Camp Edwards Modeling Presentation

Jay Clausen

Presented to NGB, AEC, USEPA, MADEP, USGS, AFCEE, and Jacobs Eng. on 9/18/2000 (Contact Ben Gregson, 508-968-5621).

Today's Presentation

- Introduction
- Background
- Current Flow Modeling Activities
- Planned Modeling Activities

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Site Location

Massachusetts Military Reservation

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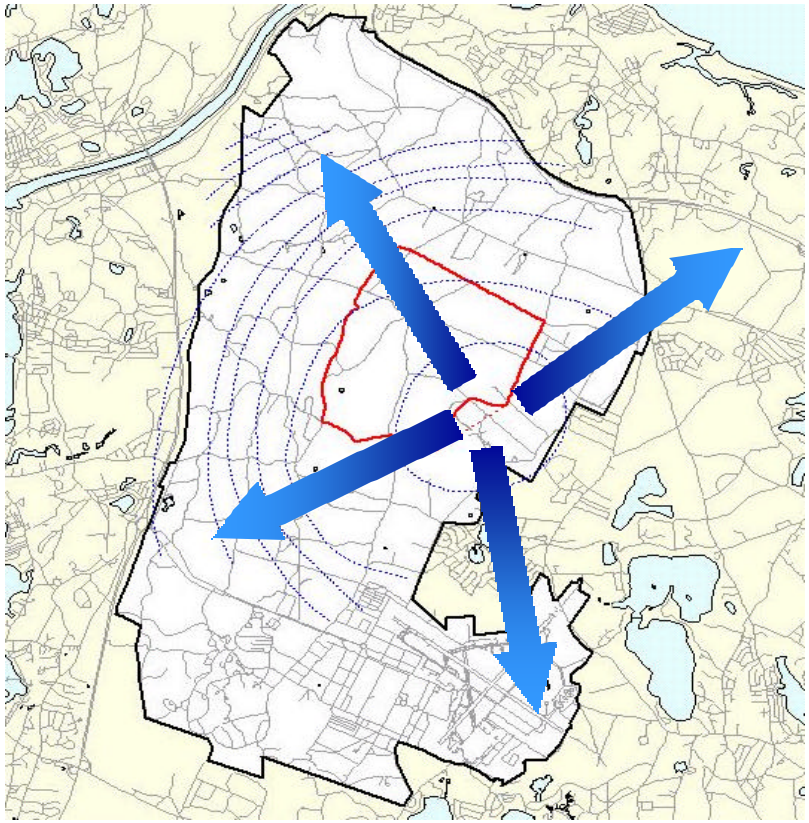
Hydrogeologic Conceptual Model

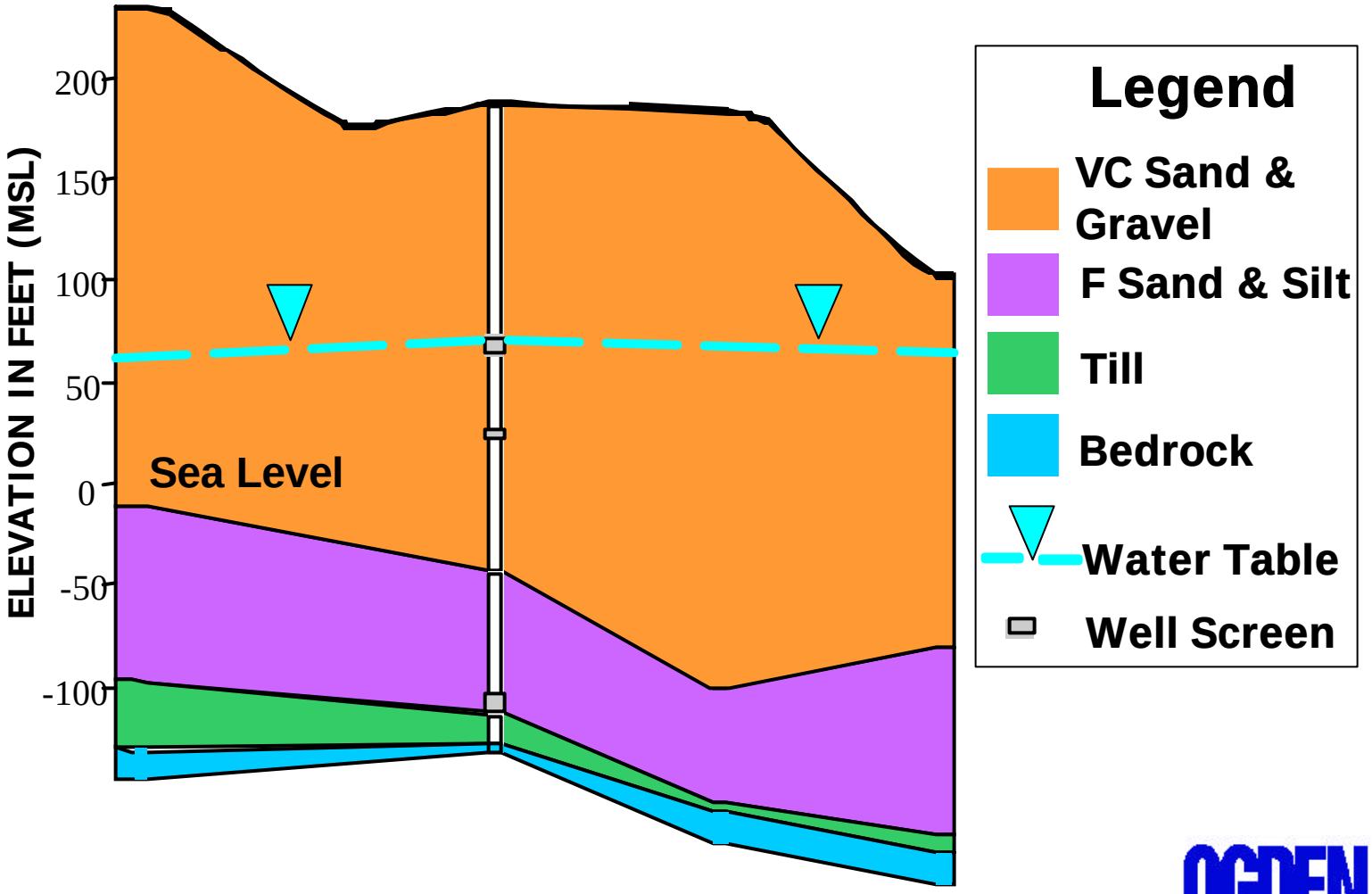
- Hydrogeologic model consists of 3 layers; unsaturated, saturated, and bedrock.
- Groundwater flow is radial with the center to the southeast of the Impact Area in the J Range Area.
- Depth to groundwater is ~ 100 ft and depth to bedrock is 300-350 ft.
- Geology consist of upward coarsening sequence.
- Aquifer is unconfined and aerobic.

Hydrogeologic Model



Groundwater flow is radial with the mound to the southeast of the Impact Area in the J Range Area

Camp Edwards Lithology



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USGS Flow Model Support

- Development of ZOCs
- Placement of monitoring wells
- Determination of screen depths
- Identification of potential source areas for soil sampling
- Estimation of migration rates

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Proposed Fate-and-Transport Studies

- **Laboratory experiments to define site-specific fate-and-transport parameters**
- **Fate-and-Transport Modeling**

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Planned Site Specific Laboratory Experiments

- Batch experiments to evaluate sorption, desorption, and biodegradation.
- Column experiments to derive MMR specific partition coefficient (RDX, HMX, TNT, DNT).
- Determination of MMR specific soil properties (density, porosity, pH, fraction of organic carbon, CEC, and grain size distribution).

Fate-and-Transport Modeling Objectives

- Predict fate, path, rate, concentrations
- Determine soil screening levels protective of groundwater
- Source identification
- Input for risk models and risk management decisions

Modeling Approach

- Determination of objectives ✓
- Conceptual model development ✓
- Model selection ✓
- Setup and input parameter estimation
- Calibration
- Sensitivity analysis
- Reconfiguration and calibration
- Scenario simulation modeling
- Post simulation analysis

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Model Recommendations

- **SESOIL (Simplified)**
- **MODFLOW / MT3D (Complex)**

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Seasonal Soil Compartment Model (SESOIL)

- Developed for EPA in 1981 by ADL
- Modified extensively in 1986, 1988, and 1989 by ORNL
- Incorporated by EPA into GEMS, 1989
- GEMS commercialized by GSC and incorporated into Windows platform in 1990 and updated in 1992 and 1995
- SESOIL also incorporated into applications for API, G&M, and CA-EPAs LUFT Manual

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SESOIL Details

- The soil compartment is 3-d
- The hydrologic cycle is 1-d (vertical movement only)
- Model accepts time-varying pollutant loading
- Extensive comparison with other models, sensitivity analysis, validation, and verification

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SESOIL Application

- Adopted by HI, MA, MI, NH, NM, and WI for developing soil cleanup standards
- EPAs Office Toxic Substances analyzed and prioritized chemical exposures

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Key SESOIL Parameters

- Soil properties
- Chemical properties
- Climatic properties
- Application properties
- Sublayer soil properties
- Mixing zone properties

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Soil Properties

- Soil database
- Bulk density ✓
- Intrinsic permeability
- Disconnectedness Index
- Effective porosity ✓
- Organic carbon content ✓
- Cation Exchange Capacity
- Freundlich Exponent

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Chemical Properties

- Solubility ✓
- Air diffusion coefficient ✓
- Henry's Law ✓
- Adsorption coefficient (K_{oc}) ✓
- Soil partitioning coefficient (K_d) ✓
- Molecular weight ✓
- Hydrolysis rate *
- Biodegradation rate *
- Complexation rate *

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Climatic Properties

- Climatic database
- Air temperature
- Cloud cover
- Humidity
- Albedo
- Evapotranspiration
- Precipitation
- Duration
- Number of storms

Application Properties

- Number of years of simulation
- Number of soil layers
- Application area
- Instantaneous or Continuos loading
- Initial soil concentration

Sublayer Soil Properties

- Thickness
- Number of sublayers
- Intrinsic permeability
- Organic carbon content
- Cation Exchange Capacity
- Biodegradation rate
- Adsorption rate
- Volatilization rate
- Runoff

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Mixing Zone Properties

- Hydraulic conductivity
- Horizontal hydraulic gradient
- Thickness of mixing zone
- Width of contaminated zone
- Background concentration

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