Appendix C-T4. Modeling

Method: Equilibrium partitioning (EQP)		
Description: Assumes pore-water concentration equivalent to NRWQC FCV, then back-calculates a bulk sediment concentration (or OC-normalized sediment concentration) using a K_{oc} (or K_{oc} calculated from a K_{ow}) of the COC of interest (dissolved phase = OC-normalized total sediment concentration * partitioning coefficient). **References:** Di Toro et al. 1991, 2005a; Di Toro 2008; Hansen et al. 1996; USEPA 1994a, 2003d	**Advantages:** Easy to calculate. Is a low-cost screening tool. **Disadvantages:** Assumptions do not take into account the presence of anthropogenic carbon or other factors which may influence default partitioning coefficients.	**Analyte capability:** PAH, PCB, nonpolar pesticides, energetic compounds (nonpolar organics)
Method: Narcosis model		
Description: Predicts toxic effects to benthic organisms from impacted sediments using a universal model that predicts toxicity based on a critical body burden that assumes the lipid compartment is the toxic target for Type I narcotic (hydrophobic) chemicals. **References:** USEPA 2003d, 2008b; Di Toro, McGrath, and Hansen 2000; Di Toro and McGrath 2000	**Advantages:** Model is validated across 156 chemicals and 33 aquatic species. TUs are assumed to be additive. Forms the basis of applying EqP to predict sediment toxicity assuming pore water is equivalent to final acute values (as the NOAEL endpoint). Is a low-cost screening tool. **Disadvantages:** Assumes that sediment toxicity is entirely the result of narcotic effects to benthic organisms when in reality other stressors may be contributing to adverse impacts.	**Analyte capability:** Type I narcotic chemicals (aliphatics, aromatics, alcohols, ethers, ketones, PAHs)
Method: Biotic ligand model		
Description: Variation of the free metal ion activity model that accounts for varying bioavailability of metals as a function of varying water chemistry. **References:** Di Toro et al. 2005b	**Advantages:** Accounts for toxicity variations due to changes in alkalinity, pH, and OC. **Disadvantages:** None reported or identified.	**Analyte capability:** Metals, mercury
Method: Simultaneously extracted metal/acid volatile sulfide (SEM/AVS)		
Description: Amorphous iron sulfide is measured as AVS; the metal in sediments that is potentially bioavailable is measured in the same extract and is termed "simultaneously extracted metals" (SEM). If AVS > SEM, then no toxicity is expected. If SEM > AVS, then toxicity may or may not occur. **References:** USEPA 2005c, Di Toro et al. 1990, Di Toro 2008, Hansen et al. 1996	**Advantages:** Easy to conduct; methods widely available from certified labs. Low-cost screening tool. **Disadvantages:** Recommended that field samples be taken as cores to avoid contact with air (which may oxidized reduced sulfides). Recent round robin of certified laboratories showed considerable variability in results.	**Analyte capability:** Divalent metals (Cd, Cu, Pb, Ni, Ag, Zn)
Method: Toxicity identification evaluation (TIE)		
Description: Series of aquatic toxicity laboratory tests that manipulate physical/chemical properties of sediment pore water to bind classes of chemicals and certain confounding factors, thus rendering them biologically unavailable. **References:** USEPA 2007b, NFESC 2003	**Advantages:** Can assist in identifying site-related COCs and/or confounding factors contributing to observed toxicity. **Disadvantages:** A precursor to the TIE test is a toxicity test—expensive and time-consuming. Does not address bioaccumulation issues. Small number of amendments to be cost-effective.	**Analyte capability:** Metals, VOCs, PAHs, PCBs, pesticides, radionuclides, energetic compounds (nonpolar organics)