Discussion of SUE & ASCE 38 What was updated in ASCE 38-22 from ASCE 38-02

Presenter: Greg Jeffries, CUC, M. ASCE
Chair-ASCE/UESI National SUE Committee
Vice Chair-ASCE/UESI Utility Risk Management Division
BAMI-I Executive Board, Secretary

Clearline KMCE

CI/ASCE 38-02

ASCE STANDARD

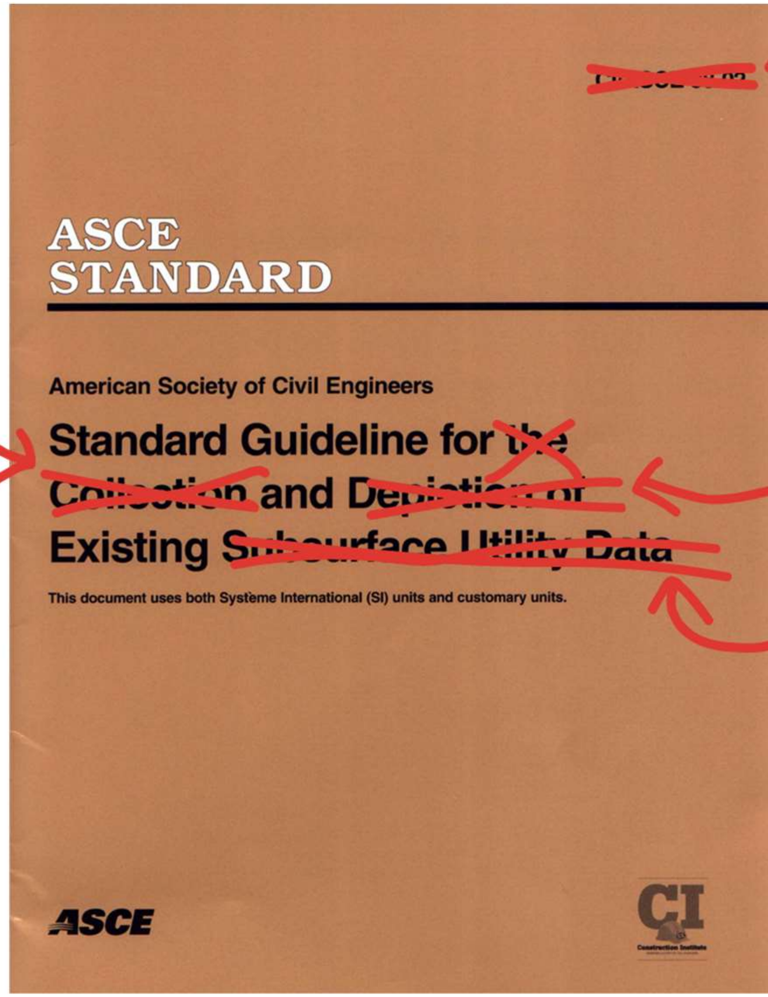
American Society of Civil Engineers

Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data

This document uses both Systeme International (SI) units and customary units.

ASCE

CI
Construction Institute


ASCE STANDARD

American Society of Civil Engineers

Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data

This document uses both Systeme International (SI) units and customary units.

ASCE

CI

ASCE/UESI/CI 38-22

INVESTIGATING

DOCUMENTING

UTILITIES

Clearline
KMCE

ASCE STANDARD

ASCE/UESI/CI

38-22

Standard Guideline for Investigating and Documenting Existing Utilities

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

UESI UTILITY ENGINEERING & SURVEYING INSTITUTE

CI CONSTRUCTION INSTITUTE

Prepared by the Standard Guideline for Investigating and Documenting Existing Utilities Committee of the Utility Engineering and Surveying Institute and the Construction Institute of ASCE

Standard Guideline for Investigating and Documenting Existing Utilities, ASCE/UESI/CI 38-22, endeavors to safeguard public welfare by providing guidance on performing utility investigations and documenting results in a standardized fashion. It serves as both a prescriptive standard and a performance standard. As a prescriptive standard, it provides a series of minimum actions necessary to achieve utility quality level documentation. As a performance standard, it describes the professional judgment necessary to determine the appropriate timing, sequencing, location, and scope of a utility investigative effort.

The standard presents a credible system for classifying the quality of utility location information that is placed in design plans. It is predicated on the original subsurface utility engineering (SUE) practice that most projects will benefit from the concurrent and integrated use of geophysics, records research, and a utility feature survey as early as possible in project development.

ASCE 38-22 replaces the previous standard, CI/ASCE 38-02. This revision adds new information on utility attributes and guidance on collecting and recording depths of utility features and utility segments. It also includes appendixes on geophysical techniques, academic and organizational studies on costs and benefits of projects that have used utility quality levels, and guidance on the development of three-dimensional utility models, a relatively new practice.

This valuable resource will assist subsurface utility engineers, design engineers, and other professionals proficient in engineering, surveying, and geological and geophysical sciences, those who directly oversee and execute utility investigations and develop the resulting documentation, as well as those responsible for management of the risks associated with development and construction that may affect or be affected by existing utilities.

Preface

ASCE 38 is a combination of a prescriptive standard and a performance standard. As a prescriptive standard, it sets forth a series of minimum actions necessary to achieve Utility Quality Level Documentation. As a performance standard, it describes the significant professional judgment exercised by the professional to determine the appropriate timing, sequencing, location, and scope of a Utility investigative effort to achieve the goal of reduced Utility issues during Project Delivery.

Clearline
KMCE

Introduction – Performance Goals

This engineering standard is developed to safeguard the public welfare by providing guidance on performing Utility Investigations and documenting results in a standardized fashion, which in turn empowers the design engineer to address two objectives: (1) Design so as to have minimal Utility related issues; and (2) protect engineers, project owners, Utility owners, and the public against Utility related claims that might arise during Project Delivery.

Introduction

This standard addresses the following:

- The Utility investigative practices, equipment, and data-processing technologies available for the effective collection and Documentation of Utility systems;
- How to convey Utility data to users through an uncertainty-based classification system; and
- The respective roles of the professionals and project owners in obtaining, communicating, and effectively deciding on the Scope of Work of investigative effort.

Introduction

This standard pertains to the investigation, identification, and Documentation of underground and aerial Utility networks including connected surface Utility Features. This standard does not replace statutory requirements for Utility owners to mark their utilities' suspected locations on the ground surface as a construction damage prevention mechanism. This edition addresses aerial Utility networks for those details not usually captured during a topographic survey, such as pole attachments, pole classification, ownership, and other data that are often included within a SUE Deliverable when part of a project Scope of Work.

Introduction

The result of using this standard is the assignment of a value to buried Utility Segments and buried Utility Features that judges the relative (nonquantifiable) uncertainty of a Utility Segment's or Utility Feature's existence, Attributes, and depicted location to that of its actual location so that sound engineering decisions throughout the Project Delivery process can mitigate and manage those project risks owing to the presence of existing utilities.

Definitions

- **Utility Quality Level:** The value, assigned by the Professional, of a Utility Segment or subsurface Utility Feature that identifies the relative (non-quantifiable) uncertainty of a Utility Segment's or subsurface Utility Feature's existence and actual location to that of its documented location.
- The value is judged and assigned on the source, precision, consistency, collection methods, and interpretation of the data put into context with information from other sources in the possession of the Professional at that point in time.
- A Utility Quality Level is assigned to a Utility Segment or Utility Feature of an underground Utility for a specific project for a specific time period, usually until substantial project completion or the end of coverage of professional liability insurance.

Clearline
KMCE

A Utility Quality Level Investigation:

- Is a competent thorough search for any and all utilities within the scope of work within a particular project boundary
- Conforms to the minimum actions required to attempt to achieve a particular Utility Quality Level
- Documents Utility Segments and Utility Features at their actual achieved Utility Quality Level
- Also conveys information that a utility is likely not occupying space where none are depicted (i.e. a search for unknown/non-recorded utilities has been competently performed)

Definitions

- **Utility Quality Level D (QLD):** A value assigned to a Utility Segment or Utility Feature, not visible at the ground surface, whose estimated position is judged through Utility records, information from others, or from visual clues such as pavement cuts, obvious trenches, or existence of service.
- A QLD data Attribute is assigned to a Utility Segment or Utility Feature after review and compilation of existing records, oral recollections, One-Call or "private-locate" markings, managed data repositories, context with other achieved Utility Quality Levels, and/or other evidence of existence.

Clearline
KMCE

- **<u>C2.2.3 Existence of Service as QLD</u>** Existence of service is best described through a judgment that a building usually has basic Utility infrastructure connecting it to the community. Water piping versus well, septic field versus sewage pipe, and wireless versus wired communications are factors to consider when basing the need to depict a Utility for which there is no record other than functionality. If a field visit was made, other visual evidence may be available that indicates the presence of a Utility. For instance, a structure such as a house that has obvious water service owing to a curb water meter, but no records for the service itself, might serve as a reason for a Professional to place a QLD Utility Segment between the water meter and the house. An alternative method would be to place a note on the Utility Drawing and in the Utility Report about the probable existence of the water without any records and forgo the QLD depiction. It is the Professional's call.
- Road patches related to trenches and previous excavations which, in the judgment of the Professional, indicate the presence of buried utilities can be used as a source of QLD information, or these patches can be used to assist in better positioning the information from other sources. Patches, and in general any indication of previous Utility excavation work, are not Utility Features; therefore, they cannot lead by themselves to a QLC Utility Feature Anchor Point. If the ownership or even nature of the Utility from the road patch evidence is unknown, it should be labeled accordingly, and a note should be added to the Utility Drawing and Utility Report to indicate the source and judgment explanation of the QLD information.

Clearline
KMCE

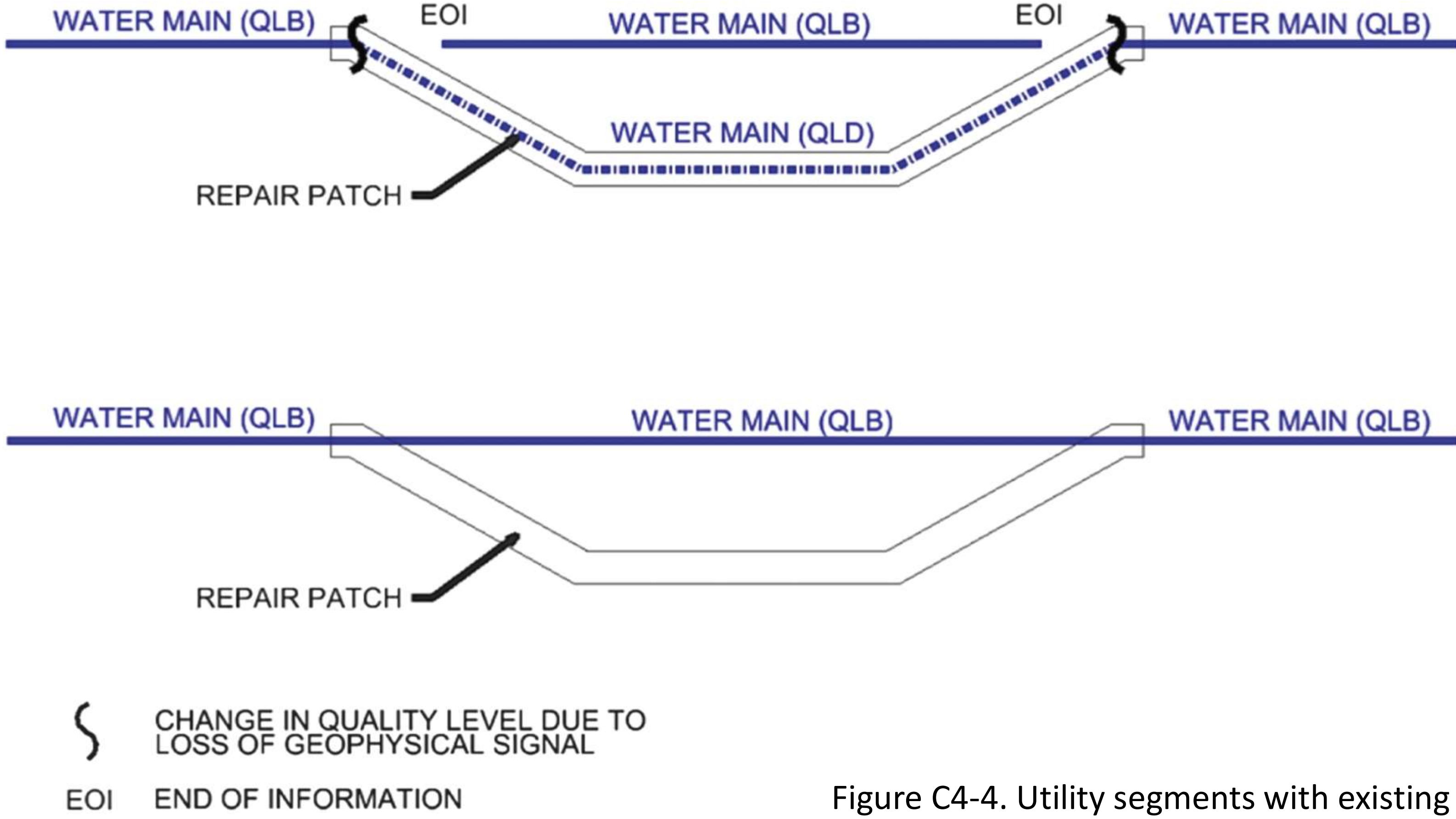


Figure C4-4. Utility segments with existing QLB segments and a QLD segment from professional judgment and a missing geophysical signal.

Clearline
KMCE

Definitions

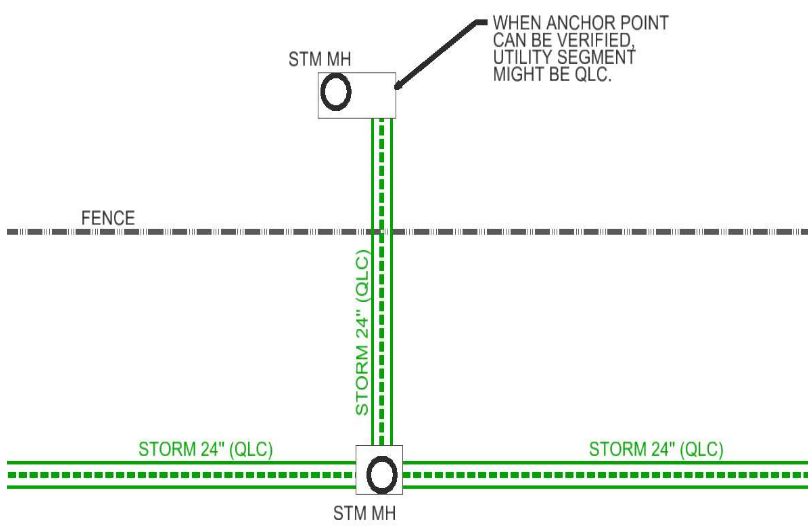
- **Utility Quality Level C (QLC):** A value assigned to a Utility Segment not visible at the ground surface whose estimated position is judged through correlating Utility records or similar evidence to Utility Features, visible above and/or below ground.
- The Utility Anchor Point on the Utility Features shall be tied to the Project Survey Datum with an accuracy of 0.2 feet (60-mm) horizontal.
- A QLC value judgment is assigned to a Utility Segment by using visible Utility Features to approximate the position of a Utility Segment between or in proximity to the visible Utility Features and in context with other achieved Utility Quality Levels.
- QLC only pertains to the underground Utility Segment(s), not the Utility Feature(s).

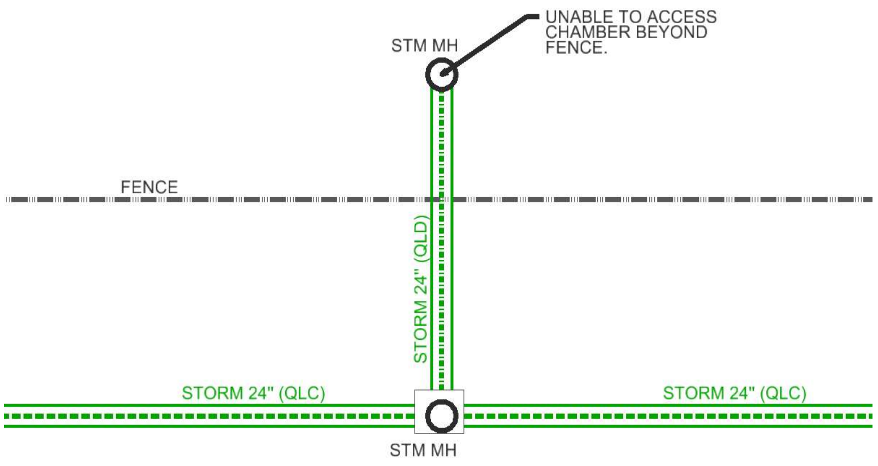
Clearline
KMCE

Definitions

- Anchor Point: A defined point on a Utility Feature or a Utility Segment.
- A Utility Feature will have at least a single Anchor Point, whereas a Utility Segment will have a minimum of two anchor points, one on each end

Clearline
KMCE





Clearline
KMCE

2.3.2.3 If a Utility Feature has an access cover or lid to a structure (e.g., vault, chamber, pull box) that likely harbors a larger horizontal structure underneath them, such as chambers, vaults, or manholes, remove the lid to allow for confirmation of the Anchor Point and Attributes of the utilities in the structure to qualify any contiguous Utility Segments as QLC (Figure 2-1) by using the following steps:

1. Open the cover or lid.
2. Document the positional relationship of the Utility Segment to the structure.
3. Document the dimensions of the structure if larger than the cover or lid.
4. If the cover or lid cannot be removed, the Utility Segment attached to the Anchor Point cannot be called QLC, only QLD.

For more detail, see Section 5.3.10, "Vaults."

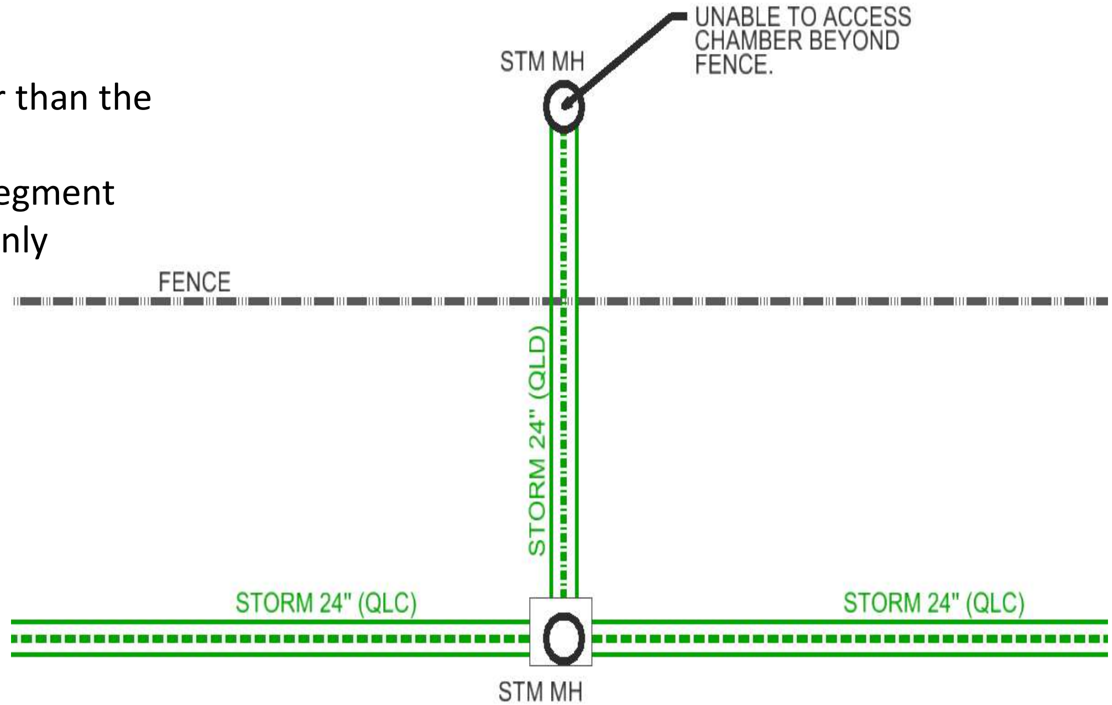
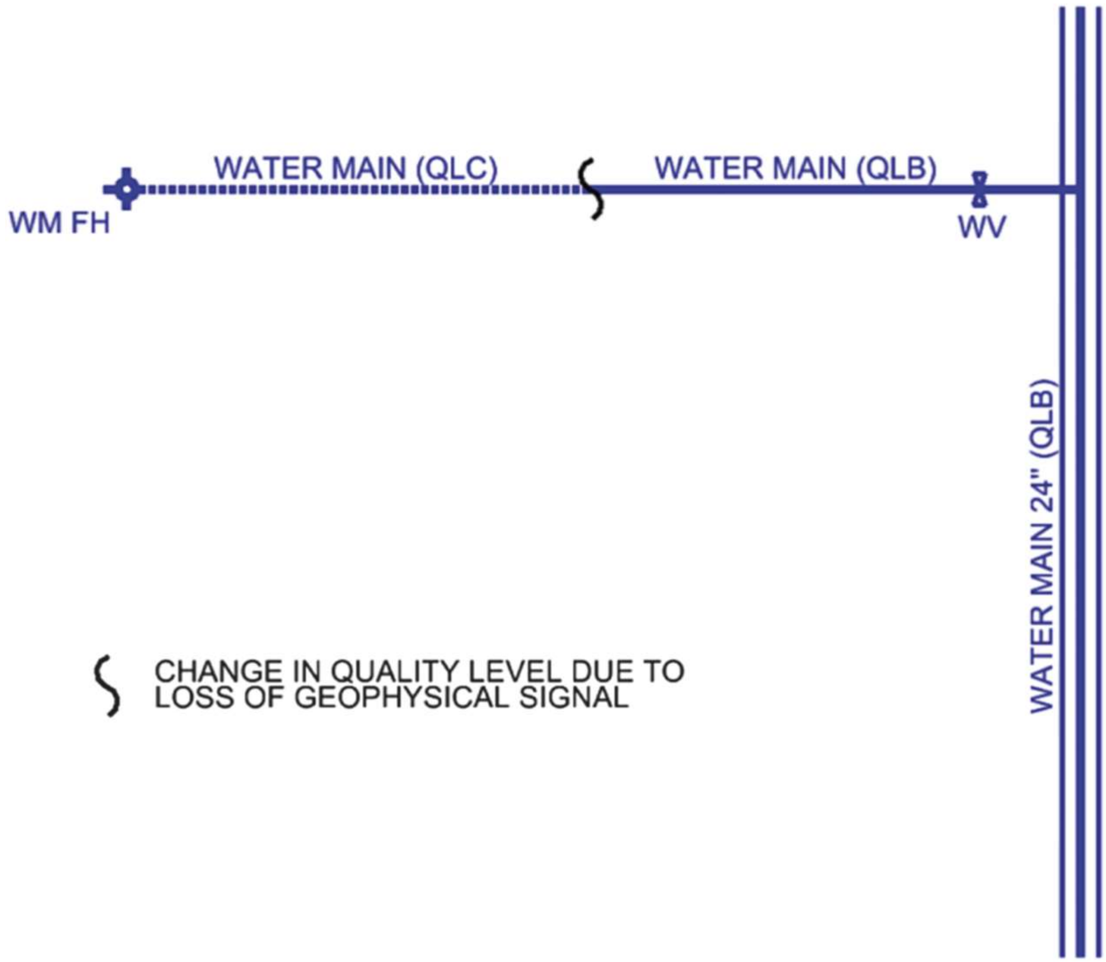


Figure 3. Since access to a structure was unavailable, the corresponding Utility Segment from that Structure must be QLD, not QLC. The reason for the lack of access is documented in a note and/or in the Utility Report.

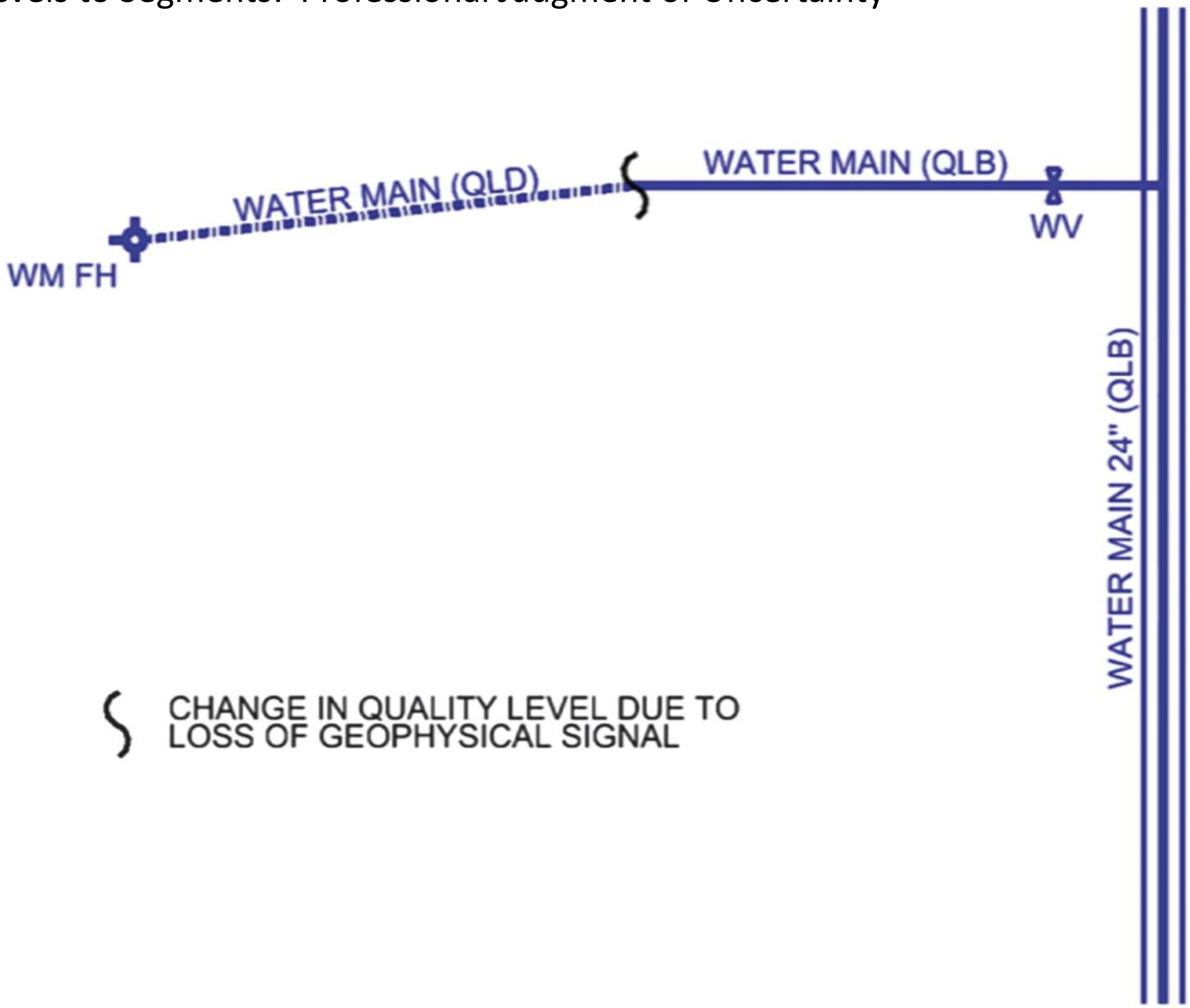
Clearline KMCE

An Anchor Point can also be an end point of a more certain Utility Quality Level Segment



Clearline
KMCE

Assigning Quality Levels to Segments: Professional Judgment of Uncertainty



Clearline KMCE

- 2.3.1 **Field Visit Required** A field visit is required to achieve QLC data.
- 2.3.2 **QLC Minimum Attempted Tasks** Assigning a QLC value judgment to a Utility Segment includes performing the following minimum tasks.
- 2.3.2.1 **Perform tasks as described for QLD**. The QLD tasks can be performed in conjunction with the QLC tasks listed as follows.
- 2.3.2.2 **Search for visible Utility Features** that are judged to be an integral part of, and attached to, existing subsurface utilities through a review of existing project survey data, and as indicated on Utility records or other research, coupled with a thorough field investigation.

See Commentary section.

Clearline
KMCE

2.3.2.4 Survey such visible surface Utility Features and the subsurface Anchor Point when applicable if the Utility Features have not already been surveyed by a professional to an accuracy of 0.2 ft (60 mm) horizontal. If Utility Features have been surveyed previously, perform adequate checks for accuracy and completeness of the work and then correct errors and omissions. Without this check, Utility Segments associated to another entities' surveyed Utility Features must default to QLD.

2.3.2.5 Connect Utility Segments to surveyed Utility Features or specific Anchor Points, considering the location, geometry, and connectivity shown on the records or discovered through field investigation.

Clearline
KMCE

Figure 2-5. Water main between two manholes sufficient to call it QLC.

Clearline
KMCE

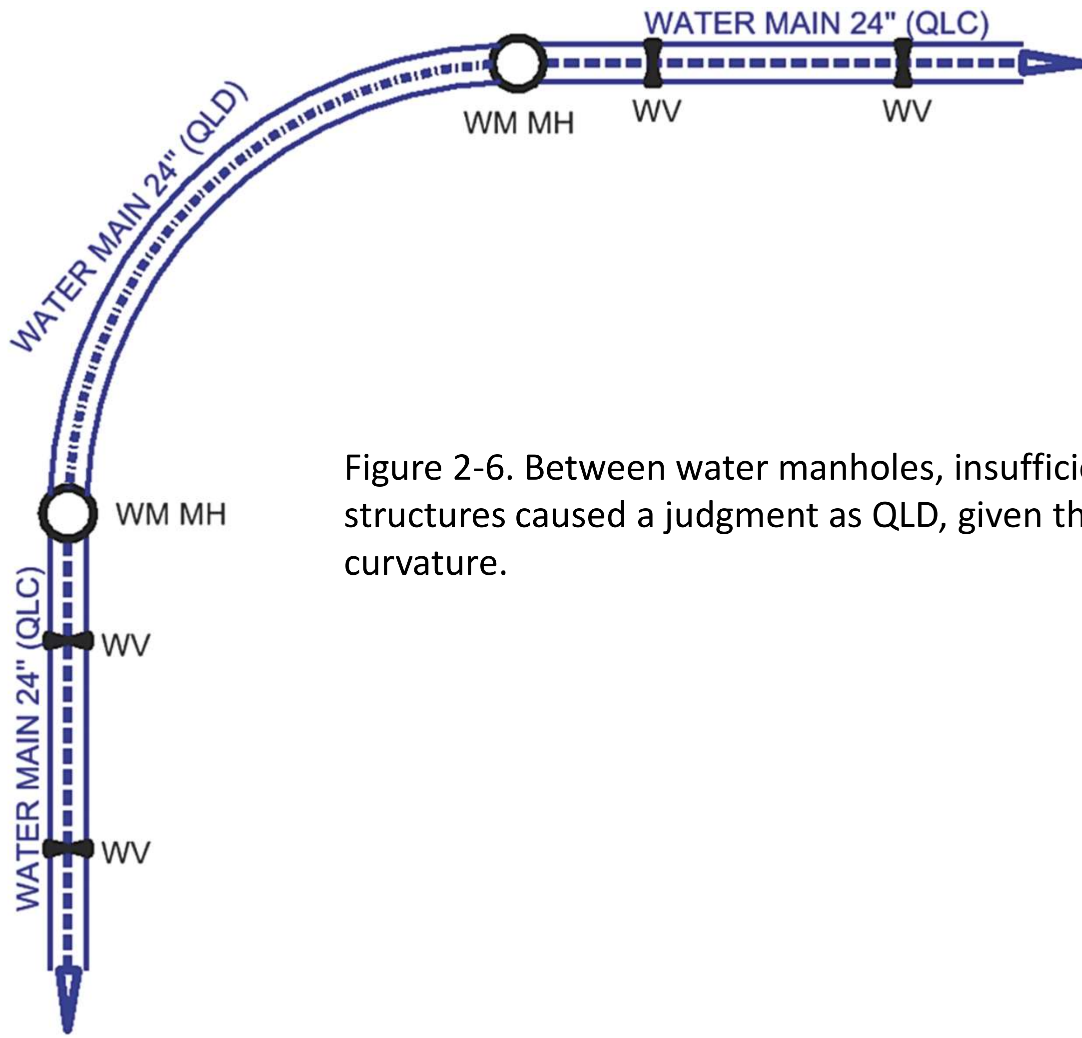
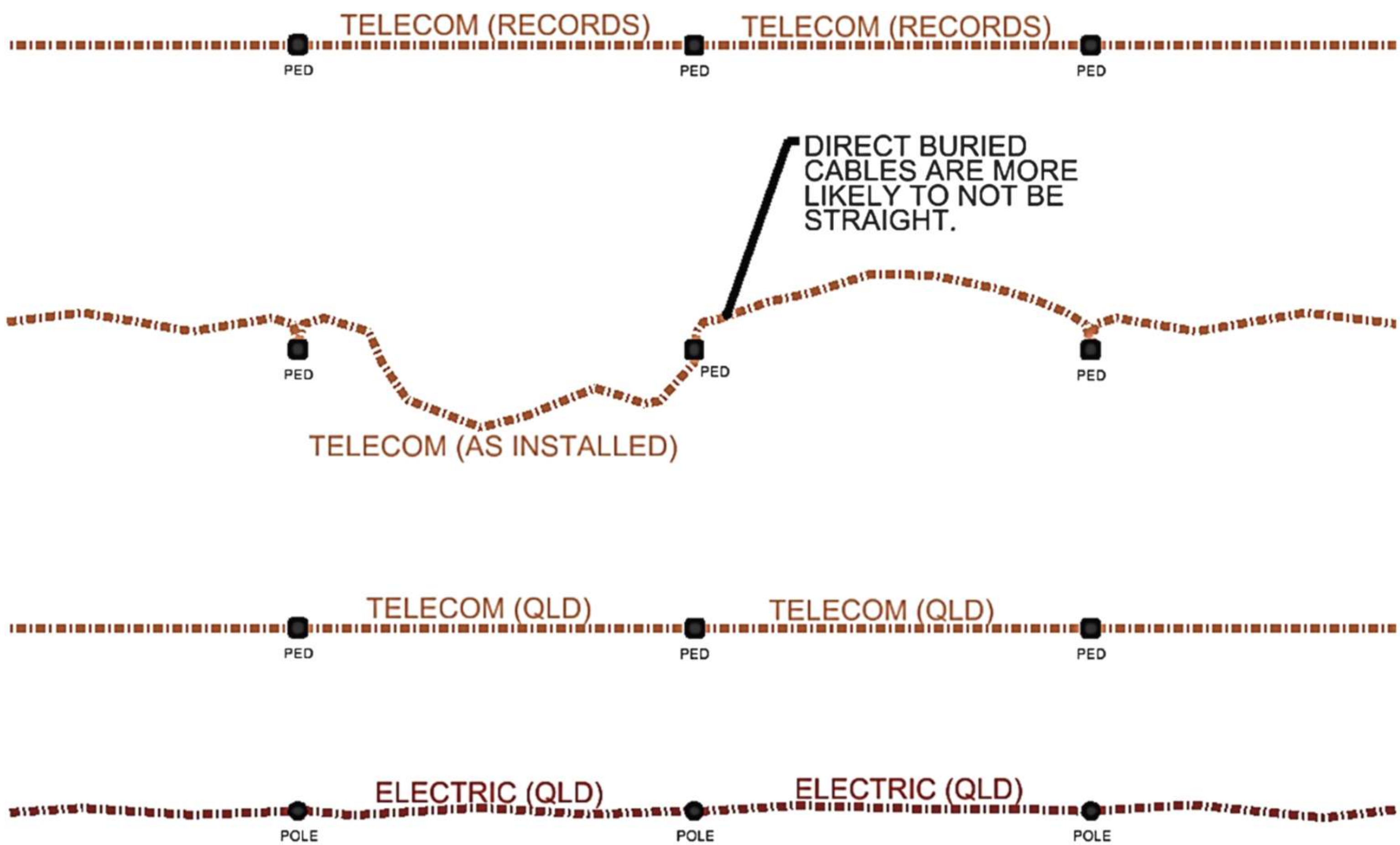


Figure 2-6. Between water manholes, insufficient water valve structures caused a judgment as QLD, given the pipe size and curvature.

Clearline
KMCE

CABLES and Quality Level Cautions



Clearline KMCE

Definitions

- **Utility Quality Level B (QLB):** A value assigned to a Utility Segment or subsurface Utility Feature whose existence and horizontal position is based on Geophysical Methods combined with professional judgment and whose location is tied to the Project Survey Datum.
- A QLB value is assigned to a Utility Segment when the following conditions are met:
  - (1) the Utility Segment was detected through the application of appropriate Geophysical Methods;
  - (2) the geophysical signal was judged to be reliable;
  - (3) the interpreted position was judged based on knowledge and use of geophysical science, Utility design and installation practices, available records, visual features, and influence of site conditions; and
  - (4) the source Designation has been tied to the Project Survey Datum with an accuracy of 0.2 ft (60 mm) horizontally.

Clearline KMCE

New Concept of Geophysical Method, leading to QLB

- B2.7 <u>Optical Methods</u> igation method is best
  described by the follo aults. If you can look
  through the pipe and pe and detect its light in
  the other vault, there en the two vaults.
  Therefore, the Utility and can receive a QLB
  judgment if the vaults not detect the laser or see
  the other vault, there een the two vaults. In this
  case, barring the use be documented between
  the two vaults at QLC le or at QLD if the vaults
  could not be accessed

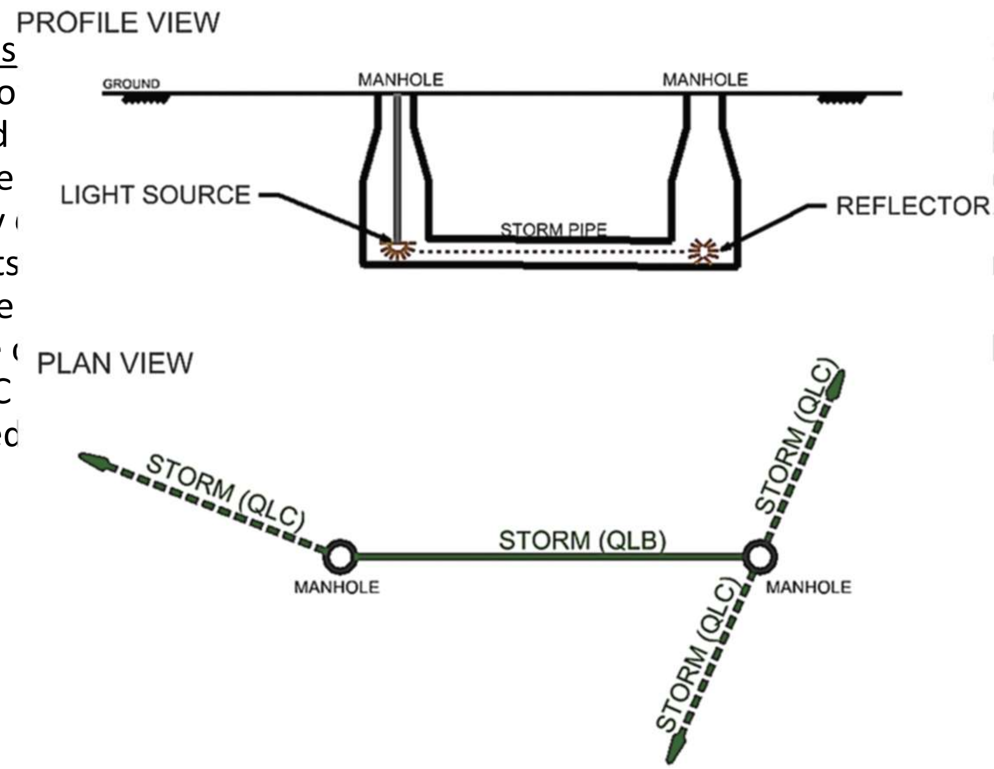


Figure C2-3. Use of visible light in determining the quality level.

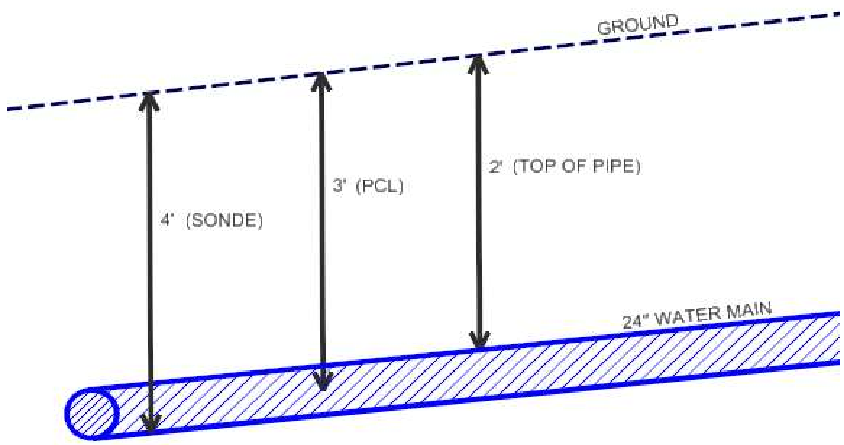
QLB Tidbits

- When conducting a QLB Utility Investigation within a defined project limit, the results of a QLB Utility Investigation attempt to indicate both the presence and absence of all utilities, barring any notes to the contrary.
- The goal is to obtain a reliable or repeatable geophysical signal that is consistent with that of a signal originating from a Utility Segment given observed conditions, knowledge of Utility systems configurations, and record data. Prudence usually calls for the use of more than one type of geophysical instrument, frequency, antenna, coupling technique, or other variation to interpret a signal as reliable or repeatable.
- Although some Geophysical Methods can estimate a Depth to the Utility, Depth is not a direct component of QLB data. Digital or Electronic Depths are Metadata that can provide additional information to the Utility Engineer or Designer when evaluating the overall utility data.
- Although the accuracy of the Utility Designations cannot be quantified in QLB, a survey of major SUE providers that provide QLA and QLB investigation services support the statement that the diligence in which Designating should be carried out should result in Designations that are within several inches of the footprint of the actual Utility Segment, most of the time.

Clearline
KMCE

Definitions

- **Depth:** Difference in elevation between the top (unless otherwise specified) of a Utility Segment or Utility Feature and a reference point datum such as DTM, surface grade, absolute elevation, or benchmarked elevation. Such data might be obtained from direct measurement, geophysical estimation, records, interpolations, and professional judgment. A change in value of the Depth does not necessarily create a new Utility Segment, unless the Professional decides it to be necessary for clarity or project-specific purposes. Depths can be converted to elevations if sufficient actual physical measurements for conversion to the Project Survey Datum are available.



Clearline
KMCE

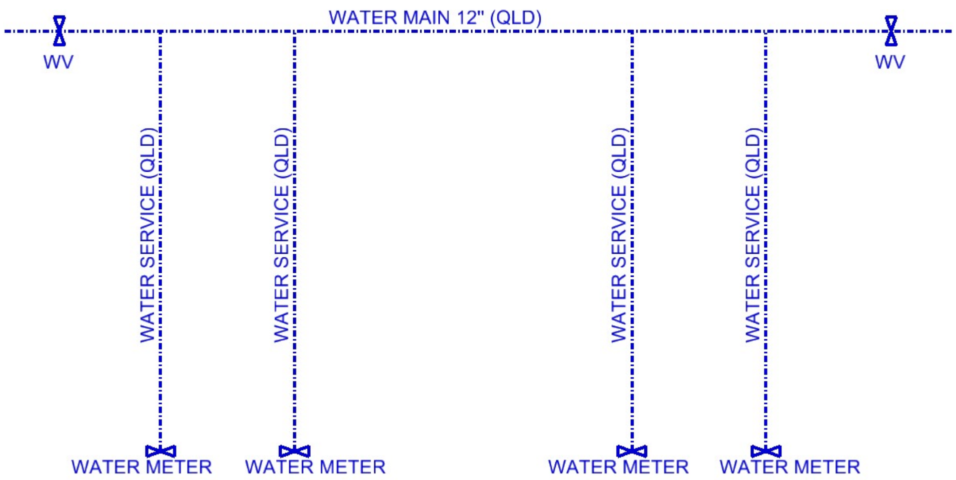


Figure 27. The Professional judged that having only two water valves on a relatively small diameter water line, with records indicating a plastic material, was insufficient to call the segment between the water valves as QLC.

Clearline
KMCE

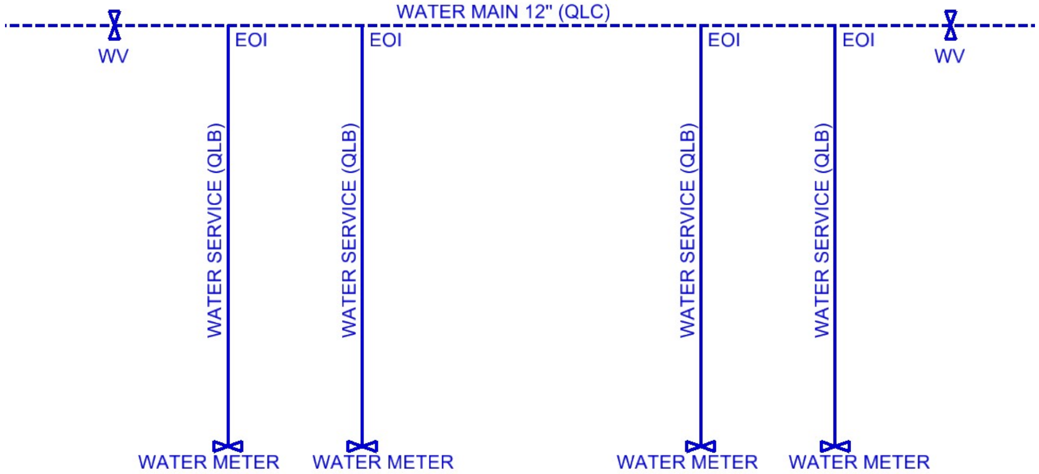


Figure 28. The Professional judged that, with the additional evidence of service lines at QLB and their loss of signal (EOI) lining up with the surveyed water valves and record information, the EOIs on the service lines can serve as Anchor Points for a continuous Depiction of the 12" water main at QLC.

Clearline
KMCE

New Survey Accuracies

> QLA: Vertical 0.1 feet; Horizontal 0.2 feet

> QLB Survey of Designations: Horizontal 0.2 feet

> Survey of Structures' Anchor Points used for QLC: Horizontal 0.2 feet

Clearline
KMCE

The Utility Report

4.1.16 Preparing the Utility Report Prepare a Utility Report that contains information about the Utility Investigation that (1) complements the Utility Drawing, (2) assists the end user in better understanding the subsurface Utility landscape and risks, and (3) provides Metadata. The Utility Report should be sealed by the Professional and provided to the Project Owner in electronic or paper format and/or within a database and/or a 3D model.

See Commentary section.

Clearline
KMCE

C4.1.16 Preparing the Utility Report The Utility Report should contain the following, but not necessarily all, inclusive information:

- Project description (e.g., project limits, type of work, existing utilities);
- Contract requirements relative to utilities;
- Metadata;
- Methods used to collect and depict subsurface Utility information;
- List of Utility Owners or other entities that have information on utilities within the project limits that were contacted and results of the contact;
- Description of the types and thoroughness of research applied to obtain information from the Utility Owners and other entities;
- Types of equipment selected and used to collect information;
- Types of software used to depict information;
- Areas swept, areas not swept, and suspect areas;
- Utilities found and documented (type, attributes, etc.);

Clearline
KMCE

CHAPTER 3
UTILITY ATTRIBUTES AND METADATA DOCUMENTATION

- Depth
  - Records
  - Geophysics
  - Direct Measurements
  - Judgement
- Utility Owner
- Utility Type
  - Unknown Utility
- Size and Shape
- Operational Status
- Date of Installation
- Condition
- Material Type
- Tracer Wire
- Pressure / Voltage

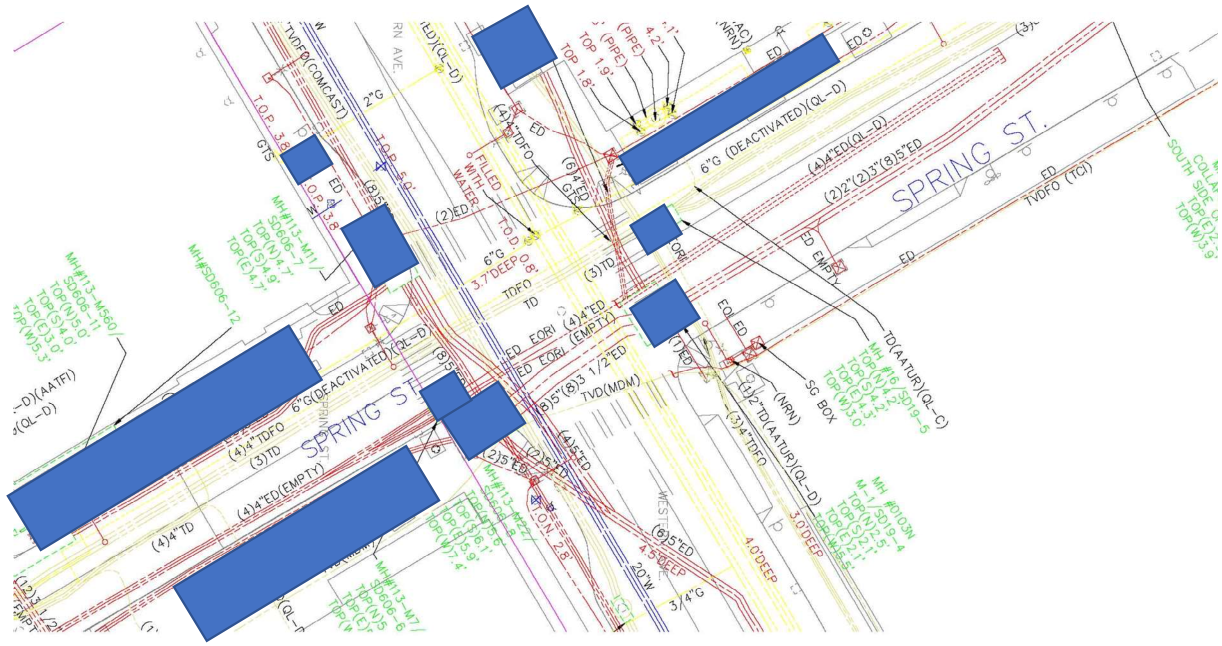
Clearline
KMCE

MetaData

- Project Survey Datum
- Project Task Dates
- Persons Performing the Investigation
- Types of Geophysics Used
- Project Limits
- Areas Unable to be Investigated
- Professional(s) Sealing the Utility Investigation
- Time of Day and Weather

VAULTS

Many times the symbol for a vault or manhole cover does not reflect the true dimensions, shape, position and orientation of underground space that is being used and/or may not be centered directly over a symmetrical space.



Vaults

> Determine Size, Contents and Location
  - Use records (if available)
  - Use specifications from Manufacturers (if identifiable & available)
  - Pump and Enter (Need Confined Space Plan, Equipment & Training)
  - Clamp and measure from surface (Extension Rod, Inductive Ring Clamp)
  - Scanners (photo, photo-dimensioned, lidar)
  - GPR might find the edges of the vault, possible TDEM might also
  - Internal Measurements with Hand-held Laser EDM
  - Document location and size of conduits
  - Document other structures
  - Check all adjacent manholes for cable / conduit continuity

Clearline
KMCE

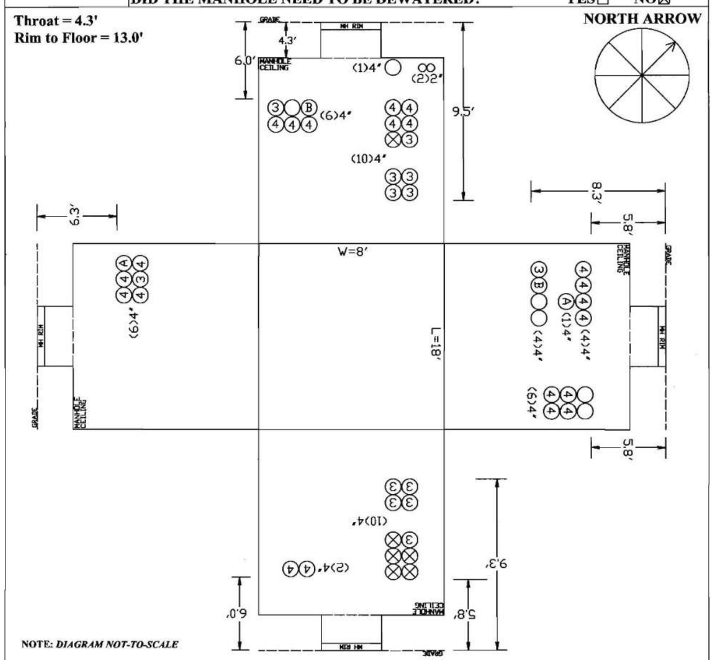
COMPANY NAME
ADDRESS
PHONE NUMBER

VAULT DIAGRAM FORM

JOB #: EXAMPLE **DATE: 01-13-12**
PLAN SHEET #: 1
MANHOLE LOCATION: NE CORNER OF MAIN ST. AND 5TH ST.
TYPE OF MANHOLE: ELECTRIC
UTILITY RECORD MANHOLE #: V-123
CREW MEMBERS: CARY/ROB/STEVE

DID THE MANHOLE NEED TO BE DEWATERED? **YES☐** **NO☒**

Throat = 4.3'
Rim to Floor = 13.0'



NOTE: *DIAGRAM NOT-TO-SCALE*

NOTES:
A - 3 INNER DUCTS WITH 2 FO CABLES
B - 2 INNER DUCTS WITH 2 FO CABLES

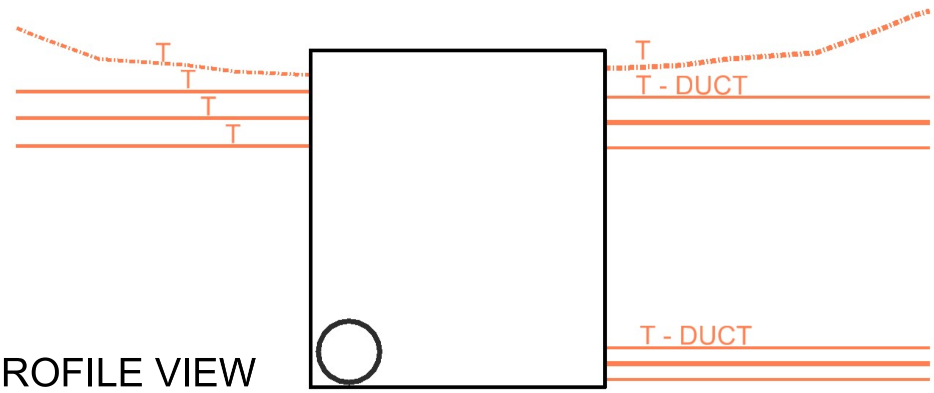
LEGEND

- ◯ EMPTY CONDUIT
- (1) ONE CABLE IN CONDUIT
- (2) TWO CABLES IN CONDUIT, ETC.
- (X) CONDUIT PLUGGED OR CAPPED
- (A) SEE NOTE A, ETC.

I.D. = INNER DUCT
FO = FIBER OPTIC

Clearline
KMCE

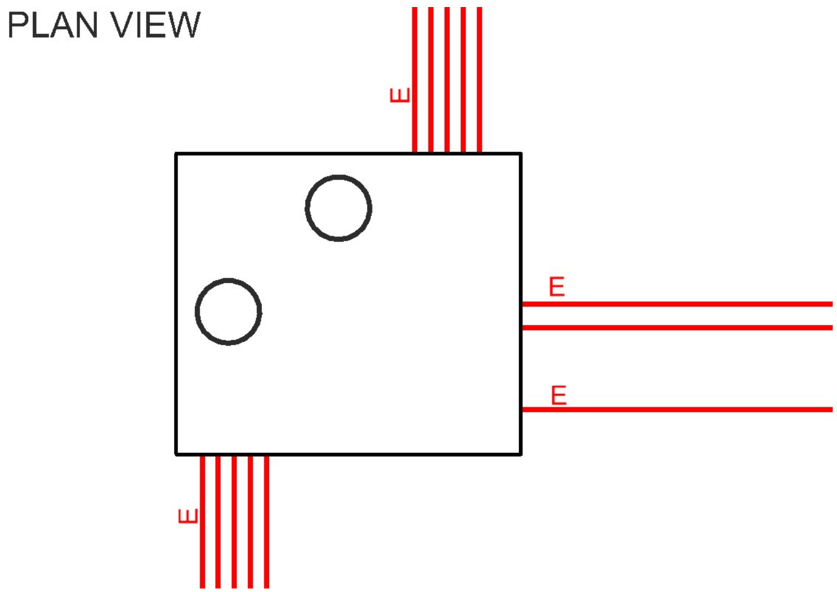
PLAN VIEW



PROFILE VIEW

Figure 36. A communication vault showing the actual surveyed location of the vault covers and the vault dimensions, with details of the interior of the vault contents via a picture. Typically the plan view is contained in the Utility Drawings, and the supporting picture referenced in the Utility Report.

Clearline KMCE



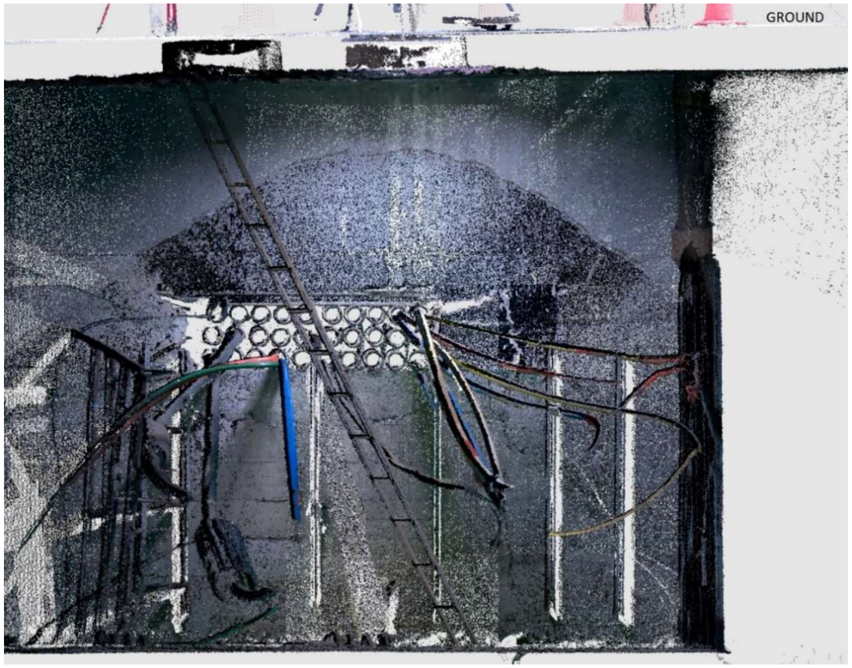


Figure 37. An electric vault showing the actual surveyed location of the vault covers and the vault dimensions, with details of the interior of the vault contents via LIDAR. Typically the plan view is contained in the Utility Drawings, and the supporting LIDAR referenced in the Utility Report.

Clearline
KMCE

Questions?

Discussion?

Presenter: Greg Jeffries, CUC, M. ASCE
Chair-ASCE/UESI National SUE Committee
Vice Chair-ASCE/UESI Utility Risk Management Division
BAMI-I Executive Board, Secretary

Clearline
KMCE