WEST YOST ASSOCIATES
Consulting Engineers


**TECHNICAL MEMORANDUM**

DATE: August 22, 2018

Project No.: 702-17-16-28
SENT VIA: EMAIL

TO: Ms. Olivia Ervin, Environmental Planner
City of Petaluma

FROM: Peter Dellavalle, PG #9189

REVIEWED BY: Andy Rodgers, CHMM #9525

SUBJECT: Technical Support Services, Haystack Landing
215 Weller, and 15 and 19 Copeland Streets
Petaluma, California

West Yost Associates (West Yost) has reviewed planning and design documents for the above-referenced Project Site for the City of Petaluma (City). This Technical Memorandum (TM) summarizes the findings of West Yost's review of the publicly available soil and groundwater data relevant to proposed development plans. The purpose of this TM is to provide the City with recommendations for soil and groundwater management during and after construction.

The Project Site property (hereafter referred to as the Site) is known locally as Haystack Landing and is located one block north of the Petaluma River near downtown Petaluma, California (Figure 1). The current Site addresses include 215 Weller Street, 15 Copeland Street, and 19 Copeland Street. The former addresses included 17 Copeland Street. The Site is bounded on the north by Copeland Street, on the west by East Washington Street, on the south by Weller Street and on the east by East D Street. The Site consists of six parcels (Figure 2); Assessor's Parcel Numbers:

- 007-143-003
- 007-143-004
- 007-143-007
- 007-143-008
- 007-143-014, and
- 007-143-015

According to the City's GIS data, the Site has an area of approximately four acres.

The Site has been used for commercial and industrial purposes since at least 1885. Early uses included storage of hay and lumber, a fruit dryer, and a distillery. Historical Site features are shown on Figure 3. By 1906 Parcel 15, the largest Site parcel, had been acquired by the Petaluma and Santa Rosa Railway and used as a rail yard, including a ticket office and a car repair barn. The Railway ceased operations in the late 1940s. The ticket office was moved from the Site in the 1990s and the car barn was destroyed by fire in 2001. In the 1960s Bar Ale Inc. leased Parcel 15 from the Railway and installed fuel underground storage tanks (UST) for its fleet of delivery trucks. Bar Ale Inc. operated out of Parcel 15 into the 1990s. A building was constructed on

Parcel 8 in the 1940s and was initially used for truck repair. It has been used subsequently as a feed warehouse and for auto repair. A grain mill was constructed on Parcel 7 in the 1950s. It has been subsequently used as a dairy supply store and a warehouse.

## PREVIOUS ASSESSMENTS

The Site has been investigated previously for a leaking fuel UST case, and as part of earlier development proposals. Petro Tec, John H. Dailey, and Trans Tech conducted investigations and remediation of impacted soil and groundwater after removal of three USTs from Parcel 15 in 1990, 1991, and 2008, respectively, under the direction of the San Francisco Bay Regional Water Quality Control Board (RWQCB). Case closure for the leaking UST case was granted by the RWQCB in a letter dated March 1, 2010, further discussed below).

ENVIRON conducted a combined Phase I and Phase II investigation of the Site in 2005 (*Phase I Environmental Site Assessment and Phase II Environmental Site Investigation of the Haystack Landing Property, 215 Weller Street and 15 & 19 Copeland Street, Petaluma, California,* March 2005). The Phase II investigation was designed to assess concerns revealed by the Phase I, principally the past industrial use of the Site as a railroad yard and car painting and maintenance facility. Their investigation consisted of collecting soil and soil gas samples from 12 locations at the Site. Soil samples were collected from depths of 0 to 0.5, 2.5 to 3, and 4.5 to 5 feet below ground surface (fbg). The sample locations are shown on Figure 4. The samples were analyzed for metals and pesticides. The investigation also included the collection and analysis of soil gas samples from 12 locations. The soil gas samples were analyzed for volatile organic compounds.

ECON performed a Phase I Environmental Site Assessment (ESA) of the Site in 2012 on behalf of Pacifica Companies LLC (ECON, *Phase I Environmental Site Assessment, Haystack Landing Property, 215 Weller, 15 and 19 Copeland Streets, Petaluma, California*, August 21, 2012).

ECON conducted a subsequent Phase II investigation in 2013. The goal of the investigation was to evaluate environmental concerns recognized by the previous assessments of the Site. ECON's Phase II investigation included 18 exploratory borings (SS-1 to SS-18). Seventeen of the borings were drilled to 5 fbg and one to a depth of 8 fbg to collect soil and groundwater samples. Perched groundwater was encountered in four borings at approximately 5 fbg. Soil samples were collected at approximately 0.5, 2.5, and 5 fbg in all borings and at 8 fbg in boring SS-15. Grab groundwater samples were collected from borings SS-5, SS-7, SS-8, and SS-9. The ECON boring locations are also shown on Figure 4. The samples were analyzed for petroleum hydrocarbons, and the metals identified as potential concerns by the ENVIRON Phase II investigation.

## DOCUMENTED ENVIRONMENTAL CONCERNS

The previous investigations of the Site documented three potential concerns: residual petroleum hydrocarbons in soil, metals in soil, and methane in soil gas.

### Residual Petroleum Hydrocarbons in Soil

Residual concentrations of petroleum hydrocarbons exist in the soil because of leaks from three fuel USTs installed in the 1960s by Bar Ale Inc. The tanks were located on Parcel 15, south of Copeland Street and west of Parcel 7 (Figure 3). The tanks included a 12,000-gallon diesel tank, an

8,000-gallon gasoline tank, and a 1,000-gallon tank with unknown contents. The tanks were removed in 1990, 1991 and 2008, respectively. Investigation and remediation of the impacted soil and groundwater was conducted under the direction of the RWQCB by Trans Tech Consultants and completed in 2008. Remedial activities included the excavation and off-site disposal of 3,373 deltertons of soil and 12,000 gallons of groundwater. The extent of the excavation is shown on Figure 3. Final confirmation of soil samples contained a maximum of 53 milligrams per kilogram (parts per million) (mg/kg) of total petroleum hydrocarbons - gasoline (TPH-g), 110 mg/kg of total petroleum hydrocarbons - diesel (TPH-d), 0.12 mg/kg of benzene, and non-detectable concentrations of methyl tert-butyl ether (MTBE). A groundwater monitoring and sampling event on September 15, 2008, contained non-detectable concentrations of TPH-g, TPH-d, benzene, toluene, ethylbenzene and xylene (BTEX), and MTBE, and 8.7 µg/kg of diisopropyl ether (DIPE).

Case closure for the fuel leaking UST case was granted by the RWQCB in a letter dated March 1, 2010. The closure letter states that:

> "…there may be residual contamination in soil and/or groundwater at the Site that could pose an unacceptable risk under certain development activities such as site grading, excavation, or installation of water wells. Therefore, the impact of the disturbance of any residual contamination or the installation of water well near the residual contamination shall be assessed and appropriate action taken so that there is no significant impact to human health, safety or the environment. Any encountered pollution must be managed in a proper manner. This could necessitate additional sampling, health risk assessment, and mitigation measures. The Sonoma County Health Dept., Public Works Dept., and the appropriate planning and building departments shall be notified prior to any changes in land use, grading activities, excavation, and installation of water wells. This notification shall include a statement that residual contamination may exist on the property and list all mitigation actions, if any, necessary to ensure compliance with this site management requirement. The levels of residual contamination and any associated site risks are expected to reduce with time".

Historical records indicate other possible sources of petroleum hydrocarbons in soil at the Site. In the late 1800s and early 1900s, furnaces were employed by three former fruit drying operations and a boiler was used by a former distillery at the Site (Figure 3). The sources do not identify the type of fuel used to ignite the furnaces and boiler or the methods or locations where the fuel was stored. Fuel types may have included wood, coal, fuel oil, and, after 1900, natural gas. Another possible source of petroleum hydrocarbons is an above ground fuel oil tank which was used by the Petaluma and Santa Rosa Railway to fuel locomotives from the late 1940s to the early 1960s. The exact location of the former tank is not documented; however, it was most likely in one of two locations: at or near the southern sand dryer adjacent to Weller Street or between the northern sand dryer and the former car barn.

### Metals in Soil

Concentrations of antimony, arsenic, cadmium, lead, vanadium, and mercury exceeding the San Francisco Bay RWQCB's Environmental Screening Levels (ESL) for residential uses (RWQCB, 2007 ESLs) were detected in shallow soil at the Site by the 2005 ENVIRON investigation. The results are summarized on Table 1 and the sample locations are shown on Figure 4. Environ collected 36 samples from three depths at 12 locations; near surface (0 to 6-inches), 2.5 to 3 fbg, and 4.5 to 5 fbg.

**Table 1. Soil Sample Analytical Results - Metals**
**May 6, 2005 ENVIRON Investigation**
**Haystack Landing, Petaluma, California**

| Sample ID | Sample Location | Sample Depth, fbg | Consentrations in mg/kg | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sb | As | Ba | Be | Cd | Cr | Co | Cu | Pb | Mo | Ni | Se | Ag | Tl | V | Zn | Hg |
| SG-1-0-0.5 | SG-1 | 0 - 0.5 | 3.4 | **3.2** | 78 | ND<0.50 | 1.2 | 25 | 7 | 220 | **160** | ND<1.0 | 26 | ND<2.0 | ND<1.0 | ND<1.0 | 17 | 250 | 0.34 |
| SG-1-2.5-3 | SG-1 | 2.5 - 3 | ND<2.0 | **2.8** | 100 | ND<0.50 | 0.64 | 29 | 5.8 | 14 | 10 | 1.1 | 21 | ND<2.0 | ND<1.0 | ND<1.0 | 23 | 24 | 0.39 |
| SG-1-4.5-5 | SG-1 | 4.5 - 5 | ND<2.0 | ND<1.0 | 180 | ND<0.50 | ND<0.50 | 20 | 8.4 | 14 | 4.1 | ND<1.0 | 19 | ND<2.0 | ND<1.0 | ND<1.0 | 12 | 20 | 0.059 |
| SG-2-0-0.5 | SG-2 | 0 - 0.5 | ND<2.0 | **8.7** | 87 | ND<0.50 | 3.7 | 30 | 12 | 27 | 31 | ND<1.0 | 34 | ND<2.0 | ND<1.0 | ND<1.0 | 35 | 270 | 0.12 |
| SG-2-2.5-3 | SG-2 | 2.5 - 3 | ND<2.0 | **14** | 170 | ND<0.50 | 1.2 | 20 | 5.9 | 24 | 58 | ND<1.0 | 20 | ND<2.0 | ND<1.0 | ND<1.0 | 12 | 170 | 0.44 |
| SG-2-4.5-5 | SG-2 | 4.5 - 5 | ND<2.0 | **4.2** | 96 | ND<0.50 | 0.99 | 30 | 12 | 17 | 14 | ND<1.0 | 38 | ND<2.0 | ND<1.0 | ND<1.0 | 28 | 41 | 0.37 |
| SG-3-0-0.5 | SG-3 | 0 - 0.5 | ND<2.0 | ND<1.0 | 43 | ND<0.50 | 1.4 | 30 | 15 | 24 | 1.8 | ND<1.0 | 38 | ND<2.0 | ND<1.0 | ND<1.0 | 38 | 32 | 0.24 |
| SG-3-2.5-3 | SG-3 | 2.5 - 3 | ND<2.0 | **10** | 110 | ND<0.50 | 2 | 29 | 11 | 38 | **96** | ND<1.0 | 26 | ND<2.0 | ND<1.0 | ND<1.0 | 41 | 320 | 0.5 |
| SG-3-4.5-5 | SG-3 | 4.5 - 5 | ND<2.0 | **1.8** | 100 | ND<0.50 | 0.64 | 27 | 19 | 14 | 7.7 | ND<1.0 | 28 | ND<2.0 | ND<1.0 | **1** | 24 | 18 | 0.12 |
| SG-4-0-0.5 | SG-4 | 0 - 0.5 | ND<2.0 | **1.8** | 40 | ND<0.50 | 0.92 | 33 | 7.2 | 16 | 24 | ND<1.0 | 38 | ND<2.0 | ND<1.0 | ND<1.0 | 30 | 41 | 0.091 |
| SG-4-2.5-3 | SG-4 | 2.5 - 3 | 9.2 | **16** | 280 | ND<0.50 | 3 | 42 | 11 | 220 | **1,200** | ND<1.0 | 31 | ND<2.0 | ND<1.0 | ND<1.0 | 27 | 370 | 1.1 |
| SG-4-4.5-5 | SG-4 | 4.5 - 5 | ND<2.0 | **5.5** | 130 | ND<0.50 | 1.1 | 39 | 8.1 | 30 | 72 | ND<1.0 | 39 | ND<2.0 | ND<1.0 | ND<1.0 | 22 | 68 | 0.41 |
| SG-5-0-0.5 | SG-5 | 0 - 0.5 | ND<2.0 | **2.2** | 73 | ND<0.50 | 1.4 | 32 | 14 | 21 | 11 | ND<1.0 | 48 | ND<2.0 | ND<1.0 | ND<1.0 | 43 | 43 | 0.11 |
| SG-5-2.5-3 | SG-5 | 2.5 - 3 | ND<2.0 | **6.4** | 69 | ND<0.50 | 0.9 | 14 | 6 | 12 | 22 | ND<1.0 | 12 | ND<2.0 | ND<1.0 | ND<1.0 | 17 | 27 | 0.1 |
| SG-5-4.5-5 | SG-5 | 4.5 - 5 | ND<2.0 | **1.3** | 280 | ND<0.50 | 0.5 | 23 | 11 | 12 | 5.2 | ND<1.0 | 26 | ND<2.0 | ND<1.0 | ND<1.0 | 13 | 15 | 0.14 |
| SG-6-0-0.5 | SG-6 | 0 - 0.5 | ND<2.0 | **3.1** | 130 | ND<0.50 | 1.1 | 57 | 11 | 23 | 7.3 | ND<1.0 | 49 | ND<2.0 | ND<1.0 | ND<1.0 | 40 | 38 | 0.92 |
| SG-6-2.5-3 | SG-6 | 2.5 - 3 | ND<2.0 | **4.4** | 84 | ND<0.50 | ND<0.50 | 16 | 5.0 | 21 | 44 | ND<1.0 | 11 | ND<2.0 | ND<1.0 | ND<1.0 | 16 | 20 | 1.2 |
| SG-6-4.5-5 | SG-6 | 4.5 - 5 | ND<2.0 | **2.6** | 160 | ND<0.50 | 0.97 | 35 | 11 | 22 | 39 | ND<1.0 | 39 | ND<2.0 | ND<1.0 | ND<1.0 | 29 | 44 | 0.77 |
| SG-7-0-0.5 | SG-7 | 0 - 0.5 | ND<2.0 | **33** | 120 | ND<0.50 | 1.6 | 32 | 11 | 33 | **97** | ND<1.0 | 33 | ND<2.0 | ND<1.0 | ND<1.0 | 33 | 220 | 0.27 |
| SG-7-2.5-3 | SG-7 | 2.5 - 3 | ND<2.0 | **6.6** | 520 | ND<0.50 | 0.91 | 39 | 7.2 | 12 | 3.9 | ND<1.0 | 35 | ND<2.0 | ND<1.0 | ND<1.0 | 18 | 29 | 0.14 |
| SG-7-4.5-5 | SG-7 | 4.5 - 5 | ND<2.0 | **2.0** | 88 | ND<0.50 | ND<0.50 | 18 | 13 | 8.5 | 4.3 | ND<1.0 | 15 | ND<2.0 | ND<1.0 | ND<1.0 | 20 | 12 | 0.056 |
| SG-8-0-0.5 | SG-8 | 0 - 0.5 | ND<2.0 | **29** | 110 | ND<0.50 | 1.8 | 35 | 18 | 32 | 64 | ND<1.0 | 39 | ND<2.0 | ND<1.0 | **1.1** | 37 | 75 | 0.13 |
| SG-8-2.5-3 | SG-8 | 2.5 - 3 | ND<2.0 | **2.2** | 160 | ND<0.50 | 0.82 | 33 | 9.5 | 14 | 5.1 | ND<1.0 | 57 | ND<2.0 | ND<1.0 | ND<1.0 | 22 | 28 | 0.13 |
| SG-8-4.5-5 | SG-8 | 4.5 - 5 | ND<2.0 | **2.0** | 150 | ND<0.50 | 0.83 | 32 | 9.6 | 17 | 5 | ND<1.0 | 48 | ND<2.0 | ND<1.0 | ND<1.0 | 21 | 28 | 0.29 |
| SG-9-0-0.5 | SG-9 | 0 - 0.5 | ND<2.0 | **27** | 220 | ND<0.50 | 2.6 | 42 | 11 | 59 | **450** | 1.0 | 32 | ND<2.0 | ND<1.0 | ND<1.0 | 33 | 360 | 0.31 |
| SG-9-2.5-3 | SG-9 | 2.5 - 3 | ND<2.0 | **3.9** | 110 | ND<0.50 | 0.54 | 25 | 6.5 | 9.2 | 4 | ND<1.0 | 25 | ND<2.0 | ND<1.0 | ND<1.0 | 15 | 20 | 0.11 |
| SG-9-4.5-5 | SG-9 | 4.5 - 5 | ND<2.0 | **1.3** | 78 | ND<0.50 | ND<0.50 | 21 | 5.6 | 7 | 2.8 | ND<1.0 | 22 | ND<2.0 | ND<1.0 | ND<1.0 | 14 | 13 | 0.1 |
| SG-10-0-0.5 | SG-10 | 0 - 0.5 | ND<2.0 | **2.5** | 120 | ND<0.50 | 1.1 | 24 | 9.7 | 22 | 13 | ND<1.0 | 28 | ND<2.0 | ND<1.0 | ND<1.0 | 26 | 47 | 0.12 |
| SG-10-2.5-3 | SG-10 | 2.5 - 3 | ND<2.0 | **13** | 68 | ND<0.50 | 1.2 | 43 | 11 | 19 | 14.0 | ND<1.0 | 44 | ND<2.0 | ND<1.0 | ND<1.0 | 30 | 45 | 0.14 |
| SG-10-4.5-5 | SG-10 | 4.5 - 5 | ND<2.0 | **35** | 170 | ND<0.50 | 0.99 | 32 | 16 | 17 | 9.5 | ND<1.0 | 49 | ND<2.0 | ND<1.0 | ND<1.0 | 27 | 32 | 0.19 |
| SG-11-0-0.5 | SG-11 | 0 - 0.5 | ND<2.0 | **2.6** | 120 | ND<0.50 | 1.1 | 37 | 11 | 18 | 6.8 | ND<1.0 | 41 | ND<2.0 | ND<1.0 | ND<1.0 | 41 | 38 | 0.7 |
| SG-11-2.5-3 | SG-11 | 2.5 - 3 | ND<2.0 | **73** | 130 | ND<0.50 | 1 | 37 | 13 | 26 | 24 | ND<1.0 | 42 | ND<2.0 | ND<1.0 | ND<1.0 | 25 | 43 | 0.35 |
| SG-11-4.5-5 | SG-11 | 4.5 - 5 | ND<2.0 | **1.1** | 130 | ND<0.50 | ND<0.50 | 24 | 6.3 | 11 | 4.1 | ND<1.0 | 28 | ND<2.0 | ND<1.0 | ND<1.0 | 16 | 14 | 0.1 |
| SG-12-0-0.5 | SG-12 | 0 - 0.5 | ND<2.0 | **3.7** | 120 | ND<0.50 | 1.1 | 38 | 10 | 21 | 19 | ND<1.0 | 39 | ND<2.0 | ND<1.0 | ND<1.0 | 41 | 48 | 0.69 |
| SG-12-2.5-3 | SG-12 | 2.5 - 3 | ND<2.0 | **1.3** | 100 | ND<0.50 | 0.69 | 30 | 10 | 32 | 16 | ND<1.0 | 21 | ND<2.0 | ND<1.0 | ND<1.0 | 26 | 28 | 4.5 |
| SG-12-4.5-5 | SG-12 | 4.5 - 5 | ND<2.0 | **3.4** | 150 | ND<0.50 | 0.98 | 34 | 11 | 21 | 5.7 | ND<1.0 | 43 | ND<2.0 | ND<1.0 | ND<1.0 | 28 | 32 | 0.35 |
| **Shallow Residential ESL[1]:** | | | **31** | **0.067** | **15,000** | **150** | **39** | **-** | **23** | **3,100** | **80** | **390** | **820** | **390** | **390** | **0.78** | **390** | **23,000** | **13** |
| **Shallow Commercial ESL[1]:** | | | **470** | **0.31** | **220,000** | **2200** | **580** | **-** | **350** | **47,000** | **320** | **5,800** | **11,000** | **5800** | **5800** | **12** | **5,800** | **350,000** | **190** |
| **Shallow Construction ESL[1]:** | | | **140** | **0.98** | **3,000** | **42.0** | **43** | **-** | **43** | **14,000** | **160** | **1,800** | **86** | **1700** | **1800** | **3.5** | **4,700** | **110,000** | **44** |
| **Total Threshold Limit Concentration:** | | | **500** | **500** | **10,000** | **75** | **100** | **500** | **8,000** | **2,500** | **1,000** | **3,500** | **2,000** | **100** | **500** | **700** | **2,400** | **5,000** | **20** |

All ESL exceedances are in **bold**.

All Total Threshold Limit Concentration exceedances are underlined.

Abbreviations:

| | | |
|---|---|---|
| Sb = Antimony | Hg = Mercury | fbg = Feet below ground |
| As = Arsenic | Mo = Molybdenu | ND = Less than reporting limit |
| Ba = Barium | Ni = Nickel | mg/kg = Milligrams per kilogram (parts per million) |
| Be = Beryllium | Se = Selenium | |
| Cd = Cadmium | Ag = Silver | |
| Cr = Chromium | Tl = Thallium | |
| Co = Cobalt | V = Vanadium | |
| Cu = Copper | Zn = Zinc | |
| Pb = Lead | | |

Notes:

[1] San Francisco Bay Regional Water Quality Control Board Interim Final February 2016 Environmental Screening Levels (ESLs) for residential land use in shallow soil (ND<=3m bgs) where groundwater is a current or potential source of drinking water.

Arsenic was detected in 34 of the 36 samples at concentrations ranging from 1.1 to 8.7 mg/kg (94%). Concentrations exceeding the 0.39 mg/kg 2007 ESL were detected in all the samples collected near the surface, all from 3 fbg and all but two from 5 fbg.

Vanadium was detected in all 36 samples at concentrations ranging from 12 to 43 mg/kg. Concentrations exceeding the 16 mg/kg 2007 ESL were detected in 31 of the 36 samples (83%). Exceedances were detected in all the near surface samples, all but two of the 3 fbg samples and all but three of the 5 fbg samples.

Cadmium was detected in 31 samples, two of which exceed the 2007 ESL of 1.7 mg/kg. The concentrations range from 0.64 to 3.7 mg/kg. Both samples with exceedances were collected from the near surface sampling interval.

Lead was detected in all the samples, two of which exceed the 2007 ESL of 200 mg/kg. The concentrations range from 1.8 to 1,200 mg/kg. One of the exceedances was detected in a near surface sample and the other was in a 3fbg sample.

Mercury was detected in all 36 samples at concentrations ranging from 0.056 to 4.5 mg/kg. One of the samples collected from 3 fbg contains mercury concentrations more than the 2007 ESL of 1.3.

### Methane in Soil Gas

Methane was detected in four of 12 soil gas samples collected by ENVIRON in 2005. The concentrations were greatest in the northern portion of the Site and in the area around the UST excavations. There are no ESLs for methane, but it is classified as a potential explosion and health hazard. Because the Site was once part of an extensive wetland surrounding the Petaluma River, it is likely that methane occurs naturally due to decomposing organic matter. The location of the Site to the historical distribution of tidal marsh land is shown on Figure 5.

## PROPOSED DEVELOPMENT PROJECT

Pacifica Companies proposes a mixed-use development project for the Site. The concept includes two, four-story townhome structures with two interior two-story parking garages. The foundation system consists of strip footings supported by drilled displacement pressure grouted columns. Excess soil generated by excavation of the columns and utility trenches will either be re-used on Site or exported for proper disposal. The new design will cover most of the Site with buildings or other impervious surfaces. The only exceptions will be tree wells and landscaped bioretention areas. Because the tree wells have metal grates, the only potential direct exposure to native soil will be the bioretention areas (Figure 6).

## POTENTIAL HAZARDS

To evaluate the potential hazards to future residents and construction workers, West Yost compared existing soil analytical data to the San Francisco Bay RWQCB's ESLs. From this analysis, ESLs were revised in 2016 and the screening levels for many constituents were changed. The analytical results from previous assessments of the Site are summarized in Tables 1, 2 and 3. The tables provide a comparison to the current ESLs for residential, commercial, and construction uses.

**Table 2. Soil Sample Analytical Results - Metals**
**February 2013 ECON Investigation**
**Haystack Landing, Petaluma, California**

| Sample ID | Date | Consentrations in mg/kg | | |
|---|---|---|---|---|
| | | Antimony | Lead | Mercury |
| SS-2-0.5 | 1/14/2013 | - | - | ND<0.2 |
| SS-2-2.5 | 1/14/2013 | - | - | ND<0.2 |
| SS-2-5.0 | 1/14/2013 | - | - | ND<0.2 |
| SS-3-0.5 | 1/14/2013 | - | - | ND<0.2 |
| SS-3-2.5 | 1/14/2013 | - | - | ND<0.2 |
| SS-3-5.0 | 1/14/2013 | - | - | ND<0.2 |
| SS-4-0.5 | 1/14/2013 | - | - | 0.9 |
| SS-4-2.5 | 1/14/2013 | - | - | ND<0.2 |
| SS-4-5.0 | 1/14/2013 | - | - | ND<0.2 |
| SS-5-0.5 | 1/14/2013 | - | 33 | - |
| SS-5-2.5 | 1/14/2013 | - | 55 | - |
| SS-5-5.0 | 1/14/2013 | - | 6.7 | - |
| SS-7-0.5 | 1/14/2013 | - | 19 | - |
| SS-7-2.5 | 1/14/2013 | - | 26 | - |
| SS-7-5.0 | 1/14/2013 | - | 14 | - |
| SS-10-0.5 | 1/14/2013 | - | 17 | - |
| SS-10-2.5 | 1/14/2013 | - | 45 | - |
| SS-10-5.0 | 1/14/2013 | - | 29 | - |
| SS-11-0.5 | 1/14/2013 | - | **150** | - |
| SS-11-2.5 | 1/14/2013 | - | 12 | - |
| SS-11-5.0 | 1/14/2013 | - | 9.1 | - |
| SS-12-0.5 | 1/14/2013 | ND<0.20 | **430** | - |
| SS-12-2.5 | 1/14/2013 | 8 | **300** | - |
| SS-12-5.0 | 1/14/2013 | ND<0.20 | 47 | - |
| SS-13-0.5 | 1/15/2013 | ND<0.20 | 74 | - |
| SS-13-2.5 | 1/15/2013 | ND<0.20 | 87 | - |
| SS-13-5.0 | 1/15/2013 | ND<0.20 | 8.3 | - |
| SS-14-0.25 | 1/15/2013 | ND<0.20 | 29 | - |
| SS-14-2.5 | 1/15/2013 | ND<0.20 | 4.3 | - |
| SS-14-5.0 | 1/15/2013 | ND<0.20 | 3.8 | - |
| SS-15-2.5 | 1/15/2013 | - | 8.7 | - |
| SS-15-8.0 | 1/15/2013 | - | 29 | - |
| SS-16-1.0 | 1/15/2013 | - | 49 | - |
| SS-16-2.5 | 1/15/2013 | - | 4.3 | - |
| SS-16-5.0 | 1/15/2013 | - | 6.5 | - |
| SS-17-0.5 | 1/15/2013 | - | 58 | - |
| SS-17-2.5 | 1/15/2013 | - | 4.1 | - |
| SS-17-5.0 | 1/15/2013 | - | 2.3 | - |
| **Shallow Residential ESL[1]:** | | **31** | **80** | **13** |
| **Shallow Commercial ESL[1]:** | | **470** | **320** | **190** |
| **Shallow Construction ESL[1]:** | | **140** | **160** | **44** |

All ESL exceedances are in **bold**

Abbreviations:
ND = Not detected at or above the respective reporting limit
mg/kg = Milligrams per kilogram (parts per million)

Notes:

[1] San Francisco Bay Regional Water Quality Control Board Interim Final February 2016 Environmental Screening Levels (ESLs) for residential land use in shallow soil (ND<=3m bgs) where groundwater is a current or potential source of drinking water.

**Table 3. Soil Sample Analytical Results - Petroleum Hydrocarbons**
**February 2013 ECON Investigation**
**Haystack Landing, Petaluma, California**

| | | Consentrations in mg/kg | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | BTEX | | | | |
| Sample ID | Date | TPHg | TPHd | TPHmo | Benzene | Toluene | Ethylbenzene | Xylenes | MTBE |
| SS-1-0.5 | 1/14/2013 | - | ND<0.660 | 20 | - | - | - | - | - |
| SS-1-2.0 | 1/14/2013 | - | ND<0.660 | 27 | - | - | - | - | - |
| SS-1-5.0 | 1/14/2013 | - | ND<0.660 | ND<1.32 | - | - | - | - | - |
| SS-3-0.5 | 1/14/2013 | - | ND<2.67 | 280 | - | - | - | - | - |
| SS-3-2.5 | 1/14/2013 | - | ND<0.660 | ND<1.32 | - | - | - | - | - |
| SS-3-5.0 | 1/14/2013 | - | ND<0.660 | ND<1.32 | - | - | - | - | - |
| SS-5-0.5 | 1/14/2013 | - | ND<4.00 | 560 | - | - | - | - | - |
| SS-5-2.5 | 1/14/2013 | - | ND<4.00 | 120 | - | - | - | - | - |
| SS-5-5.0 | 1/14/2013 | - | ND<0.660 | ND<1.32 | - | - | - | - | - |
| SS-6-0.75 | 1/14/2013 | - | ND<0.660 | ND<1.32 | - | - | - | - | - |
| SS-6-2.5 | 1/14/2013 | - | ND<0.660 | ND<1.32 | - | - | - | - | - |
| SS-6-5.0 | 1/14/2013 | - | ND<0.660 | ND<1.32 | - | - | - | - | - |
| SS-7-0.5 | 1/14/2013 | - | ND<6.60 | 720 | - | - | - | - | - |
| SS-7-2.5 | 1/14/2013 | - | 2.9[1] | 57[1] | - | - | - | - | - |
| SS-7-5.0 | 1/14/2013 | - | 2.6[1] | 22[1] | - | - | - | - | - |
| SS-8-0.5 | 1/14/2013 | - | ND<1.32 | 130 | - | - | - | - | - |
| SS-8-2.5 | 1/14/2013 | - | 2.9[1] | 42[1] | - | - | - | - | - |
| SS-8-5.0 | 1/14/2013 | - | 2.3[1] | 14[1] | - | - | - | - | - |
| SS-9-0.5 | 1/14/2013 | - | 9.3[2] | 190 | - | - | - | - | - |
| SS-9-2.5 | 1/14/2013 | - | 4.2[2] | 140 | - | - | - | - | - |
| SS-9-5.0 | 1/14/2013 | - | ND<6.60 | 720 | - | - | - | - | - |
| SS-10-0.5 | 1/14/2013 | - | ND<6.67 | 950 | - | - | - | - | - |
| SS-10-2.5 | 1/14/2013 | - | 3.5[1] | 35[1] | - | - | - | - | - |
| SS-10-5.0 | 1/14/2013 | - | ND<4.00 | 530 | - | - | - | - | - |
| SS-11-0.5 | 1/14/2013 | - | ND<4.00[3] | 520[3] | - | - | - | - | - |
| SS-11-2.5 | 1/14/2013 | - | 3.9[1] | 44[1] | - | - | - | - | - |
| SS-11-5.0 | 1/14/2013 | - | 14[1] | 38[1] | - | - | - | - | - |
| SS-15-2.5 | 1/15/2013 | ND<0.03 | - | - | ND<0.0015 | ND<0.00098 | ND<0.00086 | ND<0.0019 | ND<0.0026 |
| SS-15-8.0 | 1/15/2013 | ND<0.03 | - | - | ND<0.0015 | ND<0.00098 | ND<0.00086 | ND<0.0019 | ND<0.0026 |
| SS-18-2.5 | 1/14/2013 | - | 2.2[1] | 19[1] | - | - | - | - | - |
| **Shallow Residential ESL[5]:** | | **740** | **230** | **5,100** | **0.23** | **970** | **5.1** | **560** | **42** |
| **Shallow Commercial ESL[5]:** | | **3,900** | **1,100** | **140,000** | **1.0** | **4600** | **22** | **2400** | **180** |
| **Shallow Construction ESL[5]:** | | **2,800** | **880** | **32,000** | **24** | **4100** | **480** | **2400** | **3700** |

ESL exceedances in **bold**.

Abbreviations:
TPHg,d,mo = Total petroleum hydrocarbons as gasoline, diesel, motor oil
MTBE = Methyl-t-butyl ether
ND = Not detected at or above the respective reporting limit
mg/kg = Milligrams per kilogram (parts per million)

Notes:
[1] Chromatographic pattern does not resemble either typical diesel or motor oil reference standard; unknown organics within C10-C36 quantified as diesel and oil
[2] Diesel result due to over-lapping of oil range organics within diesel quantified range.
[3] Surrogate recovery outside the laboratory control limit due to potential matrix effects (high levels of heavy hydrocarbons).
[4] Blind duplicate of sample SS-7-2.5 ft.
[5] San Francisco Bay Regional Water Quality Control Board Interim Final February 2016 Environmental Screening Levels (ESLs) for residential land use in shallow soil (ND<=3m bgs) where groundwater is a current or potential source of drinking water.

After comparing the current ESL values to the Site analytical data, the only constituents that exceed ESLs are arsenic and lead. The concentrations of petroleum hydrocarbons, antimony, cadmium, vanadium, and mercury detected at the Site are all below the current ESLs.

Concentrations of arsenic and lead in Site soil are above current ESLs. Arsenic concentrations range from 1.1 to 33 mg/kg. These concentrations are above the current residential land use ESL of 0.067 mg/kg. However; they are consistent with natural background values found in local soil.

Therefore, lead is the only remaining constituent of concern for the Site. Lead concentrations range from 1.8 to 1,200 mg/kg. Lead was found at concentrations above the current residential ESL of 80 mg/kg in nine out of 62 soil samples.

## FINDINGS AND RECOMMENDATIONS

Methane in soil gas is no longer considered a potential concern. Methane does not have an ESL, but it is classified as an asphyxiant and potential explosion hazard if allowed to accumulate in an enclosed space. The most likely source of methane is decaying vegetation in the soil from marshes that once covered the area. West Yost evaluated the potential methane hazard by researching Petaluma Fire Department records for methane related incidents within former marshlands in other parts of the City. There were no records of fires or explosions in the last ten years caused by methane.

Site soil contains lead at concentrations that are not suitable for residential use and are a potential concern for construction workers. These conditions are mitigated by the fact the proposed project will cover most of the soil with buildings and hardscaping. West Yost understands that excess soils may be generated by foundation and utility work. This excess soil will possibly be re-used on site or exported for proper disposal.

Based on the concentrations of lead in Site soil, West Yost recommends the following:

1. Conduct construction work in accordance with CCR Title 8 Section 1532.1, Lead in Construction.
2. Use appropriate Site control measures such as wet methods to minimize airborne dust generation.
3. Excavate soil from the tree wells and bioretention areas to a depth of not less than 2 feet below final grade. Replace the excavated materials with clean imported fill.
4. Place any excess soil re-used on Site under buildings.
5. Characterize soil export by sampling and analysis for proper disposal.
6. Prepare a Soil Management Plan to inform and guide post-development construction and maintenance that involves exposure to soil.

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**Symbology**

Project Boundary

N

0 400 800

Scale in Feet

PETALUMA 1858

WEST YOST ASSOCIATES

**Figure 1**

**Location Map**

City of Petaluma
Haystack Landing
Technical Support Services

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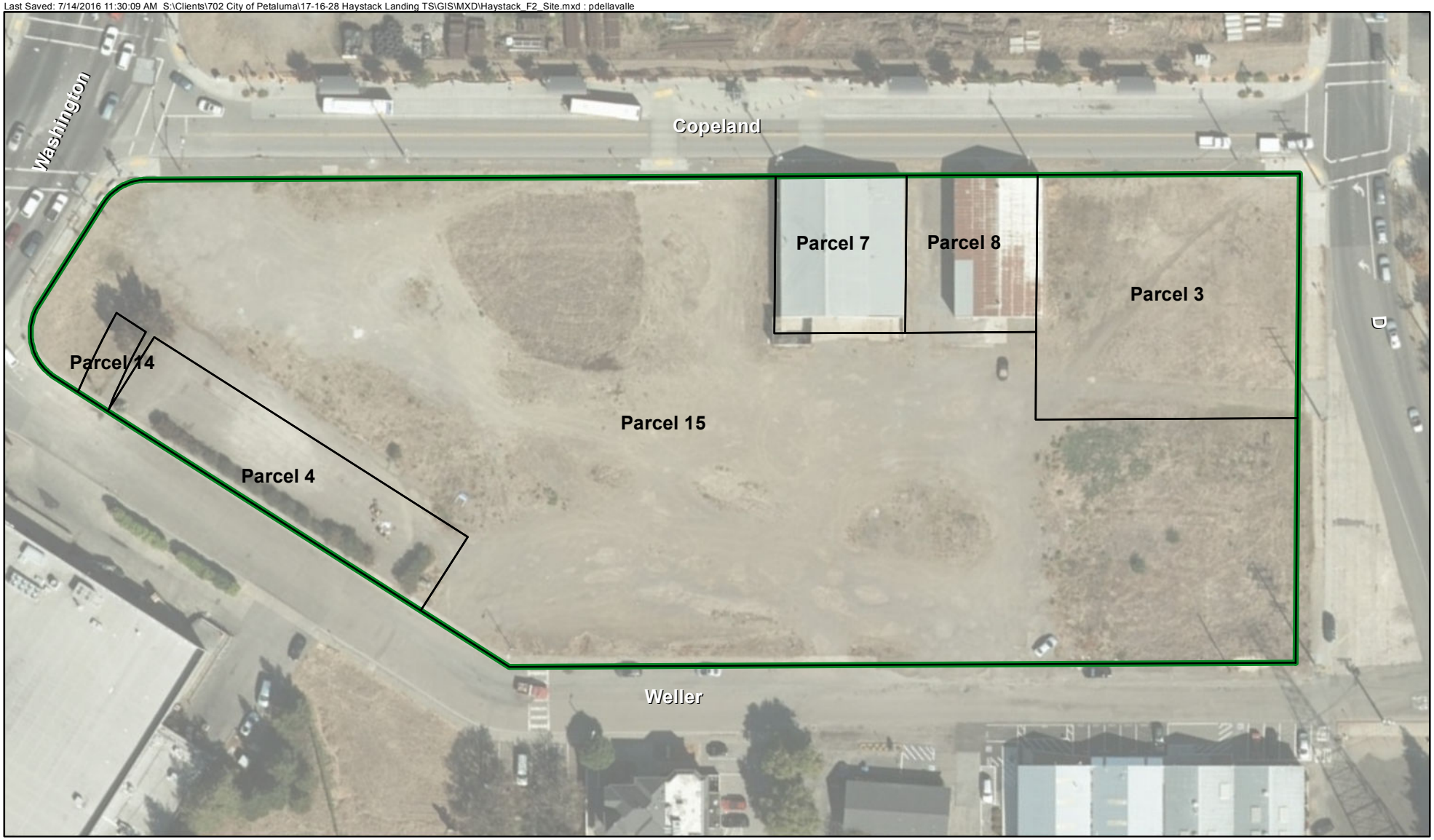


**Symbology**

- Parcel Boundary
- Project Boundary

0 40 80

Scale in Feet

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**Figure 2**

**Site Map**

City of Petaluma
Haystack Landing
Technical Support Services

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**Symbology**

- Former Building Footprint
- Former Underground Storage Tank
- Excavation in 1990
- Excavation in 2009
- Project Boundary

0 40 80

Scale in Feet

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**Figure 3**

**Historical Features**

City of Petaluma
Haystack Landing
Technical Support Services

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**Symbology**

- Boring Location - 2005 ENVIRON Investigation
- Boring Location - 2013 ECON Investigation
- Project Boundary

0 40 80

Scale in Feet

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**Figure 4**

**Environmental Boring Locations**

City of Petaluma
Haystack Landing
Technical Support Services

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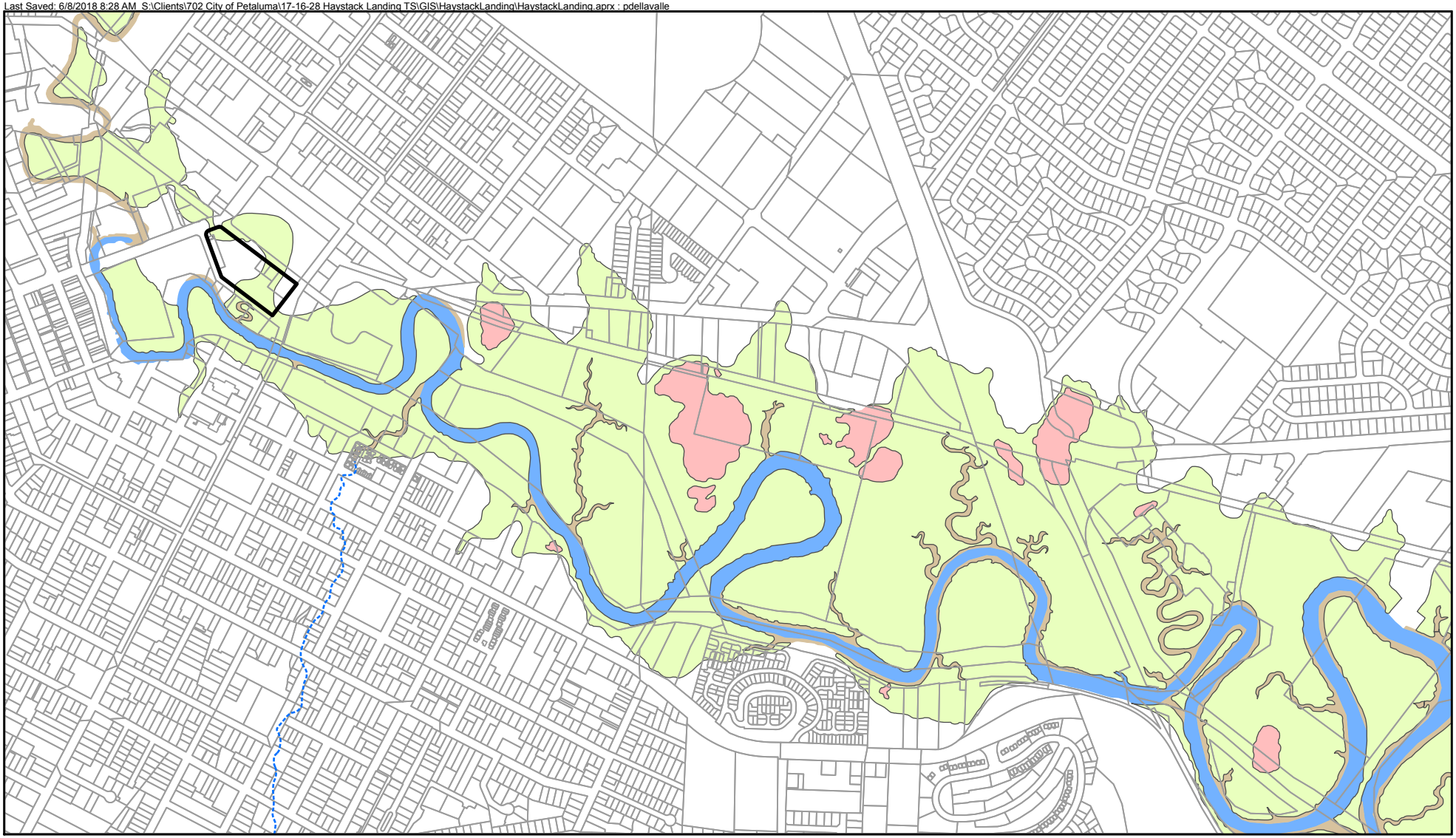

**Symbology**

- Intermittent Channel
- Project Boundary
- Parcel
- Subtidal Channel
- Tidal Mudflat
- Marsh Panne/Pond
- Tidal Marsh

0 500 1,000

Scale in Feet

N

PETALUMA 1858

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**Figure 5**

**Historic Tidal Marsh**

City of Petaluma
Haystack Landing
Techmical Review

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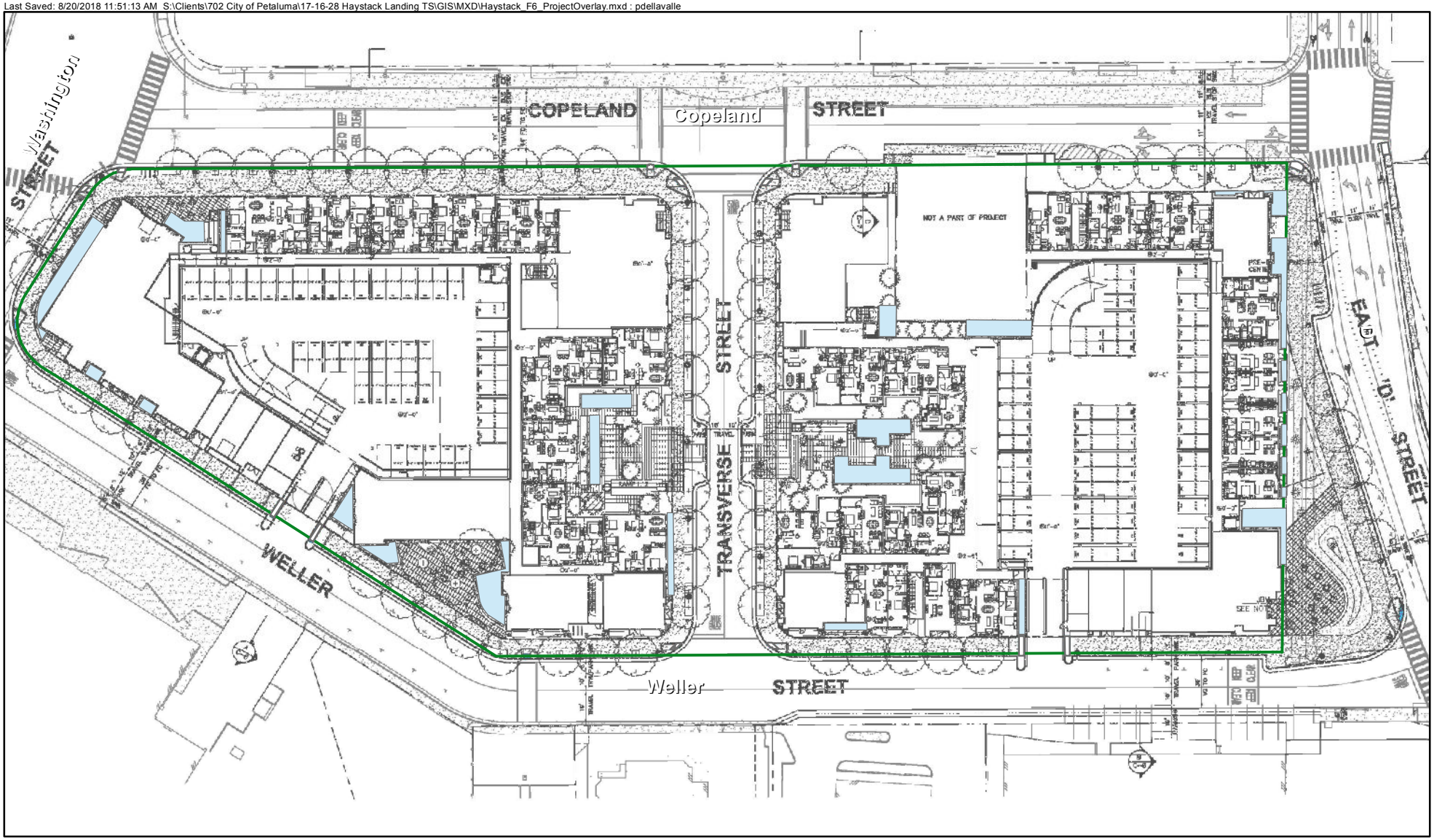


**Symbology**

- Bioretention Area
- Project Boundary

N

0 40 80

Scale in Feet

PETALUMA 1858

WEST YOST ASSOCIATES

**Figure 6**

**Proposed Project Plans**

City of Petaluma
Haystack Landing
Technical Support Services