Final Quality Control Plan

Remedial Investigation
Locomotive Building Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

Prepared By:

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Revision 0

Delivery Order DX06
IDT Contract W912QR-08-D-0013
Shaw Project Number 133767

January 23, 2009

SIGNATURE PAGE

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Submitted By:

Steven T. Downey, P. E., PMP, RME, REEDTM AP **Project Manager** **Shaw Environmental & Infrastructure, Inc.**	**Date**

Accepted By:

Kathy McClanahan **Technical Coordinator, Environmental Restoration Branch** **U.S. Army Engineer District, Nashville**	**Date**
Doug Mullendore **Chief, Environmental Restoration Branch** **U.S. Army Engineer District, Nashville**	**Date**

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Steven T Downey — 01-23-2009

Steven T. Downey, P. E., PMP, RME, REEDTM AP
Project Manager
Shaw Environmental & Infrastructure, Inc.

Date

Accepted By:

Kathy McClanahan — 26 Jan 2009

Kathy McClanahan
Technical Coordinator, Environmental Restoration Branch
U.S. Army Engineer District, Nashville

Date

26 Jan 2009

Doug Mullendore
Chief, Environmental Restoration Branch
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PROJECT OBJECTIVE AND TASKS

This Final Quality Control Plan (QCP) has been prepared in support of Remedial Investigation (RI) efforts at the Locomotive Building Area (LBA) at the former Plum Brook Ordnance Works (PBOW), Sandusky, Ohio, under Delivery Order (DO) DX06 of IDT Contract W912QR-08-D-0013.

The most recent environmental investigation at PBOW concerning the LBA was presented by U.S. Army Corps of Engineers (USACE), Louisville District in *Limited Site Inspection for the former Plum Brook Ordnance Works Garage Maintenance Building (Locomotive Building Area, July), 2000.* In accordance with the Scope of Work (SOW) issued by the Nashville District USACE (CELRN), Shaw will install temporary piezometers and groundwater monitoring wells and conduct a geophysical survey as part of the investigative tasks. Shaw will also collect groundwater samples from the groundwater monitoring wells and the piezometers, collect surface soil samples, subsurface soil samples, ditch sediment samples and surface water samples. As described in the SOW, Shaw shall perform a baseline human health risk assessment (BHHRA) and a screening level ecological risk assessment (SLERA). The LBA RI will be concluded with the preparation and submittal of the three-volume report composed of the Site Characterization Report (Volume 1), Baseline Human Health Risk Assessment (BHHRA) Report, and the Screening-Level Ecological Risk Assessment (SLERA) Report (Volume 3).

Specific tasks to accomplish under this project DO include the following:

Task 1 – Preparation and Submittal of an Updated Quality Control Plan.

Shaw has prepared this QCP based on requirements described in ER 1110-1-12, Quality Management and presented in the Site Wide Sampling and Analysis Plan (SWSAP). As part of the QCP development, Shaw has incorporated a criteria management process to ensure standard details appropriate for the USACE requirements are developed, updated, and made available to all project stake holders and reviewers involved in this project. This QCP is an addendum to the SWSAP which defines the quality verification activities for specific professional disciplines including data quality objectives, field work activities, and laboratory analysis. This verification process will be implemented to ensure that the work output is acceptable and meets all requirements detailed in the SOW.

An independent review of documents and submittals, as well as other tasks presented in this QCP, shall be performed to verify that work is conducted in an acceptable manner and meets all the requirements detailed in the SOW.

A verification statement shall be included with all products submitted to the Government under this project. The statement will be signed by the independent reviewers identified in the QCP, stating that they have reviewed the applicable document or product and that all internal comments have been resolved, thus completing the product for release to the Government. All comments generated by reviewers of a product or document, along with their resolution, shall be submitted with the verification statement. Should the independent review be conducted by individuals not identified for that activity by the QCP, an explanation of the variance and how quality was maintained despite the variation from the approved QCP will be provided with the verification statement.

As part of the QCP development, Shaw has incorporated the criteria management process as described in the SWSAP.

Task 2 – Preparation and Submittal of Site-Specific Safety and Health Plan and Site-Specific Sampling and Analysis Plan Addenda.

Shaw shall develop and submit a Site-Specific Safety and Health Plan (SSHP) addendum specific to the investigation at the LBA. The draft version of this SSHP addendum required by 29 CFR 1910.120(b)(4) shall be prepared and submitted to CELRN-EC-R for review. This addendum will describe the health and safety procedures, practices, and

equipment to be implemented and utilized to protect affected personnel from the potential hazards associated with the site-specific tasks to be performed. The level of detail provided in the addendum will be tailored to the type of work, complexity of operations to be accomplished, hazards anticipated and the extent that new conditions or procedures affect the need to supplement the updated Site-Wide Safety and Health Plan. Shaw will revise the plan based on comments by the CELRN and submit as a final plan.

Shaw will develop and submit a Site-Specific Sampling and Analysis Plan (SSAP) addendum specific to the investigation of the LBA. The SSAP will be prepared as an addendum to the updated SWSAP and will present details concerning the investigation work as described in the SOW. The SSAP addendum will identify sampling standard operating procedures, analytical methods and data quality objectives specific for the investigation of the LBA. In addition, the SSAP will identify sampling locations, rationale underlying the choice of locations and any expected variations from the SWSAP.

Task 3.0 – Geophysical Survey.

Shaw will complete a geophysical survey using both electromagnetic technology (EM) and ground penetrating radar (GPR) and a magnetometer to accurately locate any underground storage tanks (UST) in the area. The geophysical survey shall be conducted around the entire building and will provide the USACE with the results of the geophysical survey along with recommendations for locations of test pit excavations.

Task 4.0 – Soil Remedial Investigation.

Shaw will collect representative soil samples from surface to 1 foot below ground surface (bgs), 3 to 5 feet bgs, and 8 to 10 feet bgs intervals through direct push sampling techniques. Because fill has been brought into some of these sites, Shaw will approximate the original soil surface and collect surface soil samples to 1 foot below this depth. The intermediate sample, currently planned at a depth of 3 to 5 feet, may be moved based on site-specific conditions. The 8 to 10 foot interval shall be collected at the respective depth below current ground surface. If bedrock is encountered at a depth of less than 10 feet bgs, then the deepest sample within a boring shall be collected from bedrock to 2 feet above bedrock.

Shaw shall install a total of twelve (12) soil borings in the LBA. This includes six (6) in the vicinity of the former Locomotive House building, three (3) in the vicinity of the former rail car washing area, and three (3) borings into the former maintenance pit within the Locomotive House building. Samples from three intervals will be collected as described above from the six borings installed in the vicinity of the Locomotive House building and the three installed in the vicinity of the rail car washing area. Only the deepest one-foot interval will be sampled from the borings within the maintenance pit boring.

No raw explosive material is expected to be encountered during soil sampling activities. Should sampling personnel encounter raw explosives, Shaw will stop sampling and will contact CELRN to discuss procedures for disposal of the raw explosive material.

Shaw will conduct all brush clearing that will be required for equipment to access the site. All utility clearances, permits, and brush clearing will be proposed and coordinated with CELRN and NASA PBS personnel prior to start of work activities.

A qualified geologist or geotechnical engineer shall be on site for all drilling and sampling operations. The geologist/geotechnical engineer shall be capable of visually classifying and logging all boreholes and sediment material on USACE ENG FORM 5056 – R and 5056A-R according to the Unified Soil Classification System, EM 1110-1-4000, and CELRN's *HTRW Design Branch Logging Manual*. Each location selected for soil sample boring shall be logged continuously for the entire boring from ground surface to top of rock. Each location selected for soil sampling shall be logged from the ground surface to bottom of boring for visual geotechnical classification of the overburden material. This information will also be documented on USACE ENG FORM 5056 – R and 5056A-R.

All boring locations will be sketched with sufficient detail that the boring location may be revisited with the log alone. The sketch shall include critical reference points or land marks where applicable. Each location shall be surveyed to the nearest 1 foot; land elevations will be surveyed to within $\pm$ 0.01 foot referenced to the National Geodetic Vertical Datum of 1929 in accordance EM 1110-1-4000. .

Task 5.0 – Groundwater Piezometer Remedial Investigation.

Shaw shall install a total of ten piezometers in the LBA. Each boring shall be advanced to bedrock (competent shale) and continuously logged to bedrock for geotechnical classification. If bedrock is encountered at less than 5 feet below ground surface and the borehole is dry, then no piezometer will be installed at this location and another alternate borehole outside of the tank locations will be determined for piezometer installation. Previous investigations have indicated that overburden water levels are dependent upon seasonal fluctuation. Shaw shall assume ten temporary piezometers will be installed and their water levels shall be measured periodically over the course of the field effort for this site.

Groundwater samples will be collected using low-flow technology unless this technology is not appropriate for a given piezometer and a variation is approved by OEPA and USACE. It is anticipated that both filtered (for metals) and unfiltered samples will be collected from the ten piezometers, if there is sufficient overburden groundwater. TCL volatile organic compounds (VOCs), TCL semi-volatile organic compounds (SVOCs), nitroaromatics, and TAL metals will be analyzed in every sample. Shaw will coordinate with the primary and QA laboratories as to the volumes of sample necessary to satisfy all internal laboratory QC requirements. All samples will be collected, documented and analyzed in accordance with applicable EPA and USACE requirements, using techniques and equipment described in the approved SSAP or SWSAP.

Each piezometer will be purged with clean, non-contaminating equipment. Periodically during the purge process, a portion of the purge water shall be tested and recorded for pH, turbidity, specific conductance, dissolved oxygen, and temperature. When using low-flow techniques, flow-through measurement cells shall be used to perform parameter measurements. The parameter measurements shall be recorded on a sampling form in addition to other appropriate sampling information. Once the relevant parameters have stabilized (as defined by EM 200-1-3, page C-17) and three consecutive turbidity readings have been less than 100 NTUs, Shaw will measure and record the reduction-oxidation potential of the groundwater and the sample may be collected. If the relevant parameters do not stabilize and the water level cannot be maintained, appropriate Shaw personnel will consult and then propose a path forward to the CELRN.

Water samples from nearly dry piezometers (e.g., <12 inches of water) are not always representative of formation water and may inappropriately influence contaminant evaluations. If such conditions are encountered, appropriate Shaw personnel will consult and then propose a path forward to the CELRN.

The groundwater sampling equipment will either be dedicated or cleaned between each piezometer use to prevent cross-contamination. If the sampling equipment requires flexible delivery tubing, it will be constructed of a PTFE material such as Teflon. If samples are obtained using a bailer, the bailer shall be a bottom emptying device and shall be constructed of Teflon, PVC, or stainless steel. Tipping the bailer to obtain a sample from the top shall not be done.

One groundwater sample shall be collected from each of the ten piezometers and shall be analyzed for TCL (VOCs), TCL SVOCs, nitroaromatics, dissolved TAL metals (filtered), and total TAL metals (unfiltered).

Task 6.0 – Surface Water and Sediment Sampling.

A surface water and sediment sampling effort will be conducted for the LBA. Shaw will collect ten sediment samples and ten collocated surface water samples, if present. Each surface water and sediment sample will be analyzed for TCL VOCs, TCL SVOCs, nitroaromatics, TCL PCBs, and TAL metals. In addition, one sediment sample will be analyzed for total organic carbon. Sediment samples will be collected at a depth of ground surface to 6 inches bgs if sediment is present to this depth. If water is not present in sufficient quantity at any of these locations, professional judgment will be used to identify an appropriate alternative location, if it exists. This change shall be documented on the appropriate sample collection logs. All samples will be collected, documented and analyzed in accordance with applicable EPA and USACE requirements, using techniques and equipment described in the approved SSAP or SWSAP.

Task 7.0 – Monitoring Well Installation.

Shaw will install four overburden/shale monitoring wells and four limestone bedrock monitoring wells at the LBA. The specific location of each well will be determined based on the analytical results of the piezometer samples installed under a previous scope.

Shaw will be responsible for the scheduling and coordination of all underground utility locating and clearance in the vicinity of the borehole site prior to drilling activities.

A qualified geologist or geotechnical engineer will be on site for all drilling, installation, development, and testing operations. Well installation and drilling methods will be in accordance with the procedures and requirements described in EM 1110-1-4000, *Monitor Well Design, Installation, and Documentation at Hazardous and/or Toxic Waste Sites*, and applicable State regulations and requirements. Where necessary, Shaw will use "double casing" as described in Section 3-10 of EM 1110-1-4000 to install a well through a contaminated upper zone. If a plan for meeting applicable procedures and requirements is not covered in the approved SWSAP (*Work Plan for the HTW Investigation, Plum Brook Ordnance Works, Plum Brook Station/NASA,* October 1994), it will be included in the SSAP Addendum. Variation from the 1998 November EM 1110-1-4000 guidelines will be proposed for approval in the SSAP addendum.

Monitoring wells shall be installed and documented in accordance with applicable EPA and USACE requirements, using techniques and equipment described in the approved SSAP or SWSAP.

Shaw will establish coordinates and elevations according to EM 1110-1-4000 for each new well installation. A notch will be filed into the top of the well riser pipe and marked, to serve as a vertical and horizontal measurement point. The coordinates will be to the closest 1 foot and referenced to the State Plane Coordinate System. Elevations will be surveyed to within $\pm$ 0.01 feet referenced to the National Geodetic Vertical Datum of 1929.

Task 8.0 – Monitoring Well Development.

Shaw will develop four overburden/shale wells and four limestone bedrock monitoring wells at the LBA. Each well will be developed in accordance with the procedures and requirements described in EM 1110-1-4000. In addition to the requirements presented in EM 1110-1-4000, development will continue until the parameters of pH, temperature, and conductivity have reached equilibrium as described in EM 200-1-3, page C-10 and maintain three consecutive turbidity readings of less than 100 NTUs. If this criterion cannot be met, appropriate Shaw personnel will consult and then propose a path forward

to the CELRN.

Task 9.0 – Monitoring Well Sampling.

Shaw will collect groundwater samples from each of the eight new monitoring wells in two successive rounds; one in the spring and one in the fall. Each of these samples will be analyzed for TCL VOCs, TCL SVOC, TAL metals (filtered and unfiltered) and nitroaromatics. In addition to the primary water samples, certain field control samples will be prepared as described in succeeding paragraphs. Shaw will coordinate with the primary and QA laboratories as to the volumes of sample necessary to satisfy all internal laboratory QC requirements. Any laboratory performing work for the USACE will comply with ISO/IEC Guide 25, *General Requirements for the Competence of Calibration and Testing Laboratories, 1990 Edition and Updates*. All samples will be collected, documented and analyzed in accordance with applicable EPA and USACE requirements, using techniques and equipment described in the approved SSAP Addendum or SWSAP.

Each sample location will be purged and the samples collected in accordance with the requirements set forth in EM 1110-1-4000 and EM 200-1-3. The water level will be measured and recorded for each well prior to collecting a water sample. If applicable, water level measurements will be measured and recorded from associated nested wells. Following the collection of water level data, a CELRN approved low-flow purge and sample procedure will be used and the well will be purged with clean, non-contaminating equipment. During the purging process, a portion of the purged water will be periodically tested for pH, turbidity, specific conductance, dissolved oxygen, and temperature. Shaw will record these measurements on the well sampling form along with other appropriate sampling information pertaining to the sampling event. Once the relevant parameters have stabilized (as defined by EM 200-1-3, page C-10) and three consecutive turbidity readings indicate less than 100 NTUs, Shaw will measure and record the reduction-oxidation potential of the groundwater and the sample may be collected. If the relevant parameters do not stabilize and the water level cannot be maintained, appropriate Shaw personnel will consult and then propose a path forward to the CELRN.

If the well does not recharge fast enough to permit even low-flow purging, appropriate Shaw personnel will consult and then propose a path forward to the CELRN. Flexible

delivery tubing required for low-flow sampling will be constructed of a PTFE material such as Teflon. The groundwater sampling equipment will be dedicated or thoroughly cleaned between each well use to prevent cross-contamination. Low-flow sampling is the only sampling method that will be used unless the well does not contain enough water volume to allow for low flow sampling, in which case a bailer will be used. If samples are obtained using a bailer, the bailer will be a bottom emptying device constructed of Teflon, PVC, or stainless steel. Tipping the bailer to obtain a sample from the top shall not be permitted.

Task 10.0 – Analytical Requirements.

A total of 28 soil samples, ten sediment samples, ten surface water samples and ten groundwater piezometer samples and 16 groundwater monitoring samples (includes the two sampling rounds) will be collected for laboratory analysis.. Additionally, the following quality assurance/quality control (QA/QC) samples will be collected and analyzed (relative quantities in parentheses):

- Equipment rinsates (5%)
- Source water (1)
- Blind duplicates (10%)
- Trip Blanks (1 per cooler containing VOC samples)
- Split samples (10%)
- Matrix spike/matrix spike duplicate samples (10%).

All details of sampling shall conform to the CELRN approved SWSAP, and to applicable USEPA (SW-846) and USACE requirements (ER 1110-1-263, 1 April 1996). Details include sample volumes, composition and size of containers, methods of preservation, identification and labeling, packing, transportation and shipment.

Shaw will document to verify that the laboratory performing work on this project is compliant with Department of Defense Quality Systems Manual (DOD QSM) Revision 3. The most recently promulgated methods from EPA's SW-846 *Test Methods for Evaluating Solid Wastes (SW-846)* will be used with the exception of SW-846 method 8330 for nitroaromatics. For comparability purposes, multi incremental sampling will not be required.

Shaw will be responsible for collecting, packaging, coordinating and shipping QA samples to the quality assurance laboratory. All shipments will include a temperature blank. The primary samples will have project-specific QC that will be used only for this project. When sample shipments arrive at the laboratory a cooler receipt form will be completed and signed by the sample custodian. Copies of the completed chain of custody and cooler receipt forms will be included in the Site Characterization Report.

Analytical data generated by the laboratory will be extensively reviewed prior to report generation to assure the validity of the reported data. The data from all site samples, with the exception of water quality parameters and IDW samples, will be validated by qualified Shaw personnel who have no responsibility for sample collection or analysis. Validation will follow the logic and review sections included in the US Environmental Protection Agency Contract Laboratory Program - National Functional Guidelines for Organic Data Review, October 1999 (EPA 540/R-94/012) and the US Environmental Protection Agency Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, February 1994 (EPA 540/R-94/-13).

Shaw will report all data reduction procedures including the methods or equations of concentration calculations, reporting units of concentration; moisture related data and the procedures used for calculating PARCC parameters. The data will be reported in a "CLP like" format and will be of sufficient quality for a Chemical Quality Assurance Report to be submitted. Shaw will provide CLP-like data packages consisting of all elements required in CLP definitive level data deliverables. Shaw will also provide an additional electronic data deliverable for the chemical data, consisting of a Staged Electronic Data Deliverable (SEDD) as defined in the USEPA Contract Laboratory Program requirements. Shaw will prepare a table which relates all QA samples to their corresponding field and QC samples sent to the primary laboratory.

Task 11.0 –Investigation Derived Wastes Disposal.

Shaw will collect investigation derived wastes (IDW), including soil cuttings, decontamination fluids, and personal protective equipment (PPE) which can not be decontaminated and place them in properly labeled, sealed drums. IDW will be segregated by type and origin; there will be no intermixing of media. All IDW drums will be stored on pallets in a bermed area to prevent release of the material to the soil in the event of drum

failure. The SSAP will include procedures for IDW management (e.g., drumming, labeling, storage, inspection, and disposal).

Shaw shall submit one composite sample of the soil IDW from the soil and piezometer borings and one from each of the four monitoring well borehole pairs, except for those IDW aliquots to be sampled for VOCs. The IDW samples collected for VOCs shall be grab samples.

After receiving characterization data for the IDW, Shaw will review the data and prepare a letter proposing an appropriate disposal option. Shaw will arrange for disposal of the IDW through a subcontractor.

Task 12.0 – Geographic Information System Deliverable.

Shaw will incorporate information collected during this investigation to the database developed during previous investigations. This database includes information related to the installation of groundwater monitoring wells (both overburden and bedrock wells) by Morrison Knudsen Corporation, Dames & Moore, and IT Corporation. This database also includes analytical (chemical) results obtained from the previous investigation of soil and groundwater collected by Dames & Moore and IT Corporation. The deliverable package, including Metadata, will be formatted as specified in the previously provided Data Standard for Corps of Engineers Environmental Restoration Sites and the Tri Services Spatial Data Standards (TSSDS). The TSSDS are available at *http://fwgcom.wes.army.mil/projects/standards/tssds/*. Shaw will be responsible for correcting any added files with transcription errors.

Shaw will enter information collected during this investigation into a Geographic Information System (GIS) Data Base. Shaw will transfer this GIS data to Huntington District Corps of Engineers (CELRH), coordinating with CELRH (Rick Meadows) as to the appropriate data and supporting documentation formats.

Task 13.0 – Preparation and Submittal of the Site Characterization Report.

After the analytical results for the sediment, surface water, and groundwater monitoring wells have been validated, Shaw will prepare a Site Characterization Report (SCR), (Volume I of the RI Report). Data summaries for each medium will include a data

summary of all sample identification, sample locations, sample dates, detected chemical concentrations, method detection limits, qualifiers, maximum detected concentration column, background screening value (if applicable) and risk-based screening values. At this phase, screening values are not considered judicial or regulatory limits, but are included to provide perspective to the data. The screening levels will be the same levels used in a data screening portion of a human health risk assessment; unless subsequently updated prior to the risk assessment. Shaw will present the investigation results in a report, which includes a narrative detailing the nature of the work performed during the investigation, problems encountered, and conclusions and recommendations. Shaw will identify in the report when Method Detection Limits (MDLs) for individual analytes and sample location exceeded the appropriate screening value.

Shaw will prepare figures listing sampling locations (including depths) for each sample collected. Additionally, Shaw will prepare figures for sampling results that indicate which values exceed screening level criteria as well as "*for reference purposes only*", and a table listing PBOW background concentrations of inorganic analytes.

The SCR will be submitted as Volume I of the RI Report. Shaw will submit draft and final versions of the SCR. A draft version will be submitted to all reviewing parties, including RAB, USACE, OEPA, CEHNC-CX, and CHPPM. Shaw will revise the report as per agency comments. Shaw will respond to all comments and will submit official response to comments in the final report.

Task 14.0 – Human Health Risk Assessment.

Shaw shall conduct a baseline human health risk assessment (BHHRA) Work Plan and Report that are consistent with current USEPA, USACE, and OEPA guidance, and are also consistent with the standard practice used in the other BHHRA work plans and reports prepared for other PBOW sites. Shaw will use work plans and reports from these other sites (e.g., TNT Areas A and C and Acid Areas 2 and 3) as templates. Additionally, Shaw recognizes the emphasis of CELRN and the project team regarding consistency in risk assessment.

The BHHRA work plan will summarize information regarding the PBOW site background, history, and characteristics. The work plan will provide a detailed approach

in completing a BHHRA that satisfies regulatory and USACE requirements and covers the risk scenarios for current and potential future receptors. The work plan will include detailed methodology and algorithms for human health risk assessment including, but not limited to, data evaluation, selection of chemicals of potential concern, exposure assessment, toxicity assessment, risk characterization, uncertainty analysis, preliminary risk-based remediation goals derivation, and findings reporting. The work plan will be comprehensive enough for the LBA site media.

The BHHRA will evaluate the risks associated with exposure to contaminants in soil, sediment, surface water, and groundwater for LBA. It will include a site conceptual exposure model, selection of chemicals of potential concern (COPC), exposure assessment, toxicity assessment, risk characterization, uncertainty analysis, risk-based remediation goals, and recommendations/conclusions. The BHHRA Report will be submitted as Volume II of the RI Report.

Shaw will submit draft and final versions of the BHHRA work plan and report. The draft version of each plan and report will be submitted to all reviewing parties, including the RAB, USACE, OEPA, CEHNC-CX, and CHPPM. Shaw will respond to all comments and will submit official response to comments to CELRN. Shaw will revise the draft work plan and report per agency comments. Once the comments are resolved to the satisfaction of the CELRN, Shaw shall incorporate the response to the comments in the final report

Task 15.0 –Screening Level Ecological Risk Assessment.

Shaw will prepare a Screening Level Ecological Risk Assessment (SLERA) Work Plan and Report that are consistent with current USEPA, USACE, and OEPA guidance, and are also consistent with the standard practice used in the other SLERA work plans and reports prepared for other PBOW sites. Shaw will use work plans and reports from these other sites (e.g., TNT Areas A and C and Acid Areas 2 and 3) as templates. Additionally, Shaw recognizes the emphasis of CELRN and the project team regarding consistency in risk assessment.

The SLERA work plan will summarize information regarding the PBOW site background, history, and characteristics. The work plan will provide a detailed approach

in completing a SLERA that satisfies regulatory and USACE requirements and covers the exposure pathways for ecological receptors. The work plan will include detailed methodology and algorithms for subtasks of the SLERA and will be comprehensive enough for the LBA media.

The SLERA will evaluate the risks associated with exposure to contaminants in soil, sediment, and surface water (including surface expressions of groundwater if present) for the LBA. The SLERA will include an ecological problem formulation, exposure assessment, effects evaluation and development of toxicity reference values, risk characterization, uncertainty analysis, and summary/conclusions/recommendations will be provided. The SLERA Report will be submitted as Volume III of the RI Report.

Shaw will conduct two site reconnaissance walkovers by expert ecologists/wildlife biologists to develop a subtask problem formulation. The individuals conducting this subtask will have strong skills in the identification of flora and fauna of northern Ohio. These walkovers will be used to compile a vegetation community map for the LBA and also biota species checklists for that site. One walkover will be performed in late spring (May/June) and the other in early fall (September/October). The checklists and community map will be appended to the SLERA Report.

Shaw will submit draft and final versions of the SLERA work plan and report. The draft version of each will be submitted to all reviewing parties, including RAB, USACE, OEPA, CEHNC-CX, and CHPPM. Shaw will respond to all comments and will submit official response to comments to CELRN. Shaw will revise the draft work plan and report per agency comments. Once the comments are resolved to the satisfaction of the CELRN, Shaw shall incorporate the responses to the comments in the final report.

Task 16 0 – Project Management.

Shaw shall provide project management services to include DO management, quality management, prime contract administration, project cost control, subcontract administration and DO closeout.

Shaw shall provide DO management to include scheduling, planning, cost control and tracking, deliverable coordination, ensuring compliance with applicable standard operation procedures, review and processing of purchasing documents, review and submitting of

invoices, and preparation and submitting of telephone conversation documentation.

Shaw shall provide quality program management that will include conducting audits, client surveys, as well as monitor corrective action to ensure compliance with USACE and Shaw quality programs.

Prime contract administration and subcontract administration management shall include contractual interface with the USACE Contracting Officer to ensure compliance with all terms and conditions required for project execution. Shaw shall manage subcontract administration to include all activities associated with purchasing materials, equipment and supplies and soliciting, awarding, maintaining and closeout of all subcontracts.

Shaw shall provide project controls that include project cost tracking/reporting, scheduling and support for the project manager.

PROJECT SCHEDULE AND MILESTONES

The project schedule and milestones are presented in Figure 1.

KEY SHAW PROJECT PERSONNEL

- **Project Manager** - Mr. Steven T. Downey will serve as Shaw's Project Manager.
- **Technical Lead** - Mr. Michael Gunderson will serve as the Technical Lead.
- **QA Manager** - Mr. Kenneth Martinez will serve as the project QA Manager.
- **Project Chemist** -Mr. Eddie Weaver will serve as the Project Chemist.

QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) REVIEW

This section of the QCP summarizes the Shaw internal technical and external peer review. The Shaw QA program provides controls for the formal verification (checking) of documents such as calculations and the presentation of information in the form of drawings, logs, and tables. Review of necessary approvals are also cited for quality-related documents; however, during the course of a project or proposal, verification of technical decisions and concepts (such as interpretation of data and evaluation of results) is required in order that the project or proposal can proceed on a sound conceptual basis. The review concept, or approach, may be needed for the following:

- During the project planning stage, have appropriate steps been implemented to satisfy the goals and objectives of the project?

- Are data of sufficient quality and properly interpreted so that conclusions can be justified and demonstrated?

- Are design parameters reasonable for the computations performed? What is the effect of variations of the assumptions upon the results?

- Do the results presented by Shaw in the form of a report, or other document, adequately represent the work performed and the conclusions reached? Do the results fulfill the objectives of the project?

The internal technical review process is used to verify these steps. Documents to be written during a project and indicated in the proposal will be subjected to peer review. The Shaw PM will complete a matrix of these documents on a delivery order basis and use it to obtain the required reviews.

A technical reviewer is selected based upon the following criteria:

- The reviewer must be independent of the project. The reviewer must be sufficiently informed regarding the project, but should not be making decisions that determine or affect the course of the project. The peer review process is an "outside" review of the project.

- The reviewer must be a person knowledgeable in the specific area of work, preferably a senior technical associate. Technical reviewers will be part of the Shaw organization.

At the conclusion of a technical peer review, the reviewer(s) will prepare written review comments, sign off on the Discipline Sign-Off Review form (Figure 2) and forward it to the PM; a copy of these review documents will also be placed in the project files. Technical review comments will be responded to in writing by the preparer of the document, incorporated into the document as appropriate, and submitted with the document to the USACE.

External peer review will be performed on all draft project deliverables prior to issuance as final documents. It is anticipated that the external peer review will be performed, as a minimum, by the USACE and the OEPA. A formal response to peer review comments will be issued to all reviewing parties, documenting revisions made where appropriate to the draft deliverables; this does NOT apply to the Report of Finding prepared under this delivery order. All responses to the peer review comments will be coordinated with the USACE for their concurrence prior to

incorporation. Final deliverables will be submitted after incorporating any pertinent comments that arise from peer review of the draft documents. Table 1 summarizes the preparation and review process for the required project deliverables.

FIELD ACTIVITY QC REQUIREMENTS

Field investigation activities will follow the procedures specified in the SSAP to ensure that project quality requirements are satisfied. Field activity QC will be implemented by performing project-specific training; properly preparing for field work before mobilization; issuing variances, nonconformance reports, and corrective action reports; and documenting field quality control in the investigation reports.

Field team members, including Shaw personnel and subcontractor personnel, will receive project-specific training before mobilization to the job site by reading the applicable work plans and procedures. Upon mobilization to the site, but prior to commencing field activities, all site personnel will attend the project kickoff meeting, which will consist of a review of all project requirements and objectives to ensure that the project team is fully aware of the goals of the PBOW investigations. Before initiating each days field work, all team members will participate in a tailgate safety meeting (TSM) conducted by the Shaw Field Coordinator to address safety and quality issues pertinent to the activities to be performed. The TSM will be documented and all personnel will sign the attendance record. Worker training will follow the requirements specified in Shaw SOPs.

Prior to mobilization to the site, the Shaw PM, assisted by the Shaw Field Coordinator and the Shaw Analytical Coordinator, will examine project field work preparation requirements to ensure that all necessary arrangements, including personnel assignments, work plans, site entry/drilling permits, training, schedule, equipment rentals, supplies, subcontractors, have been accomplished for execution of the field effort in an efficient and effective manner. The Shaw PM and QAO must approve the project preparation prior to mobilization.

Changes or variances to the SAP, SSHP, QAPP, and/or site-specific work plans may be initiated either in the office or in the field as may be necessary. All variances will be noted on the Field Activity Daily Log (FADL) and will be formally recorded on the Field Work Variance Form and tracked on a Field Work Variance Log. Variances will be approved by the Shaw QAO and the Shaw PM prior to implementation of the change. Variances that will affect the project scope, cost, or schedule will be submitted to the USACE for approval prior to implementation.

Nonconforming equipment, items, activities, conditions, and unusual incidents that could affect compliance with project requirements will be identified, controlled, and reported in a timely manner. A nonconformance is defined as a malfunction, failure, deficiency, or deviation that renders the quality of any item unacceptable or indeterminate. The originator (any Shaw employee) of a nonconformance report will describe the finding on the Nonconformance Report provided for this purpose and will notify the Shaw PM and QAO. Each nonconformance will be reviewed and a disposition will be issued for the item, activity, or condition. The disposition of a nonconformance will be documented and approved by the Shaw organization responsible for issuing the nonconformance. The QAO will concur with the disposition of the nonconformance prior to closure of the Nonconformance Report.

In addition, the Shaw PM will notify the USACE Technical Coordinator within 48 hours of significant nonconformances that could impact the project schedule or scope of work and will indicate the corrective action taken or planned.

SUBCONTRACTOR QA/QC REVIEW

Shaw has assigned personnel to monitor and review work performed by subcontractors in conjunction with this investigation. Mr. Steven T. Downey will serve as the principal point-of-contact (POC).

The selection of qualified subcontractors, as required, will be accomplished in accordance with Shaw procurement and quality assurance (QA) procedures. Subcontractors such as drillers, geophysical specialists, surveyors, and environmental monitoring specialists, must satisfy predefined qualifications developed by the PM and Shaw that are defined in the procurement bid packages. Each subcontractor bid submittal is reviewed by technical personnel, purchasing, and QA personnel to verify that the bidders are technically qualified and can satisfy the project objectives. Before starting work, Shaw will perform a quality check to ensure that the subcontractor(s) has fulfilled the procurement requirements necessary to begin activities. Subcontractors involved in environmental measurements will be monitored by the Shaw Field Coordinator to verify the use of calibrated equipment and qualified operators.

CUSTOMER INVOLVEMENT

Customer involvement will be ongoing throughout the duration of this investigation, and Shaw personnel will be available as needed for question, consultation, etc. Project personnel may be reached at the following telephone numbers:

Mr. Steven T. Downey Project Manager	(865) 694-7496	Fax (225) 987-3034
Mr. Michael Gunderson Technical Lead	(865) 694-7446	Fax (865) 690-3626
Mr. Kenneth Martinez Quality Assurance Manager	(865) 670-2656	Fax (865) 690-3626
Mr. Eddie Weaver Project Chemist	(865) 560-5274	Fax (865) 693-4944

Each work plan or other deliverable to be prepared in more than draft form will be submitted to the USACE Nashville District as specified in the SOW for review and comment. All review comments will be addressed and incorporated into the final submittals, if appropriate.

DOCUMENTATION OF PROJECT DECISIONS AND RECORDS MANAGEMENT

The Shaw Project Records Clerk is responsible for maintaining control and retention for project-related records. Record control includes receipt from external and internal sources, transmittal, transfer to storage, and indication of record status. Retention includes receipt at storage areas, indexing and filing, storage and maintenance, and retrieval. Shaw will maintain the project repositories at 312 Directors Drive in Knoxville, Tennessee, for all project records, including correspondence. Records will be controlled and retained, as appropriate, in the office central files or laboratory files. The Project Records Clerk will assign control numbers to all outgoing documents and is responsible for properly filing the controlled records (except for those related to accounting, purchasing, and drafting, which are retained in the respective department files). Shaw will also provide the USACE Nashville District with a copy of all telephone memos, written correspondence, and meeting minutes regarding information related to the project within ten (10) days of the event. Copies of all records will be retained by Shaw for a minimum of seven (7) years after the end of the contract period. In addition, project records deemed to be of importance by the USACE will be turned over to the USACE at the time of project close-out.

PROJECT CLOSE-OUT

At the completion of this investigation, a project close-out meeting will be conducted. This will be at a time and place to be determined by Nashville District personnel, and may take the form of a teleconference. The purpose of this meeting will be to exchange feedback, discuss lessons learned, and conduct a final product verification.

Shaw
Shaw Environmental & Infrastructure, Inc.

Table 1

Preparation and Review Process for Required Project Deliverables
Remedial Investigation of Locomotive Building Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

Submittal Description/ Title	Document Preparation and Review Process					
	Principal Author(s)	Discipline	Peer Review	Discipline	Project Review	Discipline
SSAP/SCR	David Kessler Eddie Weaver	Geologist Chemist	Tom Siard Zach Parham	Risk Assessor Scientist	Steven Downey Michael Gunderson Ken Martinez	Engineer Geologist QA Manager
SSHP	Doug Russell	H&S Officer	Melissa Smith	Indus. Hygienist	Steven Downey Michael Gunderson Ken Martinez	Engineer Geologist QA Manager
BHHRA/SLERA	Tom Siard Mark Weisberg	Risk Assessor Scientist	Tom Mattis Ami Billman	Risk Assessor Engineer	Steven Downey Michael Gunderson Ken Martinez	Engineer Geologist QA Manager

NOTE: Where multiple authors are identified, one or more of those identified may be involved in the document preparation depending on availability. Should replacements be necessary, personnel of comparable experience and qualifications will be utilized.

Shaw® Shaw Environmental, Inc.

DISCIPLINE SIGN-OFF REVIEW

Client Name: U.S. Army Engineer District, Nashville; CELRN-EC-R-M

Project Description: Remedial Investigation of the Locomotive Building Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

Contract No. W 9 1 2 Q R - 0 8 - D - 0 0 1 3

Delivery Order No. D X 0 6

Project No. 1 3 3 7 6 7

Task/Phase Number:

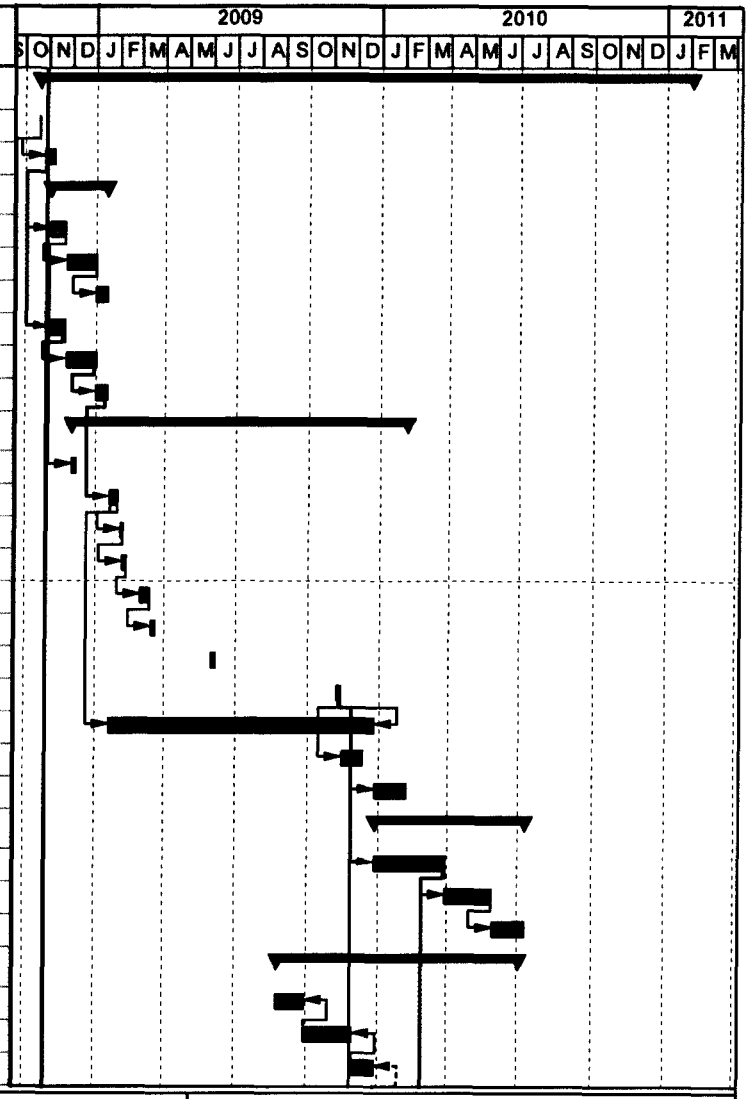
Document Type	Identify specific section or segment covered by this checkprint	Document Origin
☐ Technical / Cost Proposal	_____	☐ Originator Developed
☐ RFP	_____	☐ Edited Standard
☐ Contract / Subcontract	_____	☐ Client Furnished
☐ SHP, SSAP, CDAP, or QAPP	_____	
☐ Report	_____	**Document Status**
☐ Risk Assessment / Evaluation	_____	☐ Preliminary
☐ Specifications & Plans	_____	☐ Internal Draft
☐ Design Calculations	_____	☐ Draft
☐ Tables	_____	☐ Draft Final
☐ Drawings / Figures		☐ Final
☐ Other:		☐ Other:

	Required Person	Signature	Date
Originator			
Checker			
Peer Review (QC)			
Technical Review			
Technical Review			
Quality Assurance Mgr			
Project Manager			

NOTICE: By signature above, parties certify that the subject document has been prepared by and/or reviewed by them (as appropriate), that all review comments have been resolved, and that the document is ready for submittal.

FIGURE 2

Activity ID	Activity Name	Remaining Duration	Start	Finish
Remedial Investigation @ Locomotive Bldg Ar...		828	21-Oct-08 A	04-Feb-11
A1000	Task Order Award	0	21-Oct-08 A	21-Oct-08 A
A1010	Prepare & Submit QCP	7	27-Oct-08 A	07-Nov-08
Work Plans		75	03-Nov-08	16-Jan-09
A1020	Prepare & Submit Draft SSHP Addendum	15	03-Nov-08	21-Nov-08
A1030	Review SSHP Addendum	28	24-Nov-08	31-Dec-08
A1040	Prepare & Submit Final SSHP Addendum	11	02-Jan-09	16-Jan-09
A1050	Prepare & Submit Draft SSAP Addendum	15	03-Nov-08	21-Nov-08
A1060	Review SSAP Addendum	28	24-Nov-08	31-Dec-08
A1070	Prepare & Submit Final SSAP Addendum	11	02-Jan-09	16-Jan-09
Field Work		431	01-Dec-08	05-Feb-10
A1075	Geophysical Investigation	4	01-Dec-08	05-Dec-08
A1080	Soil Remedial Investigation	10	19-Jan-09*	30-Jan-09
A1090	Groundwater Piezometer Sampling	4	02-Feb-09	05-Feb-09
A1100	Surface Water & Sediment Sampling	2	06-Feb-09	09-Feb-09
A1110	Install Monitoring Wells	10	02-Mar-09	13-Mar-09
A1120	Develop Monitoring Wells	5	16-Mar-09	20-Mar-09
A1130	Sample Wells - Round 1	5	01-Jun-09*	05-Jun-09
A1140	Sample Wells - Round 2	5	09-Nov-09*	13-Nov-09
A1150	Analytical	245	19-Jan-09	25-Dec-09
A1160	IDW	20	16-Nov-09	11-Dec-09
A1170	GIS	30	28-Dec-09	05-Feb-10
Site Characterication Report		194	28-Dec-09	09-Jul-10
A1180	Prepare & Submit Draft Site Characterication Report	66	28-Dec-09	29-Mar-10
A1190	Review Draft Site Characterization Report	44	30-Mar-10	28-May-10
A1200	Prepare & Submit Final Site Characterization Report	30	31-May-10	09-Jul-10
Baseline Human Health Risk Assessment		312	25-Aug-09	02-Jul-10
A1210	Prepare & Submit Draft HHRA Work Plan	25	25-Aug-09	29-Sep-09
A1220	Review Draft HHRA Work Plan	44	29-Sep-09	30-Nov-09
A1230	Prepare & Submit Final HHRA Work Plan	20	30-Nov-09	28-Dec-09



Remaining Level of Effort
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work
Milestone
Start Miles...
Summary

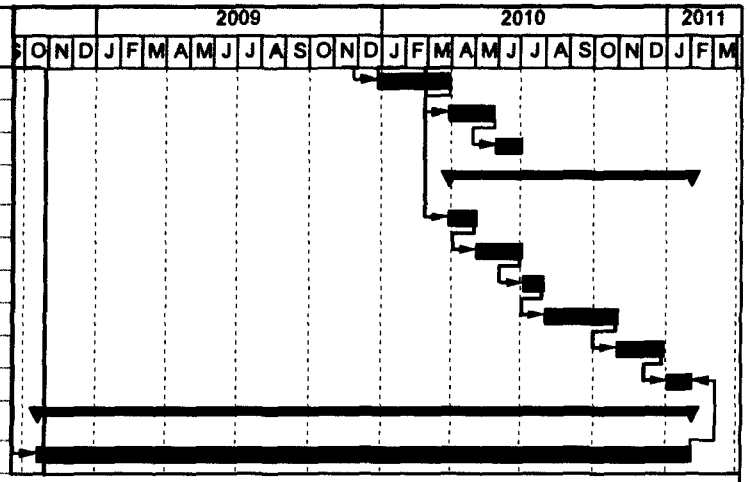
Figure 1

Louisville A/E Contract #W912QR-08-D-0013

DX06 - Remedial Investigation @ Locomotive Bldg. Area @ PBOW

Shaw Environmental & Infrastructure Project Schedule

Activity ID	Activity Name	Remaining Duration	Start	Finish
A1240	Prepare & Submit Draft HHRA Report	66	28-Dec-09	29-Mar-10
A1250	Review Draft HHRA Report	44	30-Mar-10	28-May-10
A1260	Prepare & Submit Final HHRA Report	25	31-May-10	02-Jul-10
Ecological Risk Assessment		**312**	**30-Mar-10**	**04-Feb-11**
A1270	Prepare & Submit Draft Screening Level ERA Work Plan	25	30-Mar-10	03-May-10
A1280	Review Draft Screening Level ERA Work Plan	44	04-May-10	02-Jul-10
A1290	Prepare & Submit Final Screening Level ERA Work Plan	20	05-Jul-10	30-Jul-10
A1300	Prepare & Submit Draft Screening Level ERA Report	66	02-Aug-10	01-Nov-10
A1310	Review Draft Screening Level ERA Report	44	02-Nov-10	31-Dec-10
A1320	Prepare & Submit Final Screening Level ERA Report	25	03-Jan-11	04-Feb-11
Meetings		**828**	**21-Oct-08 A**	**04-Feb-11**
A1330	Project Management	592	21-Oct-08 A	04-Feb-11



Remaining Level of Effort
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work
Milestone
Start Miles...
Summary

Figure 1

Louisville A/E Contract #W912QR-08-D-0013

DX06 - Remedial Investigation @ Locomotive Bldg. Area @ PBOW

Shaw Environmental & Infrastructure Project Schedule