CHAPTER 6
GEOPHYSICAL PLANNING STRATEGIES FOR RESPONSE ACTIONS

6-1. Introduction.

a. Planning geophysical investigations for MEC response actions requires an investigation strategy be developed to efficiently and effectively meet project needs. Developing the investigation strategy is a collaborative effort of all PDT members. The strategy defines which geophysical system or combinations of systems are needed to meet project needs and objectives, and how the systems are intended to be used to meet those needs and objectives. Included when developing strategies, the geophysical prove-out should be performed to demonstrate geophysical system(s) capabilities, define geophysical and project data needs, and provide initial criteria for defining both quality control metrics and anomaly selections.

b. Geophysics used for response actions is very similar to that used for characterization, but the critical goals and needs are specific to detecting and removing MEC, and project decisions are focused on clearly demonstrating those goal and needs have been met.

6-2. Specify response goals and needs to be addressed by geophysical investigations.

a. Key elements of the response objectives must be specified before undertaking geophysical planning because significant cost savings can be achieved by tailoring the geophysical investigation plan to the response needs. The following are the most critical issues that affect geophysical investigation planning for removal or remedial actions:

(1) Based on the Decision Document or Record of Decision, what are the project-specific MEC response requirements? (List all items and their expected detection depths.)

(2) Of the geophysical systems capable of detecting project-specific MEC, what is the effectiveness of each, and how easy or difficult is it to prove or demonstrate that effectiveness?

(3) How critical is it that each anomaly detected be positively resolved? See Chapter 8 for more information regarding anomalies reported as false positives or hot rocks.)

(a) The methods used to detect and select anomalies require each anomaly detected be positively resolved. This is common in analog mapping surveys and digital mapping surveys that use simplistic anomaly selection methods.

(b) The methods used to detect and select anomalies require each anomaly having MEC characteristics be positively resolved, a percentage of anomalies not having MEC characteristics must also be positively resolved. This is common in digital geophysical mapping surveys that use advanced anomaly characteristic analysis in their selection criteria and the MEC contamination characteristics are clearly defined (e.g. the types of MEC and their depths are well known, and they all will produce anomalies with high signal to noise ratios).

(c) Anomaly dig priorities will be developed and all MEC-priority anomalies will be positively resolved, various percentages of each other priority, as defined by the PDT, will be positively resolved. This is common in digital geophysical mapping surveys that use advanced anomaly characteristic analysis in their selection criteria and the MEC contamination characteristics are not clearly defined. This is also common when MEC can be expected below the required project response depth.

(4) Will project quality control and/or quality assurance procedures require all detected anomalies having MEC characteristics be removed or be otherwise recorded as previously investigated?

(a) Yes, QC and/or QA failure criteria include detection of any anomalies having MEC characteristics that have not been recorded as previously investigated.

(b) No, QC and/or QA failure criteria will not be affected by detecting anomalies having MEC characteristics that have not been recorded as previously investigated.

(5) Do total numbers of anomalies need to be reported? If yes, will "binning" anomaly counts according to geophysical characteristics be accepted?

(a) All detected anomalies must be reported.

(b) All detected anomalies, grouped by category or priority, must be reported.

(c) Only those anomalies listed on dig sheets need be reported (not recommended).

(6) Will high-precision position reporting suffice for project needs or will geophysical data require high-accuracy position reporting as well?

(a) Measurement positions must be reported with high precisions, high accuracies are not required because reacquisition procedures are not affected by coordinate accuracy.

(b) Measurement positions must be reported with high accuracies because of the reacquisition procedures being used.

(7) Will the project schedule support a multi-phase field effort (e.g. mapping followed by anomaly resolution?)

(a) Yes, a multi-phase approach is supported so that digging resources can be tailored to maximize efficiency.

(b) No, all work must be performed concurrently to minimize disruption to the community.

(c) No, all required work is clearly defined and planned and no efficiencies will be gained through a phased approach.

(8) Will reacquisition procedures be affected by the passage of time after data collection?

(a) No. Digging will occur soon after data collection and reacquisition will be performed before temporary survey markers are lost or removed.

(b) No. Digging will occur at some later time and reacquisition procedures will not require recovery of survey markers used to collect geophysical data.

(c) Yes. Digging will occur at some later time and reacquisition procedures require recovery of low order accuracy survey markers used to collect geophysical data.

(9) What are the vegetation conditions and are there constraints on vegetation removal (cost, habitat, endangered species, etc.)?

(a) Vegetation removal is constrained and/or costly. Some response objectives may not be met due to these constraints.

(b) Vegetation removal is constrained and/or costly. All response objectives must be met regardless of vegetation constraints or costs.

(c) Vegetation removal is not constrained but is costly. Some response objectives may not be met due to these constraints.

(10) What are the cultural and/or access constraints?

(a) Cultural and/or access constraints will impede production rates, some response objectives may not be met due to these constraints.

(b) Cultural and/or access constraints will impede production rates. All response objectives must be met regardless of cultural and/or access constraints or costs.

6-3. Specify the Removal Decision Strategy.

a. Strategies should be centered around exactly how much data are needed to support the decision that the removal is complete.

b. The Project Delivery Team (PDT) must decide what findings will constitute delineating an area as complete. A combination of statistical tools, geophysical anomaly patterns, excavation results and QC testing results should be factored into the decision logic. The decision logic should include all reasonable sources of evidence. Listed below are some possible sources, the PDT must determine which are basic sources, which are optimal, and which are excessive.

(a) Dig results for all anomalies selected for excavation.

(b) Distribution patterns of recovered MEC from throughout the site

(c) Detection depth capabilities for each target MEC

(d) Deepest depth each type of MEC was recovered from

(e) Numbers of non-MEC anomalies investigated and their dig results

(g) Geophysical anomaly densities (e.g. anomalies per acre)

(f) Visual observations

(h) QC results

(i) Findings from post-removal verification of anomaly locations and dig results

(j) Findings from post-removal verification using mapping techniques.

(k) Previous work performed in the project area

c. Once all sources of information are defined, the PDT must then identify the assumptions for each source used and this information must be conveyed to all team members. One tool for conveying this information is a decision diagram, illustrated below. This diagram presents a simplified decision logic that uses MEC anomaly characteristics, dig sheet results, QC results, and QASP results to explain how decisions will be derived to declare areas cleared of detectable MEC hazards.

Example Removal Decision Logic

Project Description

1 Project area is 100 acres
2 Access unimpeded, close to 100% mapping achievable
3 Vegetation does not impede project needs or objectives
4 Decision Document requires removal of all MEC hazards. MEC types and their depths are well defined.
5 The project area is devided into 10 acre sub-sectors for purposes of product delivery and progress payments

List MEC ↓	Deepest Known	Deepest Estimated	Deepest detectable (at worst orientation)
57mm	12 inches	12 inches	16 inches
75mm	17 inches	17 inches	28 inches
155mm	27 inches	27 inches	50 inches

Minimum target anomaly characteristics	
lowest SNR estimated:	10
smallest area estimated:	12 ft^2
minimum fit coefficient:	75%

Assumptions

1 site is easy to access, brush clearing is allowed and unrestricted
2 DGM will be used to detect all MEC
3 Concentrated metal contamination around target area will be removed prior to DGM
4 Anomaly characteristics will be developed for discriminating sources as either suspected MEC or suspected small metallic source
5 Fifteen percent of all anomalies with SNR and size characteristics smaller than those defined for the project MEC will be resolved as a means to confirm the selection criteria. Those with characteristics closest to the actual criteria will be given higher priority to be placed on dig sheets
6 QC and QA will include veryfying all anomalies having MEC characteristics are placed on dig lists and checking excavated locations for 90% or more reduction in signal.
7 All metrics for data coverage, data quality and reacquisition will be achieved.

Example Removal Decision Logic Diagram

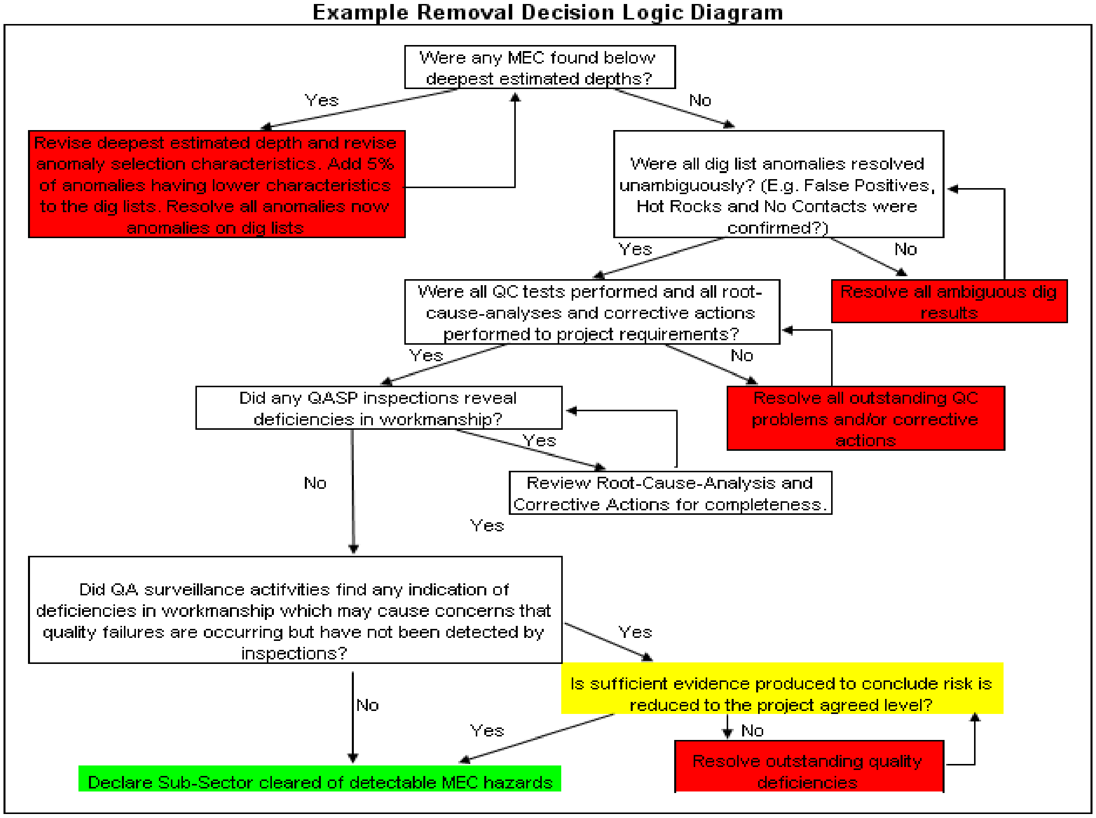

Figure 6-1: Example excavation project decision diagram.

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