Bristol
ENVIRONMENTAL REMEDIATION SERVICES, LLC

Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP) and Uniform Federal Policy for Quality Assurance Project Plans, Geophysical Classification for Munitions Response Quality Assurance Project Plan (GCMR-QAPP)

Merging at the Remedial Investigation (RI) Stage to Create a Workable Document

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Agenda

- Safety Moment
- Guidance Documents
- Example Documents
- Merging Technical Approaches Into One UFP-QAPP
- Worksheet (WS) #14 & 16, Summary of Project Tasks and Schedule with Examples
- WS #17, Sample Design and Rationale with Examples
- WS #11, Data Quality Objectives (DQO) with Examples
- WS #12, Measurement Performance Criteria with Examples
- WS #22, Field Equipment, Calibration, Maintenance, Testing and Inspection with Examples
- Assessment and Corrective Actions WS #31-33 with Examples
- Technical Approach for Former Camp Beale Remedial Investigation / Feasibility Study (RI/FS) Using Merged UFP-QAPPs
- Lessons Learned

Acronyms

AGC	Advanced Geophysical Classification
CSM	Conceptual Site Model
DFW	Definable Feature of Work
DGM	Digital Geophysical Mapping
DQO	Data Quality Objective
FS	Feasibility Study
FUDS	Formerly Used Defense Sites
GCMR	Geophysical Classification for Munitions Response
IVS	Instrument Verification Strip
MC	Munitions Constituent
MD	Munitions Debris
MEC	Munitions and Explosives of Concern
MFD-H	Maximum Fragmentation Distance – Horizontal
MRA	Munitions Response Area
MRS	Munitions Response Site
RI	Remedial Investigation
SOP	Standard Operating Procedures
TOI	Target of Interest
TPP	Technical Project Planning
UFP-QAPP	Uniform Federal Policy-Quality Assurance Project Plan
USACE	U.S. Army Corps of Engineers
VSP	Visual Sample Plan
WS	Worksheet

Safety Moment

Although the subject of this presentation is not specifically safety, throughout the preparation of the UFP-QAPP the preparer should evaluate potential safety hazards related to each task / DFW. In addition, the document should be reviewed by a safety professional and Unexploded Ordnance Supervisor and Safety Officer including a safety analysis of all activities that may pose potential hazards during the project field work.

Finally, the UFP-QAPP appendices include the Accident Prevention Plan, Site Safety and Health Plan and Activity Hazard Analysis that should address the potential hazards associated with the entire field project and/ or any site tours that may be conducted in conjunction with Technical Project Planning (TPP) meetings.

Guidance Documents

Two Primary UFP-QAPP Guidance Documents

- UFP-QAPP, Optimized UFP-QAPP WS, March 2012
  - Combined WSs with similar information into single WS
- UFP-QAPP Template, GCMR, Revised Beta Draft, February 10, 2015
  - If only preparing a GCMR QAPP with no Munitions Constituents (MC) Sampling Worksheets (WS) #15, 18, 19 & 30, 20, 23 through 28 will not be applicable; not included in GCMR QAPP

Example Documents

- Deming Precision Bombing Range No. 24 RI/FS UFP-QAPP, Final, November 2015
  - Optimized UFP-QAPP WS for a project including Digital Geophysical Survey (DGM), intrusive investigations, and Munitions Constituent (MC) Sampling
- Former Camp Beale Munitions Response Site 03 Southwest Combined Use Area RI/FS UFP-QAPP, Draft Final, July 2016
  - Includes Optimized UFP-QAPP WS and GCMR for a project that includes, DGM, advanced geophysical classification (AGC), intrusive investigations, biological resources field support, and MC sampling.
  - With Client acceptance started with the Deming approved UFP-QAPP and merged the GCMR guidance into a single UFP-QAPP
  - Former Camp Beale RI/FS will be used in this presentation to present examples of merging worksheets

Merging Technical Approaches Into One QAPP

Blending technical approaches for geophysical work including AGC, intrusive investigations, and MC sampling work can be challenging. Items/tasks to think about during document preparation and merging of WSs:

- Establish Investigation Approach and Definable Features of Work (DFWs) early in process
  - Identify WSs to serve as the initial building blocks for completing remaining UFP-QAPP WSs
    - WS #14 & 16 – Summary of Project Tasks and Schedule
    - WS #17 – Sample Design and Rationale
  - Involve Contractor/USACE technical experts early in the development of the DFWs (e.g., risk assessor, geophysicist, biologist, archaeologist, chemist, etc.)
- Organize DFWs as work will flow in the field; to reduce overall number of DFWs, multiple associated activities can be rolled into one DFW (example provided later)
- Check that each WS includes elements for each DFW, as needed

Merging Technical Approaches Into One QAPP (cont.)

- Finalize DFWs following completion of WS #11 – DQOs and WS #12 – Measurement Performance Criteria
- Verify/Confirm Decision Rules from WS #11 can be met with the tasks / DFWs proposed
- Emphasize in the Executive Summary and other WSs, such as WS #11 – DQOs and WS #12 – Measurement Performance Criteria, that the UFP-QAPP is merged with the GCMR. Example text may include:

  > "The UFP-QAPP is intended to be the primary work plan for the RI and contains optimized UFP-QAPP worksheets and Geophysical Classification Munitions Response (GCMR) QAPP worksheets applicable to the project. It serves as a guideline for the field activities and data quality assessment."

- Important to clearly explain the UFP-QAPP during TPP presentations so that Stakeholders not familiar with the approach will understand it is the sole document for describing field operations

Merging Technical Approaches Into One QAPP (cont.)

- Major WSs that may require merging or clarification that each is presenting two distinctly different activities
  - WS # 14 & 16 – Summary of Project Tasks & Schedule
  - WS #17 – Sampling Design and Rationale
  - WS #11 – Project/DQOs
  - WS #12 – Measurement Performance Criteria
  - WS #22 – Field Equipment Calibration, Maintenance, Testing, and Inspection
  - WS #31-33 – Assessments and Corrective Actions (specifically the table associated with Audit and Inspection Summary by DFW)

WS #14 & 16, Summary of Project Tasks and Schedule

- WS #14 & 16 provides a snapshot for field team use regarding required project tasks and general schedule
- Begin by developing a basic outline of tasks
- Consider required DFWs for each task
- Ensure each task has at least one DFW

WS #14 & 16, Example - Project Tasks

- Project Task Summary provides outline for field activities

14.0 QAPP WORKSHEET #14 & #16 – SUMMARY OF PROJECT TASKS AND SCHEDULE

14.1 PROJECT TASK SUMMARY

A summary of the project tasks are listed below and detailed descriptions of the definable features of work project tasks are provided in Worksheet #17 - Sampling Design and Rationale.

MEC investigation project tasks include the following:

- Geophysical System Verification (GSV) and installation of IVS;
- Analog geophysical surveys (i.e., real-time geophysical survey also known as "mag and dig") to be conducted in areas inaccessible to DGM towed-array equipment;
- DGM;
- Advanced Classification;
- Geophysical and Advanced Classification data processing;
- Intrusive investigation of geophysical anomalies / Advanced Classification TOIs and Non-TOIs (except as noted in Worksheet 11, Decision Rule Step 5, Intrusive Investigations);
- Data assimilation / analysis;
- MEC removal and disposal;
- Residential evacuations, as necessary
- MD certification and recycling; and
- Reporting.

If a potential MC source as defined in Worksheet #11 is identified, MC sampling will be completed. MC investigation project tasks include the following:

- Prepare sample location map for approval by project team prior to sampling;
- Incremental soil sampling and analyses;
- Data verification / validation;
- Statistical evaluation of site / background data for metals;
- Risk assessment(s) (if required based on analytical results); and
- Reporting.

WS #14 & 16, Example - Proposed Investigation Approach

- Provide summary table – Use tables within the WSs to provide a snapshot of key information
- Useful tool for field team to quickly understand work to be completed

Table 14-1 provides a summary of the work to be completed during the RI field operations.

Table 14-1 Proposed Investigation Approach

Acreage	Proposed Field Work	Proposed Environmental Sampling
SI investigated acreage: 7,725 (identified as MRA03) RI/FS investigation acreage: 7,725	**DGM** • 437-foot spacing – approximately 35.4 miles **Advanced Classification** • Perform MetalMapper within the potential evacuation area to reduce number of residential evacuations. Number of locations will be based on results of dynamic EM61 DGM surveys. **Analog geophysical survey** • In difficult terrain to supplement DGM transects, as required **Intrusive Investigation of geophysical anomalies and Advanced Classification TOIs and Non-TOIs** • Reacquisition of anomalies following DGM data processing, outside potential evacuation area • Intrusive investigation of TOIs and Non-TOIs within potential evacuation area following MetalMapper data analysis • Real-time investigation of anomalies identified during analog survey, if required. **MEC disposal and Material Documented As Safe (MDAS) certified scrap metal recycling**	No sampling will be conducted unless a potential source of MC is identified during the geophysical and intrusive field activities If sampling is required the following will be performed: **Site Investigation Samples** • Collection of incremental soil samples, if necessary • If small arms debris (projectiles or casings) or evidence of small arms berms are observed, analysis for selected metals (antimony, copper, lead, and zinc) will be performed • If MEC and/or MD from medium and large caliber munitions are observed, analysis for explosives will be performed **Background Samples** • If samples for metals analysis are collected from the site, background incremental samples (8 from each of soil types associated with samples collected in the MRS)will be collected • Analysis for selected metals

WS #14 & 16, Example - Merged DFWs

DFW	Responsible Party	Planned Start Date	Planned Completion Date	Deliverable(s)	Final Deliverable Due Date[1]
1. Pre-Mobilization Activities	Bristol	July 2016	August 2016	Field notes	December 2016
2. Site Preparation / Mobilization of Personnel, Equipment, and Supplies	Bristol	August 2016[3]	August 2016	Field notes / Survey records	December 2016
3. Conduct Validation Seeding, QC Seeding, and Construct IVS	Bristol / InDepth / Black Tusk	August 2016	November 2016	Seeding records / QC records / IVS memo	December 2016
4. Analog Geophysical Survey (if needed)[2]	Bristol	October 2016	November 2016	GPS data / Field notes	December 2016
5. DGM Survey[2]	InDepth	August 2016	September 2016	DGM data / Target selection memorandum / TOI dig list / QC records	December 2016
6. Advanced Classification Survey[2] AGC Survey	InDepth / Black Tusk	October 2016	November 2016	Advanced classification data / TOI dig list / QC records / Validation memo	December 2016
7. Residential Evacuations[2]	Bristol	November 2016	December 2016	Field notes / Evacuation letters	December 2016
8. Intrusive Investigation[2]	Bristol	November 2016	December 2016	Dig results list / QC records / Validation memo	December 2016
9. MPPEH Inspection, Verification, and Certification	Bristol	August 2016	December 2016	DD Form 1348-1A / QC records	December 2016
10. Demolition (as needed)	Bristol	August 2016	December 2016	Field notes	December 2016
11. MC Sampling	Bristol / Neptune	December 2016	December 2016	Field notes / chain of custody records	December 2016
12. MDAS Disposal and Demobilization	Bristol	December 2016	December 2016	Field notes	December 2016
13. RI and FS Reports	Bristol	January 2017	September 2017	Final RI and FS Reports[4]	September 2017

[1] Interim / draft deliverables will be provide as necessary during the RI field operations

[2] Several tasks may be conducted concurrently

[3] As of the date of this Draft Final UFP-QAPP, it has not been determined, if field work will need to start in January 2017, due to hunting season from September to December on the State of California owned property. Bristol and USACE are working together to determine the most appropriate field start date.

4. Relevant records created during the field operations, such as TOI dig list, validation memo, and DD Form 1348-1A, will be included as appendices to the RI report.

WS #17, Sample Design and Rationale

Table 17-1 is presented at the start of WS #17 and provides additional detail of the Associated Activities and Supporting Documents

- Each DFW presented in this table is followed by detailed text in the UFP-QAPP presenting the sample design and rationale
- Each section within the WS references the appropriate Standard Operating Procedure (SOP) that will be used during the work associated with the DFW or a reference to WS #21, Field SOPs
- This section should flow with the field work implementation throughout the project or note what activities will be concurrent with other field activities

WS #17, Example - Merged DFWs

17.0 QAPP WORKSHEET #17 – SAMPLE DESIGN AND RATIONALE

This worksheet describes the project's DFWs and related activities, which are summarized in Table 17-1. Diagrams 17-1 through 17-3 depict the decision making process that will be implemented during the RI field operations.

Table 17-1 RI/FS Activities Summary

DFW	Associated Activities	Supporting Document(s)
1. Pre-Mobilization Activities	Prepare UFP-QAPP with APP, SSHP, and AHAs Prepare ESP Set up GIS Participate in TPP process	UFP-QAPP with APP, SSHP, and AHAs ESP TPP Meeting Memorandum
2. Site Preparation / Mobilization of Personnel, Equipment, and Supplies	Mobilize Staff Mobilize Equipment and Supplies Kickoff / Safety Meeting Perform boundary survey with UXO avoidance	UFP-QAPP SOPs (Appendix E)
3. Conduct Validation Seeding, QC Seeding, and Construct IVS	Establish IVS IVS Memo Place subsurface QC seeds for analog and DGM surveys with UXO avoidance and survey locations	UFP-QAPP SOPs (Appendix E) Blind Seeding Plan (Appendix G)
4. Analog Geophysical Survey (if necessary)	Assemble and test analog metal detectors Perform initial and daily IVS Perform survey Investigate anomalies in accordance with DFW 4 Record survey results daily and weekly Analyze transect data to ensure site coverage requirements are met	UFP-QAPP Field Logs Electronic Dig Sheet (EDigS) electronic data collection SOPs (Appendix E)
5. DGM Survey	Assemble and test EM61 equipment Perform initial and daily IVS Perform survey Record survey results daily and weekly Process data and prepare list of geophysical anomalies for	UFP-QAPP Field Logs EDigS electronic data collection SOPs (Appendix E)

WS #17, Example - Decision Tree

GCMR-QAPP requires decision trees for key geophysical-related tasks

- Provide guidance to PM and field teams on process
- Prevent missed steps or decisions

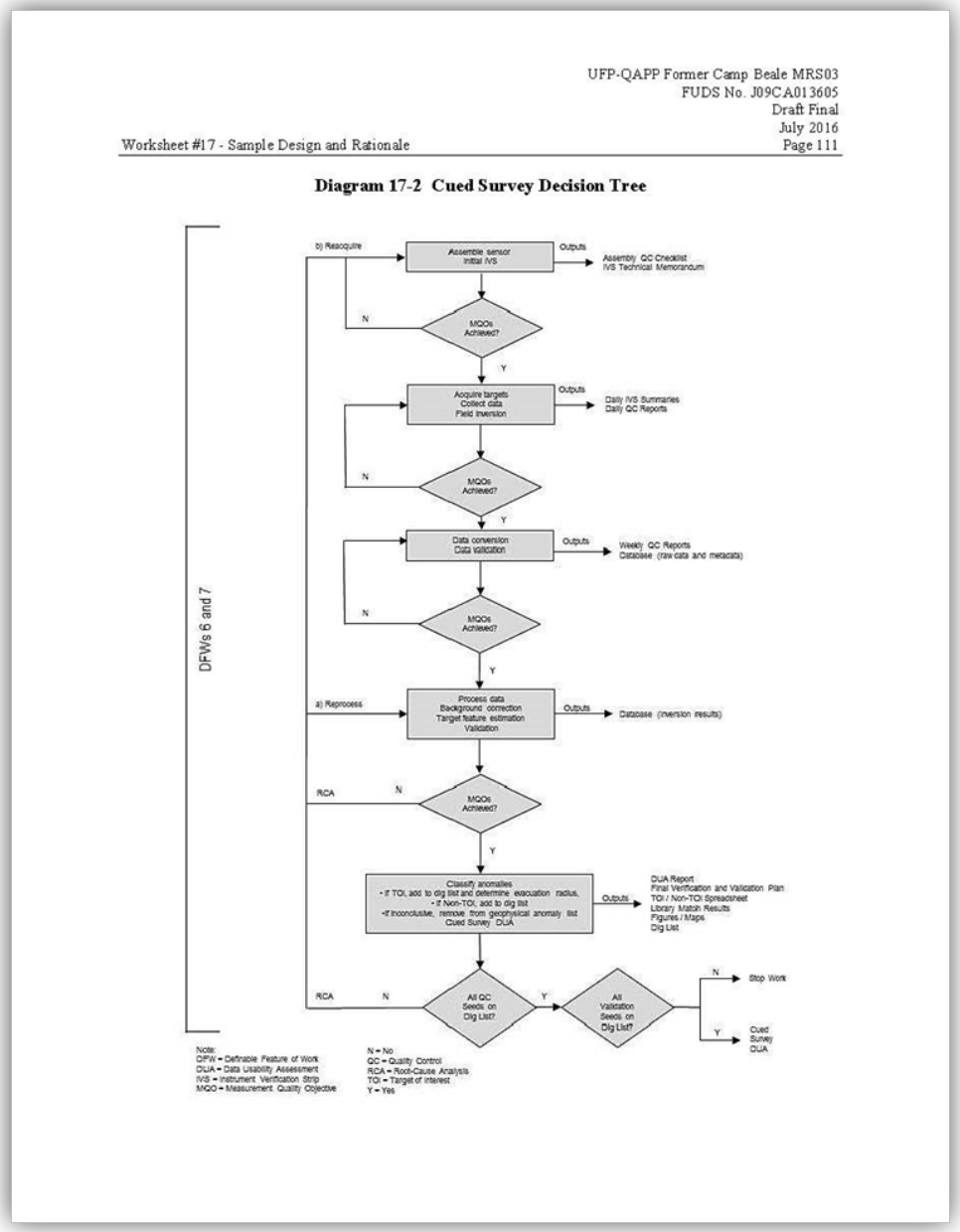


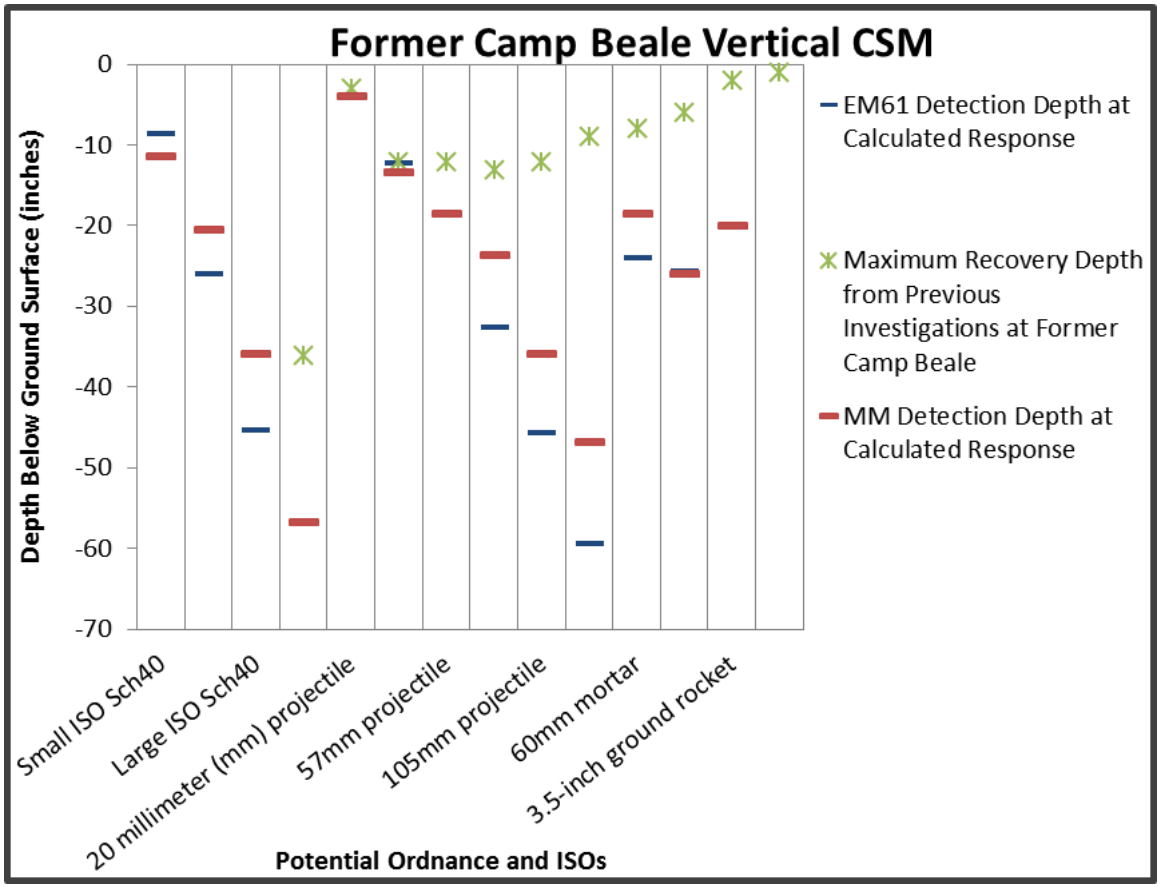
Diagram 17-2 Cued Survey Decision Tree

WS #11, Data Quality Objectives

- Combine MEC and MC investigation DQOs as one set to minimize duplication (may not be realistic based on complexity of project)
- Split into subsections when specific details for MEC and / or MC are needed
- Add Vertical Conceptual Site Model as a data input tool
- Develop strong Decision Rule(s) for MEC and MC, with additional Decision Rules for the main activities of selected DFWs
  - EM61 Detection Phase
  - Metal Mapper Cued Phase
  - Intrusive investigations
- Verify/confirm tasks and DFWs can meet the Decision Rules

WS #11, Example - Vertical CSM

- Vertical CSM has been developed and included in the UFP-QAPP to depict the potential vertical distribution of MEC/MD compared with
  - Historical depths of detection / recovered MEC/MD at the MRS
  - Depth of detection of DGM EM61 equipment
  - Depth of detection of AGC MetalMapper equipment



WS #11, Example - DQO MEC Decision Rules

5. **Develop the Decision Rules:** The decision rules integrate the DQO goals, inputs, and boundaries into statements that provide a logical basis for choosing among alternative response actions.

   The decision rules for this RI/FS that will be implemented for MEC in each MEC decision unit are:

   - If no MEC is detected within the MRS, the assumptions regarding site coverage will be verified. If the assumptions are valid (i.e., site coverage is determined to be sufficient) then no additional DGM survey work will be performed during the RI field activities.
   - If MEC is present (or sufficient evidence to suspect potential MEC, such as quantity and distribution of MD and/or munitions-related features [e.g., targets, craters]) and there is possible interaction (exposure pathway) with human receptors under current or anticipated future land use, then USEPA MEC Hazard Assessment (MEC HA) worksheets will completed and appropriate response alternatives will be evaluated. Response alternatives will be selected based on considerations of effectiveness, implementability, and cost.
   - If MEC is present define the MEC decision unit affected by the MEC (e.g., target area, and/or buffer area).

   This project will use the results from detection phase DGM surveys to identify anomalies for intrusive investigation. Then, in potential evacuation areas, advanced geophysical sensors (MetalMapper decay curves or signatures) and specialized geophysical modeling will be used to classify target anomalies detected during the geophysical detection survey. Geophysical data from MetalMapper will be interpreted with physics-based models to estimate the physical attributes of the anomalies, and classifier models will be used to evaluate the likelihood that the anomalies are intact munitions. Anomalies will be classified into one of three categories described above in the Study Goals for MEC. The final product will be a "ranked anomaly list" that classifies each geophysical anomaly cued within the potential evacuation areas, justifies the classification, and identifies the removal procedures for each anomaly. Anomalies on the list will be ranked in order of greatest likelihood to be a TOI to greatest likelihood to be an inconclusive item.

Overall MEC Decision Rule

Dynamic EM61 Detection Phase

- Parameters of interest: Measurements with an amplitude ≥ 4.9 mV and a SNR ≥ 3.
- Type of inference: Measurements meeting the criteria noted above will be considered to be geophysical anomalies selected for further evaluation during the Intrusive Investigation or Cued Phase.
- Decision rules: If a response amplitude of ≥4.9 mV is present in the dynamic data, and the signal to noise ratio is ≥3, the anomaly will be selected and placed on the Amplitude Response Anomaly List.

MetalMapper Cued Phase

- Parameters of interest: Location of the geophysical anomaly is within the potential evacuation area, cued measurement SNR, inversion fit coherence, inversion outputs of Beta (β) 1, β2, β3, x, y, and z, and offset between the inverted and cued location.
- Type of inference: The following criteria will be used to classify the anomaly:
  - 1) The polarizability matches (within specifications established on Worksheet #22) that of an item in the project-specific TOI library,
  - 2) Estimates of the size, shape, symmetry, and wall thickness calculated from the polarizability, indicates the item is a long, cylindrical, and thick-walled, or
  - 3) There is a statistically distinct group of anomalies having similar polarizabilities that, after investigation, are discovered to be TOI.
  - 4) Anomalies with poor inversion fit coherence that, after considering all available information, cannot be ruled as TOI or non-TOI will be added to the inconclusive list.
- Decision rules:

  If an anomaly is classified as a TOI, it will be placed on the ranked "TOI Dig" (intrusive investigation) list. If an anomaly is classified as non-TOI, then the anomaly will be investigated for the purpose of the RI nature and extent requirements. The following decision rules will be implemented upon completion of the MetalMapper Cued Phase:
  - If all or a portion of the study area is determined to have an anomaly density too high for cued analysis, then an alternative approach will be developed (factors for evaluating anomaly density are discussed in Worksheet #17).
  - If the object is classified as TOI (highly likely to be a munition), then the object will be excavated using the public safety precautions and exclusion zones as described in Section 17.7.1.

Activity-specific Decision Rules

WS #11, Example - DQO Decision Rules for MC

MC Sampling

Soil sampling will be conducted if a potential MC source is identified, as presented in Table 14.1 and Section 17.11. The identification of a potential MC source will be based on a MEC find and/or the presence of MD, and/or the presence of small arms debris (projectiles or casings) at a density similar to a target or impact area, as indicated on VSP density maps that will be developed from the field investigation data. The decision rules for this RI/FS that will be implemented for MC sampling and assessment are:

- If an MC source is identified and soil samples indicate MC concentrations are below background and/or project screening levels, a no further action recommendation for MC may be made for the MRS.
- If an MC source is identified and soil sample results indicate MC concentrations exceed background and/or project screening levels, the data may be used to complete human health and/or ecological risk assessments to determine whether risk management actions are warranted.
- If MC surface soil contamination is identified in the RI/FS at levels that indicate a potential for adverse human or ecological effects, the possibility of significant subsurface soil and groundwater impacts will be evaluated.
- Considerations regarding the need to proceed beyond screening-level risk assessment are described in Section 17.11.

WS #12, Measurement Performance Criteria

Layout and content of tables are different between optimized UFP-QAPP and GCMR-QAPP; therefore, individual tables are maintained so that all relevant data is included

- 12.1 Measurement Performance Criteria Table – MEC DGM and Analog Investigations
- 12.2 Measurement Performance Criteria Table – MEC AGC Investigations
- 12.3 Measurement Performance Criteria Table – Explosives
- 12.4 Measurement Performance Criteria Table – Metals

WS #12, Example - Measurement Performance Criteria for MEC Investigation

12.0 QAPP WORKSHEET #12 – MEASUREMENT PERFORMANCE CRITERIA

This worksheet documents the project-specific MPC in terms of precision, bias, sensitivity, representativeness, completeness, and comparability for the MEC investigation. These MPCs establish the minimum performance specifications that the instruments and methods (procedures) must meet to ensure collected data will satisfy the DQOs documented on Worksheet #11. Specific procedures for obtaining the MPCs are outlined in the SOPs included in Appendix E.

12.1 MEASUREMENT PERFORMANCE CRITERIA TABLE – MEC DGM AND ANALOG INVESTIGATION

Measurement Performance Activity	Data Quality Indicator (DQI)	Specification	Activity Used to Assess Performance
Analog Geophysical Survey	Completeness	Survey of analog geophysical survey transects as identified on project figures.	Confirm all surface QC seeds have been returned to UXOQCS.
Subsurface QC Seeding	Representativeness / Completeness	At least one blind subsurface QC seed will be placed for every day of geophysical and analog surveys. Seeds will be placed at different depths to cover the full range of detection requirements as specified in the vertical CSM with approximately the same number at each depth; half will be placed in a horizontal position.	Comparison of actual placement data (quantity and recorded depths and orientations) to specifications in the UFP-QAPP.
Subsurface QC Seeding	Precision	Seed location positions will be recorded to specifications per UFP-QAPP Worksheet #17.	Comparison of actual placement data (locations and GPS coordinates) to specifications in the UFP-QAPP.
Dynamic Detection Survey	Completeness	Transect-based survey sampling will be sufficient to meet project objectives.	Confirm the number of collected survey miles meet the number stated in Worksheet #17. Confirm in-line measurement spacing per Worksheet #22.
Dynamic Detection Survey	Sensitivity	The geophysical instruments are capable of consistently detecting geophysical anomalies	Confirm initial and ongoing IVS surveys and QC (blind) seed detection per Worksheet #22.

WS #12, Example - Measurement Performance Criteria for MC Investigation

12.3 MEASUREMENT PERFORMANCE CRITERIA TABLE – EXPLOSIVES

Matrix	Soil
Analytical Group	Explosives
Concentration Level	Low

Sampling Procedure[1] / SOP	Preparation Method / Analytical Method / SOP[2]	DQIs	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Incremental Sampling (SOP BERS-14)	SW-846 Method 8330B following preparation In accordance with Appendix A of the method and extraction per Section 11.4. TestAmerica (TA) SOP No. WS-QA-0028 / WS-LC-0009	Precision (field and laboratory)	No criteria specified; used to assess error	Comparison of three replicate samples[4]	S&A
		Precision (laboratory)	≤20% Relative Percent Difference (RPD).	Matrix Spike Duplicate (MSD)	A
		Accuracy (laboratory)	Compound-specific (as provided in the DoD QSM).	Laboratory Control Sample	A
		Accuracy (laboratory)	Compound-specific (as provided in the DoD QSM).	Matrix Spike (MS)	A
		Representativeness (laboratory)	No analytes detected >1/2 Limit of Quantitation (LOQ) or > 1/10 amount measured in a sample or 1/10 the regulatory limit, whichever is greater	Method Blank	A
		Completeness (field and laboratory)	100% for each compound in each DU	Data evaluation by project decision makers, see Worksheet #37	S&A

[1]Reference from UFP-QAPP Worksheet #18; SOPs are included in Appendix E.

WS #22, Field Equipment, Calibration, Maintenance, Testing, and Inspection

Individual tables are developed for each type of field equipment

- 22.1 DGM and Analog Survey
- 22.2 Cued AGC Survey
- 22.3 Intrusive Investigation

WS #22, Example - DGM and Analog

22.0 QAPP WORKSHEET #22 – FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION

Worksheet #22 presents the calibration, maintenance, testing, and inspection requirements for field sampling instruments. The worksheet also includes QC criteria for applicable DFWs. References to the applicable DFW and SOPS are included. Where appropriate the failure response will proscribe a corrective action.

22.1 DGM AND ANALOG SURVEY

Instruments: Geonics EM61 and Schonstedt GA-52Cx						
Measurement Quality Objective	DFW / SOP Reference	Metric / Acceptance Criteria	Frequency	Responsible Person / Report Method / Verified by	Consequence of Failure	Failure Response
DGM Static repeatability (instrument functionality)	DFW 5 / SOP-GEO-02A	Response (mean static spike minus mean static backgrouind) expected response. Expected response calculated as a running average within +/- 10%.	Minimum 1 daily	Data Processor / Daily DGM QC Report / QC Geophysicist	Day's data fails unless seed item is mapped that day with repeatable anomaly characteristics (see DGM data repeatability).	Root-Cause Analysis (RCA) / Corrective Action (CA)
DGM Mean Acquisition Speed	DFW 5 / SOP-GEO-02A	95% are within the max project design speed; ≤ 3.3 mph or demonstrated speed.	By dataset	Data Processor / Daily DGM QC Report / QC Geophysicist	Data submittal fails unless new max speed is successfully demonstrated at IVS.	CA: Out of specification data rejected

WS #22, Example - DGM and Analog (cont.)

Instruments: Geonics EM61 and Schonstedt GA-52Cx						
Measurement Quality Objective	**DFW / SOP Reference**	**Metric / Acceptance Criteria**	**Frequency**	**Responsible Person / Report Method / Verified by**	**Consequence of Failure**	**Failure Response**
DGM Along-Track Sample Spacing	DFW 5 / SOP-GEO-02A	98% ≤ 0.82 ft (0.25 m) along line.	By dataset	Data Processor / Daily DGM QC Report / QC Geophysicist	Failing transect or segment will be reacquired or dataset submittal fails.	CA: Out of specification data rejected
DGM Data Repeatability (IVS)	DFW 5 / SOP-GEO-02A	Response of the IVS seed items will not vary more than 25% of expected response.	Twice daily	Data Processor / Daily DGM QC Report / QC Geophysicist	Submittal fails.	RCA/CA
DGM Data Repeatability (blind seed)	DFW 5 / SOP-GEO-04	Peak response > 75% of minimum expected response.	1 per day per team based on expected production rate	Data Processor / Daily DGM QC Report / QC Geophysicist	Submittal fails.	RCA/CA
DGM Dynamic Positioning Repeatability (IVS)	DFW 5 / SOP-GEO-02A	Position offset of IVS targets ≤ 0.82 ft (0.25 m).	Twice daily	Data Processor / Daily DGM QC Report / QC Geophysicist	Submittal fails.	RCA/CA
DGM Dynamic Positioning Repeatability (blind seed)	DFW 5 / SOP-GEO-02A	Positional offsets of seed items ≤ 3.28 ft (1 m).	1 per day per team based on expected production rate	Data Processor / Daily DGM QC Report / QC Geophysicist	Submittal fails.	RCA/CA
DGM Target Selection	DFW 5 / SOP-GEO-02A	All dig list targets are selected according to project design.	By transect or dataset	Data Processor / QC Geophysicist / UXOQCS	Submittal fails.	RCA/CA
Anomaly Resolution	DFW 5 / SOP-GEO-03	Second party checks open holes to determine: 90%	Rate varies depending on lot size. See	UXOQCS / QC Geophysicist	Lot submittal fails.	RCA/CA

WS #31-33, Assessment and Corrective Actions

WS # 31-33 merges all aspects of the project to outline overall effectiveness of the QC program and is dependent on all field activities (i.e., geophysical investigation processes, intrusive investigations, instrument-aided visual surveys, MC sampling [as required], and MEC handling and disposal) being conducted in accordance with UFP-QAPP

- The textual portion of these sections provide the requirements for QC of all aspects of the project
- Table 31-1 provides the project DFWs and the associated QC audits / inspections and documentation summarized in a table format

WS #31-33, Example - DFWs Audits / Inspections, Assessment and Corrective Actions

Inspection Description	Frequency of Inspection	Inspection Responsibility	Proposed Action if Failure Occurs	Documentation Associated with DFW
DFW 3. Conduct Validation Seeding, QC Seeding, and Construct IVS				
Develop Preparatory Phase Checklist	Once at initiation of DFW	PM, UXOQCS, SUXOS, and Project Geophysicist	Do not proceed with field activities until completed.	• Preparatory Phase Checklist • IVS Memo • Daily QC Report (including initial phase and follow-up phase inspections, as required) • QC Audit Report • Data coverage maps, static response graphs, IVS results and daily geophysical survey logs • SUXOS logbook • UXOQCS logbook • Daily Safety Reports • Weekly report
IVS was constructed in accordance with the UFP-QAPP	Once during test strip construction	UXOQCS and Project Geophysicist	Reseed and resurvey seed items.	
Place subsurface QC seeds for analog and DGM surveys with UXO avoidance and survey locations	See DFWs 4, 5, and 6	UXOQCS and Project Geophysicist	Resurvey portion of the transect where blind seed item is located, check sensors, and reevaluate transects covered by dig team that missed the seeded item.	

WS #31-33, Example - DFWs Audits / Inspections, Assessment and Corrective Actions (cont.)

Inspection Description	Frequency of Inspection	Inspection Responsibility	Proposed Action if Failure Occurs	Documentation Associated with DFW
DFW 6: CUED ADVANCED CLASSIFICATION INVESTIGATION				
Develop Preparatory Phase Checklist	Once at initiation of DFW	PM, UXOQCS, SUXOS, QC Geophysicist , and Project Geophysicist	Do not proceed with field activities until completed.	• Preparatory Phase Checklist • Cued IVS Memo • Daily QC Report (including initial phase and follow-up phase inspections, as required) • QC Audit Report • TOI Investigation maps, static response graphs, cued IVS results and daily cued geophysical survey logs • SUXOS logbook • UXOQCS logbook • Daily Safety Reports Weekly report
Advanced classification IVS was constructed in accordance with the UFP-QAPP.	Once during test strip construction	QC Geophysicist and Project Geophysicist	Reseed and resurvey seed items.	
Confirm advanced classification geophysical sensors selected for the project are capable of achieving MQOs for detection performance requirements including system positioning, along-track data density, data repeatability, and geophysical target selection	Once after initial advanced classification IVS	QC Geophysicist and Project Geophysicist	Repair sensors or recommend changing instrumentation / method. Rerun IVS.	
Confirm functionality tests are performed before advanced classification investigation and results are verified	Daily and following repair or maintenance.	QC Geophysicist and Project Geophysicist	Resurvey between tests where discrepancies were observed if a resolution cannot be determined.	
The advanced classification IVS procedures documented in the UFP-QAPP are being performed before surveys	Daily	UXOQCS	Retrain or replace personnel.	

Technical Approach for Former Camp Beale RI/FS Using Merged UFP-QAPP

Blending of several geophysical techniques

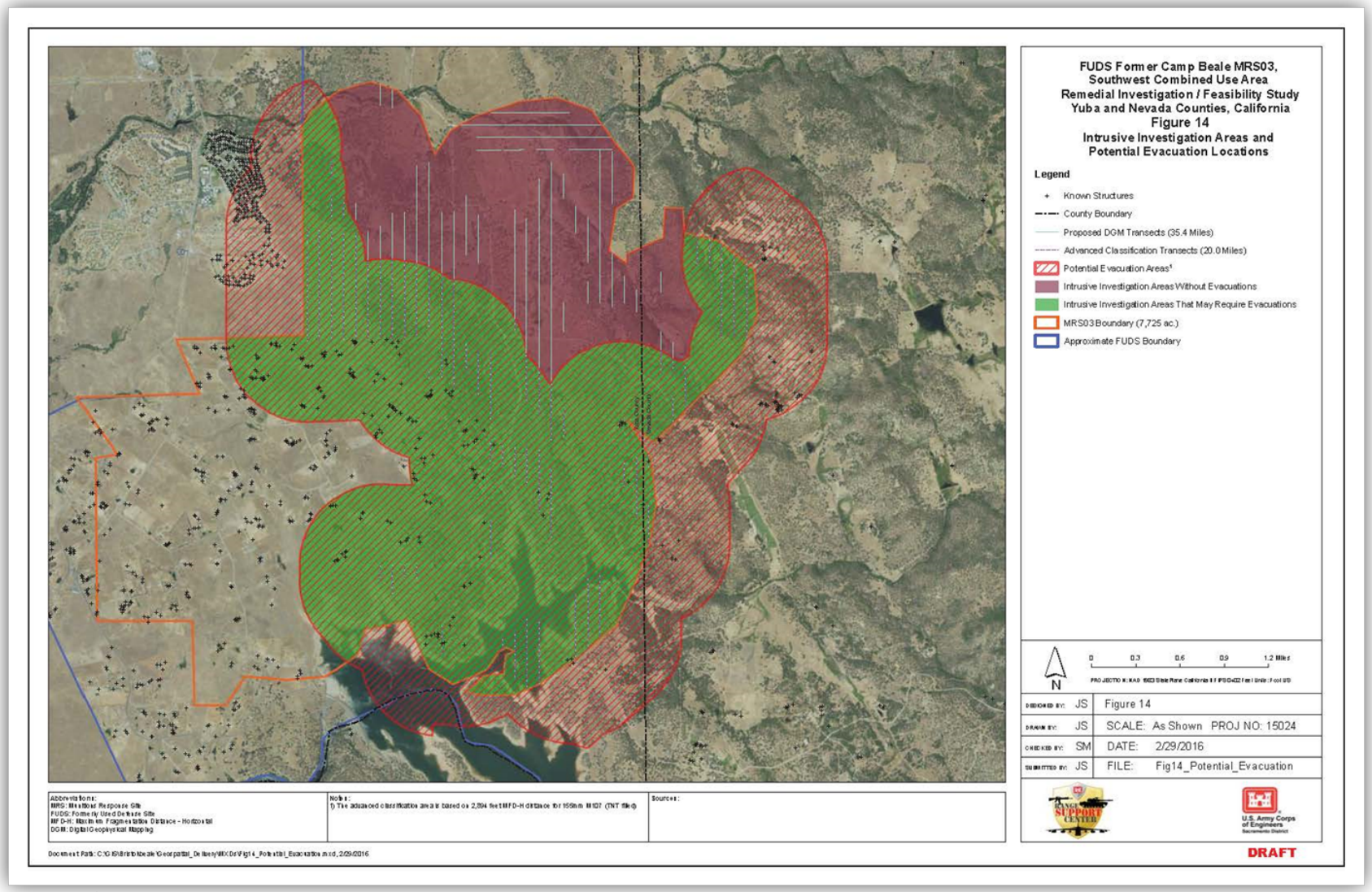
- Defining best equipment for each area based on
  - Objectives
  - Terrain
  - Vegetation
  - Access
  - Signal density
- Former Camp Beale RI/FS is using AGC to minimize evacuations
  - Modification to standard AGC requirements used during removal actions
  - No “stop dig” criteria required (nature and extent; not removal)

Technical Approach for Former Camp Beale RI/FS Using Merged UFP-QAPP (cont.)

MC sampling strategy

- Results of previous investigations
- Only sample if source identified
- Establish density of MEC/MD required to sample during the TPP process and finalize in UFP-QAPP
- Limit analytes based on munitions
  - Small arms - metals
  - Medium / larger caliber - explosives

Technical Approach for Former Camp Beale RI/FS Using Merged UFP-QAPP (cont.)



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Lessons Learned

- Perform an internal USACE/Contractor kick-off meeting to go over the basics of the UFP-QAPP and goals/ objectives for the project
  - Use recent approved / accepted UFP-QAPP examples; don't re-invent the document if a good example already exists
  - Prepare the initial DFWs to support the kick-off meeting
  - Discuss decision rules for MEC and MC
- Expect changes – the process is always evolving
- Always remember that the field teams will have to implement the program. If the UFP-QAPP does not flow or is not clear for each DFW the resulting field work and data collection will suffer.
- Always be willing to adjust UFP-QAPP as necessary based on reviewers comments/concerns; the QAPP is a template. However, resist major changes without Client's acceptance.

Questions?