Final Quality Control Plan

Remedial Investigation of the Waste Water Sewer Lines, Human Health Risk Assessment, and Ecological Risk Assessment, and Red Water Pond Areas Proposed Plan and Decision Document

Former Plum Brook Ordnance Works, Sandusky, Ohio

Prepared By:

Shaw E&I
312 Directors Drive
Knoxville, Tennessee 37923

Submitted to:

U.S. Army Corps of Engineers, Nashville District
Post Office Box 1070
Nashville, Tennessee 37202-1070

Revision 0

Delivery Order DX03
IDT Contract W912QR-08-D-0013
Shaw Project Number 132458

September 16, 2008

SIGNATURE PAGE

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and Red Water Pond Areas Proposed Plan and Decision Document,
Former Plum Brook Ordnance Works (PBOW), Sandusky, Ohio

Delivery Order DX03
IDT Contract W912QR-08-D-0013
Shaw Project Number 132458

Submitted By:

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

9-16-08
Date

Accepted By:

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

16 Sep 2008
Date

Doug Mullendore
Chief, Environmental Restoration Branch
U.S. Army Engineer District, Nashville

16 Sept 2008
Date

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PROJECT OBJECTIVE AND TASKS

This Final Quality Control Plan (QCP) has been prepared by Shaw Environmental & Infrastructure, Inc. (Shaw) in support of the Remedial Investigation of the Waste Water Sewer Lines (WW Sewer Lines), Human Health Risk Assessment, and Ecological Risk Assessment, and Red Water Pond Areas Proposed Plan and Decision Document at the former Plum Brook Ordnance Works (PBOW) in Sandusky, Ohio, under Delivery Order (DO) DX03 of IDT Contract W912QR-08-D-0013.

To date, no investigation has been conducted along the WW Sewer Lines. However, according to the TNT Areas Site Investigation Draft Report (Dames & Moore, 1996) several thousand feet of wood-stave sewer line extending from the TNT Area A pump house toward WWTP1 has been left intact. The objective of this RI is to delineate the traces of these sewer lines and to investigate potential nitroaromatics contamination which may have affected soil and groundwater along these traces. Analytical data associated with this investigation will also be used to perform a baseline human health risk assessment (BHHRA) and a screening level ecological risk assessment (SLERA) for the WW Sewer Lines. This project also includes preparation of a Proposed Plan (PP) and Decision Document (DD) for the Red Water Ponds Area.

In addition to the tasks to be completed for this project, Shaw will include preparation of a Site-Specific Safety and Health Plan (SSHP) Addendum and a Site-Specific Sampling and Analysis Plan (SSAP) Addendum as well as include meetings associated with these tasks, as per the Scope of Work (SOW).

Specific tasks to accomplish under this project include:

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

Shaw will prepare and submit a Quality Control Plan (QCP) for the work to be conducted

at PBOW. The QCP will be prepared in accordance with requirements of ER 1110-1-12, Quality Management, and CEORD 1110-1-9, Quality Control. As part of the QCP development, Shaw will develop a criteria management process to ensure design criteria and standard design details appropriate for the U.S. Army Corps of Engineers (USACE) requirements are developed, updated, and made available to the designers and reviewers involved in this project. The QCP shall clearly define the quality verification activities for specific professional disciplines. This design verification process will be implemented to ensure that the designer produces an acceptable design.

An independent review of the designer's work shall be performed to verify that an acceptable design has been provided for this work but is not intended to be a detailed check of the designer's work.

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 design or 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.

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

Shaw will develop and submit a Site-Specific Safety and Health Plan (SSHP) addendum specific to the investigation of the WW Sewer Lines. The SSHP addendum required by 29 CFR 1910.120(b)(4) shall be prepared and submitted to CELRN-EC-R. 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 to the extent that new conditions or procedures affect the need to supplement the updated *Site-Wide Safety and Health Plan.*

Shaw will also develop a Site-Specific Sampling and Analysis Plan (SSAP) addendum specific to the investigation of the WW Sewer Lines. The Site-Wide Sampling and Analysis Plan (SWSAP, prepared under Contract No W912DR-05-D-0026, DX10) will be used as the base document. The SSAP will be prepared as an addendum to the SWSAP and it will present details concerning the investigative 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 WW Sewer Line. In addition, it will identify sampling locations for this area, rationale underlying the choice of locations and any expected variations from the SWSAP.

Task 3.0 – Soil Remedial Investigations.

Shaw will conduct the soil investigation as a phased approach that will include a geophysical survey, test pit excavation, and the sampling of soil borings. Shaw will complete a geophysical survey using both electromagnetic technology (EM) (e.g., EM31) and ground penetrating radar (GPR) to accurately locate the WW Sewer Lines and their traces. Shaw will provide the USACE with the results of the geophysical survey along with a figure showing the traces of the WW Sewer Lines.

Based on the findings of the geophysical survey, approximately 30 test pits will be excavated along the two WW Sewer Lines. Soil samples will be collected within each test pit at a location immediately below each sewer line, or interpreted to be below the former sewer line in areas where it has been removed. These 30 samples will be analyzed for nitroaromatics only. Based on the analytical results of the initial 30 samples, Shaw will advance a total of 10 soil borings, with 5 planned for each sewer line using direct-push technology (DPT). The locations of these borings will generally be biased toward the areas found to have the highest concentrations of nitroaromatics based on the initial test pit soil analytical results. Two samples will be collected from each boring: one from immediately below the sewer line and one from the surface (0-1 foot below surface). These 20 soil boring samples will be analyzed for nitroaromatics, SVOC, TAL metals, and PCBs. Additionally, one surface soil sample will be analyzed for total organic carbon.

Raw explosive materials are not expected to be encountered during soil sampling activities. Should sampling personnel encounter raw explosives, all sampling activities will cease and Shaw will contact CELRN to discuss procedures for disposal of the raw

explosive material. Shaw will obtain all necessary utility clearances and permits from NASA.

All boring locations will be sketched and 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.

Task 4.0 – Groundwater Remedial Investigations.

Shaw will conduct the groundwater remedial investigation as a phased approach. In the first phase of the groundwater investigation, Shaw plans to install a total of 10 piezometers along the WW Sewer Lines. Each of these will be continuously logged to bedrock (i.e., competent shale) during installation. 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 as it is unlikely to produce measurable water. In this case a suitable alternate location for piezometer installation will be sought along the WW Sewer Line. 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, Shaw will propose to CELRN how they intend to proceed.

Before any of the piezometers are sampled, the water levels will be measured and recorded for all of the piezometers involved in this investigation. The piezometer will be purged with clean, non-contaminating equipment and a portion of the purge water will be tested periodically during the process and recorded for pH, turbidity, specific conductance, dissolved oxygen, and temperature using flow-through measurement cells. Once the relevant parameters have stabilized (as defined by EM 200-1-3, page C-17) and three consecutive turbidity readings indicate less than 100 nepholometric turbidity units (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, Shaw will propose to CELRN how they intend to proceed to ensure that sampling is of quality to fulfill one or more of the project objectives.

Piezometer groundwater samples will be collected by means of low-flow technology using a peristaltic pump and PTFE tubing (e.g. Teflon®). If this technology is not

appropriate for sample collection, the USACE will be consulted before any variation to this technology is implemented. These 10 piezometer groundwater samples will be analyzed for nitroaromatics only.

In a second phase of the groundwater investigation, Shaw will install three-overburden/shale and three limestone bedrock monitoring wells along the WW Sewer Lines. The specific location of each well will be determined based on the analytical results of the piezometer samples.

Shaw will ensure that 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. The plan for meeting applicable procedures and requirements will be included in the SAP Addendum if not covered in the approved SWSAP. Variation from the 1998 November EM 1110-1-4000 guidelines will be proposed for approval in the SAP Addendum. Shaw will schedule and coordinate the locating of all underground utilities in the vicinity of the borehole site prior to drilling activities.

Shaw will establish coordinates and elevations according to EM 1110-1-4000 for each new well. 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.

Shaw will develop each of the three-overburden/shale and three limestone bedrock monitoring wells. Each well will be developed in accordance with the procedures and requirements described in EM 1110-1-4000. In addition to the requirements of 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 three consecutive turbidity readings indicate less than 100 NTUs. If this criterion can not be met, Shaw will propose to CELRN how they intend to proceed.

Groundwater samples will be collected using low-flow technology as described above for piezometer sampling. The groundwater sampling equipment will either be dedicated or thoroughly cleaned between each piezometer/well use, to prevent cross-contamination. If the sampling equipment requires flexible delivery tubing, it will be constructed of a PTFE material such as Teflon. 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 and analyzed in conformance with applicable EPA and USACE requirements, using techniques and equipment described in the approved SSAP or SWSAP.

Task 5.0 – Analytical Requirements.

Shaw will collect a total of 50 soil samples, 10 groundwater piezometer samples and 12 groundwater samples from monitoring wells (two sampling rounds) for laboratory analysis as described in Sections 3 and 4, respectively. In addition, the following quality assurance/quality control (QA/QC) samples will be collected and analyzed (relative quantities in parentheses):

- Equipment rinsates (≤5%)
- Source water (1)
- Trip Blanks (≤5%; VOCs only)
- Blind duplicates (≤10%)
- 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 filled out and signed by the sample custodian. Copies of the completed chain of custody and cooler receipt forms will be included in the RI 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, total organic carbon, 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 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 6.0 –Investigation Derived Waste 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 bermed pallets 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).

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. All IDW generated during groundwater sampling efforts will be disposed of off-site within the mandated 90-day time frame.

Task 7.0 – Preparation and Submittal of Site Characterization Report

After the analytical results for the soil, groundwater piezometer, and groundwater monitoring well samples have been validated, Shaw will prepare a Site Characterization Report (Volume I of the RI). Data summaries for each medium will include a data summary of all sample identifications, sample locations, sample dates, detected chemical concentrations, method detection limits (MDLs), 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 as those that will be 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 will include a brief narrative that details the nature of work performed during the investigation, problems encountered, and conclusions and recommendations. Shaw will also identify in the report when MDLs for individual analytes and sample locations were higher than the appropriate screening value.

Shaw will prepare figures that show sampling locations (including depths) for each sample collected. Additionally, Shaw will prepare figures for sampling results showing those values that exceed screening criteria and *for reference purposes only*, a table showing PBOW background concentrations of inorganic analytes.

The Site Characterization Report will be submitted as Volume I of the RI. Shaw will submit draft and final versions of the Site Characterization Report. A draft version will be submitted to all reviewing parties, including OEPA, CEHNC-CX, and CHPPM. Shaw will prepare and issue responses to any review comments. Shaw will respond to all comments by the USACE and OEPA and will submit official response to comments to CELRN.

Task 8.0 – Preparation and Submittal of Baseline Human Health Risk Assessment.

Shaw will prepare a Baseline Human Health Risk Assessment (BHHRA) Work Plan and

Report for the WW Sewer Lines consistent with current USEPA, USACE, and OEPA guidance, and also consistent with the standard practice used in the other BHHRA work plans and report 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 WW Sewer Line media.

The BHHRA will evaluate the risks associated with exposure to contaminants along the WW Sewer Line. 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 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.

Task 9.0 – Preparation and Submittal of Screening Level ecological Risk Assessment

Shaw will prepare a Screening Level Ecological Risk Assessment (SLERA) Work Plan and Report consistent with current USEPA, USACE, and OEPA guidance and 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 WW Sewer Line 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 WW Sewer Line area. The SLERA will include an ecological problem formulation, exposure assessment, effects evaluation and development of toxicity reference values, risk characterization, uncertainty analysis, and provide summary/conclusions/recommendations. 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 WW Sewer Line area and also a species checklist. 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 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.

Task 10.0 – Miscellaneous Task Team Support.

Shaw will participate in and provide support for task groups formed by the PBOW project team. Services involved in task group support may include but not limited to the following:

- Participation in meetings and teleconferences
- Joint scoping sessions
- Scheduling future site activities
- Task group memoranda
- Miscellaneous CADD support
- And document reviews

Task 11.0 – 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 12.0 – Project Management.

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

Shaw shall provide Delivery Order 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.

Task 13: Preparation and Submittal of the Red Water Pond areas Proposed Plan for Soils.

Shaw will prepare a Proposed Plan for Red Water Pond Areas Soils based on the Focused Feasibility Study (2002). The Draft Proposed Plan shall consider the interim soil remedial action (2007) performed at the Pentolite Road Red Water Pond Area. This plan shall be prepared in accordance with all applicable federal, state and local guidance and policy.

The Draft Proposed Plan shall be prepared and submitted in two versions: An internal draft and a subsequent external draft. The internal draft will be distributed for USACE review only and will be reviewed by CELRN, CELRH, and CEHNC-CX. Shaw will respond to USACE comments on the internal draft and submit responses to these comments. Once all comments on the internal draft Proposed Plan are addressed to the satisfaction of CELRN, Shaw will incorporate the responses to comments into the revised Draft Proposed Plan which will be sent to the entire distribution list, including the OEPA and the USACE, for review.

Prior to finalizing the Proposed Plan, Shaw will respond to all comments on the Draft Proposed Plan. Once all comments are resolved to the satisfaction of the CELRN, Shaw shall incorporate all responses into the Final Proposed Plan, which will be submitted to the entire distribution list.

Task 14: Preparation and Submittal of the Red Water Pond Areas Decision Document for Soils

Shaw will prepare a Draft Decision Document for Red Water Pond Areas soil. This Decision Document will be prepared in accordance with all applicable federal, state and local guidance and policy. This Decision Document will address and incorporate as appropriate all comments generated by the Proposed Plan, including those submitted during the public comment period and those specifically voiced during the public meeting.

The Draft Decision Document shall be submitted in two versions: An internal draft and a subsequent external draft. The internal draft will be distributed for USACE review only and will be reviewed by CELRN, CELRH, and CEHNC-CX. Shaw will respond to USACE comments on the internal draft and submit responses to these comments. Once all comments on the internal Draft Decision Document are addressed to the satisfaction of CELRN, Shaw will incorporate the responses to comments into a revised Draft Decision Document which will be sent to the entire distribution list, including the OEPA and the USACE, for review.

Prior to finalizing the Draft Decision Document, Shaw shall respond to all comments on the Draft Decision Document. Once all comments are resolved to the satisfaction of CELRN, Shaw shall incorporate all responses into the Final Decision Document which will be submitted to the entire distribution list.

Task 15: Meetings

Shaw shall attend three meetings that are tentatively scheduled to be held in Sandusky, Ohio. Each meeting will be one day in duration and shall have two representatives in attendance.

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 and 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 QA REQUIREMENTS

Field investigation activities will follow the procedures specified in the SSAP to ensure that project quality requirements are satisfied. Field activity QA 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, SHP, 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 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.

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Table 1

Preparation and Review Process for Required Project Deliverables
Remedial Investigation
Waste Water Sewer Lines Human Health Risk Assessment and Ecological Risk Assessment, and Red Water Pond Areas
Proposed Plan and Decision Document
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	Zach Parham Eddie Weaver	Geologist Scientist Chemist	Tom Siard David Kessler	Risk Assessor Geologist	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
Red Water Ponds Proposed Plans and Decision	Tom Siard Mark Weisberg	Risk Assessor Scientist	Mike Gunderson Bill Anderson David Kessler	Geologist Engineer Geologist	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.

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haw Environmental & Infrastructure, Inc.

DISCIPLINE SIGN-OFF REVIEW

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

Project Description: Remedial Investigation of the Waste Water Treatment Plant 1 Waste Water Sewer Lines
Former Plum Brook Ordnance Works, Sandusky, Ohio

Contract No. W912QR-08-D-0013

Delivery Order No. DX03

Project No. 132458

Task/Phase Number:

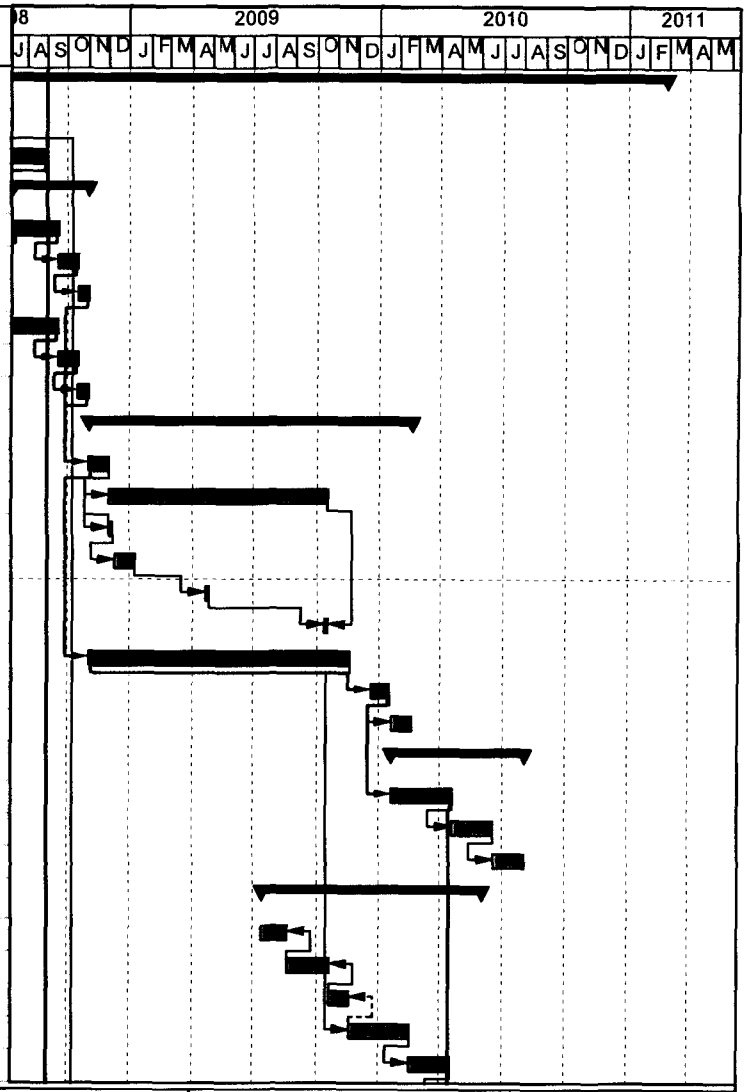
Document Type	Identify specific section or segment covered by this checkprint	Document Origin
☐ Technical / Cost Proposal		☐ Originator Developed
☐ RFP		☐ Edited Standard
☐ Contract / Subcontract		☐ Client Furnished
☐ SHP, SSAP, CDAP, or QAPP		
☐ Report		**Document Status**
☐ Risk Assessment / Evaluation		☐ 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			
ject 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
WWSL RI & RWP PP & DD @ PBOW		912	26-Jun-08 A	28-Feb-11
A1000	Task Order Award	0		26-Jun-08 A
A1010	Prepare & Submit QCP	1	27-Jun-08 A	31-Aug-08
Work Plans		61	11-Jul-08 A	31-Oct-08
A1020	Prepare & Submit Draft SSHP Addendum	16	11-Jul-08 A	16-Sep-08
A1030	Review SSHP Addendum	30	17-Sep-08	16-Oct-08
A1040	Prepare & Submit Final SSHP Addendum	15	17-Oct-08	31-Oct-08
A1050	Prepare & Submit Draft SSAP Addendum	16	11-Jul-08 A	16-Sep-08
A1060	Review SSAP Addendum	30	17-Sep-08	16-Oct-08
A1070	Prepare & Submit Final SSAP Addendum	15	17-Oct-08	31-Oct-08
Field Work		475	01-Nov-08	18-Feb-10
A1090	Soil Remedial Investigation	30	01-Nov-08	30-Nov-08
A1100	GW Remedial Investigation	322	01-Dec-08	18-Oct-09
A1101	Install & Sample Piezometers	7	01-Dec-08	07-Dec-08
A1102	Install Wells	30	08-Dec-08	06-Jan-09
A1103	Sample Wells - Round #1	7	20-Apr-09	26-Apr-09
A1104	Sample Wells - Round #2	7	12-Oct-09	18-Oct-09
A1120	Analytical	383	01-Nov-08	18-Nov-09
A1130	IDW	30	21-Dec-09	19-Jan-10
A1140	GIS	30	20-Jan-10	18-Feb-10
Site Characterization Report		195	20-Jan-10	02-Aug-10
A1150	Prepare & Submit Draft Site Characterization Report	90	20-Jan-10	19-Apr-10
A1160	Review Draft Site Characterization Report	60	20-Apr-10	18-Jun-10
A1170	Prepare & Submit Final Site Characterization Report	45	19-Jun-10	02-Aug-10
Baseline Human Health Risk Assessment		325	12-Jul-09	01-Jun-10
A1172	Prepare & Submit Draft HHRA Work Plan	40	12-Jul-09	21-Aug-09
A1174	Review HHRA Work Plan	60	21-Aug-09	20-Oct-09
A1176	Prepare & Submit Final HHRA Work Plan	30	20-Oct-09	19-Nov-09
A1180	Prepare & Submit Draft HHRA Report	90	19-Nov-09	16-Feb-10
A1190	Review HHRA Report	60	17-Feb-10	17-Apr-10



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

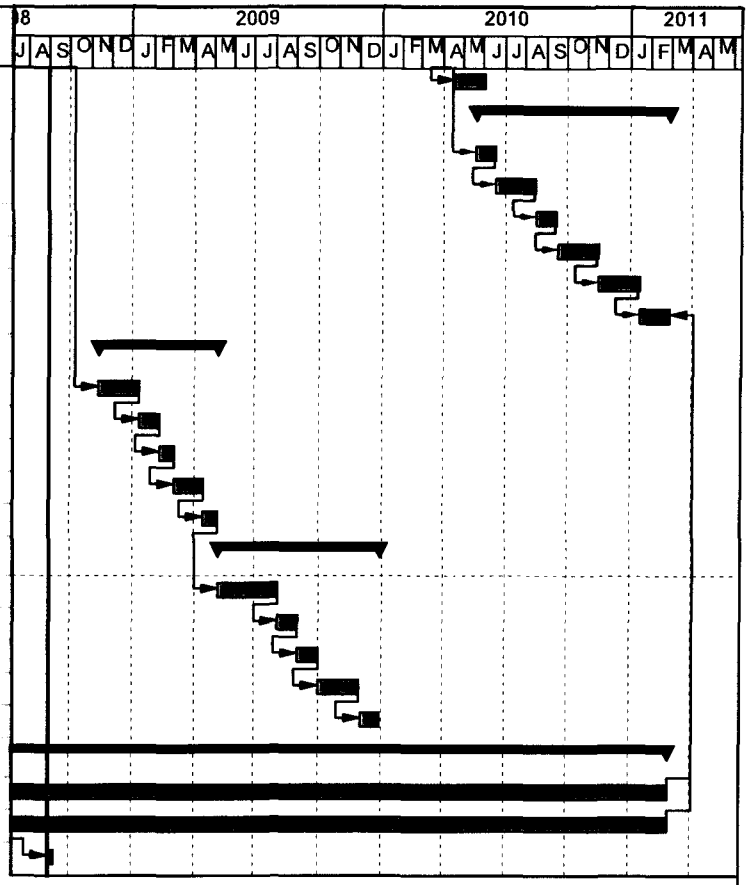
Figure 1

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

DX03 - Waste Water Sewer Lines RI & RWP PP & DD @ PBOW

Shaw Environmental & Infrastructure Project Schedule

Activity ID	Activity Name	Remaining Duration	Start	Finish
A1200	Prepare & Submit Final HHRA Report	45	18-Apr-10	01-Jun-10
Ecological Risk Assessment		285	20-May-10	28-Feb-11
A1210	Prepare & Submit Draft Ecological RA Work Plan	30	20-May-10	18-Jun-10
A1220	Review Draft Ecological RA Work Plan	60	19-Jun-10	17-Aug-10
A1230	Prepare & Submit Final Ecological RA Work Plan	30	18-Aug-10	16-Sep-10
A1330	Prepare & Submit Draft Ecological RA Report	60	17-Sep-10	15-Nov-10
A1340	Review Draft Ecological RA Report	60	16-Nov-10	14-Jan-11
A1350	Prepare & Submit Final Ecological RA Report	45	15-Jan-11	28-Feb-11
Red Water Pond Proposed Plan		175	12-Nov-08	05-May-09
A1270	Prepare & Submit Internal Draft PP	60	12-Nov-08	10-Jan-09
A1280	Review Internal Draft PP	30	11-Jan-09	09-Feb-09
A1290	Prepare & Submit Draft PP	20	10-Feb-09	01-Mar-09
A1360	Review Draft PP	45	02-Mar-09	15-Apr-09
A1370	Prepare & Submit Final PP	20	16-Apr-09	05-May-09
Red Water Pond Decision Document		240	06-May-09	31-Dec-09
A1300	Prepare & Submit Internal Draft DD	90	06-May-09	03-Aug-09
A1310	Review Internal Draft DD	30	04-Aug-09	02-Sep-09
A1320	Prepare & Submit Draft DD	30	03-Sep-09	02-Oct-09
A1380	Review Draft DD	60	03-Oct-09	01-Dec-09
A1390	Prepare & Submit Final DD	30	02-Dec-09	31-Dec-09
Project Management		912	26-Jun-08 A	28-Feb-11
A1240	Misc. Task Team Support	912	26-Jun-08 A	28-Feb-11
A1250	Project Management	912	26-Jun-08 A	28-Feb-11
A1260	Meetings	10	31-Aug-08	09-Sep-08



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

DX03 - Waste Water Sewer Lines RI & RWP PP & DD @ PBOW

Shaw Environmental & Infrastructure Project Schedule