Nobis
Engineering a Sustainable Future

In-Situ Bioremediation Pilot Test Implementation Plan

Eastland Woolen Mill Superfund Site – Operable Unit 1
Corinna, Maine

Long-Term Response Action
EPA Task Order No. 0038-RA-LR-01T6

REMEDIAL ACTION CONTRACT
No. EP-S1-06-03

FOR

US Environmental Protection Agency
Region 1

BY

Nobis Engineering, Inc.

Nobis Project No. 80038

September 2015

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1.0 INTRODUCTION

Nobis Engineering, Inc. (Nobis) has prepared this *in-situ* bioremediation (ISB) implementation plan to summarize the current Site conditions and propose the pilot study procedures to be performed at the Eastland Woolen Mill Superfund Site (Site) located in Corinna, Maine. A Site locus plan is included as Figure 1-1. This work was performed in accordance with the U.S. Environmental Protection Agency (EPA) Region I Remedial Action Contract 2 (RAC 2) No. EP-S1-06-03, Task Order No. 0038-RA-LR-01T6, Modification 013.

The ISB Implementation Plan was prepared with assistance from XDD, LLC of Stratham, New Hampshire (XDD). XDD has been contracted by Nobis to assist with the design and performance of the ISB pilot-scale application at the Site.

2.0 BACKGROUND

This Section provides a brief description of the Site and a chronological history of investigative and remedial activities performed at the Site.

2.1 Site Description and History

The Site is located in the Town of Corinna, Penobscot County, Maine, approximately 6 miles north of Newport and 25 miles northwest of Bangor, Maine. The Site was formerly dominated by the Eastland Woolen Mill (EWM) building complex, which before its demolition in 2000, was comprised of a large manufacturing building and several ancillary structures, with a total area of 250,000 square feet. The buildings stood on both sides of and over the East Branch Sebasticook River (EBSR).

Prior to closing in 1996, EWM was a manufacturer and finisher of wool and blended woven fabric. Fabric finishing included dyeing of the fabric to meet product or customer requirements. This dyeing operation took place in dye kettles and utilized various chemicals, including dyes and dye-aid. The dye-aid Carolid MXS and Carolid EWS were used in the EWM manufacturing process and reportedly contained biphenyl and chlorinated benzene compounds, including 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, and 1,2,4-trichlorobenzene. Until construction of the Town of Corinna Wastewater Treatment Plant (WWTP) in 1969, liquid wastes from the mill were discharged to the EBSR. This occurred either by overland flow to the river following discharge to the ground surface beneath Site buildings, or by direct discharge to the Mill Pond Dam tailrace also located below Eastland's buildings. It was not until 1977 that all liquid waste streams were finally directed to the WWTP.

As a result of these discharge practices, overburden soil and bedrock underlying the Site buildings and river sediment and the underlying soil extending several hundred feet down gradient were contaminated with chlorinated benzene compounds. Groundwater was contaminated at concentrations well above federal drinking water Maximum Contaminant Levels (MCLs) and State of Maine drinking water Maximum Exposure Guidelines (MEGs). Routine pumping of nearby residential bedrock wells served to spread the contamination laterally along bedrock bedding-plane fractures. Site contaminants of concern (COCs) are listed in Table 2-1. A site plan is included as Figure 2-1.

The Long-Term Response Action (LTRA) implements the remedies selected in the September 2002 EPA Record of Decision (ROD) to address the Site contamination and threats to human health and the environment posed by groundwater contamination. Since 2002, EPA has conducted *in-situ* chemical oxidation (ISCO) to remediate residual concentrations of chlorinated volatile organic compounds (VOCs) present in bedrock groundwater following the Non-time Critical Response Action (NTCRA) soil excavation and ex situ treatment and targeted ISCO applications. ISB is being considered as a “polishing” technology to remediate the residual VOC contamination above the groundwater quality criteria, including the State of Maine MEGs, the federal MCLs, and the OU1 Provisional Groundwater Cleanup Levels (GCLs) for the COCs specified in the Record of Decision (EPA, 2002). Specifically, the COCs include chlorinated benzenes (CBs): 1,2,4-trichlorobenzene (TCB); 1,2-dichlorobenzene, 1,3-dichlorobenzene, and 1,4-dichlorobenzene (collectively referred to as DCBs); chlorobenzene, or mono-chlorobenzene (MCB), and benzene.

2.2 Site Geology and Hydrogeology

2.2.1 Surficial Lithology

Overburden materials in Area 1 consist of anthropogenic fill materials (treated and reworked site soil) overlying glacial drift. The fill extends from ground surface to a maximum depth of 36 feet. Underlying the fill is a native sequence of glacial drift up to 26 feet thick, consisting of a layer of meltout till overlying basal till. The contact between the fill and till is difficult to distinguish. In the former NTCRA excavation area, a PVC liner and geomembrane underlies the fill as a remnant from the excavation; however, the liner has been punctured several times during different boring and well installation events. Weathered bedrock ranging in thickness from less than one foot to approximately ten feet was observed immediately below the till. Native soils thin to the north and west, which is consistent with the NTCRA excavation limits. Weathered bedrock surface data indicates that bedrock surface slopes generally to the east, towards the EBSR.

Overburden soil in the Building 14 area is generally consistent with Area 1. Although, there is limited data in the area, soil boring observations indicate that the fill extends to approximately 10 feet bgs underlain by layers of till to the bedrock surface.

Overburden monitoring wells in Area 1 are generally screened between 30 and 40 feet bgs in the fill stratum. Wells in the Building 14 area are screened shallow (OM-01-50; 3.5 to 13.5 feet bgs) and deep (OM-01-51; 33 to 38 feet bgs). Based on groundwater and soil sampling results in Area 1 from 2009, residual groundwater and soil contamination is present in the overburden as a result of upward bedrock fracture discharge and source material left behind at the completion of the NTCRA excavations. An estimated mass of 687 kilograms (kg) of total VOCs remains in the soil in Area 1 according to the mass estimate included in the 2009 ISCO Performance Assessment Report, Revision 01 (Nobis, 2011). Contaminant mass estimates have not been calculated for the overburden material remaining in the Building 14 area.

Overburden groundwater flow is generally to the southeast following the path of the river, as shown in Figure 2-3.

2.2.2 Bedrock Geology

The bedrock underlying Area 1 consists of essentially three distinct zones. These include a thin zone of highly weathered bedrock immediately below the basal till, which overlies a thicker zone of moderately competent fractured bedrock. The weathered bedrock consists of rock flour and pulverized and strongly weathered rock fragments and is predominantly a porous media. This zone is believed to average approximately 1 foot in thickness and extends, on average, to an elevation of 187.1 feet above mean sea level (msl). The zone of moderately competent bedrock is approximately 10 feet in thickness and grades downward into competent fractured bedrock. The moderately competent and competent bedrock are discretely fractured media and are expected to have low matrix porosities where fresh. In the fractured bedrock, weathering adjacent to fractures has produced an oxidized zone up to several inches in thickness with greatly enhanced porosity. Based on experience at other sites, these oxidized rock matrices may have porosities up to five percent and play an important role in contaminant mass retention as the compounds diffuse into the matrix and slowly leach back in to the aquifer over time. Some DNAPL may still be present in fracture apertures and may even penetrate the surface of the oxidized matrix.

The bedrock underlying the East Side Area consists of essentially three distinct zones similar to bedrock observed in Area 1 and has been identified as a light and dark grey to greenish shaley siltstone of the Waterville Formation. The zones include: pulverized “rock flour” underlying the basal till and extending up to 2 feet into bedrock; highly fractured weathered bedrock extending approximately 10 feet into bedrock; and more-competent fractured bedrock underlying the weathered bedrock. The entire bedrock formation is characterized with intermittent zones of calcitic mineralization and iron oxide staining as determined through field observations during drilling activities and borehole geophysical imaging (Nobis, 2008).

2.2.3 Primary Fractures and Bedrock Groundwater Flow

A series of 4 to 5 fracture zones dominate groundwater flow in the bedrock aquifer underlying the NTCRA Area 1 Excavation. These fractures span boreholes BM-99-04, BM-04-34, BM-04-35, BM-04-36, BM-04-37, RB-04-03, and RB-04-05. As presented in the Final Conservative Tracer Test (CTT) Design (Nobis and MACTEC, 2004), heat-pulse testing and pumping within these boreholes indicates a strong hydraulic connection exists between each location. A subset of these transmissive fractures is summarized in Table 2-2.

A more permeable bedding plane fracture or series of closely spaced bedding plane fractures connect between BM-04-35, BM-04-36, BM-04-37, and RB-04-05. Groundwater flow in this area is dominated by these bedding plane fractures, with measured heat-pulse flowmeter (HPFM) flow rates of 0.03 to 0.2 gallons per minute (gpm). These fractures are bisected by lower angle fractures in BM-04-34 and BM-04-36. Direct connection between boreholes was determined by integration of the structural and lithologic analysis of the rock core and geophysical logging results. These fractures were imaged in electrical resistivity tomography (ERT) and ERT/Induced Polarity data sets prior to the CTT injection. During the CTT, bromide tracer was injected alternately into extraction wells EW-2, EW-3, EW-6, and EW-7 to identify connectivity between the extraction wells and other monitoring locations throughout the bedrock matrix below the NTCRA excavation area (Figure 2-2). These fractures showed preferential groundwater flow pathways along specific bedrock fractures and groups of intersecting fractures. Transmissive fractures daylight immediately below the DNAPL entry area at the base of the NTCRA excavation and facilitated transport of bromide, and partitioning tracers, down-dip along fracture planes to deeper portions of the bedrock aquifer. Most of the tracer migrated through the area of RB-04-01, RB-04-02, and RB-04-03.

The HPFM interwell connectivity test and the dewatering pumping test (Nobis and MACTEC, 2004) have shown that the fractures penetrated by BM-04-32 are relatively isolated from the other more interconnected and transmissive parts of the fractured bedrock. The northeast-southwest elliptical drawdown cone of depression that developed from pumping this well correlates well with the strike of the primary water-bearing fractures.

Previous studies concluded that bedrock groundwater flow is strongly anisotropic and occurs along generally planar bedding plane fractures that are transmissive over distances greater than 100 feet (Nobis and MACTEC, 2005). The cross-borehole flow results presented herein support the conclusion that bedding plane fractures are responsible for the bedrock groundwater anisotropy. However, the borehole logging results from East Side Characterization study (Nobis, 2008) and additional bedrock data collected during the Phase IV bedrock pilot study performed in 2007 demonstrated that primary bedding plane fractures cannot be traced laterally over distances greater than 10 to 20 feet. Therefore, bedrock fracture flow is believed to occur through an interconnected network of bedding plane fractures and cross-cutting low-angle and steeply dipping fractures (for example fractures LA-1, LA-2, and J-1 [Table 1; MACTEC, 2006]) rather than single bedding plane fractures transporting groundwater over large distances.

Bedrock groundwater elevations and flow directions are displayed in Figure 2-4 and generally follow a south to southeast direction depending on the position relative you to the river.

3.0 BENCH-SCALE TEST PROCEDURES AND RESULTS

An ISB bench-scale test was conducted by XDD in 2014 (Nobis, 2014) to evaluate the efficacy of bioremediation in reducing the Site chlorinated benzenes (CBs) using samples of site groundwater so that an evaluation of the methods, amendments, and augmentations could be considered for future pilot and full-scale applications.

The bench test evaluated several combinations of aquifer conditions and amendments including:

- aerobically with oxygen addition, with and without bioaugmentation;
- anaerobically with lactate, with and without bioaugmentation;
- anaerobically with sulfate, with and without bioaugmentation; and

- sequential anaerobic (amended with lactate) to aerobic (amended with oxygen), with and without bioaugmentation.

It was determined that due to the higher VOC concentrations and historical dissolved oxygen (DO) concentrations and oxidation-reduction potential (ORP) values that groundwater from BM-04-32 would be selected for the test. Nobis collected the groundwater for the test based on sample and handling guidance provided by XDD including maintaining aerobic and anaerobic conditions in the appropriate containers. XDD received the groundwater and determined that each set had arrived in adequate conditions for the test.

XDD set up the controlled bench-scale test with 12 separate microcosms covering various combinations of aerobic and anaerobic conditions including control groups.

The bench-scale tests were performed for a total of 30 days for the aerobic tests and 140 days for the anaerobic and sequential anaerobic-aerobic tests. After the completion of the aerobic tests, a confirmation test was performed for 12 days. More specific information about the test procedures, maintenance, and monitoring of the microcosms is included in the bench test results prepared by XDD (XDD, 2014).

The test results suggested that anaerobic degradation from TCB to MCB can be achieved using Site groundwater, an electron acceptor (e.g., lactate), and a microbial culture known to degrade chlorobenzene compounds; however, MCB was not degraded in any of the anaerobic tests. Although MCB is generally more conducive to aerobic degradation, it was not effectively treated in the sequential tests either. It is likely that the aerobic bacteria capable of degrading the MCB were depleted during the anaerobic phase and no aerobic augmentation was performed during the sequential tests to replenish them. Therefore, anaerobic or sequential pilot-tests were not recommended for field application.

Complete degradation of the TCB, DCB, and MCB concentrations to below detection was observed in the aerobic tests (i.e., Microcosm #5 and #6) as described the June 2014 Tech Memo. The degradation was confirmed with a shorter confirmation test performed following the positive results of the initial test. Aerobic degradation is possible without augmentation; however, the addition of bacteria capable of CB degradation may increase the rate of destruction. For the purpose of the pilot-test and to get a representative indication of the capabilities of the naturally occurring bacteria, no additional CB-degraders will be added to the aquifer. For a full discussion of the bench-scale test procedures and results, refer to the *2014 ISB Bench Test Technical Memorandum* (Nobis, 2014).

4.0 ISB PILOT TEST DESIGN

4.1 Pilot Test Well Selection and Area

In order to test the ISB technology effectively in the field, appropriate application locations have to be selected. The selection is based on several parameters including:

- horizontal and vertical location relative to the plume;
- location of higher concentrations or mass of contamination;
- connectivity of fractures to get to the contamination or non-connectivity of bedrock fractures so the test is controlled;
- natural aerobic/anaerobic conditions in the wells; and
- natural ORP condition in the wells.

The plume in Area 1 at the Site exists in both the bedrock and overburden aquifers while the plume in the East Side Area primarily exists in the bedrock. A localized overburden plume also exists in the Building 14 area. The NTCRA excavations have removed the original source of the overburden contamination in Area 1; however, the current overburden contamination is a result of upward vertical gradients bringing the contamination up from the underlying bedrock aquifer. The pilot-test is designed to treat both the deep bedrock aquifer and the overburden aquifer. Pilot test target areas include Area 1, the East Side Area, and the Building 14 area to test the effectiveness of the technology in both aquifers and selected wells that were previously scrutinized during the ISCO work as well as the ability to achieve proper distribution in both matrices. Previous injections of ISCO provided information supporting the capability of achieving reasonable distribution in the overburden, whereas injection into the bedrock is anticipated to present more challenges. With a greater likelihood of achieving reasonable distribution in the overburden, there is a better chance of proving the technology is successful.

Based on the 2014 groundwater monitoring data (Nobis, 2015), the Area 1 overburden plume is approximately 23,000 square feet (0.5 acres) in size and is relatively circular in shape. The Building 14 area overburden plume is nominal in size and is isolated to the vicinity and depth interval of OM-01-50. The bedrock plume is approximately 43,000 square feet (1.0 acres), is irregularly shaped, and extends beneath the East Branch of the Sebasticook River to the East

Side Area. Only 25-percent of the total area of the plume (10,000 square feet) persists in Area 1. Refer to Figures 3-1 and 3-2 for the most recent interpretation of the configuration of the overburden and bedrock plumes, respectively. Figure 3-3 displays the most recent bedrock packer groundwater results along with the bedrock plume.

Of the several overburden wells in Area 1, only three have detectable concentrations of CBs during the most recent monitoring round and only one of those is significant enough to serve the purpose of the pilot-test, specifically to determine if the technology will be effective in the field at reducing high concentrations of CBs in the various aquifers. The lack of overburden wells with concentrations of CBs significant enough to warrant remediation is related more to the location of the existing overburden wells around the perimeter of the plume than to the significance of contamination in the plume. The post-ISCO soil boring program determined that sorbed CBs were still present in the subsurface within Area 1 and the groundwater results from recent monitoring events indicate that the plume extends to the East Side Area and south beneath the road. Unfortunately due to terrain, the road, and the associated right-of-way, it is not feasible to install wells and perform the pilot-test in some areas of the inferred Area 1 overburden plume.

The Building 14 area is a much smaller area than Area 1 and also contains limited monitoring wells for selection. Only four wells are intact and viable for extraction/injection and/or monitoring. Of those, only one, OM-01-50, has the persistent presence of contamination.

Several of the bedrock monitoring well/open borehole locations in both Area 1 and the East Side Area have been sampled using inflatable packers and/or have been retrofitted to isolate specific fractures and sampling intervals effectively creating up to 15 distinct locations and intervals sampled during long-term monitoring events. All but one of the locations/intervals routinely contain CBs at concentrations exceeding the groundwater cleanup criteria. Refer to Table 3-1 for a summary of the COC concentrations in the overburden and bedrock sampling locations from 2004 through 2014.

The bench test results indicate that aerobic degradation of the CBs is more effective than anaerobic degradation. DO concentrations are the generally the best indicator of the aerobic/anaerobic condition of the aquifer; however, when the aquifer is contaminated the oxygen can be used up by bacteria and other demands. Generally, concentrations above 1 milligram per liter (mg/L) are considered aerobic and below 1 mg/L are considered anaerobic. DO concentrations are monitored during routine low-flow groundwater sampling. The stabilized DO concentrations recorded for the three most recent groundwater monitoring rounds in Area 1 are listed in Table 3-2. The bench test results also indicate that the bacteria capable of degrading the CBs (CB-degraders) are naturally present in the aquifer; however, those bacteria have likely consumed the available oxygen. Therefore, the DO concentrations summarized in Table 3-2 may not provide an accurate representation of what wells should be used for the pilot test. Instead, an evaluation based on the DO, ORP, and CB concentrations compared to background may serve to better indicate the optimal locations for the pilot test.

ORP is the measure of the tendency of a solution to accept or donate electrons thereby being in a reducing or oxidizing state, respectively. Generally, solutions with an ORP of -100 millivolts (mV) to +300 mV are suitable for aerobic degradation while solutions with an ORP less than -100 mV are more suitable for anaerobic degradation. ORP is monitored during routine low-flow groundwater sampling. The stabilized ORP concentrations recorded for the three most recent groundwater monitoring rounds in Area 1 are listed in Table 3-2.

Considering the selection parameters outlined above, IM-04-04 and OM-00-46 are being selected as the overburden wells to be used for the ISB pilot test. The DO concentrations have generally ranged from 0.21 mg/L to 0.74 mg/L, with the exception of IM-04-04 during the June 2012 round when the DO was recorded at 8.56 mg/L. Both of these wells are currently in a slightly anaerobic state with ORP ranging from -11 mV to -125 mV over the most recent three rounds of groundwater monitoring. IM-04-04 is located near the northern and upgradient (relative to the core) edge of the overburden plume and is slightly more aerobic than OM-00-46 based on higher DO concentrations. OM-00-46 is located close to the center of the plume and is slightly more anaerobic due to the bacterial consumption of the available oxygen. The wells are located approximately 80 feet apart, reducing the chances of the ISB applications interfering with each other. While it is preferred to perform the aerobic pilot test at a location that is naturally aerobic, each of the wells within the plume are historically slightly anaerobic, likely due to the oxygen being consumed by the naturally-present CB-degraders identified during the bench test. The screened sections of the selected wells are included in Table 4-1.

Considering the selection parameters outlined above, BM-04-32 (68-78 feet bgs) and BM-04-36 (70-80 feet bgs) are being selected as the bedrock wells to be used for the ISB pilot test. The BM-04-36 interval has had two recorded DO readings in the past three years above 1 mg/L, thereby it is in a naturally aerobic condition despite the negative ORP readings during the three most recent rounds. The BM-04-32 interval has been anaerobic during each of the past three monitoring rounds with ORP readings generally more negative than BM-04-36. BM-04-32 is located along the northern edge of the bedrock plume while BM-04-36 is located approximately 80 feet to the south. The boreholes intersect different fractures based on the geophysical data historically reported and summarized in the 2005 Conceptual Model Update for the Site (Nobis and MACTEC, 2005). This reduces the possibility that pilot-test activities at each location will interfere with the other.

The screened sections of the selected wells or exposed sections of the selected open-boreholes are included in Table 4-1. The wells are displayed on Figure 3-4 with the inferred radius of influence developed using vertical interval (10 ft), assumed bedrock secondary porosity values, expected injection flow rates (taken from the 2007 ISCO Push-Pull tests), and the injection time as design factors.

4.2 Groundwater Extraction and Amendment

Biostimulation will be performed using a volume of native groundwater and bacteria that is amended to adjust geochemical parameters and promote bacterial growth. To prepare the necessary volume for reinjection, groundwater will be extracted from the selected overburden wells and the bedrock boreholes for the purpose of on-site batching and amending. Groundwater will be extracted using double-diaphragm pumps and will be regulated to flow rates of approximately 1.5 gpm in the overburden wells and 0.2 gpm in the bedrock wells. Time is a limiting factor in the performance of the pilot-test and it is assumed that the extraction will be performed for no longer than two working days. Based on the results of previous pumping tests the target intervals of the selected bedrock boreholes may produce limited yield. In the event that the target intervals do not produce enough water, aquifer water from other intervals or wells within the treatment zones will be used for batching purposes and if additional water is needed, it will likely come from other areas of the Site with similar water quality characteristics. If necessary, sufficient batching and injection volumes may be achieved via a potable water supply delivered to the Site to supplement the volume provided by the pilot bedrock intervals; however, this contingency is unlikely to be needed. The off-site water would initially dilute the extracted aquifer water; however, with time and amendments to bring the batched water to optimal conditions, the bacteria would continue to thrive and reproduce. This would reduce the concern for dilution.

Bacteria counts and speciation was not performed during the bench-test; therefore, it is not possible to determine which aquifer has a greater bacteria population. The presence of the CB-degrading bacteria was confirmed in the bench-test by observing the degradation of CBs in the cultured microcosms relative to control microcosms. The plan is to use overburden aquifer water for the overburden portion of the pilot-test and bedrock aquifer water for the bedrock portion of the pilot-test to improve the likelihood of positive results.

The six locations selected for the pilot test do not currently exhibit optimal conditions for the aerobic ISB; therefore, biostimulation is needed to bring the aquifer into the optimal ranges with respect to DO and ORP. In order to maintain a consistently aerobic aquifer, oxygen will be introduced to the aquifer through an oxygen release compound. Considerations for selection of the oxygen source include the longevity of the source, the construction of the injection wells/points and the method of injection, and the cost of supplying oxygen to the aquifers.

A primary goal of the pilot-test is to overcome the anaerobic condition present in each of the four wells while meeting and exceeding the oxygen demand of the soils, metals, organic acids, and the COCs and ensuring that the oxygen remains in solution for a suitable amount of time. In order to do this, the extracted water will be amended using an application of PermeOx® Ultra, manufactured by PeroxyChem. The product is an insoluble slurry slow oxygen release compound consisting of calcium peroxide that also releases nutrients required by the CB-degraders to thrive for the enhancement of ISB. The product comes in a dry powder form and will be manually added to the temporary storage tank and continually mixed with the native groundwater using an air-powered mixer. The volume of the oxygen needed is based on the most recent water quality data (August 2014). The target interval volumes, the effective porosity of the overburden and bedrock matrices, and the target DO concentrations were all taken into consideration in order to calculate the PermeOx® Ultra mass needed for the pilot-test.

The PermeOx® Ultra amended groundwater will be delivered to the overburden aquifer by injection through direct-push drilling rods at four borings located five feet from each of the pilot-test wells (twelve total). Injection through the drilling rods will improve the distribution area improving the treatment process. The injections will be at a similar flow rate and duration as the extraction. For the bedrock wells, the PermeOx® Ultra will be administered using straddle-packers to isolate the desired intervals and directly injected into the space between the packers. Hydraulic pressure will be used to push the slurry into the fractures. Vendor documentation claims that the PermeOx® Ultra can continue to release oxygen for up to one year and XDD's experience with the product supports the claim. It is anticipated that only one injection in each area will be needed for the duration of the pilot-test.

The increase in the mobility of certain metals can be a detriment to many anaerobic ISB applications. Generally, metals in aquifers that are in a reducing state (negative ORP) are more likely to release from the soil particles and become mobile in the groundwater. While the groundwater at the Site most recently exhibits a slightly reducing state, the application of the PermeOx® Ultra is expected to increase the oxygen content of the groundwater and the ORP simultaneously. The sustained increased oxygen content by the slow release compound will return the aquifer to an aerobic state where metals are more likely to remain bound to the soil particles. Therefore, with the amendment of the groundwater, the mobility of the metals historically found at the Site (arsenic, iron, and manganese) is actually expected to be reduced. A site specific adsorption/desorption test would be required to confirm this theory; however, it does not appear to be warranted at this time.

Appendix A contains tables that summarize the extraction/injection volumes and flow rates, volumes of amendments, and the dimensions of the target treatment areas for the overburden and bedrock aquifers. Appendix B contains Process and Instrumentation Diagrams provided by XDD for the extraction, mixing, and injection of the amended groundwater. Appendix C contains the information sheet and Material Safety Data Sheet (MSDS) for the PermeOx® Ultra product.

Based on the presence of naturally occurring CB-degraders discovered during the bench-test, it is not required to perform bioaugmentation using additional bacteria from an off-site source during the pilot-test.

5.0 PILOT-TEST PERFORMANCE MONITORING

5.1 Baseline Groundwater Monitoring

Prior to groundwater extraction for batching purposes, a baseline groundwater monitoring round will be performed by Nobis. The round will include the six pilot-test wells and the hydraulically connected wells surrounding them to determine the aquifer conditions immediately prior to the pilot-test. In the bedrock open boreholes, sampling will be performed using packer sampling procedures. Baseline monitoring will be performed to collect 24 samples (plus quality assurance samples) using low-flow (low-stress) sampling techniques for appropriate data comparability with previous monitoring rounds. Samples will be submitted to a contract laboratory procured by Nobis for analysis of VOCs, total and dissolved metals, anions, organic acids, organic carbon, and oxygen demand.

Overburden groundwater samples will be collected from 10 locations, 3 from the pilot-test wells and 7 from existing locations surrounding the pilot-test wells. Bedrock groundwater samples will be collected from the 3 selected pilot-test locations and intervals and the 2 intervals directly above and below the target intervals to assess short-circuiting around the packers during the injections. Additionally, bedrock groundwater samples will be collected from locations presumably within the same fracture plane (RB-04-01, 80-90 ft bgs in Area 1 and BM-07-48, 50-60 feet bgs and 91-101 feet bgs; and BM-07-50, 72-82 feet bgs and 91-101 feet bgs in the East Side Area) to determine if the amended groundwater is being adequately distributed following injection. Table 4-1 summarizes the details of the analyses to be performed, the schedule, and the wells and intervals in which samples will be collected. Table 4-2 summarizes the analytical methods, holding times, containers, and preservation requirements of the analyses.

5.2 Performance Groundwater Monitoring

During the air-powered mixing of the amendment and extracted groundwater in the temporary storage tanks, water quality measurements will be recorded hourly until the optimal conditions are met. Nobis will perform the batch tank monitoring using a multi-parameter water quality meter submerged in the tanks to approximately one half of the water column to obtain representative measurements. DO and ORP measurements will be required to be significantly above 1 mg/L and 100 mV, respectively, prior to injection into the aquifer. Acidity is expected to remain in the neutral range of 6.5 to 8.0. Mixing will continue until the PermeOx® Ultra product is sustainably held in solution before injection into the aquifers.

Performance groundwater monitoring will be performed consistent with the Baseline sampling event with respect to locations and analytes. The ISB performance monitoring events will be completed 1 week, 2 weeks, 3 weeks, 6 weeks, and 8 weeks following. The sampling for the first four events will be performed using the Maine Department of Environmental Protection's "No Purge" method, while the final (8 week) event will be performed consistent with the Baseline round and use the low-flow (low-stress) sampling method. A total of 24 locations will be sampled during each of the monitoring events. The 24 locations, and their associated analyses, sampled during the Baseline round will again be sampled during the ISB performance monitoring round for data comparison and to determine the actual radii of influence; longevity of amendments in the subsurface; and effectiveness of the technology to destroy the COCs.

6.0 SCHEDULE AND REPORTING

6.1 Pilot-Test Schedule

The pilot test activities, including equipment set-up, groundwater extraction, batching, and injection is expected to take up to fifteen days to complete. Because of the time constraints in place, groundwater will be extracted during two full working days (assume 10 hours per day) or until the target batch volume is reached, with one day of mobilization and set up time. Injection will be performed at approximately the same flow rates as extraction and could take up to 3.5 days to complete. Injection and extraction times may vary based on field conditions and achievable flow rates. Baseline sampling will be performed during ISB mobilization and set up to reduce the chance of influence from the extraction of groundwater during sampling activities.

The performance monitoring round will be performed in fall of 2015. Assuming that the Baseline round is performed in September 2015, the application and performance monitoring sampling will be scheduled to occur between September and November 2015.

6.2 Reporting

Nobis will prepare an ISB performance technical memorandum (tech memo) once the analytical results from the ISB performance monitoring round have been received and validated. The tech memo will include a summary of the activities including the groundwater extraction, batching, and injection and the baseline and performance monitoring. Field measurements and analytical results will be tabulated and plotted for display purposes and to determine if there is any change in plume dimensions or concentrations and/or the water quality based on the pilot-test activities. The tech memo will assess the efficacy and implementability of the technology; the treatment zone; the need for additional extraction, injection, or monitoring wells; and the volume and details of the amendments to be used during the full-scale implementation. The tech memo will also make recommendations for the performance of a full-scale ISB system, if warranted, based on the results of the pilot-test. The tech memo is expected to be prepared and submitted by February 2016.

7.0 REFERENCES

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TABLES

Table 2-1
OU1 Groundwater Contaminants of Concern
Eastland Woolen Mill Superfund Site
Corinna, Maine

Contaminant of Concern	GCL	MEG	MCL
1,2,4-Trichlorobenzene (1,2,4-TCB)	70	70	70
1,2-Dichlorobenzene (1,2-DCB)	85	200	600
1,3-Dichlorobenzene (1,3-DCB)	85	1	NE
1,4-Dichlorobenzene (1,4-DCB)	27	70	75
Benzene	5	4	5
Chlorobenzene	47	100	100
Arsenic	10	10	10
Manganese	200	500	NE

Notes:

All values listed are in micrograms per liter (µg/L).

GCL = Provisional Groundwater Cleanup Level. Table 9: Record of Decision Amendment, Eastland Woolen Mill Operable Unit I, September 2006.

MEG = Maine Center for Disease Control Maximum Exposure Guideline, updated October 19, 2012.

MCL = Maximum Contaminant Level: EPA's National Primary Drinking Water Regulations, updated April 2012.

NE = indicates that an applicable standard for the given compound has not been established.

Table 2-2
Bedrock Fracture Summary
Eastland Woolen Mill Superfund Site
Corinna, Maine

Fracture ID	Borehole	Top of Casing Elevation (feet MSL)	Depth (feet from TOC)	Fracture Elevation (feet MSL)	Dip Direction, degrees	Dip Angle, degrees	Strike, degrees	Heat-pulse Flowmeter Result, gallons per minute pumping
1	BM-04-34	225.86	96.16	129.70	132.98	71.28	42.98	0.03
	BM-04-35	223.57	125.71	97.86	134.86	62.64	44.86	0.05
	BM-04-35	223.57	127.78	95.79	118.14	66.42	28.14	0.05
	BM-04-37	224.20	162.04	62.16	121.88	68.27	31.88	0.02
	RB-04-08	226.65	55.92	170.73	140.05	66.64	50.05	0.01
2	BM-04-34	225.86	128.33	97.53	144.01	52.46	54.01	0.03
	BM-04-35	223.57	120.37	103.20	138.75	53.70	48.75	0.20
	RB-04-05	225.73	88.86	136.87	142.74	52.27	52.74	0.04
3	BM-04-37	224.20	163.03	61.17	121.87	62.82	31.87	0.02
	BM-04-34	225.86	78.56	147.30	128.59	63.32	38.59	0.01
	BM-04-38	224.05	186.92	37.13	127.49	73.13	37.49	0.02
4	BM-04-32	223.26	114.49	108.87	157.91	60.21	67.91	0.02
5	BM-04-31	223.18	75.53	147.65	82.65	12.21	7.35	0.01
	BM-04-32	223.26	70.54	152.82	24.16	12.86	294.16	0.01
6	RB-04-03	224.42	65.33	159.09	38.77	40.50	308.77	0.04
	RB-04-05	225.73	51.81	173.92	6.46	49.60	276.46	0.01
7	BM-04-31	223.18	167.70	55.48	347.50	3.77	256.22	0.07
	BM-04-35	223.57	143.11	80.46	88.03	27.27	1.97	0.02
	BM-04-36	224.45	131.25	93.20	5.26	24.98	275.26	0.07
	BM-04-37	224.20	130.09	94.11	338.17	6.10	68.17	0.03
8	BM-04-38	224.05	115.98	108.07	135.30	59.16	45.30	0.06
	BM-04-37	224.20	85.01	139.19	134.42	59.21	44.42	0.16
9	RB-04-05	225.73	51.92	173.81	147.55	49.89	57.55	0.01
	RB-04-07	226.41	47.31	179.10	136.64	43.82	46.64	0.06

Note:
Table extracted from the Final Conservative Tracer Test (CTT) Design (Nobis and MACTEC, 2004).
MSL = mean sea level
TOC = top of casing
Shaded fractures represent fractures interesected by proposed extraction/injection wells.

Table 3-1
Historical Groundwater COC Concentrations
Eastland Woolen Mill Superfund Site
Corinna, Maine

Sample Location	Sample ID	Sample Date	1,2,4-Trichlorobenzene		1,2-Dichlorobenzene		1,3-Dichlorobenzene		1,4-Dichlorobenzene		Benzene		Chlorobenzene	
		GCL	70		85		85		27		5		47	
Overburden Monitoirng Wells														
IM-04-03 32.5-37.5 feet bgs	IM-04-03X036LX	1/3/2007	**2300**		**720**		31		**630**		10	U	**770**	
	IM-04-03X036MX	9/5/2007	**2100**		**1100**		200	U	**1000**		100	U	**2100**	
	IM-04-03X036QX	11/16/2007	**1600**		**460**		200	U	**440**		100	U	**160**	
	IM-04-03X-021909AX	2/19/2009	**1200**		**570**		32		**550**		5	U	**1000**	
IM-04-04 37-40 feet bgs	IM-04-04X037BX	7/12/2004	**12,000**		**13,000**		**560**		**8,800**		**30**		**22,000**	
	IM-04-04X037CX	11/2/2004	**1,000**		**250**		19		**200**		10	U	**140**	
	IM-04-04X037DX	12/13/2004	**7,400**		**3,100**		**130**		**2,100**		100	U	**2,000**	
	IM-04-04X037EX	1/11/2005	**5,400**		**1,100**		53		**810**		10	U	**770**	
	IM-04-04X037FX	8/29/2005	**1,800**		**380**		**200**		**330**		10	U	**310**	
	IM-04-04X037LX	11/2/2005	**2,400**		**940**		51		**740**		10	U	**1,100**	
	IM-04-04X037MX	8/14/2006	**680**		**340**		16		**240**		10	U	**270**	
	IM-04-04X037NX	1/3/2007	**2,800**		**2,000**		64		**1,700**		10	U	**1,500**	
	IM-04-04X037OX	9/11/2007	***570***		***103***		*20*	*U*	***86.5***		*10*	*U*	***51***	
	IM-04-04X037PX	9/26/2007	**1,000**		**680**		24		**580**		1.2		**600**	
	IM-04-04X037QX	11/15/2007	**150**		**120**		20	U	**81**		10	U	**120**	
	IM-04-04X-022409AX	2/24/2009	**410**		47		2.2		**38**		5	U	33	
	IM-04-04X-092209AX	9/22/2009	**380**	**DJ**	77		3.7	J	**59**		3.8	J	**59**	
	IM-04-04X-060310AX	6/3/2010	**180**	**J**	47	J	2.5	J	**39**	**J**	5	UJ	**70**	**J**
	IM-04-04X-121510AX	12/15/2010	***250***	***D***	***135***		*3.6*	*J*	***90.5***		*3.05*	*J*	***195***	***D***
	IM-04-04X-052411AX	5/24/2011	***670***	***D***	***165***		*7.9*		***130***		*5*	*U*	***515***	***D***
	IM-04-04X-061912AX	6/19/2012	***465***		***190***		*10*		***150***		*2.55*	*J*	***590***	
	IM-04-04X-082113AX	8/21/2013	***580***		***420***		***85.5***		***330***		*50*	*U*	***1,450***	
	IM-04-04A-081914AX	8/19/2014	**930**	**J**	**930**	**J**	**490**	**J**	**780**	**J**	25	U	**3,100**	**J**
IM-04-07 31-38 feet bgs	IM-04-07X035AX	11/3/2005	**4,300**		**2,300**		**93**		**1,800**		10	U	**2,700**	
	IM-04-07X035BX	8/15/2006	**5,400**		**4,600**		**180**		**3,500**		10	U	**6,300**	
	IM-04-07X035CX	1/5/2007	**2,400**		**1,800**		57		**1,500**		10	U	**2,000**	
	IM-04-07X035DX	9/7/2007	**11,000**		**7,700**		**300**		**5,800**		100	U	**7,900**	
	IM-04-07X035EX	9/26/2007	**93**		**93**		20	U	**90**		10	U	**100**	
	IM-04-07X035FX	11/15/2007	**540**		**350**		11		**350**		10	U	**250**	
	IM-04-07X-021809AX	2/18/2009					**120**		**2,600**		250	U	**3,000**	
	IM-04-07X-092209AX	9/22/2009	**1,300**	**DJ**	**1,200**	**D**	50		**820**	**D**	5	U	**760**	**D**
	IM-04-07X-060310AX	6/3/2010	**840**	**D**	**690**	**D**	**120**		**600**	**D**	0.92	J	**410**	**D**
	IM-04-07X-121510AX	12/15/2010	5	U	23		9		**28**		5	U	**69**	
	IM-04-07X-052411AX	5/24/2011	63	B	38		11		**32**		5	U	26	
	IM-04-07X-061912AX	6/19/2012	36		41		22		**28**		5	U	23	
	IM-04-07X-082013AX	8/20/2013	62		**91**		56		**73**		5	U	**58**	
	IM-04-07A-082014AX	8/20/2014	**76**		74		60		**61**		5	U	**50**	

Table 3-1
Historical Groundwater COC Concentrations
Eastland Woolen Mill Superfund Site
Corinna, Maine

Sample Location	Sample ID	Sample Date	1,2,4-Trichlorobenzene		1,2-Dichlorobenzene		1,3-Dichlorobenzene		1,4-Dichlorobenzene		Benzene		Chlorobenzene	
		GCL	70		85		85		27		5		47	
OM-00-46 26.5-36.5 feet bgs	OM-00-46X031AX	12/8/2004	*38.5*		*34.5*		*7.85*		***29***		*0.77*		***63.5***	
	OM-00-46X031BX	11/3/2005	**720**		**1,400**		**140**		**1,600**		10	U	**2,700**	
	OM-00-46X031CX	11/28/2005	**970**		**1,900**		**170**		**2,300**		10	U	**3,100**	
	OM-00-46X031DX	8/17/2006	**2,300**		**2,500**		**160**		**2,600**		10	U	**3,700**	
	OM-00-46X031EX	1/3/2007	**1,600**		**1,200**		85		**1,200**		10	U	**1,500**	
	OM-00-46X031FX	9/11/2007	**8,900**		**3,700**		**260**		**4,700**		100	U	**4,400**	
	OM-00-46X031HA	9/26/2007	**3,500**		**2,100**		**120**		**2,100**		100	U	**2,000**	
	OM-00-46X031KX	11/14/2007	**1,900**		**1,700**		**91**		**1,600**		100	U	**2,000**	
	OM-01-46X-021809AX	2/18/2009					85		**1,500**		71	U	**1,900**	
	OM-00-46X-092209AX	9/22/2009	**3,300**	**DJ**	**2,400**	**D**	**100**		**1,700**	**D**	25	U	**2,200**	**D**
	OM-01-46X-060310AX	6/3/2010	**4,200**	**JD**	**2,400**	**JD**	**180**		**2,000**	**JD**	3.4	J	**2,300**	**JD**
	OM-00-46X-121510AX	12/15/2010	**3,300**	**D**	**2,400**	**D**	**150**		**1,700**	**D**	2.5	J	**2,100**	**D**
	OM-00-46X-052511AX	5/25/2011	**4,300**	**D**	**2,300**	**D**	**230**	**D**	**2,000**	**D**	3.7	J	**2,300**	**D**
	OM-00-46X-062512AX	6/25/2012	**1,900**		**1,100**		**480**		**930**		50	U	**1,300**	
	OM-00-46X-082113AX	8/21/2013	**510**		**680**		**770**		**610**		50	U	**990**	**J**
	OM-00-46X-082014AX	8/20/2014	**140**		**270**		**330**		**250**		10	U	**580**	
OM-01-50 3.5-13.5 feet bgs	OM-01-50X012BX	9/27/2007	13		**630**		6.2		**160**		1	U	3.7	
	OM-01-50X-091609AX	9/16/2009	14	J	**1,300**	**D**	25	U	**300**		25	U	19	J
	OM-01-50X-121410AX	12/14/2010	5	U	**340**	**D**	5	U	**55**		5	U	3.8	U
	OM-01-50X-060211AX	6/2/2011	6.2	U	**480**	**D**	6.7		**140**		5	U	18	
	OM-01-50X-062012AX	6/20/2012	8.4		**600**		5.5		**130**		5	U	24	
	OM-01-50X-082213AX	8/22/2013	16	J	**510**		25	U	**120**		25	U	39	J
	OM-01-50X-082014AX	8/20/2014	8		**430**		5.7		**92**		5	U	41	
OM-01-51 33-38 feet bgs	OM-01-51X036CX	9/28/2007	2	U	1.8		2	U	2	U	1	U	2	U
	OM-01-51X036CD	9/28/2007	2	U	1.9		2	U	2	U	1	U	2	U
	OM-01-51X-091609AX	9/16/2009	5	U	5	U	5	U	5	U	5	U	5	U
	OM-01-51X-121410AX	12/14/2010	5	U	2.6	U	5	U	5	U	5	U	5	U
	OM-01-51X-060211AX	6/2/2011	5	U	5	U	5	U	5	U	5	U	5	U
	OM-01-51X-061912AX	6/20/2012	5	U	5	U	5	U	5	U	5	U	5	U
	OM-01-51X-082213AX	8/22/2013	5	U	5	U	5	U	5	U	5	U	5	U
	OM-01-51A-082014AX	8/20/2014	5	U	5	U	5		5	U	5	U	5	U
OM-06-66 23.5-33.5 feet bgs	OM-06-66X030AX	9/21/2006	3.8		6.3		2		8.4		1	U	12	
	OM-06-66X030BX	9/27/2007	35		33		6.5		**40**		0.77		34	
	OM-06-66X-092409AX	9/24/2009	14	J	19	J	7.1	J	19	J	5	UJ	22	J
	OM-06-66X-121510AX	12/15/2010	5	U	10	U	6		27		5	U	8.3	U
	OM-06-66X-052511AX	5/25/2011	5	U	4.5	J	6.3		16		5	U	5.1	
	OM-06-66X-061912AX	6/19/2012	5	U	2.7	J	3.2	J	9.4		5	U	3.1	J
	OM-06-66X-082013AX	8/20/2013	5	U	2.1	J	2.2	J	6.7		5	U	2.8	J
	OM-06-66X-082014AX	8/20/2014	5	U	3.1	J	2.2	J	6.4		5	U	2.8	J

Table 3-1
Historical Groundwater COC Concentrations
Eastland Woolen Mill Superfund Site
Corinna, Maine
Page 3 of 8

Sample Location	Sample ID	Sample Date	1,2,4-Trichlorobenzene		1,2-Dichlorobenzene		1,3-Dichlorobenzene		1,4-Dichlorobenzene		Benzene		Chlorobenzene	
		GCL	70		85		85		27		5		47	
OM-06-67 25-30 feet bgs	OM-06-67X025AX	9/21/2006	2	U	2	U	2	U	2	U	1	U	2	U
	OM-06-67X025BX	9/26/2007	0.7		2	U	2	U	0.55		1	U	2	U
	OM-06-67X-092309AX	9/23/2009	5	U	5	U	5	U	5	U	5	U	5	U
	OM-06-67X-121610AX	12/16/2010	5	U	5	U	5	U	5	U	5	U	5	U
	OM-06-67X-052511AX	5/25/2011	67	B	12		1.5	J	10		5	U	2.5	J
	OM-06-67X-061912AX	6/19/2012	5	U	5	U	5	U	5	U	5	U	5	U
	OM-06-67X-082013AX	8/20/2013	5	U	5	U	5	U	5	U	5	U	5	U
	OM-06-67X-082214AX	8/22/2014	5	U	5	U	5	U	5	U	5	U	5	U
OM-06-68 24-34 feet bgs	OM-06-68X030AX	9/12/2006	2	U	2	U	2	U	2	U	1	U	2.5	
	OM-06-68X030BX	9/27/2007	3		15		2.3		16		1	U	38	
	OM-06-68X-091709AX	9/17/2009	5	U	5	U	5	U	5	U	5	U	5	U
	OM-06-68X-121510AX	12/15/2010	5	U	5	U	5	U	5	U	5	U	5	U
	OM-06-68X-052411AX	5/24/2011	5	U	3.9	J	1.1	J	5.2		5	U	6.5	
	OM-06-68X-061912AX	6/19/2012	7	J	1.1	J	5	U	1.3	J	5	U	0.79	J
	OM-06-68X-082113AX	8/21/2013	5	U	5	U	5	U	5	U	5	U	5	U
	OM-06-68X-082214AX	8/22/2014	5	U	5	U	5	U	5	U	5	U	5	U
OM-06-69 19-24 feet bgs	OM-06-69X022AX	9/7/2006	2	U	3.8		2	U	2	U	1	U	1.1	
	OM-06-69X022BX	9/26/2007	2	U	3.8		2	U	2	U	1	U	0.88	
	OM-06-69X-092309AX	9/23/2009	5	UJ	12		2.9	J	12		5	U	24	
	OM-06-69X-121610AX	12/16/2010	5	U	5	U	5	U	5	U	5	U	5	U
	OM-06-69X-052511AX	5/25/2011	5	U	2.8	J	5	U	5	U	5	U	5	U
	OM-06-69X-062212AX	6/22/2012	0.41	J	1.3	J	5	U	0.45	J	5	U	0.75	J
	OM-06-69X-082213AX	8/22/2013	5	U	5	U	5	U	5	U	5	U	5	U
	OM-06-69X-082514AX	8/25/2014	5	U	5	U	5	U	5	U	5	U	5	U
OM-06-73 14-24 feet bgs	OM-06-73X020BX	10/1/2007	2	U	2	U	2	U	2	U	1	U	2	U
	OM-06-73X-091609AX	9/16/2009	5	U	5	U	5	U	5	U	5	U	5	U
	OM-06-73X-122010AX	12/20/2010	5	U	5	U	5	U	5	U	5	U	5	U
	OM-06-73X-052711AX	5/27/2011	5	U	5	U	5	U	5	U	5	U	5	U
	OM-06-73X-062512AX	6/25/2012	5	U	5	U	5	U	5	U	5	U	5	U
	OM-06-73X-082013AX	8/20/2013	5	U	5	U	5	U	5	U	5	U	5	U
	OM-06-73X-082114AX	8/21/2014	5	U	5	U	5	U	5	U	5	U	5	U
OM-06-75 5-15 feet bgs	OM-06-75X010AX	9/15/2006	2	U	2	U	2	U	2	U	1	U	2	U
	OM-06-75X010DX	10/3/2007	2	U	2	U	2	U	2	U	1	U	2	U
	OM-06-75X-092409AX	9/24/2009	5	U	5	U	5	U	5	UJ	5	U	5	U
	OM-06-75X-121410AX	12/14/2010	5	U	5	U	5	U	5	U	5	U	5	U
	OM-06-75X-052611	5/26/2011	5	U	5	U	5	U	5	U	5	U	5	U
	OM-06-75X-061912AX	6/19/2012	2.2	J	5	U	5	U	5	U	5	U	5	U
	OM-06-75-082113AX	8/21/2013	5	U	5	U	5	U	5	U	5	U	5	U
	OM-06-75X-082514AX	8/25/2014	5	U	5	U	5	U	5	U	5	U	5	U

Table 3-1
Historical Groundwater COC Concentrations
Eastland Woolen Mill Superfund Site
Corinna, Maine

Sample Location	Sample ID	Sample Date	1,2,4-Trichlorobenzene		1,2-Dichlorobenzene		1,3-Dichlorobenzene		1,4-Dichlorobenzene		Benzene		Chlorobenzene	
		GCL	70		85		85		27		5		47	
Bedrock Monitoring Wells														
BM-04-32 37-200 feet bgs	BM-04-32X168AX	8/20/2004	140		240		8.5		200		10	U	880	
	BM-04-32X110BX	8/20/2004	2,100		3,400		100		2,600		100	U	7,800	
	BM-04-32X068AX	8/23/2004	1,100		1,600		200	U	1,200		100	U	3,400	
	BM-04-32X093AX	8/23/2004	880		1,400		200	U	1,000		100	U	3,100	
	BM-04-32X058AX	8/24/2004	1,500		2,300		69		1,800		100	U	4,700	
	BM-04-32X110CX	9/7/2006	1,600		1,400		68		1,300		10	U	2,200	
	BM-04-32X110DX	9/26/2007	4,000		4,900		220		4,600		100	U	6,300	
	BM-04-32X-060810AX	6/8/2010	1,700	D	1,600	D	290		1,400	D	2.4	J	2,100	JD
BM-04-32 168-178 ft bgs	BM-04-32A-062512AX	6/25/2012	3,100		3,600		620		3,300		100	U	4,000	
	BM-04-32A-082613AX	8/26/2013	780		880		200		890		40	U	2,300	
	BM-04-32A-081914AX	8/19/2014	620		730		230		760		25	U	1,200	
BM-04-32 110-120 ft bgs	BM-04-32B-062612AX	6/26/2012	9,400		7,900		370	J	5,900		500	U	8,400	
	BM-04-32B-082613AX	8/26/2013	4,100	J	4,300	J	260		2,900	J	50	U	4,900	J
	BM-04-32B-082014AX	8/20/2014	850		970		220		820		25	U	1,500	
BM-04-32 93-103 ft bgs	BM-04-32C-062612AX	6/26/2012	5,600		4,450		435		3,500		200	U	4,900	
	BM-04-32C-082713AX	8/27/2013	6,300		4,500		370		3,300		50	U	4,400	
	BM-04-32C-082014AX	8/20/2014	1,500		1,400		260		1,200		25	U	1,500	
BM-04-32 68-78 ft bgs	BM-04-32D-062612AX	6/26/2012	4,500		3,700		500		3,000		200	U	4,400	
	BM-04-32D-082713AX	8/27/2013	2,200		2,300		475		1,700		50	U	2,950	
	BM-04-32D-082014AX	8/20/2014	710		880		300		790		20	U	1,300	
BM-04-32 58-68 ft bgs	BM-04-32E-062712AX	6/27/2012	3,900		3,300		550		2,600		200	U	4,000	
	BM-04-32E-082713AX	8/27/2013	2,000		2,100		500		1,800		20	U	2,800	
	BM-04-32E-082114AX	8/20/2014	650		750		290		730		20	U	1,200	
BM-04-34 37-200 feet bgs	BM-04-34X136AX	8/10/2004	2,500		3,700		130		3,300		13		12,000	
	BM-04-34X189AX	8/10/2004	2,200		3,900		120		3,400		18		14,000	
	BM-04-34X074AX	8/11/2004	5,300		5,500		190		4,600		12		12,000	
	BM-04-34X092AX	8/11/2004	4,500		4,900		170		4,300		9.6		11,000	
	BM-04-34X124AX	8/11/2004	3,800		3,500		130		3,100		9.3		8,200	
	BM-04-34X054AX	8/12/2004	14,000		9,700		390		7,700		12		14,000	
	BM-04-34X054BX	8/29/2006	1,900		2,900		80		1,900		12		11,000	
	BM-04-34X074BX	8/29/2006	990		2,200		66		1,600		10	U	9,300	
	BM-04-34X092BX	8/29/2006	1,300		3,000		92		2,300		10		11,000	
	BM-04-34X074CX	11/10/2006	4,750		4,250		135		3,850		5.85		8,600	
	BM-04-34X080AX	8/10/2007	13,000		10,000		410		8,500		100	U	14,000	
	BM-34-13350823	8/23/2007	4,000		2,200		86		2,100		100	U	2,000	
	BM-34-16050823	8/23/2007	2,900		2,200		86		2,000		100	U	3,100	
	BM-34-18370823	8/23/2007	2,400		2,200		86		2,000		100	U	3,700	
	BM-34-21290823	8/23/2007	1,600		2,100		84		1,900		100	U	3,900	
	BM-34-00300824	8/24/2007	1,500		2,100		73		1,900		100	U	4,200	
	BM-34-03400824	8/24/2007	2,000		2,800		110		2,500		100	U	5,400	
	BM-34-06250824	8/24/2007	2,100		2,800		100		2,500		100	U	5,800	
	BM-34-09100824	8/24/2007	2,100		2,800		110		2,600		100	U	5,400	
	BM-34-12450824	8/24/2007	2,800		3,600		140		3,200		100	U	7,100	
	BM-34-14300827	8/27/2007	4,600		4,100		160		4,000		100	U	6,300	
	BM-04-34X074IX	9/25/2007	8,100		7,800		320		7,500		100	U	12,000	
	BM-04-34X054CX	9/26/2007	10,000		8,000		320		7,300		100	U	12,000	
	BM-04-34X074JX	10/15/2007	9,100		7,500		320		6,800		100	U	11,000	

Table 3-1
Historical Groundwater COC Concentrations
Eastland Woolen Mill Superfund Site
Corinna, Maine

Sample Location	Sample ID	Sample Date	1,2,4-Trichlorobenzene		1,2-Dichlorobenzene		1,3-Dichlorobenzene		1,4-Dichlorobenzene		Benzene		Chlorobenzene	
		GCL	70		85		85		27		5		47	
BM-04-34 37-200 feet bgs	BM-04-34X-021809AX	2/18/2009	**370**		**260**		16		**300**		5	U	**370**	
	BM-04-34X-092209AX	9/22/2009	5	U	6.2		5	U	3.7	J	4.7	J	8.9	
	BM-04-34X-060410AX	6/4/2010	**3,000**	**D**	**1,200**	**D**	63		**1,100**	**D**	5	U	**440**	**D**
	BM-04-34X-121610AX	12/16/2010	***4,750***	***D***	***2,400***	***D***	*66.5*		***1,800***	***D***	*5*	*U*	***1,150***	***D***
	BM-04-34X-052611AX	5/26/2011	***1,900***	***D***	***615***	***D***	*41.5*		***665***	***D***	*5*	*U*	***240***	***D***
BM-04-34 BPF2 71-81 feet bgs	BM-04-34BPF2X-062612AX	6/26/2012	***300***		*22*		*6.45*		***27.5***		*5*	*U*	*8.25*	
	BM-04-34BPF2X-082113AX	8/21/2013	***630***		***185***				***160***		*50*	*U*	*21.5*	*J*
	BM-04-34BPF2X-082614AX	8/26/2014	***1,850***		***325***	***J***	*27.5*		***265***	***J***	*25*	*U*	***135***	***J***
BM-04-34 BPF4 95-98 feet bgs	BM-04-34BPF4X-062612AX	6/26/2012	5	U	5	U	5	U	5	U	5	U	5	U
	BM-04-34BPF4X-082113AX	8/21/2013	**610**		**650**		**110**		**650**		50	U	**1,100**	
	BM-04-34BPF4X-082614AX	8/26/2014	5	U	15		4.9	J	27		5	U	**54**	
BM-04-36 42-200 feet bgs	BM-04-36X059AX	6/30/2004	***960***		***565***		*25*		***460***		*25*	*U*	***780***	
	BM-04-36X075AX	6/30/2004	**740**		**840**		44		**660**		25	U	**1,500**	
	BM-04-36X092AX	6/30/2004	**580**		**320**		50	U	**240**		25	U	**490**	
	BM-04-36X127AX	8/18/2004	**3,300**		**2,900**		**140**		**2,500**		100	U	**4,800**	
	BM-04-36X155AX	8/18/2004	**3,100**		**2,800**		**120**		**2,500**		100	U	**4,800**	
	BM-04-36X070AX	8/19/2004	**4,000**		**3,500**		**160**		**3,000**		100	U	**5,500**	
	BM-04-36X085AX	8/19/2004	**5,000**		**4,400**		**200**		**3,600**		100	U	**6,600**	
	BM-04-36X105AX	8/19/2004	**4,300**		**4,000**		**190**		**3,300**		100	U	**6,200**	
	BM-04-36X-060810AX	6/8/2010	**160**		**130**		100	U	**140**		**11**	**J**	**150**	
BM-04-36 155-165 ft bgs	BM-04-36A-061912AX	6/19/2012	**590**		**860**		**410**		**830**		100	U	**1,400**	
	BM-04-36A-082013AX	8/20/2013	**3,400**		**2,800**		**280**		**2,500**		3.6	J	**3,100**	
	BM-04-36A-082114AX	8/21/2014	**2,900**		**2,500**		**180**		**2,200**		25	U	**3,300**	
BM-04-36 127-137 ft bgs	BM-04-36B-061912AX	6/19/2012	**370**		**360**		70	J	**340**		250	U	**380**	
	BM-04-36B-082013AX	8/20/2013	**5,600**		**3,600**		**430**		**3,700**		100	U	**4,500**	
	BM-04-36B-082214AX	8/22/2014	**2,600**		**2,400**		**250**		**2,000**		50	U	**3,000**	
BM-04-36 105-115 ft bgs	BM-04-36C-062012AX	6/20/2012	**710**		**970**		100	U	**900**		100	U	**1,500**	**J**
	BM-04-36C-082113AX	8/21/2013	***9,150***		***6,350***		***500***		***5,300***		*250*	*U*	***7,250***	***J***
	BM-04-36C-082214AX	8/22/2014	**2,000**		**1,900**		**170**		**1,600**		50	U	**2,200**	
BM-04-36 85-95 ft bgs	BM-04-36D-062012AX	6/20/2012	***895***		***1,040***		***525***		***960***		*3.4*	*J*	***1,750***	
	BM-04-36D-082113AX	8/21/2013	**14,000**		**8,900**		**550**		**7,200**		500	U	**10,000**	**J**
	BM-04-36D-082514AX	8/25/2014	**4,400**		**3,300**		**180**		**2,500**		100	U	**4,300**	
BM-04-36 70-80 ft bgs	BM-04-36F-062012AX	6/20/2012	**620**		**620**		**180**		**570**		25	U	**980**	
	BM-04-36F-082113AX	8/21/2013	**3,900**		**3,100**		**380**		**2,800**		200	U	**3,500**	**J**
	BM-04-36E-082514AX	8/25/2014	**3,900**		**4,000**		**250**		**3,100**		100	U	**4,100**	

Sample Location	Sample ID	Sample Date	1,2,4-Trichlorobenzene		1,2-Dichlorobenzene		1,3-Dichlorobenzene		1,4-Dichlorobenzene		Benzene		Chlorobenzene	
		GCL	70		85		85		27		5		47	
BM-04-37 49-250 feet bgs	BM-04-37X054AX	7/30/2004	**4,300**		**4,400**		**200**		**3,700**		**6.3**		**6,500**	
	BM-04-37X081AX	8/2/2004	**6,900**		**5,800**		**250**		**4,800**		**7.8**		**8,300**	
	BM-04-37X127AX	8/2/2004	**6,300**		**6,200**		**330**		**5,300**		**11**		**9,500**	
	BM-04-37X154AX	8/3/2004	**6,100**		**10,000**		**320**		**8,300**		**18**		**23,000**	
	BM-04-37X202BX	8/3/2004	**5,900**		**11,000**		**330**		**8,900**		**20**		**27,000**	
	BM-04-37X237AX	8/4/2004	**900**		**2,200**		62		**1,600**		**16**		**11,000**	
	BM-04-37X230AX	12/8/2005	**3,500**		**7,400**		**240**		**6,100**		**12**		**18,000**	
	BM-04-37X081BX	8/25/2006	**1,100**		**3,200**		**87.5**		**2,000**		**8.35**		**11,000**	
	BM-04-37X154BX	8/25/2006	**2,100**		**4,300**		**120**		**2,900**		**12**		**15,000**	
	BM-04-37X154CX	11/10/2006	**3,100**		**5,500**		**170**		**4,400**		**6.3**		**12,000**	
	BM-04-37X085BX	8/21/2007	**3,600**		**2,850**		**135**		**3,050**		100	U	**3,450**	
	BM-37-07000831	8/31/2007	**240**		**220**		14		**480**		10	U	**260**	
	BM-37-09000831	8/31/2007	**430**		**370**		20		**740**		10	U	**420**	
	BM-37-11000831	8/31/2007	**1,400**		**870**		51		**1,800**		10	U	**890**	
	BM-37-15000831	8/31/2007	**1,600**		**920**		54		**1,600**		10	U	**1,000**	
	BM-37-19000831	8/31/2007	**1,800**		**940**		57		**1,600**		10	U	**1,000**	
	BM-37-20000831	8/31/2007	**1,600**		**790**		50		**1,400**		10	U	**870**	
	BM-37-22000831	8/31/2007	**2,200**		**1,200**		70		**2,000**		10	U	**1,300**	
	BM-37-02000901	9/1/2007	**2,300**		**1,300**		81		**2,100**		10	U	**1,600**	
	BM-37-04000901	9/1/2007	**2,700**		**1,500**		**92**		**2,400**		10	U	**1,800**	
	BM-04-37X085EX	9/25/2007	**2,900**		**1,850**		**105**		**2,450**		100	U	**2,500**	
	BM-04-37X154DX	9/26/2007	**3,000**		**1,900**		**120**		**2,400**		3		**2,600**	
	BM-04-37X080CX	10/15/2007	**1,800**		**1,500**		71		**1,500**		10	U	**1,900**	
	BM-07-51X080GX	10/17/2007	**10,000**		**4,800**		**200**		**4,500**		10	U	**4,400**	
	BM-04-37X-021809AX	2/18/2009	4.7		2.7		5	U	2.9		5	U	2.8	
	BM-04-37X-092309AX	9/23/2009	5.7	U	12		2.6	J	11		5	U	22	
	BM-04-37X-060410AX	6/4/2010	**2,250**	**D**	**1,850**	**D**	**345**	**D**	**1,950**	**D**	3.9	J	**2,500**	**D**
	BM-04-37X-121610AX	12/16/2010	**99**		**86**		11		**85**		5	U	**110**	
	BM-04-37X-052511AX	5/25/2011	**1,600**	**D**	**1,800**	**D**	**240**	**D**	**1,800**	**D**	3.4	J	**2,600**	**D**
BM-04-37 BPF1 82-90 feet bgs	BM-04-37BPF1X-062612AX	6/26/2012	5	U	5	U	5	U	1.2	J	5	U	5	U
	BM-04-37BPF1X-082613AX	8/26/2013	**300**		**610**		**350**		**750**		50	U	**930**	
	BM-04-37BPF1X-082714AX	8/27/2014	**390**		**700**		**210**		**710**		20	U	**1,000**	

Sample Location	Sample ID	Sample Date	1,2,4-Trichlorobenzene		1,2-Dichlorobenzene		1,3-Dichlorobenzene		1,4-Dichlorobenzene		Benzene		Chlorobenzene	
		GCL	70		85		85		27		5		47	
BM-06-44 128-148 feet bgs	BM-06-44X140BX	2/20/2007	29		74		20	U	60		10	U	230	
	BM-06-44X140CX	2/26/2007	2,200		4,300		170		4,000		13		15,000	
	BM-06-44X140BA	9/28/2007	860		3,800		660		3,300		28		19,000	
	BM-07-44X-091509AX	9/15/2009	50		170		55		160		10	U	930	D
	BM-06-44X-121610AX	12/16/2010	200	DJ	1,800	D	790	D	2,200	D	9.6		6,800	D
	BM-06-44X-060111AX	6/1/2011	200	JBD	2,600	D	1,000	D	2,900	D	22		9,500	D
	BM-06-44X-062212AX	6/22/2012	86	J	2,300		1,200		3,100		14	J	13,000	J
	BM-06-44X-082113AX	8/21/2013	500	U	1,700		1,400		4,200		500	U	17,000	J
	BM-06-44X-082714AX	8/27/2014	140	J	2,800		1,300		4,000		250	U	12,000	
BM-07-48 45-200 feet bgs	BM-07-48X129AX	8/15/2007	170		270		48		240		10	U	550	
	BM-07-48X129AD	8/15/2007	160		260		46		230		10	U	520	
	BM-07-48X093AX	8/15/2007	170		290		46		250		10	U	580	
	BM-07-48X080AX	8/16/2007	210		350		46		290		10	U	650	
	BM-07-48X063AX	8/16/2007	200		430		63		400		10	U	920	
	BM-07-48X063BX	8/22/2007	180		300		36		250		10	U	590	
	BM-07-48X063CX	8/22/2007	160		260		31		220		10	U	490	
	BM-07-48X063DX	8/22/2007	150		250		30		200		10	U	470	
	BM-07-48X063EX	8/22/2007	200		310		40		260		10	U	610	
	BM-07-48X063FX	10/4/2007	190		260		58		230		10	U	540	
	BM-07-48X-091509AX	9/15/2009	28		120		50		120		3.6	J	270	D
	BM-07-48X-060910AX	6/9/2010	120		200		62		180		0.68	J	510	D
	BM-07-48X-121410AX	12/14/2010	69		240		47		180		13	U	460	
	BM-07-48X-060111AX	6/1/2011	57	B	170		65		160		5	U	--	
	BM-07-48X-062212AX	6/22/2012	8.5		90		53		100		0.46	J	390	
	BM-07-48X-082013AX	8/20/2013	35		120		51		110		10	U	380	
	BM-07-48X-082714AX	8/27/2014	5	UJ	42	J	27	J	59	J	5	U	190	
BM-07-50 46-220 feet bgs	BM-07-50X127AX	8/17/2007	3,000		5,900		250		5,700		100	U	16,000	
	BM-07-50X091AX	8/20/2007	610		1,400		82		1,300		100	U	4,500	
	BM-07-50X072AX	8/20/2007	630		1,200		56		1,100		100	U	3,800	
	BM-07-50X072AD	8/20/2007	540		1,200		62		1,000		100	U	3,900	
	BM-07-50X050AX	8/21/2007	940		1,900		98		1,800		100	U	5,700	
	BM-07-50X050BX	8/22/2007	490		1,200		66		1,000		100	U	4,100	
	BM-07-50X050CX	8/22/2007	380		980		200	U	860		100	U	3,400	
	BM-07-50X050DX	8/22/2007	550		1,200		55		1,000		100	U	3,700	
	BM-07-50X127CX	10/4/2007	2,500		4,200		210		4,000		5.4		11,000	
	BM-07-50X127BD	10/4/2007	2,100		4,000		220		3,900		5.6		11,000	
	BM-07-50X-091509AX	9/15/2009	5	U	190		59		320	D	5	U	810	D
	BM-07-50X-060910AX	6/9/2010	5	U	16		5.3		30		5	U	18	
	BM-07-50X-121610AX	12/16/2010	5	U	28		6.4		55		5	U	35	
	BM-07-50X-060111AX	6/1/2011	*5*	*U*	*9.45*		*3.3*	*J*	*17.5*		*5*	*U*	*8.7*	*U*
BM-07-50 127-137 feet bgs	BM-07-50A-062712AX	6/27/2012	360		650		97		790		50	U	1,300	
	BM-07-50A-082813AX	8/28/2013	670		2,400		530		2,400		250	U	7,400	
	BM-07-50A-082714AX	8/27/2014	600		1,600		330		1,500		50	U	3,700	
BM-07-50 91-101 feet bgs	BM-07-50B-062812AX	6/28/2012	12		31		6.4		48		5	U	60	
	BM-07-50B-082813AX	8/28/2013	9.3		95		26		140		5	U	210	
	BM-07-50B-082714AX	8/27/2014	44		490		150		480		20	U	1,300	
BM-07-50 72-82 feet bgs	BM-07-50C-062812AX	6/28/2012	14		34		5.1		45		5	U	62	
	BM-07-50C-082813AX	8/28/2013	7.1		84		22		110		5	U	290	
	BM-07-50C-082714AX	8/27/2014	59		430		140		450		20	U	1,600	
BM-07-50 50-60 feet bgs	BM-07-50D-062812AX	6/28/2012	17		29		4.6	J	34		5	U	41	
	BM-07-50D-082913AX	8/29/2013	9		47		12		69		5	U	120	
	BM-07-50D-082714AX	8/27/2014	41		230		87		240		10	U	970	

Sample Location	Sample ID	Sample Date	1,2,4-Trichlorobenzene	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Benzene	Chlorobenzene
		GCL	70	85	85	27	5	47
BM-07-51 80-90 feet bgs	BM-07-51X085AX	8/21/2007	**13,000**	**7,100**	**270**	**6,000**	100 U	**7,000**
	BM-51-13450828	8/28/2007	**160**	**190**	20 U	**510**	10 U	**110**
	BM-51-16000828	8/28/2007	**240**	**220**	20 U	**520**	10 U	**91**
	BM-51-18000828	8/28/2007	**2,600**	**1,500**	200 U	**1,800**	100 U	**850**
	BM-51-19000828	8/28/2007	**3,600**	**2,100**	79	**2,200**	100 U	**1,500**
	BM-51-20000828	8/28/2007	**4,400**	**2,500**	**93**	**2,500**	100 U	**1,700**
	BM-51-02170829	8/29/2007	**4,500**	**2,000**	79	**2,100**	100 U	**1,500**
	BM-51-06000829	8/29/2007	**5,100**	**2,800**	**120**	**3,000**	100 U	**2,000**
	BM-51-10000829	8/29/2007	**5,300**	**2,700**	**120**	**2,900**	100 U	**2,000**
	BM-51-12100829	8/29/2007	**3,700**	**2,200**	83	**2,200**	100 U	**1,600**
	BM-07-51X085CX	9/25/2007	**6,200**	**2,500**	**94**	**2,700**	100 U	**1,600**
	BM-04-51X-021709AX	2/17/2009	**3,700**	**2,100**	**110**	**2,000**	2.2	**1,900**
	BM-07-51X-060410AX	6/4/2010	**4,100 D**	**3,000 D**	**170**	**2,500 D**	20 U	**3,200 D**
	BM-07-51X-062812AX	6/28/2012	**420**	**230**	12 J	**190**	20 U	**190**
	BM-07-51X-082613AX	8/26/2013	***445***	***820***	*46.5*	***625***	*25 U*	***1,350***
	BM-07-51X-082714AX	8/27/2014	**420**	**700**	54	**550**	10 U	**840**
RB-04-01 45-75 feet bgs	RB-04-01X045AX	8/24/2004	**2,200**	**2,000**	73	**1,700**	100 U	**3,500**
	RB-04-01X060AX	8/24/2004	**5,600**	**6,600**	**220**	**5,500**	100 U	**12,000**
	RB-04-01X-060810AX	6/8/2010	5 U	6.5 U	3.8 J	18	5 U	8.3
	RB-04-01A-062212AX	6/22/2012	**410**	**290**	81	**300**	0.84 J	**460**
	RB-04-01A-082814AX*	8/28/2014	***480 J***	***605 J***	*50 J*	***645 J***	*25 U*	***1,550 J***

Notes:
1. Concentrations and criteria are reported in micrograms per liter (µg/L).
2. U = below detection limit, J = quantitation approximate, D = sample diluted
3. GCL = Provisional Groundwater Cleanup Level, Table 9: Record of Decision Amendment, Eastland Woolen Mill Operable Unit I, September 2006.
4. A blank field indicates that the parameter was not analyzed during the specified monitoring round.
5. Results shown in **bold** indicate an exceedance of the OU1 Groundwater Cleanup Level (GCL).
6. Results shown in *italic and underlined* indicate that the value is an average of a field sample and field duplicate results.

Table 3-2
Historical Groundwater Geochemical Measurements
Eastland Woolen Mill Superfund Site
Corinna, Maine

Sample Location	Sample ID	Sample Date	Temperature (C)	Conductivity (μS/cm)	pH	ORP (mV)	Dissolved Oxygen (mg/L)	Turbidity (NTU)
Overburden Monitoring Wells								
IM-04-04 37-40 feet bgs	IM-04-04X-061912AX	6/19/2012	11.16	9,621	6.18	-11.2	8.56	7.51
	IM-04-04X-082113AX	8/21/2013	13.03	7,193	6.08	-14.1	0.74	7.87
	IM-04-04A-081914AX	8/19/2014	13.23	5,700	6.27	-48.0	0.56	5.98
IM-04-07 31-38 feet bgs	IM-04-07X-061912AX	6/19/2012	10.62	305	8.55	-403.4	0.20	41.5
	IM-04-07X-082013AX	8/20/2013	13.61	370	8.75	-294.0	1.10	46.0
	IM-04-07A-082014AX	8/20/2014	13.38	321	8.33	-364.3	0.21	11.0
OM-00-46 26.5-36.5 feet bgs	OM-00-46X-062512AX	6/25/2012	12.26	4,367	6.43	-67.7	0.42	32.4
	OM-00-46X-082113AX	8/21/2013	12.61	3,295	6.49	-50.4	0.21	60.0
	OM-00-46X-082014AX	8/20/2014	12.40	2,846	6.55	-125.6	0.28	170
OM-01-50 3.5-13.5 feet bgs	OM-01-50X-062012AX	6/20/2012	17.61	4,635	6.13	112.6	0.47	33
	OM-01-50X-082213AX	8/22/2013	19.30	2,905	6.48	37.2	6.12	50
	OM-01-50X-082014AX	8/20/2014	18.43	2,955	6.53	51.9	0.81	42
OM-01-51 33-38 feet bgs	OM-01-51X-061912AX	6/20/2012	18.53	2,044	6.98	-45.3	1.80	24
	OM-01-51X-082213AX	8/22/2013	19.71	1,522	7.18	-64.2	4.18	49
	OM-01-51A-082014AX	8/20/2014	20.36	1,220	5.92	2.6	1.73	113
OM-06-66 23.5-33.5 feet bgs	OM-06-66X-061912AX	6/19/2012	12.65	1,291	7.72	-94.6	0.43	1.91
	OM-06-66X-082013AX	8/20/2013	13.65	1,165	7.29	-185.8	0.41	6.49
	OM-06-66X-082014AX	8/20/2014	13.84	1,050	7.30	-209.4	0.33	11.3
OM-06-67 25-30 feet bgs	OM-06-67X-061912AX	6/19/2012	12.68	908	7.49	-161.1	0.67	12.5
	OM-06-67X-082013AX	8/20/2013	15.77	726	7.28	-90.2	0.70	24.9
	OM-06-67X-082214AX	8/22/2014	13.44	614	7.27	-73.3	0.24	12.2
OM-06-68 24-34 feet bgs	OM-06-68X-061912AX	6/19/2012	12.64	635	7.43	57.2	0.25	12.2
	OM-06-68X-082113AX	8/21/2013	15.40	553	7.94	-71.4	0.43	24.4
	OM-06-68X-082214AX	8/22/2014	13.44	614	7.27	-73.3	0.24	12.2
OM-06-69 19-24 feet bgs	OM-06-69X-062212AX	6/22/2012	13.62	2,885	6.70	-69.3	0.43	3.38
	OM-06-69X-082213AX	8/22/2013	17.29	2,482	7.09	-76.7	0.60	4.35
	OM-06-69X-082514AX	8/25/2014	17.38	1,871	7.03	-59.9	1.28	4.42
OM-06-73 14-24 feet bgs	OM-06-73X-062512AX	6/25/2012	13.25	1,314	7.63	-84.2	0.43	15.60
	OM-06-73X-082013AX	8/20/2013	15.39	1,262	7.75	-62.9	0.49	9.03
	OM-06-73X-082114AX	8/21/2014	16.03	1,206	7.62	197.3	0.51	9.29
OM-06-75 5-15 feet bgs	OM-06-75X-061912AX	6/19/2012	13.49	1,349	6.80	188.5	1.49	112
	OM-06-75-082113AX	8/21/2013	17.88	900	6.90	-18.3	1.08	11.0
	OM-06-75X-082514AX	8/25/2014	16.56	747	6.60	112.8	1.53	12.3
Bedrock Monitoring Wells								
BM-04-32 168-178 ft bgs	BM-04-32A-062512AX	6/25/2012	13.39	1,651	6.90	-105.1	0.78	218
	BM-04-32A-082613AX	8/26/2013	14.69	1,304	7.22	-145.0	0.70	185
	BM-04-32A-081914AX	8/19/2014	15.63	1,012	7.49	-212.4	0.69	10.3
BM-04-32 110-120 ft bgs	BM-04-32B-062612AX	6/26/2012	12.73	953	7.48	-152.9	0.62	42.4
	BM-04-32B-082613AX	8/26/2013	13.35	834	7.60	-168.8	0.38	35.6
	BM-04-32B-082014AX	8/20/2014	14.30	553	7.99	-232.2	0.25	13.4
BM-04-32 93-103 ft bgs	BM-04-32C-062612AX	6/26/2012	12.74	880	7.55	-123.8	0.54	73.8
	BM-04-32C-082713AX	8/27/2013	12.40	976	7.59	-172.6	0.77	52.7
	BM-04-32C-082014AX	8/20/2014	12.72	754	7.68	-225.3	0.30	26.6
BM-04-32 68-78 ft bgs	BM-04-32D-062612AX	6/26/2012	12.16	823	7.70	-195.2	0.33	109.8
	BM-04-32D-082713AX	8/27/2013	13.11	750	7.67	-169.1	0.78	153
	BM-04-32D-082014AX	8/20/2014	12.32	671	7.69	-212.3	0.43	50.3
BM-04-32 58-68 ft bgs	BM-04-32E-062712AX	6/27/2012	12.11	990	7.35	-159.0	0.42	92.3
	BM-04-32E-082713AX	8/27/2013	11.89	782	7.71	-157.5	0.67	154
	BM-04-32E-082114AX	8/20/2014	11.41	815	7.71	-138.4	0.55	91.5
BM-04-34 BPF2 71-81 feet bgs	BM-04-34BPF2X-062612AX	6/26/2012	14.96	748	7.05	182.7	1.46	144
	BM-04-34BPF2X-082113AX	8/21/2013	15.28	405	7.39	-210.2	0.24	211
	BM-04-34BPF2X-082614AX	8/26/2014	15.74	360	7.22	-110.0	0.56	41.1

Table 3-2
Historical Groundwater Geochemical Measurements
Eastland Woolen Mill Superfund Site
Corinna, Maine

Sample Location	Sample ID	Sample Date	Temperature (C)	Conductivity (µS/cm)	pH	ORP (mV)	Dissolved Oxygen (mg/L)	Turbidity (NTU)
BM-04-34 BPF4 95-98 feet bgs	BM-04-34BPF4X-062612AX	6/26/2012	16.19	274	7.39	173.6	6.82	105
	BM-04-34BPF4X-082113AX	8/21/2013	17.80	321	7.02	-121.8	0.55	3.42
	BM-04-34BPF4X-082614AX	8/26/2014	15.89	335	7.10	-94.4	0.48	2.67
BM-04-36 155-165 ft bgs	BM-04-36A-061912AX	6/19/2012	11.98	35,349	6.15	-157.4	0.22	125
	BM-04-36A-082013AX	8/20/2013	16.39	18,343	6.55	-103.8	0.67	64.1
	BM-04-36A-082114AX	8/21/2014	13.80	6,496	6.71	-140.4	0.50	60.3
BM-04-36 127-137 ft bgs	BM-04-36B-061912AX	6/19/2012	12.83	53,759	5.75	-158.1	0.38	275
	BM-04-36B-082013AX	8/20/2013	14.03	2,969	7.04	-143.6	0.83	76.4
	BM-04-36B-082214AX	8/22/2014	12.27	2,264	7.00	-165.7	0.32	34.3
BM-04-36 105-115 ft bgs	BM-04-36C-062012AX	6/20/2012	14.18	26,589	5.87	-96.8	0.60	129
	BM-04-36C-082113AX	8/21/2013	13.31	3,861	7.04	-154.9	2.01	46.2
	BM-04-36C-082214AX	8/22/2014	11.84	1,566	7.01	-166.7	0.31	60.7
BM-04-36 85-95 ft bgs	BM-04-36D-062012AX	6/20/2012	15.41	10,324	6.42	-103.5	0.31	65.4
	BM-04-36D-082113AX	8/21/2013	13.41	1,379	7.33	-167.1	0.96	219
	BM-04-36D-082514AX	8/25/2014	13.51	1,412	7.07	-171.8	3.28	56.4
BM-04-36 70-80 ft bgs	BM-04-36F-062012AX	6/20/2012	13.57	3,765	6.42	-100.6	0.54	76.8
	BM-04-36F-082113AX	8/21/2013	12.28	1,371	7.26	-119.2	1.36	76.3
	BM-04-36E-082514AX	8/25/2014	12.04	1,503	6.99	-175.7	4.69	65.3
BM-04-37 BPF1 82-90 feet bgs	BM-04-37BPF1X-062612AX	6/26/2012	16.28	107	7.13	159.4	7.92	89.2
	BM-04-37BPF1X-082613AX	8/26/2013	16.83	359	7.11	-129.0	0.71	105
	BM-04-37BPF1X-082714AX	8/27/2014	17.64	362	7.00	-104.3	0.52	54.5
BM-06-44 128-148 feet bgs	BM-06-44X-062212AX	6/22/2012	16.68	553	7.88	-158.4	0.94	39.0
	BM-06-44X-082113AX	8/21/2013	15.64	602	7.79	-143.1	0.72	37.3
	BM-06-44X-082714AX	8/27/2014	16.20	649	8.09	-134.9	1.41	30.4
BM-07-48 45-200 feet bgs	BM-07-48X-062212AX	6/22/2012	14.15	794	7.71	-181.8	0.78	4.8
	BM-07-48X-082013AX	8/20/2013	13.71	800	7.73	-153.9	0.38	230.0
	BM-07-48X-082714AX	8/27/2014	13.85	741	7.93	-188.7	0.57	14.3
BM-07-50 127-137 feet bgs	BM-07-50A-062712AX	6/27/2012	13.13	683	8.34	-148.5	0.54	39.0
	BM-07-50A-082813AX	8/28/2013	13.25	986	8.02	-215.2	0.94	36.1
	BM-07-50A-082714AX	8/27/2014	12.48	899	8.08	-204.5	1.94	29.0
BM-07-50 91-101 feet bgs	BM-07-50B-062812AX	6/28/2012	13.71	283	8.57	46.3	0.64	39.1
	BM-07-50B-082813AX	8/28/2013	12.68	236	8.34	-257.5	0.92	46.3
	BM-07-50B-082714AX	8/27/2014	12.28	702	8.02	-139.4	2.09	49.3
BM-07-50 72-82 feet bgs	BM-07-50C-062812AX	6/28/2012	14.18	234	8.58	80.5	0.30	32.8
	BM-07-50C-082813AX	8/28/2013	12.17	298	8.45	-279.4	0.79	38.2
	BM-07-50C-082714AX	8/27/2014	11.79	785	8.18	-214.6	1.82	20.9
BM-07-50 50-60 feet bgs	BM-07-50D-062812AX	6/28/2012	12.35	221	8.69	-125.6	0.23	41.6
	BM-07-50D-082913AX	8/29/2013	12.07	179	8.84	-185.1	1.06	34.7
	BM-07-50D-082714AX	8/27/2014	11.94	636	8.16	-216.1	1.72	25.1
BM-07-51 80-90 feet bgs	BM-07-51X-062812AX	6/28/2012	14.32	290	7.00	98.3	1.64	29.5
	BM-07-51X-082613AX	8/26/2013	16.22	424	7.11	-101.3	0.53	8.21
	BM-07-51X-082714AX	8/27/2014	17.77	745	6.75	-87.7	0.85	18.3
RB-04-01 60-70 ft bgs	RB-04-01A-062212AX	6/22/2012	12.23	410	7.39	-181.8	0.69	63.8
	RB-04-01A-082913AX	8/29/2013	12.80	298	8.37	-192.3	1.39	34.2
	RB-04-01A-082814AX	8/28/2014	13.12	397	8.28	-108.1	0.84	73.1

Notes:

1. ft bgs = feet below ground surface
   C = degrees Celsius
   µS/cm = microsiemens per centimeter
   mV = millivolts
   mg/L = milligrams per liter
   NTU = Nephelometric Turbidity Units

Table 4-1
Groundwater Sampling Schedule
Eastland Woolen Mill Superfund Site
Corinna, Maine

Area of Concern	Type	Sample Location	Interval	Rationale	Schedule	Analytical Parameters
Area 1	Overburden Monitoring Well	IM-04-03	32.5-37.5	Well in proximity to E/I Well; determine how far distribution extends	**Baseline** September 2015 (prior to groundwater extraction) **Interim Monitoring (4 events)** Week 1 Week 2 Week 3 Week 6 **Performance Monitoring** November 2015	**All Events:** VOCs Total and Dissolved Metals Bacteria count Anions Organic Acids Dissolved Organic Carbon Biological Oxygen Demand Chemical Oxygen Demand
		IM-04-04	37-40	Aerobic Extraction/Injection Well		
		IM-04-07	31-38	Well location downgradient and between the E/I Well and the River		
		IM-04-08B	37-37.5	Well in proximity to E/I Well; determine how far distribution extends		
		OM-00-46	29.5-39.5	Anaerobic Extraction/Injection Well		
		OM-06-66	23.5-33.5	Well location downgradient of E/I Well		
		OM-00-69	19.24	Well location downgradient and between the E/I Well and the River		
	Bedrock Open Borehole	BM-04-32	50-60*	Interval above E/I Well target interval to determine distribution		
		BM-04-32	68-78	Anaerobic extraction/Injection Well		
		BM-04-32	93-103	Interval below E/I Well target interval to determine distribution		
		BM-04-36	55-65*	Interval above E/I Well target interval to determine distribution		
		BM-04-36	70-80	Aerobic Extraction/Injection Well		
		BM-04-36	85-95	Interval below E/I Well target interval to determine distribution		
		RB-04-01	80-90*	Well in proximity to E/I Well; determine if distribution extends beyond connectivity		
East Side/Building 14 Area	Overburden Monitoring Well	OM-01-50	3.5-13.5	Aerobic Extraction/Injection Well	**Baseline** September 2015 (prior to groundwater extraction) **Interim Monitoring (4 events)** Week 1 Week 2 Week 3 Week 6 **Performance Monitoring** November 2015	**All Events:** VOCs Total and Dissolved Metals Bacteria count Anions Organic Acids Dissolved Organic Carbon Biological Oxygen Demand Chemical Oxygen Demand
		OM-01-51	33-38	Well in proximity to E/I Well; determine how far distribution extends		
		OM-06-73	14-24	Well location downgradient of E/I Well		
	Bedrock Open Borehole	BM-06-44	72-82*	Interval above E/I Well target interval to determine distribution		
		BM-06-44	91-101*	Aerobic Extraction/Injection Well		
		BM-06-44	127-137*	Interval below E/I Well target interval to determine distribution		
		BM-07-50	72-82	Potentially connected interval to E/I Well target interval		
		BM-07-50	91-101	Connected interval to E/I Well target interval		
		BM-07-48	50-60	Potentially connected interval to E/I Well target interval		
		BM-07-48	91-101	Connected interval to E/I Well target interval		

Notes:
Nobis will perform all performance monitoring sampling activities.
Total and dissolved metals include the EPA Target Analyte List plus mercury
Anions include chloride, nitrate, nitrite, and sulfate.
Organic Acids include acetic acid, butyric acid, formic acid, lactic acid, and proprionic acid.
* Well previously sampled as an open-borehole; no historical interval-specific data.
E/I Well = Extraction/Injection Well (shaded)

Table 4-2
Groundwater Analytical Requirements
Eastland Woolen Mill Superfund Site
Corinna, Maine

Parameter	Analytical Method	Container quantity and Type	Preservation	Holding Time
VOCs	CLP SOW SOM02.2	3 x 40 mL amber glass vial	HCl to pH <2 Cool to 4 ˚C	14 days
Total Metals	CLP SOW ISM02.2	1 x 1L polyethylene	HNO_3 to pH <2 Cool to 4 ˚C	180 days (Hg 28 days)
Dissolved Metals	CLP SOW ISM02.2	1 x 1L polyethylene	HNO_3 to pH <2 Cool to 4 ˚C, field filtered to 0.45 micron	180 days (Hg 28 days)
Anions	EPA Method 300.0	1 x 250 mL polypropylene	Cool to 4 ˚C	48 hours for nitrate and nitrite; 28 days for chloride and sulfate
Organic Acids	EPA Method 300.0	2 x 40 mL Teflon lined septum vials	Benzalkonium chloride; Cool to 4˚C	14 days
Dissolved Organic Carbon	EPA Method 415.1	2 x 40 mL Teflon lined septum vials	H_2S0_4 to pH<2; Cool to 4˚C	28 days
Biological Oxygen Demand	EPA Method 405.1	1 x 1 liter polypropylene	Cool to 4˚C	48 hours
Chemical Oxygen Demand	EPA Method 410.4	250 mL glass bottle	Cool to 4°C; H_2S0_4 to pH<2	28 days
Heterotrophic Plate Count	SM 9215D	500 mL polypropylene, sterilized	sodium thiosulfate, cool to 4˚C	24 hours

Notes:
EPA - United States Environmental Protection Agency
mL - milliliter
HCl - hydrochloric acid
°C - degrees Celsius
H_2SO_4-sulfuric acid
Hg - mercury
HNO_3 - nitric acid

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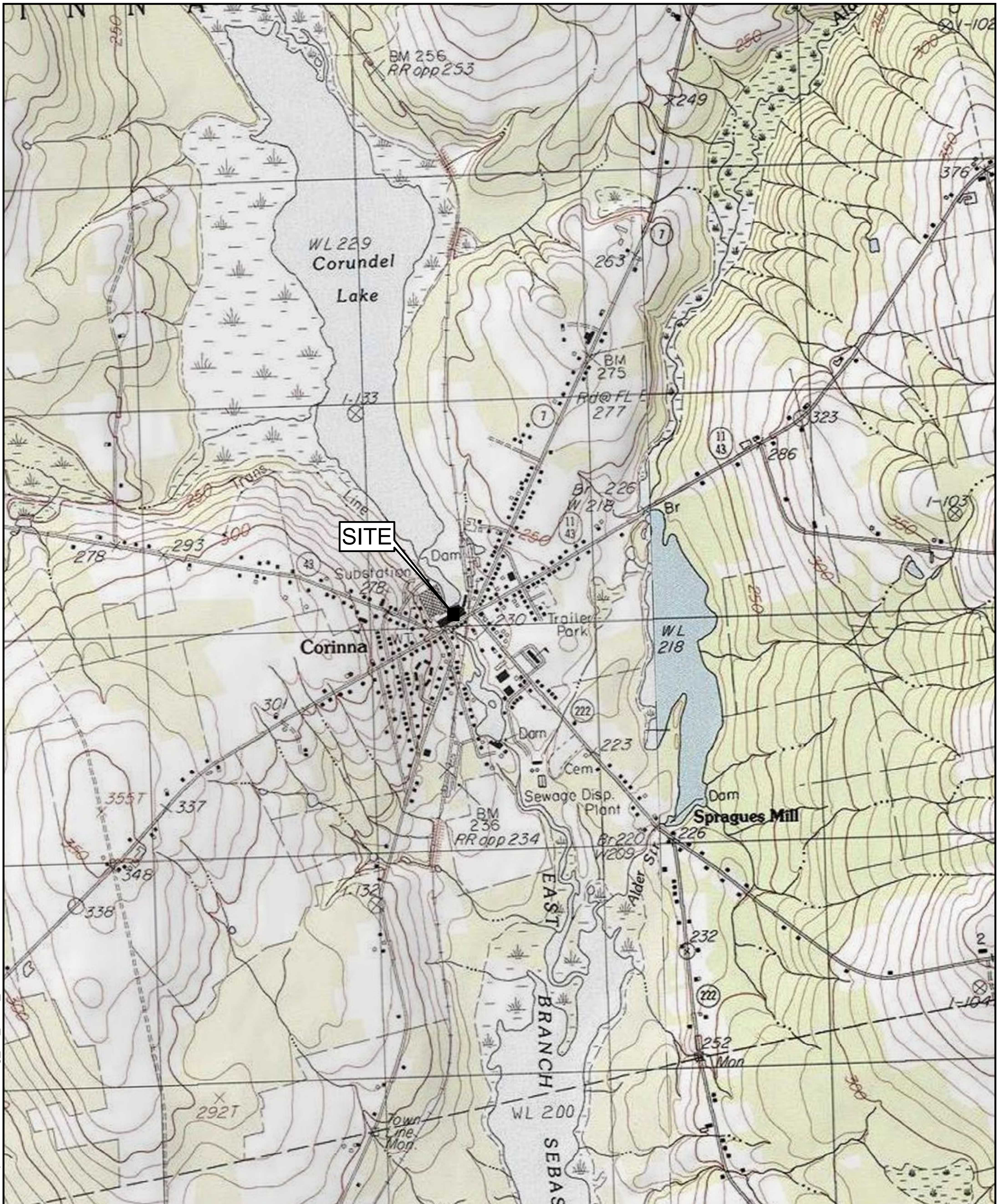

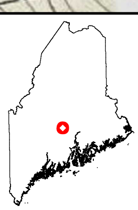

QUADRANGLE LOCATION

USGS Topographic Map
Corinna and Stetson, Maine
Revised 1982

0 500 1,000 2,000
Feet
1 inch = 2,000 feet

N

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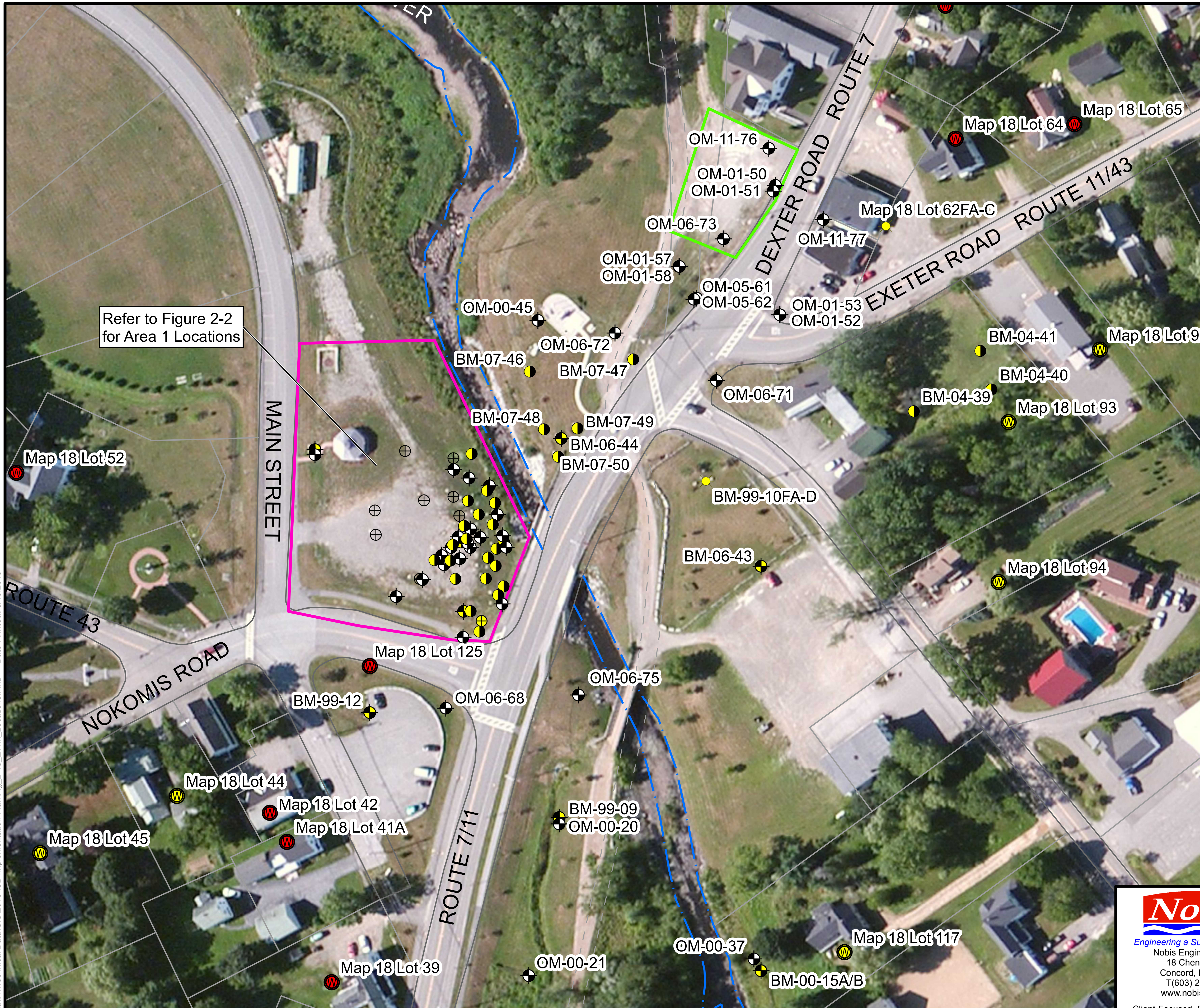
FIGURE 1

LOCUS PLAN
EASTLAND WOOLEN MILL
SUPERFUND SITE
CORINNA, MAINE

PREPARED BY: JH	CHECKED BY: TA
PROJECT NO. 80038	DATE: AUGUST 2015

Path: I:\Technical Data\GIS\2015 ISB Implementation Plan\Fig_1-1_EWM_Locus.mxd



Legend

- Bedrock Borehole
- Bedrock Extraction Well
- Bedrock Monitoring Well
- Bedrock Monitoring Well - FLUTe
- Bedrock Residential Well - Active
- Bedrock Residential Well - Inactive
- Overburden Extraction Well
- Overburden Monitoring Well
- Area 1
- Building 14 and UST Area

N

0 50 100 200
Feet
1 inch = 100 feet

Notes:

1. Only locations sampled for the 2014 sampling round are shown.

2. Locations of site features depicted hereon are approximate and given for illustrative purposes only.

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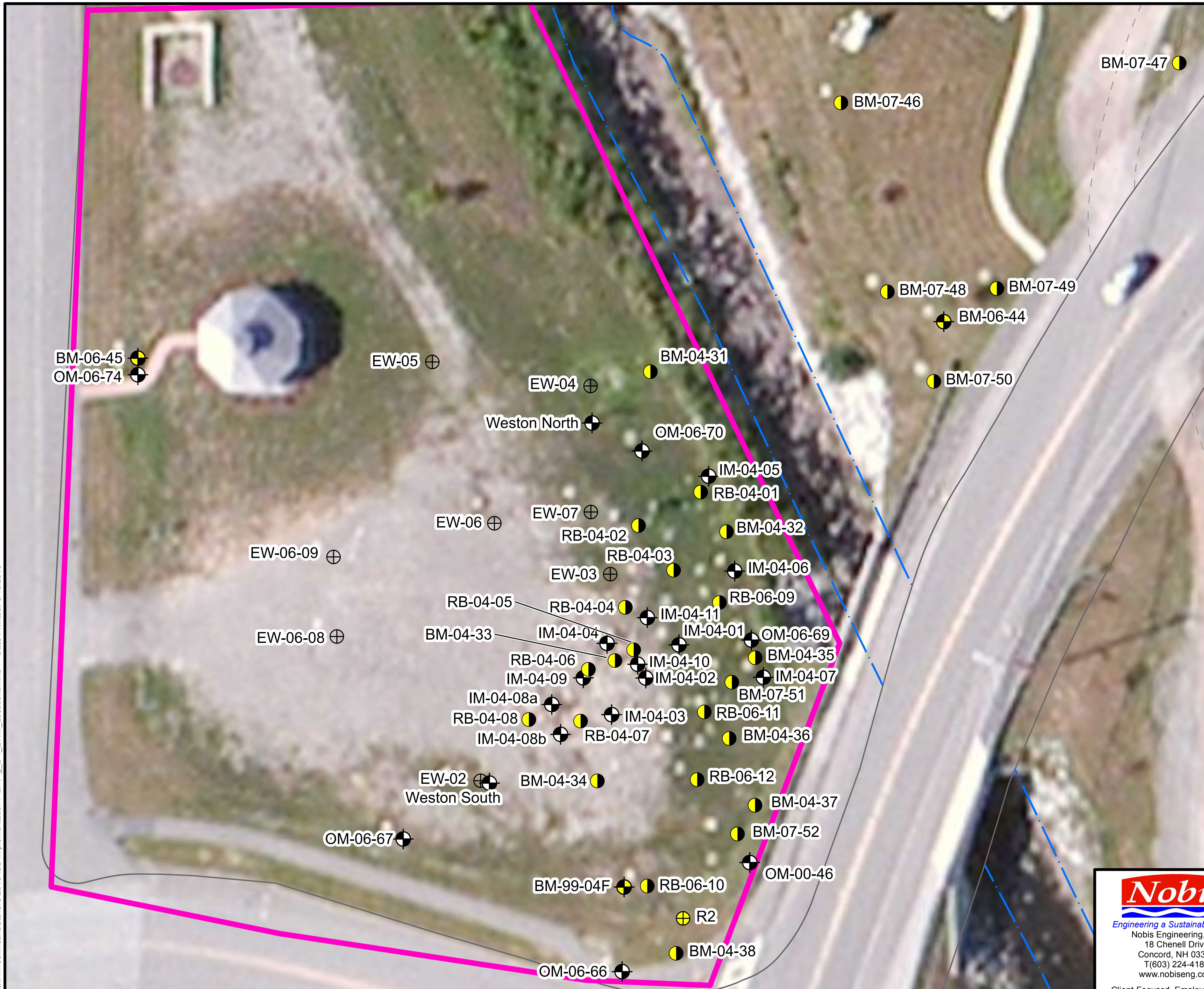
FIGURE 2-1

AREA-WIDE SITE PLAN
WELL LOCATION LAYOUT
EASTLAND WOOLEN MILL SUPERFUND SITE
CORINNA, MAINE

PREPARED BY: JH	CHECKED BY: TA
PROJECT NO. 80038	DATE: AUGUST 2015

Path: I:\Technical Data\GIS\2015 ISB Implementation Plan\Fig_2-1b_EWM_Locations.mxd Date Printed: 8/13/2015



Legend

- Bedrock Borehole
- Bedrock Extraction Well
- Bedrock Monitoring Well
- Bedrock Monitoring Well - FLUTe
- Bedrock Residential Well - Active
- Bedrock Residential Well - Inactive
- Overburden Extraction Well
- Overburden Monitoring Well
- Area 1
- Building 14 and UST Area

N

0 15 30 60

Feet

1 inch = 30 feet

Notes:

1. Only locations sampled for the 2014 sampling round are shown.

2. Locations of site features depicted hereon are approximate and given for illustrative purposes only.

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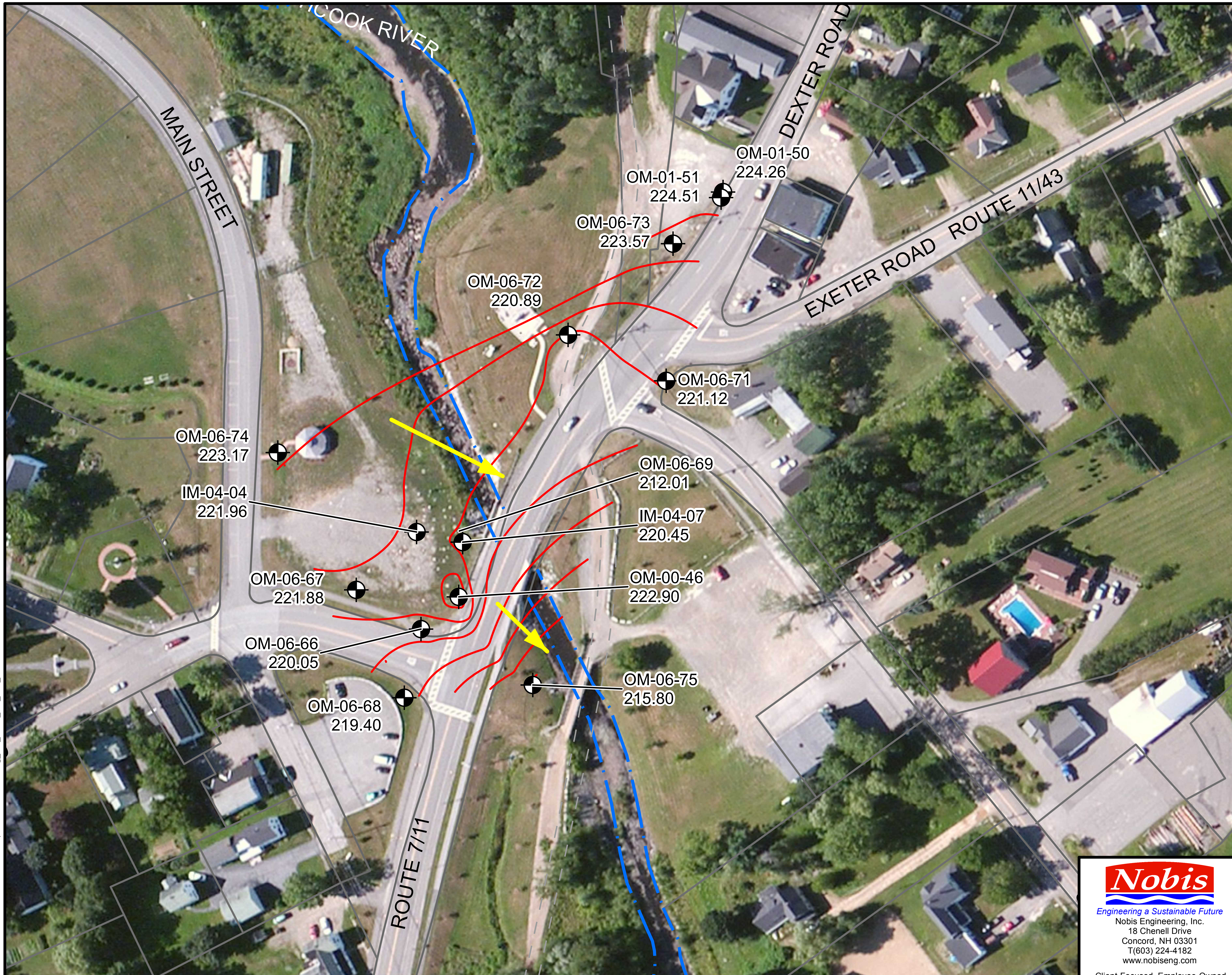
FIGURE 2-2

AREA 1 SITE PLAN
WELL LOCATION LAYOUT
EASTLAND WOOLEN MILL SUPERFUND SITE
CORINNA, MAINE

PREPARED BY: JH	CHECKED BY: TA
PROJECT NO. 80038	DATE: AUGUST 2015

Path: I:\Technical Data\GIS\2015 ISB Implementation Plan\Fig_2-1_EWM_Locations.mxd Date Printed: 8/13/2015



Legend

- Overburden Monitoring Well with Groundwater Elevation (8/18/14)
- Overburden Groundwater Elevation Contour (8/18/14)
- Inferred Groundwater Flow Direction (8/18/14)

N

0 50 100 200
Feet
1 inch = 100 feet

Notes:

1. OM-06-69 is an angled boring; elevation data from this location was not used. OM-11-76 and OM-11-77 do not have reference elevations and, therefore, groundwater elevations at these locations could not be calcuated.

2. Aerial photogrpah provided by ESRI.

3. Locations of site features depicted hereon are approximate and given for illustrative purposes only.

4. Groundwater contours are based on groundwater elevation data obtained in August 18, 2014 and were contoured using the natural neighbor interpolation method. This is one interpretation of the data; other interpretations are possible.

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FIGURE 2-3

OVERBURDEN GROUNDWATER ELEVATIONS AND POTENTIOMETRIC SURFACE CONTOURS
EASTLAND WOOLEN MILL SUPERFUND SITE
CORINNA, MAINE

PREPARED BY: JH	CHECKED BY: TA
PROJECT NO. 80038	DATE: AUGUST 2015

Path: I:\Technical Data\GIS\2015 ISB Implementation Plan\Fig_2-2_EWM_OB_GW_Elev.mxd Date Printed: 8/13/2015

Legend

- Bedrock Monitoring Well with Groundwater Elevation (8/18/14)
- Bedrock Groundwater Elevation Contour (8/18/14)
- Inferred Groundwater Flow Direction (8/18/14)

N

0 100 200 400
Feet
1 inch = 200 feet

Notes:

1. Aerial phograph provided by ESRI.

2. Locations of site features depicted hereon are approximate and given for illustrative purposes only.

3. Groundwater contours are based on groundwater elevation data obtained in August 18, 2014 and were contoured using the natural neighbor interpolation method. This is one interpretation of the data; other interpretations are possible.

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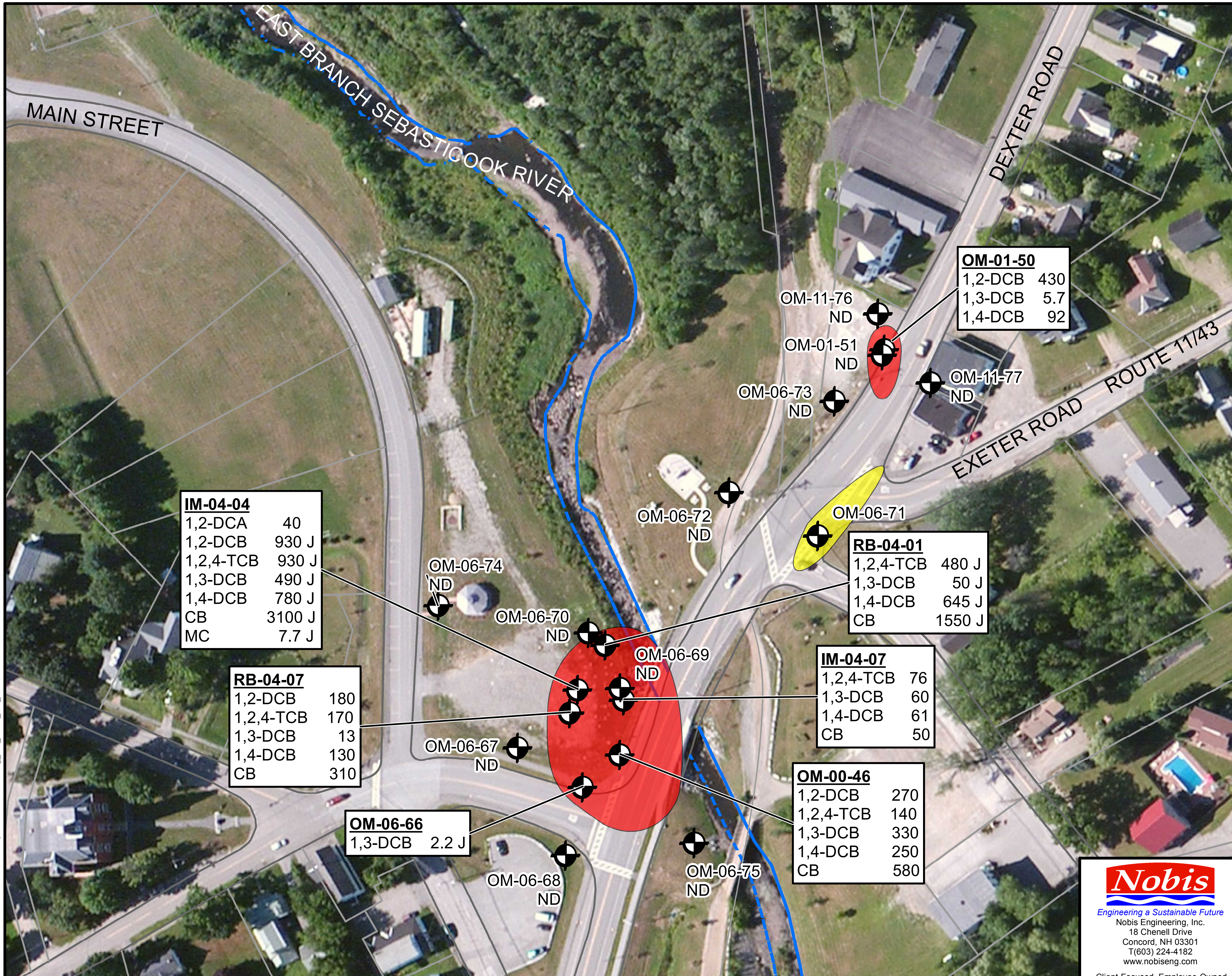
FIGURE 2-4

BEDROCK GROUNDWATER ELEVATIONS AND POTENTIOMETRIC SURFACE CONTOURS EASTLAND WOOLEN MILL SUPERFUND SITE CORINNA, MAINE

PREPARED BY: JH	CHECKED BY: TA
PROJECT NO. 80038	DATE: AUGUST 2015

Path: I:\Technical Data\GIS\2015 ISB Implementation Plan\Fig_2-3_EWM_BR_GW_Elev.mxd Date Printed: 8/13/2015



Legend

- Overburden Monitoring Well
- Estimated Extent of Overburden VOC Detections
- Estimated Extent of Overburden VOC Exceedances

N

0 50 100 200
Feet

1 inch = 100 feet

Key	Chemical	GCI	MEG	MCL
1,2-DCA	1,2-Dichloroethane	NS	4	5
1,2-DCB	1,2-Dichlorobenzene	85	200	600
1,2,4-TCB	1,2,4-Trichlorobenzene	70	70	70
1,3-DCB	1,3-Dichlorobenzene	85	1	NS
1,4-DCB	1,4-Dichlorobenzene	27	70	NS
CB	Chlorobenzene	47	100	100
MC	Methylene Chloride	NS	40	5

Notes:

1. All concentrations for contaminants exceeding criteria as indicated are presented in micrograms per liter (µg/L). GCL = Groundwater Cleanup Level; MEG = State of Maine Maximum Exposure Guidelines; MCL = Federal Maximum Contaminant Level; NS = no stadard available; J = Result is estimated; ND = VOCs were not detected above the reporting limit.

2. Field duplicate and parent sample results were averaged for display purposes. Field duplicates were collected at RB-04-01.

3. Aerial photograph provided by ESRI.

4. Locations of site features depicted hereon are approximate and given for illustrative purposes only. Additional notes and features are displayed on Figure 1-2.

5. The extent of VOC exceedances and detections is based on groundwater analytical data obtained durig the sampling program conducted in August 2014. The data were plotted using the natural neighbor interpolation technique. This is one interpreation of the data; other interpretations are possible.

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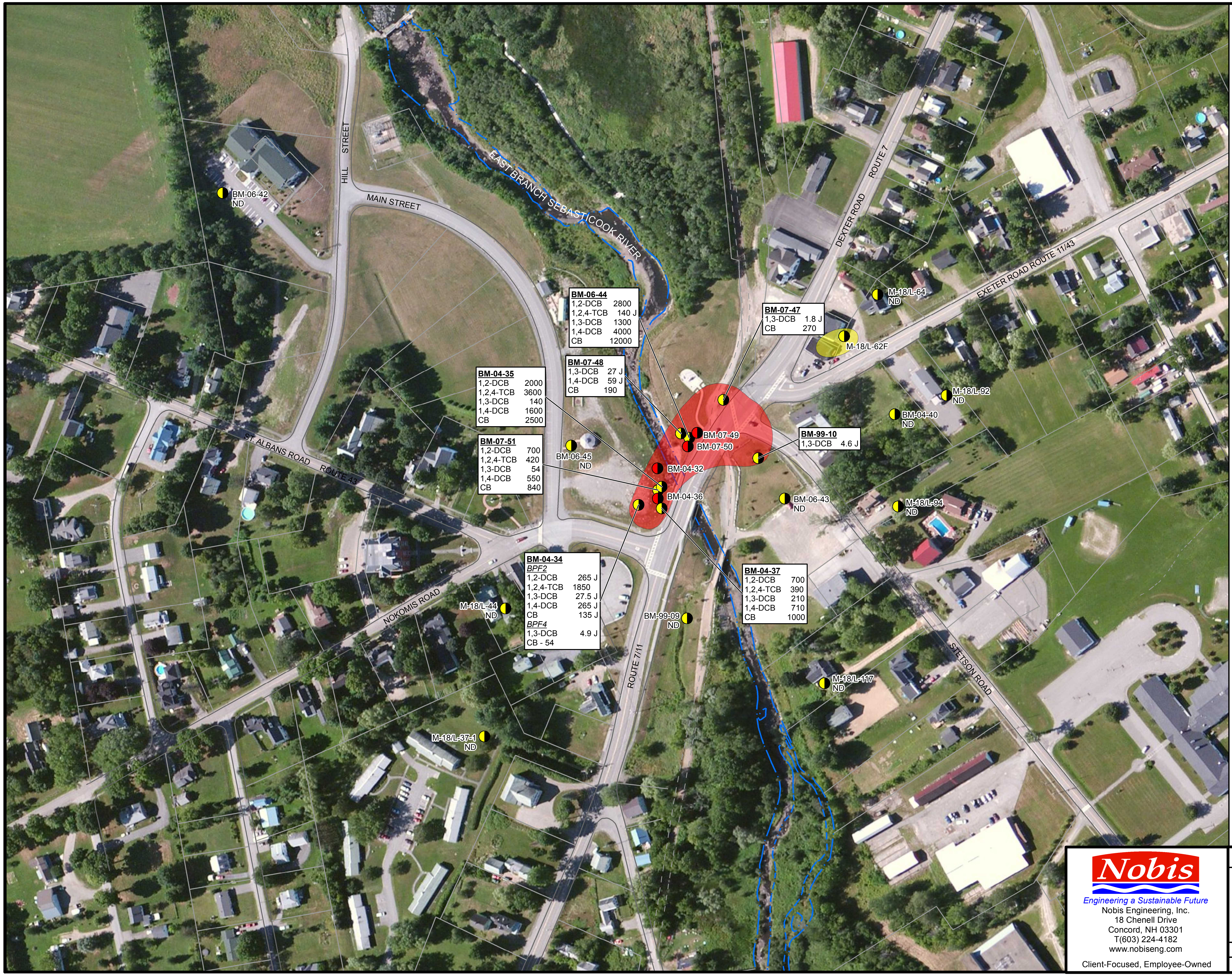
FIGURE 3-1

ESTIMATED EXTENT OF VOC CONTAMINANTS IN OVERBURDEN GROUNDWATER, AUGUST 2014
EASTLAND WOOLEN MILL SUPERFUND SITE
CORINNA, MAINE

PREPARED BY: JH	CHECKED BY: TA
PROJECT NO. 80038	DATE: AUGUST 2015



Legend

- Bedrock Monitoring Well
- Packer Sample Location (See Fig. 3-3)
- Estimated Extent of Bedrock VOC Exceedances
- Estimated Extent of Bedrock VOC Detections

N

0 100 200 400

Feet

1 inch = 200 feet

Key	Chemical	GCL	MEG	MCL
1,2-DCB	1,2-Dichlorobenzene	85	200	600
1,2,4-TCB	1,2,4-Trichlorobenzene	70	70	70
1,3-DCB	1,3-Dichlorobenzene	85	1	NS
1,4-DCB	1,4-Dichlorobenzene	27	70	NS
CB	Chlorobenzene	47	100	100

Notes:

1. All concentrations for contaminants exceeding criteria as indicated are presented in micrograms per liter (µg/L). GCL = Groundwater Cleanup Level; MEG = State of Maine Maximum Exposure Guidelines; MCL = Federal Maximum Contaminant Level; NS = no standard available; J = result is estimated; ND = VOCs were not detected above the reporting limit.

2. Field duplicate and parent sample results were averaged for display purposes. Field duplicates were collected at BM-04-34-BPF2, BM-99-10 and M-18/L-44.

3. Aerial photogrpahy provided by ESRI.

4. Locations of site features depicted hereon are approximate and given for illustrative purposes only. Additional notes and features are displayed on Figure 1-2.

5. The extent of VOC exceedances and detections is based on groundwater analytical data obtained durig the sampling program conducted in August 2014. The data were plotted using the natural neighbor interpolation technique. This is one interpretation of the data; other interpretations are possible.

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FIGURE 3-2

ESTIMATED EXTENT OF VOC CONTAMINANTS IN BEDROCK GROUNDWATER, AUGUST 2014
EASTLAND WOOLEN MILL SUPERFUND SITE
CORINNA, MAINE

PREPARED BY: JH	CHECKED BY: TA
PROJECT NO. 80038	DATE: AUGUST 2015

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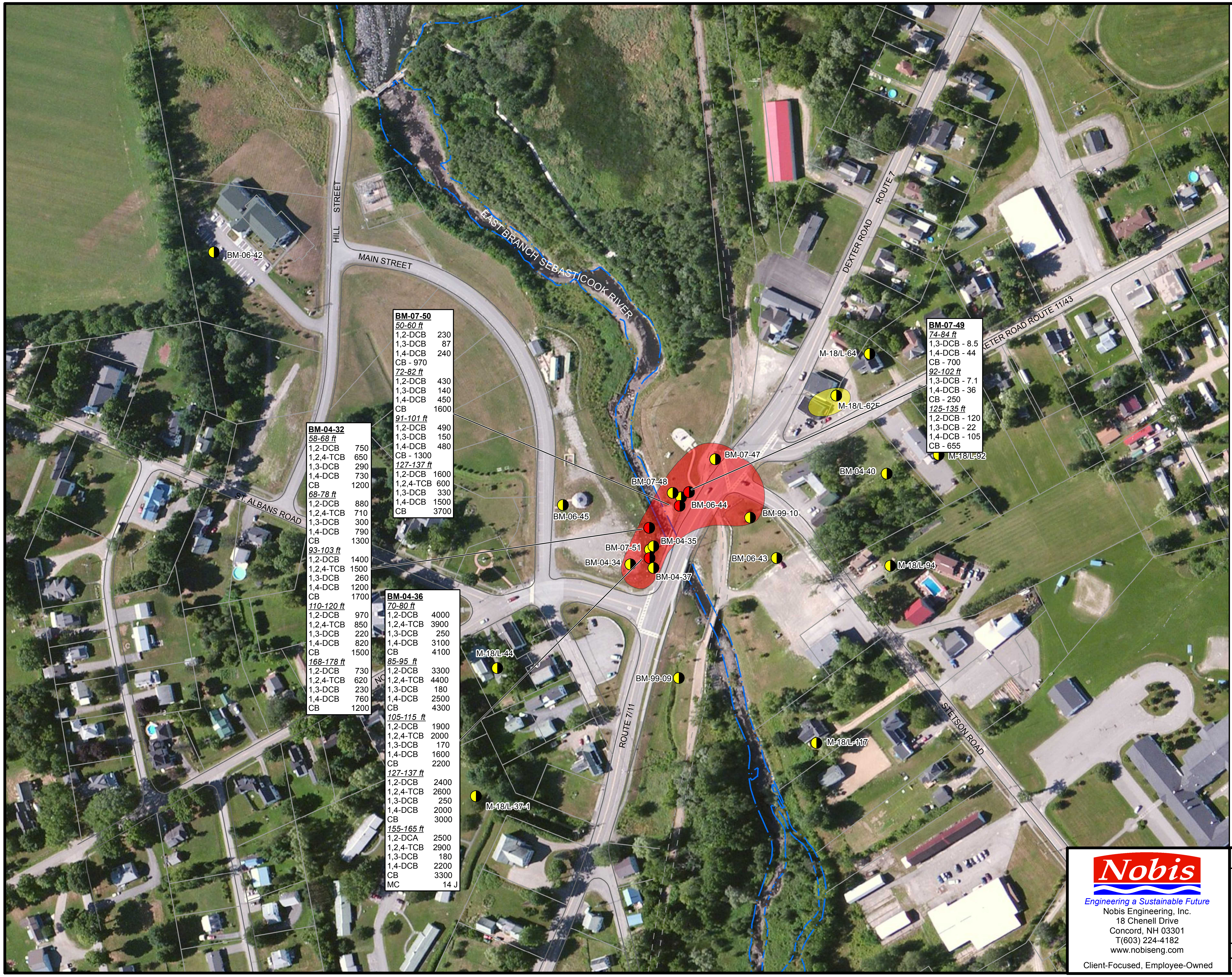
Date Printed: 8/13/2015



Legend

- Bedrock Packer Monitoring Well
- Bedrock Monitoring Well (See Fig. 3-2)
- Estimated Extent of Bedrock VOC Exceedances
- Estimated Extent of Bedrock VOC Detections

N

0 100 200 400
Feet

1 inch = 200 feet

Key	Chemical	GCI	MEG	MCL
1,2-DCB	1,2-Dichlorobenzene	85	200	600
1,2,4-TCB	1,2,4-Trichlorobenzene	70	70	70
1,3-DCB	1,3-Dichlorobenzene	85	1	NS
1,4-DCB	1,4-Dichlorobenzene	27	70	NS
CB	Chlorobenzene	47	100	100
MC	Methylene Chloride	NS	40	5

Notes:

1. All concentrations for contaminants exceeding criteria as indicated are presented in micrograms per liter (µg/L). GCL = Groundwater Cleanup Level; MEG = State of Maine Maximum Exposure Guidelines; MCL = Federal Maximum Contaminant Level; NS = no standard available; J = result is estimated. ND = VOCs were not detected above the reporting limit.

2. Field duplicate and parent sample results were averaged for display purposes. Field duplicates were collected at BM-07-49.

3. Aerial photograph provided by ESRI.

4. Locations of site features depicted hereon are approximate and given for illustrative purposes only. Additional notes and features are displayed on Figure 1-2.

5. The extent of VOC exceedances and detections is based on groundwater analytical data obtained durig the sampling program conducted in August 2014. The data were plotted using the natural neighbor interpolation technique. This is one interpreation of the data; other interpretations are possible.

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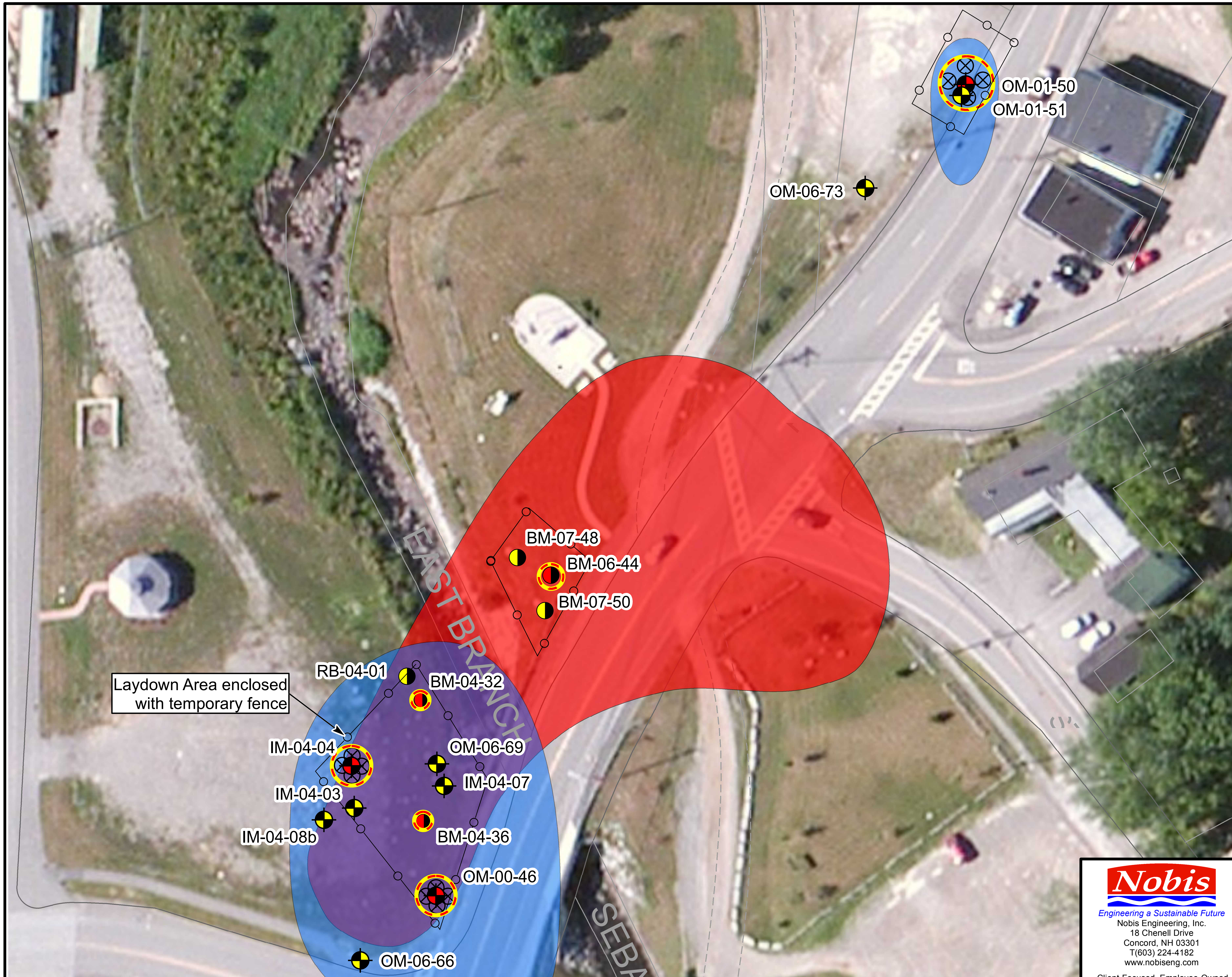
FIGURE 3-3

ESTIMATED EXTENT OF VOC CONTAMINANTS IN BEDROCK PACKER GROUNDWATER, AUGUST 2014
EASTLAND WOOLEN MILL SUPERFUND SITE
CORINNA, MAINE

PREPARED BY: JH	CHECKED BY: TA
PROJECT NO. 80038	DATE: AUGUST 2015

Path: I:\Technical Data\GIS\2015 ISB Implementation Plan\Fig_3-3_EWM_BR_VOC_Packer.mxd Date Printed: 8/13/2015



Legend

- ISB Overburden Injection Point
- ISB Overburden Target Well
- ISB Bedrock Target Well
- ISB Overburden Performance Monitoring Well
- ISB Bedrock Performance Monitoring Well
- Overburden Plume (August 2014)
- Bedrock Plume (August 2014)
- Estimated Radius of Influence
- Laydown Area

N

0 20 40 80
Feet

1 inch = 50 feet

Notes:

1. Aerial photograph provided by ESRI.

2. Locations of site features depicted hereon are approximate and given for illustrative purposes only. Additional notes and features are displayed on Figure 1-2.

3. The extent of VOC exceedances and detections is based on groundwater analytical data obtained durig the sampling program conducted in August 2014. The data were plotted using the natural neighbor interpolation technique. This is one interpreation of the data; other interpretations are possible.

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FIGURE 3-4

ISB PILOT-TEST PERFORMANCE MONITORING WELLS
EASTLAND WOOLEN MILL SUPERFUND SITE
CORINNA, MAINE

PREPARED BY: DG	CHECKED BY: TA
PROJECT NO. 80038	DATE: AUGUST 2015

Path: I:\Technical Data\GIS\2015 ISB Implementation Plan\Figure 3-4 ISB Pilot Test Perf Mon Wells.mxd Date Printed: 9/2/2015

APPENDIX A

TABLE 1A

Enhanced Aerobic Bioremediation Application Summary

Eastland Woolen Mill Superfund Site
Corinna, ME

BEDROCK TARGET AREA (Based on 3 wells)	
Treatment Area [1] (ft^2)	36
Target Treatment Interval (ft)	10.0
Volume of Soil (ft^3)	360
Estimated Soil Mass [2] (kg)	18,000
Estimated Contaminant Concentration [3] (mg/Kg)	80
Estimated Contaminant Mass (lb)	3.0
Radius of Influence (ft)	2
Target Injection Volume (gal)	280
Estimated mass of PermeOx Ultra® (lb)	225
Number of Extraction/Injection Wells	3
Estimated Rate of Extraction per Location (gpm)	0.1
Total Rate of Extraction (gpm)	0.3
Total Extraction Time [4] (Days)	3
Estimated Rate of Injection per Injection Location (gpm)	0.1
Total Rate of Injection (gpm)	0.2
Total Injection Time [4] (Days)	3

Notes:

(1) Treatment area estimated based on an assumed 2 ft ROI in bedrock fractures.

(2) Estimated Soil Mass = Target volume of soil x Soil bulk density. A bulk soil density of 50 Kg/ft^3 is assumed.

(3) Estimated based on 2014 groundwater concentrations and assumed soil sorption values.

(4) Based on 8 hours of injection per day, includes area east of river (expanded target area wells).

ft^2 = square feet
ft = feet
ft^3 = cubic feet
kg = kilograms
gal = gallons
lbs = pounds
mg/Kg = miligrams per kilogram

TABLE 1B

Enhanced Aerobic Bioremediation Application Summary

Eastland Woolen Mill Superfund Site
Corinna, ME

OVERBURDEN TARGET AREA - (Based on 3 wells)	
Treatment Area [(1)] (ft^2)	675
Target Treatment Interval (ft)	10.0
Volume of Soil (ft^3)	6,625
Estimated Soil Mass [(2)] (kg)	331,250
Estimated Contaminant Concentration [(3)](mg/Kg)	60.0
Estimated Contaminant Mass (lb)	45.0
Radius of Influence (ft)	Area 1 = 10 Building 14 Area = 2-3
Target Injection Volume (gal)	Area 1 = 3650 Building 14 Area = 95
Estimated mass of PermeOx Ultra®	2,250
Number of Injection Wells	3
Estimated Rate of Extraction per Location (gpm)	Area 1 = 1.5 Building 14 Area = 0.1
Total Rate of Extraction (gpm)	Area 1 = 3.0 Building 14 Area = 0.1
Total Extraction Time [(4)] (Days)	3
Estimated Rate of Injection per Injection Location (gpm)	Area 1 = 1.5 Building 14 Area = 0.1
Total Rate of Injection (gpm)	Area 1 = 3.0 Building 14 Area = 0.1 - 0.2
Total Injection Time [(4)] (Days)	3.5

Notes:

[(1)] Treatment area estimated based on two wells with radius of influence of 10 feet.

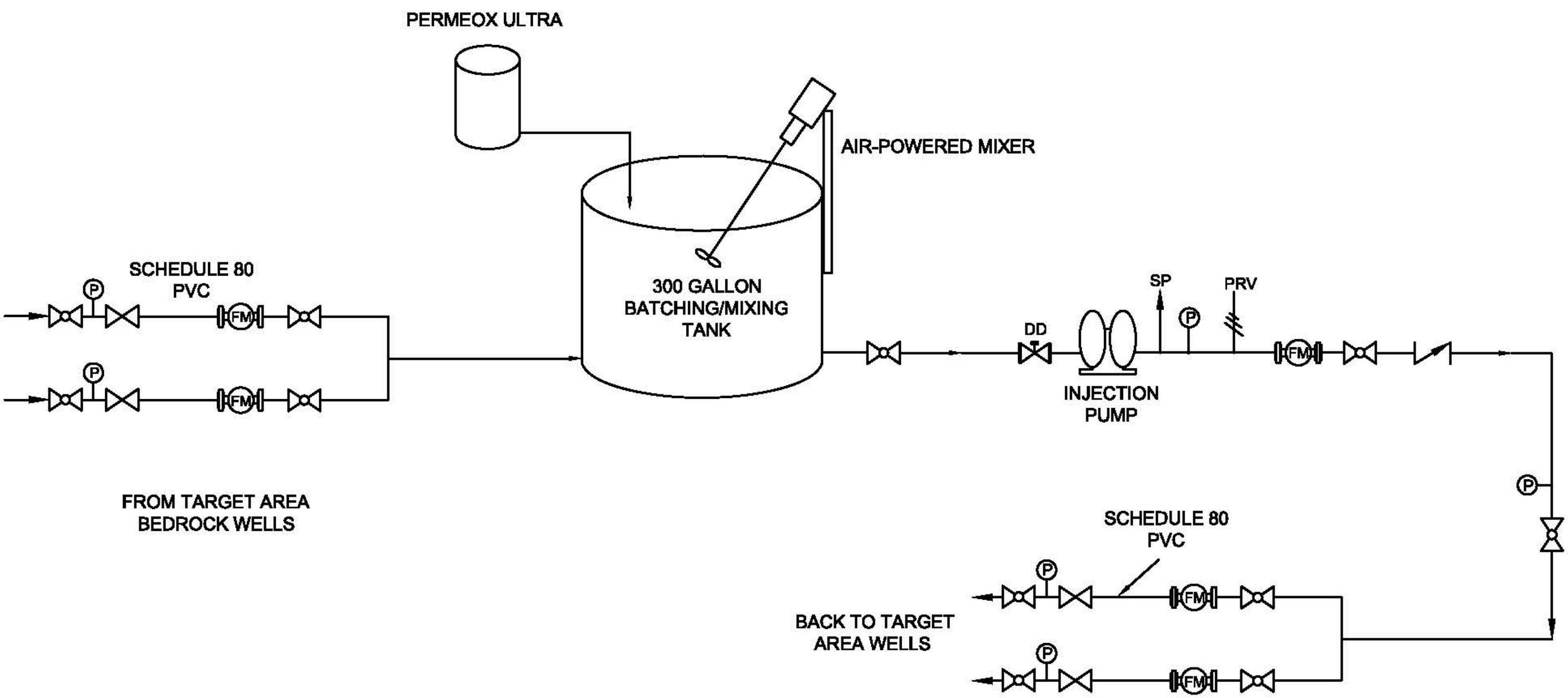
[(2)] Estimated Soil Mass = Target volume of soil x Soil bulk density. A bulk soil density of 50 Kg/ft^3 is assumed.

[(3)] Estimated based on 2014 groundwater concentrations and assumed soil sorption and organic carbon fraction values.

[(4)] Based on 8 hours of injection per day.

ft^2 = square feet
ft = feet
ft^3 = cubic feet
kg = kilograms
gal = gallons
lbs = pounds
mg/Kg = miligrams per kilogram

APPENDIX B



NOTES:

NO PROCESS EQUIPMENT WILL BE USED TO APPLY PERMEOX ULTRA AND OTHER MINERAL AMENDMENTS. THEY WILL BE ADDED MANUALLY TO THE BATCH TANK UNTIL THE DESIRED CONDITIONS ARE REACHED.

CAPACITY OF BATCHING/MIXING TANK MAY CHANGE, BUT WILL NOT EXCEED 500 GALLONS.

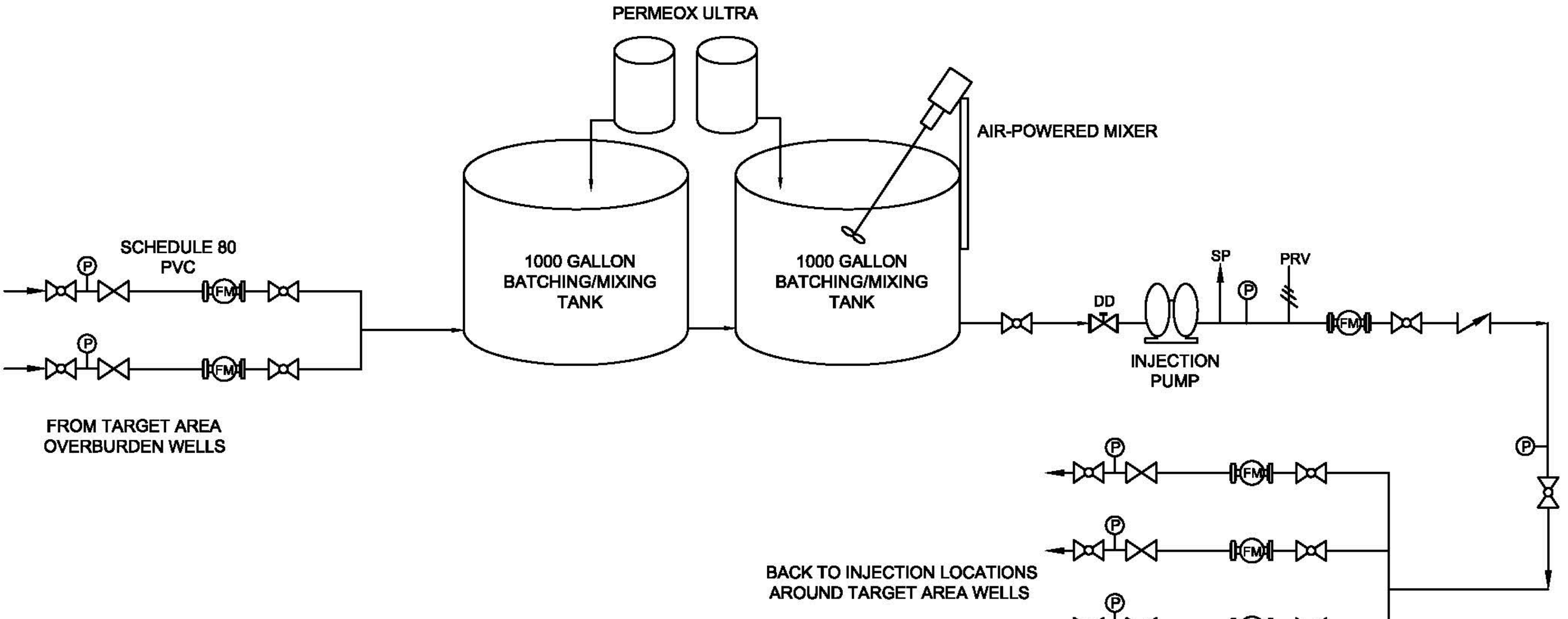
PERMEOX ULTRA WILL BE DIRECTLY INJECTED VIA GEOPROBE AROUND THE OVERBURDEN WELLS. THEREFORE, NO P&ID IS NEEDED.

LEGEND

- (P) - STAINLESS STEEL PRESSURE GAUGE (<75 PSI)
- (FM) - FLOW METER/TOTALIZER
- - CHECK VALVE
- - BALL VALVE
- - GATE VALVE
- PRV - PRESSURE RELIEF VALVE
- SP - SAMPLE PORT

XDD
STRATEGIC. ENVIRONMENTAL. SOLUTIONS.

SCALE: Not to Scale	TITLE: PROCESS & INSTRUMENTATION DIAGRAM (P&ID) FOR BEDROCK WELLS EASTLAND WOOLEN MILL SUPERFUND SITE, CORINNA, MAINE
DATE: FEBRUARY 2015	
PROJECT No.: 11031.01	
CLIENT: NOBIS	
DRAWN BY: PC	DRAWING NO. FIGURE 1 — REV. A
CHECKED BY: BC	
PROJ. MGMT. APPROVAL: BC	



NOTES:

NO PROCESS EQUIPMENT WILL BE USED TO APPLY PERMEOX ULTRA AND OTHER MINERAL AMENDMENTS. THEY WILL BE ADDED MANUALLY TO THE BATCH TANK UNTIL THE DESIRED CONDITIONS ARE REACHED.

PERMEOX ULTRA WILL BE DIRECTLY INJECTED VIA GEOPROBE AROUND THE OVERBURDEN WELLS.

LEGEND

- (P) - STAINLESS STEEL PRESSURE GAUGE (<75 PSI)
- (FM) - FLOW METER/TOTALIZER
- CHECK VALVE
- BALL VALVE
- GATE VALVE
- PRV - PRESSURE RELIEF VALVE
- SP - SAMPLE PORT

XDD
STRATEGIC. ENVIRONMENTAL. SOLUTIONS.

SCALE: Not to Scale	TITLE: PROCESS & INSTRUMENTATION DIAGRAM (P&ID) FOR OVERBURDEN WELLS EASTLAND WOOLEN MILL SUPERFUND SITE, CORINNA, MAINE
DATE: FEBRUARY 2015	
PROJECT NO.: 11031.01	
CLIENT: NOBIS	
DRAWN BY: PC	DRAWING NO. FIGURE 2
CHECKED BY: BC	REV. A
PROJ. MGMT. APPROVAL: BC	

APPENDIX C

MATERIAL SAFETY DATA SHEET

PermeOx™ Ultra

MSDS #: 1305-79-9-2
Revision date: 2014-07-24
Version 2

This MSDS has been prepared to meet U.S. OSHA Hazard Communication Standard 29 CFR 1910.1200 And Canadian Workplace Hazardous Materials Information System (WHMIS) requirements.

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name **PermeOx™ Ultra**

Recommended Use: Environmental applications

Manufacturer	**Emergency telephone number**
PeroxyChem LLC 1735 Market Street Philadelphia, PA 19103 Phone: +1 215/ 299-5858 (General Information) E-Mail: sdsinfo@peroxychem.com	For leak, fire, spill or accident emergencies, call: 1 800 / 424 9300 (CHEMTREC - U.S.A.) 1 703 / 527 3887 (CHEMTREC - Collect - All Other Countries) 1 303/ 389-1409 (Medical - U.S. - Call Collect)

2. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Odorless, off-white fine granular solid
oxidizer; Contact with combustible material may cause fire
Decomposes under fire conditions to release oxygen that intensifies the fire.
Use water to keep fire-exposed containers cool

Potential Health Effects

Eyes	Causes serious eye damage.
Skin	May cause irritation.
Inhalation	Inhalation of dust in high concentration may cause irritation of respiratory system.
Ingestion	Not an expected route of exposure. Low oral toxicity.

Chronic toxicity No known effect.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients

Chemical name	CAS-No	Weight %
Calcium Peroxide	1305-79-9	>75
Calcium Hydroxide	1305-62-0	<25

4. FIRST AID MEASURES

Eye Contact Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids intermittently. Consult a physician.

Skin Contact Wash off with soap and water. Get medical attention if irritation develops and persists.

Inhalation Move to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. If breathing difficulty or discomfort occurs and persists, obtain medical attention.

Ingestion Rinse mouth with water and afterwards drink plenty of water or milk. Do not induce vomiting or give anything by mouth to an unconscious person. Call a poison control center or doctor immediately for treatment advice. Never give anything by mouth to an unconscious person.

5. FIRE-FIGHTING MEASURES

Flash point Not flammable

Suitable Extinguishing Media Flood with water.

Unsuitable extinguishing media Dry chemical. Foam.

<u>**Explosion data**</u>
Sensitivity to Mechanical Impact Not Applicable
Sensitivity to Static Discharge Not Applicable

Specific Hazards Arising from the Chemical Decomposes under fire conditions to release oxygen that intensifies the fire.

Protective equipment and precautions for firefighters As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Move containers from fire area if you can do it without risk.

NFPA	**Health Hazards** 2	**Flammability** 0	**Stability** 1	**Special Hazards** OX

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions Avoid contact with the skin and the eyes. Avoid dust formation. Ensure adequate ventilation. For personal protection see section 8.

Methods for Containment Vacuum or shovel waste into a drum and label contents for disposal. Do not return product to the original storage container/tank due to risk of decomposition. Keep combustibles (wood, paper, oil, etc) away from spilled material.

Methods for cleaning up After cleaning, flush away traces with water. Do not flush powdered material to sewer; Runoff to sewer may create fire or explosion hazard.

7. HANDLING AND STORAGE

Handling Avoid contact with skin and eyes. Ensure adequate ventilation. In case of insufficient ventilation, wear suitable respiratory equipment if release of airborne dust is expected. If compounded with organics or combustible materials be sure to exclude moisture.

Storage Keep tightly closed in a dry and cool place. Keep away from heat and sources of ignition i.e., steam pipes, radiant heaters, hot air vents or welding sparks. Reacts with moisture. Keep container tightly closed.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Guidelines .

Chemical name	ACGIH TLV	OSHA PEL	NIOSH	Mexico
Calcium Hydroxide 1305-62-0	TWA: 5 mg/m³	TWA: 15 mg/m³ TWA: 5 mg/m³	TWA: 5 mg/m³	Mexico: TWA 5 mg/m³

Chemical name	British Columbia	Quebec	Ontario TWAEV	Alberta
Calcium Hydroxide 1305-62-0	TWA: 5 mg/m³	TWA: 5 mg/m³	TWA: 5 mg/m³	TWA: 5 mg/m³

Occupational exposure controls

Engineering measures Ensure adequate ventilation.

General information If the product is used in mixtures, it is recommended that you contact the appropriate protective equipment suppliers. These recommendations apply to the product as supplied.

Respiratory Protection If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.

Eye/Face Protection For dust, splash, mist or spray exposure, wear chemical protective goggles

Skin and Body Protection Protective shoes or boots Wear suitable protective clothing

Hand Protection Rubber/latex/neoprene or other suitable chemical resistant gloves. Wash the outside of gloves with soap and water prior to removal. Inspect regularly for leaks. Please observe the instructions regarding permeability and breakthrough time which are provided by the supplier of the gloves. Also take into consideration the specific local conditions under which the product is used, such as the danger of cuts, abrasion and the contact time.

Hygiene measures Handle in accordance with good industrial hygiene and safety practice. Clean water, preferably an eyewash station and a safety shower, should be available for washing in case of eye or skin contamination.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance White to off-white granules
Physical State solid
Odor odorless
Odor threshold Not applicable
pH (1% solution) 10.5 - 11.8 @ 25 °C
Melting Point/Range Decomposes on heating @ ~275 °C
Boiling Point/Range Not applicable

Flash point	Not flammable
Evaporation Rate	No data available
Oxidizing properties	oxidizer
Specific gravity	~2.92
Water solubility	slightly soluble
Viscosity	Not Applicable
Decomposition temperature	275 °C

10. STABILITY AND REACTIVITY

Stability Stable under recommended storage conditions. Decomposition can occur on exposure to heat or moisture.

Conditions to Avoid Heat, (decomposes at 275 °C). Humid air. Grinding with organics.

Materials to avoid Heavy metals. Combustible materials

Hazardous Decomposition Products Oxygen which supports combustion, Calcium oxides.

Hazardous polymerization Hazardous polymerization does not occur.

Hazardous reactions Oxidizable material can be ignited by grinding and may become explosive.

11. TOXICOLOGICAL INFORMATION

Acute Effects

Eye irritation	Severely irritating, corrosive (rabbit)
Skin irritation	Non-irritating (Rabbit) May cause skin irritation in susceptible persons
LD50 Oral	> 5 g/kg (rat)
LD50 Dermal	> 10 g/kg (rat)
Inhalation LC50	> 17 mg/l 1 hr (rat)

Sensitization No information available

Acute toxicity of over-exposure Dust is irritating eyes, nose, throat, and lungs.

Chronic toxicity

Chronic toxicity No known effect.

Carcinogenicity There are no known carcinogenic chemicals in this product

12. ECOLOGICAL INFORMATION

Ecotoxicity
The environmental impact of this product has not been fully investigated

Persistence and degradability Biodegradability does not pertain to inorganic substances.

Bioaccumulation Does not bioaccumulate.

Mobility No information available.

Other Adverse Effects None known

13. DISPOSAL CONSIDERATIONS

Waste disposal methods	This material, as supplied, is a hazardous waste according to federal regulations (40 CFR 261). Dispose of in accordance with local regulations.
Contaminated Packaging	Empty remaining contents. Empty containers should be taken to an approved waste handling site for recycling or disposal.
US EPA Waste Number	D001

14. TRANSPORT INFORMATION

DOT

UN/ID no	1457
Proper Shipping Name	CALCIUM PEROXIDE MIXTURE
Hazard class	5.1
Packing Group	II

TDG

UN/ID no	1457
Proper Shipping Name	CALCIUM PEROXIDE MIXTURE
Hazard class	5.1
Packing Group	II

ICAO/IATA Oxidizers are prohibited from aircraft.

IMDG/IMO

UN/ID no	1457
Proper Shipping Name	CALCIUM PEROXIDE MIXTURE
Hazard class	5.1
Packing Group	II

OTHER INFORMATION This material is shipped in 25 lb. plastic pails, and 30 lb. and 100 lb. fiber drums.

ADR/RID

UN/ID no	UN 1457
Proper Shipping Name	OXIDIZING SOLID, n.o.s. (Calcium Peroxide)
Hazard class	5.1
Packing Group	II

15. REGULATORY INFORMATION

International Inventories

TSCA (United States)	Complies
DSL (Canada)	Complies
NDSL (Canada)	Complies
EINECS/ELINCS (Europe)	Complies
ENCS (Japan)	Complies
China (IECSC)	Complies
KECL (Korea)	Complies
PICCS (Philippines)	Complies
AICS (Australia)	Complies
NZIoC (New Zealand)	Complies

U.S. Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

SARA 311/312 Hazard Categories

Acute health hazard	Yes
Chronic health hazard	No
Fire hazard	Yes
Sudden release of pressure hazard	No
Reactive Hazard	No

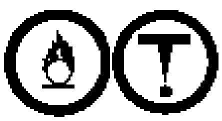
CERCLA
This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

International Regulations

Mexico - Grade No information available

Chemical name	Carcinogen Status	Mexico
Calcium Hydroxide		Mexico: TWA 5 mg/m^3

CANADA
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR
WHMIS Hazard Class
C - Oxidizing materials
D2B - Toxic materials



16. OTHER INFORMATION

HMIS	Health Hazards 2	Flammability 0	Stability 1	Special precautions J

Protection=J (Safety goggles, gloves, apron, combination dust and vapor respirator)

Revision date: 2014-07-24
Reason for revision: Initial Release.

Disclaimer
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Prepared By:

PeroxyChem

End of Safety Data Sheet

Engineered Calcium Peroxide to Enhance the Aerobic Bioremediation of Petroleum Hydrocarbons and Non-halogenated Organics

PermeOx® Ultra is a specially formulated grade of engineered calcium peroxide providing extended oxygen release for enhanced aerobic bioremediation. Often, the limiting factor in aerobic bioremediation of petroleum contaminants is oxygen. PermeOx Ultra provides oxygen through hydration of calcium oxyhydroxide component as shown below:

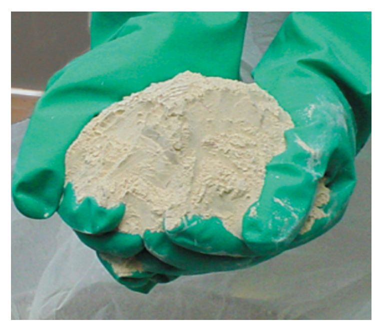
$$CaO(OH)_2 + H_2O + \rightarrow \frac{1}{2}O_2 + Ca(OH)_2 + H_2O$$

Studies have shown that PermeOx Ultra releases more oxygen into the subsurface environment over extended periods as compared to other soil remediation products. These studies have demonstrated that PermeOx Ultra can continually release oxygen for over 350 days, thus providing a useful and cost-effective tool for enhancing the aerobic bioremediation of petroleum hydrocarbons and non-halogenated organics.

Contaminants Treated

- Petroleum hydrocarbons
- Non-halogenated organics

The benefits of PermeOx Ultra



- Contains > 18% Active Oxygen for enhanced performance, which is higher than other grades of calcium peroxide
- Longest oxygen release profile of comparable products in the market
  - Releases oxygen for up to one year
  - Sustains dissolved oxygen levels in groundwater of 8-10 mg/L
- Cost-effective form of treatment and/or polishing step
  - Enhances microbial growth/bioremediation processes
  - Effective at achieving compliance end points
- No lock up or encapsulation of Calicum Peroxide surface resulting in release of all available oxygen
- Minimum site disruption
  - Slurry remains workable for injections longer and does not set up like concrete
  - Larger particle size reduces dust hazards and material handling issues in the field

Application Methods

- Direct injections in the plume (slurry)
- In a permeable reactive barrier (PRB)
- Broadcast in open pit / excavation post UST and soil removal

For more information and detailed case studies, please visit our website.

PeroxyChem

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