Open Environmental Restoration Resource (OER2) Webinar
Common Pit Falls in Site Investigation and How to Avoid Them

Presented by:
NAVFAC Environmental Restoration Program

Logistics

- **Submit all questions via chat box throughout the presentation**
- **Presentation is being recorded**
- **Complete the webinar survey (main feedback mechanism)**

Disclaimer:

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Speaker Introduction

Email: james.tarr@navy.mil

- **Hydrogeologist - NAVFAC Atlantic**
- **BS in Geology & MS in Environmental Policy and Management.**
- **25+ years of experience**
- **Licensed geologist in New Hampshire & Licensed Site Professional in Massachusetts**
- **Currently retains his Maine Certified Geologist license**
- **Former RPM, and now provides support on technical documents.**

- **Tara Meyers (Moderator): tara.meyers@navy.mil**

OER2 Webinar Series

- **Why Attend?**
  - Obtain and hear about the latest DOD and DON's policies/guidance, tools, technologies and practices to improve the ERP's efficiency
  - Promote innovation and share lessons learned
  - **FEEDBACK** to the ERP Leadership
- **Who Should Attend?**
  - ERP Community Members: RPMs, RTMs, Contractors, and other remediation practitioners who support and execute the ERP
  - Voluntary participation
- **Schedule and Registration:**
  - Every other month, 4th Wed (can be rescheduled due to holidays)
  - Registration link for each topic (announced via ER T2 email)
- **Topics and Presenters:**
  - **ERP community members** to submit topics (non-marketing and DON ERP-relevant) to POCs (Gunarti Coghlan – gunarti.coghlan@navy.mil or Tara Meyers - tara.meyers@navy.mil)
  - Selected topic will be assigned Champion to work with presenter

Common Pit Falls in Site Investigation and How to Avoid Them

James Tarr

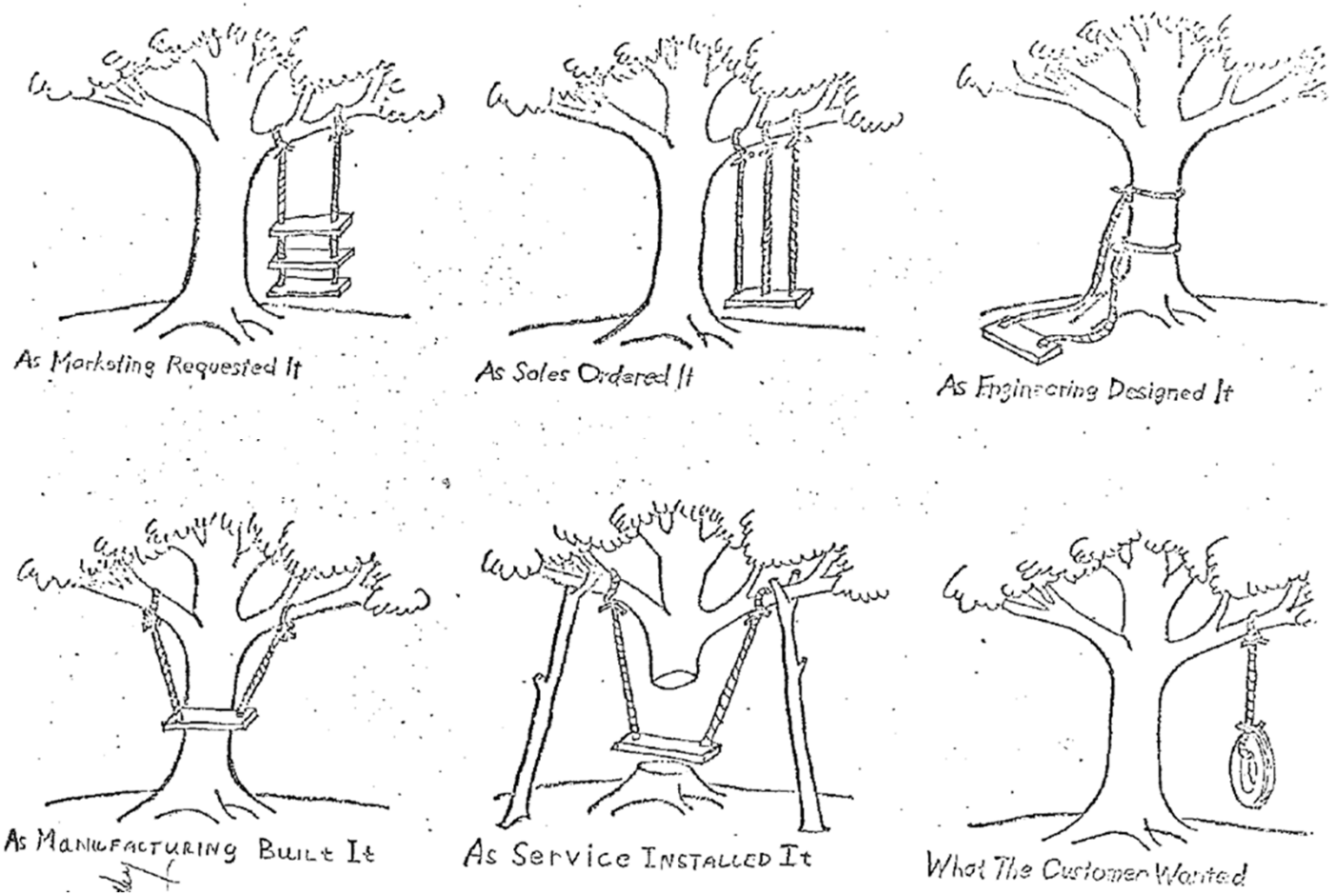
August 2016

Presentation Outline

- Introduction
- Examples
  - CSM at sites with shoreline interface
  - Groundwater flow
  - How to present environmental data
- Conclusions
- Take Home Points

Are We Producing a High Quality Work Product That the Client Wants?

(T & W Fleet 1970's)



Quality Control

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Why Is it Important To proof read?

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slpeling was ipmorantt!

So Please, double check your spelling

MA Board of Registration of Hazardous Waste Site Cleanup Professionals

STATE BOARD SUSPENDS LICENSE
OF HAZARDOUS WASTE SITE CLEANUP PROFESSIONAL

BOSTON – [redacted], whose office is located in Somerville, has entered into a consent agreement with the Massachusetts Board of Registration of Hazardous Waste Site Cleanup Professionals to resolve pending disciplinary charges. As part of this consent agreement, Mr. [redacted] license to practice as a Hazardous Waste Site Cleanup Professional will be suspended for 15 months and he will be required to complete certain continuing education courses.

Key Point

Since 1995 the MA LSP Board has Censured 19, Suspended 22, and Revoked 27 LSP licenses.

Why Does This Matter?

- The LSPs are highly qualified professionals with several years experience, degreed, and passed a significant written test. If some LSPs are making these types of errors, I wanted test what we are doing within our IR program? And how our overall work product compares.

- Although some examples of deficiencies ranging from minor to major, including the lack of data, poorly written documents, under-characterizing, and /or over-characterizing various sites, this presentation focuses on only a few relevant topics.

- Our QA/QC system that is in place is supporting RPMs and improving our work product, e.g., UFP QAPP, review of draft documents (RI/FS), and RAAs etc.

Key Point **Quality Counts!!!**

Hydrogeology/General Terms

- An accurate estimate of groundwater velocity. Darcy's law is an equation that describes groundwater movement in aquifers based on three variables: horizontal hydraulic conductivity, horizontal hydraulic gradient and effective porosity. The equation for calculating ground water velocity is: V= KI/n.

Groundwater velocity = $\frac{\text{hydraulic conductivity X hydraulic gradient}}{\text{porosity}}$

- **Seepage Velocity**-If the seepage velocity is not known or approximated then the accuracy of the transport of contaminants is in doubt.

  $V_s = Ki/n_e$

  Where: Vs=Seepage velocity, L/T

  $n_{e=}$ Effective porosity, dimensionless

Hydrogeology/General Terms

- **Porosity** refers to the amount of void (or open space) within a volume of soil or rock. The value of porosity is measured as a fraction or percentage.

- **Hydraulic Conductivity** =K

  Flow of water, in gallons per day, through a cross sectional area of one square foot, under a hydraulic gradient of one foot per foot.

- **Transmissivity** = T

  Flow of water, in gallons per day, through a one foot wide strip of the aquifer, under a hydraulic gradient of one foot per foot.

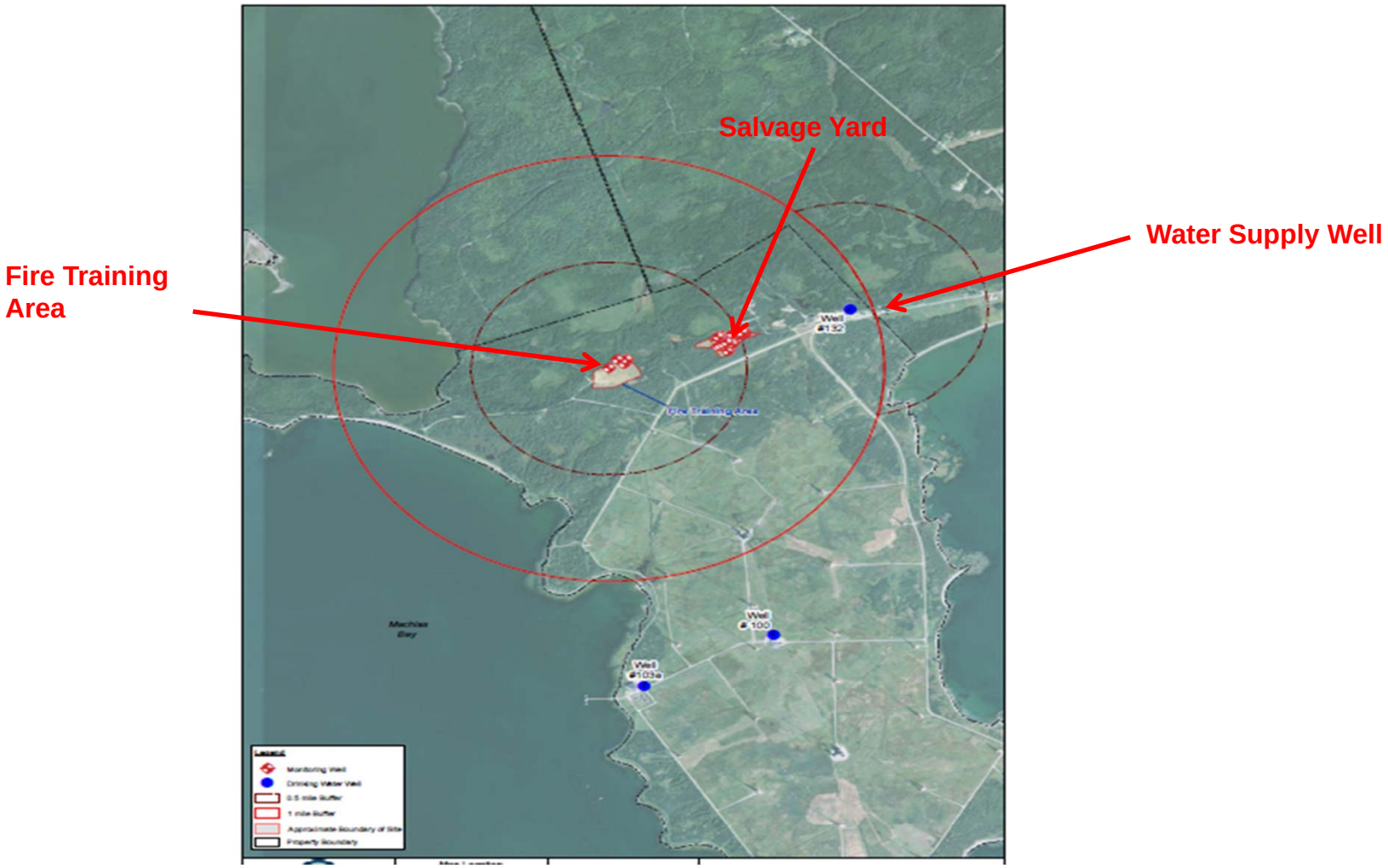
  T=Kd gpd/ft

Key Point

These groundwater parameters must be determined in order to build an accurate CSM

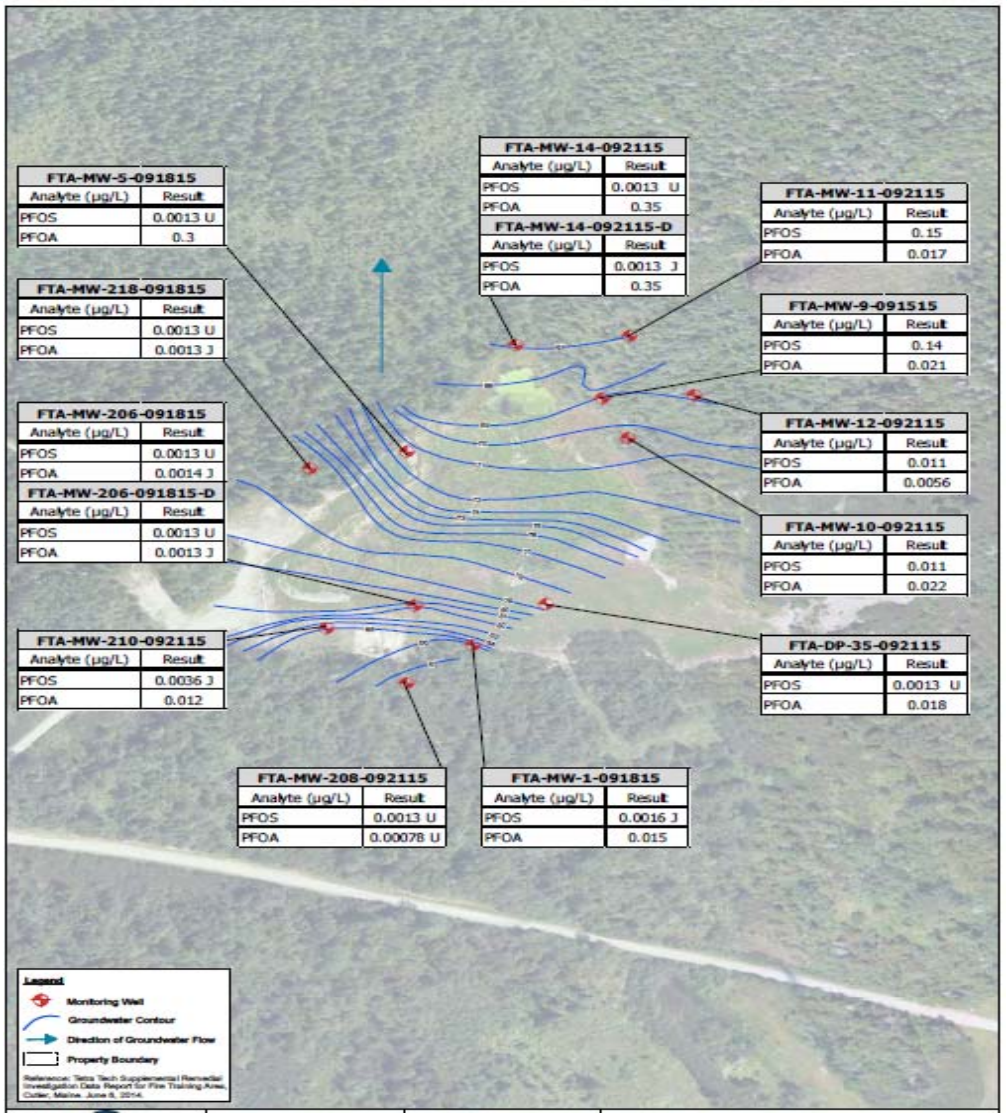
Digging Deeper to Understand Groundwater Flow

Per-Polyfluoroalkyl Substances Investigation

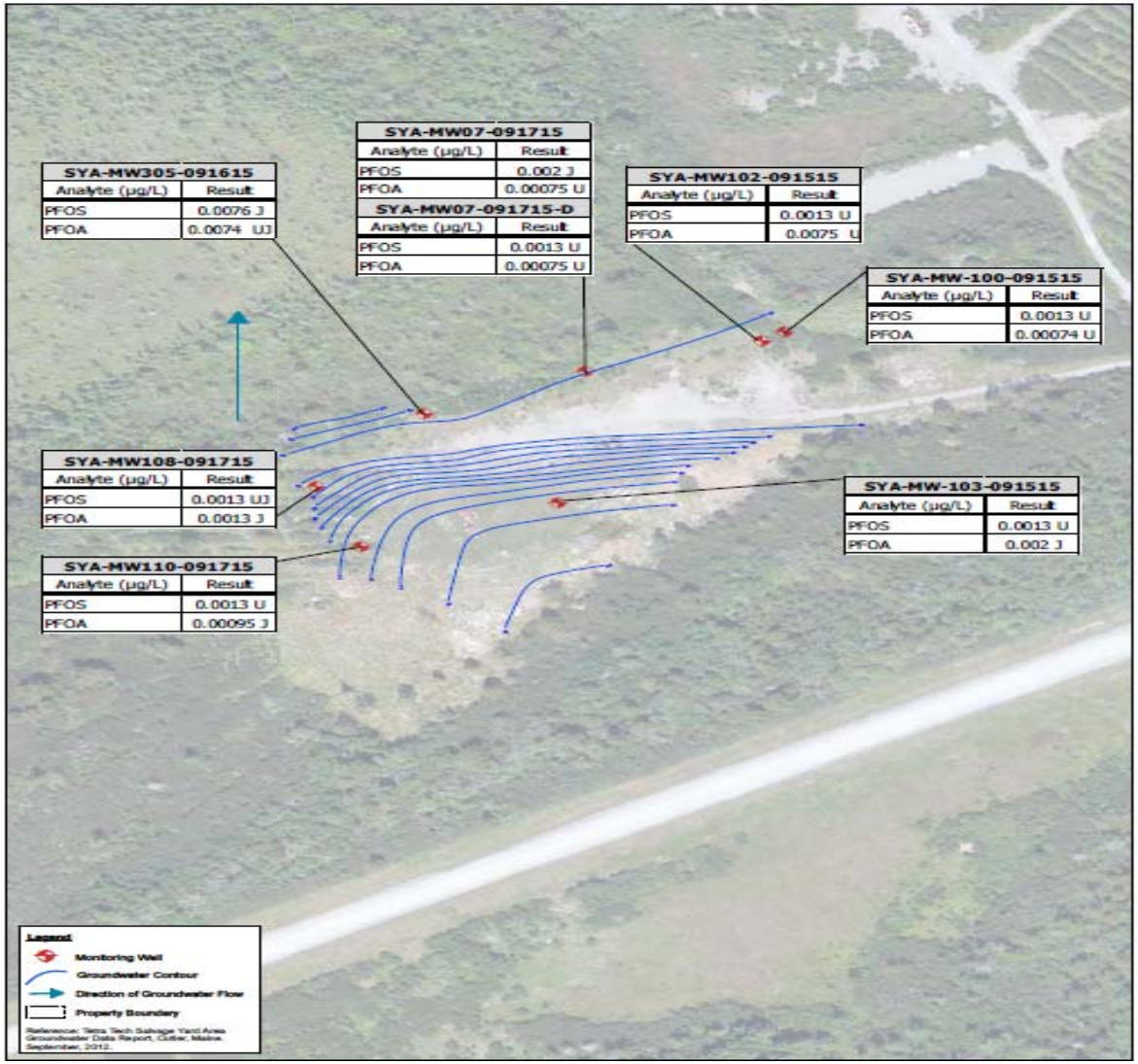


Fire Training Area

MEDEP
Groundwater
PFOS 0.100 µg/L
PFOA 0.06 µg/L

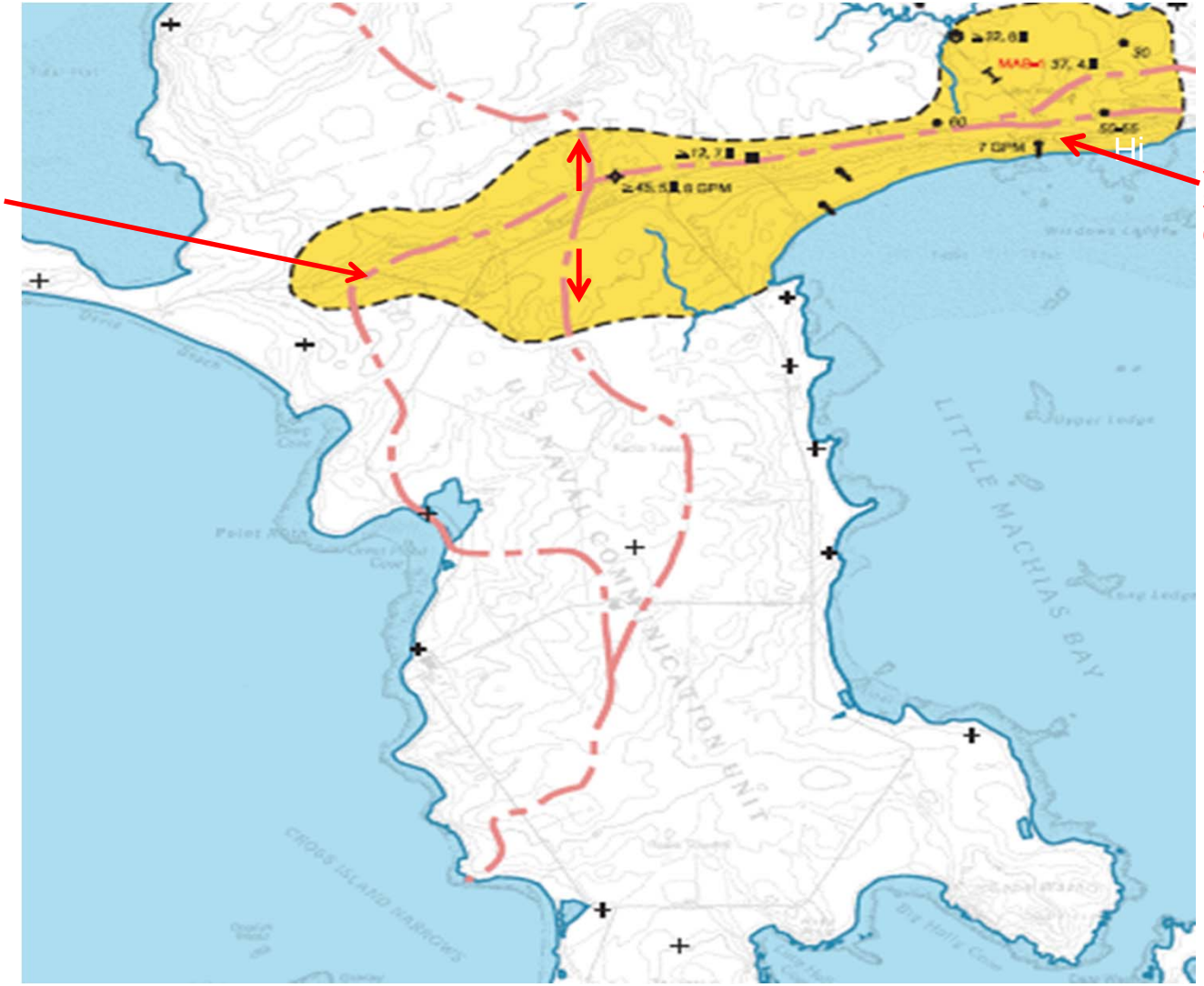


Salvage Yard Area Results



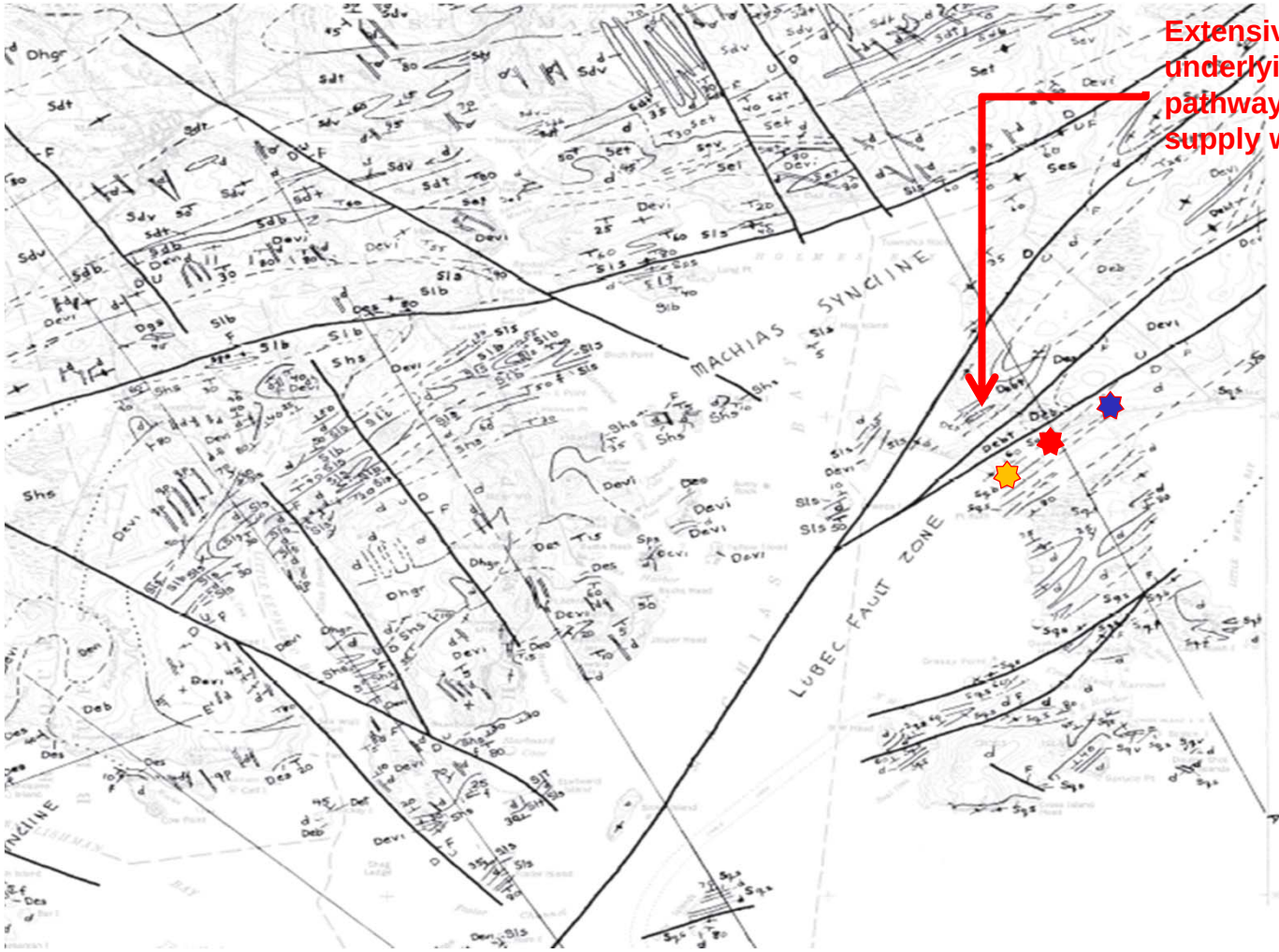
Surficial Geology

(MEGS, 2000)



Bedrock Geology

(MEGS, 1981)



Extensive fracture zone underlying sites, direct pathway to water supply well

- Drinking Water Supply Well
- Salvage Yard
- Fire Training Area

Basic CSM may need adjusting to understand complex site with shoreline interface

Conceptual Site Model

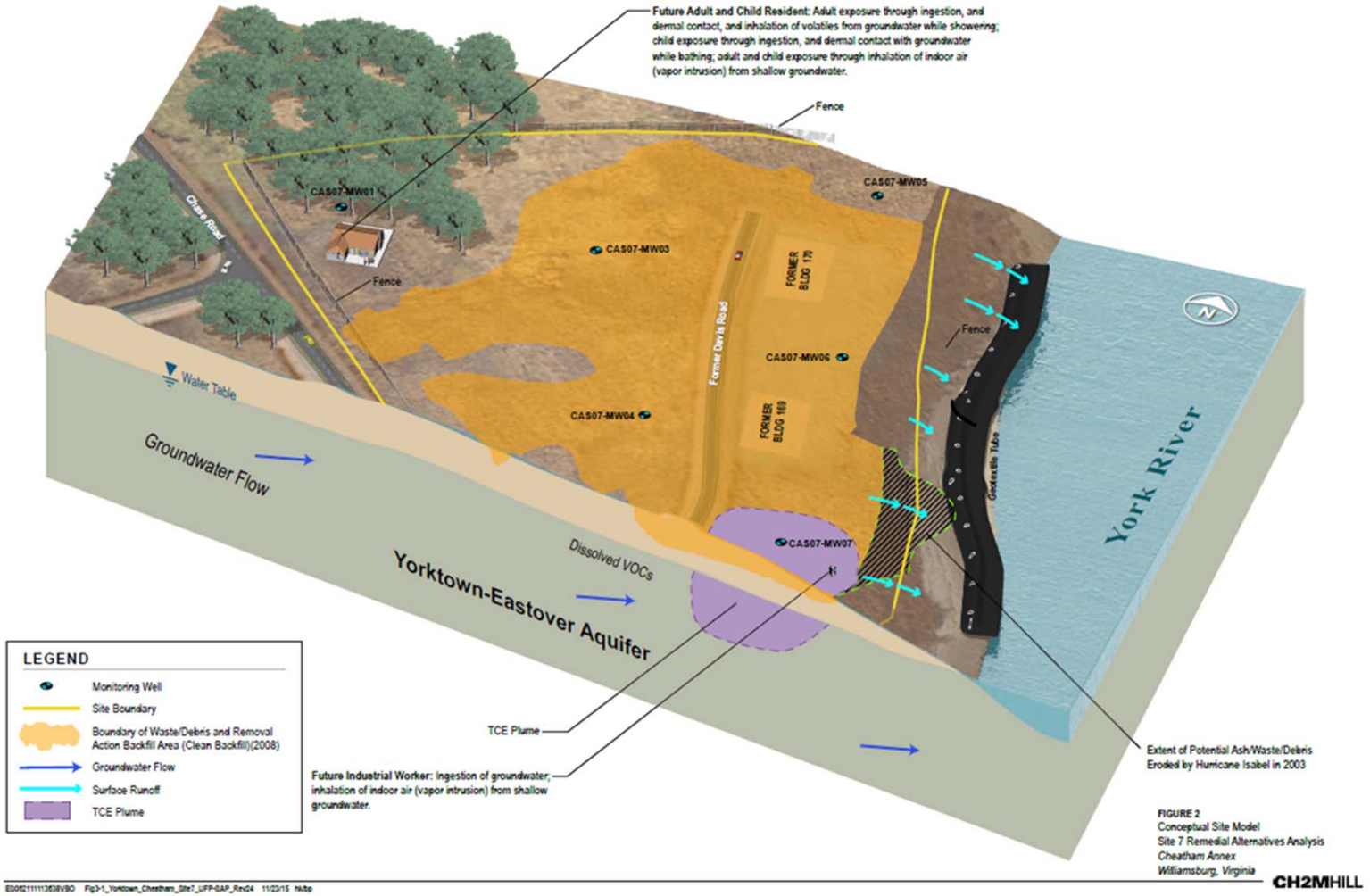


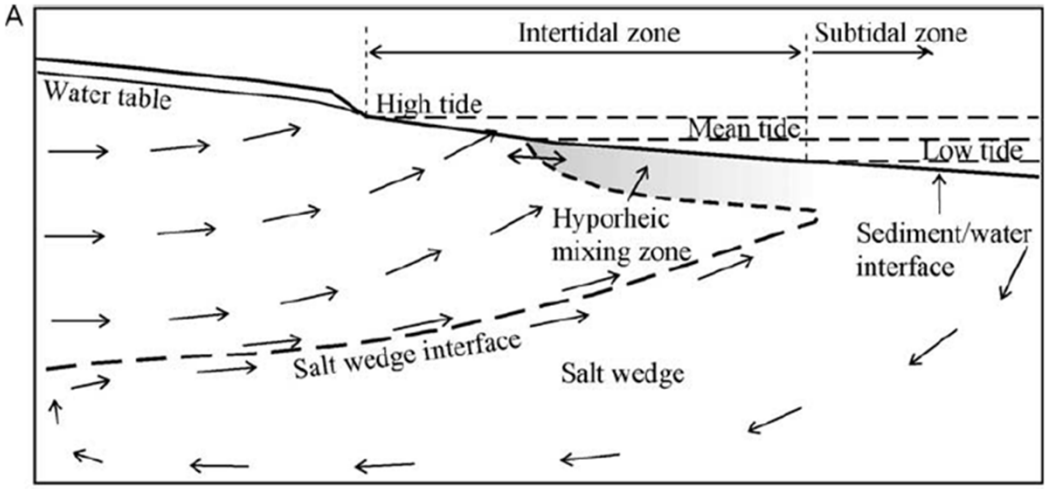
FIGURE 2
Conceptual Site Model
Site 7 Remedial Alternatives Analysis
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

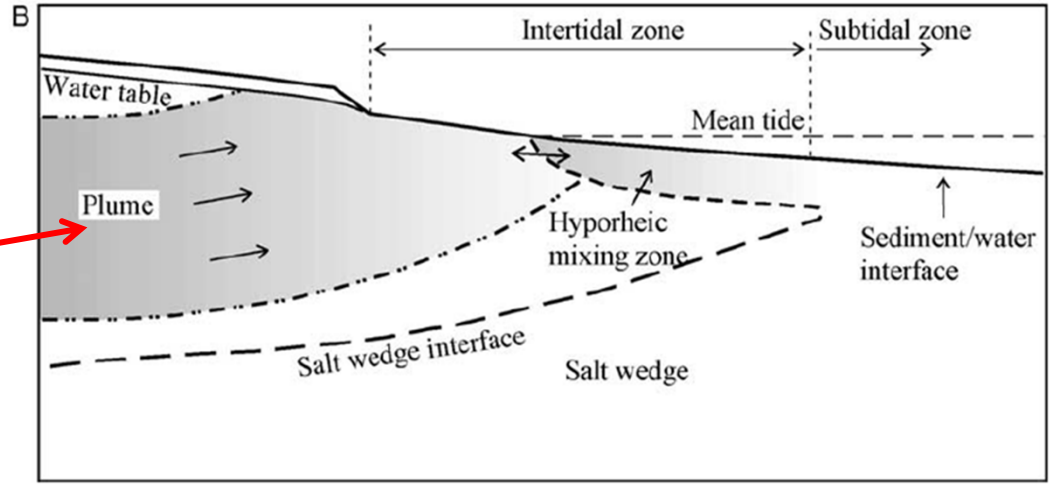
CSM Hyporheic Zone

(Westbrook et al. 2004)

January
(Summer Data)



September
(Winter Data)



Note plume

Salinity low
GW discharge
High

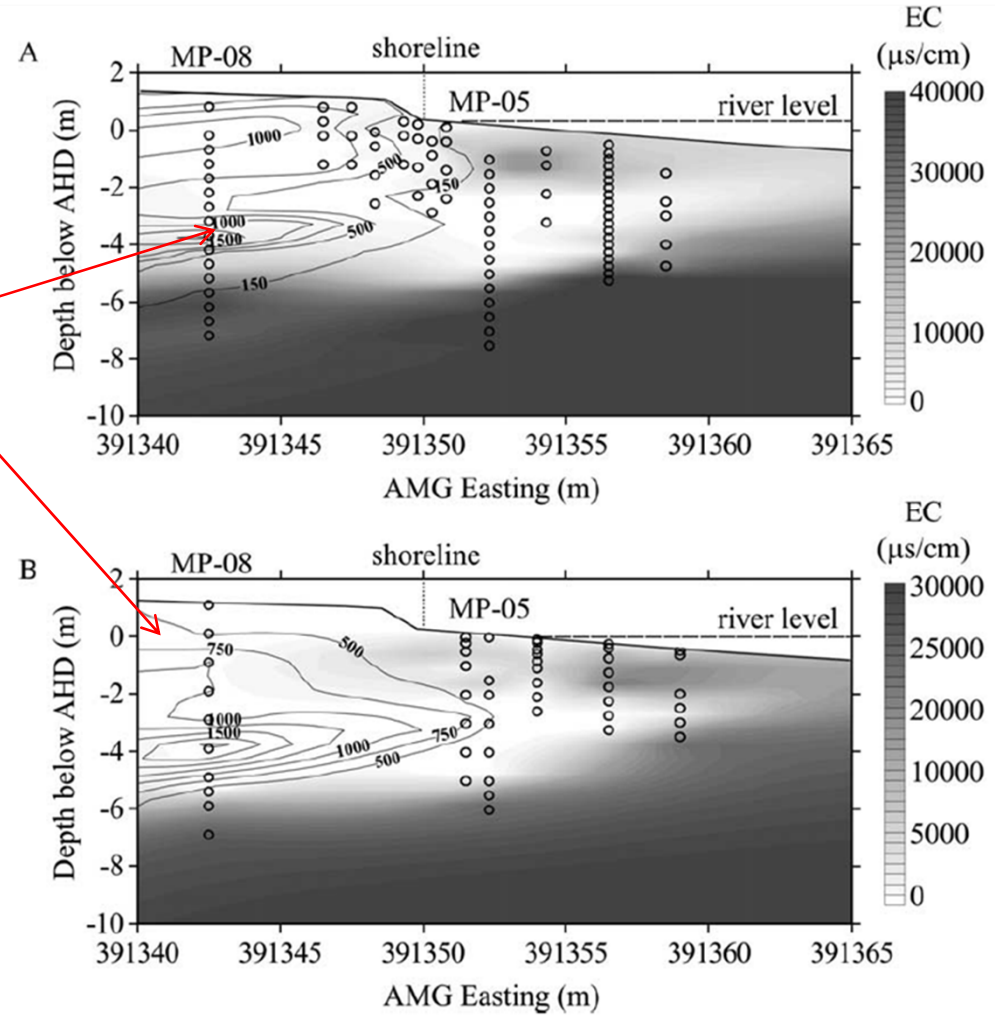
Pore Water Electrical Conductivity

(Westbrook et al. 2004)

January Data

BTEX Plume

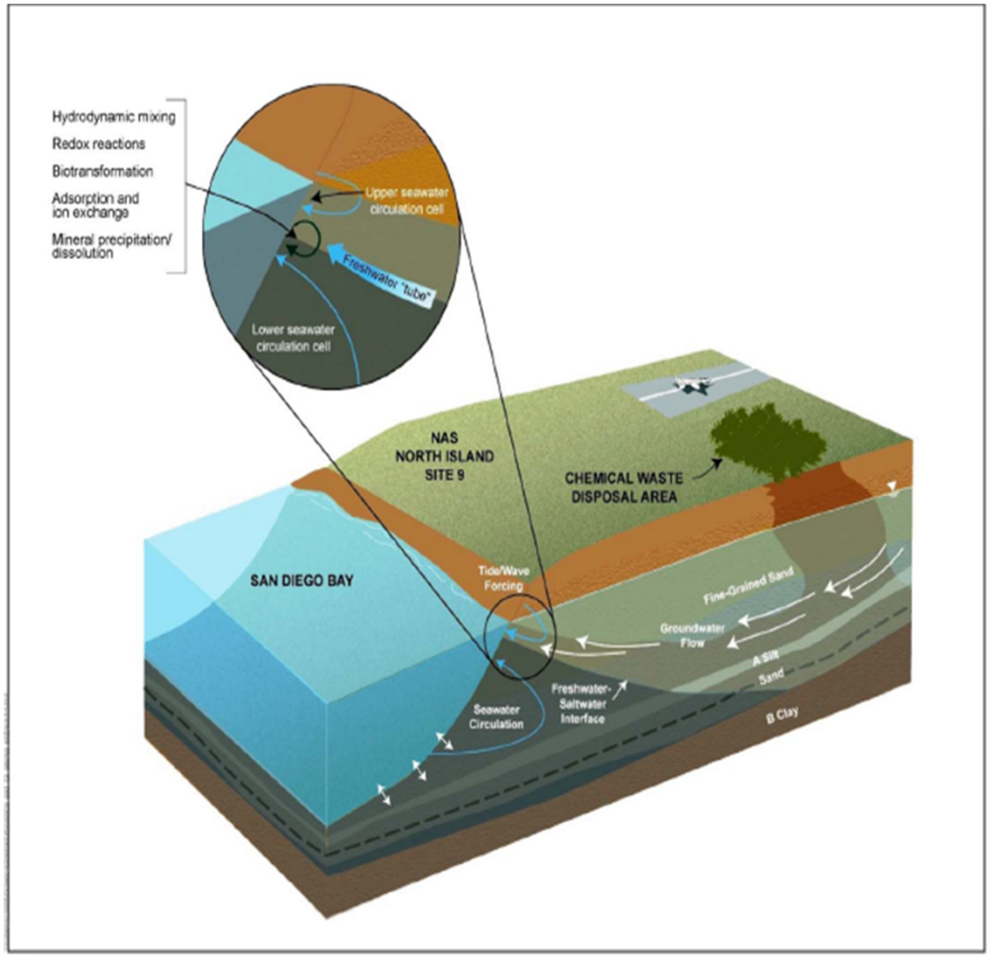
September Data



Key Point

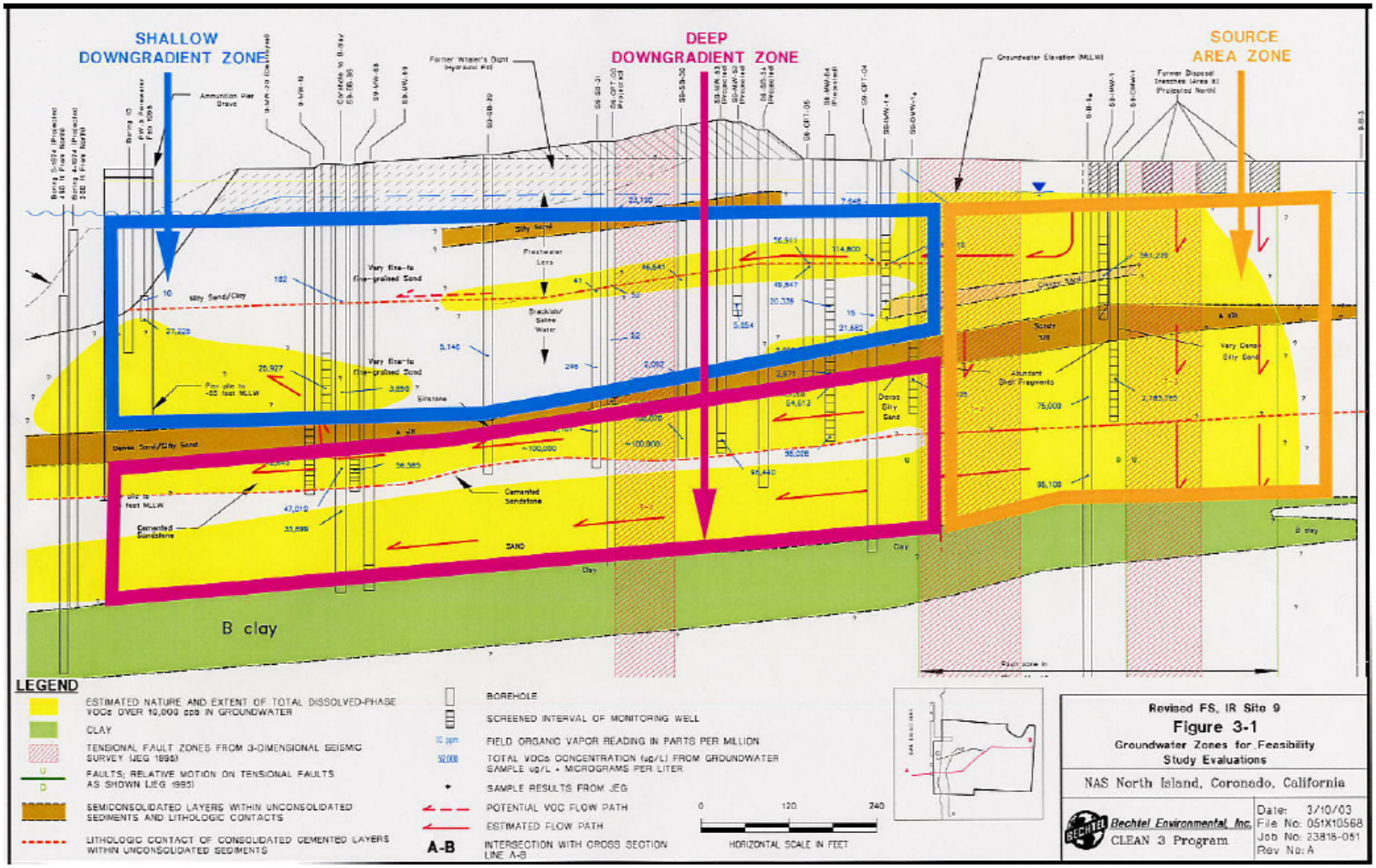
Investigations should focus on intertidal zones where contaminants are likely to impact the surface water and sediments.

Conceptual Site Model

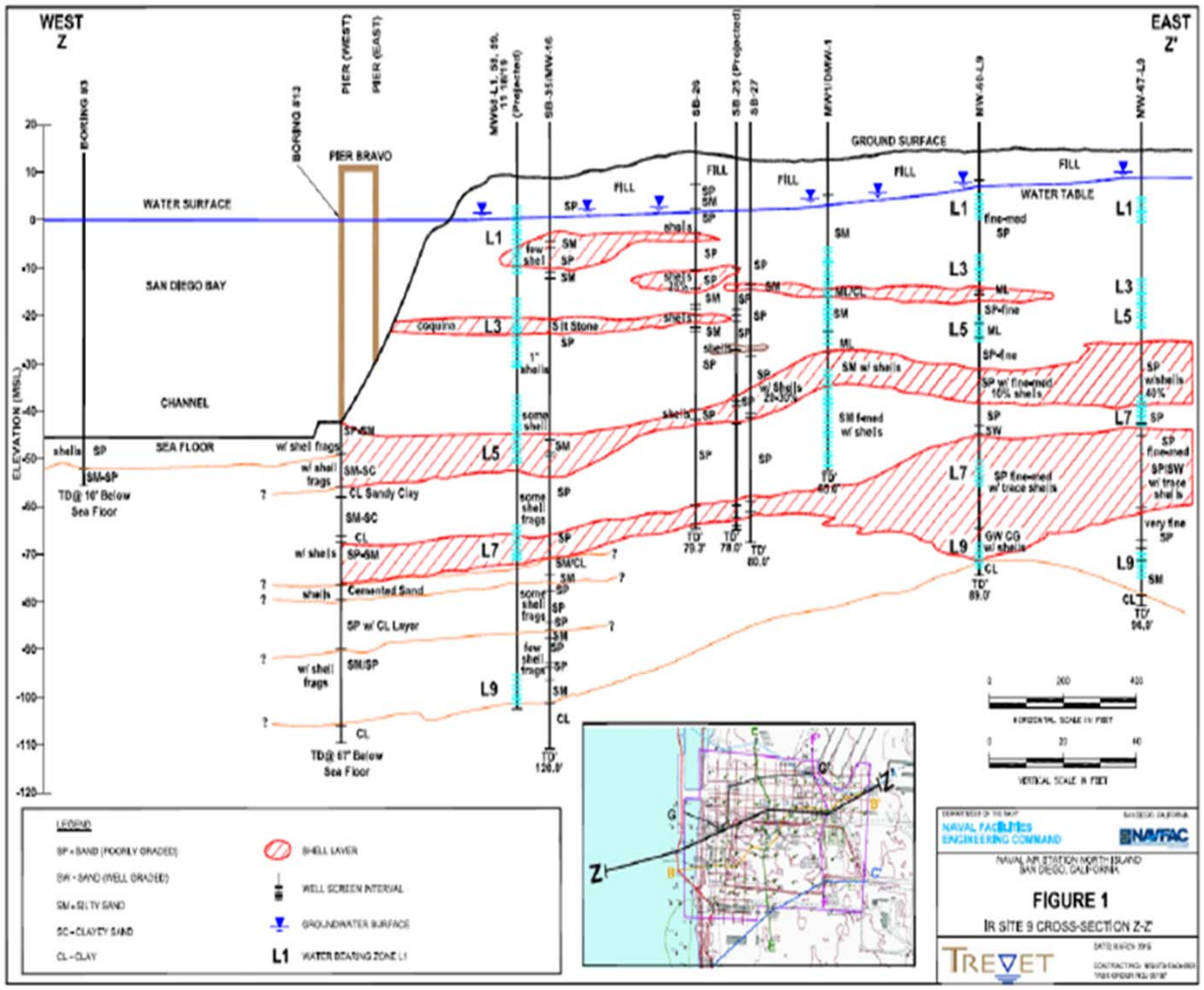


For detailed information refer to *DON Guidance for Planning and Optimizing Monitoring Strategies*, August 2008 (Chapter 8 – Monitoring Groundwater Discharge to Surface Water)

CSM-Cross Section

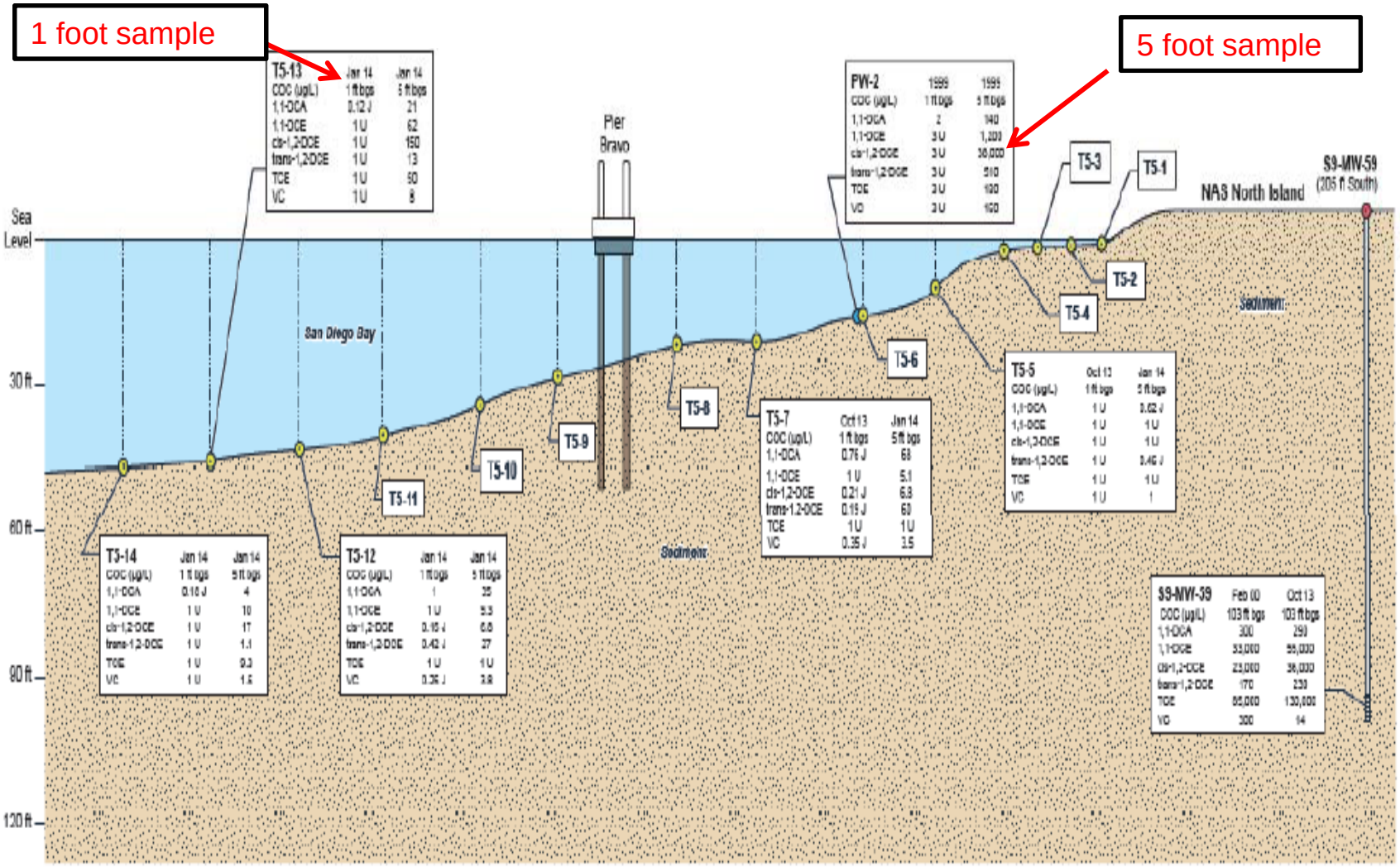


Cross Section



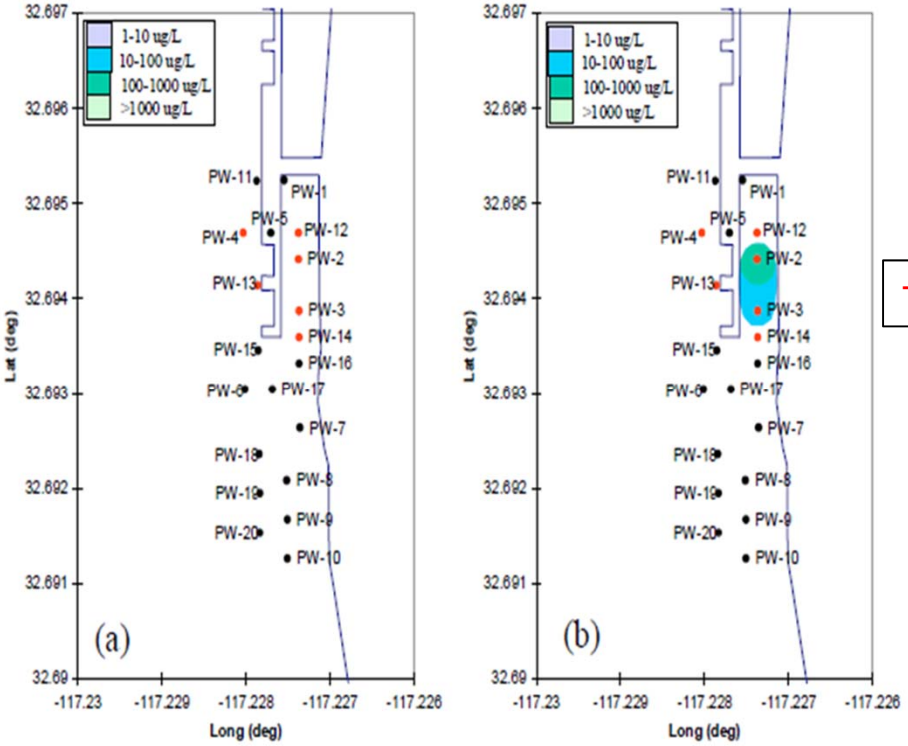
Pore Water Data

(1 ft. v 5 ft.)



Pore Water Analysis

TCE at 1 ft. depth



TCE at 5 ft. depth

Figure 5. Porewater survey results showing TCE concentrations at 1-ft sediment depth on the left (a) and TCE concentrations at 5-ft depth on the right (b).

Key Point

The Hyporheic Zone must be defined to eliminate data gaps

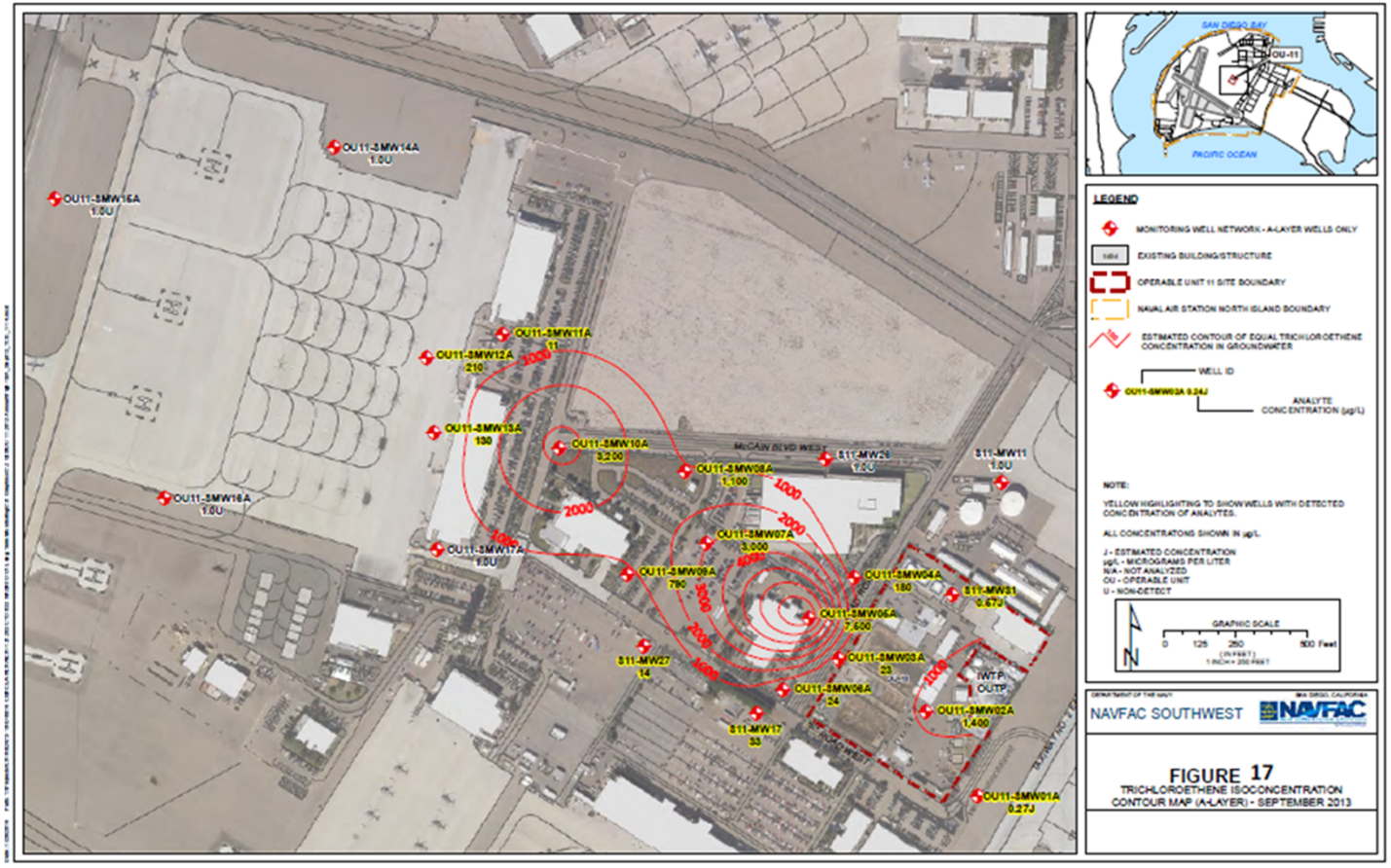
How the Environmental Data is Presented Matters

Site Location Map

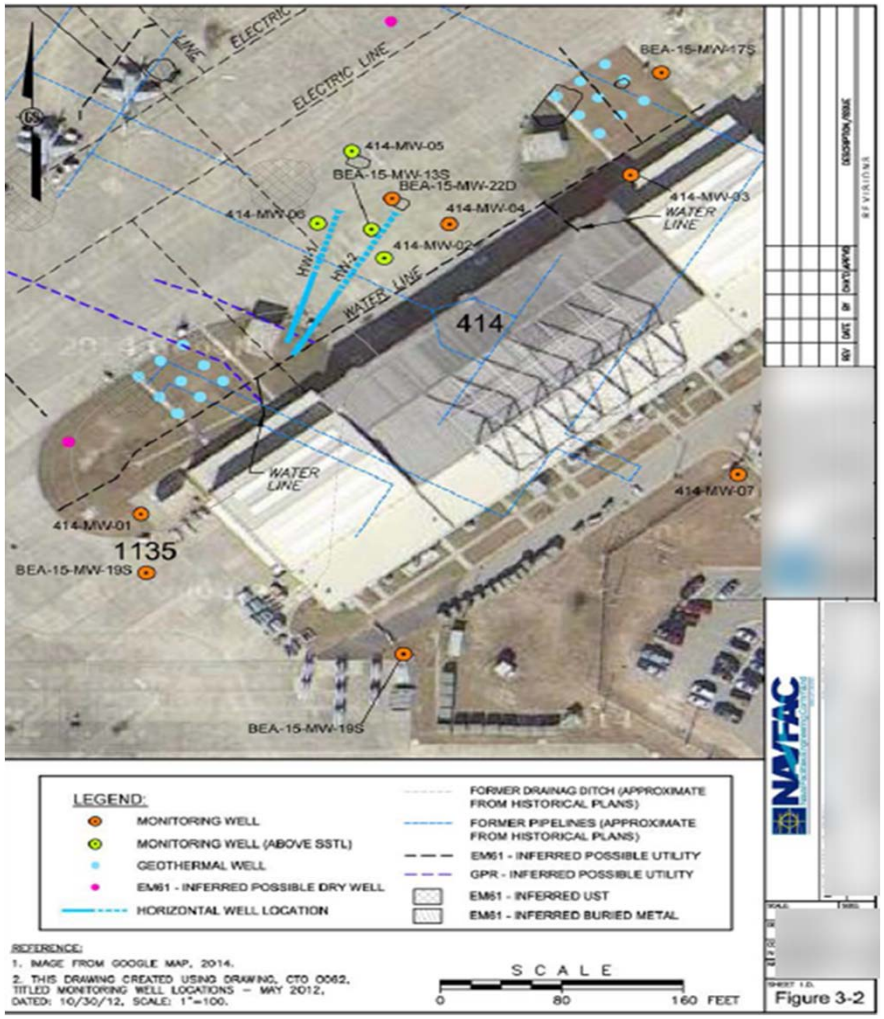
Site Location within base

Reader understands where location is

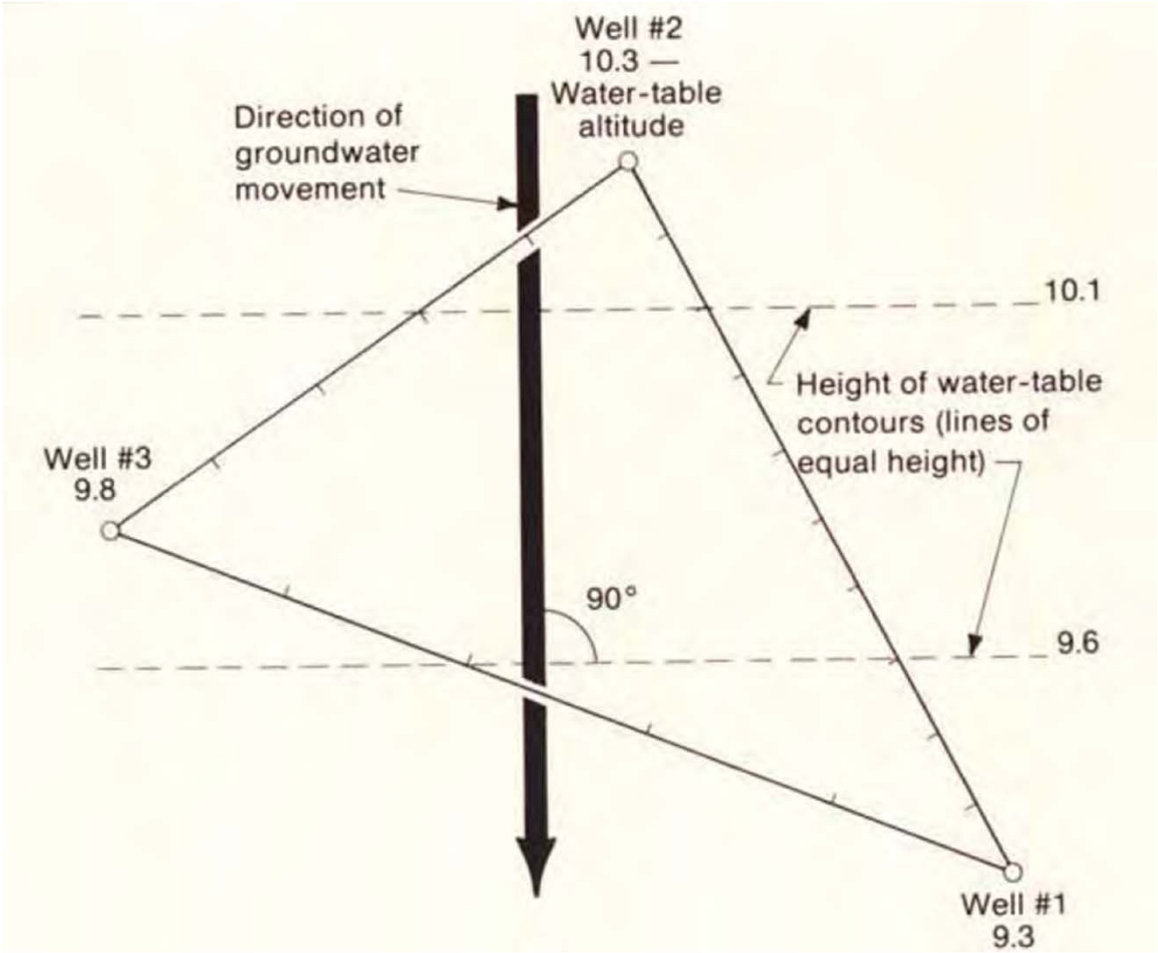
Isoconcentration Maps



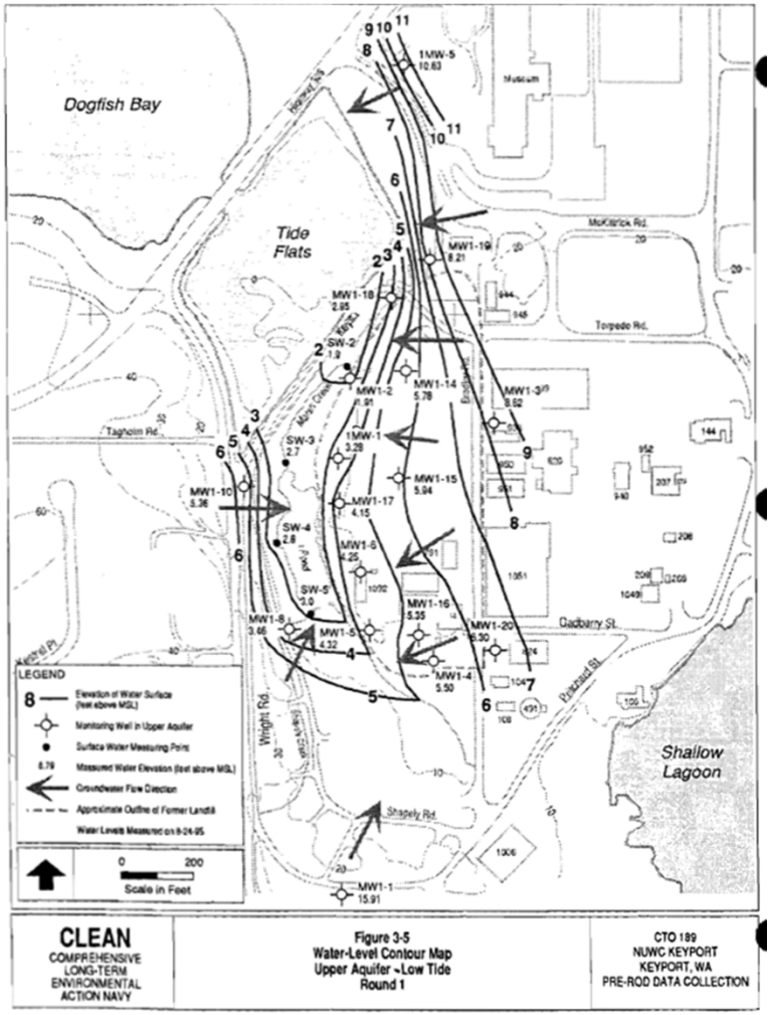
Example of Limited Figure



Determining Aquifer Flow



Acceptable Potentiometric Map



Bare Minimum Potentiometric Map

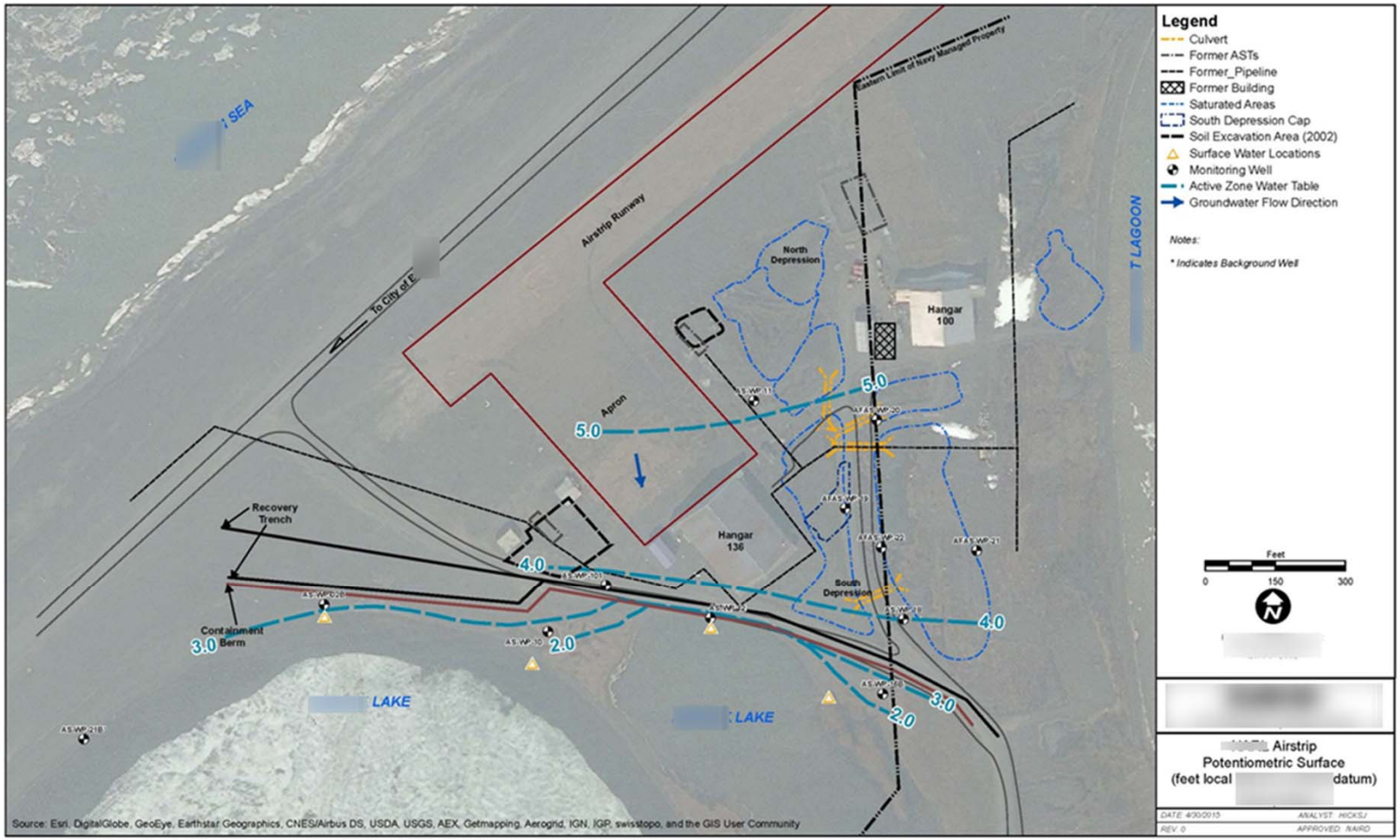
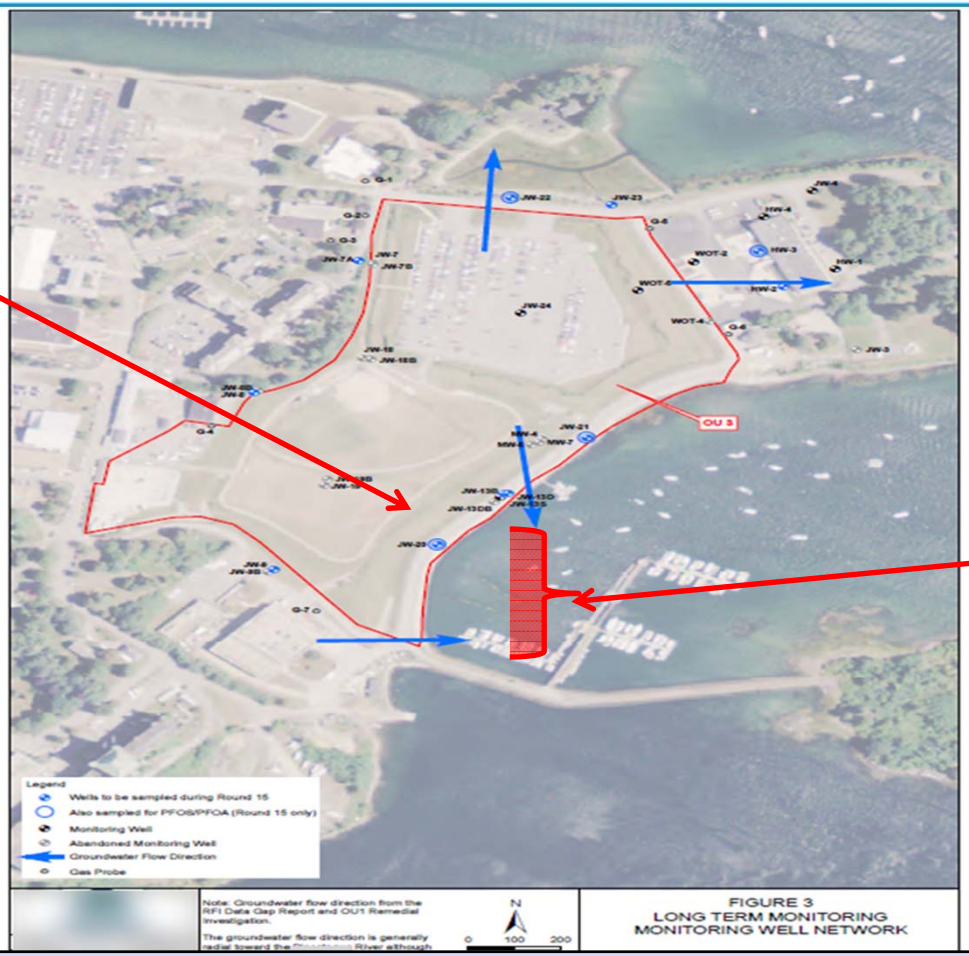


Figure 32. Airstrip Potentiometric Surface

Poor Potentiometric Map

Lack of MW Elevation Data



GW Contours?

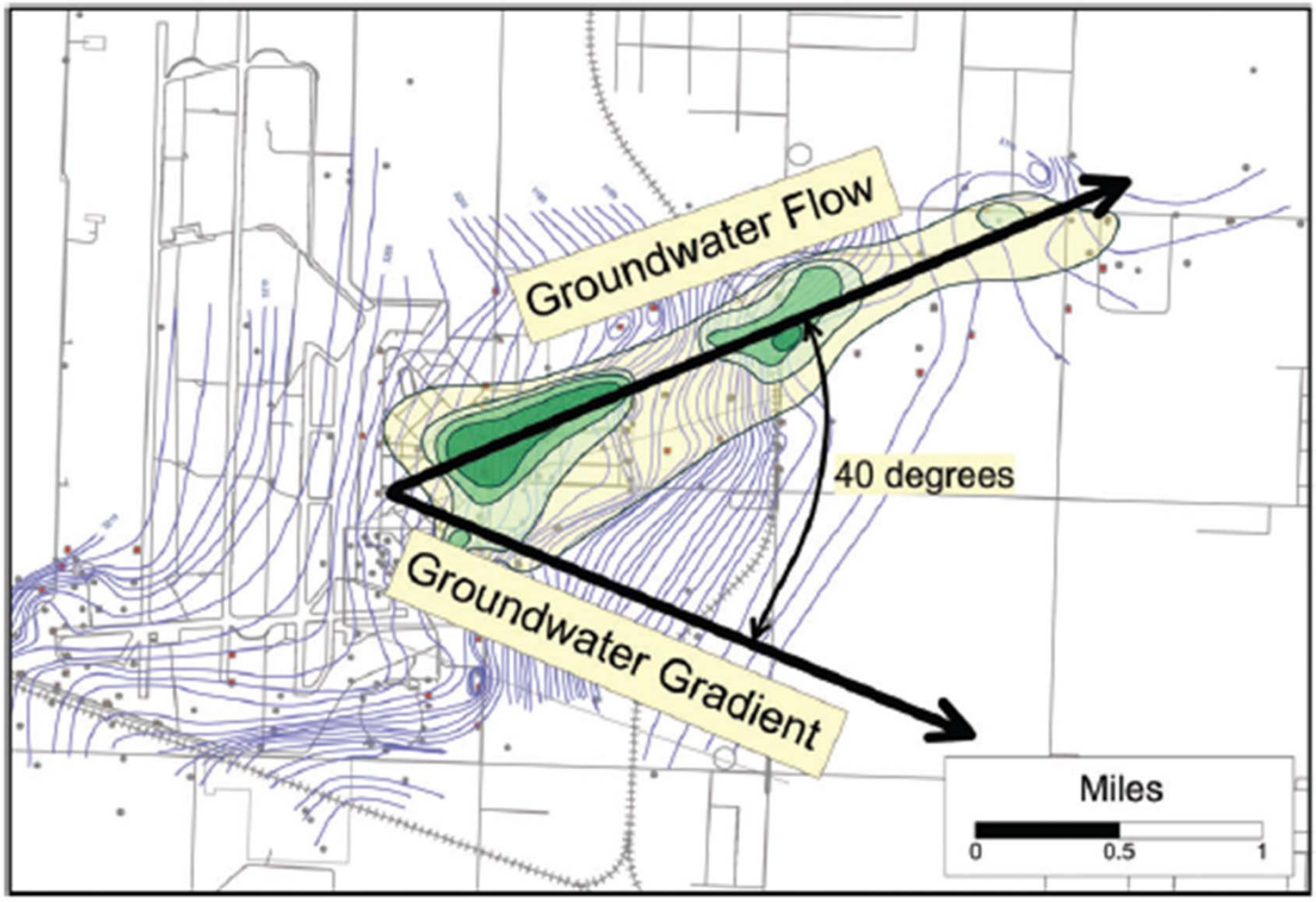
This GW Flow is really questionable

Key Point

Use fundamental groundwater methods

Groundwater Flow Not Aligned

(Suthersan et al. 2016)



Take Home Points

- Our internal QA/QC system is working as technical reviews are providing our RPMs and consultants valuable feedback.
- We are spending large sums of money for the work products in order to reach site closure and therefore a high quality work product is expected.
- Don’t forget who the client is and what the work product means.
- Spelling and grammar errors may seem trivial but they add up, and if the work product is poorly written, then one might conclude that the methods of investigation and/or remediation are of poor quality as well.
- We are being protective of human health and the environment, and by using QA/QC we can achieve closure expeditiously and in a responsible manner.

Take Home Points

- We may not have deficiencies resulting in censure, suspension or revocation like the MA LSP program, however, there is always room for improvement.
- Hydrogeologic parameters must be calculated to accurately determine aquifer characteristics.
- Things are not always as they appear and therefore update and use the CSM as tool for investigation and for developing remedial strategies.
- For sites with a hyporheric zone, it must be defined in order to eliminate data gaps, and to avoid costly investigation/remediation mistakes.
- Remember to use fundamental groundwater methods for developing the CSM.

Wrap Up

- **Please complete the feedback questionnaire at the end of this webinar. We are counting on your feedback to make this webinar series relevant!**

- **Next OER2 Webinar Info….**

Title: *Recent Developments in Petroleum Site Management*

Presenters: Mike Singletary (NAVFAC SE) & Chuck Newell (GSI)

Date: October 19th, 2016

Time: 11:00-12:00 PDT

- **Thank you for participating!**