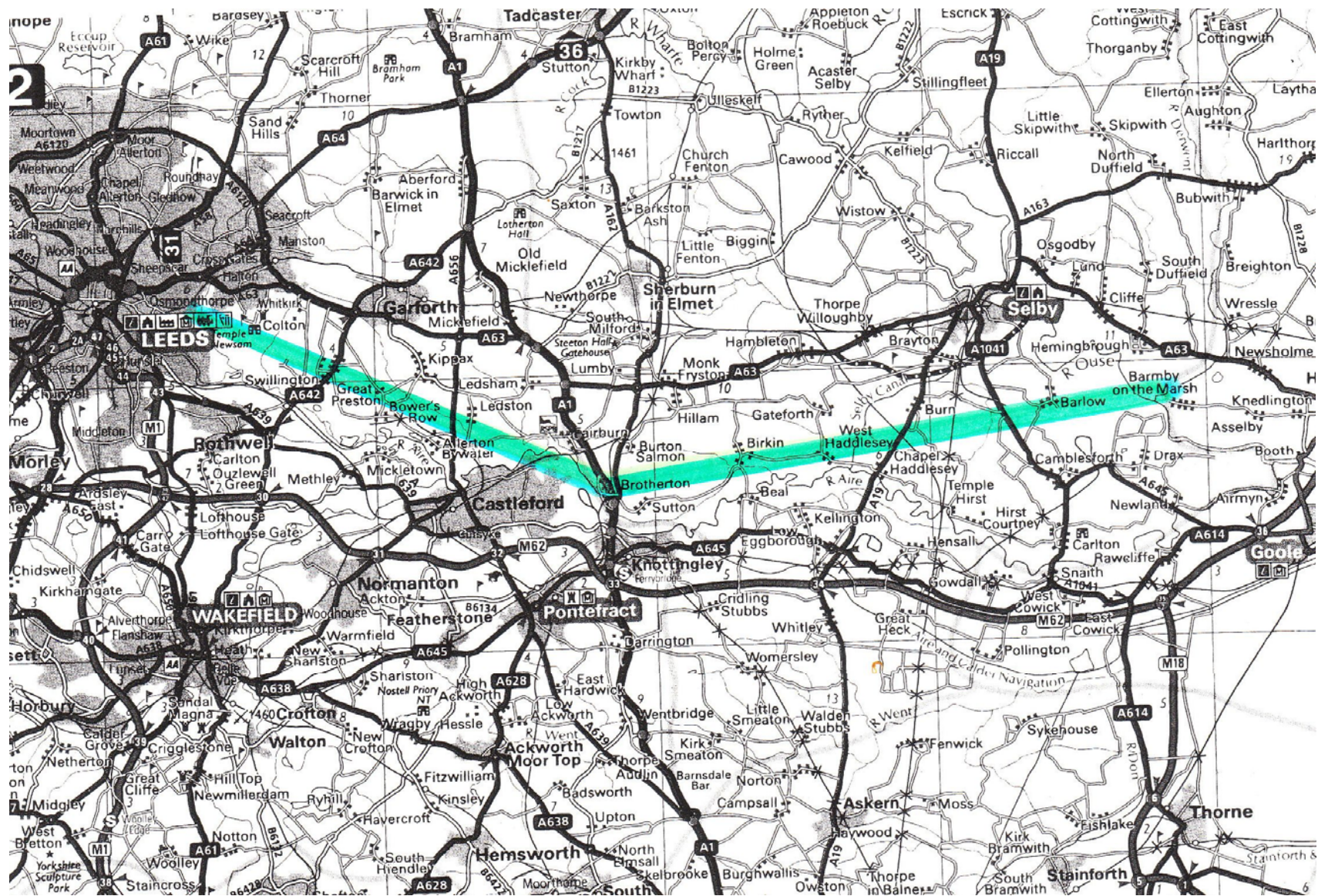
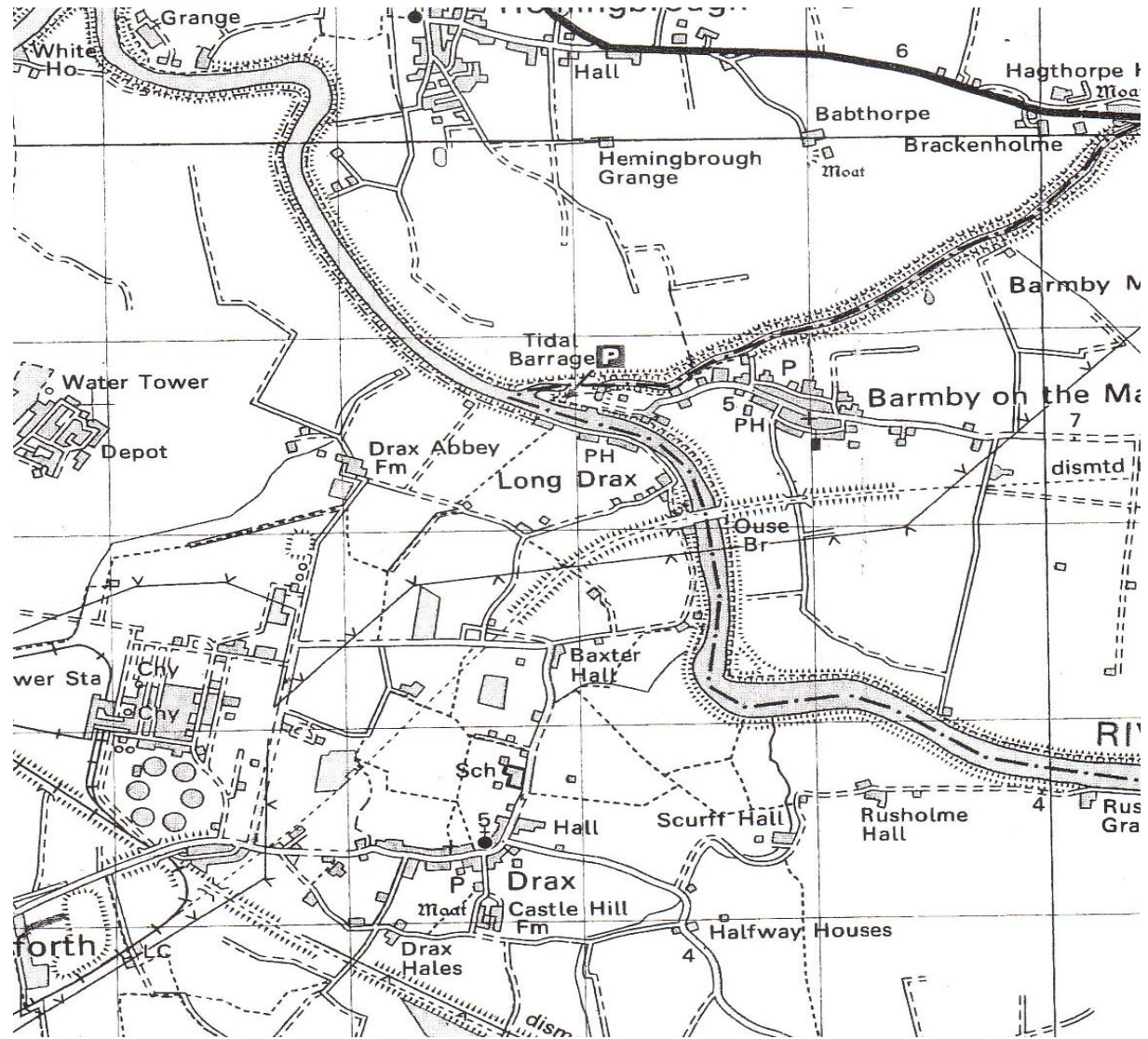


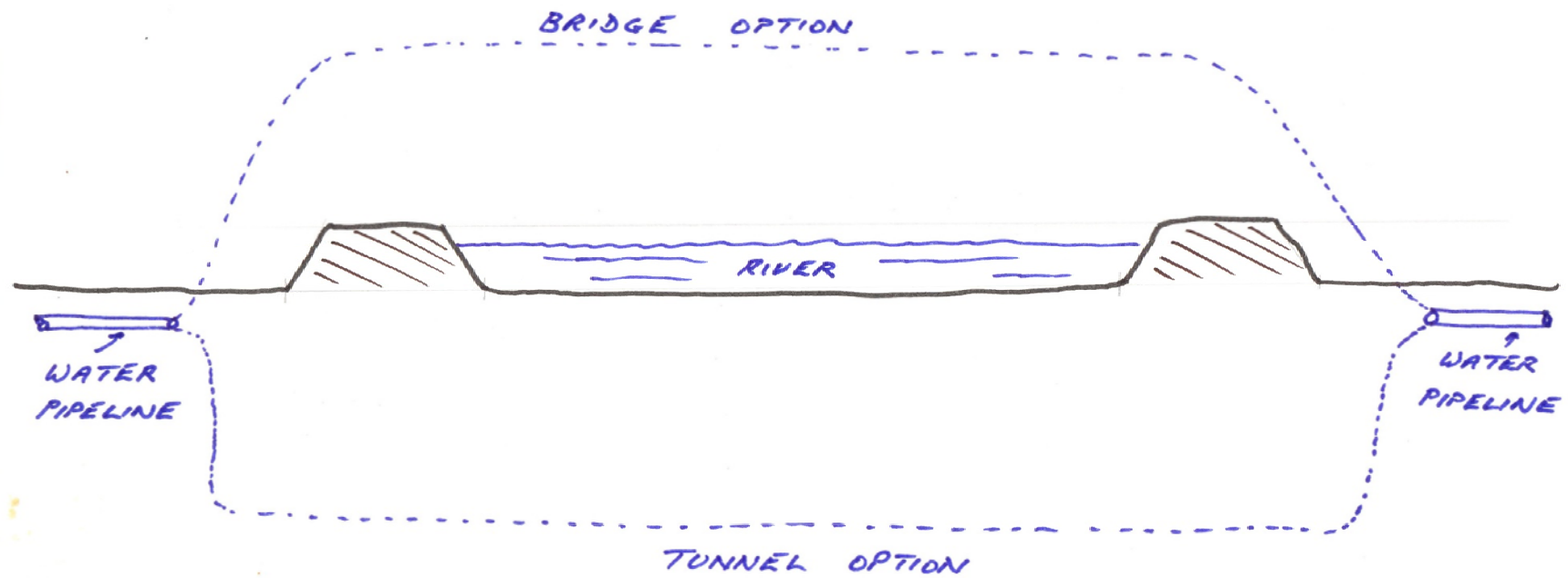
RIVER OUSE TUNNEL CROSSING

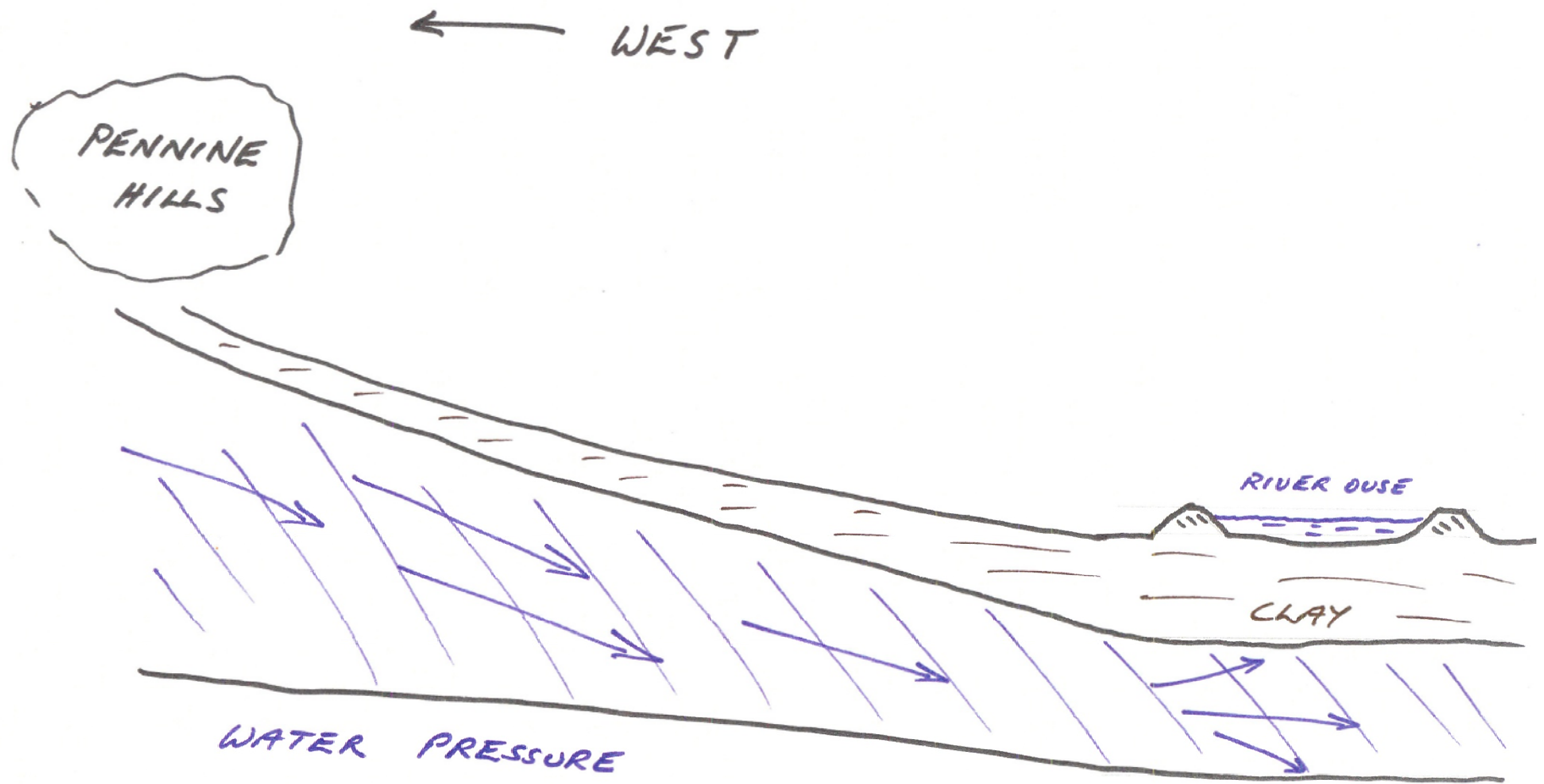
A small tunnel, but with large
construction problems.

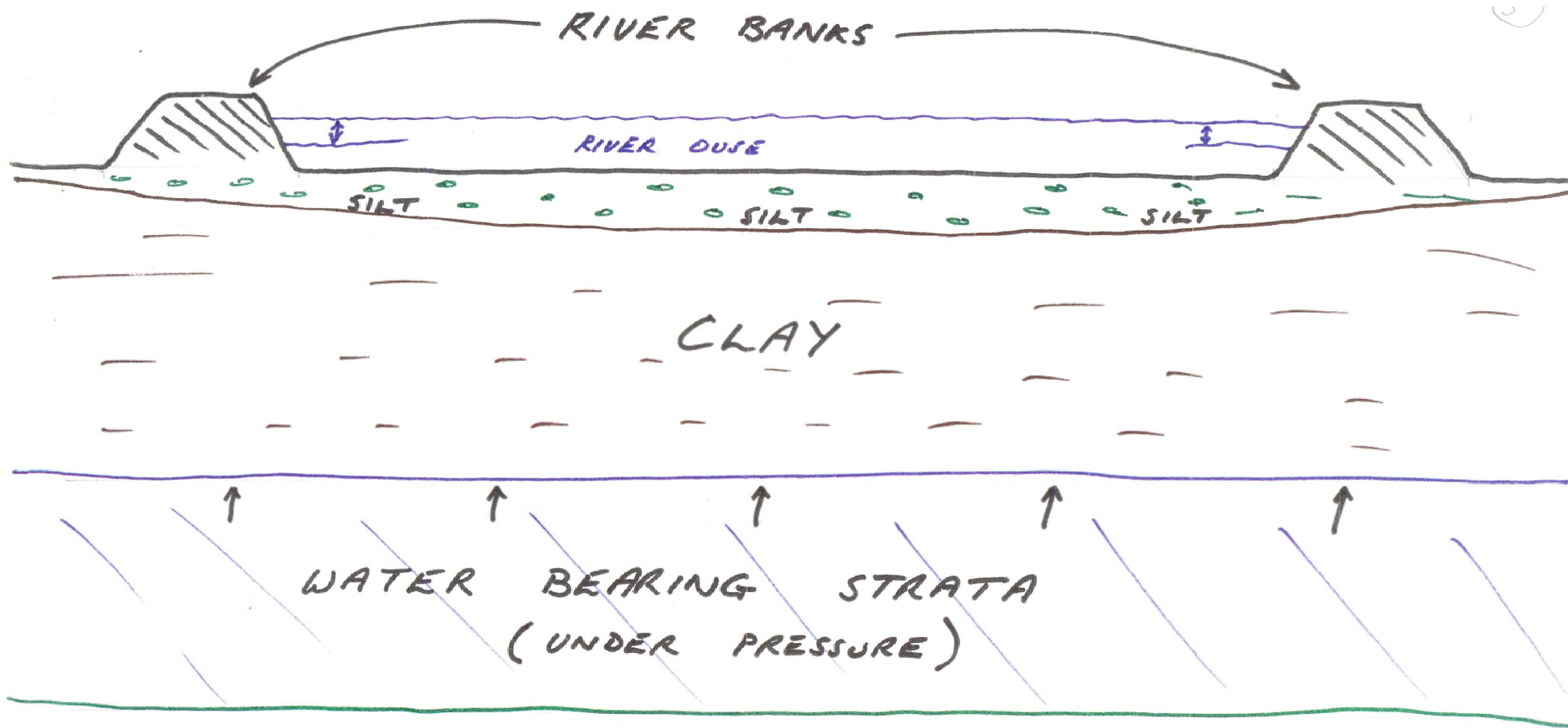


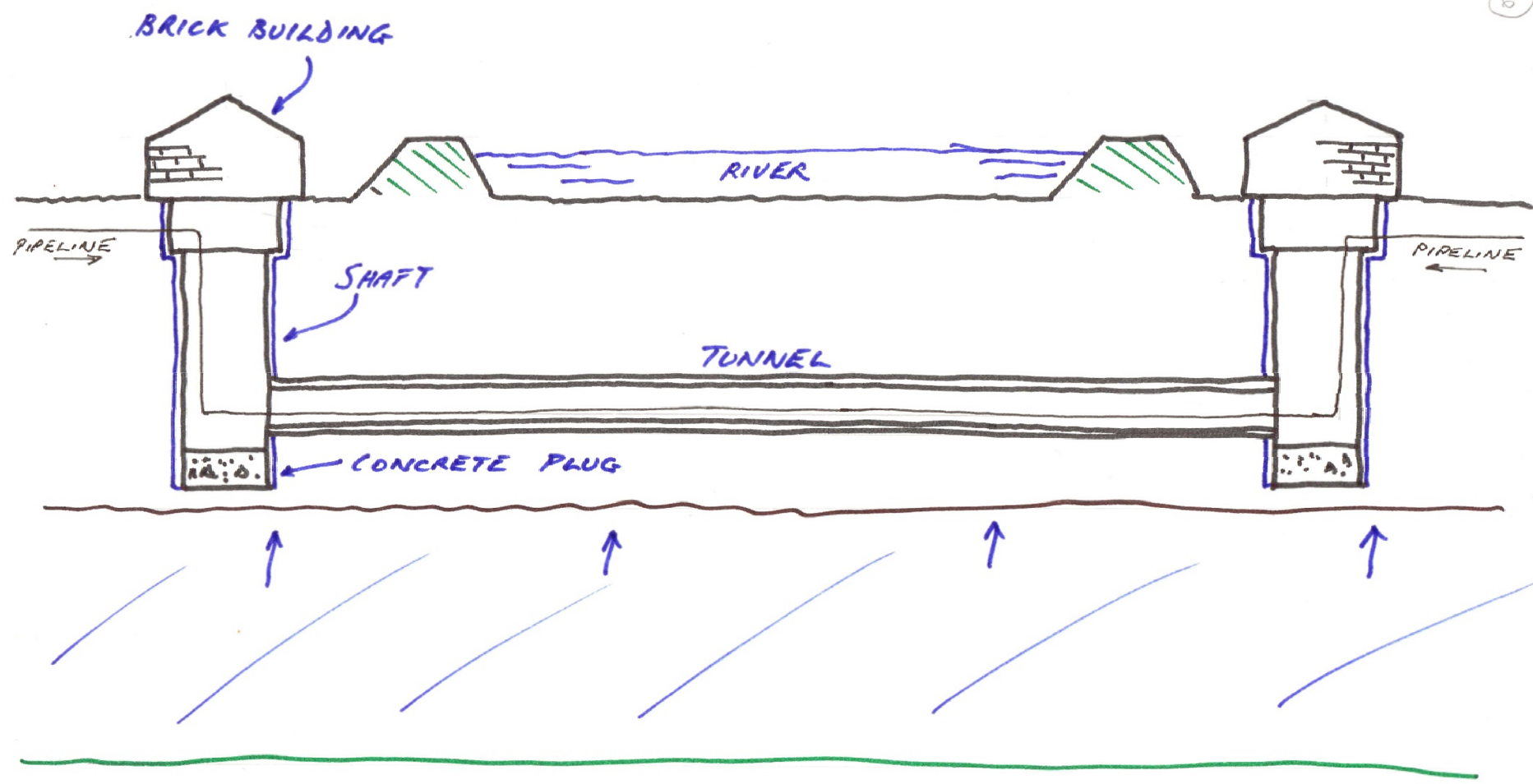








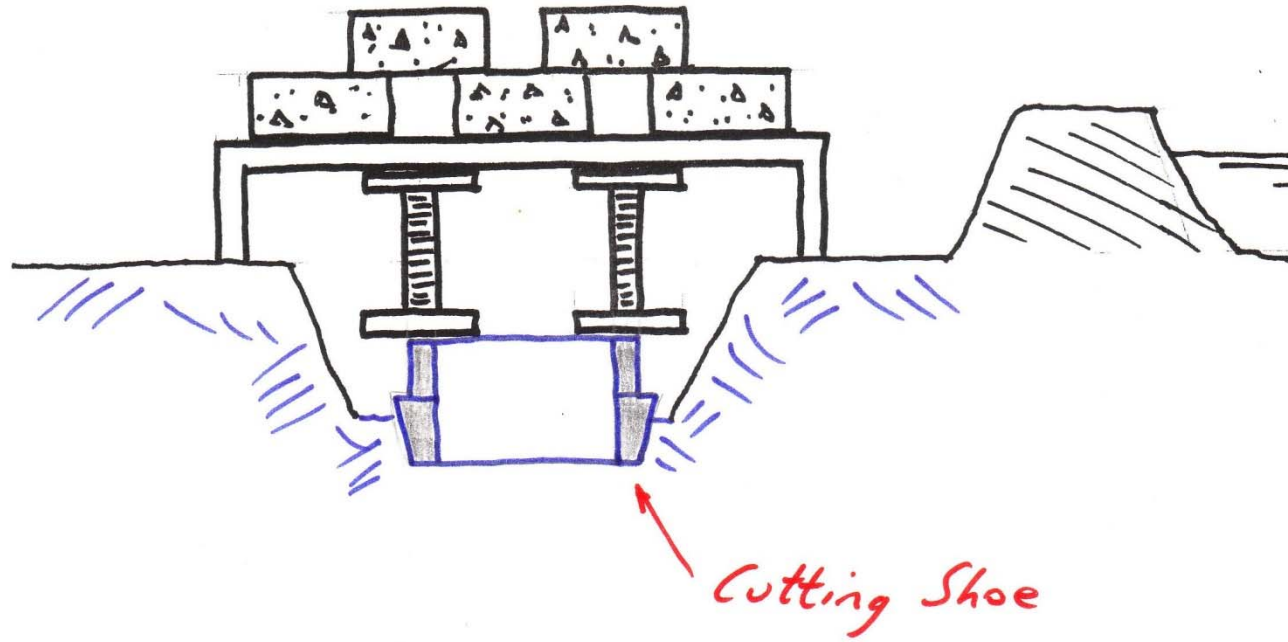




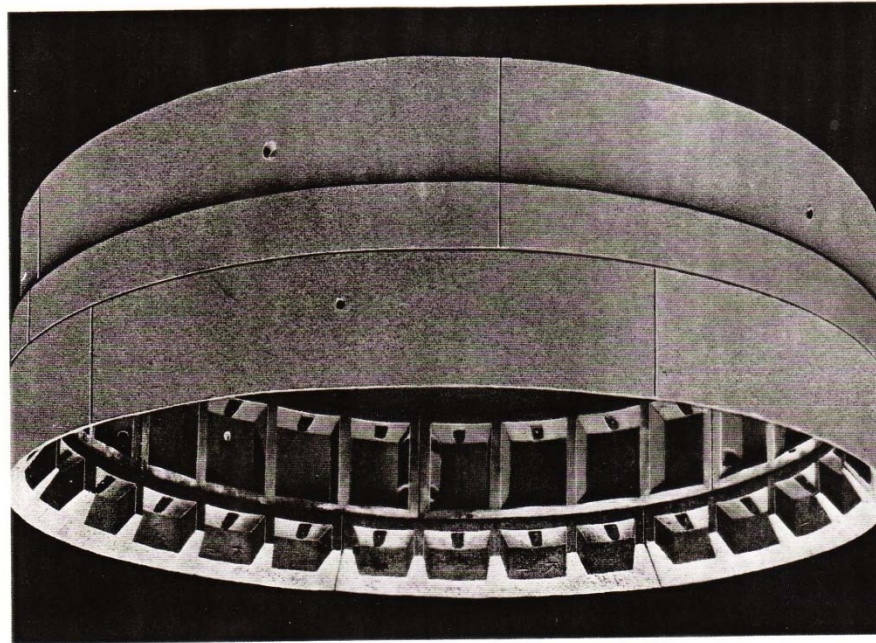
RIVER OUSE CROSSING

CONSTRUCTION SEQUENCE

- **CONSTRUCT THE VERTICAL SHAFTS TO A CERTAIN LEVEL**
 - **Shaft Sinking**
 - **Underpinning**
- **INSTALL COMPRESSED AIR EQUIPMENT**
- **COMPLETE SHAFT CONSTRUCTION**
- **BREAK OUT FROM SHAFTS AND CONSTRUCT TUNNEL**
- **REMOVE COMPRESSED AIR EQUIPMENT**
- **INSTALL TWIN WATER PIPELINES**
- **CONSTRUCT BRICK BUILDINGS**

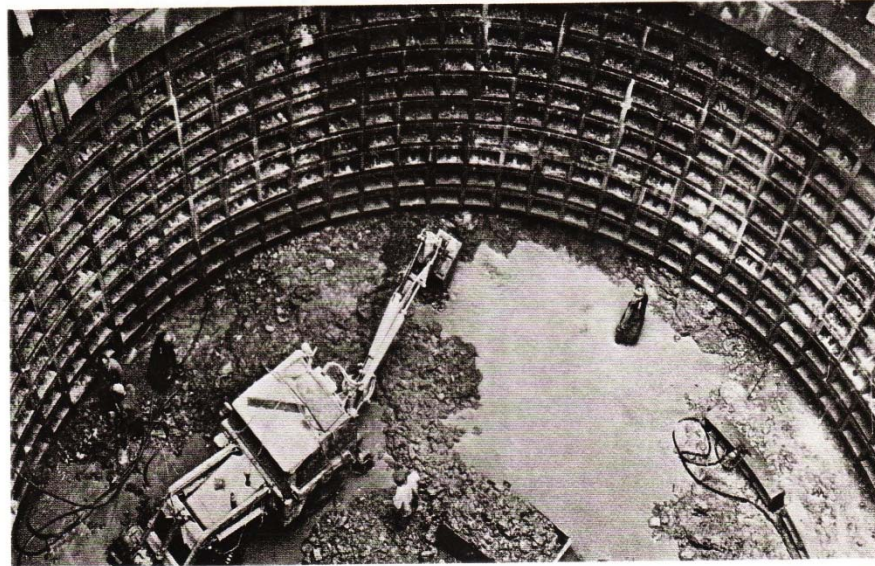


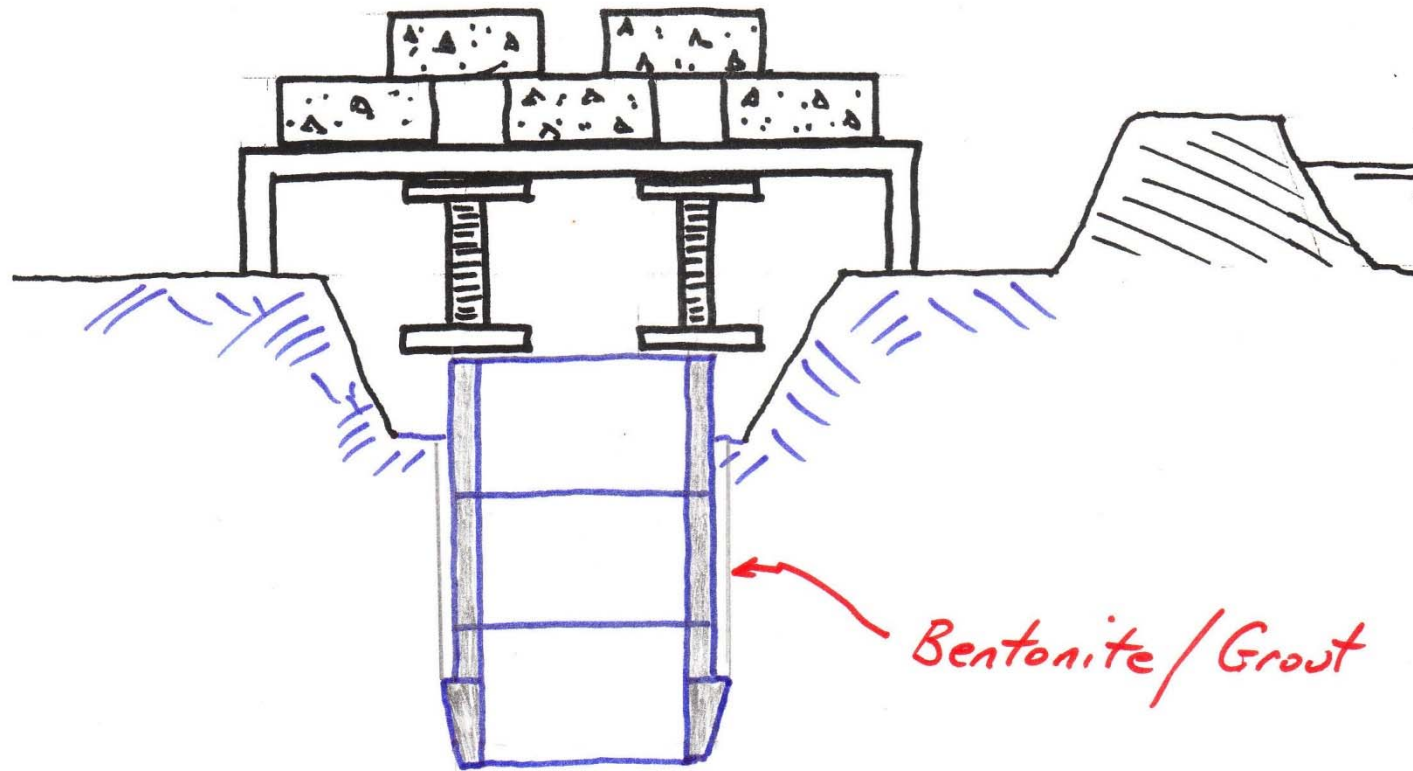
SHAFT SINKING



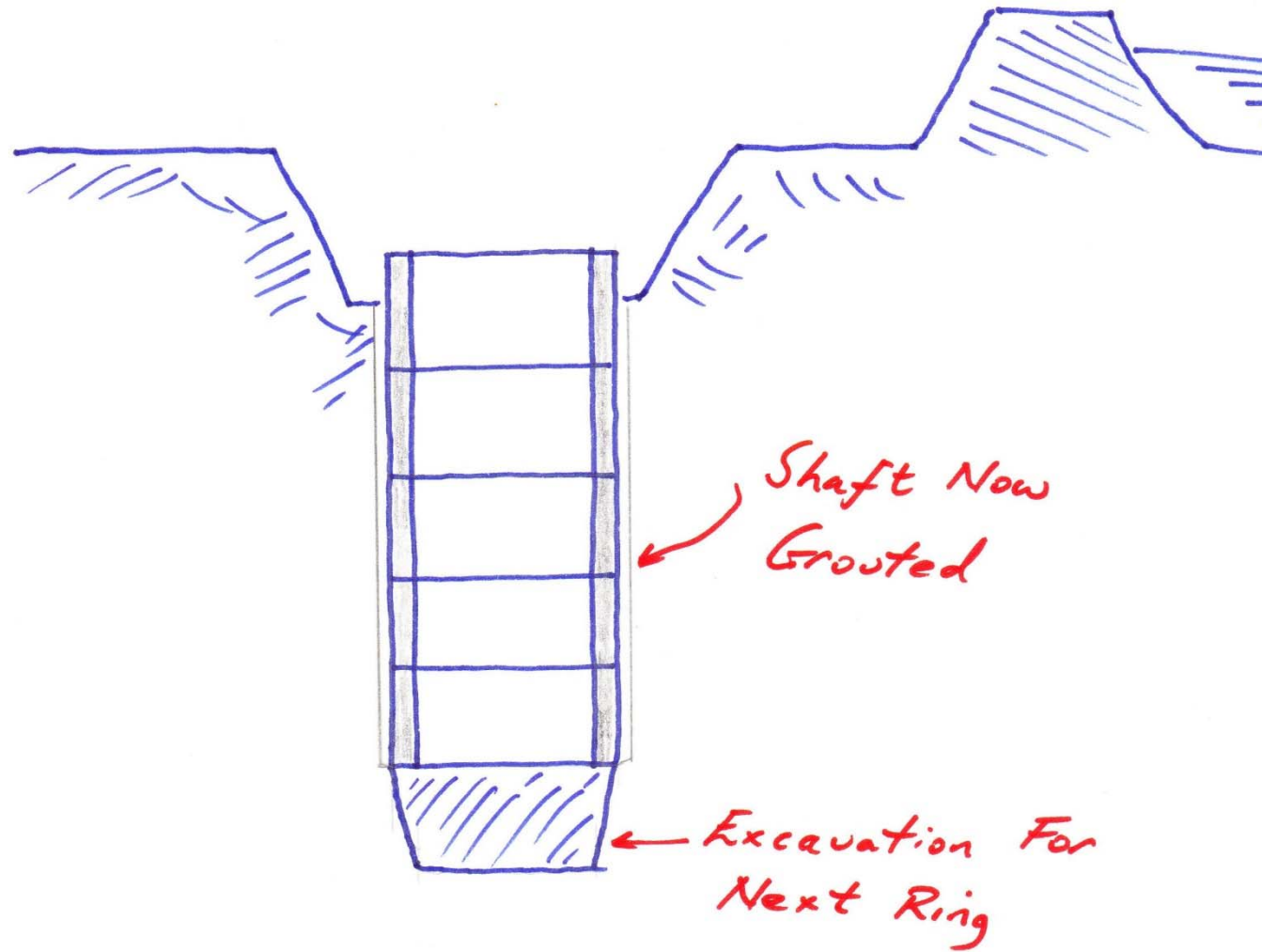
Above: 12' 0" internal diameter cutting edge shown with choker ring

Below: 58' 0" internal diameter shaft

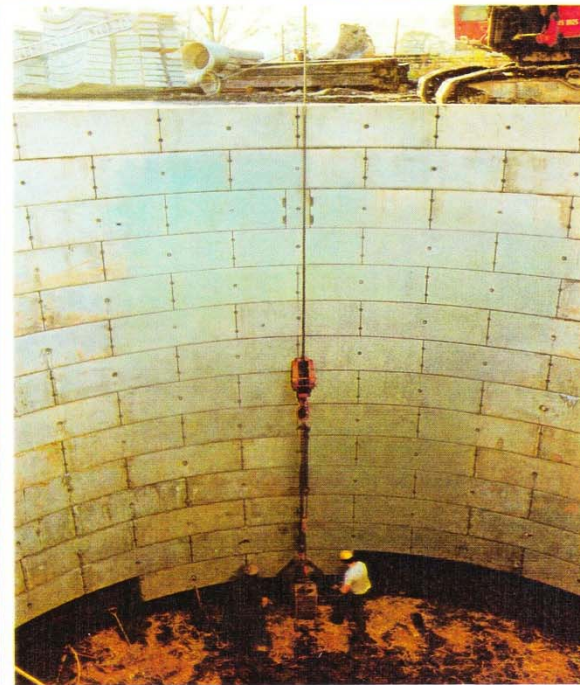
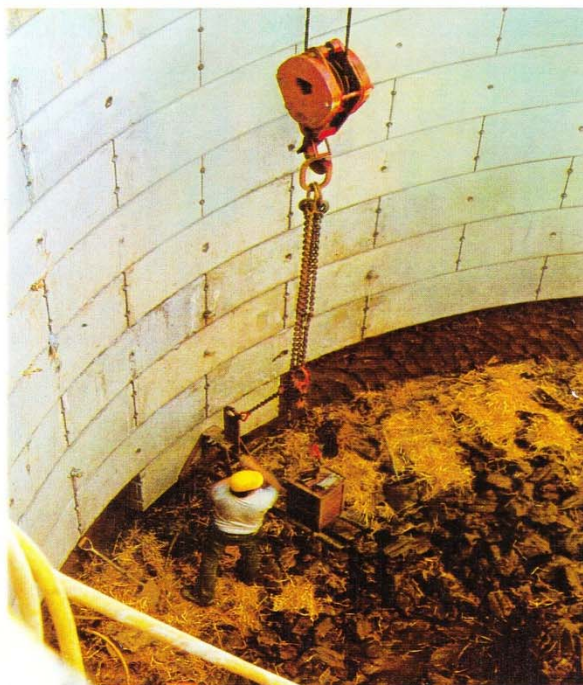


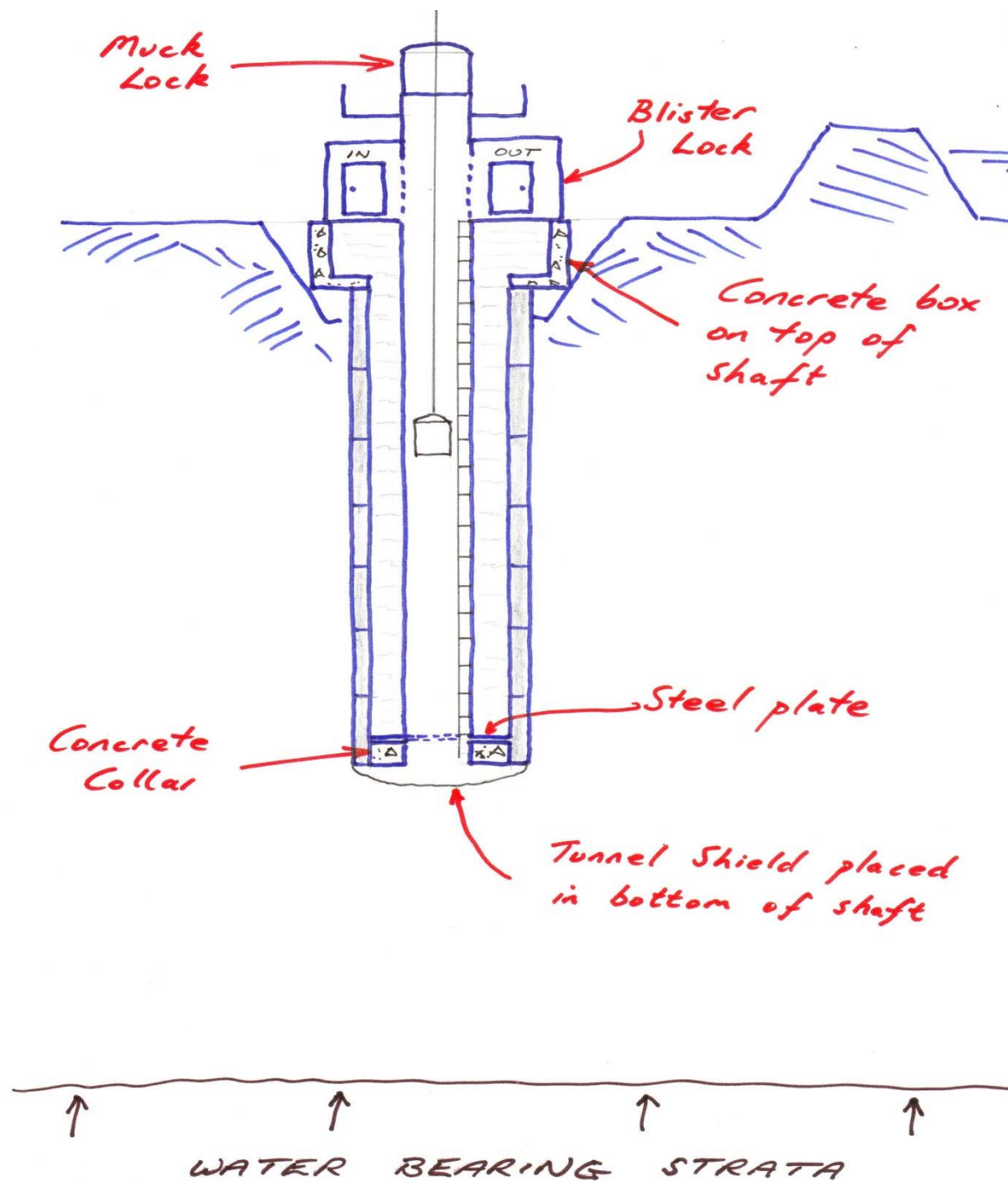


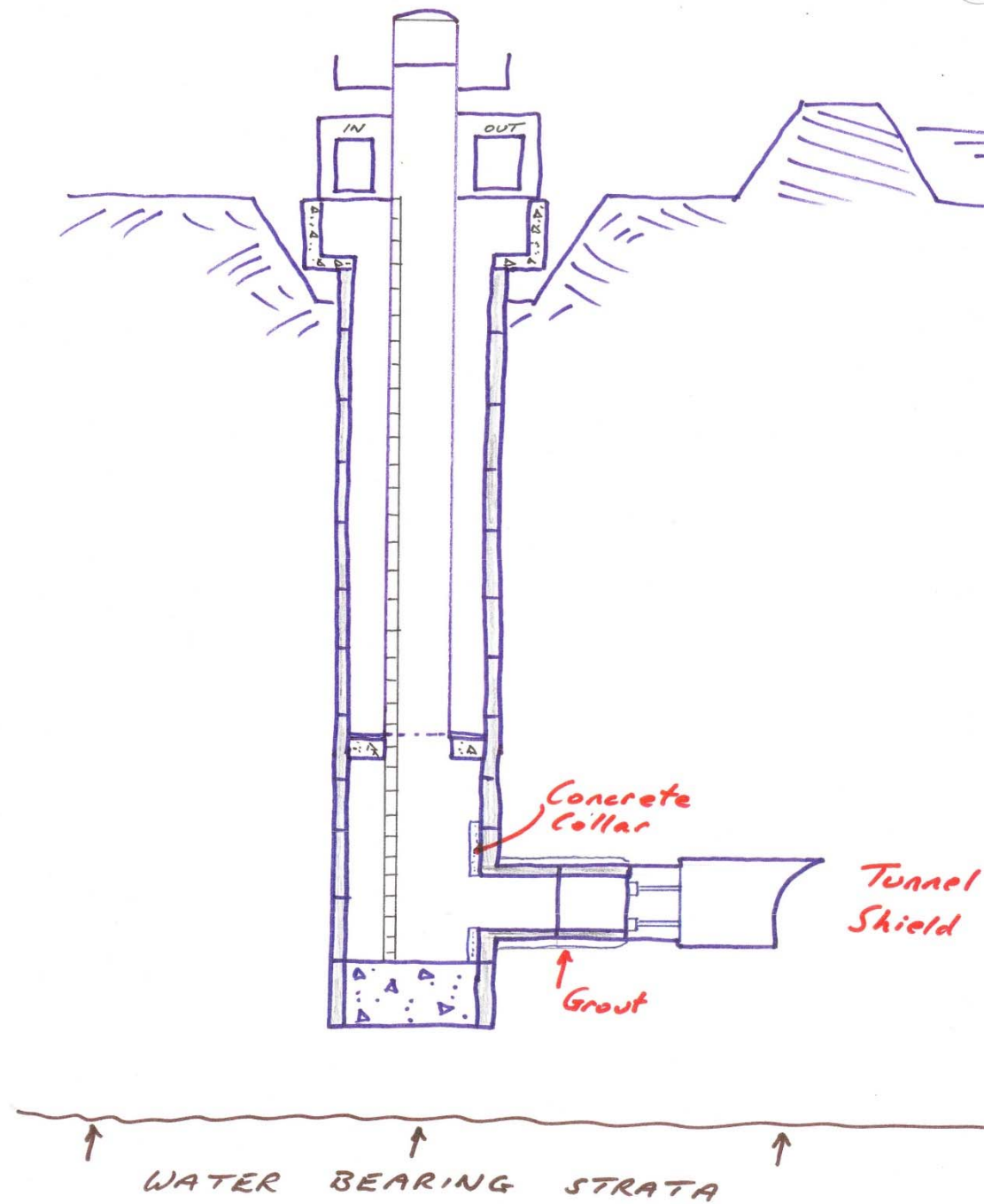
SHAFT SINKING

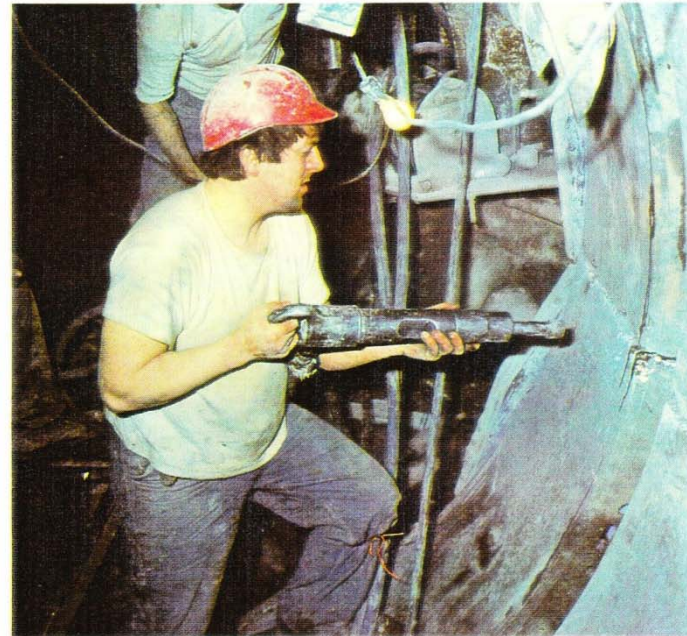
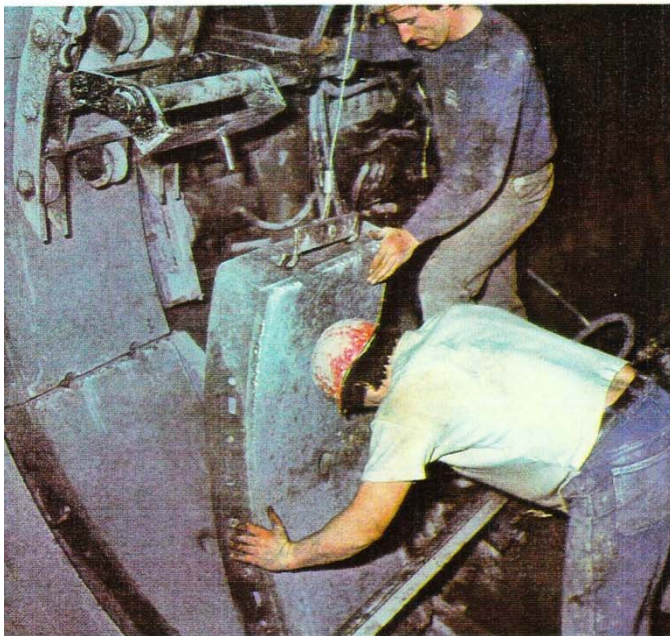
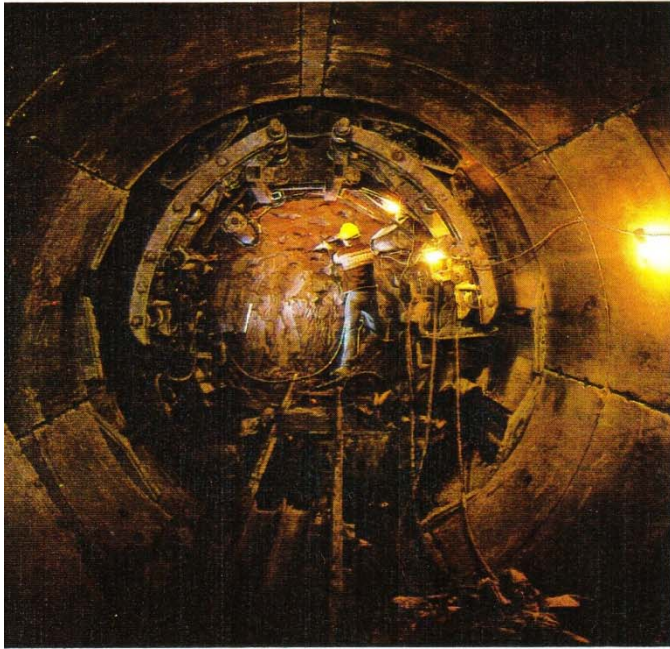


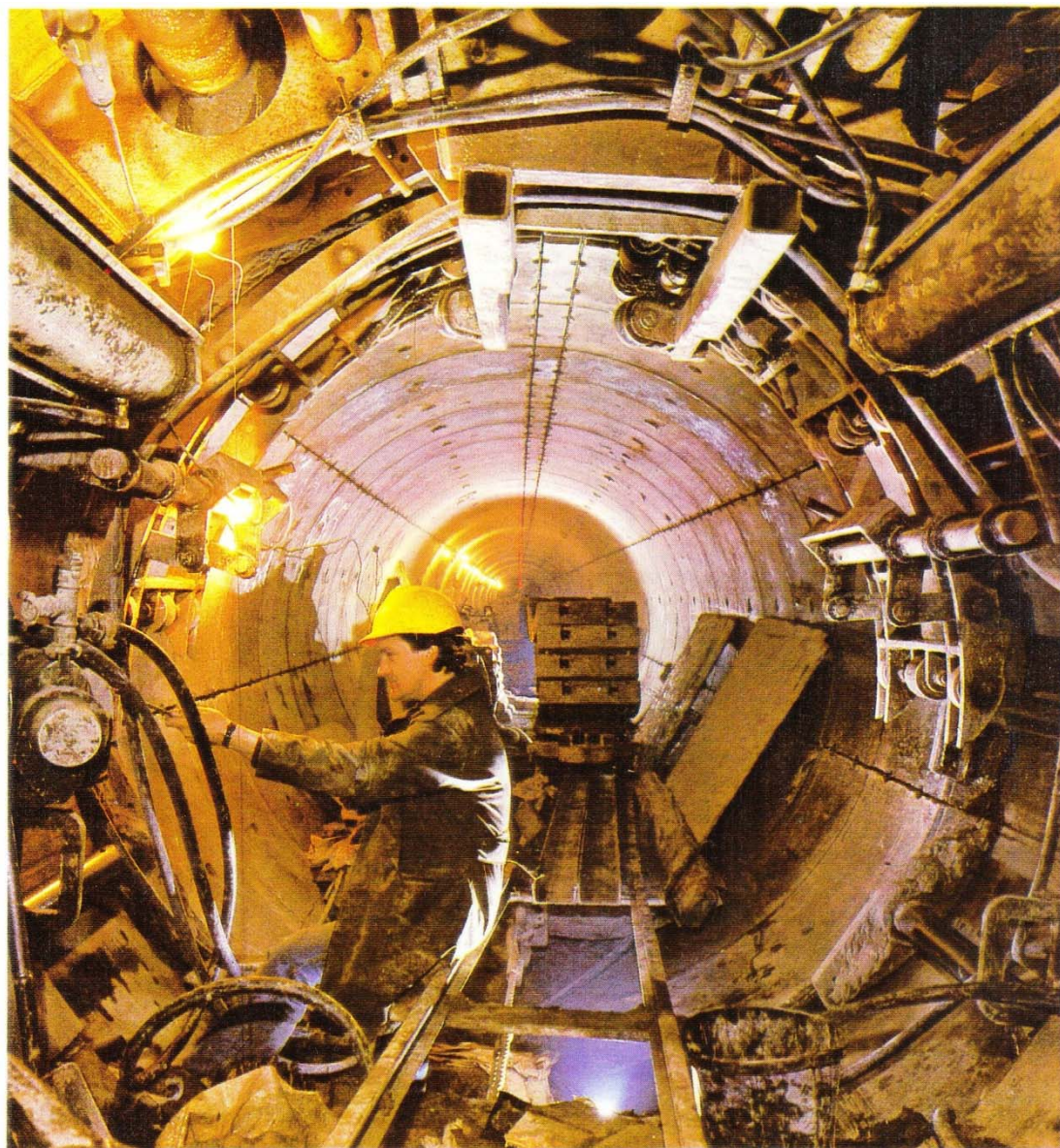
UNDER PINNING



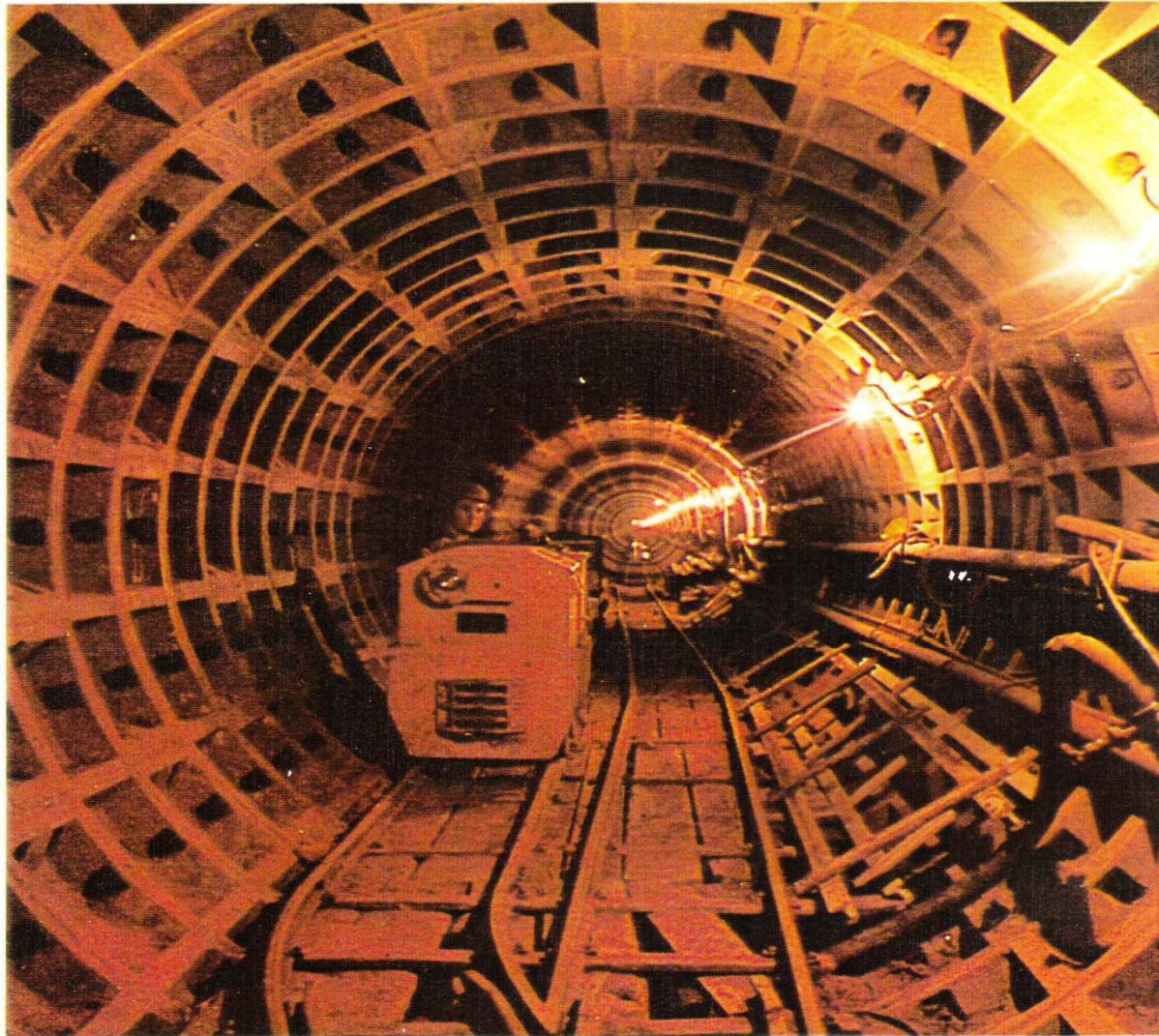


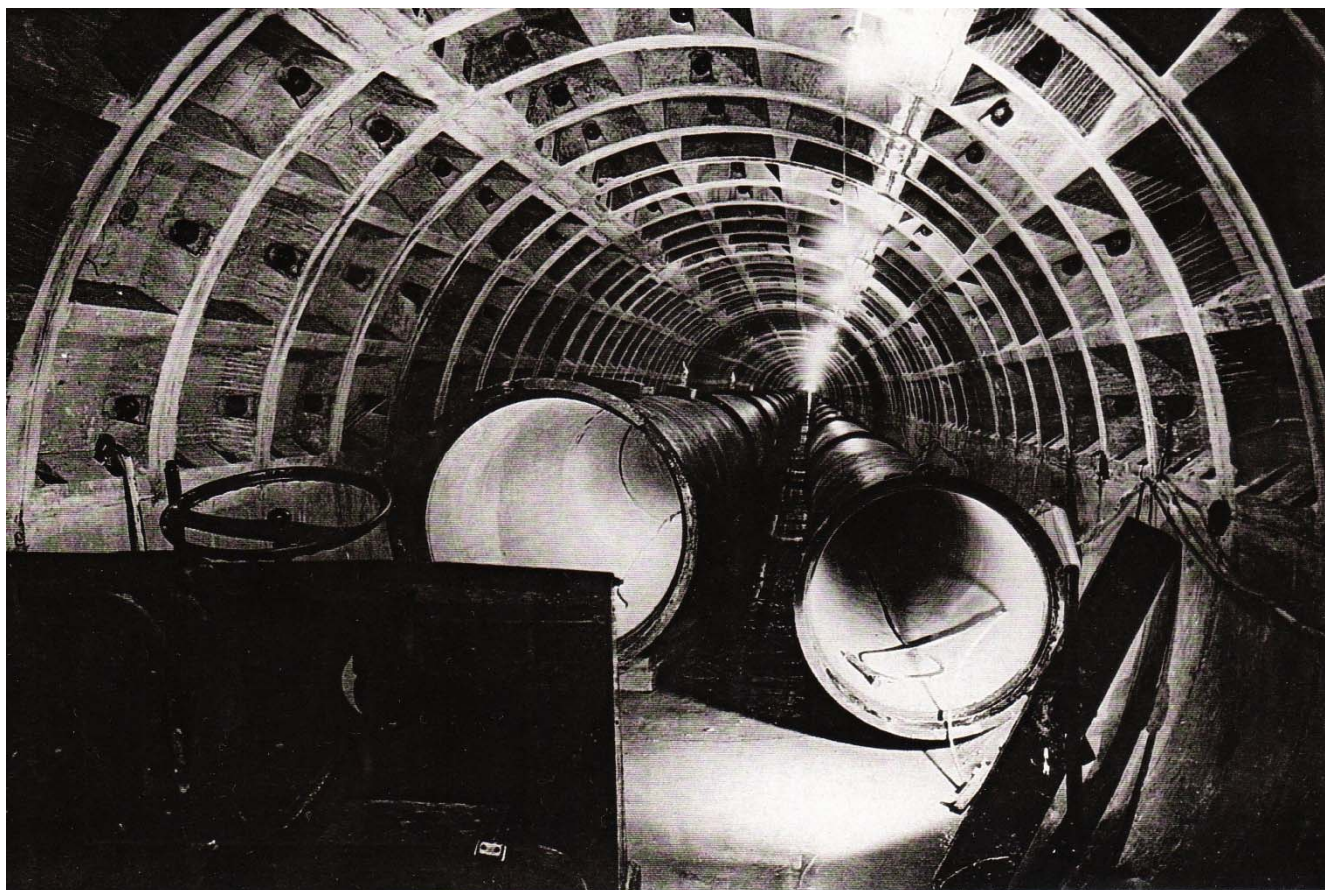






BOLTED TUNNEL AND SHAFT LININGS





RIVER OUSE CROSSING

COMPRESSED AIR HISTORY

- ROTHERHIDE TUNNEL (Late 1800's)
- COMPRESSION NOT DECOMPRESSION THOUGHT TO BE THE PROBLEM
- STUDY UNDERTAKEN ON BLACKPOOL SEA OUTFALL CONTRACT (Early 1900's)
- "BLACKPOOL TABLES COMPILED – Still used to this day

RIVER OUSE CROSSING

COMPRESSION EQUIPMENT

- **COMPRESSORS (Including back up compressors and generators)**
- **SCRUBBERS**
- **CHILLERS**
- **GUAGES AND MONITORS**
- **DUMP VALVE**

RIVER OUSE CROSSING

DECOMPRESSION

Two Methods:

- **DECOMPRESSING IN MAN LOCK**
- **DECANTING (SEPARATE LOCK)**

Need Also:

- **MEDICAL LOCK**

RIVER OUSE CROSSING

MEDICAL/HEALTH MATTERS

- **REGULAR MEDICALS**
 - **EVERY TWO MONTHS UP TO 18 PSI**
 - **EVERY MONTH OVER 18 PSI**
- **MUST ALWAYS WEAR “DOG TAG”**
- **BONE NECROSIS (nitrogen dissolves out of blood stream)**
- **INITIAL STAGES OF COMPRESSION SICKNESS
SIMILAR TO BEING DRUNK**
- **STAGE 1 COMPRESSION SICKNESS CAN TAKE UP
TO 3 DAYS TO TREAT**

Dysbaric osteonecrosis or **DON** is a form of [avascular necrosis](#) where there is death of a portion of the [bone](#) that is thought to be caused by [nitrogen embolism](#) (blockage of the [blood vessels](#) by a bubble of nitrogen coming out of solution) in divers.

Dysbaric osteonecrosis (DON) is the destruction of bone tissue in the long bones, hips and shoulders associated with diving and compressed-air work. Generally considered to be the result of circulation disruption,

The association between decompression and osteonecrosis was initially suspected because of an unexpectedly high incidence of osteonecrosis among divers and compressed-air workers. In the 1970s, the estimated prevalence was 2 to 5 percent in Navy divers, **25 to 35 percent in tunnel workers**, 16 to 55 percent in commercial divers in the U.K. and 50 to 65 percent in fishermen divers. In comparison to the risk of osteonecrosis in the general population, the risk of DON was 10 times greater in Navy divers and 100 times greater in fishermen. **The risk increased with greater deviations from safe decompression procedures.**

Dysbaric Osteonecrosis in Recreational Diving By Petar Denoble, M.D., D.Sc.

TEA/COFFEE BREAK





AND FINALLY

