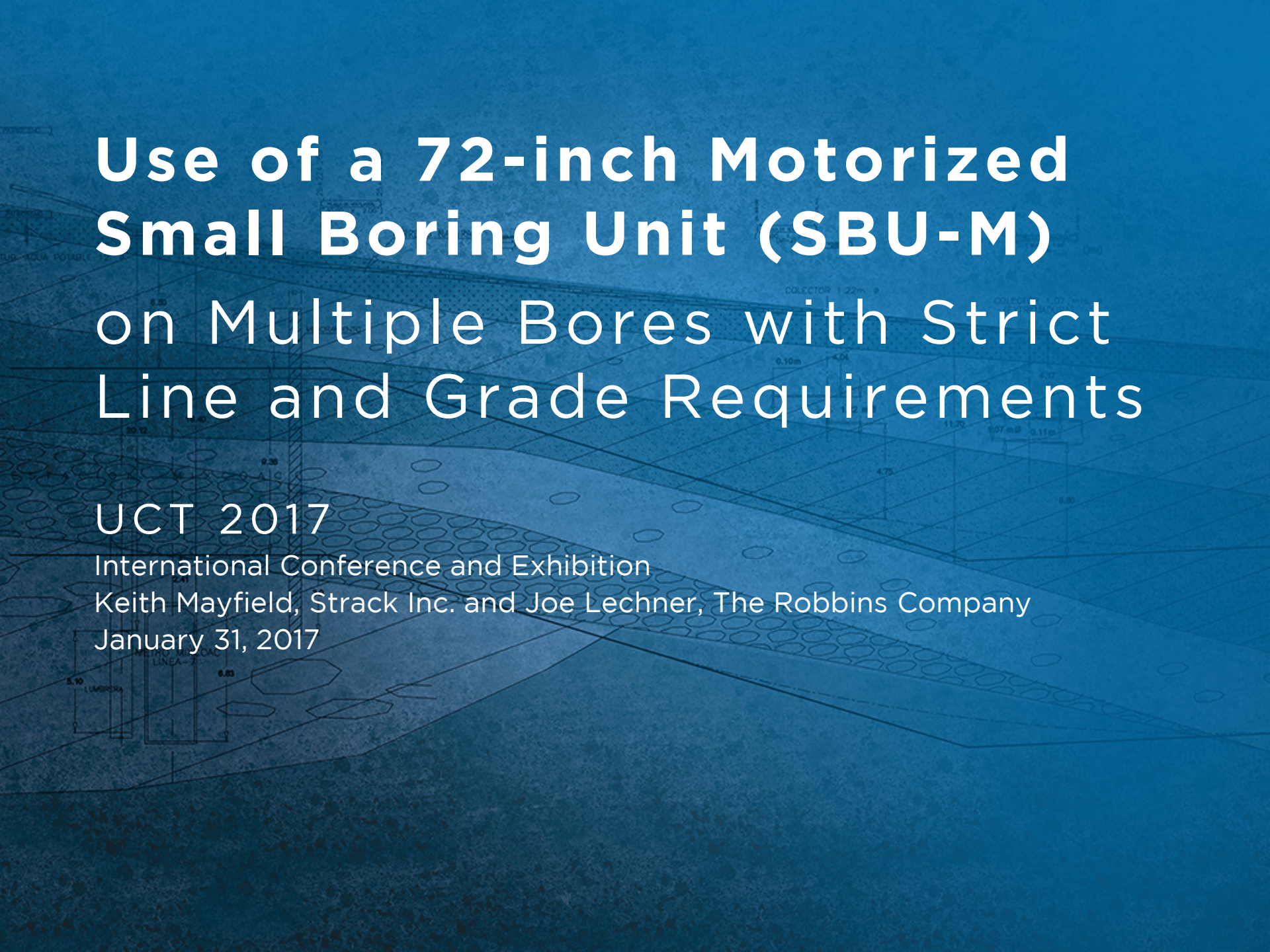


The background is a technical drawing of a sewer system plan view, overlaid on a solid blue background. The drawing shows a network of sewer lines, including a main line and several branches. It includes various annotations such as 'COLLECTOR 1.22m', 'COLLECTOR 1.07m', '0.10m', '4.04', '4.17', '11.70', '0.07 mB', '0.11m', '5.80', '4.75', '9.30', '20.12', '5.10', '6.53', 'LINEA 3.00', and 'LUMINARIA'. There are also circular symbols representing manholes or access points.

# Use of a 72-inch Motorized Small Boring Unit (SBU-M) on Multiple Bores with Strict Line and Grade Requirements

UCT 2017

International Conference and Exhibition

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January 31, 2017



# Presentation Outline

## Machine Design SBU-M

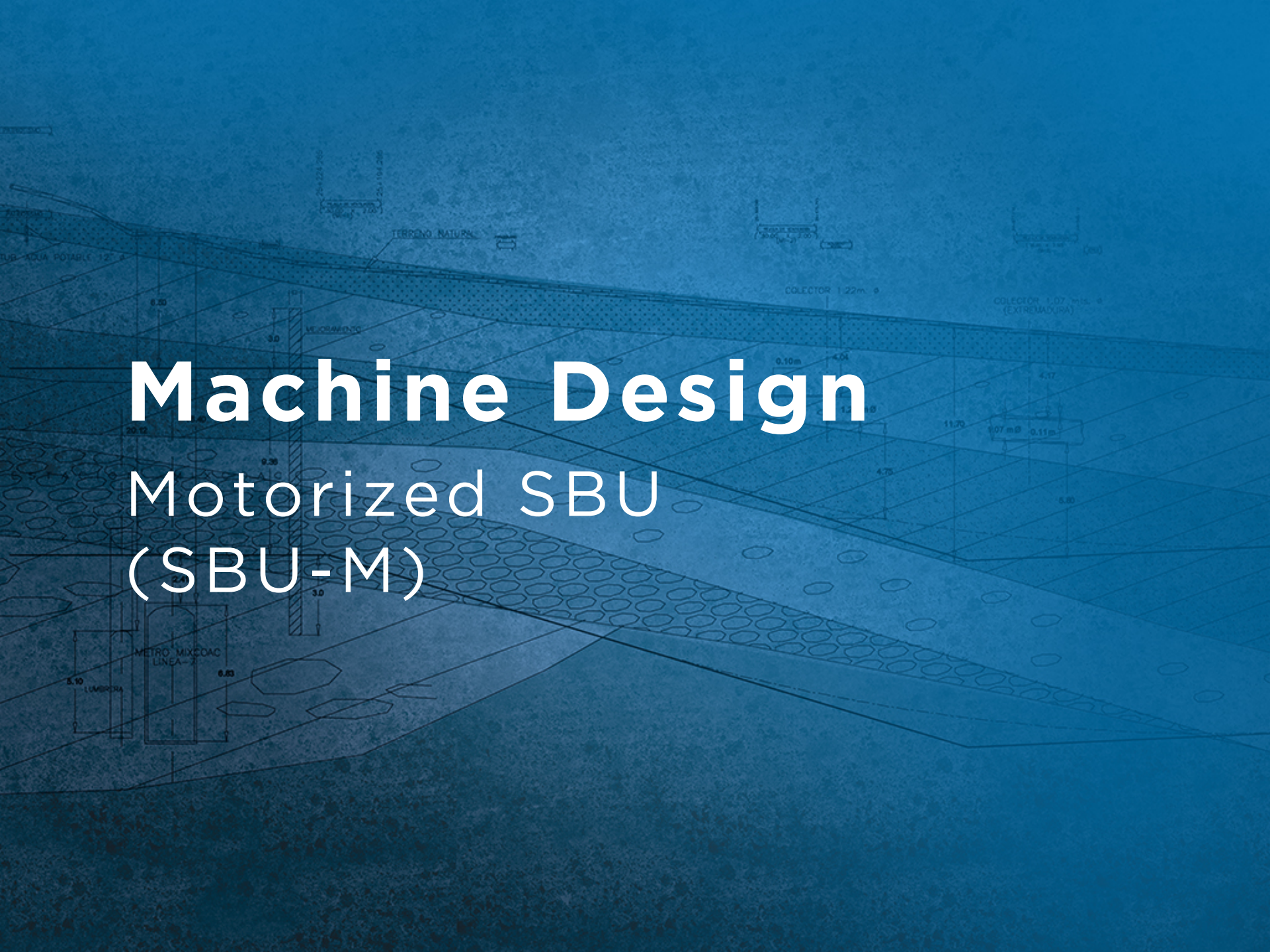
- + Cutting Tools
- + Specifications
- + Setup
- + Advantages

## Southwest Connector

- + Crossings
- + Geology
- + Setup
- + Performance
- + Conclusions





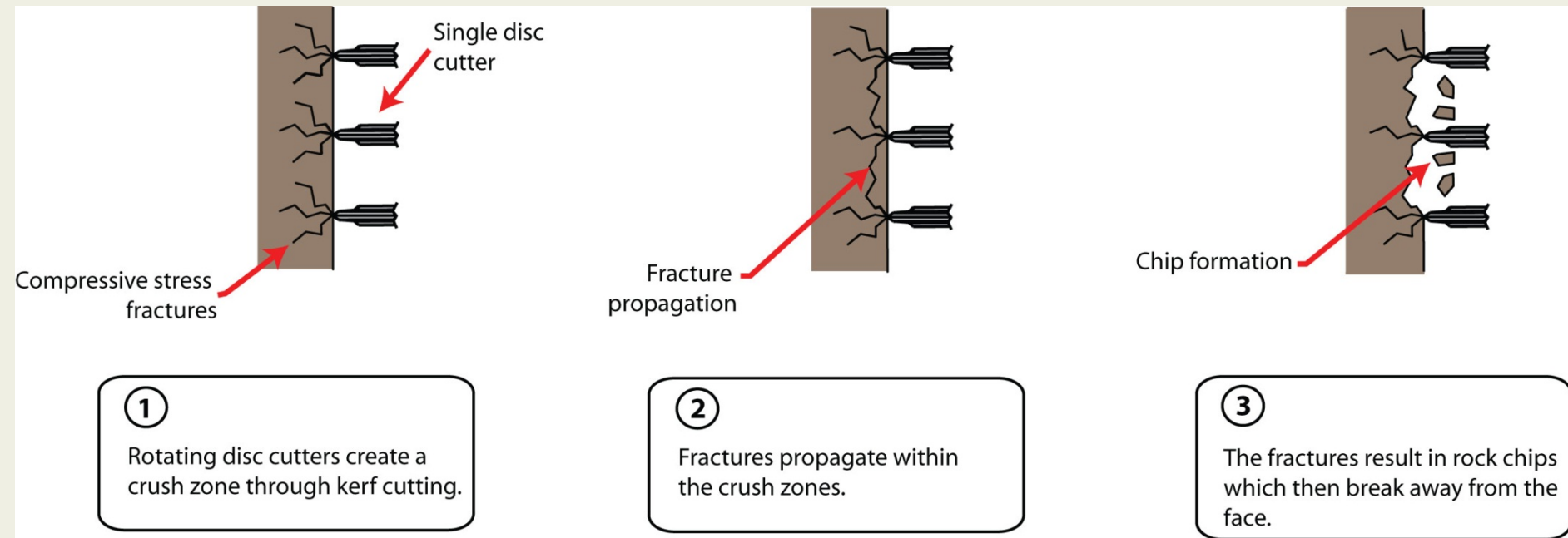


The background is a technical drawing of a water treatment facility layout. It shows various tanks, pipes, and structural elements. Labels include 'TUBO AGUA POTABLE 12"', 'TERRENO NATURAL', 'COLECTOR 1.22m Ø', 'COLECTOR 1.07 mØ Ø (EXTREMADURA)', 'METRO MIXCOAC LINEA 2', and 'LUMBRERA'. Dimensions like 6.30, 9.30, 3.0, 0.10m, 4.04, 1.16, 11.70, 0.07 mØ, 0.11m, 4.75, 5.80, 5.10, and 6.53 are also present. The drawing is overlaid with a blue gradient and the title text.

# Machine Design

## Motorized SBU (SBU-M)

# Single Disc Cutter Methodology



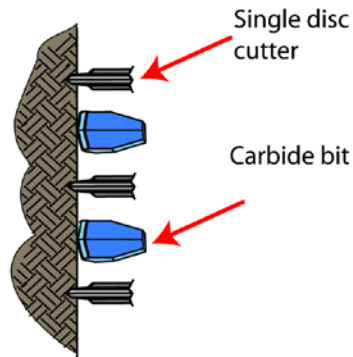


# Mixed Ground Cutter Methodology

## ROCK w/CLAY OR DIRT SEAMS

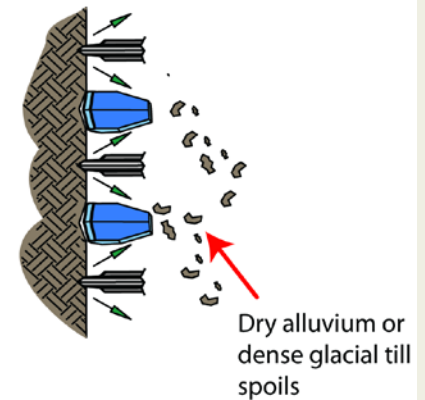
①

Disc cutters in combination with tungsten carbide bits are used in rock with clay or dirt seams. When rock is encountered the disc cutters, which stick farther out in profile, cut the rock as in hard rock cutting.



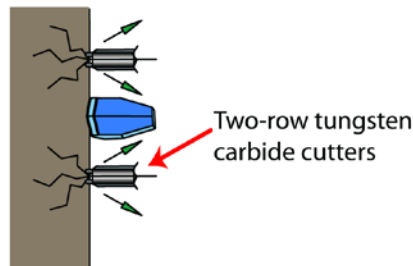
②

Any soft ground that is encountered will move past the disc cutters, where it is then excavated by tungsten carbide drill bits.



## SOFT GROUND w/COBBLES & BOULDERS

Two-row tungsten carbide cutters are used in combination with bits in soft ground conditions with cobbles and boulders. The tungsten carbide cutters crush any boulders using a pulverizing action.



# Pipe Jacking

## With the Motorized Small Boring Unit (SBU-M)



|                      | SBU-M Specifications                            |
|----------------------|-------------------------------------------------|
| Length               | 98 to 590 foot drives                           |
| Diameters            | 48 to 78 inches                                 |
| Casing               | Steel or RCP                                    |
| Types of Cutterheads | Hard Rock or Mixed Ground                       |
| Geology              | -Mixed Ground<br>-Hard Rock<br>(25 to 175 MPa+) |
| Ground Conditions    | Dry (above water table) and stable              |





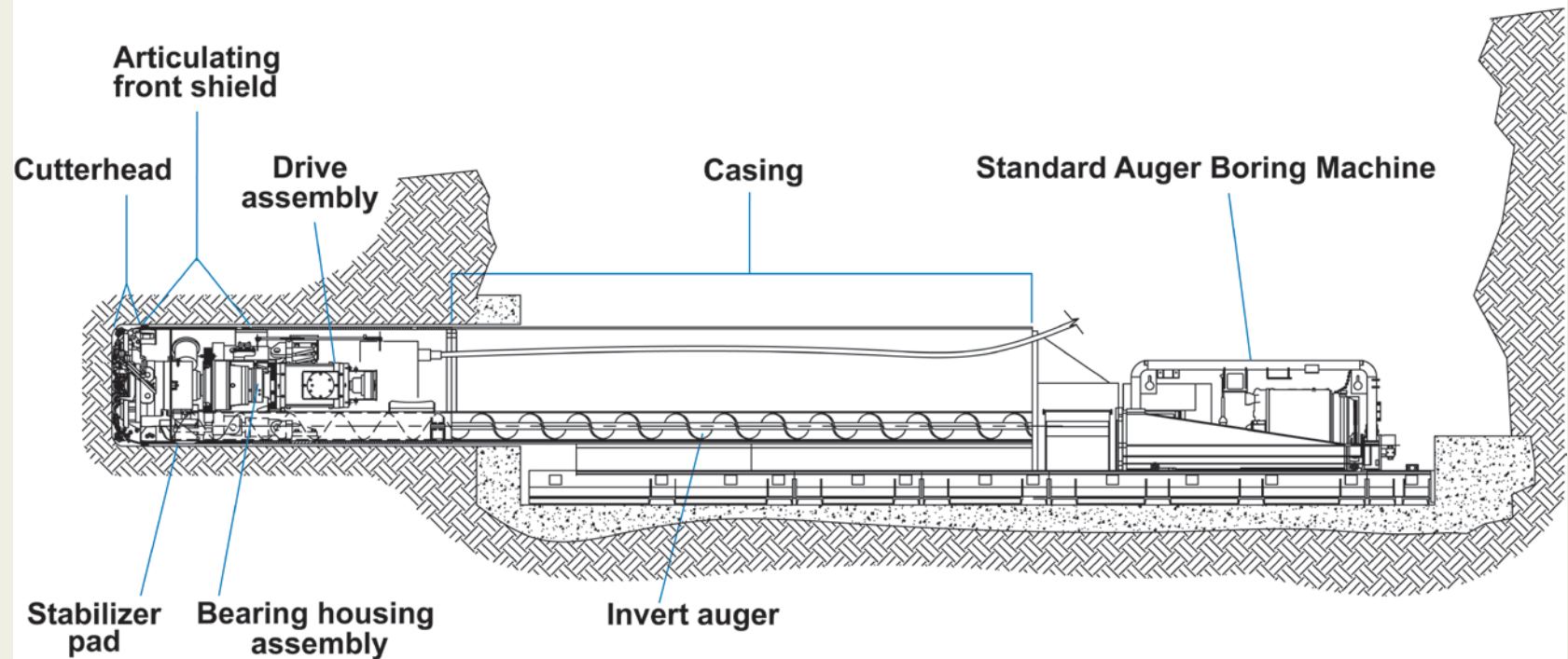
# SBU-M

Cutterhead is powered by an electric motor with a torque limiter. Spoil is removed with invert auger or vacuum removal.





# SBU-M and ABM Setup



# SBU-M Video Clip

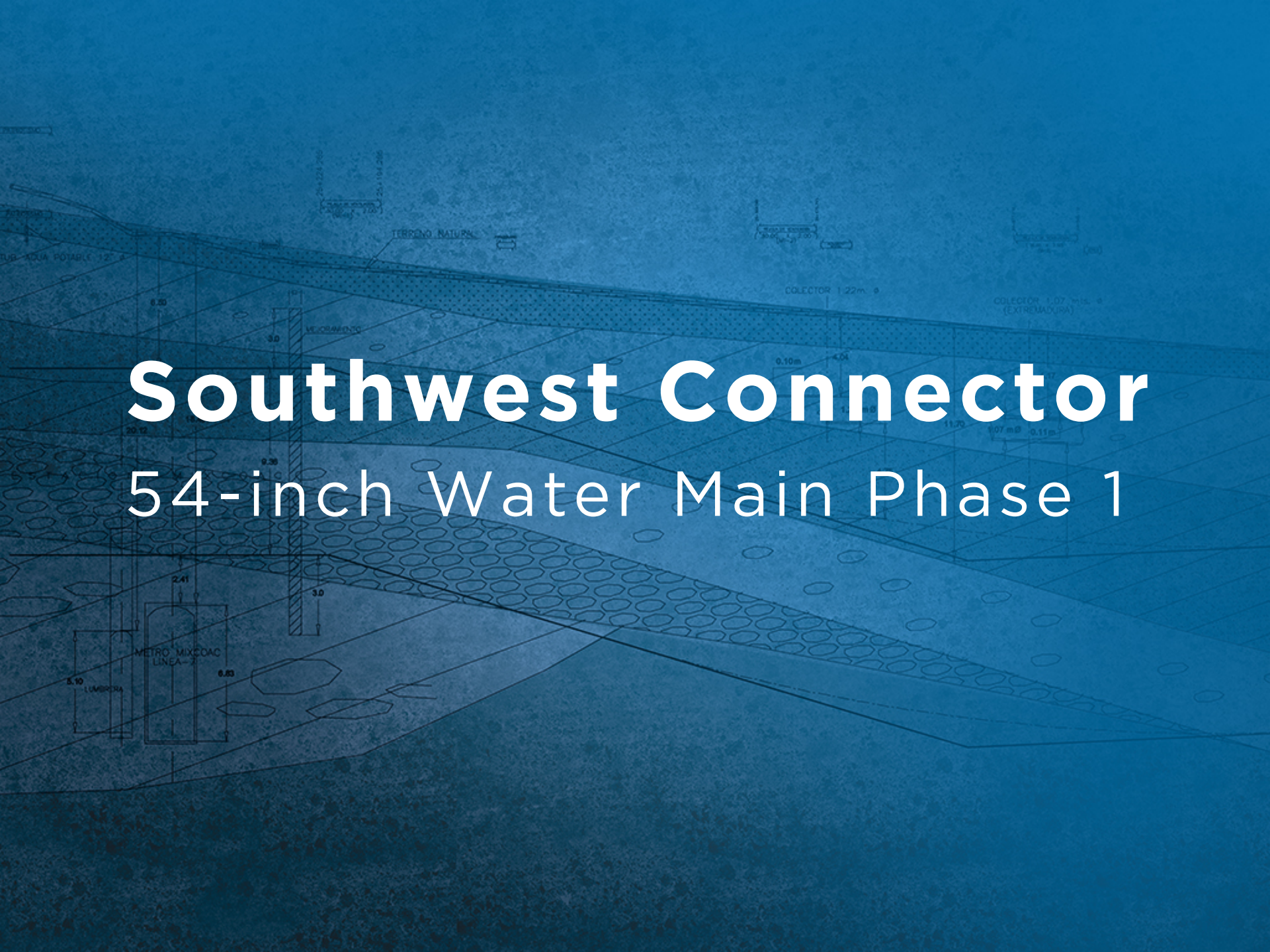




# Advantages

## SBU-M

- + Articulating forward shield allows use of typical pipe laser for line and grade control on critical bores through hard rock.
- + Use of standard ABM or pipe jacking station and spoil removal.
- + No long-term learning curve due to standard ABM operation.
- + Bores completed exceeding 492 ft.
- + Use of durable and common invert auger for spoil removal.
- + Costs are typically one half that of a microtunneling operation.



# Southwest Connector

## 54-inch Water Main Phase 1



# Crossings

A total of three crossings:

- + Rottenwood Creek- totaling 220 LF, utilizing the solid rock cutterhead.
- + I-75- totaling 590 LF, utilizing the mixed ground cutterhead.
- + Powers Ferry Road- totaling 280 LF, utilizing the mixed ground cutterhead.

# 72-inch SBU-M

with Hard Rock Cutterhead Mounted  
Disc Cutters





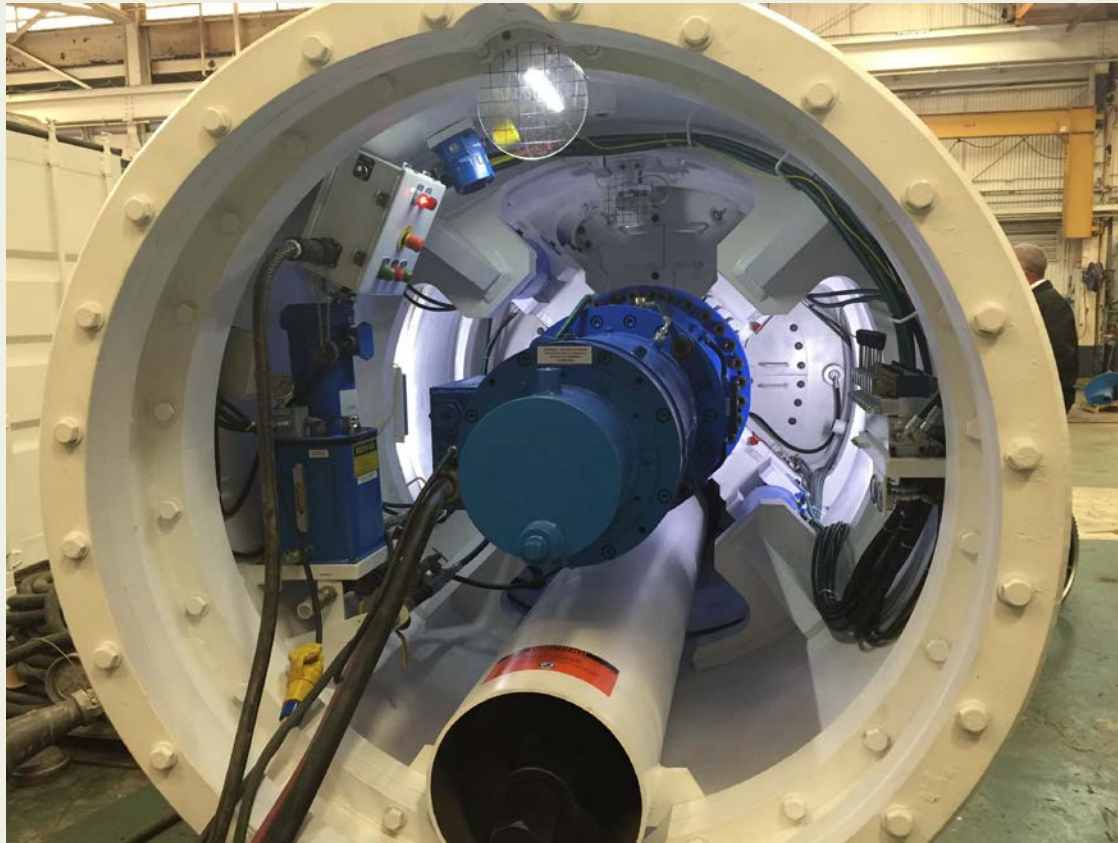
# 72-inch SBU-M

with a mixed Ground Cutterhead Mounted With  
Tungsten Carbide Roller Cutters and Carbide  
Bits



# Rear View of Machine

## Showing the In-Shield Drive Motor





# Cobb County, GA

## 72" SBU-M Bore for 54" Water Main



Bore pit underway



Complete installation of shoring along with a concrete foundation and headwall



# Launch Pit and Site Setup





# SBU-M Installation for Launch

A 150 thousand pound excavator was used to set in the SBU-M.



# Launch of SBU-M with ABM

A 48/60-1.35 ABM was utilized to push the SBU-M.

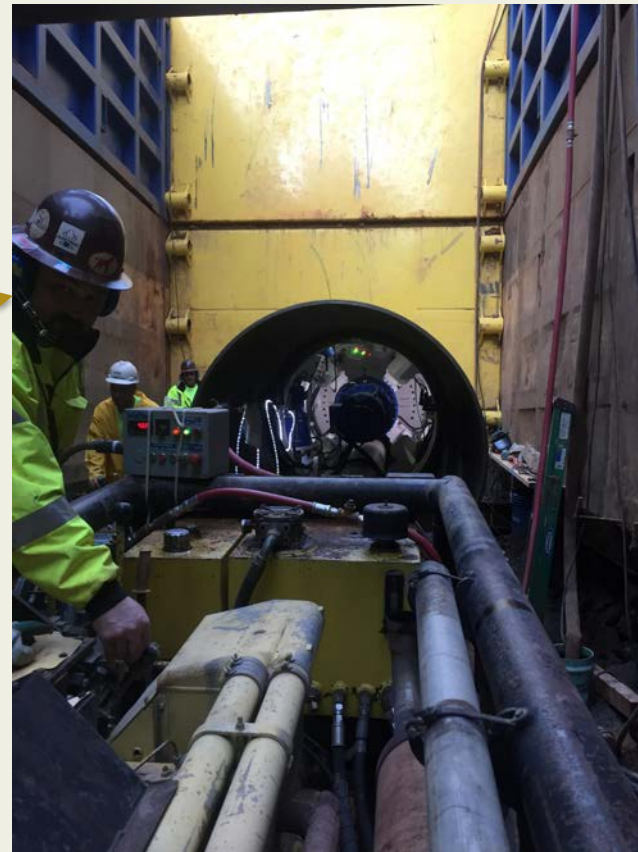




# Crew Setup at Site

We used 8 men to run this boring operation and 4 of them used push to talk headsets to communicate during boring operations, this included:

- Excavator Operator
- ABM Operator
- SBU-M Operator
- Bank Man



# Casing Installation

A mini skid steer (Dingo) was utilized to push the spoil to the rear of the pit to be removed by a large excavator.



Each 20" piece of casing took about 2 ½ hours to set in and weld up. It took approximately another 4 hours to bore in solid rock.



# Internal View of Lead Steel Casing

Bentonite Lines

Ventilation Line

Power Cables

Waterline

Spoil Can With Invert Auger



# Between Crossings

## Cutterhead Changes

- + Cutterhead was interchanged between crossings by being hauled back to shop.
- + Changed from rock cutterhead to mixed ground cutterhead.
- + This kept everything clean and allowed use of an overhead shop crane.



# Types of Geology

## Rottenwood Creek

- + Began with solid rock.
  - Rock coring was performed and the rock quality designation of the core samples ranged from 41.7 to 71.7 percent, while the recovery ranged from 80 to 100 percent. This indicates a hard to moderately hard continuous bedrock.
  - Rock had some seams so tarp was used to line the creekbed.
- + Ended in PWR
  - the PWR consisted of very dense sand with some silt or hard sandy silt.

# Creek Crossing



The Creek was layered with a tarp and sand bags in case the rock fractured during the boring process. This will help prevent water infiltration.





# Types of Geology

I-75

- + Mixed ground condition ranging from PWR, sand, clay, mica and solid rock.
- + Rock coring was performed and the RQD ranged from 36.7 to 78.3 percent while the recovery ranged from 93.3 to 100 percent.
  - This indicates hard to moderately hard continuous bedrock.

# Types of Geology

## Powers Ferry Road

- + Bore was a mixed ground that consisted of stiff sandy silt or firm to medium dense silty sand with a layer of PWR.



# Advance Rates

- + Varied in type of ground
  - Solid rock: approximately 5 feet per hour.
  - Softer material: approximately 10-15 feet per hour.
- + Cutterhead Preferences
  - Mixed face provides ability to bore solid rock and mixed ground and achieve good advanced rates.
  - when you encounter softer rock/mixed ground with the solid rock face the advanced rate isn't as consistent as the mixed face.

# Breakthrough!



Best day of the job!