RECLAMATION

Managing Water in the West

Cost Allocation Study Facility Cost Estimating

By Fred Holz

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U.S. Department of the Interior
Bureau of Reclamation

CVP Cost Allocation Study

Agenda and Meeting Purpose

- **Purpose: To Discuss the Cost Estimating Methodologies & Provide a Status Report**

- **Agenda:**
  - **History (Previous Information)**
  - **Goals & Focus of Estimating Effort**
  - **Cost Normalization Procedures**
  - **Unresolved Issues**
  - **Results & Status**
  - **Looking Forward**

Purpose of Cost Evaluation

To evaluate the capital cost of each CVP facility & relate this to a base year for comparison with the facility benefits

Facility Types

Single-purpose – Authorized for one purpose

Multi-purpose – Authorized for multiple purposes

Construction in Abeyance – Costs indefinitely suspended or terminated (but not officially de-authorized by Congress)

45 MP, 125 SP & 9 CIA – 179 Facilities

Process for Cost Evaluation

Key Definitions Used

- **Single Purpose Alternative Cost (SPA)**
  - The Least Cost Alternative which would likely be built as a federal Single-Purpose Project, providing the same benefit to one specific purpose as the Multi-Purpose Project.
- **Separable Cost**
  - The cost which would be omitted from total project cost if one purpose were to be excluded and the same project plan were retained for the rest of the purposes.

Process for Cost Evaluation

Key Definitions Used – con't

- **Base Year**
  - A common year in time where costs & benefits are related (2010)
- **Justifiable Expenditure**
  - The value of the benefit or the SPA, whichever is less
  - The amount a rationale person would pay to receive a specific benefit from a multi-purpose project

Process for Cost Evaluation

Cost Estimating Goals:

Easy to Understand **Easy to Apply** **Easy to Repeat**

S - Specific

M - Measureable

A - Achievable

R - Realistic/Repeatable

T - Time Related

Stakeholders should be able to duplicate & clearly understand how the costs were developed

Process for Cost Evaluation

Two Distinct Efforts

- **Cost Evaluation (Estimating)**

  This involves records research (contracts & design), field surveying, computer model creation & revisions, quantity take-offs, major cost drivers (+/- 85%) determination and cost curve creation as well as sound engineering judgment.

- **Cost Normalization (Index or Re-price)**

  Normalization or adjustment of major cost drivers or facility costs to a common or base year … 2010

Process for Cost Evaluation

Cost Normalization Methods (presented in March 2012)

- **Cost Indexing**
  - **USBR Index – Construction Cost Trends (CCT) – per facility**

  Engineering News Record (ENR)
  - **Construction Cost Indexes (CCI) – Common Labor Weighted**
  - **Building Cost Indexes (BCI) – Skilled Labor Weighted**

    http://enr.construction.com/economics/
- **Re-pricing**

Note: Neither Method Changes the Overall Capital Reimbursement Amount (Sch. No. 1 CVP Financial Statement)

Process for Cost Evaluation

Cost Normalization Methods, con't

- **Cost Indexing (BOR Schedule 1)**
  - Uses relative price changes, expressed as a ratio, over a period of time
  - Uses average or grouped pricing data during specific periods
  - Creates a generalized relationship between cost & time

Components: BCI vs. CCI (20 City Avg.)

BCI

- 68.38 Hrs Skilled Labor
- 25 cwt Structural Steel
- 1.128 tons Portland Cement
- 1,088 b-ft 2x4 Lumber

CCI

- 200 Hrs Common Labor
- Same Supply Components as BCI

Process for Cost Evaluation

Cost Index Comparison: *Concrete Dams*

	USBR		ENR CCI		ENR BCI	
Year	Index	Cost Impact	Index	Cost Impact	Index	Cost Impact
1940	18	18.2	203	24.1	242	36.4
1950	35	9.3	375	13.0	510	17.3
1960	42	7.8	559	8.7	824	10.7
1970	57	5.7	836	5.8	1381	6.4
1980	142	2.3	1941	2.5	3237	2.7
1990	181	1.8	2702	1.8	4732	1.7
2000	230	1.4	3539	1.4	6221	1.4
2010	327	1.0	4883	1.0	8802	1.0

Process for Cost Evaluation

Cost Normalization Methods (presented in March 2012)

- **Re-pricing**
  - Uses Original Contract Quantities for facility
    - Each Contract is Considered Independently
  - Establish Base Year Unit Cost
  - Apply Base Year Unit Cost to Original Contract Quantities

Re-pricing is Much More Labor Intensive and Less Transparent

Construction & Product Improvements Over Time Can Distort Impacts

Technology can Dramatically Alter Unit Prices

Process for Cost Evaluation

Cost Normalization Methods – Comparative Analysis

- Both Methods Use Major Cost Drivers (+/- 85%)
- Re-pricing Requires Significant Engineering Judgment to Develop Base Year (2010) Unit Prices for Major Items
- Indexing Utilizes Existing Capitalized Costs, But Generalized Normalization Ratios
- Indexing Simplifies Research and Presents Easily Documentable Summaries
- Re-pricing Requires 2-3 Times the Effort due to Records Research **(MP210 DL from $900,000 to ≈ $2,000,000)**
- Both Methods Develop Project Cost Models Comparable to Plant-in-Service Cost Representation

Shasta vs. Temperance Flat Dam

PROJECT STATUS | PROJECT STAGE | LEVEL OF COST ESTIMATE PRODUCED — Appraisal Estimate.

Shasta Dam vs Temperance Flat Dam for Appraisal Level Analysis

Description/Line Items	2010 Unit Price	Units	Shasta Dam Units	Shasta Dam Price Ext.	Temperance Flat Dam Units	Temperance Flat Dam Price Ext.
Major Cost Drivers						
Excavation	$14.66	CY	4,992,845	$73,176,000	16,879,000	$246,970,000
- Excavation for non-similar uses[1,2]					10,871,100	-$159,328,000
Subtotal					6,007,900	$87,642,000
Backfill/Compaction	$42.18	CY	2,184,712	$92,145,000	5,193,000	$94,010,000
- Backfill/Compaction for non-similar uses[2]					603,100	-$25,437,000
Subtotal					4,589,900	$68,573,000
Aggregate	$11.90	Ton	3,905	$47,000	7,022,500	$83,592,000
Cement	$135.43	Ton	-	$0	727,000	$98,454,000
Concrete	$55.83	CY	6,537,111	$364,980,000	4,450,000	$248,450,000
Subtotal Major Cost Drivers				**$530,348,000**		**$586,711,000**
Unlisted Item Estimating Percent			13.8%		20.9%	
Unlisted Items				**$84,698,000**		**$155,257,000**
Total Estimated Base Year (2010) Cost to Construct				**$615,046,000**		**$741,968,000**

Notes:

1. Excavation for Temperance Flats Dam includes Quarry and concrete batch plant with 10,268,000 CY of materials excavated, which Shasta Dam did not have.
2. Excavation and backfill/compaction for Temperance Flats Dam includes temporary cofferdams with 603,100 CY of materials.
3. Concrete values in Shasta Dam were reported as CY, where concrete values were reported as CY for small portions of conventional concrete, ton of aggregate and ton of cement for the bulk of RCC dam construction.
4. Concrete dam construction in the 1940s had a wider, more stout base and the base width for Temperance Flats Dam is at maximum 350 feet narrower than that of Shasta Dam.

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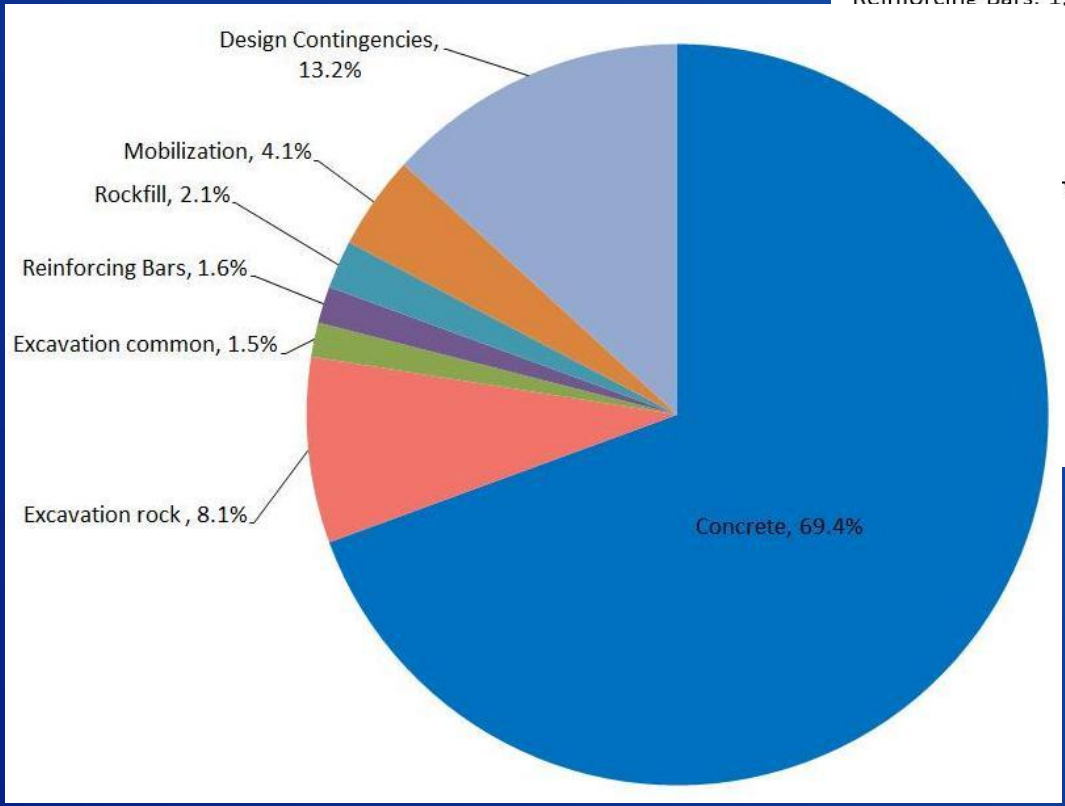
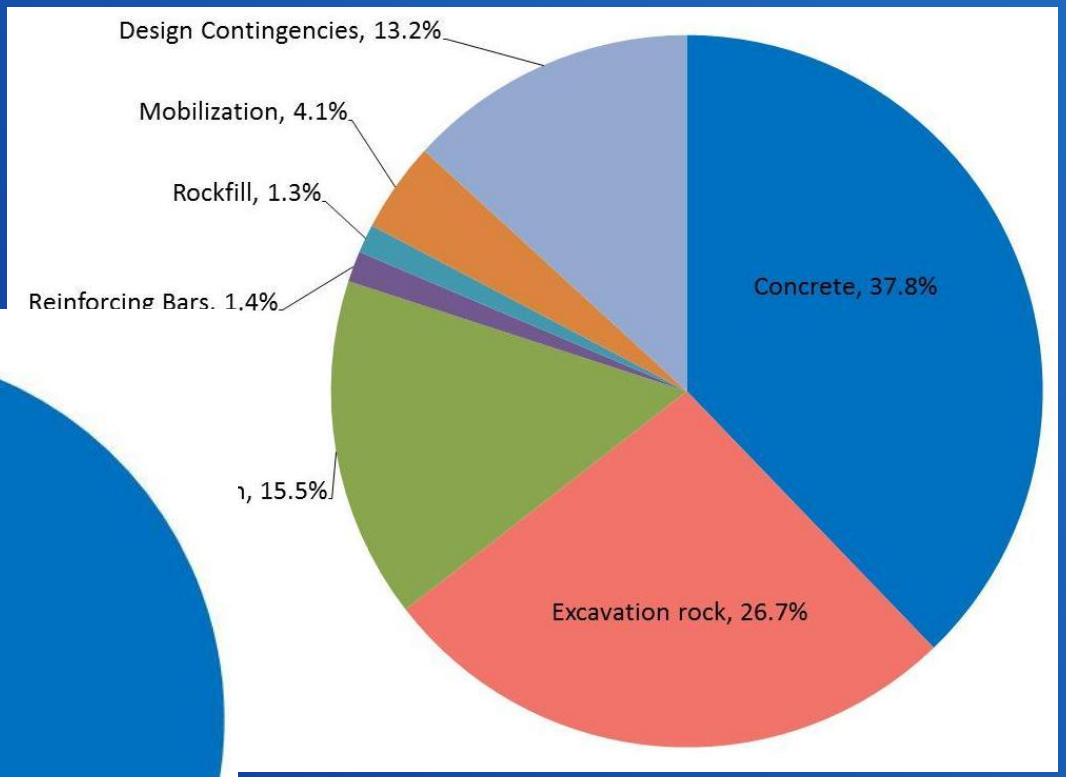
Shasta Dam Major Cost Drivers

Proportional Impacts of Re-Pricing

Re-priced 2010





Original Final Costs

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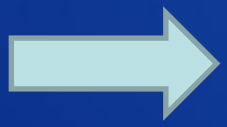
Process for Cost Evaluation

So, Re-pricing or Indexing

- **Shasta Dam vs. Temperance Flat Dam**



  - **USBR CCT - $1.5B**
  - **ENR BCI - $2.5B**
  - **ENR CCI - $3.5B**
  - **Re-pricing - $5.0B**

This is a wide range

How do we know which one to use?

- **Temperance Flat Dam – at Feasibility Level Estimate**
  - **TSC Estimate - $2.48B**

Cost Evaluation Procedure

So What is the Work Product?

Single-Purpose Facilities

- Models are not anticipated for the SP facilities
- A comprehensive summary normalizing the capitalized facility costs over time, expressing the result in 2010 (Base Year $)
- Considers accounting adjustments, which have occurred over the life of the facility

Cost Evaluation Procedure

Where Are We Getting the Capitalized Facility Cost?

Reclamation's Schedule No. 1

CVP2010

TITLE PROJECT — PLANT, PROPERTY AND EQUIPMENT CENTRAL VALLEY PROJECT — MP REGION

Schedule No. 1
September 30, 2010
Sheet 6 of 13

SGL/ PROJECT TYP/CAT	DESCRIPTION	FUND	PLANT IN SERVICE	PLANT IN SERVICE CVPIA	CONSTRUCTION IN ABEYANCE 172B	GENERAL CONSTRUCTION 1720 09	O & M CONSTRUCTION 1720 09	TOTAL TO DATE
1740 51	OTHER STRUCTURES & FACILITIES (CONTINUED)							
MP 171	MULTIPURPOSE (CONTINUED)							
	0859 - AUBURN-FOLSOM SOUTH UNIT							
0375	Auburn Powerplant		0.00		8,107,574.66			8,107,574.66
0376	Auburn Switchyard		0.00		355,146.22			355,146.22
0535	Auburn Area		0.00		2,126,845.97			2,126,845.97
0536	Foresthill Divide Area		0.00		57,768.43			57,768.43
0819	Placer County Water Agency Relift PP		0.00		6,155,499.19			6,155,499.19
0821	No Hands Bridge		1,192,567.24		0.00			1,192,567.24
0831	Auburn Dam & Reservoir		0.00		203,999,011.39			203,999,011.39
0831	Auburn Dam & Reservoir	T01	0.00		2,150,727.23			2,150,727.23
0832	Permanent Operating Facilities - Auburn		0.00		574,504.77			574,504.77
0833	Auburn Area Fish & Wildlife Lands		0.00		10,344.58			10,344.58
0887	Folsom South Canal		33,150,727.49		720,322.77			33,871,050.26
0888	Permanent Operating Facilities - Folsom South		10,141.69					10,141.69
	Total - Multipurpose - Auburn-Folsom South Unit (0859)		34,353,436.42	0.00	224,257,745.21	0.00	0.00	258,611,181.63
	0863 - DELTA DIVISION							
0825	Tracy FCF - Repl Transformers		18,716.11				0.00	18,716.11
0828	Tracy Facility Structure & Imp.		66,293.09					66,293.09
0846	Tracy Pumping Plant		4,757,570.84			0.00	297,038.97	5,054,609.81
0846	Tracy Pumping Plant	T01	597,769.88					597,769.88
0846	Tracy Pumping Plant	U5P	9,422.00					9,422.00
0848	Delta-Mendota Canal		5,010,438.73				2,841,579.24	7,852,017.97
0848	Delta-Mendota Canal	A1N	0.00				198,650.22	198,650.22
0848	Delta-Mendota Canal	T01	275,045.03					275,045.03
0848	Delta-Mendota Canal	T06	0.00			2,487,549.04		2,487,549.04
3039	Delta Cross Channel-Gate Structure Fencing 474						199,504.94	199,504.94
6220	So Delta Barrier - Old River Barrier	H30	0.00			80,001.00		80,001.00
	Total - Multipurpose - Delta Division (0863)		10,735,255.68	0.00	0.00	2,567,550.04	3,536,773.37	16,839,579.09
	0921 - SAN FELIPE DIVISION							
0381	Pacheco Substation		315,412.84					315,412.84
0382	Coyote Pumping Plant - 115 kv line		2,322,603.31					2,322,603.31
0834	Pacheco Tunnel		83,454,538.72					83,454,538.72
0835	Santa Clara Tunnel & Conduit		71,352,817.73					71,352,817.73
0836	Pacheco Conduit		32,661,769.40					32,661,769.40
0837	Pacheco Pumping Plant		33,578,275.97					33,578,275.97
0838	Coyote Pumping Plant		17,753,771.50					17,753,771.50
0839	Hollister Canal & Conduit		27,638,148.96					27,638,148.96
0840	San Justo Dam & Reservoir		37,196,399.77			6,643,881.17		43,840,280.94
0841	Permanent Operating Facilities - San Felipe		260,247.14					260,247.14
0899	Interest During Construction		35,807,943.77					35,807,943.77
	Total - Multipurpose - San Felipe Division (0921)		342,341,929.11	0.00	0.00	6,643,881.17	0.00	348,985,810.28

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Cost Evaluation Procedure

Single-Purpose Facility

Example Facility

Original Data			Adjusted Capital Costs					
Fiscal Year[1]	Cumulative Capital Total Cost to Date[2]	Fiscal Year Capital Cost[3]	Distributed Differential Fiscal Year Capital Cost[4]	Adjusted Fiscal Year Capital Cost[5]	Adjusted Cumulative Capital Cost[6]	BCI_{Year}[7]	BCI Fiscal Year Differential Capital Cost $_{2010}$[8]	Projected Capital Cost to Date[9]
1980	$35,000,000	$35,000,000	$0	$35,000,000	$35,000,000	1,941	$88,049,974	$88,049,974
1988	$45,000,000	$10,000,000	($2,000,000)	$8,000,000	$43,000,000	2,598	$15,036,182	$103,086,156
1989	$46,000,000	$1,000,000	($1,000,000)	$0	$43,000,000	2,634	$0	$103,086,156
1998	$43,000,000	($3,000,000)	$0	$0	$43,000,000	3,390	$0	$103,086,156
1999	$45,000,000	$2,000,000	$0	$2,000,000	$45,000,000	3,456	$2,826,151	$105,912,307
2000	$47,000,000	$2,000,000	$0	$2,000,000	$47,000,000	3,539	$2,759,212	$108,671,519
2001	$50,000,000	$3,000,000	($500,000)	$2,500,000	$49,500,000	3,574	$3,415,959	$112,087,478
2002	$49,500,000	($500,000)	$0	$0	$49,500,000	3,623	$0	$112,087,478
2003	$51,000,000	$1,500,000	$0	$1,500,000	$51,000,000	3,693	$1,983,168	$114,070,646
2004	$53,000,000	$2,000,000	$0	$2,000,000	$53,000,000	3,984	$2,451,203	$116,521,848
2005	$55,500,000	$2,500,000	$0	$2,500,000	$55,500,000	4,205	$2,902,976	$119,424,825
2006	$58,000,000	$2,500,000	$0	$2,500,000	$58,000,000	4,369	$2,793,904	$122,218,729
2007	$60,500,000	$2,500,000	$0	$2,500,000	$60,500,000	4,485	$2,721,648	$124,940,378
2008	$62,500,000	$2,000,000	$0	$2,000,000	$62,500,000	4,691	$2,081,896	$127,022,274
2009	$63,800,000	$1,300,000	$0	$1,300,000	$63,800,000	4,769	$1,331,099	$128,353,373
2010	$65,000,000	$1,200,000	$0	$1,200,000	$65,000,000	4,883	$1,200,000	$129,553,373
						BCI_{2010}:	4,883	

Original Capital Cost: $65,000,000

Projected Capital Cost: $129,553,373

Cost Evaluation Procedure

Multi-Purpose Facilities

- 45 Facilities … Much More Involved Process
- Involves Developing a SPA for Each Authorized Purpose

So How Are We Going About This?

- Field Surveying & Computer Model Creation
- Records Research (Design, Bids & Costs)
- Model Revisions for SPA Quantities & Estimates

Cost Evaluation Procedure

MP Facility Process Walk Through

- Establish the Base Facility Model
- Define the Major Cost Drivers (MCD)
- Create Cost Curves Using Original Bid MCD
  - Use data from all MP facilities – size issues
  - Created in 2010 $ using BCI
- Revise Facility Models to Represent SP Requirements – Criteria From Modelers
- Take-off MCD Quantities for Each Model Version & Apply to Cost Curves
- Assemble SPA Field Cost With Proportional Unlisted Items Reduction

Cost Evaluation Procedure

MP Facility Work Products (Base Year Costs)

- Existing Facility, As-Is
- SPA Cost for Each Authorized Single Purpose
- Existing Facility Without: Each Purpose Removed (Meet Benefits for All Other Purposes)

For Instance, Shasta Dam → **Authorized for 4 Purposes: WS, P, FC & N**

- We Will Produce 9 Cost Summaries for this One Facility

Cost Evaluation Procedure

Other Considerations - TBD

- Land & Land Rights vs. Construction Costs
  - How Do the Variations in Land & Construction Cost Impact the Reimbursable Allocations?

    CCT Includes Land Cost Indices on State Wide Basis

- Should Land Costs Will Be Indexed Similarly to Previous Slide or Combined with Construction?

How To Separate Land Cost & Do We Need To?

Cost Evaluation Procedure

Other Considerations (con't)

- Interest During Construction (IDC), OM&R & Construction Costs
  - IDC is an Opportunity Cost – Loss of Return on Federal Funds in Best Alternative Use

So How Are We Dealing with IDC and OM&R?

- IDC – Process is Being Defined
- OM&R is Being Present Valued & Excluded

Completed & Future Efforts

Single Purpose Facilities

- All 125 SP Facilities Will Have Capitalized Cost Indexed to 2010 by May 15, 2014
- A QC Check Will Require Another 30-days to Complete

Multi-Purpose Facilities

- Records Research Continues - Est. Completion August 2014
- Major Cost Drivers Cost Curve Creation – Est. Completion – Dec. 2014
- Facility Model Revisions & Quantity Take-offs – Est. Complete Mar. 2015

Summary & Wrap-up

- We are making good progress with the SP facilities
- The MP facilities will require more effort and some analysis elements are still being defined
- MP facilities will require hydrologic input from TSC, but this is not holding up our current efforts
- Roughly 15 of the 45 MP facilities have gaps in documentation. We are attempting to locate the information
- Some facilities were constructed by other entities, i.e. ACOE. We are working to get contract and design data on these facilities

Final Questions?