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Appendix BB
Policy Waivers

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
106 SOUTH 15TH STREET
OMAHA NE 68102-1618

CENWO-ED-H

2 December 2005

MEMORANDUM FOR CENWD-RBT

SUBJECT: Request for a Waiver of Antecedent Flood Criteria – Chatfield Dam and Lake, Denver, Colorado

1..The purpose of this memorandum is to request a waiver of the Antecedent Flood Criteria as presented in Paragraph 8f of ER 1110-8-2 (FR) dated 1 Mar 1991 for the Chatfield Dam and Lake Project. According to ER 1110-8-2 (FR), the minimum antecedent flood should be based on a storm that produces 50 percent of the Inflow Design Flood (IDF). For Chatfield, the IDF is based on the Probable Maximum Flood (PMF).

2. We believe that a waiver of the Antecedent Flood Criteria for Chatfield Dam and Lake Project should be granted for the following reasons:

a. Historical Precipitation and Storm Event data indicate that the maximum antecedent precipitation occurring before the main event is less than 30 percent of the main event precipitation for events in the magnitude of PMP.

b. The National Weather Service antecedent flood study for Cherry Creek Reservoir completed in 1997 recommended a value of 32 percent be used for the antecedent precipitation for Cherry Creek and 36 percent for Chatfield.

c. The National Weather Service regional study of Kansas, Oklahoma and Eastern Colorado completed in 1995 and published in Hydro 45, recommended a value of 10 to 20 percent be used for precipitation antecedent to PMP events in that region.

3. Therefore, the Omaha District recommends that the antecedent flood criteria of 50 percent of the PMF be waived for Chatfield Dam and Lake Project and a value of 40 percent be adopted. This request only applies to the Chatfield Dam and Lake Project and it is not applicable to any other project. A report documenting the data used, methodology, and results of the antecedent flood requirements for Chatfield Dam and Lake Project is enclosed.

4. In July 2005, the data used, methodology, and results of the Chatfield Antecedent Flood study were presented to the Corps Hydrology Committee for peer review and found to be acceptable.

5. An Independent Technical Review (ITR) of the report was completed in November 2005 by the Mr. Robert Swain and Mr. Louis Schreiner of the US Bureau of Reclamation's Flood Hydrology Group in the Denver office. Results of the ITR recommended additional studies that were completed and incorporated into the report to support the reduction from 50 percent to 40 percent for the Chatfield antecedent flood criteria. The ITR review comments and responses are contained in the appendix of the enclosed report.

6. Please provide your approval of this waiver by December 31, 2005.

7. If you have any questions regarding this information, please contact Doug Clemetson at [redacted]

Encl

LARRY S. BUSS, P.E.
Chief, Hydrologic Engineering Branch
Engineering Division

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:

Received 22 Feb 2006
L. m. B.

CECW-NWD

FEB 16 2006

MEMORANDUM FOR Commander, Northwestern Division (CENWD-RBT)

SUBJECT: Request for a Waiver of Antecedent Flood Criteria – Chatfield Dam and Lake, Denver, Colorado

1. Reference the CENWO-ED-H memorandum dated 2 December 2005, subject as above, enclosed in the CENWD-RBT undated memo, same subject.

2. Based on our review of the "Chatfield Antecedent Flood Study, December 2005" and information contained in the referenced memo, the requested waiver of the minimum antecedent flood criteria as presented in ER 1110-8-2 is granted.

FOR THE COMMANDER:

EDWARD J. HECKER
Chief, Northwestern Division
Regional Integration Team
Directorate of Civil Works

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
1616 CAPITOL AVENUE
OMAHA NE 68102-4901

30 NOV 2011

CENWO-DP

MEMORANDUM THRU Northwestern Division (CENWD-PDD/Hudson), 1125 NW Couch Street, Suite 500, Portland, OR 97209-4141

FOR Director of Civil Works, (CECW-NWD), US Army Corps of Engineers, 441 G Street, NW, Washington DC 20314-1000

SUBJECT: Request Policy Exception for Reallocation of Storage at Chatfield Reservoir for Water Supply

1. Background. Section 808 of the Water Resources Development Act of 1986, as amended, authorized study and implementation of storage reallocation at three Corps of Engineers projects (Tri-Lakes) in the Denver area, subject to the Chief of Engineers' finding of feasibility and economic justification. A copy of the authorization is attached at enclosure 1. The current study consists only of one reservoir, Chatfield on the South Platte River. The primary purpose of the study is to determine the feasibility of reallocating a portion of the storage in Chatfield Lake to water supply. The sponsor for the study is the State of Colorado through the Department of Natural Resources, Colorado Water Conservation Board (CWCB), with support from 15 local water providers that have water rights and interest in storage space that may be made available for water supply. Should reallocation prove feasible and be approved, the Corps of Engineers would enter into a water supply agreement with the CWCB for repayment of storage and annual operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) costs. The State will in turn enter into separate agreements with water users, allowing the Corps of Engineers to deal with one State entity, the CWCB, for management and for payment for the storage space.

a. On September 23 2008, the U.S. Army Corps of Engineers, Omaha District (Omaha District), the non-Federal sponsor, and several of the local water users met with Office of the Assistant Secretary of the Army in Civil Works (OASA-CW) and Headquarters U.S. Army Corp of Engineers staff. Claudia Tornblom, Doug Lamont, and Marianne Matheny-Katz of OASA-CW staff were present. At that meeting, Mr. Steve Cone of the Institute for Water Resources (IWR) presented the subject policy exception for pricing of reallocated storage on behalf of the Omaha District. The presentation was based on a reallocation of 20,600 acre-feet (AF) of storage, which is the largest reallocation being considered under the Chatfield Reallocation Study, as it is also the largest reallocation possible without adversely affecting the flood control.

b. By the U.S. Army Corps of Engineers policy, the cost of storage reallocated to municipal and industrial (M&I) use is determined using the highest of 4 methods, which is most commonly the Updated Cost of Storage (UCS). The UCS method is also the method being used at Chatfield. Other methods include: Benefits Forgone (non-recreation being replaced); Revenue forgone (none, no displacement of hydropower), and replacement costs (none, no impact to flood control). The primary intent of this policy exception request is to make UCS at Chatfield more equitable with other reallocations that have occurred across the United States by reflecting the low reliability of water supply and the limitations on the ability of users to store water in the space that would be reallocated to water supply.

2. Remaining Study Milestones. The Chatfield Reallocation Study is currently scheduled to be completed by September of Fiscal Year 2009. Current critical outstanding study milestones include the Alternative Formulation Briefing (2 March 2009), and Division submittal of draft final feasibility report (2 June 2009). Early resolution of the subject policy exception will provide the Omaha District direction on what to include in the reallocation study regarding the cost to users for M&I storage.

3. Required Implementation Authority and Appropriations. Section 808 of the Water Resources Development Act of 1986 as amended and the River and Harbor Act of 1958 (Title III, Water Supply Act of 1958, as amended) authorize this study. Section 808 also authorizes implementation of a reallocation at Chatfield Reservoir should a study find it to be feasible. All implementation costs will be the responsibility of the local sponsor.

4. Outstanding Issues. There are several other outstanding issues at Chatfield needing resolution that were discussed at the 23 September meeting. These include crediting issues, or more precisely, authority for sponsors to perform modifications to recreation facilities and environmental mitigation. The other includes studies focused on identifying whether there are dam safety issues at Chatfield on the basis of current state of the knowledge regarding seismology. Neither of these issues should affect a decision on the subject policy exception.

5. Cost of Storage. As mentioned in Paragraph 3 above, costs to be assessed the non-Federal sponsor for the capital investment on reallocated storage space is based on the updated cost of storage in the Federal project. The non-Federal sponsor will also be responsible for any specific construction and/or operational costs associated with the reallocation action including costs associated with the revision of the water control plan and for environmental mitigation. The overall cost estimate for storage space at Chatfield Reservoir equates to approximately $123M under a 20,600/AF reallocation. Approximately $34M (27%) of the cost would be attributed to the UCS. Other factors driving cost for storage at Chatfield include the following:

a. High costs associated with modification of recreational facilities ($44M). While the Omaha District is still studying how recreation facilities would be modified or relocated to account for higher water elevations, $44M is an initial estimate based on preliminary studies. While the greatest reallocation under consideration would raise pool levels up to an elevation of 5,444 National Geodetic Vertical Datum of 1929 (NGVD) feet from 5,432 feet, Northwest Division Regulation (NWDR) 1110-2-5 (Land Use Development Policy, April 2004) requires all open floodable facilities to be relocated above the 10-year flood pool. In this case, that elevation is approximately 5,453 feet NGVD, requiring significant cut and fill activities to be necessary for many facilities currently located below 5,444 feet NGVD.

b. Environmental mitigation ($45M). Again, this is a preliminary cost estimate. Omaha District has not yet completed studies for this aspect of the reallocation study. Under the maximum reallocation being studied, approximately 587 acres of additional land area would be inundated between 5,432 and 5,444 feet NGVD. As a subset of overlapping habitats, this acreage includes 468 acres of forested or scrub shrub riparian habitats important to migratory birds. Approximately 331 acres are considered suitable habitat for the Federally Threatened Preble's meadow jumping mouse, and 67 acres are designated as Critical Habitat for Preble's meadow jumping mouse habitat. There are 82 acres of vegetated wetlands. Mitigation of these habitats will include both on-site and off-site components.

c. Low reliability or yield of the new storage space. Due to water rights in the existing conservation pool and generally low rainfall and run-off, the reliability of water as measured by dependable yield is very low. Most Corps reservoirs that have storage allocated to water supply provide for an estimated dependable yield which generally determines how much storage a water user would desire to purchase. Common measurements of dependable yield include: drought of record; 50-yr low flow; 2% chance; 98% reliability; 7 day-10-year low flow. At Chatfield, all of these measures of dependable yield are 0. At Chatfield, yield is not simply a factor of precipitation and runoff, of which Denver receives 14 inches annually on average. It is also a factor of water rights. As the groups seeking storage space in Chatfield have relatively minor water rights, they will often not be able to capture inflows, as senior rights holders have priority for available water and capture most of the run-off. Some of the potential users seeking additional storage have reusable water that can be captured on a yearly basis amounting to about 2,379 AF, which can be described as "non-natural flows". In this case, non-natural flows include reuseable effluents that have been treated and released from upstream sources. See attached table at enclosure 2 for information on how much storage could be captured and made useable for the 16 entities seeking storage space at Chatfield. This table presents a period of record analysis and the basis of yield determinations and an indicator of reliability of water supply.

6. Updated Cost of Storage Policy Considerations. UCS policy is the only factor of cost that can be adjusted as the other costs are unavoidable. The UCS at Chatfield is $1650/AF ($34M/20,600AF). At other reservoirs where reallocation contracts exist, the updated cost of storage ranged from about $100 to $5,100 per acre-ft of storage in current dollars (average of $530 by contract). When reliability is factored in to the equation, as measured by yield of storage space, the cost per AF/yr of yield ranges from about $50 to $3,300, with an average of $270 at other Corps reservoirs where reallocations have been made. At Chatfield, because of the relatively high cost of storage and the very low yield to storage ratio, UCS would be about $14,300 per AF/yr of dependable yield. More than 4 times the highest of any other Corps reallocation. A summary of other Corps reservoir reallocations can be found at enclosure 3.

a. Alternatives Considered. Many alternative approaches were considered for adjusting UCS, based on reliability considerations to reflect low yield/reliability of storage space. The arrays of alternatives also provide a wide range of cost savings that could be experienced by the sponsor on UCS. Each alternative is represented as percent of the UCS of $34M. The array of alternatives considered included:

(1) Percent time in years over the 59-year period of record in which natural inflows are captured in the 20,600/AF storage space allocated to new Water Supply (WS) = 83% (5 out of 6 years); adjusted cost of storage = $28M or $1360/AF of storage.

(2) Percent of the new WS storage space utilized over the period of record making use of total inflows which include both natural and "man-made" inflows. This is the same as average use of storage = 41% (503,788/AF / 1,215,400/AF over 59 years or 8,539/AF / 20,600/AF annual average); adjusted cost of storage = $14M or $680/AF of storage.

(3) Percent of the new WS storage space utilized over the period of record based on only natural inflows. This is the same as average natural yield of the storage space = 33% (403,517/AF / 1,215,400 over 59-year period or 6,839/AF / 20,600/AF annually); adjusted cost of storage = $11M or $533/AF of storage.

(4) Dependable yield of the new storage space based on total inflows including natural and man-made = 11% (2,379/AF minimum yield / 20,600/AF of storage); adjusted cost of storage = $4M or $194/AF of storage.

b. Conclusion. Alternative 2 is recommended for consideration for the following reasons:

(1) The $680 per AF of storage is more in line with the average of $530 for all other reallocations around the country;

(2) There is no Federal costs for implementation;

(3) All inflows would be accounted for;

(4) Helps make water supply more affordable for users;

(5) Considers the reliability and utility of the storage space;

(6) Maintains policy of selling storage, not water;

(7) Forty percent takes into account all of the flows that can be stored.

7. Potential Legislative Support. Language in Section 119 of FY09 Energy and Water Appropriations Bill provides support for consideration of policy exception, as it contains language encouraging collaboration between the Secretary, the State of Colorado, and local interests to determine costs to be repaid for storage that reflects the limited ability of the non-Federal interests to make use of storage space that could be reallocated in Chatfield Reservoir. Section 119 also contains language that highlights the local sponsors desire to perform and receive credit for modifications of recreational facilities and for ecosystem mitigation that would be required if a reallocation were implemented (copy of section 119 attached at enclosure 4). Additional support is highlighted by the fact that both the Federal and State congressional delegation have provided numerous letters of support for the Chatfield Reallocation Study.

8. Recommendation. It is recommended that the Secretary provide an exception to the current updated cost of storage policy based on alternative two presented above. This exception would provide that the updated cost of storage calculation consider the percent of the new water supply storage space that is utilized over the period of record with regard to total inflows, which include both natural and "man-made" inflows. It is believed that this exception would have full support of the Colorado Federal and State Congressional delegation. It would provide a timely decision to aid in completion of the feasibility analysis, it would make the updated cost of storage more equitable with regard to reliability, and it would maintain the Federal governments' policy of selling storage space, not water.

FOR THE COMMANDER:

4 Encls
as

ERIK T. BLECHINGER
Deputy District Engineer

Oregon, authorized by the River and Harbor Act approved March 2, 1919, is modified to authorize the Secretary to raise the south jetty to protect vehicular access which was provided at non-Federal cost and to protect public use areas on accreted land adjacent to the south jetty, from damaging effects of overtopping of the jetty, on condition that local interests provide the necessary lands, easements, and rights-of-way for such modification, at a total cost of $4,700,000, with an estimated first Federal cost of $2,350,000 and an estimated first non-Federal cost of $2,350,000. The non-Federal share of the cost of the work authorized by this section shall be 50 percent.

SEC. 808. SOUTH PLATTE RIVER BASIN, COLORADO.

The project for flood control and other purposes on the South Platte River Basin in Colorado, authorized by the Flood Control Act of 1950 (64 Stat. 175) is modified to authorize the Secretary, upon request of and in coordination with the Colorado Department of Natural Resources and upon the Chief of Engineers' finding of feasibility and economic justification, to reassign a portion of the storage space in the Chatfield Lake project to joint flood control-conservation purposes, including storage for municipal and industrial water supply, agriculture, and recreation and fishery habitat protection and enhancement. Appropriate non-Federal interests shall agree to repay the cost allocated to such storage in accordance with the provisions of the Water Supply Act of 1958, the Federal Water Project Recreation Act, and such other Federal laws as the Secretary determines appropriate.

SEC. 809. KING HARBOR, REDONDO BEACH, CALIFORNIA.

The project for King Harbor, Redondo Beach, California, authorized in the River and Harbor Act of 1950, is modified to provide that--

(1) the Secretary is authorized to carry out maintenance dredging;

(2) if recommended in a report of the Chief of Engineers, the Secretary is authorized to construct the breakwaters to a height of 22 feet and maintain the breakwaters at such height, in accordance with such report; and

(3) the Secretary is authorized to carry out planning, engineering, and design for a project to raise the breakwater to a height greater than 22 feet.

The non-Federal share of the cost of the work authorized by this section shall be 50 percent.

Chatfield Reservoir With Project - Reallocation of 20,600 AF Total Annual Storable Inflows in Acre Feet			
Year	Total Available Inflows Taken by 15 Water Users		
	Sub Total Natural	Sub Total "Non-nat."	Total Nat. and "non-nat."
1942	20,600	0	20,600
1943	11	2,379	2,390
1944	6,430	2,379	8,809
1945	6,419	2,379	8,798
1946	0	2,379	2,379
1947	20,600	0	20,600
1948	20,600	0	20,600
1949	20,600	0	20,600
1950	958	2,379	3,337
1951	1,220	2,379	3,599
1952	1,142	2,379	3,521
1953	129	2,379	2,508
1954	0	2,379	2,379
1955	1,538	2,379	3,917
1956	0	2,379	2,379
1957	20,600	0	20,600
1958	15,959	1,366	17,325
1959	801	2,379	3,180
1960	1,526	2,379	3,905
1961	2,676	2,379	5,055
1962	147	2,379	2,526
1963	912	2,379	3,291
1964	171	2,379	2,550
1965	20,600	0	20,600
1966	0	2,379	2,379
1967	838	2,379	3,217
1968	0	2,379	2,379
1969	20,600	0	20,600
1970	20,600	0	20,600
1971	5	2,379	2,384
1972	2	2,379	2,381
1973	20,600	0	20,600
1974	2,153	2,379	4,532
1975	24	2,379	2,403
1976	0	2,379	2,379
1977	0	2,379	2,379
1978	11	2,379	2,390
1979	6,419	2,379	8,798
1980	20,600	0	20,600
1981	0	2,379	2,379
1982	0	2,379	2,379
1983	20,600	0	20,600
1984	20,600	0	20,600
1985	20,600	0	20,600
1986	21	2,379	2,400
1987	20,600	0	20,600
1988	4,819	2,379	7,198
1989	7	2,379	2,386
1990	7	2,379	2,386
1991	20	2,379	2,399
1992	0	2,379	2,379
1993	958	2,379	3,337
1994	1,224	2,379	3,603
1995	20,600	0	20,600
1996	129	2,379	2,508
1997	1,153	2,379	3,532
1998	15,959	1,366	17,325
1999	20,600	0	20,600
2000	129	2,379	2,508
Total, AF:	**403,517**	**100,271**	**503,788**
Avg. Yield, AF/yr:	**6,839**	**1,700**	**8,539**
Yield/Storage ratio:	**0.33**		**0.41**
Dry year yield:			**2,379**
Dry yr. yield/storage:			**0.12**

Enclosure 2

Corps Reservoirs with Reallocated Water Supply Contracts											
District	Project	Sponsor	Year of Reallocation	Storage (AF)	Storage Reallocated	Contract Price	Cost/AF at Time of Contract	CWCCI	Cost per AF in 2008 Dollars	Yield to Storage	Cost per AF/yr Yield in 2008
SAW	John H. Kerr, VA & NC	Virginia Beach	1984	10,200	Hydro	$2,275,685	$223	349.63	$442	2.07	$213.72
		VA Dept. of Corrections	1989	23	Hydro	$5,639	$245	388.68	$437	2.07	$211.27
		Mecklenburg CoGeneration	1991	600	Hydro	$150,241	$250	406.78	$427	2.07	$206.17
SAS	Hartwell, GA&SC	Anderson County Joint Municipal Water System, SC	1976	24,620	Hydro	$3,025,000	$123	203.43	$419	1.59	$263.36
		City of Lavonia, GA	1990	127	Hydro	$21,500	$169	398.34	$295	1.59	$185.31
		Hart County, GA	1997	1,827	Hydro	$335,200	$183	472.17	$269	1.59	$169.43
	Richard B. Russell, GA&SC	City of Elberton, sc	1990	381	Hydro	$419,000	$1,100	398.34	$1,914	20.37	$93.96
		SC Public Service Auth. (Santee Cooper)	2001	491	FC	$1,615,200	$3,290	503.52	$4,529	20.37	$222.36
	J. Strom Thurman, GA&SC	Savannah Valley, SC	1989	92	Hydro	$27,400	$298	388.68	$531	3.55	$149.65
		Columbia County, GA	1989	1,056	Hydro	$313,000	$296	388.68	$529	3.55	$148.93
		City of Thompson and McDuffie, GA	1990	1,056	Hydro	$334,700	$317	398.34	$552	3.55	$155.39
		City of Lincoln, GA	1990	83	Hydro	$24,600	$296	398.34	$516	3.55	$145.31
		City of Wash., GA	1982	632	Hydro	$72,800	$115	339.87	$235	3.55	$66.19
		City of McCormick, SC	2001	316	Hydro	$66,500	$210	503.52	$290	3.55	$81.62
SAM		J. Strom Thurman, GA&SC									
	Carters, GA	City of Chatsworth	1991	818	Cons. / Hydro	$609,221	$745	406.78	$1,269	2.74	$463.27
LRN	Center Hill, TN	City of Cookeville	2003	6,680	Hydro	$2,915,045	$436	529.95	$571	3.36	$169.91
		City of Smithville	2003	401	Hydro	$54,536	$136	529.95	$178	3.36	$52.95
		Riverwatch Golf Inc.	2003	131	Hydro	$103,381	$789	529.95	$1,032	3.36	$307.27
	J. Percy Priest, TN	City of LaVergne	2003	2,733	Hydro	$1,818,550	$665	529.95	$871	4.10	$212.32
		City of Murfreesboro	2003	5,084	Hydro	$3,051,429	$600	529.95	$785	4.10	$191.51
		Consolidated Utility Dist.	2003	3,007	Hydro	$1,804,609	$600	529.95	$785	4.10	$191.49
		Consolidated Utility Dist.	2003	1,367	Hydro	$820,277	$600	529.95	$785	4.10	$191.47
		YMCA	2003	22	Hydro	$16,638	$756	529.95	$989	4.10	$241.31
		Cedar Crest Golf LLC.	2004	96	Hydro	$75,951	$791	608.36	$902	4.10	$219.91
	Dale Hollow, TN/KY	Byrdstown, TN	2005	1,841	Hydro	$372,700	$202	641.91	$219	1.10	$198.77
		Dale Hollow State Park Golf Course	2005	368	Hydro	$176,500	$480	641.91	$518	1.10	$470.92
		Trooper Island, KY	2005	2	Hydro	$900	$450	641.91	$486	1.10	$441.84
	Laurel, KY	Laurel Co., Water Dist. #2, KY	2005	519	Hydro	$166,900	$322	641.91	$347	4.30	$80.77
LRH	J.W. Flannagan,	Dickenson Co. Water Auth.	1977	2,125	WQ	$3,407,700	$1,604	215.68	$5,155	1.58	$3,262.55
	Summersville,	City of Summersville	2001	468	FC	$234,000	$500	503.72	$688	4.79	$143.67
LRL	Rough R. Lake,	Hardinsburg	1979	150	NA	$78,300	$522	255.68	$1,415	10.37	$136.49
MVR	Saylorville Lake,	State of Iowa	1982	14,900	FC	$4,811,600	$323	339.87	$659	3.64	$180.97
MVK	Enid Lake, MS	LS Power Energy Ltd. Partnership	1998	4,500	FC	$1,111,898	$247	478.10	$358	2.85	$125.72
NWK	Harry S. Truman	Henry County #3	1994	1,000	Cons.	$303,000	$303	439.45	$478	2.67	$179
		HST PWSD #2									
	Kanopolis	Kansas Water Office	2002	12,500	Cons.	$4,181,200	$334	517.46	$448	1.16	$386
	Rathbun	Rathbun Lake Water Association	1985	15,000	Cons.	$2,629,000	$175	354.31	$343	0.35	$980
	Stockton	City of Springfield	1993	50,000	Multipurpose	$9,592,800	$192	427.83	$311	0.67	$464
SWL	Beaver Lake	Carroll-Boone Water District	1977	9,016	Hydro	$742,000	$82	215.68	$265	1.20	$220
		Madison County Water Dist.	1992	3,945	FC	$416,500	$106	415.22	$176	1.20	$147
		Benton/Washington County Water District	1996	7,643	FC	$939,900	$123	462.16	$184	1.20	$154
	Blue Mountain	City of Danville	1995	1,550	Cons	$417,300	$269	452.31	$413	1.45	$285
	Bull Shoals L	Marion Co. Regional Water Dist.	1988	880	Hydro	$85,000	$97	374.45	$179	1.27	$141
	Dierks Lake	Marion Tri-Lakes Water Dist.	1976	190	Hydro	$44,000	$232	203.43	$789	1.47	$537

Enclosure 3

CONTINUED - Corps Reservoirs with Reallocated Water Supply Contracts											
District	Project	Sponsor	Year of Reallocation	Storage (AF)	Storage Reallocated	Contract Price	Cost Per AF at Time of	CWCCI	Cost per AF in 2008 Dollars	Yield to Storage	Cost per AF/yr Yield in 2008
SWL	Greers Ferry Lake	Tannebaum Golf Course	1998	90	FC	$11,100	$123	478.10	$179	0.96	$186
		Community Water System Phase I	1995	3,776	FC	$457,800	$121	452.31	$186	0.96	$194
		Community Water System Phase II	1998	4,283	FC	$561,200	$131	478.10	$190	0.96	$198
		Thunderbird Golf Course	1998	55	FC	$7,100	$129	478.10	$187	0.96	$195
		Red Apple Inn & C. Club	1996	65	FC	$8,400	$129	462.16	$194	0.96	$202
	Nimrod	City of Plainview	1994	110	FC	$22,000	$200	439.45	$316	2.59	$122
SWF	Waco	Brazos River Authority	1984	47,526	NA	$15,242,000	$321	349.63	$636	1.63	$390
SWT	Denison Dam – Lake Texoma, OK & TX	Red River Authority of TX	1983	2,286	Hydro	$364,400	$159	340.21	$325	1.06	$306
		N. Texas Municipal Water District	1985	95,053	Hydro	$16,984,600	$179	354.31	$350	1.06	$330
		Buncombe Creek View Addition	1992	1	Hydro	$300	$300	415.22	$501	1.06	$473
		Greater Texoma Utility Auth.	1992	5,500	Hydro	$1,266,100	$230	415.22	$384	1.06	$363
		Greater Texoma Utility Auth.	1997	5,500	Hydro	$1,407,800	$256	472.17	$376	1.06	$355
		OK Tourist & Rec. Dept.	2005	275	Hydro	$87,700	$319	608.36	$363	1.06	$343
		Greater Texoma Utility Auty.	2005	11,600	Hydro	$3,727,100	$321	608.36	$366	1.06	$345
	Marion	Kansas Water Office	1996	12,500	WQ	$2,188,000	$175	462.16	$263	0.73	$360
	Tenkiller Ferry Lake	Tenkiller Water Company	1989	38	FC	$4,100	$108	388.68	$192	1.17	$164
		Stepp and Ross & Company	1989	17	FC	$2,000	$118	388.68	$210	1.17	$179
		Mongold Water System	1990	5	FC	$1,000	$200	398.34	$348	1.17	$298
		Tenkiller Aqua Park	1990	17	FC	$2,000	$118	398.34	$205	1.17	$175
		Gore Public Works Auth.	1990	480	FC	$51,800	$108	398.34	$188	1.17	$161
		Tenkiller Water Company	1991	34	FC	$3,800	$112	406.78	$190	1.17	$163
		Pettit Bay Water Association	1991	5	FC	$600	$120	406.78	$205	1.17	$175
		Fin and Feather Resort	1992	12	FC	$1,500	$125	415.22	$209	1.17	$178
		Sixshooter Water System	1992	2	FC	$300	$150	415.22	$250	1.17	$214
		The Dutchman's Cabins	1992	6	FC	$700	$117	415.22	$195	1.17	$166
		Bill Richardson	1992	1	FC	$100	$100	415.22	$167	1.17	$143
		Indian Hills Estate Co.	1993	3	FC	$400	$133	427.83	$216	1.17	$185
		Charles Willige	1993	2	FC	$300	$150	427.83	$243	1.17	$208
		JR and ML Mosteller	1993	2	FC	$200	$100	427.83	$162	1.17	$139
		Tenkiller Water Company	1994	30	FC	$3,800	$127	439.45	$200	1.17	$171
		Woodhaven (Tenkiller Water Company)	1994	15	FC	$1,900	$127	439.45	$200	1.17	$171
		Burnt Cabin RWD, Inc.	1994	12	FC	$1,200	$100	439.45	$158	1.17	$135
		Sunny Heights Water System	1995	10	FC	$1,200	$120	452.31	$184	1.17	$157
		Tenkiller Development Co.	1995	3	FC	$400	$133	452.31	$204	1.17	$175
		RWD #13 Cherokee Co.	2004	132	FC	$20,500	$155	571.29	$188	1.17	$161
		Petit Mountain Water Association	1997	10	FC	$600	$60	472.17	$88	1.17	$75
	Wister	AES Shady Point, Inc.	1987	7,253	FC	$1,936,800	$267	361.43	$512	1.60	$320

General Statistics	Cost Per AF	Cost per AF in 2008 Dollars	Yield to Storage	Cost per AF/yr Yield in 2008
MAX	$3,290	$5,155	20.37	$3,263
MIN	$60	$88	0.35	$53
AVG	$322	$531	2.47	$267
MED	$200	$345	1.19	$189
STDEV	$420	$763	3.24	$365

Enclosure 3

(3) inserting a new subsection (d):
`(d) COST SHARING- Any requirement for non-Federal participation in a project carried out in the bosque of Bernalillo County, New Mexico, pursuant to this section shall be limited to the provision of lands, easements, rights-of-way, relocations, and dredged material disposal areas necessary for construction, operation and maintenance of the project.'.
SEC. 117. The non-Federal interest for the project referenced in section 3154 of the Water Resources Development Act of 2007 (Public Law 110-114; 121 Stat. 1148) may carry out design and construction work on the project in advance of Federal appropriations or may provide funds directly to the Secretary for the Secretary to carry out such work. The Secretary of the Army shall reimburse the non-Federal interest for any costs incurred by the non-Federal interest that are in excess of the non-Federal share of total project costs.
SEC. 118. (a) The non-Federal interest for the project for hurricane and storm damage reduction, Morganza to the Gulf of Mexico, Louisiana, authorized by section 1001(24) of the Water Resources Development Act of 2007 (Public Law 110-114; 121 Stat. 1053) may, using its own funds, construct the Houma Navigation Canal lock complex feature of the project.
(b) Costs incurred by the non-Federal interest pursuant to subsection (a) of this section may be credited against the non-Federal share of the project or reimbursed at the Secretary of the Army's discretion, subject to initiation of the construction of the project by the Federal Government and subject to a determination by the Secretary of the Army that the work completed by the non-Federal interest pursuant to subsection (a) is an integral part of the project.
SEC. 119. The Colorado Department of Natural Resources is authorized to perform modifications of the facility (Chatfield Reservoir, Colorado), and any required mitigation which results from implementation of the project: *Provided,* That in carrying out the reassignment of storage space provided for in this section, the Secretary shall collaborate with the Colorado Department of Natural Resources and local interests to determine costs to be repaid for storage that reflects the limited reliability of the resources and the capability of non-Federal interests to make use of the reallocated storage space in Chatfield Reservoir, Colorado.
SEC. 120. The project for flood control, Big Sioux River and Skunk Creek, Sioux Falls, South Dakota authorized by section 101(a)(28) of the Water Resources Development Act of 1996 (110 Stat. 3666), is modified to authorize the Secretary to construct the project at an estimated total cost of $51,000,000, with an estimated Federal cost of $38,250,000 and an estimated non-Federal cost of $12,750,000.

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
CIVIL WORKS
108 ARMY PENTAGON
WASHINGTON DC 20310-0108

JAN 22 2009

MEMORANDUM FOR Deputy Commanding General for Civil and Emergency Operations

SUBJECT: Reallocation of Storage at Chatfield Reservoir, Colorado, for Water Supply – Policy Exception

This is in response to a December 8, 2008, Northwestern Division Regional Integration Team (CECW-NWD) memorandum requesting that I grant an exception to Corps policy of calculating the updated cost of storage (UCS) for reallocation projects. The exception would grant a one-time waiver for the Chatfield Reservoir reallocation project, in order for the UCS to more equitably reflect the reliability of inflows and yield.

The Chatfield Lake Reservoir project is part of the South Platte River Basin in Colorado. Section 808 of the Water Resources Development Act (WRDA) of 1986 authorized the Secretary, in coordination with the Colorado Department of Natural Resources to reassign a portion of the storage space in Chatfield Lake to municipal and industrial water supply, if the Chief of Engineers finds the project to be feasible and economically justified. The Chatfield reallocation project consists of raising the pool from 5,432 to 5,444 feet National Geodetic Vertical Datum to create up to an additional 20,600 acre-feet (A/F) of water supply storage. The estimated project cost associated with increased storage is $123,000,000, which is a 100 percent non-Federal responsibility in accordance with the Water Supply Act of 1958 and Section 103 of the Water resources Development Act of 1986. The sponsor for the study is the State of Colorado and the Department of Natural Resources, Colorado Water Conservation Board (CWCB) with support from 15 local water providers with current water rights.

I understand that the reallocation study is currently underway and is expected to be completed in September of 2009. Should reallocation prove feasible, the Corps would enter into a single water supply agreement with the CWCB for repayment of storage and operations, maintenance, repair, replacement and rehabilitation, and the State would enter into separate agreements with the water users. The CWCB would also be responsible for all relocation costs associated with the pool raise.

The Corps' memorandum forwarded background information, an options paper and recommendations by the Omaha District and Northwestern Division Commanders. The intent of the policy exception was to provide a method for calculating UCS at Chatfield based on reliability considerations to reflect low yield

and reliability of storage space. The overall project costs for the Chatfield reallocation are unusually high because of the impacts associated with (1) inundation of riparian habitat, (2) modifying existing recreation facilities, and (3) the UCS. The cost of reallocation is comprised of three components: $44,000,000 for modification of recreational facilities, $45,000,000 for environmental mitigation and the remaining $34,000,000 project cost represents the UCS. However, at Chatfield Lake the reliability of water, as measured by dependable yield is very low.

Given the combination of low rainfall and runoff, along with demands from existing water rights holders on the conservation pool, inflows that can be captured and stored in Chatfield Lake make up an average of about 41 percent of the newly allocated storage space and include a percentage of natural inflows along with man-made inflows from treated effluent. The low yield has the effect of driving up the cost of water supply storage when Chatfield is compared with other Corps reservoirs. When dependable yield is factored into the cost per A/F of storage, an inventory of other Corps reservoirs shows a range from a low $50 per A/F to a high $3,300 per A/F and an average of $530 per A/F. Using the same method, the cost per A/F as measured by dependable yield is $14,300 at Chatfield, which is 4 times higher than the next highest Corps reallocation cost.

The Corps' supporting documentation proposed an adjusted cost of storage based on measured flows into the reservoir over a period of 59 years. The recommended alternative used an observation of combined natural and man-made flows into Chatfield from 1949 through 2000 to calculate the average annual use of storage. This average figure was estimated to be 8,539 A/F of the total 20,600 A/F available in the reallocated storage area, which represents 41 percent of the total available storage space. The Corps, therefore, recommended adjusting the UCS to 41 percent of the current cost, which is an adjustment from $34,000,000 to $14,000,000. This figure also reflects an adjustment of $14,300 per A/F to $680 per A/F, which is more in line with the average cost of other Corps reallocations.

My staff has reviewed the memorandum, background information, options paper and recommendations by the Omaha District and Northwestern Division Commanders and the assessment by Corps Headquarters. In accordance with their recommendations, I find the analysis to be presented clearly and reasonably, and that it represents a proposed valuation method that more accurately reflects uncertainty of the water storage yield at Chatfield Lake when placing a value on the UCS. The requested policy exception is approved because of the special conditions at Chatfield Reservoir. The exception will provide a more equitable rate for the UCS, bringing the UCS in line with other Corps reservoirs.

If there are any questions, you may contact my staff members, Ms. Marianne Matheny-Katz, at [redacted] or Mr. Chip Smith, at [redacted].

John Paul Woodley, Jr.
Assistant Secretary of the Army
(Civil Works)

STATE OF COLORADO

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www.cwcb.state.co.us

November 26, 2008

Mr. Eric Laux, Project Manager
Attn: CENWO-PM-AP
U.S. Army Corps of Engineers, Omaha District
1616 Capitol Ave.
Omaha, NE 68102-4901

Re: Chatfield Reallocation Study – Land Use Development Policy (LUDP) Guidance

Dear Mr. Laux:

This letter is in response to our November 25, 2008 conference call regarding the above referenced subject. The State of Colorado and other stakeholders participating in this effort seek your guidance and conditional approval for proposed exceptions to the Corps of Engineers (Corps) LUDP as it relates to recreational structures at Chatfield State Park. We fully understand that any such exceptions that may be granted by Corps will not be construed as precedent setting. Given the unique and challenging conditions associated with Chatfield Reservoir in preserving "in kind" facilities and recreational experiences, the non-federal sponsor is proposing placement of closed floodable wet flood-proofed structures within Zone 1 (between elevations 5,444 ft and 5,453.7 ft, MSL) that are capable of withstanding periodic flooding and that can easily be placed back into service following inundation. The elevations referenced herein are based on the assumption of a 20,600 acre-foot reallocation of existing storage space in the reservoir.

Three attachments are provided for your consideration in determining if the proposed structures meet FEMA regulations and simultaneously will be satisfactory to the Corps. Attachment A contains as-built drawings of existing recreation facilities around the reservoir that are in excellent shape today after 30 years of service, a period which included three significant flood events. Details regarding the 1980, 1983, and 1995 flood events are included in Attachment B, along with post-flood photographs of the swim beach facilities. Attachment C is a copy of the existing "Flood Operation Plan" from Colorado State Parks that is used as an SOP in preparing facilities for flooding and the actions taken to bring them back into service after water levels return to normal pool elevations. This "Flood Operation Plan" will be updated with new relevant elevations following approval of these proposed exceptions, and approval of the FR/EIS report. The Flood Plan will be updated to address new elevations and other necessary revisions.

The as-built drawings illustrate the durability and inherent flood damage resistance afforded by the structures. It is understood that any exception granted at this time would be conditional based upon approval of a final recreation modification plan and updated drawings & specifications that meet current building code requirements. Our intent is that the updated plans would incorporate the same structural elements as illustrated by the attached drawings and would meet FEMA requirements for all of the impacted structures. We propose that placement of structures in Zone 1 would include a self-imposed "freeboard" of approximately three feet above elevation 5444. In addition, all electrical facilities associated with the structures, and with any other infrastructure and facilities, would be properly flood-proofed for public safety and operational purposes.

Your consideration of these items and support in assisting in such a short time frame is greatly appreciated. Please let me know if you have any questions or need additional information.

Sincerely,

Thomas W. Browning, Chief
Watershed Protection & Flood Mitigation Section

cc: Randy Behm, Chief
Flood Risk and Floodplain Management Section

Attachment A
As-Built drawings for existing recreation structures at Chatfield State Park

Files are located on the CWCB ftp site: ftp://165.127.23.92/TempStore/

(Hard copies of the drawings will be sent via FedEx)

Attachment B
Previous Flood Events and Recreation Structure Photos

Chatfield High Pools of Record:

1. May 26, 1980: Pool Elevation 5,447.58'
2. June 30, 1983: Pool Elevation 5,447.12'
3. July 4, 1995: Pool Elevation 5,446.40'

Photo Top: Sign at top of structure indicates the level of high water at Chatfield Reservoir during the 1983 spring runoff.

Photo Bottom: Chatfield State Park recreation structures at the swim beach in full operation during the 2007 summer recreation season. Buildings are cleaned and inspected following each flood event, and then re-opened for use following protocol in the "Flood Operation Plan" (see Attachment D).

Attachment C
Chatfield "Flood Operation Plan"

TO: All Chatfield Personnel

REF: Operations Procedure No. 31

SUBJECT: Flood Operation Plan

DATE: March 2007

PURPOSE:

The following is the flood plan for Chatfield State Park. The goal for this procedure is to provide for the protection of facilities and equipment owned or leased by the State of Colorado, Division of Parks. This procedure assumes that flooding would probably be a gradual cumulative situation where there is sufficient time for effective action and not the result of a sudden up stream dam failure.

HISTORY:

In the past, floods have been the result of periods when both runoff and precipitation were high and gate closures were required for downstream sewer line and bridge repairs in the river bed. The lake inflows at the time were in the range of 2,500 to 3,200 cubic feet per second (CFS) while the outflows dropped to 500 CFS. The peak rate of elevation change was between.5 to 1 vertically foot per day. The highest peak was 5,447.08 feet elevation with 53,325 acre feet of storage.

RESPONSIBILITIES:

It is the responsibility of the Park management team and the Park Resource Tech. II to ensure that every safe and practical effort is made to protect or prevent damage to the facilities and equipment of Chatfield State Park. In his absence an alternate will be designated for this duty. Most of the tasks will be performed by Park Maintenance staff with assistance from other FTE and Seasonal personnel. All Primary electric power work, whether "hot" or not, should be performed by professional licensed personnel. It is the responsibility of all personnel to be particularly careful and to observe all safety rules while working under such adverse conditions. Take photos of flooding to document damage for Risk Management and historical record.

GENERAL INFORMATION:

Sand bagging has been attempted during previous floods and found to be totally ineffective. The necessary pumping of leakage from within the sand bag dike area cannot be maintained over the long term and is not cost effective. The affected buildings will suffer some damage to paint, doors, locks, partitions, and some surface materials. Structural damage has been and probably would be minimal.

Electric power systems are high priority simply because they are very expensive to repair in both labor and material and require some lead time for replacement components. Removal of all endangered items is the only cost effective protective measure.

The sewage lift stations, though submersible under normal conditions can be damaged by flood water entering and wicking into the motors through ends of the power cable. It is necessary to remove pumps and control panels. In low lying areas it is necessary to seal all manholes with

ramneck asphalt ribbon to keep manhole lids in place. Lids can be removed by hydraulic pressure and wave action.

Shelters, tables and grills should withstand flooding. The lowest of the sites have been under water without any significant damage. Flotsam may displace a few upright grills. Circuit Breakers at the Marina Point and Riverside Group Picnic Areas need to be removed. and the stainless steel tables should be removed.

1. The **Trigger point** for this plan is a lake elevation of 5,434.00 feet. At this level water is just touching the concrete apron at the swim beach and at the top of the concrete ramp at the South boat ramp.

2. Consider snow pack, runoff, raise rate, weather forecast and ground saturation to make the implementation decision.

3. The management team, using the facility elevation list as a guide and regular inspections will be able to develop action plans to manage the situation.

4. The Corps of Engineer's automatic lake elevation gauge is accessible by telephone. The current lake elevation determined by counting tone codes which represent the TENS, UNITS and two DECIMAL digits of the lake elevation above sea level. Fifty Four hundred feet is the assumed constant to which the last two whole digits and decimal digits are added. The number of short tones (dots) indicate the numbers separated by silent periods. Long tones (dashes) indicate zeros (example; ... _____ .... would indicate 5430.75 feet. The long tone being a zero).

5. Electric power on the Deer Creek meter is the first major concern to be addressed because it is one of the first areas to be affected and the hazards of working on electrical systems with high water.

6. All water faucets, hydrants, and valves should be kept closed or in their normal operating position to prevent contamination from entering the supply system.

ACTION TASKS:

The following Action Tasks should be accomplished in an organized manner without rushing so much as to damage things.

TASK # 1. Remove the contents of all threatened buildings down to the bare walls and floors. Include stored materials, furniture, appliances, bulletin boards poster and etc. Take care to protect these items during removal, transport and storage.

TASK # 2. Remove all dumpsters, trash cans, removable dumpster and toilet screen panels and etc. from the threatened areas. If time and personnel permit, remove and store railroad tie curbing or landscaping timbers and wood fencing which are likely to float away.

TASK # 3. Make the West side electric power system safe by shutting OFF the primary electric power to permit other protection work to proceed on the electric system.
The transformers for Catfish Flats, Jamison, Swimbeach, and lift station #3 may be isolated from the primary feed. The West Entrance station can be re-connected through the Deer Creek Picnic Area transformer and power maintained until elevation 5,446.00.

a. Qualified personnel (Sturgeon Electric Company or others) must open (de-energize) the main primary disconnect switch at Highway 121 and the Corps of Engineers entrance road.

b. Qualified personnel must isolate the primary feed from the transformer at lift station #3 and re-connect to the Deer Creek Picnic Area transformer load with jumper blocks. Termination covers must be placed on the exposed transformer lugs to keep dirt out.

c. Qualified personnel may re-energize the primary feed at the main disconnect switch (in (a.) above) to keep power to the West Entrance as long as possible while removal of other electrical components proceed.

TASK # 4. Remove all electrical components including circuit breaker panel boards with circuit breakers, water heaters, unit heaters and lift station control panels. and pumps. It is recommended that all wires be tagged with permanently marked tape or tags to make re-installation easier.

This can take from one to two hours or more for each unit.

See: Instruction sheet and Decision Point list.

DECISION POINTS:

This list of "ACTION TASKS" will aid planning a course of action that will suit the situation. Due to changes over the years, all areas of the lake shoreline, inlets and low lying picnic areas must be monitored. The elevations are the levels at which water is on the floor of the listed buildings or on the lowest point of the facility. The numbers were developed from actual elevations measured during the previous floods and as-built drawings where necessary. The decision points may not always reflect the access to the facility. If action is taken at each Decision Point, there should be sufficient time to complete the indicated tasks.

ELEVATION		EXPECTED CONDITIONS OR ACTION REQUIRED
5,434.00	-	This is the trigger point for plan implementation
	-	Water at the edge of the concrete apron , the beach where it meets the sand.
	-	Water is at top of concrete on the South boat ramp
ACTION	-	Notify Beach Concessionaire
ACTION	-	Plum Creek Picnic Area
ACTION	-	Seal manhole lids on Plum Creek force main and in Marina area
ACTION		**TASK # 2**
ACTION	-	Swim Beach Complex
ACTION		**TASK #1, TASK #4**
ACTION	-	Lift Station #3 (Swimbeach) and Transformer vault including DRY TYPE transformer
ACTION		**TASK #3, TASK # 4**
5,434.75	-	Water is at the lowest point of the Plum Creek Picnic area road
5,435.33	-	Water is at Swim Beach Complex aid station & bath house floor.
ACTION	-	Transformer at Beach Complex

ACTION **TASK #4**

ACTION - Lift Station #2 (Jamison)
ACTION **TASK #4**

5,436.00 - Water is at Lift Station #3 (Swimbeach) (rim)
5,437.00 - Water is at beach concession floor and facility transformer
5,437.50 - Water is at Lift Station #2 (Jamison)
5,438.25 - Water is at C.S. #14 Plum Creek Picnic Area toilet floor and top of ramps north ramps
5,438.50 - Water at transformer at Lift Station #3 (Swimbeach)
ACTION Beach Complex to Fox Run

ACTION **TASK #2**

ACTION - C.S. #21 Jamison Toilet
ACTION **TASK #1, TASK #4**

ACTION - Lift Station #2 (Jamison) and Transformer

5,440.00 - Water at C.S. #21 Jamison toilet floor, west shore shelters Catfish Flats to Fox Run
ACTION - C.S. #19 (Catfish Flats)
ACTION **TASK #1, TASK #4**

5,441.00 - Water at shelters at east end of North Ramps peninsula
5,441.50 - Water at C.S. #19 Catfish Flats
5,443.00 - Water at Riverside Picnic Area shelter at Marina lot
ACTION - Lift Station #1 (Catfish Flats), Lift Station #5 (North Ramps), and C.S. #28, Riverside GPA
ACTION **TASK #1, TASK #4**

5,444.00 - Water is at Marina Point GPA
5,444.50 - Water is at Lift Station #1 (Catfish Flats)
5,444.75 - Water is at C.S. #28 (Riverside Picnic Area)
5,445.00 - Water is at Riverside Picnic Area east sites
5,445.00 - Water is at Marina Restroom floor
5,445.00 - Water at Platte River Bridge
ACTION - C.S. #22 (Deer Creek Picnic Area)
ACTION **TASK #1 TASK #4**

5,446.00 - Water is at C.S. #22 and transformer at Deer Creek Picnic Area
5,447.08 - Highest water mark on June 30, 1983
5,448.00 - Water at Riverside GPA
ACTION - C.S. #25 (North Ramps, and transformer and Lift Station #5 (North Ramps)
ACTION **TASK #1 TASK #4**

5,449.00 - Water at C.S. #25 at North Ramp
5,449.00 - Water at road in front of C.S. #25 (North Ramps)
5,454.50 - Rim of Lift Station #6 (Roxborough Cove)

* C.S. = Comfort Station

ELECTRICAL EQUIPMENT

INSTRUCTION SHEET

Building and Utility Electrical System Component Removal.

Each of these procedures take about one to two hours per unit to complete and double that to reinstall.

First: Turn off all power to the building.

A. Circuit Breaker Panel Board removal from restroom buildings, aid station, bath house and concession.
   a. Remove panel cover by loosening (not removing) the retaining screws and releasing the latch mechanism.
   b. Disconnect all wires from circuit breakers and tag them for reconnecting later.
   c. Disconnect the three short jumper wires and the main conductors from the 70 or 90 Amp Main breaker.
   d. Remove the four to six bolts or nuts and washers which secure the panel board to the cabinet.
   e. Dismount the entire panel board assembly by pulling forward and out of the cabinet.
   f. Coat all bare copper conductor ends with anti corrosion grease.

B. The Main and Water Heater power panels in the bath house.
   a. Disconnect all wires from the circuit breakers.
   b. Dismount the entire panel board as in A. above.

C. Water Heaters
   a. Disconnect the wiring at the fused switch box for each water heater in the bath house and remove conduit and wire from box, leaving wire and conduit attached to the heaters.
   b. Disconnect the wires and flex conduit at the junction box on the wall adjacent to the heater.
   c. Close inlet and outlet water gate valves and drain the tank. Loosen and disconnect the supply and outlet unions at the top of the tank.
   d. Handle the tank with care during removal to avoid damaging the glass lining.

D. Furnaces or Unit Heaters, Riverside #28 and North Ramps #25.
   a. Disconnect the wiring and flex conduit from the furnace.
   b. Disconnect the thermostat wires from the furnace.
   c. Unscrew the top plenum from the furnace hot air outlet, and raise the plenum about 1/2 to 3/4 inch and temporarily secure while the furnace is slid out and removed. A temporary support may need to be provided.

E. Transformer Primary fuses. (not in vaults)
   NOTE: This procedure must be performed by qualified personnel only.
   a. Disconnect the Primary (15 kv) power at the Service Entrance Oil Switch, or the PSCo cutouts.
   b. Open the transformer cabinet (both doors)
   c. Using a HOT STICK, and 20 kv gloves pull the primary fuses and remove for storage.
   d. Secure the transformer.

F. Transformer Secondary Circuit Breaker Panels.

a. Remove the four to six nuts and washers which secure the side shield panels in the right (secondary) side of the transformer cabinet and remove the panels.
b. Disconnect all of the wires from the circuit breakers and the panel board busses and tag the free ends for re-connection later.
c. Remove the panel board from the cabinet and secure the transformer.

G. Ventilation Blowers.
a. It is not generally cost effective to remove in line blowers located in the back of the small plumber's chases. This is a low priority. The water rarely will get that high.

H. Transformers in Concrete Block Vaults.
NOTE: BE ABSOLUTELY CERTAIN THAT PRIMARY POWER IS DISCONNECTED FROM THE TRANSFORMER.
a. Open the access door to the circuit breaker panel (the cabinet usually located on the inside wall of the vault).
b. Disconnect all wires from the circuit breakers and the panel board busses and tag the free ends for re-connection later.
c. Remove the panel board from the cabinet and secure the cabinet and transformer.
d. Disconnect and remove the DRY type transformer located in the Southwest inside corner of the transformer vault at Lift Station #3 (Swimbeach).

I. Lift Station #1 and #2 (Catfish Flats and Jamison).
a. Open Control Cabinet and disconnect and tag all interconnecting wires for identification.
b. Remove the six nuts and washers from the inside panel mounting studs.
c. Dismount and remove the panel and secure the cabinet.

J. Lift Station #3, the control panel must be removed in the same manner as the other lift stations.

K. Lift Station #4, the control panel must be removed from its cabinet located in the underground vault in the same manner as other Lift Stations.

L. Enhanced reservable Group Picnic Shelters (Riverside & Marina Point)
a. Remove cover plate and remove circuit breakers
b. Remove duplex outlets from wall mounted boxes.

STATE OF COLORADO

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January 8, 2009

Mr. Eric Laux, Project Manager
Attn: CENWO-PM-AP
U.S. Army Corps of Engineers, Omaha District
1616 Capitol Ave.
Omaha, NE 68102-4901

Re: Chatfield Reallocation Study – Land Use Development Policy Exception Request

Dear Mr. Laux:

This letter is a formal follow up to our November 26, 2008 letter to you regarding the above referenced subject. The State of Colorado and other stakeholders participating in the Chatfield Reservoir Reallocation Study seek approval by the Corps of Engineers (Corps) for proposed exceptions to NWDR 1110-2-5, commonly known as the Land Use Development Policy (LUDP) as it relates to recreational structures at Chatfield State Park. We fully understand that any exceptions granted by Corps will not be construed as precedent setting. Given the unique and challenging conditions associated with Chatfield Reservoir in preserving "in kind" facilities and recreational experiences, the non-federal sponsor is proposing placement of closed floodable wet flood-proofed structures within Zone 1 (between elevations 5,444 ft and 5,453.7 ft, MSL) that are capable of withstanding periodic flooding and that can easily be placed back into service following inundation. The elevations referenced herein are based on the assumption of a 20,600 acre-foot reallocation of existing storage space in the reservoir.

Four attachments are provided for your consideration in determining if the exception request can be granted:

- Attachment 1: Completed "Evaluation Criteria for Land Development Proposals", Appendix C, Part A, NWDR 1110-2-5;
- Attachment 2: Technical Memorandum (TM), Chatfield Structural Analysis, CH2M Hill, December 2008;
- Attachment 3: Memo from the CWCB certifying that structural recommendations within the TM (Attachment 2) will be followed during final design phase of the project; and
- Attachment 4: Chatfield Reservoir Recreation Facilities Plan, EDAW, January 2009

Your consideration of this request is greatly appreciated.

Sincerely,

Thomas W. Browning, Chief
Watershed Protection & Flood Mitigation Section

cc: Randy Behm, Chief
Flood Risk and Floodplain Management Section

Attachment 1

Appendix C

Evaluation Criteria for Land Development Proposals

Part A. Project Review

1. Corps Project/Reservoir: Chatfield Reservoir (Chatfield Dam & Lake)
2. Name of Development Proposal: Chatfield Reservoir Recreation Facilities Plan as part of Chatfield Storage Reallocation Project
3. Requestor Name: Colorado Water Conservation Board in association with Colorado State Parks
    a. Requestor Address: 1313 Sherman St., Room 721, Denver, CO 80203
    b. Requestor POC: Mr. Thomas W. Browning
    c. Requestor Phone number: [redacted]
    d. Requestor Fax number: [redacted]
    e. Requestor E-mail Address: [redacted]
4. Development Category:
    a. Corps Development:
        - New Area (Undeveloped)? __ Yes X No
        - Existing Recreation Area? X Yes __ No

    Details for the redevelopment of existing recreational facilities are described in Attachment 4 (Chatfield Reservoir Recreation Facilities Plan), resulting from the proposed increase of storage capacity at Chatfield Reservoir. The recreation mitigation study is based on an increase in the average high water level that requires a portion of existing recreations facilities to be relocated to new locations near their present locations.

    b. Proposed Outgrant Development:
        - New Development (Reference Land Availability Guidance)?
            __ Yes X No
        - Development in Existing Lease Area? X Yes __ No

5. Proposal Description (include area name):

Seven recreational use areas and their respective facilities are included in this proposal, they are:

- North Boat Ramp
- Massey Draw
- Swim Beach/Deer Creek/Jamison Area
- Catfish Flats/Fox Run Group Use Areas
- Kingfisher/Gravel Ponds/Platte River Trailhead
- Marina/Roxborough Cove Area
- Plum Creek Area

These affected recreational use areas and facilities are described and illustrated in Chapter 2 (Site Characteristics) of Attachment 4 (Chatfield Reservoir Recreation Facilities Plan), on pages 2-5 through 2-21. It provides an area-by-area description of what facilities would have to be relocated and redeveloped. Chapter 3 (Mitigation Plan) of Attachment 4 presents the conceptual designs for the relocation and redevelopment of park facilities that would be impacted by raising water levels. Areas that would not be influenced, such as campgrounds, are not considered in this evaluation.

6. Materials Reviewed: X Reports X Plans X Others

7. Titles and Dates of Reviewed Materials:

Northwest Division Regulation NWDR 1110-2-5 (LUDP) dated 30 APR 2004

US Army Corps of Engineers Engineer Manual EM 1110-1-400 dated 1 NOV 2004

Chatfield "Flood Operation Plan", Operations Procedure No. 31, MAR 2007

Design Memorandum PC-46 Master Plan, Chatfield Lake, CO AUG 2001

Chatfield Reallocation Study Webpage. Colorado Water Conservation Board http://cwcb.state.co.us/flood_watch/chatfieldweb-current/the_study.htm

U.S. Corps of Engineers Webpage (fact 05.20.03)

Colorado State Parks Webpage. Colorado State Parks http://parks.state.co.us/default.asp?parkID=78&action=park

Chatfield Reallocation Study Meeting Minutes from 8/7/03. Colorado Water Conservation Board

Chatfield Reallocation Study Working Group Meeting Minutes from 8/26/08. Colorado Water Conservation Board

Chatfield Reallocation Study - Storage Use Patterns. Brown and Caldwell. 2003

Chatfield State Parks Manager's Reports for 2003

Chatfield State Park Brochure

Existing Conditions Report for Biological Resources. Foster Wheeler. 2000

Road Realignment Study for Chatfield State Park. Sear-Brown. 2004

Colorado State Parks Market Assessment Study. Price Waterhouse Coopers. 2002

Class III Cultural Resources Survey of Chatfield State Park, Arapahoe, Douglas, and Jefferson Counties, Colorado. 4G Consulting, LLC and RMC Consultants, Inc. 2007

Letter from John Bertino, Jr., Omaha District to David Giger dated 8 AUG 2008

Letter from John Bertino, Jr., Omaha District to Tom Keith (EDAW) dated 1 APR 2008

Letter from Tom Browning to Eric Laux, Omaha District dated 26 NOV 2008

8. Do the facilities/structures of the proposed development comply with Appendix B "Minimum Criteria for Northwestern Division Reservoir Land Development Proposals" of NWD Policy ER 1110-2-5 and Appendix B?

_ Yes X No (If No, explain **and** District review required)

The conceptual designs for the relocation and redevelopment of park facilities at five recreation areas of the seven listed in paragraph 5 do not comply with Appendix B. These five include: Massey Draw, Swim Beach/Deer Creek/Jamison Area, Catfish Flats/Fox Run Group Use Areas, Marina/Roxborough Cove Area and Plum Creek Area. In all instances of these five areas, structures that are associated with close proximity to water require placement in Zone 1. Appendix B does not allow structures to be placed into Zone 1, but allows open floodable, wet flood-proofed structures be placed in Zone 2 and closed floodable, wet flood-proofed structures in Zone 3. Chapters 2 and 3 of Attachment 4 (Chatfield Reservoir Recreation Facilities Plan) illustrate the specific facility structures that are impacted and the mitigation plan for each of those locations. Potentially there may be a requirement to replace portable restroom facilities with permanent at Kingfisher/Gravel Ponds/Platte River Trailhead Area. At this time the plan does not specify the need for an exception to Appendix B, but would like to include this area for consideration. Also included with this proposal are steps being taken to ensure structures that are placed in Zone 1 will meet FEMA regulations and simultaneously be satisfactory to the Corps.

In a meeting between Omaha District (attended via phone by Mr. Laux and Mr. Behm) and the Chatfield Park Recreation Facility working group on 25 November 2008, the team made a preliminary assessment that placement of closed floodable wet flood-proofed structures within Zone 1, that are capable of withstanding periodic flooding and that can easily be placed back into service following inundation, would have less impact on the Corps operation requirements than excessive fills to raise the structures to elevations within Zones 2 or 3. This

preliminary assessment was contingent of additional analysis that is included with this proposal.

Appendix 6 (USACE Land Use Guidance and Exception) of Attachment 4 is a copy of the letter sent on 26 November 2008 to Mr. Laux with attachments detailing the steps being taken to meet standards for placement within Zone 1. Additionally, a structural engineering analysis was performed of existing facilities to determine what design elements would need to be incorporated into new structures to meet those standards. That analysis and the recommendations are included with this proposal as Attachment 2 (Technical Memorandum, Chatfield Structural Analysis, CH2M Hill, December 2008).

9. Will any part of the proposed development conflict with the Corps project Master Plans for the area of proposed development?

_ Yes (If Yes, explain) X No

Referencing the Design Memorandum PC-46 Master Plan for Chatfield Lake, dated AUG 2001, under the section Reservoir Regulation and on page II-25, the document discusses the coordination ongoing between the Corps and the State of Colorado. Specifically it references the initiation of a study to determine whether flood control storage may be reallocated for other purposes.

10. Is proposed development consistent with an approved Development Plan submitted in accordance with Real Estate document (lease, license, etc.)?

X Yes _ No (If No, explain)

11. Will the proposal impact waters and wetlands (a Dept. of the Army permit may be needed fro the Corps of Engineers)?

X Yes (If Yes, needs review by Regulatory Branch)
_ No

Omaha District's Colorado Regulatory Office has been participating in the ongoing EIS coordination and appropriate permit applications will be filed in accordance with existing procedures.

12. Will the proposal impact cultural resources sites?

X Yes (If Yes, need review by District Cultural Resources team)
__ No

As part of the ongoing EIS, cultural resources assessments are included to clearly identify potential impacts. An inventory of cultural resource sites prepared by the Corps (USACE 2007) was reviewed to determine if known cultural resources would be affected by the mitigation plan. We anticipate additional evaluation will be required because cultural resource sites have been identified near Deer Creek and Catfish Flats recreation areas. Further evaluation will be done during the Cultural Resource evaluation of the EIS process.

13. Is any part of the proposed development on or near the dam embankment, intake or spillway or other operational feature, including instrumentation?

_ Yes (If Yes, need review by District Dam Safety team)
X No

There will be continued review of potential impacts due to increased elevation of water. No effects are anticipated with this proposed plan.

14. Summary comments/recommendation for the proposed development:

The State of Colorado, Stakeholders and Corps of Engineers have been diligent these past several months in seeking a collaborative solution in preserving "in kind" facilities and recreational experiences while not compromising the Corps flood control and public safety mission. We believe that this proposal meets all team member requirements for the unique and challenging conditions associated with Chatfield Reservoir.

15. Initial Submittal __X____ or Resubmittal _____ (check one)

16. Project Manager: Eric Laux, Omaha District.

Attachment 2

Chatfield Structural Analysis
Beach House Complex

PREPARED FOR:	Chatfield Reservoir Recreation Relocation Working Group
PREPARED BY:	CH2M HILL
COPIES:	Colorado Water Conservation Board, Department of Natural Resources
DATE:	December 2008
PROJECT NUMBER:	383816

Purpose and Objectives

The purpose of this memorandum is to document the structural analysis of the existing Chatfield Lake Beach House Complex for the given design flood condition. This analysis focuses on the closed floodable structures and structural components within the Toilet Module, the First Aid Module, and the Rental Module of the complex. The objective of this analysis was to determine if the existing structures were sufficient to use as a model for the construction of new structures that would be located within the flood plain due to the function they serve. The results of the analysis of the existing structures are presented and recommendations are made for the design and construction of the future structures.

Structural Analysis

Loads

Flood loadings, including wave height and still water depth were calculated for the specific design flood. This design flood is based on the existing structures' locations at a raised finished floor elevation of 5447.0 and base flood elevation (BFE) of 5453.7 which was provided by the Chatfield Reservoir Recreation Relocation Working Group. Flood loads were calculated according to Chapter 5 of ASCE 7-05. In determining flood loading by the ASCE 7 method, wave height is limited by the flood water depth. For this analysis the structures were assumed to be located in a non coastal A zone, subject to breaking wave forces.

Design standards used for analysis are:

- ASCE 7-05 - Minimum Design Loads for Buildings and Other Structures
- ACI 530-08 - Building Code Requirements for Masonry Structures
- ACI 318-08 - Building Code Requirements for Structural Concrete

Forces included in a typical flood design are hydrostatic induced from standing floodwater and hydrodynamic forces induced from wave loading or flow past the structure. At this complex the water is expected to rise slowly and water will be located on the interior and

exterior of the walls, therefore much of the hydrostatic loading is reduced. Impact loadings from debris and foundation scour conditions due to flowing flood waters were not included in the analysis.

Exterior Wall Analysis

As constructed drawings were provided by the Chatfield Reservoir Recreation Relocation Working Group. The geometry and materials shown on these drawings were used as the basis for determining the design loads and capacity of specific structural elements. The exterior walls of the complex's structures were analyzed according to the design standard loads for the prescribed flood condition. Based on the as-built drawings, the existing exterior walls are a combination of double wythe masonry and brick, 12" brick and 8" masonry. The exterior wall heights vary from 8'-0" to 18'-9" at the tallest point.

Walls were analyzed for both out-of plane loadings and in-plane loadings resulting from flood loadings. Out-of-plane loading is loading perpendicular to the face of the wall, in-plane loading is loading parallel to the wall.

Table 1

Exterior Wall Analysis Results and Recommendations Table

Wall Type	Results of Out-of-Plane Analysis	Results of In-Plane Analysis	Recommendations
8" Masonry	Failed	Acceptable	Use 10" minimum masonry or concrete thickness to meet loading demands. At tallest wall height, grade should be such that no vertical exposed portion of the wall exceeds 15'-4". Cantilevered exterior site walls shall be redesigned to meet demand, or designed as breakaway wall.
8" Multi Wythe Masonry and Brick	Failed	N/A	Use 10" minimum masonry or concrete thickness to meet loading demands. Brick veneer may be added to match existing architecture.
12" Brick	Failed	N/A	Use 10" minimum masonry or concrete thickness to meet loading demands.

Concrete Roof Diaphragm

The concrete roof diaphragm was analyzed for flood loading with breaking waves at one side of the structure only. The loads distribute themselves to the vertical walls through the concrete roof diaphragm.

Table 2

Roof Diaphragm Analysis Results Table

Location	Diaphragm Thickness	Results of Analysis
First Aid Module	6”	Acceptable
Rental Module	6”	Acceptable
Toilets Module	8”	Acceptable

Steel Rollup Doors

Steel rollup doors are generally designed for wind loadings significantly less than the design flood loads. It is not practical to design a steel rollup door for the given flood loads. It is recommended a removable flood shield be installed to prevent damage of the roll up door by wave action. The jambs of the roll up doors require additional reinforcement from what is shown on the as-built drawings to address forces transferred from the flood shield. In addition, minimizing the dimensions of the door will reduce the forces seen by the door and therefore the door jambs. Another possibility is leaving the roll up door open prior to an expected flood event. This would require additional instructions be added to the Chatfield “Flood Operation Plan”.

Interior Flood Loading

It is expected water levels will rise slowly over a period of days. As water enters the interior of the structures water will equalize itself on both sides of interior walls through leakage and openings, therefore it is not expected to have unequal loadings on interior walls. New structures should provide adequate openings to ensure hydrostatic equilibrium at the interior walls of the structure due to rising flood waters.

Hydrodynamic loadings from wave action are not expected to occur on the interior of the structures.

Summary of Analysis

A structural analysis of the basic structures of the Beach House Complex was completed, structures include the Toilet Module, the First Aid Module and the Rental Module. It was determined certain structural elements do not meet demands based on current codes and the given flood conditions considered, in particular the exterior walls and site walls are not adequate. However new structures could be designed to resist flood induced forces with similar construction to the existing Beach House Complex facilities with additional strengthening and detailing involved.

The loads and recommendations presented in this report are based on the information provided by the Chatfield Reservoir Recreation Relocation Working Group to evaluate the existing structures for the specific conditions described. The loads used for design of future structures must be developed by the design engineer considering the actual siting, geotechnical, geometry, codes and standards in force at the time and other considerations as required for the specific design of those structures.

Appendix A – Structural Analysis Calculations

FLOOD LOADING CRITERIA

Closed floodable structures –

Design Standards

ASCE 7-05 ~ Minimum Design Loads for Buildings and Other Structures
ACI 318-08 ~ Structural Concrete
ACI 530-08 ~ Masonry Structures
BFE ~ 5453.7 Base Flood Elevation (provided by client)
G ~ 5447.0 Ground Elevation

Design Values – Assumed values for new structures of similar construction to as-built dwgs

Concrete: $f'_c = 4000$ psi
$f_s = 60000$ psi

Masonry: $f'_m = 1500$ psi
$f_s = 24000$ psi

Roof $\measuredangle = 9.5°$

Load Combinations per ASCE 7-05

§ 2.4.1 – Allowable Stress Design *

5) $D + 0.75Fa + W$ ← controls
6) $D + 0.75Fa + 0.75W$
7) $0.6D + W$

* Use 0.75F per § 2.4.2 – Non-coastal A-Zone

DESIGN FLOOD LOADS

- Local still water depth d_s (ASCE 7-05 5-3)

$$d_s = 0.65(BFE - G) \quad (G \rightarrow 6.7') = 4.36 \text{ ft}$$

- Breaking wave height H_b (ASCE 7-05 5-2)

$$H_b = 0.78 d_s$$
$$= 0.78 \times 4.36$$
$$= 3.40 \text{ ft}$$

Breaking wave loads on Vertical walls (ASCE 7-05 § 5.4.4.2)

$$P_{max} = C_p \gamma_w d_s + 1.2 \gamma_w d_s \quad [lb/ft^2] \quad \text{(Eq'n 5-5)}$$

(C_p dynamic; $1.2\gamma_w d_s$ static)

(Where $C_p = 2.8$ for Building Cat II)

$$= 2.8 \times 62.4 \times 4.36 + 1.2 \times 62.4 \times 4.36$$
$$= 761.8 \text{ psf} + 326.5 \text{ psf} = 1088.3 \text{ psf}$$

$$F_t = 1.1 C_p \gamma_w d_s^2 + 1.9 \gamma_w d_s^2 \quad \text{(Eq'n 5-7)} *$$
$$= 1.1 \times 2.8 \times 62.4 \times 4.36^2 + 1.9 \times 62.4 \times 4.36^2$$
$$= 3653.5 \text{ plf} + 2253.8 \text{ plf} = 5907.3 \text{ plf}$$

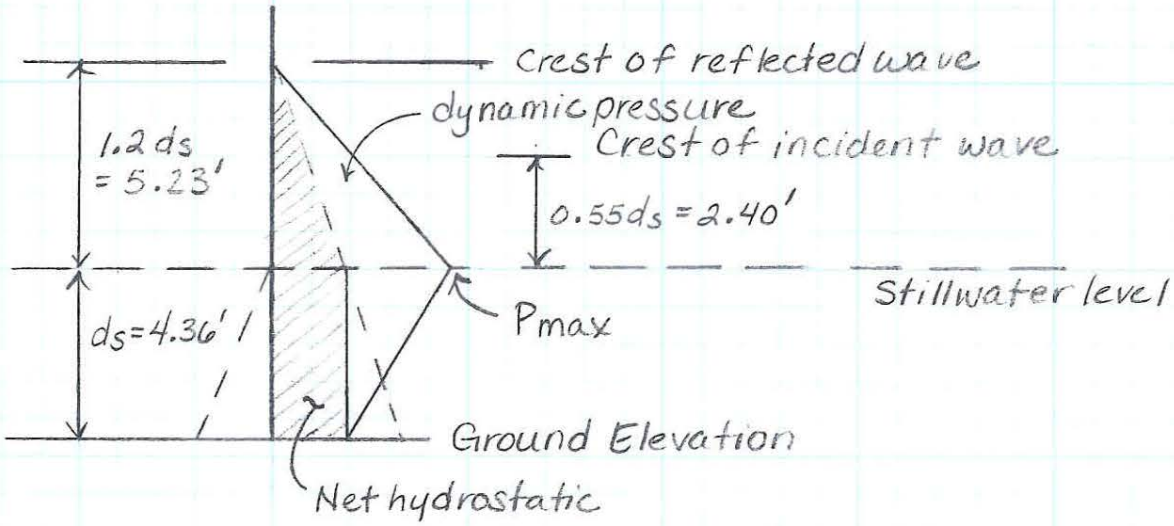
(acts near the still water elevation)

F_t = net breaking wave force per unit length of structure.

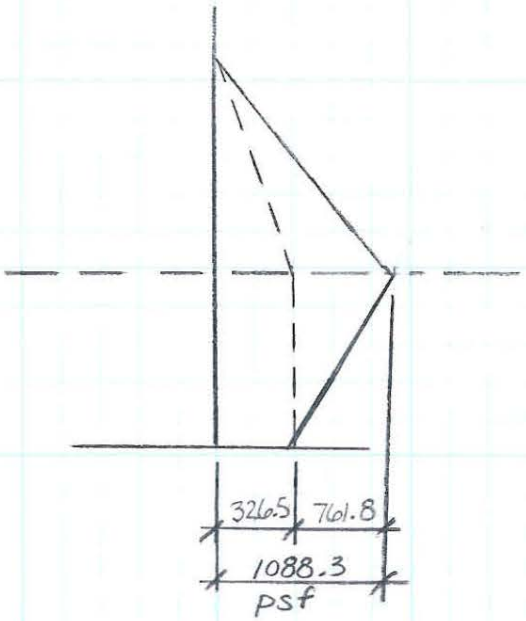
→ See following loading diagrams:

Structures are wet flood proofed:
* Free water exists behind the wall & portion of hydrostatic force dissapears

DESIGN FLOOD LOADS (ASCE 7-05 → Fig 5-2)



→ Normally Incident Breaking Wave Pressures against a vertical wall. (still water level equal on both sides of wall)



WIND LOADING - MWFRS - Main wind Force Resisting System

ASCE 7-05 - Simplified Proceedure - enclosed Structure < 60' height

Wind speed = 100mph (3-second gust)

$p_s = \lambda K_{zt} I p_{s30}$ (ASCE7-05 Eqn 6-1)

λ = adjust. factor for Building height & exposure
= 1.21 (ASCE 7-05 Fig 6-2)

K_{zt} = topographic factor
= 1.00 (ASCE7-05 Fig 6-4)
~ assumed flat @ flood condition

I = importance factor (ASCE7-05 Table 6-1)
= 1.00

p_{s30} = simplified design pressure (Fig. 6-2)

	HORIZONTAL				VERTICAL			
	A	B	C	D	E	F	G	H
Roof angle = 10° ~	17.9	~~-7.4~~ (no vert. roof component)	11.9	~~-4.3~~	-19.1	-11.6	-13.3	-8.9
p_s =	21.7	~~-8.9~~	14.4	~~-5.2~~	-23.1	-17.5	-16.1	-10.8

Components & Cladding

$p_s = \lambda K_{zt} I p_{net30}$ ~ @ vertical walls (zone 4 & 5)

* effective wind area = 18.75' x $\frac{18.75'}{3}$ = 117 ft²
~ use 100 ft²

p_{net30} = 15.3, -16.8 zone 4 (wall element)

15.3, -18.7 zone 5 (wall element)

p_s = Zone 4 ~ 18.5psf, -20.3 psf

Zone 5 ~ 18.5psf, -22.6 psf

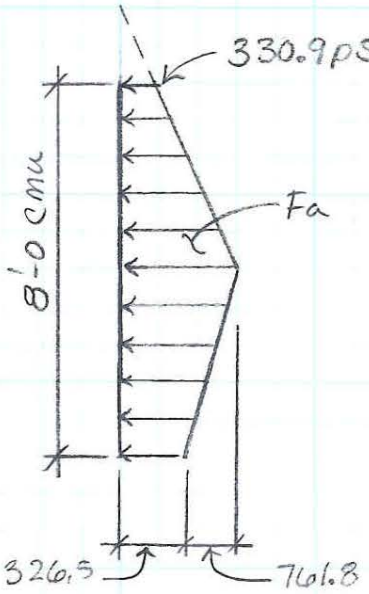
*Effective wind area is the area of wall used to determine the pressure & gust effect ~ span length * span length/3

Exterior Wall Analysis – Double wythe cmu w/ brick

Fully grouted wall: $A = 91.50 in^2/ft$

height of wall = 8'-0 , $r = \sqrt{I/A}$

$h/r = 8 \times 12 / \sqrt{443.32/91.50} = 43.6 < 99$ ∴ (use ACI530 Eq'n 2-20)



d=4" for brick & block wall designed as composite

From analysis, (see following output)

Mmax = 4984 #.ft

Vmax = 2162 # @top
2089 # @base

Axial Loads

P_{DL} = WALL = 87psf x 8' = 696 plf
ROOF = 0.5'x150pcf x 5' trib = 375 plf
ROOF MTL = 15psf x 5' = 75 plf
FASCIA = 0.5'x1.167x150 pcf = 87.5 plf
BEAM = 0.67'x1.33'x150 pcf = 133.7 plf
1367.2 plf

P_{LL} = 20psf x 5' = 100 plf

P_{TL} = 1467.2 plf

$$P_a = (0.25 f'_m A_n + 0.65 A_{st} F_s)\left(1 - \left(\frac{h}{140r}\right)^2\right)$$ ACI530-8 Eq'n 2-20

$$= 0.25 \times 1500 \times 91.5 + 0.65 \times 1.5 \times 24000 \left(1 - \left(\frac{43.6}{140}\right)^2\right)$$

$= 52,114.4\# / 91.50 in^2 = 569.6 psi$

$$f_a = \frac{P}{A} = \frac{1467.2}{91.5} = 16 psi$$

→ From design spreadsheet, d=4 will not work for exterior walls

try 10" cmu walls

$d = 8"$, $A = 115.50 in^2$

$h'/r = 8 \times 12 / \sqrt{891.67/115.50} = 33.2 < 99$ AC1530-08 use eq'n 2-20

Axial Loads

P_{DL} = wall = $111 psf \times 8' = 888 plf$

$+671.2 plf$ ← (previously calculated loads)

$1559.2 plf$

$P_{TL} = 1659.2 plf$

$P_a = (0.25 \times 1500 \times 115.5 + 0.65 \times 0.33 \times 24000)\left(1 - \left(\frac{33.2}{140}\right)^2\right)$

$= 40877\#$

$F_a = 40877\# / 115.5 = 354 psi$

$f_a = \frac{1659.2\#}{115.5} = 14.4 psi$

CH2MHILL

Project No./Calc. No. _____ Page ____ of ____
Subject: Chatfield Prepared By: RY Date: 12/08
Checked by: _____ Date: _____

Reinforced Masonry Wall Design - Allowable Strength

→ As-built 8" cmu w/ #5@48"oc

Input:			Intermediate:	
d	4.0 in		np	0.034
b	12.0 in		k	0.230
Special Insp.?	yes		j	0.923
f'_m	1500 psi		kd	0.920
M	4984 lb*ft/ft			
n	21.48	(Em=900f'm)	T-beam?	no
t_f	1.25 in		t_f/d	0.313
SolidGrouted?	yes		k	0.240
			j	0.853
Bar Size	# 5		Bar Dia.	0.63 in
No of Bars	0.25		Bar Area	0.31 in^2
f_s	24000 psi		A_s	0.08 in^2
1/3 Increase?	yes	allowable stresses increased		
Axial Stress (fa)	14 psi			
Axial Allow. (Fa)	354 psi		Ratio	0.04

Results:

		w/ 1/3 Increase			
Ms_{allow} =	567 lb*ft	755.2 lb*ft	M =	4984 lb*ft	NG
Mmallow =	849 lb*ft	1131.9 lb*ft			
fs_{allow} =	24000 psi	31992.0 lb*ft	fs =	211125 psi	NG
Fballow =	500 psi	666.4 lb*ft	fb =	2934 psi	NG

Combined Compression Stresses:

fa/Fa+fb/Fb	5.91	NG >1.33

CH2MHILL

Project No./Calc. No. Chatfield Page 8 of ___
Subject: ___ Prepared By: RY Date: 12/08
___ Checked by: ___ Date: ___

Reinforced Masonry Wall Design - Allowable Strength

Input:			Intermediate:	
d	8.0 in		np	0.074
b	12.0 in		k	0.318
Special Insp.?	yes		j	0.894
f'_m	1500 psi		kd	2.544
M	4984 lb*ft/ft			
n	21.48	(Em=900f'm)	T-beam?	no
t_f	1.25 in		t_f/d	0.156
SolidGrouted?	yes		k	0.375
			j	0.924
Bar Size	# 6		Bar Dia.	0.75 in
No of Bars	0.75		Bar Area	0.44 in^2
f_s	24000 psi		A_s	0.33 in^2
1/3 Increase?	yes	allowable stresses increased		
Axial Stress (fa)	14 psi			
Axial Allow. (Fa)	354 psi		Ratio	0.04

Results:

		w/ 1/3 Increase			
Ms_{allow} =	4739 lb*ft	6317.7 lb*ft	M =	4984 lb*ft	OK
Mmallow =	4548 lb*ft	6062.9 lb*ft			
fs_{allow} =	24000 psi	31992.0 lb*ft	fs =	25238 psi	OK
Fballow =	500 psi	666.4 lb*ft	fb =	548 psi	OK

Combined Compression Stresses:

fa/Fa+fb/Fb	1.14	OK, <1.33

Project: CHATFIELD STRUCTURES ANALYSIS

Engineer: R. Young
Company: CH2M Hill, Inc.
Exterior Wall Design

AnalysisGroup 3.0 -- Continuous Beam Analysis

Input Validated OK: No apparent problems.

Input Information

Default Material

Youngs Modulus = 3605000 psi
Poissons Ratio = 0.17000

Span Information

Span	Length	Inertia
	ft	in^4
1	8.0000	291.0000

Support Information

Support	Type	Translation	Rotation
		lb/ft	lb-ft/deg
1	Pinned		
2	Pinned		

Line Loading Information

Load Case	Start Span	End Span	Offset 1 ft	Offset 2 ft	W1 lb/ft	W2 lb/ft
Combination 1	1	1	0.0000	3.6400	-248.1750	-816.2250
Combination 1	1	1	3.6400	8.0000	-816.2250	-244.8750

Results

Results for Load Case: Combination 1

This case is included in envelope calculations.
This case does not include self weight.

Statics Check Results:

	Force-X lb	Force-Y lb	Moment-Z lb-ft
Applied Load	0.0000	-4250.4060	-16710.6393
Reaction	0.0000	4250.4060	16710.6393
Unbalanced	0.0000	0.0000	0.0000

Span	Span Offset ft	Total Offset ft	Displacement in	Moment lb-ft	Shear lb
1	0.0000	0.0000	-0.0000	-0.0000	2161.5761
1	0.5333	0.5333	-0.0112	1112.6483	2006.5773
1	1.0667	1.0667	-0.0220	2131.7596	1807.6327
1	1.6000	1.6000	-0.0317	3034.3224	1564.7422
1	2.1333	2.1333	-0.0400	3792.4372	1276.5742
1	2.6667	2.6667	-0.0466	4386.7018	944.4604
1	3.2000	3.2000	-0.0511	4794.1044	568.4007
1	3.7333	3.7333	-0.0533	4984.7447	149.1306
1	4.2667	4.2667	-0.0533	4953.2352	-261.0290
1	4.8000	4.8000	-0.0509	4714.8231	-634.2868
1	5.3333	5.3333	-0.0463	4283.7001	-969.5244
1	5.8667	5.8667	-0.0397	3685.3943	-1267.8602
1	6.4000	6.4000	-0.0314	2939.2288	-1529.2941
1	6.9333	6.9333	-0.0218	2061.1847	-1752.7079
1	7.4667	7.4667	-0.0111	1075.0007	-1939.2199
1	8.0000	8.0000	-0.0000	-0.0000	-2088.8299

Extreme Values:

Maximum d = -0.000 on span 1, offset = 8.00, ovrl offset = 8.00
Minimum d = -0.053 on span 1, offset = 3.73, ovrl offset = 3.73

Maximum M = 4984.74 on span 1, offset = 3.73, ovrl offset = 3.73
Minimum M = -0.00 on span 1, offset = 8.00, ovrl offset = 8.00

Maximum V = 2161.58 on span 1, offset = 0.00, ovrl offset = 0.00
Minimum V = -2088.83 on span 1, offset = 8.00, ovrl offset = 8.00

Support Reactions

Support	Force	Moment
1	2161.58	0.00
2	2088.83	0.00

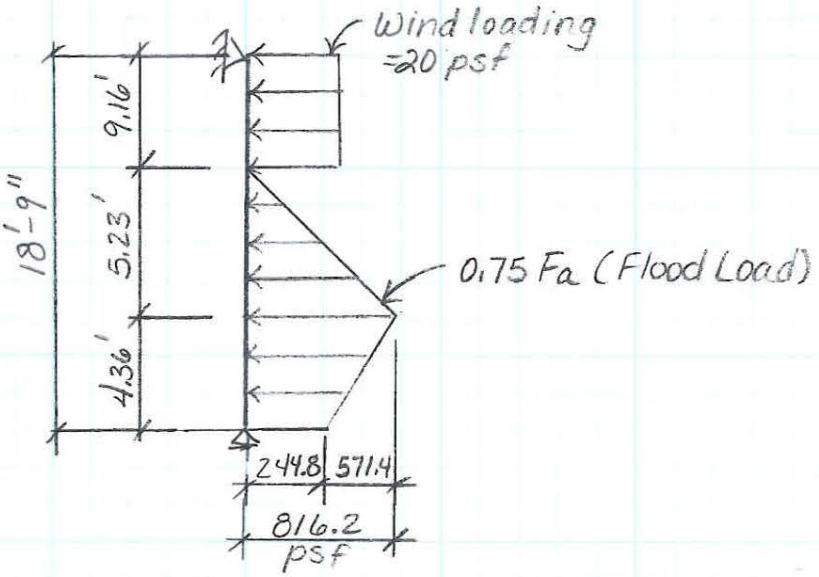
Exterior Wall Analysis - based on loading, try 12" cmu

$A = 139.5$

$r = \sqrt{I/A}$

$h'/r = 18.75' \times 12 / \sqrt{\frac{1571.01}{139.5}} = 67.0 < 99$ ∴ use ACI 530 Eq'n 2-20

Max height = 18'-9" possible @ toilet module



Worst Case Condition - assumes no backfill against exterior wall

Mmax = 11951 #·ft
Vmax = 3480 #
} req's 12" cmu w/ #7@8" oc
See following spreadsheet

P_{DL} ⇒ ROOF = 0.5' x 150pcf x 10' trib = 750 plf
ROOFING = 15psf x 10' trib = 150 plf
WALL WT = 135 x 18.75'/2 = 1266 plf (12" full grout)
2166 plf

P_{LL} ⇒ 20psf x 10' = 200 plf

P_{TL} = 2366 plf D+L

$P_a = (0.25 f'_m A_n + 0.65 A_{st} F_s)\left(1 - \left(\frac{h}{140r}\right)^2\right)$ (ACI 530-08 Eq'n 2-20)

$= \left(0.25 \times 1500 \times 139.5 + 0.65 \times 0.90 \times 24000\right)\left(1 - \left(\frac{67}{140}\right)^2\right)$

$= 40331$ #

$F_a = 289.1$ psi

* See following Spreadsheet Design

12/21

CH2MHILL

Project No./Calc. No. Chatfield Page ____ of ____
Subject: _____ Prepared By: RJ Date: 12/08
_____ Checked by: _____ Date: _____

Reinforced Masonry Wall Design - Allowable Strength

Input:			Intermediate:	
d	8.8 in		np	*0.183*
b	12.0 in		k	*0.449*
Special Insp.?	yes		j	*0.850*
f'_m	1500 psi		kd	*3.958*
M	11968 lb*ft/ft			
n	21.48	(Em=900f'm)	T-beam?	*no*
t_f	1.25 in		t_f/d	*0.142*
SolidGrouted?	yes		k	*0.595*
			j	*0.931*
Bar Size	# 7		Bar Dia.	*0.88 in*
No of Bars	1.50		Bar Area	*0.60 in²*
f_s	24000 psi		A_s	*0.90 in²*
1/3 Increase?	yes	allowable stresses increased		
Axial Stress (fa)	17 psi			
Axial Allow. (Fa)	289 psi		Ratio	*0.06*

Results:

		w/ 1/3 Increase			
Ms_{allow} =	13513 lb*ft	18012.4 lb*ft	M =	11968 lb*ft	NG
Mmallow =	7412 lb*ft	9879.8 lb*ft			
fs_{allow} =	24000 psi	31992.0 lb*ft	fs =	21256 psi	OK
Fballow =	500 psi	666.4 lb*ft	fb =	807 psi	NG

Combined Compression Stresses:

fa/Fa+fb/Fb	1.67	NG >1.33

13/21

Project: Chatfield

Engineer: R. Young
Company: CH2M Hill, Inc.
Exterior Wall Analysis
Worst Case Unburied Wall Height

AnalysisGroup 3.0 -- Continuous Beam Analysis

Input Validated OK: No apparent problems.

Input Information

Default Material

Youngs Modulus = 3605000 psi
Poissons Ratio = 0.17000

Span Information

Span	Length	Inertia
	ft	*in^4*
1	18.7500	291.0000

Support Information

Support	Type	Translation	Rotation
		lb/ft	*lb-ft/deg*
1	Pinned		
2	Pinned		

Line Loading Information

Load Case	Start Span	End Span	Offset 1 *ft*	Offset 2 *ft*	W1 *lb/ft*	W2 *lb/ft*
Combination 1	1	1	0.0000	9.1600	-20.0000	-20.0000
Combination 1	1	1	9.1600	14.3900	0.0000	-816.2000
Combination 1	1	1	14.3900	18.7500	-816.2000	-244.8000

Results

Results for Load Case: Combination 1

This case is included in envelope calculations.
This case does not include self weight.

Statics Check Results:

	Force-X *lb*	Force-Y *lb*	Moment-Z *lb-ft*
Applied Load	0.0000	-4630.5430	-65252.5382
Reaction	0.0000	4630.5430	65252.5382
Unbalanced	0.0000	0.0000	-0.0000

Span	Span Offset *ft*	Total Offset *ft*	Displacement *in*	Moment *lb-ft*	Shear *lb*
1	0.0000	0.0000	-0.0000	-0.0000	1150.4076
1	1.2500	1.2500	-0.1164	1422.0720	1125.4076
1	2.5000	2.5000	-0.2292	2813.2066	1100.4076
1	3.7500	3.7500	-0.3349	4173.4036	1075.4076
1	5.0000	5.0000	-0.4296	5501.7256	1050.4076
1	6.2500	6.2500	-0.5102	6799.1102	1025.4076
1	7.5000	7.5000	-0.5736	8065.5572	1000.4076
1	8.7500	8.7500	-0.6158	9300.1292	975.4076
1	10.0000	10.0000	-0.6343	10493.7692	909.7108
1	11.2500	11.2500	-0.6261	11482.6862	626.3622
1	12.5000	12.5000	-0.5879	11951.7730	94.2911
1	13.7500	13.7500	-0.5194	11611.8168	-679.1872
1	15.0000	15.0000	-0.4215	10177.4067	-1640.6546
1	16.2500	16.2500	-0.2972	7585.1902	-2456.5406
1	17.5000	17.5000	-0.1538	4109.7881	-3069.7009
1	18.7500	18.7500	-0.0000	0.0000	-3480.1354

Extreme Values:

Maximum d = -0.000 on span 1, offset = 0.00, ovrl offset = 0.00
Minimum d = -0.634 on span 1, offset = 10.00, ovrl offset = 10.00

Maximum M = 11951.77 on span 1, offset = 12.50, ovrl offset = 12.50
Minimum M = -0.00 on span 1, offset = 0.00, ovrl offset = 0.00

Maximum V = 1150.41 on span 1, offset = 0.00, ovrl offset = 0.00

Minimum V = -3480.14 on span 1, offset = 18.75, ovrl offset = 18.75

Support Reactions

Support	Force	Moment
1	1150.41	0.00
2	3480.14	0.00

DESIGN FLOOD LOADS – for partially buried wall

- Local still water depth

$$ds = 0.65(BFE - G) = 0.65(5453.7 - (5447 + 3.33))$$

$$= 2.19 \text{ ft}$$

- Breaking wave height H_b

$$H_b = 0.78 ds$$

$$= 1.71 \text{ ft}$$

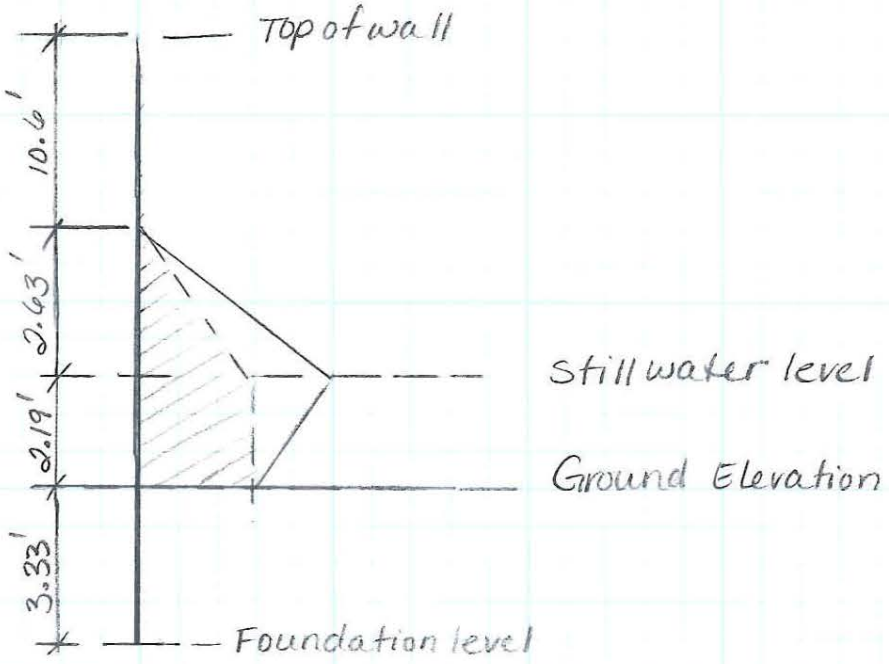
Breaking wave loads on vert. walls

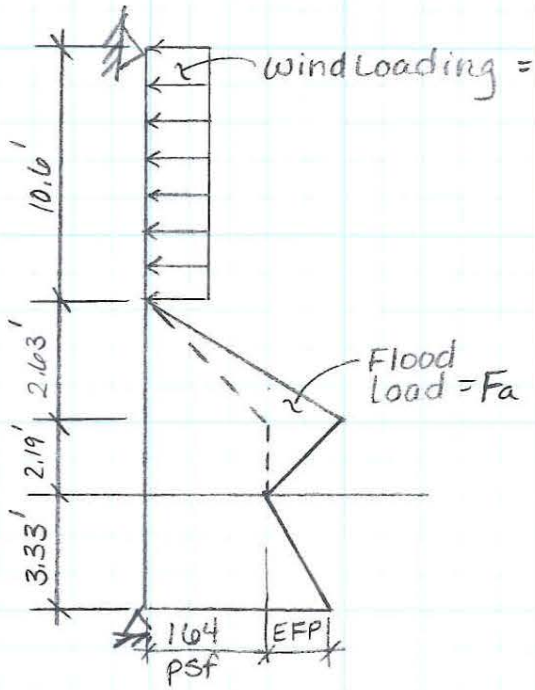
$$P_{max} = C_p \gamma_w ds + 1.2 \gamma_w ds$$

$$= 2.8 \times 62.4 \times 2.19 + 1.2 \times 62.4 \times 2.19$$

382.6 ↑ ↑ 164

$$= 546.6 \text{ psf}$$





Below grade loads assuming saturated soil at rest pressures

EFP: $(120pcf - 62.4)\,0.5 + 62.4 = 91.2pcf$ (K_{AR} ↓)

EFP: $91.2 \times 3.33' = 304psf$

$M_{max} = 5030$ #·ft
$V_{max} = 1585$ # } Per analysis output, following...

By inspection - lower walls w/ full wave/flood loading control design of exterior walls.

Walls must be partially buried @ max height, otherwise design loads will exceed allowable stresses.

17/21

Project: Chatfield

Engineer: R. Young
Company: CH2M Hill, Inc.
Exterior Wall Analysis
Worst Case Buried Wall Height

AnalysisGroup 3.0 -- Continuous Beam Analysis

Input Validated OK: No apparent problems.

Input Information

Default Material

Youngs Modulus = 3605000 psi
Poissons Ratio = 0.17000

Span Information

Span	Length	Inertia
	ft	*in^4*
1	18.7500	291.0000

Support Information

Support	Type	Translation	Rotation
		lb/ft	*lb-ft/deg*
1	Pinned		
2	Pinned		

Line Loading Information

Load Case	Start Span	End Span	Offset 1 *ft*	Offset 2 *ft*	W1 *lb/ft*	W2 *lb/ft*
Combination 1	1	1	10.6000	13.2300	0.0000	-409.9500
Combination 1	1	1	13.2300	15.4200	-409.9500	-123.0000
Combination 1	1	1	15.4200	18.7500	-123.0000	-351.0000
Combination 1	1	1	0.0000	10.6000	-20.0000	-20.0000

Results

Results for Load Case: Combination 1

This case is included in envelope calculations.
This case does not include self weight.

Statics Check Results:

	Force-X *lb*	Force-Y *lb*	Moment-Z *lb-ft*
Applied Load	0.0000	-2123.8745	-29722.5297
Reaction	0.0000	2123.8745	29722.5297
Unbalanced	0.0000	-0.0000	-0.0000

Span	Span Offset *ft*	Total Offset *ft*	Displacement *in*	Moment *lb-ft*	Shear *lb*
1	0.0000	0.0000	-0.0000	0.0000	538.6729
1	1.2500	1.2500	-0.0499	657.4036	513.6729
1	2.5000	2.5000	-0.0982	1283.8698	488.6729
1	3.7500	3.7500	-0.1431	1879.3984	463.6729
1	5.0000	5.0000	-0.1832	2443.0521	438.6729
1	6.2500	6.2500	-0.2170	2975.7682	413.6729
1	7.5000	7.5000	-0.2433	3477.5469	388.6729
1	8.7500	8.7500	-0.2604	3947.4505	363.6729
1	10.0000	10.0000	-0.2675	4386.4166	338.6729
1	11.2500	11.2500	-0.2634	4791.5358	293.7444
1	12.5000	12.5000	-0.2468	5024.0919	42.8839
1	13.7500	13.7500	-0.2175	4804.6507	-405.8231
1	15.0000	15.0000	-0.1760	4075.8475	-732.7750
1	16.2500	16.2500	-0.1239	3041.5779	-922.7354
1	17.5000	17.5000	-0.0641	1725.4686	-1201.0124
1	18.7500	18.7500	-0.0000	-0.0000	-1585.2016

Extreme Values:

Maximum d = -0.000 on span 1, offset = 0.00, ovrl offset = 0.00
Minimum d = -0.268 on span 1, offset = 10.00, ovrl offset = 10.00

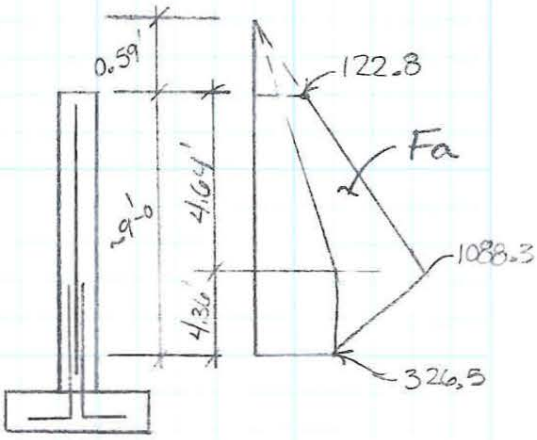
Maximum M = 5024.09 on span 1, offset = 12.50, ovrl offset = 12.50
Minimum M = -0.00 on span 1, offset = 18.75, ovrl offset = 18.75

Cantilevered Wall Analysis

8" cmu wall

Wall height ≅ 9'-0 max

Mmax = 18726 #·ft
Vmax = 4421 #
} NG by inspection



Project: Chatfield

Engineer: R. Young
Company: CH2M Hill, Inc.
Cantilevered Wall

AnalysisGroup 3.0 -- Continuous Beam Analysis

Input Validated OK: No apparent problems.

Input Information

Default Material

Youngs Modulus = 3605000 psi
Poissons Ratio = 0.17000

Span Information

Span	Length	Inertia
	ft	*in^4*
1	9.0000	291.0000

Support Information

Support	Type	Translation	Rotation
		lb/ft	*lb-ft/deg*
1	Free		
2	Fixed		

Line Loading Information

Load Case	Start Span	End Span	Offset 1 *ft*	Offset 2 *ft*	W1 *lb/ft*	W2 *lb/ft*
Combination 1	1	1	0.0000	4.6400	-92.1000	-816.2250
Combination 1	1	1	4.6400	9.0000	-816.2250	-244.8750

Results

Results for Load Case: Combination 1

This case is included in envelope calculations.
This case does not include self weight.

Statics Check Results:

	Force-X *lb*	Force-Y *lb*	Moment-Z *lb-ft*
Applied Load	0.0000	-4420.5120	-21059.0611
Reaction	0.0000	4420.5120	21059.0611
Unbalanced	0.0000	0.0000	0.0000

Span	Span Offset *ft*	Total Offset *ft*	Displacement *in*	Moment *lb-ft*	Shear *lb*
1	0.0000	0.0000	-0.5725	0.0000	0.0000
1	0.6000	0.6000	-0.5236	-22.8761	-83.9129
1	1.2000	1.2000	-0.4746	-112.2522	-223.4460
1	1.8000	1.8000	-0.4258	-300.8937	-418.5995
1	2.4000	2.4000	-0.3771	-626.5047	-671.0587
1	3.0000	3.0000	-0.3288	-1118.7322	-979.1382
1	3.6000	3.6000	-0.2812	-1810.3416	-1342.8380
1	4.2000	4.2000	-0.2346	-2742.0709	-1763.8436
1	4.8000	4.8000	-0.1897	-3940.1925	-2235.7609
1	5.4000	5.4000	-0.1472	-5417.4886	-2689.7996
1	6.0000	6.0000	-0.1079	-7157.9319	-3095.7191
1	6.6000	6.6000	-0.0728	-9125.5057	-3454.9347
1	7.2000	7.2000	-0.0431	-11292.6972	-3767.4464
1	7.8000	7.8000	-0.0202	-13636.4213	-4031.8389
1	8.4000	8.4000	-0.0054	-16123.2088	-4249.5274
1	9.0000	9.0000	-0.0000	-18725.5469	-4420.5120

Extreme Values:

Maximum d = -0.000 on span 1, offset = 9.00, ovrl offset = 9.00
Minimum d = -0.573 on span 1, offset = 0.00, ovrl offset = 0.00

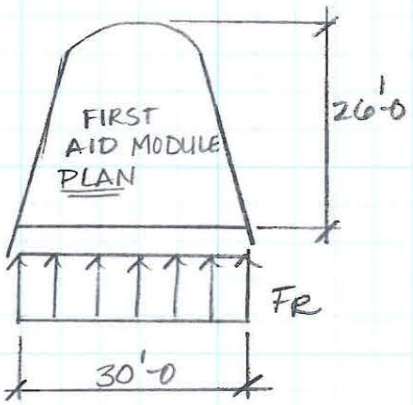
Maximum M = 0.00 on span 1, offset = 0.00, ovrl offset = 0.00
Minimum M = -18725.55 on span 1, offset = 9.00, ovrl offset = 9.00

Maximum V = 0.00 on span 1, offset = 0.00, ovrl offset = 0.00
Minimum V = -4420.51 on span 1, offset = 9.00, ovrl offset = 9.00

Roof Diaphragm for flood loadings

Reaction from flood loading assuming wave breaking @ one side of structure only = F_R

F_R = 2161.6 plf (from analysis of double wythe walls)



$2161.6 \text{ plf} \times \frac{30'}{2} = 32424^{\#}$

$32424^{\#} \div 26' = 1247.1$ plf acting @ roof/wall interface (conservative - not accounting for angle of walls)

$V_u = \frac{1247.1 \text{ plf}}{0.75} = 1662.8$ plf

by concrete → $\phi V_c = \phi 2 \sqrt{f'_c}\, b w d$ ← 6" slab, assume reinf ½ height (See as-built sheet 95)

$= 0.75 \times 2 \sqrt{4000} \times 12 \times 3$

$= 3415$ plf

by shear friction → $\phi V_n = \phi A_{vf} f_y \mu$ (as-built section 8/95 = #4@16"oc)

$= 0.75 \times 0.15 \times 60 \text{ KSI} \times 0.6 \times 1000^{\#}/k$

$= 4050$ plf

ROOF DIAPHRAGM IS OK

In-Plane Masonry Wall Shear

From diaphragm loading: 1247.1 plf

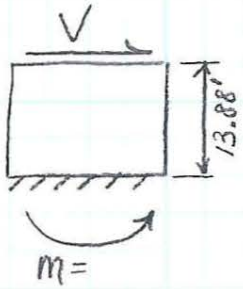
Assuming mcj' @ 20'-0, Vmax = 20k × 1247.1 plf = 24942 #

M/Vd < 1 ?

where M = 24942# × (18.75 ÷ 2 (average wall height) + 9) = 346195 #·ft

V = 24942#

d = 0.8 × 20' = 16'



M/Vd = 0.87

$F_v = \frac{1}{2}\left[4 - \frac{M}{Vd}\right]\sqrt{f'_m} = \frac{1}{2}[4 - 0.87]\sqrt{1500} = 60.6 \text{ psi}$

Vmax for wall shear = 60.6 psi × 91.50 in² (↑ 8" cmu) = 5546 plf

1247.1 plf < 5546 plf ok

→ In plane masonry wall shear ok for flood loading

Attachment 3

STATE OF COLORADO

Colorado Water Conservation Board
Department of Natural Resources
1313 Sherman Street, Room 721
Denver, Colorado 80203
Phone: (303) 866-3441
Fax: (303) 866-4474
www.cwcb.state.co.us

TO: Randy Behm, Section Chief
U.S. Army Corps of Engineers, Omaha District

FROM: Tom Browning, Section Chief
Watershed Protection & Flood Mitigation, CWCB

DATE: December 31, 2008

SUBJECT: **Certification for Structural Design Requirements: Chatfield Reservoir Reallocation Study**

Background

The State of Colorado and numerous stakeholders participating in the above referenced effort have submitted a formal proposal for exceptions to the Corps of Engineers (Corps) Land Use Development Policy (LUDP) as it relates to recreational structures at Chatfield Reservoir. The non-federal sponsor has proposed the relocation of closed floodable wet flood-proofed structures within Zone 1 of the reservoir (between elevations 5,444 ft and 5,453.7 ft, MSL) that are capable of withstanding periodic flooding and that can easily be placed back into service following inundation. The elevations referenced herein are based on the assumption of a 20,600 acre-foot reallocation of existing storage space in the reservoir.

The Corps requested that a technical analysis by the applicant be performed to determine the ability of the existing recreational structures to withstand specified hydrostatic and hydrodynamic forces based on available design documents. A study by CH2M Hill resulted in a new document entitled "Technical Memorandum, Chatfield Structural Analysis, Beach House Complex, December 2008", a copy of which was provided to the Corps. The Technical Memorandum (TM) indicates that certain components of the structures do not meet the required design demands. However, recommendations in the TM have been provided that would allow the structures to resist flood induced forces. It is the intent of the non-federal sponsor to comply fully with the design demands for recreational structures at Chatfield Reservoir.

Certification

CWCB staff hereby certifies that technical recommendations, for recreation structures at Chatfield Reservoir, contained within said TM will be carried out during the final design phase of the Project, pending approval of the Final Environmental Impact Statement (EIS) and a favorable Record of Decision (ROD) by the Assistant Secretary of the Army, Civil Works (ASA-CW).

Thomas W. Browning, P.E., CFM

Attachment 4

Recreation Facilities Modification Plan - see Appendix M of FR/EIS

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
1616 CAPITOL STREET
OMAHA NE 68102-9000

January 29, 2009

Hydrologic Engineering Branch

Mr. Thomas Browning, Chief
Watershed Protection & Flood Mitigation Section
Colorado Water Conservation Board
1313 Sherman Street, Room 721
Denver, Colorado 80203

Dear Mr. Browning:

This letter is in response to your request of January 8, 2009, for the Omaha District to consider a waiver to Northwestern Division Regulation 1110-2-5; Land Development Guidance at Corps Reservoir Projects (NWDR 1110-2-5), for the location of recreational structures at Chatfield Reservoir. Your request included background information for the waiver being sought, a completed "Evaluation Criteria for Land Development Proposals", a structural analysis conducted by CH2M Hill, and a "Chatfield Reservoir Recreations Facilities Plan".

As had been previously discussed between Mr. Eric Laux and Mr. Randall Behm of the Omaha District and yourself, the Chatfield Reservoir 20,600 acre foot reallocation currently being studied would change the current pool designations within the reservoir. Currently, Zone 1 is identified as a pool elevation of 5,444.5 feet mean sea level (ft msl) and lower. Under the proposed reallocation plan Zone 1 will be identified as pool elevation 5,453.7 ft msl and lower. Due to the proposed reallocation of the reservoir, the operation of Zone 1 will be increased by 9.2 feet. Under this modification numerous existing recreational structures will be continuously inundated and become unusable. In accordance with NWDR 1110-2-5, structures are not allowed within Zone 1. This requirement is to eliminate structural damages to the recreation structures as well as the Corps of Engineers facilities attributable to flooding, debris and wind-wave forces. A review of existing structures within Chatfield Reservoir indicated that none of the structures could sustain the effects of complete inundation.

Several discussions with Omaha District personnel focused on elevating recreation structures above elevation 5,453.7 ft msl. In those discussions, it became apparent that to make facilities such as the Bath House Complex at the swim beach user friendly, extremely large amounts of fill material and grading would be required. In lieu of making significant changes to the existing terrain to accommodate the recreation facilities you were requested to provide a structural assessment for the conceptual design of structures which could undergo periods of inundation without resulting in significant damage to the structure. A review of the results of the structural assessment indicates that by modifying the general building specifications new recreation structures could be designed and placed within an elevation range of 5,447.0 ft msl to 5,453.7 ft msl to undergo periodic inundation without sustaining significant damage.

As previously discussed and noted in your request, acceptance of the structural assessment by the Omaha District does not set a precedent for locating additional structures within Zone 1 of this reservoir beyond those currently being addressed without further review. In addition, acceptance of the structural assessment does not indicate the approval of the placement of similar type structures within Zone 1 of other reservoirs within the regulatory jurisdiction of the Omaha District.

In response to your request for a waiver regarding the placement of recreational structures within the upper range of the reallocated Zone 1 of Chatfield Reservoir, elevation 5,447.0 ft msl to 5,453.7 ft msl, the waiver is granted with the following conditions:

- All structural requirements of the Technical Memorandum, Chatfield Structural Analysis, dated December 2008 are implemented.

- In accordance with NWDR 1110-2-5, an evacuation plan is developed for all recreational activities associated with the proposed structures.

- The proposed structures meet the definition of being closed floodable, wet flood-proofed as specified in NWDR 1110-2-5

- This waiver is applicable to only structures identified as requiring relocation as part of the Chatfield Reallocation Study. Any additional structures will require a separate review.

- Upon completion of construction, the CWCB shall submit a letter, signed by a Professional Engineer, to the Omaha District, Chief, Engineering Division, certifying that all structures associated with this waiver were constructed to the specifications contained within Technical Memorandum, Chatfield Structural Analysis, dated December 2008.

If you have additional concerns or comments regarding this response or our enforcement of NWDR 1110-2-5, please contact Mr. Randall Behm of my staff at [redacted] or myself anytime at [redacted].

Sincerely,

SIGNED

John J. Bertino Jr., P. E.
Chief, Engineering Division