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FINAL COMPLIANCE MONITORING REPORT

Sub-Slab Depressurization System

8801 EAST MARGINAL WAY S., TUKWILA, WASHINGTON
AGREED ORDER NO. 6069

SHANNON & WILSON

September 26, 2023

Shannon & Wilson No: 108056-04

Submitted To: PACCAR Inc

Subject: FINAL COMPLIANCE MONITORING REPORT, SUB-SLAB DEPRESSURIZATION SYSTEM, 8801 EAST MARGINAL WAY S., TUKWILA, WASHINGTON
AGREED ORDER NO. 6069

Shannon & Wilson prepared this report and participated in this project as a consultant to PACCAR Inc. This submittal presents the Final Compliance Monitoring Report for the sub-slab depressurization system at 8801 East Marginal Way S., Tukwila, Washington. This report was prepared by the undersigned.

This report is one of multiple documents that fulfills the Compliance Monitoring Report requirements discussed in Task 4 of Exhibit C to Agreed Order No. 6069.

We appreciate the opportunity to be of service to you on this project. If you have questions concerning this report, or we may be of further service, please contact us.

Sincerely,

SHANNON & WILSON

Ryan Peterson, PE
Environmental Engineer

Scott W. Gaulke, PE, LHG
Vice President

RBP:SWG:MJS/rbp

EXECUTIVE SUMMARY

This Final Compliance Monitoring Report (CMR) summarizes the construction of the sub-slab depressurization system (SSDS) completed between August 2022 and April 2023 at 8801 East Marginal Way S., Tukwila, Washington (8801 property).

A plume of contaminated groundwater extends from the northern boundary of the 8801 property, downgradient (south and west), toward the Lower Duwamish Waterway. Although trichloroethylene (TCE) is the predominant contaminant of concern (COC) in the groundwater plume, tetrachloroethylene (PCE) and vinyl chloride (VC) are present in the groundwater plume as well. TCE, PCE, and VC belong to a group of compounds named halogenated volatile organic compounds (HVOCs).

Between August 2022 and April 2023, the current owner of the 8801 property, CenterPoint 8801 Marginal LLC (CenterPoint), constructed an approximately 414,400-square-foot warehouse for commercial use and trailer storage on the 8801 property. The warehouse was constructed approximately four feet above the ground surface elevation using crushed concrete and imported fill. Approximately one-third of the western portion of the warehouse overlays a portion of the HVOC groundwater plume. HVOCs in the groundwater plume are in equilibrium with the overlying soil vapor and the chemicals may partition from groundwater to soil vapor and migrate upwards to the ground surface. HVOC vapors from the groundwater plume could potentially migrate upward and intrude into the warehouse.

The objective of the SSDS is to reduce HVOC concentrations in soil vapor beneath the concrete floor of the warehouse. The SSDS advances this objective by providing a preferential pathway for vapors from under the concrete floor to discharge to the air above the warehouse, beyond the breathing zone. This objective is further advanced by other remedial actions that are described in separate CMRs, including targeted excavation of TCE-impacted soil, groundwater treatment injections, and expansion of the air sparging/soil vapor extraction (AS/SVE) system.

The SSDS consists of a network of vent strips placed in the crushed concrete and fill overlain by a vapor barrier placed under the concrete floor of the warehouse. Riser pipes connect the vent strips to wind-driven turbine ventilators located above the warehouse roof. The turbine ventilators create a negative pressure under the vapor barrier, causing lower density HVOC vapor to travel up the risers and exhaust above the roof.

The SSDS construction was undertaken in accordance with the SSDS Engineering Design Report, except for minor deviations unlikely to affect the efficacy of the SSDS.

The success of the SSDS will be assessed through the analysis of vapor samples collected from sample ports in the vent risers. Baseline vapor samples were collected on July 28, 2023 and results will be reported to Ecology in a separate document.

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ACRONYMS

AO	Agreed Order
AS/SVE	air sparging/soil vapor extraction
COC	contaminant of concern
CMR	Compliance Monitoring Report
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
HVOC	halogenated volatile organic compound
IAWP	Interim Action Work Plan
LDW	Lower Duwamish Waterway
MOU	Memorandum of Understanding
PCE	tetrachloroethene
PSCAA	Puget Sound Clean Air Agency
SSDS	sub-slab depressurization system
TCE	trichloroethylene
VC	vinyl chloride

1 INTRODUCTION

This Final CMR was prepared by Shannon & Wilson on behalf of PACCAR Inc to summarize the construction of the SSDS completed between August 2022 and April 2023 at 8801 East Marginal Way S., Tukwila, Washington (8801 property) in accordance with the SSDS Engineering Design Report (EDR) (Shannon & Wilson, 2021c).

1.1 Purpose of this Compliance Monitoring Report

The purpose of this CMR is to document the construction of the SSDS in accordance with the SSDS EDR (Shannon & Wilson, 2021c).

1.2 Physical Description and Use

The 8801 property occupies 24.30 acres on the east bank of the Lower Duwamish Waterway (LDW) and is relatively flat, with a ground surface elevation of approximately 20 feet above mean sea level. A vicinity map is provided as Figure 1.

The current owner of the 8801 property, CenterPoint 8801 Marginal LLC (CenterPoint), recently redeveloped the 8801 property. Between August 2022 and April 2023, CenterPoint constructed an approximately 414,400-square-foot warehouse for commercial use and trailer storage on the 8801 property (Figure 2). The warehouse was constructed approximately four feet above the ground surface elevation using crushed concrete and imported fill. The SSDS was incorporated into the construction of the warehouse.

1.3 Regulatory Framework

The 8801 site consists of both an upland portion (the 8801 property) and the adjoining sediments in the LDW that are part of a Superfund site designated by the U.S. Environmental Protection Agency (EPA). The 8801 site is subject to two separate Agreed Orders (AOs) with the Washington State Department of Ecology (Ecology): AO No. 6069, which applies to the 8801 property, and AO No. 3599, which applies to the sediments. Under a Memorandum of Understanding (MOU), Ecology is working with EPA to identify and remove sources of ongoing contamination to the LDW.

This CMR is one of multiple documents that fulfills the CMR requirements discussed in Task 4 of Exhibit C to AO No. 6069. Separate CMRs are being submitted for other remedial actions at the 8801 property as they are completed. Remedial actions required pursuant to AO No. 6069 and their status are shown in Exhibit 1-1.

Exhibit 1-1: Status of Remedial Actions

Remedial Action	Status of Implementation
Removal of PCB-containing caulk in pavement expansion joints	Completed in January 2022. This action is described in a Draft CMR for Remedial Excavations, dated July 28, 2023.
Excavation of hotspots, placement of clay/asphalt/concrete covers, and implementation of institutional controls	The hotspots identified in the East Excavations EDR and West Excavations EDR (Shannon & Wilson, 2021b and 2021d) were excavated in September 2022. CenterPoint encountered impacted soil during redevelopment activities and some impacted soil was disposed of at an appropriately licensed facility. The hotspot excavation activities completed by PACCAR and the soil disposal activities completed by CenterPoint are described in the Draft CMR for Remedial Excavations, dated July 28, 2023. The foundation of the warehouse, the clay liner installed in the footprint of the landscaped berm, and the asphalt/concrete parking areas and driveways are a cap over the 8801 property. An environmental covenant will be imposed against the 8801 property to memorialize the institutional controls, which will include prohibitions on the use of groundwater and activities that could disturb or expose contamination that will remain under the cap. The environmental covenant is anticipated to be generated in late 2023.
Injection of remediation compounds to promote enhanced reductive dechlorination of VOCs across the HVOC groundwater plume and TPH-G in the Northwest Area	Completed as described in the Final CMR for Groundwater Treatment Injections, dated March 30, 2023.
Extension and modification of the AS/SVE system	Substantially completed in May 2023. This action is described in the Final CMR for AS/SVE Extension and Modification, dated September 26, 2023.
Installation of an SSDS and implementation of institutional controls to restrict extraction of groundwater and protect indoor air from vapor	Substantially completed as described in this CMR. Sampling for post-implementation performance monitoring and to evaluate chemical emissions against PSCAA de minimis values commenced in July 2023 and results will be reported to Ecology in a separate document.
Groundwater performance monitoring	Monitoring wells throughout the 8801 property, except some near the western property boundary, were decommissioned during Spring 2021 in preparation for redevelopment. Performance monitoring wells on the 8801 property were installed and developed in May 2023. Groundwater performance monitoring commenced in August 2023 and results will be reported to Ecology in a separate document.

NOTES:

PCB = polychlorinated biphenyls; PSCAA = Puget Sound Clean Air Agency; TPH-G = total petroleum hydrocarbons in the gasoline range

2 BACKGROUND

A plume of contaminated groundwater extends from the northern boundary of the 8801 property, downgradient (south and west) toward the LDW. The approximate boundary of the groundwater plume, prior to the groundwater treatment injections completed in 2021

and 2022, is shown in Figure 2. Although TCE is the predominant COC in the groundwater plume, PCE and VC are present in the groundwater plume as well. TCE, PCE, and VC belong to a group of compounds named HVOCs.

Approximately one-third of the western portion of the new warehouse on the 8801 property overlays a portion of the HVOC groundwater plume as shown in Figure 2. HVOCs in the groundwater plume are in equilibrium with overlying soil vapor and the chemicals may partition from groundwater to soil vapor and migrate upwards to the ground surface. HVOC vapors from the groundwater plume could potentially migrate upward and intrude into the warehouse.

The purpose of the SSDS is to reduce the potential concentration of HVOC vapors beneath the concrete floor of the warehouse.

In addition to the SSDS discussed in this CMR, other remedial actions designed to reduce concentrations of HVOCs in the groundwater plume, and therefore reduce the potential for migration of chemicals to soil vapor, have been selected and are in various stages of completion but are not discussed in this CMR. These remedial actions include:

- A hotspot excavation at Area 1 to remove the TCE-impacted soil above the site-specific remediation levels was completed in Fall 2021 and is described in the Final CMR for Remedial Excavations (Shannon & Wilson, 2023b).
- Remediation compounds (bacteria, a food source, and pH buffer compound) were injected into the groundwater plume at locations upgradient of the AS/SVE system during August 2021 and December 2022 to promote enhanced reductive dechlorination. The injections are designed to complete the degradation of the HVOCs past VC to ethene. This degradation is expected to occur over a period of years following the injections. The injections are reported in the Final CMR for Groundwater Treatment Injections (Shannon & Wilson, 2023a).
- The existing AS/SVE system was extended to reduce concentrations in the downgradient portion of the groundwater plume and is described in the CMR for AS/SVE Extension and Modification (Shannon & Wilson, 2023c).

3 PLANNING AND SELECTION OF REMEDIAL ACTIONS

This section provides an overview of the process used to select the SSDS as a component of the remedy for the 8801 property. Further details are provided in the reports referenced below.

In 2020, Ecology approved the Final Feasibility Study (FS) (Shannon & Wilson, 2020a) for the 8801 property. Analytical data from previous investigations at the 8801 property was

screened against Ecology's LDW-specific preliminary cleanup levels to identify COCs and areas of concern. The COCs and areas of concern were used as the basis for the remedial alternative analysis and selection presented in the Final FS.

In 2020, Ecology approved the Final Interim Action Work Plan (Shannon & Wilson, 2020b) for the 8801 property. The Final Interim Action Work Plan was based on the findings from the Final FS and detailed the cleanup standards, remedial action alternatives, rationale for the selected remedial actions, and compliance monitoring requirements. The report was called an "Interim" Action Work Plan because it addressed only the upland portion of the 8801 site (i.e., the 8801 property), not the sediment portion of the 8801 site.

In 2020, Ecology approved an Addendum to the Final FS and Interim Action Work Plan (Addendum) (Shannon & Wilson, 2020c). The Final Interim Action Work Plan and the Addendum together constitute the Interim Action Work Plan (IAWP) for the 8801 property. The remedial actions described in the IAWP constitute the final cleanup action for the 8801 property.

In 2021, Ecology approved several EDRs describing the selected remedial actions for the 8801 property. The SSDS EDR describes the engineering design for the remedial action discussed in this CMR. Requirements for protection monitoring, performance monitoring, and confirmation monitoring to be conducted during the remedial actions, including those applicable to the SSDS, are described in the Ecology-approved Compliance Monitoring Plan (Shannon & Wilson, 2021a).

4 IMPLEMENTATION

The objective of the SSDS is to reduce HVOC concentrations in soil vapor beneath the concrete floor of the warehouse. The SSDS advances this objective by providing a preferential pathway for vapors from under the concrete floor to discharge to the air above the warehouse, beyond the breathing zone. This objective is further advanced by other remedial actions that are described in separate CMRs, including targeted excavations of TCE-impacted soil, groundwater treatment injections, and expansion of the AS/SVE system.

Construction of the SSDS was undertaken in accordance with the SSDS EDR (Shannon & Wilson, 2021c), except for minor deviations as discussed in Section 5. The SSDS was installed under the portion of the warehouse that overlays the HVOC groundwater plume and was extended 100 feet eastwards beyond the approximate boundary of the groundwater plume, consistent with EPA and Ecology guidance (Figure 2). The footprint of the SSDS is approximately 105,000 square feet.

The SSDS consists of a network of vent strips overlain by a vapor barrier placed under the concrete floor of the warehouse. Riser pipes connect the vent strips to wind-driven turbine ventilators located above the warehouse roof. The turbine ventilators create a negative pressure under the vapor barrier causing the lower density vapor to travel up the risers and exhaust above the roof, outside the normal breathing zone and away from windows and air supply intakes. Further details of the SSDS components and installation methods are provided in Sections 4.1 through 4.4.

4.1 Vent Strips

The vent strips are 12-inch-wide strips of molded plastic wrapped in a fabric. The void spaces in the vent strips allow lateral movement of soil vapor in the subsurface. The product is SiteDrain™ Strip 6412 and the data sheet is provided in Appendix A. A photo of a cut end of a vent strip is shown in Exhibit 4-1.

Exhibit 4-1: Cut End of a Vent Strip

The vent strips are "keyed" into the sub-base so that the top of the vent strips are level with the surface of the sub-base (Exhibit 4-2). The sub-base is crushed concrete and imported fill material on which the concrete floor is constructed.

Exhibit 4-2: A Roll of Vent Strip with a "Keyed" Section of Sub-Base for Installation of the Vent Strip

The vent strips are installed in rows approximately 50 feet apart and along the perimeter of the vapor barrier, creating a network as shown in Figure 2.

4.2 Vapor Barrier

The vapor barrier (30-mil Absolute Barrier ® Y30BAC) prevents vertical movement of HVOC vapor from the sub-base and deeper soil to the concrete floors. The vapor barrier was procured as large rolls and unfurled on the ground surface as shown in Exhibit 4-3.

A geotextile cushion (Mirafi® 180N) identified by the manufacturer of the vapor barrier as an optional component was placed both underneath the vapor barrier and on top of the vapor barrier to protect against punctures from the sub-base material and rebar, respectively, during construction. The product data sheets are provided in Appendix A.

Exhibit 4-3: Unfurling of the Vapor Barrier Over the Geotextile Cushion

Seams between adjacent sheets of the vapor barrier are welded. The vapor barrier was temporarily punctured in some areas for placement of anchors for concrete forms to support pouring of the concrete floor slab. The punctures were repaired with welded patches. The welded seams and patches were vacuum box tested for leaks.

The vapor barrier is sealed to the column footings and the building exterior wall using batten strips. The batten strip details are shown in Figure 5 and in Exhibit 4-4 (below).

Exhibit 4-4: Batten Strips Anchored to a Column Footing (Prior to Attachment of the Vapor Barrier)

4.3 Risers

The vent strips underneath the vapor barrier are connected to the discharge points above the warehouse roof via vertical risers consisting of 4-inch pipe. The pipe is attached to the venting strips, routed through the vapor barrier, and secured to structural columns or the warehouse perimeter wall. Figures 3 and 4 show a cross section of the riser assembly. Exhibit 4-5 shows a riser pipe passing through the vapor barrier and into a form for a structural column.

Exhibit 4-5: Riser Pipe Emerging from Underneath the Vapor Barrier and Entering a Column Form

The risers are constructed of galvanized steel pipe from floor surface to 10 feet above the floor surface; thereafter, the risers are constructed of polyvinyl chloride. A photo of the transition to above the floor surface is shown in Exhibit 4-6.

Exhibit 4-6: Riser Pipe Secured to a Structural Column

Twenty-one vapor sample ports are installed in select risers to allow for future sampling. The sample ports are placed approximately 10 feet above the finished concrete slab to limit access to the ports. The locations of riser pipes with sample ports are identified in Figure 2. A photo of a sample port is provided in Exhibit 4-7.

Exhibit 4-7: Riser Pipe with Sample Port and Label

4.4 Turbine Ventilators

The riser pipes are attached to wind-driven turbine ventilators above the roof of the warehouse. The connection points for the turbine ventilators are shown in Figures 3 and 4. A product data sheet for the turbine ventilators is provided in Appendix A. An image taken from the project data sheet is provided below (Exhibit 4-8).

Exhibit 4-8: Image of a Turbine Ventilator Taken from the Product Data Sheet

5 DEVIATION FROM THE ENGINEERING DESIGN

Construction of the SSDS deviated from the engineering design that was detailed in the SSDS EDR (Shannon & Wilson, 2021c) due to a proposed change in the design of the warehouse. Specifically, the proposed warehouse design was modified to reduce the elevation of the interior floor immediately inside of the loading docks to create loading dock pits. The modified SSDS was installed at the loading docks and in-between the loading docks; however, the loading dock pits were not installed during initial construction of the warehouse (i.e., the floor at the loading docks was installed at the same elevation as the main warehouse floor). Loading dock pits may be installed later without impacting the SSDS. The modified SSDS at the loading docks is unlikely to affect the efficacy of the SSDS.

The loading docks are located along the north and south walls of the warehouse and allow trailers to unload directly into the warehouse. The floor of the loading dock is at a fixed height above the exterior driveway. A typical loading dock pit is recessed into the interior floor of the loading dock to house an adjustable metal ramp (also known as a dock leveler). The adjustable metal ramp is used to bridge the gap between the trailer bed and main warehouse floor to allow for offloading from trailer beds of various heights. A stock image of a typical metal ramp within a loading dock pit is shown in Exhibit 5-1.

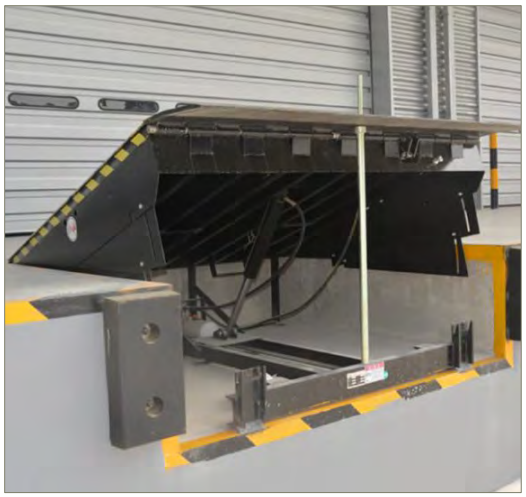

Exhibit 5-1: Stock Image of a Typical Loading Dock Pit and Metal Ramp[1]

The SSDS assembly was modified at the locations of the proposed loading dock pits and in-between the loading docks to accommodate the lower floor elevation. The modification to the SSDS consisted of sloping down the vapor barrier and vent strips from the elevation of the main floor to the elevation of the proposed loading dock pits as shown in the Contractor's drawing in Appendix B. The vent risers are placed in the standard 50-foot lateral spacing and are located between the locations of potential future loading dock pits where the floor elevation will remain the same as the main floor. The vent risers are connected to the vent strips at the top of the slope because the HVOC vapors will naturally migrate upwards; therefore, the top of the slope is an effective connection point.

6 POST-IMPLEMENTATION MONITORING

Performance monitoring will be conducted in accordance with the Compliance Monitoring Plan (Shannon & Wilson, 2021a) and will include monitoring of vapor and groundwater.

Vapor will be sampled via the sampling ports installed in the riser pipes and will be used to evaluate the concentration of vapors migrating from the HVOC groundwater plume, if present, and the change in the vapor concentration over time. Baseline vapor samples will be collected from five sampling ports, and thereafter, quarterly monitoring will be undertaken. The five sampling ports for the first two quarters will be the same as those used for the baseline sampling event. Thereafter, a randomly selected but spaced set of five ports will be sampled. After one year, if there is a significant decline (greater than 10%) in vapor concentrations, monitoring will reduce in frequency to semi-annual. Baseline vapor

[1] Source: www.transliftllc.com/loading-dock-equipment/

samples were collected on July 28, 2023 and results will be reported to Ecology in a separate document.

In accordance with the approved Compliance Monitoring Plan (Shannon & Wilson, 2021a), monitoring of SSDS vapor will cease when four consecutive events indicate the following: (a) TCE and VC concentrations in groundwater collected from monitoring wells located immediately adjacent to the warehouse are below the upper values protective of indoor air, and (b) TCE and VC concentrations in vapor samples collected from the sampling ports are below the upper values protective of indoor air.

Groundwater will be sampled from monitoring wells on the 8801 property and will be used to evaluate the potential for migration of HVOC vapors from groundwater to soil vapor. Soil vapor and groundwater samples will be analyzed for HVOCs, including TCE, PCE, and VC. Groundwater performance sampling commenced in August 2023 and results will be reported to Ecology in a separate document. The frequency of subsequent groundwater monitoring will be adjusted based on measured concentrations and trends in analytical results, per the approved Compliance Monitoring Plan (Shannon & Wilson, 2021a).

7 VAPOR EMISSION SAMPLING

The Puget Sound Clean Air Agency (PSCAA) regulates business operations that have the potential to create air pollution. PSCAA's geographic jurisdiction includes the 8801 property. The vapor discharged from the SSDS above the warehouse may have detectable concentrations of HVOCs. Sampling of the discharged vapor will be conducted to estimate the amount of chemicals present, if any, and to determine if additional measures are required to reduce the amount of chemicals being discharged.

Baseline vapor samples were collected from representative sampling ports on the vent risers on July 28, 2023. Samples were analyzed for HVOCs, including TCE, PCE, and VC by EPA Method TO-15, using gas chromatography/mass spectrometry in full scan mode. The results will be reported to Ecology in a separate document.

The detected concentrations of chemicals will be used to estimate the yearly discharge of chemicals and compared to PSCAA de minimis emission values stated in Washington Administrative Code 173-460-150. It is anticipated that the de minimis emission values will not be exceeded.

If the de minimis values are exceeded, then we will discuss potential next steps with Ecology. Potential next steps may include additional measures to reduce the mass of chemicals being discharged.

8 LIMITATIONS

The SSDS was installed under the control of CenterPoint's contractor. Shannon & Wilson periodically observed the activities of the contractor installing the SSDS and generated this report based on our observations. We have not been provided with as-built drawings by the installation contractor. The findings and conclusions documented in this report have been prepared for specific application to this project and have been developed in a manner consistent with that level of care and skill normally exercised by members of the environmental science profession currently practicing under similar conditions in this area.

Site conditions, both surface and subsurface, may be affected because of natural processes or human influence. The conclusions presented are based on interpretation of information currently available to us and are made within the operational scope, budget, and schedule constraints of this project. No warranty, express or implied, is made.

9 REFERENCES

Shannon & Wilson, 2020a, Final feasibility study, 8801 East Marginal Way S., Tukwila, Washington, agreed order no. 6069: Report prepared by Shannon & Wilson, Seattle, Wash., 21-1-12567-021, for PACCAR Inc, Bellevue, Was., July 27, available: https://apps.ecology.wa.gov/cleanupsearch/document/93568.

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0 500 1,000

Approximate Scale in Feet

Compliance Monitoring Report
Sub-Slab Depressurization System
8801 East Marginal Way S.
Tukwila, Washington

VICINITY MAP

September 2023 108056-004

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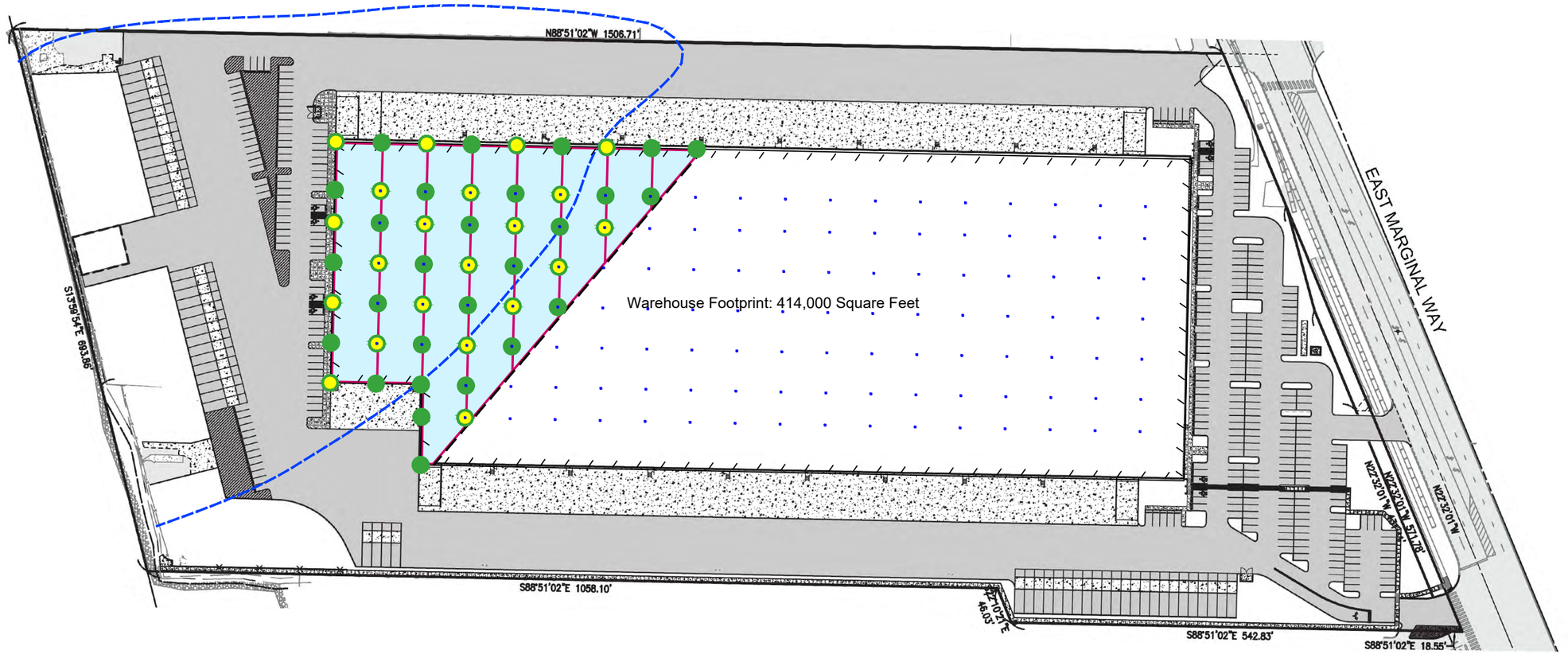
FIG. 1

Filename: C:\Users\jrs\CAD Group Dropbox\JDrive_SEA\108056\004\108056-004 Vicinity Map.dwg Date: 09-25-2023 Login: JRS



LEGEND

- Approximate Limit of HVOC Groundwater Plume Prior to Commencement of 2021 Remedial Actions.
- Footprint of the SSDS Vapor Barrier
- SSDS Vent Strips
- Structural Column
- SSDS Riser
- SSDS Riser With Sampling Port

NOTE

Figure adapted from *Cover Sheet for Centerpoint Tukwila, 8801 East Marginal Way South, Tukwila, WA 98108*, "Sheet C1.0 of 19," dated 8/4/2022, by Barghausen Consulting Engineers, Inc.

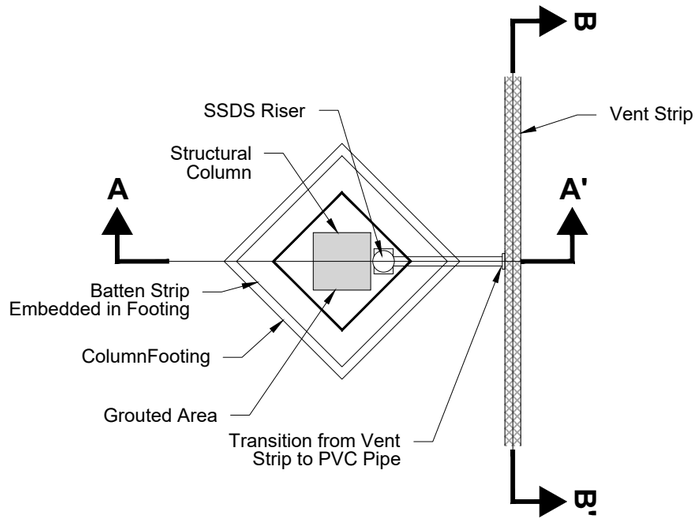
Compliance Monitoring Report
Sub-Slab Depressurization System
8801 East Marginal Way S.
Tukwila, Washington

SITE PLAN

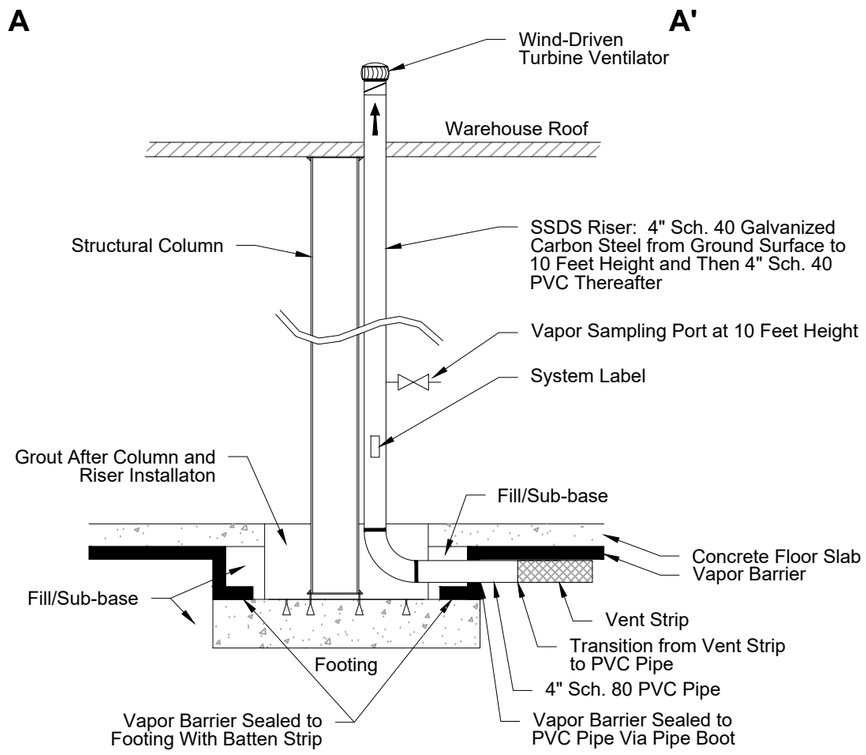
September 2023 108056-004

SHANNON & WILSON, INC. GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

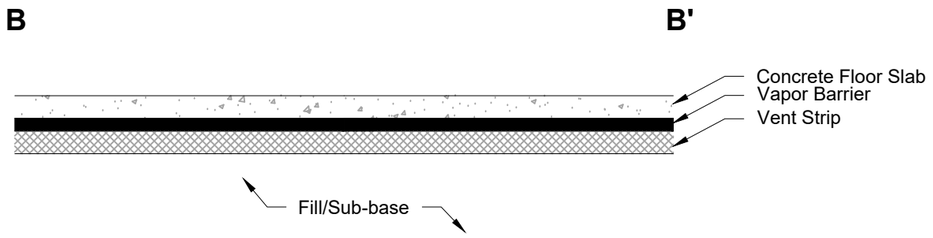
FIG. 2



PLAN VIEW
BENEATH VAPOR BARRIER



CROSS SECTION A-A'



CROSS SECTION B-B'

NOTES

1. Drawing not to scale.
2. All components not shown.

Compliance Monitoring Report
Sub-Slab Depressurization System
8801 East Marginal Way S.
Tukwila, Washington

CROSS-SECTIONS AT INTERIOR COLUMN

September 2023 108056-004

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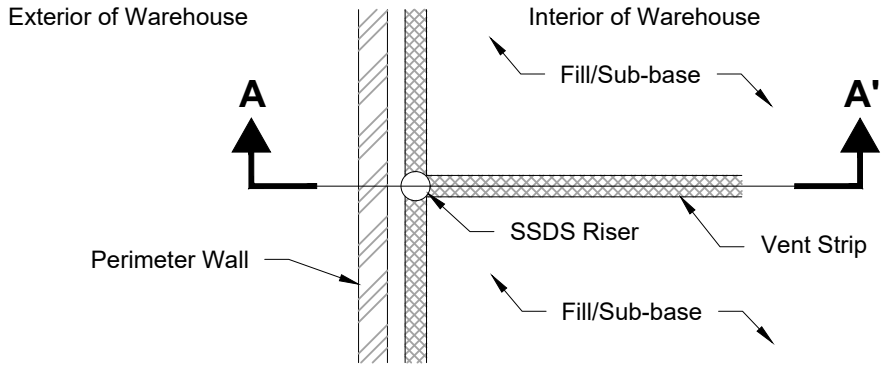
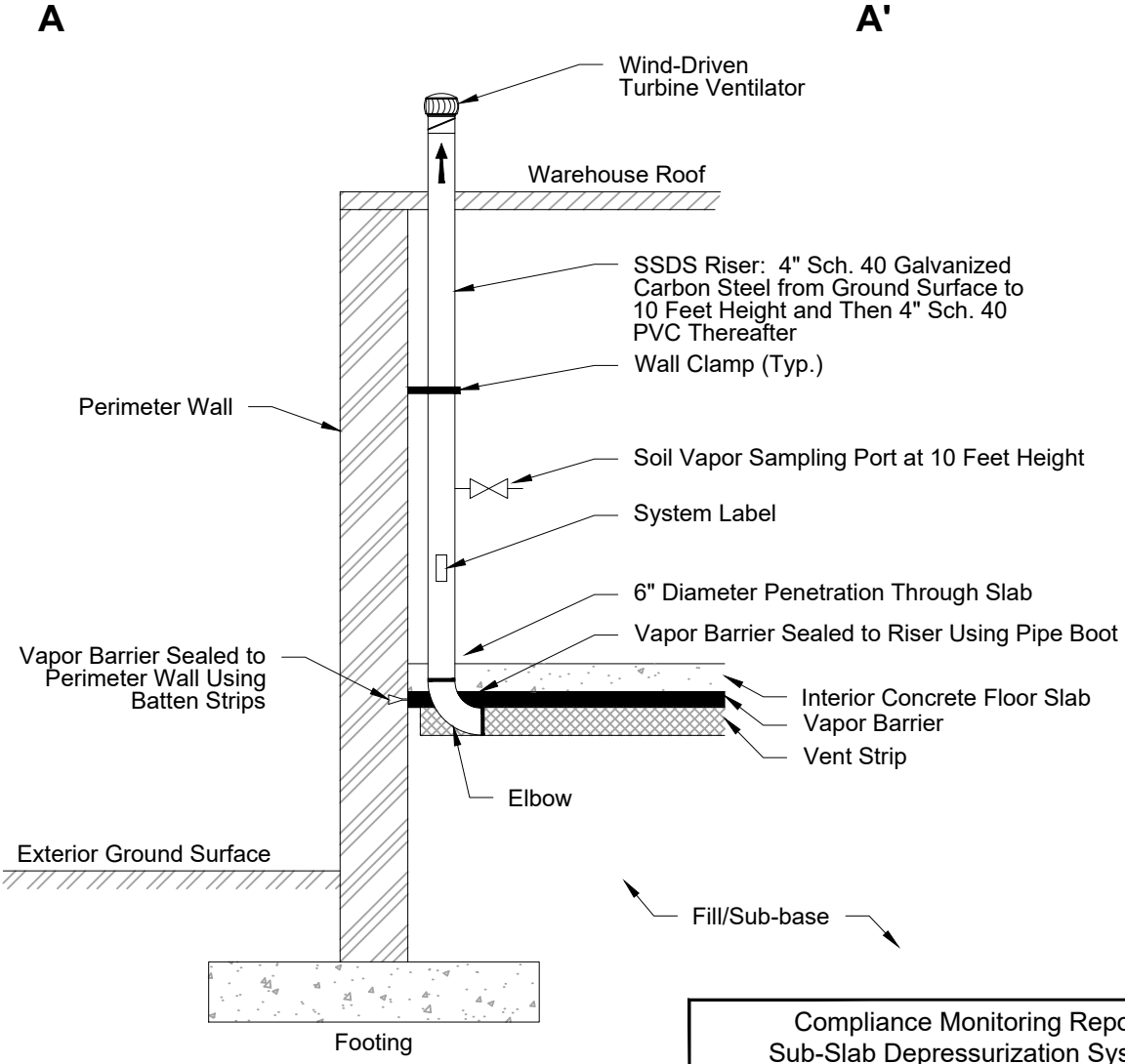
FIG. 3



PLAN VIEW
BENEATH VAPOR BARRIER



CROSS SECTION A-A'

NOTES

1. Drawing not to scale.
2. All components not shown.
3. This cross section is applicable to portion of the perimeter wall without loading docks. See the discussion in Section 5 about modifications to the SSDS near the loading docks.

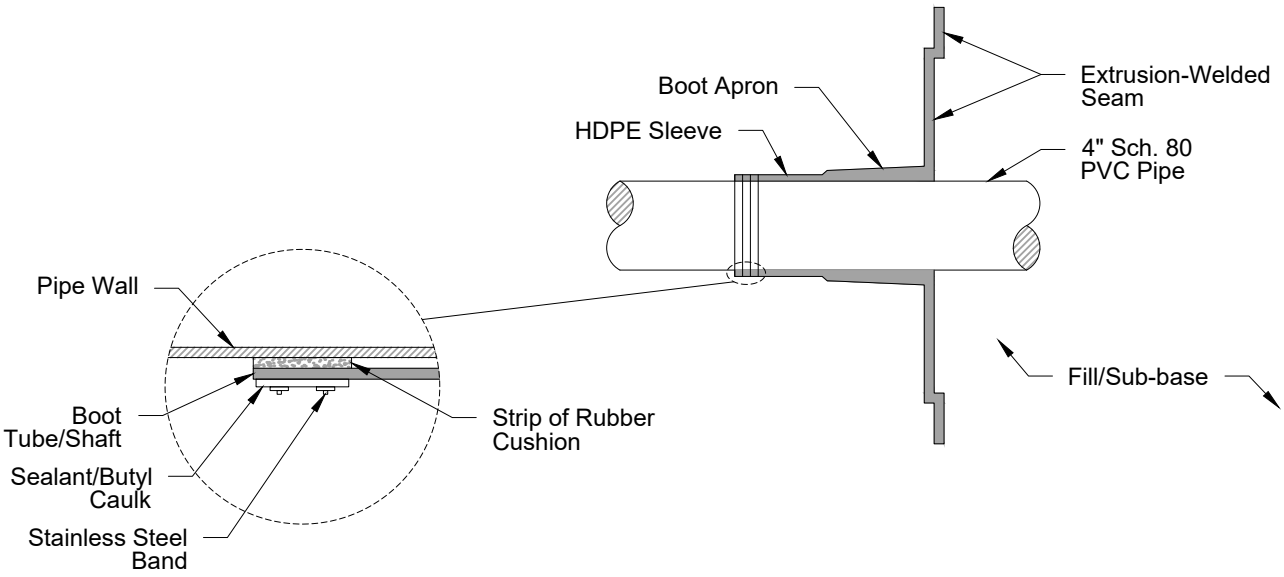
Compliance Monitoring Report
Sub-Slab Depressurization System
8801 East Marginal Way S.
Tukwila, Washington

CROSS-SECTION AT PERIMETER WALL

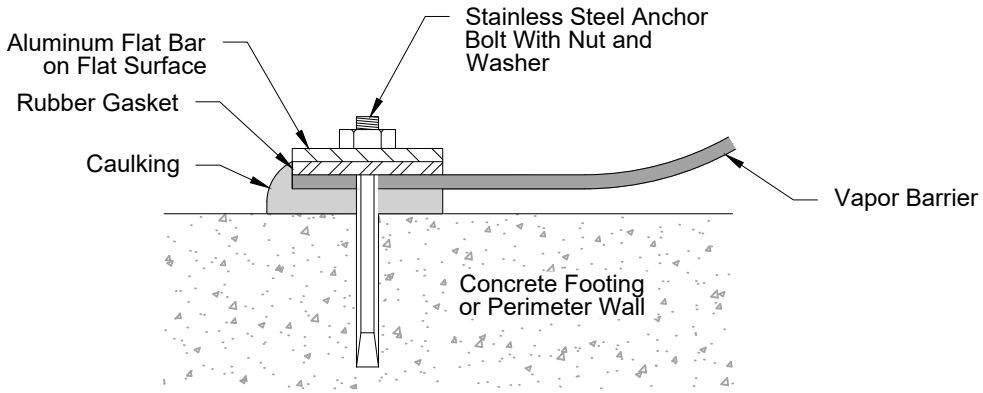
September 2023 108056-004

SHANNON & WILSON, INC. GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 4



PIPE BOOT DETAIL



BATTEN STRIP DETAIL

NOTES

1. Drawing not to scale.
2. All components not shown.

Compliance Monitoring Report
Sub-Slab Depressurization System
8801 East Marginal Way S.
Tukwila, Washington

VAPOR BARRIER ATTACHMENT DETAILS

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FIG. 5

APPENDIX A: PRODUCT DATA SHEETS

Appendix A

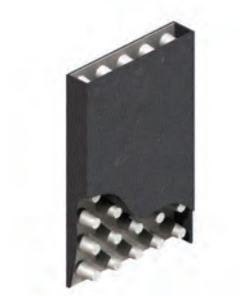
Product Data Sheets

CONTENTS

SITEDRAIN™ STRIP 6400

PREFABRICATED STRIP DRAIN

AWD
AMERICAN WICK DRAIN



PRODUCT OVERVIEW

SITEDRAIN Strip 6400 geocomposite strip drain products are composed of a dimpled polymeric perforated core fully wrapped in a nonwoven geotextile. The geotextile allows water to pass through while retaining backfill materials. The perforated core allows water collection from all sides and provides a continuous flow path to designated drainage exits.

SITEDRAIN Strip 6400 products provide a value engineered alternative to perforated pipe and aggregate subsurface drainage systems requiring moderate strength, high flow capacity, and a geotextile meeting AASHTO M288 Class 3 subsurface drainage requirements.

PROPERTY [1]	TEST METHOD	UNIT OF MEASURE	Typical Value	MARV
GEOTEXTILE				
Material [2]			PP, NPNW	PP, NPNW
Survivability	AASHTO M288	Class	3	3
Grab Tensile Strength	ASTM D4632	lbs	135	120
		N	601	534
Grab Elongation	ASTM D4632	%	60	50
CBR Puncture	ASTM D6241	lbs	365	340
		N	1,624	1,512
Trapezoidal Tear	ASTM D4533	lbs	60	50
		N	267	222
UV Resistance	ASTM D4355	% / 500 Hrs	70	70
Apparent Opening Size (AOS) [3]	ASTM D4751	sieve	70	70
		mm	0.212	0.212
Permittivity	ASTM D4491	sec^{-1}	2.4	1.7
Water Flow Rate	ASTM D4491	gpm / ft^2	175	140
		Lpm / m^2	7,130	5,704
CORE				
Compressive Strength	ASTM D6364 ASTM D1621	psf	6,000	-
		kPa	287	-
Thickness	ASTM D5199	in	1.0	-
		mm	25.4	-
In-Plane Flow Rate [4]	ASTM D4716	gpm/ft	21	-
		Lpm/m	261	-

MODEL	WIDTH	ROLL LENGTH	ROLL WEIGHT	ITEM CODE
6406	6"	150'	23 lbs	10400
6412	12"	150'	44 lbs	10410
6412	12"	500'	150 lbs	11340
6418	18"	150'	69 lbs	10420
6418	18"	500'	230 lbs	11350
6424	24"	150'	87 lbs	10430
6424	24"	500'	290 lbs	11170
6436	36"	100'	87 lbs	10440

[1] Unless otherwise noted, all physical and performance properties listed are Typical Value or Minimum Average Roll Value (MARV) as defined in ASTM D4439.
[2] PP = Polypropylene; NPNW = Needle-Punched Nonwoven; WM = Woven Monofilament; SBNW = Spunbonded Nonwoven
[3] Values for AOS represent Maximum Average Roll Value (MaxARV).
[4] In-plane flow rate measured at 3,600 psf (172 kPa) compressive load and a hydraulic gradient of 0.1.

American Wick Drain • 1209 Airport Road, Monroe, NC 28110 USA • TF: +1.800.242.9425 • PH: +1.704.238.9200 • EMAIL: info@awd-usa.com • WEB: awd-usa.com

ABSOLUTE BARRIER® Y30BAC

HIGH PERFORMANCE LLDPE/EVOH GEOMEMBRANE GAS BARRIER

RAVEN

PRODUCT DESCRIPTION

Absolute Barrier® Y30BAC is a seven-layer co-extruded geomembrane consisting of very flexible, linear-low-density polyethylene (LLDPE) with an inner core of chemically resistant EVOH barrier resin, designed specifically as a barrier against radon, methane and VOCs. High strength LLDPE provides exceptional tear and impact resistance. A robust stabilization package that exceeds the industry standard; provides long-term protection from thermal oxidation and ultraviolet degradation in exposed applications.

PRODUCT USE

Absolute Barrier® Y-Series is designed to stop gas vapor migration on Brownfield sites, in residential and commercial buildings, as well as geomembrane containment and covering systems. When installed under concrete slabs as a gas barrier, a passive system is recommended to include a ventilated system with sump(s) that could be converted to an active control system with properly designed ventilation fans. Y30BAC is over 800 times less permeable to methane gas than LLDPE vapor barriers in a comparable thickness.

Absolute Barrier® performs extremely well preventing the degradation of EPS geofoam by protecting it from harsh VOCs including direct gasoline or diesel fuel contact.

Absolute Barrier® Y30BAC is a highly effective, temporary and long-term, landfill caps with VOC diffusion coefficients ranging from 40 to 240 times less than standard 80 mil HDPE geomembranes. Contaminants found in leachate and gas in municipal and hazardous waste landfills can migrate through standard HDPE; contributing to both atmospheric and groundwater contaminations. Absolute Barrier® Y-Series is an effective barrier to a wide range of VOCs including benzene, toluene, trichloroethylene, perchloroethylene, and many others.

SIZE & PACKAGING

Absolute Barrier® Y30BAC is available in 16' c-fold or in fabricated panels up to 50,000 sq. ft. All fabricated panels are accordion folded and tightly rolled onto a heavy-duty core for ease of handling and time saving installation.

EPS Geofoam Protection

PRODUCT	PART #
ABSOLUTE BARRIER®	Y30BAC

APPLICATIONS

- EPS Geofoam Protection
- Landfill Cap
- Temporary Landfill Gas Cover
- Floating Gas Cover
- Underslab VOC Barrier
- Underslab Radon Barrier
- Underslab Methane Barrier
- Underslab Vapor Barrier
- Remediation Cover / Liner
- Leachate Collection Ponds
- Odor Control Barrier
- Secondary Containment

Absolute Barrier®

THE ULTIMATE IN GAS CONTAINMENT

ABSOLUTE BARRIER® Y30BAC

HIGH PERFORMANCE LLDPE/EVOH GEOMEMBRANE GAS BARRIER

		ABSOLUTE BARRIER® Y30BAC			
		IMPERIAL		METRIC	
PROPERTIES	TEST METHOD	MINIMUM	TYPICAL	MINIMUM	TYPICAL
Appearance		Black		Black	
Thickness	ASTM D5199	30 Mils Average	30 Mils Nominal	0.76 mm Average	0.76 mm Nominal
Weight		150 lbs/msf		732 g/m^2	
Tensile Strength at Break	ASTM D6693	85 lbs/in	100 lbs/in	149 N/cm	175 N/cm
Tensile Elongation at Break	ASTM D6693	500 %	600 %	500 %	600 %
Tear Strength	ASTM D1004	18 lbs	22 lbs	80 N	98 N
Puncture Resistance	ASTM D4833	60 lbs	75 lbs	267 N	334 N
Oxidation Induction Time (OIT) or High Pressure OIT (HPOIT)	ASTM D3895 ASTM D5885	100 min 400 min	250 min -	100 min 400 min	250 min -
Carbon Black Content [7]	ASTM D4218	2.0 %	2.3 %	2.0 %	2.3 %
Carbon Black Dispersion	ASTM D5596	Pass			
Benzene Permeance	See Note [6]	2.13 x 10^{-10} m^2/sec or 1.93 x 10^{-13} m/s			
Toluene Permeance	See Note [6]	2.95 x 10^{-10} m^2/sec or 7.77 x 10^{-14} m/s			
Ethylbenzene Permeance	See Note [6]	2.31 x 10^{-10} m^2/sec or 1.78 x 10^{-14} m/s			
M & P-Xylenes Permeance	See Note [6]	2.19 x 10^{-10} m^2/sec or 2.03 x 10^{-14} m/s			
O-Xylene Permeance	See Note [6]	2.07 x 10^{-10} m^2/sec or 1.83 x 10^{-14} m/s			
Methane Permeance	ASTM D1434	< 4.93E^{-13} m/s			
Hydrogen Sulfide	See Note [9]	1.45E^{-09} m/s			
Trichloroethylene (TCE)	See Note [6]	1.44 x 10^{-10} m^2/sec or 5.60 x 10^{-15} m/s			
Perchloroethylene (PCE)	See Note [6]	1.35 x 10^{-10} m^2/sec or 5.57 x 10^{-15} m/s			
Cold Temperature Impact	ASTM D746	-40° F		-40° C	
Maximum Static Use Temperature		180° F		82° C	
FACTORY SEAM REQUIREMENTS					
Bonded Seam Strength	ASTM D6392 Mod. [5]	57 lbs/in.	75 lbs/in.	100 N/cm	131 N/cm
Seam Peel Adhesion	ASTM D6392 Mod. [5]	45 lbs/in.	60 lbs/in.	79 N/cm	105 N/cm

[5] Raven Industries performs seam testing at 20" per minute.

[6] Aqueous Phase Film Permeance.
Permeation of Volatile Organic Compounds through EVOH Thin Film Membranes and Coextruded LLDPE/EVOH/LLDPE Geomembranes, McWatters and Rowe, Journal of Geotechnical and Geoenvironmental Engineering© ASCE/ September 2015. (Permeation is the Permeation Coefficient adjusted to actual film thickness - calculated at 1 kg/m^3.) The study used to determine PCE and TCE is titled: Evaluation of diffusion of PCE & TCE through high performance geomembranes by Di Battista and Rowe, Queens University 8 Feb 2018.

[7] No carbon black in barrier layers.

[9] The study used to determine diffusion coefficients is titled: Hydrogen Sulfide (H_2S) Transport through Simulated Interim Covers with Conventional and Co-Extruded Ethylene-Vinyl Alcohol (EVOH) Geomembranes.

Absolute Barrier® Y30BAC is a seven-layer co-extruded geomembrane consisting of very flexible, linear-low-density polyethylene (LLDPE) with an inner core of chemically resistant EVOH barrier resin, designed specifically as a barrier against radon, methane and VOCs. High strength LLDPE provides exceptional tear and impact resistance. A robust stabilization package that exceeds the industry standard; provides long-term protection from thermal oxidation and ultraviolet degradation in exposed applications.

Scan QR Code to download technical data sheets.

Note: To the best of our knowledge, unless otherwise stated, these are typical property values and are intended as guides only, not as specification limits. Chemical resistance, odor transmission, longevity as well as other performance criteria is not implied or given and actual testing must be performed for applicability in specific applications and/or conditions. RAVEN INDUSTRIES MAKES NO WARRANTIES AS TO THE FITNESS FOR A SPECIFIC USE OR MERCHANTABILITY OF PRODUCTS REFERRED TO, no guarantee of satisfactory results from reliance upon contained information or recommendations and disclaims all liability for resulting loss or damage. Limited Warranty available at www.ravenefd.com

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www.ravenefd.com

TENCATE GEOSYNTHETICS
Americas

Mirafi® 180N

Mirafi® 180N is a needlepunched nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. Mirafi® 180N is inert to biological degradation and resists naturally encountered chemicals, alkalis, and acids. Mirafi® 180N meets AASHTO M288-15 Class 1 for Elongation > 50%.

TenCate Geosynthetics Americas Laboratories are accredited by Geosynthetic Accreditation Institute – Laboratory Accreditation Program (GAI-LAP). NTPEP Listed

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value	
			MD	CD
Grab Tensile Strength	ASTM D4632	lbs (N)	205 (912)	205 (912)
Grab Tensile Elongation	ASTM D4632	%	50	50
Trapezoid Tear Strength	ASTM D4533	lbs (N)	80 (356)	80 (356)
CBR Puncture Strength	ASTM D6241	lbs (N)	500 (2224)	
			Maximum Opening Size	
Apparent Opening Size (AOS)	ASTM D4751	U.S. Sieve (mm)	80 (0.18)	
			Minimum Roll Value	
Permittivity	ASTM D4491	sec^{-1}	1.4	
Flow Rate	ASTM D4491	$gal/min/ft^2$ ($l/min/m^2$)	95 (3870)	
			Minimum Test Value	
UV Resistance (at 500 hours)	ASTM D4355	% strength retained	70	

Physical Properties	Unit	Roll Sizes	
Roll Dimensions (width x length)	ft (m)	12.5 x 360 (3.8 x 110)	15 x 300 (4.57 x 91.4)
Roll Area	yd^2 (m^2)	500 (418)	

365 South Holland Drive
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FGS000351
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GAI-LAP-25-97

Centerpoint E Marginal - Vertical

Submittal Number: **063 R1**

Submittal Date: **01/31/23**

Submittal Name: **SSDS Roof Turbine**

Subcontractor / Supplier: **State Mechanical Co.**

X REVIEWED

▪ NOTE MARKINGS

▪ REJECTED

Conor Cahill 2/7/2023

Signed Dated

THIS APPROVAL FOR DIMENSIONS ONLY

SIERRA CONSTRUCTION COMPANY, INC. GENERAL CONTRACTOR

THESE DRAWINGS/PRODUCT DATA HAVE BEEN REVIEWED BY SIERRA CONSTRUCTION CO. FOR COMPLIANCE WITH THE CONTRACT DOCUMENTS. THIS REVIEW OF ACCEPTANCE DOES NOT RELIEVE THE SUBCONTRACTOR FROM THE RESPONISIBLITY FOR CORRECTNESS AND COMPLETENESS.

SIERRA CONSTRUCTION COMPANY, INC. GENERAL CONTRACTOR

Turbine Vent

- Vents Material: Roof Ventilator Is Sturdy, Durable And Made Form High Quality Weather Resistant Materials. It Offers The Performance Of Standard Roof Venting Systems But In A Slimline, Low Finish Which Is Designed To Releases Your Trapped Air In Your Roof Space By As Much As 50 Degrees In Just Minutes.
- Vent Connect Size: 110Mm,
- Vent Function: Premium-Grade Stainless Steel Dual Ball Bearings With Integrated Molded Shield To Protect Bearings Raceway.Internally And Externally Braced; Permanently Lubricated Ball Bearings.
- Stainless Steel Exhaust Hood For: Ideal For Residential Or Light Commercial Use. Stainless Steel Turbines Fits Any Roof
- Air Vent Package: 1Pcs×Stainless Steel Roof Ventilator
- Item Weight : 1500.0 Grams

APPENDIX B: CONTRACTOR'S DRAWING OF SSDS MODIFICATION AT LOADING

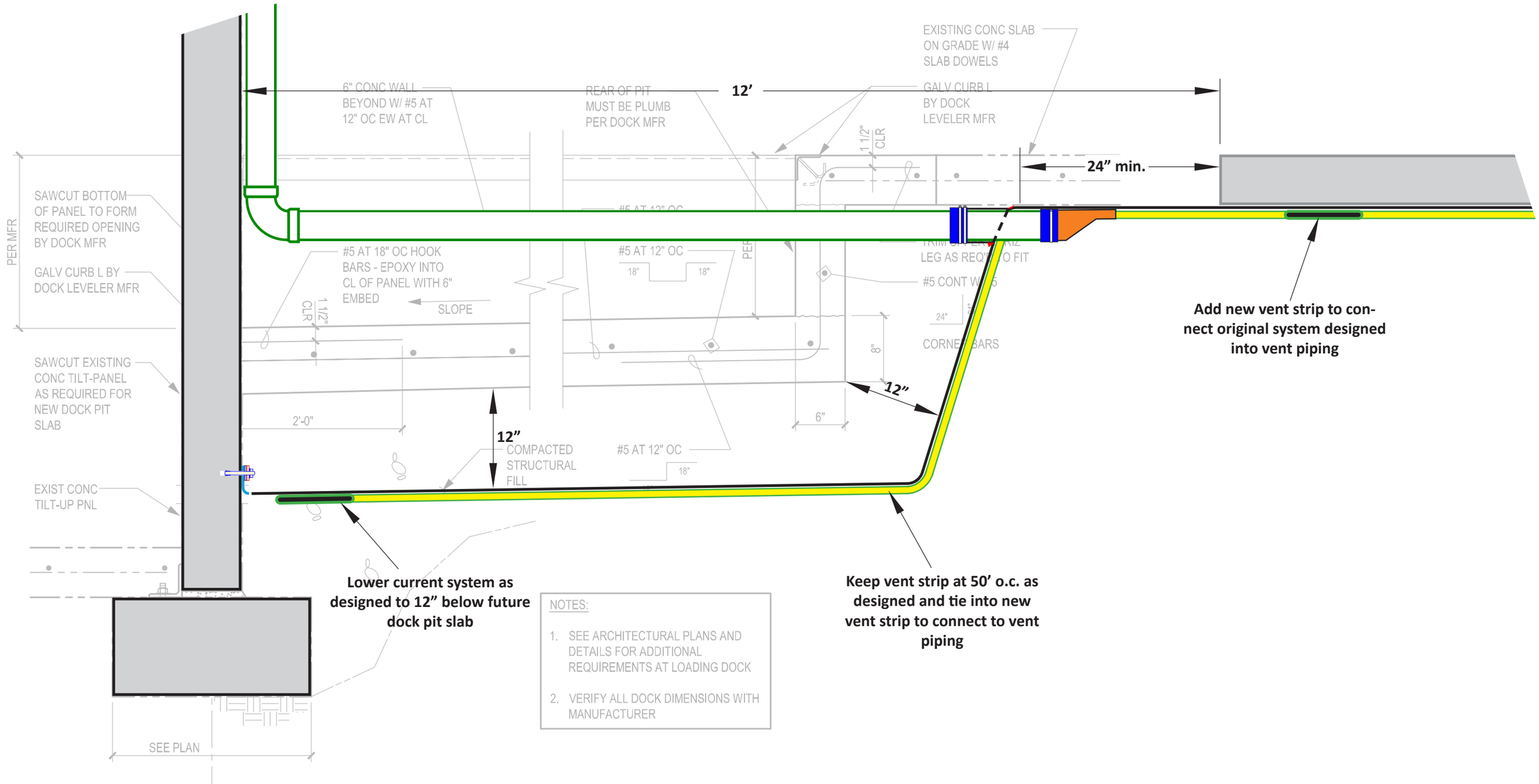
Appendix B

Contractor's Drawing of SSDS Modification at Loading Docks

CONTENTS

ACF WEST CONSTRUCTION COMPANY, INC.

8951 SE 76th Drive, Portland, OR 97206 503-802-0319 Fax: 503-517-9096



NOTES:

1. SEE ARCHITECTURAL PLANS AND DETAILS FOR ADDITIONAL REQUIREMENTS AT LOADING DOCK
2. VERIFY ALL DOCK DIMENSIONS WITH MANUFACTURER

Project:	Dock Pit Section with Barrier - Proposed Layout
Scale:	1" = 1' (ish)
Date:	February 22, 2022
Drawn by:	Jeff Boys