ITRC has developed a series of fact sheets that summarizes the latest science, engineering, and technologies regarding environmental data management (EDM) best practices. This fact sheet describes:

- field data quality challenges
- paper versus digital forms and impacts on data quality
- a field data quality checklist intended to improve the overall quality of data collected in the field

Additional information related to field data collection is provided in the ITRC subtopic sheet Using Data Quality Dimensions to Assess and Manage Data Quality, and the fact sheets Field Data Collection Process Development Considerations, and Field Data Collection Training Best Practices.

1 FIELD DATA QUALITY CHALLENGES

Data collection in the field presents unique data quality challenges. Field data are often collected in less than ideal conditions and optimized workflows are often not available. However, this does not mean that field data should not be treated with the same rigor that data collected in controlled laboratory settings demand. In fact, field data often deserve extra scrutiny due to increased likelihood of data quality complications, such as:

- lost or destroyed field forms
- dirty or damaged field forms compromised by harsh environments
- missing information
- hard to read handwriting
- inconsistent nomenclature
- inaccurate transcriptions
- instrumentation problems

This document discusses the data quality implications of paper vs. digital field forms. It also provides a Field Data Quality Checklist with a list of factors that, when considered, can improve field data quality and address many of the issues noted above. For full definitions of the data quality attributes used in this document, such as correctness, completeness, and consistency, refer to the Using Data Quality Dimensions to Assess and Manage Data Quality subtopic sheet.

2 PAPER VERSUS DIGITAL FORMS AND IMPACTS ON DATA QUALITY

The Field Data Collection Process Development Considerations Fact Sheet discusses the design considerations for selecting a paper field data collection form or a digital form. The decision to use paper or digital field forms has implications for field data quality as well. Field data correctness, completeness, and consistency all benefit from a well-designed and implemented digital field form. While switching from a paper to a digital field form may seem like an insurmountable challenge due to up-front time, cost, and training requirements, the data quality benefits that a digital field form can provide should be considered.

Field data correctness, which refers to measurements that are accurate and precise, is often improved when digital field forms are used. For example, digital field forms eliminate the need to transcribe data that has been handwritten, thus preventing the errors and misinterpretations that may arise from poor handwriting, dirty or damaged paper forms compromised by harsh environments, or lost forms. Many digital field forms present users with a list of acceptable reference values to choose from, ensuring that only accurate data is entered into the form. Moreover, a digital field form may be coded with acceptable ranges or historical values, so users can check in real-time if their data are accurate and quickly identify and correct any issues that may arise. With these built-in checks, errors can be caught and rectified immediately, eliminating the need for an additional (future) field event.

Likewise, completeness of field data improves with the use of a digital field form. Field data are complete when all relevant and required information has been collected. Digital field data can be easily backed up or submitted to a database for storage, reducing the risk of losing data. Many digital field forms mark certain fields as required, presenting the user with an error or preventing them from saving or submitting their data if the required field is not populated. Digital field forms can also often be prepopulated with information. For example, a list of locations that require sampling may be prepopulated into

a digital form, and an error can be displayed if the user misses a location. Users of digital field forms may also compare their device's GPS coordinates to the coordinates prepopulated for a given location or scan a barcode/quick response (QR) code fixed to a sampling location to ensure they are collecting data at the correct location.

Data generated from a digital field form are typically more consistent, meaning the same type of information is always represented in the same way. For instance, many digital field forms establish naming schemas for locations or samples, so that all field data use the same naming protocols. Date/time formats, with preferences for time zone or military time, for example, can be coded into a digital field form to establish consistency. Historical data may be prepopulated into a digital field form so users can compare their current readings to those collected previously and identify any glaring inconsistencies.

While field data correctness, completeness, and consistency typically improve with the use of digital field forms, it is possible to collect high quality field data through well-designed paper forms. One technique to consider when using paper field forms is double data entry. Double data entry, in which data are entered twice by two different people, may be used to improve field data correctness by reducing errors that can occur when transcribing paper forms. Refer to the Field Data Collection Decision Tree to guide your decision to use a paper or digital field data collection solution. Situations may also arise in which a "non-form" approach is recommended, such as traditional ecological knowledge (TEK) interviews or collection of nonroutine, highly unique field data. Acquisition of TEK is discussed in the Traditional Ecological Knowledge Fact Sheet.

3 FIELD DATA QUALITY CHECKLIST

The Field Data Quality Checklist below is intended to improve the overall quality of data collected in the field. The objective of this checklist is not to explain how field work should be done, but instead to provide factors to consider to ensure field data of sufficient quality is produced. This checklist may be used regardless of whether paper or digital field forms are employed. Users may consider including this checklist in their data management plan (DMP) or quality assurance project plan (QAPP). Refer to the Data Management Planning Fact Sheet for a discussion of DMPs. This checklist serves as a guideline and may not be appropriate for all types of field data collection, such as interviews, surveys, or other unique observations. In those instances, users may want to define an alternate method for evaluating and tracking data quality reviews.

Instructions for Use: This checklist is organized into three sections:

I. *Prior to Field Event:* to be completed during the planning stage, prior to commencement of field work

II. *During Field Event:* to be completed by field staff while in the field

III. *After Field Event:* to be completed after the field event has ended

Certain items included in this checklist may not apply to a particular field event or organization. This checklist can be modified and adapted to meet your organization's needs. If a checklist item is not relevant, select "NA" for not applicable. It is assumed that field staff have been properly trained and have read and understood the project's DMP and QAPP prior to field work. See the Field Data Collection Training Best Practices Fact Sheet for additional information on training.

I. PRIOR TO FIELD EVENT

Do field staff understand the data quality objectives?	☐ Yes ☐ No ☐ NA
Are field staff aware of the expected nomenclature for the site, locations, samples, and descriptions?	☐ Yes ☐ No ☐ NA
Are field staff aware of the types and frequency of QA/QC samples to be collected?	☐ Yes ☐ No ☐ NA
• Do field forms incorporate the following design considerations where possible? ◦ auto completion/automated responses ◦ prepopulation ◦ built-in help documentation ◦ reference value lists ◦ conditional logic (See the Field Data Collection Process Development Considerations Fact Sheet for additional information on digital field form design.)	 ☐ Yes ☐ No ☐ NA ☐ Yes ☐ No ☐ NA ☐ Yes ☐ No ☐ NA ☐ Yes ☐ No ☐ NA ☐ Yes ☐ No ☐ NA ☐ Yes ☐ No ☐ NA

Is the historical data available (printed or downloaded) for field reference?	☐ Yes ☐ No ☐ NA
Is equipment ready (calibrated, serviced, charged, and inspected)?	☐ Yes ☐ No ☐ NA
Has calibration information been recorded?	☐ Yes ☐ No ☐ NA

II. **DURING FIELD EVENT**

Is field documentation complete?	☐ Yes ☐ No ☐ NA
Is field documentation accurate?	☐ Yes ☐ No ☐ NA
Is information consistent across all field documents?	☐ Yes ☐ No ☐ NA
Is handwriting legible?	☐ Yes ☐ No ☐ NA
Is spelling correct?	☐ Yes ☐ No ☐ NA
Are dates/times in the proper format?	☐ Yes ☐ No ☐ NA
Are values within acceptable ranges?	☐ Yes ☐ No ☐ NA
Are values consistent with historical data?	☐ Yes ☐ No ☐ NA
If values are *not* consistent with historical data, is this outcome valid or expected?	☐ Yes ☐ No ☐ NA
Are calculations correct?	☐ Yes ☐ No ☐ NA
Have all planned activities been completed and/or samples been collected?	☐ Yes ☐ No ☐ NA
• Have appropriate field QC samples been collected? For example: ◦ field blanks ◦ equipment/rinsate blanks ◦ trip blanks ◦ field duplicates ◦ split samples ◦ matrix spike/matrix spike duplicates	☐ Yes ☐ No ☐ NA ☐ Yes ☐ No ☐ NA ☐ Yes ☐ No ☐ NA ☐ Yes ☐ No ☐ NA ☐ Yes ☐ No ☐ NA ☐ Yes ☐ No ☐ NA ☐ Yes ☐ No ☐ NA
Have all necessary documents been signed?	☐ Yes ☐ No ☐ NA

III. **AFTER FIELD EVENT**

Has field documentation been reviewed by subject matter expert(s)?	☐ Yes ☐ No ☐ NA
Has field information been accurately transcribed into a digital format?	☐ Yes ☐ No ☐ NA
Have field data been loaded correctly into the database?	☐ Yes ☐ No ☐ NA
Have field data been stored, backed up, and secured?	☐ Yes ☐ No ☐ NA
If QA/QC issues have been identified, have corrective actions been put in place for future field events?	☐ Yes ☐ No ☐ NA

4 REFERENCES AND ACRONYMS

The references cited in this fact sheet, and the other ITRC EDM Best Practices fact sheets, are included in one combined list that is available on the ITRC web site. The combined acronyms list is also available on the ITRC web site.