Carbon dioxide to restore efficiency of water wells

THE CARBON DIOXIDE (CO2)

Also known as Carbonic acid gas or Carbonic anhydride, at room temperature and ambient pressure, is a gas colorless and odorless, non-flammable and relatively inert.

At ambient pressure, is solubilized (more solubilized with major pressures) in water: 1% converts to acid carbonic (H2 CO3), a weak acid which dissociates into H- ions, HCO3- ions and CO3- -.

This acidity combined with low temperatures are used both for the neutralization of the pH of the waters and for the restoration of the wells.

It can be liquefied by subjecting it to high pressures.

In nature it is the result of the complete combustion of an organic compound, together with water (mineralization); it is also the by-product of breathing and different bacterial fermentations.

It is the main greenhouse gas of the planet.

The raw carbon dioxide is extracted from the well at temperature of 90°C and 37 Bar of pressure.

Afterwards it is expanded up to about 30 Bar e cooled to 33 ° C, to allow the subsequent stages of purification (primary and final desulphurisation and drying and liquefaction).

The liquefied gas is brought to the conditions required for it final storage (15 -17 Bar and - 25 ° C).

In the tank there are both states solid liquid and gas.

Abrupt gas expansions can lead to cooling to its solid state (dry ice); - 78° C is the sublimation temperature.

INTERCEPTION OF WATER WITH DEEP WELLS

Drill the waterproof soil layer to intercept the confined aquifer

A typical well consist of a steel pipe from 100mm of diameter; Along the wall of the wells are placed at variable depths screens with different features, beyond the screens there is the gravel packing. This packing divides the well from the aquifer.

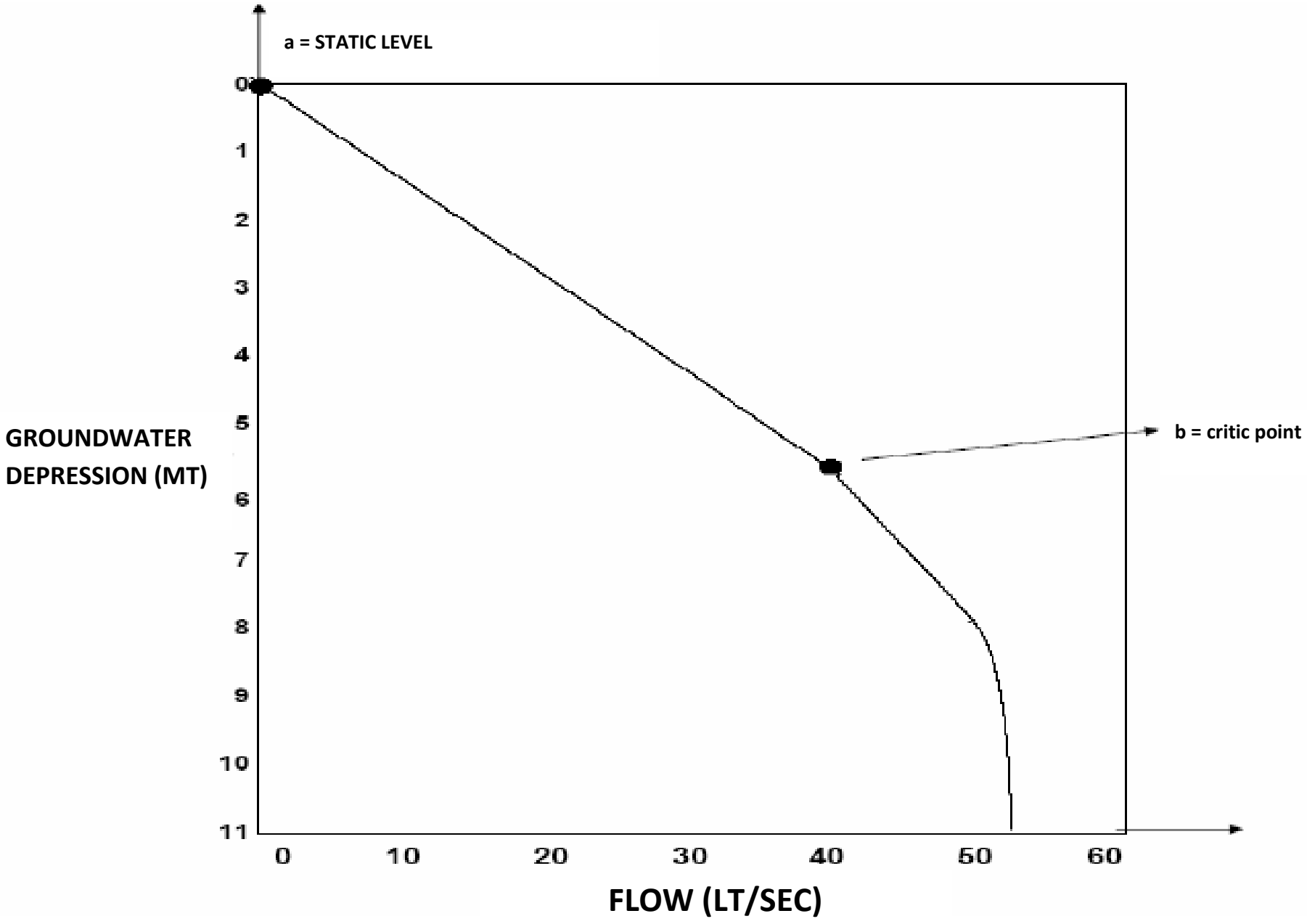
The depth of a well can start from 40mt up to 1200mt.

The extraction of water, which naturally goes back through the piping as much as the pressure of the pitch is high, is reached by pumping (except in the case of level groundwater below ground level).

The ground water in the well is characterized by a static level (when there is no elongation) and by a dynamic level (during water intake); the difference is defined as groundwater depression.

The relationship between groundwater depression and the flow rate, is a diagram (Q/H diagram) that is characteristic of every well; it is a constant feature, independent from the ground conditions.

THE CHARATERISTIC DIAGRAM OF THE WELL



POSSIBLE FLOW RESTRICTION CAUSES

They can be design and/or constructive and/or related to quality/quantity of water (decrease in the static level of the aquifer).

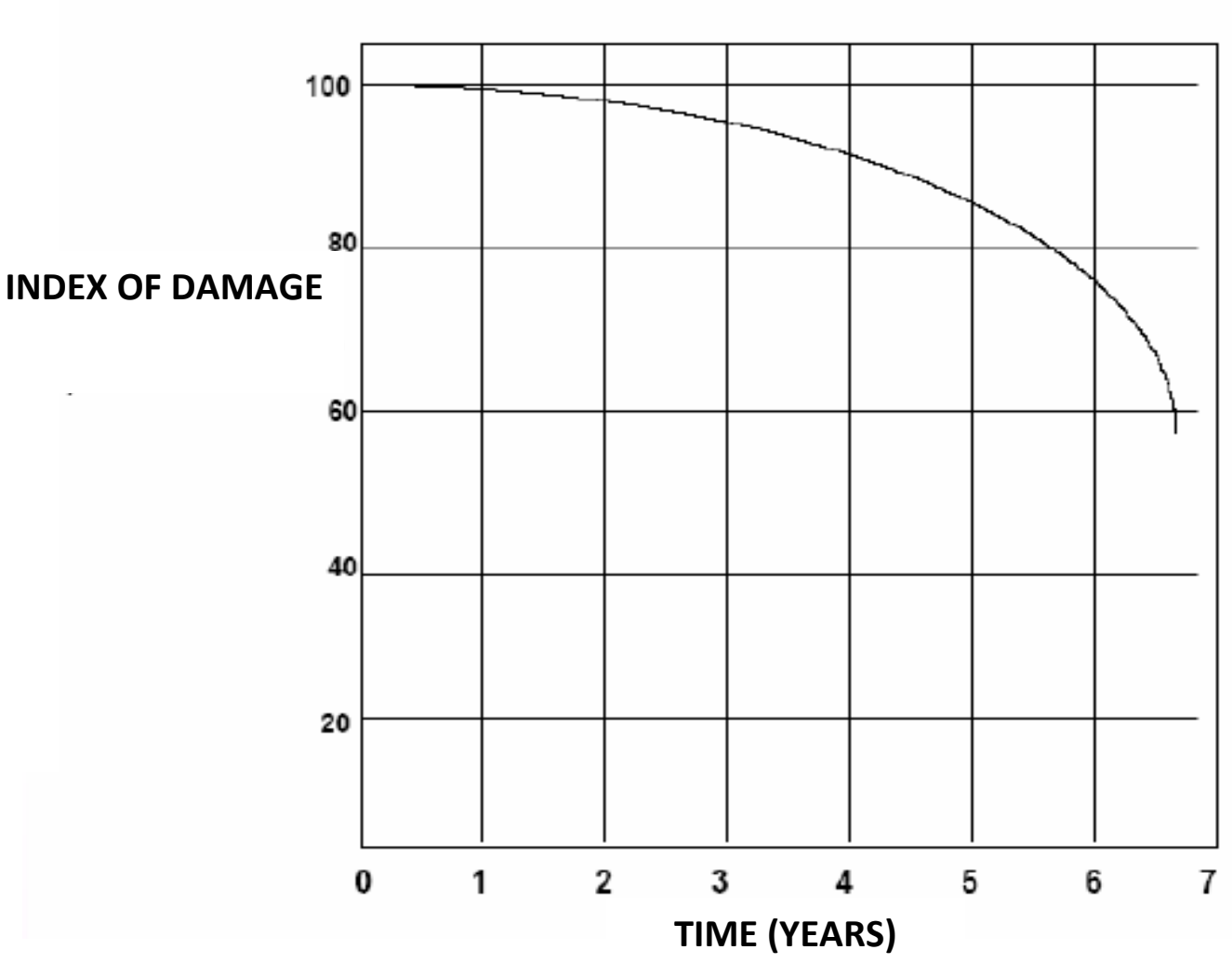
The extractable flow rate may also change over time if:

- Pump malfunctioning.
- Piping or screens are worn by corrosion
- The well has partially collapsed (if it is complete, it will arrive to the total loss flow).
- Due to interference with other nearby wells.
- The filter and the drain are clogged or encrusted; the incrustations can be made of: Chemical encrustation (carbonate / sulfate deposits of Ca or Mg or Fe oxides), biological fouling (Precipitation of oxides e hydroxides of Fe, Mn or S by bacterial species like ironbacteria, sulfobacteria etc.)

INDEX OF DAMAGE OF THE WELL

Is the relationship between original one:

I = [(Q/s)n/(Q/s)o] x100



INDEX OF DAMAGE OF THE WELL

In case of corrosive waters, they can be done only preventive interventions (choice of pump material and pipe material)

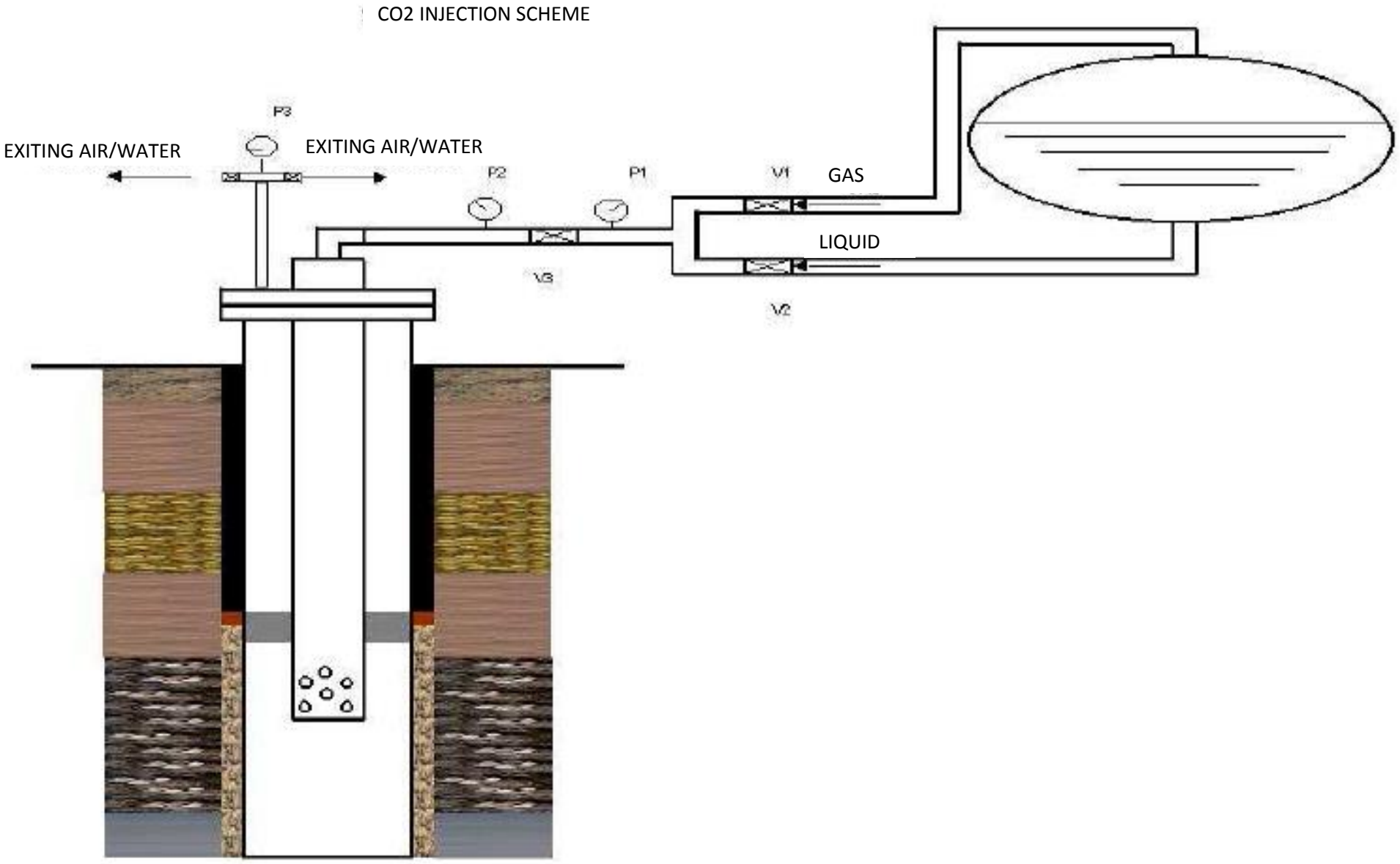
In the case of encrusting waters, as well as appropriate constructive choices can be made treatments

1. MECHANICAL (surging, brushing, "Jetting tool");

2. CHEMICALS (sodium polyphosphates, non-surfactants ionic, hydrochloric acid with glycolic acid, tartaric, citric, chlorine and its compounds).

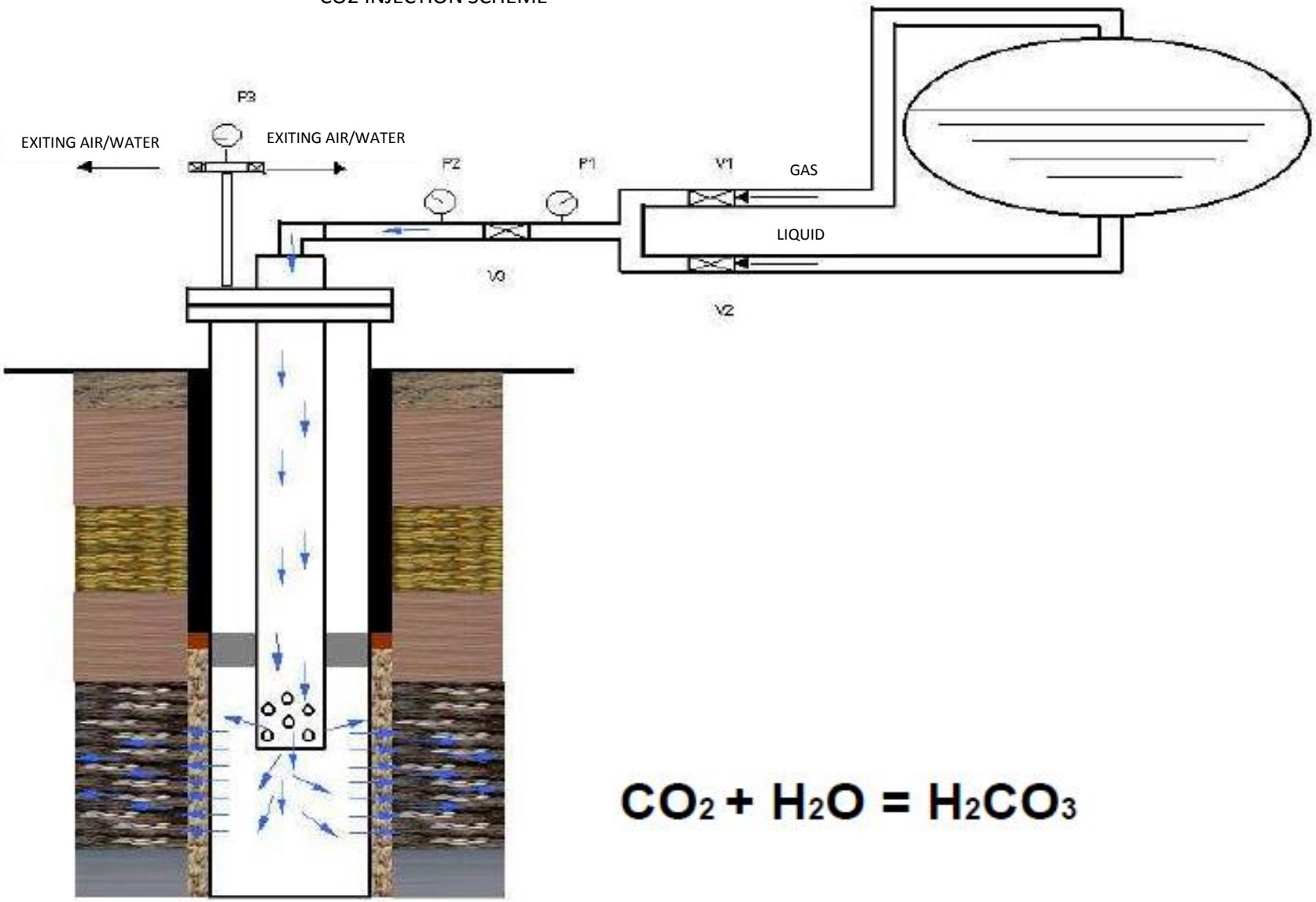
Often 1 and 2 are combined.

CO2 TREATMENT



CO2 TREATMENT

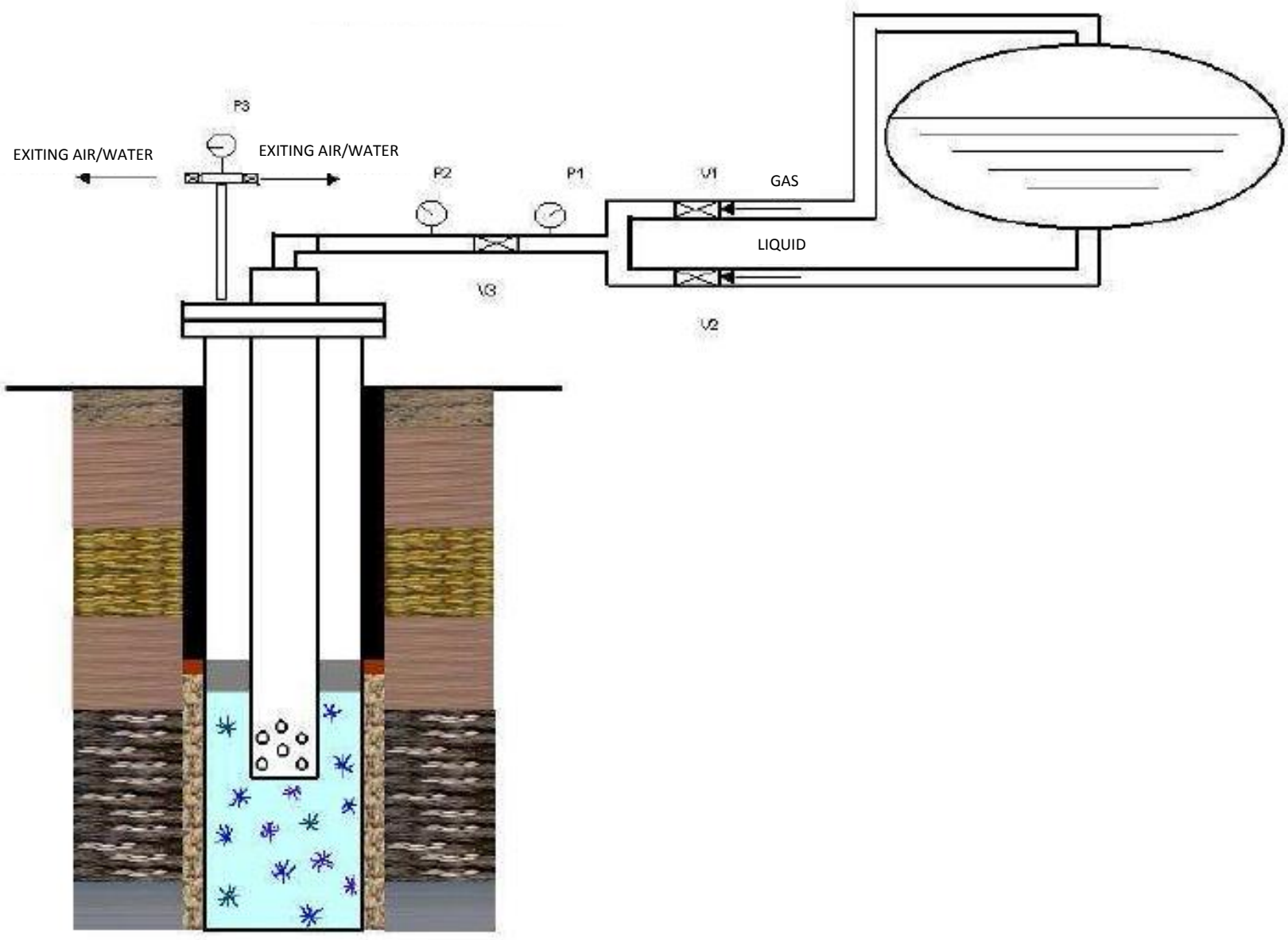
CO2 INJECTION SCHEME



$$CO_2 + H_2O = H_2CO_3$$

CO2 TREATMENT

CO2 INJECTION SCHEME



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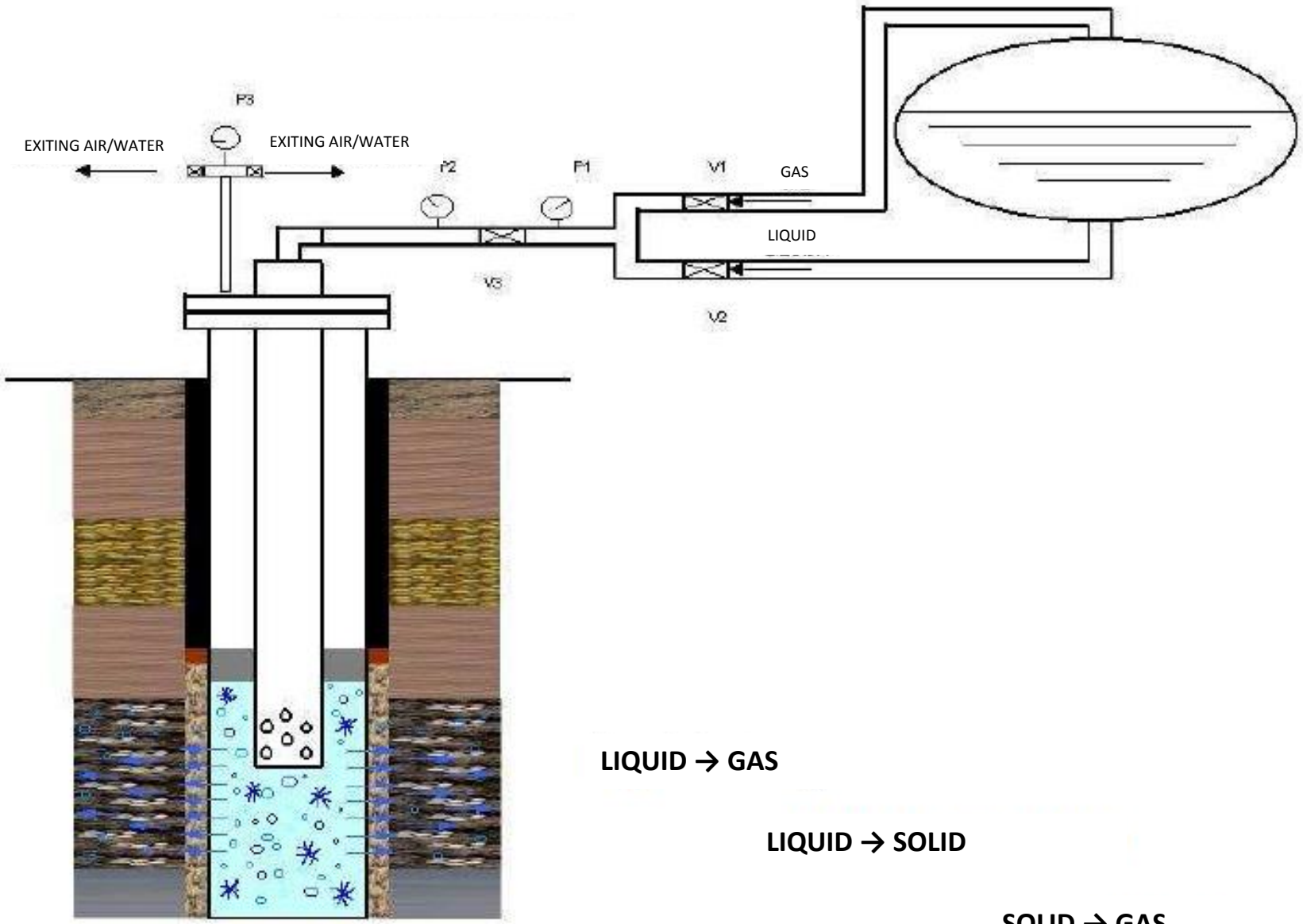


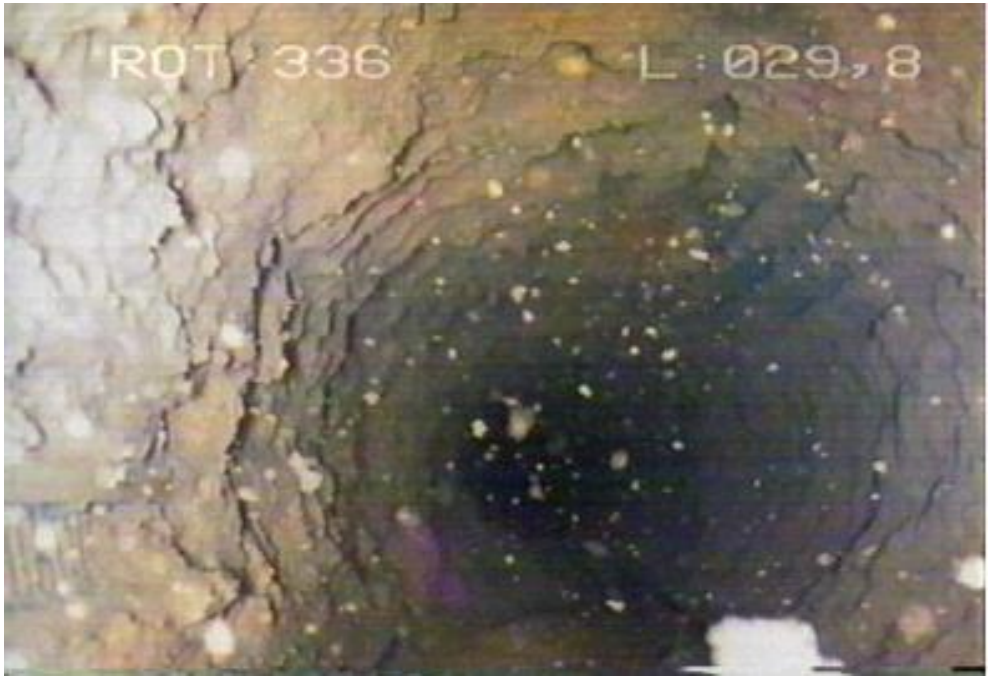
LIQUID → GAS

LIQUID → SOLID

SOLID → GAS

OPERATIONS SEQUANCE OF THE TREATMENT

1- Preliminary flow test
2- Pump extraction
3- Tv Inspection
4- Evaluation of the feasibility of the intervention.
5- Preliminary cleaning with brushing and/or jetting-tool.
6- Installation of chemical treatment equipment.
7- Injection of liquid and gaseous carbon dioxide.
8- Waiting for the reaction.
9- Unblocking and extraction of the equipment.
10- Possible mechanical surging.
11- Purge and flow test.
12- Possible tv inspection check.
13- Analysis of the results and final report.
14- Replacing the original pump.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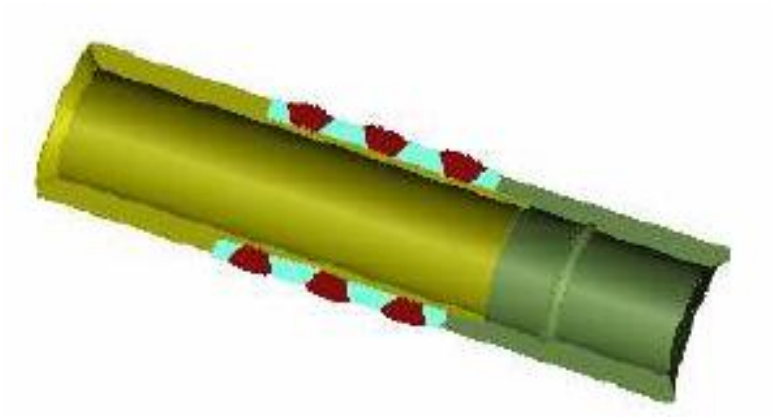
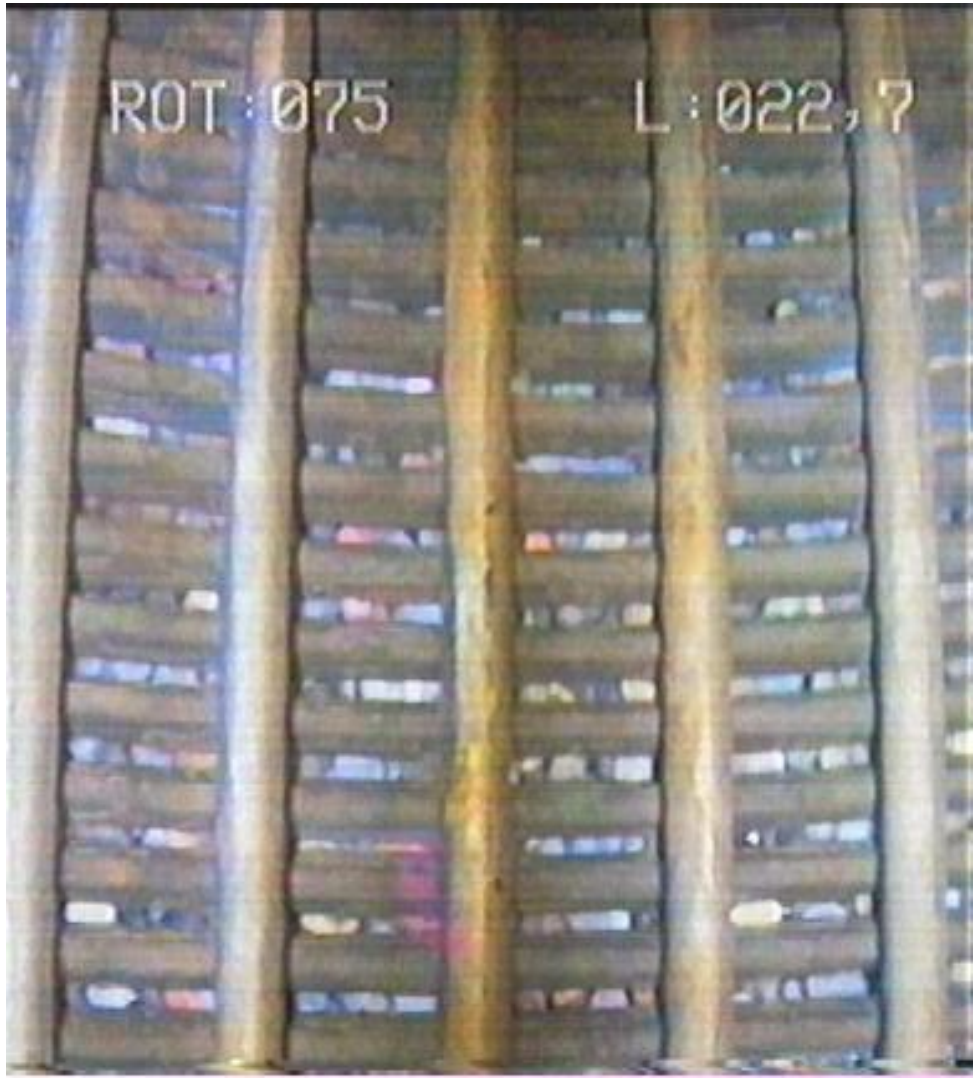


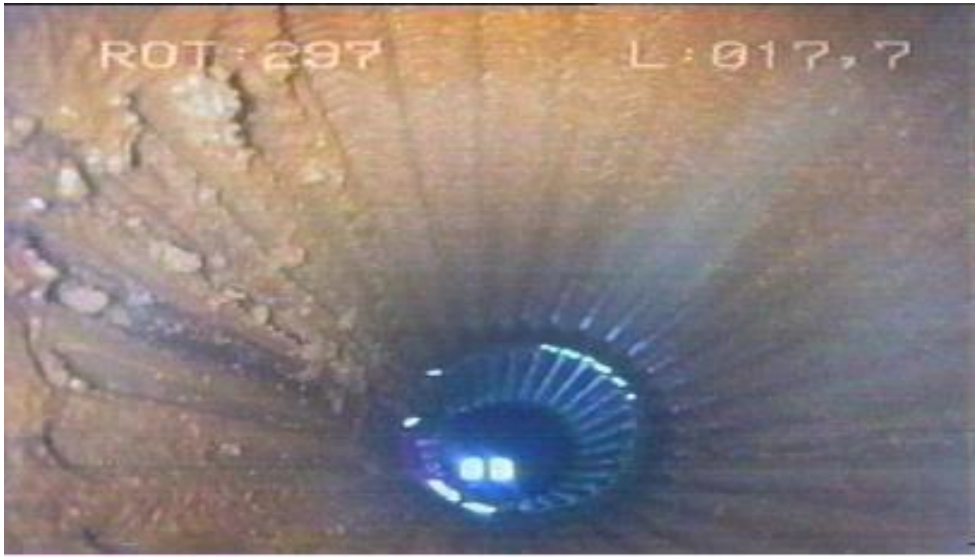
RESULTS

BEFORE

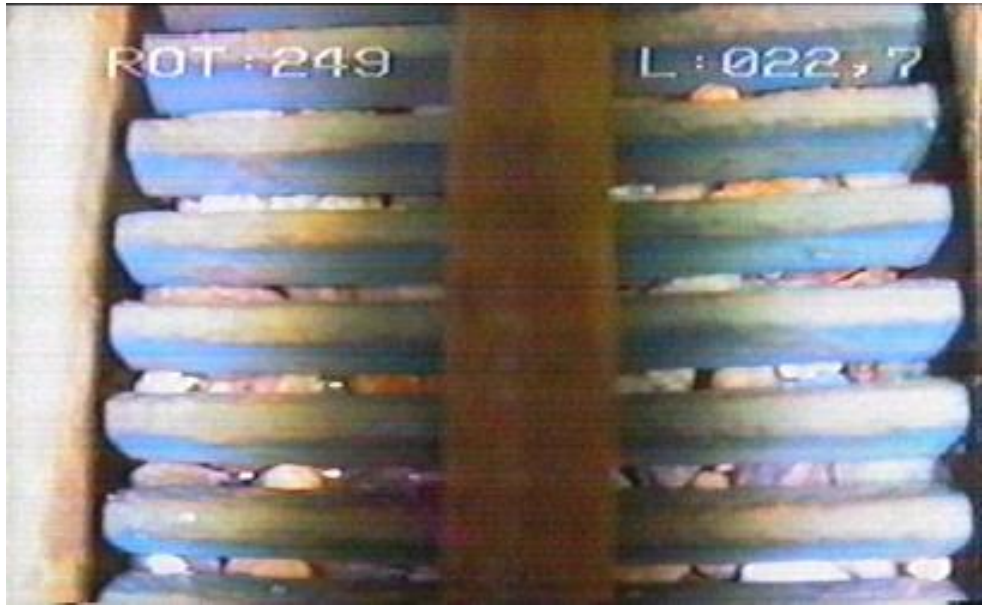
AFTER

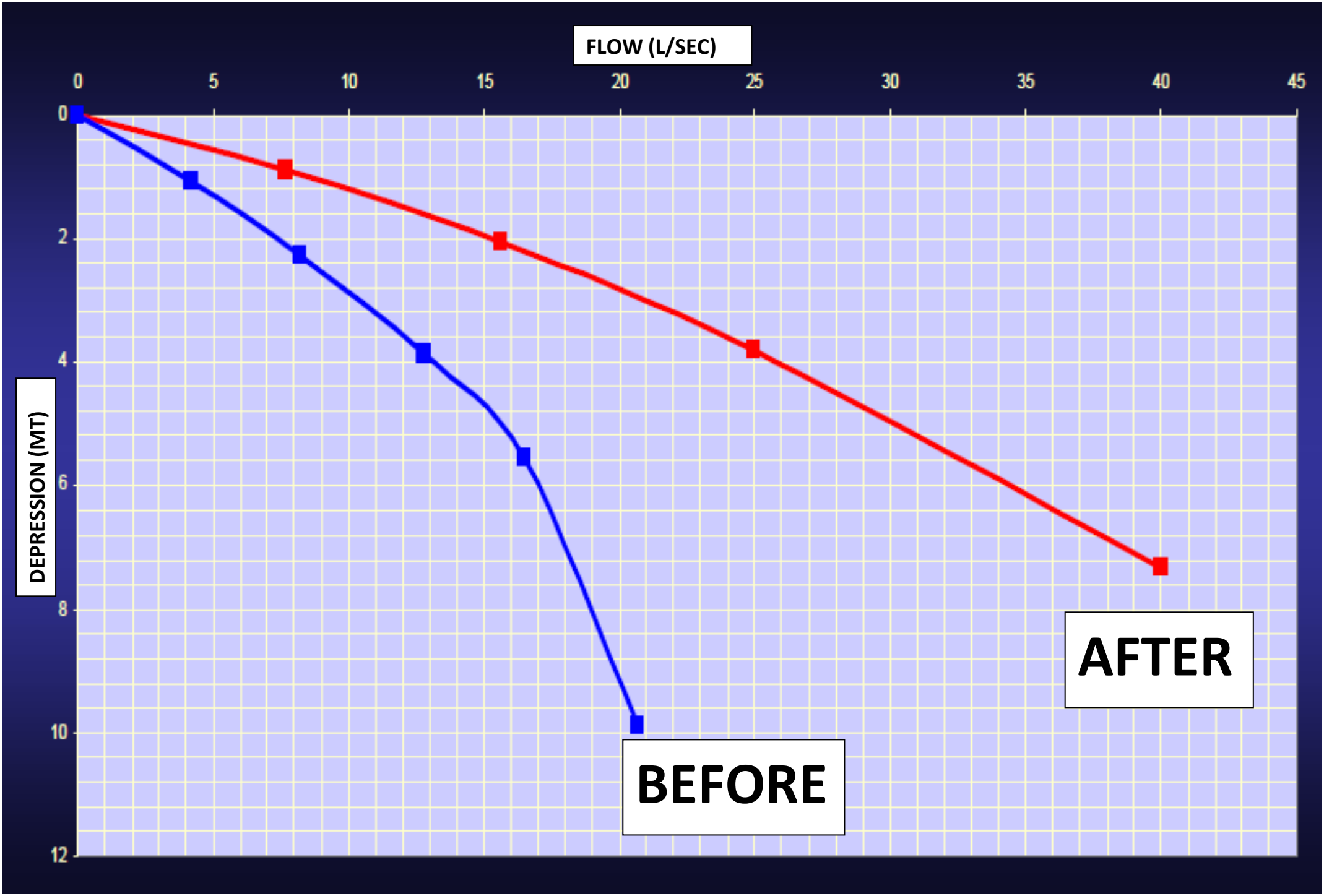


BEFORE



AFTER




FLOW (L/SEC)
0
5
10
15
20
25
30
35
40
45
DEPRESSION (MT)
0
2
4
6
8
10
12
AFTER
BEFORE