Iraq Infrastructure Reconstruction Program

SUBMITTED TO:

USAID

SUBMITTED BY:

Bechtel National, Inc.
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Assessment Report

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List of Acronyms

ATC	Air Traffic Control
ATM	Air Traffic Management
CPA	Coalition Provisional Authority
DART	Disaster Assistance Response Team
FAA	Federal Aviation Administration
HVAC	Heating, ventilation, and air conditioning
IRR	Iraq Republic Railway
km	Kilometer
kV	Kilovolt
MW	Megawatt
m	Meter
O&M	Operations and maintenance
ORHA	Office of Reconstruction and Humanitarian Assistance
NGO	Nongovernmental organization
SSA	Stevedoring Services of America
TSA	Transportation Security Administration
UXO	Unexploded ordnance
U.K.	United Kingdom
UNDP	United Nations Development Program
U.S.	United States
USAID	United States Agency for International Development
VMC	Visual metrological conditions
WFP	World Food Program

Section 1 Introduction

1.1 Background

The United States Agency for International Development (USAID) is mandated to rebuild infrastructure and public facilities and services in a postconflict Iraq. On April 17, 2003, Bechtel National, Inc. (Bechtel) was awarded a contract to provide construction services in support of an Iraq Infrastructure Reconstruction Program.

1.2 Mission

USAID has established a goal to provide tangible evidence to the people of Iraq that their country has been given the opportunity to prosper. In support of this goal, Bechtel, as contractor to USAID, will provide resources and technical expertise to rebuild potable water and wastewater treatment facilities, schools and health facilities, airports and a seaport, the electrical power system, roads and bridges, railroad infrastructure, solid waste management, irrigation systems, and selected buildings to the limits of available funding. The activities carried out under this contract are designed to contribute to the immediate objectives of rebuilding urban and rural infrastructure to accelerate economic growth, and protect and enhance human health while improving productivity. A priority medium-term objective is to invest in human and institutional capacity strengthening to better operate and maintain infrastructure and service delivery systems.

Through our work to date in Iraq, which includes conducting infrastructure assessments, working to open the Port of Umm Qasr, as well as other work on an emergency basis, Bechtel is supporting USAID's goal to provide tangible evidence to the people of Iraq that they will be given opportunities to prosper.

1.3 Contract Assessment Requirements

The Infrastructure Reconstruction Program consists of five main components:

- Assessments and preparation of an implementation plan
- Engineering and construction of selected infrastructure facilities
- Institutional capacity building for operation and maintenance
- Provision of infrastructure-related equipment and materials
- Development of a roadmap to describe how these facilities might be sustainably managed over the long-term

Under the contract, assessments were to begin in regions as soon as they became secure for civilian relief and reconstruction activities. Civil, military, and the Disaster Assistance Response Team (DART) assessments were to guide Bechtel's assessments and to identify emergency activities for immediate implementation. As Bechtel mobilized and the situation in Iraq became known, Bechtel conducted many emergency assessments, along with the emergency activities. These preceded the rapid assessment scope as defined in the contract.

It was originally envisioned that, as a permissive environment was established in a region, Bechtel would conduct rapid assessments of the condition of: water, waste, and irrigation infrastructure; health and education facilities; airports; electric power systems; irrigation; the primary and secondary road networks; the national rail system; and key government facilities.

USAID is to determine regional and sector priorities in collaboration with civilian and military authorities, international relief and development organizations, USAID implementing partners, Bechtel, and other U.S. Government agencies. The contract anticipated that the Port of Umm Qasr and selected airports would be immediate priorities for rehabilitation and repair.

Assessments are to be undertaken through Technical Directives from USAID. Based on the recommendations of Bechtel and the priorities established above, USAID's Contract Officer will approve job orders that specify the individual projects to be implemented under this program.

Bechtel has consulted with civilian and military officials, USAID local development advisors, other USAID contractors, and local stakeholders to solicit input on their reconstruction, repair, rehabilitation, and/or upgrade priorities. USAID-supported education and health contractors were to inventory education and health infrastructure and identify needs for repair and rehabilitation.

The assessments for all sectors are to include the following information:

- System configuration and condition of electric power systems; water, waste, and irrigation systems; road networks and rail systems; and evaluation of the building stock in the health, education, and selected government sectors. This includes identifying the type and source of the existing equipment.
- The requirements, including both systems and equipment, in the specified geographical areas for restoring critical services for power; water systems, wastewater treatment facilities, sanitation services, and irrigation systems; road and rail systems; and health facilities, schools, and selected government buildings. This includes a summary of the estimated impact of the repair and its significance with regard to system operation.
- An identification and categorization of emergency, short-term, and potential long-term needs in the above infrastructure sectors.
- An identification of potential issues or challenges in restoring critical infrastructure, including the needs for demining and/or dealing with unexploded ordnance (UXO).
- An identification of the existing organization for operation and management of the critical facilities.
- Recommendation for areas of intervention that will address priority needs for restoring critical infrastructure and services, and the associated costs.

1.4 Achievements and Progress

The day of contract award, April 17, 2003, Bechtel established a project office in McLean, Virginia. Bechtel's Chief of Party and the Deputy Project Director were immediately mobilized there along with other key program and functional managers.

Also on April 17, Bechtel began gathering assessment data by accessing the USAID web sites. The Program Manager for Umm Qasr port arrived in Kuwait on April 20 to continue the port assessment process. All infrastructure program managers had mobilized in Kuwait and/or Iraq by May 6.

Bechtel and USAID have jointly developed an emergency repair and assessment program based on USAID's immediate priorities. The program outlined four national priorities (port, power, airport, and key bridges) and additional regional priorities to align with the regional organization of the Office of Reconstruction and Humanitarian Assistance (ORHA), now the Coalition Provisional Authority (CPA). Using the plan as a roadmap, Bechtel sequenced its initial activities to focus on expediting the delivery of humanitarian aid to major population centers. Figure 1.4-1 illustrates the four regional assessments areas.

Bechtel's assessment teams organized single-day and overnight visits with security from Kuwait to various Iraq locations to conduct their assessments. Although this process was very restrictive, assessments were completed in a timely manner. Within 3 weeks, teams began extended trips into all four regions, thus enabling a countrywide, systems approach to the assessment. Lastly, pioneer camps or facilities have been established in each of the four regions, as well as at the Port of Umm Qasr, to support the conclusion of assessment efforts. The following is a summary of key achievements to date.

Port of Umm Qasr

Predredging bathymetric and magnetometer surveys of the immediate port area are complete. The surveys reveal that the navigation route is silted up and confirm the presence of documented and unknown wrecks and UXO on the seabed. Emergency dredging operations to facilitate delivery of food and other relief supplies are complete. Bechtel also surveyed five Iraqi dredges and assessed essential port infrastructure, including grain handling facilities, electric power supply, and security arrangements.

Airports

At the direction of USAID, Bechtel has shifted mobilization emphasis from Basrah to Baghdad International Airport. To date, we have completed assessments of these two primary international gateways of Iraq, as well as the national air traffic management infrastructure. Plans are underway to perform rapid assessments of three domestic airports once access clearance is granted.

Water, Waste, and Irrigation

Bechtel performed 29 assessments of water facilities, pump, generators, and pipelines in the Al Basrah, Baghdad, and Heartland regions. These assessments reveal that chemical feed and control systems, as well as motors, pumps, and other working mechanisms are generally in need of either replacement or major repairs. Wastewater is begin passed directly into rivers without treatment, and sewers are in danger of flooding.

Figure 1.4-1. Regions of Iraq Where Assessments are Planned

An integrated approach must be taken to address the challenges of supply and distribution of potable water to the Iraqi population. Gaps in the system can cause water usage, waste water treatment and disposal, and irrigation runoff in the northern part of the country to create a major public health hazard through degradation of water quality in the southern regions.

Power

Bechtel has completed assessments of the 400 kV and 132 kV distribution systems as well as 14 key power stations in the Central and South regions and 51 substations primarily located in the South and Heartland regions.

Rail, Roads, and Bridges

Bechtel has performed 33 field assessments of CPA's 49 priority bridges and a 40-km stretch of highway between Al Diwaniyah and An Nasiriyah. Bechtel also conducted a detailed assessment of rail infrastructure associated with food delivery in the Al Basrah region.

The Iraqi road and bridge network is incomplete, even along major national highways. Military conflict, neglect, and substandard construction have caused further deterioration of the network. At the same time, the lack of viable transport alternatives has caused traffic to continue on structures that are damaged or in some cases, in imminent danger of collapse. Those structures were the focus of Bechtel's assessment efforts.

Buildings

Bechtel's has prepared a preliminary database of schools and clinics across a number of cities. Input from key stakeholders, including CPA regional representatives, other USAID contractors, and NGOs has been collected and assessment priorities are in place. Teams have been deployed to Al Basrah and Baghdad to complete assessments of representative facilities.

1.5 Assessment Challenges

Security

Due to the instability of the security situation in Iraq, a strict security regime has been imposed upon the Bechtel assessment teams. The requirement to be in a safe location before nightfall, and to have military or other security protection as our teams travel, has resulted in an inability to conduct assessments as quickly and as easily as anticipated. This has also added cost and complexity to the assessment process.

Looting and vandalism continues unabated in many areas of Iraq, which adds fluidity to the process. The armed theft of a crimping machine, the recent break-in at warehouses at the Port of Umm Qasr, the ongoing destruction of 400 kV transmission towers in southeastern Iraq, the loss of newly installed circuit breakers at the Umm Qasr grain silo, and recent losses of rail operation records are a few examples of this situation. Since many assessment locations are not afforded either protection by the coalition forces or effective local security, looting and vandalism frequently disrupted our work. In addition, the validity of the assessment becomes compromised when additional damage occurs after the assessment team has completed its review. Often, Bechtel has to revisit sites and update results to keep assessment reports current.

Integration and Coordination

Although we have received cooperation, the actual assessments and reports from other organizations and contractors as anticipated by the contract have not materialized or have been classified. For example, USAID-supported education and health contractors were expected to inventory education and health infrastructure and identify needs for repair and rehabilitation. Bechtel has not been able to access those reports.

Part of Bechtel's added value is to evaluate the accuracy and completeness of existing assessments and to supplement with additional work where necessary. Due to the lack of documented records, such as drawings and operations and maintenance (O&M) manuals, we have found ourselves relying on people's memory and comparing that to reality.

Traditional public authorities that provide information and suggest priorities are understandably not in place. There is also considerable misunderstanding of the procedure for releasing classified information (military and DART assessments and reports), even with proper clearances.

In some situations where assessment data from others was not available, Bechtel located information by accessing the ORHA (now CPA) web site. This source of information was also used for early assessment work prior to the end of the conflict.

It is important to note that third-party assessments were often not intended for reconstruction use. Many assessments were completed and written for military use.

Mobility

Despite the best efforts of coalition military forces and many others, access to sites in Iraq has been more limited than envisioned in the original execution plan. The plan anticipated a permissive environment to be quickly established in Baghdad, allowing assessment teams to be in-country for extended periods. Relatively free travel to the assessment areas was also anticipated. Overnight accommodation has been almost nonexistent except for the coalition forces. All flights around Iraq remain courtesy of the military. Road transportation has posed special security issues and border crossings are very slow with long delays at immigration points. Vehicle breakdowns due to contaminated gasoline have been frequent.

Initial planning was based on primary interfaces in Baghdad and Al Basrah. As organized, regional interfaces included Mosul (Arbil) and Al Hillah.

1.6 Closing

Despite challenges, Bechtel has conducted in excess of the 60 assessments required by the contract. This has provided Bechtel with a better understanding of rehabilitation needs as well as an appreciation of the governing provisional authority's (CPA) priorities. With this valuable information and USAID's direction on priorities, Bechtel can prepare a viable implementation plan for work in the various sectors to achieve USAID's objectives.

Section 2.1 Port of Umm Qasr

2.1 Port of Umm Qasr

The Port of Umm Qasr is the sole deep-water seaport in Iraq capable of receiving ocean-going vessels to support the requirement to import approximately 480,000 to 580,000 tons of food per month. Land routes are not a practical immediate alternative, given extensive damage to bridges and the dilapidated state of Iraqi railways. Transport by air is prohibitively expensive and cannot meet the bulk volume required. A water route remains the only viable delivery option available to ensure sufficient delivery of food and relief supplies in the aftermath of conflict and many years of neglect.

Bechtel's mission at Umm Qasr is to provide for immediate rehabilitation and repair of port infrastructure to facilitate delivery of relief and reconstruction material and personnel. Bechtel's port manager was the first Bechtel person to be mobilized into Kuwait and then Iraq, where he began to interface with Stevedoring Services of America (SSA), the port operator, the coalition forces operating the port (the U.K. Army 17th, since replaced by the 165th Port and Maritime Regiment), and World Food Program (WFP) field operations managers. Initial meetings established three main emergency tasks:

- Dredging the new port entrance and specific berths
- Placing the grain facility back into service
- Establishing temporary power to the old port, new port, and grain facility

Some key port achievements are shown in Figure 2.1-1.

Key Port Accomplishments	
April 20	Port project manager mobilized to Umm Qasr port
April 29	Survey vessel arrived at Umm Qasr port
May 4	Initial assessment completed
May 7	Large cutter suction dredger, Carolina, from Great Lakes Dredging and Dock Co., arrived in Umm Qasr port
May 8	Dredging operations began
May 30	Dredging operation reached the 1 million cubic meter mark
Today	Six berths available to accommodate vessels of 8.5 m draft; achieved manual unloading capacity of 2,000 tons per day of bagged grain

Figure 2.1-1. Key Port Accomplishments

Bechtel began the assessment process by reviewing assessment reports prepared by the WFP, the U.K. military, and other coalition groups involved in port operations, including the U.K. Army 17th Port and Maritime Regiment. We reviewed the assessment report and implementation plan prepared by SSA. In general, Bechtel observations from visits to the port agreed with SSA observations and findings.

To verify and supplement the information Bechtel was provided, a detailed predredging bathymetric survey was performed on the area of the new port, old port, and connecting river. This survey was verified by independent engineer Halcrow International and formally submitted to USAID. The information from this survey was also shared with the coalition forces, SSA, and the 17th Port and Maritime Regiment.

After several days of weather delays, emergency dredging operations began on May 8.

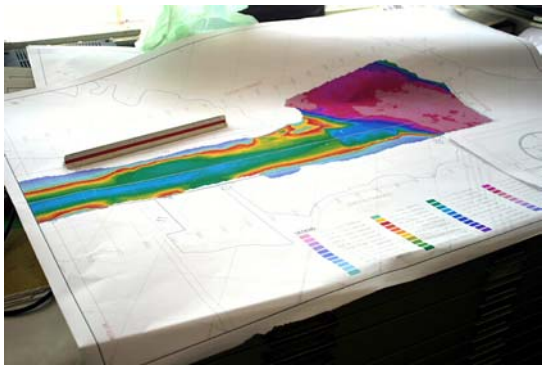
2.1.1 Existing Conditions

Port

The Port of Umm Qasr consists of the old port, new port, and grain handling facilities. To date, Bechtel has performed detailed assessments, including environmental reviews, of the following facilities and systems:

- New port
  - Administration building
  - Customs building/passenger terminal
  - 11 kV electrical distribution system
  - Low voltage distribution system
  - Fire pumps system
  - Wet utilities
  - Container cranes
  - Warehouses
  - Gantry cranes
  - Fender system
- Grain facility (initial assessment complete, but an assessment is ongoing to determine detailed needs to restart the systems)
- Security (fencing at old port, grain facility, and new port)
- Seaway
  - Wreck survey
  - Bathymetric survey of the channel from Umm Qasr to Arabian Gulf
  - Survey of five Iraqi dredges (other dredges not accessible)
  - Warehouses

Neglected ship – Umm Qasr Port



Bathymetric survey – Umm Qasr Port

Survey boat

The initial assessment revealed that ocean-going vessels are unable to make their way to Umm Qasr berths due to neglect of the navigation route for more than 12 years. The route is silted up and of insufficient depth. The assessment appraised dredging equipment in the region and confirmed that only one company, Great Lake Dredging and Dock, had sufficient resources in the region to commence emergency dredging of the port.

There are known to be approximately 11 sunken vessels within the Umm Qasr channel. To assess the suitability of the waters for dredging, Bechtel hired a subcontractor, Titan Maritime, to conduct a survey of known wrecks. Five wrecks could be physically inspected by diving operations. Seven additional wrecks were inspected by divers, but a detailed assessment could not be completed because the wrecks are completely covered by silt. The presence of the wrecks has also been confirmed by discussions with the Iraqi port authority and/or by magnetometer survey.

There are also reports of additional objects on the original seabed, such as unrecorded wrecks, UXO, and large pieces of metal waste that have been dumped into the water. To verify existence of the objects, Bechtel mobilized a magnetometer survey instrument plus experts to interpret the results. To date, the magnetometer survey has been conducted in the entrance channel to the new port, in the vicinity of berths 10 and 11, and continues throughout the full length of the port. These ongoing surveys have highlighted additional large objects under the water and in the silt. The objects are buried in approximately 4 to 7 meters of silt and could cause major damage to the dredger if not detected and removed prior to dredging.

Existing perimeter fencing at the port is in general disrepair and requires upgrading to ensure security at the site. In its current state, the perimeter fence can be easily penetrated by outsiders and does not offer much security.

The port administration building is in very poor condition and has been stripped of furniture, fittings, fixtures, and major equipment, such as HVAC. The building requires a complete refurbishment. The building is structurally sound, but there are some areas where repairs must be made to columns and beams, and replastering is required.

Grain Facility

The grain handling facilities are inoperable and in a neglected state. The complex is inactive due to the lack of power supply. The existing plant was operated as recently as February 2003, but it was done manually with a reduced operating capacity as the electrical, mechanical, and controls systems had been looted, neglected, and also suffered from shortages of spare parts.

2.1.2 Requirements for Restoration of Critical Services

Dredging

Bechtel estimates that a minimum of 3 to 4 million cubic meters of material must be removed to make the waterway navigable for ocean-going vessels large enough to effectively deliver needed food shipments. There is also an urgent requirement to remove wrecks and other sunken objects, including UXO, to enable emergency dredging to proceed unhindered to specified depths and to open additional berths for unloading ships.

Dilapidated port wiring

Power

Power needs to be restored to enable operation of the grain facility and other port equipment. To date, Bechtel has ordered 18 diesel generators for the port and grain facilities to meet immediate power needs.

Grain Facility

Emergency startup of the grain facility is required to receive, store, and distribute grain unloaded from vessels arriving at the port.

Security

The security fence at the perimeter needs to be repaired to prevent theft and ensure that the rehabilitated facility is not vandalized.

2.1.3 Needs Assessment

Port of Umm Qasr projects were divided into five categories:

- **Emergency.** Projects needing immediate action for humanitarian reasons. These are largely under way or completed
- **Short-term.** Projects that can be completed within 6 months after receipt of an approved Job Order from USAID
- **Intermediate-term.** Projects that are likely to extend 6 months but be complete before December 2004
- **Long-term.** Projects that can not be completed before contract completion in December 2004, but which are still important to restoring port infrastructure

Dredging Equipment – Umm Qasr Port

A fifth category – **unassessed projects** – includes projects or potential scope from the contract scope that were not specifically assessed, but which Bechtel can extrapolate based on knowledge of the integrated port systems.

Emergency

- Dredging of new port from main channel to Berth 10 to permit shipments of grain and other humanitarian relief supplies. This work is under way and is making good progress.
- Removal of wrecks and other sunken objects from Umm Qasr new port to enable dredging to proceed unhindered to required depths and to open up additional berths for unloading ships. (Note: additional wrecks are now to be removed under a United Nations Development Program [UNDP] initiative).
- Procurement, installation, and startup of new standby generators to establish temporary power to the port area. This work is under way and making good progress.
- Complete cleaning of the grain handling facility to prepare for the receipt of incoming grain and act as a storage buffer for food distribution within Iraq. Safety and hygienic concerns require a thorough cleaning prior to restarting the facility. Work to start up the grain facility is under way and is making good progress.
- SSA identified early on the need to upgrade the perimeter fence at Umm Qasr port. New gates are also required at the entrances and existing guard houses need to be upgraded. In addition, floodlights should be installed along the perimeter to enhance security.

Short-term

- Additional dredging in the new port to accommodate vessels of 75,000 metric tons
- Construction of interim customs facility
- Restoration of fire water systems
- Restoration of the new port administration building
- Restoration and startup of new port container cranes
- Temporary repairs of new and old port substations and restoration of emergency lighting
- Restoration of new port wet utilities
- Quick repair of two Iraqi cutter suction dredges that are in reasonably good shape so as to put them into service
- Disposal of UXO on land and in water

Intermediate-term

- Spot dredging to remove navigation obstacles in main channel from Umm Qasr to Arabian Gulf
- Restoration of the quay fendering system

Rice unloading at port

- Restoration of gantry cranes
- Restoration of customs and passenger terminal buildings


Iraqi contractors

Long-term

- Dredge main channel from Umm Qasr to Arabian Gulf to
- Structural repairs to grain facility wharf
- Restoration of customs area and passenger terminal
- Restoration of warehouses and miscellaneous buildings
- Repair and return to service of three Iraqi suction hopper dredges that are in poor condition

Unassessed Projects

- Dredge channel from Umm Qasr to Al Zubayer port
- Replace old container cranes at old port
- Replace obsolete gantry cranes to enhance port capacity
- Modernize all wet and dry utilities at both old and new port
- Upgrade all cathodic protection systems

2.1.4 Challenges

Security

Security is one of Bechtel's main concerns. Military forces are downsizing their presence and involvement in the area and there is no planned replacement organization to maintain law and order. Consequently, the port and facilities have been experiencing ongoing looting and damage to critical infrastructure, especially power and electrical systems.

Power

Another challenge is inadequate access to power distribution. The conflict has caused major damage to the power distribution network both within and outside the port. Many system assessments cannot be completed, as there is no power or water available for testing. This is being addressed to some extent by the addition of portable temporary power.

UXO and Other Safety Hazards

Potential UXO both on land and buried in silt in the water poses a major safety hazard. UXO may be buried in areas to be dredged or buried in areas where dredge material will be disposed. Sunken wrecks blocking the dredging path are another source of safety hazards.

Work Impediments

Delay in payment of wages to Iraqi government workers has caused delays at some locations, such as the grain facility. Furthermore, some areas and facilities cannot be freely assessed as they are currently in use or being occupied by military forces.

Coordination

Finally, third-party relief efforts (those not working under contract with USAID) have not been coordinated with CPA. One example is the wreck removal in Umm Qasr where a UNDP contractor arrived on site and started work virtually unannounced. Some of these activities duplicate the work Bechtel is undertaking on USAID's behalf to clear the wrecks from Umm Qasr port, requiring changes to the plan. Also, there is not enough space for two simultaneous salvage operations to work within the port.

2.1.5 Existing O&M Organization

It has been difficult to assess the existing O&M organizations at the port and grain facilities. This is because most government employees have not been called back to work. Bechtel has reached out to local Iraqi engineers to assist in assessments and to provide local knowledge. The indications are that the Iraqis are qualified and experienced in their professions, but lack the tools and material resources to perform their jobs effectively. Bechtel has not found any spare parts or equipment in storage at this point.

2.1.6 Recommendations

The key to the eventual opening and effective operation of the port is improving the route for large ocean-going vessels to make their way from the Arabian Gulf into the Umm Qasr channel, and eventual berthing at the Port of Umm Qasr. To accomplish this, Bechtel recommends:

- Dredging the new port to a depth of 12.5 meters with some berths being dredged to 13.5 meters for larger ships. The footprint of the 12.5-meter-depth should be the length of the new port and 250 meters from the face of the berth, with 13.5-meter-depths at berths 10, 19, 20, and 21. Subject to final results of the bathymetric survey, Bechtel recommends dredging the channel from Umm Qasr to the Arabian Gulf to a depth of 12.5 meters. Removal of wrecks and other objects will be required prior to additional dredging operations.
- Phased execution of work required to bring the grain facility up to the requirements recommended by SSA and international standards. Electrical and mechanical systems in the grain facility need to be rehabilitated to original conditions. However, due to the urgent need to be able to unload WFP bulk grain ships, the plant will be placed into operation in an ad hoc manner using local Iraqi operators and technical staff supervised by Bechtel. Bechtel proposes to carry out detailed assessments and a program to procure, install, and start up replacement parts.
- Improving security by repairing and upgrading the security infrastructure at the port. It is essential that the existing fence be repaired and upgraded as part of the port security plan.

In addition, Bechtel recommends:

- Restoring permanent power to all areas of the port
- Rehabilitating the administration building, customs area, passenger terminal, warehouses, and miscellaneous other buildings to functional condition:
  - Restoring all wet utilities
  - Restoring cranes to working condition
  - Repairing fender system
  - Repairing the structural damage to the grain facility wharf
  - Repairing selected Iraqi dredges
  - Restoring fire water systems

Section 2.2 Airports

2.2 Airports

Bechtel's airport assessment work has focused on the two primary international gateways of Baghdad and Basrah (Figure 2.2-1) and on the National Air Traffic Management (ATM) infrastructure. Detailed field inspections of both airports have been completed. At the direction of USAID, we shifted our mobilization emphasis from Basrah to Baghdad airport. Inspections of domestic airports at Kirkuk, Mosul, and Arbil have not been carried out as yet, reflecting the priority and urgency attached by CPA and USAID to the two international airports. Bechtel recommends performing rapid assessments of the three domestic airports upon receipt of USAID direction to do so.

Baghdad International Airport is under the control of the U.S. military and is currently serving as a major base of operations in the Central region and as a conduit for humanitarian aid and air access. Basrah Airport is under the control of the U.K. military and serves as the headquarters for U.K. operations in southern Iraq and is also serving the humanitarian and air access needs of the region. The authority for civil aviation in Iraq, including the Baghdad and Basrah airports, is currently under the command of the Senior Aviation Advisor to CPA who reports directly to the head of CPA. Supporting the Senior Aviation Advisor are senior members of the Federal Aviation Administration (FAA), Transportation Security Administration, and other agencies with purview over the direction and priority of infrastructure needs at the two international airports and throughout Iraq.

The assessment team has coordinated its work directly with the Senior Aviation Advisor and his supporting staff to reflect a consistent approach to the objectives established by CPA. Assessments of the airports included reviews of assessment reports prepared by Skylink, the airport operator, and interviews with U.S. Air Force and Army engineers, as well as U.K. military engineers.

The assessment team is comprised of senior engineers with expertise in all key areas of airport infrastructure. The findings and recommendations from the assessments reflect these areas of expertise:

- Air traffic control and navigation aids
- Airfield facilities
- Passenger terminal and other facilities
- Electrical systems and components
- Mechanical systems and components
- Telecommunications and special systems

Conflict Damage–Basrah International Airport

2.2.1 Existing Conditions and Needs Assessment

The field assessment of the airports reveals that Baghdad International Airport sustained light to moderate conflict damage to runways, terminals, and other elements. The need to house some 17,000 troops and support vital military functions has inevitably affected some facilities and equipment. A significant amount of the deficiency in airport function and infrastructure stems from a poor level of overall maintenance and a lack of replacement parts over the past 12 years.

Basrah International Airport also sustained limited damage during the conflict and is accommodating about 1,100 U.K troops. The level of ongoing impact from military functions is modest. Again, a significant part of the airport's deficiency can be attributed to lack of adequate maintenance and replacement parts. Detailed findings for both airports are shown in Figure 2.2-2.

UXO at both airports is being cleared within the airport boundaries. Most high traffic and facility areas at both airports have been cleared. Some airport navigation aids are located off-airport and UXO in those areas have not yet been cleared.

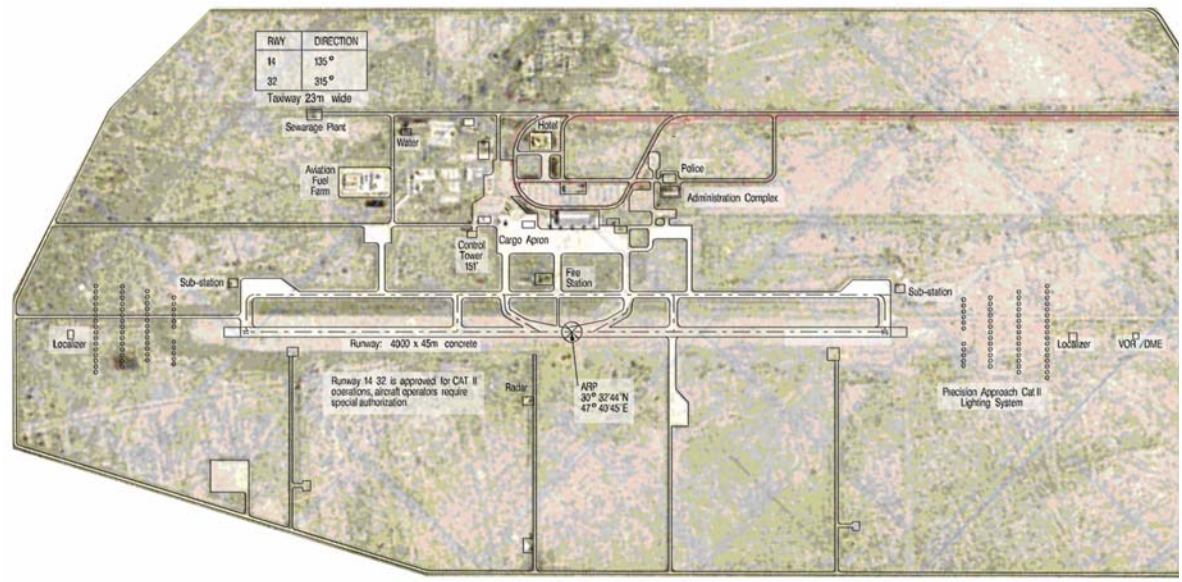


Figure 2.2-1 Aerial Maps of Baghdad (top) and Basrah International Airports

	Baghdad International Airport	Basrah International Airport
Air Traffic Control and Navigation Aids	▪ Radar inoperative *(temporary military radar provided)* ▪ Air-ground communications equipment outdated and unreliable (*temporary military service provided*) ▪ Ground-ground communications inoperative ▪ Airport VORs inoperative *(temporary military VOR provided)* ▪ Precision landing aid (ILS) equipment outdated, unreliable, and not calibrated ▪ Control tower building sound but most systems and equipment inoperative	▪ Radar has been destroyed *(temporary military radar service provided)* ▪ Air-ground communications equipment outdated and unreliable *(temporary military service provided)* ▪ Ground-ground communications inoperative ▪ VOR has been destroyed (*temporary military VOR provided*) ▪ Precision landing aid (ILS) equipment outdated, unreliable, and not calibrated ▪ Control tower building sound but most systems and equipment inoperative
Airfield Facilities	▪ Aircraft safety areas contain debris and feature uneven ground ▪ Runway, taxiway, and apron pavement in good condition ▪ Perimeter fence damaged in limited areas (*temporary security by military*) ▪ Airfield lighting partially operative; one power substation destroyed; some lighting fixtures damaged or missing ▪ Visual aids designed to 1980s standards; paint is faded ▪ Meteorological equipment inoperative *(temporary meteorological service provided by military)* ▪ Fire station buildings sound but systems inoperative; fire and rescue equipment operating (*temporary fire service provided by military)*	▪ Aircraft safety areas contain debris and marked by erosion and trenches ▪ Runway, taxiway, and apron pavement in good condition ▪ Perimeter fence and gates damaged and missing in significant lengths (*temporary security provided by military*) ▪ Airfield lighting inoperative; two power substations gutted; some lighting fixtures damaged or missing (*temporary runway edge and approach lights provided by military*) ▪ Visual aids designed to 1980s standards; paint faded ▪ Meteorological equipment inoperative (*temporary military* meteorological *service provided*) ▪ Fire station building sound but systems inoperative; fire and rescue equipment inoperative *(temporary military fire service provided*)
Passenger Terminal	▪ Extensive damage to windows and doors in terminal complex ▪ Damage to roof and ceiling in terminals B and C during conflict ▪ Extensive cosmetic damage throughout terminal complex to carpets, walls, and ceilings ▪ Limited unreliable power to lighting, escalators, elevators and other systems ▪ No potable water or sewer service in terminals and no functioning restrooms ▪ Computer and telecoms equipment for passenger processing damaged or missing	▪ Substantial damage to doors and frames throughout terminal complex ▪ Substantial cosmetic damage to carpets, walls, and ceilings ▪ No potable water or sewer to terminal and no functioning restrooms ▪ Power restored to terminal but of limited reliability and capacity ▪ Elevators and escalators not functioning ▪ Computer and telecoms equipment for passenger processing damaged or missing
Electrical Systems	▪ Only one of three 33 kV feeder lines energized, but has not yet been connected to its step-down transformer ▪ Central control of the power distribution system not functional; breakers have to be operated manually ▪ Of three standby diesel generator sets in the main substation, only one operates for short periods (*the military provides their own power in critical areas*) ▪ One of two generator sets of substation 14 operational, but cannot be paralleled with the one in main substation ▪ Control room of central plant substation gutted	▪ Only one of two 33 kV feeder lines is operational and relatively reliable ▪ One 33 kV circuit breaker and some 11 kV circuit breakers missing ▪ Protection systems not functioning (over-voltage, undervoltage, and short-circuit) ▪ Some control cabinets looted ▪ Three diesel gensets not used since 1991; Units 2 and 3 in working condition; gensets do not start automatically ▪ Some microprocessors and PC boards missing in cabinets, making remote operation of several functions impossible ▪ Substations of sewage plant and incinerator plant gutted

Figure 2.2-2. Existing Conditions at Baghdad and Basrah International Airports

	Baghdad International Airport	Basrah International Airport
Mechanical Systems	▪ Potable water not available at terminal due to storage tank leakage. Potential cross-contamination between potable water and sanitary waste system ▪ Most sewage lift stations not operating due to unreliable power supply, poor maintenance, and lack of spare parts. The sewage collection system out of service, posing potentially serious health risk ▪ Central plant equipment for HVAC systems can operate at partial loads under manual controls if reliable power available. Equipment operations unreliable due to lack of spare parts. Central Control Monitoring System not functional ▪ HVAC system at terminals B, C, and D and ATC are potentially operational but in need of spare parts and filters ▪ Plumbing system operational after clear of blockages, tested for leaks, and disinfected. Some plumbing fixtures damaged ▪ Terminal loading bridges operable but in need of replacement parts. Most components rusty, corroded, or worn. Several bridges have gunshot damage ▪ Baggage handling systems operable but in need of replacement parts. Some components worn and scales need recalibration ▪ Fuel farm operational under manual control to load and unload jet fuel by truck. Existing Air Iraqi refueler trucks not serviceable. Apron hydrant system not working since 1991 due to bomb damage to supply headers. USAF taking over fuel farm to support military operations with military refueler trucks	▪ Major components structurally sound. Plant operating at 25% of capacity. Spare parts, chemicals, and reverse osmosis membranes in short supply. Water unsuitable for human consumption due to lack of chemical treatment ▪ Onsite sewage treatment plant vandalized and inoperable; raw sewage discharged directly to waterway. Sewage lift stations not fully tested ▪ Central plant equipment for HVAC, firewater, service water, instrument air systems operable at partial loads under manual control. One of two boilers no longer serviceable. Equipment operations unreliable due to lack of spare parts. Central control monitoring system for utilities system not functional ▪ HVAC system main terminal operational but in need of spare parts and filters. Part of HVAC system at administration building has bomb damages. HVAC system at the ATC currently not operating ▪ Plumbing system operational after cleared of blockages, tested for leaks, and disinfected ▪ Loading bridges operable but in need of replacement parts. Some components rusty, corroded, or worn ▪ Baggage handling systems operable but in need of replacement parts. Some components worn and missing. Scales need recalibration ▪ Fuel farm operational under manual control to load and unload jet fuel by trucks. Existing Air Iraqi refueler trucks not serviceable. Apron hydrant system not working since 1991. U.K. Royal Air Force (RAF) operating fuel farm with military refueler trucks

Figure 2.2-2. (continued)

	Baghdad International Airport	Basrah International Airport
Telecommunications and Special Systems	▪ Existing operation control centers not functioning ▪ Checkpoint security systems not functioning ▪ Fire alarm and control system believed to be operational, but no central systems working. ▪ Central control and monitoring systems not functioning ▪ Access control systems do not exist ▪ Closed circuit television systems not operational ▪ Public address systems are not operationally reliable ▪ Trunked radio Multi-channel 800 megahertz radio system does not exist ▪ Repair existing uninterruptible power supplies and replace missing units ▪ COMM cabling systems exist for telephones, but not data ▪ Local area networks and IMOs do not exist ▪ Government systems TSA, FAA, customs, agriculture, and DEA do not exist ▪ Common use terminal equipment systems do not exist ▪ Gate management systems do not exist ▪ Local boarding applications do not exist ▪ Multi-use flight information systems not operational	▪ Existing operation control centers not functioning ▪ Checkpoint security systems not functioning ▪ Fire alarm and control system believed to be operational, but no central systems working. ▪ Central control and monitoring systems not functioning ▪ Access control systems do not exist ▪ Closed circuit television systems not operational ▪ Public address systems not operationally reliable ▪ Trunked radio multi-channel 800 megahertz radio system (800MRS) does not exist ▪ Uninterruptible power supplies do not exist ▪ COMM cabling systems exist for telephones, but not data ▪ Local area networks and IMOs do not exist ▪ Government systems TSA, FAA, customs, agriculture, and DEA do not exist ▪ Common use terminal equipment systems do not exist ▪ Gate management systems do not exist ▪ Local boarding applications do not exist ▪ Multi-use flight information system not operational

Figure 2.2-2 (continued)

In addition to the international airports, Bechtel also conducted a field assessment of the National ATM infrastructure. Our findings show that the National ATM infrastructure is completely inoperative, including the air-to-ground and ground-to-ground communications, surveillance systems (radar), and *en route* navigation aids. Limited ATM infrastructure is currently provided by the military.

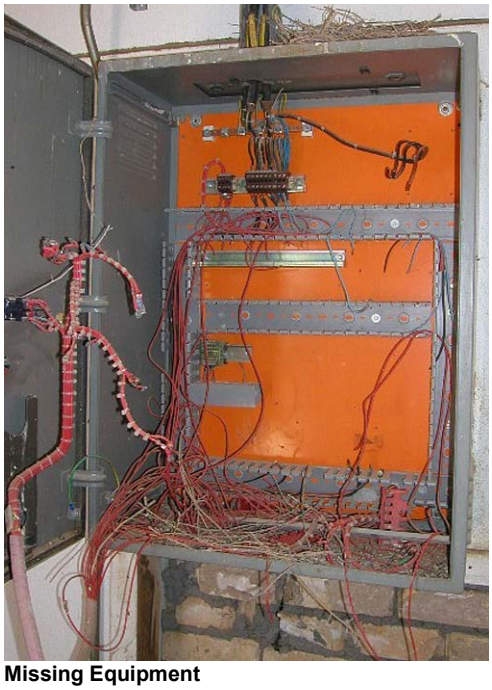
Destroyed Airfield Lighting Substation

Destroyed Equipment

2.2.2 Requirements for Restoration of Critical Services

Electrical Systems

The critical need at the two international airports is to provide enough power to the central plant, terminal, and other critical load centers to allow operations to resume as soon as possible. As a stop-gap measure, this need can be provided in Baghdad by providing a 5 MVA generator set, which can provide reliable standby power until at least one 33 kV feeder is restored. At Basrah, reliable power can be achieved by restoring the second feeder from Hammar.



Missing Equipment

Water, Sewer, and Waste Treatment Facilities

Utilities infrastructure for both airports should be restored to begin commercial flights. Reliable potable and fire water supply, delivery, storage, as well as sewage collection and treatment to and from the airport terminals should be in place. Chilled and hot water production and delivery systems must be operational to meet minimal building HVAC requirements. Restoration of the airport utilities infrastructure will be a high priority for the short and intermediate term repairs.

Passenger Services

Passenger processing systems include check-in counters, baggage inspections, baggage handling equipment, and passenger loading bridges. Initially, these processes must be operated manually. Over the long term they must be upgraded and restored to automated function to support increasing passenger needs.

Baghdad International Airport – Conflict Damage

Fuel Farm

Fuel farms at the airports must be made operational to support both civilian and military operations. Civilian operations will include jet A-1 fuel storage and dispensing. Existing apron hydrant fueling is not operational so aircraft fueling will be by civilian refueler trucks.

ATM Functions

National ATM infrastructure and national enroute ATM capability must be reestablished in order to begin international commercial flights to Baghdad and Basrah airports. Air-to-ground radio communications coverage supporting the routes of flight, and ground-to-ground communications with enroute control facilities

in adjacent Flight Information Regions must be in place. A small network is planned using low-cost satellite communication stations that should be sufficient to begin initial, low-volume services.

Environmental Issues

The emergency repairs at the airports do not include significant environmental impacts. However, assessing scoping of issues for short- and long-term work will involve water, wastewater, and other environmental concerns.

2.2.3 Challenges

Immediate Start to Commercial Operations

CPA has announced its intent to begin commercial operations as soon as possible at Baghdad International Airport. The urgency of initiating operations places significant challenges on the rapid mobilization, repair, and upgrade of facilities to support this objective.

Damaged Airfield Building

Coordination with Military

Both airports are used as key bases by coalition military forces. Coordination between CPA and military commanders is directed at adjusting military activities and areas of control within the airports so that both military and commercial operations can be accommodated.

Coordination with Airport Operator

Coordination of infrastructure improvements with Skylink, the contracted airport operator, is needed so that operational needs are supported. As traffic at the airports grows, expansion of infrastructure, facilities, and capacities will be required to meet demand.

Outdated Systems and Equipment

The Baghdad and Basrah airports were constructed in the early and mid-1980s, making the systems in place roughly 20 years old. The useful life of many systems, especially electrical, telecommunications, and computer systems, have been exceeded. Major systems and components are required to be replaced due to the lack of maintenance and technology obsolescence.

Outdated Radar Equipment

Manufacturers and Parts no Longer Available

Basrah International Airport was built by a German consortium while Baghdad International Airport was built by a French consortium. Many of the European vendors and suppliers are no longer in operation or are no longer providing replacement parts for the equipment and systems.

Integration of Local Labor with International Specialists

A primary objective of USAID's reconstruction effort is to engage local contractors and labor to rebuild the airports. However, many elements of airport infrastructure are highly complex and require specialized expertise. As a result, it will be necessary to blend local Iraqi contractors with specialist international contractors to complete the work.

2.2.4 Existing O&M Organization

The O&M organizations for both Baghdad and Basrah international airports are currently under the control of the U.S. and U.K. militaries, respectively. For the emergency and short-term phases, this will continue to be the case while the airports serve primarily military and humanitarian relief functions.

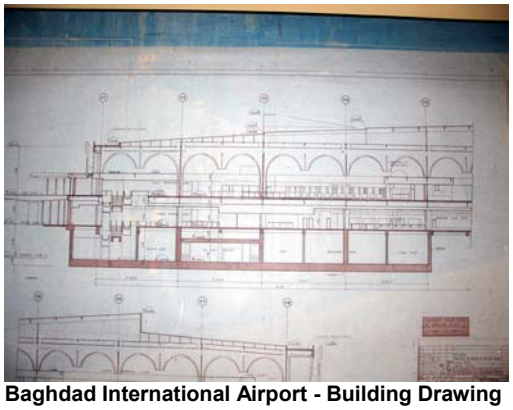
Damaged Terminal Windows – Baghdad International Airport

USAID, however, has executed a contract with Skylink as the interim operator of the two airports and to facilitate transition of the airports from military to civilian control. Skylink has begun the process of organizing and staffing the O&M organization of the Baghdad airport as a first priority, and has begun to hire elements of the prior Iraqi management and staff. As additional staff are hired, Skylink will begin training and upgrading the management and technical skills of the staff. Skylink will provide the same services at the Basrah airport.

The transition plan will ultimately pass full control of the airports to well-trained Iraqi management and staff with the capability to operate and maintain the airports to international standards of quality and service.

Air traffic control (ATC) services are also currently provided by coalition military forces at both airports. The Royal Australian Air Force provides the service at Baghdad while the U.K. Royal Air Force provides control at Basrah. CPA has indicated that they foresee the appointment of a "bridge" contractor to provide a transition to national ATC services at both airports until an Iraqi civil aviation organization is capable to assume these responsibilities.

Training of a competent cadre of Iraqi controllers is likely to be undertaken through the bridge contractor supported by such recognized leaders in aviation training as the Singapore Aviation Academy and the FAA.



Baghdad International Airport - Building Drawing

2.2.5 Recommendations

We prioritized recommendations according to five phases, or levels, of operational capability:

Emergency

Baghdad international airport is to open by mid July 2003 to limited commercial flights providing passenger services and operating under daytime visual meteorological conditions (VMC). CPA made the decision to delay the opening of Basrah until after Baghdad International Airport is open. Bechtel's emergency recommendations are shown in Figure 2.2-3. Other than the minor water treatment plant work performed on an emergency basis at Basrah airport, no other emergency work will be performed.

	Baghdad International Airport	Basrah International Airport
ATC, Landside and Airfield	▪ Clear aircraft safety areas of debris and regrade surface ▪ Restore original airside signs ▪ Install airside baricades and fence to isolate military operatins from the commercial operations ▪ Clean and sweep airside pavements ▪ Construct employee parking area and security checkpoint at airport entrance ▪ Upgrade pavement markings to current ICAO standards	
Passenger Terminal	▪ Make immediate repairs to damaged windows, doors, ceiling and roof in Terminal C ▪ Repair and restore Administration Building office area for aiport operations group ▪ Repair and restore two holding lounges for limited operations in Terminal C ▪ Repair and restore one baggage carousel for limited operations in Terminal C ▪ Provide facilities for inbound /outbound security, passport, ticketing, and passenger processing using manual procedures in Terminal C ▪ Perform life safety and fire safety audit	
Electrical Systems	▪ Install 5 MVA, 11 kV, 3 ph modular generator set ▪ Repair limited electrical systems to Terminal C, and Administration Building ▪ Restore limited electrical supply to Terminal C, Administration Building and Central Plant Facility	

Figure 2.2-3. Emergency Recommendations for Baghdad and Basrah International Airports and ATM Infrastructure

	Baghdad International Airport	Basrah International Airport
Mechanical Systems	▪ Restore limited water supply to Terminal C ▪ Restore limited sewer collection from Terminal C. Repair the main sewage lift pumps and motors. Unclog and flush limited portion of sanitary system in Terminal C. Coordinate with responsible parties to repair and restore lift stations between the airport and the off-site waste treatment plant ▪ Restock spare parts and replacement parts for all critical components ▪ Initiate equipment overhaul and/or replacement program for critical mechanical systems. Include hot water boilers, chillers, cooling towers, pump, piping, and instrumentation ▪ Initiate equipment overhaul, test, recalibrate, and rebalance of HVAC systems ▪ Restore, clean, unclog, test, and disinfect limited building plumbing systems	▪ Restore airport treatment plant operation
Telecommunications and Special Systems	▪ Install temporary satellite communications center ▪ Start security master plan ▪ Establish a Security Operations Control Center ▪ Install new multichannel trunked radio systems ▪ Stock a fire brigade room with extinguishers to ensure employee and public safety. ▪ Repair emergency power and uninterruptible power supplies where needed	
National ATM Infrastructure	▪ Install VSAT Based National ATM infrastructure communications ▪ Install remote VHF stations for *en route* ATM communications	

Figure 2.2-3. Continued.

Short-term Recommendations

The second level of operations is to continue to expand the level of service at Terminal C at Baghdad International Airport and to add services to handle regularly scheduled airline flights serving passengers under daytime VMC conditions. Once Baghdad airport is open, the repair work to open Basrah airport for limited commercial operations will begin, replicating the process used to open Baghdad airport. Short-term recommendations for Baghdad and Basrah airports are shown in Figure 2.2-4.

	Baghdad International Airport	Basrah International Airport
ATC, Ancillary Facilities and Airfield	▪ Install access road 5 meter threat fence ▪ Install landside security fence and barricades	▪ Clear aircraft safety areas of debris and regrade surface ▪ Install airside baricades and fence to isolate military operatins from the commercial operations ▪ Restore original airside signs ▪ Clean and sweep airside pavements ▪ Upgrade pavement markings to current ICAO standards
Passenger Terminal	▪ Initiate maintenance and repair program for elevators and escalators in Terminal C ▪ Refurbish two passenger loading bridges to IATA standards for airline commercial operations ▪ Continue maintenance and repair program for Terminal C architectural ▪ Repair Roof and Departure area bomb damage	▪ Make immediate repairs to damaged windows and doors in public areas of terminal ▪ Repair and restore one holding lounge for limited operations at north end of terminal ▪ Repair and restore one baggage carousel for limited operations at north end of terminal ▪ Provide facilities for inbound and outbound security, passport, ticketing, and passenger processing using manual procedures ▪ Prepare life safety and fire safety audit
Electrical Systems	▪ Continue full maintenance and repair program of Terminal C electrical systems	▪ Inspect and test the 33 kV Xfmr and change oil ▪ Change oil in the 33 kV breakers ▪ Restore electrical power in the Hammar 33KV feeder ▪ Procure and Install a 3.1 MVA Generator set in Generator Building ▪ Replace defective standby gensets in airfield substations (1000 KVA)
Mechanical Systems	▪ Continue full restroom and kitchen maintenance and repair program ▪ Continue full HVAC and control maintenance and repair program ▪ Continue full plumbing and drainage systems maintenance and repair program	▪ Restore chemical treatment capability at the water treatment plant. ▪ Test and disinfect entire water distribution network. ▪ Provide temporary means to treat sanitary waste on site. ▪ Test and clear sewer network of all blockages. Make lift stations operational.

Figure 2.2-4. Short-term Recommendations for Baghdad and Basrah International Airports.

	Baghdad International Airport	Basrah International Airport
Telecommunications and Special Systems	▪ Initiate repair and commission Paging System ▪ Initiate repair and commission CCTV System ▪ Initiate repair and commission FIDS/BIDS System ▪ Initiate repair and commision Fire Alarm System	▪ Start fire and life safety master plan ▪ Start safe operations master plan ▪ Start security master plan ▪ Establish a Security Operations Control Center ▪ Install new multichannel trunked radio systems (typically 800Mhz in USA) ▪ Install new Checkpoint Equipment System including Magnetometers, X-ray, and Trace Detection System (explosives and drug detection, as the TSA did at smaller U.S. airports) ▪ Repair existing fire alarm and control system and/or stock a fire brigade room with extinguishers to ensure employee and public safety ▪ Provide emergency power and uninterruptible power supplies where needed

Figure 2.2-4. Continued.

Intermediate-term

The third level of operations is to expand capability of Baghdad and Basrah international airports to serve scheduled airline passenger and cargo flights under daytime and nighttime instrument meteorological conditions. Intermediate-term recommendations are shown in Figure 2.2-5.

	Baghdad International Airport	Basrah International Airport
ATC, Ancillary Facilities and Airfield	▪ Repair control tower building, console replacements ▪ Install precision landing aid, such as Instrument Landing System with Distance Measuring Equipment (ILS/DME) or Local Area Augmentation System (LAAS) ▪ Install ICAO signage ▪ Repair perimeter fence ▪ Install weather observation equipment ▪ Repair airfield lighting power substations ▪ Repair and replace airfield lighting fixtures, as needed ▪ Restore lighting to visual aids ▪ Install DVOR/DME navigation aid ▪ Repair Emergency Response Station ▪ Repair Cargo Faciltiy ▪ Upgrade signage to current ICAO standards	▪ Repair control tower building, console replacements ▪ Clear aircraft safety areas of debris and regrade surface ▪ Install ICAO signage ▪ Install precision landing aid, such as Instrument Landing System with Distance Measuring Equipment (ILS/DME) or Local Area Augmentation System (LAAS) ▪ Repair perimeter fence ▪ Install weather observation equipment ▪ Repair airfield lighting power substations ▪ Repair and replace airfield lighting fixtures, as needed ▪ Restore lighting to visual aids ▪ Install DVOR/DME navigation aid ▪ Repair Emergency Response Station ▪ Upgrade signage to current ICAO standards ▪ Repair Cargo Facility

Figure 2.2-5. Intermediate-term Recommendations for Baghdad and Basrah International Airports

	Baghdad International Airport	Basrah International Airport
Passenger Terminal	▪ Expand Terminal C function from two to six holding lounges and gates ▪ Expand passenger processing facilities to handle expanded throughput ▪ Shift from manual to automated systems for security, ticketing and bag tag systems ▪ Continue upgrade of telecom, computer and special systems ▪ Continue upgrade of electrical systems ▪ Continue upgrade of mechanical systems ▪ Refurbish remaining passenger loading bridges at terminal C ▪ Refurbish baggage handling system. Tie in system with new airport structured cable local network	▪ Initiate maintenance and repair program for elevators and escalators in terminal ▪ Restore potable water and sewer to Terminal and initiate full maintenance and repair program of restrooms and kitchens ▪ Restore power to terminal and initiate full maintenance and repair program of electrical systems ▪ Expand terminal function from one to three holding lounges and gates ▪ Expand passenger processing facilities to handle expanded throughput ▪ Shift from manual to automated security and passenger processing ▪ Initiate upgrade of telecoms and special systems ▪ Implement life-and-safety and fire audit recommendations ▪ Refurbish remaining 3 passenger loading bridges
Electrical Systems	▪ Restore power flow in the second 33 kV feeder (1) ▪ Procure and install second 5 MVA generator set in generator building ▪ Replace defective standby gensets in other load centers – Assume two units of 1,000 KVA are defective – Assume four units of 500 KVA are defective ▪ Test and repair/replace defective transformers (assume six 11 kV /380 V, 2 MVA) ▪ Restore and test the relay protection systems (assume 1 panel per transformer) ▪ Repair or replace 11 kV Switchgear Equipment Module (assume 2 defective units) ▪ Replace defective 11 kV distribution cables (assume 10,000m, single circuit) ▪ Replace defective 600 V distribution cables (assume 20,000m, single circuit) ▪ Replace 11 kV cable terminations (assume 40 units are defective) ▪ Replace 600 V cable terminations (assume 1,000 units are defective)	▪ Restore and test the relay protection systems (assume 1 panel per Xfmr) ▪ Repair/Replace 11 kV Switchgear equipment Module (assume 2 defective units) ▪ Replace defective 11 kV distribution cables (assume 5000m, single circuit) ▪ Replace defective 600 V distribution cables (assume 10000m, single circuit) ▪ Replace 11 kV cable terminations (assume 20 units are defective) ▪ Replace 600 V cable terminations (assume 500 units are defective) ▪ Civil work to locate open and cover ducts with defective 11 kV cables ▪ Overhaul the #2 & #3 generators and engines. – 1000 kVA, 11 kV/380V, 3ph transformer – 11 kV switchgear and bus – 11 kV switchgear Equipment Module – Civil - foundations and building

Figure 2.2-5. Continued.

	Baghdad International Airport	Basrah International Airport
	▪ Civil work to locate open and cover ducts with defective 11 kV cables ▪ Rebuild the airfield lighting substation #1 (was completely destroyed) – 1000 kVA, 11 kV/380V, 3ph transformer – 11 kV Switchgear and bus – 11 kV Switchgear Equipment Module – Civil - foundations and building	
Mechanical Systems	▪ Restock spare parts and replacement parts for all critical components ▪ Continue equipment overhaul and/or replacement program for critical mechanical systems. Include hot water boilers, chillers, cooling towers, pump, piping, and instrumentation ▪ Continue to restore, test, recalibrate, and rebalance HVAC systems ▪ Continue to restore, clean, unclog, test, and disinfect building plumbing systems ▪ Continue to restore full operation of onsite sewage treatment plant	▪ Rebuild the Sewage Treatment Plant and the Incinerator Plant Substations (completely gutted) ▪ Overhaul the air compressor. Install automatic controls ▪ Obtain spare parts and replacement parts for all critical components ▪ Initiate equipment overhaul and/or replacement program for critical mechanical systems. Include hot water boilers, chillers, cooling towers, pump, piping, and instrumentation ▪ Restore, test, recalibrate and rebalance HVAC systems ▪ Restore, clean, unclog, test, and disinfect building plumbing systems ▪ Restore full operation of onsite sewage treatment plant
Telecommunications and Special Systems	▪ Install new Checkpoint Equipment System including Magnetometers, X-ray, and Trace Detection System (explosives and drug detection, as the TSA did at smaller U.S. airports) ▪ Install new central control monitoring system ▪ Refit existing comm rooms & closets (CR&C) with new communications equipment ▪ Install common use terminal equipment (CUTE) and local boarding application ▪ Implement a new digital master clock system ▪ Install new multi-use flight information system (MUFIDS) ▪ Install a new gate management system with MUFIDS ▪ Install a new property management system with MUFIDS ▪ Install a new security badging system (SBS) ▪ Install a new access control system (ACS) ▪ Install a new closed circuit television (CCTV) ▪ Install new structured cabling for the COMM cabling system	▪ Refurbish two passenger loading bridges to IATA Standards for airline commercial operations ▪ Install new central control monitoring sys. ▪ Refit existing comm rooms & closets (CR&C) with new communications equipment ▪ Install common use terminal equipment (CUTE) and local boarding application ▪ Implement a new digital master clock system ▪ Install new multi-use flight information system (MUFIDS) ▪ Install a new gate management system with MUFIDS ▪ Install a new property management system with MUFIDS ▪ Install a new security badging system (SBS) ▪ Install a new access control system (ACS) ▪ Install a new closed circuit television (CCTV) ▪ Install new structured cabling for the COMM cabling system

Figure 2.2-5. Continued.

	Baghdad International Airport	Basrah International Airport
	▪ Implement Local Area Network (LAN) and Integrated Media Outlet data and phone ports ▪ Install a new public address system and test existing speakers for usability; replace speaker and speaker wire if necessary ▪ Recondition ticket counters and gate podiums to accept CUTE equipment	▪ Implement Local Area Network (LAN) and Integrated Media Outlet data and phone ports ▪ Install a new public address system and test existing speakers for usability; replace speaker and speaker wire if necessary ▪ Recondition ticket counters and gate podiums to accept CUTE equipment
National ATM Infrastructure	▪ ATC Radar at Baghdad	

Figure 2.2-5. Continued.

Long-term

Once instrument meteorological conditions for daytime and nighttime operations are achieved at Baghdad and Basrah international airports, our recommendation is to expand the Iraq airport infrastructure at these facilities to continue to improve the level of service. Long-term recommendations include the opening of the remaining Baghdad terminal and administration facilities, replacement of the emergency powerhouse equipment, and repair of the ancillary facilities, such as catering kitchens, GSE repair facilities, and aircraft maintenance facilities. Continued improvements in the ATC system for Iraq include better *en route* surveillance and control using MSSR radar and VOR/OME navigation aids. Long-term recommendations are shown in Figure 2.2-6.

	Baghdad International Airport	Basrah International Airport
ATC, Ancillary Facilities and Airfield	▪ Install airport surveillance radar ▪ Install permanent terrestrial ATC communications ▪ Restore airport GSE, security and access road infrastructure	▪ Assess requirement for airport surveillance radar at Basrah ▪ Install permanent terrestrial ATC communications ▪ Restore airport GSE, security and access road infrastructure
Ancillary Facility repair such as Cargo, Catering and Maintenance Facilities	▪ Continue to restore airport ancillary facilities	▪ Continue to restore airport ancillary facilities
Electrical Systems	▪ Restore central control of all substations – One PC unit per substation – One server in the main substation – Equipment for data network, using phone line in each substation	▪ Restore central control of all substations – One PC unit per substation – One server in the main substation – Equipment for data network, using phone line in each substation

Figure 2.2-6. Long-term Recommendations for Baghdad and Basrah International Airports

	Baghdad International Airport	Basrah International Airport
Mechanical Systems	▪ Complete equipment overhaul and replacement program ▪ Tie in with new CCMS system to automate building life support systems ▪ Upgrade Ameria water treatment plant to drinking water standard ▪ Restore apron hydrant fueling system and GSE fuel system if traffic demand warrants	▪ Complete equipment overhaul and replacement program ▪ Replace CCMS system to automate building life support systems ▪ Refurbish baggage handling system. Tie in system with new airport structured cable local network ▪ Restore apron hydrant fueling system if traffic demand warrants
Telecommunications and Special Systems	▪ Accommodate airline operations systems into structured cabling system ▪ Accommodate government systems TSA, FAA, customs, agriculture, DEA ▪ Complete fire and life safety master plan ▪ Complete safe operations master plan ▪ Complete security master plan	▪ Accommodate airline operations systems into structured cabling system ▪ Accommodate government systems TSA, FAA, customs, agriculture, DEA ▪ Complete fire and life safety master plan ▪ Complete safe operations master plan ▪ Complete security master plan
National ATM Infrastructure	▪ Install *en route* VOR/OME navigation aids ▪ Consider installation of additional MSSR radar for *en route* ATM surveillance and control	

Figure 2.2-6. Continued.

Unassessed Projects

Bechtel has not assessed the three remaining unspecified domestic airports in our contract scope. The three are likely to be Mosul, Kirkuk, and Tikrit airports, which are currently military facilities. The information we have gathered from the two international airports assessed to date gives Bechtel reason to believe that the three domestic airports will require significant repair and rehabilitation to bring their facilities up to an acceptable industry standard for operations and safety. Examples of such remedial work include repair to terminal and ancillary facilities, emergency power, ATC, and general utility systems.

Appendix

Included in the Appendix is the following:

- Airport Systems Assessment Checklist

Section 2.3 Water, Waste, Irrigation

2.3 Water, Waste, and Irrigation

Water, waste, and irrigation are critical areas in terms of water supplies to southern Iraq. There is an immediate need to ensure that population has access to water for basic health and sanitation.

On a wider scale, the Bechtel assessment included reconstruction, repair, or rehabilitation and/or upgrade of water treatment plants, distribution systems, and pumping stations; wastewater collection systems, pumping stations, and treatment plants; and solid waste collection equipment and disposal facilities.

Bechtel has been tasked with assessing the critical systems in 15 urban centers within the first 6 months. Criteria for this assessment include:

- Meeting the humanitarian needs of the local populace
- Ensuring the system is sustainable
- Designing a system that accommodates expansion
- Returning the system to preconflict conditions as a minimum

Typical compact water treatment unit

To date, Bechtel has concentrated on the Al Basrah, Baghdad, and Heartland regions, which were identified by CPA and USAID early in the process as areas of greatest need. This report presents the initial findings and outlines the resulting conclusions and recommendations.

2.3.1 Existing Conditions

Bechtel performed assessments on numerous water and wastewater plants, pumps, generators, and pipelines as shown in Figures 2.3-5 through 2.3-9 at the end of this section and listed in the Appendix. In addition, military assessment reports were reviewed and incorporated into our findings. A pictorial presentation of the current status of many water and waste facilities is presented in the Appendix. The following is an overview of those assessments.

Water

The Tigris and Euphrates rivers and their tributaries supply about two-thirds of the raw water that is treated and used for potable services in Iraq. The rivers generally carry significant levels of silt from erosion, blowing sands, and agricultural runoff. This necessitates the use of water treatment processes that typically include treatment with alum; mixing, flocculation, and sedimentation to remove some of the solids; and sand filtration to remove the remaining solids prior to chlorination and transport through the distribution system to the end user. There are about 1,500 existing water treatment facilities operating in Iraq, of which 1,200 are compact units and 226 are conventional plants with clarifiers and gravity-based rapid sand filters. The remainder are wells or springs that require only chlorination to be acceptable for drinking water usage. Ninety-one percent of the urban population and 48% of the rural population are served by the potable water systems.

The extent to which Iraq's water treatment plants are functioning is attributed to the resourcefulness and dedication of the Iraqi engineers and maintenance people who are making do with few, if any, spare parts, as well as insufficient power. The plants rely on the chemical alum to aid in the removal of solids and chlorine to kill any residual bacteria. The chemical feed and controls for these systems need replacement. Motors, pumps, and other working mechanisms are generally in need of either replacement or major repairs. Effluent quality is rarely monitored.

In many cases, those who don't receive water directly have punctured the distribution system to insert their own takeoff pipes (pictured at right), creating new sources of contamination for the supply system.

Illegal tapping points on water supply pipe

Major urban centers in Iraq are shown in Figure 2.3-1. About two-thirds of the population reside in the belt between the two rivers from Samarra to the north of Baghdad to Samawah in the south. Municipal wastewater and agricultural runoff from this region exerts a tremendous load on the water resources of the area. Over the last decade, in the areas to the south of Samawah, cholera and related diseases have been common. This year cases are also being reported in the Al Basrah governorate.

Figure 2.3-1 Major Urban Centers of Iraq

Waste Management

Sewerage, which includes treatment, serves 80% of the population of Baghdad and 9% of the remainder of the urban population. Rural areas and the autonomous region in the North of Iraq are unsewered. Existing sewage treatment plants have suffered greatly from a lack of maintenance funds. Many of the treatment plants are simply bypassing the wastewater and going directly to the rivers due to a lack of one or more of the following:

Aeration tank with old sludge decaying at base.

- Spare parts
- Attention to scheduled maintenance
- Training and tools for the maintenance staff
- Power for significant periods of time

Power outages force a shutdown of lift station pumps causing the sewerage to back up in the sewers to the point where flooding may occur. This promotes deposition of solids in the sewer, which leads to further blockages of sewerage flow. Flooding from sewerage, or foul flooding, is a common problem in Baghdad. In an attempt to combat this problem, numerous generators have been installed throughout the urban areas, but the need to operate them on a nearly continuous basis has resulted in a failure of many of the generators.

Irrigation Systems

Bechtel has begun discussions with USAID agricultural program staff on determining priority needs for repair or rehabilitation of Iraq's irrigation system. Field assessments will begin shortly.

2.3.2 Requirements for Restoration of Critical Services

Water

Availability of a safe, reliable source of potable water is an absolute necessity for the citizens of Iraq. This requirement is not only challenged by the existing aging, under-maintained water supply system, but also by the discharge of large amounts of raw wastewater into the river water supply system, either from inoperative treatment plants or illegal discharges of septic tank truck effluent.

Wastewater Treatment

To combat this situation, Bechtel's recommendation is to focus on wastewater treatment plant rehabilitation from Mosul down to Samawah. The objective is to repair or replace the inoperative mechanical and electrical equipment within the wastewater treatment plants and restore the plants to their original design capacity and effluent quality. The plants that Bechtel recommends for the first tier of projects are listed in Figure 2.3-2.

Wastewater Plants Recommended for Initial Rehabilitation		
Region	**Name**	**Current Capacity**
Baghdad Mayoralty	Rusramiyah	430,000cum/da
	Kerkh	280,000cum/da
Heartlands	Karbala	116,000cum/da
	Al Kut	0
	Al Najaf	43,000cum/da
	Al Hillah	12,000cum/da
	Ad Diwaniyah	12,000cum/da
	Samawah	0

Figure 2.3-2. Wastewater Plants Recommended for Initial Rehabilitation

Nearly 75% of the wastewater discharged from these major sources comes from the Baghdad area. The existing Baghdad wastewater treatment facilities require immediate attention to reduce the bacterial and organic loading to the rivers. The best approach would be to treat as much of the effluent as possible to a secondary standard to promote bacterial kill through chlorination. Likewise, the sewage pumping stations must operate on a reliable basis to prevent flooding streets and basements with raw sewage. Any improvement of the river water quality will require significant changes to the Baghdad system.

Requirements for repair or rehabilitation of irrigation systems will be determined upon completion of the assessment program.

Water Treatment

Water treatment systems are generally not efficiently functioning due to the large quantity of wastewater entering the water supply system. Bechtel proposes focusing on the water treatment systems starting in the south and gradually working to the north. Figure 2.3-3 shows the water treatment and distribution system for the Al Basrah governorate. The majority of the water treatment plants in this area are compact units purchased through the Oil-for-Food Program. The objective will be to rehabilitate the mechanical and electrical systems of these plants to improve their reliability and operability. A major area of emphasis will be control of the chemicals, alum and chlorine, to ensure proper water treatment. Operator training is required to improve both operations and quality control within the treatment plant.

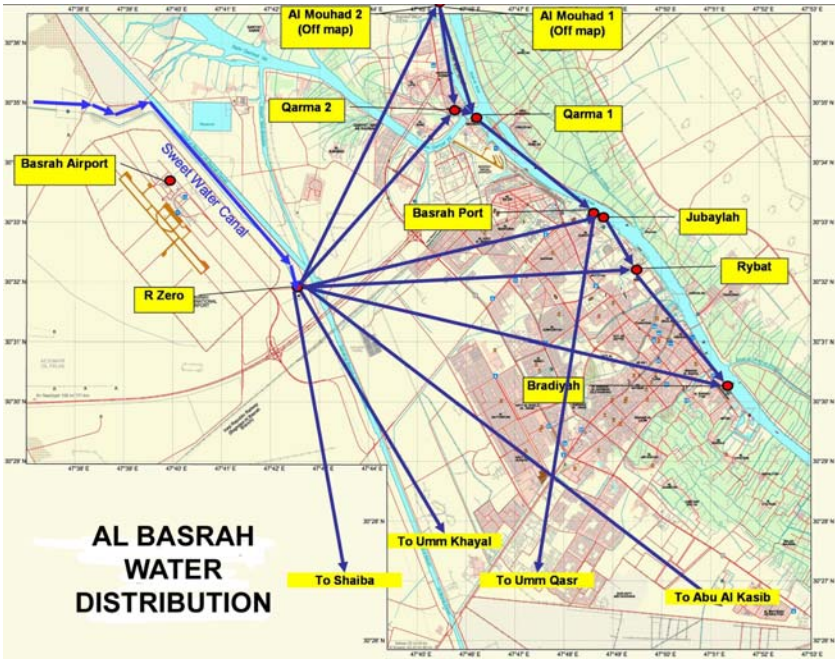


Figure 2.3-3. Water Distribution Network for Al Bashra

2.3.3 Needs Assessment

Within the water and wastewater area, the majority of the emergency situations have been assigned to military units and those NGOs that have been working in the region for the last several years. This includes a provision to truck in potable water as well as emergency repairs to mechanical and electrical systems.

The assessment team's focus has been on the short- and intermediate-term solutions to water-related issues.

Short-term

Suggested short-term solutions include:

- Rehabilitate the pump stations serving the Al Basrah governorate's potable water system
- Rehabilitate the Kerkh and Rusramiyah wastewater plants in Baghdad to the extent possible to deliver a good level of secondary water treatment (each plant has several independent process trains)
- Repair and replace mechanical and electrical systems in the existing Karbala, Al Hillah, Al Najaf, and Ad Diwaniyah wastewater plants
- Provide at least primary, and preferably secondary, treatment at Al Kut and Samawah
- Rehabilitate potable water treatment plants serving Al Basrah governorate's residents
- Repair major illegal connections to the Umm Khayal-Safwan and Al Basrah-Umm Qasr pipelines
- Complete construction of a new pump station to serve Safwan and neighboring communities (suspended due to the conflict)
- Construct a 200-million-liter/day water filtration plant extension for the Saba Nissan water treatment plant in Baghdad
- Replace critical sewerage lift station pumps and install bar screens in Baghdad sewers where conditions warrant

The above represents critical actions required at 9 of the 15 major urban areas originally listed (highlighted in red in Figure 2.3-4). These actions will allow these regions to meet basic potable water needs as well as allow them to meet minimal standards of health regarding sewage effluent discharge.

Figure 2.3-4. Urban Areas Requiring Short-term Actions

Long-term

It is anticipated that long-term solutions will continue to focus on the wastewater treatment plants north of Baghdad, the rehabilitation of the remaining portion of the Baghdad wastewater plants (if all are not completed in the near-term), and water treatment plants in the major urban areas in the central and northern parts of Iraq. In addition, Bechtel proposes clearing the Sweet Water Canal of plant growth and accumulated sand and silts and repairing the canal walls to minimize both leaks and the danger of a catastrophic failure that would sever the Al Basrah governorate from its primary source of water supply.

Idle Ad Diwaniyah Water Treatment Plant

Another long-term objective is to begin developing a method to reclaim the Mesopotamian Marshlands to restore natural river water quality.

2.3.4 Challenges

Some of the challenges that must be overcome to make the program successful for Iraqi citizens include:

- Coordinating efforts to minimize overlap among the numerous NGOs, military and civilian authorities, and private contractors in the area
- Spreading work efforts throughout the country so all areas can benefit more or less equally
- Resolving illegal water taps on the network by providing an acceptable substitute that reduces the potential for contamination of the water supply
- Maximizing Iraqi participation in the supply and installation of facilities in the face of worldwide interest in providing these same services
- Meeting community expectations for reliable water supply and wastewater collection and treatment
- Integrating with Iraqi utility engineers and engineering companies to jointly define and implement solutions to the water and wastewater issues

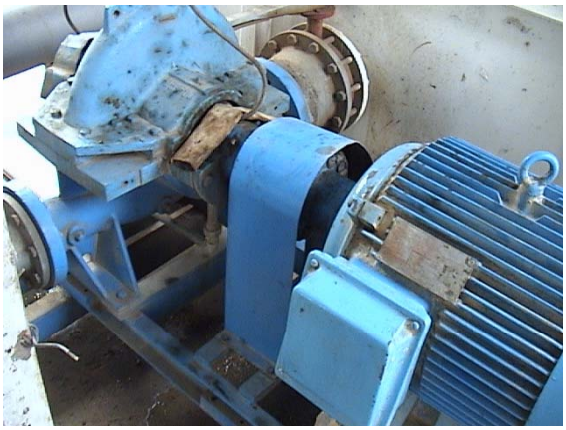
Additional community issues that must be addressed by the local citizens include:

- Developing a recognition within local communities that the upgraded facilities are theirs to maintain and protect for their own benefit
- Retraining local utility staff so they are aware of the need to closely monitor plant performance and output to ensure that the quality of the product meets public health requirements
- Increasing public awareness regarding citizen obligations to help maintain the integrity of the water supply system and to properly dispose of sewerage and household wastes so they do not degrade water supplies or the environment

2.3.5 Existing O&M Organization

With the exception of the Baghdad Mayoralty, it appears that the O&M organizations of the municipalities, both water and wastewater, lack an appreciation of how unit operations were supposed to function. Alum feed systems appeared to be fixed at some general set point regardless of flow through the plants. The same appeared to be true for chlorination systems. Little or no water quality data was being collected in the plants to ensure they were performing to expectation and it appears there was no regional or federal oversight of the water or wastewater plants to ensure they were meeting mandated water quality objectives.

The above situation may be the result of the long period of deprivation where water and wastewater utilities were barely able to keep mechanical and electrical systems running, much less monitoring plant operations through laboratories. As a result, most of the water plants were not removing turbidity to sufficient levels to render the chlorination process effective. Given the high level of raw wastewater in the supply, this is an unacceptable situation.



Pumps will require testing under all conditions to ensure availability.

Neither water nor wastewater plants were able to maintain any reasonable spare parts inventory. On the contrary, they ran a negative inventory since they were always short of spare parts for their equipment. Rehabilitating the existing equipment or replacing it should include a reasonable allowance to supply needed spares.

Bechtel strongly recommends that the governates develop an effective training program for the conventional and compact units and take this training to each water plant in their area. In addition, each plant should have a clean area dedicated to laboratory quality control and the governate should develop a quality assurance capability to help identify O&M teams that need additional assistance to ensure that they deliver a quality product.

2.3.6 Recommendations

The primary recommendation is to address the public health issue of providing a safe, reliable supply of potable water to the public. This can be achieved in two steps:

- Upgrading water treatment and transmission facilities in the southern region of the country so they effectively and reliably remove the turbidity and kill the bacteria in the water supply. Educate the public to refrain from the illegal water network taps and provide a sanitary alternative for those in the area not currently connected to the system.
- Removing the sources of raw wastewater from the highly populated south central region by rehabilitating the major wastewater treatment plants that are currently discharging raw or nearly raw wastewater to the rivers. In addition, provide a proper disposal area for the septic tank trucks and enforce a stop to the practice of dumping septic tank waste into the rivers and canals.

The following describes the general characteristics of the projects that have been identified through the assessment process, and discussions with the engineers and managers in the Baghdad Water Authority and the General Corporation for Water and Sewerage. The listed projects have been segregated into five categories, the first four of which we have assessed as part of our initial program in country:

- Emergency – projects requiring an immediate start to meet urgent humanitarian needs.
- Short-term – projects that can be completed within 6 months of receiving an approved job order.
- Intermediate – projects that can be completed between 6 months from job order approval and the end of the contract program.
- Long-term – assessed projects that we believe completion would extend beyond the end of the contract program in 2004.

Emergency Projects

These are projects that can meet a critical need in the first few months of the program (Figure 2.3-5). Providing a safe, reliable supply of water is one of these critical areas. For the east side of Baghdad, which suffers a shortage of nearly a billion liters of water daily, this amounts to a capacity increase of about a quarter of a billion liters of water in a 3 month period. In Aswan, in southern Iraq, it means finishing a pump station that is the only source of supply to a community of about 30,000 people. And finally, again in southern Iraq, it includes repairs to three existing main transmission pipelines that have several breaks and illegal penetrations, greatly increasing the chances of contaminating the potable supply to several communities.

Short- and Intermediate-Term Projects

This phase (Figures 2.3-6 and 2.3-7) will initially focus on upgrading the water plants in the area south of An Nasiriyah to the Port of Umm Qasr and the wastewater plants in the central region, from Baghdad south to just north of An Nasiriyah. Once these projects have been started, attention will turn to the water projects in the central region and the wastewater projects to the north of Baghdad.

Our initial assessments show that most, if not all, of the water treatment plants require replacement of their chemical feed systems; ammonium sulfate to help remove solids and chlorine to kill bacteria. Pumps, motors, and generators require refurbishment and in some cases replacement. Since many of the plants are compact units and of similar manufacture, one way to expedite the rehabilitation would be to initially replace the pumps on a few plants and take the surplussed pumps to a refurbishment center. Here they would be refurbished or provide parts to the process, thus providing a pool of pumps to downstream plants as they are upgraded. An Iraqi company could be established to do the rehabilitation if one does not already exist in the area.

Raw wastewater discharges to the rivers must cease. Mechanical and electrical equipment will be replaced and/or repaired as needed. Operators and tank truck drivers must be trained to properly exercise their duties.

A program also needs to be established for the canal systems. Most are in need of cleaning, dredging, and bank restabilization. Flows and salinities should be addressed to determine if some contribute significantly to

the salt load for the Tigris and Euphrates rivers. The Sweet Water canal should be cleared, dredged, and stabilized as a priority as it is the prime source of water for the Al Basrah governorate.

Long-Term Projects

The above projects focus on returning the water and wastewater systems to their design conditions. Longer-term projects generally look to extend the capabilities of the existing works or put new works in place (Figure 2.3-8). At this time, a significant portion of the wastewater generated in Baghdad is discharged to the river even when all the plants are running at capacity. Outside of Baghdad, approximately 10% of the population is sewered and all of the municipalities have less water supplied than their demand. This group of projects is intended to address those problems over the next few years.

Unassessed Projects

The objective of these strategic projects is to help move Iraq from the situation where available parts and equipment limits the choices for infrastructure development to a position where decisions can be made that benefit the long-term health, social, and economic development of the people (Figure 2.3-9). A case in point is to replace the dispersed compact units with a regional conventional water treatment plant. This would improve the reliability and maintainability of the equipment, ease the burden on operator training, and centralize the maintenance programs. Quality control monitoring would be simpler because of the centralized systems and the much-reduced number of process units to monitor. Addressing the growing salinity of Lake Tharthar, brackish agricultural waters and the marshlands issue are also key strategic programs that have significant impact on the resources of the country.

Appendix

Included in the Appendix are the following:

- Facilities Visited by Water Team
- Al Basrah Governorate Potable Water Pump Station
- Current Status

Out of service clarifier

Emergency Projects		
Location	**Action Required**	**Duration of Activity**
Safwan pump station	New pump station and rehabilitated elevated storage tank for potable water supply to approximately 40,000 people near Al Basrah.	3 months

Figure 2.3-5. Emergency Activities.

Short-term Projects			
Location	**Action Required**	**Duration of Activity**	
Saba Nissan Extension No. 1	Construct 200 million liter/day water plant extension for east side of Baghdad serving about 2.5 million residents.	Phase	Duration per phase
		1	3-4 months
		2	9-12 months
Repair water mains in Basrah region	Replace 1 - 15 km supply pipeline and repair damage incurred by illegal connections on approximately 40 km of two potable water main pipelines.	5 months	
Ba'aqubah water treatment plant	Rehabilitate or replace mechanical and electrical (including ICA) equipment.	6-8 months	
Diwaniyah water treatment plant	Rehabilitate through replacement or repair dosing (Alum, Chlorine), flocculation, clarification and filtration equipment at the treatment plant. Update QC laboratory.	3-5 months	
Al kut water treatment	Rehabilitate or replace mechanical and electrical (including ICA) equipment. Update QC laboratory.	6 months	
Al Samawah water treatment plant.	Rehabilitate and replace mechanical and electrical (including ICA) equipment. Update QC laboratory.	6-8 months	
Canal salinity and general water quality survey	Determine flow and salinity for canals/rivers tributary to Tigris and Euphrates.	8-10 months	

Note: QC - Quality Control; ICA - Instrumentation, control and automation

Figure 2.3-6. Short-term Activities.

Intermediate-term Projects		
Location	**Action Required**	**Duration of Activity**
Al Hillah water treatment plant	Complete the works for the two waste water plants serving Al Basrah. Increase the network to serve about 50%.	18-24 months
Saba Nissan Extension No. 2	Add new 50MGD (200 million liter/day) water plant expansion.	18 Months
Basrah water distribution pumps and generators	Rehabilitate or replace approximately 90 water pumps and 20 generators (and all ICA equipment) equipment that supply water to 13 areas in and around the Basrah region.	8-10 months
Basrah water treatment plants	Rehabilitate through replacement or repair 13 water treatment plants including dosing equipment (Alum, Chlorine), coagulation, filtration and disinfection within the Basrah region.	8-12 months (depending upon extent of repairs/vendor equipment availability)
Diwaniyah wastewater treatment plant	Rehabilitate or replace mechanical and electrical (including ICA) equipment. Plant is currently disposing raw wastewater into river network.	8 months
Kerballa wastewater treatment plant	Rehabilitate or replace mechanical and electrical (including ICA) equipment. Plant is currently disposing raw wastewater into river network.	12 months
Al Najaf water treatment plant	Rehabilitate through replacement or repair of dosing (Alum, Chlorine), flocculation, clarification and filtration equipment at the treatment plant.	8-10 months
Al Najaf wastewater treatment plant	Rehabilitate and replace mechanical and electrical (including ICA) equipment. Plant is currently disposing raw wastewater into river network.	10-12 months
Al Hillah wastewater treatment plant	Rehabilitate or replace mechanical and electrical (including ICA) equipment. Plant is currently disposing raw wastewater into river network .	10 months
Baghdad sewage lift stations	Pump failure is causing sewerage to back up into city streets. Install bar screens to protect lift station pumps and replace or rehabilitate existing pumps.	12 months
Kerkh wastewater treatment plant	Rehabilitate and replace mechanical and electrical (including ICA) equipment within the influent screenings. Grit removal and primary tanks currently passing raw wastewater into the river network. Plant is currently disposing raw wastewater into river network.	8-12 months (depending upon extent of repairs and equipment availability)
Rusramiyah wastewater treatment plants	Replace or rehabilitate the mechanical and electrical systems from the influent screens to the chlorination system. Plant is currently discharging raw wastewater to the river.	12-15 months (depending on the availability of equipment)

Figure 2.3-7. Intermediate-term Activities.

Intermediate-term Projects			
Location		**Action Required**	**Duration of Activity**
Kirkuk water treatment plant		Rehabilitate or replace mechanical and electrical (including ICA) equipment.	12 months
Arbil water treatment plant		Rehabilitate or replace mechanical and electrical (including ICA) equipment.	8-10 months
Rehabilitate existing flooding sewerage stations		Repair or replace pumps and provide bar screens for pump protection where recommended.	18 months
Mosul waste water treatment plant		Rehabilitate or replace mechanical and electrical (including ICA) equipment.	12 months
Mosul water treatment plant		Rehabilitate or replace mechanical and electrical (including ICA) equipment. Update QC laboratory.	10-12 months
Refurbish Sweet water canal pumps, gates and canal walls		Remove debris, clean accumulated sand, repair canal banks, (both erosion damage and serious structural concrete collapse) line canal where appropriate (only 60% canal walls are lined, bottom is unlined). Repair/replace pumps and controls, valves and penstocks.	12-15 months
Refurbish Baghdad existing water plants	Kerkh	General plant maintenance of Mechanical and Electrical equipment.	12 months
	Saba Nissan		
Complete refurbishment of Kerkh wastewater treatment plant		Upgrade, rehabilitate or replace mechanical and electrical (including ICA) equipment, as required.	12-15 months
Upgrade institutional capacity for sustainable plant O&M		Assist in implementing new management systems for O&M and in training operating staff.	12 months
Complete refurbishment of Rusramiyah wastewater treatment plant		Upgrade, rehabilitate or replace mechanical and electrical (including ICA) equipment, as required.	15-18 months

Note: QC - Quality Control; ICA - Instrumentation, control and automation

Figure 2.3-7. Continued.

Long-term Projects		
Location	**Action Required**	**Duration of Activity**
Refurbish Al Faris wastewater treatment plant	Rehabilitate or replace mechanical and electrical (including ICA) equipment. Update QC laboratory.	12 months
Baghdad water treatment plant expansion	Design and install a new conventional coagulation and filtration plant for the east side of Baghdad.	60 months
Canal dredging	Dredge canals on a continuing basis to remove silt and lower adjacent water tables.	60 months
Heartlands area interceptor sewer	Add a sewer line along river to intercept existing flows of untreated sewerage is dumped in storm sewers and transport of sewerage away from river to aeration ponds.	18-24 months
Upgrade Baghdad wastewater plants to handle existing flows	Existing plants do not have the design capacity to handle the current sewerage flows.	48 months
Install septage treatment systems in Arbil and Kirkuk	Septic tank wastes are currently not treated and most likely are discharged to the canals and rivers.	18 months
Install sewerage systems in Arbil and Kirkuk	These cities currently do not have any sewers; they rely on septic tanks and latrines.	36 months
Upgrade Basrah wastewater plant	Complete the construction and startup of the wastewater plant.	36 months
Al Hillah water treatment plant	New screens, rehabilitate and replace mechanical and electrical (including ICA) equipment. Update QC laboratory.	3-6 months
Upgrade Al Kut wastewater treatment plant	New wastewater treatment plant.	15-18 months.
Al Samawah wastewater treatment plant.	Complete the design and commence construction on a new wastewater treatment plant. Design is partially complete. Work stopped at the onset of the conflict.	18 months

Note: QC - Quality Control; ICA - Instrumentation, control and automation

Figure 2.3-8. Long-term Activities.

Unassessed Projects Activities		
Location	**Action Required**	**Duration of Activity**
Marshlands rehabilitation	Rerouting of river flows has resulted in a significant reduction in supply of water to the marshlands. This program will look to identifying and implementing solutions to the problem.	60 months
The expansion of Baghdad wastewater plants and collection systems serving the entire city	At present 80% of Baghdad has a sewer system. This project will provide sewage for the entire city.	60 months
Expand existing wastewater collection systems to serve 100% of municipalities that currently have sewage treatment	Municipalities with sewer systems generally only have service for 10-20 percent of the city. This program would provide full coverage to the entire city.	48
Expand existing wastewater treatment in GCWS municipalities to cover 100%.	The above municipalities have wastewater treatment for only 10-20 percent of the community. This will expand the treatment capacity to conform to the sewered area.	48
Install regional conventional water plant to serve Basrah users	The Basrah area is currently served by about 15 water treatment plants distributed over a wide area. This would centralize treatment in a regional conventional plant, distributing treated water to the surrounding area.	60
Install regional conventional water plants to replace compact units in areas other than Basrah	Compact uinits were meant as an interim measure during the embargo. Conventional plants more reliably serve the community over a longer period of time.	100
Convert Arbil and Kirkuk septage treatment to conventional	Once the sewer systems are in place the treatment works can be modified to permit more complete removal of wastes and possible recycling of the wastewaters.	48
Upgrade 45 municipal solid waste disposal systems	Sanitary disposal of municipal wastes is limited. This task will develop a standard landfill design and use it where applicable.	72
Rehabilitation of irrigation systems	Irrigation and brackish water canals need maintenance and upgrading to minimize contamination of agricultural lands and to minimize transfer of salts to canals and rivers.	60
Treat agricultural brines	Brackish wastes from farms should be collected and treated where agriculture is dense to limit the salt load on the rivers and downstream users.	96
Repair and restoration of additional 7 urban wastewater collection and treatment systems	Smaller communitiea either have minimal or no systems. This project will install the sewers and the treatment plant to handle the local wastes.	60

Note: QC - Quality Control; ICA - Instrumentation, control and automation

Figure 2.3-9. Unassessed Projects Activities.

Section 2.4 Power

2.4 Power

One of the basic pillars of an active and vibrant economy is a reliable supply of electric power for residential, commercial, and industrial needs. Although Iraq at one time had almost 10,000 MW of power, it has been reduced to less than half that due to wars, the U.N. embargo, looting after the recent conflict, and poor maintenance and operations. Not only have power plants been affected, but the distribution systems well. Combined, this has resulted in a significant shortage of power throughout the country. At the present time, most areas of the country receive an average of 16 to 18 hours of power each day on an intermittent basis. This same condition existed prior to the conflict. A downstream effect of these problems is a severe deficiency of environmental controls. Air emissions are significant and power plant wastewater treatment is mostly nonexistent, resulting in significant pollution to major waterways.

Bechtel's assessment efforts have focused on identifying needed repairs, restoration, new generation, and improved operations that would result in maximum increases in overall generation in the shortest time. Our assessment concentration has been on ensuring a reliable power supply to the country, with an emphasis on Baghdad. Figure 2.4-1 shows the existing electrical power system in Iraq.

2.4.1 Existing Conditions

As of June 15, approximately 3,500 MW of power was being produced throughout the country, including 1,000 MW of power from hydroelectric sources that are dependent on water levels in the reservoirs and the Irrigation Ministry's decision to discharge water. An additional 1,000 MW is expected to return to service over the next 6 months, resulting in approximately 4,500 MW of the 10,000 MW of rated capacity.

Bechtel's rapid assessments included most of the major power stations in the country as well as the majority of the 400 kV and 132 kV distribution systems and most of the substations in the South Region. Because Baghdad must import between 500 to 1,000 MW from other parts of the country depending on the demand, we placed additional focus on the plants supplying Baghdad and the transmission lines carrying that power.

Destroyed Al Qurnah Substation

CPS Substation

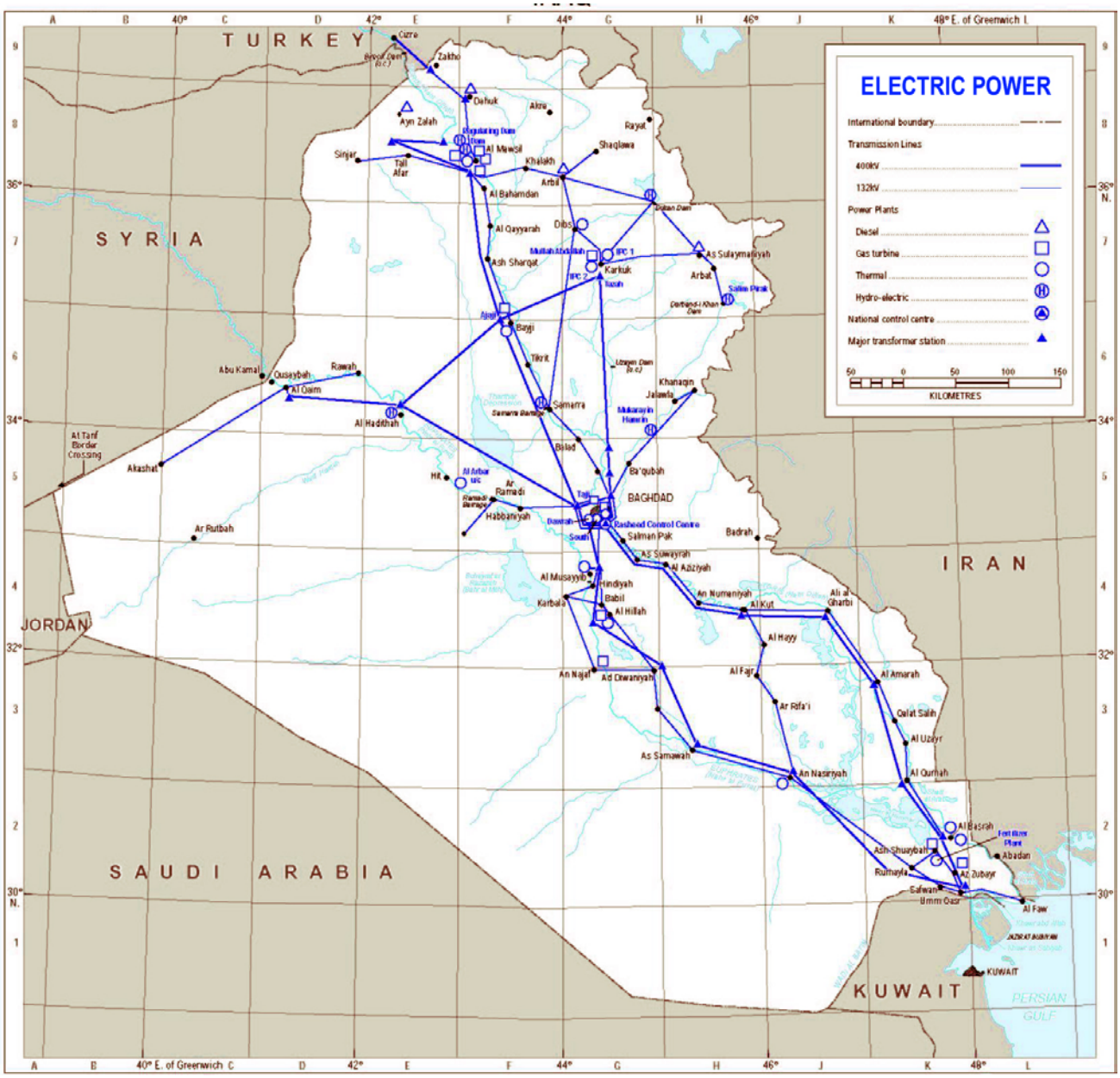


Figure 2.4-1. Electrical Power System in Iraq

Generating Stations

Assessments indicate that the generating stations received little damage during the recent conflict, although many were significantly damaged during the 1991 war. As indicated in Figure 2.4-2, most of the plants are operating well below their rated capacity and are not very reliable, resulting in frequent breakdowns and reductions in output. In general, plants are 10 to 25 years old and have suffered deterioration in excess of what would be expected for plants of similar age. This is due to lack of parts and operating chemicals, poor cooling and boiler water treatment, and the need to run the plants under conditions that rapidly accelerate normal wear and tear (i.e., improper operations and maintenance).

Station	Nameplate Capacity	Type	Condition	Cause	Approximate Output MW
Baghdad South	355	Steam	Unreliable, reduction in generation	Maintenance, spare parts, water treatment	160
Doura	640	Steam	Reduction in generation	Equipment conditions	150
Mussiab	1,200	Steam	Reduction in generation	Equipment conditions	600
Bayji	1,320	Steam	Reduction in generation	Equipment conditions	420
Najibiya	200	Steam	Reduction in generation	Equipment conditions	100
Nasiriyah	820	Steam	Unit out of service	Outage	400
Hartha	400	Steam	One unit available	Outage, equipment conditions	110
Doura	150	Gas	Reduction in generation	Equipment conditions	25
Taji Old	120	Gas	Not able to run at full power	Equipment failure	60
Najef	189	Gas	Reduction in generation	Equipment failure	90
Qudus	246	Gas	Reduction in generation	Equipment failure	200
Dibs	112	Gas	Reduction in generation	Equipment conditions	50
Mullah Abdullah	445	Gas	Reduction in generation	Equipment conditions	140
Mosul	200	Gas	Not assessed	N/A	-
Khor Zubair	252	Gas	Not reliable	Equipment conditions	180
Bayji Gas	159	Gas	Not reliable	Equipment conditions	0
Hadithah	660	Hydro	Need further assessment	N/A	460
Mosul Main	750	Hydro	Reduction in generation	Equipment conditions	400
Mosul Pump	240	Hydro	Need further assessment	N/A	-
Dokan	400	Hydro	Need further assessment	N/A	-
Derbendikhan	166	Hydro	Need further assessment	N/A	-
Total	**8,660 MW**				**3,545 MW**

Figure 2.4-2. Rapid Assessment Results of Major Generating Units

Transmission Systems

The 400 kV and 132 kV transmission system sustained relatively minor damage during the recent conflict. Most of the damage has occurred post-conflict, due primarily to looting. Nevertheless, repairs of the lines have been undertaken by utility crews. As of June 15, there continues to be significant looting of the transmission system in the North and South regions. Figure 2.4-3 shows the status of major sections:

Transmission Line	Damage
Baghdad Loop	Towers damaged, lines and insulators broken
Khor Zubar to Hartha	Towers down and damaged, lines broken due to conflict damage, looting, and vandalism
Hartha to Al Qurnah	Towers down and damaged, lines broken due to conflict damage and looting
Al Qurnah to Al Kut	Towers down due to ongoing looting and vandalism
Kohr Zubar to An Nasiriyah	Towers down and damaged, lines broken due to conflict damage
Baghdad West to Bayji	Towers down and damaged, line broken due to conflict damage
Baghdad West to Al Haditha to Bayji	Towers down and damaged, lines broken due to conflict damage

Figure 2.4-3. Rapid Assessment Results of 400 kV Transmission Lines

Substations

Substations, which allow distribution of electricity to cities and industries in the north and around Baghdad, suffered limited damage from the conflict and from looting. Substations have been repaired by utility crews using spare parts and are generally back in service. By contrast, substations in the south received minor damage during the conflict, but looting has been extensive and has effectively destroyed 75% of the major substations. Figure 2.4-4 shows some examples of this damage.

Substation	Damage	Status
Al Qurnah	Destroyed by vandalism and looting	Complete replacement required
CPS Stations 1 through 10	Destroyed by vandalism and looting	Restoration of controls complete Replacement of transformers required

Figure 2.4-4. Damage to Southern Substations

2.4.2 Requirements for Restoration of Critical Services

Iraqi power utility personnel have done an outstanding job of getting power plants operating. Major emergency problems encountered include lack of operating chemicals and gases, spare parts and tools to work on the equipment, and vendor technical representatives to assist in getting the equipment working properly. Without these items and services, the generating stations are in danger of shutting down, resulting in loss of electricity throughout the country. A sample of these items is shown in Figure 2.4-5.

Emergency Problem	Restoration Activity	Status
Power stations in Baghdad region short of critical spare parts and emergency repair activities for continued operation	Procurement of required parts, technical services and replacement equipment	In process, some parts and materials delivered, 20% complete
Power stations in Baghdad area short of boiler water treatment chemicals required for continuing operation	Procurement of emergency chemicals	Completed
Power stations in southern region short of boiler water treatment chemicals required for continuing operation	Procurement of emergency chemicals	Completed
Hand tools for maintenance of Baghdad station looted	Procurement of mechanic's tool sets	Completed
Laboratory equipment and chemicals at Hartha station looted	Procurement of hand tool sets	Procurement in process
Lack of power at Umm Qasr grain facility	Procurement of 16 generators	Installation in progress, equipment shipping
No generation supporting opening of Baghdad airport	Procurement of 5 MW of generation	Installation in progress, equipment shipped
Absence of required electrical test equipment	Procurement of test equipment	In process
Failed turbine oil at Hartha station	Procurement of replacement oil	Job Order Submitted
Lack of lubricating oil for Mosul Dam	Procurement of lubricating oil	Job Order Submitted
Combustion turbine operations issues at Taji station	Obtain vendor representative	Job Order Submitted

Figure 2.4-5. Immediate and Emergency Power Needs (as of June 5, 2003)

2.4.3 Needs Assessments

Working with Iraqi power utility personnel, U.S. Army, and USAID personnel, a matrix of power system status and needs has been developed through the end of 2004.

Short-Term

The short-term focus (the next 9 months excluding emergency work) is to improve reliability by replacing or repairing damaged equipment; increasing output through short-term rehabilitation of damaged units, and adding new generation by utilizing small, easily installed units (50 MW and less). In addition, there are several new units ready to operate that were supplied under the U.N. Oil for Food Program that require some troubleshooting and commissioning assistance. Short-term actions are listed in Figure 2.4-6.

Deficiency	Action Required	Duration of Activity
Lack of generation for critical services, with emphasis on Baghdad	Purchase of 100 MW of additional generation in sizes from 1 MW to 10 MW	1-2 months
Lack of generation for critical services, with emphasis on Baghdad	Purchase of 300 MW of additional generation in sizes from 20 MW to 70 MW	3-6 months
400 kV and 132 kV high voltage transmission lines and towers damaged or destroyed	Issue subcontract to Iraq company for repair, supply of required tower and line materials	1-3 months
Reduction in power from existing stations	Short-term restoration and rehabilitation	3-6 months
Fuel gas skid for Shoubah generating station affecting reliable operation	Procurement and installation of replacement skid	1-3 months
Battery and charger at Najibiyah generating station jeopardizing continued operation	Procurement of replacement battery and charger	1-3 months
Turbine oil contaminated and 400 kV breaker operation affecting Musayib generating station continuing operation	Procurement of replacement oil and breaker parts	1-2 months
Water treatment and wastewater systems not allowing continuing operation of power generating stations	Engineering and procurement of replacement water treatment equipment	3-9 months
Heat exchangers at four generating stations preventing full generation	Replacentme heat exchangers	3-9 months
Main transformer cooling systems on Najibiyah generating station preventing full generation	Subcontract for repair and replacement as required	3-6 months
Al Qurnah 400 kV substation totally destroyed, preventing energy supply to 132 kV system	Engineering and replacement of all equipment and building	5-9 months depending on transformer and GIS availability
Ten CPS substations severely damaged and not operable. Affects operability of oil fields	Restoration of control centers and yard insulators, replacement of transformers	3-7 months depending upon transformer availability
An Nasiriyah 132 kV substation combat-damaged	Replacement of three transformers, weld repair of breakers	3-5 months depending upon transformer availability
132 kV substations damaged and partially operable in: ▪ Port area, Al Basrah, and Umm Qasr ▪ Al Hillah area ▪ Babylon ▪ Others	Restoration of breakers, insulators, and controls, repair and replacement of transformers	2-5 months
Mullah Abdullah Power Station units damaged	Rehabilitate representative units	3-6 months depending on damage
Bayji Power Station gas turbines not commissioned (U.N. work)	Provide vendor representatives and startup assistance	2-4 months
Doura Thermal Power Station needs overhaul of steam turbine and controls	Overhaul turbine and replace controls	6-9 months

Figure 2.4-6. Short-term Power Requirements

Long-Term

In the long-term, Iraq needs additional generation to replace damaged and worn-out generating plants and provide for new power demands. There are numerous projects that were funded under the U.N. Oil for Food Program in various stages of development that will provide a portion of the long-term needs. The remaining needs will be satisfied by either rehabilitating older plants or building new ones. For example, the Bayji power station has six units rated at 220 MW for a total of 1,320 MW. Presently, only four units are operating, producing a total of 400 MW. A plan is being considered to develop a standard work package to rehabilitate one unit, which could be used as a template for all units.

Presently there is no uniformity of suppliers for the electricity system as a whole. Consequently, parts and repairs come from many different suppliers using many different codes and standards (and sometimes none at all). A standard plant design based on international codes and standards could be developed to provide a new level of quality to the Iraqi utility that would also allow them to standardize parts and operations. Some of these plants could be built around Baghdad to reduce dependence on the distribution system and others could be built near the source of fuel in the refineries. A standard plant would also allow for a standard operating and maintenance program facilitating easy transfer of personnel to other plants. The 400 kV and 132 kV systems need to be restored and should be upgraded to handle the additional power.

2.4.4 Challenges

The reconstruction of Iraq's power sector is a long-term effort. One of the biggest challenges is getting the population to accept that that there will be a delay in providing reliable, 24-hour-a-day power. In addition, without security to prevent looting, reconstruction cannot be accomplished. As of this report, widespread looting continues throughout the system where assets are not protected, especially the 400 kV and 132 kV overhead lines. Examples of the impact of looting are shown on the following page. Prioritizing power distribution, to residential, commerce, or industry, needs to be made. In the long run, the power industry needs to establish codes, standards, and a quality level for all new work.

2.4.5 Existing O&M Organization

O&M personnel are very skilled, technically competent, and resourceful. They have a strong sense of dedication to their work and continue to keep the generating units operating under difficult conditions. Because they have operated without the proper equipment, parts, and chemicals, a system-wide operating and maintenance program needs to be developed and retraining should be required for all personnel.

Rumaila Oilfield Substation Transformer Destruction

Iraqi Engineer Looking over Destruction

2.4.6 Recommendations

The primary focus of the recommendations is to ensure that adequate power is available and reliable in the coming years. The recommendations (Figure 2.4-7) focus on items from emergency repairs to long-term activities and outlines a strategic plan to achieve the power needs of the country.

Emergency Work

Emergency work activities provide immediate restoration of power and improve the reliability of generation and transmission capabilities. For example, supplies of chemicals and gases will allow power plants to continue to operate or immediately come back on line. Vendor technical representatives can correct problems with control systems to ensure that plants operate properly and reliably.

Short-Term Projects

Short-term projects can be implemented within 6 months from Job Order approvaland are focused on correcting deficiencies in equipment so as to add additional generation, improving reliability and stopping the rapid deterioration of plants that are now operating outside of proper operating parameters. This includes improvements to water treatment systems for boiler water and cooling water systems in power plants. It also includes mechanical equipment, such as heat exchangers, fans, and pumps that will increase plant output. Some substations can be repaired in the short-term to restore distribution and electrical service to the population, petroleum production, and industry. Finally, some new small units (1 to 50 MW) can be placed online to add generation capacity to replace damaged units.

Intermediate-Term

These activities can be accomplished prior to the end of 2004 and include rehabilitating some of the larger power plants to improve output and reliability, replacing destroyed substations, installing new units, and supporting commission units provided under the UNDP program where the contractor did not provide all required materials and services. Basic training for a system-wide program should begin as a start toward standardization of operation and maintenance practices.

Long-Term Projects

These projects will be follow-on rehabilitation of units now operating and would be done after the units undergoing refurbishment are complete. The goal is to bring these units back to their original capability and reliability and keep output as high as possible during the period of refurbishment so that not all units are offline at the same time. These would also include some of the units supplied under UNDP, which will take longer than 18 months to complete, and also provide equipment and commissioning support not provide by the original contractor. Additional small generating units and longer-term substation repair would also be included.

Two additional issues are developing a program for securing generating stations, transmission system, and substations from further looting, and coordinating all work with the oil sector to ensure that they have all the power they need, while ensuring that the power sector has the fuel needed to run its plants.

Unassessed Projects

Based on the assessment of most of the major gas turbine and thermal power plants, it is apparent that many units need to be rehabilitated and some may need to be retired. Most plants have been operated in a manner that has degraded the output of the plant and eliminated most environmental controls. A strategic program would include the replacement of older units with new units, addition of new and redundant transmission lines, repair of existing and installation of additional substations, and the installation of environmental controls to improve air and water quality. This plan would form the basis for providing reliable power to the population on a 24-hour basis and address the increased demand for power as the economy improves. This will also include the elimination of heavily polluting small generators currently used as backup generation. This should also include a comprehensive systemwide program for training toward uniform operations and maintenance. Finally, development of a standard plant design for both gas turbine and thermal power plants would significantly improve the overall power system and reduce operating and maintenance costs. It would also set the standards, codes, and quality requirements to be used by Iraq for all future projects in the power industry.

Transformer Destroyed

Control System for Substation

Burned Transformer

Damaged Controls

Recommendations						
Area of Work	**Actions Required**	**Emergency**	**Short-term**	**Intermediate-Term**	**Long-term**	**Unassessed Scope**
Emergency work. This includes chemicals, gases, consumables, replacement parts, vendor technical support, tools and other emergency repair items.	▪ Repairs and restoration required to keep power stations operating or immediately come back on line ▪ Immediate repair of transmission lines and substations to allow transfer of electricity to Baghdad and other areas with electricity shortages	■				
Water and wastewater systems for power plants. Heat exchangers and mechanical equipment are also included. All thermal power plants need some upgrades in their water treatment systems.	▪ Restoration and upgrading of power plant water and wastewater treatment systems to improve output and reduce water pollution ▪ Repair and replacement of heat exchangers and other mechanical equipment to increase production and reliability		■	■	■	
Small generating units from 1 to 10 MW in size	▪ Provision of immediate generation needs to support specific activities of short-term benefit such as opening of Baghdad airport and Port of Umm Qasr ▪ In the longer term, these small units may be needed to get industrial plants operating until improvements in the power system can be made		■		■	
Medium size generating units from 10 to 50 MW in size	▪ Generation to improve supply of electricity to specific locations such as Baghdad. This scope is for the Taji power station and includes 2 new 25 MW units, 2 new 15 MW units, and 2 refurbished 25 MW units ▪ In the long term, an additional 200 MW unit could possibly be added			■	■	
Substation restoration and repairs	▪ Repair and restoration of substations for distribution of electricity to the population and resumption of critical industry or petroleum production. ▪ Over 20 major substations have been destroyed by looters primarily in the South. The Commission of Electricity is developing a prioritized list of those to be addressed in the short and intermediate time frame. ▪ In the long run, additional substations must be constructed to distribute power from the new plants to be constructed. ▪ Visual aids designed to 1980s standards; paint is faded		■	■	■	■

Figure 2.4-7. Power Sector Recommendations.

Recommendations						
Area of Work	**Actions Required**	**Emergency**	**Short-term**	**Intermediate-Term**	**Long-term**	**Unassessed Scope**
Rehabilitation of generating units	▪ Rehabilitation of existing generating units to return them to design capability and reliability. This includes a new control system and rehabilitated steam turbines for Doura units 5 and 6. It also includes a standard rehabilitation package for Baiji Thermal #5 to be used as a template for later rehabilitation of the other 5 units at Baiji ▪ Most other major thermal plants will require rehabilitation over the next few years			■	■	■
New transmission and distribution	▪ Redundant and increased capacity to transmission lines to allow flexibility in distribution ▪ New transmission will be required to handle new generation expected in the long run					■
UNDP plants completion	▪ Completion of plants started under the UNDP program(s) which require additional equipment and commissioning support ▪ Based on inspection of the Doura and Baiji plants, most new UNDP plants will require additional equipment and commissioning assistance			■	■	
New generation, standard plants, 6,000 MW	▪ Provision of new units required for 24-hour service to the population, industry and petroleum production ▪ To meet the expected demand and replace aging units, an additional 6000MW will be needed over the next 5 years. The standard plant design will incorporate design and construction standards, quality standards, and codes which will form the basis of all future work in Iraq	▪				■
Standardized operations and maintenance training program	▪ Establish standard methods of operating and maintaining plants and system equipment					■

Figure 2.4-7. Continued.

Section 2.5 Rail, Roads, Bridges

2.5 Rail, Roads, and Bridges

Bechtel evaluated this sector as two distinct segments: 1) Railways and 2) Roads and Bridges. (Figure 2.5-1) Early assessments have focused on the bridge component of the surface transportation network and rail requirements in the region of Al Basrah and Umm Qasr. Bridge priorities were defined by ORHA (now CPA) while rail assessment priorities were driven by the importance of the rail link at Umm Qasr port to the delivery of humanitarian aid, construction equipment and materials, and future commercial traffic.

Rail assessments included extensive visual assessment by the Bechtel rail team. Additionally, an important element was the involvement of Iraq Republic Railway (IRR) personnel who facilitated track, locomotive, and workshop assessments. IRR officials participated directly in discussions of their needs, the condition of their assets, and their vision for the future of their system. The methodology used to assess the railway include receiving IRR's priorities, developing WFP and other humanitarian transport needs, obtaining IRR and military records on the railway, and performing selected assessments focusing on problem areas.

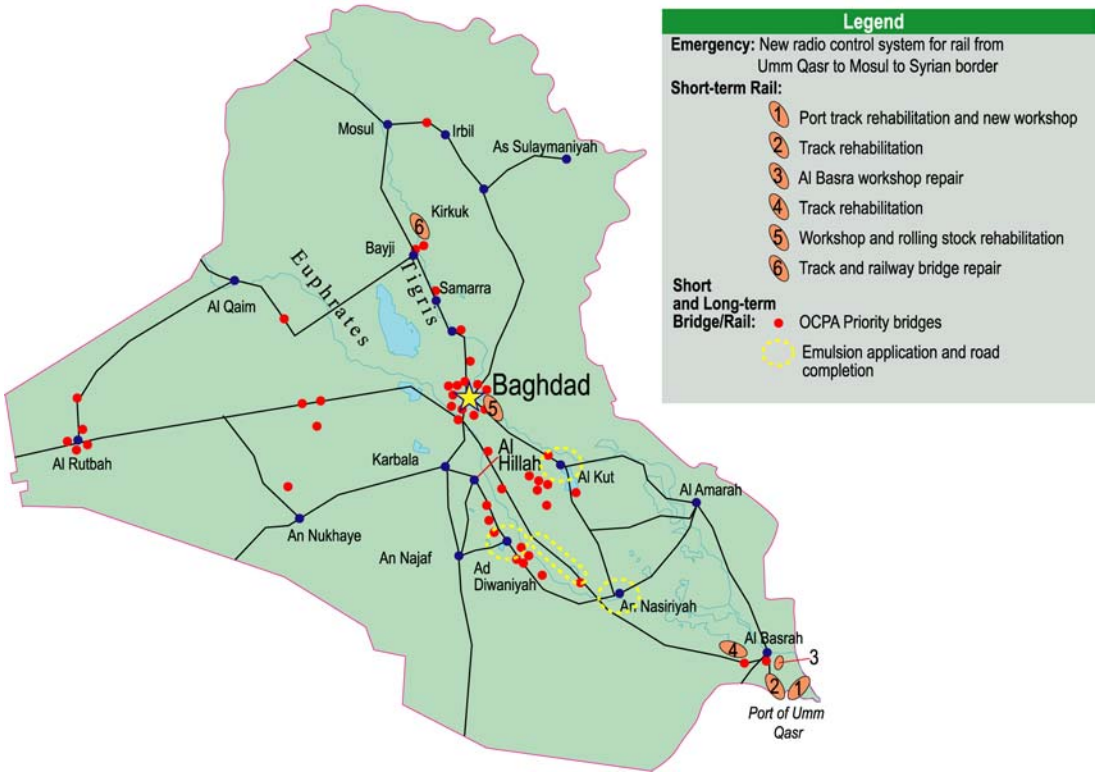


Figure 2.5.1. Priority Road, Bridge, and Rail Reconstruction Candidate Projects

2.5.1 Existing Conditions

Roads and Bridges

Initial assessments of the road and bridge network in Iraq revealed the entire system to be deteriorated due to damage from military conflict, neglect, variable and often low quality of construction, and incomplete projects allowed to degrade following abandonment.

During site visits to affected facilities, Bechtel collected damage reports produced by military units operating around the country, and by various other entities. Bechtel took guidance from a document issued by the U.K. Ministry of Housing and Construction, listing 49 priority bridges, both highway and rail, which needed to be assessed and potentially reconstructed. (see Appendix) Additionally, Bechtel personnel observed a road system that was seriously deteriorated and incomplete, even along major national highways.

Rail

Prior to the recent conflict, IRR was not providing service equal to its potential, considering the extensive size (2,600 km), huge investment in rolling stock, and significant amount of recently constructed high-quality track.

Traffic Still Flows Over Dangerously Damaged Bridges

Based on initial assessments, deteriorated train service can be primarily attributed to a lack of proper maintenance of infrastructure and rolling stock. There seems to have been an adequate quantity of rolling stock, maintenance equipment, spare parts, and materials available, but no adequate plan to deploy these resources to achieve normal running conditions. Additionally, control of train movements and basic communications over the network was substandard, and published rules governing the safe operation of trains have not been located (see Appendix).

Military personnel state there were very few predetermined railway targets in the conflict. Railway facilities were specifically avoided and overall the damage to IRR facilities in the conflict was minimal and localized. Nevertheless, UXO has been found in many locations along the railway and inside workshop buildings.

Following the conflict, IRR sustained considerable physical damage through widespread looting and vandalism, resulting in massive losses in the southern and central areas (the northern and western areas have not yet been assessed). Looters also routinely board freight trains and steal from them in transit and when stationary. Vandalism has resulted in a significant loss of IRR records, smashed and torn up passenger cars, and destroyed electrical control panels in workshops.

Worn Out Track in Al Basrah Area

Post-conflict disorder has rendered IRR virtually nonfunctional from a management

and supervisory standpoint. In this vacuum, the U.K., and subsequently U.S. military took charge in the Port of Umm Qasr to organize and manage the dispatch of one train per day from the port to Baghdad for transport of military supplies (primarily water).

2.5.2 Requirements for Restoration of Critical Services

Roads and Bridges

As of the date of this report, Bechtel has assessed 33 of the 49 priority bridges initially identified by ORHA/CPA (see Appendix) and has 13 to go. (three have been deleted). One emergency construction project, a road bypass around the dangerous Al Mat highway bridge (see page 2.5.-5) is under-way. Based on these assessments, Bechtel proposes to:

Broken Axle Assembly

- **Repair.** Where feasible and appropriate, given community needs.
- **Reconstruct.** Where a bridge is so damaged that simple repair is not possible. This is what Bechtel has found at most assessed bridges to date.
- **Build new.** Where the bridge is effectively destroyed and reconstruction is not an option, or where the location of the former bridge should be changed due to community needs or technical concerns.
- **Delete from priority bridge list.** Where damage is slight or community or other resources are available to repair/replace.

These decisions will require increasing involvement by local communities and national officials to ensure alignment with the needs of the Iraqi people, and Bechtel is working with CPA to increase the level of Iraqi involvement in decision-making, cost allocation, and day-to-day maintenance of facilities.

Local Involvement. Bechtel has begun developing a relationship with the Ministry of Housing and Construction which will ultimately be responsible for the road and bridge network of Iraq. Efforts are already underway to incorporate more Iraqi decision-making in evaluation and selection of projects to be executed.

Rail

As of the date of this report, Bechtel has assessed the trackage, signaling, and communications systems; workshops; and rolling stock in Umm Qasar and Al Basrah. Additionally, Bechtel has held meetings with IRR management in Baghdad to review and discuss IRR reconstruction priorities over the entire network.

Based on these assessments, Bechtel proposes to repair, reconstruct, build new facilities, train staff, procure new equipment, and provide management technical assistance to IRR. Bechtel is establishing a close working relationship with IRR who are expected to perform a majority of the work.

Institutional Strengthening. IRR's ability to manage and operate the system is just as important as managing its infrastructure and rolling stock. Without organized and efficient management, not only will the railway's potential not be realized, but even minimal reliable and safe service is questionable. To enhance the process of organizing IRR for success, the following issues need to be addressed:

- Training in key areas at the management and technical levels: administration, commercial operations, engineering, and maintenance.
- Preparation by IRR of a sound business plan, including analysis of potential customer base, projections of resulting future rail traffic potential, assessment of the desired market, a service plan to handle traffic, and rationalization of the network infrastructure (redundancy is a significant issue). Outside assistance in preparation of this plan would be beneficial.
- Based on the business plan, an assessment of the management organization and staffing plans.
- A comprehensive IRR safety program to be prepared and implemented as a priority.
- Implement a mentoring program through which senior expatriate experts experienced in various aspects of railroad operation and maintenance "shadow" their Iraqi counterparts to help them address the challenges of running the railroad efficiently. These resources would then review IRR O&M systems and capability of the railroad authority and recommend a program of improvements.

Contracting. There is adequate capability in Iraq to perform much of the heavy railway construction work needed for restoration, given foreign supervision to ensure quality and schedule performance. Specialty design and construction services, as well as much of the equipment, materials, and spare parts must be imported. IRR's capability to perform some portions of restoration and new construction work (including availability of supervisory and skilled labor staff and construction equipment) must be evaluated.

2.5.3 Needs Assessment

Road and Bridge Methodology

Road networks span entire regions but bridges constitute the most obvious choke points. Consequently, the Bechtel team focused on bridges as prioritized by CPA during the initial rapid assessment phase. Roads will be considered for short and long-term restoration efforts, including two major road projects: paving of 40 km north of An Nasiriyah and dust control at An Nasiriya, Ad Diwaniyah, and Al Kut.

Bridge assessments began with review of CPA data, which Bechtel supplemented through field inspections and onsite surveys. Data anticipated by the contract as being available from other sources often proved unreliable and not of beneficial use.

Bechtel's focus on CPA's priority bridge list has made road and bridge assessments more efficient to manage. Going forward, the effort should involve greater Iraqi community input to ensure that the most pressing needs are met. Bechtel's preferred practice is to have Iraqi contractors execute as much of the work as possible.

Specific Bridge and Road Assessments

Twelve priority bridges and two roadway projects have been assessed and are considered short-term. These reconstruction projects are described below:

Al Mat Bridge

The Al Mat paired bridge is on Highway 10 from Baghdad to Jordan (a major humanitarian aid and commercial route) near the village of Ar Rutbah. It is a divided highway with twin concrete girder structures over a wadi. The eastbound lanes are impassable due to ordnance damage. The westbound structure is damaged, but vehicles nevertheless cross it in both directions. The bridge is in imminent danger of collapse.

Wadi Highway Bridge

The Wadi Highway Bridge is approximately 2 km from Ar Rutbah on a road heading north. It is a concrete structure over a wadi and was destroyed in the conflict. Traffic is bypassing the structure on a temporary road through the wadi, but, the bypass will be impassible during heavy rains. Consideration should be given to repair before the rainy season.

Highway 10 Bridge

The Highway 10 Bridge crosses Highway 10 approximately 175 km east of Ar Rutbah. The highway is a major traffic route between Baghdad and Jordan and hence a major conduit for humanitarian aid and commercial traffic. This bridge is a single concrete structure with significant ordnance damage. One span that collapsed onto eastbound Highway 10 is blocking the flow of traffic. The span over westbound Highway 10 has been damaged and is partially collapsed: it could fail entirely, which would completely block Highway 10. At present, traffic continues to travel under the damaged westbound lane in a restricted flow, but this is very hazardous. To eliminate this hazard and restore traffic flow, there is a need to demolish this structure, remove the debris, and reinstate both lanes of traffic to full use.

Khazir Bridge

The Khazir Bridge is a paired bridge on Highway 2 between Mosul and Arbil (and is critical to the movement of fuel and agricultural products). It is a divided highway with twin concrete structures over the Greater Zab River, carrying two lanes of traffic in each direction. The northern abutment and first span for both bridges have significant damage and the spans have failed. The failed span on the south structure has been temporarily filled with earth to create a lane for traffic. No bypass can be feasibly constructed. The proposed plan is to phase demolition and reconstruction while maintaining reduced traffic flow.

Al Fathah Highway Bridge

The Al Fathah Highway Bridge is a concrete structure over the Tigris River. It is on a main road outside the town of Bayji and carries traffic in both directions on the single structure. The bridge is crucial to the local community and Iraq's economy, carrying petroleum pipelines from nearby refineries in addition to road traffic. During the recent conflict, the bridge suffered damage, and petroleum products from ruptured pipelines ignited. The bridge has suffered extensive fire damage and is currently being reassessed. Upon evaluation of the reassessment, Bechtel will make recommendations regarding the bridge's reconstruction. It may prove inadvisable to include both road and pipelines on the reconstructed bridge.

Tikrit Bridge

The Tikrit Bridge is a concrete structure on a main highway between Tikrit and Tuz Khurmatu in the north. It is an important link in the highway system for aid and commerce over the Tigris and provides local residents with vehicle and pedestrian access. Traffic continues to flow over the bridge on temporary bridges placed across some collapsed spans and by negotiating damaged spans. Collapsed spans fallen into the river may be causing scouring of the piers.

Az Zubadiyah Bridge

The Az Zubadiyah Bridge is a pontoon bridge crossing the Tigris. The bridge has been destroyed with only one section of approach left on each bank. This is an important crossing point in this area, allowing transport of food and other goods from major supply hubs. Bechtel recommends that the bridge be replaced and the approach roadways on each bank reconstructed.

Aziziyah Bridge

The Azizyah Bridge is a single-lane pontoon bridge over the Tigris, and is an important crossing that provides mobility for local residents and a means of distributing food and goods from major supply hubs. Early reports indicated this was a dropped pontoon structure, but site inspection revealed that the bridge did not suffer any damage from the conflict. It is, however, in perilous condition from lack of maintenance. The bridge needs urgent repairs to prevent an accident in the short-term. The long-term recommendation is to replace it with a two-lane crossing.

Al Fathah Railroad Bridge

The Al Fathah Railroad Bridge is a single-track structure crossing the Tigris near the town of Bayji. It is an important rail link from Baghdad to northern Iraq. The bridge is a concrete box girder structure with multiple spans. Currently the bridge is out of service to rail traffic with one span collapsed and another span over the river damaged by ordnance. The west abutment also received damage. UXO has been discovered in the area. Some walkway covers and railings need to be repaired or replaced.

Al Kut Bridge

The Al Kut Bridge has two lanes over the Tigris River near the town of Al Kut and is another important river crossing for local residents, providing vehicle access for moving goods and commerce in the region from major distribution hubs. Early reports described this structure as destroyed. Inspection indicates no recent conflict damage. The bridge does need repairs to prevent further deterioration.

Tuz Khurmatu Bridge

The Tuz Khurmatu Bridge is a concrete girder bridge with two lanes crossing a wide body of water. There are 42 spans with very low clearance to water level. Apparently, the waterway is not navigable. The bridge is part of the highway system that facilitates commerce in the region, along with serving the local community with vehicular traffic across the waterway. Provided reports indicated the bridge had conflict damage, but inspection reveals damage only from wear and neglect.

Ar Rutbah NE Hwy Bridge (formerly Ar Rutbah Village Bridge)

The Ar Ruthbah NE Highway Bridge was on the CPA list of damaged structures to be assessed. Although not a high priority, it is in the vicinity of a high priority structure and was assessed in the same trip. It is not an elevated structure, appearing similar to a multiple box culvert section at grade with a roadbed over the top. A job order was ready for submittal, but the bridge was deleted from Bechtel's scope by CPA on 05/31/03.

Highway 1 Paving Project

Highway 1 is the main North-South route from Kuwait to Baghdad and beyond. It is a two-lane divided asphalt highway 16.5 m in width. North of An Nasiriyah toward Baghdad, approximately 60 km of the roadway has not been completed (20 km southbound, 40 km northbound). The divided highway lanes are in different stages of completion. Drainage structures and piping must be installed and grading and drainage work performed. Completion of subgrade preparation and paving operations are required. Traffic control, pavement markings, and signage need to be installed.

MC-70 Emulsion Application Project

Typical application

Existing highways in some regions are dirt roads. With the increase of traffic in these areas by military convoys, movement of humanitarian aid, everyday use by local residents, and reconstruction efforts, application of dust control is crucial. Approximately 1.6 million m^2 need the emulsion application, and material is available in Baghdad. The three identified areas are An Nasiriyah, Ad Diwaniyah, and Al Kut.

With 12 bridges and two roadway needs assessed and their costs estimated, the surface transportation team will continue assessments of unvisited bridges while aggressively beginning construction of the approved job orders.

Rail Methodology

Railway assessments take into account the scale of IRR: 2,600 km in length, 200 locomotives, 9,000 cars, and a reported staff of 8,000 to 10,000 employees. Bechtel's strategy for assessments includes:

- Obtaining and reviewing IRR's priority list of emergency and short-term reconstruction needs and planned future train service
- Obtaining WFP other humanitarian aid, and general critical railway needs
- Obtaining railway information and assessments prepared by U.K. and U.S. militaries
- Obtaining as many relevant records from IRR as possible
- Performing field surveys in selected areas, with support from IRR
- Identifying major bridge repair needs for assessment by others
- Recording operations, maintenance, safety, training, and other institutional needs as assessments progress
- Preparing job orders based on the assessments

Technology Transfer

In the course of planning and executing the work, there will be significant opportunities for IRR personnel to receive on-the-job and formal training. As appropriate, Bechtel will maximize IRR involvement at all stages of the work. Iraqi contractors are expected to perform much of the heavy civil works. The work processes used by Bechtel to manage the work will provide a significant transfer of knowledge to both IRR and contractors.

Al Basrah Region Assessment

Al Basrah is the southernmost region of IRR. Region headquarters are located in Al Basrah City, the second largest in Iraq. The assessment covered the following areas:

- **Track.** The Port of Umm Qasr is very important to IRR and therefore special attention was given to the port trackage. In the old port area, the track is very old, in poor condition, and is currently unsuitable for reliable operation. The mainline track in the region was reportedly constructed in the early '60s and is also in poor condition, with major rehabilitation required to support reliable train operations. Grading for a new mainline adjacent to the existing main was begun prior to the 2003 conflict. An overview of track conditions in the Al Basrah Region is presented in the Appendix.

Road and Rail Debris – Umm Qasr Port

- **Locomotive and Car Maintenance Facilities.** The light running repair facility in the Port of Umm Qasr has been completely looted. In the Al Basrah main station area, the running and medium repair facility has been totally looted and major equipment stripped and vandalized. A photo depiction and narrative illustrating these conditions is presented in the Appendix.
- **Rolling Stock.** Locomotives and cars are exceedingly dirty, looted, and vandalized. No maintenance records have been located.
- **Signaling and Communications.** No evidence of any operational signaling or communication equipment has been found.
- **Regional Organization.** Current management has reported the total Southern Region IRR staff as approximately 1,100 employees, clearly an excessive number.
- **Safety.** From direct observation, no part of the railway can be considered safe in western terms. See Appendix for details.

Plan Forward

For the remaining assessments of physical assets, Bechtel will focus on the mainline track to the northern border with Syria, rolling stock repairs, workshop repair, and western regions. Management assessments will be performed in parallel.

2.5.4 Challenges

Roads and Bridges

Based on our assessments, implementation challenges are as follows:

- **Security.** Assessment teams and work sites must meet stringent security requirements. These needs, a result of unsettled conditions, add to time, cost, and rework.
- **Access to Assessment Sites.** Remote locations often require lengthy and roundabout travel and pose personal danger to assessment teams.
- **Contracting Challenges.** Bechtel's approach to executing this work is to engage Iraqi contractors whenever possible. Existing contracting practices, plus standards and language differences, add to the complexities of awarding work.

Rail

Challenges are many and include:

- **Security.** Stemming looting and vandalism, and providing security for IRR train operations and reconstruction contractors.
- **Operations.** Ensuring safe train operations through training, improved equipment, and changes in behavior.

- **Work Prioritization.** Accessing IRR properties and prioritizing work, considering the size of the IRR network.
- **Obtaining IRR Records.** Recovery of stolen records to assist in locating equipment to complete the assessment process.
- **Contractor Integration.** Facilitating foreign contractors working on IRR-owned properties while maintaining the current train service.

2.5.5 Existing O&M Organization

Roads and Bridges

National or local institutions provide minimal support under current and near-term conditions. Eventually, such governmental support will emerge; but for now, this issue awaits development of the Iraqi ministerial system.

Rail

Based on preliminary discussions with IRR, it is apparent that the management of the railway was a hierarchal structure and highly centralized in Baghdad.

Additionally, the Ministry of Transport and Communications was actively involved in setting policy and in decision making. Assessment of the 8,000- to 10,000-person organization will be undertaken and recommendations made regarding development of a business plan to address commercial requirements, organizational structure, decentralization of decision making, staffing requirements, and rationalization of the network.

2.5.6 Recommendations

Bechtel's primary recommendation is to ensure that the essential portions of the national surface transportation infrastructure are restored so they can meet the basic needs of the Iraqi people: emergency distribution of food, fuel, and other essential supplies; and mobility of goods, services, and the population, without which the Iraqi economy cannot function.

Restoration requirements for rail, roads, and bridges have been broken down into five categories:

- **Emergency –** Projects that address unsafe conditions at key control points of the surface transportation network, and which hinder the transport of food and relief supplies to the Iraqi people. These include:
  - A bypass road for the heavily damaged (but still in-use) Al Mat Bridge, which has been approved by USAID and is under construction
  - Demolition and clearing of the Highway 10 Overpass, approximately 175 miles east of the Al Mat Bridge bypass. The overpass is in danger of collapse, which could cause closure of Highway 10 – the major route between Amman and Baghdad. This project has also been approved by USAID for implementation
  - Spare parts for grain hopper cars

- **Short-Term –** High priority projects that can be completed within 6 months of receiving an approved Job Order. These have been selected from among the candidates identified on OCPA's priority listing and from assessments provided by military and other observers. They are:
  - *Highest priority vehicle bridges:* Al Fathah highway, Khazir River, and 14 July bridges
  - *Other prioritized bridges:* Old Diyala, Al Muthana, Wadi Hawran,, Al Taji, Aziziyah, Al Kut, and Az Zubaydiyah highway bridges
  - *Road projects:* Application of MC-70 emulsion to roadways in An Nasiriyah, Ad Diwaniyah, and Al Kut for dust control
- **Intermediate Term** – Other high priority projects that can be completed between 6 months from Job Order award and the end of 2004:
  - *Vehicle bridges:* Al Mat (reconstruction), Tikrit, New Diyala, Al Musayyib, Chabbab
  - *Rail bridge:* Al Fathah Rail Bridge
  - *Rail projects:* Track rehabilitation from the Port of Umm Qasr to Shuiaba Junction (56 km north), repair of Iraq Republic Railway (IRR) maintenance of way equipment, IRR training, track rehabilitation at various locations between Baghdad and Mosul, workshop repair, and rolling stock rebuilding
- **Long-Term –** Reconstruction or restoration projects identified during the assessment period as being necessary to helping Iraq establish reliable, efficient transportation links, but completion of which will extend beyond December 31, 2004:
  - *Bridges:* Kiffel, Suwaira (aka Sarabadi), Tuz Kurmatu, Ar Rumaylah, An Numaniyah, Highway 10 Overpass (reconstruction), Al Muwaffaqiyah, Ash Shamiyah, Wadi Hawran Highway North, and Gap North of An Nasiriyah bridges
  - *Road projects:* Completion of Highway 1 north of An Nasiriyah (a 40 km stretch of roadway)
  - *Rail projects:* Complete construction of new track from Al Basrah to Mosul, rebuilding passenger coaches, and installing signaling and telecommunications systems over the entire network
- **Unassessed Projects** – Other bridges (including some on CPA's priority bridge list), roads, and rail infrastructure projects that have not been physically assessed during the rapid assessment phase, but have been evaluated based on Bechtel's understanding of the Iraqi surface transportation network as an integrated system. Bechtel recommends that these additional surface transportation needs be addressed as part of a national program with a high level of Iraqi official and community involvement, and include substantial institutional strengthening components.

Appendices

Included in the Appendix are the following:

- CPA Bridge Priority Spreadsheet
- Railway Track Near Al Basrah
- Railway Running Sheds and Workshops Near Al Basrah
- Railway Safety

Section 2.6 Buildings and Facilities

2.6 Buildings

The building and facilities team is focused on field assessments and establishing a process to ensure the public health and education needs of the Iraq population are met. The large number of facilities to be assessed necessitated the establishment of a methodology to gather data and facilitate prioritization of critical needs. As the overview assessments progressed, the team quickly determined the most effective methodology to complete the detailed assessments would be to use contractors to conduct the detailed assessments based on criteria established by Bechtel.

Accomplishments to date include the following:

- Preparation of a preliminary database of schools and clinics from best available data
- Completion of assessment checklists to be used in physical inspection of buildings
- Field visits to representative schools and clinics, and performance of preliminary inspection in anticipation of engaging a contractor for more detailed assessment
- Establishment of working relationship with USAID, CPA regional representatives, other U.S. and U.K. organizations (including military), and other USAID contractors

USAID has directed that the immediate focus be on primary and secondary schools and clinics throughout the country, and selected police and fire stations in Baghdad. In the health sector, USAID and Iraqi health sector officials have directed an initial focus on clinics rather than hospitals. Few clinics are currently operational, resulting in overcrowded hospitals.

In response to USAID's direction, Bechtel's proposed assessments and rehabilitation work is shown in Figure 2.6-1.

	Population	Target Assessments	Target Immediate Rehabilitation
Northern Region (Mosul, Arbil, and Kirkuk)	2,000,000	600	150
Metropolitan Baghdad	7,000,000	1,830	695
Heartland Region (Al Hillah, An Najaf, Ad Diwaniyah, Al Kut, and Karbala)	2,260,000	800	200
Southern Region (Al Basrah, Al Nasiryah, and Al Qurnah)	2,530,000	850	300
Total		**4,080**	**1,345**

Figure 2.6-1. Proposed Assessments and Rehabilitation Work

To undertake this large a program in such a broad geographic area, Bechtel will deploy to four regions around the country (Figure 2.6-2). Accordingly, regional teams are being dispatched to Al Basrah, Al Hillal, and Mosul, in addition to Baghdad, and each will include engineers and construction supervisors under the direction of an area manager.

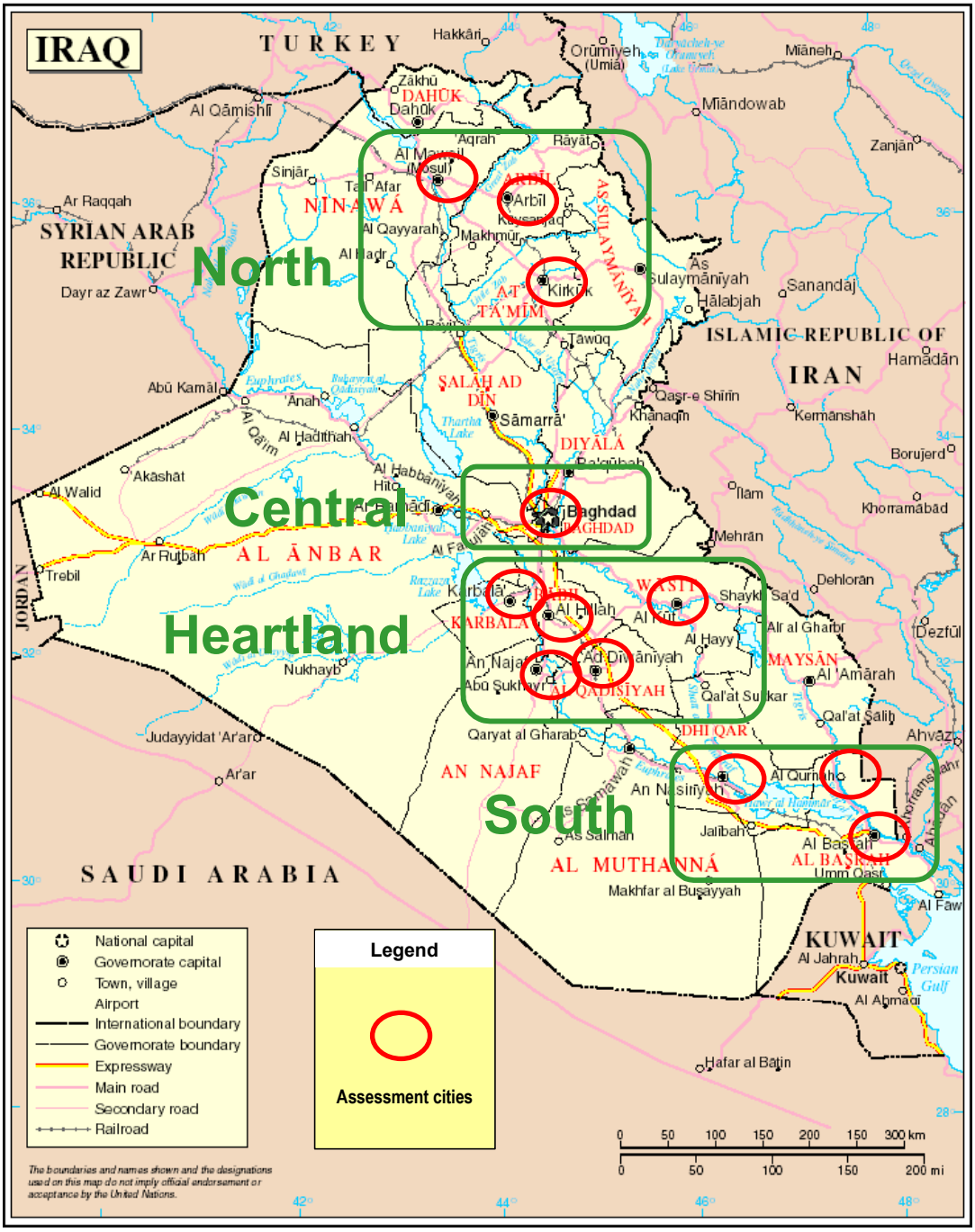


Figure 2.6-2. Four Regions of Deployment

2.6.1 Existing Conditions

Physical Conditions

Preliminary reconnaissance suggests that, in general, schools and clinics are sound and require little structural repair to make them fully functional. However, decades of maintenance neglect and deterioration, coupled with looting and vandalism, have resulted in architectural, electrical, and plumbing systems in need of significant rehabilitation. The following are typical conditions identified during a preliminary inspection of selected facilities; these are likely to be representative of such schools and clinics elsewhere in the country:

- Broken glass (often including missing frames) in most windows
- Missing, damaged, and deteriorating door frames, doors, and hardware for most doors
- Damaged security gates
- Heavily damaged and deteriorated electrical service
- Missing and nonfunctioning electrical fixtures, including fans, lights, and outlets
- Heavily damaged and deteriorated toilet systems, including clogged drains and sewers
- Damage to wall and ceiling surfaces
- Damage to exterior building surfaces
- Damage to floor tile
- Damage to roofing and roof drainage systems
- Large amounts of dirt and debris
- Missing air conditioners

School Interior

Although the above list identifies conditions that may be found at most schools and clinics in Iraq, the specific work and level of effort for each facility will not be fully known until an onsite assessment has been completed.

Existing Organizations Involved in School Assessment and Rehabilitation

There are many organizations addressing school and health facility issues in Iraq (Figure 2.6-3). Although Bechtel's scope and budget is the largest, other entities, public and private, have mobilized and in some cases have already completed assessment and rehabilitation of facilities.

The key entities or stakeholders include the following:

- CPA – through the establishment of acting ministers of education and health, and the appointment of regional representatives who have been deployed to the governate or local level

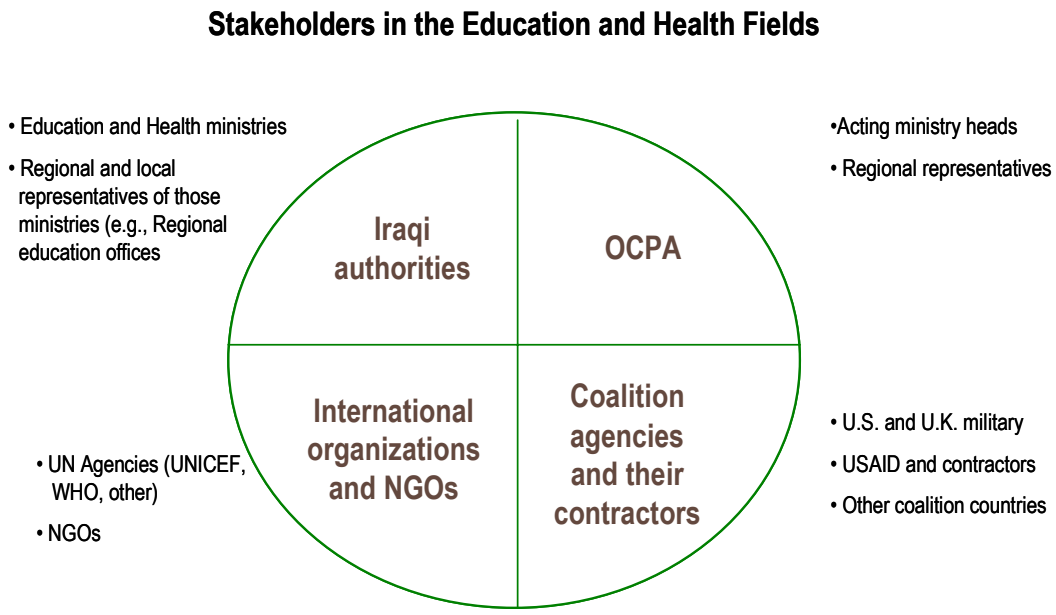


Figure 2.6-3. Education and Health Field Stakeholders

- The Humanitarian Assistance Coordination Center, the Civil-Military Operations Center (CMOC), the Civil Affairs units of the U.S. and U.K. military, and the U.S. Army Corps of Engineers, which has identified facilities in need of repair
- Other USAID contractors addressing education and health issues include Creative Associates (for schools), Abt Associates (for health), and IBT (for institutional strengthening)
- International organizations, such as UNICEF, World Health Organization (WHO), UNDP, and other agencies of the United Nations
- NGOs, which are already established in key cities and have identified potential projects. Key NGOs include Save the Children, *Medicins sans Frontieres*, International Red Cross, and the International Medical Corps.

Many of these agencies have been holding weekly coordinating meetings, often in coordination with local U.N. representatives.

Condition of Public and Local Authorities Responsible for Education and Health

Education and health authorities, like many other agencies of the post-conflict Iraqi government, are in transition, and it is often difficult to identify who is in charge and their institutional capabilities. Reconnaissance efforts to date (primarily in Al Basrah and Baghdad) have identified the presence of regional education authorities, typically staffed by holdovers from the former regional offices of the ministry, and regional health boards, also staffed by selected personnel from what exists of the ministry.

Both types of organizations, like other official Iraqi departments, are today closely linked to counterparts at CPA; and their budgets and authority are guided by the latter.

2.6.2 Requirements for Restoration of Critical Services

Bechtel is determining the requirements for specific action to restore critical services to schools and clinics in major areas of Iraq through a five-part process.

1. Determining the Totality of Schools and Clinics

The total number of schools and clinics within specified areas of Iraq will be identified and quantified through the compilation of an inventory of existing facilities. This inventory will be based on information provided by applicable ministries, local authorities, and other appropriate agencies with input from local officials. Figure 2.6-4 presents an example of the type of inventory that is needed for schools and clinics.

Figure 2.6-5 shows a neighborhood in Al Basrah and is representative of typical school environments in Iraq. Schools are scattered throughout Al Basrah, requiring an assessment process that accommodates multiple site visits in a short period of time.

Database Template	
Proposed structure of a database Bechtel recommends for joint use by all stakeholders	
Data Fields	**School**
Region/City	
Unique ID code	
School name	
Coordinates	
School Type (P/S)	
School gender (M/F)	
Number of students	
Preassessment observations	
Work by other (what and who?)	
School contact (for access)	
Remarks	

Figure 2.6-4. Proposed Database Template for Assessment Activities

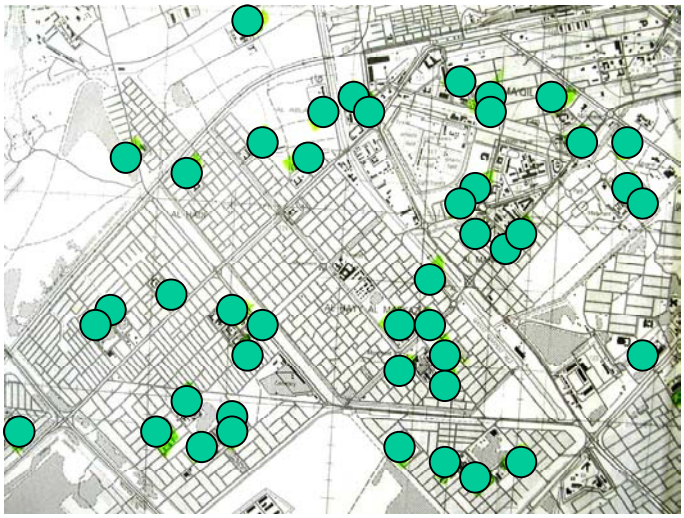


Figure 2.6-5. Representative Map of Schools in Al Basrah

2. Prioritization of Selected Facilities for Field Assessment (with input from USAID, CPA, and NGOs)

Bechtel will establish and apply screening criteria to determine which facilities in the inventory qualify as candidates for assessment and further evaluation for facility restoration. The screened list of selected candidates for restoration will be prioritized for the field assessment program with input from USAID, CPA, NGOs, and other appropriate agencies. Many of these assessed facilities will be candidates for an emergency rehabilitation program that will speed the repair process, meet completion deadlines, and keep costs low. This approach has the additional benefit of maximizing the immediate impact to the largest possible population. Figure 2.6-6 illustrates the emergency facility rehabilitation program.

Exterior of School Building

The emphasis will be on emergency rehabilitation, which is defined as work that can be accomplished in 2 to 4 weeks per facility for approximately 1,500 hours by an Iraqi contractor. Bechtel's preliminary conclusion is that many of Iraq's schools and clinics meet the criteria: buildings that are dilapidated from neglect and vandalism, but which have no fundamental structural flaws that would inhibit relatively quick repairs.

Emergency Facility Rehabilitation Program

- Thorough cleanup of the building interior and exterior
- Repair and replace windows and doors
- Upgrade electrical wiring and fuse panels
- Replace lighting and fans
- Repair restroom water and drainage systems
- Internal and external painting
- In selected cases, minor structural repairs (such as sister columns and beams)

Figure 2.6-6. Emergency Facility Rehabilitation Program

3. Assessing Iraqi Engineering and Construction Capabilities

In parallel with establishing the proceeding facility inventory, Bechtel will initiate a significant program to identify and screen in-country engineering and construction contractors. By utilizing established screening and assessment practices, contractors will be evaluated expeditiously and a list of qualified bidders established to compete for applicable scopes of work as job orders are released. In addition to direct submittals from contractor candidates, nominations, based on recent experience, will be accepted from other organizations involved in reconstruction activity.

4. Physical Assessment of Buildings

Bechtel will award contracts to perform the physical assessment of selected facilities, identifying and quantifying the physical conditions of schools and clinics throughout the selected areas of Iraq. Contractors will identify required work to be performed using assessment lists developed by Bechtel and modified to address the specific facilities and conditions that are expected to be encountered in the schools and clinics program in Iraq.

5. Scoping of Work for Rehabilitation Projects

The emphasis will be on emergency rehabilitation, which was previously described.

Debris and Building Waste in School Yard

2.6.3 Needs Assessment

The assessment of schools and clinics poses certain challenges that may be different from other elements of Bechtel's program. The sheer number of facilities to be assessed requires a different approach. The fundamental differences are:

- Greater emphasis is needed on initial intelligence gathering about the facilities (*i.e., How many? Where are they? What others organizations are already engaged in some sort of assessment and rehabilitations?*).
- Establishing a process whereby the fundamental assessment of these facilities will be done by local contractors. Bechtel's role is in identifying qualified Iraqi contractors and supervising their work.

To meet these assessment needs, Bechtel has accomplished the following in the past month:

- Participated in sector workshops with CPA and military civil affairs officials, donor agencies, NGO's, and other stakeholders to understand the scope of the assessment being done by others.
- Scoped an emergency rehabilitation program for the facilities identified in the assessments.
- Prepared prequalification documents and requests for proposals for expanded field assessment, construction supervision, and emergency rehabilitation work to be done by Iraqi engineers and contractors.
- Began assessment of Iraqi contractor availability and capabilities, including meeting with the Federation of General Contractors in Baghdad, reviewing CMOC experience with contractors in Al Basrah, and compiling preliminary lists of available contractors.

Bechtel has deployed its assessment teams to Al Basrah and Baghdad and is continuing the above activities in the field. Progress is being closely monitored – and will be reported to USAID – and adjustments in the assessment program will be proposed if circumstances warrant.

2.6.4 Challenges

The assessment team faces the following challenges:

- Operating without a single database or inventory of facilities for each geographic region.
- Undertaking an unusually large number of projects in a short period of time (assessing 4,000 schools and rehabilitating 1,400 over a 3- to 4-month period).
- Engaging and mobilizing a large number of Iraqi contractors with an aggressive completion schedule.
- Facing major security obstacles to reaching the sheer volume of facilities to be assessed. Several thousand facilities need to be assessed, taxing the logistical capabilities of the assessment team.
- Working without traditional public authorities (from ministries to local school boards and health organizations) providing information and suggesting priorities for action.

- Arranging for pre and postconstruction security at the individual sites.
- Developing an effective working relationship with an unusually large number of stakeholders (including many NGOs) and securing agreements on priorities and complementary roles and responsibilities.
- Scheduling the school rehabilitation work (Figure 2.6-7) in a way that has the least impact on school operations (the window of available time for construction may be limited because of examinations).

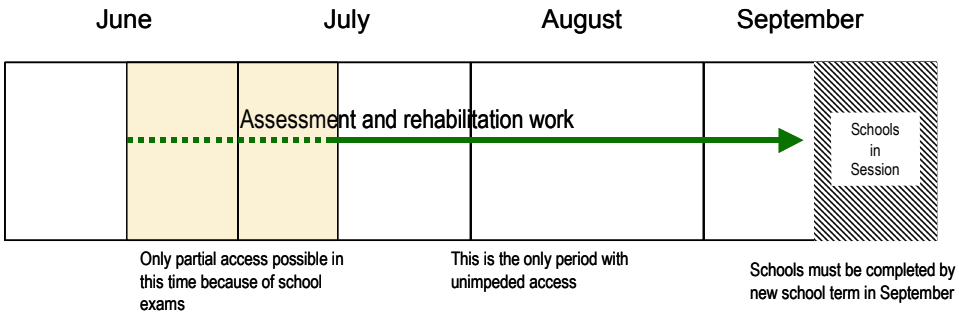


Figure 2.6-7. Scheduling Challenges for School Rehabilitation

2.6.5 Existing O&M Organization

Existing O&M organizations (schools boards and health agencies) have not yet been fully reestablished. Although individuals claim to hold titles of responsibility, the positions change frequently, there are no budgets (most people are not even being paid), and there appear to be no facilities for O&M functions—such as department buildings—other than the schools and clinics themselves. Bechtel has been seeking out representatives of the relevant ministries and organizations to explain the mission and program and secure their buy-in. Being aware, however, of the volatility to date of these management organizations (and of the individuals themselves), the team endeavors to develop and maintain working relations and understandings with parallel organizations, most notably the acting educational and health coordinators being provided by CPA, and with the officials in the coalition military units responsible for schools and health facilities.

An additional O&M issue concerns security in the postconstruction period. Virtually all officials agree that security must be in place once the rehabilitation work is complete. They acknowledge that most facilities would be looted almost immediately unless a security presence is established at each site.

The school and clinic program cannot proceed successfully without a parallel program of institutional strengthening. Efforts in institutional building must be accelerated to establish local schools and health officials with authority to make decisions on priorities and with sufficient budgets to ensure postconstruction security, as well as general operations and maintenance.

2.6.6 Recommendations

Bechtel's main recommendation is to rehabilitate quickly a large number of school buildings and clinics in dense population centers in Iraq. A comprehensive rehabilitation program for schools can bring immediate and long-term benefits to large numbers of Iraqi people by ensuring the viability of their primary and secondary education

system. Rehabilitation of clinics to acceptable industry standards will improve access to basic health care by alleviating operational pressures and overflow of patients currently encountered by large hospitals. As this rehabilitation program nears completion, the focus should shift to include referral hospitals in each major city, followed by the repair of as many general hospitals as funding would allow. In addition, in order to "stand up" the Ministries of Health and Education, repairs, upgrades, or reconstruction of these key government buildings will be required in each major city in Iraq.

The following recommendations are the results of Bechtel's assessment process, which includes consultations with representatives of USAID, the Ministries of Education and Health, UNICEF, concerned NGO's, other USAID contractors, and the US Military. These recommendations have been prioritized into five categories as follows:

- **Emergency** – projects that require an immediate start to meet urgent humanitarian needs.
- **Short-term** – projects that can be completed within 6 months of Job Order approval.
- **Intermediate-term** – projects that can be completed between 6 months from Job Order approval and the end of 2004.
- **Long-term** – projects that have been identified through the current assessment process but with a completion date beyond 2004.
- **Unassessed projects** – these are strategic projects within our contract assessment scope but which physical assessments have not been carried out by Bechtel teams. The need for such projects is determined from experience drawn from related assessments that Bechtel has performed and guidance from USAID experts in the health and educational sector.

Emergency Projects

Bechtel recommends immediate rehabilitation efforts should be targeted towards schools and clinics as well as selected police and fire stations for maximum immediate impact for the lowest cost in selected population centers. This can be accomplished by selecting facilities that are dilapidated through neglect and vandalism, but which have no fundamental structural flaw. This immediate rehabilitation program has been approved by USAID and Bechtel has commenced work already. Bechtel anticipates approximately 600 schools will be completed by the beginning of this school year and another 700 schools and clinics, plus a limited number of police and fire stations, will be completed near the end of October 2003.

Short and Intermediate-term Projects

Bechtel's short and intermediate recommendation is to continue with the rehabilitation criteria established in the emergency phase but expand the program to include an additional 1600 schools and clinics, followed by an additional 3000 facilities in the final phase. Using this phased approach, Bechtel expects the rehabilitation program of schools and clinics to be completed by December 2004 with approximately 6000 facilities rehabilitated.

Long-term Projects

To support USAID's goal of fulfilling the basic health needs of the Iraqi population, Bechtel recommends repair or rehabilitation of existing referral hospitals in each major city. This work will establish the infrastructure needed to support advanced medical and surgical services for critical cases. Identification of target facilities should be balanced between reaching as many people as possible in the shortest period of time and specific requirements in each region. Stakeholders, including USAID, international health organizations, donors, and local health officials should be involved in the prioritization, final selection, as well as execution planning of each facility.

Unassessed Projects

The objectives of these projects are to support the development of a functional and self-sufficient health and educational infrastructure in Iraq. These projects would focus on repairing and rehabilitating a large number of general hospitals in addition to repair or reconstruction of Ministry of Health buildings as well as Ministry of Education facilities in major cities.

A summary of Bechtel's recommendations is listed in figure 2.6-8 below.

Recommendations						
Location	Required Actions	Emergency	Short-term	Intermediate-term	Long-term	Unassessed
At approximately 6,000 facilities in cities across all regions of the country	▪ Assessments of schools and clinics, and selected police stations and fire stations, to identify those most amenable to immediate repairs. ▪ Repair and/or reconstruction of facilities to pre-conflict conditions. ▪ Approximately 6,000 facilities will be covered by this program in three phases: 1,350 in 12 cities in the emergency phase, 1,600 in other cities in the short-term, and an additional 3,050 in remaining cities by the end of 2004.	■	■	■		
Across 12 cities: Baghdad, Al Basrah, Al Nasiriyah, Al Qurnah, Al Hillah, An Najaf, Al Diwaniyah, Al Kut, Karbala, Mosul. Arbil, Kirkuk	▪ Repair, rehabilitate, or upgrade 1 referral hospital in each city (12 total). Non-structural rehabilitation will be carried out, and may include painting and repairs and/or upgrades t windows lighting, electrical wiring, and plumbing and HVAC systems.				■	
At population centers across the country	▪ Repair or upgrade up to 100 general hospitals. Cost assumes approximately 120 beds and each hospital at $1,500 per bed.					■

Figure 2.6-8. Recommendations for Buildings and Facilities

Recommendations						
Location	**Required Actions**	**Emergency**	**Short-term**	**Intermediate-term**	**Long-term**	**Unassessed**
In six cities: Baghdad, Al Basrah, Al Nasiriyah, Al Hillah, An Najaf, and Mosul	▪ Repair, upgrade, or reconstruct Ministry of Education buildings. Cost is estimated parametrically by assuming 20,000 m^2 per building in Baghdad, Al Basrah, and Mosul, and 15,000 m^2 per building in the other cities					■
In six cities: Baghdad, Al Basrah, Al Nasiriyah, Al Hillah, An Najaf, and Mosul	▪ Repair, upgrade, or reconstruct Ministry of Health buildings. Cost is estimated parametrically by assuming 20,000 m2 per building in Baghdad and 15,000 m2 per building in the other cities.					■

Figure 2.6-8. Continued.

Section 3 Challenges & Recommendations

3.1 Overall Program Challenges

The Iraq Infrastructure Reconstruction Program faces unprecedented programwide challenges. Among these are:

- **Security and Access.** The need to provide for the secure transport of assessment teams, as well as protection from ongoing looting and vandalism of jobsites and completed projects, will add substantially to the cost of repairs originally anticipated when the reconstruction program was conceived. Without adequate protection of facilities, looting and vandalism occurs unchecked and undoes the work just completed.
- **UXO**. The presence of UXO hazards in most areas of the country slows down and increases the cost of reconstruction across all infrastructure sectors. Some areas have not been declared cleared by the military and must undergo extensive investigation prior to beginning work.
- **Contracting Strategy.** Strict adherence to international standards for contractor selection and accountability, recognition of sanctions and embargoes, contract term flow down requirements, plus differences in industry standards, payment mechanisms, and language barriers, will pose difficulties to local contractors. Adjustments must be made to successfully engage Iraqi contractors.
- **Integration of Activities Among Diverse Participants.** The success of the program is dependent on the effective integration of diverse stakeholders, including USAID and other U.S. government entities, coalition forces, NGOs, Iraqi leaders, and local communities, all of whom may bring different cultural, language, and organizational characteristics.
- **Access to Information.** Obtaining quality information has been more difficult than anticipated. Information about infrastructure sectors has been less reliable and/or available than planned.

To meet the challenges outlined above, Bechtel recommends focusing on the following key requirements:

- **Integrated Systems Approach.** Whenever possible, infrastructure segments must be addressed as systems and not just specific pieces. Power, water, airports, rail, and the port are all integrated systems and each has to be understood as critical components of an overall infrastructure network to arrive at the most economic and effective implementation plan.
- **Alignment with USAID Priorities.** Emergency restoration of the port, airport, and power services, as well as the repair of water and waste management facilities, roads, bridges, rail, and buildings must be sequenced to align with priorities established by USAID.
- **Addressing Short-, Intermediate-, and Long-Term Needs.** The plan forward must assign priorities in a comprehensive manner. It must be sensitive to the humanitarian mission of the program and Bechtel's responsibility to control the expenditure of funds on the program.
- **Use of Iraqi Contractors.** Innovative ways must be found to make maximum use of Iraqi subcontractors and entities. Engineering and construction skills do exist in the contracting sector and ex-ministerial, now parastatal, companies have the experience and skills necessary to do much of the work to good standards.

3.2 Sector Recommendations

The following summaries are the result of Bechtel's assessments of the six primary infrastructure sectors. Bechtel will develop estimated costs at a Rough Order of Magnitude level for these reconstruction activities, which will be increasingly refined as work is approved and, following joint USAID-Bechtel agreement on an overarching set of priorities, carried out.

Port of Umm Qasr Sector

A prerequisite for the effective operation of the port is a safe navigation route that can accommodate large ocean-going vessels. Bechtel recommends dredging the new port to a minimum depth of 12.5 meters. A bathymetric survey of the channel from Umm Qasr to the Arabian Gulf is currently being carried out and a recommendation on dredging of the channel will be made by July 7. In parallel, a phased approach should be put in place to rehabilitate essential port infrastructure to meet requirements recommended by Stevedoring Services of America, USAID's port operations contractor and to meet International Maritime Organization standards and requirements.

Airport Sector

Baghdad International Airport is to open by mid-July 2003 to limited commercial flights providing passenger services and operating under daytime Visual Meteorological Conditions (VMC) – this is the first level of reconstruction project operations

The second level is to continue to expand the level of service at Terminal C at Baghdad International Airport and to add services to handle regularly scheduled airline flights serving passengers under daytime VMC conditions. Once Baghdad airport is open, the repair work to open Basrah airport for limited commercial operations will begin, replicating the process used to open Baghdad.

The third level is to expand capability of Baghdad and Basrah international airports to serve scheduled airline passenger and cargo flights under daytime and nighttime Instrument Meteorological Conditions (IMC).

Once IMC for daytime and nighttime operations are achieved at Baghdad and Basrah international airports, our recommendation is to expand the Iraq airport infrastructure at these facilities to continue to improve the level of service. Continued improvements in the ATC system for Iraq include better *en route* surveillance and control using MSSR radar and VOR/OME navigation aids.

Water, Waste Management, and Irrigation Sector

An integrated approach must be taken to address the challenge of supply and distribution of potable water to the Iraqi population. Water treatment facilities in the southern area must be rehabilitated to be much more effective in removing contaminants from the water. Wastewater treatment in the central area (from Baghdad south to Al Samawah) must, as a minimum, lessen the pollutant load from raw wastewater to the river. These projects should move forward as quickly as possible. Once under way, the program should refocus on rehabilitating water treatment systems in the Central Region and wastewater treatment in the North.

The Sweetwater Canal is another area of concern as it is the only source of potable water for the population in the Basrah area. It requires dredging and general maintenance of pump stations and the canal gates.

Power Sector

The power system in Iraq includes multiple interrelated parts, none of which can stand alone. Bechtel recommends emergency actions be taken to address immediate power needs at population centers, but also that a longer-term program be put in place to increase generation capacity and restore transmission lines and substations to support local distribution of petroleum and other industrial production.

Rail, Roads, and Bridges

Bechtel recommends focusing rehabilitation work on major artery bridges as key control points along the country's land transport network. Development of the implementation plan should be guided by USAID priorities. For the railways, minimal rehabilitation should be carried out, primarily in the south, to facilitate food movement. Longer-term objectives should be the provision of an operational fleet of 75 locomotives and 1,000 specialty freight and passenger cars, a reliable train movement control system, and institutional strengthening to develop modern management systems throughout the country's rail system.

Buildings Sector

Bechtel recommends the use of Iraqi subcontractors to conduct detailed assessments based on criteria established by Bechtel. Emergency rehabilitation should focus on the repair of buildings that are dilapidated through neglect and vandalism, but which have no fundamental structural flaws. It is Bechtel's preliminary conclusion that many of Iraq's schools and clinics meet such a criterion. This approach will enable the beneficial impact of rehabilitation work to reach large populations in an expeditious and cost-effective manner. Over time, this strategy can be replicated at as many population centers as funding allows. Repair or rehabilitation of remaining schools and hospitals, and selected Ministry of Heath and Ministry of Education buildings, will be a longer-term objective.

Appendices

Airports

Bechtel's airport assessment teams prepared a number of discipline-specific checklists that are used to record and organize data gathered in the field. The following is one such example. These checklists ensure a consistent approach is applied in the evaluation of existing conditions. By utilizing a uniform methodology, our teams are able to rapidly complete their assessments.

Iraqi Airports Assessment
Bechtel National, Inc.

Airport

System Surveyed Airport Systems

Surveyed By _____

Date ___/____/_____
Mm /dd/ yyyy

Main System	Resp. Person	Sys. No.	Checklist Descriptions
AIMS	LMS	1	Building Management and Control System (BMCS)
AIMS	LMS	2	Business and Finance Systems (BFS)
AIMS	LMS	3	Common Use Terminal Equipment (CUTE)
AIMS	LMS	4	Gate Management System (GMS)
AIMS	LMS	5	Local Boarding Application (LBA)
AIMS	LMS	6	Master Clock System (MCS)
AIMS	LMS	7	Multi-Use Flight Information System (MUFIDS)
AIMS	LMS	8	Parking Structure Systems (PSS)
AIMS	LMS	9	Property Management System (PMS)
AIMS	LMS	10	Ticket Counters (TC) & Gate Podiums (GP)
COMMS	LMS	11	COMM Cabling System
COMMS	LMS	12	Comm Rooms & Closets (CR&C)
COMMS	LMS	13	Local Area Network (LAN) &IMOs
COMMS	LMS	14	Phone System (PS)
COMMS	LMS	15	Uninterruptible Power Supply (UPS)
Government	LMS	16	Government Systems (GS) TSA, FAA, Customs, Agriculture, DEA
SEC&SAFETY	LMS	17	800 Megahertz Radio System (800MRS)
SEC&SAFETY	LMS	18	Access Control System (ACS)
SEC&SAFETY	LMS	19	Checkpoint Equipment System (CES)
SEC&SAFETY	LMS	20	Closed Circuit Television (CCTV)
SEC&SAFETY	LMS	21	Explosives Detection System (EDS)
SEC&SAFETY	LMS	22	Fire Alarm and Control System (FACS)
SEC&SAFETY	LMS	23	Operation Control Center (OCC)
SEC&SAFETY	LMS	24	Personnel X-Ray System (PXS)
SEC&SAFETY	LMS	25	Public Address (PA)
SEC&SAFETY	LMS	26	Security Badging System (SBS)
SEC&SAFETY	LMS	27	Trace Detection System (TDS)
SYSTEMS/AIRLINE	LMS	28	Airline Operations Systems (AOS)

General Description Systems consists of communications network, server(s), application software, workstations with display devices, remote controllers, and end devices providing control, sensor, displays, visual, and audible alarms or indications.

General Airport Systems Condition □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____
_____

Remedial Priority □ Urgent □ Critical □ Intermediate □ Not Critical □ Future □ Other, specify: _____

Governing Codes □ API □ NFPA □ NEC □ AWWA □ ANSI □ NPC □ NBC □ Other; Specify: _____
_____
_____

Available Documents

- Plans _____
- Specs _____
- Misc Data _____
- Photos _____
- Sketches _____

General Notes _____
_____
_____
_____

System, Subsystems, or Components

System 1 Building Management and Control System (BMCS)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____

_____communications network :_____
_____server(s) :_____
_____application software :_____
_____workstations with displays :_____
_____remote controllers :_____
_____end devices providing control :_____
_____sensor :_____
_____displays :_____
_____visual and audible alarms :_____

☐ Mechanical _____

_____ H&R Chiller, Pumps & Cooling Towers _____
_____ Air Handling Units _____
_____ Relief Air Fans _____
_____ Exhaust Air Fans _____
_____ Pumps _____
_____ Terminal Units (FP & VAV boxes) _____
_____ Hydronic Flow, Temperature and Pressure _____
_____ Air Flow, Temperature and Pressure _____
_____ Natural Gas Metering _____

☐ Plumbing _____

_____ Booster Pump _____
_____ Recirculation Pumps _____
_____ Water Heaters _____
_____ Water Metering (Tenant) _____
_____ Landscape Irrigation System _____

☐ Fire Protection & Alarm _____

_____ Fire Pumps _____
_____ Zone Control Valves _____
_____ Supervisory Values/Tamper Switches _____
_____ Pre-Action Value Controller _____
_____ FM 200 Control Panels _____
_____ Heat & Smoke Detectors _____

☐ Electrical _____

_____ Emergency Generator _____
_____ Fuel Tank _____
_____ Switchgear _____
_____ Switchgear Emergency Power ATS _____
_____ Metering (Tenant) _____
_____ Lighting Control Panel _____

☐ Natural Gas _____

_____ Pressure _____
_____ Metering _____

☐ Telecommunications _____

_____ Communications Rooms Temperature _____
_____ Communications Rooms Power _____
_____ Equipment _____
_____ Core and Edge Switches _____
_____ Public Address Systems _____

☐ Security Checkpoint _____

_____ Duress Alarms _____
_____ EDS Bag Rejections _____

Ratings _____
Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____
_____

Notes _____
_____

System 2 Business and Finance Systems (BFS)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____
_____communications network :_____
_____server(s) :_____
_____application software :_____
_____workstations with displays :_____
_____printers :_____

Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____
_____

Notes _____
_____

System 3 Common Use Terminal Equipment (CUTE)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____

_____communications network :_____
_____server(s) :_____
_____application software :_____
_____workstations with displays :_____
_____printers :_____
_____readers :_____

Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____
_____

Notes _____
_____

System 4 Gate Management System (GMS)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____

_____communications network :_____
_____server(s) :_____
_____application software :_____
_____workstations with displays :_____
_____printers :_____

Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____

_____

Notes _____

_____

System 5 Local Boarding Application (LBA)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____
_____communications network :_____
_____server(s) :_____
_____application software :_____
_____workstations with displays :_____
_____printers :_____

Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement □ Discard □ Repair □ Recondition □ Routine Maintenance □ None □ Other; Specify: _____

_____

Sketches/ Photos _____

_____

Notes _____

_____

System 6 Master Clock System

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____
_____communications network :_____
_____server(s) :_____
_____application software :_____
_____workstations with displays :_____

Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____

_____

Notes _____

_____

System 7 Multi-Use Flight Information System (MUFIDS)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____

_____communications network :_____
_____server(s) :_____
_____application software :_____
_____workstations with displays :_____
_____FIDS :_____
_____BIDS :_____
_____GIDS :_____
_____RIDS :_____
_____WWW DISPLAY :_____

Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____

_____

Notes _____

_____

System 8 Parking Structure Systems (PSS)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify:
_____communications network :_____
_____server(s) :_____
_____application software :_____
_____workstations with displays :_____
_____remote controllers, and :_____
_____end devices providing control :_____
_____sensor :_____
_____displays :_____
_____visual and audible alarms :_____

Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify:

Sketches/ Photos _____
_____

Notes _____
_____

System 9 Property Management System (PMS)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify:
_____communications network :_____
_____server(s) :_____
_____application software :_____
_____workstations with displays :_____
_____printers :_____

Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify:

Sketches/ Photos _____

_____

Notes _____

_____

System 10 Ticket Counters (TC) & Gate Podiums (GP)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____
_____CUTE capable :_____
_____Airline specific :_____
Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____

_____

Notes _____

_____

System 11 COMM Cabling System

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____
_____communications network :_____
_____server(s) :_____
_____application software :_____
_____workstations with displays :_____
_____remote controllers, and :_____
_____end devices providing control :_____
_____sensor :_____
_____displays :_____
_____visual and audible alarms :_____
Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement

□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____

_____

Notes _____

_____

System 12 Comm Rooms & Closets (CR&C)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____

_____communications network :_____
_____server(s) :_____
_____Core Switches and routers :_____
_____Edge Switches and routers :_____
_____network mgmt. software :_____
_____workstations with displays :_____
_____remote controllers, and :_____
_____end devices providing control :_____
_____sensor :_____
_____displays :_____
_____visual and audible alarms :_____

Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____

_____

Notes _____

_____

System 13 Local Area Network (LAN) & IMOs

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged

□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____

_____communications network :_____
_____server(s) :_____
_____application software :_____
_____workstations with displays :_____
_____remote controllers, and :_____
_____end devices providing control :_____
_____sensor :_____
_____displays :_____
_____visual and audible alarms :_____

Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____
_____

Notes _____
_____

System 14 Phone System (PS)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____

_____communications network :_____
_____PBX :_____
_____application software :_____
_____workstations with displays :_____
_____remote controllers, and :_____
_____end devices providing control :_____
_____sensor :_____
_____displays :_____
_____visual and audible alarms :_____

Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____

_____

Notes _____

_____

System 15 Uninterruptible Power Supply (UPS)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____

Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____

_____

Notes _____

_____

System 16 Government Systems (GS) TSA, FAA, Customs, Agriculture, DEA

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____

_____communications network :_____
_____server(s) :_____
_____application software :_____
_____workstations with displays :_____
_____remote controllers, and :_____
_____end devices providing control :_____
_____sensor :_____
_____displays :_____
_____visual and audible alarms :_____

Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____
_____

Notes _____
_____

System 17 800 Megahertz Radio System (800MRS)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____
_____antenna in terminal :_____
_____base station (s) :_____
Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____
_____

Notes _____
_____

System 18 Access Control System (ACS)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____
_____communications network :_____
_____server(s) :_____
_____application software :_____
_____workstations with displays :_____
_____remote controllers, and :_____

_____end devices providing control :_____
_____sensor :_____
_____displays :_____
_____visual and audible alarms :_____
_____Badge Readers :_____
_____Magnetic locks :_____
_____Tamper Switches :_____
_____Perimeter fence monitors :_____

Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____
_____

Notes _____
_____

System 19 Checkpoint Equipment System (CES)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other Specify: _____
_____Metal Detectors :_____
_____X-Ray :_____
_____Other :_____
Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____
_____

Notes _____
_____

System 20 Closed Circuit Television (CCTV)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____

_____Cameras :_____
_____Cabling :_____
_____Viewing :_____
_____Recording :_____

Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____
_____

Notes _____
_____

System 21 Explosives Detection System (EDS)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____

Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____
_____

Notes _____
_____

System 22 Fire Alarm and Control System (FACS)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____

_____communications network :_____
_____server(s) / panels :_____
_____application software :_____
_____workstations with displays :_____
_____remote controllers, and :_____
_____end devices providing control :_____
_____sensor :_____
_____displays :_____
_____visual and audible alarms :_____
_____emergency public address :_____

Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____
_____

Notes _____
_____

System 23 Operation Control Center (OCC)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____

_____911 dispatch system :_____

Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____

_____

Notes _____

_____

System 24 Personnel X-Ray System (PXS)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____
Drugs, explosive, and weapons detection via low yield x-ray.

Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____

_____

Notes _____

_____

System 25 Public Address (PA)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____
_____central system :_____
_____remote amplifiers :_____
_____speakers and wiring :_____
_____microphones :_____

Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____

_____

Notes _____

_____

System 26 Security Badging System (SBS)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____
_____communications network :_____
_____server(s) :_____
_____application software :_____
_____workstations with displays :_____
_____badge printers :_____
_____cameras :_____

Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____

_____

Notes _____

_____

System 27 Trace Detection System (TDS)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____

Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____

_____

Notes _____

_____

System 28 Airline Operations Systems (AOS)

Conditions □ Totally Damaged □ Partially Damaged □ Not Damaged
□ Missing □ Not Functioning □ Partially Functioning □ Functioning
□ Other; Specify: _____

_____communications network :_____
_____server(s) :_____
_____application software :_____
_____workstations with displays :_____
_____remote controllers, and :_____
_____end devices providing control :_____
_____sensor :_____
_____displays :_____
_____visual and audible alarms :_____
_____ARINC ground to air radio :_____
_____Airline specific systems :_____

Ratings _____

Dimensions _____

Remedial Actions □ Complete Replacement □ Partial Replacement
□ Discard □ Repair □ Recondition □ Routine Maintenance □ None □
Other; Specify: _____

Sketches/ Photos _____

_____

Notes _____

_____

Water, Waste Management, and Irrigation

Bechtel's water, waste, and irrigation teams focused assessments in three regions: Al Basrah, Heartland, and Baghdad. Water and waste facilities that have been assessed as of June 10, 2003, are listed in this appendix, followed by an evaluation of the Al Basrah potable water pump station and a pictorial presentation of the current status of many water and waste facilities assessed by our team.

Facilities Visited by Water Team

(as of June 10, 2003)

Al Basrah Governorate

Water Facility

Safwan

Basrah Airport

R Zero

Hartha

Mouhad Unified

Garma 1

Garma 2

Basrah Port (New)

Basrah Port (Old)

Jubaylah 1

Jubaylah 2

Al Rybat

Umm Khayal

Bradiyah 1

Bradiyah 2

Shaibah

Abu Al Khasib

Al Mhaili

Sewage Treatment Plant

Basrah Airport

Heartland Region

Water Facility

An Najaf

Sewage Treatment Plant

Al Hillah

Karbala

An Najaf

Ad Diwaniyah

Al Kut

Al Hillah

Baghdad Mayoralty

Water Facility

Sabah Nissan

Baghdad Airport

Sludge Treatment Plant

Baghdad Airport

Al Basrah Potable Water Pump Station Restoration

Background and Assumptions

Al Basrah receives raw water from the Sweet Water Canal, a 220-km-long canal that allows the area to avoid using the Shatt al Arab formed from the confluence of the Tigris and Euphrates rivers. The Shatt is brackish in its lower regions and would require desalination to make it potable. This project is part of a three-part program to improve the quality of water delivered to the more than two million residents of the area. The others address the treatment plants themselves and three of the major pipelines that deliver potable water.

Many of the pumps and generators have been in service for the last 20 years and are at the end of their useful life. In addition to the age of the units and the associated controls, all have been subjected to a minimal maintenance program. Power outages during their operating life have added to the stress on the mechanical and electrical systems. Recent looting has also affected some of the facilities. Potable water deliveries have suffered because of the frequent shutdowns due to the need to take critical pumps offline for maintenance as well as the shutdowns due to power outages.

As a consequence of the above, this job order is proposed to replace the pumps and generators that have been identified as needing replacement and to refurbish those that can be salvaged either onsite if the repairs can be made relatively quickly or off-site to minimize outages due to pump replacements. Refurbishing would be done in an Iraqi facility if at all possible with initial support as needed from the respective pump manufacturers.

Existing Conditions

The following are the conditions at the proposed pump stations.

Location	Condition
Um Kayyal	▪ Two 375m^3/hr pumps to transfer water to Safwan: one duty and one standby. ▪ Four 375m^3/hr pumps to feed water to Khor Az Zubair: two duty and two standby. All pumps require general maintenance and at least one needs replacement. ▪ One 1,000 KVA standby generator, 800 kw, 1,443 amps is available at site. The generator requires significant maintenance as it has been forced to function for considerable periods of time due to main power shutdowns.
Hartha	▪ Seven 1000m3/hr feeding to Hartha: four duty and three standby. Four of the pumps are not operational and the remaining require general maintenance. ▪ Six 1.25 KVA ABB generators; three for emergency power and three for backup. At present, only one is operational. Replace two generators and refurbish the four inoperative generators. Once refurbished, the extra two would be used elsewhere.
Jubayla 1	▪ Three 1,000m3/hr pumps transfer water to Jubayla: one duty and two standby.

Jubayla 1	The pumps are in fair condition and the assumption is that they can be refurbished in place. ▪ One 650 KVA generator for backup power located at the site. The generator is in fair condition and it is expected that it can be reconditioned onsite.
Jubayla 2	▪ Eight 200m3/hr pumps supply potable water: four duty and four standby. All pumps from this compact unit, built in1986, require maintenance; one appears to require replacement.
Gorma 1&2	▪ Four 200m3/hr pumps deliver water to the city: two duty and two standby. All pumps for this compact unit plant need replacement or major refurbishment. ▪ Two generators; both require significant maintenance.
Ar Rybat	▪ Six 200m3/hr pumps transfer water to the city: three duty and three standby. All of the pumps in this three-unit, 1986 compact plant need maintenance and at least one needs replacement. ▪ One 500 KVA standby generator provided for emergency power. The generator requires inspection and general maintenance.
Bradiya	▪ Four 400m3/hr pumps transport product water: three duty and one standby. All pumps require general maintenance. The plant was originally constructed in 1957. ▪ Two generators are provided for backup power purposes. Both require significant maintenance to reliably supply emergency power.
Al Basrah Port	▪ Four 200m3/hr product water pumps: two duty and two standby. The plant, built in 1936, serves a local hospital and neighboring hotels. All pumps are in poor condition; at least one needs replacement. ▪ No backup generators are available.
Al Basrah New Port and Umm Qasr	▪ Three 750m3/hr high lift pumps: two duty and one standby. One pump is inoperative and needs replacement; the other two need general maintenance. ▪ Two generators, one 1,000 KVA and one 230 KVA are available for emergency power. The 230 KVA generator requires major repair or replacement; the larger unit needs general maintenance.
Rzero	▪ Seven 1000m3/hr treated water pumps: five duty and two standby. ▪ Two 1,250 KVA and three 891 KVA generators used for emergency power. All generators require refurbishment.

Recommendation

The assessment of the pump stations and the associated backup power supplies indicate that a number of the units should be replaced and that the remaining units require various levels of refurbishment. In addition to the mechanical and electrical rotating equipment, many of the valves need replacing and power and control systems need upgrading. To expedite the work at hand, we propose to issue purchase orders for pumps, valves, and related control systems so there is direct control of the equipment that will be available for the rehabilitation/installation contractor when onsite. The equipment will be free-issued to the contractor. If possible, we would purchase the pumps from one or two suppliers to improve equipment commonality and to attempt to obtain a quantity discount on the equipment purchase.

Table 1 summarizes the results of the pump assessments, shows the size and number of each of the pumps in the various potable water pumping stations, indicates how many are recommended for replacement, and the number recommended for rehabilitation. Based on the assessment, we recommend replacing four of the 47, 1,000m3/hr pumps need replacing, one of the seven 750 m3/hr, one of the four 400m3/hr and eight of the 24, 200m3/hr pumps. Further, we recommend adding one of each size as a contingency for pricing purposes, resulting in a total of 18 new pumps and motors of the system that currently has 82 duty/standby pumps. The remainder would receive rehabilitation by an Iraqi contractor with support from the appropriate pump supplier as required.

Table 1: Summary of Al Basrah Potable Water Pump Requirements

Pump Station Location	Pump Size (m^3/hr)					Action required	
	1000 (m^3/hr)	750 (m^3/hr)	400 (m^3/hr)	375 (m^3/hr)	200 (m^3/hr)	Replace	Rehab
Al Mouhad	6						6
Al Mouhad			3				3
Al Rybat					6	1	5
Al Basrah Port					4	1	3
Al Basrah Port and Umm Qasr		3				1	2
Bradiya			4				4
Gorma					4	3	1
Hartha	7					4	3
Jubayla					8	1	7
R Zero		4					4
R Zero	34						34
Um Kayyal				6		1	5
Total Required	40	7	14	6	22	**12**	**77**

For generators, we propose utilizing an existing Bechtel power purchase contract to obtain the required new generators. Results of the assessments suggest that four new generators are required, three 1,250 KVA units and one 230 KVA unit. The remainder of the 18 units should be rehabilitated and returned to service.

The estimate for this job order is based on the above and on the assumption that all the new pumps and generators will require new electrical and control systems and that the remaining units will require the equivalent of 25% of the cost of new electrical and control systems to reestablish them as reliable pumping and generating systems.

Table 2 summarizes the results for the generator set assessments.

Table 2: Summary of Al Basrah Potable Water Generator Requirements

Pump Station Location	Power (KVA)						Action required	
	1250 (KVA)	1000 (KVA)	891 (KVA)	650 (KVA)	500 (KVA)	230 (KVA)	Replace	Rehab
Al Mouhad	3						1	2
Al Rybat					1			1
Al Basrah Port and Umm Qasr						1	1	
Al Basrah Port and Umm Qasr		1						1
Bradiya								1
Gorma	1							1
Hartha	6						2	4
Jubayla				1				1
R Zero			3					3
R Zero	2							2
Um Kayyal		1					1	
Total Required	12	2	3		1	1	**5**	**16**

Current Status

The following photographs provide the current status of many water and wastewater facilities assessed in Iraq. As the assessment report states, the water utilities in Iraq are generally in need of urgent attention. However, it is worth noting the plans of the government regarding the potable water treatment and wastewater treatment.

Figure 1 shows the site labeled R0 by the Iraqis. Intentions were to create master sites, R0 to R1 and so on; however R0 was the only site to be built leaving the rest of the Al Basrah area in desperate need of attention.

New equipment installed (see Figures 2a-c) adheres to British/European standards with many new levers and fittings labeled in both English and Arabic. The above dosing unit situated on the outskirts of Al Basrah was extremely modern despite the decrepit state of the surrounding facilities.

Figure 1

Figure 2a

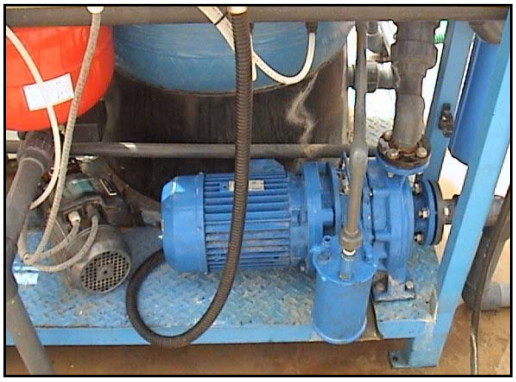


Figure 2b

Figure 2c

Despite the extreme neglect of many sites, a limited number of sites showed signs of improved systems and upgrades to come. However, for various reasons, the equipment seen in the figures above is not common. A

number of new installations have been looted, resulting in a serious impact on the distribution of drinking water.

As pumps and control systems failed, so did the distribution of the water. The amount of available water has diminished, leading to illegal tapping of water mains as shown in Figures 3a-d. The tapping of water mains has caused downstream problems. For example, as water pressure falls, pumps requiring an incoming flow hydro-lock under the lack of pressure causing instant failure of pumps and further failures downstream. In addition, the bacterial content within the water main, now open to external contamination and flowing at a much slower rate, increases exponentially.

Figure 3a

Figure 3b

Figure 3c

Figure 3d

Cholera, hepatitis, and e-coli were all spread through cross contamination due to the hazardous environment that prevailed through the lack of awareness and desperation of the Iraqi people.

Figure 4 shows local children swimming in raw water, while Figure 5 shows the raw water leaking from a break in the pipe.

Figure 4

Figure 5

Serious structural damage to water treatment plants and wastewater plants did not occur in the recent conflict. The bulk of the problems stem either from neglect due to the lack of maintenance and crucial supplies being available to the maintenance teams and looting. The end result is a vast quantity of vital systems within the plants requiring refurbishment or replacing. Items such as filters, scrapers, and pumps, all of which are essential items within the water treatment process, rely on regular maintenance to ensure they can operate correctly.

In some locations, many removable units have been looted and items such as motors for the scrapers and wheels have been removed. Panels have been stripped of copper content as well as distribution boards and general terminations. Power cables have been removed from some sites, as have signaling cable and PLCs from within the wall and floor mounted enclosures.

Current Status Summary

The following is a compilation of the current status:

- Significant reduction in water treatment, often passing water through the plant untreated (i.e., without any form of filtration or dosing), has resulted in the potential for uncontrollable distribution of water-born disease throughout the water network
- Lack of water pressure causing further serious problems such as blockages within the distribution network
- Grit erosion of network pipelines, valves, and pumps
- Decaying buildings
- Leaking tanks and chemical leakage at some sites

Figure 6

A scraper unit on bricks, a result of looting.

Figure 7

Many gauges will require replacement; all will require functionality checks.

Figure 8

Pumps will require testing under all conditions to ensure availability. Many will require refurbishment rather than replacing.

Figure 9

In many cases, the resin inside UPVC fittings has become brittle causing leaks to occur.

Figure 10
Holes and gaps in cables need to be filled using foam.

Figure 11
A three-phase supply is available at most sites surveyed, however, in some cases there is no provisions for a backup supply.

Figure 12
Control panels stripped of contents.

Figure 13
Copper content within the enclosures has been removed.

Figure 14
Chlorination equipment failed due to lack of maintenance and the lack of chlorine often caused operators to shutdown the device for long periods of time resulting in blockages.

Figure 15
At many plants, the power cables, signal cables, and pump control instrumentation has been removed.

Figure 16

In some instances, where protected cable was not available, the operator has used domestic flexible mains cable without a gland. This example puts the entire site in danger as the cable runs past chlorine tanks.

Figure 17

Temporary glands to be replaced with permanent, rodent-resistant, IP 54 (minimum) international standard glands.

Figure 18

Some panels require simple cleanup.

Figure 19

In addition to the panels, general cable runs need attention. Here, a 415 V, three-phase supply from the generator has been pulled into the transformer room with little concern for hazards around the draw pit.

Figure 20a, 20b

Either through conflict damage or operator attempts to cool components, enclosures are in need of repair or replacement to protect the internal units from rodents.

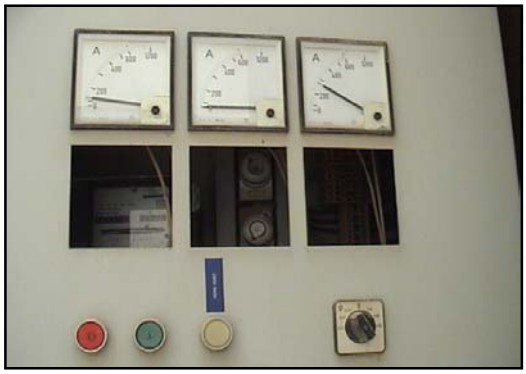


Figure 21
For unknown reasons, many cabinets have instrumentation missing without signs of cannibalism. Although this allows cooler operation for the equipment, it does cause potential rodent problems.

Figure 22
Some equipment is fully operational and requires only minimal work. The unit shown here needs to be mounted in a more appropriate, functional, and safe manner.

Civil Works Identified

Figure 23
All sites need to be cleared of disposable items.

Figure 24
Concrete cable troughs exposing power cables beneath the broken lids create a potential hazard and provide rodents with a man-made habitat.

Figure 25
Many buildings require only aesthetic repairs.

Figure 26
Due to the inoperability of control valves, a cleanup operation will be required at most wastewater treatment plants

Figure 27
Many containment walls require attention as the load bearings have grown larger than anticipated.

Figure 28
Often, only a general cleanup is required.

Figure 29
Penstocks shown in Figure 29 require rehabilitation due to lack of maintenance.

Figure 30
A lack of grease reduced control over the the plant's operation often resulting in flooding

Sewage Treatment Facilities

Although water facilities have deteriorated, most sewage treatment capacity has received less priority for parts and repair. The result is many existing plants are in poor mechanical and electrical condition or are entirely out of service. This lack of treatment has resulted in raw sewage being dumped directly into rivers.

Figure 31
Photo of an aeration tank with old sludge decaying on cleaning will be required prior to refurbishment.

Figure 32
Out-of-service clarifier with old decaying tank base; sludge at base.

Figure 33
Out-of-service primary clarifier. Sludge crust produced by rising solids provoked by gas production from decaying sludge. Cleaning will be required before refurbishment.

Figure 34
Aerators, gearboxes, and other key mechanical equipment have either been looted or Cannibalized for spare parts for other units.

Figure 35
Out of service clarifier.

Figure 36
Scene from a site on the outskirts of Al Basrah where UXO has been removed. Safety is of paramount importance and therefore all work is to be conducted with this is mind.

Rail, Roads, and Bridges

The following are included in this Appendix:

- **CPA Priority Bridge Spreadsheet.** This is a snapshot of current priority bridge projects and their locations, status, and assessment remarks. This report is frequently updated by the Ministry of Housing and Construction.
- **Railway Track Near Al Basrah.** This appendix presents an overview of track conditions at the Port of Umm Qasr and along the mainline near Al Basrah.
- **Railway Running Sheds and Workshops Near Al Basrah.** These photographs and narrative illustrate the current conditions of railroad support facilities near Al Basrah.
- **Railway Safety.** This report lists a number of safety issues found near Al Basrah.

UN Priority	Responsibility	CJTF-7 Priority	TF Fajr Priority	Iraqi Priority	TF Fajr DB ID	Facility Name	Assessment/Remarks	Cooordinates	MGRS	Mil.Br/MJ Candidate	City	Governance	ORHA Region	Unit	Status/Action	Comments
		****** Highlighted Bridges are the priorities that were discussed in detail by all personnel involved and agreed upon ******														
yes	Bechtel	#1	5	5	RDB-00214	**Exp. 1 -Hauran Valley** / Al Mat Highway Bridge (Jordan-Baghdad)	Twin Bridge, 2-Lane Highway Bridge (13 span concrete 266m x 17m)	N3303.983 E4021.85	37S FS 21239 56070		Ar Rutbah	Al Anbar	Central	V Corps	Bechtel directed a Jordanian Engineer company to do an assessment	Iraqi's cannot fix. Want US to fix. See bridging issues sheet.**Bechtel to fix. 28/05/03 Bechtel Update - Job Order for by pass Constn. Approved by USAID. Scope for demolition and reconstruction nearly ready to submit to Designer.**
yes	Bechtel	#1	5	5	RDB-00721 RDB-00722	**Khazir River Br (Mosul-Irbil)** aka Manqubah Hwy Br N1	Destroyed	N3618.717 E4332.908	38S LF 69403 19500	HDSB/MGB V Corps MJ Candidate	Manqubah	Ninawa	North	V Corps		V Corps is sending MJ up to this site to start work on after they complete RDB-01126. They will emplace (1) MJ for an eastbound lane and (1) for a westbound lane. The HDSB/MGB will then be recovered once MJ's in place. Iraqi's cannot fix. Want US to fix. **Bechtel to fix. 28/05/03 Bechtel Update - Design for demolition and construction 95% complete. Job Order nearly ready to submit formally to USAID**
	Bechtel	#1	5	5	RDB-00101	Al Fathah Hwy Br Ov Tigris River -HWY 19	Damaged/4-Lane, 12 Span Concrete Bridge (carries crude oil pipeline along lower edge of superstructure) At least 1	N3503.05 E4333.433	38S LD 68353 74918		Al Fathah	At Tamin	North	V Corps	Bridge to Tikrit route	Iraqi's cannot fix. Want US to fix. See bridging issues sheet.**Bechtel to fix. 28/05/03 Bechtel Update - Assessment underway 27/05/03.**
	Bechtel	#2	5	5	RDB-01126	Tikrit (Hwy BR Ov Tigris)	Damaged/Pier 4,5,7,8,9 damaged	N343611 E0434147	38S LD 80468 29797	AFB next to bridge. Recommend 200m MJ	Tikrit	Salah ad Din	Central	V Corps	MLC 30 by 18 May ETC 27 May MLC 70	Iraqi's cannot fix. Want US to fix.**Bechtel to fix**
yes	Bechtel	#3	5	5	RDB-00455	**New Diyala Br** (Baghdad New Hwy Br Se Ov Diyala River)	Damaged/4-Lane, 3 Span Concrete Highway Bridge (185m x 13m).	N3316.641 E4432.391	38S MB 57138 82115	MEF's MJ over bridge x2	Baghdad	Diyalah	Central	V Corps		Iraqi's cannot fix. Want US to fix. **Bechtel to fix**
yes			5	5	RDB-00451	**Old Diyala Br** (Baghdad Hwy Bridge South Over Diyala R)	Damaged/2-Lane, 5 Span Concrete Highway Bridge (119m x 13m)	N3313.967 E4431.018	38S MB 55045 77105	MGB damaged span. MEF's MJ next to bridge at MB555774	Baghdad	Diyalah	Central	V Corps	Key bridge in Baghdad.	Iraqi's say they can fix this bridge. 80 year old British bridge. Iraqi's will conduct assessement and scope of work. Will submit proposal to ORHA.
			5	5	RDB-00569	**Al Muthana Br** (Haj Sallum Hwy Br Ov Tigris River)	Damage to small bridge prior to abutment/Twin bridge, 2-way traffic. NE Baghdad. 6 lane br, 315x16m, 7 spans.	N3325.713 E4420.726	38S MB 390 990	MGB. Still crossable. By-pass avail.	Baghdad	Baghdad	Central	V Corps	N. Baghdad Br on Ring Road 3.	Iraqi's say they can fix this bridge. Iraqi's will conduct assessement and scope of work. Will submit proposal to ORHA. Iraq estimated $350 million dinar for reconstruction.
yes	Bechtel		5	5	RDB-00227	Al Musayyib Hwy Br N Ov Euphrates R	Damaged/2-Lane, 10 Span Concrete Highway Bridge (355m x 10m)	N3247.533 E4417.317	38S MB 33389 28477	By Pass lane established at 38SMB331272	Al Musayyib	Babil	South	I MEF	Main route. Damage to abutments only. Future project add 2nd bridge.	Need to arrange an Iraq/US assessment team to determine reconstruction strategy.**Bechtel to fix**
			5	5	RDB-00650	**Chabbab Br** E. of Al Kut (Chabbab Hwy Br Ov Nahr Wadi North)	Dropped/Single-Lane Concrete Span Bridge	N3237.9 E4611.233	38S PB 1136 1107	Still crossable, but difficult. MEF MJ 2 lane candidate (possible pontoon)	Kabbab	Wasit	South	I MEF	Iraqis say start now. Main route between Al Amarah & Al Kut.	MEF recommends priority. Iraqi's say they can fix this bridge.**29/05/03 Ministry propose a visit, with their contractor Al Tahreer, on Sunday 1 June.**
			5	5	RDB-00645	Jughayfah Rd Br Ov Wadi 6	Dropped/2-Lane Highway Bridge	N3414.75 E4200.8	38S KC 24939 93451		Jughayfah	Al Anbar	Central	V Corps	Main route to Syria, Hwy 13.	Iraqi's say they can fix this bridge. Need to coordinate an Iraq/US site visit with unit that owns battle space. **28/05/03 Bechtel Update - Scope nearly ready to submit to designer.**
			5	5	RDB-00671	**Al Baghdadi Br** (Khan Al Baghdadi Hwy Br W Ov Wadi Al Asad)	Dropped/Single-Lane Highway Bridge (concrete piers & abutments 46m x 7m)	N3351.067 E4231.917	38S KC 71736 48479		Khan Al Baghdadi	Al Anbar	Central	V Corps	Main route to Syria, Hwy 13.	Iraqi's say they can fix this bridge. Need to coordinate an Iraq/US site visit with unit that owns battle space.
			5	5	RDB-00726	**Wadi Hauran Br** (Mashad Hwy Br Ov Wadi Hauran Nw)	Dropped/2-Lane, Concrete Bridge, Spans Undetermined (134m x 10m)	N3356.95 E4229.017	38S KC 67450 59373		Maryyam	Al Anbar	Central	V Corps	Main route.	Iraqi's say they can fix this bridge. Need to coordinate an Iraq/US site visit with unit that owns battle space.
yes			3	3	RDB-00239	Al Taji Highway Bridge S Ov Cn -(HWY 1 North of Baghdad over canal)	Damaged/2-Lane, 5 Span Concrete Highway Bridge (208m x 9m)	N3328.265 E4417.597	38S MC 34390 03709		Al Taji	Baghdad	Central	V Corps	Alternate routes available	
	Bechtel					14 th July Suspension Bridge Over Tigris River	Damaged hanger cables, and two small areas of concrete damage in c'way				Baghdad	Baghdad	Central	V Corps	still passable , classification reduced by 50%	Specialist Repairer Reqd. Constructed by Waagner biro. LtC Mark Holt e-mailed bridge@wbag.co.at (tel:43-1-288-440) response awaited. **Bechtel to fix**
		#2	4	3	RDB-00985	**Al Batha Br** (Shatt Al Khar (RT 1 MSR Tampa ov Euphrates)	Damaged/Under construction & nearing completion. 2-lane, 12 span hwy bridge	N310644 E0460004	38R NV 95462 42470	Bridge is o.k. Approaches and road are dirt	Shatt al Khar	Dhi Qar	South	I MEF	Military upgrading approaches. HWY is not complete, but in use.	Recommended drop in priority by C7 EECP, due to military improvements done to area. Asking MEF for more info on condition of bridge area and maintenance plan.

		#2	4	3	RDB-00985	**Al Batha Br** (Shatt Al Khar (RT 1 MSR Tampa ov Euphrates)	Damaged/Under construction & nearing completion. 2-lane, 12 span hwy bridge	N310644 E0460004	38R NV 95462 42470	Bridge is o.k. Approaches and road are dirt	Shatt al Khar	Dhi Qar	South	I MEF	Military upgrading approaches. HWY is not complete, but in use.	Recommended drop in priority by C7 EECP, due to military improvements done to area. Asking MEF for more info on condition of bridge area and maintenance plan.
		#3	4	4	RDB-01127	**Suwaira Br** (Sarabadi ov Tigris River)	Dropped - 2 lane concrete bridge ov Tigris River	N325909 E0444708	38S MB 79964 49737	MJ Candidiate that MEF will emplace	Sarabadi	Wasit	South	I MEF	Iraqis state that alternate routes are available. IMEF states Safety.	Recommended drop in priority by C7 EECP, due to low amount of traffic using bridge. Asking MEF for more info on traffic use. Frago out for MEF to put in 2-40m MJ lanes
			4	4	RDB-00024	Abu Sukhayr Hwy Br E Ov Stream	Damaged (not severe) Concrete Highway Bridge (60m x 9m)	N3155.267 E4430.733	38R MA 53887 31795	2 sections of MGB. MJ candidate.	Abu Sukhayr	Al Qadisiyah	South	I MEF	Alt. route availabe. Main route between An Najaf & Ad Diwaniyah.	
			~~4~~	~~4~~	~~RDB-00109~~	~~Al Faysaliyah Hwy Br Ov Canal Sw~~	~~Damaged/Fiber Optic Bridge connects An Najaf & An Nasariyah~~	~~N3147.507 E4429.994~~	~~38R MA 52639 17453~~		~~Al Faysaliyah~~	~~An Najaf~~	~~South~~	~~I MEF~~	~~Main route between Najaf and An Nasariyah.~~	**29/05/03 - MEF Report that there is no damage to this bridge and that it is fully operational. This bridge can be taken off the spreadsheet.**
			4	4	RDB-00315	Ar Rumaylah Hwy Br N Ov Hawr Al Hammar	Damaged/(141m x 10m)	N3042.567 E4719.233	38R QU 22232 99701		Ar Rumaylah	Al Basrah	South	I MEF	Need to verify. Important for Oil Industry Not used by civilians.	Bridge is trafficable
			4	4	RDB-00435	Az Zubaydiyah Pontoon Br Ov Tigris River	Damaged/Pontoon Bridge (200m x 2.5m)	N3246.75 E4509.733	38S NB 15062 26848	MEF MJ candidate	Az Zubaydiyah	Wasit	South	I MEF	Need to replace br for community.	Can bypass on Sarabadi bridge
			4	4	RDB-00588	An Numaniyah (Hwy 27 Br Ov Canal)	Dropped	N322653 E0450606	38S NA 09556 90106	MEF's MJ	An Numaniyah	Babil	South	I MEF	Need to reconstruct. Main route to Diwaniyah.	Trafficable by wheel vehicles, but deteriorating. (MJ is used for military traffic)
			4	4	RDB-00602	HWY 10 BR to Jordan Ov Wadi Ashwah	Damaged/2-Lane, Single Span Bridge (next to Iraq-Jordan border)	N3316.91 E4226.557	38S KB 61819 85431	Need to clear debris to open EXP 1.	Unknown	Al Anbar	Central	V Corps	Overpass must be rebuild. Carries Oil trucks to Jordan (must travel on old HWY 10 and not on EXP1).	**27/05/03 V Corp agreed to arrange to clear debris to allow Exp 1 to be fully open. 28/05/03 Bechtel Update - Scope nearly ready to submit to designer.**
			~~3~~	~~3~~	~~RDB-00230~~	~~Al Muwaffaqiyah (Hwy Br ov Nahral Gharraf)~~	~~Damaged - Of unknown origin~~	~~N321556 E0455623~~	~~38S NA 88510 70251~~		~~Al Muwaffaqiya~~	~~Wasit~~	~~South~~	~~I MEF~~	~~Should be easy to repair due to type of const.~~	~~Bridge still crossable. MEF made temporary repair (steel plates over holes)~~ **29/05/03 Ministry have already carried out a repair.**
			3	3	RDB-00268	**Kiffel Br** (An Najaf N Hwy Br Ov Euphrates R)	Deteriotating/Dual-Lane, Through-Truss Supported by Multi-Concrete Pillars (466m x 7m)	N3213.45 E4421.7	38S MA 39853 65462		An Najaf	Babil	South	I MEF	Still Crossable/Not on the main route. Alternate routes available.	
			2	2	RDB-00341	Ar Rutbah Hwy Br Ov Musad Ar Rutba (Hwy 10 to Jordan)	Damaged/2-Lane highway Bridge (concrete 66m x 8m) spans unknown	N3302.181 E4017.828	37S FS 21239 56070		Ar Rutbah	Al Anbar	Central	V Corps	Small bridge.	
			2	2	RDB-00390	Ash Shamiyah Hwy Br Ov Qanat Safiyah	Dropped/Highway Bridge (75m x 8m)	N3157.817 E4440.933	38R MA 69972 36446	MGB placed over bridge	Ash Shamiyah	Al Qadisiyah	South	I MEF	Not identified as an important route. Need to validate against military requirements.	MGB possibly recovered by unit already. Need to clarify.
			2	2	RDB-00437	Aziziyah Pntn Br	Dropped/Pontoon Bridge (191m x5m) over Tigris	N3253.95 E4503.983	38S NB 06209 40111	MEF MJ candidate	Aziziyah	Wasit	South	I MEF	Town on same side as main route. Fix Az Zubaydiyah first.	
			2	2	RDB-00459	Balad Highway Bridge Northwest Bound Over Canal		N3401.044 E4402.495			Balad	Salah ad Din	Central	V Corps	Need to verify. Not damaged? According to reports.	
			2	2	RDB-00988	**Al Furat Br** (Shaykh Biyjti Highway Brg Ov Nahr Al Furat aka Saddam)	Damaged/Twin Bridge, 6-Lane Highway Bridge, 11 Span (298m x 24m)	N3300.917 E4410.467	38S MB 22892 53283	MGB placed over bridge	Shaykh Biyjti	Babil	South	I MEF	Important bridge for industrial/military sector.	Not assessed by MEF yet. Not a priority for MEF to do.
			2	2	RDB-01108	Wadi Hawran Highway Bridge North	Destroyed - Middle Pier/Span Destroyed	N3306.376 E4017.248			Wadi Hawran	Al Anbar	Central	V Corps	Route for military installations & support north of EXP 1.	
			1	1	RDB-00085	Al Basrah Pontoon Bridge Ov Shatt Al Arab (300m gap)	Dropped - Pontoon Bridge	N3034.678 E4746.647	38R QU 66670 85796	MEF MJ candidate	Al Basrah	Al Basrah	South	I MEF	Pontoon Br difficult for navigation. Don't want to replace pontoon. Need to verify high priority with south? Alternate route through Basra available??? Currently have contract with Egyptian Arabic Union Contractor to build Khalid Br., 5km south.	No replacement recommended by the Iraqi's because they do not want another pontoon bridge in water so you can navigate boats through the area. Egyptian contractor will build bridge 5km south of pontoon site. Brtis want capability to cross Challenger's and asking for ribbon bridge to be emplaced.

			~~1~~	~~1~~	~~RDB-00034~~	~~Ad Diwaniyah Hwy Br W O Shatt Al Hilla (RTE 8 ASR Jackson)~~	~~Damaged/2-Lane, 9 Span Concrete Bridge (168m x 9m)~~	~~N3159.313 E4454.774~~	~~38R MA 91760 39146~~	-	~~Ad Diwaniyah~~	~~Al Qadisiyah~~	~~South~~	~~I MEF~~	~~Need to verify damage. Send RFI for verification. 4 other bridges available in town?~~	**~~29/05/03~~ - MEF Report that there is no damage to this bridge and that it is fully operational. This bridge can be taken off the spreadsheet.**
			1	1	RDB-00134	Al Habbariyah N Hwy Br Ov Wadi - RT 21		N3231.8 E4206			Al Habariyah	Al Anbar	Central	V Corps	Need to verify location and damage. Over canal.	
yes, but agreed to remove			1	1	RDB-00153	Al Hillah Hwy Br N Ov Cnl (RT 8 ASR Jackson)	Damaged/Twin Bridge, 2-Lanes each 20m x 10m	N3234.55 E4425.367	38S MB 45821 04412		Al Hillah	Babil	South	I MEF	Need to verify damage. Send RFI for verification. Old route and br?	No damage reported by FEST team. Take bridge off list.
			~~1~~	~~1~~	~~RDB-00188~~	~~Al Kut (over Tigris River)~~	~~Destroyed - 2 lane (207m x 9m)~~	~~N322930 E0455042~~	~~38S NA 79387 95250~~		~~Al Kut~~	~~Wasit~~	~~South~~	~~I MEF~~		~~Bypass on both sides of bridge.~~**~~29/05/03~~ Ministry have already carried out a repair.**
			1	1	RDB-00240	Al Taji Hwy Br Sw Ov Cn 1		332857N 0441435E			Al Taji	Salah ad Din	Central	V Corps	Need to verify location and damage. Over canal.	
			1	1	RDB-00241	Al Taji Hwy Br Sw Ov Cn 2		N3328.942 E4414.563			Al Taji	Salah ad Din	Central	V Corps	Need to verify location and damage. Over canal.	
			1	1	RDB-00265	An Najaf Hwy Br Ne Ov Shatt Ash	Damaged/2-Lane Highway Bridge (156m x 10m)	N3204.767 E4426.983	38S MA 48068 49374		An Najaf	An Najaf	South	I MEF	Iraqis believe this is a barge, not bridge. Al Abbasyat Br is the name of the main br on route.	MEF has not done assessment on this bridge.
			1	1	RDB-00343	Ar Rutbah Ne Hwy Br Ov Wadi	Damaged/2-Lane Hard Surface Concrete Piers & Abutments (85m x 7m)	N3311.2 E4036.6	37S FS 50090 73136		Ar Rutbah	Al Anbar	Central	V Corps	N of Al Habbariyah N on same route.	**28/05/03 Bechtel Update - Bridge needs a temporary by-pass. Scope nearly ready to submit to designer.**
			1	1	RDB-00493	**Hilal Br** (Chamcha Pontoon Br Over Euphrates)	Damaged/Pontoon Bridge (87m x 5m) supported by 15 pontoons	N3125.438 E4506.573	38R NV 10402 76555		Chamcha	Al Muthanna	South	I MEF	5ton capacity.	
			1	1	RDB-01076	Tuz Khurmatu (over AQ)	Damaged - 2 lane, 42 span concrete (689m x 10m)	N345224 E0443804	38S MD 66591 59057		Tuz Khurmatu	Salah ad Din	Central	V Corps	Steel Br. Need to verify damage if any?	**28/05/03 Bechtel Update - Assessment under way 27/05/03.**
						Rail Road Bridges										
	Bechtel		5	5	RR-00205	Shab Al Hiri (over highway)	Destroyed/Single track railroad bridge across Syrian Border	334354N 0400009E	37S ET 92871 32856					V Corps	Important for phosphate mining	Iraqi's say they can fix this bridge. Need to coordinate an Iraq/US site visit with unit that owns battle space. Coordinate with Ministry of Transportation for rail road specifications. **Bechtel to fix. 27/05/03 V Corp agreed to remove debris to allow traffic through under the railway.**
	Bechtel		5	5		Al Fatah (Hwy 19 over Tigris)	Single track rail bridge concrete deck with 24 spans	350256N 0433331E	38S LD 68544 79414					V Corps		Need to coordinate an Iraq/US site visit with unit that owns battle space. Coordinate with Ministry of Transportation for rail road specifications. US lead in reconstruction. **Bechtel to fix. 28/05/03 Bechtel Update - Assessment under way 27/05/03.**
						Gap Crossing Status										
						SW of Baghdad near Sadr al Yusufiyah	Near Latifiyah Pontton Br Ov Euphrates	330823N 0440206E	38S MB 100 672	AFB / Foot Br (Obj Chamberlain next to foot bridge)				V Corps		
						NW of Baghdad	Near W. Baghdad hwy ov RR	332204N 0441018E	38S MB 2294 9238	AVLB (North Baghdad)				V Corps	Not really near anything, manuever?	
							Near Shaykh Hamid E. Br Ov Dara Xpwy	332119N 0441722E	38S MB 339 909	AVLB (North Baghdad)				V Corps		
						N of An Nasiriyah	Hwy 1-7 connector route over Saddam Canal.	3119N 04603E	38R NV 99909 65173	MEF's MJ				I MEF	No town nearby	
						N of Baghdad	Near Diltawah Pntn Br Ov Tigris River	335311N 0442608E	38S MC 47779 49641	AFB (SE of Balad)				V Corps		
						Shuzayf	Single lane pontoon br. (201m x 4m)	324647N 0450939E	38S NB 15062 26879					I MEF		

▪ Railway Track Near Al Basrah

The condition of the track, both in the Port at Umm Qasr and on the main line near Al Basrah, varies significantly, but at no location can be described as better than poor. The highest speed recorded by the assessment team on the freight service between Umm Qasr and Shaibah was 40km/h.

Much of the permanent way is unballasted and has significant faults in relation to line, level, and twist. Despite local claims of the existence of a maintenance program, little evidence was found to support the activities of the 250 track and structures engineering staff. Basic activities that do not require capital equipment, such as lifting and packing, cleaning of flangeways, and maintenance of gauge, do not appear to be occurring.

Major corrective work is urgently required in order to provide a safe and reliable permanent way, but this must be combined with assisting local staff to develop and implement an effective preventative maintenance program.

The following photos illustrate some of the deficiencies observed.

Figure 1. Kinked and sunken track in the old port at Umm Qasr.

Figure 2. Main line north of Umm Qasr with evidence of looting of bulk ammonia.

Figure 3. The main line in Az Zubayr; speed is limited to 25 kph.

Figure 4. Main line over culvert with evidence of derailment. Note poorly bolted fishplate over the culvert and inadequately secured sleepers.

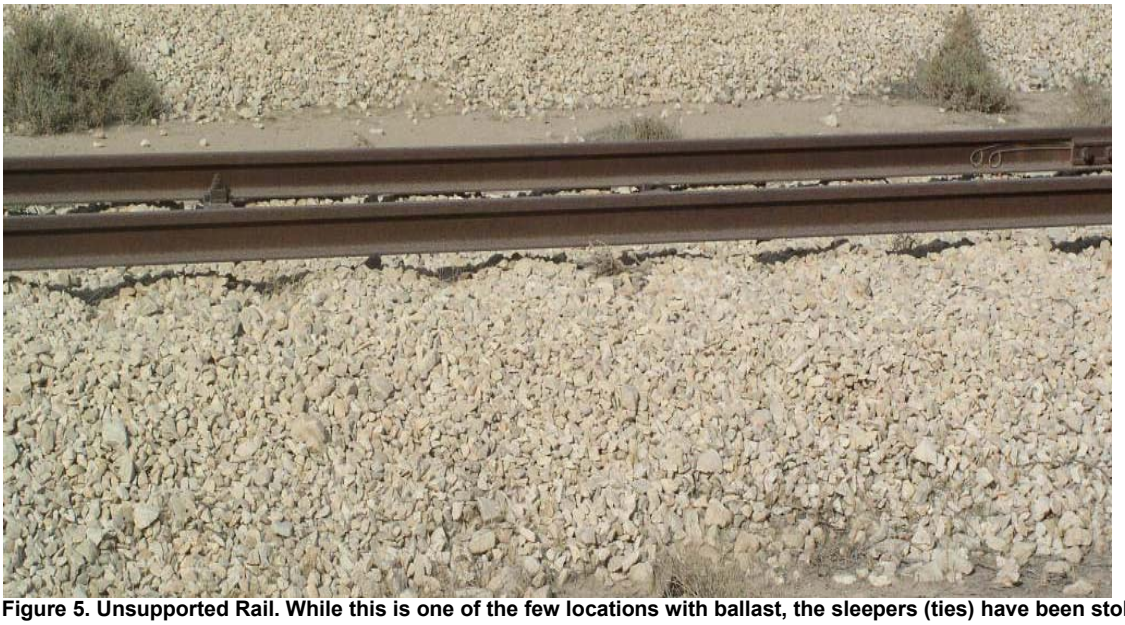


Figure 5. Unsupported Rail. While this is one of the few locations with ballast, the sleepers (ties) have been stolen, making the line unusable.

Railway Running Sheds and Workshops Near Al Basrah

While no overhauls take place at either Al Basrah or Umm Qasr, Al Basrah is responsible for maintaining locomotives allocated to the region and Umm Qasr for preparing locomotives and rolling stock for the 550 km journey to Baghdad.

The Umm Qasr shed has been comprehensively looted; even the roof has been stolen. Army tankers within the port boundaries are currently refueling locomotives. With no facilities or spares and very limited tools, the local staff, under the direction of Army personnel, are cannibalizing what they can to keep the limited service running. No freight vehicles are cleaned before being loaded with foodstuffs, despite lack of knowledge on previous cargos.

The Al Basrah shed, which is required to carry out intermediate overhauls, has been looted with even the forge being removed. While full rehabilitation is not critical in the short-term, the replacement of specific items of equipment and providing a safe electrical supply are necessary.

Figure 6. Umm Qasr shed with stolen roof, water tank, and fuelling equipment. Note also heavy ground pollution.

Figure 7. Flooded pit and forge (with empty equipment slots) in Al Basra shed

Figure 8. Al Basrah shed jacking control panel

Railway Safety

From direct observation, no part of the railway can currently be considered safe in conventional terms. The following items, witnessed during one assessment visit, represent a fraction of the total number of safety issues:

- Train reversed at approximately 10 mph into stationary locomotive
- Train reversed across two public roads without protection or warning
- Train moved while preparation staff were working between vehicle wheels
- Train in collision with a large piece of sheet steel at port gate
- Locomotive on arriving train derailed outside Umm Qasr
- Camel struck and killed by train
- Staff appear to have no common signals for movement instructions
- Between Umm Qasr and Shaibah, train struck five separate objects placed on the line in order to stop the train
- When stationary outside Umm Qasr, train attacked by looters who opened container
- Flat trucks do not all have lugs to secure containers
- Not all vehicles braked or piped (freight trains operating at least partially unfitted with heavy reliance on locomotive braking)
- No use made of the reservoir pipe on the brake system
- No brake test performed prior to departure
- Brake pistons and valves stolen
- Brake shoes on locomotives and wagons missing or very thin
- No tail marker on train
- Axle box covers removed and grease extracted (allegedly for fuel)
- Sand and dirt incursion into axle boxes
- Axle oil feed equipment stolen
- Al Basra station has no communication with the next station down the line
- Locomotives have no communication with stations
- Trains enter single line on timetable principle without certainty that it is clear
- No records of locomotive or vehicle maintenance were identified

- Vehicles not cleaned before being loaded with foodstuffs
- Inspection pits flooded with oil and other liquids
- Strong smell of diesel at one location in Basra shed
- Track condition at best can be described as poor
- Numerous slips, trips, and fall hazards
- Explosive ordnance disposal issues on entire route and in the workshops

The photographs in this appendix illustrate a fraction of the safety issues identified to date.

Figure 9. Result of collision between train and dock gate

Figure 10. Typical wiring condition in Al Basrah Locomotive Shed

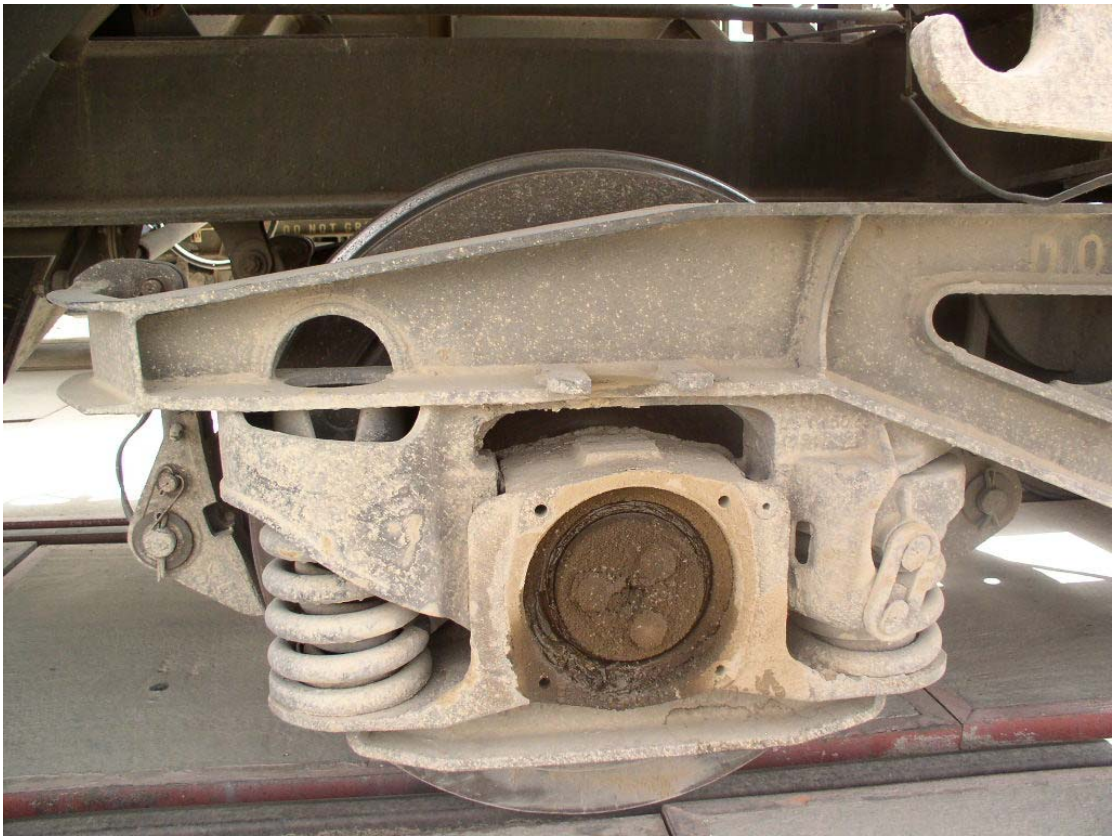


Figure 11. Typical wheel set from recently arrived wagon. Note missing brake block, axle box cover, and oil feed, also the lack of grease and ingress of dirt to the axle box

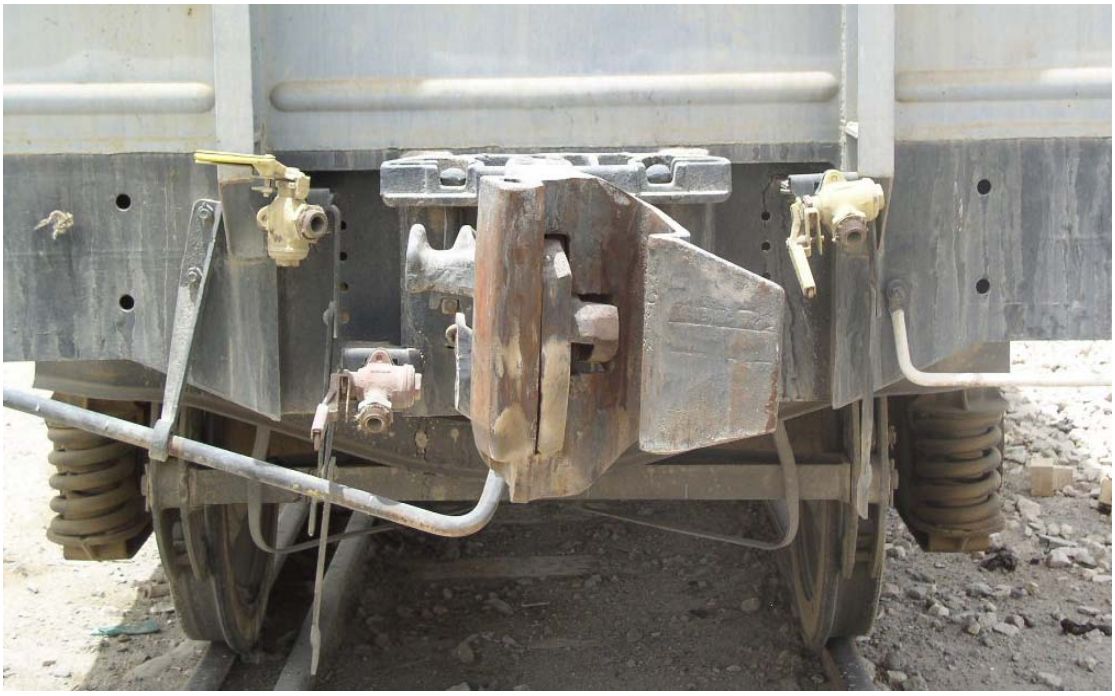


Figure 11. Typical wagon end. Note missing brake block and pipes

Figure 12. Brake piston on grain hopper (the majority of the hoppers were also missing distribution valves)

Figure 13. Locomotive brake block (to right of picture) taken just before departure on 550km journey. With no train brakes, this thin block, with others on the locomotive of similar quality, has to stop the whole train.