

## Aurora Water Utility Locators

Robert Kelly – Lead Worker / Trainer 10 Years Utility Locating Experience

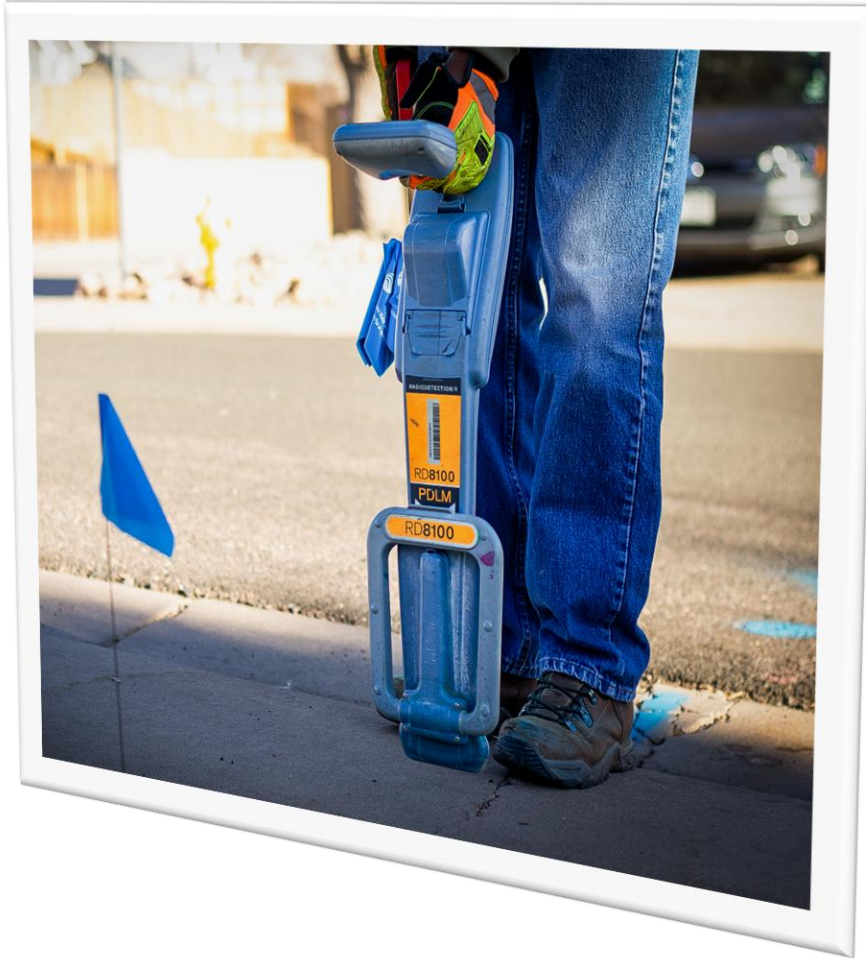
Dylan Roby – Lead Worker / Trainer 12 Years Utility Locating Experience



# WHAT UTILITY LOCATING IS AND WHY IT MATTERS



# Utility Locate Fundamentals



- One-Call / 811
- Underground Utilities
- Markings
- Tolerance Zones
- Documentation



# Why Utility Locating Matters

- Prevents damage to underground infrastructure
- Protects workers and the public
- Reduces service interruptions
- Helps prevent costly repairs and project delays
- Supports safe excavation practices



# The One-Call / 811 Process Call Before You Dig

**I'm planning to dig.  
How does **811** work?**



1. Call 811 or go to your state 811 center's website a few days before digging to request that buried utilities in your yard be marked.
2. Wait a few days for all utilities to respond to your request.
3. Confirm that all utilities have responded.
4. Respect the utility marks or flags.
5. Dig carefully around buried utilities.

**Call [811.com/811-your-state](http://811.com/811-your-state)**



1. Plan the excavation
2. Contact 811 / One-Call
3. Provide excavation location and scope
4. Utility owners are notified
5. Locators mark underground facilities
6. Review and verify markings
7. Excavate using safe practices



## 2026 C0811 Annual Assessment Tier Ticket Transmissions Fees

- **First Billing Tier = \$FREE** (0-25 Regular Annual Transmissions) – Positive Response Transmissions are still billed monthly per transmission in addition to the annual assessment amount due.
- **Second Billing Tier = \$70 Flat Annual Assessment Amount** (26-100 Regular Annual Transmissions, billed annually in one full amount in February) - Positive Response Transmissions are still billed monthly per transmission in addition to the annual assessment amount due.
- **Third Billing Tier = \$225 Flat Annual Assessment Amount** (101-300 Regular Annual Transmissions – billed annually in one full amount in February) Positive Response Transmissions are billed monthly per transmission in addition to the annual assessment amount due.
- **Fourth Billing Tier = 301+ Regular Annual Assessment Amount** (Percentage based, annually assessed amount). Positive Response Transmissions (aka Lates) are still billed monthly per transmission in addition to the annual assessment amount due. Fourth Billing Tier members pay a Percentage (%) of the budget in relation to their transmission usage actuals from July through June. Members sorted into the Fourth Billing Tier will be assessed an annual transmission fee, but the total annual fee will be broken down into twelve easy to pay billing increments billed monthly together with any positive response transmission fees.

## The NEW Annual Ticket Fee Assessment Model Saves You Money!

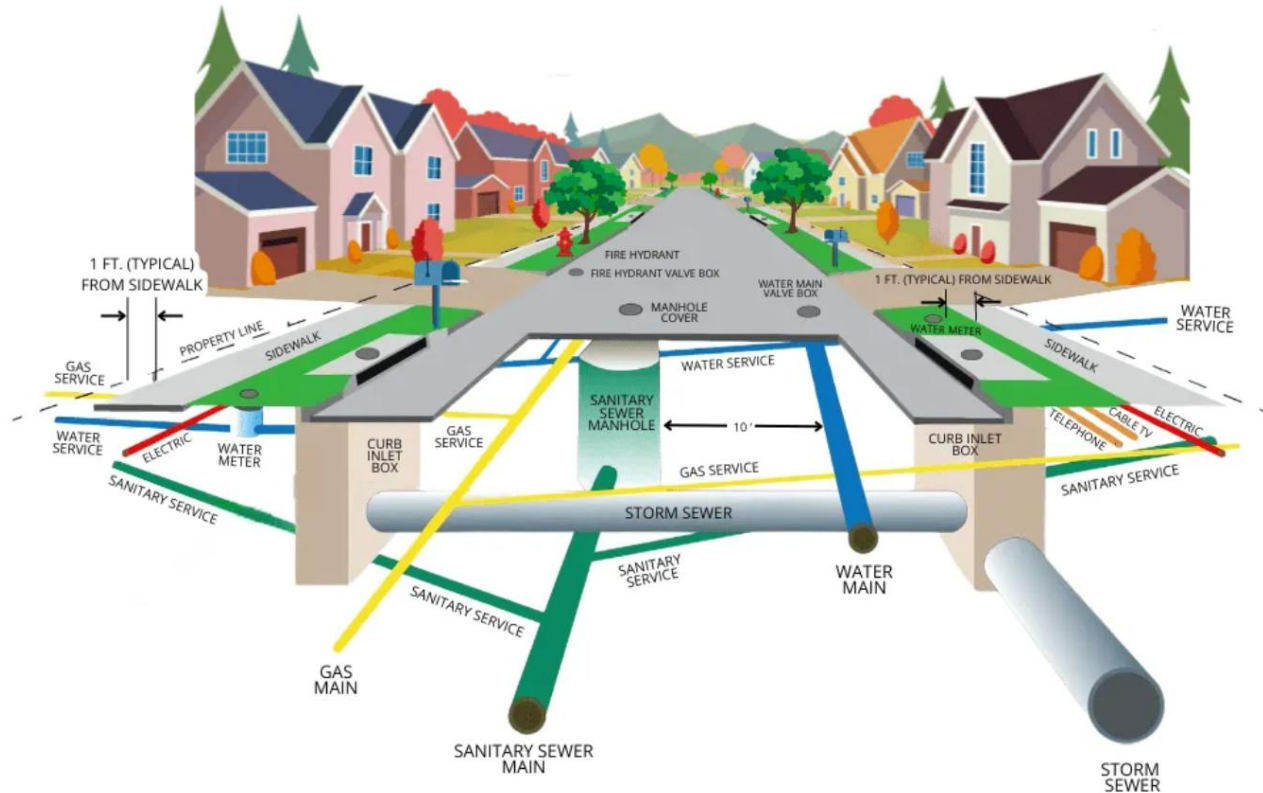
- **First Billing Tier Members** - Regular Transmissions Are Free!
- **Second - Fourth Billing Tier Members** – The 2026 fees now average about \$1.25 per transmission combined.

## Positive Response Renotifications

The new C0811 Annual Fee Assessments Billing Tier assignment is based on assessing a fee based only on the volume of regular ticket transmissions, no cancellations or positive response renotification transmissions (aka lates) are included in the Annual Billing Tier Assessment Formula. Positive Response Renotification transmissions will still be billed monthly in addition to the annual fee assessment amount due, for each positive response renotification transmission that occurred for the previous month at **\$1.75 per each Positive Response Renotification Transmission**.



# Common underground facilities include:



## Know the Colors

Underground utilities and key spots are marked with colors. Here is the national color code used.

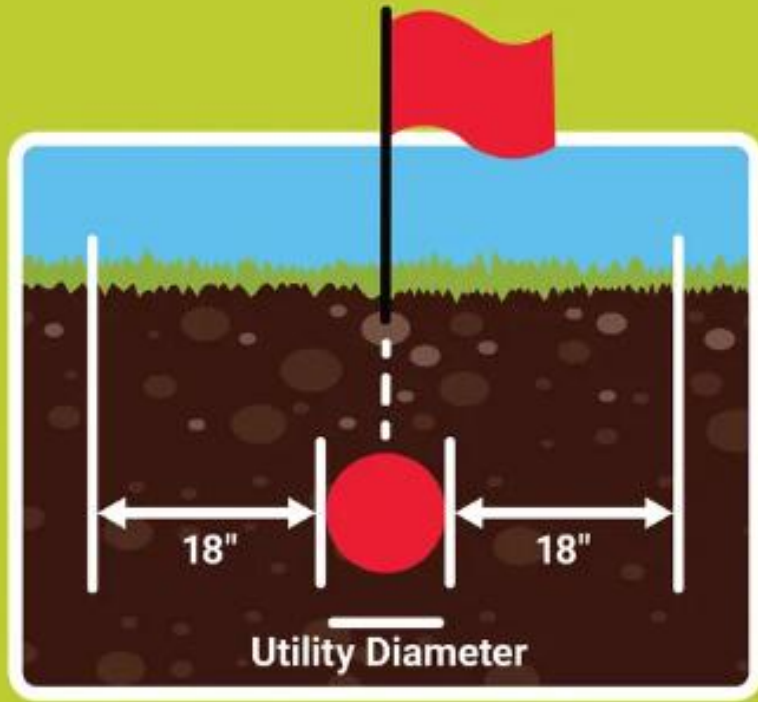
- Electric
- Gas, Oil, Steam
- Communication, CATV
- Potable Water
- Irrigation, Reclaimed Water, Slurry Lines
- Sewer
- Proposed Excavation
- Temporary Survey Markings



Dial 811 or visit [colorado811.org](http://colorado811.org)



# What Is a Tolerance Zone?



Colorado law requires you to use reasonable care when digging within 18" of the marked utilities lines. This area is known as the tolerance zone and hand digging is required.

**Tolerance Zone** = The area around a marked underground facility where extra care is required because the exact facility location may vary from the surface marking.

## Why it matters:

- Utility marks represent an **approximate location**
- Locating equipment has limitations
- Records may not perfectly reflect field conditions
- Excavation methods must account for uncertainty
- **Before digging:**
  - Confirm the marks cover the entire work area
  - Compare markings with the excavation plan
  - Check for missing or conflicting marks
  - Do not assume utilities continue exactly where expected
  - Request additional locating if the excavation area changes



# Positive Response & Documentation

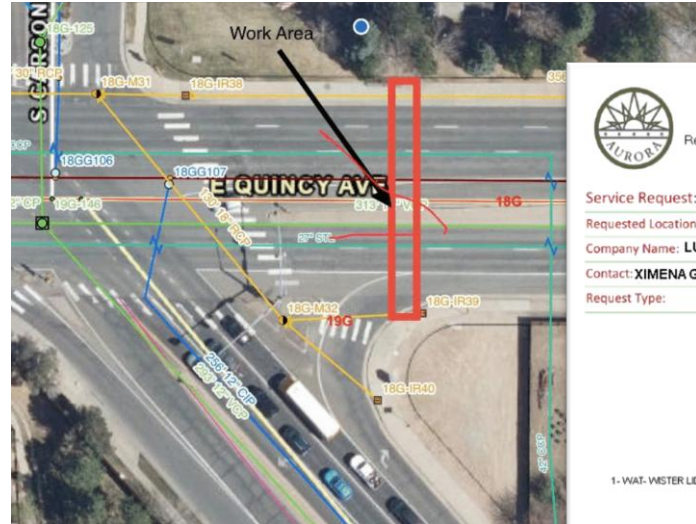
## Positive Response tells you what happened with the locate request.

Possible responses may indicate:

- *Utilities marked*
- *No facilities identified*
- *Utility owner needs additional information*
- *Locate is incomplete or delayed*
- *Private facilities may not be covered*

Document:

- *Ticket number*
- *Date/time*
- *Area located*
- *Utility owner*
- *Markings observed*
- *Photos*
- *Changes or discrepancies*
- *Communications with utility owners/locators*



City of Aurora Water Service  
Combination Underground Location Sketch  
Request a locate ticket through Colorado 811 website (iDig811) or call 811. Emergency and Damage tickets cannot be processed through the website. Call 811 for all Emergency and Damage tickets.

Service Request: 626001835 Date: 09/21/2026 23:59:00  
Requested Location: 0, E QUINCY AVE AURORA  
Company Name: LUCKY DOG  
Contact: XIMENA GODINEZ SANCHEZ (719)-722-4120 ext. EMail: XIMENAGODINEZ36@GMAIL.COM  
Request Type: Completed:

Please see attached files for more information.

1- WAT- WINTER LIDE CAU Water / AURHO Marked Units: 0 09/17/2026 00:00:00 U-Y PMN

Customer Comments:  
LOCATION: SEE FILE ATTACHMENTS : START AT THE SE CORNER OF INTERSECTION LOCATING NORTH CROSSING E : QUINCY AVE FOR APPROXIMATELY 125FT. PLEASE LOCATE A 20FT WIDE PATH OF : THE DESCRIBED RUNNING LINE. POTHOLES 6-12 INCLUDED IN THIS TICKET. : FR01.6 PAGE 9 ATTACHMENTS INCLUDED TO HELP FACILITATE LOCATES. :  
"ACCESS OPEN" GRIDS: 05S066W06SW : 05S066W07NW : LEGAL: Y LAT/LONG: 39.639104/-104.822764 39.639104/-104.821629 : 39.637937/-104.822764 39.637937/-104.821629

Additional Comments:  
STATUS: Marked - LOCATOR NOTES: Utilities located.  
STANDBY REQUIRED  
Before work begins, coordinate with City of Aurora for construction approval and schedule a standby. Allow a

• Locates are within 18" from either side of locate mark. •  
color code: Blue for water, green for sanitary and storm lines, purple for reclaim water, irrigation, and slurry lines, red for electric, orange for fiber, pink for temporary survey marks and white for proposed excavating.  
The locate documentation provided by city of Aurora must remain on the job site throughout the excavation period. When working over or crossing Aurora's utilities the excavator must pothole and expose all Aurora owned utility lines affected and visually observe the safe crossing. The marking of underground facilities shall be considered valid as long as the markings are clearly visible, but not for more than thirty calendar days following the due date of the locate request.  
315 2022: 9-1.5-101. Legislative declaration: The purpose of this article is to prevent injury to persons and damage to property from accidents resulting from damage to underground facilities by excavation. Anyone planning to dig in or near a public road, street, alley, right-of-way, or utility easement should call Colorado 811 (two business days ahead of work). If city of Aurora utilities are not found or identified by a locator in the excavations recorded, the excavator shall call 811 immediately for a re-locate.



# Aurora Water Sketch Sheet Information

Customer Comments:

Additional Comments:

**Locates are within 18” from either side of the Locate mark.**

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# Communication in the Field

## Good communication prevents mistakes.



Before excavation:

- Review markings with the crew
- Identify each utility
- Discuss the excavation limits
- Confirm the locate is current
- Communicate changes in scope
- Stop and ask questions when markings are unclear

**Key message:**

**If the field conditions don't match the locate information — STOP and VERIFY.**



# When Things Don't Look Right



## **STOP when:**

- A utility is found where it wasn't expected
- Markings are missing or unclear
- A line crosses the excavation unexpectedly
- Locate marks are damaged or removed
- Excavation extends beyond the original limits
- The ticket has expired or conditions have changed

## **Then:**

1. Stop work
2. Protect the area
3. Notify the appropriate personnel
4. Contact 811/utility owner as required
5. Re-locate or verify before continuing



# Really?



Add Video of gas line being struck

Kelly



# Private Utilities??

*Important: Not every underground utility is necessarily covered by a standard public utility locate.*

*Examples:*

- *Private electrical lines*
- *Irrigation systems*
- *Private water lines*
- *Propane/fuel lines*
- *Site lighting*
- *Building-to-building communications*
- *Facilities on private property*

## Private Locate Company Directory

Colorado 811 provides the displayed contact information of entities listed on this page for private locating companies as a courtesy and is not responsible for the accuracy and totality of the information.



Filter by County

Filter by Service

Search



# Best Practice

## Excavator Check List

### Before You Dig

- ☐ 811/One-Call ticket requested.
- ☐ Ticket Information reviewed.
- ☐ Locate marks present.
- ☐ Colors identified
- ☐ Exaction Limits Verified
- ☐ Tolerance zone identified
- ☐ Private utilities considered
- ☐ Crew briefed

## Field Locating Checklist

### Before locating

- ☐ Inspect equipment
- ☐ Check batteries
- ☐ Confirm transmitter and receiver operation
- ☐ Identify available utility information
- ☐ Assess the work area

### During locating

- ☐ Select appropriate locating method
- ☐ Choose suitable frequency
- ☐ Establish a stable signal
- ☐ Adjust gain appropriately
- ☐ Trace the utility
- ☐ Check depth and current when appropriate
- ☐ Look for distortion

### Before marking

- ☐ Confirm the signal
- ☐ Verify direction
- ☐ Recheck the utility from another position
- ☐ Document measurements as required
- ☐ Follow applicable excavation/markings procedures



# Knowledge Check



**Question 1:**

What does 811 do?

**Question 2:**

What color typically identifies natural gas?

**Question 3:**

Why is the tolerance zone important?

**Question 4:**

What should you do if you encounter an unexpected utility during excavation?

**Question 5:**

How much does it cost the utility owner for a ticket renotification?



# RD8100 Machine Utility Locating Training

## Utility Locating: Setup, Operation & Best Practices

- Radiodetection RD8100 locator
- Transmitter and receiver operation
- Active and passive locating
- Tracing, pinpointing, depth and current measurements
- Common locating mistakes



# The RD8100 system consists primarily of:

## **Receiver**

- Handheld locating unit
- Detects electromagnetic signals
- Displays signal information
- Used for locating, tracing, and measurements

## **Transmitter**

- Generates a locating signal
- Can connect directly to a utility
- Can use a clamp
- Can induce a signal without direct connection

## **Accessories**

- Direct-connect leads
- Signal clamp
- Ground stake
- Batteries/charger
- Carrying case and other locating accessories



| Color        | Applications      | Frequency | Picture                                                                            |
|--------------|-------------------|-----------|------------------------------------------------------------------------------------|
| Purple       | Non-Potable Water | 66.35kHz  |  |
| Black/Orange | Cable TV          | 77.0kHz   |  |
| Yellow       | Gas               | 83.0kHz   |  |
| Green        | Sanitary          | 121.6kHz  |  |
| Blue/Red     | Europower         | 134.0kHz  |  |
| Blue         | Water             | 145.7kHz  |  |
| Red          | Electricity       | 169.8kHz  |  |

The Radiodetection RD8100 (MRX / Marker models) detects passive radio frequency (RF) marker balls by emitting a specific resonant frequency signal that energizes the internal tuned LC circuit inside the buried marker



# Electronic Marking System

Near Surface  
• 2 ft depth



RFID Option

Ball Marker  
• 5 ft depth



RFID Option

Disk Marker  
• 5 ft depth



RFID Option

Vault Marker  
• 5 ft depth



Duct Marker  
• 2 ft depth



Mid Range  
• 6 ft depth



Full Range  
• 8 ft depth



RFID Option



## Mid-Range and Full-Range Markers

### Advantages:

Can be installed at greater depths, generally 6 to 8 feet, depending on the specific marker and installation requirements.

Provide a deeper installation option where a marker ball cannot meet the required depth.

### Disadvantages:

These markers are not self-leveling and must be installed in the correct orientation.

If the marker is installed incorrectly or becomes misaligned, the signal can be offset from the actual location of the marker.

An improperly oriented marker can result in an inaccurate locate, potentially causing the utility or asset to be incorrectly identified during locating operations.

Installation therefore requires greater attention to marker orientation and proper installation procedures.

### Summary

The primary trade-off is installation depth versus ease and accuracy of installation. **Marker balls are self-leveling and easier to install correctly,** but their installation depth is limited to approximately 5 feet. Mid-range and full-range markers allow installation at greater depths of approximately 6 to 8 feet, but they require proper orientation because they do not self-level. Incorrect installation can cause the transmitted signal to be offset and result in a mis-locate.



# Direct Connection

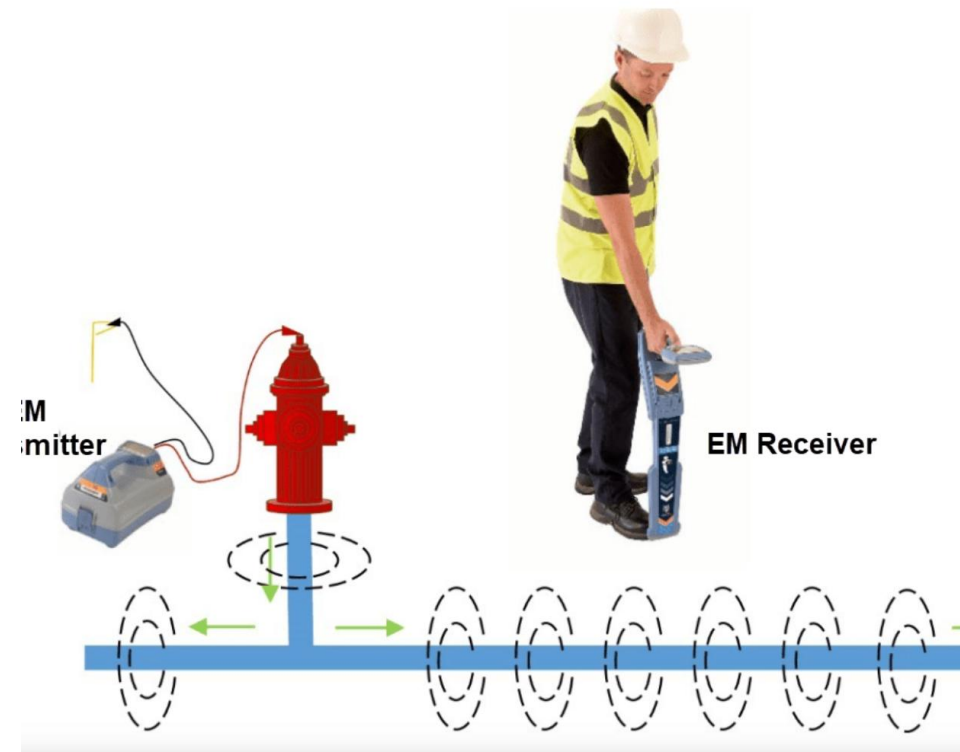
**Direct connection provides an active locating signal directly onto the utility.**

## Basic setup:

1. Connect the transmitter lead to the target utility.
2. Connect the transmitter ground lead to a suitable ground point.
3. Select an appropriate frequency.
4. Turn on the transmitter.
5. Confirm that the signal is being applied.
6. Use the receiver to trace the utility.

## Advantages

- Strong, controlled signal
- Good for long-distance tracing
- Helps distinguish the target utility from other services





**Broad Peak**

for deep or weak signals

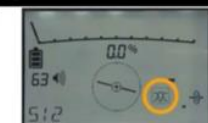


**Peak**

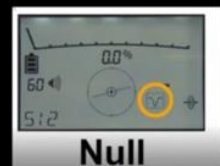
most accurate mode



For users  
graduating from  
guidance mode



**Peak+**



**Null**

for verifying your  
Peak response



Cruise control  
best for new users



**Guidance**



# Induction Method

**Induction allows a locating signal to be transferred without directly connecting to the utility.**

## **Typical process:**

1. Place the transmitter over or near the suspected utility.
2. Orient the transmitter appropriately.
3. Select the required frequency.
4. Activate the transmitter.
5. Use the receiver to detect the induced signal.
6. Move away from the transmitter before beginning detailed locating.

## **Advantages**

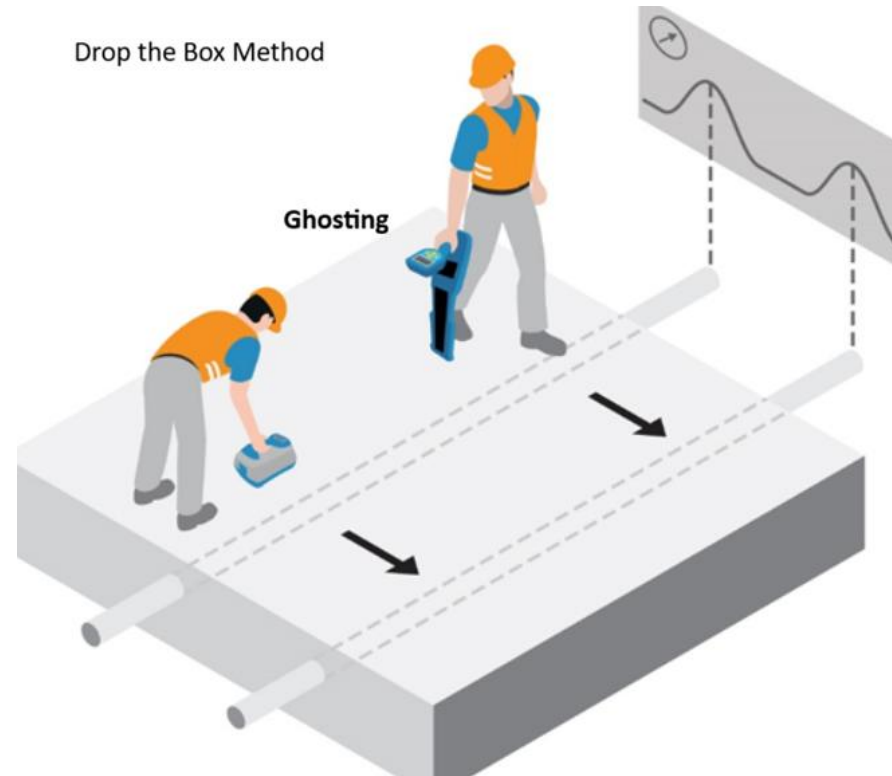
- Quick setup
- No direct connection required
- Useful when connection points are unavailable

## **Limitations**

- Signal may transfer to multiple nearby utilities
- Greater risk of locating the wrong service
- Signal strength generally decreases with distance

## **Key Point:**

Induction is convenient, but always verify the target utility when possible.



## Clamp Method

**The signal clamp transfers the transmitter signal onto a conductive utility without making a direct electrical connection.**

### Basic procedure:

1. Place the clamp completely around the target conductor.
2. Ensure the clamp is properly closed.
3. Connect the clamp to the transmitter.
4. Select the appropriate frequency.
5. Activate the transmitter.
6. Trace the signal using the receiver.

### Advantages

- No direct electrical connection to the utility
- Useful around cables and pipes where direct connection is not practical
- Helps isolate a specific conductor

### Remember:

The clamp must fully surround the conductor for effective signal transfer.



# Active vs. Passive Locating

## Active Locating

*Uses a signal generated by the transmitter.*

- *Direct connection*
- *Clamp*
- *Induction*
- *Controlled frequency*
- *Generally provides better identification of the target utility*

## Passive Locating

Detects signals that already exist in the environment.

Examples include:

- Power signals
- Radio signals
- Other detectable electromagnetic fields

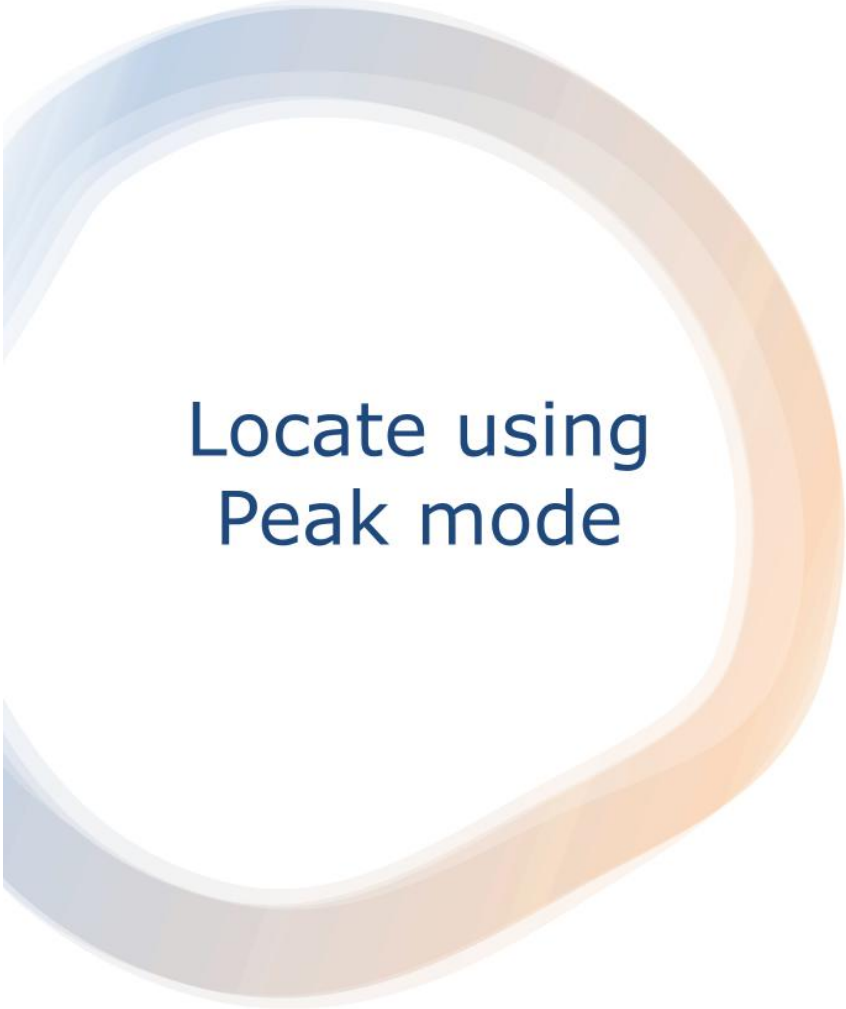
## Active locating:

"You put the signal on the utility."

## Passive locating:

"You look for signals already present."





## Locate using Peak mode

**Peak Mode-** antenna used to locate the utility, pipe or cable

Peak mode provides the most sensitive and accurate mode for location and depth measurement. It provides a sharp Peak response with a corresponding small decrease in sensitivity. Peak mode cannot be disabled using the menu.

In Peak mode the following indicators are displayed by the Depth Current Signal strength





# Locate using Null Mode

## **Null Mode- antenna used to verify the locate**

Null mode is used to verify a locate signal in environments with limited or no electromagnetic distortion.

In null mode the following indicators Signal strength.  
Compass Right and left arrows.



# Dylan's Video

## Active and Passive Locating



### **1. Low Frequency: 100Hz – 1 kHz**

- Best for cables
- Direct connection only
- Long-distance
- Low distortion

### **2. Medium Frequency: 8 kHz-33 kHz**

- Good for pipes and cables
- Direct connection and signal clamp
- Reasonable distance

### **3. High Frequency: 65 kHz-200 kHz**

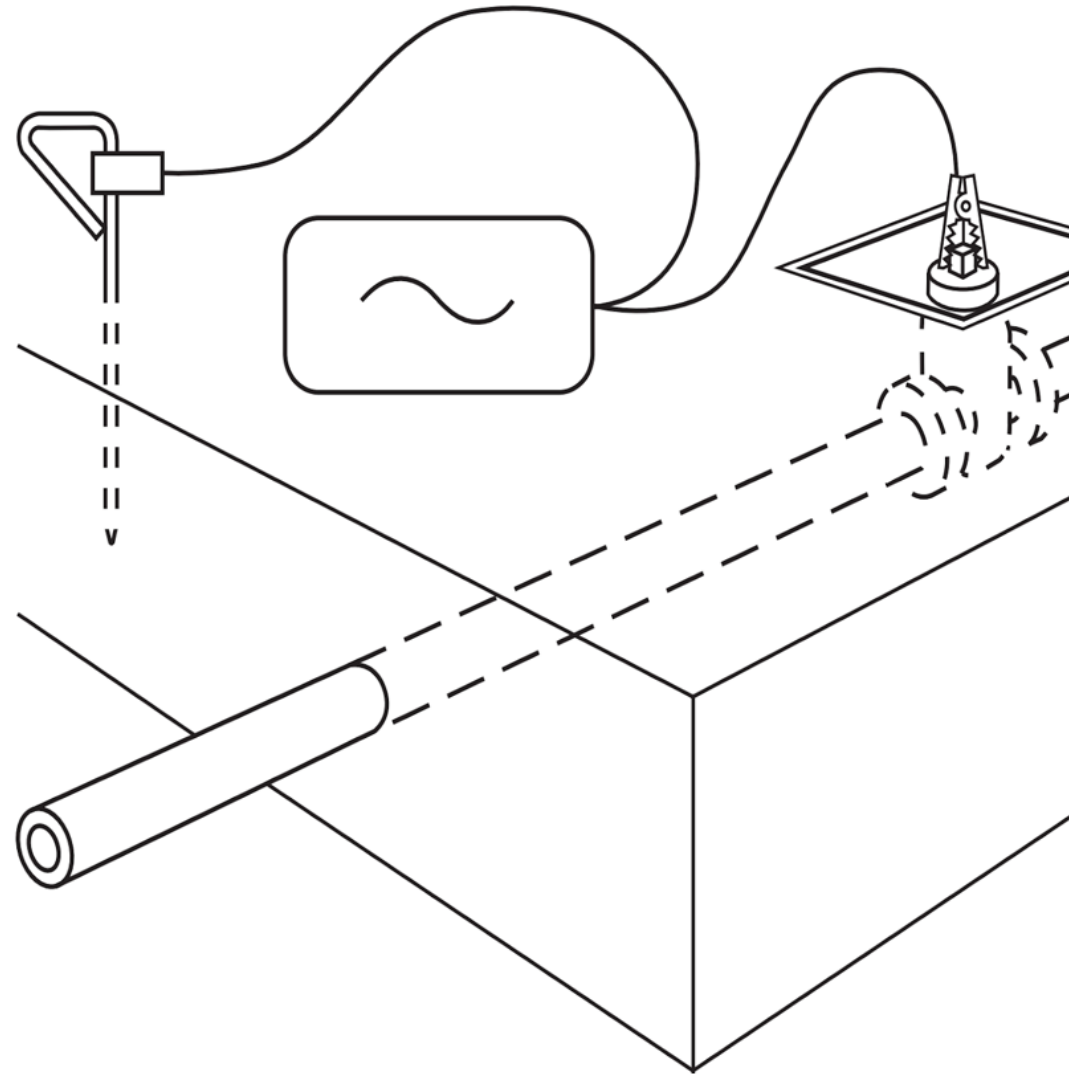
- Direct connect, signal clamp, induction
- Short distance
- Prone to distortion



Poor ground connections or bad ground placement are two of the most common rookie errors in utility locating.

If you're working in an area with multiple utility lines and place a ground stake over a telecom line, the receiver may recognize both that line and the gas line you're looking for.

That will result in bleeding off — you won't isolate the line you're trying to find.



# What can you do to improve your ground



Move your ground 90 degrees perpendicular from the target line.



Your ground could potentially be placed on top of another utility. (move your ground to another location within the target area).



Adding water to dry soil will help your ground.



# Frequency Selection

## Choosing the appropriate frequency is critical to locating performance.

### **Lower frequencies generally:**

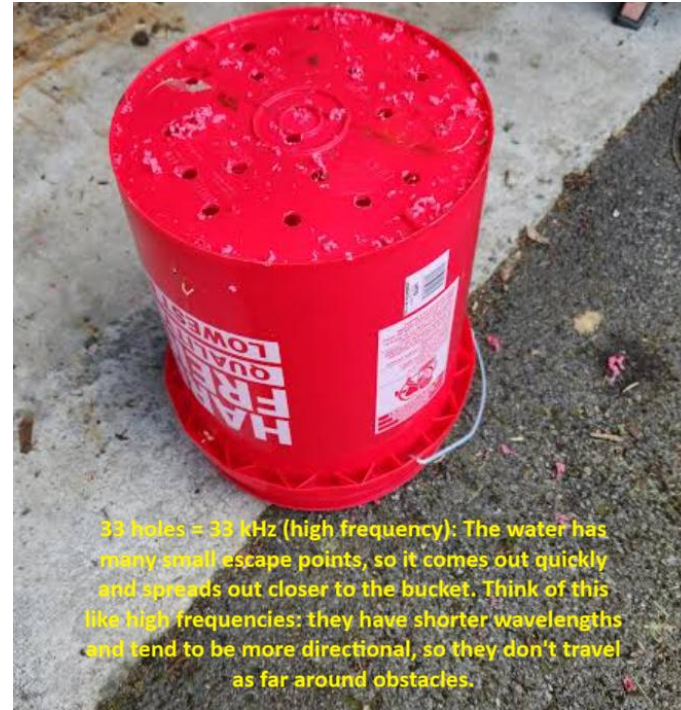
- Travel farther along conductive utilities
- Couple less readily to nearby conductors
- Can be useful for long-distance tracing

### **Higher frequencies generally:**

- Couple more easily to utilities
- Can be useful when locating difficult or poorly conductive services
- May be more susceptible to coupling onto nearby conductors

### **Frequency selection should consider:**

- Utility type
- Utility length
- Conductivity
- Soil conditions
- Nearby utilities
- Desired tracing distance



8 holes = 8 kHz (lower frequency): With fewer holes, the water exits in fewer streams and can travel farther before spreading out. Think of this like lower frequencies: they have longer wavelengths and can travel farther and bend around objects more easily.



# Bleed-over

- *Bleed off happens when more than one utility is energized in the locating process. During a locate, you're essentially using a flow of current to create a magnetic field around a utility. When utility lines are close together, it's easy to energize multiple lines at once. Bleed off reduces the quality of the readings on both the intended utility and the nearby utility the user wasn't trying to locate.*



# Depth Verification Measurements

## ***Depth measurements can be affected by:***

- Nearby conductors
- Signal distortion
- Utility configuration
- Poor locating technique
- Incorrect receiver orientation

## ***Current***

Current measurement can help determine whether the detected signal is traveling along the expected utility.

## ***Important:***

Depth and current readings should be treated as locating information, not as a substitute for proper verification. We are not allowed to give depth to the customer when performing locates.

## ***Field Practice:***

Take measurements only when the receiver is properly positioned and the signal is stable. Use only as a guide.



## Tracing a Utility

**Tracing means following the utility's path from one point to another.**

1. Identify the initial signal.
2. Establish the utility's approximate direction.
3. Walk along the suspected path.
4. Keep the receiver aligned with the signal.
5. Continuously monitor signal strength and response.
6. Check depth at appropriate intervals.
7. Watch for changes in signal behavior.

**Look for:**

Sudden signal loss

Unexpected changes in depth

Signal peaks that don't match the expected path

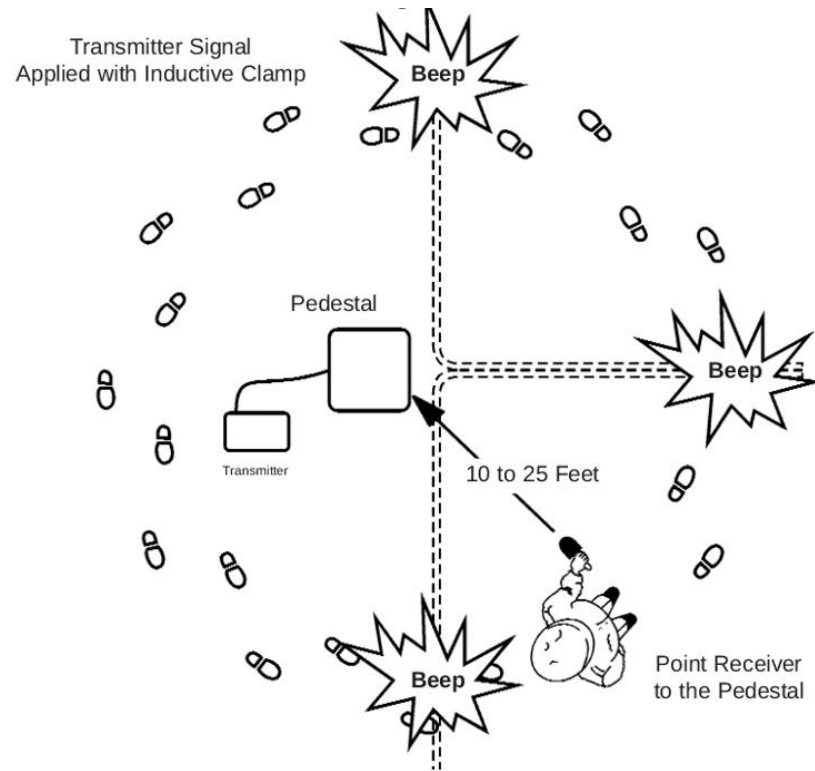
Changes in current

Possible signal transfer to another utility



# Pinpointing a Utility

**Pinpointing identifies the horizontal position of the utility as accurately as possible.**



## General technique

- Approach the utility from the side.
- **Sweep the receiver across the suspected utility path curb to curb.**
- Identify the strongest/appropriate response.
- Rotate and reposition the receiver as necessary.
- Mark the utility location.
- Confirm the reading from another direction when practical.

## Remember:

The strongest signal alone should not automatically be assumed to represent the exact utility location.

Signal distortion can produce misleading peaks.

## Best Practice:

Use multiple checks before marking the final location.



# Common mistakes locators make in the field

## *Mistake #1: Coming out swinging*

Swinging the receiver excessively to the left and right. The swinging motion is so instinctive even the most seasoned locators will catch themselves doing it from time to time. It's also the quickest way to a false locate.

***The Fix*** — Keep the locator level and parallel to the ground at all times.



# *Mistake #2: Not being "well-rounded"*

Trusting your gut during the locating process is something that comes with experience. Relying too heavily on a reading from the receiver doesn't always lend itself to an accurate locate. If a user doesn't trust his or her gut and take the time to create a round signal, they might end up with an occurrence called bleed off.

**The Fix:** There's nothing wrong with confirming a gut feeling to ensure a round signal and eliminate bleed off. Where users do a level sweep of the suspected top of the cable or utility while utilizing the Peak Mode which will show you a percentage. When the highest percentage is shown, you should stop and paint that area. Then walk to the left until the percentage reaches 0% and paint a line. Do the same thing on the right. The distance from your center point (high percentage) to your left and right marks should be equal —this indicates a round signal on the intended utility



# *Mistake #3: Fixating on one frequency*

In any trade, it's easy to learn a process one way and stick to that method because it works — and why complicate things? If you're a locator, you likely have one or two frequencies that have become your bread and butter over the years. But what happens when you're on a jobsite and you can't get an accurate reading using those tried-and-true frequencies?

**The Fix:** Experienced locators alike to take advantage of every tool in their tool belt. This means venturing outside the frequencies they're most comfortable with in order to produce the most accurate locate reading. Sometimes a frequency you swear never works for you will be the exact one to get you the most precise locate. Think outside the locate box..



# Knowledge Check



**Question 1:**

Direct connection provides ?

**Question 2:**

What is Peak Mode and Null Mode?

**Question 3:**

Why is Sweeping the area important?

**Question 4:**

What should I look for when tracing a utility?

**Question 5:**

What Frequency works best for a long distance locate?



# Key Takeaways

## ***Remember the fundamentals:***

- *Understand the receiver and transmitter.*
- *Use direct connection, clamp, or induction appropriately.*
- *Know the difference between active and passive locating.*
- *Select frequency based on the locating conditions.*
- *Adjust gain for a clear and stable signal.*
- *Use depth and current measurements as supporting information.*
- *Trace the utility before pinpointing and marking.*
- *Watch for signal distortion and unintended coupling.*
- *Never assume one reading tells the entire story.*
- *Follow company procedures and applicable utility-safety requirements.*
- ***Most Important follow all safety procedures.***

## **Final Message:**

**Good locating depends on equipment knowledge, correct technique, verification, and sound field judgment.**



ANY  
QUESTIONS?

