NJDEP Guidance for Preparation and Submittal of a Conceptual Site Model (CSM)

Nick DeRose
Rob Lux
Kimberly McEvoy
William Gottobrio

January 30, 2012

Guidance Committee

• Joseph Eaker	NJDEP - Chair
• Rob Lux	NJDEP
• Kimberly McEvoy	NJDEP
• Nick DeRose	Langan Engineering
• Richard Britton	Whitman Co
• Brendan Lazar	TRC Environmental Corp
• Jaime Wuelfing	Groundwater & Env Services
• William Gottobrio	Kleinfelder
• Carrie McGowan	ISP Management Co.

Overview and Purpose of CSM Guidance

Nick DeRose
Langan Engineering and Evnironmental Services
nderose@Langan.com
Phone 215-491-6500

CSM - What you will learn?

- What is a CSM?
- Key Components of a CSM
  - Source, Pathway, Receptor
- Development of a CSM
- Application of the CSM
  - Incorporation into submittals
  - Examples

CSM Guidance (2.0)

- Not a Required Submittal/Form

- Used in concert with other DEP guidance and applicable regulations to support remedial decisions and RAO

A Tool For Communication and Professional Judgment (2.0)

- A tool used to easily communicate information
  - Links information from beginning (PA) of project to end (RAO)
- Provides a Scientific and Technical Basis to Support Professional Judgment
  - Delineation
  - Receptor Evaluation
  - Technical Guidance (e.g., LNAPL, VI, IEC)
  - Comingled Plumes

Purpose of CSM Guidance (2.0)

- Identifies Sources, Pathways and Receptors
- Provides a framework to:
  - Present the site environmental system and risks to human health and the environment
  - Aid and document decisions throughout the remedial process
  - Make scientifically and technically defensible decisions
  - Communicate critical issues, and/or processes to interested parties

Supporting Source Material (6.0)

- American Society for Testing and Materials (ASTM) – CSM Guidance
- Interstate Technical & Regulatory Council (ITRC) – Triad Documents
- U.S. Department of Health and Human Services: Agency for Toxic Substances & Disease Registry (ATSDR) - Public Health Assessment Guidance Manual
- U.S. Environmental Protection Agency (USEPA) – Triad and Risk Documents

Definition of CSM (4.0)

The CSM is a written and/or illustrative representation of the physical, chemical and biological processes that control the transport, migration and potential impacts to receptors.

What is it really?! (5.1)

- Description of Source, Pathways, & Receptors
- Tool for Remedial Decision Making
- Iterative Process
- Written or Pictorial Description

Key Components of CSM (5.1)

- Description of Source, Pathways, & Receptors
  - Contaminants and concentrations in media
  - Extent and potential for migration of Contaminants of Concern (COCs)
  - Evaluate potential for COCs to impact receptors and assess exposure risks
  - Should also identify incomplete pathways

Key Components of CSM (5.1)

- Summary of Impacted Media
  - All environmental media (GW, surface water, soils, sediment & air) should be included
  - Identify if contaminants are not found in a particular media

Key Components of CSM (5.1)

- Tool for Remedial Decision Making
  - Evolves throughout the life of a project – Iterative Process
  - Identify and address data gaps
  - Conveys relationship between source and observed nature and extent of contamination
  - Evaluate fate and transport including to receptors

Key Components of CSM (5.1)

- Form of the Model (diagram, text, mapping)
  - Dictated by complexity of site or AOC and the available data
  - Should be refined throughout phases of project (i.e., support remedy selection/post remedy)
  - Not necessarily a computer model

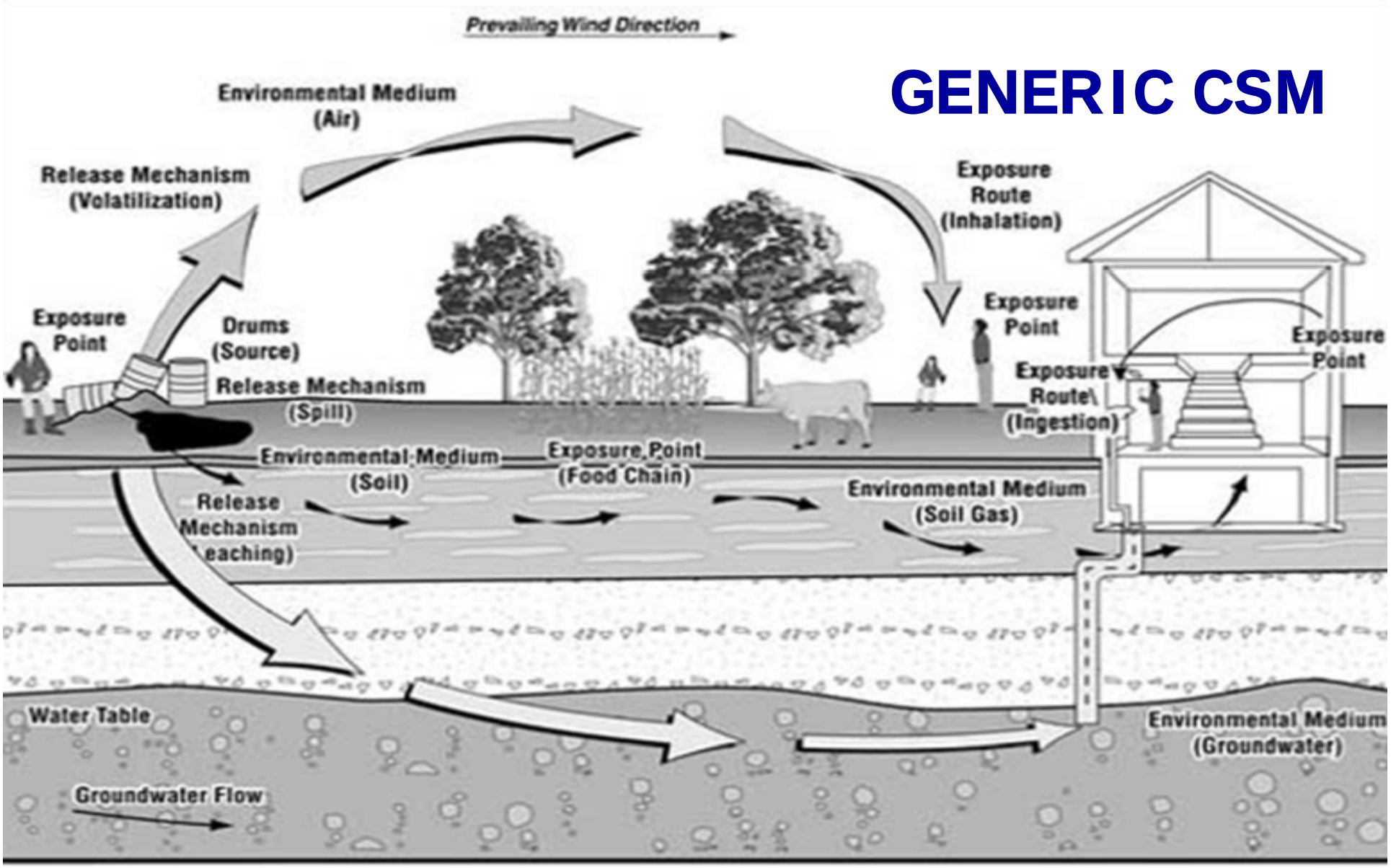


Figure 1: Conceptual Site Model – Exposure Pathway Schematic

Source: Agency for Toxic Substances and Disease Registry, Public Health Assessment Guidance Manual (2005 Update) (ATSDR, 2005)

Questions?

Developing a Conceptual Site Model

Rob Lux
Rob.Lux@dep.state.nj.us
609-292-1998

Describe Scope of CSM (5.2.1)

- AOC, Site, or Region: What will be characterized?
- Impacts to human and/or ecological receptors?
- Develop site plan depicting the extent of
  - AOCs/Source Areas,
  - COCs, and
  - Pertinent features affecting contaminant migration and receptors

Summarize Available Information (5.2.2)

- Evaluate information collected throughout the remedial process (PA/SI, RI, RA)
  - Current uses of property/surrounding properties
  - Historical property use
  - Maps/photographs
  - Subsurface utilities
  - Relevant off-site/regional information from aerials, GIS data, tax info, etc.
  - Plant personnel

Identify and Characterize (Potential) Sources (5.2.3 & 5.2.4)

- Conduct diligent inquiries of operational/ownership of the site to determine source(s)
- Identify release date/point, discharged material, and estimated volume
  - Estimated at first but refined as investigation continues
- Identify contamination on-site NOT related to past or current operations
  - Historic fill
  - Diffuse anthropogenic pollution (DAP)
  - Naturally occurring background concentrations
  - Impacts from a neighboring site

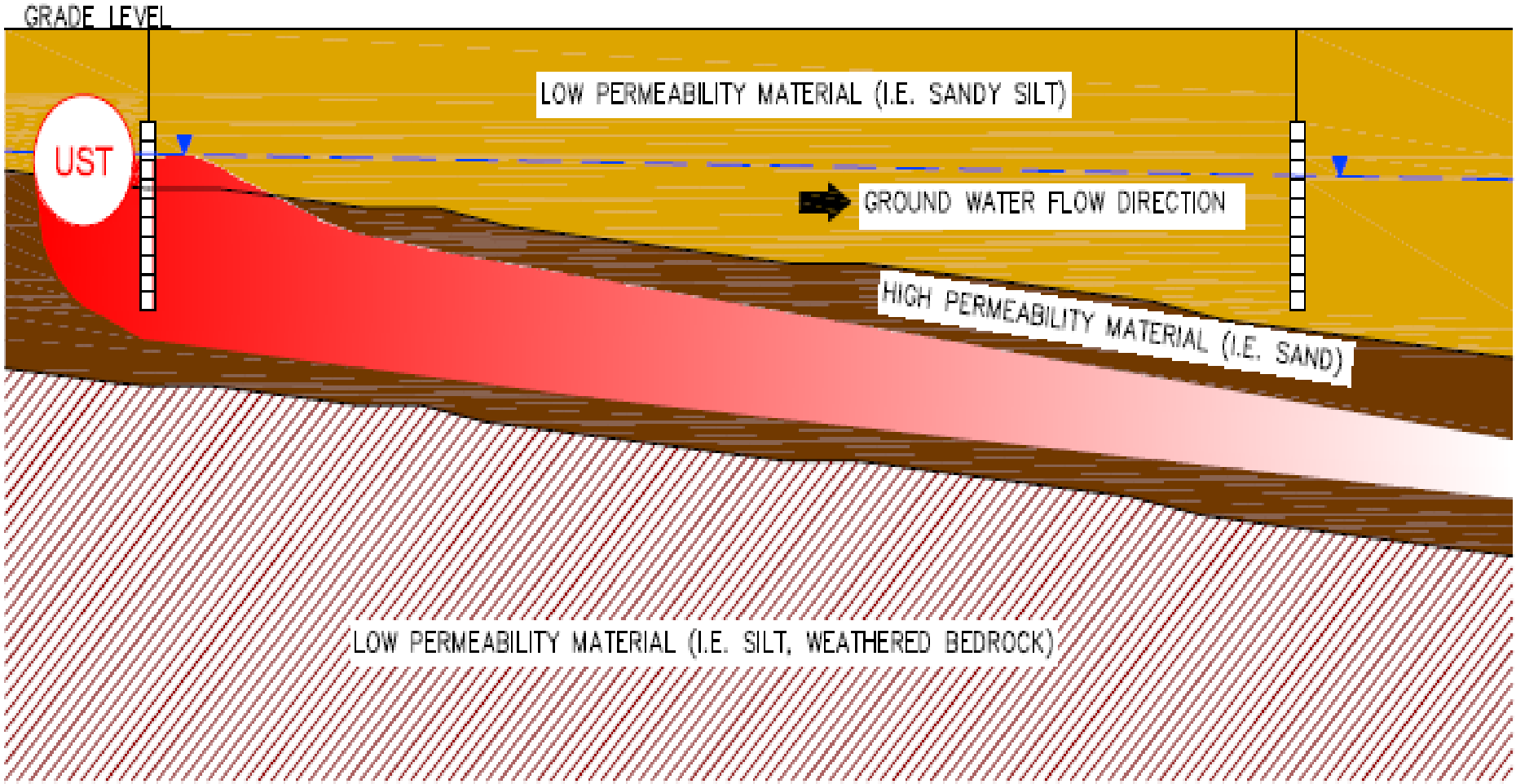
Migration Pathways: Potential, Confirmed, & Not Complete (5.2.5)

- Soil
  - Characterize nature and extent of contamination (N.J.A.C. 7:26E-3.6)
    - COCs, their distribution, physical characteristics
  - Identify potential risks and migration pathways
    - Proximity to buildings
    - Soil cover
    - Preferential pathways

Migration Pathways: Potential, Confirmed, & Not Complete (5.2.5)

- Ground water
  - Characterize nature and extent of contamination (N.J.A.C. 7:26E-3.7)
    - COCs, distribution, physical characteristics
  - Hydrogeologic information
    - Name and Class of impacted aquifer
    - Direction of groundwater flow/hydraulic gradient
    - Location of recharge and discharge areas
  - Characterize background
  - Specialized engineering and/or scientific expertise needed?

Example of Incomplete Characterization - GW



NOTE: BOTH WELLS OPEN FROM 5 TO 15' BELOW GRADE SURFACE

Migration Pathways: Potential, Confirmed, & Not Complete (5.2.5)

- Surface Water
  - Assess potential surface water impacts (N.J.A.C. 7:26E-3.8)
  - CSM should address
    - Stressed vegetation, sheens, seeps, discolored soil or sediment associated with the surface water
  - Documented ongoing or historical discharges
    - Are there historical ecological studies?
  - Identification of GW COCs exceeding SWQS migrating toward SW

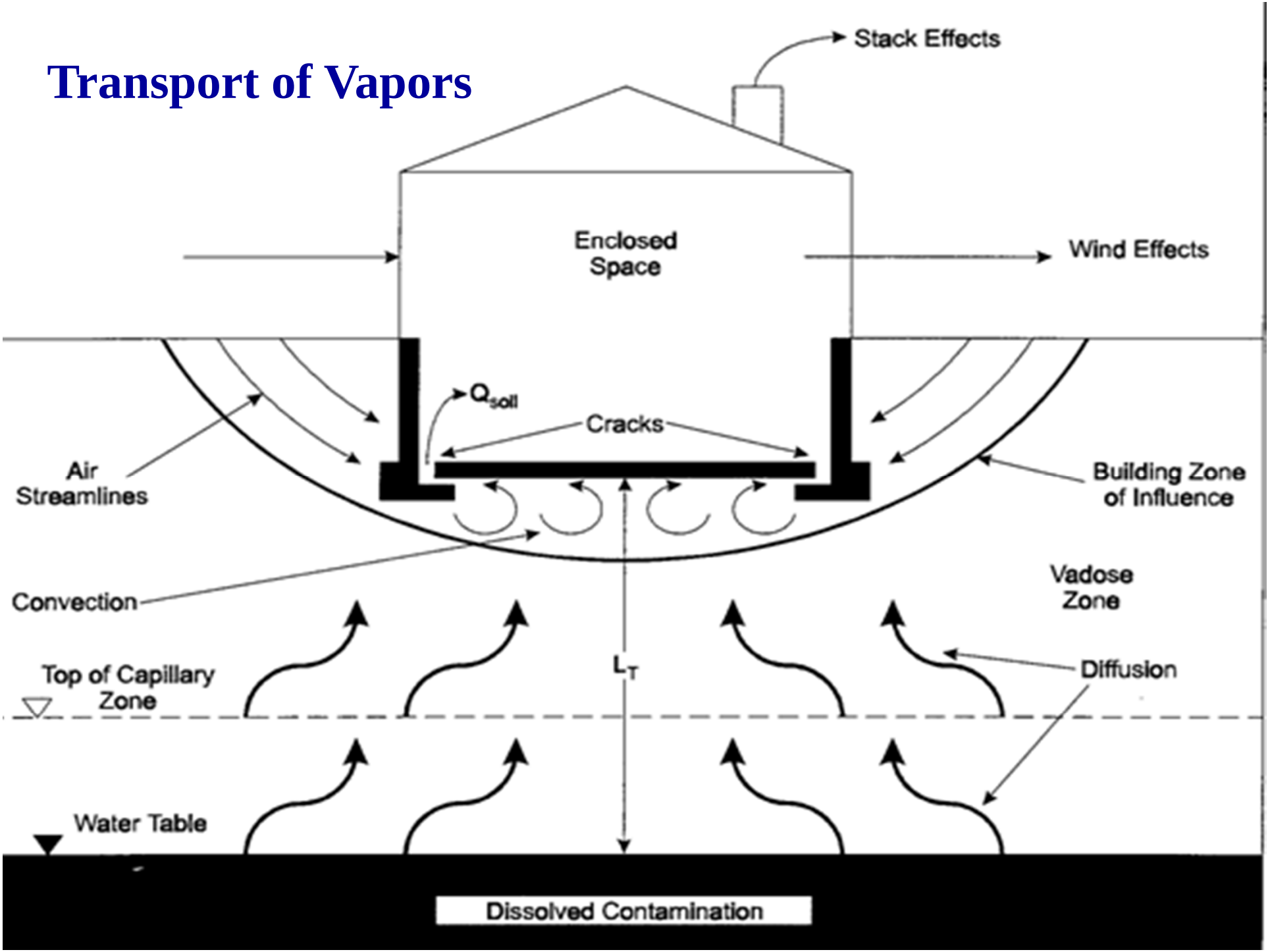
Migration Pathways: Potential, Confirmed, & Not Complete (5.2.5)

- Sediment
  - Understand nature, concentration & areal extent of contamination
  - Understand site-specific variables that affect expression of environmental impacts
    - How site-related contaminants enter system
    - How contaminants move in system (including fate & partitioning)
    - Mechanisms for exposure & uptake in human and/or ecological receptors

Migration Pathways: Potential, Confirmed, & Not Complete (5.2.5)

- Vapor and Air
  - Determine the presence/absence of conditions that would trigger vapor intrusion investigation
  - Assess identified risk(s) & actions necessary to mitigate risks
  - Document the effectiveness of mitigation activities
  - Identify airborne release mechanisms
    - Emissions from stacks, roof vents, dust collectors, fire, or excavation/construction

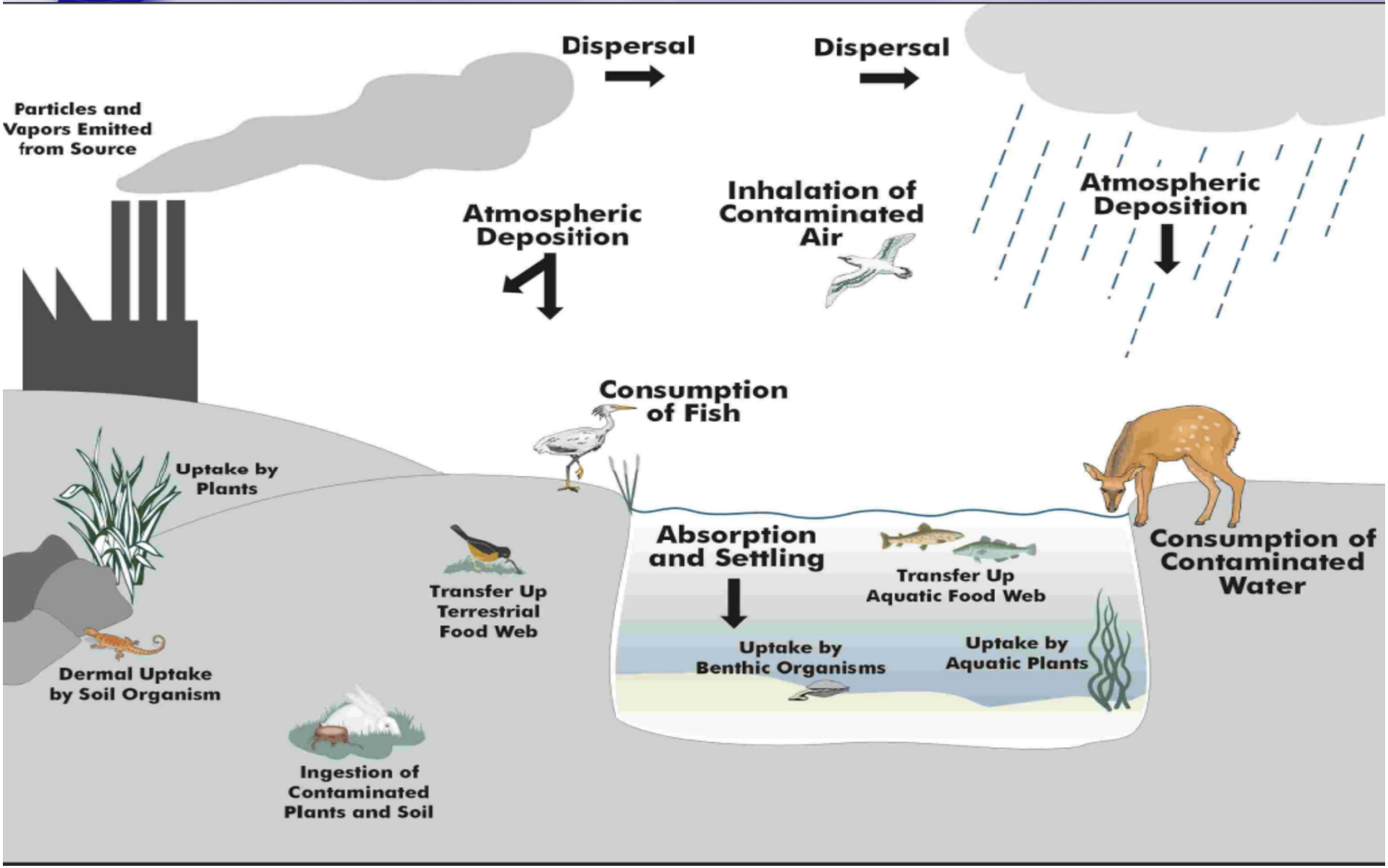
Transport of Vapors



Identify Human and Ecological Receptors (5.2.6)

- Impacted or threatened by identified COCs
- Located within investigative area or present
- Along identified migration pathway(s)
- Current and future exposure scenarios
- Ecological may be separate from human exposure

USEPA Ecological CSM



Determine Extent of Investigative Area (5.2.7)

- Identify human or critical species that may be impacted by contamination
  - Human populations (i.e., private or public supply wells)
  - Critical species living on or adjacent to the site or within the identified migration pathways
- Presented in graphic form (map, cross section) and updated as data is collected

Narrative Description of the CSM (5.2.8)

- Piece the CSM together in a summary fashion as it is understood at that time
  - Simple scenario - notes or text boxes on a drawing
  - Complex site - section of report

Questions?

Applying CSM with Case Studies

Kim McEvoy – NJDEP
kim.mcenvoy@dep.state.nj.us
609-530-8705

William Gottobrio – Kleinfelder
WGottobrio@kleinfelder.com
609-584-5271

Applying the CSM

- Preliminary Assessment (PA)/Initial Site Review
  - Summarizes collected information regarding AOCs as potential sources of contamination
  - Basis for determining approach to SI

- Site Investigation (SI)/ Remedial Investigation (RI)
  - Characterizes the physical, biological, and chemical systems
  - Describes processes that control migration and affect exposure to contaminants
  - Documents non-site related contaminants

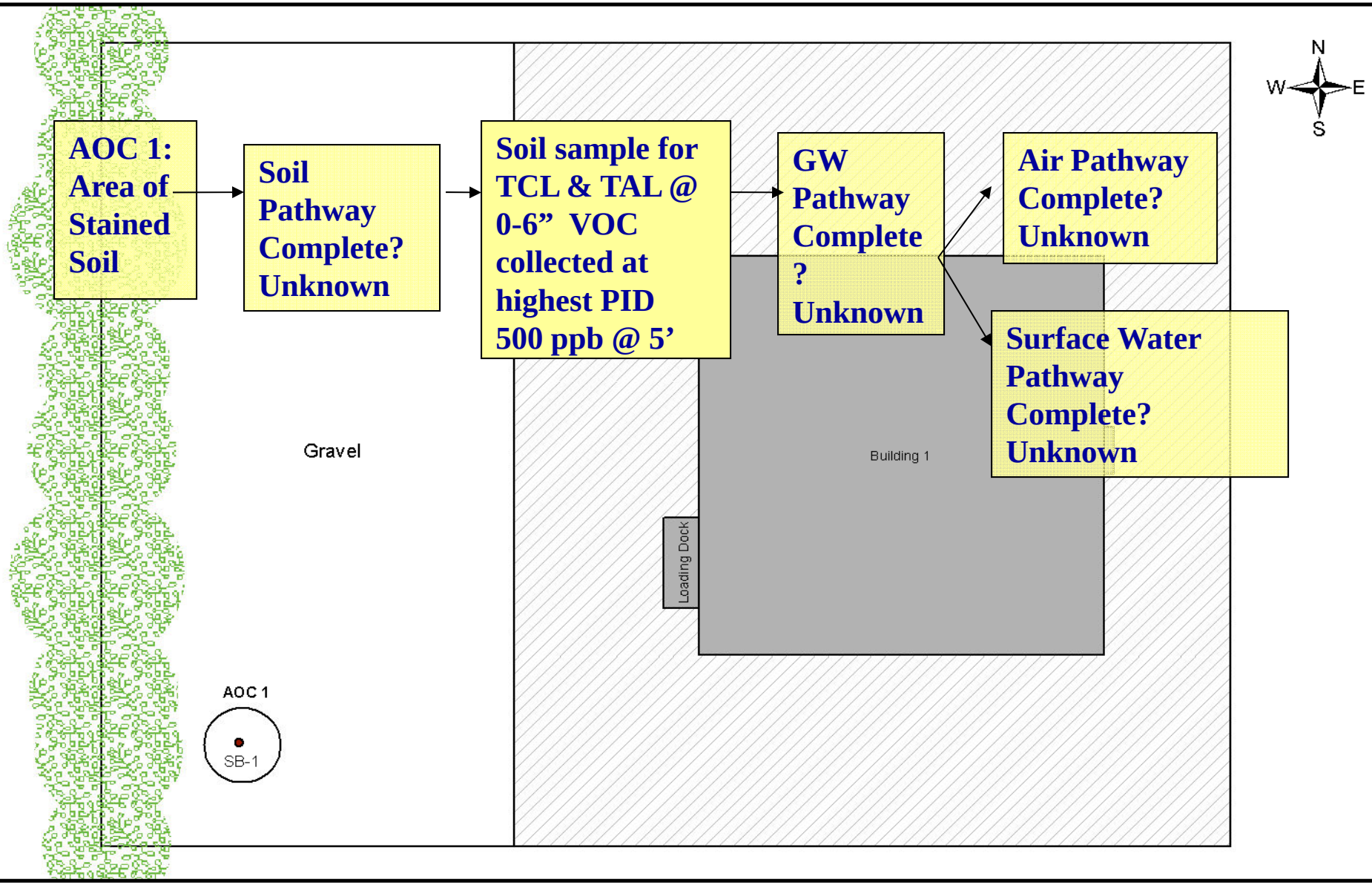
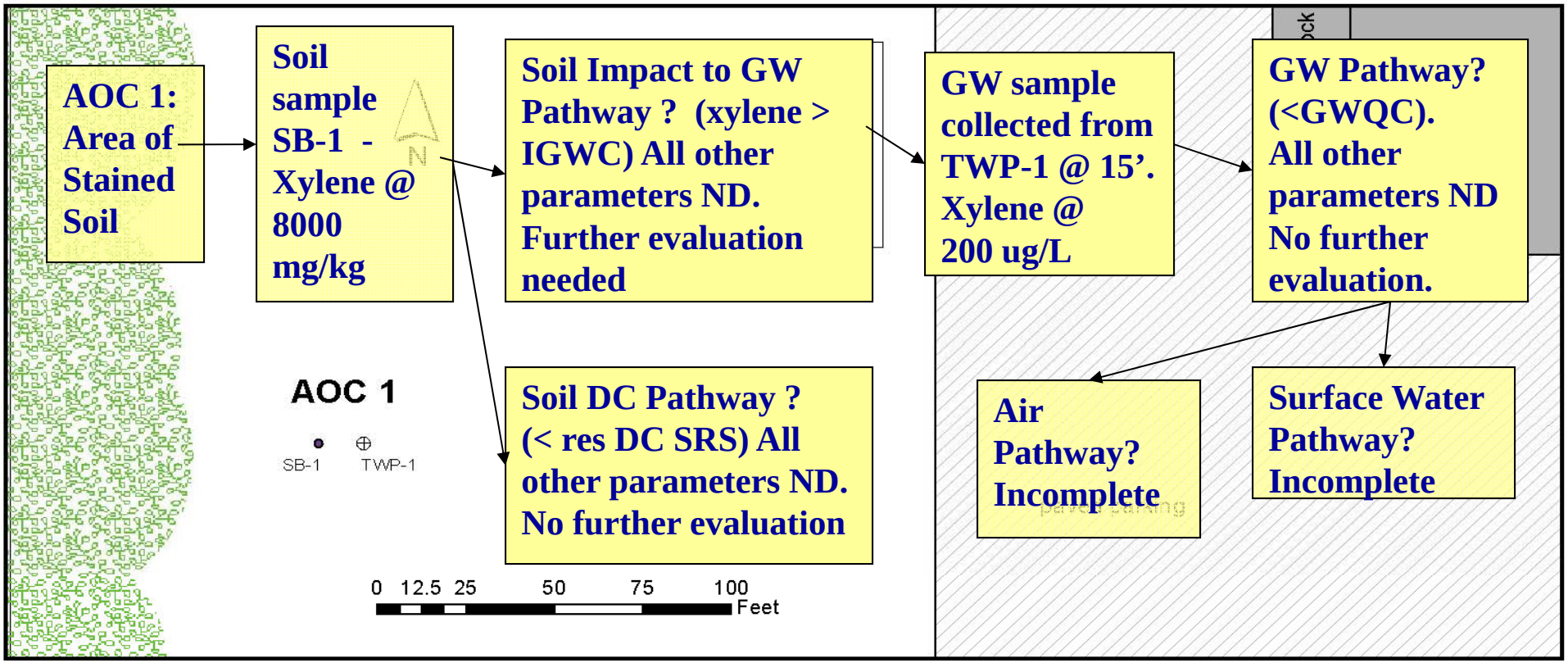
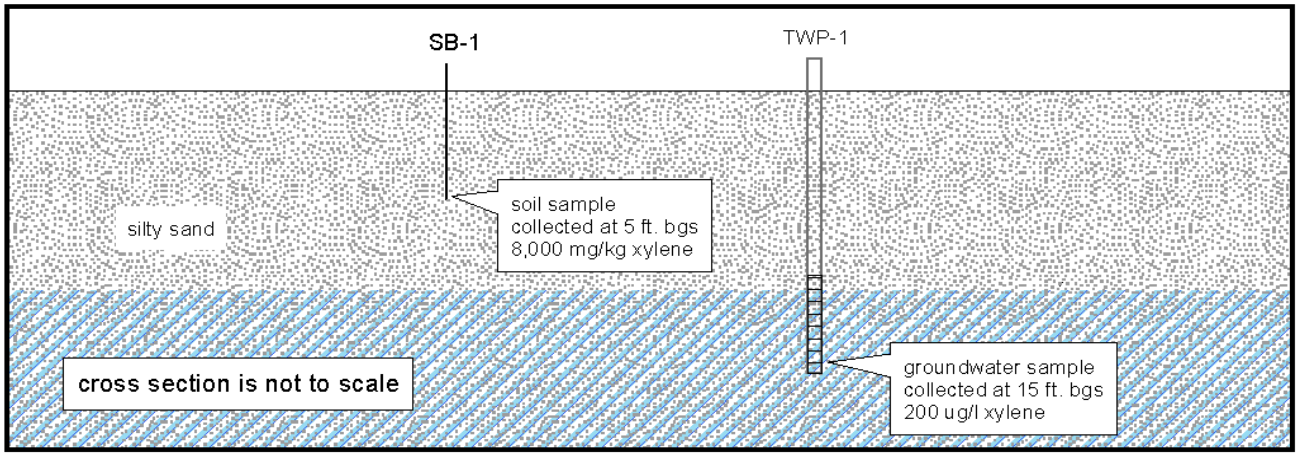


Figure C1-1 : Schematic of a site showing a single AOC and it's proximity to a building during a Preliminary Assessment.

Site Name: Vaste Warehousing Inc.
Address: 555 Vaste Lane
City/County: Forest City, Bergen Co.
NJDEP Case #: 000000
NJDEP PI #: G000000





SB-1

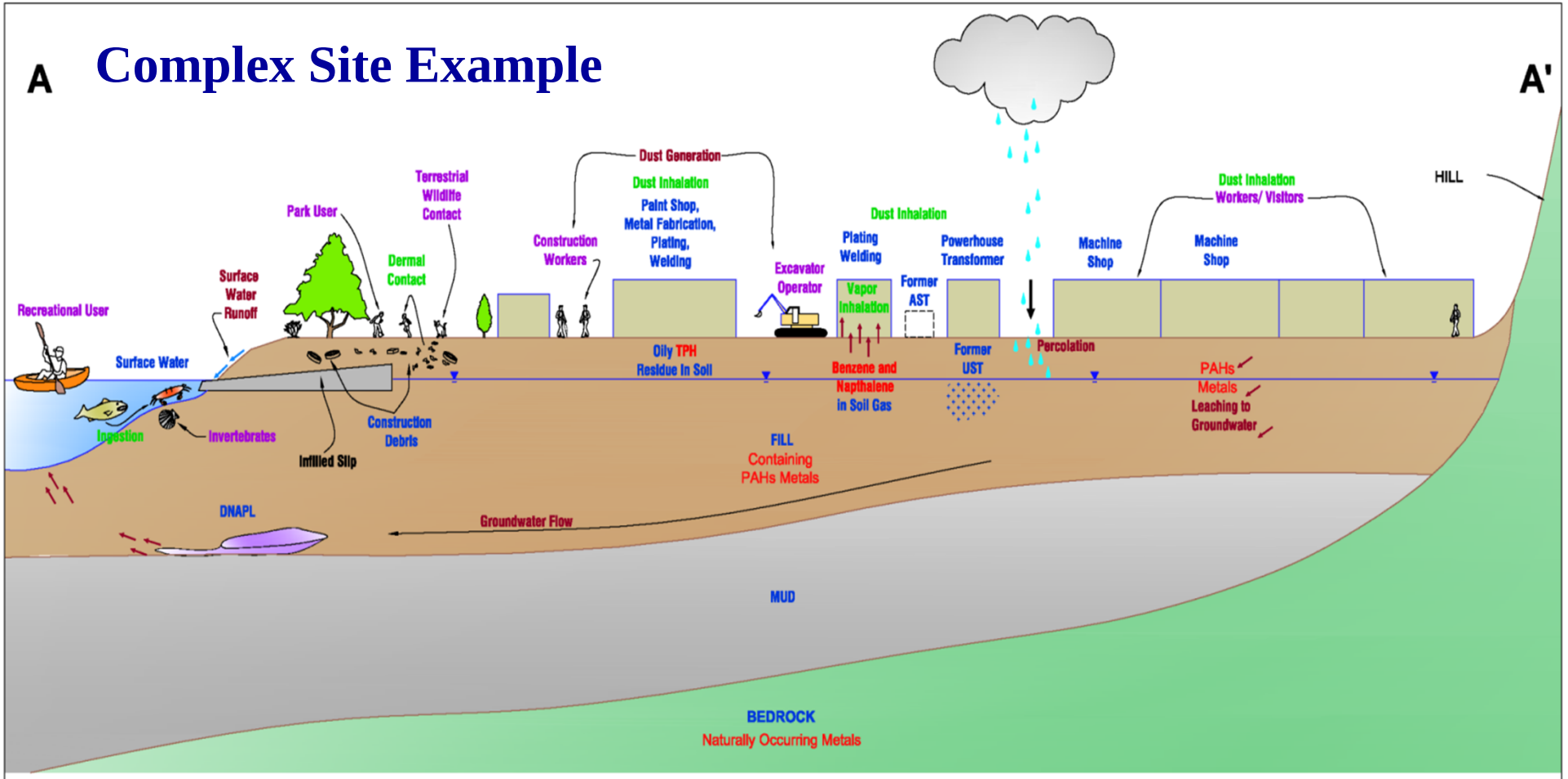
Depth	PID reading
0-4 ft.	100 ppb
4-5 ft.	500 ppb
5-7 ft.	100 ppb
7-10 ft.	ND

SB-1 VO sample collected at 5 ft.
All other constituents collected at 0-6 inches

Site Name: Vaste Warehousing Inc.
Address: 555 Vaste Lane
City/County: Forest City, Bergen Co.
NJDEP Case #: 000000
NJDEP PI #: G000000

Figure C2-1: Schematic of a site showing sampling conducted and the site specific information collected for a single AOC during the Site Investigation.

Complex Site Example



EXPLANATION

COPCs:	Contaminants of potential concern		Soil vapor
PAHs	Polycyclic aromatic hydrocarbons	B36	Building number
VOCs	Volatile organic compounds		Water table
PCBs	Polychlorinated biphenyls		Groundwater flow
TPH	Total petroleum hydrocarbons		Building
	Heavily degraded highly viscous petroleum hydrocarbons		Receptors
	Dense non-aqueous phase liquid (DNAPL)		Source
			Exposure Pathway
			Exposure Media and Release Mechanism

NOT TO SCALE

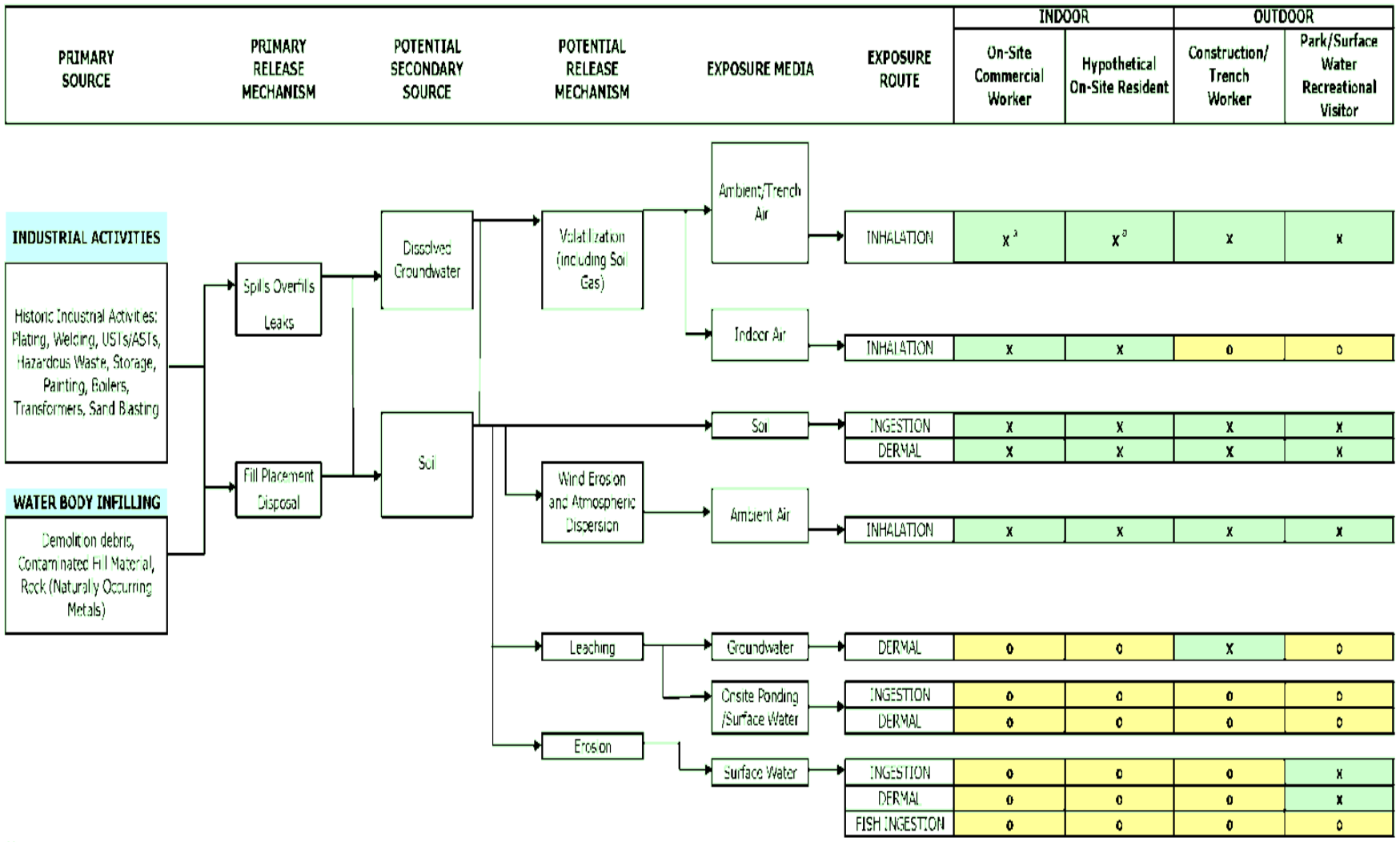
ENVIRONMENTAL INVESTIGATION

CSM X-SECTION

Date 03/02/11 | Project No. CSM

Complex Site Example

FIGURE 2-2
CONCEPTUAL SITE MODEL (CSM) FLOW CHART - SOURCE, PATHWAY & EXPOSURE ASSESSMENT
ENVIRONMENTAL INVESTIGATION



Notes:

x Complete exposure pathway.

o Incomplete exposure pathway.

[a] Ambient air exposures were not evaluated for volatile chemicals because indoor intrusion pathway is protective of outdoor soil vapor exposures for the residential and commercial receptors.

Applying the CSM

- Remedy Selection
  - Identifies potential exposure routes & risks to human health & environment
  - Discusses & supports selected remedial action by:
    - Summarizing data evaluation & feasibility testing that supports remedial approach
    - Identifying interim or active remedial approaches that will be or have been applied
    - Addressing data gaps that may impact remedial action selection

Applying the CSM

- Post Remediation
  - Supports the RAO/NFA
  - Documents effectiveness of remedial actions and phases of remediation
  - Supports that the appropriate engineering/institutional controls have been implemented
  - Summarizes post remedial monitoring plan, as appropriate
  - **Supports variance or the deviation from rules due to site-specific conditions**

Questions?