CORRECTIVE ACTION REPORT

TIME OIL PROPERTY
01-070
GRANDVIEW,
WASHINGTON

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1.0 INTRODUCTION

The following report presents a Corrective Action Plan (CAP) for the Time Oil Company (Time Oil) Property 01-070 located at 100 East Wine Country Road in Grandview, Washington. The CAP outlines proposed procedures to mitigate identified hydrocarbon impacted soil and groundwater at the property using a combination of three technologies: air sparging, soil vapor extraction and groundwater recovery (pump and treat), a brief description of each is presented below:

Air Sparging

- Air injected into the groundwater by air sparging will cause volatile organics to be stripped from the water and released into the vadose zone. Once in the vadose zone, the volatile organics will be removed through vapor extraction.

Soil Vapor Extraction (SVE)

- Vapor extraction will be used to remove current volatile organic compounds associated with gasoline from the vadose zone and, as previously stated, remove volatile organics stripped from groundwater by air sparging.

Groundwater Recovery

- A groundwater pump and treat system will recover dissolved-phased petroleum hydrocarbons from the groundwater and help control groundwater mounding that occurs during air sparging. In addition, it will allow for the lowering of the groundwater to allow the SVE system to remediate the smear zone.

Completion of the remediation operations will be based on analytical results including quarterly groundwater sampling and off-gas samples collected during system operation. If MTCA Method A cleanup levels do not appear achievable, alternate cleanup levels may be discussed at a later date. When acceptable concentration levels have been achieved, a request for final closure of the Time Oil property will be submitted to the Washington State Department of Ecology (Ecology).

2.0 BACKGROUND AND HISTORY

2.1 Site and Vicinity Characteristics

The Time Oil Property is located at 100 East Wine Country Road in Grandview, Washington, hereafter referred to as "site". As illustrated in Figure 1 (site vicinity map), the property is located on the southeast corner of Wine Country Road and Division Street. As illustrated in Figure 2 (site plan), the property is a relatively level, irregular shaped parcel, approximately one-fifth of an acre in size. The property is bordered to the east by a two story structure housing the Grandview Christian Center, the south by an alley and a structure hosting the Grandview Herald, the west by Division Street, and the north by Wine Country Road.

The site consists of a convenience store, one fuel dispenser island, and three underground storage tanks (USTs) covered with a concrete slab. The current USTs are located in the southwestern portion of the property. Former USTs were located in the eastern portion of the property, in front and partially beneath the front of the convenience store.

2.2 Site History

The site is currently an active convenience store and retail fuel facility. Time Oil has operated the UST system at the site since 1965. In May 1991, Time Oil was contacted by the Grandview Fire Department concerning the presence of gasoline vapors in a building adjacent to the property. At that time, testing of the tanks indicated that they were tight. To determine if gasoline or diesel constituents were present, a soil vapor survey was conducted in May 1991. The survey identified elevated concentrations of total petroleum hydrocarbons as gasoline (TPH-G), total petroleum hydrocarbons as diesel (TPH-D), benzene, toluene, ethylbenzene, and total xylenes (BTEX) constituents in samples collected in the vicinity of the former USTs, existing USTs, and immediately north of the convenience store.

In September 1998, Time Oil implemented site upgrade activities that included the installation of a cathodic protection system. During the installation of the cathodic protection system, six borings were advanced to 15 feet below grade with a hollow stem auger. Drill cuttings from three of the borings were observed to have a hydrocarbon odor. Results indicated that concentrations of petroleum hydrocarbons exceeding MTCA Method A Cleanup Levels were present.

In February 2000, Maxim Technologies Inc. performed a Preliminary Soil and Groundwater Survey. The survey provided research of soil and groundwater conditions; located utilities on, and immediately adjacent to the site; completed a geoprobe survey; determined the extent of hydrocarbon impacts; and identified groundwater flow direction.

In April 2000, Maxim prepared a Remedial Investigation/Feasibility Study (RI/FS) report. The RI/FS concluded that site remediation in areas impacted with petroleum hydrocarbons within soil and groundwater may be accomplished utilizing a combination of technologies. To mitigate hydrocarbon impacts, the report selected the construction of a high pressure-low flow in-situ air sparging system coupled with a SVE system. To assist in reducing the mounding of groundwater anticipated from air sparging and to control off-site migration of the dissolved phase plume, the report also recommended the construction of a groundwater recovery system.

During June, September, and December 2000, Brown and Caldwell conducted groundwater monitoring events, which collected additional groundwater quality and groundwater elevation information.

2.3 Previous Investigations

This section summarizes previous investigation's performed at the site with specific emphasis on bringing forward each of the investigations key activities and conclusions. Detailed discussions regarding soil and groundwater quality are provided in Section 2.5.

2.3.1 Tank Testing and Soil Survey – May 1991

In May 1991, Time Oil Company was contacted by the Grandview Fire Department concerning the presence of gasoline vapors in a building adjacent to the property. At that time, testing of the tanks indicated that they were tight. To determine if BTEX constituents were present, a soil vapor survey was conducted in May 1991. During the survey, soil gas probes were advanced to a depth of approximately 12 feet below grade and vapor samples were collected at depths of three, six, nine and 12 feet. Soil gas was analyzed on-site with a PhotoVac 10S70 gas chromatograph with a photo ionization detector (PID). BTEX constituents were below laboratory detection limits for samples collected in explorations located along the east property line. However, the survey identified elevated concentrations of BTEX constituents in samples collected in the vicinity of the former USTs, existing USTs, and explorations located immediately north of the convenience store.

2.3.2 Site Upgrade Activity Investigations – September 1998

In September 1998, Time Oil Company implemented site upgrade activities that included the installation of a cathodic protection system. The installation involved the advancement of six borings to 15 feet below grade with a hollow stem auger. Drill cuttings from three of the borings were noted to have a hydrocarbon odor. The borings were located immediately west of the pump island, immediately west of the existing UST pit, and immediately northwest of the convenience store. Drill cutting grab samples, estimated to be from a depth of 12 to 15 feet below grade, were collected and submitted for analytical testing. Results indicated that concentrations of petroleum hydrocarbons exceeding MTCA Method A Cleanup Levels were present in the grab samples.

2.3.3 Preliminary Soil and Groundwater Screening Survey – February 2000

The subsurface assessment program for the property site consisted of 13 soil probes (geoprobes) advanced to depths ranging from 17 to 20 feet below grade. The probe locations were completed on the subject site and within right-of-ways near the property. Seven geoprobe explorations were on-site and six explorations were off-site. Figure 3 illustrates probe locations. The soil probes were completed on January 27 and 28, 2000 by Transglobal Environmental Geosciences Northwest Inc., of Seattle, Washington under subcontract to Maxim and were logged and sampled by an experienced Maxim geoloist. A mobile laboratory for on-site analysis of TPH-G, BTEX and TPH-D was utilized.

Soil encountered in each boring consisted of moist, brown, fine grained sands with moderate silt content to a depth of approximately ten feet below ground surface (bgs). Soil logged from 10 feet bgs to the end of the borings consisted of damp to saturated, brown/gray, interbedded fine grained sands with moderate silt and damp to saturated, brown/gray, medium grained sand. The soil contained some water throughout the soil column.

Boring MGB-1 was continuously logged to fully characterize the soil profile and representative soil samples were collected from MGB-2 through MGB-13. Selected soil samples from the borings were analyzed for BTEX, TPH-G, and TPH-D. Table 1 presents the analytical test results of soil samples submitted for analytical testing during the preliminary subsurface investigation.

Groundwater was encountered in each of the probes and drilling continued three to five feet below the saturated level. Temporary well screens were placed in probes MGB-1 through MGB-6. Groundwater was allowed to recharge to near static conditions prior to taking water level measurements, surveying for groundwater gradient, and groundwater sampling. Table 2 presents groundwater analytical results from the geoprobe explorations.

Analytical results indicated that hydrocarbon impact occurs both on and off the site. The plume was identified as a 200-foot long by 80-foot wide area extending southwest from the existing site USTs. Both groundwater and soil samples exceeded MTCA Method A Cleanup Levels throughout the plume. Analytical results of the Geoprobe explorations indicated the presence of hydrocarbons in the groundwater and soil at the groundwater interface. Hydrocarbon impacts identified during the investigation were primarily related to groundwater.

Concentrations of benzene above the MTCA Method A CCLs were identified within the plume and concentrations varied from 7.2 to 1600 ug/L in groundwater. The highest benzene concentration was observed within 10 feet of the existing UST's. Elevated hydrocarbon levels continued approximately 75 feet to the southwest, which is beyond the property boundary. Beyond the site boundary, benzene concentrations ranged from 1000 ug/L in exploration MGB-9, to 20 ug/L at exploration MGB-13, approximately 150 feet down-gradient of the UST's. This suggested that a southwest limit to the plume originating from the site exists. At the time of the subsurface investigation, it was uncertain if the plume extended to MGB-13 or whether MBG-13 was being impacted by a second plume emanating from the DeBock's Texaco station, located to the north. No further assessments have been conducted to determine if a second plume exists. Exploration MGB-12 appeared to be on the southern edge of the hydrocarbon plume. Elevated constituents of gasoline noted in MGB-8 may be related to an older release in the former UST area.

Hydrocarbon concentrations in the soil mimicked the groundwater plume. Benzene concentrations above the MTCA Method A CCLs for soil ranged from 1.2 to 7.2 mg/kg within the plume. On-site, the benzene levels were lower outside of the suspected plume. However, the off-site soil samples indicated another potential contaminant source in the area MGB-13. This probe site was in the alley, south of the Sport Center and Debock's Texaco station.

2.3.4 RI/FS – April 2000

In April 2000, Maxim prepared a RI/FS report for the Time Oil Company on the subject site. The RI/FS work items included:

- Advancing eleven borings for the installation of the following groundwater monitoring wells:
  - One two-inch air sparging well,
  - Four four-inch groundwater recovery/vapor extraction wells,
  - Six groundwater monitoring wells,
- Collecting and submitting for analysis soil and groundwater samples during drilling and post well development,
- Performing an in-situ air sparging test,
- Performing a SVE test on two individual wells and multiple well configurations,
- Performing a four-hour step drawdown and a 14-hour constant rate pump test,
- Reviewing and providing an analysis of all field data,
- Completing an evaluation of several remedial alternatives, and
- Providing a preferred remedial alternative.

Eleven borings were completed as groundwater monitoring wells in key areas identified during the preliminary subsurface investigation. Due to the detailed preliminary subsurface investigation few soil samples were collected during drilling activities. Two soil samples were submitted for analysis from MW-3 to characterize the soil in the vicinity of the former USTs. Results of the submitted soil samples indicated detectable concentrations of petroleum hydrocarbons were present. Table 3 summarizes soil sampling analytical results from soil samples submitted from exploration MW-3. As illustrated on Table 4, historical groundwater sampling results also indicated that concentrations of petroleum hydrocarbons exceeding MTCA Method A Cleanup Levels were present across and downgradient of the site.

As part of the RI/FS, groundwater recovery, SVE, and air sparging tests were conducted to determine the optimal method for remediation. Interpretation of the three remedial methods investigated concludes that the most feasible option for remediation of soil and groundwater may be utilizing high pressure-low flow in-situ air sparging coupled with SVE. To assist in reducing the mounding of groundwater anticipated from air sparging, and to control off-site migration of the dissolved phase plume, the RI/FS also recommended the use of a groundwater recovery system. Parameters for each test, which are essential to the development of the CAP, are summarized below.

Four vapor extraction tests were conducted to determine the induced subsurface vacuum and radius of influence in the unsaturated soil at the site. Hydrocarbon effluent concentrations and total air velocities were monitored during the tests in order to determine remedial system equipment specifications. Single and multiple well vacuum extraction configurations were utilized for better understanding of subsurface soil conditions. The SVE tests concluded that an effective radius of influence of less than 20 feet is present on site. Airflow rates, as measured at the manifolds of the regenerative blower ranged from 32 to 87 cubic feet per minute (cfm). Off-gas samples collected at the discharge stack ranged from 1460 to 4030 mg/m^3 for volatile petroleum hydrocarbons removed from subsurface unsaturated soil. Table 5 provides laboratory off-gas analytical results.

The vapor extraction testing indicated that the vadose zone soil are of low permeability deposits. The highest rate of extracted airflow was confined to the immediate area of the tank pit, which contains more porous fill material. The low permeability of the native site soil limits airflow (i.e., reduces the effective radius of influence for the applied vacuum) and indicates that a significantly larger vacuum source is necessary to achieve feasible effective radii.

A single in-situ air sparging test was conducted to evaluate the feasibility of installing an in-situ air sparging system and, more specifically, to examine the achievable increased dissolved oxygen radius of influence in groundwater around an injection point. Dissolved oxygen concentrations significantly increased in the immediate area of the sparge well approximately three hours into the test, at which time breakthrough occurred in RW-2, located 11 feet to the west of the sparge well. Bubbling within RW-2 remained for the duration of the test. Dissolved oxygen concentrations in MW-4, located 20 feet to the west of the sparge well, increased until approximately nine hours into the test, at which time, the dissolved oxygen concentrations stabilized. The remaining monitoring wells, located 20 to 108 feet from the sparge well, exhibited statistical increases in dissolved oxygen concentrations until approximately six to eight hours into the test, at which time, the remaining dissolved oxygen concentrations stabilized or decreased.

After breakthrough, the test air pressure, measured at the air sparge manifold, stabilized at approximately 10 pounds per square inch (psi) and airflow fluctuated between 3.0 and 8.5 cfm. Observed fluctuations in pressure and airflow were possibly a direct result of channels forming through native soil, then collapsing upon reaching the more porous tank pit fill material.

A general rise in groundwater levels was observed in all monitoring wells. The minimum measured rise in groundwater level was 0.04 feet in MW-6, located 108 feet southwest of the sparge well. The maximum measured rise in groundwater level was 3.48 feet in RW-2, located 10 feet west of the sparge well. As illustrated in Table 6, pre- and post-test sampling did not indicate mobilization of any constituents of concern (e.g., lead) as a result of air sparging.

On March 20 and 21, 2000, groundwater pump tests were conducted to assess the feasibility of installing a groundwater pump and treat system. Testing included a four hour step drawdown pump test to determine the pumping rate for the 14-hour constant rate pump test. Based on the step drawdown test, a pumping rate of 1.6 gallons per minute (gpm) was identified as the best yield for the subsequent constant rate test. With an assumed fully penetrating aquifer of 16.5 feet in thickness, the RI/FS concluded that hydraulic conductivity, tansmissivity, and storativity ranges from 30.5 to 49.4 ft^2/day, 503.33 to 814.81 feet/day, and one to four, respectively. At an average pumping rate of 1.6 gpm, maximum drawdown was 7.09 feet and an effective radius of influence was 55 feet.

The RI/FS concluded that remediation of hydrocarbon impacted soil and groundwater may be accomplished utilizing a combination of the above referenced technologies. To mitigate hydrocarbon impacts, the report selected the construction of a high pressure-low flow in-situ air sparging system coupled with a SVE system. To assist in reducing the mounding of groundwater anticipated from air sparging, and to control off-site migration of the dissolved phase hydrocarbon plume, the report also recommended the construction of a groundwater recovery system.

2.3.5 Quarterly Groundwater Monitoring

Brown and Caldwell conducted a groundwater monitoring event during June 2000 and provided limited follow-up groundwater sampling in August 2000. In addition, quarterly groundwater monitoring events were completed in September and November 2000.

As illustrated in Table 4, purgeable hydrocarbons (TPH-G) and volatile aromatic hydrocarbons (BTEX) concentrations exceeding MTCA Method A cleanup levels were documented in several wells during the sampling events. Detectable Levels of these compounds were present in MW-1, MW-3, MW-5, MW-6, RW-1, RW-3, and RW-4. Dissolved phase hydrocarbon concentration have fluctuated at the subject site. These fluctuations are interpreted to occur from the seasonal fluctuation of the groundwater table occurring beneath the site.

2.4 Regional Geology and Hydrogeology

The site resides at an elevation of approximately 820 feet above mean sea level, approximately three miles south of Grandview Butte, and two miles north of the Yakima River. The property is situated within the northwest portion of the Yakima Fold Belt Subprovince of the Columbia Plateau. The Yakima Fold Belt Subprovince consists of a series of Miocene age northeast-southwest trending low anticline ridges. Subsurface soil in the vicinity of the property consist of late Pliocene lacustrine (lake) deposits made up of up to 90 foot thickness of interbedded silt and fine-grain sand. The lacustrine soil was deposited down during catastrophic flooding related to the Lake Missoula floods, approximately 12,000 years ago. Loessal deposits of wind blown glacial erosion sediments also have been deposited in the vicinity of the site.

The lacustrine deposits are overlain by the Snipes Mountain Conglomerate, which occurs as a series of linear channels representing the historic course of the Columbia River before diversion to its current location. The Snipes Mountain Conglomerate ranges from 90 to 450 feet in thickness, over laying the Wanapum Basalt of the Columbia River Basalt Group (CRBG). The unconsolidated deposits overlaying the CRBG reach a thickness of up to 2,000 feet.

Many of these sedimentary deposits were created episodically in the Pleistocene age as vast glaciers originating in Canada advanced into the northern part of the Columbia River Plateau, northern Idaho and Montana. Glacial melt water streams from northern Washington, along with gigantic floods caused by sudden breakage of ice-dammed lakes in the Selkirk and Rocky Mountains (Glacial Lake Missoula) cut deep channels (coulees) across the northern Columbia Plateau and deposited large volumes of sediments to the south. Sedimentary deposition occurred as slack water lakes when the water was partially impounded through the Columbia Gorge.

The CRBG are Miocene age (26 million years before the present) flood-basalts deposited over a vast area of eastern Washington, Oregon and western Idaho and are of substantial cumulative thickness in the Grandview area. The basalts were generated from numerous fissures located across southern Washington and southern Idaho with individual flow thickness ranging from a few tens of feet up to 300 feet. Sediment thickness accumulation varied during the periods between flows.

The overlying unconsolidated sediments and the CRBG host regional aquifer systems and are a major source of water to the Grandview area. The unconsolidated sediments are more important sources of groundwater than the basalt in areas where the sedimentary deposit is of substantial thickness. The basalt flows are a multi-layered aquifer system with major aquifers located within the sand and gravel interbeds, typically averaging five to 30 percent of the total flow thickness. Generally regional groundwater flow is southwesterly in the Wanapum Basalts. Some aquifers are hydraulically connected through vertical fractures or columnar jointing within the thinner basalt flows. These deep aquifers are the predominant water source for most municipal, industrial, domestic and agricultural needs. The overlying unconsolidated sediments are up to 400 feet thick in the central valley through the Sunnyside and Grandview area and provide water for private agricultural uses. Locally, shallow perched aquifers exist on the shallower basalts away from the main river valley. In the vicinity of the subject site, the shallow aquifer beneath the property occurs at a depth of approximately 16 feet and flows in a southwesterly direction.

2.5 Summary of Site Conditions

As provided above, multiple soil and groundwater investigations have been completed at the property. This section summarizes this information, as it relates to the development and implementation of the property's CAP.

2.5.1 Soil

Soil at the property typically consist of a medium-dense, damp to moist, brown, fine sand with moderate silt content to a depth of approximately 10 feet below ground surface. Soil encountered from 10 feet below ground surface to a depth of approximately 34 feet consist of a damp to saturated, brown/gray, interbedded fine sand with moderate silt interbedded with saturated, brown gray medium-grained sand. Soil encountered to 10 feet in depth consisted of tight, siltier soil and had lower permeabilities; and, soil below 10 feet become coarser and have greater permeabilities. In four of the deepest drillings, refusal was encountered at a depth of approximately 34 feet below ground surface. Drillers operating the drilling equipment at the site believed that they were encountering basalt bedrock at this depth.

2.5.2 Groundwater

Based on the results of several groundwater monitoring events conducted at the property, depth to groundwater is approximately 14 to 18 feet below ground surface. Groundwater data from each monitoring event indicates a general flow direction to the southwest under a hydraulic gradient of approximately 0.0084 to 0.0091 feet per foot. Groundwater levels were observed to rise approximately 2.5 feet between the March 20, 2000 and August 8, 2000 monitoring events. Figure 4 presents a groundwater contour map from the June 2000 groundwater monitoring event.

Historical groundwater sampling at the site indicates detectable levels of TPH-G, TPH-D, and BTEX constituents in groundwater. No liquid phase hydrocarbons have been measured in any of the site monitoring wells. Monitoring wells MW-5, MW-6, RW-1, RW-3, and RW-4 have historically exceeded MTCA Method A CCLs for TPH-G and BTEX constituents in groundwater. Historical groundwater elevations and concentrations of analytes identified during groundwater sampling are presented in Table 4.

3.0 REMEDIATION ALTERNATIVES

For the purpose of selecting a remedial alternative for the remeditation of soil and groundwater impacted by petroleum hydrocarbons, several alternatives were identified, developed and screened. This step is included to provide a validation of the remedial alternatives recommended by the RI/FS. Results of this process are presented below.

3.1 Soil

The following sections outline alternatives for soil remediation. These alternatives included:

- No Action,
- Ex-Situ Technology,
- Soil Vapor Extration (SVE), and
- Bioventing.

3.1.1 No Action

A "no-action" alternative would involve continued periodic sampling of soil and soil vapors. A no-action alternative is acceptable if soil petroleum levels are below MTCA Method A CCLs. Based on the investigation data, soil contaminant concentrations are above the MTCA Method A CCLs. *Therefore, implementation of the no-action alternative would not address the remediation goals for the soil, and is a less desirable alternative.*

3.1.2 Ex-Situ Technology

Excavation of soil would remove the hydrocarbons from the site if all impacted media is accessible. Treatment options for the excavated soil include:

- Thermal Treatment,
- Land Farming, and
- Landfilling.

Further excavation would eliminate the potential threat of further hydrocarbon migration to groundwater as well as vapor migration. The estimated extent of contamination would require that excavation be advanced to a depth of approximately 16 to 18 feet below ground surface and could possibly effect the building foundations. The costs associated with excavation, transport, treatment, sampling, and backfill and compaction is anticipated to be high. *For these reasons, the soil excavation alternative is considered a less desirable alternative.*

3.1.3 Soil Vapor Extraction

A soil vapor extraction (SVE) system could be utilized to remove volatile organic compounds associated with gasoline from the vadose zone and also encourage biodegradation of hydrocarbons in soil. Based on the given soil composition and experience with SVE systems, a relatively low flow rate and a small radius of influence can be expected.

The installation and operation of a SVE system on the property, Division Street and the alley would have a minimal impact on the operations of the subject site and neighboring facilities. However, the SVE system installation will have short-term impacts to the usage of Division Street. Wide spread use of SVE outside the area cited would probably be less feasible due to the number of wells that would be required to have the desired effect. The installation and operation of a SVE system for areas located beneath buildings is not practical and anticipated to adversely impact facility operations.

Because SVE provides removal of volatile organic compounds from the vadose zone, SVE will be effective in: 1) treating affected soil, and 2) treating volatile organic compounds stripped from groundwater into the vadose zone and collecting fugitive vapors generated by the selected groundwater technology. See Section 3.2 for discussions regarding the selected groundwater remedial technologies, air sparging.

3.1.4 Bioventing

Bioventing, also termed "biologically enhanced SVE," enhances the biodegradation of hydrocarbons (especially low volatility hydrocarbons) by enhancing the activity of soil microorganisms. Bioventing is especially effective at diesel and jet fuel spill sites where the petroleum products are less volatile and achieving clean-up goals cannot be efficiently achieved with SVE. *Because the impacted soil consists mainly of silt material and contaminants are limited to gasoline fuel, it is anticipated that soil vapor extraction alone will remediate the affected soil within a reasonable time period. Therefore, bioventing, while a feasible technology, is a less desirable alternative than SVE alone.*

3.2 Groundwater

The following alternatives for groundwater remediation were identified, developed and screened:

- No Action,
- Air Sparging,
- Pump and Treat,
- Intrinsic Bioremediation, and
- Enhanced Bioremediation.

3.2.1 No Action

A "no action" alternative would involve limited periodic sampling of groundwater. The potential migration of petroleum impacted groundwater would not be controlled. *Implementation of the "no action" alternative would not address the cleanup goals for groundwater, and is a less desirable alternative.*

3.2.2 Air Sparging

This technology involves the injection of air into the groundwater causing the volatile organics to be stripped from the water into the vadose zone. Once in the vadose zone, the volatile organics are typically removed through SVE. Thus, the implementation of air sparging would require the installation of SVE wells to remove volatile organics from the vadose zone and collect the fugitive vapors generated. An additional benefit of air sparging is that it provides oxygen to the groundwater and promotes the aerobic biodegradation of hydrocarbons.

Because the site soil lithology consists mainly of silt, the lateral dispersion of air through sparging would be limited. Therefore, a close spacing of sparge points will be required. This would add additional costs to the remedial system.

Because air sparging will accelerate the treatment of the elevated concentrations of gasoline range hydrocarbons in groundwater, air sparging is considered a desirable remediation alternative for this site.

3.2.3 Groundwater Pump and Treat

A groundwater pumping system would recover dissolved-phased petroleum hydrocarbons from the groundwater. The system would also protect the quality of groundwater down-gradient from the source area. The three most common treatments of pumped groundwater are:

- Air Stripping,
- Carbon Adsorption, and
- Bioremediation.

Typically, use of an air stripper is the most cost effective treatment method for affected groundwater at the levels present at the site. A pump and treat system would assist in achieving the cleanup objectives of the remediation project. A significant benefit of groundwater pumping systems is that they help control groundwater mounding that occurs during air sparging. In addition, groundwater recovery can lower the water table in order to allow the SVE system to remediate the smear zone. *Because of the high concentrations of gasoline range hydrocarbons in groundwater, site lithology, and benefits in reducing groundwater mounding, pump and treat with a tray air stripper is selected as the preferred alternative for treatment of affected groundwater.*

3.2.4 Intrinsic Bioremediation

This approach utilizes the naturally-occurring attenuation mechanisms, such as biodegradation (oxic and anoxic), to bring about a reduction in the total mass of a contaminant dissolved in groundwater. In some cases, intrinsic remediation will reduce dissolved-phase contaminant concentrations to below cleanup standards before the contaminant plume reaches potential receptors. To support intrinsic remediation, it must be demonstrated that degradation of site contaminants is occurring at rates sufficient to be protective of human health and the environment. Preliminary analytical and field test results for natural attenuation parameters suggest that the site is in a solely anoxic state. C*onsequently, intrinsic remediation is not a desirable alternative.*

3.2.5 Enhanced Bioremediation

Typically, this approach is implemented to enhance the natural attenuation processes that are already occurring by supplying the hydrocarbon-degrading micro-organisms with supplemental oxygen. Studies have shown that aerobic bioremediation of hydrocarbons is 10 to 100 times faster than anaerobic bioremediation. One method of delivering oxygen to the subsurface is by using Oxygen Release Compound (ORC®), a patented time-release formulation of magnesium peroxide. Once the ORC powder comes in contact with water, a slow and sustained release of molecular oxygen occurs and a harmless by-product of magnesium hydroxide is formed. Based on the reported anoxic condition of site groundwater and on Brown and Caldwell's experience with ORC®, a substantial amount of ORC® and frequent reapplication would be required to effectively treat the groundwater contaminant plume; thus, project cost would be greatly increased. T*he use of enhanced bioremediation (ORC, in particular) is not a preferred groundwater remediation alternative for the site. However, it may be used at a later date in remediation assist the selected remediation system.*

3.3 Selected Alternative

The selected alternative to remediate hydrocarbon impacted soil and groundwater at the site uses a combination of three technologies: SVE, air sparging, and groundwater recovery (pump and treat). In summary:

- Air injected into the groundwater by air sparging will cause volatile organics to be stripped from the water and released into the vadose zone. Once in the vadose zone, the volatile organics will be removed through vapor extraction.
- Vapor extraction will be used to remove current volatile organic compounds associated with gasoline from the vadose zone and, as previously stated, remove volatile organics stripped from groundwater by air sparging.

- A groundwater pump and treat system will recover dissolved-phased petroleum hydrocarbons from the groundwater and help control groundwater mounding that occurs during air sparging and soil vapor extraction.

The selected alternative is consistent with the RI/FS remedial recommendations.

4.0 REMEDIAL APPROACH

This section lists the remedial objectives, provides an overview for the preferred remedial alternative, and discusses remediation timeframes.

4.1 Objectives

The objectives of the remedial approach are to:

- Reduce hydrocarbon concentrations in soil and groundwater to meet MTCA Method A CCls in a timely and cost effective manner;
- Control the migration of hydrocarbons in order to minimize the potential exposure pathways (i.e., soil and groundwater ingestion, and vapor inhalation); and
- Reduce down gradient migration of dissolved hydrocarbons.

4.2 Overview

To address soil and groundwater impacted with petroleum hydrocarbons, the CAP's remedial approach employs three items:

- Implementing the remedial alternative recommended by the RI/FS/and discussed in Section 3.0 of this report,
- Implementing operation and maintenance (O&M) on the installed portions of the remedial alternative, and
- Conducting groundwater monitoring.

4.2.1 Remedial Alternative

The remedial approach will use the following technologies: high pressure, low-flow air sparging; vapor extraction; and vacuum enhanced groundwater recovery and treatment. Air sparging and vapor extraction are to be implemented in combination. Three areas have been designated based on the degree of cleanup efforts to be implemented:

- Area 1, the most aggressive area of cleanup, will focus on the areas of highest hydrocarbon concentration (i.e., the down gradient and central portions of the hydrocarbon plume).
- Area 2, undergoing moderately aggressive cleanup efforts will complement the Area 1 well array by extending full remedial coverage to the outer edges of the hydrocarbon plume and address the up gradient and central portions of the hydrocarbon plume.

- Area 3, the least aggressive area of cleanup efforts, will be implemented for the furthest upgradient portion of the hydrocarbon plume, located near the existing underground storage tanks and dispenser island.

The target for groundwater recovery will include recoverable, on site petroleum impacted groundwater in which TPH exceeds 1,000 parts per billion (ppb) or benzene exceeds five ppb. Figure 5 illustrates the "Areas" associated with the three levels of cleanup efforts and the target for groundwater recovery.

4.2.2 Operations and Maintenance

The operations and maintenance (O&M) of the installed portions of the remedial system is key to maximizing equipment performance, minimizing remediation timeframes, and insuring permit compliance. The site Operation and Maintenance/Groundwater Monitoring Plan manuals propose the scope of work required to meet these needs (e.g., system start-up, air monitoring, and operations checks).

4.2.3 Groundwater Monitoring

The groundwater monitoring component of the remedial approach focuses on the collection of groundwater information that can be used to:

- Assess the performance of the installed remedial system,
- Optimize the performance of the installed remedial system,
- Assess the achievement of cleanup goals, and
- Track up- and down-gradient groundwater quality.

Groundwater levels will be measured and groundwater samples will be collected in accordance with an approved groundwater sampling plan. No measurments or samples will be taken from sparge wells. All collected samples will be submitted for analysis of the following: Total Petroleum Hydrocarbons - Gasoline Range (TPH-G) by Ecology Method WTPH-G and BTEX by EPA Method 8020A. Full groundwater monitoring details (e.g., procedures and frequency) are provided the Operations and Maintenance/Groundwater Monitoring Plan manuals.

4.3 Remedial Timeframe

Based on vapor extraction modeling, biodegradation rate estimates and previous experience, the predicted time of soil remediation to meet MTCA Method A CCLs is approximately 36 to 72 months. Timeframes for recovery and treatment of site groundwater is expected to be the same as the soil remediation.

5.0 REMEDIAL SYSTEM DESIGN

This section outlines specific design criteria that illustrates the technical basis for design and specific remedial components that comprise the remedial system.

5.1 Design Criteria

Based on the results of previous investigations and the remedial approach discussed above, design criteria were established for the air sparging, SVE, and groundwater recovery and treatment. The design criteria discussions focus on those parameters that define the technical basis for the remedial system's layout, configuration and components. Figure 6 illustrates the site with existing and proposed remedial well locations. Figure 7 shows the proposed piping locations from each well to the remedial compound.

5.1.1 Air Sparging, Soil Vapor Extraction

Pursuant to the RI/FS, air sparging break-through was observed at approximately 10 pounds per square inch (psi) of pressure and a flow of 8.5 cubic feet per minute (cfm) was observed at the end of the test. A breakthrough distance of 11 feet was observed, and dissolved oxygen was observed to be increasing at approximately 20 feet. The effective radius for vapor extraction is cited to be less than 20 feet. Groundwater elevation changes across the site will impact the pressure, flow, and radius of influence around each air sparging well. Air sparging well spacing for Area 1 is determined by the observed air sparging break through distance of 11 feet. Air sparging well spacing for Area 2 and Area 3 is 20 feet.

As illustrated in Figure 6, six-air sparging and seven vapor extraction wells will be utilized. Four vapor extraction wells (MW-5, MW-6, RW-3, and RW-4) are already present on-site. Four additional SVE wells (VW-1 through VW-3) and one groundwater recovery well (RW-5) will be installed during construction activities. A slight vacuum will be placed on two groundwater recovery wells (RW-3 and RW-5) to enhance groundwater flow into the wells as part of the pump and treat system. Six air sparging wells (SW-2 through SW-7) will be installed during construction activities.

Location and separation distances for air sparging wells is anticipated to be sufficient to cause hydrocarbons to be stripped from the groundwater and released into the vadose zone. Air sparging is also anticipated to provide oxygen to the groundwater and promote the aerobic biodegradation of hydrocarbons. Vapor extraction from the SVE wells should provide sufficient capture for the removal of vapors stripped from groundwater.

The anticipated start-up air sparge pressure will be dependent on the time of year remedial activities are initiated. During low groundwater periods (e.g., winter), 10 to 16 psi is anticipated. During high groundwater periods (e.g., late summer), as much as 20 psi may be required.

Pressure is anticipated to stabilize at about 10 to 12 psi. In instances where breakthrough occurs, airflow is anticipated to range from 3.0 to 8.5 cfm.

SVE wells proximal to the UST pits (i.e., Area 1), are anticipated to have an initial start-up vapor flow rate of approximately 80 scfm and a well head vacuum of approximately 16-inches of water column (in WC). This flow rate is not anticipated to fluctuate as the vapor extraction system continues to operate due to anticipated short circuiting through tank pit soil. For vapor extraction wells not proximal to the UST pits (i.e., Areas 2 and 3), the anticipated start-up vapor flow rate will be 30 to 35 scfm at a well head pressure of approximately 13-in WC. Over a two to three week period the flow rates will be increased to approximately 40 to 50 scfm. Vapor samples will be collected within the first week of operation to determine benzene concentrations and to ensure that regulatory guidelines for maximum emissions are not being exceeded.

Based on RI/FS data, off-gas samples of total petroleum hydrocarbons [as gasoline (WTPH-G) and volatile aromatic hydrocarbons (BTEX)] collected during pilot testing, indicate moderate to elevated concentrations of volatile petroleum hydrocarbons were being removed from the unsaturated soil. These concentrations are anticipated to be similar during vapor extraction system start-up and are presented in Table 5. Similarly, and as illustrated in Table 6, no statistically significant changes were observed upon review of the TPH-G, BTEX and dissolved metals in RI/FS pre- and post air sparging analytical results.

5.1.2 Groundwater Recovery (Pump and Treat)

Two groundwater recovery well locations (RW-3 and RW-5) were selected with respect to affected groundwater and will be operated to capture hydrocarbon impacted groundwater that has migrated down-gradient of the existing and former UST basins. As illustrated in Figure 7, the two wells are located centrally within the hydrocarbon impacted groundwater plume. To include the lateral edges of the groundwater plume, a capture radius of 50 feet is desired. The distance between the two wells is approximately 70 feet, therefore a capture radius of 50 feet will provide an adequate overlap. The capture radius is depicted on Figure 8.

Based on RI/FS drawdown data and recovery well locations, a desired capture radius of 50 feet can easily be achieved. The RI/FS concluded that: 1) the effective radius was equal to 55 feet, and 2) because drawdown did not stabilize in observation wells at the end of the pump test, the effective radius could increase during long-term pumping.

Groundwater recovery from the designated pumping wells will range from 0.5 to 1.6 gpm resulting in a total system recovery ranging from 1.0 to 3.2 gpm. For initial operation, the pumping rate is anticipated to be approximately 1.6 gpm resulting in a total system flow of approximately 3.2 gpm. The air tray stripper is capable of treating up to 15 gpm and will, therefore, be capable of treating water produced from the recovery wells. The pumping rate will be restricted to a maximum rate of 5,000 gallons per day due to the City of Grandview discharge requirements.

5.2 System Components

This section describes the remedial system components. Drawings referenced in this section are included with the Remediation System Construction - Plan Sheets in Appendix A. Plan sheet figures include the following information.

Figure L1	Remediation System Layout
Figure D1	Treatment Shed and Fenced Compound
Figure P1	Mechanical Plan
Figure D2	Manifold (SVE)/Discharge Details
Figure D3	Manifold (Air Sparge/GW Recovery) Details
Figure D4	Trench Details
Figure D5	Extraction Well Detail
Figure F1	Flow Diagram

5.2.1 Air Sparging

The air sparging system will be comprised of six sparge wells and a 15 horsepower (hp), three-phase, 230 volt Rotary Vane sparge compressor supplying air cooled by a 0.5 hp, three-phase, 230 volt Motivair ACO 275 before entering the valved manifold for the six sparge wells. The sparge system will be housed in the equipment enclosure and connected to the sparge wells via subsurface piping. Both the airflow and pressure will be measured at the manifold prior to injection into the groundwater at the individual sparge wells. The sparge system will shut down automatically in the event of the vapor extraction shut down.

Six 2-inch air sparge wells with a 6 ½ - inch annulus will be installed. The wells will be approximately 30-feet in depth and five-feet of 0.020-inch slot screen placed approximately eight to 10 feet below the top of the mean annual groundwater table. Groundwater in the immediate vicinity of the air sparge wells is approximately 17 feet below grade. Eight-twelve sand pack will be placed to a depth one foot above the mean annual groundwater table, overlain by granular bentonite to a depth of three feet bgs, then completed with a twelve inch steel monument.

5.2.2 Soil Vapor Extraction

Eight SVE wells will be connected to a regenerative blower via subsurface piping. The blower system will be housed within the equipment enclosure located at the rear of the convenience store. Individual control valves, vacuum gauges and air velocity sampling ports will be located on each individual line within the equipment enclosure prior to the piping being manifolded together. A 55-gallon moisture separation tank will be placed in-line to remove condensation and water that may be generated during system operation. A high water level switch in the knockout tank will shut down the vapor extraction system in the event of an excessive water buildup to prevent equipment damage. A Rotron DR8, 10 hp, explosion proof regenerative blower, capable of generating a maximum flow of 400 scfm, will provide the vacuum to the system. Blower discharge will be routed into a catalytic oxidizer located in the fenced compound. Steel pipe will be used on the initial portion of the discharge line in anticipation of relatively high air temperatures as the result of high vacuums on the wells. The stack will be installed such that it is at least three feet in height above the highest portion of the building located immediately to the west of the equipment compound.

Three 4-inch PVC vapor recovery wells (VW-1 through VW-3) with a 12-inch annulus will be installed. Wells will be completed at approximately 35 feet bgs, and receive 0.020-inch slot screen for the lower 25 feet. Eight-twelve sand pack will be placed to three feet bgs, overlain by two-feet of bentonite grout, overlain by a one-foot cement seal. The new recovery wells will be located in Division Street and will therefore be constructed within reinforced concrete vaults with lockable manhole lids that are flush with the pavement surface.

5.2.3 Pump and Treat System

The pump and treat system will consist of two wells, RW-3 and RW-5. RW-3 is an existing 4-inch diameter recovery well and RW-5 will be a new recovery well, which will have similar construction as RW-3. The new recovery well will be located in Division Street and will therefore be constructed within a reinforced concrete vault with a lockable manhole lid that is flush with the pavement surface. A slight vacuum, tied into the SVE system, will be placed on the two recovery wells to enhance groundwater flow into the wells. Recovered groundwater will be piped, via subsurface piping, to the batch tank located with the equipment compound. From the batch tank, the water will be transferred to the tray stripper for treatment. Treated water will be discharged to the city sewer system.

Pneumatic airlift pumps will be installed in each of the designated recovery wells for groundwater removal and treatment. Two HammerHead™ two-inch, submersible environmental pumps, capable of producing 5 gpm, will service recovery wells RW-3 and RW-5. A five-horsepower, oilless air compressor will supply the air to operate these pumps. Air regulators will be installed at the recovery wells to regulate air pressure to the pumps. In-line flowmeters will be installed in each individual recovery line to control well production.

Water produced from the recovery wells will be containerized in a 300-gallon batch tank. This batch tank will contain high and low-level switches connected to the control panel. A 0.5 hp Teel® centrifugal pump will operate as the discharge pump from the batch tank. This pump will move water from the batch tank to the H2Oil model H2TS150-3 low profile air stripper. The air stripper consists of three stainless steel trays and is capable of treating up to 15 gpm of water. A

Rotron EN606, 3 horsepower explosion proof regenerative blower will provide 150 scfm of airflow to the air stripper. A second 0.5 hp Teel® centrifugal pump will move treated water via subsurface piping from the air stripper sump to the city sewer located in the alley. Air discharge from the stripper will be routed through the activated carbon absorbers prior to stack discharge.

5.2.4 Monitoring Wells

One 2-inch PVC monitoring well (MW-7) will be installed, completed at approximately 30 feet, and screened through the lower 15 feet. The new monitoring well will be located approximately 180 feet south of the remedial compound, near the edge of the alley right-of-way. The purpose of the new well is to evaluate the down-gradient extent of the hydrocarbon plume. A reinforced concrete vault will not be required.

5.2.5 Equipment Enclosure

The equipment enclosure will house all remedial system equipment and will consist of a treatment shed and fenced compound located at the rear of the convenience store. The treatment shed will be approximately 14 feet by 14 feet and the fenced enclosure will be approximately 14 feet by 10 feet. The area inside the shed is a Class I, Division II, Group D Fire Hazard Category. The treatment shed will include a centrally located sump with steel grate and remedial system shut-off. The sump will be fitted with a BJM R100 15 hp sump pump that is capable of transferring sump liquids to the knockout tank for treatment within the remedial system. The fenced compound, located immediately to the north of the treatment shed, will stage the catalytic oxidizer, activated carbon absorbers, and drum storage area. An eight-foot chain link fence with privacy slats and associated access gates will be constructed around the perimeter of equipment enclosure.

6.0 PERMITS, CHECKLIST, AND OTHER PLANS

During the construction and operation of the remedial system, air and water discharge permitting, State Environmental Policy Act (SEPA) Checklist, Traffic Control, and Health and Safety (H&S) Plans will be required. This section briefly discusses these items. All previously stated items were created as stand alone documents and should be reviewed with this section.

6.1 Water

Pursuant to Washington State Water Pollution Control Law, chapter 90.48 RCW, the remedial system requires a permit for the discharge of wastewater to a POTW.

6.2 Air

A copy of the "Yakima Regional Clean Air Authority - Notice of Construction" for air discharge permitting of the proposed remedial system will be required. Additional supporting information for the permit is provided in attachments to notice.

6.3 SEPA Checklist

Pursuant to SEPA, Chapter 43.21 RCW, government agencies are required to consider the environmental impacts of a proposed project before making decisions. Thus, a SEPA Checklist for the proposed remedial system will be prepared, and will be submitted to Ecology and the City of Grandview.

6.4 Traffic Control Plan

It is anticipated that a traffic control plan will be required for the remediation system installation activities. To this end, a traffic control plan will be developed prior to initiating construction activities. The traffic control plan will be developed to minimize adverse impacts to normal traffic routing in the area, utilize appropriate signage in accordance with existing local criteria, and secure the approval of the City of Grandview.

6.5 Health and Safety Plan

A H&S Plan for the installation of the remedial system has been created and Mr. Mark Engdahl of Brown and Caldwell has been listed as the Site Safety Officer (SSO). The Plan describes personnel roles and responsibilities, potential hazards and emergency protocol. As required by site specific conditions or changes to the implementation of the remedial system, this plan can and will be modified.

7.0 SYSTEM SHUT DOWN

Once soil and groundwater have reached MTCA Method A cleanup levels, the system will be temporarily shut down for one week. Following the one week of stabilization, a round of confirmatory groundwater sampling will be performed. If the confirmatory samples have parameters less than the designated clean-up goals, the system will be shut down. If any samples exceed the clean-up goals, the system will be operated for another quarter. Following the month of operation, the above closure methodology will be repeated.

Once groundwater clean-up goals are met and system shut down has occurred, one year of quarterly groundwater monitoring will be performed to confirm the success of the remediation efforts.

A final report will be prepared describing final sampling results and recommending site closure. This report will be submitted to Ecology for review and approval.

8.0 SCHEDULE FOR IMPLEMENTATION OF THE CAP

Trenching, pipe, and well installation are scheduled for September 2001. The initial system start-up is scheduled for October/November 2001. Thereafter, the system will be placed in operation and run continuously until clean-up goals are achieved.

TABLES

TABLE 1
Preliminary Screening Survey - Soil Sampling Summary
Corrective Action Plan
Time Oil Property 01-070
Grandview, Washington

Sample Number	Depth (feet)	PID (ppm)	Benezene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (mg/kg)	TPH-G (mg/kg)	TPH-D (mg/kg)
MGB S1								
S1	0.5-3.0	6.8	---	---	---	---	---	---
S-2	4.0-8.0	6.5	<0.0500	<0.0500	<0.0500	<0.100	<10.0	---
S-3	9.0-12.0	560	<0.0500	<0.0500	<0.0500	<0.100	<10.0	---
S-4	12.0-16.0	1447	3.8	9.5	18	77	1800	<20
S-5	16.0-20.0	1285	---	---	---	---	---	---
MGB S2								
S-1	5.0-7.0	12.1	---	---	---	---	---	---
S-2	10.0-11.5	850	---	---	---	---	---	---
S-3	15.0-17.0	1133	1.2	0.43	1.1	0.5	36	---
MGB S3								
S-1	5.0-7.0	14	---	---	---	---	---	---
S-2	10.0-11.5	1456	<0.100	0.694	4.17	29.4	1080	---
S-3	15.0-17.0	2115	4.1	8.4	4	24	230	<20
S-4	17.0-20.0	1359	---	---	---	---	---	---
MGB S4								
S-1	5.0-7.0	10.7	---	---	---	---	---	---
S-2	10.0-12.0	765	<0.100	<0.100	<0.100	0.207	86.4	---
S-3	15.0-17.0	2133	7.2	12	10	56	500	---
MGB S5								
S-1	5.0-7.0	9.9	---	---	---	---	---	---
S-2	10.-12.0	10.7	---	---	---	---	---	---
S-3	15.-17.0	11	<0.05	<0.05	<0.05	<0.05	<10	---
MGB S6								
S-1	5.0-7.0	1.8	---	---	---	---	---	---
S-2	10.0-12.0	1.5	---	---	---	---	---	---
S-3	15.0-17.0	3.0	<0.05	<0.05	<0.05	0.15	<10	---
MGB S7								
S-1	5.0-7.0	0.9	---	---	---	---	---	---
S-2	10.0-12.0	2.6	---	---	---	---	---	---
S-3	12.0-15.0	6.1	<0.05	<0.05	<0.05	<0.05	<10	---
S-4	15.0-18.0	4.1	---	---	---	---	---	---
MGB S8								
S-1	5.0-7.0	1.5	---	---	---	---	---	---
S-2	10.0-12.0	176	---	---	---	---	---	---
S-3	15.0-17.0	178	0.23	<0.05	0.43	1.2	13	<20
MGB S9								
S-1	5.0-7.0	13.8	---	---	---	---	---	---
S-2	10.0-12.0	10.9	---	---	---	---	---	---
S-3	12.0-15.0	558	<0.05	0.05	1	1.5	200	---
S-4	15.0-18.0	1863	---	---	---	---	---	---
MGB S10								
S1	4.0-7.0	7.1	---	---	---	---	---	---
S-2	10.0-12.0	7.3	---	---	---	---	---	---
S-3	14.0-16.0	90.2	<0.05	<0.05	<0.05	<0.05	<10	---
S-4	16.0-19.0	7.6	---	---	---	---	---	---
MGB S11								
S-1	4.0-6.5	3.2	---	---	---	---	---	---
S-2	10.0-12.0	4.0	---	---	---	---	---	---
S-3	12.0-15.0	7.3	<0.05	<0.05	<0.05	<0.05	<10	---
S-4	15.0-18.0	5.2	---	---	---	---	---	---
MGB S12								
S-1	4.0-7.0	2.4	---	---	---	---	---	---
S-2	10.0-12.0	3.0	---	---	---	---	---	---
S-3	12.0-15.0	8.7	---	---	---	---	---	---
S-4	15.0-18.0	360	0.41	0.39	<0.05	0.85	25	---
MGB S13								
S-1	10.0-12.0	5.8	---	---	---	---	---	---
S-2	12.0-15.0	301	<0.0500	<0.0500	0.0508	0.188	42.0	---
S-3	15.0-18.0	1794	9.4	40	<0.05	105	2400	---
MTCA Method A CCL's:			**0.5**	**40.0**	**20.0**	**20.0**	**100**	**200**

NOTE:

--- Not Tested

TABLE 2
Preliminary Screening Survey - Groundwater Sampling Summary
Corrective Action Plan
Time Oil Property 01-070
Grandview, Washington

Sample Number	Depth to Water (ft.)	Groundwater Elevation (ft.)	Benezene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Xylenes (ug/L)	Gasoline (ug/L)	Diesel (ug/L)
MGB-1	16.84	78.73	29	10	41	50	1900	<200
MGB-2	16.93	78.88	21	nd	<1	20	360	---
MGB-3	17.77	78.59	1600	1600	830	2900	22000	<200
MGB-4	16.99	78.31	840	81	240	440	5100	---
MGB-5	16.41	79.43	1.4	2.5	<1	7.8	<100	---
MGB-6	16.62	78.68	2.3	<1	<1	5	<100	---
MGB-7	NM	NM	1.4	<1	<1	2.4	<100	---
MGB-8	NM	NM	23	2.2	11	31	700	<200
MGB-9	NM	NM	1000	56	400	1300	9100	---
MGB-10	NM	NM	<1	<1	<1	3	<100	---
MGB-10 dup	NM	NM	<1	<1	<1	1.8	<100	---
MGB-11	NM	NM	<1	<1	<1	<1	<100	---
MGB-12	NM	NM	7.2	<1	<1	<1	<100	---
MGB-13	NM	NM	20	8.6	<1	3.9	<100	---
MGB-13 dup	NM	NM	19	9	<1	5.7	<100	---
MTCA Method A CCL's:			5	40	30	20	1000	1000

NOTES:

--- Not Tested

NM Not Meeasured

TABLE 3
RI/FS - Soil Sampling Summary
Corrective Action Plan
Time Oil Property 01-070
Grandview, Washington

Sample Number	Depth (feet)	Benezene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (mg/kg)	Gasoline (mg/kg)
MW-3						
S-2	10.0-12.0	<0.10	0.34	8.9	47.6	1510
S-3	15.0-17.0	0.847	0.789	2.93	10.9	236
MTCA Method A CCL's:		**0.5**	**40.0**	**20.0**	**20.0**	**100**

TABLE 4

Summary of Groundwater Elveation & Analytical Test Data

Time Oil Company Property 10-070

Grandview, Washington

Well ID	DATE	TOC (feet)	DTW (feet)	TWD (feet)	GWE (feet)	Change in Elevation (feet)	B (ug/l)	T (ug/l)	E (ug/l)	X (ug/l)	TPH-G (ug/l)	LAB
MW-1	3/7/2000	94.8	17.19	25	77.61	----	0.72	<0.500	<0.500	4.14	104	NCA
	3/20/2000		17.35	25	77.45	-0.16	----	----	----	----	----	----
	6/28/2000		15.07	25	79.73	2.28	1.44	<0.500	<0.500	<1.25	68.5	NCA
	9/27/2000		13.53	25	81.27	1.54	4.62	<0.500	<0.500	2.33	83.2	NCA
	12/19/2000		14.63	25	80.17	-1.10	5.70	<0.670	<0.800	<1.55	108	NCA
	4/4/2001		15.97	25	78.83	-1.34	1.04	0.678	<0.500	2.06	78.4	NCA
	7/5/2001		14.36	25	80.44	1.61	1.24	0.678	<0.500	2.06	75.6	NCA
MW-2	3/7/2000	95.21	16.95	25	78.26	----	<0.500	<0.500	<0.500	<1.00	<50.0	NCA
	3/20/2000		17.13	25	78.08	-0.18	----	----	----	----	----	----
	6/28/2000		14.56	25	80.65	2.57	<0.500	<0.500	<0.500	<1.00	<50.0	NCA
	9/27/2000		13.04	25	82.17	1.52	<0.500	<0.500	<0.500	<1.00	<50.0	NCA
	12/19/2000		14.31	25	80.90	-1.27	<0.500	<0.500	<0.500	<1.00	<50.0	NCA
	4/4/2001		15.64	25	79.57	-1.33	<0.500	<0.500	<0.500	<1.00	<50.0	NCA
	7/5/2001		13.88	25	81.33	1.76	<0.500	<0.500	<0.500	<1.00	<50.0	NCA
MW-3	3/7/2000	95.59	17.62	25	77.97	----	8.26	21.4	37.2	651	2430	NCA
	3/20/2000		17.78	25	77.81	-0.16	----	----	----	----	----	----
	6/28/2000		15.29	25	80.30	2.49	4.43	1.74	3.12	165	754	NCA
	9/27/2000		13.78	25	81.81	1.51	2.28	0.737	0.844	68.8	303	NCA
	12/19/2000		15.00	25	80.59	-1.22	2.80	<0.500	2.13	13.1	52.6	NCA
	4/4/2001		16.30	25	79.29	-1.30	<0.500	<0.500	<0.500	<1.00	<50.0	NCA
	7/5/2001		14.61	25	80.98	1.69	<0.500	<0.500	<0.500	<1.00	<50.0	NCA
MW-4	3/7/2000	94.18	16.65	25	77.53	----	<0.500	<0.500	<0.500	<1.00	<50.0	NCA
	3/20/2000		16.82	25	77.36	-0.17	----	----	----	----	----	----
	6/28/2000		14.28	25	79.90	2.54	<0.500	<0.500	<0.500	<1.00	<50.0	NCA
	9/27/2000		12.73	25	81.45	1.55	<0.500	<0.500	<0.500	1.11	<50.0	NCA
	12/19/2000		13.98	25	80.20	-1.25	<0.500	<0.500	<0.500	<1.00	<50.0	NCA
	4/4/2001		15.29	25	78.89	-1.31	<0.500	<0.500	<0.500	<1.00	<50.0	NCA
	7/5/2001		13.55	25	80.63	1.74	<0.500	<0.500	<0.500	<1.00	<50.0	NCA
MW-5	3/7/2000	93.54	16.47	25	77.07	----	4540	1610	823	3580	22700	NCA
	3/20/2000		16.63	25	76.91	-0.16	----	----	----	----	----	----
	6/28/2000		14.28	25	79.26	2.35	1290	137	132	827	3890	NCA
	8/8/2000		13.33	25	80.21	0.95	338	48	41.9	310	1740	NCA
	9/27/2000		12.74	25	80.80	0.59	750	144	109	564	3740	NCA
	12/19/2000		13.83	25	79.71	-1.09	2840	927	576	1420	13100	NCA
	4/4/2001		15.17	25	78.37	-1.34	1720	218	196	542	3740	NCA
	7/5/2001		13.55	25	79.99	1.62	1420	196	190	490	5000	NCA

TABLE 4

Summary of Groundwater Elveation & Analytical Test Data

Time Oil Company Property 10-070

Grandview, Washington

Well ID	DATE	TOC (feet)	DTW (feet)	TWD (feet)	GWE (feet)	Change in Elevation (feet)	B (ug/l)	T (ug/l)	E (ug/l)	X (ug/l)	TPH-G (ug/l)	LAB
MW-6	3/7/2000	93.60	17.06	25	76.54	----	4390	175	1190	3520	22600	NCA
	3/20/2000		17.21	25	76.39	-0.15	----	----	----	----	----	----
	6/28/2000		14.91	25	78.69	2.30	2050	71.8	370	1600	7140	----
	8/8/2000		13.97	25	79.63	0.94	1410	41.5	347	1230	6210	NCA
	9/27/2000		13.35	25	80.25	0.62	1740	47.5	332	1300	7810	NCA
	12/19/2000		14.42	25	79.18	-1.07	1590	36.7	407	1100	9250	NCA
	4/4/2001		15.74	25	77.86	-1.32	2570	45.8	568	1260	7840	NCA
	7/5/2001		14.16	25	79.44	1.58	1980	44.2	508	1550	9260	NCA
RW-1	3/7/2000	95.00	17.38	34	77.62	----	18.7	15.7	54.6	328	2100	NCA
	3/20/2000		17.57	34	77.43	-0.19	----	----	----	----	----	----
	6/28/2000		14.98	34	80.02	2.59	17.4	12.0	28.0	193	1010	NCA
	9/27/2000		13.50	34	81.50	1.48	48.3	6.15	57.1	232	1950	NCA
	12/19/2000		14.75	34	80.25	-1.25	29.2	4.09	26.0	84.7	1100	NCA
	4/4/2001		16.02	34	78.98	-1.27	8.19	<0.500	3.47	8.00	86.2	NCA
	7/5/2001		14.29	34	80.71	1.73	13.8	1.45	12.3	65.2	326	NCA
RW-2	3/7/2000	94.68	17.17	34	77.51	----	<0.900	<0.500	<1.10	<60.0	519	NCA
	3/20/2000		17.35	34	77.33	-0.18	----	----	----	----	----	----
	6/28/2000		14.72	34	79.96	2.63	<0.500	<0.500	<0.500	<1.00	<50.0	NCA
	9/27/2000		13.22	34	81.46	1.50	0.615	<0.910	<2.72	5.87	451	NCA
	12/19/2000		14.49	34	80.19	-1.27	0.923	<0.500	1.09	3.14	66.4	NCA
	4/4/2001		15.75	34	78.93	-1.26	<0.500	<0.500	<0.500	<1.00	<50.0	NCA
	7/5/2001		14.02	34	80.66	1.73	<0.500	<0.500	0.525	1.21	108	NCA
RW-3	3/7/2000	94.83	17.59	34	77.24	----	609	125	166	567	4070	NCA
	3/20/2000		17.76	34	77.07	-0.17	----	----	----	----	----	----
	6/28/2000		15.25	34	79.58	2.51	512	739	357	2850	16200	
	8/8/2000		14.24	34	80.59	1.01	169	253	158	1810	10000	NCA
	9/27/2000		13.72	34	81.11	0.52	58.2	36.9	25.7	578	5640	NCA
	12/19/2000		14.91	34	79.92	-1.19	345	22.7	14.2	203	1850	NCA
	4/4/2001		16.20	34	78.63	-1.29	455	17.9	10.3	175	1560	NCA
	7/5/2001		14.51	34	80.32	1.69	47.5	5.37	4.11	58.3	535	NCA
RW-4	3/7/2000	95.18	17.66	34	77.52	----	309	273	155	608	4080	NCA
	3/20/2000		17.54	34	77.64	0.12	----	----	----	----	----	----
	6/28/2000		15.32	34	79.86	2.22	122	158	47.6	427	1930	NCA
	9/27/2000		13.82	34	81.36	1.50	228	139	90.6	666	4690	NCA
	12/19/2000		15.04	34	80.14	-1.22	327	163	74.4	419	3470	NCA
	4/4/2001		16.32	34	78.86	-1.28	199	25.0	35.5	172	818	NCA
	7/5/2001		14.62	34	80.56	1.70	151	69.0	68.0	365	1830	NCA

TABLE 4

Summary of Groundwater Elveation & Analytical Test Data

Time Oil Company Property 10-070

Grandview, Washington

Well ID	DATE	TOC (feet)	DTW (feet)	TWD (feet)	GWE (feet)	Change in Elevation (feet)	B (ug/l)	T (ug/l)	E (ug/l)	X (ug/l)	TPH-G (ug/l)	LAB
SW-1	3/7/2000	94.91	17.24	30	77.67	----	<0.500	<0.500	<0.500	<1.00	<50.0	NCA
	3/20/2000		17.39	30	77.52	-0.15	----	----	----	----	----	----
Duplicate	3/7/2000	Collected from RW-3.					552	111	142	480	3370	NCA
Duplicate	6/28/2000	Collected from RW-3.					607	931	440	350	21200	NCA
Duplicate	9/27/2000	Collected from RW-4					43.2	31.4	19.6	430	4510	NCA
Duplicate	12/19/2000	Collected from MW-6					1570	39.3	402	1120	10700	NCA
Duplicate	4/4/2001	Collected from RW-3					391	11.1	6.54	112	1160	NCA
Duplicate	7/5/2001	Collected from MW-6					1480	32.3	368	1120	6800	NCA
Drum 12/19/2000							<0.680	<3.89	<1.02	<4.19	291	NCA
Drum 4/3/2001							<0.500	0.820	<0.500	<1.00	<50.0	NCA
MTCA Method A Cleanup Levels - Groundwater							**5.0**	**40.0**	**30.0**	**20.0**	**1000**	

Note:
Brass cap surveyed in southeast corner of concrete near the Grandview Herold (95.58).

TOC Top of Casing
DTW Depth to Water
TWD Total Well Depth
GWE Ground Water Elevation

---- No Data Collected

(shaded) Exceeds MTCA Method A Levels

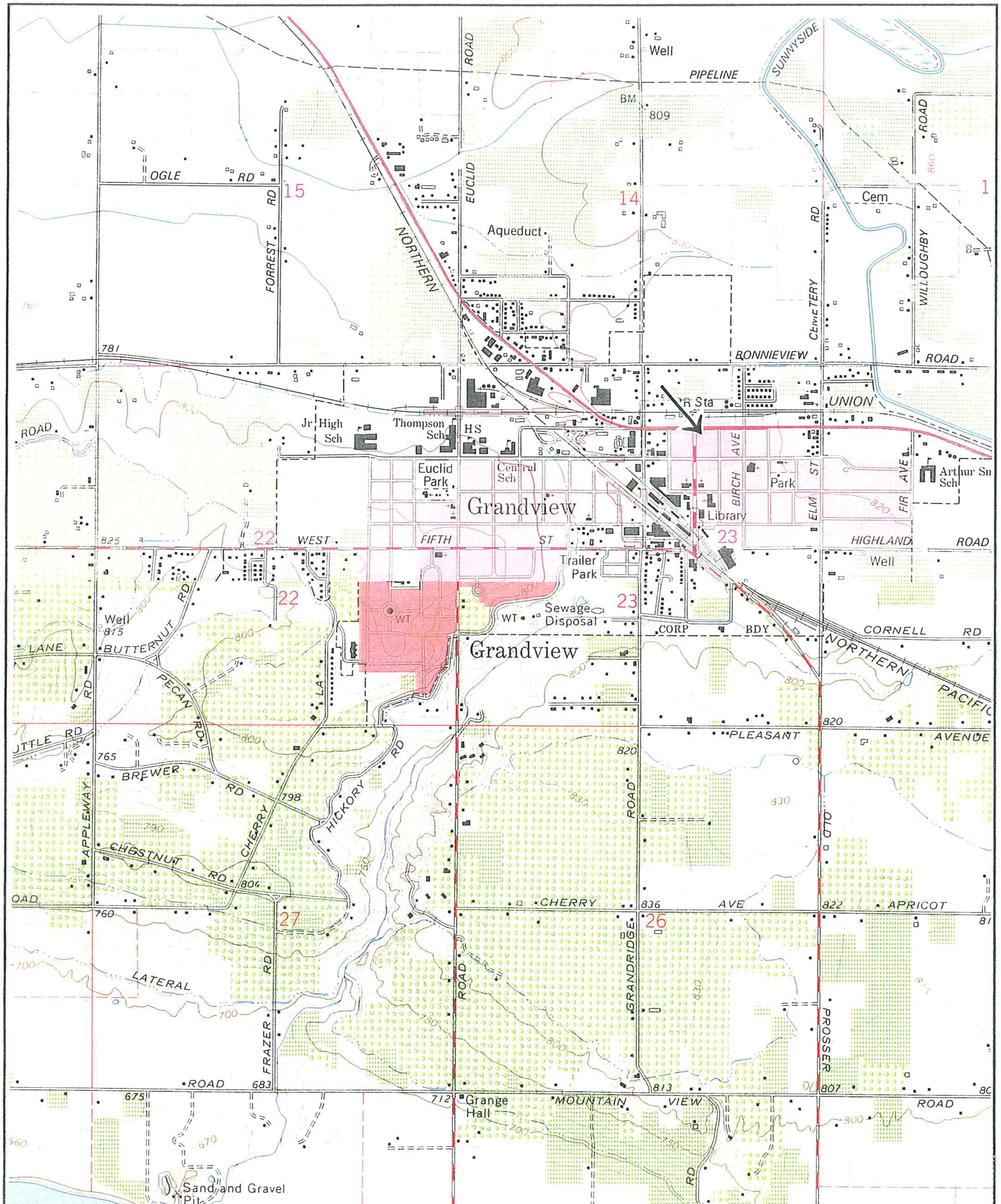
TABLE 5
RI/FS - Vapor Extraction Off-Gas Summary
Corrective Action Plan
Time Oil Property 01-070
Grandview, Washington

Well ID	DATE	B (mg/m^3)	T (mg/m^3)	E (mg/m^3)	X (mg/m^3)	TPH-G (mg/m^3)
RW-4/S-1	03/20/00	131	161	4.78	163	2690
RW-4/S-2	03/20/00	123	164	4.57	165	2410
MW-3/S-1	03/20/00	73.9	46.5	72.0	283	4030
RW-1,RW-3,RW-4/S-1	03/21/00	47.3	58.2	18.9	82.7	1460
RW-1,RW-3,RW-4/S-2	03/22/00	56.0	69.1	23.5	98.6	1660

TABLE 6
RI/FS Pre- and Post-Air Sparging Groundwater Summary
Corrective Action Plan
Time Oil Property 01-070
Grandview, Washington

Well ID	DATE	GWE (feet)	B (ug/l)	T (ug/l)	E (ug/l)	X (ug/l)	TPH-G (ug/l)	Cu (mg/l)	Fe (mg/l)	Mg (mg/l)	Mn (mg/l)	Pb (mg/l)	Zn (mg/l)
MW-4	03/22/00	77.26	<0.500	<0.500	<0.500	1.43	<50.0	0.0029	<0.150	55.2	0.0273	<0.00100	<0.0100
	03/23/00	77.24	<0.500	<0.500	<0.500	2.25	<50.0	0.0109	<0.150	62.8	0.0342	<0.00100	<0.0100
RW-1	03/22/00	77.40	110	68.2	137	1040	5190	0.0102	<0.150	57.3	1.21	<0.00100	<0.0100
	03/23/00	77.38	125	84.9	238	1110	5910	0.0066	<0.150	54.3	1.47	<0.00100	<0.0100
RW-2	03/22/00	77.28	4.70	<1.25	<2.80	20.6	1270	0.002	<0.150	51.8	1.93	<0.00100	<0.0100
	03/23/00	77.22	<0.500	<0.500	<0.500	<4.05	204	0.0617	<0.150	74.6	0.897	<0.00100	0.0155
SW-1	03/22/00	77.44	<0.500	0.521	1.26	7.92	64.9	0.0193	<0.150	72.6	0.217	<0.00100	0.0234
	03/23/00	77.26	<0.500	<0.500	<0.500	<1.00	<50.0	0.0162	<0.150	87.2	0.269	<0.00100	<0.0100

FIGURES



From 7.5 Minute - Grandview/Mabton East Quadrangle

0 1" = 2000' 2000

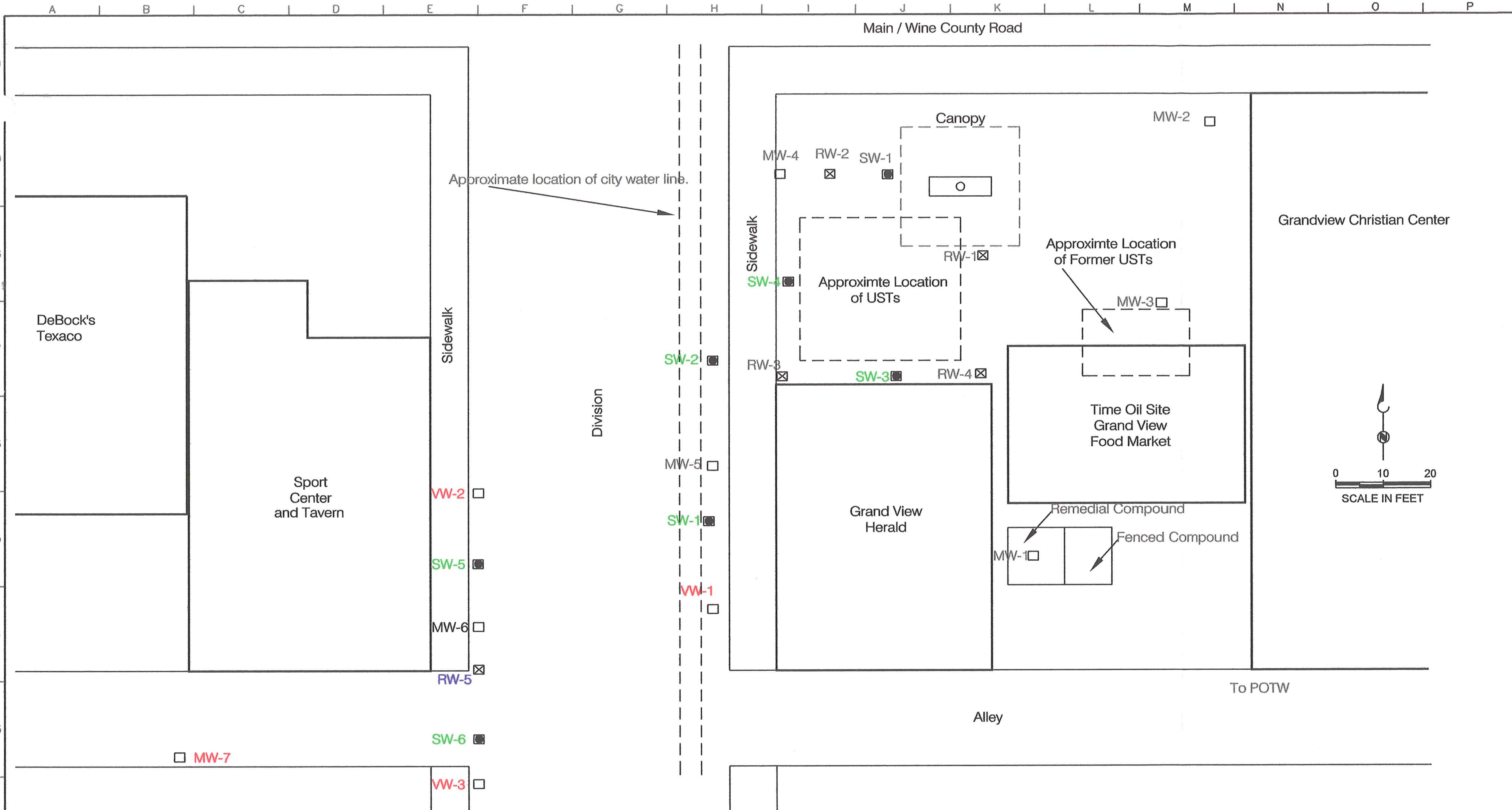
BROWN AND CALDWELL

Site Vicinity Map

Time Oil Facility 01-070

Grandview, Washington

FIGURE 1



Existing Site Conditions

- ☐ Approximate Monitoring Well Location
- ☒ Approximate Recovery Well Location
- ■ Approximate Air Sparge Well Location

Proposed Remedial Wells and Piping Routes

- ☐ VW Approximate Monitoring/Vapor Recovery Well Location - 4 New
- ☒ RW Approximate Groundwater Recovery Well Location - 1 New
- ■ SW Approximate Air Sparge Well Location - 7 New

FIGURE 6

BROWN AND CALDWELL

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

EXISTING AND PROPOSED WELL LOCATIONS

Time Oil Property #01-070
Grandview Food Mart
100 E. Wine Country Rd.
Grandview, Washington

SCALE

DRAWING NUMBER

SHEET NUMBER

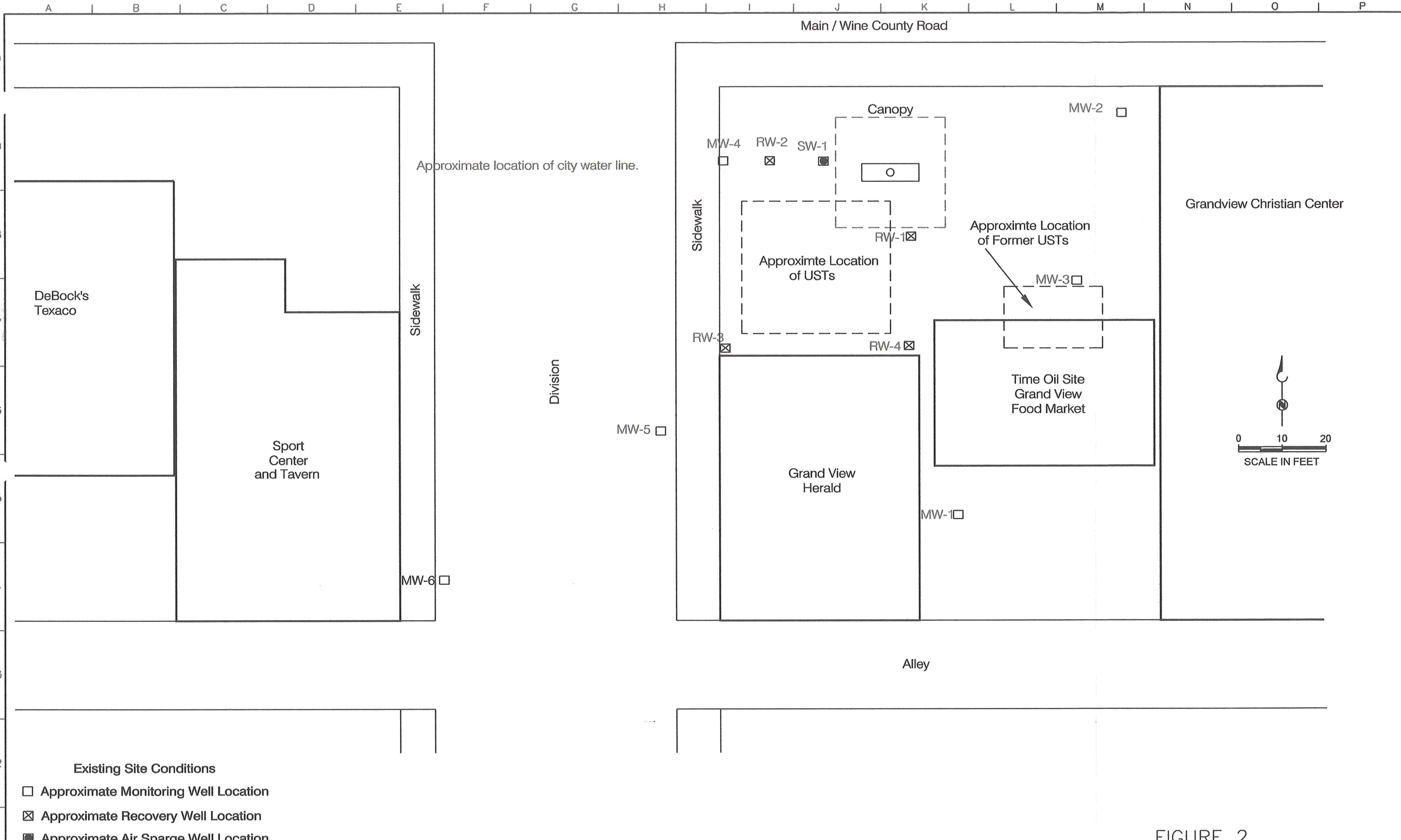


FIGURE 2

BROWN AND CALDWELL

REVISIONS

ZONE	REV.	DESCRIPTION	BY	DATE	APP.

SITE MAP

Time Oil Property #01-070
Grandview Food Mart
100 E. Wine Country Rd.
Grandview, Washington

SCALE

DRAWING NUMBER

SHEET NUMBER

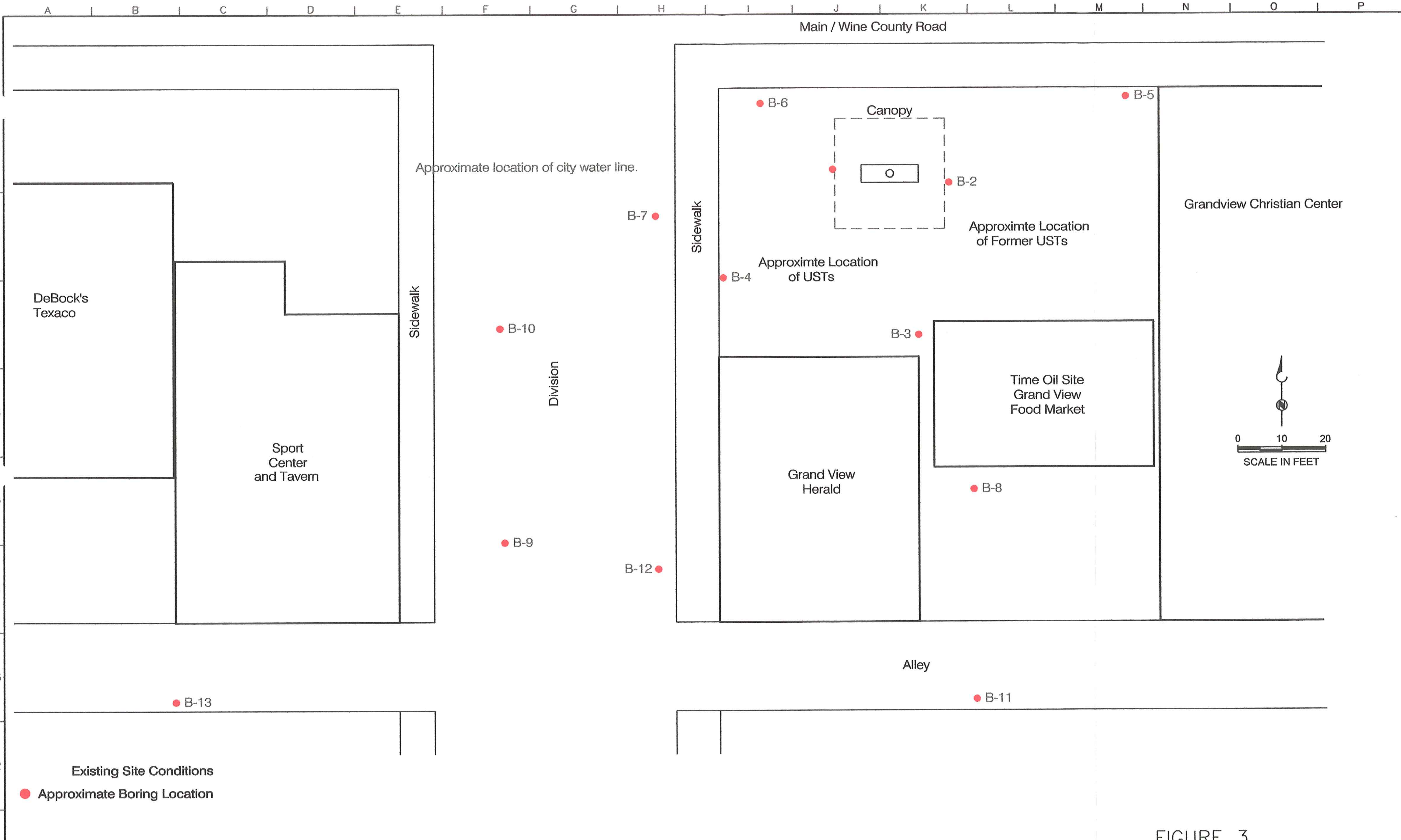


FIGURE 3

BROWN AND CALDWELL

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

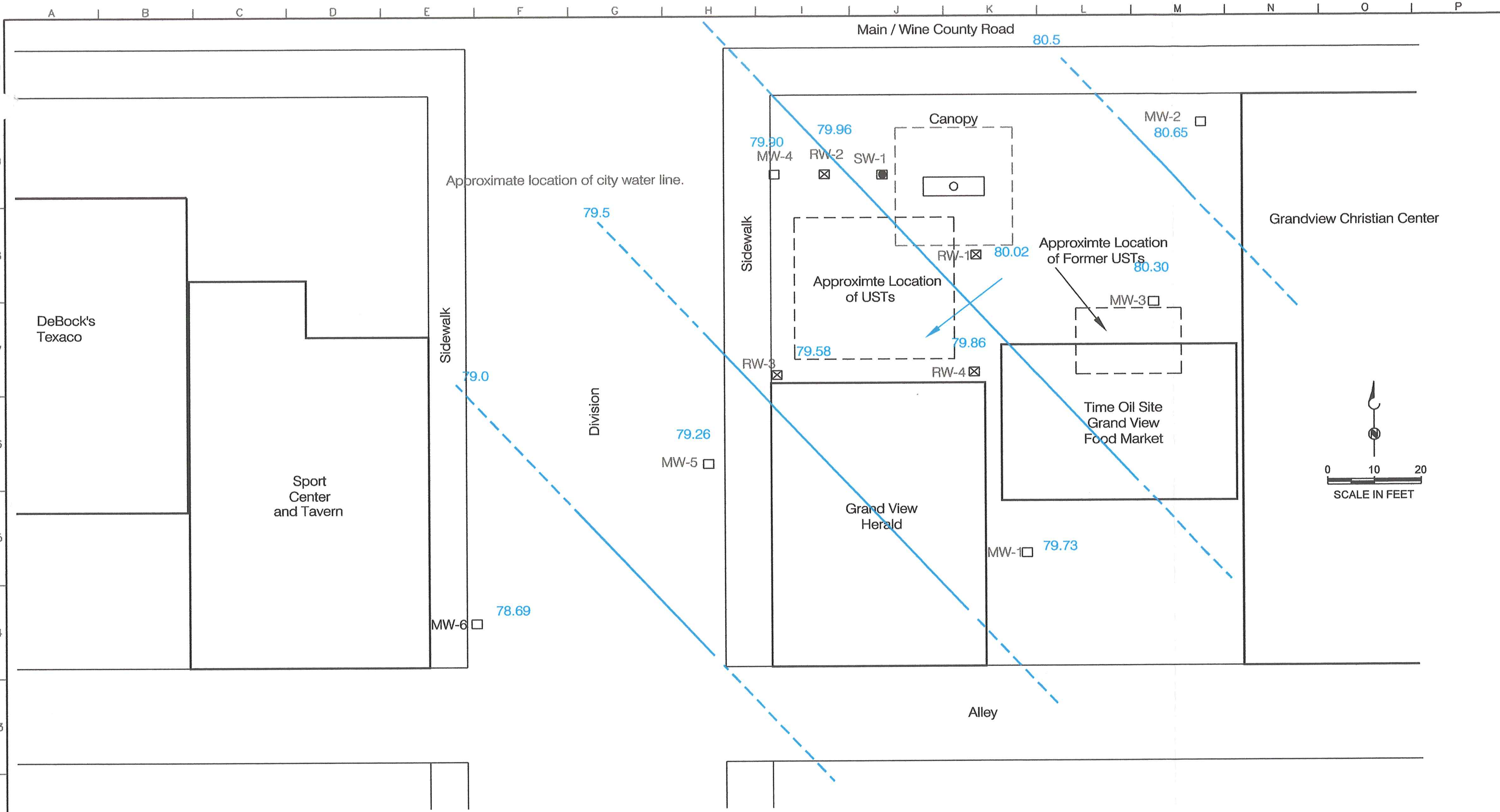
SITE AND EXPLORATION MAP– PRELIMINARY SCREENING SURVEY

Time Oil Property #01–070
Grandview Food Mart
100 E. Wine Country Rd.
Grandview, Washington

SCALE

DRAWING NUMBER

SHEET NUMBER



Existing Site Conditions

☐ Approximate Monitoring Well Location

☒ Approximate Recovery Well Location

■ Approximate Air Sparge Well Location

BROWN AND CALDWELL

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

GROUNDWATER CONTOUR MAP — JUNE 2000

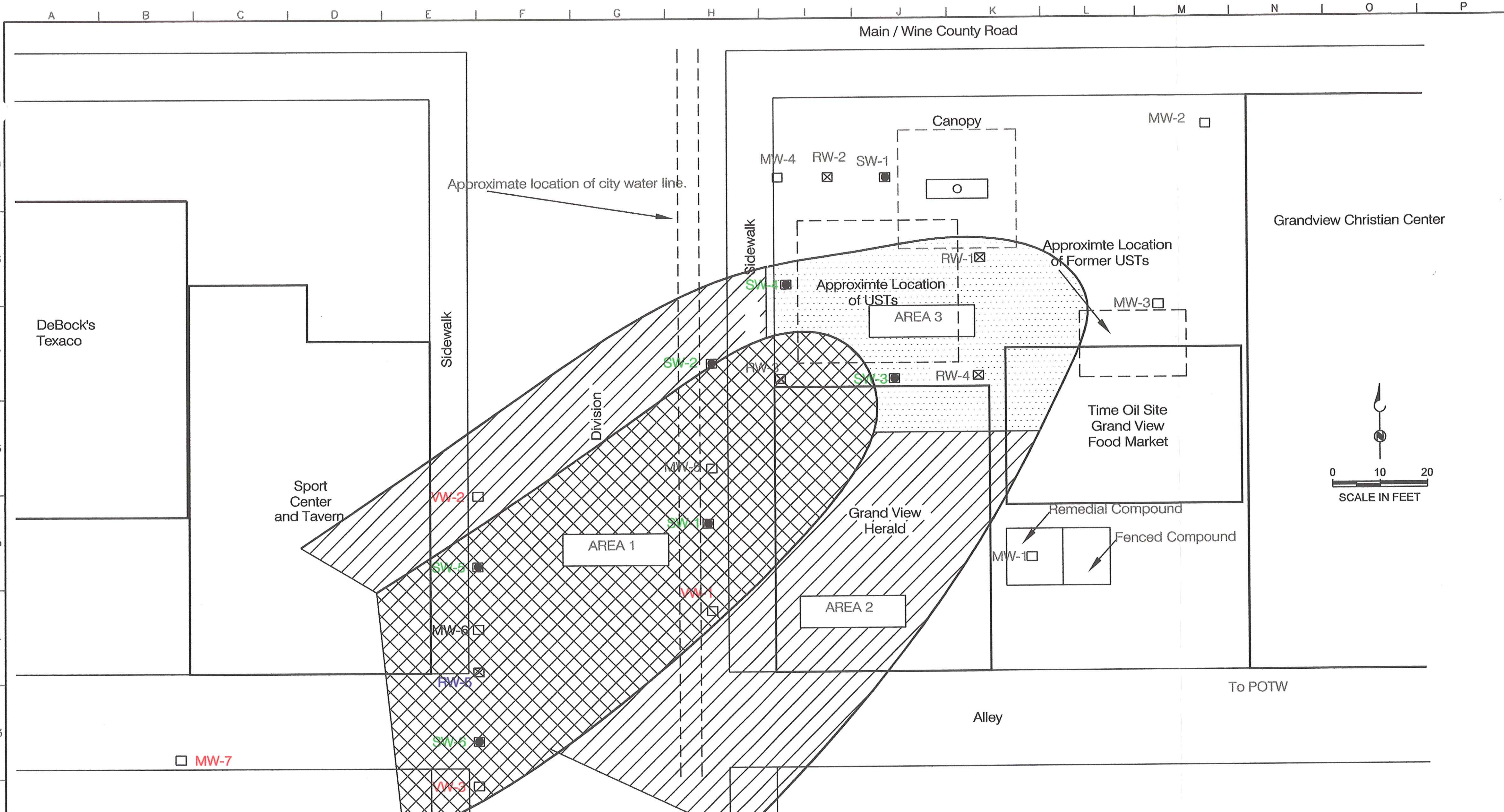
FIGURE 4

Time Oil Property #01-070
Grandview Food Mart
100 E. Wine Country Rd.
Grandview, Washington

SCALE

DRAWING NUMBER

SHEET NUMBER



Existing Site Conditions

- ☐ Approximate Monitoring Well Location
- ☒ Approximate Recovery Well Location
- ■ Approximate Air Sparge Well Location

Proposed Remedial Wells and Piping Routes

- ☐ VW Approximate Monitoring/Vapor Recovery Well Location - 4 New
- ☒ RW Approximate Groundwater Recovery Well Location - 1 New
- ■ SW Approximate Air Sparge Well Location - 7 New

FIGURE 5

BROWN AND CALDWELL

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

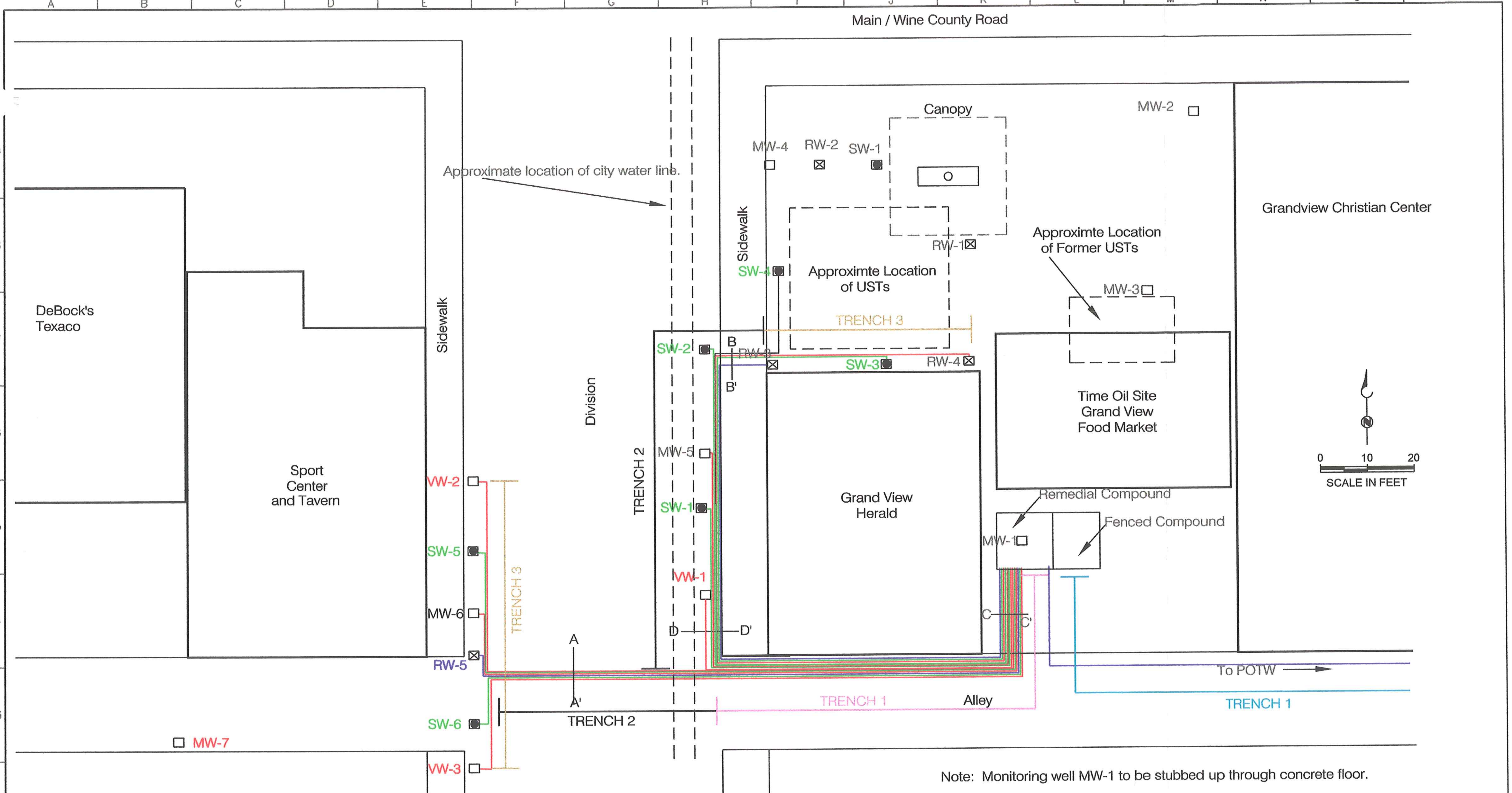
TARGET AREAS FOR REMEDIATION

Time Oil Property #01-070
Grandview Food Mart
100 E. Wine Country Rd.
Grandview, Washington

SCALE

DRAWING NUMBER

SHEET NUMBER



Existing Site Conditions

☐ Approximate Monitoring Well Location

☒ Approximate Recovery Well Location

■ Approximate Air Sparge Well Location

Proposed Remedial Wells and Piping Routes

☐ VW Approximate Monitoring/Vapor Recovery Well Location - 4 New

☒ RW Approximate Groundwater Recovery Well Location - 1 New

■ SW Approximate Air Sparge Well Location - 7 New

Vapor Extraction Line

Air Sparge Line

Groundwater Recovery Line

FIGURE 7

BROWN AND CALDWELL

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

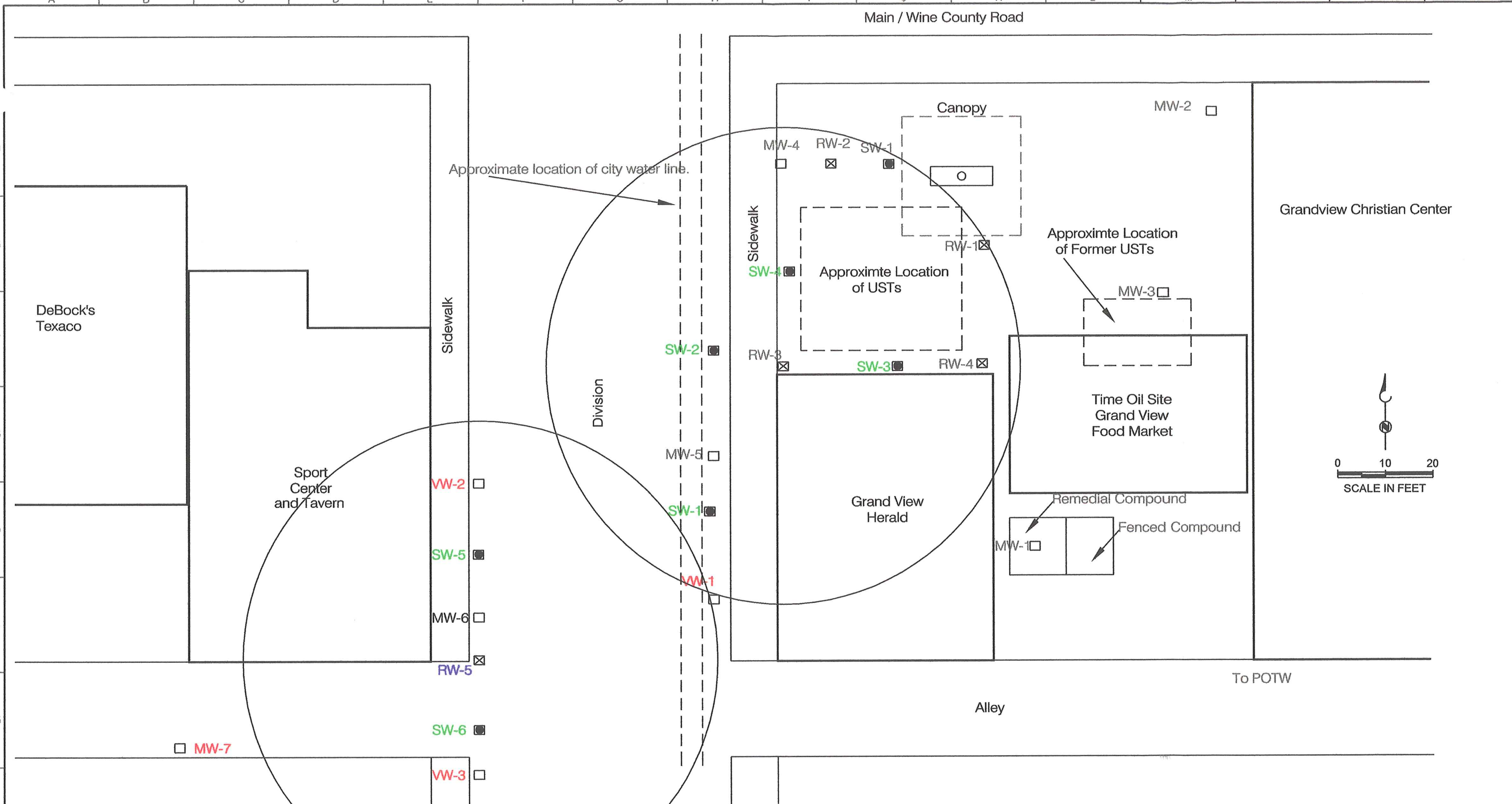
PROPOSED SUBSURFACE PIPING ROUTES

Time Oil Property #01-070
Grandview Food Mart
100 E. Wine Country Rd.
Grandview, Washington

SCALE

DRAWING NUMBER

SHEET NUMBER



Existing Site Conditions

- ☐ Approximate Monitoring Well Location
- ☒ Approximate Recovery Well Location
- ■ Approximate Air Sparge Well Location

Proposed Remedial Wells and Piping Routes

- ☐ VW Approximate Monitoring/Vapor Recovery Well Location - 4 New
- ☒ RW Approximate Groundwater Recovery Well Location - 1 New
- ■ SW Approximate Air Sparge Well Location - 7 New

FIGURE 8

BROWN AND CALDWELL

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

ESTIMATED RADIUS OF INFLUENCE MAP

Time Oil Property #01-070
Grandview Food Mart
100 E. Wine Country Rd.
Grandview, Washington

SCALE

DRAWING NUMBER

SHEET NUMBER

APPENDIX A

REMEDIATION SYSTEM CONSTRUCTION – PLAN SHEETS

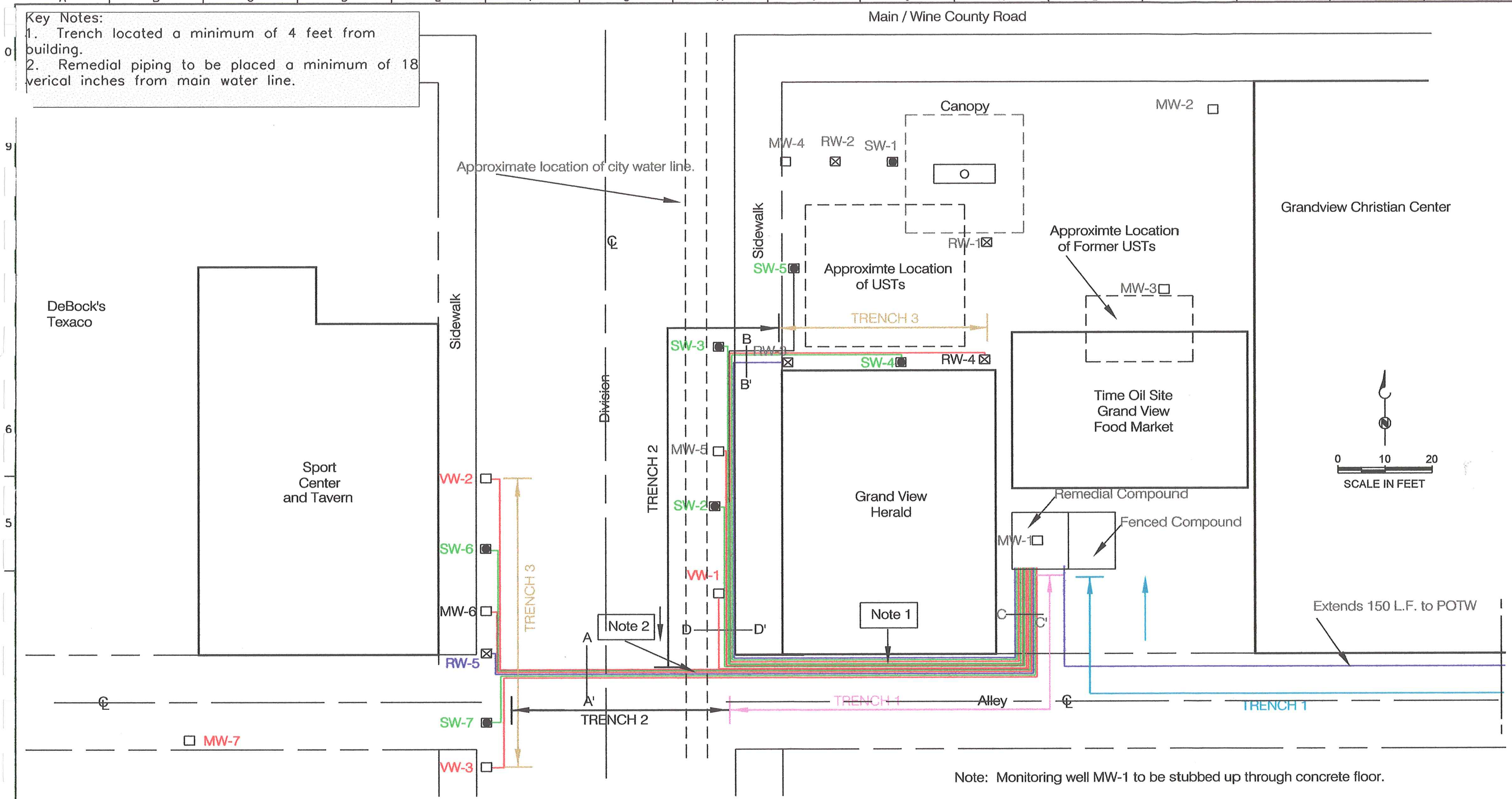
REMEDIATION SYSTEM CONSTRUCTION - PLAN SHEETS

TIME OIL PROPERTY/01-070 - GRANDVIEW, WASHINGTON

FIGURE	DESCRIPTION	SHEET
Cover	Cover	1
L1	Remediation System Layout	2
D1	Treatment Shed and Fenced Compound	3
P1	Mechanical Plan	4
D2	Manifold (SVE)/Discharge Details	5
D3	Manifolds (Air Sparge/GW Recovery) Details	6
D4	Trench Details	7
D5	Extraction Well Detail	8
F1	Flow Diagram	9

BROWN AND CALDWELL
10015 N. Division St.
Suite 100
Spokane, WA 99228

Key Notes:
1. Trench located a minimum of 4 feet from building.
2. Remedial piping to be placed a minimum of 18 verical inches from main water line.



Existing Site Conditions

- ☐ Approximate Monitoring Well Location
- ☒ Approximate Recovery Well Location
- ■ Approximate Air Sparge Well Location

Proposed Remedial Wells and Piping Routes

- ☐ VW Approximate Monitoring/Vapor Recovery Well Location - 4 New
- ☒ RW Approximate Groundwater Recovery Well Location - 1 New
- ■ SW Approximate Air Sparge Well Location - 7 New

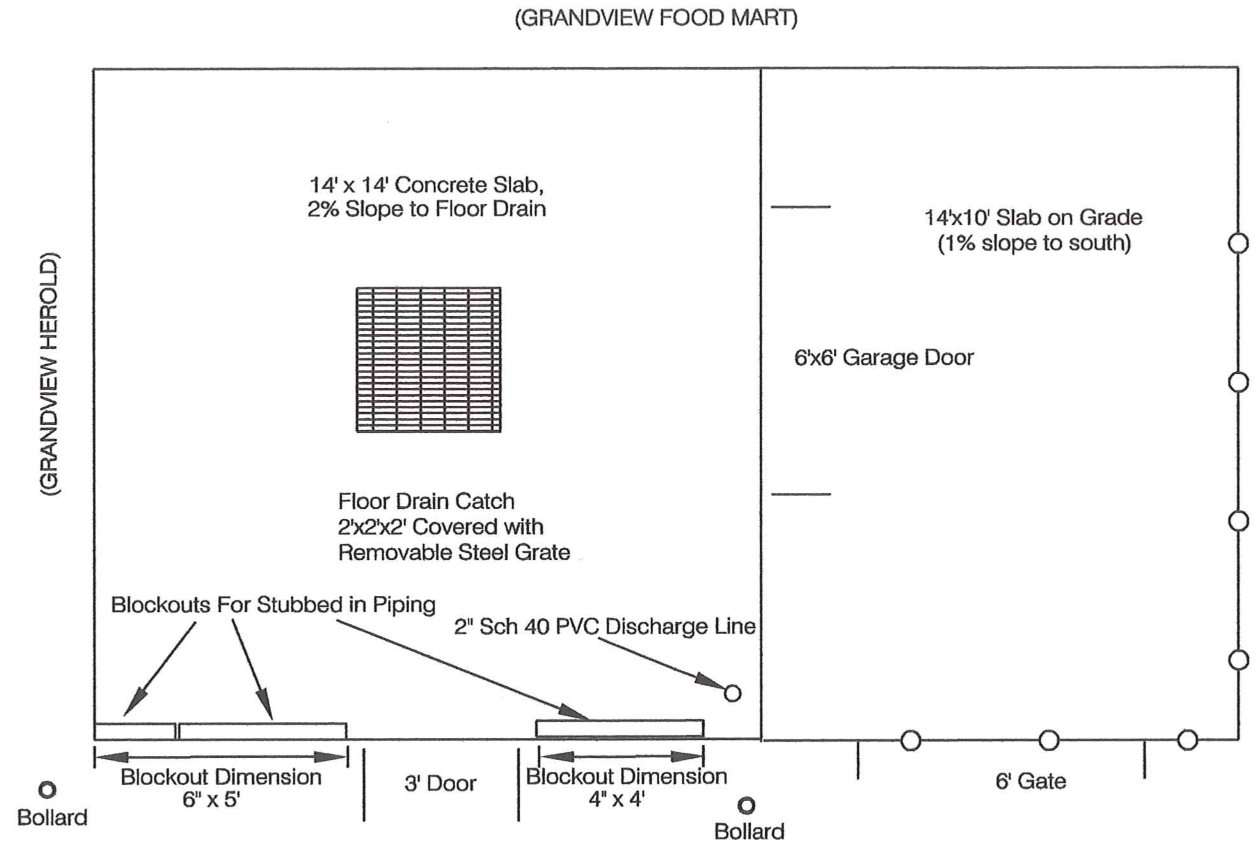
- Vapor Extraction Line
- Air Sparge Line
- Groundwater Recovery Line
- Center Line
- Edge of Public Easement

BROWN AND CALDWELL

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

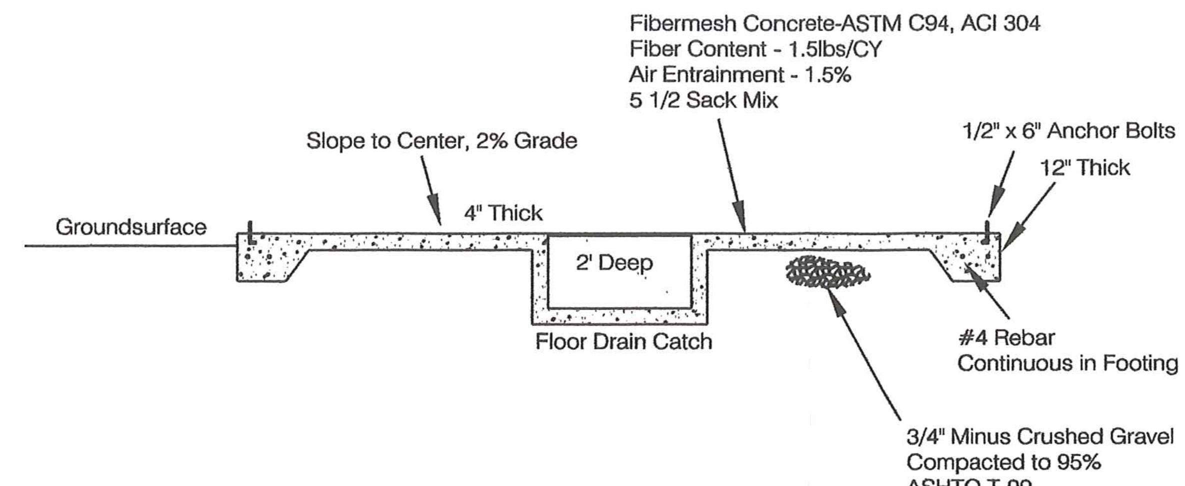
Remediation System Layout
Time Oil Facility 01-070
Grandview, Washington

SCALE 1" = 20'
DRAWING NUMBER
SHEET NUMBER SHEET 2/9



FLOOR SLAB - PLAN VIEW

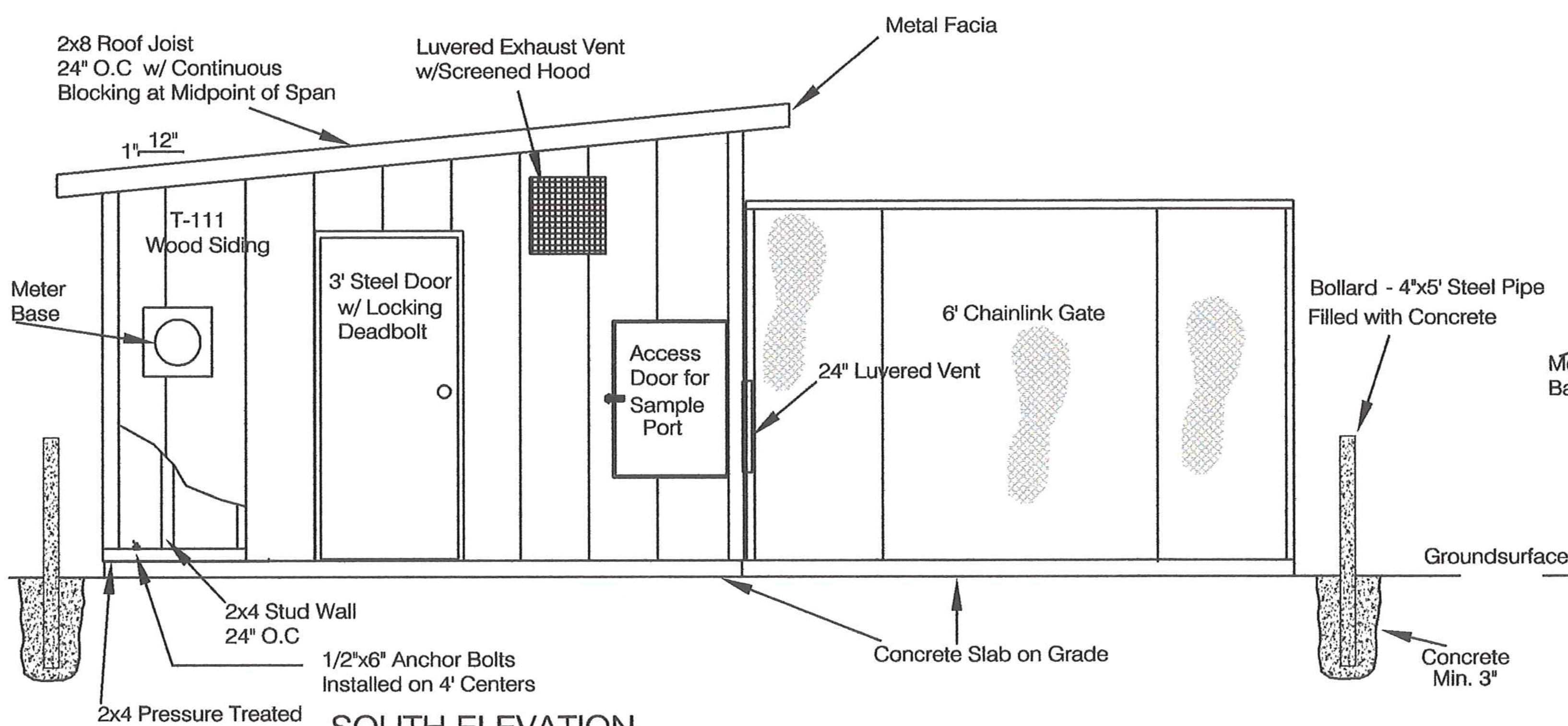
1"=4'



CENTER FLOOR SLAB - SECTION VIEW

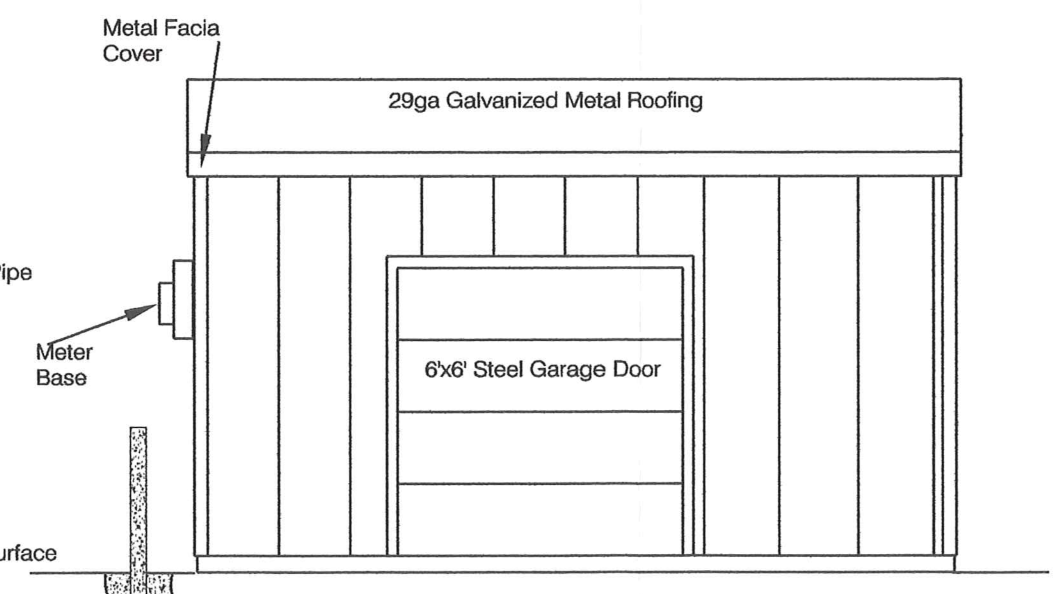
1"=4'

Key Notes:
1. Roof Snow Load: 30 lbs per square foot.
2. Seismic: Zone 2
3. Wind Load: 70 miles per hour



SOUTH ELEVATION

1"=4'



EAST ELEVATION

1"=4'

BROWN AND CALDWELL

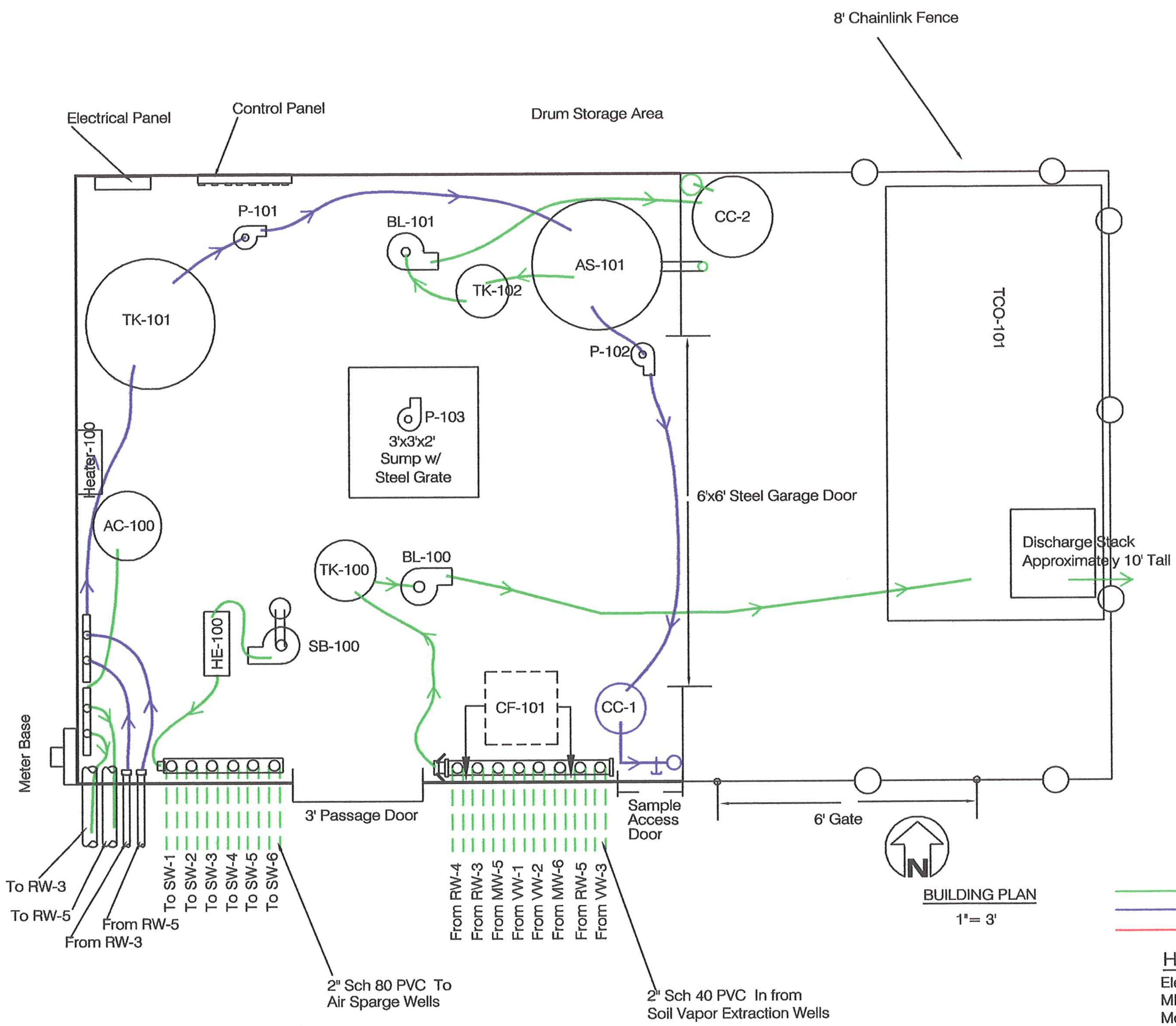
REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

Fenced Compound Detail
Time Oil Company 01-070
Grandview, Washington

SCALE 1" = 4'

DRAWING NUMBER

SHEET NUMBER SHEET 3/9



AS-101
Air Stripper- Tray Type
MFG: H2Oil
Model: H2TS150-3
Operating Point: 15 gpm
Sump Capacity: 42 gal

TC-101
Thermal Catalytic Oxidizer
MFG: H2Oil
Model: H2CO-250G
Operating Point: 100-500 scfm

TK-100
Knockout Tank
Material: Steel
Capacity: 55 Gallon

TK-101
Batch Tank
Material: Polyethylene
Capacity: 300 gal

BL-101
MFG: Rotron DR606
Operating Pt.: 150 scfm
Rating: 5HP, 230VAC,
3O Explosion Proof

BL-100
MFG: Rotron DR8
Operating Pt.: 400 scfm
Rating: 10HP, 230/460VAC,
60 Hz, 3O Explosion Proof

CC-1
Carbon Canister
Aqueous Phase
(optional)

CC-2
Carbon Canister
Vapor Phase

SB-100
Air Sparge Compressor
MFG: GAST
Model: 1290-P110A
Rating: 15 Hp, 230 VAC,
60Hz, TEFC Motor

HE-100
Heat Exchanger
MFG: H2Oil
Model: H2HE25X
Rating: 3/4 Hp, 230 VAC,
1-Phase

P-101, 102
Transfer Pump
MFG: Goulds
Model: 1ST
Operating Point: 20gpm
@ 28' of Head
Rating: 1/2hp, 230VAC, 1O,
Explosion Proof

P-103
Sump Pump
MFG: BJM
Model: R100
Operating Point: 17gpm
@ 5' of Head
Rating: .15hp, 110VAC, 1O

Heater-100
Electric Heater - Wall Mounted
MFG: Grainger
Model: 3UG37
Thermostat: 2E499
Rating: 208 VAC, 1O, 3.6 kw
Explosion Proof

AC-100
Air Compressor
MFG: Ingersoll-Rand
Rating: 5 Hp, 230 VAC
1 phase, TEFC motor on
80 Gallon Receiver

CF-101
Cooling Fan - Wall Mounted
MFG: Grainger
Model: 3XK55
Operating Point: 3390 scfm
Wallgaurd: 6D584 (20.5")
Thermostat: 2E499
Rating: .1/3hp, 120VAC, 1O

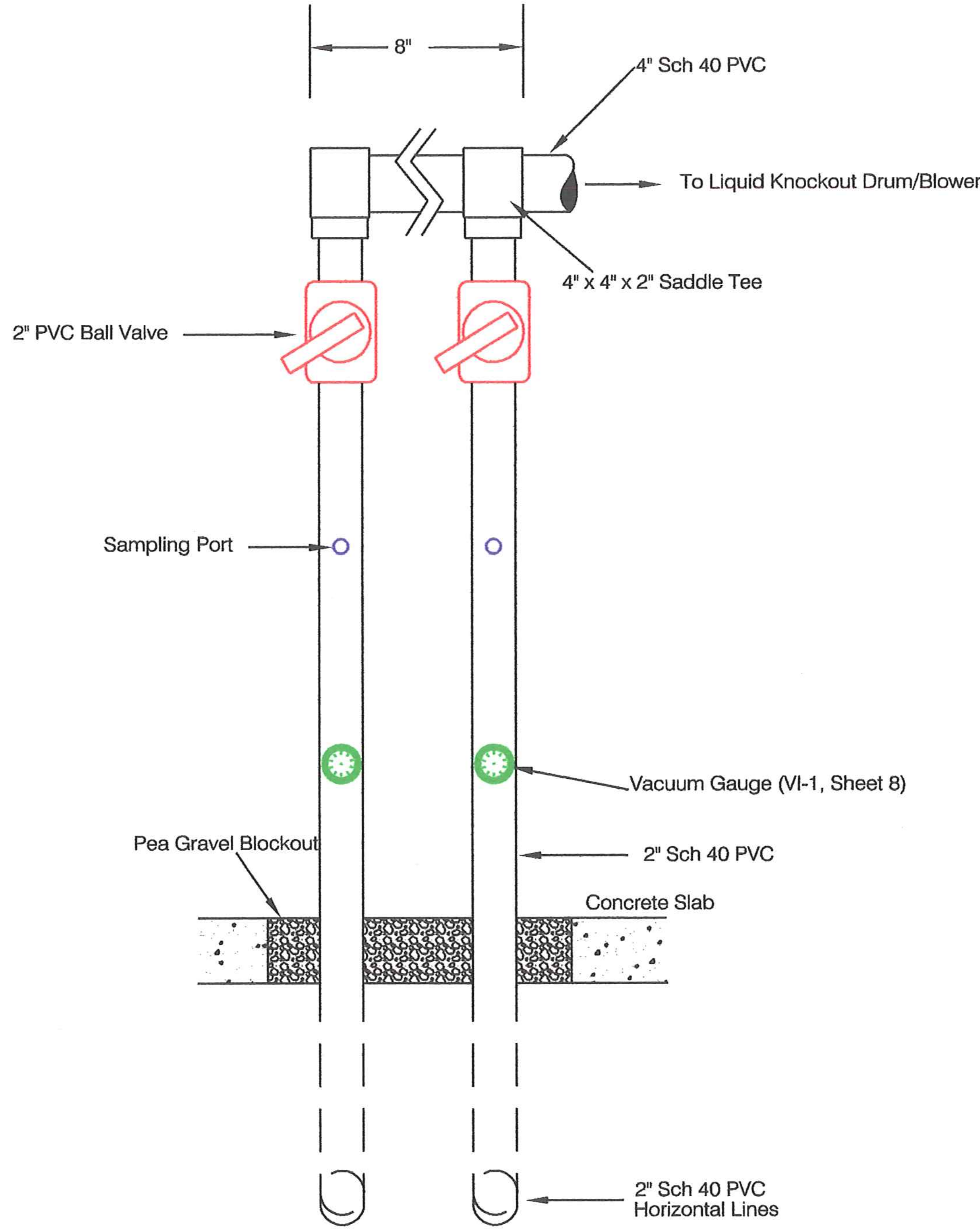
BROWN AND CALDWELL

REVISIONS

ZONE	REV.	DESCRIPTION	BY	DATE	APP.

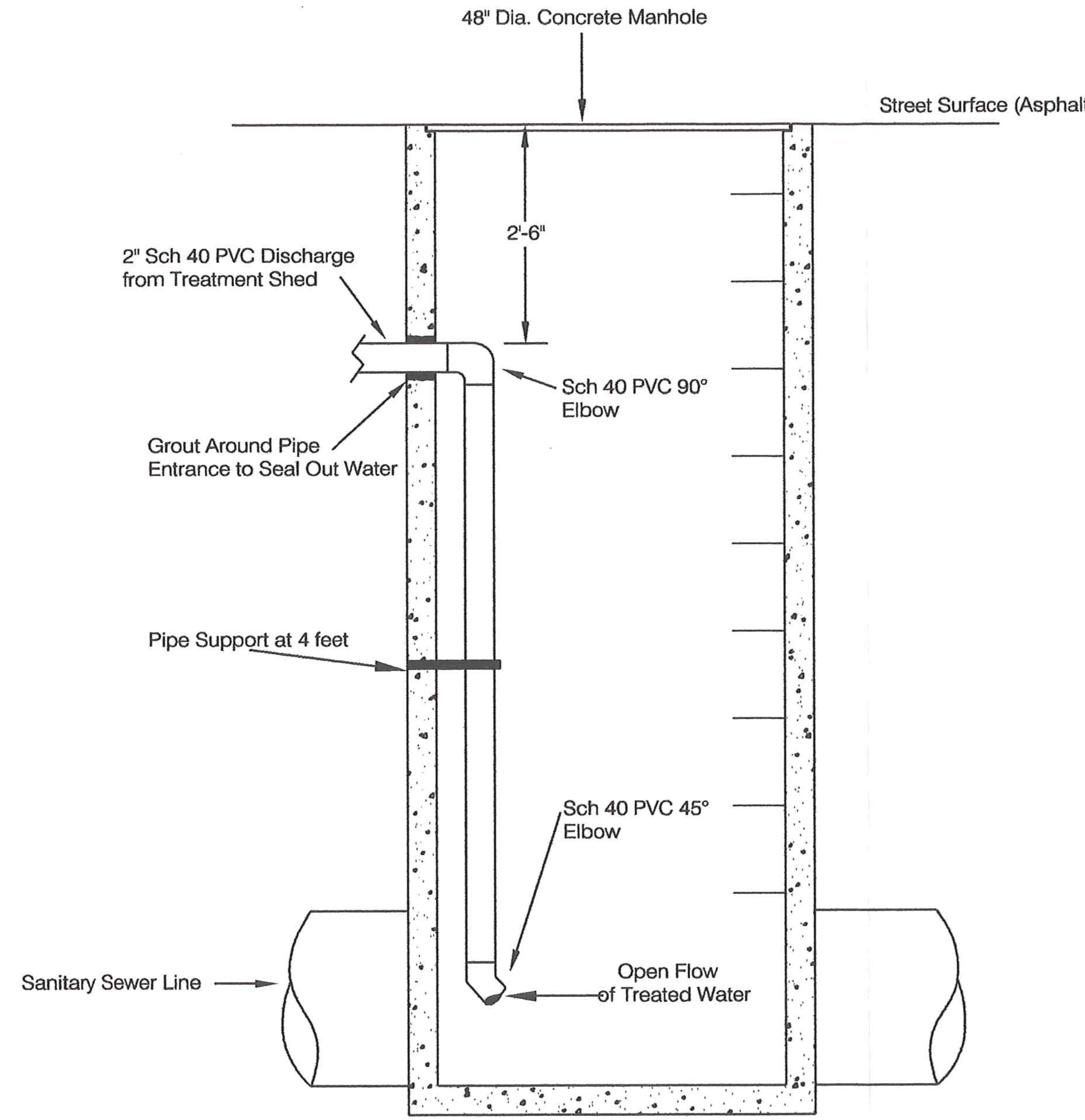
Mechanical Plan
Time Oil Facility 01-070
Grandview, Washington

SCALE 1" = 3'
DRAWING NUMBER
SHEET NUMBER SHEET 4/9



SVE MANIFOLD DETAIL (TYP.)

Not to Scale



EXISTING MANHOLE (Grandview Public Works)

1" = 2'

BROWN AND CALDWELL

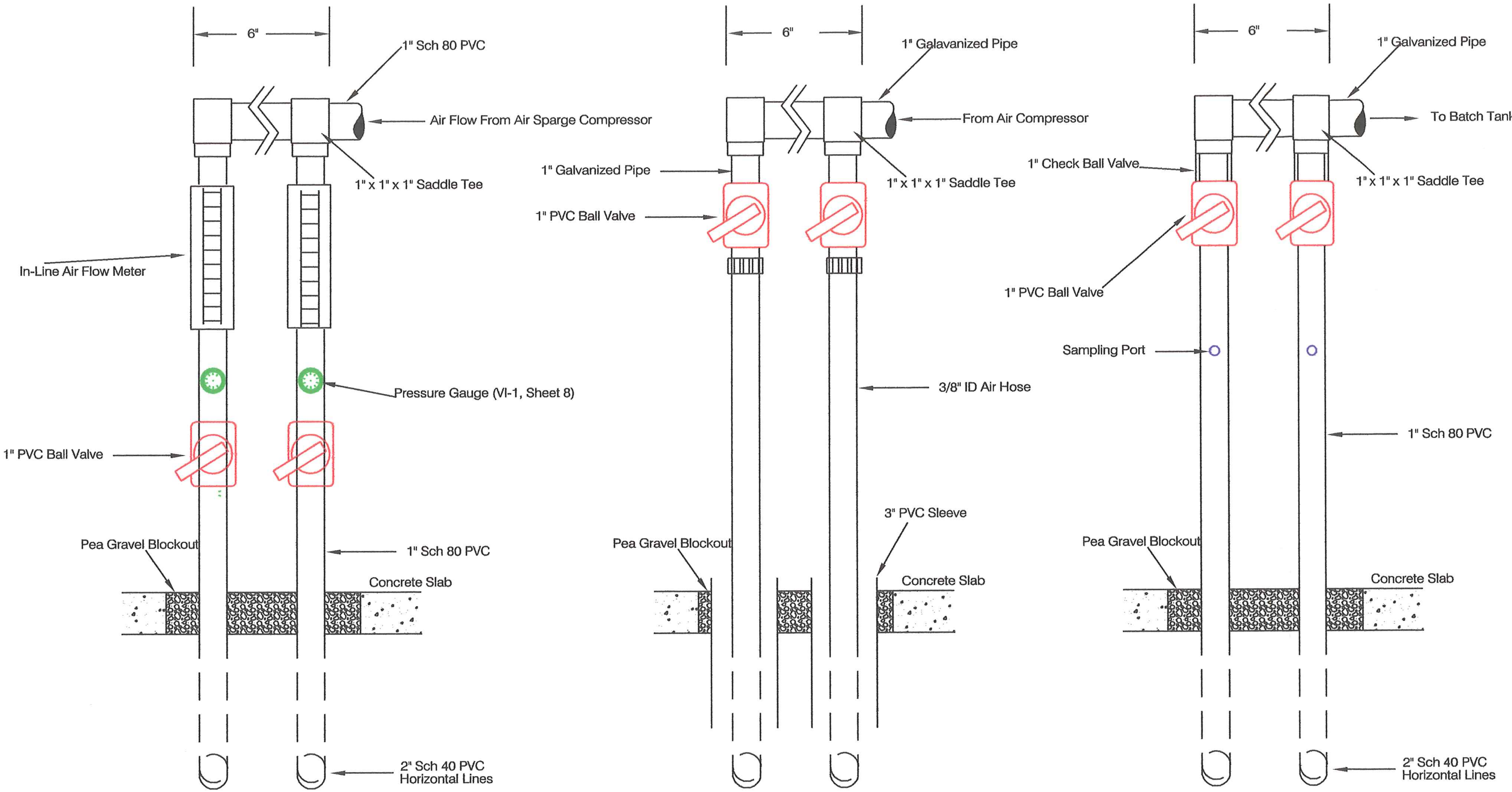
REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

Manifold/Discharge Details
Time Oil Property 01-070
Grandview, Washington

SCALE: 1" = 2'

DRAWING NUMBER

SHEET NUMBER: SHEET 5/9



AS MANIFOLD DETAIL (TYP.)

Not to Scale

GW AIR LINE MANIFOLD DETAIL (TYP.)

Not to Scale

GW WATER RETURN
MANIFOLD DETAIL (TYP.)

Not to Scale

BROWN AND CALDWELL

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

Mainifolds (AS/GW Recovery) Details
Time Oil Property 01-070
Grandview, Washington

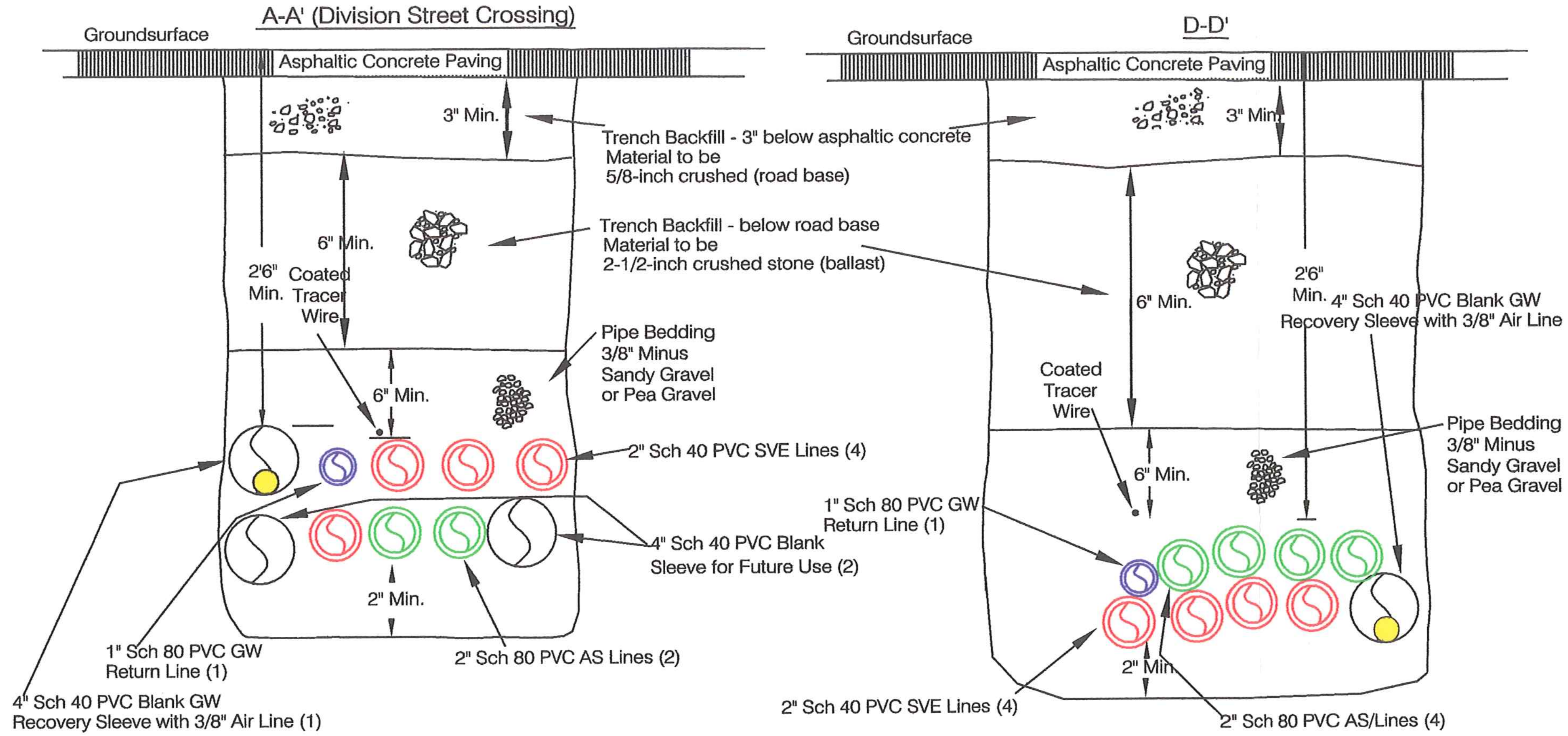
SCALE: Not To Scale
DRAWING NUMBER
SHEET NUMBER: SHEET 6/9

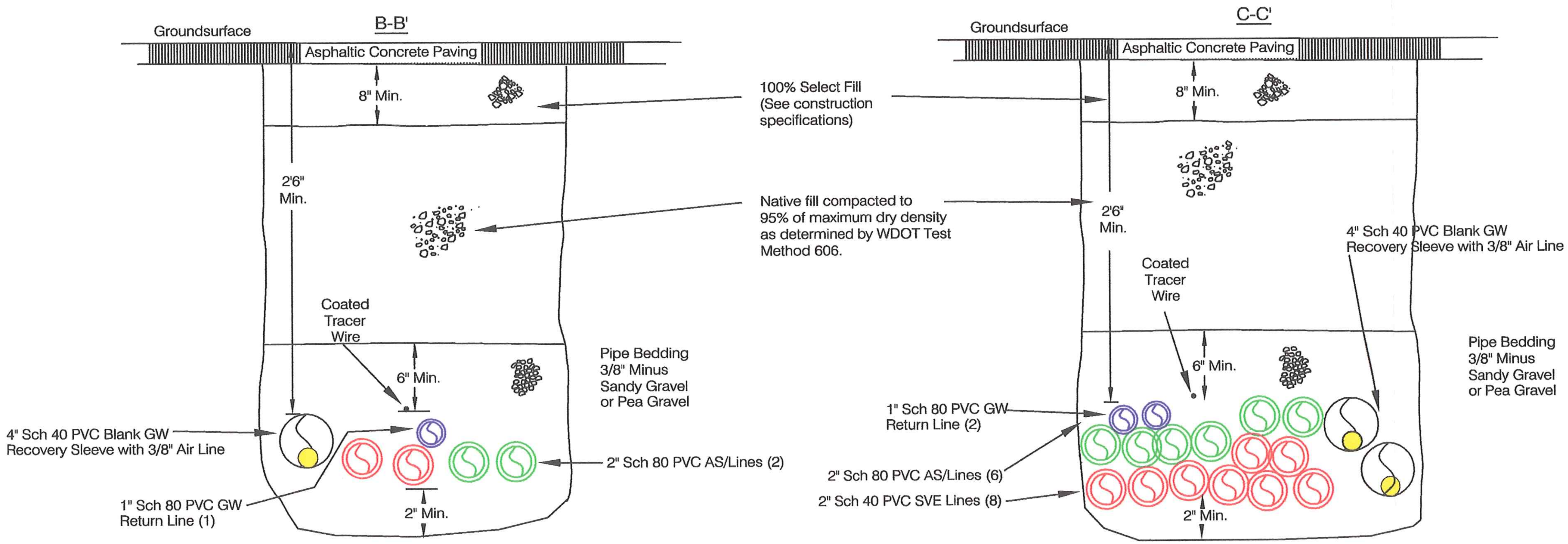
ROAD CROSSING TRENCH SPECIFICATIONS:

1. Trench subgrade preparation shall be performed in accordance with WDOT 1998 Standard Specifications contained in Division 2, Section 6.
2. Material used for trench backfill shall be deposited in maximum 6" lifts, wetted to within 2% of the optimum moisture content, and compacted to at least 95% of the maximum dry density as determined by WDOT Test Method 606.
3. All excess rock and debris in R/W shall be hauled away by contractor.
4. Backfill material at Division Street to consist of a minimum thickness of 3-inches of 5/8-inch crushed rock (road base) beneath the asphaltic concrete, and a minimum depth of 6-inches consisting of 2-1/2-inch crushed rock beneath the road base material.
5. Road surface to be smoothed and graded to preconstruction conditions.
6. Asphaltic concrete paving shall be a minimum of 3" or 1 1/2 times the existing paving whichever is greater.
7. No steel tracks, wheels or outrigger pads shall be allowed on the pavement.
8. Where pavement is damaged, the contractor shall saw and remove a 4' minimum width of pavement, recompact sub-base and repave.
9. All excavation work shall be performed in accordance with OSHA regulations.

NOTES:

1. Trenchless pipe installation techniques are acceptable for road crossings.
2. All excavation work shall be performed in accordance with OSHA regulations.
3. Place loose backfill soil in 8-inch maximum lift height.
4. Remedial trenches to be completed a minimum of 30-inches wide and a maximum of 40-inches wide.
5. Dishcarge line trench to be completed between 12-18 inches wide.



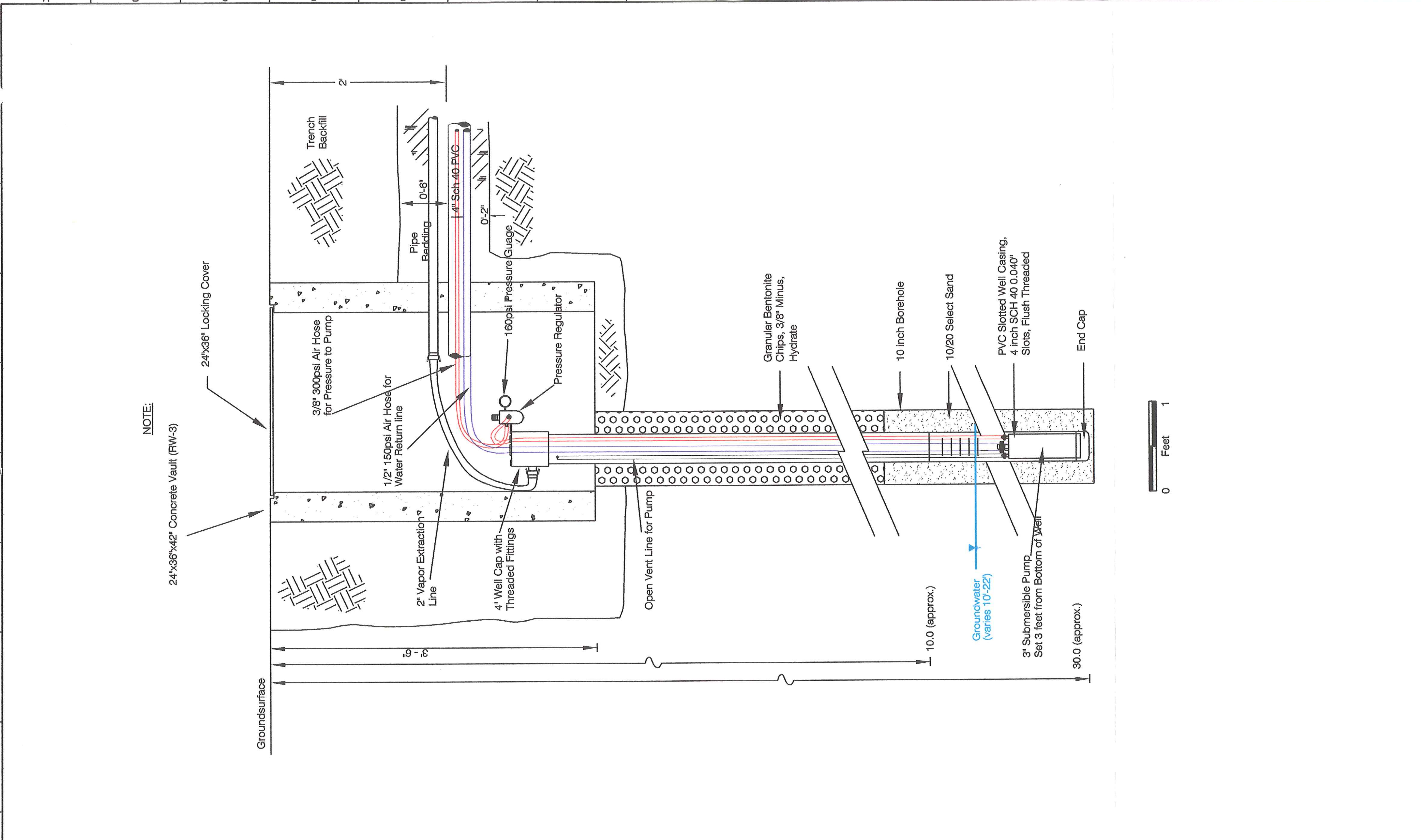


BROWN AND CALDWELL

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

Trench Details
Time Oil Property 01-070
Grandview, Washington

SCALE: Not To Scale
DRAWING NUMBER
SHEET NUMBER: SHEET 7/9



BROWN AND CALDWELL

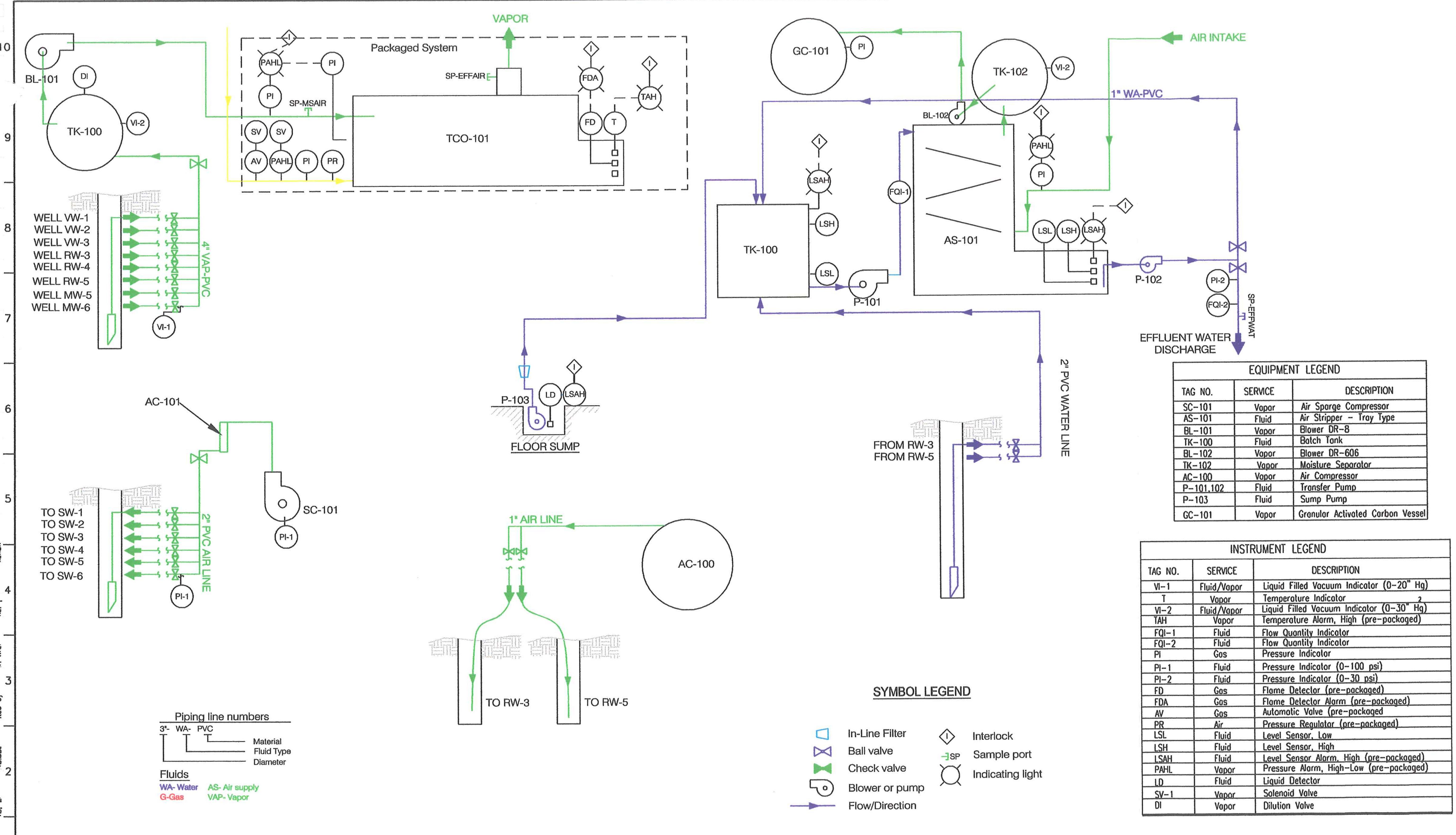
REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

Groundwater Extraction Well Detail
Time Oil Property 01-070
Grandview, Washington

SCALE 1" = 1'

DRAWING NUMBER

SHEET NUMBER SHEET 8/9



EQUIPMENT LEGEND

TAG NO.	SERVICE	DESCRIPTION
SC-101	Vapor	Air Sparge Compressor
AS-101	Fluid	Air Stripper – Tray Type
BL-101	Vapor	Blower DR-8
TK-100	Fluid	Batch Tank
BL-102	Vapor	Blower DR-606
TK-102	Vapor	Moisture Separator
AC-100	Vapor	Air Compressor
P-101,102	Fluid	Transfer Pump
P-103	Fluid	Sump Pump
GC-101	Vapor	Granular Activated Carbon Vessel

INSTRUMENT LEGEND

TAG NO.	SERVICE	DESCRIPTION
VI-1	Fluid/Vapor	Liquid Filled Vacuum Indicator (0-20" Hg)
T	Vapor	Temperature Indicator
VI-2	Fluid/Vapor	Liquid Filled Vacuum Indicator (0-30" Hg)
TAH	Vapor	Temperature Alarm, High (pre-packaged)
FQI-1	Fluid	Flow Quantity Indicator
FQI-2	Fluid	Flow Quantity Indicator
PI	Gas	Pressure Indicator
PI-1	Fluid	Pressure Indicator (0-100 psi)
PI-2	Fluid	Pressure Indicator (0-30 psi)
FD	Gas	Flame Detector (pre-packaged)
FDA	Gas	Flame Detector Alarm (pre-packaged)
AV	Gas	Automatic Valve (pre-packaged
PR	Air	Pressure Regulator (pre-packaged)
LSL	Fluid	Level Sensor, Low
LSH	Fluid	Level Sensor, High
LSAH	Fluid	Level Sensor Alarm, High (pre-packaged)
PAHL	Vapor	Pressure Alarm, High-Low (pre-packaged)
LD	Fluid	Liquid Detector
SV-1	Vapor	Solenoid Valve
DI	Vapor	Dilution Valve

BROWN AND CALDWELL

REVISIONS

ZONE	REV.	DESCRIPTION	BY	DATE	APP.

Flow Diagram
Time Oil Property 01-070
Grandview, Washington

SCALE: Not To Scale

DRAWING NUMBER

SHEET NUMBER: SHEET 9/9