

Summary of Testimony

- ◆ Small land farms pose low risk
- ◆ Flexibility should be afforded operators who utilize site specific data
- ◆ Regulations should be internally consistent, reasonably protective, and implementable



Natural Recharge

- ◆ Water percolation below the root zone which reaches the groundwater table
- ◆ Important to assessing potential for chloride in landfarm to reach groundwater and exceed standards

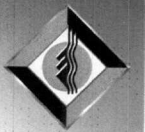


Types of Natural Recharge

- ◆ Mountain Front Recharge
- ◆ Local Recharge
- ◆ Diffuse Recharge



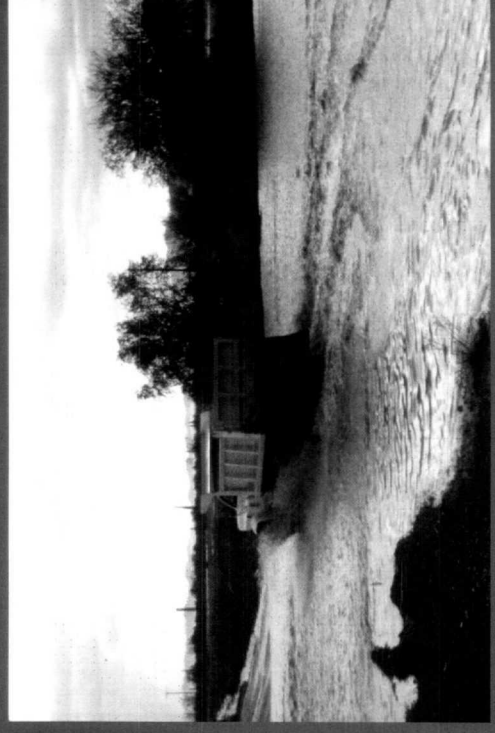
Mountain Front Recharge: Importance of Snowpack



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Local Recharge

- ◆ Topography
- ◆ Concentrated Runoff
 - ◆ Arroyos
 - ◆ Playas
- ◆ Top photo is Rio Puerco (south)
- ◆ Bottom photo is Central AZ



Factors Affecting Natural Recharge

- ◆ Permeability, vegetation, topography
- ◆ Sand dunes north of Socorro
- ◆ Variable recharge



Proposed Siting Requirements for Landfarms

- ◆ 200 feet from water courses
- ◆ Landfarm location is required to be in an area of potential diffuse recharge, between water courses
 - ◆ Depending on site characteristics, diffuse natural deep soil-water movement may be:
 - ◆ Downward (recharge to groundwater)
 - ◆ Upward
 - ◆ Zero



Diffuse Natural Recharge

- ♦ Sevilleta National Wildlife Refuge, Bernardo, NM
 - ♦ Floodplain of Rio Salado
 - ♦ Unconsolidated sand
 - ♦ Salt bush dominant
 - ♦ Precipitation = 200 mm/yr
- ♦ Recharge: 2.5- 8.4

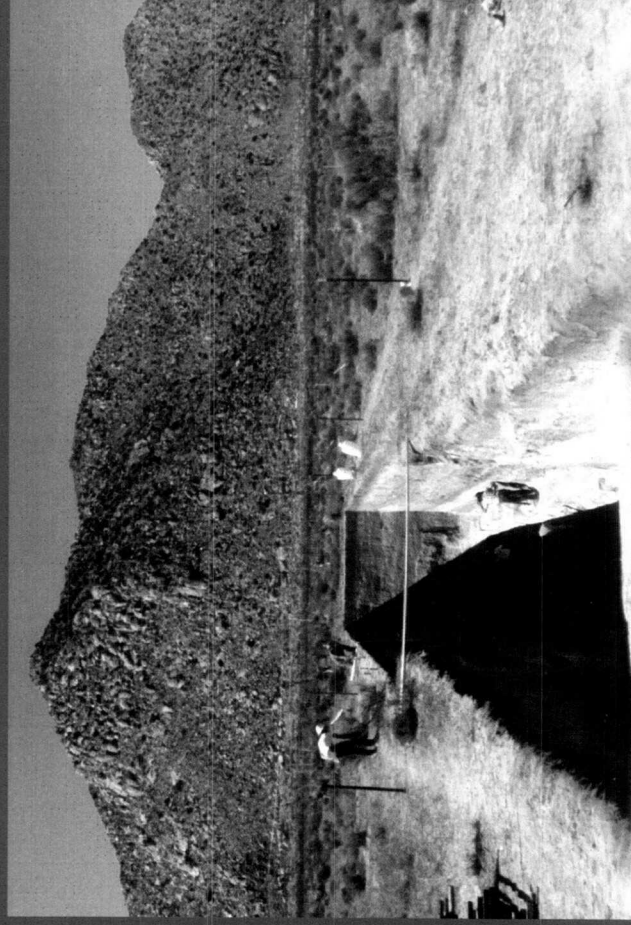


mm/yr

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Diffuse Natural Recharge



- ♦ NMSU Ranch Site
 - ♦ Sandy loam, carbonate zones
 - ♦ Grass, yucca, shrubs
 - ♦ Precipitation = 230 mm/yr
- ♦ Recharge: 1.5-9.5 mm/yr
- ♦ Phillips et al. 1988



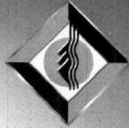
Example of Site with Upward Gradient in Deep Vadose Zone

- ◆ Sunland Park, NM
 - ◆ Rain: 8 inches/yr
 - ◆ Potential Evapotranspiration: 50 in/yr
 - ◆ Santa Fe Group
 - ◆ Creosote
 - ◆ Terrace-Floodplain transition zone
- ◆ Upward gradient (9-39 ft bgs), no recharge
- ◆ Stephens & Coons (1994)



Summary

- ◆ Vegetation is important in evaluating recharge
- ◆ Recharge is mm per year in diffuse recharge areas.
- ◆ Landfarms will be sited in diffuse recharge areas



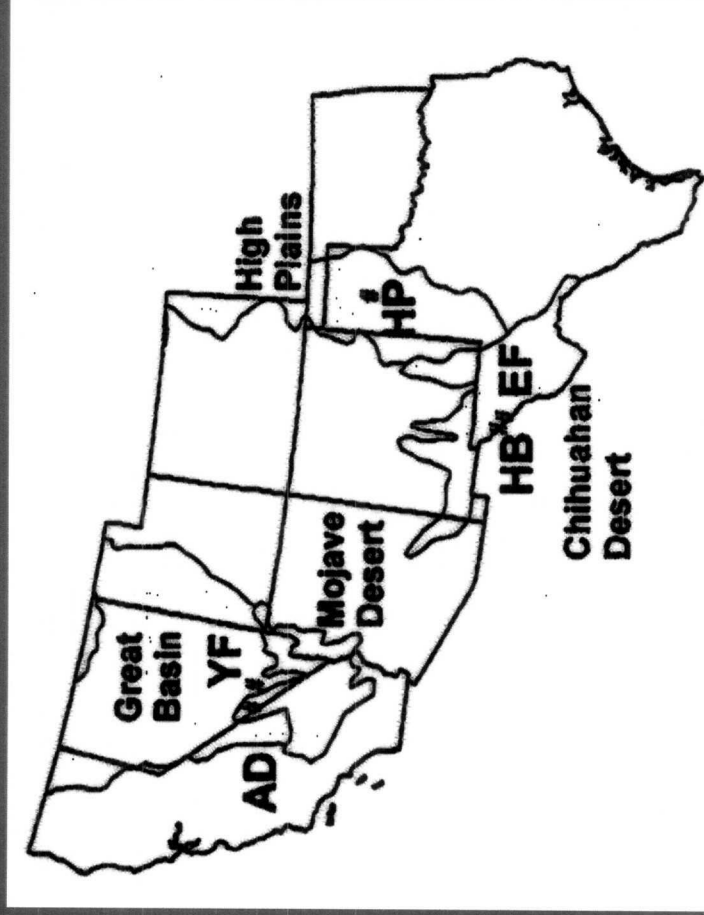


Natural Chloride Soil Profiles

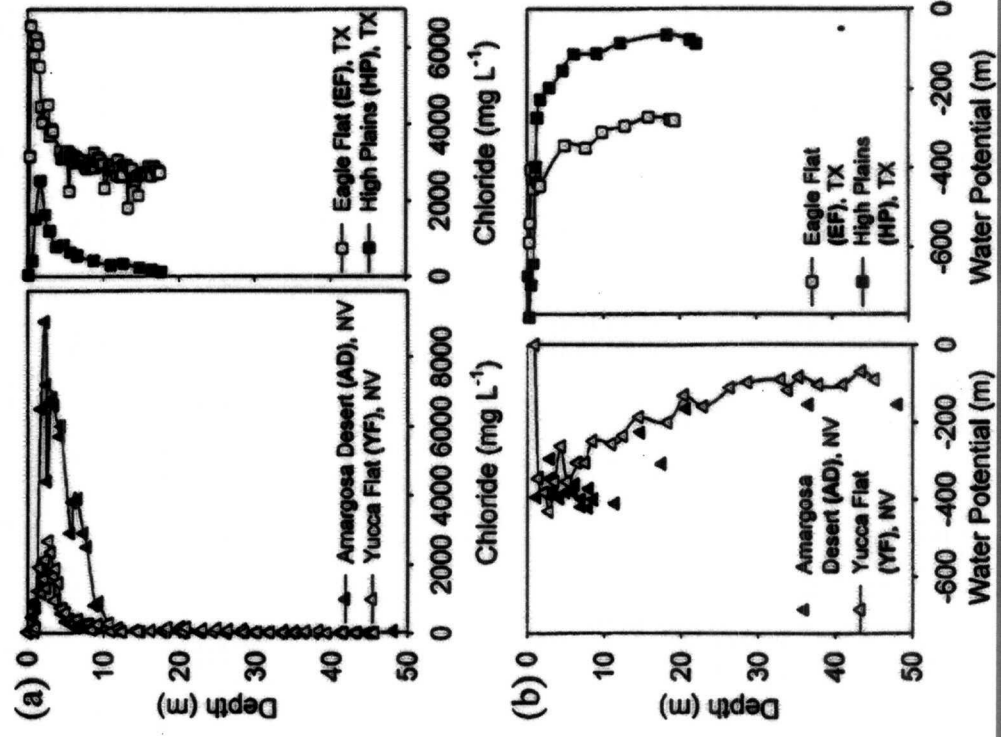


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Natural Soil Chloride 'Bulges'



Source: Walvoord & Scanlon, 2004



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Natural Soil Chloride Profile

- ◆ Varies depending on:
 - ◆ Soil texture; soil moisture
 - ◆ Vegetation; ET
 - ◆ Net infiltration; age/time of accumulation
 - ◆ Proximity to oceans
- ◆ Concentrations vary considerably with depth; up to 540 mg/kg at 3 ft bgs;
- ◆ Useful for interpreting recharge
 - ◆ Chloride mass balance method



Chloride Bulges in Soil Occur over Large Areas in New Mexico

Location	Depth to Cl- Peak bgs (ft)	Pore Water Cl- at Peak (mg/L)	Soil Cl- at Peak (mg/kg)	Reference
Chihuahan Desert, TX and NM	6 to 22	480 to 6,500	50 to 290	Stephens and Coons, 1994; Scanlon, 1991; Phillips et al., 1988
San Juan Basin, NM	2 to 28	490 to 4,170	50 to 540	Stone, 1984; Scanlon and Goldsmith, 1997
Santa Fe County, NM	2 to 16	1,170 to 9000	150 to 440	Scanlon, 1991; USGS 1994; Stone, 1984; Moore, 2003
Socorro County, NM	0.5 to 14	740 to 1,860	70 to 230	Stone, 1984c; Stonestrom and Akstin, 1998; Phillips et al., 1988
Southern High Plains of TX and NM	3 to 31	640 to 2,900	80 to 260	USGS 1994; Scanlon and Goldsmith, 1997



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Summary

- ◆ Chloride bulges common in the Southwest
- ◆ Indicates scant recharge for the past 10,000 years



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Low Recharge Leads to Long Travel Times through the Vadose Zone



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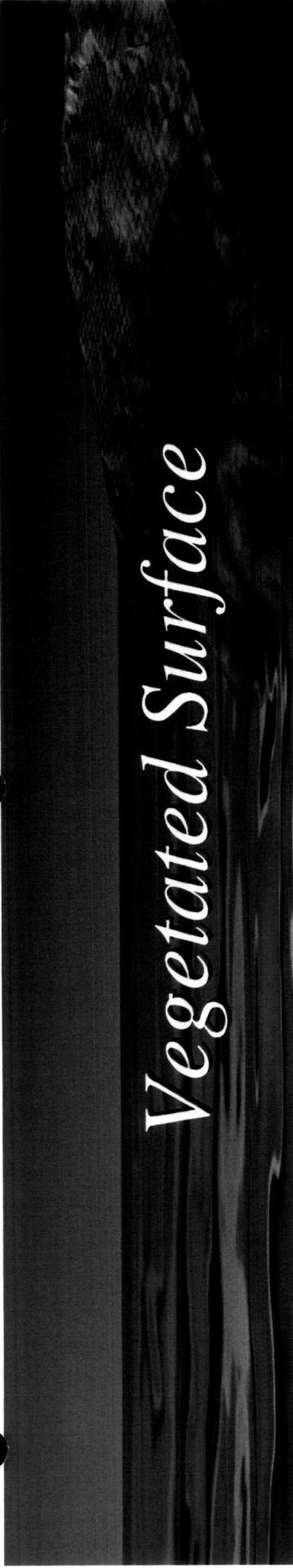
Diffuse Recharge in Southwest

Site	Estimated Annual Recharge (mm/yr)	Reference
Socorro, New Mexico	2.0-7.0	Phillips et al., 1988
El Paso, Hudspeth County, Texas	0.9-7.0	Scanlon, 1992
Las Cruces, New Mexico	1.5-9.5	Phillips et al., 1988
Sunland Park, New Mexico	0.066-0.19	Stephens & Coons, 1994
Ogallala Aquifer of Texas High Plains	2.3	Baker & Wall, 1976
Ogallala Aquifer at Portales, New Mexico	3.2-16.9	<u>Theis, 1937</u>
Ogallala Aquifer in Lea County, New Mexico	9.6	McAda, 1984

Long Travel Time From Root Zone to Groundwater

- ◆ Natural soil water typically moves slowly through vegetated, unconsolidated soils
- ◆ Example:
 - ◆ Net infiltration: 1mm/yr
 - ◆ Water content: 5%
 - ◆ Depth to water table 50 feet
 - ◆ Time to reach water table: 760 years



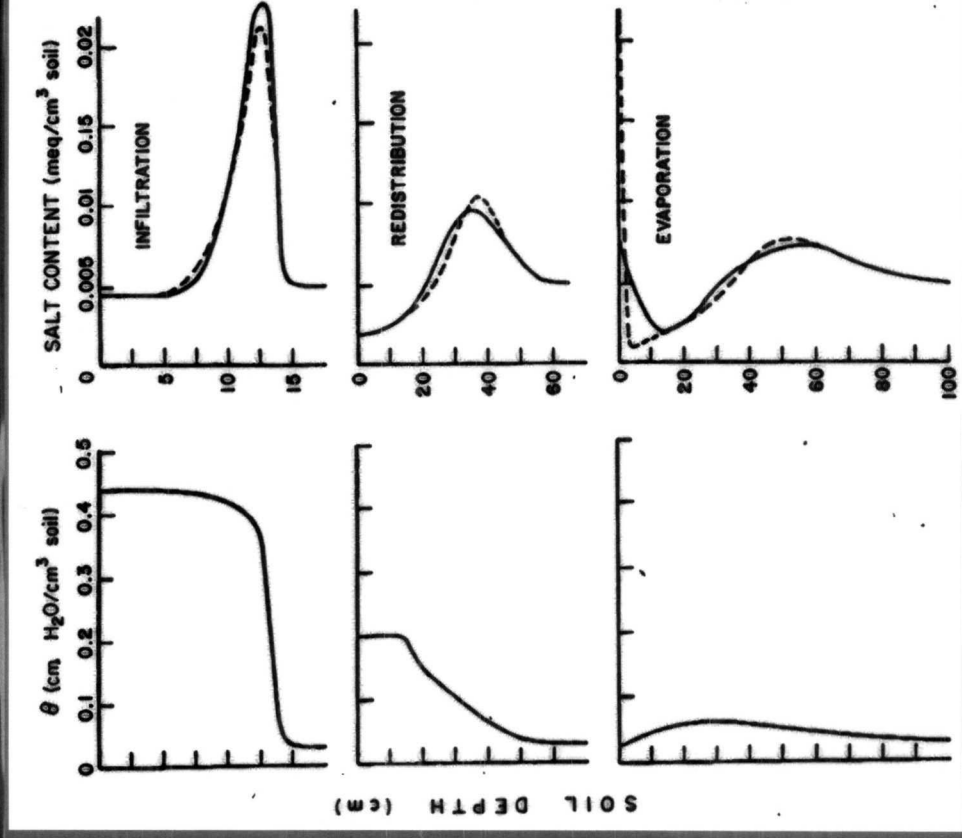


Vegetated Surface

- ◆ Low levels of diffuse natural recharge are the result of transpiration by vegetation
- ◆ Vegetated covers at landfarms enhance water extraction and restrict recharge



Shallow Soil Transport Processes (Bare Soil)



Source: Bresler, 1972

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Density of Pore Water at Chloride = 1000 mg/kg;

	Volumetric Water Content*	Unsaturated Hydraulic Conductivity (cm/s)	Fluid Density (gr/cm ³)
Sand	0.0453	5.13E-14	1.0350
Silty Loam	0.1709	1.45E-08	1.0080

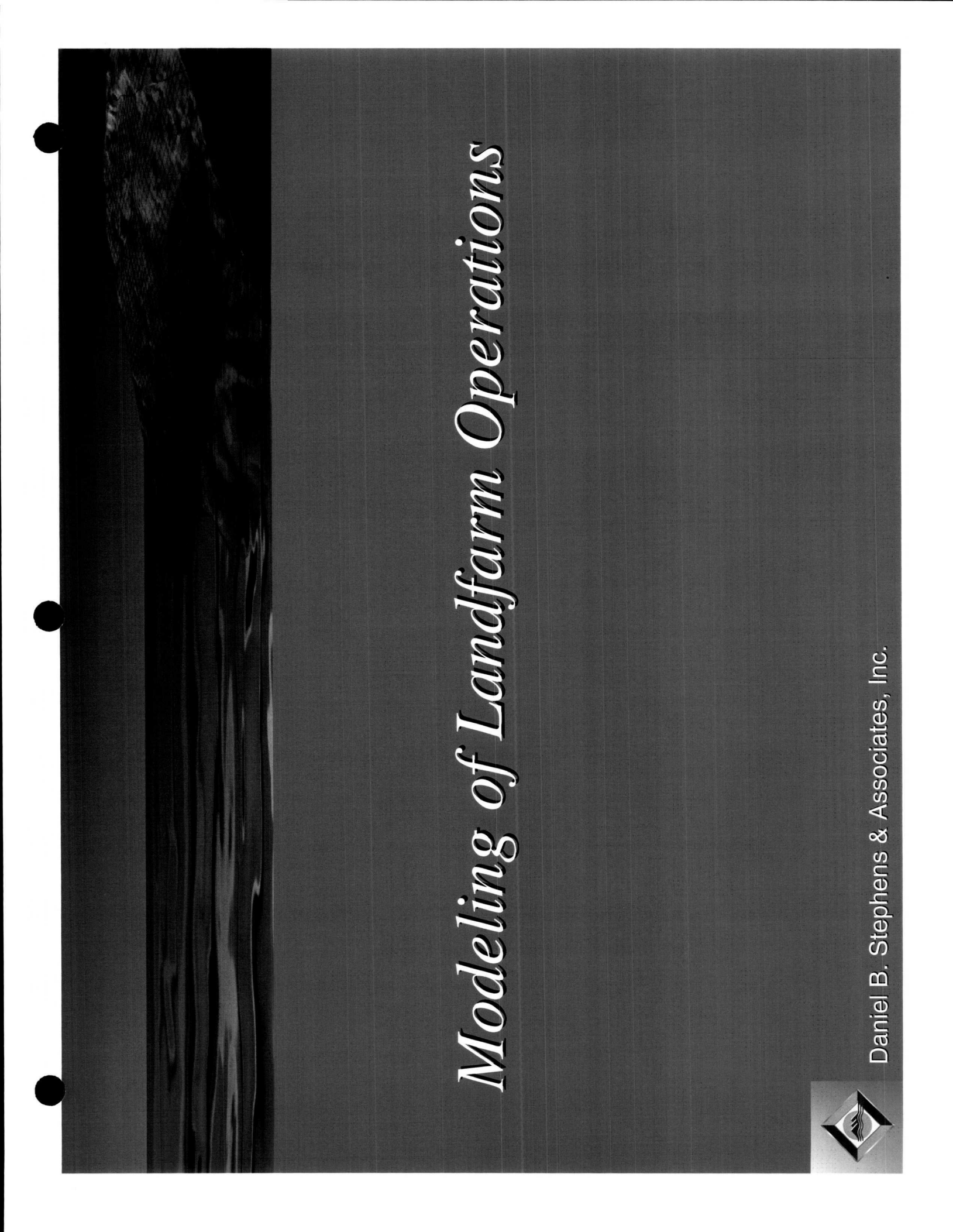


* volumetric water content is the average of the field capacity and wilting point
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Summary

- ◆ Recharge is low in diffuse areas of the Southwest
- ◆ Low recharge leads to long travel times
- ◆ Vegetation reduces recharge
- ◆ Density of pore water fluid not of concern





Modeling of Landfarm Operations



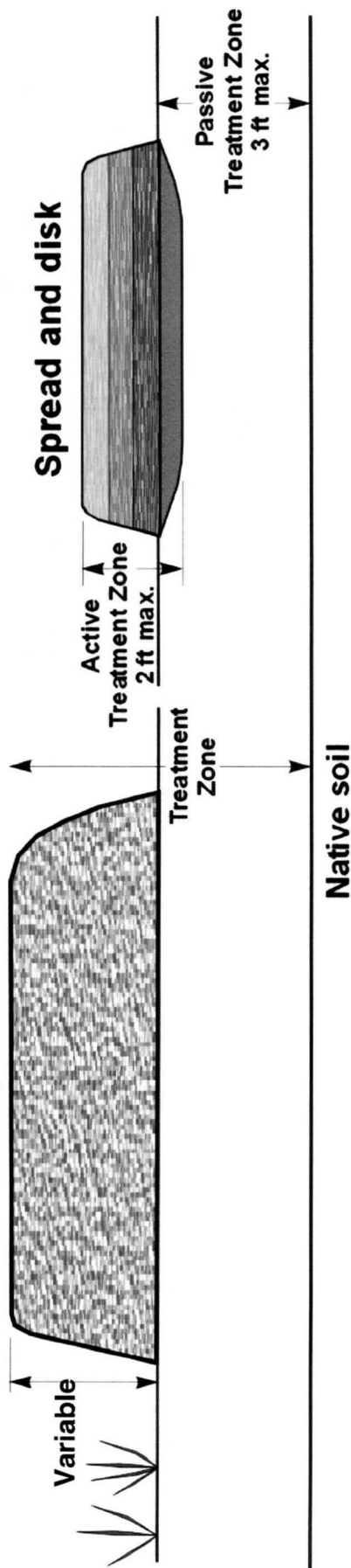
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Small Landfarm Operation

- ◆ Placed on natural soil surface
- ◆ Vadose zone water flow dynamics created over 10,000 + years;
- ◆ Operation duration 3 years; no ponding
- ◆ Small area (< 2 acres) sited in diffuse recharge area and surrounded by native plants
- ◆ Re-establish native vegetation on landfarm
- ◆ After closure conditions approach natural conditions



Biopile

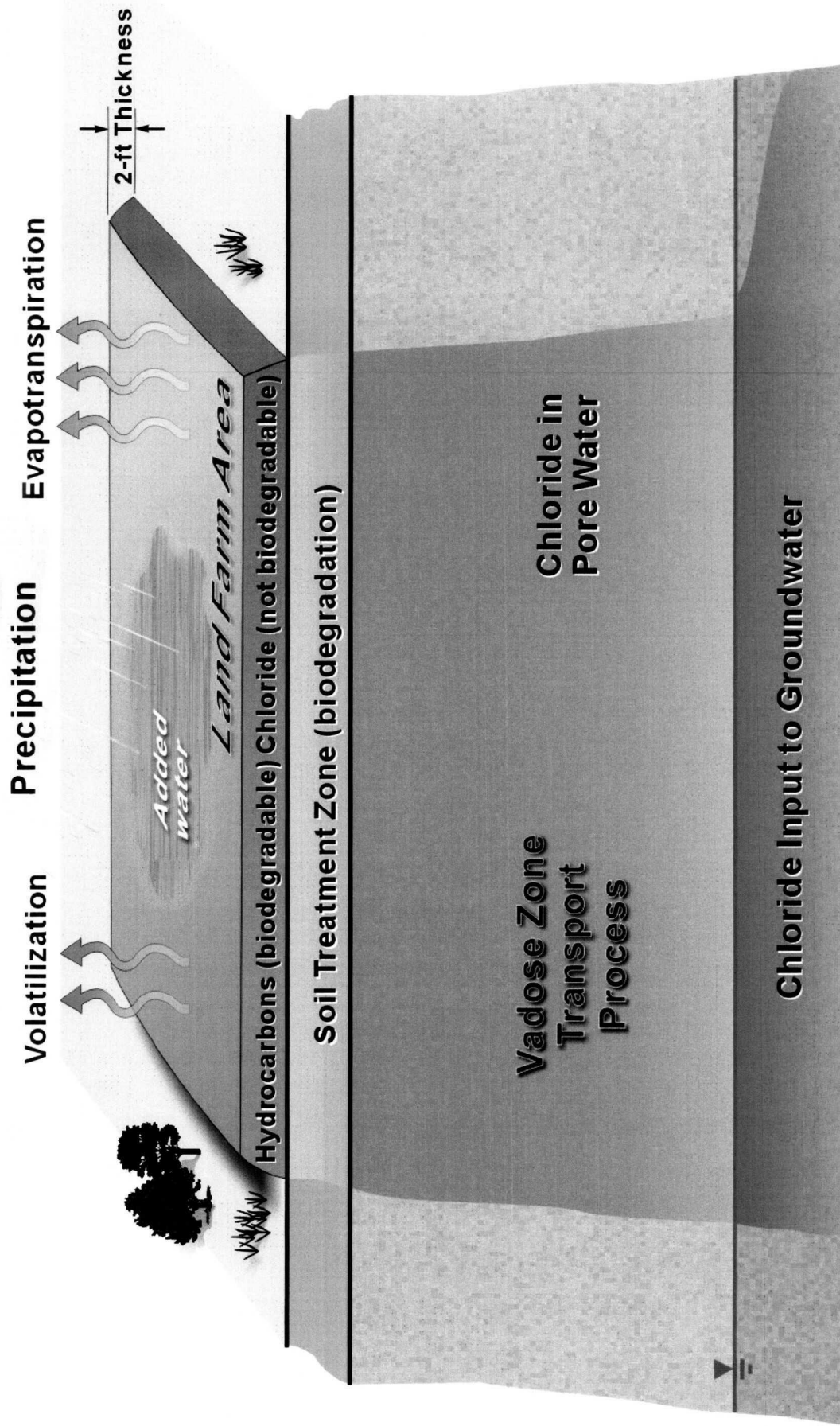


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NMOCC HEARING
Landfarm Cell Types



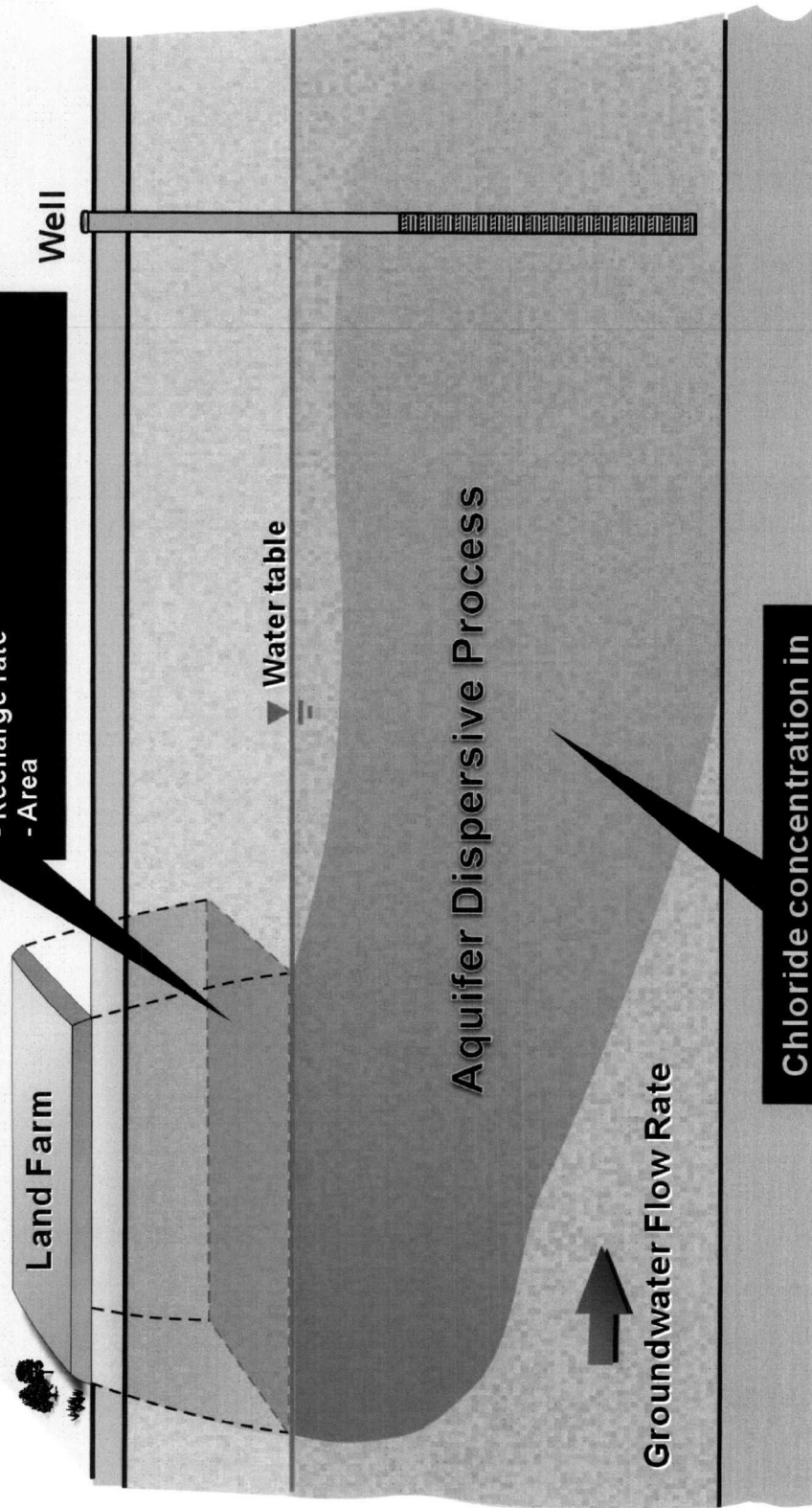
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NMOCC HEARING
Vadose Zone Transport Process

Chloride Source Area

Chloride impact to groundwater depends on:

- Chloride concentration in pore water
- Recharge rate
- Area



Chloride concentration in groundwater depends on:

- Chloride mass flux
- Groundwater flow rate
- Aquifer dispersion
- Aquifer thickness

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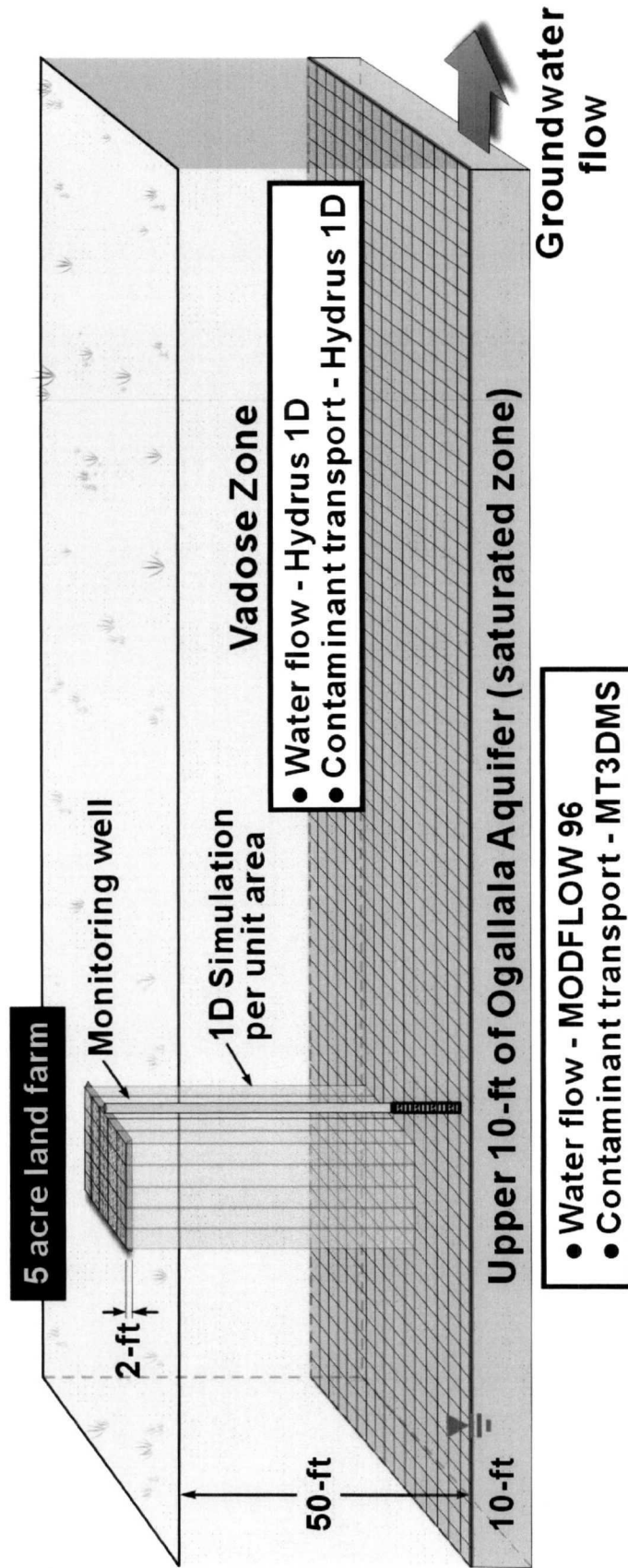


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Exhibit D

NMOCC HEARING

Aquifer Dispersive Processes



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Conceptual Model for Vadose and Saturated Zone Modeling

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Exhibit F

Prior Work: Model Input Parameters

PHYSICAL PROPERTIES

Waste zone thickness (ft)	2	Maximum thickness
Depth from bottom of waste zone to groundwater (ft)	50	Assumed based on OCD proposed regulations
Distance from downgradient edge of landfill to receptor (ft)	10	Based on location of peak simulated concentration

SOIL PROPERTIES

Parameter	Silty Loam	Clay*	Sand	Loamy Sand	Source
Saturated Hydraulic Conductivity (Ks, ft/day)	0.35	0.16	23.4	11.5	Carsel and Parrish, 1988
Total Porosity (ϕ , --)	0.45	0.38	0.43	0.41	Carsel and Parrish, 1988
Residual Water Content (θ_r , --)	0.067	0.068	0.045	0.057	Carsel and Parrish, 1988
van Genuchten Inverse Air Entry Pressure (α , 1/m)	2	0.008	14.5	12.4	Carsel and Parrish, 1988
van Genuchten curve fitting Parameter (n , --)	1.41	1.09	2.68	2.28	Carsel and Parrish, 1988
Bulk Density (gm/cm ³)	1.46	1.64	1.51	1.56	Calculated from ϕ and rock grain density [2.65 gm/cm ³] as given by Domenico and Schwartz, 1998
Effective Porosity	Not Used in Saturated Zone	Not Used in Saturated Zone	0.3	0.3	Based on specific yield given in Domenico and Schwartz, 1998
Average Initial water content	0.329	0.364	0.063	0.085	Based on HYDRUS-1D steady state result for natural infiltration
Saturated zone seepage velocity (ft/d)	Not Used in Saturated Zone	Not Used in Saturated Zone	0.3	0.15	Calculated

* Clay is agricultural clay as used by Carsel and Parrish, 1988 (60% clay, 30% silt, 10% sand)

DISPERSION

Vadose zone vertical dispersivity (ft)	1.05	Based on Depth to Groundwater. API, 1995 after Gelhar et al, 1985
Longitudinal dispersivity (ft)	1.50	Based on distance to receptor. Xu and Eckstein, 1995 based on Gelhar et al., 1992
Lateral dispersivity (ft)	0.150	1/10 longitudinal based on Gelhar et al., 1992
Vertical dispersivity (ft)	0.075	1/20 longitudinal based on Gelhar et al., 1992

HYDROLOGY

Natural infiltration rate (in/yr)	0.67	Upper end of range (0.09 to 0.67 in/yr) given in API, 1996
Aquifer Hydraulic Gradient (--)	0.004	R.T. Hicks Consulting, 2005

CHLORIDE CONTAMINANT PROPERTIES

Initial soil concentration (mg/kg)	1000	Assumed based on OCD proposed regulations
Average initial pore water concentration in waste zone (mg/L)	4438	Calculated from initial water content, soil concentration, and bulk density
Background concentration in aquifer and vadose zone pore water (mg/L)	66	Median chloride concentration reported by USGS for southern Ogallala (USGS, 2003)



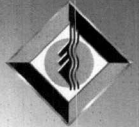
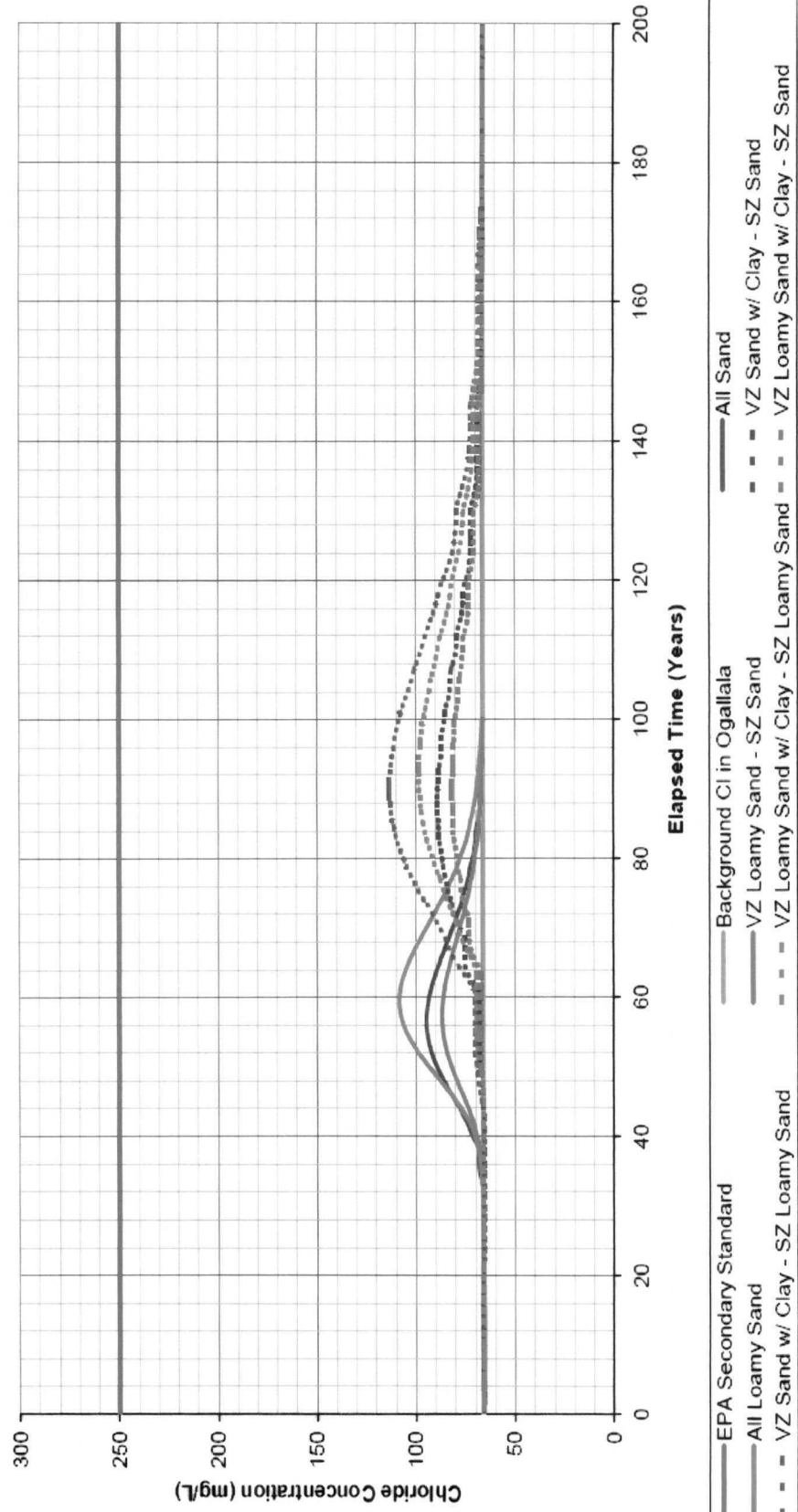
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Plot of Chloride Concentration in Groundwater at Receptor

Concentration in Groundwater at Downgradient Edge of Landfarm

Class B

Temporary source (removed after 3 years), 1,000 mg/kg initial concentration, 2-ft thick, 2½ Acres



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Predicted Chloride Concentration Which is Protective of Groundwater

Class B Landfarm (Source Removed After 3 Years)

Vadose Zone Soil	Aquifer Soil	Landfarm Area	Maximum change in concentration for 1,000 mg/kg source (mg/L; ΔC)	Time to reach maximum concentration at receptor (years)	Recommended limit for chloride concentration in Landfarm soil ⁽¹⁾⁽²⁾ (mg/kg)
Sand	Sand	2½ Acres	29	56	6423
Loamy sand	Loamy sand	2½ Acres	42	59	4350
Loamy sand	Sand	2½ Acres	21	57	8847
Sand w/ Clay layer	Sand	2½ Acres	23	88	7994
Sand w/ Clay layer	Loamy sand	2½ Acres	47	91	3890
Loamy sand w/ Clay layer	Loamy sand	2½ Acres	32	92	5682
Loamy sand w/ Clay layer	Sand	2½ Acres	16	90	11652



Predicted Chloride Concentration Which is Protective of Groundwater

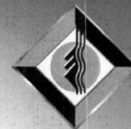
Class A Landfarm (Permanent Source)

Vadose Zone Soil	Aquifer Soil	Landfarm Area	Maximum change in concentration for 1,000 mg/kg source (mg/L; ΔC)	Time to reach maximum concentration at receptor (years)	Recommended limit for chloride concentration in Landfarm soil ⁽¹⁾⁽²⁾ (mg/kg)
Sand	Sand	2½ Acres	66	64	2772
Sand	Sand	5 Acres	107	64	1722
Loamy sand	Loamy sand	2½ Acres	145	85	1270
Loamy sand	Loamy sand	5 Acres	179	87	1030
Loamy sand	Sand	2½ Acres	71	83	2602
Loamy sand	Sand	5 Acres	88	84	2101
Sand w/ Clay layer	Sand	5 Acres	79	80	2333
Sand w/ Clay layer	Loamy sand	5 Acres	161	83	1141
Loamy sand w/ Clay layer	Loamy sand	5 Acres	143	102	1288
Loamy sand w/ Clay layer	Sand	5 Acres	70	98	2643

NOTES:

- (1) The recommended concentration limit is based on the USGS median background chloride in the Ogallala (66 mg/L; USGS, 2003) for the given model scenario and the EPA secondary standard for chloride (C_{EPA}; 250 mg/L)
- (2) Concentration in soil needed to cause exceedance in groundwater at receptor can be calculated for any given background concentration of chloride in the aquifer from:

$$C_{soil} = 1,000 \frac{mg}{kg} \frac{C_{EPA} - C_{background}}{\Delta C}$$



Summary of Prior Modeling Analysis

- ◆ Impacts to groundwater at WQCC standards depend heavily on period of operation;
- ◆ Impacts also depend on landfill area, groundwater flow and vadose zone characteristics
- ◆ Small landfills (previously referred to as Class B) with chloride more than 10,000 mg/kg may be protective



Current Work on Small Landfarms: Vegetated Cover and Variable Recharge

- ◆ Conceptual Model
 - ◆ Deep percolation reduced by evapotranspiration to rates reported by Phillips et al., 1988 and Keese et al., 2005.
 - ◆ Landfarm material left in place and vegetation is reestablished.
 - ◆ Soil is texturally variable.



Current Work on Small Landfarms: Vegetated Cover and Variable Recharge

- ◆ Conceptual Model (Continued)
- ◆ Landfarm operates with high recharge rate (19 mm/yr) for three years to maintain bioremediation.
- ◆ After 3 years, landfarm is re-vegetated and recharge is 9.5 mm/yr.
- ◆ After 10 years, vegetation is reestablished. Recharge is 0.8 mm/yr to 2.5 mm/yr



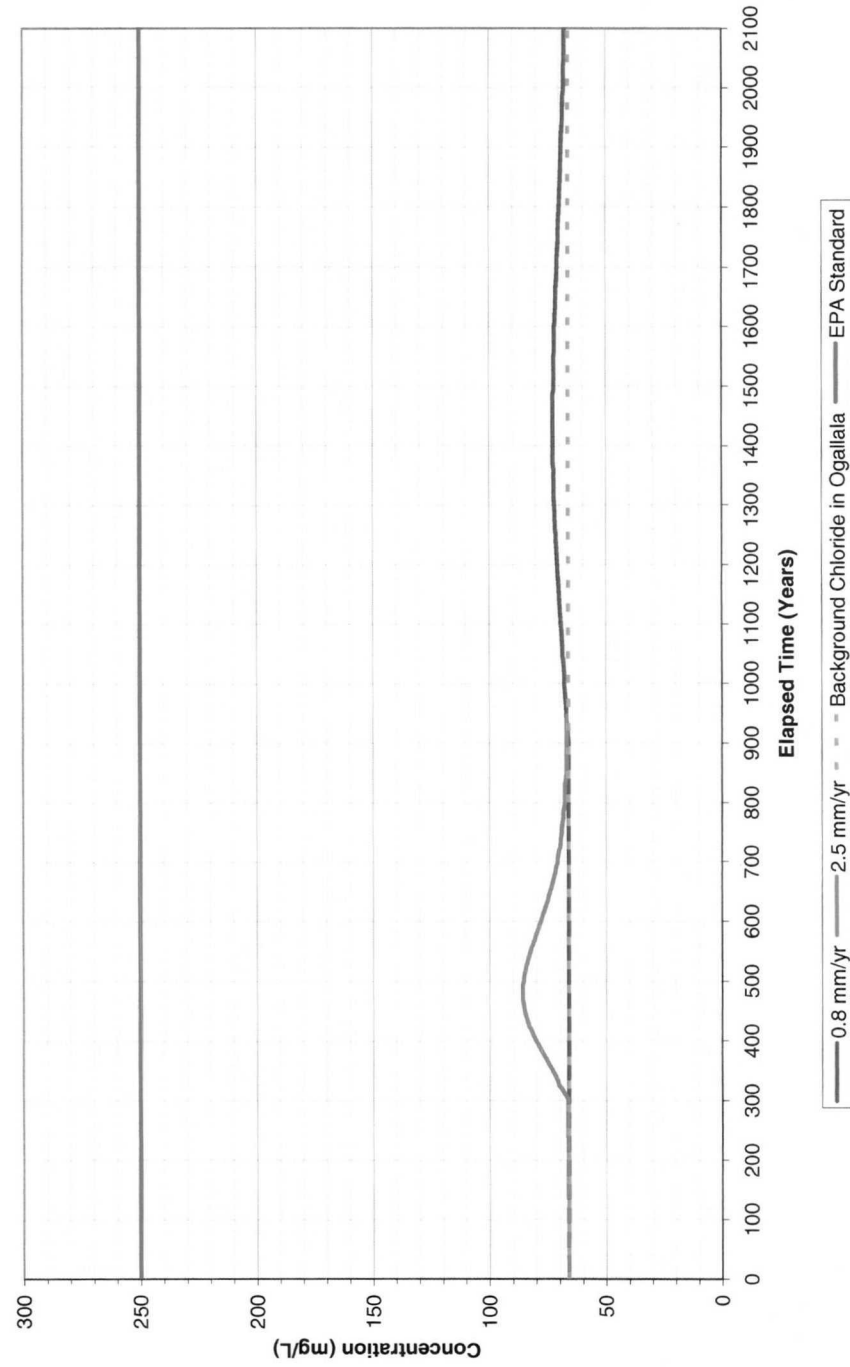
Current Work on Small Landfarms: Vegetated Cover and Variable Recharge

Long-term Recharge (mm/yr)	Time to reach maximum concentration at receptor (years)	Chloride concentration in soil estimated to impact groundwater at 250 mg/L (mg/kg)
0.8	1,400	51,000
2.5	500	9,500



Current Work on Small Landfarms: Vegetated Cover and Variable Recharge

Chloride Concentration in Groundwater at Downgradient of 2-Acre Landfarm



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Current Work on Small Landfarms: Vegetated Cover and Variable Recharge

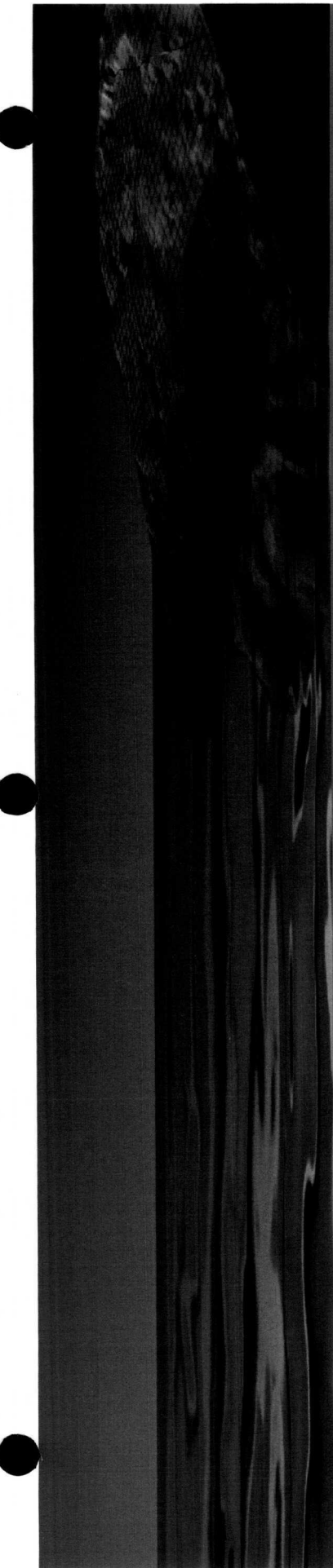
- ◆ Recommendations based on modeling results
 - ◆ Tier 1 recommend 1,000 mg/kg
 - ◆ Tier 2 use site specific data available in references and modeling to develop risk based standard



Summary of Simulations

- ◆ “One size does not fit all”
 - ◆ Impacts to groundwater in excess of 3103 standards are unlikely, even if chloride exceeds 1000 mg/kg;
- ◆ A flexible, operator- and site-specific waste acceptance limit is reasonable;
- ◆ Use a risk-based modeling approach to meet 3103 standards in groundwater



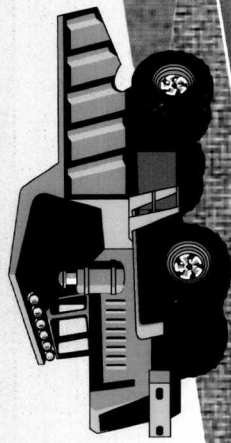


Concerns with OCD's Rules



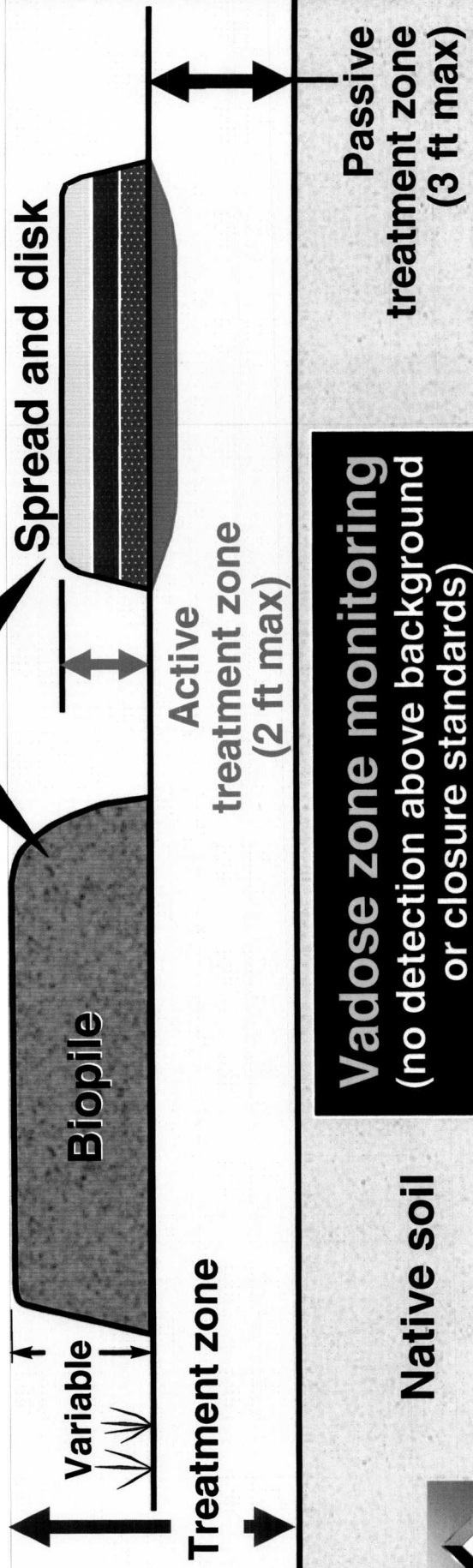
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“OCD Proposed Monitoring is Excessive”



Sample, analyze,
certify waste
CI < 1,000 mg/kg

Semi annual monitor treatment zone
CI < 1,000 mg/kg



Vadose zone monitoring
(no detection above background
or closure standards)



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OCD Proposed Monitoring is Excessive

- ◆ Requiring treatment zone monitoring is excessive, with source and vadose zone monitoring in place.
- ◆ Treatment zone monitoring is appropriate if using the bioremediation endpoint approach to closure.



Corrective Action Trigger is Background

- ◆ OCD regarding vadose zone monitoring per G.5.e:
 - ◆ No releases to the vadose zone can occur, no matter how minute the concentration or small the risk
 - ◆ Any 3103 constituent in vadose zone above background triggers corrective action
 - ◆ Soil anti-degradation standard may be unprecedented in NM
 - ◆ Prematurely terminates landfarm operation, which removes ability to reduce toxicity of hydrocarbons by bioremediation (e.g., Sublette)



NM Law, Policy and Practice Allows Groundwater Degradation

- ◆ Limit of degradation by dischargers is the 3103 groundwater standards
- ◆ Groundwater can be degraded up to the standard;
- ◆ Point of reasonable foreseeable future use:
 - ◆ Groundwater well beneath discharge area
- ◆ No anti-degradation policy in place for groundwater or soil.



NM Groundwater Abatement

- ◆ Cleanup is to the NM Groundwater Standards (3103) (e.g., 250 mg/L chloride)
- ◆ Cleanup is not to background
- ◆ Practice is to cleanup soil if chloride leaching would cause groundwater to be impacted above standards
- ◆ NMED Regulators acknowledge: presence of COCs in soil above background and dilution

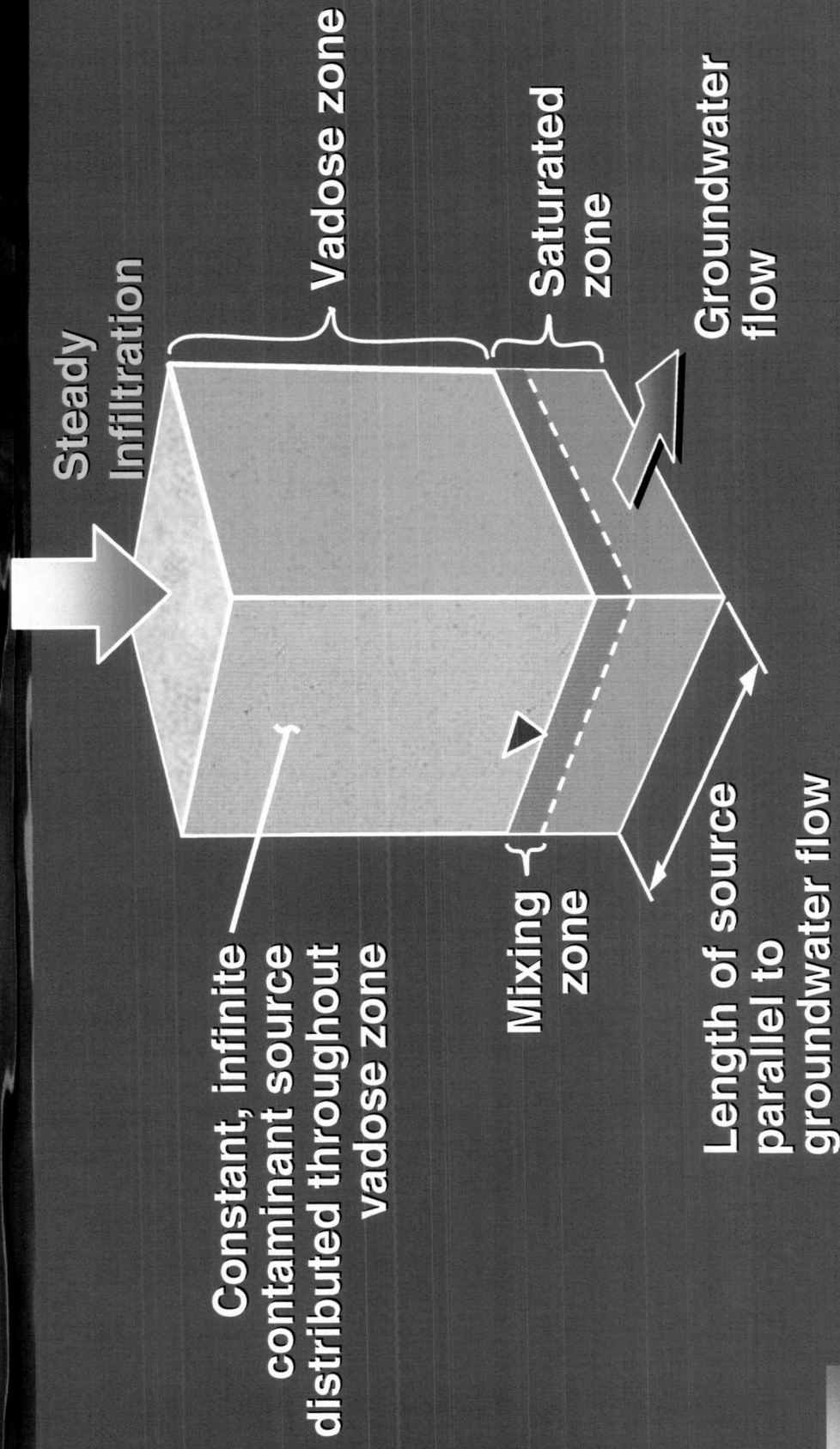


NMED Hazardous Waste and GW Quality Bureau's Voluntary Cleanup Program (VCP)

- ◆ Sets Site Specific Soil Screening Levels (SSLs)
 - ◆ Compute dilution attenuation factor (DAF) (=1 + groundwater flow rate/vadose zone flow rate)
 - ◆ Find maximum pore water concentration to protect groundwater (Multiply groundwater standard by dilution factor)
 - ◆ Compute soil matrix concentration



NMED Dilution Attenuation Factor Model



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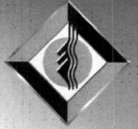
NMED SSL Model Assumptions

- ◆ The source is infinite (a constant concentration is maintained for the duration of the exposure period).
- ◆ Contamination is uniformly distributed from the surface to the water table.
- ◆ Soil/water partitioning is instantaneous and follows a linear equilibrium isotherm.



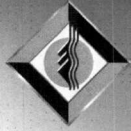
NMED SSL Model Assumptions

- ◆ No attenuation in soil or the aquifer
- ◆ Unconfined aquifer with homogenous and isotropic hydrologic properties.
- ◆ The receptor well (point of exposure) is at the downgradient edge of the source and is screened within the potentially impacted aquifer.
- ◆ Non-aqueous phase liquids (NAPLs) are not present.



NMED VCP Clearly Tolerates Impacts to Soil Above Background

- ◆ Example:
 - ◆ Assume groundwater is distilled
 - ◆ Assume vadose zone leachate has benzene at the 3103 standard, 10 µg/L
 - ◆ Assume DAF=2
 - ◆ With DAF=2, the groundwater impact would only be 5 µg/L, below standards
 - ◆ As per NMED, there would be No Further Action (NFA). However, benzene would be in soil above background.



OCD Specifies Treatment Zone Closure Performance Standards

- ◆ Closure can occur when:
 - ◆ Benzene, BTEX, GRO/DRO, and chloride meet: 0.2, 50, 500, and 1000 mg/kg.
- ◆ 3103 constituents:
 - ◆ Do not exceed background, or
 - ◆ Do not exceed the “applicable closure concentration specified”



OCD's "Applicable Closure Criteria"

- ◆ Section G.6.e Closure Standards (SSLs)
 - ◆ List is based on DAF=1 in NMED's VCP
 - ◆ except chloride which is arbitrarily set to 1000 mg/kg and sulfate which is set to background;
- ◆ DAF=1
 - ◆ Groundwater does not flow
 - ◆ Ignores vadose zone processes which can attenuate constituents;
 - ◆ Fails to recognize that the receptor is a groundwater well



EPA Suggests $DF > 1$ in Nationwide Survey

- ◆ “The USEPA conducted an extensive evaluation of the range and distribution of DAFs to select a default value to be used for developing generic SSIs that would be reasonably protective of groundwater quality...Results... indicate that for a 0.5 acre source area a DAF of approximately 170 is protective of groundwater at 90 percent of the sites. Groundwater is protected at 95 percent of the sites with a DAF of 7.” (NMED, 2004; p. 30)
- ◆ USEPA’s additional analysis found that “a DAF of 10 was protective of groundwater for a 30-acre source and that a DAF of 20 was protective of groundwater for a 0.5 acres source”. (NMED, 2004; p. 30)

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NMED Finds DAF > 1 in NM

- ◆ “NMED believes that a DAF of 20 for a 0.5 acre source area is protective of groundwater in New Mexico,” (NMED, 2004; p. 31) and
- ◆ “If the default DAF is not representative of conditions at a site, then it is appropriate to calculate a site-specific DAF based on available site data.” (NMED, 2004; p. 31)



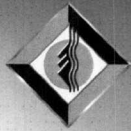
NMED Published DAF=1 Tables for Convenience

- ◆ “The inclusion of the SSL for a DAF of 1 is provided for convenience to the user. If data on hydrologic conditions are readily available, a site specific DAF can be calculated and multiplied by the generic SSL for a DAF of 1 to provide a site-specific SSL.” (NMED, 2004; p. 32)



OCD Strategy Will Not Lead to In-Place Closure

- ◆ When landfarm is full, treatment continues until:
 - ◆ Benzene <0.2; BTEX<50; GRO,DRO<500; and chloride<1000 mg/kg; and
 - ◆ all 3103 constituents < the greater of:
Background or list of closure concentrations



OCD Strategy Will Not Lead to In-Place Closure

- ◆ DAF=1 says pore water within the treatment zone must meet groundwater standards before closure can commence
- ◆ Closure may never occur if the background criteria is retained.
- ◆ Excavation and hauling to a landfill is likely the only approach to closure.
- ◆ Consequence: Landfarming as method to reduce hydrocarbon toxicity is not an option



OCD's Groundwater Protection Strategy is Inconsistent

- ◆ At closure chemicals can exceed background in the treatment zone but not in the vadose zone.
- ◆ In the treatment zone closure performance standard, if $DAF=1$, then the maximum allowable concentration in vadose zone porewater would be the groundwater standard, e.g. 3103
- ◆ However, according to the vadose zone closure standard, no releases of chemicals on 3103 list can occur.



OCD's Treatment Zone Closure Concentrations Are Unquantifiable

- ◆ NMOCD used a DAF of 1, which gave SSLs below the practical quantification limit (PQL) for 13 constituents
- ◆ NMOCD should be consistent with NMED and use higher of NMED residential SSL, NMED DAF 20, or PQL.
- ◆ NMOCD SSL is based on drinking and inhaling tap water

Constituent (as listed in 20.6.2.3103)	NMOCD Proposed Soil Screening Level*	Practical Quantification Limit (PQL) **
Arsenic (As)	0.0146	1.0
Barium (Ba)	106	0.1
Cadmium (Cd)	1.37	0.1
Chromium (Cr)	2.10	0.3
Fluoride (F)	329	0.3
Lead (Pb)	400	0.25
Total Mercury (Hg)	0.105	0.03
Nitrate (NO ₃ as N)	17.1	0.3
Selenium (Se)	0.953	1.0
Silver (Ag)	1.57	0.25
Uranium (U)	16	0.5
Toluene	0.347	0.05
Carbon Tetrachloride	0.000988	0.05
1,2-dichloroethane (EDC)	0.000248	0.05
1,1-dichloroethylene (1,1-DCE)	0.133	0.05
1,1,2,2-tetrachloroethylene (PCE)	0.00215	0.05
1,1,2-trichloroethylene (TCE)	0.000131	0.05
ethylbenzene	1.01	0.05
total xylenes	0.167	0.05
methylene chloride (dichloromethane)	0.00853	0.15
chloroform	0.000414	0.05
1,1-dichloroethane	0.201	0.05
ethylene dibromide (EDB)	0.000029	0.05
1,1,1-trichloroethane	1.34	0.05
1,1,2-trichloroethane	0.000498	0.05
1,1,2,2-tetrachloroethane	0.000172	0.05
vinyl chloride	0.000143	0.1
benzo-a-pyrene	0.621	0.2
Chloride (Cl)	1000	0.3
Copper (Cu)	51.5	0.2
Iron (Fe)	277	1.0
Manganese (Mn)	334	0.1
Sulfate (SO ₄)	background	1.5
Zinc (Zn)	0.0682	0.25

Summary

- ◆ OCD's monitoring is excessive
- ◆ Corrective action trigger (background) is inconsistent with NMED
- ◆ NMOCD DAF = 1 is not supported by science
- ◆ SSLs are lower than laboratory PQLs
- ◆ OCD's rules inhibit landfarming
 - ◆ leads to almost exclusive landfilling



Overall Summary of Testimony

- ◆ Natural vadose zone processes at likely waste management (land farm) sites in New Mexico have very low diffuse recharge, and at some sites where water moves upward from the water table there is no recharge.
- ◆ Vadose zone and groundwater modeling shows that using site specific data that concentrated concentrations of chloride far in excess of 1000 mg/kg proposed by the OCD are protective of groundwater.
- ◆ Waste acceptance criteria should be set based on an approach which allows operators and OCD flexibility to take into account site specific data.



Summary (Continued)

- ♦ The OCD proposed monitoring strategy is excessive and the treatment zone monitoring requirements should be eliminated, except where the operator elects to use a bioremediation endpoint approach to closure.
- ♦ The OCD proposed corrective action trigger as any detection above background in the vadose zone is unreasonable, precedent setting, and inconsistent with treatment zone closure criteria.
- ♦ The OCD treatment zone closure criteria are also unreasonable. Any treatment zone closure criteria should be based on impacts to groundwater in a monitor well in which some dilution in the aquifer is taken into account.



Recommendations

- ◆ Small land farms chloride limit in waste
 - ◆ Tier 1 recommend 1,000 mg/kg
 - ◆ Tier 2 use site specific data available in references and modeling to develop risk based chloride standard



Recommendations

- ◆ Reassess Surface Waste Management Rules:
 - ◆ Internally consistent
 - ◆ Protective
 - ◆ Implementable
 - ◆ Appropriate treatment zone monitoring
 - ◆ Appropriate corrective action trigger
 - ◆ Appropriate closure standards

