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Student Research Report

Ocean Heat Pump Regulatory Review

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CONTENTS

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ABSTRACT

As part of UBC's plan to reduce its GHG emissions significantly, the University's Energy Centre is working towards installing an ocean-source heat pump for the Vancouver campus. This paper explored the multitude of regulations and requirements from the Federal, Provincial, and Municipal governments, to support setting up an ocean-source heat pump as a supplementary heat source for UBC's Vancouver campus buildings. A general evaluation of the potential impacts of the ocean heat pump project was presented in this paper. The paper also summarizes the feedback obtained from a broad stakeholder engagement process conducted from September to November 2020, to enable UBC identify, manage and address the needs and concerns of stakeholders with setting up an ocean-source heat pump at the Vancouver campus. This report is to serve as a guiding document and reference resource for the entire ocean source heat pump project implementation process at UBC, and for future expansion or similar research projects.

LIST OF ACRONYMS

BC HYDRO – British Columbia Hydro Services

CCP – Comprehensive Community Plan

CEA – (BC) Clean Energy Act

CEEN – Clean Energy Engineering

CHP – Combined Heat and Power

CO2 – Carbon Dioxide

COP – Coefficient of Performance

DFO – Department of Fishery and Oceans, Canada

DH – District Heating

FN – First Nation

GHG – Greenhouse Gases

HVAC – Heating Ventilation Air Conditioning

LEED – Leadership in Energy and Environmental Design

OCP – Official Community Plan

OSHP – Ocean Source Heat Pump(s)

OSHP – Ocean-source heat pump

SEED – Social Ecological Economic Development Studies

UBC – University of British Columbia.

UEL – University Endowment Lands

DEFINITION OF TERMS

Foreshore is the land between the high and low watermarks of streams, rivers, lakes, and the ocean. In British Columbia, the Province owns nearly all freshwater and saltwater foreshore. Land adjacent to foreshore may be privately owned, but in common law the public retains the privilege or "bare licence" to access the foreshore (Government of British Columbia: Land Use – Private Moorage webpage).

Navigable water as defined in the Canadian Navigable Waters Act, means a body of water, including a canal or any other body of water created or altered as a result of the construction of any work, that is used by vessels, in full or in part, for any part of the year as a means of transport or travel for commercial or recreational purposes, or as a means of transport or travel for Indigenous peoples of Canada exercising rights recognized and affirmed by section 35 of the Constitution Act, 1982, and

- there is public access, by land or by water;
- there is no such public access but there are two or more riparian owners; or
- The only riparian owner is either the Federal Government or a Provincial Government.

Ocean-source heat pump (OSHP) system refers to a heat pump system which harnesses the ocean's thermal energy as a means of generating renewable energy (Z.K. Cao et al, 2009).

Riparian Owner owns the land in which a body of water sits. The ocean water itself is owned by the provincial government in BC, and all aquatic crownlands are administered by the Ministry of Environment and Climate Change Strategy for commercial, industrial, conservational, and recreational uses.

University Endowment Lands (UEL) is an unincorporated area that lies to the west of the city of Vancouver, British Columbia, Canada, and adjacent to the University of British Columbia and the lands associated with the Vancouver campus.

1. INTRODUCTION

The University of British Columbia (UBC) is a leading player both academically and practically in clean energy. Since 1997, UBC has been striving to be environmentally responsible and setting up programs like the SEEDS program through the Sustainability Office in 2000. The campus serves as a nexus of research and practice, serving as a test bed in creating green sustainable communities. The Vancouver campus has set its own GHG reduction targets, and has already made significant financial investments into innovative systems, such as the $24 million Campus Energy Centre (CEC), which is a state-of–the-art hot water boiler facility on campus, the Energy and Water Services (EWS) unit, the Bioenergy Research Demonstration Facility (BRDF), the Academic District Energy System, Eco-TREK, and several other innovative projects. UBC set up its own Climate Action Plan in 2010, with a target GHG emission reduction of 67% by 2020 and 100% by 2050. UBC also created the Green Building Action Plan in 2018 to control energy demand in campus buildings.

UBC is developing its Climate Action Plan (CAP) 2030, looking to further reduce GHG emissions from the 2020 target of 67% below 2007 levels. This product focuses on UBC's academic district energy system, as the CEC, which burns natural gas, is a significant contributor to UBC's GHG inventory. One option to replace the heat generated by the CEC is an Ocean-Source Heat Pump (OSHP). However, there are potentially significant political and regulatory hurdles to implement this. This project would help to identify some of the potentially significant hurdles. UBC's SEEDS (Social Ecological Economic Development Studies) Sustainability Program in collaboration with UBC Energy & Water services is looking for solutions to replace the heat generated by the CEC using an Ocean-Source Heat Pump that could further reduce the natural gas consumption in the campus after the Bioenergy Research & Demonstration Facility (BRDF) expansion.

This research project takes UBC's Energy Centre one step closer to actualizing this by providing a reference point for some key regulatory requirements and stakeholder needs. The goal of this research

was to determine the social and regulatory frameworks to support setting up an ocean heat pump at UBC Vancouver by reviewing the various existing laws and regulations which might dictate how and where an ocean-source heat pump could be installed and operated at UBC Vancouver, and assessing stakeholders' interests and influence levels for this project. The objectives set at the start to meet the research goal were:

- Stakeholder analysis for a potential OSHP connecting to UBC's Academic District Energy System
- Investigation of the regulatory framework in which such a project might exist – which laws and regulations would govern the design, placement, and operation of a potential OSHP, and at which level of government do each of those regulations exist?

The research is presented in 4 major parts or sections, excluding this introductory section. The first section below presents the findings from the regulatory review. Section 2 discusses the equity, environmental, economic, and cultural impacts of ocean heat pumps, based on a literature review and feedback from stakeholders. Section 3 discusses and presents the feedback from the stakeholder engagement. The last section provides a brief summary and recommendations from the research project.

2. REVIEW OF REGULATORY REQUIREMENTS

In the past, several reports have been carried about relating to this topic about an Ocean Source heat pump at UBC. All the reports have been technical and economic in detail. These projects over the years have investigated different kinds of heat pump available to UBC. In addition, they are looked at other source of energy that could be displayed by the campus as well as the cost analysis for those sources. It is important to note that none of the projects have gone in depth on the social-economic studies relating to an OSHP at UBC. This is the sole reason this project is unique and of high importance. It is the missing piece that ties all other parts already researched in this project. Other reports reviewed before diving into this report include the report on, "Decarbonizing UBC's District Energy System: District Energy Heat Pump Technology" written by Thivya Viswanathan at UBC in 2019, and "An Evaluative Framework for District Energy Projects in British Columbia" written by Mahindar (Dar) Purewall and Mark Haines, written in 2010. This was included since it was a policy report.

This section discusses the various regulations and controls that are in place to guide the installation of an ocean-source heat pump in UBC Vancouver, and the requirements that must be met for the project to be in good standing with the regulatory bodies. The information is summarized in the table below.

Organization/Body	Related Requirements	Relevant Links & Documents
Federal Government – Department of Fisheries and Oceans (DFO) Transport Canada	• The Department of Fisheries and Oceans (DFO) sets standards/guidelines for installing an ocean heat pump system, but the department does not directly approve the systems themselves (Canadian Geo-Exchange Coalition does).	• Department of Fisheries and Oceans Projects Near Water • Self-assessment for DFO permit requirement •

• From the stakeholder engagement survey, the DFO also recommends accessing the Projects Near Water website to determine if this OSHP project needs to be reviewed by the Fish and Fish Habitat Protection Program, which is the office responsible for reviewing projects in or near water for potential impacts to fish and fish habitat. • If the proponent determines that the project cannot be carried out without causing harm to the fish and fish habitat, a request for review will be required. This can be filled out and sent to the Triage Unit of the program office for processing and delegation to the appropriate regulatory review team responsible for that area where the project is being undertaken. • The review process will assess the project in more detail, including potential risk mitigation measures	• Species at Risk Act (SARA) • Fisheries Act Authorization Application Guide • Transport Canada New Navigation Safety Regulations (SOR-2020-216)

and the Species at Risk Act (SARA), and make a determination as to whether or not a Letter of Advice can be issued or if a Fisheries Act Authorization (FAA) is required. • If a FAA is required, then UBC would need to submit an application for an FAA (also found on the Projects Near Water website) to start this process. • There is a currently a regulation in place that details what information is required to go with the FAA application to the Program. • Similarly, the review would assess whether there is potential for SARA species or their Critical Habitat to be impacted by the proposed works. This may require the project manager to obtain a SARA permit or a SARA compliant FAA (FAA with SARA permit conditions within it). • The reviewing team has the ability to deny the project approval	

depending on what is being proposed, when, habitat values of the impacted site, etc.

Transport Canada sets navigation safety regulations. The new regulations were released November 6, 2020. The changes apply mostly to the vessels and vessel-owners. The closest regulation that may apply to setting up the pump on the foreshore is the floating plant activities regulation:

- floating plant includes any type of manned barge, scow or similar watercraft that is used for river or harbor improvements, salvage, scientific work, cargo handling, exploration or exploitation of mineral resources, or other similar operations. (Section 1)
- A floating plant may be operated, anchored or moored for the purposes of engaging in dredging,

	construction or wrecking only if the perason having conduct of the floating plant obtains an authorization from the Assistant Commissioner, the District Commander, the Captain of the Port or the Windsor harbor master having jurisdiction in waters in which the floating plant will operate, anchor or moor, on such terms and conditions as are necessary to ensure the safety of navigation. (Section 318)	
Provincial Government – Ministry of Environment and Climate Change Strategy - Environmental Assessment Office Transport Canada Marine Transport -	• Environmental Assessment: The Reviewable Projects Regulation of the BC Environmental Assessment Act considers projects that may require a permit. The BC Environmental Assessment office handles such matters. • Crown Land Tenure: An ocean-source heat pump may require approval from the provincial government for tenue over the	Environmental Assessment: 2020 user guide Crown Land Tenure Application for Ocean Energy – Clean Energy projects: • Crown Land Application (including site map) • Ocean Energy List/Development Plan

Navigation Protection Act Ministry of Forests, Lands, Natural Resource Operations & Rural Development	foreshore area where it will be located. The regulating Agency responsible for leasing and licensing crown lands for projects is the Ministry of Forests, Lands, Natural Resource Operations and Rural Devt. • Navigable Waters: The NPA regulates activities that may risk obstructing or interfering with navigation in the listed water bodies in the Act. Proponents are required to apply to the Navigation Protection Program to obtain an approval. • Clearing Trees on Crown land: If the project will involve clearing trees to lay the pipes, an application for a license to cut is required by the Ministry of Forest, Lands, Natural Resources, and Rural Development, as authorized by the Forest Act. • Contaminated sites and spills: The Ministry of Environment and	Information Requirements (PDF) • Ocean Energy Policy (PDF) • Clean Energy Guidebook (PDF) • Crown Land Fees schedule (PDF) Park Use Permits: • FrontCounter Park Use Permits • Permit Policy for Commercial Filming [PDF] • Permit Insurance Requirements [PDF] • Permit Application [PDF] • Permit Cancellation [PDF] • Ecological Reserve Permits [PDF] • Permit Fees [PDF]

Climate Change Strategy is authorized by the Environmental Management Act (s.79) to assess for spill prevention and require risk mitigation by proponents. This assessment is covered by the Environmental Impact Assessment. • Provincial park use: The Ministry of Environment and climate change strategy regulates the use of provincial parklands for activities in protected areas. A park use permit is required for this project if it is to be situated at wreck beach, which is a protected parkland. Applications are processed by FrontCounter BC. Permits are reviewed under the BC Parks Impact Assessment process. • Water use or diversion: Ministry of Environment and Climate Change Strategy requires an application through FrontCounter BC if a project will use water or affect its	• Permit Term Length [PDF] Research Permit Policy [PDF] Navigable Waters: Navigation Protection Program Application Indian Reserve Land use: Indian Act, 1985, s.28(2) Clearing Trees on Crown Land: Application for a license to cut Water use or diversion: FrontCounter BC Water License application

	flow, as authorized by the Water Sustainability Act. • Indian Reserve Lands: The Indian Act regulates temporary use of reserve lands for any purpose, and a Permit needs to be obtained from INAC to occupy or use reserve land.	
Metro Vancouver	• The metro Vancouver Area A zoning bylaw of 2016 (Bylaw no. 1144, 2011) does not make any specific provisions for the installation of an ocean-source heat pump on the foreshore, as recommended by Island Trust (Renewable Energy Technologies in the Trust Area, 2013) for zoning bylaw amendments to permit this use in marine zones. Hence, there are no direct clear regulations for where and how to site the pump. The following are the only provisions related to this project as found in the bylaws:	

	• As defined in the Bylaw, "water resource use" means a use providing for the generation of hydro-electric power or for the extraction, compounding, pumping, filtering and treatment of water for bulk shipment or distribution. This is the closest bylaw related to the ocean heat pump technology. • Water Resource use is permitted in 2 designated zones: The A-2 (Extensive rural and recreation) zone and the NR (Natural resource) zone. • Specifically, there are no minimum lot sizes required for any water resource use in these 2 zones.	
UBC: Governance Board UBC Planning Office (C+CP) – Land Use Committee	• UBC's Land Use Plan currently does not provide any regulations for installing this technology on campus sites. • UBC's Campus + Community Planning (C+CP), the Land Use	• UBC Development and Building Regulations, 2019 • UBC Development Handbook

Development Permit Board	Committee specifically, requires any company wanting to 'make any changes to the public realm' (work that impacts UBC's built environment, such as the public realm, tree removals, landscapes and public art, which may include installing the connecting system underground) to apply for and obtain a development permit (UBC C+CP Development Permits). The Development Permit Board reviews all applications. To confirm whether or not this permit is required, contractors and project managers are encouraged to contact Development Services on UBC. • This permit is not required when the structure is an accessory structure less than 2.0 m high and not more than 10 m2 in floor area provided it is in conformity with Section 7.0 (UBC Development Handbook 2020):	• Development Permit Application Form and relevant reference materials • Building Permit Application form and reference materials • BC Building Code 2018 • Application form for System shutdown • UBC Building Operations Service Shutdown Policy and Procedures • UBC Service Connection Permit Application form (Energy & Water Services) • Technical Safety BC

▪ Maximum height 4.5m ▪ Must not exceed site coverage of 18%, a building area of 140 m^2, or be wider than 80% of the lot width. • Some considerations for whether a permit would be required can include: whether the pipes be laid underground, What the receiving station at UBC will look like, whether the receiving station already exists or if it needs to be built, whether it be indoors or outside, These considerations will determine whether this project gets classified by the Board as Class A (no permit required), class B (minor and easily approved permits), or class C (all other developments, major projects). • C+CP may also require the contractor to obtain a building permit if changes are to be made to the buildings that will be connected	

to this new heat/electricity source (consult the BC Building Code). C+CP administers the Code on campus, ensuring buildings and fittings are in compliance. • This project will likely require an Excavation and Backfill Permit from the Associate director of Municipal Engineering (Landscape and Infrastructure Group, C+CP), because it involves drilling for connections to underground utilities. • The permits expire 12 months after issuance. The contractors will also need to submit an application for service shutdown and will have to have obtained a Service Connection permit prior to start of the work, from the Department of Building Operations. The contracted company will be responsible to calling all applicable inspection authorities (water, sewer, gas,	

	electrical) after project completion, in accordance with their requirements: • Electrical – Technical Safety BC • Gas – BC Safety Authority Inspector • An Engineer would have to certify the HVAC system where an ocean heat pump provides heating and cooling (Repository of Board of Governors Policies, Procedures, Rules, and Guidelines).	
Canadian Geo-Exchange Coalition	• The system must meet the CSA standard C-448-02, use ISO/CSA approved equipment, and engage such best practices as providing 'as-builts', and proper labelling of all pipes and valves (ibid). • The system must also be designed by an accredited designer and installed by an accredited installer. • Accreditation/certification is through the Canadian Geo-	• CGC

exchange Coalition (CGC's) Global Quality Geo-Exchange Program (ibid).	

3. POTENTIAL IMPACTS OF OSHP TO STAKEHOLDER GROUPS

This section presents a summary of the feedback received from stakeholder on potential impacts in the 4 criteria defined at the start of this research: equity, economic, cultural, and environmental impacts. Stakeholder feedback (where provided) was complimented with various online sources (including guiding documents, reports, and web pages of renewable energy-affiliated organizations). In many cases however, feedback on impacts to stakeholders was not received, as the focus of the discussions were around regulatory requirements. Therefore, the potential impacts presented here are general estimates and assumptions made based on the research available and may not reflect the actual impacts that stakeholders may experience. This section therefore can serve as a guide for further conversations with stakeholder groups and for a more in-depth stakeholder impact analysis, when the specifications of the OSHP system are determined by the project managers.

3.1 Equity Considerations

Based on the feedback from residential building users on campus, the district energy center at UBC, and surrounding communities, there were no identified equity impacts of setting up the OSHP at the Vancouver campus. It was anticipated that the campus residents (students and faculty) may have concerns around noise pollution during installation and possibly from running the OSHP and temporary disruptions to outdoor spaces during installation. It was also anticipated that the Energy and water Services would have concerns around additional installation and ongoing maintenance costs, and neighboring communities would be concerned about potential land and water use impacts, animals that feed in the area et cetera. However, none of these concerns were raised during the stakeholder

engagement process as anticipated, which would have been useful in developing an equity impact rating for various stakeholder groups, based on the expected costs and benefits.

3.2 Economic Impacts

There was very little feedback that indicated any perceived economic impacts of installing OSHP by the stakeholder groups identified and engaged. The expectation was that UBC campus residents would be concerned about the impacts on their utility bills. The feedback received from residents however, did not include any such concerns. The conversations with representatives from the Department of Fishery (DFO) and Wreck Beach Preservation Society revealed concerns around environmental and aesthetic impacts of installing the heat pumps. The representative from the DFO was concerned with restoring the habitat to its original state that could support local economy in terms of fishing as a source of livelihood and some concerns were raised about the extension of certain species due to this activity. The wreck beach representative expressed some concerns about how revenue could be affected from recreational activities that may be halted due to the project setup time and its final conclusion.

3.3 Environmental Impacts

UBC Vancouver campus has about 56,000 students and about 16,000 staff, totaling over 70,000 people (UBC Overview and Facts 2019-2020). As at the end of last fiscal year, UBC Vancouver campus purchases/used 297 gigawatt hours of electricity and generated 14.3GWh through renewable natural gas. In the same year, UBC purchased 339,000 gigajoules of natural gas for hot water generation and generated 88,000 megawatt hours of thermal energy for heating (UBC Energy and Water Services, Stats & Metrics). The UBC Green House Gas emissions report also shows a 30% reduction in overall emissions at the campus even with an increase in the floor space on Campus (UBC GHG Inventory).

UBC prioritizes environmental stewardship and demonstrates leadership in this area through the various projects carried out to date to reduce its carbon footprint. For example, there are currently 31 LEED (Leadership in Energy and Environmental design) certified buildings at the Vancouver campus. This OSHP represents another opportunity for UBC to substitute a large portion of these energy purchases with locally generated renewable energy, thereby reducing UBC's carbon footprint. Given the political will at the federal, provincial, municipal, and local (UBC) level to reduce emissions and to be a leader in environmental responsibility, renewable energy sources serve as more environmentally sustainable means of meeting the energy demand needs of people and communities. The OSHP technology is arguably more efficient than other conventional sources of energy, as the evidence suggests. The table below shows a comparison to demonstrate the relative efficiency of ocean-source heat pump technology.

Table 3: Estimated Energy Efficiency of different heat sources

Heat Source	**Estimated Energy Efficiency Ratios (converted to %)**
Wood/fireplace	30-50%
Oil furnace/boiler	65-85%
Natural gas furnace/boiler	80-95%
Propane furnace/boiler	80-95%
Electric heaters/furnace	100%
Air-source heat pump	200-300%
Water-source heat pump	300-400%

Information Source: Renewable Energy Technologies in the Trust Area – Ocean Based Geo-Exchange Systems. 2013. Islands Trust Memorandum.

From an energy-efficiency standpoint, there is a potential positive environmental impact of setting up the OSHP on UBC grounds. There are, however, other considerations to the environment that the setup of this technology may impact. Depending on where the project will be sited (does it cross a wildlife area or a migratory bird sanctuary?), UBC may be required to conduct a formal environmental assessment (SOR/2012-147, Physical Activities schedule). As part of the (formal or informal) environmental impact assessment, we must determine the following:

1. Will any forest or other land vegetation be cleared to lay the pipes underground from the foreshore to the campus energy center? To what extent, if any, will the disruption to the land occur? (consider impacts on wildlife, bird populations).
2. What construction materials will be utilized? What precautions will be taken to prevent potential contamination from the materials and ensure water quality is intact? (consider impacts on fish population in the immediate area).
3. How much noise impact (vibrations underground, noise from machinery running) can be expected from installing and running this technology at the foreshore and on campus? (consider mitigation efforts for outdoor/recreational activities during installation).

Depending on the type of system set up (vertical versus horizontal, open versus closed loop system), various degrees of disruption to the ground may be necessary. The set up typically includes pipes which contain a heat transfer liquid, anchored to the seabed, and connected to the buildings (Renewable Energy Technologies in the Trust Area, 2013, p.2). The system can either be an open loop or a closed loop. In an open loop, the water is first extracted, then the heat is extracted from the water, and then the water is returned to the ocean (ibid, p.2). A closed loop on the other hand circulates a heat transfer liquid through the pipes.

Metrics would have to be considered as to how these Ocean heat source would affect the balance of wildlife species in the Ocean (Pacific Ocean). It is important to note a lot of people and animals eat and rely on the fish and other sea animals for food and for balance in the eco-system as a whole. Care must

be taken to ensure the project creates minimal harm or disruption to ocean animals and other important species.

3.4 Cultural Impacts

UBC's Vancouver campus is located on the traditional, ancestral, and unceded territory of the Musqueam people. The communities in the neighborhood may be concerned about the potential disturbance of the eelgrass beds and other habitats on the foreshore. Prior to the project starting, it is highly recommended that UBC engage the leaders of Musqueam FN, to ensure that the installation of the pumps will not impact their cultural/traditional uses of the land in the area around the foreshore, and to make the necessary accommodations in the event that they do. On December 3rd, 2020, Bill C-15 was tabled by Minister Lametti (Minister of Justice). This Bill is a follow up to Bill C-262 that affirms the rights of Indigenous peoples in Canada, which was tabled in 2018 in an effort to pass legislation on implementing the UN Declaration on the Rights of Indigenous People. There is thus strong political attention on Indigenous rights across the country, making it very important for adequate and early engagement prior to the formal consultation process. Before the project commences, the provincial government has a duty to consult with the Indigenous groups on their traditional rights on all impacted lands in their territory, and to make efforts to mitigate any impacts. UBC will have to demonstrate that installing the pipes will be done in an area mapped for low disturbance, and in accordance with the Department of Fisheries and Ocean guidelines. One way is to install the system with an existing (or new) dock, to minimize the use of concrete and other cementing materials for the pipe laying, which disturb the area (Renewable Energy Technologies in the Trust Area, 2013). They may also have concerns about potential leaks, if a closed loop system is built (the heat transfer liquid may leak). UBC would have to demonstrate its past commitments to maintaining systems adequately, use an open loop system with water only, or use low-toxicity liquids for the heat transfer in the pipes.

The UBC culture is one that has over the decades centered around climate impact awareness and leadership in green energy. Therefore, having an OSHP promotes cultural pride and heritage at UBC.

4. STAKEHOLDER ANALYSIS

Stakeholder analysis is an evaluative tool that provides details on various stakeholders of a project. It will be conducted based on the stakeholder impact index, which would be used as a planning and as an evaluation tool. As a planning tool, it can be used proactively to structure the project stakeholders and their potential impact on the project. As an evaluation tool, it can be used to evaluate the stakeholder management process during the project and after project completion.

The stakeholder analysis for this project was conducted with the goal of assessing the interest and influence level of stakeholders. This was done through email and phone interviews with various identified stakeholder organization representatives. The feedback received from these groups is presented in this section. This summary will enable UBC to identify, manage and address the needs and concerns of stakeholders with setting up an ocean-source heat pump at the Vancouver campus.

Stakeholders for this project were identified from various sources – communications with the UBC Energy and Water Services, identification of the various regulatory bodies involved based on the project description, and identification of Indigenous communities in the locale using Aboriginal and Treaty Rights Information System (ATRIS). ATRIS is an open government initiative tool accessible to anyone to provide access to documents and maps that are used to help governments, industry and others determine their consultation obligations and in carrying out their consultation research, and links reports with related geographic shapes on an interactive map, allowing users to locate Indigenous groups and become familiar with each group's established or asserted rights.

This broad-based search yielded the following identified stakeholder groups for this project, shown in the following table:

Table 4: Decision Makers and Stakeholder Identification

Stakeholder Group Identified	Type of Organization	Interest Area
Metro-Vancouver (Decision maker)	Municipal government	Bylaws guiding setting up OSHP, regional park land regulation
UBC Board of Governors (Decision maker)	University Endowment Lands governance	Approval of any projects, land use regulations
Canada Department of Fisheries & Oceans	Federal government	Policies/regulations on fish habitats in ocean.
Wreck Beach Preservation Society	Conservation advocacy group	Advocating for protecting wreck beach's visual appeal
BC Pavilion Corporation (PavCo)	Provincial crown corporation	Share information on how they set up their OSHP for the building
Transport Canada	Federal government	Regulating the Navigation Act, administering the Navigation Protection Program
UBC Housing (Vancouver Campus)	UBC Vancouver residents	Concerns around disruptions on campus from installation, noise from use of OSHP
Front-Counter BC	Provincial government	Licensing and registrations to use natural resources in BC
Musqueam, Tsleil-Waututh and Solh Temexw Nations	Indigenous communities	Traditional uses of the land and water resources

BC Hydro	Provincial government crown corporation	Feasibility, program supports

For this project, UBC Board of Governors and Metro Vancouver government are the primary decision makers. UBC Vancouver by population size is large enough to be a municipality but has no municipal government and are thus considered unincorporated (university endowment lands). Thus, all UBC's land use regulations (the zoning and bylaw implications of installing ocean-source heat pumps) will be overseen by Metro Vancouver (of which UBC belongs to the Electoral Area A). In year 2000, UBC signed a memorandum of understanding with Metro Vancouver to oversee its own neighborhood planning. The UBC Board of Governors therefore vets and approves all campus neighborhood plans. The Board develops and approve policies for the University, which provide direction on specific topics and issues, along with procedures and standards for compliance. The Board is also responsible for deciding whether to approve the project and ensuring the mitigation of potential adverse impacts and enhancement of project benefits (Repository of Board of Governors Policies, Procedures, Rules, and Guidelines). In most cases, decision will be based upon if there are significant adverse impacts associated with this option and if they are justified under the circumstances.

Metro Vancouver is a federation consisting of 21 municipalities, one Electoral Area and one Treaty First Nation which plans for and delivers regional-scale services for these parties as a collective, with focus on drinking water, wastewater treatment and solid waste management. It also regulates air quality, plans for urban growth, manages a regional park system (including the Pacific Spirit Regional Park which surrounds the UBC Vancouver campus and where Wreck Beach is located, on Musqueam territory) and provides affordable housing (Metro Vancouver: About Us). UBC's University Endowment Lands are part of metro Vancouver. However, UBC is not governed by metro Vancouver's regional district governance board. UBC is directly administered by the provincial government. UBC signed a

memorandum of understanding with metro Vancouver in 2015 for strategic collaboration in areas of research and innovation, operations, and general prosperity (UBC and Metro Vancouver Strategic Collaboration, December 2015). Because parts of the OSHP may be located on the regional park land, metro Vancouver would have to provide approval to UBC to set up.

The Government of Canada's Department of Fisheries and Oceans (DFO) is the federal department responsible for safeguarding all of Canada's fisheries, oceans, and freshwater resources and protecting aquatic habitats to ensure healthy, sustainable ecosystems. The department works with proponents to review their projects through the Fish and Fish Habitat Protection program, to determine if a formal review is required.

Wreck Beach Preservation Society is an advocacy group for keeping the visual appeal of wreck beach and protecting the natural environment from deforestation, road and marina construction, and pollution by jet fuels and other pollutants (Wreck Beach: About). The beach itself is located on traditional Musqueam land and lies within the Pacific Spirit regional park. Because of its proximity to the Vancouver campus and it's 7.8km long foreshore, wreck beach is the ideal location for the OSHP.

BC Pavilion Corporation is a provincial crown corporation that owns and operates 2 public facilities in downtown Vancouver: BC Place and the Vancouver Convention Center. The Pavilion was identified as a stakeholder because they have set up OSHP in their 2 commercial size buildings. They are therefore able to share learnings from their experience navigating the regulatory controls and with the use of the pumps.

Transport Canada is responsible for administering the federal Navigation Protection Program (NPP), under the authority of the Canadian Navigable Waters Act. The NPP sets terms and conditions for projects in navigable waters, manages obstructions, and enforce rules on dewatering and depositing

materials into navigable waters (Transport Canada: Navigation Protection Program). The NPP requires an application for any project involving any navigable water body in Canada.

UBC Housing was identified as a stakeholder group to capture some feedback from residents at the Vancouver campus.

FrontCounter BC is a provincial government office responsible for processing all fish, wildlife, and park use permits applications for the province. They took over this role from the former Permit and Authorization Service Bureau in 2014. This office will be a primary point of contact for UBC to acquire all the necessary permits at project implementation stage.

Musqueam, Tsleil-Waututh and Solh Temexw Nations were identified by ATRIS as the 3 Indigenous groups that are directly located within the area. The provincial government is legally obligated to consult and accommodate First Nations, where required, on land and resource decisions that could impact their indigenous interests (Government of British Columbia: Consulting with First Nations). At various stages of the formal consultation process, the proponent (UBC) will be involved. The provincial government recommends that proponents engage with the leadership of these Nations prior to the formal consultation process as a best practice (Building Relationships with First Nations: Respecting Rights and Doing Good Business).

4.1 Summary of Stakeholder Engagement

This section provides a summary of the stakeholder engagement process. This was carried out over the course of 2 months from early October to late November. Various key persons from the stakeholder organizations identified above were contacted by email and phone calls (refer to appendix 8.1 for details). It should be noted that not all stakeholder group key persons contacted responded to the inquiries. As no reasons were provided, it can be assumed that several offices are either short-staffed or dealing with

increased workload due to the public health restrictions with COVID19. This was particularly the case with the Musqueam Band Office. The following table summarizes the feedback received during the engagement process.

Table 5: Summary of Discussions with Stakeholder Groups

Stakeholder Group	**Questions**	**Summary of Feedback**
Government of Canada Department of Fisheries and Oceans – Fish and Fish Habitat Protection Program, Regulatory Review Unit. Vancouver headquarter office.	• Will any critical fish habitats be impacted by this project? • What regulations does UBC need to ensure we meet, as we proceed with this OSHP project? • Can you provide pointers on how to navigate the system of regulations, to ensure that UBC is in good standing with the DFO on this project? • Do you have any general advice to give UBC, to	• Yes. Wreck Beach is a critical habitat for the southern resident killer whale and the Northern Abalone, two very rare species. There are several others, which a proper DFO assessment will identify. • UBC needs to determine whether or not the OSHP will impact fish and fish habitats, based on information on the DFO's Projects Near Water webpage. Initial assessment based on information provided during conversation indicates that the project has the potential to impact the fish population in the area: installation can cause death of fish, piping can impact

ensure the project gets approved by your review team when this process is embarked on?	the water column, causing isolation of fish. Therefore, it requires a DFO review. • refer to part B of this document for details on what this process entails, as provided by the contact person. UBC may also choose to use the Species at Risk interactive mapping site on the website to assess which critical habitat the OSHP will be affecting in the area. • Engage all involved parties early, as shaping the design to mitigate potential risks will save UBC a lot of money. This includes engaging the First Nations communities in the area, before the federal government initiates the duty to consult process. UBC must demonstrate to the DFO how potential impacts may be avoided or mitigated through project design, timing of the works, where the project is being carried out, the environmental values of the area, etc. UBC must come up

		with an offsetting plan that the DFO agrees is sufficient: hire a consultant to design and monitor the habitat. UBC must provide the DFO with a Letter of Credit and a financial guarantee in the event that UBC chooses not to do it themselves and want the DFO to assign a consultant.
Indigenous neighboring communities – Musqueam Band Office, Environmental Stewardship Unit. Tsleil-Waututh and Solh Temexw Communities.	• Will setting up an OSHP by the foreshore with connecting pipes to the campus impact your traditional and cultural use of the land in the affected area? • What can UBC do to minimize this impact or accommodate the disruption to activities by your community?	• Response received with intent to set up meeting when possible, but no success in getting a meeting date set up for a conversation to date. • Tsleil-Waututh Nation has an online map showing land areas requiring consultation with their Chief and council by the Federal Government. This area includes every foreshore in the Vancouver area. They were reached out to, but no response has been received to date. It is therefore advisable for UBC to engage TW Nation prior to the duty to consult process, as a best practice approach.

		Tel: 604.929.3454 Email: communications@twnation.ca • Temexw is a Treaty Association of 5 Coast Salish member Nations - Beecher Bay, Malahat, Snaw-Naw-As, Songhees and T'Sou-ke. The member Nations are spead out across southern and central Vancouver Island. Email: info@temexw.org (250) 360-2202.
Wreck Beach –Wreck Beach Preservation Society	• Do you have any concerns about having an OSHP located along the foreshore at Wreck Beach? • What would be your recommendations for UBC to accommodate your concerns?	• They would need more detail on the project specifics (exactly where it will be set up, et cetera) to provide their feedback in a very specific way. But, WBS strives to protect the ocean views cape and cliff-face forests and are concerned about exposed pipes running along the forested cliffs or beside their access trails. Also, Trail 4 and the Acadia end of Wreck are surf-smelt spawning beaches and must be protected at all costs. The Musqueam reserve is located to the south of the

		beach, and Wreck beach is located in a regional park. • There are currently no docks at wreck beach that the pump could be sited at to reduce disruption, and WBS has no interest in seeing a dock installed anywhere along the 7.3km of wreck beach. They recommend asking the Band office if UBC can locate the pump on their territory in the estuary by the mouth of the river, but caution that they may be reluctant due to the potential harms to the Fraser River Salmon. They also recommend that UBC contacts the Vancouver Board of Parks and Recreation to see if they would allow your experimental ocean beach pump to be sited off their section of Spanish Banks.
UBC Vancouver campus residence	• Do you have any concerns about campus setting up OSHP technology? – concerns with noise from	• UBC Housing office receives a lot of requests for feedback on projects at UBC and currently does not have the capacity to support this research by

	the facility when up and running? Concerns with streets and pathways obstruction with construction activity during the installation? Concerns about the financial implications for your bills?	conducting a survey to go out to all residents, to find out any concerns they may have. • No concerns were raised by the respondent, Sean Ryan, who indicated he was speaking on behalf of the residents and the team at the office.
BC Pavilion Corporation- Vancouver Convention Center, BC Place	• You have an OSHP set up to power the center. What regulations are you aware of that can guide UBC in setting up ocean source heat pumps in the area? • What other advice can you give UBC to assist in its risk mitigation efforts for this project?	• Requires follow up, as respondent said he would need to search for previous documentation submitted to various government offices to support applications. • Save costs from biological growth around the pump's strainers and heat exchangers. Keeping them clean improves energy efficiency of the system, saving UBC costs. The Center tried injecting chlorine to prevent biological growth, but this was unsuccessful. They recommend UBC contact EMCS Industries Ltd about

		installing a copper anode touch tank. While they don't have this in place yet, Canada Place uses it and finds it works great at reducing biological growth.
FrontCounter BC	• What licenses would UBC be required to obtain prior to accessing the water at the foreshore and the land for setting up the OSHP and the pipes?	•
Vancouver Board of Parks and Recreation	• Would you have any concerns with UBC potentially locating an ocean source heat pump on your immediate area within the park (close to Wreck Beach)?	• Email sent. Awaiting response.
Canadian Geo-Exchange Coalition	• Do you have any relevant information to share with UBC as we work on	• The Geothermal Resources Act regulates defined geothermal resources through a system of permits and leases – but the definition is of

setting up OSHP technology for use at the Vancouver campus?	fluid/steam greater than 80C when produced at surface. The Act does not cover geo-exchange system. For a geo-exchange, wells are drilled under the Water Sustainability Act and its regulations. • For ocean or lake-based systems, a land tenure is required and there may be requirements under the Federal Government with respect to fisheries. • Respondent offered to find a contact through Geoexchange BC that may have more helpful information and connect the researcher to said contact.

4.2 Stakeholder Analysis

Based on the stakeholder engagement process, a simple stakeholder analysis was performed. This involves ranking the various stakeholder groups interest and influence levels on a scale of 1-10 (a higher number for a higher influence or interest and a lower number for a lower interest or influence). From this qualitative assessment, the stakeholder groups with the highest levels of power or authority/influence in this project are the various federal, provincial, and municipal government regulatory bodies that require UBC to meet certain requirements in order to be in good standing when implementing this project. These

include the government of Canada's Department of Fisheries and Oceans, the City of Vancouver, Metro Vancouver, FrontCounter BC, BC Hydro, the UBC Board of governors, and the Indigenous communities in the immediate area. The stakeholder groups with high levels of interest include organizations and groups that stand to be directly impacted (whether positively or negatively, based on their assessment) by the installation and running of OSHP technology. These include the Indigenous communities with traditional land use rights, Wreck Beach Preservation Society with their protection/conservation mission, and the UBC Board of Governors with its desire to continue to be leaders in environmental stewardship provincially and nationally.

Stakeholders with high interest and influence levels are the top ranked stakeholders as this project progresses. These include the UBC Board of Governors and the Indigenous communities directly impacted by this project. One stakeholder group falls under the high interest-low influence region – Wreck Beach Preservation Society. This group must be engaged and accommodated as best as possible before and during installation of the OSHP, as such groups (especially those with activist mandates) can acquire social influence using media. This is particularly true for Wreck Beach Preservation Society, as they expressed in their email response during the stakeholder engagement that they have in the past expressed dissatisfaction with UBC's proposed and completed projects that affect their views capes. The table below summarizes this exercise.

Table 6: Assessed Stakeholder Group Interest-Influence Scaling

Stakeholder Groups	Influence Scale	Interest Scale
Metro-Vancouver	8	5
Department of Fishery and Oceans	8	5
Ministry of Energy, Mines and Petroleum resources	7	4
BC Hydro	8	5
Transport Canada	7	4
FrontCounter BC	8	4
The President of UBC Board of Governors.	8	8
Indigenous Communities - Musqueam, Tsleil-Waututh and Solh Temexw Nations	7	8
BC Hydro	7	5
Wreck Beach Preservation Society	5	7
UBC Housing (Vancouver Campus)	4	6

To better visually depict this scaling, refer to the below interest-influence matrix.

Table 7: Interest-Influence Matrix

	High Influence	Low Influence
High Interest	UBC Board of Governors Indigenous Communities Department of Fishery and Oceans Metro Vancouver	Wreck beach Society UBC Housing (Vancouver Campus) UBC residents (Students)

	Front-Counter BC BC Hydro	
Low Interest		BC Activist groups / media

5. SUMMARY AND RECOMMENDATIONS

This research project has reviewed and presented the existing policies and regulations that guide ocean-source heat pumps from pre-installation assessments to monitoring and maintenance stages of the project. The various assessments, licenses, permits, and approvals were identified in this report. The project also captured the results of the stakeholder engagement process, providing results of the feedback collected and a stakeholder assessment based on influence and interest levels. Finally, the project provided a summary of the potential economic, environmental and cultural impacts that this project may have on the various stakeholders based on research and feedback from stakeholder engagement process.

Setting up an ocean-source heat pump on UBC grounds will require the project manager to carefully review the regulations and ensure the project complies with the DFO regulations, obtains the necessary permits from UBC and FrontCounter BC, and makes all necessary accommodations and mitigation efforts to meet the needs of the Indigenous communities in the area that are impacted by the project. The recommended next step is to commence an environmental assessment and submit a request for review to the DFO Fish and Fish Habitat Protection Program. It is also recommended that the Indigenous communities identified through ATRIS are engaged at every stage of this project to ensure that UBC is respecting their rights and communicating with their representatives from the various offices.

Considering the breadth of regulatory requirements to support the OSHP and similar projects, the significant potential impacts to the environment and people living in the vicinity, and all of the installation and equipment efficiency considerations, it is recommended that UBC SEEDS creates a compilation of all the research done so far on various aspects of this OSHP project (the engineering sections, the economic cost sections and the regulation section) and creates a step-wise project plan with evaluation metrics built into the timeline for each major project area, to ensure close monitoring and evaluation. This may require hiring a professional team or firm that can provide site assessment and

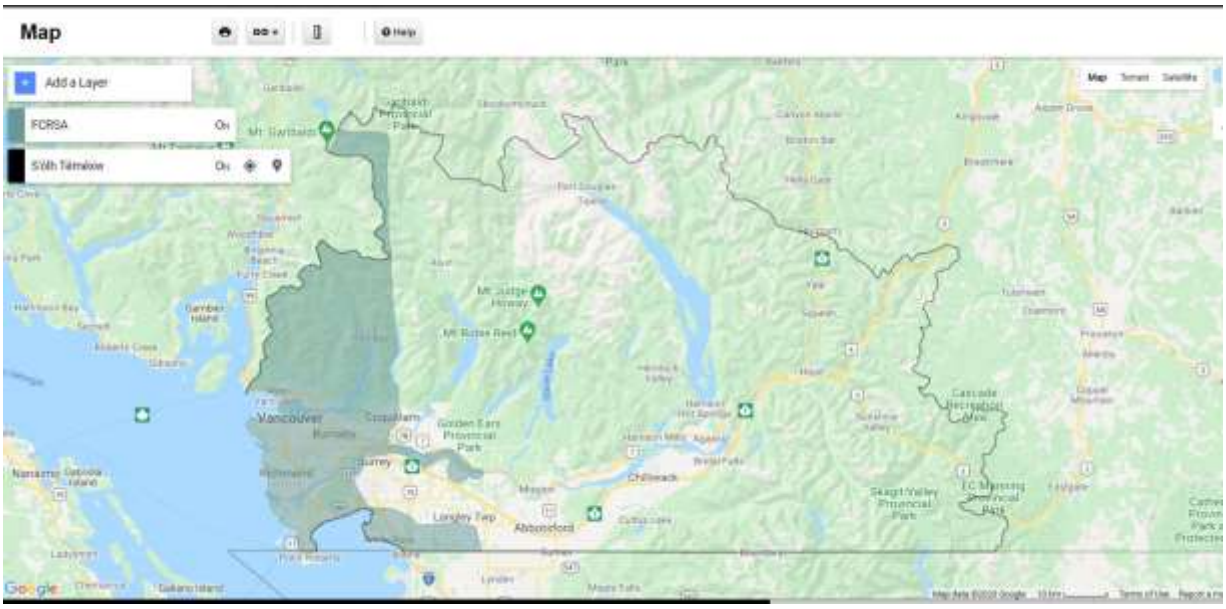
evaluation in real time is a recommended action going forward. As the situation of activities around UBC keeps changing, it is important to keep abreast and track these changes as they affect the results from various parties concerned about this technology.

During the stakeholder engagement, a lot of stakeholders expressed interest in having more detailed and specific information on what the actual system (location, material types, dimensions, et cetera) would look like on the ground. Some wanted a formal written report or request and at least a previous site assessment on file to evaluate the impacts for their individual groups. For example, in addition to the site assessment done for the location of the OSHP, the Department of Fishery wanted proof (Letter of Credit which is refundable over a period of time) from UBC stating that they would cover any unforeseen damages for offsetting the Natural ecosystem in the region where this project would be conducted. Hence, it is important for UBC's OSHP project team to ensure that there is ongoing engagement with the stakeholder groups, particularly those with high interest and high influence in this project.

A potential next step for research through SEEDS could be an assessment of evaluations conducted on various alternative sources of energy across BC, to pull the lessons learned and to compare the efficiency of the various systems, identify pitfalls to avoid, and discuss considerations for upscaling systems. Particularly, a research interest that could be explored is the ocean and other water source heat pumps currently running across BC. This can form part of a series of research pieces that, put together, serve as a guiding document for UBC's energy and water services, and serves as a baseline for monitoring and evaluating projects – emission reduction met, job creation, negative impacts, risks and mitigation.

6. APPENDIX

6.1 Geographical Map of Indigenous Communities in the Area of Proposed project.



6.2 Stakeholder Engagement Tracker

Date	Organization	Contact Person/info	Summary of discussion	Action items
Nov 3 2020	Fisheries and Oceans Canada	Vincent Harper Tel: 250-756-7261 Fax: 250-756-7229	Concerns at Department of Fishery and Fish Act	Reach out to the DFO to conduct a pre-review of the project.
Oct 19 2020	City of Vancouver	604-673-8299	City of Vancouver follow Building Efficiency codes of BC and UBC would follow same codes for this project	✓

Nov 2020 Dec 15 2020	UBC residents (Student/ Professor) UBC Housing rep	Dr. Amanda Gang Professor at UBC Sean Ryan, Associate Director, Resident Life, Student Housing and Hospitality Services P: 604 827-1996 E: sean.ryan@ubc.ca	Excited to see the possibilities of OSHP at UBC. Highlighted attention to the energy policy directed at getting approval from Decision maker at UBC Unable to support a survey roll out to residents. No concerns raised.	✓
Nov 3 2020	Front Counter BC	Alicia frontcounterbc@gov.bc.ca	Impact of Chemical substance on foreshore and any interruptions to human recreational activity	✓
Nov 3 2020	Musqueam Band Office	Yeganeh Asadian, Manager of Environmental Stewardship office yasadian@musqueam.bc.ca	Yet to respond	Reach out to Yeganeh again to confirm a meeting date and present more information.
Nov 3 2020	Barrister & Solicitor	Ian Moore E: ian@ianmoore.ca	Yet to respond	✓

Nov 23 2020		P: 236-990-0378	Responded on this day with general advice.	
Dec 15 2020	Canadian Geoexchange Coalition	Warren Walsh, Msc P. Geo, Strategic Energy Manager, Energy and Industry Decarbonization, Electricity and Alternative Energy Division. E: warren.walsh@gov.bc.ca	Responded with general advice.	Reconnect with a few other key persons. Meeting invitation pending.

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