

8.0 ACOUSTIC ENVIRONMENT

The assessment of potential effects of the Project on the acoustic environment is provided in Section 8 of the EIS. This section of the EIS Addendum provides:

- An update to the potential project and cumulative effects on the Acoustic Environment VC as a result of the project changes
- An updated list of all mitigation measures for the Acoustic Environment VC
- Conclusions on the assessment of effects on the Acoustic Environment VC, taking into account project changes and the requested additional information.

Table 8-1 lists the documents applicable to the acoustic environment submitted by PNW LNG as part of the environmental assessment process to date and identifies if information is either *updated by EIS Addendum*, *superseded*, *not relevant*, or *not affected* by information in the EIS Addendum. The following sections of the EIS Addendum contain information that updates the documents classified as *updated by EIS Addendum* in Table 8-1. Figure 8-1 to Figure 8-10 have been updated from those provided in the EIS to reflect the project changes and any other applicable updates.

Table 8-1 Status of Previously Submitted Documents

Document Name	Status
Section 8 and Appendix D (Acoustic Environment TDR) of the EIS (February 2014)	Updated by EIS Addendum
Responses to the Working Group (June 2014)	Not affected

8.1 PROJECT EFFECTS ASSESSMENT UPDATE

8.1.1 Baseline Conditions

Baseline conditions described in the EIS and the acoustic environment Technical Data Report (TDR) are applicable to the marine terminal design mitigation. The design mitigation results in the relocation of the marine terminal berth by about 510 m from the location described in the EIS; however, the Acoustic Environment baseline conditions at the new location are similar to those originally presented in the EIS and TDR.

8.1.2 Effects Assessment

Project noise emissions will result in adverse effects on the acoustic environment. Potential effects of the marine terminal design mitigation are similar to those reported in Section 8 and Appendix D of the EIS. The following sections describe changes to the assessment of effects on the acoustic environment due to the project changes. Figure 8-1 illustrates the spatial boundaries including the local assessment area (LAA), regional assessment area (RAA), noise sensitive receptors, and the three potential shipping routes (central, north, and south) for this VC.

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8.1.2.1 Construction

In the EIS, the construction noise assessment considered three different scenarios within the five year project construction phase. Scenarios are summarized in Table 8-2.

Table 8-2 Construction Noise Assessment Model Scenarios Presented in the EIS

Scenario	Timeline	Activity Description
1	First 6 months of Year 1	<ul style="list-style-type: none"> • Administration and bridge area – clearing and site preparation • Pioneer dock – marine construction, piling, dredging • Bridge – marine construction and piling • Tug boat traffic to and from Pioneer dock.
2	Second 6 months of Year 1	<ul style="list-style-type: none"> • Administration area – site preparation • Liquefied natural gas (LNG) facility area – site preparation • Materials off-loading facility (MOF) – marine construction, piling, and dredging • Tug boat traffic to and from MOF.
3	Peak Year – Year 3	<ul style="list-style-type: none"> • Administration area – land-based construction • LNG facility area – land-based construction • Marine terminal – marine construction, piling, and dredging • Tug boat traffic to and from marine terminal.

The marine terminal design mitigation will eliminate all dredging at the marine terminal and associated noise emissions from dredging equipment. It will also reduce pile driving activities for the trestle, resulting in reduced noise effects during construction Scenario 3. The results provided in the EIS and the revised results for Scenario 3 are summarized in Table 8-3. Figure 8-2 to Figure 8-4 present the noise effect in sound contours for the three construction scenarios. The final column presents the net change in sound level at each receptor due to the marine terminal design mitigation. The net change results shown in negative values indicate that the predicted levels are expected to be less due to the marine terminal design mitigation.

This change, however, is predicted to be negligible and does not change the potential effects, residual effects identified, or the characterization of the residual adverse effects (i.e., context, magnitude, extent, duration, frequency, reversibility) or predicted significance of those effects (i.e., remains not significant) for the project construction phase described in Section 8 of the EIS (see Table 8-10). Changes to the information presented in Table 8-10 (compared to Table 8-20 in the EIS) are identified with underlined text.

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Table 8-3 Construction Noise Modelling Results

ID	Receptor Description	Scenario 3 (EIS 2014)		Scenario 3 (Marine Terminal Design Mitigation)		Net change
		Day L _d (dBA)	Night L _n (dBA) ^a	Day L _d (dBA)	Night L _n (dBA) ^a	
7	Port Edward Community School	44.9	N/A	44.9	N/A	0.00
19	Residence	47.0	N/A	47.0	N/A	0.00
20	Residence	47.6	N/A	47.6	N/A	0.00
21	Residence	50.6	N/A	50.6	N/A	0.00
22	Kitson Island Campsite	42.3	N/A	42.3	N/A	0.00
29	ICEC Terminals	36.6	N/A	36.6	N/A	0.00
30	Port Edward –Commercial	45.6	N/A	45.6	N/A	0.00
31	Cannery Museum and Village	32.1	N/A	32.0	N/A	-0.10
34	Ridley Island West Side	37.2	N/A	37.1	N/A	-0.10
37	Ridley Island	41.0	N/A	40.9	N/A	-0.10
38	Kinahan Islands	24.4	N/A	24.3	N/A	-0.10
42	Digby Island	25.8	N/A	25.7	N/A	-0.10
43	Smith Island	40.8	N/A	40.7	N/A	-0.10
44	Kinahan Islands 2	28.0	N/A	27.9	N/A	-0.10

NOTE:

^a Construction phase activities will be conducted during daytime period only

N/A – not applicable

dBA – A-weighted decibel level

L_d – daytime equivalent sound level

L_n – nighttime equivalent sound level

The change in percentage highly annoyed (%HA) results for the construction phase is summarized in Table 8-4. The change in %HA is below 6.5% for all receptors. The table lists construction phase modelling results and calculated change in %HA for each receptor. The results represent the highest predicted level out of the three construction Scenarios 1, 2, and 3. Project changes will only affect results for construction Scenario 3. Results for construction Scenarios 1 and 2 remain the same. The highest predicted level at most receptors are from scenarios 1 and 2, only results for Receptors 22 and 44 are from construction scenario 3. There is 0 and -0.1 dB net change in predicted daytime sound level result at Receptor 22 and 44, respectively. Subsequently, there is no change in the %HA results in comparison to the results presented in the EIS.

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Table 8-4 Construction Phase Compliance with HC Noise Limits

ID	Receptor Description	Day L _d ^a (dBA)	Night L _n (dBA)	Day-Night L _{dn} (dBA)	Change in %HA	Exceeds Change in %HA limit of 6.5%
7	Port Edward Community School	52.3	N/A	50.3	1.0	No
19	Residence	53.0	N/A	51.0	1.4	No
20	Residence	54.4	N/A	52.4	1.8	No
21	Residence	61.6	N/A	59.6	5.9	No
22	Kitson Island Campsite	42.3	N/A	50.3	0.6	No
29	ICEC Terminals	39.9	N/A	37.9	0.1	No
30	Port Edward –Commercial	54.5	N/A	52.5	1.9	No
31	Cannery Museum and Village	34.2	N/A	32.2	0.0	No
34	Ridley Island West Side	41.4	N/A	49.4	0.5	No
37	Ridley Island	43.7	N/A	51.7	0.8	No
38	Kinahan Islands	26.5	N/A	34.5	0.0	No
42	Digby Island	28.1 ^b	N/A	36.1	0.0	No
43	Smith Island	44.3	N/A	42.3	0.2	No
44	Kinahan Islands 2	27.9 ^b	N/A	35.9	0.0	No

NOTE:

^a highest predicted results from construction Scenarios 1, 2, and 3

^b predicted results from Scenario 3

L_{dn} – daytime and nighttime equivalent sound level

8.1.2.2 Operations

During the operations phase, noise emissions from marine vessels at the terminal will be the same, but in a slightly different location. The central shipping route has been revised with the updated alignment, located further south than the central route presented in the EIS. Figure 8-1 shows the three potential shipping route alignments.

Noise effects on the acoustic environment during operations are shown in Table 8-5 and Table 8-6 below.

The modelling results with the marine terminal design mitigation have been revised. A comparison of the previous and updated results is shown in Table 8-5. The net change in sound level at each receptor due to the marine terminal design mitigation is shown in Table 8-6. The net change results in negative values which indicate that the predicted levels are expected to be less due to the design mitigation. Figure 8-5 to Figure 8-10 present the noise effect in sound contours for the three potential shipping routes.

The net change in noise level at Kinahan Islands (R38), Lucy Islands (R40), Triple Island (R41), and Digby Island (R42) has increased due to the updated central shipping route. However, noise effects at these four receptor locations meet the noise threshold (i.e., BC OGC and Health Canada). In addition, the modelled sound level results at all four

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receptors are below the baseline daytime and nighttime equivalent sound level (L_{dn}). A low magnitude classification is determined for all four receptors, the same results as presented in the EIS.

This marine terminal design mitigation does not change the potential effects, residual effects identified, or the characterization of the residual adverse effects (i.e., context, magnitude, extent, duration, frequency, reversibility) or predicted significance of those effects (i.e., remains not significant) for the project operations phase described in Section 8 of the EIS (see Table 8-10). Changes to the information presented in Table 8-10 (compared to Table 8-20 in the EIS) are identified with underlined text.

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Table 8-5 Comparison of Operations Phase Noise Prediction Results

ID	Receptor Description	Previous Design						New Design					
		LNG Facility and Southern Shipping Route		LNG Facility and Northern Shipping Route		LNG Facility and Central Shipping Route		LNG Facility and Southern Shipping Route		LNG Facility and Northern Shipping Route		LNG Facility and Central Shipping Route	
		Day L _d (dBA)	Night L _n (dBA)	Day L _d (dBA)	Night L _n (dBA)	Day L _d (dBA)	Night L _n (dBA)	Day L _d (dBA)	Night L _n (dBA)	Day L _d (dBA)	Night L _n (dBA)	Day L _d (dBA)	Night L _n (dBA)
7	Port Edward Community School	39.9	40.0	39.9	40.0	40.0	40.0	39.9	39.9	39.9	39.9	39.9	39.9
19	Residence	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5
20	Residence	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1
21	Residence	44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9
22	Kitson Island Campsite	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.7	39.8	39.8	39.8
29	ICEC Terminals	32.7	32.7	32.7	32.8	32.7	32.8	32.6	32.6	32.6	32.6	32.6	32.6
30	Port Edward –Commercial	47.1	47.1	47.1	47.1	47.1	47.1	47.1	47.1	47.1	47.1	47.1	47.1
31	Cannery Museum and Village	33.5	33.6	33.5	33.6	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5
34	Ridley Island West Side	33.1	33.1	33.1	33.1	33.1	33.1	33	33	33.0	33.0	33.0	33.0
37	Ridley Island	36.1	36.1	36.1	36.1	36.0	36.1	35.9	35.9	35.9	35.9	35.9	35.9
38	Kinahan Islands	23.6	23.9	25.1	26.0	26.0	27.2	23.6	23.9	25.2	26.2	23.7	24.1
39	Rachael Islands	16.6	18.8	9.1	11.4	14.0	16.2	16.6	18.8	9.2	11.4	18.0	20.2
40	Lucy Islands	8.4	10.6	19.7	21.9	13.2	15.4	8.4	10.6	19.6	21.8	12.2	14.4
41	Triple Island	19.7	21.9	19.4	21.6	19.7	21.9	19.7	21.9	18.8	21.0	19.1	21.3
42	Digby Island	25.5	25.6	25.8	26.1	25.7	26.0	25.3	25.4	25.7	25.9	25.4	25.5
43	Smith Island	41.3	41.3	41.3	41.3	41.3	41.3	41.3	41.3	41.3	41.3	41.3	41.3
44	Kinahan Islands 2	27.4	27.6	27.3	27.5	27.4	27.6	27.4	27.6	27.4	27.6	27.6	28.0
45	Rachael Islands 2	20.6	22.8	7.8	10.0	12.0	14.2	20.6	22.8	7.9	10.1	14.7	17.0

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Table 8-6 Net Change in Operations Phase Noise Prediction Results

ID	Description	Net Change from Previous Design ^a					
		LNG Facility and Southern Shipping Route		LNG Facility and Northern Shipping Route		LNG Facility and Central Shipping Route	
		Day L _d (dBA)	Night L _n (dBA)	Day L _d (dBA)	Night L _n (dBA)	Day L _d (dBA)	Night L _n (dBA)
7	Port Edward Community School	0.00	0.10	0.00	0.10	0.10	0.10
19	Residence	0.00	0.00	0.00	0.00	0.00	0.00
20	Residence	0.00	0.00	0.00	0.00	0.00	0.00
21	Residence	0.00	0.00	0.00	0.00	0.00	0.00
22	Kitson Island Campsite	0.00	0.00	0.10	0.00	0.00	0.00
29	ICEC Terminals	0.10	0.10	0.10	0.20	0.10	0.20
30	Port Edward –Commercial	0.00	0.00	0.00	0.00	0.00	0.00
31	Cannery Museum and Village	0.00	0.10	0.00	0.10	0.00	0.00
34	Ridley Island West Side	0.10	0.10	0.10	0.10	0.10	0.10
37	Ridley Island	0.20	0.20	0.20	0.20	0.10	0.20
38	Kinahan Islands	0.00	0.00	-0.10	-0.20	2.30	3.10
39	Rachael Islands	0.00	0.00	-0.10	0.00	-4.00	-4.00
40	Lucy Islands	0.00	0.00	0.10	0.10	1.00	1.00
41	Triple Island	0.00	0.00	0.60	0.60	0.60	0.60
42	Digby Island	0.20	0.20	0.10	0.20	0.30	0.50
43	Smith Island	0.00	0.00	0.00	0.00	0.00	0.00
44	Kinahan Islands 2	0.00	0.00	-0.10	-0.10	-0.20	-0.40
45	Rachael Islands 2	0.00	0.00	-0.10	-0.10	-2.70	-2.80

Note: ^a Positive value indicates an increase while negative value indicates a decrease when comparing to the results in the EIS.

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The change in %HA results for the operations phase is summarized in Table 8-7. The change in %HA is below 6.5% for all receptors. The table lists operations phase modelling results and calculated change in %HA for each receptor. The results presented for the operations case represent the highest predicted level out of the three potential shipping routes at all receptors. The highest predicted level is inclusive of the noise contribution from the LNG facility, which remains the same for all the three potential shipping routes. The change in %HA at all receptors is below the limit of 6.5%. The project changes result in slightly lower (i.e., 0.1 %) change in %HA result at receptors 7, 34, 37, and 38. A marginal increase (i.e., 0.1%) in the “change in %HA” value occurs at receptor 44.

Table 8-7 Operations Phase Compliance with HC Noise Limits

ID	Receptor Description	Day L _d ^a (dBA)	Night L _n (dBA)	Day-Night L _{dn} (dBA)	Change in %HA	Exceeds Change in %HA limit of 6.5%
7	Port Edward Community School	39.9	39.9	51.3	1.2 ^a	No
19	Residence	41.5	41.5	52.9	2.0	No
20	Residence	42.1	42.1	53.5	2.2	No
21	Residence	44.9	44.9	56.3	3.6	No
22	Kitson Island Campsite	39.8	39.8	51.2	5.2	No
29	ICEC Terminals	32.6	32.6	44.0	0.4	No
30	Port Edward – Commercial	47.1	47.1	58.5	5.0	No
31	Cannery Museum and Village	33.5	33.5	44.9	0.4	No
34	Ridley Island West Side	33.0	33.0	44.4	1.4 ^a	No
37	Ridley Island	35.9	35.9	47.3	2.6 ^a	No
38	Kinahan Islands	25.2	26.2	37.5	0.3 ^a	No
39	Rachael Islands	18.0	20.2	31.4	0.1	No
40	Lucy Islands	19.6	21.8	33.0	0.1	No
41	Triple Island	19.7	21.9	33.1	0.1	No
42	Digby Island	25.7	25.9	37.3	0.3	No
43	Smith Island	41.3	41.3	52.7	2.0	No
44	Kinahan Islands 2	27.6	28.0	39.4	0.5 ^b	No
45	Rachael Islands 2	20.6	22.8	34.0	0.1	No

NOTE:

^a decrease by the value of 0.1% when comparing to EIS results

^b increase by the value of 0.1% when comparing to EIS results

8.2 CUMULATIVE EFFECTS ASSESSMENT UPDATE

The cumulative effects assessment provided in the EIS was reviewed with respect to the project changes. The update is summarized in this section.

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The marine terminal design mitigation results in negligible changes to residual adverse effects identified in the EIS for project construction and operations; therefore, there is no change to the cumulative effects assessment. The changes in the construction schedule for the Project are not expected to result in a material change to the assessment of residual cumulative effects on the Acoustic Environment. Conclusions on significance of cumulative effects on the Acoustic Environment are based primarily on spatial overlaps, rather than temporal overlaps; therefore, changes in the construction schedule do not affect these conclusions.

The construction camp location has changed and will not be owned or operated by PNW LNG. Workers will be transported to and from Lelu Island via designated shuttles. The cumulative effects are limited to the shuttle bus transportation noise effect. At peak construction, the camp will accommodate up to 4,500 workers/ day. A traffic noise model was established to predict the traffic noise effect for residential receptors along Skeena Drive close to Lelu Island. The traffic noise model predicted traffic noise effect for the following two scenarios:

- Scenario 1: Baseline
- Scenario 2: Camp shuttle bus noise contribution only.

The Scenario 1 noise model represents the baseline condition. It was based on the recent traffic volume along Skeena Drive. The MOTI AADT data indicate the Annual Average Daily Traffic Volume (AADT) is approximately 1,498 vehicles per day along Skeena Drive. The model assumed daytime and nighttime traffic volume split is 90% and 10%, respectively.

The Scenario 2 noise model was based on the following assumptions:

- Two shift changes will occur during the daytime period (7:00 AM to 10:00 PM)
- 100 shuttle bus round trips per day will be required between the camp and Lelu Island during the shift changes
- Shuttle buses will operate for two hours during each shift change for a total of 4 hours per daytime period.

The noise model predicts a daytime equivalent sound level (L_d) and an hourly equivalent sound level ($L_{eq, 1hr}$). The L_d represents the equivalent sound level during the daytime period. The $L_{eq, 1hr}$ represents the equivalent sound level for an hourly period during a shift change period. The prediction results for Receptors 19, 20, and 21 (residences along Skeena Drive closest to Lelu Island) are presented in Table 8-8 for both scenarios. The cumulative sound level is presented in the table to show the combined noise effect of the baseline and bus shuttle.

Table 8-8 Traffic Noise Assessment Prediction Results

ID	Scenario 1	Scenario 2		Cumulative Sound level
	L_d (dBA)	L_d (dBA)	$L_{eq, 1hr}$ (dBA)	L_d (dBA)
19	40.5	32.5	38.3	41.1
20	37.0	28.9	34.7	37.6
21	47.0	39.0	44.8	47.6

NOTE:

$L_{eq, 1hr}$ – hourly equivalent sound level

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The predicted shuttle bus only noise contribution L_d levels at all three receptors are at least 8 dB below the existing traffic noise effect. Cumulative effect from the shuttle bus noise contribution is less than 3 dB for all three receptors. For example, cumulative sound level at receptor 19 is 41.1 dBA (A-weighted decibel level), based on the logarithmic sum of 40.5 dBA (baseline) and 32.5 dBA (shuttle bus only). The net increase is 0.6 dBA (41.1 dBA minus 40.5 dBA). Noise effect during the construction worker shift change is expected to be of low magnitude. The prediction is conservative based on the following factors:

7. The rail traffic noise effect is not considered in the existing scenario. The existing L_d level is expected to be higher if the rail traffic noise effect is included
8. The assessment was based on peak workload during a 6 month period. The average shuttle frequency during the 46 month lifespan of the accommodation camp is 57 shuttle round trips per day, almost half of the value of 100 used for peak period
9. The highest predicted $L_{eq,1hr}$ level at Receptor 21 is 2 dB below the predicted existing level of 47 dBA. The existing level is expected to be higher if hourly traffic volume during morning or evening rush hours are used.

Traffic noise associated with the change in location of the accommodation camp is not predicted to change the potential adverse cumulative effects, the mitigation measures, or the residual adverse cumulative effects identified in the EIS for the acoustic environment.

The characterization of the residual adverse cumulative effects and the determination of significance of those effects remain the same. A summary of cumulative residual environmental effects on the acoustic environment is presented in Table 8-11.

8.3 RESPONSES TO THE OUTSTANDING INFORMATION REQUESTS

There is no outstanding information for the acoustic environment VC.

8.4 MITIGATION

8.4.1 Changes to Mitigation Measures Presented in the EIS

Based on project changes to the Project and the feedback received during the environmental assessment process, the set of mitigation measures originally presented in the EIS to address potential effects to the Acoustic Environment has been updated. The following mitigation measure has been added to the list of mitigation measures initially included in the EIS:

- If the assumptions used in the assessment are changed (i.e., shift change occurs during nighttime period) PNW LNG will update the traffic management plan to include measures to reduce effects of traffic noise from transportation of workers on the community.

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The following mitigation measure has been removed to the list of mitigation measures initially included in the EIS because the accommodation camp will no longer be owned or operated by PNW LNG:

- The provision of electrical power supplied by the BC Power and Hydro Authority to the construction site on Lelu Island is under active investigation. Timely provision of power from this utility may negate the need for on-site diesel powered electrical power generators. If diesel power generators are required, enclosed units equipped with ventilation, combustion air inlet, and gas exhaust silencers will be considered to reduce any sleep disturbance issue for workers.

8.4.2 Complete List of Current Mitigation Measures

All of the technically and economically-feasible mitigation measures currently being presented by PNW LNG to address potential effects to the Acoustic Environment are listed below. This includes those originally presented in the EIS that remain relevant, as well as those that have been revised or added as a result of feedback received during the environmental assessment process or as a result of the project changes. By implementing this full set of mitigation measures, PNW LNG is confident that the Project will not result in significant adverse effects to the Acoustic Environment.

A Noise, Vibration, and Ambient Light Management Plan (Appendix J) will be implemented across all phases of the Project. Additional phase-specific mitigations are detailed below.

8.4.2.1 Construction Phase

The following mitigation measures will be implemented to address noise effects during construction and decommissioning activities including potential for significant effects, as recommended in the BC Oil and Gas Commission (BC OGC) Noise Guideline:

- Nighttime construction activity will be limited to low noise activities (no impact type pile driving or blasting activities)
- All construction equipment with gas or diesel engines are fitted with a muffler system (consider alternatives such as hydraulic or electric controlled units where feasible)
- Vibro-hammer piling equipment will be used where conditions permit for piling operations. Piling is expected during the construction of the pioneer dock and MOF in the first year and the marine terminal during year 2 to 5
- Equipment enclosure doors will be kept closed as much as possible
- Exhaust vents will be equipped with commercially available silencers
- A noise complaint mechanism will be implemented to address any noise complaints in a timely manner during all phases of the Project
- If the assumptions used in the assessment are changed (i.e., shift change occurs during nighttime period) PNW LNG will update the traffic management plan to include measures to reduce effects of traffic noise from transportation of workers on the community
- The provision of electrical power supplied by the BC Power and Hydro Authority to the construction site on Lelu Island is under active investigation. Timely provision of power from this utility may negate the need for on-site diesel powered electrical power generators. If diesel power generators are required, enclosed units equipped with ventilation, combustion air inlet, and gas exhaust silencers will be considered to reduce any sleep disturbance issue for workers.

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8.4.2.2 Operations Phase

A combination of the following mitigation measures will be implemented to meet regulatory limits. The measures will address potential noise effects during the operations phase:

- Large machinery such as gas turbine generators and refrigerant compressors will be located in enclosure with minimum acoustic sound transmission loss rating
- Inlet and exhaust silencers will be installed on gas turbines if required to meet regulatory limits
- Acoustic performance of noise emission equipment will be specified to manufacturers or suppliers (not exceeding 85 dBA at 1 m from equipment and 120 dBA for emergencies)
- Building doors and windows will be closed.

Information on building enclosures, acoustic performance specification, and silencers are discussed in the following three subsections.

8.4.2.2.1 Operations Phase – Building Enclosures

Some equipment will be enclosed in buildings. Noise sources within buildings transmit sound to the outside environment through the building shell (e.g., walls and roof), as well as through ventilation openings and doorways. The amount of noise that passes through the building shell depends on the sound transmission loss through the building shell. The technical specification of the building enclosure requirements are summarized in the Acoustic Environment TDR (Appendix D of the EIS).

8.4.2.2.2 Operations Phase - Inlet and Exhaust Silencers

If proven necessary when the detailed design information is available for the LNG facility, the equipment listed in Table 8-9 should be fitted with inlet or exhaust silencer.

Table 8-9 Equipment with Inlet and Exhaust Silencer

ID	Unit Area	Equipment Description	PWL (dBA)
A-5120A/B/C/D/E/F	51	Power Generation GT Combustion Air Inlet	101
F-5101A/B/C/D/E/F	51	Power Generation HRSG Exhaust Stack	90
KT1-1601A/B	16	LP MP HP, and PR compressor GT exhaust stack	103
KT1-1601A/B	16	LP MP HP, and PR compressor GT air inlet	100
1-12-MB01-MJ01-M	19	Thermal oxidizer air blower inlet	92
73-MJ06-M	73	Propane return vapor blower motor	92
1-16-MJ01B-J07A-M	16	PR GT exhaust frame blower motor	98
N/A	N/A	LNG vessel main engine exhaust	102
N/A	N/A	LNG vessel auxiliary engine exhaust	90

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8.4.2.2.3 Operations Phase - Acoustic Performance Specifications

The operational sound levels listed in the acoustic environment TDR (Appendix D of the EIS) are the target equipment sound level or acoustical specification used in the acoustic modelling, and it is assumed that these acoustical specifications can be achieved by the suppliers. The goal for acoustic specification on each piece of equipment will be based on ALARA (as low as reasonably achievable); if this is not possible, supplemental mitigation measures will be considered. However, detailed mitigation design for some sources is not practical until the final selection of equipment is determined.

A noise complaint mechanism will be implemented to address any noise complaints in a timely manner during the operations phase of the Project. The BC OGC noise guideline provides a Noise Complaint Investigation Form (Appendix 2 of the guideline). For further reference, the Alberta provincial noise guideline Alberta Utilities Commission Rule 012: Noise Control provides a sample framework to handle noise complaint issue. The framework includes general investigation procedure and sample investigation form.

8.5 CONCLUSION

Based on the assessment of changes in the potential project and cumulative effects on the acoustic environment, there are no changes to the potential adverse effects, the mitigation measures, or the characterization of residual adverse effects (i.e., context, magnitude, extent, duration, frequency, reversibility) identified in the EIS.

Because there is not expected to be an increase in the existing ambient acoustic environment such that the permissible sound levels for the daytime and the nighttime at a receptor (as determined by the guidance of the BC OGC) are exceeded after mitigation has been implemented, or the noise effects exceeds the Health Canada guideline prescribed limits, the adverse effects on the acoustic environment are expected to be not significant.

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Table 8-10 Characterization of Residual Effects for Acoustic Environment

Project Phase	Mitigation Measures	Residual Effects Characterization						Likelihood	Significance	Confidence	Follow-up and Monitoring
		Context	Magnitude	Extent	Duration	Reversibility	Frequency				
Increase in Noise Levels											
Construction	<ul style="list-style-type: none"> Nighttime construction activities will be limited to low noise activities Pile driving using vibro-hammer where feasible Noise, Vibration, and Ambient Light Management Plan Use of building enclosures and/or silencers on large machinery and equipment A policy will be implemented to keep windows and doors closed when not in use Implementation of a noise complaint mechanism Specification of acoustic performance of noise emission equipment <u>If workers shift change occurs during nighttime period, the traffic management plan will be updated to include measures to reduce effects of traffic noise from transportation of workers on the community.</u> 	M	M	RAA	MT	R	C	H	N	M	None
Operations		M	M	RAA	MT	R	C				
Decommissioning		M	M	RAA	MT	R	C				
Residual effects for all phases		M	M	RAA	MT	R	C				

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Project Phase	Mitigation Measures	Residual Effects Characterization						Likelihood	Significance	Confidence	Follow-up and Monitoring
		Context	Magnitude	Extent	Duration	Reversibility	Frequency				
<p>KEY</p> <p>CONTEXT:</p> <p>L = Low resilience: occurs in a fragile ecosystem and/or highly disturbed environment</p> <p>M = Moderate resilience: occurs in a stable ecosystem and/or moderately disturbed environment</p> <p>H = High resilience: occurs in viable ecosystem and/or undisturbed environment</p>	<p>MAGNITUDE:</p> <p>Negligible (N) = noise from the Project is imperceptible (10 db or more below) when compared to the baseline sound level.</p> <p>Low (L) = noise from the Project is barely perceptible (between 0 to 10 dB below) when compared to the baseline sound level.</p> <p>Moderate (M) = noise from the Project is perceptible (equal to or higher) when compared to the baseline sound level.</p> <p>High (H) = project noise effect exceeds the applicable guideline (BC OGC and HC noise limits).</p> <p>EXTENT:</p> <p>LAA—effects extend into the LAA</p> <p>RAA—effects extend into the RAA</p>	<p>DURATION:</p> <p>Short-term (ST) = restricted to no more than 1 year</p> <p>Medium-term (MT) = Effect extends beyond 1 year but less than the duration of operations (estimated 30 years).</p> <p>Long-term (LT) = Effect extends beyond the project operations phase</p> <p>Permanent (P) = measurable parameter unlikely to recover to baseline</p> <p>FREQUENCY:</p> <p>Single event (SE) = effect occurs once</p> <p>Multiple irregular event (no set schedule) (MI) = effect occurs sporadically at irregular intervals throughout the project lifespan, but less than 7 days per year.</p> <p>Multiple regular event (MR) = effect occurs on a regular basis and at regular intervals throughout the project lifespan (more than 7 days per year, but less than 60 days per year).</p> <p>Continuous (C) = effect occurs continuously</p> <p>REVERSIBILITY:</p> <p>R = Reversible</p> <p>I = Irreversible</p>	<p>LIKELIHOOD OF RESIDUAL EFFECT:</p> <p><i>Based on professional judgment.</i></p> <p>L = Low probability of occurrence</p> <p>M = Medium probability of occurrence</p> <p>H = High probability of occurrence</p> <p>SIGNIFICANCE:</p> <p>S = Significant</p> <p>N = Not Significant</p> <p>CONFIDENCE AND RISK</p> <p><i>Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation, and assumptions made.</i></p> <p>L = Low level of confidence</p> <p>M = Moderate level of confidence</p> <p>H = High level of confidence</p>								

Table 8-11 Summary of Cumulative Residual Environmental Effects on Acoustic Environment

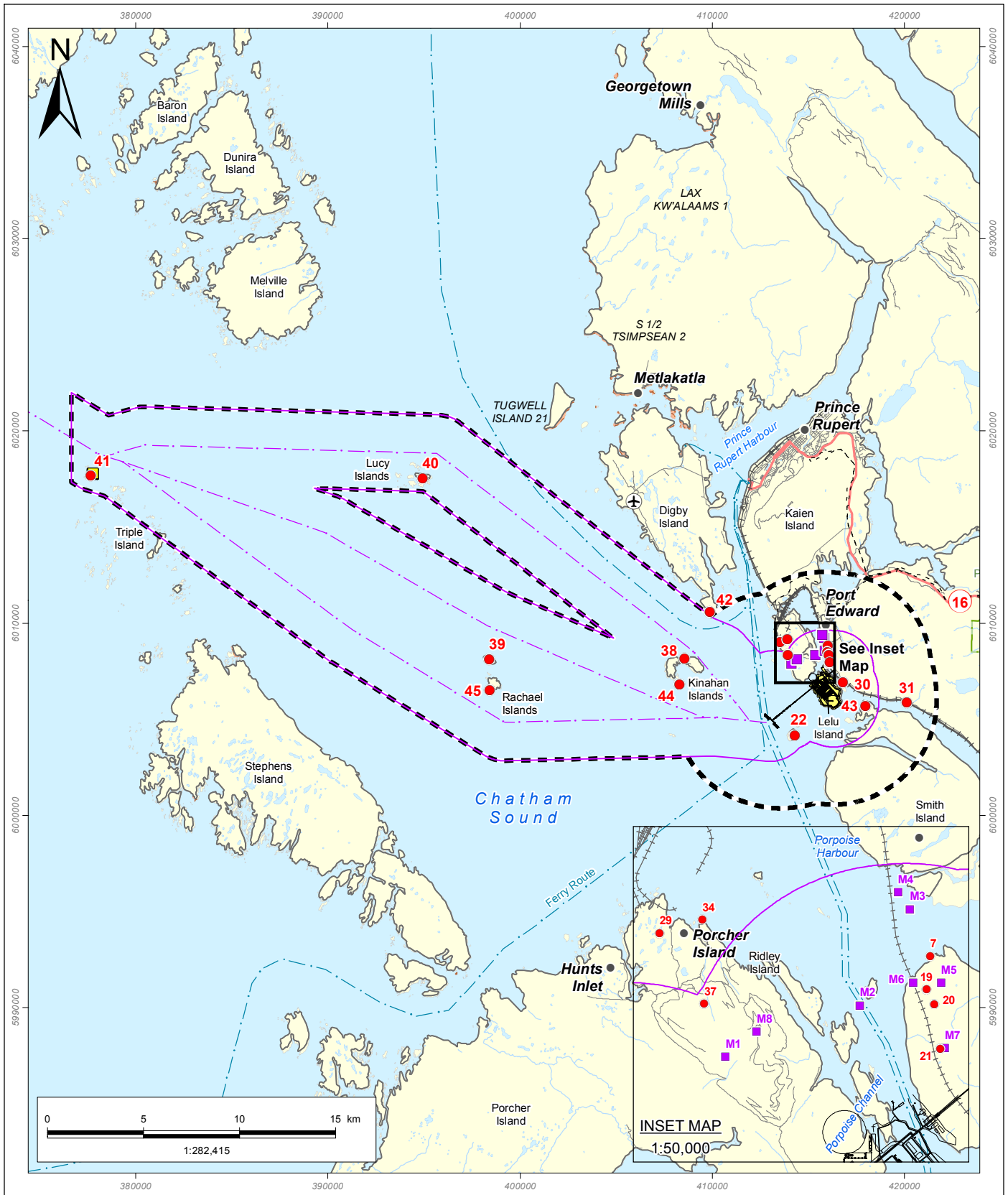
Cumulative Environmental Effect and Project Contribution	Other Projects, Activities and Actions	Mitigation and Compensation Measures	Residual Cumulative Effects Characterization						Likelihood	Significance	Prediction Confidence	Follow-up and Monitoring Programs	
			Context	Magnitude	Extent	Duration	Reversibility	Frequency					
Increase in ambient sound level Required parameters to quantify the project noise contribution, and for comparison to BC OGC and HC noise guidelines	Cumulative Effect with Project (future case) <ul style="list-style-type: none"> Noise is expected to attenuate to levels well below the background within 5 km of their source. 	<ul style="list-style-type: none"> Canpotex Potash Export Terminal CN Rail Line Fairview Container Terminal Phase I Fairview Container Terminal Phase II Northland Cruise Terminal Prince Rupert LNG Facility Prince Rupert Ferry Terminal Prince Rupert Grain Limited Ridley Terminals Inc. 	None	M	N -M	LAA and RAA	MT	R	C	H	N	M	None
	Project Contribution to Cumulative Effect (in RAA) <ul style="list-style-type: none"> Operations will result in residual effects of low to moderate magnitude Construction activities will result in negligible to moderate magnitude. 	Construction: <ul style="list-style-type: none"> Site preparation (land-based) Onshore construction Transportation of workers between the accommodation camp and Lelu Island Dredging Marine construction Disposal at sea Operational testing and commissioning Site clean-up and reclamation. Operations: <ul style="list-style-type: none"> LNG facility and supporting infrastructure on Lelu Island Marine terminal use Shipping. Decommissioning: <ul style="list-style-type: none"> Dismantling facility and supporting Infrastructure Dismantling of marine terminal Site cleanup and reclamation. 	See Table 8-10 Characterization of Residual Effects for Acoustic Environment	M	M	RAA	MT	R	C	H	N	M	None
KEY CONTEXT: L = Low resilience: occurs in a fragile ecosystem and/or highly disturbed environment M = Moderate resilience: occurs in a stable ecosystem and/or moderately disturbed environment H = High resilience: occurs in viable ecosystem and/or undisturbed environment		MAGNITUDE: Negligible (N) = noise from the Project is imperceptible (10 db or more below) when compared to the baseline sound level. Low (L) = noise from the Project is barely perceptible (between 0 to 10 dB below) when compared to the baseline sound level. Moderate (M) = noise from the Project is perceptible (equal to or higher) when compared to the baseline sound level. High (H) = project noise effect exceeds the applicable guideline (BC OGC and HC noise limits). EXTENT: LAA—effects extend into the LAA RAA—effects extend into the RAA		DURATION: Short-term (ST) = restricted to no more than 1 year Medium-term (MT) = Effect extends beyond 1 year but less than the duration of operations (estimated 30 years). Long-term (LT) = Effect extends beyond the project operations phase Permanent (P) = measurable parameter unlikely to recover to baseline FREQUENCY: Single event (SE) = effect occurs once Multiple irregular event (no set schedule) (MI) = effect occurs sporadically at irregular intervals throughout the project lifespan, but less than 7 days per year. Multiple regular event (MR) = effect occurs on a regular basis and at regular intervals throughout the project lifespan (more than 7 days per year, but less than 60 days per year). Continuous (C) = effect occurs continuously REVERSIBILITY: R = Reversible I = Irreversible						LIKELIHOOD: <i>Based on professional judgment.</i> L = Low probability of occurrence M = Medium probability of occurrence H = High probability of occurrence SIGNIFICANCE: S = Significant N = Not Significant CONFIDENCE AND RISK <i>Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation, and assumptions made.</i> L = Low level of confidence M = Moderate level of confidence H = High level of confidence			

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December 12, 2014

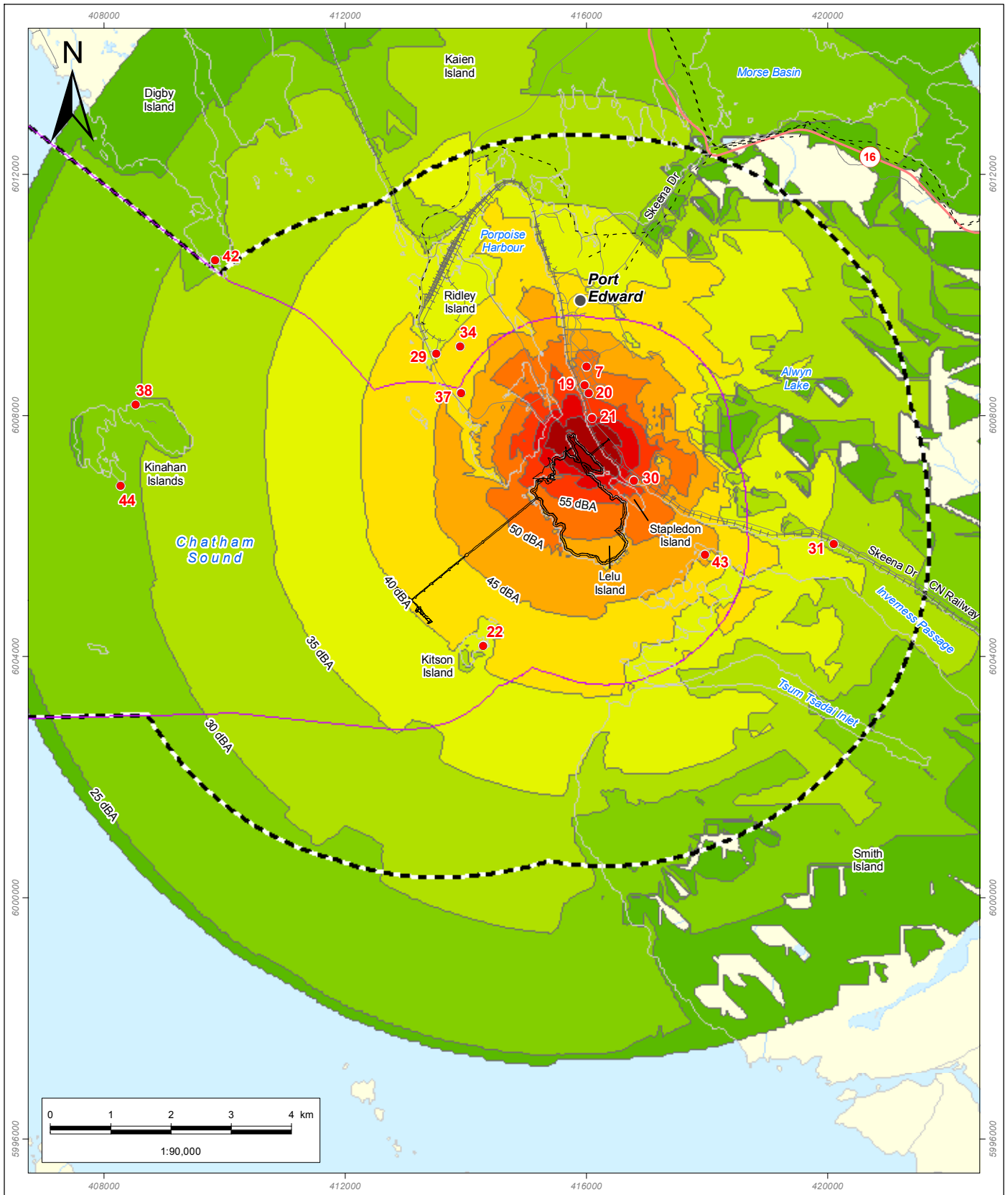
8.6 FIGURES

Please see the following pages.

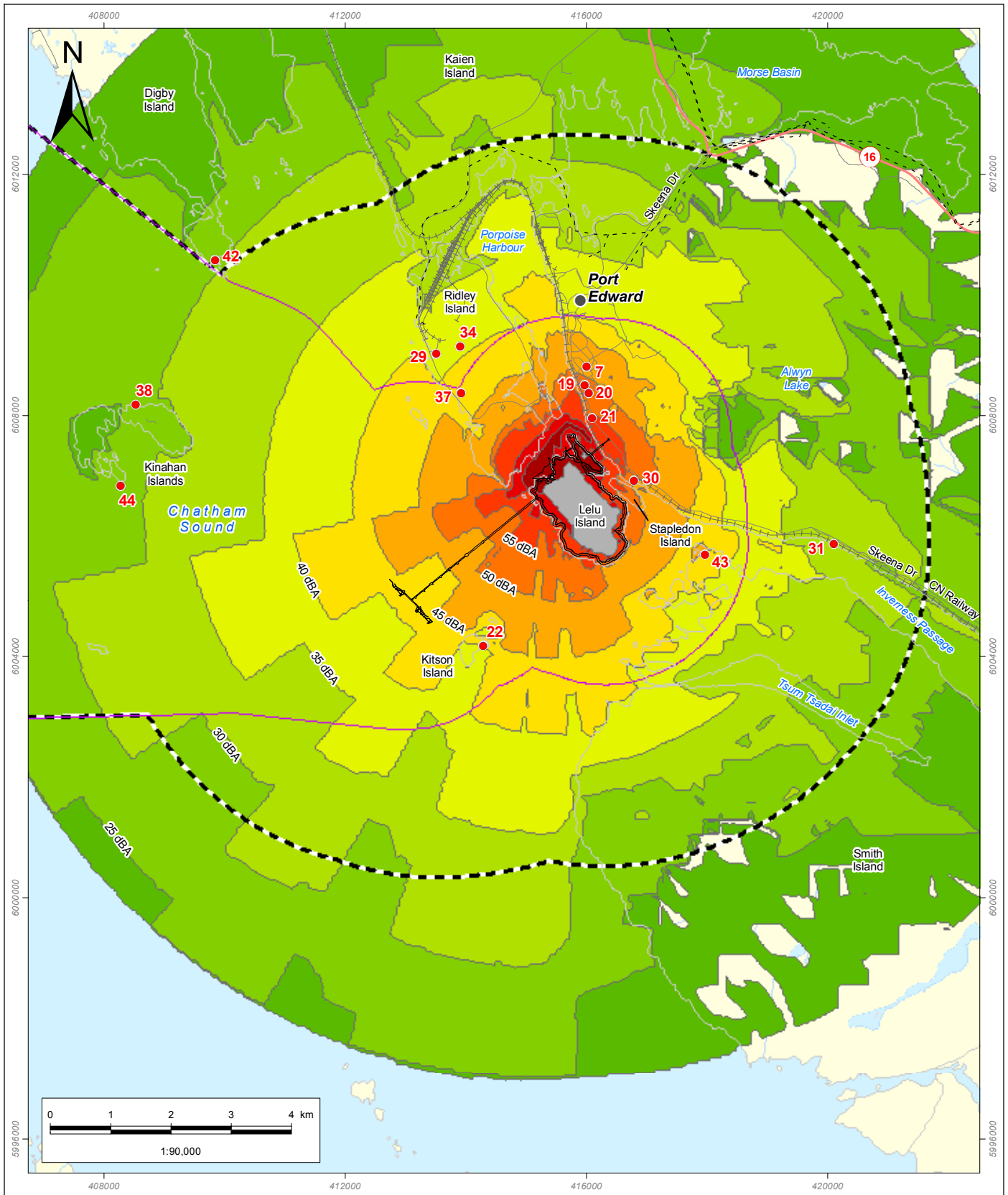


<ul style="list-style-type: none"> ■ Ambient Sound Monitoring Location ● Noise Sensitive Receptor Location Project Component Local Assessment Area Regional Assessment Area 	<ul style="list-style-type: none"> Airport ● City or Town Pilotage Station Electrical Power Transmission Line Ferry Route 	<ul style="list-style-type: none"> Highway Railway Secondary Road Watercourse Indian Reserve Waterbody 	<p>Pacific NorthWest LNG</p> <p>Acoustic Environment Local Assessment Area and Regional Assessment Area</p> <p><i>EIS ADDENDUM</i></p> <p><small>Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.; Worldview-2 Imagery. Imagery date: 2011.</small></p> <p><small>Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.</small></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">DATE: 19-NOV-14</td> <td style="width: 50%;">PROJECTION: UTM - ZONE 9</td> </tr> <tr> <td>FIGURE ID: 123110537-362</td> <td>DATUM: NAD 83</td> </tr> <tr> <td>DRAWN BY: K. POLL</td> <td>CHECKED BY: J. CHUI</td> </tr> </table>	DATE: 19-NOV-14	PROJECTION: UTM - ZONE 9	FIGURE ID: 123110537-362	DATUM: NAD 83	DRAWN BY: K. POLL	CHECKED BY: J. CHUI	<p>PREPARED BY:</p> <p style="text-align: center;"> Stantec</p> <p>PREPARED FOR:</p> <p style="text-align: center;"> Pacific NorthWest LNG</p> <p>FIGURE NO:</p> <p style="text-align: center; font-size: 24pt; font-weight: bold;">8-1</p>
DATE: 19-NOV-14	PROJECTION: UTM - ZONE 9									
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DRAWN BY: K. POLL	CHECKED BY: J. CHUI									

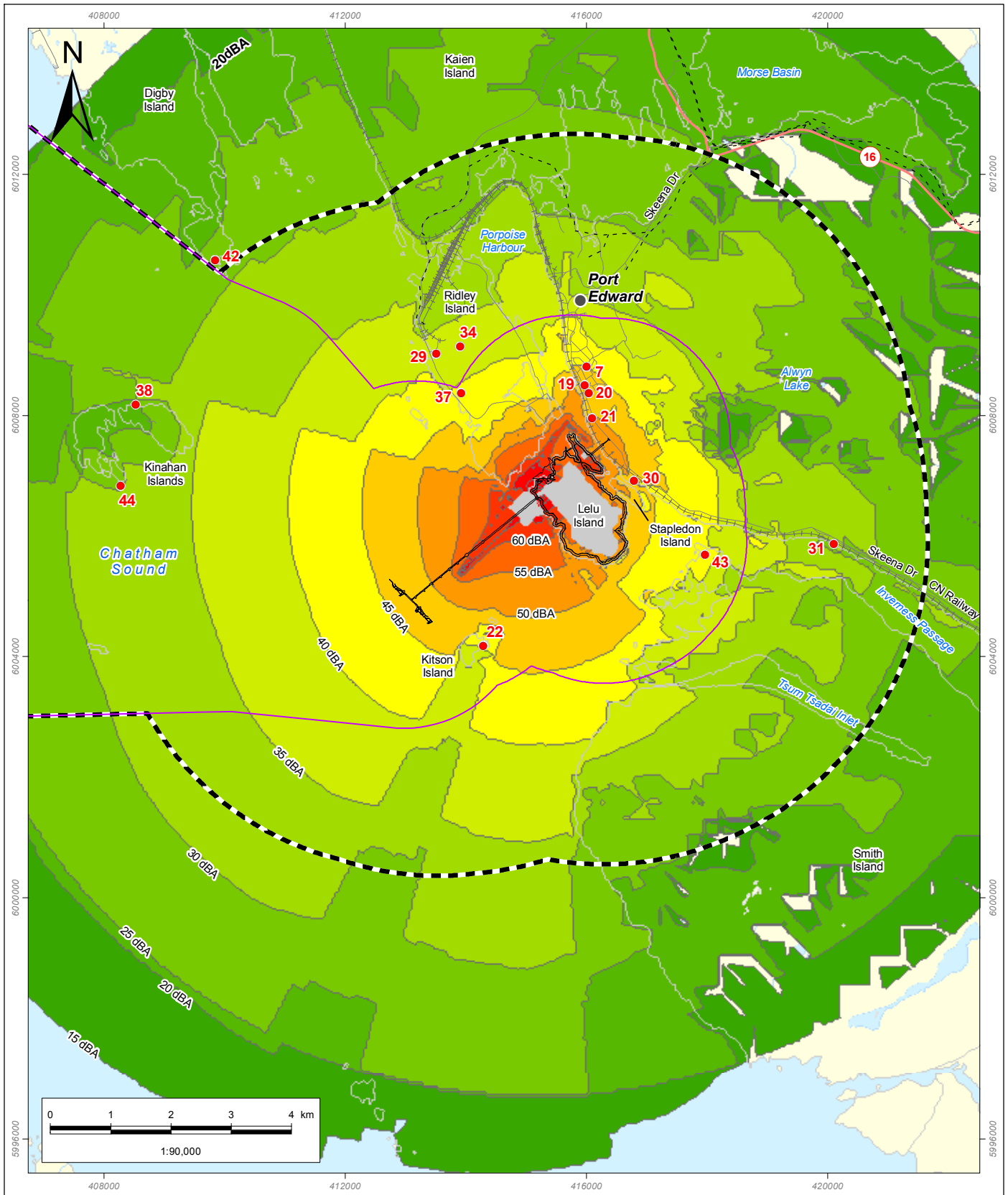
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<p>Noise Contours (dBA)</p> <ul style="list-style-type: none"> 20 - 25 25 - 30 30 - 35 35 - 40 40 - 45 45 - 50 50 - 55 55 - 60 60 - 65 > 65 	<ul style="list-style-type: none"> ● Noise Sensitive Receptor Location Local Assessment Area Regional Assessment Area Project Development Area ● City or Town Electrical Power Transmission Line Highway Railway Secondary Road Watercourse Waterbody 	<p align="center">Pacific NorthWest LNG</p> <p align="center">Construction Phase Scenario 1</p> <p align="center">Daytime Noise Level Modelling Results</p> <p align="center"><i>EIS ADDENDUM</i></p> <p><small>Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information.</small></p> <p><small>Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.</small></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"><small>DATE: 20-NOV-14</small></td> <td style="width: 50%;"><small>PROJECTION: UTM - ZONE 9</small></td> </tr> <tr> <td><small>FIGURE ID: 123110537-510</small></td> <td><small>DATUM: NAD 83</small></td> </tr> <tr> <td><small>DRAWN BY: K. POLL</small></td> <td><small>CHECKED BY: J. CHUI</small></td> </tr> </table>	<small>DATE: 20-NOV-14</small>	<small>PROJECTION: UTM - ZONE 9</small>	<small>FIGURE ID: 123110537-510</small>	<small>DATUM: NAD 83</small>	<small>DRAWN BY: K. POLL</small>	<small>CHECKED BY: J. CHUI</small>	<p><small>PREPARED BY:</small></p> <p align="center"> Stantec</p> <p><small>PREPARED FOR:</small></p> <p align="center"> Pacific NorthWest LNG</p> <p><small>FIGURE NO:</small></p> <p align="center" style="font-size: 24px; font-weight: bold;">8-2</p>
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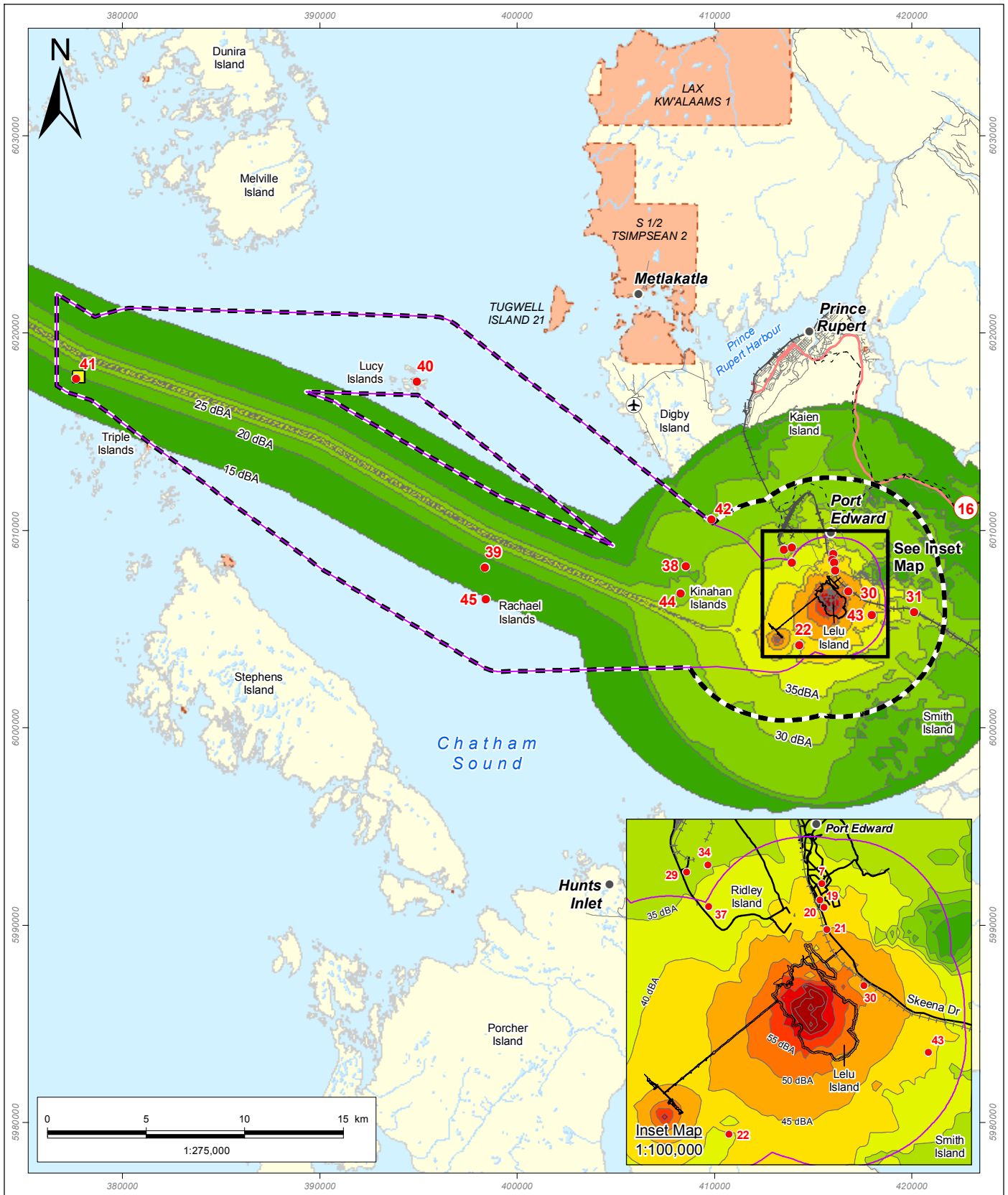


<p>Noise Contours (dBA)</p> <ul style="list-style-type: none"> 20 - 25 25 - 30 30 - 35 35 - 40 40 - 45 45 - 50 50 - 55 55 - 60 60 - 65 > 65 <p>Legend:</p> <ul style="list-style-type: none"> Noise Sensitive Receptor Location Local Assessment Area Regional Assessment Area Project Development Area City or Town Electrical Power Transmission Line Highway Railway Secondary Road Watercourse Waterbody 	<p>Pacific NorthWest LNG</p> <p>Construction Phase Scenario 2</p> <p>Daytime Noise Level Modelling Results</p> <p><i>EIS ADDENDUM</i></p> <p><small>Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information.</small></p> <p><small>Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.</small></p> <table border="1" style="width: 100%;"> <tr> <td>DATE: 20-NOV-14</td> <td>PROJECTION: UTM - ZONE 9</td> </tr> <tr> <td>FIGURE ID: 123110537-511</td> <td>DATUM: NAD 83</td> </tr> <tr> <td>DRAWN BY: K. POLL</td> <td>CHECKED BY: J. CHUI</td> </tr> </table>	DATE: 20-NOV-14	PROJECTION: UTM - ZONE 9	FIGURE ID: 123110537-511	DATUM: NAD 83	DRAWN BY: K. POLL	CHECKED BY: J. CHUI	<p>PREPARED BY:</p> <p> Stantec</p> <p>PREPARED FOR:</p> <p> Pacific NorthWest LNG</p> <p>FIGURE NO:</p> <p style="font-size: 24px; font-weight: bold; text-align: center;">8-3</p>
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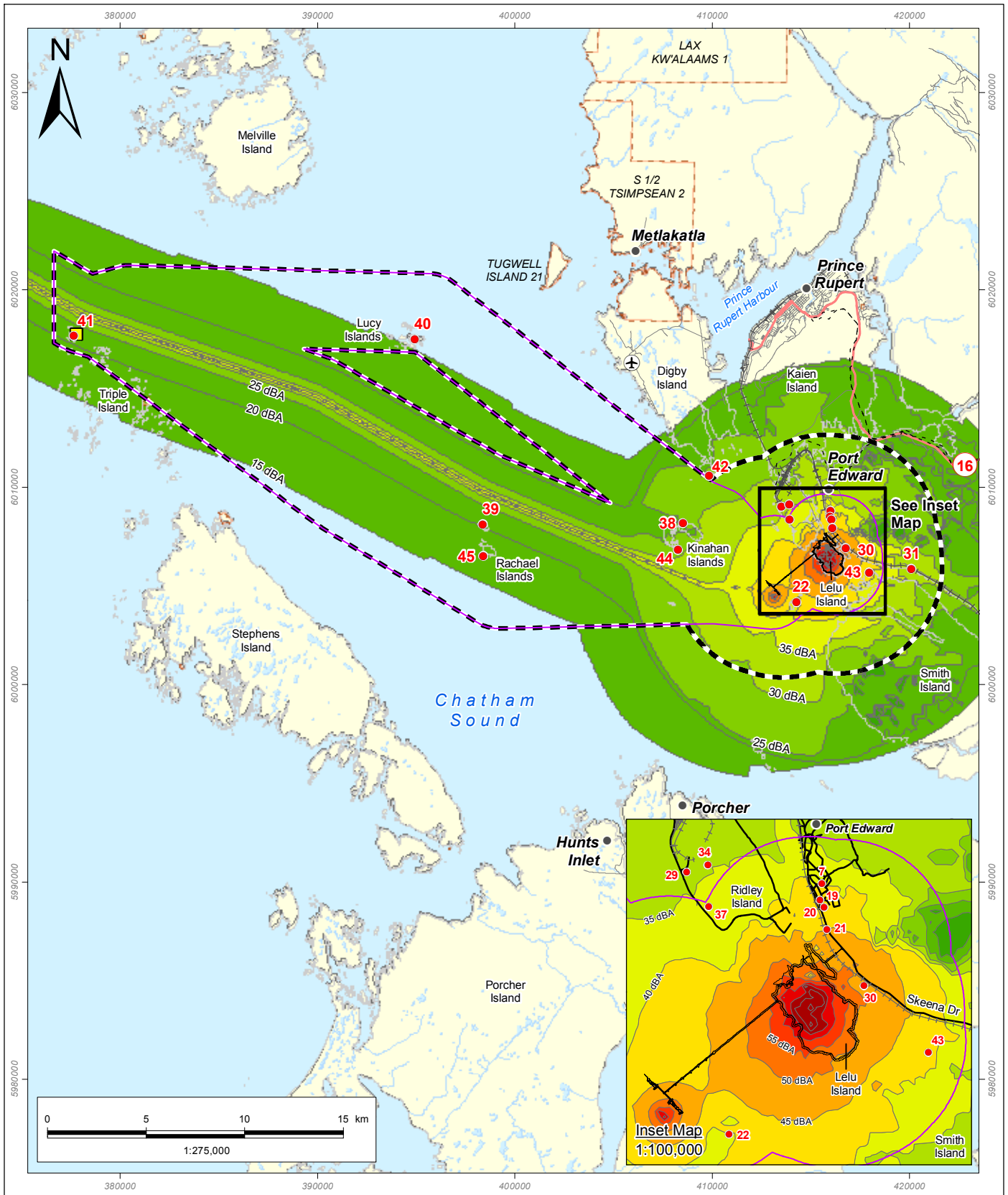


Noise Contours (dBA) <ul style="list-style-type: none"> 15 - 20 20 - 25 25 - 30 30 - 35 35 - 40 40 - 45 45 - 50 50 - 55 55 - 60 60 - 65 > 65 			<ul style="list-style-type: none"> ● Noise Sensitive Receptor Location Local Assessment Area Regional Assessment Area Project Development Area City or Town Electrical Power Transmission Line 	<ul style="list-style-type: none"> Highway Railway Secondary Road Watercourse Waterbody
<p>Pacific NorthWest LNG Construction Phase Scenario 3 Daytime Noise Level Modelling Results</p> <p><i>EIS ADDENDUM</i></p> <p><small>Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information.</small></p> <p><small>Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.</small></p>			<p>PREPARED BY: </p> <p>PREPARED FOR: </p> <p>FIGURE NO: 8-4</p>	
<p>DATE: 20-NOV-14 FIGURE ID: 123110537-512 DRAWN BY: K. POLL</p>	<p>PROJECTION: UTM - ZONE 9 DATUM: NAD 83 CHECKED BY: J. CHUI</p>			

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Noise Contours (dBA) 		Noise Sensitive Receptor Location Local Assessment Area Regional Assessment Area Project Development Area Airport City or Town Pilotage Station	Electrical Power Transmission Line Highway Railway Secondary Road Watercourse Indian Reserve Waterbody	<p align="center">Pacific NorthWest LNG</p> <p align="center">Operations Phase and Central Shipping Route Daytime Noise Level Modelling Results</p> <p align="center"><i>EIS ADDENDUM</i></p> <p><small>Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.; Worldview-2 Imagery. Imagery date: 2011.</small></p> <p><small>Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.</small></p>	<p>PREPARED BY:</p> <p>PREPARED FOR:</p> <p>FIGURE NO:</p> <p align="center">8-5</p>
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Noise Contours (dBA)		Other Features	
15 - 20	50 - 55	● Noise Sensitive Receptor Location	--- Electrical Power Transmission Line
20 - 25	55 - 60	□ Project Development Area	— Highway
25 - 30	60 - 65	□ Local Assessment Area	— Railway
30 - 35	> 65	□ Regional Assessment Area	— Secondary Road
35 - 40		✈ Airport	— Watercourse
40 - 45		● City or Town	■ Indian Reserve
45 - 50		■ Pilotage Station	■ Waterbody

Pacific NorthWest LNG

Operations Phase and Central Shipping Route Nighttime Noise Level Modelling Results

EIS ADDENDUM

Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.; Worldview-2 Imagery. Imagery date: 2011.

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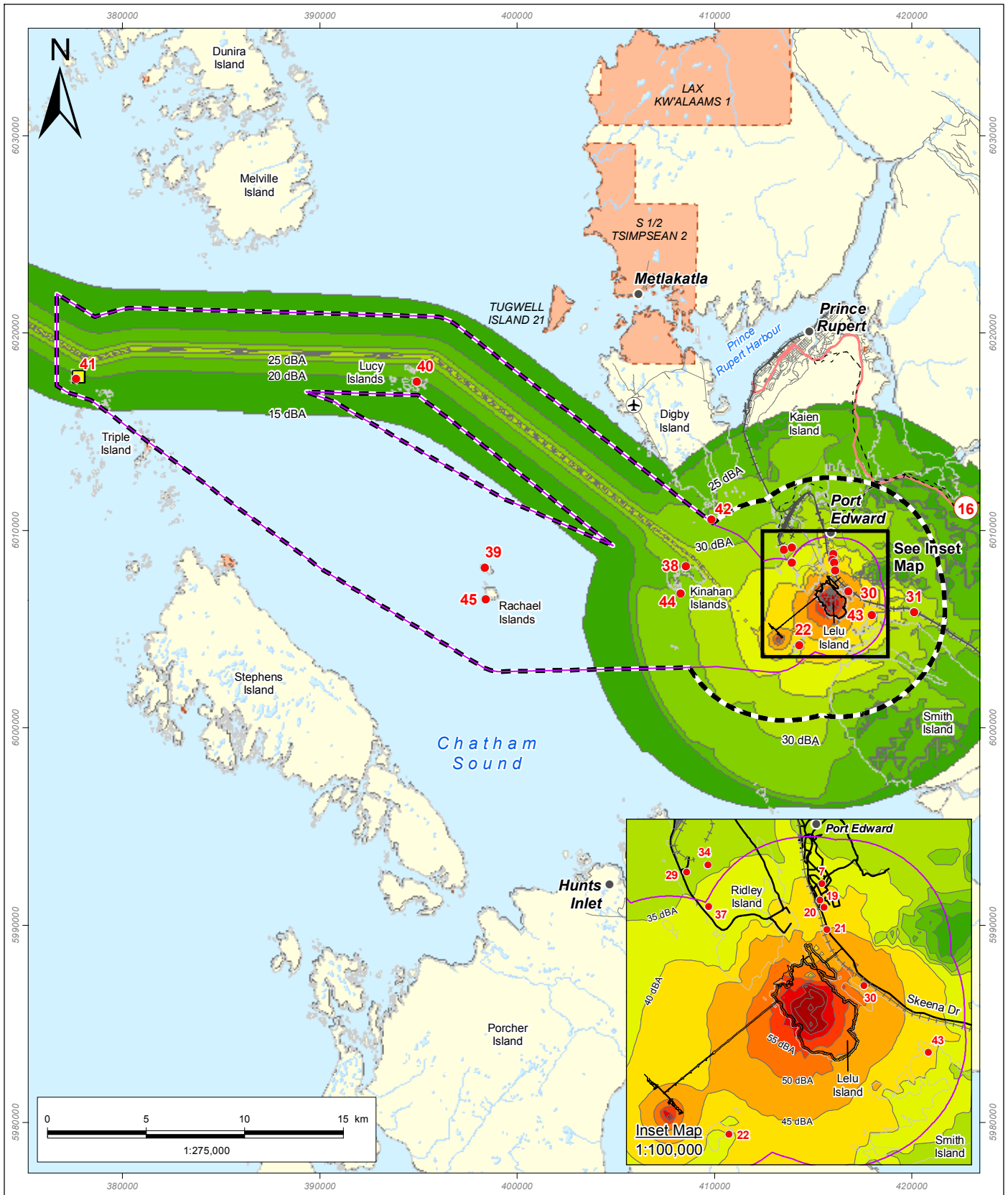
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FIGURE ID: 123110537-505	DATUM: NAD 83
DRAWN BY: K. POLL	CHECKED BY: J. CHUI

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PREPARED FOR:

FIGURE NO:

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Noise Contours (dBA)		
15 - 20	50 - 55	● Noise Sensitive Receptor Location
20 - 25	55 - 60	□ Local Assessment Area
25 - 30	60 - 65	▣ Regional Assessment Area
30 - 35	> 65	□ Project Development Area
35 - 40		✈ Airport
40 - 45		● City or Town
45 - 50		■ Pilotage Station
		--- Electrical Power Transmission Line
		— Highway
		—+— Railway
		— Secondary Road
		— Watercourse
		■ Indian Reserve
		■ Waterbody

Pacific NorthWest LNG

Operations Phase and Northern Shipping Route Daytime Noise Level Modelling Results

EIS ADDENDUM

Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.; Worldview-2 Imagery. Imagery date: 2011.

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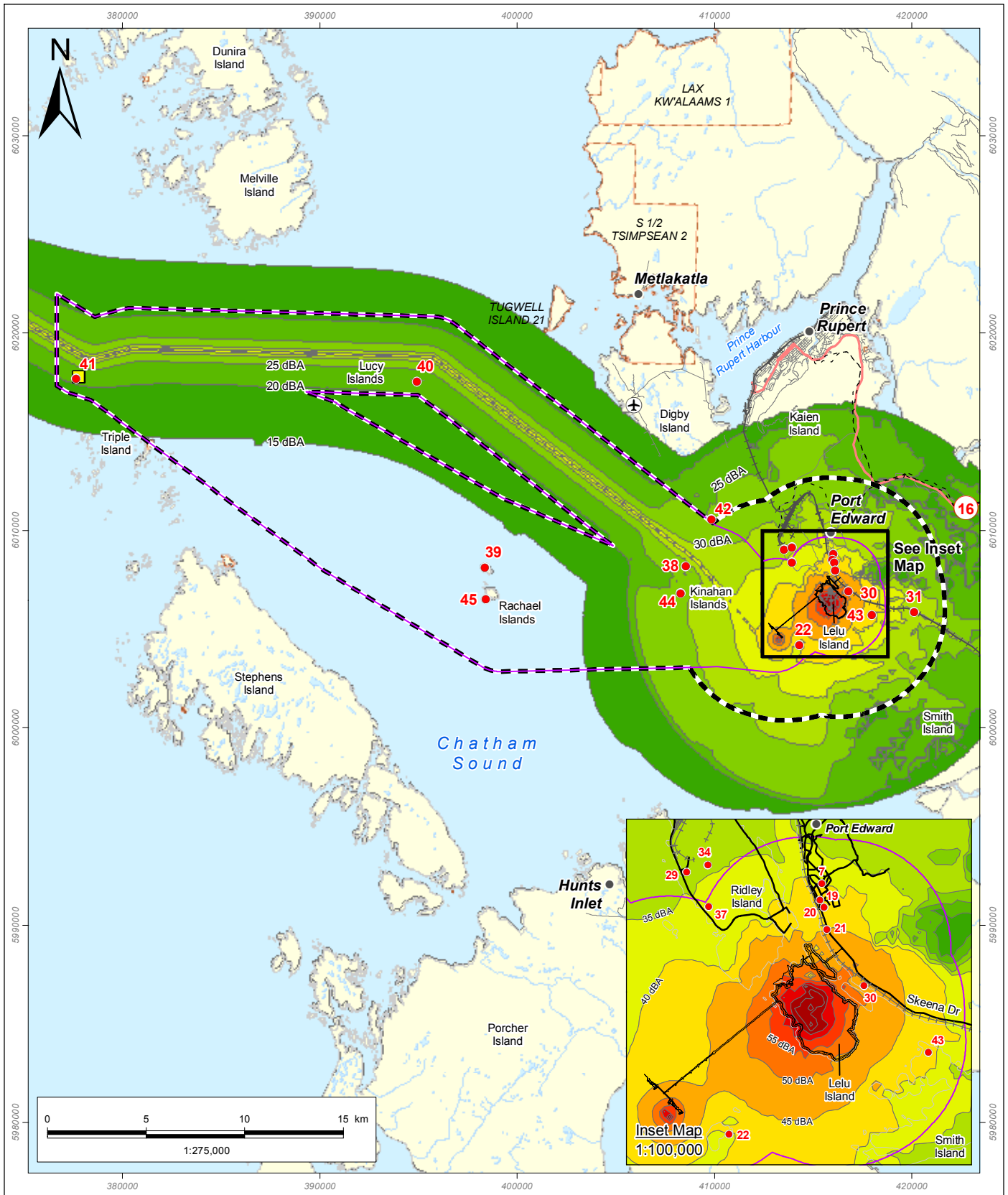
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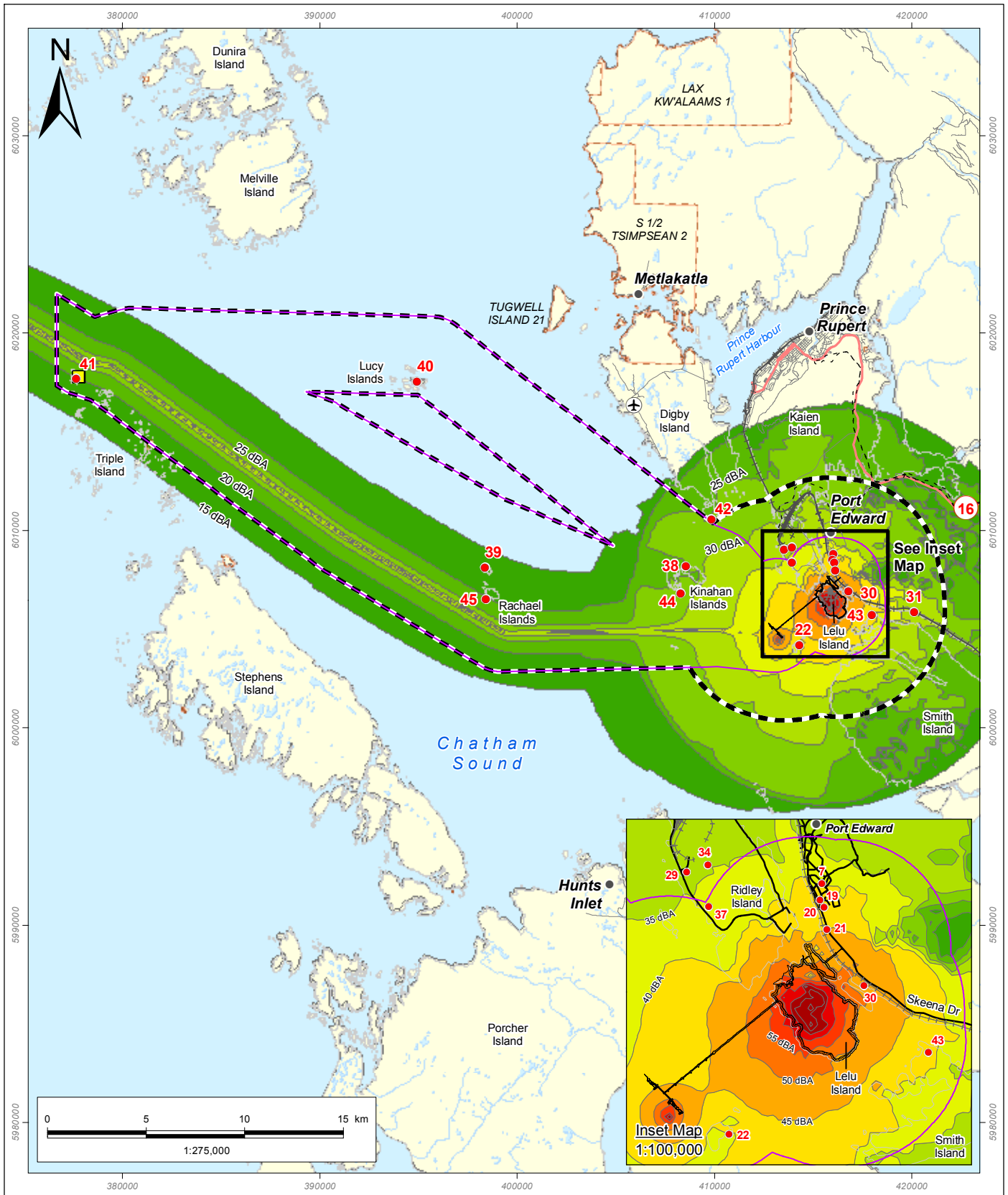
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<p>Noise Contours (dBA)</p> <ul style="list-style-type: none"> 15 - 20 20 - 25 25 - 30 30 - 35 35 - 40 40 - 45 45 - 50 50 - 55 55 - 60 60 - 65 > 65 		<ul style="list-style-type: none"> Noise Sensitive Receptor Location Local Assessment Area Regional Assessment Area Project Development Area ✈ Airport City or Town Pilotage Station Electrical Power Transmission Line Highway Railway Secondary Road Watercourse Waterbody 	<p align="center">Pacific NorthWest LNG</p> <p align="center">Operations Phase and Northern Shipping Route Nighttime Noise Level Modelling Results</p> <p align="center"><i>EIS ADDENDUM</i></p> <p><small>Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.; Worldview-2 Imagery. Imagery date: 2011.</small></p> <p><small>Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.</small></p> <table border="1"> <tr> <td>DATE: 20-NOV-14</td> <td>PROJECTION: UTM - ZONE 9</td> </tr> <tr> <td>FIGURE ID: 123110537-507</td> <td>DATUM: NAD 83</td> </tr> <tr> <td>DRAWN BY: K. POLL</td> <td>CHECKED BY: J. CHUI</td> </tr> </table>	DATE: 20-NOV-14	PROJECTION: UTM - ZONE 9	FIGURE ID: 123110537-507	DATUM: NAD 83	DRAWN BY: K. POLL	CHECKED BY: J. CHUI	<p>PREPARED BY:</p> <p align="center"></p> <p>PREPARED FOR:</p> <p align="center"></p> <p>FIGURE NO:</p> <p align="center">8-8</p>
DATE: 20-NOV-14	PROJECTION: UTM - ZONE 9									
FIGURE ID: 123110537-507	DATUM: NAD 83									
DRAWN BY: K. POLL	CHECKED BY: J. CHUI									



Noise Contours (dBA)			
15 - 20	50 - 55	● Noise Sensitive Receptor Location	- - - Electrical Power Transmission Line
20 - 25	55 - 60	□ Local Assessment Area	— Highway
25 - 30	60 - 65	⊞ Regional Assessment Area	—+— Railway
30 - 35	> 65	□ Project Development Area	— Secondary Road
35 - 40		✈ Airport	— Watercourse
40 - 45		● City or Town	■ Indian Reserve
45 - 50		■ Pilotage Station	■ Waterbody

Pacific NorthWest LNG

Operations Phase and Southern Shipping Route Daytime Noise Level Modelling Results

EIS ADDENDUM

Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.; Worldview-2 Imagery. Imagery date: 2011.

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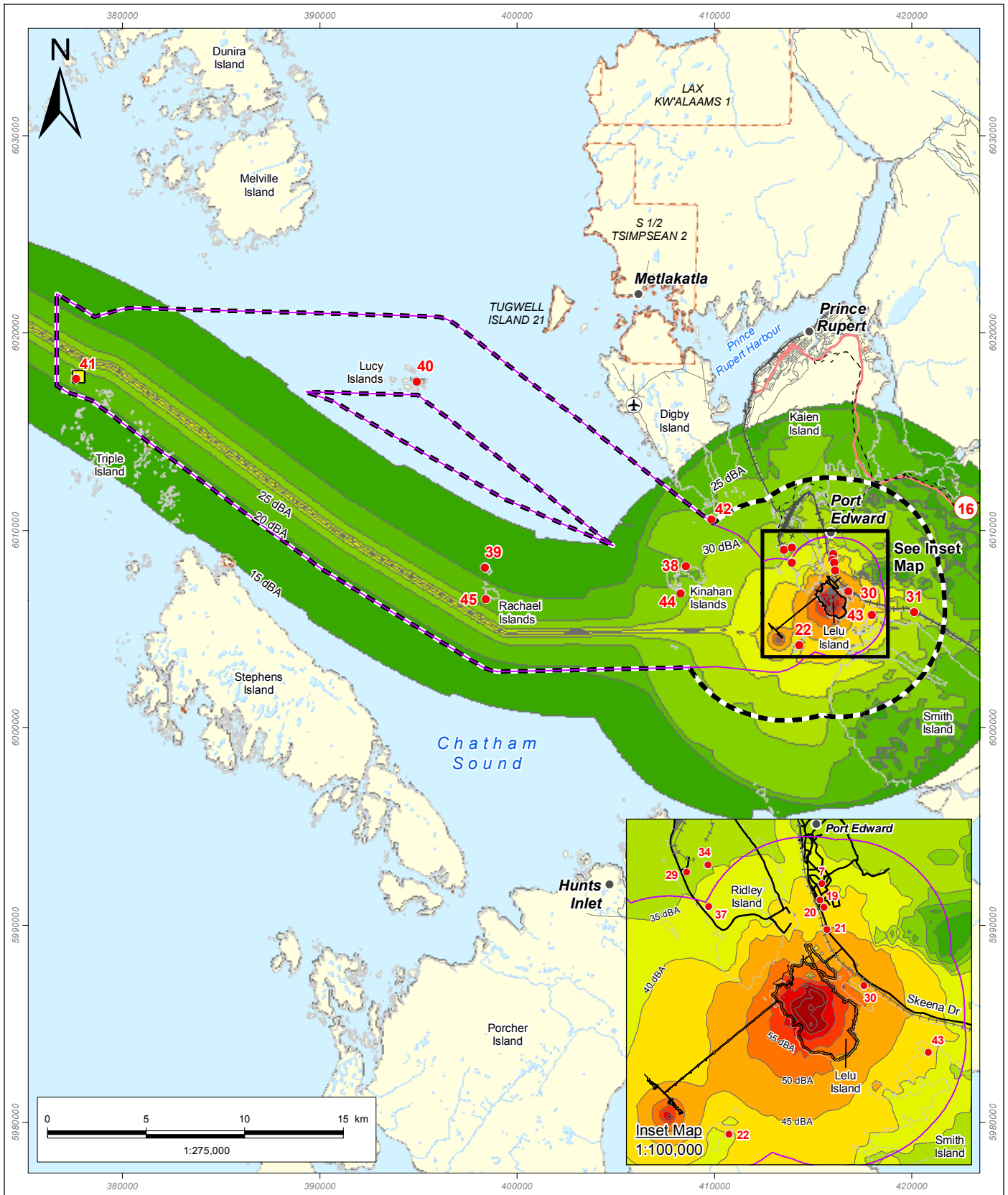
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FIGURE ID: 123110537-508	DATUM: NAD 83
DRAWN BY: K. POLL	CHECKED BY: J. CHUI

PREPARED BY:

PREPARED FOR:

FIGURE NO:

8-9



Noise Contours (dBA)			
15 - 20	50 - 55	● Noise Sensitive Receptor Location	- - - Electrical Power Transmission Line
20 - 25	55 - 60	□ Local Assessment Area	— Highway
25 - 30	60 - 65	▣ Regional Assessment Area	—+— Railway
30 - 35	> 65	□ Project Development Area	— Secondary Road
35 - 40		✈ Airport	— Watercourse
40 - 45		● City or Town	■ Indian Reserve
45 - 50		■ Pilotage Station	■ Waterbody

Pacific NorthWest LNG

Operations Phase and Southern Shipping Route Nighttime Noise Level Modelling Results

EIS ADDENDUM

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Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

DATE: 08-DEC-14	PROJECTION: UTM - ZONE 9
FIGURE ID: 123110537-509	DATUM: NAD 83
DRAWN BY: K. POLL	CHECKED BY: J. CHUI

PREPARED BY:

PREPARED FOR:

FIGURE NO:

8-10

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