

**Desktop Environmental
Review, Former U.S. Military
Facility, Hopedale, NL**



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1.0 INTRODUCTION

Stassinu Stantec Limited Partnership (Stantec) was retained by Newfoundland and Labrador Department of Municipal Affairs and Environment (NLDMAE) to conduct a Desktop Environmental Review for the Former U.S. Military Facility located in Hopedale in Newfoundland and Labrador (NL) (see Drawing No. 121413099-800-EE-01 in Appendix A), herein referred to as the “Site”.

The Desktop Environmental Review was conducted for NLDMAE in support of environmental due diligence of the Site. The purpose of the Environmental Review was to review available historical environmental reports for the Site and to identify sources of potential environmental contamination associated with the Site, which may exist as a result of past activities. The scope of work did not include a site visit or environmental sampling of soil, water or sediment. Note that Hopedale Harbour including the wharf area is not included in this review.

1.1 Regulatory Framework

1.1.1 Management of Impacted Sites – Newfoundland and Labrador

The Newfoundland and Labrador Department of Municipal Affairs and Environment (NLDMAE) released soil and groundwater remediation guidelines for petroleum hydrocarbons and other chemicals of concern on February 22, 2005 under Department Policy Document PPD05-01. These criteria are outlined in the Guidance Document for the Management of Impacted Sites, Version 2.0 (January 2014). The purpose of this guidance document is to provide a clear process for the management of impacted sites in Newfoundland and Labrador that result in the satisfactory resolution of environmental impacts. The guidance document is applicable to all chemicals of concern (COCs) that have been released into the environment and is applicable to historical and active impacts.

Based on NLDMAE (2014), the guiding principles of the document include:

1. Human health and the environment must be protected through the timely and proper management of impacted sites.
2. The Person Responsible for an impacted site must ensure that the Impacted Site Management Process is taken to completion to provide adequate protection of human health and the environment.
3. The Site Professional providing the technical expertise and final documentation is responsible for the results of their work.
4. The Department requires final documentation of the Site Professional’s opinion stating the condition and safe uses of the site. This is achieved through completion of a Record of Site Condition by the Site Professional and subsequent acknowledgement by the Pollution Prevention Division of the Department (PPD) or Service NL.
5. The management process shall be applicable to all impacted sites and provide a flexible, cost-effective approach to achieving regulatory closure for identified impacts.

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The Newfoundland and Labrador Guidance Document for the Management of Impacted Sites is mandatory for all impacted sites that are privately/publicly owned, provincially owned/controlled, governed provincially, or subject to divesture to provincial agencies. If the site is federally owned or controlled, a federal approach applies. If chemical impacts are identified on a property and it is determined to be privately/publicly owned, provincially owned/controlled, governed provincially, or subject to divesture to provincial agencies, as discussed above, the Newfoundland and Labrador Guidance Document for the Management of Impacted Sites applies.

A key party that must be initially identified is the Person Responsible. NLDMAE defines the Person Responsible as “the person, association of person, corporate entity, or municipally determined, by the Province, to be responsible for the remediation of an impacted site”. Note that the Person Responsible is not necessarily the polluter.

Based on NLDMAE (2014), the Impacted Site Management Process is divided into five steps as follows:

1. Initial Actions – All active and historical spills must be reported to Service NL or the Pollution Prevention Division (PPD) of NLDMAE.
 - a) For active impacts, an Environmental Protection Office (EPO) will assess the type and potential extent of contamination, determine the presence of human and ecological concerns including sensitive receptors on or near the site, determine the Person Responsible, determine if initial emergency response is satisfactory, and issue an impacted sites letter to the Person Responsible informing them of their requirement to hire a Site Professional to complete an Environmental Site Assessment (ESA).
 - b) For historical impacts, the initial actions of the EPO may vary depending on site-specific information.
2. Environmental Site Assessment and Risk Assessment – The Person Responsible must employ a Site Professional to complete an ESA that meets the Minimum Site Assessment Requirements set out by Atlantic PIRI (2012, updated 2015). The Site Professional must determine which COCs are present and if concentrations exceed Tier I guidelines. If the concentrations exceed Tier I guidelines, the Site Professional may recommend remediation or conduct a Tier II or Tier III risk assessment. The Site Professional must also complete the Atlantic PIRI Ecological Screening Checklist. Note that if actual or potential impacts are identified at the property line, the Person Responsible must notify third parties.
3. Remedial Action Planning and Implementation – Remediation or risk management would be required wherever impacts exceed the applicable guidelines (i.e., Tier I, II or III) and in some cases, may require submission of a remedial action plan to Service NL or PPD for review and approval. Details of monitoring also require submission to Service NL or PPD.
4. Regulatory Closure – Once impacts at the site have been addressed, the Site Professional prepares a Closure Report including a Record of Site Condition for submission to Service NL or PPD. NLDMAE may approve final closure (situations where remediation is complete and no further work is required) or conditional closure (all remediation is complete and a monitoring program is required to verify that all the remedial objectives have been achieved).

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5. Decommissioning of Monitor Wells – Monitor wells and remedial infrastructure require decommissioning, where applicable. Decommissioning is per the Protocol presented in NLDMAE (2014).

Note that there is a review process for NLDMAE with respect to remedial action plans and risk assessments. The review of remedial action plans is generally a four to six-week process while the review of risk assessments is generally an eight-week process.

The Management of Impacted Sites in Newfoundland and Labrador is a three-tiered approach. The tiered approach generally involves applying generic guidelines and is applicable to a variety of chemicals and each tier has an equivalent level of health protection.

Tier I

The Tier I approach involves applying generic guidelines. For petroleum hydrocarbons, this includes application of the Tier I Risk Based Screening Levels (RBSLs) which were calculated using the Atlantic RBCA Toolkit using conservative default parameters typical of sites in Atlantic Canada. The RBSLs are protective of human health. To apply the Tier I RBSLs, the following must be satisfied:

1. All Minimum Site Assessment Requirements as set out by Atlantic PIRI (2012, updated 2015) must be fulfilled. If some of these requirements are not met, full professional justification acceptable to PPD or Service NL must be provided;
2. All mandatory conditions as listed in the Minimum Site Assessment Requirements must be met; and
3. All default site characteristics as listed in the Minimum Site Assessment Requirements must be applicable to the site and surrounding properties.

Atlantic PIRI also publishes the Tier I Ecological Screening Levels (ESLs) which are protective of ecological health.

For most other chemicals, the Tier I approach involves applying the Canadian Council of Ministers of the Environment (CCME) Canadian Environmental Quality Guidelines (CEQGs).

Tier II

The Tier II approach for petroleum hydrocarbons involves the application of site-specific or pathway-specific guidelines generated by a Site Professional. Generally, the Tier II approach is only applied to the protection of human health.

For petroleum hydrocarbons, a Tier II approach may involve the application of Tier II Pathway Specific Screening Levels (PSSLs) or the calculation of site specific target levels (SSTLs) using the Atlantic RBCA Toolkit. The PSSLs can be applied when certain exposure pathways are not active at the site if there is no building present or planned for a site, the indoor air exposure pathway can be excluded. To apply the Tier II PSSLs or to use the Atlantic RBCA Toolkit, the same conditions must be satisfied as for the Tier I RBSLs.

For chemicals other than petroleum hydrocarbons, CCME provides pathway specific guidelines in their fact sheets specific to each chemical. Similar to the PSSLs, these guidelines may be applied when an exposure

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pathway can be excluded. SSTLs may also be calculated using CCME's *Protocol for the Derivation of Environmental and Human Health Soil Quality Guidelines* or Health Canada's *Guidance on Human Health Preliminary Quantitative Risk Assessment*.

Tier III

The Tier III approach involves the use of additional risk assessment models or alternate scientific approaches. The Tier III approach is usually applied when the Tier II approach is not applicable or does not fully address the range of issues present at the site. Soil vapour testing and ecological risk assessment are examples of Tier III assessments.

1.1.2 Applicable Guidelines for the Site Going Forward

The Site is crown land property; therefore, NLDMAE soil and groundwater remediation guidelines for petroleum hydrocarbons and other chemicals of concern under Department Policy Document PPD05-01 are applicable.

For petroleum hydrocarbons in soil and groundwater, the NLDMAE guidance document recommends the current version of the Atlantic RBCA (Risk-Based Corrective Action) guidance (Version 3.0 User Guidance Document, July 2012, revised 2015).

The applicable criteria for other chemicals such as volatile organic carbons (VOCs), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and/or metals in soil, surface water and sediment are the CCME CEQGs and its associated documents.

For chemicals such as VOCs, PAHs, PCBs and/or metals in groundwater, preference is given to the CCME Environmental Quality Guidelines. In the absence of CCME, guidelines or other types of benchmarks from other Canadian or American agencies would be identified and adopted. If a guideline for a particular chemical or pathway was not provided, the next jurisdiction in the hierarchy was referenced until an appropriate environmental quality standard could be established.

The 2010 Phase II/III ESA, Human Health and Ecological Risk Assessment (HHERA) and Remedial Action Plan (RAP) for the Site (Stantec, 2010) developed SSTLs in soil for the Residential Area including PCBs (9 mg/kg) and Antimony (30 mg/kg) and SSTLs in soil for the Former Radar Site including PCBs (22 mg/kg), total petroleum hydrocarbons (TPH) (1,700 mg/kg), Lead (75 mg/kg), Antimony (5 mg/kg), Chromium (20 mg/kg) and Cadmium (1.3 mg/kg).

Stantec understands that Atlantic PIRI is currently developing regulatory guidance for COCs other than petroleum hydrocarbons in groundwater, sediment and surface water. The Atlantic PIRI guidance would likely be adopted by NLDMAE and incorporated into their Guidance Document for the Management of Impacted Sites. Should the guidance become available before or during future site assessments for the Site, the Atlantic PIRI guidance would likely be applicable.



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2.0 SITE DESCRIPTION

2.1 General

The overall site is located adjacent to the Town of Hopedale, which is located on the Labrador coast approximately 148 air miles north of Goose Bay, as shown on Drawing 121413099-800-EE-01. The Former U.S. Military Site consists of three main hilltop sites (i.e., BMEWS, Main Base and Mid-Canada Line) as well as several other associated sites located west of the town. The Residential Subdivision is also located west of the main town area. There is no outside road access to Hopedale, however coastal boat service is available from mid-summer to late fall. Local access to all sites is via a gravel road network (referred to as the “main access road”) that is in varying conditions of repair. Figure 1 shows the site layout and locations of site infrastructure during site operation.

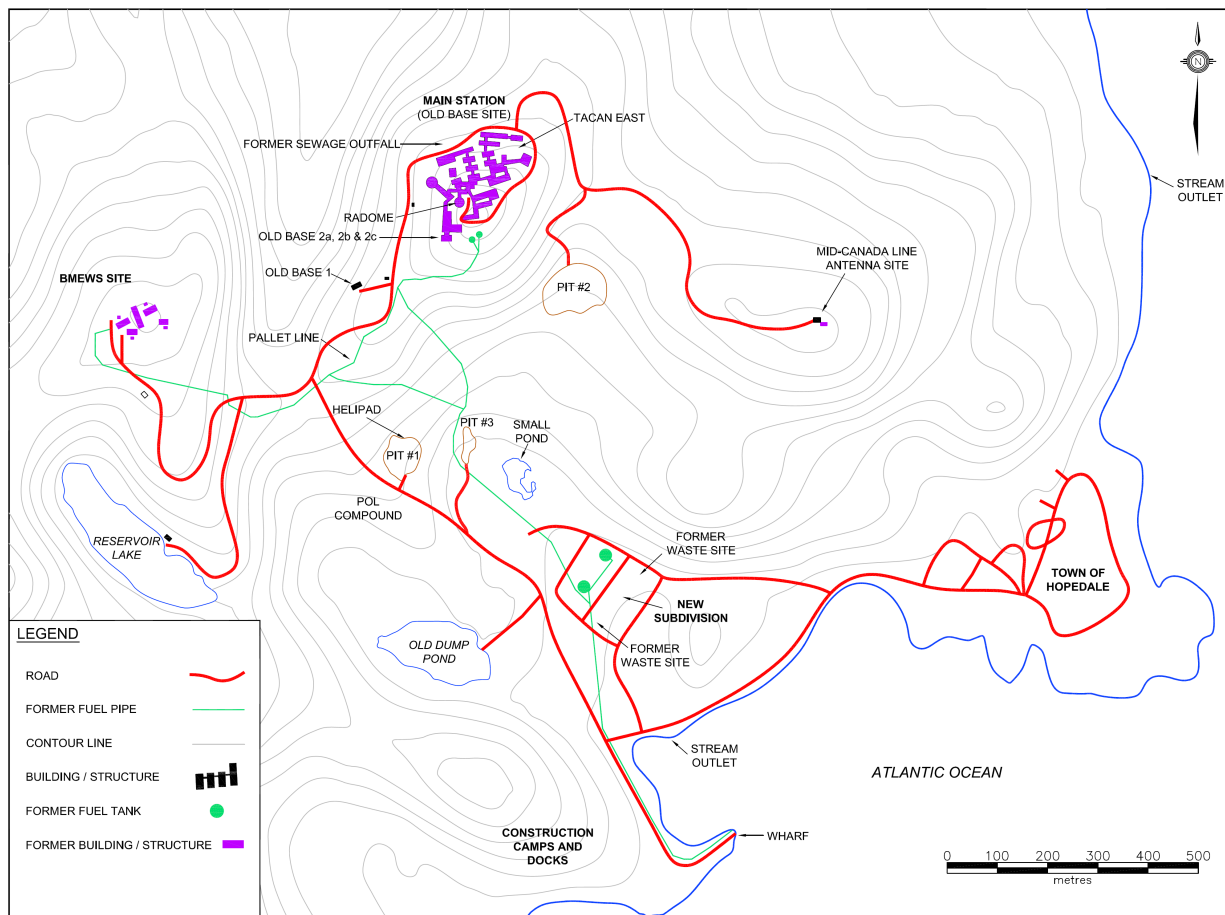


Figure 1 Map of Hopedale Showing the Former Military Base and Radar Site (Source: ESG, 2007)

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2.2 Topography, Regional Drainage and Geology

The overall site is dominated by three installations on hilltops elevated between 100 m and 150 m above sea level, including (from west to east): the BMEWS site, the Main Base and the Mid-Canada Line antennae site. The BMEWS site, which has an area of approximately 1 hectare, is located on the top of a hill approximately 2 km northwest of the Town of Hopedale. Drainage from the BMEWS site is in all directions (i.e., to the north, east, south and west), including to the south towards Reservoir Lake (approximately 300 m to the south). The Main Base site, which has an area of approximately 45 hectares, is located on the top of a hill approximately 1.2 km northwest of the Town of Hopedale. The Mid-Canada Line antennae site is located on the top of a hill approximately 700 m northwest of the Town of Hopedale. Drainage from the Main Base and Mid-Canada Line sites is in all directions. Much of the area around the sites is exposed bedrock, with limited soil cover.

Based upon the site topography and site inspections, the majority of contaminants of potential concern released from the Former U.S. Military Site would eventually make their way towards the Small Pond Bog, and, from there, through the Residential Subdivision to be discharged at the mouth of the small creek located near the wharf. A potential pathway for contaminant of potential concern migration could extend north from Old Base 1 and BMEWS through the Valley Drainage Ponds. This pathway leads through a series of small ponds and wetlands within the Valley Drainage Ponds site. A third possible pathway extends northwest from BMEWS towards Big Lake approximately 650 m northwest of the overall site.

Bedrock is granite and gneiss, and is largely exposed. Soil cover on the hills is relatively thin (generally < 0.5 m), with accumulations of rock, gravel, sand and organic matter in low lying areas. Deeply incised U-shaped valleys occur in conjunction with steep-sided, rounded mountains and fjords that extend well inland. Large bogs can be found in the low-lying areas.

2.3 Current Site Operations

The former military base and radar site is primarily a vacant “brownfield” site, with no existing buildings or structures, except for a small building at the Mid-Canada Line antennae site. The Residential Subdivision is an active residential development.

Existing reports indicate that much of the previously developed portions of the former military base and radar site contain large areas of exposed bedrock, with limited soil and vegetative cover. Existing reports indicate that portions of the former military base and radar site are regularly used by Hopedale residents as walking areas, picnic areas, “hangout” areas for children, and for berry picking or hunting. Small mammals such as mice, rabbits and partridge are reported to be present on and around the site. Hopedale residents reportedly hunt rabbits and partridge in the general site area.

Based on previous environmental reports, the Former Military Radar Site was divided into 22 smaller sites as follows:

1. BMEWS
2. Old Base 1
3. Main Base (includes TACAN, Radome, Old Base 2a, 2b and 2c)

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4. Mid Canada Line
5. POL Compound
6. Pit No. 1/ Helipad
7. Pit No. 2
8. Pit No. 3
9. Sewage Outfall
10. Wharf Area
11. Pallet Line
12. Old Dump Pond
13. Reservoir
14. Second Reservoir
15. Small Pond Bog
16. Valley Drainage Ponds
17. Old Dam
18. Roadway
19. Pipeline

2.4 Property Information

The following property descriptions for each of the smaller sites are based on information gathered during previous investigations as provided in the available previous reports.

2.4.1 Main Base Site

The Main Base (also referred to as “the old base”, “the upper site” and the “TACAN site” in previous environmental reports), which has an area of approximately 45 hectares, is located on the top of a hill approximately 1.2 km northwest of Hopedale as shown on Drawing No. 121413099-800-EE-02 in Appendix A. The site served as the Tactical Air Navigation Site (TACAN) when the site was operational and included the radar complex, maintenance building, generator building, accommodations buildings and several additional buildings required to service the complex. The only remains of the former site infrastructure on the site are the concrete foundations.

Terrain in the vicinity of the Main Base site was moderately sloped and surface drainage (apparent groundwater flow direction) appears to be in all directions. There are distinct drainage courses at the site that drain to the northwest through the former sewage outfall and to the southeast towards Pit No. 2. The site consists of gravel, bedrock outcrops and minimal low vegetation.

2.4.2 Roadway

The main access road provides access to the Former U.S. Military Site from the wharf area. The Roadway site investigated historically consisted of the upper portion of the main access road, beginning near the turn-off to the BMEWS site, passing the Old Base 1 site and looping around the Main Base, as shown on Drawing No. 121413099-800-EE-02 in Appendix A. The road was composed of compacted sand and gravel



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and was lined with low vegetation and shrubs. The Roadway follows the topography of the surrounding terrain and surface runoff appears to be in all directions.

2.4.3 Sewage Outfall

The Sewage Outfall is located north of the Main Base, on the north side of the main access road. During operation of the Former U.S. Military Base, the site served as a sewage outfall for the Main Base site. There was a drainage course that originates at the Main Base site and flows north through the Sewage Outfall. Terrain in the vicinity of the site was moderately to steeply sloped towards the northwest and surface drainage (apparent groundwater flow direction) appears to be to the northwest towards the Valley Drainage Ponds.

2.4.4 Valley Drainage Ponds

The Valley Drainage Ponds are located within a deeply incised U-shaped valley with steep-sided, rounded mountain slopes. The site is located between the hilltop BMEWS, Old Base 1 and Main Base sites. The site consists of dense vegetation with ponds and wetlands. Based on local topography, the site was expected to receive surface runoff and groundwater recharge from the Former U.S. Military Site. Terrain at the site slopes slightly to the north and surface drainage (apparent groundwater flow direction) appears to be to the north.

2.4.5 Mid-Canada Line

The Mid-Canada Line site is located approximately 700 m southeast of the Main Base on top of a hill as shown on Drawing No. 121413099-800-EE-02 in Appendix A. The site formerly included a Mid-Canada Line antenna and small buildings. The concrete foundations from the former antenna and buildings currently remain at the site. The site also included two fenced antennae and a communications trailer. Terrain in the vicinity of the Mid-Canada Line site was moderately sloped and surface drainage (apparent groundwater flow direction) appears to be to in all directions, including to the west towards Pit No. 2. Vegetation at the site was limited and consists of patches of grasses and some low bushes. Bedrock and boulder outcroppings are common at the site.

2.4.6 Pallet Line

The Pallet Line site is located between the Old Base 1 site and BMEWS on the south side of the main access road. During operation of the Former U.S. Military Site, the site was used as a storage area. The site was a heavily worked area consisting of sand and gravel. Terrain at the site slopes moderately to the southeast. Surface drainage (apparent groundwater flow direction) is expected to be to the southeast towards Pit No. 1 and Pit No. 3.

2.4.7 Pit No. 1/Helipad

The Pit No. 1/Helipad site is located south of the Main Base on the north side of the main access road, as shown on Drawing No. 121413099-800-EE-02 in Appendix A. The site was a heavily worked area consisting of gravel and boulders with low vegetation along the perimeter. Terrain at the site slopes moderately to the



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west. Surface drainage (apparent groundwater flow direction) is expected to be to the east towards Pit No. 3.

2.4.8 Pit No. 2

The Pit No. 2 site is located southeast of the Main Base on the south side of the main access road. The site was a heavily worked area consisting of gravel and boulders with low vegetation along the perimeter. Terrain at the site slopes moderately to the south. Surface drainage (apparent groundwater flow direction) is expected to be to the south towards the Small Pond Bog and the Residential Subdivision.

2.4.9 Pit No. 3

The Pit No. 3 site is located south of the Main Base and east of Pit No. 1/Helipad, on the north side of the main access road, as shown on Drawing No. 121413099-800-EE-02 in Appendix A. The site was a heavily worked area consisting of gravel, boulders and bedrock outcroppings with low vegetation and some trees along the perimeter. Terrain at the site slopes moderately to the southwest. Surface drainage (apparent groundwater flow direction) is expected to be to the southeast towards the Small Pond Bog and the Residential Subdivision.

2.4.10 Small Pond Bog

The Small Pond Bog is located between Pit No. 3 and the Residential Subdivision. The site is a relatively flat marshy area that was believed to receive surface water runoff from various Former U.S. Military Sites located upgradient (i.e., Old Base 1, Main Base, Pallet Line, Pit No. 1, Pit No. 2, Pit No. 3 and Mid-Canada Line). There are two drainage streams that flow into the Small Pond Bog, one originating from the Pit No. 3 direction, the other from the northeast.

2.4.11 POL Compound

The POL Compound is located south of the main access road, immediately south of Pit No. 1/Helipad, as shown on Drawing No. 121413099-800-EE-02 in Appendix A. Previous environmental reports revealed that the site was likely used as a former storage area for petroleum, oil and lubricants (POL). It was believed that waste materials at the site may have been disposed of by pushing materials into the gully. Terrain at the site consists of a relatively flat area of exposed bedrock and soil, with a vegetated gully located further south. The site is located at a lower elevation than the other Former U.S. Military Site areas, allowing for water to pool at the site during rainfall events. Surface drainage (apparent groundwater flow direction) is expected to be south to southeast towards Old Dump Pond.

2.4.12 Old Dump Pond

Old Dump Pond is located downgradient of Reservoir Lake on the south side of the main access road. An area of residential development was present on an elevated gravel pad approximately 200 m northeast of Old Dump Pond. The pond was historically used for storage of various metal waste and debris (i.e., wastes were stored in and around the pond).



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The shore of the pond was heavily vegetated with some bedrock outcroppings. The road in the residential area was constructed out of gravel. Terrain in the vicinity of the site sloped towards the pond which discharges to the southeast into Hopedale Harbour via a stream. Surface drainage (apparent groundwater flow direction) near the site was expected to be towards the pond.

2.4.13 Sewer System

The historical understanding of the sewer system suggested it began with a concrete tank located approximately 5 m north of Main Access Road. The tank was likely a settling tank designed to separate liquids and solids. The tank collected upstream liquids via an inlet sewer pipe. The inlet pipe entered the southern end of the tank and was oriented in the direction of the Transmitter Building. Three manholes were located in the vicinity of the settling tank and appeared to provide access and clean-outs for the tank, as well as inlet and outlet pipes. The outlet pipe continued underground in a northerly direction from the tank at a depth of approximately 2.4 m through at least two additional manholes, ending at an outfall structure approximately 50 m from the shore of Lake Melville. Water flowed from the end of the pipe down onto a concrete pad and onward overland towards Lake Melville.

2.4.14 Pipeline

During operation of the Former U.S. Military Site, fuel used at the site was received at the wharf and transferred upgradient via aboveground pipelines to two large aboveground fuel storage tanks located at the Main Base site. The fuel tanks and pipelines have been removed, with the exception of some sections of the aboveground pipeline present near the wharf. The Pipeline site was identified as the corridor where the former pipeline crossed the site.

2.4.15 Old Dam

The Old Dam is a concrete structure located northwest of the Town of Hopedale. The dam has a small stream passing through it that originates at the Mid-Canada Line site. Terrain in the vicinity of the Old Dam slopes to the southeast towards the Town of Hopedale. Vegetation at the site consists of patches of grasses and trees.

2.4.16 Reservoir

The Reservoir site is located in a valley, approximately 300 m south of the BMEWS site. The site encompasses Reservoir Lake and is used as the primary source of potable water for the town of Hopedale. Reservoir Lake is a freshwater aquatic environment. Terrain in the vicinity of the Reservoir site slopes steeply towards the lake. A small stream feeds into the lake from the north. It is assumed that surface runoff and apparent groundwater flow follow the general slope. The shore of the lake consists of bedrock outcroppings and lush vegetation. Visible substrate along the shore of the lake was generally coarse.

2.4.17 Second Reservoir

The Second Reservoir is located in a valley, approximately 600 m west of Reservoir Lake. The Second Reservoir is used as a back-up source of potable water for the Town of Hopedale. There was a waterline

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connecting the Second Reservoir to Reservoir Lake; however, the Second Reservoir appears to lie west of any significant activities or infrastructure on the Former U.S. Military Site. A strong bedrock ridge lies between the Second Reservoir, a small pond and a large forested bog complex and the known areas of contamination on the Former U.S. Military Site. The Second Reservoir lies within a drainage system that discharges between the town wharf and the airport. The lower part of this watershed was under development for residential purposes at the time of the previous investigations. Terrain in the vicinity of the site slopes moderately towards the Second Reservoir. It was assumed that surface run-off and apparent groundwater flow follow the general slope. The shore of the reservoir consists of gravel, boulders and lush vegetation.

2.5 Historical Land Use

Hopedale is located on the Labrador coast, 148 air miles to the north of Goose Bay, Newfoundland and Labrador. Construction of the military base and radar site in Hopedale, NL commenced in 1952 and was completed in 1957. The Hopedale site was a station on the United States Air Force Pinetree Line and was also the most easterly site on the Mid-Canada Line of antennae stations which had extended across the country. The Hopedale site was also one of a series of sites which functioned as a Ballistic Missile Early Warning System (BMEWS) at which information was gathered and communicated to the United States. It has been reported that, at its peak, the site housed 300 personnel.

Hopedale was operated as a radar site from 1957 until 1969 by the United States government. The base was closed down in 1969 and the radome and radar antennae were removed. Portions of the remaining site were operated by Canadian Marconi as a telecommunications site until 1972 and by ITT as a telecommunications site until 1975. The complex was finally closed in 1975. Most of the remaining aboveground structures were demolished and buried in several locations around the site in the mid 1980s. At that time, limited clean-up efforts, including the removal and disposal of PCB containing transformers, were carried out. Only the foundations and floor slabs of buildings and the foundations and bases of antennae remained on the site.

The former Pinetree Line site construction included a dock, approximately 2.5 km of roads from the dock to the Main Base (also referred to as “the Old Base”, “the Upper Site” and the “TACAN site”), the main base and a separate BMEWS site located approximately 600 m southwest of the Main Base. A separate Mid-Canada Line antennae site was located approximately 700 m southeast of the Main Base (refer to Figure No. 1). The Main Base included the radar complex, maintenance building, generator building, accommodations buildings and several additional buildings required to service the complex. The BMEWS site included four troposcatter antennae and an operations building. The Mid-Canada Line antennae site included small buildings and antennae. Fuel used at the site was received at the wharf and transferred via aboveground pipelines to two large aboveground fuel storage tanks at the Main Base site. Historical photographs also show the presence of large aboveground storage tanks at the BMEWS site. The fuel tanks and pipelines have been removed. Two large aboveground fuel storage tanks were also located approximately 600 m north of the wharf, in an area that is surrounded by the Residential Subdivision; these tanks were removed in 2001.

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The BMEWS site, which has an area of approximately 1 hectare, is located on the top of a hill approximately 2 km northwest of the community of Hopedale. Much of the area around the site is exposed bedrock, with limited soil cover. Drainage from the site is in all directions, including to the south towards Reservoir Lake (approximately 300 m to the south). The Main Base site, which has an area of approximately 45 hectares, is located on the top of another hill approximately 1.2 km northwest of Hopedale. Much of the area around the site is exposed bedrock, with limited soil cover. Drainage from the site is in all directions. The Mid-Canada Line antennae site is located on the top of another hill approximately 700 m northwest of Hopedale. Much of the area around the site is exposed bedrock, with limited soil cover. Drainage from the site is in all directions. Previously disturbed areas associated with the former base and radar site include: Pit No. 1/helipad located to the north of the upper site access road; Pit No. 2 located to the southeast of the Main Base; Pit No. 3 located to the north of the upper site access road and east of Pit No. 1/helipad; the POL compound (i.e., an area for storage of petroleum products, oils and lubes) located across the access road from the Pit No. 1/helipad; and the Pallet Line, which was a storage area located between the Old Base site and BMEWS. Old Dump Pond, located approximately 200 m southwest of the Residential Subdivision, was historically used for storage of various metal waste and debris (i.e., wastes were stored in and around the pond). Some surface drainage from the Main Base area and drainage from the Pit No. 3 area drains via a small stream and pond through the Residential Subdivision to the harbour near the wharf. Another component of surface drainage from the Main Base drains via a small stream to the harbour north of the town.

3.0 REVIEW OF AVAILABLE HISTORICAL ENVIRONMENTAL REPORTS

The following reports were reviewed as part of this Desktop Environmental Review:

1. Plan Forward Associated with the Former Radar Site, Hopedale, Newfoundland and Labrador, Sikumiut Environmental Management Ltd. (Sikumiut) and Minaskuat Limited Partnership (now Stantec), March 2008
2. Phase II/III Environmental Site Assessment, Human Health and Ecological Risk Assessments and Remedial Action / Risk Management Plan for the Former U.S. Military Site and Residential Subdivision at Hopedale, Labrador, Stantec, May 2010
3. Additional Delineation and Risk Assessment Re-evaluation, Former U.S. Military Site and Residential Subdivision, Hopedale, Labrador, Stantec, February 2011
4. Implementation of Remedial Action Plan – Year 1, Former U.S. Military Site and Residential Subdivision, Hopedale, Labrador, Stantec, April 2012
5. Implementation of Remedial Action Plan – Year 2, Former U.S. Military Site and Residential Subdivision, Hopedale, Labrador, Stantec, February 2014
6. Implementation of the Remedial Action Plan – Year 3, Former U.S. Military Site and Residential Subdivision, Hopedale, Labrador, Stantec, April 2014
7. Additional Delineation and Updated Remedial Action Plan, Former U.S. Military Site, Hopedale, Labrador, Stantec, July 2014



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8. Implementation of the Remedial Action Plan – Year 4, Former U.S. Military Site, Hopedale, Labrador. Stantec, June 2015
9. Implementation of the Remedial Action Plan – Year 5, Former U.S. Military Site, Hopedale, Labrador. Stantec, August 2016
10. Implementation of the Remedial Action Plan – Year 6, Former U.S. Military Site, Hopedale, NL, Stantec, July 2017

The following sections summarize the previous investigations conducted at the site.

3.1 Plan Forward Associated with the Former Radar Site (Sikumiut and Stantec, 2008)

This 2008 report (Sikumiut and Stantec, 2008) was a desktop review of 14 available environmental assessment reports that were previously completed for the Site. The purpose of the Plan Forward was to form the basis for development and implementation of remedial action plans/risk management plans for the former Hopedale military base and radar site and Residential Subdivision. During the review of the existing reports, various data gaps and outstanding actions were identified for the former Hopedale military base and radar site and Residential Subdivision.

The eight previous reports for the Military Site that were reviewed included the following:

1. Site Restoration, Former Dew Line Radar Sites, Labrador: Status Report #1, Period Ending July 31, 1987; Bond Architects & Engineers Limited
2. Environmental Inspection, Abandoned Military Sites in Labrador; Toby Matthews report for Department of Environment and Labour, October 1996
3. Phase II Reconnaissance Testing Program, Former US Military Facility, Hopedale, Labrador; AGRA Earth & Environmental Limited report for Department of Environment and Labour, November 2, 1998
4. Environmental Assessment of the Former Military Facility at Hopedale, Labrador; Environmental Sciences Group Royal Military College & The Labrador Inuit Association report for the Labrador Contaminants Working Group, March 2005
5. Review of Remediation Efforts Relating to Former Radar Site and Associated Facilities, Hopedale, Labrador; Matthews Environmental Services report to Department of Environment and Conservation, December 2006
6. Investigation of PCB Concentrations in the Terrestrial Food Chain at the Former Military Site in Hopedale, Labrador; Environmental Sciences Group Royal Military College & the Nunatsiavut Government report for the Nunatsiavut Government, March 2007
7. Further Investigation of PCB Concentrations in the Terrestrial Food Chain at the Former Military Site in Hopedale, Labrador; Environmental Sciences Group Royal Military College & the Nunatsiavut Government report for the Nunatsiavut Government, May 2007
8. Hopedale Former Military Site, Soil Delineation Report, Hopedale, Newfoundland & Labrador; Environmental Sciences Group Royal Military College & the Nunatsiavut Government report for the Nunatsiavut Government, May 2007

The six previous reports for the Residential Subdivision that were reviewed included the following:



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1. Environmental Site Assessment, Abandoned Petroleum Storage Tank Farm, Hopedale, Labrador; AGRA Earth & Environmental Limited draft report for Department of Provincial and Municipal Affairs, July 14, 2000
2. Remedial Program Final Report, Abandoned Petroleum Storage Tank Farm, Hopedale, Labrador; AGRA Earth & Environmental Limited report for Department of Provincial and Municipal Affairs, November 26, 2001
3. Assessment Samples from the New Subdivision in Hopedale, Labrador; Environmental Sciences Group Royal Military College & the Nunatsiavut Government report for the Nunatsiavut Government, March 2006
4. Summary of Environmental Investigations at Hopedale Residential Subdivision; Sikumiut Environmental Management Ltd. report for the Nunatsiavut Government, October 2006
5. EM31 Survey, Hopedale New Subdivision, Hopedale, Labrador; AMEC Earth & Environmental Limited report for Sikumiut Environmental Management Limited, November 6, 2006. This report was appended to report No. 4 above.
6. Summary of 2007 Environmental Investigations at Hopedale Residential Subdivision; Sikumiut Environmental Management Ltd. report for the Nunatsiavut Government, November 2007

During the review of existing reports, various data gaps and outstanding actions were identified for the former Hopedale military base and radar site and the Residential Subdivision.

Previous site investigations confirmed the presence of PCBs, metals and petroleum hydrocarbons in soil and/or sediment and/or tar-like debris at the former military base and radar site, and PCBs and petroleum hydrocarbons in soil and/or sediments and/or tar-like debris at the Residential Subdivision at concentrations that exceed the regulatory guidelines at the time of the assessment. However, most of the identified environmental issues at the former military base and radar site and at the Residential Subdivision had not been sufficiently defined at this time to enable the completion of an overall remedial options review or the development of an overall remedial action plan.

Preliminary remedial action/risk management plans were developed in the Plan Forward for the five identified areas of the former military base and radar site with elevated PCBs in soil or on bedrock (i.e., PCBs concentrations > 50 mg/kg), even though the extent of the PCBs impacts had not been fully defined on each of these areas. At two of these areas (i.e., BMEWS and Radome), the remedial action/risk management approach carried forth in the Plan Forward was to remove PCB impacted soil and transport it to an approved disposal facility in Quebec (QC). At the other three areas (i.e., Old Base 1, Old Base 2a and Old Base 2b), a combined remedial action/risk management plan was carried forth in the Plan Forward because of the likely presence of PCBs in fractured bedrock. If the combined remedial action/risk management plan was carried out in these areas, PCB impacted tar-like materials and soil would be removed and transported to approved disposal facilities and a concrete cap would be installed over the affected bedrock to prevent contact with or migration of any residual PCBs in the fractured bedrock. Subject to further evaluation of remedial action/risk management options for the PCB impacted portions of the site, changes could be made before remedial action/risk management plans were finalized for the five identified areas on the former military base and radar site with PCBs concentrations > 50 mg/kg.



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Based on the limited amount of site and analytical information available for the site, the Plan Forward did not include the completion of a remedial options review or development of a remedial action plan / risk management plan for other specific site areas or chemicals of concern. The Plan Forward suggested the completion of various studies and investigations at the former military base and radar site and the Residential Subdivision prior to the development of overall remedial action / risk management plans for the areas.

3.2 Phase II/III ESA/HHRA (Stantec, 2010)

The purpose of the environmental site investigation and risk assessment (Stantec, 2010) was to address data gaps and/or actions recommended in the Plan Forward prepared for the overall site in March, 2008 (Sikumiut and Stantec, 2008) to enable the development of an overall RAP/Risk Management Plan (RMP). The field component of this project was carried out between October 2008 and October 2009 and consisted of the identification of debris and physical hazards, the excavation of 249 test pits, borehole drilling and monitor well installation (74), the collection of 570 soil samples from test pits and boreholes/auger, 271 surface soil samples, 77 sediment samples, 18 surface water samples, 64 groundwater samples, five benthic invertebrate samples, 53 vegetation samples, 37 berry samples, 56 small mammal samples, one larger mammal (e.g., rabbit) sample and 11 fish samples, the remediation of PCB impacted tar and the removal of debris from the stream near the Residential Subdivision.

A total of 16 barrels of PCB-impacted materials were removed from the overall site in the three areas (i.e., Old Base 1, Old Base 2a and Old Base 2b) identified during previous environmental investigations. PCB-impacted tar was manually removed using hand scrapers and powered chippers from the surface of the bedrock, manually picked up and placed into open-top drums and shipped to the Newalta facility in Foxtrap, NL. Bedrock chipping and tar removal continued until no visible evidence of staining remained at the site.

A total of three tandem dump truck loads of debris were removed from the stream northeast of the Residential Subdivision and a transformer shell was removed from the BMEWS site and were disposed of at the Hopedale Landfill.

The ESA identified the following impacts exceeding applicable regulatory guidelines at the time of the assessment:

1. TPH/BTEX (benzene, toluene, ethylbenzene and xylenes) in soil at BMEWS, Old Base 1, Old, Sewage Outfall, Roadway, Pallet Line, Pit No. 1 and 3, Small Pond Bog, POL compound, Old Dump Pond, Pipeline and the Residential Subdivision.
2. Metals in soil at BMEWS, Old Base 1, Main Base, Sewage Outfall, Pit No., POL compound, Old Dump Pond, Pipeline and the Residential Subdivision
3. PCB in soil at BMEWS, Old Base 1, Main Base, Sewage Outfall, Pallet Line, Pit No. 1, Small Pond Bog, POL compound, Old Dump Pond, Pipeline and the Residential Subdivision
4. TPH/BTEX in groundwater at Pit No. 3, Small Pond Bog, POL compound and Pipeline
5. Metals in groundwater at BMEWS, Main Base and Sewage Outfall
6. PCB in groundwater at POL compound, Old Dump Pond and the Residential Subdivision
7. TPH, metals and/or PCB in sediment at Small Pond Bog, Old Dump Pond, Old Dam, Reservoir, Second Reservoir, Residential Subdivision and Big Lake



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8. Metals in surface water at Old Dump Pond, Residential Subdivision and Big Lake

The end goals of the risk assessment (Stantec, 2010) were to quantify risk associated with the identified chemicals of concern at the Former U.S. Military Site in Northwest Point for the various receptor pathways that humans, animals and other biota may be exposed to. These receptor pathways were determined for the overall site and associated risk evaluated for each of these pathways and SSTLs were calculated for the overall site. This output would assist NLDMAE in focusing on those areas that required remedial efforts and provided more realistic clean up goals than those provided that were site specific and protective of both human health and ecological components, hence providing a cost effective approach to risk manage the Site. Public consultation was an essential component for remedial efforts at this Site.

For the purposes of the human health risk assessment, the Site was divided into two areas to adequately reflect the expected human exposure time and activities; the “Residential Area” refers to areas where residents of Hopedale would be expected to spend the majority of their time and the “Former Radar Site” refers to areas where residents of Hopedale would be expected to occasionally visit for recreational purposes (e.g., berry picking, hunting, walking). Ecological receptors with relatively small home ranges could spend their entire life in one particular portion of the Site; therefore, the Site was divided into three areas (Area 1, Area 2 and Area 3) to model risks to ecological receptors with relatively small home ranges as part of the ecological risk assessment. The results of the HHERA indicated the potential for adverse risks to human and/or ecological receptors from exposure to TPH, PCBs and/or metals impacts at the Site; therefore, precautionary actions, remedial activities and risk management strategies were recommended for the control of hazards identified at the Site. It was recommended that SSTLs generated as part of the HHERA be used as remediation criteria for soil at the Site. The SSTLs generated for soil at the Site are provided in Table 1.1.

Table 1.1 Summary of SSTLs to be Applied to Soil at the Former U.S. Military Site (Stantec, 2010)

Chemical	SSTL (mg/kg)	Source	Areas Requiring Remediation
Residential Area			
PCBs	9	HHRA	Old Dump Pond, Pipeline/Wharf Area, Residential Subdivision
Antimony	30	HHRA	Old Dump Pond
Former Radar Site			
PCBs	22	HHRA	BMEWS, Old Base1, Main Base
TPH	1,700	ERA	BMEWS, Main Base, Pit No. 3, POL Compound
Metals	Lead: 75 Antimony: 5 Chromium: 20 Cadmium: 1.3	ERA	BMEWS, Main Base, Mid-Canada Line, POL Compound

Since the 2010 report, NLDMAE has requested that Stantec apply the residential SSTL of 9 mg/kg to PCB-impacted soil over the entire site. This decision was made following consultation with the Inuit Community Government of Hopedale (ICGH) based on their potential future plans for residential expansion in certain

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areas of the Former Radar Site, as well as their concerns with maintaining traditional use of the land around the Former Radar Site.

The following actions, remedial activities, and risk management strategies were recommended as part of the Phase II/III ESA (Stantec, 2010) for the control of hazards related to petroleum hydrocarbon, PCBs and metals impacts at the Site. Some of these recommendations were intended to be flexible, and would be modified as appropriate, depending upon the results of consultation with regulators and local residents.

Actions Recommended

1. Issue an advisory (similar to that issued in 2009) advising of potential risks associated with consuming wild game and berries from the Former Radar Site.
2. Remove metal and other debris from Old Dump Pond as well as from the area of test pit TP229, which is located in the proximity of Old Dump Pond.
3. Remove the septic tank from the Main Base Site.
4. In order to assess the potential risks associated with inhalation of petroleum hydrocarbon vapours in indoor air, soil vapour monitoring should be considered for homes constructed within the footprint of the former landfill.
5. Soil samples should be collected from individual properties located within the footprint of the former landfill at the Residential Subdivision and analysed for petroleum hydrocarbons, PCBs and metals. The results of this additional sampling would require comparison to applicable guidelines or the SSTLs calculated in the HHRA.
6. Further evaluation is required for homes constructed on the former landfill with respect to the long term structural stability of these affected homes.
7. Additional fish samples should be collected from Big Lake to confirm that concentrations are below applicable fish advisory guidelines.
8. If site conditions or land uses change (e.g., residential usage, potable groundwater or if further development takes place on the site), the results of the on-site risk assessment may need to be revisited to ensure that there are no additional or increased risks to potential receptors, on-site or off-site.
9. It is recommended that if vegetable gardens are grown in the future, they are kept away from contaminated areas of the overall site. Clean imported topsoil should be brought in for this purpose.
10. It is our understanding that there is no current groundwater use for potable drinking water. The assumption is made that prior to any future use of groundwater for potable drinking water or other human use (i.e., showering, washing), the groundwater will be tested to demonstrate that groundwater quality is within the Guidelines for Canadian Drinking Water Quality.

Remedial Activities Recommended

1. Perform additional delineation and investigations in areas requiring soil remediation, as identified in the HHERA to provide more accurate estimates of soil volumes to be remediated.
2. Carry out active remediation of site soil for those COCs which exceed the SSTLs developed as part of the HHERA. PCB, TPH and metals impacts at Old Dump Pond and the Wharf Area should be given priority over other impacted areas identified throughout the overall site, due to the proximity of the main area of the Town of Hopedale.



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3. Where possible, implement mitigative measures to reduce the potential for the remobilization of impacts and to enhance natural attenuation.
4. Following remediation, carry out a confirmatory sampling program for soil and groundwater to demonstrate that remedial goals have been attained.
5. Obtain closure for the site remediation from NLDMAE.

Stantec recommended that soil be remediated in certain areas of the Site in order to eliminate unacceptable risks to individual human receptors and to populations of ecological receptors. It was recommended that soil containing concentrations of COCs in exceedance of SSTLs derived for the protection of human health be remediated (PCB and antimony-impacted soil in the Residential Area and PCB-impacted soil at the Former Radar Site). It was also recommended that selected areas containing concentrations of COCs in exceedance of SSTLs derived for the protection of ecological health (TPH, lead, antimony, chromium and cadmium) be remediated in order to produce area- and site-wide exposure point concentrations (EPCs) less than the calculated SSTLs.

The remedial targets applied in the RAP and areas requiring remediation are summarized in Table 1.2. Additional information on how the SSTLs were calculated and how the remedial areas were selected is provided in the 2010 HHERA (Stantec, 2010).

Table 1.2 Summary of Remedial Targets (Stantec, 2010)

Chemical of Concern	Remedial Target (mg/kg)	Source	Areas Requiring Remediation
PCBs	9	HHRA	Old Dump Pond Wharf Area/Pipeline Residential Subdivision (stream) BMEWS Main Base Old Base1 Pit No. 1
TPH	1,700	ERA	BMEWS Main Base Pit No. 3
Metals (Residential Area)	Antimony: 30	HHRA	Old Dump Pond
Metals (Former Radar Site)	Antimony: 5 Chromium: 20 Cadmium: 1.3 Lead: 75	ERA	BMEWS Main Base Mid-Canada Line POL Compound

3.3 Additional Delineation and Risk Assessment Re-evaluation (Stantec, 2011)

In the summer of 2010, Stantec conducted additional soil and sediment delineation, soil vapour monitoring, and a preliminary marine sampling program at the Site to address data gaps and/or actions recommended in the 2010 Phase II/III ESA and HHERA report (Stantec, 2010), and recommendations provided through consultation with the Nunatsiavut Government (NG) (Stantec, 2011). Volume estimates were refined for

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areas requiring soil remediation. Elevated concentrations of PCBs were detected in sediment and fish samples collected from Hopedale Harbour and from select sediment samples collected from freshwater ponds and streams near the Former U.S. Military Base; therefore, a comprehensive marine study was recommended.

A Stakeholder Scientific Advisory Working Group (referred to as the “Stakeholder Committee”) consisting of representatives from the ICGH, NG, Labrador Grenfell Health, the Labrador and Aboriginal Affairs Office, NLDMAE and technical advisors was established in 2011 to advise on go-forward work plans at the Site. Based on the remedial options evaluation, the preferred options for soil remediation were as follows:

1. PCB-Impacted Soil: Stockpile soil and transport to a licensed soil treatment facility
2. TPH-Impacted Soil: Pre-treat soil in temporary on-site biopile and place soil in the local landfill once treated
3. Metals-Impacted Soil: Stockpile soil and transport to a licensed soil treatment facility

Priorities were assigned to different areas requiring remediation, with the highest priority assigned to PCB-impacted soil in the Residential Area and PCB-impacted soil located up-gradient of the community water supply source (the BMEWS site), followed by PCB-impacted areas in the remaining areas, then TPH-impacted areas and then metals-impacted areas. Consideration was given to the anticipated soil treatment times for TPH when preparing a go forward work plan.

It was recommended that SSTLs be used as remediation criteria for soil at the site. Based on the remedial options evaluation, the preferred options for soil remediation were as follows:

1. *PCB-Impacted Soil*: Stockpile soil and transport to a licensed soil treatment facility
2. TPH-Impacted Soil: Pre-treat soil in temporary on-site biopile, then place soil in the local landfill
3. Metals-Impacted Soil: Prior to selecting a remedial option, perform bioaccessibility testing on metals impacted soil requiring remediation and re-evaluate the SSTLs for metals within the HHERA

3.4 Implementation of Remedial Action Plan – Year 1 (Stantec, 2012)

In 2011, the Government of Newfoundland and Labrador committed funds to support ongoing remediation efforts in Hopedale and the completion of a Marine Study over the following three years. During each year, site remediation and investigative work was to be conducted in accordance with NLDMAE budget allowances. A Stakeholder Scientific Advisory Working Group (referred to as the “Stakeholder Committee”) consisting of representatives from the ICGH, NG, Labrador Grenfell Health, the Labrador and Aboriginal Affairs Office, NLDMAE and technical advisors was established in 2011 to advise on go-forward work plans at the site. The data collected to date was discussed by a Stakeholder Committee in May 2011, and a mutually-agreeable plan for Years 1 to 3 of the site remediation and investigative work was determined.

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The following scope of work was proposed for Years 1 to 3 of the Implementation of the RAP:

Year 1 (2011-2012)

1. Conduct hot-spot removal of PCB-impacted sediment in the stream running through the Residential Subdivision (estimated 15 m³).
2. Conduct remediation of PCB-impacted soil in the vicinity of Old Dump Pond (estimated 350 m³).

Year 2 (2012-2013)

1. Complete the remediation of PCB-impacted soil in areas that were not finished in Year 1, if necessary.
2. Conduct the remediation of PCB-impacted soil in the Wharf Area/Pipeline area (estimated 350 m³).

Year 3 (2013-2014)

1. Complete the remediation of PCB-impacted soil in area(s) that were not finished in Year 2, if necessary.
2. Start the remediation of PCB-impacted soil in the BMEWS area (estimated 850 m³ total).

The work scope was meant to be revised each year and was meant to be flexible based on the results of marine studies and risk modeling (reported under separate covers) and recommendations provided by the Stakeholder Committee.

In 2011 (Year 1 of the Implementation of the RAP), 286 one tonne capacity enviro-bags were filled with PCB-impacted soil from one of two areas requiring remediation at the Old Dump Pond site, referred to as "ODP-Area 1".

The scope of work for Year 1 of the Implementation of the RAP (Stantec, 2012) included environmental site remediation of PCB-impacted soil and sediment exceeding the calculated SSTL of 9 mg/kg in two areas at the Old Dump Pond site and in the stream in the Residential Subdivision in Hopedale, NL and the collection of confirmatory soil/sediment samples. Due to circumstances beyond the control of the site contractor (RJG Construction Ltd. (RJG)) (i.e., freight service delays due to weather and staffing issues), remedial work at the site did not commence until October 30, 2011. As a result, due to time constraints, remediation was only conducted in one area at the Old Dump Pond site. Additional horizontal and vertical delineation of PCB impacted soil and sediment was conducted in the areas that were not remediated in Year 1. These areas were planned to be remediated in conjunction with Year 2 remedial activities at the Former U.S. Military Site in Hopedale in 2012.

Site preparation activities consisting of site clearing and grubbing at the Old Dump Pond site and in the stream in the Residential Subdivision, and the excavation of a trench in the stream to enhance drainage were conducted between September and October 2011.

Between October 30 and on November 16, 2011, RJG removed PCB-impacted soil and buried debris from the area surrounding monitor well MW-61 and test pit ODP-TP2 at the Old Dump Pond site under Stantec's supervision. Soil was loaded into 1 tonne capacity polypropylene soil bags that were tied shut and transported to a laydown area at Pit No. 1 of the Former U.S. Military Site. The bags were not transported



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offsite to an approved PCB treatment/disposal facility in the fall of 2011 as the risk associated with the transportation of the contaminated soil by barge in the late fall/winter was considered too great. The bags were planned to be transported in Year 2 along with soil removed as part of the Year 2 remedial activities. Confirmatory soil sampling was conducted along the limits of the excavation as soil removal progressed. Concentrations of PCBs detected in confirmatory soil samples collected along the final limits of the remedial excavation at the Old Dump Pond site ranged from 0.41 mg/kg (11-ODP-BS18) to 2.5 mg/kg (11-ODP-BS1) which were below the calculated SSTL of 9 mg/kg. A total of 286 bags (approximately 283 tonnes) were filled and removed from the Old Dump Pond site.

Large pieces of metal debris encountered in the remedial excavation were manually segregated from the soil and were placed in a temporary scrap metal stockpile at the Old Dump Pond site. High visibility caution tape was placed around the metal stockpile to warn potential recreational vehicle users passing through the area. Three PCB swab samples were collected from pieces of metal (11-ODP-SWAB1 to 11-ODP-SWAB3) within the stockpile. PCBs were not detected in the swab samples (laboratory reportable detection limit, or RDL = 5 µg/ 100 cm²).

Following receipt of confirming soil samples, the remedial excavation at the Old Dump Pond site was backfilled using 140 mm minus sized material. Approximately 60 tonnes of material obtained from a rock pit created along the road to the local landfill in Hopedale was placed in the remedial excavation.

On October 31 and November 7, 2011, additional soil sampling was conducted in the area surrounding monitor well MW-32 to further delineate the horizontal and vertical extent of PCB impacts in soil. A total of 11 soil samples were collected from test pits excavated in the vicinity of monitor well MW-32 and were submitted for analysis of PCBs. Concentrations of PCBs were detected in the 11 soil samples at concentrations ranging from 0.94 mg/kg to 67 mg/kg. The detected concentrations of PCBs in six soil samples exceeded the SSTL of 9 mg/kg. Based the results of soil sampling conducted as part of the current and previous investigations, there was an estimated 230 m³ of PCB-impacted soil requiring remediation in the area surrounding monitor well MW-32 at the Old Dump Pond site.

Between October 4 and November 5, 2011, 10 sediment samples were collected from the stream to delineate the horizontal and vertical extent of PCB impacted sediment. Concentrations of PCBs were detected in five of the sediment samples at concentrations ranging from 0.02 mg/kg (11-Stream-SED5) to 22 mg/kg (11-Stream-SED3). The detected concentration of PCBs in one sediment sample collected from a depth of 0.5 m below the stream bottom exceeded the SSTL of 9 mg/kg. Based on the results of sediment sampling conducted as part of the current and previous investigations, for an assumed excavation width of 1.5 m there was an estimated 54 m³ of sediment requiring removal from the stream in the Residential Subdivision.

3.5 Implementation of Remedial Action Plan – Year 2 (Stantec, 2014a)

In 2012 for Year 2 of the Implementation of the RAP (Stantec, 2014a), 451 bags were filled with PCB-impacted soil from the second area requiring PCB remediation in the Old Dump Pond area (ODP – Area 2), 218 bags were filled with PCB-impacted soil/sediment from the stream in the Residential Subdivision



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and 245 bags were filled with PCB-impacted soil from the Wharf Area. The results of confirmatory soil sampling indicated that no further soil remediation for PCBs was necessary in the stream or Wharf Area. Refer to Drawing Nos. 121411777-600-EE-03 and 121411777-600-EE-12 in Appendix A. PCB concentrations exceeding the applicable SSTL of 9 mg/kg remained in soil along the north and west limits of the ODP – Area 2 excavation; therefore, additional soil removal was required in this area during Year 3 of the Implementation of the RAP. Following soil removal, the remedial excavations were backfilled with locally obtained clean 140 mm minus sized material. A 40 mil polyethylene liner was temporarily placed along the northern, eastern and western edges of the Year 2 excavation to prevent the potential contamination of clean backfill material along the impacted edges of the excavation. Metal debris encountered during Year 2 of the Implementation of the RAP was cleaned by shaking/brushing/scraping and was stored with metal unearthed during Year 1 in the Old Dump Pond area. High visibility caution tape was placed around the metal stockpile for winter storage.

In November 2012, 567 bags (599.32 tonnes) of PCB-impacted soil were transported to a soil treatment facility in St.-Ambroise, QC for treatment and disposal. The remaining 633 filled bags in Hopedale were stored at the Main Laydown Area over winter.

Based on the observations and results obtained from the work completed, the following conclusions are made:

1. Old Dump Pond site: 421 bags of soil were removed from Old Dump Pond- Area 2 (ODP – Area 2) in Year 2. Results of confirmatory soil sampling in this area indicated that additional soil removal was required in the vicinity of samples (12-ODP-BS7, 12-ODP-BS8, 12-ODP-BS27, 12-ODP-BS29 to 12-ODP-BS34), which contained concentrations of PCBs ranging from 11 mg/kg to 63 mg/kg along the northeast and northwest sidewalls of the excavation and 200 mg/kg to 260 mg/kg along the southwest sidewall of the excavation. Soil removal at ODP – Area 2 was halted on October 1, 2012 due to concerns that the number/weight of bags filled to date exceeded the barge limit; therefore, remediation was not completed at ODP – Area 2 in Year 2 as planned. This area was planned to be remediated in conjunction with Year 3 remedial activities to be conducted in 2013. Additional soil removal along the southwest sidewall of the remedial excavation is not deemed possible due to the proximity to the pond. It was recommended that this area be assessed during the development of a remedial action/risk management plan for the pond sediments. Based the results of soil sampling conducted as part of the current and previous investigations, there was an estimated 125 m3 of additional PCB-impacted soil requiring remediation to the northeast and northwest of the limits of the ODP – Area 2 remedial excavation.
2. Stream site: 218 bags of soil/sediment were removed were from Stream site in Year 2. Results of confirmatory soil sampling in this area indicated that concentrations of PCBs detected in soil samples collected along the final limits of the excavation ranged from non-detect to 6.7 mg/kg, which were below the calculated SSTL of 9 mg/kg. Soil/sediment remediation for PCBs in this area was deemed complete.
3. Wharf site: 245 bags of soil were removed were from two areas at the Wharf site in Year 2. Results of confirmatory soil sampling in these areas indicated that concentrations of PCBs detected in soil samples collected along the final limits of the excavation ranged from 1.1 mg/kg to 7.5 mg/kg, which

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were below the calculated SSTL of 9 mg/kg. Soil remediation for PCBs in this area was deemed complete.

4. The highest recorded concentrations of PCBs in soil/sediment removed from the site in Year 2 were 510 mg/kg at the Old Dump Pond site, 370 mg/kg at the Stream site and 96 mg/kg at the Wharf site.
5. A total of 1,200 1-tonne capacity bags of PCB-impacted soil were excavated in Year 1 and Year 2 of the Implementation of the RAP. 567 of these bags (599.32 tonnes) were transported by barge/tug, and tractor trailer to the Récupère Sol (a division of Benev Capital Inc. (BCI)) thermal treatment facility in St. Ambroise, QC. PCB-contaminated soil was treated by thermal oxidation in accordance with the Quebec Ministry of Sustainable Development, Environment, Wildlife and Parks “<A” Treatment Criteria (i.e., <0.05 mg/kg). The remaining 633 bags were stored at the laydown area over winter and will be transported out of Hopedale to a treatment facility in Year 3 of the Implementation of the RAP.
6. Deterioration due to UV exposure and protruding metal was noted for some of the bags. Bags that were in poor condition were double-bagged prior to shipment.
7. Bags left in the laydown area for temporary storage until Year 3 that were in poor condition were double-bagged and the stockpile was covered in a plastic liner. Clean backfill material was poured onto the plastic liner to prevent movement. Boulders were then placed at the entrance to the laydown area to block access from roadway. A public notice sign was also placed at the entrance to the laydown area.
8. Large pieces of metal debris encountered in the remedial excavations were segregated from the soil and were cleaned by shaking/brushing/scraping. The metal was cut into smaller pieces, consolidated in a stockpile at the Old Dump Pond site and swab sampled for PCBs. The portion of metal with detected concentrations of PCBs was segregated into a separate pile. High visibility caution tape was placed around the metal stockpile for winter storage.
9. The Year 2 remedial excavations were backfilled using a total of approximately 935 tonnes of clean backfill. An additional 44 tonnes of clean backfill was also added to the Year 1 remedial area (ODP – Area 1) in 2012. Backfill material was obtained from a local rock pit (owned by Max Kinden of Nain) created along the road to the landfill in Hopedale in 2011 and stockpiled at Pit No. 1.

3.6 Implementation of Remedial Action Plan – Year 3 (Stantec, 2014b)

In Year 3 of the Implementation of the RAP (Stantec, 2014b), the following remedial activities were carried out at the site:

1. A total of 1,068 bags were filled with PCB-impacted material in Year 3, as follows:
 - a. Old Dump Pond: 363 bags of PCB-impacted soil from the remedial excavation and the upper 0.05 m to 0.15 m of areas affected by the work, including the temporary soil laydown area and metal stockpile area.
 - b. BMEWS: 647 bags of PCB-impacted soil from the remedial excavation and the upper 0.10 to 0.15 m of the temporary laydown area used to store filled bags in this area.
 - c. Other: 58 bags were filled with surficial soil (0.10 m to 0.15 m) removed from the temporary soil storage area the Main Laydown Area (on and beneath the liner), surficial soil (0.10 m to 0.15 m)



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removed from areas affected by the work at the Main Laydown Area, with tarps/liners used during the handling of PCB impacted material and with a limited quantity of unsampled metal debris removed from the Old Dump Pond area in Year 3.

2. Large pieces of metal debris encountered in the remedial excavations were segregated from the soil and were cleaned by shaking/brushing/scraping. The metal was cut into smaller pieces, consolidated in stockpiles at the Old Dump Pond area and swab sampled for PCBs. None of the sampled pieces of metal from the Year 1, 2 or 3 metal stockpiles contained detectable concentrations of PCBs (i.e., > 5 µg/kg per 100 cm²) during this round of sampling; therefore, the metal was shipped out of Hopedale via barge on July 28, 2013. A total of 93.6 tonnes of metal was transported to the Newco Metal and Auto Recycling Facility in St. John's, NL for recycling. A small amount of metal was unearthed at the Old Dump Pond site after the barge departure. This unsampled metal was cut up and placed in bags to be treated as PCB-impacted material.
3. A total of 1,765.83 tonnes of PCB-impacted material was transported out of Hopedale in Year 3. This included the bags stored at the Main Laydown Area (filled during Years 1 and 2) and the bags filled during Year 3. No bags filled with PCB-impacted material remained in Hopedale following the completion of the three year contract.
4. PCB-impacted material was transported by barge/tug and tractor trailer to the Récupère Sol (a division of BCI) thermal treatment facility in St.-Ambroise, QC.
5. The Year 3 remedial excavations and laydown areas were backfilled using a total of 1,393 tonnes of clean backfill. Backfill material was obtained from a local rock pit created along the road to the landfill in Hopedale in 2011 and stockpiled at Pit No. 1.

3.7 Additional Delineation and Updated Remedial Action Plan (Stantec 2014c)

In 2013, Stantec collected bulk soil samples from 41 hand-dug test pits in order to further delineate the extent of PCB-impacted soil in at Old Base 1 and the Main Base, and to further investigate concentrations of COCs in the POL West portion of the Main Base (Stantec, 2014c). Each area requiring remediation was visually assessed to document a more accurate average depth of impacts based on the depth to bedrock determined during previous site investigations and the percentage of soil cover in the area. A summary of impacts that remained in each area of the Site is provided below:

BMEWS

1. An estimated 312 m³ of TPH-impacted soil requiring remediation was identified in the BMEWS area. Impacts were spread across three areas and had not been fully delineated on the downgradient (northwest) sides of the two areas located west of the access road. The maximum detected concentration of TPH in soil in the BMEWS area was 94,000 mg/kg.
2. An estimated 15 m³ of metals (cadmium)-impacted soil requiring remediation had been identified in the BMEWS area. Impacts were spread across two areas and have been fully delineated. The maximum detected concentration of cadmium in soil in the BMEWS area was 15 mg/kg.



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Old Base 1

1. An estimated 178 m³ of PCB-impacted soil requiring remediation was identified at Old Base 1. Impacts are located in two areas and had not been fully delineated to the east (along the access road) or to the south of sample 22567. The maximum detected concentration of PCBs in soil at Old Base 1 was 6,540 mg/kg.

Main Base

1. An estimated 825 m³ of PCB-impacted soil requiring remediation was identified at the Main Base. Impacts were located in five areas (including an area of un-remediated tar-like material) and had been fully delineated in all but one area (along the access road to the POL West). The maximum detected concentration of PCBs in soil at the Main Base was 41,000 mg/kg.
2. Elevated levels of PCBs were identified in sludge contained within an old abandoned septic tank at the Main Base (72 mg/kg). Sludge removal had been recommended in this area.
3. An estimated 253 m³ of TPH-impacted soil requiring remediation was identified at the Main Base. Impacts were spread across three areas and had not been fully delineated on the downgradient sides of the two southernmost areas or north of MB-TP5 in the area located next to the access road. The maximum detected concentration of TPH in soil at the Main Base was 37,000 mg/kg.
4. An estimated 43 m³ of metals (chromium)-impacted soil requiring remediation was identified at the Main Base. Impacts were located in one area and had not been fully delineated to the south. The maximum detected concentration of chromium in soil at the Main Base was 100 mg/kg.

Mid-Canada Line

1. An estimated 10 m³ of metals (cadmium, chromium and lead)-impacted soil requiring remediation was identified at the Mid-Canada Line. Impacts were spread across two areas and have not been fully delineated in the northern area. The maximum detected concentrations of cadmium, chromium and lead are 13 mg/kg, 1,200 mg/kg and 3,200 mg/kg, respectively.

Pit No. 1

1. An estimated 190 m³ of PCB-impacted soil requiring remediation was identified at Pit No. 3. Impacts were identified in two areas that have not been fully delineated. The maximum detected concentration of PCBs at Pit No. 1 was 20 mg/kg.

Pit No. 3

1. An estimated 3,945 m³ of TPH-impacted soil requiring remediation was identified at Pit No. 3. Impacts were spread across two areas and had not been fully delineated in several areas. The maximum detected concentration of TPH in soil at Pit No. 3 was 77,000 mg/kg.



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POL Compound

1. An estimated 376 m³ of TPH-impacted soil requiring remediation was identified at the POL Compound. Impacts were spread across two areas and had not been fully delineated near the access road. The maximum detected concentration of TPH in soil at the POL Compound was 25,000 mg/kg.
2. An estimated 19 m³ of metals (antimony, chromium and lead)-impacted soil requiring remediation was identified at the POL Compound. Impacts were spread across two areas and had not been fully delineated in one of the areas. The maximum detected concentrations of antimony, chromium and lead at the POL Compound were 120 mg/kg, 650 mg/kg and 1,900 mg/kg, respectively.

Old Dump Pond

1. An estimated 26 m³ of metals (antimony)-impacted soil requiring remediation was identified at Old Dump Pond. Impacts were spread across two areas and had not been fully delineated in either area. The maximum detected concentration of antimony in the Old Dump Pond area was 42 mg/kg. Refer to Drawing No. 121411777-600-EE-03 in Appendix A.

3.8 Implementation of the Remedial Action Plan – Year 4 (Stantec, 2015)

In 2014, the Government of Newfoundland and Labrador committed funds for an additional three years to support ongoing remediation efforts in Hopedale. The following scope of work was recommended for Years 4 to 6 of the Implementation of the RAP:

Year 4 (2014-2015)

1. Removal of treated soil from the temporary biopile
2. Remediation of PCB-impacted soil at the Main Base (estimated 1,500 tonnes)
3. Remediation of TPH-impacted soil at the Main Base, BMEWS and POL Compound, with associated soil placement in the temporary biopile (estimated 1,700 tonnes)

Year 5 (2015-2016)

1. Remediation of impacted soil in areas that were not finished in Year 4, if necessary
2. Remediation of PCB-impacted soil at Old Base 1 and Pit No. 1 (estimated 670 tonnes)
3. Remediation of metals-impacted soil at Old Dump Pond, BMEWS, Main Base, Mid-Canada Line and POL Compound (estimated 200 tonnes)
4. Biopile maintenance, including soil tilling and nutrient placement

Year 6 (2016-2017)

1. Remediation of impacted soil in areas that were not finished in Year 4 or 5, if necessary
2. Removal of treated soil from the temporary biopile
3. Remediation of TPH-impacted soil at Pit No. 3 (estimated 7,110 tonnes)



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Site remediation and investigative work was to be conducted in accordance with annual NLDMAE budget allowances. The work scope was meant to be revised each year and was meant to be flexible based on the actual volumes of soil removed from each site and the time required for treatment of TPH-impacted soil in the biopile. The proposed work scope was designed based on the assumption that it would take only 2 years for concentrations of TPH in soil within the biopile to be reduced below the landfill acceptance criteria of 1,000 mg/kg. The Stakeholder Committee agreed with the above recommendations for the Years 4 to 6 of the Implementation of the RAP.

In 2014 for Year 4 of the Implementation of the RAP (Stantec, 2015), remediation was carried out in the Main Base, BMEWS and POL Compound areas. A total of 1,513.62 tonnes of PCB-impacted soil was removed from the Main Base area and transported off-site for treatment and disposal at an approved soil treatment facility in Saint-Ambroise, QC. Following remediation, additional soil removal was required along the northern limits of the remedial excavation, in the area of Main Base-Area 4, Main Base-Area 5 and POL West-Area 1 in accordance with the SSTL for PCBs calculated for the Site as part of the HHERA (Stantec, 2010). Sludge removal was also required at the septic tank at Main Base-Area 6. Metal debris removed from the PCB remedial excavation at Main Base (approximately 1.66 tonnes) was stockpiled on tarps at the Laydown Area at Pit No. 1 was transported to a licensed recycling facility in St. John's, NL as part of the Year 6 activities.

In 2014, the biopile was sampled following NLDMAE's standard Certificate of Approval (COA) for soil treatment facilities and concentrations of TPH in the composite soil samples were below the landfill acceptance criteria of 1,000 mg/kg. Approvals were obtained from the Happy Valley-Goose Bay Government Service Centre (now Service NL) and the Inuit Community Government of Hopedale to dispose of treated soil in the Hopedale landfill. Soil was transported to the landfill on October 7, 2014 and was stockpiled in a designated area for use as landfill cover material. A 450 mm thick layer of soil was left in place at the bottom of the biopile containment cell to minimize the risk of damage to the bottom liner. Approximately 1,700 tonnes of TPH-impacted soil was then removed from impacted areas of the Site (BMEWS, the Main Base and the POL Compound) and placed in the biopile containment cell for treatment. Biopile maintenance activities, consisting of the addition of specified nutrients and mechanical aeration, were carried out following the placement of TPH-impacted soil. A cover was placed over the biopile and was secured in place using clean sand. Metal debris removed from the TPH remedial excavations at BMEWS was stockpiled on tarps at the Laydown Area at Pit No. 1 and kept separate from the metal debris unearthed at the Main Base site. Following site remediation, additional TPH-impacted soil removal was required based on the SSTL along the southeast sidewall of BMEWS-Area 1, in the area of BMEWS-Area 3, to the east, south and west of Main Base-Area 7 and in the area of Main Base-Area 9. Remediation of TPH-impacted soil at Main Base-Area 7 and at the POL Compound was deemed complete in accordance with the SSTL calculated for the Site as part of the HHERA (Stantec, 2010).

3.9 Implementation of the Remedial Action Plan – Year 5 (Stantec, 2016)

In 2015 for Year 5 of the Implementation of the RAP (Stantec, 2016), the existing biopile was sampled following NLDMAE's standard COA for soil treatment facilities. Concentrations of TPH in the composite soil samples exceeded 1,000 mg/kg; therefore, the soil required additional treatment before it could be

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disposed. Biopile maintenance activities, consisting of the addition of specified nutrients and mechanical aeration were carried out following the placement of TPH-impacted soil in the biopile containment cell. The treatability of the biopile was evaluated and the biopile treatment was anticipated to be effective given the observed baseline soil conditions, however, several follow-up activities were required for successful completion, including: monitoring, addition of specified nutrients, irrigation and aeration.

In 2015, a total of 749 tonnes of PCB-impacted soil was removed from the north and west areas of Main Base-Area 1 and was transported to Saint-Ambroise, QC by sea for PCB destruction. Confirmatory soil sampling was carried out along the limits of the remedial excavation to determine if the soil remaining on-site contained concentrations of PCBs below the residential SSTL of 9 mg/kg. To meet the SSTL, additional soil removal was required to the north, centre and west of the Main Base-Area 1 excavations. PCB-soil removal was also required at Main Base-Area 4, Main Base-Area 5 and POL West-Area 1 that had not been remediated. A total of 201.6 tonnes of metals-impacted soil was removed from BMEWs-Area 4, BMEWs-Area 5, Main Base Area 2, POL-Area 3 and POL-Area 4 and was transported to Chicoutimi, QC for treatment. Confirmatory soil sampling was carried out along the limits of the remedial excavations to determine if soil remaining on-site contained concentrations of metals below the applicable SSTLs. No additional soil removal was deemed necessary in these areas; however, metals impacted soil removal was required at Mid-Canada Line Areas 1 and 2 that had not been remediated.

Also in 2015, forecasted EPCs were generated using available confirmatory soil sampling results and predicted confirmatory soil sampling results (based on concentrations of COCs observed in nearby samples) to predict EPCs once areas designated in the 2010 HHERA and RAP have been remediated. A comparison of the historical versus forecasted EPCs indicates a substantial decrease in EPCs as a result of the multi-year remediation program (1 to 2 orders of magnitude); however, some EPCs are forecasted to remain above the SSTLs for the protection of ecological health. This indicated the potential need for re-evaluation of the Ecological Risk Assessment with potential additional remediation.

3.10 Implementation of the Remedial Action Plan – Year 6 (Stantec, 2017)

In 2016 for Year 6 of the Implementation of the RAP (Stantec, 2017), the existing biopile was sampled following NLDMAE's standard COA for soil treatment facilities. Concentrations of TPH in the composite soil samples exceeded 1,000 mg/kg; therefore, the soil required additional treatment before it could be disposed. Biopile maintenance activities, consisting of the addition of specified nutrients and mechanical aeration were carried out following the placement of TPH-impacted soil in the biopile containment cell. The treatability of the biopile was evaluated and the biopile treatment was anticipated to be effective given the observed baseline soil conditions, however, several follow-up activities were required to ensure successful completion, including: monitoring, addition of specified nutrients, irrigation and aeration.

In 2016, a total of 1,227 tonnes of PCB-impacted soil was removed from the northeast, centre and northwest areas of Main Base-Area 1, Main Base-Area 4, POL West-Area 1 and Old Base 1-Areas 1 and 2 and was transported to Saint-Ambroise, QC by sea for PCB destruction. Confirmatory soil sampling was carried out along the limits of the remedial excavation to determine if the soil remaining on-site contained concentrations of PCBs below the residential SSTL of 9 mg/kg. To meet the SSTL, additional soil removal



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was required to the centre of the Main Base-Area 1 excavation and to the northeast of the Main Base-Area 1. PCB-soil removal was also required at Main Base-Area 5 and Pit No. 1 used as a laydown area for the PCB-impacted soil. These areas have not been remediated. Sludge removal was required at the septic tank along the northern of the Main Base (referred to as “Main Base-Area 6”). Refer to Drawing Nos. 121413099-800-EE-03 to 121413099-800-EE-09 in Appendix A.

A total of 27.32 tonnes of metal debris was removed from the PCB remedial excavation at Main Base was stockpiled on tarps at the Laydown Area at Pit No. 1 during the remediation activities along with debris stockpiled from Years 4 and 5. The metal debris was shipped from Hopedale, NL to a licensed metal recycling facility in St. John’s, NL. Metals impacted soil removal was required at Mid-Canada Line Areas 1 and 2 that had not been remediated.

Based on the results of the Year 6 of the Implementation of the RAP program, Stantec made the following recommendations:

1. Complete the removal of TPH-impacted soil exceeding the ecological SSTL of 1,700 mg/kg in areas specified for remediation at BMEWS (estimated 243 tonnes), Main Base (estimated 722 tonnes) and Pit No. 3 (estimated 7,700 tonnes) as per Table 5.1. Once clean boundaries are obtained, return the site to its original condition. This will include backfilling, levelling and/or the placement of topsoil, as necessary. Refer to Drawing No. 121413099-800-EE-03 in Appendix A.
2. Complete the removal of PCB-impacted soil exceeding the residential SSTL of 9 mg/kg at Main Base (estimated 484 tonnes) and Pit No. 1 (estimated 547 tonnes) as per Table 5.1. Once clean boundaries are obtained, return the Site to its original condition. This will include backfilling, levelling and/or the placement of topsoil, as necessary. Refer to Drawing No. 121413099-800-EE-04 in Appendix A.
3. Complete the removal of metals-impacted soil exceeding the ecological SSTLs of 1.3 mg/kg for cadmium, 20 mg/kg for chromium and 75 mg/kg for lead at the Mid-Canada Line (estimated 17 tonnes) as per Table 5.1. Once clean boundaries are obtained, return the Site to its original condition. This will include backfilling, levelling and/or the placement of topsoil, as necessary. Refer to Drawing No. 121413099-800-EE-07 in Appendix A.
4. Monitor concentrations of TPH in the biopile and perform maintenance activities, as necessary. Collect composite soil samples for the laboratory analysis of metals leachability to confirm disposal options.
5. Once site remediation is complete, re-evaluate area- and site-wide EPCs for comparison to the SSTLs.
6. Continue remediation efforts at the Former U.S. Military Site in accordance with the RAP/RMP and the recommendations provided by the Stakeholder Scientific Advisory Working Group.

4.0 RECOMMENDATIONS

Based on the results of the current desktop review of available environmental assessment reports for the Site, Stantec recommends to follow the recommendations detailed in the Report for the Implementation of the Remedial Action Plan – Year 6 (Stantec, 2017).



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5.0 CLOSURE

This report documents work that was performed in accordance with generally accepted professional standards at the time and location in which the services were provided. No other representations, warranties or guarantees are made concerning the accuracy or completeness of the data or conclusions contained within this report, including no assurance that this work has uncovered all potential liabilities associated with the identified property.

This report provides an evaluation of selected environmental conditions associated with the identified portion of the property that was assessed at the time the work was conducted and is based on information obtained by and/or provided to Stantec at that time. There are no assurances regarding the accuracy and completeness of this information. All information received from the client or third parties in the preparation of this report has been assumed by Stantec to be correct. Stantec assumes no responsibility for any deficiency or inaccuracy in information received from others.

The opinions in this report can only be relied upon as they relate to the condition of the portion of the identified property that was assessed at the time the work was conducted. Activities at the property subsequent to Stantec's assessment may have significantly altered the property's condition. Stantec cannot comment on other areas of the property that were not assessed.

Conclusions made within this report consist of Stantec's professional opinion as of the time of the writing of this report, and are based solely on the scope of work described in the report, the limited data available and the results of the work. They are not a certification of the property's environmental condition. This report should not be construed as legal advice.

This report has been prepared for the exclusive use of the client identified herein and any use by any third party is prohibited. Stantec assumes no responsibility for losses, damages, liabilities or claims, howsoever arising, from third party use of this report.

The report is limited by the following:

1. The Desktop Environmental Review did not include a site visit or interviews with persons associated with the Site.

The conclusions are based on the site conditions encountered by Stantec at the time the work was performed at the specific testing and/or sampling locations, and conditions may vary among sampling locations. Factors such as areas of potential concern identified in previous studies, site conditions (e.g., utilities) and cost may have constrained the sampling locations used in this assessment. In addition, analysis has been carried out for only a limited number of chemical parameters, and it should not be inferred that other chemical species are not present. Due to the nature of the investigation and the limited data available, Stantec does not warrant against undiscovered environmental liabilities nor that the sampling results are indicative of the condition of the entire site. As the purpose of this report is to identify site conditions which may pose an environmental risk; the identification of non-environmental risks to structures or people on the site is beyond the scope of this assessment.



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If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein. This report was prepared by Paula Brennan, M.A.Sc., P.Eng. and reviewed by Jim Slade, P.Eng., P.Geo. We trust that this report meets your present requirements.

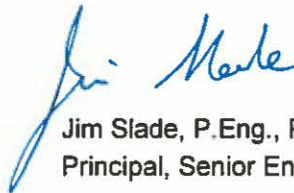
If you have any questions or require additional information, please contact our office at your convenience.

Respectfully submitted,

STANTEC CONSULTING LTD.



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April 29, 2019

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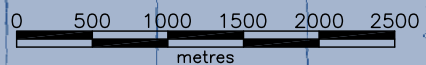
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APPENDIX A

Drawings



NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO THE STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

CLIENT:	NEWFOUNDLAND AND LABRADOR DEPARTMENT OF MUNICIPAL AFFAIRS AND ENVIRONMENT		
	SCALE:	DATE:	REV. No.
PROJECT TITLE:	1:50,000	MAR. 15, 2017	0
	IMPLEMENTATION OF REMEDIAL ACTION PLAN - YEAR 6, FORMER U.S. MILITARY SITE, HOPEDALE, NL		
DRAWING TITLE:	DRAWN BY:	EDITED BY:	CHECKED BY:
	N.M.	-	
	DRAWING No:	CAD FILE:	
	121413099-800-EE-01	121413099_800-EE-01.DWG	
DRAWING TITLE:			
SITE LOCATION PLAN			

FILE NAME: T:\00851214\3009\YEAR 6 REMEDIATION REPORT\131413099_800-EE-01.dwg

LEGEND

● BULK SOIL SAMPLE (STANTEC 2015)



CLIENT: NEWFOUNDLAND AND LABRADOR DEPARTMENT OF MUNICIPAL AFFAIRS AND ENVIRONMENT		SCALE: 1:12,000	DATE: MAR. 15, 2017	REV. No. 0
PROJECT TITLE: IMPLEMENTATION OF REMEDIAL ACTION PLAN - YEAR 6, FORMER U.S. MILITARY SITE, HOPEDALE, NL		DRAWN BY: N.M.	EDITED BY: -	CHECKED BY: P.B.
DRAWING TITLE: SITE PLAN		DRAWING No. 121413099-800-EE-02	CAD FILE: 121413099_800-EE-02.DWG	

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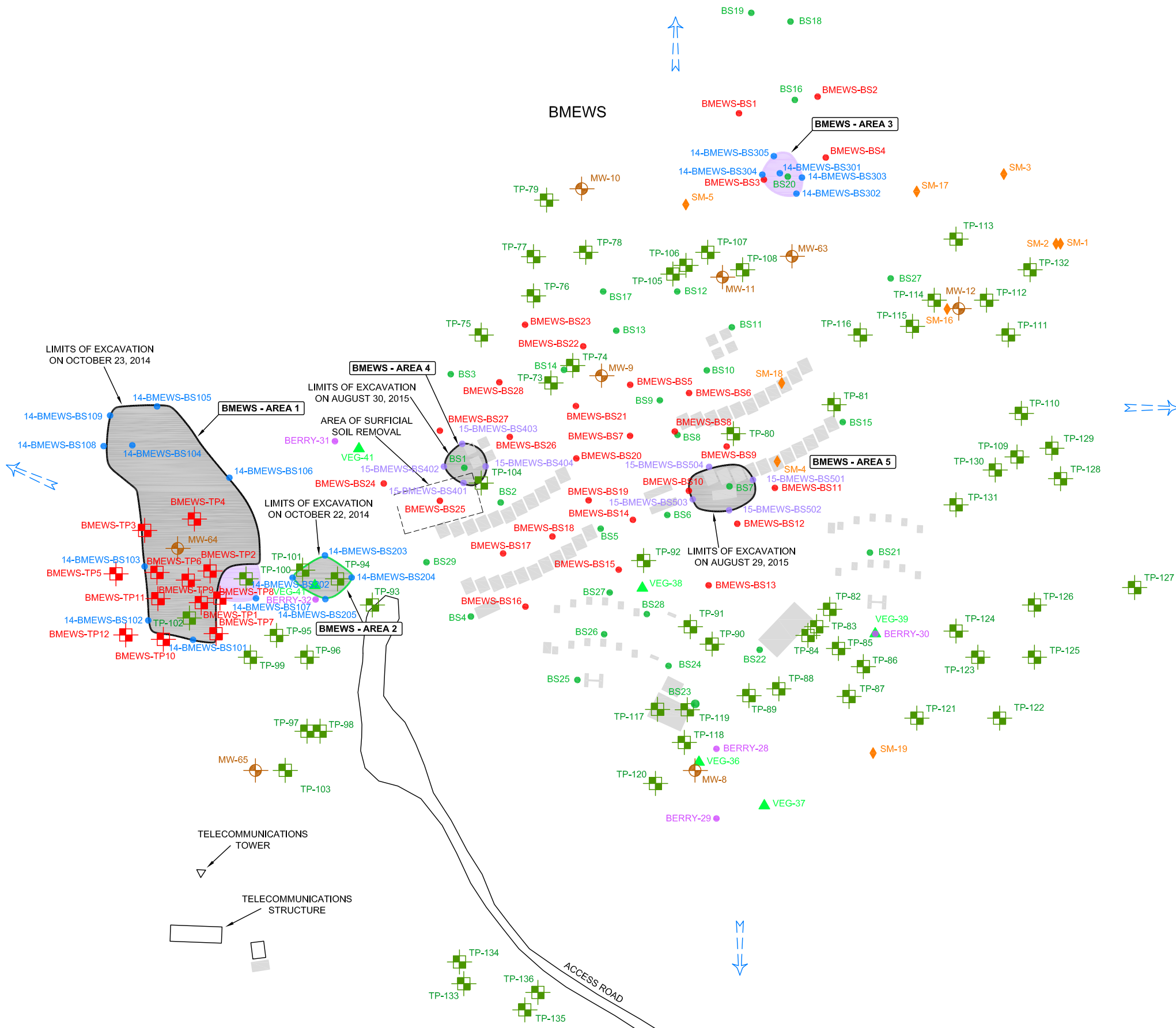
BS33

BS32

BS31

BS30

BMEWS



LEGEND

- TEST PIT (STANTEC 2010)
- TEST PIT (STANTEC 2009)
- MONITOR WELL (STANTEC 2009)
- BULK SOIL SAMPLE (STANTEC 2015)
- BULK SOIL SAMPLE (STANTEC 2014)
- BULK SOIL SAMPLE (STANTEC 2010)
- BULK SOIL SAMPLE (STANTEC 2009)
- BERRY SAMPLE (STANTEC 2009)
- VEGETATION SAMPLE (STANTEC 2009)
- SMALL MAMMALS (STANTEC 2009)
- INFERRED GROUNDWATER FLOW DIRECTION
- REMEDIAL EXCAVATION
- CONCRETE FOUNDATION
- ESTIMATED AREA OF TPH-IMPACTED SOIL EXCEEDING SSTLS REQUIRING REMOVAL

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

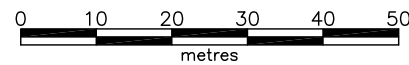
CLIENT:
NEWFOUNDLAND AND LABRADOR DEPARTMENT OF MUNICIPAL AFFAIRS AND ENVIRONMENT

PROJECT TITLE:
IMPLEMENTATION OF REMEDIAL ACTION PLAN - YEAR 6, FORMER U.S. MILITARY SITE, HOPEDALE, NL

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REMEDATION AREAS AND SAMPLE LOCATION PLAN - BMEWS

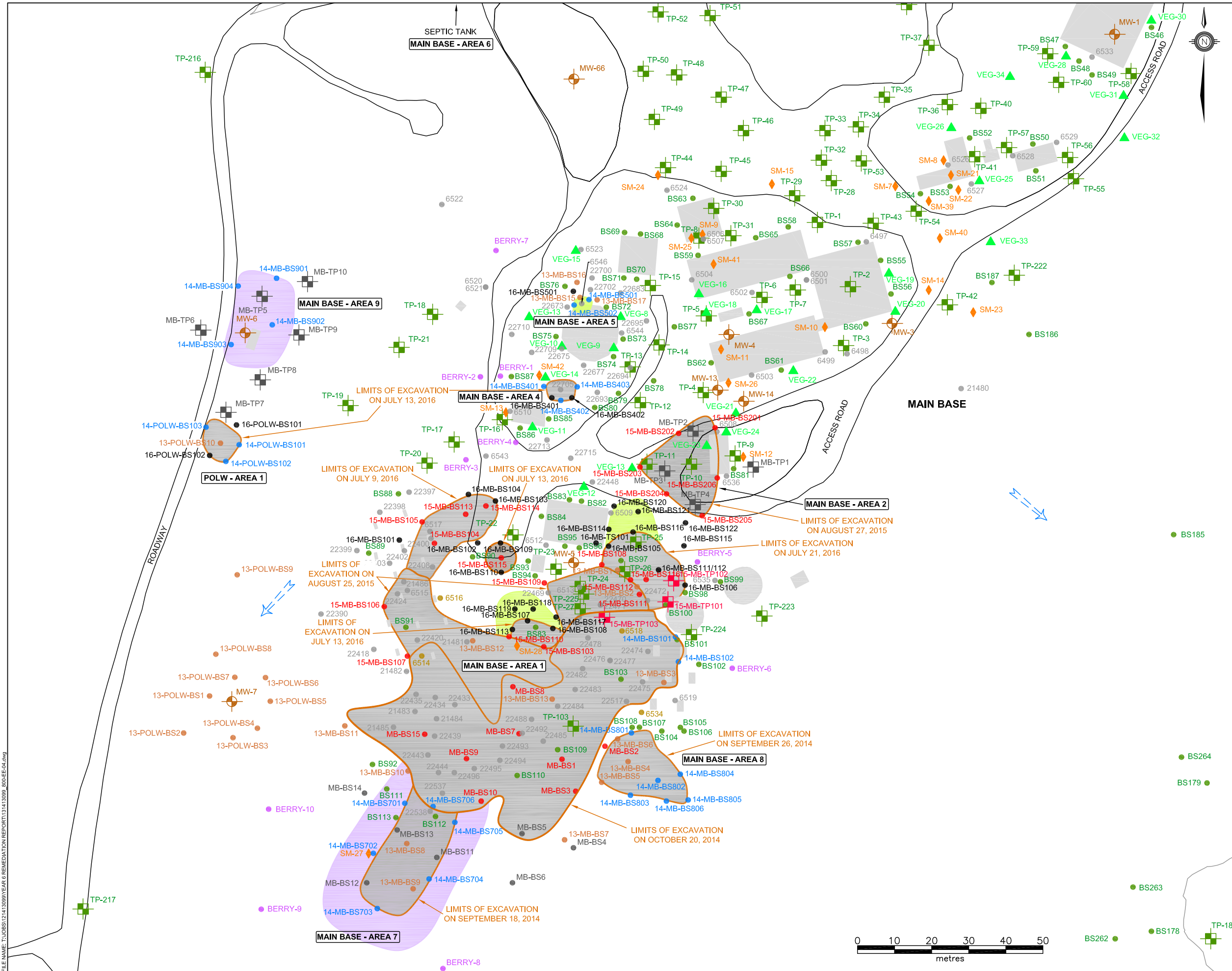
Stantec Consulting Ltd.

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DRAWN BY: N.M.	EDITED BY: -	CHECKED BY: P.B.
DRAWING No: 121413099-200-EE-03		CAD FILE: 121413099_200-EE-03.DWG



NOTE: LOCATIONS OF MONITOR WELLS AND ASSOCIATED DELINEATION POINTS WERE ADJUSTED ON THIS DRAWING BASED ON GPS COORDINATES RECORDED AS PART OF THE 2014, 2015 AND 2016 FIELD PROGRAMS.

FILE NAME: T:\JOBS\121413099\YEAR 6 REMEDIATION REPORT\131413099_800-EE-03.dwg



LEGEND

- TEST PIT (STANTEC 2015)
- TEST PIT (STANTEC 2010)
- TEST PIT (STANTEC 2009)
- MONITOR WELL (STANTEC 2009)
- BULK SOIL SAMPLE (STANTEC 2016)
- BULK SOIL SAMPLE (STANTEC 2015)
- BULK SOIL SAMPLE (STANTEC 2014)
- BULK SOIL SAMPLE (STANTEC 2013)
- BULK SOIL SAMPLE (STANTEC 2009)
- BULK SOIL SAMPLE (STANTEC 2010)
- BULK SOIL SAMPLE (ESG 2006)
- BULK SOIL SAMPLE (ESG 2004)
- BERRY SAMPLE (STANTEC 2009)
- VEGETATION SAMPLE (STANTEC 2009)
- SMALL MAMMALS (STANTEC 2009)
- UNKNOWN EXTENT OF IMPACTS
- INFERRED GROUNDWATER FLOW DIRECTION
- REMEDIAL EXCAVATION
- CONCRETE FOUNDATION
- ESTIMATED AREA OF PCB-IMPACTED SOIL EXCEEDING SSTL REQUIRING REMOVAL
- ESTIMATED AREA OF TPH IMPACTED SOIL EXCEEDING SSTLS REQUIRING REMOVAL

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

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DEPARTMENT OF MUNICIPAL
AFFAIRS AND ENVIRONMENT

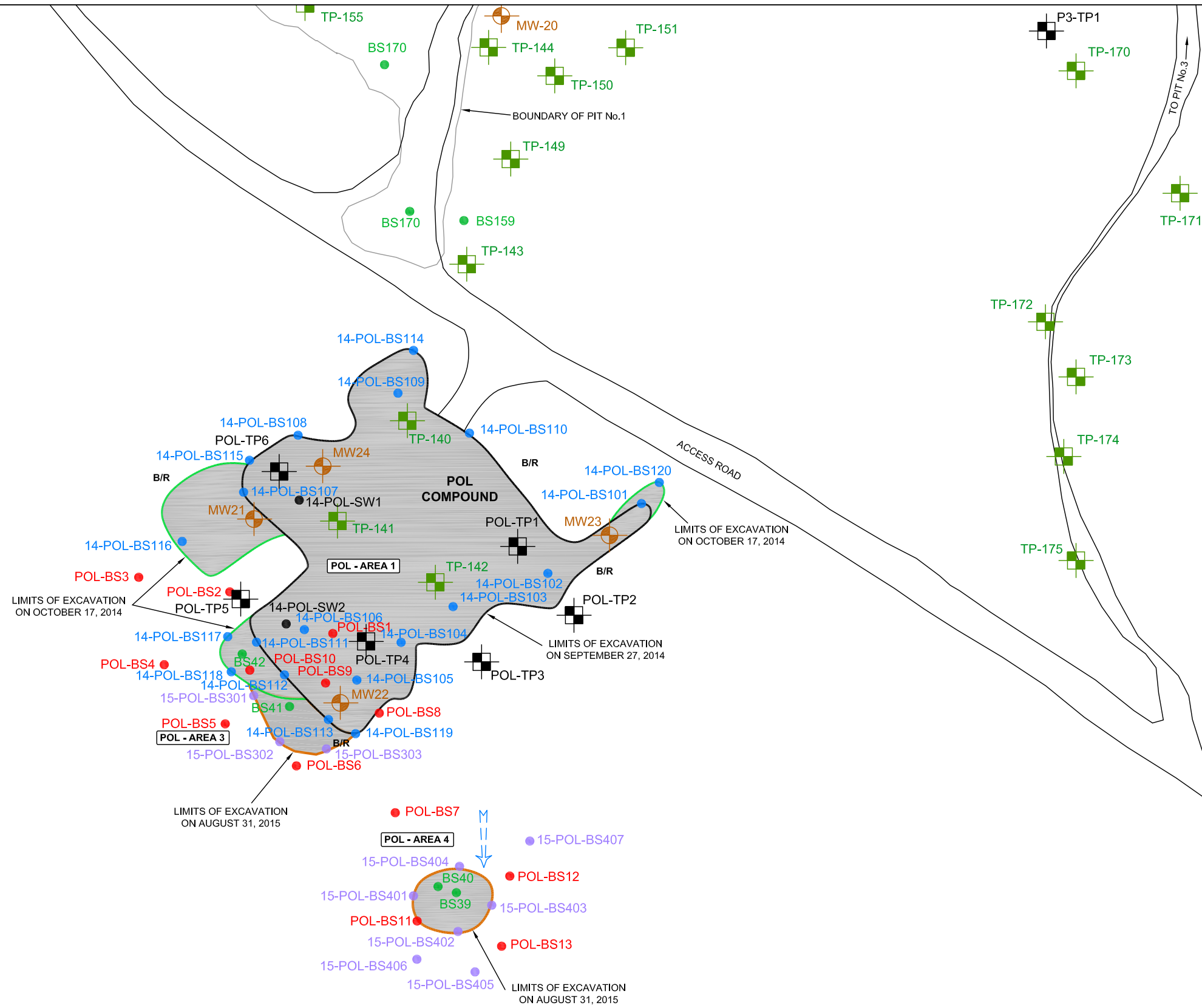
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**IMPLEMENTATION OF
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FORMER U.S. MILITARY SITE, HOPEDALE, NL**

DRAWING TITLE:
**REMEDIATION AREAS AND
SAMPLE LOCATION PLAN - MAIN BASE**

Stantec Consulting Ltd.

SCALE: 1:1000	DATE: MARCH 29, 2017	REV. No. 0
DRAWN BY: N.M.	EDITED BY: -	CHECKED BY:
DRAWING No: 121413099-800-EE-04		CAD FILE: 121413099_800-EE-04.DWG





LEGEND

- TEST PIT (STANTEC 2010)
- TEST PIT (STANTEC 2009)
- MONITOR WELL (STANTEC 2009)
- GRAB WATER SAMPLE (STANTEC 2014)
- BULK SOIL SAMPLE (STANTEC 2015)
- BULK SOIL SAMPLE (STANTEC 2014)
- BULK SOIL SAMPLE (STANTEC 2010)
- BULK SOIL SAMPLE (STANTEC 2009)
- INFERRED GROUNDWATER FLOW DIRECTION
- REMEDIAL EXCAVATION
- B/R EXPOSED BEDROCK

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

CLIENT:

NEWFOUNDLAND AND LABRADOR
DEPARTMENT OF MUNICIPAL
AFFAIRS AND ENVIRONMENT

PROJECT TITLE:

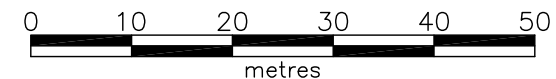
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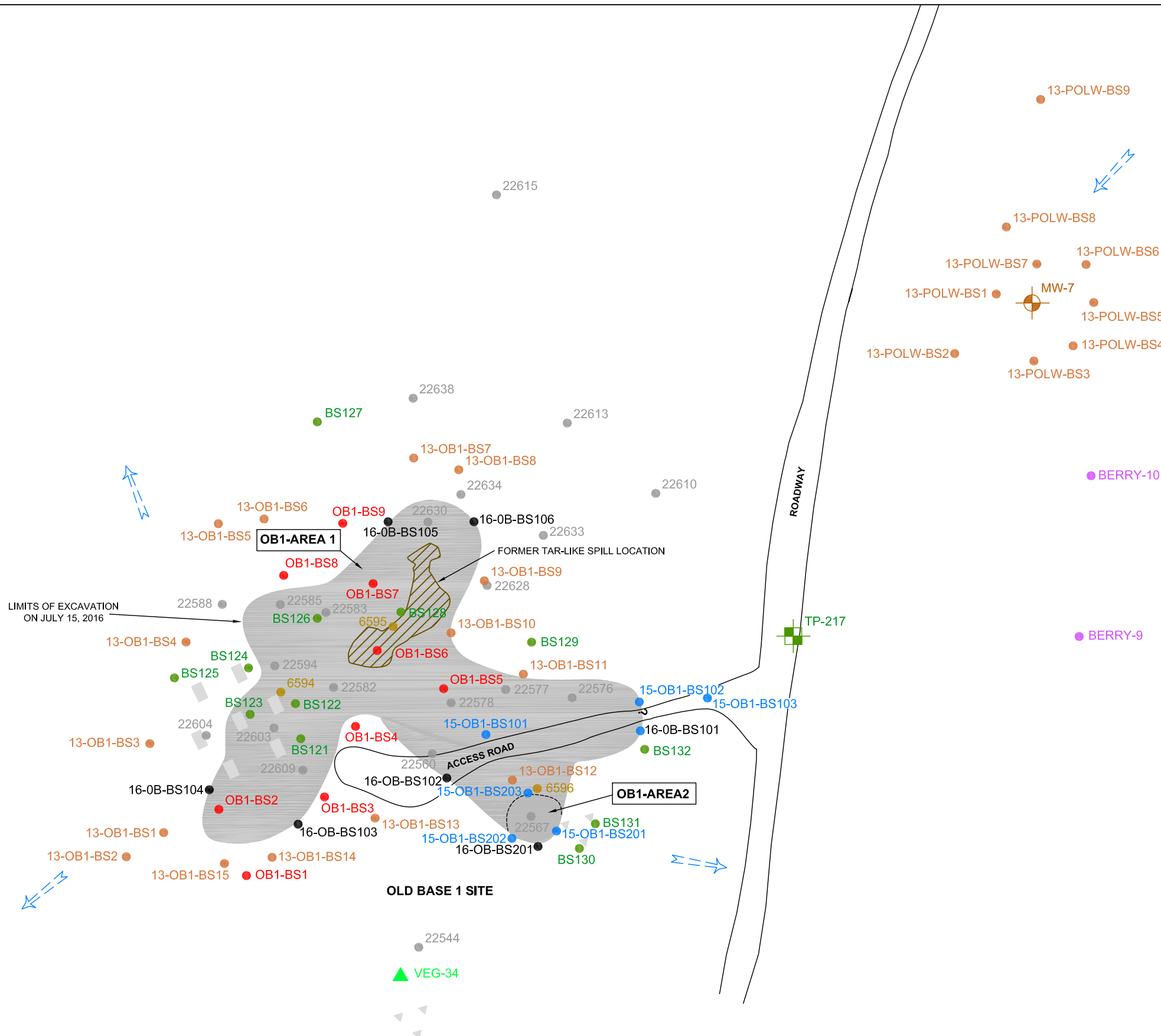
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REMEDIATION AREAS AND
SAMPLE LOCATION PLAN - POL COMPOUND

Stantec Consulting Ltd.

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DRAWN BY: N.M.	EDITED BY: -	CHECKED BY: P.B.
DRAWING No: 121413099-200-EE-05	CAD FILE: 121413099_200-EE-05.DWG	





LEGEND

- TEST PIT (STANTEC 2009)
- MONITOR WELL (STANTEC 2009)
- BULK SOIL SAMPLE (STANTEC 2016)
- BULK SOIL SAMPLE (STANTEC 2015)
- BULK SOIL SAMPLE (STANTEC 2013)
- BULK SOIL SAMPLE (STANTEC 2010)
- BULK SOIL SAMPLE (STANTEC 2009)
- BULK SOIL SAMPLE (ESG 2006)
- BULK SOIL SAMPLE (ESG 2004)
- BERRY SAMPLE (STANTEC 2009)
- VEGETATION SAMPLE (STANTEC 2009)
- INFERRED GROUNDWATER FLOW DIRECTION
- UNKNOWN EXTENT OF IMPACTS
- CONCRETE FOUNDATION
- REMEDIAL EXCAVATION

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

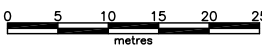
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**NEWFOUNDLAND AND LABRADOR
DEPARTMENT OF MUNICIPAL
AFFAIRS AND ENVIRONMENT**

PROJECT TITLE:
**IMPLEMENTATION OF
REMEDIAL ACTION PLAN - YEAR 6,
FORMER U.S. MILITARY SITE, HOPEDALE, NL**

DRAWING TITLE:
**REMEDATION AREAS AND SAMPLE
LOCATION PLAN - OLD BASE 1**

Stantec Consulting Ltd.

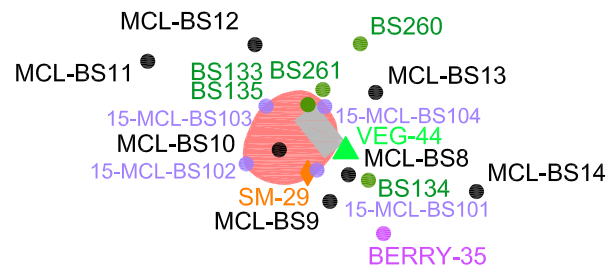
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MCL-AREA 1



BS135



SM-30

SM-31

SM-32

SM-38

SM-37

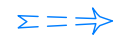
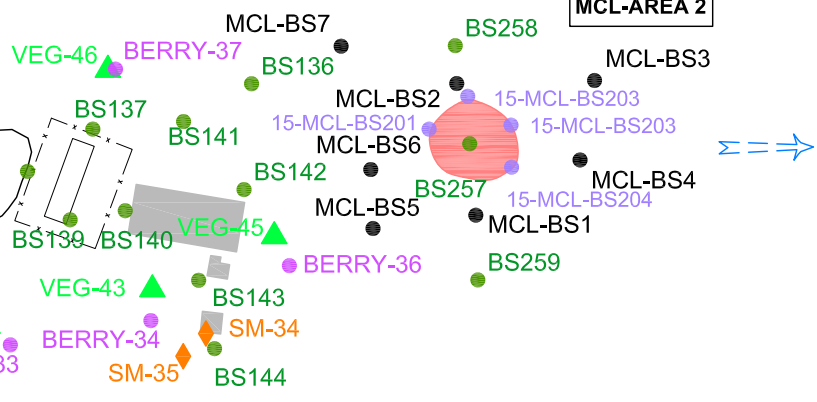
SM-36



BS145

MID-CANADA LINE

MCL-AREA 2



LEGEND

- BULK SOIL SAMPLE (STANTEC 2015)
- BULK SOIL SAMPLE (STANTEC 2010)
- BULK SOIL SAMPLE (STANTEC 2009)
- BERRY SAMPLE (STANTEC 2009)
- ▲ VEGETATION SAMPLE (STANTEC 2009)
- ◆ SMALL MAMMALS (STANTEC 2009)
- ? — UNKNOWN EXTENT OF IMPACTS
- CONCRETE FOUNDATION
- ⇄ INFERRED GROUNDWATER FLOW DIRECTION
- ESTIMATED AREA OF METALS-IMPACTED SOIL EXCEEDING SSTLs REQUIRING REMOVAL

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

CLIENT:

**NEWFOUNDLAND AND LABRADOR
DEPARTMENT OF MUNICIPAL
AFFAIRS AND ENVIRONMENT**

PROJECT TITLE:

**IMPLEMENTATION OF
REMEDIAL ACTION PLAN - YEAR 6,
FORMER U.S. MILITARY SITE, HOPEDALE, NL**

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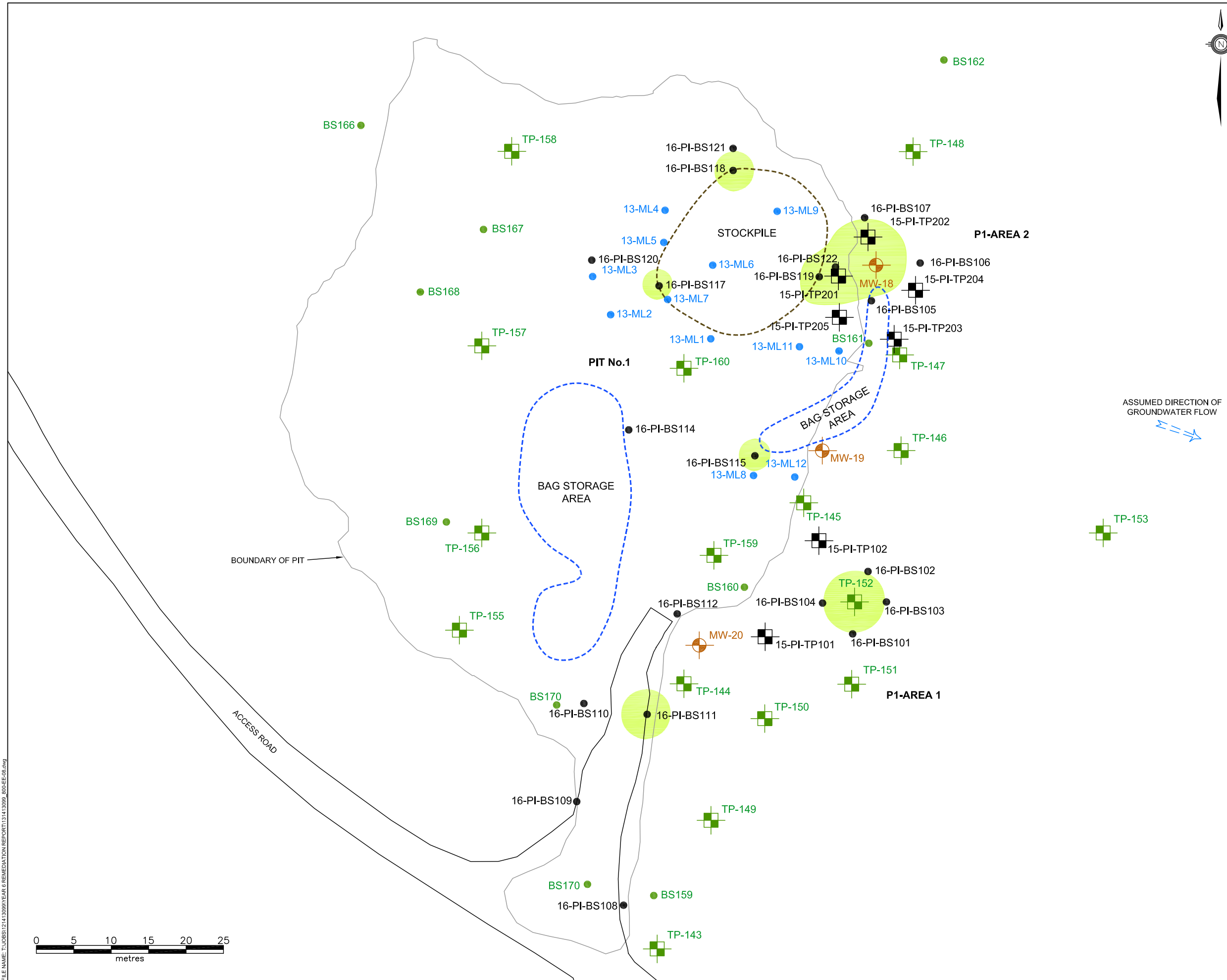
SAMPLE LOCATION PLAN - MID-CANADA LINE

Stantec Consulting Ltd.

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EDITED BY:	-	CHECKED BY:	-
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LEGEND

- TEST PIT (STANTEC 2015)
- TEST PIT (STANTEC 2009)
- MONITOR WELL (STANTEC 2009)
- BULK SAMPLE (STANTEC 2009)
- BULK SAMPLE (STANTEC 2013)
- BULK SOIL SAMPLE (STANTEC 2016)
- ESTIMATED AREA OF PCB IMPACTED SOIL EXCEEDING SSTLS REQUIRING REMOVAL
- ASSUMED DIRECTION OF GROUNDWATER FLOW

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

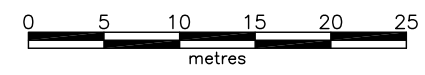
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NEWFOUNDLAND AND LABRADOR DEPARTMENT OF MUNICIPAL AFFAIRS AND ENVIRONMENT

PROJECT TITLE:
IMPLEMENTATION OF REMEDIAL ACTION PLAN - YEAR 6, FORMER U.S. MILITARY SITE, HOPEDALE, NL

DRAWING TITLE:
SAMPLE LOCATION PLAN - PIT No. 1

Stantec Consulting Ltd.

SCALE: 1:500	DATE: MARCH 27, 2017	REV. No. 0
DRAWN BY: N.M.	EDITED BY: -	CHECKED BY: -
DRAWING No: 121413099-800-EE-08		CAD FILE: 121413099_800-EE-08.DWG



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LEGEND

- TEST PIT (STANTEC 2015)
- TEST PIT (STANTEC 2010)
- TEST PIT (STANTEC 2009)
- MONITOR WELL (STANTEC 2009)
- BULK SOIL SAMPLE (STANTEC 2010)
- BULK SOIL SAMPLE (STANTEC 2009)
- SEDIMENT SAMPLE (STANTEC 2009)
- UNKNOWN EXTENT OF IMPACTS
- ESTIMATED AREA OF TPH IMPACTED SOIL EXCEEDING SSTLS REQUIRING REMOVAL
- INFERRED GROUNDWATER FLOW DIRECTION

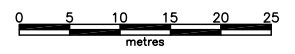
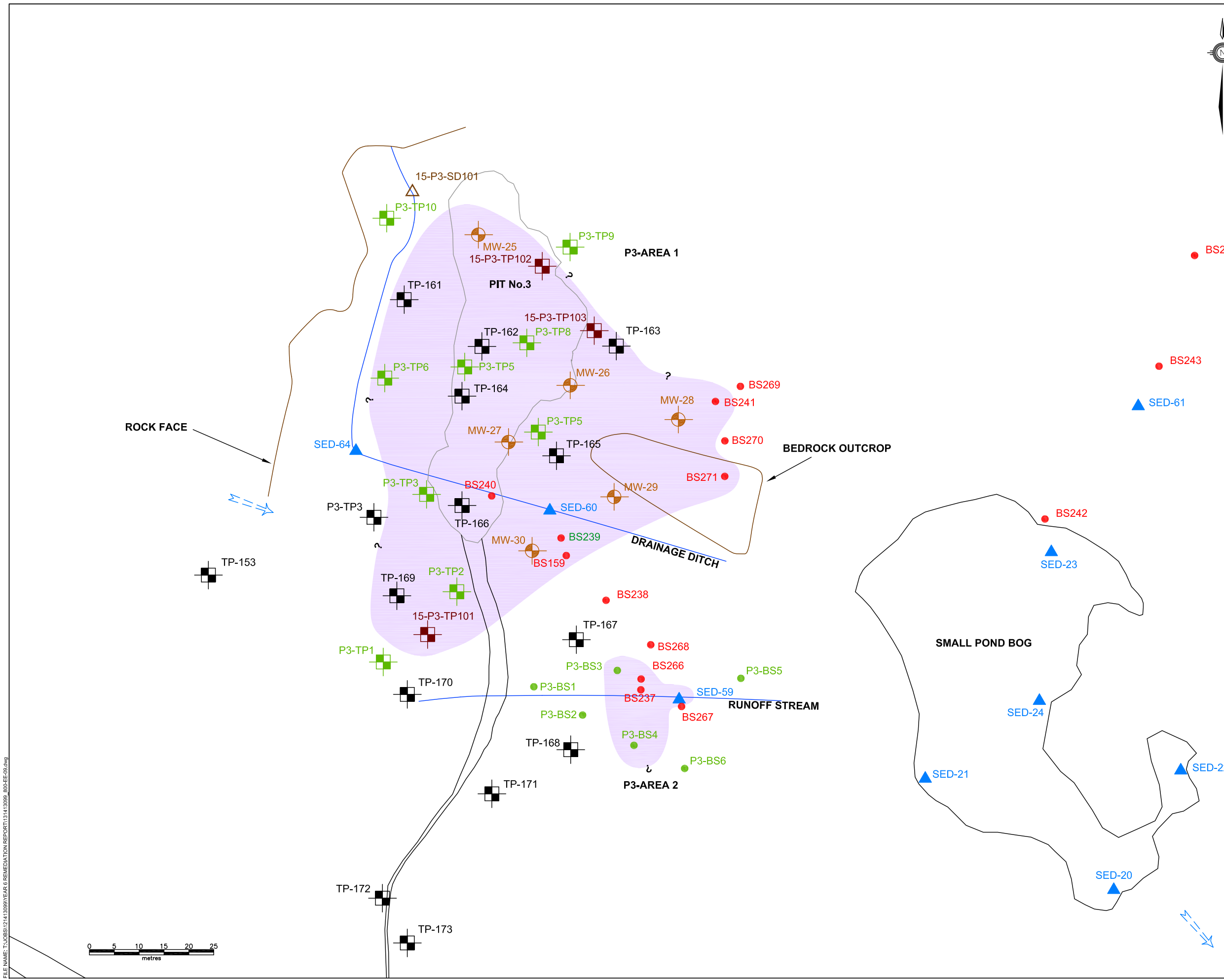
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CLIENT:
NEWFOUNDLAND AND LABRADOR DEPARTMENT OF MUNICIPAL AFFAIRS AND ENVIRONMENT

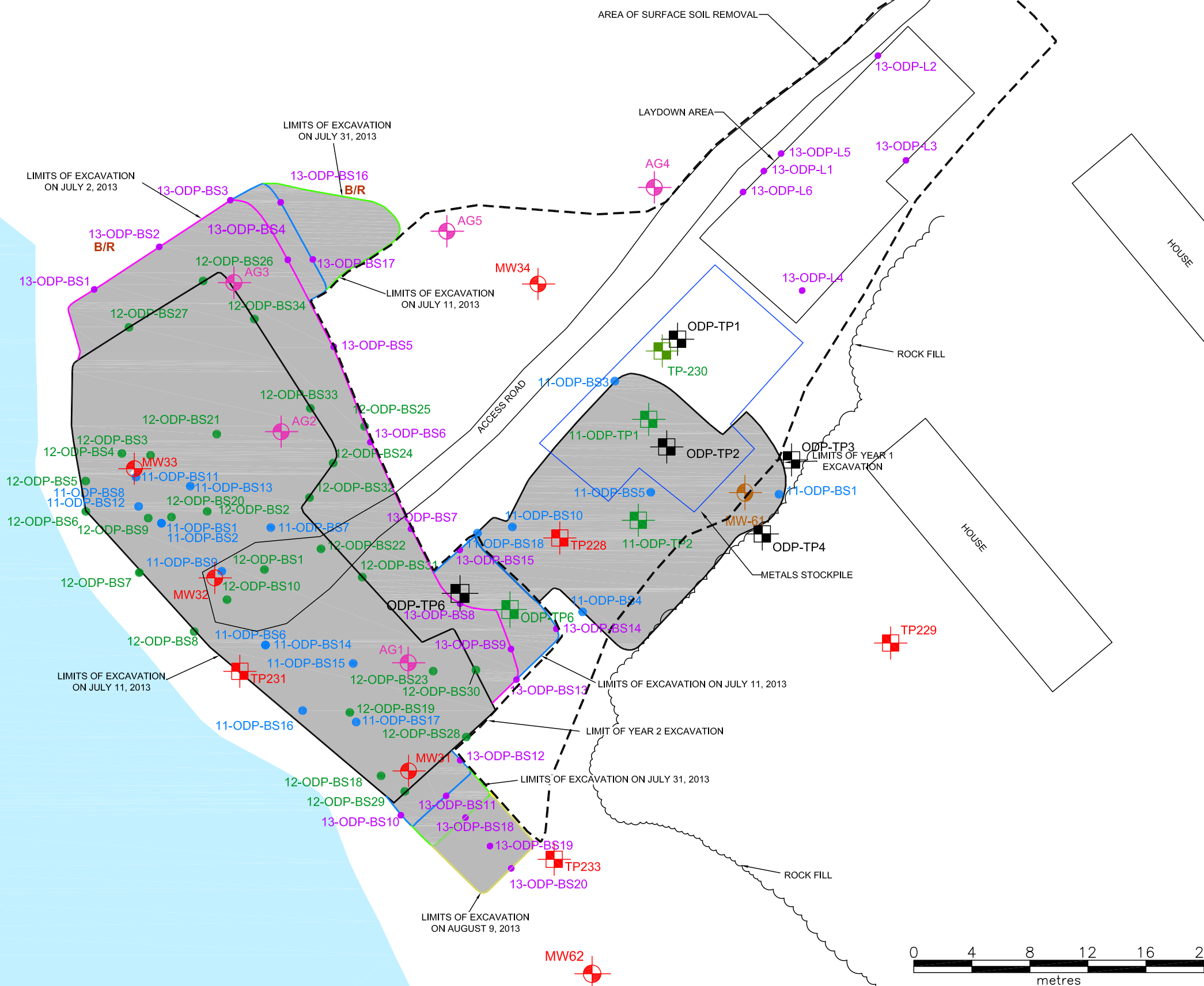
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IMPLEMENTATION OF REMEDIAL ACTION PLAN - YEAR 6, FORMER U.S. MILITARY SITE, HOPEDALE, NL

DRAWING TITLE:
SAMPLE LOCATION PLAN - PIT No. 3

Stantec Consulting Ltd.		
SCALE: 1:750	DATE: MARCH 15, 2017	REV. No. 0
DRAWN BY: N.M.	EDITED BY: -	CHECKED BY: -
DRAWING No: 121413099-800-EE-09	CAD FILE: 121413099_800-EE-09.DWG	



FILE NAME: T:\JOBS\121413099\YEAR 6 REMEDIATION REPORT\121413099_800-EE-09.dwg



- LEGEND**
- BULK SOIL SAMPLE (STANTEC, 2012)
 - BULK SOIL SAMPLE (STANTEC, 2011)
 - BULK SOIL SAMPLE (STANTEC, 2013)
 - TEST PIT (STANTEC, 2011)
 - TEST PIT (STANTEC, 2010)
 - TEST PIT (STANTEC, 2009)
 - MONITOR WELL (STANTEC, 2009)
 - B/R EXPOSED BEDROCK

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

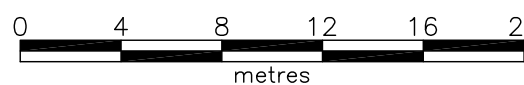
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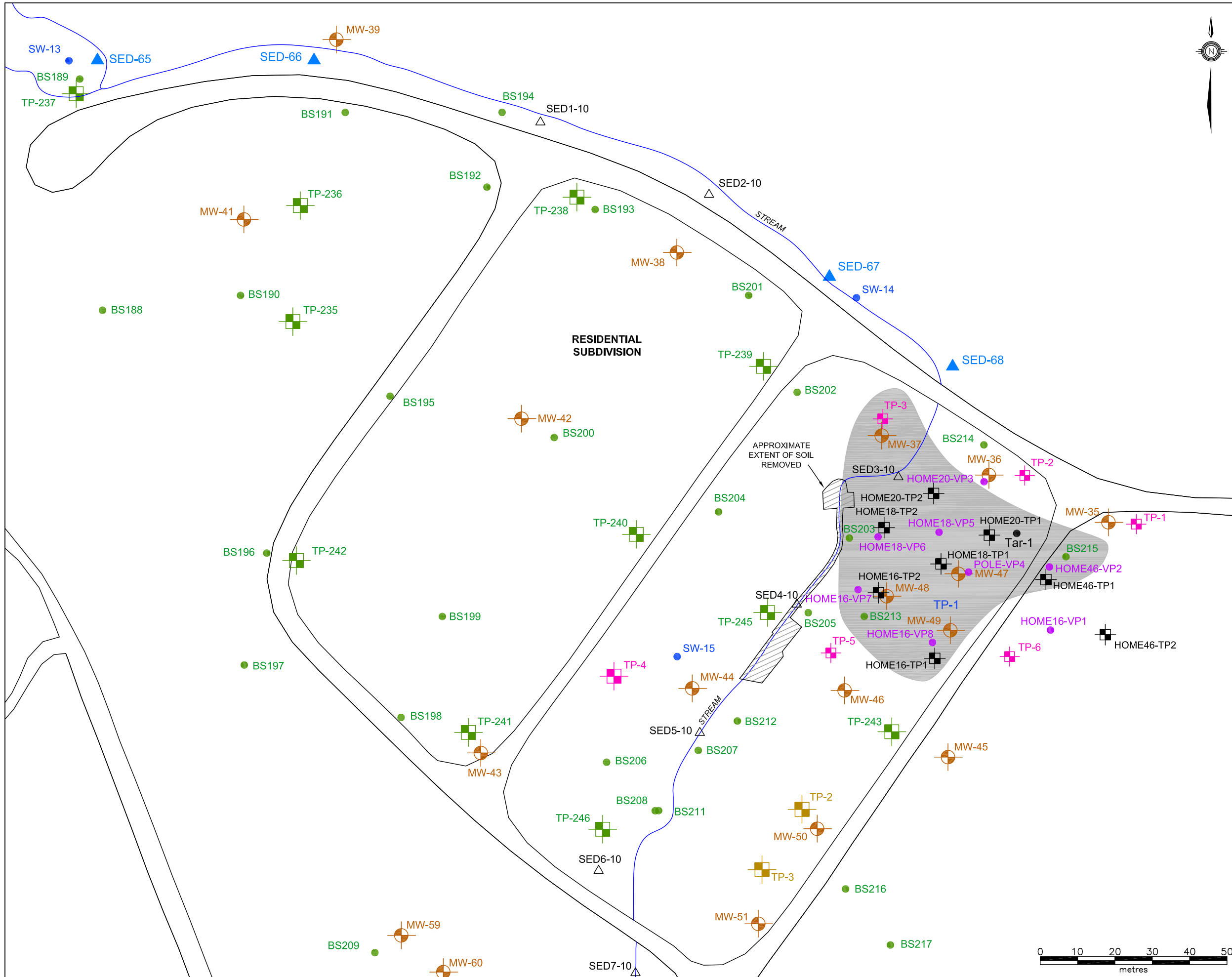
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IMPLEMENTATION OF REMEDIAL ACTION PLAN - YEAR 3, FORMER U.S. MILITARY SITE AND RESIDENTIAL SUBDIVISION, HOPEDALE, NL

DRAWING TITLE:
REMEDIATION AREA AND SAMPLE LOCATION PLAN OLD DUMP POND

Stantec Consulting Ltd.

SCALE: 1:300	DATE: APR. 15, 2014	REV. No. 0
DRAWN BY: N.M.	EDITED BY: S.N.	CHECKED BY:
DRAWING No: 121411777.600-EE-03		CAD FILE: 121411777_600-EE-03.DWG





LEGEND

- TEST PIT (STANTEC 2010)
- TEST PIT (STANTEC 2009)
- TEST PIT (2008)
- TEST PIT (2007)
- MONITOR WELL (STANTEC 2009)
- BULK SOIL SAMPLE (STANTEC 2010)
- BULK SOIL SAMPLE (STANTEC 2009)
- WATER SAMPLE (STANTEC 2009)
- SOIL VAPOUR SAMPLE (STANTEC 2010)
- SEDIMENT SAMPLE (STANTEC 2010)
- SEDIMENT SAMPLE (STANTEC 2009)
- INFERRED GROUNDWATER FLOW DIRECTION
- PRESUMED EXTENT OF FORMER LANDFILL (STANTEC 2011)
- APPROXIMATE EXTENT OF SOIL / SEDIMENT REMOVED (STANTEC, 2011)

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

CLIENT:

**NEWFOUNDLAND AND LABRADOR
DEPARTMENT OF ENVIRONMENT
AND CONSERVATION**

PROJECT TITLE:

**ADDITIONAL DELINEATION AND UPDATED
REMEDIAL ACTION PLAN, FORMER U.S.
MILITARY SITE, HOPEDALE, NL**

DRAWING TITLE:

SITE PLAN - RESIDENTIAL SUBDIVISION

Stantec Consulting Ltd.

SCALE: 1:1000	DATE: JUNE 2, 2014	REV. No. 0
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