

MUTHANNA VILLAGE ROADS  
SEGMENT 4  
GOVERNORATE OF  
MUTHANNA, IRAQ

**PROJECT NUMBER SIGIR-PA-06-055**

**JUNE 30, 2006**



## SPECIAL INSPECTOR GENERAL FOR IRAQ RECONSTRUCTION

June 30, 2006

MEMORANDUM FOR COMMANDING GENERAL, MULTI-NATIONAL FORCES -  
IRAQ  
COMMANDER, GULF REGION DIVISION-PROJECT AND  
CONTRACTING OFFICE, U.S. ARMY CORPS OF  
ENGINEERS  
DIRECTOR, IRAQ RECONSTRUCTION MANAGEMENT  
OFFICE

SUBJECT: Report on Project Assessment of the Multhanna Village Roads Segment 4,  
Muthanna Governorate, Iraq (Report Number SIGIR-PA-06-055)

We are providing this project assessment report for your information and use. We assessed the in-process construction work being performed for the Muthanna Village Roads, Segment 4 construction to determine its status and whether intended objectives will be achieved. This assessment was made to provide you and other interested parties with real-time information on a relief and reconstruction project underway and in order to enable appropriate action to be taken, if warranted. The assessment team included an engineer and an auditor.

Additionally, the Commander, Gulf Region Division-Project and Contracting Office, generally concurred with the information, conclusions, and recommendations in the draft of this report. However, the Commander, Gulf Region Division-Project and Contracting Office did not concur with one section of the report based on information provided in the SIGIR interview with the Gulf Region Division Resident Engineer. There was an apparent misinterpretation by the SIGIR assessment team regarding the information provided by the Resident Engineer. Therefore, the statements in question contained in the draft report have been removed from the final report. The other comments received from the Commander, Gulf Region Division-Project and Contracting Office addressed the issues raised in the report and the actions taken and planned should correct the issues we identified. As a result, comments on this final report are not required.

We appreciate the courtesies extended to our staff. This letter does not require a formal response. If you have any questions please contact Mr. Brian Flynn at (703) 604-0969 or [brian.flynn@sigir.mil](mailto:brian.flynn@sigir.mil) or Mr. Andrew Griffith, P.E., at (703) 343-9149 or [andrew.griffith@iraq.centcom.mil](mailto:andrew.griffith@iraq.centcom.mil).

Stuart W. Bowen, Jr.  
Inspector General

# Special Inspector General for Iraq Reconstruction

SIGIR-PA-06-055

June 30, 2006

## Muthanna Village Roads – Segment 4 Governorate of Muthanna, Iraq

### Synopsis

**Introduction.** This project assessment was initiated as part of our continuing assessments of selected sector reconstruction activities for Facilities and Transportation. The overall objectives were to determine whether selected sector reconstruction contractors were complying with the terms of their contracts or task orders and to evaluate the effectiveness of the monitoring and controls exercised by administrative quality assurance and contract officers. We conducted this project assessment in accordance with the Quality Standards for Inspections issued by the President's Council on Integrity and Efficiency. The assessment team included a professional engineer and an auditor.

**Project Assessment Objectives.** The objective of this project assessment was to provide real-time relief and reconstruction project information to interested parties in order to enable appropriate action, when warranted. Specifically, we determined whether:

1. Project components were adequately designed prior to construction or installation;
2. Construction or rehabilitation met the standards of the design;
3. The Contractor's Quality Control plan and the United States Government's Quality Assurance program were adequate;
4. Project results were consistent with original objectives; and
5. Project sustainability was addressed.

**Conclusions.** The assessment determined that:

1. The design provided to the United States Army Corps of Engineers Resident Office staff was not complete. The contract drawings included only basic cut and fill roadway cross sections, as well as typical details on reinforced concrete pipe culverts, curbs, and retaining walls. There were no details in the contract drawings on box culverts, such as reinforcing steel requirements, wall and slab thickness, headwall and wing wall dimensions, and backfill requirements. In addition, the Iraq State Commission for Roads and Bridges developed drawings containing centerline and vertical profiles that were provided directly to the contractor. The Deputy Manager for Transportation in the Gulf Region Division and the Project and Contracting Office were aware of this procedure, but the Muthanna Resident Office staff did not have the centerline and vertical profile drawings, nor were they aware the Iraq State Commission on Roads and Bridges provided the centerline and vertical profile drawings to the contractor. There appeared to be a disconnect regarding information flow between the Gulf Region Division, the Project and Contracting Office Facilities and Transportation Sector, and the Muthanna Resident Office staff.

2. The construction appeared to be consistent with the intent of the project. Security conditions prevented the assessment team from visiting the project site and observing any on-site construction. Thus, the conclusion is based on a review of the contract files, including quality assurance reports and progress photos, as well as interviews with the United States Army Corps of Engineers Area and Resident Office staff. The United States Army Corps of Engineers Iraqi Quality Assurance Representative identified and documented construction deficiencies as they occurred, as well as corrective action taken by the contractor.
3. The contractor's Quality Control plan was sufficiently detailed to effectively guide the contractor's quality management program. The contractor did not submit quality control reports, and the United States Army Corps of Engineers Resident Engineer did not enforce the contractor to provide quality control reports. In addition, the contractor did not maintain deficiency logs to document problems noted with construction and/or renovation activities.

The Government Quality Assurance program was effective in monitoring the contractor's Quality Control program for the Muthanna Village Road project. In addition, the quality assurance activities were sufficiently and accurately documented. This condition occurred due to the efforts of the Iraqi Quality Assurance Representative during the course of the project.

4. If the current level of oversight continues by the United States Army Corps of Engineers, Muthanna Resident Office, the project when completed should meet and be consistent with the original contract objectives. The completed project should result in a paved two-lane, 34 kilometer road in the Muthanna Governate.
5. A review of the contract file and discussions with the United States Army Corps of Engineers, Resident Engineer disclosed no sustainability issues associated with the project. There was no specialized equipment provided by the contract, nor was there a need for any maintenance manuals.

**Recommendations.** On current and future village road projects, the Gulf Region Division-Project and Contracting Office should provide to their respective district area and resident offices:

- The appropriate centerline and profile drawings prepared by the Iraq State Commission of Roads and Bridges; and
- Standard or project specific reinforced concrete box culvert drawing details.

**Management Comments.** The Gulf Region Division generally concurred with the information, conclusions and recommendations contained in the draft report with one exception concerning a section in the report regarding the use of the triple pipe culvert design provided in the contract statement of work in lieu of box culverts.

**Evaluation of Management Comments.** SIGIR noted the comments provided by the Gulf Region Division. With regard to the section in the report pertaining to the use of the triple pipe culvert design in lieu of box culverts, SIGIR removed the statements in question from the final report.

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# **Introduction**

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## **Objective of the Project Assessment**

The objective of this project assessment was to provide real-time relief and reconstruction project information to interested parties in order to enable appropriate action, when warranted. Specifically, we determined whether:

1. Project components were adequately designed prior to construction or installation;
2. Construction or rehabilitation met the standards of the design;
3. The Contractor's Quality Control (CQC) plan and the United States Government's Quality Assurance (QA) program were adequate;
4. Project results were consistent with original objectives; and
5. Sustainability was addressed.

## **Pre-Site Assessment Background**

### **Contract and Costs**

The Muthanna Village Roads Project is funded through the U. S. Government's appropriated Iraq Relief and Reconstruction Fund and administered through the Facilities and Transportation Sector of the Project and Contracting Office (PCO). The PCO awarded contract W914NS-05-C-0029, a firm fixed price contract, for \$2,888,268 to the Ashour General Construction Contracting Company on 13 November 2004. The contract period was for 365 days from the date of the preconstruction conference. The U.S. Army Corps of Engineers (USACE) Gulf Region Division (GRD) - South District (GRS) is administering the contract construction.

There were four modifications to the initial contract:

- Modification #P0001, issued 29 November 2004, changed the contract number from W914NS-05-C-0029 to W914NS-05-C-0041. There was no change to contract funding.
- Modification #P0002, issued 24 October 2005, to make an equitable adjustment in the contract due to a rise in the price of materials. The contract was increased by \$51,000 from \$2,888,268 to a contract value of \$2,939,268.
- Modification #P0003, issued 12 November 2005, was for an administrative change to the contract. There was no change to contract funding.
- Modification #P0004, issued 27 December 2005, was for an administrative change to the contract. There was no change to contract funding.

The contract required the contractor to complete the project in 365 days from the date of the preconstruction conference. According to the USACE GRS fact sheet, the pre-construction meeting was held on 20 December 2004, and construction began on 6 January 2005. According to the USACE GRS Muthanna Resident Engineer (RE), the USACE-GRS intends to issue another modification to extend the required contract completion date in conjunction with another possible modification for quantity adjustment.

## Project Objective

The objective of the Segment 4 project was to construct 34 kilometers (km) of paved village roads in the northern part of the Muthanna Governorate for everyday use by the local population. Diagram 1 provides the route location of the roads, based on the original contract scope of work.

## Description of the Facility (preconstruction)

The description of the facility (preconstruction) was based on information obtained from the contract and the USACE project file. The northern part of the Muthanna Governorate is primarily agricultural land. Due to the conditions of the local roads, farmers were experiencing difficulty transporting their crops to the grain silos located in the city of Samawah. The Iraq State Commission on Roads and Bridges (SCRB) prioritized a list of unpaved roads (including Segment 4) in need of upgrade within the rural areas of the Muthanna Governorate.

The Segment 4 road project site is shown in Diagram 1. The project site is located north of the city of Samawah and the Euphrates River. The terrain along the 34 km project length is level or slightly rolling. The original scope included a spur off the main route from the Al Risala Bridge heading north for several kilometers. The spur route is shown in green on Diagram 1. However, based on discussions with the USACE RE and documentation provided by PCO, the northern spur section is not in the current scope. The USACE RE did indicate that this northern spur could be constructed if funding became available.

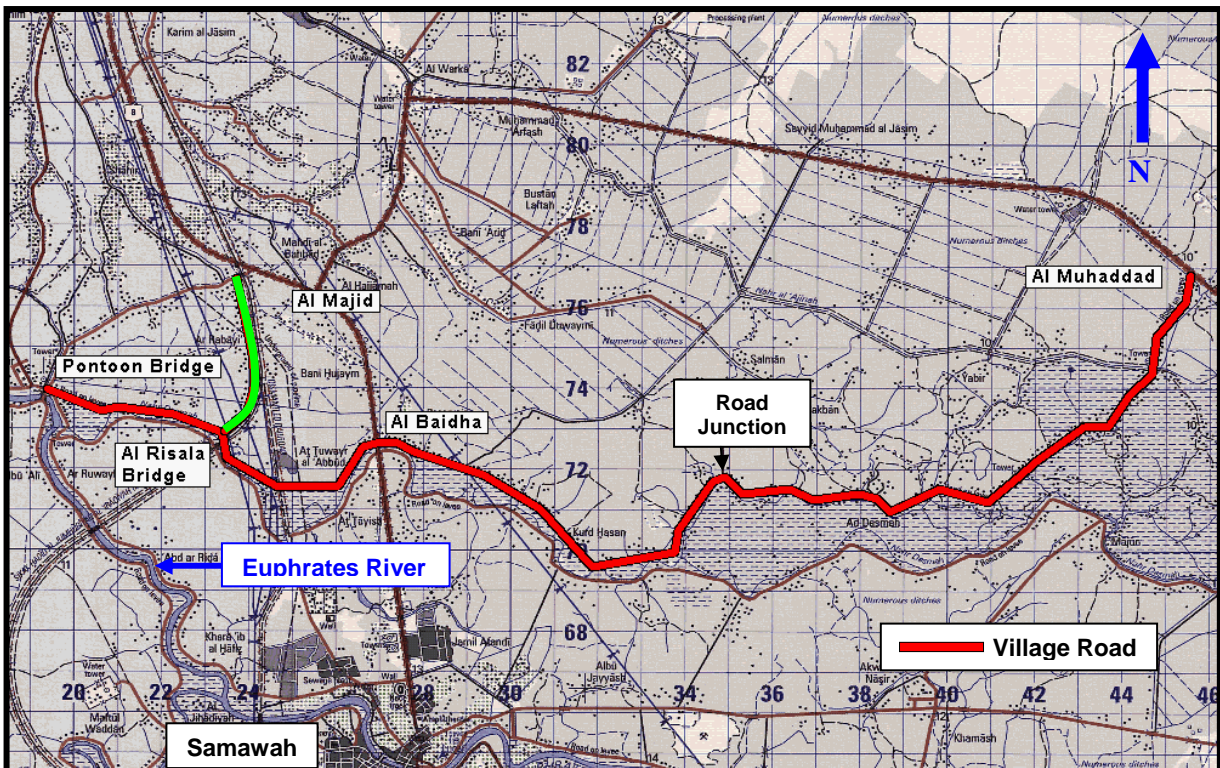


Diagram 1: Muthanna village roads segment 4 project



Key points along the project length (e.g., bridge crossings, road intersections, culvert crossings) were referenced using stations<sup>1</sup>. On this project, a station consisted of 1 kilometer in horizontal distance, subdivided in meters. For example, “Station 1+234” is a point along the project route that is 1.234 kilometers or 1,234 meters from the starting point of the project. On the Muthanna Village Road project, station 0+000 is located at the beginning of the project at the Pontoon Bridge. Station 9+500 is at Al Baidha. The eastern terminus of the project is at Al Muhaddad, Station 34+000.

Based on information provided to the assessment team by the USACE RE, the project was subdivided into three sections (listed and shown in Diagram 2), along the 34 km route.

Section	From:	To:
1	0+000 (Pontoon Bridge)	9+500 (Al Baidha)
2	9+500 (Al Baidha)	20+800 (Road Junction)
3	20+800 (Road Junction)	34+000 (Al Muhaddad)

**Diagram 2: Project section limits along the 34 km road length**

### **Scope of Work of the Contract**

Based on the contract Scope of Work (SOW), the major tasks for the 34 km Segment 4 village road project included:

- Earthwork (cut and fill sections)
- Building a crushed aggregate sub-base
- Paving an asphalt bituminous base course
- Constructing soil shoulders
- Providing cross drainage structures (culverts) where necessary

### **Current Project Design and Specifications**

#### **Design and Specification Requirements**

The SOW required the contractor to review the existing design, revise and complete the design as necessary, and construct the roads. The existing design drawings provided in the contract included two typical cross sections of the roadway, one for a fill section, and the other for a cut section. In addition, the contract contained drawings that provided typical details for reinforced concrete pipe culverts, concrete

<sup>1</sup> A station is a unit of measurement for referencing horizontal distance along the route of a highway construction project.



retaining walls, and concrete curbs. However, the contract drawings did not show the locations along the route for these items.

The contract included a bill of quantities (BOQ) for quantifying the material requirements on the project. The BOQ consisted of requirements and quantities for construction of:

- Cut sections (earthwork, i.e., clearing, grubbing, material removal etc.)
- Fill sections (earthwork, i.e., clearing, grubbing, adding suitable fill material, etc.)
- 30 centimeter (cm) compacted sub-base layer
- 10 cm asphalt base course layer<sup>2</sup>
- Reinforced concrete box culverts
- Reinforced concrete pipe culverts

The SOW requirements for design and construction work included adherence to the specifications in the design criteria manual “Republic of Iraq; Ministry of Construction and Housing; State Organization of Roads and Bridges; Highway Design Manual; 1982 Design & Study Department; Road and Traffic Division”, and standard Iraqi specifications found in the publication “Republic of Iraq; Ministry of Construction and Housing; State Organization of Roads & Bridges; Standard Specifications for Roads and Bridges; Department of Design Studies, 1983.” The USACE RE maintained a copy of the Iraqi Standard Specifications for Roads and Bridges at the Resident Office.

In addition to the standard drawings provided in the contract SOW, the SOW stated that the Iraq Ministry had previously surveyed the village roads in the Muthanna Governorate and the Ministry had prepared plan and profile grade drawings for the roads, which were available upon request. The SOW required the contractor to verify the existing site surveys, perform construction surveying and geotechnical investigations (as required), and provide as-built computer aided design (AutoCAD version 2002) drawings.

The SOW required the contractor to verify the designs, BOQs, roadway alignment, geometry, profile grades, and typical cross-sections as provided by the Iraqi Ministry. According to the PCO Transportation Sector Deputy Program Manager, the Iraq Ministry of Construction and Housing, the SCRIB planned and surveyed the route locations for the village road projects in Muthanna and other governorates. The SCRIB prepared basic layout drawings based on the survey information for the 34 km route to include:

- Horizontal curve locations with design parameters (degree of curvature, radius, etc)
- Profile views of the roadway showing existing grades and the proposed road grade
- Reinforced concrete pipe and box culvert locations

In an interview, the PCO Transportation Sector Deputy Program Manger confirmed the SCRIB provided these drawings to the contractor prior to the start of construction. Conversely, in an interview with the assessment team, the USACE RE stated that the USACE Resident Office did not have any design drawings showing plan and profiles for the Muthanna village road project. The USACE RE

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<sup>2</sup> The base layer is the wearing surface layer of asphalt pavement.

indicated the contractor was creating profile sheets as the contractor constructed the road based on the existing sub-grade levels.<sup>3</sup>

Although the contract provided drawings showing standard cross sections and typical culvert details it did not include any design details for box culverts. Box culverts are reinforced concrete structures, either square or rectangular shaped, which allow water to flow underneath the roadway.

### Design Submittal Requirements

The SOW required the submission of bituminous asphalt concrete mix designs. The assessment team verified the submission of a bituminous mix design by the contractor.

The SOW required drawings and design changes, as necessary. A review of contract records showed the contractor did not submit drawings or design changes, nor had the PCO or USACE Resident Office requested them.

### Design Assessment Summary

The design drawings provided in the contract lacked details on the box culverts such as reinforcing steel requirements, wall and slab thickness, headwall and wing wall dimensions, and back fill requirements.

There was an information disconnect between the USACE Resident Office and PCO. The USACE RE did not have the roadway centerline and profile drawings, nor was the USACE RE aware that the drawings had been prepared by the SCRB and provided to the contractor. However, PCO's Deputy Transportation Sector Manager was aware that the SCRB prepared the drawings and furnished the drawings to the contractor.

## **Site Assessment**

At the time of our visit to the USACE RE office, official security representatives could not escort the inspection team to the project site because they did not consider it to be safe. Therefore, our project assessment relied solely on information obtained from the contract files and interviews with the USACE RE and the PCO Transportation Sector Manager and Deputy Manager. Information contained in the contract files included the design drawings, the USACE quality assurance reports and photographs, and correspondence between the Resident Office and the contractor.

In assessing the village road project, we focused on the completed earthwork associated with the cut and fill sections, the sub-base and asphalt base course construction, and the construction of the reinforced concrete pipe and box culverts. According to the USACE RE, the project was approximately 50% complete as of 12 April 2006.

### Work Completed

The contractor had not completed any of the work items listed in the project scope when the assessment team interviewed the USACE RE on 12 April 2006.

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<sup>3</sup> Subgrade refers to the earth material underneath the constructed pavement layers (i.e., crushed aggregate sub-base, and asphalt base).

## Work in Progress

At the time of our visit to the USACE RE office, the contractor was not working, nor was there any record of the contractor being on site during the month of January. The USACE RE was considering issuance of a cure notice requesting a recovery plan because of the contractor's failure to complete the project.

## Earthwork

The contract BOQ included requirements for earthwork cut and fill sections.

For cut sections, the BOQ required the contractor to:

*“Open a box on the embankment to a depth mentioned on the drawings, with a width of 6.5 m [meters], and make use of the soil to widen the embankment in the needed places and complete the shoulders including the spraying of water and compaction according to section R2, R5 of the general specifications for Roads and Bridges and instructions of the RE.”*

Diagram 3 illustrates the typical cut section provided in the contract drawings. On a cut section, unneeded materials are removed so as to match the elevations provided in the design profile. The excess materials removed can then be used to widen the embankment (if needed) or to build fill sections of the roadway.

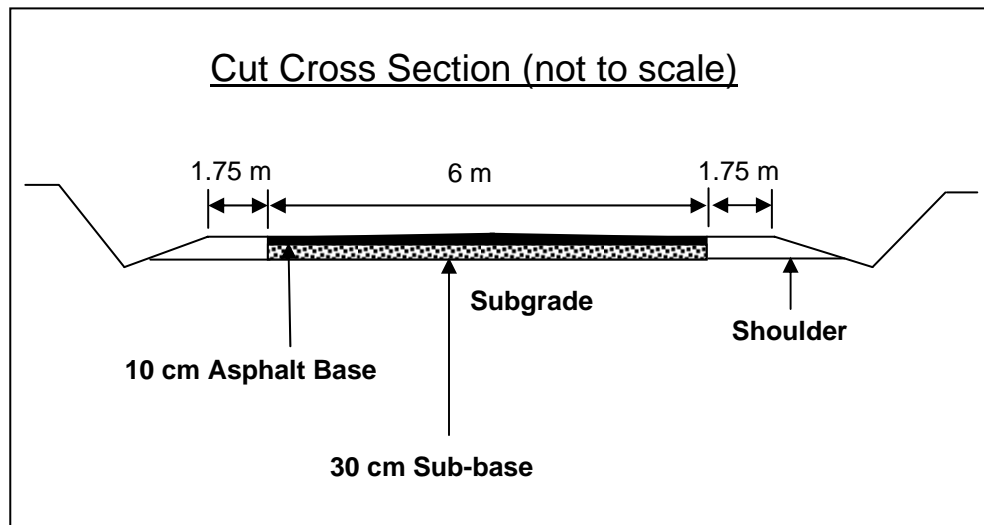
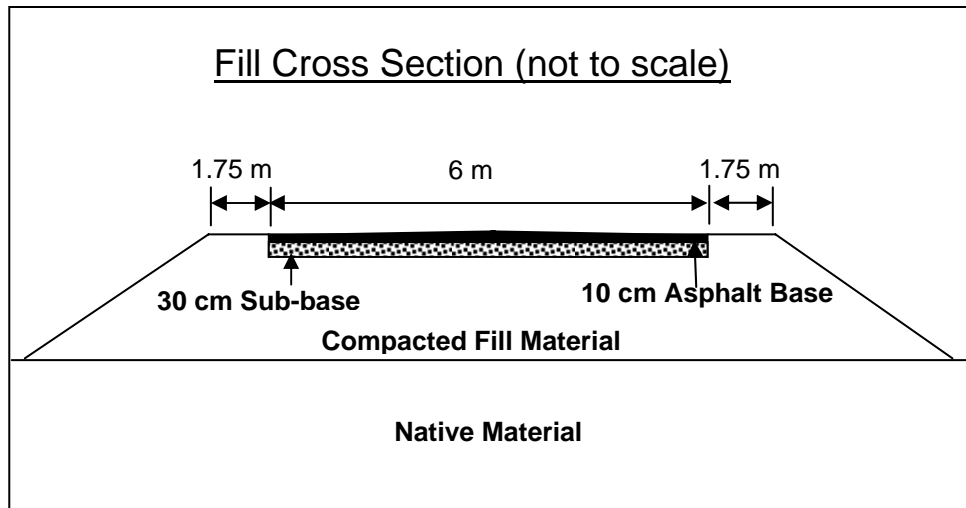


Diagram 3. Typical cut cross section

For fill sections, the BOQ required the contractor to widen the existing embankment in the places needed to include:

*“Clearing and grubbing of the natural ground and side slopes making use of the soil from opening the box and bringing the rest from right of way according to section R2, R5, of the general specification for Roads and Bridges and instruction of RE.”*

For an illustration of the typical fill cross section provided in the contract drawings, see Diagram 4.



**Diagram 4. Typical fill cross section**

The USACE RE stated that the project has some cut and fill sections, and the contractor experienced problems with obtaining fill material adjacent to the roadway due to objections from the farmers living alongside the roadway. Therefore, the contractor was compelled to cut and fill within the roadway limits. As a result, there are some switchbacks in the roadway alignment because there was not enough fill to straighten out the roadway. Consequently, the USACE RE indicated that a modification was pending to add the hauling and placement of 140,000 cubic meters ( $m^3$ ) of borrow material to complete the fill sections on the village road project.

Based on the most recent contractor invoice submitted to the USACE RE on 20 December 2005, the contractor had been approved for payment for completing 42,000  $m^3$  of the total requirement of 48,549  $m^3$  of earthwork on cut sections. On fill sections, the USACE RE had approved for payment 84,000  $m^3$  of the total requirement of 260,000  $m^3$ .

There appeared to be no qualitative issues associated with the earthwork removal and placement based on a review of the USACE QA deficiency logs.

#### Aggregate Sub-base

The contract BOQ and typical cross section drawings required the contractor to spread the sub-base layer, using Type B material with a thickness of 30 cm and a width of approximately 6.5 m in accordance with Section R6 of the Iraq Standard Specifications for Roads and Bridges, and direction from the USACE RE. According to the Iraq Standard Specifications for Roads and Bridges, Type B sub-base material is a sand-gravel mixture containing coarse and fine aggregate. The specifications required the coarse aggregate to consist of hard, durable particles or fragments of gravel free from dirt and other objectionable matter. In addition, the specifications required the fine aggregate to be natural sand, free from organic and other objectionable matter.

The BOQ required 66,203  $m^3$  of sub-base material. The contractor divided the construction of the sub-base into two layers, each 15 cm in depth. The USACE RE's summary report dated 19 April 2006 indicated the sub-base was nearly complete. The report showed the bottom 15 cm layer was complete from station 0+000 (the

Pontoon bridge), to station 29+000, a distance of 29 kilometers. The report noted the top layer of sub-base was complete for five kilometers in Section 1 (Station 0+000 to 5+000) and 9.5 kilometers in Section 2 (Station 9+500 to Station 19+000).

Based on a review of the quality assurance reports and photos, it appeared the contractor used suitable material for constructing the sub-base. The contractor would deliver the material to the roadway, and then spread and level the material with a motor grader as shown in Site Photo 1.



**Site Photo 1. Contractor motor grader leveling the sub-base – Photo provided by USACE**

To achieve the compaction requirements stated in the Iraq Standard Specifications for Roads and Bridges, the Contractor added water as shown in Site Photo 2 to spread the sub-base material in order to achieve an optimum moisture content<sup>4</sup> to facilitate proper compaction.

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<sup>4</sup> The amount of water at which the maximum density of a material can be obtained within a given compactive effort.



**Site Photo 2. Water distributor adding moisture to the sub-base – Photo provided by USACE**

To compact the sub-base, the contractor utilized rubber tire pneumatic rollers and steel drum rollers as shown in Site Photos 3 and 4, respectively. In constructing a sub-base, the most positive means of determining and monitoring the adequacy of water and compactive effort is with field density tests. The assessment team verified that the contractor conducted density tests on the sub-base, which were documented in the USACE QA reports. The testing records provided to the team indicated testing was performed at every 200 meters. The USACE RE stated that the Director General (SG) for the SCRIB oversees the testing, and an SCRIB technician performs the testing.



**Site Photo 3. Compacting the sub-base with a pneumatic rubber tired roller – Photo provided by USACE**



**Site Photo 4. Compacting the sub-base with a steel wheeled roller – Photo provided by USACE**

During the sub-base construction, the USACE QAR identified and documented problems in the deficiency log. For example, the USACE QAR noted in the deficiency log on 18 February 2006, the contractor had used poor quality sub-base material that did not comply with the Iraq Standard Specifications for Roads and

Bridges between stations 6+000 and 7+500. Four days later the contractor corrected the deficiency.

Overall, based on our review of the contract documents and discussions with the USACE RE, it appeared the construction of the sub-base, completed as of mid-April 2006, was in accordance with the contract requirements.

#### Asphalt Concrete Base Course

The BOQ and typical cross section drawings required the contractor to spread the base layer of asphalt concrete with a thickness of 10 cm and width of 6 m. The contract required the asphalt concrete paving to be in accordance with Section R9 and R8A of the Standard Specifications for Roads and Bridges, and directions from the USACE RE. Based on the status report provided by the USACE RE, the contractor had paved approximately 4 km in Section 1 (stations 0+000 to 4+000) and about 8 km in Section 2 (between stations 9+500 and 17+000).

The contractor utilized a self-propelled paver for spreading asphalt concrete. The haul trucks carrying the asphalt concrete from the mixing plant, directly deposited their load into the paver hopper as shown in Site Photo 5.



**Site Photo 5. Placing and spreading asphalt concrete pavement –Photo provided by USACE**

The Iraq Standard Specifications for Roads and Bridges required the asphalt concrete mat to be compacted by rolling immediately after the paver spread the asphalt concrete mix. Site Photo 7 shows the rolling operations taking place on the asphalt concrete base layer.





**Site Photo 6. Steel wheel roller behind paver compacting the asphalt concrete layer – Photo provided by USACE**

Since paving operations began on the project, the USACE Iraqi QAR identified problems as they occurred on road segments, which were documented in the QA reports and deficiency logs. Examples of some of the problems included:

- The prime coat<sup>5</sup> application rate did not meet coverage requirements (not less than 0.5-1.2 liters per square meter) prior to paving between stations 14+500 and 14+650 (Site Photo 7).
- The outside edge of the pavement between stations 9+500 and 10+000 was uneven, resulting in some of the asphalt mix sloughing off from the mat (Site Photo 8).
- The improperly constructed fill to support the base and sub-base layers and the lack of adequate sub-base width in roadway sections between stations 0+000 and 9+5000 (Site Photo 9).

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<sup>5</sup> A coating of asphalt oil (typically an emulsified asphalt), used to seal the sub-base and enhance bonding to the asphalt concrete course.



**Site Photo 7. Lack of sufficient prime coat on sub-base prior to paving – Photo provided by USACE**



**Site Photo 8 – Asphalt along edge that is “Sloughing Off of the Mat” – Photo provided by USACE**



**Site Photo 9. Asphalt mix sloughing off along pavement edge due to poor sub-base and fill construction – Photo provided by USACE**

The QAR’s deficiency log indicated the contractor took corrective action to fix the prime coat problems. According to the USACE RE, the pavement edge problems will not be corrected until the 1.75 m wide shoulders are in place alongside the paved base layer. Once the shoulder work is complete the deficient pavement areas will be repaired to their required widths. In the case of the problems shown in Site Photo 9, the USACE RE reported the road will be repaired when the additional borrow is available to widen the roadway fill structure (Diagram 3) in order to obtain the required section widths for the sub-base, pavement, and shoulders.

#### Culvert Construction

The BOQ required three types of culverts:

- 1.0 m diameter reinforced concrete pipe culverts
- 0.75 m diameter reinforced concrete pipe culverts
- Reinforced concrete box culverts

Based on discussions with the USACE RE, the original BOQ quantities changed after the construction began. Table 1 provides the original and updated quantities, as well as the quantities completed as of 12 April 2006.

Item	Original Quantity	Updated Quantity	Completed Quantities <sup>6</sup>
1.0 m reinforced concrete pipe culverts (linear meter)	300	215	215
0.75 m reinforced concrete pipe culverts (linear meter)	1,400	1,360	1,275
Reinforced concrete box culverts (m <sup>3</sup> )	400	264	214

**Table 1. BOQ quantities and actual totals for culvert construction**

<sup>6</sup> Table 1. The Completed Quantities column is current as of 12 April 2006.

The BOQ required construction of reinforced concrete pipe culverts, in accordance with Sections R3, R5, and R8 of the Iraqi Standard Specifications for Roads and Bridges, and as directed by the USACE RE. The locations for the culverts were not specified in the contract, although they were shown on the centerline and profile drawings provided by the SCRB. The centerline and profile drawings showed the locations of:

- 17 reinforced concrete pipe culverts (1.0 m diameter)
- 80 reinforced concrete pipe culverts (0.75 m diameter)
- 10 reinforced concrete box culverts (8 culverts at 2.0 m x 1.5 m; 2 culverts at 1.5 m x 1.5 m)

Not all of the culvert locations shown on the centerline and profile drawings were documented as actual locations for constructed culverts in the USACE QA reports. However, the USACE RE stated that the Multhanna Governorate Director General for SCRB has been deciding where to place the culverts. Additionally, the USACE RE provided the assessment team with a summary listing dated 1 March 2006, indicating that a total of 74 culverts had been constructed including:

- 4 reinforced concrete pipe culverts (1.0 m diameter)
- 67 reinforced concrete pipe culverts (0.75 m diameter)
- 3 reinforced concrete box culverts

In addition, the summary shows the extension of 12 existing pipe culverts (0.5 m in diameter).

Although the assessment team could not verify the actual number of each type of culvert, we utilized the QA reports to review the construction of the culverts.

#### *Box Culverts*

The box culverts, as documented in the QA reports, were constructed as cast-in-place reinforced concrete structures. Site Photo 10 shows the bottom slab for a box culvert under construction at station 19+300. Site Photo 11 shows a similar type box culvert at station 24+745, with the reinforcing steel in place for the top slab prior to concrete placement. In our review of the QA reports and the USACE Iraqi QAR's deficiency logs, we did not find any deficiencies associated with the construction of the box culverts.





**Site Photo 10. Construction of reinforced concrete box culvert foundation – Photo provided by USACE.**



**Site Photo 11. Construction of reinforced concrete box culvert – Photo provided by USACE.**

### *Pipe Culverts*

Based on our review of the QA reports, it appeared that the reinforced concrete pipe culverts were constructed in the following manner:

1. Trench excavated to required depth.
2. Concrete poured to line the bottom of the trench.
3. Concrete pipe sections installed in concrete lined trench.
4. Concrete pipe sections jointed using a cement mortar to form a durable watertight joint.
5. Concrete poured to encase the concrete pipe.

6. Concrete headwalls constructed at each end of the concrete pipe.
7. Trench backfilled and compacted.

Site Photos 12 and 13 illustrate part of the construction process noted above. Based on the quantities shown in Table 1, over 90% of reinforced concrete pipe construction had been completed on the project as of 12 April 2006. The assessment team reviewed the USACE Iraqi QAR's deficiency logs and found the Iraqi QAR had documented deficiencies associated with the backfilling. In addition, the Iraqi QAR reported a deficiency when the contractor failed to prepare cube samples for concrete compressive strength tests or when the tests did not meet specification standards.



**Site Photo 12. Pipe culvert in trench –  
Photo provided by USACE**



**Site Photo 13. Pipe culvert encased in concrete –  
Photo provided by USACE**

### **Work Pending**

Remaining project work included completion of earthwork on primary fill sections. Other unfinished project work consisted of the bottom sub-base layer (15 cm) from Station 29+000 to station 34+000 and the top 15 cm layer of sub-base in portions of Sections 1, 2, and 3 of the roadway. In addition, 65% of the asphalt concrete base course paving remained, as well as all of the shoulder construction, although the concrete culvert construction was almost complete, with less than 10% remaining.

## **Project Quality Management**

### **Contractor's Quality Control Program**

The Muthanna Village Roads contract stated that the quality control shall be performed throughout the duration of design, construction, installation, testing, and acceptance. The contractor submitted a quality control (QC) plan. The plan addresses the QC organization; document control; design control; procurement control; control of subcontractors; special processes; inspection and testing; nonconforming items; and records. The plan also included a list of the definable features of work. We determined the contractor's QC plan met the standards addressed in Engineering Regulation 1180-1-6 (*Construction Quality Management*) or PCO Standard Operating Procedure CN-103 (*Contractor Construction Quality Control Plan*).

The contractor did not submit QC reports. The USACE Resident Engineer (RE) did not enforce the contractor to provide QC reports, which were supposed to contain information such as work accomplished each day with the location, activity and by whom, test results, deficiencies and corrective actions, labor distribution, equipment utilized, and material received on site. In addition, the contractor did not maintain deficiency logs to document problems noted with construction/renovation activities.

### **Government Quality Assurance**

Engineering Regulation (ER) 1110-1-12 and PCO Standard Operating Procedure CN-100 specify requirements for a Government QA program. The USACE Iraqi Quality Assurance Representative (QAR) maintained daily QA reports that documented any deficiencies noted at the site. Based on our review, we found the Iraqi QAR's reports to be sufficiently complete, accurate, and timely. In addition to containing project specific information to document construction progress and highlight deficiencies, the Iraqi QAR also supplemented them with detailed photographs that reinforced the narrative information provided in the reports. The USACE Iraqi QAR did maintain a QA deficiency log, and the Resident Engineer ensured that the deficiencies cited during QA inspections were corrected.

The Iraqi QAR was on site and managed the Muthanna road project. The Iraqi QAR spent time at the project site interacting with the contractor and observing the road construction activities. Further, the Iraqi QAR ensured that potential construction deficiencies were detected, evaluated, and properly corrected, in a timely manner.

The Government Quality Assurance program was effective in monitoring the contractor's Quality Control program for the Muthanna Village Road project. In addition, QA activities were sufficiently and accurately documented. This condition occurred due to the efforts of the Iraqi QAR during the course of the project.

### **Project Sustainability**

A review of the contract file and discussions with the USACE RE disclosed no sustainability issues associated with the project. There was no specialized equipment provided by the contract, nor was there a need for any maintenance manuals.

### **Conclusions.**

We reached the following conclusions for the assessment objectives 1, 2, 3, 4, and 5. Appendix A provides details pertaining to Scope and Methodology and limitations of this project assessment due to the security conditions at the project site at the time of our visit to the USACE RE.

1. Determine whether project components were adequately designed prior to construction or installation.

The design provided to the U.S. Army Corps of Engineers Resident Office staff was not complete. The drawings provided with the contract statement of work included only typical cut and fill roadway cross sections, as well as typical details on reinforced concrete pipe culverts, curb and retaining walls. The design drawings provided in the contract lacked details on the box culverts such as reinforcing steel requirements, wall and slab thickness, headwall and wing wall dimensions, and back fill requirements. In addition, the Iraq State commission for Roads and Bridges developed drawings



containing centerline and vertical profiles that were provided directly to the contractor. The Deputy Manager for Transportation in the Gulf Region Division and Project and Contracting Office was aware of this procedure, but the Muthanna Resident Office staff did not have the centerline and vertical profile drawings, nor were they aware the State Commission on Roads and Bridges provided them to the contractor. There appeared to be a disconnect regarding information flow between the Gulf Region Division and Project and Contracting Office Facilities and Transportation Sector and the Muthanna Resident Office staff.

2. Determine whether construction met the standards of the design.

Security conditions precluded the assessment team from visiting the site and observing any on-site construction. However, based on a review of the contract files, including quality assurance reports and progress photos, as well as interviews with the U.S. Army Corps of Engineers Area and Resident Office staff, the construction appeared to be consistent with the intent of the project. The U.S. Army Corps of Engineers Quality Assurance Representative maintained an active presence on the project site. The Quality Assurance Representative identified and documented construction deficiencies as they occurred, as well as the corrective action taken by the contractor.

3. Determine whether the Contractor's Quality Control plan and the Government Quality Assurance Program were adequate.

The contractor's Quality Control plan was sufficiently detailed to effectively guide the contractor's quality management program. The contractor did not submit QC reports, and the USACE Resident Engineer did not enforce the contractor to provide QC reports. The QC reports were to contain information such as work accomplished each day with the location, activity and by whom, test results, deficiencies and corrective actions, labor distribution, equipment utilized, and material received on site. In addition, the contractor did not maintain deficiency logs to document problems noted with construction/renovation activities.

The Government Quality Assurance program was effective in monitoring the contractor's quality control program. The Project Engineer and the Iraqi QAR ensured all deficiencies cited during QA inspections were corrected. The QAR also maintained daily QA reports containing project-specific information to document construction progress and highlight deficiencies. The QAR also supplemented the daily reports with detailed photographs reinforcing the narrative information provided in the reports. The USACE Iraqi QAR did maintain a QA deficiency log, and the Resident Engineer ensured the deficiencies cited during QA inspections were corrected.

4. Determine whether project results were consistent with original objectives.

If the current level of oversight continues by the U.S. Army Corps of Engineers Muthanna Resident Office, the project when completed should meet and be consistent with the original contract objectives. The completed project should result in a paved two-lane, 34 km road in the Muthanna Governorate.

Corrective action and management comments pertaining to this non-finding are not required.

5. Determine if project sustainability was addressed.

A review of the contract file and discussions with the USACE RE disclosed no sustainability issues associated with the project. There was no specialized equipment provided by the contract, nor was there a need for any maintenance manuals.

## **Recommendations.**

On current and future village road projects, the Gulf Region Division-Project and Contracting Office should provide to their respective District, Area and Resident offices:

- The appropriate centerline and profile drawings prepared by the Iraq State Commission of Roads and Bridges; and
- Standard or project specific reinforced concrete box culvert drawing details.

## **Management Comments.**

The Gulf Region Division generally concurred with the information, conclusions and recommendations contained in the draft report with one exception concerning a section in the report regarding the use of the triple pipe culvert design provided in the contract statement of work in lieu of box culverts. The full text of the Gulf Region Division's comments and SIGIR responses are offered in the next section.

## **Evaluation of Management Comments.**

1. **Draft Report Text** (Page i. Conclusions). The design provided to the United States Army Corps of Engineers Resident Office staff was not complete. The contract drawings included only basic cut and fill roadway cross sections, as well as typical details on reinforced concrete pipe culverts, curb, and retaining walls. There were no details in the contract drawings on box culverts such as reinforcing steel requirements, wall and slab thickness, headwall and wing wall dimensions, and backfill requirements. In addition, the Iraq State Commission for Roads and Bridges developed drawings containing centerline and vertical profiles that were provided directly to the contractor. The Deputy Manager for Transportation in the Gulf Region Division and the Project and Contracting Office were aware of this procedure, but the Muthanna Resident Office staff did not have the centerline and vertical profile drawings, nor were they aware that the State Commission on Roads and Bridges provided the centerline and vertical profile drawings to the contractor. There appeared to be a disconnect regarding information flow between the Gulf Region Division, the Project and Contracting Office Facilities and Transportation Sector, and the Muthanna Resident Office staff.

**GRD-PCO Comments.** Designs for village roads in Iraq are completed by the Iraq State Commission of Roads and Bridges (SCRB). These designs are generally the same for all projects except for the depth of cut and fill. The cross section prepared by the SCRB design sector shows sufficient detail to complete the work to the required specifications. All village road profiles are also provided by SCRB. The profile for this project was given to the contractor by SCRB prior to construction. Some additional site specific profile information was given to SCRB by the Al Muthanna Roads and Bridges Directorate to be included in the final design. Further, SCRB provided a standard design for culverts (Box and Pipe). This design contains related tables giving wall thickness and reinforcement requirements depending on the size of the required culvert. The contractor was given this information by SCRB prior to the start of construction. In coordination

with SCRB and the contractor, drawings for the project, including the box culvert design, were provided to the Resident Office local national Project Engineer prior to construction.

**SIGIR Statement.** Comments noted.

2. **Draft Report Text** (Page 5). Conversely, in an interview with the assessment team, the USACE RE stated that the USACE Resident Office did not have any design drawings showing plan and profiles for the Muthanna Village roads project. The USACE RE indicated the contractor was creating profile sheets as the contractor constructed the road based off the existing sub-grade levels.

**GRD-PCO Comments.** Though the paragraph is correct in citing the Resident Engineer, the Resident Office local national Project Engineer did in fact have a complete set of road and culvert design drawings.

**SIGIR Statement.** Comments noted.

3. **Draft Report Text** (Page 5). The USACE RE indicated on this project, the contractor used the triple pipe culvert design provided in the SOW in lieu of box culverts. However, in reviewing the USACE QA reports, we found that rectangular box culverts were constructed on this project. Further, the SCRB provided design profiles that showed the locations for ten new box culverts.

**GRD-PCO Comments.** The Resident Engineer did not state the triple pipe culvert design was used in lieu of the box culvert design. The Resident Engineer indicated that the only drawing meeting the description of D20 in Section R3 for Item 6 of the BOQ, Box Culverts, was in Table 3.1 under the Triple Pipe Culvert heading. The Resident Engineer was knowledgeable of the box culverts constructed on this project.

**SIGIR Statement.** The Gulf Region Division-Project and Contracting Office stated the Resident Engineer indicated the only drawing meeting the description of culvert type D20 in Section R3 for Item 6 of the BOQ, Box Culverts, was in Table 3.1 under the Triple Pipe Culvert Heading. Table 3.1 (*from the Iraq Standard Specifications for Roads and Bridges*) is not a drawing, but a table containing the dimension and strength test requirements for various sized reinforced concrete pipe culverts. SIGIR acknowledges the USACE Resident Engineer discussed Table 3.1 as providing equivalent dimensioning for box culverts. However, based on notes independently recorded by the SIGIR Engineer and SIGIR Auditor taken from the interview of the Resident Engineer, it was SIGIR's understanding that the typical design for triple pipe culverts was used as a substitute for the box culverts. Nevertheless, it is evident there was a misinterpretation about the use of triple pipe culverts in lieu of box culverts. Accordingly, the statements in question noted above are removed from the final SIGIR report.

4. **Draft Report Text** (Page 5). The SOW required drawings and design changes, as necessary. A review of contract records showed the contractor did not submit drawings or design changes, nor had the PCO or USACE Resident Office requested them.

**GRD-PCO Comments.** The Resident Engineer has subsequently requested a complete copy of all revised drawings and design changes from the contractor.

**SIGIR Statement.** Comments noted.

5. **Draft Report Text** (Page 6 Work in Progress). At the time of our site visit, the contractor was not working, nor was there any record of the contractor being on site during the month of January. The USACE RE was considering issuance of a cure notice requesting a recovery plan because of the contractor's failure to complete the project.

**GRD-PCO Comments.** A cure notice was issued on 06 June 06, and a meeting was held on 21 June 06 to discuss the contractor's response. Current options and recommendations will be discussed with the Contracting Officer.

**SIGIR Statement.** Comments noted.

6. **Draft Report Text (Page ii. Recommendations).** On current and future village road projects, the Gulf Region Division/Project and Contracting Office should provide to their respective District, Area, and Resident offices:
  - The appropriate centerline and profile drawings prepared by the Iraq State Commission of Roads and Bridges; and
  - Standard or project specific reinforced concrete box culvert drawing details.

**GRD-PCO Actions Taken.** Concur. On future projects GRD-PCO will ensure that the District Area and Resident Offices receive all required drawings for the project, including centerline profiles and reinforced concrete box culvert drawing details. Drawings for this project, including the box culvert design, were provided to the Resident Office local national Project Engineer prior to construction in coordination with SCRB and the contractor. The GRS Resident Engineer did not know at the time that the SIGIR inspection team requested the drawings that the drawings were kept by the local national Project Engineer.

**SIGIR Statement.** Comments noted.

## **Appendix A. Scope and Methodology**

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We performed this project assessment from April through May 2006, in accordance with the Quality Standards for Inspections issued by the President's Council on Integrity and Efficiency. The assessment team included a professional engineer and an auditor.

Official Security representatives would not escort the Inspection Team to the project site because they did not consider it to be safe at the time of our visit to the USACE RE. Therefore, our project assessment relied solely on information obtained from:

- Reviewing contract documentation to include the following: Contract, Contract Modifications, Contract documentation, and Statement of Work;
- Reviewing the design package (drawings and specifications), Quality Control Plan, Testing Reports, and Quality Assurance Reports; and
- Interviewing the U.S. Army Corps of Engineers Resident Engineer and the Project and Contracting Office Transportation Program Manager and Deputy Manager.

## Appendix B. Acronyms

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BOQ	Bill of Quantity
cm	Centimeter
CQC	Contractor Quality Control
DG	Director General
GRD	Gulf Region Division
GRS	Gulf Region Division, South District
km	Kilometer
m	Meter
m <sup>3</sup>	Cubic meters
PCO	Project and Contracting Office
QA	Quality Assurance
QAR	Quality Assurance Representative
RE	Resident Engineer
SOW	Scope of Work
SCRB	State Commission of Roads and Bridges ( <i>Iraq government agency</i> )
USACE	United States Army Corps of Engineers

## **Appendix C. Report Distribution**

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### **Department of State**

Secretary of State

Senior Advisor to the Secretary and Coordinator for Iraq

U.S. Ambassador to Iraq

Director, Iraq Reconstruction Management Office

Inspector General, Department of State

### **Department of Defense**

Secretary of Defense

Deputy Secretary of Defense

Director, Defense Reconstruction Support Office

Under Secretary of Defense (Comptroller)/Chief Financial Officer

Deputy Chief Financial Officer

Deputy Comptroller (Program/Budget)

Inspector General, Department of Defense

### **Department of the Army**

Assistant Secretary of the Army for Acquisition, Logistics, and Technology

Principal Deputy to the Assistant Secretary of the Army for Acquisition,

Logistics, and Technology

Deputy Assistant Secretary of the Army (Policy and Procurement)

Assistant Secretary of the Army for Financial Management and Comptroller

Chief of Engineers and Commander, U.S. Army Corps of Engineers

Commanding General, Gulf Region Division

Auditor General of the Army

### **U.S. Central Command**

Commanding General, Multi-National Force - Iraq

Commanding General, Joint Contracting Command – Iraq/Afghanistan

Commanding General, Multi-National Corps – Iraq

Commanding General, Multi-National Security Transition Command – Iraq

Commander, Joint Area Support Group – Central

### **Other Defense Organizations**

Director, Defense Contract Audit Agency



## **Other Federal Government Organizations**

Director, Office of Management and Budget  
Comptroller General of the United States  
Inspector General, Department of the Treasury  
Inspector General, Department of Commerce  
Inspector General, Health and Human Services  
Inspector General, U.S. Agency for International Development  
Mission Director – Iraq, U.S. Agency for International Development

## **Congressional Committees and Subcommittees, Chairman and Ranking Minority Member**

### **U.S. Senate**

Senate Committee on Appropriations  
    Subcommittee on Defense  
    Subcommittee on State, Foreign Operations and Related Programs  
Senate Committee on Armed Services  
Senate Committee on Foreign Relations  
    Subcommittee on International Operations and Terrorism  
    Subcommittee on Near Eastern and South Asian Affairs  
Senate Committee on Homeland Security and Governmental Affairs  
    Subcommittee on Federal Financial Management, Government Information and International Security  
    Subcommittee on Oversight of Government Management, the Federal Workforce, and the District of Columbia

### **U.S. House of Representatives**

House Committee on Appropriations  
    Subcommittee on Defense  
    Subcommittee on Foreign Operations, Export Financing and Related Programs  
    Subcommittee on Science, State, Justice and Commerce and Related Agencies  
House Committee on Armed Services  
House Committee on Government Reform  
    Subcommittee on Management, Finance and Accountability  
    Subcommittee on National Security, Emerging Threats and International Relations  
House Committee on International Relations  
    Subcommittee on Middle East and Central Asia

## **Appendix D. Project Assessment Team Members**

The Office of the Assistant Inspector General for Inspections, Office of the Special Inspector General for Iraq Reconstruction, prepared this report. The principal staff members who contributed to the report were:

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