

From Maps to Apps

How the Evolution of
GIS Led to SUE

Introduction

DAVE VEILLEUX



*Strategic Account
Executive & Head of
Municipal Partnerships*

From Maps to Apps – Part 1

1970's → Emerging Technology

1980's → Computational Advancements

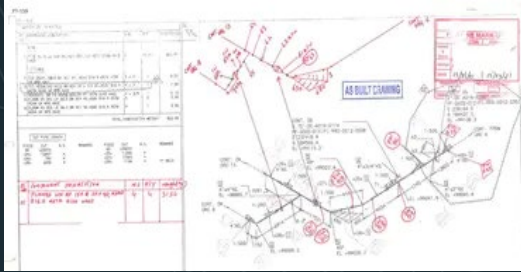
1990's → Adoption and Refinement of Tools

2000's → Business Systems and ASCE 38-02

2010's → Accessibility, Security, Persistence

Our Timeline and Adoption Cycles

TECHNOLOGY



Paper as-builts and drafting to keep up with suburbia expansion & maintenance



1970

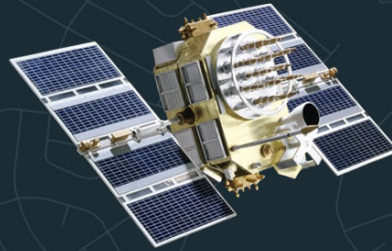
1980

Our Timeline - Innovation

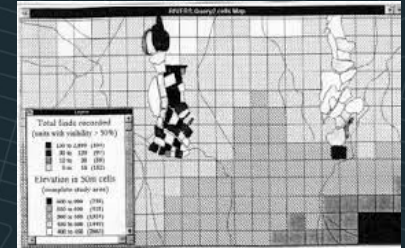
TECHNOLOGY



AutoCad and ArcInfo



NAVISTAR Satellite



Mapping in 1990

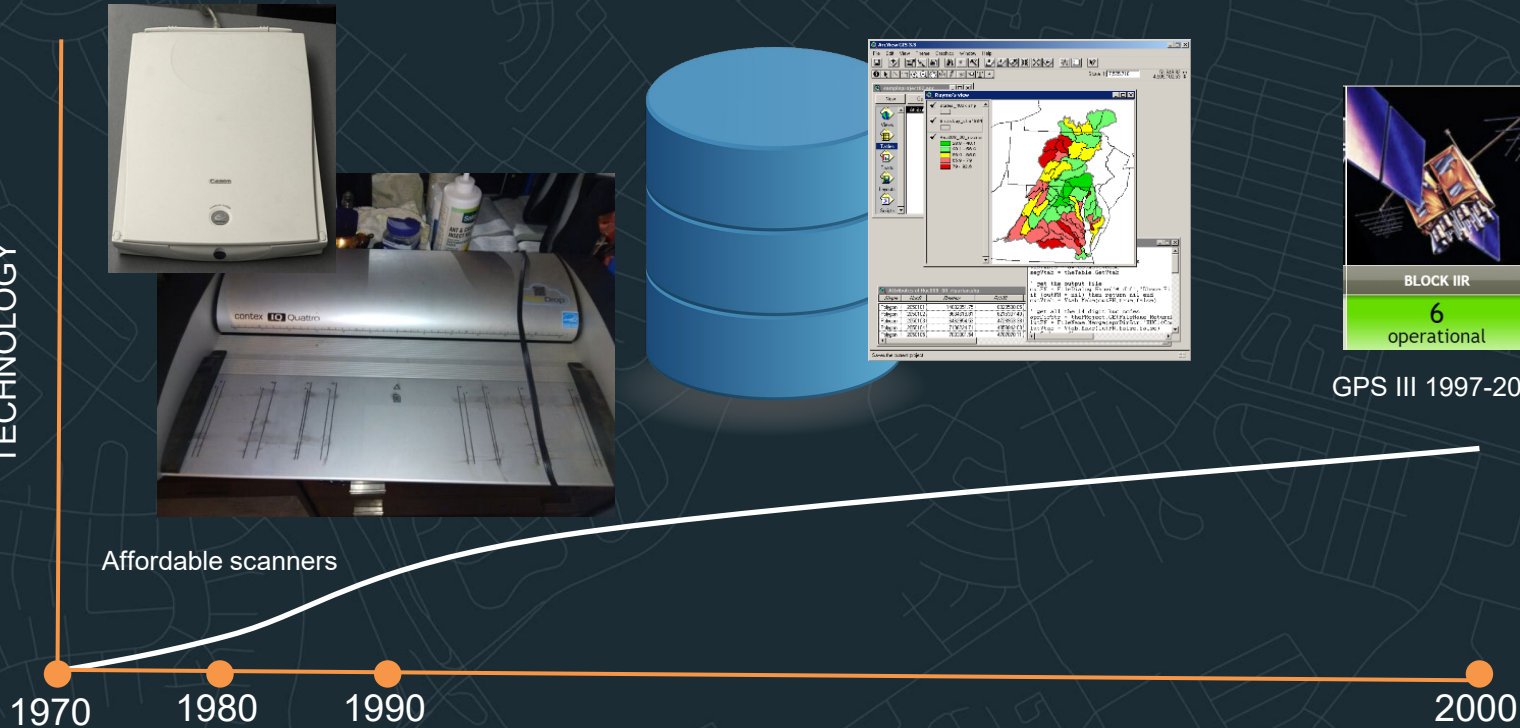
1970

1980

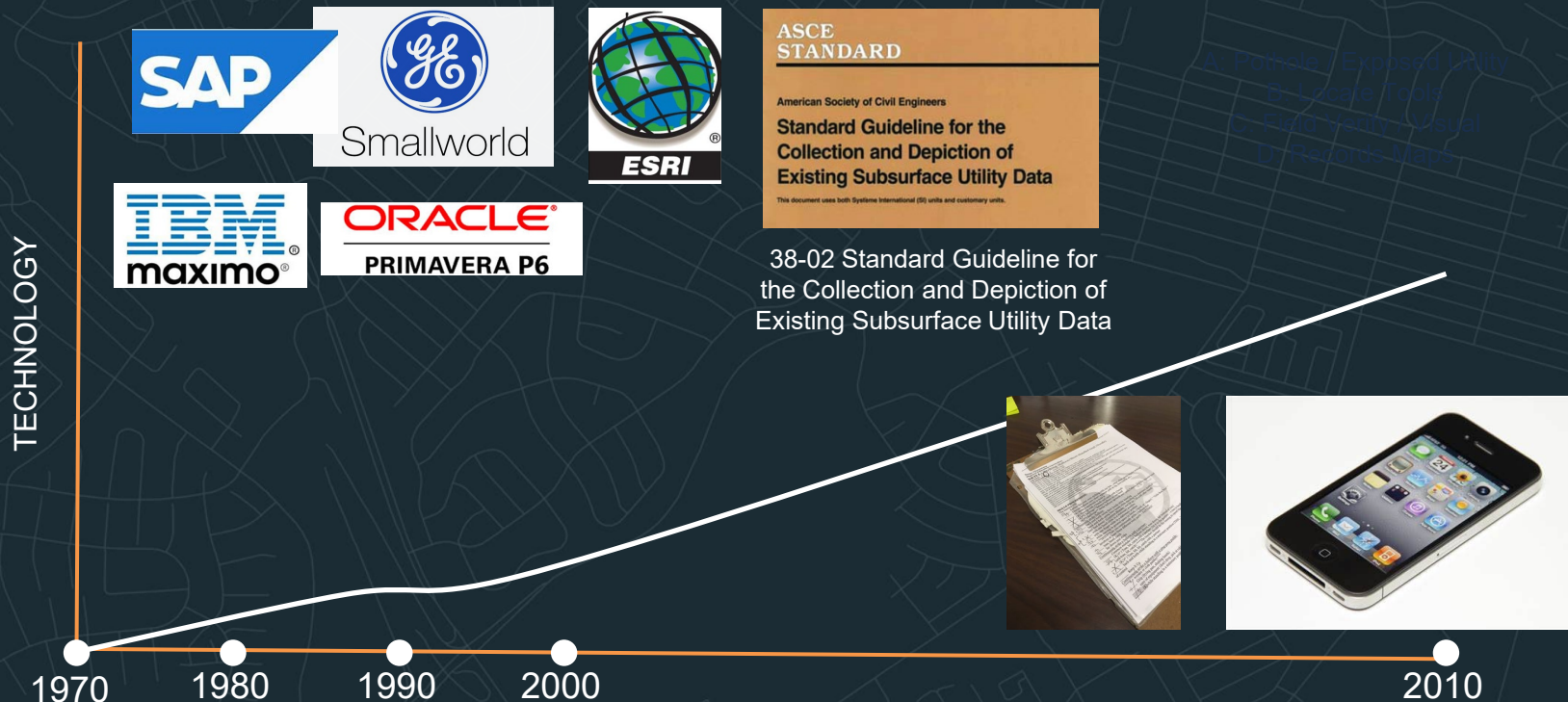
1990

Our Timeline - Adoption

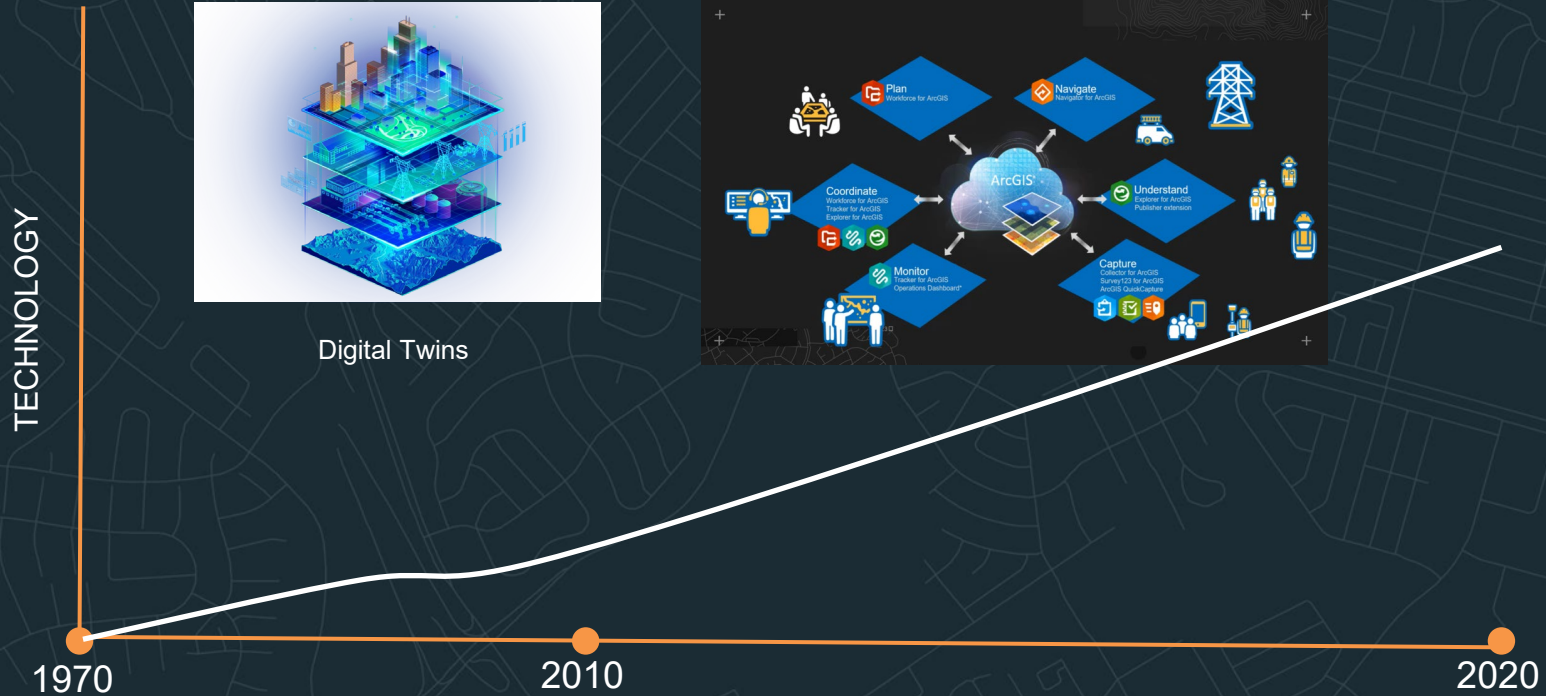
TECHNOLOGY



Our Timeline - Innovation



Our Timeline - Innovation



What do we still do the old way?

1970's	→	Digitize and Use QLD Records
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1980's	→	GPS Constellations
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1990's	→	Legacy Programs and Models
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2000's	→	Data Models, XML, Linux
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2010's	→	Legacy Hardware & Digital Twins
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SUE - ASCE 38-22

Standards



What is subsurface utility engineering (SUE)

Alphabet Soup



What are SUE quality levels anyway

Swiss Cheese



Why a complete SUE process is important



END RESULT

\$40,000

Change Order

2 Week

Delay

What is SUE?



SUE: Subsurface Utility Engineering

The specialty practice of civil engineering's Utility Engineering branch that includes investigation, analysis, judgment, and documentation of existing Utility networks

ASCE 38-22

Standard Guideline for Investigating and Documenting Existing Utilities

ASCE 75-22

Standard Guideline for Recording and Exchanging Utility Infrastructure Data

Quality Levels

D
Maps



Records Research

C
Eyes



Field Verify & Survey

B
Tools



Locating & Scanning

A
Pothole



Vac-truck & Hand Excavation

Quality Level D - Maps

QL-D

- Identify utility owners in the project area
- Source utility records
- Consolidate and compare to other sources
- *Field visit optional*



+



Google Earth

OR



CIVILGRID

Segments and feature QL-D designation must be made by the Professional

Quality Level C - Eyes

QL-C

- Complete SUE level D research
- Perform field visit and identify surface features
- Open vaults and manholes, measuring dimensions and depths
- Utility segments not bookended by features remain quality level D
- Must survey features to within 0.2ft



Segments and feature QL-C designation must be made by the Professional

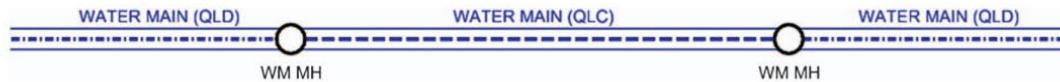


Figure 2-5. Water main between two manholes sufficient to call it QLC.

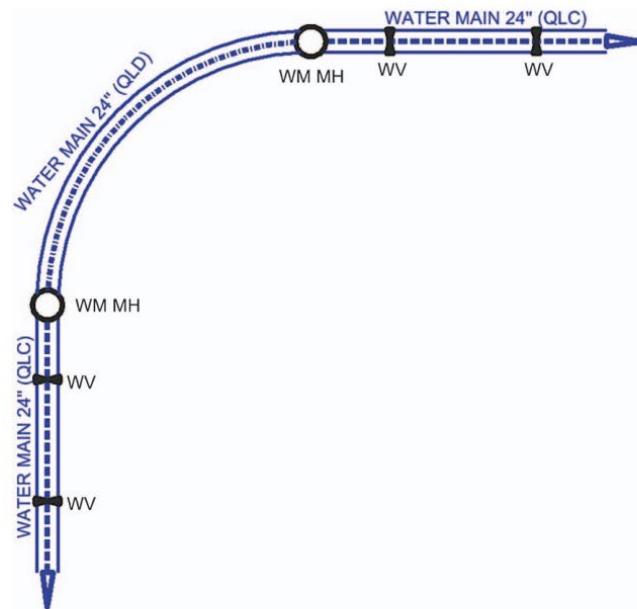


Figure 2-6. Between water manholes, insufficient water valve structures caused a judgment as QLD, given the pipe size and curvature.

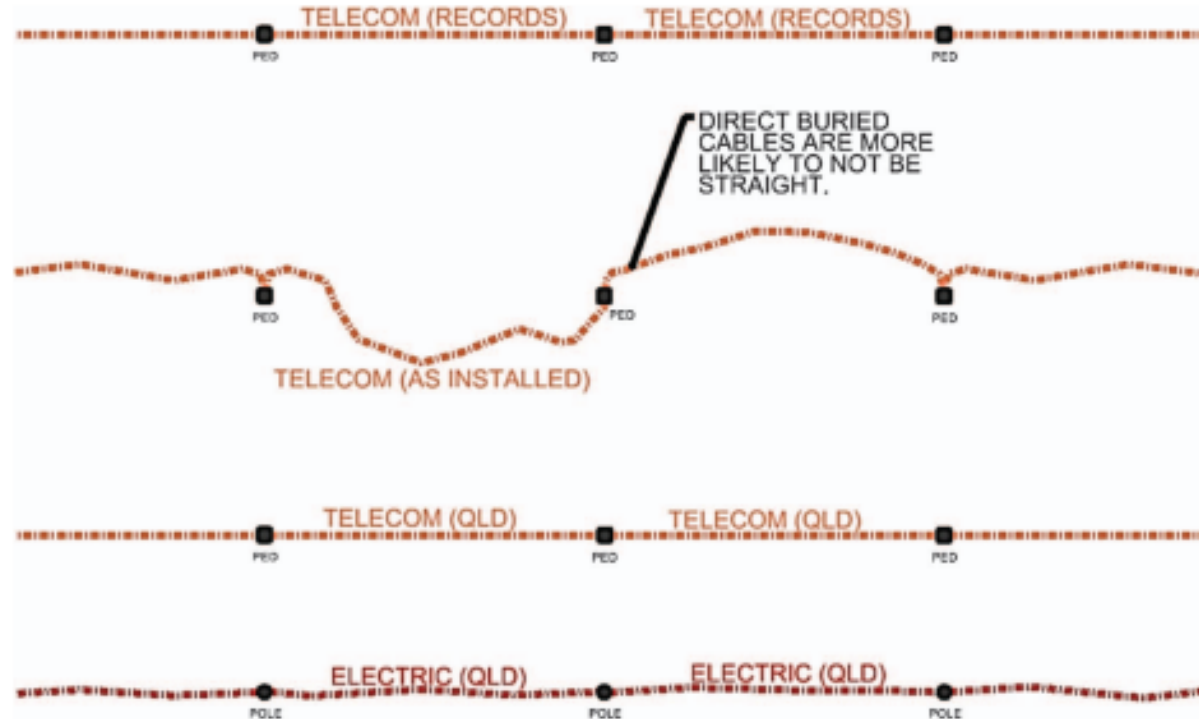


Figure 2-7. The first diagram at the top shows a Telecom record that indicates that the cable runs between the pedestals; actual cable installation (second diagram); resulting utility quality level judgment for Telecom (third diagram); similar judgment for certain electric facilities (fourth diagram).

Quality Level B - Tools

QL-B

- Complete SUE level C research
- Select detection methodology:



- Understand limitation of technology (Issue of compounding error)
- Must survey findings with 0.2ft accuracy

Segments and feature QL-B designation must be made by the Professional



Figure 2-11. Portion of water main not continuously designated, requiring a separate utility segment at a more uncertain utility quality level.

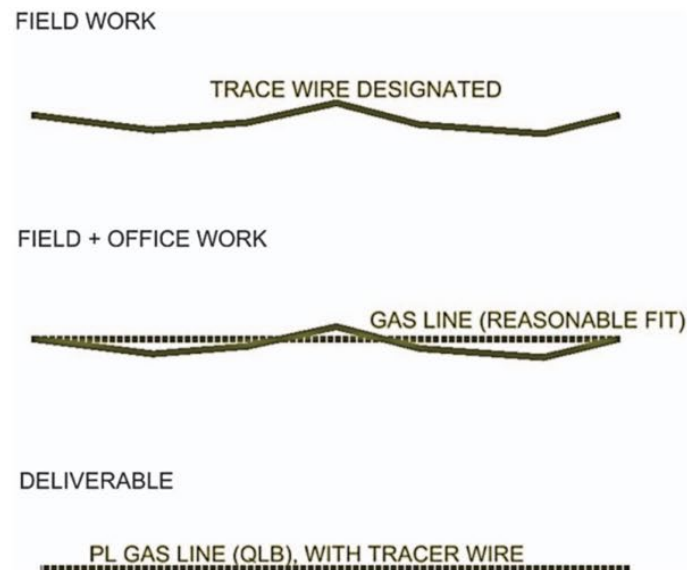


Figure 2-10. Designated trace wire that leads to a judgment of a QLB utility segment of a gas line, with attributes noted.

Quality Level A – Test hole / Pothole

QL-A

- Complete SUE level B research
- Select non-destructive excavation methodology:
- Expose utility
- Document key utility features and metadata
- Must survey findings with 0.2ft accuracy



Segments and feature QL-A designation must be made by the Professional

Symbology

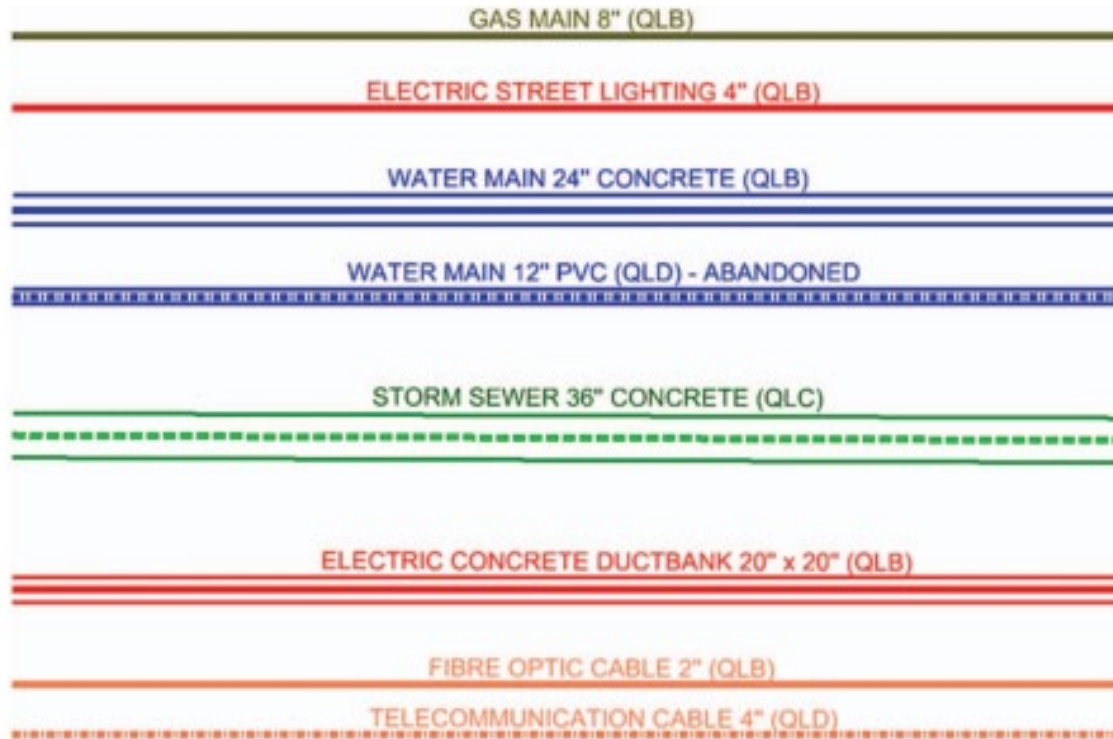
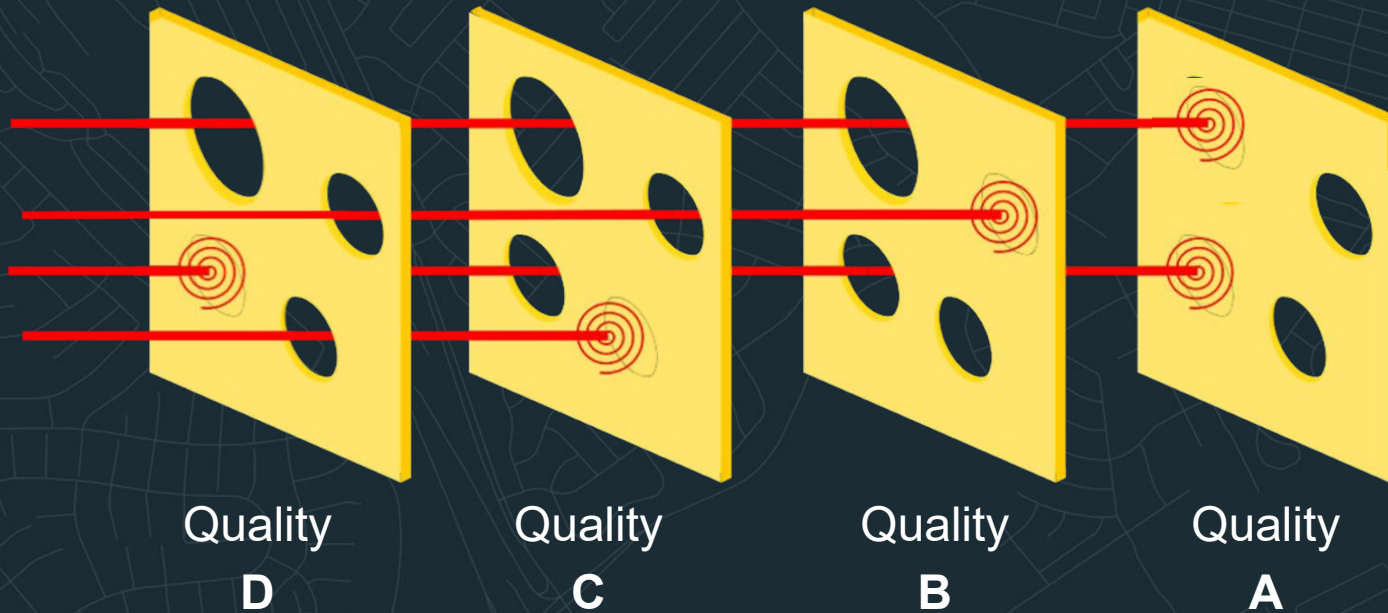


Figure 5-1. Different examples of line weight or type to show width of utilities.

Do I have to do it all?



When to do what?

Quality Level	Cost
D	Low
C	Medium
B	Medium
A	High

	Project Type	
Quality Level	Simple Infrastructure	Complex Infrastructure
D	10% Design	10% Design
C	30% Design	30% Design
B	30% or Mob	
A	Mobilization	

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Standard Guideline for Investigating and Documenting Existing Utilities

ASCE 75-22

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ASCE 75-22

Standard Guideline for Recording and
Exchanging Utility Infrastructure Data

Overview

Use recommendations of ASCE 75-22

Standardize data capture  Accuracy, Intervals and Attributes

Facilitate data exchange  Feature Types, Geometry, Attributes

Be compatible with design platforms  **CAD, BIM, GIS, JSON, XML**

Maintain Records  Consistent, Complete, Validated

Data Capture Best Practices

- Know your accuracy in the field
- Capture everything. Mob cost is high
- Elevations for every shot!
- Simple data dictionaries
- Consistent data dictionaries

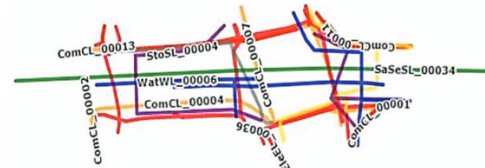


Figure A-1. Installation of an 8 in. diameter sanitary sewer force main (SaSeSI_00034).

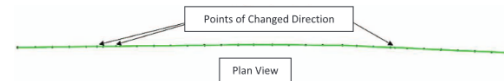


Figure A-2. Plan view of an 8 in. diameter sanitary sewer force main installation recorded observation points.

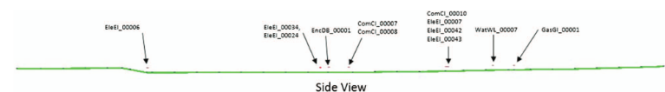


Figure A-3. Profile view of an 8 in. diameter sanitary sewer force main installation showing survey observations of exposed utility installations.

Data Model Best Practices

Table A-3. X-Y-Z Observed Positional Data of Utilities Crossed and Exposed During Installation of an 8 in. Diameter Sanitary Sewer Force Main.

Point number	Latitude (Y)	Longitude (X)	Elevation (Z)	Feature code	Positional	Survey note
					Accuracy Level	
858	47.0581813	– 122.7622991	205.91	CTH_00001	2	Communication, top
859	47.0584807	– 122.7623087	205.51	CTH_00003	2	Communication, top
860	47.0584815	– 122.7623091	205.60	CTH_00004	2	Communication, top
861	47.0585430	– 122.7623091	205.18	CTH_00008	2	Communication, top
1221	47.0581767	– 122.7622993	205.85	ETH_00001	2	Electricity, top
1222	47.0581778	– 122.7622995	205.90	ETH_00002	2	Electricity, top
1223	47.0585688	– 122.7623111	205.09	ETH_00003	2	Electricity, top
1224	47.0585699	– 122.7623110	205.10	ETH_00004	2	Electricity, top
1225	47.0591000	– 122.7623435	204.93	ETH_00007	2	Electricity, top
1226	47.0581755	– 122.7622993	205.88	ETH_00009	2	Electricity, top
1279	47.0579722	– 122.7623024	207.24	GTH_00001	2	Gas, top
1405	47.0580377	– 122.7623006	206.86	WTH_00001	2	Water, top

Important Takeaways

- Capture Z data
- CAD & GIS compatible (geometry, attributes and metadata)
- Document capture process and accuracy in detail
- ASCE 75 is a framework, adapt the principals
- Completeness and consistency is key

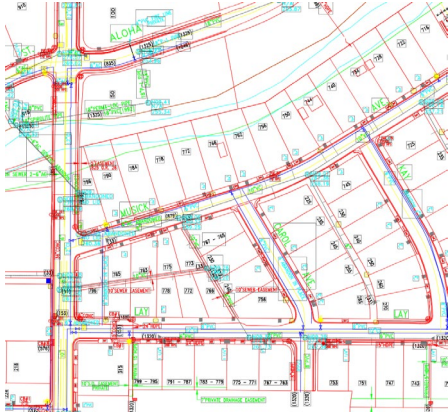
FAQs

- Do I capture 3rd party facilities when I find them?
- What if I don't have Survey Grade GPS equipment?
- How do I determine Accuracy Standards & Attribute Domains?
- How compatible does my data need to be?
- What is the difference between SB 865 in CA and ASCE 75?

Where to we go from here?

- Current State Summary
- Outstanding Challenges
- Exciting Opportunities

The Present



Digitized Utility Maps



GPS Enabled Locating



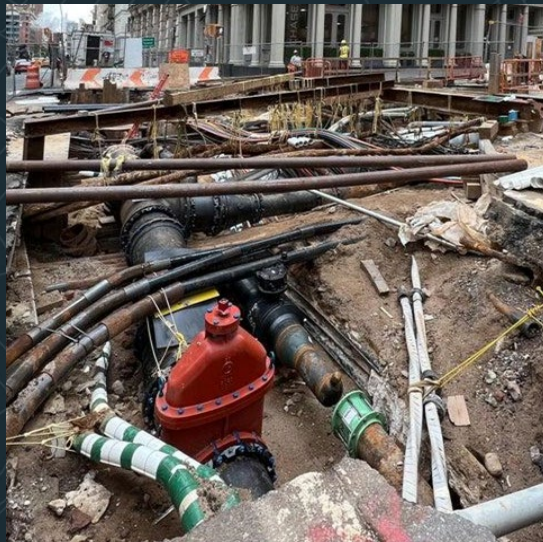
Basic Subsurface Scanning

We still have work to do...

TIME CONSUMING RESEARCH



FIELD SURPRISES



500,000 DIG INS



Why are utilities still such a problem?

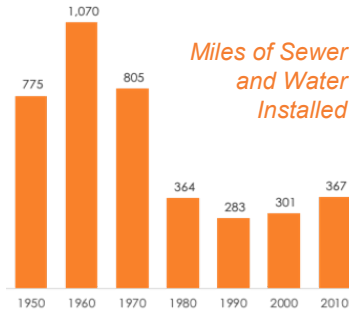
Application of Best Practices

- SUE not known or applied
- No quality levels in GIS
- New facilities aren't GPS-ed



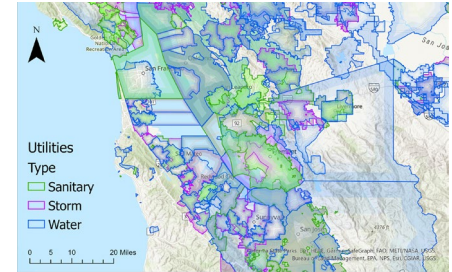
Recordless or Abandoned Facilities

- Legacy infrastructure
- Records not retained when facilities abandoned



Data Fragmentation and Loss

- Data spread across operators
- Data boxed after every job



The Future

Laws, Standards & Training

SB 865

CA Law requiring all new or exposed subsurface installation to be maintained in GIS

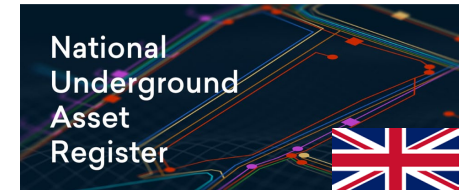


Better Detection & Digitization Technology



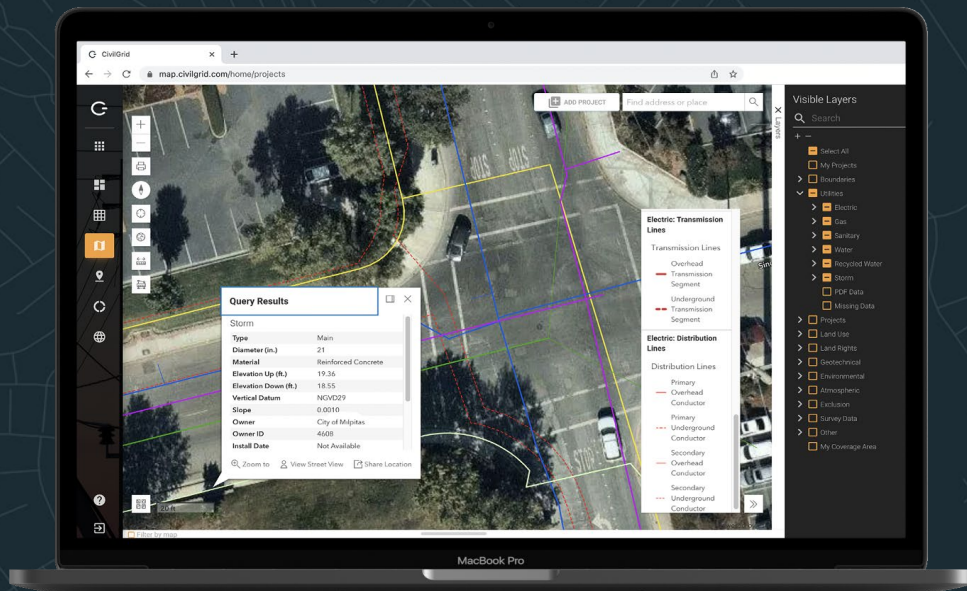
Secure Shared Single Source of Truth

CIVILGRID



CIVILGRID

SECURE, SHARED, SINGLE SOURCE OF TRUTH



Utility lines



Environmental



Imagery



Land Rights



Paving &
Moratoriums



Historical
Survey



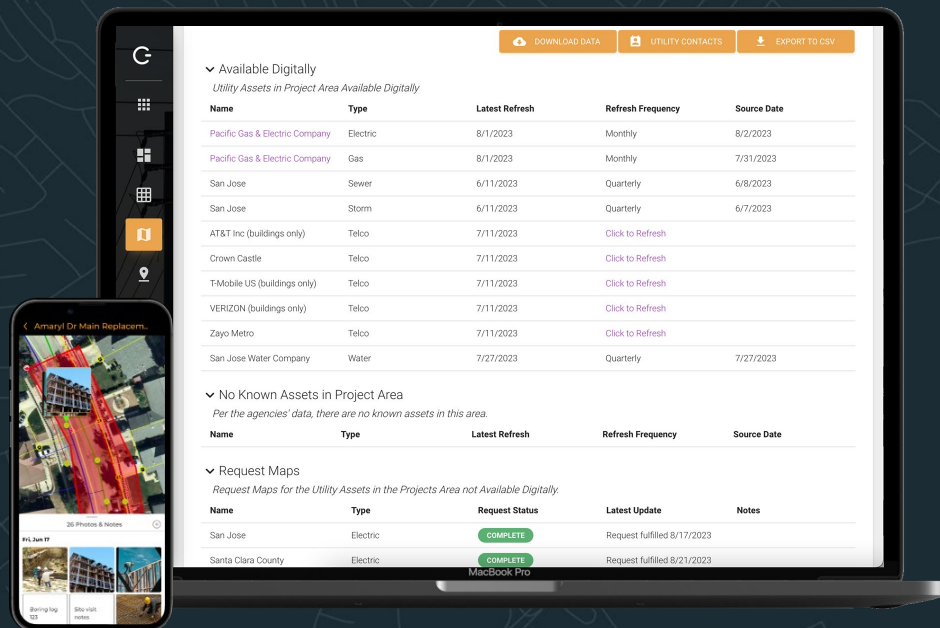
Hazardous
Materials



Historical Geotech

Capabilities

ACCESS CONSOLIDATED DATA IN REAL TIME & COLLABORATIVELY PLAN



- Source utility list relevant to your project
- Submit and manage utility requests
- Plan potholing and document on mobile
- Auto-generate CAD plan view drawings

Challenges Addressed by CIVILGRID

- Secure & seamless inter-agency data flows
- Reduce quality D research & drafting time
- Identify source data quality where available
- Reduce data loss at project close

Conclusion & Takeaways

- Become a SUE ambassador
- Robust GIS systems are essential to a better SUE future
- New technology is here, but it won't have an impact without you

If you have questions

COME VISIT US



Josh Mackanic

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Strategic Account Executive

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Questions?

The screenshot displays the CivilGrid web application interface on a laptop screen. The interface includes a sidebar with navigation tools, a main map area showing an aerial view with overlaid project data, and a 'Visible Layers' panel on the right. A 'My Projects' pop-up window is also visible over the map.

Visible Layers

- ☒ Electric
 - ☒ Distribution Devices
 - ☒ Distribution Structures
 - ☒ Distribution Lines
 - ☒ Service Lines
 - ☒ Vault
 - ☒ Transmission Structures
 - ☒ Transmission Lines
 - ☒ Street Lights
 - ☒ Other
- ☒ Gas
 - ☒ Points
 - ☒ Main Lines
 - ☒ Services
- ☒ Sanitary
 - ☒ Points
 - ☒ Pipes
- ☒ Water
 - ☒ Points
 - ☒ Main Pipes
 - ☒ Service Pipes
- ☒ Recycled Water
 - ☒ Points
 - ☒ Pipes
- ☒ Storm
 - ☒ Points
 - ☒ Pipes
- ☐ Telco
- ☐ PDF Data
- ☐ Missing Data
- ☐ Projects
- ☐ Land Use
- ☐ Land Rights
- ☐ Infrastructure

My Projects

Storm: Pipes

- ☒ Storm Pipes
- ☒ Mains
- ☒ Lateral
- ☒ Abandoned
- ☒ Other

Storm: Points

- ☒ Storm Points
- ☒ Manhole
- ☒ Inlet

ID	Name	Project Manager	Status	Phase	Project Year	Engineer	Project Start	Project Start Quarter	Project End	Submitted	Scope
87	Meridian Condo	Sharath Prabhal	Needs Attention	Planning	2021	Sharath Prabhal	03/03/2021	2021 - Q1	12/06/2022	10/26/2021	The Meridian project consists of
KBXKYS	New San Jose Condo	Josh Mackanic	On Track	Proposed	2021	Josh Mackanic	12/06/2021	2021 - Q4	12/06/2022	12/07/2021	
ZMVH2	New Sewer Main	Josh Mackanic	On Track	Proposed	2021	Josh Mackanic	12/07/2021	2021 - Q4	12/07/2022	12/08/2021	
QK1IPW	New Project	Brandon Cohen	On Track	Proposed	2021	Brandon Cohen	12/22/2021	2021 - Q4	12/22/2022	12/23/2021	
7ARDGO	Park Project	Josh Mackanic	On Track	Proposed	2021	Josh Mackanic	12/19/2021	2021 - Q4	12/19/2022	12/20/2021	

CIVILGRID

SECURE, SHARED, SINGLE SOURCE OF TRUTH



CONTRA COSTA
WATER DISTRICT



SAN JOSE
WATER



CITY OF
FAIRFIELD
CALIFORNIA



EDISON
INTERNATIONAL®



CITY OF
SAN MATEO
CALIFORNIA



ANTIOCH
CALIFORNIA

150+ UTILITY OPERATORS



Utility lines



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Imagery



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