SALT MIGRATION

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OBJECTIVE

To demonstrate that salts do not migrate or accumulate at the soil surface when drilling pits are properly closed and revegetated.

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Statement

Research and practical experience from the fields of soil chemistry, soil physics and reclamation will be discussed to support the position that upward salt migration to the surface of closed drilling pits does not occur when the site is properly reclaimed.

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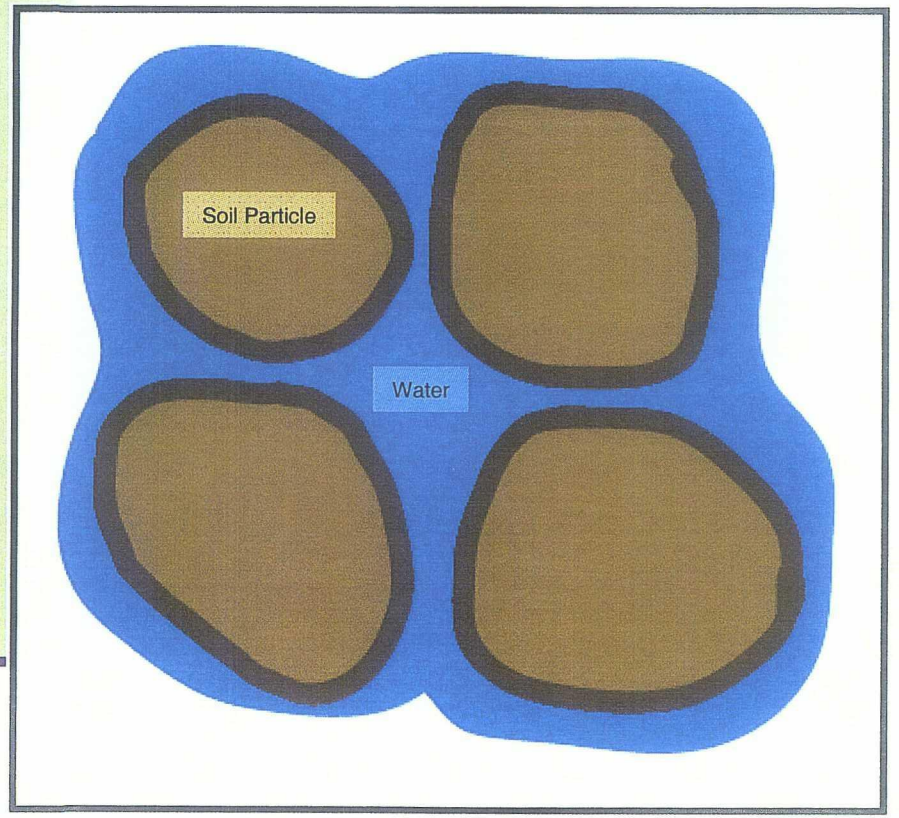
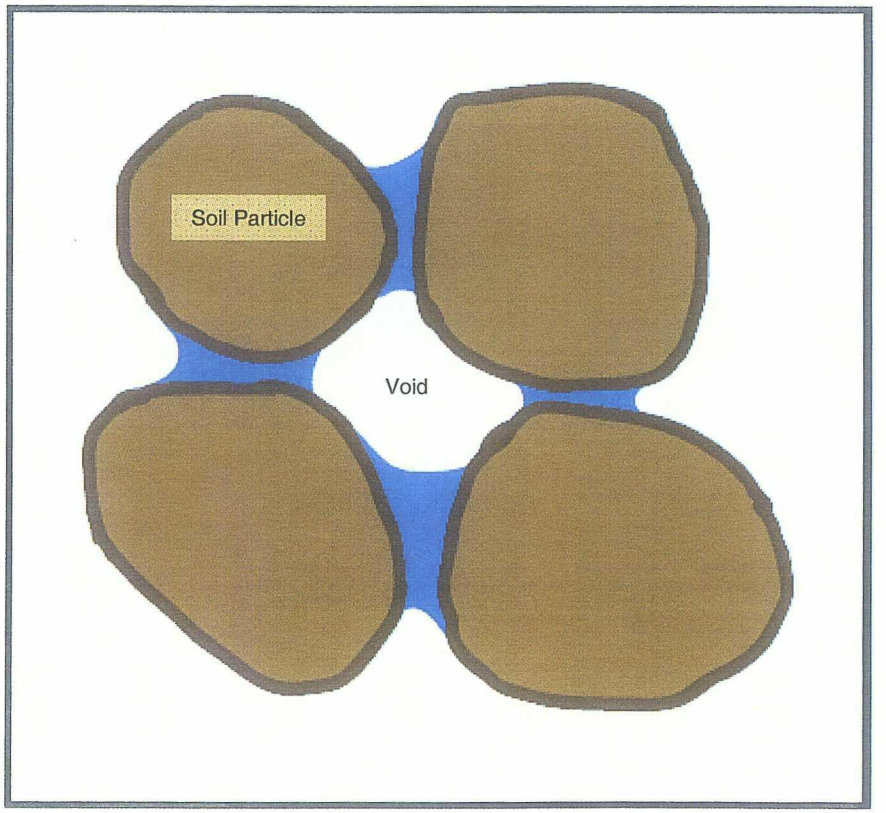
Soil Water Movement



Saturated Flow



Unsaturated Flow

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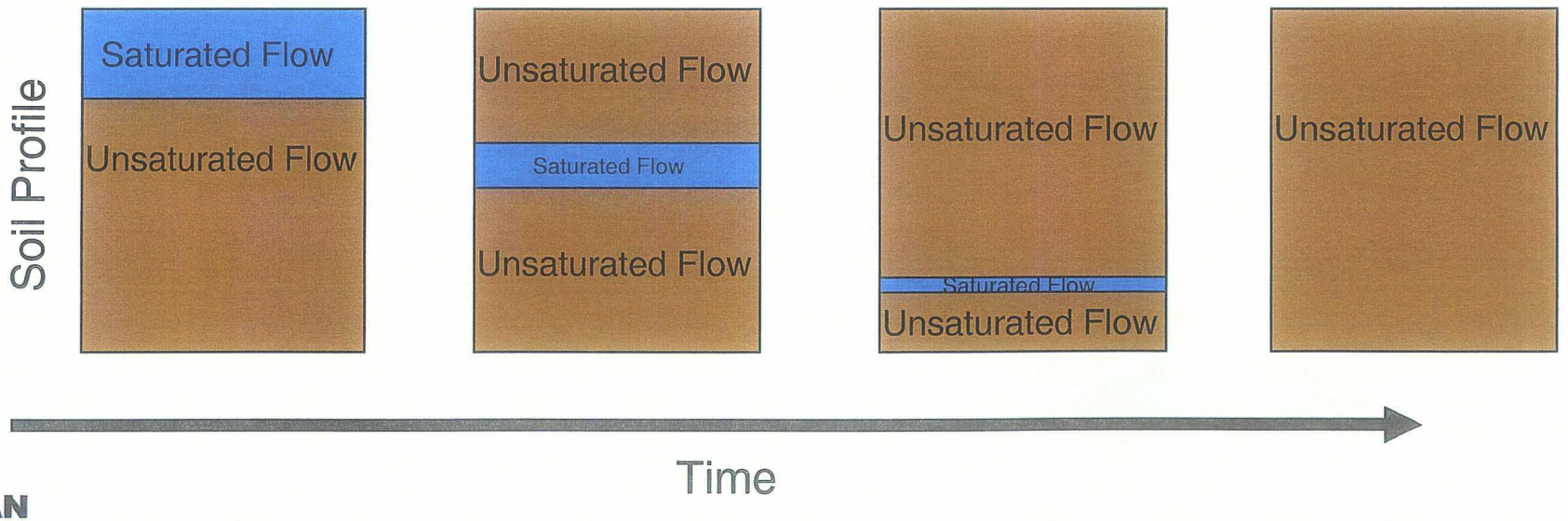
Water Flow



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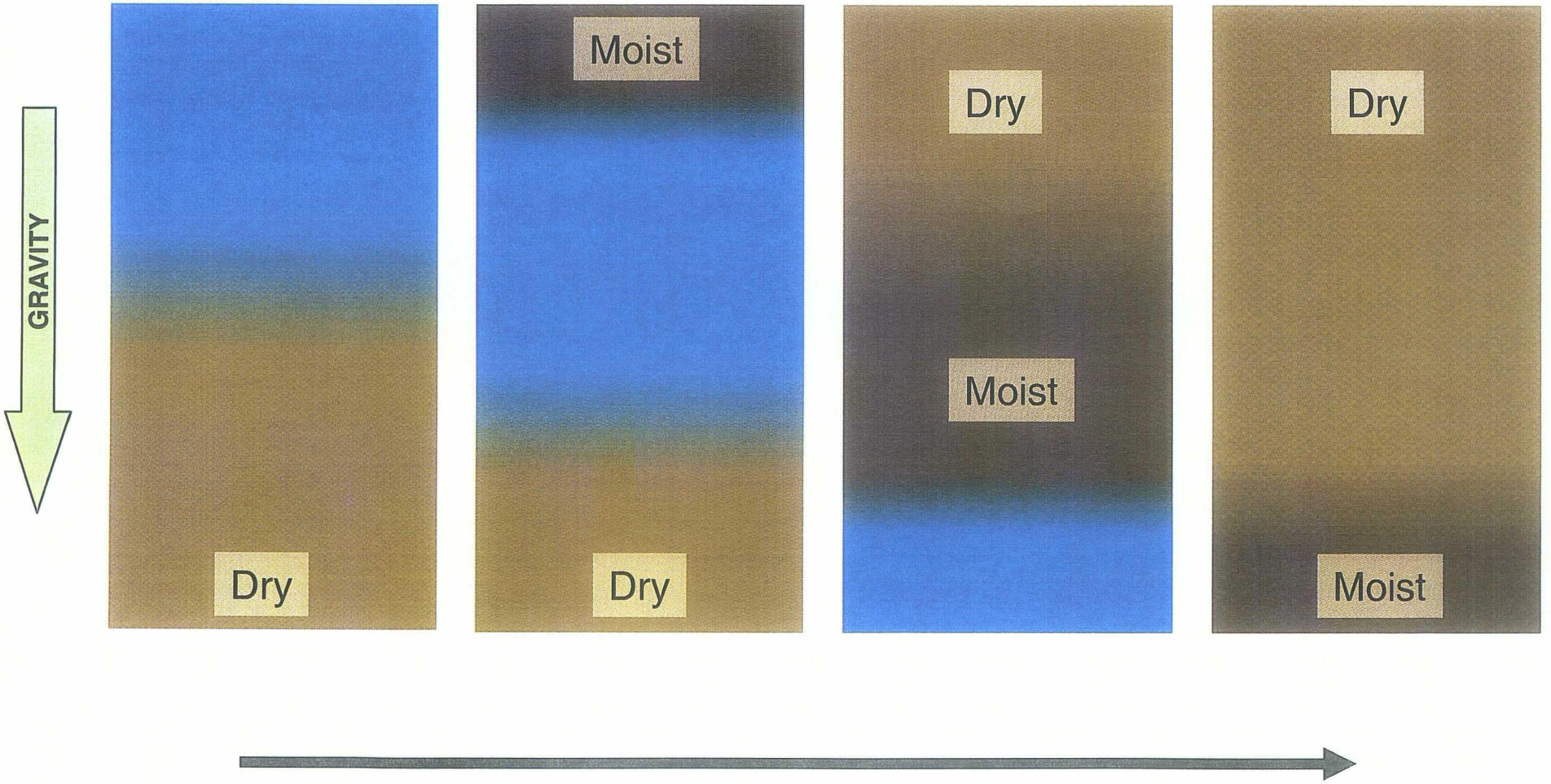
Soil Water Redistribution



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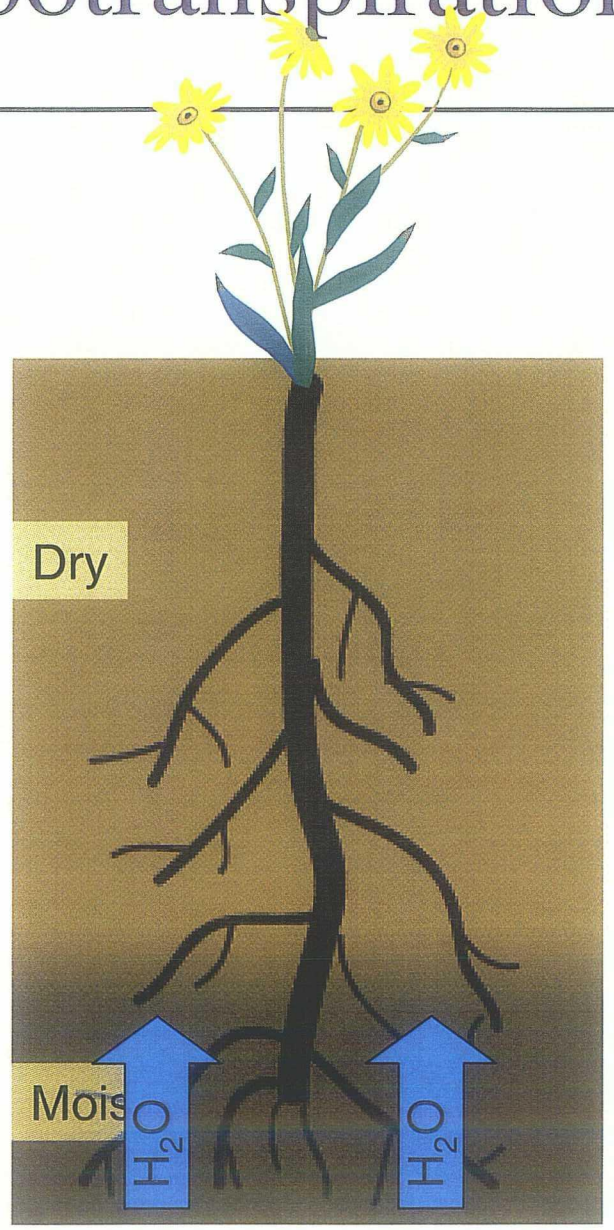
Plant Evapotranspiration



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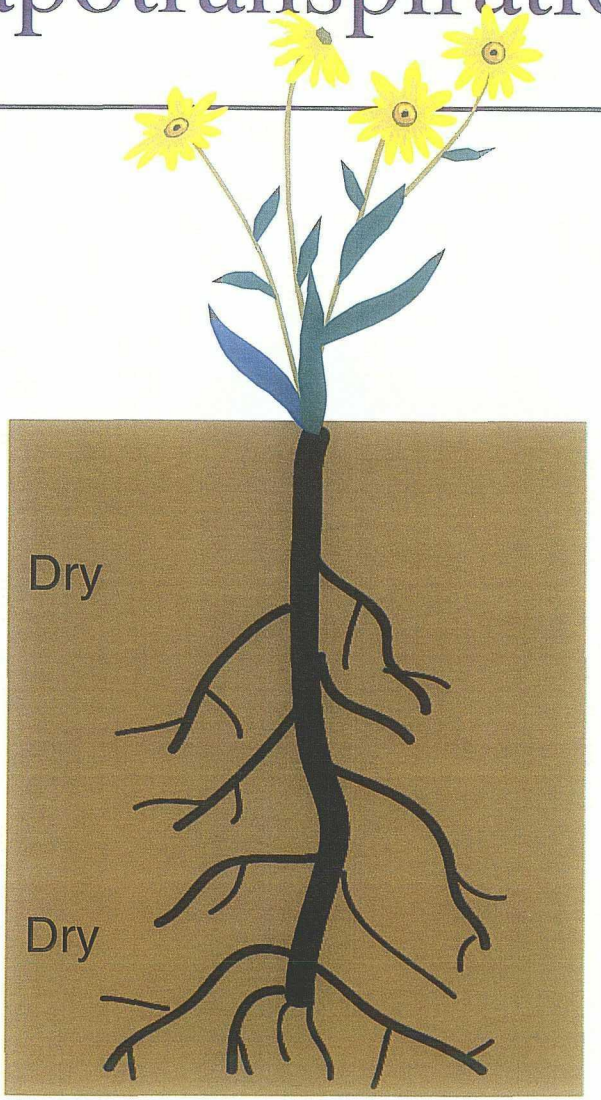
Plant Evapotranspiration



Time

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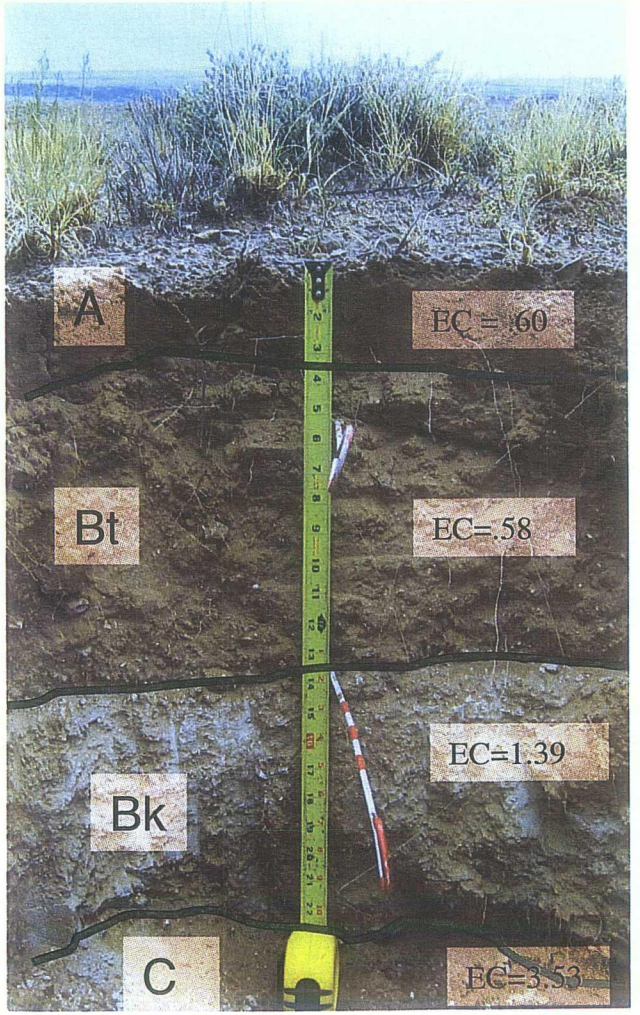
Representative Native Soil



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Reclaimed Mine Spoils
Stutz & Buchanan 1987

- New Mexico
- 12 years
- No coversoil applied
- Salts migrated downward 10 to 30 inches

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Reclaimed Mine Spoils
Barth and Martin 1984

- Wyoming, Montana and North Dakota
- 5 years
- 60 inches of coversoil
- Salts did not accumulate at the surface
- Sodium migrated upward 3 to 6 inches from the spoil

Reclaimed Mine Spoils
Dollhopf et al. 1992

- Montana
- 11 years
- 27 inches of coversoil
- Salts did not accumulate at the surface
- 9 inches of upward salt migration

Reclaimed Mine Spoils Buchanan 1998

- New Mexico
- 4 years
- 24 inches of coversoil
- Salts did not accumulate at the surface
- 2 to 4 inches of upward salt migration

Reclaimed Mine Spoils
Bailey 2001

- Northern Great Plains – Canada
- 16 years
- 28 and 43 inches of coversoil
- Salts did not accumulate at the surface
- 6 inches of upward salt migration

Reclaimed Drilling Pits McFarland et al. 1992

- Texas
- 20 months
- 36 inches of coversoil
- Salts did not accumulate at the surface
- 6 and 12 inches of upward salt migration

Mertz Study Site

	EC (mmhos/cm)	Na (mmols/L)	Cl (mmols/L)		EC (mmhos/cm)	Na (mmols/L)	Cl (mmols/L)
36"	0.6	0.9	1.1	Soil Surface	0.5	0.7	1.6
30"	0.5	1.1	1.0	C	0.5	0.8	1.7
24"	0.5	1.3	1.0	o v e r	0.4	1.1	0.9
12"	0.4	1.4	1.1	S	0.5	1.4	1.6
6"	1.8	7.5	14.4	o i l	8.1	44.3	81
0"							
12"	169	1913	2085	Drilling Pit Contents			

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1 Month

20 Months

Weatherby Study Site

	EC (mmhos/cm)	Na (mmols/L)	Cl (mmols/L)
36"	0.8	1.4	1.1
30"	0.6	1.3	1.6
24"	0.5	1.5	1.1
12"	0.5	1.1	1.4
6"	2.2	14.6	8.1
0"			
12"	180	1609	2011

Soil Surface

Cover Soil

Drilling Pit Contents

1 Month

EC (mmhos/cm)	Na (mmols/L)	Cl (mmols/L)
0.5	0.4	0.8
0.4	0.7	0.7
0.7	2.3	0.8
5.2	13.7	36.0
19.5	166.9	202.9

20 Months

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Conclusion

- Salts migrate upward a maximum 6 to 12 inches from spoil or drilling materials
- Salts do not migrate or accumulate at the soils surface when drilling pits are properly reclaimed.

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Recommendations

- Stabilize drilling materials with soil
- Apply 4 feet of cover soil;
  1. Sufficient to prevent salt migration to the surface.
  2. Sufficient to establish a sustainable native vegetation.
  3. Sufficient to maintain a community similar to conditions prior to oil and gas operations.
- Reclaim with site-specific native species