United States Department of the Interior

BUREAU OF RECLAMATION
Pacific Northwest Region
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Boise, Idaho 83706-1234

IN REPLY REFER TO:

PN-1000
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JAN 29 2008

VIA ELECTRONIC MAIL ONLY

MEMORANDUM

To: Team Leads, Managing for Excellence Team 12
Attn: GP-3000 (Macartney), 86-62000 (Hensley)

From: J. William McDonald
Regional Director

Subject: Transmittal of the Final Report for Action Item 11, Managing for Excellence

The enclosed report, entitled "Cost Comparison of Engineering Work Performed In-House Versus Outsourcing," is the final product of the team which addressed action item 11. This action item called for a comparative analysis of the unit costs of performing engineering work in-house versus outsourcing such work. To the extent available data permitted, the team expanded its analysis to also look at some total costs, not just unit costs.

This final report is being provided to assist Team 12 in completing its assigned task and writing its final report. As you know, the data in the final report for action item 11 have previously been provided to Team 12. The final report merely brings everything together in one package.

As with the final reports of Teams 9 and 10, which were previously forwarded to you in October and November, 2006, by Maryanne Bach (in her capacity as the initial executive sponsor of Teams 9-16), Team 12 should thoroughly review the information in the enclosed final report and use it to inform its deliberations in completing action item 12.

By copy of this memorandum, I am authorizing the subject report to be posted as a final document on the Managing for Excellence Internet website.

Attachment

cc: 91-00000, 92-00000, 94-00000, 94-30000, 96-00000, 96-40000
84-20000, 84-21000, 84-27000, 84-40000, 84,50000, 84-56000, 86-60000, 86-68000
PN-1000, MP-100, LC-1000, UC-100, GP-1000

RECLAMATION

Managing Water in the West

Managing for Excellence
Action Item 11

Cost Comparison of Engineering Work Performed In-House Versus Outsourcing

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Introduction

This report addresses Action Item No. 11 of Reclamation's Managing for Excellence Action Plan. It compares data on the cost to contract with private firms (i.e., outsourcing) for engineering and design-related work with data on the cost to perform similar work with Reclamation staff. This information, along with the information developed for Action Items 9 and 10, is being provided to the team which is addressing Action Item 12. This latter Action Item pertains to processes for the continuous "right sizing" of Reclamation's engineering and other technical services workforce.

Comparative data are provided both for unit costs and for total costs for a given kind of engineering job. However, as this report notes, data which can be validly compared are very limited, particularly for total costs.

Unit Cost Comparisons

Information on the unit costs of work obtained by Reclamation from private firms (i.e., work which was outsourced) was derived from a summary of technical labor line items from Reclamation's fiscal year 2006 Indefinite Delivery, Indefinite Quantity (IDIQ) contracts. These are contracts Reclamation uses to procure the services of architectural and engineering (A&E) firms. Because there is considerable variation among the contracts, median values were calculated to perform comparisons. To compare the labor costs of the IDIQ contracts with labor costs within Reclamation, the data were segregated into three skill categories: junior or entry level (skill level 1), journey level (skill level 2), and senior level (skill level 3). Attachment A is a summary of the IDIQ data in reduced form.

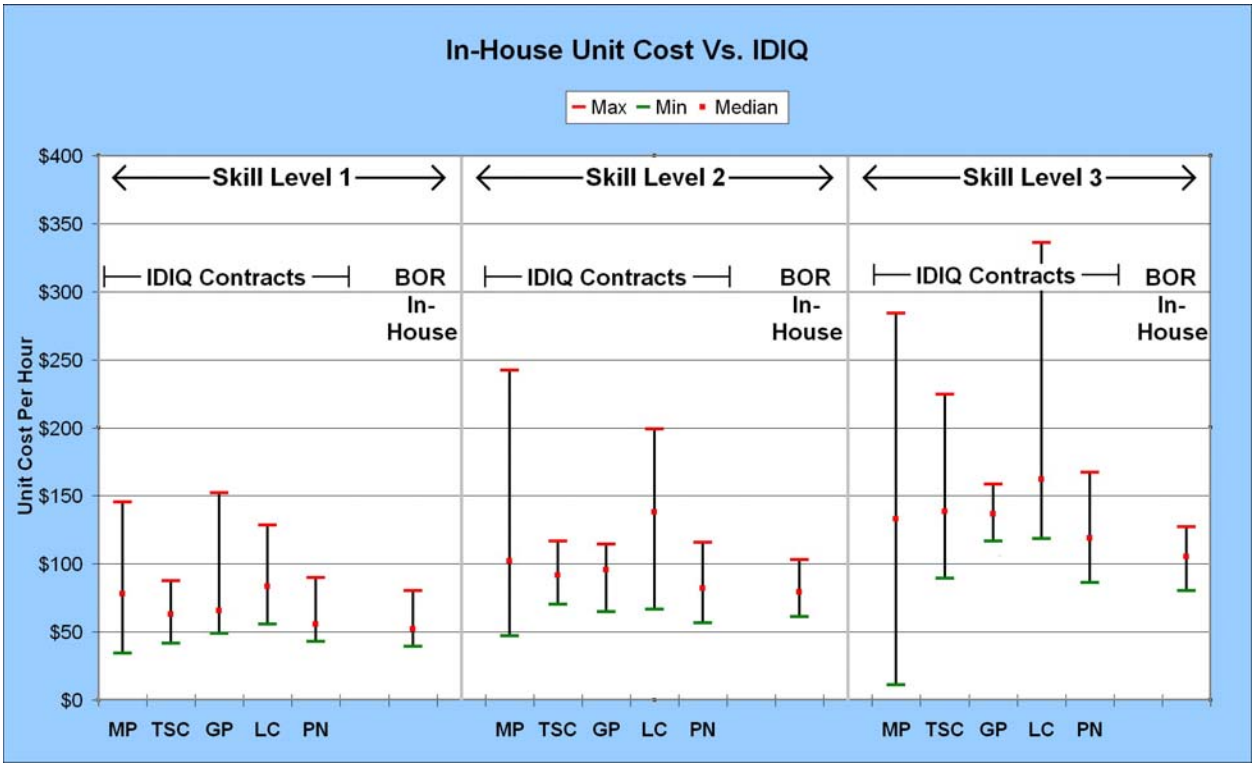
The unit cost to perform technical work in-house varies across Reclamation because of differences in locality pay, labor additives, and indirect costs. While offices that supply technical services to other organizational units in Reclamation use similar methods to charge work, indirect costs and rates are variable due to differences in program, staffing, and other factors. For purposes of comparison with the IDIQ data, the Reclamation staff costs (encompassing a broad range of General Schedule (GS) pay grade/steps) were also grouped into 3 skill categories:

- Junior Staff and Technicians – GS-1 through 10
  (represented by grade GS-9, step 4)
- Journey Staff – GS-11 through 12 (represented by grade GS-12, step 6)
- Senior Staff – GS-13 through GS-15
  (represented by grade GS-13, step 10)

The comparative IDIQ and Reclamation labor costs are summarized below:

	Skill Level 1			Skill Level 2			Skill Level 3		
	Min	Max	Median	Min	Max	Median	Min	Max	Median
Reclamation	$ 39	$ 80	$ 52	$ 61	$103	$ 79	$ 80	$127	$ 105
Contract	$ 34	$152	$ 73	$ 47	$242	$ 99	$ 11	$336	$ 138

The number and variety of labor-cost data points for each IDIQ contract varied because the contracts themselves varied both in the number of technical disciplines and the breadth of technical labor experience levels. The following chart graphically depicts this variation of the IDIQ contracts and also compares all the IDIQ contracts from different contracting entities (regions and the TSC) with the summary Reclamation in-house data. The median contract cost for Skill Level 1 is 40 percent higher than Reclamation's median cost for this Skill Level. Similarly, for Skill Level 2, median contract costs are 25 percent higher, and Skill Level 3 costs are 31 percent higher.



Cost Comparisons for Specific Tasks

Comprehensive Facility Reviews

Comparing hourly rates takes into account only part of the total equation of a true comparison of cost. A true comparison would require the total cost to complete the task, not just the hourly rates.

Data for these types of true "apple-to-apple" comparisons were difficult to obtain. Given the complexity of the technical work performed on Reclamation facilities or for Reclamation operations, it is seldom that comparable work is performed by both the private contractors and Reclamation. It would be wasteful, for example, to have a fish-screen structure designed by a contractor and independently by in-house Reclamation technical service providers simply to determine which is more cost effective.

In order to achieve a reasonable degree of comparability, there needs to be a recurring need for the same engineering product, with this being produced both in-house by Reclamation staff and by private firms obtained by Reclamation. One such circumstance has been documented by Reclamation over the past couple of years.

Reclamation performs Comprehensive Facility Reviews (CFR) on its most critical structures every six years as part of Reclamation's Dam Safety Program. A CFR is a detailed review of a dam and the appurtenant structures in which past and present performance is evaluated. Each review requires a "Senior Engineer" (SE).

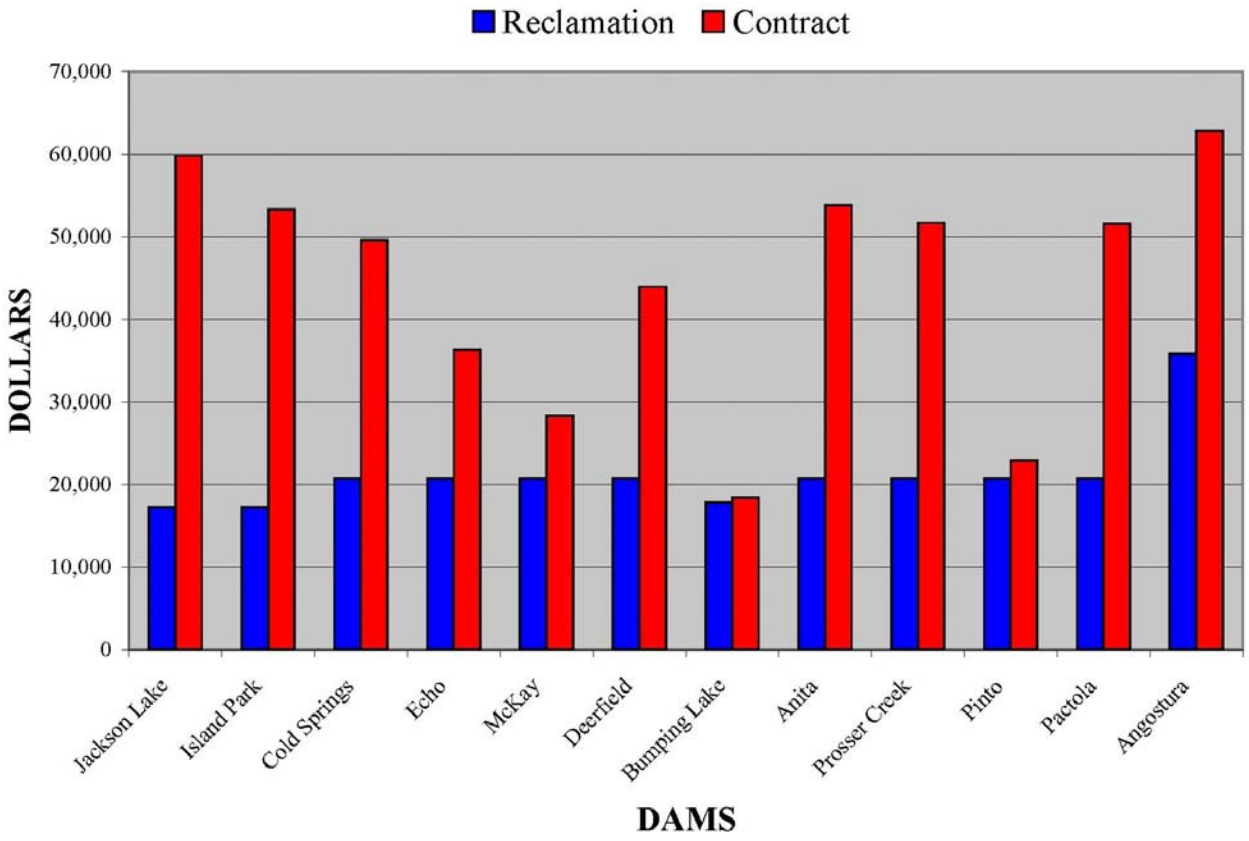
Historically, Reclamation has performed the SE function with its own personnel. In recent years, though, Reclamation has contracted out the SE function of some CFRs while continuing to do others in-house. The SE is required to possess current state-of-the-art practice and/or knowledge in a related technical field, have at least 10 years experience in the related technical area, be licensed as a professional engineer in the related field of technical expertise, and have an extensive knowledge of dam incidents and dam safety concerns and deficiencies. Contracting for these technical services is performed through task orders on existing IDIQ contracts.

Attachment B is a table comparing the total "technical" cost of performing the SE requirements of a CFR through outsourcing to a private firm versus use of Reclamation's in-house engineers. The cost data for this example are comparable because all indirect costs for performing the work are included in both scenarios. In order for the contracted work to be accepted, there is an additional Reclamation

cost for technical oversight of the work. This oversight cost does not include the additional "administrative" costs required to administer the IDIQ task order.

The chart on the following page graphically depicts the comparison of total costs to perform the SE services for the twelve dams in the data sample. In this chart, costs depicted for the contractor represent actual costs incurred under the contract for Senior Engineer services. The Reclamation costs represent estimates based upon historic knowledge of the requirements and duration for Reclamation to conduct a CFR at each specific facility.

In every case, it was more expensive to perform the Senior Engineer work through outsourcing and in many cases double the cost. This particular technical work is clearly more economically performed in house. The reasons for this are two-fold: first, the unit cost for the senior engineer when contracted through an IDIQ contract are about 50 percent higher; and, second, the contractor charges for a junior level engineer to assist the senior engineer in the production of the report. This assistance is not a part of Reclamation performing these services in-house.



Carter Lake Case Study

Carter Lake is the southern terminal storage facility of the Colorado-Big Thompson Project. The Northern Colorado Water Conservancy District

(Northern) has assumed responsibility for the operation and maintenance of this facility (which is thus referred to as a transferred works) under a contract with Reclamation.

Initially, Reclamation and Northern prepared separate cost estimates for each agency to design and construct a new, completely separate outlet at Carter lake Dam No. 1. However, the two organizations subsequently agreed to share the design, procurement, and construction oversight responsibilities for the new outlet. Northern retained URS Corporation (URS) to perform its portion of these engineering tasks for it.

While the methods of tracking costs over the course of this effort do not allow direct comparison of Reclamation's estimated design costs directly with URS' actual design costs for the same tasks, it is possible to compare:

- Estimated costs for Reclamation design and procurement with Northern/URS oversight versus estimated costs of URS design and Northern procurement with Reclamation review, and
- Estimated costs for Reclamation design and procurement versus actual costs of a shared design and procurement, wherein each party has responsibilities for specific features and each reviews the work of the other.

Some of the summary data from this report is as follows:

In 2002	Reclamation's Estimate (Construction Costs Only)	$9.8 million
In 2006	URS' Estimate (Construction Costs Only)	$9.3 million
In 2007	Actual Construction Contract Award	$9.8 million
Reclamation's Complete Design Estimate (Mostly Prescriptive Specifications and Drawings)		$1.5 million
URS Complete Design Estimate (Mostly Performance-based Specifications and Drawings)		$1.1 million
Estimated (Reclamation & URS) Design Costs (Combined Performance Based and Prescriptive)		$1.4 million
Actual Joint Design Costs (Combined Performance Based and Prescriptive – 10% under estimate)		$1.3 million
Reclamation's Total Non-Contract Cost Estimate (Includes Design, Procurement, Contract Administration and Construction Management)		$2.6 million
Latest Estimate (Reclamation and URS) Total Non-Contract Cost (Includes Design, Procurement, Contract Administration and Construction Management)		$2.6million

The complete Carter Lake Case Study is included as Attachment C. As indicated in the summary, Reclamation's estimate to perform the design and procurement was 38 percent above the URS estimate to perform the design and complete their portion of the procurement activities. The design effort estimated by URS relied on the use of performance specifications (i.e. specifying the required performance of a feature and leaving the detailed design of that feature to the contractor) for several project features. While this approach does reduce the design effort required to issue a solicitation, it moves responsibility for those details to the construction contractor and moves the cost for review of these designs to the contracting phase of the project. Reclamation's design estimate, which was higher, reflects the use of more prescriptive designs (i.e. detailed designs to be included in the solicitations) for most of the features. Since these detailed designs are not the construction contractor's responsibility, construction contract costs and owner costs (for design reviews) during the construction phase should be lower. Even though data was collected from this project for the specific purpose of comparing in-house to contracted costs, these differences in design approach illustrate the difficulty in making a direct comparison.

Summary of Findings

- Based upon the limited information available, a comparison of technical labor unit costs between Reclamation and outside private engineering firms indicates that Reclamation is generally at the low end of the cost range as compared with the unit costs of the private sector.
- In some specific instances, contracted labor costs are lower than Reclamation labor costs. However, the median contracted cost for the junior staff and technicians is 40 percent higher for private firms than the Reclamation median, the median contracted cost for the journeyman staff is 25 percent higher, and the median contracted cost for senior staff is 31 percent higher.
- There is limited information directly comparing the total cost of performing work in house verses outsourcing due to the unique nature of each task. However, the data that is available from the contracting of Senior Engineer services for Comprehensive Facility Reviews indicates that the outsourcing of highly technical engineering work is significantly more costly than doing it with Reclamation employees.
- The Carter Lake Outlet Case Study shows the total project costs to perform in-house design, procurement, and contract administration and construction management by Reclamation compares closely with the estimated actual total cost for a shared effort to perform the same work.

MANAGING FOR EXCELLENCE RECOMMENDATIONS – TEAM 11

Engineering and Design Services

Executive Sponsor: J. William McDonald

Team Members: Perry Hensley, Jamie Macartney, Julie Bader, Dave Gore, Karen Knight, Karl Martin, Rick Scott, Roger Slater, Jame Todd, Karl Wirkus, Barry Wirth, and (initially) Darryl Beckmann.

Key Organizational Function Interfaces: Reclamation Leadership Team, managers, employees, customers, and stakeholders.

Action Item Statements from the Managing for Excellence Action Plan: Analyze the unit to unit costs of in-house performance of the commercial workload vs. outsourcing.

Scope Statement: In today's engineering and construction climate, it is imperative that Reclamation make a concerted effort to collaborate with customers and stakeholders such that our operations are transparent and efficient. At the same time, Reclamation must take positive steps to maintain our core technical capability in order to remain good stewards over our dams and other facilities. The proposed business model is an attempt to meet these objectives while ensuring that our technical resources are fully utilized to the maximum extent possible.

Approach and Methodology:
Collected available comparable data to be provided to Team 12.

Deliverables:
Team 11 Final Report –
Cost Comparison of Engineering Work Performed In-House Versus Outsourcing

Recommendations: Provide the cost comparison data to Managing for Excellence Team 12 for consideration in the right-sizing effort.

Submitted by:

Perry Hensley — 1/29/08
Co-Team Leader — Date

Jamie Macartney — 1/29/08
Co-Team Leader — Date

Attachment A — Indefinite Delivery, Indefinite Quantity Contracting Data

	"Skill Level 3"			"Skill Level 2"			"Skill Level 1"		
	Max	Min	Median	Max	Min	Median	Max	Min	Median
MP A	$125	$86	$101	$73	$63	$68	$86	$73	$80
MP B	$155	$124	$143	$108	$93	$101	$127	$42	$108
MP C	$198	$118	$167	$198	$92	$119	$89	$54	$88
MP D	$120	$120	$120	$85	$85	$85	$95	$65	$80
MP E	$205	$145	$175	$195	$95	$95	$145	$52	$64
MP F	$190	$140	$190	$190	$100	$125	$140	$58	$125
MP G	$150	$150	$150	$125	$119	$122	$95	$95	$95
MP H	$180	$130	$155	$180	$110	$145	$90	$58	$74
MP I	$170	$140	$140	$125	$108	$125	$88	$50	$88
MP J	$178	$131	$144	$96	$90	$93	$81	$65	$78
MP K	$148	$91	$113	$144	$66	$72	$69	$52	$56
MP L	$208	$127	$175	$208	$80	$126	$93	$53	$91
MP M	$284	$136	$157	$242	$79	$118	$81	$61	$71
MP N	$172	$157	$157	$172	$115	$141	$141	$68	$94
MP O	$157	$89	$121	$100	$73	$84	$89	$58	$79
MP P	$183	$136	$160	$136	$126	$131	$120	$89	$105
MP Q	$165	$103	$112	$154	$64	$85	$70	$57	$62
MP R	$134	$109	$119	$134	$85	$85	$122	$54	$68
MP S	$202	$115	$131	$195	$77	$115	$89	$58	$74
MP T	n/a	n/a	n/a	$62	$62	$62	$60	$60	$60
MP U	$139	$112	$132	$191	$82	$95	$66	$57	$65
MP V	$160	$150	$155	$150	$122	$125	$91	$69	$81
MP W	$160	$160	$160	$74	$74	$74	$110	$110	$110
MP X	$108	$81	$101	$138	$47	$86	$70	$61	$67
MP Y	$149	$122	$138	$134	$80	$111	$87	$44	$69
MP Z	$154	$140	$140	$113	$113	$113	$93	$93	$93
MP AA	$135	$90	$90	$108	$70	$80	$87	$47	$67
MP AB	$135	$135	$135	n/a	n/a	n/a	$110	$110	$110
MP AC	$175	$150	$150	$175	$135	$165	$120	$90	$120
MP AD	$177	$127	$127	$168	$102	$114	$87	$47	$82
MP AE	$152	$121	$121	$173	$110	$116	$110	$47	$99
MP AF	$132	$130	$130	$132	$90	$103	$103	$45	$65
MP AG	$135	$110	$112	$177	$75	$85	$66	$52	$53
MP AH	$149	$146	$148	$204	$100	$122	$94	$69	$70
MP AI	$171	$151	$167	$171	$91	$138	$89	$74	$82
MP AJ	$239	$123	$123	$123	$94	$101	$94	$60	$80
MP AK	$157	$11	$110	$195	$69	$84	$92	$55	$60
MP AL	$150	$95	$95	$150	$85	$95	$95	$45	$75
MP AM	$168	$104	$127	$168	$79	$92	$104	$48	$68
MP AN	$133	$75	$88	$166	$58	$65	$83	$34	$51
MP AO	$258	$101	$119	$144	$60	$89	$72	$43	$59
MP AP	$189	$115	$134	$149	$103	$122	$105	$68	$79
MP AQ	$166	$118	$118	$157	$84	$106	$81	$57	$73
Summary Data For:									
MP IDIQ	$284	$11	$133	$242	$47	$102	$145	$34	$78

	"Skill Level 3"			"Skill Level 2"			"Skill Level 1"		
	Max	Min	Median	Max	Min	Median	Max	Min	Median
TSC A	$185	$89	$137	$71	$70	$71	$66	$44	$55
TSC B	$182	$119	$151	$82	$70	$76	$69	$56	$63
TSC C	$123	$104	$114	$93	$81	$87	$72	$43	$58
TSC D	$122	$105	$113	$94	$78	$86	$66	$50	$58
TSC E	$144	$135	$140	$97	$97	$97	$79	$59	$69
TSC F	$94	$94	$94	$89	$77	$83	$63	$63	$63
TSC G	$179	$138	$159	$106	$106	$106	$66	$66	$66
TSC H	$147	$122	$135	$111	$81	$96	$75	$41	$58
TSC I	$214	$146	$180	$117	$97	$107	$87	$46	$67
TSC J	$225	$132	$179	$107	$87	$97	$81	$51	$66
Summary Data For:									
TSC IDIQ	$225	$89	$138	$117	$70	$91	$87	$41	$63
GP A	$149	$117	$133	$103	$65	$97	$151	$49	$62
GP B	$159	$122	$140	$114	$65	$94	$152	$59	$69
Summary Data For:									
GP IDIQ	$159	$117	$136	$114	$65	$96	$152	$49	$65
LC A	$224	$146	$151	$151	$94	$108	$94	$61	$82
LC B	$209	$118	$145	$145	$66	$111	$101	$56	$79
LC C	$251	$148	$162	$199	$106	$138	$128	$74	$83
LC D	$252	$180	$183	$183	$135	$141	$128	$68	$109
LC E	$336	$151	$173	$173	$118	$144	$105	$85	$95
Summary Data For:									
LC IDIQ	$336	$118	$162	$199	$66	$138	$128	$56	$83
PN A	$167	$137	$141	$116	$90	$103	$90	$65	$79
PN B	$137	$86	$96	$82	$56	$62	$67	$43	$48
PN C	$167	$108	$119	$106	$75	$82	$64	$44	$55
Summary Data For:									
PN IDIQ	$167	$86	$119	$116	$56	$82	$90	$43	$55
Summary Data For All IDIQ Contracts:									
	$336	$11	$138	$242	$47	$99	$152	$34	$73

Attachment B — Comparison of CFR Activities, In-House Versus Outsourced

LOCATION	Reclamation SE Services (1)	Contractor Proposal (2)	Costs for Oversight of Contractor	Total Cost to Contract SE Services (3)
Reviews Performed in Fiscal Year 2005				
Jackson Lake Dam — Minidoka Project, Wyoming	**$17,280**	$54,700	$5,184	**$59,884**
Island Park Dam — Minidoka Project, Idaho	**$17,280**	$48,150	$5,184	**$53,334**
Reviews Performed in Fiscal Year 2006				
Cold Springs Dam — Umatilla Project, Oregon	**$19,000–22,464**	$42,681	$6,912	**$49,593**
Echo Dam — Weber River Project, Utah	**$19,000–22,464**	$29,401	$6,912	**$36,313**
McKay Dam — Umatilla Project, Oregon	**$19,000–22,464**	$24,000	$4,320	**$28,320**
Deerfield Dam — Rapid Valley Project, South Dakota	**$19,000–22,464**	$37,052	$6,912	**$43,964**
Bumping Lake Dam — Yakima Project, Washington	**$17,820**	$14,933	$3,456	**$18,389**
Anita Dam — Huntley Project, Montana	**$19,000–22,464**	$46,888	$6,912	**$53,800**
Prosser Creek Dam — Washoe Project, California	**$19,000–22,464**	$44,800	$6,912	**$51,712**
Pinto Dam – Columbia Basin Project, Washington	**$19,000–22,464**	$18,600	$4,320	**$22,920**
Pactola Dam – P-SMBP, Rapid Valley Unit, South Dakota	**$19,000–22,464**	$44,700	$6,912	**$51,612**
Angostura Dam – P-SMBP, Angustora Unit, South Dakota	**$35,844**	$54,781	$8,000	**$62,781**

Notes: (1) Cost for Reclamation performing the "Senior Engineer" services in-house for the CFR.

(2) Contractor's proposal for performing the "Senior Engineer" service on the CFR.

(3) Cost of Contractor Services plus Reclamation costs for contract oversight and administration.

RECLAMATION

Managing Water in the West

Carter Lake Case Study

Colorado – Big Thompson Project, Colorado
Great Plains Region

U.S. Department of the Interior
Bureau of Reclamation

May 2007

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

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BUREAU OF RECLAMATION

Signature Page

This report has been developed jointly by the Bureau of Reclamation and the Northern Colorado Water Conservancy District, with the participation and concurrence of the individuals listed below.

Lowell Pimley
Chief, Engineering Services Division
Bureau of Reclamation, Technical Services Center

11/26/07
Date

Beth Boaz
Program Manager
Bureau of Reclamation, Dam Safety Office

11/26/07
Date

Carl Brouwer
Project Management Department Manager
Northern Colorado Water Conservancy District

11/26/07
Date

Executive Summary

Study Objective

In the design process for the additional outlet at Carter Lake, the Northern Colorado Water Conservancy District (Northern) contracted with URS for design work originally estimated by Reclamation's Technical Service Center (TSC). In light of this rather unique opportunity to directly compare the cost of work performed by a consultant hired by a district with that same work performed by the TSC, Reclamation's Managing for Excellence (M4E) Team 12 requested this case study be prepared to document these relative costs.

Conclusions

Reclamation and Northern agreed to share design and procurement of the new outlet, with Reclamation designing the tunnel, Northern's consultant, URS, designing the other features, and Northern executing the construction contract. Northern's contract with URS did not separate design tasks from non-design tasks, such as documentation, data analysis, and acquisition. The work and costs for those non-design tasks were shared between Reclamation and Northern. While this makes it impossible to compare Reclamation's estimated design costs directly with the consultant's *actual* design costs for the same tasks, it *is* possible to compare:

- Estimated costs for Reclamation design and procurement with Northern/URS oversight vs. estimated costs of URS design and Northern procurement with Reclamation review
- Estimated costs for Reclamation design and procurement vs. estimated or actual costs of a shared design and procurement, wherein each party has responsibilities for specific features and each reviews the work of the other. This may be a workable model of how Reclamation and districts can jointly design future projects.

Reclamation and Northern both participated in the development of this case study and concur with the following conclusions:

1. Since 1999, Reclamation has prepared a number of estimates of the cost of project construction, as have consultants working for Northern. These estimates converged as the scope of the project was better defined. Reclamation's 2002 estimated contract cost was about $9.8 million when adjusted for inflation. URS' 2006 estimated contract cost was $9.3 million without contingencies. In early 2007, the construction contract

was awarded to SEMA Construction, Inc. for $9,795,060. Thus both organizations' estimates compare favorably to the bid price.

2. Estimates were prepared for three scenarios of design data analysis, design, and pre-construction procurement:
    a. URS design and Northern procurement with Reclamation review: $1,096,477, not including the cost of Northern's activities
    b. Reclamation design and procurement with Northern/URS oversight: $1,512,363 (38 percent greater than scenario a)
    c. Shared design with Northern procurement: $1,413,373, not including the cost of Northern's activities (29 percent greater than scenario a and 6.5 percent less than scenario b)
3. The actual costs for Reclamation and URS' work on the design data analysis, design, and pre-construction procurement phase using a shared design and Northern procurement were $1,276,462, approximately 10% below estimates, with both Reclamation and URS completing their tasks at less than their estimated costs.
4. At the time of this case study, construction had only been underway for a few months; therefore, total costs of construction support were not yet available. The current estimate for the total Reclamation and URS non-contract costs was $2,556,996, including estimated Reclamation and URS costs for contract administration and construction management. This was $25,198 less than Reclamation's estimated $2,582,194 in non-contract costs for a Reclamation-led effort.

Reclamation and Northern agree that the following lessons can be drawn from our experiences with this shared design:

1. Estimated design and construction costs evolve as project scope is better defined. Several actions facilitate development of an accurate cost estimate, including:

    - Collection of site-specific design data

    - Ensuring that any design and/or construction cost estimates provided by Reclamation are fully reviewed and accurately reflect current assumptions before providing them to their stakeholders.

    - Development of a common understanding of the project's technical requirements among all parties (i.e., Reclamation, its stakeholders, and their consultants) to avoid development of projected costs based on widely differing views of the project configuration.

2. At least in this case, once the design and construction professionals of Reclamation and its stakeholder developed a common understanding of the project's technical requirements, their estimated design and construction costs were somewhat similar.

3. Remaining differences in the projected design costs were largely due to differing philosophies as to whether the design and specifications should be predominately site-specific designs and prescriptive specifications or should use more "standard" designs and/or performance specifications.

4. Development and implementation of a detailed project management plan were critical to maintaining a common understanding of the project status and potential future changes. Plan features should include:
   - Periodic project status reports
   - Intermediate target dates as the designs are developed
   - Regularly scheduled meetings of a small senior management level Project Management Team made up of Reclamation and partner staff
   - A process by which Project Management Team members communicate with other members of their organization
   - A well-defined process for identifying and agreeing to any changes in project scope, schedule, and/or cost

5. Periodic face-to-face meetings integrating design and construction professionals as well as senior executives from both Reclamation and its partner provide an efficient and effective method of ensuring a common understanding of the project.

6. Reclamation's willingness to be flexible in its requirements concerning responsibility for project design, procurement, and construction management can result in total project cost savings to the benefit of project beneficiaries who are responsible for payment of project costs.

Case Study

Scope of this Case Study

The focus of this case study is on the evolution of the outlet works project as Reclamation and Northern came to share responsibilities for design, procurement, and construction management of the project. After providing some general background on the reasons for the additional outlet and the configuration ultimately selected, this case study provides data and analysis related to the relative costs to design, procure, and construct the project. (Note: since construction of the project began in March 2007, final construction costs are not known at this time).

Carter Lake Outlet Background

Carter Lake is the southern terminal storage facility for the Colorado – Big Thompson Project, supplying municipal and industrial water as well as irrigation water to entities in northeastern Colorado. The facility is operated and maintained by the Northern Colorado Water Conservancy District (Northern) under a contract with Reclamation. The existing outlet works were designed to handle large, seasonal flows to meet agricultural demands. The transition from seasonal agricultural use toward more municipal and industrial use has required that releases from the outlet works be made year-round and at lower average release rates. The lower flows are causing cavitation damage to the regulating gates, and the year-round demands make it more difficult to take the outlet works out of service to perform preventative maintenance and repairs. Since 2002, Reclamation and Northern have been working together to design and construct a new, completely separate outlet at Carter Lake Dam No. 1. Because the outlet will be a single-purpose water feature, Northern is responsible for all costs.

Reclamation originally maintained that Reclamation must design and construct such a modification. In subsequent discussions, Reclamation and Northern agreed to share the design of the outlet, with Reclamation responsible for the tunnel portion (deemed the most critical aspect of the design in terms of safety of the dam) and Northern's consultant (A&E) designing the remaining components. In 2004, Northern selected URS Corporation (URS) as their A&E for this project.

The Outlet Works Addition will be located on the right abutment of the dam and will include the following primary features:

Intake Tower and Access Bridge (designed by URS):

- 107-foot tall, freestanding reinforced concrete tower
- 3 exterior cast iron slide gates for selective level reservoir withdrawal
- Guard gate (cast iron slide gate) located inside the tower at the upstream end of the conduit.
- Bubbler system to prevent freezing of the reservoir surface near the tower.
- Reinforced concrete building on top of the tower to protect gate operators and other mechanical equipment.
- Commercially-manufactured steel truss bridge with a free span of approximately 180 feet.

Tunnel (designed by Reclamation):

- Through the right abutment of the dam
- Finished diameter of 72 inches.
- Welded steel liner encased in concrete.
- Approximately 780 feet long.

Downstream Conduit (designed by URS):

- Welded steel pipe
- Encased in reinforced concrete.
- Wye branch bifurcation for future hydropower installation upstream of the valve structure.

Flow Meter Vault (designed by URS):

- Located on the conduit alignment just downstream of the tunnel exit.
- Reinforced concrete
- 72-inch ultrasonic flow meter
- Access manhole to permit entry into the outlet conduit.
- Equipment hatches for servicing flow meter.

Valve Structure (designed by URS):

- Located at the base of the slope adjacent to the existing St. Vrain Supply Canal.
- Comprised of a cast in place reinforced concrete structure
- 48-inch or 42-inch sleeve valve to regulate discharges and provide energy dissipation
- Transition structure to convey flow from the valve structure to the existing St. Vrain Supply Canal.
- Equipment hatches for servicing the sleeve valve and other mechanical equipment.

Evolution of Estimated Construction Costs

In **1999**, GEI Consultants, Inc. (under contract with Northern) conducted a feasibility- level study and concluded an additional outlet could be constructed through the right abutment of Carter Lake Dam No. 1 for a direct construction subtotal (DCS) of $1.7 to $4.9 million. The higher value assumed construction of a hydroelectric powerplant as part of the construction (which was later removed from the project). The DCS included 4 percent for mobilization and bonding and 10 percent for contingencies. GEI estimated 7.5 percent of DCS for design, $35,000 for permitting (for configurations not including a powerplant), 2 percent of DCS for legal and administrative, and 7.5 percent for Construction Engineering and Administration, resulting in total costs (design, procurement, and construction) of $2.0 to $5.8 million.

In **2002**, Reclamation (under an agreement with Northern) also produced a feasibility- level design and construction cost estimate. At that time, Reclamation estimated the construction contract cost (including 5 percent for mobilization and 10 percent for unlisted items) for the project configuration eventually selected to be about $7.6 million. To estimate the field cost for the project (i.e. the amount of money recommended to cover bid prices and possible changes during construction), Reclamation added a 25% contingency to reflect the preliminary

stage of their design. Thus the estimated field cost (or recommended budget) for the project was about $9.5 million. Reclamation did not perform a detailed estimate of the design, contract administration and oversight costs, but estimated them to be 35 percent of the field costs. Therefore, Reclamation's estimated total project cost for the project configuration eventually selected was about $13 million.

Thus, Northern had one engineering organization telling them they could design and construct an outlet for $2.0 to $5.4 million and another telling them the project (without power generation capability) would cost $13 million. (Note: In 2002, a variety of project configurations with varying costs were considered by Reclamation and Northern, so records from the time indicate Reclamation's Project Cost Estimates ranged from $11.5 to $13 million).

Reclamation's design and construction cost estimates were higher largely for two main reasons: First, GEI estimated the tunneling costs based upon less expensive micro-tunneling. Subsequent geotechnical investigation by Reclamation led both they and URS to conclude that micro-tunneling would likely not be possible. Second, while GEI assumed a submerged intake structure with a submerged gate operator, Reclamation's operational experience with this type of installation had proven problematic. Reclamation therefore assumed this gate would be provided either in a full height intake tower or in a gate chamber excavated within the right abutment upstream of the dam's centerline.

In **2004**, Northern contracted with URS Corp. to provide technical services for the project. A meeting among Reclamation, URS, and Northern was scheduled in October 2004 to discuss the technical issues associated with the tunnel construction and intake configuration. In preparation for that meeting and in response to Northern's concerns with the cost of the project, Reclamation re-examined the concept of using a submerged intake structure with a submerged gate operator (as GEI had assumed in its design study) in a manner which would address Reclamation's earlier operational concerns. This concept was discussed with Northern and URS and accepted as a viable project configuration at the October 2004 meeting. This concept was estimated to reduce construction costs by approximately $1.7 million.

Later evaluations by Northern and URS led them to conclude that Reclamation's original project configuration concept (i.e. construction of a full height multi-level intake tower and access bridge) had significant operational benefits to the project that justified the increased cost and should be included in the preferred alternative. These benefits included the operational flexibility provided by the multi-level intake tower to address future water quality and water temperature considerations.

In **2006**, at the 30 percent completion milestone of final design, URS, using quantities developed by Reclamation and themselves, estimated the construction contract cost of this project configuration to be $9,305,083 without contingencies.

In early **2007**, the construction contract was awarded to SEMA Construction, Inc. for $9,795,060. Reclamation's 2002 estimated contract cost was $7.6 million (about $9.8 million adjusted for inflation[1]). As stated above, in 2006, URS estimated the contract cost at $9.3 million. Thus both organizations' estimates compare favorably to the bid price.

Evolution of Non-Contract Costs (Through Procurement)

As mentioned above, the first estimate of the pre-construction non-contract costs was in GEI's **1999** study. GEI assumed 7.5 percent of the Direct Construction Subtotal (DCS) for design engineering, $35,000 for permitting, 2 percent of the DCS for legal and administration costs, and 7.5 percent for construction administration and engineering, GEI estimated a total non-contract cost of $325,000 to $335,000 for configurations without hydropower, with $195,000 to $205,000 being pre-construction costs.

Reclamation's first estimate of the non-contract costs was part of the feasibility-level design and construction cost estimate produced in **2002** under an agreement with Northern. The total design, contract administration and oversight costs were estimated to be 35 percent of the $8.6 to $9.7 million field costs, ranging from $2.9 to $3.5 million. Pre-construction costs were not computed separately.

In **April 2003**, Reclamation prepared another design cost estimate. This final-design level estimate included provisions for both drill and blast tunneling and microtunneling for a straight tunnel alignment, and either a gate chamber or an upstream intake tower and totaled $1.4 million (for design only).

In **December 2003**, Northern provided Reclamation with a draft proposal from URS estimating their design cost to be $524,159 (including development of design criteria and geotechnical investigations).

Throughout 2004, Northern and Reclamation continued their dialogue regarding which organization would take the lead on designing and administering a construction contract to build the outlet. Meanwhile, Reclamation (under an MOU with Northern) completed a Concept Design Comparison document and Reclamation and Northern drafted an MOU by which Reclamation would perform final design.

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[1] Using Reclamation's Construction Cost Trends for Earth Dams' Outlet Works comparing January 2007 price levels to October 2002 price levels

In **December 2004**, in order to accommodate Northern's need to get the draft MOU before their Board of Directors at their January meeting, Reclamation provided them with an estimated cost for design and procurement. At the time, Reclamation noted that the estimate likely contained some double counting of design costs, because the project configuration had changed numerous times since Reclamation had computed a comprehensive design cost estimate. Representatives from Northern and Reclamation agreed to submit the existing estimate with the understanding that Reclamation would refine their estimate in early 2005. The estimated costs provided to Northern at that time totaled $2,021,147 for design data collection, final design, and procurement.

In **February 2005**, at the request of Northern and in preparation for an April 2005 meeting between Northern, URS, and Reclamation, URS was requested to develop an itemized cost estimate in the same manner and format that Reclamation used. This estimate totaled $814,546 (including estimated costs for technical review by Reclamation).

In preparation for the **April 2005** meeting with Northern and URS, Reclamation refined their scope and estimated costs for field data collection, rock testing, final design, and procurement based on the project configuration envisioned at that time. That estimate totaled $1,480,015 (including estimated costs for technical review by URS).

Comparing the estimates illustrates that Reclamation and URS had similar design concepts, but employed differing methods to develop and deliver the designs and specifications. URS assumed extensive use of performance specifications and "standard" designs for numerous project components while Reclamation assumed greater use of site-specific prescriptive designs for many of these components. In Reclamation's experience, performance specifications shift the cost for detailed designs of certain components (e.g. HVAC, lighting, etc.) from the design organization to the construction contractor or sub-contractor/supplier. This approach also shifts design and review costs to the construction phase of a project and presumes the cost and schedule risks of extensive re-designs by sub-contractors or suppliers to meet project needs are minor and acceptable. While Reclamation employs this approach on many project features (e.g. valves, operators, etc.) based on its corporate experience, it assumed a more limited use of the performance specifications approach than URS.

Reclamation also assumed a higher level of effort than URS for the rock testing and design of the tunnel and its associated features. This difference in effort reflected the two organizations' differing experience regarding the risks associated with tunneling in the abutment of a high or significant hazard dam.

After the April 2005 meeting, Reclamation proposed bifurcating the design effort in a manner which allowed Reclamation to retain its focus on the aspects of the

project which most directly affect the safety of the dam (i.e., the tunnel) while accommodating Northern's preference to employ their consultant to design the rest of the project.

In **August 2005**, Reclamation provided Northern with cost estimates for three potential options for completing the data collection, design and procurement.

The first estimate assumed shared responsibilities as noted above, with Reclamation designing the tunnel and reviewing designs of the rest of the project and URS designing all project features except the tunnel, reviewing Reclamation's tunnel design, and developing the solicitation for Reclamation procurement. Reclamation estimated the cost of this option as reflected in the attached Table 3 in the set of columns labeled "ESTIMATED COSTS - BIFURCATED DESIGN/CONSTRUCTION (August 2005)", and as summarized below:

Reclamation	$ 696,361
URS:	$ 655,255
Total:[2]	$1,351,616

In order to contrast the shared approach to designing and procuring the project, Reclamation also provided estimates of a Reclamation-led effort and a Northern/URS-led effort.

The second estimate assumed full Reclamation design and procurement and added technical oversight by URS, with the following distribution:

Reclamation Data Collection, Design and Procurement

Reclamation	$1,439,363
URS[3]:	$ 73,000
Total[4]:	$1,512,363

The third estimate was based on Northern/URS performing the data collection, design, and procurement, with Reclamation reviewing the URS design, with the following distribution:

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[2] This estimate does not include any costs to be incurred by Northern

[3] URS' cost is for review of Reclamation design

[4] This estimate does not include costs to be incurred by Northern in the procurement process.

Northern/URS Data Collection, Design, and Procurement

Reclamation[5]	$ 184,511
URS[6]:	$ 911,966
Total[7]:	$1,096,477

The second and third estimates described above are detailed in Table 3 in the set of columns labeled "ESTIMATED COSTS - SINGLE DESIGNER/CONSTRUCTOR (August 2005)".

Thus the estimated additional cost of having Reclamation do the designs and procurement in-house compared to URS and Northern taking the lead roles was $415,886 ($1,512,263 - $1,096,477) or about 38 percent. Sharing the responsibilities for design and procurement reduced the estimated costs by about $160,757 ($1,512,363 - $1,351,616), or 12 percent, compared to a Reclamation-only design and procurement approach. Using this shared approach was estimated to cost $255,139 ($1,351,616 - $1,096,477) more than the estimated cost for a URS/Northern led effort, an increase of about 19 percent.

In September of 2005, Northern and Reclamation agreed to proceed with design of the project using a shared approach for design and procurement. This approach called for Reclamation to design the tunnel, with URS designing the other project features. In **December 2005**, Reclamation and Northern agreed that Northern would also handle procurement and contract administration, subject to concurrence by the Solicitor. A January 2006 Solicitor's opinion affirmed that Northern could procure the construction contractor. Cost estimates were refined and are reflected in Table 3. The set of columns labeled "ESTIMATED COSTS - BIFURCATED DESIGN/CONSTRUCTION (from MOUs)" reflects the agreement reached in December 2005. Reclamation's numbers for the rows through "Reviews of Designs by Others" are those included in Memorandum of Understanding No. 06AG602084 executed on December 1, 2005. Additional work in the amount of $5,279 was transferred from a previous MOU in July 2006. With that addition, the estimated cost for this approach was distributed as follows:

Reclamation	$ 667,538
URS:	$ 751,114
Total[8]:	$1,418,652

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[5] Reclamation costs are for review of specifications and cost estimates, project management, participation in the acquisition process, and NEPA compliance

[6] Based on estimate prepared by URS and provided to Reclamation by Northern

[7] This estimate does not include costs to be incurred by Northern.

[8] This estimate does not include costs to be incurred by Northern.

The actual costs incurred in the design data analysis, design, and procurement processes are listed below:

Reclamation[9]	$ 626,462
URS:	$ 650,000
Total[10]:	$1,276,462

The history of the estimated cost of design data analysis, design, and pre-construction procurement is summarized in Table 1.

Table 1 - History of Estimated Preconstruction Costs

Date	Estimated Cost of Design Data Collection/Analysis, Design, and Pre-Construction Procurement			Notes
	Reclamation	Northern/URS	Total	
Apr-03	$1,400,000		$1,400,000	Design only
Dec-03		$524,159	$524,159	
Dec-04	$2,021,147		$2,021,147	Some tasks were double-counted
Feb-05		$814,546	$814,546	Includes Technical review by Reclamation
Apr-05	$1,480,015		$1,480,015	Includes technical review by URS
Aug-05	$696,361	$655,255	$1,351,616	"Bifurcated" design with Reclamation procurement
Aug-05	$1,439,363	$73,000	$1,512,363	Reclamation design and procurement with Northern/URS oversight
Aug-05	$184,511	$911,966	$1,096,477	Northern/URS design and procurement with Reclamation review
Dec-05	$662,259	$751,114	$1,413,373	"Bifurcated" design with Northern procurement
Jul-06	$667,538	$751,114	$1,418,652	Additional drill hole logging transferred from field exploration phase
Actual	$626,462	$650,000	$1,276,462	Reclamation costs as of 4/30/2007 (Total costs under MOU 06AG602084 minus $5200 for construction-phase work conducted before execution of MOU 07AG602201)

The difference between Reclamation's August 2005 estimate for full Reclamation design and procurement ($1,512,363) and the actual cost of the shared design and procurement ($1,276,462) was $235,901, or 15.6 percent. The difference between Reclamation's August 2005 estimate for Northern/URS design and procurement ($1,096,477) and the actual cost of the shared design and procurement effort was $179,985, or 16.4 percent.

[9] Reclamation costs as of 4/30/2007 (Total costs under MOU 06AG602084 minus $5200 for construction-phase work conducted before execution of MOU 07AG602201)

[10] This total does not include costs incurred by Northern.

Evolution of Non-Contract Costs (Construction and Post-Construction)

GEI's **1999** feasibility study estimated construction administration and post-design engineering costs of 7.5 percent of the Direct Construction Subtotal, or $130,000 for configurations not including hydroelectric generation.

Reclamation's original (**2002**) feasibility-level estimate did not break out the construction and post-construction phase costs, but included them in a general estimate of 35 percent of the field costs for total non-contract costs throughout the project, including design.

In **August 2005**, Reclamation estimated the construction phase non-contract costs for the project to be $1,069,831, assuming Reclamation administered the contract and took the lead role in construction management. The estimated construction-phase cost for a situation with URS design, Northern procurement, and URS construction management was estimated at $1,268,320, based on an estimate prepared by URS and including Reclamation costs of $4,740 for construction management and $269,320 for construction oversight. These estimates are reflected in Table 3 in the set of columns labeled "ESTIMATED COSTS - SINGLE DESIGNER/CONSTRUCTOR (August 2005)".

In **2007**, Reclamation and URS developed estimates for their respective roles in this phase of the project assuming Reclamation would focus its efforts on oversight of the tunnel construction with some oversight on the rest of the project, while URS and Northern would take the lead in contract administration and construction management for the overall project. The Reclamation estimates for the Construction and Post-Construction phases reflected in Table 3 in the set of columns labeled "ESTIMATED COSTS - BIFURCATED DESIGN/CONSTRUCTION (from MOUs)" are those agreed to and included in MOU No. 07AG602201 executed on March 5, 2007, plus $5200 for tasks completed after award of the construction contract, but prior to implementing an MOU for the construction/post-construction phase. They are distributed as follows:

Table 2 - Reclamation and URS 2007 Estimates of Non-Contract Costs

	Reclamation	URS	Total
Construction Phase	$362,449	$824,801	$1,187,250
Post-Construction Phase	$46,317	$46,937	$93,254
Total	$408,766	$871,738	**$1,280,504**

Conclusions

1. The feasibility-level estimated contract cost developed by Reclamation in 2002 ($7.6 million in 2002 dollars) equates to $9.8 million when adjusted to 2007 dollars, and is very close to the contract cost awarded to SEMA in March 2007 ($9.8 million).
2. Reclamation's actual costs for design data analysis, design and specification preparation ($626,462[11]) were under the July 2006 budget ($667,538) by $41,076, or 6.2 percent, and the design was completed within the design schedule.
3. URS' actual costs for design data analysis, design and specification preparation ($650,000) were under their December 2005 estimate ($751,114) by $101,114, or 13.5 percent, and the design was completed within the design schedule.
4. The current estimate for the total non-contract costs is $2,556,996. This sums the *actual* Reclamation and URS costs for design and procurement ($1,276,462) and the current *estimated* Reclamation and URS costs for contract administration and construction management ($1,280,504).
5. In August of 2005, Reclamation estimated its non-contract costs (design, procurement, contract administration, and construction management) for a Reclamation-led effort would be $2,582,194 (see Table 3).
6. Based on the latest estimates of each, the shared approach to design, procurement, contract administration, and construction management shows a net savings to Northern of $25,198 in non-contract costs when compared to a Reclamation-led effort.

Lessons Learned

1. Estimated design and construction costs evolve as project scope is better defined. Several actions facilitate development of an accurate cost estimate, including:
   - Collection of site-specific design data
   - Ensuring that any design and/or construction cost estimates provided by Reclamation are fully reviewed and accurately reflect current assumptions before providing them to their stakeholders.

[11] Reclamation costs as of 4/30/2007 (Total costs under MOU 06AG602084 minus $5200 for construction-phase work conducted before execution of MOU 07AG602201)

- Development of a common understanding of the project's technical requirements among all parties (i.e., Reclamation, its stakeholders, and their consultants) to avoid development of projected costs based on widely differing views of the project configuration.

- At least in this case, once the design and construction professionals of Reclamation and its stakeholder developed a common understanding of the project's technical requirements, their estimated design and construction costs were somewhat similar.

2. Remaining differences in the projected design costs were largely due to differing philosophies as to whether the design and specifications should be predominately site-specific designs and prescriptive specifications or should use more "standard" designs and/or performance specifications.

3. Development and implementation of a detailed project management plan were critical to maintaining a common understanding of the project status and potential future changes. Plan features should include:
   - Periodic project status reports
   - Intermediate target dates as the designs are developed
   - Regularly scheduled meetings of a small senior management level Project Management Team made up of Reclamation and partner staff
   - A process by which Project Management Team members communicate with other members of their organization
   - A well-defined process for identifying and agreeing to any changes in project scope, schedule, and/or cost

4. Periodic face-to-face meetings integrating design and construction professionals as well as senior executives from both Reclamation and its partner provide an efficient and effective method of ensuring a common understanding of the project.

5. Reclamation's willingness to be flexible in its requirements concerning responsibility for project design, procurement, and construction management can result in total project cost savings to the benefit of project beneficiaries who are responsible for payment of project costs.

Table 3 - Comparison of Carter Lake Design/Contract Administration/Construction Management Cost Estimates

	ESTIMATED COSTS - SINGLE DESIGNER/CONSTRUCTOR (August 2005)		ESTIMATED COSTS - SHARED DESIGN, RECLAMATION PROCUREMENT AND CONSTRUCTION MANAGEMENT (Reclamation's August 2005 Estimate)			ESTIMATED COSTS - SHARED DESIGN, NORTHERN PROCUREMENT, URS CONSTRUCTION MANAGEMENT (from MOUs/Contract)		
Project Feature	**Reclamation**	**District/URS**	**Reclamation**	**District/URS**	**Total**	**Reclamation**	**District/URS**	**Total**
Intake Structure	$186,044	$64,636	$0	$64,636	$64,636	$0		
Intake Tower (Str. Analysis Only)	$36,796	$46,290	$0	$46,290	$46,290	$0		
Tunnel	$183,820	$98,042	$183,820	$0	$183,820	$202,104		
Discharge Portal	$23,740	$15,678	$0	$15,678	$15,678	$0		
Outlet Pipe	$95,816	$63,351	$0	$63,351	$63,351	$0		
Canal Transition	$75,280	$22,756	$0	$22,756	$22,756	$0		
Control Building	$57,608	$121,598	$0	$121,598	$121,598	$0		
Project-Wide	$40,568	$49,591	$18,904	$49,591	$68,495	$19,352		
Specifications & Cost Estimates	$260,788	$122,610	$116,836	$101,105	$217,941	$90,486		
Documentation	$70,108	$44,600	$37,140	$44,600	$81,740	$36,840		
Design Data	$130,960	$81,268	$104,560	$23,059	$127,619	$111,811		
Project Management	$178,006	$154,277	$116,022	$70,991	$187,013	$101,709		
Acquisition	$82,150	$85,060 [2]	$50,774	$15,000 [4]	$65,774	$26,285		
NEPA Compliance	$17,679	$17,679	$17,679	$0	$17,679	$21,477		
TOTAL (Design & Procurement Only)	**$1,439,363**	**$987,436**	**$645,735**	**$638,655**	**$1,284,390**	**$610,064**		
Reviews of Designs by Others	$73,000 [1]	$109,041	$50,626	$16,600 [5]	$67,226	$52,195		
TOTAL (Design & Procurement Plus Review of Work by Others)	**$1,512,363**	**$1,096,477**	**$696,361**	**$655,255**	**$1,351,616**	**$662,259**	**$751,114**	**$1,413,373**
Contract Administration	$24,350	$0	$24,350	$0	$24,350			
Construction Management	$1,045,481	$999,000 [3]	$876,081	$170,000 [6]	$1,046,081			
Construction Oversight		$269,320						
TOTAL (Construction Phase)	**$1,069,831**	**$1,268,320**	**$900,431**	**$170,000**	**$1,070,431**	**$357,249**	**824,801**	**$1,182,050**
Post-Construction						$46,317	46,937	$93,254
TOTAL	**$2,582,194**	**$2,364,797**	**$1,596,792**	**$825.255**	**$2,422,047**	**$1,065,825**	**$1,622,852**	**$2,688,677**

= Not Estimated

Notes:

1 Reclamation estimate of cost of URS review
2 Includes $10, 420 for Reclamation participation in contractor selection
3 From District proposal, November 2003
4 Includes $15,000 for Reclamation participation in contractor selection
5 Reclamation estimate of cost of URS review of tunnel design
6 Reclamation estimate of cost of URS review of submittals