Remedial Investigation and Corrective Measures Work Plan
Compliance Order on Consent Number: 24-02-01-01

Thornton Shopping Center
East 88th Avenue and Washington Street
Thornton, CO 80229
May 2024

1. Introduction

This Remedial Investigation and Corrective Measures Work Plan (Work Plan) is submitted on behalf of the Thornton Development Authority (TDA), consistent with Paragraph 23 of the Compliance Order on Consent (Consent Order) Number 24-02-01-01 between the TDA and the Colorado Department of Public Health and Environment (CDPHE) through the Hazardous Material and Waste Management Division (Division). The Consent Order outlines the compliance and schedule requirements for the remediation of the 15.86-acre Thornton Shopping Center, located at the northeast corner of East 88th Avenue and Washington Street, Thornton, Colorado (the "Facility") and constitutes a "Corrective Action Plan" or "CAP" pursuant to 6 CCR 1007-3 § 100.26.

Facility remediation will be an iterative process, with many data-driven decisions that rely on information obtained from past and future investigations. The initial priority of this Work Plan is the evaluation of the human health exposure pathway and source area contaminant mass reduction. For this reason, this Work Plan provides specific outlines of the assessment and remedial tasks to evaluate the indoor air pathway, the extent of groundwater impacts, and to facilitate source area mass removal. Each section describes the task-specific plans to be submitted to the Division which will include data specific to the task, schedules, figures, plan drawings, evaluation criteria, and/or other applicable information in such detail to allow for technical review, comment, and approval by the Division. Because many future corrective measure decisions rely heavily on the data from the initial tasks, this Work Plan also presents additional conceptual corrective measure alternatives and provides the likely implementation scenario should they be deemed warranted or necessary. Specific submittals and implementation schedules for the priority tasks are presented at the end of this Work Plan as are additional components intended to protect future Facility users, document Work Plan progress, and provide for public involvement.

1.1. Facility Background

The Facility was first constructed in 1954, with several additions completed into the late 1970s. The Facility has housed numerous retail businesses including, but not limited to, a gasoline station, dry cleaners, auto supply and repair, a laundromat, retail stores, and restaurants. Historical dry cleaning operations typically used the solvent perchloroethylene, also known as PCE, and the use and/or improper disposal of which commonly resulted in soil, groundwater, and vapor contamination. At least four dry cleaners have historically operated on the Facility, three within the main portion of the building at 8860, 8866 and 8876 North Washington Street and one in the northeasterly building at 8946 North Washington Street (**Attachment 1**).

Beginning in 2005, numerous site investigations have been conducted at the Facility (referred to herein as "on-site") and beyond the Facility boundaries (referred to herein as "off-site," and collectively together with "on-site" as the "Site"). The former dry cleaner at 8866 North Washington Street has been identified as the primary source for a PCE release presumed to be associated with dry cleaning operations that date to the 1950s. To date, assessments of the nature and extent of the contamination have consisted of drilling soil borings; installing groundwater monitoring wells; sampling soils, groundwater, soil vapor and indoor air; and mapping contaminant concentrations. Reports detailing the sampling have been submitted to the Division as the regulatory agency.

General Site conditions and the current understanding of the extent of Site contamination are summarized below:

- The primary source of PCE contamination is presumed to be the former dry cleaner location at 8866 North Washington Street portion of the Facility. This unit is referred to as the "source area" based on data obtained from soil borings drilled inside the building and evaluation of groundwater data.
- Site soil and groundwater are impacted by the source area above the current Colorado Basic Standards for Groundwater[1] and U.S. EPA Regional Screening Levels (RSLs) for soils[2].
- PCE soil contamination within and near the source area has migrated vertically to depths of at least 60 feet below ground surface (bgs).
- A shallow aquifer is located on the Site and consists of clay with minor amounts of sand overlying weathered claystone and mudstone bedrock. Groundwater occurs within the clays and bedrock of this aquifer at depths of about 15 feet bgs within the source area, shallowing to about 10 feet bgs within the residential areas off-site to the east and southeast of the Facility.
- A deeper bedrock aquifer has been identified within the more competent bedrock claystones. Groundwater depths in this aquifer are highly variable.
- PCE contamination in groundwater is primarily located within the shallow aquifer and flows off-site to the southeast at least 2,000 feet from the source area. The currently known extent of groundwater contamination is shown on **Attachment 2**.
- PCE contamination in deep bedrock groundwater appears to be limited in area, but limited assessment has been conducted and PCE has been detected downgradient of the source area to a depth of up to 75 feet bgs.
- Limited indoor air sampling from 2012 and 2019 was conducted in off-site residential and commercial spaces overlying portions of the groundwater plume. PCE was detected in several locations, but none of the reported concentrations exceeded current 2023 EPA Vapor Intrusion Screening Levels (VISLs)[3] .

[1] Colorado Water Quality Control Commission, Regulation 41 – The Basic Standards for Ground Water. 5 CCR 1002-41.
[2] https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables
[3] https://www.epa.gov/vaporintrusion/vapor-intrusion-screening-level-calculator

1.2. Regulatory Background and Purpose

The Consent Order is the mechanism by which the Division will ensure the TDA complies with the Colorado Hazardous Waste Act and its implementing regulations for the Facility, and replaces the previously approved CAPs submitted by the former property owner, Thornton, LLC. This Work Plan is required by the Consent Order Paragraph 23 and presents the proposed activities to further investigate, delineate, and remediate Site contamination. Because remediation is an iterative process, this Work Plan provides a phased approach pursuant to 6 CCR 1007-3, § 100.26(c)(7)(ii), anticipating modifications and updates as new data become available.

Remediation of the dry cleaning release at the Facility will require a multi-year, multi-phased approach. The goals of the Work Plan are to achieve the following:

- Reduction of source area contamination to the greatest extent feasible;
- Evaluation and, if needed, elimination of the remaining contaminant exposure pathways for current and future land use at the Facility and off-site; and
- Provide assurance that remedial measures will remain protective of human health and the environment into the future.

To accomplish these goals, the Work Plan consists of the following actions:

1. Off-site indoor air monitoring for residential and commercial structures and reporting to the Division;
2. Quarterly groundwater monitoring, sampling, and reporting for both on-site and off-site areas with additional groundwater monitoring well installations as needed to delineate the extent of the groundwater plume;
3. Performance groundwater monitoring to evaluate effectiveness of corrective measures, including off-site BOS-100 injections conducted in 2021;
4. On-site corrective action measures including a supplemental characterization of the source area after building demolition that may include, but are not limited to: source area contaminated soil removal by excavation; deep bedrock source area treatment by solution injection; contaminated groundwater treatment through the installation of a permeable reactive barrier; and groundwater treatment through treatment solution injections to promote bioremediation;
5. An aggressive, yet realistic implementation timeline for Site remedial and monitoring activities; and
6. Management of generated wastes in accordance with Colorado Solid and Hazardous Waste Regulations.

The phases of the Work Plan are described below and will be provided in greater detail in subsequent submittals to the Division as modifications to this Work Plan for review, approval, or approval with modifications. An anticipated timeline and list of anticipated submittals is provided in Section 2.4.

2. Remedial Investigation and Corrective Measures Work Plan

2.1. Off-Site Indoor Air Monitoring

2.1.1. Background

The current understanding of potential off-site soil vapor intrusion impacts from contamination originating from the Facility is limited to two historical indoor air sampling events from 2012[4] and 2019[5]. Although previous sampling did not identify indoor air PCE concentrations that exceed the current EPA VISLs, the previous sampling program was insufficient in sample size, geographic area, and scope to adequately characterize the indoor air exposure pathway due to vapor intrusion. The inadequacies of the previous indoor testing include the following:

- There are an estimated 30 to 35 single family residential structures and up to 48 multi-family residential units over the existing, off-site groundwater PCE plume, but only 13 separate dwellings or residential units were previously sampled[6];
- Only four separate single family residential structures and nine apartment units were tested;
- All the apartment units previously tested are located within the same building complex and are of similar construction;
- Three of the commercial structures originally sampled were located within or adjacent to the source area and are unlikely to be representative of the groundwater to indoor air exposure pathway;
- Sampled residential and commercial structures were limited to the area immediately adjacent to the source area and immediately downgradient of East 88th Avenue.

As part of a comprehensive evaluation of the potential extent of off-site soil vapor intrusion, the proposed indoor air monitoring program will be conducted in the early stages of this Work Plan.

2.1.2. Indoor Air Monitoring Plan

The Indoor Air Monitoring Plan (IAMP) will provide the details of the indoor air exposure pathway evaluation for off-site structures, both residential and commercial. The IAMP to be submitted to the Division for approval will include each of the following sections, in greater and sufficient detail, to evaluate the potential for vapor intrusion associated with Site groundwater contamination. In addition, applicable portions of the Division's Vapor Intrusion Guidance Document[7] will be specifically incorporated into the IAMP to be consistent with Division guidance:

- *Geographic Scope* – The initial scope of the indoor air monitoring will include requesting access to sample indoor air quality from residential units – both single family detached and multi-family – along the axis of the identified groundwater plume. The goal will be a sample size of up to 17 single family residential structures and up to 24 apartment units. Additional units/locations may be added, pending results of the first phase of the IAMP. Existing sampling data is sufficient to identify the targeted axis of the plume where data will be collected.

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[4] Eurofins. Data package for Project #36549254 for Indoor Air Quality Results and Testing, Thornton Shopping Center. May 25, 2012.

[5] Rettew. 2019 Site Characterization Data Package (Flywheel Capital LLC). April 24, 2019.

[6] ____. Proposed Indoor Air Sampling Work Plan For Thornton Shopping Center EPA#COR000212639 Compliance Order On Consent #11-00-00-01. February 27, 2019.

[7] CDPHE Vapor Intrusion Guidance Document. Most recent version March 31, 2023.

- *Site Access and Notification* – TDA will request access to residences both within and outside the targeted sampling area to assure adequate participation within the boundaries of the currently known targeted groundwater plume location to sample indoor air for dry cleaning compounds. Notifications will originate from TDA and reference the Division Project Manager and include a customized notice letter and informational fact sheet. Written consent for air sampling will be obtained prior to all sampling. Access denial will be documented in written correspondence with the Division.
- *Chemical Inventory/Owner Interviews* – Prior to sampling, an initial chemical inventory and interview will be completed with each property owner as close as possible to the sampling period. The purpose of the inventory and interview is to identify any activities, products, or chemicals present that may interfere with the testing.
- *Sample Locations* – Sampling will be performed using 6-Liter Summa, individually certified, stainless steel canisters for the collection of indoor air samples from the lowest occupied floor or living space away from areas of increased air movement such as vents, fans, windows, or doors. The canister will be placed at a height of 3 to 5 feet above the ground, where possible, and the location documented on sampling field sheets. Samples will consist of a 24-hour sample collected from residential and day care facilities and 8-hour samples collected from commercial units.
- *Background and Quality Assurance/Quality Control (QA/QC) Sampling* – Background ambient air samples will be collected at select locations, concurrent with the building sampling. Ambient air samples will be collected from exterior locations in the same manner as the closest target sample location. Duplicate samples will be collected for QA/QC purposes and will consist of co-located sample canisters at a primary sample location. Ambient air and QA/QC samples will be collected at a frequency of one per 20 samples or sample group. This section of the IAMP will also include a detailed discussion of field procedures, laboratory requirements, and field documentation.
- *Analyte List* – Air samples will be submitted to a Division-approved laboratory for analysis of chlorinated compounds associated with dry cleaning activities, including PCE, using EPA Method TO-15, selected ion monitoring (SIM).
- *Documentation* – All sampling activities will be documented through field sheets, standardized interview questionnaires, sample location photographs, and adhere to laboratory chain-of-custody protocols.
- *Schedule* – Notifications is anticipated to begin within 30 days of the Division's approval of the IAMP. Notifications is anticipated to include community outreach, targeted mailings, in-person contact, and telephone communications. The notifications will target initial monitoring for the late summer 2024 with a follow-up sampling event in the opposite season (anticipated mid-winter 2025), however this schedule is highly dependent on access.
- *Reporting* – Raw analytical data will be submitted to the Division within 30 days of receipt from the laboratory. A comparison of values against EPA VISLs will be submitted no later than 45 days after receipt of raw analytical data. A report documenting the implementation of the IAMP will be prepared and submitted to the Division within 60 days of receipt of laboratory analytical data. The report will present a comparison of testing results to current VISLs and propose any remedial actions, monitoring, and/or expansion of the monitoring program with a semi-annual reporting schedule.

Any conclusions regarding monitoring frequency, vapor mitigation measures, or addition/subtraction of monitoring locations will be considered in consultation with the Division at a minimum on a semi-annual basis.

2.1.3. IAMP Implementation Schedule

Table 1. IAMP Implementation Schedule.

Task	Timeline
IAMP submittal	15 days after Division Work Plan approval
IAMP Notifications begin	30 days of Division approval of IAMP
IAMP Sampling	Dependent on access request success
Raw Data Reporting	30 days from receipt of data from laboratory
Data Comparisons	45 days from receipt of data from laboratory
IAMP Reporting	60 days from receipt of data from laboratory
IAMP Program Semi-Annual Reporting	Semi-annually by January 31 and July 31

2.2. Groundwater Monitoring Program

2.2.1. Background

Groundwater monitoring, sampling, and reporting will document the groundwater contaminant plume extent, changes in the size or shape of the plume, and provide a measure of remedial action performance. Groundwater monitoring consists of groundwater sampling, laboratory analysis, reporting of results, and management of wastes generated. Monitoring locations will include both performance monitoring of wells specifically related to a remedial action as well as groundwater plume wells that document the extent of groundwater contamination and provide insight into contaminant and groundwater elevation trends.

2.2.2. Long Term Groundwater Monitoring Plan

The Long Term Groundwater Monitoring Plan (LTGMP) will present the details of the proposed groundwater monitoring across the Facility and groundwater plume stability evaluation for on-site and off-site areas. The LTGMP will initially detail the current monitoring plan being implemented in accordance with the 2022 Transfer of CHWA Corrective Action Plan Letter from the Division to TDA[8] and documented within quarterly groundwater monitoring reports submitted to CPDHE by TDA since January 2023, most recently in February 2024[9]. The LTGMP to be submitted to the Division for approval will include each of the following sections, in greater and sufficient detail, to evaluate the groundwater plume stability, changes, and completeness of the contamination delineation:

- *Scope* – The initial geographic scope of the LTGMP will be consistent with the documented scope of on-site and off-site groundwater monitoring wells, consisting of the quarterly monitoring of approximately 40 groundwater wells as outlined in current groundwater monitoring reports submitted to the Division. Any changes to the previous monitoring well network will be proposed within the LTGMP.
- *Sample Locations* – Sample locations will be detailed in the LTGWMP and include rationale for each location. The actual number of wells monitored is anticipated to fluctuate as wells are

[8] CDPHE, HMWMD. Transfer of CHWA Corrective Action Plan Letter. Thornton Shopping Center, Northwest Corner 88th and Corona, Thornton, Colorado. October 27, 2022.
[9] ERO. 4Q23 Groundwater Monitoring Report, Thornton Shopping Center, NE Corner East 88th Avenue and Washington Street, Thornton, Colorado. February 1, 2024.

abandoned during corrective measures implementation, as wells are added for performance monitoring of mitigation measures, or additional wells are added for further groundwater plume delineation (discussed below).

- *Frequency* – Monitoring frequency of individual wells may be adjusted between quarterly to annual basis, depending on the purpose of the specific groundwater well, trend analysis, or other factors, all subject to Division approval. To maintain consistency with historical sampling timelines, quarterly sampling is proposed to occur in January, April, July, and October; semi-annual sampling in January and July; and annual sampling in July – all subject to Division approval.
- *Sampling Protocols* – Groundwater wells will continue to be sampled in the manner historically documented and samples will be submitted for laboratory analysis of dry cleaning compounds, including PCE by U.S. EPA Method 8260B. Additional analytes may be added on a case by case basis as warranted, typically to support groundwater geochemical evaluations or performance monitoring.
- *QA/QC* – QA/QC protocols for the LTGMP will be included and detail steps to assure data quality, meet Division requirements, and include detailed discussion of field procedures, laboratory requirements, field documentation, trip blanks, field duplicate, and duplicate samples.
- *Reporting* – Reporting of site-wide groundwater monitoring results will occur on a semi-annual basis within the LTGMP Report. Any changes to the monitoring program independent of those related to corrective measures implementation will be proposed to the Division within the semi-annual LTGMP Reports to be submitted by February 28 and August 30 of each year.

Long-term groundwater monitoring is anticipated to continue until such time as the Division concurs that conditions meet criteria sufficient to meet the requirements of a Notice of Completion per Paragraph 63 of the Consent Order. At this time, long-term groundwater monitoring is anticipated to last at least 15 years.

2.2.3. Off-Site Plume Delineation

Based on recent groundwater data presented in quarterly groundwater reports, additional groundwater wells are anticipated to be needed to fully delineate the extent of the groundwater plume. As part of this Work Plan, additional groundwater monitoring wells will be installed in locations to be proposed within the LTGMP and in coordination with the Division. This Work Plan anticipates the installation of the following:

- Deep groundwater monitoring wells to delineate the deep groundwater plume on and off-site.
- Shallow, off-site groundwater wells within the eastern part of the groundwater plume extent to delineate the easterly extent of groundwater impacts.

Details specific to the well installation, timing, location, installation techniques, and sampling will be in the LTGMP to be submitted to the Division for approval prior to implementation. In general, groundwater wells are anticipated to be installed using hollow-stem auger methods, similar to the existing network of groundwater wells. Soil and groundwater samples will be collected during drilling and locations and sample depths will be confirmed with the Division prior to implementation. The additional groundwater monitoring wells installed as part of plume delineation will be incorporated into the long term monitoring program detailed within the LTGMP.

2.2.4. Off-Site Performance Monitoring

In 2021, groundwater at four off-site areas (OFS-1 through OFS-4) were treated with BOS 100® under a previously approved CAP. To date, performance monitoring of these treatment areas has consisted of the quarterly visual confirmation of the continued presence of the BOS 100® injectant and quarterly sampling from wells upgradient from the treatment areas.

The downgradient performance monitoring wells (well IDs MW-36 through MW-39) originally proposed in the previously-approved CAP have yet to be installed in accordance with the Division's May 3, 2022 approval of locations[10]. Initial performance monitoring actions to be conducted as part of this Work Plan will consist of the installation of groundwater monitoring wells downgradient of the injection areas, incorporation of the wells into the LTGMP, and sampling of the wells for the same constituents as the up-gradient wells. Details specific to the well installation, timing, location, installation techniques, and sampling will be presented in the LTGMP to be submitted to the Division for approval prior to implementation.

Based on groundwater monitoring activities, treatment of the groundwater within the prior injection areas will be deemed successful if one or more of the following groundwater trends occurs:

- Decrease in contaminant concentrations between the upgradient and downgradient wells;
- Decreasing trend in contaminant concentrations in wells downgradient of treatment area; and/or
- Increasing chloride concentrations in wells downgradient of treatment area.

Details of the performance monitoring will be incorporated into the subsequent LTGMP Reports. Any additional corrective measures, discussed here or proposed in the future, will include specific performance monitoring plans within the design proposal submitted to the Division for approval.

2.2.5. LTGMP Implementation Schedule

Table 2. LTGMP Implementation Schedule.

Task	Timeline
LTGMP Submittal	15 days after Division Work Plan approval
LTGMP Implementation	15 days after LTGMP approval
LTGMP Quarterly Sampling	January, April, July, and October
LTGMP Semi-Annual Sampling	January and July
LTGMP Annual Sampling	July
LTGMP Reporting	By February 28 and August 30
Delineation/Performance Well Installations	180 days after Division LTGMP approval

2.3. Corrective Measures

Corrective measures will be designed upon the completion of a supplemental characterization of the source area after building demolition. Because corrective measures will be an iterative process, the remedial strategies presented within this Work Plan include varying levels of specificity for each alternative that would be included within project-specific work plans for each activity. The initial

[10] CDPHE. Email from Lindsay Murl (CDPHE) to John Dellaport (Quantum Water & Environment). RE: Approval of 4 offsite replacement monitoring well locations. May 3, 2022.

corrective measure consists of source area contaminated soil removal by excavation with the design based on supplemental source area characterization described below. Additional corrective measure alternatives for the Facility are presented at a conceptual level and include deep bedrock source area treatment by treatment solution injection, contaminated groundwater containment and treatment through the installation of a permeable reactive barrier, and groundwater treatment through treatment solution injections. Prior to the implementation of any corrective measure, a detailed plan will be submitted to the Division for review, comment, and approval.

2.3.1. Supplemental Characterization

2.3.1.1. Background

All source area site characterization activity to date has occurred with the building in place, effectively covering or limiting lateral and vertical access to the subsurface historical release points and/or locations of significant contaminant mass. With the building removed during the initial part of site activities, additional drilling and sampling will be conducted within the footprint in the building, both within and adjacent to the source area, to confirm the depths and lateral extent of subsurface PCE impacts. Beyond the interior of the source area unit, limited soil testing has documented PCE soil contamination beneath the adjacent units to the east (8870 North Washington Street) and to the west (8858 North Washington Street)[11] with limited interior remedial injections in 2014[12]. Although no known confirmation sampling has occurred, leaving the current conditions and level of residual contamination uncertain.

Beyond the known source area, historical groundwater monitoring reports have identified elevated PCE groundwater concentrations near the most recent dry cleaning facility at 8946 North Washington Street. No known soil investigations have occurred within the building footprint to evaluate the site as a potential secondary release of PCE within the Facility.

In addition, little to no data exists regarding the Facility sanitary sewer utility as a potential contaminant transport pathway that crosses beneath the Facility easterly of the source area and extends easterly into the adjoining neighborhood.

2.3.1.2. Supplemental Source Area Characterization Plan (SSACP)

The Supplemental Source Area Characterization Plan (SSACP) will provide the details of the supplemental investigations to evaluate the extent of PCE soil and bedrock contamination associated with the Facility. The SSACP to be submitted to the Division for approval will include each of the following sections, in greater and sufficient detail, to evaluate the extent of subsurface soil and bedrock PCE contamination, potential utility corridors as contaminant transport pathways, evaluate the potential for a second release source at 8946 North Washington Street, and support the design a source area removal plan.

Scope – The initial geographic scope of the SSACP will focus on the source area at 8866 North Washington Street and adjacent units, the potential secondary source at 8946 North Washington Street, and the Facility sanitary sewer. Details to be provided within the SSACP include graphical and tabular

[11] LT Environmental, Inc. (LTE). Limited Site Assessment Report – Revision 1, Thornton Shopping Center, Northeast Corner of East 88th Avenue and Washington Street, Thornton, Colorado. January 11, 2017.
[12] _. Supplemental Injection Summary Report – 2014, Thornton Shopping Center, Northeast Corner of East 88th Avenue and Washington Street, Thornton, Colorado. March 2014.

display of historical data used to identify data gaps, rationale for sample locations, and illustrate the extent of the characterization.

Sample Locations – The SSACP will provide details regarding site-specific soil sample locations, anticipated sample depths, drilling techniques, sampling protocols, and documentation procedures to adequately characterize the soil and bedrock contamination.

Deep Groundwater Characterization – The known extent of deep groundwater contamination is currently limited to two well clusters at MW-22 and MW-23. The SSACP will include details of additional deep bedrock groundwater assessment beyond these two locations and provide the data to support deep groundwater remediation alternatives discussed below.

QA/QC – QA/QC protocols for the SSACP activities will be included and detail steps to assure data quality, meet Division requirements, and include detailed discussion of field procedures, laboratory requirements, field documentation, trip blanks, field duplicate, and duplicate samples.

Sewer Scoping Data – The SSACP will provide details of sewer scoping activities conducted to date or planned to identify and document release points.

Waste Characterization and Management – The SSACP will be designed and implemented with the anticipated source area removal (described below), and include evaluation of waste streams anticipated to be generated during excavation activities.

Reporting – The SSACP results will be submitted to the Division before source area excavation is designed and include a narrative of site activities, all site data generated, maps depicting new and historical soil and bedrock data, sewer line exploratory results, and proposed design of source area removal. Should the SSACP data indicate that additional characterization within or outside the initial scope of the SSCAP, recommendations and/or proposals for additional assessment will be included.

2.3.1.3. SSACP Implementation Schedule

Table 3. SSACP Implementation Schedule.

Task	Timeline
SSACP Submittal	30 days after Division Work Plan approval
SSACP Implementation	15 days after Division approval of SSACP
SSACP Completion Reporting	90 days after Division approval of SSACP

2.3.2. Source Area Excavation

The source area excavation is anticipated to remove soils from beneath 8866 North Washington Street and adjacent units– the extent of which will be determined during the SSACP implementation. The conceptual excavation design includes the following, with the understanding that certain aspects may be modified in response to data obtained from the supplemental characterization or conditions encountered and will be presented in a Source Area Excavation Plan (SAEP):

- Removal of shallow soils to be staged for waste characterization or reuse under an approved Waste Management Plan (WMP).
- Removal of presumed PCE-contaminated soils and bedrock from beneath the source area and adjacent units as applicable.

- Soils will be characterized and treated on-site under a permit with the Division to reduce contaminant concentrations for disposal as non-hazardous waste at a permitted disposal facility or disposed as hazardous waste at a permitted facility.
- Confirmation sampling will be conducted according to a defined plan to confirm contaminant removal and document remaining conditions prior to backfilling.
- Prior to backfilling, an infiltration system is anticipated to be installed within the base of the excavation using a series of slotted piping connected to the surface that would allow for future remedial injections within the excavation footprint.
- Upon completion of the excavation, the excavation will be backfilled with clean fill material.

Groundwater is anticipated to be encountered during the excavation. A groundwater dewatering treatment system will be constructed to containerize, treat and reduce contaminant concentrations such that treated groundwater can be disposed of at a permitted disposal facility as non-hazardous, solid waste. Waste management will be conducted in accordance with an approved WMP for the Site and in conformance with Colorado Hazardous Waste Regulations.

The proposed SAEP detailing the design, implementation, waste management, and performance monitoring plan for the source area excavation will be submitted to the Division for review, comment, and approval prior to implementation, in accordance with the Consent Order Paragraph 27. The SAEP will be submitted to the Division within 30 days of the SSACP approval and include a schedule for implementation.

2.3.2.1. Comfort Letters

In accordance with Paragraph 28 of the Consent Order, as soil remediation is completed and data presents conditions protective of intended land use of the Facility, or portions thereof, TDA will seek "comfort letters" for prospective purchasers and/or tenants of remediated portions.

2.3.1. Additional Corrective Measure Alternatives

Several additional corrective measure alternatives are anticipated to be considered and evaluated during the iterative process of Facility remediation. Although a thorough evaluation and alternatives analysis yet to be conducted, the currently anticipated options under consideration are summarized below. Actual implementation of any of the alternatives will be based on the data obtained from the previous investigations and any implementation plan will be submitted to the Division for review, comment, and approval prior to implementation, in accordance with the Consent Order Paragraph 27.

2.3.1.1. Permeable Reactive Barrier (PRB)

A biological barrier treatment wall, also known as a permeable reactive barrier (PRB) system, at the Facility boundary could provide the long term, continual passive treatment of on-site groundwater leaving the Facility. The PRB would intercept groundwater within the natural flow path and treat groundwater within a permeable biological treatment zone. Two different methods for installing the PRB are expected to be evaluated – either direct trenching/soil mixing or a network of closely-spaced injection wells. Construction is anticipated to consist of the following:

- Extend the PRB along the south and easterly sides of the Facility boundary, downgradient of the source area;
- If trenched, soils and bedrock to a design depth below the groundwater table would be excavated and replaced, or mixed in-situ with a mix of organic material and sand;

- If installed by drilled points, injection points drilled within the footprint would be used to inject treatment solution into zone below the water table;
- Permanent injection wells would be installed within the footprint of the PRB for injection of treatment solution/amendment; and
- Groundwater monitoring wells would be installed upgradient, within and downgradient of the PRB to evaluate performance.

Any proposed design, implementation, waste management, and performance monitoring plan for the construction of a PRB would rely on both existing data and any additional characterization deemed necessary and would be submitted to the Division for review, comment, and approval prior to implementation, in accordance with the Consent Order Paragraph 27.

2.3.1.2. Bedrock Treatment Injections

As noted above, it is not feasible or practicable to excavate deep bedrock contamination within the source area. For this reason, deep bedrock contamination remediation will require in-situ methods. Deep injection of treatment solution through injection wells is anticipated to be the most effective course of action to address the deeper contamination, should this action be deemed warranted. The actual number and locations of injection points and associated performance monitoring wells will be dependent on data from the supplemental investigation described above and additional characterization as deemed necessary. In general, it is anticipated that deep bedrock injection points would be installed within the permanent well network and be used for injection of a carbon substrate solution and bioaugmentation or biostimulation product. Performance monitoring of the treatment would use monitoring wells not used for injection to ensure data quality is achieved.

Any proposed design, implementation, waste management, and performance monitoring plan for deep bedrock treatment injections via deep injection wells would be submitted to the Division for review, comment, and approval prior to implementation, in accordance with the Consent Order Paragraph 27.

2.3.1.3. On-Site Shallow Injections

If deemed necessary based on performance data evaluation, the area between the excavation and the PRB could be utilized for shallow bioremediation injection treatments within the groundwater plume. A treatment solution could be injected directly into the aquifer to treat contaminated groundwater behind the PRB to enhance the reduction in contaminant concentrations. Conceptually, the remedial injection protocol would consist of multiple, closely-spaced injection points used to distribute a carbon substrate injection solution and bioaugmentation or biostimulation product throughout the source area within a grid pattern to provide overlapping treatment zones.

Any proposed design, implementation, waste management, and performance monitoring plan for on-site shallow treatment injections would be submitted to the Division for review, comment, and approval prior to implementation, in accordance with the Consent Order Paragraph 27.

2.3.1.4. Off-Site Injections

Off-site remedial injections have previously been conducted as a mechanism to treat off-site groundwater contaminant plume, most recently in 2021. The performance monitoring of these injections has not been fully completed and the success and/or any unintended groundwater impacts have yet to be evaluated. Based on the results of the performance monitoring of previous injections discussed above, the need, benefit, and risks of additional off-site plume treatment injections will be

evaluated. Many injection technologies can result in unintended byproducts from contaminant destruction that need evaluation prior to full-scale implementation. For these reasons, additional off-site injections are not anticipated until a thorough evaluation of the recent injections can be completed and thorough consultation with the Division can be conducted. If deemed appropriate, feasible, and practicable, a conceptual design may be developed that would consist of numerous, closely spaced borings within the rights-of-ways throughout the groundwater plume, similar in concept to the on-site treatment injections.

After the performance monitoring of previous off-site injections discussed above, a corrective measures evaluation of additional off-site injection, any proposed design, implementation, waste management, and performance monitoring plan would be submitted to the Division for review, comment, and approval prior to implementation, in accordance with the Consent Order Paragraph 27.

2.3.2. Waste Management Plan

PCE-contaminated soil, groundwater, and debris will be generated during all investigation, monitoring, and remedial activities. Depending on the media, the waste may or may not be considered hazardous waste under Colorado Hazardous Waste Regulations. PCE-contaminated wastes are required to be thermally-treated by incineration or other thermal extraction methods. Therefore, to the greatest extent practicable, the generation of hazardous waste will be minimized as much as possible to lessen the overall environmental impact of remedial actions and increase cost efficiency. All wastes generated at the Site will be managed in accordance with Colorado regulations.

Corrective measures will all have specific waste streams and nuanced management requirements that will be outlined within the specific Work Plan Modifications submitted to the Division for review and approval. In addition, specific corrective measures may utilize alternative waste treatment and management methods specified within the regulations. Any such plans would be incorporated into the specific Work Plan modification and be subject to the Division approval.

2.4. Implementation Timeline

Site remediation is an iterative approach, with each phase relying on information obtained from previous investigations, monitoring, and evaluation.

A general implementation timeline of the various components of the site assessment and remediation tasks is presented in the table below. It is anticipated that the majority of the high priority assessment and source area activities will reach substantial completion within the first two years of Work Plan implementation. The implementation of the additional corrective measure alternatives discussed is highly dependent on the data obtained and success of the high priority tasks.

Implementation Year	Remediation Phase/Activity
Years 1-2	Off-Site indoor air monitoring evaluation
	Public Involvement
	Groundwater Monitoring
	Off-Site performance monitoring and evaluation
	Supplemental source area characterization
	Reporting
Years 2-3	Source area excavation
	Quarterly groundwater monitoring
Years 3-5	Additional corrective measures (if applicable)
	Groundwater monitoring
	Initial requests for comfort letters, parcel conveyance and recording
Years 5-15	Long term monitoring and reporting

2.4.1. Implementation Schedule and Submittals

The implementation of the investigation and remedial action tasks outlined within this Work Plan and associated deliverable schedule is outlined below in Table 4.

Table 4. Work Plan Implementation Schedule.

Task	Timeline
Indoor Air Monitoring	
IAMP Submittal	15 days after Division Work Plan approval
IAMP Notifications Start	30 days after Division approval of IAMP
IAMP Sampling	Dependent on access request success
Raw Data Reporting	30 days from receipt of data from laboratory
Data Comparisons	45 days from receipt of data from laboratory
IAMP Reporting	60 days from receipt of data from laboratory
IAMP Program Semi-Annual Reporting	Semi-annually by January 31 and July 31
Long Term Groundwater Monitoring	
LTGMP Submittal	15 days after Division Work Plan approval
LTGMP Implementation	15 days after LTGMP approval
LTGMP Quarterly Sampling	January, April, July, and October
LTGMP Semi-Annual Sampling	January and July
LTGMP Annual Sampling	July
LTGMP Reporting	February 28 and August 30
Delineation/Performance Well Installations	180 days after Division LTGMP approval
Supplemental Source Area Characterization	
SSACP Submittal	30 days after Division Work Plan approval
SSACP Implementation Start	15 days after Division approval of SSACP
SSACP Completion Reporting	90 days after Division approval of SSACP
SAEP Submittal	30 days after Division approval of SSACP Report
Waste Management Plan	
Waste Management Plan	15 days after Division Work Plan approval

3. Additional Components

3.1. Use Restrictions

In accordance with Paragraph 29 of the Consent Order, as appropriate, institutional controls in the form of notices of environmental use restrictions are anticipated to be required as part of the remedy for the Site. Depending on the outcome of the work outlined hereunder, these restrictions are anticipated to include restrictions on the use of groundwater on the Facility, or portions thereof, and potentially vapor mitigation installation in future structures and/or soil management during certain construction activities. Proposed restrictions will be submitted to the Division for approval and Notices of Environmental Use Restrictions (NEURs), or other forms of use restrictions, implemented following completion of source excavation.

3.2. Progress Reports

In accordance with Paragraph 26 of the Consent Order, monthly progress reports will be submitted to the Division that provide a summary of activities completed the previous month and a description of activities to be performed in the upcoming month.

3.3. Public Involvement

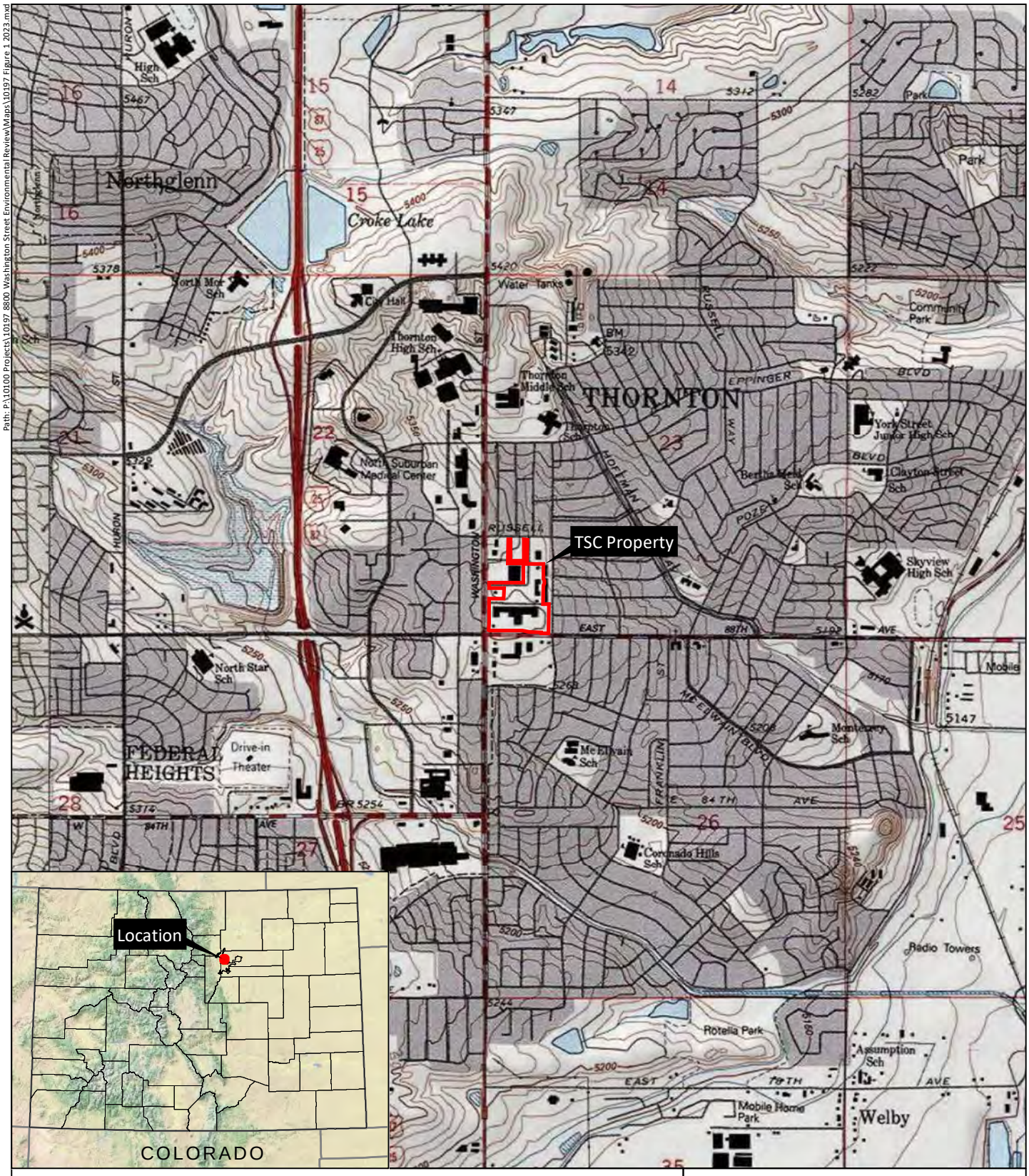
In accordance with Paragraph 31 of the Consent Order, TDA will undertake a meaningful public participation component in connection with this Work Plan, its implementation, and ultimate redevelopment of the Facility.

4. Summary

This Work Plan has been designed and submitted on behalf of the TDA in accordance with Paragraph 23 of Consent Order 24-02-01-01 between the Division and TDA. Implementation of this Work Plan will begin within fifteen (15) calendar days of the Division's approval of this Work Plan in accordance with Paragraph 25 of the Consent Order. TDA acknowledges that implementation of the phases of this Work Plan will require additional, phase-specific modifications that will present detailed plans, maps, procedures, locations, and other specifics associated with the phase of the Work Plan. All approved plans or plan modifications, including all procedures and schedules contained in the plans, will be incorporated into the Consent Order, and shall constitute enforceable requirements.

Attachments

Attachment 1 –Site Plan



Thornton Shopping Center

Section 23, T2S, R68W; 6th PM

UTM NAD 83: Zone 13N; 502054mE, 4411959mN

Longitude 104.975982°W, Latitude 39.857657°N

USGS Commerce City, CO Quadrangle

Adams County, Colorado

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0 1,000 2,000 feet

N

Attachment 1
Site Map

ERO
ERO Resources Corp.

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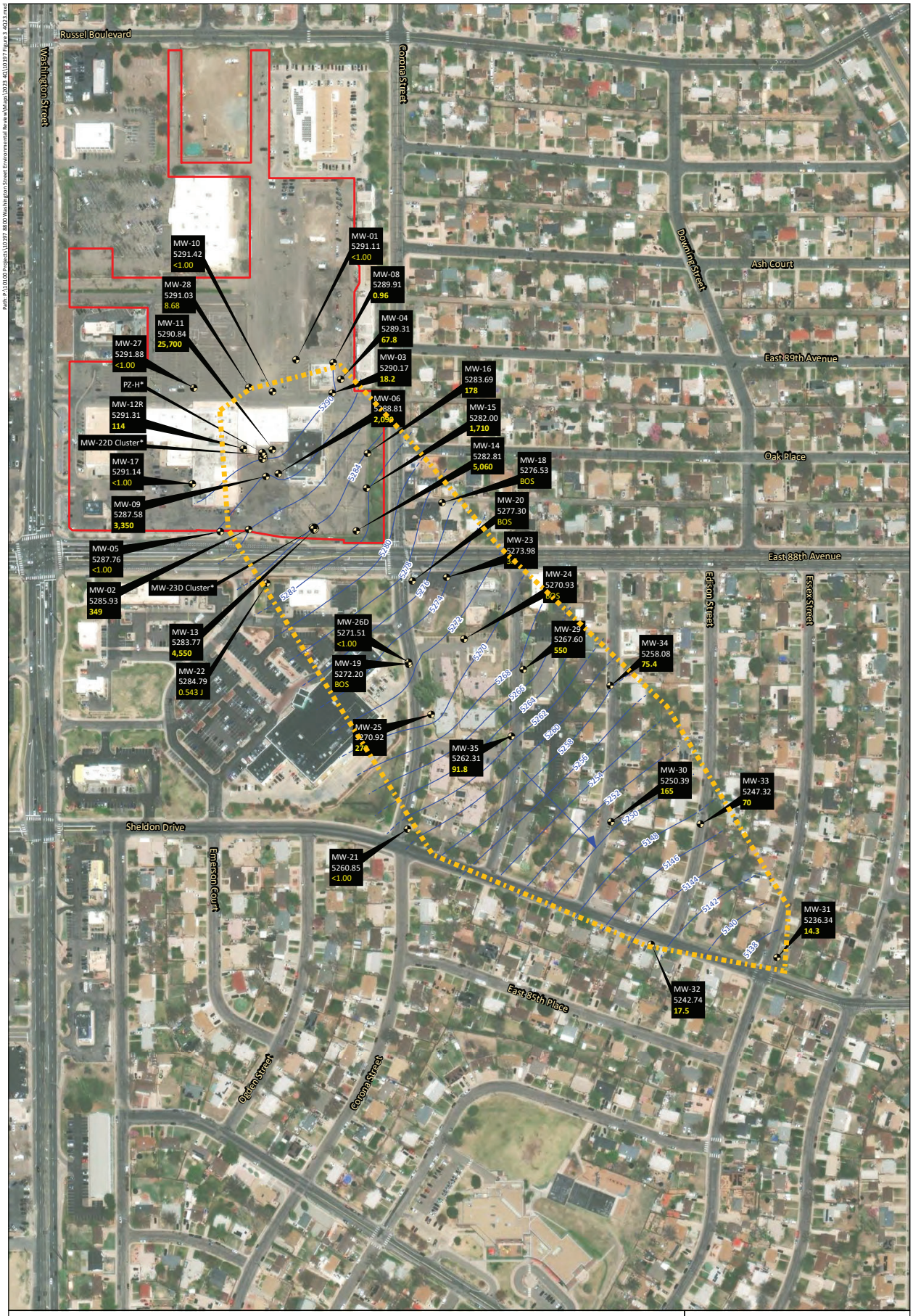
Path: P:\10100 Projects\10197 8800 Washington Street Environmental Review\Maps\10197 Figure 1 2023.mxd

Attachment 2 – Groundwater Flow and Contaminant Plume



Thornton Shopping Center

TSC Property
Monitoring Well Location
2-Foot Groundwater Contour Interval
Inferred Contour
Direction of Groundwater Flow
* - Not Used for Contouring

MW-21 5260.85 <1.00 — Well ID, Groundwater Elevation (feet AMSL), PCE Concentration in µg/L

Approximate extent of known PCE plume (4Q2023)

0 125 250 feet

N

Attachment 2
Groundwater Flow
and Contaminant Plume

ERO Resources Corp.

Aerial Image: © Copyright Google Earth Pro 6/10/2021