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INTERIM CORRECTIVE MEASURES WORK PLAN & VAPOR MITIGATION SYSTEM 100% DESIGN REPORT

FOR THE:
PROPOSED BUILDING 36 EXPANSION AT THE FORMER HOOVER FACILITY
NORTH CANTON, STARK COUNTY, OHIO

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HULL
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1.0 INTRODUCTION

1.1 Overview

Maple Street Commerce LLC (Maple Street) is the owner of the Former Hoover Facility located at 101 East Maple Street in North Canton, Ohio (Site). The Site includes multiple buildings in various states of occupancy, renovation, or vacancy. Building 36 is currently occupied by a tenant that uses the building for manufacturing, warehousing, and offices. Maple Street is working with the tenant to construct an expansion to Building 36, adding approximately 132,000 square feet of interior space, as well as site improvements, including an entrance road from Hower Street and construction of a truck turnaround area and docks. The Site is currently undergoing RCRA Corrective Actions under the direction of the U.S. EPA Region 5. It is understood that the proposed Building 36 expansion is to be designed to include shallow foundations with a bearing pressure of 2,500 pounds per square foot (psf).

There are four (4) existing ponds located within the proposed building expansion area. These ponds were previously used as industrial wastewater treatment ponds but have been closed ever since Hoover ceased operations at the Site. Environmental assessments of the Site are on-going and it is understood that additional excavations may be required to remove potentially contaminated soils within the proposed development areas. These excavation areas and existing pond areas will be backfilled with soil from on-Site and/or off-Site borrow sources. All of this work is performed in accordance with a Soils Management Plan for the Site, as well as an approved Ohio EPA Permit-to-Install (PTI) relating to the pond closures. In accordance with the drawings prepared for the Permit-to-Install Application Closure Plan – Settling Ponds 1, 2, 3, and 4, the ponds will be backfilled with compacted fill, compacted in 12-inch lifts with a minimum of 98 percent of maximum dry density as established by ASTM D698 (Standard Proctor).

This Interim Corrective Measures Work Plan & Vapor Mitigation System (VMS) 100% Design Report (the "Report") is submitted for U.S. EPA approval in accordance with paragraph 16 of the Administrative Order on Consent (AOC) executed by U.S. EPA and Maple Street on May 24, 2016.

1.2 Vapor Intrusion and Mitigation Theory and Current Practices

Vapor intrusion (VI) refers to the migration of volatile contaminants from the subsurface into overlying structures. VI generally occurs due to a combination of diffusion and advection of volatile organic compounds (VOCs) through the subsurface from sources that include contaminated soil or groundwater, non-aqueous phase liquid (NAPL), and/or stray gas into buildings through gaps or cracks in building slabs or foundation walls. The extent and severity of VI can vary based on the concentrations of source area VOCs; the horizontal and vertical location of the source in relation to the subject structure; heterogeneities in subsurface soils and/or sub-slab fill materials; the condition of the building slab and foundation features; temporal

variations in wind, temperature and atmospheric pressures contributing to the overall "stack effect" of the building; and building operations including HVAC operation, air exchange rates and occupant behaviors (i.e., opening/closing of windows and doors).

There are several mitigation approaches for preventing subsurface vapors from intruding into homes and other buildings, including active approaches (e.g., sub-slab depressurization and building pressurization through HVAC modifications) and passive approaches. While active approaches are widely considered the most practical and effective vapor intrusion mitigation strategy for existing structures (an active system is in place for the West Factory buildings on a different part of the Site), new construction typically relies on passive venting systems to provide vapor mitigation. This is because features that would otherwise be difficult to install for an existing building, can be implemented cost effectively if incorporated into the original building design (e.g., sub-slab vents, a layer of open-graded gravel, sub-slab vapor barrier).

The intent of a passive venting system is to induce a small negative pressure underneath the building slab and provide a preferential pathway for vapors to safely move from beneath the building to the ambient environment above the roof, thereby preventing VI into the building. A passive venting system is one that does not rely on any motorized equipment (i.e., blowers) to achieve the vapor mitigation goal. Instead, the passive venting system relies on a combination of thermal effects ("the stack effect", which occurs due to the differences in buoyancy of air as it is warmed by passing through a heated indoor space), and wind effects (low pressure at the exhaust pipe from wind blowing over it). Some passive systems also include a wind-driven turbine to increase the wind effect.

Because the pressure differential created in passive venting system is small, they are generally not employed as a stand-alone solution to issues of VI. In most cases of new construction where VI may be an issue, the standard approach is to combine a vapor barrier with passive venting. Therefore, for the purpose of this design report the term "passive VMS" or "passive system" will refer to the combination of a vapor barrier component and a passive venting system. Also, for the remainder of this document, the term "vapor barrier" will refer to a spray-applied flexible membrane installed underneath the building slab (as opposed to other types of vapor barriers that are not sealed at the seams or edges of the building, which are marketed to limit moisture in other building applications).

1.2.1 Industry Guidelines and Recommendations for Passive Vapor Mitigation Design

The following is a list of guidance for vapor intrusion assessment and mitigation which have informed the design of this vapor mitigation system:

OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air (U.S. EPA, June 2015)

Engineering Issue: Indoor Air Vapor Intrusion Mitigation Approaches (U.S. EPA, 2008)

Ohio EPA Sample Collection and Evaluation of Vapor Intrusion to Indoor Air: For Remedial Response, Resource Conservation and Recovery Act and Voluntary Action Programs (Ohio EPA, March 2020)

Vapor Intrusion Mitigation in Construction of New Buildings Fact Sheet (U.S. Navy, Naval Facilities Engineering Command, 2011)

Vapor Intrusion Pathway: A Practical Guideline (Interstate Technology & Regulatory Council (ITRC), 2007)

Methane Mitigation Standards (Los Angeles Department of Building and Safety, 2004)

A complete list of references is included in Section 7.0.

1.3 Purpose of VMS 100% Design Report

This Report was developed to address the need for vapor mitigation systems on new construction on the Site, as deemed necessary by the U.S. EPA during a previous public meeting.

The vapor barrier design is approved as an interim remedy, only (see EPA's July 1, 2021 Evaluation of Comment 4, and EPA's May 20, 2021 Comments 4 and 11).

1.3.1 Organization of the 100% Design Report

The Report is organized with text divided into sections, followed by figures, plates and appendices. Tables are embedded in the document for ease of reference.

The contents of Sections 1.0 through 7.0 are briefly described below.

1. Section 1.0, Introduction – provides a brief summary of the project, the Interim Measures proposed for vapor intrusion mitigation, and an overview of vapor intrusion and mitigation principles.

2. Section 2.0, Site Description – provides a brief summary of the historic and recent investigations completed at the Site, including a discussion of sub-slab soil gas and indoor air concentrations.

3. Section 3.0, Basis of Design – describes the objectives of the VMS and provides an overview of ARARs and permitting requirements.

4. Section 4.0, 100% Design – provides an overview of the VMS design, descriptions of major design components, design assumptions, constructability, and a summary of site features and design considerations evaluated during the design process.

5. Section 5.0, SSDS Construction and Work Plans – outlines the general construction sequence for the VMS and project schedule.

6. Section 6.0, VMS Startup and Performance Monitoring – provides an overview of post-construction operation and maintenance activities including system monitoring and compliance sampling activities.

7. Section 7.0, References – presents references relied upon or cited in the report.

2.0 SITE DESCRIPTION

2.1 Site Location

The Former Hoover Facility is located at 101 East Maple Street, North Canton, Ohio. The Hoover Company (referred to hereinafter as "Hoover") manufactured vacuum cleaners at the factory complex located at the Site from the late-1800s until 2007. Hoover used various chemicals in its decades of manufacturing and historical environmental investigations identified groundwater and soil impacts at and surrounding the Site. In 1999, Hoover entered into a voluntary corrective action agreement with the U.S. EPA to conduct a Site-wide cleanup and closure of a RCRA regulated unit. In 2008, Hoover sold the Site to Maple Street. Part of the Site, herein referred to as the North Yard, includes a former spray pond, wastewater treatment pond, and dewatering pond

2.2 Current Site Conditions

The Site consists of multiple buildings on the property, including an existing building (Building 36), which houses a tenant that uses it for manufacturing and warehousing. Maple Street plans to add onto the existing Building 36 to the north an additional 132,000 square feet of mixed warehouse space and office and lab space. This expansion is located in the North Yard in the area of the former wastewater ponds (primarily in Solid Waste Management Unit #2 and #4).

On behalf of Maple Street and under the direction of U.S. EPA, Hull has collected on-Site soil vapor and ambient air samples along with numerous groundwater and soil samples from on-Site and off-Site locations as part of recent on-going RCRA Facility Investigation (RFI) activities at the Site. Soil vapor and ambient air samples were used in order to assess the vapor intrusion exposure pathway. The samples were analyzed by an independent, accredited laboratory and then reviewed for quality assurance and control purposes.

Based on analysis of samples collected during the above investigation within the North Yard and historical observations of the same area, as shown on Figures 1 through 4, a chlorinated groundwater plume is present within the North Yard. This groundwater plume was identified as part of historical RFI activities, was thoroughly assessed and investigated, subjected to active remedy, and is being monitored to further evaluate natural attenuation.[1] Current RFI activities have verified the continued presence of the groundwater plume and extensive vapor/soil gas sampling as part of these RFI activities has identified adverse impacts to vapor

[1] Current groundwater data shows that natural attenuation is occurring, both in terms of contaminant concentration and size of the plume. A comprehensive assessment of groundwater data, including data from additional forthcoming RFI activities, will be completed as part of the Corrective Measures Study to evaluate the viability of a Monitored Natural Attenuation groundwater remedy for the Site.

beneath much of the North Yard. Additional RFI activities have been deemed necessary for this area and will be presented in a forthcoming RFI Work Plan Addendum.

Soil vapor sampling described above indicated that tetrachloroethene (PCE), trichloroethene (TCE), vinyl chloride, 1,1,2-Trichlorethane, chloroform and ethylbenzene exceeded respective screening levels in soil gas beneath portions of the proposed building expansion.

The above referenced groundwater plumes (see Figures 1 through 4) indicate the presence of the following chlorinated compounds in shallow groundwater beneath portions of the proposed building expansion:

1. PCE at interpolated concentrations up to 1,000 ug/L;
2. TCE at concentrations up to 1,310 ug/L;
3. cis-1,2-dicholoroehene at concentrations up to 67,700 ug/L; and
4. vinyl chloride at concentrations up to 14,000 ug/L.

Note: concentrations identified are lower than past sampling results indicated at HSB-247, HSB-150, SB-439, and SB-525, among others, and additional RFI work is planned by MSC that may alter these concentration assumptions.

Based on soil vapor sampling results, it is probable that the VOCs present in shallow groundwater and emanating as soil vapor beneath the proposed building expansion would constitute a risk of unacceptable vapor intrusion. Furthermore, based on Hull's experience in designing, overseeing construction and monitoring several VMSs under similar hydrogeologic and magnitude of impact conditions to those documented at the Site, the design described herein will be effective in mitigating risk to vapor intrusion.*see modification below

Additionally, polychlorinated biphenyls (PCBs) have been detected in the soil underneath and around the proposed building, as shown in Figures 5 through 11. Most areas near the proposed building showed concentrations of PCBs between 10 and 500 ppm, with some elevated areas above 500 ppm. Remedial activities are currently being conducted within the area in accordance with TSCA PCB cleanup regulations under 40 CFR 761.61. Based on the anticipated end use of the building, and as per the approved Self-Implementing Cleanup Plan (March 2021), concentrations of PCBs above 10 mg/kg will have been removed from the area of development below the building prior to its construction. Based on the concentrations of PCBs that may remain within the soils below the building and the proposed function of the VMS, air/vapor concerns related to PCBs are not anticipated. To confirm this, verification sampling will be conducted to show that concentrations of PCBs in the indoor air are below applicable standards. Confirmation sampling will be described in more detail in the forthcoming O&M Plan, to be submitted within 30 days of U.S. EPA's approval of the 100% Design Report.

* An evaluation of active remedies must presented in the Corrective Measure Proposal to ensure that principal threat wastes are remediated, and to reduce long-term reliance on this interim remedy (see EPA's July 1, 2021 Evaluation of comment 4, and EPA's May 20, 2021 Comments 4 and 11).

3.0 BASIS OF DESIGN

3.1 VMS Design Objectives

The objective of the VMS is to mitigate vapor intrusion to indoor air at the expansion to Building 36 intended for industrial and office use by late 2021. As discussed in Section 1.2, this will be accomplished through a passive VMS consisting of a combination of a low-permeability barrier and venting features installed underneath the slab. The VMS will be passive and will rely on environmental factors (e.g., wind and thermal gradients) to create negative pressure underneath the slab. The design should also include sample ports to aid in future operation and maintenance activities and should be able to be activated in the future if passive operation does not achieve the design goal.

3.2 VMS Design Assumptions

Hull used both public agency and industry guidance to inform the design of the VMS for the Building 36 expansion. Design considerations include: type of impermeable layer, thickness of layer, venting type, venting layout, size and number of vent risers. Most guidance for the design of passive vapor barriers has reached consensus that the impermeable layer must have a minimum thickness of 60 mil to be effective (ITRC, 2007). The size and number of vent risers is mostly dependent on the size of the building. Guidance on this point varies, but the recommended pipe sizes are between 3" and 6", which can cover a building footprint of approximately 1,500 – 15,000 square feet per vent riser, depending on the pipe size.

Venting for passive VMSs typically consist of either perforated pipe or commercial venting products (for example, a rectangular fabric-covered plastic that mimic the cross-sectional area of PVC pipe and can be rolled out for rapid installation). The venting components are installed in an open-graded gravel layer beneath the slab. Sub-slab vents are arranged in some sort of grid across the footprint of the building to provide adequate coverage. Industry guidance for the spacing between the vent strips varies, typically between 25 and 100 ft on center.

The vent risers that connect to the sub-slab venting components must be solid-walled pipe and must penetrate the roof of the building in a location at least 10 ft. away from, or 3 ft. above any window, door, roof hatch, opening or air intake. The vent risers should also terminate at least 1 foot away from any parapet wall and a minimum of 2 ft above the roof.

3.3 Appropriate Requirements

The system is designed to be in compliance with Section VIII, Paragraph 16 of the Administrative Order on Consent (AOC) dated May 24, 2016.

3.3.1 Compliance with AOC

The VMS design complies with the AOC. The design for the Building 36 Expansion VMS include the following rules and regulations at a minimum:

1. Resource Conservation and Recovery Act (RCRA) – The remedial activities will be performed in accordance with all applicable provisions of RCRA.

2. Occupational Safety and Health Administration (OSHA) – All construction and field activities, including monitoring of the VMS, will be performed in accordance with the applicable health and safety regulations governing work conducted at hazardous waste sites.

3.3.2 VMS Permitting Plan

3.3.2.1 Site Access and Easement Agreements

VMS implementation will be conducted entirely within the North Yard area of the Site, owned by Maple Street. No off-Site access agreements, easement agreements or otherwise are anticipated to be necessary for VMS construction.

3.3.2.2 Local Building Permits

The VMS will be installed as part of the overall construction of the building expansion and will not require separate building permits from the City of North Canton Department of Permits and Development.

4.0 100% DESIGN

4.1 Overview

The Vapor Mitigation System consists of two main components: an impermeable layer to mitigate vapor pathways to the indoor air space, and a venting layer connected to vent risers that penetrate the roof of the building. The VMS is based on the Nitra-Seal™ system as manufactured and sold by Land Science®. It is a 3-part barrier, consisting of a base layer that combines HDPE and geotextile, a spray-applied core layer in the middle, and top layer that also combines HDPE and geotextile. The Nitra-Seal™ system also includes a venting strip product called Terra-Vent. The venting layout connects to thirteen 4" vent risers that penetrate through the roof and terminate with wind-driven turbines. The passive venting system materials and construction as specified in the design are suitable for conversion to an active venting system, through the addition of fans or blowers at the roof, if necessary, in the future. Construction plans for the VMS are included at Appendix A and product info for the Nitra-Seal™ system is included in Appendix B.

4.2 Subgrade and Sub-Slab Venting Components

A 4-inch gravel vent layer with Terra-Vent venting strips will be installed immediately beneath the vapor barrier. To promote airflow through the gravel, the ideal gravel size is ¾" minus open graded gravel with rounded edges and <10 % fines passing through No. 4 Sieve. For this design, ODOT #57 gravel is selected because it is able to provide venting, while also meeting the needs of the slab-on-grade construction. To prevent damage to the vapor barrier, the stone must be rolled flat prior to barrier installation.

The Land Science® Terra-Vent® geo-composite venting strip is roughly equivalent to 4-inch perforated PVC pipe. The venting layout includes a perimeter vent that runs along the entire perimeter of the building, 25 ft off of the foundation. Vents run across the building approximately every 75 ft.

4.3 Impermeable Layer

The Land Science® Nitra-Seal™ vapor barrier components (Nitra-Base; 40 dry mil Nitra-Core; and Land Science Bond) should be installed directly beneath the concrete building slab. The overall thickness of the barrier will be greater than 60 mils. Spray applied vapor barriers such as this one must adhere directly to the concrete foundation features to create a complete seal across the entire building footprint. The vapor barrier will adhere to the perimeter foundation wall, interior and perimeter column footings, and any other sub-slab foundation features. See the plans for details on how the vapor barrier interacts with relevant sub-slab features, including the dock levelers at the rear of the building. The vapor barrier must also seal around all utility penetrations, including the vent risers that connect to the sub-slab vents.

4.4 Vent Risers

Vent piping for other applications is typically sized based on a design flow. But because passive systems are, by nature, dependent on environmental conditions, a design flow is not calculable and the vent piping must meet the general design objective to provide a preferential pathway for vapors to the atmosphere (instead of into the building). This is why design guidance for passive venting varies widely; most guidance recommends three to six inch diameter pipes, but some guidance includes sizes as small as 1 ½" diameter. Generally, larger diameter pipes are preferrable because they allow high flow, while minimizing pressure losses. Larger vent risers can also serve longer runs of vent strips, translating to fewer vent risers for the same area. Another principle is to select a vent riser size that is equal to or larger than the venting layer piping or vent strips, as this promotes the stack effect. In this case, the commercial venting products were selected, which have a cross-sectional area equal to a 4" diameter pipe.

Based on the above design considerations and past experience on similar projects, a 4" pipe was chosen. This pipe size will also allow the system to be activated in the future, if necessary, and is similar to the conveyance pipe sizes installed in the other active vapor mitigation systems (SSDSs) on the property at the West Factory and the Community Christian Church.

According to the Los Angeles Department of Building and Safety (LADBS) methane design standards, a building should have one 4" vent riser for every 10,000 square feet of building area (see Sheet 4, Table 2, of the LADBS Standard Plan for Methane Hazard Mitigation). Based on the size of the Building 36 expansion (132,000 sq. ft.), thirteen 4" vent risers were selected for the VMS design. Locations of the vent risers were selected to spread them evenly throughout the building and to locate them on building columns.

Each vent riser will be stubbed up through the slab and run vertically along building columns through the heated space of the building to above the roofline. Vent riser piping will be4" Sch. 40 PVC. Vent risers should be constructed as vertical runs from top of slab through to roof completion, without bends if possible. A maximum of two 45-degree elbows are generally recommended on perimeter risers to off-set the pipes from the parapet, or to route around structural beams. 90-degree elbows and horizontal runs are not recommended as they could inhibit passive venting.

Each vent riser will be equipped with a 4" ball valve and sample port. The valve will be used to close off the riser for focused sampling near the sub-slab and/or as use as a control valve for adjustment of vacuum application if the system is ever converted to an active system using a fan or blower in the future.

Each riser pipe should terminate 12 inches minimum above adjacent parapet (or 3 ft. above any air intake within 10 ft. radius); 2-ft. minimum above roof line (or 3 ft. above any air intake within 10 ft. radius) is

recommended for vents located away from parapet walls. Wind turbines will be included on each vent riser to enhance passive venting. An internally braced, galvanized steel, wind turbine (ventilator) (Empire Model TV04G, or equivalent) has been specified for this project.

5.0 VMS CONSTRUCTION AND WORK PLANS

5.1 Construction Sequence

VMS installation will occur through the following phases:

1. Bidding and contractor selection;
2. VMS Installation, consisting of:
    a. Installation of gravel venting layer, rolled flat;
    b. Installation of venting strips and vent riser stubs;
    c. Installation of spray-applied vapor barrier by a certified installer, including QA/QC testing; and
    d. Complete vent risers to above roof line, including sample ports, valves, and wind-driven turbine.
3. Initial startup and testing.

Bidding and contractor selection and coordination will be closely coordinated between Hull and Maple Street Commerce.

5.2 Quality Assurance/ Quality Control

Hull will observe the installation of the VMS to confirm that it is installed according to the construction documents and specifications. The vapor barrier will be installed by a certified installer, in accordance with all manufacturer recommendations. Coupon sampling and wet mil thickness gauge testing will be conducted to confirm a minimum of 60 mil thickness is achieved throughout the building. Smoke testing will be conducted to confirm that no punctures or leaks are present at sealed utility penetrations, foundation features, or other parts of the vapor barrier.

Hull will follow manufacturer guidance for coupon sampling and smoke testing. The manufacturer's inspector manual is included as Appendix C. In accordance with the inspector's manual, the thickness of the vapor barrier should be verified every 500-1,000 square feet, using either a wet mil gauge or by coupon sampling. Coupon sampling is the most accurate method to measure the barrier thickness, but too many coupon samples can be counter-productive; therefore, Hull recommends only taking one coupon sampler per 5,000 square feet. One smoke test can typically cover 2,000-3,000 square feet, but actual coverage is largely dependent on sub-grade characteristics. The first two or three smoke tests should be used to estimate the coverage for the site.

Hull will document the installation activities, coupon sampling, and smoke testing for the vapor barrier, which will be included in a post-construction summary report documenting VMS effectiveness.

5.3 Health and Safety Plan

Since each entity may be contracted to Hull or Maple Street, or a combination thereof, each subcontracted party will be required to follow their contractor's health and safety protocols. However, health and safety will be viewed as a collaborative effort during the project and all parties will participate in daily group tailgate meetings and work cooperatively to ensure a safe work Site.

Each company will be required to maintain a copy of their Health and Safety Plan (HASP) on-Site during the work. Hull will develop a HASP specific to VMS installation work prior to construction.

5.4 Waste Management

All wastes generated as part of the building construction will be handled in accordance with all Federal and local rules and regulations. Waste characterization samples will be collected from each specific waste stream (i.e., soil and water), when applicable, for laboratory analysis to determine the final classification for waste disposal.

5.5 Construction Schedule

The duration for installing the VMS is anticipated to be 3-4 weeks total during construction of the building. The exact schedule is dependent on the rest of the building construction, since it is important that the vapor barrier is installed just before the concrete slab is poured. Hull will inspect construction work as necessary to document that the VMS installation is being completed in accordance with the plans and specifications.

Post-construction monitoring and confirmatory sampling are expected to be complete within 6 weeks of building completion. A summary report documenting VMS effectiveness will be submitted to the U.S. EPA within 60 days of receipt of confirmatory analytical results.

6.0 VMS STARTUP AND PERFORMANCE MONITORING

6.1 Operations and Maintenance * see modifications on following page

Because the VMS is passive, it should not need regular O&M for continued operation; however, monitoring will be performed during the initial phase of the building's HVAC system operation to verify performance objectives are being met. After verification of the system's design objectives, monitoring will continue semi-annually throughout the first year, and then annually (during the heating season) after that. At each sampling event, the VMS risers and building slab will be inspected for any damage or changes that may impact the effectiveness of the system. Items that would impact the system could include broken or leaking vent riser; alterations to the building slab; new utility penetrations; or broken or poorly functioning wind turbines.

6.2 Verification of VMS Operation * see modifications on following page

Due to the passive nature of the VMS, the differential pressure between the indoor air space and sub-slab space will be small and will fluctuate with environmental conditions. Because of this, vapor mitigation guidance states that for passive systems, the best indicator of performance is indoor air sampling. For new buildings, indoor air sampling should occur between 30-45 days after the building interior is complete, to allow enough time for vapors associated with construction and new products (e.g., paint, coatings, and new furniture) to dissipate. The number and locations of the indoor air samples will be outlined in the O&M Plan, to be submitted under a separate cover. The number and locations of the samples will take into account building size and use of the indoor spaces.

The initial verification of the system's effectiveness will be considered complete after two rounds of indoor air sampling are completed with acceptable analytical results, with at least one sample set collected during the heating season. One ambient (outdoor) air sample will be collected upwind of the North Yard Area to evaluate ambient air conditions during each indoor air sampling event. All samples will be collected using 6-Liter Summa canisters regulated for 8-hr sample collection duration and submitted to Pace Analytical for laboratory analysis of target list VOCs by U.S. EPA Method TO-15 (run to detect lower levels of VOCs).

6.3 Ongoing VMS Monitoring * see modifications on following page

For the same reasons discussed above (specifically that the system is passive), the primary system performance data will consist of collection of indoor air samples to verify the performance objective is being met. The number, location and frequency of the indoor air samples will match the initial verification sample locations established in the O&M Plan, to be submitted under a separate cover.

6.4 O&M Plan * see modifications on following page

A draft O&M Plan will be submitted within 30 days of U.S. EPA's approval of this 100% Design Report.

System operations, maintenance, and monitoring will be outlined in the draft O&M Plan, and will consist primarily of:

1. Procedures and timing of initial and ongoing indoor air sampling;
2. Quality Control and Quality Assurance (QA/QC) procedures for all sampling;
3. A site-specific Quality Assurance Project Plan (submitted under separate cover on May 21, 2021, included by reference); and
4. Guidelines/checklist for visual inspections of the building and VMS. * see modifications below

The analytical results of the confirmatory samples will be compared to U.S. EPA Regional Screening Levels (RSLs) for Industrial Indoor Air. If results are below the RSLs for the target VOCs, then the VMS implementation will be deemed effective with ongoing O&M and periodic indoor air sampling in accordance with the O&M Plan. If analytical results exceed the RSLs, an evaluation will also be made to determine if materials stored within or as part of new construction may be contributing to the indoor air exceedances. The indoor air sample will be recollected following another 2 to 4 weeks. If the resampling shows analytical results exceeding the RSLs again, system operational adjustments and/or modifications to enhance performance may then be necessary and activation of the VMS by adding blowers will be evaluated. Should the system require blowers to achieve the design objective, a new design report and O&M plan will be developed. The results of the confirmatory sampling event(s) will be reported to the U.S. EPA in a summary report within 60 days of receipt of indoor air confirmatory analytical results.

6.4.1 Sampling and Analysis Plan

The existing Facility Sampling and Analysis Plan will be updated and submitted to U.S. EPA prior to system startup to include air sample collection requirements for the VMS at the Building 36 expansion. All other monitoring requirements in which laboratory analyses are not required, such as system inspections, are outlined in the draft O&M Plan.

* EPA has not received an O&M plan for the vapor barrier. Sampling data is needed before the building is determined to be suitable for occupancy, and the (future) O&M plan will require at least two years of quarterly sampling to assess seasonality, followed by annual sampling in connection with long term stewardship (see EPA's July 1, 2021 Evaluation of comment 1, and EPA's May 20, 2021 Comment 11). The use of a vapor barrier as an engineering control must also be part of a Environmental Restrictive Covenant, for which long term stewardship will require a demonstration of the barrier's effectiveness for the Building 36 100% Design in perpetuity or until cleanup levels are attained. An Environmental Restrictive Covenant includes annual reporting. Annual indoor air sampling will also be required under the 2016 AOC (see attached EPA Evaluation of comment 1, and EPA's May 20, 2021 Comment 11), to ensure saturation of the barrier material and contaminant breakthrough does not occur. Under the 2016 AOC, the sampling is needed to demonstrate that the RCRA CA725 Environmental Indicator is attained and remains valid .

7.0 REFERENCES

A variety of technical documents and publications were referred to during the preparation of this document. Some of the references consulted are presented below. Referenced documents and publications may or may not have been referenced in their entirety. The guidelines and procedures presented in the documents and publications referenced may not have been strictly adhered to unless stated otherwise.

ITRC *Vapor Intrusion Pathway: A Practical Guideline*, January 2007.

Los Angeles Department of Building and Safety. *Methane Mitigation Standards*. 2004

NJDEP *Vapor Intrusion Technical Guidance (Version 3.1)*, March 2013, Section 6.4.2.4, pp. 88.

Ohio Environmental Protection Agency. *Sample Collection and Evaluation of Vapor Intrusion to Indoor Air: For Remedial Response, Resource Conservation and Recovery Act and Voluntary Action Programs*. March 2020

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U.S. Environmental Protection Agency, Region 3 web-based guidance document. *Elements of RCRA Corrective Action, Attachment A - Corrective Measures Implementation Scope of Work*. https://www3.epa.gov/reg3wcmd/ca/pdf/RCRA_CorrectiveMeasureImpli_sow.pdf

U.S. Environmental Protection Agency. *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air*. OSWER Publication 9200.2-154. June 2015.

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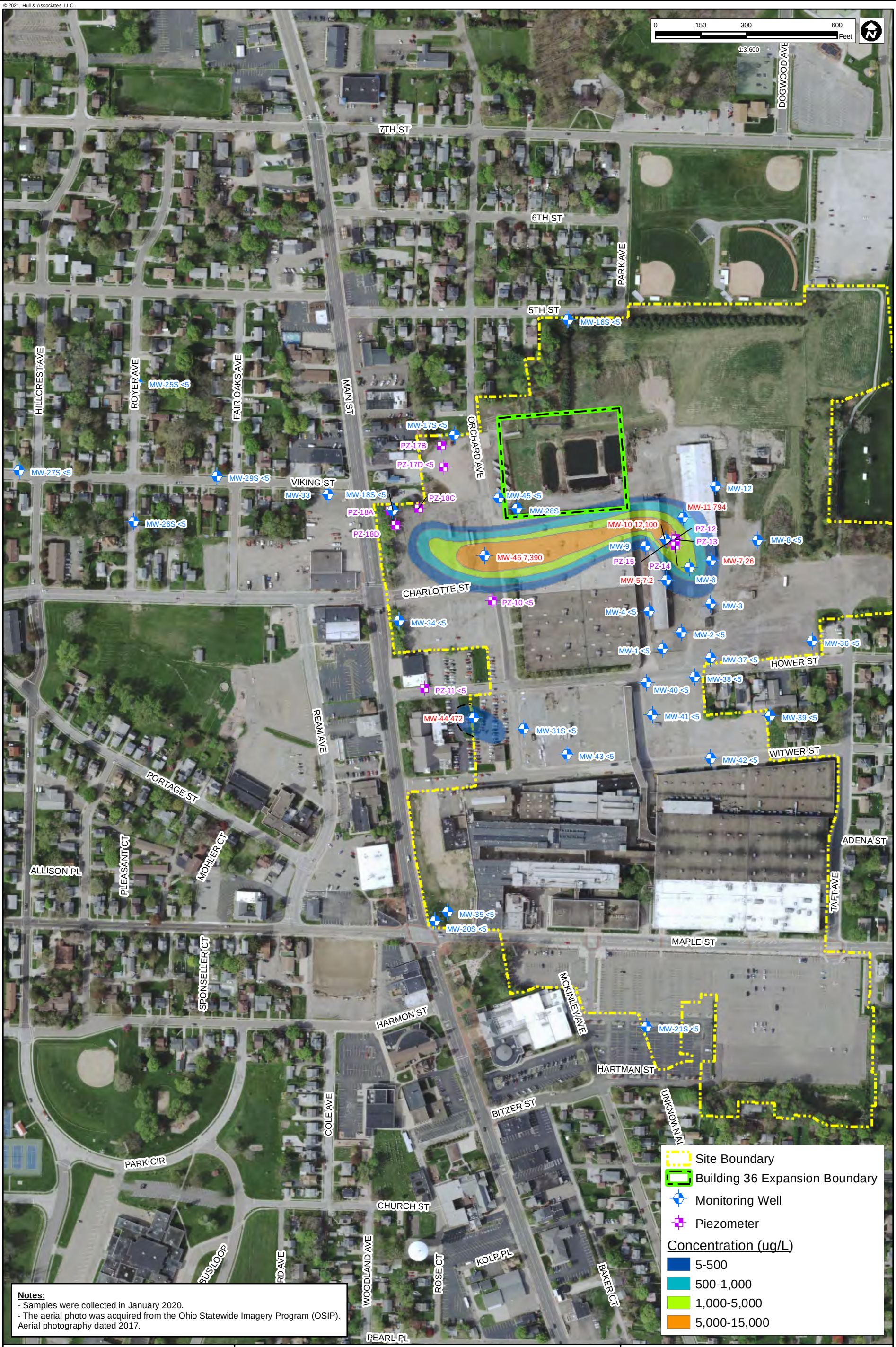
U.S. Environmental Protection Agency. 1994. *Radon Prevention in the Design and Construction of Schools and Other Large Buildings*. Air and Energy Engineering Research Laboratory EPA/625/R-92/016, Research Triangle Park, North Carolina, pp.13-14, 22.

U.S. Naval Facilities Engineering Command. Vapor Intrusion Mitigation in Construction of New Buildings Fact Sheet. 2011

FIGURES



Notes:
- Samples were collected in January 2020.
- The aerial photo was acquired from the Ohio Statewide Imagery Program (OSIP). Aerial photography dated 2017.

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June 2021

Former Hoover Facility
Interim Corrective Measures Work Plan &
Vapor Mitigation System100% Design Report

Tetrachloroethene (PCE) Groundwater Concentrations - 2020

101 E. Maple Street
North Canton, Stark County, Ohio

Figure 1

Produced Using Esri's ArcGIS Software

File Name: MPL001_89_Fig01_GwPCE2020nosewers.mxd

Edited: 6/9/2021 By: dreed

Notes:
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- The aerial photo was acquired from the Ohio Statewide Imagery Program (OSIP). Aerial photography dated 2017.

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Trichloroethene (TCE) Groundwater Concentrations - 2020

101 E. Maple Street
North Canton, Stark County, Ohio

Figure 2

Produced Using Esri's ArcGIS Software

File Name: MPL001_89_Fig02_GwTCE2020nosewers.mxd

Edited: 6/9/2021 By: dreed

0 150 300 600 Feet

1:3,600

7TH ST
6TH ST
5TH ST
DOGWOOD AVE
PARK AVE
HILLCREST AVE
ROYER AVE
FAIR OAKS AVE
MAIN ST
ORCHARD AVE
VIKING ST
CHARLOTTE ST
REAM AVE
PORTAGE ST
HOWER ST
WITWER ST
ADENA ST
TAFT AVE
ALLISON PL
PLEASANT CT
MOHLER CT
SPONSELLER CT
HARMON ST
MAPLE ST
MCKINLEY AVE
HARTMAN ST
BITZER ST
COLE AVE
PARK CIR
CHURCH ST
WOODLAND AVE
ROSE CT
KOLP PL
BAKER CT
PEARL PL

MW-27S <5
MW-29S 20.9
MW-33
MW-18S 2,610
PZ-18A
PZ-18D
PZ-18C
MW-26S <5
MW-25S <5
MW-17S <5
PZ-17B
PZ-17D 9,030
MW-45 67,700
MW-28S
MW-46 7,390
MW-12
MW-11 196
MW-10 4,120
PZ-12
PZ-13
MW-9
PZ-15
PZ-14
MW-5 168
MW-6
MW-8 <5
MW-7 131
MW-3
MW-4 <5
MW-2 <5
MW-1 <5
MW-36 <5
MW-37 <5
MW-38 <5
MW-40 <5
MW-41 58.8
MW-39 <5
MW-42 <5
MW-43 <5
MW-31S 12.4
MW-44 103
PZ-11 <5
PZ-10 23.1
MW-34 <5
MW-16S <5
MW-35 <5
MW-20S <5
MW-21S <5

Site Boundary
Building 36 Expansion Boundary
Monitoring Well
Piezometer

Concentration (ug/L)
70-250
250-500
500-5,000
5,000-30,000
30,000+

Notes:
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cis-1,2-Dichloroethene (DCE) Groundwater Concentrations - 2020

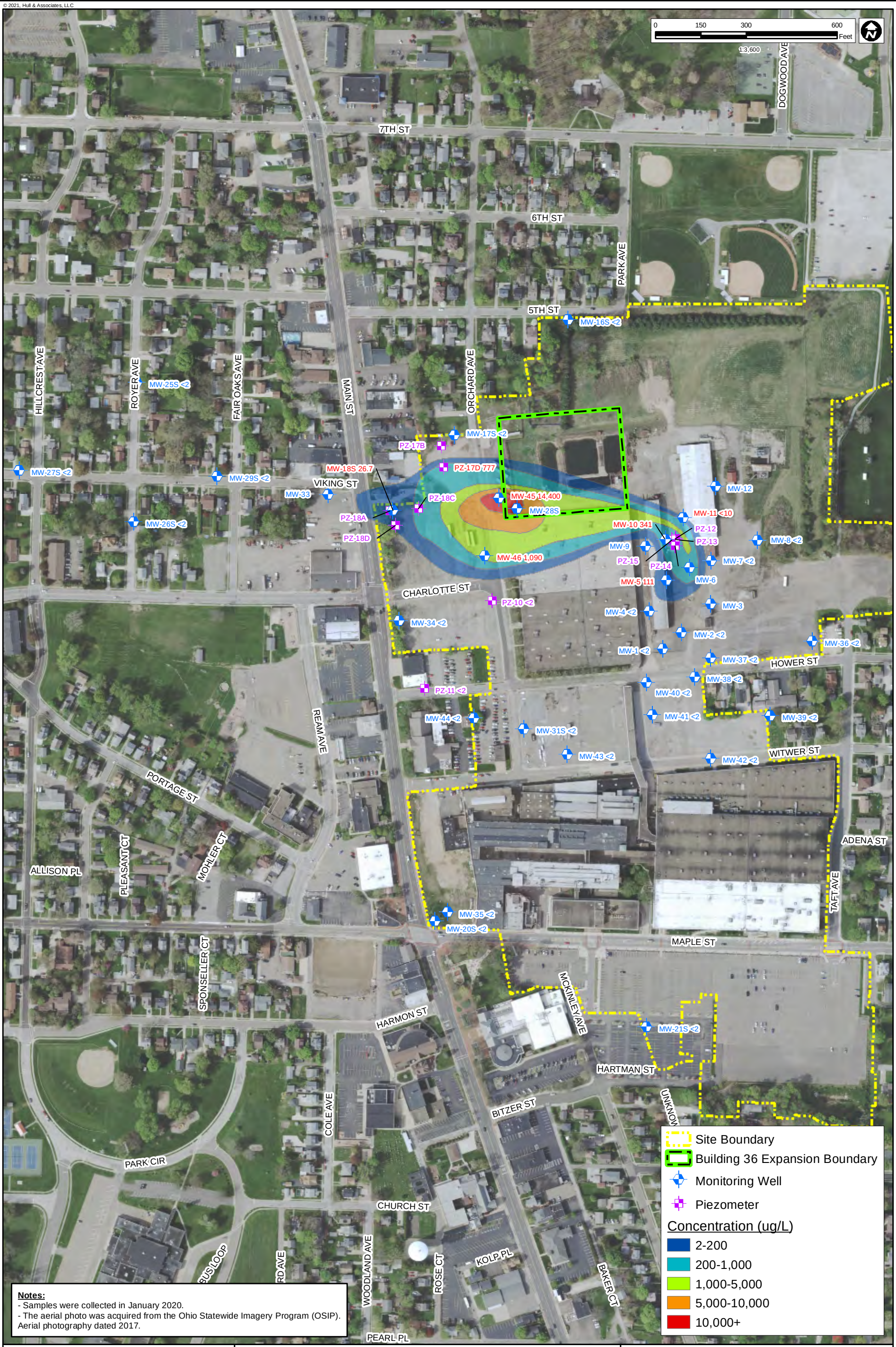
101 E. Maple Street
North Canton, Stark County, Ohio

Figure 3

Produced Using Esri's ArcGIS Software

File Name: MPL001_89_Fig03_GwDCE2020nosewers.mxd

Edited: 6/9/2021 By: dreed



Notes:
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Vinyl Chloride (VC) Groundwater Concentrations - 2020

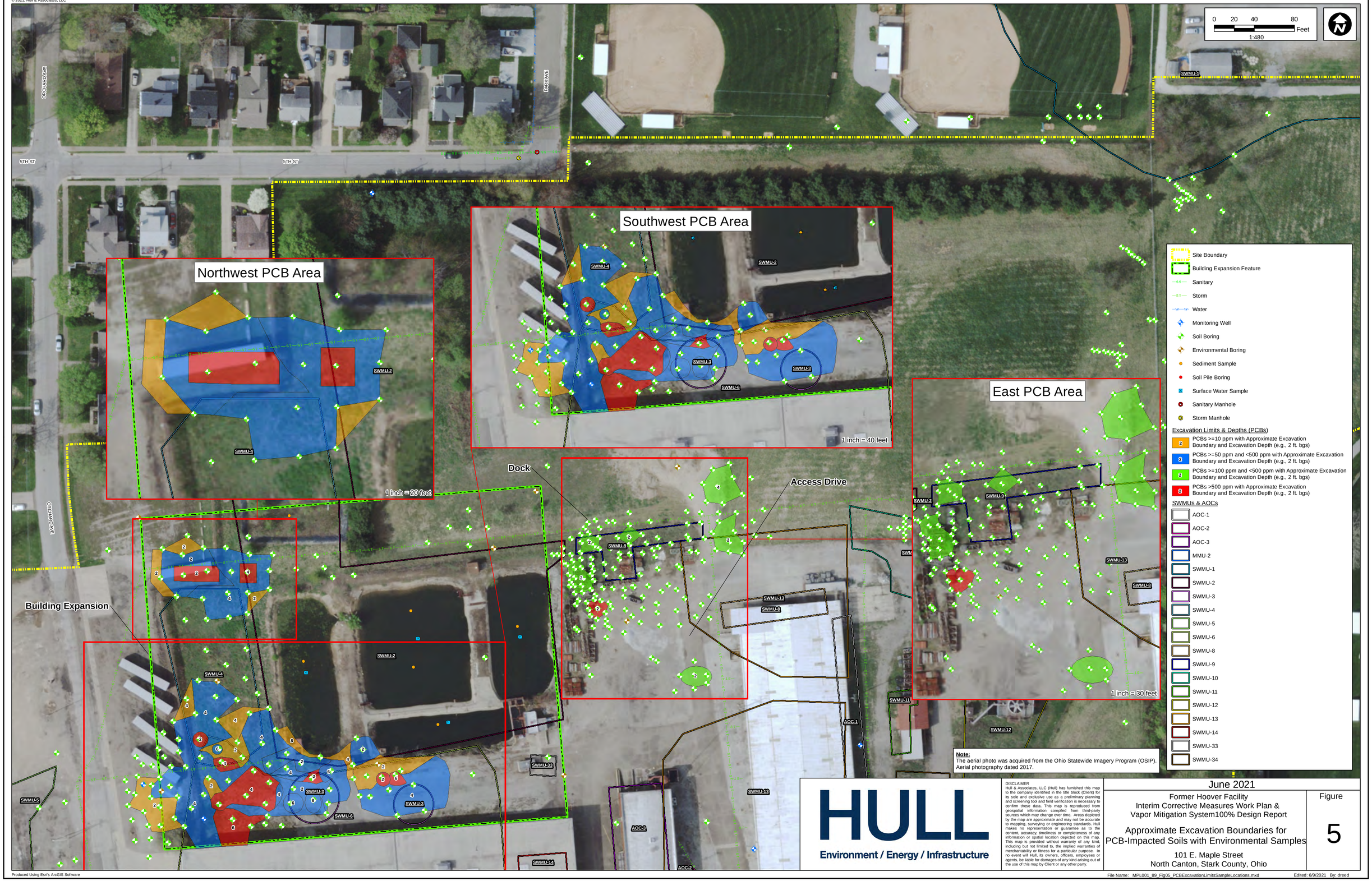
101 E. Maple Street
North Canton, Stark County, Ohio

Figure 4

Produced Using Esri's ArcGIS Software

File Name: MPL001_89_Fig04_GwVC2020nosewers.mxd

Edited: 6/9/2021 By: dreed



Note:
The aerial photo was acquired from the Ohio Statewide Imagery Program (OSIP). Aerial photography dated 2017.

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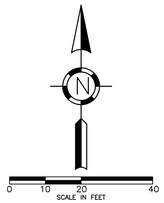
Interim Corrective Measures Work Plan &
Vapor Mitigation System100% Design Report

Approximate Excavation Boundaries for PCB-Impacted Soils with Environmental Samples

101 E. Maple Street
North Canton, Stark County, Ohio

Figure 5



NORTHWEST PCB AREA
(SEE FIGURE 7)

EAST A PCB AREA
(SEE FIGURE 10)

EAST B PCB AREA
(SEE FIGURE 11)

EAST C PCB AREA
(SEE FIGURE 11)

SOUTHWEST A PCB AREA
(SEE FIGURE 8)

SOUTHWEST B PCB AREA
(SEE FIGURE 9)

WASTEWATER POND #1

WASTEWATER POND #2

WASTEWATER POND #3

WASTEWATER POND #4

LEGEND

HSB-284 — SOIL BORING LOCATION

LIMITS OF PROPOSED EXCAVATION

2 — EXCAVATION DEPTH

AREA WHERE PCB ANALYTICAL RESULTS WERE >10 PPM AND <50 PPM AND WILL BE DISPOSED OF IN ACCORDANCE WITH 40 CFR 761.61 (A)(5)(i)(B)(2)(ii) AT A SUBTITLE D LANDFILL.

AREA WHERE PCB ANALYTICAL RESULTS WERE ≥50 PPM AND <500 PPM AND WILL BE DISPOSED OF IN ACCORDANCE WITH 40 CFR 761.61 (A)(5)(i)(B)(2)(iii) AS TSCA SPECIAL WASTE.

AREA WHERE PCB ANALYTICAL RESULTS WERE >100 PPM AND <500 PPM AND WILL BE DISPOSED OF IN ACCORDANCE WITH 40 CFR 761.61 (A)(5)(i)(B)(2)(iii) AS TSCA SPECIAL WASTE.

AREA WERE PCB ANALYTICAL RESULTS WERE ≥500 PPM AND WILL BE DISPOSED OF IN ACCORDANCE WITH 40 CFR 761.61 (A)(5)(i)(B)(2)(iii) AS TSCA SPECIAL WASTE.

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Project Title:

TSCA SELF-IMPLEMENTING CLOSURE PLAN
FORMER HOOVER FACILITY

101 E. MAPLE STREET
NORTH CANTON, STARK COUNTY, OHIO

Owner:

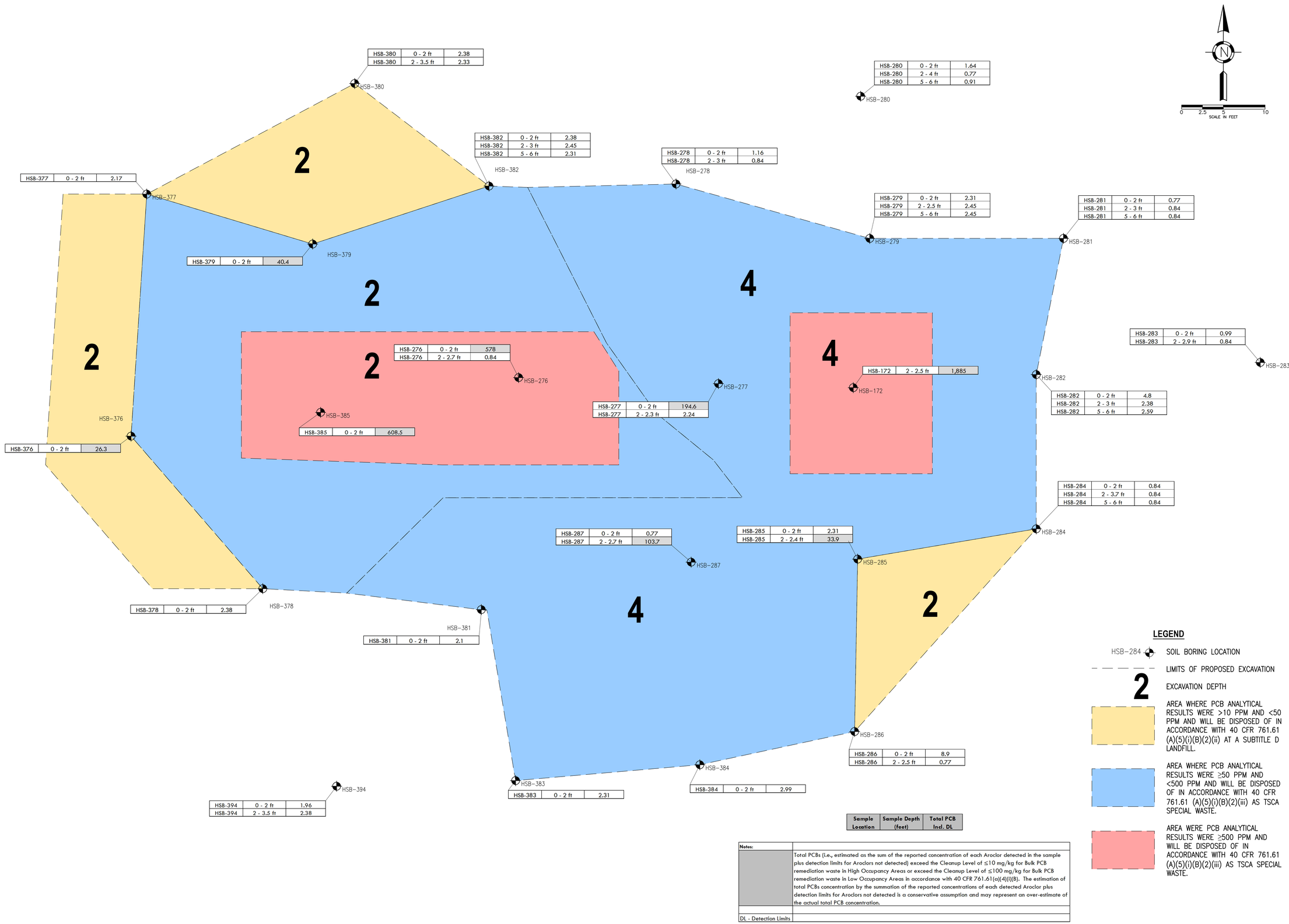
Mark	Description	Date

Project No.:	MPL001
Plot Date:	3/25/21
Layout By:	CS/SAH
Drawn By:	SAH
Check By:	CS
Scale:	AS NOTED
Issue Date:	June 2021
Sheet Title:	

OVERALL SITE
LAYOUT OF
REMEDIAL AREAS

Figure Number:
6

C:\Users\ahanson\VpnDrive\Locus\Temp\AcPublish_21604\MPL001_Excavation-Self Implementing.dwg, Fig 4, ahanson, Mar 25, 2021 - 8:39pm



Sample Location	Sample Depth (feet)	Total PCB Incl. DL

Notes:	
	Total PCBs (i.e., estimated as the sum of the reported concentration of each Aroclor detected in the sample plus detection limits for Aroclors not detected) exceed the Cleanup Level of ≤10 mg/kg for Bulk PCB remediation waste in High Occupancy Areas or exceed the Cleanup Level of ≤100 mg/kg for Bulk PCB remediation waste in Low Occupancy Areas in accordance with 40 CFR 761.61(a)(4)(i)(B). The estimation of total PCBs concentration by the summation of the reported concentrations of each detected Aroclor plus detection limits for Aroclors not detected is a conservative assumption and may represent an over-estimate of the actual total PCB concentration.
DL - Detection Limits	

LEGEND

- HSB-284 — SOIL BORING LOCATION
- LIMITS OF PROPOSED EXCAVATION
- 2 — EXCAVATION DEPTH
- AREA WHERE PCB ANALYTICAL RESULTS WERE >10 PPM AND <50 PPM AND WILL BE DISPOSED OF IN ACCORDANCE WITH 40 CFR 761.61 (A)(5)(i)(B)(2)(ii) AT A SUBTITLE D LANDFILL.
- AREA WHERE PCB ANALYTICAL RESULTS WERE ≥50 PPM AND <500 PPM AND WILL BE DISPOSED OF IN ACCORDANCE WITH 40 CFR 761.61 (A)(5)(i)(B)(2)(iii) AS TSCA SPECIAL WASTE.
- AREA WERE PCB ANALYTICAL RESULTS WERE ≥500 PPM AND WILL BE DISPOSED OF IN ACCORDANCE WITH 40 CFR 761.61 (A)(5)(i)(B)(2)(iii) AS TSCA SPECIAL WASTE.

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Mark	Description	Date

Project No.:	MPL001
Plot Date:	3/25/21
Layout By:	CS/SAH
Drawn By:	SAH
Check By:	CS
Scale:	AS NOTED
Issue Date:	June 2021

Sheet Title:

BORING LOCATIONS AND PCB DATA WITHIN NORTHWEST AREA WITH APPROXIMATE EXCAVATION BOUNDARIES

Figure Number:

7

C:\Users\shanson\AppData\Local\Temp\AcPublish_21604\MPL001_Excavation-Self Implementing.dwg, Fig 5A, shanson, Mar 25, 2021 - 8:39pm

HSB-396	0 - 2 ft	2.52
HSB-396	2 - 3 ft	2.1

HSB-396

HSB-400	0 - 2 ft	2.31
HSB-400	2 - 3 ft	2.31

HSB-400

HSED-1

HSED-1	12.1 - 62 ft	9.9
HSED-1	12.1 - 0 ft	11.15

HSB-395	0 - 2 ft	2.38
HSB-395	2 - 3 ft	2.03

HSB-395

HSB-170	0 - 2 ft	1.12

HSB-170

HSB-401	0 - 2 ft	2.45
HSB-401	2 - 2.5 ft	2.24

HSB-401

WASTEWATER POND #4

HSB-392	0 - 2 ft	2.31
HSB-392	2 - 3 ft	29.5
HSB-392	5 - 6 ft	2.03

HSB-392

HSB-399	0 - 2 ft	2.98
HSB-399	2 - 3 ft	5.07

HSB-399

HSB-403	0 - 2 ft	28.1
HSB-403	2 - 2.5 ft	2.59

HSB-403

HSB-397

HSB-397	0 - 2 ft	2.24
HSB-397	2 - 3 ft	283.2

HSB-402	0 - 2 ft	2.68
HSB-402	2 - 3 ft	2.57

HSB-402

HSB-404	0 - 2 ft	2.24
HSB-404	2 - 4 ft	2.94
HSB-404	5 - 6 ft	2.31

HSB-404

HSB-393	0 - 2 ft	2.65
HSB-393	2 - 4 ft	6.58

HSB-393

HSB-391	0 - 2 ft	2.38
HSB-391	2 - 4 ft	2.38

HSB-391

HSB-398	0 - 2 ft	3.12
HSB-398	2 - 3 ft	2.66

HSB-398

HSB-405	0 - 2 ft	2.29
HSB-405	2 - 4 ft	2.17
HSB-405	5 - 6 ft	2.17

HSB-405

HSB-390	0 - 2 ft	2.24
HSB-390	2 - 3.5 ft	2.45
HSB-390	5 - 6 ft	2.38

HSB-390

HSB-362	0 - 2 ft	3,338
HSB-362	5 - 7 ft	2.38
HSB-362	7 - 9 ft	2.45

HSB-362

HSB-367	0 - 2 ft	24.6
HSB-367	2 - 3.5 ft	426.8
HSB-367	5 - 6 ft	2.59

HSB-367

HSB-361	0 - 2 ft	3.25
HSB-361	2 - 3 ft	2.45
HSB-361	5 - 7 ft	2.27

HSB-361

HSB-365	0 - 2 ft	2.26
HSB-365	2 - 3 ft	28.6

HSB-365

HSB-359

HSB-354	0 - 2 ft	2.38
HSB-354	2 - 2.3 ft	2.8

HSB-354

HSB-359	0 - 2 ft	2.83
HSB-359	2 - 3.5 ft	2.24
HSB-359	5 - 7 ft	2.38

HSB-364	0 - 2 ft	2.8
HSB-364	2 - 35.5 ft	9.2
HSB-364	5 - 6 ft	74.7

HSB-364

HSB-369	0 - 2 ft	70.4
HSB-369	5 - 6.5 ft	2.38

HSB-369

HSB-373	0 - 1.5 ft	33.1
HSB-373	5 - 7 ft	33.1

HSB-373

HSB-361

HSB-363	0 - 2 ft	2.17
HSB-363	2 - 3.5 ft	69.6
HSB-363	5 - 6 ft	2.73

HSB-363

HSB-366	0 - 2 ft	8.85
HSB-366	5 - 7 ft	2.75

HSB-366

HSB-370	0 - 2 ft	68.6
HSB-370	2 - 3.5 ft	248.3
HSB-370	5 - 7 ft	43.9

HSB-370

HSB-266	0 - 2 ft	0.84
HSB-266	2 - 2.8 ft	0.84

HSB-266

HSB-368	0 - 2 ft	74
HSB-368	5 - 7 ft	6.7

HSB-368

HSB-357

HSB-357	0 - 2 ft	2.38
HSB-357	2 - 3 ft	3.08
HSB-357	5 - 7 ft	2.24

HSB-360

HSB-360	0 - 2 ft	2.52
HSB-360	2 - 2.5 ft	2.52
HSB-360	5 - 7 ft	2.38

HSB-268

HSB-268	0 - 2 ft	8.4
HSB-268	2 - 4 ft	5,776

HSB-273

HSB-273	0 - 2 ft	69.5
HSB-273	2 - 4 ft	27.8
HSB-273	5 - 6 ft	2.38

HSB-374

HSB-374	0 - 2 ft	71.7
HSB-374	5 - 6 ft	355.6

HSB-355

HSB-355	0 - 2 ft	4.43
HSB-355	2 - 3 ft	2.52
HSB-355	5 - 6 ft	2.45

HSB-269

HSB-269	0 - 2 ft	274.6

HSB-271

HSB-271	0 - 2 ft	330.8
HSB-271	2 - 3 ft	2,004
HSB-271	5 - 6 ft	2.72

HSB-371

HSB-371	0 - 2 ft	572.4
HSB-371	5 - 6 ft	9.1

HSB-351

HSB-351	0 - 2 ft	4.8

HSB-267

HSB-267	0 - 2 ft	45.3

HSB-272

HSB-272	0 - 2 ft	30.3
HSB-272	2 - 3.5 ft	3,628

HSB-375

HSB-375	0 - 2 ft	78.5
HSB-375	5 - 6 ft	28.2

HSB-316

HSB-316	0 - 2 ft	28.9
HSB-316	2 - 3 ft	2.17

HSB-317

HSB-317	0 - 2 ft	2.31
HSB-317	2 - 2.5 ft	2.45

HSB-274

HSB-274	0 - 2 ft	307.1
HSB-274	2 - 4 ft	2.31
HSB-274	5 - 5.5 ft	3.95

HSB-439

SB-439	0 - 2 ft	0.32
SB-439	2 - 4 ft	1.6
SB-439	4 - 6 ft	0.093
SB-439	6 - 8 ft	0.066
SB-439	8 - 10 ft	0.96

HSB-353

HSB-353	0 - 2 ft	23.5
HSB-353	2 - 2.5 ft	2.31

HSB-169

HSB-169	2 - 2.8 ft	750.8

HSB-244

HSB-244	2 - 4 ft	332.8

HSB-270

HSB-270	0 - 2 ft	328
HSB-270	2 - 3.5 ft	819.5

HSB-315

HSB-315	0 - 2 ft	2.48
HSB-315	2 - 2.8 ft	2.31

HSB-265

HSB-265	0 - 2 ft	8.6
HSB-265	2 - 2.7 ft	2.66

HSB-275

HSB-275	0 - 2 ft	241.5
HSB-275	5 - 5.5 ft	376.2

HSB-372

HSB-372	0 - 2 ft	294.2
HSB-372	2 - 3 ft	330.6
HSB-372	5 - 7 ft	352.2

HSB-245

HSB-245	2 - 4 ft	8,779

HSB-248

HSB-248	0 - 2 ft	1.04
HSB-248	2 - 3.4 ft	2,043
HSB-248	4 - 5 ft	88.8
HSB-248	8 - 10 ft	2.62

HSB-352

HSB-352	0 - 2 ft	2.52

HSB-264

HSB-264	0 - 2 ft	2.89
HSB-264	2 - 3 ft	0.84

HSB-243

HSB-243	2 - 3.5 ft	193.5
HSB-243	5 - 6 ft	8.7

HSB-123

HSB-123	10 - 12 ft	0.84
HSB-123	12 - 14 ft	0.85

HSB-356

HSB-356	0 - 2 ft	2.96
HSB-356	2 - 2.4 ft	2.24

HSB-263

HSB-263	0 - 2 ft	10.85
HSB-263	2 - 2.7 ft	2.38

HSB-246

HSB-246	2 - 4 ft	238.8
HSB-246	4 - 4.5 ft	1,773

SB-462A	4 - 6 ft	7.1
SB-462A	6 - 8 ft	0.54

SB-462A

SB-462

SB-462	0 - 2 ft	0.48
SB-462	2 - 4 ft	17

HSB-247

HSB-247	0 - 2 ft	0.77
HSB-247	2 - 4 ft	0.99
HSB-247	4 - 4.5 ft	0.77
HSB-247	9 - 11 ft	10.3

HSB-249

HSB-249	0 - 2 ft	0.77
HSB-249	2 - 2.2 ft	0.87
HSB-249	4 - 6 ft	0.77
HSB-249	8 - 10 ft	8

HSB-358

HSB-358	0 - 2 ft	20.5
HSB-358	2 - 2.8 ft	2.59

HSB-262

HSB-262	2 - 3.2 ft	1.08

Sample Location	Sample Depth (feet)	Total PCB Incl. DL

BUILDING FOUNDATION

Notes:	
	Total PCBs (i.e., estimated as the sum of the reported concentration of each Aroclor detected in the sample plus detection limits for Aroclors not detected) exceed the Cleanup Level of ≤10 mg/kg for Bulk PCB remediation waste in High Occupancy Areas or exceed the Cleanup Level of ≤100 mg/kg for Bulk PCB remediation waste in Low Occupancy Areas in accordance with 40 CFR 761.61(a)(4)(i)(B). The estimation of total PCBs concentration by the summation of the reported concentrations of each detected Aroclor plus detection limits for Aroclors not detected is a conservative assumption and may represent an over-estimate of the actual total PCB concentration.
DL - Detection Limits	

LEGEND

HSB-284 — SOIL BORING LOCATION

— — — LIMITS OF PROPOSED EXCAVATION

2 — EXCAVATION DEPTH

AREA WHERE PCB ANALYTICAL RESULTS WERE >10 PPM AND <50 PPM AND WILL BE DISPOSED OF IN ACCORDANCE WITH 40 CFR 761.61 (A)(5)(i)(B)(2)(ii) AT A SUBTITLE D LANDFILL.

AREA WHERE PCB ANALYTICAL RESULTS WERE ≥50 PPM AND <500 PPM AND WILL BE DISPOSED OF IN ACCORDANCE WITH 40 CFR 761.61 (A)(5)(i)(B)(2)(iii) AS TSCA SPECIAL WASTE.

AREA WERE PCB ANALYTICAL RESULTS WERE ≥500 PPM AND WILL BE DISPOSED OF IN ACCORDANCE WITH 40 CFR 761.61 (A)(5)(i)(B)(2)(iii) AS TSCA SPECIAL WASTE.

0 5 10 20
SCALE IN FEET

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Project Title:

TSCA SELF-IMPLEMENTING CLOSURE PLAN
FORMER HOOVER FACILITY
101 E. MAPLE STREET
NORTH CANTON, STARK COUNTY, OHIO

Owner:

Mark	Description	Date

Project No.:	MPL001
Plot Date:	3/25/21
Layout By:	CS/SAH
Drawn By:	SAH
Check By:	CS
Scale:	AS NOTED
Issue Date:	June 2021

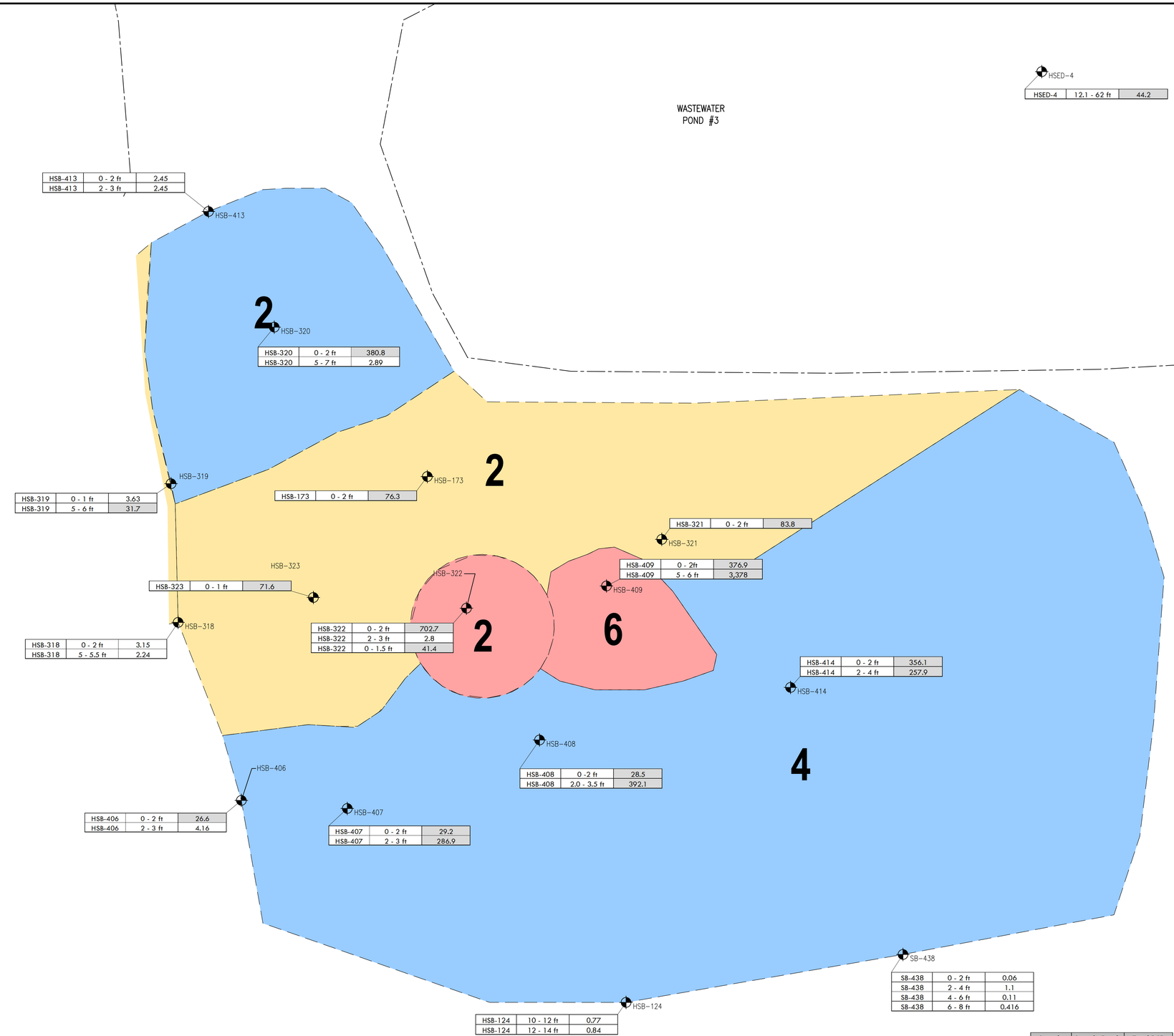
Sheet Title:

BORING LOCATIONS AND PCB DATA WITHIN SOUTHWEST A AREA WITH APPROXIMATE EXCAVATION BOUNDARIES

Figure Number:

8

C:\Users\shanson\AppData\Local\Temp\AcPublish_21604\MPL001_Excavation--Self Implementing.dwg, FIG SB, shanson, Mar 25, 2021 - 8:39pm



Sample Location	Sample Depth (feet)	Total PCB Incl. DL

Notes:	
	Total PCBs (i.e., estimated as the sum of the reported concentration of each Aroclor detected in the sample plus detection limits for Aroclors not detected) exceed the Cleanup Level of ≤10 mg/kg for Bulk PCB remediation waste in High Occupancy Areas or exceed the Cleanup Level of ≤100 mg/kg for Bulk PCB remediation waste in Low Occupancy Areas in accordance with 40 CFR 761.61(a)(4)(i)(B). The estimation of total PCBs concentration by the summation of the reported concentrations of each detected Aroclor plus detection limits for Aroclors not detected is a conservative assumption and may represent an over-estimate of the actual total PCB concentration.
DL - Detection Limits	

LEGEND

- HSB-284 — SOIL BORING LOCATION
- LIMITS OF PROPOSED EXCAVATION
- 2 — EXCAVATION DEPTH
- AREA WHERE PCB ANALYTICAL RESULTS WERE >10 PPM AND <50 PPM AND WILL BE DISPOSED OF IN ACCORDANCE WITH 40 CFR 761.61 (A)(5)(i)(B)(2)(ii) AT A SUBTITLE D LANDFILL.
- AREA WHERE PCB ANALYTICAL RESULTS WERE ≥50 PPM AND <500 PPM AND WILL BE DISPOSED OF IN ACCORDANCE WITH 40 CFR 761.61 (A)(5)(i)(B)(2)(iii) AS TSCA SPECIAL WASTE.
- AREA WERE PCB ANALYTICAL RESULTS WERE ≥500 PPM AND WILL BE DISPOSED OF IN ACCORDANCE WITH 40 CFR 761.61 (A)(5)(i)(B)(2)(iii) AS TSCA SPECIAL WASTE.

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www.hullinc.com

Project Title:

TSCA SELF-IMPLEMENTING CLOSURE PLAN
FORMER HOOVER FACILITY
101 E. MAPLE STREET
NORTH CANTON, STARK COUNTY, OHIO

Owner:

Mark	Description	Date

Project No.:	MPL001
Plot Date:	3/25/21
Layout By:	CS/SAH
Drawn By:	SAH
Check By:	CS
Scale:	AS NOTED
Issue Date:	June 2021

Sheet Title:

BORING LOCATIONS AND PCB DATA WITHIN SOUTHWEST B AREA WITH APPROXIMATE EXCAVATION BOUNDARIES

Figure Number:

9

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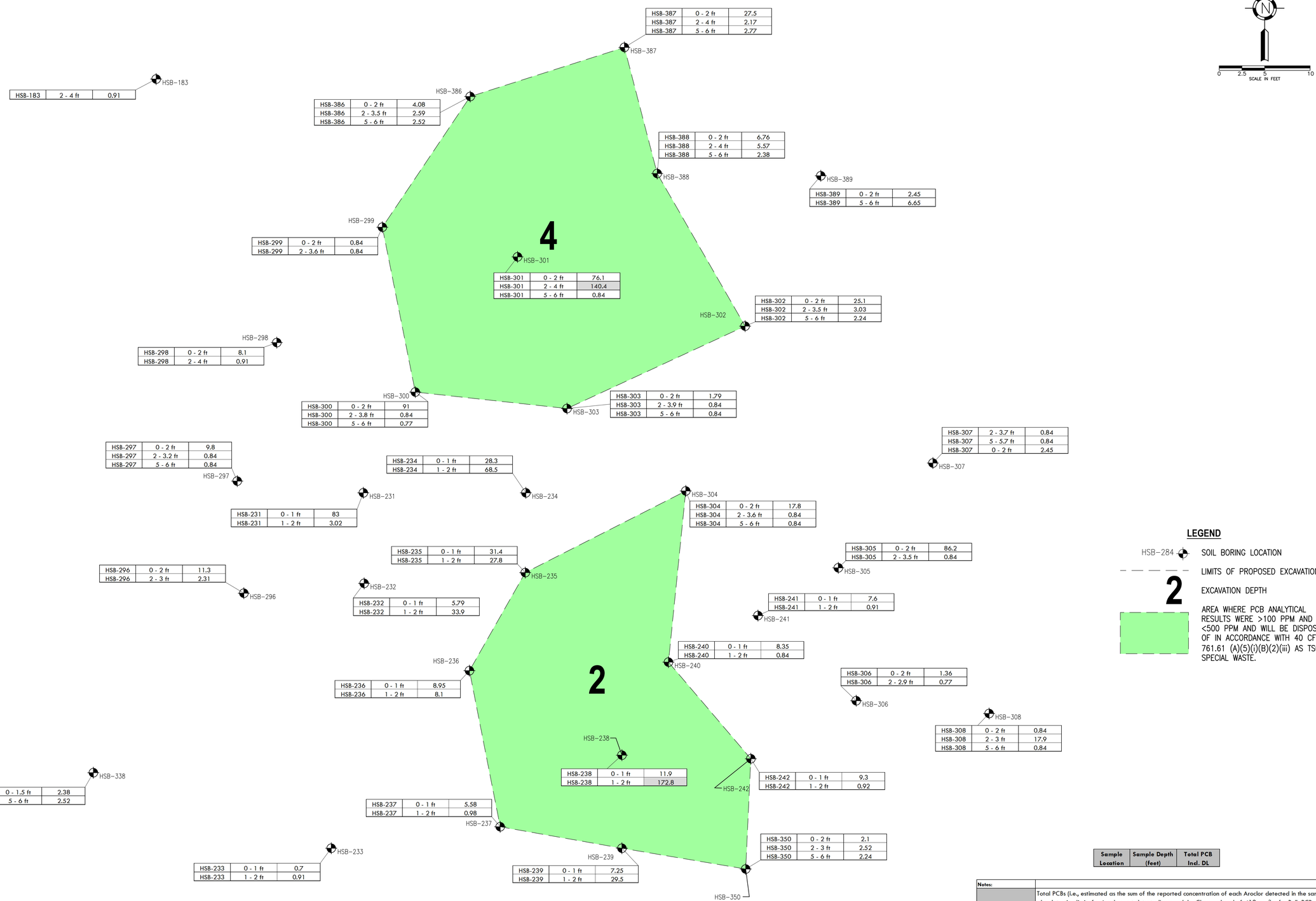

LEGEND

HSB-284 — SOIL BORING LOCATION

LIMITS OF PROPOSED EXCAVATION

2 — EXCAVATION DEPTH

AREA WHERE PCB ANALYTICAL RESULTS WERE >100 PPM AND <500 PPM AND WILL BE DISPOSED OF IN ACCORDANCE WITH 40 CFR 761.61 (A)(5)(i)(B)(2)(iii) AS TSCA SPECIAL WASTE.

Sample Location	Sample Depth (feet)	Total PCB Incl. DL

Notes:	
	Total PCBs (i.e., estimated as the sum of the reported concentration of each Aroclor detected in the sample plus detection limits for Aroclors not detected) exceed the Cleanup Level of ≤10 mg/kg for Bulk PCB remediation waste in High Occupancy Areas or exceed the Cleanup Level of ≤100 mg/kg for Bulk PCB remediation waste in Low Occupancy Areas in accordance with 40 CFR 761.61(a)(4)(i)(B). The estimation of total PCBs concentration by the summation of the reported concentrations of each detected Aroclor plus detection limits for Aroclors not detected is a conservative assumption and may represent an over-estimate of the actual total PCB concentration.
DL - Detection Limits	

TSCA SELF-IMPLEMENTING CLOSURE PLAN
FORMER HOOVER FACILITY
101 E. MAPLE STREET
NORTH CANTON, STARK COUNTY, OHIO

BORING LOCATIONS AND PCB DATA WITHIN EAST A AREA WITH APPROXIMATE EXCAVATION BOUNDARIES

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Owner:

Mark	Description	Date

Project No.:	MPL001
Plot Date:	3/25/21
Layout By:	CS/SAH
Drawn By:	SAH
Check By:	CS
Scale:	AS NOTED
Issue Date:	June 2021
Sheet Title:	

Figure Number:
10

C:\Users\shanson\AppData\Local\Temp\AcPublish_21604\MPL001_Excavation-Self Implementing.dwg, Fig 50, shanson, Mar 25, 2021 - 8:39pm

EAST B

Sample Location	Sample Depth (feet)	Total PCB Incl. DL
HSB-343	0 - 2 ft	2.33
HSB-343	2 - 3 ft	2.24
HSB-343	5 - 6 ft	2.45
HSB-291	5 - 6 ft	2.38
HSB-291	0 - 2 ft	14.2
HSB-344	0 - 2 ft	2.45
HSB-344	2 - 2.5 ft	2.66
HSB-344	5 - 6 ft	2.38
HSB-292	0 - 2 ft	0.91
HSB-292	2 - 2.5 ft	0.84
HSB-292	5 - 6 ft	0.77
HSB-341	0 - 2 ft	5.29
HSB-341	5 - 6 ft	2.38
HSB-342	0 - 2 ft	28.3
HSB-340	0 - 2 ft	44.1
HSB-340	5 - 6 ft	2.25
HSB-345	0 - 2 ft	57.6
HSB-290	0 - 2 ft	0.98
HSB-290	2 - 3 ft	1.47
HSB-295	0 - 1 ft	12
HSB-218	0 - 1 ft	85.5
HSB-218	1 - 2 ft	471.3
HSB-219	0 - 1 ft	1.57
HSB-219	1 - 1.5 ft	0.91
HSB-339	0 - 2 ft	8.35
HSB-339	5 - 6 ft	2.45
HSB-260	0 - 2 ft	126.2
HSB-258	0 - 1.5 ft	8.5
HSB-333	0 - 1.5 ft	0.91
HSB-261	0 - 2 ft	0.77
HSB-214	0 - 1 ft	3.36
HSB-214	1 - 2 ft	3.08
HSB-220	0 - 1 ft	71.9
HSB-220	1 - 2 ft	31.5
HSB-334	0 - 1 ft	9.1
HSB-334	1 - 2 ft	10.1
HSB-259	0 - 1.5 ft	0.88
HSB-332	0 - 2 ft	0.77
HSB-331	0 - 2 ft	25.8
HSB-331	2 - 2.5 ft	0.84
SB-690	0 - 2 ft	3.2
HSB-257	0 - 1.8 ft	1.23
HSB-199	0 - 1 ft	78.4
HSB-199	1 - 2 ft	2.66
SB-744	0 - 2 ft	18
HSB-330	0 - 2 ft	6.93
HSB-330	2 - 2.5 ft	3.15
HSB-190	0 - 1 ft	339.5
HSB-190	1 - 2 ft	2.38
HSB-329	0 - 2 ft	6.7
HSB-329	2 - 2.5 ft	2.52
HSB-213	0 - 1 ft	0.77
HSB-213	1 - 2 ft	0.77
HSB-222	0 - 1 ft	8.65
HSB-222	1 - 2 ft	14.4
HSB-191	0 - 1 ft	245.5
HSB-191	1 - 1.5 ft	21
HSB-200	0 - 1 ft	45.4
HSB-200	1 - 2 ft	2.59
HSB-209	2 - 2.5 ft	2.94
HSB-216	2 - 2.5 ft	0.82
HSB-210	0 - 1 ft	0.77
HSB-210	1 - 1.7 ft	0.77
HSB-328	0 - 2 ft	0.86
HSB-201	0 - 1 ft	11.7
HSB-201	1 - 2 ft	271.9
HSB-327	0 - 2 ft	4.22
HSB-211	0 - 1 ft	0.77
HSB-211	1 - 2 ft	0.77
HSB-221	2 - 3 ft	1.23
HSB-192	0 - 1 ft	21.8
HSB-192	1 - 2 ft	43.8
HSB-202	0 - 1 ft	28.7
HSB-202	1 - 2 ft	3.1
HSB-326	0 - 2 ft	78.9
HSB-326	2 - 3 ft	0.85
HSB-193	0 - 1 ft	55.2
HSB-193	1 - 2 ft	91.7
HSB-203	0 - 1 ft	64.9
HSB-203	1 - 2 ft	10.3
HSB-212	0 - 1 ft	0.7
HSB-212	1 - 2 ft	4.25
HSB-289	0 - 2 ft	2.1
HSB-325	0 - 2 ft	27.7
HSB-324	0 - 2 ft	39
HSB-324	2 - 3 ft	2.31
HSB-194	0 - 1 ft	29.3
HSB-194	1 - 2 ft	38.2
HSB-204	0 - 1 ft	33.7
HSB-204	1 - 2 ft	610.6
HSB-195	0 - 1 ft	36.9
HSB-195	1 - 2 ft	12
HSB-205	0 - 1 ft	0.7
HSB-205	1 - 2 ft	0.693
HSB-288	0 - 2 ft	14.2
HSB-206	0 - 1 ft	3.02
HSB-206	1 - 2 ft	36.4
HSB-196	0 - 1 ft	13.4
HSB-196	1 - 2 ft	2.52
HSB-207	0 - 1 ft	0.7
HSB-207	1 - 2 ft	0.77
HSB-197	0 - 1 ft	0.7
HSB-197	1 - 2 ft	0.7
HSB-208	0 - 1 ft	27.6
HSB-208	1 - 2 ft	25.3
HSB-181	2 - 3.5 ft	3.52
HSB-346	0 - 2 ft	6.55
HSB-347	0 - 2 ft	28.7
SB-704	0 - 2 ft	16
HSB-225	0 - 1 ft	65.3
HSB-225	1 - 2 ft	2.52
HSB-224	2 - 2.4 ft	4.9
HSB-227	2 - 2.5 ft	2.31
HSB-230	0 - 1 ft	42
HSB-230	1 - 2 ft	2.61
HSB-228	0 - 1 ft	0.77
HSB-228	1 - 2 ft	2.59
HSB-223	0 - 1 ft	0.7
HSB-223	1 - 2 ft	2.66
HSB-217	2 - 2.5 ft	2.31
HSB-215	2 - 2.5 ft	0.92
HSB-349	0 - 2 ft	2.77
HSB-229	0 - 1 ft	2.59
HSB-229	1 - 2 ft	28.7
HSB-348	0 - 2 ft	25
HSB-348	2 - 3 ft	2.38

Notes:

Total PCBs (i.e., estimated as the sum of the reported concentration of each Aroclor detected in the sample plus detection limits for Aroclors not detected) exceed the Cleanup Level of ≤10 mg/kg for Bulk PCB remediation waste in High Occupancy Areas or exceed the Cleanup Level of ≤100 mg/kg for Bulk PCB remediation waste in Low Occupancy Areas in accordance with 40 CFR 761.61(a)(4)(i)(B). The estimation of total PCBs concentration by the summation of the reported concentrations of each detected Aroclor plus detection limits for Aroclors not detected is a conservative assumption and may represent an over-estimate of the actual total PCB concentration.

DL - Detection Limits

EAST C

Sample Location	Sample Depth (feet)	Total PCB Incl. DL
HSB-310	2 - 3.3 ft	11.2
HSB-310	2 - 3 ft	9.4
HSB-310	0 - 2 ft	93.4
HSB-311	0 - 2 ft	118.3
HSB-311	2 - 3 ft	1.43
HSB-184	0 - 2 ft	112.4
HSB-309	2 - 2.5 ft	1.18
HSB-309	0 - 2 ft	15.9
HSB-312	0 - 2 ft	89.8
HSB-312	2 - 2.4 ft	23.8
HSB-313	0 - 2 ft	0.84
HSB-313	2 - 3 ft	0.84
HSB-313	5 - 6 ft	0.84

SCALE IN FEET: 0, 2.5, 5, 10

LEGEND

- HSB-284 — SOIL BORING LOCATION
- LIMITS OF PROPOSED EXCAVATION
- 2 — EXCAVATION DEPTH
- AREA WHERE PCB ANALYTICAL RESULTS WERE >100 PPM AND <500 PPM AND WILL BE DISPOSED OF IN ACCORDANCE WITH 40 CFR 761.61 (A)(5)(i)(B)(2)(iii) AS TSCA SPECIAL WASTE.
- AREA WERE PCB ANALYTICAL RESULTS WERE ≥500 PPM AND WILL BE DISPOSED OF IN ACCORDANCE WITH 40 CFR 761.61 (A)(5)(i)(B)(2)(iii) AS TSCA SPECIAL WASTE.

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Project Title:

TSCA SELF-IMPLEMENTING CLOSURE PLAN
FORMER HOOVER FACILITY

101 E. MAPLE STREET
NORTH CANTON, STARK COUNTY, OHIO

Owner:

Mark	Description	Date

Project No.:	MPL001
Plot Date:	3/25/21
Layout By:	CS/SAH
Drawn By:	SAH
Check By:	CS
Scale:	AS NOTED
Issue Date:	June 2021

Sheet Title:

BORING LOCATIONS AND PCB DATA WITHIN EAST B & C AREA WITH APPROXIMATE EXCAVATION BOUNDARIES

Figure Number:

11

APPENDICES

Appendix A

VMS Construction Plans

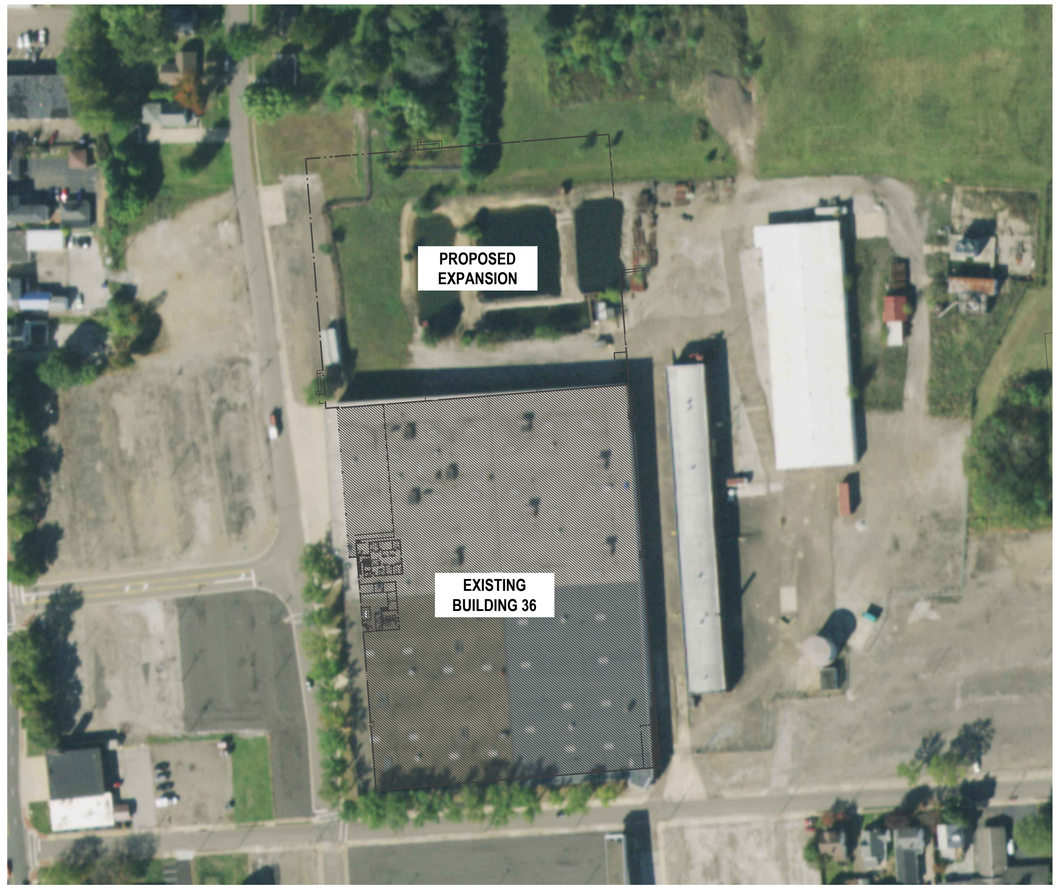
SITE CONSTRUCTION PLANS FOR:

VAPOR MITIGATION SYSTEM FOR THE BUILDING 36 EXPANSION

FORMER HOOVER FACILITY
STARK COUNTY
NORTH CANTON, OHIO

LOCATION MAP

0 500 1000 2000
SCALE IN FEET



0 50 100 200
SCALE IN FEET

SHEET TITLE	SHEET
TITLE SHEET	VM1.0
VMS LAYOUT - FOUNDATION PLAN	VM2.0
VMS LAYOUT - 1ST FLOOR PLAN	VM2.1
VMS LAYOUT - MEZZANINE PLAN AND VMS DETAILS	VM2.2
VMS LAYOUT - ROOF PLAN AND VMS DETAILS	VM2.3
VMS DETAILS	VM3.0

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Professional Seal:

STATE OF OHIO
DANIEL STARKEY
E-83981
REGISTERED
PROFESSIONAL ENGINEER

Date: 03/12/2021

Project Title:

VAPOR MITIGATION SYSTEM
FOR THE PROPOSED BUILDING 36 EXPANSION AT THE
FORMER HOOVER FACILITY

101 E. MAPLE STREET
STARK COUNTY
NORTH CANTON, OH 44720

Owner:

MAPLE STREET COMMERCE, LLC

101 E. MAPLE STREET
NORTH CANTON, OH 44720

Mark	Description	Date
	FOR U.S. EPA REVIEW	03/15/2021

Project No.:	MPL001
Plot Date:	6/1/21
Layout By:	DWS
Drawn By:	DWS
Check By:	LC
Scale:	AS NOTED
Issue Date:	MARCH 2021

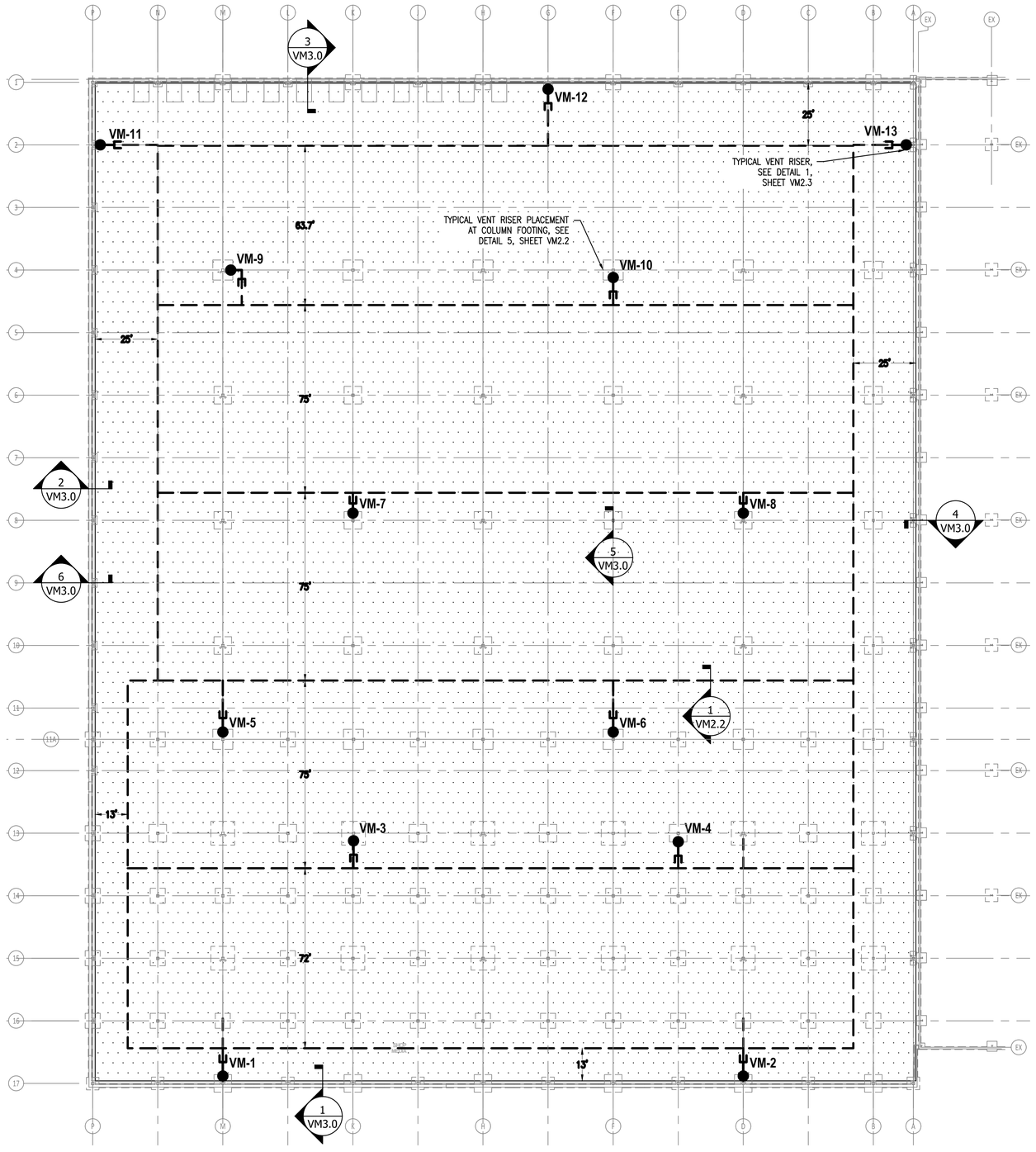
Sheet Title:

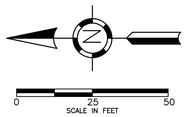
TITLE SHEET

Sheet Number: 01 OF 06

VM1.0

F:\Clients\Active\MPL\MPL001\Confidential\Design\Drawing\Sheets\ON Expansion Vapor Mitigation Plans\MPL001_VMS Title Sheet.dwg, VM1.0 TITLE SHEET, dstarkey, Jun 01, 2021 - 4:23pm





GENERAL NOTES:

1. SHEET VM2.0 WAS PREPARED USING DRAWINGS PROVIDED TO HULL & ASSOCIATES, INC. (HULL) BY FREEMAN BUILDING SYSTEMS ON 02/25/2021. REVISIONS MADE BY HULL INCLUDE THE ADDITION OF THE VAPOR BARRIER AND PASSIVE VENTING FEATURES ONLY.
2. DRAWINGS VM1.0 THROUGH VM3.0 SHALL BE USED FOR THE CONSTRUCTION OF THE VAPOR BARRIER AND PASSIVE VENTING SYSTEM ONLY. ALL OTHER FEATURES SHALL FOLLOW THE APPLICABLE ARCHITECTURAL AND ENGINEERING PLANS. BUILDING AND FOUNDATION DETAILS SHALL BE VERIFIED ON THE APPLICABLE PLAN SHEETS FOR ACCURACY.
3. MODIFICATIONS TO THE CONSTRUCTION OR LOCATIONS OF VAPOR BARRIER OR PASSIVE VENTING FEATURES MUST BE APPROVED BY THE ENVIRONMENTAL ENGINEER PRIOR TO CONSTRUCTION AND COORDINATED WITH THE STRUCTURAL ENGINEER, ARCHITECT AND MEP CONTRACTORS.
4. SEE STRUCTURAL PLANS FOR FOUNDATION DETAILS AND ELEVATIONS.
5. ALL VAPOR BARRIER AND PASSIVE VENTING SYSTEM COMPONENTS SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER SPECIFICATIONS.
6. VENT RISERS SHALL BE STUBBED UP AND CAPPED (DO NOT GLUE) A MINIMUM OF 8" ABOVE FINISHED FLOOR ELEVATION, PENDING EXTENSION OF RISERS TO THE ROOF BY PLUMBING CONTRACTOR.
7. ALL PIPING SHALL BE SCHEDULE 40 PVC PRESSURE RATED PIPE UNLESS OTHERWISE NOTED.
8. ALL PVC PIPE SHALL BE SOLVENT WELDED USING LOW VOC PVC CEMENT (GLUE) AND PRIMER IN ACCORDANCE WITH PIPE MANUFACTURER SPECIFICATIONS.
9. ALL VENT RISERS SHALL BE LABELED WITH THE VENT RISER NUMBER INDICATED ON THE PLANS USING THE NOTATION VM-#. ALL LABELS SHALL BE MADE USING A PERMANENT (NON-GREASE) MARKER OR PERMANENT AFFIXED LABEL.
10. EACH VENT RISER SHALL BE EQUIPPED WITH A BALL VALVE AND SAMPLE PORT FOR PERIODIC SYSTEM MONITORING. VENT RISERS TO BE CONSTRUCTED IN ACCORDANCE WITH THE DETAILS PROVIDED ON SHEETS VM2.3 AND VM3.0. NO DEVIATIONS SHALL BE MADE WITHOUT PRIOR APPROVAL FROM ENVIRONMENTAL ENGINEER.
11. VAPOR BARRIER CONTRACTOR IS RESPONSIBLE FOR THE INSTALLATION OF ALL VAPOR BARRIER COMPONENTS (NITRA-BASE, NITRA-CORE, LAND SCIENCE BOND), TERRA-VENT AND VENT RISER TRANSITIONS, AND VENT RISER PIPE STUBBED UP AND CAPPED A MINIMUM OF 8" ABOVE FINISHED FLOOR ELEVATION (SEE NOTE 6). ALL OTHER ITEMS TO BE COMPLETED BY PLUMBING CONTRACTOR FOLLOWING FLOOR SLAB INSTALLATION.
12. ALL BALL VALVES ON VAPOR VENT RISERS TO BE PLACED IN THE OPEN POSITION UPON COMPLETION ABOVE ROOF LEVEL.
13. VENT RISERS ARE TO BE LOCATED ON COLUMNS. BALL VALVES AND SAMPLE PORTS MUST BE ACCESSIBLE FOR PERIODIC MONITORING. VAPOR MITIGATION CONTRACTOR TO VERIFY VENT LOCATIONS WITH GENERAL CONTRACTOR PRIOR TO BARRIER INSTALLATION.
14. NITRA-CORE MUST BE APPLIED DIRECTLY AGAINST CONCRETE. COORDINATE PLACEMENT OF INSULATION AND EXPANSION MATERIALS WITH GENERAL CONTRACTOR PRIOR TO INSTALLATION.

LEGEND

- VM-# — 4" DIAMETER VENT RISER
- VAPOR VENT GEOCOMPOSITE VENTING STRIP
- SPRAY-APPLIED VAPOR BARRIER
- VAPOR VENT TO PVC PIPE TRANSITION FITTING

VAPOR MITIGATION COMPONENTS ARE EXAGGERATED FOR CLARITY

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Professional Seal:

STATE OF OHIO
DANIEL STARKEY
E-83981
REGISTERED
PROFESSIONAL ENGINEER

Date: 03/12/2021

Project Title:

VAPOR MITIGATION SYSTEM FOR THE PROPOSED BUILDING 36 EXPANSION AT THE FORMER HOOVER FACILITY

101 E. MAPLE STREET
STARK COUNTY
NORTH CANTON, OH 44720

Owner:

MAPLE STREET COMMERCE, LLC

101 E. MAPLE STREET
NORTH CANTON, OH 44720

Mark	Description	Date
	FOR U.S. EPA REVIEW	03/15/2021

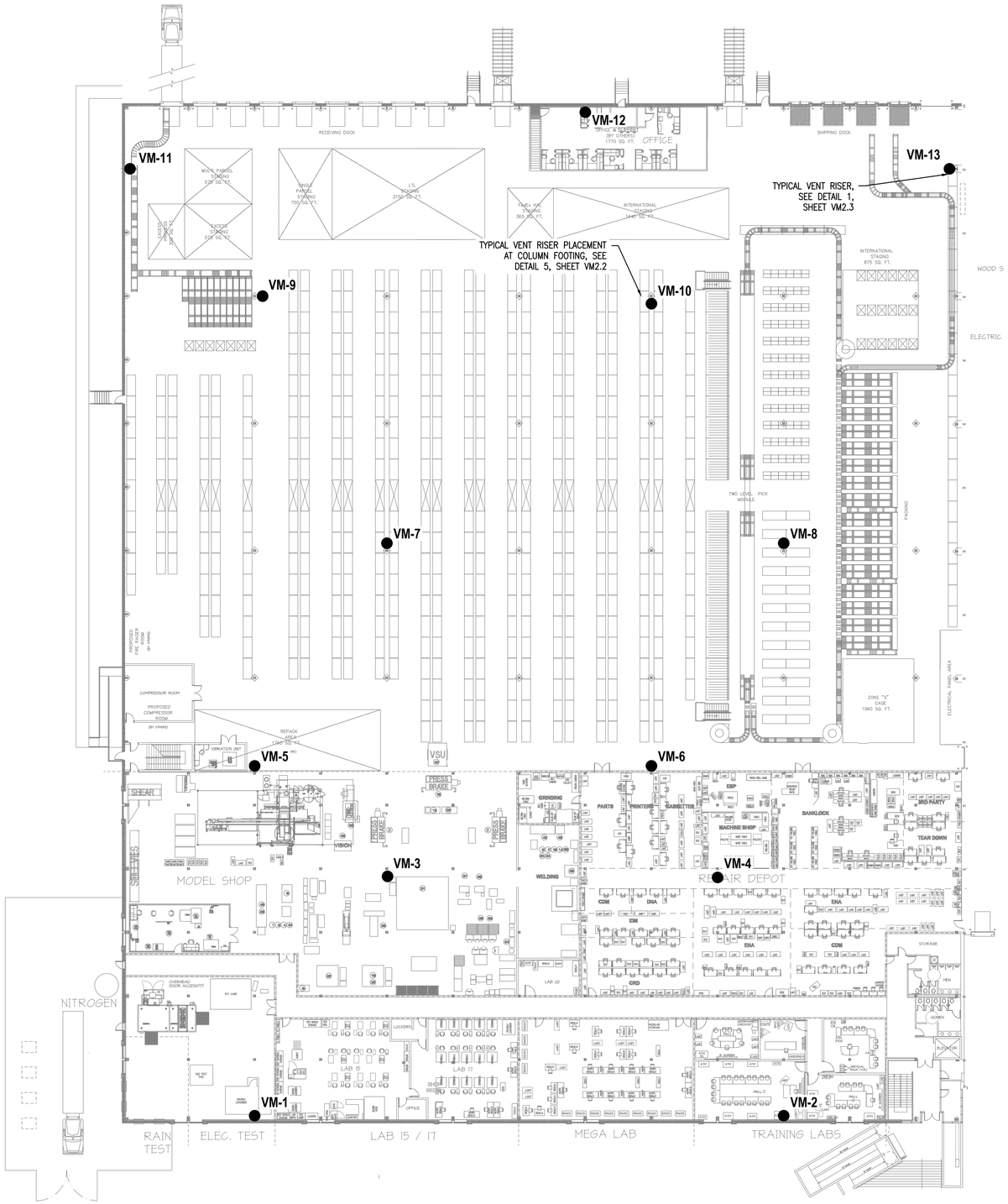
Project No.:	MPL001
Plot Date:	6/1/21
Layout By:	BWS-
Drawn By:	BWS-
Check By:	LG--
Scale:	AS NOTED
Issue Date:	MARCH 2021

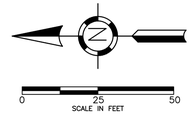
Sheet Title:

VMS LAYOUT - FOUNDATION PLAN

Sheet Number: -- OF 06

VM2.0





NOTES:

1. SHEET VM2.1 WAS PREPARED USING DRAWINGS PROVIDED TO HULL & ASSOCIATES, INC. (HULL) BY FREEMAN BUILDING SYSTEMS ON 02/05/2021. REVISIONS MADE BY HULL INCLUDE THE ADDITION OF THE VAPOR BARRIER AND PASSIVE VENTING FEATURES ONLY.
2. SEE GENERAL NOTES ON SHEET VM2.0.

LEGEND

● VM-# 4" DIAMETER VENT RISER

VAPOR MITIGATION COMPONENTS ARE EXAGGERATED FOR CLARITY

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STATE OF OHIO
DANIEL STARKEY
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REGISTERED
PROFESSIONAL ENGINEER

Date: 03/12/2021

Project Title:

VAPOR MITIGATION SYSTEM
FOR THE PROPOSED BUILDING 36 EXPANSION AT THE FORMER HOOVER FACILITY

101 E. MAPLE STREET
STARK COUNTY
NORTH CANTON, OH 44720

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Layout By:	BWS-
Drawn By:	BWS-
Check By:	LG--
Scale:	AS NOTED
Issue Date:	MARCH 2021

Sheet Title:

VMS LAYOUT - 1ST FLOOR PLAN

Sheet Number: -- OF 06

VM2.1

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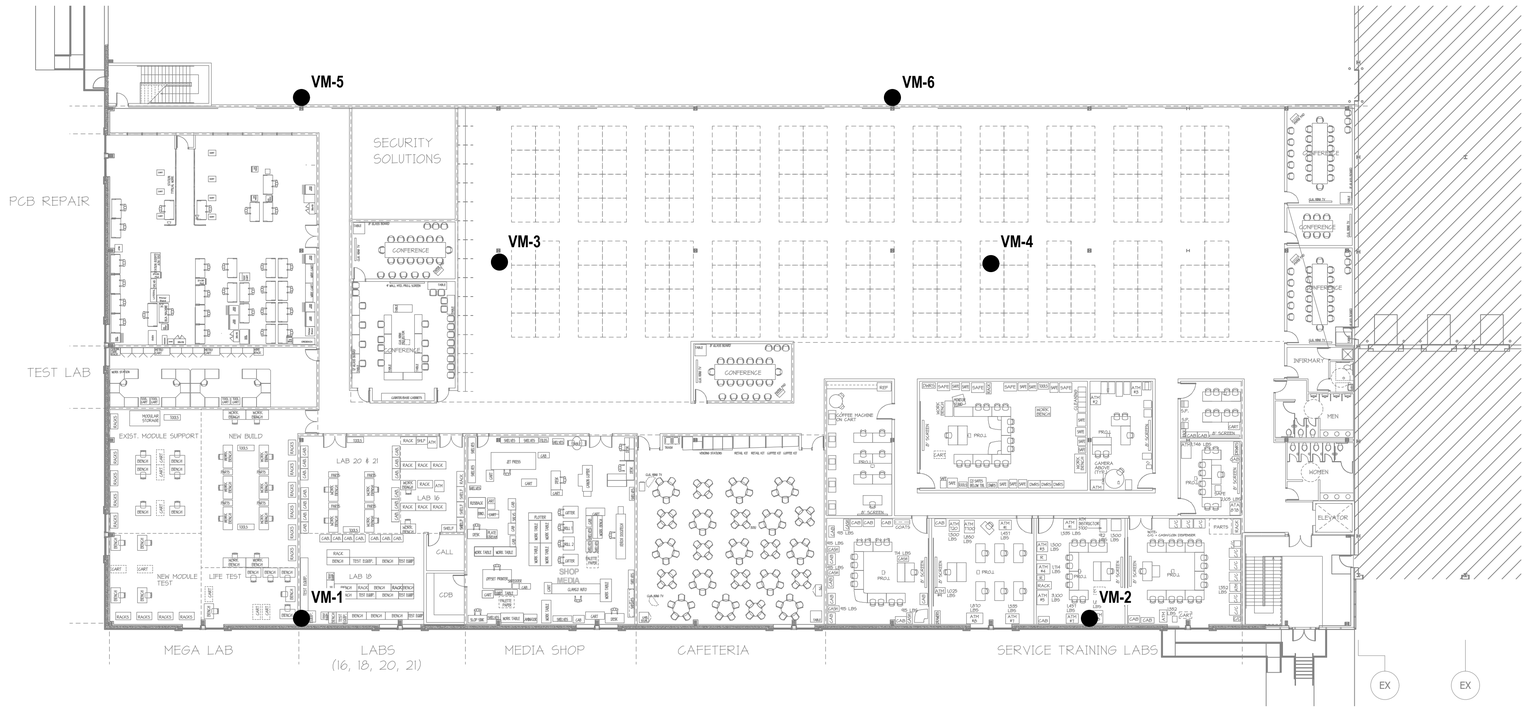
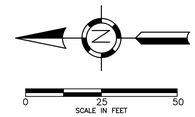
F:\Clients\Active\MPL\MPL001\Confidential\Design\Drawing\Sheets\UN Expansion Vapor Mitigation Plans\Vapor Mitigation System Layout.dwg, VM2.1 VMS LAYOUT - 1ST FLOOR PLAN, dstarkey, Jun 01, 2021 - 4:24pm



MEZZANINE PLAN

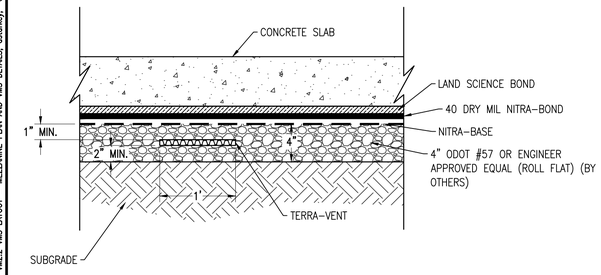


1. SHEET VM2.1 WAS PREPARED USING DRAWINGS PROVIDED TO HULL & ASSOCIATES, INC. (HULL) BY FREEMAN BUILDING SYSTEMS ON 02/05/2021. REVISIONS MADE BY HULL INCLUDE THE ADDITION OF THE VAPOR BARRIER AND PASSIVE VENTING FEATURES ONLY.
2. SEE GENERAL NOTES ON SHEET VM2.0.

LEGEND

● VM-# 4" DIAMETER VENT RISER

VAPOR MITIGATION COMPONENTS ARE EXAGGERATED FOR CLARITY



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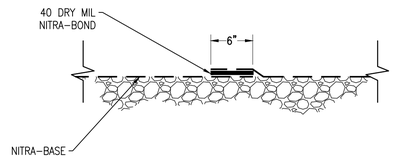
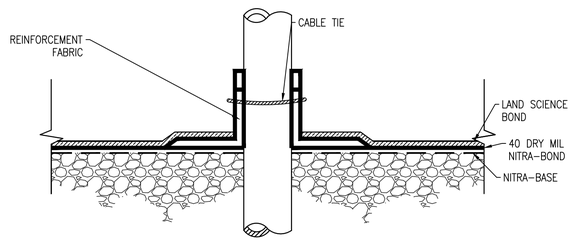
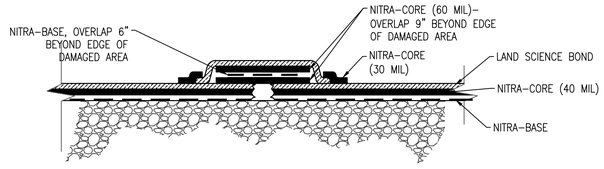


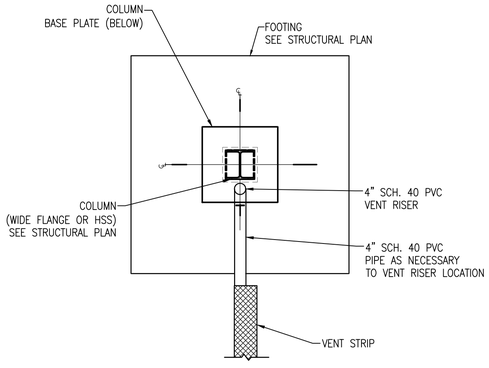
2 **TYPICAL VAPOR BARRIER MEMBRANE LAP JOINT**
Scale: N.T.S.



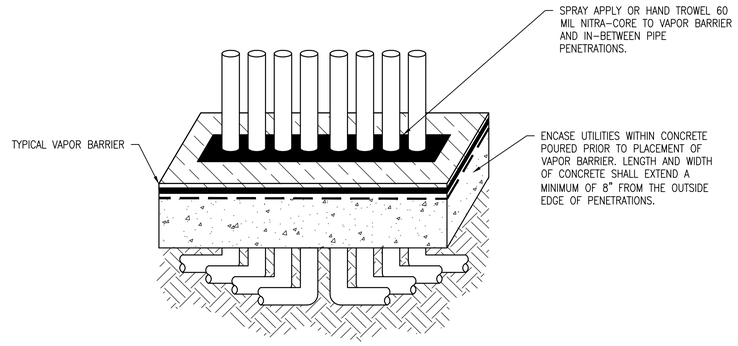
3 **TYPICAL VAPOR BARRIER PENETRATION**
Scale: N.T.S.



4 **TYPICAL REPAIR OF VAPOR BARRIER**
Scale: N.T.S.



5 **TYPICAL VENT RISER PLACEMENT AT COLUMN**
Scale: N.T.S.



6 **OPTIONAL INSTALLATION METHOD FOR CLUSTERED PENETRATIONS**
Scale: N.T.S.

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F:\Clients\Active\MPL\MPL001\Confidential\Design\Drawing\Sheets\ON Expansion Vapor Mitigation Plans\Vapor Mitigation System Layout.dwg, VM2.2 VMS LAYOUT - MEZZANINE PLAN AND VMS DETAILS, dstarkey, Jun 01, 2021 - 4:24pm

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Professional Seal:

STATE OF OHIO
DANIEL STARKEY
E-83981
REGISTERED
PROFESSIONAL ENGINEER

Date: 03/12/2021

Project Title:

VAPOR MITIGATION SYSTEM FOR THE PROPOSED BUILDING 36 EXPANSION AT THE FORMER HOOVER FACILITY

101 E. MAPLE STREET
STARK COUNTY
NORTH CANTON, OH 44720

Owner:

MAPLE STREET COMMERCE, LLC

101 E. MAPLE STREET
NORTH CANTON, OH 44720

Mark	Description	Date
	FOR U.S. EPA REVIEW	03/15/2021

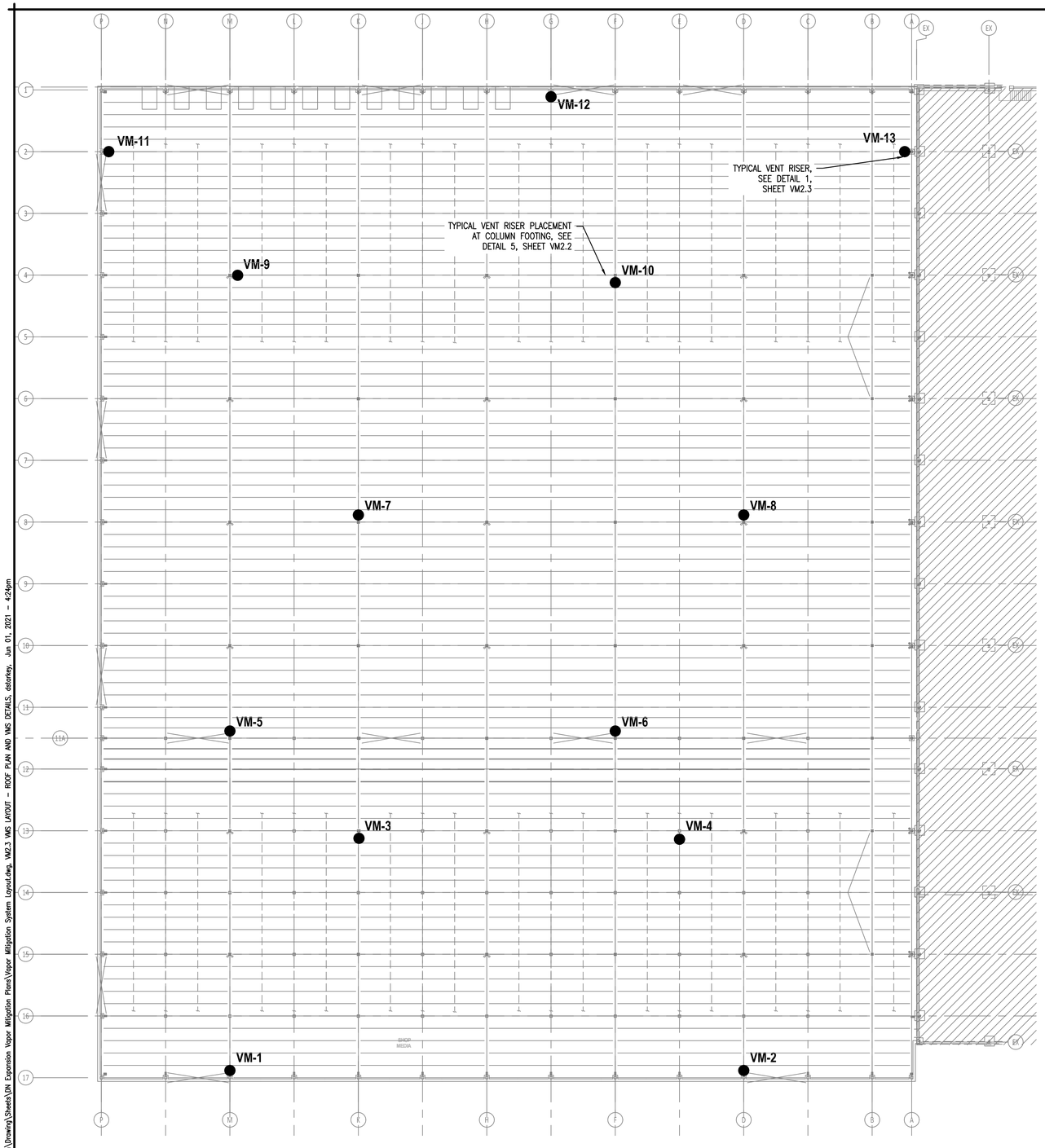
Project No.:	MPL001
Plot Date:	6/1/21
Layout By:	BWS-
Drawn By:	BWS-
Check By:	LG--
Scale:	AS NOTED
Issue Date:	MARCH 2021

Sheet Title:

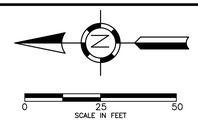
VMS LAYOUT - MEZZANINE PLAN AND VMS DETAILS

Sheet Number: -- OF 06

VM2.2



ROOF PLAN



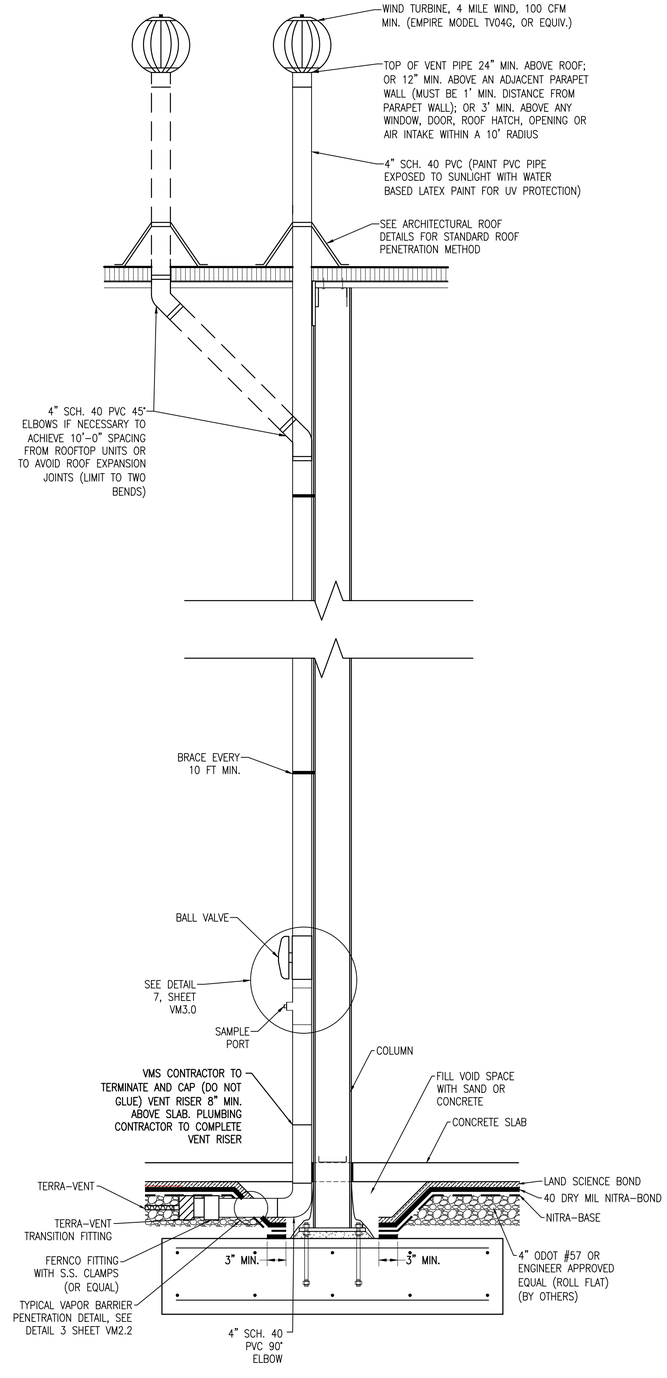
NOTES:

1. SHEET VM2.3 WAS PREPARED USING DRAWINGS PROVIDED TO HULL & ASSOCIATES, INC. (HULL) BY FREEMAN BUILDING SYSTEMS ON 02/25/2021. REVISIONS MADE BY HULL INCLUDE THE ADDITION OF THE VAPOR BARRIER AND PASSIVE VENTING FEATURES ONLY.
2. SEE GENERAL NOTES ON SHEET VM2.0.

LEGEND

● VM-# 4" DIAMETER VENT RISER

VAPOR MITIGATION COMPONENTS ARE EXAGGERATED FOR CLARITY



1 **TYPICAL VENT RISER**
Scale: N.T.S.

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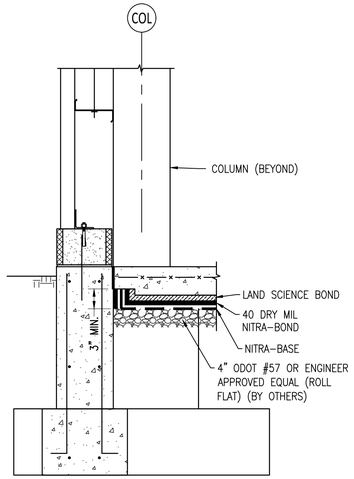
Sheet Title:

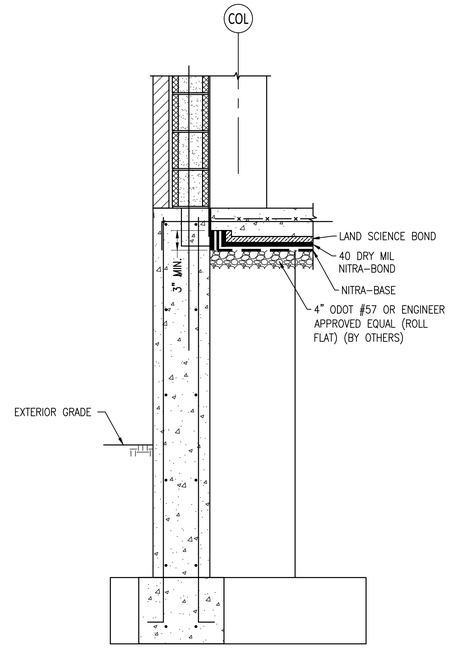
VMS LAYOUT - ROOF PLAN AND VMS DETAILS

Sheet Number: 5 OF 06

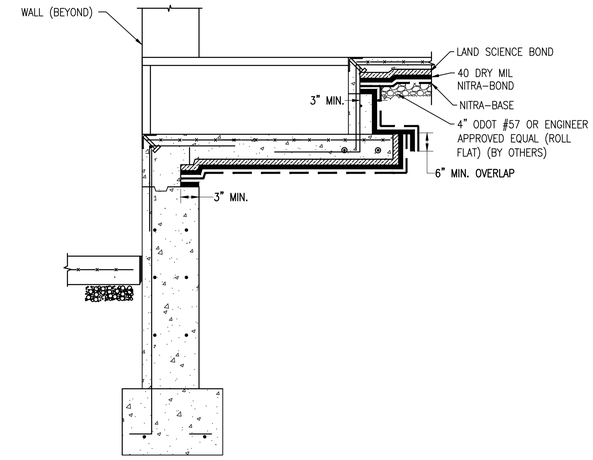
VM2.3



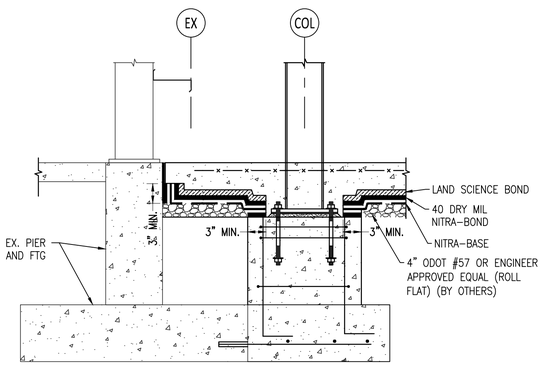
1 TYPICAL VAPOR BARRIER TERMINATION AT EXTERIOR FOUNDATION WALL WITH SHALLOW FOOTERS Scale: N.T.S.



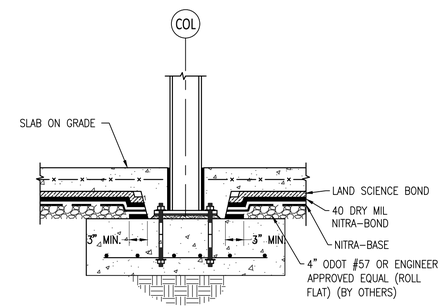
2 TYPICAL VAPOR BARRIER TERMINATION AT EXTERIOR FOUNDATION WALL WITH DEEP FOOTERS Scale: N.T.S.



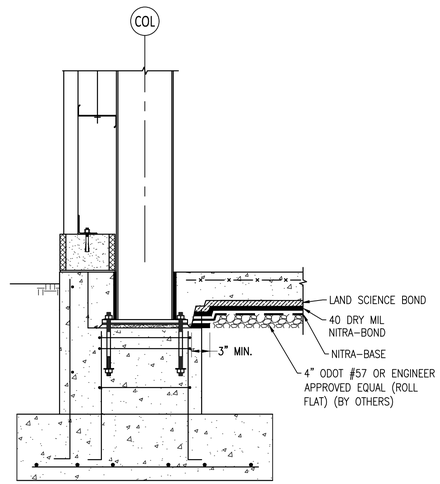
3 TYPICAL VAPOR BARRIER UNDERNEATH DOCK LEVELER Scale: N.T.S.



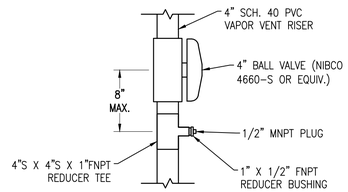
4 TYPICAL VAPOR BARRIER TERMINATION AT COLUMN ADJACENT TO EXISTING BUILDING Scale: N.T.S.



5 TYPICAL VAPOR BARRIER TERMINATION AT INTERIOR COLUMN FOOTING Scale: N.T.S.



6 TYPICAL VAPOR BARRIER TERMINATION AT EXTERIOR COLUMN FOOTER Scale: N.T.S.



NOTE:
BALL VALVE SHALL BE PLACED IN OPEN POSITION UPON VENT RISER CONSTRUCTION COMPLETION ABOVE ROOFLINE

7 VENT RISER VALVE AND SAMPLE PORT Scale: N.T.S.

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101 E. MAPLE STREET
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Mark	Description	Date
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Check By:	LC
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Sheet Title:

VMS DETAILS

Sheet Number: 06 OF 06

VM3.0

Appendix B

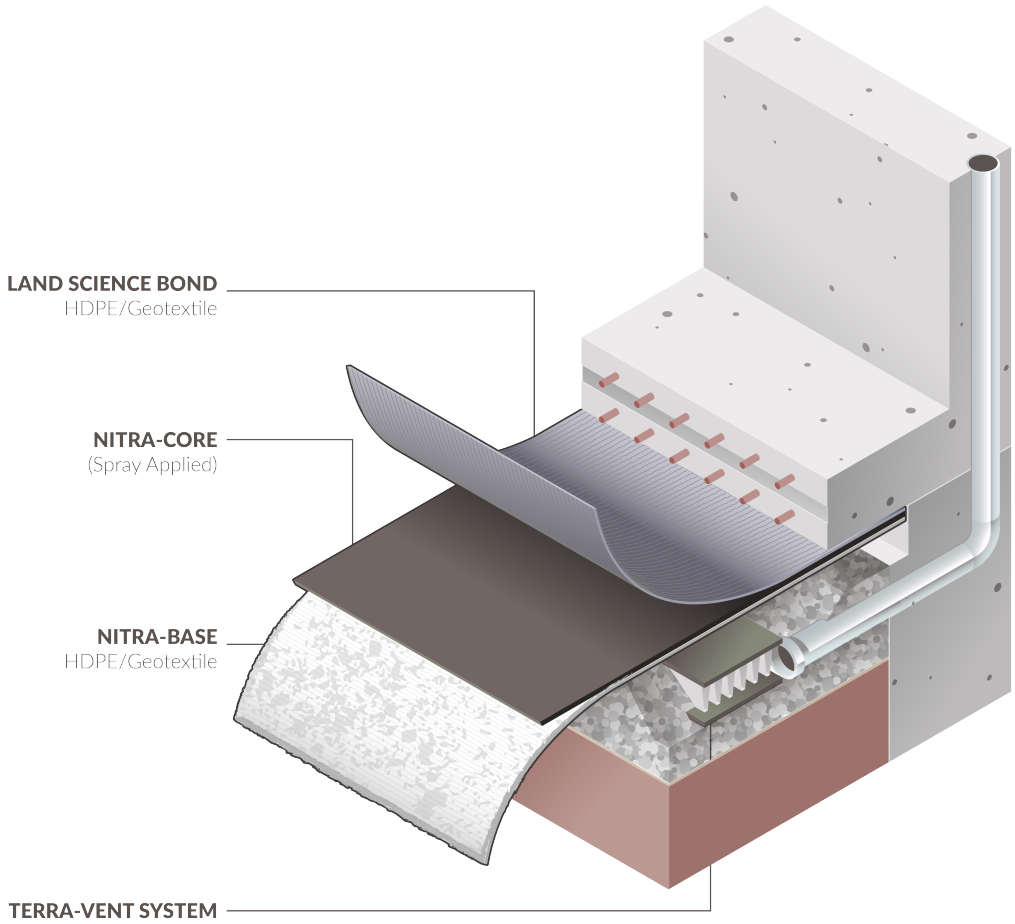
Nitra-Seal Vapor Barrier Product Data Sheets

Nitra-Seal™ Technical Data Sheet

Nítra-Seal™
Nitrile-Advanced Vapor Barrier

Nitra-Seal is an update/improvement on current vapor barrier systems, providing a more chemically resistant spray-applied core material. Nitra-Seal is a triple-layer system. The Nitra-Base layer (bottom) and the Land Science Bond layer (top) are composed of a HDPE material bonded to a geo-textile on the out-facing side. HDPE is known for chemical resistance, high tensile strength, excellent stress-crack resistance and highly reliable subsurface containment. The geo-textile, which is physically bonded to the chemical resistant layer, accomplishes two goals; it allows the Land Science Bond layer to adhere to the slab, and provides friction course between the Nitra-Base layer and the soil.

The Nitra-Core layer is composed of a unique, nitrile-modified asphaltic membrane which also provides additional protection against vapor transmission[1]. Nitrile has been proven to offer exceptional chemical resistance in a wide range of applications. This layer creates a highly-effective seal around slab penetrations and eliminates the need for mechanical fastening at termination points.



[1] US and International patents pending

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Nítra-Seal™
Nitrile-Advanced Vapor Barrier

Nitra-Core General Properties

Properties	Nitra-Core
Application to Nitra-Base	40 mils (23 ft^2/gal)

Typical Uncured Properties

Properties	Test Method	Nitra-Core
Specific Gravity	ASTM D 244	1.0
Brookfield Viscosity	ASTM D 2196	75 - 90 centipoises
pH	Oakton	10 - 13
Residue Content	ASTM D 2939	62 - 65%
Color		Brown to Black
Demulsibility	ASTM D 6936	35 - 40%
Non-Toxic		No Solvent
Shelf Life		6 months

Typical Cured Properties with Nitra-Base

Properties	Value	Nitra-Core
TCE Diffusion Coefficient	Land Science Internal Method	Ongoing
Benzene Diffusion Coefficient	Land Science Internal Method	Ongoing

Packaging

Properties	Value
Drums	55 gal
Totes	275 gal

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Nítra-Seal™
Nitrile-Advanced Vapor Barrier

Nitra-Base General Properties

Properties	Test Method	Nitra-Base
Film Thickness		23 mil
Color		Clear HDPE - White Geotextile
Weight	ASTM D751 - 06	Avg. 6.85 oz/yd²
Tensile Strength (Grab)	ASTM D751 - 06	CD - 270.5 lbf.
		MD - 350.9 lbf.
Tear Strength (Trapezoidal)	ASTM D751 - 06	CD - 48.3 lbf.
		MD - 44.4 lbf.
Puncture Resistance	ASTM D4833 - 07	103.1 lbf.
Life Expectancy	ASTM E 154 - 93	Indefinite
Elongation	ASTM D751 - 06	CD - 26.0%
		MD - 32.6%
Chemical Resistance		Excellent
Packaging		102” x 150’ Roll

Land Science Bond General Properties

Properties	Test Method	Land Science Bond
Film Thickness		18 mil
Color		Gray HDPE - White Geotextile
Weight	ASTM D751 - 06	6.76 oz/yd²
Tensile Strength (Grab)	ASTM D751 - 06	CD - 186.8 lbf.
		MD - 153.4 lbf.
Tear Strength (Trapezoidal)	ASTM D751 - 06	CD - 36.7 lbf.
		MD - 28 lbf.
Puncture Resistance	ASTM D4833 - 07	61.2 lbf.
Life Expectancy	ASTM E 154 - 93	Indefinite
Elongation	ASTM D751 - 06	CD - 72.1%
		MD - 49.6%
Chemical Resistance		Excellent
Packaging		102” x 150’ Roll

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TerraVent™
SOIL GAS COLLECTION SYSTEM
Version 1.1

SECTION 02 56 19 – GAS CONTROL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Substrate preparation.
2. TerraVent™ installation.
3. TerraVent accessories.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 2 Section “Earthwork”, “Pipe Materials”, “Sub-drainage systems”, ”Gas Control System”, “Fluid-Applied gas barrier”.
2. Division 3 Section “Cast-in-Place Concrete” for concrete placement, curing, and finishing.
3. Division 5 Section “Expansion Joint Cover Assemblies”, for expansion-joint covers assemblies and installation.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide a gas venting material that collects gas vapors and directs them to discharge or to collection points as specified in the gas vapor collection system drawings and complies with the physical requirements set forth by the manufacturer.

1.4 SUBMITTALS

A. Submit Product Data for each type of gas venting system specified, including manufacturer’s specifications.

B. Sample – Submit representative samples of the following for approval:

1. Gas venting, TerraVent.
2. TerraVent accessories.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who is certified in writing and approved by vapor intrusion barrier manufacturer Land Science for the installation of the TerraShield and Nitra-Seal vapor intrusion barrier system.

B. Manufacturer Qualification: Obtain gas venting, vapor intrusion barrier and system components from a single manufacturer Land Science.

C. Pre-installation Conference: A pre-installation conference shall be held prior to installation of the venting system, vapor intrusion barrier and waterproofing system to assure proper site and installation conditions, to include contractor, applicator, architect/engineer and special inspector (if any).

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site as specified by manufacturer labeled with manufacturer’s name, product brand name and type, date of manufacture, shelf life, and directions for handling.

B. Store materials as specified by the manufacturer in a clean, dry, protected location and within the temperature range required by manufacturer. Protect stored materials from direct sunlight.

C. Remove and replace material that is damaged.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Land Science, San Clemente, CA. (949) 481-8118

1. TerraVent™

2.2 GAS VENT MATERIALS

A. TerraVent – TerraVent is a low profile, trenchless, flexible, sub slab vapor collection system used in lieu or in conjunction with perforated piping. TerraVent is recommended for sites with methane gas and aggressive chlorinated volatile organic or petroleum vapors. Manufactured by Land Science.

B. TerraVent physical properties

PROPERTIES	TEST METHOD	TerraVent
Vent Core Properties		
Compressive Strength	ASTM D-1621	9,500 psf.
Thickness		1 inch
Flow Rate (Hydraulic gradient = 0.1)	ASTM D-4716	30 gpm/ft width
Vent Fabric Properties		
Grab Tensile Strength	ASTM D-4632	100 lbs.
CBR Puncture	ASTM D-6241	250 lbs.
Flow	ASTM D-4491	140 gpm/ft2
AOS	ASTM D-4751	70 U.S Sieve
Permittivity	ASTM D-4491	2.0 sec-1
U.V Resistance	ASTM D-4355	70% @500 hrs.
Packaging:	Dimension: 12”x 165’	
	Weight: 68 lbs.	

2.3 AUXILIARY MATERIALS

A. TerraVent End Out

B. Reinforced Tape.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions under which gas vent system will be installed, with installer present, for compliance with requirements. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 SUBSTRATE PREPARATION

A. Verify substrate is prepared according to project requirements.

3.3 PREPARATION FOR STRIP COMPOSITE

A. Mark the layout of strip geocomposite per layout design developed by engineer.

3.4 STRIP GEOCOMPOSITE INSTALLATION

A. Install TerraVent over substrate material where designated on drawings with the flat base of the core placed up and shall be overlapped in accordance with manufacturer's recommendations.

B. At areas where TerraVent strips intersect cut and fold back fabric to expose the dimpled core. Arrange the strips so that the top strip interconnects into the bottom strip. Unfold fabric to cover the core and use reinforcing tape, as approved by the manufacturer, to seal the connection to prevent sand or gravel from entering the core.

C. When crossing TerraVent over footings or grade beams, **consult with the specifying environmental engineer and structural engineer for appropriate use and placement of solid pipe materials**. Place solid pipe over or through concrete surface and attach a TerraVent End Out at both ends of the pipe before connecting the TerraVent to the pipe reducer. Seal the TerraVent to the TerraVent End Out using fabric reinforcement tape. Refer to TerraVent detail provided by Land Science.

D. Place vent risers per specifying engineer's project specifications. Connect TerraVent to TerraVent End Out and seal with fabric reinforced tape. Use TerraVent End Out with the specified diameter piping as shown on system drawings.

3.5 PLACEMENT OF OVERLYING AND ADJACENT MATERIALS

A. All overlying and adjacent material shall be placed or installed using approved procedures and guidelines to prevent damage to the strip geocomposite.

B. Equipment shall not be directly driven over and stakes or any other materials may not be driven through the strip geocomposite.

Land Science Bond™ Technical Data Sheet

LandScienceBond™
HDPE Composite Geomembrane

Land Science Bond is comprised of a gray high strength HDPE membrane that is thermally bonded to a polypropylene geotextile. Land Science Bond layer is installed as a protection course over the Nitra-Core layers with the geotextile side facing up. The Land Science Bond layer also provide an excellent substrate and friction surface for concrete to adhere to.

Land Science Bond General Properties

Properties	Test Method	Land Science Bond
Film Thickness		18 mil
Color		Gray HDPE - White Geotextile
Weight	ASTM D751 - 06	6.76 oz/yd²
Tensile Strength (Grab)	ASTM D751 - 06	CD - 186.8 lbf.
		MD - 153.4 lbf.
Tear Strength (Trapezoidal)	ASTM D751 - 06	CD - 36.7 lbf.
		MD - 28 lbf.
Puncture Resistance	ASTM D4833 - 07	61.2 lbf.
Life Expectancy	ASTM E 154 - 93	Indefinite
Elongation	ASTM D751 - 06	CD - 72.1%
		MD - 49.6%
Chemical Resistance		Excellent
Packaging		102” x 150’ Roll

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Nítra-Base™
Geo-Textile Substrate

Nitra-Base™ Technical Data Sheet

Nitra-Base is comprised of a high strength HDPE membrane that is thermally bonded to a polypropylene geotextile. Nitra-Base layer is installed as a base layer prior to Nitra-Core™ spray application with the HDPE side facing up.

Nitra-Base General Properties

Properties	Test Method	Nitra-Base
Film Thickness		23 mil
Color		Clear HDPE - White Geotextile
Weight	ASTM D751 – 06	Avg. 6.8 oz/yd^2
Tensile Strength (Grab)	ASTM D751 – 06	CD – 270.5 lbf.
		MD – 350.9 lbf.
Tear Strength (Trapezoidal)	ASTM D751 – 06	CD – 48.3 lbf.
		MD – 44.4 lbf.
Puncture Resistance	ASTM D4833 - 07	103.1 lbf.
Life Expectancy	ASTM E 154 - 93	Indefinite
Elongation	ASTM D751 – 06	CD – 26.0%
		MD – 32.6%
Chemical Resistance		Excellent

Packaging

Weight of Roll	8.5’ x 150’

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Nítra-Core™
Nitrile-Modified Asphalt

Nitra-Core™ Technical Data Sheet

Nitra-Core is a patent pending spray applied vapor barrier that is comprised of an elastic, water-based, co-polymer modified asphaltic nitrile latex, in addition to other proprietary compounds. This chemically resistant barrier is typically installed at 40 mils thickness uniformly above the Nitra-Base layer to provide a monolithic and seamless system. Nitra-Core has exceptional bonding to a wide variety of substrates including green concrete. This barrier will build up to a specific thickness in a single application through multiple passes, allowing for easy installation around penetrations, uneven surfaces and oddly shaped areas.

Nitra-Core General Properties

Properties	Nitra-Core
Application to Nitra-Base	40 mils (23 ft²/gal

Typical Uncured Properties

Properties	Test Method	Nitra-Core
Specific Gravity	ASTM D 244	1.0
Brookfield Viscosity	ASTM D 2196	75 – 90 centipoises
pH	Oakton	10-13
Residue Content	ASTM D 2939	62 – 65%
Color		Brown to Black
Demulsibility	ASTM D 6936	35 – 40%
Non-Toxic		No Solvent
Shelf Life		6 months

Typical Cured Properties with Nitra-Base

Properties	Value	Nitra-Core
TCE Diffusion Coefficient	Land Science Internal Method	On going
Benzene Diffusion Coefficient	Land Science Internal Method	On going

Packaging

Properties	Value
Drums	55 gal
Totes	275 gal

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Advanced Nitrile Composite Barrier System

Nítra-Seal™

Nitrile-Advanced Vapor Barrier

www.nitra-seal.com

Introduction

Nitra-Seal™ is an update/improvement on current vapor barrier systems. Originally, passive vapor barrier systems were waterproofing systems adapted for use as contaminant vapor barriers. An acknowledged weakness in these systems is in the penetration and perimeter termination locations, where spray-applied core material composed of Styrene-Butadiene (SBR)- modified asphalt is used. While excellent at repelling water, aggressive chemicals such as petroleum solvents and chlorinated volatile organic compounds (VOCs), will permeate into the SBR-modified asphalt at a relatively high rate particularly in sensitive areas of the building construction such as barrier seams, slab penetrations and perimeters. Nitra-Seal offers a substantial upgrade as it employs a more chemically resistant nitrile latex instead of the more susceptible SBR material. Nitrile is recognized throughout the environmental engineering industry as being more chemically resistant than rubber or SBR and is often used in personal protective equipment when working on hazardous waste sites (e.g. nitrile gloves).

Nitra-Seal is a composite system creating the ideal blend between constructability and chemical resistance by using both high density polyethylene (HDPE) and nitrile-advanced, spray-applied asphalt core.

Nítra-Seal™
Nitrile-Advanced Vapor Barrier

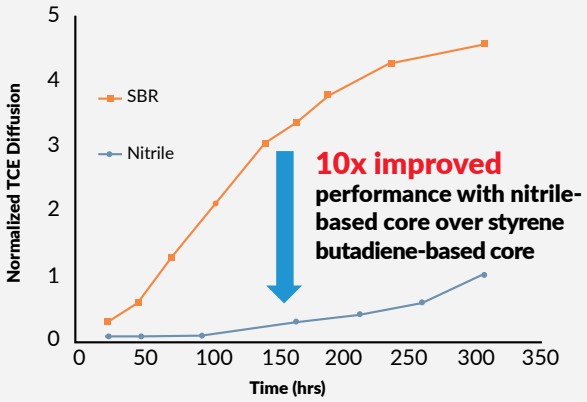
Nitra-Seal has been lab-tested and proven to be highly effective against VOCs like chlorinated solvents and petroleum contaminants, and methane.

Nitra-Seal is a significant improvement over all other composite vapor barriers on the market due to the use of chemically resistant Nitrile instead of typical spray applied barriers.

Nitra-Core is laboratory tested to be 10x more effective than typical spray-applied SBR modified asphalt material.

Land Science Certified Applicators ensure barriers are properly installed, reducing risk.

Nítra-Core
Nitrile-Modified Asphalt



Accelerated comparison of the TCE vapor resistance of Nitra-Core, a nitrile-modified spray applied asphalt layer, against spray-applied asphalt latex core, a styrene butadiene-modified asphalt layer. Both asphalt layers were sprayed to an identical thickness for the test.

Overview

Nitra-Seal is a composite barrier system that incorporates a nitrile spray-applied component significantly reducing the potential for indoor air exposure to sub-slab chemical vapors.

Land Science Bond

HDPE/Geotextile

10 mil high density woven scrim polyethylene sheet thermally bonded to a 3 ounce/square yard non-woven geotextile facing up so as to bond into concrete.

Nitra-Core

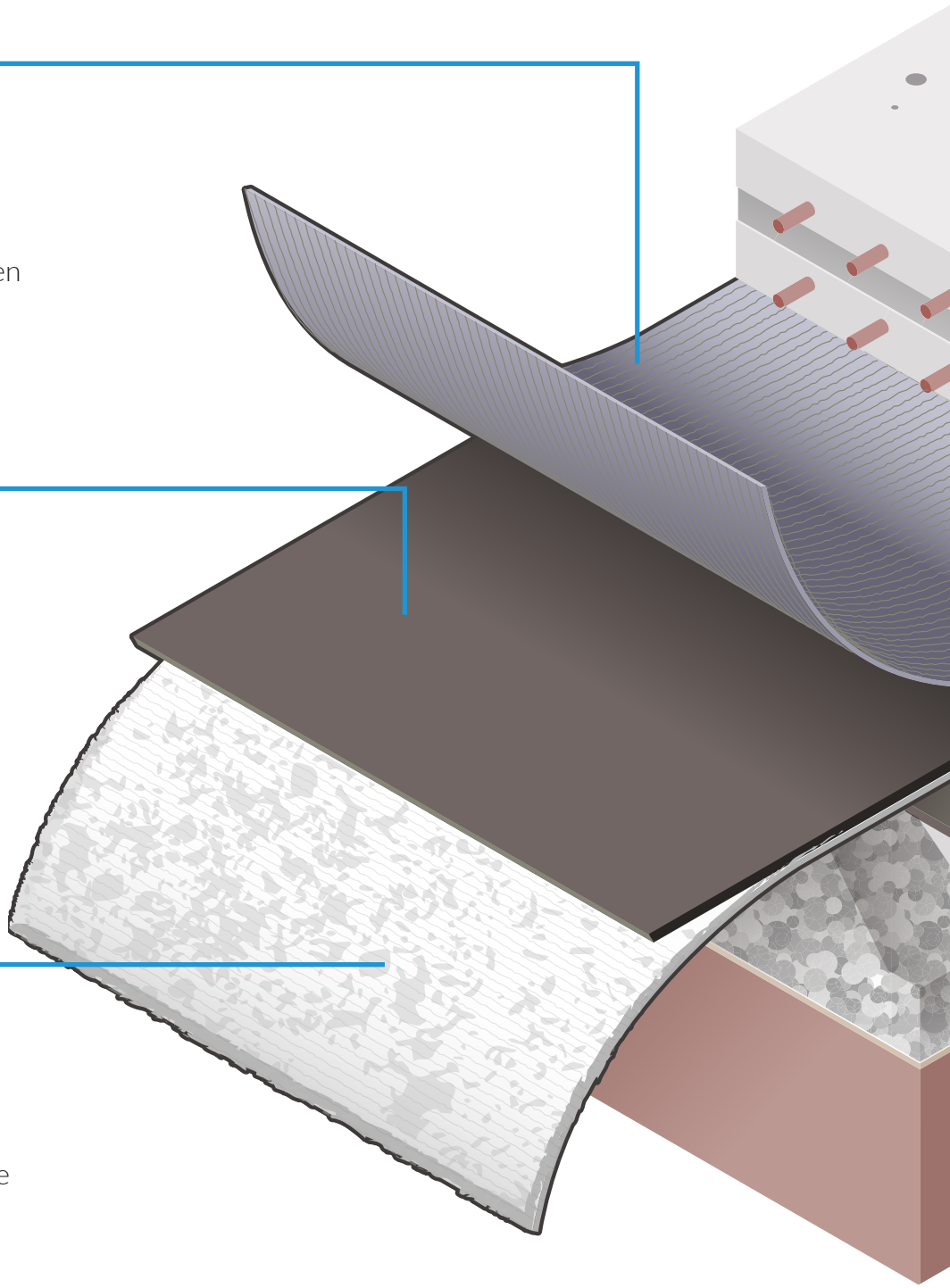
(Spray Applied)

Spray applied as a nitrile/ asphalt emulsion to form a chemically resistant layer with nominal thickness of 40 mils (dry).

Nitra-Base

(Spray Applied)

5 mil high density grey polyethylene (HDPE) sheet extruded to a 3-ounce/ square yard non-woven white geotextile facing down as a course-protection.



Nitra-Seal Triple-Layer System

Dual Chemical Resistant Layers

The Nitra-Base layer (bottom) and the Land Science Bond layer (top) are composed of a HDPE material bonded to a geo-textile on the out-facing side. HDPE is known for chemical resistance, high tensile strength, excellent stress-crack resistance and for highly reliable subsurface containment. The geo-textile which is physically bonded to the chemical resistant layer accomplishes two goals; it allows the Land Science Bond layer to adhere to the slab, and provides a friction course between the Nitra-Base layer and the soil.

Spray-Applied Nitra-Core Layer

The Nitra-Core layer is composed of a unique, nitrile-modified asphaltic membrane which also provides additional protection against vapor transmission. Nitrile has been proven to offer exceptional chemical resistance in a wide range of applications. This layer creates a highly-effective seal around slab penetrations and eliminates the need for mechanical fastening at termination points.

Key Benefits of Nitrile

Chemical Resistance

The dual chemical resistant layers combined with the spray-applied Nitra-Core form a barrier highly resistant to a broad range of chemical pollutant vapors.

Enhanced Curing

Nitra-Seal is “construction friendly” as the reduced curing time of the Nitra-Core layer and the ability to apply it in cooler temperatures ensures quick installation and minimizes the impact on construction schedules.

Puncture Resistance

Nitra-Seal forms a highly puncture resistant barrier that greatly reduces the chance of damage occurring after installation and prior to the placement of concrete.

Additional Protection

TerraVent can be used in conjunction with Nitra-Seal to alleviate the buildup of vapors beneath structures as a result of vapor barrier implementation. Vapor-Vent can be utilized as an active or passive ventilation system depending on the requirements of the design engineer.

Key Product Benefits

- Puncture Resistant
- Excellent Constructability
- Chemically Resistant
- Competitively Priced

Certified Applicator Network

The application of Nitra-Seal and TerraVent can be performed by any one of many certified applicators throughout North America.

Service and Support

Land Science Technical Sales Managers are available to provide job and site-specific assistance. A local representative can ensure Nitra-Seal and TerraVent is installed as per the specification.

World Class Clients

Environmental consultants, engineers, and real estate professionals trust Land Science to produce results knowing our expertise and industry knowledge has been proven time and again at the job site. Our world class clients include leaders in the food, banking, government, and housing industries.

WE'RE READY TO HELP YOU FIND THE RIGHT SOLUTION FOR YOUR SITE

Land Science®
a division of REGENESIS®

Global Headquarters

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Ph: (949) 481-8118
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Get Started Today

To recieve a custom vapor intrusion solution, please call 949.481.8118 or e-mail info@landsciencetech.com One of our Technical Solutions Managers will review your project details and provide you with a customized vapor intrusion solution designed to achieve your goals.

Nítra-Seal™

Nitrile-Advanced Vapor Barrier

Land Science®
a division of REGENESIS®

(949) 481-8118

Appendix C

Land Science Applicator Training Manual

Applicator Training Manual - TerraShield

This manual is intended to provide guidance in how to properly install the TerraShield membrane. Due to varying job site conditions and different construction methods some conditions are not covered in this manual. Please contact Land Science to clarify any job specific questions.

Application Process

As a certified applicator for the TerraShield system you are expected to observe the application protocols set forth in this application manual and in the product specifications. Failure to abide by Land Science's protocols may result in loss of application privileges and certification. Land Science shall offer applicator recertification webinars for all qualified TerraShield applicators every 2 years. It is the responsibility of the applicator to maintain a good standing status by participating in the recertification process.

Installation Inspections

TerraShield will be inspected, unless otherwise stated in the project documents, by a manufacturer's representative or third-party certified inspector. It is the responsibility of the applicator to coordinate with the inspector as to the time of the inspection. To ensure the installation and inspection goes smoothly, the applicator should consult the inspector to coordinate schedules and time allowances prior to commencing membrane installation.

Questions? Please contact Land Science. Telephone: (949) 481-8118

Table of Contents

Material Handling

Arrival of Material

ColdMark indicators are placed on emulsion materials when shipped. Clear indicates the material is OK, purple indicates the material has been exposed to below freezing temperatures and should be replaced. Check ColdMark indicators before accepting shipment, if the indicator is purple accept delivery and immediately make notation on BOL: Freeze Indicator Activated. Contact Land Science to inform them freeze indicators activation status.

Material Returns

In the event, Nitra-Core may be damaged or defective, it is the responsibility of the applicator to notify Land Science immediately. Applicator will require to provide photos of the defective products, batch numbers and descriptions/reasons of being defective. Land Science shall troubleshoot with the applicator and if necessary, to provide guidance on the replacement products to reasonably meet construction schedules.

Any suspected to be defective products should NOT be used without Land Science's authorization. All defective products and/or representation samples must be shipped back to a Land Science's location for evaluations. The cost of replacement products and shipping of the returned defective material will be free of charge to the applicator IF the product was confirmed defective by Land Science's Technical Department. However, IF the product was tested and confirmed to be in good condition, it is the responsibility of the applicator to cover the cost of the replacement product less the amount returned, and the shipping cost incurred.

Storage

Materials will bear the manufacturer's name, product brand name, date of manufacture, and directions for storing and mixing with other components.

Materials will be stored in a clean, dry, protected location and above 45°F as required by manufacturer. Protect stored materials from direct sunlight. Do NOT allow the material to freeze; if temperatures are expected to fall within the range of 32°F steps should be taken to elevate ambient air temperature of the storage area above the possibility of freezing. If Nitra-Core emulsion does freeze after it has arrived on site, it will be replaced at the applicator's expense.

In colder climates, storage of material in temperature controlled areas is preferred, alternatives can include: space heaters, tenting storage area, and others. The method chosen should be verified and maintained.

Material that exceeds the stated shelf life should be removed from the jobsite and disposed of using the proper legal methods.

Spill and Disposal Procedures

Contain spillages with sand or earth and remove by normal methods. Dispose of according to state and local regulations. If the Nitra-Core enters a water course or sewer, advise the respective water authority. The un-cured and cured material is non-toxic and non-flammable and can be disposed of in landfills.

Material Disposal

55 Gallon Drums
55 gallon drums need to be disposed of per local waste regulations. The drum liner can be removed and disposed of with general construction waste. The steel drums can be sold, sent to a recycling center, disposed of in a landfill or any other area, as long as disposal is done in accordance with local regulations.

275 Gallon Totes

Totes are easier to dispose of than 55 gallon drums and are recommended for this purpose. Simply remove the plastic liner, collapse the cardboard frame, and dispose both items with construction waste. The pallet may also be disposed of with construction waste; however, some pallet companies will purchase and collect your pallets.

Safety

The TerraBase+ rolls are 6.56' x 164', weight 60 lbs. and Land Science Protection Fabric is 12.5' x 360', weight 223 lbs. Care should be taken in lifting and transporting the rolls around the jobsite.

The Nitra-Core layer is a water based nitrile co-polymer latex and asphaltic emulsion. The material is non-toxic, but that does not mean one should be careless when handling the material.

- Avoid contact with eyes
- Avoid inhalation
- Avoid ingestion

Frequent or prolonged exposure of the Nitra-Core layer may cause skin irritation. The following actions are recommended:

- Protective Equipment: Use of clothing, gloves, and/or barrier cream is recommended for skin protection.
- Respiratory Protection: Inhalation should be avoided, but is not considered to be hazardous.
- Ventilation: Use local exhaust ventilation when applying in a confined area.

Emergency and First Aid Procedures

For ingestion: DO NOT induce vomiting. Keep at rest and get prompt medical attention.
For eye contamination: Irrigate eyes with water.
For skin contact: Wash affected areas of the body with hand cleaner, and then use soap and water.

Contact a physician as needed for any of the above occurrences.

Spray Set Up

Materials Needed

Tyvek® protective coveralls, or other suitable clothing to cover skin or clothing
Latex gloves
Safety glasses
Dust mask
Neoprene rubber boots
Reflective vest
Hard hat

Spray gun nozzles

- 8001 for saline solution
- 4005 for asphaltic emulsion

1 set of extra spray tips
1 welders tip cleaning kit
1 gallon of Land Science Green Cleaning Solution
1x35 pound bag of calcium chloride flakes (77% pure) for every eight 55 gallon drums (Or liquid calcium alternative)

1 mil reading caliper (1 mil = 0.001 inch)
1 wet mil gauge (Optional)
1 needle nose digital depth gauge (For concrete surfaces only)
TerraShield Applicator Training Manual
Digital camera
Video camera to document smoke test (Optional)

A Land Science pump system (Graco 833), AD55 Drum Pump or as approved by the manufacturer

Pump Systems and Maintenance

We recommend the use of Graco 833 or AD55 Drum Pump. Other pump systems may be used if the system meets LS specifications; please contact LS to ensure the desired pump system meets the requirements.

Refer to current LS price list for current pricing of the Graco 833 pumping system.

Depending on the frequency of use, periodic pump maintenance is suggested to ensure lasting pump performance. For directions on how to properly disassemble the pump manifold, clean pump valves and replace diaphragms, refer to maintenance information provided by Land Science.

Material Preparation

55 Gallon Drums
Loosen and remove lid. Use a clean stir stick to stir material to achieve a consistent uniform consistency. When removing the lid there might be a crust that formed due to moisture being trapped in the drum as it was sealed. Remove any crust that forms on the surface by skimming the crust off the surface with a large strainer.

275 Gallon Totes
The totes generally perform better when attaching to the 2" ball valve and camlock set up located at the bottom of the tote. There is no need to remove any crust as all air is removed after filling the tote, however the top of the tote does need to be vented so that there is no airlock.

The contents of the tote may also be emptied into 55 gallon drums to increase material mobility on the jobsite.

Catalyst

The ratio of catalyst drums to emulsion is 1 to 8 or 1 to 9. The variance generally depends on weather conditions and substrate.

There are two options for mixing catalyst:

Calcium Chloride Flakes

One 35 pound bag of calcium chloride flakes (77% pure) should be mixed with 55 gallons of water. Avoid using cold water if possible as it will require more effort to dilute the solution. When properly mixed in water, the calcium chloride will completely dissolve.

Liquid Calcium

Obtain 32 to 36 percent calcium chloride premixed solution. The solution can typically be found at a ready-mix concrete plant and should be mixed as ratio of three parts water with one part solution. The mixture will yield a catalyst that is between 8 and 9 percent calcium chloride.

Pump Operation Instructions

ASDRY: MODEL AD55 DRUM PUMP

CAUTION: The engine on this unit should only be started with the ball valve at the end of the suction hose in the open position and the cam/lock plug removed.

FAILURE TO FOLLOW THIS CAUTION WILL RESULT IN DAMAGE TO THE DIAPHRAGMS IN THE PUMP AND WILL NOT ALLOW IT TO PUMP WITHOUT EXTENSIVE REPAIRS.

A. STARTUP

1. Position product drum next to sprayer and insert the intake and return stingers into the drum
.
2. Hook up intake and drum lines with respective stingers
3. Open ball valve that controls pump
.
4. Open ball valve at end of intake hose
5. Position catalyst water supply as close as possible (without obstructing product drum). Make sure inlet line to catalyst pump is in the catalyst water container
6. Attach spray gun to end of spray hose
7. Turn on the water pump
8. If using the priming tube, do so at this point. This unit is equipped with a priming tube to allow easier priming

    To use priming tube:
    1. While engine is shut off, open valve on top of priming tube
    2. Pour tube full of Nitra-Core or diesel
    3. Shut valve completely. Pump will not pump if any air is drawn through this valve
9. Start engine and let run at full throttle for 3 to 4 minutes
10. While waiting, turn on water at the ball valve on the spray gun to check for pressure and/or clean nozzles
11. Close ball valve that controls pump

    Engine should come under a load and the gauge will come up to application pressure. Maximum spraying pressure should be 1000 PSI. You can spray at a lower pressure if product and/or conditions warrant. Pressure can be adjusted with the adjustment screw on top of the bypass valve. Clockwise to increase and counter-clockwise to decrease pressure. Tighten locking nut after pressure is adjusted
12. You are now ready to spray.

B. CHANGING DRUMS

1. When product drum is empty, open control ball valve on pump and turn off engine
2. After engine has stopped, immediately close large ball valve at drum-end of intake line. DO NOT TURN OFF LARGE BALL VALVE WHEN ENGINE IS RUNNING. DAMAGE TO PUMP WILL OCCUR
3. Wait a few minutes for the product in the intake stinger to run back into the drum
4. Disconnect both the intake line and the return line. Slide new drum of product into position
5. Insert drum stingers into new drum and re-attach return line and intake line
6. Open large ball valve on intake line and immediately start engine. FAILURE TO OPEN BALL VALVE WILL CAUSE DAMAGE TO PUMP
7. Allow 2 to 3 minutes for pump to draw material from new drum

8. Close control ball valve on pump. The engine should come under load and the gauge will indicate spraying pressure

9. You are again ready to spray.

C. OVERNIGHT SHUTDOWN

1. Open control ball valve on pump and turn off engine

2. Immediately shut large ball valve at end of intake hose

3. Turn off water pump

4. Leave all lines attached and stingers in place

5. Be sure valve at top of priming tube is completely closed

6. Reel in hose

7. Disconnect spray gun, (optional)

8. To re-start, refer to steps A5 through A11.

D. EXTENDED SHUTDOWN

1. Open control valve on pump and turn off engine

2. Detach intake and return lines from drum

3. Remove stingers from product drum. Seal drum if any product remains

4. Place intake stinger in 5-gallon pail of diesel fuel and place return line stinger into an empty 5-gallon pail

5. Re-attach intake and return lines

6. Make sure throttle is set on low speed. Start engine and let run until diesel is coming out return line

7. IF EXTENDED SHUTDOWN IS TO BE LONGER THAN 30 DAYS:
Remove product spray nozzle from spraygun and place spray end of gun in an empty pail. Squeeze gun handle and run until diesel fuel is coming out of gun

8. REPEAT Steps 4 through 7 using soapy water instead of diesel fuel

9. Shut engine off and fill priming tube with soapy water. THIS TRAPS SOAPY WATER IN THE PUMP AND PREVENTS THE VALVES FROM STICKING. Do not allow water to drain until the next time you are ready to use the pump

10. Disconnect spray gun and remove water nozzles

11. Place all spray nozzles, both product and water, in small container of diesel for cleaning

12. Roll up hose

13. Clean drum stingers with diesel fuel

14. Clean cam-locks on intake line and return line with diesel fuel

15. STORE UNIT IN AREA WHERE IT WILL NOT FREEZE.

Substrate Requirements

Concrete Surfaces

In general, only apply the Nitra-Core material to dry, clean and uniform substrates. Concrete surfaces must be a light trowel, light broom or equivalent finish. Remove fins, ridges and other projections and fill honeycomb, aggregate pockets, grout joints and tie holes, and other voids with hydraulic cement or rapid-set grout. It is the applicator's responsibility to point out unacceptable substrate conditions to the general contractor and ensure the proper repairs are made.

When applying the Nitra-Core or Nitra-Core Detail material to concrete it is important to not apply the product over standing water. Applying over standing water will result in the membrane not adhering to the substrate.

Applying Nitra-Core to a damp concrete surface is acceptable. Check to ensure that proper adhesion has occurred.

When applying the Nitra-Core to concrete, or sheet components, it is important to maintain a clean surface. It is recommended to remove excess dirt and dust from concrete and clean pipe penetrations prior to application.

Surfaces may need to be wiped down or cleaned prior to application. This includes, but is not limited to, the removal of forming oils, concrete curing agents, dirt accumulation, and other debris.

Conduit Penetrations

When applying the Nitra-Core to pipe penetrations or conduits, it is important to maintain a clean surface. It is recommended to remove excess dirt and dust and clean pipe penetrations prior to application. Slick finishes, like those found on steel or plastic pipes might need to be given a profile by using emery cloth or sand paper.

Substrate Preparation

Earth, sand or gravel substrate should be prepared and compacted to general building code requirements.

If installing over native soils, pieces of debris, gravel and/or any other material that can potentially puncture the TerraBase+ layer should be removed. Remove any debris from substrate that can potentially puncture the TerraShield system prior to application.

A sand substrate requires no additional preparation.

When installing the TerraShield system over a gravel layer, contact the manufacturer to insure the gravel layer will not be detrimental to the membrane. **The gravel layer must be compacted and rolled flat.** Ideally a ¾" minus gravel layer with rounded edges should be specified; however the TerraShield system can accommodate a wide variety of different substrates. Contact LS if there are questions regarding the compatibility of TerraShield and the utilized substrate.

The use of pea gravel will eliminate the concern of any jagged edges puncturing the membrane, however if not compacted properly, pea gravel can be an unstable substrate and potentially detrimental to the system.

Green Concrete

Applying the Nitra-Core to "green" concrete is acceptable and can be advantageous in creating a superior bond to the concrete surface. To help reduce blistering, apply a primer coat of only the asphalt component of the Nitra-Core system. Some blistering of the membrane will occur and may be more severe on walls exposed to direct sunlight. Blistering is normal and will subside over time. Using a needle nose depth gauge confirm that the specified mil thickness has been applied.

As the concrete cures and the moisture extracts from the concrete, the curing concrete draws the membrane into the pores of the concrete surface. This process will create a bond to concrete that will be stronger than spraying directly to fully cured concrete.

Installation Instructions

TerraBase+ Installation and Seam Overlaps

A depiction of this process can be found in Appendix A.

TerraBase+ layer shall be overlapped a minimum of 6" prior to application of the Nitra-Core layer.

Begin by rolling out the TerraBase+ layer across the subgrade and overlap the seams 6". The geotextile side (fabric side) should be facing down, with the smooth Metallized/Polyethylene layer facing up. At the seam overlap, pull back the TerraBase+ layer that is on top and then apply 60 mils of Nitra-Core or Nitra-Core Detail between the seams. Place the top TerraBase+ layer back over the recently applied Nitra-Core layer and step on the seam to ensure a tight seal.

Visually verify there are no gaps/fish-mouths in seams or reinforcement fabric used in details.

NOTE: To eliminate any moisture collecting on the TerraBase+ layer, only install the amount of the TerraBase+ layer that will be able to sprayed the same day. If the TerraBase+ layer is left out overnight and not sprayed, moisture may collect on the TerraBase+ layer. Moisture should be removed by using a broom, squeegee, or leaf blower to channel the water off the membrane in the same direction of the ridges found on the TerraBase+ layer. The trapped moisture may result in the blistering of the Nitra-Core membrane, this is normal, and the blisters will subside. Verify that the proper mil thickness has been applied.

NOTE: In windy conditions it might be necessary to encapsulate the seam by spraying the Nitra-Core layer over the completed TerraBase+ seam.

Spraying of Nitra-Core Material

It is crucial to achieve the proper mil thickness when applying the spray applied Nitra-Core layer. Several approaches can be used, use the following options as guidance in developing a method that is the most efficient for you.

- Build up the required mil thickness in one slow pass.
- Take several quick passes to build up the required mil thickness.
- An efficient blend of the two methods is to build up the membrane to the specified thickness using roughly 6 passes and then begin to build up 30 mils by making 3 passes (each pass is approximately 10 mils) with ½ of the fan pattern. Continue to overlap ½ of the fan pattern with each 30 mill build up, in effect overlapping 2, 30 mil layers.

NOTE: Care should be taken to not trap moisture between the layers of the membrane. Trapping moisture may occur from applying a second coat prior to the membrane curing.

NOTE: Repairs and detailing may be done over the Nitra-Core layer prior to the original layer of the Nitra-Core being fully cured. However, standing water produced as a result of the Nitra-Core curing should be removed prior to a new application of Nitra-Core.

The two catalyst nozzles (8001) should be adjusted to cross at about 18" from the end of the wand. This apex of catalyst and emulsion spray should then be less than 24" but greater than 12" from the desired surface when spraying. When properly sprayed the fan pattern of the catalyst should range between 65° and 80°. To regulate the catalyst fan pattern adjust the flow rate by adjusting the ball valve on the hose.

Adjust the amount of catalyst used based on the ambient air temperature and surface temperature of the substrate receiving the membrane. In hot weather use less catalyst as hot conditions will quickly "break" the emulsion and facilitate the curing of the membrane. In cold conditions and on vertical surfaces use more catalyst to "break" the emulsion quicker to expedite curing and set up time in cold conditions.

To spray the Nitra-Core layer, pull the trigger on the gun. A 42° fan pattern should form when properly sprayed.

Apply the Nitra-Core layer in a spray pattern that is perpendicular to the application surface. The concern when spraying at an angle is that an area might be missed. Using a perpendicular spray pattern will limit voids and thin spots, and will also create a uniform and consistent membrane.

When the membrane application is complete, review the membrane for any missed or lightly sprayed areas and mark them for repair. If any thin areas are found, they can be quickly repaired using Nitra-Core Detail or the spray applied Nitra-Core material.

Taking wet mil thickness measurements is the preferred method to verify mil thickness; coupon samples can be counter-productive due to their destructive nature, but should be used as a second option to verifying mil thickness.

When beginning to spray each day, take samples with the wet mil gauge every 500 square feet to ensure the proper thickness is being applied. Verify initial wet mil thickness readings by cutting a coupon sample and measuring thickness using a caliper.

The Nitra-Core layer will shrink as it cures. Observed shrinkage ranges between 20 and 30% for vertical surfaces and 5% for horizontal surfaces. When taking wet mil measurements, readings should indicate 50-57 wet mils for a vertical surface in order to yield a 40-mil cured membrane. After the verification of mil thicknesses is complete mark the area for repair. For more detail on the TerraShield quality control procedures, refer to the "TerraShield Quality Control" section.

The membrane will cure in 24 to 48 hours. As a rule, when temperature decreases or humidity increases, the curing of the membrane will be prolonged. If temperature limits the ability of the membrane to cure, take wet mil thickness readings to ensure proper thickness and then place the Land Science Protection Fabric layer over the Nitra-Core layer.

NOTE: The Nitra-Core spray is a water based emulsion and heightened awareness should be taken when spraying in cooler temperatures. Refer to the section in the manual titled "Weather Conditions" for specific guidance.

Land Science Protection Fabric Layer Installation

Remove any water that has collected on the surface of the Nitra-Core layer, prior to the placement of the LS Protection Fabric layer.

After the installation of 40 mils of the Nitra-Core layer is complete, the Nitra-Core thickness has been verified and repairs have been made, install the final LS Protection Fabric layer.

Roll out the LS Protection Fabric layer perpendicular to the TerraBase+ layer. The seams of the LS Protection Fabric layer will be overlapped a minimum of 6".

NOTE: Land Science Protection Fabric layer designed to adhere on top of Nitra-Core asphalt/latex barrier via physical bond. On case by case basis, the use fabric reinforced tape or a layer of Nitra-Core tack coat may be needed to seal the seams and to prevent damages to Nitra-Core. For further clarification, refer to the termination detail provided by manufacturer.

TerraShield Repair Procedures

The repair procedures for the TerraShield membrane vary depending on the type of damage that occurred and at what step during the installation process. Repairs can be made using Nitra-Core or Nitra-Core Detail and both options are explained.

In addition to the potential damage caused by construction traffic, repair procedures to the TerraShield system should conducted at areas where measurement devices that were used to verify thickness of Nitra-Core membrane.

Damage to Nitra-Core Only

Nitra-Core
Apply Nitra-Core asphalt emulsion component to a 9” area around the damaged Nitra-Core; allow the asphalt emulsion to flow into the damaged area. Apply the catalyst to set the Nitra-Core in place. It might be necessary to repeat this process if the damage is severe.

Nitra-Core Detail
Apply a tack coat of Nitra-Core Detail to a 9” area around the damaged Nitra-Core. Apply two additional 40 mil coats of Nitra-Core Detail over the tack coat. The first coat should be dry to touch prior to the application of the second coat.

Damage through the Entire TerraShield System

A depiction of this process can be found in Appendix B.

Nitra-Core
Apply a Nitra-Core tack coat 9” around the damaged area. Cut a square piece of TerraBase+ that extends 6” beyond the damaged area and place TerraBase+ (fabric side down) into the tack coat of Nitra-Core by pressing firmly. Apply a 40 mil Nitra-Core layer to the TerraBase+, thus encapsulating the TerraBase+ layer. Cut a square piece of Land Science Protection Fabric that will extend 3” beyond the Nitra-Core layer. Place the Land Science Protection Fabric over the Nitra-Core layer.

Nitra-Core Detail
Treat the area 9” around the damaged area with a coat of Nitra-Core Detail. Cut a square piece of TerraBase+ that extends 6” beyond the damaged area and place TerraBase+ (fabric side down) into the base coat of Nitra-Core Detail by pressing firmly. Apply two coats (30 mil each) of Nitra-Core Detail over the TerraShield layer, thus encapsulating the TerraBase+ layer. Cut a square piece of Land Science Protection Fabric that will extend 3” beyond the Nitra-Core layer.

Damage to the Nitra-Core and Land Science Protection Fabric

Nitra-Core
Pull back Land Science Protection Fabric exposing damaged Nitra-Core, apply 40 mil coat of Nitra-Core to the damaged Nitra-Core layer and 4” beyond the damaged area. Cut a square piece of Land Science Protection Fabric and extended 3” beyond the damaged area.

Nitra-Core Detail
Pull back Land Science Protection Fabric exposing damaged Nitra-Core, apply two coats (30 mil each) of Nitra-Core Detail to the damaged Nitra-Core layer and 4” beyond the damaged area. Cut a square piece of Land Science Protection to extend 3” beyond the damaged area and place the Land Science Protection layer over the Nitra-Core Detail layer.

Damage to TerraBase+

Nitra-Core
Apply a 30 mil tack coat of Nitra-Core 9” from the edge of the damaged TerraBase+ layer. Cut a square piece of TerraBase+ that extends 6” beyond the damaged area and place TerraBase+ (fabric side down) into the tack coat of Nitra-Core by pressing firmly. Apply a 30 mil coat of Nitra-Core to the TerraBase+ layer edges to secure and seal the TerraBase+ layer in place.

Nitra-Core Detail
Apply a coat of Nitra-Core Detail 9” from the edge of the damaged TerraBase+ layer. Cut a square piece of TerraBase+ that extends 6” beyond the damaged area and place TerraBase+ (fabric side down) onto the base coat of Nitra-Core Detail by pressing firmly. Apply a 30 mil coat of Nitra-Core Detail to the TerraBase+ layer edges to secure and seal the TerraBase+ layer in place.

Repair to a Fish-Mouth at Termination

A fish-mouth occurs when the TerraShield system is not properly terminated to the intended surface and thus a void is created that looks like an inverted “U” or “fish-mouth”. To remove, the fish-mouth area should be cut to allow the membrane to lie flat against the termination surface. Apply a 30 mil tack coat of the Nitra-Core or Nitra-Core Detail to

the termination surface and then secure the membrane into the Nitra-Core or Nitra-Core Detail by pressing firmly. Finish the repair process based on the material selected.

Nitra-Core
Apply a 40 mil coat of Nitra-Core 3” around the fish-mouth area

Nitra-Core Detail
Apply a 20 mil coat of Nitra-Core Detail 3” around the fish-mouth area. When dry to the touch, apply two additional 20 mil coats of Nitra-Core Detail.

Membrane Terminations

A depiction of this process can be found in Appendix C.

Ensure that the substrate surface the membrane is being terminated to is prepared in accordance with the “Substrate Requirements” section in this manual. Concrete surfaces that are not a light trowel, light broom or equivalent finish, will need to be repaired.

Apply 60 mils of Nitra-Core to the terminating surface and then embed the TerraBase+ layer by pressing it firmly into the Nitra-Core layer. Then apply 40 mils of Nitra-Core to the TerraBase+ layer. Apply the Land Science Protection Fabric layer.

This process is appropriate for terminating the membrane onto exterior footings, pile caps, interior footings and grade beams. When terminating the membrane onto stem walls, terminate the membrane 6" onto the vertical surface.

Terminations on horizontal and vertical surfaces should extend 6" onto the termination surface. Job specific conditions may prevent a 6" termination. In these conditions, contact Land Science for recommendations. If less than 1" of termination surface is available, then additional concrete may need to be poured or termination bar may be used to achieve the proper termination requirements.

When terminating to a stem wall, the slab thickness may be less than the 6". If this is the case, the slab is thinner than the required tie in (6") for the membrane. It will be necessary to remove aggregate in order to obtain the proper termination without extending the membrane beyond the top of the slab.

NOTE: Reinforcement fabric may be used to provide additional strength to terminations, but is not required.

Sealing Penetrations

A depiction of this process can be found in Appendix D.

NOTE: All pipe penetrations should be securely in place prior to the installation of the TerraShield system. Any loose penetrations should be secured prior to TerraShield application, as loose penetrations could potentially exert pressure on the membrane and damage the membrane after installation.

To properly seal around penetrations, cut a piece of the TerraBase+ layer that will extend 6" beyond the outside perimeter of the penetration. Cut a hole in the TerraBase+ layer just big enough to slide over the penetration, insuring the TerraBase+ layer fits snug against the penetration. **There should not be a gap larger than a 1/8" between the TerraBase+ layer and the penetration.** Other methods can also be utilized, provided, there is not a gap larger than 1/8" between the TerraBase+ layer and the penetration.

Seal the TerraBase+ layer using the Nitra-Core or Nitra-Core Detail to the underlying TerraBase+ layer.

Apply one coat of Nitra-Core Detail or Nitra-Core spray to the TerraBase+ layer and around the penetration at a thickness of 30 mils. Penetrations should be treated in a 3-inch radius around penetration and 3 inches onto penetrating object.

Embed a fabric reinforcing strip after the first application of the Nitra-Core spray or Nitra-Core Detail material and then apply a second 30 mil coat over the embedded joint reinforcing strip ensuring its complete saturation of the embedded strip and tight seal around the penetration.

After the placement of the Land Science Protection Fabric layer, a cable tie should then be placed around the finished penetration. The cable tie should be snug, but not overly tight so as to slice into the finished seal.

NOTE: Metal or other slick penetration surfaces may require treatment in order to achieve proper adhesion. For plastic pipes, sand paper may be used to achieve a profile, while an emery cloth is more appropriate for metal surfaces. An emery cloth should also be used to remove any rust on metal surfaces.

OPTION: The cable tie may be placed after the reinforcement fabric and before the second 30 mil layer of CORE is applied.

Pile Penetrations

Seal the TerraShield system onto piles in the same manner as a pipe penetration. Additional questions about how to properly seal onto or around a pile should be directed to Land Science.

Penetration Clusters

To maximize the seal around penetrations, Land Science recommends that a minimum of 3" spacing be placed between penetrations. However, in some cases several penetrations will be clustered together tightly and will make it very difficult to seal the penetrations properly. NOTE: Land Science provides these options as a recommendation to the specifying engineer, but does not warrant products not supplied by Land Science.

Option 1
Pour unreinforced concrete in between and extending 6" around the penetration cluster. Seal the TerraShield system to the 6" collar using the standard termination method. Then apply a solvent free sealant around the penetrations cluster and allow curing.

Option 2
Use 1 larger diameter pipe to incase all the smaller diameter pipes. Seal the TerraShield membrane to the larger diameter pipe per the standard penetration detail. Then fill the annular space inside the large diameter pipe with a non-shrink solvent free caulking material.

Vertical Walls

NOTE: If hydrostatic pressure is present contact Land Science for the project specific recommendations. In hydrostatic conditions the TerraShield membrane will run under the entire foundation slab and up the vertical walls. The membrane will terminate 1' above the design watertable specified in the published soils report.

Free Standing Walls

On vertical walls, form tie holes need to be grouted.

Grouted form tie holes and repaired concrete surfaces should be prepped by coating the repaired surface with Nitra-Core Detail. Use a paint brush to apply a 30 mil coat of material to these areas. When applying material to form tie holes, dab material on using a 3" paint brush. This action will help fill in the tie hole without leaving excess material.

Form joints in concrete should be reinforced using Nitra-Core Detail and reinforcement fabric. Apply a coat of Nitra-Core Detail 3" on each side of the form joint. Then embed the reinforcement fabric and apply another layer of Nitra-Core Detail making sure to fully encase the reinforcement fabric with the Nitra-Core material. Once complete, apply the specified mil thickness of the Nitra-Core to the wall and over the form joint.

Shoring Systems

Due to the use of many different types of shoring systems contact Land Science if applying TerraShield to shoring walls.

Weather Conditions

Application in Cold Temperatures

The application of TerraShield in colder temperatures is done on a case by case basis and subject to the applicator's discretion. The applicator should determine if the application conditions will adversely affect the quality of the TerraShield installation.

FROST is the biggest threat to a successful TerraShield application. Do NOT apply the Nitra-Core material over FROST.

The ideal temperature to install the TerraShield system is 45ºF or higher. Application of the TerraShield system in temperatures between 25°F and 45°F can be accomplished by heating the Nitra-Core layer prior to application. Heating the material can be done using drum heaters or by using a heat exchange pump system which circulates heat through the material. Keeping the temperature of the Nitra-Core material and the catalyst above freezing is imperative; failure to do so will result in the material freezing. If the Nitra-Core material freezes, it will need to be replaced at the applicator's expense.

Temperatures under 25°F require additional measures for application. If heat will be circulated through the Nitra-Core material, ensure the ambient air temperature is increased to >35°F. If heat will not be circulated through the material, raise the ambient air temperature to 45°F and higher.

The exposure of the pump hoses to cold temperatures should also be limited. If hoses are left outside, exposed to the elements and filled with material, the material can freeze in the hoses.

In addition to maintaining the temperature of the material, the temperature of the concrete may need to be heated to ensure proper adhesion. Heating of the concrete surface can either be done using a torch or by tenting the area and heating it artificially.

DO NOT torch the concrete surface without getting permission from the general contractor and concrete contractor. Artificially heating concrete with a high temperature device can be detrimental to some types of concrete.

Application in Hot Temperatures

TerraShield installation is not restricted by warm temperatures. One advantage to applying the Nitra-Core layer in hot weather (substrate temperature over 105°F), is the membrane will cure very quickly. However, it will become very tacky and susceptible to damage by foot traffic. Inspections should be done in the early morning or late afternoon in order to minimize foot traffic on the membrane.

When spraying in hot temperatures, the protective Land Science Protection Fabric layer should be placed over the spray applied Nitra-Core layer immediately after the wet mil thickness of the Nitra-Core layer has been verified.

Application in Wind

Wind over 10 miles per hour can present a problem when trying to apply the TerraShield.

- Use good judgment when applying TerraShield in windy conditions.
- Material can be lost due to the wind blowing it away before it reaches the surface. This can potentially damage areas several hundred feet away from the intended application surface.
- The applicator is responsible to mask off any areas on the job site where overspray could present a problem.
- One way to combat the overspray problem in windy conditions is to have one member of the spray crew stand in front of the sprayer with a large piece of plywood, or other similar material.

Wind can blow the TerraBase+ or Land Science Protection Fabric from its intended location. Secure sheet layers using sand bags or other methods to prevent the sheets from blowing away.

Application in Rain

A light mist or even drizzle is acceptable, provided water is not ponding on the surface that the Nitra-Core will be applied to. If the intensity increases, do not spray any further. Wait until the rain stops and begin to remove the water from the intended Nitra-Core application surface, a push broom, large squeegee, leaf blower will be sufficient.

Even though ponding water has been removed, some moisture can remain. If moisture does remain, it is possible the membrane will not adhere immediately to the Nitra-Core layer; this is normal and the Nitra-Core should fully adhere as the membrane begins to cure.

Troubleshooting

Why is the Nitra-Core material not setting up properly?

The reason the membrane is not setting up properly could be for the following reasons.

1. The spray fan pattern is off. Confirm that the catalyst and emulsion are mixing 18" from the tip of the gun and at least 12" from the intended surface

2. The catalyst is not flowing properly. Check the ball valve to insure the proper flow and spray additional catalyst

3. Calcium chloride are not dissolving in water. Check calcium chloride dissolved solution for consistencies, if needed, add more Calcium Chloride to catalyst solution.

Why is the Nitra-Core not adhering?

The reason the membrane is not adhering could be for the following reasons.

1. There is ponding moisture between the Nitra-Core and the substrate you are trying to apply it to. Remove all excess moisture

2. The substrate is dirty. Remove excess dust, dirt, or other compounds from the desired surface

3. The catalyst is reaching the surface you're spraying to prior to the Nitra-Core. Check spray gun fan pattern to ensure the proper fan pattern is being sprayed.

I think I have a bad batch of material.

Contact Land Science ASAP, Telephone: 949.481.8118

What happens if I have to stop spraying and come back several days later to start again?

The biggest challenge to stopping and starting are the dirt and debris that accumulates on the tie-in area. Construction traffic around the tie-in area also poses a challenge.

If there is low traffic in the area you are spraying, leave a 6" area of the TerraBase+ layer with 40mil Nitra-Core exposed so you can tie into it later. When arriving back to the jobsite, inspect the Nitra-Core layer to insure there is not severe damage. Rinse off the Nitra-Core layer with water to remove dirt and dust and let the area dry. Then apply 40 mils of Nitra-Core to the existing Nitra-Core layer and then firmly press the new TerraBase+ layer into the freshly sprayed membrane.

In higher traffic areas, a heavier protective course should be placed over the Nitra-Core and TerraBase+ layer to help protect the membrane from heavy construction traffic. Leave a 6" area of the TerraBase+ layer with 40mil Nitra-Core exposed so you can tie into it later. When ready to continue installation, clean off the exposed area and continue the installation. In some cases when the membrane has been exposed for a long period of time, a light application of a mineral spirit to Nitra-Core surface might be necessary to obtain adhesion between the new and existing Nitra-Core.

I got material all over my skin what do I do?

The Nitra-Core can be cleaned off with WD-40, baby oil, GOJO or other similar product.

What will happen if I wash my clothes with Nitra-Core on it?

Unfortunately, once Nitra-Core adheres to clothing, it might not come out with normal washing. After washing, do not place into the dryer as the heat from the dryer can melt the Nitra-Core membrane and cause it to attach to other items or the interior of the dryer. Nitra-Core will most likely be removed from clothing with solvents used by a drycleaner.

What do I do if sprayed Nitra-Core on something I was not supposed to?

On the jobsite accidents do happen. While masking off certain non-application areas, the Nitra-Core may be applied to unwanted surfaces. To remove the Nitra-Core layer from unwanted surfaces we recommend the following options:

1. Scrape off the unwanted material using a putty knife or other tool with a hard straight edge

2. Clean area with a mineral spirit, i.e. paint thinner or other mild solvent

3. Clean area with tar remover or asphalt remover

4. Sand blast the area.

TerraShield Quality Control

Certified Applicator

Authorized installation of TerraShield can only be accomplished by one of Land Science's Certified Applicators.

Membrane Inspections

For projects that will require a material or system (workmanship and material) warranty, Land Science will require a manufacturer's representative or certified 3rd party inspector to inspect and verify that the membrane has been installed per the manufacturer's recommendations.

The applicator is responsible for contacting the inspector for inspection. Prior to application of the membrane, a notice period for inspection should be agreed upon between the applicator and inspector.

Material Yield

Material yield is one of the first indicators in determining if the Nitra-Core layer has been installed correctly. A baseline standard for yield is as follows:

Material Container	30 dry mils	40 dry mils	60 dry mils	80 dry mils
55 Gallon Drum	1,823 ft^2	1,367 ft^2	911 ft^2	783 ft^2
275 Gallon Tote	9,115 ft^2	6,835 ft^2	4,555 ft^2	3,415 ft^2

The estimated yield is 25 ft^2 per gallon for a 40 dry mil application using the recommended thickness, unless otherwise noted by a specified engineer or regulatory agency.

Yields can decrease based on the complexity of the foundation. Projects containing many penetrations and areas where a lot of detailing is required might reduce the material yield to 20 ft^2 or 22 ft^2 per gallon for a 40 mils membrane.

Millage Verification

The measurement tools listed below will help verify the thickness of the Nitra-Core layer. As measurement verification experience is gained, these tools will help confirm thickness measurements that can be obtained by pressing one's fingers into the Nitra-Core membrane.

To verify the mil thickness of the Nitra-Core, the following measurement devices are available:

Mil reading caliper (required): Calipers are used to measure the thickness of coupon samples. To measure coupon samples correctly, the thickness of the TerraShield sheet layers must be taken into account (This is best done by obtaining a sample of the TerraBase+ layer and then zeroing out the caliper to the TerraBase+ layer). Mark sample area for repair.

Wet mil thickness gauge (optional): A wet mil thickness gauge may be used to quickly measure the mil thickness of the Nitra-Core layer. The thickness of the TerraBase+ sheet layers do not factor into the mil thickness reading, but the softness of the subgrade might result in inaccurate readings.

NOTE: When first using a wet mil thickness gauge on a project, collect coupon samples to verify the wet mil gauge thickness readings.

Needle nose digital depth gauge (for concrete only): A needle nose depth gauge can be used when measuring the Nitra-Core thickness on vertical walls or in field measurements. Mark measurement area for repair.

To obtain a proper wet mil thickness reading, take into account the 20% to 30% shrinkage that will occur as the membrane fully cures. Not taking into account the thickness of the sheet layers, a freshly sprayed membrane should have a minimum wet thickness of 50 (20%) to 57 (30%) wet mils.

Visual Inspections

The guidelines outlined in this section provide ways to quantify and observe the proper installation of the TerraShield system. However, a visual inspection should also be done to ensure any visual imperfections are not present, i.e. fish-mouths, punctures, voids, etc. During a visual inspection post installation, punctures in the TerraShield system should be easy to identify due to the color contrasting layers of the system.

Membrane Testing Log

To aid in the inspection process and properly document the TerraShield membrane inspection, create a membrane testing log. We recommend creating the log by using the foundation plan (plan view) of the structure and then creating a 500 square foot grid over the foundation. If this is not able to be done, enclosed is a membrane testing log template that can also be used. (Appendix E)

Wet Mil Thickness Readings

A wet mil thickness gauge is one method to verify the mil thickness of the Nitra-Core layer. An advantage to this method is the ability to verify the Nitra-Core thickness by minimizing destructive coupon sampling.

1. Create a membrane testing log by obtaining a copy of the foundation plan and then draw a 500 square foot grid over the foundation plan. Make two copies of the membrane testing log; one should be used when collecting coupon samples and the other should be used when conducting the smoke test.

2. Note time, date, project name, inspector name, temperature and weather conditions on testing log.

3. Number each quadrant and inspect sequentially.

4. When arriving at each quadrant quickly assess if there are any conditions that might present any challenges in establishing a proper seal. Note areas and discuss with applicator.

5. Conduct a visual inspection of the membrane. Look for areas where a proper seal was not created, i.e. a fish-mouth at the termination and areas where the membrane might be sprayed thin. Mark areas needed for repair in the field with florescent paint or with chalk. Also make a note on the testing log.

6. Conduct a thickness sample in the area that is suspected to be sprayed thin and take three readings within 3" of one another. **When beginning a project, verify the wet mil gauge thickness reading by cutting a coupon sample and measuring the thickness with a caliper.** Once wet mil thickness readings have been confirmed and established, confirm wet mil thickness periodically by taking a coupon sample and caliper measurement.

7. After sampling 5 quadrants it is at the discretion of the inspector to continue collecting samples every 500 ft^2 or 1,000 ft^2.

8. This method will verify the thickness of the Nitra-Core layer prior to it fully curing. To obtain a proper wet mil thickness reading, take into account the 20% to 30% shrinkage that will occur as the membrane fully cures. Not taking into account the thickness of the sheet layers, a freshly sprayed membrane should have a minimum wet thickness of 50 (20%) to 57 (30%) wet mils.

9. If using a wet mil gauge to verify a fully cured membrane the gauge should read 40 mils.

10. When testing is complete, send a copy of the membrane testing log to Land Science. Keep the coupon samples for the file, or send them to Land Science.

Coupon Sampling

Coupon sampling is the most accurate way to verify the Nitra-Core thickness. However, please note that taking too many coupon samples, or destructive samples, can be counter-productive. To collect a coupon sample the following steps should be followed:

1. Create a membrane testing log by obtaining a copy of the foundation plan and then draw a 500 square foot grid over the foundation plan. Make two copies of the membrane testing log, one should be used when collecting coupon samples and the other should be used when conducting the smoke test.

2. Note time, date, project name, inspector name, temperature and weather conditions on testing log.

3. Number each quadrant and inspect sequentially.

4. When arriving at each quadrant quickly assess if there are any conditions that might present any challenges in establishing a proper seal. Note areas and discuss with applicator.

5. Conduct a visual inspection of the membrane. Look for areas where a proper seal was not created, i.e. a fish-mouth at the termination and areas where the membrane might be sprayed thin. Mark areas needed for repair in the field with florescent paint or with chalk. Also make a note on the testing log.

6. Calibrate mil reading caliper to account for the thickness of the TerraBase+ layer. This is best done by obtaining a sample of the TerraBase+ layer and then zeroing out the caliper to the TerraBase+ layer.

7. Collect a coupon sample in the area that is suspected to be sprayed thin. Use a box cutter to cut a 3 square inch sample from the membrane. Measure each side to confirm the specified minimum thickness has been obtained. Number each sample and save in the job file. Mark the area for repair in the field and on the site plan.

8. After sampling 5 quadrants it is at the discretion of the inspector to continue collecting samples every 500 ft^2 or 1,000 ft^2.

9. This method will verify the thickness of the Nitra-Core layer prior to it fully curing. Observed shrinkage of the Nitra-Core layer during the curing process ranges from 20% to 30%. When taking uncured samples assume a minimum of 5% loss for horizontal surfaces and 20% for vertical surfaces. Assuming a 20-30% loss, the wet mil gauge should read a mil thickness between 50 and 57 mils.

10. When testing is complete, send a copy of the membrane testing log to Land Science. Keep the coupon samples for the file, or send them to Land Science.

Smoke Testing

This test is intended to visually verify and confirm the proper installation of the TerraShield system. Land Science requires a smoke test on all projects in order to obtain a warranty. The smoke test will be performed by the applicator.

Smoke testing should occur after the Nitra-Core layer has been installed and mil thickness verified. Smoke testing may be conducted before the Nitra-Core is fully cured. Smoke testing may occur after the Land Science Protection Fabric layer is installed, if preferred by the applicator. Upon completion of the original smoke test, additional smoke tests can be conducted per the membrane manufacturer's, specifying engineer or regulatory agency's request. To conduct a smoke test follow these steps:

1. One smoke test can cover between 2000-3000 square feet per test. However, coverage will greatly depend on the sub grade under the membrane. On sites where multiple smoke tests will be needed, use the first two smoke tests to estimate the coverage area per test.

2. Visual verification of soundness of seams, terminations and penetrations should be performed. Identify/correct any apparent deficiencies and/or installation problems.

3. Note time, date, project name, inspector name, temperature and weather conditions on testing log. In addition, record humidity, barometric pressure, and wind speed/direction. Confirm wind speed is below 15 mph. Visual identification of leaks becomes more difficult with increasing wind speed.

4. Cap other vent outlet(s) not being used. If the installation has no sub-slab vent system or the membrane is isolated from the vent system, connect the smoke testing system directly to the membrane using a temporary boot collar or other method. Insert the smoke test hose into coupon sampling locations, creating a seal around the smoke test hose with a rag.

5. Activate the smoke generator/blower system and connect to sub-slab vent riser or directly to the membrane.

6. To confirm the adequate flow of smoke under the membrane cut a 2" vent in the membrane to facilitate the purging of air pockets under it. If working properly, smoke will consistently flow though the 2" vent. If a low rate of smoke flow is observed it is an indication of poor smoke flow under the membrane. If low flow does occur, insert the smoke testing hose into the 2" membrane vent.

7. Mark sampling locations with fluorescent paint or chalk. Repair sampling locations per Land Science recommendations.

8. Maintain operation of smoke generator/blower system for 10-15 minutes following purging of membrane. Thoroughly inspect entire membrane surface. Use fluorescent paint or chalk to mark/label any leak locations. Mark/label leak locations on testing log. NOTE: The duration of the smoke test will vary depending on the size of the area being tested. To help determine the duration, monitor the pressure building up under the membrane. If excessive lifting (1"-2" lift) of the membrane occurs, decrease the duration or pressure of the smoke test.

9. Prepare membrane inspection log. Identify the type of leak found, i.e. poor seal around penetration, fish-mouth, puncture, etc.

10. Repair leak locations marked in step 7 and step 8 per procedures outlined in "TerraShield Repair Procedures" section using Nitra-Core or Nitra-Core DETAIL. Repairs can be made when the smoke machine is in operation. If the smoke machine is shut down in order to make the necessary repairs, restart the smoke machine to verify the repairs have been made properly.

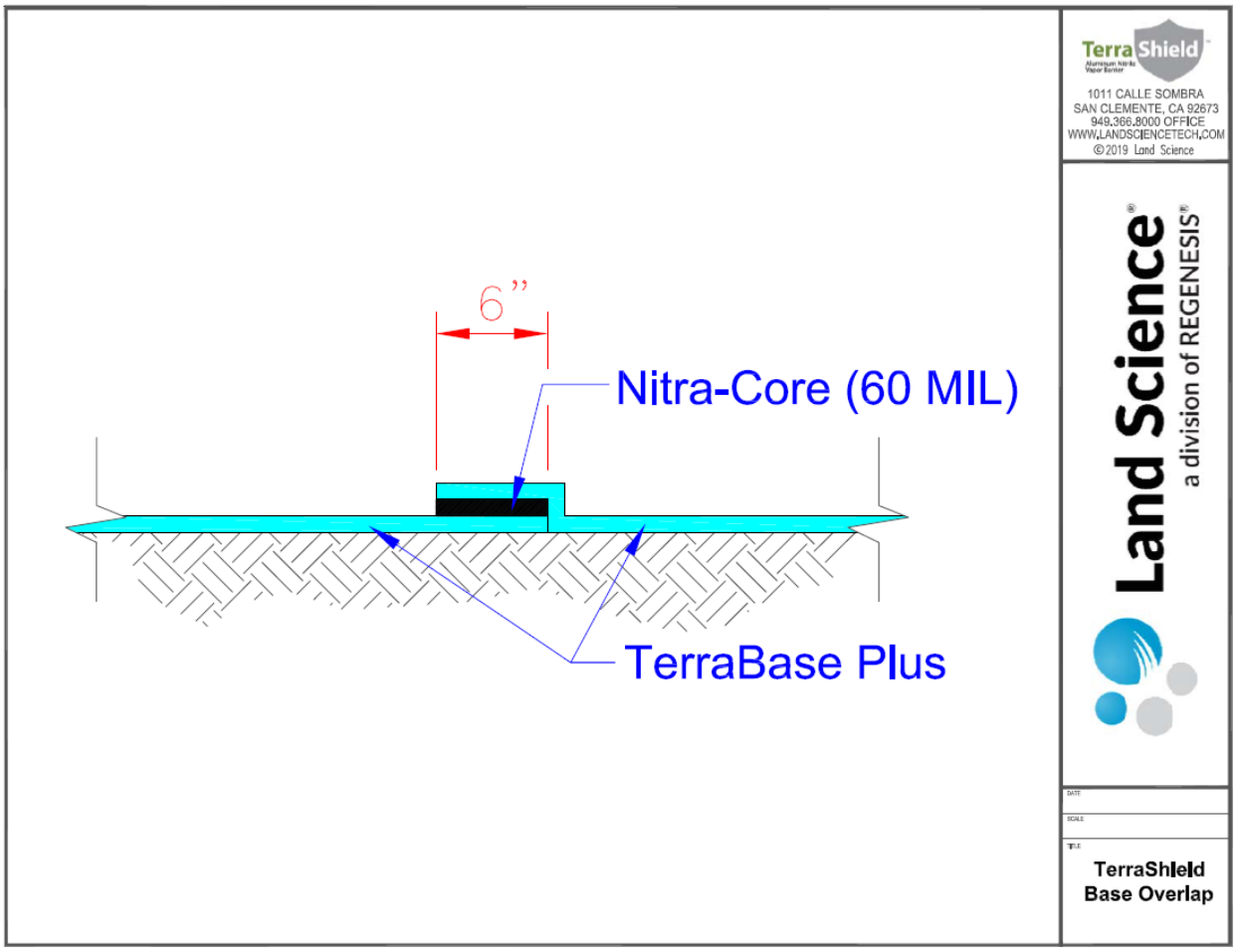
11. Repeat steps 4 through 10 as necessary to confirm the integrity of the membrane.

12. Complete the smoke testing inspection form indicating the successful completion of the smoke test.

Post Installation Inspection

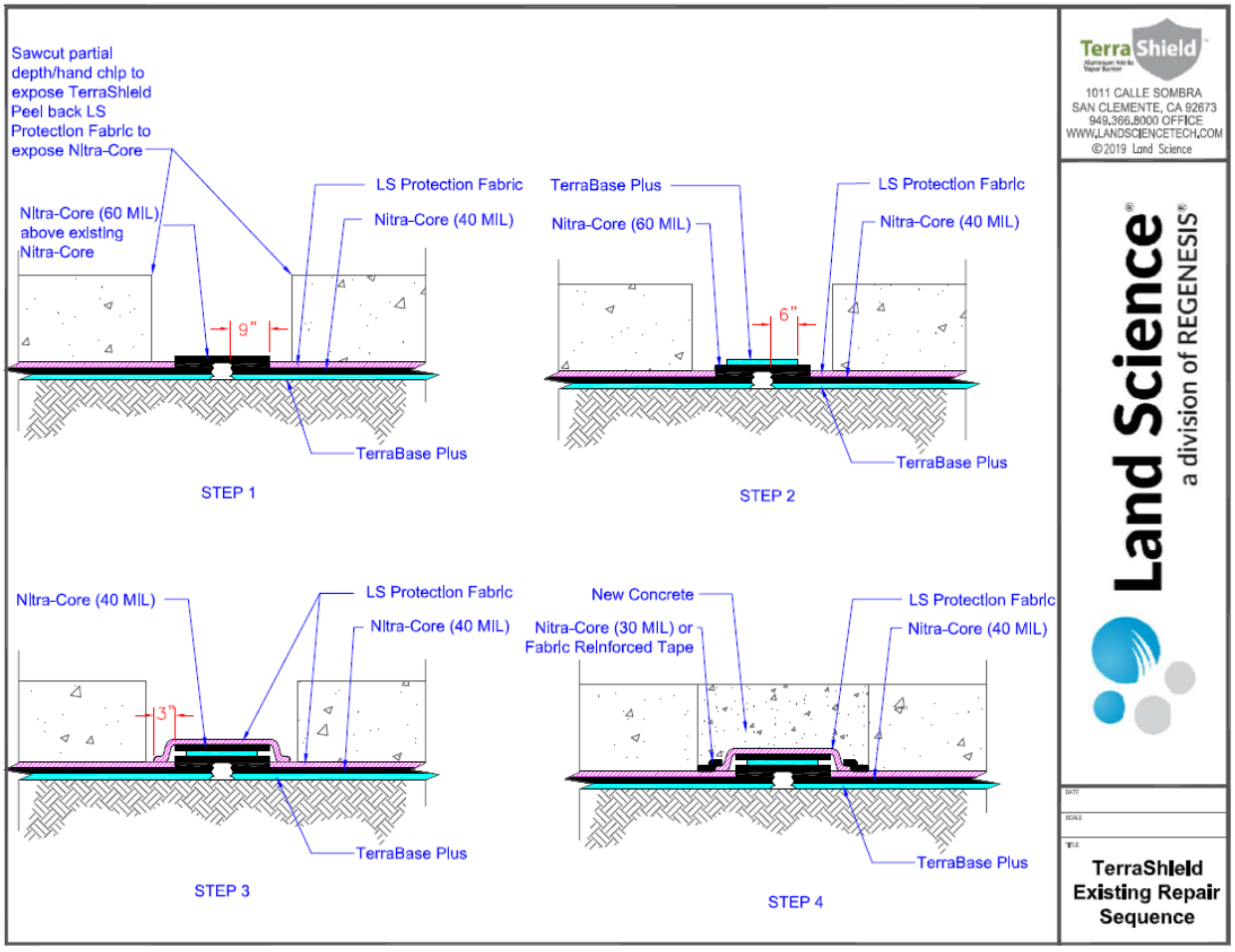
After a manufacturer's representative or 3rd party inspector signs off on the membrane installation and the steel workers begin to install the rebar, it is recommended to conduct a visual inspection prior to the placement of concrete. Damages are most likely to occur during this time and it is imperative that punctures are identified prior to the placement of the slab.

Appendix A



Appendix B

TerraShield Repair Procedures


Sawcut partial depth/hand chip to expose TerraShield Peel back LS Protection Fabric to expose Nitra-Core
Nitra-Core (60 MIL) above existing Nitra-Core
LS Protection Fabric
Nitra-Core (40 MIL)
9"
TerraBase Plus
STEP 1
TerraBase Plus
Nitra-Core (60 MIL)
LS Protection Fabric
Nitra-Core (40 MIL)
6"
TerraBase Plus
STEP 2
Nitra-Core (40 MIL)
LS Protection Fabric
Nitra-Core (40 MIL)
3"
TerraBase Plus
STEP 3
New Concrete
Nitra-Core (30 MIL) or Fabric Reinforced Tape
LS Protection Fabric
Nitra-Core (40 MIL)
TerraBase Plus
STEP 4
TerraShield
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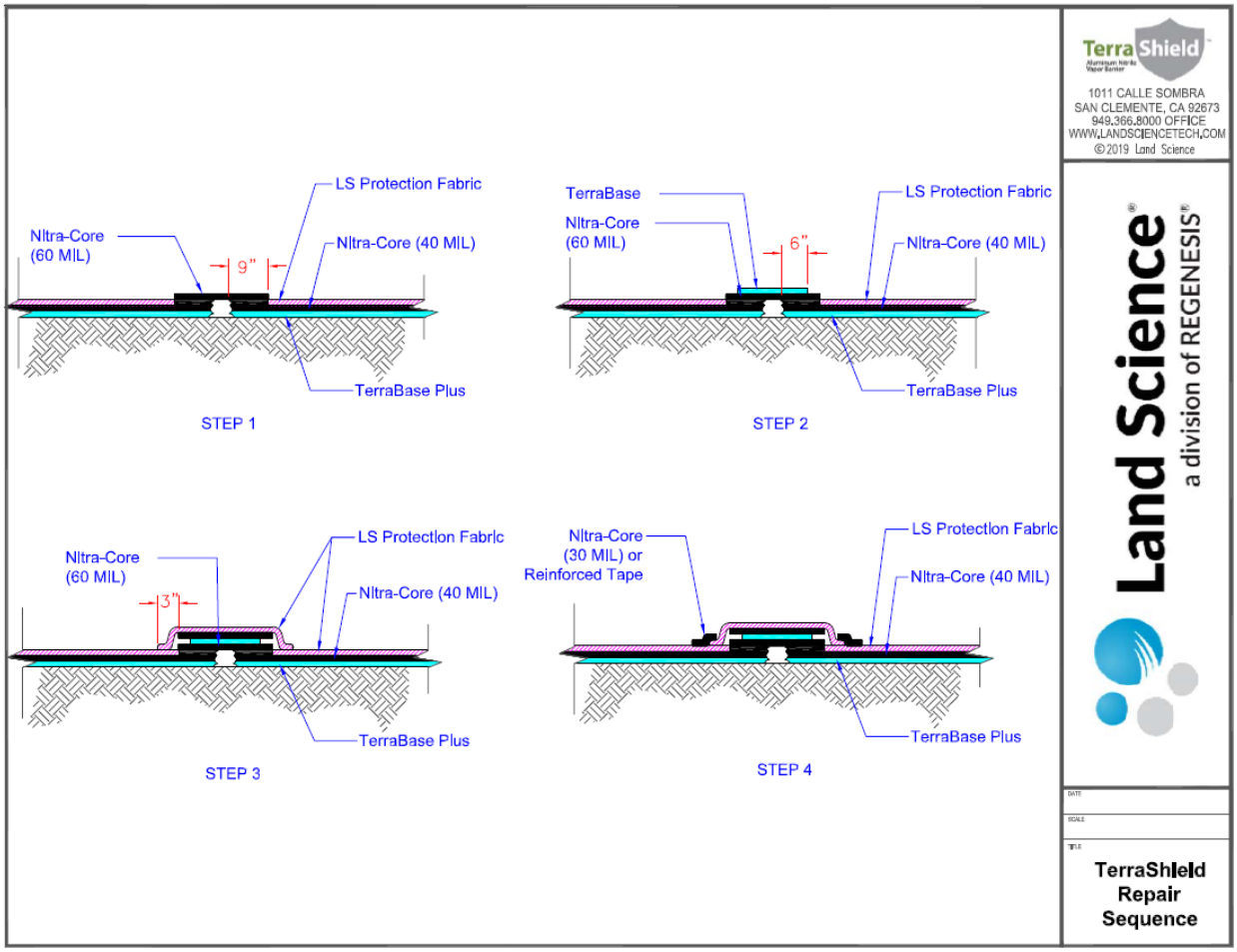
DATE
SCALE
TITLE
TerraShield Existing Repair Sequence


LS Protection Fabric
Nltra-Core
(60 MIL)
9"
Nltra-Core (40 MIL)
TerraBase Plus
STEP 1
TerraBase
Nltra-Core
(60 MIL)
6"
LS Protection Fabric
Nltra-Core (40 MIL)
TerraBase Plus
STEP 2
Nltra-Core
(60 MIL)
3"
LS Protection Fabric
Nltra-Core (40 MIL)
TerraBase Plus
STEP 3
Nltra-Core
(30 MIL) or
Reinforced Tape
LS Protection Fabric
Nltra-Core (40 MIL)
TerraBase Plus
STEP 4
TerraShield
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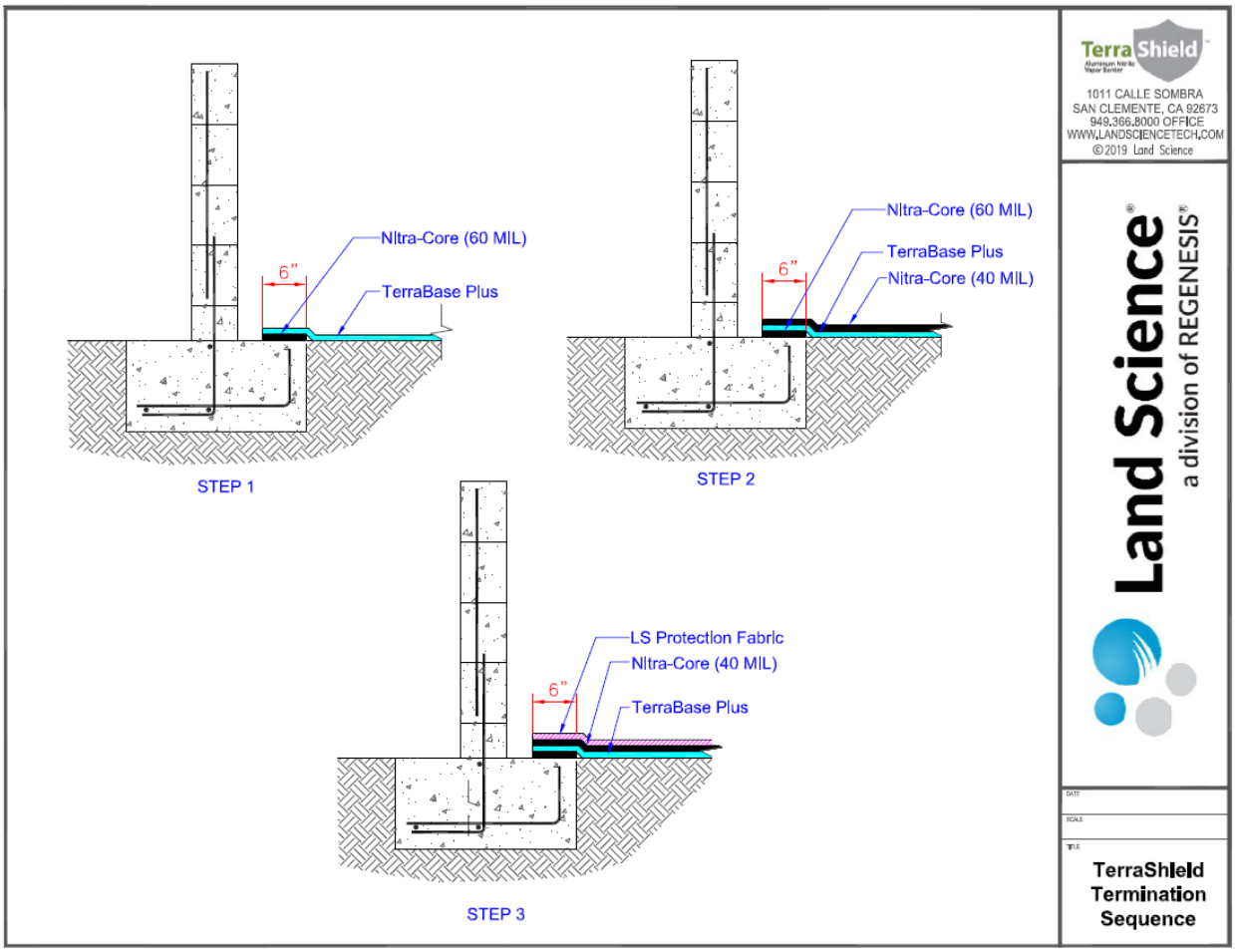
SCALE
TITLE
TerraShield
Repair
Sequence

Appendix C


Nltra-Core (60 MIL)
TerraBase Plus
6"
STEP 1
Nltra-Core (60 MIL)
TerraBase Plus
Nitra-Core (40 MIL)
6"
STEP 2
LS Protection Fabric
Nltra-Core (40 MIL)
TerraBase Plus
6"
STEP 3
TerraShield
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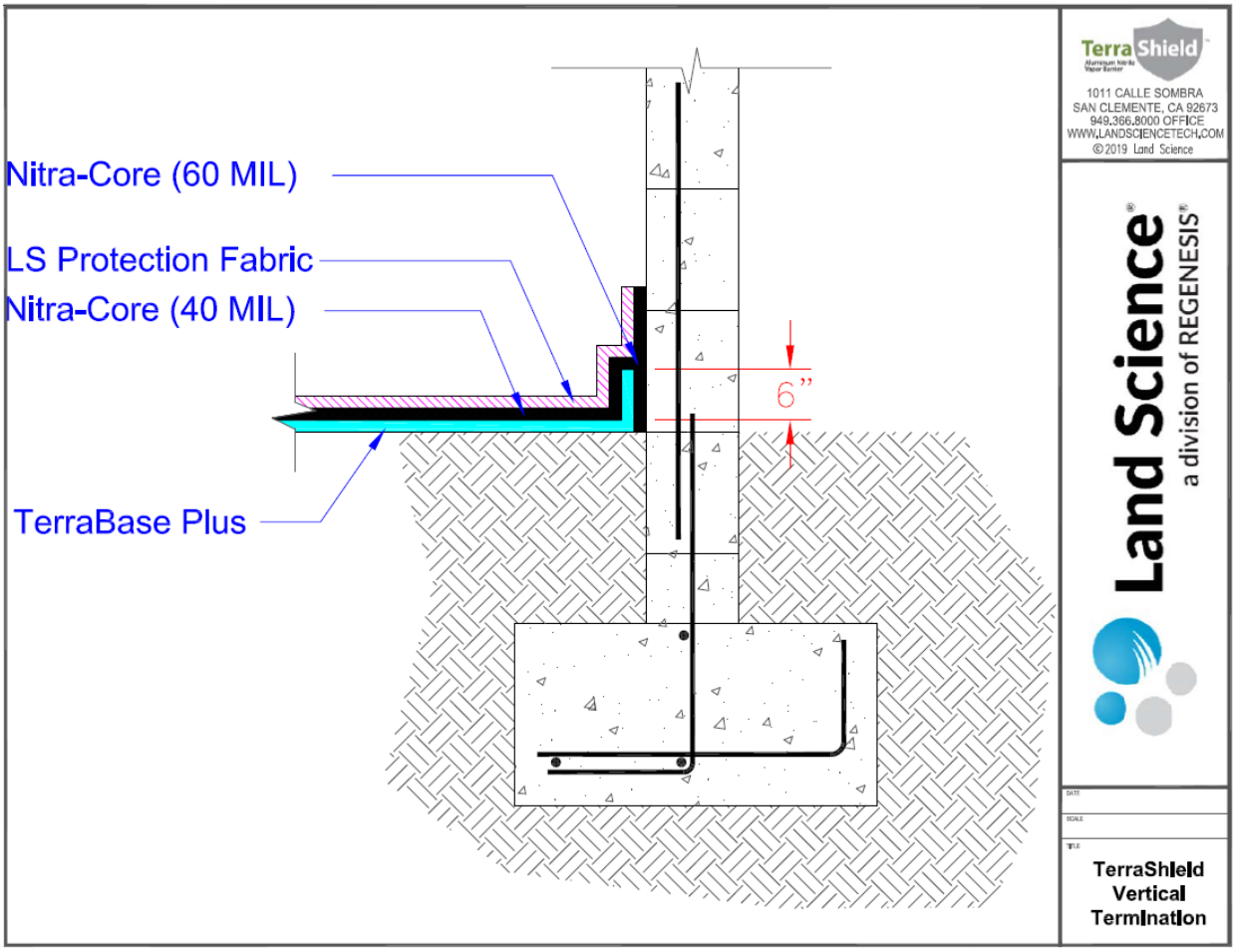
TerraShield Termination Sequence


Nitra-Core (60 MIL)
LS Protection Fabric
Nitra-Core (40 MIL)
TerraBase Plus
6”
TerraShield
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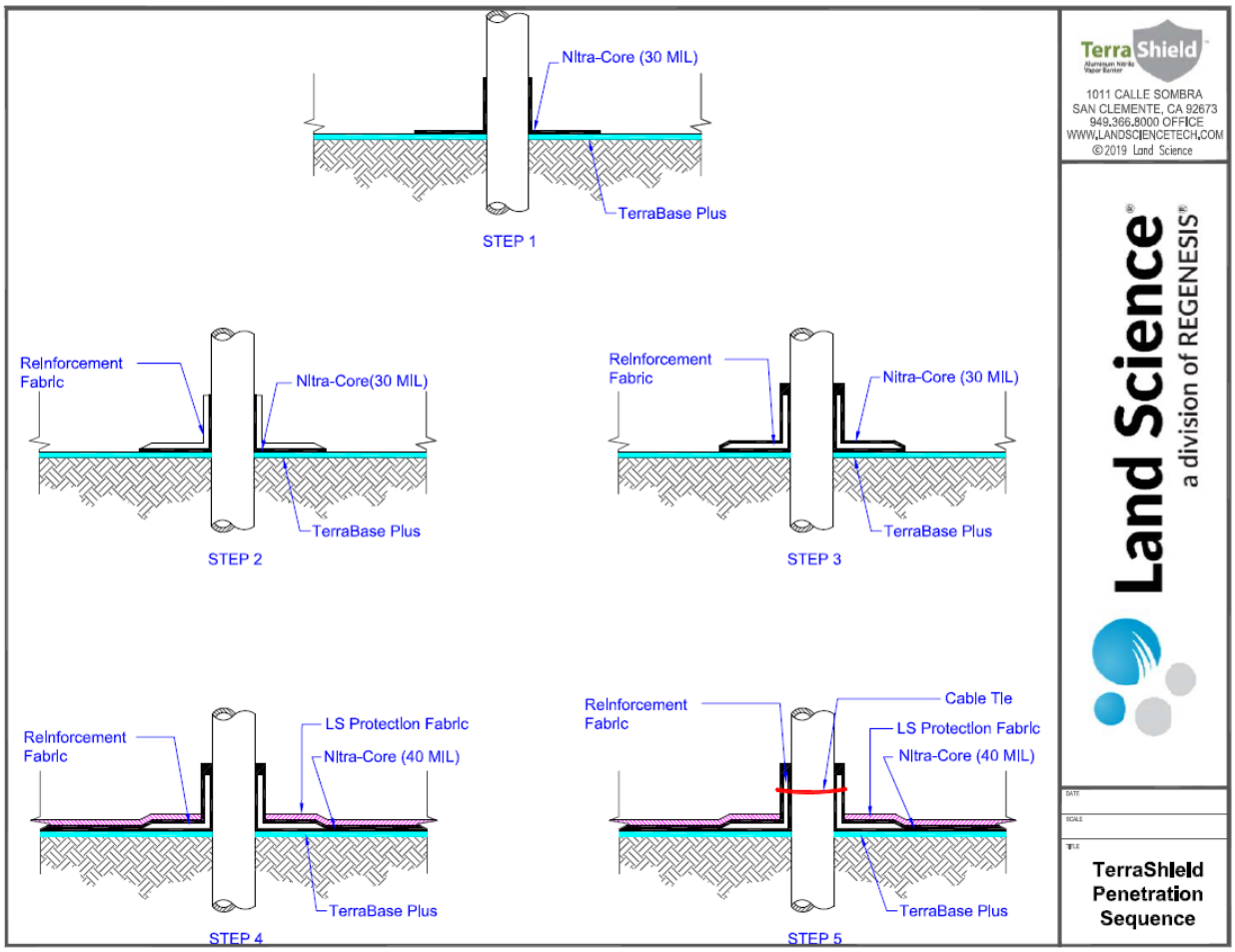
TITLE
TerraShield
Vertical
Termination

Appendix D


Nltra-Core (30 MIL)
TerraBase Plus
STEP 1
Reinforcement Fabric
Nltra-Core(30 MIL)
TerraBase Plus
STEP 2
Reinforcement Fabric
Nitra-Core (30 MIL)
TerraBase Plus
STEP 3
Reinforcement Fabric
LS Protection Fabric
Nltra-Core (40 MIL)
TerraBase Plus
STEP 4
Reinforcement Fabric
Cable Tie
LS Protection Fabric
Nltra-Core (40 MIL)
TerraBase Plus
STEP 5
TerraShield
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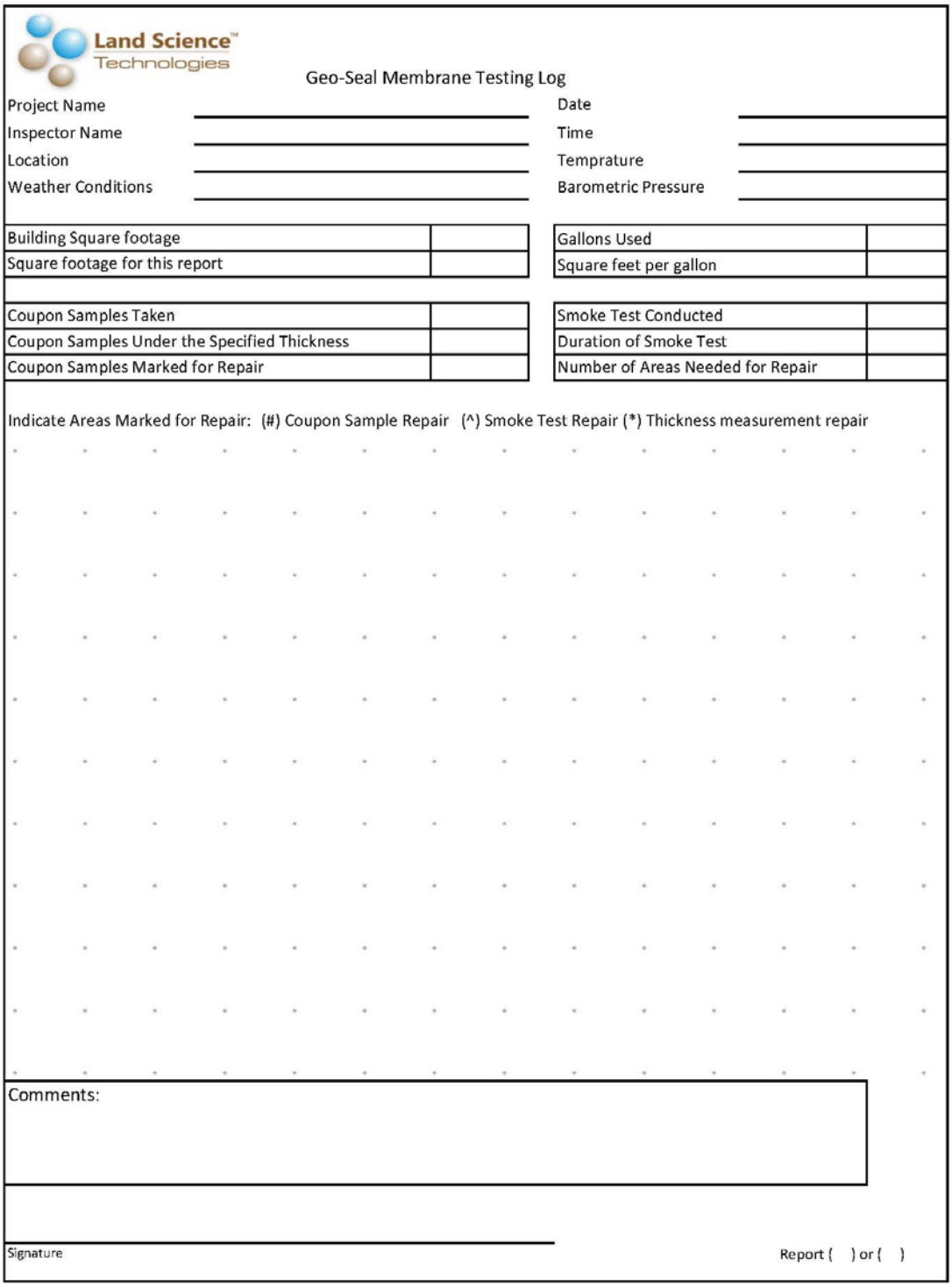
DATE
SCALE
TITLE
TerraShield Penetration Sequence

Appendix E
(A full size file can be provided upon request)



Land Science™ Technologies

Geo-Seal Membrane Testing Log

Project Name		Date	
Inspector Name		Time	
Location		Temprature	
Weather Conditions		Barometric Pressure	

Building Square footage		Gallons Used	
Square footage for this report		Square feet per gallon	

Coupon Samples Taken		Smoke Test Conducted	
Coupon Samples Under the Specified Thickness		Duration of Smoke Test	
Coupon Samples Marked for Repair		Number of Areas Needed for Repair	

Indicate Areas Marked for Repair: (#) Coupon Sample Repair (^) Smoke Test Repair (*) Thickness measurement repair

Comments:

Signature

Report { } or { }