# Geob. 270 Group Project:

# An Environmental Assessment of the Pacific NorthWest LNG Project

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## *Abstract*

In late September a multi billion dollar liquefied natural gas project was approved by the Liberal cabinet. This terminal is being built by Pacific Northwest LNG in northern British Columbia and the company claims that the project will have significant economic benefits for Canada. These contributions include adding an estimated 2.9 billion dollars annually to Canada's GDP and creating 4,500 jobs at the peak of construction (Pacific NorthWest LNG, 2010). Opponents to the project believe these economic benefits do not outweigh the environmental risks that this project creates. The main concerns are that Canada will not be able to meet their emission goals and that the location of the facility puts several habitats and species at risk. Our project was to determine the ecological components and habitat that could be affected if there was a disaster (leak, spill, explosion, etc.) at the proposed facility and determine if the project should go ahead or should consider a new location. Immediate observation of the location showed that it was close to the Skeena river estuary as well as the Flora Banks, both of these habitats have high biodiversity and are important for many species. We created several maps from available online databases and showed where the location of the pipeline and the terminal would be located as well as how the construction of the terminal would impact the riparian vegetations and streams on the island itself. We then took a step back and examined species in the area that could be at risk if there were to be an environmental incident at the site. We also looked at a case study done using GIS that examined the Flora Banks in depth and took this into consideration when coming up with our recommendation. The map we created using ArcMap shows the impact area of the terminal if there were to be an incident at the site. The map shows the roads, rivers, riparian habitat and endangered species habitat that would be impacted.

## *Introduction*

In late September of 2016 the federal Liberal cabinet approved the construction of an 11 billion dollar terminal that would export liquefied natural gas in northern British Columbia. The company claims that natural gas is a young industry in B.C. that will provide significant economic and social potentials for the area, the province, and the country. The company claims that once they have received all the necessary permits and met the conditions, that the construction will take approximately four years. Even with the nearly 200 requirements they must meet the environmental community has argued against the project. Their main concern with the project is the location, with First Nations groups and environmentalists

worried that this project would harm the habitat of many important species in the area, including but not limited to, salmon.

The aim of our group project is to perform an environmental assessment for the project and determine if the project would put these species at risk and provide a professional opinion of whether we believe the project site should be reconsidered. The project is attempting to be built on Lelu Island near the town of Prince Rupert in Northern British Columbia. The island is relatively small and right now is comprised almost completely of forest. The project will cover almost the entire island, as shown in figure 1 which is a model created by Pacific Northwest LNG. The location of the project is immediately concerning as Lelu island is part of the Skeena River estuary (Map 1).

The Skeena River is the second largest river basin located entirely in British Columbia, second only to the Fraser River (Gottesfeld, Rabnett, 2009). The Skeena River is home to many species of fish, wildlife, and vegetation. The following species of Pacific Salmon can be found in the Skeena: Chinook, Chum, Coho, Sockeye, and Pink salmon.

The Skeena river is an important breeding group for many species and one of the focuses of our environmental assessment will be to determine what species if any will be put at risk by the construction of this habitat. The Skeena river estuary is extremely important because it creates mudflats as it deposits sediments carried down river to the ocean (Faggetter, Hall, 2009). These mudflats are extremely rich in organic matter and are home to many species of aquatic life. One of these mudflats commonly called Flora Banks in between Lelu and Kitson islands. The model released by Pacific Northwest LNG shows a bridge that will bring the liquified natural gas to carriers crossing right over Flora Banks.

This concerns many environmentalists because the Flora Banks has been recognized as having a high habitat value meaning that the area is a critical habitat for many species (Faggetter, Hall, 2009). Relatively few studies have been done on this area and therefore spatial data for the Flora Banks was difficult to find. We will still be considering it when making our recommendation for the terminal.

## *Methodology of Analysis*

Our project is situated in the map sheet 103J using the National Topographical Systems of Canada map. We used this map sheet when downloading all of our data from various sources. For the basic elements of our map we used the TRIM layers available on the UBC Geography G: drive, this included rivers, and lakes layers. All of these layers were projected in the coordinate system ‘NAD_1983_UTM_Zone_9N’ in order for the boundaries to line up correctly. All other layers were

acquired from DataBC and the BC Oil and Gas Commission Open Data Portal. This included where the terminal would be as well as the path of the pipeline. This pipeline being built by Prince Rupert Gas Transmission Ltd. will run for 900 km from Hudson's Hope to the Pacific Northwest LNG facility on Lelu Island (Prince Rupert Gas Transmission Project, 2016). The files for the location of the pipeline are available for download on the BC Oil and Gas Commission Open Data Portal. Map 1.

In order to determine the impact area of a potential LNG facility disaster we based our radius off of a statement by LNG expert Michael Hightower who was contracted by the United States government to model possible LNG explosions (Hightower et al., 2004). In an interview regarding the proposed Woodier LNG export plant located near Squamish, Hightower estimated that the maximum impact distance of large LNG accident has a radius of three kilometres from the facility or tankers (Aldous, 2014). We decided to use this estimate for our study because it was stated by a highly regarded researcher and was used in another Canadian project.

Using this three kilometre area of impact we then analyzed some points of interest falling inside the risk area. We added buffer zones to the rivers in order to take into account the riparian habitat that would be at risk in the case of a serious accident. We determined that these rivers would most likely be fish bearing as they are all at an elevation below six hundred meters (Geob 270 Lab 5). Taking this into account we created a buffer of fifty meters on either side of the rivers (100 meters total). In order to add the buffers on ArcMap the we used the buffer analysis tool and input a distance of fifty meters. This produced a new layer where each segment of river inside the risk area had a buffer with a total width of one hundred meters. In order to merge all the individual buffers the dissolve tool was used and the final step was to clip the buffer layer to the base map.

We then attempted to examine the Flora Banks which are located to the West of Lelu Island. However this area is extremely understudied and most studies contain data that are not made available to the public. We found an excellent project that was a study of the Eelgrass habitats in the Flora Banks. We emailed and phoned the two scientists that were involved in the project but did not get any response from them. We thought that it would still be important to look at the studies they did in the area and we plan on taking this into consideration when coming to a conclusion. In addition we added a feature class polygon to show the area where the flora bank is situated however, this layer was not used in any analysis.

## *Results and Discussion*

Proponents for the Pacific Northwest LNG terminal are insistent that that this project will bring billions of dollars into the Canadian economy and would create thousands of jobs. There are also many proponents to the project that believe that the construction of the fossil fuel infrastructure will massively inhibit Canada from reaching its emissions reduction goals. Further concerns about the terminal mainly centre around the decided location, which is very close to the Skeena estuary and is therefore surrounded by many species rich wetlands and mudflats.

Our approach to this project was to look first closely at how the construction of the terminal would directly impact Lelu island and then to change scales to see how the project would impact the areas around the island. Lelu island seems at first to be an excellent location for the terminal since it currently has no human inhabitants and consists mainly of forested areas. In this respect the location of Lelu island is ideal because it would not impact any Canadian citizens and there are no First Nations reserves in the maximum risk area. However, while the island has no human habitation, it is an area of prime importance for the habitats of Pacific salmon.

Assuming a serious disaster were to occur at the Pacific Northwest LNG facility, a significant amount of surface or intertidal areas could be in danger within the three kilometre radius risk zone. The total area that could be affected by such a disaster could be as much as 29.32 square kilometers, a vast area of potential damage which could have multiple lasting impacts. Following our analysis, we have determined that riparian areas falling inside this area total to 3.74 square kilometers with approximately eighteen percent of that riparian habitat being located on Lelu island. As a result, it is clear that the potential for serious environmental harm is large and as such, the decision to construct a facility on Lelu island is unsupported and unjustifiable.

As well as having potentially disastrous consequences for the wildlife on Lelu island, an accident at the facility may also have even more catastrophic impacts on the areas surrounding the island. Within the risk area, for example, there is 2.71 square kilometres of crucial habitat for the marbled murrelet. This species is incredibly vulnerable as it only lays one egg per breeding season, and often resides in small concentrated populations (Canadian Wildlife Federation). This means that a potentially explosive disaster could obliterate large parts of the population immediately, as these birds primarily find food by diving into the seas near coastlines in groups of up to one hundred (Canadian Wildlife Federation). Such a disaster could therefore result in a significant reduction in population numbers which would take many years to fully recover. As a result, a potential disaster at the proposed Lelu Island facility could result in innumerable losses of this species, and many others as well as the food chain would be quickly derailed.

This could occur as the impact of an explosion would destroy the majority of the Flora banks intertidal area, an area of importance for juvenile salmon, and leave many species which depend on salmon without a source of regular food income.

Following on from this brief discussion of the Flora Banks, we shall now look into more detail at the importance of this region in an environmental and ecological sense. This region is believed to host as much as fifty to sixty percent of the entire tidal and sub-tidal eelgrass habitat in the Skeena estuary region (Carr-Harris et. al., 2015). This is important as it is these eelgrass habitats which form the basis for the majority of the habitats in the region for juvenile salmon, in fact, Flora Banks has been described by previous studies as being the most important early marine habitat for pink salmon coming from the Skeena area (Carr-Harris et. al., 2015). This specifically highlights how the Flora Banks area is vital to the healthy development of pink salmon within the Skeena region and the damage to it, through a disaster or simply increased activity due to construction works would be devastating for the growth of these salmon. In fact, previous developments had been rejected solely on the basis that they would potentially impact this crucial ecological area and limit the productivity of salmon growth (Carr-Harris et. al., 2015). It is also worth noting that within the total risk area for a disaster, the entirety of the Flora Banks in included, meaning that a potential accident could destroy permanently the greatest habitat for pink salmon leaving the Skeena estuary. This is even more concerning when coupled with the data that the Skeena river has the highest number of genetically different salmon populations in all of northern British Columbia, according to a study conducted in 2011 (Beacham et. al.) Therefore, a potential disaster at this proposed facility could eliminate the largest salmon producing region in northern British Columbia, an impact which seems to far outweigh the possible benefits of this facility on Lelu island. There is likely even more potential impacts as a result of damage to Flora Banks however, there have been very few studies done on it and very little data is made available to the public concerning the site. We were able to find two scientists to who worked on the Flora Banks GIS project and we attempted to contact them to see if we could use their data in our project but they did not respond to us.

We would still like to reference their project and take it into consideration when doing the assessment. Our map (Map 1) shows a rough outline of where the Flora Banks is located in relation to Lelu island. Figure 1 shows the exact location of the Flora Banks as based on the research of Barb Faggetter and Kennard Hall, they also noted the habitats of eelgrass (in lime green) and added a buffer of 65 meters around the habitat (Faggeter and Hall, 2009). This study is concerning because it shows that a large amount of eelgrass habitat will be at risk upon the completion of this LNG terminal. The South Coast Conservation Program states that eelgrass communities are one of the most productive and vulnerable habitats in the seas off the coast of British Columbia. It should be noted that more than 80

percent of commercial fish depend on these habitats at some point in their lifecycle (South Coast Conservation Program). The three kilometer radius of the maximum risk area indicates that all of the Flora Banks area is being put at risk by the location of this facility.

Yet, it is not only the ecological and environmental which is potentially at risk following an accident at the facility located on Lelu island, there is a likelihood for residential and infrastructural damage as well. Within the total risk area there is 16.24 kilometers of paved roads which are likely to face damage and face the risk of being impassable due to potential danger. In addition, and perhaps more significantly, while there is no human habitation on Lelu island, there is a residential area called Port Edward to the north of the proposed project (Map 1). This residential area, which contains most of the paved roads likely to be impacted, is within the potential risk area following a large scale disaster at the facility. This is very important as it shows that there is the potential for Canadian lives to be at risk if the facility faces a crisis, this is critical when considering the importance of constructing the project in its current location.

## *Error and Uncertainty*

Several aspects of our analysis may have introduced error and uncertainty into our final results. As we analyzed the possible effects of a disaster at an LNG plant, we used a radial estimate of 3 km for the possible maximum extent of health hazards. While this distance was quoted by a professional LNG author and researcher and therefore has a high degree of credibility, it is a rough estimate and could vary in reality (Aldous, 2014). Additionally, due to time and resource constraints we did not consider the potential effects of topography and climate on the boundaries of the possible health hazard area, which could create potential for error. In the event of a real disaster this health hazard area could assume a different shape than a circle around the plant (which is what we mapped for this project) due to environmental aspects like predominant winds and slopes. Most of the spatial data we acquired for this project was found on DataBC which is the online data catalogue for the province of British Columbia. Other files were acquired from the BC Oil and Gas Commission open data portal. Both of these services are provided by the BC government, so we were able to assume that the spatial data they provided was reliable and had a high degree of accuracy. However, it is possible that there were some errors in this data (e.g. imprecise locations or simplifications of features) that could have lead to error in our analysis. We also had uncertainty resulting from the nature of the pipeline that is being constructed. The pipeline near the facility will be located primarily underwater. However, the research we found about the potential hazard area of an LNG disaster only discussed events that occurred at or near the surface (i.e. from ships

or from facilities located on land). As a result, we could not accurately estimate the possible health hazard area that could originate from a pipeline failure, and we did not attempt to map this area. Our map only indicates the potential risk from a disaster at the facility located on Lelu Island. Another source of uncertainty in our analysis is the precise effects of an LNG disaster on various ecosystems. We know the area in which there are potential health hazards for humans, but not how these health hazards would affect different types of organisms like plants and invertebrates.

## *Conclusion and Further Recommendations*

There are many factors to take into consideration when conducting an environmental assessment. It is our job as employees of either the government or the company who is proposing the project to conduct this assessment with as minimal bias as possible. We have consulted third party papers and websites in order to learn as much as we can about the project and the impact it will have on the surrounding areas. It was determined that in the case of an explosion or other incident at the LNG facility, the hazard radius was 3km. We then set this as our boundary for further analysis of the habitats that would be at risk. The map we produced shows the roads, rivers, riparian habitat, and endangered species habitat at risk. It also shows the location of the Flora Banks which is also put at risk by the location of the LNG facility. The full impact that the facility would have on the delicate ecosystem of Flora Banks has not been studied sufficiently. We would recommend that the ecosystem be further studied to determine what the impacts this facility would have on the ecosystem and subsequently what impact it would have on the species that rely on this wetland. With our current knowledge and analysis of potential risks from an LNG facility disaster, we believe that this facility should not be constructed at the Lelu Island location as of yet. In the event of a disaster such as leak or spill, large areas of sensitive habitat and a number of protected species could be adversely affected. In particular, habitat of the threatened species called the marbled murrelet could be at risk, as well as eelgrass communities and numerous salmon bearing streams and their riparian zones.

*Appendices*

## I. Works Cited

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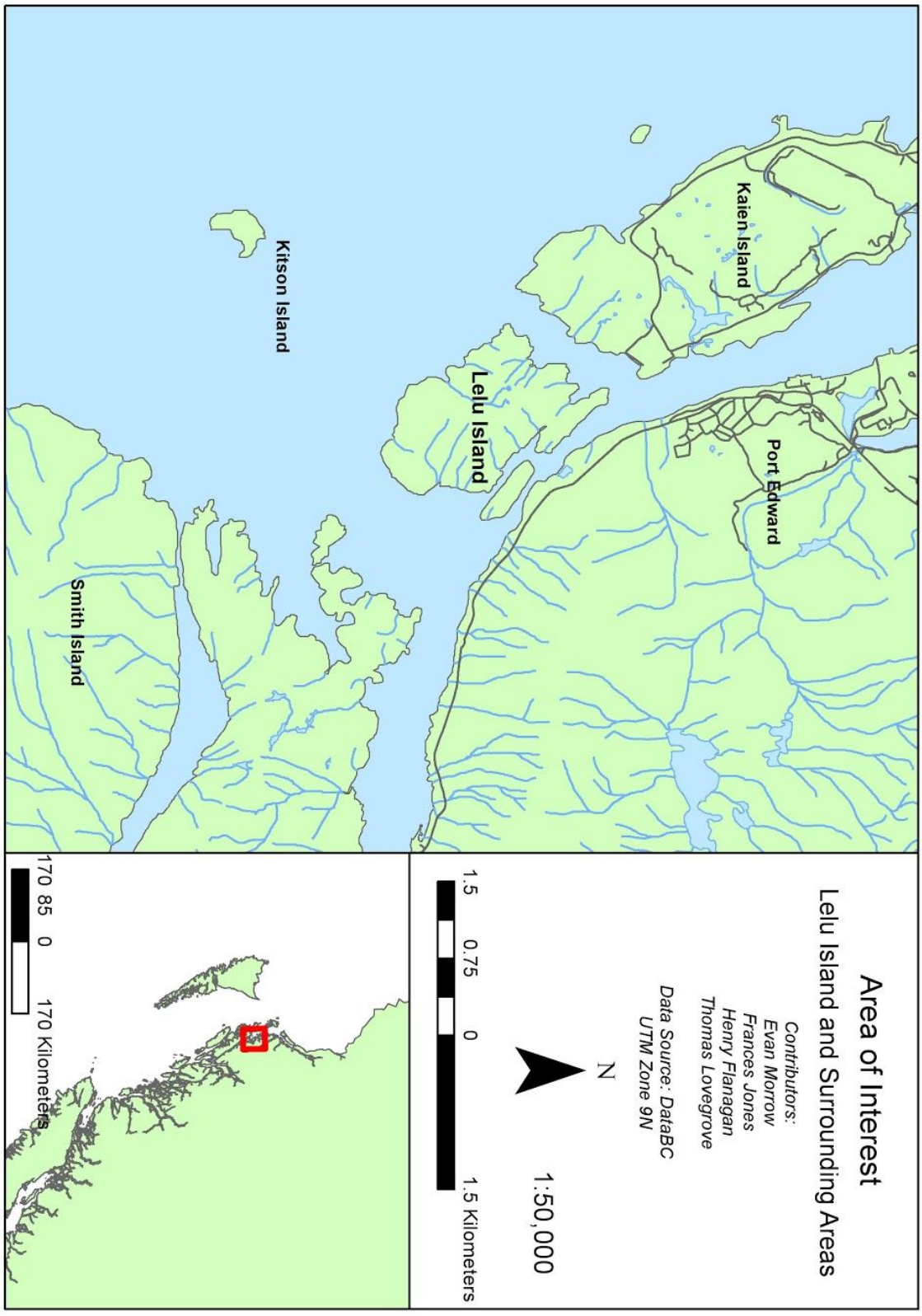
## II. Maps and Figures


Area of Interest
Lelu Island and Surrounding Areas
Contributors:
Evan Morrow
Frances Jones
Henry Flanagan
Thomas Lovegrove
Data Source: DataBC
UTM Zone 9N
N
1:50,000
1.5 0.75 0 1.5 Kilometers
170 85 0 170 Kilometers
Kaien Island
Port Edward
Lelu Island
Kitson Island
Smith Island

# Lelu Island and the Surrounding Critical Habitat

# Infrastructure and Habitats at Risk

## From Potential LNG Facility Disaster

Rivers at Risk
Paved Roads at Risk
Riparian Habitat at Risk
Endangered Species Habitat at Risk
Flora Banks
Proposed Facility
Proposed Pipeline
Maximum Hazard Area

*Data Sources: UBC Geography G:Drive, DataBC, BC Oil and Gas Commision Open Data Portal*

*Projection: UTM Zone 9N*

N

1:40,000

1 0.5 0 1 Kilometers

Fig 1: Model for Proposed Lelu Island Facility looking west (Pacific Northwest LNG)

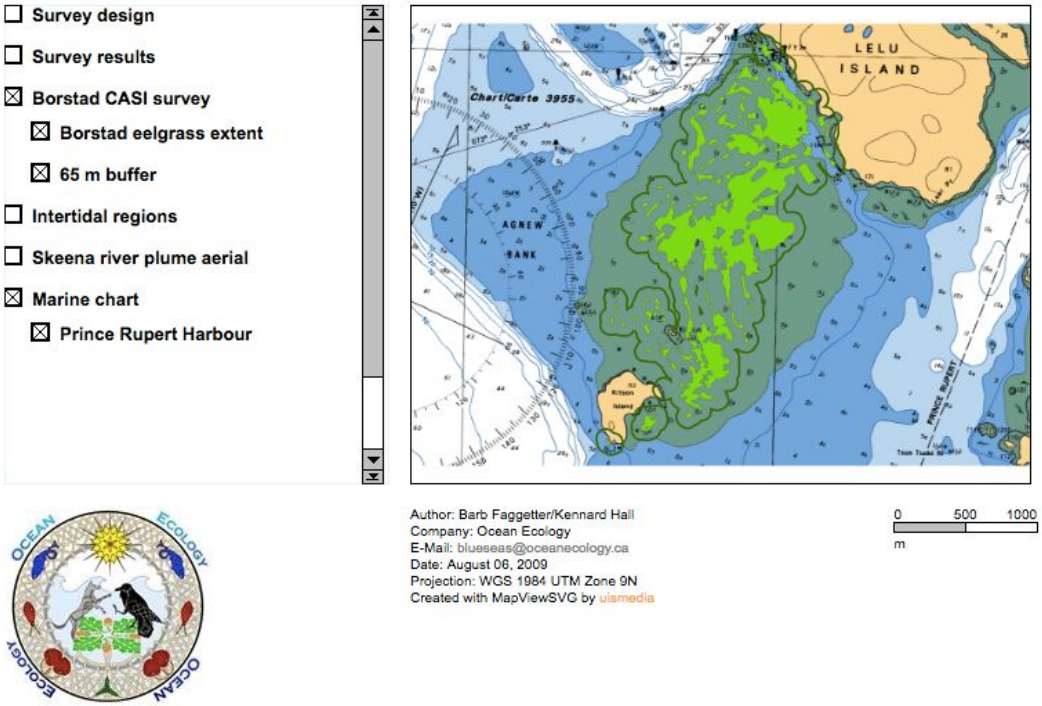



Fig 2: Ocean Ecology Flora Banks Study (Ocean Ecology)

## III. Flow chart