Passive and Active Soil Gas Sampling Along Sanitary Sewer Line used for Source Area Delineation and Vapor Intrusion Assessment

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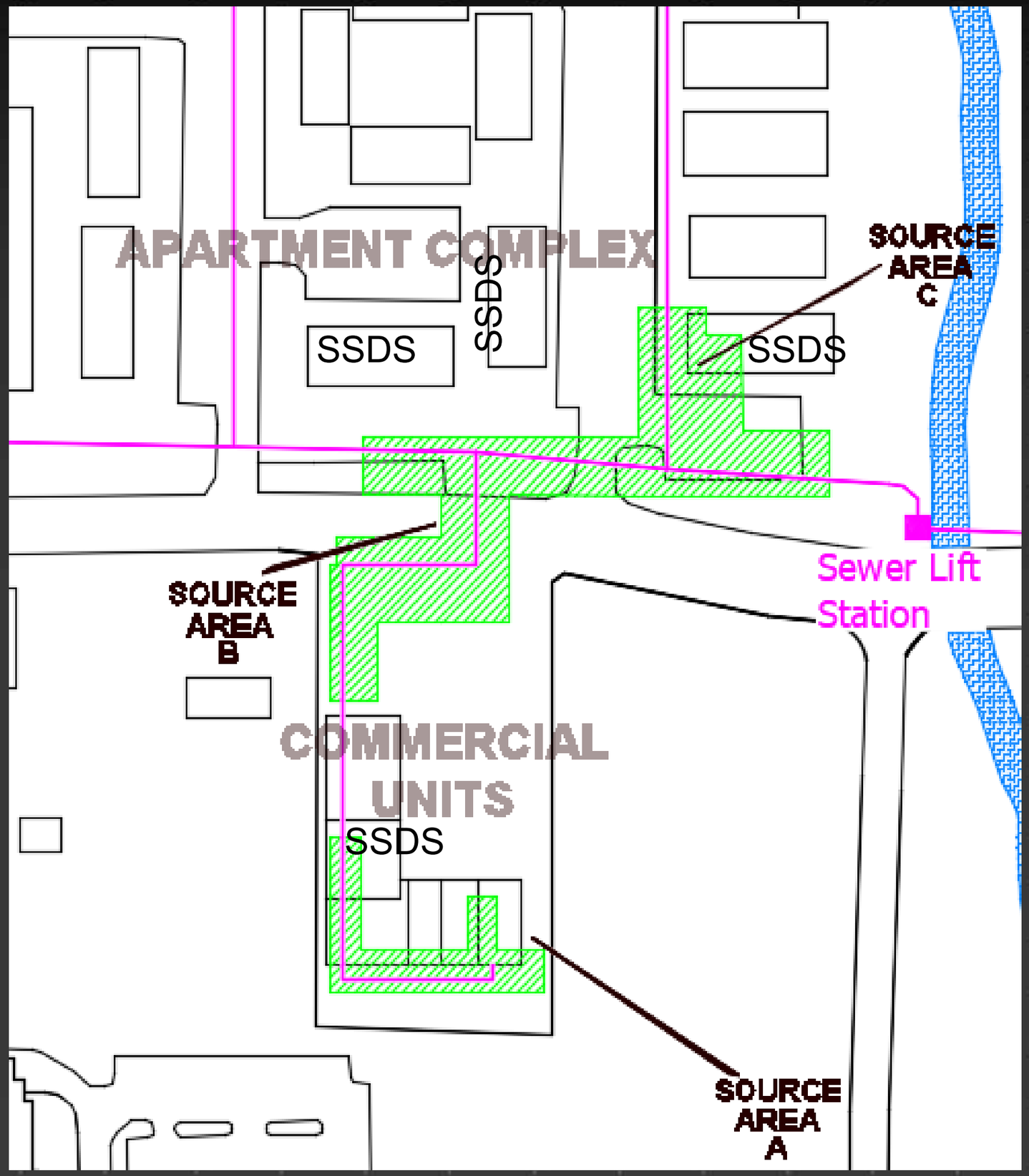
Site Setting & CSM

- Midwest Location
- Multi Unit Apts to North
- Multi Unit Commercial Retail to South
- PCE disposed at Drycleaner via sanitary sewers

- Groundwater flows to the south
- Upgradient source for cVOCs (namely cis-DCE and VC)
- EPA Involvement

Source Areas

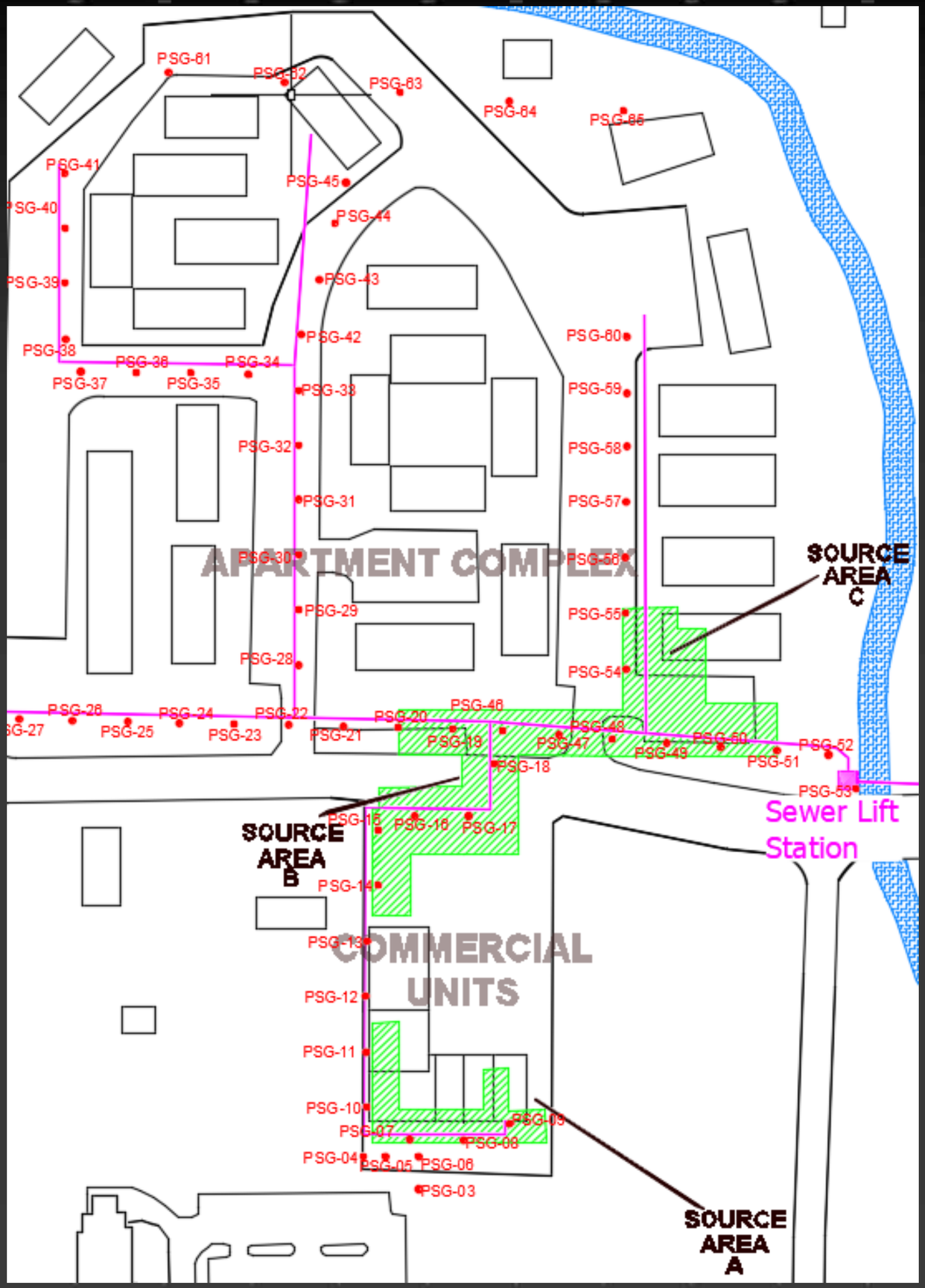
- Soil sampling identified the source area releases along the sanitary sewer.
- Lift station plugged causing backup in sewers
- The northern source argues that cVOCs detected under Apts. were from widespread release / backup throughout Apts.
- EPA required additional confirmation of source area delineation.



Source Area Confirmation

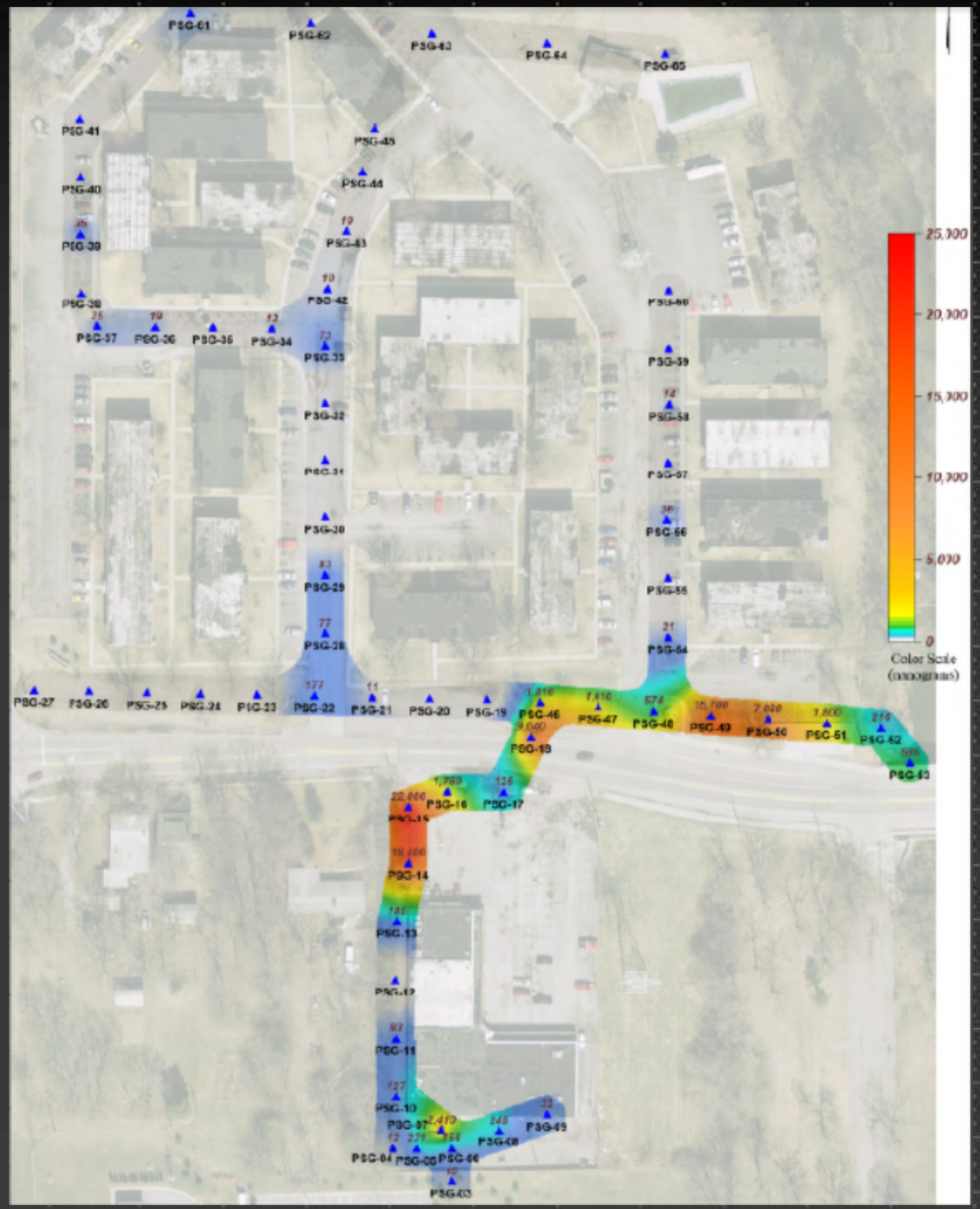
Passive Soil Gas (PSG) Investigation:

- Installed 65 PSG samplers (Beacon Passive Soil-Gas Technology™) along sanitary sewer line 30 inches below ground surface
- Retrieved samplers 14 days after installation
- Analyzed samples for volatile organic compound mass by Beacon



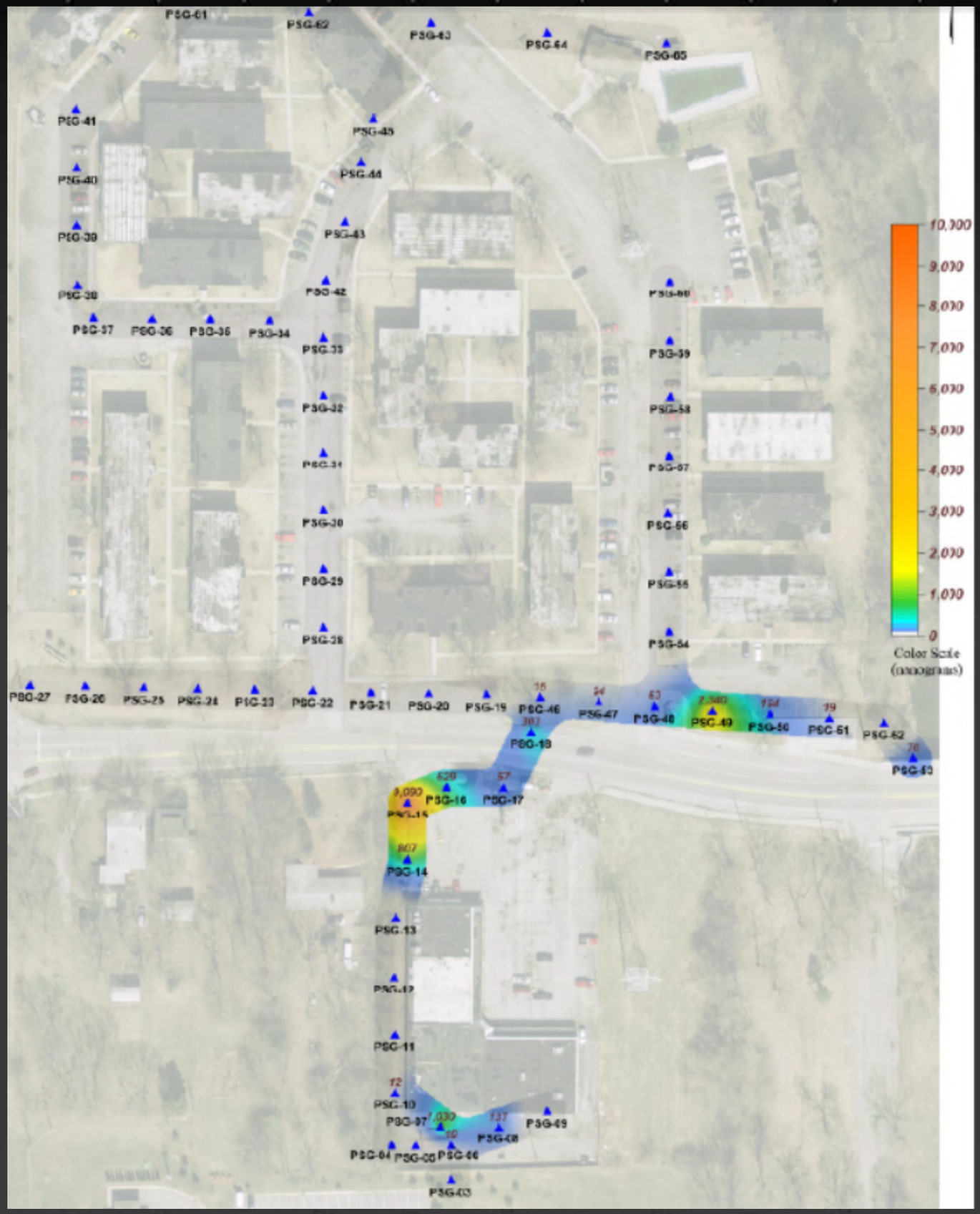
PSG Results
PCE Mass

- Lateral distribution of PCE along sanitary sewer
- Highest detections within previously identified Source Areas
- PCE mass was along the sanitary sewer was not widespread throughout the apartment complex
- Sewer corridor provides some preferential pathway for vapors; explains PCE detections on western side of apt complex



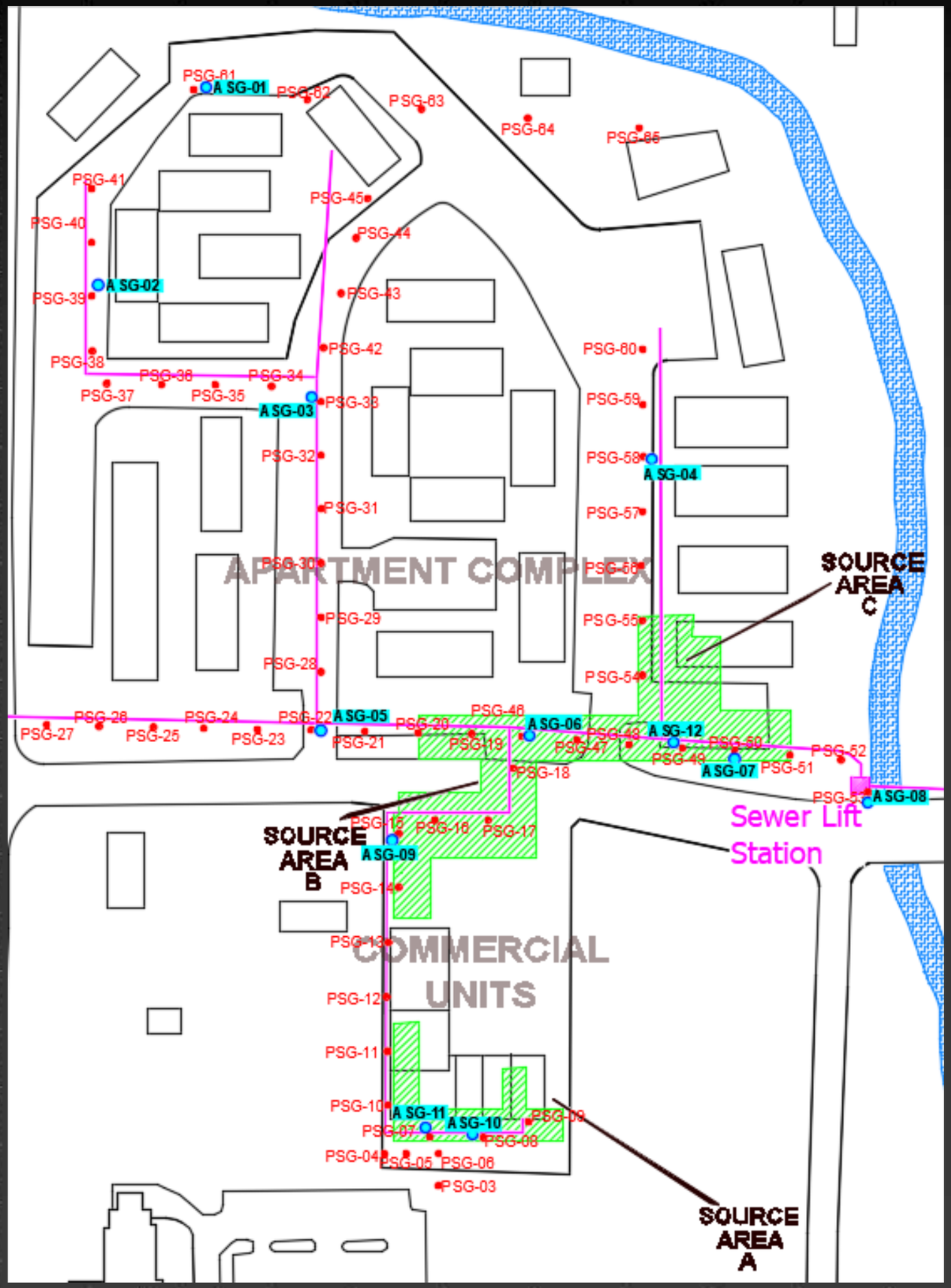
PSG Results
TCE Mass

- Lateral distribution of TCE along sanitary sewer
- Highest detection within previously identified Source Areas coincidental with
- TCE not detected along sanitary sewer throughout the apartment complex

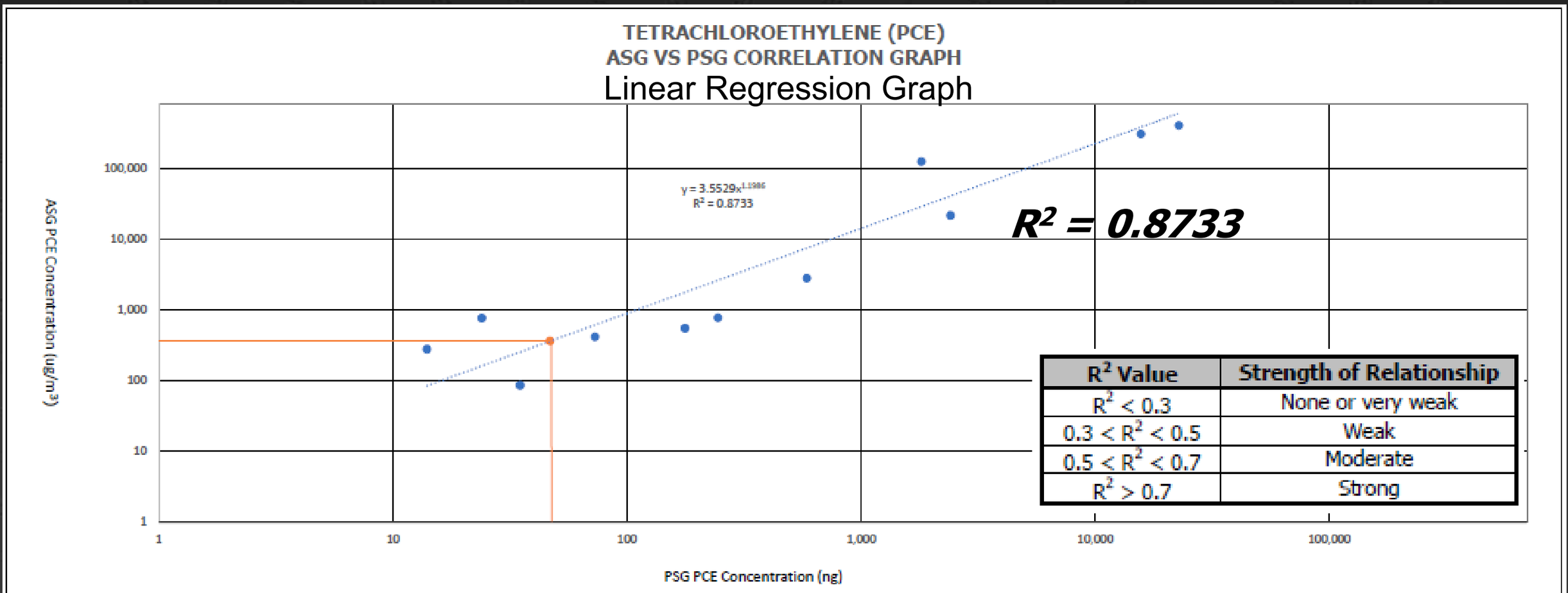


Active Soil Gas Sampling

- EPA requested the validation of PSG results with ASG sampling.
- Installed 12 ASG monitoring points along sanitary sewer line 48 inches bsg.
- Locations selected based on PSG results
- Soil Gas Sampling SOP
- Analyzed samples for volatile organic compounds via TO-15.

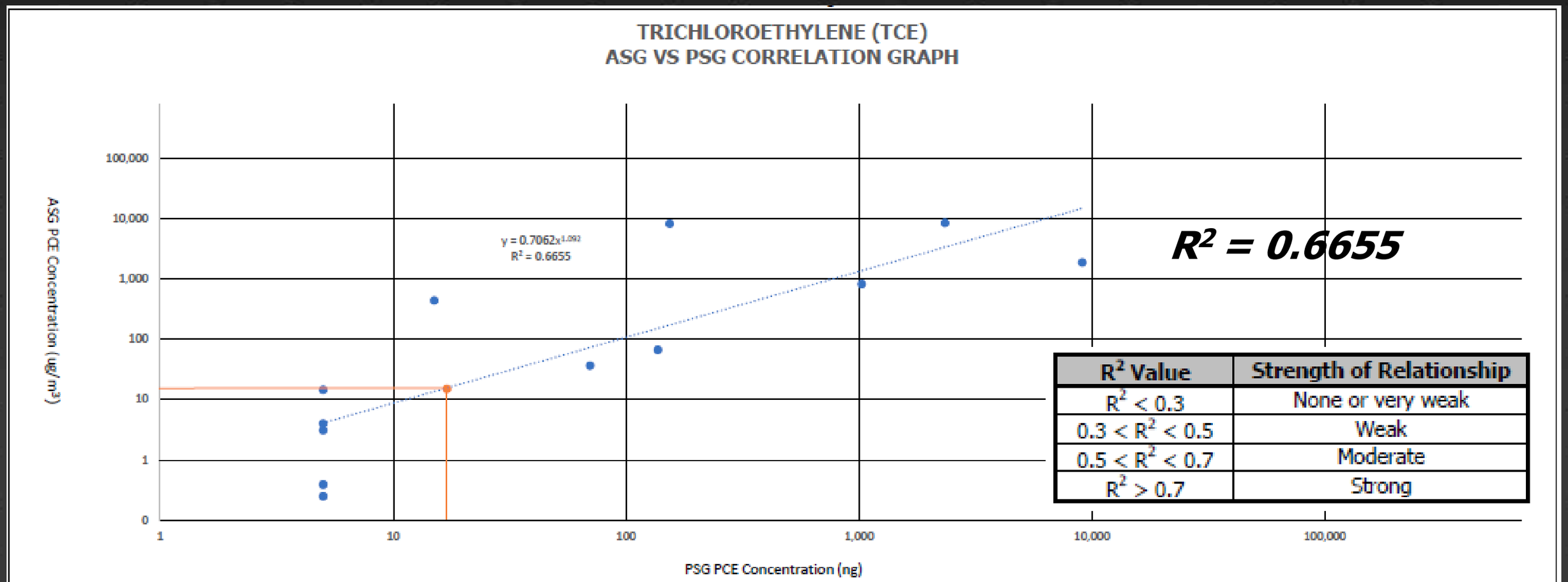


PCE Results - Statistical Correlation



Sample ID	ASG (µg/m³)	Sample ID	PSG (ng)	Correlation Prediction (µg/m³)
ASG-09	402,000	PSG-15	22,800	705,531
ASG-12	305,000	PSG-49	15,700	437,846
ASG-07	905,000	PSG-50	7,080	158,148
ASG-11	21,500	PSG-07	2,410	39,867
ASG-06	124,000	PSG-46	1,810	27,645
ASG-08	2,800	PSG-53	586	6,536
ASG-10	771	PSG-08	245	2,143
ASG-05	548	PSG-22	177	1,414
ASG-04	277	PSG-58	14	55
ASG-03	416	PSG-33	73	456
ASG-02	85.7	PSG-39	35	178
ASG-01	763	PSG-61	24	110

TCE Results - Statistical Correlation



R^2 = 0.6655

R^2 Value	Strength of Relationship
$R^2 < 0.3$	None or very weak
$0.3 < R^2 < 0.5$	Weak
$0.5 < R^2 < 0.7$	Moderate
$R^2 > 0.7$	Strong

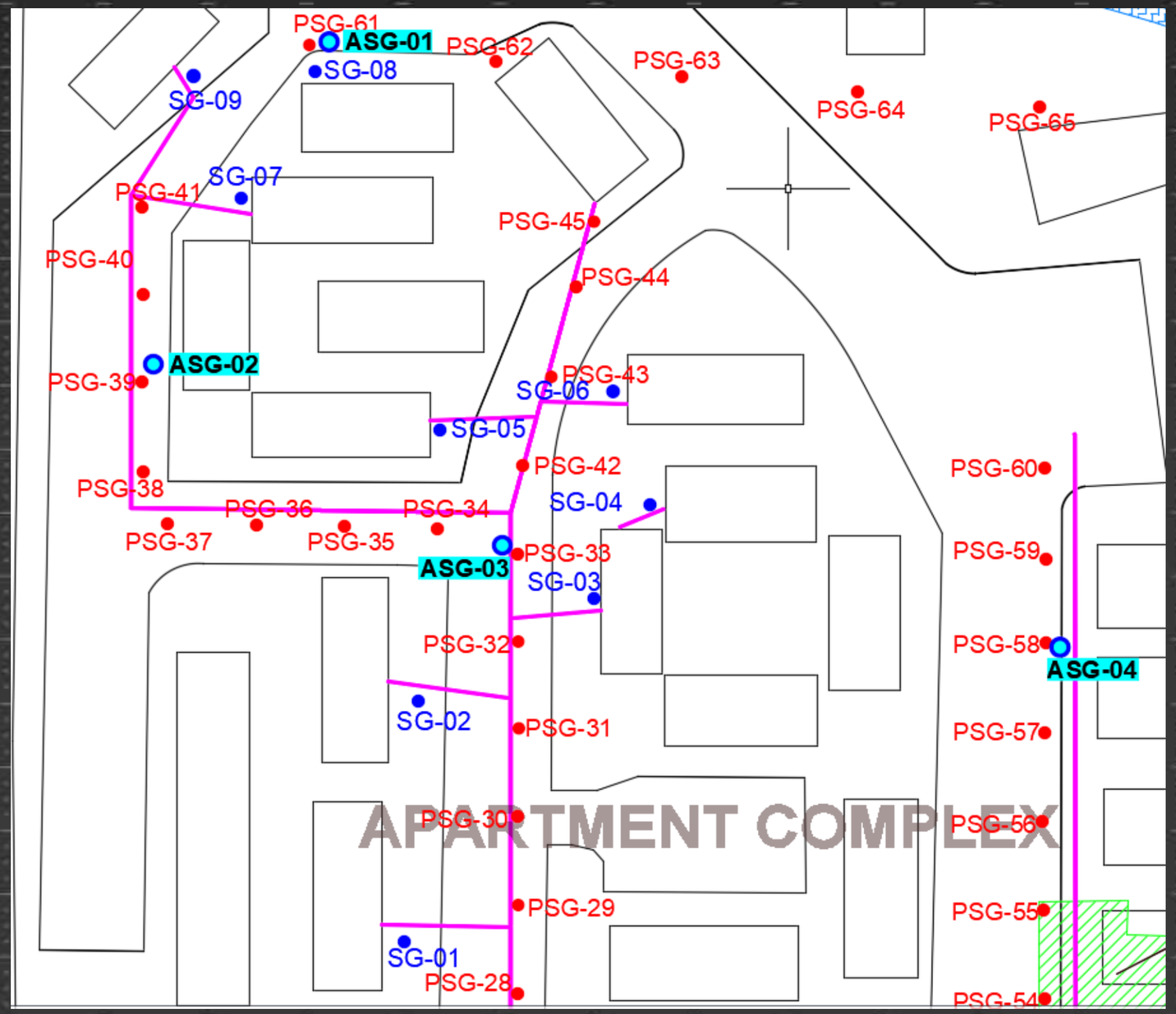
Sample ID	ASG (µg/m³)	Sample ID	PSG (ng)	Correlation Prediction (µg/m³)
ASG-09	1,880	PSG-15	9,090	14,848
ASG-12	8,480	PSG-49	2,340	3,374
ASG-07	8,270	PSG-50	154	173
ASG-11	829	PSG-07	1,030	1,377
ASG-06	440	PSG-46	15	14
ASG-08	37	PSG-53	70	73
ASG-10	67	PSG-08	137	152
ASG-05	0.25	PSG-22	5	4
ASG-04	4	PSG-58	5	4
ASG-03	3.1	PSG-33	5	4
ASG-02	0.39	PSG-39	5	4
ASG-01	15	PSG-61	5	4

Key Takeaways of PSG and ASG

- PSG sampling confirmed initial CSM that the sanitary sewer was the release point of cVOCs AND the sewer back up was limited in its extent into the apartment complex.
- Statistical Correlation of PSG and ASG analytical results convinced EPA of the suitability of using PSG for source area delineation purposes.
- No additional source area delineation was required by the USEPA

Follow-Up Soil Gas Sampling for VI Assessment

- PSG sampling identified preferential soil gas pathway via the sanitary sewer backfill
- EPA requested follow up ASG sampling to evaluate VI risk at apartment complex buildings
- Installed 9 ASG points at location & depth corresponding to adjacent sewer laterals
- Sampled using Soil Gas SOP
- Analyzed samples for volatile organic compounds via TO-15



Follow-up ASG Sampling Results

- No VOCs detected above USEPA Residential Vapor Intrusion Screening Levels.
- Other than the continued SSDS units near the source areas… no further vapor intrusion assessments at the apartments were necessary.

Lessons Learned

- For correlation purposes, the ASG sampling points were set shallow to correspond with PSG sampling points.
  - A small number of the ASG points reported leak test failure during sampling. Commonality was failure points were with points through paved surfaces.
  - The failures were associated with short circuiting via the granular foundation of the concrete surfaces and poor integrity of the concrete.
- The ability to validate our PSG results was critical with EPA involvement.
  - Highly recommend that a limited number of ASG samples be collected during any PSG investigation.

QUESTIONS?

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