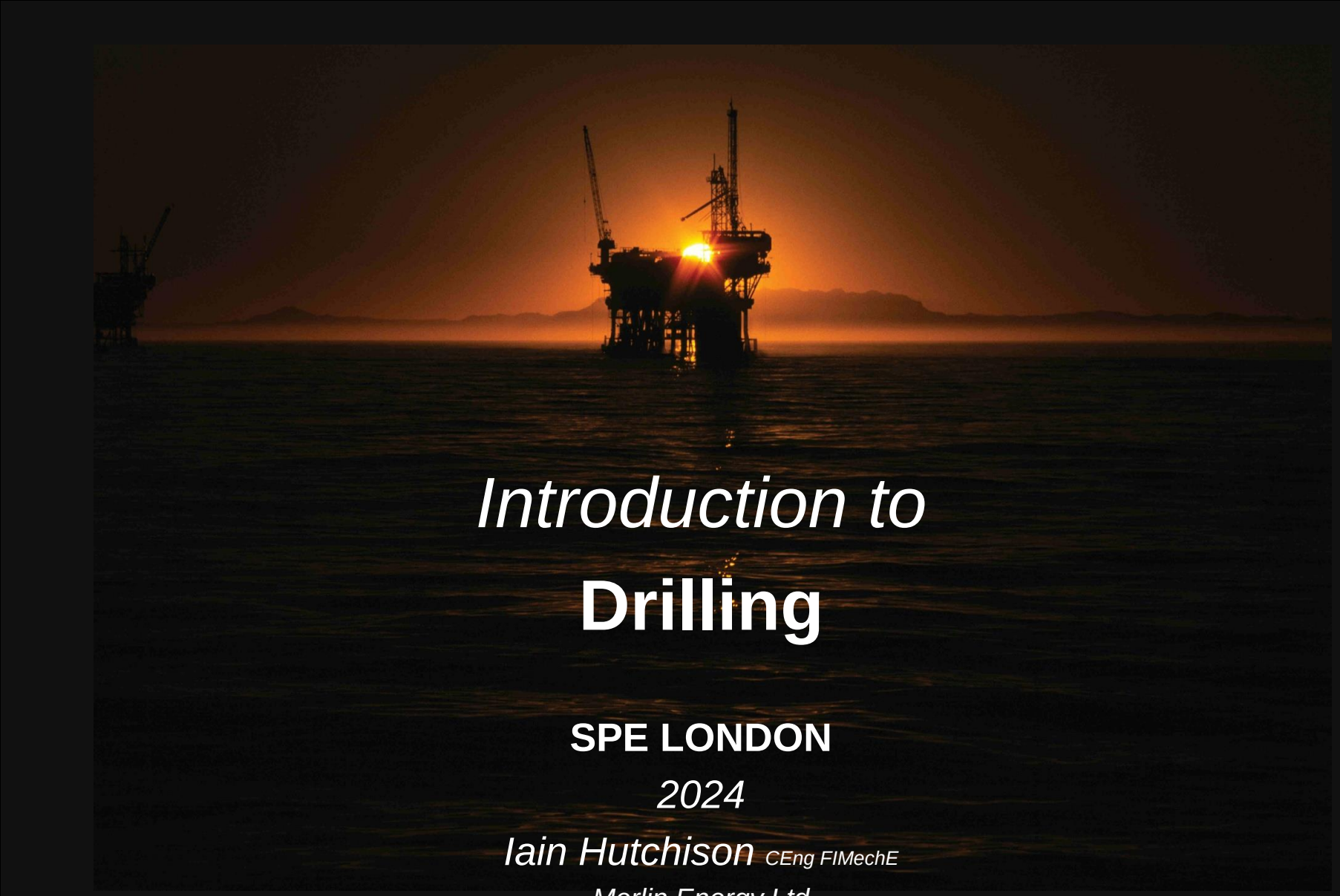


Introduction to
Drilling

SPE LONDON

2024

Iain Hutchison *CEng FIMechE*

Merlin Energy Ltd

Content

- History & Well Types
- Phases of a Well
- Rig Types
- Costs & Values

It's ALL about Drilling!

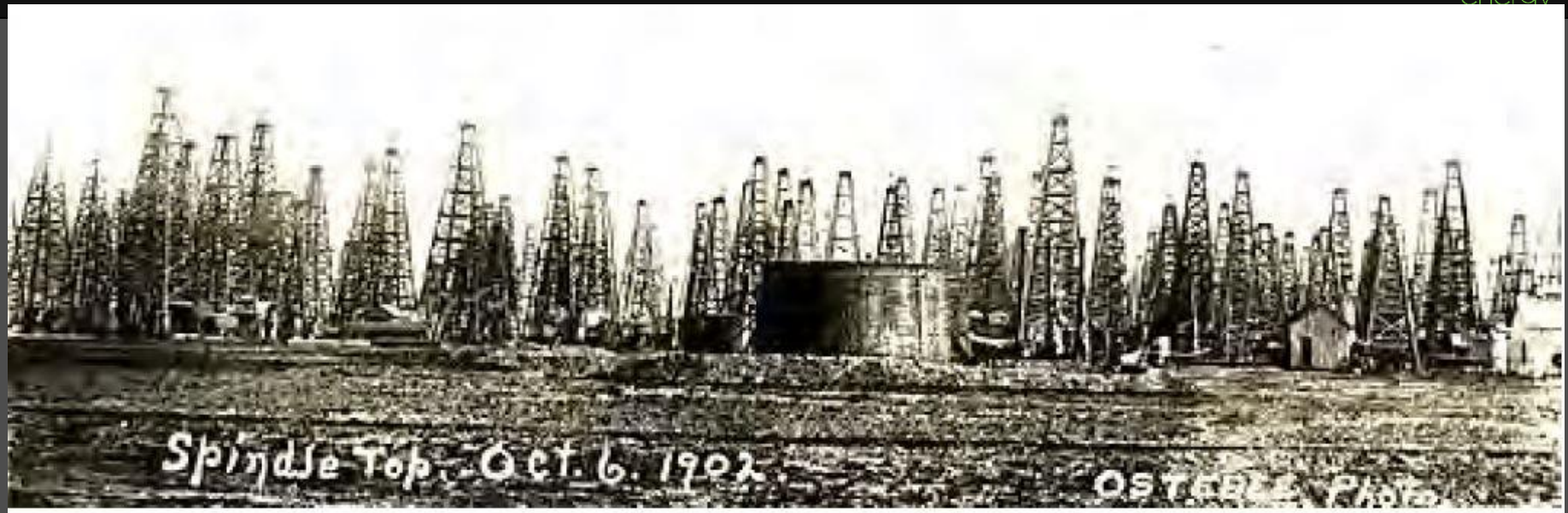
Drilling Through Time

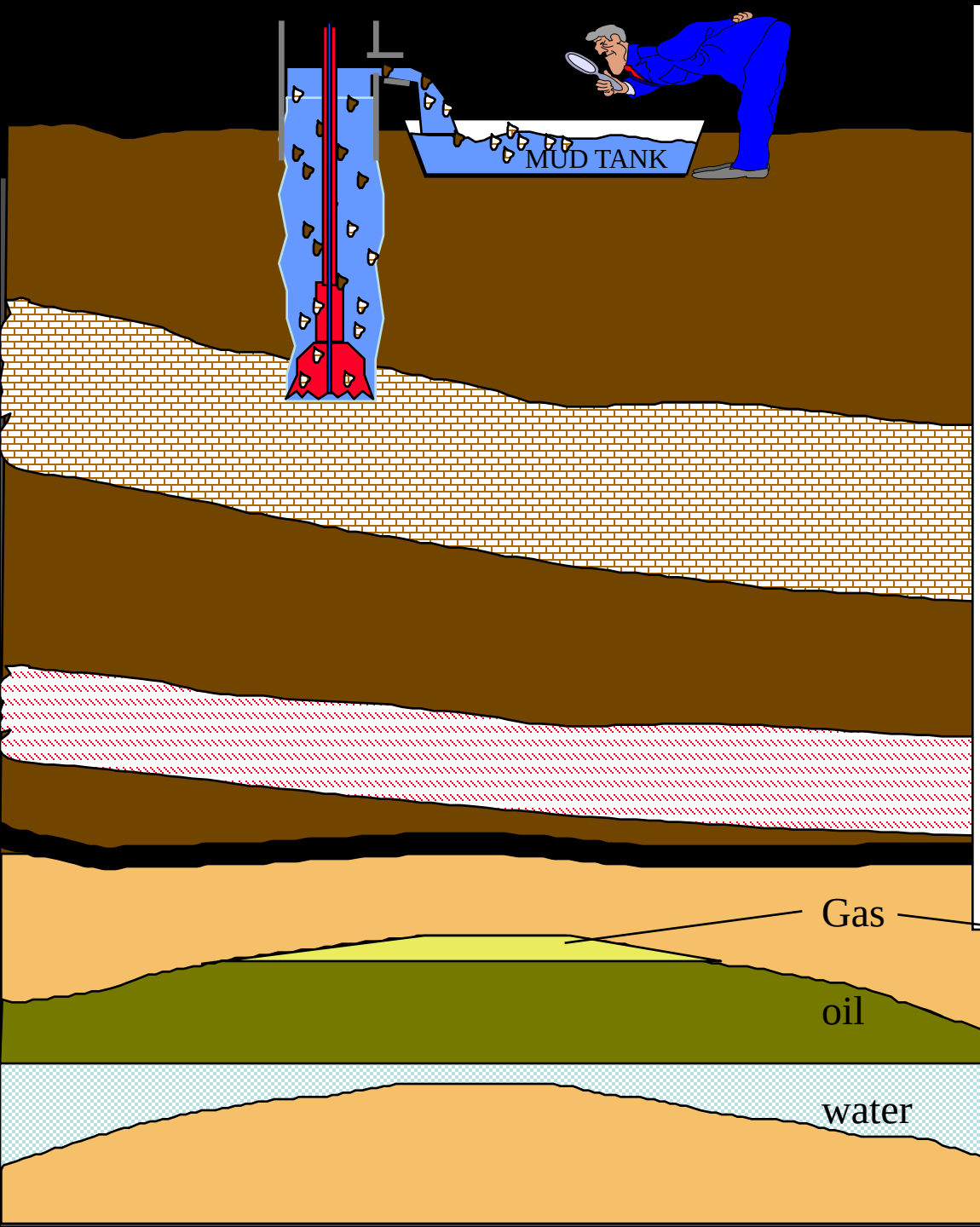
- 1000 BC salt drilling China, 800 ft by 300 AD
- 1264 mining oil seeps Baku
- 1594 oil wells hand dug (115 ft)
- 1859 1st oil well in USA (70 ft)
- 1989 vertical well : 40,230 ft (Kola, Russia)
- 2022 directional well : 50,001 ft (Abu Dhabi, UAE)

Well Types

- Exploration
  - Anything there? (success rate 1:5)
- Appraisal
  - How much is there?
- Development (**Hydrocarbon** / **Geothermal** / **CCS**)
  - Production : makes the money
  - Injection : keeps it coming

Vertical & Directional Wells



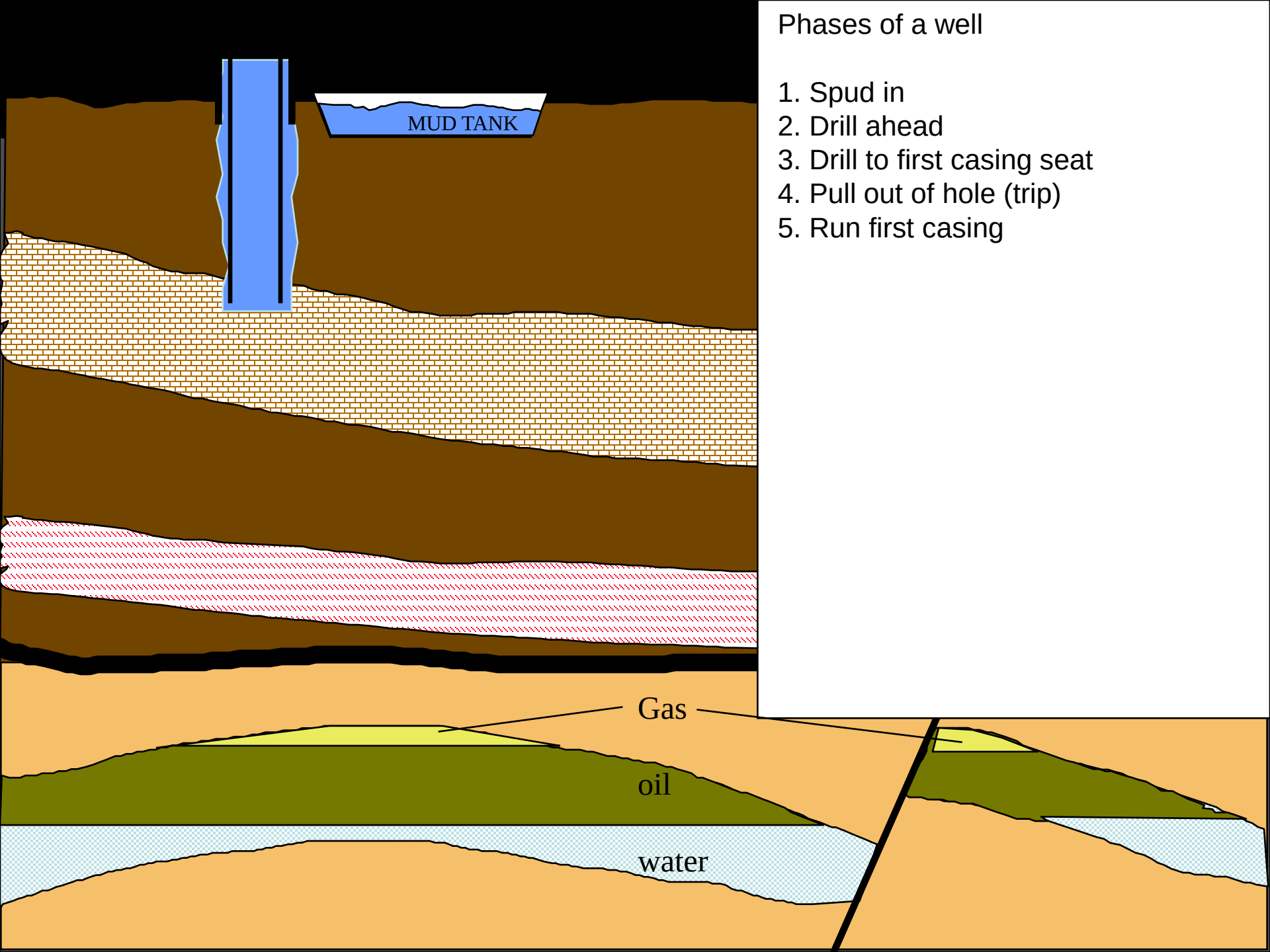


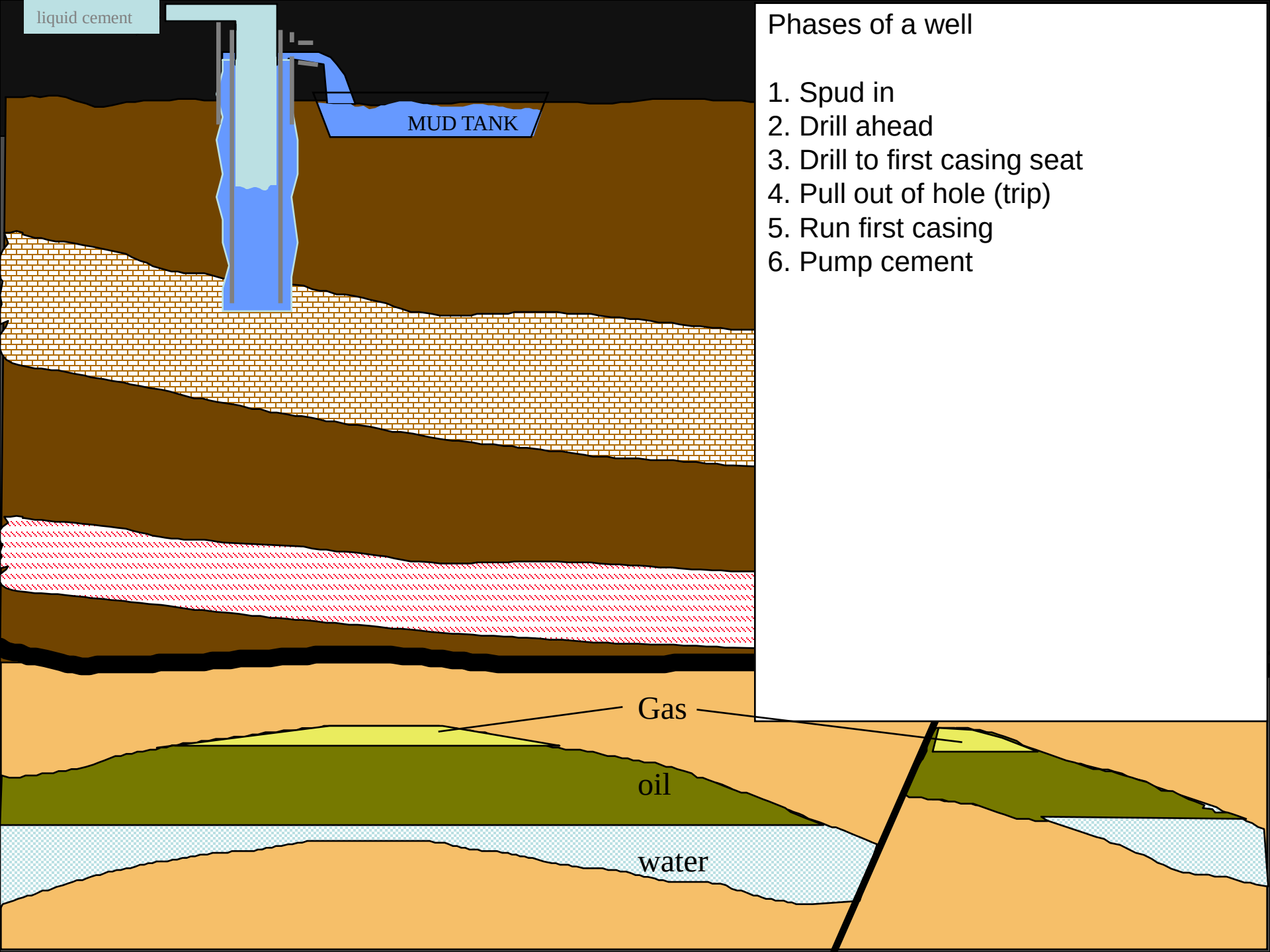
Phases of a well

1. Spud in
2. Drill ahead
3. Drill to first casing seat

Phases of a well

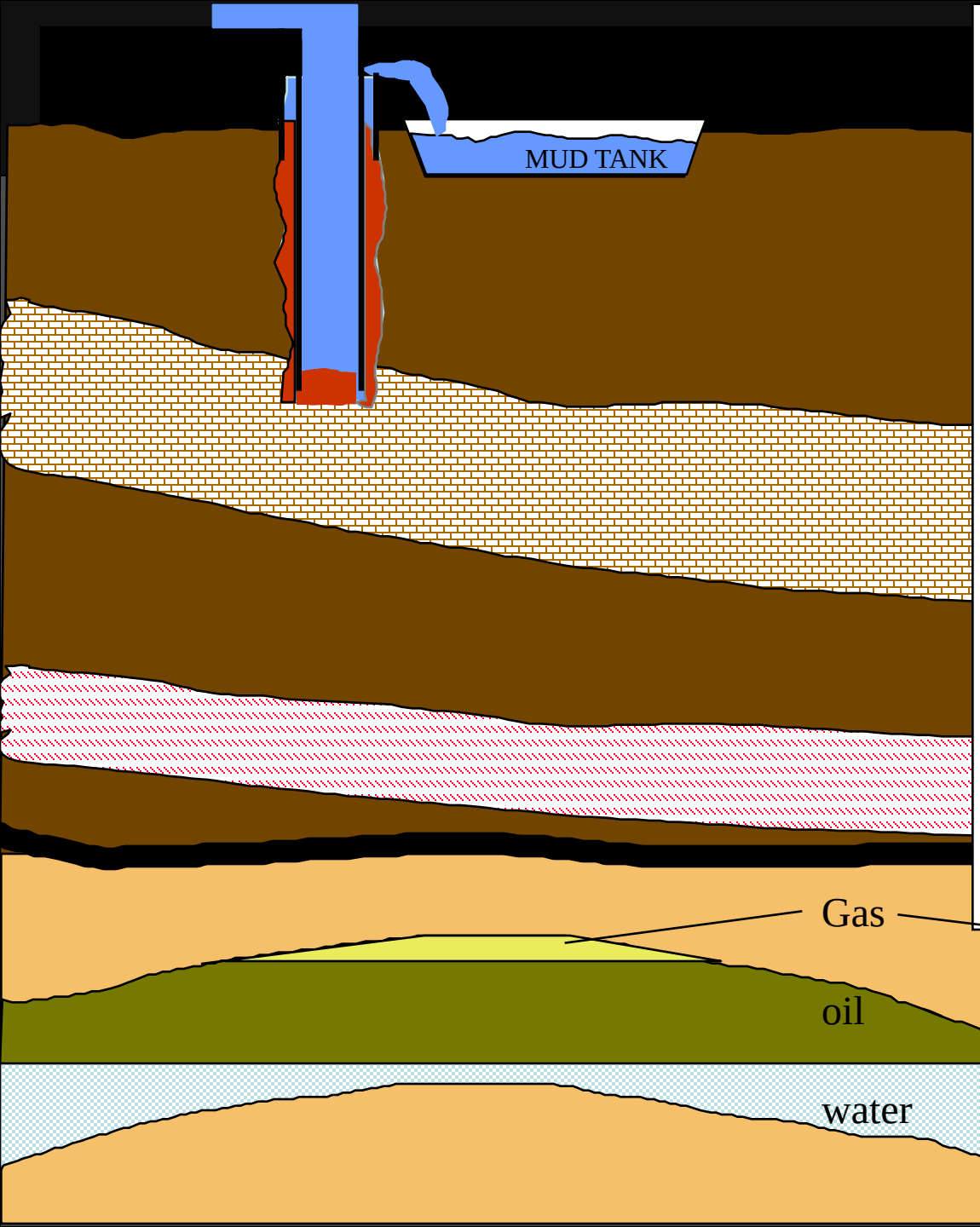
1. Spud in
2. Drill ahead
3. Drill to first casing seat
4. Pull out of hole (trip)
5. Run first casing





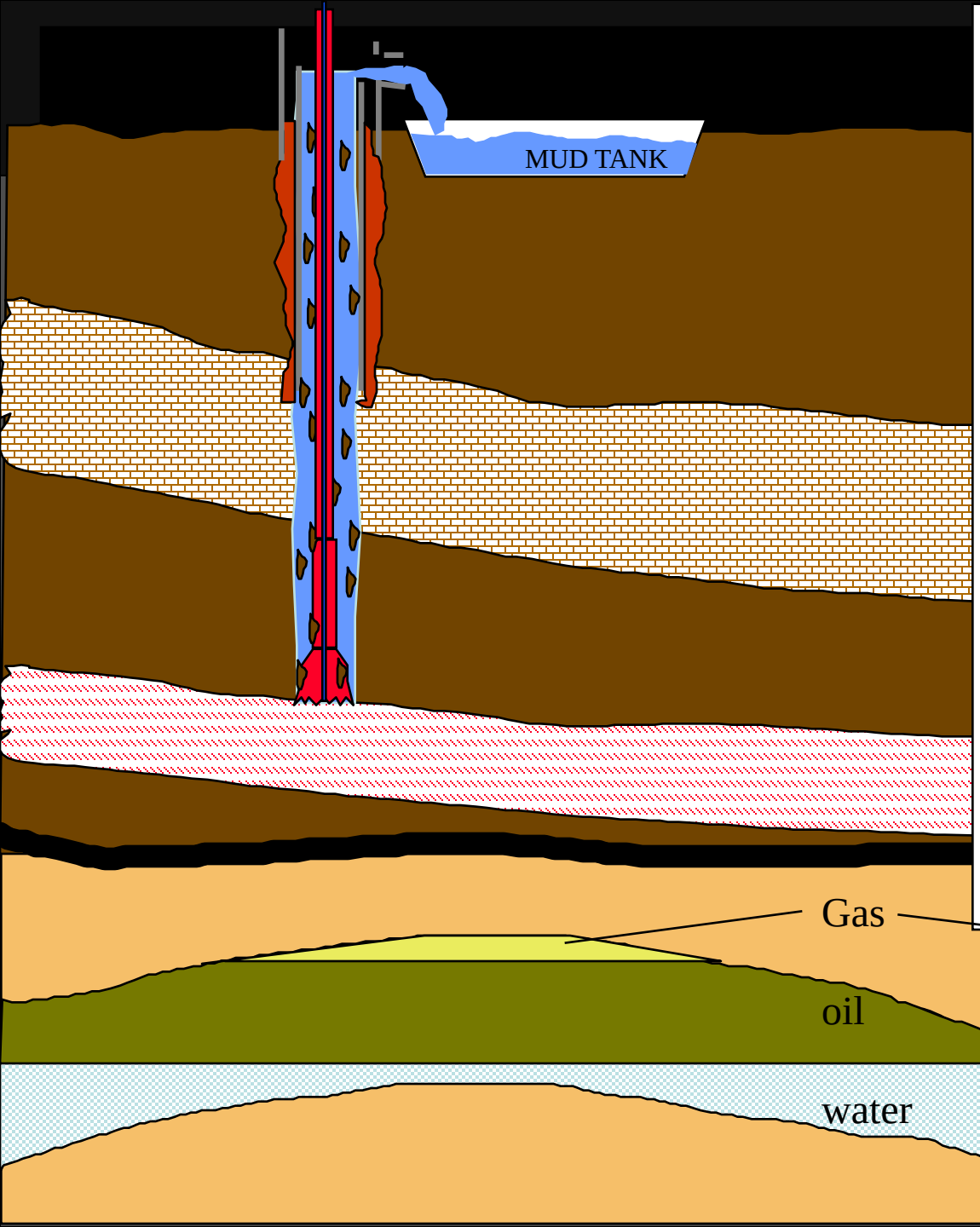
Phases of a well

1. Spud in
2. Drill ahead
3. Drill to first casing seat
4. Pull out of hole (trip)
5. Run first casing
6. Pump cement



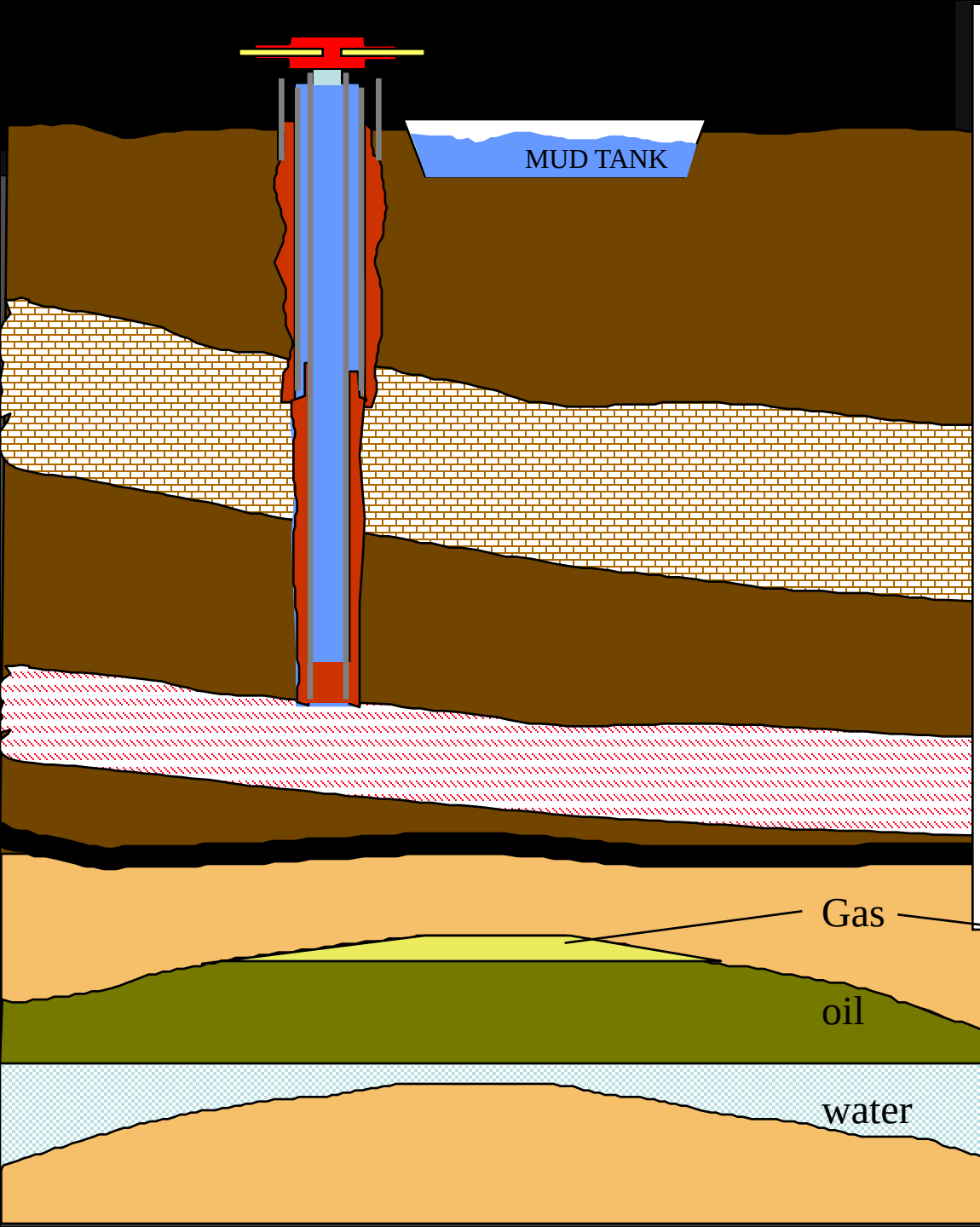
Phases of a well

1. Spud in
2. Drill ahead
3. Drill to first casing seat
4. Pull out of hole (trip)
5. Run first casing
6. Pump cement
7. Displace cement “behind” casing



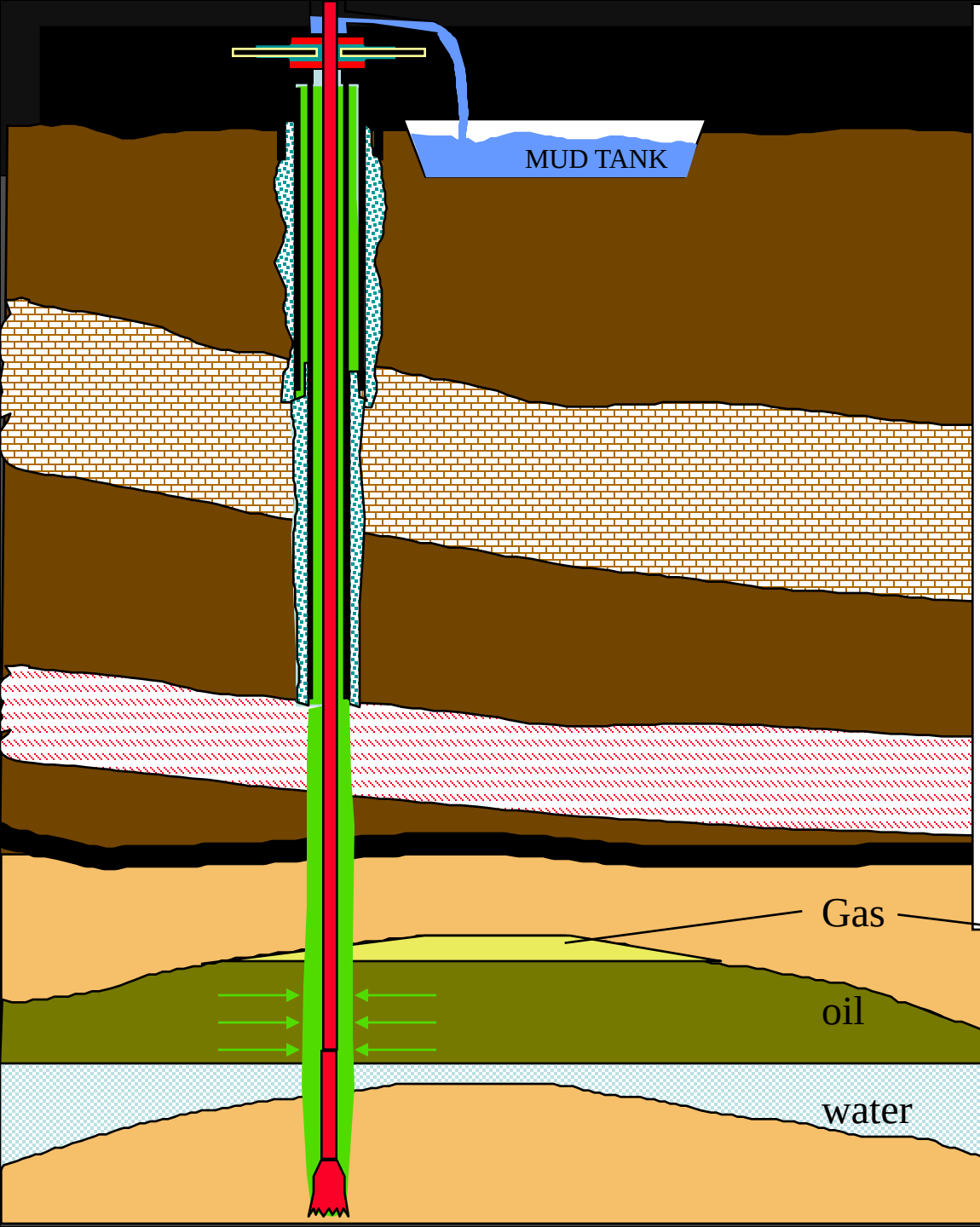
Phases of a well

1. Spud in
2. Drill ahead
3. Drill to first casing seat
4. Pull out of hole (trip)
5. Run first casing
6. Pump cement
7. Displace cement “behind” casing
8. Drill ahead to 2nd casing seat



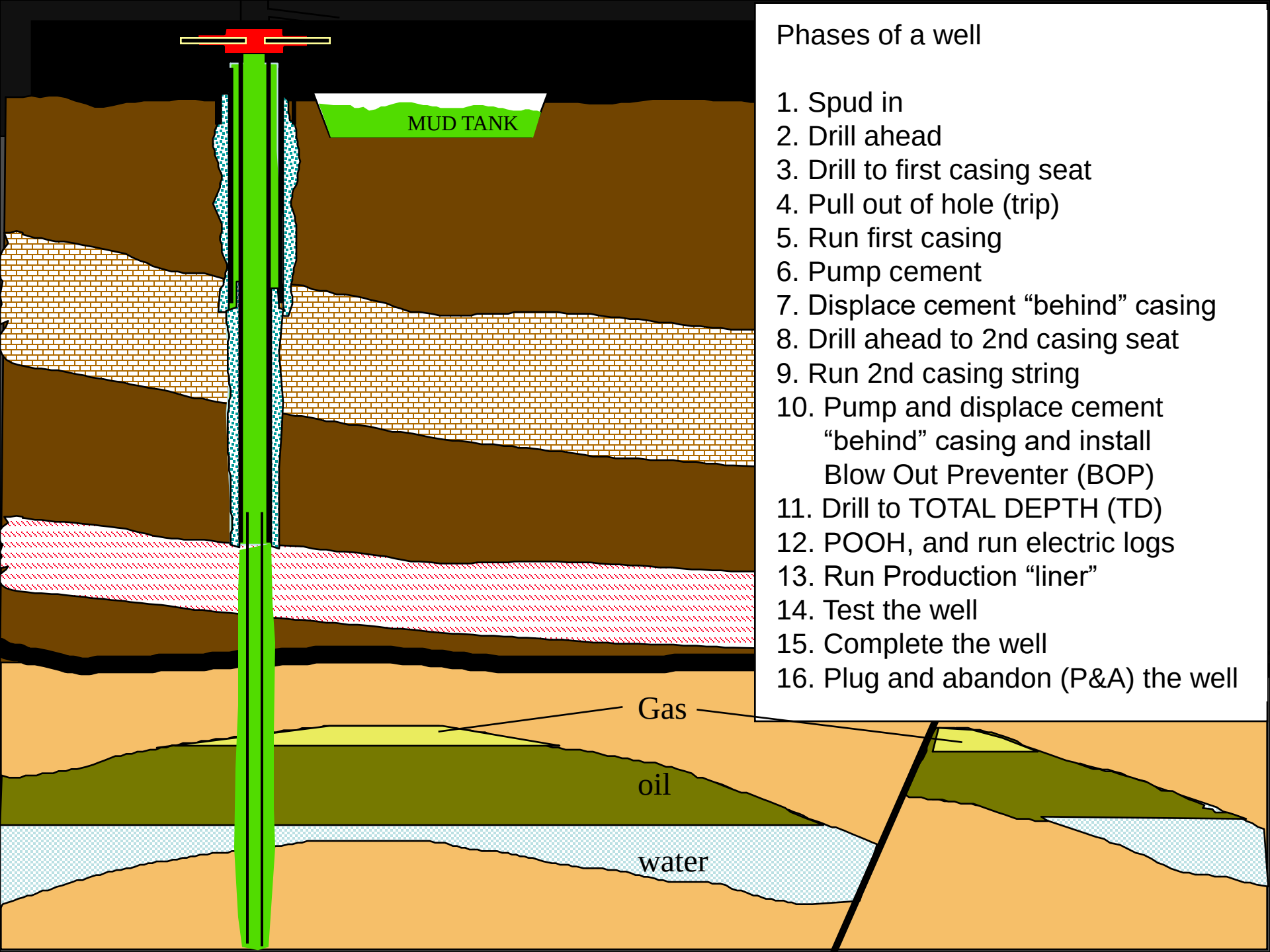
Phases of a well

1. Spud in
2. Drill ahead
3. Drill to first casing seat
4. Pull out of hole (trip)
5. Run first casing
6. Pump cement
7. Displace cement “behind” casing
8. Drill ahead to 2nd casing seat
9. Run 2nd casing string
10. Pump and displace cement “behind” casing and install Blow Out Preventer (BOP)



Phases of a well

1. Spud in
2. Drill ahead
3. Drill to first casing seat
4. Pull out of hole (trip)
5. Run first casing
6. Pump cement
7. Displace cement “behind” casing
8. Drill ahead to 2nd casing seat
9. Run 2nd casing string
10. Pump and displace cement “behind” casing and install Blow Out Preventer (BOP)
11. Drill through the reservoir to TOTAL DEPTH (TD)



Phases of a well

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5. Run first casing
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7. Displace cement “behind” casing
8. Drill ahead to 2nd casing seat
9. Run 2nd casing string
10. Pump and displace cement “behind” casing and install Blow Out Preventer (BOP)
11. Drill to TOTAL DEPTH (TD)
12. POOH, and run electric logs
13. Run Production “liner”
14. Test the well
15. Complete the well
16. Plug and abandon (P&A) the well

Extended Reach Drilling (ERD)

Access distant targets

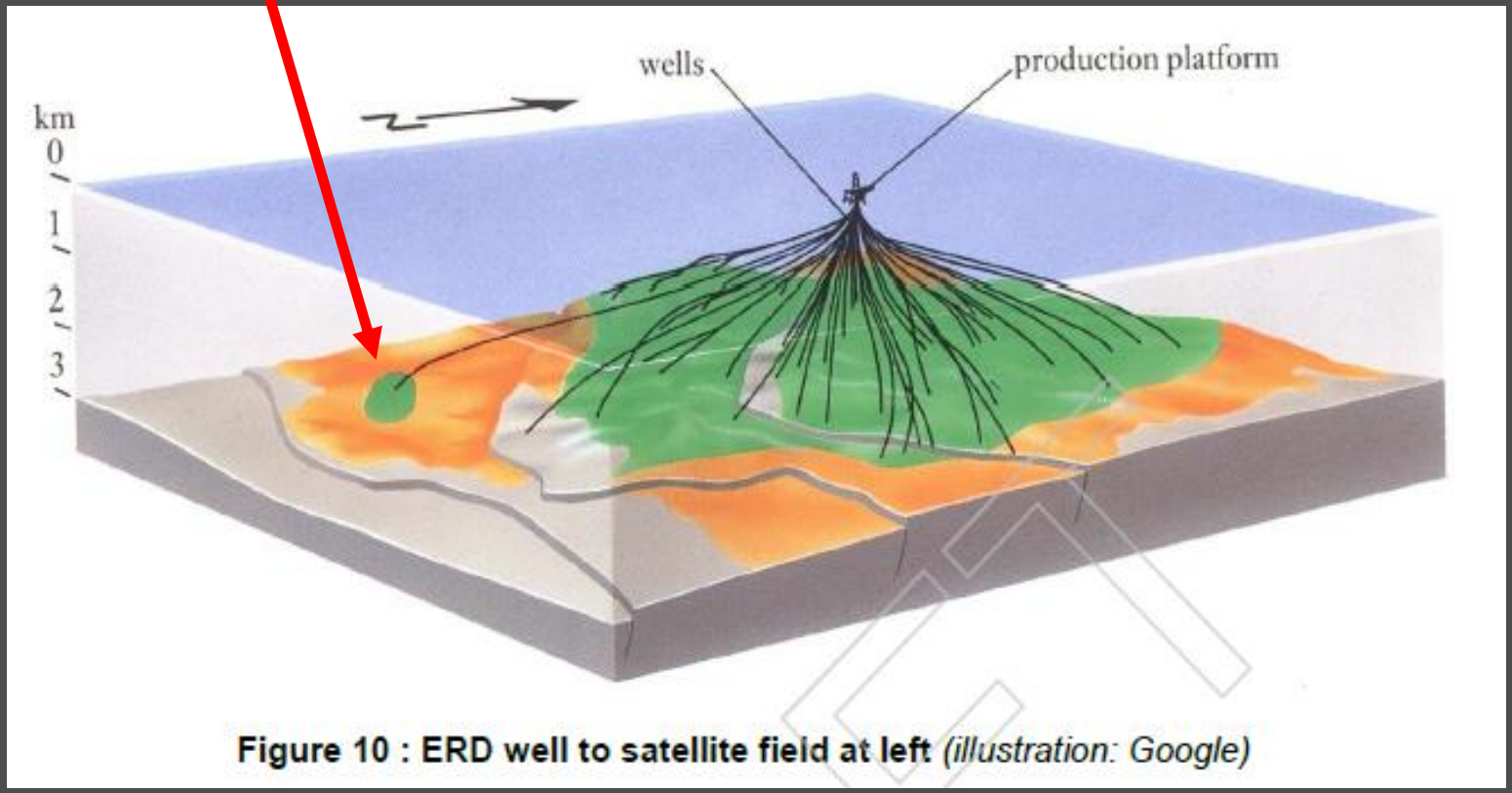
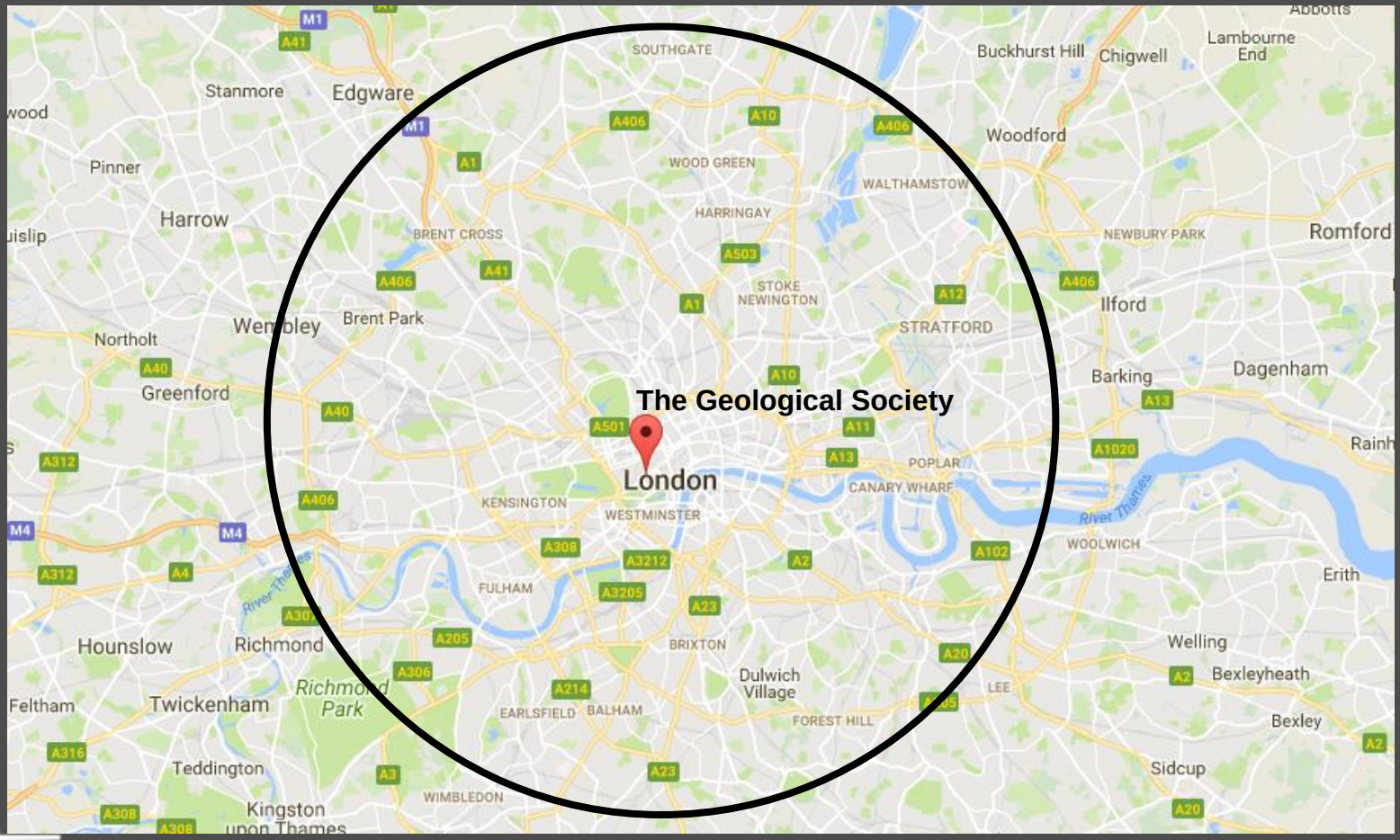


Figure 10 : ERD well to satellite field at left *(illustration: Google)*

Drainage Radius

ERD Record: 50.001ft (15.2 km)

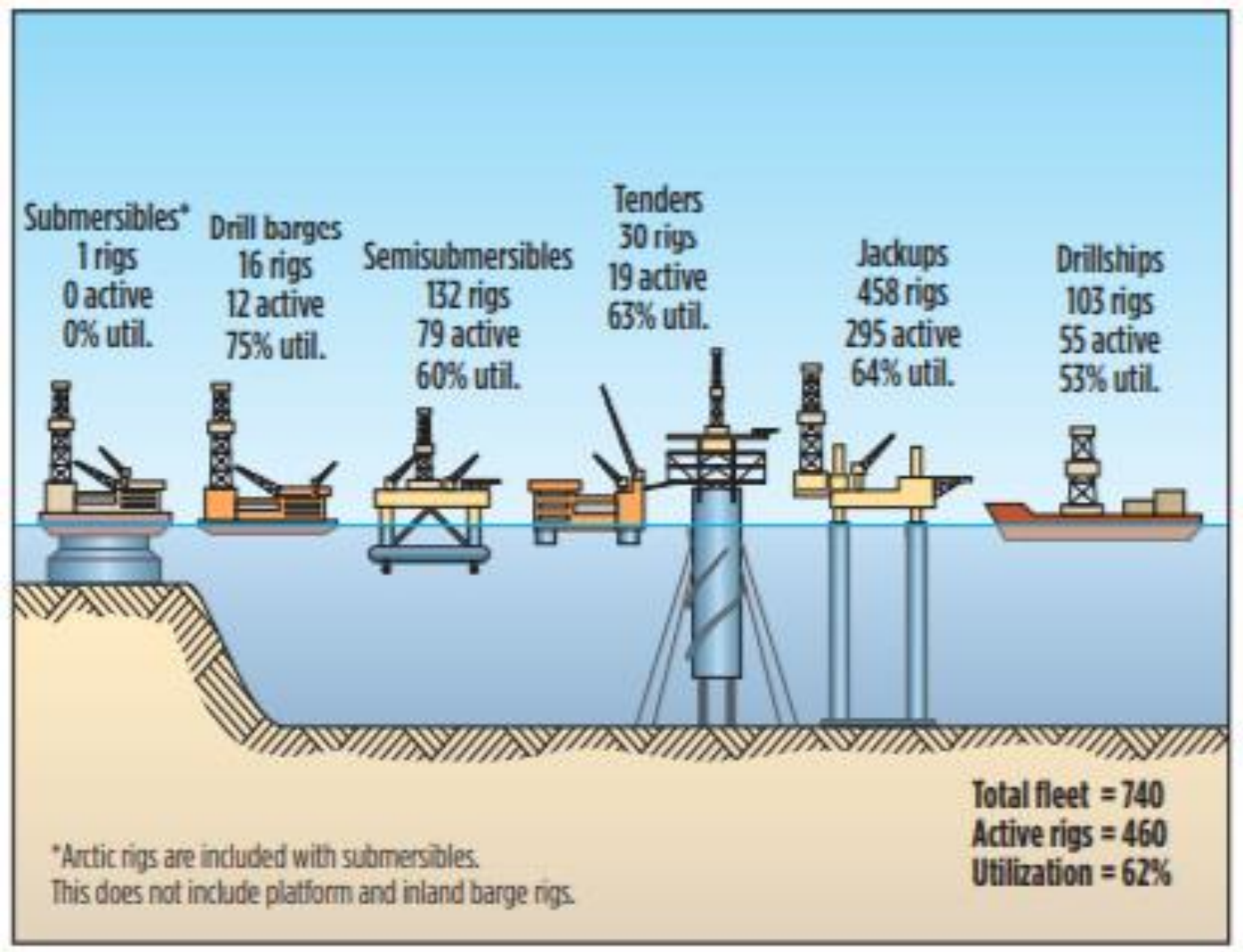


Drilling Rigs - Land

Drilling Rigs - Offshore

Drilling Rigs - Offshore

Drilling Rigs - Offshore



Well Time & Costs

- Drilling times
  - 5 to 500 days
  - Typical 20 – 50 days
- Drilling costs
  - US$100k – US$1Mn per day
  - Well : US$2Mn to US$100's Mn
  - Typical onshore US$5Mn / offshore US$30Mn
  - ≈ 80% of costs are time dependent

Value of Drilling Quickly!

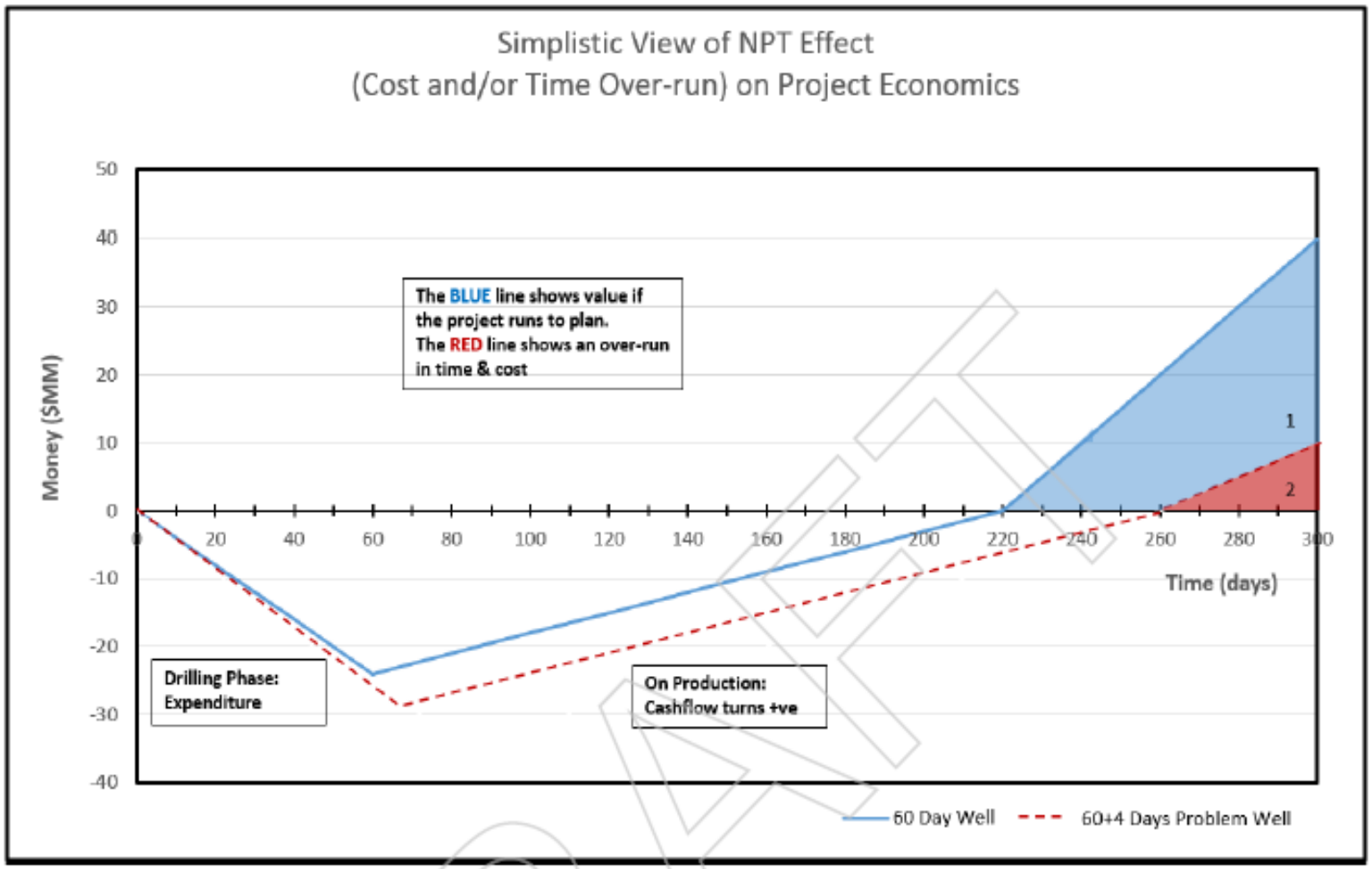


Figure 12 : Impact of Non Productive Time on Project Economics *(Merlin ERD Ltd)*

In Summary


I CAN'T HELP FEELING YOU MAY HAVE OVER SIMPLIFIED OUR OBJECTIVES SOMEWHAT...
GO OUT TO SEA
FIND SOME OIL
DRILL A BIG HOLE
BINGO!
SORTED

Summary

- Wells
- Costs
- Phases of a Well
- Rigs

All Prospects look good on paper – need to drill

If we always do what we've always done, we'll only get what we've always had!