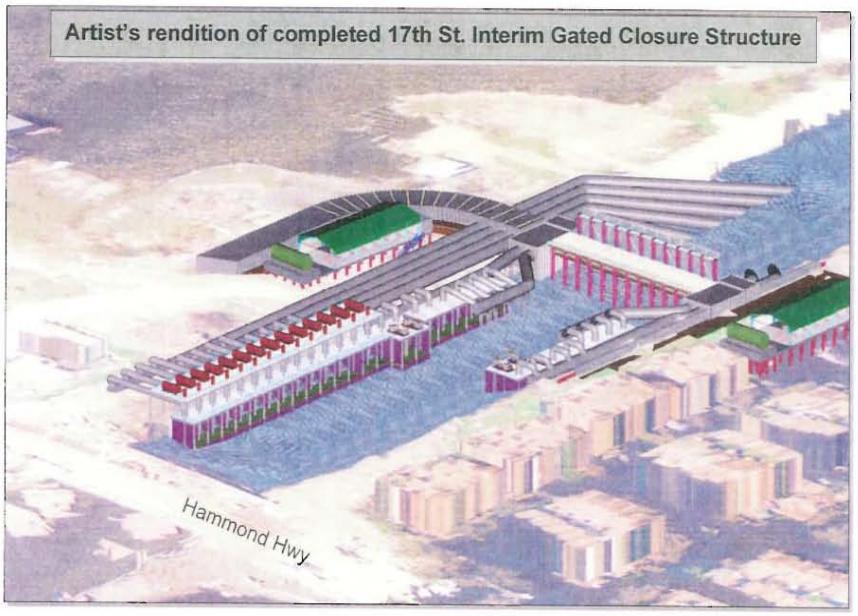
Project Fact Sheet

Stronger Protection for New Orleans

The U.S. Army Corps of Engineers' efforts to upgrade the flood and storm protection system will continue through 2010. The Corps will engineer, construct and improve storm flood protection infrastructure to a 100-year protection level. This work includes:

- Constructing permanent pump and flood gate structures to block storm surges from entering the 17th St., Orleans Avenue, and London Avenue Canals.
- Constructing the best engineering solution for providing the 100-year level of protection for the Inner Harbor Navigational Canal.
- Raising levees to the 100-year level protection.

The federal government has appropriated more than $7 billion to complete the work of restoring and improving the hurricane protection system. The work currently consists of more than 100 planned construction projects.



Artist's rendition of completed 17th St. Interim Gated Closure Structure

US Army Corps
of Engineers ®
Hurricane Protection Office

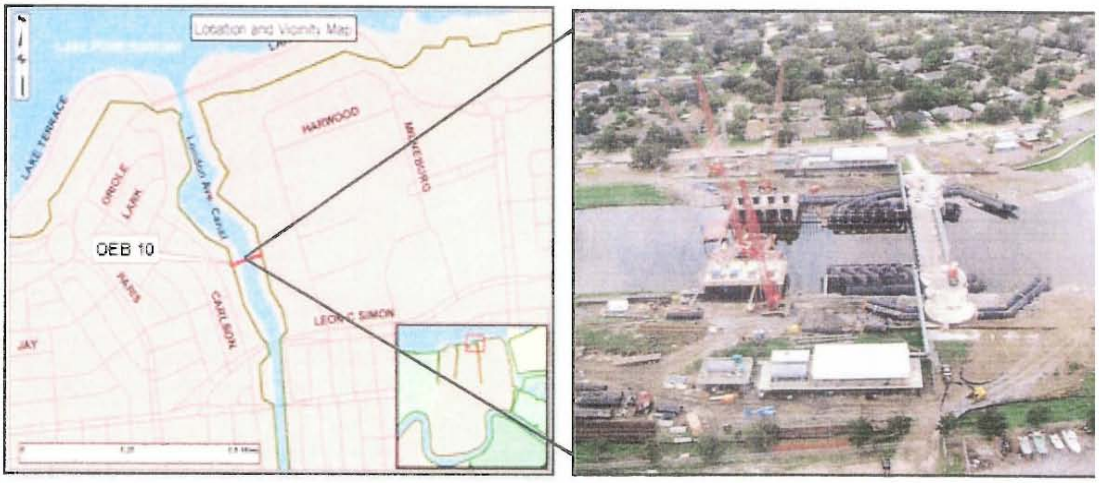
London Avenue Outfall Canal

Project Fact Sheet

The London Avenue Outfall Canal is located in Orleans Parish, east of Orleans Avenue Canal. The canal extends approximately 3 miles from Pump Station #3 to its outfall at Lake Pontchartrain.

The project includes the construction of an interim gated closure structure on London Avenue Canal at Lake Pontchartrain. This structure has a series of 11 panel gates that will be open under normal conditions and may be closed during rising Lake Pontchartrain surge from impending tropical storm activity.

- The structure currently has 12 temporary pumps with a pumping capacity of 2,800 cubic feet per second. By mid-August, the pumping system will be able to evacuate water at a rate of 5,000 cubic feet per second with the addition of 8 new direct drive pumps. That is equivalent of filing an Olympic-sized swimming pool in less than 20 seconds.
- The massive movable gates are 35.5 feet tall and nearly 12 feet wide. They are supported by structures called jackets. The jackets are anchored to a depth of 110 feet.
- Rounded concrete cells, 46 feet in diameter, provide support for the pumps' discharge pipes and integrate the gated structure into the earthen levee. Anchoring the cells and providing support for the discharge pipe are H-piles that are driven more than 66 feet.
- I-wall breaches at Robert E. Lee and Mirabeau have been repaired with the replacement of new T-wall.



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New Orleans Hurricane Protection Office *Shaping Today, Securing Tomorrow*

US Army Corps
of Engineers ®
Hurricane Protection Office

London Avenue Outfall Canal

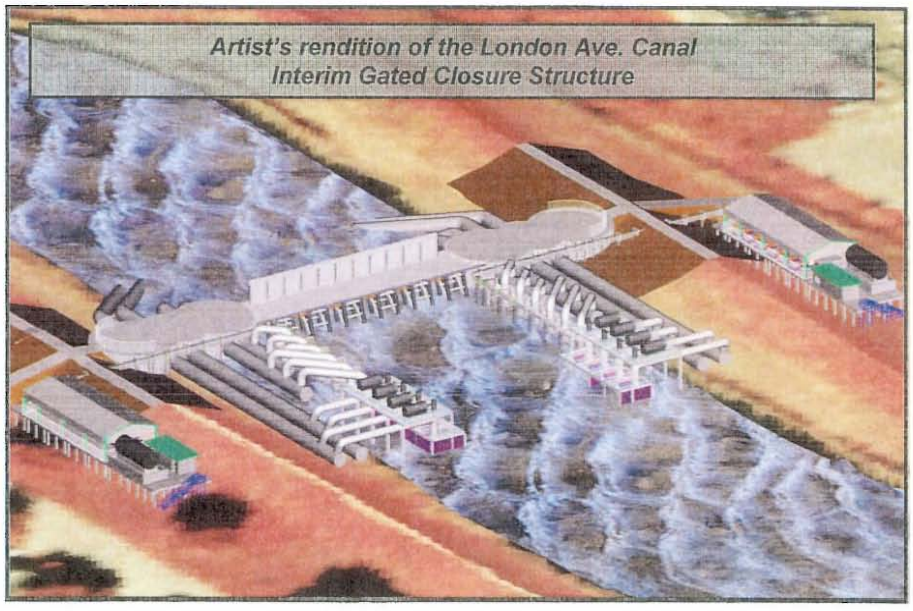
Project Fact Sheet

Stronger Protection for New Orleans

The U.S. Army Corps of Engineers' efforts to upgrade the flood and storm protection system will continue through 2010. The Corps will engineer, construct and improve storm flood protection infrastructure to a 100-year protection level. This work includes:

- Constructing permanent pump and flood gate structures to block storm surges from entering the 17th St., Orleans Avenue, and London Avenue Canals.
- Constructing the best engineering solution for providing the 100-year level of protection for the Inner Harbor Navigational Canal.
- Raising levees to the 100-year level protection.

The federal government has appropriated more than $7 billion to complete the work of restoring and improving the hurricane protection system. The work currently consists of more than 100 planned construction projects.



Artist's rendition of the London Ave. Canal Interim Gated Closure Structure

AUG 2007

New Orleans Hurricane Protection Office *Shaping Today, Securing Tomorrow*

US Army Corps of Engineers ®
Hurricane Protection Office

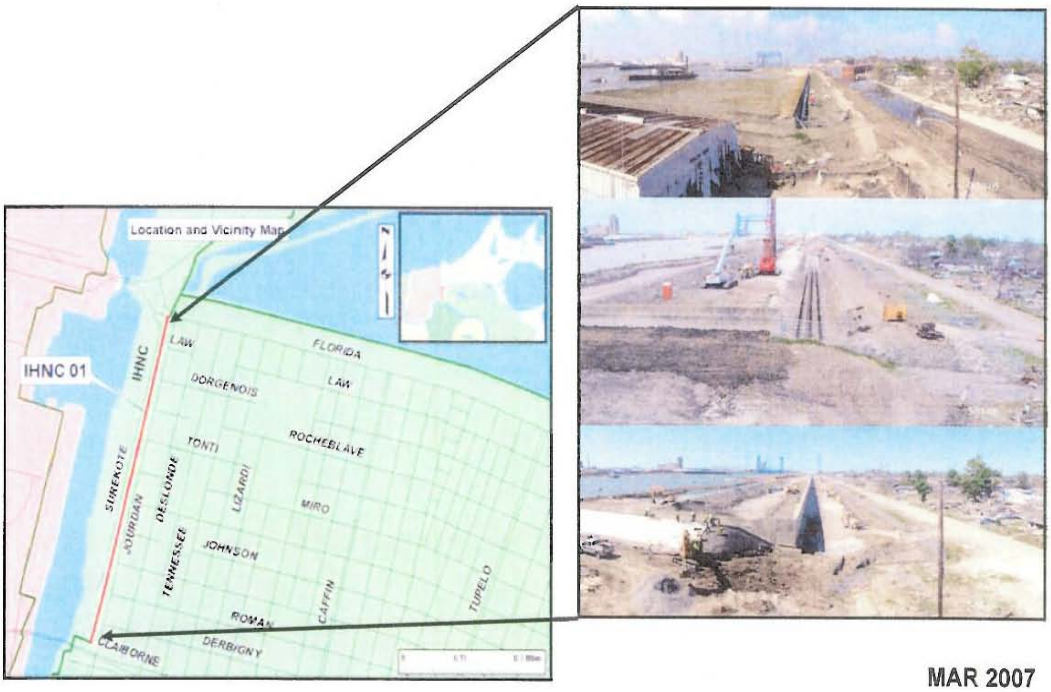
Inner Harbor Navigation Canal

Project Fact Sheet

Overtopping of the hurricane protection system by Hurricane Katrina was evident along portions of the Inner Harbor Navigation Canal, also known as the Industrial Canal. There were four breaches in this part of the protection system, two on the east side and two on the west side. The east side breaches were located in the Lower 9th Ward neighborhood and had devastating results. The west side breaches were in the vicinity of France Road and Benefit Street.

Improvements made to the Inner Harbor Navigation Canal levee wall include:

- The U.S. Army Corps of Engineers repaired the east side breaches by replacing the I-walls with strengthened T-walls, and raised the heights back to the previously authorized elevation. T-walls increase stability and are more capable of resisting lateral pressure.
- The walls are built to elevation 15 feet, about 2 feet higher than pre-Katrina conditions.
- Sheet piles driven to a depth of 23 feet provide protection against seepage.
- Concrete splash pads adjacent to the T-walls help keep water from scouring and eroding ground around the base of the walls.



MAR 2007

New Orleans Hurricane Protection Office *Shaping Today, Securing Tomorrow*

Inner Harbor Navigation Canal

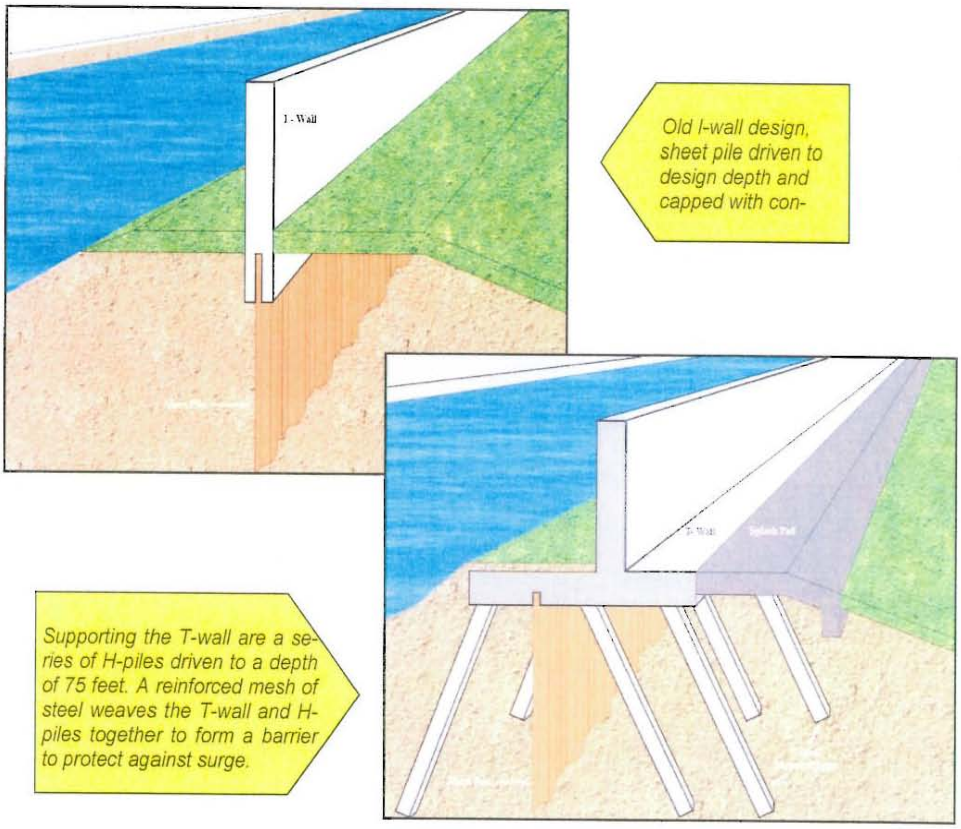
Project Fact Sheet

US Army Corps
of Engineers ®
Hurricane Protection Office

Stronger Protection for New Orleans

The U.S. Army Corps of Engineers work to upgrade the flood and storm protection system will continue through 2010. The Corps will engineer, construct and improve storm flood protection infrastructure to a 100-year protection level. This work includes stronger levees, floodwalls and interior drainage, including:

- Constructing permanent pump and flood gate structures to block storm surges from entering the 17th St., London and Orleans Ave. Canals.
- Replacing I-walls damaged by Hurricane Katrina with stronger T-wall or L-wall design floodwalls.
- Reinforcing undamaged I-walls and the surge protection closures.



New Orleans Hurricane Protection Office *Shaping Today, Securing Tomorrow*

MAR 2007

MISSISSIPPI RIVER GULF OUTLET

Project Fact Sheet

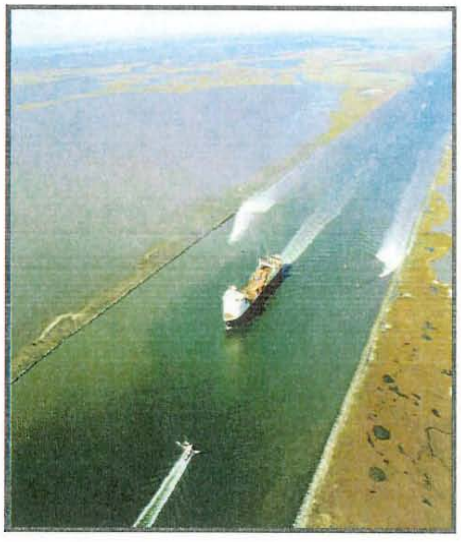
US Army Corps
Of Engineers ®
Protection Restoration Office

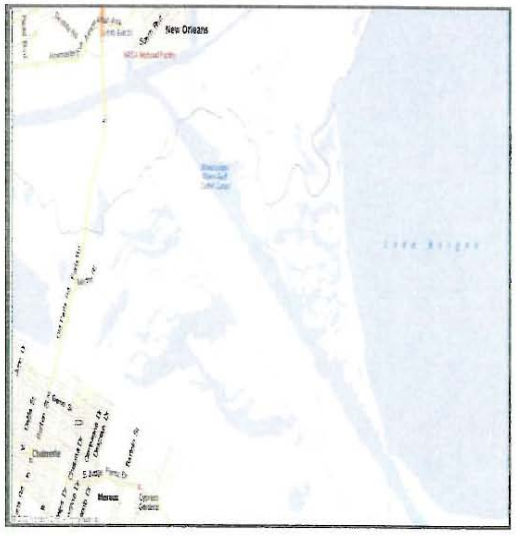
The Mississippi River Gulf Outlet (known as "Mister Go") is a 76-mile federal navigation channel connecting the Gulf of Mexico to tidewater port facilities in New Orleans. Authorized in 1956 and completed 1968, the channel provided a safer and shorter route for deep draft international shipping. Portions of the channel are fronted with hurricane protection levees, flood gates and flood walls.

Large sections of the levee along the channel were destroyed or severely damaged during Hurricane Katrina. Following the hurricane, the Congress directed the Corps of Engineers to develop a comprehensive plan to de-authorize deep draft navigation on the channel between the Gulf of Mexico and the Gulf Intracoastal Waterway. An interim report, submitted to Congress in December 2006, concluded that no national economic justification exists for continuing navigation on the channel. In addition, the report noted that a best solution for the future of the channel would be total closure with an earthen or rock structure near Hopedale at the Bayou La Loutre ridge in St. Bernard Parish, Louisiana.

The MRGO is a high-profile and highly controversial issue for the Corps of Engineers.

- Environmental impacts to coastal wetlands through dredging, vessel wake erosion and salt water intrusion into sensitive tidal estuaries are noted public and government concerns. Currently no dredging is being conducted to maintain the channel and vessels are limited to approximately 20-foot draft.
- Public perception that the channel funnels hurricane storm surge from the Gulf of Mexico into St. Bernard Parish and the City of New Orleans is widespread. Note numerous lawsuits are active on this subject related to Hurricane Katrina damages.
- Annual operations and maintenance costs associated with frequent dredging (~$14 million per year and higher following storm events due to offshore shoaling).
- Limited and diminishing navigation use of the MRGO channel.
- High public demand (both locally and with National environmental organizations) calling for "Closing Mister Go".





MISSISSIPPI RIVER GULF OUTLET

Project Fact Sheet

US Army Corps
Of Engineers ®
Protection Restoration Office

The future of the MRGO in terms of continuing navigation or "closure" is a linchpin decision affecting a number of ongoing USACE actions in the area. These important missions include hurricane protection, navigation, and ecosystem restoration. The following activities are currently underway on or near the channel:

- Completing 100-year protection for hurricane surge. Installing new levees and/or flood gates and raising some existing levees. Authorized in the 4th Supplemental to prevent storm surge from entering inner harbor area from Lake Borgne east of New Orleans.

- Louisiana Coastal protection and Restoration (LACPR). Technical effort to develop a comprehensive plan for all of south Louisiana for coastal restoration, flood control, and hurricane protection. Congressional authority calls for "Category 5" protection.

- MRGO Deep Draft De-authorization Study – Due to Congress in December 2007. Conducted at full Federal expense of $3.3 million. CEMVN team is expediting preparation of final report. Draft Executive Summary released in May 2007 to aid other efforts and to meet public demand. Heavy stakeholder involvement underway.

FACT SHEET
MISSISSIPPI RIVER GULF OUTLET

Background

The Mississippi River Gulf Outlet (known as "Mister Go") is a 76-mile federal navigation channel connecting the Gulf of Mexico to tidewater port facilities in New Orleans. Authorized in 1956 and completed 1968, the channel provided a safer and shorter route for deep draft international shipping. Portions of the channel are fronted with hurricane protection levees, flood gates and flood walls. Large sections of the levee along the channel were destroyed or severely damaged during Hurricane Katrina. Following the hurricane, the Congress directed the Corps of Engineers to develop a comprehensive plan to de-authorize deep draft navigation on the channel between the Gulf of Mexico and the Gulf Intracoastal Waterway. An interim report, submitted to Congress in December 2006, concluded that no national economic justification exists for continuing navigation on the channel. In addition, the report noted that a best solution for the future of the channel would be total closure with an earthen or rock structure at the Bayou La Loutre ridge near Hopedale in St. Bernard Parish, Louisiana.

Issues

The MRGO is a high-profile and highly controversial issue for the Corps of Engineers.

- Environmental impacts to coastal wetlands through dredging, vessel wake erosion and salt water intrusion into sensitive tidal estuaries are noted public and government concerns. Currently no dredging is being conducted to maintain the channel and vessels are limited to approximately 20-foot draft.
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- Annual operations and maintenance costs associated with frequent dredging (~$14 million per year and higher following storm events due to offshore shoaling).
- Limited and diminishing navigation use of the MRGO channel.
- High public demand (both locally and with National environmental organizations) calling for "Closing Mister Go".

Current Actions

The future of the MRGO in terms of continuing navigation or "closure" is a linchpin decision affecting a number of ongoing USACE actions in the area. These important missions include hurricane protection, navigation, and ecosystem restoration. The following activities are currently underway on or near the channel:

- Completing 100-year protection for hurricane surge. Installing new levees and/or flood gates and raising some existing levees. Authorized in the 4th Supplemental to prevent storm surge from entering inner harbor area from Lake Borgne east of New Orleans.

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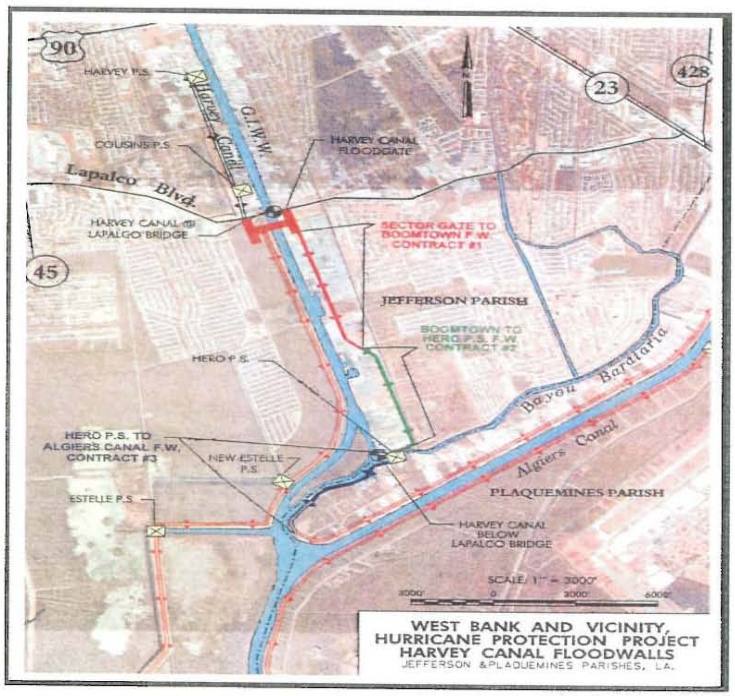
Harvey Canal Hurricane Protection Project
Fact Sheet

U.S. Army Corps of Engineers
New Orleans District, MVN-PM-E

PROJECT AUTHORITY: The Westwego to Harvey Canal Hurricane Protection Project was authorized by the Water Resources Development Act (WRDA) of 1986 (PL 99-662). The WRDA of 1996 (PL 104-303) modified the project and added the Lake Cataouatche area to the project. WRDA 1996 also authorized the East of Harvey Canal Hurricane Protection Project. WRDA 1999 (PL 106-53) combined the three projects under the current name. Due to Hurricane Katrina, the Department of Defense, Emergency Supplemental Appropriations to Address Hurricanes in the Gulf of Mexico and Pandemic Influenza Act, 2006 (PL 109-148) appropriated funds in the amount of $147,614,000.00 to accelerate completion of the West Bank and Vicinity Hurricane Protection Project at full Federal expense.

PROJECT SPONSORS: The West Jefferson Levee District (WJLD) was the sponsor for the originally authorized project (Westwego to Harvey Canal) and a Local Cooperation Agreement (LCA) was executed in December 1990. Subsequently, in June 1993, the Louisiana Department of Transportation and Development (LADOTD) was designated as the non-Federal sponsor for the project, including the additional areas of Lake Cataouatche and East of Harvey Canal. In November 1995, a Cooperative Endeavor Agreement was executed between WJLD and LADOTD that designates WJLD as the Executive Agent of LADOTD for the purposes of the project. Amendment Number 1 of the LCA was executed in April 1999, with LADOTD as the sponsor for construction of the current project and WJLD as the sponsor for OMRR&R of the current project. Amendment Number 2 of the LCA was executed on 2 April 2007. In this agreement, DOTD remains the non-Federal sponsor for the project for construction, and WJLD represented by the President of the Board of Commissioners of the Southeast Louisiana Flood Protection Authority – West Bank, as the sponsor for the OMRR&R of the current project.



PROJECT LOCATION:
The project is located on the west bank of the Mississippi River in the vicinity of New Orleans and in Jefferson, Orleans and Plaquemines parishes.

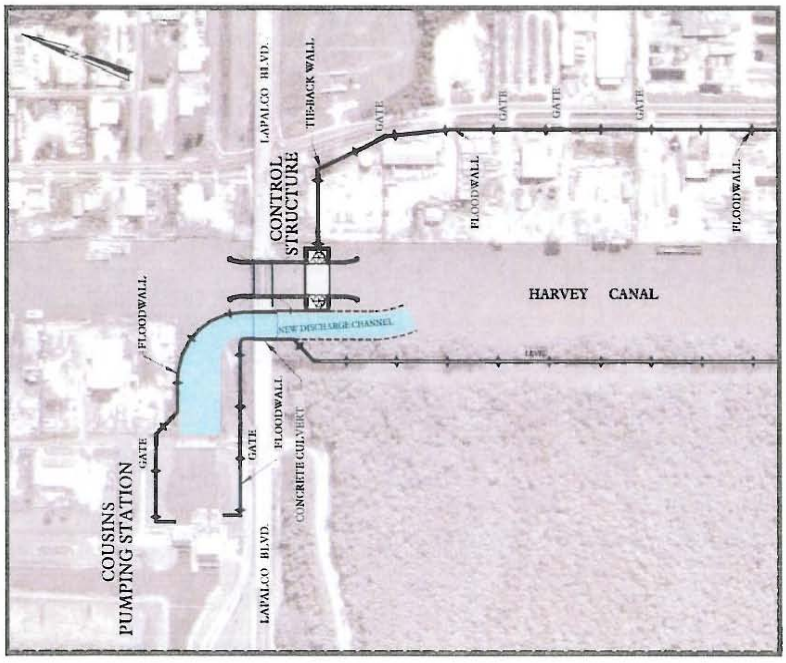
PROJECT PURPOSE:
The project will provide storm damage reduction to residents from storm surges from Lakes Cataouatche and Salvador, and waterways leading to the Gulf of Mexico.

Harvey Canal Hurricane Protection Project
Fact Sheet

U.S. Army Corps of Engineers
New Orleans District, MVN-PM-E

PROJECT DESCRIPTION: The project provides hurricane protection to the urban area from Lake Cataouatche to Oakville, Louisiana along the west bank of the Mississippi River, in the vicinity of New Orleans, Louisiana. The project area is an area of high-density residential and commercial development. As a result of extremely low elevations and the inadequacy of existing local levees, much of the area is subject to flooding during moderate tropical storms. To protect residents and businesses approximately 66 miles of levees and floodwalls and a sector gate will be constructed. In the Westwego to Harvey Area approximately 22 miles of levee and 2 miles of floodwall will be constructed. In the West of Algiers Canal Area about 11 miles of levee and 5 miles of floodwalls will be constructed, including the construction of a navigable sector flood gate. In the East of Algiers Canal Area about 14 miles of levee and about ½ mile of floodwall will be constructed, and in the Lake Cataouatche Area about 10 miles of levee and 2.5 miles of floodwall will be constructed. The features of these plans will provide protection to vulnerable areas from the standard project hurricane events and will avert catastrophic loss of life and property during such events.

Engineering, design, and construction efforts are underway on all three areas of the project. The authorized project was about 50% complete when Hurricane Katrina made landfall. Prior to Hurricane Katrina, the project was scheduled to be completed in 2018, dependent on funding. Emergency Supplemental Funding Bills 3 and 4 have provided additional funds and authority to accelerate the completion of the project as well as raise the project to the 100 year level of protection.



MAJOR PROJECT FEATURES: The Harvey Sector Gate is a major navigable floodgate located in the Harvey Canal at Lapalco Boulevard. This floodgate installation is complete and work continues on the adjacent Cousins Pump Station discharge wall. Floodgate and discharge walls are scheduled to be

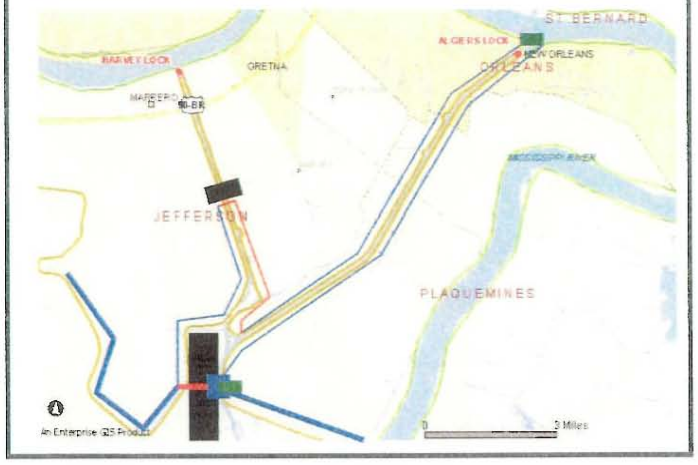
Harvey Canal Hurricane Protection Project
Fact Sheet

U.S. Army Corps of Engineers
New Orleans District, MVN-PM-E

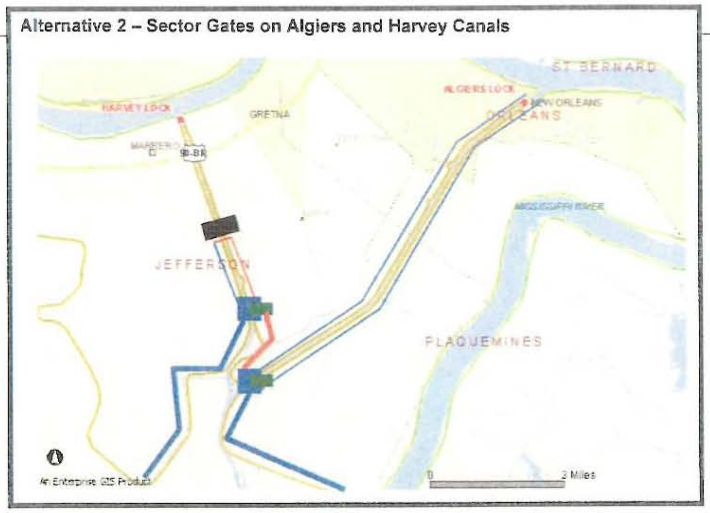
complete to elevation +11.5 NGVD by summer 2008; however, an interim closure across the canal to elevation +8 will be in place by the peak of hurricane season 2007 and will provide hurricane surge protection to residents and businesses north of the gate. This gate closes when water levels in the canal

reach + 3.0 NGVD. To complete the flood protection to the south of this gate, about 3.5 miles of floodwalls and 1 mile of levee will be constructed along the east bank of the canal. Currently, no federal protection exists along the east bank of Harvey Canal. A levee constructed to 9.5 NGVD, completed in FY 06, protects the west side of the canal. The first of these critical floodwall contracts was awarded in March, with 4 subsequent contract awards in the weeks following. Completion of all floodwall contracts is scheduled for late 2008. The attached map shows the sector gate and the floodwall and levee alignment along the canal.

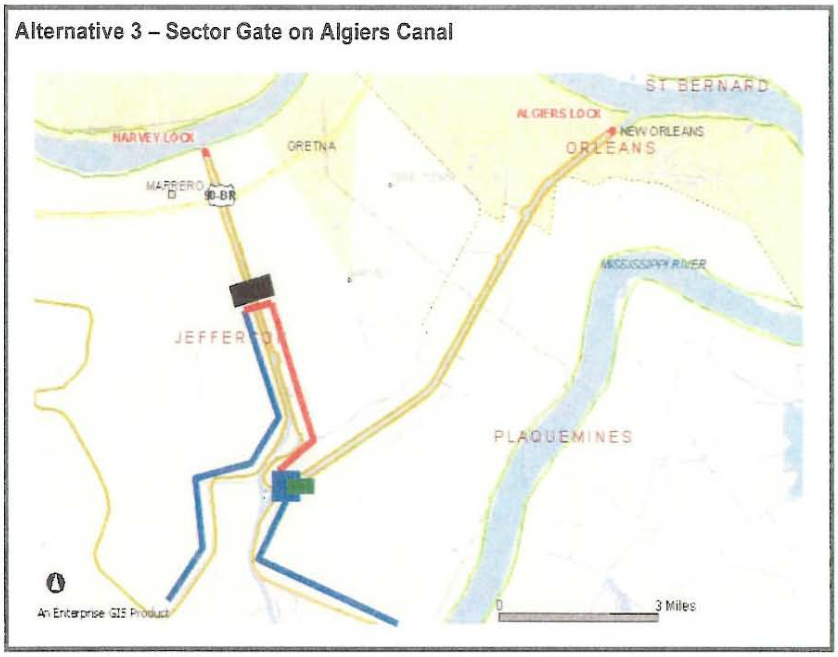
Alternative 1 – Sector Gate on GIWW



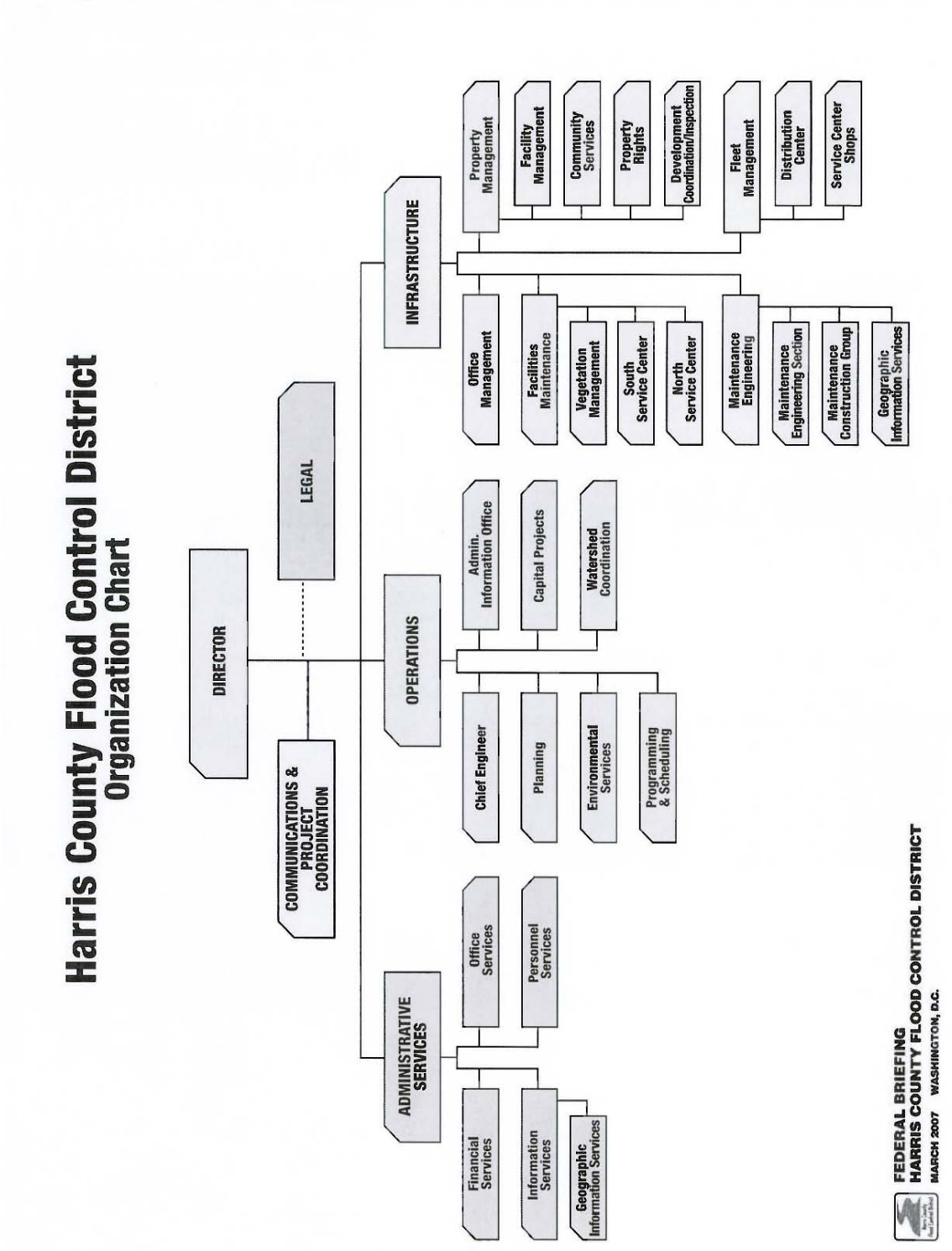
Alternative 2 – Sector Gates on Algiers and Harvey Canals



Alternative 3 – Sector Gate on Algiers Canal



附件四　Harris County's 防洪管理局



OUR MISSION

Provide flood damage reduction projects that work, with appropriate regard for community and natural values.

The District accomplishes its mission by:

- *Devising flood damage reduction plans*
- *Implementing the plans*
- *Maintaining the infrastructure*

Harris County
Flood Control District
9900 Northwest Freeway
Houston, Texas 77092
713 684-4000
www.hcfcd.org

- The Harris County Flood Control District (District) is a special purpose district created by the Texas Legislature in 1937 in response to devastating floods that struck the region in 1929 and 1935. The District's boundaries are coincident with Harris County, a community of more than 3.9 million that includes the City of Houston. Nature gave us 22 primary watersheds within the county's 1,756 square miles, each with its own independent flooding problems.

- The District's mission, in simple terms, is to: (1) Devise flood damage reduction plans; (2) Implement the plans; and (3) Maintain the infrastructure. The District's drainage and flood control infrastructure is extensive, including more than 1,500 channels totaling about 2,500 miles in length (about the distance from Los Angeles to New York). Nature also challenges us with flat terrain, clay soils that do not absorb water well, and annual rainfall of 48 inches. The flooding problems in the community are severe, with several hundred thousand homes and businesses in the identified flood plain (not all flooding areas are mapped yet), and projects to reduce the risk are estimated to cost several billion dollars.

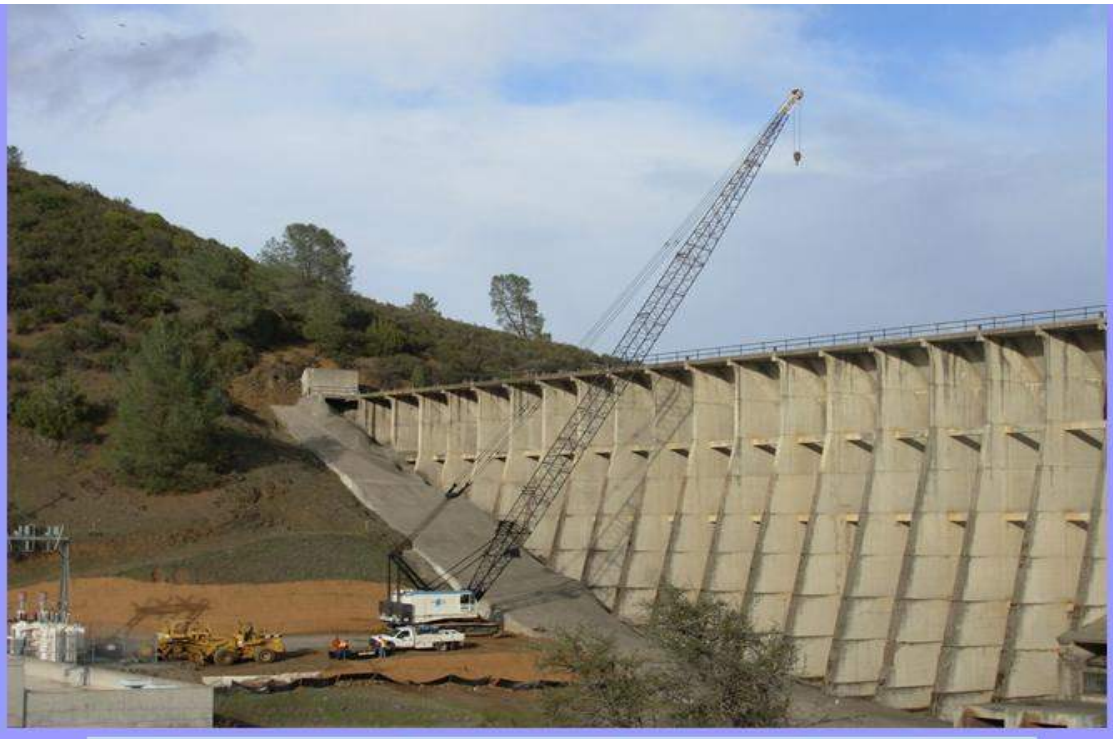
- The District's income is derived primarily from a dedicated ad valorem property tax. The rate is variable depending on operation and maintenance needs, and in 2006 was set at 3.2 cents per $100 valuation (the statutory limit for the District's tax rate is 30 cents per $100 valuation). Capital projects are funded with District short term borrowing and long term bonds, Harris County long term bonds, impact fees, and cash. By using the combined resources of Harris County and the District, many more projects can be implemented across Harris County. The District's Capital Improvement Program proposed for FY2007-08 calls for about $220 million in projects.

- Through aggressive privatization and managed competition, the District has reduced its full time staff to 409, down from nearly 1,000 in 1989. The District is organized into four primary divisions, as shown on the next page. The District obtains virtually all engineering design work for capital projects and maintenance repairs through consulting contracts, and obtains all construction work through the competitive bidding process. All of the District's routine maintenance (mowing) is performed through contracts with private companies.

- The District's Mission Statement is: "Provide flood damage reduction projects that work, with appropriate regard for community and natural values." This balancing act is a continual challenge in the third most populous county in the United States, and achieving needed flood risk reduction within financial limitations is the major component of the District's commitment to make every taxpayer dollar count.

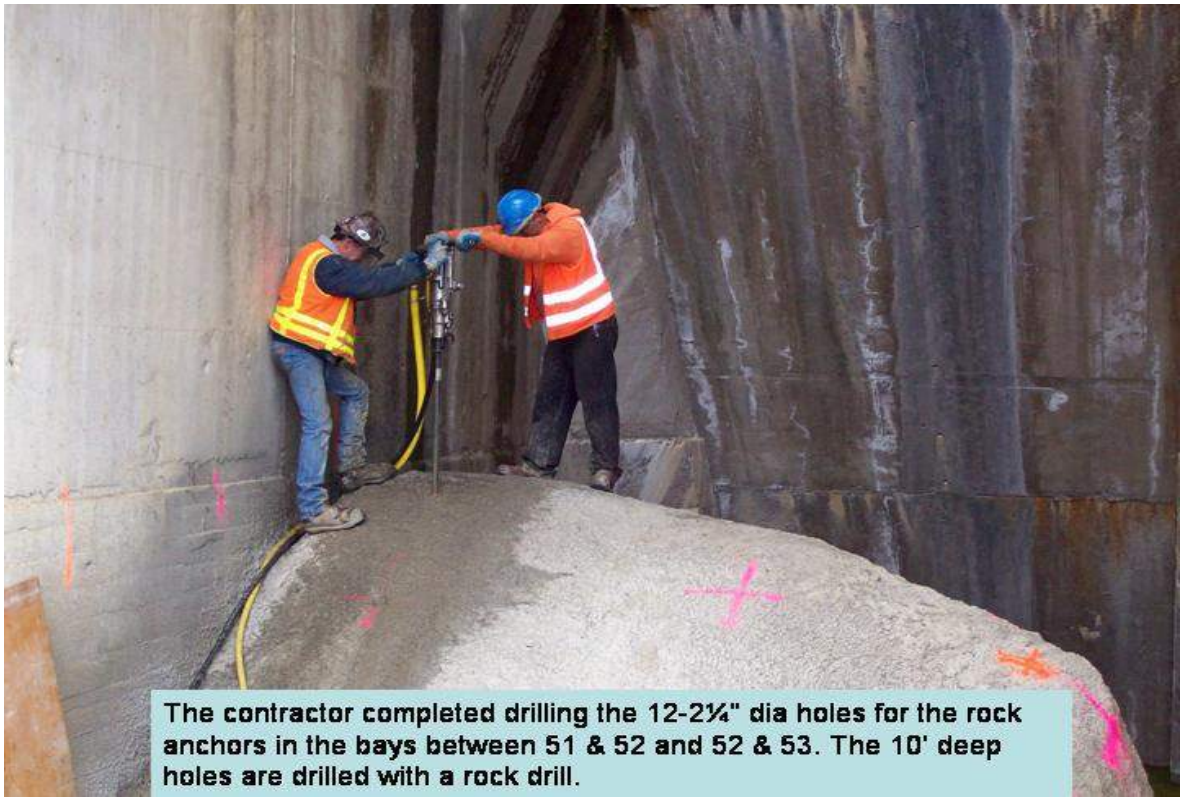
附錄五　石峽大壩更新改善工程

STONY GORGE DAM
MODIFICATION
2007

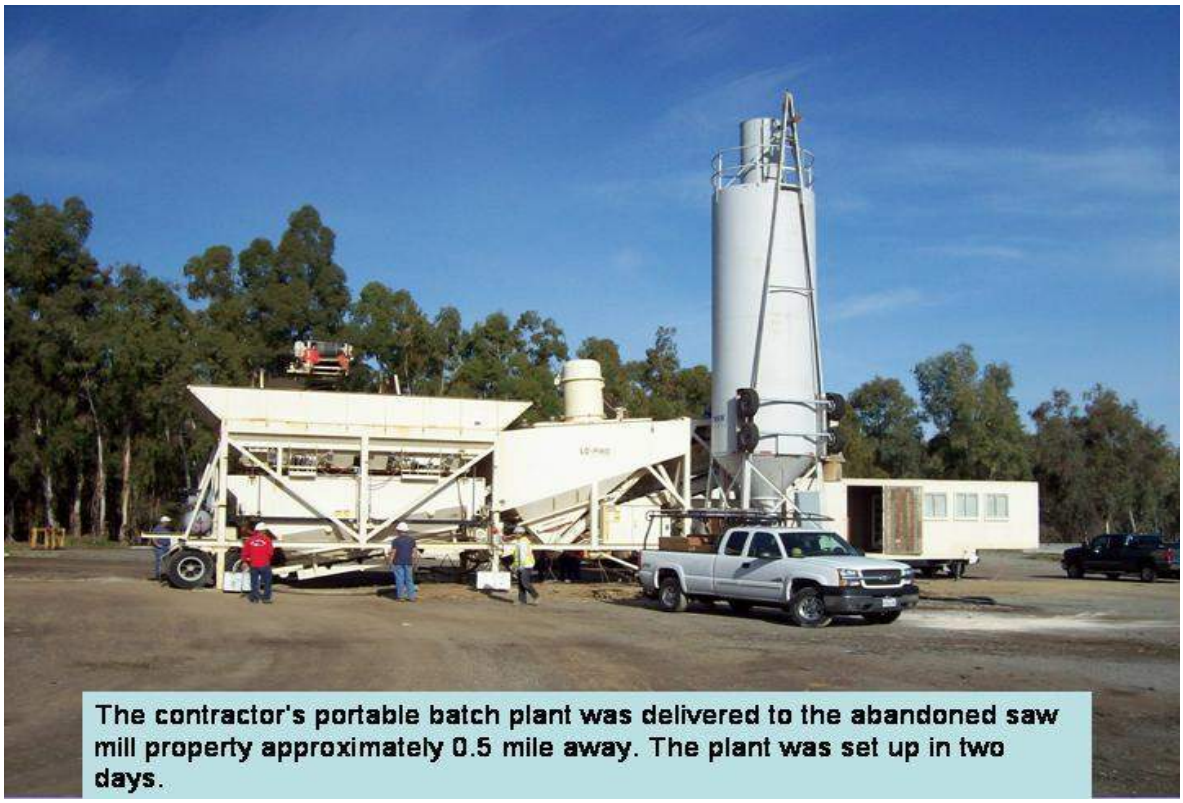


A 165-ton crawler crane was delivered to the site on February 1, 2007

The contractor is pressure washing the existing shotcrete foundation between the buttresses on the right abutment



The contractor completed drilling the 12-2¼" dia holes for the rock anchors in the bays between 51 & 52 and 52 & 53. The 10' deep holes are drilled with a rock drill.



The contractor's portable batch plant was delivered to the abandoned saw mill property approximately 0.5 mile away. The plant was set up in two days.

A crew fabricates the elevated access platform (C-hanger) . The approximately 16,000 pound C-hanger will be supported from the top of the dam and provide access to construct the diaphragm wall, the capitals/struts, and the additional struts. There will be total of six C-hangers used in adjacent bays.

A truck load of rebar for the diaphragm starter wall was delivered. The iron workers installed the rebar in the bays between buttresses #37 to #42.

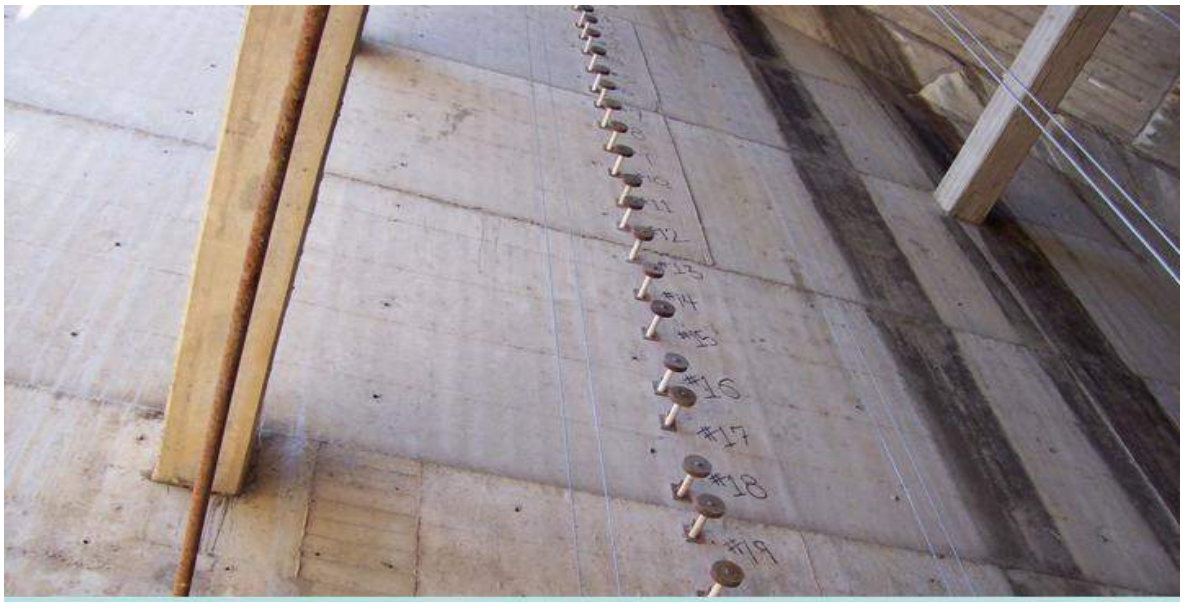
The contractor's portable batch plant was operational on May 4. MPCO provided three 4,000 psi concrete mixes for test batches with 35% to 25% flyash.

The completed C-hanger is being set on top of the dam with the 165 ton crane

Three of the seven completed C-hanger setting in place on top of the dam

The 10' wide starter wall in the bay between 18-19 will be placed in two lifts. The height of the first lift was 7' from the lowest point.

A small caterpillar excavator is used to establish access to and foundation cleanup in the bays between the buttresses.



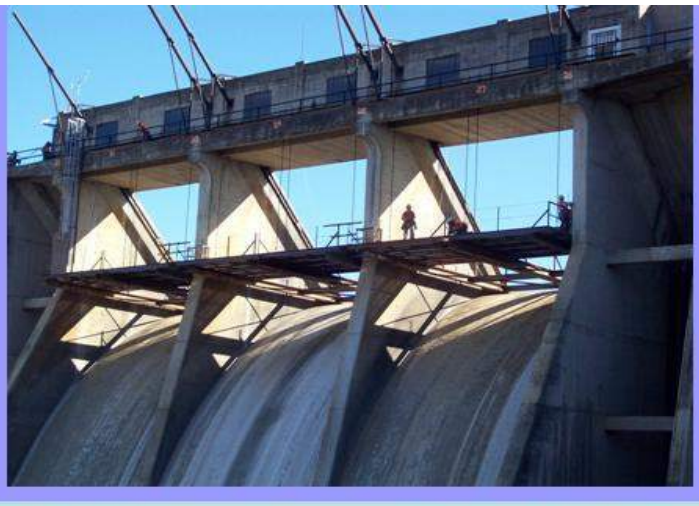
The survey scan of the existing reinforcement in the buttresses continued prior to any core drilling for the end threaded anchor bars located on 2 foot centers in the center of the diaphragm wall anchor beam and the four anchor bars in the capitals. When the survey indicated the core hole would encounter rebar, the core hole was adjusted to miss the rebar.

The carpenters concentrated on setting the Doka metal framed and plywood sheathing forms for the 12.0 foot high diaphragm walls for 38-39, 39-40, and 40-41.

The walls have a 5.0 foot wide by 11.0 high arch doorway openings.

The concrete was batched from their batch plant and transported in three transit mixers. The contractor placed 86.5 cubic yards of concrete on Monday, 10/1, in all three walls utilizing a truck mounted concrete pump setting on the lower right abutment crane pad. The top of the forms were accessed from a swing stage platform on the u/s and d/s side of the forms. The swing stages are fastened to the C-hangers and are air operated from the platforms.

A ramp constructed of spawning gravel was placed from the lower crane pad over the Santa Clara penstocks and down onto the spillway apron. 12"X 12" crane mats were set on the concrete apron.
The 165 ton Sumitomo crane was moved out on the spillway apron



The crew of Pile Butts (iron workers) completed fabricating the spillway access platforms. The 40 long by 15 feet wide platforms (two per spillway bay) were installed with the 160 ton Sumitomo Crane with 220 foot of boom. The crane is setting on the spillway apron. The three spillway gate are in the full down position. The platforms were raised up over the gatehouse and installed from the upstream side of the spillway. The platforms were threaded through the spillway openings and the upstream ends of the platform are setting on the spillway crest. The downstream ends of the platform are connected to two 1.25-inch steel rods that penetrated through the top of dam walkway with an "H" beam spanning across the opening and setting on top of the buttresses.

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