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USACE / NAVFAC / AFCEC                  UFGS-01 31 20 (May 2022)


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Preparing Activity:  USACE              New



                    UNIFIED FACILITIES GUIDE SPECIFICATIONS

            References are in agreement with UMRL dated January 2025
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PROJECT TECHNICAL DATA MANAGEMENT AND VISUALIZATION

05/22

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SECTION 01 31 20

PROJECT TECHNICAL DATA MANAGEMENT AND VISUALIZATION
05/22

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        **NOTE: This guide specification covers the
        requirements for project technical data management
        and visualization.**

        Adhere to UFC 1-300-02 **Unified Facilities Guide
        Specifications (UFGS) Format Standard when editing
        this guide specification or preparing new project
        specification sections. Edit this guide
        specification for project specific requirements by
        adding, deleting, or revising text. For bracketed
        items, choose applicable item(s) or insert
        appropriate information.**

        **Remove information and requirements not required in
        respective project, whether or not brackets are
        present.**

        **Comments, suggestions and recommended changes for
        this guide specification are welcome and should be
        submitted as a** Criteria Change Request (CCR).

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PART 1   GENERAL

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        **NOTE: This specification has been developed from
        lessons learned over a decade of DoD mega contracts,
        and input from the data management industry. What
        this has taught us is where the Contractor fully
        understands the activities and efforts associated
        with the collection and display of data during the
        bidding process, the more successful they are in
        providing what the Government requires from its
        system. It has also taught us that the
        enforceability of a specification depends on
        specific measures such as turnover times, government
        approval submittals, work product expectations, and**

dedicated measurement and payment for features.

The data management system's primary function is to ensure quality construction that meets the organization's regulatory requirements, meets time and budget constraints. None of these components have been added frivolously but were thoughtfully developed with the hindsight of lessons learned on other mega contracts which resulted in significant additional cost, or a failure of some or all aspects of the system to meet the Government's needs.

Good data management system design relies heavily on communication and a common understanding of technical designer and construction office during the design process considering the project staff's technologic capabilities and the scope of the project. This communication is required to adequately customize this specification. It is strongly recommended to be as specific as possible about government goals and expectations and design the system and products with the same amount of detail as any other feature of work.

The Government has specific cybersecurity, project documentation, as built drawing specifications and software constraints defined by our security protocols and engineering regulations. Therefore, writing a vague, performance style specification without a thorough description of these needs and constraints - placing the onus entirely on the contractor to premeditate government needs - is not appropriate. A specification that is adequately descriptive but with room for contractor innovation will lead to better biddability, and a better understanding of the Government's goals and desired end products. This will lead to a better overall outcomes and avoid lengthy submittal processes and disagreements with the Contractor to arrive at acceptable workflows and deliverables.

Tailoring options have been added for:

SQL RDBMS EDB (for use of SQL RDBMS - generic database language which must be customized will remain even if this option is removed. Choose this option OR ACCESS ENTERPRISE DATABASE, not both)

ACCESS ENTERPRISE DATABASE (for small projects where Access is more appropriate choose this option - if removed generic database language will remain. Choose this option OR SQL RDBMS EDB, not both)

WEB INTERFACE Utilize this option for all types of web interfaces - spatial and non-spatial. This option contains the general requirements for security, accessibility and QA tools.

WEB-BASED GIS INTERFACE Utilize this option for

web-hosted GIS models such as ESRI ArcGIS on a federated ArcServer platform.

DYNAMIC DATA WEB INTERFACE Utilize this option for web-hosted data visualizations such a Microsoft PowerBI, QLIK, Tableau. to show data plots and analytics on testing or installation QC data.

DESKTOP GIS FILES Utilize this option for the receipt of files for GIS desktop products in the full-scale version of the software. This is different from the GIS web viewer in that you have the source files that can edited and republished to the Agency web service. The GIS web viewer is limited to viewing only and will no longer be available after the contract ends.

OPENGROUND USACE users should use this option for all boring data. If no rock or soil boring data will be collected, or if a different software format will be used, do not use this option.

SAMPLE DATA DELIVERABLES Intended to give a sample of the types of requirements that need to be detailed for different types of work. In a perfect world, these requirements would be placed in the feature of work section which details the work requirements.

ADDITIONAL DATA COLLECTION PLAN SUBMITTALS Contains sample data collection plans for the collection of automated grouting data and remote sensing data such as LiDAR, imagery, and photogrammetry. This option may become redundant if a grouting and remote sensing guide specification is published.

CAD 3D MODEL Utilize this option if Section 01 78 00 CLOSEOUT SUBMITTALS is not properly descriptive of standards and requirements for a spatially referenced CAD model.

CAD QUALIFICATIONS AND ROLES Utilize this option is Section 01 78 00 CLOSEOUT SUBMITTALS is not properly descriptive of qualifications for CAD personnel.

DATA VISUALIZATION SPECIALIST Utilize this option if this role is desired in addition to a data manager. See PART 1, PERSONNEL for a description of the position and notes about when it should be considered for use.

SDSFIE Utilize this option only if there is SDSFIE schema available for data to be collected on the project.

NETWORK INFRASTRUCTURE Utilize this option only if the project requires the Contractor to provide internet connectivity to the site for themselves or the Government.

1.1   MEASUREMENT AND PAYMENT

1.1.1   Develop The Data Management System

1.1.1.1   Payment

Payment will be made for development and delivery of products to provide a
complete and fully functioning data management system, as specified herein
and in the Contract documents including [required preconstruction
submittals, complete construction and testing of the enterprise database
(EDB), all components of the web-based GIS/dynamic data interface, a
functional SFTP site, data management planning meeting completion,
delivery of the initial training session, and approval of the quick
reference guide. Related costs include, but are not limited to, uploading
of all existing data as provided by the Government into the data
management system, initial design, build, scripting, and populating layers
the web interface and desktop GIS products, and including incidental items
per the Contract documents.] All incidental costs associated with the
performance of work in this section are included in the Contract price.
The Government will make no additional separate payment for items included
herein or by reference.

1.1.1.2   Measurement

Measurement for payment of DEVELOP THE DATA MANAGEMENT SYSTEM will be paid
in one lump sum. Payment for the data management system will be made after
completion of the following work:

[a.   The data management staff have been submitted and approved,

  b.   All preconstruction submittals have been submitted and approved,

  c.   The data management planning meeting with the Government has been
       conducted,

  d.   The 100 Percent Data Management Plan (and all related addenda)
       submitted and approved,

  e.   The initial training session has been conducted, and the quick
       reference guide submitted and approved, and

  f.   The database, web interface and GIS being fully developed to 95
       percent including all available design features and historical project
       data loaded to the system, as submitted/demonstrated by the Contractor
       and approved by the Government. The five percent will account for any
       changes needed just prior to the start of work for which various
       components of the system has been built, or testing required to be
       conducted once initial data has been received.]

1.1.1.3   Unit of Measurement

Unit of Measurement: Lumps Sum (Ea).

1.1.2   Maintain The Data Management System And Turnover Of Final Products

1.1.2.1   Payment

Payment will be made on a monthly basis for the maintenance of the data
management system in a fully functional state with 24/7 accessibility by
the Government, and up to date as specified in PART 1, "Data Turnover
Timeframes". This includes the enterprise database, SFTP site, Web
Interface, and desktop GIS components to be up to date (as defined by the
turnover time requirements) at all times, and timely resolution of any
issues with data correctness, completeness or other quality control
measures identified by the Government as defined in this contract.

These payments include the timely submittal of all required data, digital
CAD and GIS products, progress drawings, periodic as-built updates, and
reports - as required by this and other sections of the Contract -
throughout the Contract duration. This item includes all required support
staff. This item also includes all final turnover items detailed in Part
Three, FINAL EDB TURNOVER, PART 1, SUBMITTALS, SD-11 CLOSEOUT SUBMITTALS,
and throughout this section. An amount not to exceed 10 percent of the
total payments may be withheld if the Contractor fails to perform the
required work. All incidental costs associated with the performance of
work in this section are included in the Contract price. The Government
will make no additional separate payment for items included herein or by
reference.

1.1.2.2   Measurement

Measurement of payment for MAINTAIN THE DATA MANAGEMENT SYSTEM AND
TURNOVER OF FINAL PRODUCTS will be made monthly for work completed and
submitted as described above for the duration of the Contract activities
for which the data management system applies.

1.1.2.3   Unit of Measure

Monthly (Mo) for the number of months which data management work is
ongoing.

1.2   REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 19110   (2016) Geographic Information Methodology for Feature Cataloguing

ISO 19115-1   (2014) Geographic Information -- Metadata -- Part 1: Fundamentals

ISO 19115-2   (2019; AMD 1 2022) Geographic Information — Metadata — Part 2: Extensions for Acquisition and Processing

ISO 19119   (2016) Geographic Information - Services

ISO TS 19139-1   (2019) Geographic Information — XML Schema Implementation — Part 1: Encoding Rules

U.S. ARMY CORPS OF ENGINEERS (USACE)

ERDC/ITL TR-19-7   (2019) A/E/C CAD Standard - Release 6.1

U.S. DEPARTMENT OF DEFENSE (DOD)

SDSFIE Standards   Spatial Data Standards for Facilities, Infrastructure, and Environment

1.3   DEFINITIONS

1.3.1   Data

A representation of facts, concepts or instructions in a structured, semi-structured or unstructured format, suitable for processing and interpretation by humans or machines. Records generated by any activities related to features of construction detailed in this Contract or by any

instrumentation or monitoring equipment or processes in use on the
project. Includes raw data generated by automated collection systems,
recorded manually on paper or tablets, and data tables and databases and
their constituent records which can be used with custom or off-the-shelf
software.

1.3.2   Data Cleaning

The process of preparing data for analysis by correcting or qualifying
data that is incorrect, incomplete, irrelevant, duplicated, or improperly
formatted.

1.3.3   Data Management

The identification, definition, collection, organization, verification,
correction, storage, protection, processing, communication, and transfer
of data in order to maintain project records in an organized, complete,
and rapidly accessible archive for immediate and future use.

1.3.4   Data Management System (DMS)

The hardware, software and network components, architecture, policies,
technical processes, and workflows that efficiently manage data and
information for the duration of the contract-required activities.

1.3.5   Data Validation/Verification

The process of checking the accuracy and quality of source data before
using, importing or otherwise processing data. The same process as data
QA or QC. One form of data cleaning.

1.3.6   Documented Enterprise Database (EDB)

A relational database hosted on a server that is utilized to contain,
organize, and relate large collections of data stored in individual
tables. Capable of handling a range of 100 or more users at a time, and
running queries of multiple users simultaneously. A database that is
"documented" has detailed written documentation of the schema, in which
all items from DEFINITIONS "Schema" are provided in table format, as well
as an accompanying entity relationship diagram supplemented with
explanatory text.

1.3.7   Metadata

A set of data that gives information about data. For geospatial data this
includes information about the feature or dataset location in space (i.e.
datums, projections, resolution, collection resolution and accuracy, and
other common requirements), entered into the appropriate form in the GIS
software platform; as well as information about the data attributes
(units, assumptions, sources, and other common information). File
metadata are stored in a text file with the same name as the target file.
Database metadata are stored in table descriptions or in appropriately
labeled metadata fields.

1.3.8   Relational Database Management System (RDBMS)

Relational Database Management System. A type of database management
system (DBMS) that stores data in a row-based table structure which
connects related data elements. An RDBMS includes functions that maintain

the security, accuracy, integrity, and consistency of the data.

1.3.9   Report

  Any data or information in a format designed for human communication,
  where file format is not tabular but comprised of conceptual narrative,
  formatted tables, or static visualizations, and the contained data is
  either static or requires conversion to other file formats or manual
  cleaning or entry for aggregation, processing and analysis by machines.

1.3.10   Schema

  Also referred to as "database schema", it is the logical structure of the
  of the database.   Schema consists of the following database elements:

            (1) Table definitions and names;
            (2) Field names;
            (3) Field definitions;
            (4) Field types (constraints), including precision and units for
            numeric fields;
            (5) Primary and Foreign Keys (to determine table relationships);
            (6) Field default values;
            (7) Domains;
            (8) Calculated fields and the calculations and equations to
            produce values that populate them;
            (9) Selected database views required to produce values displayed
            in the web interface, used to derive reports, for ongoing CAD/GIS
            feature generation, or as requested by the COR.

1.3.11   Secure File Transfer Protocol (SFTP)

  Also SSH File Transfer Protocol, a networked protocol to handle file
  transfers between computers over the internet.   It provides file transfer,
  access and management over a secure connection communicating on server
  data port 22. This should not be confused with similarly-named "Simple
  File Transfer Protocol" which operates on server data port 115, and does
  not meet the requirements of an SFTP site for the purpose of this contract.

1.3.12   Tabular Data

  Any structured or semi-structured numerical or qualitative facts in a
  character-limited field and record format.   Suitable for processing by
  machines with minimal human interpretation, cleaning or processing, and in
  a file format suitable for importing into a database software program
  without any structural changes to the file.

1.3.13   Tag

  A keyword or term applied to a computer file that is stored in the file
  metadata that can aid in searching for that file or document.   Most
  commonly used with files such as imagery to aid in computer-based
  searching.

1.4   ADMINISTRATIVE REQUIREMENTS

1.4.1   Data Management Planning Meeting

****
            NOTE: This meeting was added as a forum for getting

the initial setup of the Contractor's data
management system to meet the Government's
expectations and goals and give the Government
insight into the limiting factors for turnover times
and other requirements. The meeting circumvents
using the submittal process to accomplish that. It
allows the Government to have an immediate feedback
about what kind of time requirements for turnover
are realistic, and to set expectations, determine
workflows, discuss schema changes to the database,
and build rapport. Adjust the length of this meeting
commensurate with the complexity and intensity of
data production of the project.

Covid-19 has changed many elements of how we do
business. If both parties are comfortable with
in-person meetings based on current transmission and
new case trends, it is recommended to have the
meetings in person to help build rapport. If
in-person meetings do not make sense given infection
rates on site or in the area where personnel will be
traveling from, this requirement can be relaxed by
the government. If the project thinks it might want
in-person attendance, leave the more stringent
requirement in the specification so that it can be
enforced as needed, however it can always be relaxed
later.

Tailoring option is available for "DATA
VISUALIZATION SPECIALIST" and "WEB-BASED GIS
INTERFACE".
****

Hold a collaborative meeting with the [Contracting Officer (COR)]
[Administrative Contracting Officer (ACO)] within 15 days of the approval
of all applicable SD-01 submittals. This collaborative effort will consist
of a meeting over [_____][4 full consecutive business] days, where primary
Contractor and data management Contractor (if subcontracted) each provide
in-person attendance. The data manager, data visualization specialist, and
data management QC must physically attend this meeting with [COR][ACO] in
order to facilitate the building of rapport and efficient communication.
Additionally, personnel from each subcontractor having technical knowledge
of data collection and processing for that subcontractor's features of
work must also attend this meeting in person during designated days to be
decided in the agenda. The meeting must not take place until submittals
from paragraph SUBMITTALS - SD-01 are received and approved including:

      (1) 50 Percent Data Management Plan
      (2) Automated and Manual Data Collection Output Examples
      (3) Data Cleaning and Verification Plan
      (4) QC Data Collection Plan
      (5) Backups, Archiving And Disaster Recovery Plan
      (6) Data Transfer Workflow
      (7) Data Management System Demobilization Plan

The goals of this meeting are:

a. To provide a venue for problem-solving on data requirements and
    workflows;

b. Discuss and decide on needed changes to the database schema;

c. To view, discuss and provide feedback on the web interface displays and functionality as specified;

d. Discuss and provide feedback on the SFTP file organization structure;

e. Discuss and resolve any Government questions about Contractor workflows as detailed in submittals;

f. Presentation and discussion of any Contractor-proposed changes to methods of execution;

g. Development of field data collection app form formats and associated products (if applicable);

h. Collaborate to support the Contractor in submittal of a 100 Percent Data Management Plan that meets the Government's expectations - including documentation of all requested or agreed changes to facilitate completion of the 100 Percent Data Management Plan submittal;

i. To establish a working rapport between all data management personnel;

j. To communicate and clarify the specific goals and expectations of the Government with respect to any part of the data management system.

****
            NOTE: The following paragraphs are needed on large
            contracts with multiple features of work where the
            subcontractor for certain features will not be on
            site at the time of the initial data management
            planning meeting. In these cases, the methods and
            equipment which determine database schema, report
            formats, turnover times, and others may not be known
            until years after the NTP. It then becomes necessary
            to have a special planning meeting for each of these
            features due to timing.
****

1.4.2   Additional Planning Meetings

An additional data management planning meeting specifically for the [_____][Cutoff Wall][Concrete Placement][Excavation][Grouting] is required no later than 30 days prior to the start of work on that feature. For any feature of work where the data-generating Contractor will not be on site, and specific data-generating equipment will not be detailed until the start of that work which would affect the data management system, hold a specific data management planning meeting no later than 30 days prior to the start of work on that feature. These delayed coordination meetings must be of at least [_____][4 hours] duration (or as directed by COR) and must not be combined with other kickoff or coordination meetings. All the same personnel are required to be in attendance as the initial data management planning meeting.

1.4.3   Coordination and Technical Meetings

The Contractor's Data Manager, or another employee that can act competently on their behalf, must participate in recurring data management

technical meetings as needed, scheduled at [COR][ACO] request. These
meetings will be critical prior to, and at the start of work for which
intensive or voluminous data collection will take place, but are not
intended to be ongoing weekly throughout the entire project. For bidding
purposes assume monthly meetings for the duration of work. Conduct these
meetings in order to ensure the timely and adequate collection,
formatting, quality, and flow of data from site to the EDB, SFTP site, and
web interface, and to troubleshoot any recurring problems. These meetings
are also a venue for collaboration to solve technical problems, make data
management progress updates, give feedback, and make technical decisions
about data.

Include high level data management updates in the overall weekly
coordination meeting for the project.

1.5   SUBMITTALS

****
            **NOTE: Review submittal description (SD) definitions
            in Section** 01 33 00 **SUBMITTAL PROCEDURES and edit
            the following list, and corresponding submittal
            items in the text, to reflect only the submittals
            required for the project. The Guide Specification
            technical editors have classified those items that
            require Government approval, due to their complexity
            or criticality, with a "G." Generally, other
            submittal items can be reviewed by the Contractor's
            Quality Control System. Only add a "G" to an item,
            if the submittal is sufficiently important or
            complex in context of the project.**

            For Army projects, fill in the empty brackets
            following the "G" classification, with a code of up
            to three characters to indicate the approving
            authority. Codes for Army projects using the
            Resident Management System (RMS) are: "AE" for
            Architect-Engineer; "DO" for District Office
            (Engineering Division or other organization in the
            District Office); "AO" for Area Office; "RO" for
            Resident Office; and "PO" for Project Office. **Codes
            following the "G" typically are not used for Navy
            and Air Force projects.**

            **The "S" classification indicates submittals required
            as proof of compliance for sustainability Guiding
            Principles Validation or Third Party Certification
            and as described in Section** 01 33 00 **SUBMITTAL
            PROCEDURES.**

            **Tailoring options are available for "ADDITIONAL DATA
            COLLECTION PLAN SUBMITTALS", "DATA VISUALIZATION
            SPECIALIST", "WEB-BASED GIS INTERFACE", "DESKTOP GIS
            FILES", "CAD 3D MODEL", "CAD QUALIFICATIONS AND
            ROLES", and "OPENGROUND".**
****

Government approval is required for submittals with a "G" or "S"
classification. Submittals not having a "G" or "S" classification are for
Contractor Quality Control approval. Submittals not having a "G" or "S"

classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

50 Percent Data Management Plan; G, [_____]

****
        NOTE: The intent of a Data Management Plan is to
        ensure that all data processes and policies are
        fully documented, and that the Contractor fully
        understands the expectations of the Government. The
        50% Data Management Plan is the Contractor's first
        attempt to document their data management system.
        The finalization of the plan will be a collaborative
        effort, with the Government and the Contractor
        collaborating on the final 100 Percent Data
        Management Plan, which will be submitted by the
        Contractor after Government input during the data
        management planning meeting. For some data,
        supplied to the Contractor by the Government, these
        sections may need to be written by the Government
        and supplied to the Contractor.
****

Automated and Manual Data Collection Output Examples; G, [_____]

****
        NOTE: csv, ASCII - which are common standard open
        data formats - are readable by MS Excel. Other
        programs than Excel can be used if the other program
        is nearly universally available at the home
        district. This is for ease of data sharing as needed
        among the construction and design teams. PDF
        captures the static view of the data but prevents
        data from easily being added to a database. It is
        used primarily for data verification purposes, with
        a static view that is more difficult to change for
        the purposes of QA/QC. Excel readable files (or
        database tables) allow the data to be better
        searched and analyzed and more easily ported into a
        database without the need for re-typing data that
        was already generated by a computer.
****

Data Cleaning and Verification Plan; G, [_____]

QC Data Collection Plan; G, [_____]

QC Daily Information Collection Plan; G, [_____]

Backups, Archiving And Disaster Recovery Plan; G, [_____]

Data Transfer Workflow; G, [_____]

Data Management System Demobilization Plan; G, [_____]

100 Percent Data Management Plan; G, [_____]

Proposed Changes To The Enterprise Database Schema; G, [_____]

Web Interface; G, [_____]

Quick Reference Guide; G, [_____]

****
NOTE: The following preconstruction submittals are
ONLY to be included when the specification section
covering the work does not already require one. They
become especially important to understand what data
will be collected in a performance specification
where a methodology is not specified and so the
Government will not know the details of the data
collection until a proposed method is approved.
These plans are samples based on common features of
work. Customize the requirements, and add any
additional plans as needed.
****

Automated Grouting And Water Pressure Testing Data Collection Plan; G, [_____]

Remote Sensing Data Collection Plan; G, [_____]

System Testing; G, [_____]

SD-05 Design Data

GIS Files; G, [_____]

SD-06 Test Reports

Photograph PDF'S; G, [_____]

Digital Photographs; G, [_____]

Database Files; G, [_____]

Digital 3D CAD Model Files; G, [_____]

SD-07 Certificates

Data Manager; G, [_____]

Data Visualization Specialist; G, [_____]

CAD Technician(s); G, [_____]

CAD Supervisor; G, [_____]

SD-10 Operation and Maintenance Data

Data Management Plan Updates; G, [_____]

Data Transfer and QC Reports; G, [_____]

Ongoing Schema Updates; G, [_____]

        Web Interface Updates; G, [_____]

    SD-11 Closeout Submittals

        Data Management System Demobilization Plan Updates; G, [_____]

        Finalized Enterprise Database; G, [_____]

        Finalized OpenGround Cloud Borehole Database; G, [_____]

        Final File Indexes; G, [_____]

        Data Management Manual; G, [_____]

        Final GIS Files; G, [_____]

1.6   PERSONNEL

1.6.1   Qualifications

1.6.1.1   Data Manager

  The data manager must have the following verifiable credentials:

  a. Have a minimum of [_____][5] years of advanced experience occurring in
      the past [_____][8] years overseeing the import, cleaning,
      verification, processing, storage, backup and scripted transfer of
      construction data, similar to the type that will be generated by work
      in the contract.

  b. Have a minimum of [_____][5] years' experience occurring in the past
      [_____][5] years designing and editing [SQL][MS Access] enterprise
      databases utilizing an RDBMS such as MS SQL Server.

  c. Have served as the data manager on at least two construction projects
      of similar complexity, with similar data production volume and data
      management requirements. Each project should be described in the
      resume detailing the data management tasks performed.

  d. Be approved by the [COR][ACO] before any data is transferred into the
      EDB.

  Submit the resume for approval within 15 calendar days after notice to
  proceed.

1.6.1.2   Data Visualization Specialist

  The Data Visualization Specialist is responsible for the design,
  deployment, and maintenance of the spatial (GIS) and dynamic data web
  interface, and must have the following verifiable credentials:

  a. Have a minimum of [_____][3] years of experience in use of
      [_____][ESRI ArcGIS Pro and ArcGIS Online];

  b. A current working knowledge of cartographic design and geoprocessing

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methods to produce the required visualizations in planimetric, profile and 3D views;

c. Have a minimum of [_____][3] years of experience utilizing data visualization software such as Power BI, Qlik, PowerPivot, Tableau, Python/R data visualization/data science libraries, or equivalent web tools that will be used by the Contractor to meet the specification requirements.

d. Have performed similar work for one other construction project of similar size and complexity to this contract, and containing similar [geotechnical, civil and structural] engineering work.

Submit the resume for approval within 30 calendar days after the notice to proceed. Provide in the resume samples of the individual's work, including maps, visual analytics and other graphics that demonstrate the individual's analytical and problem-solving skills, and maximization of the tools to meaningfully visualize technical datasets.

1.6.1.3   CAD Supervisor

All CAD work must be completed under the supervision of a CAD supervisor with at least 10 years of CAD experience, [_____][5] years of which is in [_____][AutoDesk AutoCAD][Bentley MicroStation][Open Roads Designer SS4], and who has produced as-built drawings for a Contract of similar scale and complexity.

Submit resume for approval within 30 days of the notice to proceed including relevant education and experience, and details of previous work on the qualifying Contract as-builts. All CAD personnel must be approved by the [COR][ACO] prior to performing work as part of this contract.

1.6.1.4   CAD Technician(s)

The CAD technician(s) are responsible for the completion of all required prefinal and final as-built drawings and all digital 3D CAD model files in accordance with the requirements specified in Section 01 78 00 CLOSEOUT SUBMITTALS.

All CAD Technicians employed on the project must have at least [_____][3] years of experience utilizing [_____][AutoDesk AutoCAD][Bentley MicroStation][Open Roads Designer SS4]. In addition, at least one CAD technician must have at least [_____][3] years of experience utilizing [_____] [Autodesk Revit and Inventor]. Submit resume for approval within 30 days of the notice to proceed including relevant education and experience, and details of previous work on the qualifying Contract as-builts. All CAD personnel must be approved by the [COR][ACO] prior to performing work as part of this contract.

1.6.2   Roles and Responsibilities

1.6.2.1   Data Manager

The Data Manager is responsible for:

a. Population, maintenance, quality control, and oversight of the Contractor's Data Management System and components;

b. Coordination with data collection professionals from the primary

Contractor and sub-contractors, QC personnel, and other parties performing work on and offsite as necessary to obtain data;

c. Automated and manual input of data into the enterprise database (EDB);

d. Ensuring all data generated physically or digitally during construction is captured, converted, cleaned, validated, QC-checked, and organized in the appropriate tabular and non-tabular formats as described in this specification;

e. Coordination with all other data management personnel to ensure data flows efficiently from site to database to visualizations or other end use;

f. Scripting of autogenerated reports required in this specification;

g. Automated and manual transfer of database .csv and backup files, non-tabular files, raw data, and all other documents to the SFTP site within the specified turnover timeframes;

h. Develop and oversee the processes for QC review of data entered into the EDB as required by this specification;

i. Develop and oversee the processes for backups of data as required by this specification;

j. Participate in all data-related technical meetings and report and speak on technical data matters when requests are made by the Government.

k. Author and compile the data management plans and other data-related submittals.

l. Provide username and password access to platforms required by this specification including the web interface and SFTP site, and any web applications utilized;

m. Work with the Data Management QC to develop and incorporate the workflows for integrating QC data into the data management system (via digital collection methods and automated transfer processes as applicable);

n. Design forms for QA digital data collection and processes to facilitate direct input of data by the Government to the web interface/ database (as applicable).

o. All other data management tasks not specifically assigned.

If the Data Manager does not know how to execute any part of the technical processes needed to accomplish any work specified, provide them with the appropriate training. Provide training within 30 days of the data management kickoff meeting.

1.6.2.2   Data Visualization Specialist

The Data Visualization Specialist is responsible for:

a. Development, deployment, maintenance and updates of the web-based GIS and dynamic data display interfaces. Including all specified

visualizations and graphical representations of data to communicate
project progress, construction quality, and as applicable dam/life
safety monitoring;

b. Coordination with the Government's data manager to design and edit
data displays for maximum comprehension by Government personnel;

c. Development and maintenance of the desktop ArcGIS Pro projects and
source files (.aprx, .gdb, feature classes, rasters, and other GIS
products);

d. Assisting the Contractor's Data Manager in authoring and compiling the
Data Management Plan for all visualization duties, GIS metadata and
other documentation;

e. Working with the Contractor's data manager to provide scripted and
digital updates to the visualizations whenever possible. Utilizing
spatial data collected from the field that is outside of the database;

1.6.2.3   CAD Supervisor

The CAD supervisor is responsible for:

a. Quality Control of the CAD Technician work.

b. Ensuring proper use of advanced CAD tools and functions including the
use of the [_____][eTransmit][Packager] tool and the proper export and
transmittal of digital model files so that the full functionality of
layers, data files, annotation, and other functions, are retained upon
transmittal.

c. Ensuring the correct use of A/E/C CAD standard [_____][R6.1],
contained in reference ERDC/ITL TR-19-7, in the creation of the
digital CAD model and as-built drawings.

d. Ensuring the features in the 3D digital CAD model are geospatially
referenced to the project survey control and incorporated using the
correct horizontal and vertical datums.

e. Ensuring the inclusion of all required drawing elements and formatting
as specified in Section 01 78 00 CLOSEOUT SUBMITTALS, and other
feature of work sections of the contract.

f. Acting as a point of contact (POC) for any needed corrections or
changes to either the preliminary as-built submissions or the 3D CAD
model, or directly assigning a POC to interface with the Government as
needed to address corrections and changes.

1.7   EXISTING DATA

The Government will provide existing data for use by the Government in the
data management system including but not limited to [_____][boring logs,
CAD drawings, and GIS feature classes and rasters]. The Government will
provide all files via the SFTP site once it has been established.

1.8   DATA REQUIREMENTS

****
NOTE: This section is comprised of industry and

1.8.1   Data Integrity

Maintain integrity of data such that records are accurate and internally
consistent, that all data and records reflect the quality of the data
gathered on the site, and that all data is preserved and archived for
future use.

1.8.2   Data Ownership

All data generated on-site by [_____][instrumentation, monitoring,
anchorage, excavation, construction equipment, sampling, concrete and soil
testing, grouting, blasting, surveying, concrete production, conveyance
and placement, tunneling, mapping, cutoff wall construction, equipment
calibration, maintenance], and all other data associated with the work
performed is the property of the Government. All calculations and
formulae and any constants or variables used to produce data, reports, or
analytical products are the property of the Government and must be
included in any required database fields, and turned over in an editable
or otherwise specified format upon request.

For any data to be excluded from the system, submit a written request for
a Government determination of whether data can be classified as
proprietary, along with a detailed justification. No data source is
exempt from these data requirements unless a specific exemption is
requested of and granted in writing by the [COR][ACO]. Under no
circumstances will "proprietary data" impede the Government's ability to
monitor construction, perform analyses, or evaluate the effectiveness of
construction.

1.8.2.1   Custom Algorithms

****

If software developed by or for the Contractor will be used for processing
of data provided to the Government, detail to the Government the
algorithms and procedures used to process the data. The Contractor
maintains ownership of its computer code, unless otherwise specified, but
must allow the Government access to the algorithms (with all
values/variables defined) and procedures to verify how the data is
processed so that the quality of the final data can be assessed.

1.8.3   Disclosure of Data or Advertisement of Project

Do not disclose any project data to third parties, and do not publish any
data without prior written approval of the [COR][ACO]. Request and
receive permission in writing prior to publishing or presenting any data
from the project to any third parties not associated with this contract,
this includes data with project references removed. If the data
management system is the subject of any Contractor-produced papers, proper
design credit must be explicitly attributed to the Government's data
management designers, as well as appropriate Contractor/subcontractor
personnel.

1.8.4   Backups, Archiving and Disaster Recovery

Avoid data loss by backup and archival of all digital and paper data
records from the time of data generation until final data turnover. This

includes having specific policies, workflows, and infrastructure in place to archive and have redundant backups on servers in either a commercial cloud computing platform or multiple locations according to industry standard practice. Address backups, archiving and disaster recovery plans in the appropriate submittal, as specified in paragraph SUBMITTALS, SD-01 Preconstruction Submittals.

If a data loss occurs, the Contractor is responsible for regeneration of the data. Any data which are re-generated from a non-primary source must be clearly noted in the record as shown in the EDB. Backup data within 24 hours of generation. Should a data loss occur, even if is within this 24-hour window, the Contractor is responsible for all steps necessary to recover from this data loss and will receive no additional payment for these data recovery efforts. Notify the [COR][ACO] of any data loss in writing within 12-hours of discovery that it has occurred.

****
          NOTE: This section is needed to establish the
          expectation of industry-standard data backup
          routines on projects and assign ownership of all
          data loss risk to the Contractor. 24 hours is
          industry standard for backup times and should not be
          increased.
****

1.8.5   Contractor Quality Control of Technical Data Including Metadata

Verify and perform cleaning (see definitions provided in paragraph DEFINITIONS) of all tabular data entered into the databases including at a minimum:

          (1) Verification of completeness of records such that all records
          are completed with all data within required turnover times;
          (2) Correction of entry errors;
          (3) Verification of source field data;
          (4) Data review for verification of entry correctness;
          (5) Consistency and accuracy of naming convention;
          (6) Consistency and accuracy of field formats;
          (7) Standardized character entry of fields and records, for
          example consistent use of spelling, capitalization, spaces and
          special characters (where allowed);
          (8) Entry of required QC or correction metadata associated with
          the records (per paragraph RECORD TRACKING REQUIREMENTS).

Conduct this process in accordance with all procedures and policies outlined in the submitted and approved "Data Cleaning and Verification Plan" in paragraph SUBMITTALS, SD-01 Preconstruction Submittals. See paragraph DATA TURNOVER TIMEFRAMES for turnover time requirements.

1.8.6   Raw Data Requirements

1.8.6.1   Digital Raw Data

Submit raw digital data files for any data gathering system used on the project in accordance with the following:

****
          NOTE: The types of data that will be expected by
          the design team should be listed above. The list in

a. Provide these files in a format readable by the current version (at
    the time of the contract) of Microsoft Excel, such as a tab-delimited
    ASCII file, a CSV file, or other format readable by MS Excel.

b. To the extent possible, use data gathering systems that will generate
    "non-proprietary" or industry standard format data files readable in
    ASCII, CSV or with Microsoft Excel. Any necessary export or
    conversion, or software required to perform conversions, will be
    completed at the Contractor's expense.

c. Label all data columns so that it is apparent what data they contain,
    and provide metadata to [COR][ACO] including units, any formulae used
    to calculate the data, and any criteria used to generate the data.
    Detail metadata for these files in the Data Management Plan or in
    addenda to that plan as appropriate.

d. Where these files as generated are not directly readable by Microsoft
    Excel, submit raw data to the [COR][ACO] in their raw format and in a
    second file created in Microsoft Excel with column headings that
    include units.

e. Detect and correct any inconsistencies, mistakes, missing records or
    fields, or other anomalies in the data that may be generated through
    use of automated data collection systems - including but not limited
    to the automated grout monitoring and data collection system, and the
    instrumentation data collections system. Provide a written
    explanation of the nature and cause of any anomalies, and any
    corrected records within 48 hours of the resolution of the anomaly.
    Paragraph RECORD TRACKING REQUIREMENTS, Items 7-9 apply to corrections
    made as required in this section.

f. All data columns must be labeled so that it is apparent what data they
    contain, and metadata provided to [COR][ACO] including units, any
    formulae used to calculate the data, and any criteria used to generate
    the data. Metadata for these files must be detailed in the Data
    Management Plan or in addenda to that plan as appropriate. For all
    files with the same structure, metadata may be provided for the set of
    data documents and is not required for every single file. Data
    included in the EDB data tables from these raw data sources may be
    uploaded from the data source to minimize any duplicate data entry of
    tracking data.

1.8.6.2   Analog Raw Data

Submit clear, complete, readable, center-justified digital scans or
photographs of all analog raw data collected for the project in accordance
with the following requirements:

a. All analog reports of raw data must be scanned and transferred to the
    Government via the Secure File Transfer Protocol (SFTP) site within 24
    hours of generation in the field.

b. Any data collected via manual methods must be entered into the
    database by the Contractor within 48 hours of field generation.
    Analog data entered in the database must include a field in the
    appropriate table of the database with a hyperlink to the scan of the
    analog file for URL referencing. Ensure coordinate X, Y, and Z of
    features are included for any data collected by analog methods and
    entered into the database table for the associated record.

c. Handwriting and scan quality must be clear and legible, and contain
    any related information needed to place the data in context, to which
    the raw data pertains.

d. Scanned digital files must be named according to the approved naming
    convention, and stored in the appropriate location of the SFTP
    according to the file structure organization provided in the
    attachments.

e. Adjust data collection forms utilized at any time at [COR][ACO]
    request.

1.8.7   Data Turnover Timeframes

****
          NOTE: Tailoring options are available for "DYNAMIC
          DATA INTERFACE" and "DESKTOP GIS FILES"
****

Provide all data from any automated data gathering system or manual
collection system which is not otherwise described specifically in the
feature of work sections, or this section, according to the following
requirements:

Data Format	Turnover Time	Turnover Location	Section
Raw Data Files	24 hours	SFTP	a
Converted Raw Data Files	24 hours	SFTP	b
Reports	24 hours	SFTP	c
Generated Data as required by data dictionary	24 hours	EDB/Dynamic Data Interface	c
Appended QC Data	48 hours	EDB/Dynamic Data Interface	d

Data Format	Turnover Time	Turnover Location	Section
QC Data collected synchronously to work	24 hours	EDB/Dynamic Data Interface	d
[Instrumentation Readings – Automated]	10 mins	Field Interface/Dynamic Data Interface	e
[Instrumentation Readings - Manual]	1 hour – or as directed by [COR][ACO]	USGS/MIDAS database as directed by [COR][ACO]/Dynamic Data Interface	e
[Cofferdam Piezometer Readings]	collect hourly 24 hours	EDB	f
[Seismograph]	10 mins	Seismic Website	f
[Concrete Thermal]	10 mins	Concrete Thermal Data Website	f
QC Verification of Data	72 hours	EDB	g
Metadata	72 hours	EDB	g
[GIS Project Package (.aprx)]	24 hours when updated	SFTP	h
[ESRI Geodatabase (.gdb)]	24 hours when updated	SFTP	h
Enterprise Database Tables (.csv)	[_____][24 hours]	SFTP	
Enterprise Database backup files	[_____][Quarterl	SFTP	

****
NOTE: All time frames listed in the table above and the text below have been reviewed for feasibility by industry practitioners and are considered appropriate. For small projects without significant concern for life safety or risk, or time-sensitive construction components, it may be appropriate to use longer time windows based on the amount of project staff, automation, and how often the Government needs to review the data being generated.

Customize the elements in accordance with the scope of this specification. For example if no GIS files are required, delete the associated text.
****

a. Submit all raw data within 24 hours of data collection to the [COR][ACO] via the SFTP site.

b. If conversion of this raw data is necessary in order for it to be readable by Microsoft Excel, submit this converted raw data file within 24 hours of data collection.

c. Transfer all non-tabular files (as defined in Part One, DEFINITIONS "REPORT") to the SFTP site within 24 hours of submittal to RMS unless otherwise stated elsewhere in the Contract.

d. Import data records into the Enterprise Database (EDB) within 24 hours of generation.

e. Enter or append, as applicable, QC data collected after the initial generation of data for a given feature of work to the appropriate records in the EDB within 48 hours of the QC data collection, except where specifically stated otherwise. Enter QC data for features of work being collected synchronously to the work within 24 hours of generation.

f. Provide near real time access to continuously-recorded automated data. Maintain accessibility to [COR][ACO] using hyperlinks in the secure web interface as described in Part 2 PRODUCTS or other sections of this contract. Make any manually collected data that is part of this system available in the reporting system no later than 24 hours after it has been gathered. Enter all required data into the SQL EDB within 24 hours if applicable.

g. C verify the data and provide data verification metadata within the appropriate table of the EDB, with appropriate relationships in the database created within 72 hours of initial data appearing in the EDB. For detailed QC requirements see PART 1, "Contractor Quality Control of Data".

h. 8) Provide the most recent version of the ArcGIS Pro .aprx, .gdb and raster datasets within 24 hours of an update (or nightly when updates are occurring daily), to the SFTP site. See PART 3, DESKTOP GIS FILES for details.

i. Make data available in the dynamic data interface within 10 minutes for continuously recorded automated data (e.g., all automated instrumentation). Make any manually collected data that is part of this system (e.g., instrumentation data) available in the reporting system no later than 1 hour after it has been entered into the EDB per the timeframes above, unless internet connectivity at the site causes the inability of rapid transmission from the collection device. In this case update the data within 8 hours or as directed by the [COR][ACO].

1.8.8   Record Tracking Requirements

****
        NOTE: The following record tracking practices are
        industry standard. The intent is to be able to
        understand the provenance and quality of data. They
        track when and how records were created, entered,
        and altered.
****

Each record entered into the Enterprise Database (EDB) must document the

following if not already specifically defined in the database schema, or
allowed by the Government to be non-applicable in the Data Management Plan:

a. Source of the record (e.g. laboratory information, sample ID,
    instrument name, name and affiliation of observer/tester/data
    gatherer);

b. Organization generating the data (e.g. [COR][ACO], Contractor,
    Contractor Laboratory);

c. Date and Time where data was created (e.g. when sample was taken,
    start and stop time of drilling or grouting, when observation was
    made);

d. Name of the data collector (when manually collected);

e. Date and Time data was entered into the system;

f. Name of the individual entering the data.

Where a complete record was modified after submission, document the
following:

g. Date/time any data in the system was modified;

h. Name of personnel who made the edit;

i. Reasons for the edit (e.g. where laboratory testing data is appended
    to a sample record, correction was requested by the Government,
    correction for entry error of analog data, or other edits).

1.8.9   Naming Conventions

****
            NOTE: Naming conventions are important for several
            reasons.

            For certain programs such as MS SQL, Oracle PL/SQL
            or ArcGIS there are characters that should never be
            used in certain places because they interfere with
            the internal programming and cause features not to
            work. Assuring compatibility with the programs is
            very important to avoiding future labor to eliminate
            these errors.

            All files must be named according to the same
            convention in order to automate the use, movement or
            querying of files.

            Manually searching through hundreds or thousands of
            raw data records is much easier if the naming
            convention is meaningful. If the agency has already
            established a file naming convention that meets
            these criteria, utilize that one.

            For photographs, contractors often have decent
            naming conventions, and renaming files according to
            a Government requirement is a large cost-driver. To
            avoid these costs, allow the Contractor to propose a

1.8.9.1   Fields of Database, ArcGIS Feature Classes, or Tables

Naming conventions for all elements must be developed according to the following requirements. Where a precedent exists in the project design or other parts of this contract, use the established precedent, however, change names prior to use in GIS/database to be consistent with the following:

a.   No spaces. If a space is needed an underscore must be used;

b.   256-character limit;

c.   No special characters;

d.   No characters that are considered reserved in ArcGIS or MS SQL;

e.   Do not start a name with an underscore or a number;

f.   Each record must be named utilizing the same format and character length. For record names containing a numeric ID that could utilize a different number of characters between records, zeroes must be utilized as placeholders at the start of the ID number to ensure consistent character lengths for scripted searches;

g.   Employ a standardized scheme for names that include element-specific information as required in the Contract section where required and eliminates random alphanumeric characters that do not relate to the element.

1.8.9.2   Folder and File Names

All files and report (non-tabular) and raw data files loaded to the SFTP site must be consistently named according to the following conventions (except photographs). Work with the Government to resolve any naming convention issues in the initial data management kickoff meeting, however the [COR][ACO] may direct a change to the naming convention of any files at any time throughout the duration of the Contract if the convention is not conducive to automation.:

a.   No spaces. If a space is needed an underscore must be used;

b.   256-character limit;

c.   No special characters;

d.   No characters that are considered reserved in ArcGIS, or common database programs such as MS SQL, Oracle PL/SQL, Postgres, MySQL or other full scale RDBMS's;

e.   Do not start a name with an underscore or a number;

f. Each group of file types must be named utilizing the same format and
    character length (where possible).

Propose in the Data Management Plan a file nomenclature for each file
classification that should include the project/Contract code, work
feature, applicable unit ID, and date data was generated (or began being
generated if it spans across multiple dates). See the following examples:

Feature of Work File Type	Unit ID	Date	Sample File Name
Concrete Batch Ticket	Monolith R12 Lift 2	06/02/21	BatchTickets_R12-2_20210622
Grouting CSV - raw data file	Hole R1440P Stage 15-25	08/20/21	R1440P_15-25_20210802
Drilling Log PDF	Hole R32	07/26/21	BoringLog_R32_20220731
Load Cell Installation Log	Load cell 15	09/05/21	LoadCellInstall_15_20210905

1.8.9.3   Site Feature ID's

Propose a consistent naming convention for all features and tests on site
in the Data Management Plan and utilize it unless otherwise specified in
other locations of the plans and specifications. For features or tests
that have failed or been abandoned where another feature or test for the
same purpose is conducted, utilize the original ID for that feature or
test, but designate a letter R (for "retest" or "redrill") or other letter
convention as appropriate to the test.

For all naming conventions, document the convention and define all numbers
and letters utilized for each in the associated work plan submittal and
the Data Management Plan. Provide a table in the EDB which defines the
naming convention components.

Feature	Specification	Sample Name
Grout Hole station 1(plus sign)00, Upstream, Primary hole	Yes, meets spec	0100UXP
Grout Hole station 1(plus sign)00, Upstream, Primary hole	No, does not meet spec	_P100USejlzhfo56

1.8.9.4   Photograph Naming Convention

Propose a naming convention for raw digital photograph files in the 50
Percent Data Management Plan which provides meaningful information about
the subject of the photo. Utilize the approved convention for all
photographs.

1.8.10   Spatial Data Projections

****
          **NOTE: Within the US, CAD and surveys will be done
          most commonly in State Plane. Using the same
          projection in GIS as well as in CAD will prevent**

All spatial data must be projected in modeling products using [_____]
coordinates. The Horizontal Datum must be [_____], [_____], U.S. Survey
Feet. The Vertical Datum is [_____], U.S. Survey Feet. Clearly describe
projections and datums of data collection and display in the Data
Management Plan and in all associated metadata forms and tables.

1.8.11   Geospatial Metadata

For all geospatial metadata, utilize the ISO TS 19139-1 standard template
XML for creation of fields in the GIS dataset level metadata. Follow the
SDSFIE-M SDSFIE Standards, ISO 19115-1, and ISO 19115-2 for the completion
of the ISO metadata form. The following list should also be included in
the information completed in the ISO metadata form, as applicable.
Utilize the following additional standards where applicable ISO 19110,
ISO 19119, and ISO TS 19139-1.

Include all metadata as records in a metadata table of the EDB:

1.8.11.1   Vector Datasets

a. Date dataset was created;

b. Equipment used to collect the data;

c. Agency, personnel, and contact information for original dataset;

d. Name, description, and location of survey control the original dataset
    is referenced to;

e. Is the geometry and location as designed or as built;

f. If the data was derived, converted, or imported from another dataset, the source dataset file name, format, date, datum, projection, resolution, and description (as applicable);

g. Narrative information about the data and what it depicts (from "Summary/Description");

h. For layer files where the symbology is interpretive of engineering data (for example grout stage permeability, grout stage volumes, barrier wall element overlap/thickness) - describe in the notes section of the application any description needed to understand the symbology and binning applied. If symbology is calculated based on a field value, describe the field values and how they are derived in the field-level metadata;

i. If it is a derivative product made by geoprocessing from other datasets - document the datasets used to produce it including file name, format, date, and a description of the datasets. Include any information about interpolation methods, geoprocessing tools, and relevant variables (and their definitions) or settings used to create it.

1.8.11.2   Raster Datasets

a. Date data was collected;

b. Dataset resolution (raster): (1) Equipment resolution, (2) Accuracy of equipment resolution, (3) Dataset resolution;

c. Equipment used to collect the data;

d. Corrections or processing steps applied to the raster;

e. If the data was derived, converted, or imported from another dataset, the source dataset file name, format, date, datum, projection, resolution, and description (as applicable);

f. Narrative information about the data and what it depicts (from "Summary/Description");

g. For layer files where the symbology is interpretive (for example subsidence data from InSAR) - describe in the notes section of the application any description needed to understand the symbology and binning applied. If symbology is calculated based on a field value, describe the field values and how they are derived in the field-level metadata;

h. If it is a derivative product made by geoprocessing from other datasets - document the datasets used to produce it including file name, format, date, and a description of the datasets. Include any information about interpolation methods, geoprocessing tools, and relevant variables (and their definitions) or settings used to create it.

1.8.12   Photographs

****
        NOTE: The intent of this section is to ensure that

Submit Digital Photographs taken at the project site as specified throughout the contract, including progress photos required in Section [_____], with a minimum of 181.11 pixels per cm 300 pixels per in resolution for all photo files. Provide photos in a lossless compression file format that does not lose any pixels in the compression process (e.g. .TIFF, .PNG and .GIF). Ensure no loss of original resolution from the raw photo if converted to a lossless format. Create digital images and metadata that meet or exceed the specifications of the Exchangeable Image File Format (EXIF) version [_____][2.3] or higher.

The enterprise database must contain a populated table which identifies all images taken at the project, and includes fields for the listed captioning items, and fields for the basic metadata encoded in each digital image including resolution, latitude, longitude. Include a field for hyperlinking to the digital images.

1.8.13   SDSFIE

Work with the Government's Data Manager to ensure all applicable spatial data and spatial metadata are SDSFIE compliant. This is not required for datasets where there is no established SDSFIE standard.

1.8.14   Network Infrastructure

Provide the Government with, and utilize network infrastructure that can achieve speeds of at least [_____][250] Kbps or the maximum commercially available in the area if [_____][250] Kbps cannot be achieved.

1.8.15   COR Access to Data

Provide any data or assistance in accessing the data, as specified in PART 2, SFTP SITE, and at any time as requested by the [COR][ACO]. Provide current database table [_____][.csv, backup] files or any other data/report files upon request.

Provide username and password access to any interfaces required by this Contract to any member of the Government or applicable third party at [COR][ACO] request. Provide access within 48 hours of the request.

****
         NOTE: If any components referenced in this section
         are not required in the contract, remove the
         associated language (i.e. "SFTP", "interface",
         "database").
****

1.8.16   Conflicts of Data Requirements

In the case of a conflict between any data requirements in the Contract, the data requirement must be whichever is more detailed, rigorous, specific, precise, and complete as determined by the [COR][ACO].

1.8.17   Data Collection Prior to Full Approval of the Data Management System Components

If the Contractor is able to mobilize for the start of work prior to all components of the data management system being fully approved, collect all data and input/convert as necessary to integrate it into the final database, SFTP site, and web interface.

****
         NOTE: The process for approving the data management
         system as laid out in this specification is complex
         and lengthy on large-scale projects. It is intended
         to premeditate and work out all potential issues at
         the start of construction when it is easy to fix
         them rather than wait until they occur. However,
         the cost associated with this strategy is extended
         time prior to system approval. This language is
         intended to make sure the contractor is aware that
         they need to apply the same standards and be able to
         integrate early data with the main dataset.
****

1.9   RELATED WORK SPECIFIED ELSEWHERE

****
         NOTE: It is the role of the 01 31 20 section to
         ensure the timely receipt of the data in a format
         appropriate for real time verification, and
         long-term retention and display. To do this, an
         understanding of what work verifications will be
         performed, and the data products needed to

facilitate this is needed.

Data management design requires rigorous cross-checking of other specification sections for data generation requirements, and conflicts with the 01 31 20 data requirements. In this section of the 01 31 20 specification, list any technical sections where there is a data requirement or a reference back to 01 31 20. It is important to make sure they are cross-referenced, but NOT to restate the requirements in 01 31 20.

For any technical specification that has a data generation requirement, add the following to that section in the part one Requirements. Adapt the sections in 01 31 20, or in the technical specification section for the work if the requirements are different from the general requirements in the 01 31 20 language. This includes items such as file formats and nomenclature, turnover times, special reporting in the form of drawings.

The narrative below each section identifies common data and verification needs of each section. This is not an exhaustive list but a guide for how to think about designing the data specification based on the features of work of the contract.

For more data intensive features of work, the digital data generation should be addressed in that technical section or in the data management specification, and how the Government wants to receive it needs to be specified. See Part 3 "DATA REPORTS AND DISPLAYS" for examples.

General Data Management Requirements Sample Language for other specification sections in the Part 1 requirements:

1.X DATA MANAGEMENT REQUIREMENTS

The Contractor and any Subcontractors performing work specified in this section must provide all generated data. All data generated as part of this specification is subject to the requirements in Section 01 31 20 DATA MANAGEMENT. Conduct a thorough review of the data specifications in this section and in 01 31 20 DATA MANAGEMENT, and ensure proper review and compliance.

Provide data for all of the fields in the EDB for the project pertaining to the work described herein via the appropriate tables as specified by the Section 01 31 20 DATA MANAGEMENT, and the data dictionary.

Provide all analog data related to the specified work via the SFTP in accordance with the

requirements specified in Section 01 31 20 DATA
MANAGEMENT.

DIVISION 01
SURVEY CONTROL AND REMOTE SENSING

This is not a guide specification yet, however every
construction project should include a section which
identifies survey control requirements including
accuracy and precision. Requirements typically
stated in this section include personnel
requirements, datums, project survey control points
to be used for development of survey baseline and
construction of structures, survey accuracy and
precision, and types of surveys to be conducted.

For remote sensing (such as LiDAR, orthoimagery,
photogrammetry, bathymetry), the requirements
include a data collection plan, the specific
accuracy and precision of the equipment and the
dataset, equipment and dataset resolution, any QC
tests on the equipment or data, calibration
requirements, and other standards related to
geospatial accuracy of the dataset collected, data
processing methods and steps, raw data and final
data products and reports, and any procedural or
security requirements related to the equipment
utilized (i.e. UAS). These requirements will be
developed in tandem with the technical designer for
the data management specification and system, and
the technical designer for the feature of work they
are required on. For example, if LiDAR is required
to be collected for quantities, the land surveyor
and the RE may be involved in developing the
requirements. If photogrammetry, LiDAR and or
Orthoimagery are being collected to document
geologic foundations, the lead geologist may also be
involved in developing them to ensure the proper
resolution is required. The 01 31 20 specification
details for instance, what data is to be collected,
the turnover times, the specific dataset
requirements as needed for short term verifications
or long-term project documentation.

For contractor-proposed methods, it is important to
require detailed submittals on the specific accuracy
and precision of the equipment and the dataset,
equipment and dataset resolution, any QC tests on
the equipment or data, calibration requirements, and
other standards related to geospatial accuracy of
the dataset collected, data processing methods and
steps, raw data and final data products and reports.
It is also essential to have all of this information
reviewed and approved by qualified personnel (such
as a licensed land surveyor) prior to approving it's
use. It is also important to understand any
procedural or security requirements related to the
equipment utilized to ensure cybersecurity standards
or other applicable federal regulations are followed

(for example in UAS use).

Minimum references to be included in this section as applicable to specified work:

EM 1110-1-1005 (2007) Control and Topographic Surveying

EM 1110-1-1000 (2015) Photogrammetric and LiDAR Mapping

EM-1-1002 (2012) Survey Markers and Monumentations

EM 1110-1-1003 (2011) NAVSTAR Global Positioning System Surveying

Section 01 45 00 QUALITY CONTROL

It was determined as a major lesson learned that a QC person as part of the QC organization who is not the Contractor's Data Manager or other personnel in the data management spec should be assigned to coordinate the flow of the data from the field to the data management staff (typically remote employees). This role can also help the data management staff understand how the database schema will be set up for the specific data when the Contractor proposes means, methods and equipment. They also have a role in verifying data.

This person's role and responsibilities will be detailed in the quality control program specification section. This person should be an engineer and capable of understanding the work represented by the data. Sample language to be entered into the Experience Matrix table of Part 3 is as follows. Change the work experience requirement to match the project needs. This person is referenced in 01 31 20 under the QC data collection plan and the Data Management Planning Meeting - both of which they are required to participate in.

Data Management

Graduate Civil Engineer with 5 years' experience in the QC verification of features of work being performed as part of this contract. This requirement is a full time Quality Control staff position performing duties at the job site to support Data Management, facilitating the flow of data and documentation generated during work by all Contractors into the data management system in accordance with the specifications. This position also assists in verifying the validity of provided data as necessary. This position is in addition to the offsite Data Manager requirement in specification Section 01 31 20 and must not be combined with that position. This individual reports

directly to the Quality Control Manager and must be not be assigned duties outside of Quality Control or as outlined in the specifications, however the position is expected to work in close collaboration with the Contractor's Data Manager in these and any specified duties. The Contractor must fill this position within 60 days of NTP.

The need for comprehensive digital collection of QC data also needs to be addressed in Section 01 45 00 so that the Contractor understands what we want and bids it properly. The guide specification emphasis for this section is on QC daily reports submitted via RMS. It is strongly advised to add language in PART 1 that refers to this specification, and at least mentions the types of requirements that will apply to QC data. It is also strongly advised to add a requirement that the Contractor streamline the collection of QC data via digital means in coordination with their Data Manager. If the Contractor is struggling with manual entry of QC data, this will impact their turnover times, and our ability to use that information effectively. It is important to include the language in the QC section, so it is understood that this effort is part of the prime contractor's responsibility. If written in the Data Management section it will be assumed to be the responsibility of the data management subcontractor rather than a dedicated effort of the QC team. Sample language to be entered in PART 1 is as follows:

"1.X QUALITY CONTROL DATA
Section 01 31 20 DATA MANAGEMENT outlines specific requirements for the reporting of QC data and information as fields in the database related to the feature data (for example, concrete fresh properties tests, or the taped depths of blast holes prior to loading is a field in the drilling report tables). Collect discrete field QC data in such a way that it reduces the effort and time required to incorporate into the database and data management system. This may include utilizing digital data collection devices in the field, utilizing apps with customized forms that directly populate the database, or other methods developed by the Contractor in consultation with their Data Manager. The data management QC personnel in the QC matrix must assist in supporting and streamlining this effort.

Refer to Section 01 31 20 DATA MANAGEMENT for other details about time requirements for this data to be entered into the database, the preconstruction submittal "QC data collection plan", and data management coordination planning meeting. The data management QC personnel must coordinate with the Contractor's Data Manager as needed to create an efficient flow of field and QC data into the data management system. The Contractor must design this

effort so that no repetition of effort between the data management system and RMS is required."

In addition to this, it is strongly recommended to add an item to the QC Plan submittal where the Contractor will outline how they plan to integrate data to the data management system. See the following sample language:

"Procedures, workflows and equipment used to collect QC data from the field and facilitate rapid integration into the project database and data management system. Describe how the QC data collection plan from 01 31 20 DATA MANAGEMENT will be integrated into this plan."

Section 01 78 00 CLOSEOUT SUBMITTALS

The CAD standards, as-built drawing, and 3D CAD model requirements are contained in the 01 31 20 section. However, they are specified as a closeout submittal in 01 78 00, meaning the Government doesn't receive them until the end of the contract. This is a problem for more than one reason. The as-built library on a major project is enormous, and the contractor often doesn't apply resources to creating it until the end of a contract. If the Contractor is losing money, they may forego completing the as builts at all. This has happened. This also pushes reviews into a very short time period at the end of the contract when the project is likely to be losing staff. Review of the 3D CAD model by skilled CAD technicians should be taking place at milestones throughout the contract to make this more manageable and ensure a thorough review. For data management systems where the Government produces their own GIS or CAD model, the submission of the updated 3D CAD model weekly or however often is needed to utilize features for the construction of GIS features.

A MAJOR OVERSIGHT OF THE GUIDE SPECIFICATION IS THE LACK OF A REQUIREMENT THAT ALL FEATURES BE GEOSPATIALLY REFERENCED TO REQUIRED PROJECT SURVEY CONTROL POINT(S).

Other issues that should be addressed:
1)   The requirement of document submission via "optical disk". Change this requirement to submission via the SFTP site, directly to the Government's data exchange platform if other than the SFTP site (i.e. Microsoft Azure, common cloud, ProjectWise - as the Government's methods and data transfer capabilities evolve), or external hard drive.
2)   The requirement that "The CAD files must be complete in all details and identical in form and function to the CAD drawing files supplied by the Government." Is problematic when the Government's

CAD model features are geometrically incorrect, not geospatially referenced, or otherwise incomplete. The Contractor should not be allowed to allow sloppy mistakes to matriculate into the final 3D CAD model. 3)   The specification does not specifically require the use of the current A/E/C CAD model standard version [R.XX]], it only references where to find the government's CAD/BIM standards. The use of correct annotation references and other components of the standard should be a requirement to ensure you can fully understand the model.

DIVISION 02

Section 02 32 13 SUBSURFACE DRILLING AND SAMPLING

Ensure the format for data collection and final data products are consistent between 01 31 20 and any section that covers drilling or subsurface exploration. It is common for the software and format of drill logs to be specified in this section. For example, the USACE has moved to an enterprise subsurface data program called OpenGround. The requirements are stated within Section 01 31 20 and referenced in Section 02 32 13.

DIVISION 03 CONCRETE MATERIALS

There are several separate subsections for concrete, shotcrete, aggregate, and other materials, many of which have a specific and unique requirement for data. Include all subsections which require the generation of data that will be input into the data management system. The main datasets generated by concrete specifications are concrete and aggregate, grout and shotcrete QC testing. This includes tests covered by ASTM standards such as fresh properties (bleed, slump, mix temperature, air content, unit weight), strength development (with data collected at different time intervals), and thermal monitoring - among others. These tests are critical to ensuring concrete quality and structural integrity over time, and the data should be collected in the project database so that the project can accurately assess the concrete quality and any future variance requests, as well as identify potential areas of future O&M or remediation.

DIVISION 31

Section (TBD) INSTRUMENTATION

Because of the data-intensive nature of automated data acquisition systems, and the need for real time review, this specification is likely to be very data-heavy, and potentially include the use of a web-based user interface, a joint instrumentation monitoring plan (JIMP), data management duties, and a file sharing site. Make sure the two are

cross-checked for consistency and ensure all applicable data requirements listed in 01 31 20 are understood to apply to instrumentation data as well.

Section 31 00 00 EARTHWORK

Excavation data is of interest to the government in order to verify quantities submitted for payment, to track the progress of work, to verify the excavation was achieved, and to assess spoils and disposal quantities and waste when the excavated materials must be reused in specific designations. Often the contractor is allowed to survey at stations and produce cross sections for quantity determinations utilizing the "end area method". However, the use of the "composite method" is increasing, where subtraction is calculated between two LiDAR - derived DEM's with a much higher degree of accuracy. Quantities of material excavated and disposed of can also be tracked utilizing truck tickets. If the data management system will be used to track these quantities, it is important to ensure the correct data fields and data products are required within the specification.

Section 31 23 06.00 BLASTING - SURFACE

Blasting is a data-intensive feature of work. The blast design and quality, and whether the contractor followed specified tolerances are evaluated through specific data. Datasets to be collected as a baseline for any blasting program should include:
1)   All blast design parameters used to include bench, burden, blast hole depth and diameter, stemming, decking, explosive agent and primers types, sizes and weights, holes per delay, pounds per delay, fragmentation index, and other pertinent design parameters.
2)   Post blast evaluation and misfire information
3)   Loading logs
4)   Vibration and airblast predictions and reports (generally delivered realtime via website)
5)   Drill hole plans and reports including penetration rates
6)   Blast photos and videos

The blasting specification needs to support the receipt of the data types, and the 01 31 20 specification details what to do with them, entry into the database, if and how they are to be displayed in the web interface, relevant turnover times, file formats and other requirements. This data is valuable for protecting the government against differing site conditions claims or claims that the geology caused blast damage rather than the blast design.

Division 31 [31 32 23] Foundation Drilling and Grouting (no UFGS as of 2022)

Grouting is concrete injected into the subsurface via drill holes to fill in voids in the geology that might allow too much water to move through an area where that is not desirable for structural stability or operational efficiency. On civil works projects subject to engineering regulation ER 1110-2-1156 Safety of Dams, the grouting data requirements are intensive and specific. As of the writing of this specification the guide specification does not exist, however that technical section is where they should be housed. This includes the requirements for the automated grouting control data collection system, grouting data collection plan, and other data and reporting verification requirements of the program needed to assess closure and final permeability. Ensure the receipt of data and the display formats properly capture needed verifications in this section.

Section [31 56 10] CUTOFF WALL (no UFGS as of 2022)

A cutoff wall, or barrier wall, is a specific structure installed into the subsurface of a dam where the geologic foundation is highly karstic and introduces significant risk of seepage and piping or internal erosion to the structure. This structure consists of concrete panels or secants placed along the upstream dam axis directly through the dam and into the rock foundation. This process involves the excavation of embankment material and rock, and replacement with concrete in panels or secants.

USACE has an informal guide specification for cutoff walls that has not yet been published through UFC as of the writing of this specification. Pertinent data for this feature of work will be detailed in the specification section, and generally includes the following:

1)   Excavation verticality and orientation measurements - including raw data from a sonic measurement tool (i.e. Koden) or other equipment that does the measuring, and then analytical reports that show the verticality for approval prior to concrete placement. Because a section of the dam is sitting open with slurry stabilizing the embankment during this verification, it is very time sensitive;
2)   Concrete placement including quantities, and all normal QC tests including fresh properties, strength, and other requirements.
3)   Concrete verification cores including classification of concrete anomalies as specifically defined in the technical section;
4)   Permeability testing, conducted using some method of falling head testing and converted to permeability values;
5)   Analysis of panel or secant overlap and thickness in relationship to specification tolerance

and geologic conditions (if sub-specification).
This work feature has very specific engineering
verification needs in the field, and as a part of
the post implementation evaluation conducted after
the work has been completed. These needs are filled
by a combination of static reports (1), numerical
analysis (4) and visualizations (1-5).

Section 31 66 10 ROCK FOUNDATION PREPARATION

Foundation preparation is an important part of any
project where concrete will contact rock or other
concrete. For projects subject to engineering
regulation ER 1110-2-1156 Safety of Dams, ER
1110-1-1901 or EM 1110-1-2908 Rock Foundations the
Government is required to document the rock
foundations of its projects, and any dental
treatments completed. As technology advances, USACE
is employing remote sensing methods such as
photogrammetry, LiDAR, and Orthoimagery to
compliment hand-collected data on maps. The
requirements in the foundation preparation section
will coordinate with the requirements in any remote
sensing and survey specification as well as this
specification for data. There are no dedicated
remote sensing guide specifications yet published,
however the data product requirements are presented
here for reference.

Section 31 63 26 DRILLED CAISSONS
Section 31 63 29 DRILLED CONCRETE PIERS AND SHAFTS

Drilled shafts and caissons are installed when the
geologic foundation of a structure does not have
rock of sufficient bearing strength for the weight
of the structure that will be built on top of it.

The data generated by the installation of these
features is important to verify the design
assumptions have been met for the integrity of the
structure. For drilled shafts, some of the data
generated will be the pilot hole geologic log,
penetration test, proof test, load tests,
orientation and dimensions of the final shaft (ex.
cross hole sonic logs), plumbness the installed
reinforcement structure, groundwater data, concrete
fresh properties, and strength data.

Section 31 68 13 SOIL AND ROCK ANCHORS

Where anchors are a technical component of
structural stability, the documentation of anchor
installation data is very important. Data such as
the geologic log of the pilot hole, bond zone,
alignment, water tightness test results,
installation QC and QA, stressing and lock off, and
any installed instrumentation such as load cells
will be detailed in this technical section. Often
concrete will be placed over anchors, and so anchor

approval becomes part of the time sequencing for the
construction schedule - the concrete should not be
placed prior to the approval of the anchors, though
the contractors will often try to negotiate this. In
this case, the turnover time for this data in order
to effectively assess and approve the anchor
installation is very important, and should be
considered in the time requirements for the
submittal of the data.
****

Section Number   Section Title

[_____]   WEATHER AND WATER STAGE DATA RESTRICTIONS

[_____]   SURVEY CONTROL

[_____]   REMOTE SENSING

01 33 00   SUBMITTAL PROCEDURES

01 33 16.00 10   DESIGN DATA (DESIGN AFTER AWARD)

01 45 00   QUALITY CONTROL

[_____]   LABORATORY TESTING FACILITIES

01 78 23   OPERATION AND MAINTENANCE DATA

02 32 13   SUBSURFACE DRILLING AND SAMPLING

03 23 00   STRESSED TENDON REINFORCING

03 30 00   CAST-IN-PLACE CONCRETE

03 30 53   MISCELLANEOUS CAST-IN-PLACE CONCRETE

03 33 00   CAST-IN-PLACE ARCHITECTURAL CONCRETE

03 37 00   PREPLACED-AGGREGATE CONCRETE

03 37 13   SHOTCRETE

03 37 23   ROLLER-COMPACTED CONCRETE FOR MASS CONCRETE CONSTRUCTION

03 37 29   CONCRETE FOR CONCRETE CUTOFF WALLS

03 70 00   MASS CONCRETE

31 00 00   EARTHWORK

[_____]   INSTRUMENTATION AND MONITORING

PART 2   PRODUCTS

2.1   SYSTEM DESCRIPTION

****
NOTE: Tailoring options are available for "SQL
RDBMS EDB" and "ACCESS ENTERPRISE DATABASE".
****

The work covered by this section consists of a data management system for
engineering and construction technical data. The system encompasses every
aspect of how this technical data is handled from generation to turnover,
and its constituent components - including specified metadata (e.g.
time/date of generation, equipment name for tracking, name of person
generating the data). Elements of the data management system include
hardware, software, network infrastructure, database architecture, a Data
Management Plan, raw and processed tabular data, a web-based interface,
and reports and documents incidental to all construction or verification
activities, coordination, training, quality checking, and any other
associated information deliverables required during the construction
contract.

However, this specification does not replace nor supersede the USACE
Resident Management System - Section 01 45 00.15 10 RESIDENT MANAGEMENT
SYSTEM CONTRACTOR MODE (RMS CM) used for Contract monitoring, submittals
and administration of the contract. It also does not replace nor
supersede the Quality Control Specification 01 45 00 QUALITY CONTROL
except where the specific data requirements are called out in this
specification. The requirements in this specification are in addition to,
but do not replace Section 01 78 00 CLOSEOUT SUBMITTALS which details
closeout submittals and requirements for CAD as built drawings.

2.1.1   Overview of Goals and Components

The goals of the Government are to:

a.   Minimize the cost to the Government required to transform, translate,
     research, aggregate, query and analyze data.

b.   Consume project data in graphical and spatial displays that allow a
     rapid assessment of progress, and easy comprehension of dam safety and
     quality management verification.

c.   Aggregate the project's data record in an organized manner for easy
     access during construction.

d.   Receive data products in a timely manner that have been subject to
     thorough QC checking.

To accomplish these goals, an effective data management system ensures the following for data: complete collection, appropriate record formatting, cleaning, verification, timely transmission, complete documentation, and secure and organized storage. An [SQL][MS Access] enterprise database (EDB) using a relational database management system (RDBMS) is required to house all project data. The complete initial data dictionary to be used for the tables transferred to the Government and an entity relationship diagram will be provided by the Government.

The data collected must follow the guidelines as specified in this section. All coordinates for spatially located data must be provided in three dimensions such that the data can be used in 2D or in 3D GIS and other visualization, CAD and mapping software. In any instance where the Contract does not specify, the receipt of clean tabular data in a digital format is the default standard for project data.

****
          NOTE: Depending on the requirements of the
          contract, the system should utilize some type of
          tabular database. For very large datasets such as
          are collected on dam safety modifications and
          navigation projects, an enterprise SQL language
          database, maintained using a relational database
          management system (RDBMS) should be required. This
          is the only type of database with the functionality
          and storage capacity to handle very large datasets,
          power web-based visualization applications, and
          limit user entry error through the use of database
          rules and domain tables. For small contracts where
          data is to be collected and querying capabilities
          are desirable, use of an MS Access or similar
          database is acceptable.

          The smallest datasets can utilize Microsoft Excel
          workbooks; however, we would caution against doing
          so. Excel has the most limited functionality, and
          there is no way to limit user entry to comply with
          field types or entry choices, so the dataset will
          require more manual cleaning, QA/QC, and data
          validation which would be avoided in true
          databases. This work will fall to the Government
          and is VERY labor-intensive.

          If the database is the primary deliverable and the
          Government will utilize it to power their own
          web-based visualization applications, consider
          requesting the specific type of SQL database - e.g.,
          Oracle PL/SQL, MSSQL, or PostgreSQL.
****
2.2   DOCUMENTED ENTERPRISE [SQL][MS ACCESS] DATABASE

****
          NOTE: The purpose of utilizing an SQL language
          enterprise database is the greater functionality it
          has and number of simultaneous users it can
          accommodate. For any megaproject, an SQL language
          EDB and RDBMS is the standard.

For projects of smaller scope and complexity, an
access database may suffice for the effort. Excel is
not a functional database structure and should not
be utilized for several reasons unless the
Government already has an established database to
import excel files into, and provides the contractor
with the specific data tables, fields and field
types - all formatted for easy import into the
Government's database. This is essentially the
product the specification is designed to deliver in .csv
updates, but for a different reason as explained
below. Only a database has the power to query and
aggregate data, and to accommodate massive datasets
without becoming corrupted.

The nightly updates of .csv files are intended to be
used by projects that already have a database and
can perform automated updates for rapid
reconciliation of new data. This would be the case
for projects who are building and hosting their own
visualizations (i.e. web model, dashboard). These
same .csv files could be used to view the data in
Microsoft Excel (by just opening the file with
Excel), but would need to be loaded into a database
in order for the data to be readily queried. If the
Contractor will host the visualizations, nightly .csv
updates are not necessary, however the work to
produce nightly versus weekly, monthly, or other is
the same because the Contractor will be scripting
these updates to run automatically - meaning the
system updates itself - a person isn't performing
this task.

The requirement for closeout backup files to be
submitted should apply to all projects, regardless
of whether the project or the Contractor is hosting
the visualizations. The backup files allow the
Government to inspect the Contractor's full work and
obtain any required views or scripts in the
database. Backup files can also be used by the
Government to create the database if the project dos
not have staff skilled in SQL database construction.
In this case, the Contractor will usually be
required to administer the web-based visualizations
and database for the duration of the contract. The
submitted SQL database backup files can be used by
the agency's IT department/contractor to create the
database on the Government's servers. For example
USACE personnel can submit a service request ticket
with G6 to "restore" - or set up a local instance of
- the database and grant local user read/write/edit
access. This is not an efficient workflow for
transferring the database though, and should not be
used as a substitute for the nightly .csv update due
to the large amount of labor involved in setting up
the database from backup files.

The requirement of a database mirror in Part Three

DOCUMENTED ENTERPRISE [SQL][MS ACCESS] DATABASE of this specification is designed to provide a way for personnel to interact with the Contractor's SQL database data during a contract if the project does not have qualified personnel to set up an interface. The database mirror will provide the project with a Microsoft Access database updated daily. The benefit of the mirror is being able to directly access and manipulate the tabular data if there isn't a database on the Government's servers.

An ESRI EGDB is not a substitute for an enterprise database. Data is not designed to be easily queried and aggregated outside of the desktop GIS environment, and most project personnel are not usually GIS users. The database requirement and the ESRI products requirements are not redundant and should not be combined.

There are different ways to accomplish data transfer, this is the easiest currently, however that may change in the near future, and when it does this document will be updated accordingly. Having a non-DoD entity connecting to the DoD network through the firewall to transfer data is currently only allowable with specific G6-authorized exceptions. If the project wants to have a shared data space that both the Contractor and the Government can access, Microsoft Azure is currently (2022) an approved cloud platform. Amazon cloud is also approved for DoD data. The transfer system would require different specifications with this method; however, data system developers savvy enough to use Azure or Amazon should have no problem tailoring this specification accordingly.

The use of the SFTP to receive .csv and backup files of the database is the least expensive, and most tried and true method for transfer of data (in files). If the Contractor will build a web interface, daily updates of the database tables are less important, however, it is still strongly recommended that these updates are required throughout the contract and not just as a closeout submittal so that USACE can examine the data for data QA.

Applicable to USACE projects only: The Contractor may utilize separate subs for instrumentation where applicable, however when the Contractor manages the instrumentation data outside of MIDAS, it absolutely should utilize an SQL EDB due to the massive amount of data it will store. Make sure to have a requirement that covers this need in the instrumentation monitoring specification. If the project will utilize the Contractor for instrumentation, but will also utilize MIDAS, set up a requirement for the Contractor to provide this data directly through API or some other means into

Set-up, maintain and update a documented [SQL][MS Access] enterprise database (EDB) in a full-scale RDBMS that is compatible with the Government's [SQL][MS Access] database, as proposed in the 50 Percent Data Management Plan and approved by the COR, for the duration of the contract. Store the EDB on the Contractor's servers or the Contractor's cloud storage account for the duration of the contract. Update Database Files including .csv files of the most current version of the database tables to the SFTP site by midnight daily. Update the [SQL RDBMS][MS Access] database backup file of the complete and most current version of the Government's portion of the database to the SFTP on a quarterly basis, and no later than 60 days after the loading of the last record, and at anytime requested by the [COR][ACO]. Utilize industry best practices in the formatting of .csv files so that text fields containing commas do not interfere with the structure of the .csv (i.e. enclose in double quotes or other industry standard).

Provide the Government with an exported data dictionary of the Contractor's EDB optimized for QA of the database tables and fields (to ensure all field types, names, units, precision, and other field parameters are correct) in the 100 Percent Data Management Plan submittal. Upon completion of the Contract and before final demobilization, deliver to the [COR][ACO] the Finalized Enterprise Database according to PART 1, SUBMITTALS prior to final payment.

2.3   CLOUD-BASED DATABASE SERVICES

If a cloud-based database solution is utilized for the database and file management which offers secure file transfer equivalent to or higher than the SFTP requirement, and third-party database access, this may be utilized in lieu of an additional SFTP or database mirror. Provide the Government username and password access to the project via that cloud environment, and include any instructions for access and use of all database and file transfer tools in the "Quick Reference Guide".

2.4   SFTP SITE

utilized remain the venue for satisfying legal
requirements of submission for payment. If the
Contractor becomes able to load data directly into
ProjectWise, or the structure of RMS permits it to
function in this capacity, this could replace the
SFTP use for non-tabular file document storage and
transfer. Currently the database structure of RMS
does not accommodate structured data from the
Contractor.

If the Government needs to have the Contractor
database hosted in a common environment that the
Government can interact with in real time, and
provides real time access to data, the Microsoft
Azure specialty software is currently FedRAMP
approved. However Azure required for use by the
Contractor will add expense as it is not considered
a common software for the Contractor to use, and it
may also incur a licensing-usage fee for the
district. Any cloud-based solution must be FedRAMP
approved prior to implementation. The other methods
for direct connection between the Contractor
database and Government data management system would
be through the approval of a firewall exception, a
Government DMZ, or a Contractor-hosted DMZ. All of
these are governed by G6 policy and permissions
which have no standard criteria for application. If
you are interested in one of these methods, discuss
with your local G6 or IT security professional.

The organizational structure of an SFTP site that is
used by the Government to populate their own
web-viewer and dashboards should be especially
well-thought out because of the automated data
transfer that will be designed to pull data from
that location. Also consider the ease of access and
intuitiveness of navigation for users.
Alternatively, the Contractor may be required to
propose a structure to be used, but this often only
delays the Government having to think about it until
the submittal process when it may be less convenient
and there may be less time to design it properly.
The Contractor prefers to know what the Government
wants in most cases.

Tailoring options are available for "SQL RDBMS EDB"
and "ACCESS ENTERPRISE DATABASE".
****

Host a SFTP site which serves as a system for file transfer for the
duration of the contract. [COR][ACO] personnel must be granted unlimited
24/7 access to the SFTP site. Provide username and password access to this
site to COR. Establish the SFTP site and provide [COR][ACO] access to the
site no later than 7 days after notice to proceed has been issued. Provide
[COR][ACO] personnel access from the list provided by the Government
within 48 hours of the SFTP site being created, and for 6 months following
the uploading of the last project record. Add new users as requested by
the Government within 24 hours of the request. The SFTP site must allow
traffic over Port 22 for compliance with US Government security protocols.

Other web-based document sharing tools (e.g., OneDrive, Google Drive, DropBox or others) that do not comply with the SFTP requirements may not be used as a substitute for an SFTP site.

Host all reports and non-tabular files, raw data, [SQL][MS Access] database .csv and backup files, and other files as directed by the [COR][ACO], on the SFTP site in the same organizational structure as the template provided by the Government in the Volume [_____] attachments. The SFTP folder structure must be fully functional, accessible, current, easy to navigate, and complete with all specified data available for retrieval by both automated and manual methods. If this criteria is not met, pertinent payments will be withheld until the issue is resolved and acceptable to the [COR][ACO].

2.4.1   SFTP File Indexes

No later than 30 days after the last file transfer has been completed, and prior to demobilization, provide Final File Indexes of the SFTP site and all data files transferred in accordance with PART 1, SUBMITTALS, SD-11. Include an index of all files according to the specified organizational scheme, utilizing a standard naming convention, detailing all other files transferred to the Government. Account for all listed files on the SFTP site and verify they are within the same organizational structure as the index. Provide a signed accountability checklist showing the verification was conducted.

2.5   DATA TRANSFER AND QC REPORTS

****
            **NOTE: Typically, QA of the SFTP, database and GIS
            model have been problematic on large projects,
            especially when the Government's Data Manager is not
            on site and integrated in the construction office.
            The intent of the reports and automated emails is to
            ensure the Contractor is keeping the DMS components
            up to date based on the actual site project as work
            progresses.**

            **Tailoring options are available for "DESKTOP GIS
            FILES".**
****

Produce scripted reports of the following Data Transfer and QC Reports:

a. Data Transfer Reports:

    (1) Automate the delivery of a weekly report (Excel-readable
         attachment) on Mondays before 7 am [_____][Eastern] time zone to
         COR-requested email recipients that summarizes all of the changes
         to the SFTP within the previous week, ending at 2359 hours local
         project time the previous day. Include the date, filepath,
         document name, associated submittal section and submittal item
         number, and other data for each record as requested by the COR.
         Format the attachment so that it is easy to understand what
         changes were made.

    (2) Automate the delivery of a daily report (Excel-readable
         attachment) to COR-requested email recipients that lists all of
         the changes to the SFTP within the previous 24 hours from 0000 to

2359 local project time. Include the date, filepath, document
name, associated submittal section and submittal item number, and
other data as requested by the COR. Format the report so that it
is easy to understand what changes were made.

    (3)   If a list of digital deliverables is provided by the Government,
prepare the above reports in one and two to show what items on
the list were submitted with a date, and what items are still
outstanding.

    (4)   Automate the delivery of a daily report (Excel-readable
attachment) to COR-requested email recipients that lists all of
the changes within the previous 24 hours from 0000 to 2359 local
project time to the EDB parent tables for which a feature ID
number is associated (for example a Hole ID, Blast ID, Anchor ID,
Stage ID, or other ID type). Include in the report the name of
the parent table, the feature ID of each record added, and date
the work was completed/record generated. If data records were
updated - as opposed to newly generated - indicate this for each
record. Filter out records in this report that would be generated
by routine database maintenance and update processes. The goal of
the Government is to track the addition of new records to the
database to ensure the Contractor is updating the EDB within the
specified turnover times.

    (5)   Automate the delivery of a weekly report (Excel-readable
attachment) to COR-requested email recipients that lists all of
the changes within the previous 24 hours from 0000 to 2359 local
project time to the GIS EGDB. Include in the report the GIS model
alignment (i.e. 3D, 2D Plan, 2D Profile Cutoff Wall, and any
others used) feature class name, the feature ID's added or
updated, and date of update. The goal of the Government is to
track the addition of new geospatial features and records to the
web interface to ensure the Contractor is updating the GIS models
within the specified turnover times so the Government can
effectively track progress using the viewer.

  b. QC Reports: Provide the contract-required individual QC inspector
daily reports and combined QC daily report from RMS - including any
attached reports or documentation - to the appropriate location of the
SFTP site within 24 hours of upload to RMS.

Store copies of all above reports in the appropriate folder of the SFTP
site. Add new reports to the SFTP synchronously to turnover time
requirements for each item. Propose report formats for all elements
described in this section as part of the 50 Percent Data Management Plan
submittal. The Government will use these reports to QA the SFTP site, the
database, and the web viewer to ensure the required data work is up to
date. Process any requested changes to the report format or content within
48 hours of the request.

2.6   WEB-BASED SERVICE DELIVERY EXPECTATION

For all web-based services required within this Contract, ensure that
service availability is maintained from 6:00 am to 10:00 pm local project
time.

2.7   ESRI GIS REST SERVICES

****
> NOTE: This product gives the Government pre-processed and pre-published access to the GIS products that are directly connected to the Contractor's project database and hosted within ESRI's online products on the web. Feature services are generally point, line and polygons, or tabular data you want in a dashboard that contains dummy coordinates (such as concrete QC test results). Imagery Layers or Tile Services are published for raster datasets such as aerial images and other DEM files. The benefit of this requirement is the ability to have full creative control over your visualizations if ESRI Enterprise Portal is used for CAC users on the Government's Portal, while avoiding the scripting and publishing from the database directly, which has not been effectively implemented in DoD to date. This requirement is used in conjunction with database requirements, but replaces the "WEBSITE INTERFACE OF DATA" and "WEB-BASED GIS INTERFACE". Using this method requires that the Government build and maintain their own web maps and dashboards, and to successfully accomplish this it will require providing the Contractor with a starting list of web services desired, including the schema of the attributes and any additional fields needed to filter or classify the data. For example if the dashboard will show passing or failing, that is easiest as a field in the feature service. Additionally, if QC narrative is desired for the feature service, ensure that is included in a comments field of the attribute table schema.

****

Provide ESRI REST feature services, scene layers, image layers, and tile services hosted on ArcGIS Online (AGOL) or ArcGIS Enterprise Portal with export capability enabled. Deliver links to feature services which are shared with the Government's user group utilizing an ESRI collaboration, or provide username and password access to the Contractor's AGOL or Enterprise Portal account to access the links. Update REST feature services and scene layers within 15 minutes of an update to the database, and update other services within 24 hours of generation of the new dataset.

Specific feature service attribute schema is provided in the attachments to the solicitation. Ensure the attribute data in the feature services follows the schema requirements specified for the documented SQL database. The data within the attribute tables of all feature services must be free from errors, appropriately attributed, and utilize the field type of the corresponding database field. Make any changes to the feature services including the addition of attribute fields, corrections to data errors, numerical field precision, and field type as requested. Make the requested change within 48 hours of the request.

Provide the following web services in 2D and 3D:
   a. [_____][Lifts of embankment material by zone];
   b. [_____][Most current top of rock surface and contours];
   c. [_____][Excavated quantities per billing cycle];

d. [_____][Placed quantities per contract billing cycle];
e. [_____][Spoils quantities per contract billing cycle];
f. [_____][Concrete structures including attributes for concrete materials testing. For concrete testing data without spatial coordinates create dummy coordinates. Include pass/fail for each test performed, retest and retest ID if applicable to the sample, and QC narrative about the test included in a comments field for all tests if failing or resampled];
g. [_____][Soils material testing locations including attributes for soil testing with pass/fail for each test performed, retest and retest ID if applicable, and QC narrative about the test included for all failing or retested samples];
h. [_____][Blast Plans and Reports including blast holes, polygons, overbreak in final surfaces, final grade survey, and any overexcavation];
i. [_____][All processed orthophotographs or aerial photos produced, and DEMs from LiDAR data gathered on site];
j. [_____][All grout stages and holes in 2d profile with grout stage summary data including grout volume, mix design, effective pressure]
k. [_____][Verification holes including all attribute data of water pressure testing, falling head testing, concrete anomalies]
l. [_____][Anchors including all attribute data for testing, and pass/fail for each test performed];
m. [_____][Cutoff wall panels and secant piles orientation and location in space, including all attribute data associated with alignment acceptance and materials testing].
n. Provide [_____][15] additional feature services not requested in this list or the schema provided as requested throughout the course of construction.

2.8   WEB INTERFACE AND GEOGRAPHIC INFORMATION SYSTEMS (GIS)

Develop a web-based visual user interface to spatial and tabular project data that incorporates the following elements. Host this interface for the entire Contract duration, and for [_____][6] months following demobilization, or the Contract closeout, whichever comes first.

Within 30 days of the end of the data management planning meeting, provide a presentation of the initial Web Interface build for preliminary approval by the [COR][ACO]. Within 30 days after any subsequent Data Management Planning Meetings held for major features of work that weren't covered by the initial planning meeting, or where a change to the web interface is made due to the subject feature of work starting much later in the Contract (for example the [_____][cutoff wall]), provide a presentation of the components of the web interface to be added/updated including GIS and dynamic data components for approval by the COR to satisfy the Web Interface Updates submittal requirement.

****

2.8.1   Web-based GIS Interface

****
**   NOTE: ESRI ArcGIS is already a FEDRAMP approved**
**   software platform, and as such many agencies are**
**   already using it for web-hosted display and desktop**
**   products of geospatial data. If the designer wishes**
**   to specify a different service/program, remove and**
**   replace all bracketed language. If the designer will**
**   specify ESRI products, remove all brackets around**
**   ESRI language and empty brackets.**
****

Develop [_____][ESRI] GIS web viewers in plan, profile and 3D views using
web services published with [_____][ArcGIS Server or Enterprise]. Grant
read-only access to the Government to all GIS services used in the web
viewers such that the Government can securely add services to Government
web viewers and [_____][ArcGIS Enterprise or Portal maps] applications.
For details of execution see Part Three, EXECUTION.

2.8.2   Dynamic Data Web Interface

Develop the web interface to have a display component featuring tables,
charts, graphs, plots, widgets, and other visualizations in an integrated
dashboard style user interface with the GIS views as exampled in the
mockups provided in the Volume [_____] attachments. Display data in near
real-time from the appropriate enterprise database, even when the data
displayed is not real-time from generation (i.e. analog data collection).
As the needs of the project evolve, the [COR][ACO] will direct changes or
additions to these displays. Make additions and changes to display
components as requested by COR.

2.8.3   Desktop GIS Files

****
**   NOTE: Verify versions and update the software**
**   utilized based on what the project uses prior to**
**   finalization of spec. The intent of the last**
**   sentence in brackets is to clarify for the**
**   Contractor that there is not an existing 3D model of**
**   the planned or existing features and that the**
**   Contractor is to build it. Delete this language if**
**   this is not required.**
****

Develop, update, and maintain the required 2D and 3D models, complete with
all existing feature classes and rasters provided by the Government, and
all available planned and completed elements of work as directed by this
specification and the [COR][ACO] for the project duration. Develop desktop
GIS files in ESRI ArcGIS Pro version [_____][2.X] or current as directed
by the [COR][ACO]. The desktop map packages and associated spatial data
(e.g. .aprx, .gdb's, and other appropriate file types) must contain all
formatting, symbology, labeling, binning, and other information requested
by the Government. The formatting must be such that the user can easily
produce a printed map(s) after performing only the most minor formatting
or rescaling. Print templates will be provided by the Government. Provide
these documents and all source files as specified in PART 3 EXECUTION.

The Government will provide all historical GIS layers, as detailed in the Volume [_____] attachments, that are required for display in the 2D web interface.[The Government will not provide a base 3D model or any 3D feature classes, however the Government will provide any data required to be displayed in the 3D GIS by the Contractor (as detailed in the Volume [_____] attachments).]

2.9   QUICK REFERENCE GUIDE

****
          NOTE: Tailoring options are available for
          "WEB-BASED GIS INTERFACE" and "WEB INTERFACE"
****

Develop a Quick Reference Guide that meets the following criteria at a minimum:

a. Describes how to access and view information management system tools and components;

b. Describes how to download data, reports, drawings and maps;

c. Describes how to make or change graphical outputs for the project;

d. Is designed in an indexed, and well-organized manner and written in plain English rather than technical jargon;

e. Includes web addresses of web-hosted sites in use, and POC information for administrators who can provide user-access to the Government;

f. Documents and indexes all the views and group layers and available graphical datasets in an intuitive user guide to the web viewer so that the user has an understanding of the full capabilities of each view;

g. Clearly describes how to view and filter data in the web viewer, as well as the use of all other functionality of the web interface of spatial and graphical data;

h. Clearly describes how to utilize field forms on digital devices to input data into the web viewer;

i. Clearly describes how to download and utilize any phone app required to utilize field forms for direct entry of field data;

j. Documentation of all URL's used and credentials.

k. Clearly describes the use of the custom web-based QA tool for the database;

l. Clearly describes how to use the database mirror functions.

Text, recorded videos (not to exceed 3 minutes each) with separate videos for each topic, and other COR-approved format may be provided as the quick reference guide, however it must meet the requirements for organization and indexing by subject. General software manufacturer product literature in whole or in part will not satisfy this requirement. Host the guide to an additional page of the web interface and provide meaningful user

search, reference and selection options to find related videos/topical
text/pictures. Prepare and submit the guide within 30 days of the approval
of the initial web interface. If the guide is part of the web interface,
schedule a 1-hour meeting to walk through the tool and functionalities.
Record the meeting and submit the recording to RMS and the SFTP site, and
make it accessible on the website itself.

2.10   DIGITAL CAD MODEL

****
          NOTE: If these requirements and submittals are
          already stated in Section 01 78 00 CLOSEOUT
          SUBMITTALS, remove the "CAD 3D MODEL" tailoring
          option from this specification.

          If the project intends to maintain and update its
          own web interface in ESRI products, the turnover
          times and formats of the CAD model are more
          important to consider so that the 3D CAD model can
          be used to update the GIS model. Also consider the
          Interoperability between CAD and GIS programs used
          when requiring a specific CAD format.
****

Provide the Digital 3D CAD Model Files files comprising the 3-dimensional
CAD model and associated data files in [_____][Autodesk AutoCAD][Bentley
MicroStation][OpenRoads Designer 3D] format, compatible for use with
[_____][AutoCAD 2018][Bentley CONNECT V.8]. The CAD files must be complete
in all as-constructed details, and identical in form and function to the
Contract drawing files supplied by the Government, except to replace
design with as-built data, and to correct mistakes in original design
files.

Provide the most up to date version of all [.dwg][.dgn] files and
associated data files comprising the 3D CAD model in a weekly update to
the SFTP site by [_____][0600 hours] local time zone every
[_____][Monday]. All items (polylines, points or others) in [.dwg][.dgn]
files must be on correct A/E/C Layers, in accordance with A/E/C CAD
standard ERDC/ITL TR-19-7. Utilize the same required templates as are
required and used for redline and final as-built drawings as applicable.
Utilize [_____][e-Transmit][Packager] to export all features and submit
all associated files in one zip file when submitting the CAD files. The
Government reserves the right to reject any files it deems incompatible
with the Government CAD system, files not compliant with the [_____][R6.1]
A/E/C standard, and files containing features without accurate geospatial
referencing or with geometric inaccuracies.

2.10.1   Spatial Referencing

Spatially reference the features of the 3D CAD model to the verified
primary project survey control, utilizing the established project
horizontal and vertical datums and projections. Create all applicable
features as geometrically correct closed 3D features which can be imported
as closed multipatch features in ArcGIS. Ensure all features are true to
as-constructed dimensions and locations.

2.11   DATA MANAGEMENT PLANS AND ADDENDA TO 100 PERCENT DATA MANAGEMENT PLAN

2.11.1   50 Percent Data Management Plan

****
          NOTE: Tailoring options are available for WEB-BASED
          GIS INTERFACE", "SQL RDBMS EDB" and "ACCESS
          ENTERPRISE DATABASE".
****

Within 60 days after Notice to Proceed, prior to conducting the data
management planning meeting, submit a 50 percent plan for management of
all the various data collected throughout this contract. The Plan must be
well-organized, and in a digital format where both text and tables can be
easily edited during the data management planning meeting. The Plan must
include all sections and information detailed in PART 3, DATA MANAGEMENT
PLAN to the best of the Contractor's knowledge at the time. Proposed
substitutions for any requirements will be approved in the 100 Percent
Data Management Plan submittal. Include the following proposals to
Contract requirements:

a.   Any proposed substitutions to required visualizations in this document;

b.   Proposed naming conventions per paragraph in PART 1 Naming Conventions;

c.   Proposed Contractor database platform per paragraph in PART 2,
     DOCUMENTED ENTERPRISE [SQL][MS ACCESS] DATABASE;

d.   Proposed format for required Data Transfer and QC Reports per
     paragraph Data Transfer and QC Reports in PART 2;

e.   Proposed photograph PDF organization format per paragraph PHOTOGRAPH
     PDF'S AND RAW DIGITAL PHOTOS in PART 2.

This document serves as the seed document for use in the data management
kickoff meeting containing all necessary information about the
Contractor's side of the data management system with respect to the
Contract requirements and in light of changes that may occur due to the
design-build nature of the Contract. The 50 percent plan will be used to
record all decisions and information about the joint data management
system that are agreed upon in the meeting, and will become the basis for
the 100 Percent Data Management Plan. Government approval of this plan
indicates it is complete enough for use in the data management planning
meeting. Approval does not indicate an approval of any proposed deviations
or substitutions.

2.11.2   100 Percent Data Management Plan

Within 30 days after the end of the data management planning meeting,
submit the initial comprehensive Data Management Plan for the project. The
100 Percent Data Management Plan must include all sections and information
detailed in PART 3, DATA MANAGEMENT PLAN, and must reflect all [COR][ACO]
input, and collaborative decisions, products and workflows from the data
management planning meeting. It must be updated with the results of any
subsequent kickoff meetings for features of work where the data-generating
Contractor will not be on site, and specific data-generating equipment
will not be detailed until the start of that work.

This document serves as the authoritative data management guide which

documents the collection, processing, storage, flow, and visualization of information and data throughout the contract. At the end of construction, the final version will become the Data Management Manual outlined in SD-11 Closeout Submittals. Resubmit this document every 6 months with any updates per PART 1, SUBMITTALS SD-10. A sample Data Management Plan will be provided upon request after award.

2.11.3   Addenda to the 100 Percent Data Management Plan

****
                **NOTE: The following plans are intended to make the
                Contractor detail the workflows utilized to meet the
                specification requirements, and submit them for
                review by the Government. The plans are submitted
                prior to the data management planning meeting to
                give the Government a chance to review and discuss
                them with the Contractor during the meeting to help
                resolve any issues prior to the start of intensive
                data collection.**
****

The addenda to the data management plans are submitted and approved prior to the data management planning meeting with the exception of the Proposed Changes to the Enterprise Database Schema, which is submitted synchronously to the 100 Percent Data Management Plan. These individual plans may be changed during the data management planning meeting based on the collaboration that occurs and are subject to a second approval as part of the 100 Percent Data Management Plan submittal, of which they are a component.

The addenda to the 100 Percent Data Management Plan must include the following:

2.11.3.1   Automated and Manual Data Collection Output Examples

Within 45 days after Notice to Proceed, before conducting the data management planning meeting, submit digital samples of all raw outputs from automated data collection systems and all manual processes. Submit automated systems outputs in two formats: 1) Excel-readable digital format with field types defined on separate pages or in a separate document as needed. 2) PDF of digital printouts. Submit forms or logs to be completed manually digitally in PDF format. The purpose of this submittal is to have all necessary data output formats available for use in the data management planning meeting and for the Government understanding of proposed changes to the EDB schema.

2.11.3.2   Data Cleaning and Verification Plan

Within 30 days after Notice to Proceed, before conducting the data management planning meeting, submit and have approved a detailed plan for cleaning and verification (see definitions provided in PART 1) of data generated either by an automated or manual process on site. This includes the identification of all procedures and policies related to consistency and accuracy of naming convention, field formats, standardized character entry of fields and records, correcting entry errors, verification of source field data and data review for verification of entry correctness. This plan must include all technical specifications for all hardware and software utilized in this process. This plan must be developed by the data manager and the data management quality control representative identified

in Section 01 45 00 QUALITY CONTROL as applicable. Reference PART 1 for
record tracking requirements of EDB contents.

2.11.3.3   QC Daily Information Collection Plan

Within 60 days after Notice to Proceed, before conducting the data
management planning meeting, submit and have approved a detailed QC daily
information collection plan that includes:

a. How the narrative information about installation procedures and
    performance of the work that goes into the QC daily reports will be
    added to the EDB and related to records for the features of work the
    QC was performed on.

b. How activity codes will be collected in conjunction with "a" and
    incorporated into the database and related to relevant fields.

c. How personnel hours and equipment and hours will be incorporated into
    the EDB.

d. Any proposed changes to the EDB that will be required to incorporate
    items a-c, and how the information will be related to the features of
    work.

2.11.3.4   Backups, Archiving and Disaster Recovery Plan

Within 30 days after Notice to Proceed, before conducting the data
management planning meeting, submit and have approved a detailed plan for
the backup, archiving and disaster recovery for data and data systems,
sufficient to describe the steps the Contractor will take to protect and
store project data of all types from the time of automated or manual
generation, through project record turnover to [COR][ACO] and
discontinuation of the SFTP site.

2.11.3.5   Data Transfer Workflow

Within 45 days after the Notice to Proceed, before conducting the data
management planning meeting, submit and have approved a detailed plan
describing the Contractor's data transfer technical workflow in detail.
The plan must show in depth how the data transfer system on the
Contractor's side will integrate all features specified by the Government
in PART 1, Data Turnover Timeframes, how turnover times will be met, and
how it will dovetail with the Government's system architecture (if
applicable).

2.11.3.6   Proposed Changes to the Enterprise Database Schema

****
          NOTE: Tailoring options are available for "SQL
          RDBMS EDB" and "ACCESS ENTERPRISE DATABASE".
****

Within 30 days after conducting the Data Management Planning Meeting,
submit proposed changes to the EDB for approval. The Government
acknowledges schema changes to the enterprise database will be required as
a result of Contractor-specific systems and methods. Provide a detailed
description of any proposed changes to the schema of the enterprise
database required to make actual data collection for the project
consistent with the Government's goals. As one example - adding fields to

the table "Concrete_MixDesign" for the specific cementitious materials that will be used in the concrete mixes. As another example, adding fields specific to the type of hardware used to verify cutoff wall panel or secant alignment. This addendum must include written justification for each proposed change, and a draft version with all of the following with proposed changes highlighted:

        (a) Data Dictionary
        (b) Entity Relationship Diagram

Additionally, for each schema change, submit the SQL statement for the change. All changes must be in accordance with paragraphs DOCUMENTED ENTERPRISE [SQL][MS ACCESS] DATABASE in PART 1 and PART 2, and will require [COR][ACO] approval prior to implementation.

2.11.3.7   Data Management System Demobilization Plan

Within 45 days after Notice to Proceed, before conducting the data management planning meeting, submit a step-by-step plan documenting how the data management system will be demobilized including:

a. Schedule correlated to project schedule milestones and overall project completion for final deliverable completion and transfers and decommissioning of data system components.

b. Proposed method for transfer of all final datasets, (viewer components, GIS files, algorithms, scripts, and other products) to the Government.

c. Schedule of preliminary test of final data transfer from item b that includes adequate time to address these issues prior to data system closeout.

d. The steps of equipment/component demobilization and details of all impacts of these steps on the data management system functionality.

2.11.3.8   Data Management System Demobilization Plan Updates

Within [_____][12] months of scheduled project completion, begin submitting updates to the data management system demobilization plan. Provide any updates to the plan required for changes in technology (i.e., hardware, software, applications) and methodology that may have taken place throughout the execution of the contract. Resubmit the entire demobilization plan but clearly denote in the body of the plan what has been removed and what it was replaced by, or what has changed.

Full details of execution of the Data Management Plan are in PART 3, DATA MANAGEMENT PLAN.

2.12   TRAINING

****
        NOTE: The purpose of training is user integration to the web-based tools and the DMS. If the Contractor is not hosting a web interface it may still provide value for familiarization with any other product they are producing such as the database, database mirror. This must be determined by each individual project.

Provide training sessions, on site or at the Government office – as
coordinated with the Government, to familiarize and train Government users
on the GIS and dynamic data web interfaces and use of the database mirror.
Provide [_____][3] sessions, [_____][4] hours in length each.

2.12.1   Initial Training Session

Coordinate the initial session to take place no later than 15 days after
the approval of the initial web interface. Contractor's Data Manager, and
Data Visualization Specialist must be physically present at the meeting,
and any other data management staff who made integral contributions must
participate either in person or via webinar hosted by the Contractor.

Record the training session, bookmark the recordings according to topic,
and host to the help section of the web interface (specified in PART 2,
QUICK REFERENCE GUIDE) within 5 business days of the completion of the
session.

2.12.2   Intermediate and Final Sessions

Coordinate the intermediate session to take place during execution of the
Contract with date/time to be arranged between the Government and the
Contractor. Demonstrate at this meeting that Government feedback from
initial meeting has been implemented, and that adequate coordination
between the Government and the Data Manager is taking place prior to the
start of features of work for which intensive data collection will occur.

Coordinate the final session to take place near Contract completion to aid
in transfer of information management system to the Government systems,
including but not limited to transfer of databases, web services, and
other data system components.

2.13   PHOTOGRAPH PDF'S AND RAW DIGITAL PHOTOS

In addition to the raw digital photo submissions described in Part One,
submit PDF documents displaying all Contract required progress or other
photos organized into separate documents. Propose document organization
in the 50 Percent Data Management Plan for approval by the [COR][ACO] (for
example by feature of work, work phase, work location, or other parameters
which make navigation intuitive). Render the photos in the PDF with a
resolution that represents the original photo resolution to the human

eye. Place photos according to their proper orientation (portrait or
landscape). Create an index with bookmarks for each PDF organized by
submittal section and suborganized by work area (if applicable) and then
by date in the sequence which they were taken.

Process all raw photos for inclusion in the PDF submission with a border
including a 13 mm 0.5 in caption at the base of each photo for descriptive
information. Include the following information for each photographic image
in the caption:

> Project Name
> Contract Number
> Contractor Name
> Date
> Station and Offset
> Photo Number
> Orientation View
> Work Element Depicted
> General Project Area

2.13.1   Turnover Times

Submit all raw photographs to the SFTP site within 48 hours of collection
and organize in folders on the SFTP site in accordance with the provided
file structure in the Volume [_____] attachments. Photos must be updated
to the PDF documents within 7 days of collection. PDF documents must be
updated and uploaded to the SFTP site weekly.

2.14   OPENGROUND CLOUD DATABASE AND RECORDS

****
        NOTE: This section applies to USACE projects only -
        USACE uses OpenGround Cloud for drilling data.
        Delete the tailoring option for OPENGROUND if used
        by other agencies or OpenGround will not be
        needed/used.

        The Drilling Data Standards Committee in the
        Geotech, Geology & Materials Community of Practice
        in USACE developed the fields for boring log entry
        to streamline the usage of geologic terms and
        descriptors. These terms have been researched from
        USACE ER, EM, ATSM, and other standards. References
        to the standards can be found in the OpenGround
        Cloud program. This schema is available for use by
        any organization, and the software is DoD-approved.
        For more information, contact the Data Standards
        Committee Chair via the Geotech, Geology and
        Materials Community of Practice lead at USACE
        Headquarters.

        In the most recent update to EM 1110-1-1804
        Geotechnical Investigations, a National Drilling
        Manual was compiled from the drilling manuals of
        several districts. This manual was edited to include
        the use of the terms utilized in the drilling
        database fields. The manual is meant to be used in
        conjunction with the database and is intended to be
        provided to the Contractor and required for use in

Provide all drilling and soil testing data utilizing USACE Bentley
OpenGround Cloud configured for the [_____] project. USACE will provide
necessary permissions to Contractors entering data. Provide a list of
users with name and emails for the Government to grant access. If the
Contractor does not already have a license for OpenGround cloud,
user-specific "named user" or concurrent licenses must be obtained.

Enter the data for all drill holes on the project, including but not
limited to [exploratory drilling, grout holes, pilot holes, verification
holes, instrumentation holes, blast holes]. See PART 3, OpenGround Cloud
Database and Records for details of execution.

PART 3   EXECUTION

3.1   DOCUMENTED ENTERPRISE [SQL][MS ACCESS] DATABASE

Transfer the digital datasets identified in the data dictionary, and any
additional datasets requested by the COR, to the Government via the
project enterprise database (EDB). Provide data for all fields of each
table, according to the field definitions provided in the data dictionary.

3.1.1   EDB Structure

The documented [SQL][MS Access] enterprise database must utilize the
tables, fields and relationships detailed in the data dictionary. **The
Contractor must supply all data for all tables and fields of the database
for work being conducted within applicable turnover times.** If data is not
provided within specified turnover times, funds for both the features of
work being completed and for data management may be withheld until the

data is provided.

A preliminary data dictionary will be provided with the Volume [_____]
attachments. The database is required to convey the data in a way that can
be easily researched, understood and ingested by the Government. The
Contractor may utilize their own schema structure as needed within the
above constraints for the values used by the Government. Populate all
fields within each table for every record as applicable. Utilize the same
table names, fields, field names, field types, domains, units, precision,
and relationships as defined in the data dictionary agreed upon in the 100
Percent Data Management Plan. Tables added to the database exclusively for
use by the Contractor for their own internal business processes not
related to the verification of work are not required to be transferred to
the Government. This exemption does not include QC data.

3.1.2   Schema Changes

Incorporate any additional requested database fields, tables,
relationships and database views, either as requested by the [COR][ACO],
or as necessary to capture new features of work, throughout the Contract.
The Government's data manager will work with the Contractor's data manager
to ensure requested new structural changes do not add significant burden.

Propose modifications to the database schema that will impact the
Government's ability to ingest the data as needed. Any changes to the
schema impacting the tables, fields and relationships ingested by the
Government must be approved by [COR][ACO] prior to any change to the EDB
and documented in the subsequent update to the Data Management Plan. This
requirement does not apply to triggers, tables, and fields, and other
elements that are built for the Contractor's use only. Clearly identify
the table(s), field(s), and or relationship(s) to be changed, and the
specific changes to be made. Repair or populate any records that were
collected prior to the schema change that may be affected.

3.1.3   Database Mirror

Allow the Government to view all tables in the EDB using Microsoft Access
software. This can be accomplished through upload of a mirror database to
the SFTP (database(s) files updated daily which contain copies of the EDB
tables but are not directly updated with new project data from sources
other than the EDB), or by providing a Microsoft Access file with
security-compliant live-linked data tables, and/or through other means
proposed by the Contractor in the 50 Percent Data Management Plan, and
accepted by the [COR][ACO].

3.1.4   Ongoing Schema Updates

For updates to schema of the Government's tables throughout construction
after the initial "Proposed Changes To The Enterprise Database Schema"
submittal in PART 1, SUBMITTALS SD-01, update the following documents
hosted to the appropriate location of the SFTP site that detail the
changes:

a.   An excel document detailing the new field name, field type, associated
     units, field definition, relationships if any, and any associated
     calculation used to produce the value.

b.   ER diagram of the database structure that reflects the change.

c. Any impacts to the existing dataset arising from the change.

d. Reason for the change.

Submit this spreadsheet weekly with all changes from the week for [COR][ACO] approval. If there are no schema updates, formal submittal is not necessary

3.1.5   Database Views

The construction of database views is required by the Contractor in order to facilitate providing data specified in some of the visualizations. The Government will provide the required calculations, constants and definitions needed to facilitate the construction of these database views.

3.2   DATA DELIVERABLES FOR SPECIFIC FEATURES OF WORK

****
            **NOTE: The state of data requirements across UFGS
            specifications are highly variable from document to
            document. This section is intended to specifically
            detail the data deliverables for work already
            specified in the feature of work sections as the
            examples in section 1.3 outline. This section is
            intended to provide a venue for detailing data and
            report deliverables that are NOT properly detailed
            in other sections of the contract. For example if
            there is no remote sensing section, the LiDAR, or
            photogrammetry deliverables may be stated here. Or
            if not covered in the grouting section, OPTV
            deliverables may be stated here. Keep in mind, this
            opens a can of worms. These types of work have
            precision, accuracy, equipment, calibration, QC,
            processing, and other requirements that should be
            stated somewhere to ensure a quality data product is
            received. In a perfect world there would be no
            sections of requirements like this in this
            specification. Alternatively, this template can also
            be used for consistency in the appropriate feature
            of work specification sections if needed.**
****

3.2.1   Data and Reports

****
            NOTE: Insert a description of the data type.
****

 [_____]

3.2.1.1   Raw Data

****
            **NOTE: Insert a list of the raw data file types,
            contents and turnover times and methods if different
            from what is specified in Part One "Geospatial
            Metadata". Some datasets may be appropriate for
            scanned copy of a paper record generated by the**

```
            equipment, such as Koden raw data, however the
            majority of data will be received digitally.
   ************************************************************************

   [_____]

3.2.1.2   Processed Data

   ************************************************************************
            NOTE:  Include any final deliverables required to be
            produced from the raw data including file type,
            resolution, hosting size.
   ************************************************************************

   [_____]

3.2.1.3   Reports

   ************************************************************************
            NOTE:  Include the contents and requirements for
            reports associated with data submissions. Some
            verifications will be satisfied through the
            submission of a report containing the data rather
            than the data itself. One example of this is
            verticality verification for cutoff wall panel
            excavations - a report submitted showing
            verticality, alignment, and rotation of each element
            with plots generated from the Koden data is far more
            useful for rapid approvals than the raw data where
            the government would have to generate these
            products. Remember, these requirements belong in the
            appropriate work section. Only list them here if
            they have not been required there.
   ************************************************************************

   [_____]

3.2.1.4   Visualizations

   ************************************************************************
            NOTE:  Include any specific visualizations needed in
            GIS including symbology and binning, plots, charts,
            graphs, and tables of data. in this section.
   ************************************************************************

   [_____]

3.2.1.5   Drawings

   ************************************************************************
            NOTE:  If progress drawings are required as part of
            the delivery, detail here.
   ************************************************************************

   [_____]

[3.2.2   Grouting and Water Pressure Testing

   ************************************************************************
```

3.2.2.1   Raw Data

 Provide digital raw and appended raw data files of the automated grouting
 control and data collection system in .csv format and load to the
 appropriate location of the SFTP site within 12 hours for raw data and 24
 hours for appended raw data. Format raw data files, or appended data files
 if not an option for raw data, such that the field headers have names that
 allow the user to understand what date they contain.

3.2.2.2   Processed Data

 Provide grouting and water pressure testing data to all required fields of
 the EDB as detailed in the data dictionary, provided in the Volume [_____]
 attachments. Differentiate water pressure testing records in the naming
 convention and in the EDB records in accordance with the provided data
 dictionary.

3.2.2.3   Reports

 Furnish records of pay quantities to the [COR][ACO] within 24 hours for
 the previous day's activities. Submit daily records in the form of
 drilling and grouting reports with the daily log of construction.

 Include in the drilling report:

          (1) The location and station/offset of each hole drilled;
          (2) The date;
          (3) Drill rig identification;
          (4) Inclination and azimuth;
          (5) Time drilling was started and stopped;
          (6) Rock type and condition if core is logged;
          (7) Any unusual drilling conditions encountered;

(8) Depth and quantity of drilling fluid loss and gain;
(9) Total footage drilled.

Include in the water pressure testing report:

(1) Equipment calibration logs;
(2) Date;
(3) Hole ID tested;
(4) Depth of test;
(5) Pressures applied;
(6) Time interval;
(7) Volume of flow.

Include in the grouting report:

(1) Hole ID;
(2) Date;
(3) Grout mixes used for each zone;
(4) Time of each grouting effort and pressures attained;
(5) Maximum, minimum and end injection pressure;
(6) Maximum injection rate;
(7) Volume of grout mixture placed;
(8) Volume of cement solids injected in the hole;
(9) Itemized total quantities of grout materials placed;
(10) Quantity of grout wasted;
(11) Temperature of the grout;
(12) A plot of the evolving permeability and pressure with time.

3.2.2.4   Visualizations

a. Graphs - Included in PDF documents, may also be included in Raw Data.

(a) 1) Gauge Pressure, Effective Pressure (and Down hole Pressure if used) vs. Test Duration in minutes
(b) 2) Flow Rate (gal/min) vs. Test Duration in Minutes
(c) 3) Apparent Lugeon value vs. Test Duration in Minutes
(d) 4) Volume of grout, water, or dye vs. Test Duration in Minutes

b. Grouting, Water Pressure Testing or Grout Trend Plots in PDF format for each borehole and for each test type with all stages and graphs shown (e.g., each borehole will have one PDF record of Grout Trends plots for all stages and one PDF record for water pressure test plots for all stages). Hyperlink grout stages in GIS profile view alignment to trend plots.

c. Grout summary symbology in the GIS environment: Symbolize grout stages as a layer(s) in a section view within the simplified and desktop GIS environment. Color stages along a borehole to highlight areas of high grout take. Initial symbology must be gray for 0-5 gallons, yellow for 5-15 gallons, brown for 15-30 gallons and red for over 30 gallons.

d. Water Pressure summary plots in the GIS Environment: Water (and dye testing) stages must be colored along a borehole to highlight areas of high lugeon values. Initial symbology must be green for 0-3 lugeons, yellow for 3-10 lugeons, brown for 10-50 lugeons and red for greater than 50 lugeons. Final "As-built" grout summary plot(s) must be provided in an Adobe PDF and as per Section 01 78 00 CLOSEOUT

e. Create and maintain a georeferenced, three-dimensional CAD file with plan and section views for the development of the as-built drawings outlined in this specification. Represent each hole drilled and grouted in both plan and section views of the model. Display the following information in section view, and submit accompanying plan view drawings for orientation of the profile. This may require more than one view of the same section:

      (a) 1) Hole location by station with applicable orientation or orientation indication and inclination;
      (b) 2) Grout volumes and mixes placed per stage in gallons;
      (c) 3) Symbolized by grout volume;
      (d) 4) Lugeon values from water pressure testing by stage;
      (e) 5) Drilling information (e.g., cavities, rod drops, water losses,and other data as applicable);
      (f) 6) Geologic formations along the profile as a backdrop;
      (g) 7) Location and type of lost tooling;
      (h) 8) Irregular events;
      (i) 9) Hole depths and top and bottom elevations;
      (j) 10) Stationing at regular intervals;
      (k) 11) Grout hole IDs;
      (l) 12) Elevations.

Display the following information in plan view:

      (m) 1) Grout holes with labeled hole ID;
      (n) 2) Instrumentation, exploratory drill holes, or other related structures in the immediate vicinity;
      (o) 3) Final bottom elevation of the holes;
      (p) 4) Northing and easting grid;
      (q) 5) Compass rose and scale;
      (r) 6) Total grout takes for finished holes in liters gallons;
      (s) 7) Hole symbolized by status (such as planned, drilled, in-progress, completed, and other symbologies commonly used).

Provide all updated CAD source files for the drawings and all other necessary data to view and edit the drawings in the full CAD program via the SFTP site weekly. Use all applicable projections and datums specified and ensure all features are georeferenced to project survey control. Update records and drawings within [_____][48] hours of data collection, or [24] hours of progress status changes, and submit updated digital PDF copies on a weekly basis for the duration of the grouting via the SFTP site. Provide one full-size, color printed copy submitted to the Contracting Officer weekly. The [COR][ACO] may request changes in format or symbology at any time and should take effect within [_____][5] calendar days.

][3.2.3   Cutoff Wall Verticality and Orientation

****
       **NOTE: Tailoring options are available here for
       "WEB-BASED GIS INTERFACE".**
****

3.2.3.1   Raw Data

Provide the digital raw data files of the verticality and orientation

measuring device. If the native file format requires proprietary software to read, convert the files into an Excel-readable format. Provide printed hard copy data produced by the [_____][Koden] via a clean, legible scan in PDF format.

Load raw data files and scans to the SFTP within 12 hours of the measurement of the excavated element.

3.2.3.2   Processed Data

Provide active data and associated plots of verticality and rotation in Microsoft 365 Excel or another approved software application which clearly demonstrate actual position in space along every axis. Plot this against theoretical location in space and specification tolerances. Label all data, constants, and values with units, and orientation in relation to the project baseline. Provide plots within 24 hours of the excavation via RMS and the appropriate location on the SFTP.

3.2.3.3   Reports

Submit detailed reports of the verticality, alignment, and rotation of each element excavation within 24 hours of measurement of each excavation. Submit reports of verticality, alignment, and rotation for each element and its neighboring elements for signed off by the [COR][ACO] prior to backfilling the element with concrete, as detailed in Section [_____][Section 31 56 10 CUTOFF WALL]. Both reports must depict actual versus theoretical alignment as specified in this section. Refer to both the raw and corrected verticality and rotation measurement data with a full list and explanation of all values, constants, formulas, and information used to process this data. Submit to-scale graphical plots for each test per the requirements herein. Submit any diagrams/schematics necessary for interpretation of the data. Use the same reference orientation in all instrument reports.

3.2.3.4   Visualizations

Drawings showing an analysis of barrier wall elements must be completed for each element and each set of adjoining elements showing the verticality, orientation, overlap and continuity of the barrier wall. These drawings must be completed weekly.

Display actual location of these elements in space in the GIS environment, in plan and section views. Display overlap between elements in the GIS environment as a separate layer.

a. Sections of barrier wall elements taken at [_____] meters (m) [_____] foot (ft) depth intervals of the actual location of all barrier wall elements must be shown in plan view such that they are located correctly in space and the verticality and alignment of each element at each [_____] m [_____] ft depth intervals can be seen.

b. These plan view section cuts of the elements must also include a section at the top of the wall, at the soil-rock interface and at the bottom of the wall. The element section cuts at depths must be placed in layers by depth that can be turned on and off by the user separately such that user can look at section cuts of all completed barrier wall at some specified depth individually (e.g., 30 feet below work platform, or at bottom of barrier wall elements).

c. Overlap between adjoining elements must be shown as red when criteria
   specified in [31 56 10] is not met, yellow when criteria are within
   0-5 percent over requirement and green where criteria is more than
   five percent over requirement. Final overlap analysis and drawings
   must be completed in CAD format as per Section 01 78 00 CLOSEOUT
   SUBMITTALS (as-built drawings).

d. Include all relevant base layers such as stratigraphic units,
   embankments extent, abutment contacts, instruments, station/elevation
   grid, location of features that cross-cut the embankment, existing
   grout curtain, existing post-grouting water permeability data,
   top-of-rock, and other datasets as requested. Also include the
   [Koden-]calculated excavation and placement geometry of
   panels/secants, and [hydromill-]detected top-of-rock if data is
   collected.

e. Visualize verification holes in the cutoff wall as line/polyline
   features, and concrete anomalies as point features with unique
   symbology for each type of concrete anomaly. See the Volume [_____]
   attachments for details.

f. Hyperlink verification hole elements in GIS to Hvorslev plots, CCTV
   footage files, and OPTV/ATV logs.

][3.2.4   LiDAR Surveys

****
         NOTE: Tailoring options are available here for
         "DESKTOP GIS FILES".
****

3.2.4.1   Raw Data

Provide raw LiDAR data in .LAS format, including acquired LiDAR line
strips and the SBET files with all EO information included. Calibrate raw
files. [The .LAS files must include all returns, intensity data and RGB
values.] Submit all raw data to the SFTP within [_____][48] hours of
generation.

Deliver mass point data utilizing .LAS [_____][V1.4], containing all .LAS
items of point data record format 1. The header file must contain all
system-generated .LAS items as defined in the Public Header Block, and at
a minimum must contain the "File Creation Year Day" and "File Creation
Year" which will represent the final deliverable-generated .LAS date.
Specify the projection information for the point data in the Variable
Length Record using the appropriate GeoTIFF tags.

3.2.4.2   Processed Data

a. Noise-removed LiDAR point cloud (classified points) with return number
   in .LAS format. Break files up into approved tile scheme. [The .LAS
   files must include all returns, intensity data and RGB values.]

b. Create Digital Elevation Model (DEM) using an appropriate
   interpolation method to produce [_____][0.01] m[_____][.3937008] in
   posting DEM for geologic foundations and slope monitoring surveys, and
   [_____][1.0] m[_____][3.28084] in -posting DTM for quantity surveys,
   however this resolution may be adjusted at the direction of the
   [COR][ACO]. Reference DEMs to the same horizontal and vertical datums

as the .LAS files. Produce DEMs in GeoTIFF file format. Tiles must be
edge joined and seamless within the project. Document interpolation
and other data processing methods and provide in the metadata.

c. Process geologic foundation datasets to produce vector features in GIS
   of all discontinuity and other structural rock features and of dental
   concrete.

d. A sample symbology and visualization for monitoring survey
   deliverables showing cumulative displacement is provided in the Volume
   [_____] attachments. Utilize this sample as the basis for showing
   changes to monitored areas over time.

e. Provide project-based metadata for all final data products.

f. Submit processed datasets within [_____][7] days of conducting the
   field survey.

3.2.4.3   Reports

Produce a report for each foundation (horizontal and inclined surfaces or
tunnel section), that includes all requisite metadata, quality control,
field forms, the field checklist for foundation cleaning signoff showing
data collection was not started until the [COR][ACO] confirmed appropriate
cleaning had taken place, data collection technician and Government
representative sign off that compliance with Section SURVEY CONTROL
paragraphs LAWS AND REGULATIONS GOVERNING AERIAL DATA COLLECTION and
SECURITY REQUIREMENTS were followed, and any other information as directed
by the [COR][ACO].

For monitoring surveys produce a report including survey drawings showing
cumulative displacement calculated between initial and most recent DEM
datasets, and field notes, within [_____] [48] hours of data collection.
For displacement drawings, utilize a binning for features that captures
[_____][0.01] m [_____][.3937008] in changes, and a symbology that makes
these changes easily identifiable utilizing both raster symbology and
contouring lines as necessary to achieve a high-quality visualization.
Submit a final report of monitoring surveys at the completion of the
project and prior to demobilization. Submit all quantity surveys conducted
utilizing LiDAR in accordance with [_____] SURVEY CONTROL.

][3.2.5   Orthoimagery

3.2.5.1   Raw Data

Provide the raw imagery exposures acquired (Stereo Pairs), the final
aero-triangulation solution (Exterior Orientation EO files) in the format
required, or as directed by the [COR][ACO]. Submit raw data to the
appropriate folder of the SFTP within [_____] [48] hours of generation.

3.2.5.2   Digital Data

Orthorectify the imagery to create a digital mosaic for the entire project
area. Employ software techniques to radiometrically process the
orthophotos to ensure maximum tone and contrast balance between adjacent
tiles. Document the techniques applied in the Data Management Plan.

Use the same tiling scheme from the LiDAR deliverables for each ortho
deliverable, and provide the final 4-band digital orthophotos in

uncompressed GeoTIFF format (.TIFF) with world files (.TFW) for each tile. Produce vector polygons in GIS of the dental concrete placed if collected with imagery. Submit all processed data to the appropriate folder of the SFTP site within [_____] [7] calendar days of generation for geologic foundations. Submit monthly site overview imagery within [_____] [48] hours of data collection.

3.2.5.3   Metadata

Project-level Metadata must comply with the current ISO Content Standards for Digital Geospatial Metadata including ISO 19115-2. ESRI ArcCatalog, ArcGIS Pro, or script-based geoprocessing tools may be used to create the metadata records. Construct metadata records with sufficient quality to pass through the USGS Metadata Compiler with less than three errors. All products generated must be identified in the metadata.

3.2.5.4   Reports

Include in the report for each foundation part all applicable information for orthoimagery collection. Submit to the appropriate folder of the SFTP site within [_____] [7] calendar days from data collection.

][3.2.6   Bathymetric Surveys

3.2.6.1   Raw Data

Provide all field verified survey control monuments as digital data in US Survey Feet reduced to the nearest [_____][0.3048] cm [_____][.01] foot. Survey control must be provided in PNEZD format and submitted in comma-separated values (.csv) file extensions.

Provide all hydrographic elevation soundings and topographic shots (if applicable) as digital data in US Survey Feet reduced to the nearest [_____][3.048] cm [_____][.1] foot referenced to mean lower low water (MLLW). Provide point files in ENZ format and submit with ".xyz" file extensions for all multi-beam hydrographic soundings sorted into [_____][30.48] cm [_____][1] foot cell size, mean biased (on cell-center), with z values in elevation mode.

3.2.6.2   Processed Data

Provide [.dgn] graphics files and DEM files with [Bentley OpenRoads Designer; MicroStation SS10; Autodesk]. Create files utilizing a data-reduction and averaging technique submitted and approved in the Bathymetric Survey Plan. Additionally, provide all vector feature classes (in a file geodatabase) for topographic contours or other applicable features loaded to the GIS model and created to produce progress or as-built drawings.

3.2.6.3   Progress Drawings

Provide progress drawings for each survey made, showing the excavated surfaces, and as applicable benches, fractures, any blast damage and whether slopes are in or out of specification tolerance.

Include [_____][15.24] cm [_____][0.5] foot contours and use a continuous color symbology for the raster surface which clearly shows how the excavated surface is changing over time. Reference surfaces to the digital plan files provided at award. Include all pertinent Contract information

in the title block. Include below the notes section all tables for survey
limits, survey project control, and excavation limits. Submit one digital
PDF of the drawing for each slope verification survey, and the final
survey with the digital stamped/signature of the Certified Hydrographer.
Submit all required drawings and data files with the submittal for payment.

]3.3   WEBSITE INTERFACE OF DATA

****
          NOTE: The complexity of the web interface should be
          dependent upon the scale and complexity of the work
          performed. The requirements in this section should
          be added to the contract if there is any type of web
          interface utilized - they include general security,
          operability and system QA tools. The tailoring
          option for "WEB INTERFACE" is utilized for this
          section.
****

3.3.1   General

Visualize every element for which there are spatial coordinates, and
provide construction verification and monitoring data and visualizations
in a format constructed to maximize user comprehension of the data. [A
mockup and tables of dashboard views, GIS alignments, specified plots,
tables and GIS layers and group layers] are available in the Volume
[_____] attachments. The verification and monitoring goals are specified
in this section throughout PART 3 EXECUTION [and in the Volume [_____]
attachments]. Show planned element layouts and positions for all designed
elements within the Contract (such as [_____][barrier wall elements, rock
reinforcements, or drilling and grouting locations]), in their geospatial
location, at their proposed location before construction begins. Show
these same elements in their correct geospatial location after
construction of each element is complete in separate layers. Symbolize
planned, in progress, and as-constructed elements using the COR-provided
symbology, or as directed by the COR. Include as many data fields in the
feature attributes appearing in the viewer as practical. Append related
data to geospatial features at [COR][ACO] request.

Propose any visualization substitutions in the 50 Percent Data Management
Plan in accordance with PART 2, DATA MANAGEMENT PLANS AND ADDENDA. Where
an alternative will be utilized, incorporate in the 100 Percent Data
Management Plan submittal for approval by the [COR][ACO]. Provide a
preliminary presentation of the Web Interface components in accordance
with PART 1, SUBMITTALS, SD-01. Provide Web Interface Updates for any
features where the interface needs to be updated, changed, or further
developed due to major features of work starting later in the contract, in
accordance with PART 1, SUBMITTALS, SD-10. Examine these goals and
requirements, and where the specified item would increase the cost of the
system substantially due to additional software licensing, or where there
is a superior or more innovative solution, propose an alternative
visualization or process that accomplishes the same goal.

3.3.2   Security Credentials

****
          NOTE: Bracketed language is applicable to USACE
          personnel only. Verify this for any organizations
          outside of USACE prior to including in contract

   Grant 24/7 read access to the Government, the Contractor, and any related
   subcontractors for this contract. Grant representatives of the Government
   any necessary username and password or other security credential for
   access no later than 30 days from the Notice to Proceed. The Government
   will provide a list of names and email addresses of users. [All Government
   employees can be assumed to have a ESRI Viewer license suitable for
   read-only access to ArcGIS Online map tools]. For new personnel requested
   by the Government throughout the contract, grant access and provide
   security credentials within 24 hours of the request.

3.3.3   Site Operability and Usability

   Ensure the website is fully functional, current, easy to navigate, and
   complete with all data available for retrieval by both automated and
   manual methods. If the website does not meet this criteria, pertinent
   payments will be withheld until the issue is resolved and acceptable to
   the Contracting Officer.

3.3.4   User QA Feedback and Tracking

   Provide graphic user interface forms on a web interface (can be a separate
   tool from the GIS viewer, but must still be linked/embedded via a tab or
   other integrated means into the main viewer) for any authorized user to
   provide direct feedback on the Contractor's database records, web
   interface, and SFTP site work including the ability to:

   a.   Verify, flag for correction or masking, and accept data from the
        database tables;

   b.   Submit corrections or updates needed to the GIS;

   c.   Submit corrections or updates needed to the dashboard;

   d.   Submit corrections or file updates needed to the SFTP site;

   e.   Track the status of submitted requests including relevant related
        information in a table which shows the following information:

        (1)   Data management system (DMS) component the correction was
               requested for;

        (2)   Date/time the request was submitted by the user;

        (3)   The dashboard page, GIS model alignment and feature class, SFTP
               folder or other element the comment/request pertains to;

        (4)   The narrative request entered by the user;

        (5)   Requesting user's name or initials;

        (6)   The status of the Contractor's response - i.e. "requested", "in
               progress", "resolved", and "expired resolution window". Script an
               automatic update of any "in progress" issues to "expired
               resolution window" when the 48-hour resolution window from the
               date and time of submission is exceed prior to the issue status
               being changed to "resolved".

(7) Date of resolution;

(8) Any resolution notes;

(9) Initials of Contractor personnel making the correction.

f.   Provide the ability to filter the information shown in the table based
     on items a, c, and e above. Make any requested corrections or updates
     to data records or displays within 48 hours of the request. The
     Government will provide a list of authorized users for accepting and
     flagging database records, however submission of comments on the rest
     of the DMS components must be available to all Government project
     personnel.

3.4   WEB-BASED GIS INTERFACE

****
         NOTE: Tailoring option "WEB-BASED GIS INTERFACE" is
         employed for this entire section".
****

Provide a secure GIS interface per PART 2, "Web-based GIS Interface" which
meets the following minimum criteria:

a.   Produce dynamic views of data in 2D plan view, profile view, section
     view and 3D, and integrate CAD and BIM elements to these views as
     appropriate to depict constructed components in correct geometry and
     geospatial location. Incorporate alternative alignments and static
     section views as specified in the Volume [_____] attachments or as
     requested by the COR;

b.   Symbology of represented data in the GIS must be changeable upon
     request by the Government, but does not need to be editable inside the
     web environment. Complete requested symbology, filters, or other
     display changes within 24 hours of the request. Provide symbology for
     progress to represent "planned", "in progress" and "as-built" such
     that specific subcomponents of the structures (i.e. [cutoff wall bites
     and panels, control tower lifts, outlet works lifts]) can be tracked
     for progress with this layer. Additionally for all testing data
     displayed in the GIS, provide a symbology for passing, failing, and
     passing re-test (or as directed by COR);

c.   Include a well-organized table of contents for the GIS viewer windows
     with the capability of turning layers and groups of layers on and off;

d.   Group relevant layers in the GIS table of contents together by
     features of work as specified in the Volume [_____] attachments (e.g.
     [instrumentation, geotechnics, designed structures, blasting (plan and
     report), cutoff wall, tunnel, control tower, excavation, monitoring]);

e.   Apply scaling labels to features so that at an appropriate scale the
     labels appear, but never overwhelm the view. Include the ability to
     turn labels off. Apply one feature class in each view with labels that
     always appear as a reference for the user for orientation such as a
     station line or other primary project location reference;

f.   Include a self-serve function for downloading the most data associated
     with a selected feature in the web browser;

g. Provide a standard, off-the-shelf option to generate a PDF map from
    the current view in any GIS viewer alignment. The PDF must be of a
    formatting quality suitable for including in reports, for example the
    frame must be centered and in an appropriate size on the page, and
    contain a legend for all elements included. The Government may request
    any structural changes to the graphical displays of data at any time.
    Complete any requested changes within 48 hours of the request.

h. Include links to static documents and plots where documents are
    associated with a single location or location range - for example:
    photographs, PDF QA/QC reports, scanned handwritten documents and logs
    in PDF, PDF checklists, PDF or JPEG sample tickets, PDF test reports,
    grout plots, water pressure test results, and other important
    documents as directed), final submittal packets, interactive reports
    such as concrete breaks or other reports listed in this specification,
    and As-built or Progress Drawings for construction elements within
    this system. Set up the links using hyperlinks as specified or other
    techniques proposed by the Contractor in the 50 Percent Data
    Management Plan, and approved by [COR][ACO] in the 100 Percent Data
    Management Plan.

    For reports (e.g. pdf's, photos, field form scans, and others) that
    are approved by the Government's data manager, provide a location on
    an anonymized external web folder such that the user does not have to
    provide user credentials to access each hyperlink. Examples of this
    type of data include [boring logs, verticality reports, or items for
    pay]. Hyperlink all documents which contain any structural schematics
    or information about distress in the embankment or structures directly
    to the SFTP site so that secured access is maintained. The [COR][ACO]
    will direct which additional datasets may be sensitive. Any document
    determined by the [COR][ACO] to contain sensitive information must be
    password protected.

[i. Provide the option of a storymap/operations dashboard style format
    with embedded GIS and summary statistics for QC testing data;

] j. Make new spatial features available in the ArcPortal environment
    within 24 hours of generation;

  k. Make other data available within 24 hours of generation, or as
    specified in other sections of the contract.

3.5   SYSTEM TESTING

Provide a test of the data management system within 30 days prior to the
start of production data generation. This includes loading dummy records
to all fields of the database and feature services, and verifying that the
data is correctly appearing in the digital delivery products required by
the Contract.

Clearly mark all dummy records as such within a record tracking field of
the database. Once the test has been successfully completed, remove the
dummy records from the database. Provide documentation of the test
conducted including the following:

    a. Date the test was conducted;
    b. Name(s) of person(s) conducting the test;
    c. Specific steps conducted in order to test the system including a

brief narrative explanation of the purpose of each step;
d. The results of each test step;
e. Any actions that were taken to achieve an acceptable test result
which include a final operational system;
f. Documented support including any screenshots necessary to
demonstrate that the system is operational according to the
requirements of this specification.
g. Date and verification all/only dummy records were removed from the
database.

3.6   DYNAMIC DATA WEB INTERFACE

Provide functionality within the web interface platform to provide dynamic
views of data plots, charts, graphs, tables, widgets, and other formats as
directed by the COR. Visualization must meet or exceed requirements,
deviations in style and navigation controls are acceptable however must be
approved by the Government in the web viewer approval. The initial plots
and other formats will be provided in the Volume attachments. The spatial
web interface must meet the following criteria at a minimum, and must add
other criteria as directed by the COR:

a. Build the plots and other data-displays for each feature of work as
    specified in the Volume attachments. As work progresses the may
    request additional plots or data displays based on specific issues
    encountered. Add new data displays within 48 hours of the request;

b. Provide the ability to adjust scales on the data displays, or update
    scales as requested by the COR, and complete requested changes within
    24 hours;

c. Provide the ability to select data to be displayed (e.g. by groups of
    features, location, feature of work, and others as pertinent to the
    work) and to filter the data by crucial elements such as date range,
    feature subpart or other elements as directed by the COR.

d. Symbolic and color components of display, and scales or binning of
    values (where applicable) must be changed at [COR][ACO] request.

Complete any requested changes within 24 hours;

e. Include an intuitive, well-organized, graphic user interface for
    navigation between and within the spatial and dynamic data portions of
    the website, and for hosting the user guide, recorded trainings, and
    user input forms for system QA;

f. Provide the ability to view relevant data displays together for ease
    of access and comparison. Specific requests are listed in the Volume
    [_____] attachments;

g. Provide legible symbology and legends for all plots, and label axes,
    axis points, and data points on displays as appropriate to balance the
    need for information with the need for comprehendible display. Apply
    scaling labels to features so that at an appropriate scale the labels
    appear, but never overwhelm the view - or so that labels appear when
    the mouse hovers above a plotted point/bar, or other feature. If the
    option for the user to turn labels on or off is available in the
    application, employ it. Make changes to symbology, scaling, labeling,
    and/or erroneous data masking when requested by the [COR][ACO] within
    24 hours;

h. Script the connection of data displays to the Contractor's EDB, so
    that data is updated to the visualizations within 10 minutes of an
    update to the EDB;

i. Provide a method to create printed products with legends.

3.7   DESKTOP GIS FILES

****
          NOTE: For software products such as ESRI ArcGIS,
          make sure to look up the version that is most
          currently available to the organization and fill it
          in. It is advised to have the contractor utilize
          software that is already FedRAMP approved and widely
          available to all Government technology users via an
          enterprise license. Allowing the contractor the
          flexibility to use their own choice of software may
          result in a product that cannot be used by the
          project.

          The tailoring option for "DESKTOP GIS FILES" had
          been employed for this entire section.
****

Build the ArcPro GIS project to contain geospatial data such as feature
classes in geodatabases, rasters (e.g. DEM, DTM, .GeoTiff, .Tiff), point
clouds, and other applicable geospatial file formats. Display all elements
associated with the 3-dimensional location in this environment and include
all associated attribute data. Build plan and profile views, any special
section or other views, and 3D view as detailed in the Volume [_____]
attachments. Add all data from EDB tables with associated spatial
components, feature classes, rasters, imagery or CAD layers visualized in
the simplified GIS as layers within this project package.

Publish updates of element progress or geometry/location changes, to the
web-viewer within 48 hours of field generation of the data. Update the .aprx, .gdb(s),

and raster datasets to the SFTP within 24 hours of an update (i.e. nightly
when daily changes are occurring). Complete metadata fields for each
feature class within the feature class
and in a separate document according to the metadata standards specified
in PART 1, Geospatial Metadata. Upon completion of the contract,
complete metadata documentation and deliver to the Government finalized .aprx, .gdb,
raster and other applicable files in the closeout submittal Final GIS Files.

3.8   FIELD DATA COLLECTION

```
**************************************************************************
          NOTE:  This requirement should be utilized when
          digital data collection in the field is needed by
          the Government and the Contractor is administering
          the database and all visualizations in a web viewer
          throughout the contract. The Government can develop
          and use the app forms themselves, however the
          Contractor needs to provide a method for ingestion
          and display of this data into the viewer.

          The tailoring option for "WEB-BASED GIS INTERFACE"
          has been employed for this entire section as this
          work will only be utilized in association with a GIS
          viewer.
**************************************************************************
```

Provide a method for Government input of data into the project database
and GIS web interface through the use of custom forms in an off-the-shelf
app designed for use Survey123 or Collector, or a similar app accessible
by the Government. Work with the Government's data manager to develop any
additions to the database schema, spatial and dynamic data layers on the
web interface, EGDB, and workflows for the input and visualization of this
data not already detailed in this specification and attachments. If the
Contractor will build the app forms and provide the ESRI account, the
[COR][ACO] will provide the necessary information required for the
Contractor to create the app fields and GIS features no later than 30 days
prior to the start of data collection.

3.9   DATA MANAGEMENT PLAN

```
**************************************************************************
          NOTE:  Tailoring options are available for "SQL
          RDBMS EDB" and "ACCESS ENTERPRISE DATABASE".
**************************************************************************
```

Submit the 100 Percent Data Management Plan within 30 days of the data
management planning meeting, and update at least every six months for the
duration of the Contract to include any changes or updates to any part of
the data management system. Attach all data submittals or plans required
as submittals in PART 1, SUBMITTALS SD-01 as addenda to the 100 Percent
Data Management Plan. The Data Management Plan must include:

a. A data flow diagram describing Contractor's Data Management System
    including each data source type (e.g. raw data, raw appended data,
    analog field data, digital field data), and processes for structured
    and unstructured data collection and aggregation.

b. A table of all datasets generated during the project that includes:
    raw data format, data generation method, identifying the data

generation system if digital or automated, necessary data transformations, data appending, estimated start date of data collection, and description of the data transfer process to the EDB and/or SFTP site. If data management is subcontracted, the primary Contractor must coordinate with all applicable subcontractors to provide all necessary information for the completion of this table.

c. Descriptions of components of the data management system including software used to create, store, transfer, process, analyze or visualize data.

d. Naming conventions utilized as detailed in PART 1, Naming Conventions.

e. Identify and describe data recording and gathering software and hardware (e.g. make, model, version and manufacturer) and the raw data file formats it produces.

f. Documentation of any formulae, queries, scripts, and macros used to calculate fields. Present the information in an organized and methodical format.

g. A realistic estimated (50 percent)/agreed (100 percent) schedule for data collection and upload frequency for each data source if different from what is required in Part 1, Data Turnover Timeframes.

h. A list with screenshots or written details of the visualizations and verification reports to be utilized as agreed in the data management planning meeting. The Contractor may propose better or more cost-efficient ways to show what is needed than what the Government required in the 50 Percent Data Management Plan submittal. These changes must be reviewed in the data management planning meeting and approved in the final 100 Percent Data Management Plan submittal.

i. Explain how automated data that is obtained directly from field sensors by various subcontractors will be integrated into the web-viewer. Examples of this data would be automated instrumentation data, seismic data, and concrete thermal data;

j. Enterprise database documentation including relationship diagrams, data source tables, and database schema including fields, field types, units, precision, views, and other pertinent data as directed. If new tables, fields, relationships or views are added to the EDB (as described in PART 3, Documented Enterprise [SQL][MS Access] Database, the changes must be reflected in the schema, and added to the Data Management Plan in an addendum table titled "Schema Changes". This table must show all information about each change and the date the change was effective in the EDB.

k. A table of names, roles and contact information for the data management personnel. Include one person for each feature of work identified from each subcontractor that will serve as the POC for technical data questions and problem-solving. Update when personnel changes.

l. Approved data transfer and data QC report format.

m. Approved Photograph PDF format.

n. All proposed and approved changes to any component of the data

management system.

o. At no more than 6-month intervals, incorporate all changes into the main document and resubmit to COR. Resubmission is also required when a revision to the Data Management Plan is issued due to design after award components, or other such significant changes or additions to the EDB schema and visualizations. Resubmittal may occur after all additions for each such approved feature of design/work have been completed.

Ensure all final documentation of the EDB and other components of the data management system have been documented prior to a final closeout submission of the Data Management Plan.

p. Maintain all data plans listed in PART 2, Addenda to the 100 Percent Data Management Plan and submitted per PART 1, SUBMITTALS SD-01 Preconstruction submittals as addenda to the Data Management Plan. Updates to these plans must be reflected in Data Management Plan Updates.

3.10   FEATURE OF WORK DATA COLLECTION PLANS

****
        NOTE: The following plans are provided in case the
        specification section associated with the feature of
        work does not contain the plans. It is more
        appropriate for these data collection plans to be
        located within the corresponding feature of work
        section.

        This entire section is part of the tailoring option
        "ADDITIONAL DATA COLLECTION PLAN SUBMITTALS".
****

3.10.1   Automated Grouting And Water Pressure Testing Data Collection Plan

No later than [_____][90] days prior to the commencement of the work, submit a detailed description, name, manufacturers name, specifications, sample outputs, and sample MS Excel-compatible data files generated by the Automated Grouting and Data Collection Systems to be used during grouting and water pressure testing. Name and provide product specifications for all software products used to control or process data from the automated grouting system(s). Additionally, name and provide specifications for any proprietary software required for gathering, processing, or viewing the automated data. Specifications for commonly used software such as Microsoft Office, Adobe Acrobat, or other similar programs are not required. Include descriptions of all mathematical operations and formulae contained within the software that are related to output files, such as the method for calculating the effective pressure. Provide calibration certificates for all instruments measuring pressure and flow.

3.10.2   Remote Sensing Data Collection Plan

No later than [_____][90] days prior to the start of data collection, propose a methodology and plan for the collection of [_____][LiDAR][orthoimagery][photogrammetry] in accordance with the data requirements specified for [_____][geologic foundations, routine monitoring, site progress, quantities], or for any other purpose that

would impact the resolution and accuracy of the data collection. Organize the plan into separate sections for each method, and only combine sections applicable to both such as ground control and datums. Include the following at a minimum:

a. Data acquisition methods, workflow onsite, and how the data collection will be coordinated with construction activities and the brief window of time in which data may be collected;

b. Identify a designated lead in charge of mobilization, planning, and the coordination of activities with other elements of construction (e.g., foundation preparation and concrete placement) and define responsibilities in detail;

c. Identify roles and responsibilities of all personnel involved in the data collection and processing effort;

d. Data collection, classification, and other parameters to be employed as applicable (e.g., pulse rate, scanner frequency, point density or other parameters) in order to produce data to specified requirements;

e. Product delivery formats - list each product;

f. Metadata fields to be collected and provided and metadata format;

g. Ground control and accuracy standards;

h. Calibration testing methodology(s), equipment calibration schedule, and certificates/proof of calibration;

i. Proposed equipment for the collection of datasets including manufacturers specifications, catalog cuts and any applicable regulatory or calibration certificates/records for the specific equipment used;

j. Description of internal verification quality control processes;

k. Data processing workflow and methodologies for converting raw data into post-processed data products;

l. Data validation processes;

m. Pre-processing and accuracy check;

n. Processing quality control;

o. Product delivery workflow and quality control;

p. Propose a tile scheme and size for deliverables.

q. Propose a sample monitoring survey symbology for visualizing cumulative change detected if applicable.

3.11   OPENGROUND CLOUD DATABASE AND RECORDS

****
          NOTE: This section applies to USACE projects only -
          USACE uses OpenGround Cloud for drilling data.

3.11.1   Digital Logging

  The Contractor is encouraged but not required to utilize tablets in the
  field for borehole logging, with the software Dataforensics pLog, which is
  seamlessly integrated with Bentley OpenGround to import data from the
  field into the database. If a digital data-gathering device is utilized,
  apply the same record tracking requirements and data loss prevention
  standards as described in PART 1, Backups, Archiving and Disaster Recovery
  and Record Tracking Requirements. Load raw data files from the device to
  the SFTP site in .csv format in accordance with the turnover times stated
  in PART 1, Data Turnover Timeframes. The Contractor must be able to
  produce a written or printed backup of field data in case an equipment
  malfunction causes a data loss. In the event of a data loss, the
  Contractor is responsible to re-log the hole from the core, and must take
  all necessary steps to ensure the data has been captured prior to core
  disposal or storage as applicable. Store legible scans of these logs on
  the appropriate location of the SFTP site in PDF format within 48 hours of
  completion of the hole.

  For digitally collected logs, the geologist who completed the logs must
  perform the required verification QC of the data in the database, and the
  Government-approved digital log format must be used to produce PDF's of
  the logs for submittal according to the same requirements as manually
  completed logs.

3.11.2   Manual Logging

  If logs are completed manually, manually, enter the data into the
  OpenGround cloud database within 48 hours of the hole being drilled. The
  geologist who logged the hole must perform the data entry for continuity,
  and a separate geologist must perform the QC verification of the data in
  OpenGround within 96 hours of the hole being drilled.

3.11.3   Data Entry and PDF Drill Logs

  For data entry into OpenGround, utilize fields with dropdown lists where
  applicable. Only use additional descriptions for text entry of data when a
  dropdown list for that feature does not exist. Verify there is no
  applicable field for a feature before using the Comments/Remarks fields in
  any table to enter data.

  Produce PDF logs of each hole from the Cloud, and place on the SFTP site
  within 24 hours of hole entry into OpenGround, and submit in accordance
  with requirements in [_____][Section 02 32 13 SUBSURFACE DRILLING AND

SAMPLING]. Submit a notification to the Government that the Finalized OpenGround Cloud Borehole Database is ready for review in the cloud environment within 96 hours of the final hole for the project being drilled.

3.12   DATA MANAGEMENT MANUAL

****
        NOTE: Tailoring options are available in this
        section for "DESKTOP GIS FILES", and "WEB-BASED GIS
        INTERFACE".
****

Within 90 days of the last record update to the EDB and prior to demobilization, submit a final Data Management Manual. Incorporate as part of this manual the following:

a.   All sections and contents of the final Data Management Plan, with the information updated to the end of the contract;

b.   Final documentation of the EDB including all metadata, data dictionary and entity relationship diagrams (including table names, field names, table fields, and relationships between these tables, added field definitions), views/queries, macros, scripts (except those used as interim tools and not applicable for archiving), summary tables, formulae used to calculate values or automatically assign categories (e.g. Pass or Fail based on a number or criteria from another field), data source documentation, units, and file structure for all hyperlinked or referenced documents such that these links and references can be used once the EDB is installed on the [COR][ACO] network;

c.   An index and description of all components of the Desktop GIS model, including all elements contained in the .aprx and .gdb(s), and any separate metadata documentation;

d.   A detailed index of the published feature classes organized in the table of contents of the web-hosted GIS model;

e.   The submitted and approved final index of the SFTP site contents by file structure - described in Part 2, SFTP SITE.

3.13   FINAL EDB TURNOVER

****
        NOTE: Tailoring options are available in this
        section for "SQL RDBMS EDB" and "ACCESS ENTERPRISE
        DATABASE".
****

Notify [COR][ACO] when the EDB is considered final with all data being uploaded and finalized. Submittal of the Finalized Enterprise Database includes complete backup files from the [SQL RDBMS][MS Access] database and separate .csv files of the final, fully documented [SQL][MS Access] EDB tables containing all project data. Transfer must take place via the SFTP site prior to demobilization and within 60 days after the final record has been added to the database. The final database structure and contents are subject to the same QC requirements for final data verification and integrity, and must be approved by the [COR][ACO] prior

to the final payment for data management. Host the final EDB for 6 months
after transmitting EDB documentation, or until Contract closeout,
whichever comes first.

-- End of Section --