



1

Common Report Problems	Following the CSM
	Sampling
	Tables & Figures
	Reporting

2

Common Problems with the CSM

- Fully describe the property setting
 - Site history and use
- Were ALL the following addressed as part of the CSM?
 - Contaminants of Concern (Soil and/or Groundwater)
 - Release Mechanisms
 - Migration Pathways
 - Receptors
 - Exposure routes

3

Sampling

When is enough, enough?

- Analyze samples for all known or anticipated constituents of concern

Composite vs Grab samples

Have you determined the nature and extent of impacts?

Confirm if groundwater sampling and investigation is required

Field Screening vs Laboratory analysis

4



Do data gaps exist?



5

Figures

1

Provide figures drawn-to-scale.
Use current air photos and/or site CAD drawings to define features and boundaries.
Label relevant features.

2

Include a comprehensive legend – all items depicted should be defined.
Don't forget a north arrow and scale bar!

3

Figure title should indicate content.
Example: "Site Groundwater" should include groundwater contours and flow direction as required.

4

Clearly depict sampling locations in a way the reader can quickly and easily identify presented locations (i.e., soil boring, monitoring well, surface water sampling point).

6

Tables

1

Table is clearly titled

2

Don't forget Notes.
Spell out acronyms, data
qualifiers, sample id
nomenclature, applicable
standards.

3

Avoid the "Data Dump".
Include data summary
tables specific to sample
medial (i.e., soil,
groundwater, vapor)

4

QC, QC, QC.
Data tables should be
checked to confirm
accuracy and standards are
correctly applied.
Table # is properly
referenced in the text...

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Reporting



Does the report
describe the CSM
and all activities that
have taken place to
date?



Follow the state
specific regulations
for preparing the
report



The report must
stand alone.



Do not direct your
reader to
consistently look
back at an old report
→ provide a
summary in the
current report



Follow the
regulations



Take ownership of
the document. If you
sign it you own it.

You are putting your
license/reputation
on the line.

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Reporting – Conclusions and Recommendations




- Define if objectives were achieved...has nature and extent of impacts been adequately defined.
- Define if the outcome of the report meets the requirements under the regulations.
- If appropriate recommend future actions.
- Provide an update CSM using assembled data
- Tell a Good Story

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Phase 2 Blues (Notes From a Regulator)

John Fitzgerald, MassDEP

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Don't Do These Things



*There is no evidence of
contamination...*




*I'll make my data fit my
Conceptual Site Model...*

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Real-Life Example

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A site somewhere near Boston....

Textile Manufacturing 1850 – 1930
Metal plating/Anodizing 1940 – 1986

PCE – TCE – 1,1,1-TCA – MEK
Sulfuric Acid

Process Waste Discharge to Sewer &
Dry Well

Depth to GW 3 to 13 feet at site

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First Phase 2 Study – 1993

BY THE NUMBERS

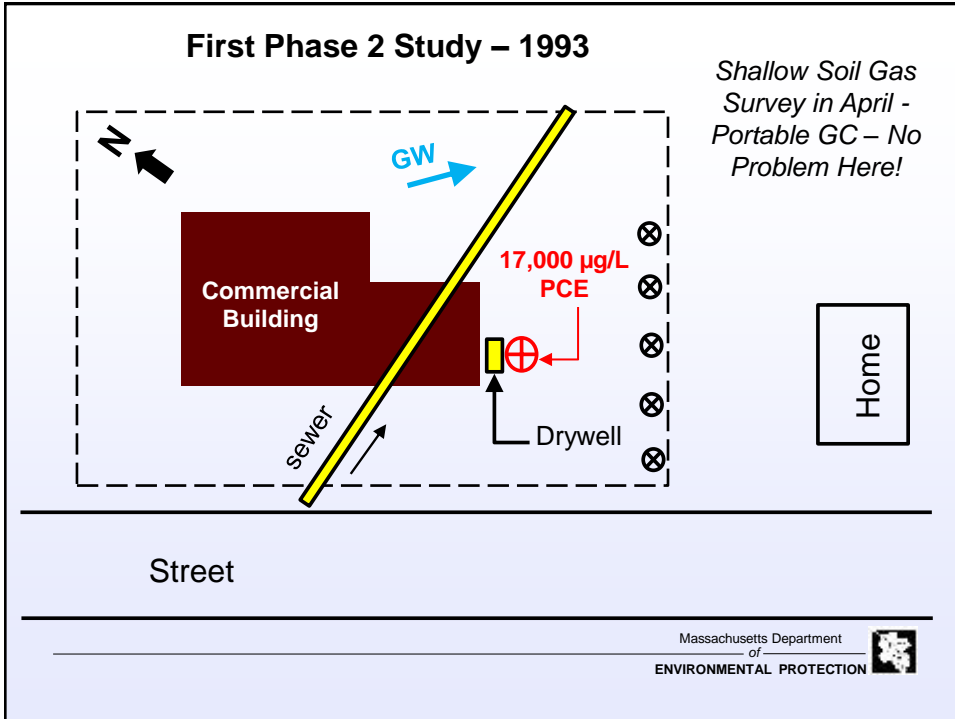
- 1 acre property
 - 12 borings
 - 16 shallow GW wells
 - Soil Vapor Survey
- ALL ON
PROPERTY!

REPORT

- 21 pages of text
- Contamination due to spills and drywell
- References to numerous other prior reports

*DON'T DO THAT – PHASE II SHOULD BE
STAND ALONE!*

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First Phase 2 Study – 1993

REPORT CONCLUSIONS:

“the pathways for potential exposure were found to be incomplete.”

“there was no evidence of VOCs migrating off-site”

MassDEP CONCLUSION

“The Phase II report did not meet the requirement to identify the source or to characterize the extent of the release and is therefore in violation of the MCP.”

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What Would YOU Do Differently?

Conceptual Site Model

PCE/TCE is denser than water.....



Preferred Flow Paths?



Vapor Intrusion Concern?



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Do-Over

18

Second Phase 2 Study – 2014

BY THE NUMBERS

- 7 more shallow wells
- 2 deep wells (30 feet)
- soil gas/sub-slab probes
- Indoor air sampling @ 3 Buildings (1 off site)

Some up to 100 feet off property

REPORT

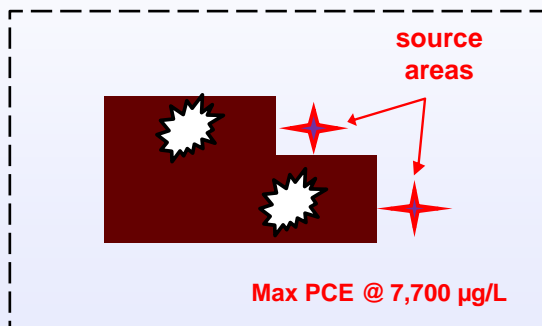
- Data tabulations/contours and cross-sections ✓
- 2 source areas on-property (dry well & waste pipe)
- High PCE (3000 µg/L) in deep well
- Vapor Intrusion Pathways Identified

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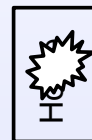
Second Phase 2 Study – 2014



Commercial Building

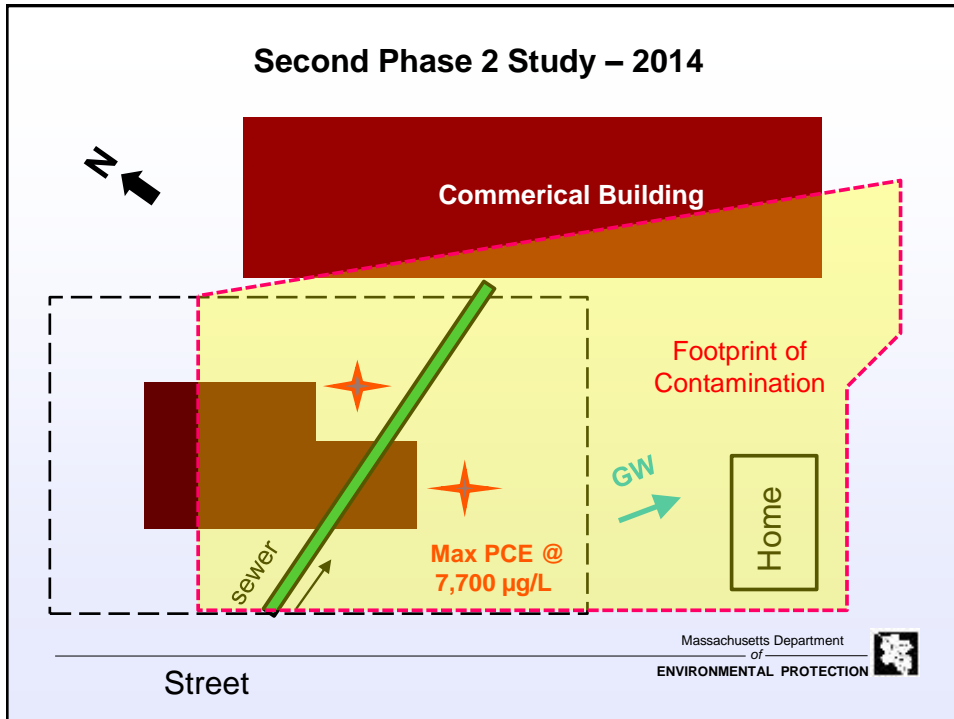


3 vapor intrusion pathways identified



Street

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Second Phase 2 Study – 2014

REPORT CONCLUSIONS:

“the sewer crossing the site “does not seem to serve as a significant groundwater sink, since the plume of dissolved CVOCs in shallow groundwater migrates across this feature”

*“(consultant) did not observe separate phase material during our investigation, and the observed concentrations of PCE or TCE in soil did not exceed the Upper Concentration Limits for these compounds set forth in the MCP. Accordingly, (consultant) **does not have information to suggest that DNAPL is present at this Site.***

“Current Site conditions do not pose a significant risk to current receptors”

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Second Phase 2 Study – 2014

MassDEP CONCLUSION

- *Need more off-property/deeper investigations*
- *Potential for sewer to act as preferred flow path must be further evaluated.*

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What Would YOU Do Differently?

Conceptual Site Model

Preferred Flow Paths? Sewer Issue?



Can't see DNAPL? Below MCP UCL value? So
Must be OK?



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Do-Over

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Third Phase 2 Study – 2021

BY THE NUMBERS

- 23 more wells
- deep wells to 102 feet
- Multiple sampling rounds in 48 GW wells
- Indoor air sampling @ multiple buildings

REPORT

- Extensive tabulations, figures, discussions ✓
- Plans for sewer obtained and sewer sampled; no significant impacts from site
- “Detached” site plume and “orphan” plume

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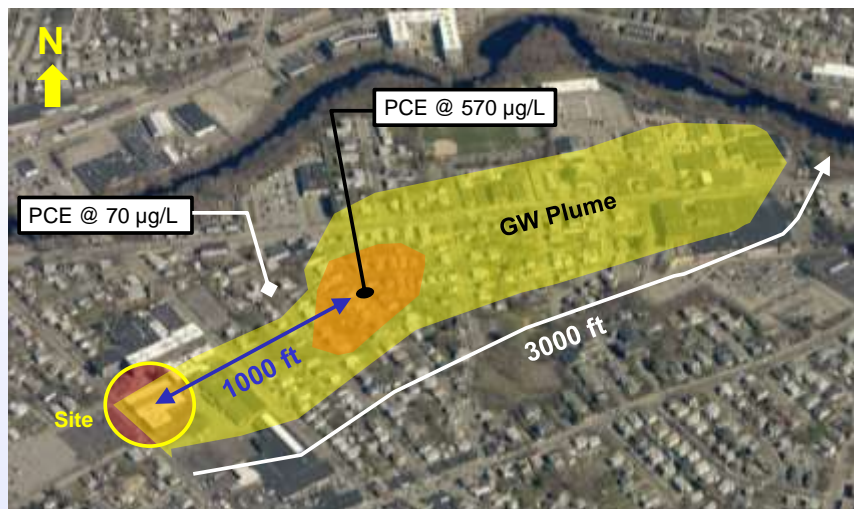
Third try.....mandated off property investigations



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(Phase 2)³ Report (2021)



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Third Phase 2 Study – 2021

REPORT CONCLUSIONS:

“No Significant Risk exists under current and future conditions with the operation of the existing sub-slab depressurization systems”

Sewer not a preferred flow path for site contaminants

Side area with 70 µg/L PCE not from site

MassDEP CONCLUSION

“Yeah....about that....”

What's up with that Detached Plume, with the highest downgradient PCE concentration in groundwater 1000 feet from the site?

What's up with that “Orphan Plume” of 70 µg/L next to the site plume....

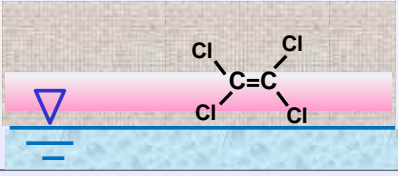
What Conceptual Site Model could explain this?

2021 Phase 2 Report CSM


“Detached Plume” with highest gw contamination 1000 feet from release location? → Report CSM did not address

70 µg/L not from site? ↓

Likely a “surfacial release” at this location... BECAUSE...PCE is present in vadose zone @ 2-4 feet and 5-7 feet below ground surface.



A – HA!

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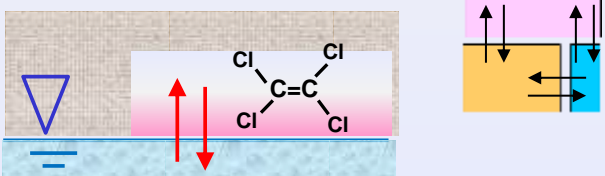
2021 Phase 2 Report CSM

Report CSM may be plausible EXCEPT THAT

Depth to GW only 4 – 5 feet below ground surface AND

Soil PCE concentrations values were wicked LOW (0.003 mg/kg) AND


Partitioning calculations show that a PCE groundwater concentration of 70 µg/L can partition to the vapor phase and then sorb onto vadose zone soils at levels well above 0.003 mg/kg PCE reported



$$Z_1 = 1/RT$$

$$Z_2 = 1/H$$

$$Z_3 = (\rho Kd)/H$$

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Are there alternative Conceptual Site Models that could better explain site conditions?



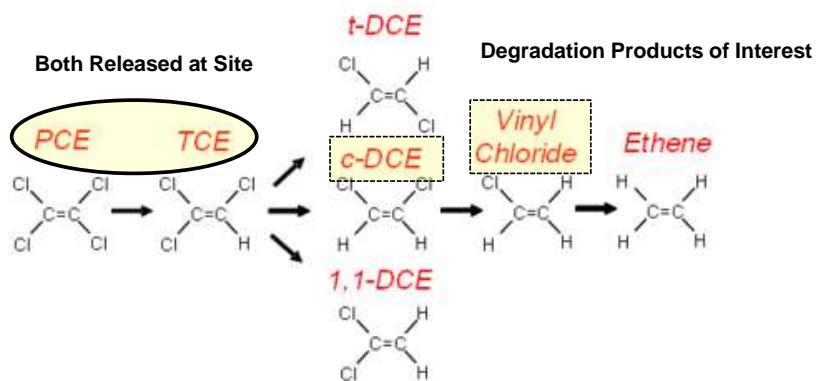
Need to open the CSM toolbox

Chemistry of Plume
Preferred Flow Path research
Hydraulic Evaluation

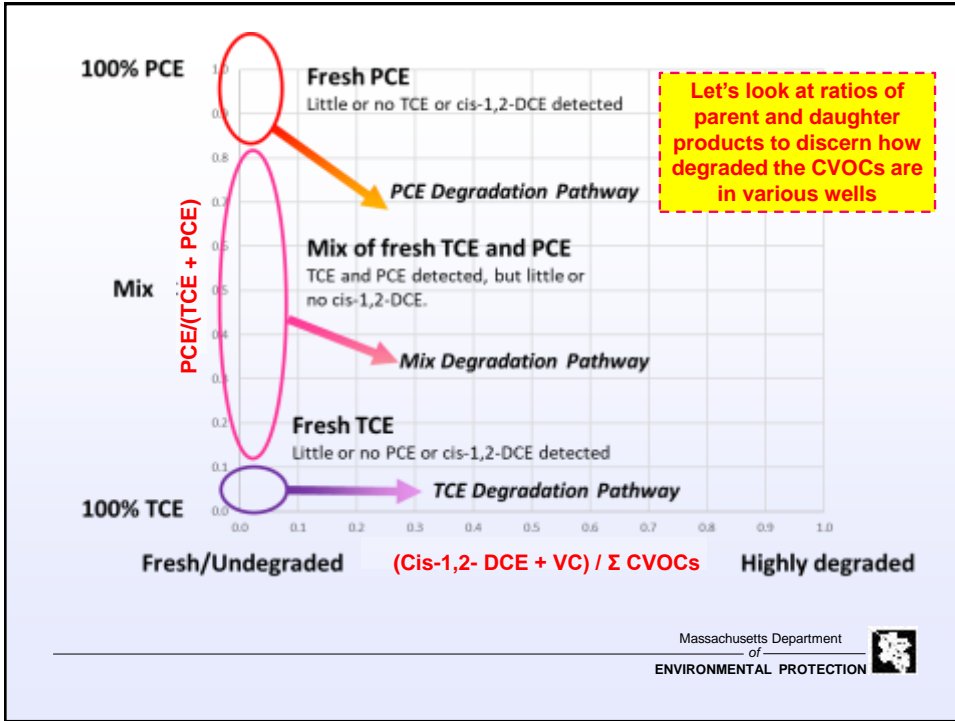
33

Groundwater Plume Chemistry

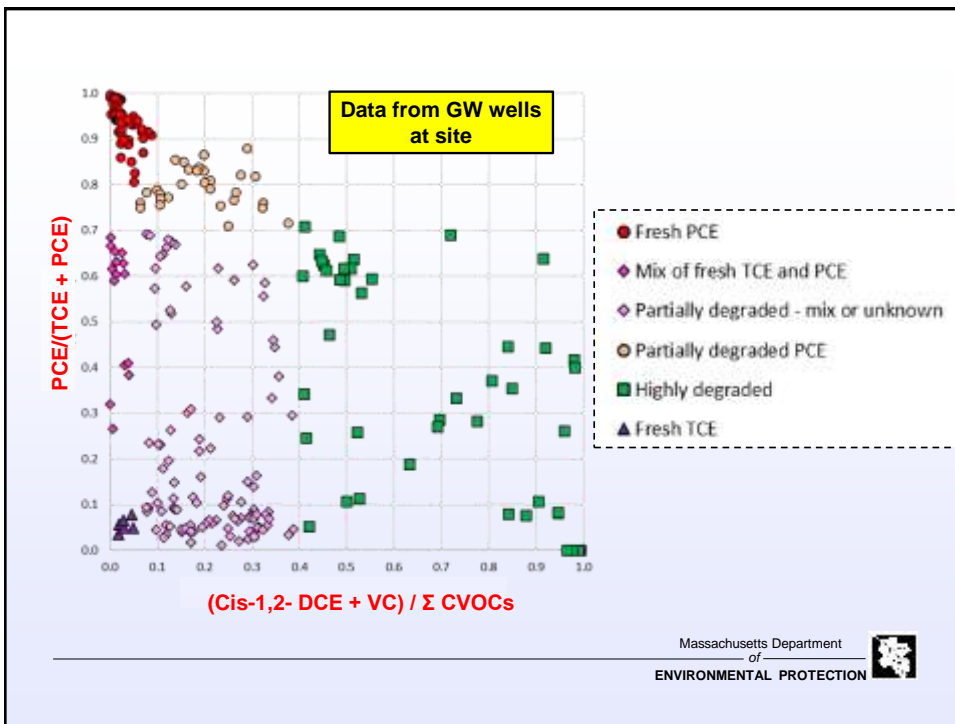
Let's check the chemistry of the groundwater plume (with respect to fresh/weathered contaminants)



34

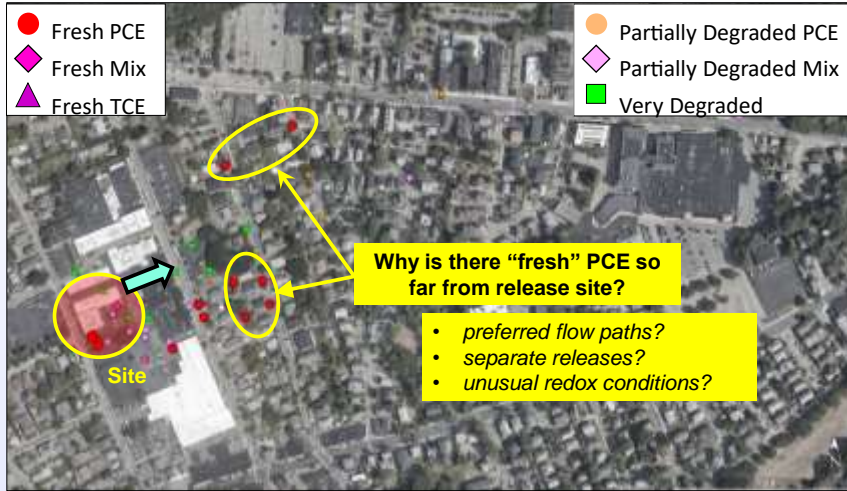


35



36

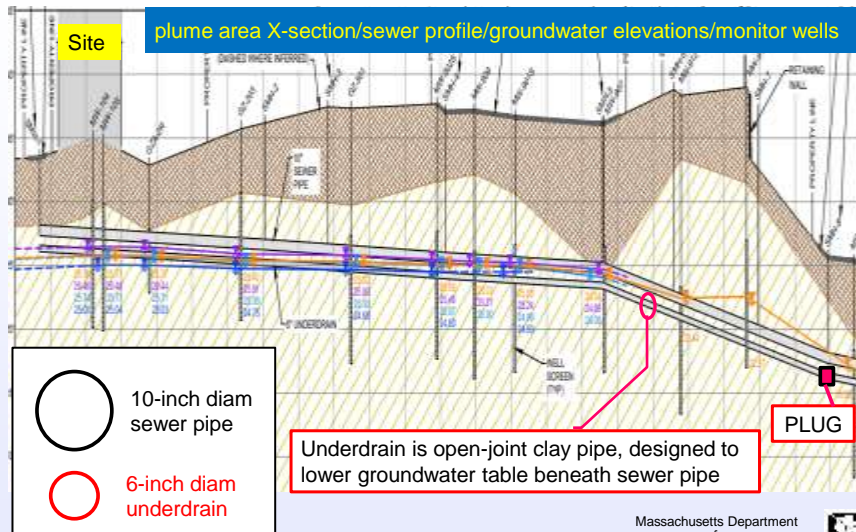
Groundwater Plume Chemistry



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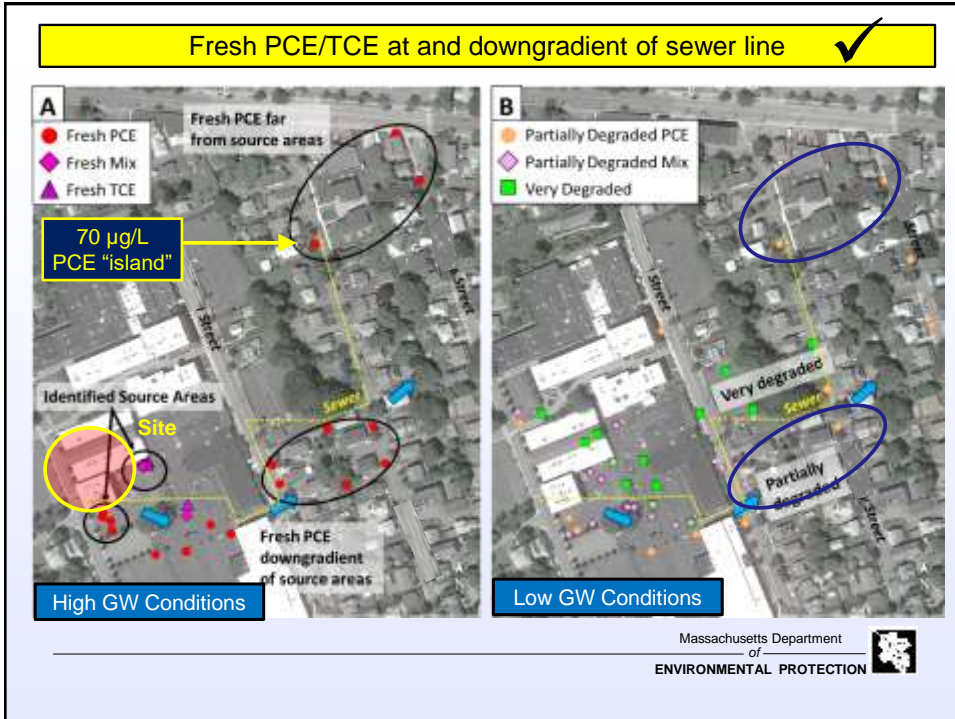
37

Preferred Flow Path - Sewer

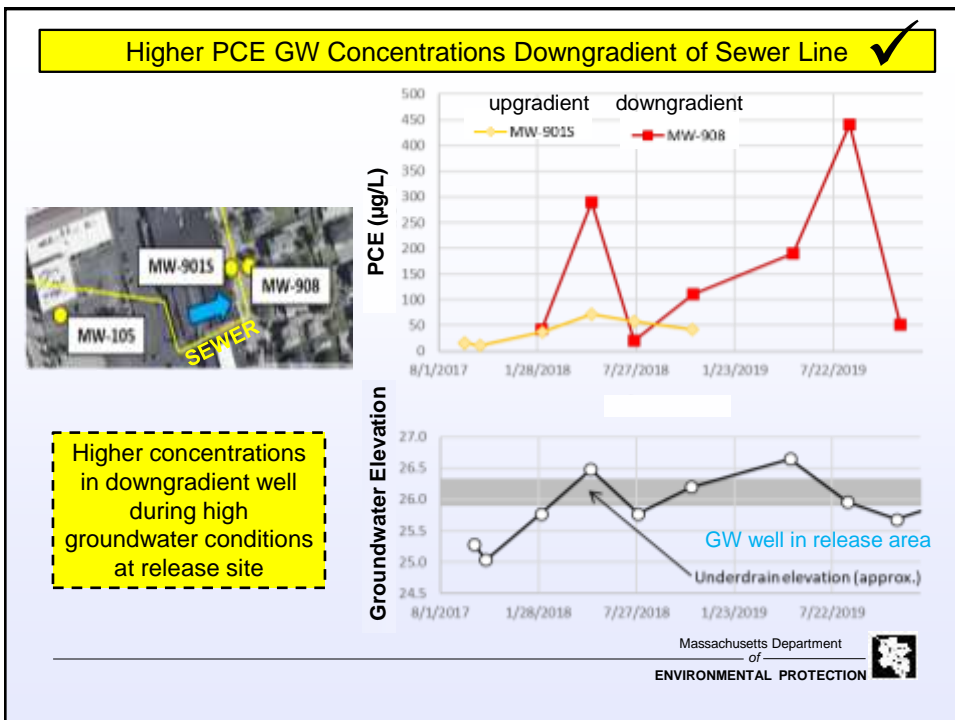


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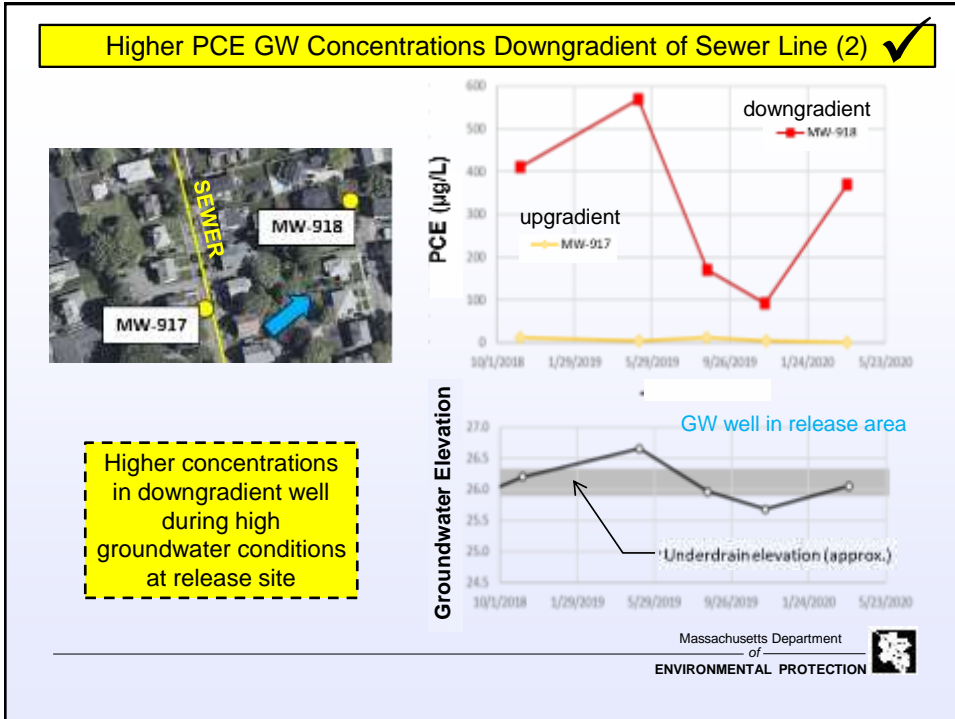
38



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So, groundwater/contaminant transport in the sewer underdrain seems to explain....

- *The appearance of a “detached plume” and high/“fresh” conc of PCE 1000 ft downgradient*
- *The mystery origin of the 70 µg/L PCE “Island” (spoiler alert – the spills at the site in question)*

Next Steps.....

- *Obtain data to confirm or deny this CSM, e.g., locate and sample water in underdrain system*
- *Phase 2 take 4?*

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Executive Summary/Conclusion

Don't just talk the talk...
Walk the walk.



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