



**LIMITED PHASE II ENVIRONMENTAL SITE ASSESSMENT  
16 SPEERS ROAD  
WINNIPEG, MANITOBA**

Submitted to:

**Star Building Materials**  
16 Speers Road  
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Submitted by:

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Amec Foster Wheeler Project No: WX18198

## EXECUTIVE SUMMARY

Amec Foster Wheeler Environment & Infrastructure, a division of Amec Foster Wheeler Americas Ltd. (Amec Foster Wheeler), was retained by Mark Kennedy of Star Building Materials to conduct a Phase II Environmental Site Assessment (ESA) of a portion of the property located at 16 Speers Road in Winnipeg, Manitoba (the “Site”). The purpose of the Phase II ESA was to investigate the potential of environmental impacts in soil related to the presence and use of two diesel fuel aboveground storage tanks (ASTs) located centrally on Site.

At the time of the investigation, the property was occupied by Star Building Materials and consisted of a variety of buildings including retail space, office space, warehouses, outdoor storage areas and outdoor storage racking. It is understood that a new office and retail store building is proposed for development in the western portion of the Site, with associated parking areas to be a combination of asphalt and gravel.

Amec Foster Wheeler’s Brad Kennedy conducted the drilling program on 10 May 2016 which consisted of advancing three test holes (TH16-12 to TH16-14, inclusive) near the ASTs. The test holes were not completed as groundwater monitoring wells. The maximum soil headspace vapour concentration encountered during the test hole drilling program was 55 parts per million organic vapours (ppm<sub>v</sub>) in soil sample TH16-13 at a depth of 1.5 to 1.8 m below grade level (bgl). Remaining test holes did not have soil sample vapour concentrations exceeding the equipment detection limit of <5 ppm<sub>v</sub>. Soil staining was observed in test hole TH16-13 in clay soil between 1.4 and 2.0 m bgl.

Three soil samples were selected to be submitted for laboratory analysis of petroleum hydrocarbon (PHC) constituents, including benzene, toluene, ethylbenzene, and xylenes (BTEX) and PHC fractions F1 to F4. Sample selection was based on stratigraphic location, visual observations of potential impacts, and field screening results.

Results indicated that the sample collected from TH16-13, northeast of the ASTs, from a depth of 1.5 to 1.8 m bgl had a PHC fraction F2 concentration of 1390 mg/kg, exceeded the assessment guideline of 1000 mg/kg. As the Manitoba Sustainable Development (MSD) reporting standards were equal to the assessment guideline for PHC F2, the concentration exceeding the assessment guidelines also represent an exceedance of the MSD reporting standards.

As per discussions with Star Building Materials, Amec Foster Wheeler understands that the Site is to remain as a commercial development, with a new retail building and warehouse scheduled to be constructed over the AST area. Based on the observations made during the investigation conducted on 10 May 2016, it is suspected that the volume of impacted soil is limited and localized. Therefore, Amec Foster Wheeler recommends that PHC impacted soils from the area surrounding the AST be excavated as a part of any new construction, and disposed at a licensed soil treatment facility. If necessary, the soil should be replaced with clean fill or non-impacted fill materials generated on-Site as part of the redevelopment.

As the MSD Reporting Standards have been exceeded, this report is required to be submitted to MSD for their review.

Limited Phase II ESA  
16 Speers Road  
Winnipeg, Manitoba  
June 2017



Subject to approval from Star Building Materials, Amec Foster Wheeler will develop a remedial plan (RP) to submit to MSD detailing remedial work to be completed during the redevelopment of the Site.

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*Amec Foster Wheeler Environment & Infrastructure is committed to achieving sustainability through balancing economic growth, social responsibility and environmental protection. Learn more at: <http://amecfw.com/aboutus/sustainability.htm>*

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## 1.0 INTRODUCTION

Amec Foster Wheeler Environment & Infrastructure, a division of Amec Foster Wheeler Americas Ltd. (Amec Foster Wheeler), was retained by Mark Kennedy of Star Building Materials to conduct a Phase II Environmental Site Assessment (ESA) on a portion of the property located at 16 Speers Road in Winnipeg, Manitoba (the “Site”). The location of the Site within the City of Winnipeg is shown on Figure 1 (Appendix A). The purpose of the Phase II ESA was to investigate for the potential of impacts in the soil related to the presence and use of two diesel fuel aboveground storage tanks (ASTs) located on Site.

## 2.0 BACKGROUND

### 2.1 Site and Surrounding Land Use

At the time of the investigation the property was occupied by Star Building Materials and consisted of a variety of buildings including retail space, office space, warehouses, outdoor storage areas and outdoor storage racking. The two diesel fuel ASTs were located centrally, in a gravelled portion of the Site.

Amec Foster Wheeler understands that portions of the Site are to be redeveloped with a new retail building and warehouse scheduled to be constructed over the AST area.

The Site is in a light industrial and commercial area of the City of Winnipeg, and is zoned as M3 – Manufacturing Heavy. The Site is surrounded by Speers Road to the west, a rail line to the north, a utility corridor followed by Route 59 (Lagimodiere Boulevard) to the east, and an office building to the south. The remaining neighbouring properties are primarily commercial or industrial land use, or vacant land. The surrounding land uses as observed at the time of the Site visits are shown on Figure 1 (Appendix A) and summarized in Table 1 (Appendix B).

## 3.0 SCOPE OF WORK

Field work was completed at 16 Speers Road as per Amec Foster Wheelers’ proposal WPG2016.123. The scope of work included:

- ▶ Completion of up to four test holes in the area of the diesel ASTs. Monitoring wells were not to be installed.
- ▶ Submission of up to five soil samples for laboratory analysis of benzene, toluene, ethylbenzene, xylene (BTEX) and PHC Fractions F1-F4.

Amec Foster Wheeler received verbal approval of the scope and completed the field work on 10 May 2016. Written approval was received on 3 April 2017.

## **4.0 INVESTIGATIVE METHODOLOGY**

### **4.1 Hazard Assessment and Service Locations**

Prior to the start of the intrusive investigation, Amec Foster Wheeler completed a site specific health and safety checklist to identify project health and safety requirements, work site classification and personal protective equipment requirements.

The locations of buried and overhead services were obtained prior to the initiation of the subsurface investigation. The “Manitoba Click Before You Dig” program was contacted which notified the local service providers: Manitoba Telecommunications System (MTS), Manitoba Hydro, City of Winnipeg Sewer and Water, and City of Winnipeg Traffic Signals to mark their respective underground utility locations. In addition, the following local service providers were contacted directly by Amec Foster Wheeler: TeraSpan Fiberoptic, and Shaw Cable. A private locator was employed to identify private utilities for the test holes.

### **4.2 Test Hole Drilling and Soil Sampling Program**

Amec Foster Wheeler’s Brad Kennedy conducted the drilling program on 10 May 2016. The drilling program consisted of advancing three test holes (TH16-12 to TH16-14, inclusive). The test holes were not completed as groundwater monitoring wells. Test holes were drilled to a maximum depth of 6.1 m bgl utilizing continuous sampling techniques with a direct push track rig supplied and operated by Maple Leaf Drilling Ltd. of Winnipeg, Manitoba.

Test hole locations are outlined on Figure 2 (Appendix A). Test hole were advanced in the area of the ASTs located centrally on Site.

During test hole advancement, soil samples were recovered at regular depth (0.8 m) intervals. Soil samples were classified according to the Modified Unified Soil Classification System and visually assessed for evidence of impacts. Soils samples were collected and split; one portion was placed in laboratory prepared glass jars and pre-preserved glass vials (for possible laboratory analyses) and the other portion was placed in disposable soil bags (for field screening). Soil samples were field screened for combustible organic vapours using ambient temperature headspace (ATH) techniques and an RKI™ Eagle combustible vapour analyzer set in the no methane response mode. The ATH method involved partially filling and sealing a disposable soil bag with soil and allowing vapours to accumulate prior to analyzing the headspace. Accumulated vapours were measured in parts per million total organic vapours (ppm<sub>v</sub>). Soil samples were retained in laboratory prepared sample jars for possible laboratory analyzes.

Soil samples were stored in an insulated cooler that contained ice packs while on-Site and during transport to the laboratory. Field protocols and QA/QC procedures utilized by Amec Foster Wheeler were in accordance with industry standard protocols.

### **4.3 Laboratory Analysis**

Three select soil samples were submitted for laboratory analysis of BTEX and PHC fractions F1 to F4 and two samples were submitted for grain size analysis. Samples were submitted to

Amec Foster Wheeler's laboratory in Edmonton, Alberta. The Canadian Association Laboratory Accreditation Inc. (CALA) has accredited Amec Foster Wheeler's laboratory for testing parameters in accordance with the International Standard ISO/IEC 17025. The laboratory QA/QC is provided in Appendix D.

## 5.0 ASSESSMENT CRITERIA

### 5.1 General

Manitoba has adopted a series of environmental quality guidelines to be used in the assessment, management and reporting of contaminated Sites in Manitoba. Environmental assessment in Manitoba is based on the assessment protocol as produced by the Canadian Council of Ministers of the Environment (CCME) (CCME 2006). The following documents produced by CCME were selected as being applicable to assess the Site based on the contaminants of concern.

- ▶ CCME 2001 (revised 2011). Canada-Wide Standards (CWS) for Petroleum Hydrocarbons in Soil.
- ▶ CCME 1999 (updates to 2016). Canadian Environmental Quality Guidelines (EQGs).

Based on the above current CCME documents (and their precursors), Amec Foster Wheeler conducted an evaluation of the applicable exposure pathways, land uses, key receptors and a laboratory analysis of the predominant soil texture at the Site. The sensitivity assessment was conducted in accordance with current CCME guidelines and did not include the modification or recalculation of the formulas used to derive the criteria values.

### 5.2 Land Use

The CCME CWS 2008 has been developed for four generic land uses that have been adopted within these guidelines. A generic land use scenario is envisioned for each category based on the normal activities on these lands. The four land uses as defined by CCME are:

**Agricultural lands:** Agricultural land encompasses a wide range of activities including dairy, livestock and/or crop production. Most farms include a homestead, so the possible presence of an onsite residence (similar to those specified for residential/parkland sites, below) is considered in the default scenario. Agricultural lands are generally accessible by the farmer and his/her family members, including children, which represent the more sensitive human receptor category. Therefore, the critical human receptor in the agricultural land use category is assumed to be a toddler who receives 100% of his/her daily intake of soil and drinking water (groundwater) from the property.

**Residential/Parkland:** The generic residential property is a typical detached, single family home with a backyard where children, particularly toddlers, play. The critical receptor assumed on a residential property is a toddler who receives 100% of his/her daily intake of soil, drinking water (groundwater), and air (indoors) from the property. Separate guidelines have been developed for two house foundation construction styles; below grade concrete foundation wall and floor slab (basement) and concrete slab-on-grade foundation. Parks may serve as areas for

children's play and other family activities and are therefore also included in the residential land use category.

**Commercial:** Commercial properties span a wide variety of uses with varying degrees of public access. For purposes of criteria, the generic commercial property is assumed to contain a daycare facility, a sensitive commercial property use that is permitted in many municipal jurisdictions in Canada. It is assumed that the critical receptor (toddler) spends a substantial portion of the weekdays at a daycare. In particular, it is assumed that the toddler spends 10 hours per day, 5 days per week for 48 weeks per year at the daycare. The toddler thereby receives an amount of his/her daily intake of drinking water (groundwater), and air (indoors) from the commercial property proportional to the number of hours per day, days per week and weeks per year spent at the facility. Intake via direct contact with soil (soil ingestion and dermal contact) is proportional to the days per week and weeks per year spent at the facility. Most commercial buildings are constructed with concrete slab-on-grade foundations.

**Industrial:** Industrial properties span a wide variety of uses but generally do not permit direct public access and therefore, children are not likely or frequently present. For purposes of deriving criteria, the generic industrial property is assumed to be a site with a building frequented by an adult worker who spends 10 hours per day, 5 days per week for 48 weeks per year on the property. The adult receptor thereby receives an amount of his/her daily intake of drinking water (groundwater), and air (indoors) from the industrial property proportional to the number of hours per day, days per week and weeks per year spent at the facility. Intake via direct contact with soil (soil ingestion and dermal contact) is proportional to the days per week and weeks per year spent at the facility. Most industrial buildings are constructed with concrete slab-on-grade foundations.

It is understood that the Site use will remain as commercial land use, and so commercial guidelines will be used for assessment in this report.

### 5.3 Grain Size Designation

The CCME guidelines are prescribed for coarse-grained and fine-grained soils for select impact assessments. Fine-grained soils are defined as having a median grain size of less than or equal to 75  $\mu\text{m}$ ; coarse-grained soils have a median grain size of greater than 75  $\mu\text{m}$ . Where both fine and coarse-grained strata are present, the dominant soil particle size is determined by the stratum governing horizontal and vertical migration to a receptor.

Laboratory grain size analysis was completed on two soil samples representative of the potential contaminant migration zone at the Site. The results of the grain size analysis indicated the following:

- ▶ TH16-14 @ 1.2 – 1.5 m had 99.8 % of its material pass through the 75  $\mu\text{m}$  sieve.
- ▶ TH16-14 @ 5.2 – 5.5 m had 99.3 % of its material pass through the 75  $\mu\text{m}$  sieve.

Based on these results the Site has been classified as fine-grained for the purposes of this assessment.

## **5.4 Applicable Exposure Pathways**

CCME recognizes two soil horizons; surface soil and sub soils for PHC assessments. As indicated in the Manitoba Sustainable Development (MSD) Information Bulletin dated October 2014, surface soil is inclusive of material from the surface to 1.5 m (i.e. 1.5 m depth) and sub soils includes the material located below 1.5 m (i.e. >1.5 m depth). Exposure pathways are assessed individually for both horizons.

### **5.4.1 Human Exposure Pathways**

Potential human exposure pathways include the following: direct contact (soil ingestion, dermal contact, and soil inhalation), indoor vapour inhalation, and the protection of potable groundwater. The applicability of each of these potential exposure pathways are discussed in the following sections.

#### **5.4.1.1 Direct Contact Pathway**

The majority of the Site is currently surfaced with gravel which is not a sufficient barrier to prevent direct contact. As such, the direct contact (soil ingestion, dermal contact, and soil inhalation) pathways would be considered applicable to the surface soil horizon.

The direct contact pathway is not considered applicable for the subsoil as the surface soil creates a suitable barrier to avoid contact. It is assumed that any ground disturbance in which soils at depth previously not accessible are brought to ground surface would result in short term exposure and not be considered applicable to the exposure models in which the CCME guidelines are derived.

#### **5.4.1.2 Vapour Inhalation Pathway**

The indoor vapour inhalation (slab-on-grade) pathway would be considered applicable to both the surface and subsoil horizons at the Site due to the presence of occupied buildings on the Site.

#### **5.4.1.3 Protection of Potable Groundwater Pathway**

##### Potable Groundwater Pathway

CCME considers all water bearing units as a potential potable groundwater resource; however CCME defines a water bearing unit as having a hydraulic conductivity of greater than  $10^{-4}$  cm/s. Furthermore, MSD recognizes the division between contaminated soil and groundwater that is not hydraulically connected to an underlying aquifer. A 5 m thickness of massive unfractured saturated fine-grained material, with a bulk hydraulic conductivity less than  $10^{-5}$  cm/s is considered sufficient isolation of groundwater aquifers.

A substantial thickness of fine-grained soil was not confirmed during the subsurface investigation. However, based on available stratigraphic information as presented in section 6.2.1, the bedrock limestone aquifer underlying this area is the main known aquifer for this area. The bedrock consists of dolomitic limestone and is estimated to occur at 15 to 18 m. As the

bedrock is known to be overlain by up to 15 m of glacial lacustrine, fine-grained sediment (silt and clay), it is expected that a sufficient confining layer between known contaminants and the underlying aquifer is present.

The present and potential future land use of the Site and surrounding properties are supplied with potable water through the City of Winnipeg municipal system, which is drawn from a source over 100 km from the city. It is therefore unlikely that there would be usage of groundwater for potable purposes at or in the vicinity of the Site.

Based on the above, the potable groundwater pathway is not considered to be applicable for the Site.

## **5.4.2 Ecological Exposure Pathways**

Potential ecological exposure pathways include the ecological soil contact and freshwater aquatic life pathways. The applicability of each of these potential exposure pathways are discussed in the following sections.

### **5.4.2.1 Ecological Soil Contact Pathway**

The ecological soil contact pathway is protective of potential ecological receptor exposure, from terrestrial and subterranean organisms and plant root systems, to soils in the surface soil horizon. As the majority of the Site is surfaced with gravel, which is not considered to be an appropriate barrier, the ecological soil contact pathway is considered applicable to the Site.

Ecological receptor direct contact exposure to soils in the subsoil horizon is not considered applicable as the surface soil creates a suitable barrier to avoid subsoil ecological contact from organisms at the ground surface and the subsoil horizon is not typically suitable to support invertebrates or burrowing mammals.

### **5.4.2.2 Freshwater Aquatic Life Pathway**

CCME states that the freshwater aquatic life pathway may be excluded in cases where there is no surface water body within 10 m of a site classified as fine-grained and 500 m of a site classified as coarse-grain for BTEX components. The freshwater aquatic life pathway is excluded in cases where there is no surface water body within 500 m for other parameters. If a surface water body is within 500 m it must be assessed to determine whether the freshwater aquatic life pathway is applicable.

The closest surface water body is the Seine River located approximately 1900 m west of the Site. As such the freshwater aquatic life pathway is not applicable to the Site.

## **5.4.3 Miscellaneous Exposure Pathways**

An off-site migration pathway was developed to compensate for more sensitive land uses in the vicinity of assessed sites.

#### **5.4.3.1 Off-Site Migration Check**

As the neighbouring properties consist of industrial and commercial land uses, the off-site migration check does not apply to the Site.

#### **5.4.3.2 Management Limit**

The management limits for PHCs applies for soils in the surface soil and subsoil horizon.  
Summary of Applicable Criteria

Given the commercial land use of the Site, the fine-grained nature of the soil and the applicable exposure pathways as outlined in the previous sections, Amec Foster Wheeler determined assessment guidelines for each parameter. The most stringent of the applicable exposure pathway guideline values as produced by CCME was employed for assessment of each contaminant for both the surface soil and subsoil horizons, where applicable.

Amec Foster Wheeler has chosen the following applicable guideline criteria for the Site which are further summarized in Table 2 (Appendix B):

##### Soil Assessment Criteria - Petroleum Hydrocarbons

Commercial values less than or equal to 1.5 m bgl in in a non-potable groundwater situation as limited by the:

- ▶ Indoor vapour inhalation for benzene; and,
- ▶ Ecological Soil Contact for toluene, ethylbenzene, xylenes, and PHC fractions F1 to F4.

Commercial values greater than 1.5 m bgl in in a non-potable groundwater situation as limited by the:

- ▶ Indoor vapour inhalation for benzene, toluene, ethylbenzene, and xylenes; and,
- ▶ Management Limits for PHC fractions F1 to F4.

### **5.5 MANITOBA SUSTAINABLE DEVELOPMENT CONTAMINATED/IMPACTED SITE REPORTING REQUIREMENTS**

As of 1 April 2014, the Contaminated Sites Remediation Act (CSRA) states “that the owner or occupier of a site must notify MSD in writing when he or she becomes aware of information that indicates that the site has been contaminated at a level that exceeds a standard established or adopted by regulation (CSRR)” (CSRA C205, 2014).

The Contaminated Site Remediation Regulation (CSRR) establishes standards for when it is necessary to submit a site report to MSD. The reporting threshold outlined in the CSRA and CSRR includes the CCME guideline values listed in the previous section as the primary values, augmented by the Ontario Ministry of Environment (MOE), Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, 2011 and the Government of Alberta (ABEnv), Tier 1 Soil and Groundwater Remediation Guidelines 2014 for parameters that are not assessed under CCME. As such, the MSD reporting threshold values may not be equivalent to the applicable exposure pathway guidelines for the Site.

The applicable reporting requirements (referred to as the reporting standard) are included in the remedial criteria assessment Table 2 (Appendix B) as well as in soil analytical results tables for comparison purposes.

## **6.0 ASSESSMENT RESULTS**

### **6.1 Service Locations**

Manitoba Hydro, MTS, Shaw, City of Winnipeg Sewer and Water, City of Winnipeg Traffic Signals, Rogers, Shaw, TeraSpan Fiberoptic, as well as a private locator, were used to determine the location of underground utilities. The City of Winnipeg water and sewer indicated that water and sewer lines were present on Speers Road, but did not enter the Site near the work area. A Manitoba Hydro electrical and gas lines, as well as communications lines, were determined to not be located within the work area. The private utility locator indicated that a private underground electrical line ran west to east from the shed to the west of the ASTs, near Speers Road to a lamp and the ASTs. The Site plan is detailed on Figure 2 (Appendix A).

### **6.2 Soil Conditions**

#### **6.2.1 Regional and Local Geology**

Surficial geological conditions in the Red River valley region, which includes Winnipeg, generally consist of offshore glaciolacustrine sediments. These laminated sediment deposits, which consist of clay, silt, and minor sand, ranging from 1 to 20 m in thickness, were originally from deep waters of glacial Lake Agassiz (Matile and Keller 2004). These glaciolacustrine sediments are underlain by glacial till at an approximate depth of 12 to 15 m followed by bedrock. The bedrock in this area consists of dolomitic limestone and is of the Selkirk member (Baracos et al., 1983). Bedrock is estimated to occur at 15 to 18 m bgl.

#### **6.2.2 Site Stratigraphy**

Stratigraphy at test hole locations generally consisted of the following soil strata, in descending order from grade level:

- ▶ Granular Fill;
- ▶ Clay Fill;
- ▶ Silt; and,
- ▶ Clay.

A brief description of each of the soil strata is presented in the following paragraphs. More detailed depths and descriptions are included in the test hole logs (Appendix C).

##### Granular Fill

Granular fill materials were present on the Site at the surface and extended below the surface to a depth of 0.1 to 0.6 m bgl. The granular fill was typically poorly-graded sand and gravel, medium grained, damp, and brown.

### Clay Fill

Underlying the granular fill materials was a clay fill. The clay fill was generally silty, with trace gravel, high plastic, damp, stiff, and grey to black. The clay fill extended to depths between 0.7 and 1.4 m bgl.

### Silt

Silt was observed in test holes TH16-13 and TH16-14 to depths of 1.2 and 1.5 m bgl, respectively. The material had some clay, was low plastic, damp, firm and tan.

### Clay

High plasticity clay was observed to the termination depth of the test holes. The clay typically was silty, damp, stiff, black, grey and brown. Features such as silt and sulphate inclusions, silt seams, and oxides were observed at various depths in the test holes.

## **6.2.3 Field Observations**

Soil vapour concentrations and field observations made during the field investigations are summarized in Table 3 (Appendix B) and detailed on the test hole logs (Appendix C).

As Table 3 indicates, the maximum soil headspace vapour concentration encountered during the test hole drilling program was 55 ppm<sub>v</sub> in soil sample TH16-13 collected from a depth of 1.5 to 1.8 m bgl. Remaining test holes did not have soil sample vapour concentrations exceeding the equipment detection limit of <5 ppm<sub>v</sub>. Soil staining was observed in test hole TH16-13 in the clay between 1.4 and 2.0 m bgl.

## **6.2.4 Soil Laboratory Results**

Soil samples were submitted for laboratory analysis of PHC parameters to Amec Foster Wheeler's Edmonton Laboratory. Copies of the detailed analytical reports are provided in Appendix D.

### Petroleum Hydrocarbons

Three soil samples were selected to be submitted for laboratory analysis for PHC constituents, including BTEX and PHC fractions F1 to F4. Sample selection was based on stratigraphic location, visual observations of potential impacts, and field screening results. Results of the PHCs analysis are summarized in Table 4 (Appendix B) and shown on Figure 3 (Appendix A).

As indicated in Table 4, the sample collected from TH16-13, northeast of the AST, from a depth of 1.5 to 1.8 m bgl had a PHC fraction F2 concentration of 1390 mg/kg, exceeding the assessment guideline of 1000 mg/kg. The sample also had detectable concentrations of PHC fractions F1 and F3 which were below assessment guidelines. The remaining sample submitted for analysis had concentrations of PHCs below the laboratory's method detection limits. As the MSD reporting standards were equal to the assessment guideline, the concentration exceeding the assessment guideline also represent an exceedance of the MSD reporting standards.

## 6.3 Quality Assurance

### 6.3.1 Accreditation

The analytical laboratory employed to perform the laboratory analyses (Amec Foster Wheeler located in Edmonton, Alberta) is certified with the CALA.

### 6.3.2 Data Validation

#### Laboratory QA/QC

The laboratory also incorporates various QA/QC procedures to ensure the accuracy of the laboratory results and assess the possibility of false positives attributed to analytical equipment contributions and laboratory control samples. The laboratory QA/QC includes the completion of laboratory blanks, blank spikes and blank spike recovery. A summary of laboratory QA/QC findings is present below:

- ▶ Samples/sample extracts were analyzed within their applicable hold times using approved analytical methods;
- ▶ Agreement between the corresponding datasets for the reference material samples, where applicable, and recoveries reported for spiked samples/blanks, where applicable, were within acceptable range;
- ▶ Reported detection limits were met for the tested parameters;
- ▶ Surrogate recoveries were within acceptable ranges in all cases for all samples.

Based on the laboratory analysis, sample collection, sample storage, sample bottles and transportation of the samples to the laboratory, had no material effect on the quality of the data collected as part of this assessment. The laboratory results for the samples obtained during Amec Foster Wheeler's investigation are considered to be valid. The results of the QA/QC analyses are detailed on the laboratory Certificates of Analyses have been reviewed and are presented in Appendix D.

## 7.0 DISCUSSION

The results of the Phase II ESA drilling completed in May 2016 identified the presence of PHC impacted soil near the diesel fuel AST. The soil sample collected from TH16-13 from a depth of 1.5 to 1.8 m bgl had a PHC F2 concentration exceeding the applicable commercial guideline value.

Laboratory results of a sample collected from the same test hole (TH16-13) from a depth of 2.7 to 3.1 m bgl did not have detectable concentrations of PHC parameters, indicating that the impacts are not expected to extend to depths below 2.7 m. Additionally, as only one test hole had a sample with detectable PHC concentrations, it is anticipated that the impacts are limited and localized.

## 8.0 CONCLUSION & RECOMMENDATIONS

As per discussions with Star Building Materials, Amec Foster Wheeler understands that the Site is to remain as a commercial development, with a new retail building scheduled to be constructed over the AST area. Based on the observations made during the investigation conducted on 10 May 2016, it is suspected that the volume of impacted soil is limited and localized. Therefore, Amec Foster Wheeler recommends that PHC impacted soils from the area surrounding the AST be excavated as a part of the construction of the new building, and disposed of at a licensed soil treatment facility. If necessary, the soil should be replaced with clean fill or non-impacted fill materials generated on-Site as part of the redevelopment.

As the MSD Reporting Standards have been exceeded, this report is required to be submitted to MSD for their review.

Subject to approval from Star Building Materials, Amec Foster Wheeler will develop a remedial plan (RP) to submit to MSD detailing remedial work to be completed during the redevelopment of the Site.

## 9.0 CLOSURE

The American Society for Testing and Materials Standard of Practice notes that no environmental site assessment can wholly eliminate uncertainty regarding the potential for recognized environmental conditions in the connection with a property. Performance of a standardized environmental site assessment protocol is intended to reduce, but not eliminate, uncertainty regarding the potential for recognized environmental conditions in connection with the property, given reasonable limits of time and costs. The findings of this investigation are based on the interpretation of data from a limited number of hand auger boreholes and analytical results pertaining to specific samples. The evaluation and interpretations do not preclude the existence of chemical substances other than those identified herein, or the possibility that contamination levels can vary between the areas of the investigation.

This report was prepared for the exclusive use of Star Building Materials for the portion of the property containing ASTs located at 16 Speers Road in Winnipeg, Manitoba at the time the work was completed. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of the third party. Should additional parties require reliance on this report, written authorization from Amec Foster Wheeler will be required. With respect to third parties, Amec Foster Wheeler has no liability or responsibility for losses of any kind whatsoever, including direct or consequential financial effects on transactions or property values, or requirements for follow-up actions and costs.

The report is based on data and information collected by Amec Foster Wheeler during the supplemental investigation conducted on the property. It is based solely on the conditions of the Site encountered at the time of the site visits on 10 May 2016. Except as otherwise specified, Amec Foster Wheeler disclaims any obligation to update this report for events taking place, or with respect to information that becomes available to Amec Foster Wheeler after the time during, which Amec Foster Wheeler conducted the supplemental investigation.

In evaluating the property, Amec Foster Wheeler has relied in good faith on information provided by other individuals noted in this report. Amec Foster Wheeler has assumed that the information provided is factual and accurate. In addition, the findings in this report are based, to a large degree, upon information provided by the current owner/occupant. Amec Foster Wheeler accepts no responsibility for any deficiency, misstatement or inaccuracy contained in this report as a result of omissions, misinterpretations or fraudulent acts of persons interviewed or contacted.

Amec Foster Wheeler makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in this report, including, but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and change. Such interpretations and regulatory changes should be reviewed with legal counsel.

The general conditions of this report are specified in Appendix E.

We trust that this report meets your present requirements. If you have any questions or if we can be of further assistance, please contact our office.

Respectively submitted,  
**Amec Foster Wheeler Environment & Infrastructure,  
a Division of Amec Foster Wheeler Americas Limited**



Nathan Bartel, EIT  
Environmental Engineer-In-Training



Justin Huberdeau, C.E.T., EP  
Senior Environmental Technologist  
Project Manager

Reviewed by:



Michael Bertram, P.Eng.  
Senior Environmental Engineer

## 10.0 REFERENCES

Baracos, A., D.H. Shields, B.H. Kjartanson. 1983. Geological Engineering Report for Urban Development Winnipeg

Canadian Council of Ministers of the Environment (CCME) 1999 (updates to 2016). Canadian Environmental Quality Guidelines (EQG).

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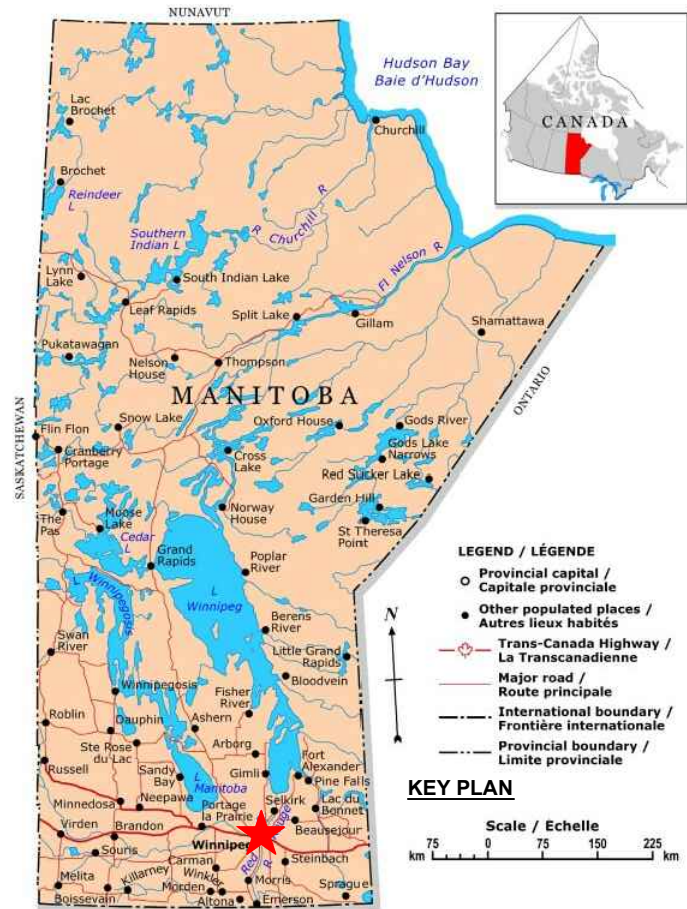
Matile, G.L.D. and Keller, G.R. 2004: Surficial geology of the Winnipeg map sheet (NTS 62H0, Manitoba; Manitoba Industry, Economic Development and Mines, Manitoba Geological Survey, Surficial Geology Compilation Map Series, SG-62H, scale 1:250 000.

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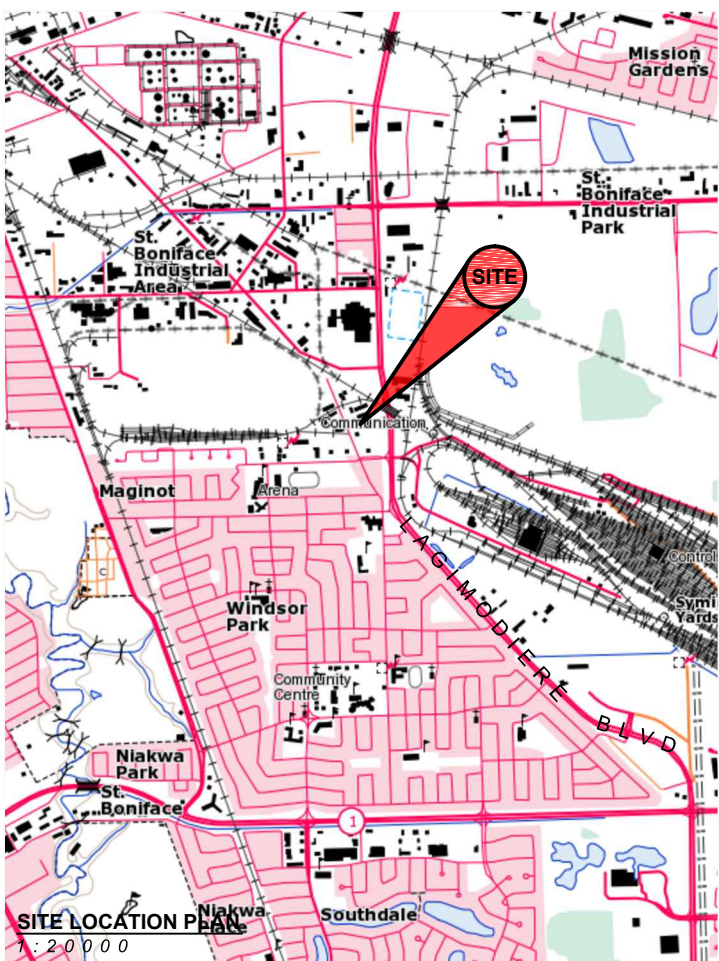


**APPENDIX A**

**FIGURES**



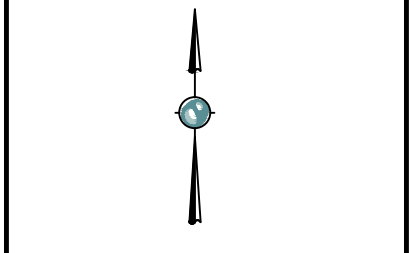
UNITED STATES OF AMERICA © 2001. Her Majesty the Queen in Right of Canada, Natural Resources Canada. ÉTATS-UNIS D'AMÉRIQUE Sa Majesté la Reine du chef du Canada, Ressources naturelles Canada.



**STAR BUILDING MATERIALS**

**LEGEND:**  
APPROXIMATE PROPERTY LINE — — — — —

**NOTE:**  
- SITE FEATURE LOCATIONS ARE APPROXIMATE.  
- IMAGES FROM C.O.W. TOPOGRAPHY TILES AND TOPO MAP.



NO.	REVISION	DATE	BY

**PHASE II ENVIRONMENTAL SITE ASSESSMENT**

16 SPEERS ROAD  
WINNIPEG, MANITOBA

**SITE AND SURROUNDING LAND USE PLAN**

SCALE: AS SHOWN  
DATE: APRIL 2017  
DRAWN BY: MD  
PROJECT NO.: WX18198

P:\J0851610\181905181905181905 - 16 SPEERS ROAD - PHASE II ES\DRAWINGS\WX18198.DWG

**STAR BUILDING MATERIALS**

**LEGEND:**  
 APPROXIMATE PROPERTY LINE   
 TEST HOLE 

**NOTE:**  
 - SITE FEATURE LOCATIONS ARE APPROXIMATE.  
 - IMAGES FROM C.O.W. TOPOGRAPHY TILES.



NO.	REVISION	DATE	BY

PHASE II ENVIRONMENTAL SITE ASSESSMENT

16 SPEERS ROAD  
WINNIPEG, MANITOBA

TEST HOLE LOCATION PLAN

SCALE: 1:200  
 DATE: APRIL 2017  
 DRAWN BY: MD  
 PROJECT NO.: WX18198

FIGURE 2



P:\J08\1619\051619\051619B - 16 SPEERS ROAD - PHASE I ESA\DRAWINGS\WX18198.DWG

STAR BUILDING MATERIALS

LEGEND:

APPROXIMATE PROPERTY LINE	---
TEST HOLE	⊕
BELOW CRITERIA	⬆
ABOVE CRITERIA	⬇

CCME Industrial CWS PHC – fine grained soils		
D(m)	<1.5	>1.5
B(µg/g)	2.8	2.9
T(µg/g)	330	13000
E(µg/g)	430	6400
X(µg/g)	230	1600
F1(µg/g)	320	800
F2(µg/g)	260	1000
F3(µg/g)	2500	5000
F4(µg/g)	6600	10000

NOTE:  
 - SITE FEATURE LOCATIONS ARE APPROXIMATE.  
 - IMAGES FROM C.O.W. TOPOGRAPHY TILES.



NO.	REVISION	DATE	BY

PHASE II ENVIRONMENTAL SITE ASSESSMENT

16 SPEERS ROAD  
 WINNIPEG, MANITOBA

SOIL ANALYTICAL RESULTS  
 (PHCs)

SCALE: 1:200  
 DATE: APRIL 2017  
 DRAWN BY: MD  
 PROJECT NO.: WX18198

FIGURE 3



TH16-13		
D(m)	1.5-1.8	2.7-3.1
V.L.(ppm)	55	<5
B(µg/g)	<0.005	<0.005
T(µg/g)	<0.03	<0.03
E(µg/g)	<0.01	<0.01
X(µg/g)	<0.03	<0.03
F1(µg/g)	60.6	<5.0
F2(µg/g)	1390	<30
F3(µg/g)	407	<30
F4(µg/g)	<30	<30

TH16-12	
D(m)	1.2-1.5
V.L.(ppm)	<5
B(µg/g)	<0.005
T(µg/g)	<0.03
E(µg/g)	<0.01
X(µg/g)	<0.03
F1(µg/g)	<5.0
F2(µg/g)	<30
F3(µg/g)	<30
F4(µg/g)	<30

P:\JOB\16190\16190\16190 - 16 SPEERS ROAD - PHASE II ES&D\DRAWINGS\WX18198.DWG



## **APPENDIX B**

### **TABLES**

TABLE 1: SITE AND SURROUNDING LAND USE		
Direction	Land Use	Approx. Distance (m)
Site	16 Speers Road, Commercial Land Use (Star Building Materials)	Site
North	CN Rail spur line, followed by a building materials staging property, and vacant land	adjacent / 15m / 40m
East	Utility Corridor followed by Route 59 and CN Rail Main Line	adjacent / 55m
South	Frontier School Division Office, followed by Maginot Street	adjacent / 70m
West	Speers Road followed by commercial/industrial properties. 24 Speers Road is located near the southwest corner of the Site, and is adjoined to the north, east and south with the Site. The property operates as part of the Star Building Materials facility (Administration Building).	adjacent / 30m

TABLE 2: ASSESSMENT GUIDELINES

Land Use	Exposure Pathway	Fine Grained Soil Guidelines (µg/g) (PHCs)							
		Benzene <sup>1</sup>	Toluene	Ethylbenzene	Xylenes	PHC (F1)	PHC (F2)	PHC (F3)	PHC (F4)
Commercial (≤ 1.5 m depth)	Soil Ingestion	110	82000	36000	560000	19000	10000	23000	RES
	Dermal Contact	250	790000	210000	NA				
	Soil Inhalation	NC	NC	NC	NC	NA	NA	NA	NA
	Indoor Vapour Inhalation (slab on grade)	<b>2.8</b>	13000	6500	1600	4600	23000	NA	NA
	Ecological Contact	310	<b>330</b>	<b>430</b>	<b>230</b>	<b>320</b>	<b>260</b>	<b>2500</b>	<b>6600</b>
	Management Limits	NA	NA	NA	NA	800	1000	5000	10000
	<i>MSD Reporting Standard</i> <sup>2</sup>	<b>2.8</b>	<b>330</b>	<b>430</b>	<b>230</b>	<b>320</b>	<b>260</b>	<b>2500</b>	<b>6600</b>
Commercial (> 1.5 m depth)	Indoor Vapour Inhalation (slab on grade)	<b>2.9</b>	<b>13000</b>	<b>6400</b>	<b>1600</b>	4600	23000	NA	NA
	Management Limits	NA	NA	NA	NA	<b>800</b>	<b>1000</b>	<b>5000</b>	<b>10000</b>
	<i>MSD Reporting Standard</i> <sup>2</sup>	<b>2.9</b>	<b>13000</b>	<b>6400</b>	<b>1600</b>	<b>800</b>	<b>1000</b>	<b>5000</b>	<b>10000</b>

Notes:

<sup>1</sup> Benzene guidelines were selected based on the 10<sup>-5</sup> incremental risk for human health

<sup>2</sup> As per the Contaminated Sites Remediation Act (CSRA) and the standards for reporting established by regulation (CSRR) . Standards are based on CCME standards unless otherwise noted

J PHC (F1) - volatile petroleum hydrocarbons (C<sub>6</sub> – C<sub>10</sub>); correct for BTEX concentrations

J PHC (F2) - extractable petroleum hydrocarbons (C<sub>10</sub> – C<sub>16</sub>)

J PHC (F3) - extractable petroleum hydrocarbons (C<sub>16</sub> – C<sub>34</sub>)

J PHC (F4) - extractable petroleum hydrocarbons (C<sub>34</sub> – C<sub>50</sub>)

J mg/kg - concentration in milligrams per kilogram equivalent to µg/g - micro gram per gram

J mg/L - concentration in milligrams per litre

**BOLD** – selected guideline

*Italics* – MSD Reporting Standard

J NA- not applicable

J NG - no guideline available

J RES - Residual PHC formation. Calculated value exceeds 30,000 mg/kg and solubility limit for PHC fraction.

J CCME EQG Guideline – commercial land use criteria as outlined in the Canadian Council of the Ministers of the Environment (CCME) "[Canadian Environmental Quality Guidelines](#)", 1999 (updates to 2016).

J CCME CWS PHC Guideline - commercial land use criteria as outlined in the Canadian Council of the Ministers of the Environment (CCME) "[Canada-Wide Standards for Hydrocarbons in Soil](#)", 2001, revised 2008.

J MSD - Manitoba Sustainable Development

TABLE 3: FIELD OBSERVATIONS AND SOIL VAPOUR TESTING					
Test Hole	Converted to well	Total Depth (m bgl)	Suspect Staining Encountered (m)	Max. FID Soil Vapour Concentration (PHC field screening)	
				Level (ppm <sub>v</sub> )	Depth (m)
TH16-12	No	6.1	None	<5	0 to 6.1
TH16-13	No	6.1	1.4 - 2.0	55	1.5 to 1.8
TH16-14	No	6.1	None	<5	0 to 6.1

Notes:

- ) ppm<sub>v</sub> – parts per million combustible vapour
- ) m - metres
- ) N/A - not applicable
- ) FID - Flame Ionization Detector

TABLE 4: SOIL ANALYTICAL RESULTS - PHCs											
Sample ID	Depth (m)	Soil FID Vapour Concentration (ppm <sub>v</sub> )	Grain Size Analysis (% passing 75 µm sieve)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (mg/kg)	PHC F1 (mg/kg)	PHC F2 (mg/kg)	PHC F3 (mg/kg)	PHC F4 (mg/kg)
TH16-12 @ 1.2-1.5m	0.6-0.9	< 5	---	< 0.005	< 0.03	< 0.01	< 0.03	< 5.0	< 30	< 30	< 30
TH16-14 @ 1.2-1.5m		< 5	99.8	---	---	---	---	---	---	---	---
<b>CCME Industrial EQG (≤ 1.5m depth) <sup>1</sup></b>				<b>2.8</b>	<b>330</b>	<b>430</b>	<b>230</b>	<b>NG</b>	<b>NG</b>	<b>NG</b>	<b>NG</b>
<b>CCME Industrial CWS PHC – fine grained soils (≤ 1.5m depth below grade) <sup>1</sup></b>				<b>NG</b>	<b>NG</b>	<b>NG</b>	<b>NG</b>	<b>320</b>	<b>260</b>	<b>2500</b>	<b>6600</b>
TH16-13 @ 1.5-1.8m	2.1-2.4	55	---	< 0.005	< 0.03	< 0.01	< 0.03	60.6	<b>1390</b>	407	< 30
TH16-13 @ 2.7-3.1m	2.1-2.4	< 5	---	< 0.005	< 0.03	< 0.01	< 0.03	< 5.0	< 30	< 30	< 30
TH16-14 @ 5.2-5.5m		< 5	99.3	---	---	---	---	---	---	---	---
<b>CCME Industrial EQG (&gt; 1.5m depth) <sup>1</sup></b>				<b>2.9</b>	<b>13000</b>	<b>6400</b>	<b>1600</b>	<b>NG</b>	<b>NG</b>	<b>NG</b>	<b>NG</b>
<b>CCME Industrial CWS PHC – fine grained soils (&gt; 1.5m depth below grade) <sup>1</sup></b>				<b>NG</b>	<b>NG</b>	<b>NG</b>	<b>NG</b>	<b>800</b>	<b>1000</b>	<b>5000</b>	<b>10000</b>

Notes:

- ppm<sub>v</sub> – parts per million organic vapour
- FID - Flame Ionization Detector
- **BOLD** – exceeds the referenced guideline
- PHC F1 - volatile petroleum hydrocarbons (C<sub>6</sub> – C<sub>10</sub>); corrected for BTEX concentrations
- PHC F2 – extractable petroleum hydrocarbons (C<sub>10</sub>-C<sub>16</sub>)
- PHC F3 – extractable petroleum hydrocarbon (C<sub>16</sub>-C<sub>34</sub>)
- PHC F4 – extractable petroleum hydrocarbons (C<sub>34</sub>-C<sub>50</sub>)
- < - less than the method detection limit
- NG - No Guideline

<sup>1</sup> CCME EQG Criteria – commercial land use criteria as outlined in the Canadian Council of the Ministers of the Environment (CCME) "Canadian Environmental Quality Guidelines", 1999 (updates to 2016). The benzene concentration is based on one in one hundred thousand (10<sup>-5</sup>) incremental risk of cancer.

• CCME CWS PHC Criteria - commercial land use criteria as outlined in the Canadian Council of the Ministers of the Environment (CCME) "Canada-Wide Standards for Hydrocarbons in Soil", 2001, revised 2008.

• See laboratory report for detection limits, testing protocols and QA/QC procedures. Laboratory analysis was performed by Amec Foster Wheeler's Edmonton Laboratory.

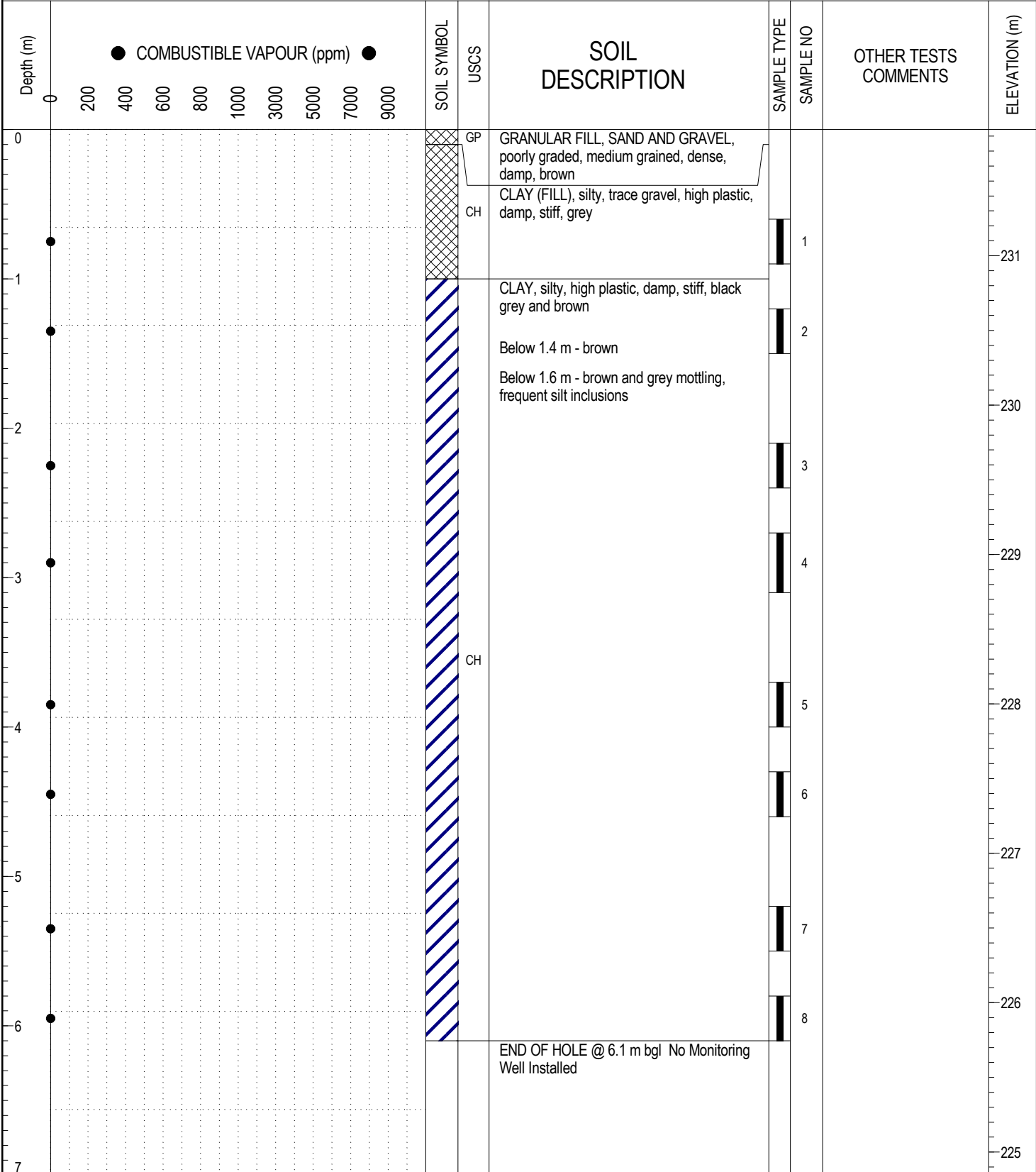
<sup>1</sup> As per the Contaminated Sites Remediation Act (CSRA) and the standards for reporting established by regulation (CSRR) . In this instance the reporting standards are equal to the guidelines and as such are not represented as a separate line



**APPENDIX C**

**TEST HOLE LOGS**

PROJECT: Phase II ESA	DRILLED BY: Maple Leaf Drilling	TEST HOLE NO: TH16-12
CLIENT: Qualico Communities		PROJECT NO: WX18198
LOCATION: 16 & 29 Speers Road	DRILL TYPE: Geoprobe	ELEVATION: 231.85 m
SAMPLE TYPE	<input type="checkbox"/> Shelby Tube <input type="checkbox"/> No Recovery <input type="checkbox"/> SPT Test (N) <input type="checkbox"/> Grab Sample <input type="checkbox"/> Split-Pen <input type="checkbox"/> Core	
BACKFILL TYPE	<input type="checkbox"/> Bentonite <input type="checkbox"/> Pea Gravel <input type="checkbox"/> Drill Cuttings <input type="checkbox"/> Grout <input type="checkbox"/> Bentonite Chips <input type="checkbox"/> Sand	



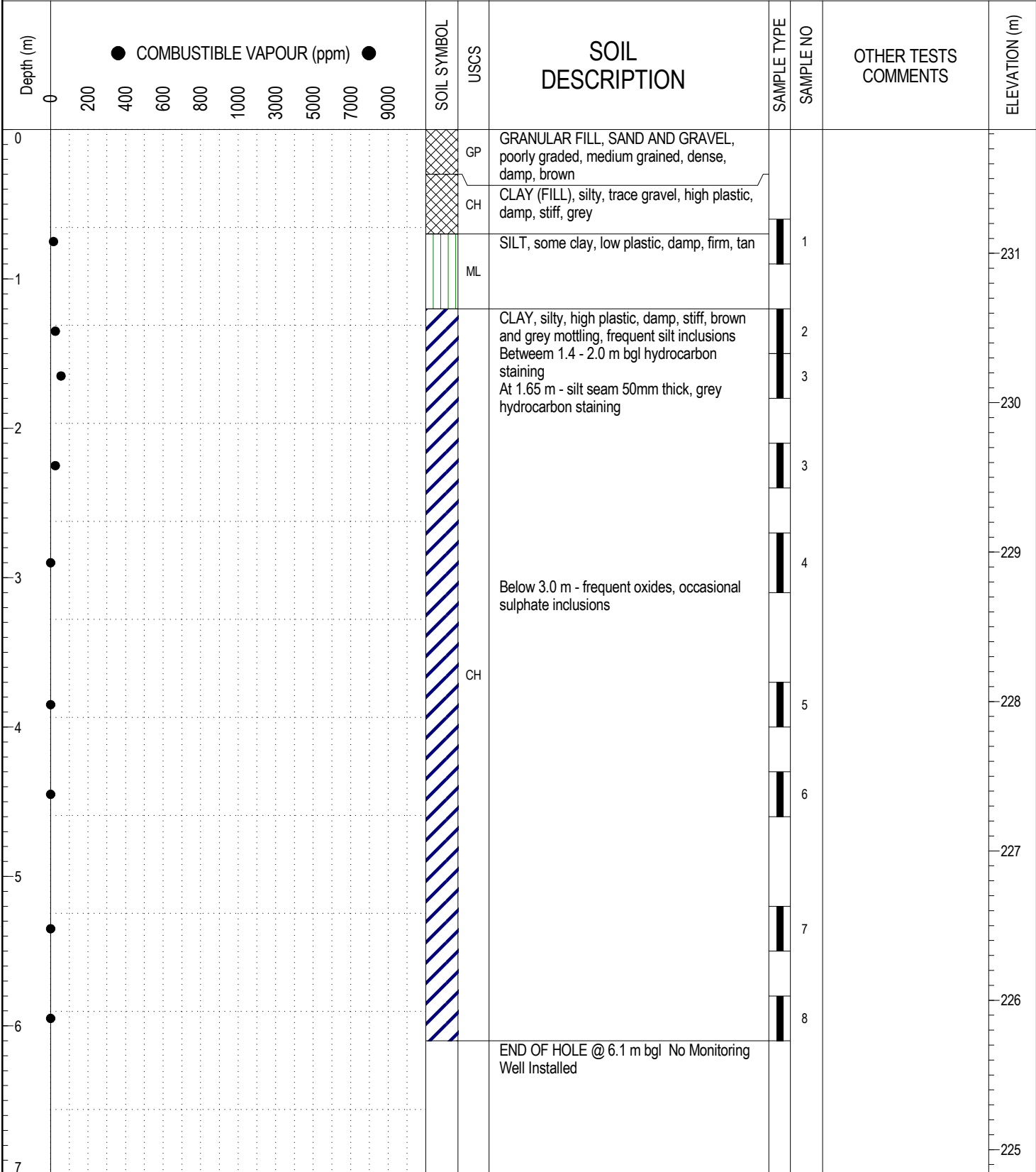
WX17937 - SPEERS RD PH II ESA.GPJ 16/05/12 12:04 PM (CO-OP ENV)



**Amec Foster Wheeler Environment & Infrastructure**  
Winnipeg, Manitoba

LOGGED BY: BK	COMPLETION DEPTH: 6.1 m
REVIEWED BY: PC	COMPLETION DATE: 10 May 2016
	Page 1 of 1

PROJECT: Phase II ESA	DRILLED BY: Maple Leaf Drilling	TEST HOLE NO: TH16-13
CLIENT: Qualico Communities		PROJECT NO: WX18198
LOCATION: 16 & 29 Speers Road	DRILL TYPE: Geoprobe	ELEVATION: 231.83 m
SAMPLE TYPE	<input type="checkbox"/> Shelby Tube <input type="checkbox"/> No Recovery <input type="checkbox"/> SPT Test (N) <input type="checkbox"/> Grab Sample <input type="checkbox"/> Split-Pen <input type="checkbox"/> Core	
BACKFILL TYPE	<input type="checkbox"/> Bentonite <input type="checkbox"/> Pea Gravel <input type="checkbox"/> Drill Cuttings <input type="checkbox"/> Grout <input type="checkbox"/> Bentonite Chips <input type="checkbox"/> Sand	



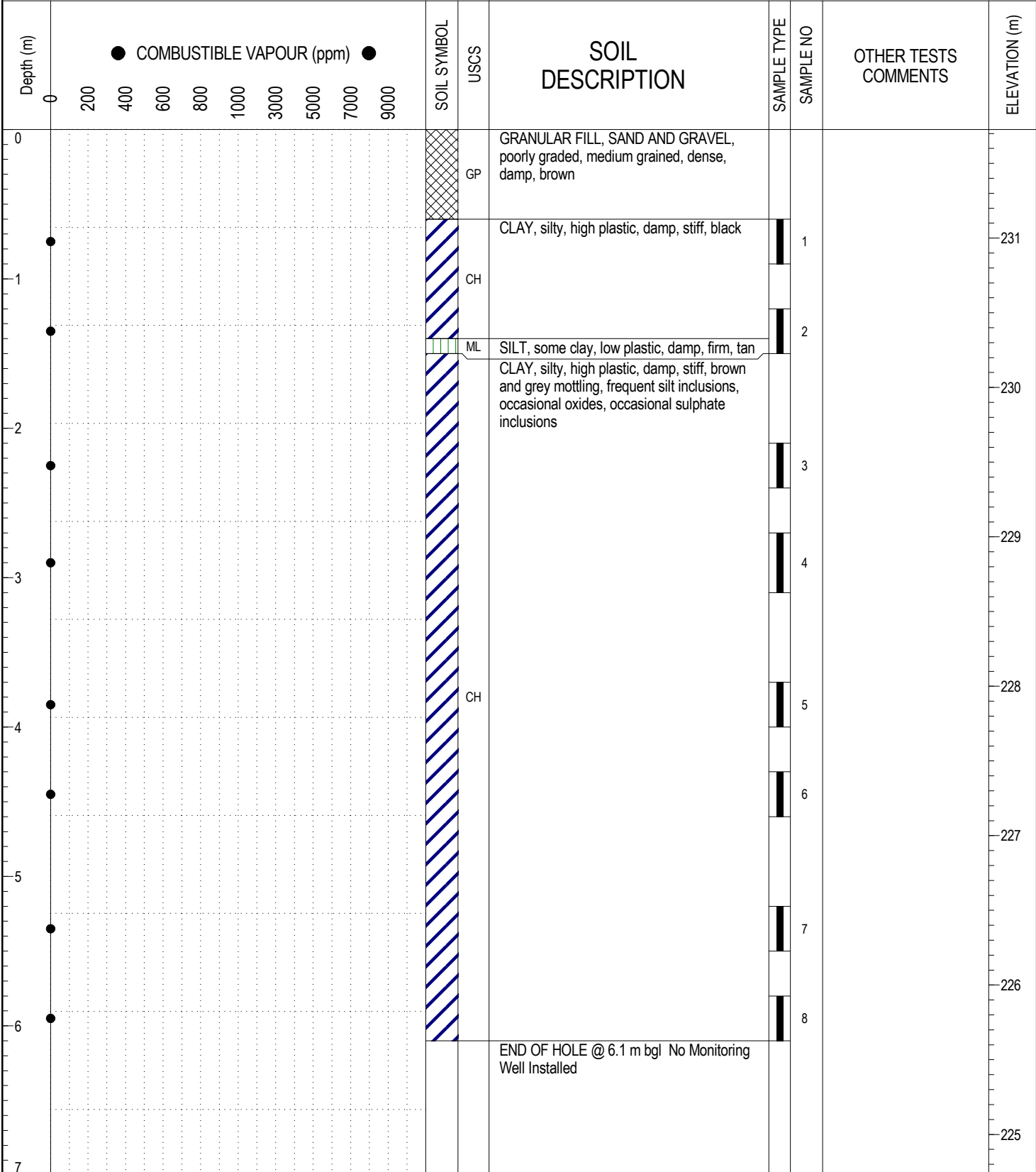
WX17937 - SPEERS RD PH II ESA.GPJ 16/05/12 12:04 PM (CO-OP ENV)



**Amec Foster Wheeler Environment & Infrastructure**  
Winnipeg, Manitoba

LOGGED BY: BK	COMPLETION DEPTH: 6.1 m
REVIEWED BY: PC	COMPLETION DATE: 10 May 2016
	Page 1 of 1

PROJECT: Phase II ESA	DRILLED BY: Maple Leaf Drilling	TEST HOLE NO: TH16-14
CLIENT: Qualico Communities		PROJECT NO: WX18198
LOCATION: 16 & 29 Speers Road	DRILL TYPE: Geoprobe	ELEVATION: 231.73 m
SAMPLE TYPE	<input type="checkbox"/> Shelby Tube <input type="checkbox"/> No Recovery <input type="checkbox"/> SPT Test (N) <input type="checkbox"/> Grab Sample <input type="checkbox"/> Split-Pen <input type="checkbox"/> Core	
BACKFILL TYPE	<input type="checkbox"/> Bentonite <input type="checkbox"/> Pea Gravel <input type="checkbox"/> Drill Cuttings <input type="checkbox"/> Grout <input type="checkbox"/> Bentonite Chips <input type="checkbox"/> Sand	



WX17937 - SPEERS RD PH II ESA.GPJ 16/05/12 12:04 PM (CO-OP ENV)



**Amec Foster Wheeler Environment & Infrastructure**  
Winnipeg, Manitoba

LOGGED BY: BK	COMPLETION DEPTH: 6.1 m
REVIEWED BY: PC	COMPLETION DATE: 10 May 2016
	Page 1 of 1



**APPENDIX D**

**LABORATORY RESULTS**

## Final Analytical Report

Attention: Pat Campbell

Amec Foster Wheeler Environment & Infrastructure  
440 Dovercourt Drive  
Winnipeg, MB R3Y 1N4

Results for File: EC-70898

Project Number: WX17937

Project Name: Phase II ESA Speers Road

Date Received: 2016/05/12

Date of Report: 2016/05/19

Report reviewed by:



Jesse Dang, B.Sc.  
Manager  
Laboratory Services



Kristine Connor  
Director of QA/QC  
Laboratory Services

\*\* All samples will be disposed of after 30 days following analysis. Please contact the lab if you require additional sample storage time. (Samples deemed hazardous will be returned to the client at their own expense or disposal will be arranged.) \*\*

# ANALYTICAL REPORT



## Soil Analysis - Hydrocarbons

Project No. WX17937

Final  
File No. EC-70898

Analyst	Date of Analysis (yyyy/m/d)	Analytical Parameter	Units	Reference Method	Lab #:	16-4218	16-4221	16-4222	16-4223
					Client ID:	Surface B	Surface E	TH16-02 @ 1.2-1.5m	TH16-02 @ 2.1-2.4m
					Sample Date:	2016/05/06 0:00	2016/05/09 0:00	2016/05/09 0:00	2016/05/09 0:00
					DL				
MS	2016/05/17	Grain Size	%Fine<75µm	Carter 55.2.3	0.1	---	---	---	99.7
LL	2016/05/12	Benzene	mg/kg (ppm)	EPA 8260B	0.005	---	---	0.010	---
LL	2016/05/12	Toluene	mg/kg (ppm)	EPA 8260B	0.03	---	---	< 0.03	---
LL	2016/05/12	Ethylbenzene	mg/kg (ppm)	EPA 8260B	0.01	---	---	0.05	---
LL	2016/05/12	Total Xylenes	mg/kg (ppm)	EPA 8260B	0.03	---	---	0.05	---
LL	2016/05/12	Surrogate Recovery	%	--	0.1	---	---	101	---
LL	2016/05/12	F1 (C6-C10)	mg/kg (ppm)	CCME	5.0	---	---	< 5.0	---
PC	2016/05/12	F2 (EPH C10-C16)	mg/kg (ppm)	CCME	30	107	265	325	---
PC	2016/05/12	F3 (EPH C16-C34)	mg/kg (ppm)	CCME	30	53200	40400	6870	---
PC	2016/05/12	F4 (EPH C34-C50)	mg/kg (ppm)	CCME	30	2220	7760	1190	---
PC	2016/05/12	Moisture	%	---	0.5	3.3	5.1	26.1	---
MS	2016/05/17	F1 - BTEX	mg/kg (ppm)	CCME	5.00	---	---	< 5.00	---

Analyst	Date of Analysis (yyyy/m/d)	Analytical Parameter	Units	Reference Method	Lab #:	16-4223-D	16-4225	16-4226	16-4227
					Client ID:		TH16-03 @ 0.6-0.9m	TH16-03 @ 2.1-2.4m	TH16-04 @ 0.6-0.9m
					Sample Date:	Lab Duplicate	2016/05/09 0:00	2016/05/09 0:00	2016/05/09 0:00
					DL				
MS	2016/05/17	Grain Size	%Fine<75µm	Carter 55.2.3	0.1	99.7	---	---	---
LL	2016/05/12	Benzene	mg/kg (ppm)	EPA 8260B	0.005	---	6.98	< 0.005	0.038
LL	2016/05/12	Toluene	mg/kg (ppm)	EPA 8260B	0.03	---	248	< 0.03	0.05
LL	2016/05/12	Ethylbenzene	mg/kg (ppm)	EPA 8260B	0.01	---	155	< 0.01	0.54
LL	2016/05/12	Total Xylenes	mg/kg (ppm)	EPA 8260B	0.03	---	1040	< 0.03	0.34
LL	2016/05/12	Surrogate Recovery	%	--	0.1	---	109	101	100
LL	2016/05/12	F1 (C6-C10)	mg/kg (ppm)	CCME	5.0	---	3740	< 5.0	59.2
PC	2016/05/12	F2 (EPH C10-C16)	mg/kg (ppm)	CCME	30	---	2280	< 30	97
PC	2016/05/12	F3 (EPH C16-C34)	mg/kg (ppm)	CCME	30	---	85	< 30	1410
PC	2016/05/12	F4 (EPH C34-C50)	mg/kg (ppm)	CCME	30	---	< 30	< 30	511
PC	2016/05/12	Moisture	%	---	0.5	---	16.5	28.6	22.9
MS	2016/05/17	F1 - BTEX	mg/kg (ppm)	CCME	5.00	---	2290	< 5.00	58.2

# ANALYTICAL REPORT



## Soil Analysis - Hydrocarbons

Project No. WX17937

Final  
File No. EC-70898

Analyst	Date of Analysis (yyyy/m/d)	Analytical Parameter	Units	Reference Method	Lab #:	16-4228	16-4229	16-4230	16-4231
					Client ID:	TH16-05 @ 0.6-0.9m	TH16-06 @ 2.1-2.4m	TH16-06 @ 5.8-6.1m	TH16-07 @ 1.2-1.5m
					Sample Date:	2016/05/09 0:00	2016/05/09 0:00	2016/05/09 0:00	2016/05/10 0:00
					DL				
MS	2016/05/17	Grain Size	%Fine<75µm	Carter 55.2.3	0.1	---	---	99.4	---
LL	2016/05/12	Benzene	mg/kg (ppm)	EPA 8260B	0.005	< 0.005	< 0.005	---	< 0.005
LL	2016/05/12	Toluene	mg/kg (ppm)	EPA 8260B	0.03	< 0.03	< 0.03	---	< 0.03
LL	2016/05/12	Ethylbenzene	mg/kg (ppm)	EPA 8260B	0.01	< 0.01	< 0.01	---	< 0.01
LL	2016/05/12	Total Xylenes	mg/kg (ppm)	EPA 8260B	0.03	< 0.03	< 0.03	---	0.06
LL	2016/05/12	Surrogate Recovery	%	--	0.1	101	99.0	---	100
LL	2016/05/12	F1 (C6-C10)	mg/kg (ppm)	CCME	5.0	< 5.0	< 5.0	---	< 5.0
PC	2016/05/12	F2 (EPH C10-C16)	mg/kg (ppm)	CCME	30	< 30	< 30	---	< 30
PC	2016/05/12	F3 (EPH C16-C34)	mg/kg (ppm)	CCME	30	180	< 30	---	1480
PC	2016/05/12	F4 (EPH C34-C50)	mg/kg (ppm)	CCME	30	100	< 30	---	654
PC	2016/05/12	Moisture	%	---	0.5	18.5	27.2	---	24.1
MS	2016/05/17	F1 - BTEX	mg/kg (ppm)	CCME	5.00	< 5.00	< 5.00	---	< 5.00

Analyst	Date of Analysis (yyyy/m/d)	Analytical Parameter	Units	Reference Method	Lab #:	16-4231-D	16-4232	16-4233	16-4234
					Client ID:		TH16-08 @ 1.2-1.5m	TH16-09 @ 1.2-1.5m	TH16-10 @ 1.2-1.5m
					Sample Date:	Lab Duplicate	2016/05/10 0:00	2016/05/10 0:00	2016/05/10 0:00
					DL				
LL	2016/05/12	Benzene	mg/kg (ppm)	EPA 8260B	0.005	< 0.005	< 0.005	< 0.005	< 0.005
LL	2016/05/12	Toluene	mg/kg (ppm)	EPA 8260B	0.03	< 0.03	< 0.03	< 0.03	< 0.03
LL	2016/05/12	Ethylbenzene	mg/kg (ppm)	EPA 8260B	0.01	0.01	< 0.01	< 0.01	< 0.01
LL	2016/05/12	Total Xylenes	mg/kg (ppm)	EPA 8260B	0.03	0.06	< 0.03	< 0.03	< 0.03
LL	2016/05/12	Surrogate Recovery	%	--	0.1	100	100	100	101
LL	2016/05/12	F1 (C6-C10)	mg/kg (ppm)	CCME	5.0	< 5.0	< 5.0	< 5.0	< 5.0
PC	2016/05/12	F2 (EPH C10-C16)	mg/kg (ppm)	CCME	30	< 30	< 30	< 30	< 30
PC	2016/05/12	F3 (EPH C16-C34)	mg/kg (ppm)	CCME	30	1120	79	839	< 30
PC	2016/05/12	F4 (EPH C34-C50)	mg/kg (ppm)	CCME	30	633	43	292	< 30
PC	2016/05/12	Moisture	%	---	0.5	20.0	26.4	24.1	28.7
MS	2016/05/17	F1 - BTEX	mg/kg (ppm)	CCME	5.00	< 5.00	< 5.00	< 5.00	< 5.00

# ANALYTICAL REPORT



## Soil Analysis - Hydrocarbons

Project No. WX17937

Final  
File No. EC-70898

Analyst	Date of Analysis (yyyy/m/d)	Analytical Parameter	Units	Reference Method	Lab #:	16-4235	16-4236	16-4237	16-4238
					Client ID:	TH16-12 @ 1.2-1.5m	TH16-13 @ 1.5-1.8m	TH16-13 @ 2.7-3.1m	TH16-14 @ 1.2-1.5m
					Sample Date:	2016/05/10 0:00	2016/05/10 0:00	2016/05/10 0:00	2016/05/10 0:00
					DL				
MS	2016/05/17	Grain Size	%Fine<75µm	Carter 55.2.3	0.1	---	---	---	99.8
LL	2016/05/12	Benzene	mg/kg (ppm)	EPA 8260B	0.005	< 0.005	< 0.005	< 0.005	---
LL	2016/05/12	Toluene	mg/kg (ppm)	EPA 8260B	0.03	< 0.03	< 0.03	< 0.03	---
LL	2016/05/12	Ethylbenzene	mg/kg (ppm)	EPA 8260B	0.01	< 0.01	< 0.01	< 0.01	---
LL	2016/05/12	Total Xylenes	mg/kg (ppm)	EPA 8260B	0.03	< 0.03	< 0.03	< 0.03	---
LL	2016/05/12	Surrogate Recovery	%	--	0.1	101	103	102	---
LL	2016/05/12	F1 (C6-C10)	mg/kg (ppm)	CCME	5.0	< 5.0	60.6	< 5.0	---
PC	2016/05/12	F2 (EPH C10-C16)	mg/kg (ppm)	CCME	30	< 30	1390	< 30	---
PC	2016/05/12	F3 (EPH C16-C34)	mg/kg (ppm)	CCME	30	< 30	407	< 30	---
PC	2016/05/12	F4 (EPH C34-C50)	mg/kg (ppm)	CCME	30	< 30	< 30	< 30	---
PC	2016/05/12	Moisture	%	---	0.5	25.5	28.2	34.6	---
MS	2016/05/17	F1 - BTEX	mg/kg (ppm)	CCME	5.00	< 5.00	60.6	< 5.00	---

Analyst	Date of Analysis (yyyy/m/d)	Analytical Parameter	Units	Reference Method	Lab #:	16-4239
					Client ID:	TH16-14 @ 5.2-5.5m
					Sample Date:	2016/05/10 0:00
					DL	
MS	2016/05/17	Grain Size	%Fine<75µm	Carter 55.2.3	0.1	99.3

# ANALYTICAL REPORT



## Soil Analysis - Metals

Project No. WX17937

Final  
File No. EC-70898

Analyst	Date of Analysis (yyyy/m/d)	Analytical Parameter	Units	Reference Method	Lab #:	16-4217	16-4219	16-4220	16-4225
					Client ID:	Surface A	Surface C	Surface D	TH16-03 @ 0.6-0.9m
					Sample Date:	2016/05/06 0:00	2016/05/09 0:00	2016/05/09 0:00	2016/05/09 0:00
					DL				
TY	2016/05/16	Antimony	mg/kg (ppm)	EPA 3050/6010	0.5	< 0.5	< 0.5	< 0.5	< 0.5
TY	2016/05/16	Aluminum	mg/kg (ppm)	EPA 3050/6010	5	2660	3870	2220	8550
TY	2016/05/16	Arsenic	mg/kg (ppm)	EPA 3050/6010	0.5	1.2	2.4	1.4	2.9
TY	2016/05/16	Barium	mg/kg (ppm)	EPA 3050/6010	1	41	56	53	87
TY	2016/05/16	Beryllium	mg/kg (ppm)	EPA 3050/6010	0.1	< 0.1	< 0.1	< 0.1	0.3
TY	2016/05/16	Cadmium	mg/kg (ppm)	EPA 3050/6010	0.2	0.5	0.5	1.0	< 0.2
TY	2016/05/16	Calcium	mg/kg (ppm)	EPA 3050/6010	5	122000	97100	162000	67900
TY	2016/05/16	Chromium	mg/kg (ppm)	EPA 3050/6010	0.5	6.7	14.3	12.8	14.7
TY	2016/05/16	Cobalt	mg/kg (ppm)	EPA 3050/6010	0.5	1.4	2.5	2.0	4.4
TY	2016/05/16	Copper	mg/kg (ppm)	EPA 3050/6010	0.1	40.8	24.4	20.7	17.2
TY	2016/05/16	Iron	mg/kg (ppm)	EPA 3050/6010	5	7400	10800	13600	15400
TY	2016/05/16	Lead	mg/kg (ppm)	EPA 3050/6010	0.5	44.9	186	35.2	25.3
TY	2016/05/16	Magnesium	mg/kg (ppm)	EPA 3050/6010	1	58400	30300	84200	26600
TY	2016/05/16	Manganese	mg/kg (ppm)	EPA 3050/6010	0.5	122	154	122	251
TY	2016/05/16	Mercury	mg/kg (ppm)	EPA 3050/6010	0.2	< 0.2	< 0.2	< 0.2	< 0.2
TY	2016/05/16	Molybdenum	mg/kg (ppm)	EPA 3050/6010	0.5	< 0.5	< 0.5	7.6	< 0.5
TY	2016/05/16	Nickel	mg/kg (ppm)	EPA 3050/6010	0.5	4.6	7.0	7.1	13.1
TY	2016/05/16	Phosphorus	mg/kg (ppm)	EPA 3050/6010	5	700	483	170	250
TY	2016/05/16	Potassium	mg/kg (ppm)	EPA 3050/6010	5	1500	1760	618	3000
TY	2016/05/16	Selenium	mg/kg (ppm)	EPA 3050/6010	0.5	< 0.5	< 0.5	< 0.5	< 0.5
TY	2016/05/16	Sodium	mg/kg (ppm)	EPA 3050/6010	1	447	433	520	406
TY	2016/05/16	Silver	mg/kg (ppm)	EPA 3050/6010	0.1	< 0.1	< 0.1	< 0.1	< 0.1
TY	2016/05/16	Thallium	mg/kg (ppm)	EPA 3050/6010	0.5	< 0.5	< 0.5	< 0.5	< 0.5
TY	2016/05/16	Tin	mg/kg (ppm)	EPA 3050/6010	0.5	1.6	1.3	1.6	< 0.5
TY	2016/05/16	Vanadium	mg/kg (ppm)	EPA 3050/6010	0.2	6.2	9.6	4.4	22.1
TY	2016/05/16	Uranium	mg/kg (ppm)	EPA 3050/6010	15	< 15	< 15	< 15	< 15
TY	2016/05/16	Zinc	mg/kg (ppm)	EPA 3050/6010	0.5	178	156	195	37.6

# ANALYTICAL REPORT



## Soil Analysis - Polycyclic Aromatic Hydrocarbons

Project No. WX17937

Final  
File No. EC-70898

Analyst	Date of Analysis (yyyy/m/d)	Analytical Parameter	Units	Reference Method	Lab #:	16-4220	16-4231	16-4231-D
					Client ID:	Surface D	TH16-07 @ 1.2-1.5m	TH16-07 @ 1.2-1.5m
					Sample Date:	2016/05/09 0:00	2016/05/10 0:00	Lab Duplicate
PC	2016/05/12	Acenaphthene	mg/kg (ppm)	EPA 3550/8270D	DL	0.05	0.23	* 0.25
PC	2016/05/12	Acenaphthylene	mg/kg (ppm)	EPA 3550/8270D		0.05	0.27	* 0.24
PC	2016/05/12	Anthracene	mg/kg (ppm)	EPA 3550/8270D		0.0046	1.42	* 0.8590
PC	2016/05/12	Benzo(a)anthracene	mg/kg (ppm)	EPA 3550/8270D		0.07	1.73	* 2.10
PC	2016/05/12	Benzo(a)pyrene	mg/kg (ppm)	EPA 3550/8270D		0.05	< 0.05	* 2.1
PC	2016/05/12	Benzo(b+)fluoranthene	mg/kg (ppm)	EPA 3510/8270D		0.05	< 0.05	* 2.13
PC	2016/05/12	Benzo(g,h,i)perylene	mg/kg (ppm)	EPA 3550/8270D		0.1	< 0.1	* 2.0
PC	2016/05/12	Benzo(k)fluoranthene	mg/kg (ppm)	EPA 3550/8270D		0.05	< 0.05	* 4.0
PC	2016/05/12	Chrysene	mg/kg (ppm)	EPA 3550/8270D		0.05	2.1	* 2.3
PC	2016/05/12	Dibenzo(a,h)anthracene	mg/kg (ppm)	EPA 3550/8270D		0.1	< 0.1	* 0.4
PC	2016/05/12	Fluoranthene	mg/kg (ppm)	EPA 3550/8270D		0.032	3.31	* 4.47
PC	2016/05/12	Fluorene	mg/kg (ppm)	EPA 3550/8270D		0.05	0.72	* 0.29
PC	2016/05/12	Indeno(1,2,3-cd)pyrene	mg/kg (ppm)	EPA 3550/8270D		0.1	< 0.1	* 2.0
PC	2016/05/12	2-Methylnaphthalene	mg/kg (ppm)	EPA 3550/8270D		0.1	4.5	0.3
PC	2016/05/12	Naphthalene	mg/kg (ppm)	EPA 3550/8270D		0.013	0.557	* 0.288
PC	2016/05/12	Phenanthrene	mg/kg (ppm)	EPA 3550/8270D		0.046	4.27	* 3.57
PC	2016/05/12	Pyrene	mg/kg (ppm)	EPA 3550/8270D		0.034	4.38	* 3.95
PC	2016/05/12	B[a]P Total Potency Equivalent	mg/kg (ppm)	Calculation		0.1	0.3	* 3.3
PC	2016/05/12	Surrogate 2-Fluorobiphenyl	%	--		0.1	104	101
PC	2016/05/12	Surrogate Terphenyl d-14	%	--		0.1	120	115

# ANALYTICAL REPORT



## Soil Analysis - Volatile Organic Compounds

Project No. WX17937

Final  
File No. EC-70898

Analyst	Date of Analysis (yyyy/m/d)	Analytical Parameter	Units	Reference Method	Lab #:	16-4224	16-4230	16-4230-D
					Client ID:	TH16-02 @ 5.8-6.1m	TH16-06 @ 5.8-6.1m	TH16-06 @ 5.8-6.1m
					Sample Date:	2016/05/09 0:00	2016/05/09 0:00	Lab Duplicate
					DL			
LL	2016/05/12	Chloromethane	mg/kg (ppm)	EPA 5035/8260B	0.07	< 0.07	< 0.07	< 0.07
LL	2016/05/12	Vinyl Chloride	mg/kg (ppm)	EPA 5035/8260B	0.00034	< 0.00034	< 0.00034	< 0.00034
LL	2016/05/12	Bromomethane	mg/kg (ppm)	EPA 5035/8260B	0.025	< 0.025	< 0.025	< 0.025
LL	2016/05/12	Chloroethane	mg/kg (ppm)	EPA 5035/8260B	0.04	< 0.04	< 0.04	< 0.04
LL	2016/05/12	Trichlorofluoromethane	mg/kg (ppm)	EPA 5035/8260B	0.08	< 0.08	< 0.08	< 0.08
LL	2016/05/12	1,1-Dichloroethene	mg/kg (ppm)	EPA 5035/8260B	0.002	< 0.002	< 0.002	< 0.002
LL	2016/05/12	Dichloromethane	mg/kg (ppm)	EPA 5035/8260B	0.02	< 0.02	< 0.02	< 0.02
LL	2016/05/12	Tr-1,2-dichloroethene	mg/kg (ppm)	EPA 5035/8260B	0.03	< 0.03	< 0.03	< 0.03
LL	2016/05/12	1,1-Dichloroethane	mg/kg (ppm)	EPA 5035/8260B	0.03	< 0.03	< 0.03	< 0.03
LL	2016/05/12	Cis-1,2-dichloroethene	mg/kg (ppm)	EPA 5035/8260B	0.03	< 0.03	< 0.03	< 0.03
LL	2016/05/12	Chloroform	mg/kg (ppm)	EPA 5035/8230B	0.001	< 0.001	< 0.001	< 0.001
LL	2016/05/12	1,1,1-Trichloroethane	mg/kg (ppm)	EPA 5035/8260B	0.03	< 0.03	< 0.03	< 0.03
LL	2016/05/12	Carbon tetrachloride	mg/kg (ppm)	EPA 5035/8260B	0.00030	< 0.00030	< 0.00030	< 0.00030
LL	2016/05/12	Benzene	mg/kg (ppm)	EPA 5035/8260B	0.005	< 0.005	< 0.005	< 0.005
LL	2016/05/12	1,2-Dichloroethane	mg/kg (ppm)	EPA 5035/8260B	0.001	< 0.001	< 0.001	< 0.001
LL	2016/05/12	Trichloroethene	mg/kg (ppm)	EPA 5035/8260B	0.01	< 0.01	< 0.01	< 0.01
LL	2016/05/12	1,2-Dichloropropane	mg/kg (ppm)	EPA 5035/8260B	0.010	< 0.010	< 0.010	< 0.010
LL	2016/05/12	Bromodichloromethane	mg/kg (ppm)	EPA 5035/8260B	0.045	< 0.045	< 0.045	< 0.045
LL	2016/05/12	Cis-1,3-dichloropropene	mg/kg (ppm)	EPA 5035/8260B	0.005	< 0.005	< 0.005	< 0.005
LL	2016/05/12	Toluene	mg/kg (ppm)	EPA 8260B	0.01	< 0.01	< 0.01	< 0.01
LL	2016/05/12	Tr-1,3-dichloropropene	mg/kg (ppm)	EPA 5035/8260B	0.005	< 0.005	< 0.005	< 0.005
LL	2016/05/12	1,1,2-Trichloroethane	mg/kg (ppm)	EPA 5035/8260B	0.065	< 0.065	< 0.065	< 0.065
LL	2016/05/12	Tetrachloroethene (Perc)	mg/kg (ppm)	EPA 5035/8260B	0.015	< 0.015	< 0.015	< 0.015
LL	2016/05/12	Dibromochloromethane	mg/kg (ppm)	EPA 5035/8260B	0.07	< 0.07	< 0.07	< 0.07
LL	2016/05/12	Chlorobenzene	mg/kg (ppm)	EPA 5035/8260B	0.001	< 0.001	< 0.001	< 0.001
LL	2016/05/12	Ethylbenzene	mg/kg (ppm)	EPA 8260B	0.01	< 0.01	< 0.01	< 0.01
LL	2016/05/12	m+p-Xylene	mg/kg (ppm)	EPA 5035/8260B	0.085	< 0.085	< 0.085	< 0.085
LL	2016/05/12	o-Xylene	mg/kg (ppm)	EPA 8260B	0.045	< 0.045	< 0.045	< 0.045
LL	2016/05/12	Styrene	mg/kg (ppm)	EPA 8260B	0.045	< 0.045	< 0.045	< 0.045
LL	2016/05/12	Bromoform	µg/g (ppm)	EPA 5035/8260B	0.15	< 0.15	< 0.15	< 0.15
LL	2016/05/12	1,1,2,2 Tetrachloroethane	mg/kg (ppm)	EPA 5035/8260B	0.001	< 0.001	< 0.001	< 0.001
LL	2016/05/12	1,3-Dichlorobenzene	mg/kg (ppm)	EPA 5035/8260B	0.06	< 0.06	< 0.06	< 0.06
LL	2016/05/12	1,4-Dichlorobenzene	mg/kg (ppm)	EPA 5035/8260B	0.03	< 0.03	< 0.03	< 0.03
LL	2016/05/12	1,2-Dichlorobenzene	mg/kg (ppm)	EPA 5035/8260B	0.06	< 0.06	< 0.06	< 0.06
LL	2016/05/12	Surrogate Recovery	%	EPA 5035/8260B	0.1	98.3	95.7	98.5

**Quality Control Standard**

Project No. WX17937

File No. EC-70898

**Soil Analysis - Hydrocarbons**

Analyst	Date of Analysis (yyyy/m/d)	Analytical Parameter	Units	Reference Method	Analyzed Value	Advisory Range	Target Value	Reference No.
LL	2016/05/12	Benzene	%	EPA 8260B	111	80-120	100.000	Spike Recovery
LL	2016/05/12	Toluene	%	EPA 8260B	112	80-120	100.00	Spike Recovery
LL	2016/05/12	Ethylbenzene	%	EPA 8260B	112	80-120	100.00	Spike Recovery
LL	2016/05/12	Total Xylenes	%	EPA 8260B	112	80-120	100.00	Spike Recovery
LL	2016/05/12	F1 (C6-C10)	%	CCME	98.9	80-120	100.0	Spike Recovery
PC	2016/05/12	F2 (EPH C10-C16)	mg/kg (ppm)	CCME	1030	868 - 1279	1074	Spike Recovery
PC	2016/05/12	F3 (EPH C16-C34)	mg/kg (ppm)	CCME	5710	4704 - 6484	5594	Spike Recovery
PC	2016/05/12	F4 (EPH C34-C50)	mg/kg (ppm)	CCME	2400	1903 - 2687	2295	Spike Recovery

**Soil Analysis - Metals**

Analyst	Date of Analysis (yyyy/m/d)	Analytical Parameter	Units	Reference Method	Analyzed Value	Advisory Range	Target Value	Reference No.
TY	2016/05/16	Antimony	µg/g (ppm)	EPA 3050/6010	2.5	0.6-4.8	2.7	Metal-1
TY	2016/05/16	Aluminum	µg/g (ppm)	EPA 3050/6010	10700	8310-12500	10400	Metal-1
TY	2016/05/16	Barium	µg/g (ppm)	EPA 3050/6010	210	158-256	207	Metal-1
TY	2016/05/16	Beryllium	µg/g (ppm)	EPA 3050/6010	1.1	1.2-1.8	1.5	Metal-1
TY	2016/05/16	Cadmium	µg/g (ppm)	EPA 3050/6010	2.5	1.8-2.9	2.3	Metal-1
TY	2016/05/16	Calcium	µg/g (ppm)	EPA 3050/6010	16000	14600-19100	16800	Metal-1
TY	2016/05/16	Chromium	µg/g (ppm)	EPA 3050/6010	73.4	63.8-89.3	76.6	Metal-1
TY	2016/05/16	Cobalt	µg/g (ppm)	EPA 3050/6010	14.3	10.2-20.1	15.2	Metal-1
TY	2016/05/16	Copper	µg/g (ppm)	EPA 3050/6010	199	144-239	192.0	Metal-1
TY	2016/05/16	Iron	µg/g (ppm)	EPA 3050/6010	25000	17000-27800	22400	Metal-1
TY	2016/05/16	Lead	µg/g (ppm)	EPA 3050/6010	114	74.6-125	99.6	Metal-1
TY	2016/05/16	Magnesium	µg/g (ppm)	EPA 3050/6010	5750	4730-6520	5624	Metal-1
TY	2016/05/16	Manganese	µg/g (ppm)	EPA 3050/6010	891	738-1000	871.0	Metal-1
TY	2016/05/16	Mercury	µg/g (ppm)	EPA 3050/6010	2.5	0.2-4.6	2.1	Metal-1
TY	2016/05/16	Molybdenum	µg/g (ppm)	EPA 3050/6010	1.2	0.5-3.3	1.0	Metal-1
TY	2016/05/16	Nickel	µg/g (ppm)	EPA 3050/6010	341	289-389	339.0	Metal-1
TY	2016/05/16	Phosphorus	µg/g (ppm)	EPA 3050/6010	4190	2240-5480	3860	Metal-1
TY	2016/05/16	Potassium	µg/g (ppm)	EPA 3050/6010	1870	1070-2180	1630	Metal-1
TY	2016/05/16	Sodium	µg/g (ppm)	EPA 3050/6010	715	186-1290	740	Metal-1
TY	2016/05/16	Silver	µg/g (ppm)	EPA 3050/6010	0.5	0.2-0.7	0.5	Metal-1
TY	2016/05/16	Thallium	µg/g (ppm)	EPA 3050/6010	0.7	0.5-1.2	0.6	Metal-1
TY	2016/05/16	Tin	µg/g (ppm)	EPA 3050/6010	26.4	18.9-35.1	27.0	Metal-1
TY	2016/05/16	Vanadium	µg/g (ppm)	EPA 3050/6010	95.7	36.5-194	115.0	Metal-1
TY	2016/05/16	Zinc	µg/g (ppm)	EPA 3050/6010	876	761-1030	896.0	Metal-1

## Quality Control Standard

Project No. WX17937

File No. EC-70898

## Soil Analysis - Polycyclic Aromatic Hydrocarbons

Analyst	Date of Analysis (yyyy/m/d)	Analytical Parameter	Units	Reference Method	Analyzed Value	Advisory Range	Target Value	Reference No.
PC	2016/05/12	Acenaphthene	%	EPA 3550/8270D	87	65-120	100.00	Spike Recovery
PC	2016/05/12	Acenaphthylene	%	EPA 3550/8270D	91	65-120	100.00	Spike Recovery
PC	2016/05/12	Anthracene	%	EPA 3550/8270D	91.0	65-120	100.0000	Spike Recovery
PC	2016/05/12	Benzo(a)anthracene	%	EPA 3550/8270D	93.9	65-120	100.00	Spike Recovery
PC	2016/05/12	Benzo(a)pyrene	%	EPA 3550/8270D	86	65-120	100.00	Spike Recovery
PC	2016/05/12	Benzo(g,h,i)perylene	%	EPA 3550/8270D	89	65-120	100.0	Spike Recovery
PC	2016/05/12	Benzo(k)fluoranthene	%	EPA 3550/8270D	88	65-120	100.00	Spike Recovery
PC	2016/05/12	Chrysene	%	EPA 3550/8270D	93	65-120	100.00	Spike Recovery
PC	2016/05/12	Dibenzo(a,h)anthracene	%	EPA 3550/8270D	90	65-120	100.0	Spike Recovery
PC	2016/05/12	Fluoranthene	%	EPA 3550/8270D	86.5	65-120	100.0000	Spike Recovery
PC	2016/05/12	Fluorene	%	EPA 3550/8270D	80	65-120	100.00	Spike Recovery
PC	2016/05/12	Indeno(1,2,3-cd)pyrene	%	EPA 3550/8270D	90	65-120	100.0	Spike Recovery
PC	2016/05/12	Naphthalene	%	EPA 3550/8270D	86.8	65-120	100.0000	Spike Recovery
PC	2016/05/12	Phenanthrene	%	EPA 3550/8270D	94.0	65-120	100.0000	Spike Recovery
PC	2016/05/12	Pyrene	%	EPA 3550/8270D	86.3	65-120	100.0000	Spike Recovery

## Soil Analysis

Analyst	Date of Analysis (yyyy/m/d)	Analytical Parameter	Units	Reference Method	Analyzed Value	Advisory Range	Target Value	Reference No.
MS		Grain Size	%Fine <75µm	Carter 55.2.3	52.7	48.7-56.5	52.6	SS # 19

**Quality Control Standard**

Project No. WX17937

File No. EC-70898

**Soil Analysis - Volatile Organic Compounds**

Analyst	Date of Analysis (yyyy/m/d)	Analytical Parameter	Units	Reference Method	Analyzed Value	Advisory Range	Target Value	Reference No.
LL	2016/05/12	Chloromethane	%	EPA 8260B	101	80-120	100.00	Spike Recovery
LL	2016/05/12	Vinyl Chloride	%	EPA 8260B	99.4	80-120	100.00000	Spike Recovery
LL	2016/05/12	Bromomethane	%	EPA 8260B	94.9	80-120	100.000	Spike Recovery
LL	2016/05/12	Chloroethane	%	EPA 8260B	98.1	80-120	100.00	Spike Recovery
LL	2016/05/12	Trichlorofluoromethane	%	EPA 8260B	101	80-120	100.00	Spike Recovery
LL	2016/05/12	1,1-Dichloroethene	%	EPA 8260B	99.5	80-120	100.000	Spike Recovery
LL	2016/05/12	Dichloromethane	%	EPA 8260B	97.5	80-120	100.00	Spike Recovery
LL	2016/05/12	Tr-1,2-dichloroethene	%	EPA 8260B	98.0	80-120	100.00	Spike Recovery
LL	2016/05/12	1,1-Dichloroethane	%	EPA 8260B	96.4	80-120	100.00	Spike Recovery
LL	2016/05/12	Cis-1,2-dichloroethene	%	EPA 8260B	96.4	80-120	100.00	Spike Recovery
LL	2016/05/12	Chloroform	%	EPA 8260B	96.5	80-120	100.000	Spike Recovery
LL	2016/05/12	1,1,1-Trichloroethane	%	EPA 8260B	97.9	80-120	100.00	Spike Recovery
LL	2016/05/12	Carbon tetrachloride	%	EPA 8260B	98.9	80-120	100.00000	Spike Recovery
LL	2016/05/12	Benzene	%	EPA 8260B	96.5	80-120	100.000	Spike Recovery
LL	2016/05/12	1,2-Dichloroethane	%	EPA 8260B	97.3	80-120	100.000	Spike Recovery
LL	2016/05/12	Trichloroethene	%	EPA 8260B	97.3	80-120	100.00	Spike Recovery
LL	2016/05/12	1,2-Dichloropropane	%	EPA 8260B	96.1	80-120	100.000	Spike Recovery
LL	2016/05/12	Bromodichloromethane	%	EPA 8260B	96.4	80-120	100.000	Spike Recovery
LL	2016/05/12	Cis-1,3-dichloropropene	%	EPA 8260B	95.3	80-120	100.000	Spike Recovery
LL	2016/05/12	Toluene	%	EPA 8260B	95.8	80-120	100.00	Spike Recovery
LL	2016/05/12	Tr-1,3-dichloropropene	%	EPA 8260B	95.9	80-120	100.000	Spike Recovery
LL	2016/05/12	1,1,2-Trichloroethane	%	EPA 8260B	96.1	80-120	100.000	Spike Recovery
LL	2016/05/12	Tetrachloroethene (Perc)	%	EPA 8260B	98.3	80-120	100.000	Spike Recovery
LL	2016/05/12	Dibromochloromethane	%	EPA 8260B	96.2	80-120	100.00	Spike Recovery
LL	2016/05/12	Chlorobenzene	%	EPA 8260B	95.6	80-120	100.000	Spike Recovery
LL	2016/05/12	Ethylbenzene	%	EPA 8260B	96.3	80-120	100.00	Spike Recovery
LL	2016/05/12	m+p-Xylene	%	EPA 8260B	96.7	80-120	100.000	Spike Recovery
LL	2016/05/12	o-Xylene	%	EPA 8260B	95.5	80-120	100.000	Spike Recovery
LL	2016/05/12	Styrene	%	EPA 8260B	91.2	80-120	100.000	Spike Recovery
LL	2016/05/12	Bromoform	%	EPA 8260B	97.1	80-120	100.00	Spike Recovery
LL	2016/05/12	1,1,2,2 Tetrachloroethane	%	EPA 8260B	97.5	80-120	100.000	Spike Recovery
LL	2016/05/12	1,3-Dichlorobenzene	%	EPA 8260B	97.9	80-120	100.00	Spike Recovery
LL	2016/05/12	1,4-Dichlorobenzene	%	EPA 8260B	97.8	80-120	100.00	Spike Recovery
LL	2016/05/12	1,2-Dichlorobenzene	%	EPA 8260B	96.9	80-120	100.00	Spike Recovery

## Analytical Comments

Project No. WX17937

File No. EC-70898

\*Note: PAH Laboratory Duplicate results outside QC criteria possibly due to non-homogenous sample. Results have been verified.

All Analytical results pertain to samples analyzed as received.

Carter, M.R. and E.G. Gregorich Ed. 2008 (2nd Edition). Soil Sampling and Methods of Analysis. CRC Press. Boca Raton.

CCME (EPH) - Canadian Council of Ministers of the Environment - Method for Canada Wide Standards for Petroleum Hydrocarbon in Soil, Tier 1 Method, Revision 5.0. The method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.

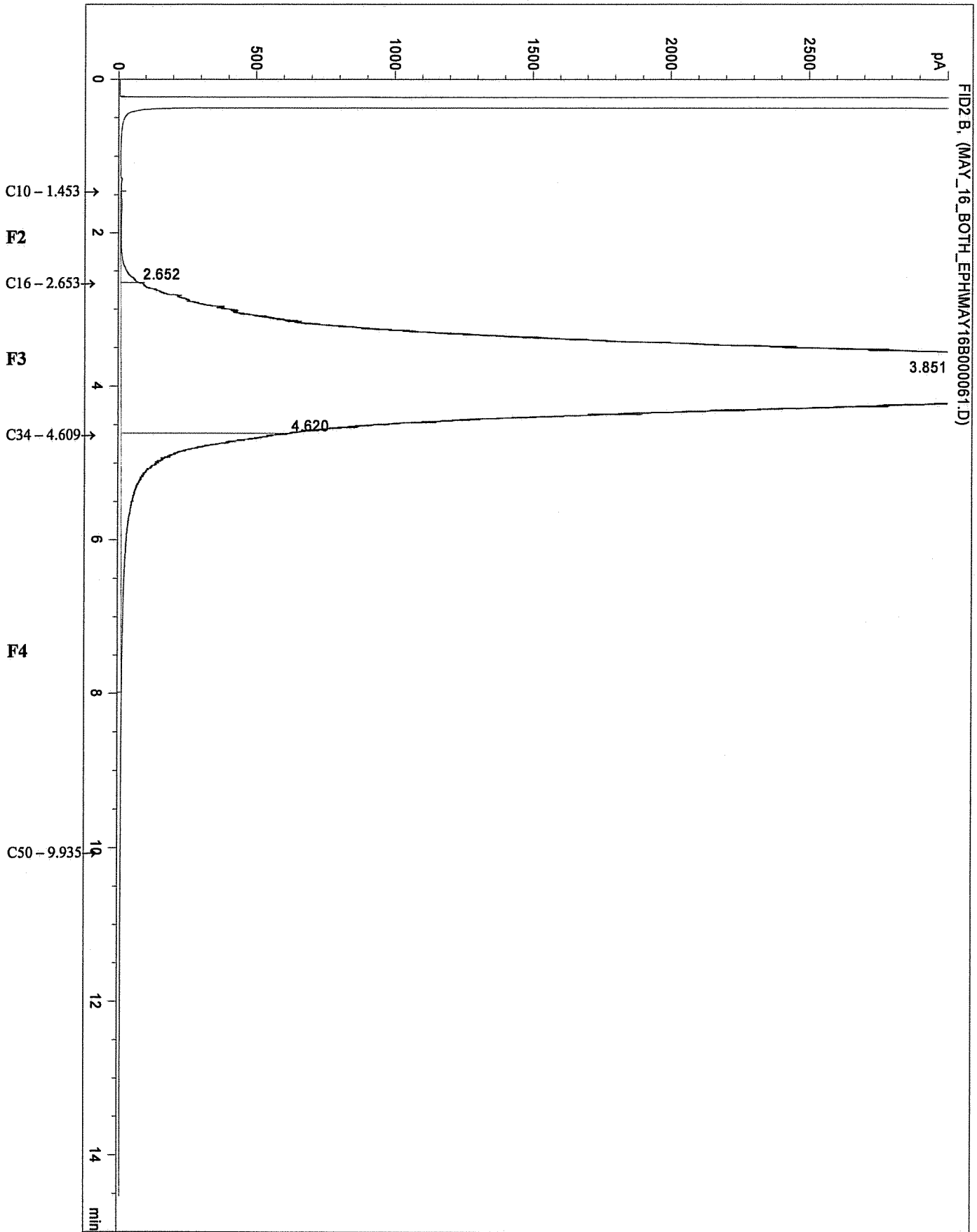
Chromatography returned to baseline by C50.

DL - Detection Limit

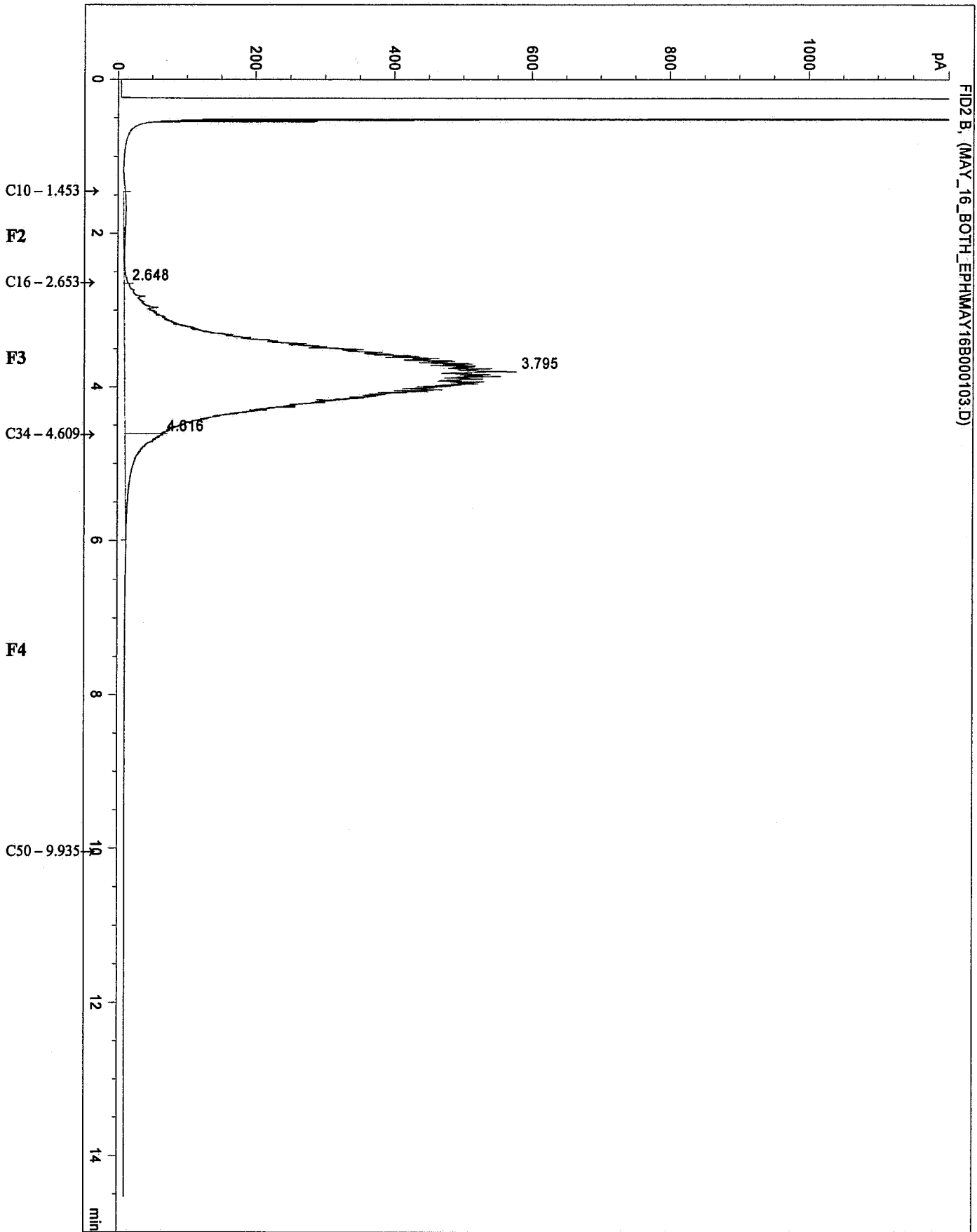
EPA: U.S. Environmental Protection Agency. 1997. Test Methods of Evaluation of Solid Waste 3rd Ed through Update III. Office Solid Waste Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPH: Extractable Petroleum Hydrocarbon - not corrected for PAH content.

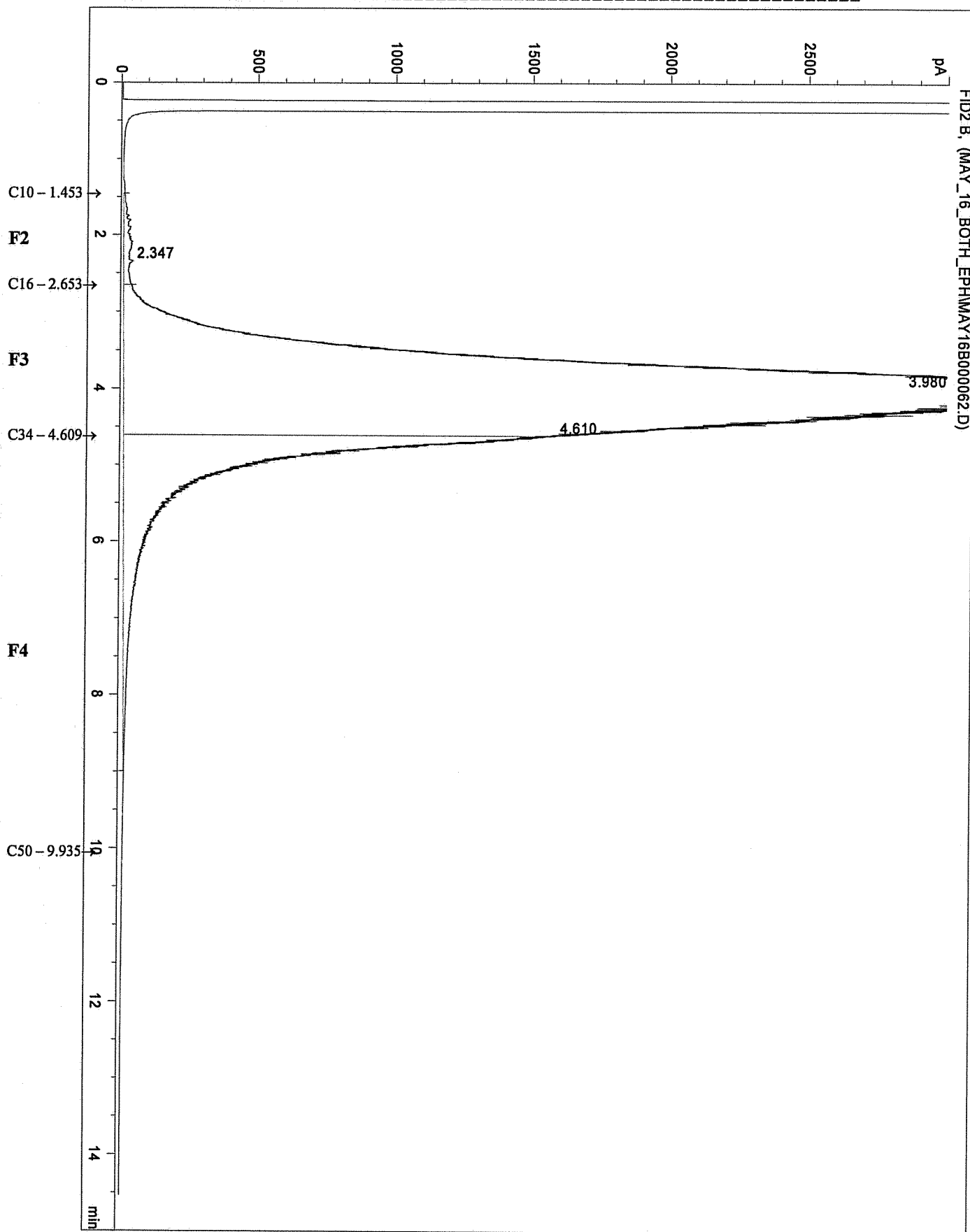
Extraction and analysis limits for holding time for Hydrocarbons were met.



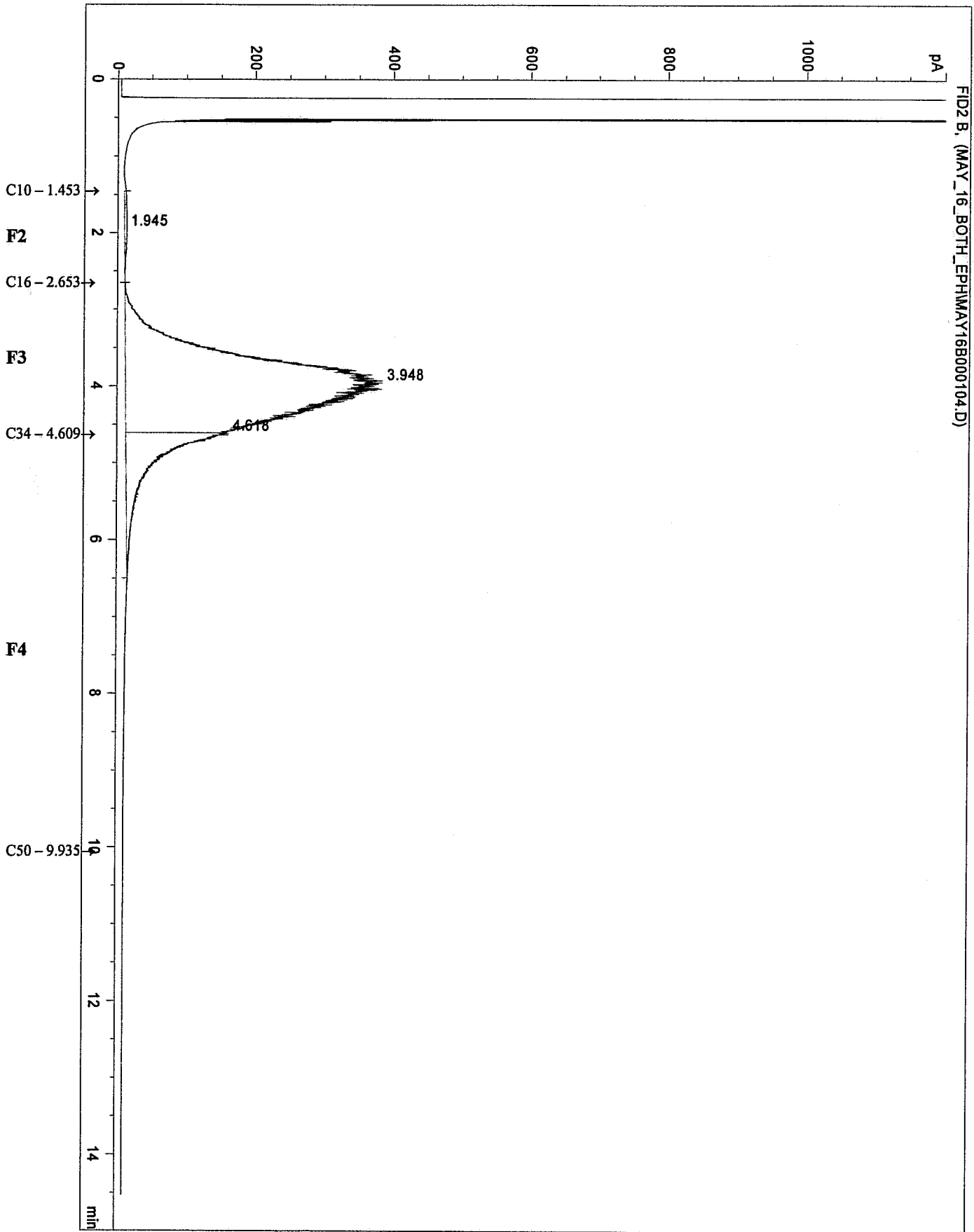
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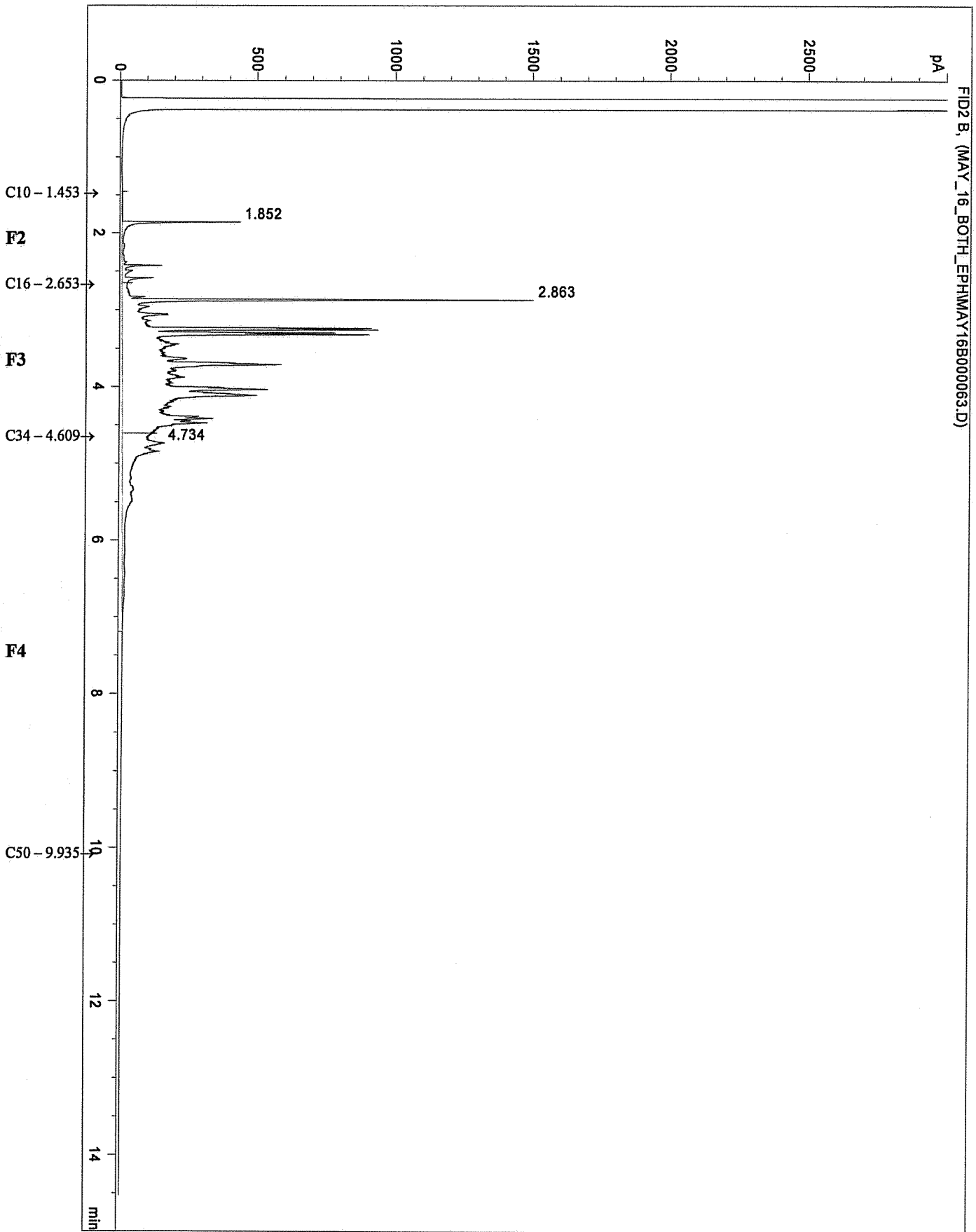
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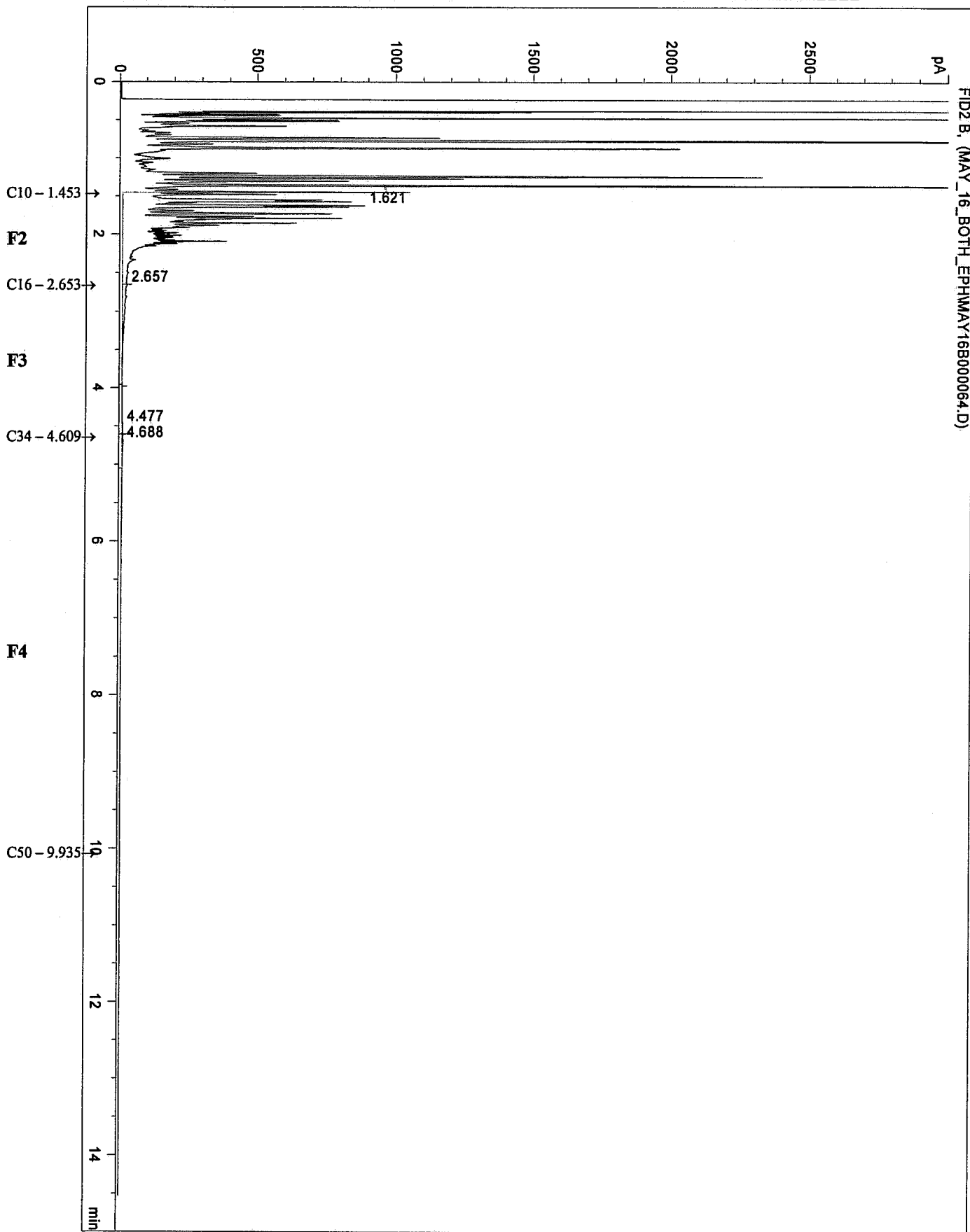
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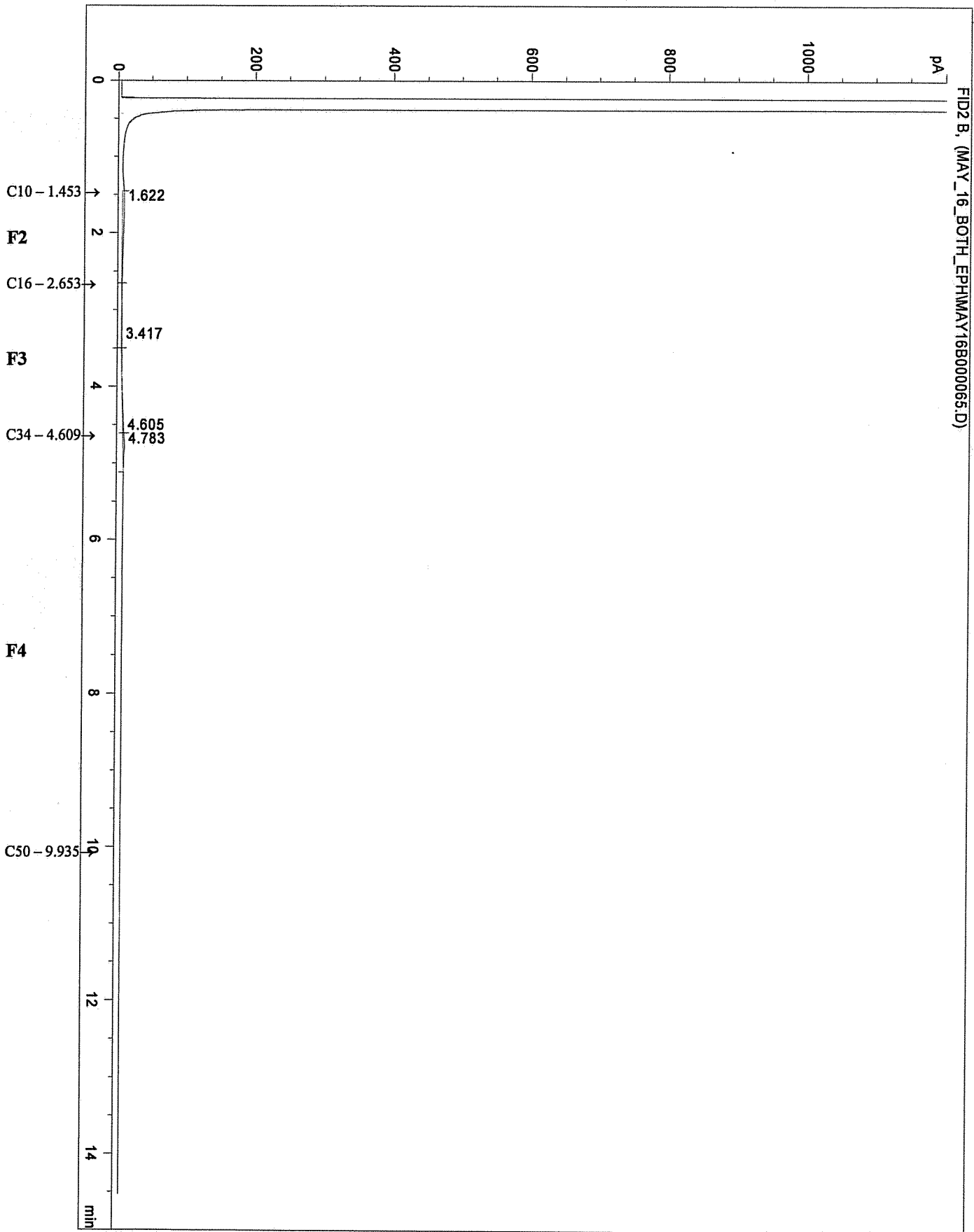
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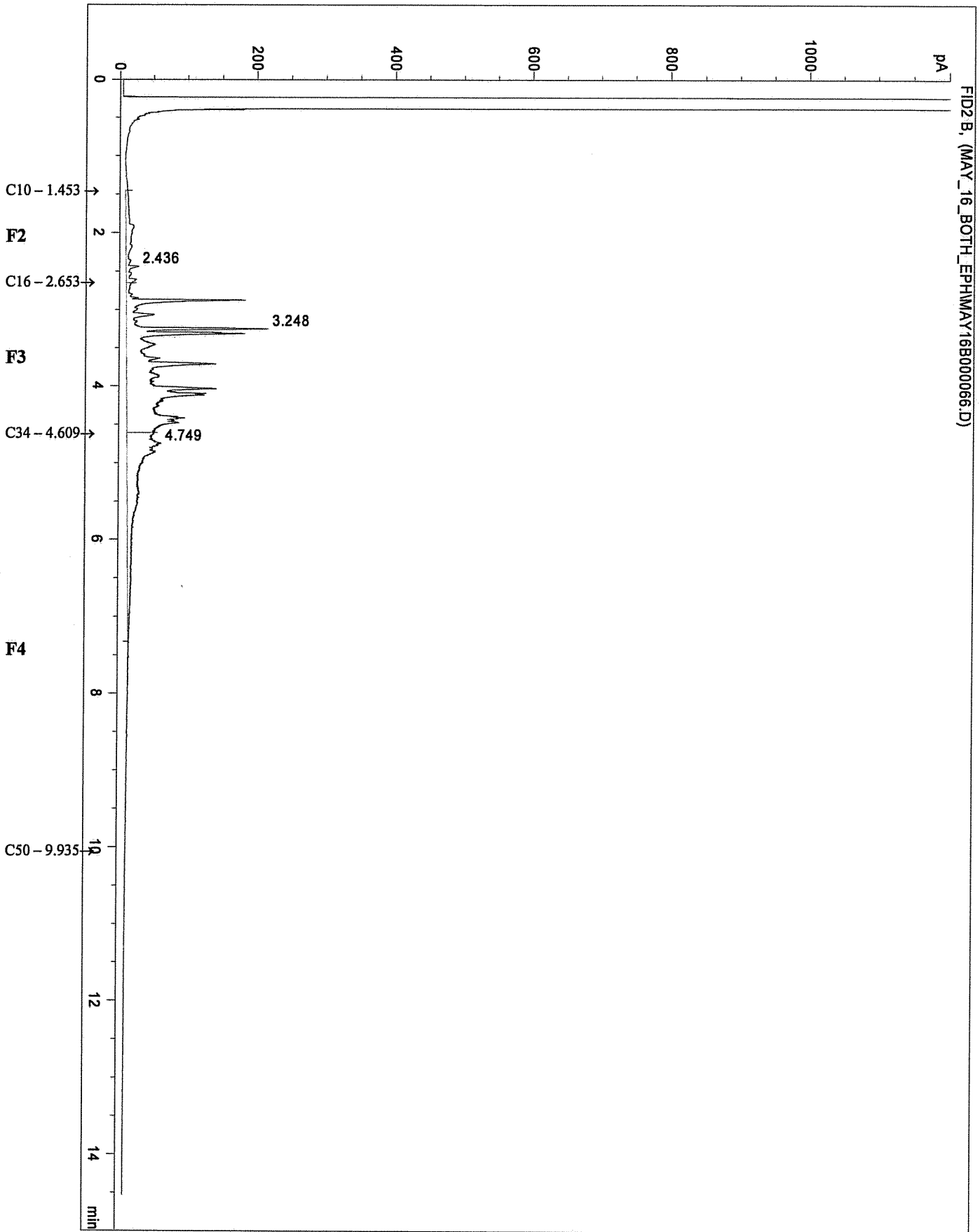
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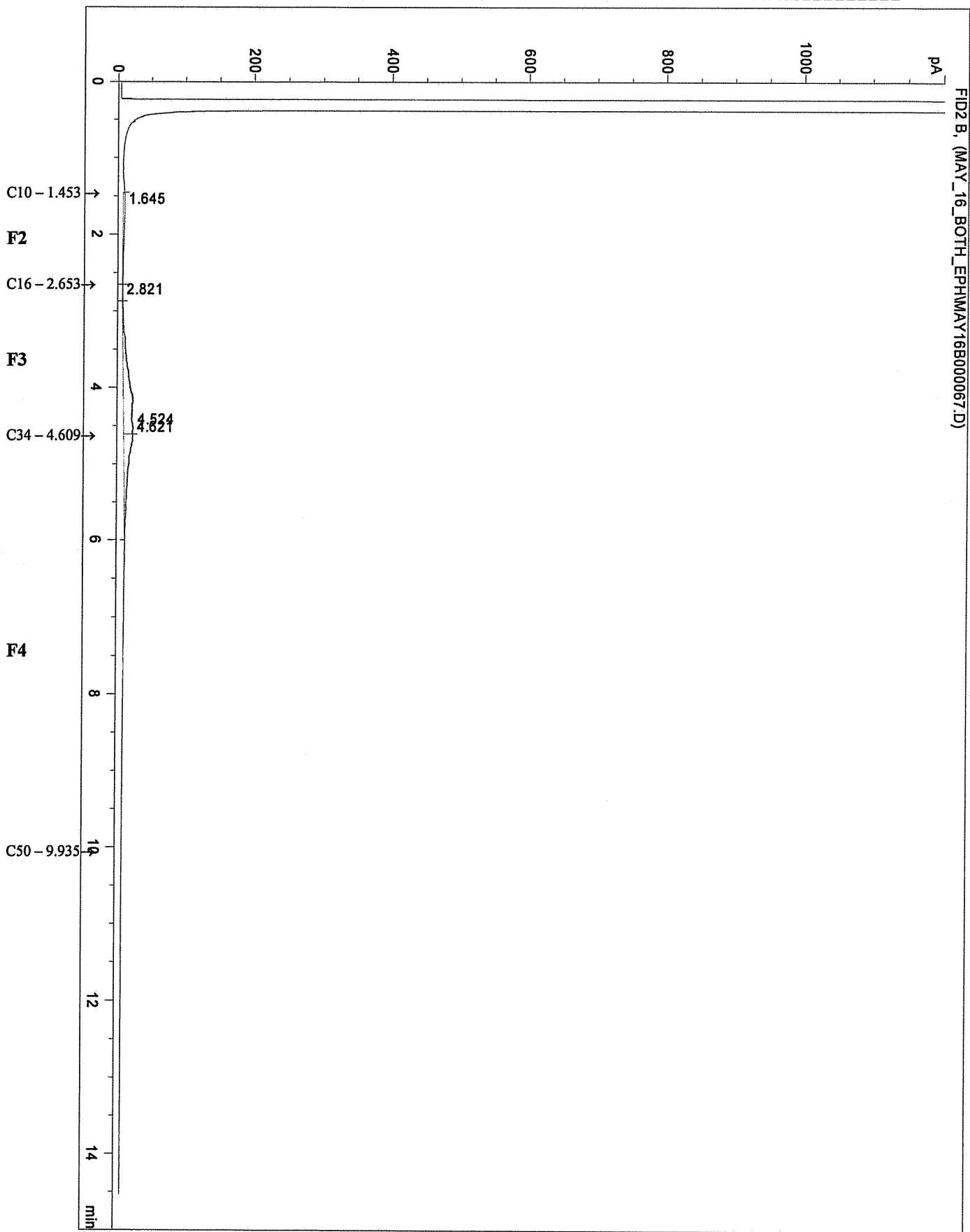
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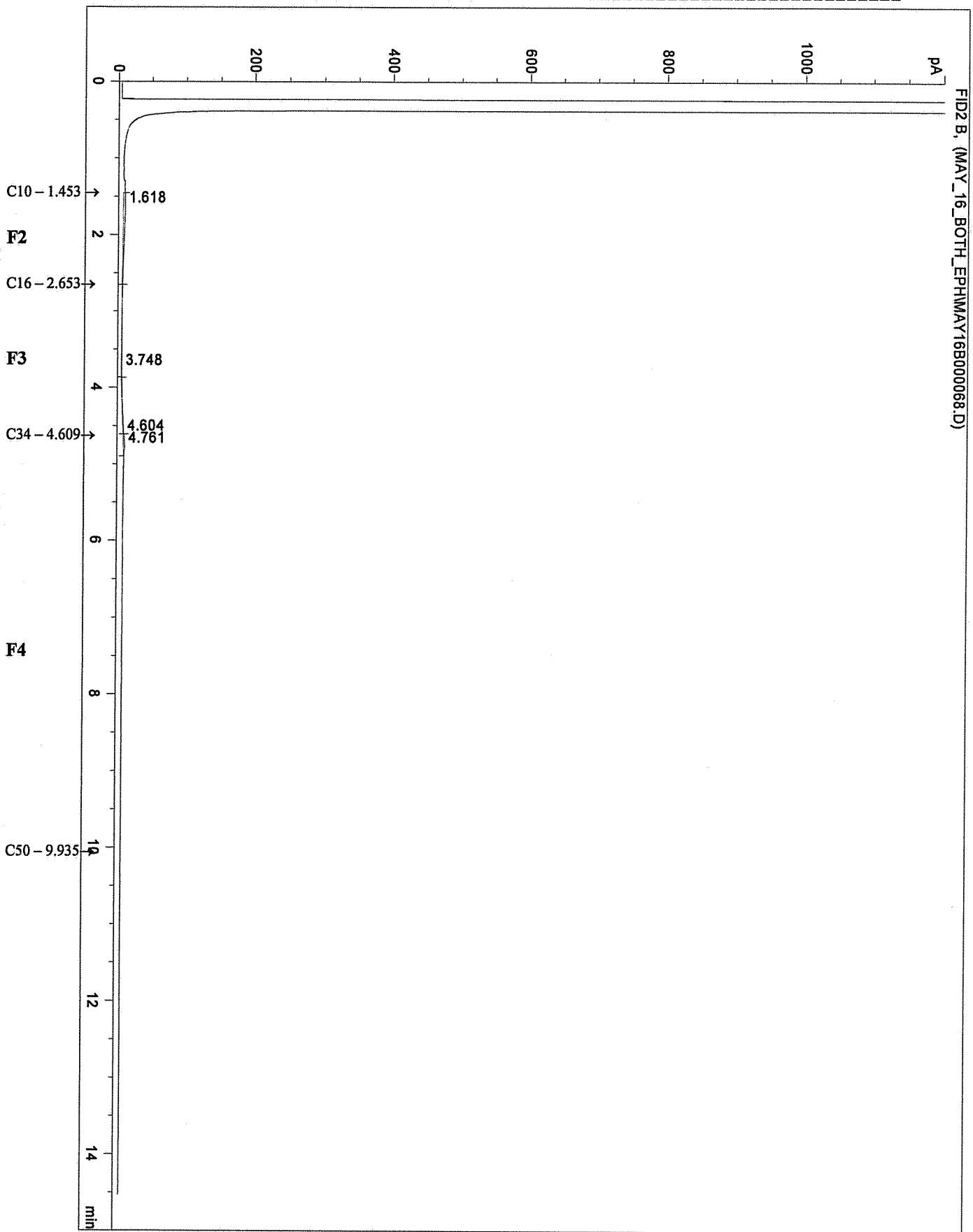
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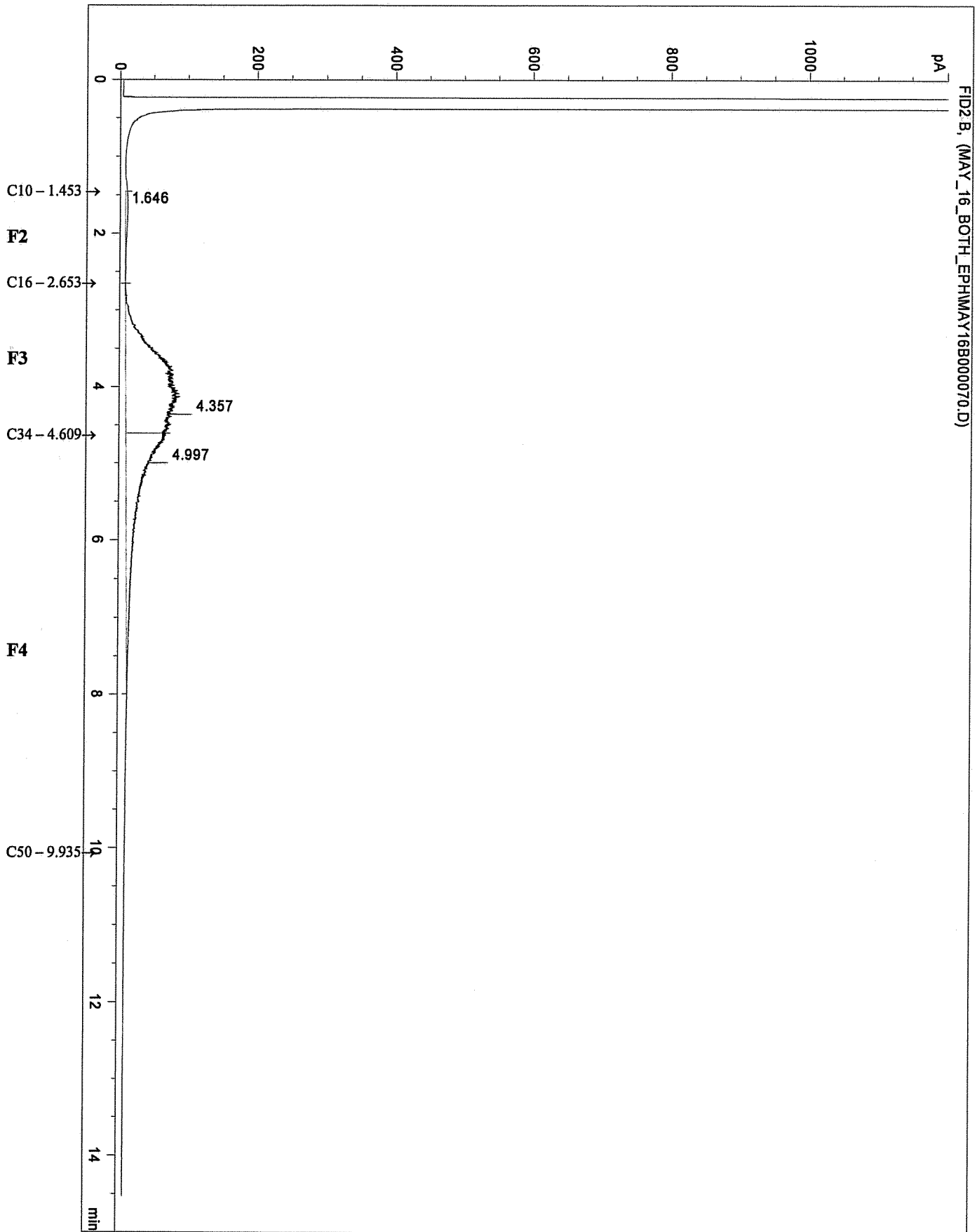
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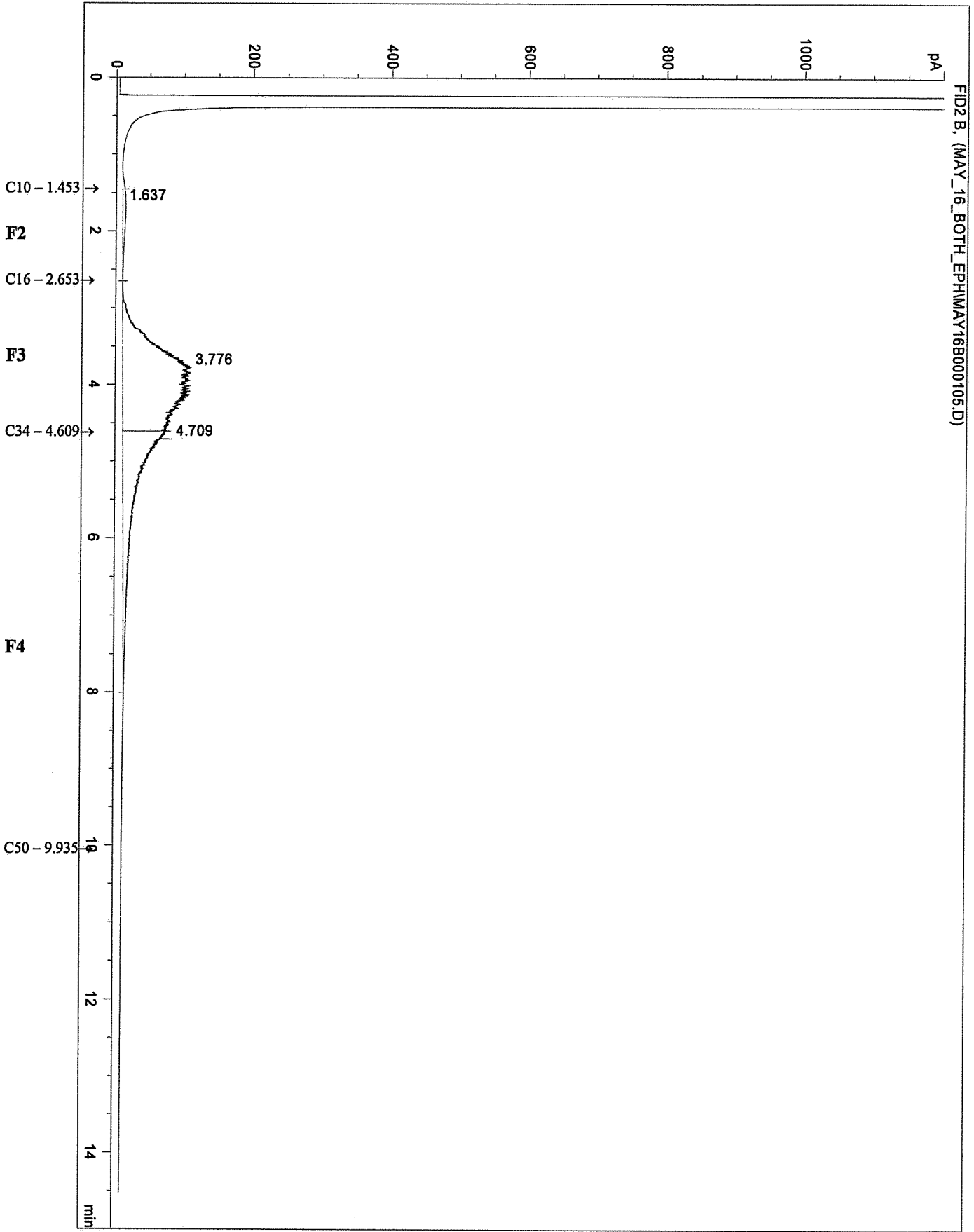


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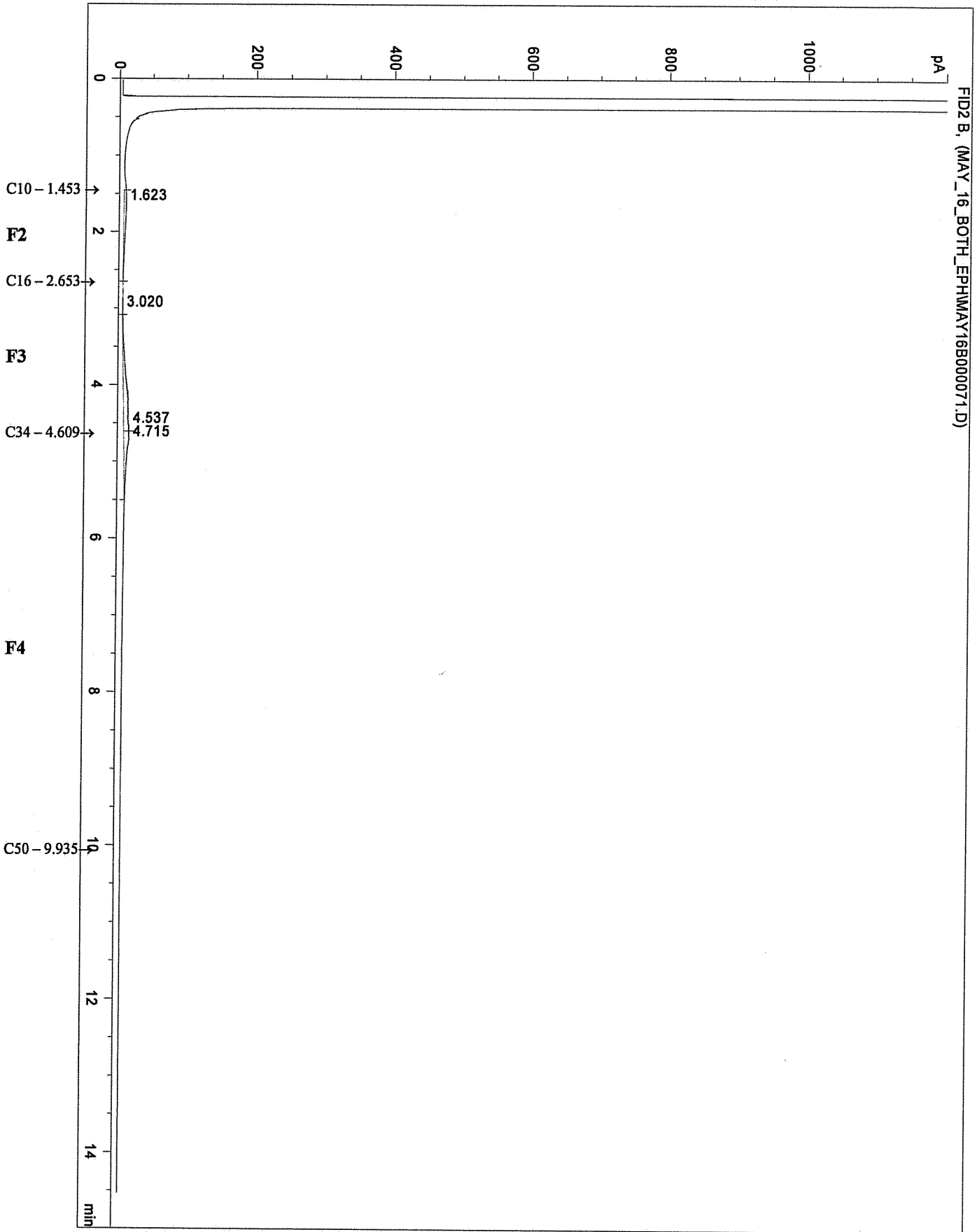


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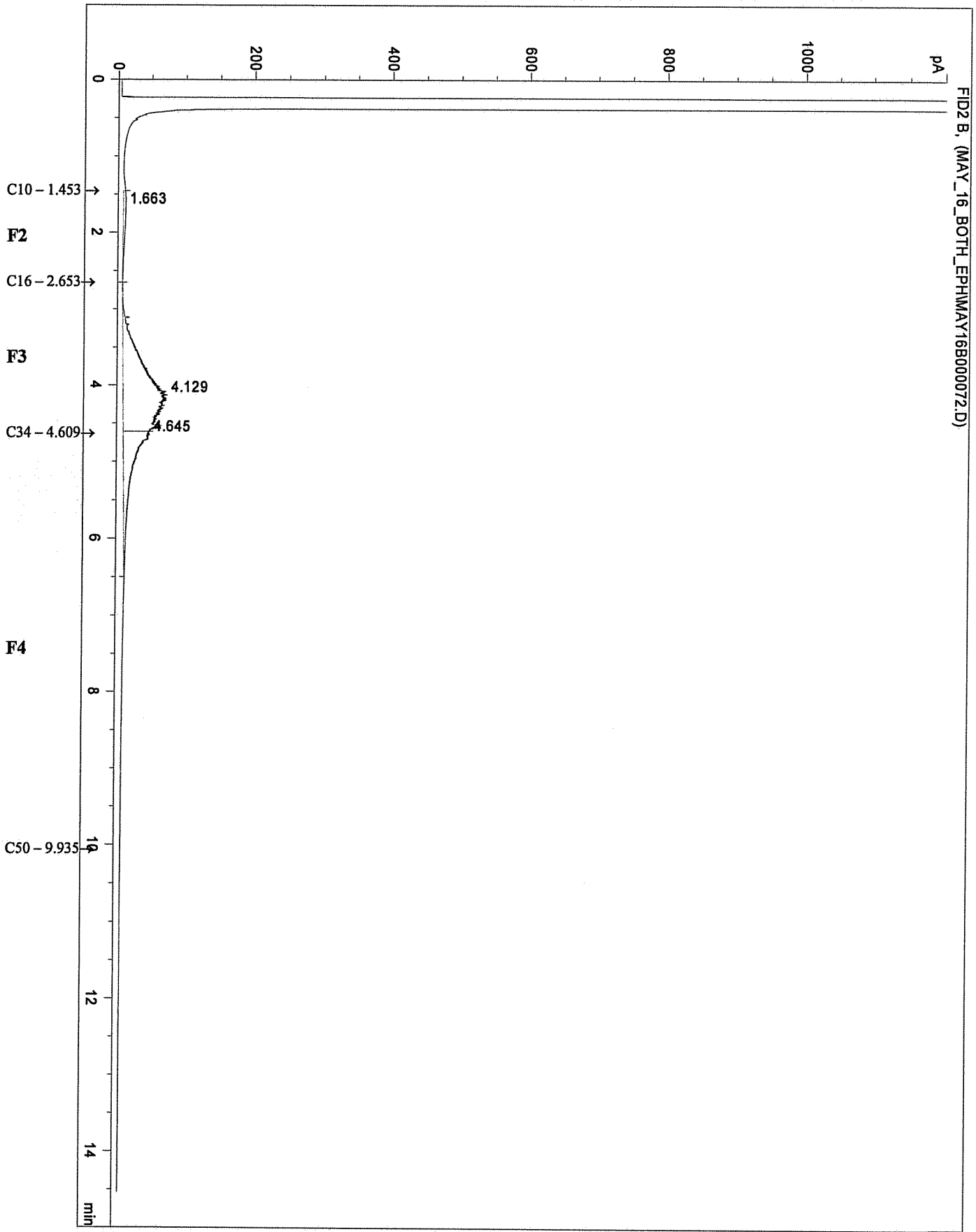
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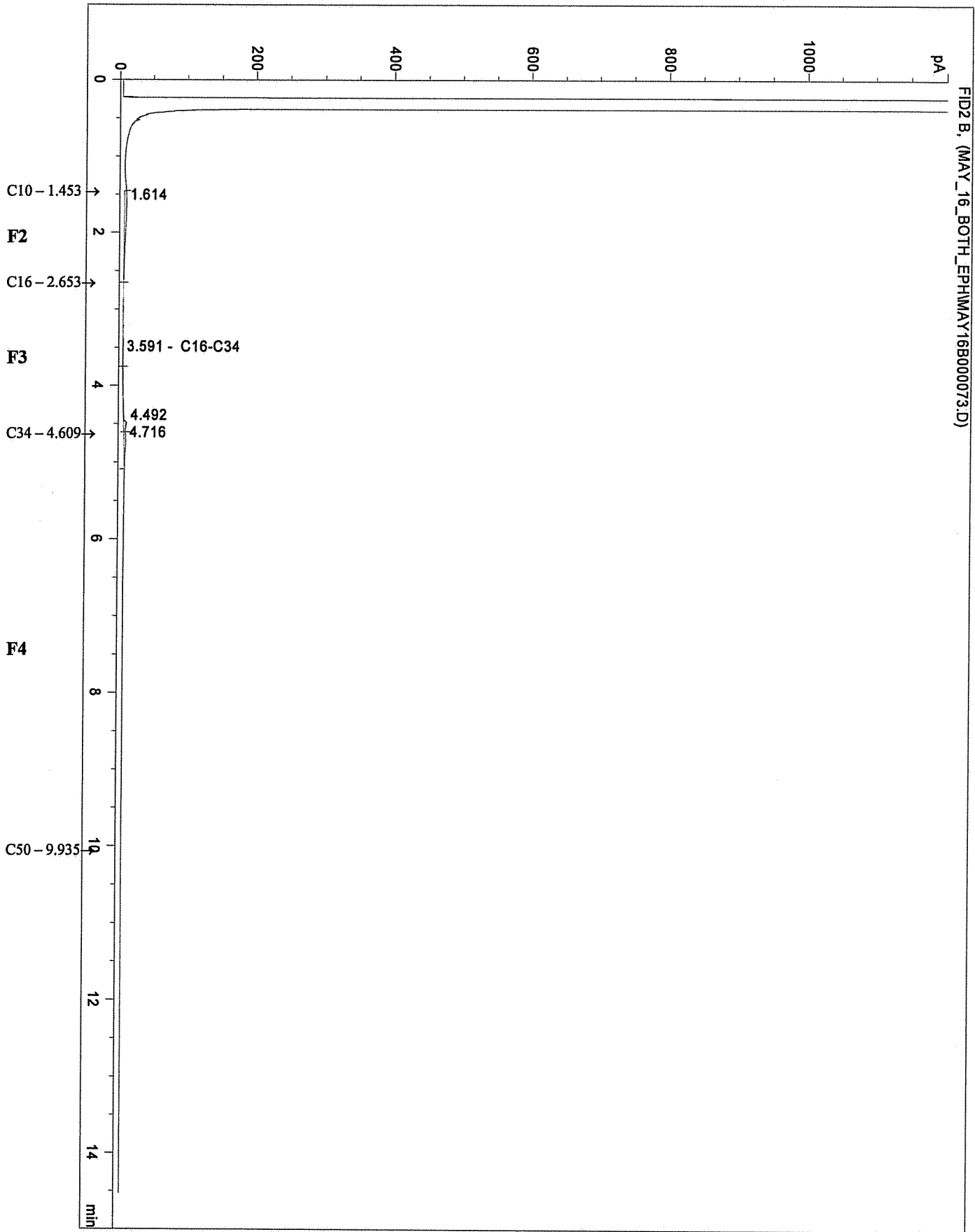
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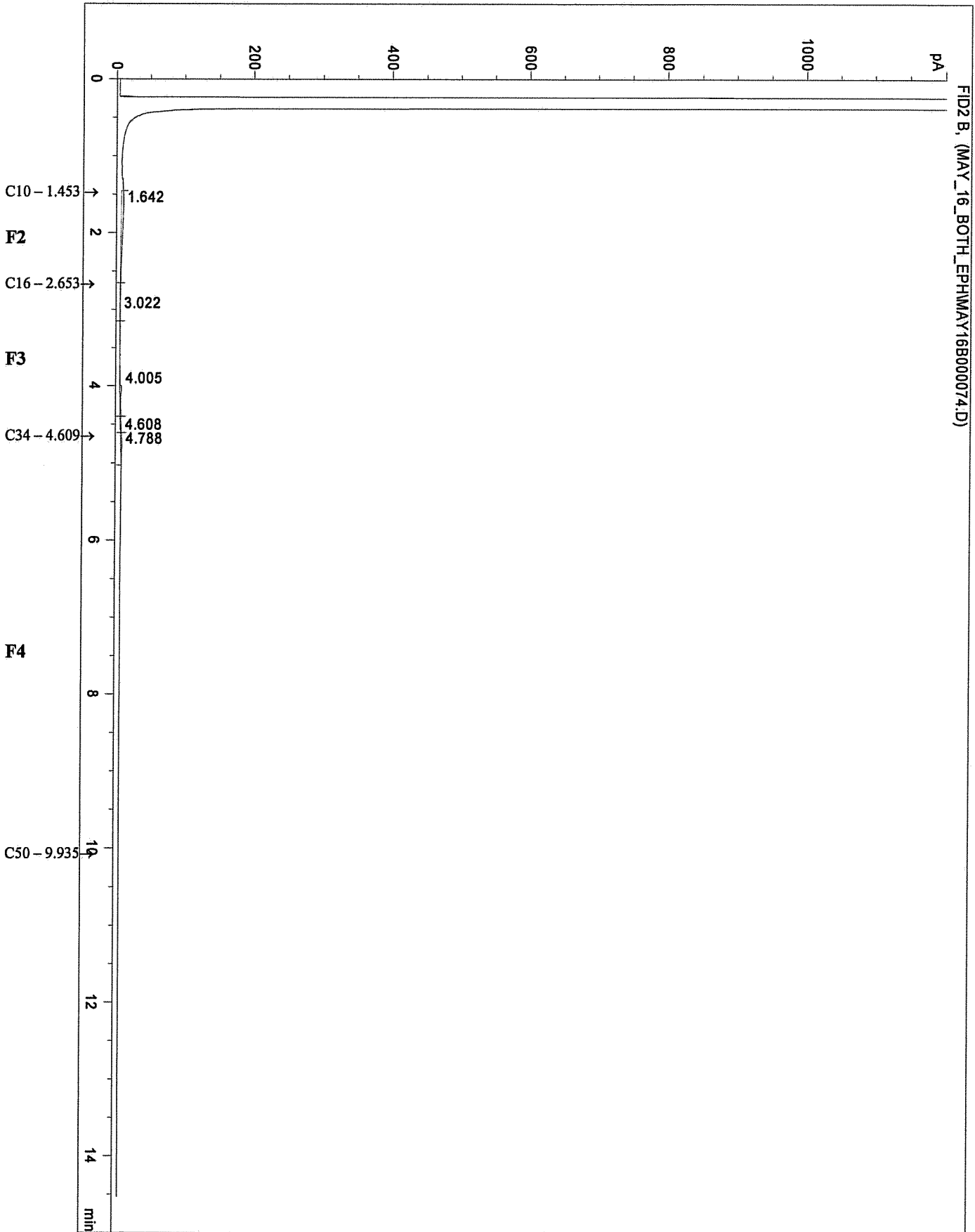


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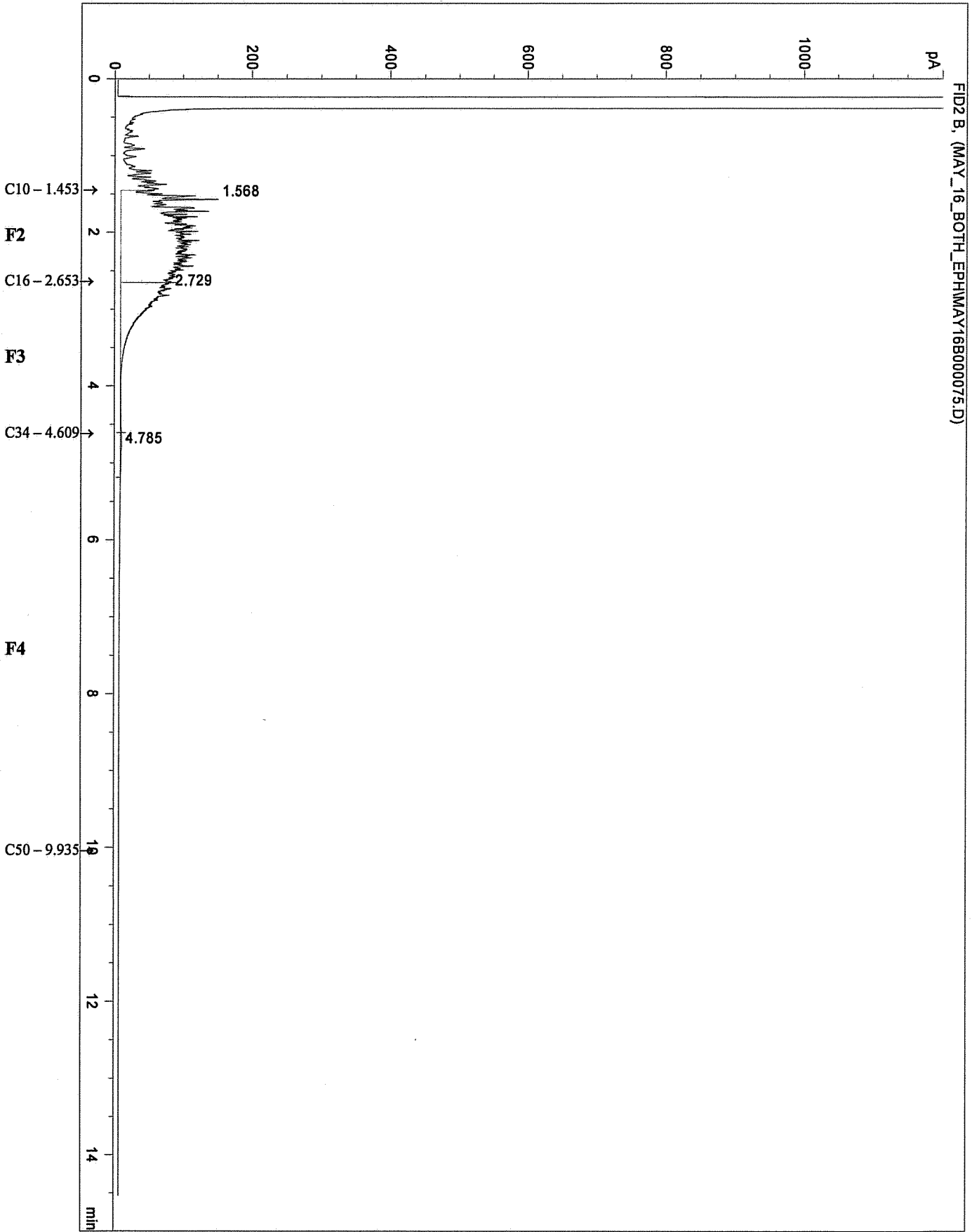


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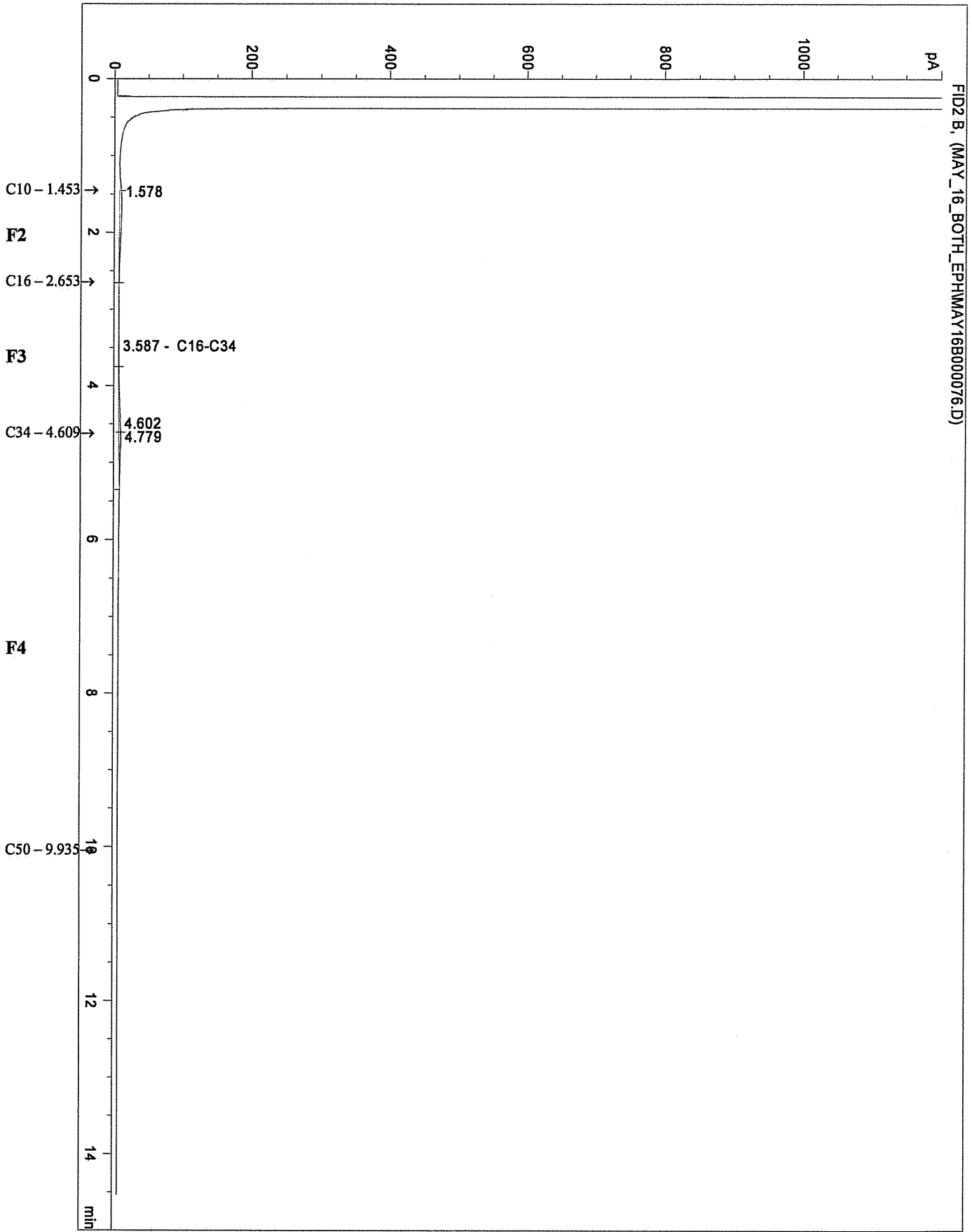
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\*\*\* End of Report \*\*\*



\*\*\* End of Report \*\*\*



Amec Foster Wheeler Edmonton Chemistry Lab  
5667-70 St, Edmonton AB T6B 3P6

Chain of Custody Record/Analysis Request  
ANALYSIS REQUIRED (Note preferred method)

EL-76898

35

ISSUING OFFICE: Wmnpjg  
Tracking #: \_\_\_\_\_

Project Name: Phase II ESA Speers Road  
Project Manager: Patrick Campbell/Brad Kennedy  
Project Number: WX17937

Sampler: Brad Kennedy  
Phone No.: 204 488 2997

Client Sample ID	AMEC E & E Lab Sample ID FOR LAB USE ONLY	Date Collected dd-mm-yy	Time Collected hh:mm	Matrix	# of Containers	BTEX, F1-F4	Metals	PAHs	VOCs	F2-F4	Grain Size	50% RUSH (Please Notify Lab!)	100% RUSH (Please Notify Lab!)	REQUIREMENTS
Surface A	16-4217	06-05-16		soil/sed		X	X							AD Tier 1 AB Tier 1 CCME BCME Other
Surface B	9	06-05-16		soil/sed			X							
Surface C	9	06-05-16		soil/sed			X							
Surface D	90	09-05-16		soil/sed			X							
Surface E		09-05-16		soil/sed						X				
TH16-02 @ 1.2-1.5m		09-05-16		soil/sed			X							
TH16-02 @ 2.1-2.4m		09-05-16		soil/sed							X			
TH16-02 @ 5.8-6.1m		09-05-16		soil/sed										
TH16-03 @ 0.6-0.9m		09-05-16		soil/sed			X							
TH16-03 @ 2.1-2.4m		09-05-16		soil/sed			X							
TH16-04 @ 0.6-0.9m		09-05-16		soil/sed			X							
TH16-05 @ 0.6-0.9m		09-05-16		soil/sed			X							
TH16-05 @ 2.1-2.4m		09-05-16		soil/sed			X							
TH16-06 @ 5.8-6.1m		09-05-16		soil/sed			X							
TH16-07 @ 1.2-1.5m		09-05-16		soil/sed							X			
TH16-08 @ 1.2-1.5m		09-05-16		soil/sed			X							
TH16-09 @ 1.2-1.5m		10-05-16		soil/sed			X							
TH16-10 @ 1.2-1.5m		10-05-16		soil/sed			X							
TH16-12 @ 1.2-1.5m		10-05-16		soil/sed			X							
TH16-13 @ 1.2-1.5m		10-05-16		soil/sed			X							
TH16-13 @ 2.7-3.1m		10-05-16		soil/sed			X							
TH16-14 @ 1.2-1.5m		10-05-16		soil/sed			X							
TH16-14 @ 5.2-5.5m		10-05-16		soil/sed			X							

RELINQUISHED BY: \_\_\_\_\_ RECEIVED BY: \_\_\_\_\_  
Signature: \_\_\_\_\_ Signature: \_\_\_\_\_

Printed Name: \_\_\_\_\_  
Digital pdf \_\_\_\_\_ Excel \_\_\_\_\_ Hardcopy \_\_\_\_\_

Printed Name: \_\_\_\_\_  
Digital pdf \_\_\_\_\_ Excel \_\_\_\_\_ Hardcopy \_\_\_\_\_

Amec Foster Wheeler  
Date/Time: 12-5-16 (Sri/15 Am)  
Temperature °C: 3-1



## **APPENDIX E**

### **STATEMENT OF GENERAL CONDITIONS**

**Amec Foster Wheeler Environment & Infrastructure,  
A Division of Amec Foster Wheeler Americas Limited  
STATEMENT OF GENERAL CONDITIONS - ENVIRONMENTAL SERVICES**

1. **STANDARD OF CARE** - In the performance of professional services, Amec Foster Wheeler uses that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession practicing in the same or similar localities. No warranty, either express or implied, is made or intended by this Agreement or by furnishing oral or written reports of the findings. Amec Foster Wheeler is to be liable only for damage proximately caused by the negligence of Amec Foster Wheeler. The CLIENT recognizes that subsurface conditions may vary from those encountered at the location where borings, surveys or explorations are made by Amec Foster Wheeler and that the data, interpretations and recommendation of Amec Foster Wheeler are based solely on the information available to him. Amec Foster Wheeler will not be responsible for the interpretation by others of the information developed.

2. **SITE INFORMATION** - The CLIENT has agreed to make available to Amec Foster Wheeler all relevant information and documents under his control regarding past, present and proposed conditions of the site. The information shall include, but not be limited to, plot plans, topographic surveys, hydrologic data and previous soil and geologic data including borings, field or laboratory tests and written reports. The CLIENT shall immediately transmit to Amec Foster Wheeler any new information that becomes available or any change in plans. The CLIENT also ensured uninterrupted site access for Amec Foster Wheeler throughout performance of this Agreement.

Amec Foster Wheeler agrees to include a review of all historical information obtained by the CLIENT or provided by the Client to assist in the investigation of the Site unless and except to the extent that such a review is limited or excluded from the scope of work to be performed by Amec Foster Wheeler.

3. **FULL DISCLOSURE** - The CLIENT acknowledges that in order for Amec Foster Wheeler to properly advise and assist the CLIENT in respect of the investigation of the Site, Amec Foster Wheeler has relied upon full disclosure by the CLIENT of all matters pertinent to an investigation of the Site.

4. **DELAYS AND INTERRUPTIONS** - Should Amec Foster Wheeler have been delayed or interrupted by others in the performance of its services or be required to perform additional services as a result of any delay or interruption caused by others, Amec Foster Wheeler shall be equitably compensated by the CLIENT for all costs, charges and expenses which it may incur as a result of such delay or interruption and any such additional services to be performed and any and all consequences resulting from such delay or interruption.

5. **USE OF WORK PRODUCT** - Amec Foster Wheeler agrees to provide to the CLIENT interim reports outlining the progress of the investigation of the Site on a periodic basis and a final comprehensive report upon the completion of the investigation of the Site.

6. **COMPLETE REPORT** - This document being a part of the Report is of a summary nature and is not intended to stand alone without reference to the instructions given to Amec Foster Wheeler by the CLIENT, communications between Amec Foster Wheeler and the CLIENT, and to any other reports, writings or documents prepared by Amec Foster Wheeler for the CLIENT relative to the specific Site described herein, all of which constitute the Report. Wherever the word "Report" is used herein, it shall refer to any and all of the documents referred to herein.

In order to properly understand the suggestions, recommendations and opinions expressed herein, reference must be made to the whole of the Report. Amec Foster Wheeler cannot be responsible for use by any part of portions of the report without reference to the whole report.

7. **LIMITATIONS ON SCOPE OF INVESTIGATION AND WARRANTY DISCLAIMER**

There is no warranty, expressed or implied, by Amec Foster Wheeler that:

- a) The investigation shall uncover all potential contaminants, including asbestos, on the Site; or
- b) The Site will be entirely free of all Targeted Contaminants or other contaminants as a result of any cleanup work undertaken on the Site, since it is not possible, even with exhaustive sampling, testing and analysis, to document all potential contaminants on the Site.

Classification and identification of soils, rocks, geological units, contaminated materials and contaminant quantities have been based on commonly accepted practices in environmental consulting practice in this area.

The CLIENT acknowledges that:

- a) The investigation findings are based solely on the information generated as a result of the specific scope of the investigation authorized by the CLIENT;
- b) any assessment regarding the presence of contamination of the Site is based on the interpretation of conditions determined at specific sampling locations and depths and that conditions may vary between sampling locations;
- c) there can be no assurance that isolated pockets of contaminants are not located on the Site;
- d) any assessment is also dependent on and limited by the accuracy of the analytical data generated by the sample analyses;
- e) any assessment is also limited by the scientific possibility of determining the presence of contaminants for which scientific analyses have been conducted; and
- f) the analytical parameters selected are limited to those outlined in the CLIENT's authorized scope of investigation (in the absence of any evidence of potential contamination sources on the Site, which may warrant expanding the analytical parameters).

8. **REMEDIATION COST ESTIMATES** - Estimates of remediation costs can only be based on the specific information generated and the technical limitations of the investigation authorized by the CLIENT. Accordingly, estimated costs for remediation only represent the cost to clean up known contaminants that have been identified during the course of the investigation. As remediation of a Site is often an iterative exercise, estimated costs for remediation should only be interpreted to cover the first stage of any Site remediation until such time as verification samples indicate that the Site has been fully remediated and Amec Foster Wheeler shall therefore not be liable for the accuracy of any estimates of remediation costs provided.

9. **CONTROL OF WORK AND JOBSITE SAFETY** - Amec Foster Wheeler is only responsible for the activities of its employees on the jobsite. The presence of Amec Foster Wheeler personnel on the Site shall not be construed in any way to relieve the CLIENT or any contractors on Site from their responsibilities for Site safety. The CLIENT undertakes to inform Amec Foster Wheeler of all hazardous conditions, or possible hazardous conditions which are known to him. The CLIENT also recognizes that the activities of Amec Foster Wheeler may uncover previously unknown hazardous materials and that such a discovery may result in the necessity to undertake emergency procedures to protect Amec Foster Wheeler employees as well as the public at large and the environment in general. The CLIENT also acknowledges that in some cases the discovery of hazardous conditions and materials will require that certain regulatory bodies be informed and the CLIENT agrees that notification to such bodies by Amec Foster Wheeler will not be a cause of action or dispute.

#### 10. **LIMITATION OF RESPONSIBILITY**

**Limitation of Liability** - The CLIENT has agreed that, notwithstanding any other provision negotiated as part of Amec Foster Wheeler's contract, the total liability of Amec Foster Wheeler, its officers, directors and employees for liabilities, claims, judgments, demands and causes of action arising under or related to this Agreement, whether based in contract or tort, shall be limited to the total compensation actually paid to Amec Foster Wheeler for the services hereunder or \$50,000, whichever is less. All claims by the CLIENT shall be deemed relinquished unless filed within one (1) year after substantial completion of the services hereunder.

**No Special or Consequential Damages** - CLIENT and Amec Foster Wheeler agree that to the fullest extent permitted by law that Amec Foster Wheeler shall not be responsible for any consequential, incidental or indirect damages.

**Indemnification** - Because CLIENT owns and/or operates the site where work is being performed, CLIENT has and shall retain all responsibility and liability associated with the environmental conditions at the site. Unless specifically identified elsewhere, CLIENT'S responsibility and liability includes the handling and disposal of any samples or hazardous materials generated on the site as a result of Amec Foster Wheeler's performance hereunder. To the fullest extent permitted by law, the CLIENT agrees to defend, indemnify and hold Amec Foster Wheeler, its agents, subcontractors, and employees harmless from and against any and all claims, defense costs, including attorney's fees, damages, and other liabilities arising out of or in any way related to CONSULTANT's reports or recommendations concerning this Agreement, Amec Foster Wheeler's presence on the project property, or the presence, release, or threatened release of asbestos, hazardous substances, or pollutants on or from the project property; provided that the CLIENT shall not indemnify Amec Foster Wheeler against liability for damages to the extent caused by the negligence or intentional misconduct of Amec Foster Wheeler, its agents, subcontractors, or employees.