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Project No. P329

Letter Report
Remedial Action Plan
7110, 7143, and 7179 Elphick Road
Sebastopol CA
RWQCB Case No. 1NSO732
Geotracker ID T0609793467

Dear Mr. Mazzia (ecopy) and Ms. Beletsis (ecopy):

This letter report describes remedial actions to mitigate chloroethenes (in particular, tetrachloroethene and trichloroethene) currently detected in domestic wells located at 7110 Elphick Road, 7143 Elphick Road, and 7179 Elphick Road. One of the wells with detectable chloroethenes - the well at 7110 Elphick Road - has already been fitted with a wellhead treatment system, suitable for removal of chloroethenes, that treats all water discharged from the well. The other two wells with detectable chloroethenes (7143 Elphick Road and 7179 Elphick Road) are not fitted with treatment systems and this remedial action plan proposes to install wellhead treatment systems at each well. Monitoring of the three wells indicates chloroethenes are naturally attenuating (decreasing with time) and this remedial action plan proposes continued monitoring until chloroethenes are below water quality objectives.

BACKGROUND

According to the written documentation available to Streamborn, as early as March 1999, tetrachloroethene (a chloroethene compound, also known as PCE) was measured at a concentration of 50 µg/L in the "Middle Well" at 7160-7176 Witter Road. Calvin and Winifred Chang own the property at 7160-7176 Witter Road, along with the adjacent properties to the

west (7188-7190 Witter Road) and east (7156 Witter Road). Collectively, these three properties comprise the "Chang's Witter Road properties" (Figures 1-4).

The North Coast Regional Water Quality Control Board mandated a series of environmental investigations designed to characterize the source, nature, extent, and fate of groundwater contamination. The investigations included (Table 1):

- Sampling and analysis of groundwater from areawide domestic wells.

  The North Coast Regional Water Quality Control Board performed these sampling efforts from 1999 through 2002.

- Focused sampling and analysis of groundwater from domestic wells at and near the Chang's Witter Road properties.

  Weeks Drilling and Pump, Harris & Lee, and Streamborn performed these sampling efforts from 1999 through 2014.

- Areawide placement, retrieval, and analysis of passive soilgas samplers.

  W.L. Gore & Associates performed this sampling in 2002 under the direction of the North Coast Regional Water Quality Control Board.

- Drilling of soil borings at and near the Chang's Witter Road properties, collection of soil and grab groundwater samples from the borings, and analysis of groundwater samples and selected soil samples.

  Harris & Lee performed this work in 2003.

- Cone penetrometer test soundings at the Chang's Witter Road properties, collection of grab groundwater samples from the soundings, and analysis of the groundwater samples.

  Streamborn performed this work in 2005.

- Video logging and gamma ray logging of domestic wells at the Chang's Witter Road properties.

  Welenco performed this logging in 2005 under the direction Streamborn.

- Drilling of monitoring wells at the Chang's Witter Road properties, collection of soil samples during drilling, analysis of selected soil samples, and subsequent collection and analysis of groundwater samples from the monitoring wells.

  Streamborn performed this work from 2005 through 2013.

The reader is referred to the bibliography (Table 2) for reports that describe these activities in detail; many of these reports are available at the Geotracker website (http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0609793467).

In general, the results of these investigations indicated the following:

- The greatest concentrations of tetrachloroethene in groundwater were measured in the "Middle Well" at 7160-7176 Witter Road.
- As of March 2013, chloroethenes were no longer detectable in groundwater at the Chang's Witter Road properties.
- As of August 2014, chloroethenes were (only) detected in groundwater at the three wells that are the subject of this remedial action plan (7110, 7143, and 7179 Elphick Road).
- No source of chloroethenes was identified.

These general conclusions will be discussed further in the following sections of this report.

HYDROGEOLOGY

Detailed hydrogeologic information was gathered via borings/soil sampling, cone penetrometer test soundings, geophysical logging in domestic wells, and water level monitoring at the Chang's Witter Road properties (Tables 3, 4, 5a, and 5b, Figures 5 and 6).

General hydrogeologic information was gathered via well completion reports (DWR-188 forms and related information) submitted to the California Department of Water Resources, which was queried regarding available information for the domestic wells in the vicinity of the Chang's Witter Road properties. Well completion reports and related information were discovered for the "Middle Well" at 7160-7176 Witter Road, the "East Well" at 7156 Witter Road, and the new well at 7110 Elphick Road (Streamborn 2014). Well completion reports were not discovered for the wells at 7143 and 7179 Elphick Road.

Information regarding areawide groundwater elevations and the areawide direction of groundwater gradient was gathered via reports generally pertaining to the City of Sebastopol groundwater supply and geology (City of Sebastopol 2005 and 2011, PES Environmental 2007, Streamborn 2013 and 2014, SWiG 2012, USGS 2004). This information was consistent; in the vicinity of the Chang's Witter Road properties, the direction of groundwater gradient varied from east to southeast (Figure 4), which is in agreement with the direction of groundwater gradient that may inferred from surface topography (Figure 1).

During monitoring conducted June 2014 and August 2014, water levels were measured in two of the three wells that are the subject of this remedial action plan (water levels were measured in 7110 Elphick Road and 7143 Elphick Road); the well at 7179 Elphick Road was not amenable to water level monitoring. At 7110 Elphick Road and 7143 Elphick Road, water levels were measured approximately 68 feet below ground surface (Table 6). The ground surface elevation at both properties is essentially the same; accordingly, the groundwater table elevation is essentially the same at both wells.

As summarized in Table 3, Figures 5 and 6, and more fully described in previous Streamborn reports (Streamborn 2013 and 2014), two hydrogeologic profiles exist at the Chang's Witter

Road properties. The western portion of the Chang's properties exhibits shallow depth to groundwater with saturated fine-grained and coarse-grained soils. The eastern portion of the Chang's properties exhibits deeper depth to groundwater, with saturated coarse-grained sediments. Because of similar groundwater elevations, we believe the three wells that are the subject of this remedial action plan (7110 Elphick Road, 71443 Elphick Road, 7179 Elphick Road) are completed in a hydrogeologic profile similar to the east side of the Chang's Witter Road properties.

The saturated zone and intercepted interval for the wells that are the subject of this remedial action plan (7110 Elphick Road, 71443 Elphick Road, 7179 Elphick Road) are embedded in residual soil and intact sandstone of the Wilson Grove formation. The residual soil is predominantly coarse-grained (sand and gravel) with occasional fine-grained (silt and clay) layers. The predominant soil types are well-graded sand and well-graded gravel. Cemented and/or very dense sand has commonly been observed coincident with the groundwater table.

CONTAMINANTS OF CONCERN

Historic groundwater monitoring has included testing for volatile organic compounds, typically by EPA Method 8260, which includes a comprehensive scan of approximately 60 of the most common toxic volatile organic compounds. Chloroethenes have been part of the volatile organic compound scan, including: tetrachloroethene, trichloroethene, cis-1,2-dichloroethene, and vinyl chloride.

For groundwater monitoring conducted at and near the Chang's Witter Road properties (Table 7):

- Tetrachloroethene has been the most frequently-detected compound. Tetrachloroethene has been the compound detected at the greatest concentrations.
- Trichloroethene has been the second most frequently-detected compound.
- Following tetrachloroethene and trichloroethene, the next most frequently-detected compounds have been of cis-1,2-dichloroethene, 1,1,1-trichloroethane (not a chloroethene), carbon tetrachloride (not a chloroethene), and chloroform (not a chloroethene).

The most recent groundwater monitoring (conducted in 2014) for the three wells that are the subject of this remedial action plan (7110 Elphick Road, 71443 Elphick Road, 7179 Elphick Road) revealed the following (Table 8):

- Tetrachloroethene and trichloroethene were detected at concentrations exceeding health-based thresholds of concern.
- Cis-1,2-dichloroethene was detected at concentrations below health-based thresholds of concern.
- Carbon tetrachloride was detected (only) in the well at 7143 Elphick Road at concentrations exceeding health-based thresholds of concern.

- Chloroform was detected at concentrations below health-based thresholds of concern.

Based solely on the 2014 monitoring results, contaminants of concern in groundwater consist of chloroethenes and carbon tetrachloride (these compounds were measured at concentrations exceeding thresholds of concern). Because carbon tetrachloride has never been detected in groundwater at the Chang's Witter Road properties (despite collecting and analyzing more than 60 groundwater samples from six wells from 1999-2013, along with groundwater samples from borings and cone penetration test soundings), we conclude the Chang's Witter Road properties have not been a source of carbon tetrachloride and the current and former owners of the Chang's Witter Road properties should not be held responsible for the investigation and remediation of carbon tetrachloride contamination. Accordingly, we will generally limit our discussions to chloroethenes for the purposes of:

- Analyzing the source and fate of groundwater contamination.
- Determining when monitoring obligations - of the current and former owners of the Chang's Witter Road properties - will end.

The existing wellhead treatment system at 7110 Elphick Road and the wellhead treatment systems proposed for 7143 Elphick Road and 7179 Elphick Road, as part of this remedial action plan, will treat well water with any of the detected volatile organic compounds. The monitoring proposed in this remedial action plan includes the analysis of the entire suite of volatile organic compounds (EPA Method 8260).

SOURCE OF CHLOROETHENES IN THE WELLS AT 7110 ELPHICK ROAD, 7143 ELPHICK ROAD, AND 7179 ELPHICK ROAD

The presence of trichloroethene is likely due to biotic reductive dechlorination of tetrachloroethene and the presence of cis-1,2-dichloroethene is likely due to biotic reductive dechlorination of trichloroethene (Pivetz et al. 2013). In other words, tetrachloroethene was likely the chemical that was originally released and trichloroethene/cis-1,2-dichloroethene are likely the result of bacterial transformations in the subsurface.

Based on the following, the Chang's Witter Road properties appear to be a source of tetrachloroethene:

- The Chang's Witter Road properties are generally upgradient of 7110 Elphick Road, 7143 Elphick Road, and 7179 Elphick Road; however, as discussed below, the Chang's Witter Road properties may be hypothesized to be upgradient of two but not all three Elphick Road properties.
- The highest concentrations of tetrachloroethene in groundwater (up to 65 µg/L) have been measured in the "Middle Well" at the Chang's Witter Road properties (Table 7, Figure 4).

- The soil vapor survey performed in July-August 2002 identified a tetrachloroethene "hot spot" at the southeast corner of Chang's Witter Road properties, along with seven other tetrachloroethene measurements at other locations on the Chang's Witter Road properties that were very low or nondetect (RWQCB 2002a, Streamborn 2013).

Streamborn's 2013 report (Streamborn 2013) provided a detailed review and discussion of the investigations that have been completed at the Chang's Witter Road properties in search of a tetrachloroethene source area. Historic investigations by Harris & Lee and Streamborn included sampling and analysis of soil and groundwater near the soil vapor "hot spot"; despite these investigations, a contaminant source or source area was not located.

Using straightforward advection-dispersion interpretations, Streamborn's 2013 report (Streamborn 2013) analyzed whether a source area on the Chang's Witter Road properties could conceivably explain the present-day (August 2014) tetrachloroethene plume (Figure 4). We concluded that:

- The hypothesized source area could explain the simultaneous occurrence of groundwater contamination at either (a) 7110 Elphick Road and 7143 Elphick Road, or (b) 7143 Elphick and 7179 Elphick Road; but not all three wells.
- Unrealistically large dispersion (lateral spreading) must be assumed for the Chang's Witter Road properties to be considered a source area for all three wells.
- For example, if the direction of groundwater gradient were assumed to be east-southeast and the source was assumed coincident with the "Middle Well" at the Chang's Witter Road properties, a travel distance along the gradient direction would be approximately 400 feet before intersecting the transect that encompasses the wells at 7110, 7143, and 7179 Elphick Road. The transect width exceeds 400 feet (in order to encompass all three wells) and lateral plume spreading must have occurred in excess of 45˚ from the gradient direction.
- Given the generally sandy (permeable) nature of the saturated zone, such lateral spreading is unrealistically large. For such soils, lateral spreading may be expected to be less than 30˚ (Cedegren 1967).
- Multiple source areas (including a source off the Chang's Witter Road properties) need to be hypothesized in order to explain the simultaneous occurrence of chloroethenes in groundwater at 7110 Elphick Road, 7143 Elphick Road, and 7179 Elphick Road.

Carbon tetrachloride (not a chloroethene) has been detected in selected wells (Table 7). The June 2014 and August 2014 monitoring detected carbon tetrachloride in the well at 7143 Elphick Road and monitoring in 2001-2002 detected carbon tetrachloride in the well at 7179 Elphick Road. Carbon tetrachloride has not been detected at the Chang's Witter Road properties, despite collecting and analyzing more than 60 groundwater samples from six wells from 1999-2013, along with groundwater samples from borings/soundings and soil samples from borings. The

detection of carbon tetrachloride in the wells at 7143 Elphick Road and 7179 Elphick Road and the confirmed absence of carbon tetrachloride at the Chang's Witter Road properties suggest an additional contaminant source off the Chang's Witter Road properties.

Historically, tetrachloroethene has been detected at 7177 Witter Road (Table 7, Figure 4), a property that is clearly located sidegradient of the Chang's Witter Road properties. This evidence suggests a source of tetrachloroethene southwest (sidegradient) of the Chang's Witter Road properties.

A variety of potential sources have been hypothesized to explain the detections of tetrachloroethene in groundwater:

- A discharge of tetrachloroethene to septic systems has been hypothesized; however, given the strong reducing conditions that typically exist in septic systems, we would expect to measure concentrations of reductive dechlorination daughter products; specifically trichloroethene, cis-1,2-dichloroethene, and vinyl chloride; at concentrations greater than those that have actually been measured.
- A discharge of tetrachloroethene has been hypothesized for the former "Marshall's Garage", located at 7156 Witter Road, that began operations in the 1950's and terminated operations circa the late 1980's when Mr. Marshall died. In 2005, Streamborn installed monitoring wells adjacent to former "Marshall's Garage" and subsequently monitored the wells (Tables 1 and 7, Figure 4), with all soil and groundwater results nondetect, indicating the former "Marshall's Garage" was not a contamination source.
- A discharge of tetrachloroethene has been hypothesized for the former "Gardiner's Machine Shop", located at 7160-7176 Witter Road, which closed operations prior to the 1950's. This hypothesized source would have predated the detection of tetrachloroethene in the "Middle Well" at the Chang's Witter Road properties by 50 years or more. However, for such an old release, reductive dechlorination daughter products (trichloroethene and cis-1,2-dichloroethene) would be expected to occur in greater concentrations than have actually been measured in the "Middle Well" at 7160-7176 Witter Road. Furthermore, the rates of natural attenuation of tetrachloroethene in the subsurface that have been observed at and near the Chang's Witter Road properties (discussed in a subsequent section of this report) suggest the hypothesized source would have dissipated in less than 50 years.
- A discharge of tetrachloroethene has been hypothesized directly into the "Middle Well" at 7160-7176 Witter Road. An examination of the temporal tetrachloroethene concentrations in the "Middle Well" (Figure 7) reveals that tetrachloroethene concentrations decreased at an accelerated rate after pumping from the well was terminated (in January 2011, the "New West Well" at the Chang's Witter Road properties replaced the "Middle Well"). The observed tetrachloroethene response to the termination of pumping from the

"Middle Well" indicates the tetrachloroethene source is not at the well itself.

- Streamborn's 2013 report (Streamborn 2013) contained a detailed listing and evaluation of the hypothesized tetrachloroethene sources.

In summary, the sources of chloroethenes in the domestic wells at 7110 Elphick Road, 7143 Elphick Road, and 7179 Elphick Road have not been identified, despite focused investigations and thorough examination of the available information. Surface discharges of tetrachloroethene upgradient (west to northwest) of these three wells remain the best working hypothesis.

EXTENT AND MASS OF RESIDUAL CHLOROETHENES

Streamborn has interpreted the approximate extent and mass of residual (August 2014) chloroethenes in groundwater (Figure 4). The groundwater plume encompasses an area of approximately 82,000 square feet (approximately 2 acres) and contains about 0.5 pounds of chloroethenes - this represents a small area and small dissolved mass.

The saturated sediments within the limits of the chloroethene plume generally consist of sand without significant organic carbon (fraction of organic carbon less than 0.05%). Using the octanol/water partition coefficient of the detected chloroethenes and common partitioning equations (Wiedemeier et al. 1995), we calculate the absorbed mass is approximately equal to the dissolved mass. Thus, we estimate the total (absorbed and dissolved, soil and groundwater) mass of residual chloroethenes is approximately one pound.

Although Streamborn has depicted the groundwater chloroethene plume as a single contiguous plume (Figure 4), evidence exists to suggest that multiple sources of chloroethenes have caused the observed chloroethenes plume and instead of a single plume, separate and/or commingled plumes actually exist.

INTERPRETATION OF THE NATURAL ATTENUATION OF CHLOROETHENES

Of the three Elphick Road properties with currently detectable chloroethenes, the new well at 7110 Elphick Road contains the most complete historic record (Table 7). For this well, we plotted temporal concentrations of tetrachloroethene, trichloroethene, cis-1,2-dichloroethene, and the sum of tetrachloroethene/trichloroethene/cis-1,2-dichloroethene (Figures 8-11).

For purposes of interpreting the natural attenuation of chloroethenes, temporal plots of the molar sum of tetrachloroethene/trichloroethene/cis-1,2-dichloroethene (Figure 11) present the most unambiguous interpretation (Pivetz et al. 2013, Chapelle et al. 2003, Chapelle et al. 2007). The molar sum interpretation assumes cis-1,2-dichloroethene has been derived from the reductive dechlorination of trichloroethene and trichloroethene has been derived from the reductive dechlorination of tetrachloroethene. By making these assumptions, we will interpret the longest attenuation timeframe.

Figure 12 presents our natural attenuation interpretation, which predicts that by early 2021, chloroethenes in the new well at 7110 Elphick Road will decrease to below the (current) laboratory detection limit of 0.5 µg/L (roughly equivalent to a concentration of 0.003 µmoles/L). More conservatively, our judgment indicates that chloroethenes in the new well at 7110 Elphick Road will decrease to below a laboratory detection limit of 0.5 µg/L by 2025. Chloroethenes concentrations in the wells at 7143 Elphick Road and 7179 Elphick Road are lower than those at 7110 Elphick Road; accordingly, chloroethenes will likely become nondetect in the wells at 7143 Elphick Road and 7179 Elphick Road prior to 2025.

HUMAN HEALTH RISKS ASSOCIATED WITH THE CHLOROETHENES

Two thresholds of concern are applicable to the evaluation of human health risks associated with exposure to chloroethenes: California Maximum Contaminant Level (MCL) and California Public Health Goal (PHG). The California Maximum Contaminant Level is a regulatory-enforceable threshold while the California Public Health Goal is an advisory. Contaminant concentrations below these thresholds are typically considered insignificant and not candidates for remedial action.

For tetrachloroethene, the California Public Health Goal is below the laboratory (analytical) detection limit; accordingly, "nondetect" may be substituted.

A comparison of measured concentrations versus thresholds of concern is presented in Table 8. For the three wells that are the subject of this remedial action plan (7110 Elphick Road, 7143 Elphick Road, and 7179 Elphick Road):

- Tetrachloroethene concentrations are at or below the California Maximum Contaminant Level but above the California Public Health Goal.
- For the wells at 7110 Elphick Road and 7179 Elphick Road, trichloroethene concentrations are at or below the California Maximum Contaminant Level but above the California Public Health Goal. For the well at 7143 Elphick Road, trichloroethene concentrations are below the California Maximum Contaminant Level and California Public Health Goal.
- Cis-1,2-dichloroethene concentrations are below the California Maximum Contaminant Level and California Public Health Goal.

The California Public Health Goals for tetrachloroethene (0.06 µg/L) (OEHHA 2001) and trichloroethene (1.7 µg/L) (OEHHA 2009) consider chronic (long-term) carcinogenic risks from direct ingestion (drinking), inhalation (while taking a shower and other potential inhalation exposure scenarios), and dermal absorption (while bathing and other potential direct exposure scenarios). The numeric thresholds correspond to an excess lifetime cancer risk of one-in-one million.

Since the California Public Health Goal for tetrachloroethene was published in 2001, the US Environmental Protection Agency revised its toxicity factors; now believing tetrachloroethene is

approximately five times less toxic than previously thought (USEPA/IRIS 2012). The California Maximum Contaminant Level and California Public Health Goal have not (yet) been revised in light of the updated toxicity factors; however, we have recalculated the thresholds of concern using the updated toxicity factors (Table 8) (Streamborn 2013). The recalculated California Public Health Goal for tetrachloroethene remains below the laboratory (analytical) detection limit.

Our assessment of the human health risks from present-day (August 2014) concentrations of tetrachloroethene and trichloroethene in the wells at 7110 Elphick Road, 7143 Elphick Road, and 7179 Elphick Road indicates remedial actions should be evaluated to mitigate the risks.

WATER QUALITY OBJECTIVES FOR CHLOROETHENES

Water quality objectives should consist of the California Maximum Contaminant Level or the California Public Health Goal, whichever is lower. According, the following water quality objectives are proposed:

- Tetrachloroethene $\leq$ 0.06 µg/L = nondetect.
- Trichloroethene $\leq$1.7 µg/L.
- Cis-1,2-dichloroethene $\leq$6 µg/L.
- Vinyl Chloride $\leq$0.05 µg/L = nondetect.

SCREENING OF POTENTIAL REMEDIAL ACTIONS

Further investigation of the source, nature, extent, and fate of chloroethenes is not needed to screen and select remedial actions; the existing information is sufficient.

Because contaminant sources remain unidentified, source control remedial actions, such as excavation and soil vapor extraction, are not feasible. Because domestic wells extract groundwater from the present-day chloroethenes plume, the following remedial actions are not feasible:

- Insitu remedial actions, such as insitu bioremediation and insitu chemical oxidation, are not feasible because such actions would detrimentally impact the quality of groundwater and consequently the quality of the water extracted in each domestic well.
- Containment remedial actions, such as cut-off walls and pump-and-treat systems, are not feasible because such actions would cause the existing domestic wells to "dry up".

The following remedial actions are feasible:

- Drilling replacement domestic wells at each property; the replacement wells would be screened over intervals deeper than the chloroethenes

plume. A variation on this remedial action would be to install a single, new, deep well with distribution piping to the three properties.

- Adding treatment to the existing domestic well systems. This remedial action could include adding point-of-use treatment systems at specific exposure locations, such as the kitchen faucet. This remedial action could also include adding wellhead treatment, where all extracted water - even irrigation water - would be treated.

Adding treatment to the existing domestic wells will be most cost-effective. Streamborn's 2014 report (Streamborn 2014) provided a comparison of point-of-use treatment versus wellhead treatment. Wellhead treatment will eliminate human exposure to volatile organic compounds (including chloroethenes), whereas point-of-use treatment will significantly reduce exposure. Although slightly more expensive, wellhead treatment has been selected because exposure will be eliminated.

Culligan had previously installed a point-of-use treatment system at 7179 Elphick Road, treating water at the kitchen faucet. The property owner at 7179 Elphick Road discontinued the point-of-use system shortly after installation, citing operations and maintenance difficulties.

Weeks Water Treatment (Sebastopol CA) had previously installed (nearly) identical wellhead treatment systems at 7110 Elphick Road and 7177 Witter Road; each system has operated for more than a decade and each system is still in service. Because of the proven track record, we have selected the Weeks' system.

SELECTED REMEDIAL ACTIONS

Table 9 presents a summary of the selected remedial actions. The actions consist of wellhead treatment and monitored natural attenuation.

Weeks Water Treatment should install their wellhead treatment system (Figure 13) at 7143 Elphick Road and 7179 Elphick Road. The Weeks' system is currently installed at 7110 Elphick Road. The Weeks' system employs two contactors in series to absorb volatile organic compounds. Each contactor contains 4 cubic feet (approximately 110 dry pounds) of activated carbon. Activated carbon is effective in absorbing all the volatile organic compounds that have historically been detected in the three wells of interest.

In terms of absorption capacity, the Weeks' system is oversized. As shown on Figure 13, the theoretical time of breakthrough for the first carbon contactor would be more than 100 years at present-day (August 2014) concentrations of volatile organic compounds. This may be compared to the ten-year timeframe wherein detectable chloroethenes are expected to persist. Despite having excess absorption capacity, the Weeks' system is suitably sized considering requisite flow rates, water pressures, and carbon contact times - smaller carbon contactors would detrimentally limit flow rates, water pressures, and the removal efficiency for volatile organic compounds.

The wellhead treatment systems should be monitored frequently enough to detect breakthrough of the upstream contactor, prior to breakthrough of the downstream contactor, thereby indicating the need for carbon change-out before actual exposure occurs. At present-day (August 2014) concentrations of volatile organic compounds, the theoretical time of breakthrough for one contactor would more than 100 years and the theoretical time of breakthrough for two contactors in series would be more than 200 years. Recognizing that naturally-occurring, non-toxic organic compounds will consume a significant portion of the activated carbon absorption capacity, along with other mechanisms that shorten the time until breakthrough, Weeks' and Streamborn's experience indicates the actual time of breakthrough could be as short as five years for a single contactor.

Untreated groundwater and treated groundwater (downstream of the first contactor) should be sampled and the samples should be analyzed for volatile organic compounds by EPA Method 8260. For 7143 Elphick Road and 7179 Elphick Road, the first monitoring event should immediately follow installation and startup of the (new) treatment systems. Two years after installing the systems at 7143 Elphick Road and 7179 Elphick Road, all three wells should be monitored. Thereafter, the monitoring frequency should be once-every-four-years. On a well-by-well basis, when untreated groundwater reaches water quality objectives for chloroethenes, the monitoring obligations should cease; however, it may be prudent for the well owner to continue monitoring if other contaminants are detectable.

Weeks Water Treatment should provide periodic maintenance of the wellhead treatment systems at all three properties. At each well, this will include inspection of the entire treatment system and as-needed cleaning/replacement of the particulate filter and ultraviolet disinfection lamp. On a well-by-well basis, when untreated groundwater reaches water quality objectives for chloroethenes, the maintenance obligations should cease; however, it may be prudent for the well owner to continue maintenance if other contaminants are detectable.

Should breakthrough occur in any carbon contactor while groundwater concentrations exceed water quality objectives for chloroethenes, a carbon change-out should be performed (remove the upstream contactor, move the downstream contactor into the upstream position, provide a new carbon contactor in the downstream position).

Prior to implementing the selected remedial actions, access agreements will need to be negotiated between each well owner (7110 Elphick Road, 7143 Elphick Road, 7179 Elphick Road) and the current and former owners of the Chang's Witter Road properties.

Streamborn evaluated periodic sampling and analysis of additional domestic wells, beyond that proposed for 7110, 7143, and 7179 Elphick Road. In particular, wells at 7081, 7099, and 7125 Elphick Road, along with the well at 1200 Gravenstein Highway South, are downgradient of the present-day (August 2014) chloroethene plume (Figure 4). Given the timeframe over which these additional domestic wells have already been monitored (2002 through 2014) and because present-day chloroethene concentrations are very low (total chloroethenes less than 0.08 μmoles/L) and decreasing (indicating the chloroethenes plume is shrinking with time), we judge these additional wells are at low risk of future chloroethene contamination. Accordingly, we do not recommend additional sampling and analysis.

If conditions change in an unexpected manner, additional monitoring may be warranted. For example, if the planned sampling and analysis at 7110, 7143, and 7179 Elphick reveal an unexpected trend of increasing chloroethene concentrations, (a) more frequent monitoring of these three wells may be warranted, and/or (b) sampling of additional downgradient wells may be warranted.

Please contact us with any questions or comments.

Sincerely,

STREAMBORN

Douglas W. Lovell, PE
Geoenvironmental Engineer

Expires 31 December 2016

Attachments

cc: Calvin and Winifred Chang, Tiburon CA (ecopy)

An electronic version (.pdf) of this report was uploaded to the Geotracker website.

The Geotracker data for this site may be viewed at
http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0609793467

Table 1 (Page 1 of 3)

Environmental Chronology

Date	Activities Performed By	Description
Circa 1910s to circa 1949	Raymond Gardiner	• Raymond Gardiner was the father of Betty Marshall. • As reported in the following: - An article from the Santa Rosa Press Democrat dated 28 May 1961. - Historic "yellow pages" advertising dated 1947-1948. - A telecom record in the RWQCB files dated 17 May 2002 documenting allegations from an anonymous male caller. Raymond Gardiner operated "Gardiner's Machine Shop" on "Elphick Road." The machine shop was operating in 1946-1947, went out of business circa 1949, and operated for approximately 37 years. For at least part of its operating history, the machine shop was operated at 7160-7176 Witter Road (it may have operated at more than one location over its ±37-year history). After closing the machine shop at 7160-7176 Witter Road, the machine shop building was converted into single-story apartments. • On 27 May 1961, Raymond Gardiner was killed in a vehicle crash at the age of 68.
1943 to circa 1954	Jim Marshall	• As reported by Betty Marshall, the 7156 Witter Road property was used primarily for farming.
Circa 1954	Jim Marshall	• As reported by Betty Marshall, Jim Marshall began operating "Marshall's Garage" at 7156 Witter Road. The garage was primarily used for the repair and maintenance of farm machinery and pickup trucks.
1965	Jim Marshall	• As reported by Betty Marshall, Jim Marshall closed "Marshall's Garage". Mr. Marshall continued to repair his own tractor and pickup truck at 7156 Witter Road.
1987		• Jim Marshall died.
8 March 1999 through 6 May 2002	RWQCB, Weeks Drilling and Pump, Harris & Lee	• Samples were collected from the domestic wells at many properties along Lynch Road, Pearl Court, Witter Road, Elphick Road, Saraview Way, Gravenstein Highway, and Waverly Court. Samples were analyzed for volatile organic compounds (EPA Method 8260).
July-August 2002	RWQCB	• Soilgas survey was conducted for the general area surrounding 7156, 7160-7176, and 7188-7190 Witter Road. • 248 soilgas sorbers were installed near the ground surface at various locations and collected approximately 3 weeks after installation. The sorbers were analyzed for volatile organic compounds. • The soilgas survey results were documented in a report prepared by W.L. Gore & Associates dated 20 September 2002.
October 2002	Weeks Drilling and Pump	• Domestic water supply was changed from the East Well to the Middle Well (this is based on verbal information provided by Tim Ehlert of Weeks Drilling and Pump Company, Sebastopol CA).
21-24 April 2003	Harris & Lee	• Ten borings (B1 - B10) were drilled at and near 7156 and 7160-7176 Witter Road. The borings were drilled to depths between 11 and 26 feet. Soil samples were collected on five-foot intervals during drilling. At least two samples were retained from each boring for chemical analysis. • Selected soil samples were analyzed for TPH-gasoline, TPH-diesel, TPH-motor oil, and volatile organic compounds (EPA Method 8260). • Temporary casings were placed in the borings and allowed to equilibrate for at least one hour. Grab groundwater samples were collected from the temporary casings. After collection of groundwater samples, the temporary casings were removed, and the borings were grouted. • Groundwater samples were analyzed for TPH-gasoline, TPH-diesel, TPH-motor oil, and volatile organic compounds (EPA Method 8260). • The results of this work were documented in a report prepared by Harris & Lee dated 19 June 2003.
2004	Weeks Drilling and Pump	• During 2004, approximately 695,000 gallons of water were pumped from the Middle Well for domestic use. This equates to an average pumping rate of approximately 1,900 gallons per day = 1.32 gallons per minute (gpm). Tim Ehlert of Weeks Drilling and Pump Company (Sebastopol CA) provided this information.

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Environmental Chronology

Date	Activities Performed By	Description
21 March 2005	Streamborn	• Gregg Drilling and Testing mobilized a 30-ton cone penetrometer testing rig to the site to conduct soundings at 5 locations. • Cone pentrometer soundings were conducted at two locations (CPT1 and CPT5) at/near 7156 and 7188-7190 Witter Road. Refusal was encountered at a depth of 56 in CPT1 and at a depth of 41 feet in CPT5. • At each of the two CPT locations, the CPT rig was moved laterally approximately 1-foot and advanced again to refusal. Temporary casings were installed. CPT5 was dry and CPT1 contained water. The water level was measured and a grab water sampler was collected with a bailer at CPT1. The groundwater sample was analyzed for volatile organic compounds (EPA Method 8260). • The cone penetrometer investigation was aborted because the CPT tool was incapable of penetrating to sufficient depth. • Water levels were measured in the Old West Well, Middle Well, and East Well. • A grab groundwater sample was collected from the (then operating) Middle Well; the sample was collected upstream of any treatment. The sample was analyzed for volatile organic compounds (EPA Method 8260).
6 April 2005	Streamborn	• An elevation survey was conducted for the Old West Well, Middle Well, and East Well. An elevation survey was conducted for the CPT1 and CPT5 cone penetrometer locations.
24 May 2005	Streamborn	• Welenco completed video logging and gamma ray logging of the Old West Well and the East Well. • Blaine Tech Services performed groundwater sampling of the Old West Well and the East Well. Purged groundwater samples were collected and analyzed for volatile organic compounds (EPA Method 8260). • A grab groundwater sample was collected from the (then operating) Middle Well; the sample was collected upstream of any treatment. The sample was analyzed for volatile organic compounds (EPA Method 8260).
18 October 2005	Streamborn	• Wells MW1 and MW2 were installed to a depth of approximately 110 feet at 7156 Witter Road. Soil samples were collected during drilling and selected samples were subsampled in accordance with EPA Method 5035 (Soil Grabber subsampling or equivalent). The subsamples were analyzed for volatile organic compounds (EPA Method 8260).
28 October 2005	Streamborn	• Water levels were measured in wells MW1, MW2, Old West Well, Middle Well, and East Well. • An elevation survey was performed for wells MW1, MW2, Old West Well, Middle Well, and East Well. • Purged groundwater samples were collected from wells MW1, MW2, and the East Well. The samples were analyzed for volatile organic compounds (EPA Method 8260). • A grab groundwater sample was collected from the (then operating) Middle Well; the sample was collected upstream of any treatment. The sample was analyzed for volatile organic compounds (EPA Method 8260).
26 January 2006	Streamborn	• Water levels were measured in wells MW1, MW2, Old West Well, Middle Well, and East Well. • Another elevation survey was performed for wells MW1, MW2, Old West Well, Middle Well, and East Well. The results confirmed the previous survey. • Purged groundwater samples were collected from wells MW1, MW2, and the East Well. The samples were analyzed for volatile organic compounds (EPA Method 8260). • A grab groundwater sample was collected from the (then operating) Middle Well; the sample was collected upstream of any treatment. The sample was analyzed for volatile organic compounds (EPA Method 8260).
28 April 2006	Streamborn	• Water levels were measured in wells MW1, MW2, Middle Well, and East Well. • Purged groundwater samples were collected from wells MW1, MW2, and the East Well. The samples were analyzed for volatile organic compounds (EPA Method 8260). • A grab groundwater sample was collected from the (then operating) Middle Well; the sample was collected upstream of any treatment. The sample was analyzed for volatile organic compounds (EPA Method 8260). • Soil cuttings generated during the installation of wells MW1 and MW2 were spread on the ground surface at 7156 Witter Road, underlain by plastic sheeting. In total, 16 drums of soil were spread over an area approximately 20 feet x 10 feet.

Table 1 (Page 3 of 3)

Environmental Chronology

Date	Activities Performed By	Description
27 July 2006	Streamborn	• Water levels were measured in wells MW1, MW2, Middle Well, and East Well. • Purged groundwater samples were collected from MW1, MW2, Middle Well, and East Well. The samples were analyzed for volatile organic compounds (EPA Method 8260). • Plastic sheeting was removed from beneath the previously-spread soil cuttings. The soil cuttings were graded into the surrounding soil.
15 December 2010 to 21 December 2010	Weeks Drilling & Pump	• The New West Well was drilled and completed/installed.
January 2012	Weeks Drilling & Pump	• Use of the Middle Well was discontinued. • Use of the New West Well began. • Several of the Chang's Witter Road properties have their domestic water supplied by the New West Well.
September 2012	Weeks Drilling & Pump	• Downhole pump and piping was removed from the Middle Well.
23 October 2012	Streamborn	• Water levels were measured in wells MW1, MW2, Old West Well, New West Well, Middle Well, and East Well. • Wells MW1, MW2, Old West Well, Middle Well, and East Well were purged and sampled. The samples were analyzed for volatile organic compounds (EPA Method 8260). • A level survey was completed for the Old West Well, New West Well, Middle Well, and East Well.
19 March 2013	Streamborn	• Water levels were measured in wells MW1, MW2, Old West Well, New West Well, Middle Well, and East Well. • The Middle Well, and East Well were purged and sampled. The samples were analyzed for volatile organic compounds (EPA Method 8260).
25-26 June 2014	RWQCB and Streamborn	• Offsite domestic wells were sampled near the Chang's Witter Road properties. The following addresses were sampled: 1200 Gravenstein Highway South, 7081 Elphick Road, 7099 Elphick Road, 7110 Elphick Road, 7125 Elphick Road, 7143 Elphick Road, 7173 Witter Road, 7177 Witter Road, 7179 Elphick Road, 7191 Witter Road, 7249 Witter Road. The RWQCB secured permission to sample the wells from the well owners. Streamborn assisted the RWQCB by measuring water quality parameters, collecting the samples, and making field observations. • Each offsite domestic well was purged and then sampled. Selected wells had been fitted with water treatment systems and in all cases Streamborn collected samples upstream of the treatment systems. Where possible, Streamborn also collected samples upstream of the pressure tanks. • Chloroethenes were detected at 7110 Elphick Road, 7143 Elphick Road, and 7179 Elphick Road. Benzene was detected at 7177 Witter Road. The RWQCB decided that these four wells should be resampled.
5 August 2014	RWQCB and Streamborn	• In a manner similar to the 25-26 June 2014 work, offsite domestic wells were sampled near the Chang's Witter Road properties. The following addresses were sampled: 7110 Elphick Road, 7143 Elphick Road, 7177 Witter Road, and 7179 Elphick Road. The RWQCB secured permission to sample the wells from the well owners. Streamborn assisted the RWQCB by measuring water quality parameters, collecting the samples, and making field observations. • The well at 7110 Elphick Road was fitted with a treatment system, including two carbon contactors. Streamborn collected samples (1) at the wellhead - upstream of the pressure tank - also upstream of any treatment system components, and (2) between the carbon contactors. • The well at 7143 Elphick Road was not fitted with a treatment system. Streamborn collected samples (1) at the kitchen sink faucet, and (2) at the wellhead - upstream of the pressure tank. • The well at 7177 Witter Road was fitted with a treatment system, including two carbon contactors. Streamborn collected samples (1) immediately upstream of the first carbon contactor - downstream of the pressure tank - also downstream of a particulate filter, and (2) between the carbon contactors. • The well at 7179 Elphick Road was fitted with a point-of-use treatment system that had been installed at the kitchen sink; however, the system was not in use at the time of monitoring. Streamborn collected samples (1) at the kitchen sink faucet, and (2) at the wellhead - downstream of the pressure tank.

General Note

(a) TPH = total petroleum hydrocarbons. Chloroethenes = tetrachloroethene (PCE), trichloroethene (TCE), dichloroethene (DCE), and vinyl chloride.

(b) RWQCB = North Coast Regional Water Quality Control Board (Santa Rosa CA).

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Table 3

Hydrogeologic Summary for the Chang's Witter Road Properties

Subsurface lithology

- Subsurface lithology has been documented in the boring logs for two monitoring wells (MW1 and MW2), the logs for two cone penetrometer soundings (CPT1 and CPT5), the California Department of Water Resources Form 188 (DWR 188) for selected domestic wells, and the Gamma logs for two domestic wells (Old West Well and East Well).
- The most accurate and detailed subsurface information is available in the following:
  - Cone penetration log for CPT1 (the sounding encountered "refusal" at a depth of 56 feet).
  - Cone penetration log for CPT5 (the sounding encountered "refusal" at a depth of 41 feet).
  - Boring logs for MW1 and MW2 (during drilling, soil samples were collected at approximate 10-foot intervals).
  - The DWR-188 for the New West Well provides the only site-specific information below a depth of 110 feet.
- The following subsurface profile generally characterizes the lithology at the Chang's Witter Road Properties:
  - Starting at the ground surface and extending to a depth of approximately 20-30 feet:

    Alternating layers of fine-grained soil (silt and clay) and coarse-grained soil (sand and gravel). The predominant soil types consist of low-plastic silt and poorly-graded sand, both with occasional layers of silty sand.
  - Starting at a depth of approximately 20-30 feet and extending to a depth of approximately 250 feet:

    Predominantly coarse-grained soil (sand and gravel) with occasional layers of fine-grained soil (silt and clay). The predominant soil types consist of well-graded sand and well-graded gravel.

    Within this layer, starting at a depth of approximately 35-55 feet and extending to a depth of approximately 60-70 feet, cemented and/or very dense sand exists.
  - Starting at a depth of approximately 250 feet and extending to the maximum depth logged (340 feet):

    Sandstone.

Groundwater zones

- Groundwater in the Old West Well, New West Well, and Middle Well has been measured at an approximate depth of 20 feet (measurement period 2005 to present). A similar depth to groundwater was measured in nearby cone penetration sounding CPT1. The New West Well was installed in December 2010 with a grout seal extending to 200 feet and a sandpack/screen interval from 200-330 feet. Streamborn is inclined to believe the grout seal for the New West Well was constructed with integrity; thereby indicating the piezometric head for the (deep) New West Well is similar to nearby (shallow) Old West Well and (shallow) Middle Well (both the Old West Well and Middle Well were drilled to a depth of less than 70 feet).

  These locations are on the western portion (slightly uphill portion) of the Chang's Witter Road Properties. The hydrogeologic profile associated with these conditions is termed the "**West Hydrogeologic Profile**".
- Groundwater in the East Well and monitoring wells MW1 and MW2 has been measured at an approximate depth of 80-100 feet (measurement period 2005 to 2013). Next to well MW2, a cone penetrometer sounding (CPT5) was advanced to a depth of approximately 40 feet; this hole was left open for approximately 90 minutes without observing infiltrating groundwater, indicating the groundwater was deeper than 40 feet.

  These locations are on the eastern portion (slightly downhill portion) of the Chang's Witter Road Properties. The hydrogeologic profile associated with these conditions is termed the "**East Hydrogeologic Profile**".
- The geologic cause of two apparently-distinct zones has not been determined.
- Insufficient information exists to identify different groundwater zones with depth; however, to a depth of approximately 110 feet, continuous aquitard material has not been observed, indicating confined groundwater is unlikely at the Chang's Witter Road Properties.

Depth to groundwater and groundwater gradient in the West Hydrogeologic Profile

- The depth to groundwater in the West Hydrogeologic Profile has typically been at approximately 20 feet below ground surface.
- Since measurements began in 2005, the depth to groundwater has exhibited little variation.

Depth to groundwater and groundwater gradient in the East Hydrogeologic Profile

- The depth to groundwater in the East Hydrogeologic Profile has typically been between approximately 80-100 below ground surface.
- Comparing measurements in 2013 to those in 2005, the depth to groundwater has decreased approximately 20 feet (the groundwater table has come up approximately 20 feet).

Groundwater advection velocity (very approximate) in the East Hydrogeologic Profile

- The characteristic soil type in the upper saturated portion of the East Hydrogeologic Profile is sand with an approximate permeability of 0.02 centimeters per second (60 feet per day) (Cedegren 1967). Using a groundwater gradient of 0.008 and assuming an effective porosity of 0.3, the average advection velocity may be calculated as:

  $V_{ave} = (k)\ (i) / (n_e) = (60 \text{ feet per day})\ (0.008) / (0.3) = 2 \text{ feet per day (600 feet per year)}$

Table 4

Well Completion Information for the Chang's Witter Road Properties

Well Identification	Ground-water Zone	Measuring Point Description	Original Boring Diameter (inches)	Well Casing Material	Well Casing Diameter (inches)	Grout Seal Interval (referenced to ground surface) (feet)	Bentonite Seal Interval (referenced to ground surface) (feet)	Total Depth as Originally Drilled (referenced to ground surface) (feet)	Total Depth of Well Casing and Date of Last Measurement (referenced to Measuring Point) (feet)	Sandpack Interval (referenced to ground surface) (feet)	Screened/ Slotted/ Perforated Interval (referenced to ground surface) (feet)	Depth to Water and Date of Measurement (referenced to Measuring Point) (feet)	Ground Surface Elevation (site-specific datum) (feet)	Measuring Point Elevation (site-specific datum) (feet)	Conductor/ Isolation Casing Diameter (inches) and Material Type	Conductor/ Isolation Casing Depth (depth referenced to ground surface) (feet)	Borehole Diameter to Install Conductor/ Isolation Casing (inches)	GPS Latitude	GPS Longitude	Surveyed Latitude (NAD83)	Surveyed Longitude (NAD83)
MW1	East	Top of PVC casing, N side	8	PVC	2	1-93	93-94	110	106.2 (2013.3.19)	94-110	95-110	75.60 (2013.3.19)	999.76	999.31	None	None	None	N 38° 23.258'	W 122° 48.956'		
MW2	East	Top of PVC casing, N side	8	PVC	2	1-93	93-94	110	105.8 (2013.3.19)	94-110	95-110	74.88 (2013.3.19)	999.51	999.23	None	None	None	N 38° 23.242'	W 122° 48.955'		
Old West Well (West Well, 7188-7190 Witter Road Well)	West	Top of metal ring on top of well casing, N side	?	Steel Video Log	6 Video Log	?	?	?	67.0 (2013.3.19)	?	64-66 Video Log	21.57 (2013.3.19)	1,007.95	1,008.48	None	None	None	N 38° 23.229'	W 122° 49.037'		
Middle Well (Center Well, 7160-7176 Witter Road Well)	West	Top of well casing, N side	From 0-10 feet, borehole diameter = 30 inches From 10-66 feet, borehole diameter = 24 inches DWR-188	Steel DWR-188	8 DWR-188	0-22 DWR-188	None DWR-188	66 DWR-188	58.8 (2013.3.19)	22-66 or 46-66 Pea gravel DWR-188	46-66 DWR-188	18.15 (2013.3.19)	1,003.58	1,004.88	None	None	None	N 38° 23.228'	W 122° 49.003'		
East Well (7156 Witter Road Well)	East	Top of metal ring on top of well casing, N side	?	Steel Video Log	8 Video Log	?	?	?	107.8 (2013.3.19)	?	97-112 Video Log	75.95 (2013.3.19)	1,000.27	1,000.49	None	None	None	N 38° 23.242'	W 122° 48.967'		
New West Well (Well #1, Well #4, 7188 Witter Road Well)	West	Top of metal port on well cap, N side	11 DWR-188	PVC DWR-188	5 DWR-188	0-21 (concrete) 21-200 (grout) DWR-188	None DWR-188	340 DWR-188	330 (2010.11.23) DWR-188	200-330 16x30 sand DWR-188	230-330 DWR-188	22.18 (2013.3.19)	1,007.86	1,009.29	None	None	None	N 38° 23.225'	W 122° 49.029'		

General Notes

(a) Measurements cited in units of feet. Elevations referenced to site-specific datum (NOT Mean Sea Level). Streamborn completed level surveys to determine the ground surface elevations and measuring point elevations. Elevations were surveyed relative to each other; a benchmark was not employed, nor was an established datum employed.

(b) The information for wells MW1 and MW2 was extracted from the Streamborn boring logs and well completion schematics.

(c) Streamborn measured the GPS coordinates using a Garmin GPS II Plus handheld meter.

(d) A survey of the horizontal locations of the wells has not been performed; accordingly, the surveyed latitude and surveyed longitude have not been determined.

(e) ? = reliable information was not available.

Table 5a

Groundwater Levels for the Old West Well, Middle Well, and New West Well

Location	Old West Well			Middle Well			New West Well		
Alias	West Well, 7188-7190 Witter Road Well			Center Well, 7160-7176 Witter Road Well			Well #1, Well #4, 7188 Witter Road Well		
Ground Surface Elevation	1,007.95			1,003.58			1,007.86		
Measuring Point GPS Coordinates	N 38° 23.229' W 122° 49.037'			N 38° 23.228' W 122° 49.003'			N 38° 23.225' W 122° 49.029'		
Measuring Point Description	Top of metal ring on top of well casing, North side			Top of steel casing, North side			Top of metal port on well cap, North side		
Measuring Point Elevation	**1,008.48**			**1,004.88**			**1,009.29**		
Pump Type	Former centrifugal (surface) pump			Former jet/centrifugal (surface) pump			Submersible pump		
Inside Diameter of Well Casing	6 inches			±8.2 inches			5 inches		
Intercepted Interval	Depth	Elevation	Pumping?	Depth	Elevation	Pumping?	Depth	Elevation	Pumping?
	64.0-66.0	942.0-944.0		46.0-66.0	937.6-957.6		200-330		
21 March 2005	21.59	986.89	no	18.10	986.78	**Yes***			
24 May 2005	20.18	988.30	no	21.33	983.55	**Yes***			
28 October 2005 (Pre-Development)	23.45	985.03	no	20.31	984.57	**Yes***			
26 January 2006	21.99	986.49	no	21.38	983.50	**Yes***			
28 April 2006				18.80	986.08	**Yes***			
27 July 2006				18.95	985.93	**Yes***			
23 October 2012	23.36	985.12	no	19.93	984.95	no	23.86	985.43	**Yes***
19 March 2013	21.57	986.91	no	18.15	986.73	no	22.18	987.11	**Yes***
Total Depth (Last Measurement)	67.0			58.8					

General Notes

(a) Measurements in units of feet. Elevations referenced to site-specific datum (NOT Mean Sea Level).

(b) Elevations based on level surveys performed by Streamborn on 6 April 2005 and 23 October 2012.

(c) The intercepted interval corresponds to either (1) the perforated/slotted interval of the well casing or (2) the sandpack interval, whichever is greater.

(d) The log for the Middle Well shows perforations to a depth of 66 feet; however, the field measurements show the total depth of this well to be shallower.

(e) * = on the date of the measurement, the well was in use as the domestic water supply for the site; the well was observed to pump periodically. However, at the exact time of measurement, the well was not pumping.

(f) On 19 March 2013, we observed an operational chlorination tank and chemical feed pump inside the pump shed for the New West Well.

Table 5b

Groundwater Levels for MW1, MW2, and the East Well

Location	MW1		MW2		East Well		
Alias					7156 Witter Road Well		
Ground Surface Elevation	999.76		999.51		1,000.27		
Measuring Point GPS Coordinates	N 38˚ 23.258' W 122˚ 48.956'		N 38˚ 23.242' W 122˚ 48.955'		N 38˚ 23.242' W 122˚ 48.967'		
Measuring Point Description	Top of 2" Dia PVC well casing, North side		Top of 2" Dia PVC well casing, North side		Top of metal ring on top of well casing, North side		
Measuring Point Elevation	**999.31**		**999.23**		**1,000.49**		
Pump Type	None (monitoring well)		None (monitoring well)		Former submersible pump		
Inside Diameter of Well Casing	2 inches		2 inches		8 inches		
Intercepted Interval	Depth	Elevation	Depth	Elevation	Depth	Elevation	Pumping?
	94.0-110.0	889.8-905.8	94.0-110.0	889.5-905.5	97.0-112.0	888.3-903.3	
21 March 2005					95.69	904.80	no
24 May 2005					98.02	902.47	no
28 October 2005 (Pre-Development)	101.06	898.25	100.31	898.92	101.44	899.05	no
28 October 2005 (Post-Development)	101.20	898.11	100.31	898.92	101.28	899.21	no
26 January 2006	98.28	901.03	97.46	901.77	98.55	901.94	no
28 April 2006	94.03	905.28	93.18	906.05	94.24	906.25	no
27 July 2006	95.83	903.48	94.95	904.28	96.00	904.49	no
23 October 2012	81.46	917.85	80.74	918.49	81.63	918.86	no
19 March 2013	75.60	923.71	74.88	924.35	75.95	924.54	no
Total Depth (Last Measurement)	106.2		105.8		107.8		

General Notes

(a) Measurements in units of feet. Elevations referenced to site-specific datum (NOT Mean Sea Level).

(b) Elevations based on level surveys performed by Streamborn on 6 April 2005 and 23 October 2012.

(c) The intercepted interval corresponds to the perforated interval for the East Well. The intercepted interval corresponds to the sandpack interval for MW1 and MW2.

Table 6

Depth to Water, Purging, and Sampling Information for Domestic Wells That Were Monitored in June 2014 and August 2014

Well Identification	Sample Date	Depth to Water Before Purge [1] (feet below ground surface)	Purge Method	Purge Duration (minutes)	Volume Purged (gallons)	Relative Volume Purged (static water casing volumes)	Purged Dry?	Depth to Water After Purge [1] (feet below ground surface)	Dissolved Oxygen (mg/L)	pH	Specific Conductance (µS/cm)	Temp (˚C)	ORP (mV)	Turbidity/ Color
1200 Gravenstein	26 Jun 2014	43.5+0.3 = 43.8	Sub	10	100	0.5	no		1.9	8.0	310	18	-10	Clear/None
7081 Elphick	25 Jun 2014		Sub	7	49	Unknown	no		5.6	7.6	610	17	0	Clear/None
7099 Elphick	25 Jun 2014		Sub	20	120	1.1	no	81.3-0.5 = 80.8	2.1	7.6	490	19	10	Clear/None
7110 Elphick	26 Jun 2014	69.0-1.4 = 67.6	Sub	10	60	0.5	no		8.2	7.4	600	18	-10	Clear/None
	5 Aug 2014	69.4-1.4 = 68.0	Sub	10	60	0.5	no		8.0	7.2	600	17	30	Clean/None
7125 Elphick	25 Jun 2014		Sub	7	35	0.2	no	89.0-1.5 = 87.5	4.0	7.5	380	18	0	Clear/None
7143 Elphick	25 Jun 2014		Sub	5	30	Unknown	no	70.2-1.0 = 69.2	7.5	7.4	430	18	10	Clear/None
	5 Aug 2014	68.9-1.0 = 67.9	Sub	10	60	Unknown	no		7.8	7.3	420	18	0	Clear/None
7173 Witter	25 Jun 2014		Sub	20	100	Unknown	no	40.5-0.5 = 40.0	9.1	7.8	320	18	0	Clear/None
7177 Witter	25 Jun 2014		Sub	15	90	Unknown	no		6.9	6.6	460	19	-10	Clear/None
	5 Aug 2014		Sub	10	60	Unknown	no		7.1	6.5	470	17	40	Clear/None
7179 Elphick	25 Jun 2014		Sub	46	276	1.3	no	73.9-1.0 = 72.9	8.0	6.9	400	18	0	Clear/None
	5 Aug 2014		Sub	10	50	0.2	no	72.8-1.0 = 71.8	8.8	6.9	400	18	20	Clear/None
7191 Witter	25 Jun 2014		Jet	10	50	0.4	no	35.2-0.5 = 34.7	7.2	5.9	260	22	0	Clear/None
7249 Witter	26 Jun 2014	26.2-1.0 = 25.2	Jet	10	60	Unknown	no		9.0	7.7	410	16	-20	Clear/None

General Notes

(a) Measurements cited in this table correspond to the end of purging (the time of sampling).

(b) Samples were grab samples.

(c) Static water casing volume = volume of water inside the well casing. The relative volume purged = the absolute volume purged divided by one static water casing volume.

(d) ORP = oxidation-reduction potential.

(e) Turbidity/Color = qualitative (eyeball) assessment of the water clarity and color. Turbidity (clarity) was classified as either "Clear", "Translucent", or "Opaque".

(f) Sub = submersible well pump. The pump inside the well was activated for purging and sampling.

(g) Jet = aboveground jet pump.

(h) On 5 August 2014, samples were collected from the faucet of the kitchen at 7143 Elphick and 7179 Elphick. The purge and sampling results for the kitchen sink faucet samples are not summarized in this table.

Footnote

(1) The depth to water calculation accounts for the difference in elevation between the measuring point and the ground surface.

Groundwater Analytical Data from Wells (all results represent untreated groundwater)

Location	Sample Date	Sampled by	Sample Type	PCE (µg/L)	TCE (µg/L)	TCA (µg/L)	Carbon Tetrachloride (µg/L)	Other Volatile Organic Compounds (EPA Method 8260) (µg/L)	Nitrate as N (µg N/L)	Nitrite as N (µg N/L)	Other Analyses (µg/L)	Domestic Well In Service During Sampling?
MW1 (located at 7156 Witter Road)	28 Oct 2005	Streamborn	Grab (bailer)	<0.5	<0.5	<0.5	<0.5	Chloroform = 1.2 Others <0.5 to <50				
	26 Jan 2006	Streamborn	Grab (bailer)	<0.5	<0.5	<0.5	<0.5	Ethylbenzene = 0.64 Others <0.5 to <50				
	28 Apr 2006	Streamborn	Grab (bailer)	<0.5	<0.5	<0.5	<0.5	Chloroform = 1.5 Others <0.5 to <50				
	27 July 2006	Streamborn	Grab (bailer)	<0.5	<0.5	<0.5	<0.5	Chloroform = 1.8 Others <0.5 to <5				
	23 Oct 2012	Streamborn	Grab (bailer)	<0.5	<0.5	<0.5	<0.5	<0.5 to <50				
MW2 (located at 7156 Witter Road)	28 Oct 2005	Streamborn	Grab (bailer)	<0.5	<0.5	<0.5	<0.5	<0.5 to <50				
	26 Jan 2006	Streamborn	Grab (bailer)	<0.5	<0.5	<0.5	<0.5	<0.5 to <50				
	28 Apr 2006	Streamborn	Grab (bailer)	<0.5	<0.5	<0.5	<0.5	<0.5 to <50				
	27 July 2006	Streamborn	Grab (bailer)	<0.5	<0.5	<0.5	<0.5	Chloroform = 0.64 Others <0.5 to <5				
	23 Oct 2012	Streamborn	Grab (bailer)	<0.5	<0.5	<0.5	<0.5	<0.5 to <50				

Groundwater Analytical Data from Wells (all results represent untreated groundwater)

Location	Sample Date	Sampled by	Sample Type	PCE (µg/L)	TCE (µg/L)	TCA (µg/L)	Carbon Tetrachloride (µg/L)	Other Volatile Organic Compounds (EPA Method 8260) (µg/L)	Nitrate as N (µg N/L)	Nitrite as N (µg N/L)	Other Analyses (µg/L)	Domestic Well In Service During Sampling?
East Well (also known as "7156 Witter Road Well")	8 Mar 1999	Weeks	Unknown	<1.0	<1.0	<1.0	<1.0	<1.0			TPH-gasoline <50	**Yes**
	16 Mar 1999	Harris & Lee	Unknown	<1.0	<1.0	<1.0	<1.0	<1.0				**Yes**
	28 July 1999	Weeks	Unknown	<0.5	<0.5	<0.5	<0.5	1,3-Dichloropropane = 0.6 Others <0.5				**Yes**
	14 Sep 1999	Weeks	Unknown	<0.5	<0.5	<0.5	<0.5	cis-1,2-Dichloroethene = 2.0 Chloroform = 1.0 1,2-Dichloroethane = 0.56 Bromodichloromethane = 0.87 o-Xylenes = 0.60 Total Trihalomethanes = 1.87 Others <0.5 to <1.0				**Yes**
	28 Dec 2000	Weeks	Unknown	0.55	ND	ND	ND	ND				**Yes**
	16 Apr 2002	RWQCB	Unknown	ND	ND	ND	ND	Total Trihalomethanes = 0.6 Others = ND				
	6 May 2002	RWQCB	Unknown	1.6	ND	ND	ND	ND	15,000 (1)	<200		**Yes**
	24 May 2005	Streamborn	Grab (bailer)	11	0.67	<0.5	<0.5	<0.5 to <50				no
	28 Oct 2005	Streamborn	Grab (bailer)	9.6	0.6	<0.5	<0.5	<0.5 to <50				no
	26 Jan 2006	Streamborn	Grab (bailer)	5.6	<0.5	<0.5	<0.5	<0.5 to <50				no
	28 Apr 2006	Streamborn	Grab (bailer)	4.8	<0.5	<0.5	<0.5	<0.5 to <50				no
	27 July 2006	Streamborn	Grab (bailer)	12	0.92	<0.5	<0.5	<0.5 to <50				no
	23 Oct 2012	Streamborn	Grab (bailer)	1.6	<0.5	<0.5	<0.5	<0.5 to <50				no
	19 Mar 2013	Streamborn	Grab (bailer)	<0.5	<0.5	<0.5	<0.5	<0.5 to <50				no

Groundwater Analytical Data from Wells (all results represent untreated groundwater)

Location	Sample Date	Sampled by	Sample Type	PCE (µg/L)	TCE (µg/L)	TCA (µg/L)	Carbon Tetrachloride (µg/L)	Other Volatile Organic Compounds (EPA Method 8260) (µg/L)	Nitrate as N (µg N/L)	Nitrite as N (µg N/L)	Other Analyses (µg/L)	Domestic Well In Service During Sampling?
Middle Well (also known as "Center Well" and "7160-7176 Witter Road Well")	8 Mar 1999	Weeks	Unknown	50	1.2	<1.0	<1.0	<1.0			TPH-gasoline <50	
	16 Mar 1999	Harris & Lee	Unknown	65	1.1	<1.0	<1.0	<1.0				
	16 Jul 1999	Harris & Lee	Unknown	1.3	ND	ND	ND	ND				
	17 Apr 2002	RWQCB	Unknown	5.1	4.1	1.1	ND	1,1-Dichloroethene = 1.7 Methylene Chloride = 2.3 Others = ND	4,980 (1)			
	6 May 2002	RWQCB	Unknown	0.57	ND	ND	ND	ND	22,150 (1)	<200		
	24 Sep 2002	Weeks	Unknown	0.83	<0.5	<0.5	<0.5	<0.5				
	26 Jan 2005	Streamborn	Grab (faucet)	19	<0.5	<0.5	<0.5	<0.5 to <50				**Yes**
	21 Mar 2005	Streamborn	Grab (faucet)	18	<0.5	<0.5	<0.5	<0.5 to <50				**Yes**
	24 May 2005	Streamborn	Grab (faucet)	17	<0.5	<0.5	<0.5	<0.5 to <50				**Yes**
	28 Oct 2005	Streamborn	Grab (faucet)	20	<0.5	<0.5	<0.5	<0.5 to <50				**Yes**
	6 Apr 2006	Streamborn	Grab (faucet)	14	<0.5	<0.5	<0.5	<0.5 to <50				**Yes**
	28 Apr 2006	Streamborn	Grab (faucet)	23	<0.5	<0.5	<0.5	<0.5 to <50				**Yes**
	19 July 2006	Weeks	Unknown	21	0.81	<0.5	<0.5	<0.5 to <12				**Yes**
	27 July 2006	Streamborn	Grab (faucet)	28	0.79	<0.5	<0.5	<0.5 to <50				**Yes**
	18 Oct 2006	Weeks	Unknown	23	0.60	<0.5	<0.5	<0.5 to <12				**Yes**
	17 Jan 2007	Weeks	Unknown	13	0.61	<0.5	<0.5	MtBE = 0.74 Others <0.50 to <5.0				**Yes**
	17 Apr 2007	Weeks	Unknown	16	0.52	<0.5	<0.5	<0.5 to <5.0				**Yes**
	17 Jul 2007	Weeks	Unknown	21	0.67	<0.5	<0.5	<0.5 to <5.0				**Yes**
	18 Oct 2007	Weeks	Unknown	19	0.50	<0.5	<0.5	<0.5 to <5.0				**Yes**
	15 Jan 2008	Weeks	Unknown	16	0.56	<0.5	<0.5	<0.5 to <5.0				**Yes**
	7 Apr 2008	Weeks	Unknown	19	<0.5	<0.5	<0.5	<0.5 to <5.0				**Yes**
	8 Jul 2008	Weeks	Unknown	30	0.67	<0.5	<0.5	<0.5 to <5.0				**Yes**
	7 Oct 2008	Weeks	Unknown	28	0.65	<0.5	<0.5	<0.5 to <5.0				**Yes**
	12 Jan 2009	Weeks	Unknown	13	<0.5	<0.5	<0.5	<0.5 to <5.0				**Yes**

Groundwater Analytical Data from Wells (all results represent untreated groundwater)

Location	Sample Date	Sampled by	Sample Type	PCE (µg/L)	TCE (µg/L)	TCA (µg/L)	Carbon Tetrachloride (µg/L)	Other Volatile Organic Compounds (EPA Method 8260) (µg/L)	Nitrate as N (µg N/L)	Nitrite as N (µg N/L)	Other Analyses (µg/L)	Domestic Well In Service During Sampling?
Middle Well (also known as "Center Well" and "7160-7176 Witter Road Well") (continued)	13 Apr 2009	Weeks	Unknown	15	<0.5	<0.5	<0.5	<0.5 to <5.0				**Yes**
	21 July 2009	Weeks	Unknown	12	<0.5	<0.5	<0.5	<0.5 to <5.0				**Yes**
	26 Oct 2009	Weeks	Unknown	21	0.68	<0.5	<0.5	<0.5 to <5.0				**Yes**
	26 Jan 2010	Weeks	Unknown	12	<0.5	<0.5	<0.5	<0.5 to <5.0				**Yes**
	19 Apr 2010	Weeks	Unknown	18	0.54	<0.5	<0.5	<0.5 to <5.0				**Yes**
	13 Jul 2010	Weeks	Unknown	10	<0.5	<0.5	<0.5	<0.5 to <5.0				**Yes**
	11 Oct 2010	Weeks	Unknown	12	<0.5	<0.5	<0.5	<0.5 to <5.0				**Yes**
	23 Oct 2012	Streamborn	Grab (bailer)	0.86	<0.5	<0.5	<0.5	<0.5 to <50				no
	19 Mar 2013	Streamborn	Grab (bailer)	<0.5	<0.5	<0.5	<0.5	<0.5 to <50				no
New West Well (also known as "Well #1", "Well #4", and "7188 Witter Road Well")	27 Dec 2010	Weeks	Unknown	<0.5	<0.5	<0.5	<0.5	<0.5 to <5.0				
	14 Dec 2011	Weeks	Unknown	<0.5	<0.5	<0.5	<0.5	<0.5 to <5.0				**Yes**
Old West Well (also known as "West Well" and "7188-7190 Witter Road Well")	16 Jul 1999	Harris & Lee	Unknown	0.71	ND	ND	ND	Chloroform = 1.2 Bromodichloromethane = 2.0 Dibromochloromethane = 3.2 Bromoform = 0.71 Others = ND				
	24 May 2005	Streamborn	Grab (bailer)	<0.5	<0.5	<0.5	<0.5	Toluene = 2.3 Others <0.5 to <50				no
	23 Oct 2012	Streamborn	Grab (bailer)	<0.5	<0.5	<0.5	<0.5	<0.5 to <50				no

Groundwater Analytical Data from Wells (all results represent untreated groundwater)

Location	Sample Date	Sampled by	Sample Type	PCE (µg/L)	TCE (µg/L)	TCA (µg/L)	Carbon Tetrachloride (µg/L)	Other Volatile Organic Compounds (EPA Method 8260) (µg/L)	Nitrate as N (µg N/L)	Nitrite as N (µg N/L)	Other Analyses (µg/L)	Domestic Well In Service During Sampling?
1200 Gravenstein Hwy	8 Apr 1999	RWQCB	Unknown	<0.5	<0.5	<0.5	<0.5	<0.5 to <3.0	240			
	19 Apr 2002	RWQCB	Unknown	<0.5	<0.5	<0.5	<0.5	<0.5 to <10	<890	<200		
	26 Jun 2014	Streamborn	Grab (h-bib)	<0.5	<0.5	<0.5	<0.5	<0.5 to <5.0				**Yes**
7063 Elphick Road	16 Apr 2002	RWQCB	Unknown	<0.5	<0.5	<0.5	<0.5	<0.5 to <10				
7081 Elphick Road	18 Apr 2000	RWQCB	Unknown	ND	ND	ND	ND	ND				
	17 Apr 2007	RWQCB	Unknown	ND	ND	ND	ND	Trihalomethanes = 3.3 Others = ND				
	25 Jun 2014	Streamborn	Grab (h-bib)	<0.5	<0.5	<0.5	<0.5	<0.5 to <5.0				**Yes**
7099 Elphick Road	19 Apr 2002	RWQCB	Unknown	ND	ND	ND	ND	1,1-Dichloroethene = 0.5 Others = ND				
	25 Jun 2014	Streamborn	Grab (h-bib)	<0.5	<0.5	<0.5	<0.5	<0.5 to <5.0				**Yes**
7110 Elphick Road Old Well (discontinued circa Jul 2002)	9 Apr 1999	RWQCB	Unknown	ND	ND	ND	ND	Toluene = 0.86 Others = ND				
7110 Elphick Road New Well (constructed 25-27 Jun 2002)	24 Sep 2002	RWQCB	Unknown	14	0.7	ND	ND	Methylene Chloride = 0.5 Trihalomethanes = 0.51 Others = ND				
	29 Feb 2004	Analytical Sciences	Unknown	24	6.0	1.5	1.3	1,1-Dichloroethene = 5.1 Methylene Chloride = 0.92 1,1-Dichloroethane = 0.48 Chloroform = 1.4 cis-1,2-Dichloroethene = 1.2 1,2-Dichloropropane = 0.62 Others <0.3 to <0.5	9,500			

Groundwater Analytical Data from Wells (all results represent untreated groundwater)

Location	Sample Date	Sampled by	Sample Type	PCE (µg/L)	TCE (µg/L)	TCA (µg/L)	Carbon Tetrachloride (µg/L)	Other Volatile Organic Compounds (EPA Method 8260) (µg/L)	Nitrate as N (µg N/L)	Nitrite as N (µg N/L)	Other Analyses (µg/L)	Domestic Well In Service During Sampling?
7110 Elphick Road New Well (constructed 25-27 Jun 2002)	Circa Aug 2008	Weeks Drilling and Pump	Unknown						11,000		Total Alkalinity = 188,000 as $CaCO_3$ Total Hardness = 14,000 gpg Total Iron = 300 Total Manganese = 100 ph = 7.3 Total Dissolved Solids = 470,000	
	15 Dec 2008	Weeks Drilling and Pump	Unknown	15	9.1	<0.5	<0.5	1,1-Dichloroethene = 2.4 Chloroform = 1.8 cis-1,2-Dichloroethene = 0.79 Others <0.5 to <5.0	8,350	<60	Total Coliform <1 MPN/100 mL E. Coli <1 MPN/100 mL Total Antimony <5.0 Total Arsenic <2.0 Total Selenium <5.0 Total Thallium <2.0 Total Aluminum <50 Total Barium = 70 Total Beryllium <2.0 Total Cadmium <1.0 Total Chromium = 10 Total Iron <100 Total Manganese <20 Total Nickel <10 Total Mercury <0.20 Total Calcium = 97,000 Total Magnesium = 5,800 Total Hardness = 270,000 as $CaCO_3$ pH = 7.28 Total Alkalinity = 210,000 as $CaCO_3$ Fluoride <100 Total Dissolved Solids = 450,000 Cyanide <50	
	18 Sep 2010	Analytical Sciences	Unknown	<0.5 (2)	<0. 5 (2)	<0. 5 (2)	<0. 5 (2)	<0.5 to <12 (2)	7,700		Total Coliform = 3 MPN E. Coli <1 MPN Total Arsenic <2.0	
	30 Sep 2010	Analytical Sciences	Unknown	10	9.2	<0.5	<0.5	1,1-Dichloroethene = 2.8 Chloroform = 1.5 cis-1,2-Dichloroethene = 1.7 1,2-Dichloropropane = 0.62 Others <0.5 to <12	9,500			
	26 Jun 2014	Streamborn	Grab (s-tap)	5.0	5.3	<0.5	<0.5	1,1-Dichloroethene = 0.7 Chloroform = 1.5 cis-1,2-Dichloroethene = 0.6 Others <0.5 to <5.0				**Yes**
	5 Aug 2014	Streamborn	Grab (s-tap)	5.0	5.0	<0.5	<0.5	Chloroform = 1.4 cis-1,2-Dichloroethene = 0.6 Others <0.5 to <5.0				**Yes**

Groundwater Analytical Data from Wells (all results represent untreated groundwater)

Location	Sample Date	Sampled by	Sample Type	PCE (µg/L)	TCE (µg/L)	TCA (µg/L)	Carbon Tetrachloride (µg/L)	Other Volatile Organic Compounds (EPA Method 8260) (µg/L)	Nitrate as N (µg N/L)	Nitrite as N (µg N/L)	Other Analyses (µg/L)	Domestic Well In Service During Sampling?
7125 Elphick Road Old Well (discontinued circa 2004)	8 Apr 1999	RWQCB	Unknown	0.54	0.55	0.51	ND	Methylene Chloride = 0.67 Toluene = 1.1 Others = ND				
	26 Apr 1999	RWQCB	Unknown	0.61	0.65	0.58	ND	Methylene Chloride = 0.64 1,1-Dichloroethene = 0.55 Others = ND				
	16 Apr 2002	RWQCB	Unknown	3.5	2.7	0.52	ND	1,1-Dichloroethene = 0.93 Others = ND				
	Jun 2003	RWQCB	Unknown	4.8	3.3	0.47	ND	1,1-Dichloroethene = 0.86 Others = ND				
	29 Sep 2003	RWQCB	Unknown	6.5	4.4	0.64	0.27	Cis-1,2-Dichloroethene = 0.67 1,1-Dichloroethene = 1.3 Others = ND				
7125 Elphick Road New Well (constructed circa 2004)	25 Jun 2014	Streamborn	Grab (s-tap)	<0.5	<0.5	<0.5	<0.5	<0.5 to <5.0				**Yes**
7132 Elphick Road	22 Apr 2002	RWQCB	Unknown	ND	ND	ND	ND	ND				
7143 Elphick Road	8 Apr 1999	RWQCB	Unknown	ND	ND	ND	ND	ND				
	17 Apr 2002	RWQCB	Unknown	5.1	4.1	1.1	ND	1,1-Dichloroethane = 1.7 Methylene Chloride = 2.3 Others = ND				
	25 Jun 2014	Streamborn	Grab (h-bib)	0.7	1.1	<0.5	0.5	<0.5 to <5.0				**Yes**
	5 Aug 2014	Streamborn	Grab (h-bib)	0.6	1.0	<0.5	0.6	<0.5 to <5.0				**Yes**
	5 Aug 2014	Streamborn	Grab (faucet)	0.7	1.2	<0.5	0.5	<0.5 to <5.0				**Yes**
7173 Witter Road	9 Apr 1999	RWQCB	Unknown	ND	ND	ND	ND	Toluene = 0.69 Others = ND				
	25 Jun 2014	Streamborn	Grab (h-bib)	<0.5	<0.5	<0.5	<0.5	<0.5 to <5.0				**Yes**

Groundwater Analytical Data from Wells (all results represent untreated groundwater)

Location	Sample Date	Sampled by	Sample Type	PCE (µg/L)	TCE (µg/L)	TCA (µg/L)	Carbon Tetrachloride (µg/L)	Other Volatile Organic Compounds (EPA Method 8260) (µg/L)	Nitrate as N (µg N/L)	Nitrite as N (µg N/L)	Other Analyses (µg/L)	Domestic Well In Service During Sampling?
7177 Witter Road	23 Mar 1999	Weeks	Unknown	0.67	0.5	ND	ND	ND				
	9 Apr 1999	RWQCB	Unknown	1.2	ND	ND	ND	Others = ND				
	19 Apr 2002	RWQCB	Unknown	2.3	ND	ND	ND	Toluene = 1.2 Others = ND				
	25 Jun 2014	Streamborn	Grab (s-tap)	<0.5	<0.5	<0.5	<0.5	Benzene = 0.8 Others <0.5 to <5.0				**Yes**
	5 Aug 2014	Streamborn	Grab (s-tap)	<0.5	<0.5	<0.5	<0.5	<0.5 to <5.0				**Yes**
7179 Elphick Road	15 Apr 2001	RWQCB	Unknown	13	10	1.7	0.62	1,1-Dichloroethene = 2.9 cis-1,2-Dichloroethene = 1.1 Methylene Chloride = 0.52 Total Trihalomethanes = 1.4 Others = ND				
	15 Apr 2002	RWQCB	Unknown	13	10	1.6	0.64	1,1-Dichloroethene = 2.7 cis-1,2-Dichloroethene = 0.96 Methylene Chloride = 0.53 Total Trihalomethanes = 1.4 Others = ND	6,330 (1)			
	25 Jun 2014	Streamborn	Grab (h-bib)	1.9	2.5	<0.5	<0.5	Chloroform = 1.3 cis-1,2-Dichloroethene = 0.8 Others <0.5 to <5.0	6,330 (1)			**Yes**
	5 Aug 2014	Streamborn	Grab (h-bib)	2.5	4.1	<0.5	<0.5	Chloroform = 1.9 cis-1,2-Dichloroethene = 1.4 Others <0.5 to <5.0				**Yes**
	5 Aug 2014	Streamborn	Grab (faucet)	1.5	2.8	<0.5	<0.5	Chloroform = 1.4 cis-1,2-Dichloroethene = 1.1 Others <0.5 to <5.0				**Yes**
7188 Elphick Road	15 Apr 2002	RWQCB	Unknown	<0.5	<0.5	<0.5	<0.5	<0.5 to <10				
7189 Elphick Road	15 Apr 2002	RWQCB	Unknown	<0.5	<0.5	<0.5	<0.5	<0.5 to <10				

Groundwater Analytical Data from Wells (all results represent untreated groundwater)

Chang's Witter Road Properties
Sebastopol CA

Location	Sample Date	Sampled by	Sample Type	PCE (µg/L)	TCE (µg/L)	TCA (µg/L)	Carbon Tetrachloride (µg/L)	Other Volatile Organic Compounds (EPA Method 8260) (µg/L)	Nitrate as N (µg N/L)	Nitrite as N (µg N/L)	Other Analyses (µg/L)	Domestic Well In Service During Sampling?
7191 Witter Road (sometimes mistaken for 7191 Elphick Road)	15 Apr 2002	RWQCB	Unknown	ND	ND	ND	ND	Total Trihalomethanes = 0.50 Others = ND	7,230 (1)			
	25 June 2014	Streamborn	Grab (h-bib)	<0.5	<0.5	<0.5	<0.5	<0.5 to <5.0				**Yes**
7193 Elphick Road	15 Apr 2002	RWQCB	Unknown	<0.5	<0.5	<0.5	<0.5	<0.5 to <10				
7205 Elphick Road	16 Apr 2002	RWQCB	Unknown	<0.5	<0.5	<0.5	<0.5	<0.5 to <10				
7248 Witter Road	16 Jul 1999	Harris & Lee	Unknown	ND	ND	ND	ND	ND				
7249 Witter Road	26 June 2014	Streamborn	Grab (h-bib)	<0.5	<0.5	<0.5	<0.5	<0.5 to <5.0				**Yes**
7260 Witter Road	16 Jul 1999	Harris & Lee	Unknown	ND	ND	ND	ND	ND				
7270 Elphick Road	8 Nov 2000	RWQCB	Unknown	<0.5	<0.5	<0.5	<0.5	<0.5 to <50				
7286 Witter Road	16 Jul 1999	Harris & Lee	Unknown	ND	ND	ND	ND	ND				
7274 Elphick Road	19 Apr 2002	RWQCB	Unknown	2.0	1.0	ND	ND	1,1-Dichloroethane = 0.91 Total Trihalomethanes = 0.61 Others = ND	7,000 (1)			
7282 Elphick Road	17 Apr 2002	RWQCB	Unknown	ND	ND	ND	5.3	Total Trihalomethanes = 1.2 Others = ND	10,400 (1)			
	5 May 2002	RWQCB	Unknown	ND	ND	ND	3.5	Total Trihalomethanes = 1.1 Others <0.50 to <10	10,000	<200		
7494 Elphick Road	6 May 2002	RWQCB	Unknown	<0.5	<0.5	<0.5	<0.5	<0.5 to <10	220	<200		
7039 Lynch Road	16 Apr 2002	RWQCB	Unknown	1.4	0.79	ND	ND	ND	5,650 (1)			
	6 May 2002	RWQCB	Unknown	1.1	0.61	ND	ND	<0.5 to <10	5,400	<200		
7041 Lynch Road	8 Mar 1999	Unknown	Unknown	50	1.2	<0.5	<0.5	<0.5				
7050 Lynch Road	17 Apr 2002	Unknown	Unknown	0.85	ND	ND	ND	ND	17,630 (1)			
	5 May 2002	RWQCB	Unknown	1.9	ND	ND	ND	<0.5 to <10	14,000	<200		

Groundwater Analytical Data from Wells (all results represent untreated groundwater)

Location	Sample Date	Sampled by	Sample Type	PCE (µg/L)	TCE (µg/L)	TCA (µg/L)	Carbon Tetrachloride (µg/L)	Other Volatile Organic Compounds (EPA Method 8260) (µg/L)	Nitrate as N (µg N/L)	Nitrite as N (µg N/L)	Other Analyses (µg/L)	Domestic Well In Service During Sampling?
7051 Lynch Road	16 Apr 2002	Unknown	Unknown	10	2.1	ND	ND	1,1-Dichloroethene = 0.54 Others = ND	13,560	90		
	5 May 2002	RWQCB	Unknown	8.0	1.9	<0.5	<0.5	1,1-Dichloroethane = 0.66 Others <0.50 to <10	13,000	<200		
	16 Nov 2004	RWQCB	Unknown	1.4	ND	ND	ND	ND				
	11 Jan 2006	RWQCB	Unknown	5.9	0.58	ND	ND	ND				
	5 Jul 2007	RWQCB	Unknown	ND	ND	ND	ND	1,1-Dichloroethene = 0.92 Others = ND				
7061 Lynch Road	28 Sep 2001	RWQCB	Unknown	6.0	0.5	ND	ND	ND				
	19 Apr 2002	Unknown	Unknown	10	0.92	ND	ND	ND	17,630 (1)			
7105 Lynch Road	19 Apr 2002	Unknown	Unknown	ND	ND	0.83	ND	ND	6,550 (1)			
7149 Lynch Road	15 Apr 2002	Unknown	Unknown	2.1	ND	ND	ND	ND	9,270 (1)			
	5 May 2002	RWQCB	Unknown	1.8	ND	ND	ND	ND	8,900	<200		
1021 Pearl Court	16 Jul 1999	Harris & Lee	Unknown	<0.5	<0.5	<0.5	<0.5	<0.5				
7210 Saraview Way	3 Aug 1999	RWQCB	Unknown	ND	ND	ND	ND	ND				
7416 Saraview Way	3 Aug 1999	RWQCB	Unknown	ND	ND	ND	1.55	ND				
	27 Sep 1999	RWQCB	Unknown	ND	ND	ND	1.35	ND				
	16 Apr 2002	Unknown	Unknown	ND	ND	ND	0.59	ND	5,420 (1)			
7435 Saraview Way	11 Feb 2000	RWQCB	Unknown	ND	ND	ND	ND	ND				
7447 Saraview Way	11 Feb 2000	RWQCB	Unknown	ND	ND	ND	ND	ND				
7460 Saraview Way	27 Sep 1999	RWQCB	Unknown	ND	ND	ND	ND	ND				
400 Waverly Way	15 Apr 2002	RWQCB	Unknown	ND	ND	ND	ND	Total Trihalomethanes = 0.54 Others = ND				
1080 Waverly Way	15 Apr 2002	Unknown	Unknown	ND	ND	ND	ND	Total Trihalomethanes = 0.53 Others = ND	3,620 (1)			

Groundwater Analytical Data from Wells (all results represent untreated groundwater)

Location	Sample Date	Sampled by	Sample Type	PCE (µg/L)	TCE (µg/L)	TCA (µg/L)	Carbon Tetrachloride (µg/L)	Other Volatile Organic Compounds (EPA Method 8260) (µg/L)	Nitrate as N (µg N/L)	Nitrite as N (µg N/L)	Other Analyses (µg/L)	Domestic Well In Service During Sampling?
8749 Nora Way	3 Aug 1999	RWQCB	Unknown	ND	ND	ND	1.55	ND				
	27 Sep 1999	RWQCB	Unknown	ND	ND	ND	1.35	ND				
	16 Apr 2002	RWQCB	Unknown	ND	ND	ND	0.59	ND				
City of Sebastopol Well #7	21 May 2000	Unknown	Unknown	ND	ND	0.5	ND	ND				

General Notes

(a) TPH = total petroleum hydrocarbons.

(b) ND = not detected.

(c) PCE = Tetrachloroethene. TCE = Trichloroethene. TCA = 1,1,1-Trichloroethane.

(d) Some domestic wells employ treatment systems and some samples have been collected downstream of the treatment systems - these data have not been included in this table. This table only includes data indicative of insitu groundwater concentrations.

(e) Weeks = Weeks Drilling and Pump (Sebastopol CA).

(f) s-tap = sample tap, located upstream of any carbon contactors.

(g) h-bib = sample collected from exterior hose bib.

(g) faucet = sample collected from the faucet at the kitchen sink.

(h) Well locations have been documented on Figure 4 of Streamborn's 29 March 2013 report (Streamborn 2013).

(i) In general, Streamborn has limited entries in this table to samples supported by laboratory data sheets.

Footnote

(1) Analyzed as nitrate plus nitrite.

(2) The volatile organic compound analysis on 18 September 2010 for the New Well at 7110 Elphick Road has been excluded from interpretation. The volatile organic compounds were nondetect and this sample was likely collected downstream of treatment.

Table 8

Groundwater Analytical Data for Domestic Wells That Were Monitored in June 2014 and August 2014

Well Identification	Sample Date	Tetrachloro-ethene (PCE) (µg/L)	Trichloro-ethene (TCE) (µg/L)	Cis-1,2-Dichloro-ethene (Cis-1,2-DCE) (µg/L)	Vinyl Chloride (µg/L)	Sum of Detected PCE, TCE, Cis-1,2-DCE, Vinyl Chloride (µg/L / µmoles/L)	Carbon Tetrachloride (µg/L)	Chloroform (µg/L)	Other Volatile Organic Compounds (EPA Method 8260) (µg/L)	Comments
1200 Gravenstein Highway South	26 Jun 2014	<0.5	<0.5	<0.5	<0.5	0 / 0	<0.5	<0.5	<0.5 to <5.0	
7081 Elphick Road	25 Jun 2014	<0.5	<0.5	<0.5	<0.5	0 / 0	<0.5	<0.5	<0.5 to <5.0	
7099 Elphick Road	25 Jun 2014	<0.5	<0.5	<0.5	<0.5	0 / 0	<0.5	<0.5	<0.5 to <5.0	
7110 Elphick Road	26 Jun 2014	5.0	5.3	0.6	<0.5	10.9 / 0.077	<0.5	1.5	1,1-Dichloroethene = 0.7 Others <0.5 to <5.0	At the time of sampling, a carbon treatment system existed for this water system. The sample was collected upstream of any of the carbon contactors.
	5 Aug 2014	5.0	5.0	0.6	<0.5	10.6 / 0.075	<0.5	1.4	<0.5 to <5.0	At the time of sampling, a carbon treatment system existed for this water system. The sample was collected upstream of any of the carbon contactors.
7125 Elphick Road	25 Jun 2014	<0.5	<0.5	<0.5	<0.5	0 / 0	<0.5	<0.5	<0.5 to <5.0	
7143 Elphick Road	25 Jun 2014	0.7	1.1	<0.5	<0.5	1.8 / 0.013	0.5	<0.5	<0.5 to <5.0	No carbon treatment system existed at the time of sampling.
	5 Aug 2014	0.6	1.0	<0.5	<0.5	1.6 / 0.011	0.6	<0.5	<0.5 to <5.0	No carbon treatment system existed at the time of sampling.
	5 Aug 2014	0.7	1.2	<0.5	<0.5	1.9 / 0.013	0.5	<0.5	<0.5 to <5.0	This sample was collected from the faucet at the kitchen sink.
7173 Witter Road	25 Jun 2014	<0.50	<0.50	<0.50	<0.5	0 / 0	<0.5	<0.5	<0.5 to <5.0	
7177 Witter Road	25 Jun 2014	<0.50	<0.50	<0.50	<0.5	0 / 0	<0.5	<0.5	Benzene = 0.8 Others <0.5 to <5.0	At the time of sampling, a carbon treatment system existed for this water system. The sample was collected upstream of any of the carbon contactors.
	5 Aug 2014	<0.50	<0.50	<0.50	<0.5	0 / 0	<0.5	<0.5	<0.5 to <5.0	At the time of sampling, a carbon treatment system existed for this water system. The sample was collected upstream of any of the carbon contactors.
7179 Elphick Road	25 Jun 2014	1.9	2.5	0.8	<0.5	5.2 / 0.039	<0.5	1.3	<0.5 to <5.0	No carbon treatment system was operational at the time of sampling.
	5 Aug 2014	2.5	4.1	1.4	<0.5	8.0 / 0.061	<0.5	1.9	<0.5 to <5.0	No carbon treatment system was operational at the time of sampling.
	5 Aug 2014	1.5	2.8	1.1	<0.5	5.4 / 0.042	<0.5	1.4	<0.5 to <5.0	This sample was collected from the faucet at the kitchen sink.
7191 Witter Road	25 Jun 2014	<0.50	<0.50	<0.50	<0.5	0 / 0	<0.5	<0.5	<0.5 to <5.0	
7249 Witter Road	26 Jun 2014	<0.50	<0.50	<0.50	<0.5	0 / 0	<0.5	<0.5	<0.5 to <5.0	

California Public Health Goal (PHG), drinking water criteria	0.06	1.7	100	0.05		0.1	5.7 [1]	Benzene = 0.15 1,1-Dichloroethene = 10	California Office of Environmental Health Hazard Assessment (OEHHA) (http://oehha.ca.gov/water/phg/allphgs.html)
California Maximum Contaminant Level (MCL), drinking water criteria	5	5	6	0.5		0.5	80 [2]	Benzene = 1 1,1-Dichloroethene = 6	California EPA (http://www.cdph.ca.gov/certlic/drinkingwater/Documents/Lawbook/dwregulations-2013-07-01.pdf)
Recalculated California Public Health Goal using the US EPA February 2012 revised cancer risk factors for tetrachloroethene	0.3								Details of the revised drinking water criteria were provided in Streamborn's 29 March 2013 report (Streamborn 2013) and EPA's revised toxicological review of tetrachloroethene (EPA/IRIS 2012).
Recalculated California Maximum Contaminant Level using the US EPA February 2012 revised cancer risk factors for tetrachloroethene	20								Details of the revised drinking water criteria were provided in Streamborn's 29 March 2013 report (Streamborn 2013) and EPA's revised toxicological review of tetrachloroethene (EPA/IRIS 2012).

General Notes

(a) All samples were grab samples.

(b) For the purpose of calculating the sum of PCE, TCE, Cis-1,2-DCE, and Vinyl Chloride; nondetectable measurements were assumed equal to zero.

(c) In February 2012, the US EPA issued revised toxicity indexes/factors, indicating tetrachloroethene is less toxic than previously thought and trichloroethene is more toxic than previously thought. The California Public Health Goal and California Maximum Contaminant Level do not reflect the revised toxicity indexes/factors.

Footnotes

(1) No California Public Health Goal currently exists for chloroform. The cited chloroform criterion of 5.7 µg/L corresponds to the US EPA "Draft Revised Human Health Criteria" dated January 2004, which is the most recent criterion available from the US EPA. (http://water.epa.gov/scitech/swguidance/standards/criteria/health/draftfs.cfm)

(2) No California Maximum Contaminant Level currently exists for chloroform. The chloroform criterion of 80 µg/L corresponds to the California Maximum Contaminant Level for "Total Trihalomethanes", defined as the sum of bromodichloromethane, bromoform, chloroform, and dibromochloromethane. (http://www.cdph.ca.gov/certlic/drinkingwater/Documents/Lawbook/dwregulations-2013-07-01.pdf)

Table 9

Selected Remedial Actions for the Domestic Wells at
7110 Elphick Road, 7143 Elphick Road, and 7179 Elphick Road

Wellhead Treatment and Monitored Natural Attenuation

Water Quality Objectives for Chloroethenes

- Tetrachloroethene ≤ 0.06 µg/L = nondetect.
- Trichloroethene ≤1.7 µg/L.
- Cis-1,2-dichloroethene ≤6 µg/L.
- Vinyl Chloride ≤0.05 µg/L = nondetect.

Access Agreements

- Access agreement will need to be negotiated between each well owner and the current and former owners of the Chang's Witter Road properties.

Wellhead Treatment at 7143 Elphick Road and 7179 Elphick Road

- Suitable wellhead treatment currently exists at 7110 Elphick Road.
- Install wellhead treatment at 7143 Elphick Road and 7179 Elphick Road. Wellhead treatment should consist of the "Standard Installation Configuration" by Weeks Water Treatment (Sebastopol CA). The Weeks' system includes:
  - Two carbon contactors in series. Each contactor will include 4 cubic feet of activated carbon.
  - Particulate pre-filter, upstream of the carbon contactors.
  - Ultraviolet disinfection, downstream of the carbon contactors.
  - Water meter, valves, pressure gauges, and sample ports.

Periodic Sampling and Analysis of Untreated and Treated Groundwater at 7110 Elphick Road, 7143 Elphick Road, and 7179 Elphick Road

- At each well, two samples should be collected: (1) untreated groundwater, and (2) treated water downstream of the first (upstream) carbon contactor.
- Samples should be analyzed for volatile organic compounds by EPA Method 8260. The sampler should specify that the analysis include vinyl chloride.
- Samples should be collected according to the following frequency:
  - For 7143 and 7179 Elphick Road, monitor immediately after installing and starting up the wellhead treatment systems.
  - For all three wells (7110, 7143, and 7179 Elphick Road), monitor two years after installing wellhead treatment at 7143 and 7179 Elphick Road.
  - Thereafter for all three wells (7110, 7143, and 7179 Elphick Road), monitor every four years.
- On a well-by-well basis, when untreated groundwater reaches water quality objectives for chloroethenes, monitoring should cease; however, it may be prudent for the well owner to continue monitoring if other contaminants are detectable.

Periodic Maintenance of the Treatment Systems at 7110 Elphick Road, 7143 Elphick Road, and 7179 Elphick Road

- Approximately annually, each treatment system should be inspected and, as-needed, particulate filters and ultraviolet lamps should be cleaned/replaced.
- On a well-by-well basis, when untreated groundwater reaches water quality objectives for chloroethenes, maintenance should cease; however, it may be prudent for the well owner to continue maintenance if other contaminants are detectable.

Carbon Change-Out

- Should breakthrough occur in any carbon contactor while groundwater concentrations exceed water quality objectives for chloroethenes, a carbon change-out should be performed (remove the upstream contactor, move the downstream contactor into the upstream position, provide a new carbon contactor in the downstream position).

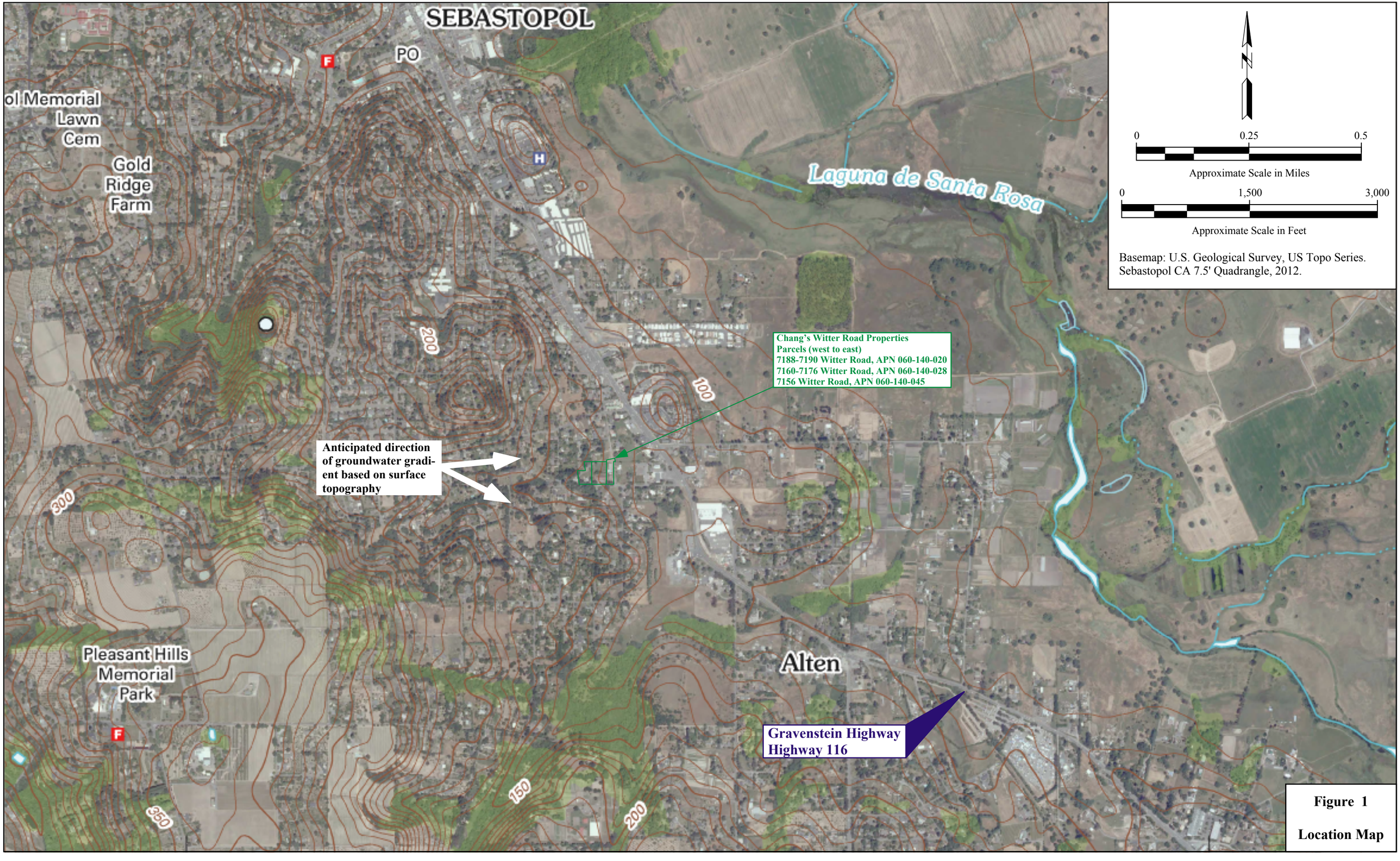

Figure 1

Location Map

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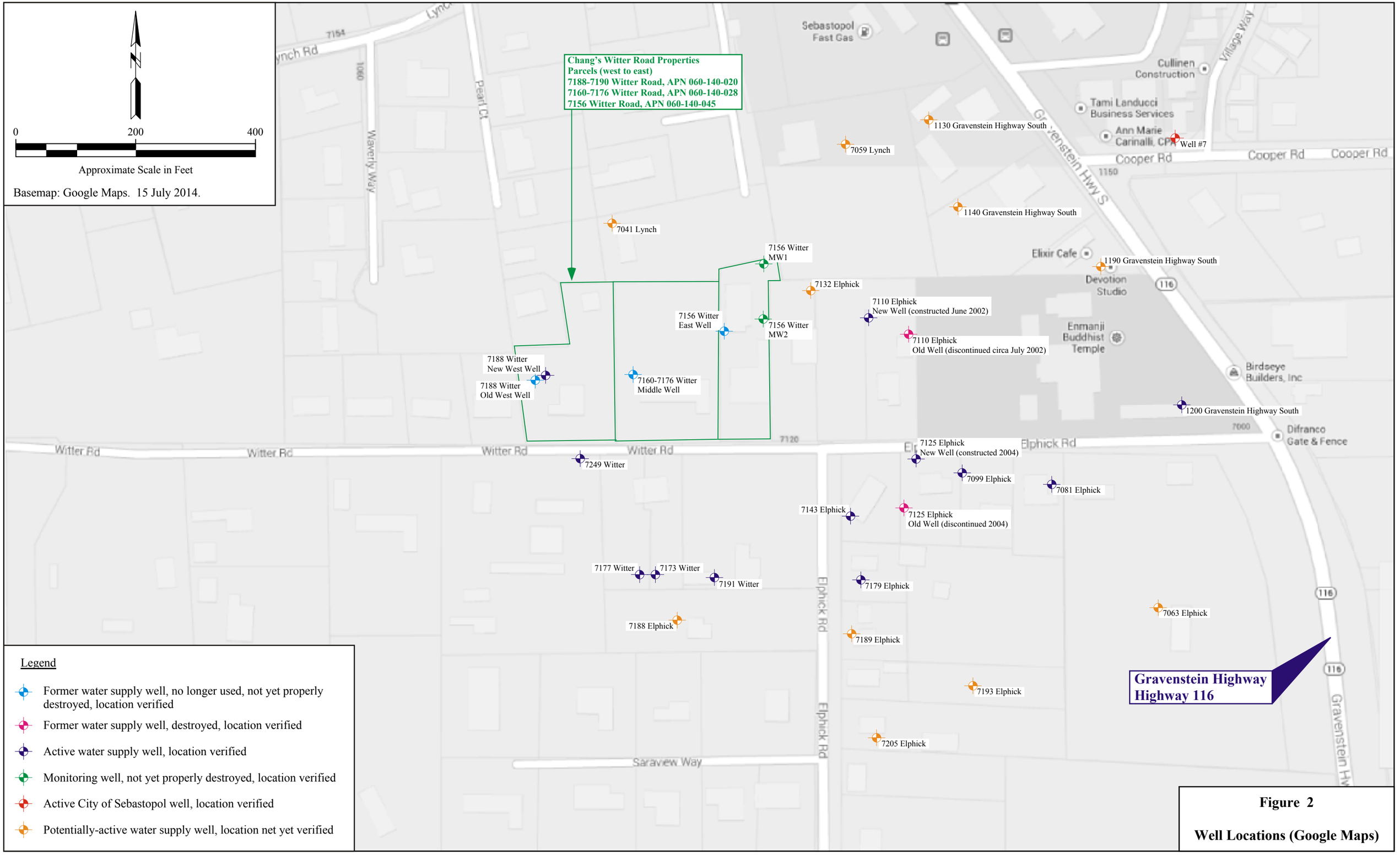

Figure 2

Well Locations (Google Maps)

STREAMBORN

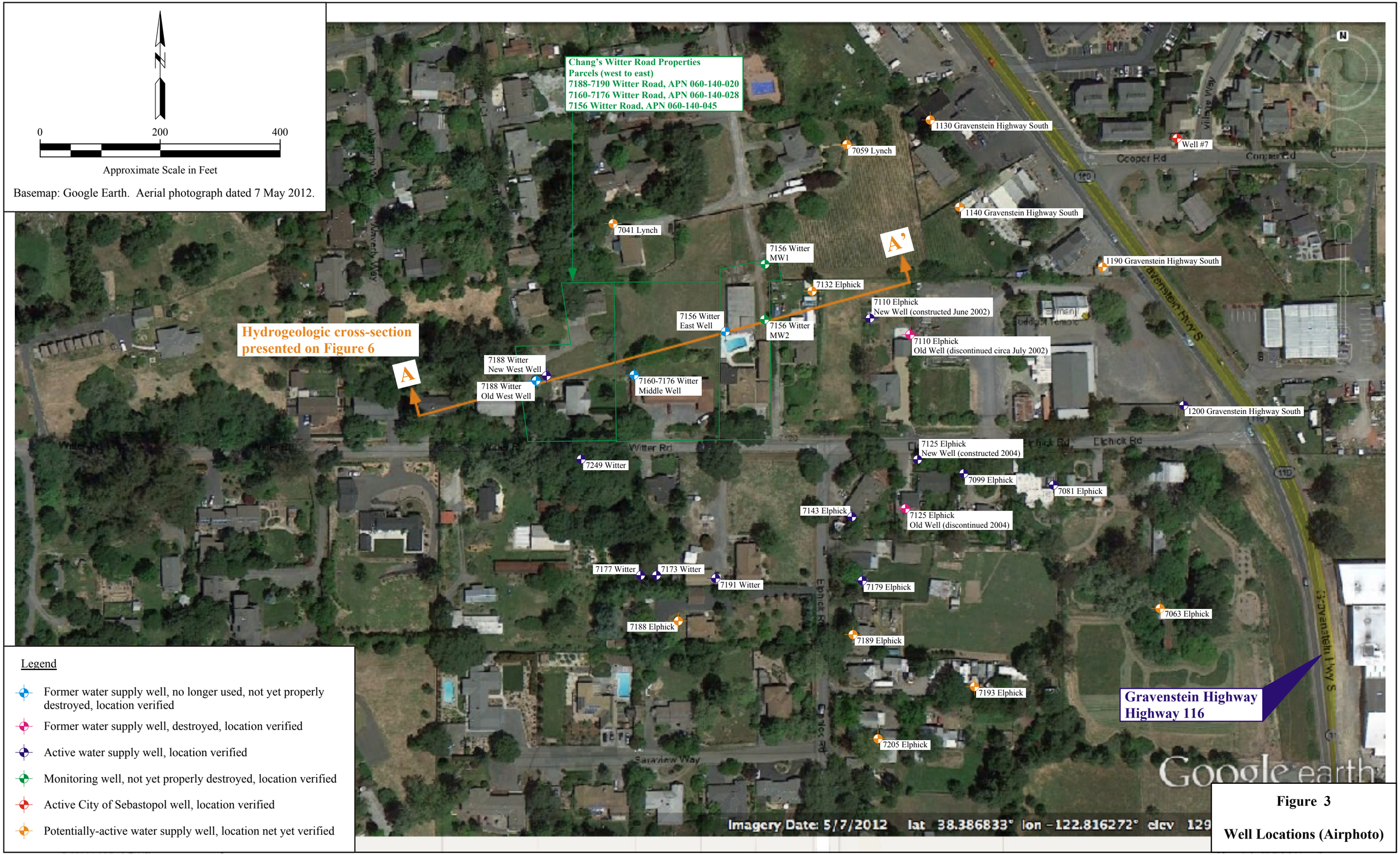

Figure 3

Well Locations (Airphoto)

STREAMBORN

0 200 400

Approximate Scale in Feet

Basemap: Google Earth. Aerial photograph dated 7 May 2012.

Chang's Witter Road Properties
Parcels (west to east)
7188-7190 Witter Road, APN 060-140-020
7160-7176 Witter Road, APN 060-140-028
7156 Witter Road, APN 060-140-045

Mass of dissolved chloroethenes (August 2014)

- **Surface area = 82,000 square feet**
- **Depth to groundwater = 70 feet**
- **Assumed maximum depth of contaminated groundwater = 120 feet**
- **Thickness of contaminated groundwater = 50 feet**
- **Assumed porosity = 0.3**
- **Volume of contaminated groundwater = 82,000 x 50 x 0.3 = 1,230,000 cubic feet (9,200,000 gallons) (34,830,000 L)**
- **Average concentration (sum of chloroethenes) = 6.7 µg/L**
- **Mass of chloroethenes = 0.2 kg (0.5 pounds)**

Range in the likely direction of groundwater gradient in the immediate vicinity of the groundwater plume

Extent of chloroethenes in groundwater as of August 2014 (the most recent sampling date). Footprint = 82,000 square feet. Although the groundwater plume has been depicted as a single contiguous plume, evidence exists to suggest that multiple sources of choroethenes have caused the observed plume and instead of a single plume, separate and/or commingled plumes may actually exist.

1130 Gravenstein Highway South

7059 Lynch

Well #7

Date	PCE
May 2000	<0.5

1140 Gravenstein Highway South

7041 Lynch

7156 Witter MW1

Date	PCE
Oct 2005	<0.5
Oct 2012	<0.5

7110 Elphick
New Well (constructed June 2002)

Date	PCE
Sep 2002	14
Feb 2004	24
Dec 2008	15
Sep 2010	10
Jun 2014	5.0
Aug 2014	5.0

7132 Elphick

Date	PCE
Apr 2002	<0.5

1190 Gravenstein Highway South

7156 Witter East Well

Date	PCE
May 2005	11
Oct 2012	1.6
Mar 2013	<0.5

7156 Witter MW2

Date	PCE
Oct 2005	<0.5
Oct 2012	<0.5

7110 Elphick
Old Well (discontinued circa July 2002)

Date	PCE
Apr 1999	<0.5

7188 Witter New West Well

Date	PCE
Dec 2010	<0.5
Dec 2011	<0.5

7188 Witter Old West Well

Date	PCE
May 2005	<0.5
Oct 2012	<0.5

7160-7176 Witter Middle Well

Date	PCE
Mar 1999	65
Oct 2010	12
Oct 2012	0.86
Mar 2013	<0.5

7125 Elphick
New Well (constructed 2004)

Date	PCE
Several since 2004	<0.5
Jun 2014	<0.5

1200 Gravenstein Highway South

Date	PCE
Apr 2002	<0.5
Jun 2014	<0.5

7249 Witter

Date	PCE
Apr 2002	<0.5
Jun 2014	<0.5

7143 Elphick

Date	PCE
Apr 1999	<0.5
Apr 2002	5.1
Jun 2014	0.7
Aug 2014	0.6

7099 Elphick

Date	PCE
Apr 2002	<0.5
Jun 2014	<0.5

7081 Elphick

Date	PCE
Apr 2007	<0.5
Jun 2014	<0.5

7177 Witter

Date	PCE
Apr 1999	1.2
Apr 2002	2.3
Jun 2014	<0.5
Aug 2014	<0.5

7173 Witter

Date	PCE
Apr 1999	<0.5
Jun 2014	<0.5

7125 Elphick
Old Well (discontinued 2004)

Date	PCE
Apr 1999	0.61
Apr 2002	3.5
Jun 2003	3.5
Sep 2003	6.5

7191 Witter

Date	PCE
Apr 2002	<0.5
Jun 2014	<0.5

7179 Elphick

Date	PCE
Apr 2001	13
Apr 2002	13
Jun 2014	1.9
Aug 2014	2.5

7063 Elphick

Date	PCE
Apr 2002	<0.5

7188 Elphick

Date	PCE
Apr 2002	<0.5

7189 Elphick

Date	PCE
Apr 2002	<0.5

7193 Elphick (well shared with 7195 Elphick, adjacent property to the west)

Date	PCE
Apr 2002	<0.5

7205 Elphick

Date	PCE
Apr 2002	<0.5

Gravenstein Highway
Highway 116

Imagery Date: 5/7/2012 lat 38.386833° lon -122.816272°

Legend

- Former water supply well, no longer used, not yet properly destroyed, location verified
- Former water supply well, destroyed, location verified
- Active water supply well, location verified
- Monitoring well, not yet properly destroyed, location verified
- Active City of Sebastopol well, location verified
- Potentially-active water supply well, location net yet verified

PCE = tetrachloroethene. Concentrations cited in units of µg/L (parts per billion, ppb). All results from raw (untreated) groundwater.

Figure 4

Groundwater Sampling Locations, Representative Results for Tetrachloroethene (PCE) (µg/L), and Mass of Residual Chloroethenes

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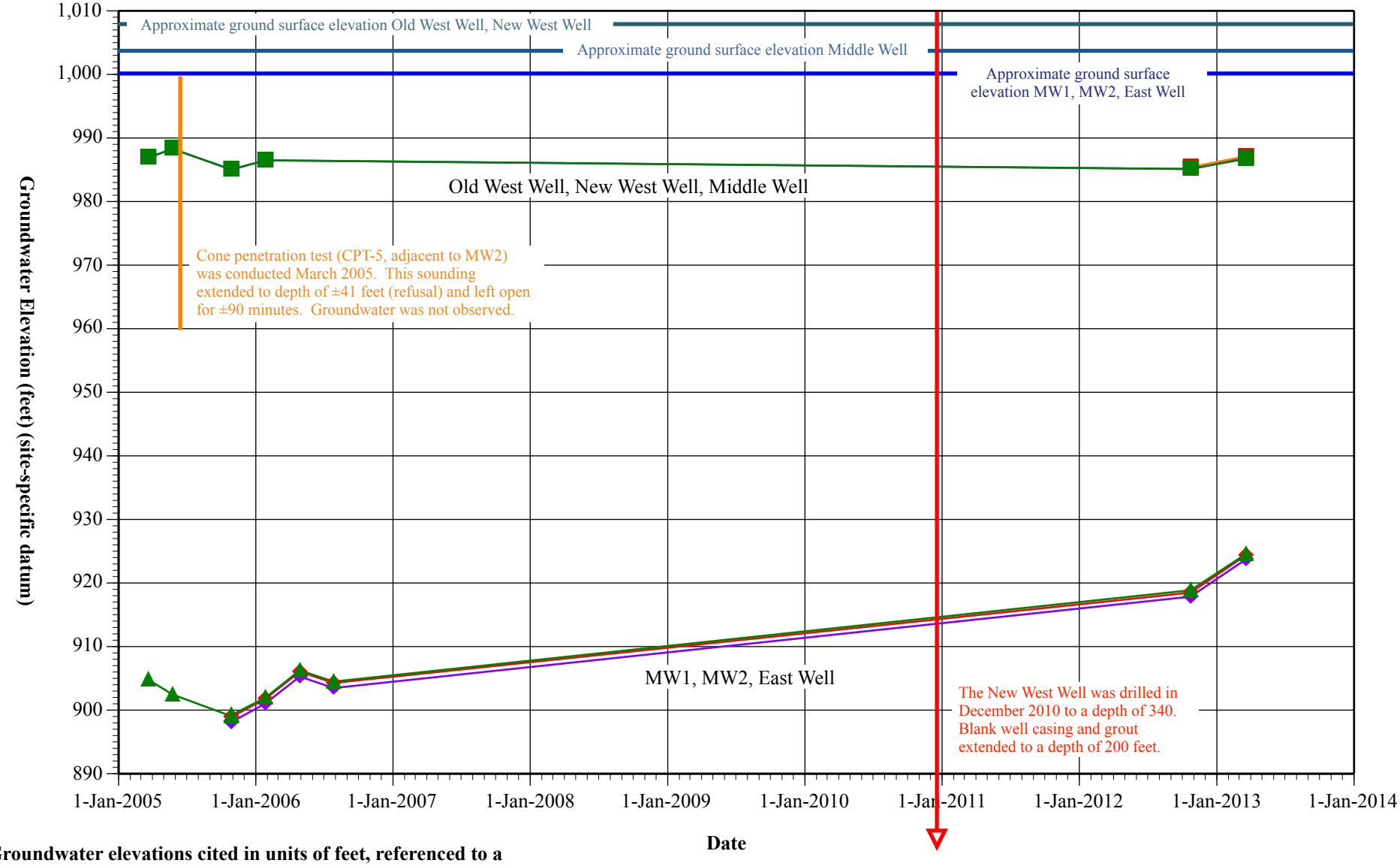

Groundwater elevations cited in units of feet, referenced to a site-specific datum (NOT Mean Sea Level).

MW1 — Old West Well
MW2 — New West Well
East Well — Middle Well

The East Well was used as the domestic supply well until October 2002. The Middle Well was used as the domestic supply well from October 2002 through January 2011. The New West Well has been used as the domestic supply well since January 2011. The approximate average pumping rate for the supply wells = 1.3 gallons per minute (gpm) (equivalent continuous pumping rate).

Figure 5

Hydrographs for Wells on the Chang's Witter Road Properties

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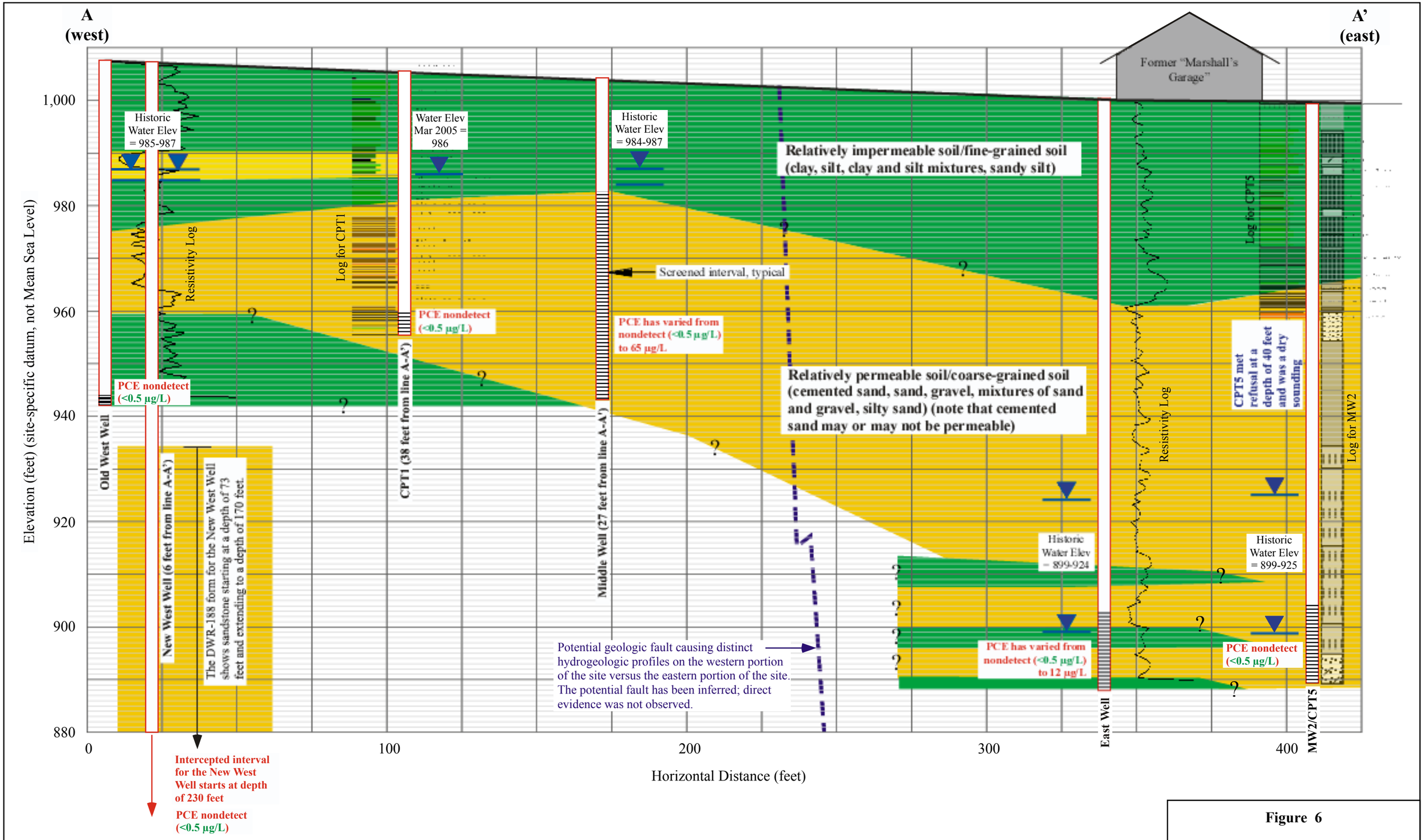


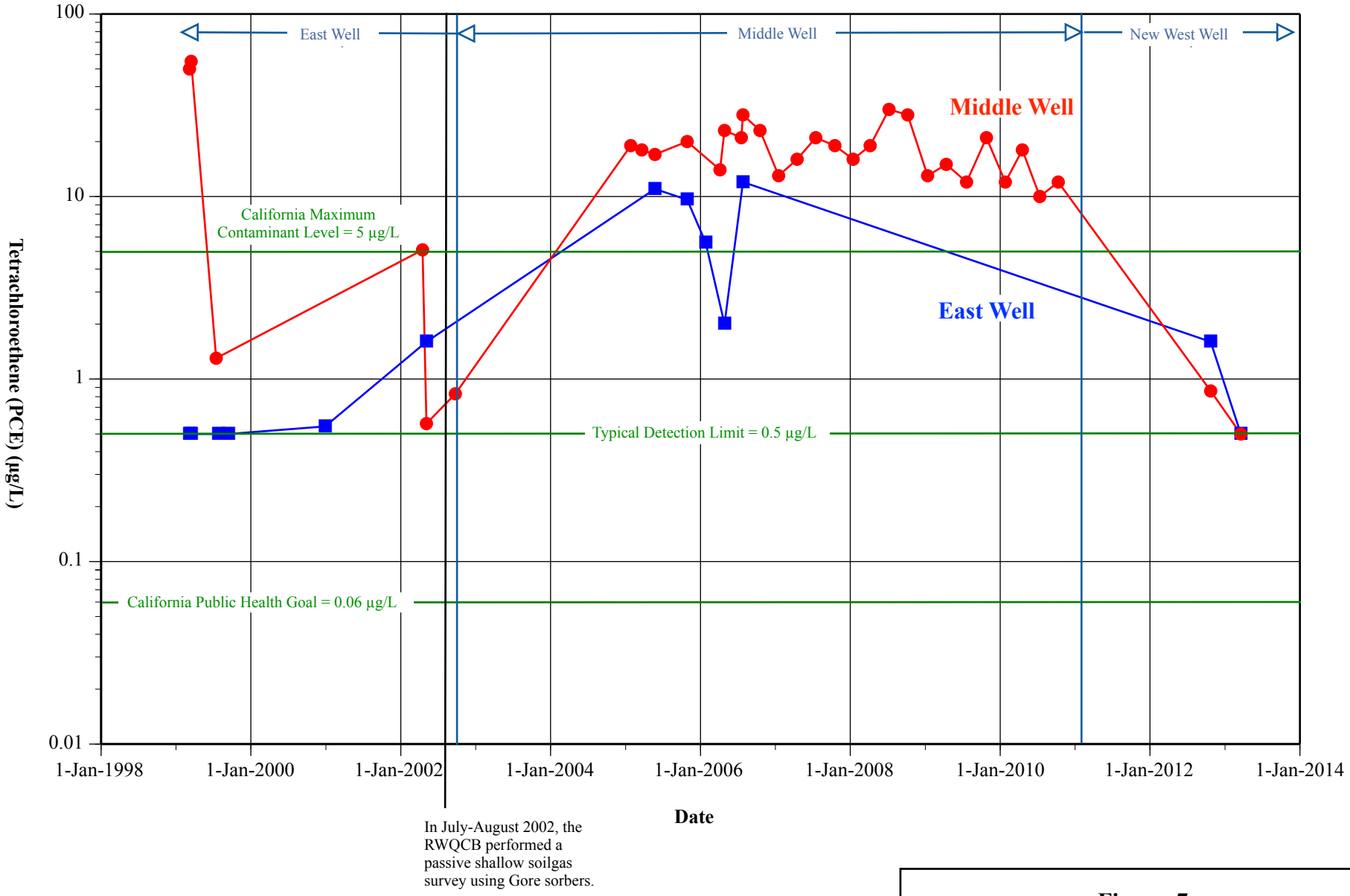
The location of the cross-section is shown on Figure 3. The cross-section is aligned east-northeast whereas the direction of groundwater gradient has likely been east to southeast. Elevations relative to site-specific datum (**NOT** Mean Sea level).

PCE = tetrachloroethene

Figure 6

Hydrogeologic Cross-Section at the Chang's Witter Road Properties

STREAMBORN



Nondetectable measurements have been plotted at the typical detection limit of 0.5 µg/L, even though the detection limit may have varied among sampling events.

The East Well was used as the domestic supply until October 2002. The Middle Well was used as the domestic supply from October 2002 through January 2011. The New West Well has been used as the domestic supply since January 2011. The approximate average pumping rate for the supply wells = 1.3 gallons per minute (gpm) (equivalent continuous rate).

Figure 7

Tetrachloroethene (PCE) (µg/L) Versus Time in the "Middle Well" and "East Well" at the Chang's Witter Road Properties

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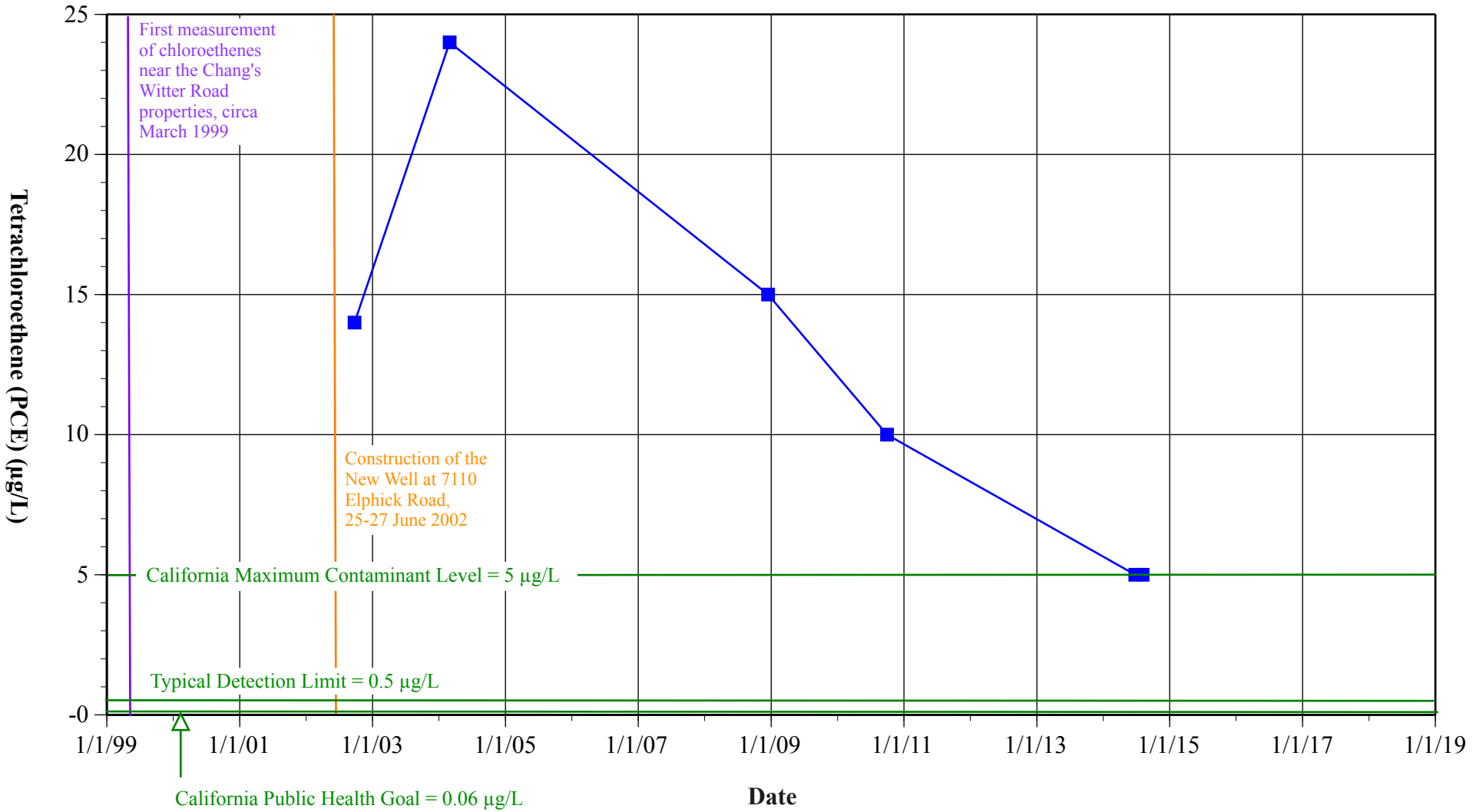

Figure 8

Tetrachloroethene (PCE) (µg/L) Versus Time in the New Well at 7110 Elphick Road

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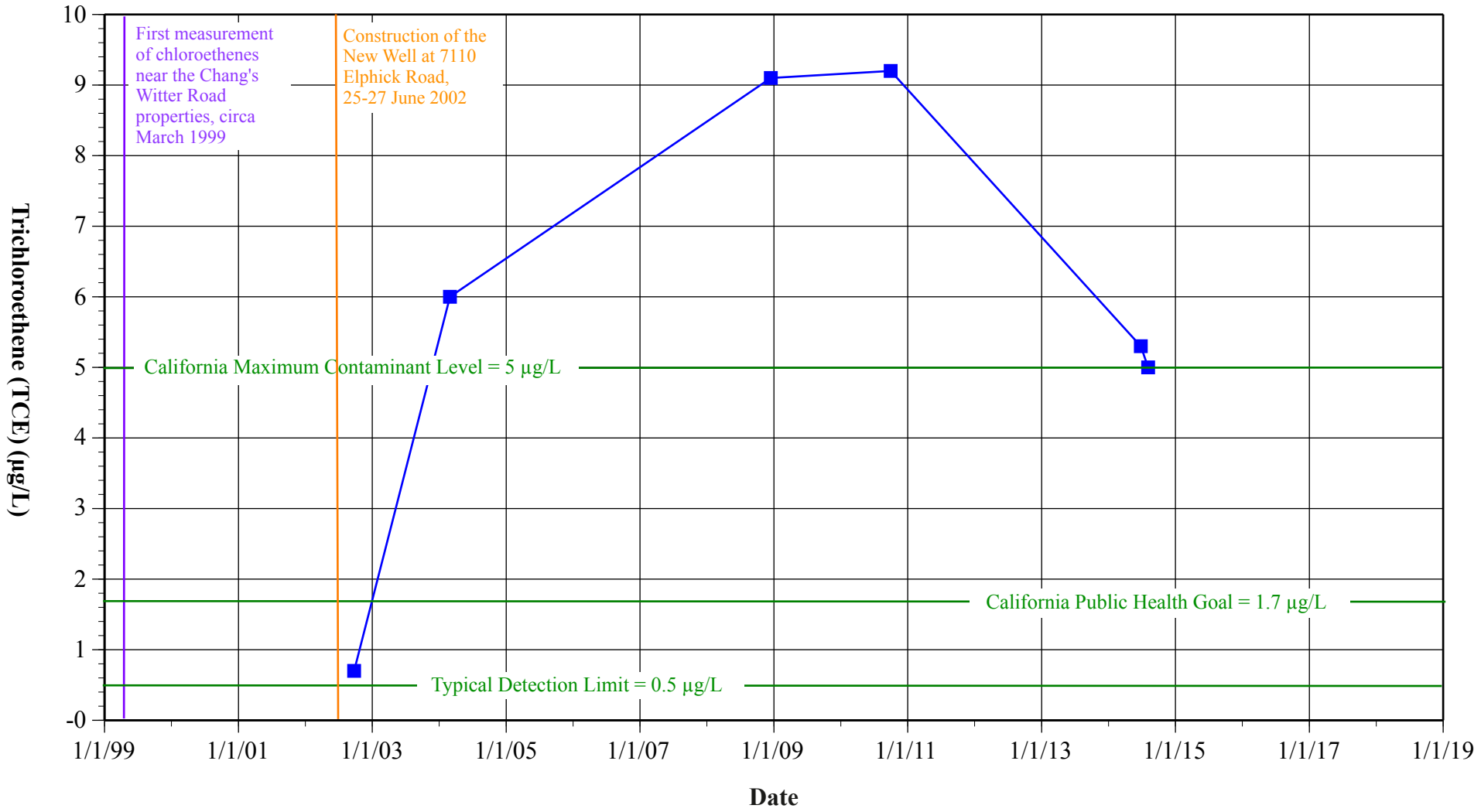

Figure 9

Trichloroethene (TCE) (µg/L) Versus Time in the New Well at 7110 Elphick Road

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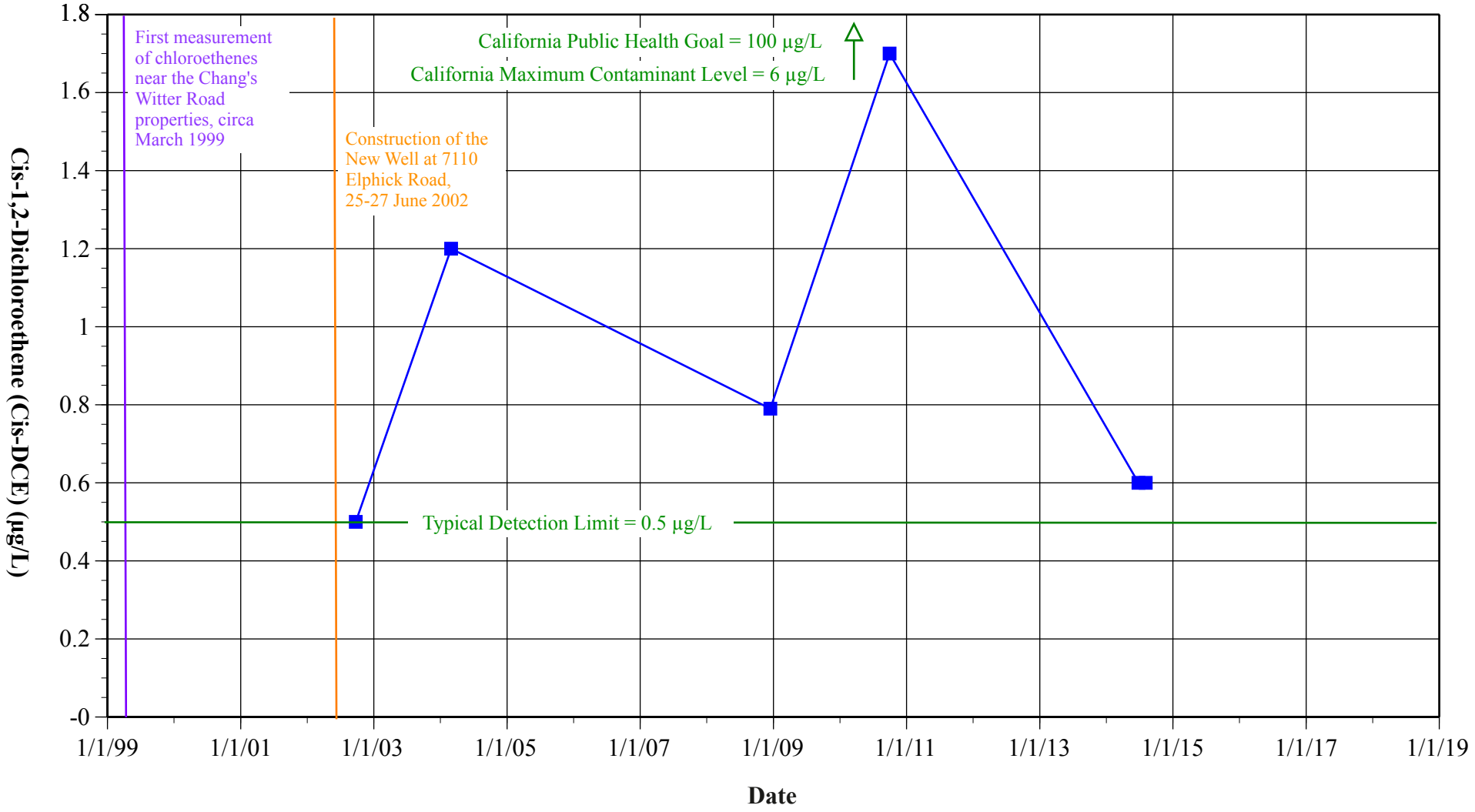

Figure 10

Cis-1,2-Dichloroethene (Cis-DCE) (µg/L) Versus Time in the New Well at 7110 Elphick Road

Nondetectable measurements have been plotted at the typical detection limit of 0.5 µg/L.

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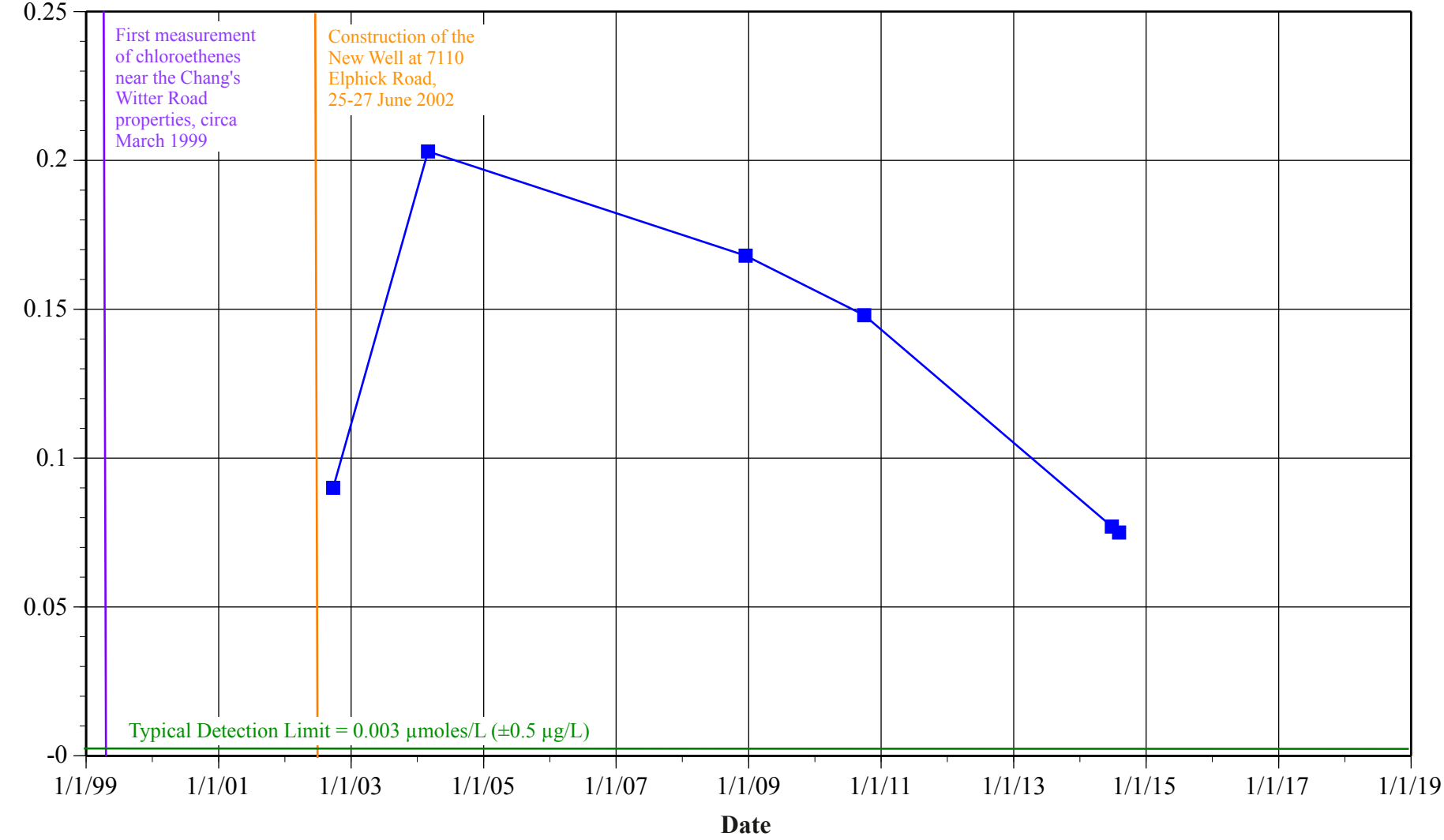

Figure 11

Molar Sum of Chloroethenes (Tetrahloroethene, Trichloroethene, Cis-1,2-Dichloroethene, and Vinyl Chloride) (µmoles/L) Versus Time in the New Well at 7110 Elphick Road

To calculate the sum, nondetectable measurements have been assumed equal to zero.

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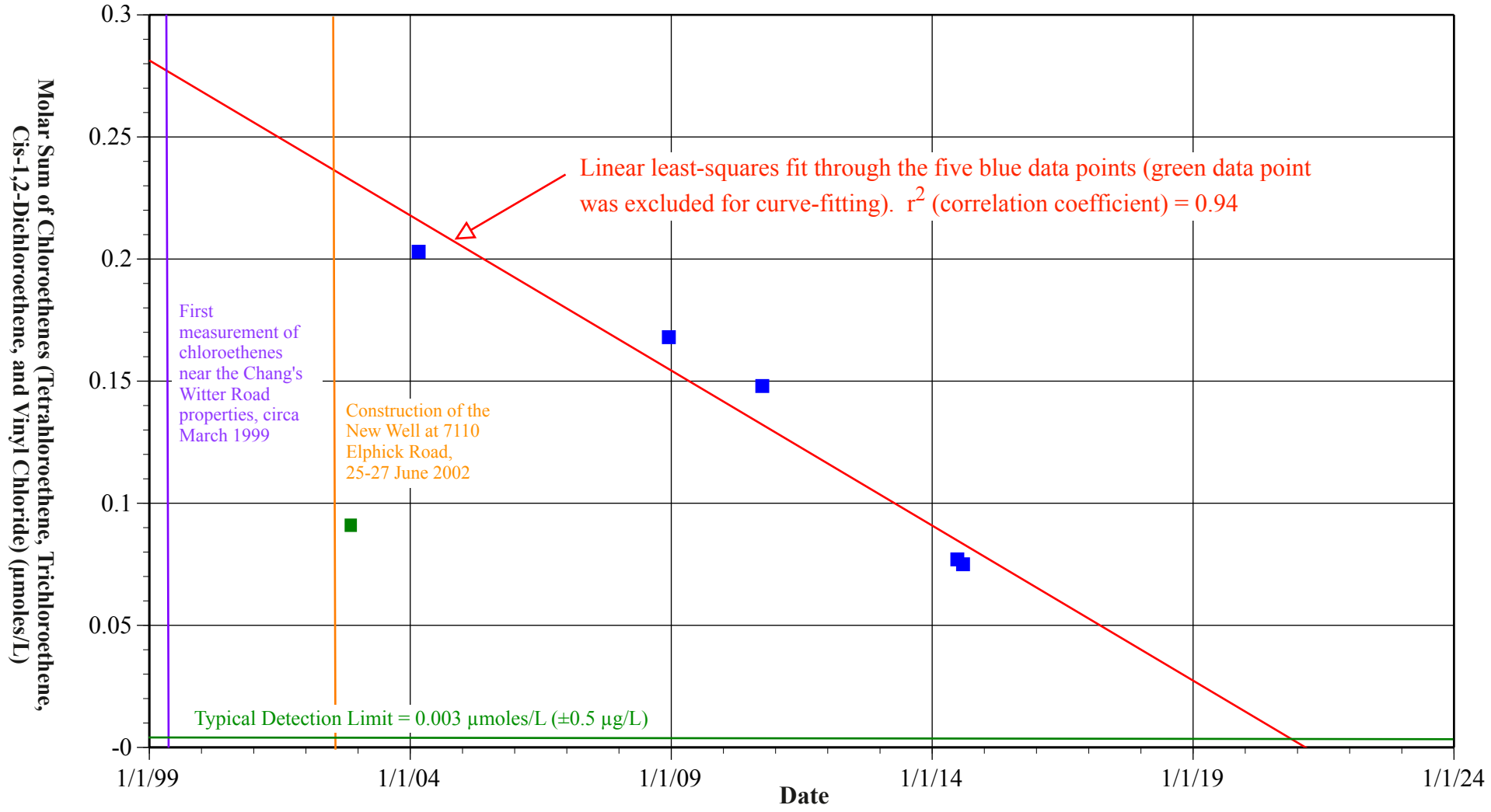

The green data point was excluded from the interpretation of the linear least-squares fit. The data point for September 2002 was excluded because the sampling was performed immediately after well construction and the analytical results may not have been indicative of long-term natural attenuation.

To calculate the sum, nondetectable measurements have been assumed equal to zero.

Figure 12

Natural Attenuation Interpretation for the Molar Sum of Chloroethenes (Tetrahloroethene, Trichloroethene, Cis-1,2-Dichloroethene, and Vinyl Chloride) (µmoles/L) in the New Well at 7110 Elphick Road

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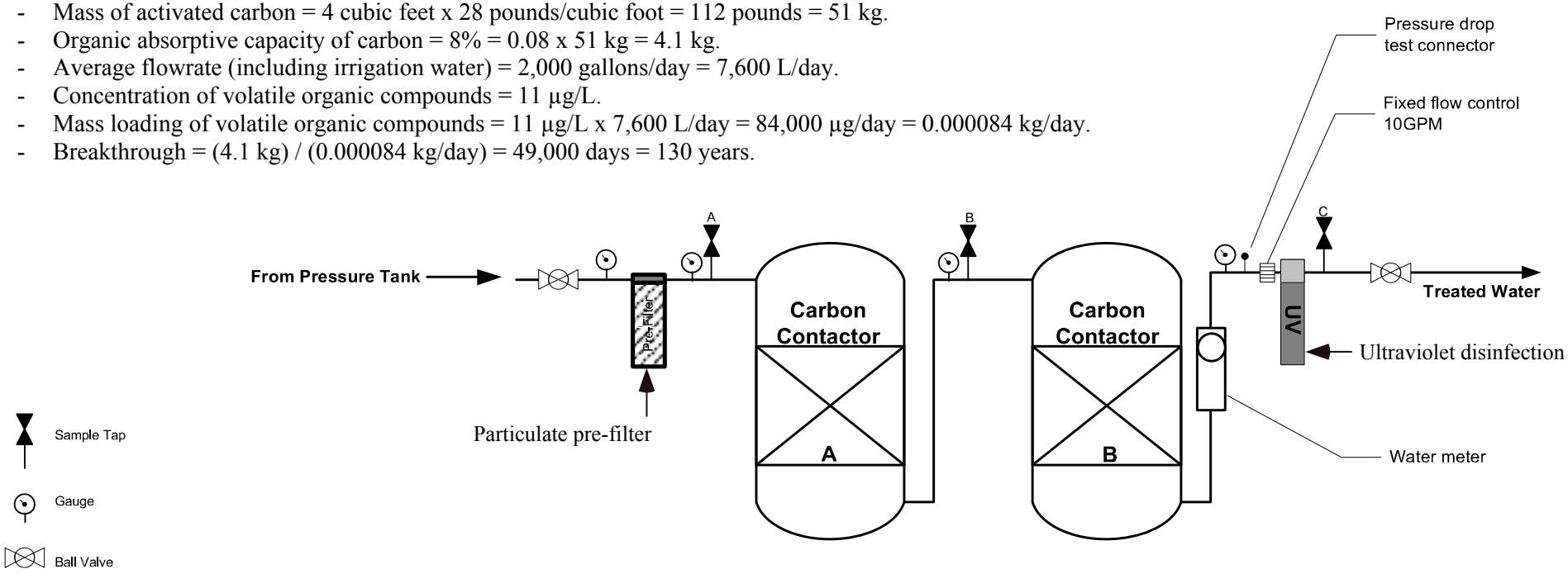
Streamborn calculation of breakthrough for one contactor

- Volume of activated carbon = 4 cubic feet.
- Mass of activated carbon = 4 cubic feet x 28 pounds/cubic foot = 112 pounds = 51 kg.
- Organic absorptive capacity of carbon = 8% = 0.08 x 51 kg = 4.1 kg.
- Average flowrate (including irrigation water) = 2,000 gallons/day = 7,600 L/day.
- Concentration of volatile organic compounds = 11 µg/L.
- Mass loading of volatile organic compounds = 11 µg/L x 7,600 L/day = 84,000 µg/day = 0.000084 kg/day.
- Breakthrough = (4.1 kg) / (0.000084 kg/day) = 49,000 days = 130 years.



Component	# Required	Description	Model	
			Size 4	
Ball Valve	2		3/4"	
Pre-Filter	1	5 Micron Cartridge	1.5"	
Sample Tap	3	Brass Valve w/ tube	1/4"	
Carbon Contactor	2	Fibreglass Tank w/ Activated Carbon	14"x65"	
Activated Carb		Per Contactor	4 cu.ft	
UV Unit	1	Pura UV20	3/4"	
Gauge	3	Oil Filled 0-100 PSI	2.5"	
Water meter	1	Water meter, gals	3/4"`	
Flow Control	1	Dole Flow Cntrl 10GPM	3/4"	
Piping	Varies	PVC Sched 40	3/4"	

Standard Installation Configuration - *Flowrates up to 12 gallons per minute*

Systems requiring more than 12 GPM to be configured individually

WEEKS WATER TREATMENT
A Division of Weeks Drilling & Pump Co., Inc.

November 6, 2000

Wellhead AC Treatment

General configuration and equipment list

Figure 13

Wellhead Treatment System

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