Basics of Dust Control and Wind Erosion

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DEPARTMENT of HEALTH

NDR10-0000

PART II – STORM WATER DISCHARGE REQUIREMENTS

C. Storm Water Pollution Prevention Plans

2. Operational Controls

b. Good housekeeping practices to maintain a clean and orderly facility. Litter, debris, chemicals and parts must be handled properly to minimize the exposure to storm water. This includes measures to reduce and remove sediment tracked off-site by vehicles or equipment, and the **generation of dust**.

Wind Erosion

- Major contributor to erosion of fine-grain soils.
- A thick layer of accumulated sand and silt may not support plant growth.

Wind Erosion

- Wind erosion can be a problem in most states.

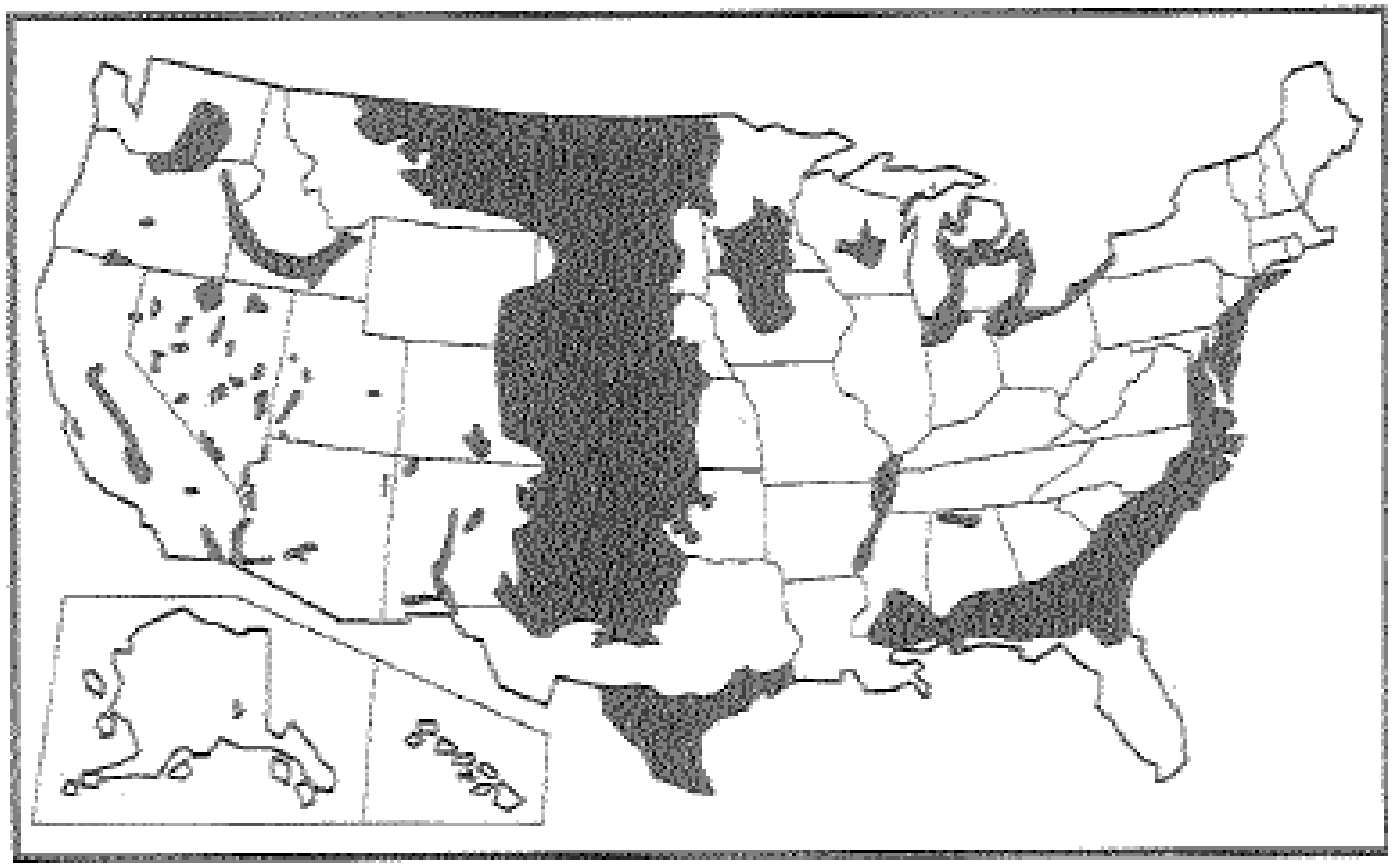

Figure 39. Areas of Highest Potential for Wind Erosion (SCS, 1989)

Field Manual on Sediment and Erosion Control Best Management Practices for Contractors and Inspectors, Fifield, 2002

Wind Erosion

- An issue during dry conditions when soil is exposed to wind.
- Unlike water-borne sediment, wind-borne sediment does not flow downhill.

Wind Erosion

Methods of Soil Particle Transportation

- Surface Creep
- Saltation
- Suspension

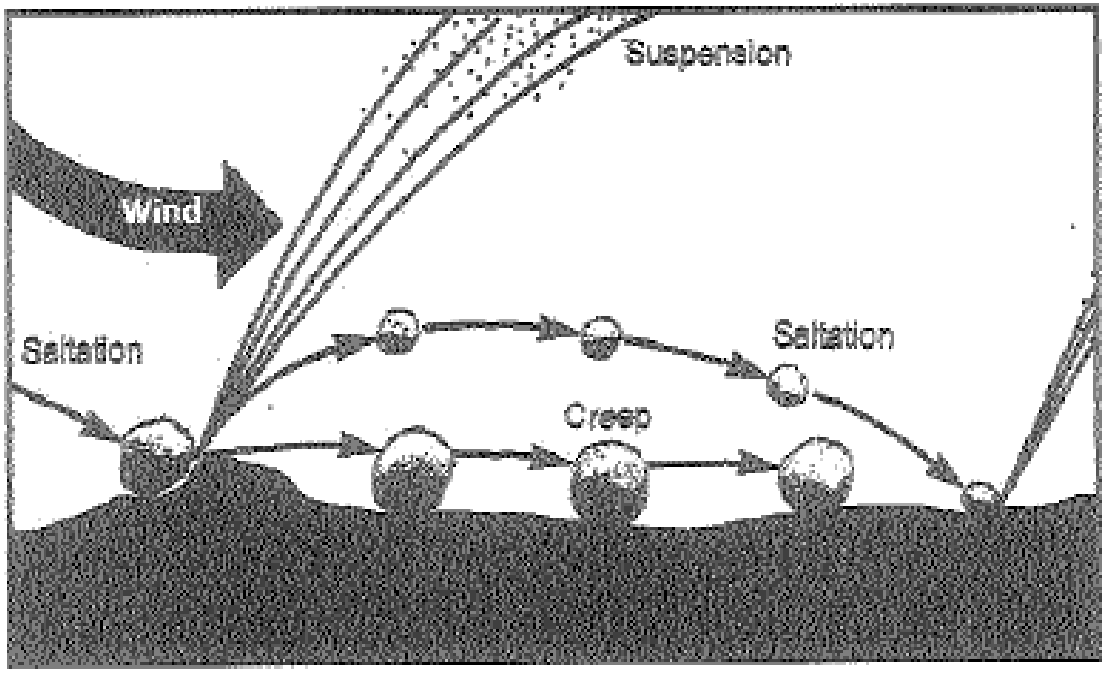

Figure 40. Mechanisms of Wind Erosion and Sedimentation (SCS, 1989)

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Surface Creep

- The rolling and sliding movement of particles across a surface.
- Can represent 5 – 25% of total soil loss from a construction site.

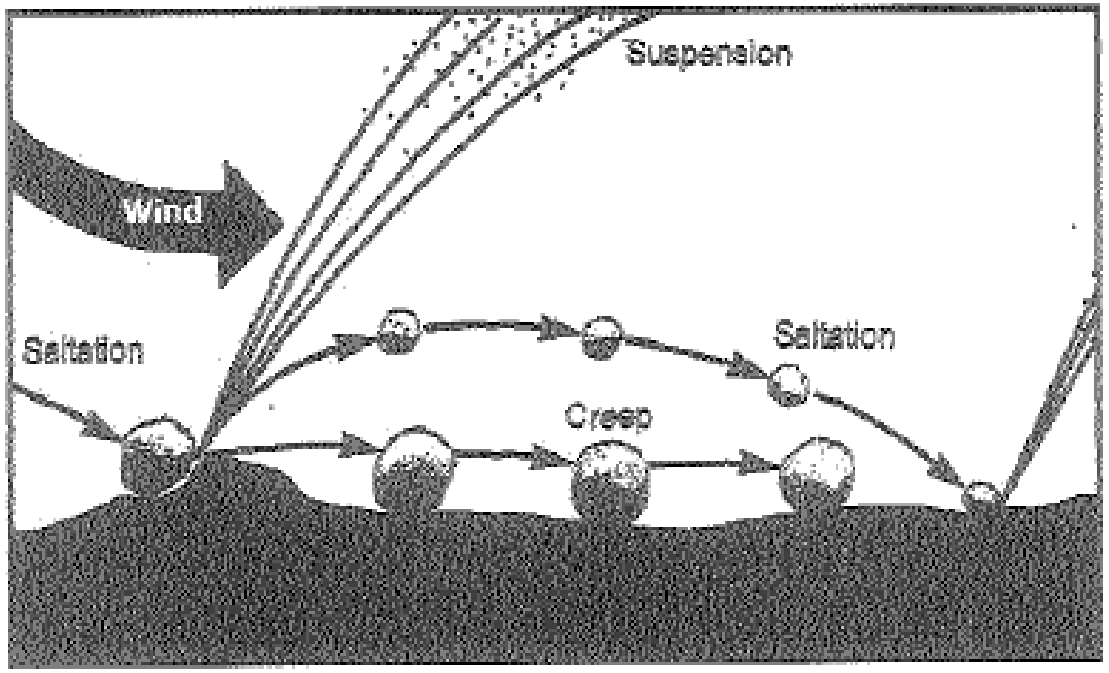

Figure 40. Mechanisms of Wind Erosion and Sedimentation (SCS, 1989)

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Saltation

- The hopping and bouncing movement of particles.
- The particles are small enough to be lifted by wind, but are too large to stay in the air.
- Upon returning to the ground they dislodge more particles.
- Can represent approximately 50 – 80% of total soil loss due to wind.

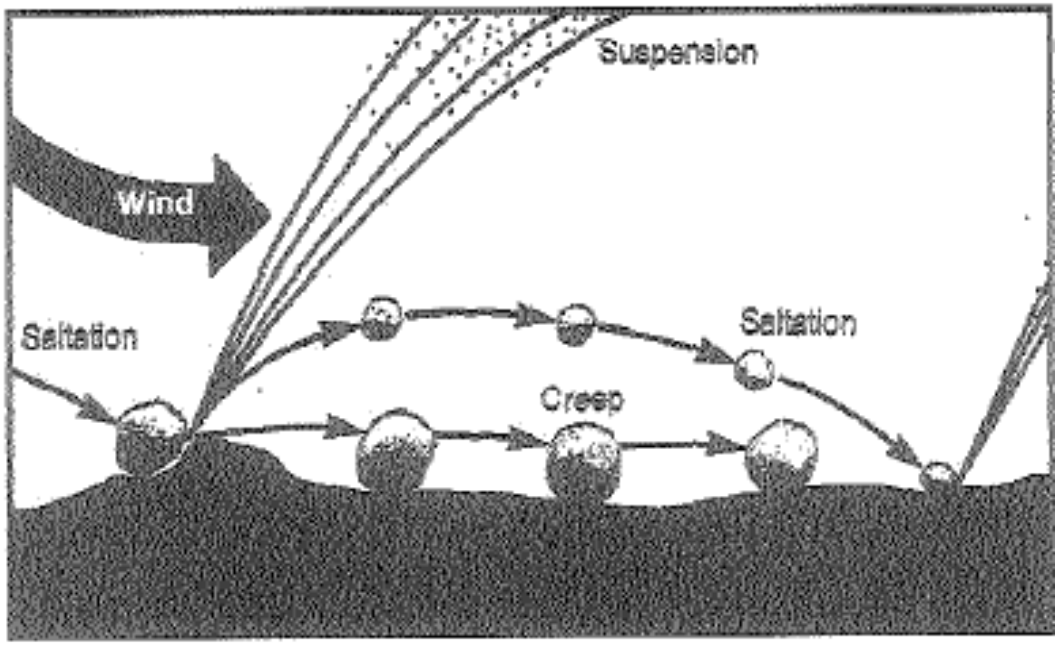

Figure 40. Mechanisms of Wind Erosion and Sedimentation (SCS, 1989)

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Suspension

- Particles small enough to be suspended by wind.
- Remain in suspension for long durations and can travel great distances.
- Can represent less than 10% of total soil loss due to wind.

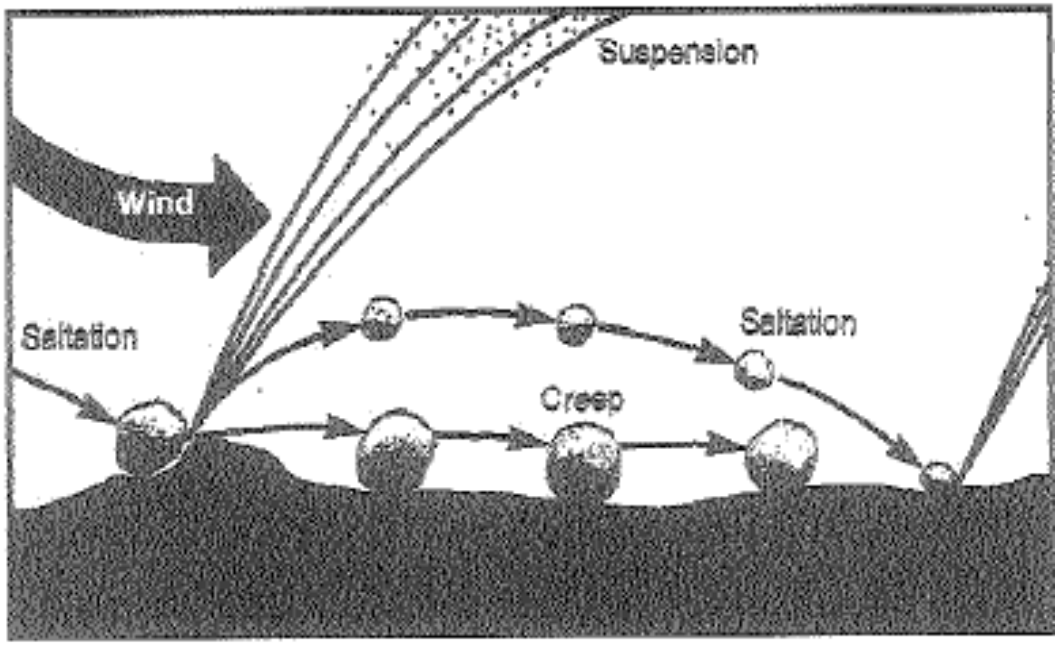

Figure 40. Mechanisms of Wind Erosion and Sedimentation (SCS, 1989)

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Size Distribution

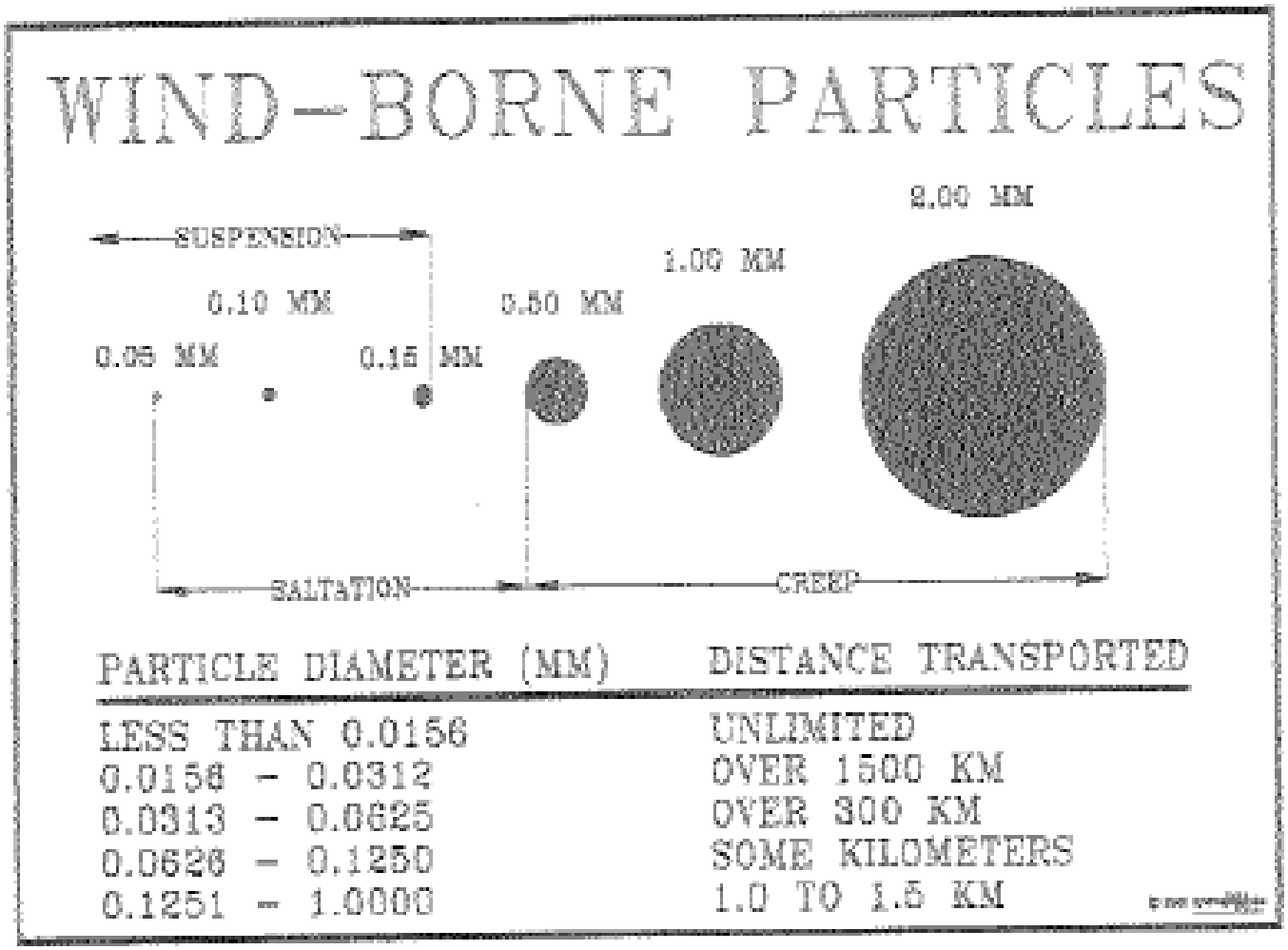


Figure 41. Relative Size Distribution of Wind-Borne Particles (Fifield, 1995)

Field Manual on Sediment and Erosion Control Best Management Practices for Contractors and Inspectors, Fifield, 2002

Erosion Rates

- Depend on erodibility of the soil and erosivity of the wind.
- Erosivity falls into two categories
  1. Atmospheric Flow
     - The rate of soil movement is proportional to the cube of the wind velocity.
  2. Surface Roughness
     - Five major categories:
       - Vegetation height and density
       - Clods and non-erodible fractions
       - Ridges
       - Field shelterbelts (or windbreaks)
       - Local changes in topography.

Surface Roughness

1. Vegetation height and density
   - Determines the extent wind contacts the soil surface
2. Clods and non-erodible fractions
   - Provide cover for smaller soil particles
3. Ridges
   - Shelter and trap suspended particles when the wind is perpendicular to them
   - Provide little protection when wind is parallel to them
4. Field shelterbelts or windbreaks
   - Intercept suspended particles
   - Particles deposit on the leeward side of the barrier
5. Local changes in topography
   - Wind shear is greatest in upper part of the windward slope

Erodibility

- Erodibility of soil is dependent upon
  - Diameter
  - Density
  - Shape
- Most soil is held together in clods in the following ways:
  - Water tends to hold soil grains together
    - Sands tend to dry quickly
    - Finer grains retain moisture longer and are more cohesive
  - Texture relates to a soil's moisture-retention capability
    - More silt and clay results in more clods
    - More sand results in fewer clods
  - Organic cements resulting from breakdown of organic material
  - Desegregating processes
    - Freeze-thaw breaks down clods

Minimizing Wind Erosion

- Things to consider:
  - Control methods available during major grading activities
  - Control methods to use after major grading activities
  - Amount of area exposed
  - Dust generating activities (cutting concrete)
  - Location (near populated areas)
  - Time of year
  - Type of people affected
    - People with health issues
    - “Concerned citizens”

Control Methods

- Minimize amount of soil exposed
- Mulch and seeding
- Mulch
- Structural Barrier and windbreaks
- Surface Roughening
- Dust suppression chemicals
- Water

Mulch

- Straw or other organic material

Mulch

- In order to prevent mulch from blowing away, it should be disc-anchored into the soil, hydraulically bonded, or covered with netting and stapled
- Mulch may help when optimum germination conditions do not exist (i.e., midsummer, early winter)

Structural Barrier and Windbreaks

- Deposition zone of 10 feet for every 1 foot of fence height
  - Soil deposition zone = 10 x fence height
- Spacing between barriers depends on soil erodibility
  - Low (erodibility) = 1,000 ft
  - Moderate = 200 ft
  - High = 50 ft
- The best sediment collection occurs when 40% to 50% of the fence is open (porosity)

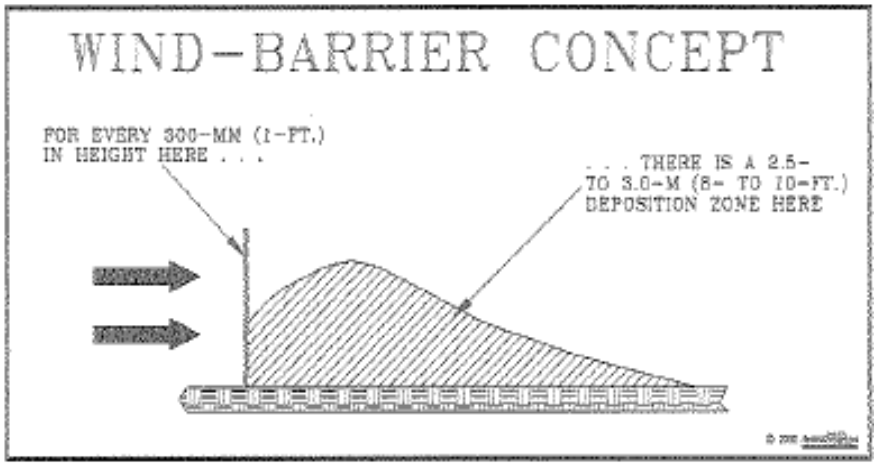
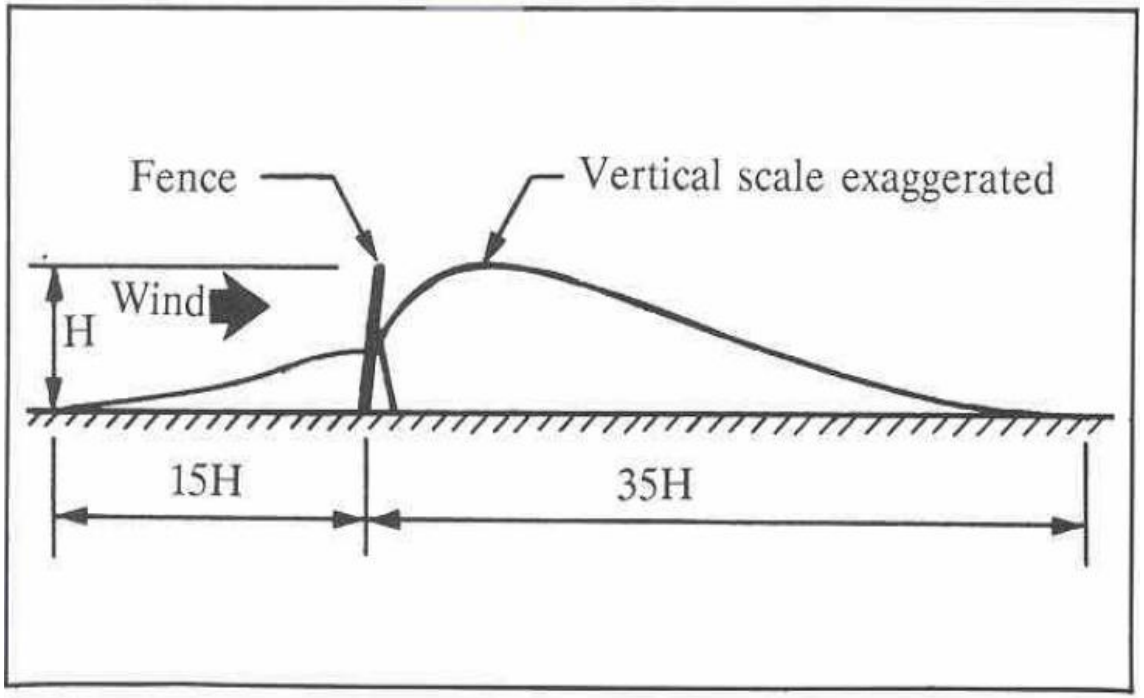


Figure 42. Impact of Barriers on Deposition of Wind-Borne Sediments (Fifield, 1996)

Field Manual on Sediment and Erosion Control Best Management Practices for Contractors and Inspectors, Fifield, 2002

Structural Barrier and Windbreaks

- Caution should be used when placing barriers before snow fall, then the deposition zone is 35 feet for every 1 foot of fence
  - Snow deposition zone = 35 x fence height



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Snow Fence Guide, Tabler, 1991

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Control Methods

- Surface Roughening
  - Construct ridges perpendicular to the prevailing wind or to the direction you want to protect
  - Ridges should be 6 inches in height
- Water
  - Useful when equipment is available and water retention capability of the soil
- Dust Suppression Chemicals
  - Apply according to directions (do not over apply) or NDDoH guidelines (e.g., oilfield salt brine)
  - Use caution when applying near waters of the state (do not violate a water quality standard)
  - A significant amount of time should be provided prior to a rain event to allow the product to set and avoid being washed away by stormwater

36 mph winds
4/6/2006

36 mph winds
4/6/2006
ASPEN
Group
REAL ESTATE SERVICES
223-2450

36 mph winds
4/6/2006
43 AVE NE
ASH COULEE DR
EAGLE CREST
ON ASH COULEE DR
presented by:
Boulder Ridge
Development, Inc.
Jack
Knutson

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4/6/2006

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36 mph winds
4/6/2006
POSTED
NO TRESPASSING

36 mph winds
4/6/2006

Questions?

References

- Designing for Effective Sediment and Erosion Control on Construction Sites; Jerald S. Fifield; 2001
- Field Manual on Sediment and Erosion Control Best Management Practices for Contractors and Inspectors; Jerald S. Fifield; 2002
- SHRP-W/FR-91-106, Snow Fence Guide; Ronald D. Tabler, Tabler & Associates; 1991
- Protecting Water Quality in Urban Areas; MPCA; 2000