DFO West Vancouver Laboratory

Archaeological Overview Assessment

Submitted to:
Fisheries and Oceans Canada
4160 Marine Drive
West Vancouver, BC
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Submitted by:
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Musqueam Heritage Research/Investigation Permit MIB-2018-135-AOA
Squamish Archaeological Investigation Permit 18-0118
Tsleil-Waututh Nation Cultural Heritage Investigation Permit 2018-042

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Important Notice

This study identifies potential impacts to archaeological resources by the proposed DFO West Vancouver Laboratory development project. It does not address potential impacts to traditional use activities and sites by this development. It is not the intent of this report to document First Nations' interests in the lands at this locality. The study was conducted without prejudice to First Nations' treaty negotiations, Aboriginal rights, or Aboriginal title.

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Management Summary

A review of baseline archaeological information pertaining to heritage resources for the proposed developments at the DFO West Vancouver Laboratory was conducted by the Archaeology Unit of Inlailawatash Limited Partnership (ILP). The review was conducted in accordance with the British Columbia Archaeological Overview Assessment (AOA) standards and guidelines (Archaeology Branch 1998, 2009). Archaeological sites are locations with material remains produced by human activities in the past. Archaeological sites older than 1846 are protected under the *Heritage Conservation Act* (*HCA*) (Government of BC 1996). In British Columbia archaeological sites are most frequently attributed to settlement and land use of Aboriginal peoples.

This AOA evaluates archaeological site potential in the project area. Our assessment consisted of a desk-based literature review and compilation of existing historical knowledge about recorded archaeological site locations, historical First Nations land use and place names, and environmental features in areas likely to effect site location. In addition, a Preliminary Field Reconnaissance (PFR) was conducted across the project area. This information is used to create a potential model of where archaeological sites are expected to be located.

There are no recorded archaeological sites within the project area property. However, several archaeological sites are recorded near to the project area along the north shore of Burrard Inlet, and eight of these sites have been recorded within five km of the project area. Additionally, ethnographic accounts provide place names at the location of the DFO West Vancouver Laboratory site, as well as several locations nearby. The historic account of Matthews (1955) describes the location of the DFO laboratory as once a seasonal village called Stuckale. The village consisted of split cedar plank houses that compare to houses that were formerly located at Horseshoe Bay. Information on recorded archaeological sites, First Nations place names, ethnographic accounts, historic records, and environmental characteristics indicate that the project area was a culturally, economically, and spiritually important place that was utilized by Coast Salish peoples for a wide range of activities that may leave archaeological traces.

The PFR was conducted on April 24, 2018. The survey identified four areas that are testable by shovel testing, and other areas for monitoring. Recommendations from this AOA are that:

1. An Archaeological Impact Assessment (AIA) be conducted to identify the potential existence of any deeply buried intact sub-surface archaeological deposits within the project area.
2. An AIA include shovel-testing in the areas not capped by impenetrable surfaces (e.g., concrete, asphalt, existing buildings).

3. In areas capped by impenetrable surfaces it is recommended that any future construction excavations be monitored by a professional archaeologist to assess the sediments beneath the cap.
4. In the fill mound located on the eastern side of the property near the shoreline no further archaeological assessment is required if future construction excavations occur above the original ground surface. If excavations reach original ground surface elevations, then monitoring by a professional archaeologist is recommended.
5. The inter-tidal and shoreline areas should be monitored for archaeological features if any development work such as shoreline stabilization or dock construction occur.

Acknowledgements

We thank all those who contributed their time, energy, and experience throughout the duration of this project. We particularly acknowledge the First Nations communities – Musqueam, Squamish, and Tsleil-Waututh – within whose territories of interest this assessment occurred. All the Nations supported and acknowledged the work by issuing heritage permits to Inlailawatash Archaeology. We would like to thank Aviva Finkelstein (Musqueam Indian Band) who was very helpful in providing Musqueam place names for our report.

In addition, we thank Cher Lacoste who facilitated our research at the West Vancouver Laboratory site, providing background information on the projects, the history of the site, and led the field crew on a tour of the laboratory grounds.

Table of Contents

List of Figures

List of Tables

1 INTRODUCTION

This report describes the results of an Archaeological Overview Assessment (AOA) of cultural heritage resources for the proposed upgrades to laboratory facilities undertaken by Inlailawatash Limited Partnership (ILP) on behalf of the Department of Fisheries and Oceans (DFO) in West Vancouver, British Columbia (Figure 1). The project is located within the territories of interest for the Musqueam, Squamish, and Tsleil-Waututh Nations. The AOA was conducted under the standards and guidelines of the Archaeology Branch (1998, 2009) and Musqueam Indian Band Heritage Research/Investigation Permit MIB-2018-135-AOA, Squamish Nation Archaeological Investigation Permit 18-0118, and Tsleil-Waututh Nation Cultural Heritage Investigation Permit 2018-042.

A Preliminary Field Reconnaissance (PFR) of the project area was conducted on April 24, 2018 by Inlailawatash archaeologists Sean P. Connaughton and Walter Homewood. Field representatives from Squamish, Musqueam, and Tsleil-Waututh were not available on the day of the PFR but they approved the field work schedule.

1.1.1 AOA Objectives

The primary objective of the AOA is to describe the distribution of known and potential archaeological sites within the local study area. The purpose is to assess whether the proposed developments at the DFO laboratories poses a risk to known or unidentified archaeological sites. The characteristics of archaeological sites that may be identified within the local study area, based on relevant biophysical, ethnographic, and ethnohistoric data, are outlined to assess the potential risks of development to cultural resources. Based on this information, management recommendations are provided regarding the need for further archaeological investigations (e.g., an archaeological impact assessment) for potential and known archaeological resources within the project area, and to assess the risks associated with proposed developments.

The assessment described in this report conforms to an AOA as defined in the “British Columbia Archaeological Impact Assessment Guidelines” (Archaeology Branch 1998, 2009). The objectives of this AOA are to:

- Review cultural significance of the lands and archaeological resources of the project;
- Obtain local First Nations heritage investigation permits for work within their territories of interest and engage their field representatives;
- Identify and describe archaeological sites that may conflict with the proposed project;

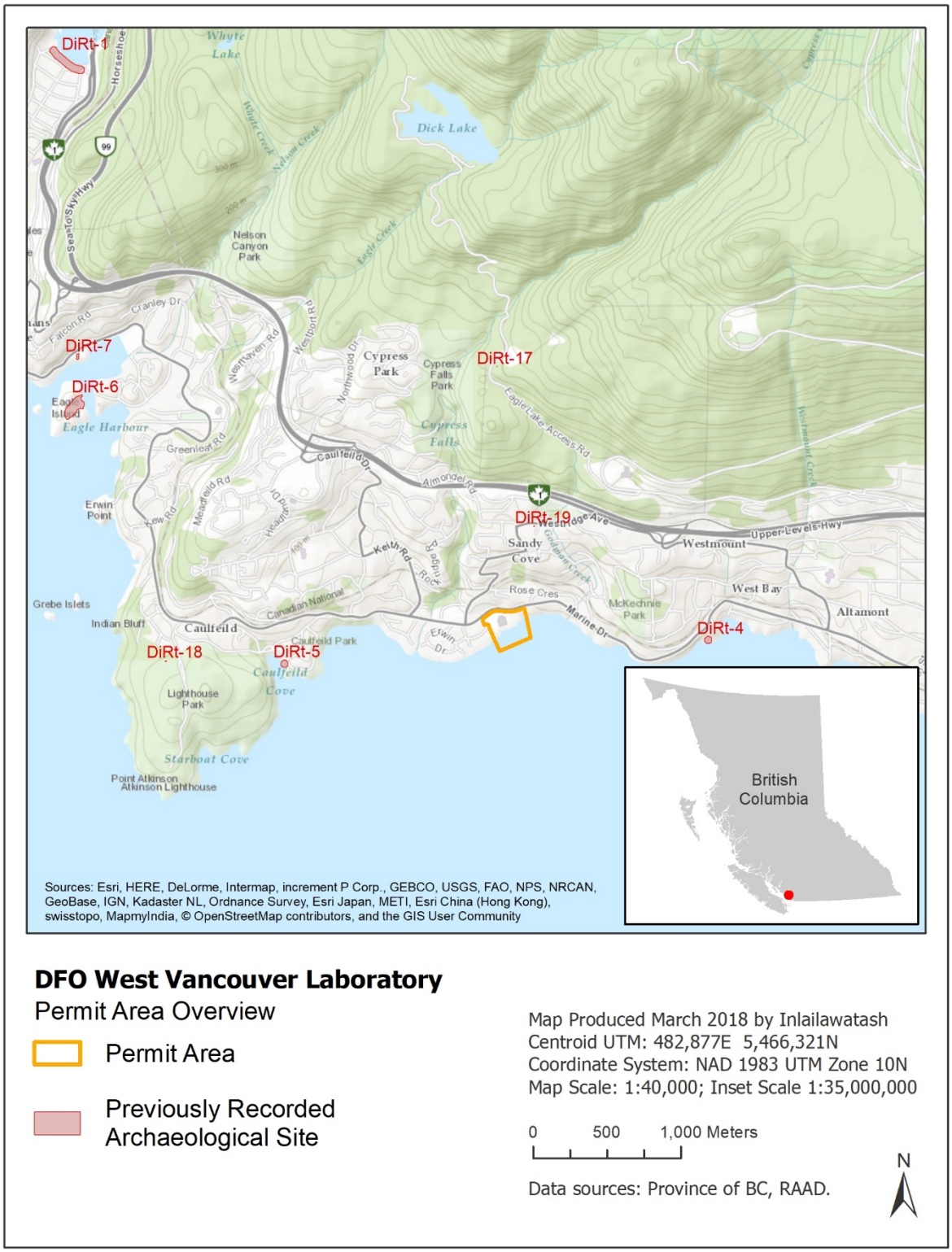

Figure 1. Project area location in West Vancouver.

- Identify lands or landforms that have the potential to contain archaeological sites within the project area through a desk-based analysis and Preliminary Field Reconnaissance;
- Assess potential impacts to archaeological resources that might result from construction activities during development projects; and
- Provide recommendations for measures to avoid, limit, protect or otherwise mitigate potential adverse effects of the proposed project to identified archaeological resources.

1.2 Project Development Description

DFO proposes upgrades to their fisheries laboratories located at 4160 Marine Drive, West Vancouver. At this time the upgrades are still in the design phase and have not been finalized, however the development construction will likely include excavations. Much of the project area has been paved, and includes parking lots, an access road to Marine Drive, and a wharf extending into the intertidal zone (Figure 2). Several buildings are present in the project area that provide workspace for the DFO West Vancouver Laboratories and the Center for Aquaculture and Environmental Research. The local shoreline has been modified with rip-rap of boulders and large cobbles. Grassy areas exist within the project area between Marine Drive and the access road and to the west of the wharf.

1.3 Archaeological Heritage Legislation

Heritage resources as a general term are defined as “a human work or a place that gives evidence of human activity or has spiritual or cultural meaning and that has historic value.” The Canadian Environmental Assessment Act (Government of Canada 1992) outlines four categories of heritage resources: paleontology, archaeology, historic sites, and traditional land use (Canadian Environmental Assessment Agency 1996). One type of heritage resource, i.e., archaeological sites, are the subject of an AOA, and while other types of heritage resources are important sources of background information, only archaeological resources are assessed in this report.

Figure 2. Detailed site map of the project area.

1.3.1 Heritage Conservation Act of British Columbia

This project is situated on lands that fall under British Columbia provincial heritage jurisdiction where archaeological sites are defined as locations that:

> …consist of the physical remains of past human activity. The scientific study of these remains, through the methods and techniques employed in the discipline of archaeology, is essential to the understanding and appreciation of prehistoric and historic cultural development in British Columbia. These resources may be of regional, provincial, national or international significance (Archaeology Branch 1998).

In British Columbia, most archaeological sites are attributable to settlement and resource use by Aboriginal people. All archaeological sites that are located on Provincial Crown or private land that are assumed to pre-date AD 1846 are automatically protected from damage, desecration, alteration, or excavation under the *Heritage Conservation Act* (*HCA*) (RSBC 1996, Chap. 187). Some sites, including burials and rock art sites, are protected through designation regardless of their age, as "Provincial Heritage Sites" under Section 9 of the *HCA*, or through automatic protection under Section 13 due to their defined historic or archaeological value.

Inspection, investigation, or alterations to archaeological sites require a permit issued by the Archaeology Branch, Ministry of Forests, Lands, Natural Resource Operations, and Rural Development under Sections 12 or 14 of the *HCA*. Sites automatically protected under Section 13 include:

- Archaeological sites occupied or used before AD 1846
- Rock art with historical or archaeological value
- Burial places with historical or archaeological value
- Heritage shipwrecks or aircraft wrecks (after a 2-year abandonment), and
- Archaeological sites of unknown age, with a reasonable possibility of having been occupied or used before AD 1846.

Additionally, archaeological sites of Aboriginal origin may be subject to interpretations of the Supreme Court of Canada decision in *Delgamuukw v. British Columbia* (1997) regarding the fiduciary responsibility of provincial governments for protecting cultural heritage. Furthermore, heritage sites of Aboriginal origin not automatically protected by the *HCA* may still be of interest to First Nations who may wish to discuss their interest in any engagement process.

To assist with the management of archaeological sites the Archaeology Branch issued the *British Columbia Archaeological Impact Assessment Guidelines* (Archaeology Branch 1998), and an updated *AOA Standards and Guidelines* (Archaeology Branch 2009). These guidelines identify several kinds of archaeological assessments that may be undertaken in response to proposed developments, with the kind of assessment dependent on the stage of development design and the types of archaeological information required. The assessment described in this report is an AOA, as described in the *Guidelines* (1998, 2009).

Archaeological sites are numbered according to the *Borden Site Designation Scheme* used throughout Canada (Borden 1952). This scheme is based on the maps of the National Topographic System and uses latitude and longitude to identify the location of a site. The four-alternating upper and lower-case letters in a site number (e.g., DiRt-) designate a unique block of 10 minutes of latitude and longitude, called a "Borden block." Sites are then numbered sequentially with a "Borden block," usually in the chronological order in which they were found and recorded at the provincial Archaeology Branch. The BC Archaeology Branch is responsible for assigning new Borden numbers for new sites found and recorded in British Columbia, and for maintaining all archaeological site inventory records and reports.

1.3.2 First Nations Heritage Policy and Permitting Processes

Several First Nations in British Columbia have developed their own heritage policies and permits to manage their archaeological and heritage concerns. These permits are separate from the Provincial *HCA* permits, and although they are not required to meet Provincial regulatory standards, Inlailawatash respects the important First Nation oversight that these permits provide for the archaeology that is conducted within the traditional territories. The First Nations permits are generally issued with a set of cultural protocols or policies around the treatment of heritage resources, for which ancestral remains and spiritual places are particularly sensitive. The permits allow for First Nations' comment and input into the study and its methods, and for engagement in any field reconnaissance work if applicable.

Inlailawatash applied for heritage permits from Musqueam, Squamish, and Tsleil-Waututh Nations. Musqueam Heritage Research/Investigation Permit MIB-2018-135-AOA, Squamish Archaeological Investigation Permit 18-0118, and Tsleil-Waututh Cultural Heritage Inspection Permit 2018-042 were issued to Inlailawatash Limited Partnership for an Archaeological Overview Assessment in the project area.

2 METHODS OF ARCHAEOLOGICAL OVERVIEW ASSESSMENT

2.1 Objectives and Tasks

The Archaeological Overview Assessment involved the following tasks:

- Applications for a Musqueam Indian Band Heritage Research/Investigation Permit, a Squamish Nation Archaeological Investigation Permit, and a Tsleil-Waututh Nation Cultural Heritage Investigation Permit;
- Desk-based review of background ethnographic and archaeological literature for the project area;
- Review of previous Archaeological Overview Assessments (AOA) and Archaeological Impact Assessments (AIA) in the background study area;
- Search for documented archaeological sites in the Provincial Heritage Register maintained by the Archaeology Branch, accessed via the Remote Access to Archaeological Data (RAAD) system;
- Review of paleoenvironmental, biophysical, and topographic information for landforms within the project area;
- Preliminary Field Reconnaissance (PFR);
- Evaluation of archaeological resource potential within the project area;
- Preparation of a written report describing the AOA findings and recommendations; and
- Distribution of the report to the First Nations.

Because no archaeological sites are being altered during this study, and the property is under Federal jurisdiction, a provincial Section 14 Heritage Inspection Permit (HIP) was not required.

2.2 Information Sources and Methods for Baseline Overview Assessment

An Archaeological Overview Assessment consists of a desk-based literature review and compilation of existing knowledge about recorded archaeological site locations within 1000 m of the project area, historical First Nations land use, and cultural and environmental characteristics and changes in the area likely to effect site location and preservation. This information is synthesized to develop a potential model of where archaeological sites are expected to be located. A Preliminary Field Reconnaissance is also conducted, and when combined with the other datasets, allows for the assessment of probable site types and their potential to exist within the project area. The overview assessment is then used to make recommendations for management, including the need for additional studies such as an Archaeological Impact Assessment.

2.2.1 Desktop Study and Document Review

Review of archaeological and ethnographic sources, along with biophysical characteristics and landform typology, provides information for presenting a baseline heritage context for understanding the archaeological potential for the project area. Documents required to undertake this study were available from the Inlailawatash Archaeology library, the Simon Fraser University library, and from unpublished reports obtained from the electronic library of the Archaeology Branch. The document review searched for general information on pre-Contact archaeology, settlement, and land use patterns, and historic land use patterns within the area of the northwest shore of Burrard Inlet.

To evaluate the project area for archaeological site potential we reviewed several sources of data:

- Relevant archaeological records and reports from the study area and surrounding areas;
- Ethnographic, ethnohistoric, and traditional use data pertaining to the study area;
- Historic maps; and
- Biophysical and geomorphological landform data pertinent to pre-Contact and post-Contact land use activities.

Recorded archaeological sites with their geo-referenced location can be downloaded from the Provincial Heritage Register Inventory via the Remote Access to Archaeological Resources (RAAD) system, an electronic database maintained by the Archaeology Branch. This system enables access to information about recorded sites within the local and regional study area. Topographic information was gathered from 1:20,000 scale TRIM maps, as well as scalable orthophotos from Google Earth™. Access to previous Archaeological Overview and Impact assessment reports within the study area is provided through the Provincial Archaeological Report Library (PARL).

2.3 Evaluation of Biophysical and Landform Potential

Information on past and present biophysical characteristics of the project area is important to provide a context for predicting the potential for locating archaeological resources as they pertain to past human occupation and land use. Past hydrology, landforms, and ecological resources are used to inform archaeological potential models. For example, access in the past to food resources, fresh water, and level terrain made an area more suitable for human habitation, therefore increasing the potential of cultural materials being deposited to become part of the archaeological record.

Land use, settlement patterns, and subsistence practices of all people are generally adaptions to specific environments. Environmental conditions influence the availability of natural resources and the suitability of the natural landscape for human habitation, subsistence, technology, and other cultural factors. The location, accessibility, and quantity of culturally-valued minerals, plant, animal, and fish species can influence the type and location of heritage and modern sites. Physical factors such as climate, terrain, proximity to water, and vegetation cover can also determine the location, preservation, and visibility of archaeological sites. Environmental factors may also be instrumental in spiritual and ceremonial aspects associated with special places or landscapes, but unless there are material correlates, an evaluation of this is not within the scope of an archaeological study.

The biophysical evaluation considers the major physiographic processes and climate changes that have created the topography and the primary attributes of the physical landscape, i.e., the landforms, hydrology, and surficial sediments. The ecological environments and geological histories of the region, both past and present, have implications for understanding long-term land-use activities and cultural historical practices.

Geological processes such as erosion and soil conditions can influence the preservation of archaeological evidence. Certain conditions, particularly very dry or wet soils, may enhance preservation of organic (perishable) archaeological materials, while other processes such as flooding, or erosion can destroy archaeological evidence. Over the past 200 years human activities (industrialization and urbanization) have generally had a greater influence on the biophysical setting than natural ones, and these have also likely had the greatest effect on the destruction of archaeological evidence in the project area.

2.4 Archaeological Site Types

Locations on the land with material remains that were produced by human activities in the past are called archaeological sites. In British Columbia, most archaeological sites are attributed to the past activities of Aboriginal peoples before European contact and are referred to as pre-Contact archaeological sites. There are also post-Contact sites, often called historic archaeological sites, that may have structural remains and material culture associated with both European and Aboriginal technology. Known archaeological sites are recorded in the Provincial Heritage Register and maintained by the Archaeology Branch (Site Inventory Section), the government agency responsible for the management of archaeological resources under the *Heritage Conservation Act.*

Archaeological sites are recorded in the Heritage Register according to site type, which usually specifies the type of features and artifacts known, the size and of the site, its stratigraphy and sediments, and the kinds of traditional activities inferred to have taken place at the site. Examples of site types on the coast include shell middens, house depressions, lithic/artifact scatters, cache pits, hearth features, rock art, burial sites, canoe runs, fishweirs and traps, clam gardens, and culturally modified trees (CMTs). A review of known information near the project area will suggest the expected age and types of archaeological sites in areas of potential.

2.5 Evaluation of Archaeological Resource Potential

Archaeological resource potential can be defined as the capacity of a landscape, or parts of a landscape, to have supported types of Aboriginal cultural activities that would have produced the formation and preservation of archaeological material cultural remains. Certain types of activities, for example, plant collecting, would probably not result in physical remains, and therefore cannot be archaeologically assessed. Plant processing activities however, such as the use of roasting pits or hearths, would potentially leave subsurface archaeological features or preserved plant remains. Likewise, various places of cultural or spiritual significance may not have any type of material evidence that would identify it as such, but Aboriginal place name information can be used as context for assessing landscape potential for archaeological resources.

Archaeological and landscape potential are assessed on a case-by-case basis, but in general areas of well-drained level terrain immediately adjacent to existing or relic bodies of water, or places near known archaeological or traditional use sites, are considered to have highest archaeological potential. In urban places archaeological potential may be obscured due to development, or deeply buried under modern fill deposits.

Archaeological potential is not the same as probability of site occurrence. Potential simply rates the suitability of lands for possessing archaeological remains, and therefore whether they should be examined in detail in advance of land-altering development activities.

2.6 Field Investigations: Preliminary Field Reconnaissance

The purpose of Preliminary Field Reconnaissance (PFR) is to visually assess and field-inspect the surficial landscape of the project area, assessing landforms or eroding shorelines that may have the potential to contain archaeological resources. The primary objective is to evaluate the potential for subsurface archaeological materials, but also to identify any existing surficial archaeological materials observable in the field. The PFR is also used to determine what

potential archaeological features or site types (e.g., shell middens or artifact scatters) are most likely to exist within the project area based on the site types identified during the desktop analysis.

3 OVERVIEW ASSESSMENT RESULTS

A desktop assessment prior to fieldwork sought to predict archaeological potential within the project area. The assessment was both inductively and deductively based on generalized principles of human behavior, environmental variables considered favourable to human activity, and reference to previously recorded sites and ethnographic data within the background study area. This was followed up by a field reconnaissance of the project area. In this section the information from the desktop assessment and the Preliminary Field Reconnaissance is presented.

3.1 Biophysical Review

3.1.1 Physiographic Setting

Southern British Columbia lies in the Western Cordillera region of North America, a region characterized by a complex system of mountains, plateaus, fjords, lakes, and alluvial valleys. Burrard Inlet is the major coastal physiographic feature of the British Columbia Lower Mainland, and home to the City of Vancouver's primary port. Burrard Inlet, a shallow-sided coastal fjord, is part of the Georgia Depression that borders on the Coast Mountain and Cascade Mountain physiographic regions that was formed during the last ice age (Church and Ryder 2010).

The inlet is oriented west to east from Point Atkinson on the Strait of Georgia (Salish Sea) to Port Moody at its eastern extent, about 25 km. Its calm waters are protected from open ocean, making it an ideal area for human habitation. Burrard Inlet is today heavily industrialized with some shoreline residential and commercial, but most is port-industrial, including railyards, terminals for container and bulk cargo ships, grain elevators, and oil refineries (Armitage 2001).

The project area is located within the municipalities of West Vancouver, British Columbia, along the north shore of Burrard Inlet at Sandy Cove (Figure 1). East of the project area is Godman Creek which flows into Burrard Inlet at Sandy Cove Park; the creek contains cutthroat trout. To the west is Cypress Creek, which drains from Yew Lake, and is the largest watershed in West Vancouver. Cypress Creek contains pink, chum, and coho salmon, as well as cutthroat trout, and rainbow trout occurs in Yew Lake (Pacific Stream Keepers 2017).

3.1.2 Glaciation and Sea Level History

While tectonic activity has formed the underlying geology of British Columbia, it is the effects of Pleistocene glaciation that have determined the topographic landscape detail and their surficial sediments. The scouring of the land by both glacial ice and glacial meltwater determined the type of sediments and landscape features present in the Lower Mainland. The sedimentary evidence of the last glaciation provides explanation for the character of the contemporary landscape, a principle concern for understanding human occupation. The timing of deglaciation is around 13,000 - 11,000 years ago, after which the development of habitable environments for human occupation occurred, placing the earliest approximal age for the oldest potential archaeological sites in the Lower Mainland (Clague 1989).

At the peak of the last glaciation in North America, called the Late Wisconsin, the Lower Mainland was covered by ice up to two km in thickness. The weight of glacial ice and its subsequent melting determined relative sea-levels which rose and fell between the periods of glaciation and deglaciation. Coastal areas up to about 200 m above sea level were inundated during periods of deglaciation. Relative sea levels stabilized near modern levels by approximately 5,500 years ago (Armstrong 1981; Church and Ryder 2010; Clague 1989; Clague et al. 1982; Demarchi 2011; Fulton et al. 2004). The changes in sea level have influenced the location of archaeological sites such that some sites will now be submerged, others close to the shoreline are being eroded due to sea level rise, or other sites may be found far inland from current shorelines when sea levels were higher than today. The project area is currently between 0 and 20 m above sea level. Any sites found within the project area are most likely the result of cultural activities associated with sea levels of the past 5,500 years.

3.1.3 Ecological Resources

The project area is within the Coastal Western Hemlock Very Dry Maritime (CWHxm1) biogeoclimatic zone, one of the most productive zones in British Columbia for overall biomass (Jones and Annas 1978). The climate is typically mild and rainy with annual precipitation averaging around 1500 mm. Western hemlock is the dominant forest cover for this zone, and is typically accompanied by western red cedar, Douglas fir, and Sitka spruce. Amabalis fir, grand fir, western white pine, and bigleaf maple are sometimes present in the southern portions of the zone. Ferns make up most of the understory and several moss species make up the ground cover (Pojar et al 1991: 96-98). The project area has been deforested. The current flora of the area is a cultivated set of native and non-native species.

Economically important animal species that would have been found in the project area in the past include large mammals such as black bear and mule deer. Birds including various water fowl and eagle species would have been present. The Inlet is also a large source of fish, particularly salmon, of which five species would have migrated through Burrard Inlet and into fresh water sources. Salt water fish, shellfish, and sea mammals would have been available nearby in the Inlet. For Aboriginal peoples these faunas provided food, as well as hide, bone, antler and horn as raw materials for manufacturing clothing, tools, and other artifacts. Salmon of all species were important for food as well as for ceremonial and social purposes. Birds were hunted for food, but their feathers were also important for ceremonial regalia and other social purposes. While many of these faunas are no longer found in the area due to urbanization, the boney remains of them, when found in archaeological sites, provide useful data about the environments of the past and the human use of the available resources.

3.1.4 Summary of Biophysical Setting

The pre-industrial landforms, hydrology, and ecological resources of the past suggest that the project area has a high potential for archaeological sites. Pre-Contact Aboriginal people occupied villages and camps along the shores of Burrard Inlet where a variety of fish, shellfish, plant, and animal and sea mammal resources could have been easily harvested from the marine and freshwater creek environments. The project area has a highly favourable environmental setting for the location of aboriginal settlements that may be reflected archaeologically. However, urbanization has altered the hydrology and landscape, and may have also destroyed archaeological sites associated with resource collection activities.

3.2 Cultural Setting Review

3.2.1 Regional Archaeological Background

The project area is situated within the Northwest Coast Culture Area as defined by anthropologists, which is an immense coastal culture area that encompasses the west coast of North America from southern Alaska to Cape Mendocino in northern California. Archaeologists have defined a chronological sequence of pre-Contact cultural periods within this culture area for the south British Columbia coast based on site investigations in the Salish Sea and Lower Fraser River delta. Summaries of the south coast regional prehistory sequences have been prepared by Ames and Maschner (1999), Matson and Coupland (1995), and Mitchell (1990).

Researchers have noted continuities through time in the reliance on marine and riverine resources particularly salmon and other fishing, woodworking technology, food storage,

ceremonialism, and the acquisition of wealth and status. Based on diagnostic artifact types and technologies, as well as inferred economic, social and other cultural traits, six distinct cultural chronological periods, variably referred to as 'Phases' or 'Cultures' are identified with associated time frames expressed in years before present (BP):

- Pebble Tool/Old Cordilleran (ca. 10,000 - 5,500/4,500 years BP)
- Charles (ca. 5,500/4,500 - 3,500 BP)
- Locarno Beach (ca. 3,500- 2,500 BP)
- Marpole (ca. 2,500- 1,200 BP)
- Gulf of Georgia (ca. 1,200 - 200 BP), and
- Historic or Ethnographic Period (ca. 200 BP to Present)

A summary of the cultural traditions and their site types and artifact assemblages is presented below to provide background context for the possible archaeological materials and their associated age that may be recovered within the project area.

Pebble Tool/Old Cordilleran Tradition (12,000 - 5,500/4,500 BP)

The earliest culture tradition identified for the coast is called by various names including the Pebble Tool Tradition (Carlson 1990, 1996), the Old Cordilleran Tradition (Matson 1976, 1992), the Lithic Culture Type (Mitchell 1990), or the Protowestern Tradition (Ham 1982; McLaren 2017). This early tradition, which dates from approximately 12,000 to 5,500 BP is associated with a period of lower and/or fluctuating sea levels in the early Holocene. The artifact assemblages are dominated by flaked stone artifacts, including cobble/pebble tools and leaf-shaped bifaces, along with rare bone and antler tools (Carlson 1990; Carlson and Della Bona 1996; Matson 1992).

In the Fraser River delta, the subsistence pattern is diversified towards deer and wapiti hunting, sea mammals (seals), fish (salmon, stickleback, sturgeon, eulachon, flatfish), and shellfish (Matson 1976, 1992). One of the important Pebble Tool Tradition sites for the Fraser delta is the Glenrose Cannery site (DgRr-006) (Matson 1976) where faunal remains have been found indicating this subsistence pattern.

Charles/St. Mungo Culture Type (5,500 to 3,300 BP)

This culture type has been defined based on three sites in the Fraser River delta: St. Mungo (DgRr-002), Glenrose Cannery (DgRr-006), and Crescent Beach (DgRr-001) (Matson and Coupland 1995). There is a continuation of some tool types from the previous period, but new types, including chipped stone scrapers, drills, stemmed bifaces, as well as ground slate, bone, and antler implements are introduced (Ham et al. 1986). The presence of adzes and wedges

suggest a well-developed woodworking technology. Wet sites containing fishweirs, basketry, cordage, carved wood, and cedar bark clothing have been found dating to this period in the Fraser River delta (Eldridge 1991).

Locarno Beach Culture Type (3,500/3,300 to 2,500 BP)

Chipped stone tools predominate with a small proportion of large ground stone tools. Flaked tool types include shouldered and lanceolate points, microblades and cores, bilaterally and unilaterally barbed points, one-piece and composite toggling harpoon heads, woodworking tools including abraders, grinding slabs, and wedges, and large faceted ground slate points and thick ground slate knives. Cordage, basketry, and other wood items have been recovered from wet sites in the Lower Mainland (Bernick 1991; Borden 1976; Stantec 2017). Faunal remains show a diversified resource utilization.

Marpole Culture Type (2,500 to 1,200 BP)

Many artifact types from the Locarno period continue into Marpole, however there is a decrease in the proportion of chipped stone tools and an increase in the refinement of ground stone tools. The non-toggling, barbed harpoon point is exclusive to the Marpole period. Native copper ornaments are present, along with midden burials containing grave inclusions such as shell or slate disc beads. Large-scale woodworking technology and large house outlines and post moulds suggest that the ethnographic pattern of heavy timber frame houses with cedar planks was well developed by this time. The artistic traditions were well-developed including the presence of seated human figurine bowls, decorated stone bowls, incised siltstone objects, and carved bone and antler objects with zoomorphic designs. The ability to harvest and preserve large quantities of salmon for winter storage most likely supported the development of large ranked societies during this time (Mitchell 1990; Burley 1980).

Developed Coast Salish Culture Type (1,200 to 200 BP)

This culture is directly ancestral to the ethnographic Coast Salish culture. Artifacts that define this culture archaeologically include small triangular flaked basalt points, thin ground slate points and knives, unilaterally barbed bone points, composite toggling harpoon heads, large well-made ground stone adzes, and net weights and anchor stones for netting technology. Salmon was a dietary staple, along with a varied use of many land mammal, sea mammal, bird, fish, and plant resources. The resource economy was based on a seasonal round with the presence of large winter villages with heavy timber frame houses, large summer gathering settlements, and smaller seasonal harvesting camps (Mitchell 1990).

3.2.2 History of Archaeological Studies in West Vancouver

Two large-scale archaeological surveys, Winram (1975) and Arcas (1998), were conducted in Howe Sound, and included the northwest shore of Burrard Inlet. Winram's (1975) study was conducted for the Archaeological Sites Advisory Board, but provides very little site-specific information, providing instead general site type descriptions. Site impact recommendations in Winram (1975) are focused on impacts caused by wave action.

Arcas (1998) provides an in-depth and comprehensive survey of sites within Squamish territory with the purpose of preparing an inventory of sites for the Squamish Nation (Arcas 1998: 10). The archaeological survey, conducted between 1989 and 1998, revisited and evaluated 61 previously recorded sites and recorded 39 new sites. In addition, archaeological excavations were conducted at 10 sites. The Arcas (1998) work was intended to be on-going, with the site inventory being continuously updated, however this report was completed in 1998 and not released until 2014 with no new updates since 1998.

3.2.2.1 Previously recorded sites

Within the Provincial Archaeological Inventory database there are eight registered archaeological sites within five km of the project area (Table 1; Figure 1). These sites include village sites, shell middens, rock art, and lithic scatters. However, no archaeological sites have been recorded within the DFO laboratory project area which is surprising given that an historic village called Stuckale was known to have existed there (Matthew 1955: 103-104). Stuckale is described as a village similar to another village located in Horseshoe Bay, for which there is a recorded archaeological component in the Provincial database (DiRt-1) (Figure 1). While no archaeological site is recorded within the project area, it is possible that archaeological materials may exist in relation to the historic village of Stuckale or other associated cultural activities.

Table 1. Archaeological Sites Within Five km of the Project Area.

Site	Description	Reference
DiRt-1	Large (13,561 m^2) pre-Contact subsurface shell midden village located at Horseshoe Bay.	Winram (1975)
DiRt-4	Small (1,953 m^2) surface lithic scatter. Site was recorded in 1964 with very little information known about it.	Unknown (1964)
DiRt-5	Small (1,953 m^2) pre-Contact subsurface shell midden village.	Unknown (ca. 1950s); BC Provincial Museum (1973)

Site	Description	Reference
DiRt-6	Large (11,118 m^2) subsurface lithic site.	Winram (1975)
DiRt-7	Small (522 m2) subsurface shell midden site.	Winram (1975)
DiRt-17	Rock art site first recorded in 1993 by a private individual. Doris Lundy revisited in 1994 determining that this is not a genuine rock art site as the images are pictographic duplicates of known petroglyphs at sites DgRx-6 and DgRw-6.	Unknown (1993); Lundy (1994)
DiRt-18	Small surface lithic scatter on Point Atkinson.	Arcas (n.d.) for *HCA* Permit # 1995-0233 report not available on PARL
DiRt-19	Small subsurface lithic scatter. Approximately 600 m to the north of the project area it is the closest site to the DFO West Vancouver Laboratory.	Arcas (1998)

3.2.3 Post-Contact Regional History and Ethnographic Overview

3.2.3.1 Ethnographic Background

The project area is located within the territories of interest for the Musqueam Indian Band, Squamish Nation, Stó:lō Nation, and Tsleil-Waututh Nation, which collectively are part of the Central Coast Salish peoples, speakers of either the Mainland Halkomelem language, or the Squamish language (Barnett 1955; Hill-Tout 1905, 1978; Suttles 1990). More recent ethnographic overviews include the Stó:lō Atlas (Carlson 2001), Morin (2015), and Tsleil-Waututh and Alexander (2001). At the time of European contact, the First Nations had many villages and camps throughout Burrard Inlet, and the name Tsleil-Waututh means "people of the inlet" (Tsleil-Waututh and Alexander 2001: 61). The locations of former trails along the shore of Burrard Inlet and Cypress Creek linking various Aboriginal settlements have also been recorded (Tsleil-Waututh and Alexander 2001: 175).

The first European known to have travelled to Burrard Inlet was the Spaniard Jose Maria Narvaez who entered the inlet by ship in the summer of 1791. From Narvaez's charts and notes it is determined by historians that he called Burrard Inlet "Florida Blanca," however there is no surviving log, so it is not known if he directly interacted with Aboriginal people (Armitage 2001:22-23). The first direct contact between European explorers and the Aboriginal peoples of Burrard Inlet occurred in June of 1792 as recorded in the journals of Captain George Vancouver. A few very brief passages from his journals are insightful in how he describes the nature of the physical settings of village sites in the Inlet, which he named "Burrard's Channel" after his navy friend Sir Harry Burrard (Armitage 2001: 27). Vancouver described how they were

met by about fifty people in their canoes who were from “a small border of low marshy land on the northern shore intersected by several creeks of fresh water” (Bartroli 1997: 71; Matthews 1955: 414). Vancouver wrote that “Most of their canoes were hauled up into the creeks….None of their habitations could be discovered, whence we concluded that their village was within the forest” (Bartroli 1997: 75). The explorers camped overnight near the mouth of Indian Arm on the present site of the Barnett Marine Park. They left the inlet the next morning without actually having seen any villages, “leading to the conclusion that the villages were hidden from view to provide protection” (Tsleil-Waututh and Alexander 2001:62). Various smallpox epidemics, including one in the early 1700s in Burrard Inlet that had spread from Washington, created population losses and abandonment of many of the villages prior to the first European explorers arrival (Boyd 1990).

Within the District of West Vancouver, the DFO West Vancouver Laboratory is in what is now called Sandy Cove. First Nations’ use of Sandy Cove is recorded historically in Matthews (1955) and Rozen (1979). Sandy Cove became the location of the Great Northern Cannery from 1891-1968 and was then transferred to the Department of Fisheries and Oceans and developed into the DFO West Vancouver Laboratory.

Central Coast Salish peoples along Burrard Inlet practiced lifeways in the past characteristic of the Northwest Coast Culture Area in general. Common cultural traits include a coastal settlement pattern; a diverse subsistence base and associated technologies with a focus on fishing for anadromous fish, but also shellfish, sea mammal, game and bird hunting, and plant collecting; a complex storage economy particularly for the storage of surplus salmon; extensive wood-working and basketry technologies; a social/political organization with families, household, local groups and winter villages; and a myth system that included shamanism, vision quests, and life-cycle and subsistence cycle celebrations and rituals (Suttles 1990).

Cultural activities that may be reflected within the archaeological record near and within the project area include resource procurement technologies (e.g., stone, bone, wood, and basketry tools used in fishing, hunting, and gathering; and fishweirs); food preparation and storage (e.g., hearths, roasting pits, post holes for drying/smoking racks); habitation (e.g., house floors, refuse deposits such as middens, post holes); transportation (e.g., canoe skids); and mortuary practices (e.g., burials, cairns).

3.2.3.2 First Nations Place Names

One of the most powerful and direct links between ethnographic information and the physical landscape are place names. Indigenous place names have long been recognized by anthropologists as having inherent cultural value (Basso 1996; Bierwert 1999; Carlson 2007).

This cultural value can arise in many ways. For example, 1) place names may identify locations of specific importance to the culture in question; 2) place names may reflect aspects of the Indigenous ways of understanding and organizing local geography; and 3) place names may be associated with 'supernatural' events in the deep past (i.e., the time of transformers).

Place names reference places of historical or cultural events, topographical features such as mountains, islands, streams, and oceans as well as places such as camps, villages, seasonal resource harvesting areas, locations of battles, defensive sites, burials, and transformations. In short, place names provide information about the history of the landscape and how people interacted with their natural surroundings.

Matthews (1955) refers to the Great Northern Cannery location (Sandy Cove) in three accounts. The first account is in discussion with August Jack Khahtsahlano while reviewing maps made by Spanish explorers in 1791:

> *Major Matthews*: "August. What do you think of this map? What does this Punta de Bodega mean here?
>
> *August:* (studying it) "May be the Spanish was travelling at night; at night after they left Boundary Bay. Long summer evening, early morning, June, may be they travel; not see very good. Maybe these houses (square dots on map) be at Horseshoe Bay, and Great Northern Cannery. There was always a big place (Indian settlement) at Cha-hai (Horseshoe Bay); I never seen them, but they tell me (split cedar) houses there one time. Indian from big village at Whoi-nuck (Squamish) go down there to troll and fish. Then there was cedar shake houses at Stuckale, (Great Northern Cannery). There's a creek there, and the salmon goes up it, and that's where the Indians goes to live. They had cedar shake houses at Cha-hai and Stuckale" (Matthews 1955:103-104).

A second account, which is a discussion with Reverend C.M. Tate, Matthews records Tate saying:

> "I am not sure about the meaning of "Stuckale" (Great Northern Cannery, West Vancouver). It seems to me there must be a head or something there – a mountain. I once composed a hymn, and wanted a title for it, so I chose "Stuckale to Jesus", which interprets "head of all, chief of chiefs", or "Jesus, head of all." But I believe the local Squamish Indians have another meaning for it" (Matthews 1955:185-186).

Finally, in an account titled "Nomenclature: Indian Villages and Landmarks Burrard Inlet and English Bay Before the Whitemans Came to Ulksen" Matthews records place name locations

with translations (1955: 388-421). Regarding Stuckale, August Jack Khahtsahlano is recorded as having said:

> "Stuc-k-ail. 'Stuck' is a rude word for smell. That's why we say 'Stuckale', so our children not become rude. A bad smell, such as made by a skunk, Skunk Cove (Caufield's) not far away. Terrible bad smell" (Matthews 1955:416).

Andrew Paull, quoted by Matthews, translates Stuckale as "it means literally expelling human gas" (Matthews 1955: 416). Rozen (1979: 6) also describes the location of the Great Northern Cannery site as having the name Stuckale and lists alternative spelling for it. Rozen also provides translations as bad smell for Stuckale and also in reference to Cypress Creek (Rozen 1979: 6).

Rozen goes on to describe the location as "This site was evidently located at the mouth of Cypress Creek and was used for camping. It has also been noted that blue grouse were hunted by the Squamish here, in the spring. The eastern side of Claymore Cove was apparently the mouth of Cypress Creek" (Rozen 1979:6). Place names near Sandy Cove are listed in Table 2.

Table 2. Place Names Along the Northwest Shore of Burrard Inlet.

Recorded by	Place Name	Description
Matthews (1955:415-418)	**Stuckale**	Now the location of the DFO West Vancouver Laboratory and previously the Great Northern Cannery. May refer to Cypress Creek, translations include "terribly bad smell" and "expelling human gas."
	Smullaqua	West of Dundarave, ¾ - 2 miles east of Stuckale. Possibly the spot where eight or nine men were killed in the fight for Kokohalik, the noble woman. Translated as "a thigh" (upper part of the leg).
	Skaywitsut	Now referred to as Point Atkinson. Translated as "go around point."
	Cha-hai	Now referred to as Horseshoe Bay. Translated as the sound that small fish (smelts) make swimming in shallow water. Chai-Hai had split cedar houses like those at Stuckale.
Musqueam (Finkelstein 2017)	**xʷməq'məq'əs**	Now referred to as Point Atkinson. This was reportedly a watchmen's camp because there was a good view of who was coming and going from the inlet.

3.2.3.3 Post-Contact Developments

The landscape within and surrounding the project area has been significantly altered in the post-Contact historic period. For the northwest shore of Burrard Inlet Sandy Cove was one of the first locations to become industrialized. Beyond Sandy Cove to the east is West Bay, and to the west is Pilot Cove, Caulfeild Cove, and Starboat Cove leading to Point Atkinson. The first lighthouse was built on Point Atkinson in 1874 (the current lighthouse built in 1912 is a National Historic Site), and at this time the earliest land pre-emptions were also taking place (Hayes 2005:96). The Great Northern Cannery opened in 1891 at Sandy Cove (see Figures 3 and 4).

Figure 3. Photo of the Great Northern Cannery in 1908. Original photo loaned to the archives by L. Grafton [West Vancouver Archives reference code: 0268.WVA.RAH].

Figure 4. Aerial photo of the Great Northern Cannery circa 1950s. Photo by Aero Surveys Limited [West Vancouver Archives reference code: 1126.WVA.RAH].

In 1898 Francis William Caulfeild arrived at Skunk Cove (now Caulfeild Cove), and a year later purchased land there. He began laying out properties for what would become Caulfeild Village, with the first lots for sale in 1909 (Stone 1939:7-8, 25; Hayes 2005:96). H. A. Stone purchased one of the first three lots in 1909, and in 1939 he authored the book called *A Short History of Caulfeild Village.* Stone (1939:10) refers to Sandy Cove, describing the Great Northern Cannery and the shoreline adjacent to it as a spot frequented by campers during the summer. The camp was near a fresh water creek, possibly Godman Creek. This area is now partially contained by Sandy Cove Park. For land use elsewhere in the North Shore, Stone (1939:10) mentioned the light house at Point Atkinson, and the houses and pilot station in Pilot Cove. Beyond this Stone noted that only four or five dwellings existed in the eight miles of timbered land between Caulfeild Village and the Indian Reserve in North Vancouver (Capilano 5).

The Municipality of West Vancouver was founded in 1912 (Stone 1939:16; Hayes 2005:97). By 1914 the Pacific Great Eastern Rail line is in operation (Hayes 2005: 97), approximately 200 m to the north of the Great Northern Cannery. In 1915 Marine Drive was completed to Caulfield Village (Stone 1939: 17; Hayes 2005: 98); the completed road is shown passing the project area in Figure 5. Sandy Cove became the location of the DFO West Vancouver Laboratory after the Great Northern Cannery closed in 1968. Sandy Cove Park was established to the east of the DFL Laboratory in the former camping location, and approximately 15 residences were built between them.

Figure 5. Photo of Henry Nesbitt's McLaughlin Buick automobile on Marine Drive at Sandy Cove Bridge. The Great Northern Cannery is visible in the background by the edge of the water. Photo taken by F. Gowen (1917) black and white hand tinted in colour [West Vancouver Archives reference code: 0224.WVA.PHO].

In summary, the historical records indicate that Sandy Cove has seen several substantial industrial, commercial, and residential activities for the north shore of Burrard Inlet. The location has high archaeological potential but archaeological sites in Sandy Cove have very likely been impacted and possibly destroyed by the land use activities that have taken place here over the past 127 years. Any evidence of trails or culturally modified trees are now lost to modern development activities.

3.3 Expected Site Types

The development property is situated along the north shore of Burrard Inlet, known for pre-Contact village locations and fishing facilities such as fish camps and fishweirs, and shellfish harvesting sites (Morin 2015; Tsleil-Waututh and Alexander 2001). Based on the geography of the area, proxies from nearby sites, and the detailed historic record for this specific location

(Matthews 1955; Rozen 1979), the most common site types in the project area would be village sites or camp sites with associated features such as shell midden, fishweirs, lithic scatters, hearths, and cultural depressions. Shell middens and lithic scatters (refuse and stone tools) can range in size, complexity, and density depending on the persistence of use over time and activity type.

Burials may also be present in association with village sites and may be intact below the ground surface within the project area. Trails and culturally modifies trees likely existed within or around the project area but have since been destroyed by urbanization. There exists the potential for fishweirs, petroforms, and rock art along the shoreline and in the intertidal that have survived the industrial activities at the Great Northern Cannery, however these would only be impacted if developments were to occur along the shoreline or within the intertidal zone. There is potential that fishweir features or perishable materials may be submerged in the intertidal mudflats.

In summary, activities that the Aboriginal people living within the area engaged in may be reflected in the archaeological record of the project area. Based on the background overview of ethnographic, archaeological, and place name sites, and the environmental context of the project area, these types of sites may have existed in the local area:

1. Village sites (shell midden, hearths, cultural depressions, lithic and bone artifacts, faunal remains, burials, canoe runs)
2. Fishing sites (fishweirs and traps, perishables, canoe runs)
3. Plant collecting and hunting camps (lithic scatters, hearths, cultural depressions)
4. Culturally Modified Trees (CMTs)
5. Rock Art (petroglyphs and pictographs)
6. Burials (ancestral remains, funerary objects)
7. Trails

3.4 Preliminary Field Reconnaissance

A Preliminary Field Reconnaissance was conducted by Inlailawatash on April 24, 2018. The crew consisted of Inlailawatash archaeologists Sean P. Connaughton and Walter Homewood. Field representatives from Musqueam, Squamish, and Tsleil-Waututh Nations were not available on the day of the PFR but they approved of the fieldwork schedule.

The PFR consisted of a pedestrian ground survey of 100% of the property that was not capped with an impenetrable surface (e.g., asphalt). The ground surface and all subsurface exposures were examined for the presence of artifacts and to assess sediment type. Two subsurface

exposures (tree throws) were identified and examined (Figures 6, 7). No surface or subsurface artifacts were observed, and sediment descriptions from the tree throws are provided in Table 3. Four potential shovel test areas (STA) were identified and assigned the reference labels STA1, STA2, STA3, and STA4. All four areas are grass-covered and topographically flat. The four shovel test areas are shown in Figures 8 - 11.

Based on the results of the desktop background review the entire project area is considered to have potential to contain archaeological materials. Therefore, the PFR focused on identifying the areas where shovel testing is currently possible (see Figure 12).

Figure 6. Exposed sediments at tree throw 1.

Figure 7. Exposed sediments at tree throw 2.

Table 3. Sediment Description of Two Subsurface Exposures.

Exposure Label	Description
TT1	Located in the southwest section of northern portion of the project area – largely sandy deposits of yellow-grey medium to coarse sand with 10% sub-rounded to rounded pebbles.
TT2	Far eastern end of northern portion of project area – sediment is brown silty sand with sub-rounded pebbles.

Figure 8. STA1, a grassy area adjacent to the shoreline. The area has been broken up by a gravel parking lot, a walking path, and two small buildings. Photo facing south.

**Figure 9. STA2, a small grassy area with planted shrubs and bushes.
The area is bounded by a asphalt driveway and parking lot. Photo facing north.**

Figure 10. STA 3, a narrow grassy area with cedar trees along the western boundary of the DFO property. Photo facing northwest.

Figure 11. STA4, a large open grassy area at the north end of the DFO property. The area is bounded by a driveway to the south and a fence seperating the property from Marine Drive to the north. Photo facing west.

3.5 Archaeological Potential of the Project Area

This desktop assessment has sought to predict archaeological potential within the project area. The assessment is inductively and deductively based, utilizing previously recorded site data and ethnographic data along Burrard Inlet near the project area.

Overall archaeological potential is considered high given the desktop review of all cultural and environmental variables for the proposed DFO property development. Two registered archaeological sites in similar environmental settings as Sandy Cove along the north side of Burrard Inlet are located to the west and east of the property (i.e., DiRt-4, DiRt-5; Figure 1), and six other sites are found within five km of the property. Subsurface testing has the potential to discover previously unknown archaeological materials on the DFO property despite the disturbed context of much of the property from various construction activities in the past.

The PFR identified four areas that have penetrable surfaces that are accessible to shovel-testing. All of these are flat grassy areas in the western portion of the property (Figure 12). Based on historic information, these flat areas were formerly occupied by houses during the operation of the Great Northern Cannery. It seems reasonable to suppose that these flat areas may also have been where the cedar shake houses described by August Jack Khahtsahlano (Matthews 1955) were located before the existence of the cannery dwellings, and perhaps also the location of even earlier pre-Contact settlements.

Other areas within the project area were identified as untestable (Figure 12) for the following reasons:

- *No Access* (this area is within the project area but is beyond the fence line and is inaccessible);
- *Impenetrable* (these areas are capped by surfaces such as asphalt and concrete and cannot be tested by hand shovels or probes);
- *Slope* (these areas had slopes that were too steep for shovel testing); and
- *Water* (this portion of the project area falls below the water line and cannot be tested by hand shovels or probes).

A two m high mound of fill composed of gravel mixed with asphalt and concrete was also identified in the eastern portion of the property. This oval-shaped mound is approximately 50 m long running northeast to southwest, and 15 m wide running northwest to southeast. The mound possibly covers original land surface however the depth of the fill is too great to allow for shovel testing to reach native soil.

Figure 12. Preliminary Field Reconnaissance results showing testable and untestable areas.

3.6 Information Gaps

This desk-top and Preliminary Field Assessment did not include shovel-testing. Subsurface sediments were only able to be assessed at two tree-throw exposures. The small number of subsurface exposures existing on the property presents an information gap that could be addressed during a subsequent Archaeological Impact Assessment that includes subsurface archaeological testing. Areas that were capped by impenetrable surfaces could be shovel-tested during the construction phase if impenetrable surfaces are removed during construction.

4 RECOMMENDATIONS FOR RESOURCE MANAGEMENT

Developments at the DFO West Vancouver Laboratory property have the potential to impact unknown archaeological site components. There is a high potential for the existence of archaeological sites within the project area because there was a known ethnographic village in the vicinity called Stuckale that is described in the historic accounts. The village of Stuckale was similar to the village that existed at Horseshoe Bay, now a recorded archaeological site with shell midden components (DiRt-1). Also of importance, the property is adjacent to the largest watershed in West Vancouver, including Cypress Creek and Godman Creek which are both fish-bearing streams of significance to First Nations people. The DFO property is also surrounded by other locations in the area with known ethnographic place names.

If present, archaeological sites on the onshore portion of the DFO project area may potentially include shell midden, burials, artifacts, lithic scatters, and hearth features. Petroforms such as canoe runs or fish traps, and petroglyphs may also have existed along the shoreline or in the intertidal zone, as well as fishweirs and shellfish harvesting places. If any development is to occur along the shoreline and into the inter-tidal zone then there is a potential to impact inter-tidal and shoreline cultural features, if such features exist.

The project area has been the site of intensive industrial activities (i.e., the Great Northern Cannery and the DFO Laboratory) and has seen recreational use by nearby residences since the late 1800s. Given the intensive industrial use of the project area much of the archaeological record may have been destroyed.

The PFR was conducted on April 24, 2018. The survey identified four areas that are testable by shovel testing, and other areas for monitoring. Recommendations from this AOA are that:

1. An Archaeological Impact Assessment (AIA) be conducted to identify the potential existence of any buried intact sub-surface archaeological deposits within the project area.

2. An AIA include shovel-testing in the areas not capped by impenetrable surfaces (e.g., concrete, asphalt, existing buildings).
3. In areas capped by impenetrable surfaces it is recommended that any future construction excavations be monitored by a professional archaeologist to assess the sediments beneath the cap.
4. In the mound of fill located on the eastern side of the property near the shoreline no further archaeological assessment is required if future construction excavations occur above the original ground surface. If excavations reach original ground surface elevations, then monitoring by a professional archaeologist is recommended.
5. The inter-tidal and shoreline areas should be monitored for archaeological features if any development work such as shoreline stabilization or dock construction occur.

5 REFERENCES CITED

Ames, K. M., and H. D. G. Maschner
1999 *Peoples of the Northwest Coast: Their Archaeology and Prehistory.* Thames and Hudson, London.

Archaeology Branch
1998 British Columbia Archaeological Impact Assessment Guidelines. Archaeology Planning and Assessment Section, Ministry of Sustainable Resource Management, Victoria.

2009 Archaeological Overview Assessments as General Land Use Planning Tools – Provincial Standards and Guidelines http://www.for.gov.bc.ca/ftp/archaeology/external/!publish/web/professionals/FIA_AOA_Standards_2009.pdf

Armitage, D.
2001 *Burrard Inlet A History*. Harbour Publishing, Madeira Park, British Columbia.

Armstrong, J. E.
1981 Post-Vashon Wisconsin Glaciation, Fraser Lowland, British Columbia. *Geological Survey Bulletin* 322. Geological Survey of Canada, Ottawa.

Barnett, H.
1955 *The Coast Salish of British Columbia*. University of Oregon Monographs, Studies in Anthropology 4, reprinted 1975 by Greenwood Press, Westport, Connecticut.

Bartroli, T.
1997 *Genesis of Vancouver City: Explorations of its site 1791, 1792 & 1808*. Marco Polo Books, Vancouver.

Basso, K.
1996 *Wisdom Sits in Places: Landscape and Language Among the Western Apache.* University of New Mexico Press, Albuquerque.

Boyd, R. T.
1990 Demographic History. In *Handbook of North American Indians, Volume 7: Northwest Coast*, edited by W. Suttles, pp. 135-148. Smithsonian Institution Press, Washington, DC.

Bernick, K.
1998 *Hidden Dimensions. The Cultural Significance of Wetland Archaeology*, edited by K. Bernick. UBC Press, Vancouver.

Borden, C.
1952 A Uniform Site Designation Scheme for Canada. *Anthropology in British Columbia*, no 3: 44 - 48.

1976 A Water-Saturated Site on the Southern Mainland Coast of British Columbia. In *The Excavation of Waterlogged Sites (Wet Sites) on the Northwest Coast of North America*, edited by Dale Croes, pp. 233-260. National Museum of Canada, Ottawa.

Burley, D.
1980 *Marpole: Anthropological Reconstructions of a Prehistoric Northwest Coast Culture Type*. Archaeology Press, Simon Fraser University, Burnaby.

Carlson, K. (editor)
2001 *A Stó:lō Coast Salish Historical Atlas*. Stó:lō Heritage Trust, Douglas & McIntyre, Vancouver.

Carlson, K.
2007 Precedent and Aboriginal Response to Global Incursions: Small Pox and Identity Reformation among the Coast Salish. *Journal of the Canadian Historical Association* 18(2): 165-201.

Carlson, R. L.
1990 Cultural Antecedents. In *Handbook of North American Indians, Volume 7, Northwest Coast,* edited by W. Suttles, pp. 60-69. Smithsonian Institution Press, Washington, DC.

Carlson, R. L. and L. Della Bona (editors)
1996 *Early Human Occupation in British Columbia*. UBC Press, Vancouver.

Church, M. and J. M. Ryder
2010 The Physiography of British Columbia, Chapter 2. In *Compendium of Forest Hydrology and Geomorphology in British Columbia*, edited by R. Pike, T. Redding, R. Moore, R. Winkler and K. Bladon. British Columbia Ministry of Forests and Range, Land Management Handbook 66: 17-45.

Clague, J. J. (compiler)
1989 The Quaternary Geology of the Canadian Cordillera. *In Quaternary Geology of Canada and Greenland*, edited by R. J. Fulton, Geological Survey of Canada, Vol 1: 17-96, Ottawa.

Clague, J. J., J. Harper, R. Hebda, and D. Howes
1982 Late Quaternary Sea Levels and Crustal Movements, Coastal British Columbia. *Canadian Journal of Earth Sciences* 19:597-618.

Delgamuukw v. British Columbia, (1997) 3 S.C.R. 1010.

Demarchi, D.A.
2011 The British Columbia Ecoregion Classification, third edition. Ministry of Environment, Victoria. Available at http://www.env.gov.bc.ca/ecology/ecoregions/

Eldridge, M.
1991 The Glenrose Cannery Wet Component: A Significance Assessment. Report on file Archaeology Branch, Victoria.

Finkelstein, A.
2017 Musqueam Indian Band Archaeologist. Personal Communication.

Fulton, R. J., J. M. Ryder, and S. Tsang
2004 The Quaternary Glacial Record of British Columbia, Canada. *In Quaternary Glaciation: Extent and Chronology, Part II: North America*, edited by J. Ehlers and P. L. Gibbard. Devel. Quaternary Science, pp. 39-50. Elsevier, Amsterdam.

Government of BC
1996 *Heritage Conservation Act.* RSBC 1996, Chapter 187.

Government of Canada
1992 *Canadian Environmental Assessment Act* (CEA Act). S.C. 1992, c37.

Ham, L.
1982 Seasonality, Shell Midden Layers, and Coast Salish Subsistence Activities at the Crescent Beach Site, DgRr-1. PhD dissertation, University of British Columbia, Vancouver.

Ham, L., S. Yip, and L. V. Kullar
1986 The 1982/83 Archaeological Excavations at the St. Mungo Site (DgRr-2), North Delta, British Columbia. A Charles Culture Fishing Village, Vol 1. Report on file Archaeology Branch, Victoria.

Hayes, D.
2005 *Historical Atlas of Vancouver and the Lower Fraser Valley*. Douglas and McIntyre Ltd, Vancouver.

Hill-Tout, C.
1905 The Salish Tribes of the Coast and Lower Fraser Delta. Ontario Provincial Museum *Annual Archaeological Report* 12: 225-235.

1978 *The Salish People, Volume III: The Mainland Halkomelem*, edited by R. Maud. Talonbooks, Vancouver.

Jones, R. L. and R. Annas
1978 Vegetation. In *The Soil Landscapes of British Columbia*, edited by K.W.G. Valentine, P. N. Sproat, T. D. Baker, and L. M. Lavkulich, pp. 35-45. BC Ministry of Environment, Victoria.

Matson, R.G.
1976 *The Glenrose Cannery Site*. National Museum of Man Mercury Series, paper no. 52. Archaeological Survey of Canada, Ottawa.

1992 The Evolution of Northwest Coast Subsistence. In *Long-term Subsistence Change in Prehistoric North America.* Research in Economic Anthropology, Supplement 6, edited by D. R. Croes, R. A. Hawkins, and B. L. Isaacs, pp. 367-428. JAI Press, Connecticut.

Matson, R. G. and G. Coupland
1995 *The Prehistory of the Northwest Coast.* Academic Press, New York.

Matthews, J. S.
1955 *Conversations with Khatsahlano 1932-1954.* Vancouver City Hall, Vancouver.

McLaren, D.
2017 The Occupational History of the Stave Watershed. In *Archaeology of the Lower Fraser River Region*, edited by M. K. Rousseau, pp. 149 - 158. Archaeology Press, Simon Fraser University, Burnaby.

Mitchell, D.
1990 Prehistory of the Coasts of Southern British Columbia and Northern Washington. In *Handbook of North American Indians, Volume 7, Northwest Coast,* edited by Wayne Suttles, pp. 340-358. Smithsonian Institution, Washington, DC.

Morin, J.
2015 Tsleil-Waututh Nation's History, Culture and Aboriginal Interests in Eastern Burrard Inlet. Prepared for Gowlings, Lafleur, Henderson LLP. Submitted to the National Energy Board. http://twnsacredtrust.ca/trans-mountain-assessment-report/

Pacific Streamkeepers Federation
2017 Watershed Profiles. Cypress Creek. Godman Creek. Last site update October 9, 2017. Accessed March 20, 2017. http://www.pskf.ca/ecology/watershed/index.html

Pojar, J., K. Klinka, and D. Demarchi
1991 Coastal Western Hemlock Zone. In *Ecosystems of British Columbia*, edited by D. Meidinger and J. Pojar, pp. 95-112. Research Branch, Ministry of Forests, Victoria.

Rozen, D.
1979 Ethnographic Sites in the Greater Vancouver Regional District. In Lower Fraser Valley Planning Study, part 3: 125-230, by L. Ham, S. Yip, P. Gose and D. Rozen. Unpublished permit report on file with the Archaeology Branch, Victoria. *HCA* Permit 1978-6.

Stantec
2017 2012-0233: Alteration to DgRs-56, the Nottingham Farm Site. Permit report on file Archaeology Branch, Victoria. *HCA* permit 2012-0233.

Suttles, W.
1990 Central Coast Salish. In *Handbook of North American Indians*, volume 7, *Northwest Coast*, edited by W. Suttles, pp. 453-475. Smithsonian Institute, Washington DC.

Tsleil-Waututh Nation and D. Alexander
2001 Tsleil-Waututh First Nation Eco-Cultural Resource Guide for Burrard Inlet and Indian Arm. Report on File with Tsleil-Waututh Nation, North Vancouver, BC.

Winram, P.
1975 A report on the Howe Sound Archaeology Survey. Prepared for the Archaeological Sites Advisory Board. Report on file with Ministry of Forests, Land, Natural Resource Operations, and Rural Development, Victoria, BC. *HCA* Permit 1975-0011.

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Arborist Report

Authored by: Sean Wightman

ISA Certification #: PN2013A

File #:	18-128
Date:	17 October 2018
Weather:	Clear
Client:	Northern Touch Landscaping
Telephone:	604-987-6742
Email:	dgraham@northern-touch.com
Site Address:	4160 Marine Dr. West Vancouver, British Columbia V7V 1H2

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Purpose:

Burley Boys Tree Service Ltd. has been contracted to provide an arborist report & tree risk assessment for trees within the property at 4160 Marine Dr., West Vancouver

The primary objective is to identify and assess trees which present high levels of risk to the subject and neighbouring properties around the perimeter of the property owned and managed by the Department of Fisheries & Oceans, in preparation for construction of a new fence around the perimeter of the property.

This report is intended to serve as an assessment of the trees' current health and conditions as well as their future health, sustainability and stability given the current structural condition of their canopies. The determined level of risk associated with each tree is intended to give the risk mitigator for the property information to aid in deciding what course(s) of action should be taken to keep the level of risk presented by these trees within the threshold of what they consider to be acceptable.

Method:

The site was visited with all trees being assessed from the ground only, using the Visual Tree Assessment (VTA) technique. No trees were climbed or cored during the site visit. Overall TRAQ risk levels are noted in the Appendix below.

Observations:

The request for this assessment is to outline recommended work towards a plan for safety mitigation on trees within the property in preparation for construction of a new fence. Safety concerns have been raised by the neighbouring homeowners following a recent tree failure originating from within the subject property.

17 trees, or groups of trees, within the property was assessed. The trees are not individually tagged, but they are referred to as Trees # 1 through #17 in the Appendix below. Trees on the District blvd and neighbouring properties were not assessed for the purpose of this report.

Trees #1 and #2 are both Douglas firs, growing directly adjacent to each other near the west fence line at the south side of the property. They measure 62 & 31cms DBh, respectively. Both are in good condition, though they have moderate ivy growing up their main stems. These trees present a moderate risk. They are recommended to be retained and to be lightly pruned and to have ivy stripped from their stems.

Tree #3 is a row of laburnums growing along the west fence line. Their stems average 10cms DBH and they are in good condition. These trees do not present risk to the properties, though they will likely require removal to facilitate construction of the new fence.

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Tree #4 is a group of 11 Douglas firs growing on a berm between the west property line & parking lot. They are in good condition measuring 10-39cm DBH. There is some minor mechanical damage to some roots on the east side of the berm, though stability does not appear to have been compromised. These trees are recommended to be retained, as they are unaffected by the proposed fence and present a low level of risk. Recommendations include pruning their canopies to remove deadwood & stripping ivy from stems.

Tree #5 consists of a group of 1 maple and 3 alders growing at the fence line adjacent to Evergreen Ave. These 4 trees are in poor condition; they have heavy lean towards the street, stem defects and are growing into/pushing over the existing fence. They pose a high risk; targeting designated street parking on Evergreen. These trees are in direct conflict of and require removal to facilitate the construction of the new fence. 100% ownership of these trees is not clear, it is possible that they may be partially on DWV property, ownership should be confirmed prior to removing any of these trees.

Tree #6 is a 35cms DBH pine. It is in poor condition, with an ivy covered stem and heavy lean towards the parking lot. While it is not in conflict with the new fence, it does pose a high risk and is recommended to be removed.

Tree #7 is a group of 6 cedars growing at the west side of the entrance. They are in good health with low-moderate risk. These trees are to be retained. Recommendations include pruning to raise their canopies to a maximum height of 6m above grade, if desired, for increased light and/or use of space.

Tree #8 is a 70cms DBH pine, growing adjacent to the driveway at the north side. This tree is dead/dying and is recommended to be removed due to high risk.

Tree #9 is a 55cm DBH pine. This tree presents a low risk due to low target occupancy, however, it is dead/dying and is recommended to be removed.

Trees #10 is an oak growing at the north side adjacent to the existing fence. It measures 44cm DBH. This tree is in poor condition with poorly formed stems. Recommendations for this tree include pruning to clean its canopy of deadwood & raise from the fence line, or this tree could be considered for removal due to its condition.

Tree #11 is an oak located to the east of Tree #10 above. This tree is in good condition. Recommendations for this tree include pruning to clean its canopy of deadwood & raising from the fence line.

Tree #12 is a 82cms DBH fir growing at the north side near the Quonset hut. This tree is in good condition, though it has evidence of previously failed limbs. This tree may require removal to facilitate new fence construction, but if retained is recommended to be pruned.

Tree #13 is a group of 3 maples growing just east of Tree #12 above. These trees are in poor condition, measuring between 20 & 38cms DBH. They have been previously topped, have lean to the north towards the road and are growing into the fence. These trees will require removal to facilitate construction of the new fence.

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Tree #14 is a cedar growing directly north of the building at the NE corner. This tree is in fair condition; it has been previously topped & shaped, and is weighted to the south, towards the building. This tree presents a moderate risk. It is unaffected by the new fence and is to be retained. It is recommended to be retopped & shaped, trimming back it's south side.

Tree #15 is a 65cms DBH fir. It is in fair condition; it has been previously topped, has large heavy limbs and an ivy covered stem. It is unaffected by the new fence and is recommended to be retained. Pruning recommendations to this tree include re-topping and pruning its large limbs to reduce risk of limb loss.

Tree #16 is a cedar growing at the NE corner of the building. It measures 88cms DBH and is in poor condition; previously topped. A large stem on this tree has previously failed and is hung up on the existing chain link fence. This tree presents a high risk and is recommended to be removed.

Tree #17 is a row of maple, fir & cedar trees growing along the east property line. These trees were not accessible to determine DBH or inspect closely to confirm conditions. They present a low risk to the subject & neighbouring property, however, they may require removal to facilitate the new fence.

Conclusions:

All removal / retention recommendations are based on both the trees' current health, condition and long-term viability as a retained tree. The trees assessed are exempt from municipal bylaws; a permit is not required for any work proposed..

Limitations:

 This report is to be used in its entirety, for its purpose only. Only the subject trees were inspected, and no others. This report does not imply or in any other way infer that other trees on neighboring sites are sound and healthy.

The inherent characteristics of trees or parts of trees to fall due to environment conditions and internal problems are unpredictable. Defects are often hidden within the tree or underground. The project arborist has endeavored to use his skill, education and judgment to assess the potential for failure, with reasonable methods and detail. It is the owner's responsibility to maintain the trees to reasonable standards and to carry our recommendations for mitigation suggested in this report.

It is the sole responsibility of the client or their representatives to follow through with all recommendations for future consultations or site inspections.

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Appendix:

Below details the tree assessed. "DBH" is the main trunk diameter of the tree measured approximately 1.2m from grade. The determined health and condition of each tree is relative to its canopy structure, colour and vigor and any defects noted in the stem, canopy or root plate. Risk levels are calculated according to Matrixes 1 & 2 in the TRAQ data below.

Tree #	**Species**	**DBH (cm)**	**Condition** Good Fair Poor Dead/Dying	**Overall TRAQ Rating** Low Moderate High Extreme	**Comments & Recommendations**
1	Fir	62	Good	Moderate	• Ivy covered stem **Recommend:** • Retain • Prune to lightly thin • Strip ivy
2	Fir	31	Good	Moderate	• Ivy covered stem **Recommend:** • Retain • Prune to lightly thin • Strip ivy
3	Laburnum (row)	10 (avg)	Good	Low	• Row of trees along west fence line **Recommend:** • Remove to facilitate new fence
4	Fir x 11	10-39	Good	Low	• Group of firs on berm • Deadwood • Minor mechanical damage to roots **Recommend:** • Retain • Prune to remove deadwood • Strip ivy
5	Maple x 1 Alder x 3	22-37	Poor	High	• Group of trees along west fence line • Heavy lean towards Evergreen Ave • Growing into/damaging existing fence • Stem defects **Recommend:** • Remove to facilitate new fence
6	Pine	35	Poor	High	• Ivy covered stem • Lean towards parking lot/driveway **Recommend:** • Remove
7	Cedar x 6	40-89	Good	Low-Moderate	• Group of trees at NW corner **Recommend:** • Retain • Prune raising to 6m for light & use of space if desired

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8	Pine	70	Dying	High	• Nearly dead • Targeting driveway **Recommend:** • Remove
9	Pine	55	Dying	Low	• Nearly dead • Low target occupancy **Recommend:** • Remove
10	Oak	44	Poor	Moderate	• Poorly formed stems **Recommend:** • Retain & prune to remove deadwood & clear from fence line; or • Consider for removal
11	Oak	53	Good	Moderate	**Recommend:** • Prune to remove deadwood & clear from fence line
12	Fir	82	Good	Moderate	• Previously failed limbs **Recommend:** • Retain & prune to reduce risk of future limb loss; or • Remove if in conflict with new fence
13	Maple x 3	20-38	Poor	Moderate	• Previously topped • Lean towards road • Growing into existing fence **Recommend:** • Remove to facilitate new fence
14	Cedar	128	Fair	Moderate	• Previously topped • Weighted to south **Recommend:** • Retain • Retop, shape & trim back from south side
15	Fir	65	Fair	Moderate	• Previously topped • Large heavy limbs • Ivy covered stem **Recommend:** • Retain • Re-top & prune to reduce risk of future limb loss
16	Cedar	88	Poor	High	• Previously topped • Recent large stem failure **Recommend:** • Remove
17	Maple, fir, cedar (row)	-	-	Low	• Row of trees along east property line • Unaccessible for further inspection **Recommend:** • Retain; or • Remove if required to facilitate new fence

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TRAQ Data:

Matrix 1. Likelihood matrix.

Likelihood of Failure	Likelihood of Impacting Target			
	Very low	Low	Medium	High
Imminent	Unlikely	Somewhat likely	Likely	Very likely
Probable	Unlikely	Unlikely	Somewhat likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

Matrix 2. Risk rating matrix.

Likelihood of Failure & Impact	Consequences of Failure			
	Negligible	Minor	Significant	Severe
Very likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

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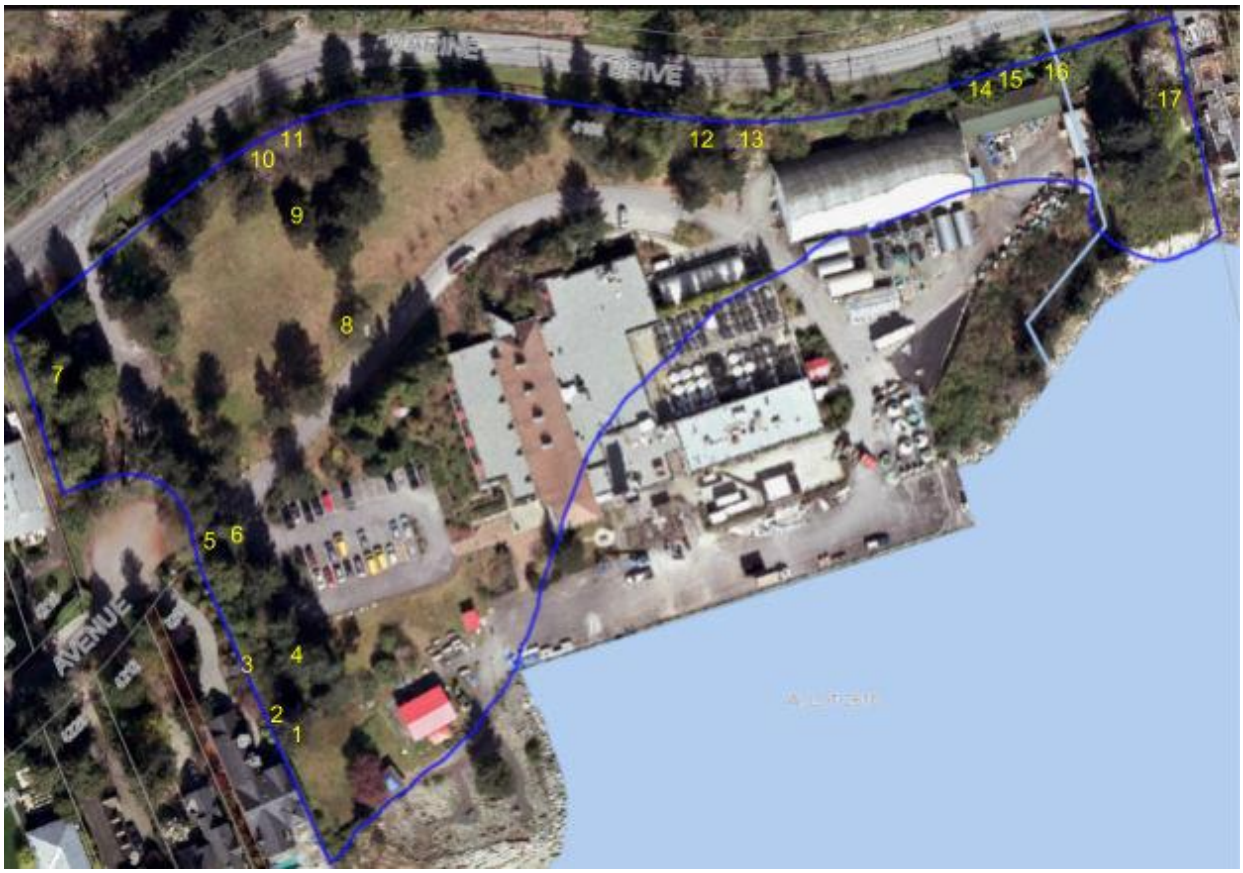
Map & Site Survey:



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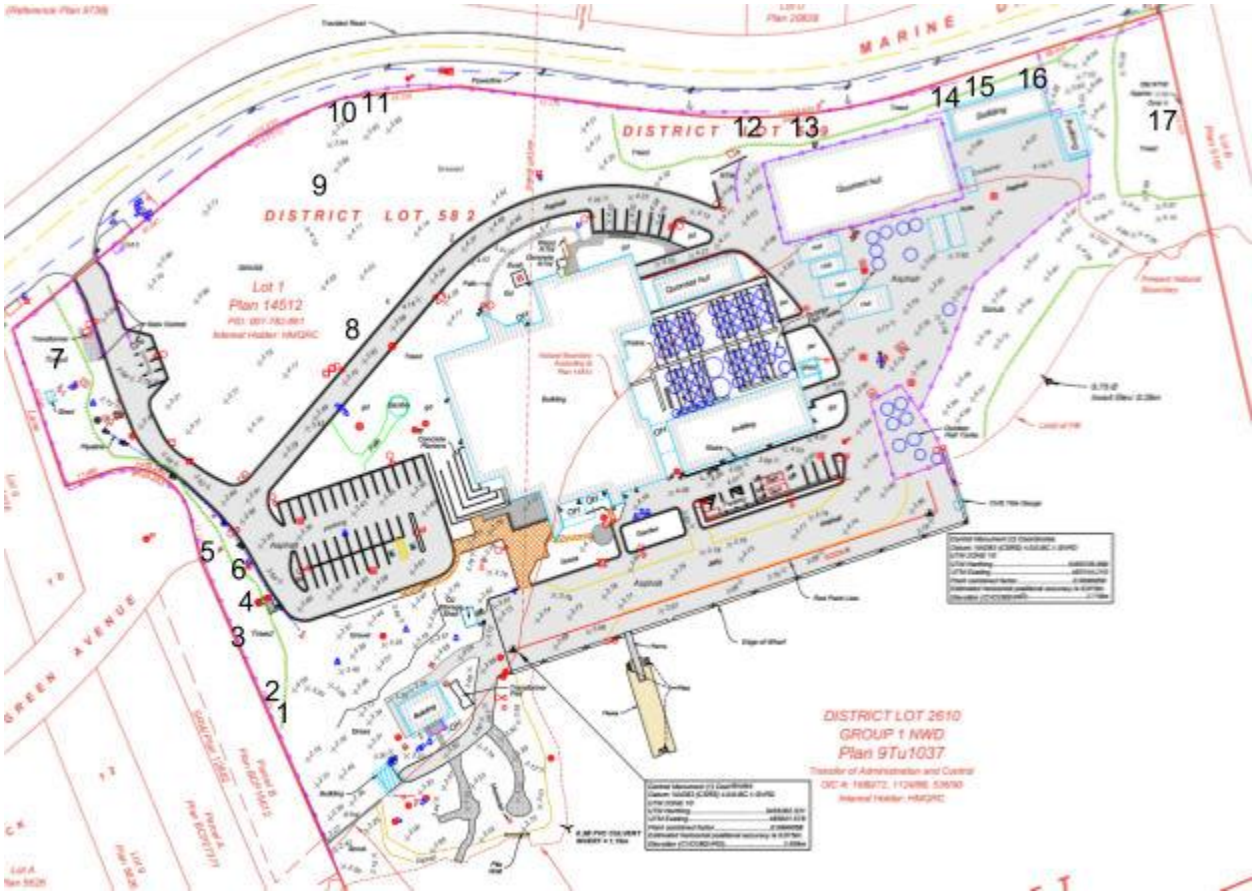

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Images:

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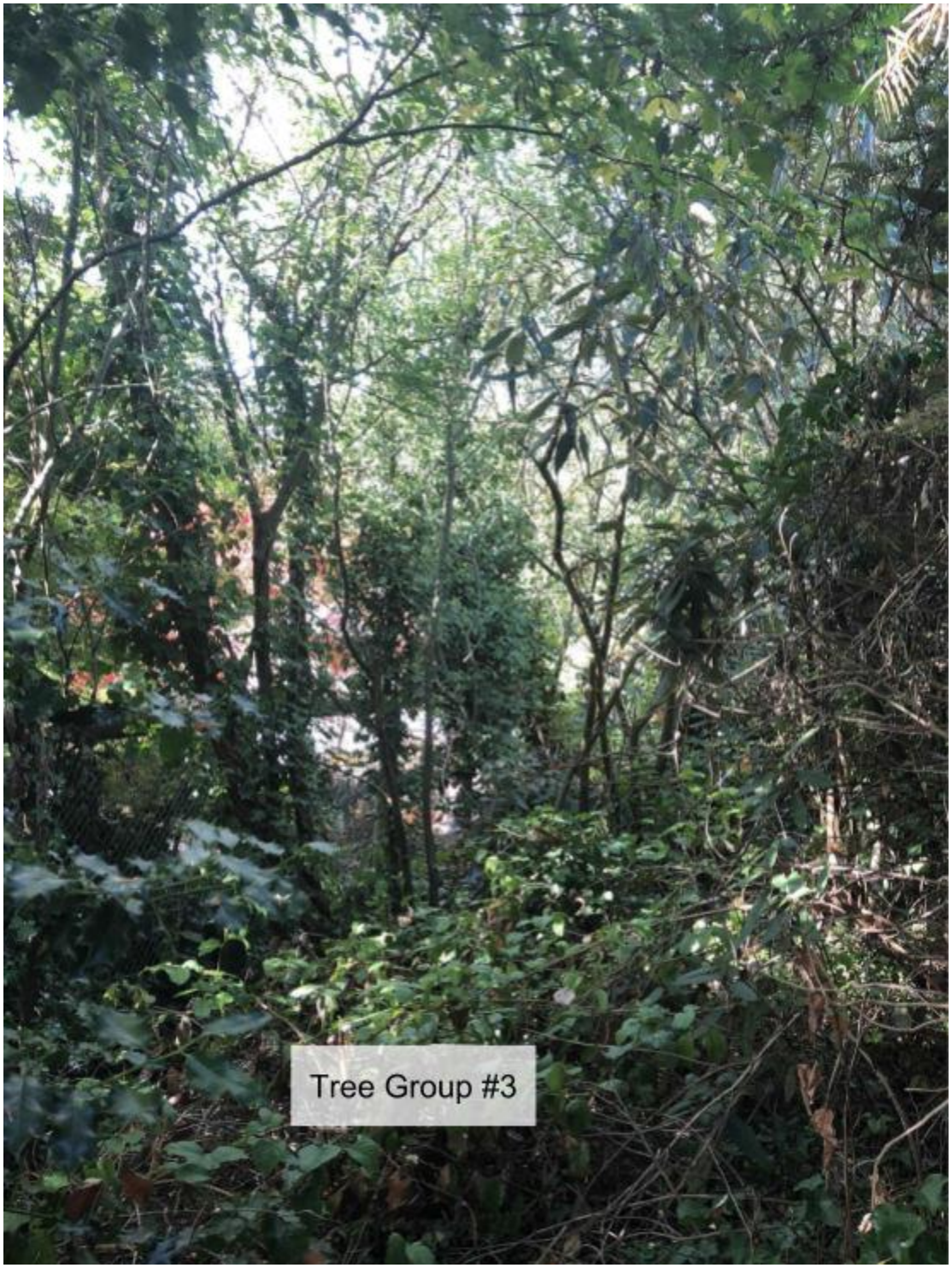

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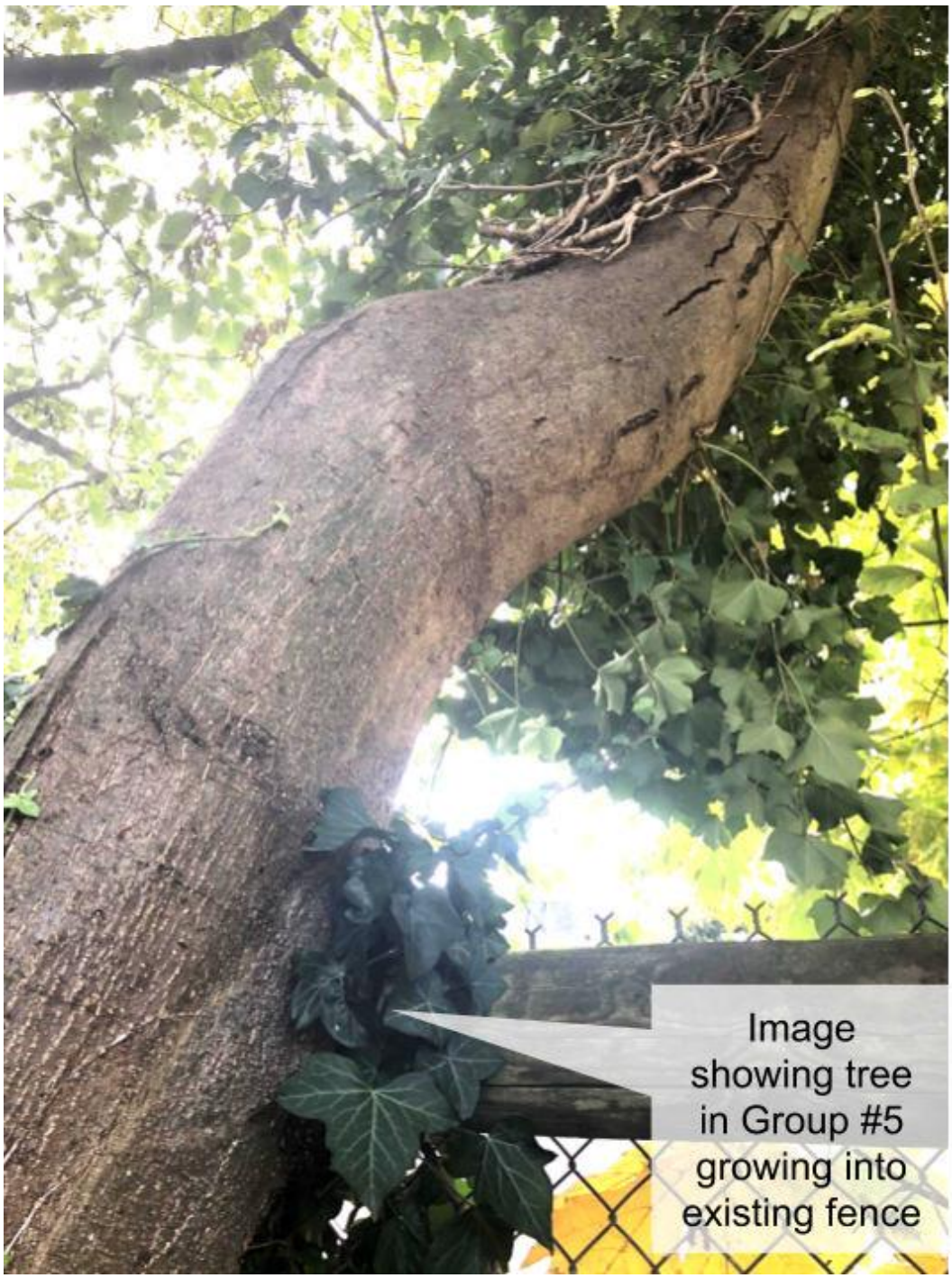

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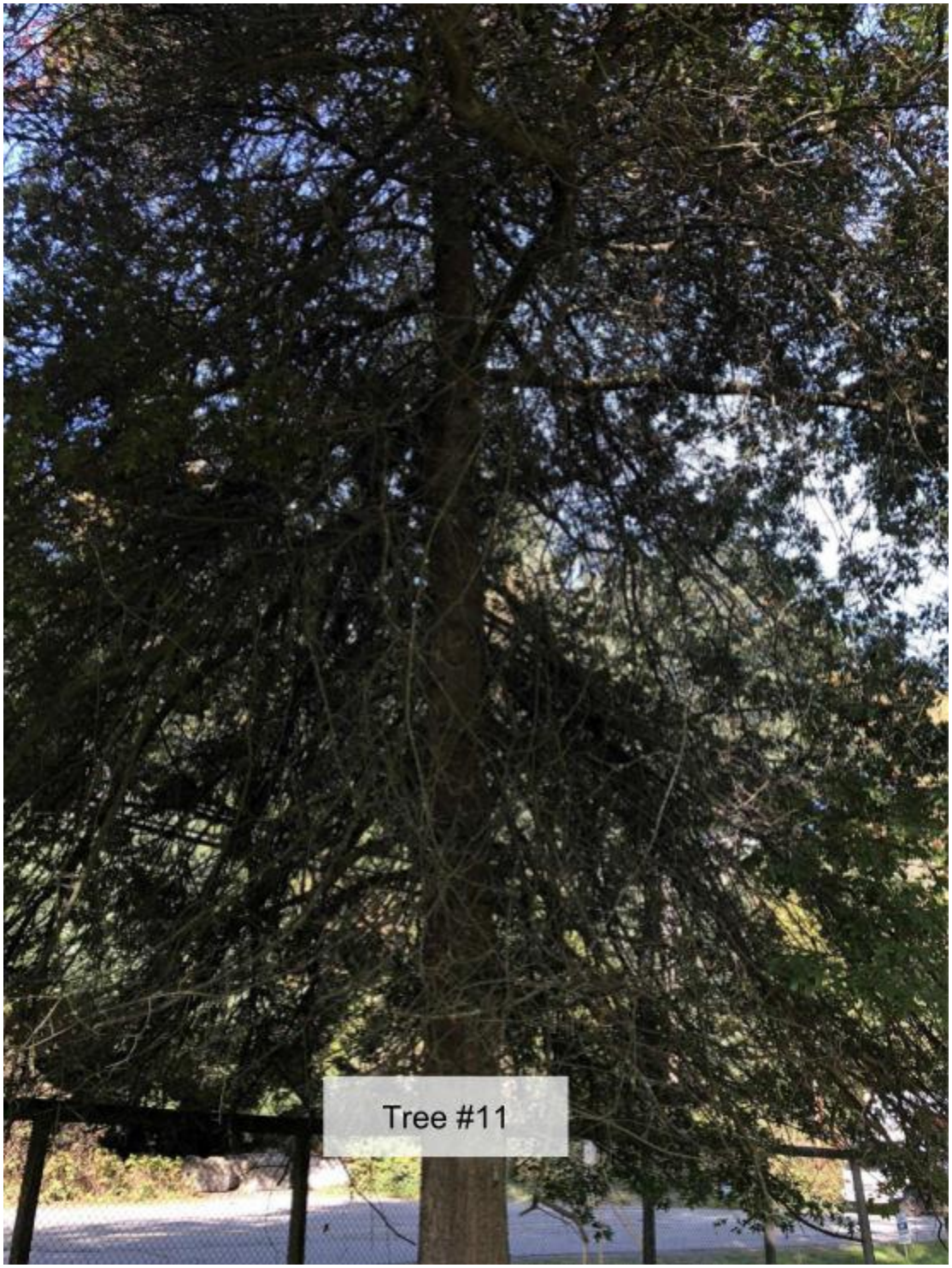
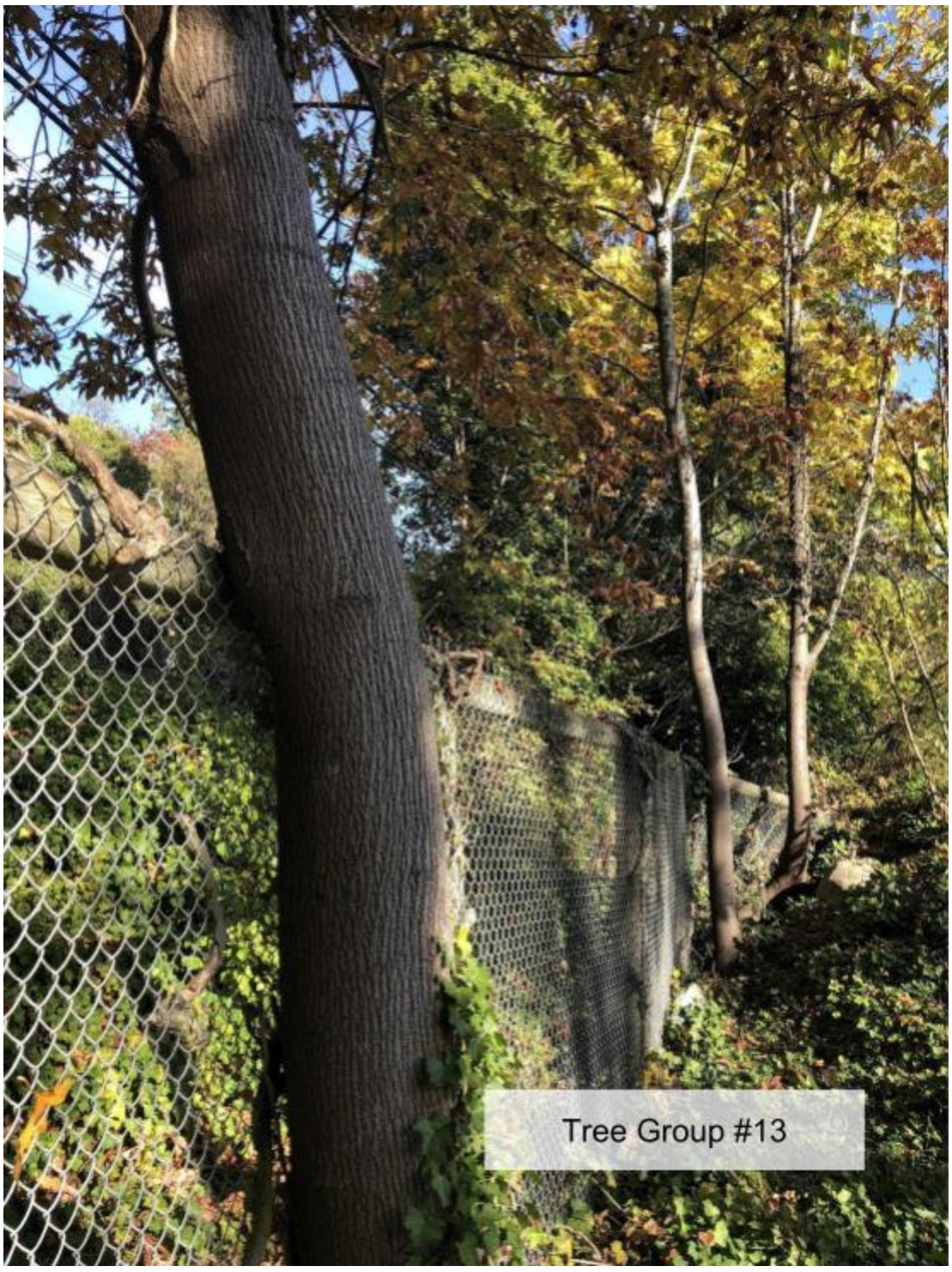



Tree #12


Tree Group #13

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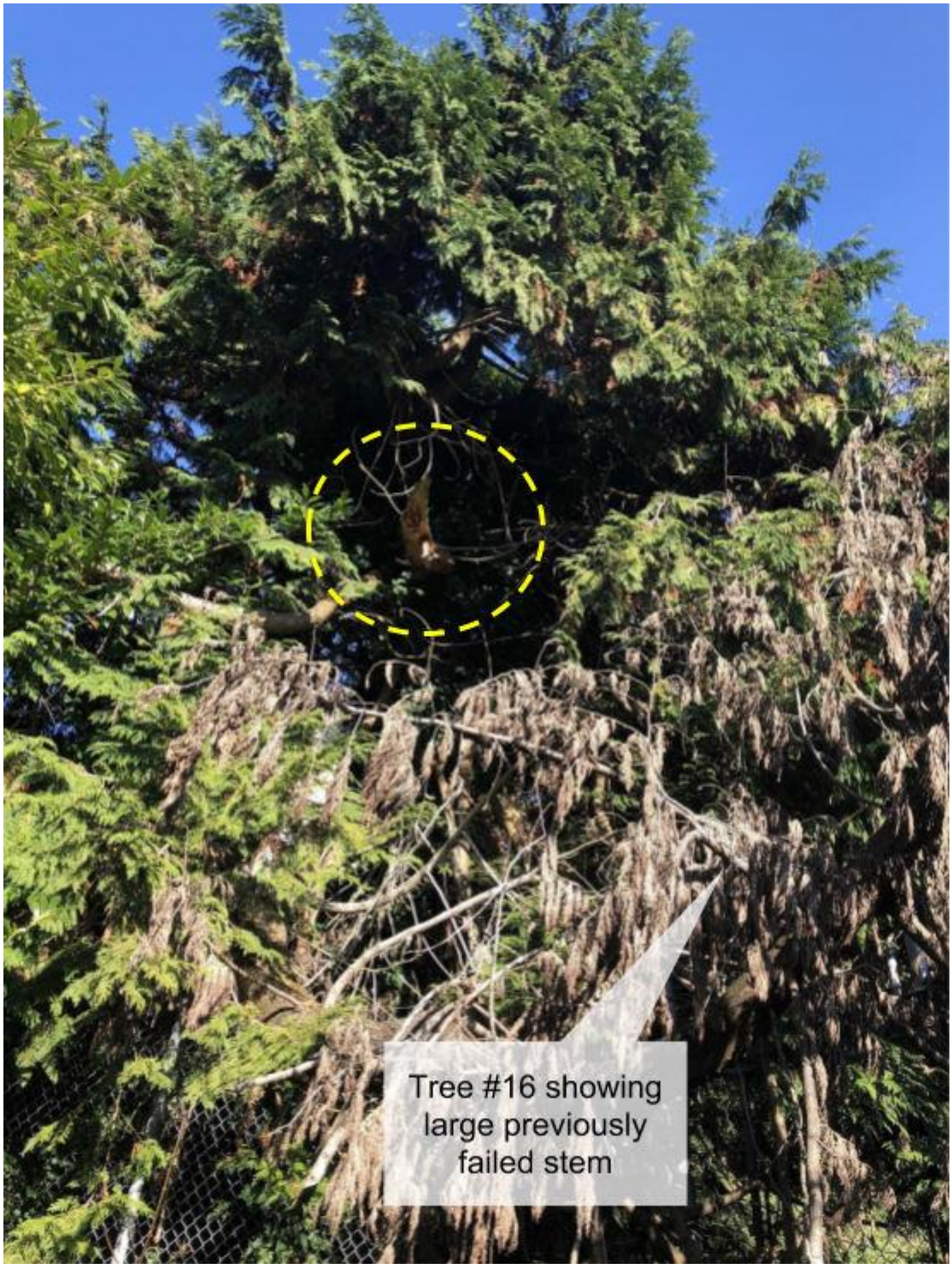

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23 August 2018

Cher LaCoste, M.Sc., R.P.Bio.
Project Lead
Pacific Science Enterprise Center
Fisheries and Oceans Canada
4160 Marine Drive
West Vancouver V7V 1N6

Re: Chance Find Procedure for Fisheries and Oceans Canada West Vancouver Laboratory

This document provides Fisheries and Oceans Canada and their contractors with archaeological management procedures for the Pacific Science Enterprise Center at 4160 Marine Drive, West Vancouver, BC. The document supplements the 2018 *Archaeological Overview Assessment* conducted by Inlailawatash and outlines the appropriate response to the accidental discovery of suspected archaeological or cultural materials, including intact and disturbed deposits, during excavation, construction, and maintenance activities on the property. This document does not replace professional archaeological assessment of excavation in areas with high potential for archaeological material, and is only to be used following a thorough archaeological assessment of a property.

The objectives of this *Chance Find Procedure* are to provide guidelines for the preservation, management, and proper handling of archaeological and historic resources if accidentally encountered on the property, and to ensure the respectful and culturally appropriate protection of human remains according to local First Nations protocols and heritage policies and the British Columbia Archaeology Branch's *Found Human Remains Policy*. A secondary objective is to minimize disruptions to construction schedules and activities during the project.

Document Limitations

This document was prepared by Inlailawatash Limited Partnership (Inlailawatash) for the exclusive use of Fisheries and Oceans Canada and their subcontractors on the West Vancouver Laboratory property at 4160 Marine Drive, West Vancouver. Consistent with the *Heritage Conservation Act*, Fisheries and Oceans Canada is advised that if unanticipated archaeological or cultural materials or features are encountered during construction, all work in the immediate vicinity should halt, and the guidelines presented herein for the management of these resources should be implemented.

Any use, reliance, or decisions made by third parties based on this document are the sole responsibility of such third parties. Inlailawatash accepts no responsibility for damages, if any, suffered by any third party because of decisions or actions based on this document.

Legislation

An archaeological site is defined as a location that contains artifacts, features, materials, or other physical evidence of past human habitation or use regardless of age if they have cultural heritage (historical) or archaeological value.

The Fisheries and Oceans Canada West Vancouver property is located within Federal jurisdiction and is not subject to provincial cultural heritage legislation such as the Heritage Conservation Act (HCA). However, the recommendations made here are consistent with the policies outlined by the Archaeology Branch of the Province of British Columbia and is designed to meet professional archaeological standards set forth in the HCA.

Guidelines for Managing Archaeological and Cultural Heritage Chance Finds

General guidelines for managing suspected archaeological or cultural materials throughout any construction and operations maintenance projects within the property are presented below. The proponent should also be familiar with the best practices outlined in the BC Archaeology Branch's Policy Statement on found human remains. Please note: affected First Nations will also have human remains policies.

Chance Find Procedure for Archaeological and Cultural Heritage Sites

Initial Process for Proponent

If suspected archaeological or cultural materials or features (both intact and disturbed) are encountered:

- **First:** Stop work in the immediate vicinity of the suspected archaeological or cultural heritage materials and secure the area. Do not move any soil from the vicinity of the site, including any spoil material.
- **Second:** Contact Inlailawatash archaeologists Catherine Carlson (work: 604-924-4158), Sean P. Connaughton (cell: 778-866-1497), Ian Sellers (cell: 778-231-5797), or Walter Homewood (cell: 604-340-9542). If these archaeologists are not available, contact the Inlailawatash's Operations Manager, Allison Hunt, at 604-992-6677.

Archaeologist Actions

Following a telephone discussion relating to the incident, there are several possible responses from the archaeologist:

- It may be decided that there are no further concerns regarding the incident and work can commence;
- Photos of the potential archaeological or cultural heritage materials may be requested by the archaeologist; or
- A site visit by the archaeologist to confirm/deny the presence of archaeological or cultural heritage materials may be required.
- If archaeological materials are confirmed, all local First Nations should be contacted.

Management Options

If an archaeological or cultural heritage site (intact or disturbed) is present, the archaeologist will coordinate communications with the proponent and the First Nations to evaluate management options. Note that First Nations approval is required prior to the implementation of any of the management options that require archaeological investigations or alterations to an archaeological site. Potential management options are provided below.

Option 1: Avoidance through project redesign or relocation. This is the preferred option as it minimizes impacts to sensitive archaeological sites. It can also minimize cost and schedule impacts to the Project.

Option 2: Enforcement of site protection measures, both temporary and permanent. Temporary options could include fencing, flagging, or a barricade to protect the site. Permanent solutions could include capping the area with fill. Appropriate measures should be discussed with all affected First Nations.

Option 3: Systematic data recovery in the form of controlled archaeological excavation. This option is destructive to the archaeological site and can delay proposed project activities.

Option 4: Monitoring of construction or operations maintenance activities by a professional archaeologist and First Nations representative. Monitoring is appropriate where project impacts cannot be predicted or evaluated before construction or operations maintenance activities or in cases where deeply buried deposits are expected that cannot be accessed without the assistance of heavy machinery. Monitoring may also be appropriate where systematic data recovery has been undertaken but where significant archaeological deposits remain.

Chance Find Procedure for Human Remains

Initial Process for Proponent

If suspected human remains (either intact or disturbed) are encountered:

First: Stop work in the vicinity of the human remains and secure the area. Do not undertake further work that could disturb the remains. Do not move soil from the vicinity of the remains, including adjacent spoil material.

Second: Contact Inlailawatash archaeologists Catherine Carlson (work: 604-924-4158), Sean P. Connaughton (cell: 778-866-1497), Ian Sellers (cell: 778-231-5797), or Walter Homewood (cell: 604-340-9542). If these archaeologists are not available, contact the Inlailawatash's Operations Manager, Allison Hunt at 604-992-6677.

Third: The archaeologist will advise on further action. If the above contacts are unreachable for direction, call the RCMP.

Archaeologist Actions

- The archaeologist will immediately notify relevant First Nations communities;
- The archaeologist will contact the local policing authority and the Office of the Coroner, if appropriate;
- An archaeologist or a representative who has specialized training in physical anthropology, and representatives from all available local First Nations, will visit the site as soon as possible;
- If it is determined that the human remains are archaeological in nature, discussions will take place to establish an appropriate procedure for handling of the remains; and
- If it is determined that the human remains are not archaeological in nature, the local policing authority and Office of the Coroner will provide further guidance.

Management Options

An appropriate protocol for handling human remains requires consultation with First Nations, many of whom have their own existing policies and cultural protocols for taking care of human remains. Any management options for found human remains would need to encompass First Nations requirements as well as reference to the Archaeology Branch's *Found Human Remains Policy*.

Option 1: Avoidance through partial or complete project redesign or relocation. This would protect the remains from any further disturbance; or

Option 2: Emergency systematic excavation of the remains following best practices to respectfully remove the remains for reburial in a location chosen by the First Nations.

The proponent must be aware that removal of human remains, and subsequent reburial may involve certain cultural ceremonies or procedures that could delay project activities and will require funding from the proponent.

Concluding Remarks

If there are any concerns regarding impacts or potential impacts to any archaeological or cultural heritage materials throughout the construction and operations management of the Pacific Science Enterprise Centre, please contact an Inlailawatash archaeologist for further instructions.

We trust that the information provided is sufficient for your needs. In addition, we provide an Archaeological Material Brief (Appendix) to serve as a quick guide to common archaeological materials in the area. If there are any questions regarding this Chance Finds Procedure, please contact Catherine Carlson, Sean P. Connaughton, or Ian Sellers.

Kind Regards,

Ian Sellers

Archaeologist

Inlailawatash Limited Partnership

3075 Takaya Drive, North Vancouver, BC V7H 3A8

c: 778.231.5797 e: isellers@inlailawatash.ca

APPENDIX A: ARCHAEOLOGICAL MATERIALS BRIEF

This guide is to assist in the recognition of archaeological materials accidentally found during construction. Artifacts or features may be visible on or immediately below the ground surface. If you identify any archaeological material, stop work and contact a professional archaeologist (see above).

TYPES OF ARCHAEOLOGICAL MATERIALS

Coast Salish inhabitants of the area left behind a range of artifacts and features that indicate where and how they lived, what they subsisted on, how they hunted, fished, and harvested plants, and how they interacted with the natural and social world around them. The following section outlines several artifacts and site types that could be present in and around the surrounding areas, including both historic and pre-Contact archaeological sites.

Artifacts and Artifact Scatters

The objects that commonly preserve in non-waterlogged (dry sediment) archaeological sites are made of bone, stone, shell, and antler. Distinguishing cultural from natural modification in many of these types of archaeological materials can be difficult. One means is by identifying toolmarks and intentional modification such as flake scars on chipped stone and grinding or sawing marks on bone, antler, and shell.

Figure 1. Bone Artifacts

Artifacts can be found as isolates or in association with other features. Isolated artifact scatters usually consist of stone artifacts (including formed tools and waste materials resulting from the production of such tools), and less-frequently, butchered animal bones.

Figure 2. Chipped Stone Artifacts

Figure 3. Ground Stone Artifacts

Fire Cracked Rock

Small rounded river cobbles were used as boiling stones for heating water in wood, bark, or other containers. After use, they fracture along jagged and angular lines and are deposited in hearth and midden contexts. These are very common in sites of this region and are a key indicator of First Nations occupation.

Figure 4. Fire Cracked Rock

Architectural Features

Architectural features from wooden structures are sometimes preserved for centuries after use. Large posts sunk into the ground, or beams lying on the ground surface, may appear natural, but they will be stripped of bark and may show evidence of adzing or other toolmarks. The protective root network of nurse trees can shelter these features and aid their preservation.

Shell Midden

Shell midden deposits are one of the clearest identifiers of coastal archaeological sites in BC. The dark, often greasy, shelly sediment builds during centuries of site occupation and can range from centimeters to over 10 meters in depth.

Figure 5 and Figure 6 show the variation in appearance of shell midden deposits. They can include varying densities of many shell types such as clam, mussel, cockle, barnacle, and urchin. In this area, middens are likely to be

characterized by dark black sediment with clam shell, charcoal, fire cracked rock, and sometimes preserved bone.

Figure 5. Midden with Whole Clam Shell and FCR

Figure 6. Midden with Fragmentary Mussel Shell, Clam Shell, Charcoal, FCR, and Bone

Cultural Depressions

Cultural depressions are depressions in the ground, sometimes representing the recessed floors of buildings, cache pits, or cooking features. They may have associated charcoal, artifacts, or preserved bone. Cultural depressions can range from less than one meter to over 8 meters in size.

Fish Traps and Weirs

Intertidal marine resource features such as wooden fish traps or stone weirs are present near the shorelines and mouths of streams. These will be identifiable by small wooden stakes or boulder alignments.

Figure 7. Wooden Fish Weir Alignment

Hearths

Hearth features are the remnants of fires, identifiable by dense black charcoal and light-coloured ash. Natural forest fires are very common on the coast and can leave similar traces, but hearths tend to be well-defined and associated with white-coloured burned bone, fire-cracked rock, and artifacts.

Figure 8. Stacked Hearth Features in a Deeply Stratified Site. Note Shell in Upper Layer.

Rock Art (Petroglyphs and Pictographs)

Petroglyphs are pecked art on boulders, rock faces, or other exposed rock surfaces. These are often faint, incised designs. Pictographs are applied designs to rock faces, using red ochre paint or other pigments.

Figure 9. Pictograph, red ochre designs applied onto a protected bedrock face

Petroforms

Petroforms are rock arrangements and could be used for a variety of purposes, including rock cairns, clam garden walls, fish traps, or canoe skids. Boulder alignments also serve as markers for burials or other important features.

Waterlogged Deposits

Wood, sedge, grass, and other organic materials were used as the raw materials to manufacture the clear majority of Coast Salish material culture. Most decay over time and are lost in archaeological contexts. However, water-saturated sediment can preserve these materials for long time periods. Intact basketry, arrow shafts, planks, wedges, rope, and other artifact types have been found across British Columbia in these conditions.

Historical Sites

Historical material from Indigenous and other use of the area may also be present in the project area. Ceramics, glass, and metal are the primary indicators of historic use and can provide important information on recent occupations of the area.

Figure 10. Historic Bottle Base

Human Remains

Human remains or bone that cannot be definitively determined to be non-archaeological and non-human require immediate notification of First Nations and identification by a professional archaeologist. Human remains are found in many contexts and may be scattered due to previous disturbances or found fully intact and associated with a mortuary context, such as a burial mound.

THURBER ENGINEERING LTD.

celebrating 60 YEARS

December 11, 2017 File: 21575

Fisheries and Oceans Canada
4160 Marine Drive
West Vancouver, BC
V7V 1N6

Attention: Cher LaCoste, M.Sc., R.P.Bio

DFO – WEST VANCOUVER LABORATORY, MODULAR BUILDINGS
GEOTECHNICAL REPORT

Dear Cher:

Thurber Engineering Ltd. has conducted a geotechnical investigation for the above-mentioned project. This letter describes the results of the investigation and provides geotechnical engineering recommendations for design and construction of the proposed buildings.

It is a condition of this letter that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

1. BACKGROUND

We understand that DFO is proposing to install two modular buildings to facilitate immediate needs at the West Vancouver Laboratory located at 4160 Marine Drive. The proposed buildings are 24' by 24', constructed of foam board and proposed to be founded on lock blocks.

Assessment of soil and groundwater contamination was not in our scope of work.

2. SITE INVESTIGATION

Prior to conducting the field investigation, BC One Call was notified to identify utilities in the vicinity of the proposed investigation area. In addition, Western Utilities Services Ltd. was retained to scan for underground utilities at the proposed test pit locations.

The field investigation was scheduled for November 27, 2017, with a total of four test pits to be completed by an excavator. Due to the inability to locate a gas line during the utility scan, the investigation was delayed. A decision was made on site that three test holes would be completed using a hydrovac contractor due to the presence of utility lines in the area.

The field investigation comprised three test pits (TP17-1 to TP17-3) located within the proposed footprints of the modular buildings. TP17-1 and TP17-2 were completed in the footprint of the northern building, and TP17-3 in the footprint of southern building. The test pits were completed on December 1, 2017 using a hydrovac truck operated by First Call Energy. The test pits terminated at depths ranging from 1.4 m to 3.0 m.

The soils were logged in the field by a Thurber representative and disturbed samples were obtained at selected depths from the test pit walls for visual identification and moisture content determination. The test pits were backfilled with sand and gravel fill.

Test pit locations are shown on the attached Dwg. 21575-1.

3. SOIL AND GROUNDWATER CONDITIONS

The results of the field and laboratory testing are provided on the attached test pit logs. The logs provide a complete, detailed description of the conditions encountered and should be used in preference to the generalized summary provided below.

The ground conditions generally comprise compact sand and gravel to 0.6 m in depth over a matrix of boulders and cobbles with some compact gravel and sand. Construction debris and wood were encountered near the bottom of TPs 17-02 and 17-03.

Ground water was encountered at 2.1 m below existing grade in TP17-2.

4. GEOTECHNICAL ASSESSMENT & RECOMMENDATIONS

4.1 Limitations

The depth of our investigation was limited due to the ground conditions encountered. Our test pits did not encounter native material. However, based on the information collected and exposed bedrock nearby we provide following recommendations.

4.2 Base Preparation

In preparation for lock block placement, all organics, loose or wet, or any delirious material should be removed near surface. A 150 mm thick layer of well-graded 19 mm crushed sand and gravel should be placed on the subgrade. The sand and gravel pad should extend 200 mm beyond the edge of the lock block footing. The sand and gravel should be compacted to 100% Standard Proctor maximum dry density (SPMDD).

4.3 Bearing Resistances

We understand that the proposed structure will be bearing on lock blocks. Foundations can be designed using a bearing pressure of 50 kPa under SLS loading conditions and 70 kPa under ULS loading conditions.

Long-term settlement of footings should be expected due to the presence of decomposable material such as wood. The footings may require height adjustments in the future.

THURBER

60 YEARS

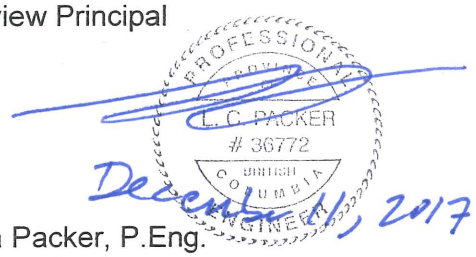
4.4 Seismic Design

Based on the results of our investigation, seismically induced soil liquefaction is not a concern for the two proposed modular buildings. In our opinion, Site Class D is appropriate for seismic design.

5. CLOSURE

We trust the above provides the information you require at this time. If you have any questions regarding this letter, please contact either of the undersigned.

Yours truly,
Thurber Engineering Ltd.
David Regehr, P.Eng.
Review Principal



December 11, 2017

Liza Packer, P.Eng.
Project Engineer

Attachment(s)
Statement of Limitations and Conditions (1 Page)
Test Pit Location Plan (1 Page)
Symbols and Terms (1 Page)
Test Pit Logs (3 Pages)
Photos (2 Pages)

THURBER

STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

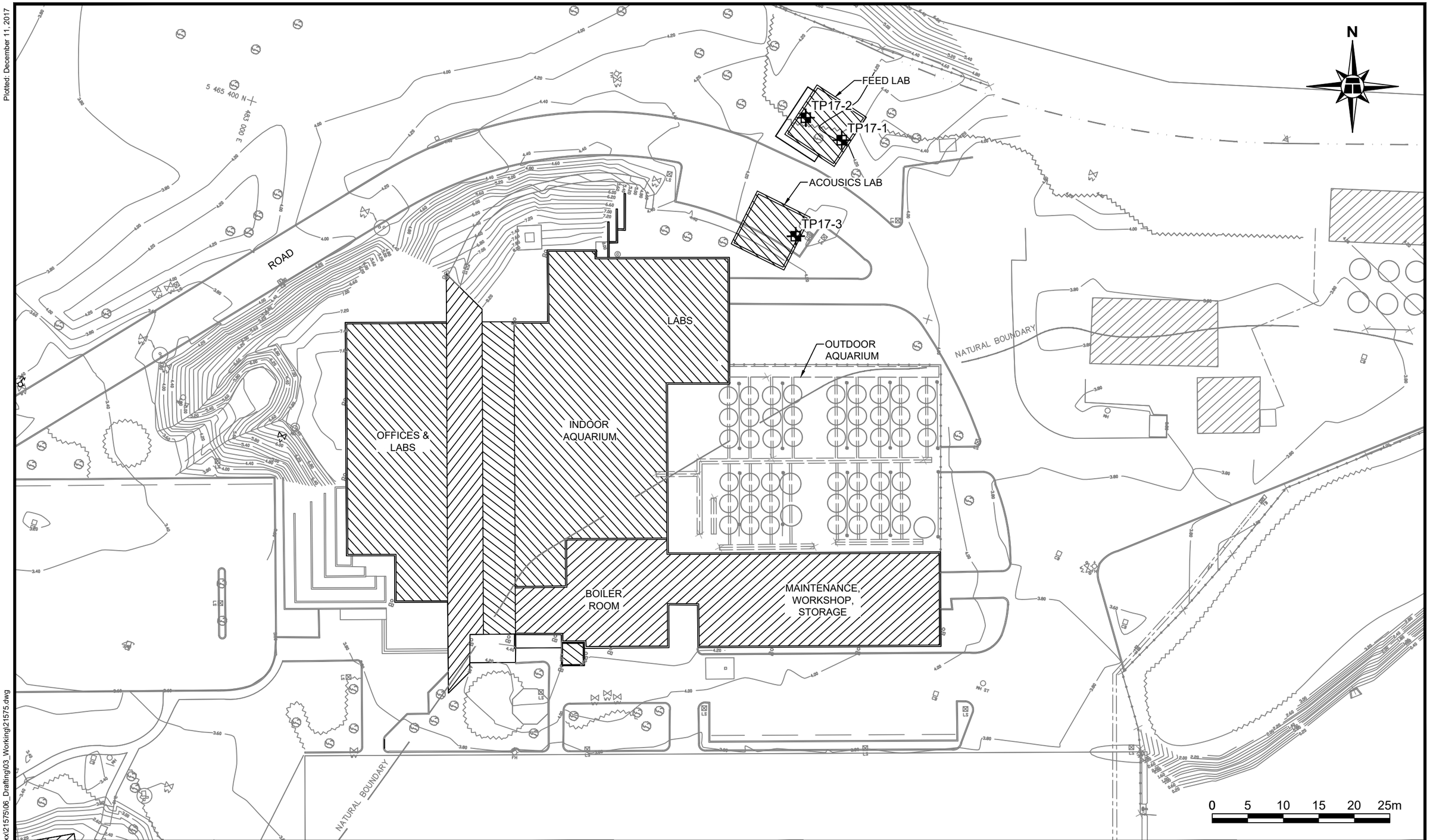
6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

Plotted: December 11, 2017



LEGEND:

TEST PIT

NOTES:

1. BASE PLAN TAKEN FROM THE PIUBLIC WORKS AND GOVERNMENT SERVICES OF CANADA SSO# 00314 DRAWINGS 1 TO 3.
2. TEST PIT LOCATIONS ARE APPROXIMATE.

THURBER ENGINEERING LTD.

CLIENT: FISHERIES AND OCEANS CANADA

TEST PIT LOCATION PLAN

WEST VANCOUVER LABORATORY
MODULAR BUILDINGS - 4160 MARINE DRIVE WEST VANCOUVER, BC

DESIGNED	DRAWN	APPROVED
LP	NAK	DNR

DATE	SCALE
11/12/17	1:500

PROJECT No.	DWG. No.	REV.
21575	1	0

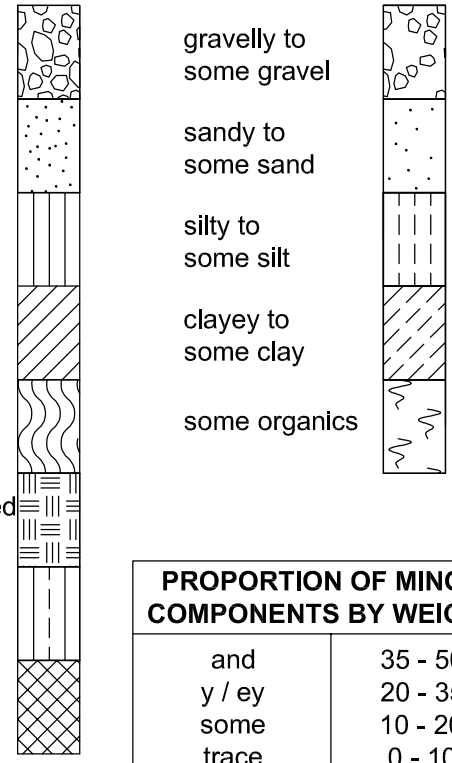
S:\Data\BST Projects\21xxx\21575\06_Drafting\03_Working\21575.dwg

CANCEL PRINTS BEARING EARLIER NUMBER

SYMBOLS AND TERMS
FOR SOIL DESCRIPTION AND TEST HOLE LOGS

BASIC SOIL SYMBOLS

Predominant Material	Secondary Material
GRAVEL	gravelly to some gravel
SAND	sandy to some sand
SILT	silty to some silt
CLAY	clayey to some clay
PEAT / ORGANICS	some organics
Undifferentiated BEDROCK	
ORGANIC SILT	
FILL / DEBRIS	

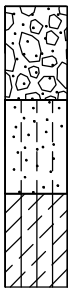


SYMBOL VARIATIONS - EXAMPLES (1)

SAND and GRAVEL

SAND, silty

SILT with some clay



PROPORTION OF MINOR COMPONENTS BY WEIGHT (2)

and	35 - 50%
y / ey	20 - 35%
some	10 - 20%
trace	0 - 10%

DENSITY OF GRANULAR SOILS

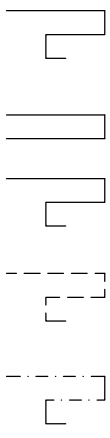
Description	SPT N (5) (6)
Very Loose	0 - 4
Loose	4 - 10
Compact	10 - 30
Dense	30 - 50
Very Dense	> 50

CONSISTENCY OF COHESIVE SOILS

Description	Undrained Shear Strength (kPa) (6)
Very Soft	< 12
Soft	12 - 25
Firm	25 - 50
Stiff	50 - 100
Very Stiff	100 - 200
Hard	> 200

PENETRATION TESTS

Dynamic Cone Penetration	
Standard Penetration	
Becker Closed Casing	
Becker Open Casing	
Bounce Chamber Pressure	



CLASSIFICATION BY PARTICLE SIZE

Name		Size Range (6) (mm) (3)	U.S. Standard Sieve Size Retained	U.S. Standard Sieve Size Passing
Boulders		> 200	8 inch	-
Cobbles		75 - 200	3 inch	8 inch
Gravel:	coarse	19 - 75	0.75 inch	3 inch
	fine	5 - 19	No. 4	0.75 inch
Sand:	coarse	2 - 5	No. 10	No. 4
	medium	0.4 - 2	No. 40	No. 10
	fine	0.075 - 0.4	No. 200	No. 40
Fines (Silt or Clay) (4)		< 0.075	-	No. 200

(1) Only selected examples of the possible variations or combinations of the basic symbols are illustrated.
(2) Example: SAND, silty, trace of gravel = sand with 20 to 35% silt and up to 10% gravel, by dry weight. Percentages of secondary materials are estimates based on visual and tactile assessment of samples.
(3) Approximate metric conversion.
(4) Fines are classified as silt or clay on the basis of Atterberg limits.
(5) SPT N values on test hole logs are uncorrected field values.
(6) Reference Canadian Foundation Engineering Manual 4th Edition, 2006.

THURBER

Sheet 1 of 1

LOG OF TEST PIT

TEST PIT NO. **TP17-1**

LOCATION: See Dwg. 21575-1

TOP OF HOLE ELEV:

METHOD: Hydrovac

DRILLING CO.: First Call Energy

INSPECTOR: ANR

THURBER

CLIENT: Fisheries and Oceans Canada

PROJECT: DFO West Vancouver Lab - Modular Buildings

DATE: December 1, 2017

FILE NO.: 21575

REVIEWED BY: DNR

DEPTH (m) | PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit – Liquid Limit | SAMPLES: ◧ Disturbed ■ Undisturbed ☒ No Recovery | UNDRAINED SHEAR STRENGTH (kPa): ◆ Peak ◇ Residual ◆ Remolded | GRAIN SIZE (%): ▲ Passing #200 sieve △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): ✱ GASTECH reading ⊠ PID reading

10 20 30 40 50 60 70 80 90 100

COMMENTS

DEPTH (m)		SOILS DESCRIPTION
0		Grey, moist SAND and GRAVEL with some silt and a trace of organics (Fill).
	GP-GM	Grey, moist COBBLES and BOULDERS with some gravel, sand and a trace of silt (Fill).
1		
	GM/SM	
		End of test pit due to refusal. Water level undetermined due to hydrovac method.
2		
3		
4		

Sheet 1 of 1

LOG OF TEST PIT

TEST PIT NO. **TP17-2**

LOCATION: See Dwg. 21575-1

TOP OF HOLE ELEV:

METHOD: Hydrovac

DRILLING CO.: First Call Energy

INSPECTOR: ANR

THURBER

CLIENT: Fisheries and Oceans Canada

PROJECT: DFO West Vancouver Lab - Modular Buildings

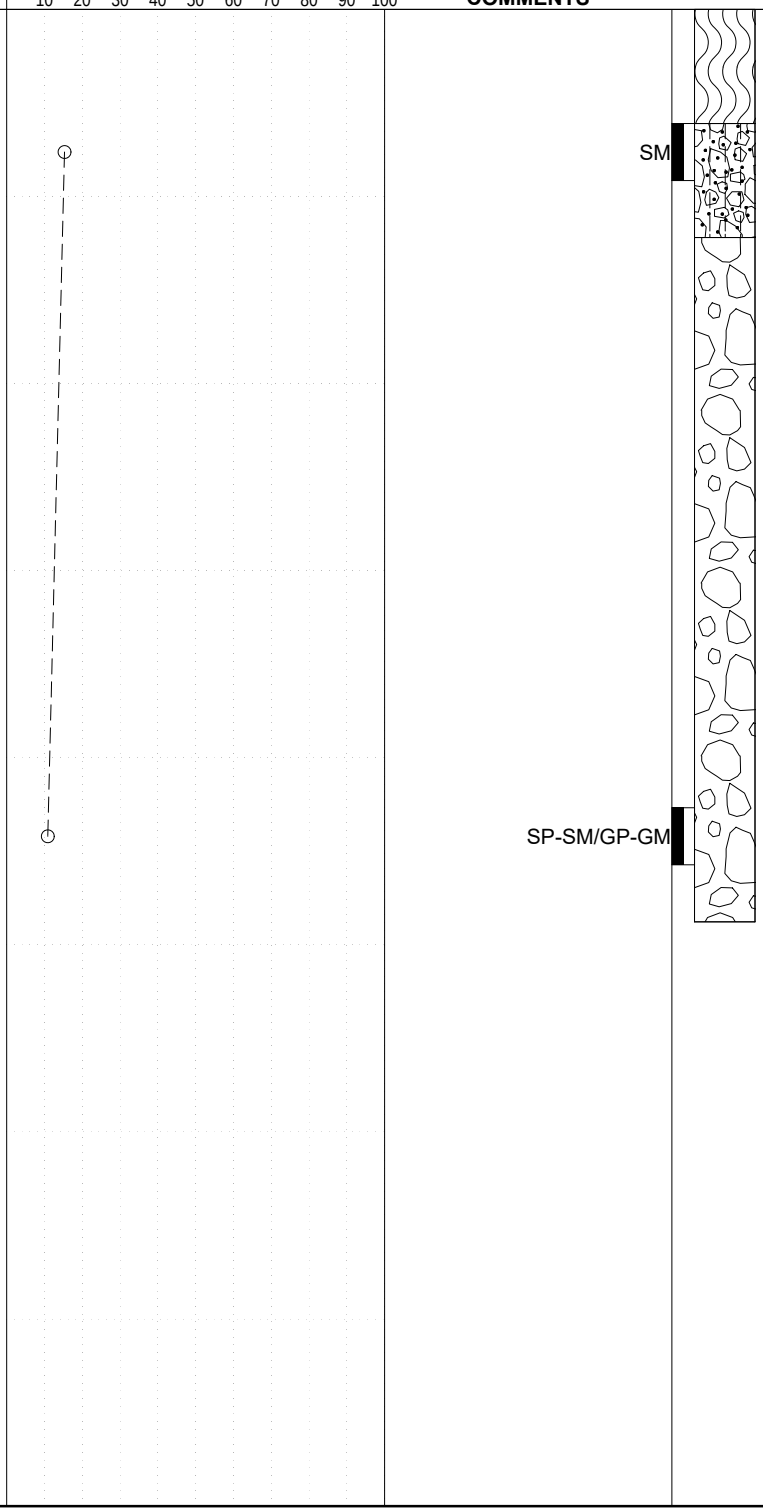
DATE: December 1, 2017

FILE NO.: 21575

REVIEWED BY: DNR

PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: ◧ Disturbed ■ Undisturbed ☒ No Recovery | UNDRAINED SHEAR STRENGTH (kPa): ◆ Peak ◇ Residual ◆ Remolded | GRAIN SIZE (%): ▲ Passing #200 sieve △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): ✱ GASTECH reading ⊠ PID reading

DEPTH (m) | 10 20 30 40 50 60 70 80 90 100 | **COMMENTS** | SOILS DESCRIPTION | DEPTH (m)



DEPTH (m)		SOILS DESCRIPTION
0		TOPSOIL
	SM	Grey, moist SAND and GRAVEL with some silt (Fill).
		Grey, moist COBBLES and BOULDERS with some gravel and traces of sand and silt (Fill).
1		
2	SP-SM/GP-GM	- bricks from 2.1 to 2.4 m depth - possible wood at bottom of test hole - cloth at 2.4 m depth
		End of test pit due to refusal. Wwater observed at 2.1 m depth upon completion of test pit.
3		
4		

LOG OF TEST PIT (NO EST.) 21575.GPJ PRACTICE MARLON.GDT 17-12-11- THURBER BC 2017.GLB

Sheet 1 of 1

LOG OF TEST PIT

TEST PIT NO. **TP17-3**

LOCATION: See Dwg. 21575-1

TOP OF HOLE ELEV:

METHOD: Hydrovac

DRILLING CO.: First Call Energy

INSPECTOR: ANR

THURBER

CLIENT: Fisheries and Oceans Canada

PROJECT: DFO West Vancouver Lab - Modular Buildings

DATE: December 1, 2017

FILE NO.: 21575

REVIEWED BY: DNR

PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: ◧ Disturbed ■ Undisturbed ☒ No Recovery | UNDRAINED SHEAR STRENGTH (kPa): ◆ Peak ◇ Residual ◆ Remolded | GRAIN SIZE (%): ▲ Passing #200 sieve △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): ✱ GASTECH reading ⊠ PID reading

10 20 30 40 50 60 70 80 90 100

COMMENTS

DEPTH (m)	SOILS DESCRIPTION
0	ASPHALT (75 mm thick).
	Grey, moist GRAVEL with some sand (Road Base). GM/SM
1	Grey, moist COBBLES with some boulders, gravel and sand and a trace of silt (Fill). SM/GM
2	
3	WOOD (Possible log).
	End of test pit at required depth. Water level undetermined due to hydrovac method.
4	

TP17-1

TP17-2

TP17-2, Brick from test pit

TP17-3

Quadra Utility Locating
(604) 897-4616
www.quadralocating.com

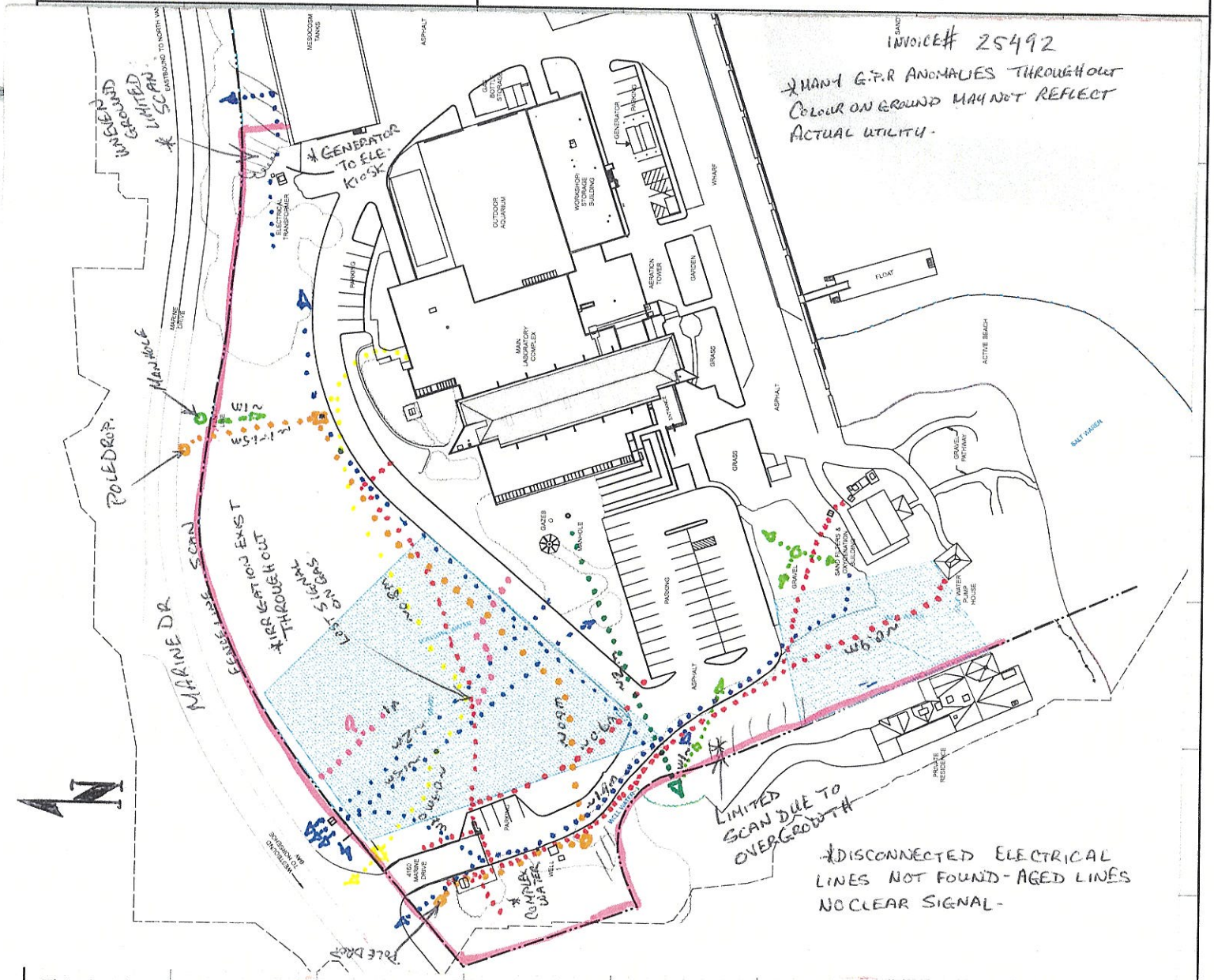
Site Address:	Date of Survey:
4160 MARINE DR. WEST VANCOUVER	JAN 24, 2019
Quadra Site Rep:	**Client Company:**
CLINT MAVETY	FISHERIES & OCEANS CANADA / GOV. OF CANADA.

25492

Facilities / Utilities Assessed: Colour Code

Gas Line		
Water Line	W	
Storm Sewer	St	
Sanitary Sewer	S	
Electrical Line		
Comm		

Comments: LOCATE / MARK UTILITIES THROUGH DEFINED WORK AREA. DEPTHS ARE APPROXIMATE - OLD FACILITIES MAY EXIST -



This sketch is not a surveyed drawing. It is a general representation of buried utility lines and other relevant site features.

Quadra Utility Locating Ltd. will not accept any liability for damages incurred as a result of this locate. Locations of marked utilities are approximate. The exact location of any utility can only be determined by physically exposing the utility.

Refer to BC WCB Regulation 20.79 (Excavations, Underground Utilities) when performing subsurface work near buried utilities.

Client PO Number:

Client Job Number:

Type of Survey: (GPR) (EM) Camera Scope

BCOneCall Number: 20190401 38

Locate Package Provided By: Client (Quadra)

Client Name: CHER LACOSTE / MATT

Time: 5 HRS G.P.R. (HEAVY CONGESTION MORNING COMMUTE +0.5 HR.)
8:45 - 4:30 + TRAVEL -

- [x] Private Property
- [ ] Public Property
- [ ] Both

Client Signature:

				Sub Total	
Division	***Specification Title***	***Unit of Measurement***	***Estimated Quantity***	***Price per Unit (applicable taxes extra)***	***Extended amount (EQ x PU) applicable taxes extra***
1.0	**GENERAL REQUIREMENTS**				
1.1	Control of Public Traffic	Lump Sum	1		
1.2	Survey Layout for Fence	Lump Sum	1		
2.0	**CLEARING AND GRUBBING**				
2.1	Tree Clearing (Arborist flagged to be removed)	Each	12		
2.2	Site Grubbing (estimate)	Lump Sum	1		
3.0	**DEMOLITION AND REMOVALS**				
3.1	Removal and Disposal of Post and Wire Fence	Lump Sum	1		
3.2	Removal and Disposal of Chain Link Fence * Barbwire	Lump Sum	1		
4.0	**EARTHWORK**				
4.1	Soil Stripping and Stockpiling (1m x 1m x 1.2m) x 158 posts	m^3	189.6		
4.2	Topsoil/organics reused on site (1m x 1m x 0.4m) * 158 posts	m^3	63.2		
4.3	Topsoil/organics disposed off site **Assumption reused topsoil	m^3			
4.4	Unsuitable subgrade disposed off site	m^3	126.4		
5.0	**FENCE AND GATE SYSTEMS**				
5.1	Concrete Sonotube base (for fence posts and gates, less 2 not needed at pedestrian gate by dock)	Each	168		
5.1	Sonotube (0.30 x 1.20) 8' lengths	Each	84		
5.2	Montage II Panel Invincible 3R ext 3" Gap 8' x 8'	Each	160		
	Post 2.5" x 10'	Each	170		
	Universal brackets (sold 2 per packet) (3 per post)	Package	510		
5.3	Custom Fence Panel at Quonset Hut	Each	1		
5.4	Custom Fence Panel at Main Gate	Each	1		
5.5	Transport Vehicle Gate	Each	1		
	Vehicle Gate hardware and posts	Each	1		
5.6	Pedestrian Gate (requires 2 posts) (Includes gate at entrance to dock)	Each	2		
	Box Hinges and Posts for single swing gate	Each	2		
	Custom panels for Gate at entrance to Dock	Each	2		
	Universal brackets (sold 2 per packet) (3 per post)	Package	6		
6.0	**LANDSCAPING**				
6.1	Seeding with soil 100mm depth (1m x 440m)	m^2	440		
6.2	Restore topsoil to edge of construction	m^2	63.2		
				TOTAL EXTENDED AMOUNT (A) Excluding applicable taxes	