Dewatering & Foundations

Water

• It seems every time we dig a hole it fills up with rainwater, or groundwater... if we’re lucky we hit an underground river or spring that keeps the hole nice and wet.

• But a wet excavation slows down construction, so the builder usually employs some sort of "De-Watering" strategy.

Low tech

• The simplest approach to dewatering a sloping site is to dig a trench through the slope to allow the excavation to drain freely.
Pumping…

• Next on the simple to complicated scale is pumping.
  - A low spot or sump is dug in the bottom of the excavation to collect water.

*Diagram*

Pumping…

• A pump (electric, gas, or diesel powered) is placed on the high ground near the excavation.

*Diagram*

Pumping…

• Water is pumped from the excavation to (ideally) the adjacent storm sewer.

*Diagram*
This works well for some rainwater accumulating in the excavation, but what about that underground spring that keeps filling the excavation with water?

In cases where the amount of water entering the excavation is steady, not intermittent as in the case of rain, the builder can try to block the water from entering the excavation or intercept the water before it reaches the excavation.

Slurry walls or corrugated sheet piling are two types of shoring that also act as barriers to underground water flow. Their effectiveness depends on the depth of the water bearing soils or sands, generally they reduce the amount of water in the excavation, but don’t eliminate it.
Dewatering...dealing with higher flows

Intercepting the water around the site perimeter is accomplished by using multiple wellpoints distributed around the excavation perimeter.

Well points

- The well point is a hollow pipe with a screened opening at the tip to allow water into the pipe, but keep sand and mud from clogging the tip. (similar to a sand point on a domestic water well)

Many wellpoints ... interconnected

- The well points are placed at 4 to 6 foot intervals around the sides of the excavation where water is entering
Many wellpoints ... interconnected

- The well points are then connected to common headers

The headers are connected to a manifold at the pump

And the pump is piped to the storm sewer
Lowering the water table

• The good news is, when the dewatering works, the water table is pulled down below the level of the excavation.

• The bad news is, when the dewatering works, the water table is pulled down below the level of the excavation.

• In certain types of soil (expansive clays) and with certain types of existing foundation systems (wooden piles) lowering the water table may have dramatic effects on adjacent structures.
  • Dry expansive clays displace less volume...the building next door settles
  • The absence of water allows bacteria which eat wood to flourish...the building next door settles
Lowering the water table

- But if it's not expansive soil, if the neighboring structures don't have wood pile foundations, the dewatering allows the excavation to proceed.

Undermining prevention...

- When it is known that the footings for the new project will extend below the footings of the existing building, the existing footing can be sequentially underpinned before the footing is undermined.

- Sequential underpinning leaves masses of earth below the existing footings, but removes earth between these masses.
- The existing footing spans the void temporarily until the new footing can carry the load.
• So part of the wall is still supported on undisturbed earth.

• While an adjacent section is spanning, its new footing/foundation is constructed.

• When the new footings/footings are ready to carry load, the mass of earth between is removed.
• When the new footings / foundations are ready to carry load, the mass of earth between is removed.
• And infilled with new foundation and footing.

• The ends of the wall are a little more fragile and are replaced in smaller pieces to minimize cracking above.

• When completed the footing is extended to a depth equal to or below the new buildings footing depth to prevent undermining.
• Not easy, not inexpensive, not fast, but cheaper than buying the business (& building) next door.
• In a project without shoring or slurry walls, the unexpected sometimes happens... the backhoe bucket takes too big a bite, or a sidewall collapses
• The exposure of the footing of an adjacent structure requires timely replacement of the structural capacity of the exposed footing...

Needling neighbors...

• If the undermined building has a basement, it is possible to temporarily support the foundation wall and building above by placing steel beams through the foundation wall

Needling neighbors...

• The steel beams are blocked up or cribbed up from a temporary footing
• The steel beams support a triangle of load, immediately above them.

• Formwork is placed to allow filling the void below the exposed footing.

• Concrete is poured below the exposed footing.
• Needle beams are removed, foundation wall is patched, and construction resumes.
Minipile underpinning

- It’s also possible to drill small piles through the exposed footing to support the building.
- Holes are drilled through the footing, similar to tiebacks.
- These are poured full of high strength grout, sometimes with tendons like the tiebacks to support the footing.