Costs, Benefits, and Risks of Landfill Development within the Groundwater Table

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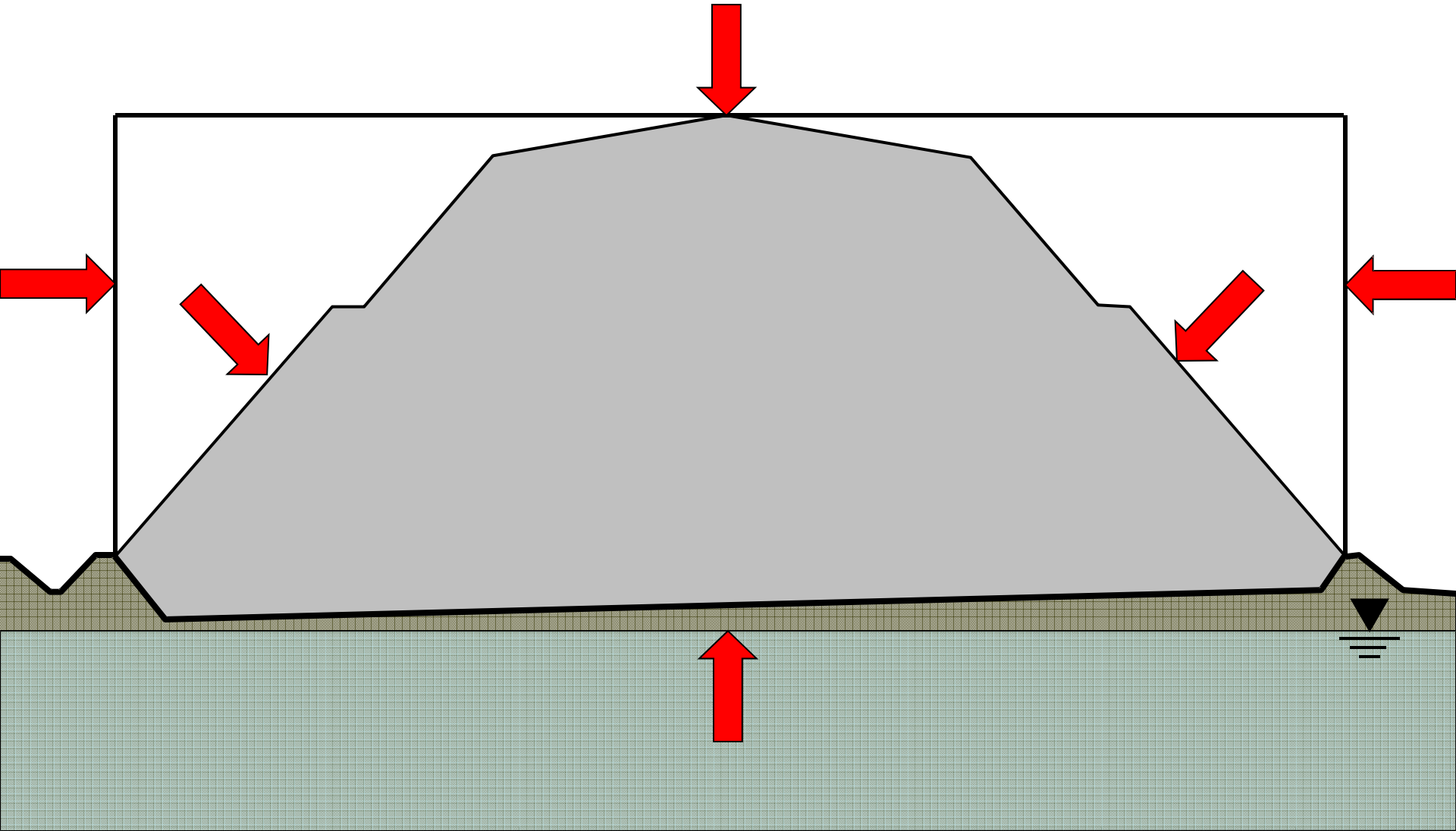
What commodity do landfill owners and operators deal in?

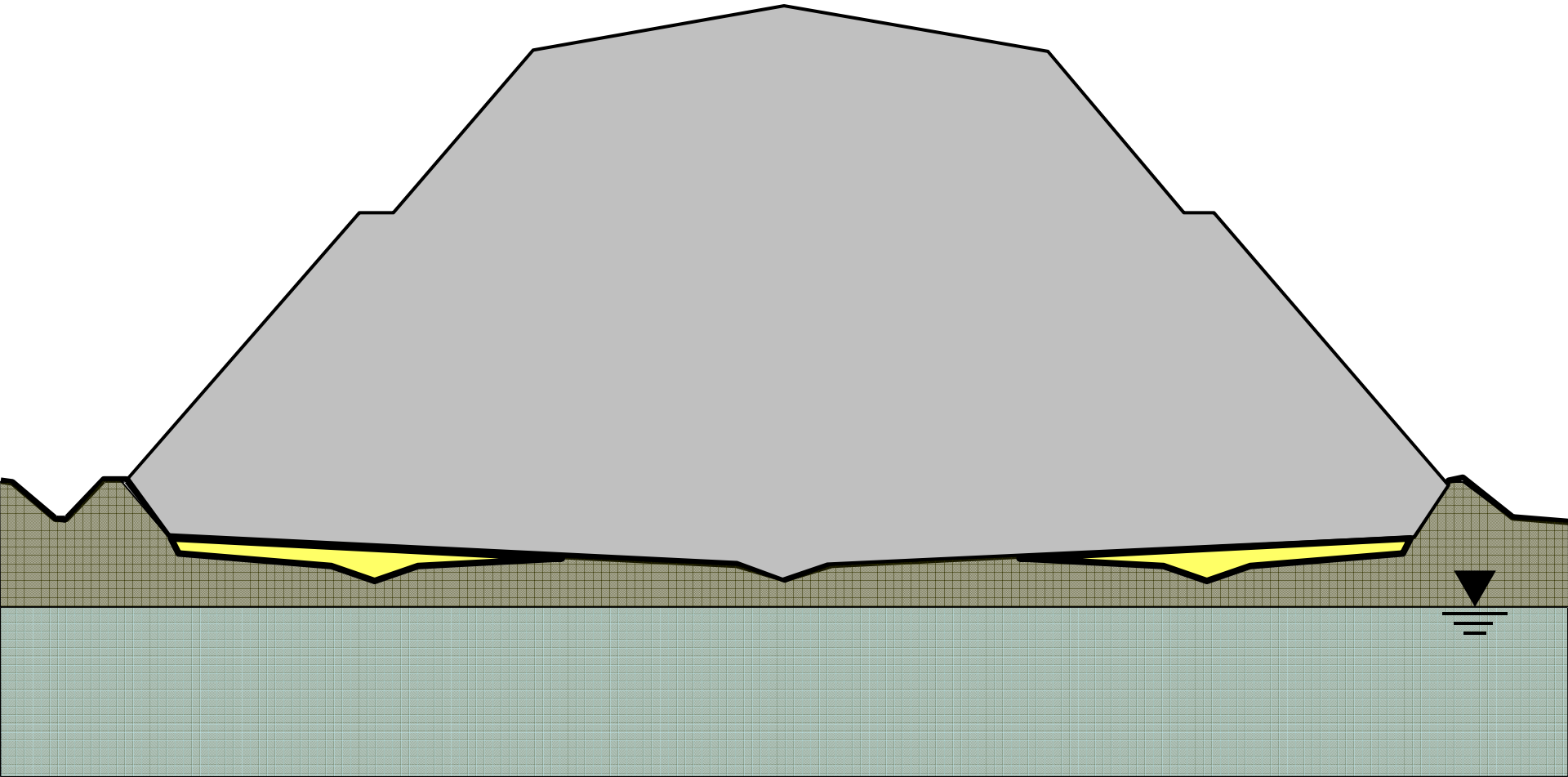
- Development challenges
  - Population growth
  - Siting
  - Cost of expansions
- Geological challenges
  - High groundwater table
  - Soil availability

Design Constraints



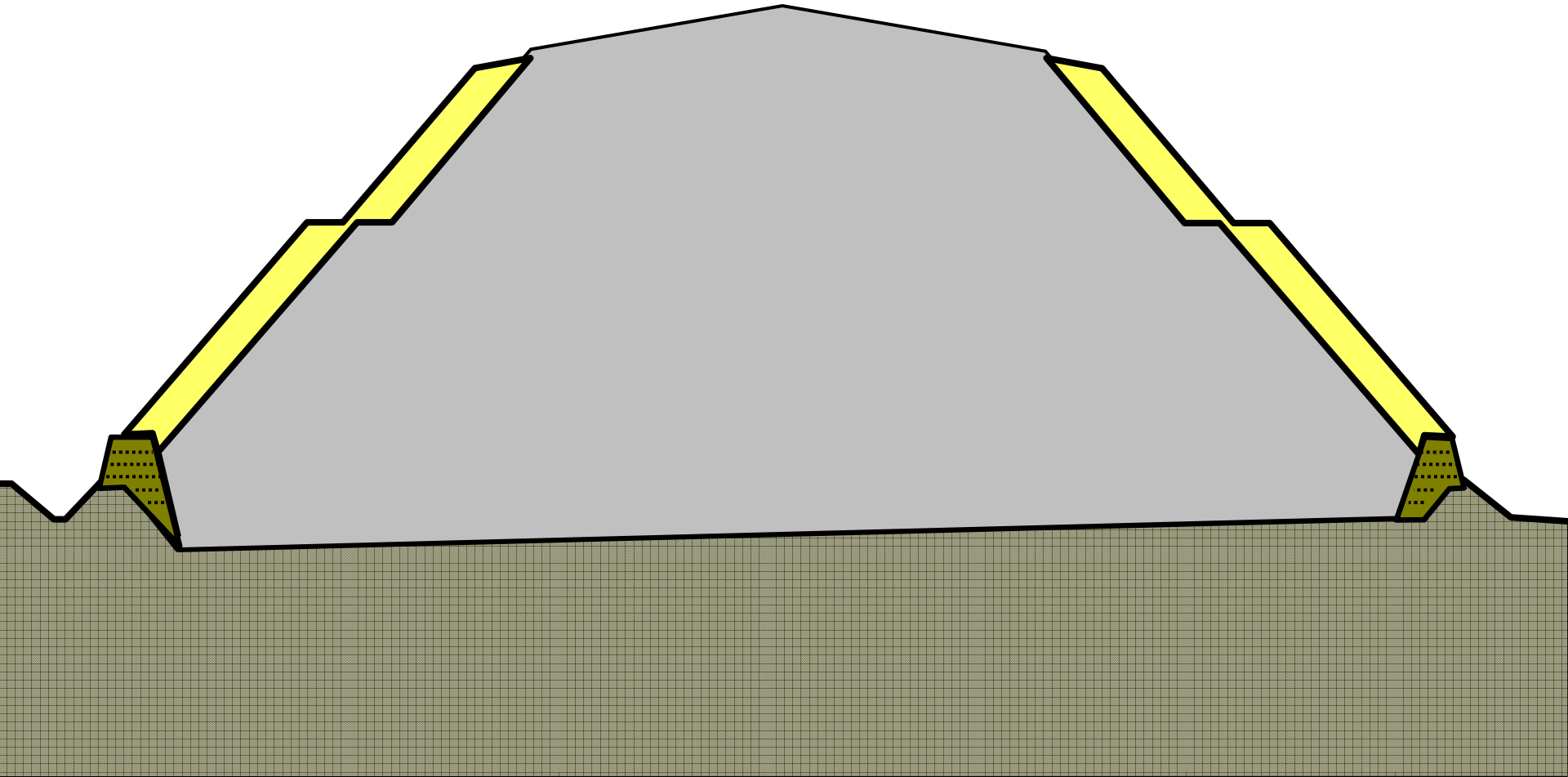
Design Opportunities

Sawtooth Design



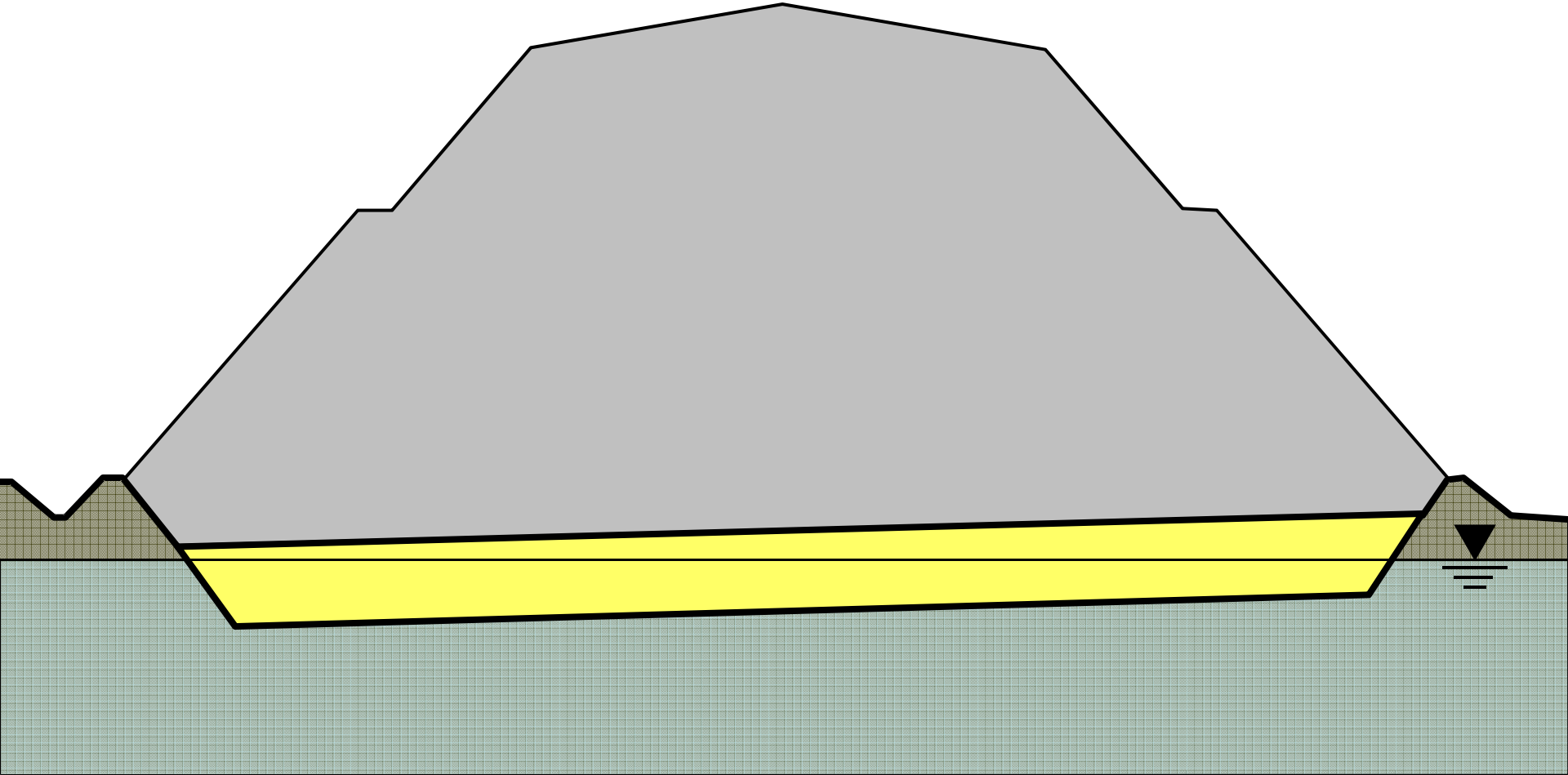
Design Opportunities

Mechanically Stabilized Earth Berm

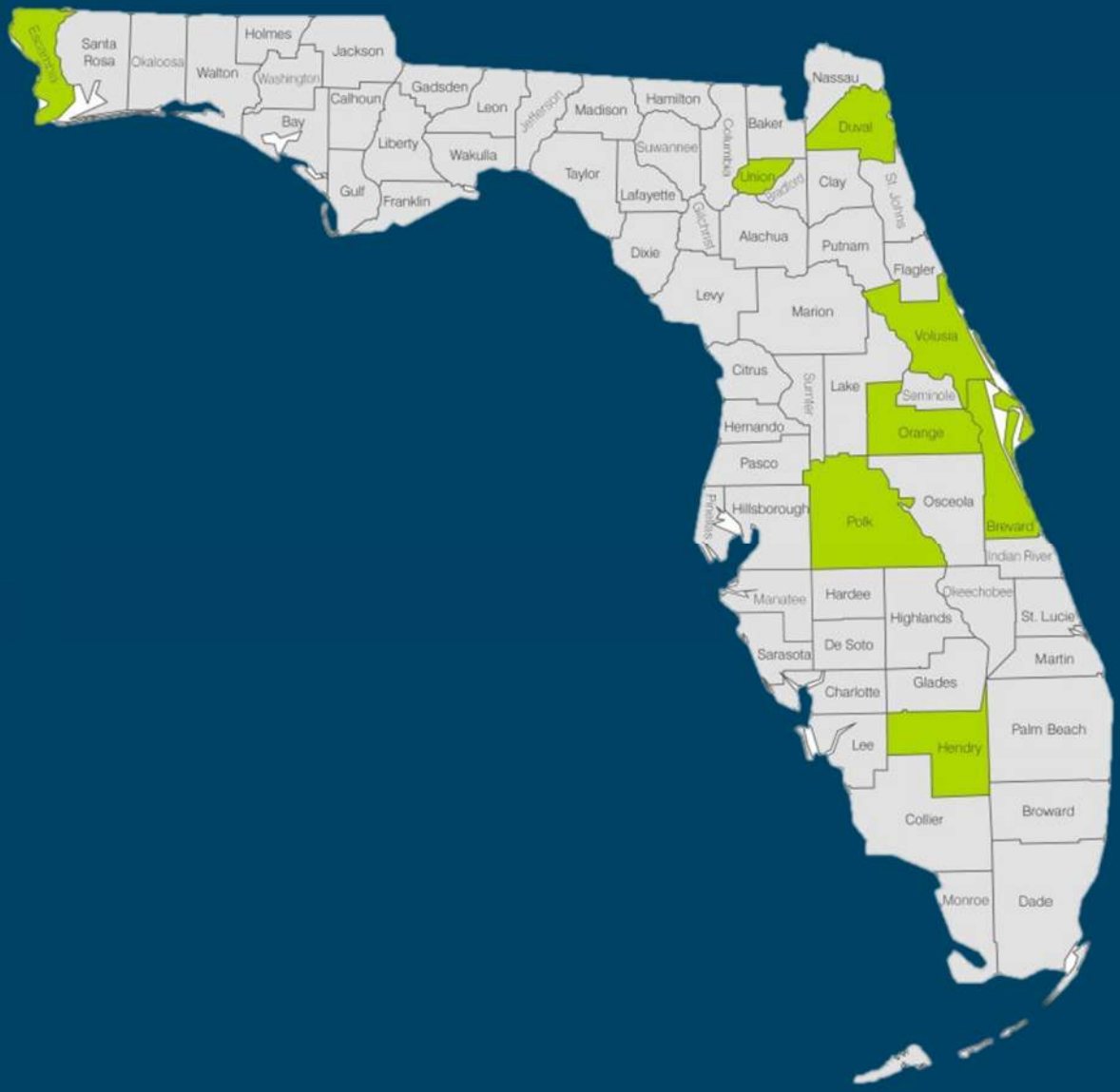


Design Opportunities

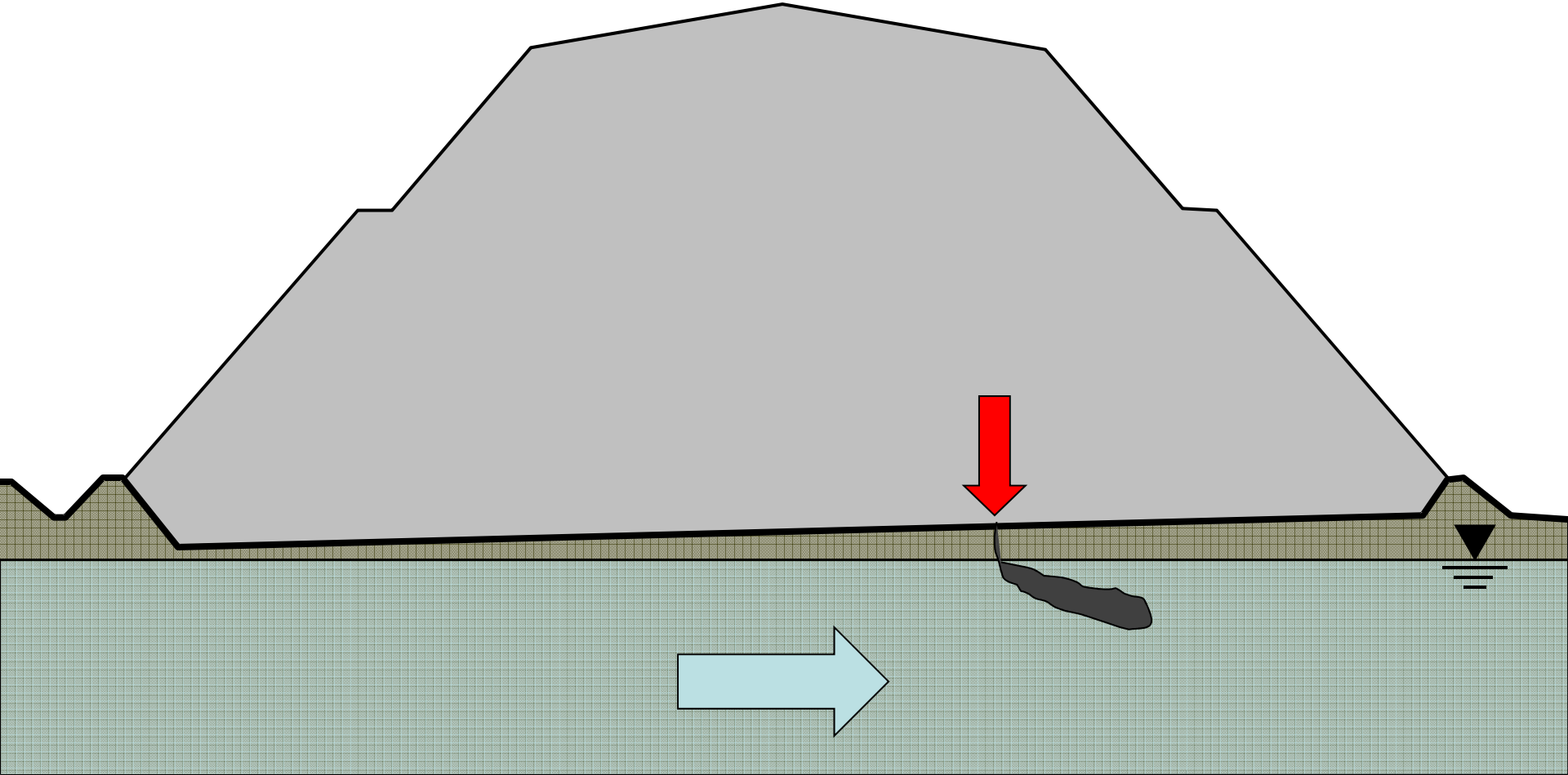
Lower Bottom Liner



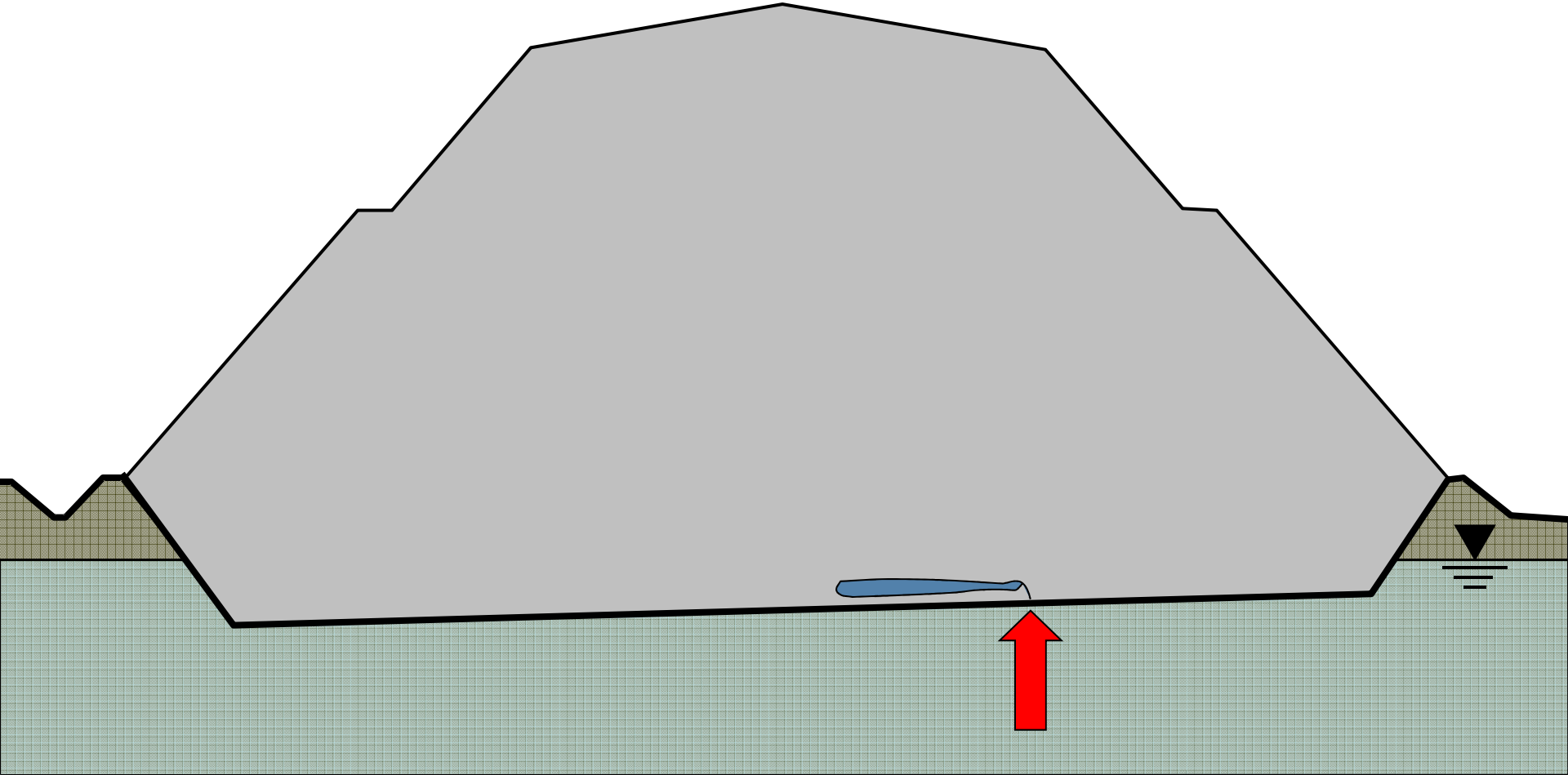
Landfills within Groundwater Table



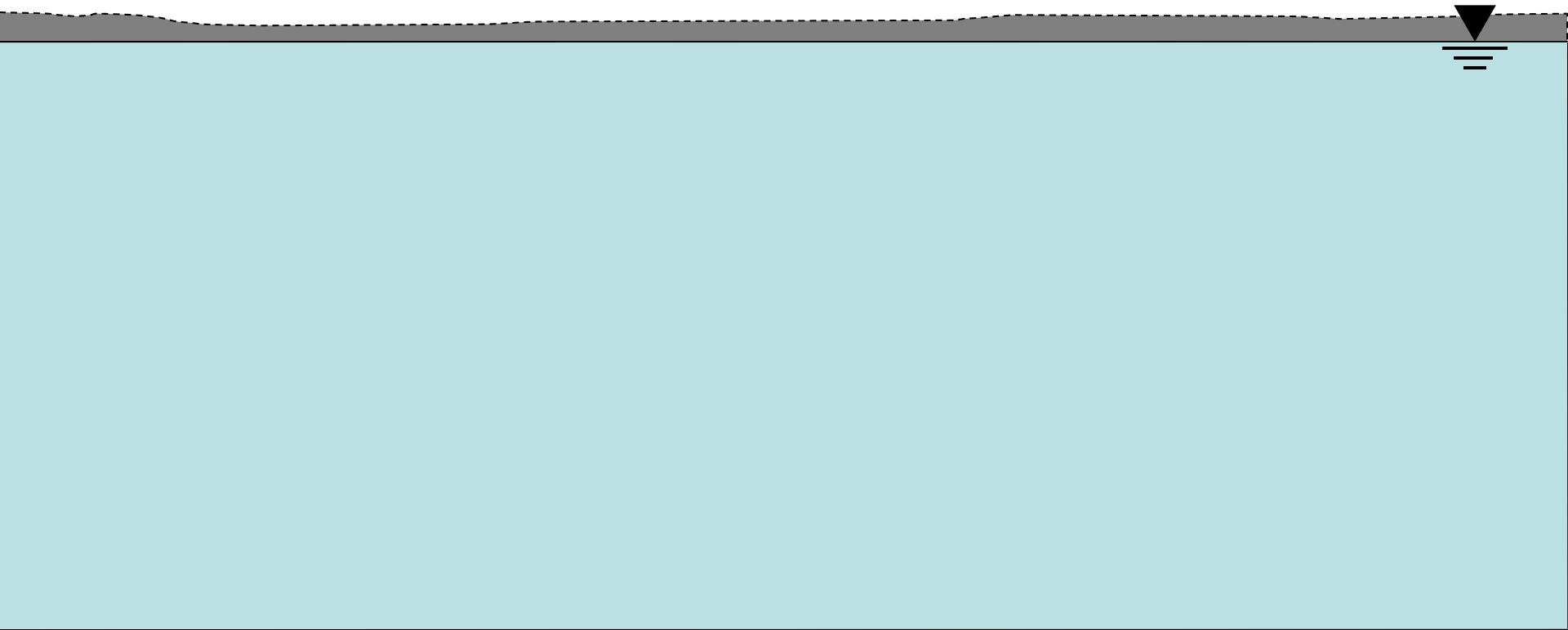
Outward Gradient



Inward Gradient

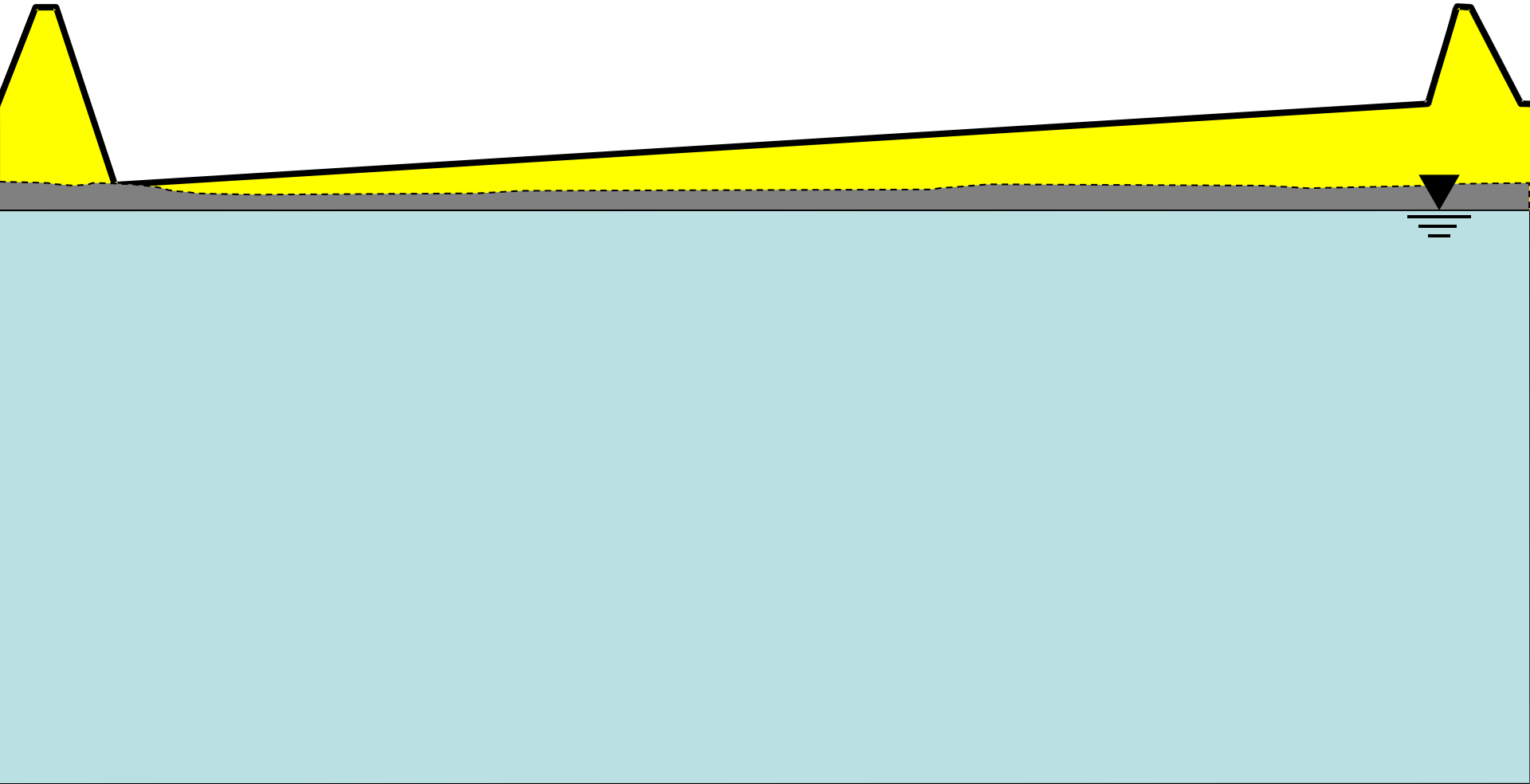


Design Opportunities



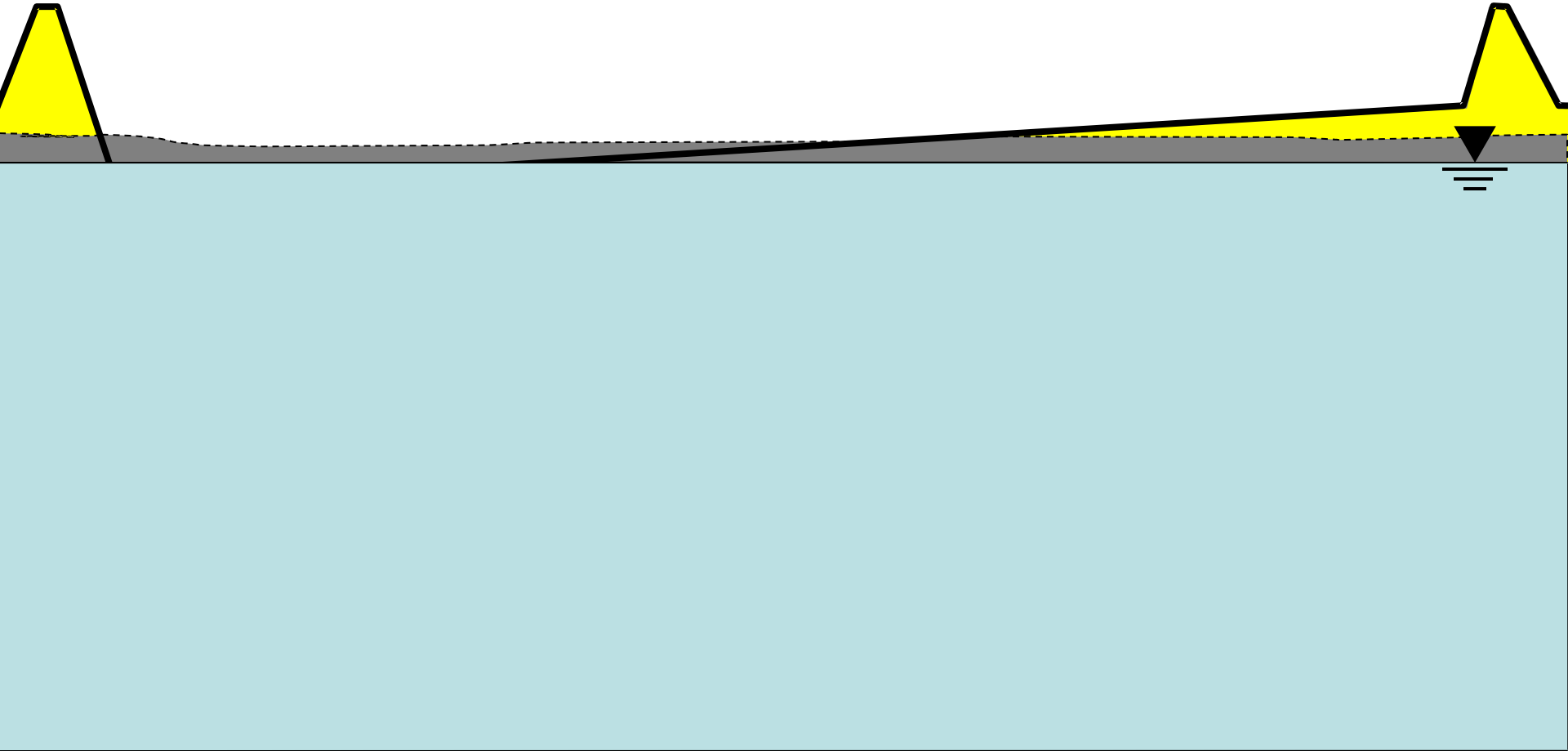
Design Opportunities

- Import



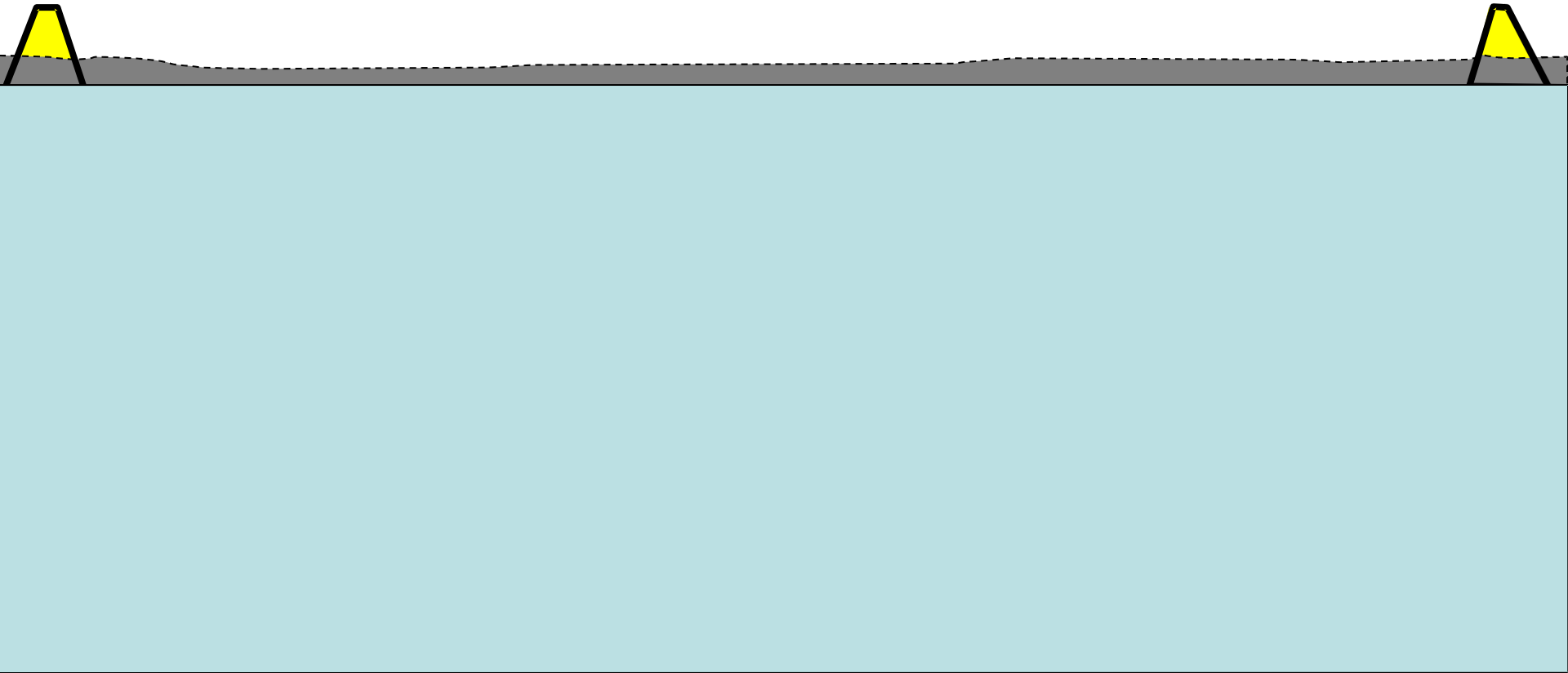
Design Opportunities

- Balance



Design Opportunities

- Cut



Cost-Benefit

Within the Groundwater

Item*	Cost
ECW	$1,810,000
Dewatering	$379,000
Dewatering Subtotal	**$2,191,000**
Everything else	**$**16.7 M
Total Cost	**$18.9 M**

*bid prices

$8.85 M Addition Capacity

Item	Cost
Soil Import	$6,000,000
Everything else	$16.7 M
Total Cost	**$22.7 M**

$3.8 M Construction Cost Savings (17%)

$8.85 M Addition Capacity

Cost-Benefit

Item	Import	Within Groundwater
Dewatering	-	$2.1 M
Soil Import	$6.0 M	-
Everything else	$16.7 M	$16.7 M
Total Cost	**$22.7 M**	**$18.9 M**

$3.8 M Construction Cost Savings (17%)

$8.85 M Addition Capacity

Can We Construct the Bottom Liner System within the Groundwater Table?

Considerations

- Regulatory
- Technical
  - Feasibility
  - Risks
  - Approach
- Economic
  - Costs
  - Benefits

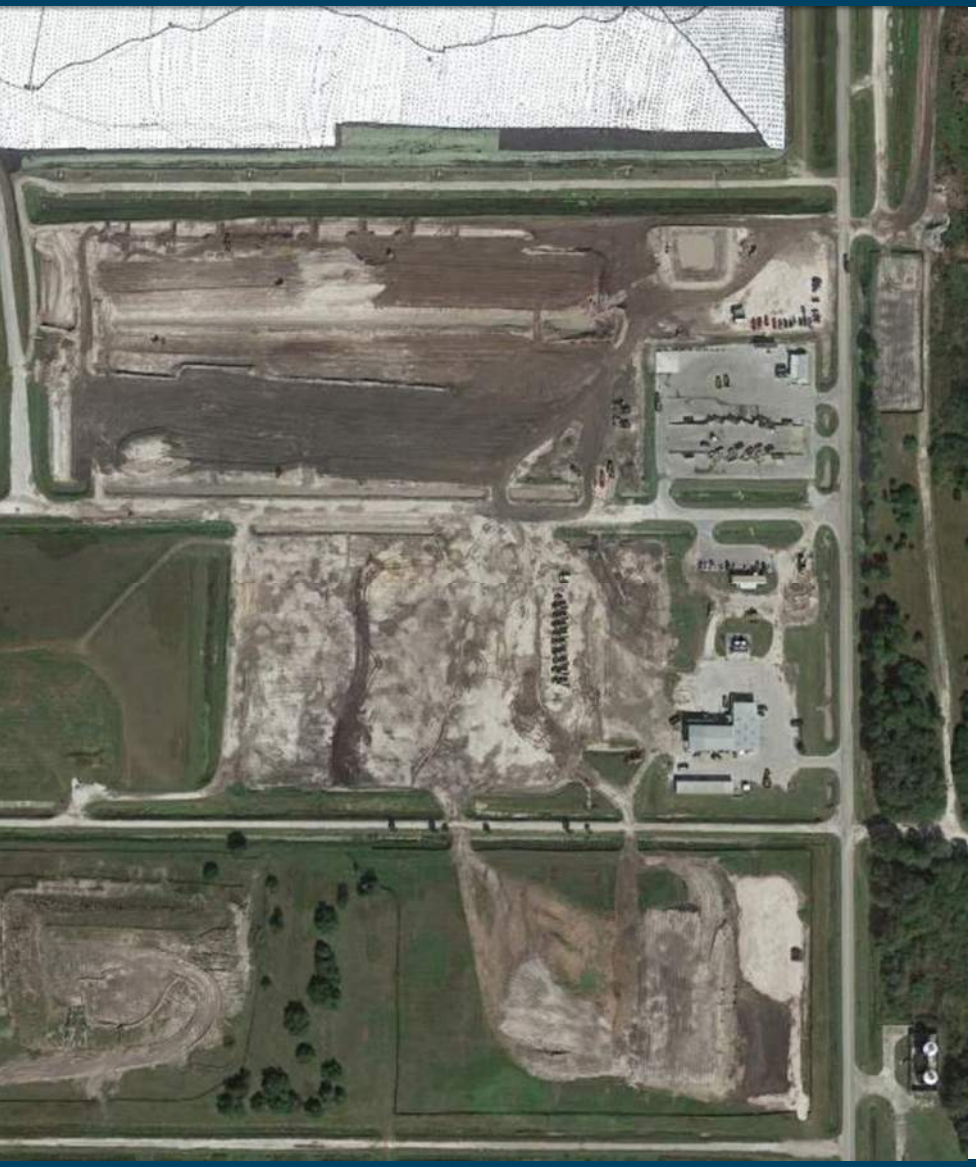
Regulatory

- 62-701.400(3)(a)

  1. Constructed so that the bottom of the liner system is not subject to fluctuations of the ground water so as to adversely impact the integrity of the liner system;

  2. Designed to resist hydrostatic uplift if the liner is located below the seasonal high ground water table

Technical – Site Considerations



- Soil Types
- Hydrogeology
- Existing Infrastructure
- Existing Contamination

Know Your Site

Site Specific Investigations

Technical - Risks

- Understand Potential Problems/Risks
  - Preparing Subgrade
  - Compaction
  - GCL Hydration
  - Floating Liner
  - Mobilize Existing Contamination
  - Damage Existing Infrastructure
  - Soil Heaving
  - Impacts to Existing Slurry Wall Containment Systems
  - Dewatering System Failure

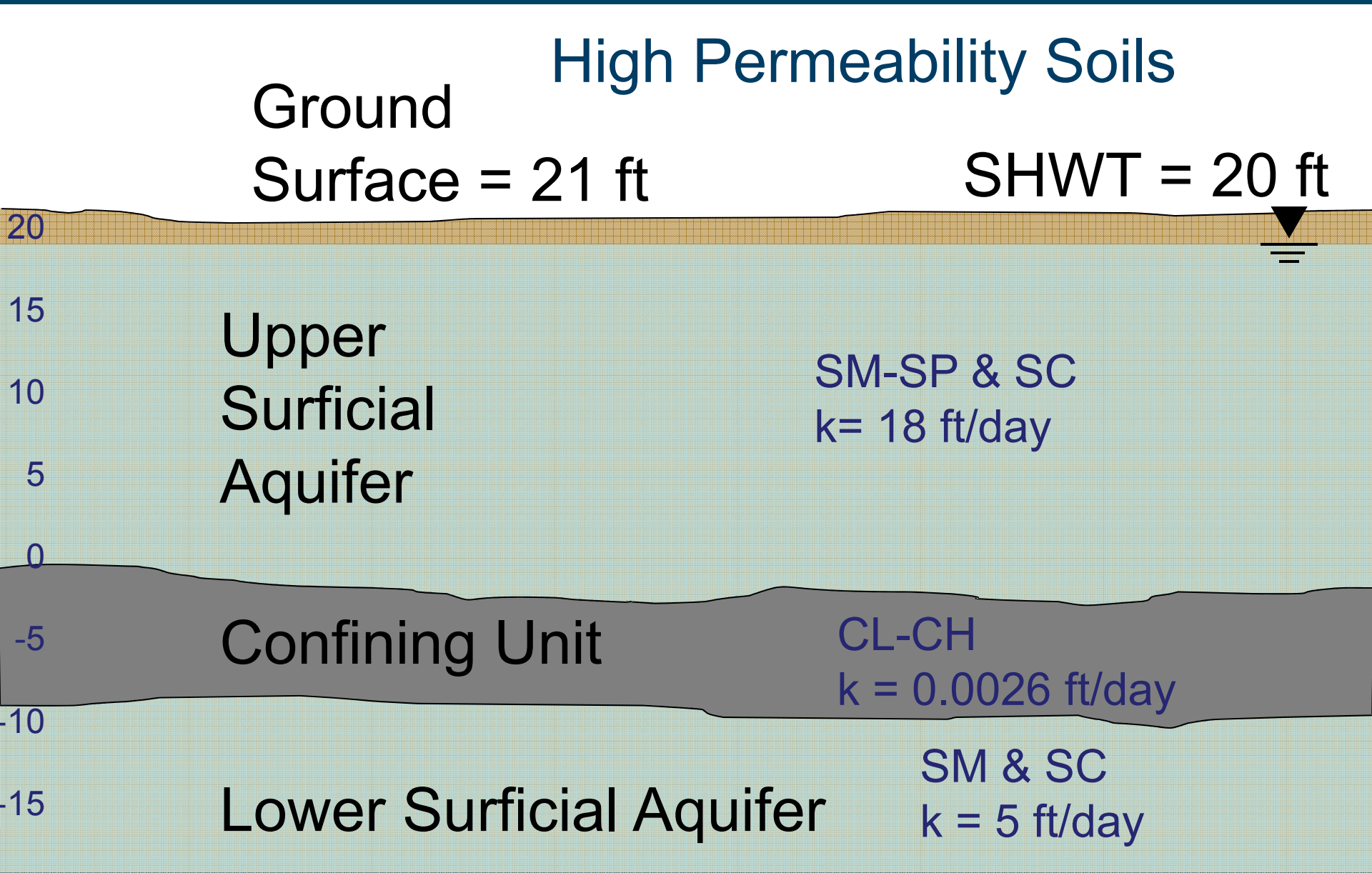
Technical - Risks

- To Avoid Potential Cost
  - Change Orders
  - Delays
  - Lawyers

Technical - Feasibility

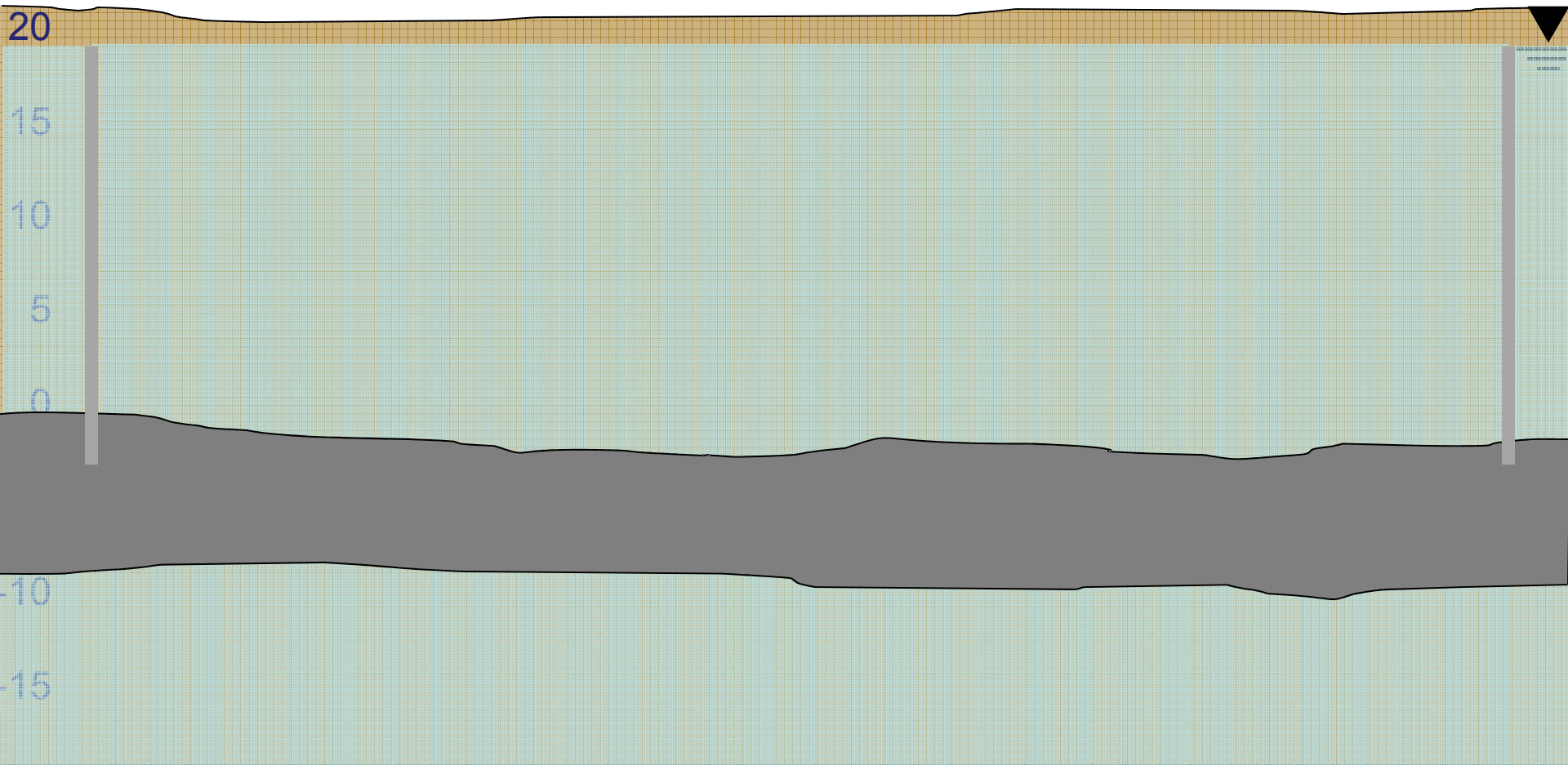
- Understand Potential Approaches
  - Trench Drains / Rim Ditch
  - Wellpoints
  - Sock Drains
  - Sheet Piling

Technical – Site Approaches



Technical – Site Approaches

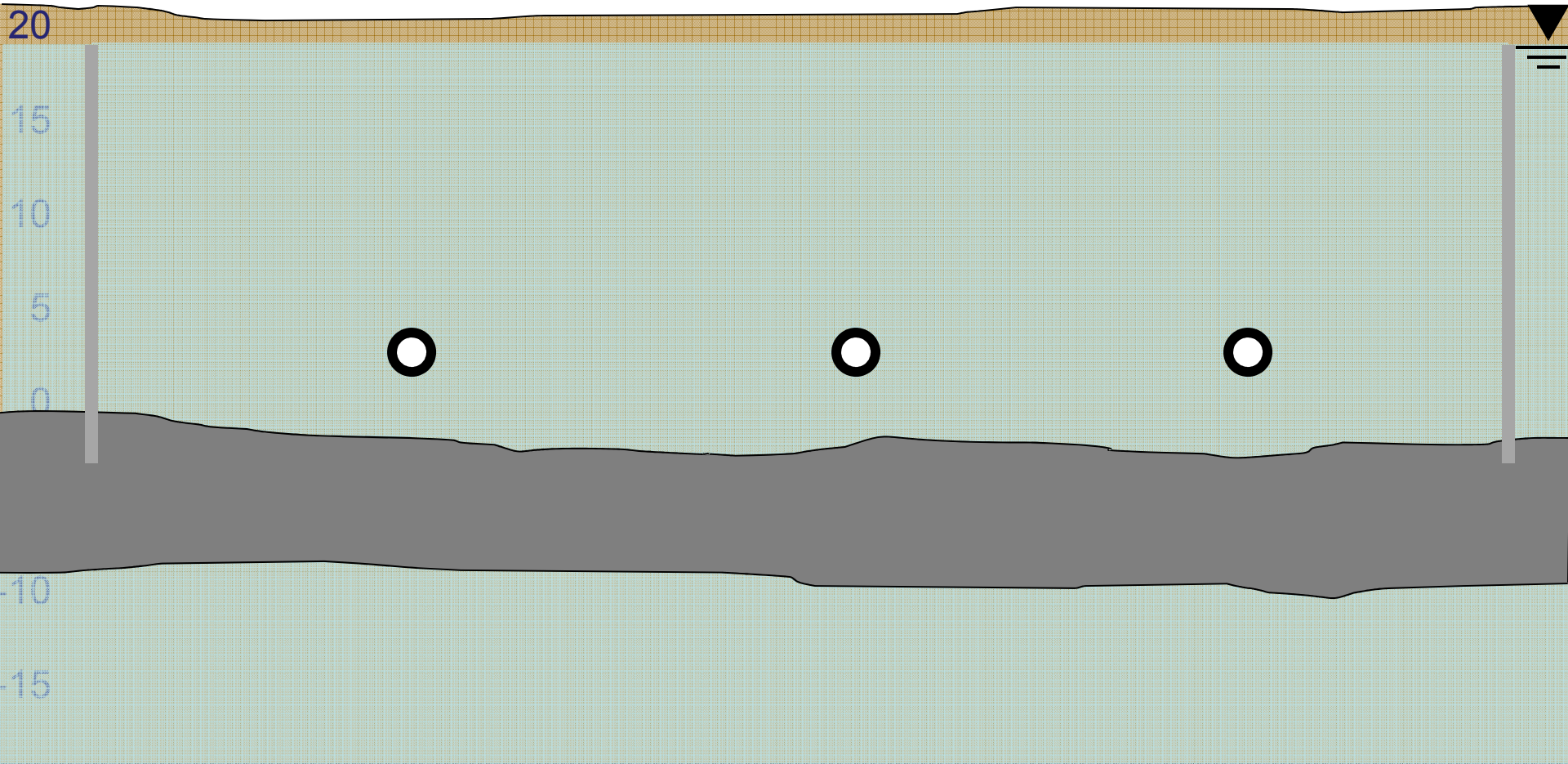
High Permeability Soils
Install Sheet Piling



Technical – Site Approaches

Technical – Site Approaches

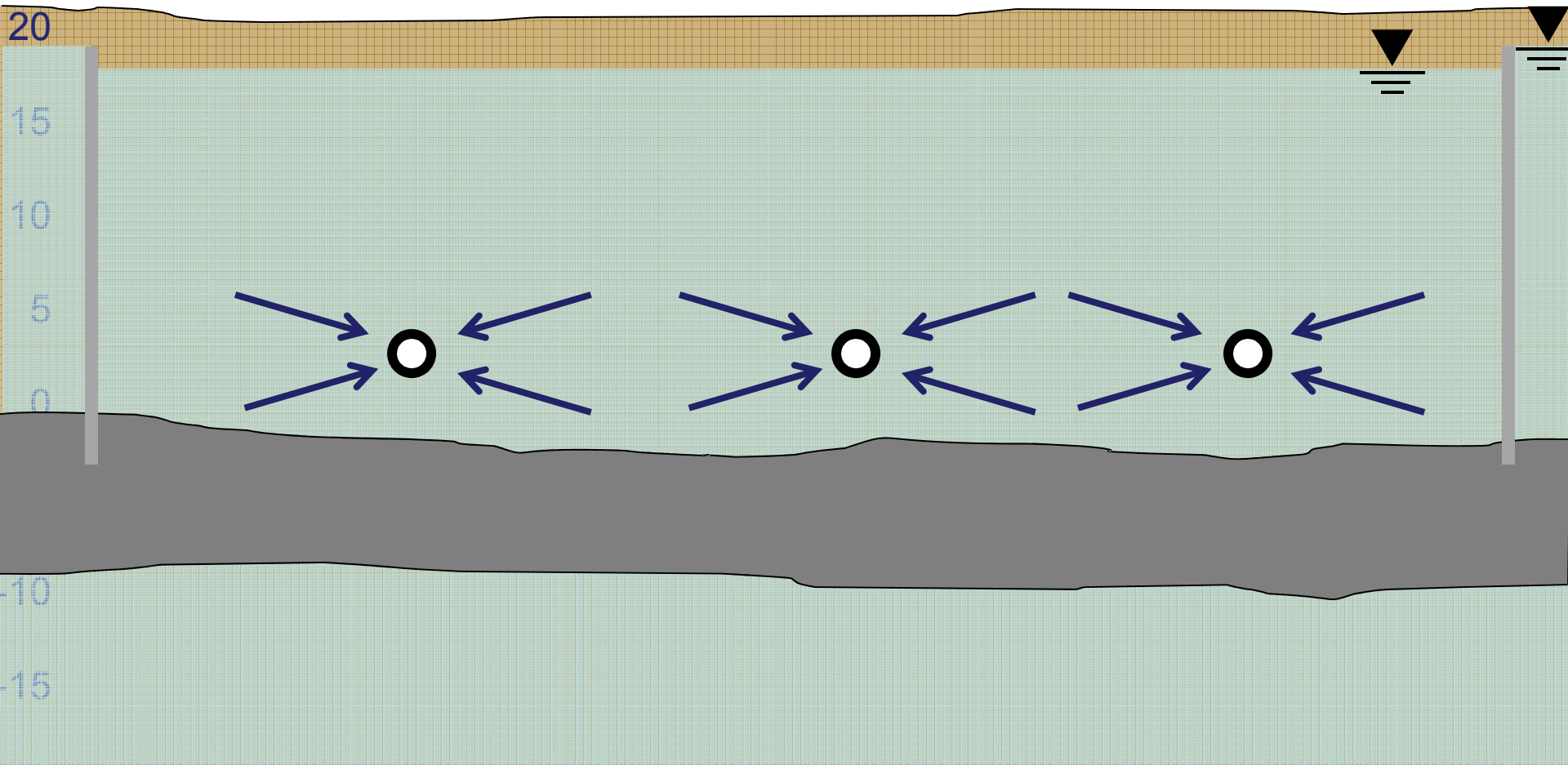
High Permeability Soils
Install Dewatering System



Technical – Site Approaches

Technical – Site Approaches

High Permeability Soils
Dewater the Site



Technical – Site Approaches

High Permeability Soils
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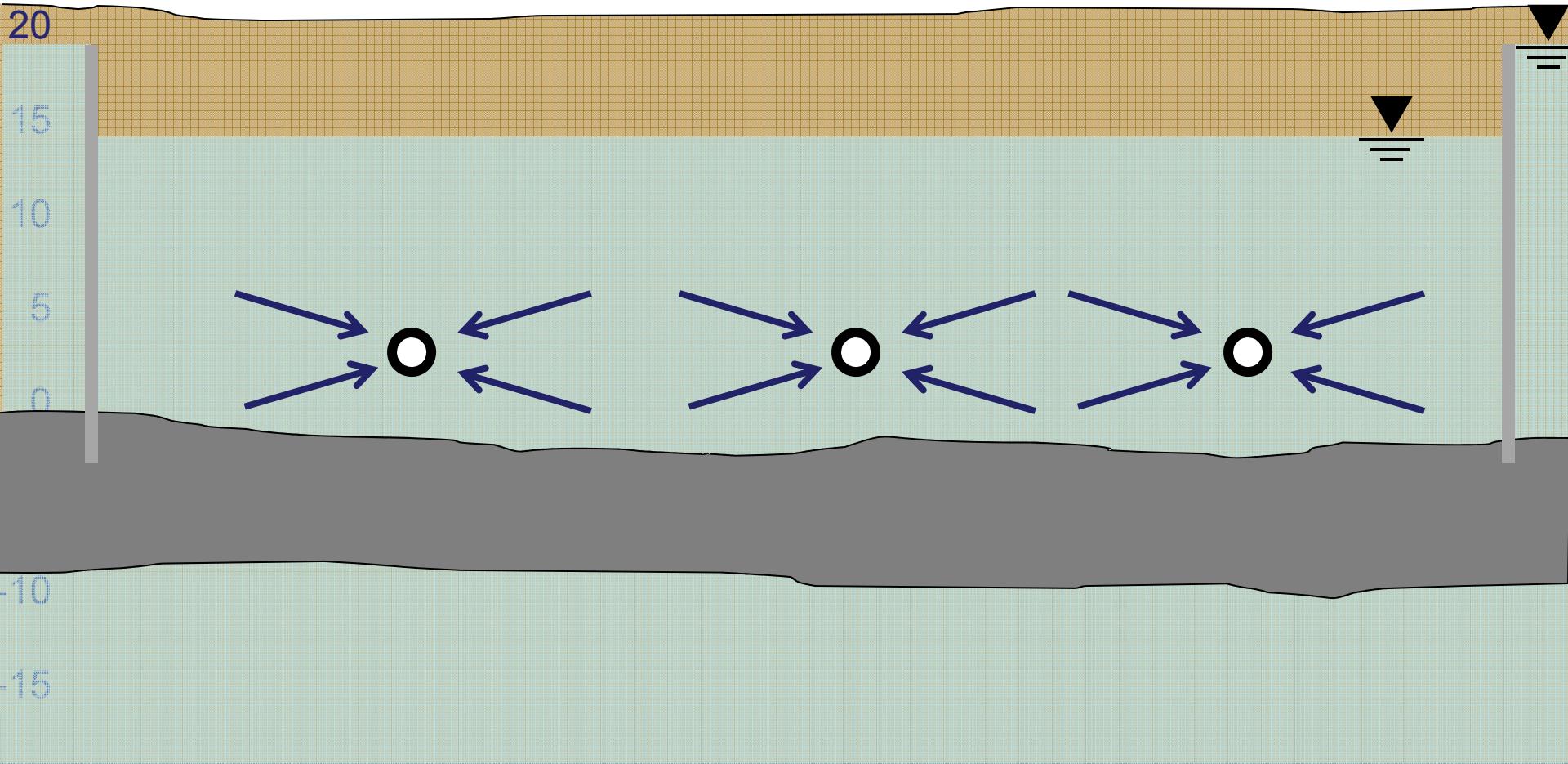
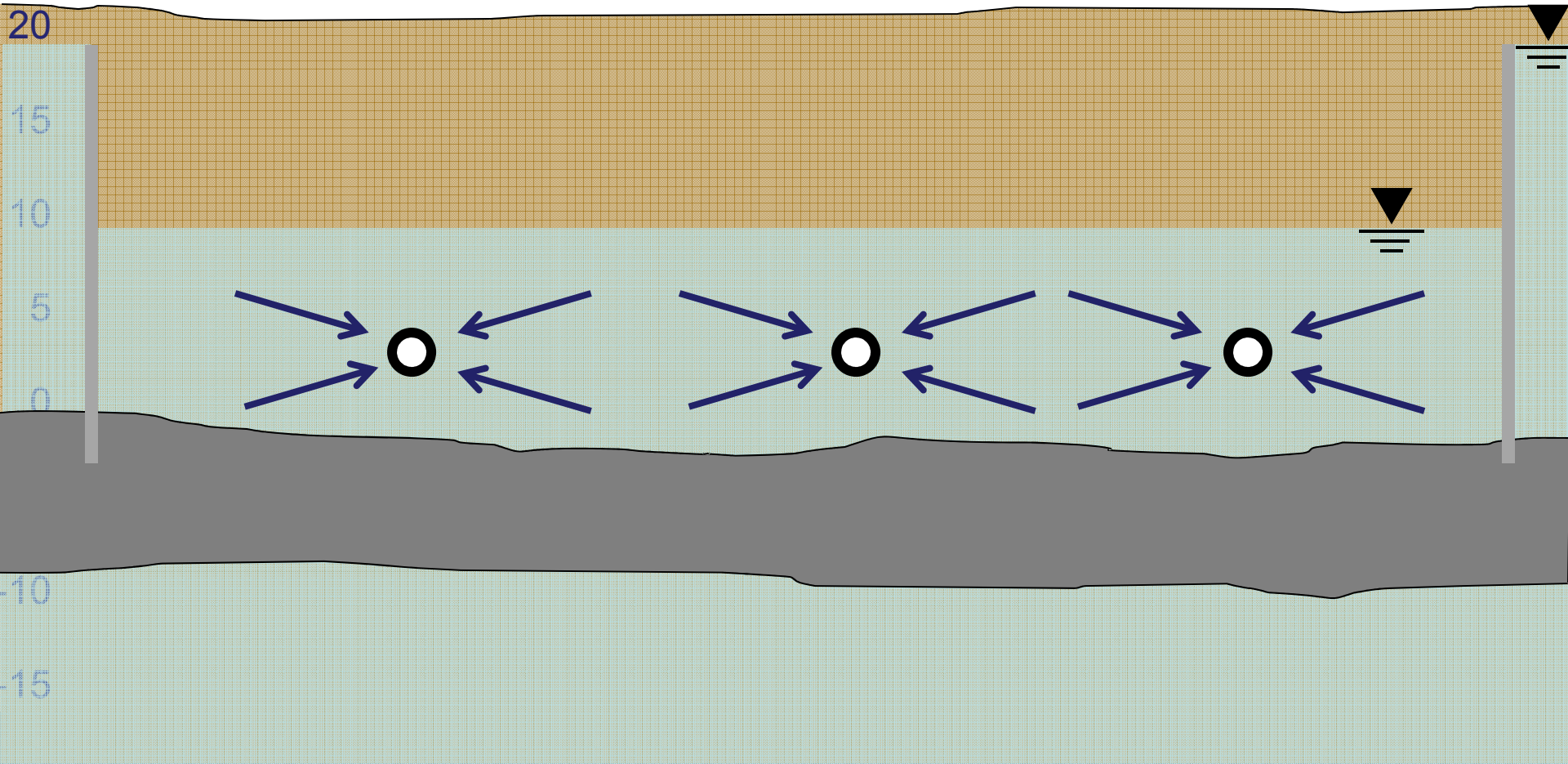


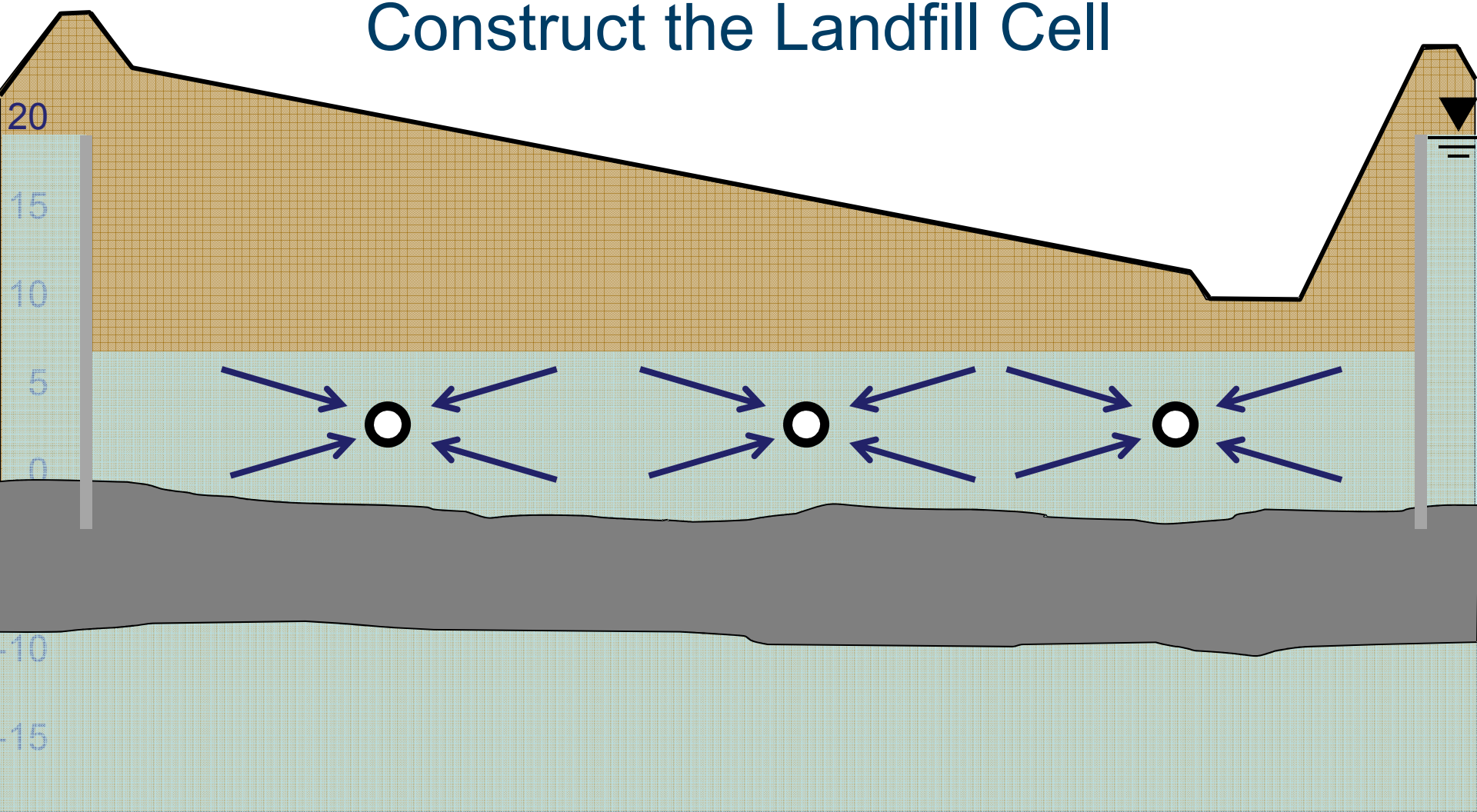
Technical – Site Approaches

High Permeability Soils
Dewater the Site



Technical – Site Approaches

High Permeability Soils
Construct the Landfill Cell



Low Permeability Soils

Technical – Site Approaches

Low Permeability Soils

Localized Dewatering

- Geocomposites
- Sock Drains
- High Permeability Soils

Low Permeability Soils

Localized Dewatering

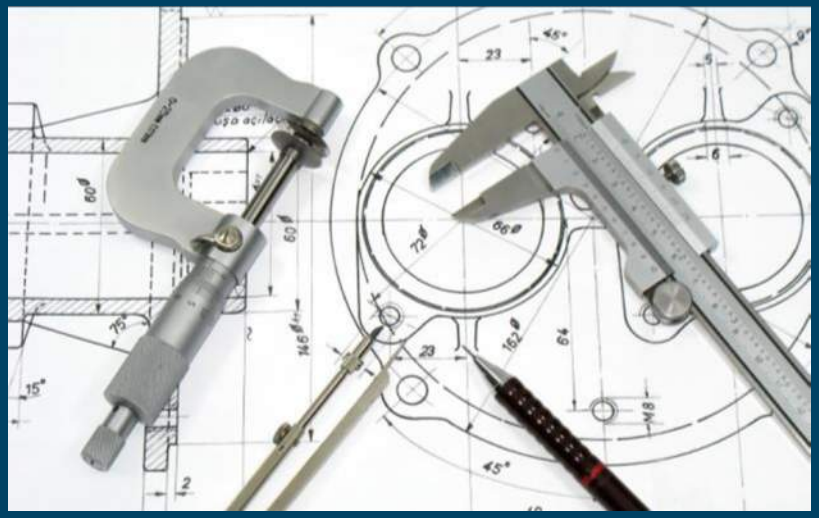
- 12 Feet Below the SHWT at Low Point

Technical – Recharge

Takeaways


DANGER
DEWATERING
CAN BE RISKY


GB USA MEX
ONE SIZE
DOES NOT
FIT ALL
Von links bügeln/ Iron inside out/
repasser sur l'envers /




SAVINGS
AHEAD

Questions?

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