Denise Trabbic-Pointer, CHMM
November 2024; Revised December 26, 2024

Residential Areas of Concern at the Former Fort Ord site

Purpose: To determine if current and future residents on and near the former Fort Ord (FO) military base are at risk of exposure to hazardous chemicals and to identify, using available information, where concerns remain and/or where more information is needed.

Summary of What We Know, and What We Don't Know

- We know that levels of chlorinated solvents like trichloroethylene (TCE), perchloroethylene (PCE) and carbon tetrachloride (CT) continue to exist in groundwater that underlies sections of the former Fort Ord military base, including existing residential and future planned development areas.
- We know that there are numerous areas at FO where soil and groundwater has been contaminated by per- and polyfluoroalkyl substance (PFAS), often called "forever chemicals" because of their persistence in the environment and in peoples' bodies.
- We know that the Department of Defense (DoD) that is responsible to clean up the messes that they made and to assure that people and the environment are protected, has not fulfilled their obligations in either regard.
- We know that governmental agencies like the Agency for Toxic Substances and Disease Registry's (ATSDR) have not met their mission to assess and protect communities from the harmful health effects of exposure to hazardous substances at FO and neighboring communities.
- What we don't know about are the full implications and probable consequences of the DoD and ATSDR's negligence in assessing the real and cumulative hazards[1] that have and continues to face the resident at and near FO.
- What we don't know are historic levels of chemical contaminants in the drinking water that was and is provided to the communities.
- We know that municipal water treatment plants and particularly Marina and Salinas, have not fully disclosed the levels or the hazards of the chemicals in the drinking water that they currently provide to the community.

The following provides additional detail and summaries of available information, what we know and what we need to know more about.

Summary of Findings – Volatile Organic Compounds (VOC)

Inhalation Route of Exposure

With regard to volatile chemicals such as TCE, PCE and CT, aside from looking at GW contours and contaminant levels, the DoD and ATSDR have not performed vapor intrusion (VI) studies and/or a review of Volatilization to the Indoor Air Pathways (VIAP) inside residential homes at Fort Ord. The fact that there are no such studies where people actually live, is a significant oversight and places all current and future residents in VOC contaminated soil and GW areas of FO at risk.

[1] To assess cumulative health hazards, you need to conduct a "cumulative risk assessment" which involves identifying all potential health hazards from multiple sources, analyzing their individual toxicity, and then combining them to determine the overall combined risk to human health, considering factors like exposure pathways and shared mechanisms of toxicity across different hazards; this often requires a comprehensive review of scientific data and collaboration with experts in different fields.

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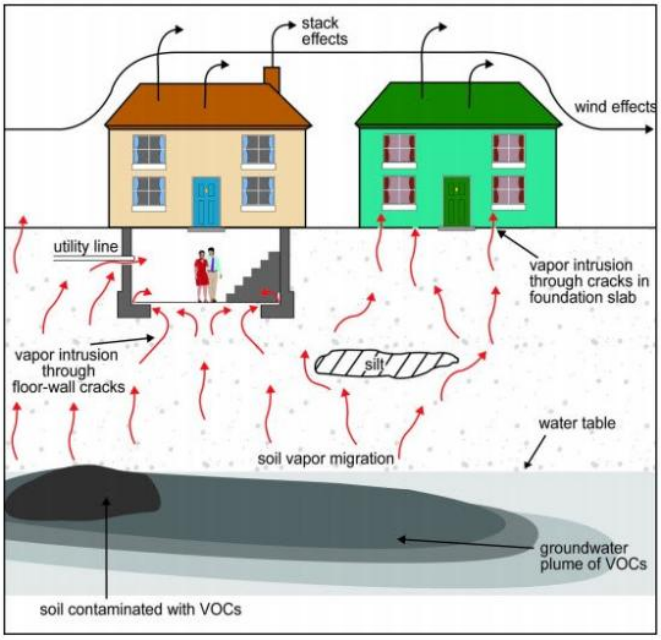
Relevant definitions:

Vapor Intrusion is the process by which chemicals from contaminated soil or groundwater enter the indoor air of a building. The following diagram is from EPA's Migration of Soil Vapors to Indoor Air.



Volatilization to the Indoor Air Pathway (VIAP) is the pathway describing the inhalation of hazardous substance vapors volatilizing from a vapor source to indoor air.

A vapor source is a concentration that above which a hazardous substance may form vapors that have the potential to migrate to a structure and cause an unacceptable human health risk.

Specific areas of concern at FO

Site 2/12 (see Figures 1 and 2) is one location where there has been vapor phase measurements. Site 2/12 is where the highest levels of TCE in groundwater were historically found (as high as 360 ug/L (ppb)) and where TCE and PCE levels still exist. The existing buildings within Site 2/12 are commercial (Michael's, Kohl's, Best Buy, Target) and not residential homes. The VIAP studies performed in 2013 and 2015 concluded that there was no unacceptable risk to indoor receptors for people working and frequenting these commercial businesses. It is important to note that the time that people would be exposed on a day-to-day basis is much less in a commercial establishment than where people live. It is also important to note that the elderly, infants and children, and people with pre-existing medical conditions would be at additional risk and at even lower VOC airborne concentrations. **The results and conclusions of the 2013 and 2015 studies in the Site 2/12 area should not be considered in any assessment of current or future residential exposures in other areas of FO.**

The OUCTP area includes a vapor extraction system for the upper 180-foot aquifer but the decisions appear to be based on carbon tetrachloride (CT) in groundwater levels and not actual vapor phase measurements. There has not been a VIAP study of the OUCTP area. There is an area in Marina, north of Reservation Road, where residential homes are located above the

OUCTP contaminated shallow A-aquifer (see Figure 3). Without having had a VIAP study of the potential for exposure to the residents in these homes, we have no way of knowing if overexposures to the carcinogen CT have occurred or are a potential in the future.

The OU2 former landfill plume area is the largest where current and future residents are at risk from inhalation of TCE inside their homes. The risk of inhalation exposure also extends to the California State University, Monterey Bay (CSUMB) Promontory Student Housing Center. Both the A-aquifer and upper 180-foot aquifer are impacted by TCE in the OU2 area. Figures 3, 4, and 5 show the historic and current outline and extent of this TCE plume. The DoD has never performed vapor phase measurements or a VIAP study inside homes within the OU2 plume areas.

Inhalation when showering with water that contains volatile chemicals can also add to people's exposure. See the *Dermal Route of Exposure* section for consideration to the dermal and inhalation risks of volatile chemicals in water sources.

If any of the areas above are uncovered with loose surface soil, it can become airborne during windy days and the particulate can be inhaled.

Ingestion Route of Exposure

Relevant Definitions

A Maximum Contaminant Level (MCL) is set by the EPA and is the highest amount of a chemical that is permitted in public drinking water systems.

EPA's Maximum Contaminant Level Goal (MCLG) is a non-enforceable public health goal that represents the highest level of a contaminant in drinking water that is not expected to cause any known or anticipated adverse health effects.

A Public Health Goal (PHG) is a level of a chemical contaminant in drinking water that is not considered a significant health risk. PHGs are not regulatory standards, but state laws require that drinking water standards for chemical contaminants be set as close to the corresponding PHG as possible.

Specific Areas of Concern near FO

There are also continued unknowns and concerns about the safety of the drinking water sources at and near the former FO base, particularly in Marina and Salinas. After analyzing Marina water reports from 2017 through 2023, we found that TCE is still present at levels that are above EPA's Maximum Contaminant Level Goal (MCLG) of zero and Public Health Goal (PHG) of 1.7 parts per billion (ppb).

Historically, there is a lack of data for actual levels of volatiles such as Trichloroethylene (TCE), Perchloroethylene (PCE) and carbon tetrachloride (CT) in drinking water sources at the FO base and surrounding communities. But it is important to understand that contaminants continue to be detected in current drinking water sources. The following is what we know about contaminant levels in drinking water systems near the former FO base.

The following is from the Marina 2023 Consumer Confidence Report (CCR).

"Trichloroethylene (TCE) TCE was a common solvent used by the U.S. Army on the former Fort Ord. In 2023, TCE was detected in wells 29, 30, and 31 at low levels, with the average level from the source wells at 0.4 parts per billion (ppb). The Public Health Goal (PHG), which is determined by a level that would not cause significant adverse health effects in people who drink the same water every day for 70 years, is 1.7 ppb for TCE. The Maximum Contaminant Level (MCL), which is the maximum level of a contaminant that can be within the drinking water, is 5 ppb for TCE. The District continues to regularly monitor for TCE in its water supply. The U.S. Army is actively cleaning up the shallow ground water plumes of TCE within the former Fort Ord lands. They also operate a network of shallow groundwater monitoring wells to track the progress of the TCE cleanup efforts. The U.S. Army groundwater monitoring wells do not supply drinking water to District customers. For more information on the ongoing cleanup efforts, please visit https://fortordcleanup.com/programs/groundwater/ ."

Table 1 is a compilation of TCE and per- and polyfluoroalkyl substances (PFAS) levels in Marina drinking water from 2017 through 2023. PFAS was not reported in the Marina prior to 2020 and was not mentioned in the 2023 Consumer Confidence Reports (CCR). The 2 PFAS compounds found in Marina drinking water, perfluorohexanoic acid (PFHxA) and perfluorobutane sulfonic acid (PFBS), do not currently have enforceable EPA MCL. PFBS has an MCLG of 2,000 parts per trillion (ppt). Michigan has an MCL for PFBS of 420 ppt. The science and understanding about the health-based risks of individual PFAS compounds is still evolving and acceptable limits for these and other PFAS compounds will likely be reduced as more is learned.

Table 1

Detected Contaminants	Units	MCL	PHG (MCLG)	Year Tested	Annual Average	Range Low - High
Trichloroethylene [TCE]	ppb	5	1.7	2023	0.4	ND - 2.3
Trichloroethylene [TCE]	ppb	5	1.7	2017	ND	ND - 1.7
Trichloroethylene [TCE]	ppb	5	1.7	2018	ND	ND – 2.2
Trichloroethylene [TCE]	ppb	5	1.7	2019	0.3	ND – 1.6
Trichloroethylene [TCE]	ppb	5	1.7	2020	0.3	ND - 1.9
Trichloroethylene [TCE]	ppb	5	1.7	2021	0.4	ND - 1.9
Trichloroethylene [TCE]	ppb	5	1.7	2022	0.4	ND – 2.3
Perfluorohexanoic acid (PFHxA)	ppt	n/a	n/a	2020	0.6	ND – 4.9
Perfluorobutanesulfonic acid (PFBS)	ppt	n/a	n/a	2020	0.1	ND – 2.0
Perfluorohexanoic acid (PFHxA)	ppt	n/a	n/a	2022	0.4	ND – 3.5

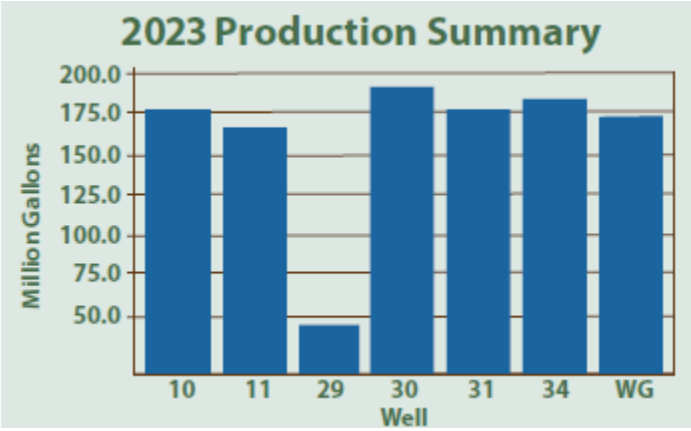
It is notable that the high range TCE level never goes below the Public Health Goal (PHG) of 1.7 ppb and is pretty much staying where it is with little change. The annual average that Marina lists is not defined and is therefore questionable in its importance and/or impact to human health and not at all useful for assessment of risk to public health. **They are significantly minimizing the risk of drinking Marina water in the annual CCR.**

The presence of even low levels of PFAS compounds in drinking water is important to understand because many PFAS compounds impact[2] some of the same target organs and systems in the human body as TCE. Kidneys are particularly at risk from ingestion of TCE and PFAS.

The 2023 Marina CCR also states that "The District provides groundwater produced from seven wells delivered through a distribution system network of eight storage tanks and nearly 215 miles of water main pipeline.

Two deep supply wells (10 and 11) located in Central Marina, draw groundwater from the 900-foot aquifer in the Salinas Valley Groundwater Basin where the water is then treated on-site for disinfection. The remaining five supply wells (29, 30, 31, 34, and Watkins Gate) located in the Ord Community, draw groundwater from the Salinas Valley Groundwater Basin's 900-foot, 400-foot, and lower 180-foot aquifers[3]. Groundwater from these supply wells is disinfected in the Ord Community chlorination treatment facility." Disinfection does not remove chemicals from the drinking water.

Well 29 has constantly and historically indicated low levels of PFAS and the well continues in use where it is blended with water from the other listed wells as shown in the for following graph from the 2023 CCR.



In response to concerns about this blending practice, the contract company responded on behalf of the DoD that "Water source blending is a common and lawful practice, though with some additional requirements, in many communities for various reasons. Though the MCWD water supply system operates as a blended system, there is no evidence this is because any particular well has exceeded state or federal drinking water standards. To the contrary, the Army and MCWD test water supply wells 29, 30, and 31 at least every three months[4] and there has been no indication these wells are not meeting drinking water standards."

As stated, it is true that measured levels of TCE and PFAS do not exceed existing drinking water standards. The problem is that, as shown in Table 1, although TCE never exceeds the

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[2] Also see "Response to ATSDR planned reevaluation of hazards posed at Fort Ord (Final)" especially regarding PFHxA, and synergistic impacts.
[3] According to the DoD Fort Ord website, "There is a very limited amount of contamination detected well below drinking water standards in the Lower 180-Foot Aquifer and no contamination was detected in the 400-Foot Aquifer."
[4] Local individuals and activist groups should request these results. Not edited results like averages and ranges, but actual results from an independent lab.

regulatory maximum contaminant level (MCL) of 5 ppb, levels do consistently meet and exceed the Public Health Goal for TCE of 1.7 ppb. In regard to PFAS, neither PFHxA nor PFBS have EPA regulatory MCL. States that do regulate PFHxA have MCL much higher than levels found in Marina drinking water and only one state has an MCL for PFBS, which is also well above the levels found in Marina drinking water. But there are cumulative and synergistic[5] impacts from the combined hazards posed by chlorinated solvents and PFAS, especially in the case of TCE and these interactions can be especially problematic in vulnerable populations (e.g. elderly, infants and children, and people with pre-existing medical conditions).

California State University, Monterey Bay (CSUMB) uses Marina drinking water but has also had their drinking water analyzed for PFAS. May 2023 PFAS testing for CSUMB indicated 5.9 ppt PFBA. Subsequent resamples did not show PFAS above the Minimum Reporting Limit (MRL) but there is no mention of if they added treatment system or why there is no further data.

One note of interest regarding CSUMB is that they have committed to using nonpotable water for some purposes. CSUMB's water model uses CalGreen standards to calculate unit demands. The average for new building demands is 87% potable and 13% non-potable. CSUMB's water model also suggests that new construction projects should reduce potable water use below CalGreen standards.

CSUMB is looking to other sources for their water – referred to collectively as ‘alternative water sources’.

These include:

- Recycled Water: Water from a municipal wastewater plant that has been treated to the point that it can be safely used again.
- Desalinated Water: Water from the ground or surface (e.g., brackish water or seawater) that has had the excess salts removed from it for use.
- Stormwater: Water from runoff from precipitation events that is captured and sometimes treated for use. The focus is not on reservoir releases for water supply or flood control. Urban dry weather runoff is often discussed in this same context as stormwater.
- Graywater: Wastewater from households or office buildings that does not contain human waste and that is diverted and sometimes treated for reuse for landscapes and for flushing toilets.

I strongly suggest that CSUMB rethink this effort and at the least include a requirement that all ‘alternate water sources’ must be tested for all drinking water quality parameters as well as PFAS. Even if they are only using the water for lawn and garden irrigation, using nonpotable water that contains bioaccumulative chemicals like mercury and PFAS could ultimately be harmful to people’s health.

The **Salinas District** drinking water has historically been impacted by tetrachloroethylene (aka: perchloroethylene (PCE or PERC)). PCE is likely to be carcinogenic to humans. The 2021 consumer confidence report (CCR) indicated that the upper range of PCE in Salinas District drinking water was 0.68 ppb vs a public health goal (PHG) of 0.06 ppb and an MCL of 5 ppb. The Salinas 2023 CCR did not include PCE results.

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[5] In the context of chemical exposure, "synergistic" means that the combined effect of two or more chemicals is greater than the sum of their individual effects, essentially meaning that when exposed to multiple chemicals together, the overall toxic response is significantly higher than what would be expected if each chemical was considered separately; it's like the chemicals amplify each other's effects.

My research did not find information that indicates Salinas District drinking water has ever contained detectable levels of PFAS.

Health Impacts from Ingesting TCE, PCE, PFHxA, and PFBS

According to the Agency for Toxic Substances and Disease Registry's (ATSDR), "People who are overexposed to moderate amounts of **trichloroethylene (TCE)** may experience headaches, dizziness, and sleepiness." ATSDR also goes on to say that "Other effects seen in people exposed to high levels of trichloroethylene include evidence of nervous system effects related to hearing, seeing, and balance, changes in the rhythm of the heartbeat, liver damage, and evidence of kidney damage. There is strong evidence that trichloroethylene can cause kidney cancer in people and some evidence that it causes liver cancer and malignant lymphoma (a blood cancer). The Department of Human Health Services (HHS) has classified trichloroethylene as "known to be a human carcinogen" based on sufficient evidence of carcinogenicity from humans. Similarly, the International Agency for Research on Cancer (IARC) has classified it as "carcinogenic to humans" and EPA has characterized it as "carcinogenic in humans by all routes of exposure." These agencies concluded that there were sufficient evidence from human studies that trichloroethylene exposure can cause kidney cancer in humans. There is also some evidence of an association between trichloroethylene exposure and non-Hodgkin's lymphoma in humans."

According to the EPA, "effects resulting from acute (short term) high-level inhalation exposure of humans to **tetrachloroethylene (PCE)** include irritation of the upper respiratory tract and eyes, kidney dysfunction, and neurological effects such as reversible mood and behavioral changes, impairment of coordination, dizziness, headache, sleepiness, and unconsciousness. The primary effects from chronic (long term) inhalation exposure are neurological, including impaired cognitive and motor neurobehavioral performance. Tetrachloroethylene exposure may also cause adverse effects in the kidney, liver, immune system and hematologic system, and on development and reproduction. Studies of people exposed in the workplace have found associations with several types of cancer including bladder cancer, non-Hodgkin lymphoma, multiple myeloma. EPA has classified tetrachloroethylene as likely to be carcinogenic to humans.

According to EPA's IRIS Toxicological Review of **Perfluorohexanoic Acid (PFHxA)**, "the available evidence indicates that PFHxA exposure is likely to cause hepatic (liver), developmental, hematopoietic (blood), and endocrine effects in humans, given sufficient exposure conditions."

In a Fact Sheet, EPA states that, "Health outcomes evaluated across available studies included effects on the thyroid, reproductive organs and tissues, development, liver, lipids and lipoproteins, and kidneys following oral exposure to **PFBS**. Based on information across different sexes, lifestages, and durations of exposure, the thyroid appears to be particularly sensitive to oral PFBS exposure."

Dermal Route of Exposure

There also must be recognition that people might be exposed to the contaminants that are present at the former FO site through the dermal route. Examples include through the use of contaminated water for washing and showering as well as from working, playing, and training in

contaminated soil. Dermal contact can also be an ingestion route of exposure if people do not wash their hands before eating and handling food products.

All of the chlorinated solvents present at the former FO site could be absorbed through the skin. Some PFAS compounds are also now known to absorb through skin. Particularly short chain, water miscible PFAS might be absorbed via the dermal route of exposure.

All of the locations discussed under inhalation, OU2, OUCTP, and unsurfaced areas of Site 2/12 could include contaminants in the soil and present a dermal contact route.

Focus on Cumulative and Synergistic Impacts

At this point in time, there has been no consideration by the DoD to the cumulative hazards posed by the contaminants remaining at the former FO site to people or the environment. Nor has consideration been given to cumulative routes of exposure to the same chemicals.

We have recommended the following to ATSDR for the 2024 reevaluation. “Cumulative exposures to chlorinated chemicals have not been assessed. Cumulative exposures should include inhalation from volatilization to indoor air, ingestion of drinking water, and dermal contact with drinking water, showering, etc. In addition, and as mentioned above, ATSDR has also not included consideration of the endocrine disrupting effects of chemicals of concern at Fort Ord in their 1996 evaluation.” ATSDR confirmed that they will include an assessment of inhalation of drinking water while showering using “data from 1985 – 1994 that is available from the U.S. Army and the Marina Coast Water District.”

There is emerging information indicating that there could be synergistic effects of exposure to PFAS and other chemicals, including some of the listed chemicals at Fort Ord, namely trichloroethylene (TCE), tetrachloroethylene (PCE), and carbon tetrachloride. A chemical synergistic effect in human health occurs when the combined effect of two or more chemicals is significantly greater than the sum of their individual effects, meaning exposure to a mixture of chemicals can produce a much more severe health impact than exposure to each chemical alone; essentially, the chemicals amplify each other's toxicity when combined. A list of resources are included at the end of this document that provide further information about the synergistic effects of PFAS.

Some of the chemicals of concern at Fort Ord are Endocrine Disrupting Chemicals (EDC) and exhibit known impacts at even low doses. Chemicals of concern at Fort Ord include benzene, TCE, PFAS and vinyl chloride. The endocrine system is a network of glands and organs that produce, store, and secrete hormones. When functioning normally, the endocrine system works with other systems to regulate your body's healthy development and function throughout life. Endocrine-disrupting chemicals (EDCs) are substances in the environment (air, soil, or water supply), food sources, personal care products, and manufactured products that interfere with the normal function of your body’s endocrine system.

<u>List of Resources</u>

- *Early life exposure to per- and polyfluoroalkyl substances (PFAS) and latent health outcomes: A review including the placenta as a target tissue and possible driver of peri- and postnatal effects* Bevin E. Blake et al… 2020, Toxicology. 2020 Oct; 443: 152565.

- *High-content analysis shows synergistic effects of low perfluorooctanoic acid (PFOS) and perfluorooctane sulfonic acid (PFOA) mixture concentrations on human breast epithelial cell carcinogenesis,* Paula Pierozan, et al…2023, https://doi.org/10.1016/j.envint.2023.107746

- *Combined effects and toxicological interactions of perfluoroalkyl and polyfluoroalkyl substances mixtures in human liver cells (HepG2),* Atinuke F. OjoAtinuke F. Ojo et al, 2020, https://doi.org/10.1016/j.envpol.2020.114182

- *PFAS Toxicology – What is Driving the Variation in Drinking Water Standards*, Christy A. Barlow. GZA Whitepaper

- *Strategies for grouping per- and polyfluoroalkyl substances (PFAS) to protect human and environmental health*, Ian T. Cousins et al…, 2020, Environ Sci Process Impacts. 2020 Jul 1; 22(7): 1444–1460

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Qualifications

My name is Denise Trabbic-Pointer. I am a Chemical Engineer with a BS and MS in Hazardous Materials Management, a career EHS professional and a Certified Hazardous Material Manager Emeritus. I retired in January 2019 after 42 years with DuPont. The last 7 years of my career were with a spin-off company, Axalta Coating Systems, as their Global Environmental Competency Leader. As it specifically relates to the topic of existing hazards to the residents in and near the former Fort Ord site and their related health risks, I was an acting occupational health manager for more than 30 years. In that role, I trained employees and facility first responders on the hazards of the chemicals that they worked with and encountered and how to properly protect themselves. For the same time period, and as part of my role as an environmental manager, I managed a number of site clean-up and remediation projects. As a global environmental manager, I reviewed numerous remediation projects, including review of proposed remedial methods as well as Phase I and II environmental impact statements (EIS) for possible acquisition. Since May 2019, I have been the Sierra Club – Michigan Chapter, Toxics & Remediation Specialist, and volunteer nationally as a technical resource for communities impacted by releases of toxics to air, water and/or soil.

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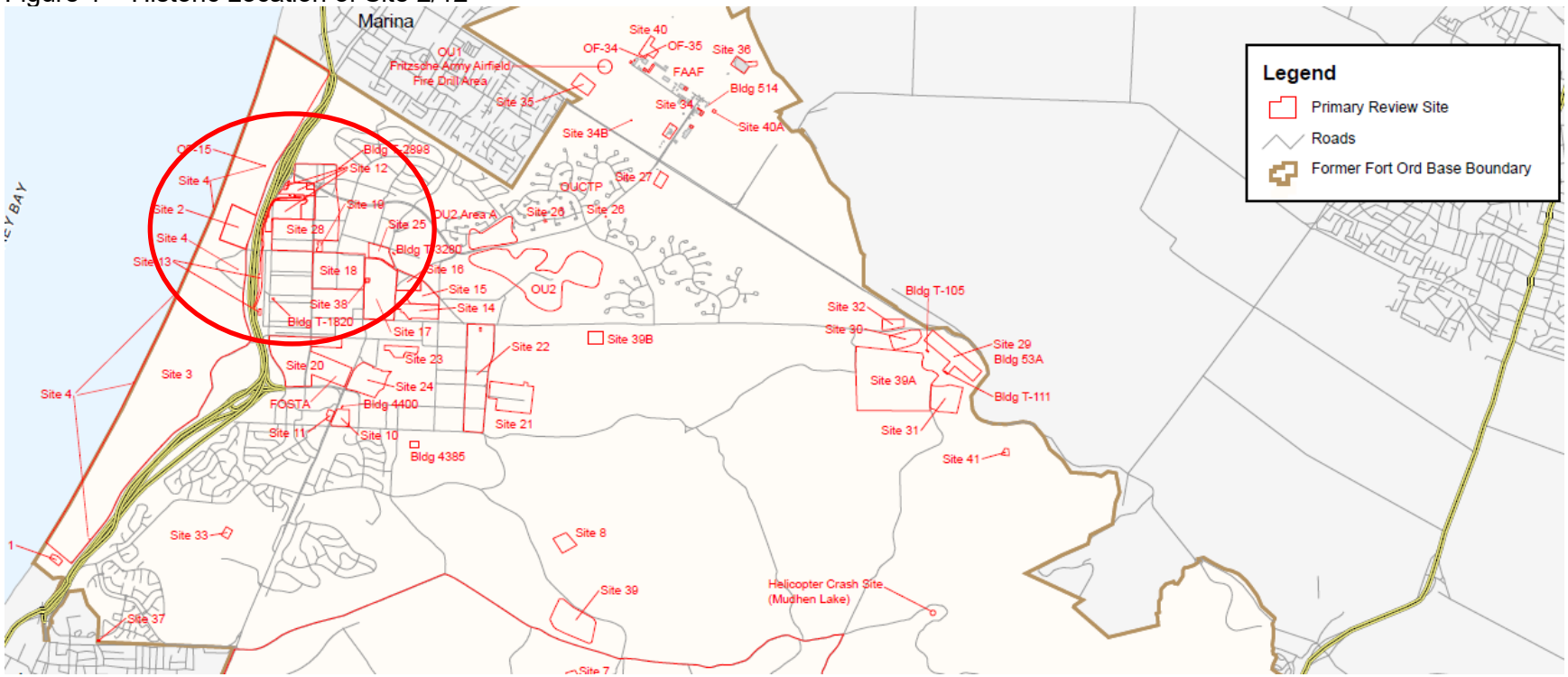
Figure 1 – Historic Location of Site 2/12



Red circle indicates Site 2/12 and historic highest TCE/PCE levels

Figure 2 – March 2024 Soil Gas TCE/PCE Concentrations (ppb). Buildings shown are currently commercial

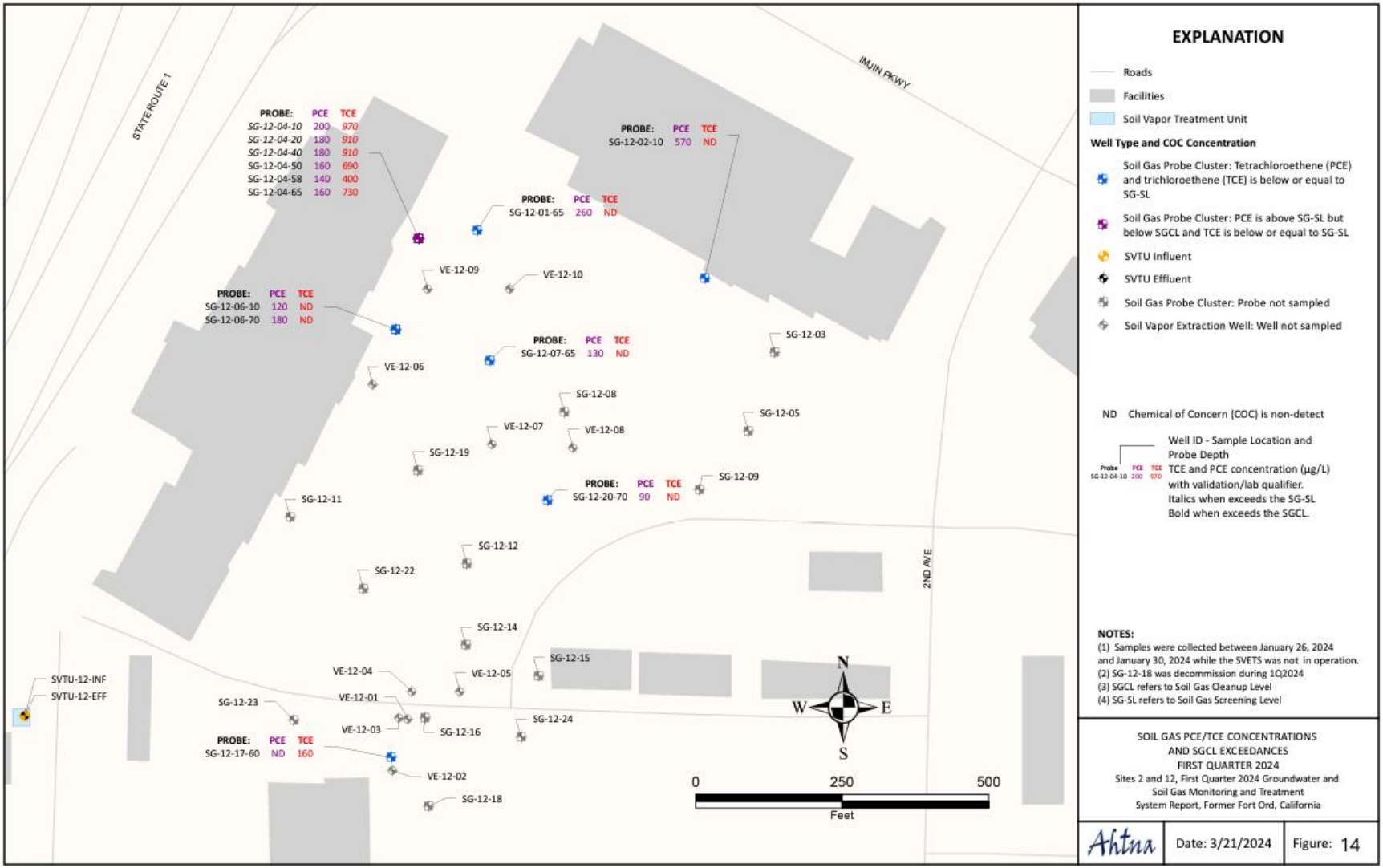


Figure 3 – Current and Historic Plume Extents

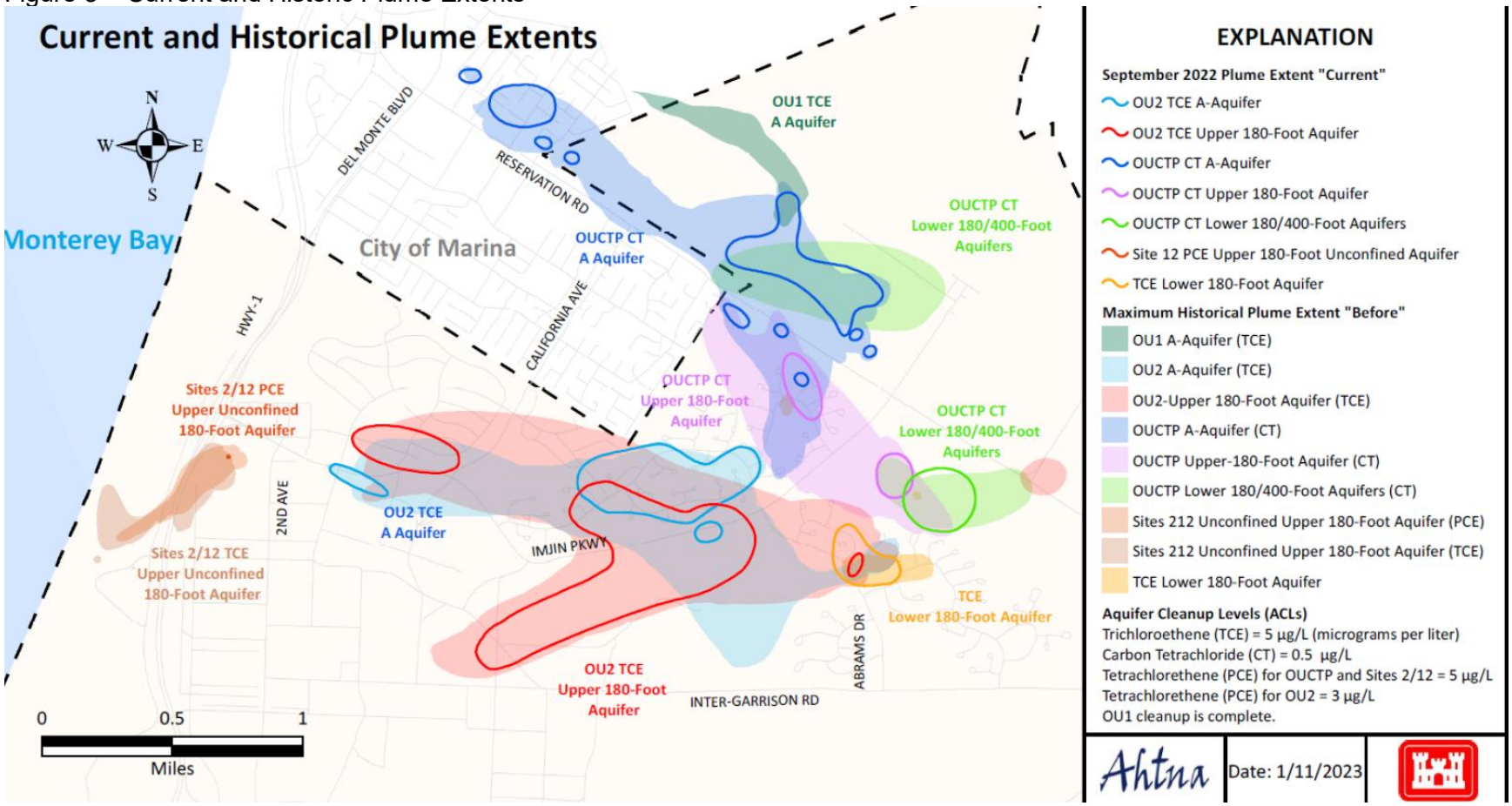
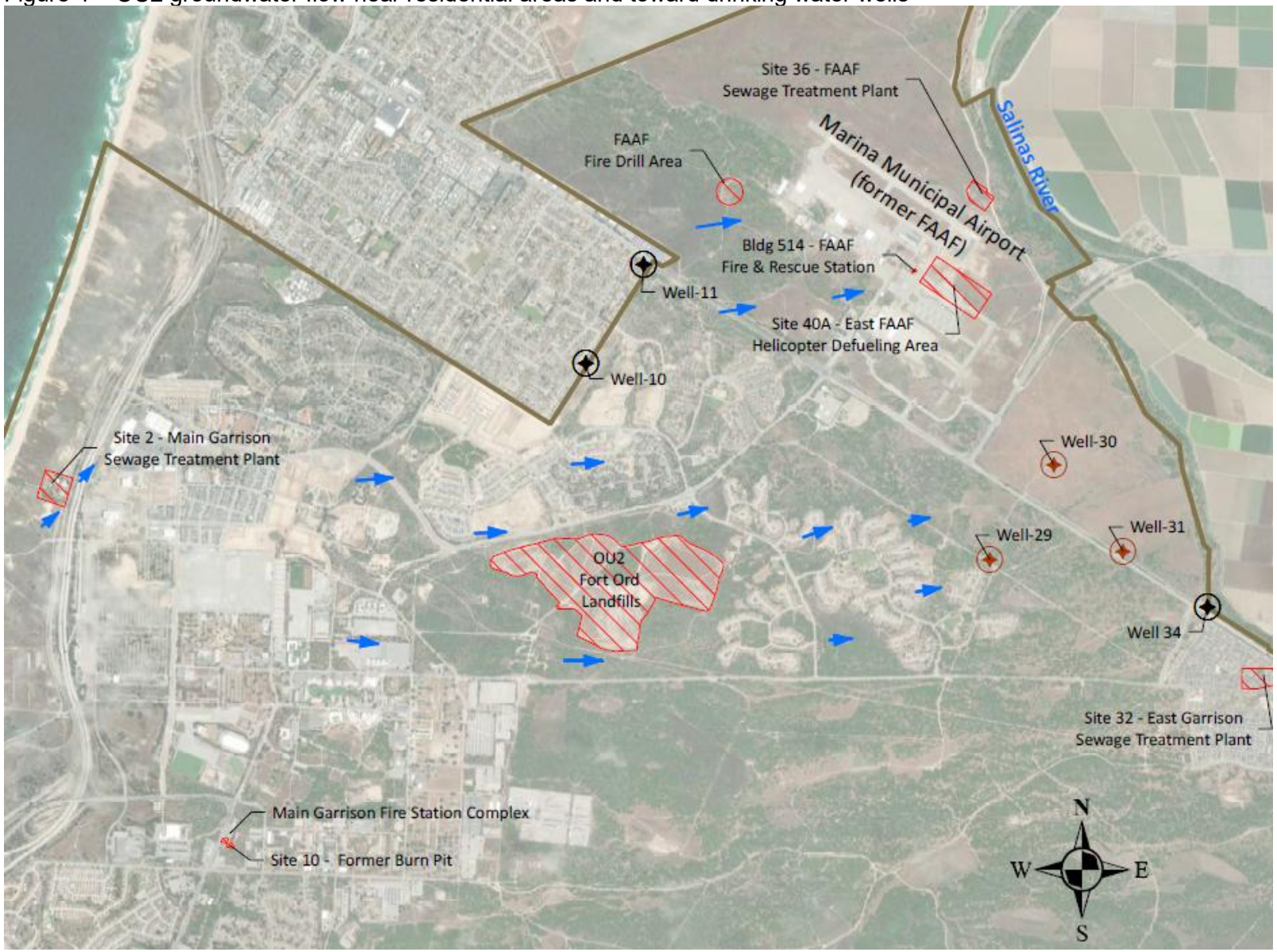


Figure 4 – OU2 groundwater flow near residential areas and toward drinking water wells



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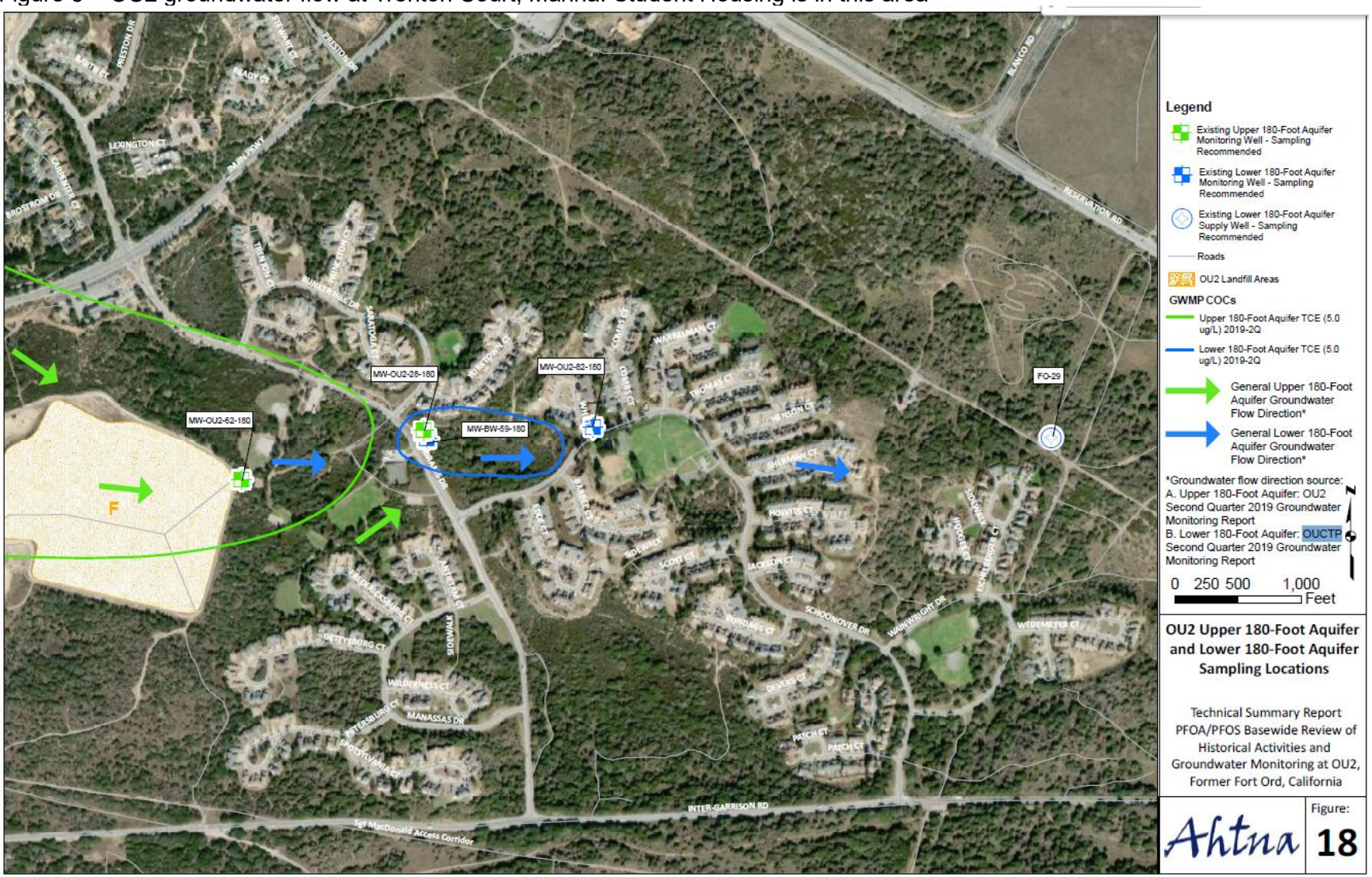
Figure 5 – OU2 groundwater flow at Trenton Court, Marina. Student Housing is in this area