

New England Pipeline Safety Representatives (NEPSR)

Capturing & Integrating System Information

“Trace & Traceability”
GIS & GPS



Speakers

Mel Ciulla

Manager, Gas Distribution Operations

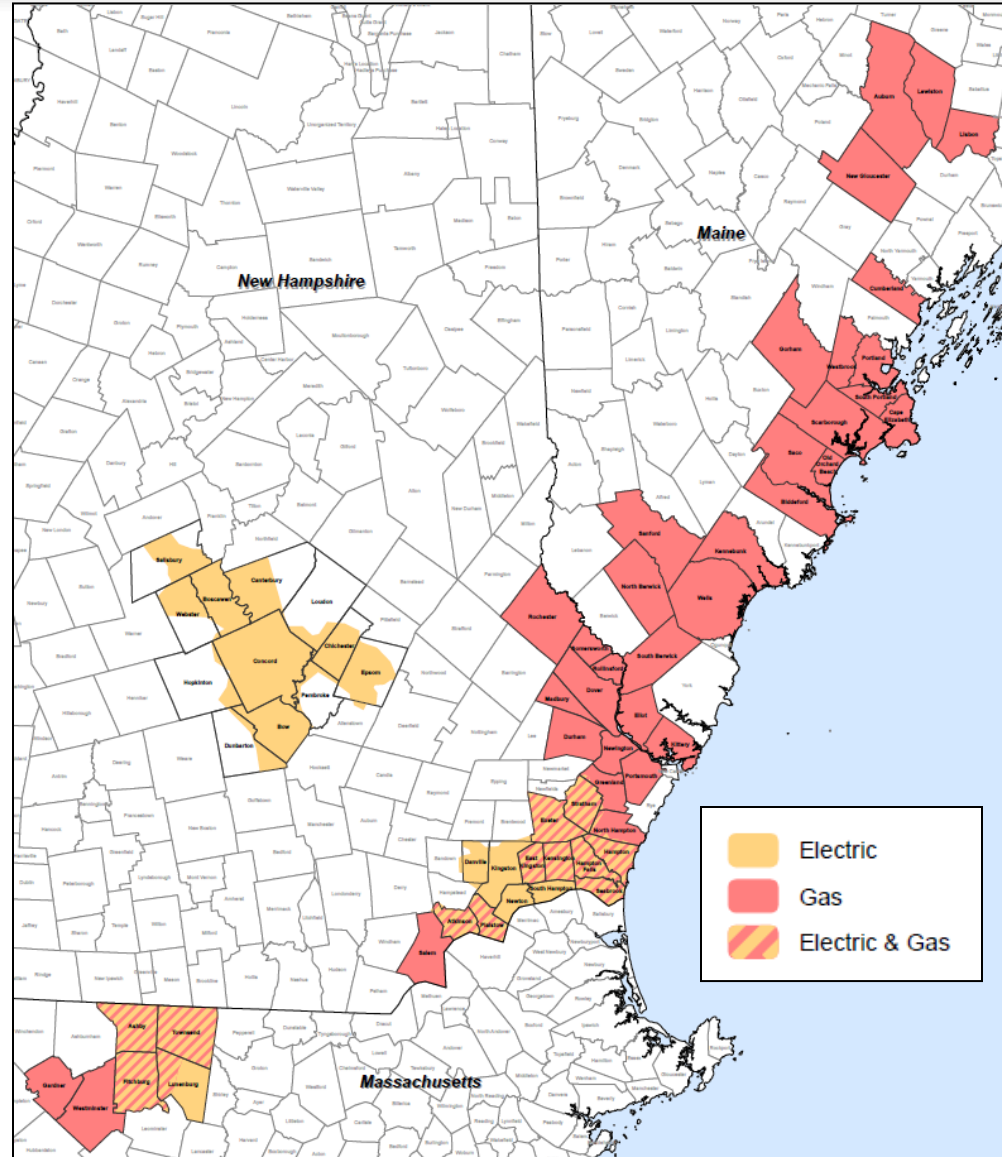
Charlie Kickham

Manager, GIS & CAD

Who is Unitil?

Public Utility Holding Company

- Unitil Energy Systems (NH)
29,600 (E) Capital
44,300 (E) Seacoast
- Fitchburg Gas & Electric Light Company (MA)
28,500 (E)
15,120 (G)
- Northern Utilities (NH and ME)
54,200 (G)
- Granite State Gas Transmission
87 miles of
Interstate Pipeline



Overview

- GPS Program / Logistics
- Evolution
- GIS Data Processing
- Scanning / Construction Logistics
- Procurement Asset Management
- Data Risk Management

Objective

To develop an electronic Asset Management tracking system (i.e. "*Trace and Traceability*") that would enable Unitil to establish a geospatial reference point for every component installed on our gas system(s) as well as the detailed data on each of the components attributes (e.g. size, material, SDR etc.).



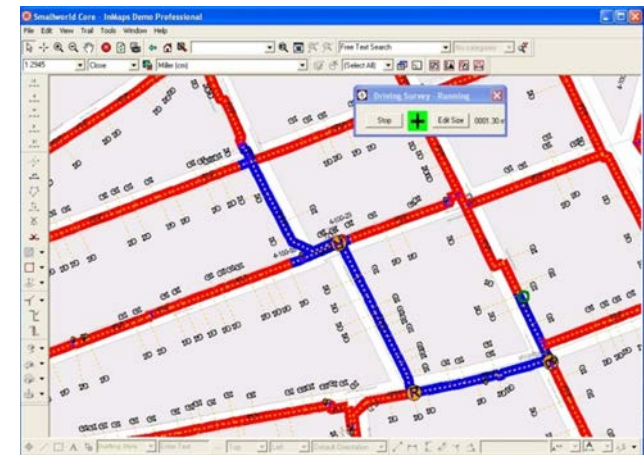
GPS Data Capturing at Unitil

- New Mains & Services (steel / plastic)
- Existing Main & Service Locations
- Leak Repairs
- Leak Survey Program
- Critical & Distribution Valves
- Transmission Pipeline Support
- GPS Marker Ball

Leak Progression Maps



GPS Mobile Leak Survey



GPS & GIS the Foundation of our DIMP

New Installations: § 192.1007 (a)
(5) Provide for the capture and retention of data on any new pipeline installed. The data must include, at a minimum, the location where the new pipeline is installed and the material of which it is constructed.

**IS THE MINIMUM ENOUGH TO
ASSESS RISK??????**

Data Capture by Unitil

Key Data	Examples
Pipe Size & Sizing System	1" IPS
Wall Thickness	SDR 11
Product Name	Driscoplex
Series	8100
Pipe Material Designation	PE3408/PE4710
Manufacturing Standard	ASTM D 2513
Date of MFG	July 1, 2012
Plant Code & Extrusion Line	KV-4 (Knoxville Tennessee)
Resin Code	RN-B53m1
Shift & Operator No.	04-201
Unitil Installer	Employee No. 7066

GPS & GIS the Foundation of our DIMP

Existing

Components: § 192.1007 (a) (3)

Identify additional information needed and provide a plan for gaining that information over time through normal activities conducted on the pipeline (for example, design, construction, operations or maintenance activities).

**How to identify and collect
“missing data” on existing
components**

Data Capture by Unitil

Known Data:

- Pipe Size
- Material (e.g. Plastic, Coated Steel, Cast Iron etc.)

Additional Data Captured

- Plastic Pipe Material (HDPE, MDPE)
- SDR/Wall Thickness
- Type of Coating on steel (Pritec, FBE)
- Product Name
- Fittings & Couplings

GPS Program at Unitil

- Development
 - 2009
 - In-House / Contractor
 - Cost / Contracts
 - Process Data Collection
- Equipment
- Data Workflow – Contractor / In-House to GIS

GPS Barcode

- Barcode Accessibility:
 - Barcode Placement
 - Sticker Falling off
 - Barcode on pipe only one side
 - Barcode damaged
 - 1D vs 2D scanning
- Data Dictionary / Field Collection Issues
 - Repeat
 - Log Later – scanning feature before collecting point

Evolution

TerraSync 1:15

Data ▾

New ▾

Create New Data File

File Type: Rover ▾

Location: Default ▾

File Name: NH4_092113A

Dictionary Name: 2012 NH Neuco Gas Barcode

Create

TerraSync 3:40

Data ▾

Collect ▾ Options ▾

File: NH4_092113A

GPS Scan - MAIN

GPS Scan - SERVICE

Close

TerraSync 3:42

Data ▾

Collect ▾ Options ▾

1 GPS Scan - MAIN Cancel

CWO Project Number: [Dropdown]

GPS User: [Dropdown]

Fuser: [Dropdown]

Locate Ball: ☐ Yes ☒ No

Address: [Text Field]

Gas Line Type: [Dropdown]

Done Pause

Evolution

- Concept
 - GPS
 - One field Scanning Feature



TerraSync 8:27 ok

Data Collect Options Pause

1 Other Gas Work OK Cancel

CWO Number::

Gas Line Type:

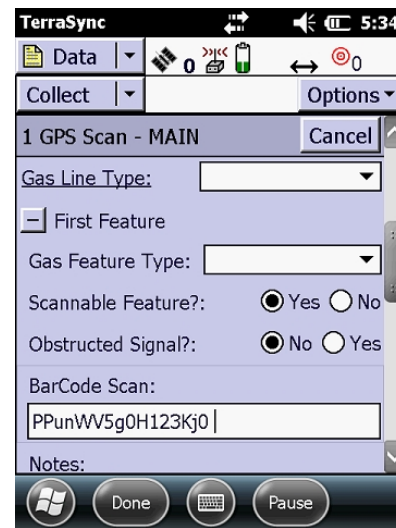
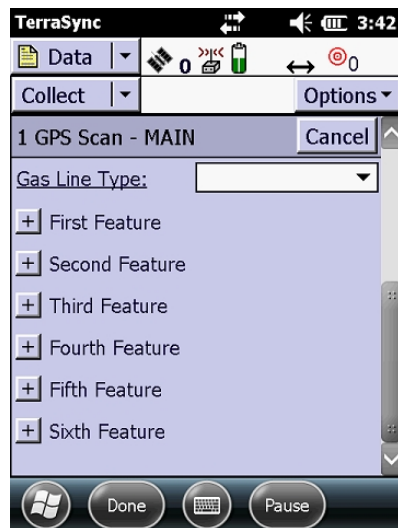
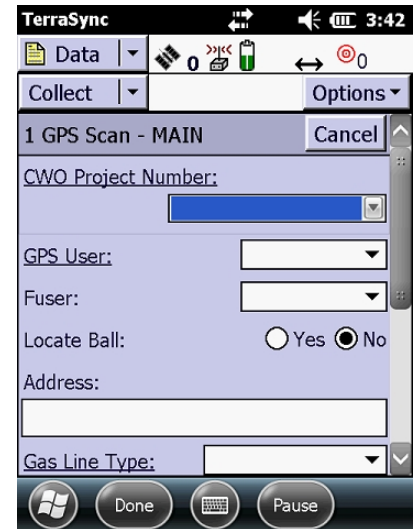
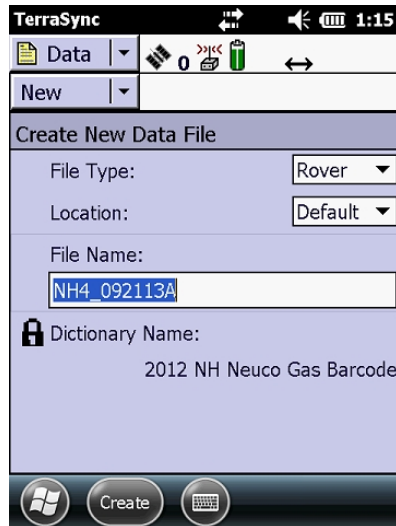
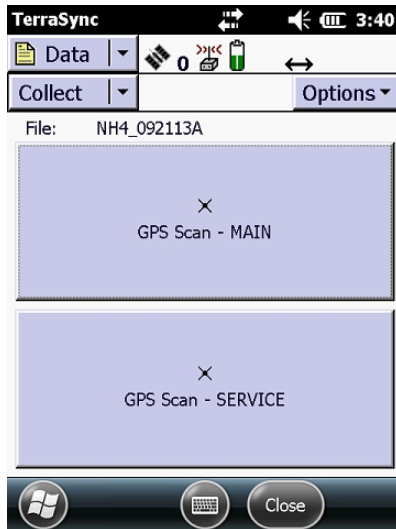
Gas Job Type:

*Gas Feature Type:

Address:

OK Pause

Evolution



Evolution

- Evolution of GPS with Contractors / Company workforces
 - Opposition to Learning Curve to Culture
 - Contractors, Multiple Year Contract, Massachusetts, Maine, New Hampshire
 - Mains & Services
 - Company Workforce
 - Union environment
 - Leak Investigation
 - Leak Repair
 - Relocations
 - Surveys
 - Valve Inspections
- GPS / Scanning
 - Supplier Resistance
 - Common Approach
 - NGA Fall Conference 2010
 - Pilot Main Renewal with Services
 - Recognize; PolyPipe, Central Plastics
 - Expectations



Multiple Feature GPS Scan Data

The screenshot displays a GIS application window with a map of a residential area. The map shows several gas service lines and features, including a 3030' 4" Bare Steel line and a 2815' 3" Bare Steel line. The 'Identify' window is open, showing details for a selected feature. The 'Attributes of GPS_Service_Install' window is also open, displaying a table of feature data.

Identify Window:

Field	Value
Address	269 wibird st portsmouth
Barcode_S2	PPVWwE6kKH120ot0
Barcode_S3	
Barcode_Sc	
CWO_Projec	2036 1272 - Wibird
Datafile	09191237A.cor
Feat_Name	GPS_Sca3
Fuser	Senfleben
Gas_Featu2	Misc. Location
Gas_Featu3	
Gas_Line_T	Gas Service
GPS_Date	9/19/2012
GPS_Second	329248
GPS_Time	03:27:13pm
GPS_User	Senfleben
GPS_Week	1706
Latitude	43.065682349
Locate_Bal	No
Longitude	-70.763229161

Identified 13 features

Attributes of GPS_Service_Install:

Gas_Line_T	Gas_Featu	Scannable_	Barcode_Sc	Gas_Featu2	Scannable2	Barcode_S2	Gas_Featu3	Scannable3	Barcode_S3	GPS_Date	GPS_Time	Feat_Name	Datafile	GPS_Week	GPS_Second	Latitude	Longitude
Gas Service	Tee	Yes	CP1aO25HqC8A0p00		Yes			Yes		9/19/2012	03:16:28pm	GPS_Sca3	09191237A.cor	1706	328603	43.065492941	-70.763216267
Gas Service		Yes		Misc. Location	Yes	PPVWwE6kKH120ot0		Yes		9/19/2012	03:19:24pm	GPS_Sca3	09191237A.cor	1706	328779	43.065516327	-70.763153707
Gas Service		Yes			Yes		Riser	No	99	9/19/2012	03:20:32pm	GPS_Sca3	09191237A.cor	1706	328847	43.065542274	-70.763116075
Gas Service	Tee	Yes	CP1aO25HqC8A0p00		Yes			Yes		9/19/2012	03:21:28pm	GPS_Sca3	09191237A.cor	1706	328903	43.065555461	-70.763280542
Gas Service		Yes		Misc. Location	Yes	PPVWwE6kKH120ot0		Yes		9/19/2012	03:27:13pm	GPS_Sca3	09191237A.cor	1706	329248	43.065682349	-70.763229161
Gas Service		Yes			Yes		Riser	No	99	9/19/2012	03:27:58pm	GPS_Sca3	09191237A.cor	1706	329293	43.065729098	-70.763184423
Gas Service	Tee	Yes	CP1aO25HqC8A0p00		Yes			Yes		9/19/2012	03:29:42pm	GPS_Sca3	09191237A.cor	1706	329397	43.065798841	-70.763362094
Gas Service		Yes		Misc. Location	Yes	PPVWwE6kKH120ot0		Yes		9/19/2012	03:30:49pm	GPS_Sca3	09191237A.cor	1706	329463	43.065839581	-70.763295768
Gas Service		Yes			Yes		Riser	No	99	9/19/2012	03:32:19pm	GPS_Sca3	09191237A.cor	1706	329554	43.065857608	-70.763259512

Record: 0 | Show: All | Selected | Records (9 out of 12 Selected) | Options

Data Dictionary – Old vs New

The image displays two side-by-side screenshots of the TerraSync software interface, illustrating the evolution of its data dictionary. The left window represents an older version, while the right window shows a newer version.

Left Window (Old Version):

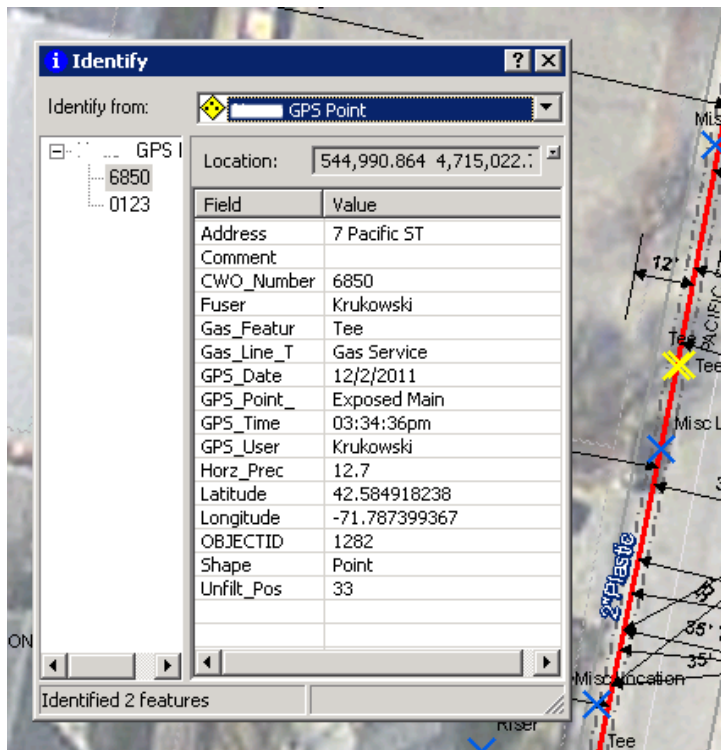
- Name:** 2012 NH Gas BC
- Version:** TerraSync V5.00 and later
- Features:**
 - GPS Scan - MAIN
 - GPS Scan - SERVICE
- Attributes:**
 - CwO Project Number
 - GPS User
 - Fuser
 - Locate Ball
 - Address
 - Gas Line Type
 - First Feature
 - Gas Feature Type1 (Gas Feature Type)
 - Scannable Feature1 (Scannable Feature?)
 - Poor GPS Signal1 (Obstructed Signal?)
 - Feet From Feature1 (Feet to Feature?)
 - Feature Description1 (Feature Description)
 - Barcode Scan1 (Barcode Scan)
 - Notes1 (Notes)
 - Second Feature
 - Gas Feature Type2 (Gas Feature Type)
 - Scannable Feature2 (Scannable Feature?)
 - Poor GPS Signal2 (Obstructed Signal?)
 - Feet From Feature2 (Feet to Feature?)
 - Feature Description2 (Feature Description)
 - Barcode Scan2 (Barcode Scan)
 - Notes2 (Notes)
 - Third Feature
 - Gas Feature Type3 (Gas Feature Type)
 - Scannable Feature3 (Scannable Feature?)
 - Poor GPS Signal3 (Obstructed Signal?)
 - Feet From Feature3 (Feet to Feature?)

Right Window (New Version):

- Name:** 2014
- Version:** TerraSync V5.00 and later
- Features:**
 - PROJ_INFO (PROJECT INFO)
 - PPFusion (Pipe-Pipe Fusion)
 - PPWeld (Pipe-Pipe Weld)
 - PipeLoc (Pipe Location)
 - MnTee (Main Tee)
 - MnValve (Main Valve)
 - MnFitting (Main Fitting)
 - MnCoupling (Main Coupling)
 - MnReducer (Main Reducer)
 - MnEndCap (Main End Cap)
 - MnOther (Main Other)
 - SvPipe (Service Pipe)
 - SvTee (Service Tee)
 - SvValve (Service Valve)
 - SvFitting (Service Fitting)
 - SvCoupling (Service Coupling)
 - SvReducer (Service Reducer)
 - SvEndCap (Service End Cap)
 - SvRiser (Service Riser)
 - SvOther (Service Other)
 - SqzOff (Squeeze Off)
 - ★ Leak (Leak or Leak Repairs)
- Attributes:**
 - Fuser (Fuser/Installer)
 - FuserOth (Fuser/InstallerName(if Other))
 - Welder
 - WelderOth (Welder (if Other))
 - WeldInsp (Weld Inspector)
 - WeldID (Weld ID)
 - Status
 - Material
 - Size
 - Coating
 - CoatingOth (Coating (if Other))
 - WallThick (Wall Thickness(nnn))
 - TensilStr (Tensile Strength)
 - Depth (Depth (Inches))
 - MfrName (Manufacturer)
 - MfrNameOth (Mfr Name (if Other))
 - MfgDate (Mfg Date)
 - ScanFeat (Scannable Feature?)
 - PipeScan1
 - PipeScan2
 - Comment
- Text:**
 - Length: 10
 - Default Value:
- On Creation:** Normal
- On Update:** Normal
- Condition:** Disabled
- Default Feature Settings:**
 - Min. Positions: 45
 - Accuracy: Code
 - Log Interval: 1 seconds
 - Label 1: MfgDate
 - Label 2: Coating

Press F1 for help

Data Dictionary – Old / New

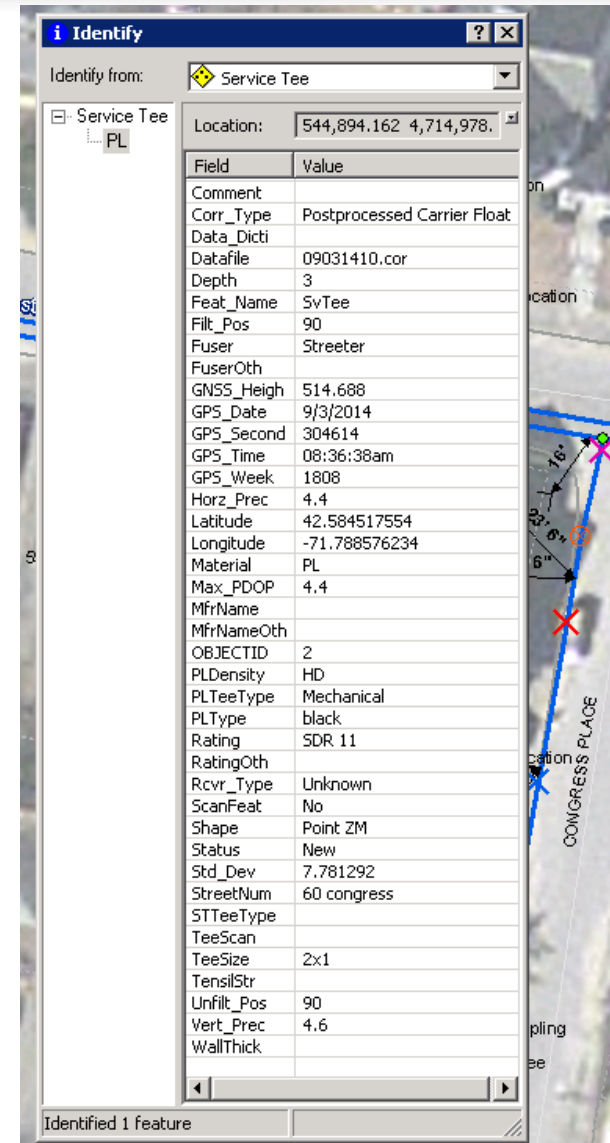


Identify from: GPS Point

Location: 544,990.864 4,715,022.

Field	Value
Address	7 Pacific ST
Comment	
CWO_Number	6850
Fuser	Krukowski
Gas_Featur	Tee
Gas_Line_T	Gas Service
GPS_Date	12/2/2011
GPS_Point_	Exposed Main
GPS_Time	03:34:36pm
GPS_User	Krukowski
Horz_Prec	12.7
Latitude	42.584918238
Longitude	-71.787399367
OBJECTID	1282
Shape	Point
Unfilt_Pos	33

Identified 2 features



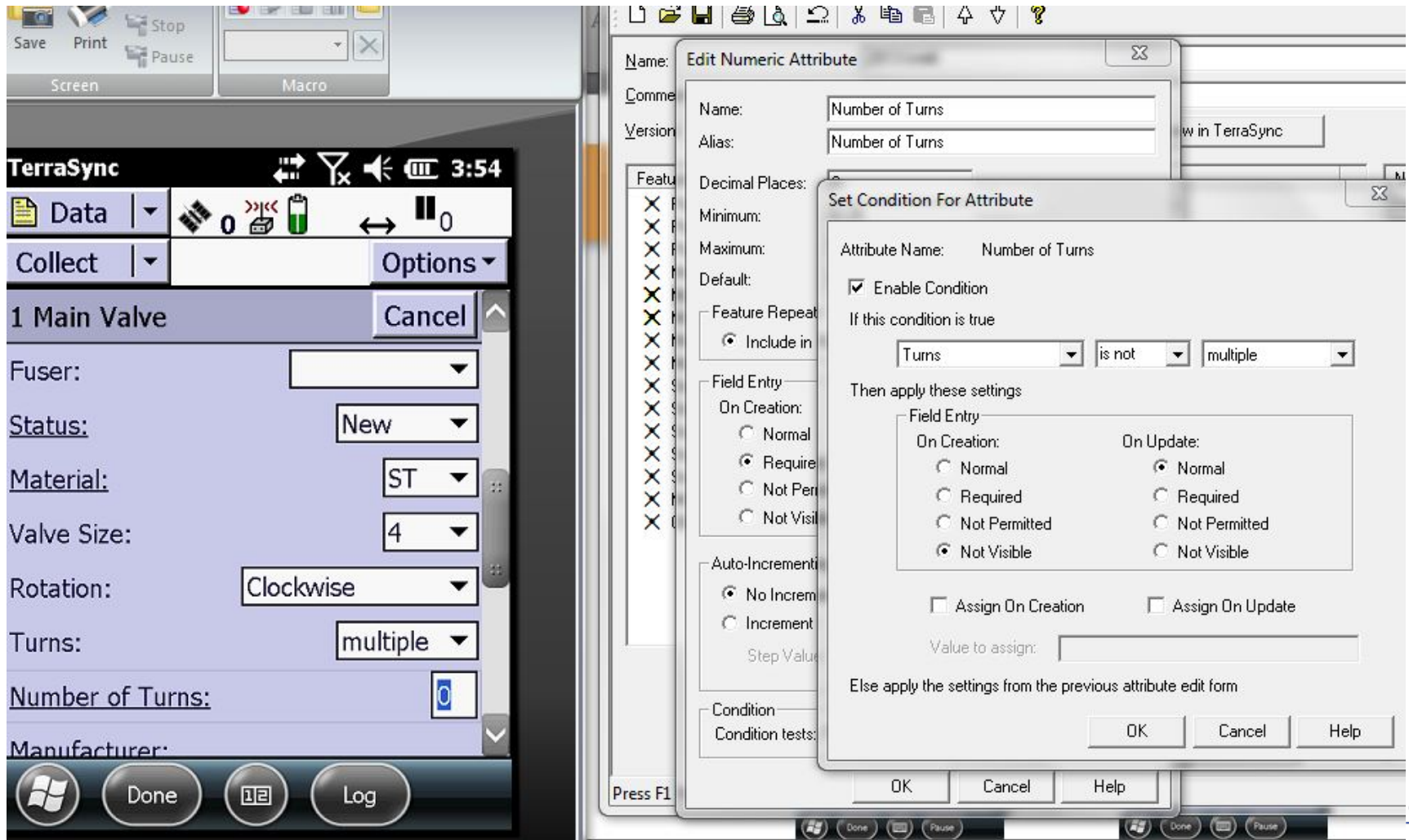
Identify from: Service Tee

Location: 544,894.162 4,714,978.

Field	Value
Comment	
Corr_Type	Postprocessed Carrier Float
Data_Dicti	
Datafile	09031410.cor
Depth	3
Feat_Name	SvTee
Filt_Pos	90
Fuser	Streeter
FuserOth	
GNSS_Heigh	514.688
GPS_Date	9/3/2014
GPS_Second	304614
GPS_Time	08:36:38am
GPS_Week	1808
Horz_Prec	4.4
Latitude	42.584517554
Longitude	-71.788576234
Material	PL
Max_PDOP	4.4
MfrName	
MfrNameOth	
OBJECTID	2
PLDensity	HD
PLTeeType	Mechanical
PLType	black
Rating	SDR 11
RatingOth	
Rcvr_Type	Unknown
ScanFeat	No
Shape	Point ZM
Status	New
Std_Dev	7.781292
StreetNum	60 congress
STTeeType	
TeeScan	
TeeSize	2x1
TensilStr	
Unfilt_Pos	90
Vert_Prec	4.6
WallThick	

Identified 1 feature

Data Dictionary – Conditions



Feature Focused GPS Capture

TerraSync 3:34

Data Collect Options

File: NH6_041015A

Choose Feature:

Type	Feature Name
X	Pipe-Pipe Weld
X	Pipe Location
X	Main Tee
X	Main Valve
X	Main Fitting
X	Main Coupling
X	Main Reducer
X	Service Tee
X	Service Valve
X	Service Fitting
X	Service Coupling

Create Close

TerraSync 3:39

Data Collect Options

1 Main Valve Cancel

Status: New Existing

Material:

Valve Size:

Rotation:

Turns: 1/4

Manufacturer:

Scannable Feature?:

Done Log

TerraSync 3:43

Data Collect Options

1 Main Valve Cancel

Scannable Feature?: Yes

Valve Scan:

Pipe Scan:

Pipe Scan:

Done Log

TerraSync 3:45

Data Collect Options

1 Pipe-Pipe Fusion Cancel

Status: Existing

Material: PL

Size:

Plastic Type: HD

Rating: Unknown

Manufacturer: Perf Pipe

Mfg Date:

Done Log

TerraSync 3:45

Data Collect Options

1 Pipe-Pipe Fusion Cancel

Manufacturer: Perf Pipe

Mfg Date:

Scannable Feature?:

Pipe Scan1:

Pipe Scan2:

Done Log

TerraSync 3:35

Data Collect Options

File: NH6_041015A

Choose Feature:

Logging Interval...

- Repeat
- Log Now
- Log Later
- QuickPoint
- Continue...

Type	Feature Name
X	Pipe-Pipe Weld
X	Pipe Location
X	Main Tee
X	Main Valve
X	Main Fitting
X	Main Coupling
X	Main Reducer
X	Service Tee
X	Service Valve
X	Service Fitting
X	Service Coupling

Create Close

Feature Focused GPS Capture

- GPS
 - Project Information

The screenshot displays the TerraSync mobile application interface. At the top, a status bar shows the time as 8:56 and various system icons. Below this, a navigation bar includes a 'Data' dropdown menu and a 'New' button. The main content area is titled 'Create New Data File' and contains several input fields: 'File Type' set to 'Rover', 'Location' set to 'Default', 'File Name' with the text 'GSGT_100108B' entered, and 'Dictionary Name' set to '2014_Unitil'. At the bottom, there is a Windows logo icon, a 'Create' button, and a keyboard icon.

Feature Focused GPS Capture

- GPS
 - Feature

The screenshot displays the TerraSync mobile application interface. At the top, the status bar shows the time as 11:15 and various system icons. Below the status bar, there is a navigation bar with a 'Data' menu item and several status icons. The main screen is titled 'Create New Data File'. It contains several input fields and dropdown menus: 'File Type' is set to 'Rover', 'Location' is set to 'Default', 'File Name' is 'GSGT_092611A', and 'Dictionary Name' is set to '2014_Unitil'. At the bottom of the screen, there is a dock with three buttons: a Windows logo, a 'Create' button, and a keyboard icon.

TerraSync 11:15

Data | 0

New |

Create New Data File

File Type: Rover

Location: Default

File Name: GSGT_092611A

Dictionary Name: 2014_Unitil

Create

Feature Focused GPS Capture

- GPS
 - Main line Valve

The screenshot shows the TerraSync mobile application interface. At the top, the status bar displays 'TerraSync', signal strength, battery level, and the time '11:42'. Below the status bar is a navigation bar with a 'Data' dropdown menu, a 'Collect' dropdown menu, and an 'Options' dropdown menu. The main content area is titled '1 Main Valve' and contains several form fields for data entry: 'Status:' with a 'New' dropdown, 'Material:' with an 'ST' dropdown, 'Size:' with a '4' dropdown, 'Valve Type:' with a 'Ball (Full-Port)' dropdown, 'Rotation To OPEN:' with a 'Clockwise' dropdown, 'Turns:' with a 'multiple' dropdown, 'Number of Turns(n.n):' with a text input field containing '3.5', and 'Depth (Inches):' with an empty text input field. A 'Cancel' button is located at the top right of the form area. At the bottom of the screen is a Windows-style taskbar with icons for 'Done', a keyboard, and 'Log'. A small 'il' logo is visible in the bottom right corner.

TerraSync

Data | Collect | Options

1 Main Valve Cancel

Status: New

Material: ST

Size: 4

Valve Type: Ball (Full-Port)

Rotation To OPEN: Clockwise

Turns: multiple

Number of Turns(n.n): 3.5

Depth (Inches):

Done Log

Feature Focused GPS Capture

- GPS
 - Coupling

The screenshot displays the TerraSync mobile application interface. At the top, the status bar shows 'TerraSync', signal strength, battery level, and the time '12:02'. Below the status bar is a navigation bar with 'Data' and 'Collect' tabs, and an 'Options' button. The main screen shows a form titled '1 Main Coupling' with a 'Cancel' button. The form contains several fields with dropdown menus: 'Status' (New), 'Material' (ST), 'Connecting Material' (ST-ST), 'Coupling Type' (Mechanical), 'Mech Coupling Type' (empty), 'Size' (Nut Follower), 'Depth (Inches)' (Compression), and 'Manufacturer' (empty). The bottom of the screen features a Windows logo and three buttons: 'Done', 'Log', and 'Log'.

TerraSync

Data | Collect | Options

1 Main Coupling Cancel

Status: New

Material: ST

Connecting Material: ST-ST

Coupling Type: Mechanical

Mech Coupling Type:

Size: Nut Follower

Depth (Inches): Compression

Manufacturer:

Done Log

2015 Expectations

- Barcode, product availability
- Connections, GPS Photo Capture – Geotag photo to feature captured
- Existing Infrastructure Data Capture
 - GIS data validation
 - DIMP Support

Approve Material Database (SAM)

All materials used in Unitil's gas systems are subject to Engineering approval. Specific characteristics of an approved item are stored in Unitil's System Approved Material Database (SAM). Some of these characteristics include :

- Item Description
- Manufacture Part Number
- Design Pressure
- To be included *Subset of the item's 16 Character Bar Code*

Record Details							
Stock Code:	61510						
Unit of Measure:	FT						
Cat Code:	80 - GAS DISTRIBUTION						
Stock Description:	PIPE 2 IN IPS PE3408 PLASTIC						
Long Description:	PIPE 2 IN IPS PE3408 PLASTIC .216W (2.375 OD) SDR-11 350						
Class:	Capital: Seacoast: Fitchburg: NU NH: B NU ME: B GSG:						
Last Update Date:	7/6/2012 2:33:13 PM						
Last Update By:	bestl						
Approved Manufacturer(s):	<table><thead><tr><th>Manufacturer</th><th>Cat No</th></tr></thead><tbody><tr><td>PERFORMANCE PIPE</td><td>2 IN IPS SDR11 PE3406/4710 - Coil</td></tr><tr><td>Poly Pipe Inc.</td><td>1403897</td></tr></tbody></table>	Manufacturer	Cat No	PERFORMANCE PIPE	2 IN IPS SDR11 PE3406/4710 - Coil	Poly Pipe Inc.	1403897
Manufacturer	Cat No						
PERFORMANCE PIPE	2 IN IPS SDR11 PE3406/4710 - Coil						
Poly Pipe Inc.	1403897						
Design Pressure:	<table><thead><tr><th>Value</th><th>Units</th></tr></thead><tbody><tr><td>102.00</td><td>PSI</td></tr></tbody></table>	Value	Units	102.00	PSI		
Value	Units						
102.00	PSI						

Future Expectations

- Material Procurement / Validation / Traceability
 - Unitil's barcoding initiative has benefits that go beyond traceability and Distribution Integrity Management Program (DIMP). Various back office functions have the opportunity for streamlining based on the data collected in the field. The back office functions of inventory management, project closeout, and plant asset allocation all rely on data associated with components and their installation within Unitil's gas systems.
- Close out Process
 - Material validation
 - Non-Approved Materials

GPS Program at Unitil

- Equipment
 - Trimble GeoXH sub-foot / pole-mounted Zephyr antenna
 - Pathfinder Office / Terrasync
 - Bluetooth enabled barcode scanner
- Data Workflow – Contractor to GIS
 - Post Processing (contractor / in-house)
 - GTI Program

GIS at Unitil

- GIS at Unitil
 - ESRI & ArcFM
 - Five full-time GIS staff
 - ArcGIS Desktop (GIS/Eng) / ArcReader (Field/Office viewers)
 - Integrated with many systems
 - GIS critical for DIMP & TIMP analysis

Questions

