RECORD OF DECISION

MARSH LUMBER SAWMILL SITE

Florence County, South Carolina

Prepared by

South Carolina Department of Health and Environmental Control

Bureau of Land and Waste Management

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6.0 Authorizing Signature

This ROD documents the Department's selected remedy for contaminated soil and groundwater at the Marsh Lumber Sawmill Site.

12-2-2021

Henry Porter, Chief
Bureau of Land and Waste Management
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Date

Part I - THE DECLARATION

1.0 Site Name and Location

The Marsh Lumber Sawmill Site (Site) is located in Pamplico, South Carolina in a light industrial area. The physical address of the Site is 119 West Sixth Avenue, Pamplico, SC. The Site consists of approximately 15 acres of a larger 28-acre parcel. The site location is illustrated on Figure 1. The current owner is Marsh Furniture Company, Inc. (Marsh). The property is zoned light industrial in Florence County, SC.

2.0 Statement of Basis and Purpose

This Decision Document presents the Final Selected Remedy for the Marsh Lumber Sawmill Site. This remedy was selected by the South Carolina Department of Health and Environmental Control (The Department) in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and to the extent practicable the National Contingency Plan (NCP). The decision is based on the Administrative Record for the Site.

3.0 Assessment of the Site

The remedial action selected in this Record of Decision (ROD) is necessary to protect the public health and welfare or the environment from actual or threatened releases of hazardous substances into the environment.

4.0 Description of the Selected Remedy

The Department has identified Air-sparging as the selected remedy for the Site. This remedial alternative involves the injection of air into the groundwater aquifer to strip contaminants from the groundwater. The air-sparging system is made up of a series of vertical or horizontal injection points. The injections points are located based on the expected area of influence of each well and the groundwater flow direction. The system provides a source of oxygen to promote aerobic biodegradation.

This Alternative was further developed for detailed analysis from the installation and field pilot testing. The pilot study concluded that air sparging resulted in the reduction of pentachlorophenol (PCP) concentration in the groundwater and acts like a barrier to prevent downstream migration. The system will be operated for approximately five (5) years or until the groundwater contamination has been adequately treated.

5.0 Statutory Determinations

The selected remedy attains the mandates of CERCLA 121, and to the extent practicable, the NCP.

This remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions.

The selected remedy also satisfies the statutory preference for treatment as a principal element of the remedy; permanently and significantly reducing the toxicity, mobility, and volume of hazardous substances, pollutants, or contaminants.

PART II - THE DECISION SUMMARY

1.0 Site Name, Location, and Description

The Site (Figure 1 & Figure 2) is in Pamplico, Florence County, South Carolina, and consists of a larger approximately 15 acres of approximate 28-arce parcel. The current owner is Marsh Furniture Company, Inc. (MARSH). The property is zoned industrial and has been occupied by MARSH since the mid-40s.

2.0 Site History and Activities

2.1 Site History

On May 17, 1946, MARSH acquired the property from H.M. Propst. MARSH constructed and began operation of the first sawmill in 1953. Following 1953, activities on the property have included lumber handling and storage, saw and dimension milling, and lumber treating and drying. The lumber treatment for the purpose of preventing mold insect infestation included the use of a dip tank containing liquid sodium pentachlorophenol (PCP) and a drip pad located in the "Green Chain Area". This was a common process that lumber mills used for wood treating, during this period of operation.

A concrete pad was constructed beneath the conveyor in the Green Chain Area and a portion of the temporary wood drying/storage area in the late 1980's. The concrete drip pad beneath the Green Chain was reportedly designed to channel residual wood preservative chemicals to a sump where excess liquids were pumped back into a storage unit in the dip tank area.

The use of PCP-containing products was discontinued by MARSH in 1986 prior to EPA listing of certain wood preserving wastes as hazardous under RCRA in 1990. The MARSH sawmill operations and associated non-PCP wood treatment activity ceased in 2007. Subsequently, the sawmill building, and associated structures were dismantled. MARSH currently operates a dimension mill on the subject site. MARSH receives lumber for processing which is already kiln dried, and no treatment is currently conducted at the site.

2.2 Previous Investigations

In 1991 a Preliminary Environmental Site Assessment performed on behalf of MARSH identified the Green Chain Area, shop area, and former underground storage tank (UST) areas potential areas of concern.

The shop area was identified as an area of concern. In 1992 and 1993, Total Petroleum Hydrocarbons (TPH) were detected in the soil in the shop area; however, petroleum constituents were not detected in the groundwater.

The former UST was identified as an area of concern. In 1992, benzene, toluene, ethylbenzene, and xylenes were detected in the soil at the former UST area and groundwater results indicated benzene, toluene, and ethylbenzene in this area. The notice of this release was forwarded to SCDHEC's UST section in September 1993. Further assessment of the UST release was conducted between 2002 and 2004. The UST incident was closed by SCDHEC UST Division in 2004 and the monitoring wells were properly abandoned.

In 1992, soil and groundwater samples were collected in the Green Chain Area and analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, tentatively identified compounds, and the eight Resource Conservation and Recovery Act (RCRA) metals. Multiple soil samples were collected in the Green Chain Area and the treated wood storage area to assess source and secondary source area contamination. The soil samples detected PCP and PCP was present in the groundwater at concentrations exceeding the Maximum Contaminant Levels (MCL).

MARSH conducted additional assessment after 1993 to identify the source, nature, and extent of PCP contamination at the site and implemented remedial measures to address the contamination. Between 1998 and 2016, multiple additional soil and groundwater assessment activities were conducted to refine an understanding of the source, nature, and extent of contamination at the site.

In March 2009 the first a bio-sparge pilot test was initiated to evaluate the potential of this technology as a clean-up alternative. The pilot test has been operating from 2009 to present day.

2.3 Recent Activities

In May 2016, additional assessment was conducted to investigate for the PCP area. During this time the South Carolina Department of Transportation (SCDOT) agreed to relocate the storm water drain line which traverses the site and re-route the line within the road right-of-way to remove a potential pathway for the contaminations.

In October 2016 a second bio-sparge pilot test was initiated to evaluate the potential of this technology as a clean-up alternative. The pilot test was modified in 2018, to include five additional bio-sparge injection wells. Based on the data collected over the years from the pilot study, the bio-sparge system has resulted in the reduction of PCP in groundwater.

3.0 Community Participation

Public participation activities prior to the issuance of this ROD included a virtual community meeting, maintenance of a website including site-specific information, informational post cards and the publication of notices in the local newspaper. All reports and documents that formed the basis for the selection of the response action are contained in the Administrative Record. The Administrative Record is available for review at the Pamplico Public Library and on DHEC's webpage. The notice of the availability of these documents was published in the City of Florence in the Morning News on September 9, 2021.

On September 9, 2021, a virtual presentation was posted on the DHEC's webpage for the site. In the virtual presentation, representatives of the Department presented the results of recent investigation work, explained the remedial alternatives evaluated in the Focused Feasibility Study, and presented the Department's preferred alternative (the Proposed Plan). This meeting initiated the official public comment period, which concluded on October 9, 2021. There was one formal comment submitted via email.

4.0 Scope and Role of Response Action

The remedial action in this proposed ROD will be the final cleanup action for the Site. The remedial action objectives for this proposed action include reducing the potential for soil leaching

contamination to groundwater and to further mitigation and control the migration of contaminants through groundwater into surface water.

As contamination will remain onsite a 5-year review will be required once the remedial action is conducted to evaluate the effectiveness of the remedy.

5.0 Site Characteristics

5.1 Overview of Site Characteristics

Soil impacted by PCP and possible PCP degradation compounds are limited to a relatively small area in the former Green Chain Area, with reported concentrations that were less than EPA RSL for Industrial Soil. Groundwater impacts were limited to the water table aquifer, contained within the property boundary, and limited to points prior to groundwater reaching, an unnamed tributary to Big Swamp Branch. Surface water sampling conducted to date has yielded no confirmed impacts to surface waters downgradient and adjacent to the PCP groundwater plume.

5.2 Geology/Hydrogeology

The Site is located within the Atlantic Coastal Plain Province of South Carolina. The coastal plain is a gently rolling flat region underlain by a wedge of unconsolidated to semi-consolidated, predominantly clastic sedimentary rocks that range in age from Cretaceous to Holocene. The sedimentary package thickens seaward from a feather edge at their up-dip limit (Figure 3 & 4).

Soils in this region are generally interbedded silts, sands, and clays that have been deposited during successive advances and retreats of the ocean over the past several million years. The marine deposits located near rivers and creeks have been eroded and may be overlain by alluvial deposits.

The Town of Pamplico lies on one of a series of nearly level beach terraces formed in the relatively recent geologic past. These terraces have been extensively mapped and generally identified based on surface elevation (Law Engineering, 1993). Downtown Pamplico and the surrounding area were mapped as part of the Wicomico Terrace. Terrace deposits are typically 40 to 50 feet in thickness and overlie more ancient, consolidated, or lithified strata below. The terraces soil is typically characterized by relatively sandy soils near the southeast margin of the terrace. The soils become increasingly clayey in composition proceeding to the northeast, toward the upper margin of the terrace, reflecting an archaic back-bay depositional deposit.

The uppermost stratigraphic unit at the site consist primarily of an unconsolidated package of sediments primarily classified as silts, clays, clayey silts, sandy silts, and silty sands. The lithologic descriptions do not suggest any distinct lateral continuity of most lithologies. The uppermost stratigraphic unit overlies a relatively continuous clay-rich layer commonly occurring at approximately 18 feet below land surface (bls), which overlies a distinct gray semi-consolidated, calcareous, fossiliferous, silty sand unit. The thickness of the clay-rich layer varies, and it appears to pinch and swell on a local scale as one might expect in an archaic back-bay sedimentary deposit. The clay-rich layer does exhibit some variability in clay and sand content. In some locations the material may be described as a clayey sand rather than a sandy clay.

The surficial aquifer is the saturated zone that underlies the land surface and is generally very shallow in the region. It is the first aquifer to receive recharge from precipitation. This recharge water is stored in the surface aquifer as the groundwater migrates toward local discharge points (streams, lakes, or rivers). A portion of the groundwater in the surficial aquifer migrates vertically

to recharge reaches the deeper aquifers (Campbell and Coes, 2006). On average, only a fraction of the surficial aquifer recharge reaches the deeper aquifers. This often reflects the influence of confining and semi-confining layers, and the substantial amount of time it takes for groundwater to reach these deeper units. The deeper aquifers tend to be less susceptible to contamination from the surface; therefore, they are more often used in the region as potable water sources.

Based upon the topography of the subject site, groundwater flow is anticipated to mimic topography, flowing down dip, perpendicular to topographic contour lines. On this basis, shallow groundwater beneath the site would be forecast to flow generally west/southwest toward the adjacent unnamed tributary of Big Swamp Branch. The water table aquifer in the study area is composed of interbedded layers of silts, clays, clayey silts, sandy silts, and silty sands, with no distinct lateral continuity of the upper most layers. Aquifers composed of layered sediments often exhibit greater vertical than horizontal anisotropy.

Based upon groundwater analytical data obtained during the 1999 investigations, the clay-rich layer appeared to limit the vertical migration of dissolved phase PCP in the groundwater beneath the studied area. Undulations in the top of the clay-rich layer could influence the migration of dissolved-phase PCP in the water table aquifer, possibly providing migration pathways that might deviated from those expected based solely on hydraulic gradients. Stratigraphic information gather from direct push macro core sampling was used to map approximate elevations of the top of clay-rich layer, which was found to exhibit varying topography.

The groundwater contours suggest that groundwater flow in the water table aquifer generally migrates toward the west. This flow direction is generally consistent with prior monitoring events. In situ hydraulic conductivity tests were performed on wells MW-1, MW-3A, MW-10, MW-17, MW-22, and MW-23. These rising head slug test results were analyzed using the Bouwer and Rice (1976) method, used to calculate hydraulic conductivity values for water table aquifer at these locations. The hydraulic conductivity values obtained ranging from 0.245 feet/day at monitoring well MW-3A to 3.183 feet/day to 3.183 feet/day at monitoring well MW-13.

5.3 Nature and Extent of Contamination

The occurrence of wood preservative chemical of concern at the site have been assessed in the soil, groundwater, and surface water at this site through numerous investigations. The physical and chemical properties of PCP tend to bind to organic materials and has high octanol-water partition and soil adsorption coefficients. Consequently, this compound exhibit limited partitioning to water that contacts impacted soil, sediments, or woody material, and thus exhibits limited mobility as aqueous constituents in the subsurface. These compounds can, however, be mobilized by surface water and groundwater flow while bound to entrained sediments and particulate matter.

5.3.1 Soil

Soil assessment activities were conducted by Law Engineering in 1992 and 1993. During January 1992, Law Engineering completed four hollow-stem auger borings and four shallow hand-auger boring to initiate an investigation into potential soil impacts. The collected soil samples were submitted for analysis by Method 8270 for the detection of SVOCs. During October 1993, Law Engineering completed four additional hand-auger borings in the Green Chain Area to aid in the

delineation of source area soil impacts. At each of the four soil boring locations, a soil sample collected one foot below the ground surface was submitted for laboratory analyses according to Method 8270 for SVOCs and for the eight RCRA metals (arsenic, barium, cadmium, chromium, lead, selenium, silver, and mercury).

During September 2016 eight soil samples were collected in the Green Chain area. Summary of 2016 analytical results for SVOCs by Method 8270 and provides corresponding RSLs for comparison (Figure 5).

PCP was detected in sample GC-2-1, representing the 0.5 to one (1) foot bls interval at probe location GC-2. The detected concentration was less than the corresponding Industrial Soil screening level and greater than the corresponding Residential Soil screening level. PCP was not detected in the deeper sample (GC-2-6) representing 5.5 feet to six (6) feet bls.

2, 3, 4, 6-Tetrachlorophenol was detected in sample GC-1-1, representing the 0.5-to-one-foot bls interval at probe location GC-1. The detected concentration was greater than the corresponding Residential Soil screening level but less than the Industrial Soil screening level. 2, 3, 4, 6-Tetrachlorophenol was not detected in the deeper sample (GC-2-6) representing 5.5 feet to six feet bls. This compound is a probable first-order PCP degradation daughter compound.

No other SVOCs were detected in the remaining soil samples.

Probe location GC-1 was at the former PCP dip tank and probe location GC-2 was approximately 68 feet northwest of the former dip tank, down the alignment of the former Green Chain drip pad. Based on the sampling conducted, the extent of soil impacted by SVOCs at concentrations greater than corresponding Residential Soil screening levels but less than the Industrial Soil screening levels is limited.

5.3.2 Groundwater Contamination and Plume Analyses

Assessment of the extent of groundwater impacts included collection of samples using direct push discrete interval sampling tools and samples obtained from permanent monitoring wells. Considering the potential for PCP to sink in groundwater, the groundwater quality sampling strategies employed targeted collection of groundwater samples just above the clay-rich layer underlying the water table aquifer, with fewer samples collected below the clay-rich layer to assess the vertical extent. The VCC assessment primarily focused on delineation of PCP in groundwater.

Most groundwater samples collected were analyzed for SVOCs by Method 8270, with PCP as the primary consistent of concern (Figure 6). Method 8270 was historically considered appropriate for assessing the extent of PCP and potential PCP breakdown compounds; therefore, it was specified in each approved VCC Work Plan. It is documented that Method 8270 cannot achieve the Maximum Contaminant Level (MCL) for PCP established at 1 µg/L. Method 8151 can achieve a reporting limit of 1 µg/L or less for PCP; however, this test method does not report other potential PCP breakdown compounds.

Recognizing that prior to selection of the final remedy, delineation of the extent of the PCP plume to the level of the MCL, groundwater monitoring events conducted in 2019 and 2020 incorporated groundwater samples analyzed by Method 8151 (Figure5).

Groundwater analytical data for the March 2020 monitoring event defined the horizontal extent of PCP, with PCP was reported as less than 1 µg/L at monitoring wells MW-3A, MW-11, MW-13A, MW-14A, MW-15, MW-16, MW- 18B, MW-19, MW-20, MW-21, MW-23, MW-24, and MW-26. The water table aquifer impacts are delimited on- site and are not known to reach on-site surface water receptor, Big Swamp Branch, as indicated by analytical results for monitoring well MW-18B.

The vertical extent of PCP in groundwater was previously defined by analytical data for monitoring well MW-8, and historic grab groundwater samples obtained from direct push tools at sample locations GP-1-30, GP-2-24, DS-1, DS-2, and DS-3D. The laterally continuous clay-rich layer at depth is thought to reasonably restrict the vertical migration of PCP below this layer (Figure 7). Based on trends of PCP concentrations over time, the plume appears to be generally stable if not naturally attenuating before it reaches surface waters of the unnamed tributary to Big Swamp Branch.

5.3.3 Surface Water

The assessment of surface water quality began in December 2005, with the collection of surface water samples at points along the unnamed tributary of the Big Swamp Branch, located along the southern and western portions of the site. One segment of the stream flows within a storm drain conduit, which originates up stream of the PCP plume. Another segment of the stream exists as open channel flow down-gradient of the PCP plume, in an area of expected shallow groundwater discharge. Surface water sample location SW-1 represents water quality up-gradient of the PCP contaminant plume. Surface water sample location SW-2 represent surface water quality near the expected discharge area for the shallow groundwater PCP plume. Sample location SW-3 is approximately 400 feet down stream of location SW-2, just prior to the stream leaving the site. A fourth surface water sample location, referred to as SW-4, was involved in the assessment between June 30, 2013 and February 18, 2019. Sample location SW-4 represents surface water quality at the point water leaves the piped stream segment, down-stream of sample location SW-1.

6.0 Current and Potential Future Site and Resource Uses

Current land use of the MARSH property is light industrial use. The reasonably anticipated future land use would remain the same. The site assessment activities conducted have determined the source, nature, and extent of PCP at the MARSH site.

Soil impacted by PCP and possible PCP degradation compounds are limited to a relatively small area in the former Green Chain Area, with reported concentrations that were less than EPA RSL for Industrial Soil.

Groundwater impacts were limited to the water table aquifer, contained within the property boundary, and PCP does not reach the groundwater discharge point to the unnamed tributary to Big Swamp Branch.

7.0 Summary of Site Risks

The planned future use of the site will remain industrial. PCP has been identified as the constituent of concern and has limited impact to the soil and groundwater. Surficial soil impacts were limited and only detected in the former dip-tank in the Green Chain Area. Groundwater contamination of PCP has been detected at concentrations that exceed the EPA Maximum Contaminant Levels. There is no confirmed PCP impact to the surface water.

Due to the limited extent of surface soil PCP impacts and the site remaining industrial, site worker exposure scenarios area low risk and could be managed with institutional controls. Based on the topography being relatively flat and sandy soils, and low concentrations at the site, surface runoff PCP impacted from soils is unlikely. The primary potential exposure route for PCP would be from a potential drinking water source. Considering that the PCP plume is contained within the subject site and the nearest known active water supply wells are approximately 0.5 mile away, the receptor pathway is currently incomplete.

8.0 Remedial Action Objectives

Remedial action objectives (RAOs) are developed to set goals for protecting human health and the environment. The goals should be as specific as possible but should not unduly limit the range of remedial alternatives that can be developed. The remedial action objectives for the site are to reduce the mass of chemicals of concern in groundwater and to reduce the potential for off-site migration of chemicals of concern in groundwater to adjacent surface water. Accordingly, the following RAOs were developed for the MARSH site:

- Reduce the potential for soil leaching to groundwater.
- Reduce source area groundwater impacts to further mitigate/control impacts to downgradient groundwater and streams.
- Restore groundwater to maximum contaminant levels.

9.0 Remedial Alternatives

Based on information collected during previous investigations, a Feasibility Study-Revision # 1 (S&ME Inc., November 2020) was conducted to identify, develop, and evaluate cleanup options and to address the contamination at the Site. This evaluation considered the nature and extent of contamination and associated potential human health risks developed during the remedial investigations and associated studies to determine and evaluate potential remedial alternatives and their overall protection of human health and the environment. Each remedial alternative evaluated by the Department is described briefly below.

- Alternative 1: No Action
- Alternative 2: Monitored Natural Attenuation (MNA)
- Alternative 3: Groundwater Extraction and Pre-Treatment by GAC
- Alternative 4: Air Sparging
- Alternative 5: Bio-enhancement

9.1 Description of Remedial Alternatives

9.1.1 Alternative 1: No Action

The No Action alternative is included as a baseline for comparison with other Alternatives. Under this Alternative, no action is taken to treat or prevent potential exposure to contaminated groundwater, or reduce volume, toxicity, or mobility of contaminants. This action would rely on natural attenuation processes to reduce contaminant concentrations over time. This action does not include any institutional controls (e.g., deed restrictions) or monitoring to evaluate natural attenuation or contaminants of concern (CoCs) extent and the Site would be uncontrolled. The cost associated with the No Action alternative is $25,000. This cost includes abandonment and removal of all monitoring wells, remediation wells and equipment associated with the existing remediation pilot system, and preparation of a site closure report.

9.1.2 Alternative 2: MNA

MNA is a passive approach in which monitored groundwater is to track the natural degradation or reduction of CoCs in groundwater. A typical MNA approach centers on monitoring groundwater regularly to evaluate and confirm that site conditions are supportive of CoC degradation. Additionally, land use controls would be implemented to protect human health and the environment by restricting development and groundwater use. PCP has been shown to aerobically degrade but usually at a lower rate than other volatile and semi-volatile contaminants. The persistence of PCP and its degradation products are prolonged in the groundwater. Figure 2 depicts the locations of the existing monitoring well network. It is assumed that the entire well network would be incorporated within the MNA approach and groundwater samples would be collected for analysis annually.

The annual cost for the MNA alternative would be about $25,000 a year for about 30 to 40 years. The total cost of this alternative is estimated at $1,025,000.

9.1.3 Alternative 3: Groundwater Extraction and Pre-Treatment by Granular Activated Carbon (GAC)

The groundwater extraction and ex-situ treatment alternative involves extraction of groundwater using recovery wells. Groundwater would be recovered through a piping network and routed to a pre-treatment area, then the groundwater would pass through GAC treatment system causing mass transfer of contaminants from water to the filter media. The pre-treatment system would require permits from DHEC industrial wastewater program. The GAC does not destroy the contaminants, it just captured and suspended in the media, which requires periodic replacements of the carbon. Groundwater would be monitored for 30 years. The estimated total cost would be $3,980,000 to implement the groundwater extraction and pre-treatment by GAC and monitor groundwater for 30 years.

9.1.4 Alternative 4: Air Sparing

Air-sparing involves the injection of air into the groundwater aquifer to strip contaminants from the groundwater. It provides a source of oxygen to promote aerobic biodegradation. Air-sparging can be used for boundary control and reduction of dissolved-phase contaminants of concern in the source and stimulate aerobic biodegradation. This alternative also involves groundwater monitoring for 10 years and institutional controls. The total estimated cost to implement air-

sparging is $630,000. This cost includes system expansion costs, sampling, reporting and operating cost per year for ten years.

9.1.5 Alternative 5: Bio-enhancement

Bio-enhancement involves the remediation of groundwater contamination through injection of microbes that are known to metabolize the contaminant of concern, or nutrients to increase the population of naturally occurring microbes in the subsurface. Bio-enhancement would be useful for source area mass reduction or as polishing treatment in persistent area where contaminant mass reduction is not occurring. Groundwater monitoring for 20 years and institutional controls would also be a component of this remedy. The duration of this remediation would take between five to ten years. The total cost of bio-enhancement as the remedial alternative would be $945,000. This cost includes capital cost of $420,000, sampling and reporting cost of $25,000 per year for 20 years, with $25,000 for well abandonment at the project termination.

10.0 Comparative Analysis of Alternatives

The NCP requires the Department use specific criteria to evaluate the different remediation alternatives individually and against each other in order to select a remedy. Two of these criteria, overall protection of human health and the environment and compliance with State and Federal regulations, are threshold criteria. If an alternative does not meet these two criteria, it cannot be considered as the Site remedy. Five of the criteria are balancing criteria: long-term effectiveness and permanence; reduction of toxicity, mobility, or volume of contaminants through treatment; short-term effectiveness; implementability; and cost. These criteria are used to weigh the strengths and weaknesses of the alternatives. Community response to the preferred alternative and the other considered alternatives is a modifying criterion that was carefully considered by the Department prior to the final remedy selection.

The following section of the ROD profiles the relative performance of each alternative against the criteria, noting how it compares to the other options under consideration.

10.1 Overall Protection of Human Health and the Environment

When evaluating alternatives in terms of overall protection of human health and the environment, consideration is given to the way site-related risks are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Air-sparging received the highest score for protection of site-specific exposure pathways because the technology has been successfully pilot tested at the Site and has been shown to result in a sustained decrease contaminant concentration. Bio-enhancement received a moderate score for providing protection of human health and the environment. The No Action and MNA do not provide for overall protection of human health and the environment on site as there will be no decrease in contaminants in the source areas. The potential for off-site impacts to protect human health and the environment would be uncontrolled. Groundwater Extraction and Pre-treatment by GAC received the lowest score to protect human health and the environment by extracting groundwater and removing contaminants through the GAC and eliminates exposure pathways.

10.2 **Compliance with ARARs** (Applicable or Relevant and Appropriate Requirements)

This evaluation criterion evaluates whether an alternative meets federal and state environmental statutes and regulations that pertain to the site. Each alternative is evaluated with respect to its ability to comply with such requirements.

All the alternatives listed would require a period of natural attenuation for the groundwater downgradient of the treatment area to reach regulatory limits with all of the alternatives received high to moderate scores for meeting the chemical specific ARARs, with the exception of No Action and MNA. The No Action and MNA alternative received the lowest score because regulatory limits would not be achieved in any portion of the plume during implementation.

10.3 **Long-term Effectiveness and Permanence**

The magnitude of residual risk remaining from untreated impacted media or treatment residuals and the adequacy and reliability of containment systems and institutional controls are evaluated under this criterion.

Air-sparging received the highest score for long-term effectiveness and permanence because the pilot test demonstrated that Air-sparging will results in a sustained decrease in contaminant concentrations. Air-sparging would involve the system to operate and to conduct groundwater sampling for ten years. Bioremediation received a moderate score for potential residual risk because the naturally occurring anaerobic conditions be present for anaerobic bioremediation to successfully be implemented. Groundwater extraction and pretreatment by GAC received a moderate score due to physical and chemical properties of the contaminant and geologic formation, extraction and pre-treatment of dissolved contaminants is often unsuccessful in restoring groundwater concentrations to established target concentrations. The No Action and MNA alternatives received the lowest score because the source mass is not removed or destroyed and consequently the long-term risks remain.

10.4 **Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment**

The degree to which an alternative employs treatment to reduce the harmful effects of contaminants, their ability to move in the environment, and the amount of contamination present is evaluated by this criterion.

Air-sparing received the highest score for reduction in toxicity, mobility, or volume of contamination because it has been demonstrated to effectively treat contamination by stimulating the naturally occurring micro-organisms in the aquifer allowing for breakdown of the contamination through biological processes. Bio-enhancement and groundwater extraction had moderate ratings. Bio-enhancement would reduce the contaminant where mass reduction is not occurring. Groundwater extraction and pretreatment by GAC would capture the contaminants and not destroy them. The No Action and MNA alternatives received lowest ranking because the remedies do not promote active treatment of contamination.

10.5 Short-Term Effectiveness

The short-term effectiveness evaluation takes into consideration any risk the alternative poses to on-site workers, the surrounding community, or the environment during implementation, as well as the length of time needed to implement the alternative.

Air-sparging received the highest score of the active remedies because it has the shortest active remediation implementation period and does not cause disturbance of, or the handling of chemicals and majority of the infrastructure is already in place from the pilot study. Groundwater Extraction received a moderate score by achieving hydraulic control and mass reduction of the contaminants. Bio-enhancement, No Action and MNA received low scores due to not being able to protect human health and the environment in a short-time period.

10.6 Implementability

The analysis of implementability considers the technical and administrative feasibility of remedy implementation, as well as the availability of required materials and services needed for implementation.

Air-sparging received the highest score since the air-sparing system framework is already in place from the pilot study. Bio-enhancement received moderate score since an underground injection control permit must be obtained, and additional site information will need to be collected. Groundwater Extraction received the lowest score as it would require new infrastructure to be installed.

10.7 Cost

The following table presents the probable range of costs for each alternative:

Alternative	Most Likely Cost
1. No Action	$25,000
2. MNA	$1,025,000
3. Groundwater Extraction and Pre-treatment by Granular Activated Carbon (GAC)	$3,980,000
4. Air-Sparging	$630,000
5. Bio-enhancement	$945,000

10.8 Community Acceptance

The Department posted, on DHEC's website for the site, MARSH Proposed Plan on September 9, 2021 for a public comment period. During the public comment period, one emailed comment asked about. Public response to the Department's preferred alternative was favorable. The public comment period ended October 9, 2021.

The Department received one comment that is summarized in Responsiveness Summary. The comments were not directly concerned with the remedy but with the testing of the local water system.

11.0 Selected Remedy

The Department has selected Alternative #4: Air Sparging as the selected remedy.

11.1 Description of Selected Remedy

Alternative 4, Air Sparging is groundwater remediation technology in which air is injected into the groundwater aquifer using system made up with a series of vertical or horizontal injection points. The injections points are located based on the expected area of influence of each well and the groundwater flow direction.

This Alternative was further developed for detailed analysis from the installation and field pilot testing of air sparging system. The pilot study concluded reduction of PCP concentration in the groundwater and has acted like a barrier to downstream migration. The system will be operated for approximately five (5) years or until the groundwater contamination has been adequately treated.

This Alternative is best in terms of it meets the effectiveness, implementability, and the air sparing system has reduced the PCP concentrations within the area of influence of the system.

The total estimated net present worth of this alternative combination is approximately $630,000. It is the Department's judgment that the Preferred Alternative identified in this Proposed Plan is necessary to protect public health and the environment.

12.0 Statutory Determinations

Based on information currently available, the Department believes the selected remedy meets the mandatory threshold criteria required by the NCP and provides the best balance of trade-offs among the other alternatives. The Department expects the selected remedy to satisfy the following statutory requirements: be protective of human health and the environment; comply with applicable or relevant and appropriate requirements; be cost-effective; utilize permanent solutions to the maximum extent practicable; and satisfy the preference for treatment as a principle element of the remedy.

PART III - RESPONSIVENESS SUMMARY

The Department's provided the Proposed Plan through a virtual presentation online through the Department's webpage. was presented to local residents and other interested parties at a public meeting that was held on September 9, 2021. In the presentation, representatives of the Department presented the results of past investigations, explained the remedial alternatives evaluated in the Feasibility Study, presented the Department's preferred alternative, and received comments from the public.

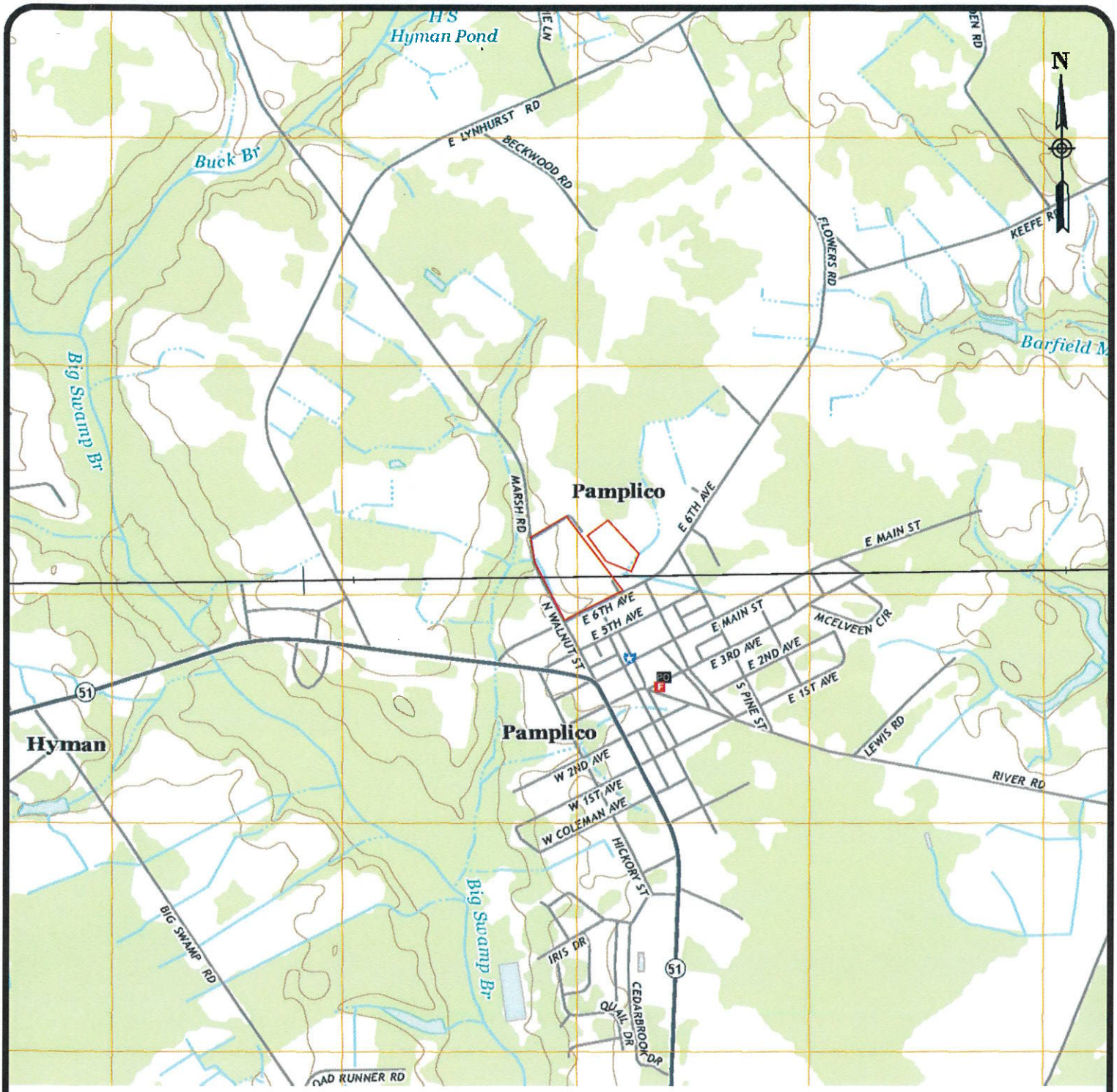
The presentation initiated the official public comment period for interested parties to comment on the Department's Proposed Plan. No requests for an extension of the comment period were received, and therefore, the comment period ended on October 9, 2021.

The Department received one comment during the comment period. The comment and response is listed below:

Question: Just wanted to know if the drinking water in Pamplico is being tested also? Is the drinking water in Pamplico effected by the contamination?

Answer: Thank you for submitting your comment. The contamination from this site is not affecting the drinking water in Pamplico. The contamination at this site is in the shallower aquifer and the towns well draws from the deeper aquifer. I hope this answers your questions.

Figures



SOURCE: PAMPLICO NORTH, SC AND PAMPLICO SOUTH, SC, 7.5-MINUTE SERIES, USGS TOPOGRAPHIC MAPS (2014).

0 2000 4000

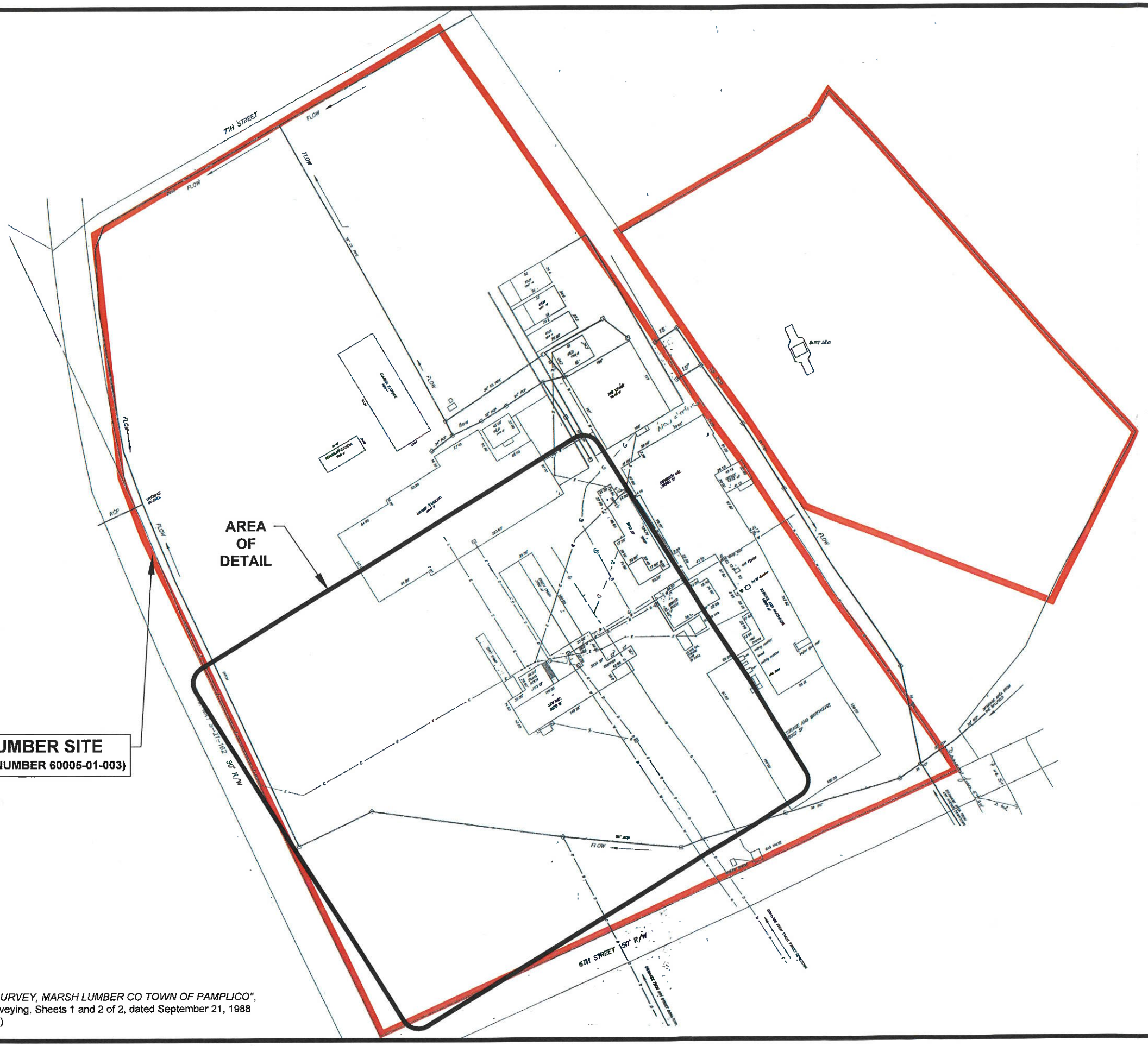
GRAPHIC SCALE (IN FEET)

AREA TOPOGRAPHIC MAP

MARSH LUMBER
PAMPLICO, SOUTH CAROLINA

SCALE:	FIGURE NO.
AS SHOWN	1
DATE:	
FEB. 2020	
PROJECT NUMBER	
1584-98-146C	

Drawing Path: Q:\1584\98\98-146 - MARSH LUMBER\C\2-20 Summary Report\Figures 1 & 11.dwg



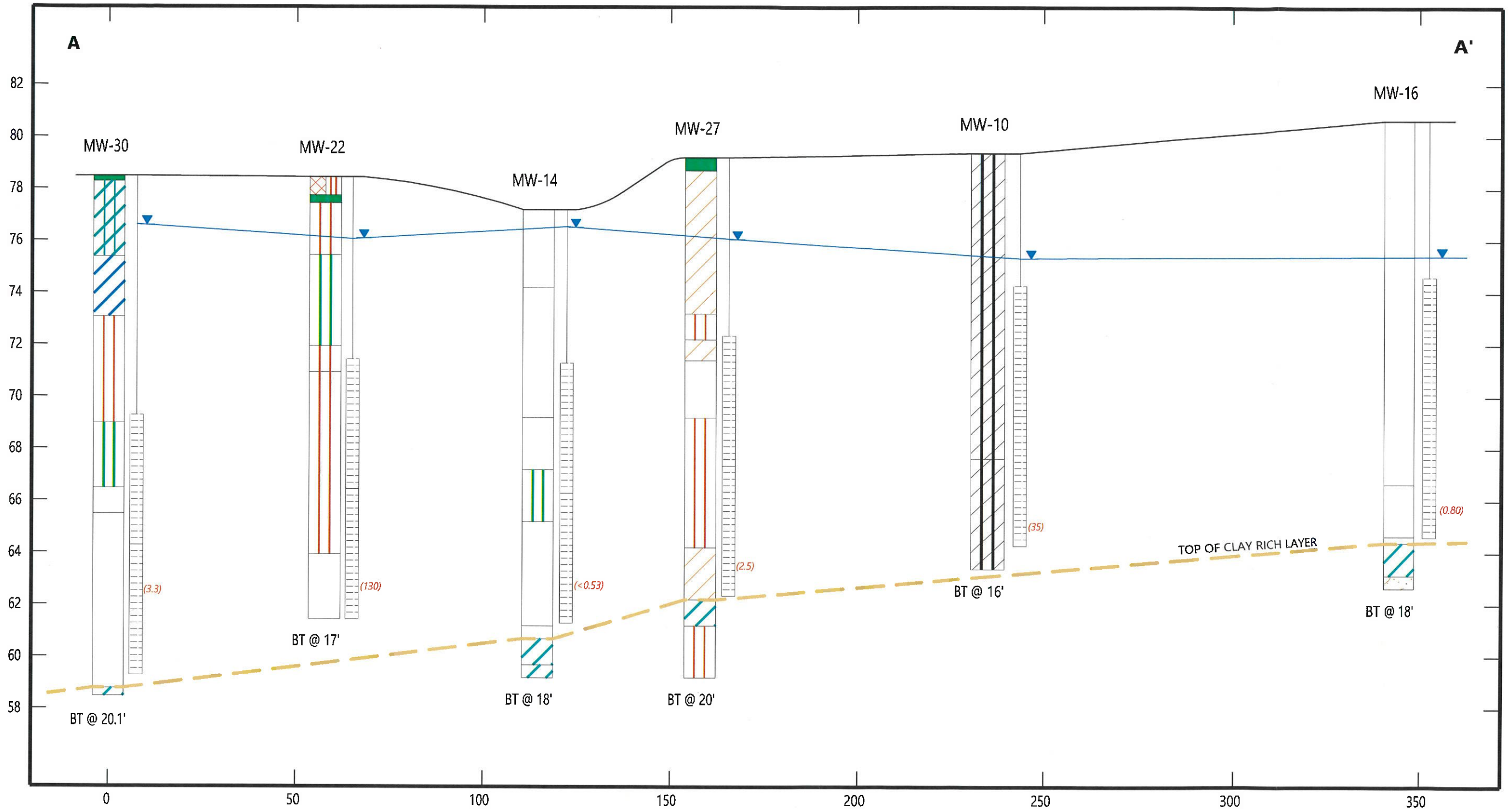
Reference: *"AS - BUILT SURVEY, MARSH LUMBER CO TOWN OF PAMPLICO"*, by Prosser Surveying, Sheets 1 and 2 of 2, dated September 21, 1988 (Revised 10/95)

HISTORIC SITE SURVEY

MARSH LUMBER COMPANY
PAMPLICO, SOUTH CAROLINA

SCALE:
AS SHOWN
DATE:
FEB. 2020
PROJECT NUMBER
1584-98-146C
FIGURE NO.
2

Drawing path: Q:\1584\98\98-146 - MARSH LUMBER\C\2-20 Summary Report\Figure 2.dwg



Drawing path: Q:\1584\98\98-146 - MARSH LUMBER\C\2-20 Summary Report\Figure 9 &10.dwg

CROSS-SECTION A - A'

MARCH LUMBER
PAMPLICO, SOUTH CAROLINA

SCALE:	AS SHOWN
DATE:	FEB. 2020
PROJECT NUMBER	1584-98-146C
FIGURE NO.	3

B

B'

MW-17A

MW-23

MW-25

MW-14

MW-28

MW-21

MW-3

ND

(NO DATA)

(<0.54)

(42)

(<0.53)

(310)

(<0.15J)

(<0.15J)

BT @ 16.1' ?

BT @ 12.2'

BT @ 14.7'

BT @ 18'

BT @ 17.4'

BT @ 17'

BT @ 15.5'

* BASED ON GP-16 TOP OF CLAY

TOP OF CLAY RICH LAYER

86
84
82
80
78
76
74
72
70
68
66
64
62
60
58

0
50
100
150
200
250
300
350
400

(xxx) - PCP CONCENTRATION IN ug/L BY METHOD 8151. MOST RECENT CONCENTRATIONS REPORTED SHOWN.

Sand
Topsoil
Silty Clay
Sandy Silt
Silty Sand
Clay
Sandy Clay
Silt
Clayey Sand

0 5 10
VERTICAL SCALE (IN FEET)

Drawing path: Q:\1584\98\98-146 - MARSH LUMBER\CV2-20 Summary Report\Figure 9 &10.dwg

CROSS-SECTION B - B'

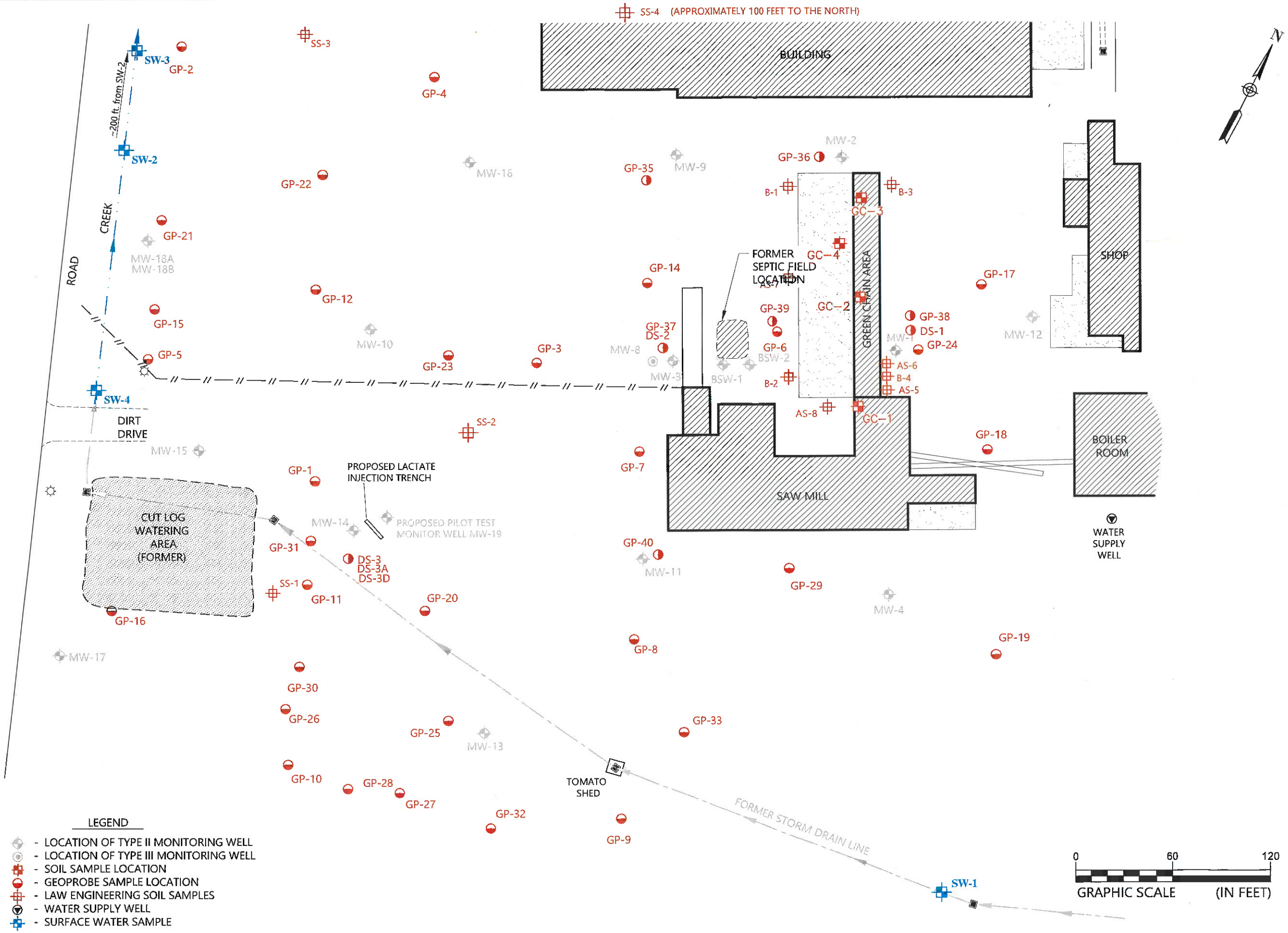
MARCH LUMBER
PAMPLICO, SOUTH CAROLINA

SCALE:
AS SHOWN

DATE:
FEB. 2020

PROJECT NUMBER
1584-98-146C

FIGURE NO.
4



SOIL SAMPLE LOCATION MAP

MARSH LUMBER COMPANY
PAMPLICO, SOUTH CAROLINA

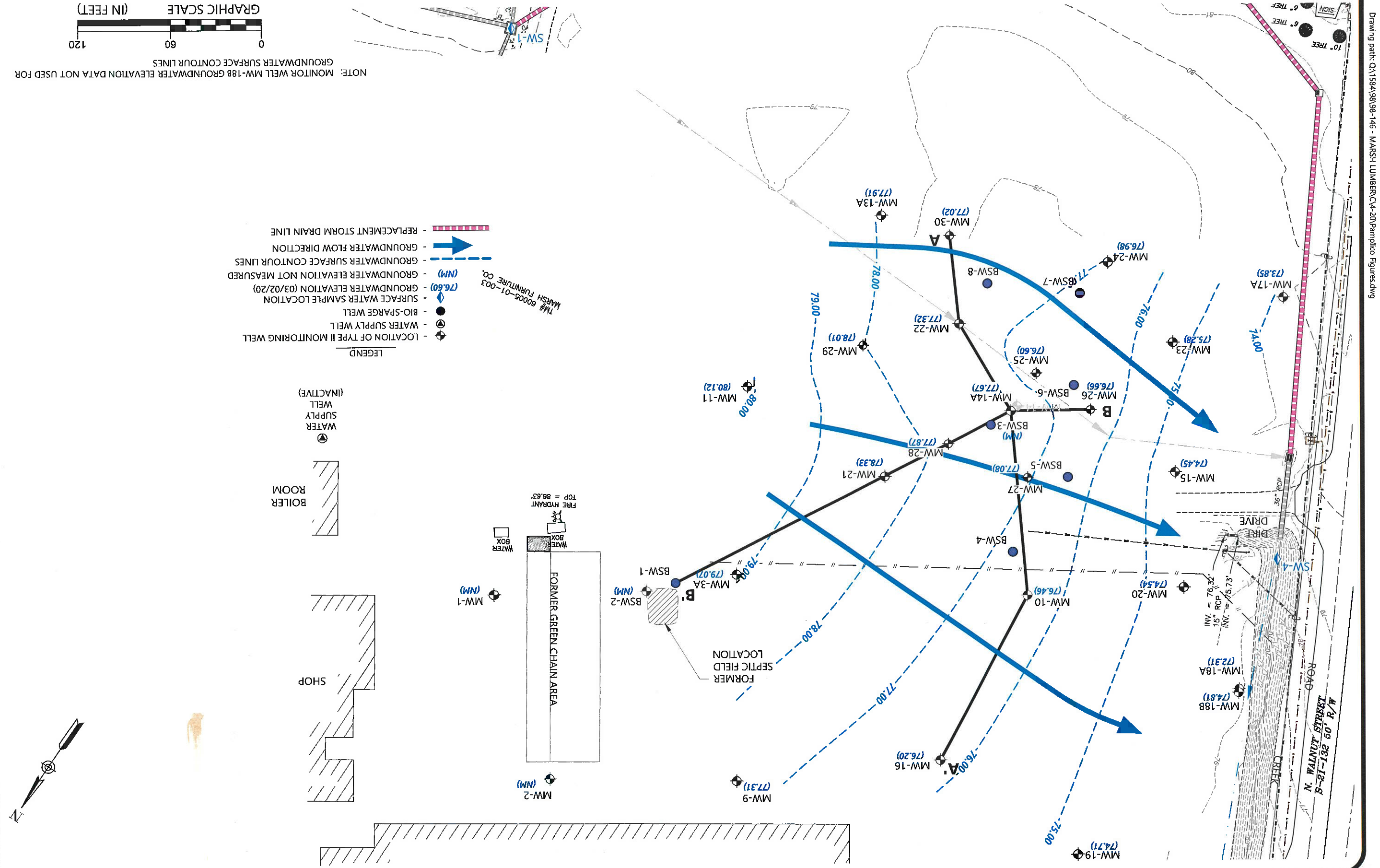
SCALE:	AS SHOWN
DATE:	FEB. 2020
PROJECT NUMBER	1584-98-146C
FIGURE NO.	5

Drawing path: Q:\1584\98\98-146 - MARSH LUMBER\Q2-20 Summary Report\Figure 5 & 6.dwg

GROUNDWATER ELEVATION DATA - MARCH 2020

MARSH LUMBER
PAMPLICO, SOUTH CAROLINA

SCALE:	AS SHOWN
DATE:	APRIL 2020
PROJECT NUMBER	1584-98-146C
FIGURE NO.	6



EXTENT OF PCP IN GROUNDWATER - MARCH 2020

MARSH LUMBER
PAMPLICO, SOUTH CAROLINA

SCALE:	AS SHOWN
DATE:	APRIL 2020
PROJECT NUMBER	1584-98-146C
FIGURE NO.	7

GRAPHIC SCALE (IN FEET)
0 60 120

NOTE: MONITOR WELL MW-18B GROUNDWATER ELEVATION DATA NOT USED FOR GROUNDWATER SURFACE CONTOUR LINES

LEGEND
- LOCATION OF TYPE II MONITORING WELL
- WATER SUPPLY WELL
- BIO-SPARGE WELL
- SURFACE WATER SAMPLE LOCATION
- [83.8] PENTACHLOROPHENOL CONCENTRATION IN ug/L BY METHOD 8151
- [NS] WELL NOT SAMPLED
- PENTACHLOROPHENOL ISOCONCENTRATION CONTOUR (ESTIMATED) BY METHOD 8151 ANALYSIS
- ug/L MICROGRAMS PER LITER
- NEW STORM DRAIN LINE
- A A' CROSS SECTION LOCATION

TM# 6006-01-003 MARSH FURNITURE CO.

FORMER STORM DRAIN LINE - ABANDONED

FORMER SEPTIC FIELD LOCATION

FORMER GREEN CHAIN AREA

TOMATO SHED

BOILER ROOM

SHOP

WATER SUPPLY WELL (INACTIVE)

FIRE HYDRANT TOP = 86.63'

WATER BOX

WATER BOX

MW-1 [NS]
MW-2 [NS]
MW-3A [<0.51]
MW-9 [NS]
MW-10 [22]
MW-11 [<0.51]
MW-13A [<0.51]
MW-14A [<0.52]
MW-15 [<0.51]
MW-16 [0.54]
MW-17A [NS]
MW-18A [ANR]
MW-18B [<0.55]
MW-19 [0.51]
MW-20 [<0.52]
MW-21 [<0.50]
MW-22 [65]
MW-23 [<0.51]
MW-24 [<0.51]
MW-25 [81]
MW-26 [0.52]
MW-27 [55]
MW-28 [220]
MW-29 [37]
MW-30 [1.8]
GWS-1
BSW-1
BSW-2
BSW-3
BSW-4
BSW-5
BSW-6
BSW-7
BSW-8
SW-1
SW-4

1 ug/L
50 ug/L
100 ug/L
50 ug/L

A A'
B B'

INV.= 76.32 15" RCP INV.= 75.73'

36" RCP

DIRT DRIVE

N. WALNUT STREET S-21-132 60' R/W

ROAD

CREEK

6" TREE
10" TREE
SIGN

Drawing path: Q:\1584\98\98-146 - MARSH LUMBER\C\4-20\Pamplico Figures.dwg

Appendix A

S.C. Department of Health and Environmental Control

Proposed Plan for Site Remediation
Marsh Lumber Sawmill
119 West Sixth Avenue, Pamplico, South Carolina

September 2021

ANNOUNCEMENT OF PROPOSED PLAN

The South Carolina Department of Health and Environmental Control (DHEC or the Department) has completed an evaluation of cleanup alternatives to address source area contamination at Marsh Lumber Sawmill (the Site). This Proposed Plan identifies DHEC's Preferred Alternative for cleaning up the contaminated area and provides the reasoning for this preference. In addition, this Proposed Plan includes summaries of the other cleanup alternatives evaluated. These alternatives were identified based on information gathered during environmental investigations conducted at the Site since 1991.

The Department is presenting this Proposed Plan to inform the public of our activities conducted at the Site, gain public input, and fulfill the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (National Contingency Plan or NCP). This Proposed Plan summarizes information that can be found in greater detail in the Feasibility Study-Revision #1 (November 2020) and other documents contained in the Administrative Record. The Department encourages the public to review these documents to gain an understanding of the Site and the activities that have been completed.

The Department will select a final cleanup remedy after reviewing and considering comments submitted during the public comment period. The Department may modify the Preferred Alternative or select another response action presented in this Proposed Plan based on new information or public comments. Therefore, the public is encouraged to review and comment on all the alternatives presented in this Proposed Plan.

DHEC's Preferred Cleanup Summary
Alternative 4: Air Sparging

DHEC's preferred remedial option is:

- Air Sparging;
- Promote aerobic biodegradation;
- This remedy involves injection of air into the groundwater to reduce contaminants.

MARK YOUR CALENDAR

❑ PUBLIC MEETING:

DHEC has recorded a presentation and it is available at the website below. If requested, DHEC will hold a meeting to further explain the Proposed Plan and all the alternatives presented in the Remedial Alternatives Evaluation and answer questions.

Link to presentation:

www.scdhec.gov/MarshLumberSawmill

❑ PUBLIC COMMENT PERIOD:

September 9, 2021 through October 9, 2021

DHEC will accept written comments on the Proposed Plan during the public comment period. Please submit your written comments to:

Kimberly Kuhn, Project Manager
SC DHEC Bureau of Land & Waste Management
2600 Bull Street
Columbia, SC 29201
kuhnkm@dhec.sc.gov

❑ FOR MORE INFORMATION:

Call: Kimberly Kuhn, Project Manager, 803-898-0722

See: DHEC's website at:
www.scdhec.gov/MarshLumberSawmill

View: The Administrative Record at the following locations:

Pamplico Public Library
100 East Main Street, Pamplico, SC
Hours: Monday 10 am - 5 pm
Tuesday 10am - 7 pm
Wednesday 10 am - 5 pm
Thursday 10 am - 7 pm
Friday 10 am - 5 pm
Saturday 10 am - 1 pm
Sunday CLOSED

DHEC Freedom of Information Office
2600 Bull Street, Columbia, SC
(803) 898-3817
Monday - Friday: 8:30 am - 5:00 pm

SITE HISTORY

Marsh Lumber property is located at 119 Sixth Avenue, Pamplico, Florence County, South Carolina. The Property includes approximately 15 acres of an approximate 28-acre parcel. The current owner is Marsh Furniture Company, Inc. (MARSH). The property is zoned industrial and occupied by MARSH operations. The site is zoned as light industrial in Florence County, South Carolina.

On May 17, 1946, MARSH acquired the property from H.M Propst. MARSH constructed and began operation of the first sawmill in 1953. Following 1953, MARSH activities on the property have included lumber handling and storage, saw and dimension milling, and lumber treating and drying. The lumber treatment for the purpose of preventing mold and insect infestation included the use of a dip tank containing liquid sodium pentachlorophenol (PCP) and a drip pad located in the "Green Chain Area." This was a common process for lumber mills to treat wood during this period of operation.

A concrete pad was constructed beneath the conveyor in the Green Chain Area and a portion of the temporary wood drying/storage area in the late 1980's. The concrete drip pad beneath the Green Chain was reportedly designed to channel residual wood preservative chemicals to a sump where excess liquids were pumped back into a storage unit in the dip tank area.

The use of PCP-containing products was discontinued by MARSH in 1986 prior to EPA listing of certain wood preserving wastes as hazardous under RCRA in 1990. The MARSH sawmill operations and associated non-PCP wood treatment activity ceased in 2007. Subsequently, the sawmill building and associated structures were dismantled. MARSH currently operates a dimension mill on the subject site. MARSH receives lumber for processing which is already kiln dried, and no treatment is conducted at the site.

In 1991 a Preliminary Environmental Site Assessment performed on behalf of MARSH identified the Green Chain Area, shop area, and former underground storage tank (UST) areas as potential areas of concern.

1. **Shop Area**: In 1992 and 1993, Total Petroleum Hydrocarbons (TPH) were detected in the soil in the shop area; however, petroleum constituents were not detected in the groundwater.

2. **Former UST**: In 1992, benzene, toluene, ethylbenzene, and xylenes were detected in the soil at the former UST area and groundwater results indicated benzene, toluene, and ethylbenzene in this area. The notice of this release was forwarded to SCDHEC's UST section in September 1993. Further assessment of the UST release was conducted between 2002 and 2004. The UST incident was closed by SCDHEC in 2004 and the monitoring wells were properly abandoned.

3. **Green Chain Area**: Beginning in 1992, the soil and groundwater were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, tentatively identified compounds, and the eight Resource Conservation and Recovery Act (RCRA) metals. Multiple soil samples were collected in the Green Chain Area and the treated wood storage area to assess source and secondary source area contamination. The soil samples were analyzed for base-neutral/acid extractable (no target compounds including PCP were detected) and metals (no results exceeding background). Several tentatively identified compounds (TICs) were reported, however. PCP was detected in the groundwater at concentrations exceeding the Maximum Contaminant Levels (MCL).

After 1993, MARSH conducted assessments to identify the source, nature, and extent of PCP contamination at the site and implemented remedial measures to address the contamination. Between 1998 and 2016, multiple additional soil and groundwater assessment activities were conducted to refine an understanding of the source, nature, and extent of contamination at the site. These reports can be found in the administrative record located on the website. In October 2016 a bio-sparge pilot test was initiated to evaluate the potential of this technology as a cleanup alternative. The pilot test was modified in 2018, to include five additional bio-sparge injection wells, and continues to date.

The bio-sparging pilot study has been operating from 2009 to present day. Based on the data collected over the years from the pilot study, the concentrations of PCP have declined in the groundwater.

SUMMARY OF SITE RISKS

The planned future use of the site will remain industrial. PCP has been identified as the constituent of concern and has limited impact to the soil and groundwater. Surficial soil impacts were limited and only detected in the former dip-tank in the Green Chain Area. Groundwater contamination of PCP has been detected at concentrations that exceed the EPA Maximum Contaminant Levels. There is no confirmed PCP impact to the surface water.

Due to the limited extent of surface soil PCP impacts and the site remaining industrial, site worker exposure scenarios area low risk and could be managed with institutional controls. Based on the topography being relatively flat and sandy soils, and low concentrations at the site, surface runoff PCP impacted from soils is an unlikely. The primary potential exposure route for PCP would be from a potential drinking water source. Considering that the PCP plume is contained within the subject site and the nearest known active water supply wells are approximately 0.5 mile away, the receptor pathway is currently incomplete.

CLEANUP GOALS

Remedial action objectives (RAOs) are developed to set goals for protecting human health and the environment. The goals should be as specific as possible but should not unduly limit the range of remedial alternatives that can be developed. The remedial action objectives for the site are to reduce the mass of chemicals of concern in groundwater and to reduce the potential for off-site migration of chemicals of concern in groundwater to adjacent surface water. Accordingly, the following RAOs were developed for the Site:

Reduce the potential for soil leaching to groundwater.

Reduce source area groundwater impacts to further mitigate/control impacts to downgradient groundwater and streams.

Restore groundwater to maximum contaminant levels.

SCOPE AND ROLE OF THE ACTION

The proposed action in this Proposed Plan will be the final cleanup action for the Site. The remedial action objectives for this proposed action include reducing the potential for soil leaching contamination to groundwater and to further mitigate and control the migration of contaminants through groundwater and into surface water. As contamination will remain onsite a 5-year review will be required once the remedial action is conducted to evaluate the effectiveness of the remedy.

SUMMARY OF REMEDIAL ALTERNATIVES

Based on information collected during previous investigations, *a Feasibility Study-Revision # 1* (S&ME Inc., November 2020) was conducted to identify, develop, and evaluate cleanup options and to address the contamination at the Site. This evaluation considered the nature and extent of contamination and associated potential human health risks developed during the remedial investigations and associated studies to determine and evaluate potential remedial alternatives and their overall protection of human health and the environment. Each remedial alternative evaluated by the Department is described briefly below.

Remedial Alternatives	Description
No Action	This alternative would require conditions to stay the same without any active treatment or monitoring.
Monitoring Natural Attenuation	MNA relies on the natural physical, chemical, and/or biological processes to achieve site-specific goals within a reasonable time. Groundwater monitoring is also included in this alternative.
Groundwater Extraction and Pre-Treatment by Granular Activated Carbon (GAC)	This Alternative involves extraction/recovery wells equipped with submersible pumps used to withdraw contaminated groundwater. The contaminants are not destroyed by the GAC, but are captured and suspended in the media, requiring periodic replacement of the GAC media.
Air Sparging	Air sparging can be used for boundary control and reduction of dissolved-phase contaminants of concern. Air sparging can stimulate aerobic biodegradation with the sparge system area of influence.
Bio-enhancement	Bio-enhancement techniques involves injecting either microbes that are known to break down the contaminant of concern, or nutrients to increase the population of naturally-occurring microbes in the subsurface promoting reduction of contaminate.

DESCRIPTION OF ALTERNATIVES

Alternative 1 - No Action

The No Action alternative is included as a baseline for comparison with other Alternatives. Under this Alternative, no action is taken to treat or prevent potential exposure to contaminated groundwater, or reduce volume, toxicity, or mobility of contaminants. This action would rely on natural attenuation processes to reduce contaminant concentrations over time. This action does not include any institutional controls (e.g., deed restrictions) or monitoring to evaluate natural attenuation or contaminants of concern (CoCs) extent and the Site would be uncontrolled. The cost associated with the No Action alternative is $25,000. This cost includes abandonment and removal of all monitoring wells, remediation wells and equipment associated with the existing remediation pilot system, and preparation of a site closure report.

Alternative 2– Monitoring Natural Attenuation (MNA)

MNA is a passive approach in which monitored groundwater is to track the natural degradation or reduction of CoCs in groundwater. A typical MNA approach centers on monitoring groundwater regularly to evaluate and confirm that site conditions are supportive of CoC degradation. Additionally, land use controls would be implemented to protect human health and the environment by restricting development and groundwater use. PCP has been shown to aerobically degrade but usually at a lower rate than other volatile and semi-volatile contaminants. The persistence of PCP and its degradation products are prolonged in the groundwater. The annual cost for the MNA alternative would be about $25,000 a year for about 30 to 40 years. The total cost of this alternative is estimated at $1,025,000.

Alternative 3 – Groundwater Extraction and Pre-Treatment by Granular Activated Carbon (GAC)

The groundwater extraction and ex-situ treatment alternative involves extraction of groundwater using recovery wells. Groundwater would be recovered through a piping network and routed to a pre-treatment area, then the groundwater would pass through GAC treatment system causing mass transfer of contaminants from water to the filter media. The pre-treatment system would require permits from DHEC industrial wastewater program. The GAC does not destroy the contaminants, it just captured and suspended in the media, which requires periodic replacements of the carbon. Groundwater would be monitored for 30 years. The estimated total cost would be $3,980,000 to implement the groundwater extraction and pre-treatment by GAC and monitor groundwater for 30 years.

Alternative 4 – Air-sparging

Air-sparing involves the injection of air into the groundwater aquifer to strip contaminants from the groundwater. It provides a source of oxygen to promote aerobic biodegradation. Air-sparging can be used for boundary control and reduction of dissolved-phase contaminants of concern in the source and stimulate aerobic biodegradation. This alternative also involves groundwater monitoring for 10 years and institutional controls. The total estimated cost to implement air-sparging is $630,000. This cost includes system expansion costs, sampling, reporting and operating cost per year for ten years.

Alternative 5- Bio-enhancement

Bio-enhancement involves the remediation of groundwater contamination through injection of microbes that are known to metabolize the contaminant of concern, or nutrients to increase the population of naturally occurring microbes in the subsurface. Bio-enhancement would be useful for source area mass reduction or as polishing treatment in persistent area where contaminant mass reduction is not occurring. Groundwater monitoring for 20 years and institutional controls would also be a component of this remedy. The duration of this remediation would take between five to ten years. The total cost of bio-enhancement as the remedial alternative would be $945,000. This cost includes capital cost of $420,000, sampling and reporting cost of $25,000 per year for 20 years, with $25,000 for well abandonment at the project termination.

EVALUATION OF ALTERNATIVES

The National Contingency Plan requires the Department use specific criteria to evaluate and compare the different remediation alternatives individually and against each other to select a remedy. This section of the Proposed Plan profiles the relative performance of each alternative against the criteria, noting how it compares to the other options under consideration. The criteria are:

1. Overall protection of human health and the environment;
2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs);
3. Long-term effectiveness and permanence;
4. Reduction of toxicity, mobility, or volume through treatment
5. Short-term effectiveness;
6. Implementability;
7. Cost; and
8. Community acceptance

The main objectives for the preferred remedial action are to be protective of human health and the environment and to comply with State and Federal regulations. These two objectives are considered *threshold criteria*. Threshold criteria are requirements each alternative must meet to be eligible for selection.

The following measures are considered *balancing criteria*: long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost. These criteria are used to weigh the technical feasibility, strengths and weaknesses, and cost advantages and disadvantages of each alternative.

Community acceptance of the cleanup alternative is a *modifying criterion* that will be carefully considered based on public comments sent to the Department during the public comment period.

COMPARATIVE ANALYSIS OF ALTERNATIVES

A comparative analysis of each alternative was performed and can be observed in the EPA Performance Criteria table included. The alternatives were evaluated in relation to one another for each of the evaluation criteria. The purpose of the analysis is to identify the relative advantages and disadvantages of each alternative.

Overall Protection of Human Health and the Environment

When evaluating alternatives in terms of overall protection of human health and the environment, consideration is given to the way site-related risks are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Air-sparging received the highest score for protection of site-specific exposure pathways because the technology has been successfully pilot tested at the Site and has been shown to result in a sustained decrease contaminant concentration. Bio-enhancement received a moderate score for providing protection of human health and the environment, due to its short-term effectiveness receiving a low score. The No Action and MNA does not provide for overall protection of human health and the environment on site as there will be no decrease in contaminants in the source areas. The potential for off-site impacts to protect human health and the environment are uncontrolled. Groundwater Extraction and Pre-treatment by GAC received the lowest score to protect human health and the environment by extracting groundwater and removing contaminants through the GAC and eliminates exposure pathways due to the implementation and cost of this alternative.

Compliance with ARARs (Applicable or Relevant and Appropriate Requirements)

This evaluation criterion evaluates whether an alternative meets federal and state environmental statutes and regulations that pertain to the site. Each alternative is evaluated with respect to its ability to comply with such requirements.

All of the alternatives listed would require a period of natural attenuation for the groundwater downgradient of the treatment area to reach regulatory limits with all of the alternatives received high to moderate scores for meeting the chemical specific ARARs, with the exception of No Action and MNA. The No Action and MNA alternative received the lowest score because regulatory limits would not be achieved in any portion of the plume during implementation.

Long-Term Effectiveness and Permanence

The magnitude of residual risk remaining from untreated impacted media or treatment residuals and the adequacy and reliability of containment systems and institutional controls are evaluated under this criterion.

Air-sparging received the highest score for long-term effectiveness and permanence because the pilot test demonstrated that Air-sparging will results in a sustained decrease in contaminant concentrations. Bioremediation received a moderate score for potential residual risk because the naturally occurring anaerobic conditions for anaerobic bioremediation to successfully be implemented. Groundwater extraction and pretreatment by GAC received a moderate score due to physical and chemical properties of the contaminant and geologic formation, extraction and pre-treatment of dissolved contaminants is often unsuccessful in restoring groundwater concentrations to established target concentrations. The No Action and MNA alternatives received the lowest score because the source mass is not removed or destroyed and consequently the long-term risks remain.

Reduction of Toxicity, Mobility, or Volume through Treatment (TMV)

The degree to which an alternative employs treatment to reduce the harmful effects of contaminants, their ability to move in the environment, and the amount of contamination present is evaluated by this criterion.

Air-sparing received the highest score for reduction in toxicity, mobility, or volume of contamination because it has been demonstrated to effectively treat contamination by stimulating the naturally occurring micro-organisms in the aquifer allowing for breakdown of the contamination through biological processes. Bio-enhancement and groundwater extraction had moderate ratings. Bio-enhancement would reduce the contaminant where mass reduction is not occurring. Groundwater extraction and pretreatment by GAC would capture the contaminants and not destroy them. The No Action and MNA alternatives received lowest ranking because the remedies do not promote active treatment of contamination.

Short-Term Effectiveness

The short-term effectiveness evaluation takes into consideration any risk the alternative poses to on-site workers, the surrounding community, or the environment during implementation, as well as the length of time needed to implement the alternative.

Air-sparging received the highest score of the active remedies because it has the shortest active remediation implementation period and does not cause disturbance of, or the handling of chemicals and majority of the infrastructure is already in place from the pilot study. Groundwater Extraction received a moderate score by achieving hydraulic control and mass reduction of the contaminants. Bio-enhancement, No Action and MNA received low scores due to the unable to protect human health and the environment in the short-term period.

Implementability

The analysis of implementability considers the technical and administrative feasibility of remedy implementation, as well as the availability of required materials and services needed for implementation.

Air-sparging received the highest score since the air-sparing system framework is already in place from the pilot study. Bio-enhancement received moderate score since an underground injection control permit must be obtained, and additional site information will need to be collected. Groundwater Extraction received the lowest score as it would require new infrastructure to be installed.

Cost

The following table presents the probable cost for each alternative:

Alternative	Cost
1. No Action	$25,000
2. Monitored Natural Attenuation	$1,025,000
3. Groundwater Extraction and Pre-treatment by Granular Activated Carbon (GAC)	$3,980,000
4. Air Sparging	$630,000
5. Bio-enhancement	$945,000

Community Acceptance

Community acceptance of the preferred remedy will be evaluated after the public comment period. Public comments will be summarized, and responses provided in the Responsiveness Summary Section of the Record of Decision document that will present the Department's final alternative selection. The Department may choose to modify the preferred alternative or select another remedy based on public comments or new information.

SUMMARY OF THE DEPARTMENT'S PREFERRED ALTERNATIVE

The Department has identified a preferred alternative to address the contamination in both the soil and groundwater at the Site. The preferred remedial alternative is Alternative 4, Air Sparging.

Alternative 4, Air Sparging is groundwater remediation technology in which air is injected into the groundwater aquifer using system made up with a series of vertical or horizontal injection points. The injections points are located based on the expected area of influence of each well and the groundwater flow direction.

This Alternative was further developed for detailed analysis from the installation and field pilot testing of air sparging system. The pilot study concluded reduction of PCP concentration in the groundwater and has acted like a barrier to downstream migration. The system will be operated for approximately five (5) years or until the groundwater contamination has been adequately treated.

The total estimated net present worth of this alternative combination is approximately $630,000. It is the Department's judgment that the Preferred Alternative identified in this Proposed Plan is necessary to protect public health and the environment.

USE THIS SPACE TO WRITE YOUR COMMENTS

Your input on the Proposed Plan for the Marsh Lumber Facility Site is important. Comments provided by the public are valuable in helping DHEC select a final cleanup remedy.

You may use the space below to write your comments, then fold and mail. Comments must be postmarked by October 9, 2021. If you have any questions, please contact Kim Kuhn 803-898-0722. You may also submit your questions and/or comments electronically to: kuhnkm@dhec.sc.gov

Name _____ Telephone _____

Address _____ Email _____

City _____

State _____ Zip _____

Alternatives 1-5 are compared against each other for groundwater cleanup. The final remedy will be a combination of remedies to address both medias. The tables below rank the alternatives from 0-5 based off their effectiveness for each category. The remedy with the highest total score is considered the best alternative for each media.

Comparative analysis of Alternatives Table:

Criterion	Alternative 1 No Action	Alternative 2 Monitored Natural Attenuation	Alternative 3 Groundwater Extraction and Pretreatment by GAC	Alternative 4 Air Sparging	Alternative 5 Bio-enhancement
Protection Human Health and the Environment	2	3	3	4	3
Compliance with ARARs	2	2	3	4	3
Short-Term Effectiveness	2	2	3	4	2
Long-Term Effectiveness	3	3	3	5	4
Reduction of toxicity, mobility, & volume through Treatment	2	2	3	4	3
Implementability	5	5	1	3	4
Costs	5	3	1	4	3
Total Score	21	20	17	28	22