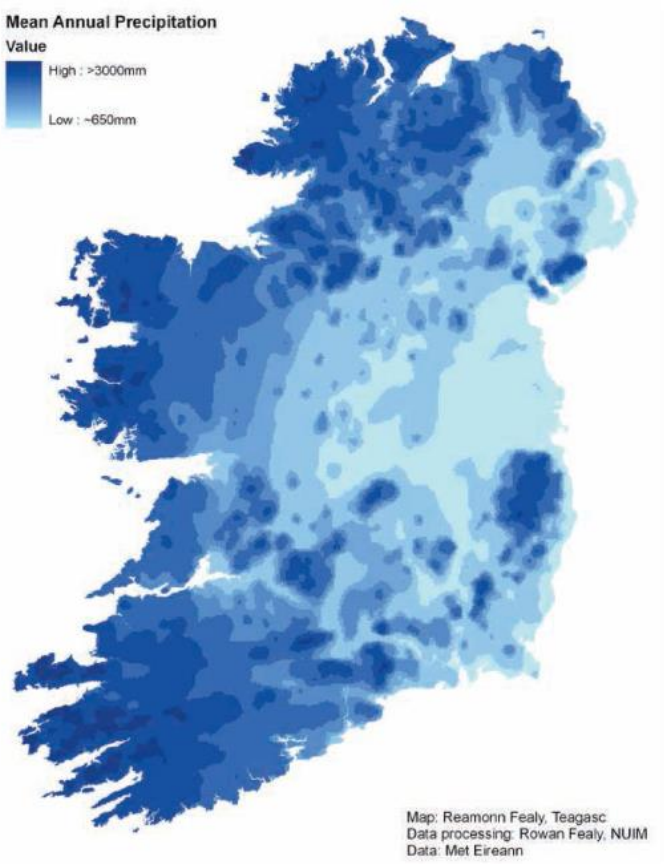
Land Drainage

Teagasc Animal & Grassland Research & Innovation Centre, Moorepark

Soils and rainfall

- Marginal land occupies just under 50% of Irish land area
- Trafficability for machinery and livestock is a major limitation in wet conditions
- Use of such soils is curtailed due to;
  - Reduced stocking capacity and grass yields.
  - Increased susceptibility to poaching and machinery damage

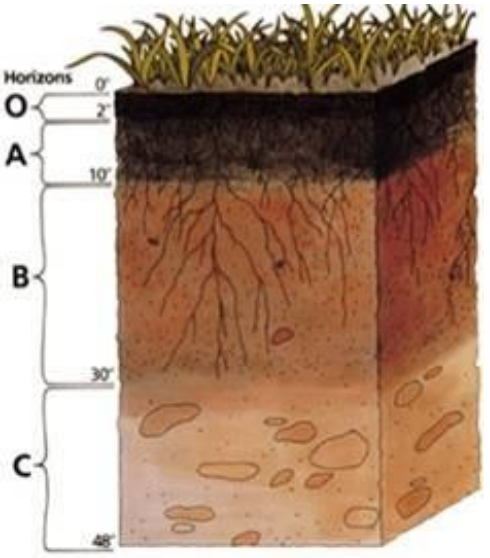


Drainage problems

- In free draining soils the rate of water flow through the soil will be higher than all bar very extreme rainfall rates.
- In poorly drained soil the rate of water flow can be regularly exceeded by rainfall rate due to:
  - Low permeability
  - High Water table due to low lying position and poor out-fall
  - Upward movement of water from seepage and springs

Drainage Investigations

- **Before planning a drainage system the causes of poor drainage must be understood**
- No “one size fits all” solution
- Test pits are dug within the area to be drained
- In test-pits
  - Establish soil type-varying with depth
  - Record depth and rate of water seepage
- Where is water impeded and where is water moving?

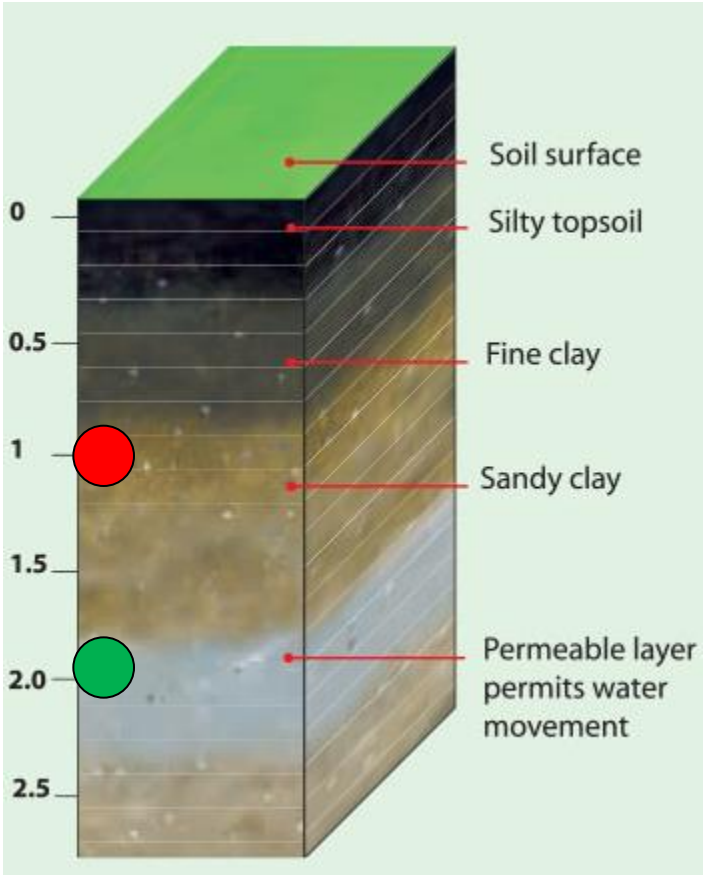


Types of drainage system

- Two principle types are distinguished:
  - **Groundwater drainage system:** A network of piped drains exploiting permeable layers.
  - **Shallow Drainage system:** Where movement of water is impeded at all depths.

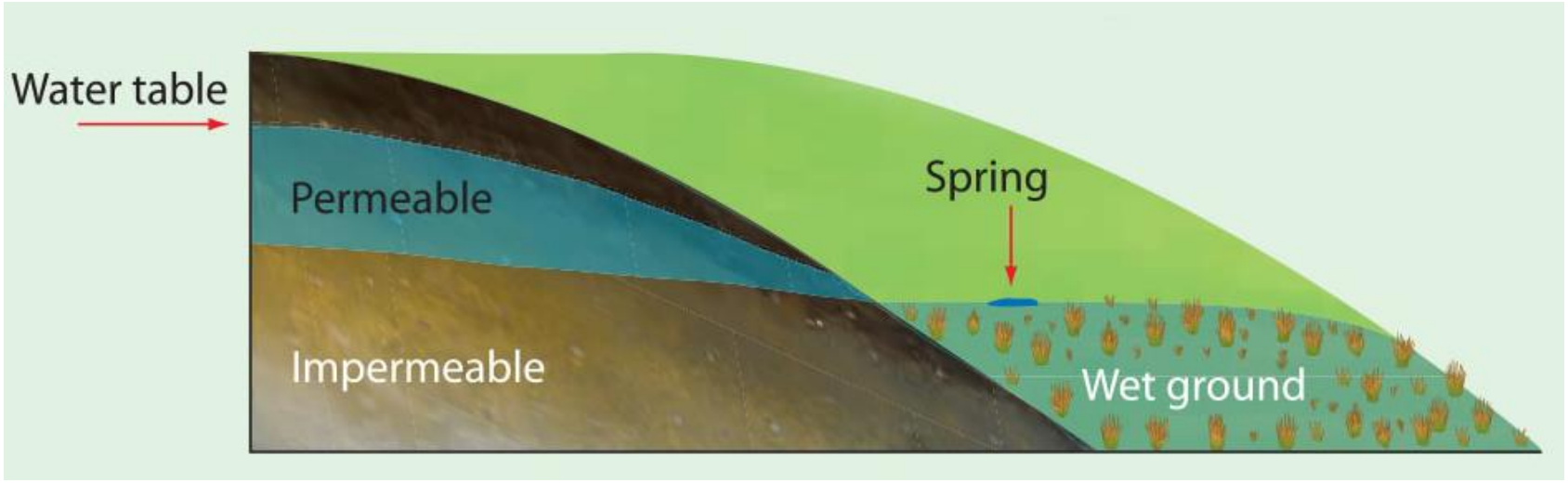
Groundwater Drainage System

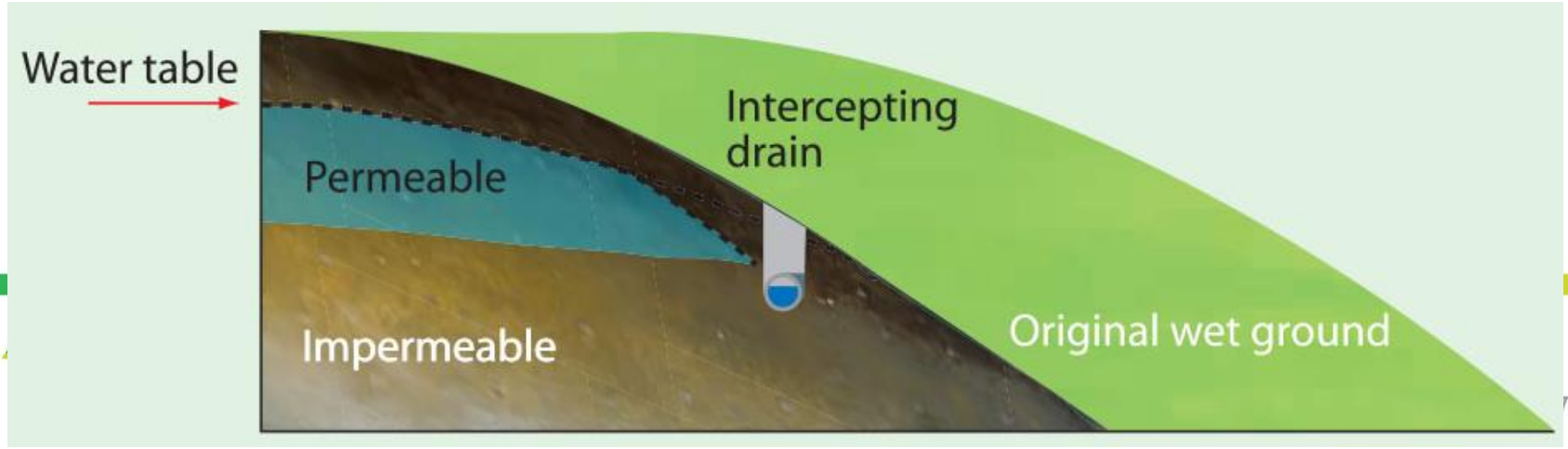
- **Where inflow of water to test pit**
- Controls the watertable by discharging groundwater
- Exploit layers of high permeability → wide spacings
- Lower watertable allows for natural (cracking, root penetration) or artificial (sub-soiling/ripping) improvements in permeability in the shallower layers



Groundwater Drainage System

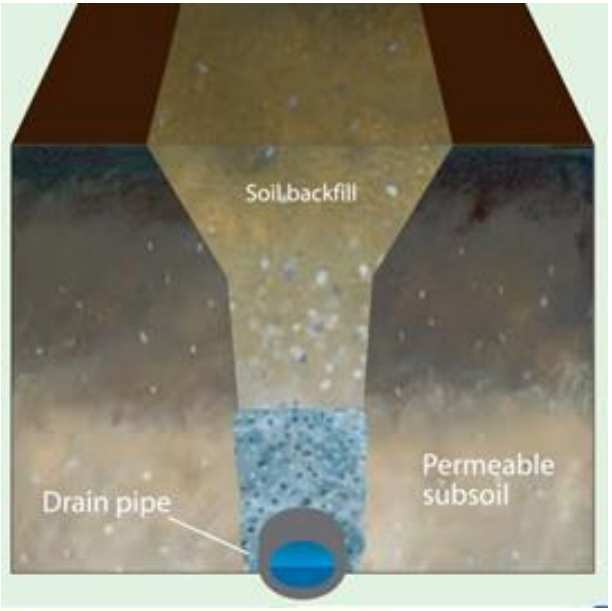
- Groundwater seepage and springs





Backfilling groundwater drains

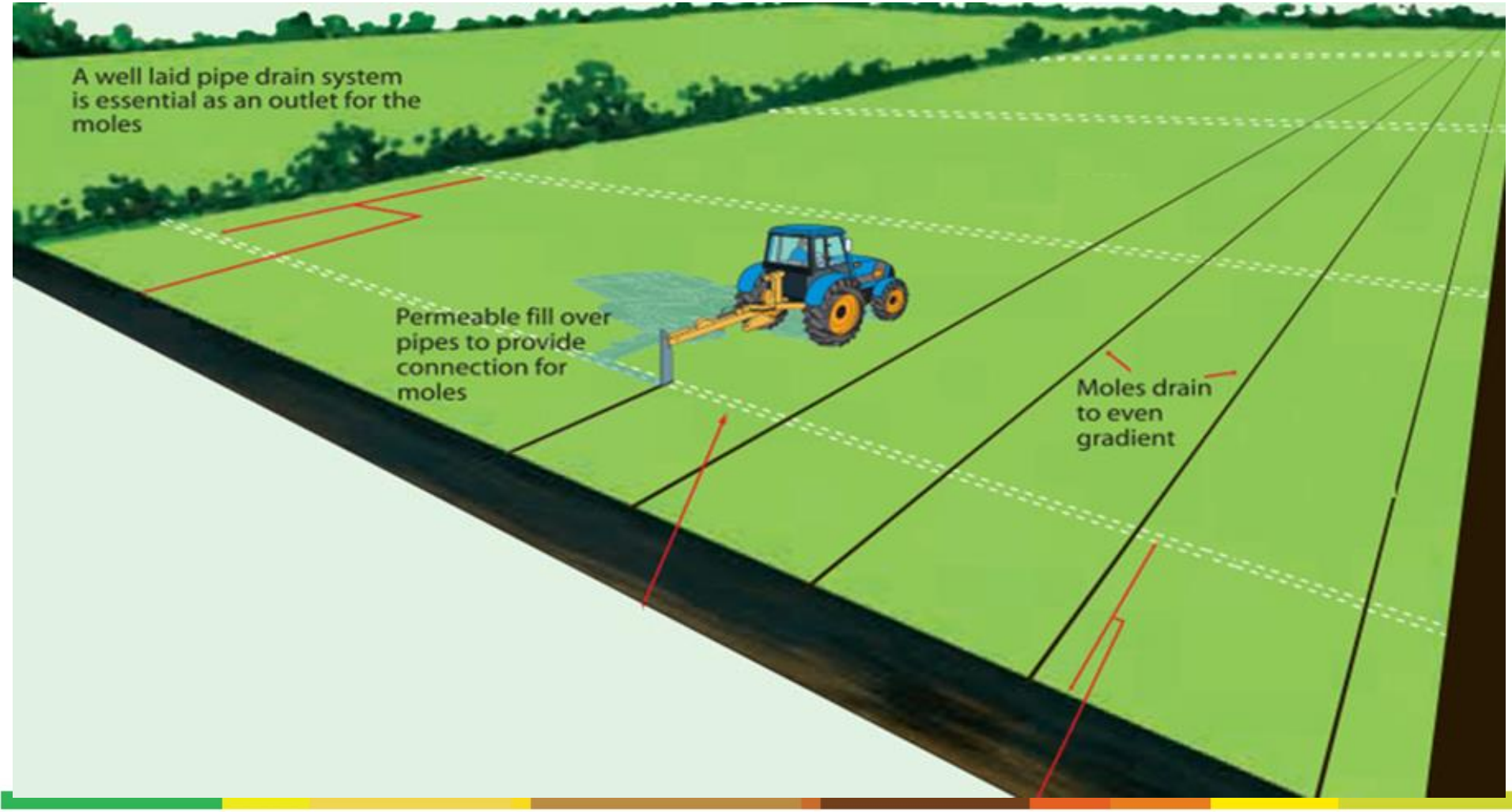
- Drainage stone should:
  - be filled to a minimum depth of 300mm from the drain bottom
  - provide connectivity with layer of high permeability
  - be **clean** aggregate (10-40 mm / 0.4 -1.5 inch)



Shallow Drainage System

- **Where no inflow of water to test pit**
- NO permeable layer to be exploited
- Drainage must incorporate a soil disruption technique in tandem with collector drains.
- The aim of such a system is to improve soil structure and permeability

Shallow drainage-collector drains



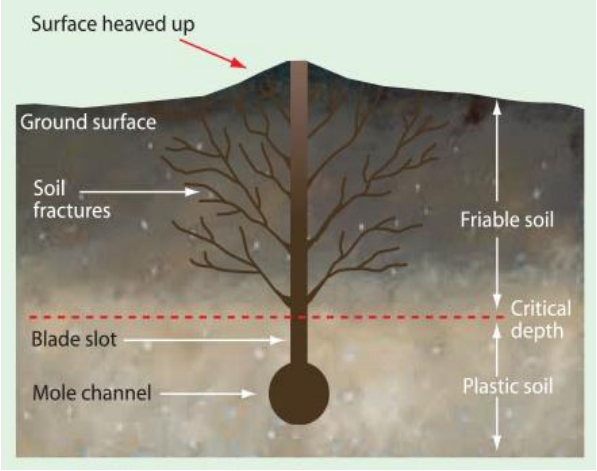
Shallow Drainage

- **Mole drainage**
  - Increased permeability at shallower depths and creates drainage channel

- **Gravel mole drainage**
  - Gravel moles increase lifespan (extra cost)

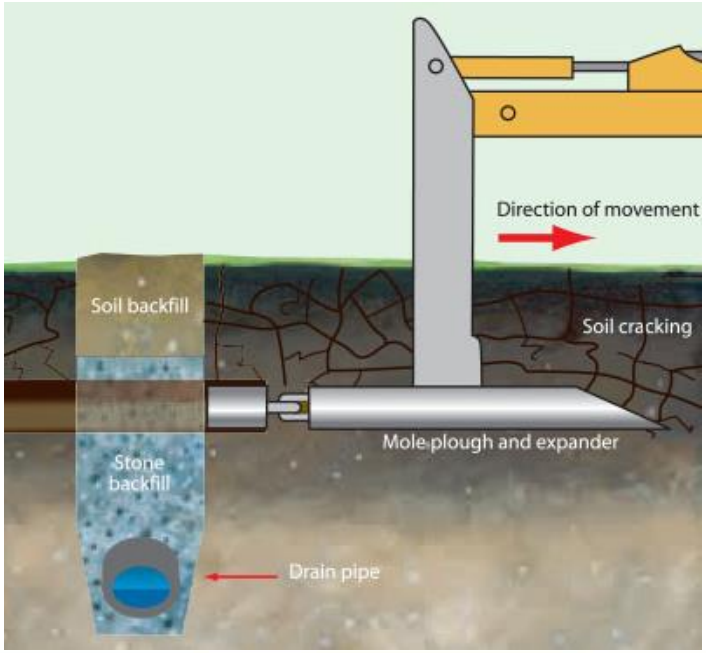
- **Subsoiling/Ripping**
  - To break a pan at shallow depth or to supplement both shallow and groundwater drainage systems

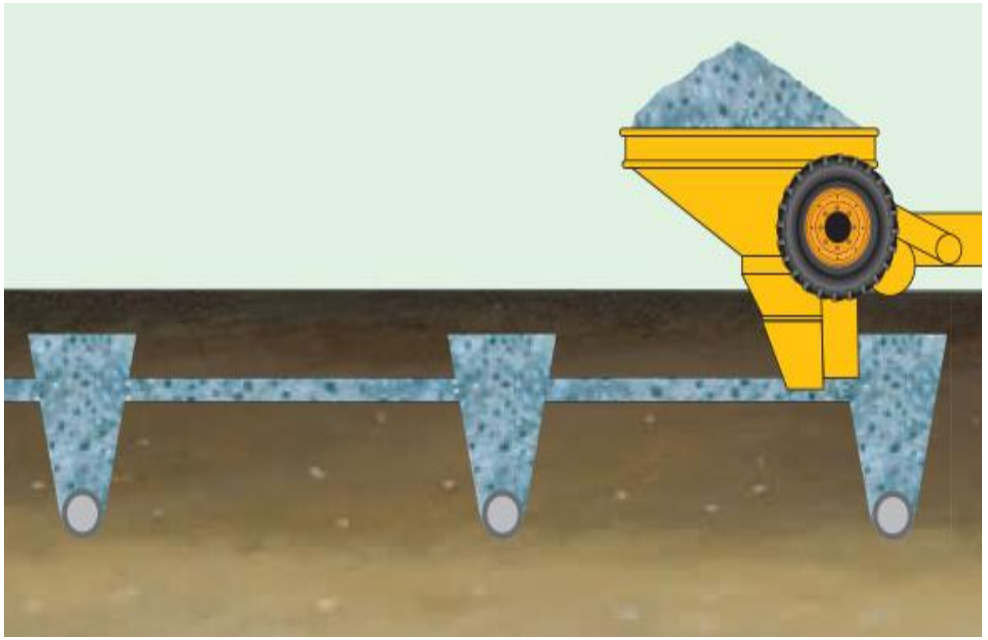
- **Carried out when upper soil layers are dry**



Backfilling collector drains

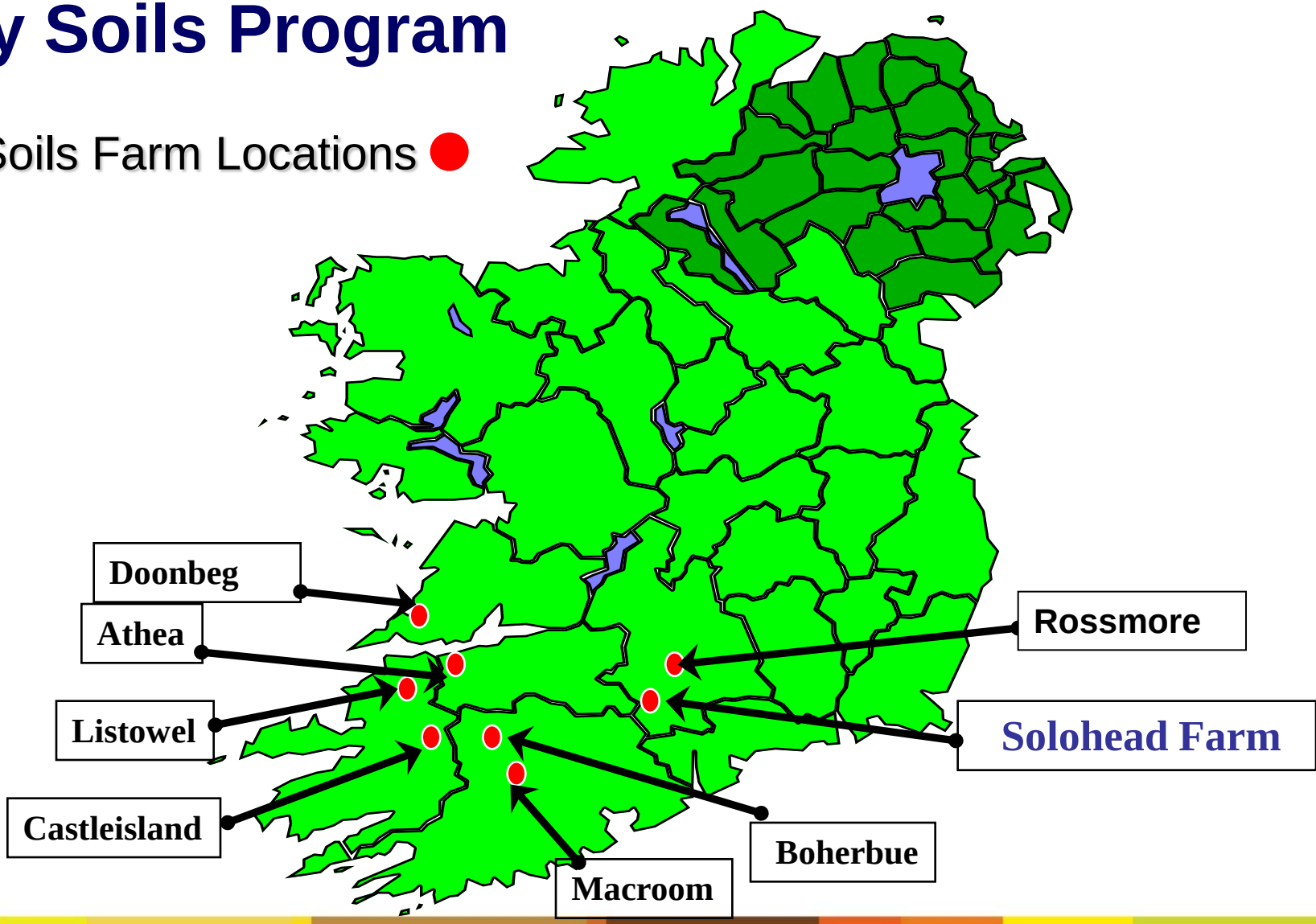
- Drainage stone should:
  - fill the trench to within 250mm of ground surface
  - provide connectivity with mole channels and topsoil
  - be **clean** aggregate (10-40 mm / 0.4 -1.5 inch)





Heavy Soils Program

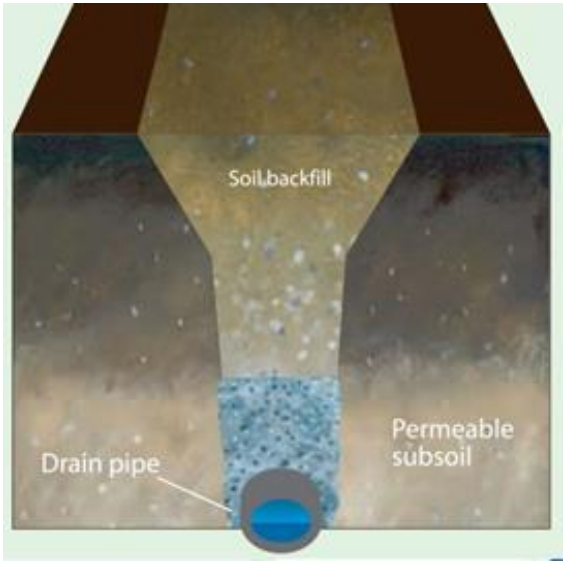
Heavy Soils Farm Locations

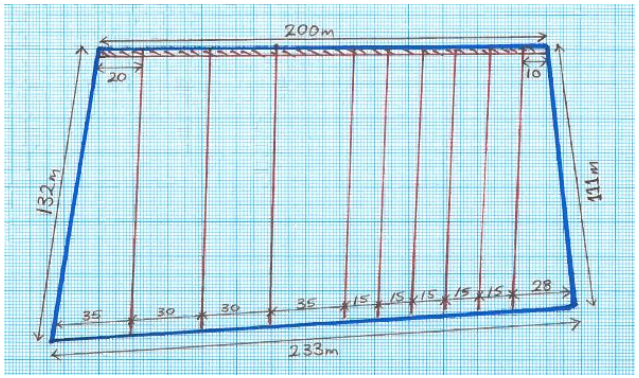


Rossmore: Groundwater drainage system

Problem Diagnosis

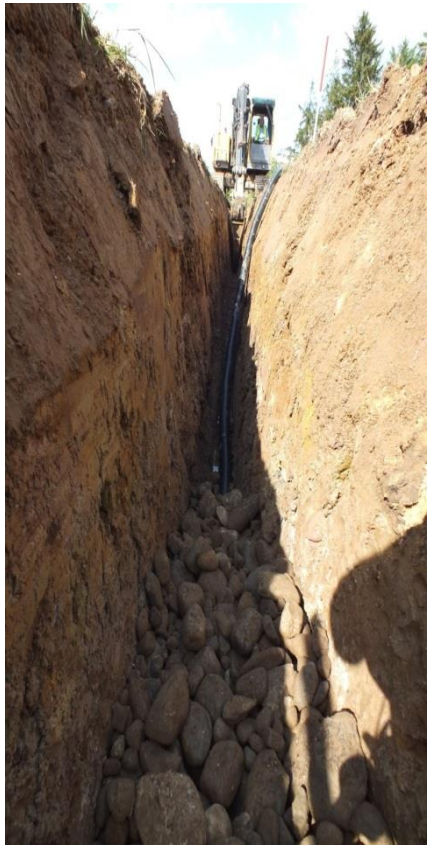
Soil Test pits





- Where a permeable layer will transmit water
- Where water can percolate to watertable
- Most effective way to discharge water

Rossmore: Groundwater drainage work and costs

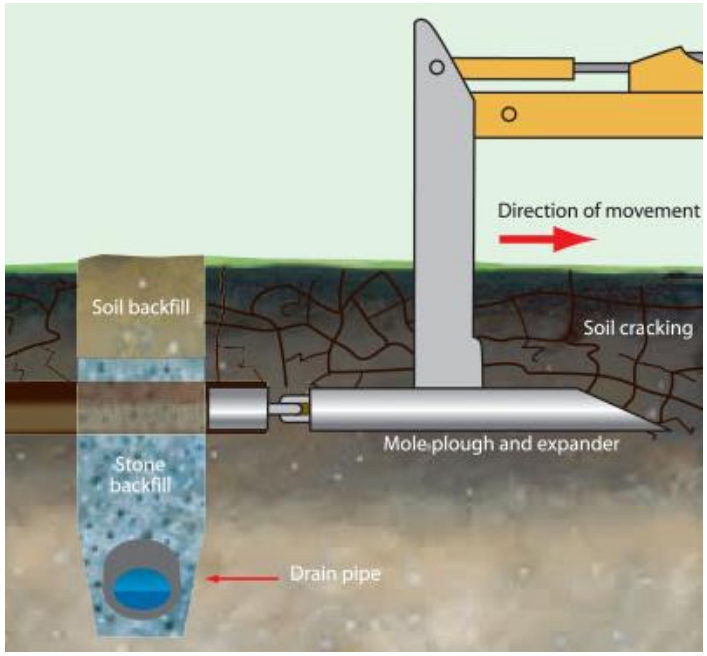


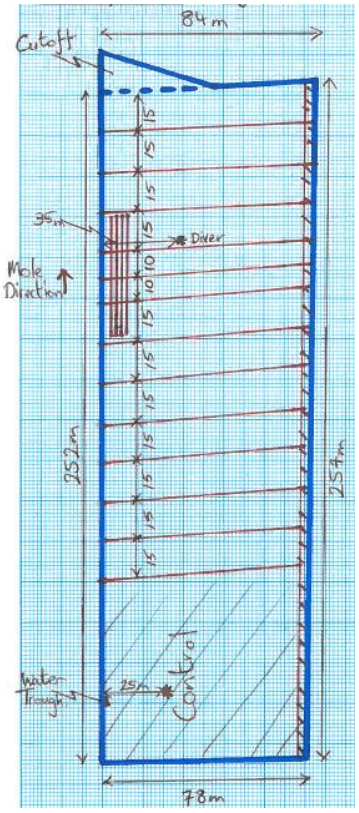
Costs	Total/ha
Drain installation @ €45/hr (55 hrs)	€2,476
Drainage pipe @ €0.70/m (429 m)	€300
Drainage stone @ €11.10/t (141 t)	€1,562
Drainage cost	€4,338

Doonbeg: Shallow drainage system

Problem Diagnosis

Soil Test pits



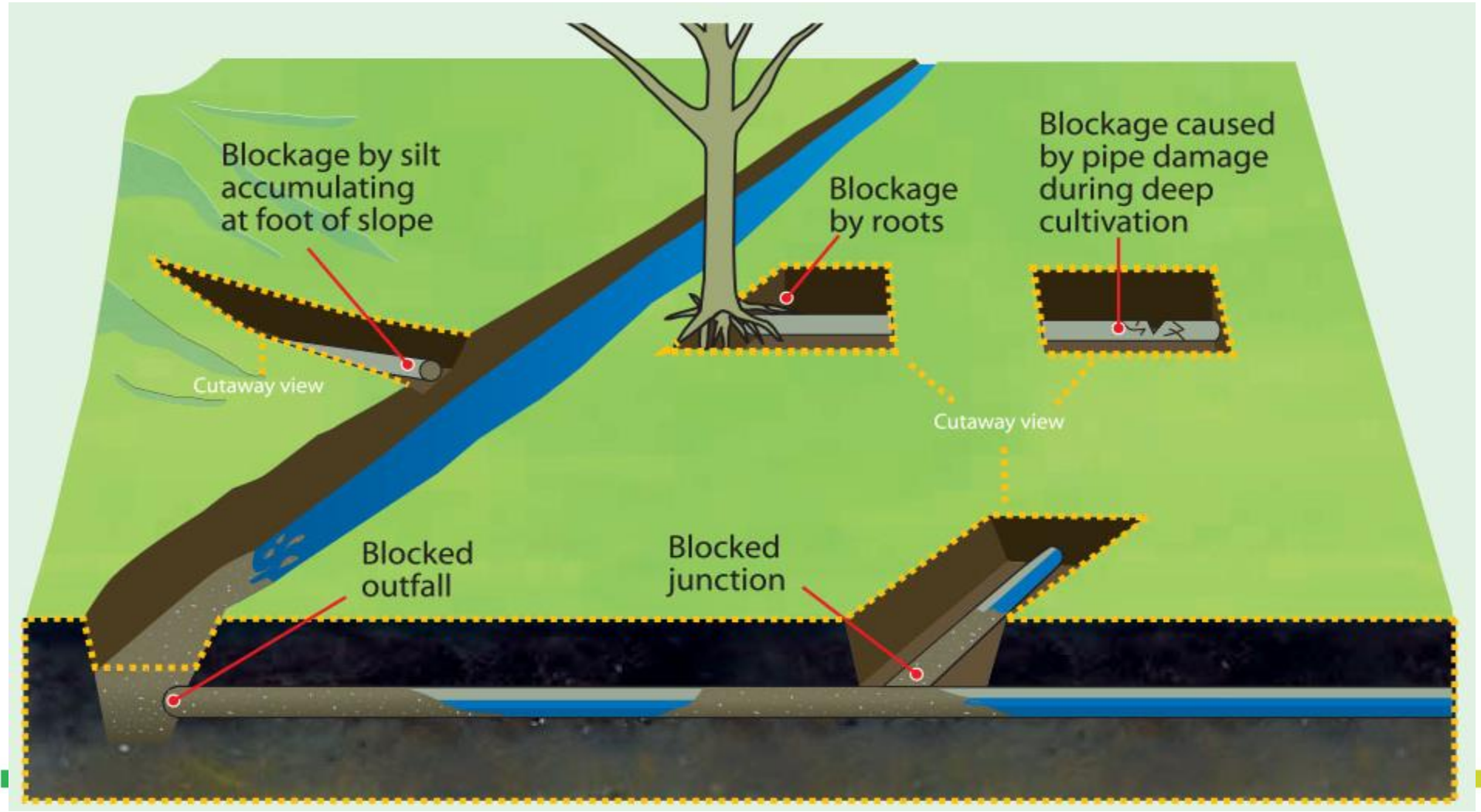


- Aim to crack the soil
- Dependent on:
  - Soil clay content (>40%)
  - Weather conditions
- Used in tandem with collector drains

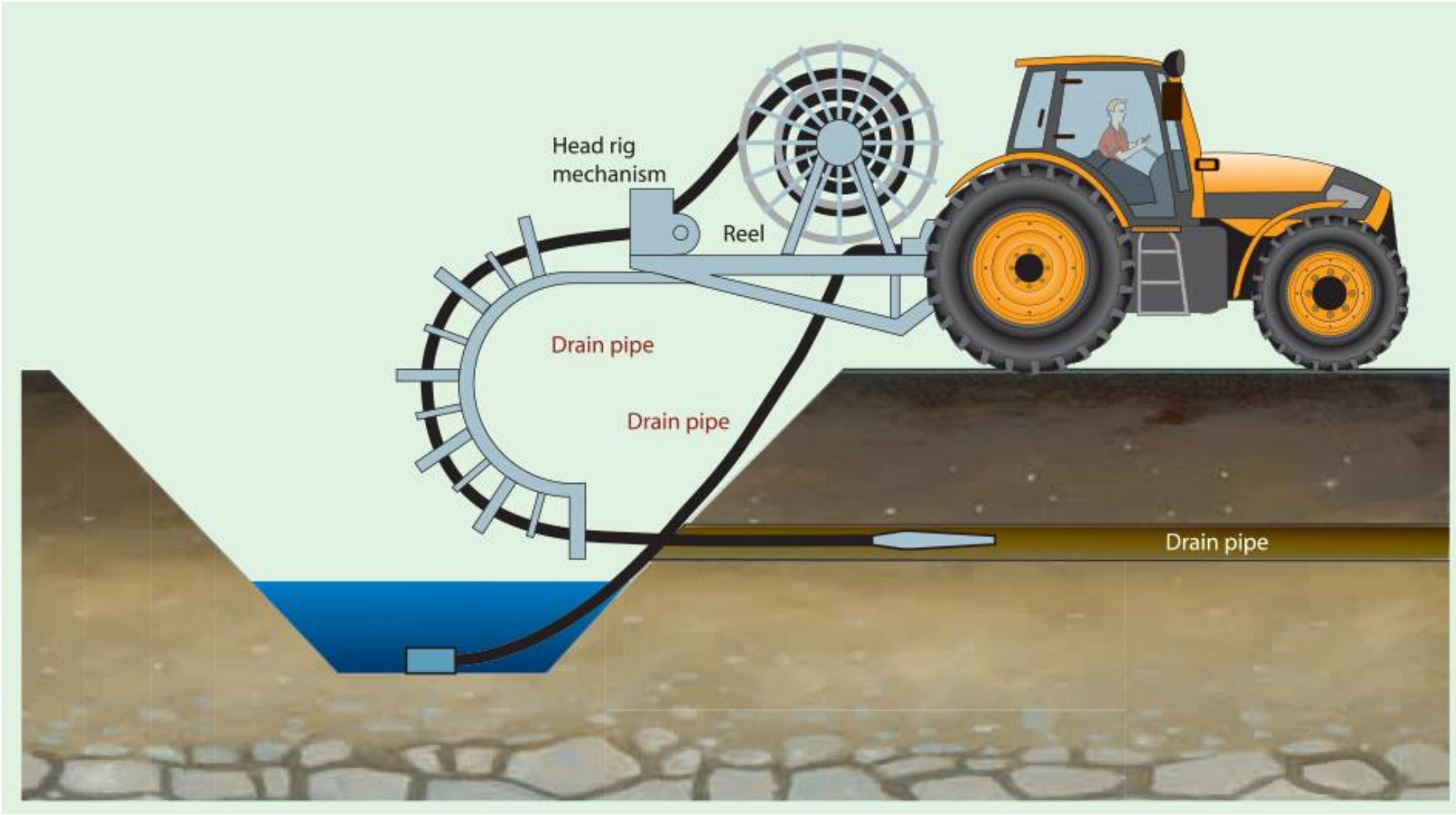
Doonbeg: Shallow drainage work and costs

Costs	Total/ha
Drain installation @ €40/hr (66 hrs)	€2,639
Drainage pipe @ €0.80/m (688 m)	€550
Drainage stone @ €13.48/t (197 t)	€2,650
Mole installation	€100
Drainage cost	€5,939

Maintenance



Maintenance



Approximate costs

Drainage System	Spacing(m)	Depth (m)	Cost/m (€)	Cost/Acre (€)	Cost/hectare (€)
Piped Drainage System					
Conventional System (Costly and ineffective)	8	0.8 - 1.5	5-7	2500-3500	**6200-8600**
Groundwater Drainage	15 - 50	1.0 - 2.5	8-11	1500-2500	**3700-6200**
Shallow Drainage System					
Mole Drainage	1 - 1.5	0.45 - 0.6	-	50	**125**
Gravel Mole Drainage	1.5 - 2.5	0.35 - 0.5	-	600	**1480**
Collector Drains	20	0.75	5-7	1000-1400	**2500-3500**
Collector Drains	40	0.75	5-7	500-700	**1200-1700**

Thanks for your attention

Teagasc
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