Large On-Site Sewage Systems Wastewater Treatment Workshop

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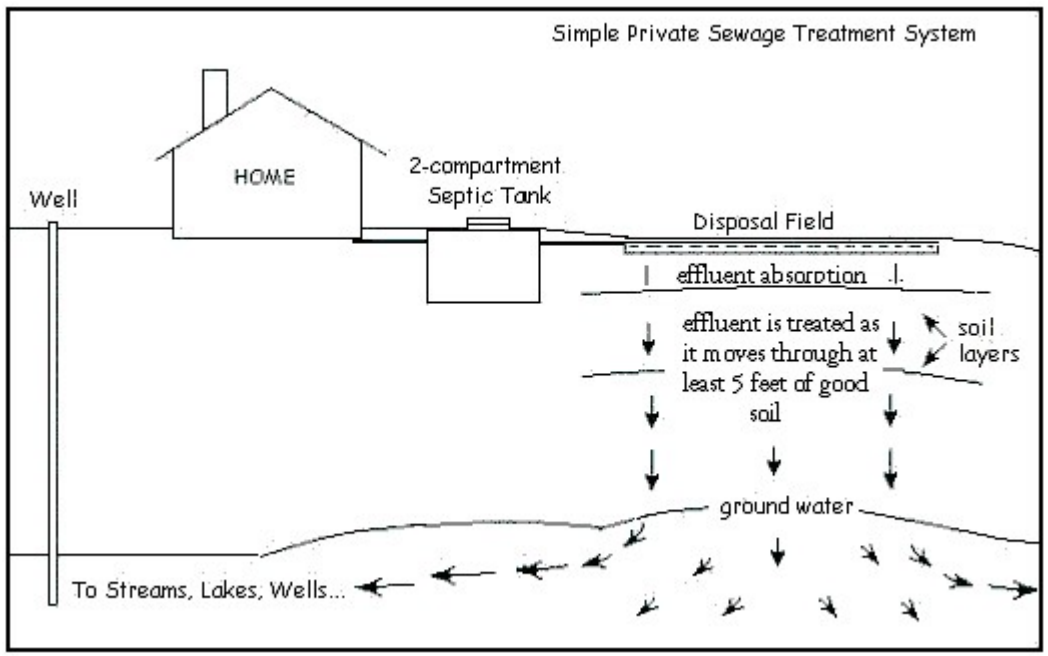
Large On-Site Sewage Systems

- Introduction
- Effluent Pre-treatment
- Disposal Beds
- Recent Developments
- Experience
- Conclusions

Large On-Site Systems

Typical On-Site System



Introduction

- On-site sewage services the wastewater needs of:

  25% Canadians.

  25 to 30% Americans.

  >37% of new American housing.

- On-site sewage offers cost effective long term wastewater solutions.
- Technology changes faster than regulations.

Introduction

- On-site (OSS) and municipal systems fail.
- Failure teaches us more than success.
- OSS life expectancy can be 20 to 30 yrs by control of design, construction and maintenance.
- Operation and maintenance are responsibility of an informed owner (beyond legislation's reach)

Introduction

- On-site research developments being driven by regulations, cost comparisons, technology, etc.
- Traditional municipal water systems (excluding sewage) cost >$4000 per capita.
- Pure on-site and pure municipal merging of approaches has been well under way for decades. (E.g. Cluster Systems, STEP, GLIDE)
- “Change of paradigm” - USEPA Assistant Director M. Tracy Mehan (May 2000)

Introduction
Newfoundland Legislation

- Public Health Act: Sanitation Regulations 803/96
  - Application to Develop Land
  - Standards Accepted Practice… Private Sewage Disposal Systems (< 4546 LPD)
  - Licensed designers required

Introduction
Newfoundland Legislation

- Water Resources Act (W04-01)– Section 36
- Dept of Government Services or MOU with Dept of Environment & Conservation

  - Non municipal systems i.e. OSS (> 4546 LPD)
  - Licensed designers required
  - Professional Eng required

  - Somewhat similar split of jurisdiction as other provinces

Large On-site Systems
(principle design & citing issues)

- Quality of wastewater being generated
- Quantity of wastewater being generated
- Limitations of the proposed site

Quality of Wastewater

All wastewater is NOT the same

- food processors, restaurants, large truck stops - gas stations, schools, motels, “get-away resorts”
- elevated BOD, TSS, grease
- large peaks in flow
- elevated wastewater temperatures

Quantity of Wastewater

- Older regs; limited categories and high estimates
- Obtaining accurate flow estimate
- Obtaining agreement on estimate

- Metered flow from similar facility located elsewhere?

- Nova Scotia & Alberta good references

- Dampen peak flow loads – how ?

Quantity of Wastewater

- How do we evenly disperse large water volumes within the disposal bed ?
- Gravity – substantial limitations
- Siphons – step in right direction
- Pumps – better step
  - small diameter disposal pipe
  - drip irrigation methods

  - All dispersal methods work better and beds last longer if the tank effluent quality is improved

Limitations of a Site

- Wet or low area
- Small property
- Poor soils
  - Thin and sandy
  - Thick but glacial till (high silt & clay content)
  - Little thickness
- Valuable location but site has a combination of above

Limitations - Balance

- Additional design considerations to offset (partially) site limitations

- Reduce amount of waste water generated
- Reduce the strength of wastewater generated
- Imported soils**
- Pressure dosing

Effluent Pre-treatment

- Grease traps
- 2 Compartment septic tanks & Effluent filters
- Biogreen / Bio cycle/ FAST
- Waterloo & Zabel biofilters
- Peat based
- RBC

Effluent Pre-treatment

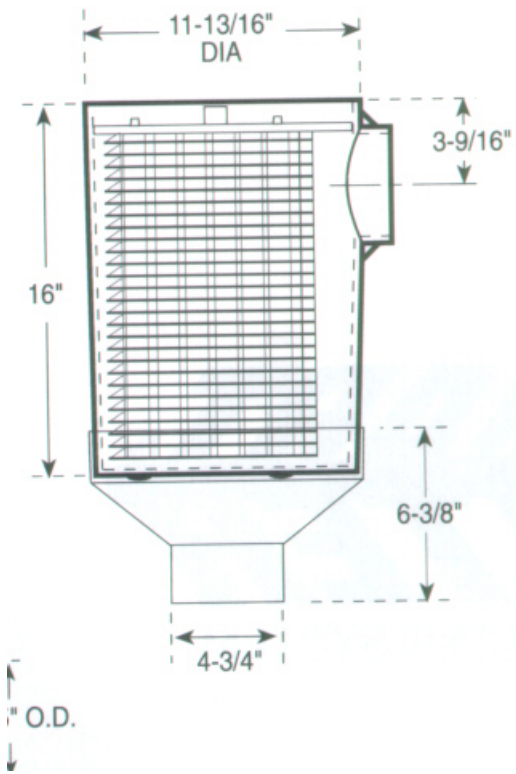
- Grease traps – absolutely necessary for all food service establishments
- Site specific design (not cookie cutter)
- Operate according to manufacturer's requirements
- Regulator's and supplier's experience
- Maintenance is an absolute must

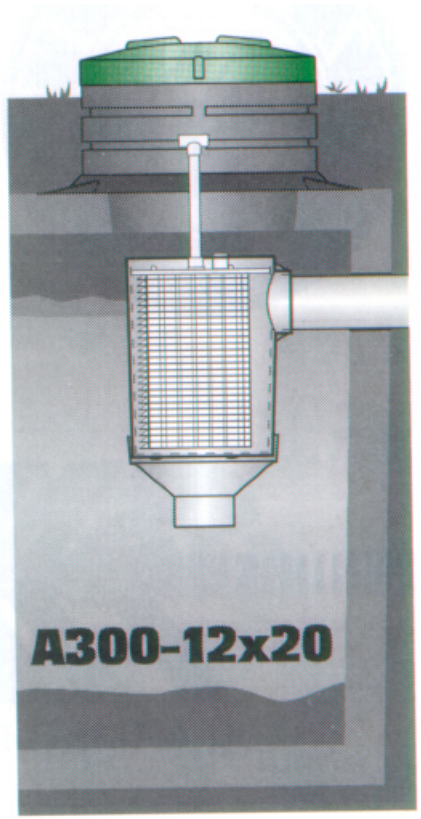
Effluent Pre-treatment

- 2 Compartment septic tanks & Effluent filters
- 500 Igal tanks – my opinion they're too small
- 750 Igal tanks with 2 compartments and an effluent filter – my opinion should be the minimum
- A bit more $$ but longer lived disposal bed

Effluent Pre-treatment

Zabel brand



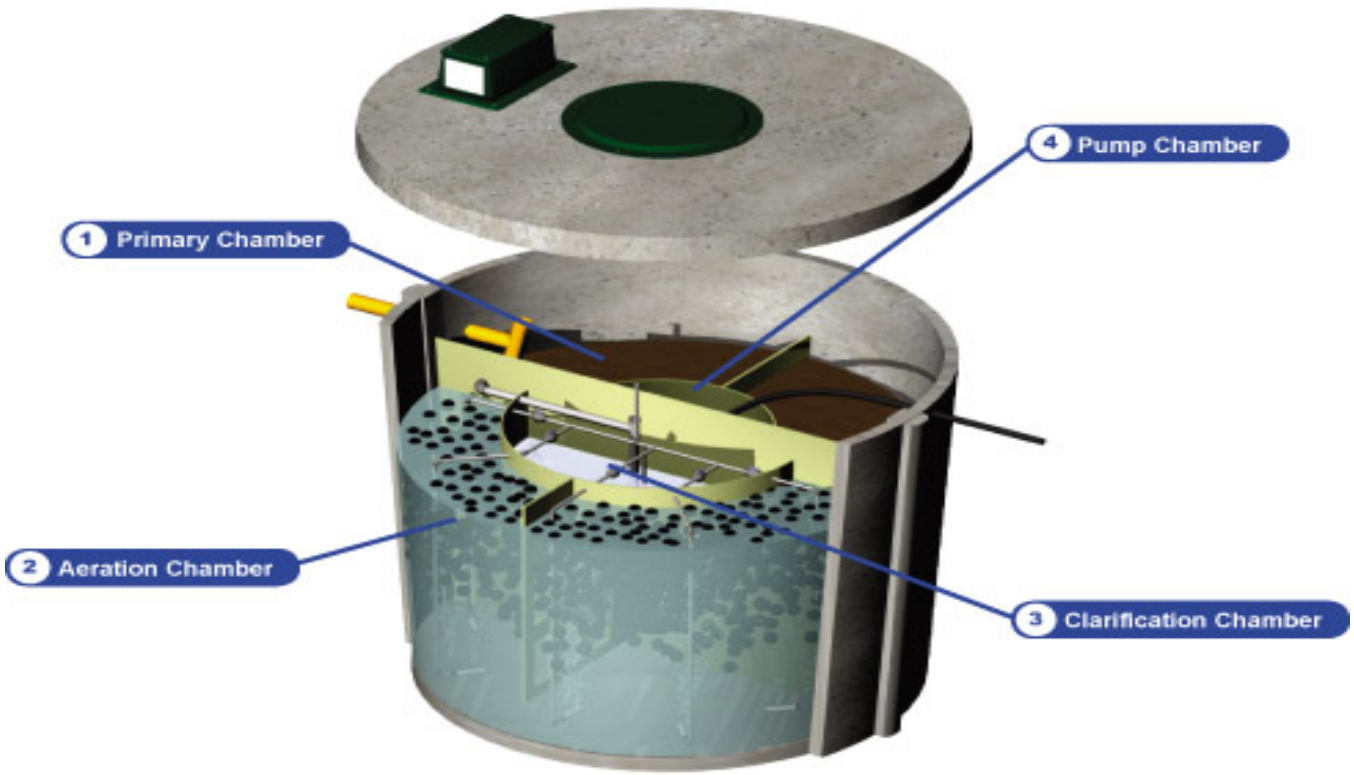


Effluent Pre-treatment

Bio green / Bio cycle/ FAST

- Settling compartment, (anoxic section), followed by aeration with fixed film surfaces
- High aeration and compact/modular systems -/+ $10 k
- When maintained these produce an effluent with low BOD, TSS, (N partial reduction prior to aeration chamber)
- Units commonly NSF certified
- Regulators in some provinces don’t like these systems for non-commercial settings

Effluent Pre-treatment



Effluent Pre-treatment

Waterloo biofilter/Zabel AeroDiffuser

- mimics passive sand filter system
- open-cell foam media with spray application
- high loading rates (> sand filter)
- upstream grease trap, septic tank, effluent filter required, perhaps even more pre-conditioning

Effluent Pre-treatment

Peat Systems

Dr. Joan Brooks - University of Maine

- Effluent can be low TSS, BOD, nutrient
- Hydraulic loading is very critical
- Disposal bed required post filter
- Canadian technologies

Effluent Pre-treatment

RBC

- Rotating Biological Contactor
- fixed film media
- proven technology
- larger more expensive but more robust
- Can be designed to reduce nitrogen

Disposal Beds

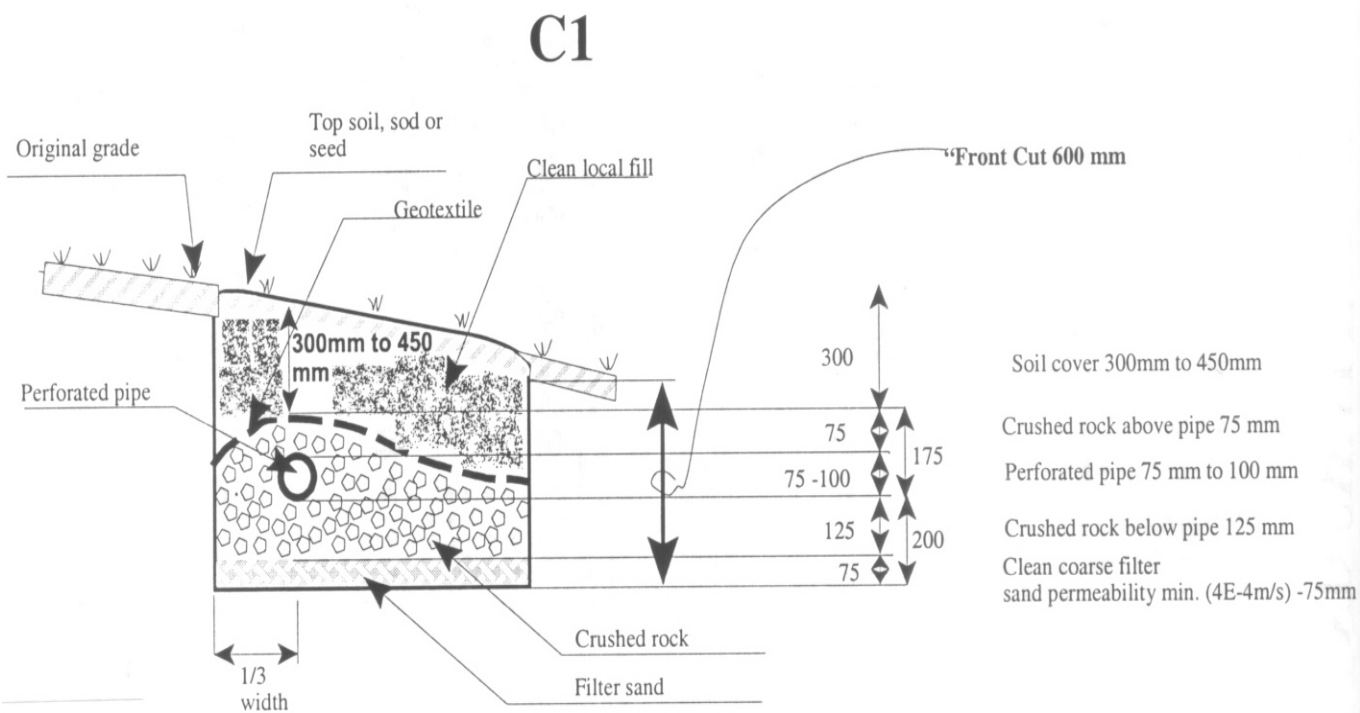
- Contour is a long narrow disposal trench
- Follows equal elevation “contour” of land
- Contour disposal trench
  - Wisconsin disposal bed refined in Nova Scotia
  - Long narrow disposal bed superior to square “area” bed
- Nova Scotia terminology C1, C2, C3
- Sloping land (>3%) required for the disposal bed

Disposal Beds

- Type of Contour used depends on:
- Soil conditions
- Limiting factors
- Length can be calculated or look up tables

- Construction is critical
  - Work from up-slope side
  - Floor of trench essentially level
  - Interface sand specification
  - Up-slope cut off trench

Disposal Beds



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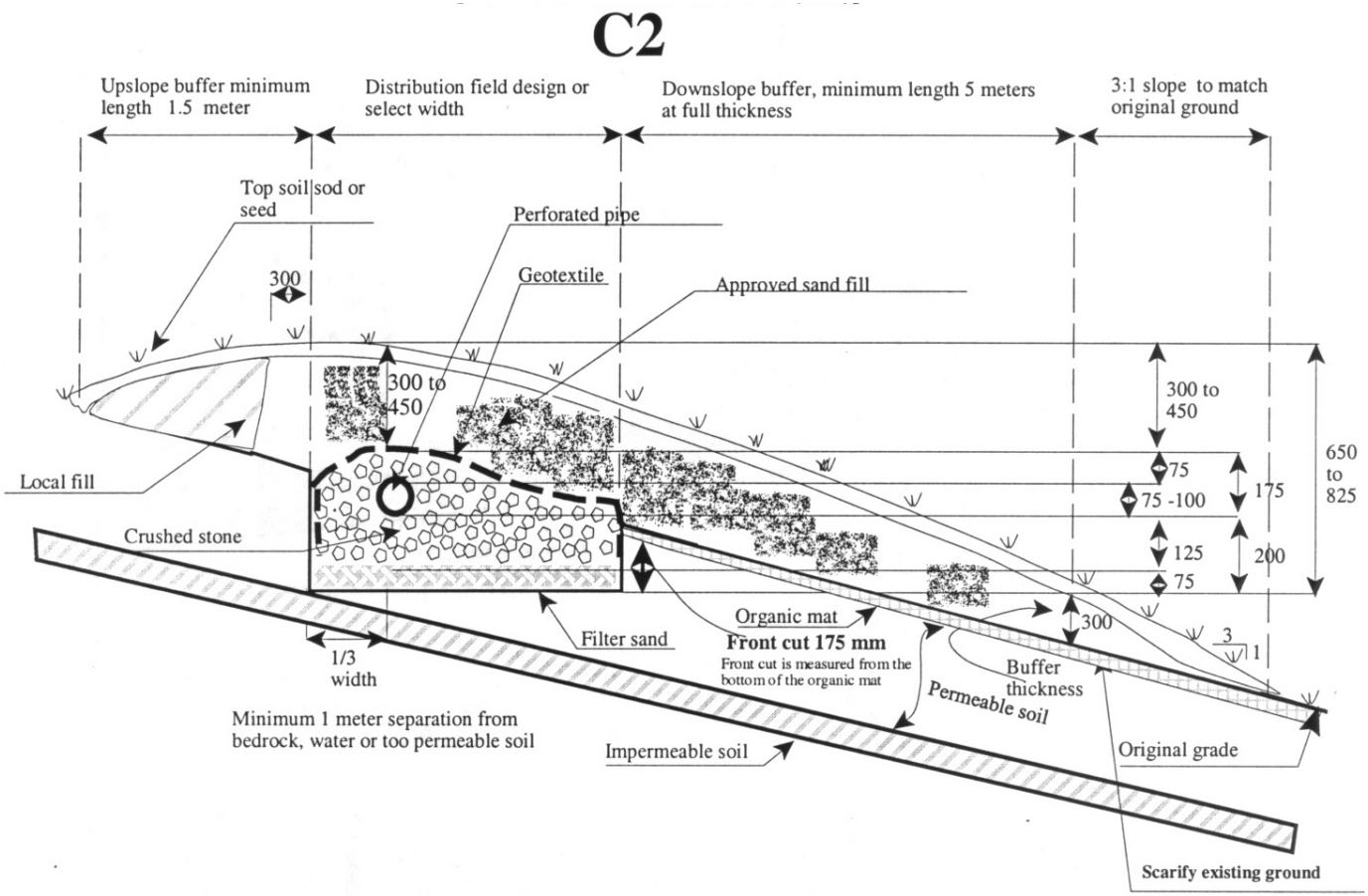

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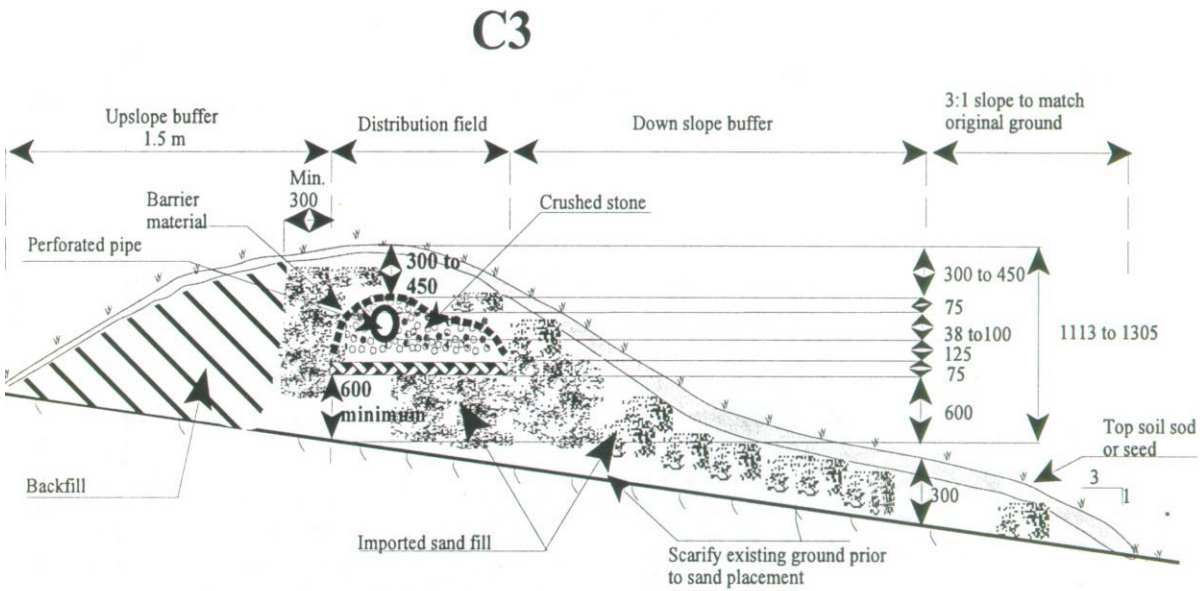

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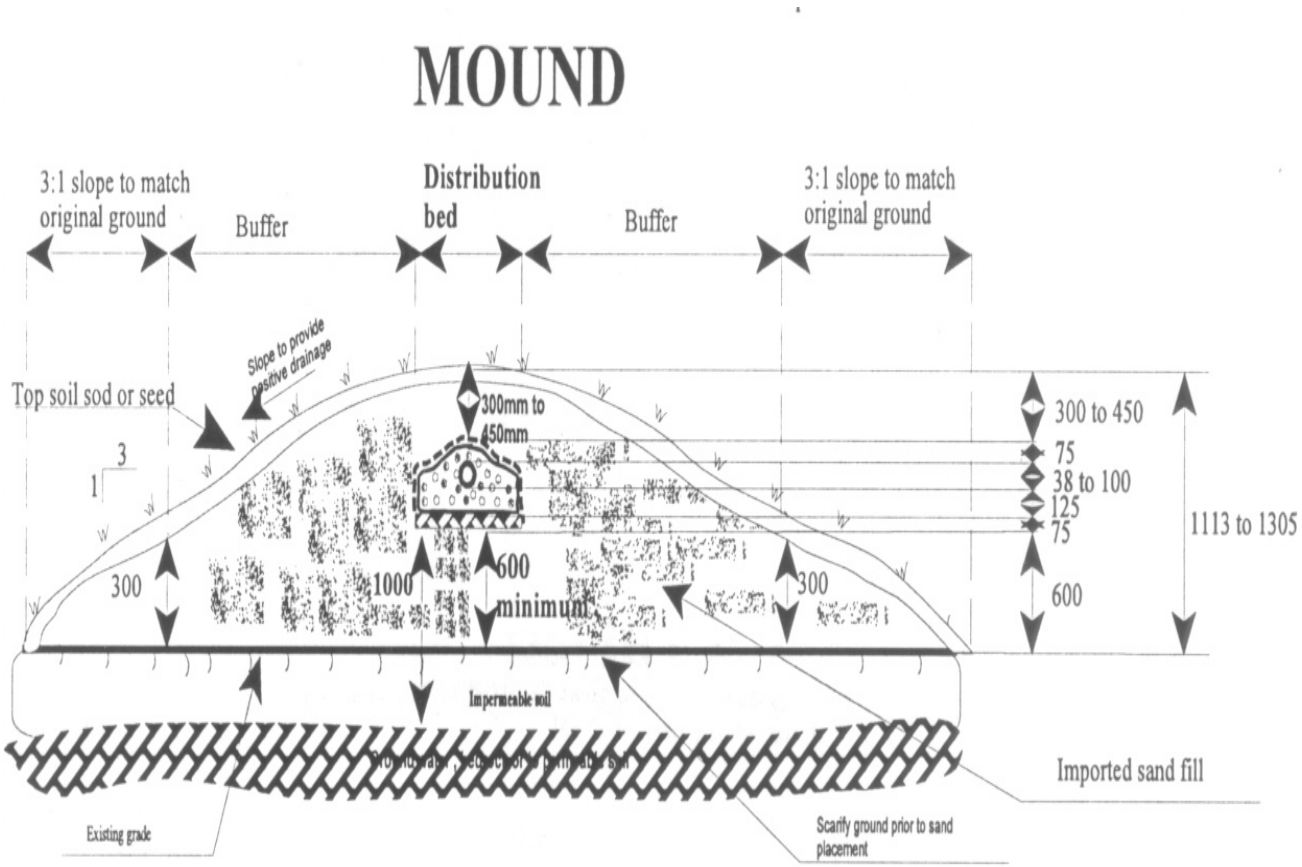
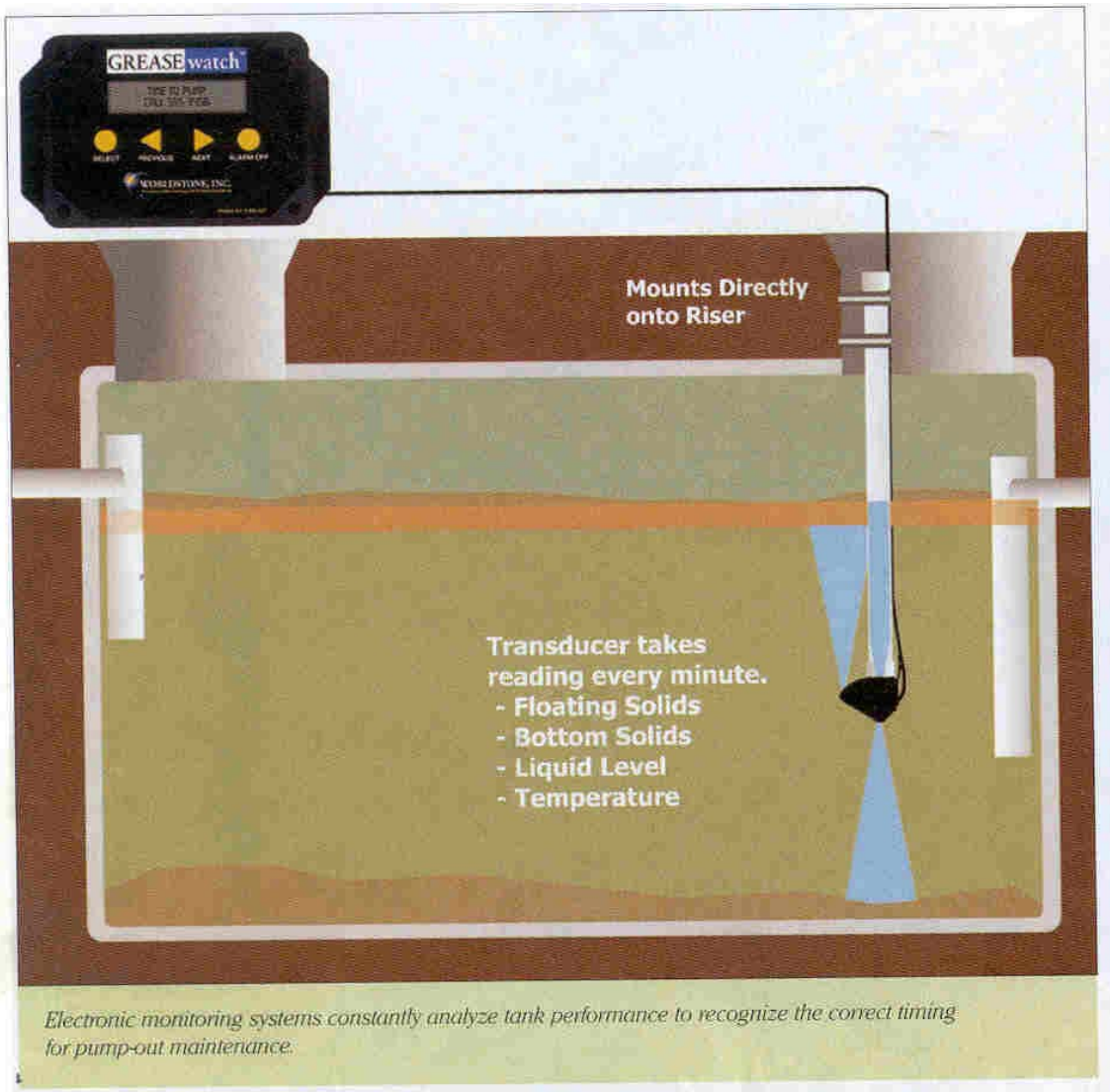


Recent Developments

- Increase minimum septic tank (500 to 750 Igal)
- Two compartment septic tanks
- Mandatory use of effluent filters

- Tanks followed by pumping chambers to offsite location or pressurized on-site distribution.
- In tank monitoring e.g. “Grease Watch” determines pump out frequency, leaks and infiltration.

Recent Developments



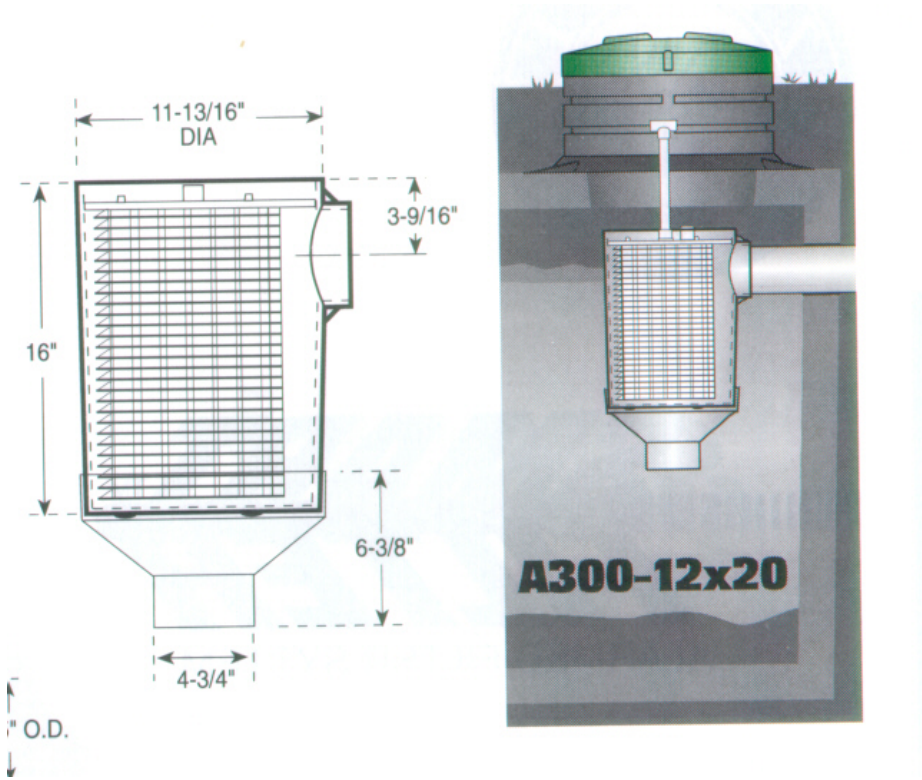
Electronic monitoring systems constantly analyze tank performance to recognize the correct timing for pump-out maintenance.

Recent Developments

- Effluent filters e.g. Zabel, Polylok, etc.
- Filter captures grease & “floaties”& “washout”
- Filter forces routine maintenance
- Pump chambers after filtered tanks provide benefit of even effluent distribution
- Receiving bed can typically occupy a smaller footprint, fewer feet of pipe and the bed lasts longer

Recent Developments

Zabel brand



Recent Developments

Pressure test of new system

-small diameter pipe

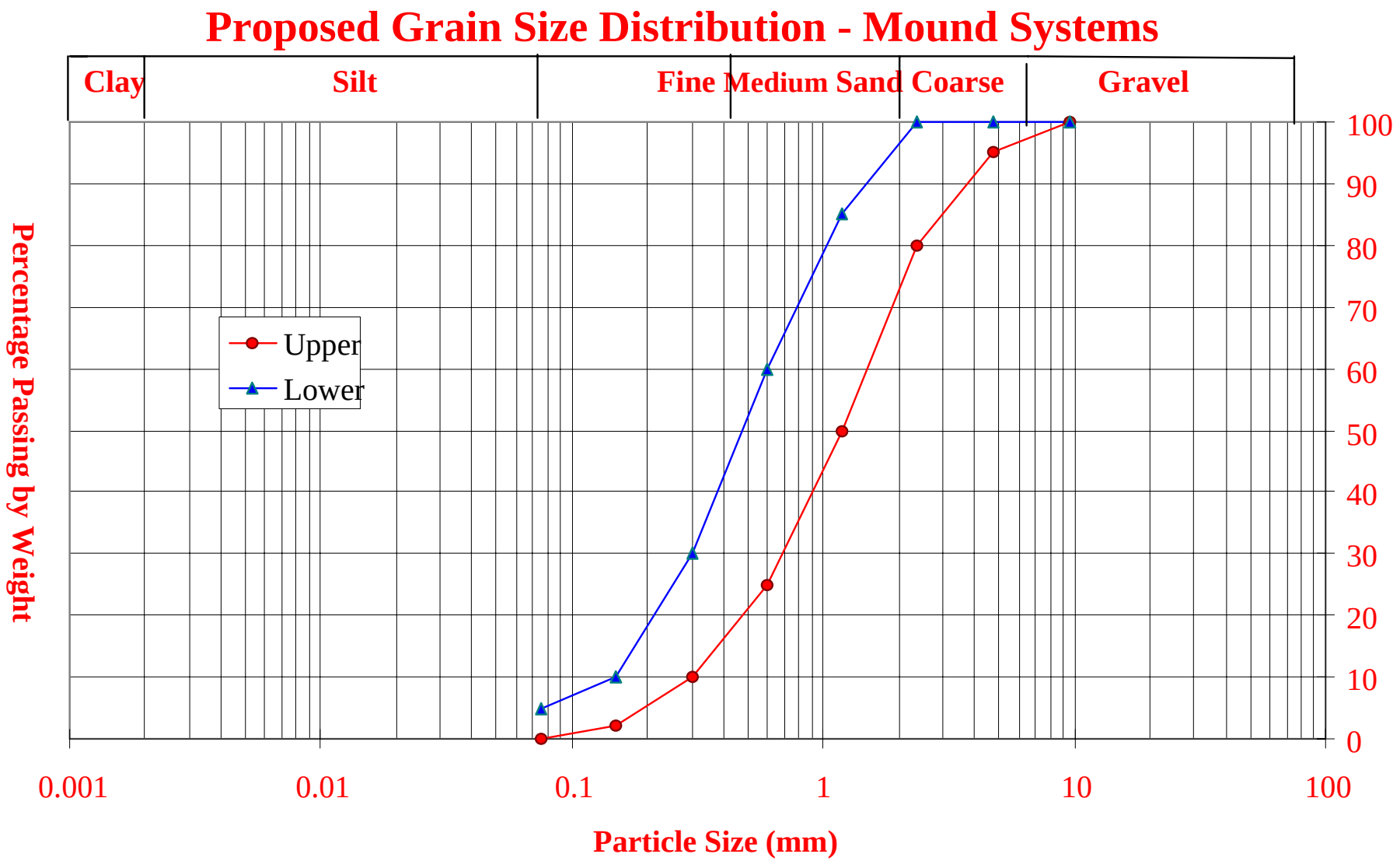
-flow splitter, valves

-end caps risers for clean out

Recent Developments

- Site soil conditions by observation, test pits, sieve, permeameter.
- Perc tests being phasing out.
- Hydraulic loading to match soils conditions.
- Import soils to meet defined criteria
  - Converse and Tyler at University of Wisconsin
  - Jordon Moores at Nova Scotia Centre Water Research
  - Infiltrator brand chambers soil spec
  - ASTM – C33 commonly referenced as suitable spec

Recent Developments



Recent Developments

- Regulations should require stricter onus on designer and increased installer training (fits well with home warranty programs).
- Effective for regulator to control permit process on design and construction – problematic to enforce after failure
- Decentralized systems with centralized management.

Experience

- Owners want cheapest solution because of a lack of knowledge.
- Low bid mentality = recipe for failure.
- Installers should be subject to more than a basic licensing test
- Owner should be part of design process and should be required to sign off on design and O&M
- Standard write up for failures benefits installers and regulators.

Fouled Disposal Chamber

Failure caused by:

15 to 18% fines in soil

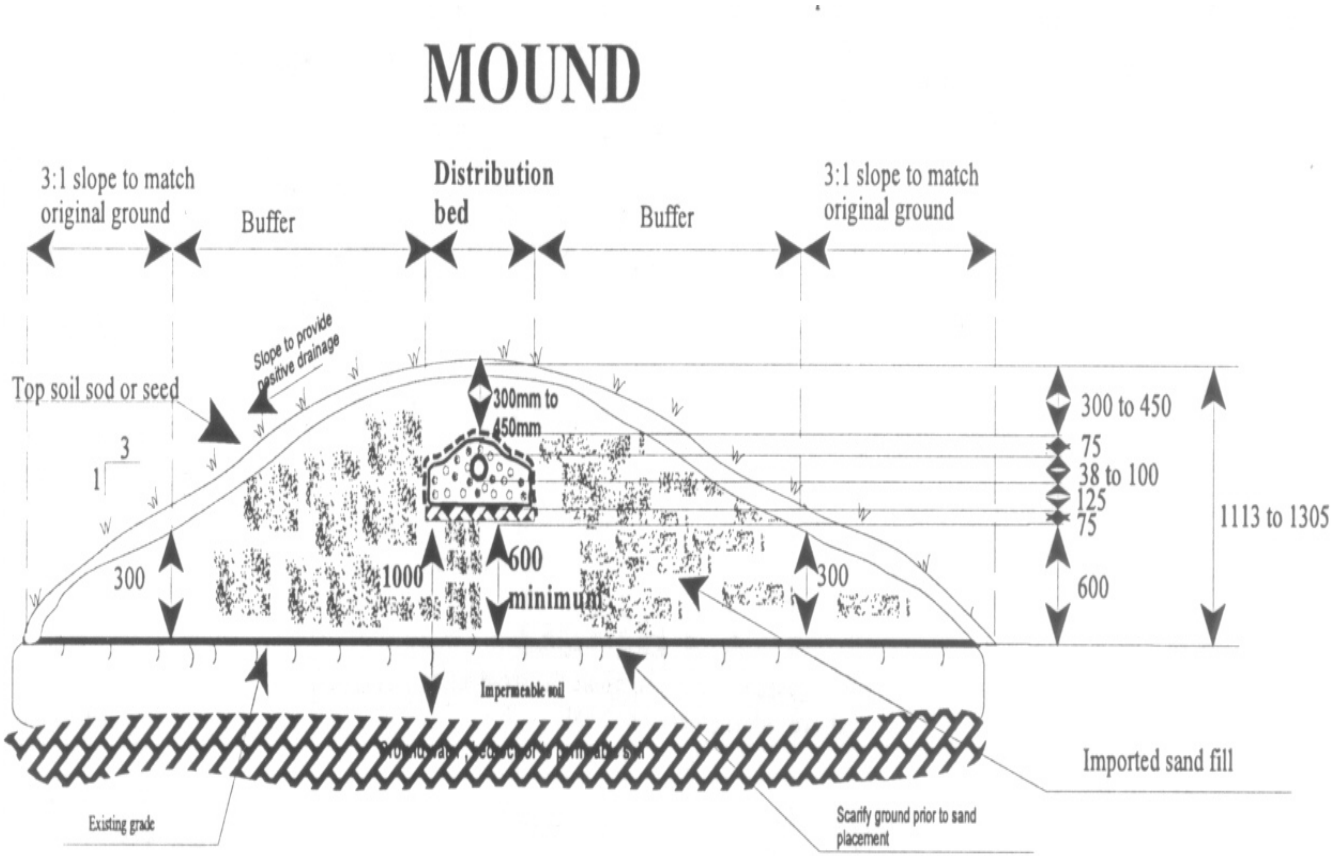
Pump in septic tank

Lack of grease trap cleaning

Experience

- Court cases seem to be problematic for regulators in terms of cost and success
- Hydraulics appear to be a challenge for some e.g. import soils can magically change receiving soil hydraulic conductivity
- Installers will create “bath tub” situations

Experience


MOUND
3:1 slope to match original ground
Buffer
Distribution bed
Buffer
3:1 slope to match original ground
Top soil sod or seed
Slope to provide positive drainage
3
1
300mm to 450mm
300
1000
600 minimum
300
300 to 450
75
38 to 100
125
75
600
1113 to 1305
Impermeable soil
Imported sand fill
Existing grade
Scarify ground prior to sand placement

Experience

- Building contractors set building foundation elevation before considering on-site systems.
- Installers plough off the natural soils.
- Installer types, “Tell me what to do”.
- Regulator types, “Design, Oversee & Approve”.
- Transition period for regulatory agencies

Experience

- Engineers tackling on-site system designs believing its a simplified version of municipal services.
- Technology “sales pitch” this new widget will allow development of poor land.
- Tank & line cleaning compounds – bad news
- D-boxes

Conclusion

- Improved training of installers, designers & regulators is a good thing
- New technologies and methods are good
- Transition to more responsibility for designer, installer and owner
- Regulator ensures design meets regulation or intent of regulation