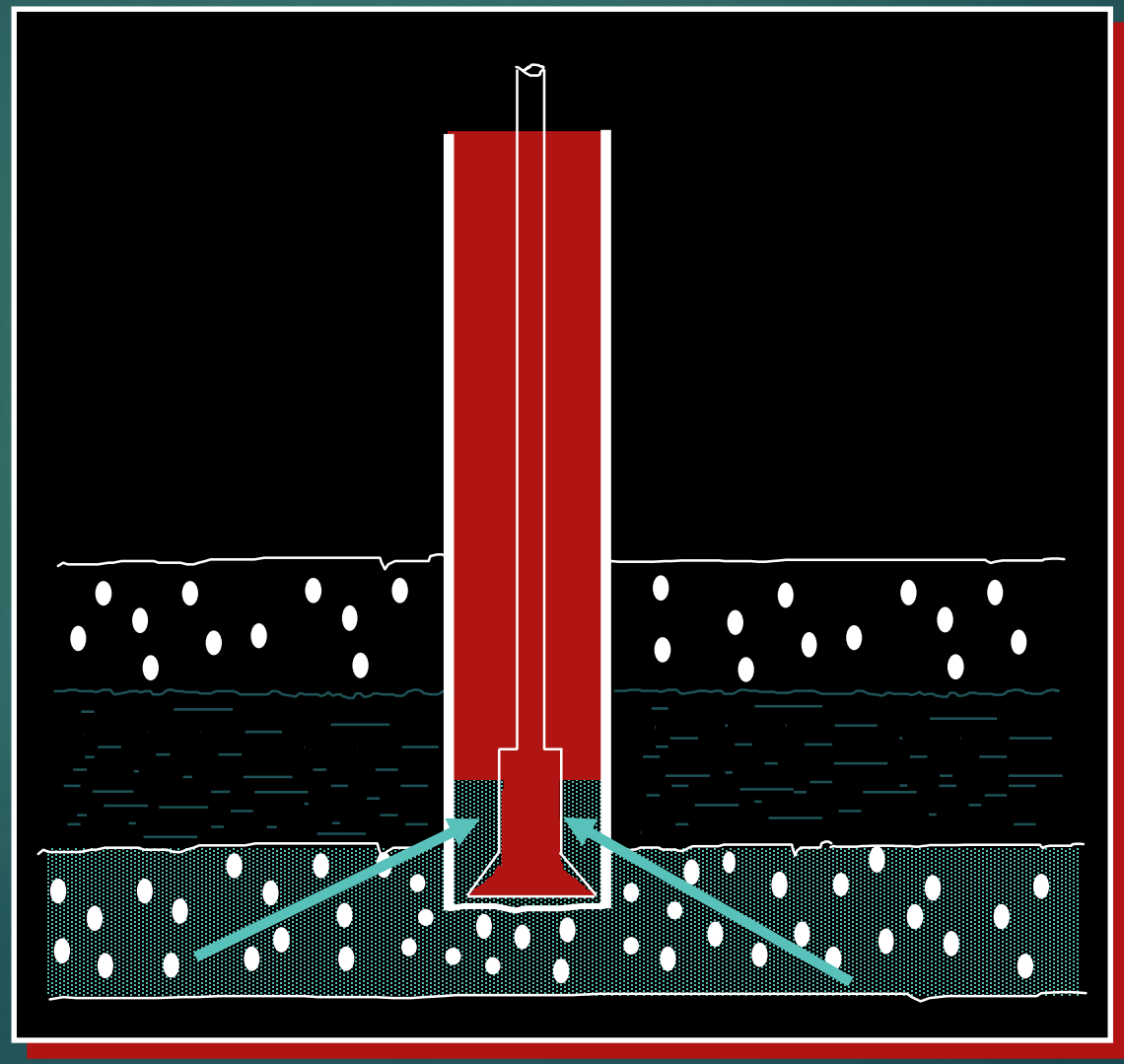
WHAT IS A KICK?

IT IS AN INFLUX OF FORMATION FLUID THAT CAUSES THE WELL TO FLOW.



WHAT IS A BLOWOUT?

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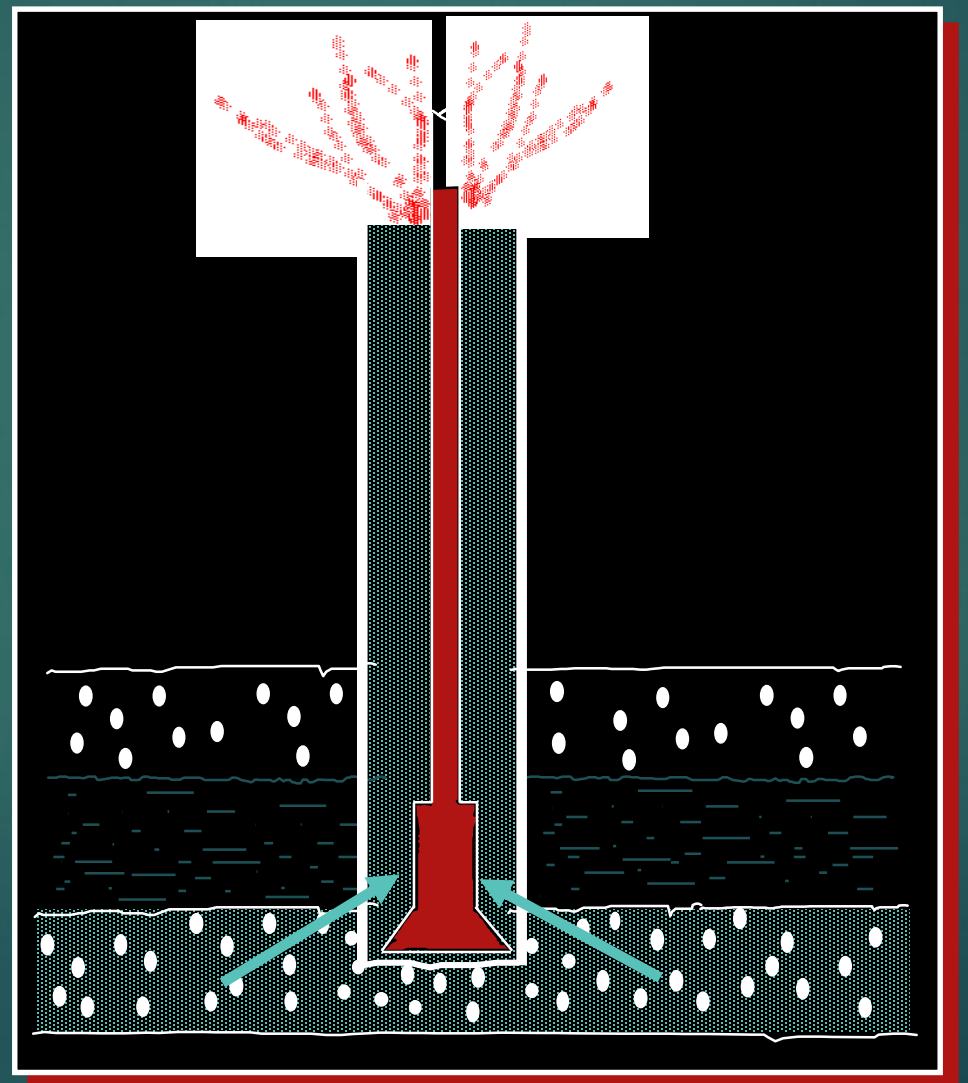
AN UNCONTROLLED EXIT OF THE FORMATION FLUIDS AT THE SURFACE



Hydrostatic Pressure

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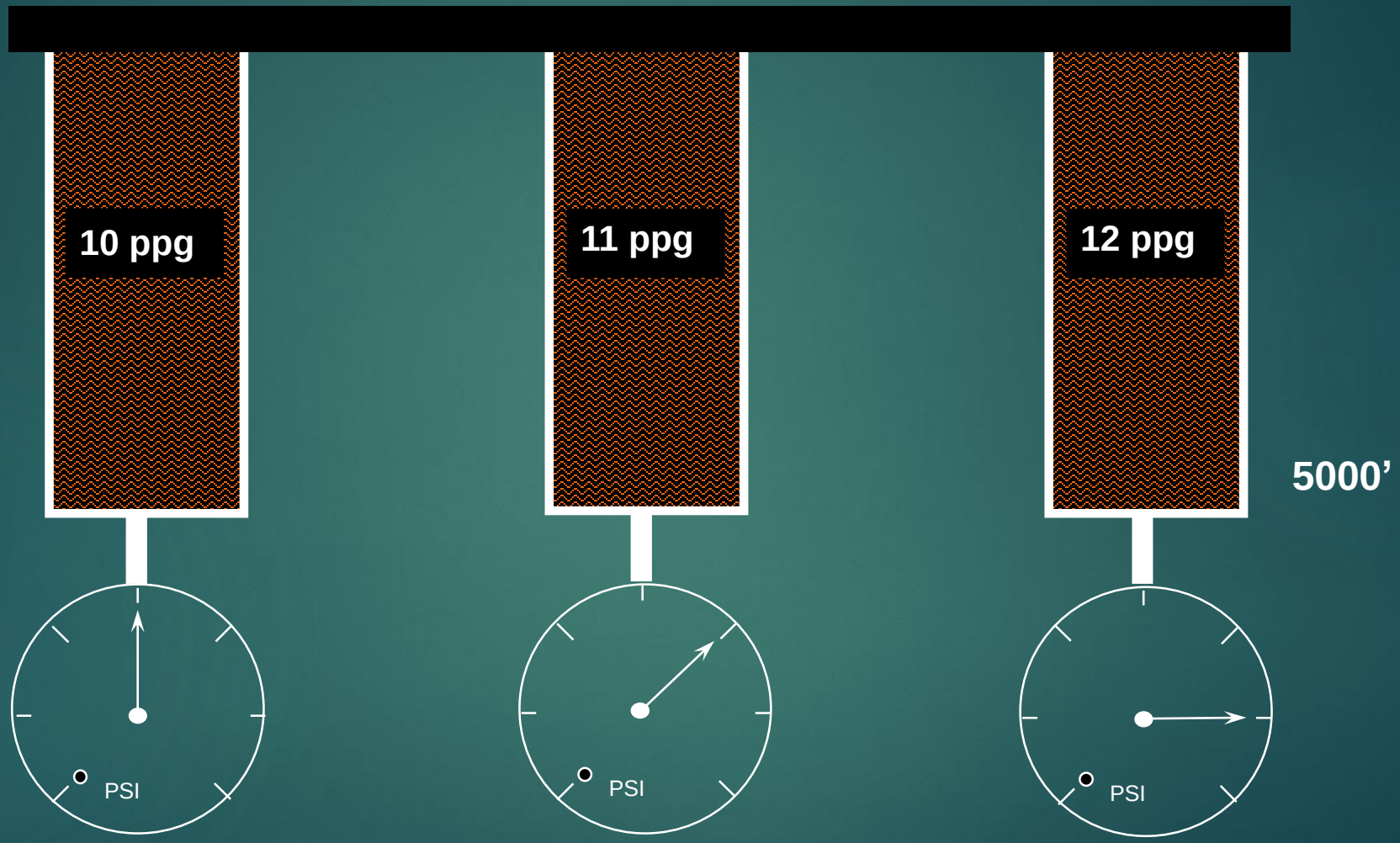
Hydrostatic Pressure
Hp (psi)
=
0.052
X
Mwt (ppg)
X
TVD (ft)

Hydro- means a fluid

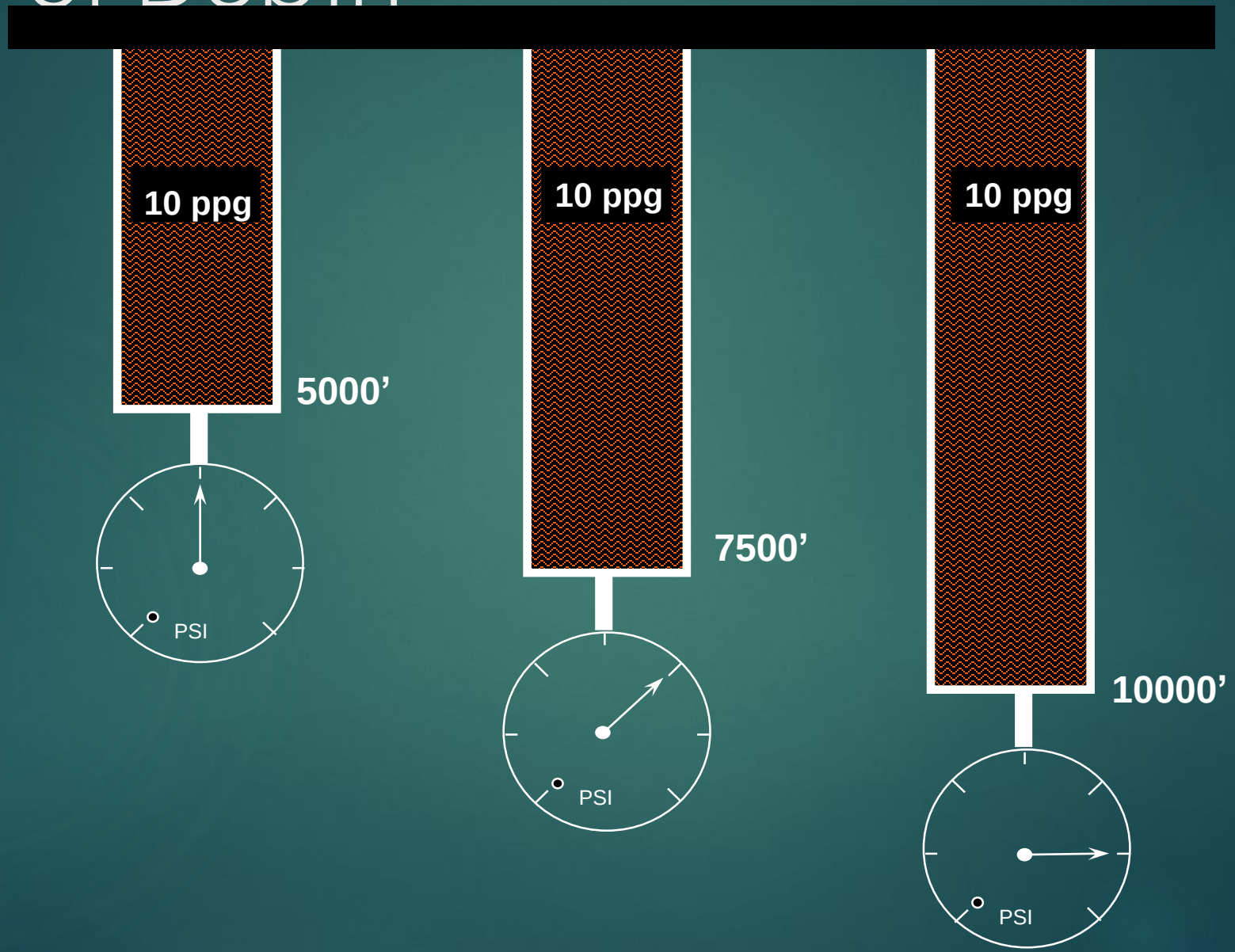
Static- means at rest

Hydrostatic in the wellbore is from the mud

Effect of Density



Effect of Depth



MUD HYDROSTATIC -1

VERTECAL WELL

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STANDERED FORMULA WITH FT., PPG AND PSI

MUD HYDROSTATIC HP = 0.052 X MUD WEIGHT X DEPTH

MUD GRADIANT = 0.052 X MUD WEIGHT PSI\FT.

Pressure (psi) = Mud Weight x .052 x TVD

Pressure Gradient (psi/ft) = Mud Weight, ppg x .052

Pressure Gradient (psi/ft) =Pressure, psi ÷ TVD, ft

Mud Weight, ppg = Pressure Gradient ÷ .052

Mud Weight (ppg) = Pressure ÷ TVD ÷ .052

TVD (ft) = Pressure (psi) ÷ Mud Weight (ppg) ÷ 0.052

TRY SOME EXAMPLES

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1-Well TVD = 8000 ft. Calculate Mud Hydrostatic pressure for each of the following Mud Weights.

11 ppg	12 ppg	14 ppg
4576 psi	4992 psi	5824 psi

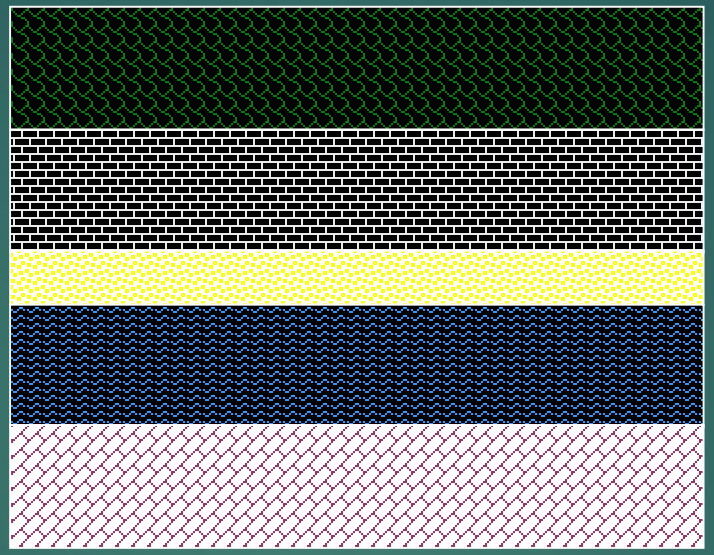
2-What Mud Weight is required to give a pressure gradient of 0.59 psi/ft? (11.4 ppg)

3-Mud Hydrostatic = 3900 psi at the bottom of an 8000 ft. TVD well. What would be the pressure gradient for the mud? (0.49 psi\ft.)

4-For question above what is the equivalent Mud Weight? (9.4 ppg)

5-Pressure Gradient = 0.57 psi/ft. What is hydrostatic at 12000 ft. TVD? (6840 psi)

FORMATION FLUID

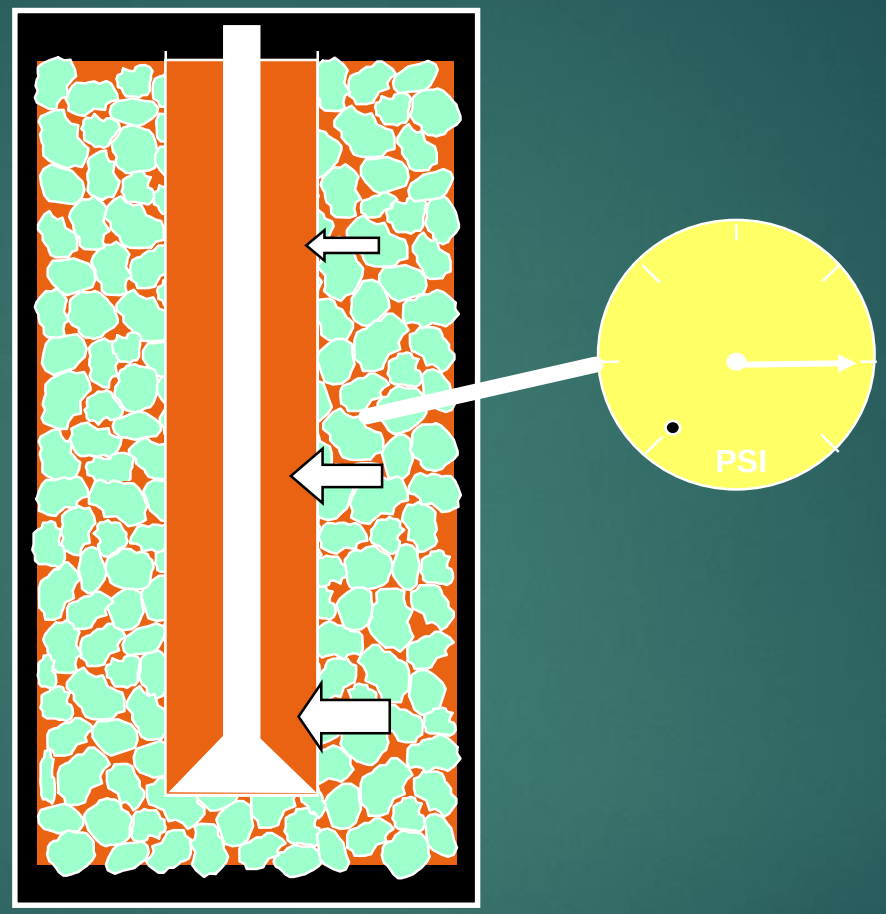


Fluid present in the pore space of the rock.

FORMATION PRESSURE

The pressure of the formation fluids.

What is formation fluid pressure?

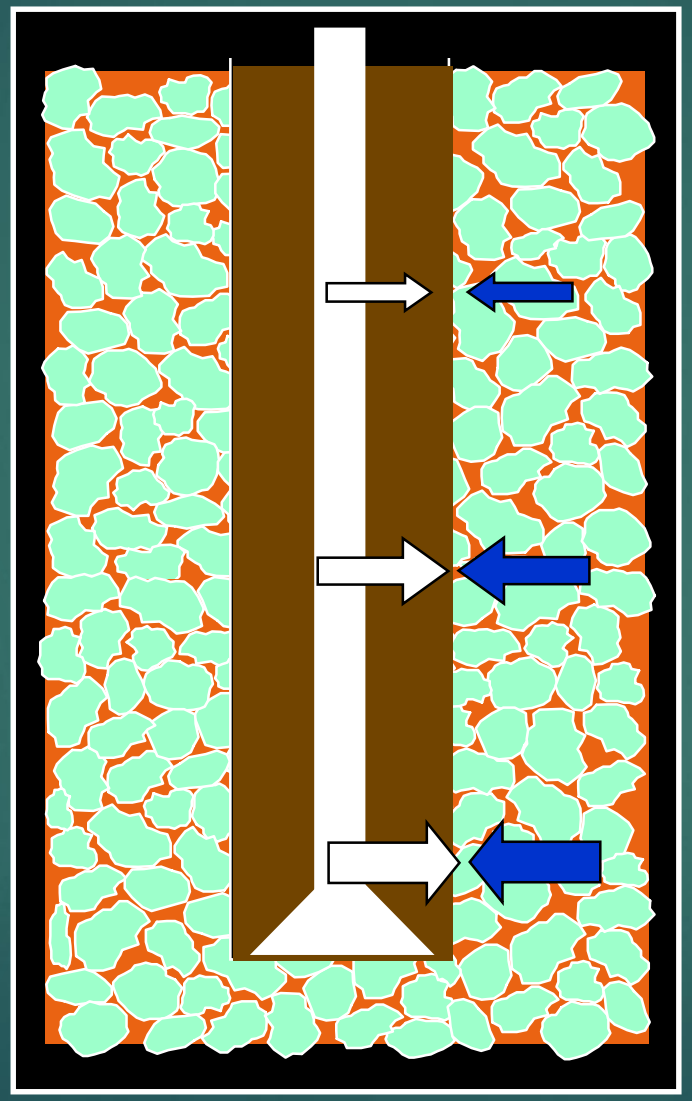


Formation Pressure: is the fluid pressure in the pore spaces of the formation.

BOTTOM HOLE PRESSURE

IT IS THE TOTAL PRESSURES EXERTED AT THE BOTTOM OF THE WELL.

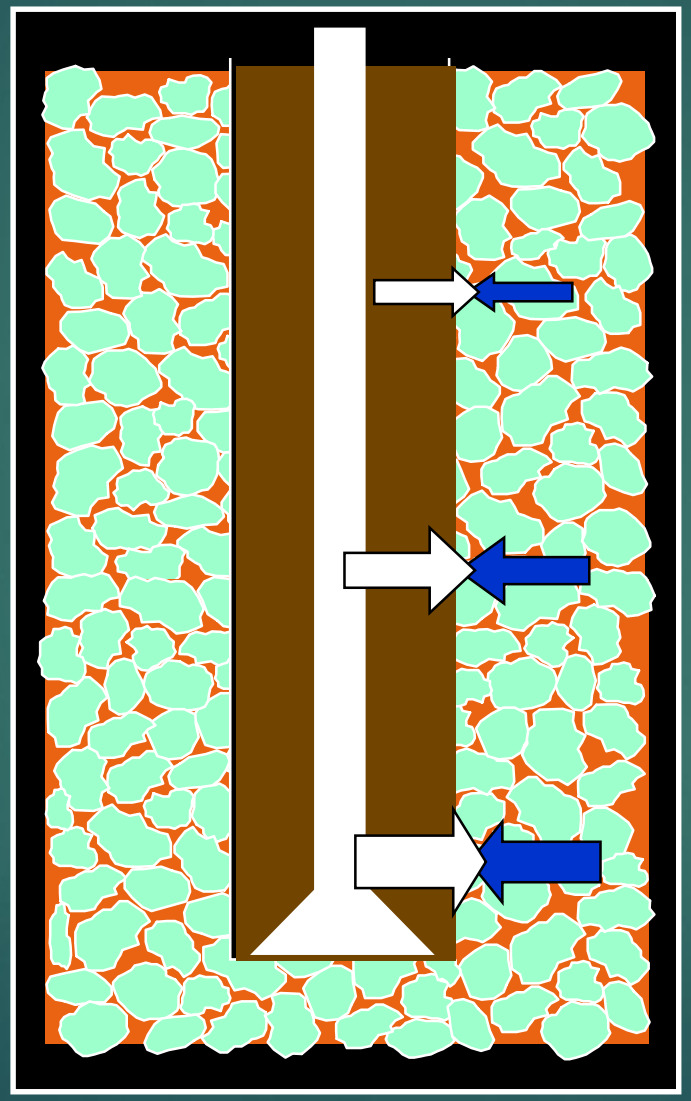
Balance



Mud Hydrostatic =

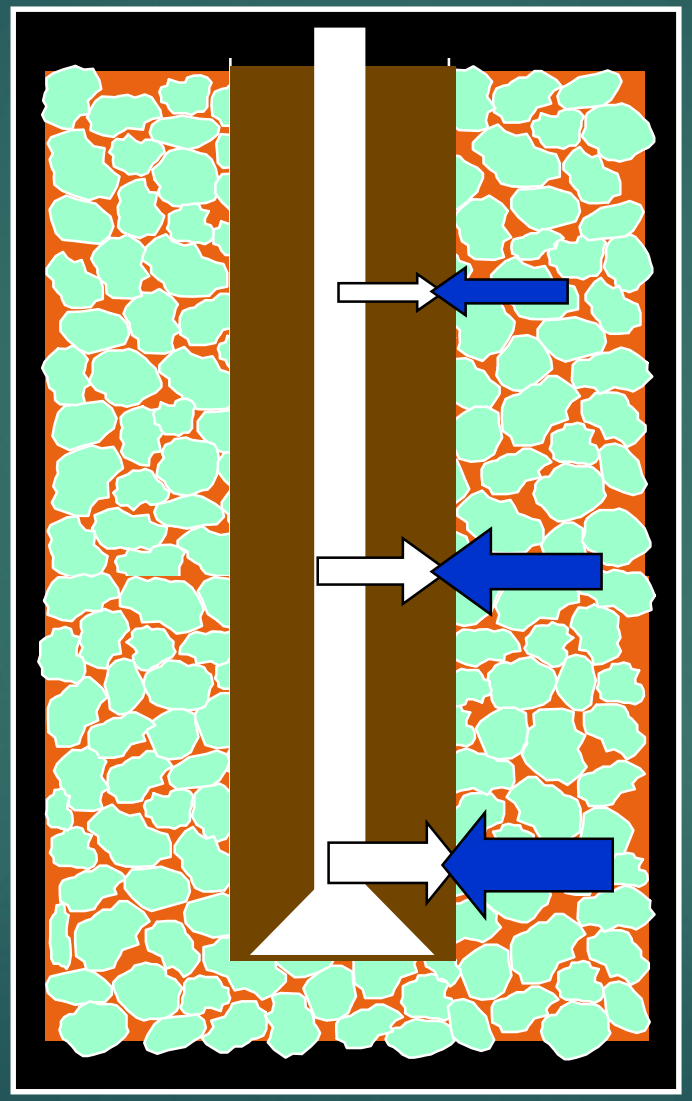
Formation Pressure

Overbalance



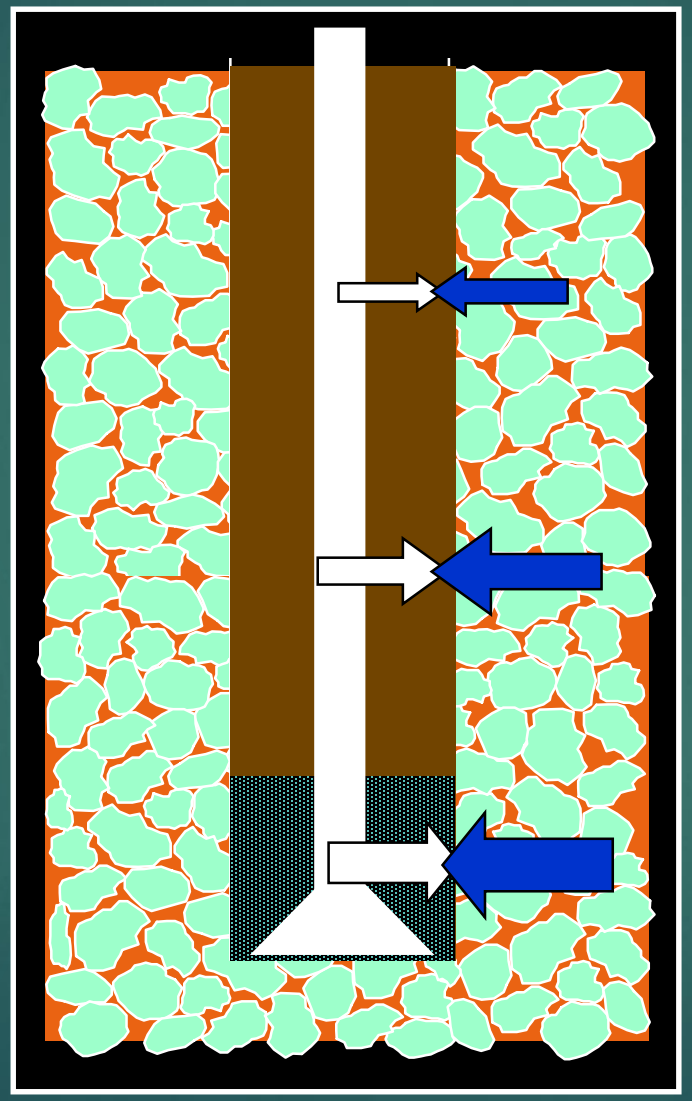
Mud Hydrostatic > Formation Pressure

Underbalance



Mud Hydrostatic < Formation Pressure

Underbalance



Mud Hydrostatic < Formation Pressure

WHAT IS WELL CONTROL?

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1/ PREVENTING A KICK

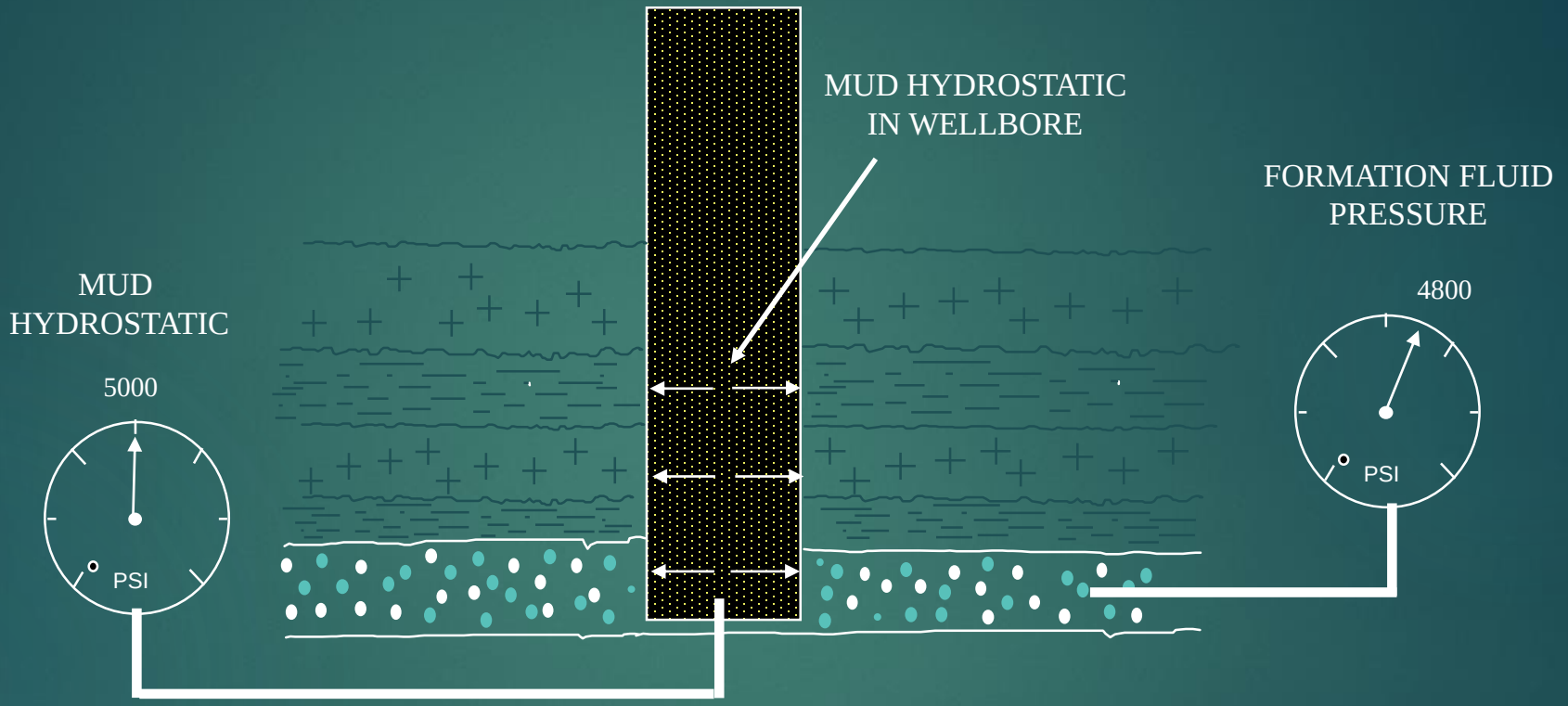
PRIMARY → MUD HYDROSTATIC PRESSURE

OR

2/ SHUTTING IN THE WELL AFTER A KICK HAS BEEN TAKEN

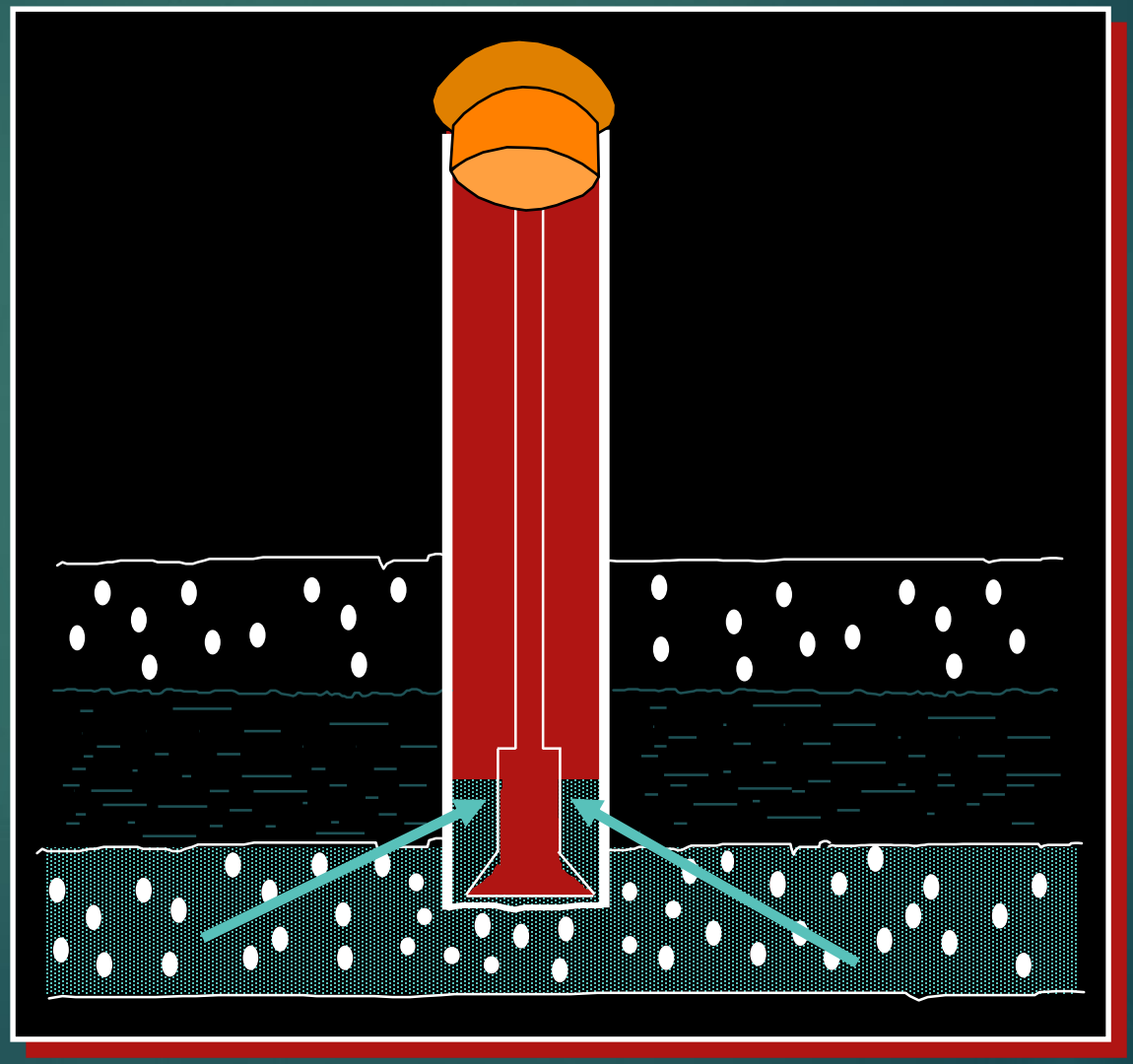
SECONDARY → BLOW OUT PREVENTERS

Primary control MUD



MUD HYDROSTATIC PREVENTS FORMATION FLUIDS ENTERING THE WELLBORE

Secondary Control BOP



(BOP)

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ONSHORE BOP

15000 PSI

OFFSHORE BOP

30000 PSI

Type of rams

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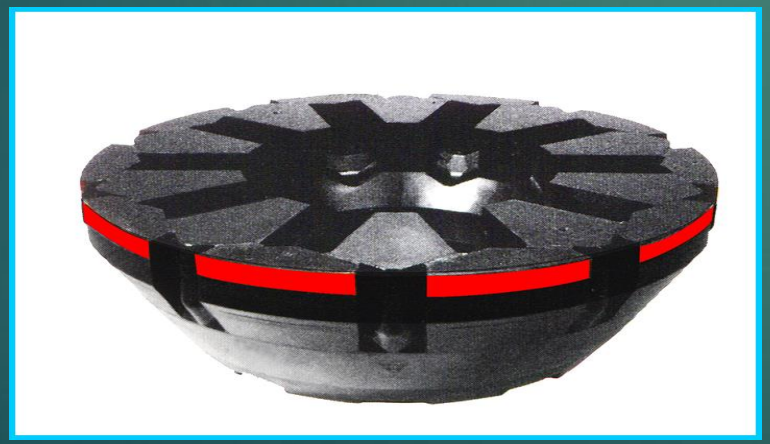
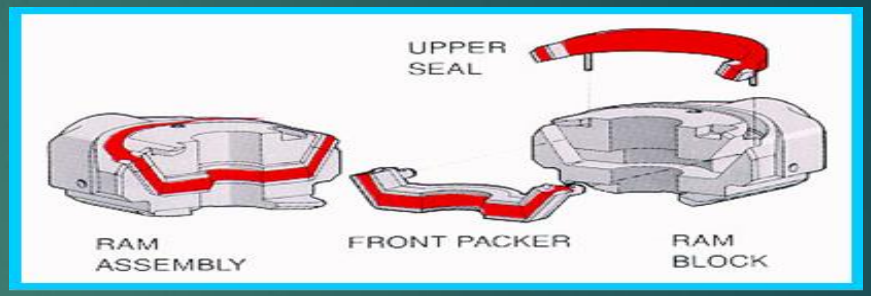
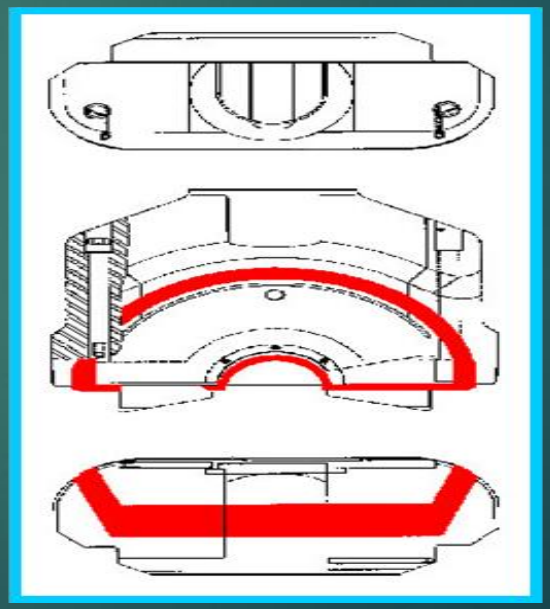
1- Hydrill/Annular rams 2- Pipe r

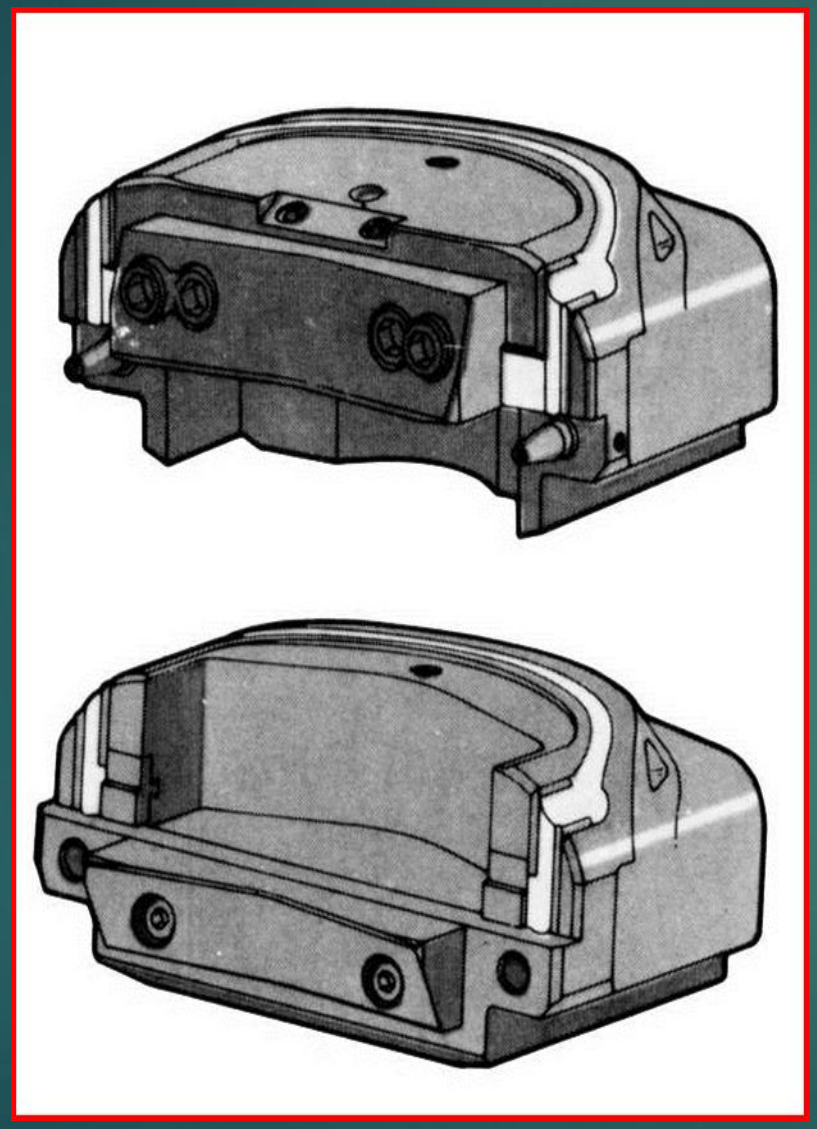
K-Series

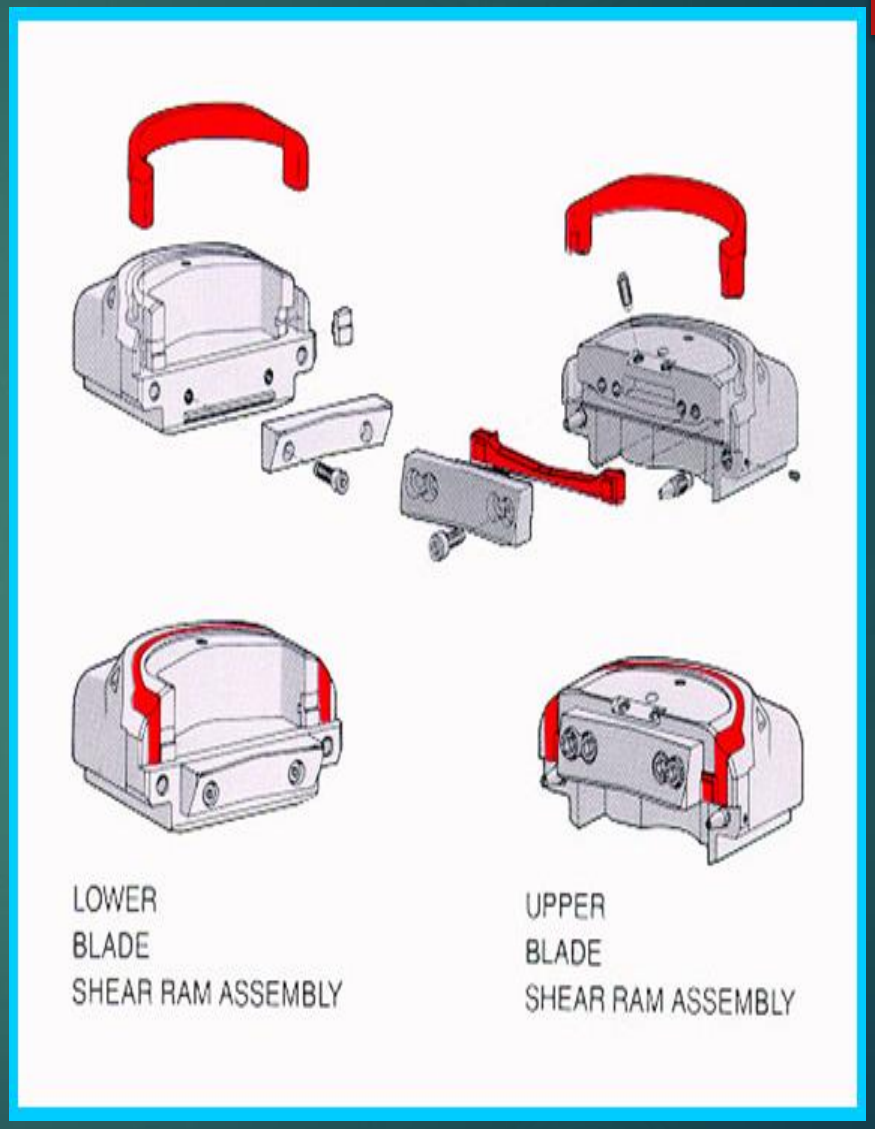






3- Blind/Shear rams





Koomy Unit
(Surface Control Unit)

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How 4 way valve works ?

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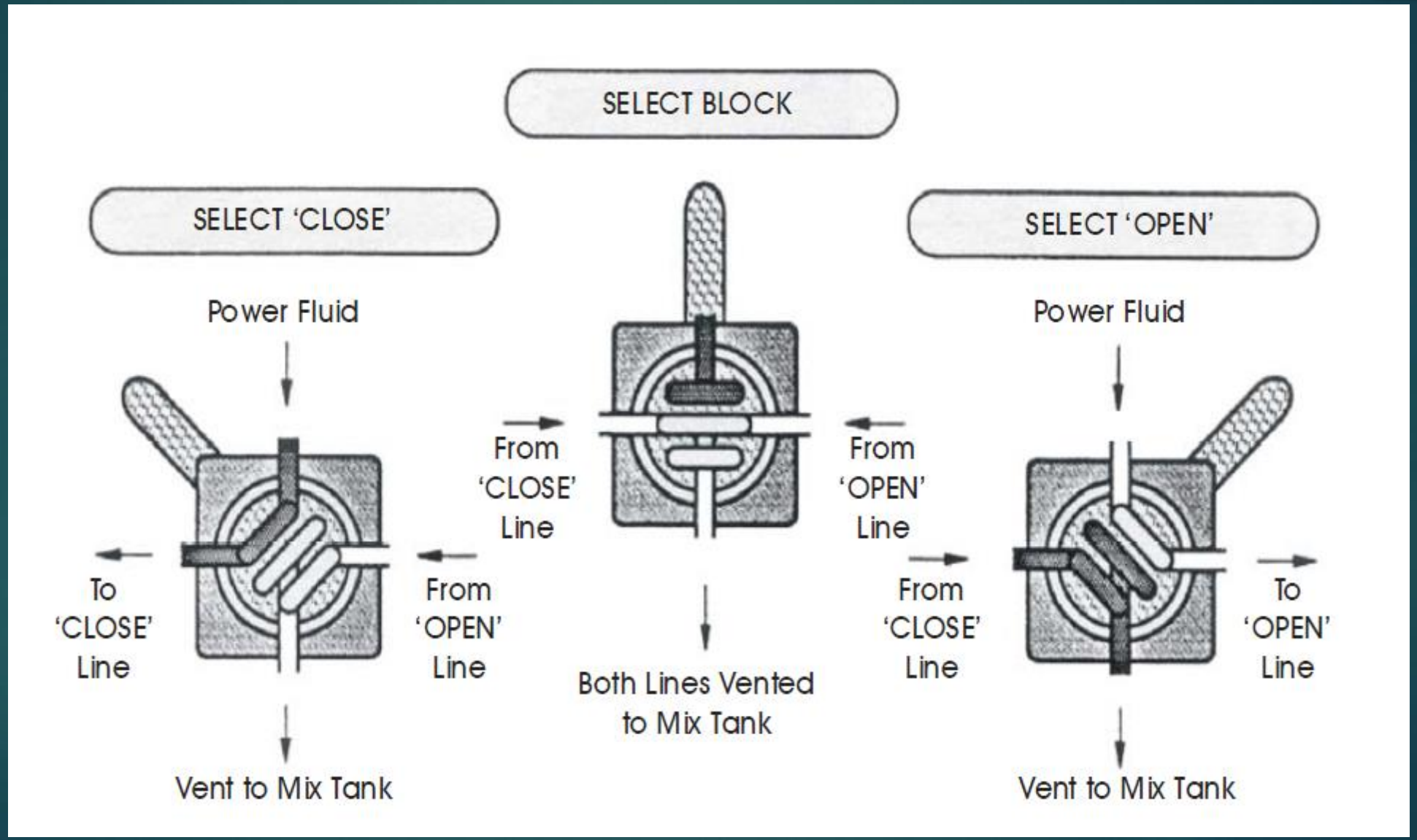
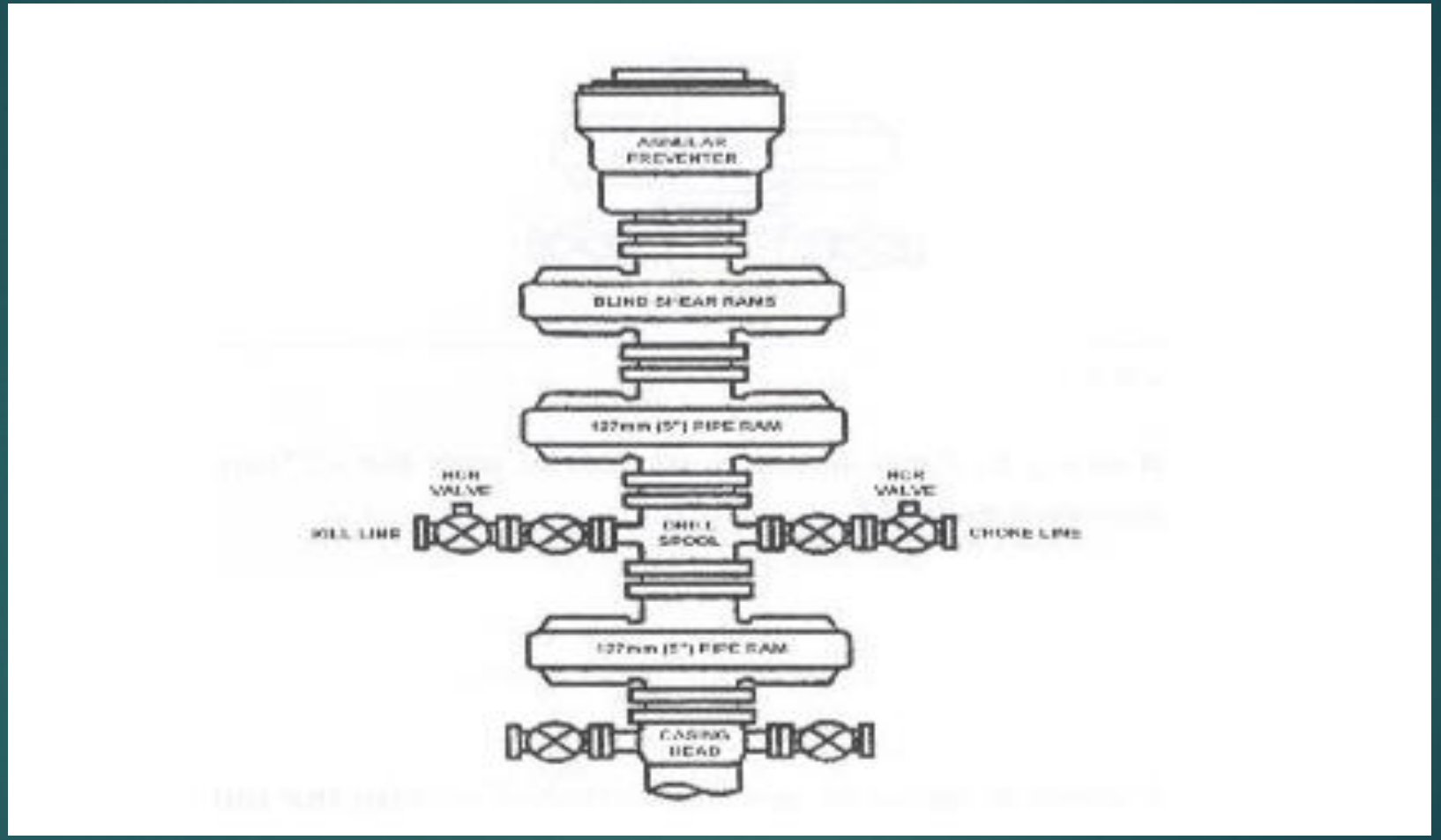


Killing well by high weight mud



WELL CONTROL CYCLE

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PRIMARY

PREVENTION

WELL CONTROL CYCLE

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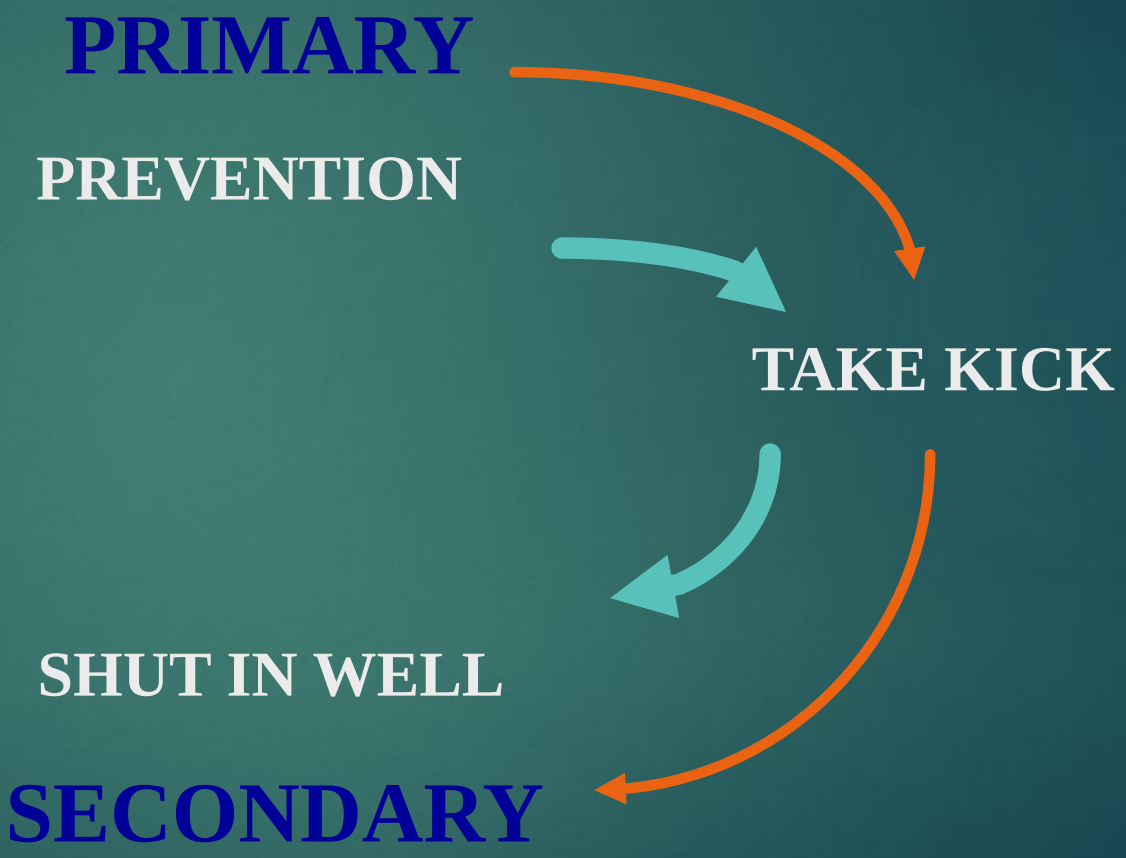
PRIMARY

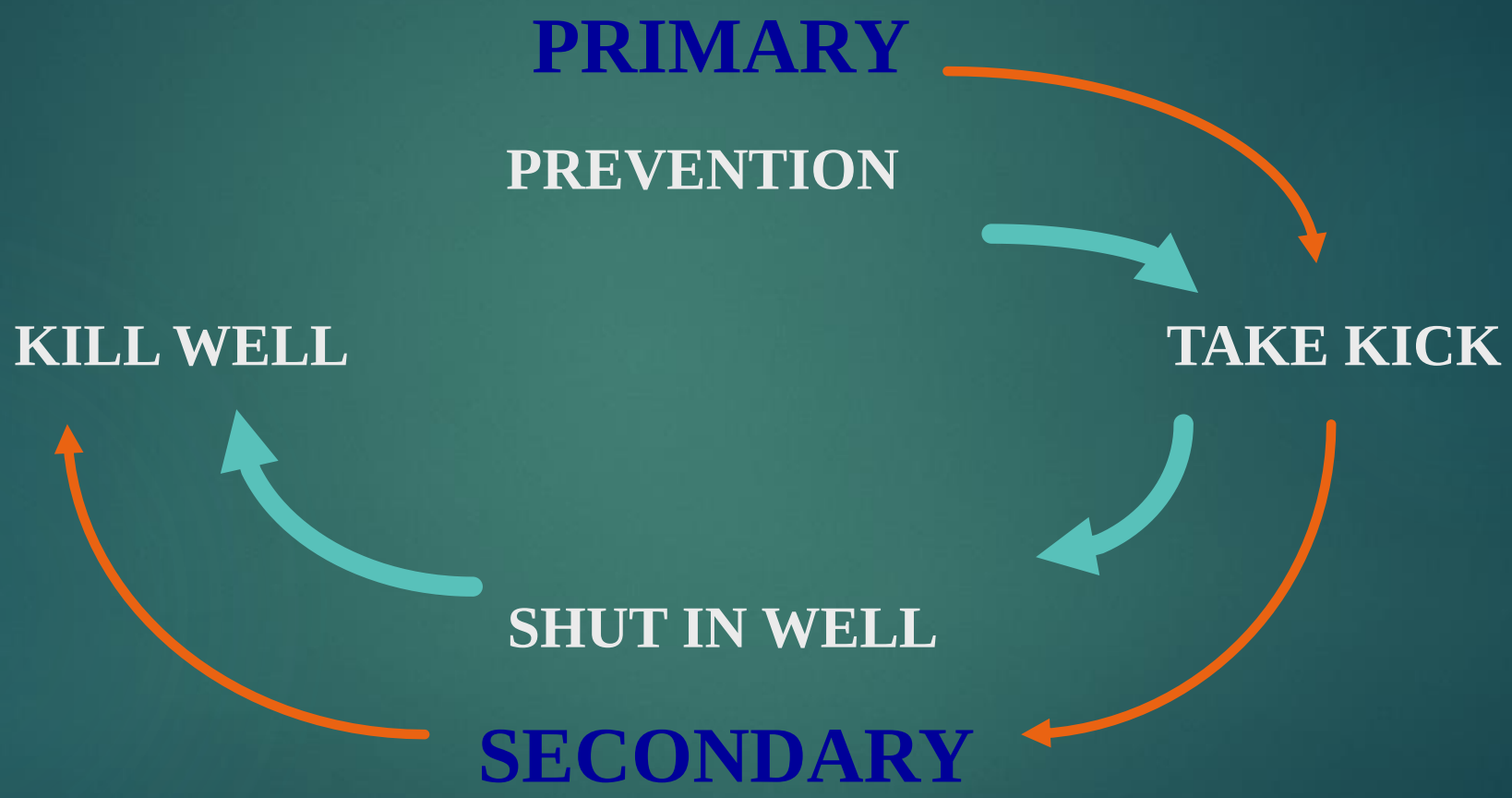
PREVENTION

TAKE KICK

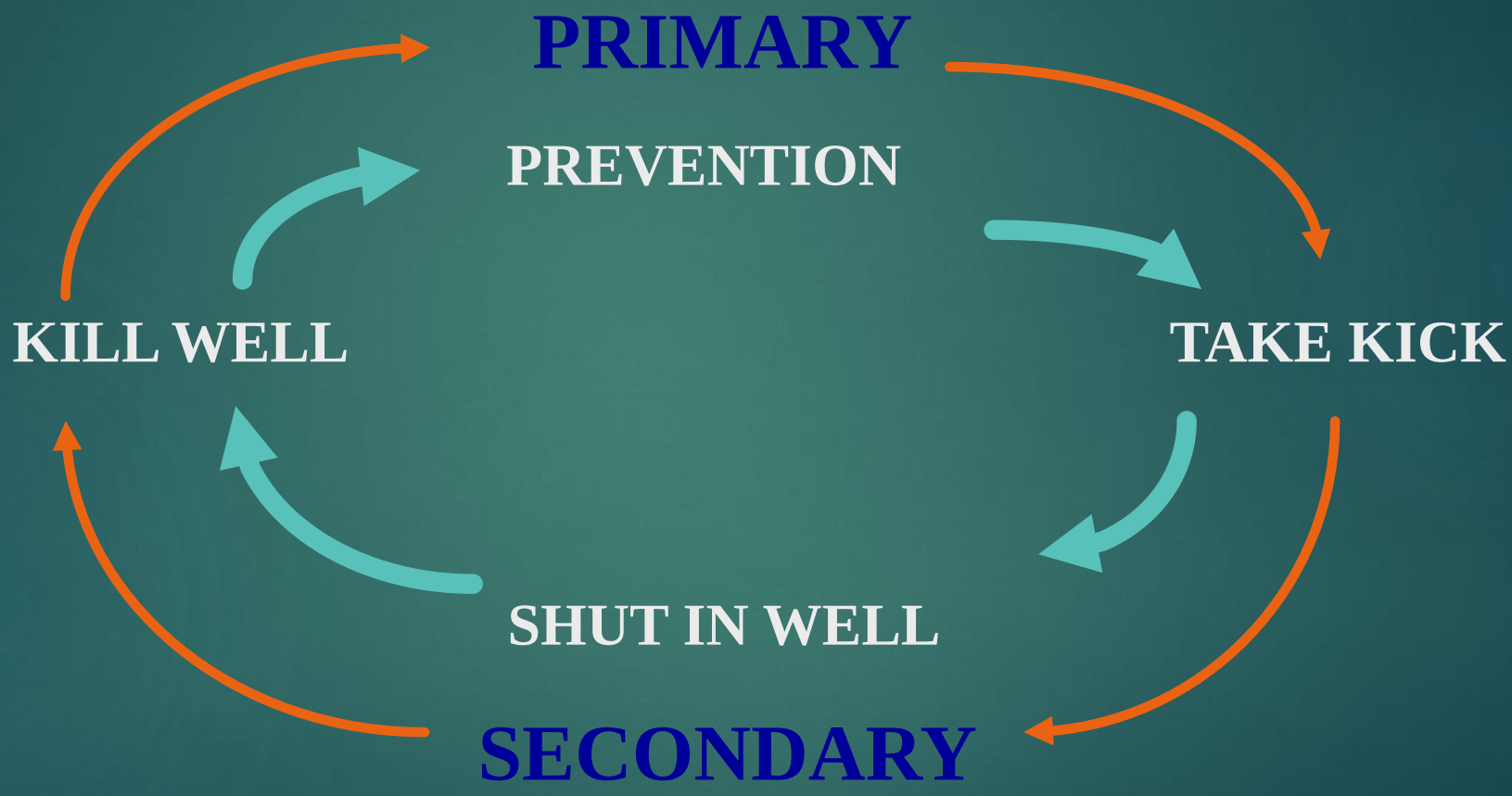
WELL CONTROL CYCLE



WELL CONTROL CYCLE



WELL CONTROL CYCLE



HOW CAN KICKS HAPPEN?

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MUD HYDROSTATIC FALLS

HOW CAN KICKS HAPPEN?

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MUD HYDROSTATIC FALLS

HOW CAN KICKS HAPPEN?

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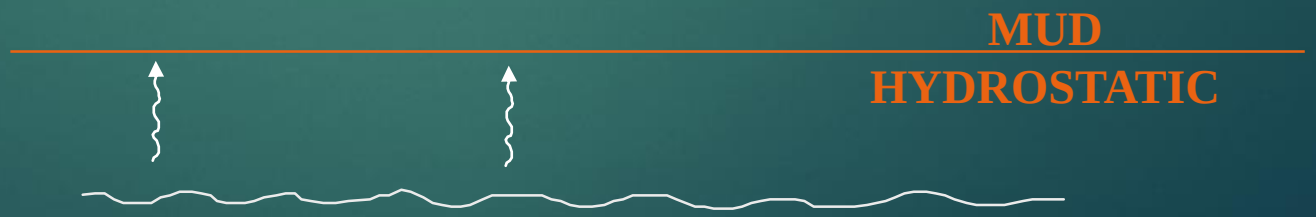
MUD HYDROSTATIC FALLS

OR



FORMATION PRESSURE RISES

HOW CAN KICKS HAPPEN?

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MUD HYDROSTATIC FALLS

OR

FORMATION PRESSURE RISES

Mud Hydrostatic and Formation Pressure

Always Remember that HP and FP are two opposite forces.

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CAUSES OF KICKS

PRIMARY CONTROL

NORMALLY:

= MUD HYDROSTATIC ? FORMATION PRESSURE

? GREATER / LESS ?

KICKS OCCUR WHEN:

= MUD HYDROSTATIC ? FORMATION PRESSURE

? GREATER / LESS ?

WHAT CAUSES MUD HYDROSTATIC TO DROP?

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PRESSURE = 0.052 X MUD WT X TVD

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CAUSES OF KICKS
(REDUCTION IN MUD WEIGHT)

GAS IN THE WELLBORE

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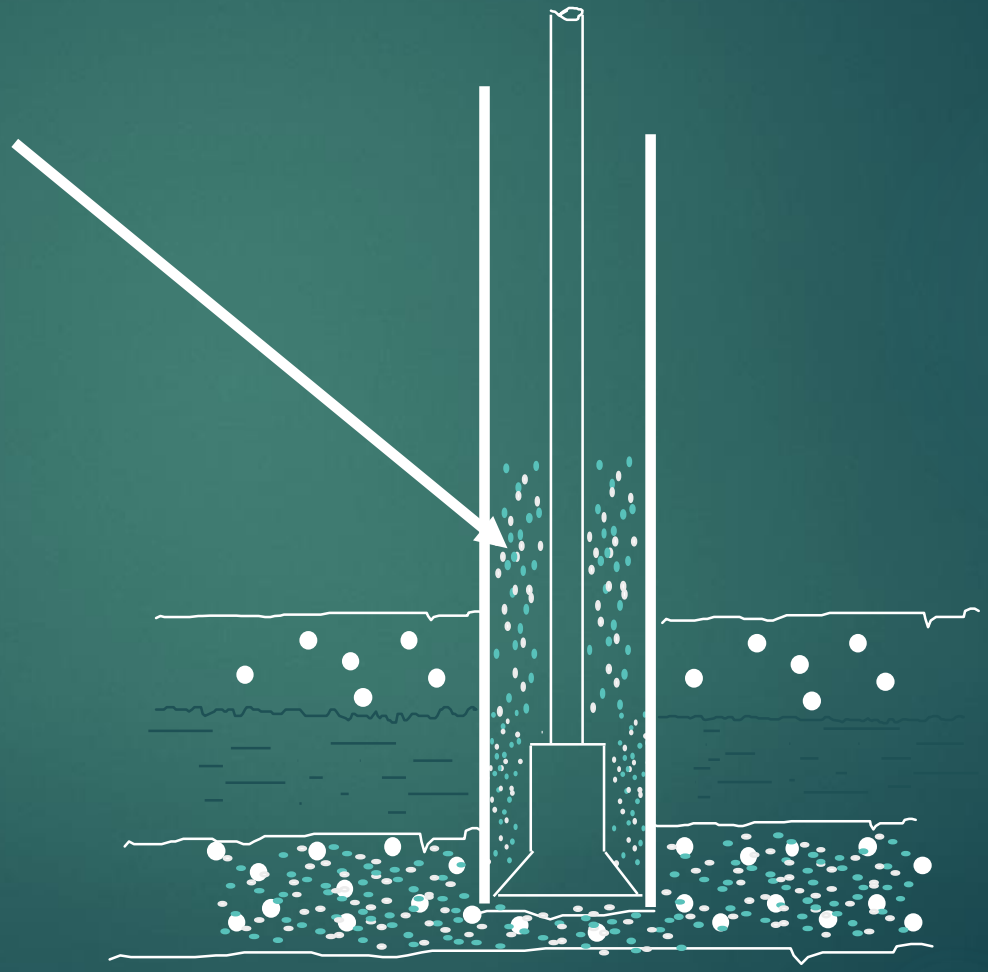
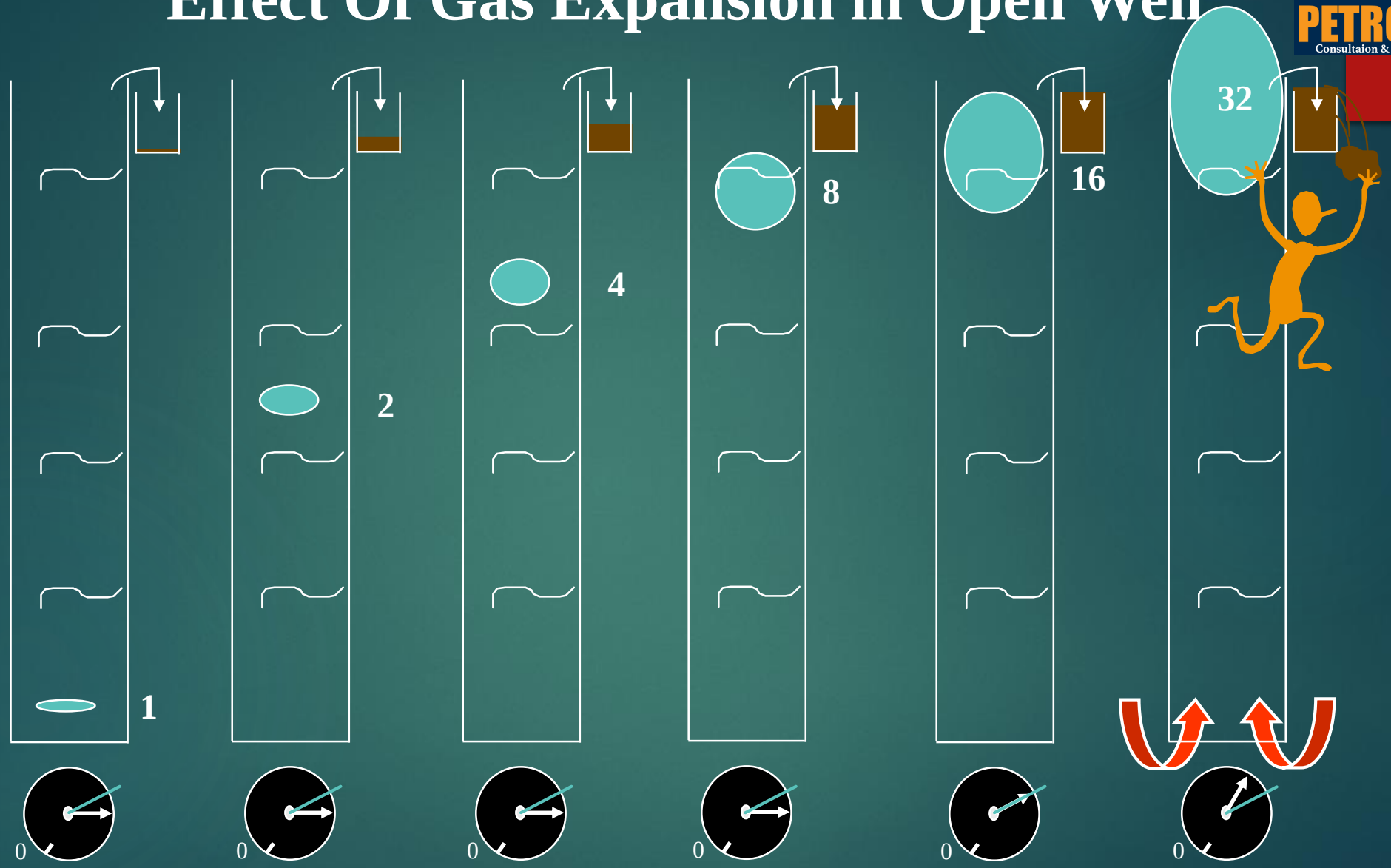
- **DRILLED GAS**



Effect Of Gas Expansion in Open Well



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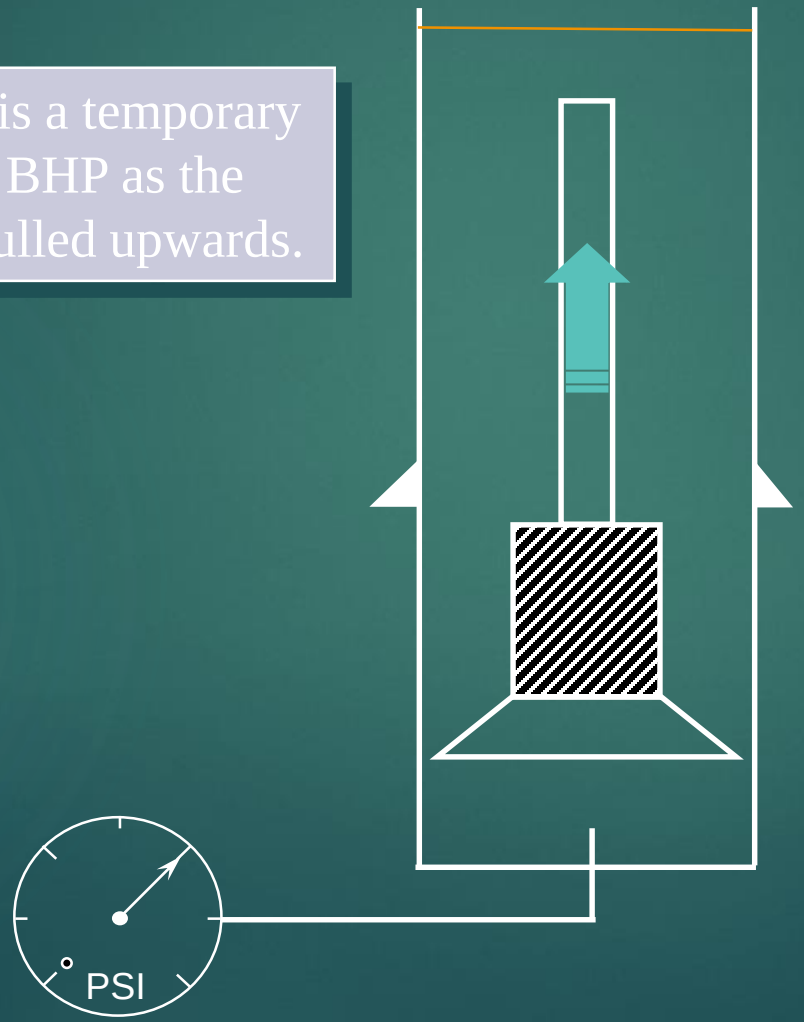
Why Monitor the Hole Fill?

swabbing

What is swabbing?

Swabbing is a temporary drop in BHP as the string is pulled upwards.



Swabbing

Main causes;

- Pull pipe too fast
- Balled bit/BHA
- Viscous mud
- Narrow annulus

All these make it more difficult for mud to move past the bit to fill space created by pulling drill string.

Surface indications of swabbing

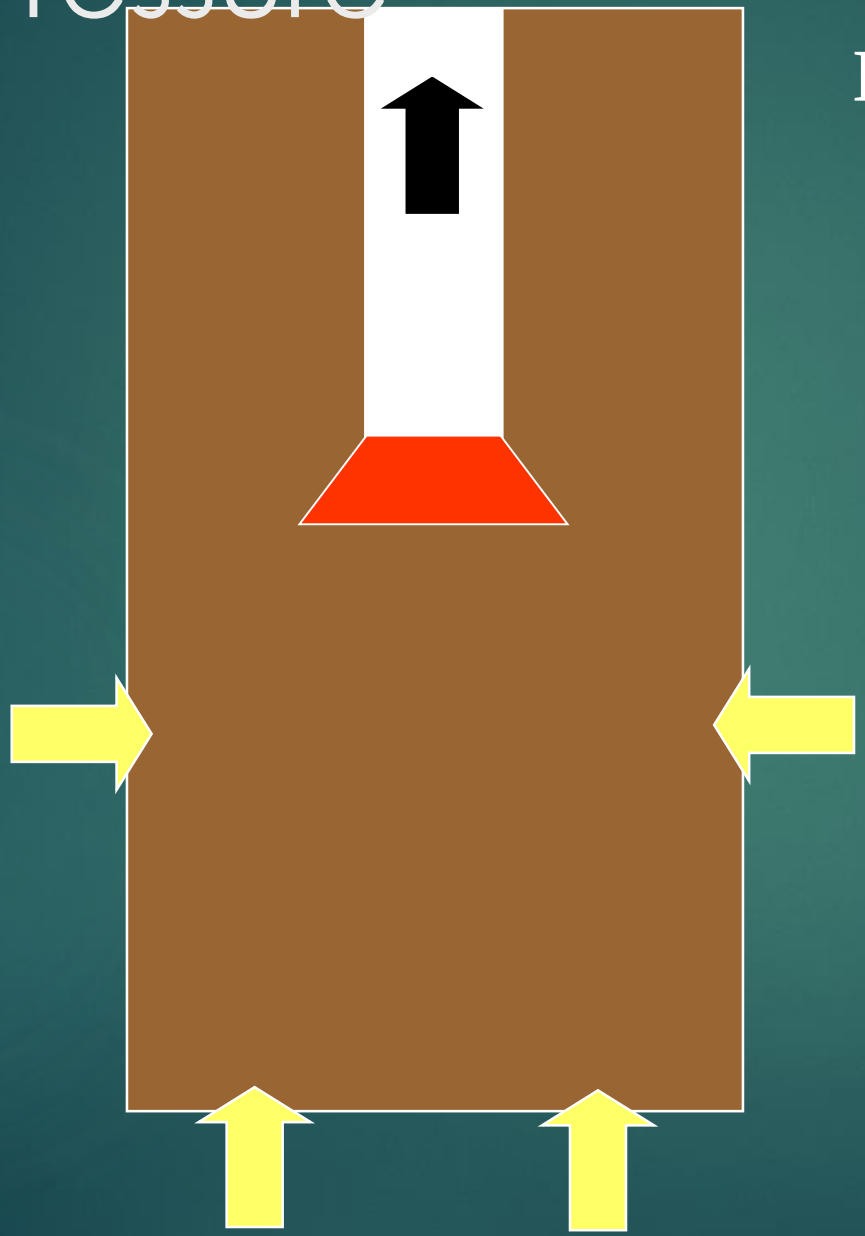
- Swabbing can be recognized by
  - incorrect hole fill

- Monitoring the trip tank is of vital importance

Actions to be taken if swabbing is observed

- The acknowledged procedure is:-
  - Flow check
  - If negative, run back to bottom
  - Circulate bottoms up (consider taking returns via the choke)

Swab Pressure



Bottom Hole Pressure

=

Mud Hydrostatic

-

Swab Pressure

Surging

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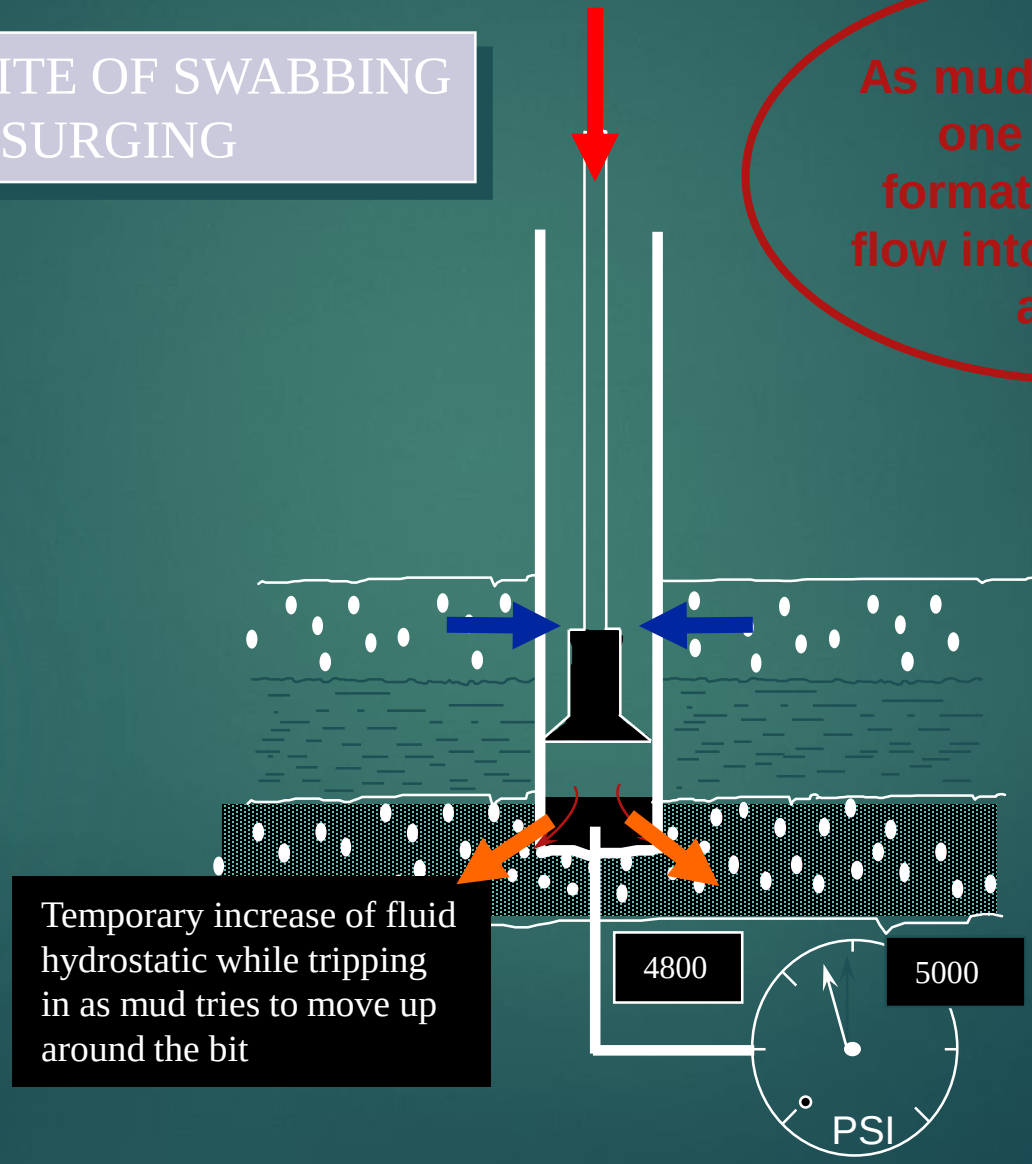
THE OPPOSITE OF SWABBING IS SURGING

As mud is forced into one formation, formation fluid may flow into the well from another

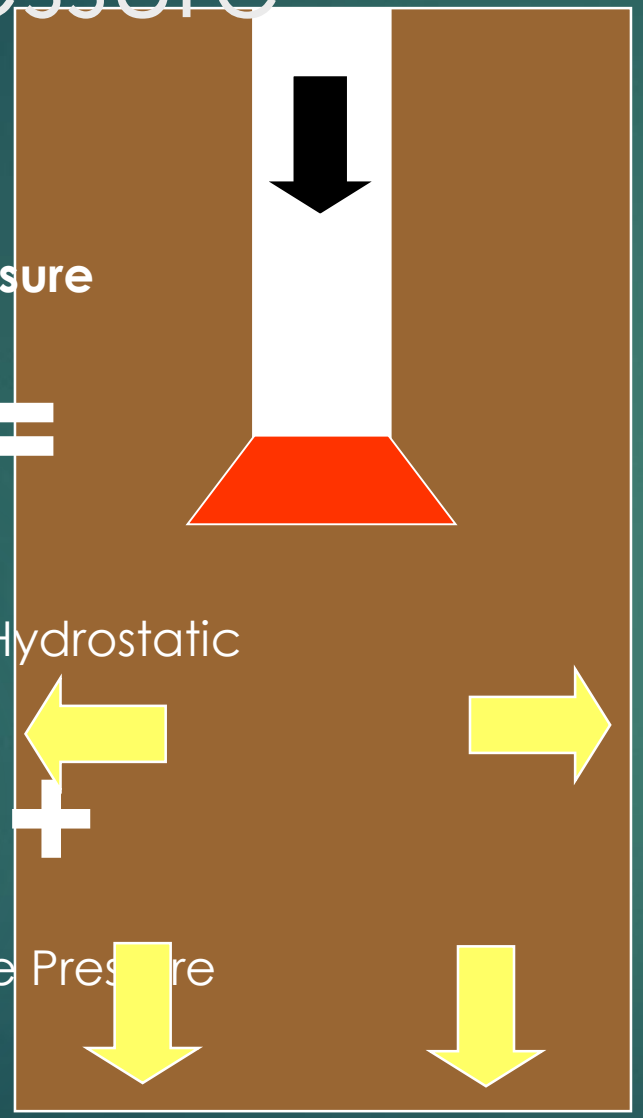


Temporary increase of fluid hydrostatic while tripping in as mud tries to move up around the bit

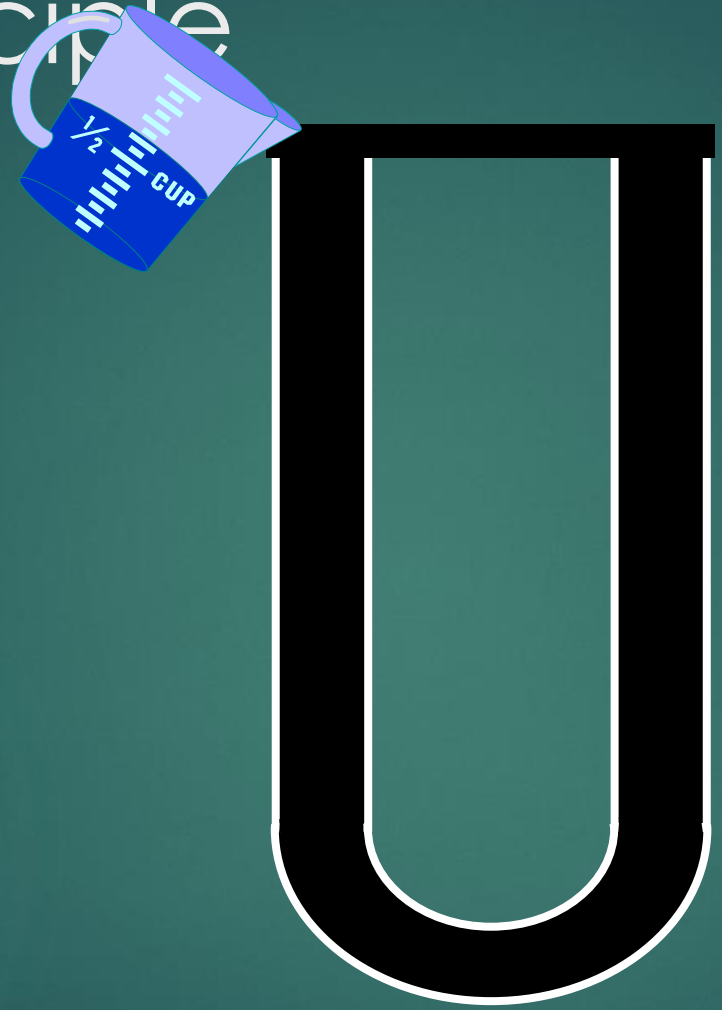
Surge Pressure

Bottom Hole Pressure

=



U-Tube Principle



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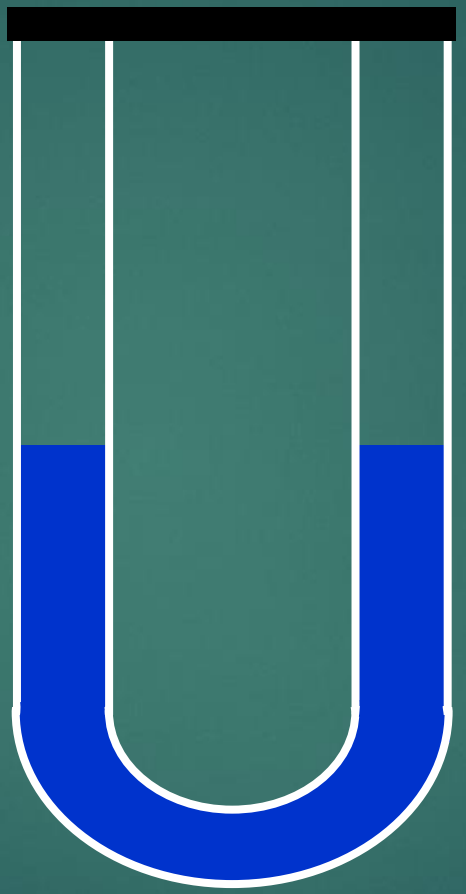
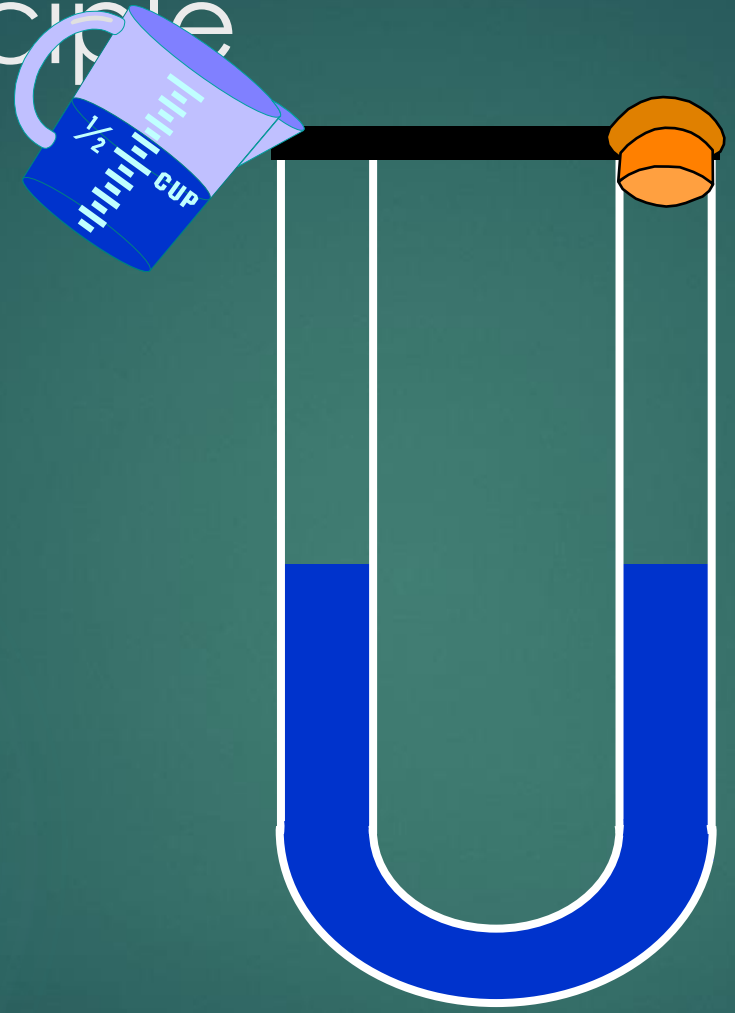
U-Tube Principle



U-Tube Principle



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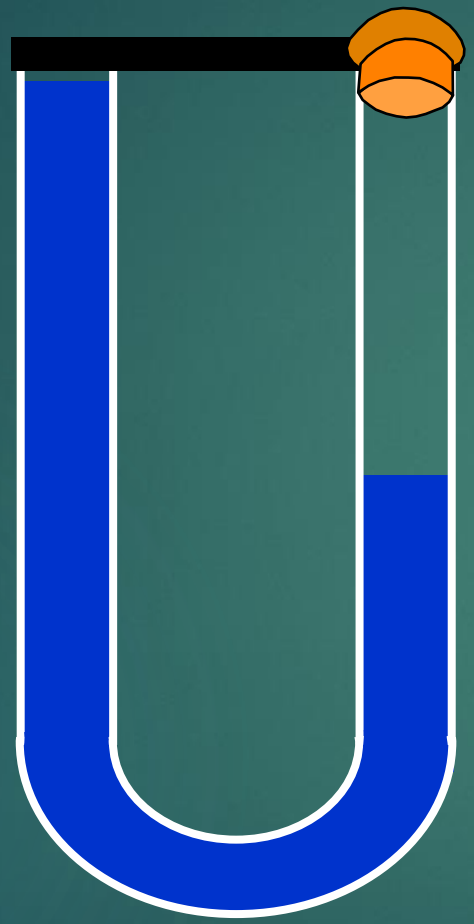
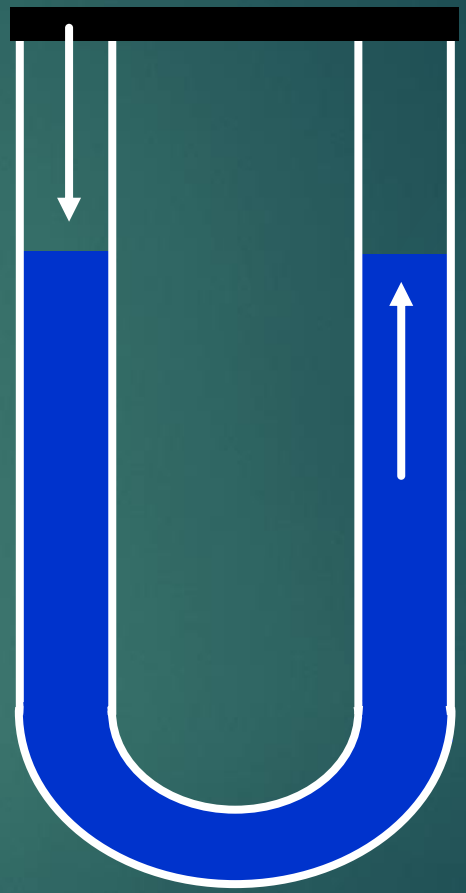
U-Tube Principle





U-Tube Principle

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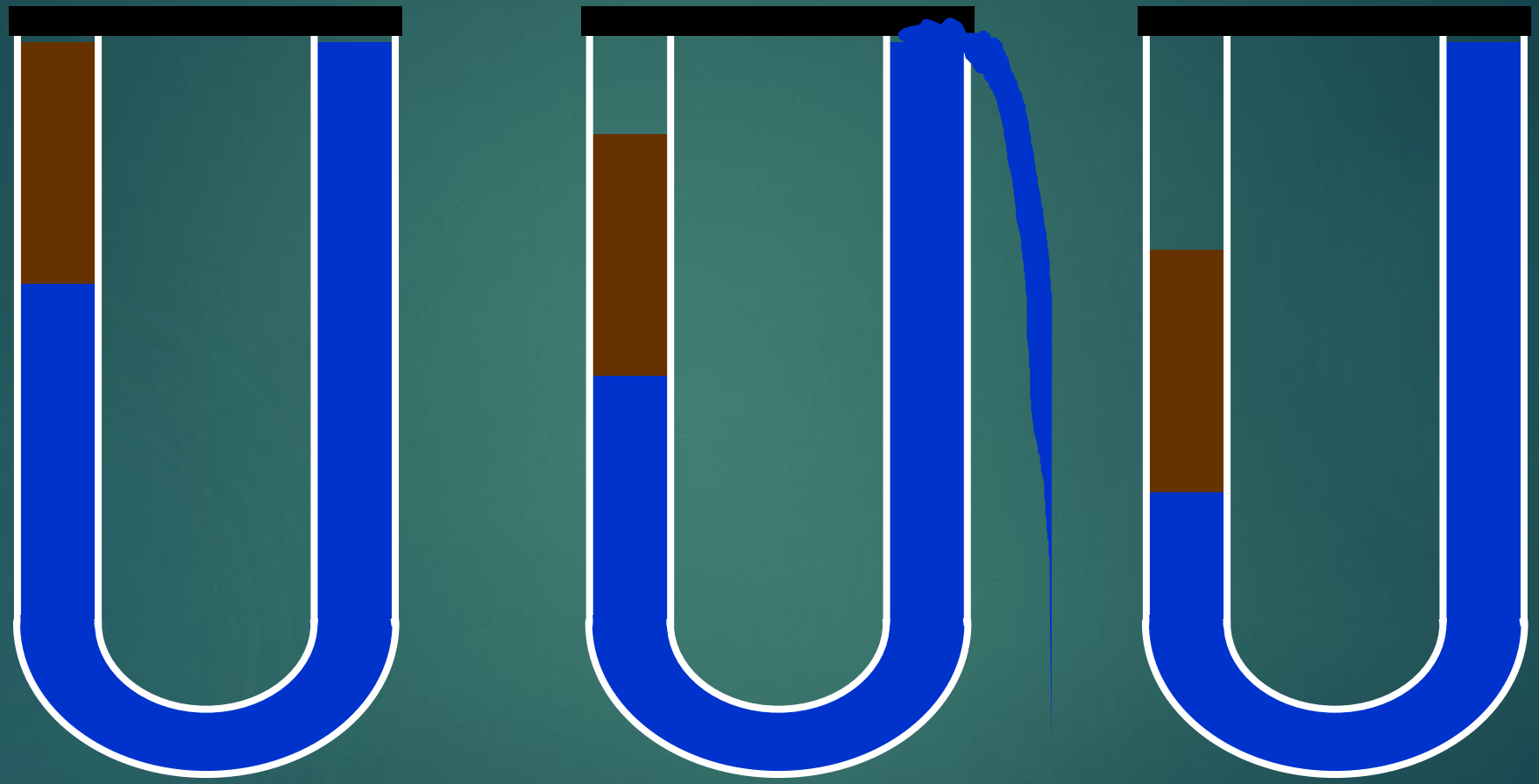

Slug Mud

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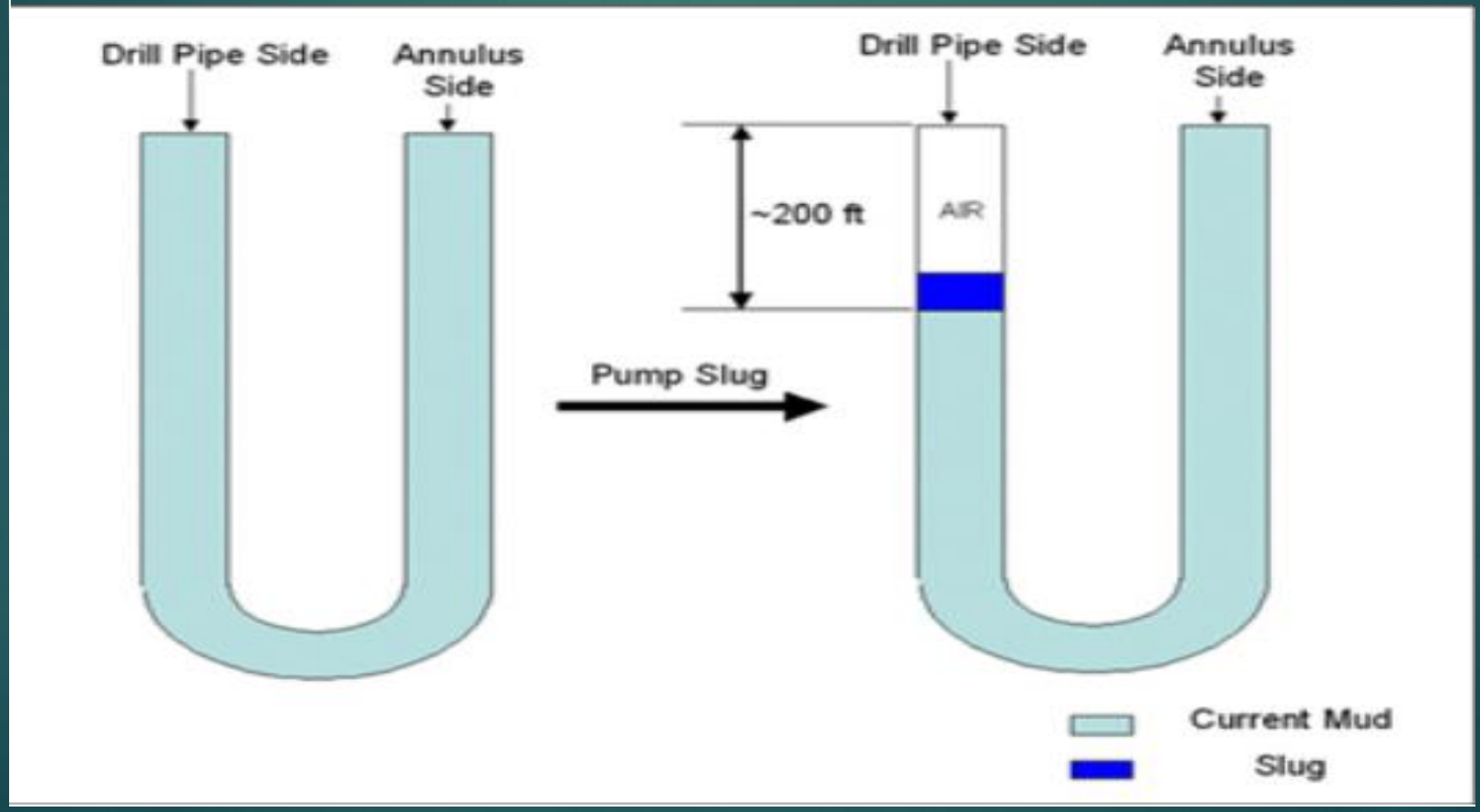
It is heavy mud which is used to push lighter mud weight down before pulling drill pipe out of hole. Slug is used when pipe became wet while pulling out of hole.

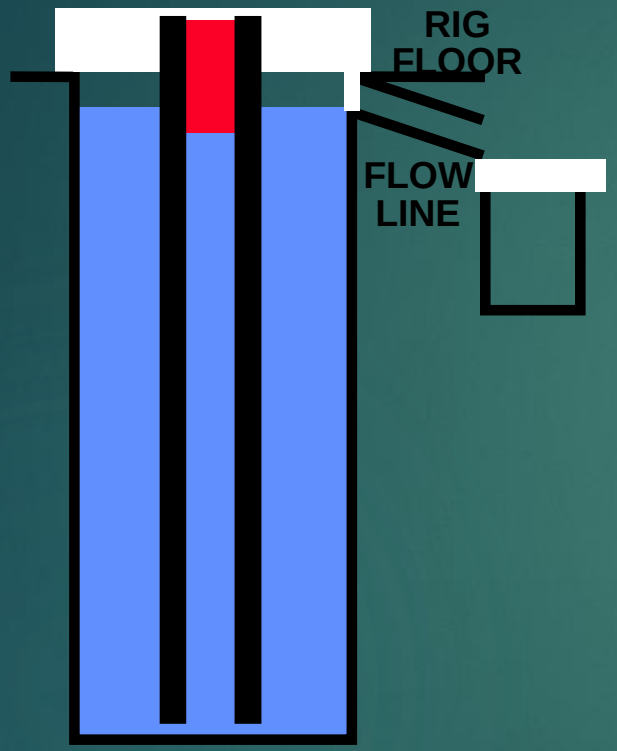
Normally, 1.5 to 2 PPG over current mud weight is a rule of thumb to decide how much weight of slug should be. For example, current mud weight is 10 PPG. Slug weight should be about 11.5 to 12 PPG.

Normally, slug is pumped to push mud down approximate
200 ft (+/2 stands) and slug volume can be calculated by applying a concept of U-tube.

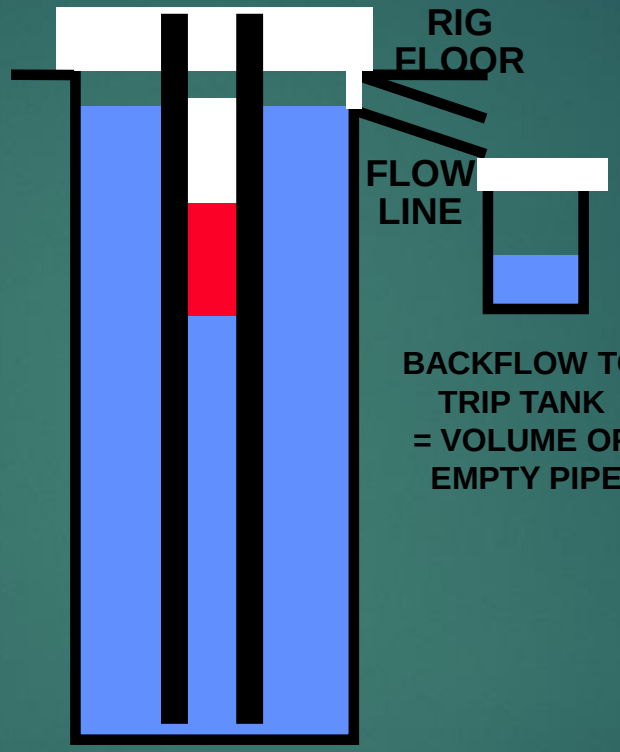
$$Slug\ Volume = \frac{MW\,(ppg) \times Length\,Dry\,PIpe\,(ft) \times DP\,in.\,volumeCap\,(bbl/ft)}{Slug\,MW\,(ppg) - MW\,(ppg)}$$



Effect of Pipe Slugging

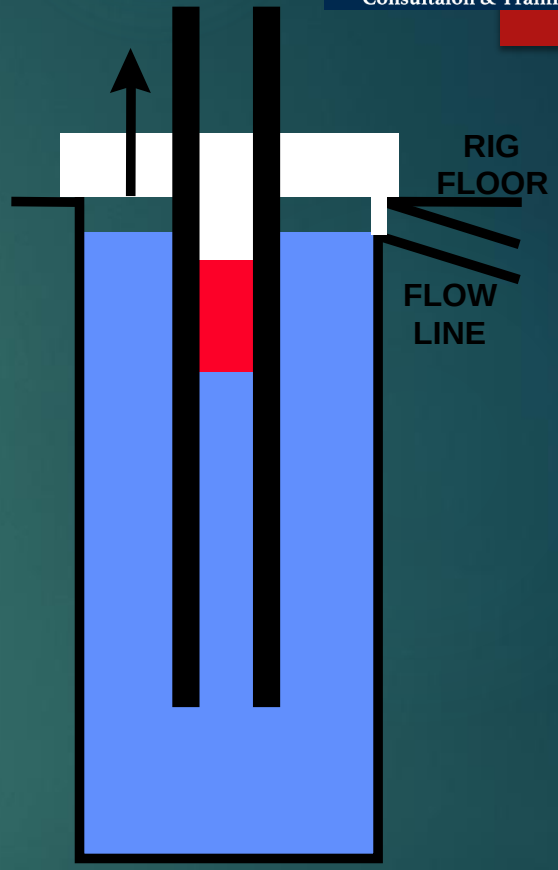


BEFORE SLUG HAS
U-TUBED



BACKFLOW TO
TRIP TANK
= VOLUME OF
EMPTY PIPE

AFTER SLUG HAS
U-TUBED



HEAVY SLUG KEEPS
MUD LEVEL INSIDE PIPE
BELOW RIG FLOOR
(*Pulling 'DRY'*)

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CAUSES OF KICKS
(REDUCTION IN MUD LEVEL)

HOW CAN HYDROSTATIC PRESSURE CHANGE?

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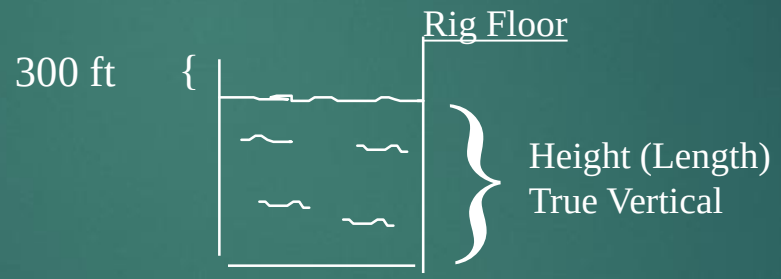
Mud Wt

Mud Level



Mud Wt = 11 ppg
Level Drop = 300 ft

What is loss of hydrostatic pressure?

LOSSES

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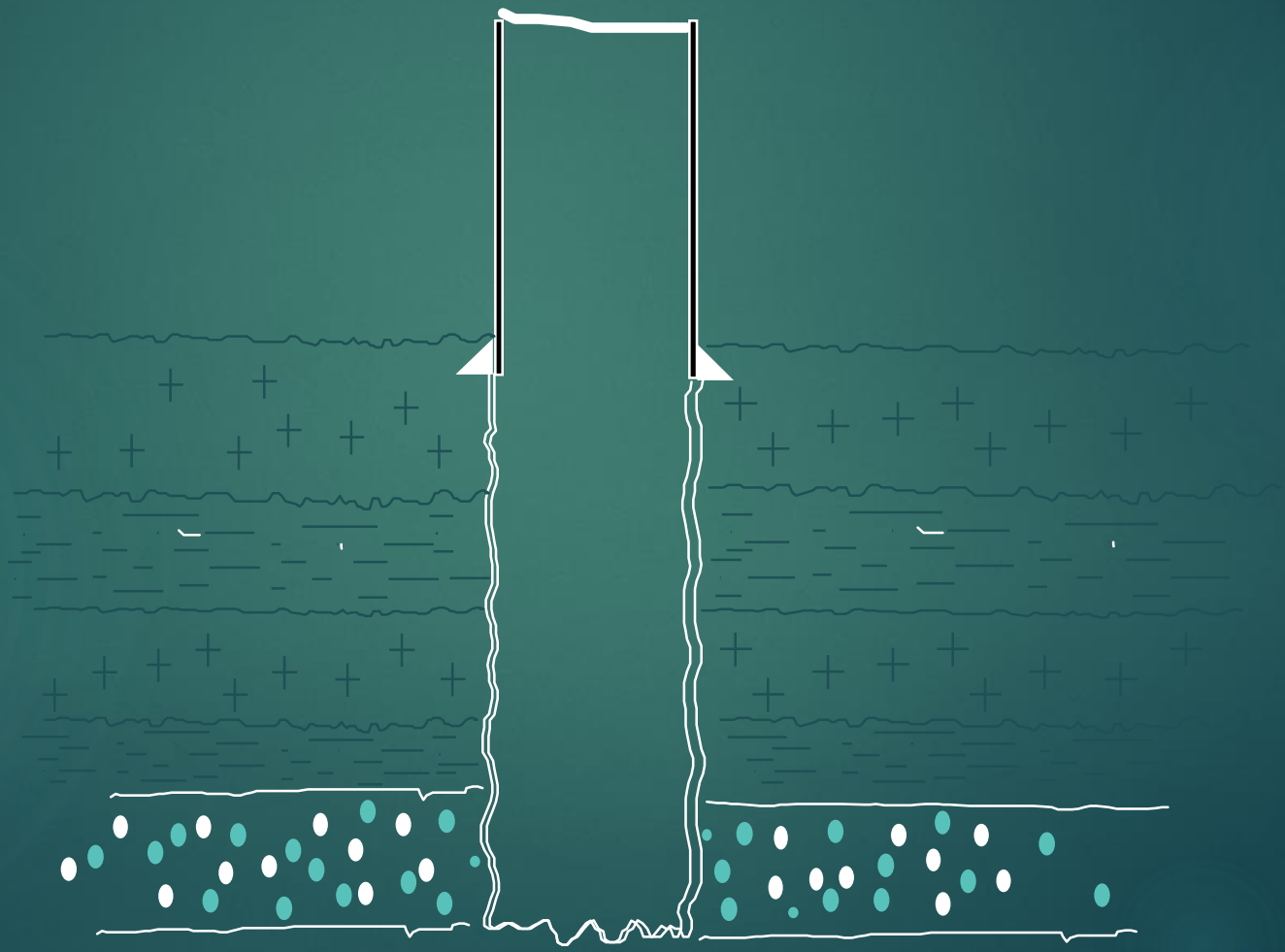

LOSSES

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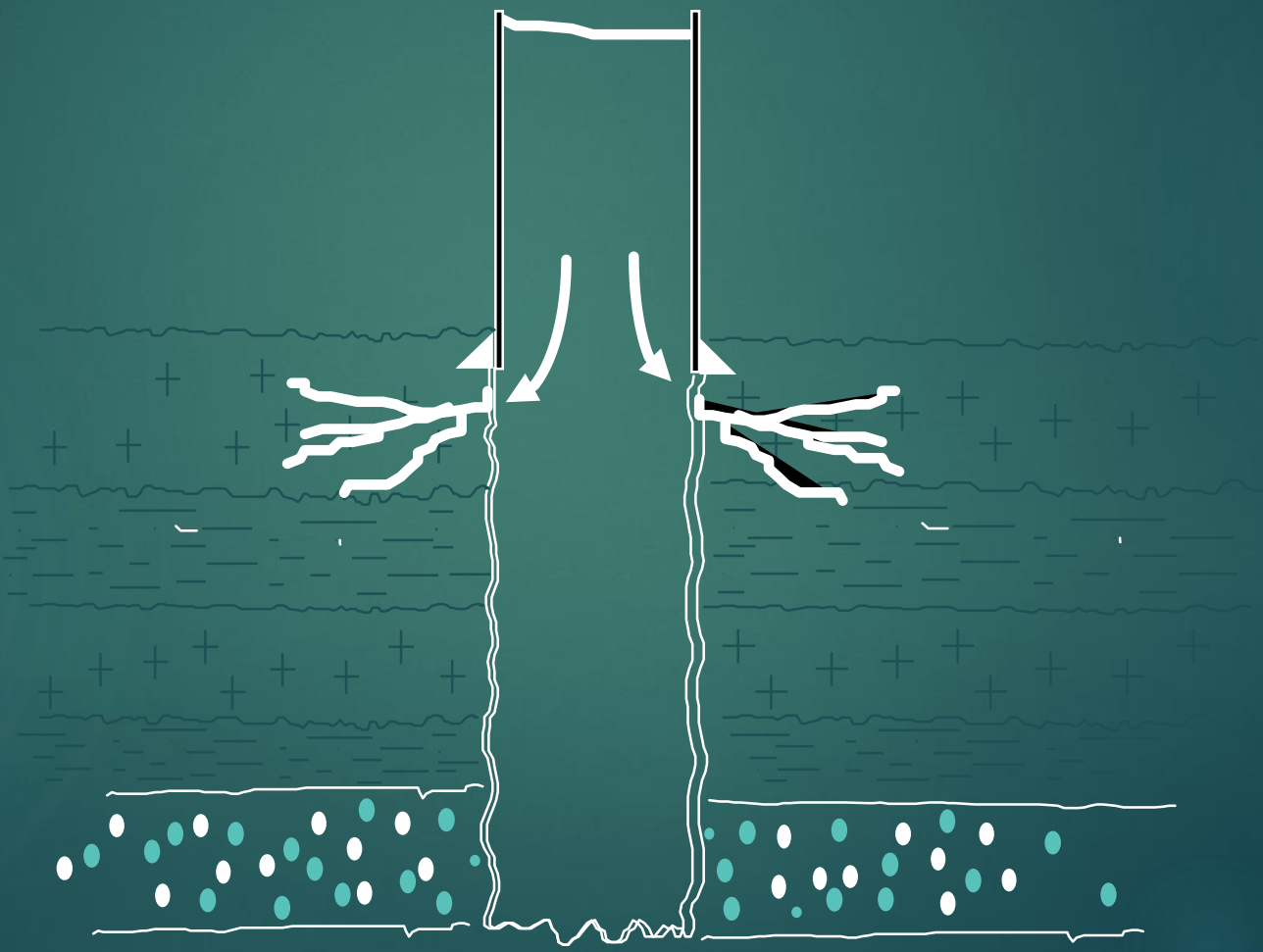

LOSSES

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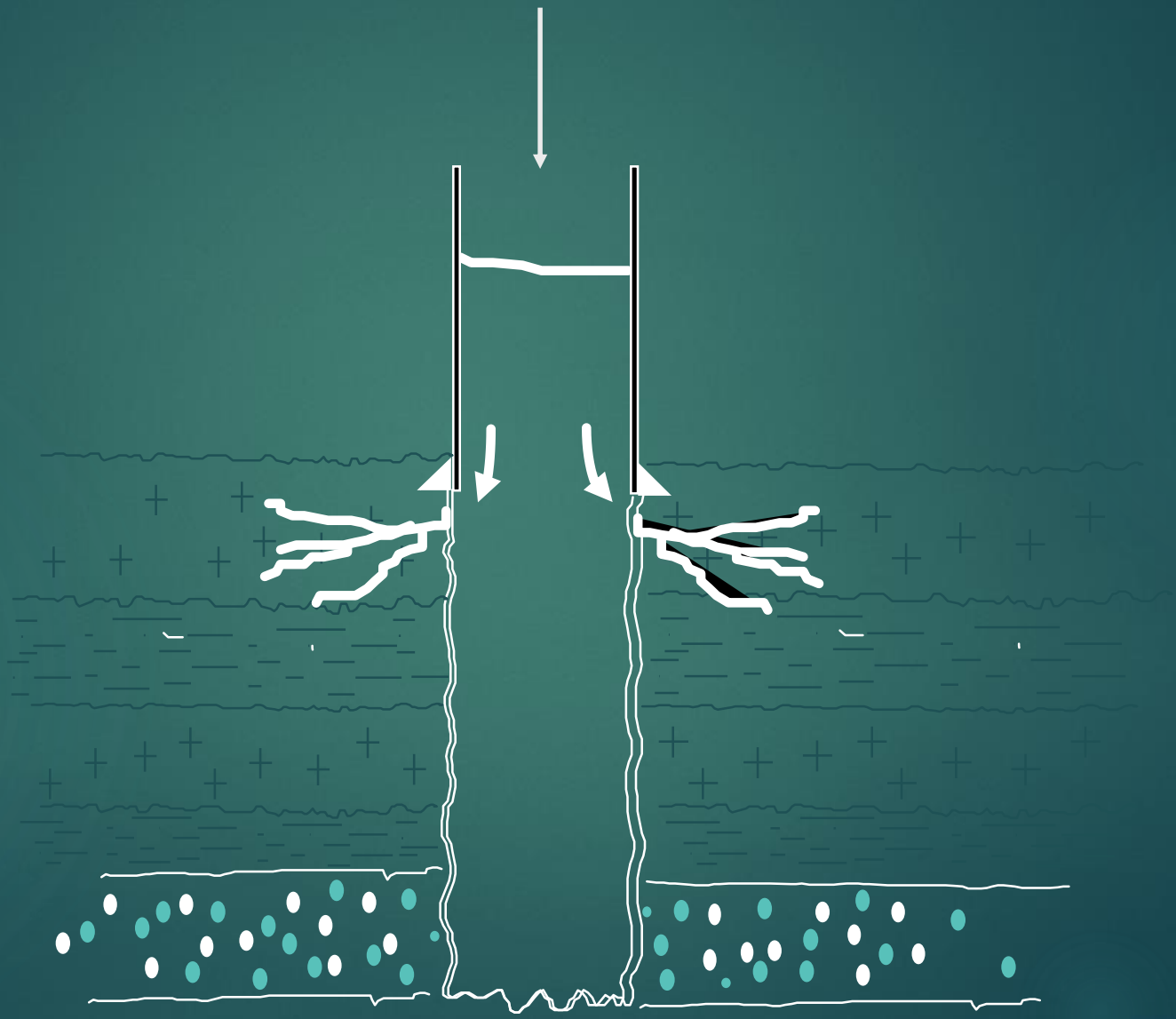

Avoid losses by Lost Circulation Material (LCM)

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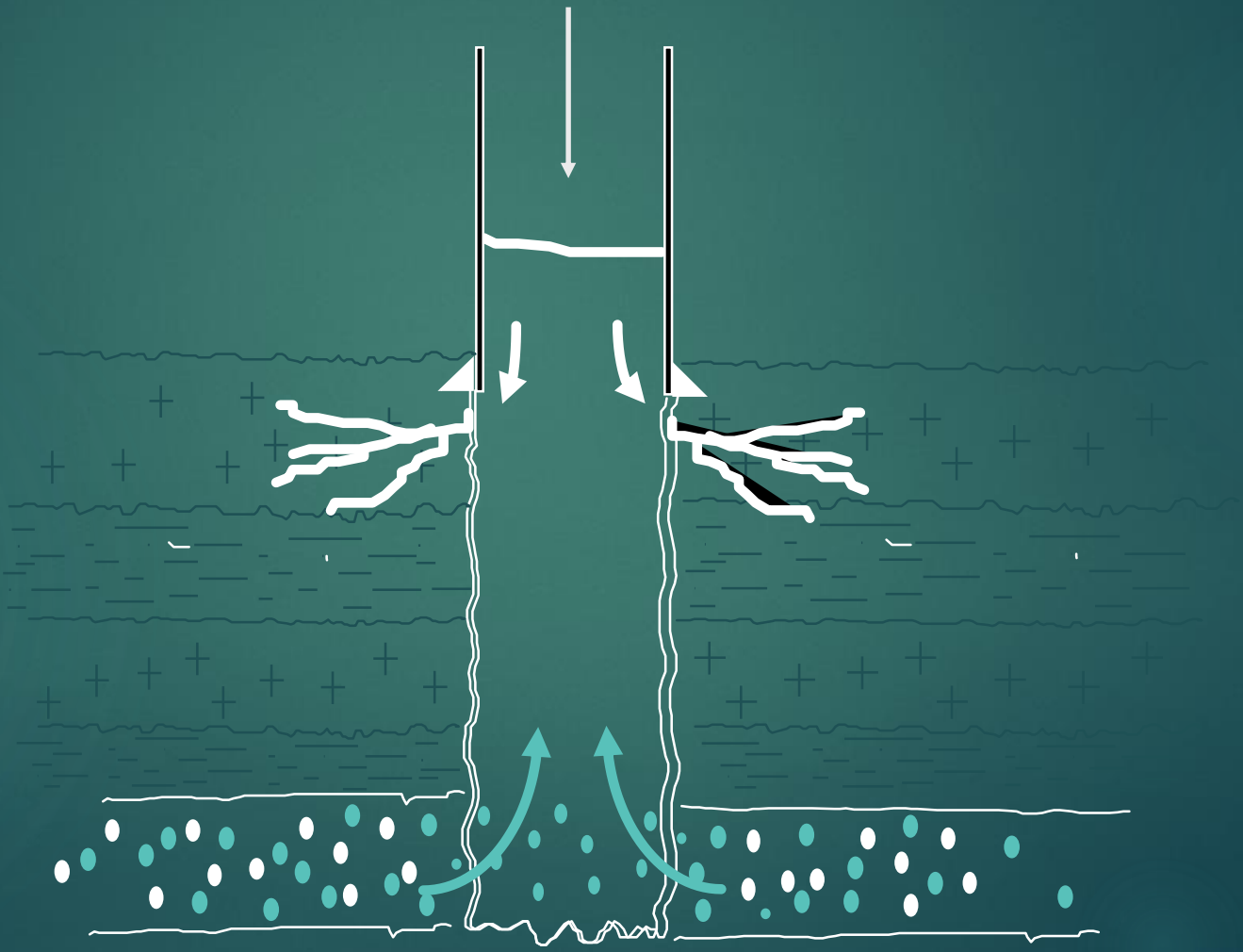
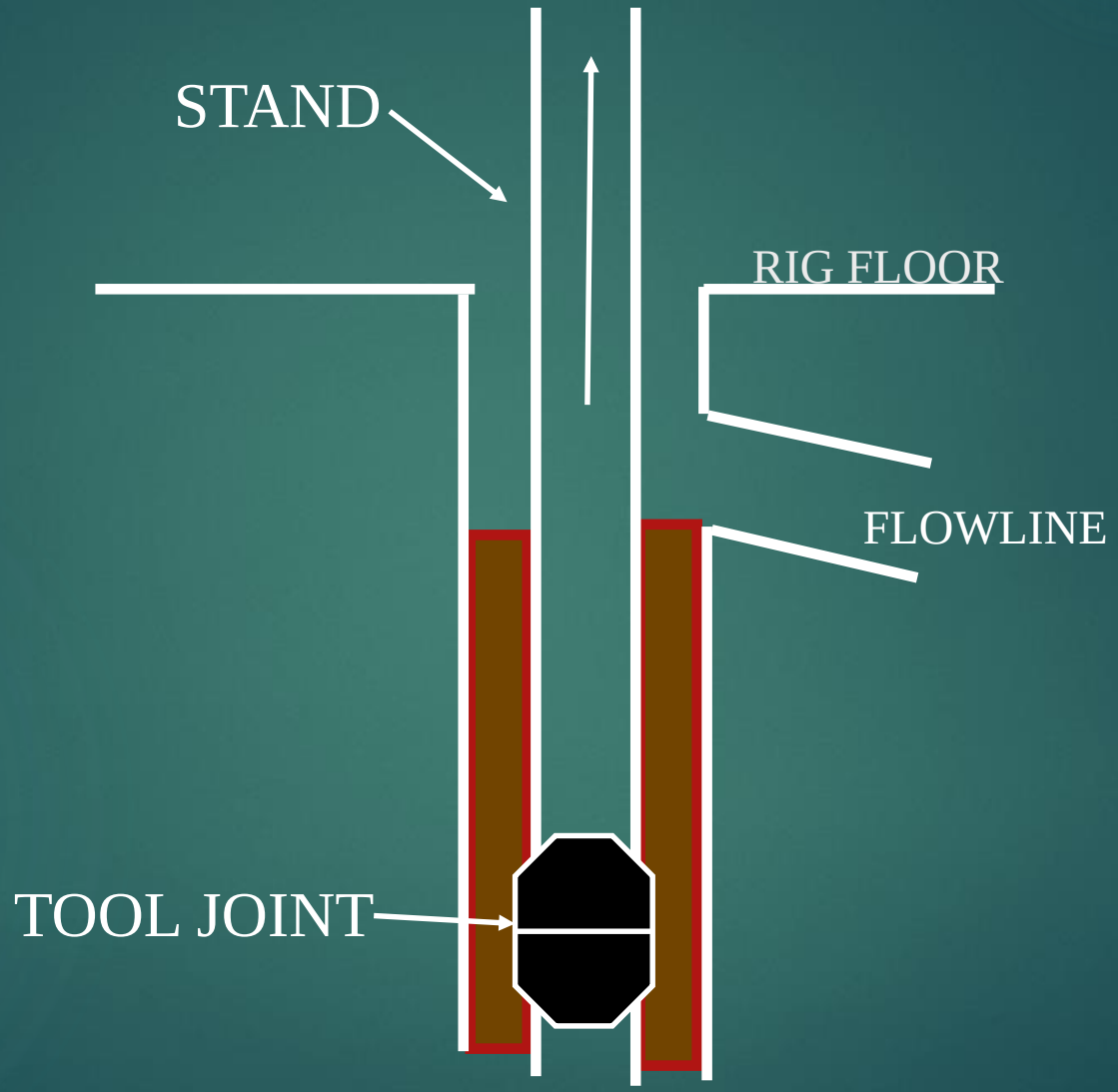
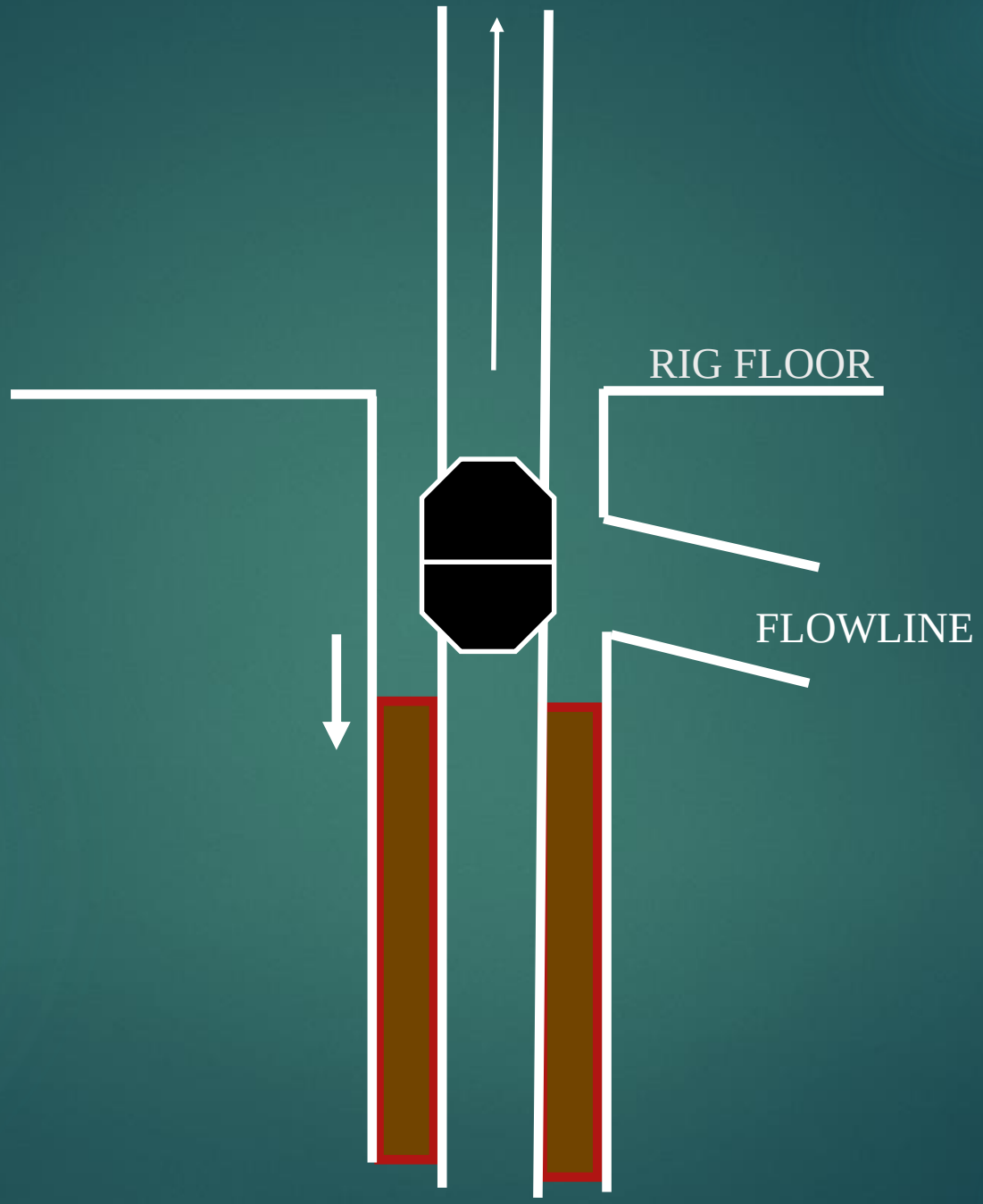
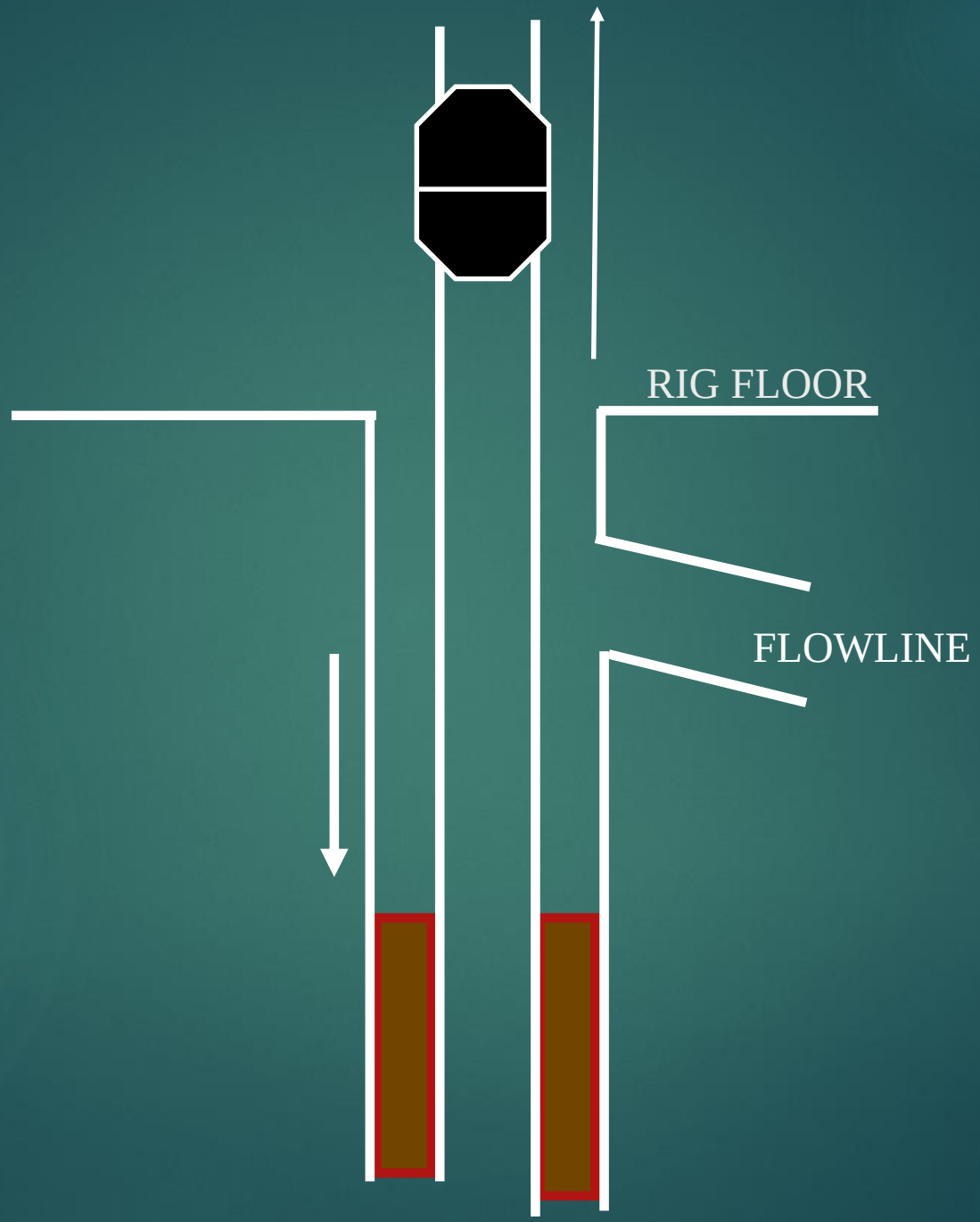


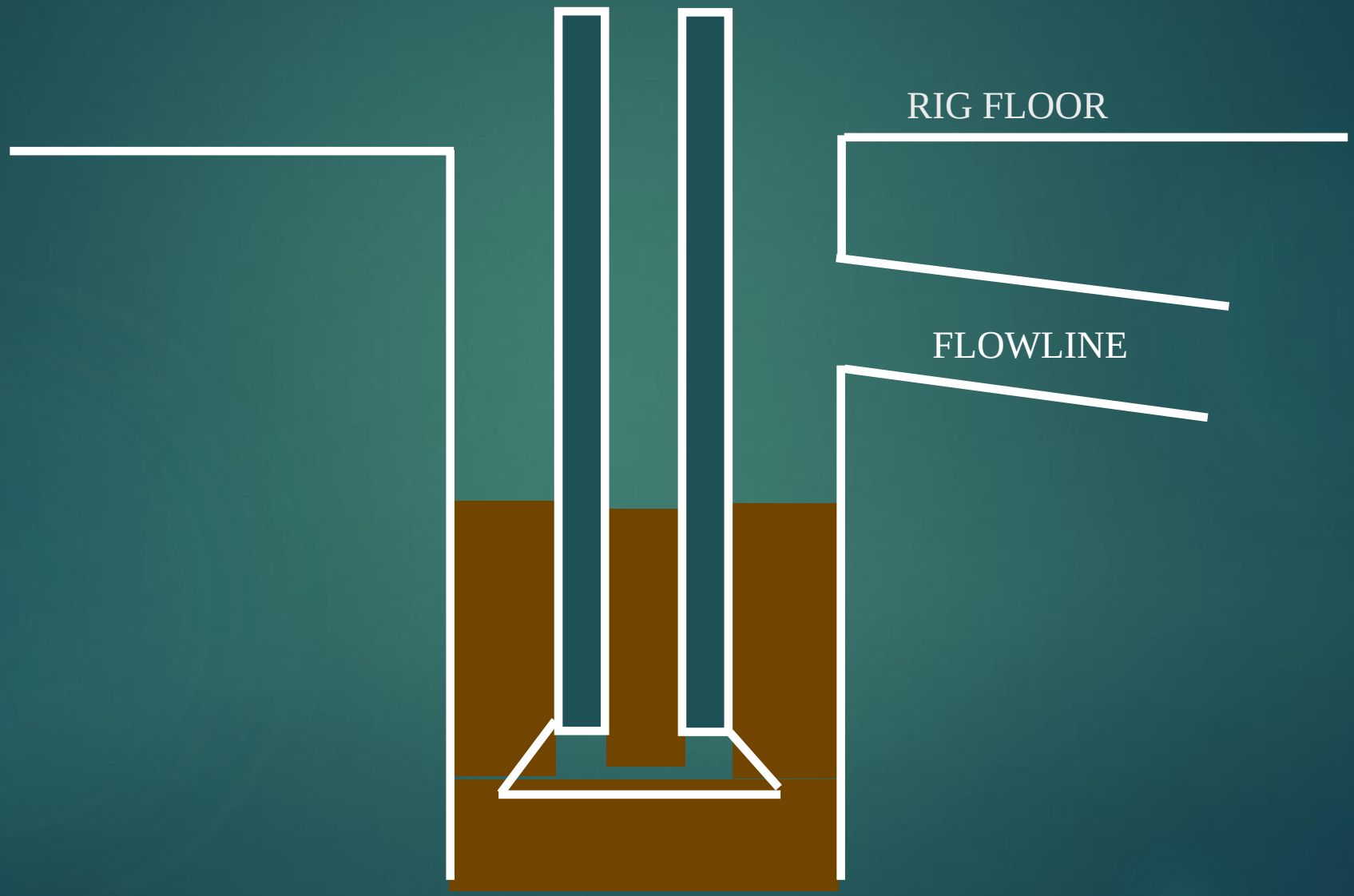
Pulling out drill string



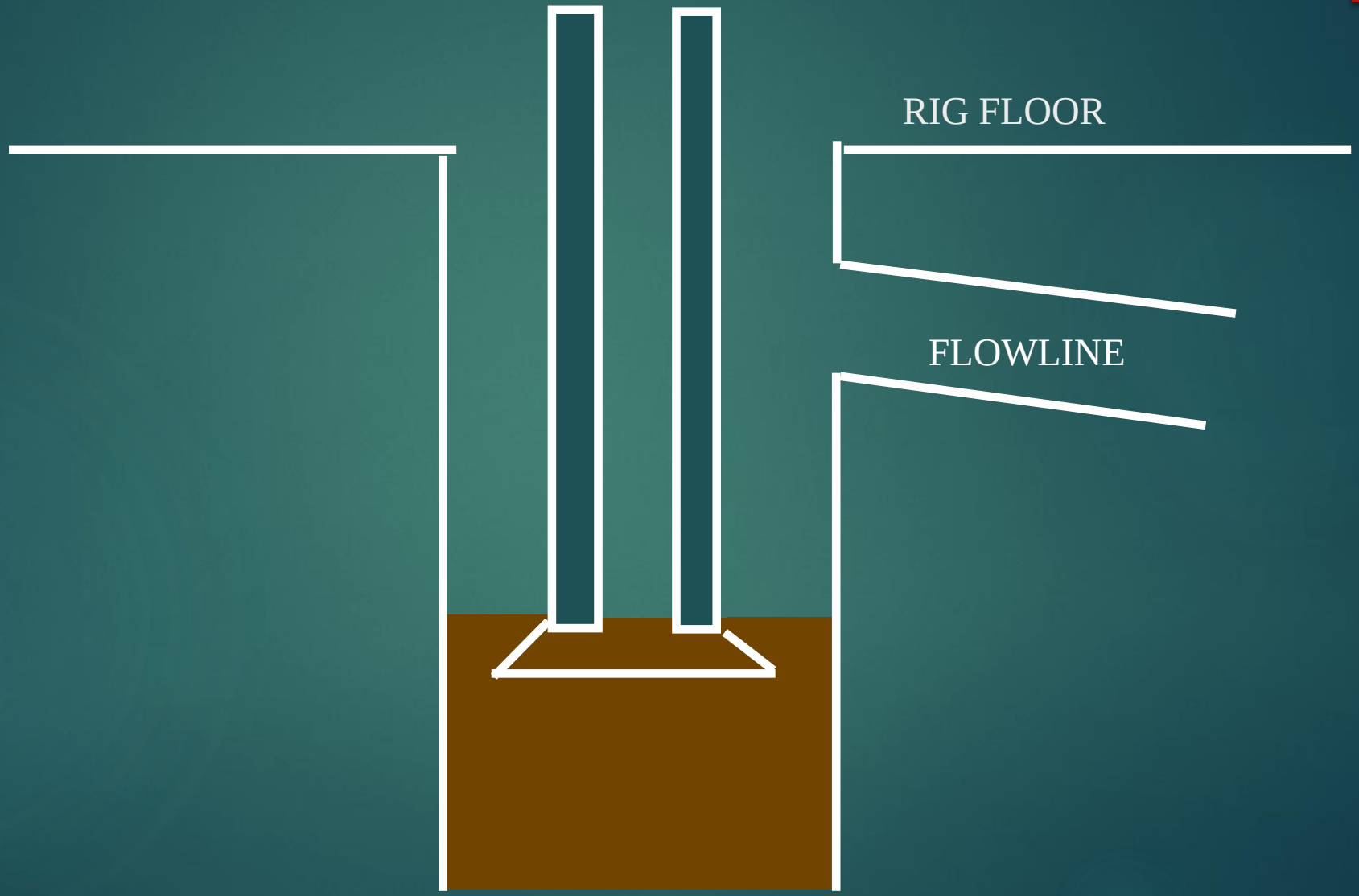

RIG FLOOR
FLOWLINE


RIG FLOOR
FLOWLINE

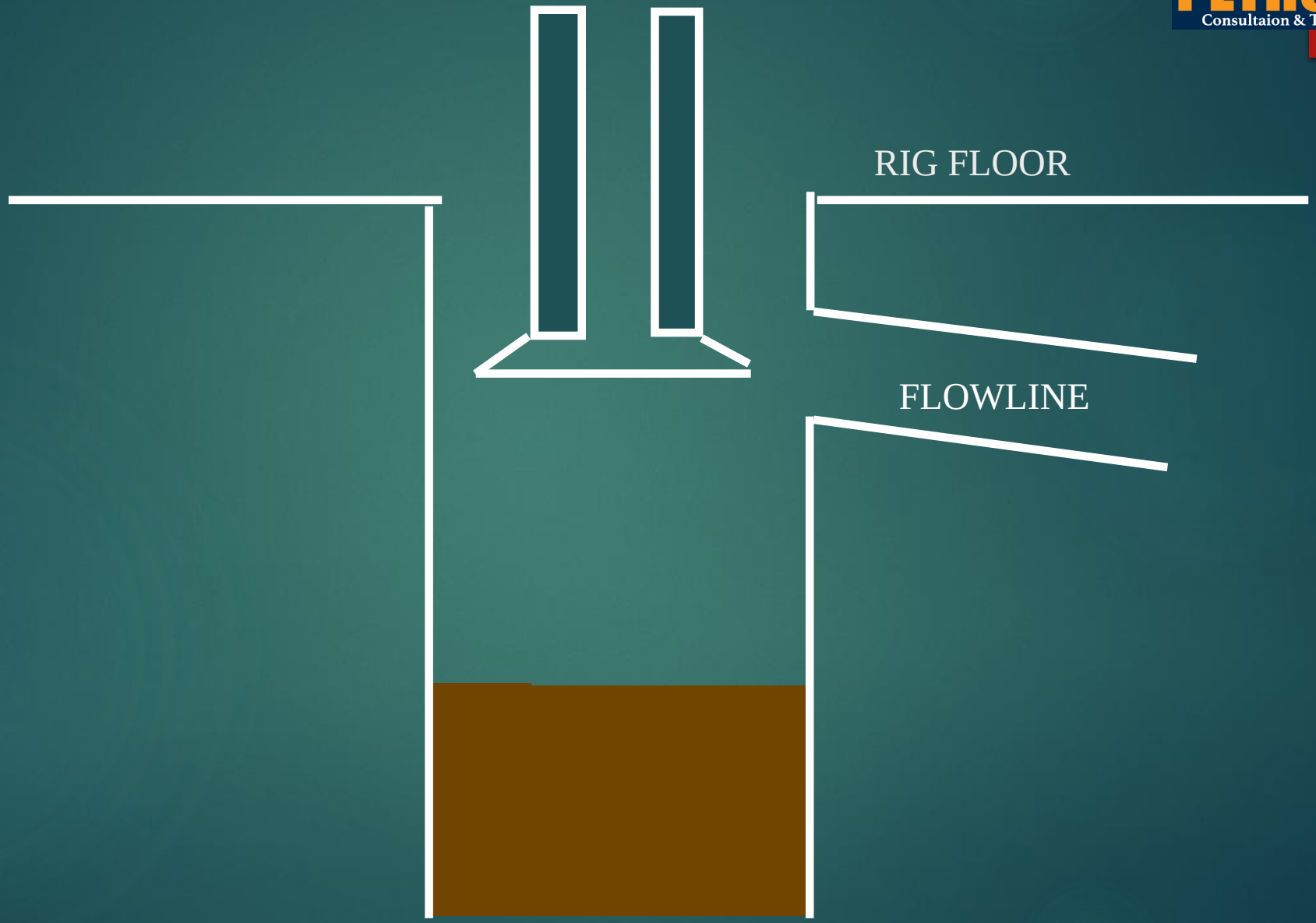
PULLING COLLARS



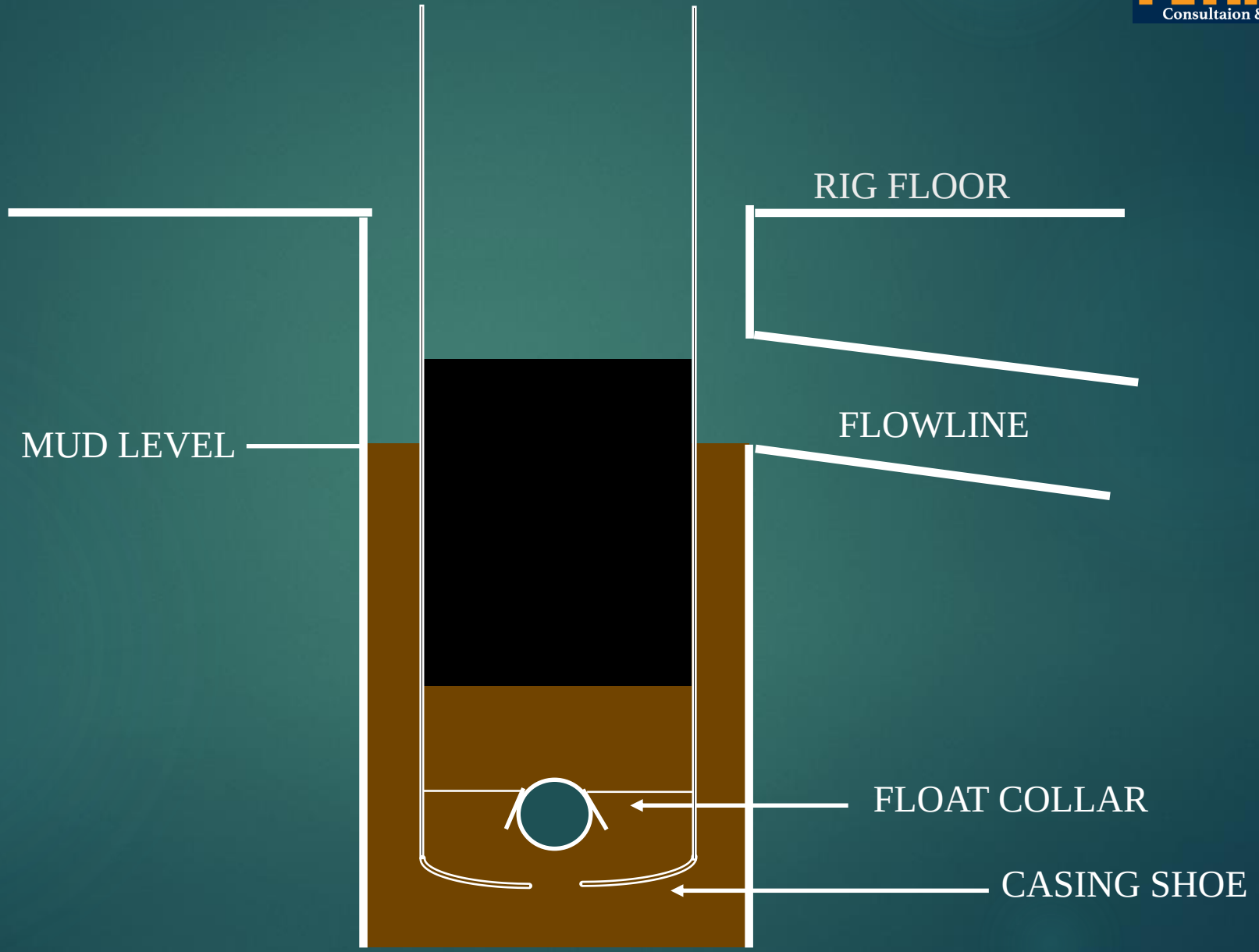
PULLING COLLARS



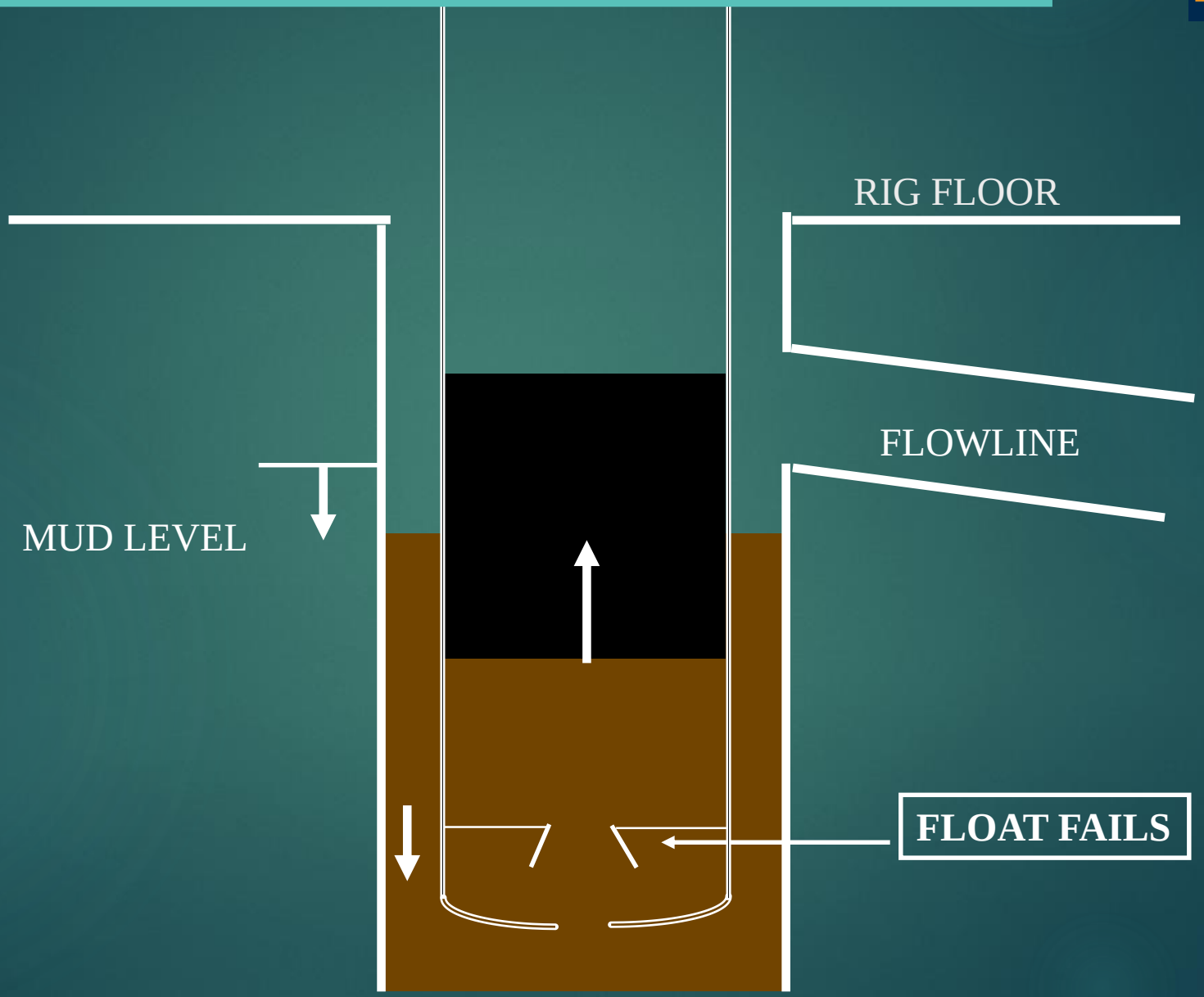
PULLING COLLARS



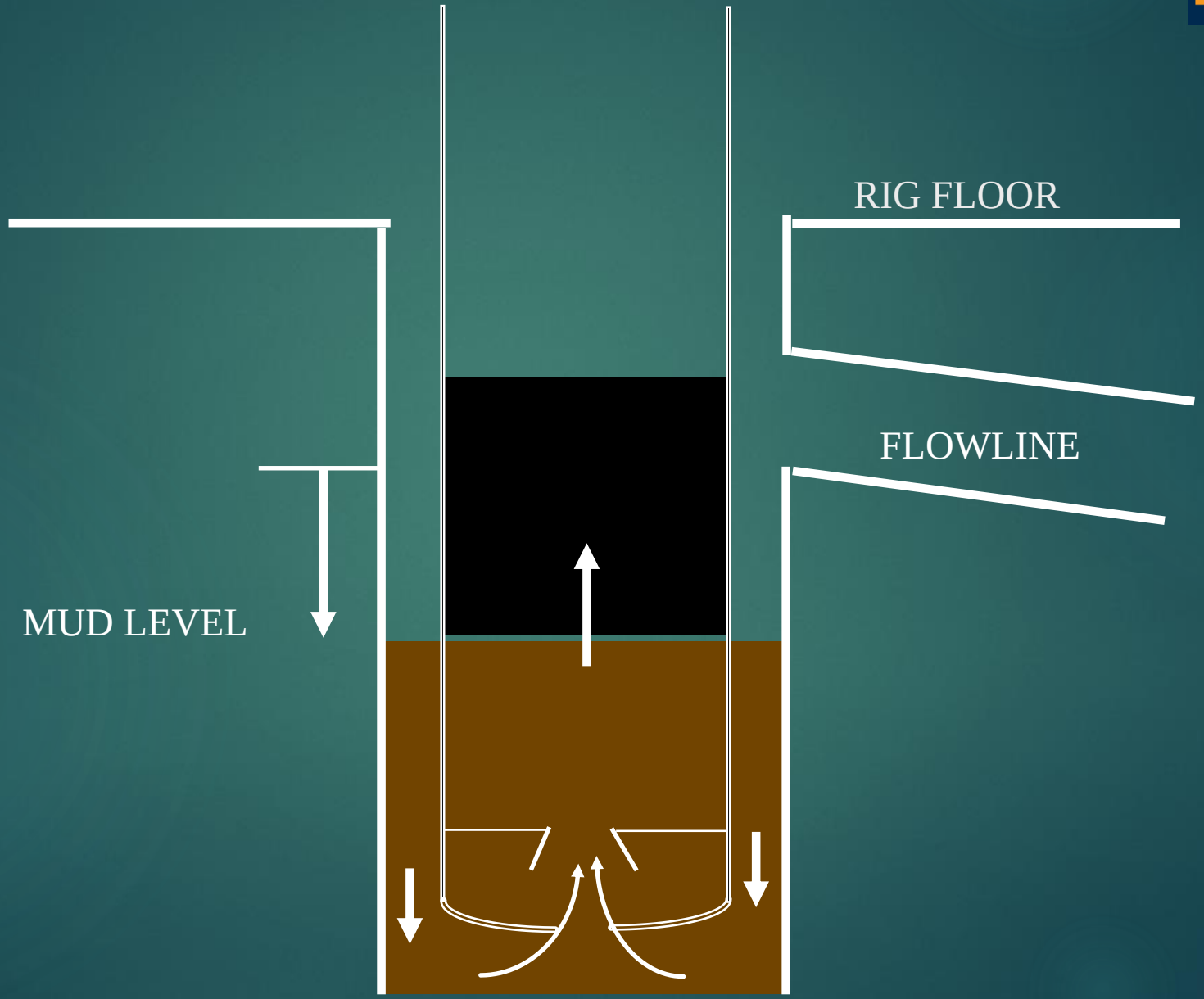
FAILURE OF FLOAT COLLAR



FAILURE OF FLOAT COLLAR



FAILURE OF FLOAT COLLAR



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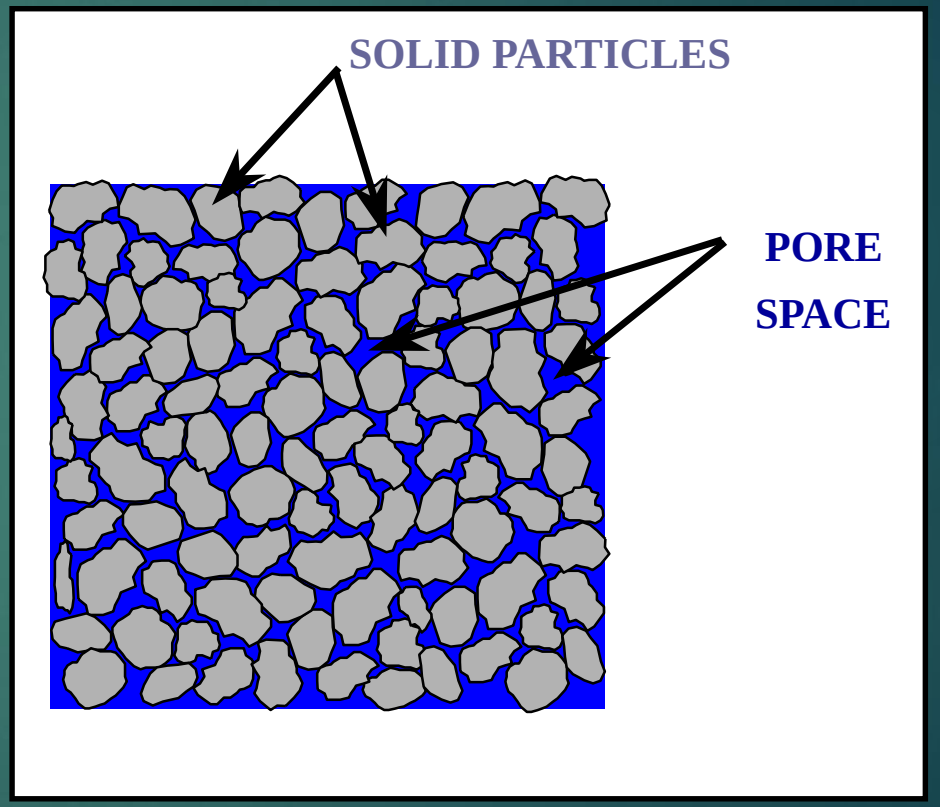
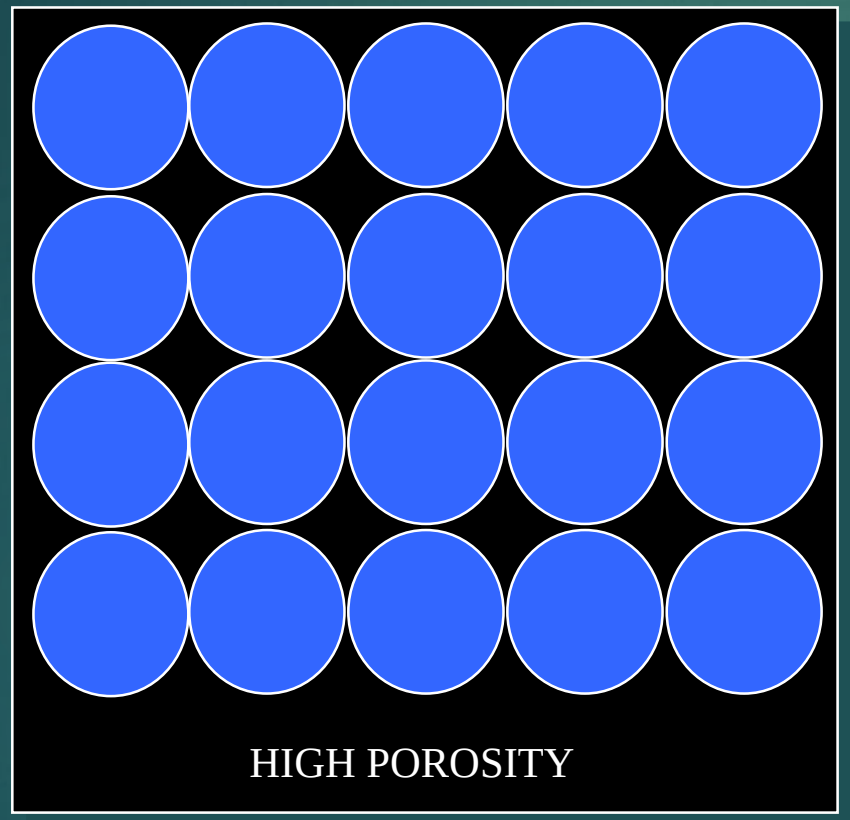
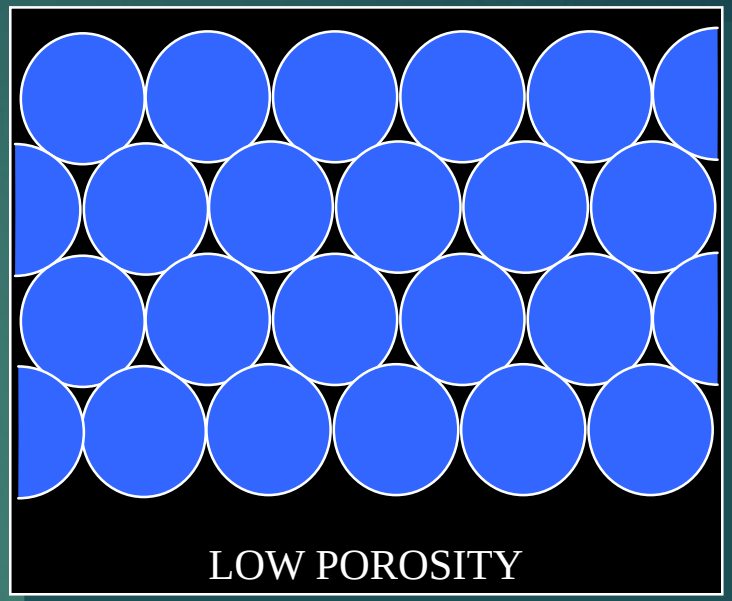
CAUSES OF KICKS
(ABNORMAL PRESSURE)

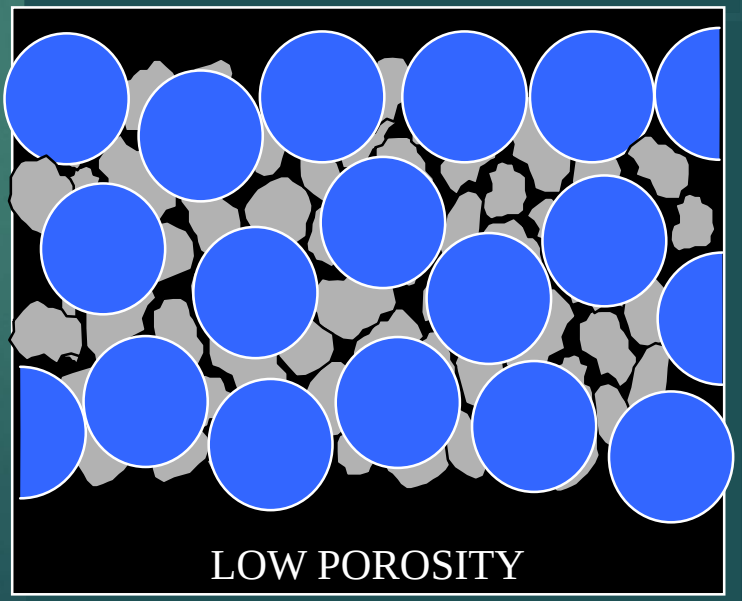
Porosity



Porosity







What is Permeability?

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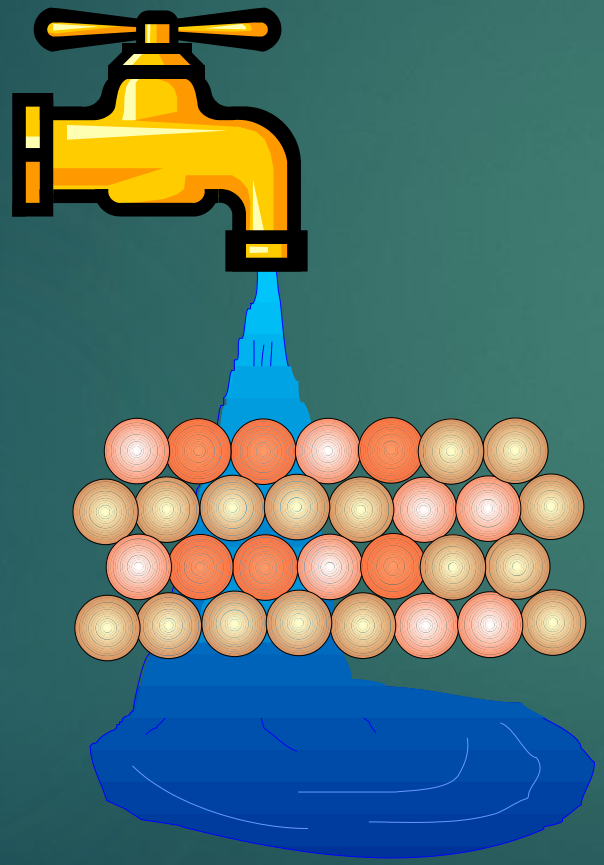
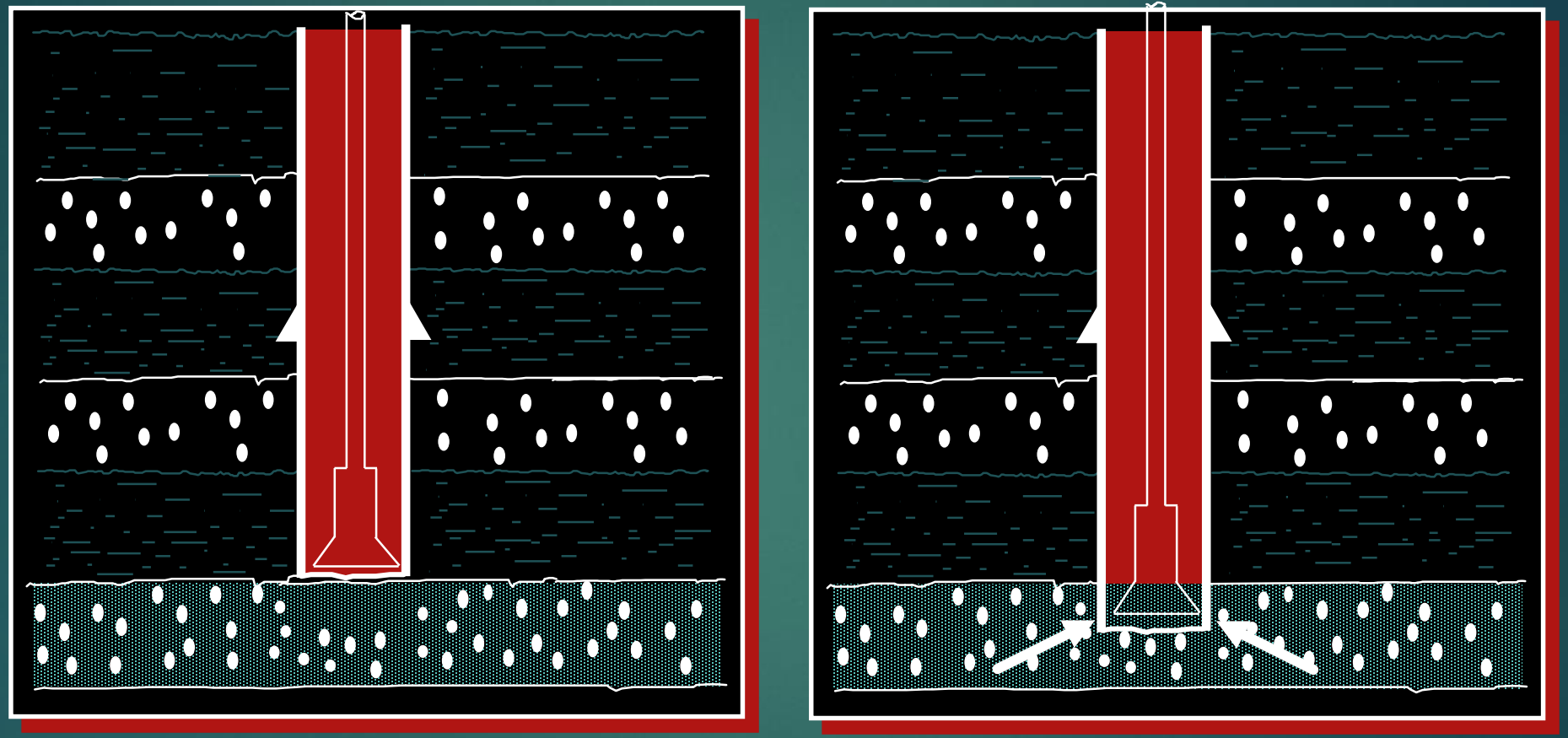
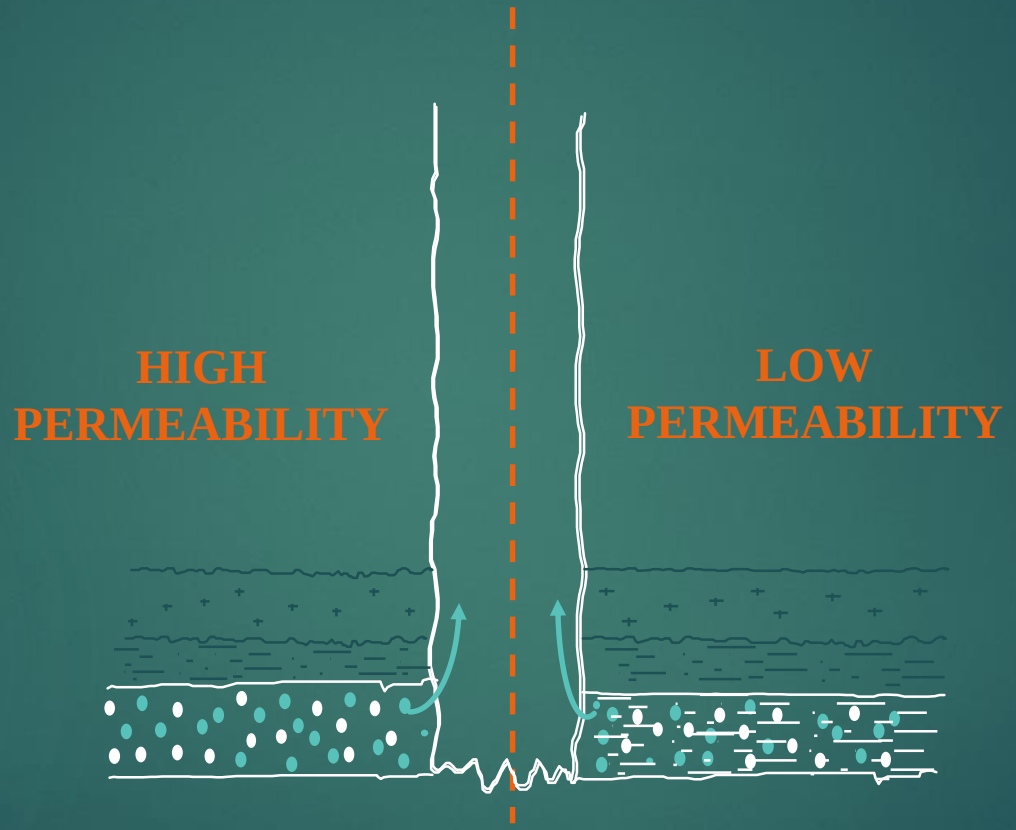


Permeability



FORMATION PERMEABILITY

Ability of rock to allow fluid to move between pore spaces



CAUSES OF KICKS.

REVISION:

KICKS OCCUR WHEN

“ UNDERBALANCE ”

CAUSES OF KICKS.

REVISION:

KICKS OCCUR WHEN

“ UNDERBALANCE ”

UNDERBALANCE IS CAUSED BY :

CAUSES OF KICKS.

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REVISION:

KICKS OCCUR WHEN

“ UNDERBALANCE ”

UNDERBALANCE IS CAUSED BY :

1. MUD WEIGHT REDUCTION.

CAUSES OF KICKS.

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REVISION:

KICKS OCCUR WHEN

“ UNDERBALANCE ”

UNDERBALANCE IS CAUSED BY :

1. **MUD WEIGHT REDUCTION.**
2. **DROP IN MUD LEVEL.**

CAUSES OF KICKS.

REVISION:

KICKS OCCUR WHEN
“ UNDERBALANCE ”

UNDERBALANCE IS CAUSED BY :

1. **MUD WEIGHT REDUCTION.**
2. **DROP IN MUD LEVEL.**
3. **INCREASE IN FORMATION PRESSURE.**

WHAT IS ABNORMAL PRESSURE?

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- FORMATION FLUID GRADIANT IS GREATER THAN RESSURE GRADIANT OF SEA WATER.

- 99.99+% OF FORMATION FLUIDS ARE WATER

- FORMATION WATER EQUALS

  Average Density = 8.9 PPG

  Pressure Gradient = 0.465 PSI/FT

CAUSES OF ABNORMAL PRESSURE

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1/ UNDER COMPACTION

2/ FAULTING

3/ SALT DOME

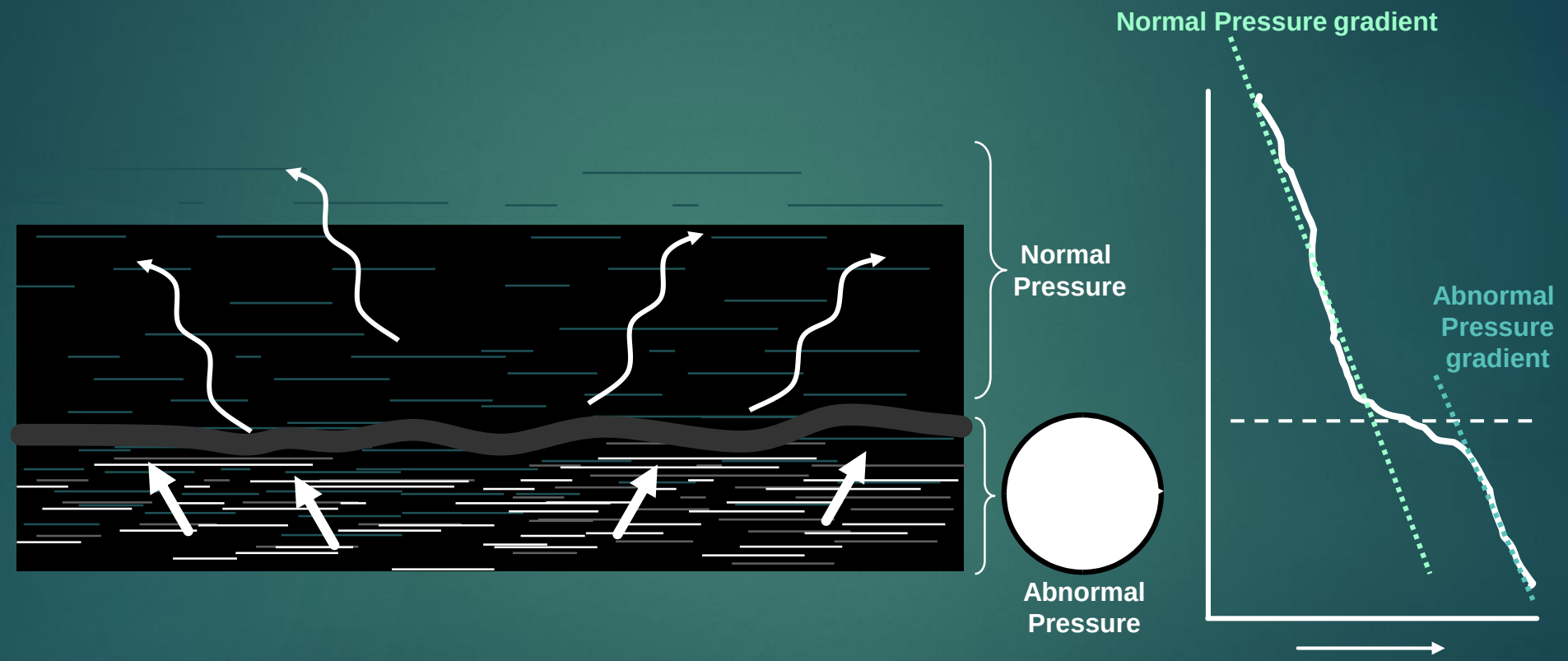
4/ ARTESIAN

5/ GAS CAP

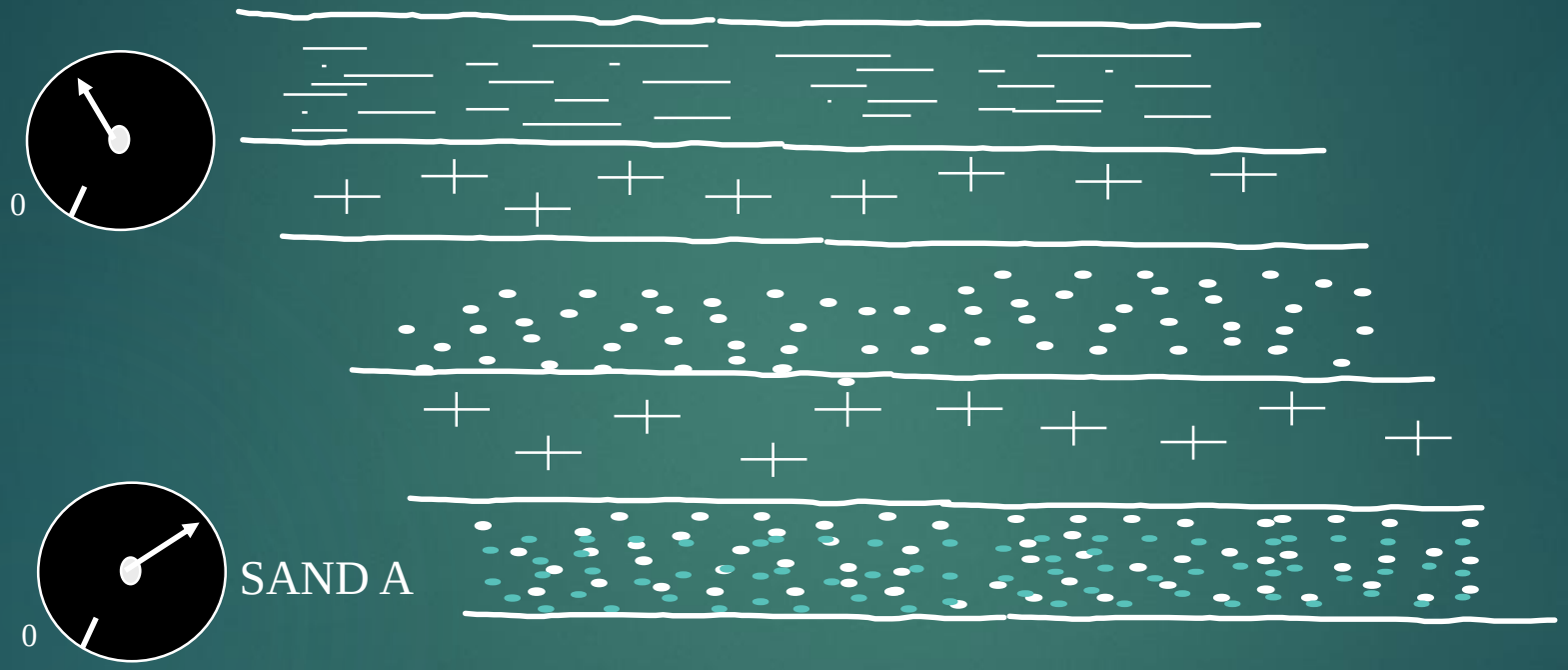
1- Compaction

= Dewatering

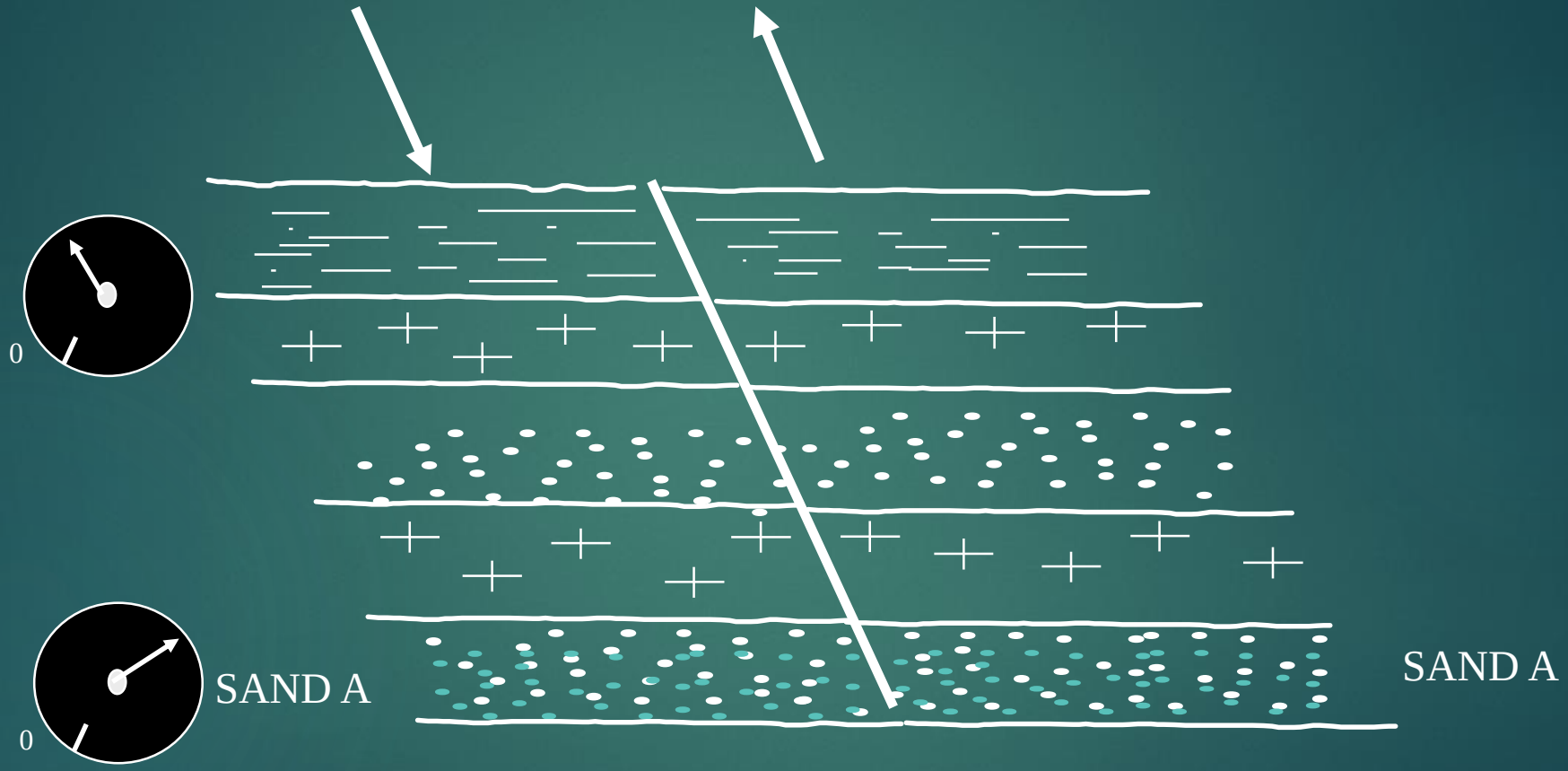
Trapped Water in Clays



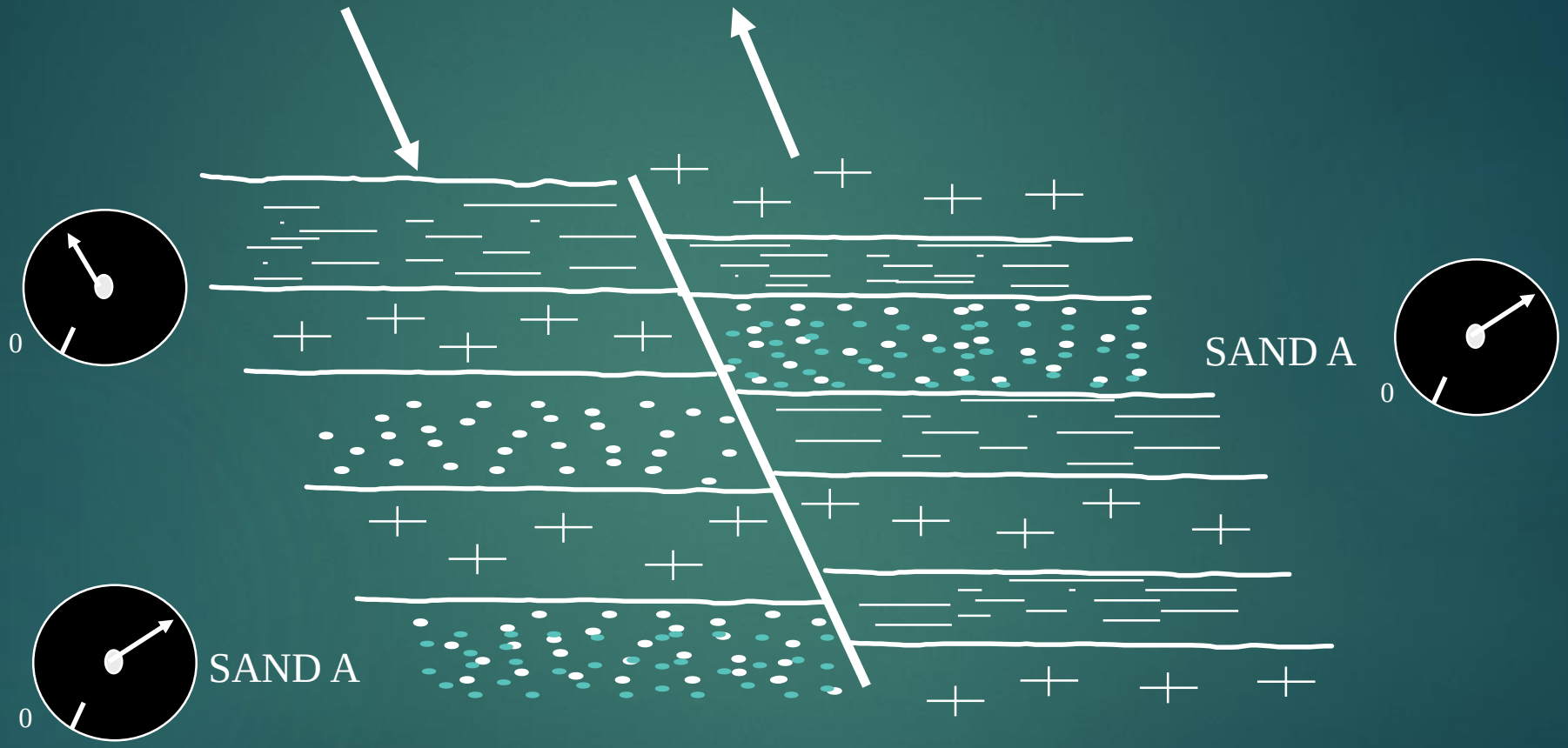
2- FAULTING



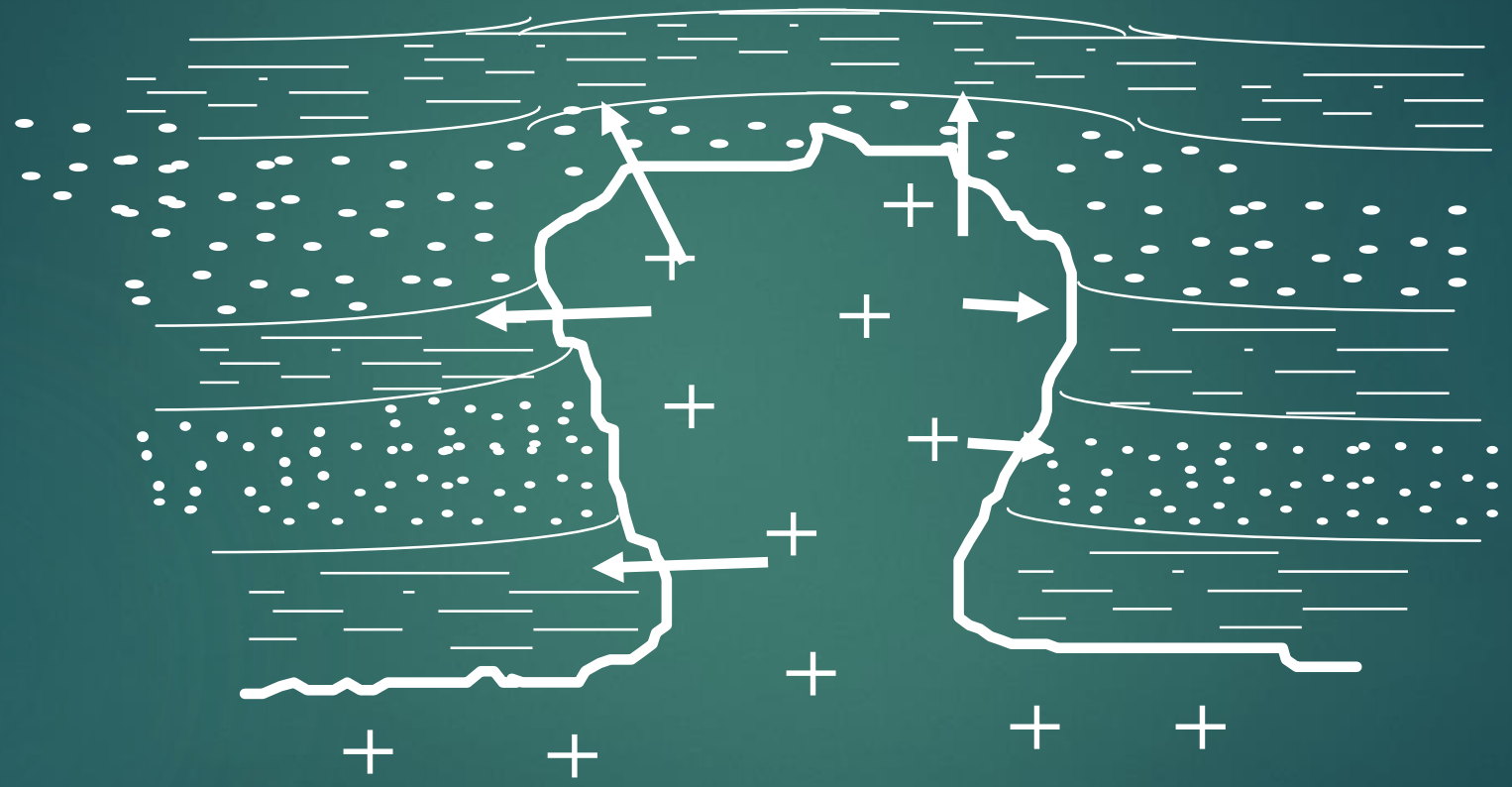
FAULTING



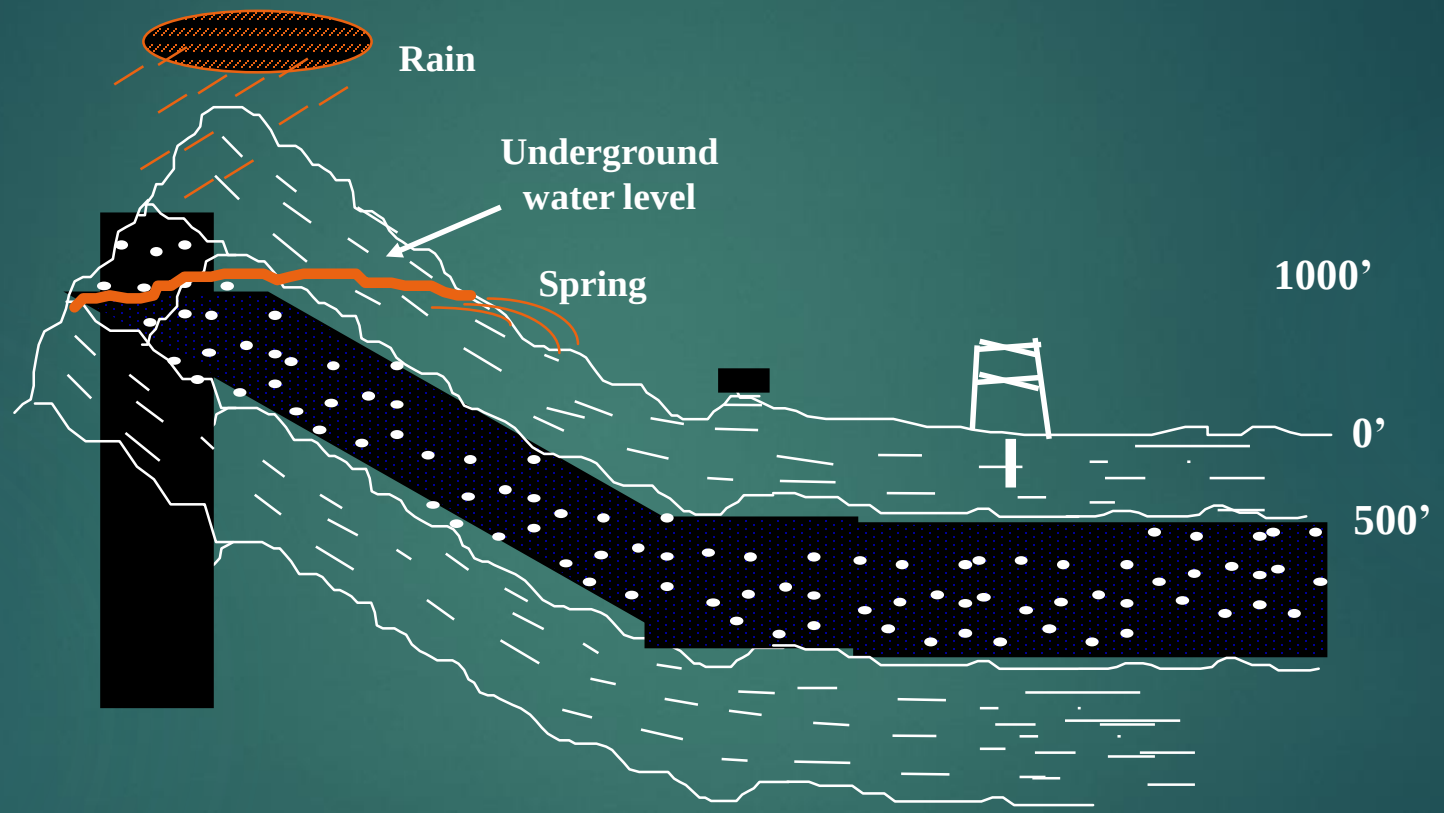
FAULTING



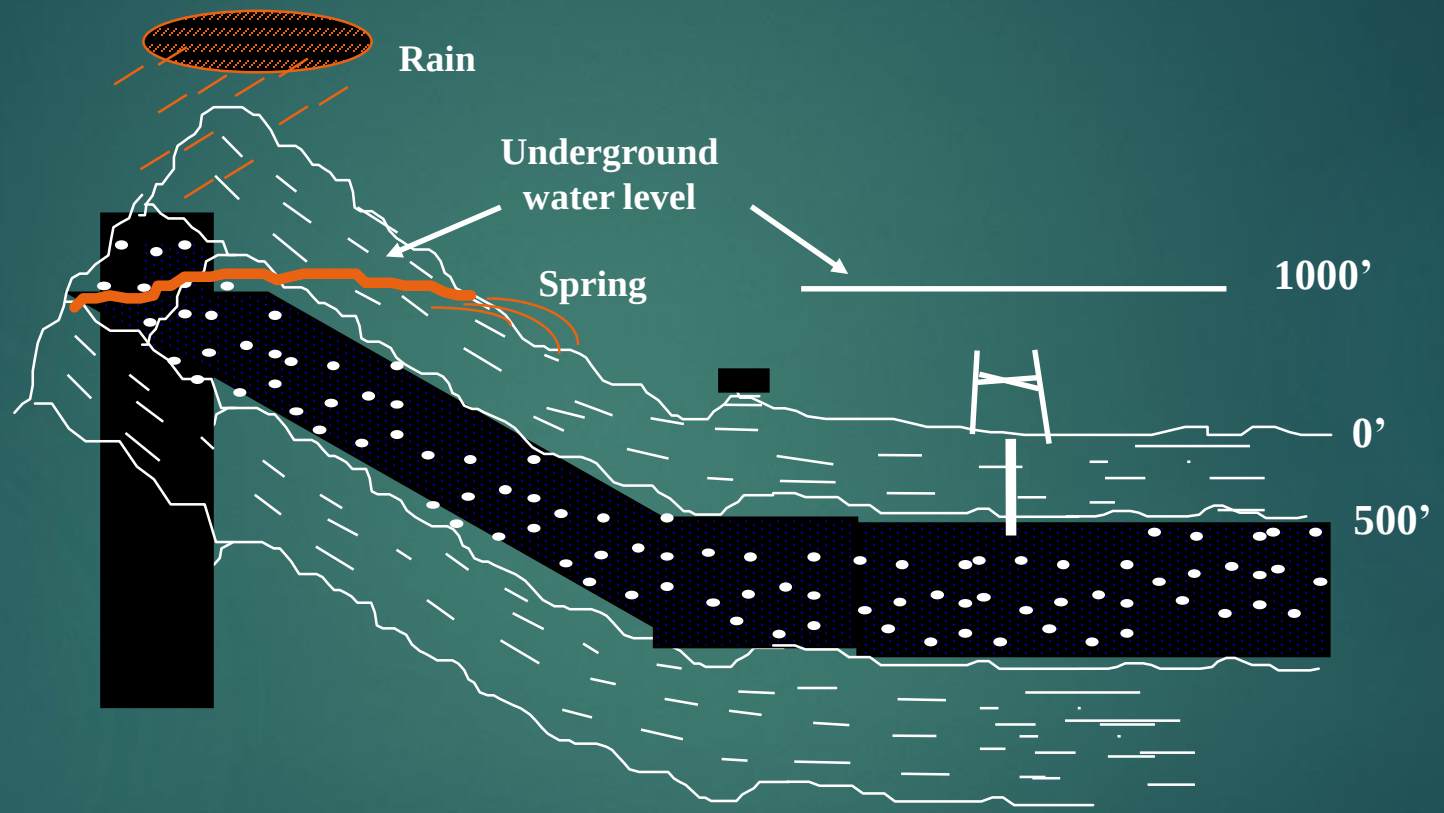
3- SALT DOMES



4- ARTESIAN EFFECTS



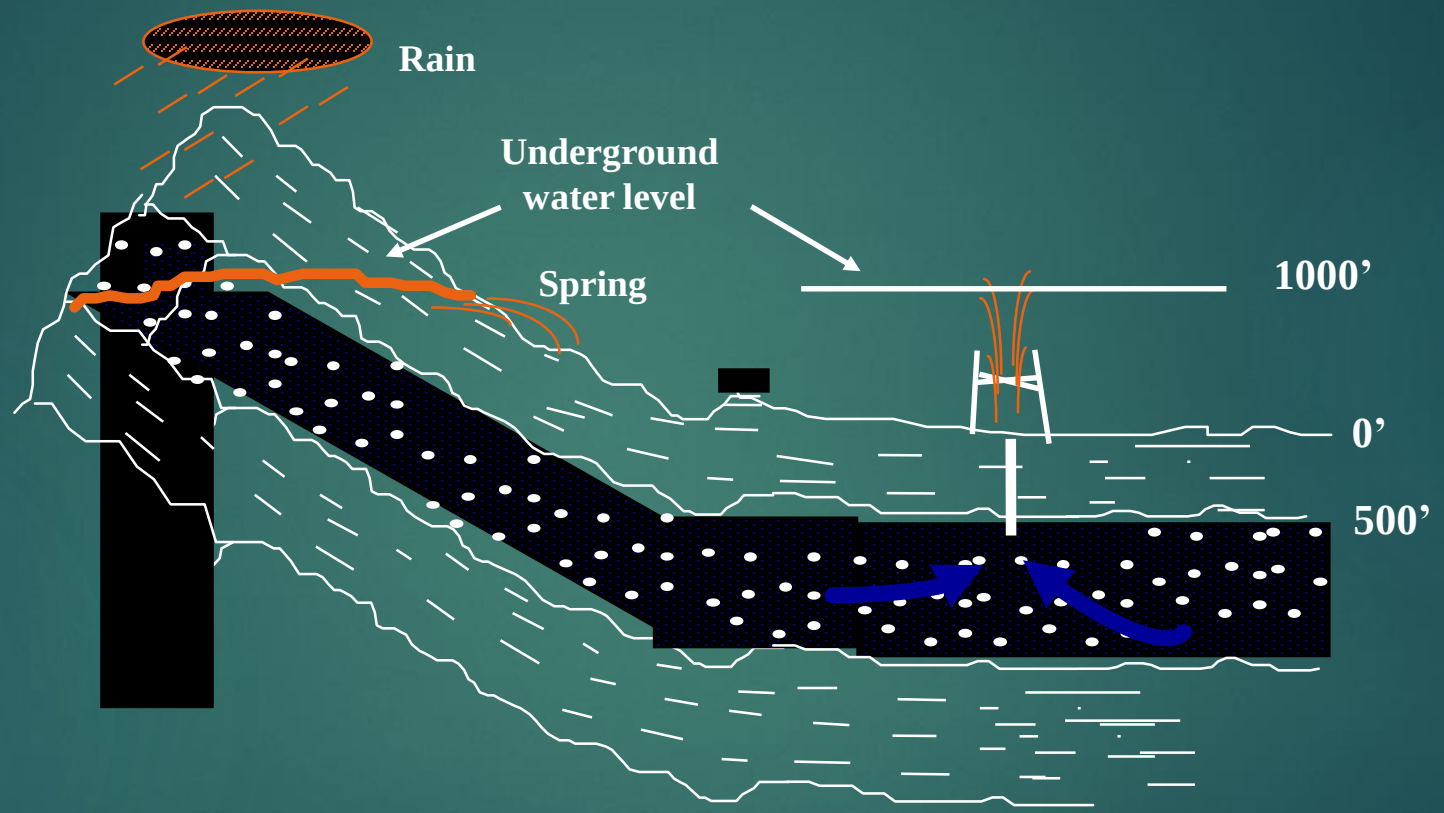
ARTESIAN EFFECTS



CALCULATE MUD WEIGHT TO BALANCE?

FORMATION WATER = 0.433 PSI/FT

ARTESIAN EFFECTS



CALCULATE MUD WEIGHT TO BALANCE?

FORMATION WATER = .433 PSI/FT

GAS CAP EFFECT