DRAFT ANALYSIS OF BROWNFIELD CLEANUP ALTERNATIVES
436/444 C Street
Tulelake, California

Prepared For:
City of Tulelake
591 Main Street
Tulelake, California

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1.0 INTRODUCTION

On behalf of the City of Tulelake, California (Tulelake), Langan CA, Inc. (Langan) has prepared this Analysis of Brownfield Cleanup Alternatives (ABCA) report (report) for the property located at 436/444 C Street in Tulelake, Siskiyou County, California (site; Figure 1). This ABCA is being prepared under the United States Environmental Protection Agency (USEPA) Community-wide Assessment (CWA) Grant.

This report presents an evaluation of site conditions and potential remedial and/or mitigative alternatives proposed to address previously identified environmental conditions. This evaluation will be expanded and modified, if necessary, if additional information (e.g., environmental characterization, development plans, etc.) is made available after the date this report is prepared. Langan anticipates that this report may be presented and/or reviewed by the community, stakeholders, project partners, regulatory oversight agency (as needed), and the USEPA.

The site occupies approximately 0.2 acres and is located in downtown Tulelake in a mix of residential neighborhoods, undeveloped or vacant land parcels, and commercial business spaces. This site is a potential location for revitalization or redevelopment for recreational and commercial use.

The site shares a roof with the adjoining property located at 408 Main Street. The site is bordered on the north by C Street followed by a vacant commercial structure and asphalt-paved parking spaces (398 Main Street), on the south by a commercial building identified as Tule Tillers 4x4 Auto (428 Main Street), on the west by 408 Main Street followed by a vacant commercial building (407 and 409 Main Street), and on the east by an unpaved, gravel alley followed by the Tulelake Police Department (470 C Street).

Langan understands that Tulelake, potentially along with a coalition of other parties (including Primera Baptista), intends to reuse and redevelop the site for commercial use. Langan understands that the intent of the planned redevelopment is to keep the existing building, which will likely remain mostly intact post-development, with some interior and exterior modifications. Additional details regarding the planned development are not available at the time this report was prepared.

Environmental assessments have been conducted by Langan since 2024. These assessments were conducted under Tulelake's USEPA Brownfield CWA Grant, as discussed above. Langan also understands that Tulelake and other stakeholders are evaluating potential additional USEPA grant funding options to support the environmental cleanup and development of the site, including a USEPA Brownfield Cleanup Grant (Cleanup Grant). Prior to submitting an application for a Cleanup Grant, an ABCA report is required to be prepared and shared with the community. This report was prepared in an effort to meet Cleanup Grant application requirements.

2.0 BACKGROUND

Langan prepared the following environmental documents related to a previous site investigation:

- Langan, 2024. *Quality Assurance Project Plan (QAPP), City of Tulelake, USEPA Community-wide Brownfield Assessment Grant, Tulelake, California, Grant Number: BF-98T43701-0*. 17 June. (QAPP).

- Langan, 2024*. Pre-Demolition Regulated Building Materials Survey for 436/444 C Street, Tulelake, California*. 27 August.

- Langan, 2024. *Phase I Environmental Site Assessment (ESA) for 436 and 444 C Street, Tulelake, California*. 5 December. (Phase I ESA).

- Langan, 2025. *Phase II ESA for 408 Main Street and 436 and 444 C Street, Tulelake, California*. 27 August (Phase II ESA).

Information in the above reports were used in the sections and subsections below.

2.1 Site Background

The site was previously occupied by Tulelake Auto Parts from approximately 1992 to 2000. Primera Iglesia Baptista currently owns the site. During a site reconnaissance conducted by Langan on 9 July 2024, two subsurface structures that appear to be floor drains or sumps were observed on the floor of the former car wash area. As presented in Langan's Phase I ESA, the site was previously used for on-site vehicle maintenance within the car wash area. The site was approved as a brownfield grant-eligible site by the USEPA via email on 2 August 2023. Due to the previous operations as a car wash and vehicle maintenance activities, petroleum hydrocarbons and metals were suspected to be potentially present in the subsurface. Based on the conclusions of the Phase I ESA at the site, a Phase II ESA was recommended to further assess the subsurface conditions beneath the site.

2.2 Previous Investigations

The following is a summary of the previous investigations conducted by Langan in 2024 and 2025, as presented in the reports listed in the subsection above.

Prior to conducting the investigations noted below, Langan prepared the QAPP, per CWA Grant requirements. This QAPP outlined Langan's environmental sampling plans and the steps that would be conducted to ensure quality of data collected during environmental sampling events. The QAPP was submitted and approved by the USEPA on 18 June 2025.

2.2.1 Pre-Demolition Building Material Surveys

Regulated building materials surveys were conducted at the site by Langan in August of 2024. The goal of the surveys was to identify asbestos containing materials (ACM), lead-based paints (LBP), and Universal Hazardous Waste (UHW). As presented in the 2024 Pre-Demolition Materials Survey report, Langan confirmed the presence of ACM in the building materials of the building at the site. As a result, Langan recommended that the ACM be removed by a licensed, certified, or accredited (as appropriate) asbestos abatement contractor in accordance with applicable federal, state, and local regulations. Langan recommended that any materials containing asbestos in concentrations 1% or less be disturbed or removed by a qualified asbestos abatement contractor prior to renovation or demolition activities.

2.2.2 2024 Phase I ESA

Langan prepared a Phase I ESA for the site. This Phase I ESA identified four recognized environmental conditions (RECs) associated with site. Specifically, the site was listed with a North American Industry Classification System (NAICS) code as a Gasoline Station with Convenience Store. No other information is provided for this facility. Based on a review of other historical documents, the site was used for vehicle maintenance activities. Environmental information (e.g., soil and/or groundwater sampling data) apparently had not been conducted at the site previously.

Based on the site's listing as a gas station, apparent historical vehicle maintenance activities, and the lack of information regarding soil and groundwater conditions at the facility, this listing represented a REC associated with the site. Additionally, historical on-site vehicle maintenance and car washing activities were identified as a REC.

Per- and polyfluoroalkyl substances (PFAS) are known to be present in sprays, waxes, and rinses used in car washes. Based on historical operations, PFAS compounds were suspected to be present in the products previously used at the site. The discharge locations of the car wash drains and/or sumps were not known at the time the Phase I ESA report was prepared. As a result, the handling of wash water (and the potential for PFAS compounds to be present in wash water) and the unknown location of discharge points represented a REC for the site.

During the Phase I ESA site reconnaissance, Langan observed indications of historical releases such as staining on cracked concrete and adjacent to floor drains in the garage spaces. Due to the poor condition of the building slab, historical spills may have migrated to the building subsurface. This represented a REC associated with the site.

Based on the four aforementioned RECs associated with the site, subsurface sampling of soil, groundwater, and soil vapor was recommended.

2.2.3 2025 Phase II ESA

Based on the RECs identified in the Phase I ESA, Langan conducted a Phase II ESA that included soil, groundwater and soil vapor sampling. The Phase II ESA was conducted in accordance with the QAPP. It's noted that the Phase II ESA conducted at the property located at 408 Main Street and the site (located at 436/444 C Street). This ABCA only applies to the site and does not include the property at 408 Main Street. As a result, results associated with sampling conducted at 408 Main Street are not discussed in this report, though they are presented in detail in the Phase II ESA report.

Langan contracted with Remedy Engineering, Inc. (Remedy) to conduct the Phase II ESA on 3 through 5 June 2025. Remedy contracted Cascade Drilling of Richmond, California, a licensed C-57 driller, to provide drilling services. Remedy collected eight soil samples from four borings across the site (LAN-SB-01 through LAN-SB-04). Three grab-groundwater samples were collected at the site (LAN-SB-01GW, LAN-SB-03GW, and LAN-SB-04GW). Groundwater was encountered at depths ranging from 5.5 to 7.5 feet below ground surface (bgs). Two soil vapor samples were collected at the site (LAN-SV-01 and LAN-SV-02). The soil, groundwater, and soil vapor sample locations were selected to provide lateral coverage across the site to assess the potential extent of contamination from the former site operations, including the garage/car wash. Soil, groundwater and soil vapor sample locations are shown on Figure 2. Soil, groundwater, and soil vapor samples were analyzed for constituents associated with garage and car wash activities, including petroleum hydrocarbons, volatile organic compounds, metals and PFAS.

Soil analytical results for some compounds are provided on Figure 3. Total petroleum hydrocarbons as diesel (TPHd) was detected in soil above applicable screening levels in LAN-SB-04 at 7.5 feet (bgs) and lead was detected in soil above applicable screening levels in LAN-SB-01 at two feet bgs. These two boring locations are located in the northern portion of the site (Figure 3). Based on these results it appears that TPHd and lead are present in soil at depths up to 7.5

feet bgs in this area of the site. These potential impacts appear to be localized to northern portion of the site, though the vertical extent of impacts has not yet been defined.

Perfluorooctanoic acid (PFOA) was detected at concentrations in groundwater in LAN-SB-03GW and LAN-SB-04GW (Figure 2) at concentrations of 1.85 and 2.05 nanograms per liter (ng/L), respectively. These detected concentrations of PFOA did not exceed the USEPA Regional Screening Level Groundwater Maximum Contaminant Level (MCL) of four ng/L. No other PFAS compounds were detected in groundwater samples at concentrations above their respective MCLs. PFAS compounds were also not detected at concentrations above their respective laboratory reporting limits in soil samples collected from the site; therefore, detected concentrations of these compounds in groundwater, and not soil, may be attributable to regional background or a potential off-site source of PFAS.

TPHd was detected at a concentration of 2,400 micrograms per liter (µg/L) in groundwater collected from LAN-SB-04GW. Soil samples at this boring, LAN-SB-04, also reported TPHd concentrations above its respective laboratory reporting limit at two and 7.5 feet bgs, suggesting a potential release in the vadose zone that may be contributing to the observed TPHd in groundwater. Naphthalene was also detected in groundwater at this location above its laboratory reporting limit at a concentration of 0.5 µg/L. The presence of TPHd and naphthalene is likely attributable to historical activities such as auto repair and maintenance, auto parts storage, car washing, and the potential handling or storage of fuels and waste oils. These observed impacts in LAN-SB-04GW appear to be localized as the TPHd in the upgradient groundwater sample at LAN-SB-01GW was an order of magnitude lower than the detection observed at LAN-SB-04GW. In addition, naphthalene was not detected in LAN-SB-01GW at concentrations at or above its laboratory reporting limit.

Tetrachloroethene (PCE) was detected in soil vapor at LAN-SV-02 at concentrations exceeding its Tier 1 and VI residential Environmental Screening Level (ESL) for Subslab/Soil Gas (RWQCB, 2025); though it's noted that the detected concentration of PCE did not exceed its commercial ESL. This location is adjacent to a former floor drain, installed approximately two feet below ground surface, in an area historically used for commercial car washing operations. These operations often involve the use of solvents for degreasing and cleaning vehicle components, which may include PCE. The elevated concentration of PCE in soil vapor suggests that past activities in this area likely resulted in a release to the subsurface, potentially through direct discharge to the floor drain or via surface spills that infiltrated into the subsurface soil through cracks or pathways through the concrete slab. The presence of PCE in soil vapor warrants further delineation to assess the extent and potential vapor intrusion risks at the site and potential remedial or mitigative actions.

In summary, petroleum hydrocarbons as diesel and lead are present in site soil and groundwater above commercial screening criteria. These compounds appear to be limited to the northern portion of the site, though the vertical extent of these impacts in soil has not yet been defined. PCE is present in soil vapor at concentrations above residential screening criteria near an existing floor drain in the southeastern portion of the site and the extent of these impacts has not yet been defined.

2.3 Project Goal and Objectives

Langan understands that Tulelake, along with a coalition of other parties intends to reuse and redevelop the site to include potential commercial uses. Based on the results from the Phase II ESA performed in June 2025, elevated concentrations of TPHd and lead above commercial screening criteria are present in the northern portion of the site. TPHd in groundwater is present in the northern portion of the site above applicable commercial screening criteria. Additionally, PCE in soil vapor is present in the southern portion of the 436/444 C Street site above residential screening criteria, and impacts associated with PCE in soil vapor have not been delineated laterally or vertically at the time this report was prepared.

The objective of this report is to identify a recommended cleanup alternative to remediate the identified environmental impacts such that the planned development will be protective of future site users.

3.0 REGULATIONS AND CLEANUP STANDARDS

3.1 Cleanup Oversight Responsibility

Langan understands that the site is not currently under environmental regulatory oversight. However, for the purposes of this report, Langan has assumed that local, state, and federal environmental guidelines and standards will apply to the site cleanup. We also anticipate that Tulelake and other stakeholders envision obtaining regulatory approval for commercial land use.

3.2 Cleanup Standards for Major Contaminants

In the absence of a regulatory oversight agency and based on our experience with commercial and residential reuse of Brownfield sites, Langan has assumed that cleanup goals for the site will be based on the San Francisco Bay Regional Water Quality Control Board's (RWQCB) ESLs

(RWQCB, 2025). Given the planned mixed use of the site as commercial, compounds that have been detected previously in soil, soil vapor, or groundwater at concentrations will be conservatively compared to their respective screening criteria. As noted above, compounds detected at concentrations above their respective ESLs in soil, groundwater and/or soil vapor include:

- TPHd;
- Lead; and
- PCE.

In addition to ESLs, concentrations of these contaminants will also be compared to USEPA Regional Screening Levels (RSLs) for commercial/industrial soil and to MCLs for groundwater.

4.0 EVALUATION OF BROWNFIELD CLEANUP ALTERNATIVES

The objective of this report is to recommend a cleanup alternative that will address identified environmental impacts and ensure the planned development is protective of future site users, including commercial occupants. Environmental concerns include TPHd and lead exceedances in soil and groundwater, which appear to be localized in the northern portion of the site, and the presence of PCE in soil vapor near an existing floor drain in the southeastern area.

4.1 Description of Alternatives

To achieve the objectives described above, the following remedial and mitigative alternatives were considered:

1. No Action
2. Additional Soil Vapor Sampling with Soil Vapor Extraction (SVE), Limited Excavation and Application of Oxygen-releasing compound (ORC)
3. Limited Excavation and Application of ORC
4. Additional Soil Vapor Characterization Sampling with Vapor Barrier, Limited Excavation and Application of ORC

4.1.1 Description of Alternative 1 - No Action

Under the No Action Alternative, impacted media would remain in place without treatment or removal. The No Action Alternative is included as a baseline for evaluating and comparing the remedial alternatives.

4.1.2 Description of Alternative 2 – Additional Soil Vapor Sampling with SVE, Limited Excavation and ORC Application

Alternative 2 consists of additional soil vapor characterization sampling, installation of an SVE system, limited excavation of soil impacts and application of ORC to address groundwater impacts. This alternative will address the PCE impacts in the southeastern portion of the site within the area of previous sample LAN-SV-02 (treatment area) as well as impacts to soil and groundwater in the northern portion of the site.

It is noted that the SVE system would consist of a series of extraction and vacuum monitoring points within a treatment area. SVE systems typically consist of:

- Extraction wells – extraction wells will be installed within the treatment area to actively remove impacted soil vapor from the subsurface. Well spacing and depth will be determined based on site-specific lithology, results of the additional soil vapor characterization sampling, and vapor concentration gradients.

- Monitoring wells – soil vapor monitoring wells will be located strategically around the proposed treatment area to assess system performance, monitor vacuum influence, and evaluate vapor concentrations over time.

- Treatment system – extracted vapors will be routed through a treatment train, which may include granular activated carbon (GAC) vessels or other vapor phase treatment technologies, depending on the concentration and composition of VOCs.

- Conveyance piping – subsurface and aboveground piping will connect extraction wells to the treatment system. Piping will be designed to minimize pressure losses and allow for system flexibility and maintenance access.

System operation will be optimized to achieve sufficient vacuum radius of influence and contaminant mass removal. Performance monitoring will include periodic sampling of influent and effluents vapor streams, vacuum measurements, and soil vapor rebound testing.

Regulatory coordination will be conducted with the appropriate oversight agency to confirm system design, permitting requirements, and performance metrics.

Additional Soil Vapor Characterization Sampling

Prior to designing or implementing the SVE system, additional soil vapor characterization would be conducted to further delineate potential soil vapor impacts identified in the Phase II ESA conducted by Langan in 2025. Results associated with this additional sampling would be used to inform the final design of the SVE system. Additional soil vapor sampling would include installation of four temporary soil vapor points (Figure 4A).

Proposed soil vapor sampling locations were chosen based on the concentrations detected in prior sample LAN-SV-02, historical garage/car wash operations, and groundwater flow direction. The temporary soil vapor sampling points will be installed across the interior of the site building and down-gradient from LAN-SV-02. A licensed driller will advance four soil vapor borings and four temporary soil vapor probes will be installed for the collection of soil vapor samples at a depth of approximately five feet bgs. Upon completion of the temporary soil vapor probes and after the equilibration period, soil gas samples will be collected in accordance with California Department of Toxic Substance Control (DTSC)-approved methods[1]. Soil vapor samples from each of the temporary soil vapor probes will be collected into laboratory provided, clean one-liter SUMMA canisters. Soil vapor samples will be analyzed for VOCs by USEPA Method TO-15.

If groundwater is encountered at shallow depths (less than five feet bgs), sub-slab soil vapor will be assessed. Instead of installing soil gas borings and temporary soil gas probes at a depth of approximately five feet bgs, Vapor Pins will be installed within the existing building slabs for the collection of sub-slab soil vapor.

SVE System Design

Once results for the additional soil vapor sampling are reviewed, SVE system would be designed and installed. SVE can be effective in reducing VOC concentrations in soil vapor. SVE systems rely on a high vacuum extraction system to remove soil vapor via a network of extraction wells. An SVE remediation contractor would need to be contracted to construct and install the new system on the property. Additionally, SVE wells, associated conveyance piping to the treatment system, and vacuum monitoring points would need to be installed throughout the site to monitor VOC concentrations and confirm that adequate vacuum is sustained in the subsurface to achieve

[1] DTSC, 2015. *Active Soil Gas Investigations*. July.

target mass extraction rates. It is anticipated that SVE extraction wells would be screened from approximately five to 10 ft bgs, or shallower, to target peak soil vapor concentrations and remain above the groundwater table. Treatment of extracted soil vapor would likely consist of granular activated carbon (GAC) vessels in series to achieve sufficient treatment of VOCs in vapor prior to discharge to the atmosphere. Selection of treatment GAC vessel size would be dependent upon maximum soil vapor concentrations detected at the site and the anticipated extraction flow rate of the system. The exact radius of influence (ROI) of each extraction well is not yet known. Based upon our experience with other SVE applications, an effective ROI is typically up to 15 to 25 feet; however, given the tight soils noted at the site, the ROI may be substantially smaller such that the required well spacing may result in an inordinate number of wells relative to the site area in order to effectively capture contaminated soil vapor at the site.

The final SVE system design and treatment system would be provided under a separate cover at a later date, if this is the selected remedial alternative for soil vapor.

Limited Excavation of Soil Impacts

This alternative includes the physical removal of soil around impacts identified in soil in the northern interior of the site. Specifically, TPHd and lead around boring locations LAN-SB-01 and LAN-SB-04 discussed in Section 2.2 above.

Due to the depth of excavation (up to eight feet bgs or to the depth of saturated soil, whichever is shallower), excavation activities would likely need to be completed in coordination with a licensed geotechnical engineer to prevent undermining of the building's foundation. Due to the depth of the groundwater table (eight feet bgs as per most recently recorded measurement), Langan anticipates that groundwater dewatering may be required during soil excavation. Groundwater treatment of petroleum hydrocarbon impacted groundwater through application of ORC is also included in this alternative. Prior to excavation and ORC application, additional characterization sampling around LAN-SB-01 and LAN-SB-04 would be needed.

Pre-excavation Sampling and Limited Excavation

Langan proposes to collect up to eight additional soil samples across four boring locations in the northern portion around LAN-SB-01, as shown on Figure 4B, to further delineate the lead impacts in soil at the site. Based on the results of the pre-excavation soil characterization sampling (described below), the excavation boundary (Excavation 1) may be revised or updated to address impacts elevated above screening criteria. Figure 5 shows the planned limited excavation boundaries around lead impacts (Excavation 1) and TPHd impacts (Excavation 2). Currently, Excavation 1 is approximately eight feet by eight feet and is anticipated to be excavated to a depth of eight feet bgs. Excavation 2 is approximately ten feet by ten feet and is anticipated to be excavated to a depth of ten feet bgs. The total volume of soil to be excavated from Excavation 1 and 2 is approximately 60 cubic yards. Once Excavation 2 is complete, ORC would be applied to the saturated soil at the bottom of the excavation to enhance degradation and address residual compounds in groundwater, as discussed below. Prior to conducting the excavation, drawings with final excavation boundaries, depths and shoring or sloping plans (if needed) will be prepared under a separate cover.

Due to the depth of excavation (up to 10 feet bgs or to the depth of saturated soil, whichever is shallower), excavation activities would likely need to be completed in coordination with a licensed geotechnical engineer to prevent undermining of the building's foundation. Due to the depth of the groundwater table (eight feet bgs as per most recently recorded measurement), Langan anticipates that groundwater dewatering may be required during soil excavation, and is discussed in the following section.

After pre-excavation sampling is complete, analytical results associated with soil samples will be compared to applicable screening criteria (i.e., RWQCB ESLs). If needed, the boundaries of the planned excavation around the exterior of the building will be refined based on the comparison of these results to applicable screening criteria. After the excavation boundaries are revised, if needed, the excavation activities will be conducted. Langan assumes that material will be excavated and stockpiled onsite pending off-haul to a licensed disposal facility. Excavation confirmation samples will be collected to confirm final excavation extents, as discussed below.

Excavation Confirmation Sampling

When the excavation around the impacted area is complete, confirmation sampling will be conducted at both excavation areas shown on Figure 5. Langan anticipates that excavation sidewall samples will be collected to confirm the lateral extent of the excavation. Sidewall confirmation samples will be from each of the exposed walls of the excavation. Samples will be collected at a frequency of one sample every 10 linear feet along the excavation sidewalls at depths where contamination was previously encountered (as discussed in Section 2.2, above). For Excavation 1 (Figure 5), Langan does not anticipate that excavations will exceed 10 feet bgs due to the likely presence of saturated soil at depths greater than 10 feet (Langan notes that recent measured depths of groundwater located at approximately eight feet bgs). As a result, excavation bottom samples would not be collected.

Excavation sidewall soil samples from Excavation 1 would be analyzed for the following constituent of concern and would be compared to its respective RWQCB ESL:

- Lead by USEPA Method 6020.

Excavation sidewall soil samples from Excavation 2 (Figure 5) would be analyzed for the following constituents of concern and would be compared to their respective RWQCB ESLs:

- TPH-multi range by USEPA Method 8015A.

If the sidewall sample concentrations exceed their RWQCB ESLs, the excavation will be extended an additional one foot, if feasible. After excavation is complete, an additional confirmation sample would be collected from the newly exposed sidewall from the same height as the original sample that exceeded the ESL criteria. The excavation will continue in an iterative manner, until confirmation samples meet screening criteria.

Groundwater Dewatering and Treatment

Groundwater may be encountered during the proposed excavation activities, which are anticipated to reach depths of approximately 10 feet below ground surface in Excavation 2 (Figure 5). If groundwater intrusion occurs, dewatering will be conducted to facilitate safe and effective excavation.

If groundwater is encountered, dewatering will be performed via mechanical pumping from the excavation area. Extracted groundwater will be temporarily stored on-site in appropriate containment systems such as Baker tanks or other approved holding vessels. These systems will be designed to prevent overflow, minimize exposure to stormwater, and allow for sampling and characterization of the water prior to disposal.

Stored groundwater will be evaluated for potential contaminants of concern as outlined above. If analytical results indicate that the water meets discharge criteria, it may be discharged under the applicable National Pollutant Discharge Elimination System (NPDES) General Order for construction dewatering discharges. If contamination is present, the water will be managed as a non-hazardous or hazardous waste, as appropriate, and transported off-site to a permitted treatment or disposal facility in accordance with applicable federal and state regulations

Depending on site-specific conditions and discharge pathways, the following groundwater discharge permits may be required:

- General Waste Discharge Requirements/NPDES Permit for Limited Threat Discharges to Surface Waters, Order R5-2016-0076, or similar; and/or

- Local municipal discharge permits if discharging to Tulelake-managed storm drain systems.

Permit applicability will be confirmed with the appropriate RWQCB prior to initiation of dewatering activities.

If groundwater is found to be contaminated or if discharge to surface waters under a NPDES (or similar) permit is not feasible, groundwater will be off-hauled by a licensed contractor to a permitted disposal facility. Transportation and disposal will comply with applicable Department of Transportation (DOT) and RCRA requirements.

Application of ORC

ORC Advanced® Pellets will be applied to the bottom of the excavation around the area of LAN-SB-04 (Excavation 2, Figure 5). The ORC Advanced® Pellets will be placed within the saturated portion of the excavation to promote further degradation of petroleum compounds detected in groundwater. ORC Advanced® Pellets by Regenesis are designed for direct, in-situ treatment compounds in excavations, pits and trenches. The pellets are approximately three to 10 millimeters in size. The direct application of the dry pellets to the saturated excavations minimize the potential for dust generation during application. ORC Advanced® Pellets provide a controlled release of oxygen (up to 15 percent by weight), to promote the natural biodegradation of petroleum hydrocarbons, for up to one year after a single application. ORC Advanced® Pellets also contain additional nutrients, such as nitrogen, phosphorous and potassium, which assist in the biodegradation process.

Dosing calculations and specifications for ORC Advanced® Pellets are pending at the time of this report. Once pre-characterization sampling is complete, calculations and specifics will be updated. Once the final excavation depth (i.e. saturated soil conditions) have been reached, ORC will be applied to the bottom of the excavation. ORC Advanced® Pellets will be applied evenly across the footprint of the excavation bottom, and raked with the excavator bucket. After ORC Advanced® Pellets are applied at the bottom of the excavation, the excavation will be backfilled immediately after application as it is inadvisable to leave the excavation open for days after applying the ORC Advanced®.

Post-Treatment Groundwater Monitoring

To evaluate the effectiveness of the proposed limited excavation and subsequent in-situ chemical oxidation using ORC, Langan recommends a focused groundwater monitoring program around the area of Excavation 2 (Figure 5). This program will assess post-remediation trends in TPHd concentrations in shallow groundwater.

Three permanent groundwater monitoring wells will be installed downgradient and cross-gradient of the excavation area to provide representative coverage of the treatment zone and potential migration pathways. The wells will be constructed to target the shallow saturated zone where TPHd impacts have been historically observed.

Groundwater sampling will be conducted quarterly for a period of six to 12 months following ORC application. This timeframe is intended to capture seasonal variations and allow for evaluation of short- to mid-term trends in contaminant concentrations. The monitoring events will include:

- Measurement of groundwater elevation to assess flow direction and gradient.
- Field parameters (pH, temperature, conductivity, dissolved oxygen, oxidation-reduction potential).
- Laboratory analysis for TPHd using EPA Method 8015 (modified).
- Monitoring of dissolved oxygen and/or ORP over time to evaluate the persistence of aerobic conditions induced by ORC.

Analytical results will be compared to baseline concentrations to assess the effectiveness of the ORC treatment. A decreasing trend in TPHd concentrations over the monitoring period will be used as an indicator of successful remediation. If concentrations remain elevated or rebound after initial reductions, additional remedial actions may be considered.

4.1.3 Description of Alternative 3 – Limited Excavation and ORC Application

This alternative includes the physical removal of soil around the northern portion of the site (LAN-SB-01) to address lead impacts, excavation around LAN-SV-02 to address PCE impacts in soil vapor, and excavation and application of ORC to address the localized impacts of TPHd (LAN-SB-04) in groundwater (as discussed in Section 2.2 above). Prior to excavation and ORC application, additional characterization sampling around LAN-SB-01 and LAN-SB-04 would be needed.

Pre-excavation Sampling

Langan proposes to collect up to eight additional soil samples across four boring locations in the northern portion around LAN-SB-01, as shown on Figure 4B, to further characterize the lead impacts at the site. Based on the results of the pre-excavation soil characterization sampling (described below), an excavation boundary (Excavation 1) will be designated (Figure 5) to address impacts elevated above screening criteria.

In addition, Langan proposes to conduct a limited excavation around the area of former boring LAN-SB-04, as shown on Figure 5, to remove TPHd impacts in soil. Due to the depth of excavation (up to 10 feet bgs or to the depth of saturated soil, whichever is shallower), excavation activities would likely need to be completed in coordination with a licensed geotechnical engineer to prevent undermining of the building's foundation. Due to the depth of the groundwater table (eight feet bgs as per most recently recorded measurement), Langan anticipates that groundwater dewatering may be required during soil excavation, and is discussed in the following section.

Additional soil vapor characterization would be conducted to further delineate potential soil vapor impacts identified in the Phase II ESA conducted by Langan in 2025. Results associated with this additional sampling would be used to inform the final excavation boundary (Figure 5). Additional soil vapor sampling would include installation of two temporary soil vapor points to the northwest and southeast of LAN-SV-02.

Proposed soil vapor sampling locations were chosen based on the concentrations detected in prior sample LAN-SV-02, historical garage/car wash operations, and groundwater flow direction. The temporary soil vapor sampling points will be installed across the interior of the site building and down-gradient from LAN-SV-02. A licensed driller will advance four soil vapor borings and four temporary soil vapor probes will be installed for the collection of soil vapor samples at a depth of approximately five feet bgs. Upon completion of the temporary soil vapor probes and after the equilibration period, soil vapor samples will be collected in accordance with California Department of Toxic Substance Control (DTSC)-approved methods[2]. Soil vapor samples from each of the temporary soil vapor probes will be collected into laboratory provided, clean one-liter SUMMA canisters. Soil vapor samples will be analyzed for VOCs by USEPA Method TO-15.

If groundwater is encountered at shallow depths (less than five feet bgs), sub-slab soil vapor will be assessed. Instead of installing soil vapor borings and temporary soil vapor probes at a depth

2 DTSC, 2015. *Active Soil Gas Investigations*. July.

of approximately five feet bgs, Vapor Pins will be installed within the existing building slabs for the collection of sub-slab soil vapor.

After pre-excavation sampling is complete, analytical results associated with soil samples will be compared to applicable screening criteria (i.e., RWQCB ESLs). If needed, the boundaries of the planned excavation around the exterior of the building will be refined based on the comparison of these results to applicable screening criteria. After the excavation boundaries are revised, if needed, the excavation activities will be conducted. Langan assumes that material will be excavated and stockpiled onsite pending off-haul to a licensed disposal facility. Excavation confirmation samples will be collected to confirm final excavation extents, as discussed below.

Excavation Confirmation Sampling

When the excavation around the impacted area is complete, confirmation sampling will be conducted at both excavation areas shown on Figure 5. Langan anticipates that excavation sidewall samples will be collected to confirm the lateral extent of the excavation. Sidewall confirmation samples will be from each of the exposed walls of the excavation. Samples will be collected at a frequency of one sample every 10 linear feet along the excavation sidewalls at depths where contamination was previously encountered (as discussed in Section 2.2, above). For Excavation 1 (Figure 5), Langan does not anticipate that excavations will exceed 10 feet bgs due to the likely presence of saturated soil at depths greater than 10 feet (Langan notes that recent measured depths of groundwater located at approximately eight feet bgs). As a result, excavation bottom samples would not be collected.

Figure 5 shows the planned limited excavation boundaries around lead impacts (Excavation 1) and TPHd impacts (Excavation 2). Currently, Excavation 1 is approximately eight feet by eight feet and is anticipated to be excavated to a depth of eight feet bgs. Excavation 2 is approximately ten feet by ten feet and is anticipated to be excavated to a depth of ten feet bgs. Excavation 3, around the area of soil vapor impacts, is approximately ten feet by ten feet and is anticipated to be excavated to a depth of ten feet bgs. The total volume of soil to be excavated from Excavations 1, 2, and 3 is approximately 93 cubic yards. Once Excavation 2 is complete, ORC would be applied to the saturated soil at the bottom of the excavation to enhance degradation and address residual compounds in groundwater, as discussed below. Prior to conducting the excavation, drawings with final excavation boundaries, depths and shoring or sloping plans (if needed) will be prepared under a separate cover.

Excavation sidewall soil samples from Excavation 1 would be analyzed for the following constituent of concern and would be compared to its respective RWQCB ESL:

- Lead by USEPA Method 6020.

Excavation sidewall soil samples from Excavation 2 (Figure 5) would be analyzed for the following constituents of concern and would be compared to their respective RWQCB ESLs:

- TPH-multi range by USEPA Method 8015A.

Excavation sidewall soil samples from Excavation 3 (Figure 5) would be analyzed for the following constituents of concern and would be compared to their respective RWQCB ESLs:

- VOCs by USEPA Method 8260B.

If the sidewall sample concentrations exceed their RWQCB ESLs, the excavation will be extended an additional one foot, if feasible. After excavation is complete, an additional confirmation sample would be collected from the newly exposed sidewall from the same height as the original sample that exceeded the ESL criteria. The excavation will continue in an iterative manner, until confirmation samples meet screening criteria.

Groundwater Dewatering

Groundwater may be encountered during the proposed excavation activities, which are anticipated to reach depths of approximately 10 feet below ground surface in Excavation 2 (Figure 5). If groundwater intrusion occurs, dewatering will be conducted to facilitate safe and effective excavation.

If groundwater is encountered, dewatering will be performed via mechanical pumping from the excavation area. Extracted groundwater will be temporarily stored on-site in appropriate containment systems such as Baker tanks or other approved holding vessels. These systems will be designed to prevent overflow, minimize exposure to stormwater, and allow for sampling and characterization of the water prior to disposal.

All stored groundwater will be evaluated for potential contaminants of concern as outlined above. If analytical results indicate that the water meets discharge criteria, it may be discharged under the applicable NPDES General Permit for Construction Dewatering Discharges. If contamination is present, the water will be managed as a non-hazardous or hazardous waste, as appropriate, and transported off-site to a permitted treatment or disposal facility in accordance with applicable federal and state regulations.

Dewatering discharges must comply with water quality standards, including pH (6.5 – 8.5) and turbidity (≤ 250 NTU), and will be monitored in accordance with the Construction General Permit (Order WQ 2022-0057-DWQ), Attachment J. Discharges to municipal storm sewer systems (MS4s) or surface waters will require notification to the RWQCB at least 24 hours prior to discharge. A site-specific Stormwater Pollution Prevention Plan (SWPPP) will be required and must be uploaded to the appropriate online regulatory database within 14 days following discharge.

If groundwater is found to be contaminated or if discharge to surface waters is not feasible, groundwater will be off-hauled by a licensed contractor to a permitted disposal facility. Transportation and disposal will comply with applicable Department of Transportation (DOT) and RCRA requirements.

Depending on site-specific conditions and discharge pathways, the following permits may be required:

- General Waste Discharge Requirements/NPDES Permit for Limited Threat Discharges to Surface Waters, Order R5-2016-0076, or similar; and/or

- Local municipal discharge permits if discharging to Tulelake-managed storm drain systems.

Permit applicability will be confirmed with the appropriate Regional Water Board prior to initiation of dewatering activities.

Application of ORC to Excavation 2

ORC Advanced® Pellets will be applied to the bottom of the excavation around the area of LAN-SB-04 (Excavation 2, Figure 5). The ORC Advanced® Pellets will be placed within the saturated portion of the excavation to promote further degradation of petroleum compounds detected in groundwater. ORC Advanced® Pellets by Regenesis are designed for direct, in-situ treatment compounds in excavations, pits and trenches. The pellets are approximately three to 10 millimeters in size. The direct application of the dry pellets to the saturated excavations minimize the potential for dust generation during application. ORC Advanced® Pellets provide a controlled release of oxygen (up to 15 percent by weight), to promote the natural biodegradation of petroleum hydrocarbons, for up to one year after a single application. ORC Advanced® Pellets also contain additional nutrients, such as nitrogen, phosphorous and potassium, which assist in the biodegradation process.

Dosing calculations and specifications for ORC Advanced® Pellets are pending at the time of this report. Once pre-characterization sampling is complete, calculations and specifics will be updated. Once the final excavation depth (i.e. saturated soil conditions) have been reached, ORC will be applied to the bottom of the excavation. ORC Advanced® Pellets will be applied evenly across the footprint of the excavation bottom, and raked with the excavator bucket. After ORC Advanced® Pellets are applied at the bottom of the excavation, the excavation will be backfilled immediately after application as it is inadvisable to leave the excavation open for days after applying the ORC Advanced®.

Post-Treatment Groundwater Monitoring

To evaluate the effectiveness of the proposed limited excavation and subsequent in-situ chemical oxidation using ORC, Langan recommends a focused groundwater monitoring program around the area of Excavation 2 (Figure 5). This program will assess post-remediation trends in TPHd concentrations in shallow groundwater.

Three permanent groundwater monitoring wells will be installed downgradient and cross-gradient of the excavation area to provide representative coverage of the treatment zone and potential migration pathways. The wells will be constructed to target the shallow saturated zone where TPHd impacts have been historically observed.

Groundwater sampling will be conducted quarterly for a period of six to 12 months following ORC application. This timeframe is intended to capture seasonal variations and allow for evaluation of short- to mid-term trends in contaminant concentrations. The monitoring events will include:

- Measurement of groundwater elevation to assess flow direction and gradient.
- Field parameters (pH, temperature, conductivity, dissolved oxygen, oxidation-reduction potential).
- Laboratory analysis for TPHd using EPA Method 8015 (modified).
- Monitoring of dissolved oxygen and/or ORP over time to evaluate the persistence of aerobic conditions induced by ORC.

Analytical results will be compared to baseline concentrations to assess the effectiveness of the ORC treatment. A decreasing trend in TPHd concentrations over the monitoring period will be used as an indicator of successful remediation. If concentrations remain elevated or rebound after initial reductions, additional remedial actions may be considered.

Waste Disposal

Soil excavated from the excavation would be stockpiled onsite in an on-site roll-off bin, pending waste characterization sampling. Langan assumes most of the soil excavated would be disposed of as Class II Non-Hazardous material; however, waste characterization of excavated soil will likely be required to confirm waste classification prior to acceptance by the receiving facility. Waste characterization samples will be collected in general accordance with the California DTSC's Information Advisory Clean Imported Fill Material Fact Sheet dated October 2001. Waste characterization samples may be analyzed for some of the following constituents:

- TPH as gasoline, diesel and motor oil by USEPA Method 8015B;
- VOCs by USEPA Method 8260;
- California assessment metals (CAM) 17 by USEPA Method 6020;
- Semi-volatile organic compounds (SVOCs) by USEPA Method 8270C;
- Organochlorine pesticides (OCPs) and polychlorinated biphenyls (PCBs) by USEPA Method 8081A/8082;
- Chlorinated herbicides by USEPA Method 8151; and
- Asbestos by California Air Resources Board (CARB) Method 435.

If any total metal concentration exceeds 10 times its soluble threshold limit concentration (STLC), a STLC test will be required for that metal. If STLC concentrations exceed State of California disposal criteria, then a total characteristic leaching procedure (TCLP) will be required.

Once characterized, the excavated soil would be transported off-site for disposal at an appropriately licensed treatment/disposal facility. The excavation would be backfilled and compacted with acceptable material. Analytical sampling data for the proposed backfill material must be sourced, reviewed and approved by the development team prior to placement.

4.1.4 Description of Alternative 4 – Soil Vapor Characterization Sampling, Vapor Barrier, and Limited Excavation and ORC Application

Alternative 4 consists of additional soil vapor characterization sampling, placement of a vapor barrier beneath the building foundation, and limited excavation. This alternative will address the PCE impacts in the southeastern portion of the site within the area of previous sample LAN-SV-02 as well as impacts to soil and groundwater in the northern portion of the site.

Additional Characterization Soil Vapor Sampling

Additional soil vapor characterization would be conducted to further delineate potential soil vapor impacts identified in the Phase II ESA conducted by Langan in 2025. Results associated with this additional sampling would be used to inform the choice and placement of a vapor barrier. Additional soil vapor sampling would include installation of four temporary soil vapor points (Figure 4A).

Proposed soil vapor sampling locations were chosen based on the concentrations detected in prior sample LAN-SV-02, historical garage/car wash operations, and groundwater flow direction. The temporary soil vapor sampling points will be installed across the interior of the site building and down-gradient from LAN-SV-02. A licensed driller will advance four soil vapor borings and four temporary soil vapor probes will be installed for the collection of soil vapor samples at a depth of approximately five feet bgs. Upon completion of the temporary soil vapor probes and after the equilibration period, soil vapor samples will be collected in accordance with California Department of Toxic Substance Control (DTSC)-approved methods[3]. Soil vapor samples from each of the temporary soil vapor probes will be collected into laboratory provided, clean one-liter SUMMA canisters. Soil vapor samples will be analyzed for VOCs by USEPA Method TO-15.

If groundwater is encountered at shallow depths (less than five feet bgs), sub-slab soil vapor will be assessed. Instead of installing soil vapor borings and temporary soil vapor probes at a depth of approximately five feet bgs, Vapor Pins will be installed within the existing building slab for the collection of sub-slab soil vapor.

Pre-excavation Sampling

Langan proposes to collect up to eight additional soil samples across four boring locations in the northern portion around LAN-SB-01, as shown on Figure 4B, to further characterize the lead impacts at the site. Based on the results of the pre-excavation soil characterization sampling

[3] DTSC, 2015. *Active Soil Gas Investigations*. July.

(described below), an excavation boundary (Excavation 1) will be designated (Figure 5) to address impacts elevated above screening criteria.

In addition, Langan proposes to conduct a limited excavation around the area of former boring LAN-SB-04, as shown on Figure 5. Due to the depth of excavation (up to 10 feet bgs or to the depth of saturated soil, whichever is shallower), excavation activities would likely need to be completed in coordination with a licensed geotechnical engineer to prevent undermining of the building's foundation. Due to the depth of the groundwater table (eight feet bgs as per most recently recorded measurement), Langan anticipates that groundwater dewatering may be required during soil excavation, and is discussed in the following section.

If groundwater is encountered at shallow depths (less than five feet bgs), sub-slab soil vapor will be assessed. Instead of installing soil vapor borings and temporary soil vapor probes at a depth of approximately five feet bgs, Vapor Pins will be installed within the existing building slabs for the collection of sub-slab soil vapor.

After pre-excavation sampling is complete, analytical results associated with soil samples will be compared to applicable screening criteria (RWQCB ESLs). If needed, the boundaries of the planned excavation around the exterior of the building will be refined based on the comparison of these results to applicable screening criteria. After the excavation boundaries are revised, if needed, the excavation activities will be conducted. Langan assumes that material will be excavated and stockpiled onsite pending off-haul to a licensed disposal facility. Excavation confirmation samples will be collected to confirm final excavation extents, as discussed below.

Excavation Confirmation Sampling

When the excavation around the impacted area is complete, confirmation sampling will be conducted at both excavation areas shown on Figure 5. Langan anticipates that excavation sidewall samples will be collected to confirm the lateral extent of the excavation. Sidewall confirmation samples will be from each of the exposed walls of the excavation. Samples will be collected at a frequency of one sample every 10 linear feet along the excavation sidewalls at depths where contamination was previously encountered (as discussed in Section 2.2, above). For Excavation 1 (Figure 5), Langan does not anticipate that excavations will exceed 10 feet bgs due to the likely presence of saturated soil at depths greater than 10 feet (Langan notes that recent measured depths of groundwater located at approximately eight feet bgs). As a result, excavation bottom samples would not be collected.

Excavation sidewall soil samples from Excavation 1 would be analyzed for the following constituent of concern and would be compared to its respective RWQCB ESL:

- Lead by USEPA Method 6020.

Excavation sidewall soil samples from Excavation 2 (Figure 5) would be analyzed for the following constituents of concern and would be compared to their respective RWQCB ESLs:

- TPH-multi range by USEPA Method 8015A.

If the sidewall sample concentrations exceed their RWQCB ESLs, the excavation will be extended an additional one foot, if feasible. After excavation is complete, an additional confirmation sample would be collected from the newly exposed sidewall from the same height as the original sample that exceeded the ESL criteria. The excavation will continue in an iterative manner, until confirmation samples meet screening criteria.

Groundwater Dewatering

Groundwater may be encountered during the proposed excavation activities, which are anticipated to reach depths of approximately 10 feet below ground surface in Excavation 2 (Figure 5). If groundwater intrusion occurs, dewatering will be conducted to facilitate safe and effective excavation.

If groundwater is encountered, dewatering will be performed via mechanical pumping from the excavation area. Extracted groundwater will be temporarily stored on-site in appropriate containment systems such as Baker tanks or other approved holding vessels. These systems will be designed to prevent overflow, minimize exposure to stormwater, and allow for sampling and characterization of the water prior to disposal.

All stored groundwater will be evaluated for potential contaminants of concern as outlined above. If analytical results indicate that the water meets discharge criteria, it may be discharged under the applicable National Pollutant Discharge Elimination System (NPDES) General Permit for Construction Dewatering Discharges. If contamination is present, the water will be managed as a non-hazardous or hazardous waste, as appropriate, and transported off-site to a permitted treatment or disposal facility in accordance with applicable federal and state regulations

Dewatering discharges must comply with water quality standards, including pH (6.5 – 8.5) and turbidity (≤ 250 NTU), and will be monitored in accordance with the Construction General Permit (Order WQ 2022-0057-DWQ), Attachment J. Discharges to municipal storm sewer systems

(MS4s) or surface waters will require notification to the RWQCB at least 24 hours prior to discharge. A site-specific Stormwater Pollution Prevention Plan (SWPPP) will be required and must be uploaded to the appropriate online regulatory database within 14 days following discharge.

If groundwater is found to be contaminated or if discharge to surface waters is not feasible, groundwater will be off-hauled by a licensed contractor to a permitted disposal facility. Transportation and disposal will comply with applicable Department of Transportation (DOT) and RCRA requirements.

Depending on site-specific conditions and discharge pathways, the following permits may be required:

- General Waste Discharge Requirements/NPDES Permit for Limited Threat Discharges to Surface Waters, Order R5-2016-0076, or similar; and/or
- Local municipal discharge permits if discharging to Tulelake-managed storm drain systems.

Permit applicability will be confirmed with the appropriate Regional Water Board prior to initiation of dewatering activities.

Application of ORC to Excavation 2

ORC Advanced® Pellets will be applied to the bottom of the excavation around the area of LAN-SB-04 (Excavation 2, Figure 5). The ORC Advanced® Pellets will be placed within the saturated portion of the excavation to promote further degradation of petroleum compounds detected in groundwater. ORC Advanced® Pellets by Regenesis are designed for direct, in-situ treatment compounds in excavations, pits and trenches. The pellets are approximately three to 10 millimeters in size. The direct application of the dry pellets to the saturated excavations minimize the potential for dust generation during application. ORC Advanced® Pellets provide a controlled release of oxygen (up to 15 percent by weight), to promote the natural biodegradation of petroleum hydrocarbons, for up to one year after a single application. ORC Advanced® Pellets also contain additional nutrients, such as nitrogen, phosphorous and potassium, which assist in the biodegradation process.

Dosing calculations and specifications for ORC Advanced® Pellets are pending at the time of this report. Once pre-characterization sampling is complete, calculations and specifics will be updated. Once the final excavation depth (i.e. saturated soil conditions) have been reached, ORC will be applied to the bottom of the excavation. ORC Advanced® Pellets will be applied evenly across the footprint of the excavation bottom, and raked with the excavator bucket. After ORC Advanced® Pellets are applied at the bottom of the excavation, the excavation will be backfilled immediately after application as it is inadvisable to leave the excavation open for days after applying the ORC Advanced®.

Post-Treatment Groundwater Monitoring

To evaluate the effectiveness of the proposed limited excavation and subsequent in-situ chemical oxidation using ORC, Langan recommends a focused groundwater monitoring program around the area of Excavation 2 (Figure 5). This program will assess post-remediation trends in TPHd concentrations in shallow groundwater.

Three permanent groundwater monitoring wells will be installed downgradient and cross-gradient of the excavation area to provide representative coverage of the treatment zone and potential migration pathways. The wells will be constructed to target the shallow saturated zone where TPHd impacts have been historically observed.

Groundwater sampling will be conducted quarterly for a period of six to 12 months following ORC application. This timeframe is intended to capture seasonal variations and allow for evaluation of short- to mid-term trends in contaminant concentrations. The monitoring events will include:

- Measurement of groundwater elevation to assess flow direction and gradient.
- Field parameters (pH, temperature, conductivity, dissolved oxygen, oxidation-reduction potential).
- Laboratory analysis for TPHd using EPA Method 8015 (modified).
- Monitoring of dissolved oxygen and/or ORP over time to evaluate the persistence of aerobic conditions induced by ORC.

Analytical results will be compared to baseline concentrations to assess the effectiveness of the ORC treatment. A decreasing trend in TPHd concentrations over the monitoring period will be used as an indicator of successful remediation. If concentrations remain elevated or rebound after initial reductions, additional remedial actions may be considered.

Waste Disposal

Soil excavated from the excavation would be stockpiled onsite in a roll-off bin, pending waste characterization sampling. Langan assumes most of the soil excavated would be disposed of as Class II Non-Hazardous material; however, waste characterization of excavated soil will likely be required to confirm waste classification prior to acceptance by the receiving facility. Waste characterization samples will be collected in general accordance with the California DTSC's Information Advisory Clean Imported Fill Material Fact Sheet dated October 2001. Waste characterization samples may be analyzed for some of the following constituents:

- TPH as gasoline, diesel and motor oil by USEPA Method 8015B;
- VOCs by USEPA Method 8260;
- California assessment metals (CAM) 17 by USEPA Method 6020;
- Semi-volatile organic compounds (SVOCs) by USEPA Method 8270C;
- Organochlorine pesticides (OCPs) and polychlorinated biphenyls (PCBs) by USEPA Method 8081A/8082;
- Chlorinated herbicides by USEPA Method 8151; and
- Asbestos by California Air Resources Board (CARB) Method 435.

If any total metal concentration exceeds 10 times its soluble threshold limit concentration (STLC), a STLC test will be required for that metal. If STLC concentrations exceed State of California disposal criteria, then a total characteristic leaching procedure (TCLP) will be required.

Once characterized, the excavated soil would be transported off-site for disposal at an appropriately licensed treatment/disposal facility. The excavation would be backfilled and compacted with acceptable material. Analytical sampling data for the proposed backfill material must be sourced, reviewed and approved by the development team prior to placement.

Placement of Vapor Barrier

Langan understands that the planned development of the site may include maintaining the existing building. Given that the elevated PCE concentration observed in LAN-SV-02 is located within the footprint of the existing building, this alternative includes installing a retrofit vapor barrier system, such as Retro-Coat™ to the building floors and/or walls. Langan estimates that the area around LAN-SV-02 that may require Retro-Coat™ is approximately 100 square feet. Retro-Coat™ is manufactured by Land Science Technologies, San Clemente, California. Langan notes that Retro-Coat™ is a vapor intrusion product that is widely known, often used and has been accepted by environmental regulatory agencies as a method of mitigating vapor intrusion in existing buildings.

Retro-Coat™ is a blend of modified epoxy containing special flexibilizers and specially formulated resins and hardeners for superior chemical resistance and enhanced resilience. Retro-Coat™ does not contain solvents and is chemically resistant to diffusion of chlorinated solvents including PCE. This chemical resistance to diffusion helps mitigate the intrusion of vapors from the subsurface into indoor air or above-ground occupied spaces. Retro-Coat™ is applied as a combination of products known collectively as the Retro-Coat™ System. The Retro-Coat™ System consists of Retro-Coat™ CAULK, Retro-Coat™ PRIMER, and the Retro-Coat™ material. These products are applied directly to the face of the building basement floor and walls after scarification to create a barrier for vapor intrusion. During site development and application of the Retro-Coat™ System, the building must be adequately ventilated (through open windows and doors, operation of the HVAC system or fans) during construction to minimize indoor air concentrations of VOCs in the site building. Long-term, Langan also recommends working alongside HVAC contractors to optimize air exchanges and provide positive pressure in the occupied area to further reduce vapor intrusion risk.

Langan acknowledges that the RetroCoat™ portion of this alternative is a mitigative, not a remedial, approach to addressing potential human health risk from subsurface impacts in the area of LAN-SV-02. Once installed, the performance and effectiveness of the Retro-Coat™ System is typically evaluated through indoor air monitoring prior to occupancy. Based on our experience, Langan anticipates that indoor air monitoring will be required by regulators and completed on a quarterly basis for the first year followed by semi-annual sampling the next year. Analytical samples will be analyzed for constituents of concern, including PCE. The frequency of air monitoring may be reduced or stopped when consecutive air monitoring results indicate that indoor air concentrations of constituents of concern are below their respective screening criteria. Langan anticipates the air monitoring schedule will be developed in conjunction with the lead regulatory agency. For budgeting purposes, Langan assumes up to four indoor air samples may need to be collected (including ambient air samples) to evaluate the effectiveness of the vapor barrier.

Langan also anticipates that this approach which includes application of the Retro-Coat™ System to the building's basement slab, may need to be managed under a land use control (LUC). Langan anticipates that, at a minimum, the LUC may include the following:

- annual visual inspections of the Retro-Coat™ System to visually identify any cracks, breaks or damage to the barrier system;
- documenting annual inspections in an annual report to be prepared, submitted and approved by the regulatory oversight agency;
- repairing any cracks, breaks or other damage that may be observed to the barrier system during the annual visual inspection;
- preparing an operations and maintenance manual which would outline procedures to maintain and repair the barrier system;
- restricting building-based alterations or improvements that may result in the building slab from being fully penetrated without regulatory oversight agency approval and coordination; and
- potentially restricting contact with impacted soil unless managed under a soil management plan.

4.2 Alternative Evaluation Criteria

The remedial alternatives were evaluated based on the following criteria: technical effectiveness, implementability, remedial time frame, and relative cost range. These criteria were ranked as ‘low,’ ‘medium,’ and ‘high’ as described below.

Technical Effectiveness – Ability to meet project goals objectives under site-specific conditions, regardless of time frame:

- Low – Unlikely to meet objectives
- Medium – Likely to meet objectives partially
- High – Highly likely to meet objectives.

Implementability – Potential to be implemented as planned, without need of any extraordinary measures that affect the cost and/or implementation time frame of the remedial plan and/or cause disruption to the site or site tenants:

- Low – Unlikely to be implemented as planned and will likely require measures that may affect the cost and/or implementation time frame of the remedial or mitigative plan and/or will cause disruption to the site.
- Medium – May be implemented as planned and may not require measures that may affect the cost and/or implementation time frame of the remedial or mitigative plan and/or may not cause disruption to the site.

- High – Highly likely to be implemented as planned, and not expected to require measures that may affect the cost and implementation time frame of the remedial or mitigative plan, or not expected to cause disruption to the site.

Remedial Time Frame – Range of minimum to maximum system operation, active data collection and/or active management time required to meet remedial objectives, as applicable to the alternative.

- Short – three to six months
- Medium – One month to 12 months
- Long – > One year

Cost Range – Range of minimum to maximum estimated cost for implementation and performance monitoring of the remedial alternatives. The cost includes implementation, operation and maintenance, and performance monitoring. Costs were estimated based on similar projects and are presented with a ± 25% cost range. Costs that apply equally to all alternatives, such as routine site-wide monitoring, project management and other tasks are not included in the cost estimates.

- Low - < $500,000
- Moderate – $500,000 – $1,000,000
- High - > $1,000,000

4.3 Alternative Evaluation

The following is an analysis of the potential Brownfield cleanup alternatives. Each subsection includes an analysis of the estimated technical effectiveness, implementability, timeframe and cost range. Each section also includes an estimate of the sustainable nature of each alternative.

4.3.1 Evaluation of No Action

Under the No Action Alternative (Alternative 1), impacted media would remain in place without treatment. This alternative would not lower concentrations of contaminants known to pose a potential risk to future visitors and construction workers at the site. For this reason, Alternative 1 would not be effective with respect to the protection of human health. This alternative is easily or highly implementable. No cost would be incurred during the implementation of this alternative, so this alternative is considered low cost.

4.3.2 Evaluation of Additional Soil Vapor Sampling with SVE, Limited Excavation and ORC Application

The Additional Soil Vapor Sampling with SVE, Limited Excavation and Application of ORC (Alternative 2) will involve additional soil vapor characterization sampling to further delineate the impacts to soil vapor at the site as well as the design and implementation of a SVE system within the designated treatment area. Additionally, this alternative will include limited excavation to address soil and groundwater impacts in the northern portion of the site. ORC Advanced® Pellets will be applied to the bottom of the excavation around the area of LAN-SB04 (Excavation 2, Figure 5). The ORC Advanced® Pellets will be placed within the saturated portion of the excavation to promote further degradation of petroleum compounds detected in groundwater. ORC Advanced® Pellets provide a controlled release of oxygen (up to 15 percent by weight), to promote the natural biodegradation of petroleum hydrocarbons, for up to one year after a single application. ORC Advanced® Pellets also contain additional nutrients, such as nitrogen, phosphorous and potassium, which assist in the biodegradation process.

This alternative is considered highly effective in addressing the soil vapor impacts beneath the site as well as the impacts of lead in shallow soil and TPHd in groundwater. Given the subsurface conditions encountered during the June 2025 Phase II ESA, the site is underlain with some fine-grained materials (silts and clays), which may limit the effectiveness of SVE. The implementability would also be considered medium given the site's layout, depth of subsurface impacts, and existing infrastructure. Installation of the extraction and monitoring wells can typically be completed by using conventional drilling methods, and treatment equipment such as GAC units that are commercially available and scalable to site-specific needs.

Once installed, the proposed system can be operational within two to four weeks, pending startup testing and baseline monitoring which may require two to four weeks to complete. The expected operation timeframe for the SVE system could range between at least six to 12 months, depending on contaminant mass removal rates, rebound behavior, and regulatory criteria. In addition, this alternative includes potentially long-term groundwater monitoring. Given the long term groundwater monitoring and SVE operation, this alternative will likely require greater than a year to achieve the required goals, as a result the time frame for this alternative is considered to be long.

A rough estimated of anticipated costs associated with this alternative are presented in Table 1. This alternative can be implemented for a high cost ($1,040,000 to $1,320,000), based on the engineering cost estimates, additional subsurface characterization, and off-haul and disposal of soils.

From a sustainability perspective, this alternative is also anticipated to be a carbon intensive option as it involves excavation and off haul/ disposal of soil impacted over large distances.

4.3.3 Evaluation of Limited Excavation and ORC Application

This alternative would involve a tiered approach to address the impacts to soil, soil vapor and groundwater across the site. This alternative includes the physical removal of soil around the northern interior of the site (LAN-SB-01) to address lead impacts, limited excavation and application of ORC to address the localized impacts of TPHd (LAN-SB-04) (as discussed in Section 2.2 above), and limited excavation in the southeastern interior of the site (LAN-SV-02) to address PCE in soil vapor. Prior to excavation and ORC application, additional characterization sampling around LAN-SB-01, LAN-SV-02, and LAN-SB-04 would be needed.

The goal of this alternative is to reduce the existing concentration of lead in the shallow soil around LAN-SB-01 and TPHd in the soil and groundwater in the area around LAN-SB-04. Additionally, the limited excavation around the soil vapor impacts in LAN-SV-02 would be addressed with limited excavation. However, given the uncertainty associated with excavation of soil to address soil gas impacts at LAN-SV-02, this alternative is considered to be medium to high for effectiveness.

This alternative involves soil excavation, that may be conducted concurrently with development of the site. However, given the depths of the potential excavations, geotechnical design and coordination with a licensed geotechnical engineer to prevent undermining the building foundation may be required. As a result, the implementability of Alternative 3 is considered medium.

The time frame to implement this alternative is estimated to be approximately one to three months as excavation and backfill may have to be completed in phases to avoid undermining the building foundation. In addition, this alternative includes potentially long-term groundwater monitoring. As a result, the time frame for this alternative is considered short to medium.

A breakdown of the estimated costs for this alternative are presented in Table 2. This alternative can be implemented for a low to moderate cost ($480,000 to $690,000), based on the engineering cost estimates prepared. It's noted that the costs could be moderately higher if additional geotechnical accommodations are required for the excavation.

From a sustainability perspective, this alternative is also anticipated to be a carbon emission intensive option as it involves excavation and, off haul and disposal of large quantities of soil over large distances.

4.3.4 Evaluation of Additional Soil Vapor Characterization Sampling with Vapor Barrier, Limited Excavation and ORC Application

Alternative 4 consists of placement of a vapor barrier beneath the building foundation, limited excavation of soil and application of ORC to address impacts in groundwater. The goal of this alternative is to reduce the potential risk of vapor intrusion for future occupants of the building and address the soil and groundwater impacts in the northern portion of the site. Given that this alternative includes a mitigative measure (vapor barrier), not a remedial measure, to address impacts in soil vapor, the alternative is considered medium for overall effectiveness.

This alternative involves additional soil vapor sampling to further delineate potential soil vapor impacts identified in the Phase II ESA conducted by Langan in 2025. Results associated with this additional sampling would be used to inform the choice and placement of a vapor barrier. Additional soil vapor sampling would include installation of four temporary soil vapor points (Figure 4A). This alternative also involved excavation and in-situ treatment of the soil and groundwater impacts in the northern portion of the site. As a result, the implementability of Alternative 4 is considered medium.

The time frame to implement this alternative is estimated to be approximately five to six months as excavation and backfill may have to be completed in phases, the initial phase of sampling to delineate soil vapor impacts, and the final phase to determine placement of the vapor barrier. This alternative includes potentially long-term groundwater and indoor air monitoring. As a result, the time frame for this alternative is considered medium to long.

A breakdown of the estimated costs for this alternative are presented in Table 3. This alternative can be implemented for a moderate to high ($680,000 to $940,000), based on the sampling and potential contractor costs.

From a sustainability perspective, this alternative is also anticipated to be a low carbon emission intensive option as it does not involve excavation, off haul and disposal of large quantities of soil over large distances.

4.4 Selection of the Preferred Alternative

Table 4 – Summary of Alternatives Evaluation

Evaluation Criteria	Alternative 1 – No Action	Alternative 2 – Additional Soil Vapor Sampling with SVE, Limited Excavation and ORC Application	Alternative 3 – Limited Excavation and ORC Application	Alternative 4 – Additional Soil Vapor Sampling with Vapor Barrier, Limited Excavation and ORC Application
Technical Effectiveness	Low	High	Medium to High	Medium
Implementability	High	Medium	Medium	Medium
Remedial Time Frame	NA	Long	Short to Medium	Medium to Long
Cost	Low	High	Low to Moderate	Moderate to High

Alternative 1, the no action alternative, would not meet the goals or objectives for this project and is hence dismissed without additional evaluation.

Alternative 2 is also a less preferred alternative because of the following reasons:

- The implementability is medium, however the time frame for this alternative is long.
- This alternative does not address all impacts at the site.

Alternative 4 is also the less preferred alternative because of the following reasons:

- The implementability is medium, however the time frame for this alternative is potentially long, with long-term groundwater and indoor air monitoring.
- This alternative is a mitigative, not remedial, approach to address soil vapor impacts.

Of the four remedial and mitigative alternatives evaluated above, Alternative 3 offers the best combination of effectiveness, implementability, time frame, and cost. This alternative addresses both the petroleum impacted soil and groundwater, as well as the lead impacted soil in the northern portion of the site. This alternative also proposes to remove volatile organic impacted soil vapor in the eastern portion of the site. This alternative is anticipated to effectively reduce the potential for exposure to residual impacts to current or future site users at the site's building. This alternative is expected to have a higher effectiveness, higher implementability, and lower cost than the other alternatives.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the analysis detailed in the preceding sections, the recommended Brownfield cleanup alternative for the site is Alternative 3.

6.0 REFERENCES

DTSC, 2015. *Advisory Active Soil Gas Investigations. July.*

Langan, 2024. *Phase I ESA for 436 and 444 C Street, Tulelake, California*. 5 December.

Langan, 2024. *Quality Assurance Project Plan (QAPP), City of Tulelake, USEPA Community-wide Brownfield Assessment Grant, Tulelake, California, Grant Number: BF-98T43701-0*. 17 June.

Langan, 2025. *Sampling and Analysis Plan for Brownfields Grant Assistance, Tulelake, California*. 15 April.

Langan, 2025. *Draft Phase II Environmental Site Assessment for 408 Main Street and 436/444 C Street, Tulelake, California.* 22 August.

San Francisco Bay Regional Water Quality Control Board (RWQCB), 2025. Update to Environmental Screening Levels (ESLs), Revision 2, 25 July.

RWQCB, 2019. *User's Guide: Derivation and Application of Environmental Screening Levels (ESLs)*.

TABLES

Table 1
Alternative 2 - Additional Soil Vapor Sampling with SVE, Limited Excavation and ORC Application Cost Estimate
Tulelake, California

PRELIMINARY COST ESTIMATE

	DESCRIPTION OF ITEM	SUBTOTAL Low Estimate	SUBTOTAL High Estimate	COST Range	
I.	**Additional Soil Vapor Characterization**				
	A. Sampling and Analysis Plan	-	$5,000		
	B. Fieldwork and Sampling	-	$25,000		
			SUBTOTAL	**-**	**$30,000**
II.	**Soil Vapor Extraction (SVE) System Design & Permitting**				
	A. Engineering Design (SVE design and report preparation)	-	$50,000		
	B. Bid Documents & Support	-	$10,000		
	C. Air Permitting	-	$15,000		
			SUBTOTAL	**-**	**$75,000**
III.	**SVE System Construction**				
	A. Engineering Coordination	-	$10,000		
	B. Extraction Well Install and Development	$75,000	$100,000		
	C. Well Installation Oversight	-	$30,000		
	D. Connection and System Start-up	-	$40,000		
	E. Waste Disposal	$5,000	$10,000		
			SUBTOTAL	**$160,000**	**$190,000**
IV.	**SVE Remedial Completion Report**				
	A. Completion Report (includes as-built drawings)	-	$15,000		
			SUBTOTAL	**-**	**$15,000**
V.	**SVE Performance Monitoring and O&M**				
	A. Required and Contingency O&M	$190,000	$215,000		
	B. Laboratory Analyses	-	$30,000		
			SUBTOTAL	**$220,000**	**$245,000**
VI.	**Consultation During SVE Design and Construction**				
	A. Client Consultation	-	$8,000		
	B. Regulatory Meetings	-	$8,000		
			SUBTOTAL	**-**	**$16,000**
VII.	**Excavation, Oversight, and ORC Application**				
	A. Pre-Excavation Characterization Sampling		$30,000		
	B. Excavation Activities	$50,000	$75,000		
	C. Backfill Material	$10,000	$20,000		
	D. Disposal and Off-haul	$10,000	$20,000		
	E. Langan Oversight of Excavation and Backfill (assumes two weeks of oversight)		$30,000		
	F. Excavation Confirmation Sampling (Analytical Fees)	$8,000	$12,000		
	G. ORC Product and Application	$15,000	$30,000		
	H. Additional Costs	$20,000	$40,000		
			SUBTOTAL	**$173,000**	**$257,000**
V.	**Groundwater Dewatering**				
	A. Permit (e.g., NPDES) Application	$15,000	$30,000		
	B . Treatment System Services (system mobilization and demobilization, one to three month rental)	$25,000	$75,000		
	C. Self Monitoring Reports	$5,000	$20,000		
	D. Treatment System (O&M and Permit Compliance) Sampling	$5,000	$15,000		
	E. Treatment System Analytical Fees	$5,000	$15,000		
	F. Regulatory Coordination	-	$5,000		
	G. Consultation and Meetings	-	$5,000		
			SUBTOTAL	**$65,000**	**$165,000**
VI.	**Remedial Completion Report**				
	A. Completion Report	-	$20,000		
			SUBTOTAL	**-**	**$20,000**
VII.	**Groundwater (GW) Monitoring**				
	A. GW Monitoring Well Installation	-	$48,000		
	B. GW Performance Monitoring	-	$38,000		
	C. Annual GW Report	-	$20,000		
			SUBTOTAL	**-**	**$106,000**
VIII.	**Environmental Consulting Services During Design and Construction**				
	A. Project Team Meetings (up 12 meetings)	-	$10,000		
	B. Regulatory Meetings (up to 12 meetings)	-	$10,000		
			SUBTOTAL	**-**	**$20,000**
			TOTAL COST	**$900,000**	**$1,140,000**
			Contingency (15%)	**$140,000**	**$180,000**
			Total with Contingency	**$1,040,000**	**$1,320,000**

Notes:

1. This cost estimate is a preliminary and subject to change. The estimated costs reflects available cost information for construction located in California. The estimate is preliminary and based on engineering judgement. No formal quotes or proposals were obtained during development of this estimate.

2. This cost estimate represents an opinion of the probable costs of construction, within a reasonable degree of certainty. This estimate does not guarantee the cost of labor, material, or equipment, nor the means, methods and procedures of third-party or contractor work as determined by contractor(s) and/or Owner, nor the competitive bidding submissions.

3. This cost estimate is based on our experience and qualifications as an engineer and shall be deemed to represent our opinion and judgment. No formal quotes or proposals were obtained during development of this estimate. This estimate cannot and does not guarantee that proposals, bids or actual costs will be the same as or within a specific percentage of the total costs presented in this table.

4. This cost estimate was prepared in advance of regulatory agency input, approvals and established cleanup goals. Inherent in soils, foundations, groundwater, and other investigations, actual conditions may vary from those assumed. Due to these uncertainties, changed or unanticipated conditions may arise during construction activities at the project site subsequent to the initial investigation(s) that could potentially affect project scope and cost. Therefore, this estimate, with respect to potential construction costs, including environmental mitigation costs, shall not be deemed a guaranteed maximum price or cost of the project.

5. This cost estimate does not include costs associated with commercial space repairs (e.g., business shut down time or restoration of interiors) that may become necessary due to site mitigation or remediation measures.

6. Costs provided should be verified based on results of further investigation and design efforts.

Assumptions

Additional soil vapor sampling assumes up to four additional soil vapor samples will be collected. Estimated fees include subcontractor fees (drillers, laboratory analytical and permitting) and Langan time.

SVE engineering design services include Langan's time prepare design and construction drawings associated with the SVE System and associated reporting. SVE bid documents and support includes subcontractors, procurement and planning fees.

Engineering coordination fees include Langan time to provide engineering and management services during SVE installation and Langan coordination with SVE contractors.

Extraction Well Install and Development assumes up to five SVE extraction wells and four SVE monitoring wells will be installed. Up to two weeks of subcontractor drilling at $8,000 per day)
Well Installation Oversight assumes up to two weeks of installation and development oversight by Langan.

Connection and System Start-up assumes trenching, conveyance piping, pump install, startup fees and Langan engineering oversight.

SVE waste disposal costs assumes up to one soil drums per two wells installed. Drums assumed to contain non-hazardous investigation derived waste.

SVE required and contingency O&M assumes up to 15 regular O&M visits and up to six contingency visits for system inspections and maintenance for one year of operation. This includes one carbon changeout event and four quarterly O&M reports.

SVE performance monitoring laboratory analyses assumes up to four quarters of soil vapor sampling from the four soil vapor monitoring wells. Langan assumes samples will be analyzed for volatile organic compounds.

SVE client consultation assumes one kickoff meeting and four quarterly meetings over one year of SVE system operation.

SVE regulatory meetings assumes one kickoff meeting and four quarterly meetings over one year of SVE operation.

Pre-excavation characterization sampling assumes one week of soil sampling at up to eight locations, subcontractor driller and analytical fees.

Costs associated with limited excavation activities assumes that the excavation depths of the two excavation areas (Excavation Areas 1 and 2) may range from five to 10 feet below ground surface. Langan estimates that a total of approximately 75 cubic yards will be excavated from the two excavation areas. These costs include subcontractor fees to conduct excavations at the two areas and install shoring, if needed. This task includes Langan time to coordinate with the excavation subcontractor.

Backfill material assumes up to 75 cubic yards of clean backfill material will be needed to backfill the two excavation areas.
Estimated costs associated with soil off-haul assumes non-hazardous soil. This estimate assumes approximately 75 cubic yards of material will be excavated from the two excavation areas. Assumes a conversion factor of 1.4 from cubic yards to tons. Assumes a transport and disposal fee of $100/ton of non-hazardous material.

Estimated costs associated with the ORC Application assumes approximately $5,000 to purchase the ORC product from a vendor and approximately $10,000 for a subcontractor to apply the ORC under Langan observation.

Additional costs associated with the limited excavation areas may include obtaining a grading permit, traffic control plans, temporary fencing, utility locate, odor control and/or compaction testing.

GW Treatment System services costs estimated based on a similar project, assumes $25,000 equipment rental per month.

Dewatering treatment system self-monitoring reporting includes $5,000 of labor for one to three self monitoring reports, per permit requirements.

GW monitoring well installation costs assume that up to four permanent GW monitoring wells will be installed. Estimated fees include subcontractor fees to install the wells, develop the wells and survey the wells. Estimated fees include Langan observation of well installation and development.

GW performance monitoring assumes up to four GW sampling events after the permanent wells are installed. Estimated fees include Langan's time to collect samples and laboratory analytical fees.
Annual groundwater report will summarize the four performance monitoring groundwater sampling events.

Table 2
Alternative 3 - Limited Excavation and ORC Application
Cost Estimate
Tulelake, California

PRELIMINARY COST ESTIMATE

	DESCRIPTION OF ITEM	SUBTOTAL Low Estimate	SUBTOTAL High Estimate	COST Range	
I.	**Excavation, Oversight, and ORC Application**				
	A. Pre-Excavation Characterization Sampling		$30,000		
	B. Excavation Activities	$50,000	$75,000		
	C. Backfill Material	$10,000	$20,000		
	D. Disposal and Off-haul	$10,000	$20,000		
	E. Langan Oversight of Excavation and Backfill (assumes two weeks of oversight)		$30,000		
	F. Excavation Confirmation Sampling (Soil and Soil Vapor Analytical fees)	$10,000	$15,000		
	G. ORC Product and Application	$30,000	$50,000		
	H. Additional Costs	$20,000	$40,000		
			SUBTOTAL	**$190,000**	**$280,000**
II.	**Groundwater Dewatering**				
	A. Permit (e.g., NPDES) Application	$15,000	$30,000		
	B . Treatment System Services (system mobilization and demobilization, one to three month rental)	$25,000	$75,000		
	C. Self Monitoring Reports	$5,000	$20,000		
	D. Treatment System (O&M and Permit Compliance) Sampling	$5,000	$15,000		
	E. Treatment System Analytical Fees	$5,000	$15,000		
	F. Regulatory Coordination	-	$5,000		
	G. Consultation and Meetings	-	$5,000		
			SUBTOTAL	**$65,000**	**$165,000**
III.	**Remedial Completion Report**				
	A. Completion Report	-	$20,000		
			SUBTOTAL	**-**	**$20,000**
IV.	**Groundwater (GW) Monitoring**				
	A. GW Monitoring Well Installation	-	$48,000		
	B. GW Performance Monitoring	-	$38,000		
	C. Annual GW Report	-	$20,000		
			SUBTOTAL	**-**	**$106,000**
V.	**Environmental Consulting Services During Design and Construction**				
	A. Project Team Meetings (up 12 meetings)	-	$10,000		
	B. Regulatory Meetings (up to 12 meetings)	-	$10,000		
			SUBTOTAL	**-**	**$20,000**
			TOTAL COST	**$410,000**	**$600,000**
			Contingency (15%)	**$70,000**	**$90,000**
			Total with Contingency	**$480,000**	**$690,000**

Notes:

1. This cost estimate is a preliminary and subject to change. The estimated costs reflects available cost information for construction located in California. The estimate is preliminary and based on engineering judgement. No formal quotes or proposals were obtained during development of this estimate.

2. This cost estimate represents an opinion of the probable costs of construction, within a reasonable degree of certainty. This estimate does not guarantee the cost of labor, material, or equipment, nor the means, methods and procedures of third-party or contractor work as determined by contractor(s) and/or Owner, nor the competitive bidding submissions.

3. This cost estimate is based on our experience and qualifications as an engineer and shall be deemed to represent our opinion and judgment. No formal quotes or proposals were obtained during development of this estimate. This estimate cannot and does not guarantee that proposals, bids or actual costs will be the same as or within a specific percentage of the total costs presented in this table.

4. This cost estimate was prepared in advance of regulatory agency input, approvals and established cleanup goals. Inherent in soils, foundations, groundwater, and other investigations, actual conditions may vary from those assumed. Due to these uncertainties, changed or unanticipated conditions may arise during construction activities at the project site subsequent to the initial investigation(s) that could potentially affect project scope and cost. Therefore, this estimate, with respect to potential construction costs, including environmental mitigation costs, shall not be deemed a guaranteed maximum price or cost of the project.

5. This cost estimate does not include costs associated with commercial space repairs (e.g., business shut down time or restoration of interiors) that may become necessary due to site mitigation or remediation measures.

6. Costs provided should be verified based on results of further investigation and design efforts.

Assumptions

Pre-excavation characterization sampling assumes one week of soil sampling at up to eight locations, subcontractor driller and analytical fees.

Costs associated with limited excavation activities assumes that the excavation depths of the three excavation areas (Excavation Areas 1, 2 and 3) may range from five to 10 feet below ground surface. Langan estimates that a total of approximately 100 cubic yards will be excavated from the three excavation areas. These costs include subcontractor fees to conduct excavations at the two areas and install shoring, if needed. This task includes Langan time to coordinate with the excavation subcontractor.

Backfill material assumes up to 100 cubic yards of clean backfill material will be needed to backfill the three excavation areas.
Estimated costs associated with soil off-haul assumes non-hazardous soil. This estimate assumes approximately 100 cubic yards of material will be excavated from the three excavation areas. Assumes a conversion factor of 1.4 from cubic yards to tons. Assumes a transport and disposal fee of $100/ton of non-hazardous material.

Estimated costs associated with the ORC Application assumes approximately $10,000 to purchase the ORC product from a vendor and approximately $20,000 for a subcontractor to apply the ORC under Langan observation.

Additional costs associated with the limited excavation areas may include obtaining a grading permit, traffic control plans, temporary fencing, utility locate, odor control and/or compaction testing.
GW Treatment System services costs estimated based on a similar project, assumes $25,000 equipment rental per month.

Dewatering treatment system self-monitoring reporting includes $5,000 of labor for one to three self monitoring reports, per permit requirements.

GW monitoring well installation costs assume that up to four permanent GW monitoring wells will be installed. Estimated fees include subcontractor fees to install the wells, develop the wells and survey the wells. Estimated fees include Langan observation of well installation and development.

GW performance monitoring assumes up to four GW sampling events after the permanent wells are installed. Estimated fees include Langan's time to collect samples and laboratory analytical fees.
Annual groundwater report will summarize the four performance monitoring groundwater sampling events.

Table 3
Alternative 4 - Additional Soil Vapor Characterization Sampling with Vapor Barrier, Limited Excavation and ORC Application Cost Estimate
Tulelake, California

PRELIMINARY COST ESTIMATE - Alternative 4

	DESCRIPTION OF ITEM	SUBTOTAL Low Estimate	SUBTOTAL High Estimate	COST Range	
I.	**Additional Soil Vapor Characterization**				
	A. Sampling and Analysis Plan	-	$5,000		
	B. Fieldwork and Sampling	-	$25,000		
			SUBTOTAL	**-**	**$30,000**
II.	**Excavation, Oversight, and ORC Application**				
	A. Pre-Excavation Characterization Sampling	-	$30,000		
	B. Excavation Activities	$50,000	$75,000		
	C. Backfill Material	$10,000	$20,000		
	D. Disposal and Off-haul	$10,000	$20,000		
	E. Langan Oversight of Excavation and Backfill (assumes two weeks of oversight)	-	$30,000		
	F. Excavation Confirmation Sampling (Soil and Soil Vapor Analytical fees)	$10,000	$15,000		
	G. ORC Product and Application	$30,000	$50,000		
	H. Additional Costs	$20,000	$40,000		
			SUBTOTAL	**$190,000**	**$280,000**
III.	**Groundwater Dewatering**				
	A. Permit (e.g., NPDES) Application	$15,000	$30,000		
	B . Treatment System Services (system mobilization and demobilization, one to three month rental)	$25,000	$75,000		
	C. Self Monitoring Reports	$5,000	$20,000		
	D. Treatment System (O&M and Permit Compliance) Sampling	$5,000	$15,000		
	E. Treatment System Analytical Fees	$5,000	$15,000		
	F. Regulatory Coordination	-	$5,000		
	G. Consultation and Meetings	-	$5,000		
			SUBTOTAL	**$65,000**	**$165,000**
IV.	**Vapor Barrier Design & Permitting**				
	A. Retro-Coat System Design Plan - Soil Vapor Barrier	$10,000	$20,000		
	B. Operation, Maintenance, and Monitoring Plan	$10,000	$15,000		
	C. Bid Documents & Support		$10,000		
			SUBTOTAL	**$30,000**	**$45,000**
V.	**Vapor Barrier Construction and Observation**				
	A. Vapor Barrier Application	$15,000	$25,000		
	B. Langan Observation of Barrier Installation	-	$5,000		
			SUBTOTAL	**$20,000**	**$30,000**
VI.	**Remedial Completion Report**				
	A. Completion Report	-	$20,000		
			SUBTOTAL	**-**	**$20,000**
VII.	**Groundwater (GW) Monitoring**				
	A. GW Monitoring Well Installation	-	$48,000		
	B. GW Performance Monitoring	-	$38,000		
	C. Annual GW Report	-	$20,000		
			SUBTOTAL	**-**	**$106,000**
VIII.	**Post-Vapor Barrier Installation Performance Monitoring**				
	A. Indoor Air Sampling	-	$20,000		
	B. Laboratory Analyses	-	$20,000		
	C. Post-installation Performance Monitoring Reporting	-	$40,000		
			SUBTOTAL	**-**	**$80,000**
VIIII.	**Long-term Vapor Barrier Management**				
	A Land Use Covenant Preparation	$10,000	$15,000		
	B Operation and Maintenance Plan	$10,000	$15,000		
			SUBTOTAL	**$20,000**	**$30,000**
X.	**Environmental Consulting Services During Design and Construction**				
	A. Project Team Meetings (up 12 meetings)	-	$10,000		
	B. Regulatory Meetings (up to 12 meetings)	-	$10,000		
			SUBTOTAL	**-**	**$20,000**
			TOTAL COST	**$590,000**	**$810,000**
			Contingency (15%)	**$90,000**	**$130,000**
			Total with Contingency	**$680,000**	**$940,000**

Notes:

1. This cost estimate is a preliminary and subject to change. The estimated costs reflects available cost information for construction located in California. The estimate is preliminary and based on engineering judgement. No formal quotes or proposals were obtained during development of this estimate.

2. This cost estimate represents an opinion of the probable costs of construction, within a reasonable degree of certainty. This estimate does not guarantee the cost of labor, material, or equipment, nor the means, methods and procedures of third-party or contractor work as determined by contractor(s) and/or Owner, nor the competitive bidding submissions.

3. This cost estimate is based on our experience and qualifications as an engineer and shall be deemed to represent our opinion and judgment. No formal quotes or proposals were obtained during development of this estimate. This estimate cannot and does not guarantee that proposals, bids or actual costs will be the same as or within a specific percentage of the total costs presented in this table.

4. This cost estimate was prepared in advance of regulatory agency input, approvals and established cleanup goals. Inherent in soils, foundations, groundwater, and other investigations, actual conditions may vary from those assumed. Due to these uncertainties, changed or unanticipated conditions may arise during construction activities at the project site subsequent to the initial investigation(s) that could potentially affect project scope and cost. Therefore, this estimate, with respect to potential construction costs, including environmental mitigation costs, shall not be deemed a guaranteed maximum price or cost of the project.

5. This cost estimate does not include costs associated with commercial space repairs (e.g., business shut down time or restoration of interiors) that may become necessary due to site mitigation or remediation measures.

6. Costs provided should be verified based on results of further investigation and design efforts.

Assumptions

Pre-excavation characterization sampling assumes one week of soil sampling at up to eight locations, subcontractor driller and analytical fees.

Costs associated with limited excavation activities assumes that the excavation depths of the three excavation areas (Excavation Areas 1, 2 and 3) may range from five to 10 feet below ground surface. Langan estimates that a total of approximately 100 cubic yards will be excavated from the three excavation areas. These costs include subcontractor fees to conduct excavations at the two areas and install shoring, if needed. This task includes Langan time to coordinate with the excavation subcontractor.

Backfill material assumes up to 100 cubic yards of clean backfill material will be needed to backfill the three excavation areas.

Estimated costs associated with soil off-haul assumes non-hazardous soil. This estimate assumes approximately 100 cubic yards of material will be excavated from the three excavation areas. Assumes a conversion factor of 1.4 from cubic yards to tons. Assumes a transport and disposal fee of $100/ton of non-hazardous material.

Estimated costs associated with the ORC Application assumes approximately $10,000 to purchase the ORC product from a vendor and approximately $20,000 for a subcontractor to apply the ORC under Langan observation.

Additional costs associated with the limited excavation areas may include obtaining a grading permit, traffic control plans, temporary fencing, utility locate, odor control and/or compaction testing.

GW Treatment System services costs estimated based on a similar project, assumes $25,000 equipment rental per month.

Dewatering treatment system self-monitoring reporting includes $5,000 of labor for one to three self monitoring reports, per permit requirements.

Estimated costs associated with the Retro-Coat installation include application of barrier in the areas of potential vapor impacts on the eastern portion of the site (approximately 100 square feet) and walls (approximately 350 square feet). Estimated costs include installation (labor) fees ($3.50 per square foot) and material (product) fees ($8.50 per square foot). Langan assumes an approximate 10.25% tax on materials. Estimated fees also include quality control (calcium chloride) testing.

Estimated fees associated with Langan observation of vapor barrier application assumes up to a week of Langan observation would be required.

Langan assumes up to four rounds of indoor sampling will be required to post-vapor barrier installation. Langan assumes up to four indoor air samples will be collected and analyzed for constituents of concern during each sampling event. Estimated time for Langan to collect the indoor air samples is $5,000 per sampling event. The estimated laboratory analytical fees associated with each event is $10,000.

Langan assumes that a Land Use Covenant will be required to manage long-term risk associated with the vapor barrier system. Langan assumes that this LUC will also require preparation of an operation and maintenance plan to maintain the integrity of the Retro-Coat barrier system. Estimated fees associated with routine (anticipated to be conducted, at a minimum, on an annual basis) inspections and/or contingency inspections are not included in this estimate.

GW monitoring well installation costs assume that up to four permanent GW monitoring wells will be installed. Estimated fees include subcontractor fees to install the wells, develop the wells and survey the wells. Estimated fees include Langan observation of well installation and development.

GW performance monitoring assumes up to four GW sampling events after the permanent wells are installed. Estimated fees include Langan's time to collect samples and laboratory analytical fees.

Annual groundwater report will summarize the four performance monitoring groundwater sampling events.

FIGURES

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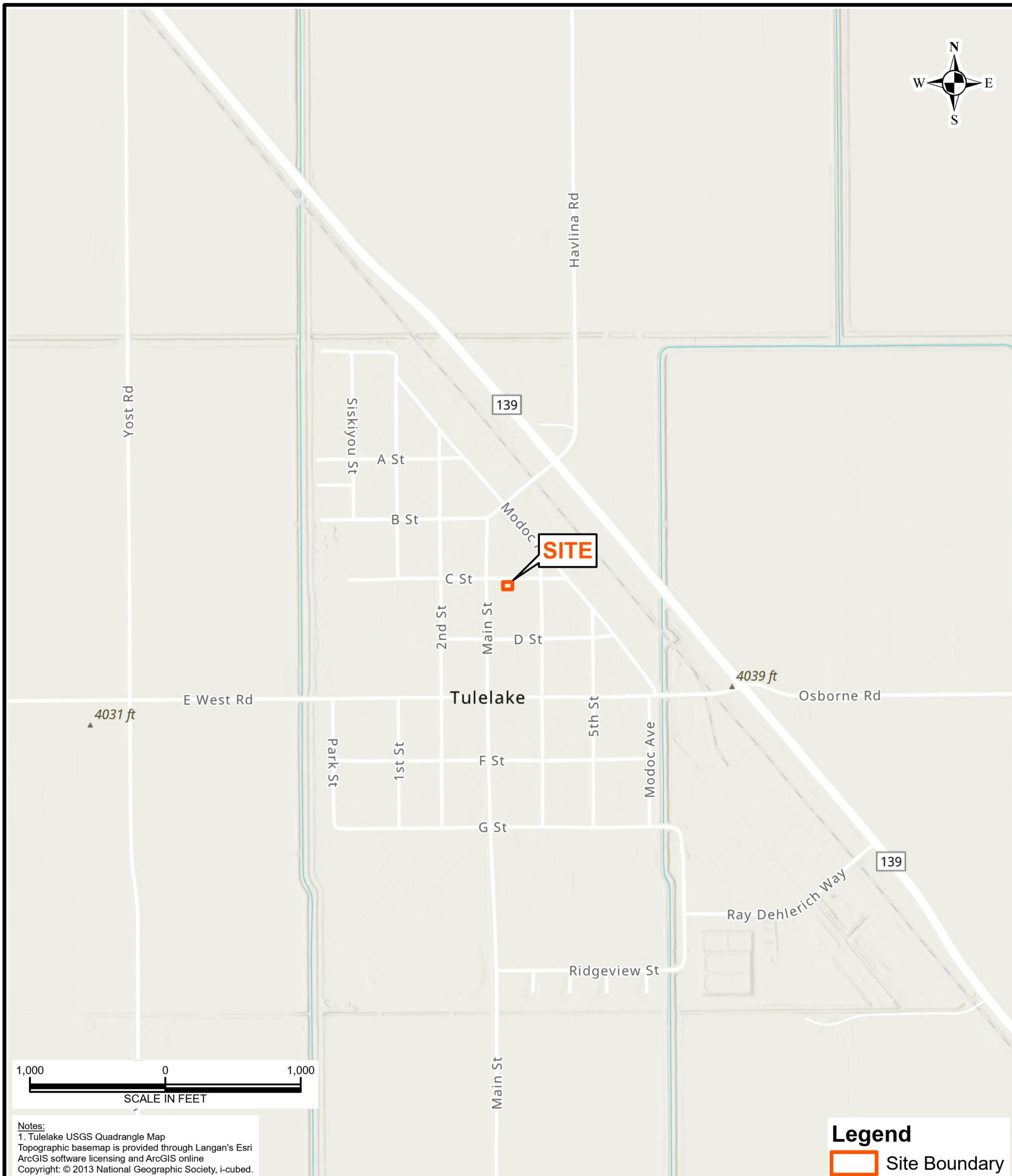

Notes:
1. Tulelake USGS Quadrangle Map
Topographic basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online
Copyright: © 2013 National Geographic Society, i-cubed.

LANGAN Langan CA, Inc. 3320 Data Drive, Suite 350 Rancho Cordova, CA 95670-7982 T: 279.399.8200 F: 279.399.8201 www.langan.com	Project TULELAKE BROWNFIELDS GRANT TULELAKE SISKIYOU COUNTY CALIFORNIA	Figure Title SITE LOCATION MAP	Project No. 760613502 Date 9/24/2025 Scale 1" = 1,000 feet Drawn By GS	Figure 1

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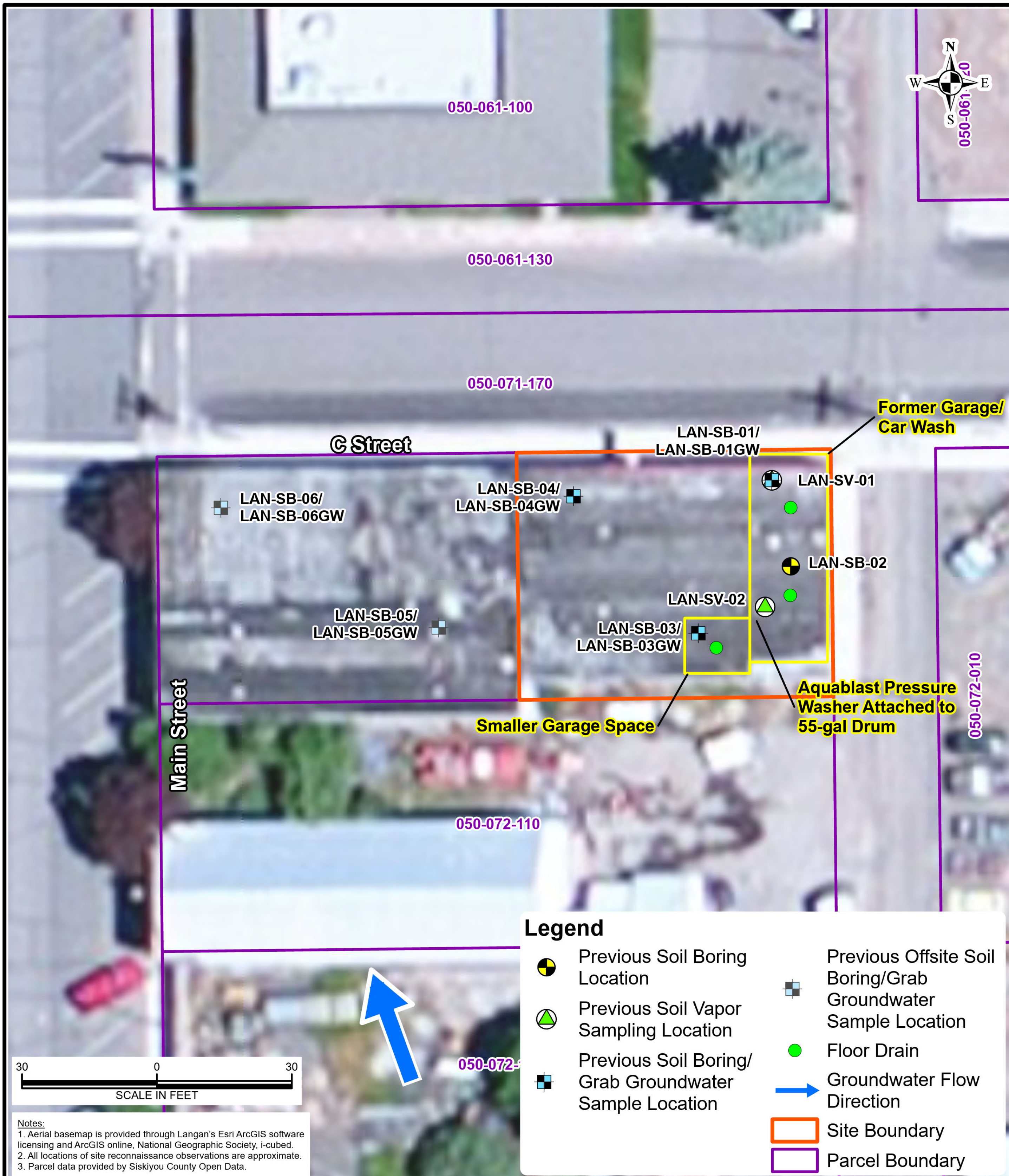

Notes:
1. Aerial basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online, National Geographic Society, i-cubed.
2. All locations of site reconnaissance observations are approximate.
3. Parcel data provided by Siskiyou County Open Data.

LANGAN Langan CA, Inc. 3320 Data Drive, Suite 350 Rancho Cordova, CA 95670-7982 T: 279.399.8200 F: 279.399.8201 www.langan.com	Project TULELAKE BROWNFIELDS GRANT TULELAKE SISKIYOU COUNTY CALIFORNIA	Figure Title SITE PLAN	Project No. 760613502 Date 12/12/2025 Scale 1" = 30 feet Drawn By GS	Figure 2

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Location	LAN-SB-04	LAN-SB-04	LAN-SB-04
Sample Name	LAN-SB-04-2	LAN-SB-04-6	LAN-SB-04-7.5
Sample Date	06/04/2025	06/04/2025	06/04/2025
Sample Depth (feet bgs)	2	6	7.5
TPH			
TPHd	110	<24 U	*290*
Metals			
Lead	NA	15	NA

Location	LAN-SB-01	LAN-SB-01
Sample Name	LAN-SB-01-2	LAN-SB-01-5.5
Sample Date	06/03/2025	06/03/2025
Sample Depth (feet bgs)	2	5.5
TPH		
TPHd	7.4 J	<18 U
Metals		
Lead	***270***	NA

Location	LAN-SB-02
Sample Name	LAN-SB-02-3
Sample Date	06/03/2025
Sample Depth (feet bgs)	3
TPH	
TPHd	<18 U

Location	LAN-SB-06	LAN-SB-06	LAN-SB-06
Sample Name	LAN-SB-06-2	LAN-SB-06-5.5	LAN-SB-06-7
Sample Date	06/04/2025	06/04/2025	06/04/2025
Sample Depth (feet bgs)	2	5.5	7
TPH			
TPHd	<33 U	<25 U	<24 U

Location	LAN-SB-05	LAN-SB-05
Sample Name	LAN-SB-05-2	LAN-SB-05-6
Sample Date	06/04/2025	06/04/2025
Sample Depth (feet bgs)	2	6
TPH		
TPHd	<33 U	<23 U

Location	LAN-SB-03	LAN-SB-03
Sample Name	LAN-SB-03-3	LAN-SB-03-6
Sample Date	06/03/2025	06/03/2025
Sample Depth (feet bgs)	3	6
TPH		
TPHd	<18 U	<23 U
Metals		
Lead	4.6	NA

Legend

- Soil Boring Location
- Offsite Soil Boring Location
- Floor Drain
- Site Boundary
- Parcel Boundary

Analyte	USEPA RSL Residential Soil	USEPA RSL Industrial Soil	Soil Tier 1 ESL	Soil Direct Exposure Residential ESL	Soil Direct Exposure Commercial/ Industrial ESL
TPH					
TPH - Diesel	NS	NS	110	200	940
Metals					
Lead	200	800	32	80	500

Exceedance Summary:

10 - Result exceeds USEPA RSL Residential Soil
10 - Result exceeds USEPA RSL Industrial Soil
10 - Result exceeds Soil Tier 1 ESL
10 - Result exceeds Soil Direct Exposure Residential ESL
10 - Result exceeds Soil Direct Exposure Commercial/Industrial ESL

Notes:
1. Aerial basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online, National Geographic Society, i-cubed.
2. All locations of site reconnaissance observations are approximate.
3. Parcel data provided by Siskiyou County Open Data.
4. Site A - 436 and 444 C Street
5. Site B - 408 Main Street
6. Soil results and comparison criteria are shown in milligrams per kilogram (mg/kg).
7. Soil results were compared to United States Environmental Protection Agency (USEPA) Regional Screening Level (RSL) Residential and Commercial/Industrial criteria using a Target cancer risk (TCR) of 1x10-6 and a Target hazard quotient (THQ) of 1 (November 2024), and the San Francisco Bay Regional Water Quality Control Board (RWQCB) Soil Direct Exposure Human Health Risk Levels - Tier 1, Residential and Commercial/Industrial Environmental Screening Level (ESL), Lower of Cancer Risk and Noncancer Hazard Values (July 2025)
8. TPH - total petroleum hydrocarbons
9. TPHd - total petroleum hydrocarbons as diesel
10. bgs - below ground surface
10. CAS - Chemical Abstract Service
11. NS - No standard
12. NA - Not analyzed
13. <RL - Not detected

Qualifiers:
J - The analyte was detected above the method detection limit (MDL), but below the reporting limit (RL); therefore, the result is an estimated concentration.
U - The analyte was analyzed for, but was not detected at a level greater than or equal to the RL; the value shown in the table is the RL.

20 0 20
SCALE IN FEET

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Project
TULELAKE BROWNFIELDS GRANT
TULELAKE
SISKIYOU COUNTY CALIFORNIA

Figure Title
PREVIOUS SITE INVESTIGATION SOIL RESULTS

Project No. 760613502
Date 12/12/2025
Scale 1" = 20'
Drawn By GS
Figure No. 3

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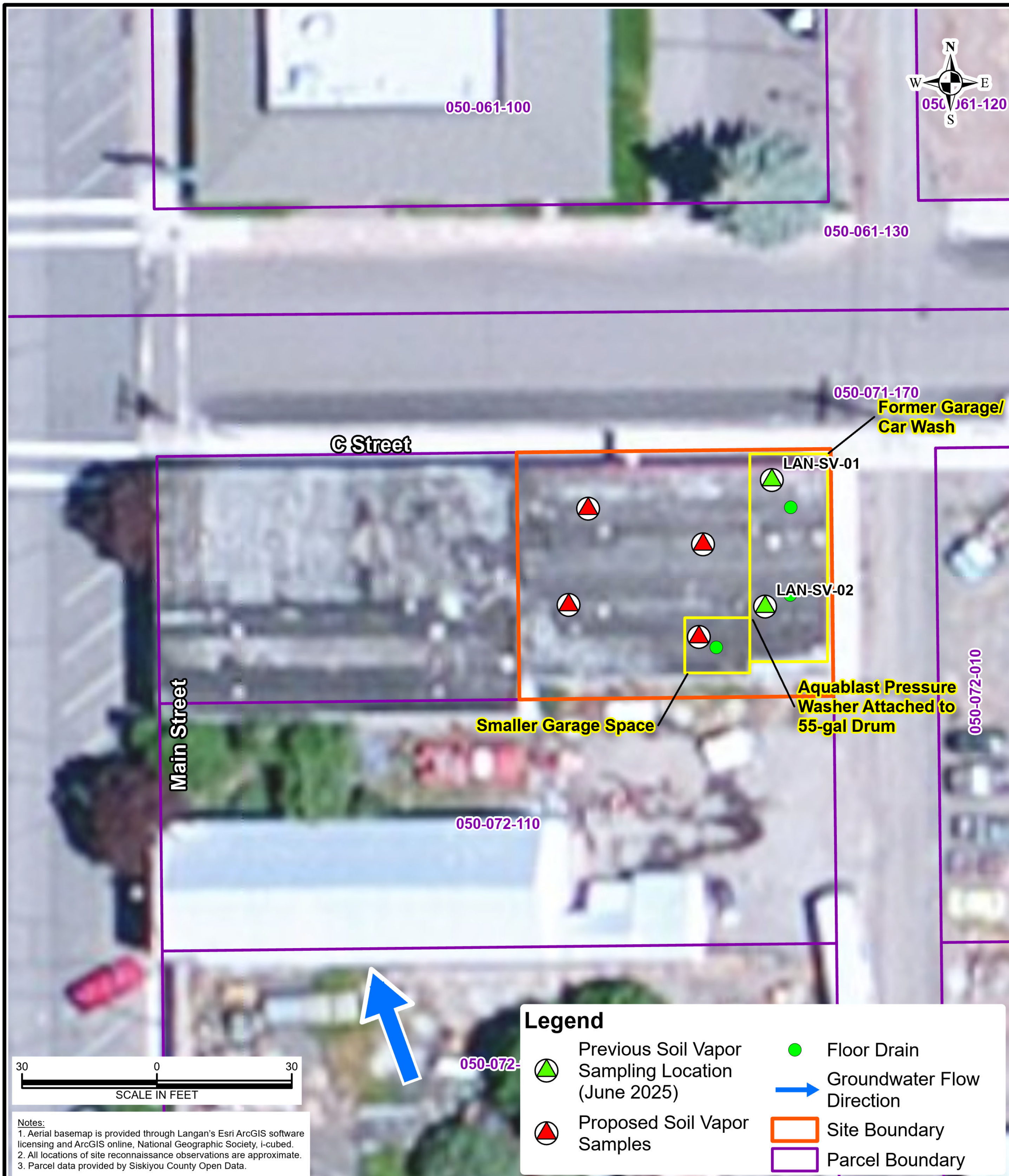

Notes:
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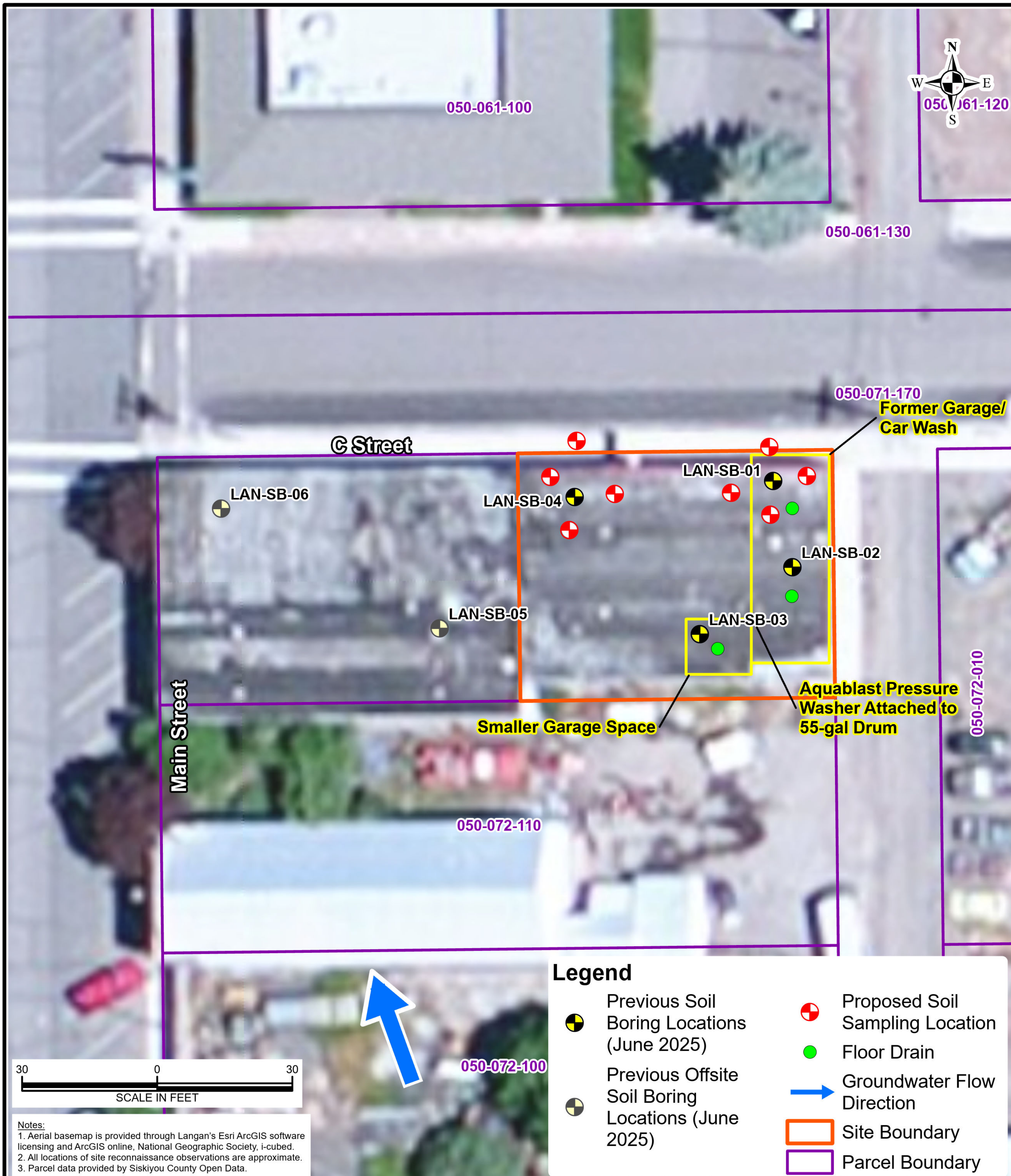

Notes:
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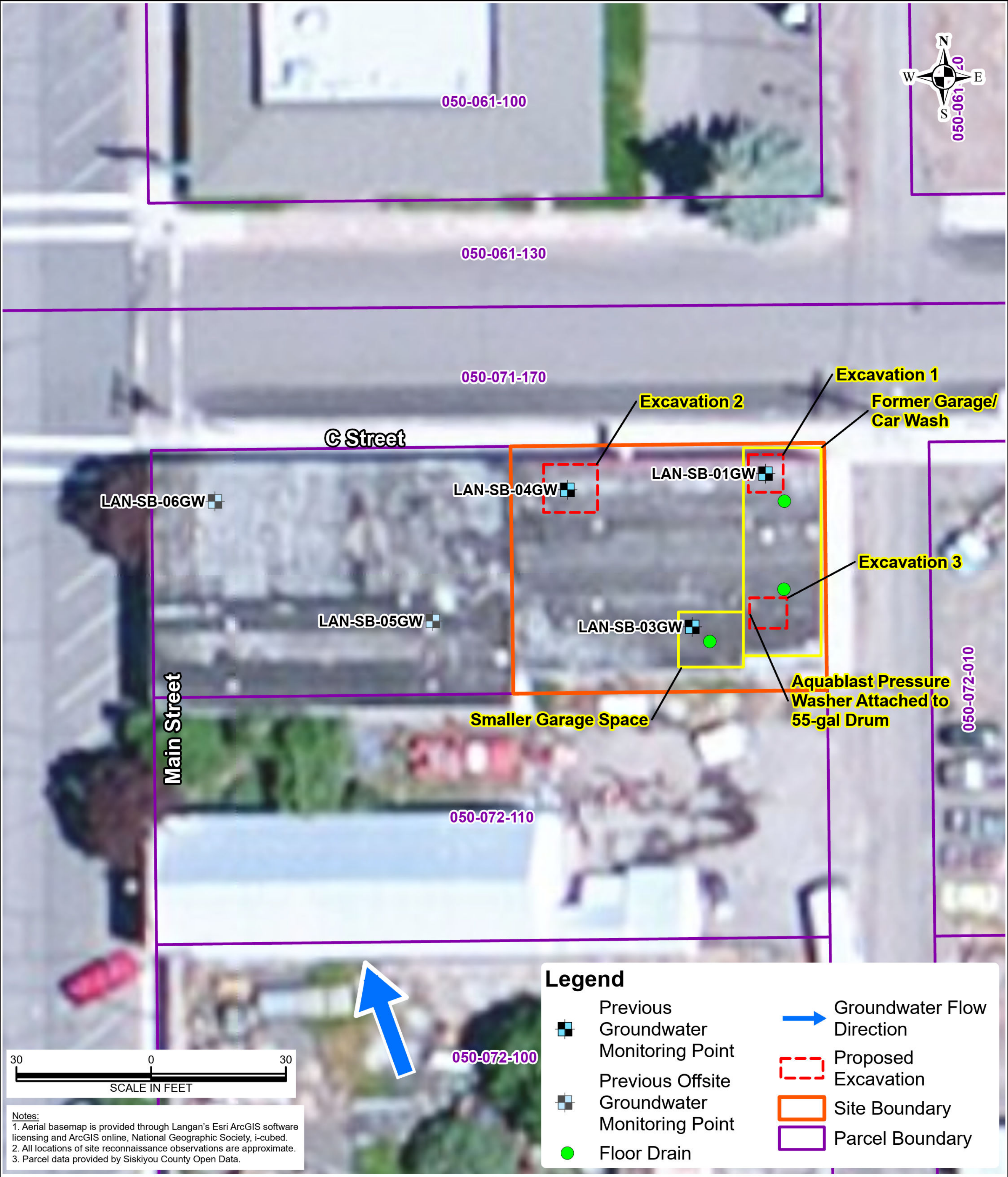
DRAFT



Notes:
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