RTDF GW/SW Workshop

Review of discussions 10-28 & 29 -02

NRG

Conceptual Models

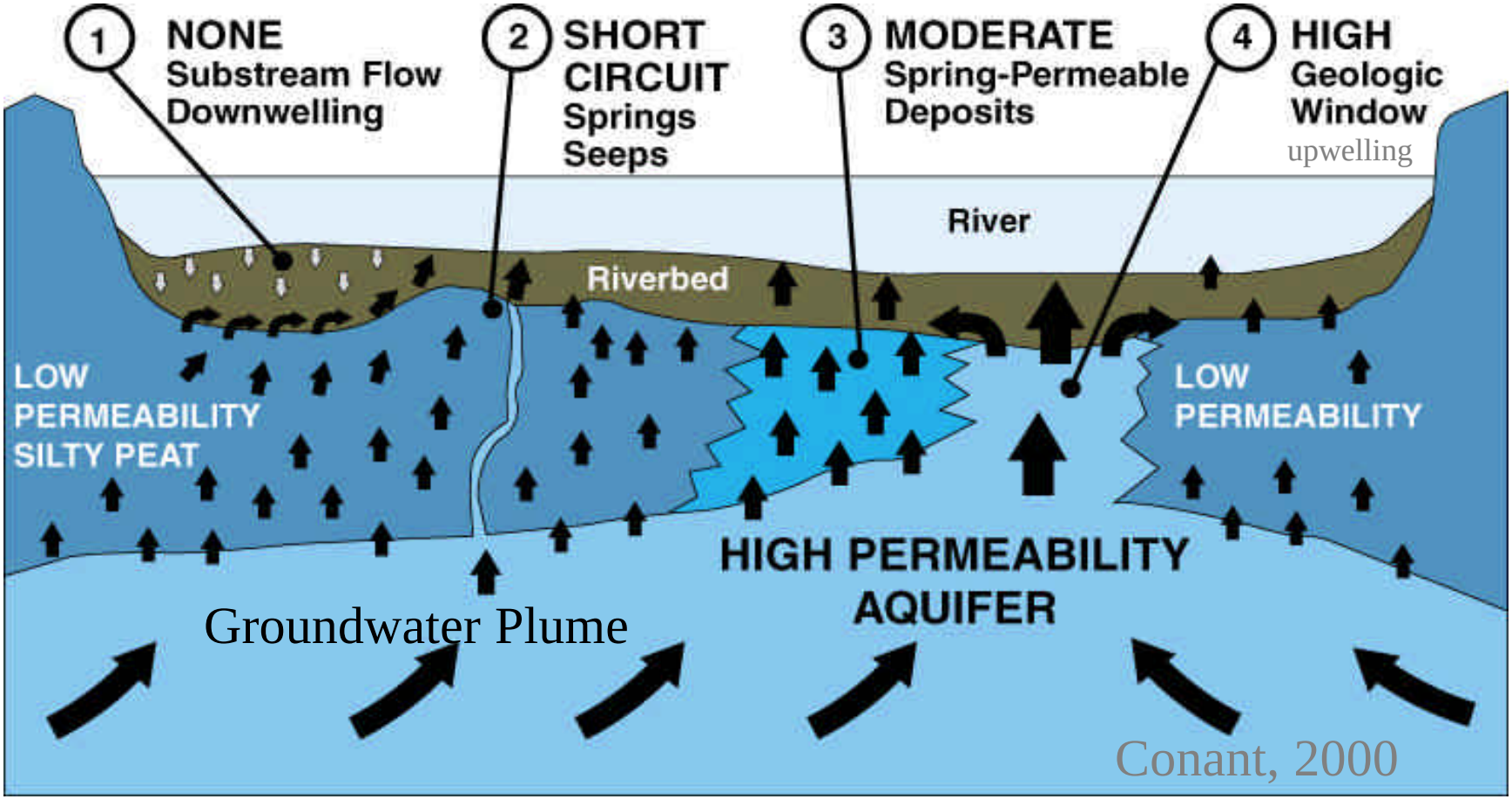
- Require inclusion of physical, chemical and biological processes - superimpose contaminant behavior:
  - NAPL behavior, moves independently of water in most cases
  - Dissolved plume - a hint to the expression of contaminant in the surface water body
  - Hydrophobic
    - Volatiles
    - PCBs and PAHs - rare in groundwater
  - Metals
- Integrated: All aspects are interdependent and affect the system characteristics
- Dynamic: Consider the spatial and temporal variations (daily, seasonally, depositional areas, sediments and ecology)

GW/SW Zones

- Aquifer
  - Regional and local hydraulic gradients
  - stratigraphy and hydraulic conductivity
  - zones of upwelling and down-welling
  - plume
- Transition Zone between GW /SW
  - Biologically Active Zone- sediments (surface to ~10cm)
  - Hyporheic Zone (limited to river environments)
  - Geochemical and physical
  - Significant transformation areas - Changes shape and composition of plume
- Surface Water Column
  - Far Field
  - Near field
  - Sediment / water column interface (also transitional)

Groundwater Discharge Due to Sediment Permeability Affects Plume Expression in SW

1) Geochemically similar to surface water – not contaminated
2) Localized areas of high concentrations of COC
3) COC concentrations below AWQC due to natural attenuation
4) Localized areas of high concentrations of COC



Groundwater Flow-
Estuaries or Marine Sites

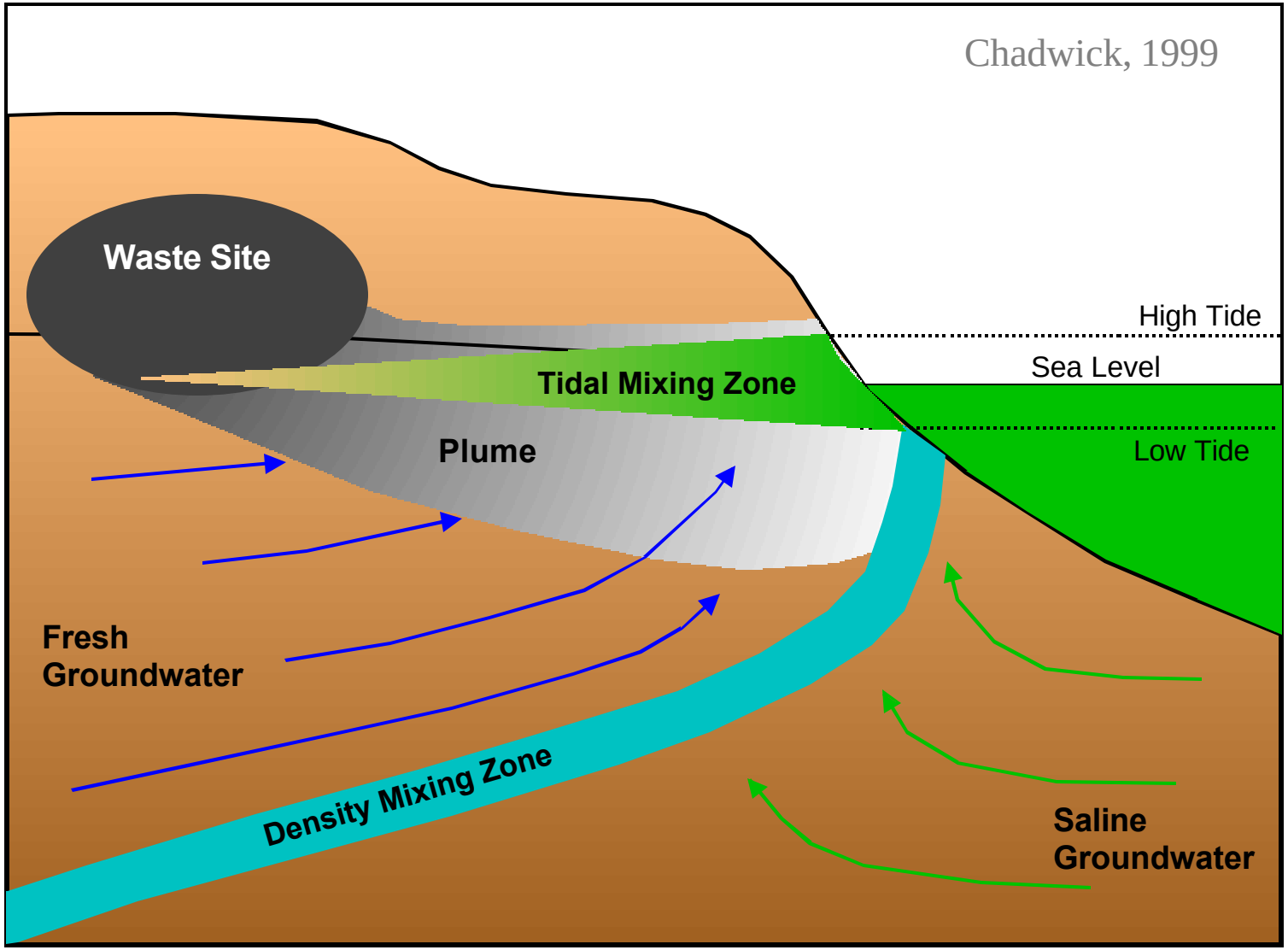
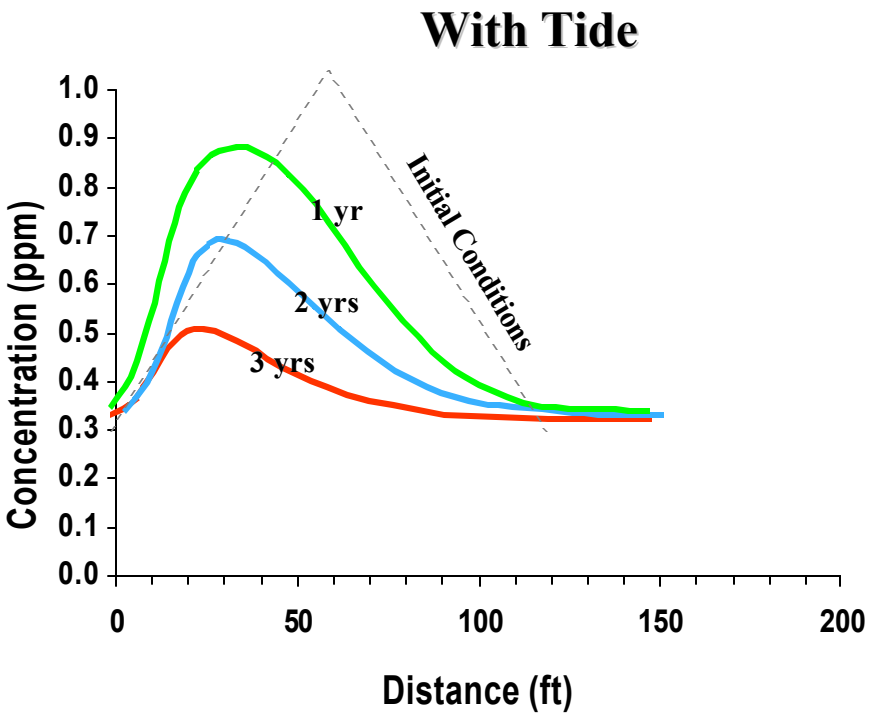
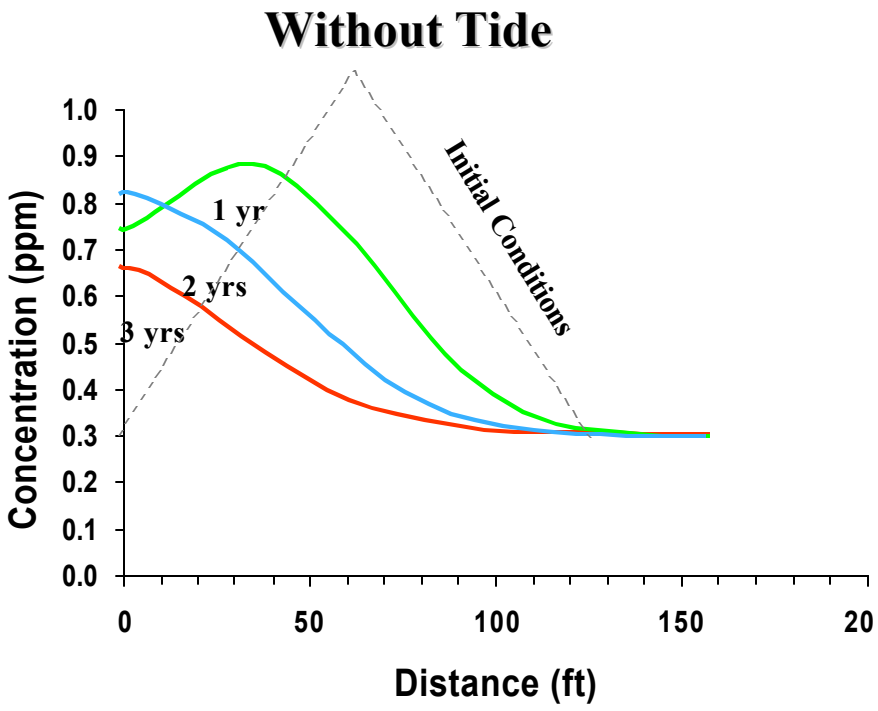


Illustration of Tidal Effects to Estimate Groundwater Concentrations Discharging to Surface Water





Mohsen, 1999

Study of Groundwater-Surface Water Interaction

- Hydrogeology
  - Groundwater discharge area
  - Groundwater flow rates and velocity
  - Plume and contaminant concentrations/trends upland
- Surface Water Hydrology
  - Flow and variability (compare base flow with flood flow to get a sense of groundwater contribution, tidal, seasonal, flood events)
  - Chemistry (conventional parameters and Constituents of concern)
- Transition
  - Sediment characteristics and contamination
  - Small scale water flow and mixing patterns
  - Biogeochemical reactions
  - Ecology

Possible Approaches for GW Plume Discharge Assessment

- Build preliminary conceptual model - including “3 zones”, mass flux estimates, mass balance estimates, estimated concentrations in surface water, preliminary modeling; which processes or parameters are significant?
- Continue to characterize plume from the land side if NA indicated
- RECON: characterize stratigraphy and lithology on banks, beach, etc. Look for seeps

FIELD EVALUATION METHODS

- Non-invasive methods for river and sub-surface lithology (GPR)
- Non-invasive methods for GW discharge areas (IR imaging, drag probes based on contrasts in temp, conductivity, geochemistry)
- Rapid assessment methods using push probes (Navy's “trident probe”)
- Hydraulic heads (nested peizos)
- Water samples - COCs, daughter products, geochem and redox indicators
- Eco toxicity - in situ chambers

Remediation Technologies Discussed - to control seeps

- Constructed wetlands
- Permeable Treatment Caps
- Upland groundwater containment/treatment

At some point must Formulate the problem

- What is the question?
- What are we protecting?
- Determine the appropriate scale of evaluation
  - Near field surface water sampling
  - Water sampling near Sed/SW interface
- Considerations
  - Is the habitat unique? E.g. Hanford Site and salmon spawning grounds. Prepare habitat map and prioritize areas.
  - What is the appropriate scale for evaluation (meter scale, reach, watershed)? What are you willing to “miss”?
  - Is contaminant a PBT?
  - What are other potential sources besides GW?
  - What is the incremental risk that the groundwater plume adds to the sediments?
  - Where will resources and time be best spent to improve the quality of the system?
  - What is the best approach - large to small or small to large?

Suggestions for Building Preliminary Understanding of System and Potential Impacts from GW

PAPER REVIEW

1. Determine COCs - relevant criteria and environmental fate (volatilization, sorption, other attenuation factors, PBT)
2. Is COC expected to accumulate in sediments?
3. Does this COC present a problem in the system locally?
4. Is there a sensitive receptor or habitat potentially at risk?
5. Determine mass flux of relevant COCs and estimate average surface water concentration.
6. Compare resulting average to criteria for general feeling of potential significance.
7. Compare estimated concentration to ambient background.
8. Compile information with conceptual model - does weight of evidence indicate additional evaluation is warranted? YES - Go to field