APPENDIX A

Part 5 Housing Effects Model

1 INTRODUCTION

The Housing assessment (Volume 4 Section 29) examined the effects of increased demand for housing arising from the predicted increase in the non-camp population. This appendix presents the main assumptions used to forecast Site C Clean Energy Project (Project) effects on Housing, providing support to Volume 4 Section 29. Hypotheses and assumptions are identified and justified while data collection methods are documented so that the analyses are transparent and reproducible.

The spatial boundaries for Volume 4 Section 29 Housing are the Peace River Regional District. The housing model distinguishes between communities in the LAA that are nearby the Project and those further away. Therefore, model output is presented for North Peace (i.e., communities in the LAA north of the Peace River) and South Peace (i.e., communities in the LAA south of the Peace River). The temporal boundaries are the nine years of the construction phase.

2 DESCRIPTION AND METHODOLOGY

The purpose of the model is to project demand and supply conditions in the housing market in the absence and in the presence of the Project.

The population model (Volume 4 Appendix A Social Assessment, Part 3 Population Effects Model) indicated that the Project would require the labour of persons not presently residing in the PRRD, which would add to the local population. The decision to reside in the PRRD would be a personal choice of one of two following options:

- on-site accommodation
- in-community accommodation

Indirect and induced employment attributable to the Project would also contribute to population change and, therefore, housing demand. The full weight of this demand would be on in-community accommodation, as workers in indirect or induced positions would not have access to on-site accommodation provided for Project workers.

The focus of the housing model is change attributable to the second option, in-community accommodation, as it results in incremental demand on the housing market by direct, indirect and induced workers.

The model does not consider the non-market sector. This aspect is based on information provided by non-market housing providers, as assessed in Volume 4 Section 29 Housing.

This model was developed specifically for this assessment and has not been used in other, similar assessments.

2.1 Model Components

Figure 1 shows the basic inputs and logic of the housing model, with model parameters and data sources presented in Table 1.

Table 1 Model components and data sources

Indicator	Source	Model Input		Model Output	
		Base Case	Project Case	Base Case	Project Case
Housing ownership	Statistics Canada 2006 Census	Yes	Yes	Yes	Yes
Housing type Owed dwellings Rented dwellings Temporary accommodation	Statistics Canada 2011 Census Canada Mortgage and Housing HelloBC and municipalities	Yes	Yes	Yes	Yes
Occupancy rates Temporary accommodation	Personal communications	Yes	Yes	No	No
Vacancy rates Rented dwellings	Canada Mortgage and Housing	Yes	Yes	Yes	Yes
Occupancy costs Owned dwellings Rented dwellings	Statistics Canada 2006 Census Canadian Real Estate Association Canada Mortgage and Housing	No	No	No	No
Residential construction activity	BC Stats	No	No	No	No
Planned housing developments and land available for housing	Municipalities, Peace River Regional District	No	No	No	No

The housing model has the following basic logic:

- Projections of the supply of housing in the LAA by ownership and type are made for the base case
- Projections of the demand for housing in the LAA by ownership and type are made for the project case
- A comparison between base case supply and project case demand projections is made to determine the existence of imbalances

The model only estimates the supply and demand of units for the duration of the construction period, 2014-2022. There is no cost function.

3 DATA SOURCES

Data sources included the following:

- The number of occupied private dwellings and distribution by dwelling type (e.g., single detached versus multi-family) was available for the 2011 Census.
- The type of dwelling by ownership status (e.g., owned versus rented) was based on the 2006 Census because at time of writing the 2011 data for this variable had not been released.
- The inventory of rental dwellings as indicated in the Census was checked against the inventory estimated by Canada Mortgage and Housing Canada (CMHC) rental market reports for the 2007 to 2011 period. As the CMHC data are derived by survey, the Census data were considered a more accurate reflection of inventory at the time.
- Multiple Listing Service (MLS) listing, sales and price activity for the 2006 to 2010 period were analysed for the B.C. Northern Real Estate Board (BCNREB), the

Northern Lights Real Estate Board (NLREB) and the Fort St. John Areas.[1] The data are used by analysts to identify housing trends and the existence of balanced, buyers' and sellers' markets.

- The inventory of temporary accommodation was compiled based on a review of HelloBC.com and municipal websites in 2011.
- Occupancy rates for temporary accommodation segment were based on personal communications with hotel and RV operators.
- Vacancy rates for the rental dwellings were based on Canada Mortgage and Housing Canada (CMHC) rental market reports for the 2007 to 2011 period.

3.1 Assumptions and input data

3.1.1 Baseline conditions

Baseline conditions for housing in the PRRD are described in Volume 4 Section 29 Housing, Section 29.3 Baseline Conditions.

3.1.2 Base case projections

Inputs and assumptions for projecting Base Case housing levels in the absence of the Project include the following:

- The primary input was the projection of the number of households between 2014 and 2022, which was based on the population forecast in Volume 4 Section 28 Population and Demographics, Figure 28.6, and converted to households using BC Stats population to household ratios (BC Stats 2011).
- The future proportion of dwellings that would be owned versus rented would be the same as indicated in the 2006 Census.
- The future proportion of dwellings by type would be the same as indicated in the 2011 Census.
- Census tables provided by Statistics Canada do not cross-tabulate ownership status by housing type for the PRRD. In the housing model it was necessary to make this inference, because worker housing preferences are expected to be sensitive to both variables. Data for the Canadian housing market in the 2006 Census was reviewed as a guide, and were adjusted to maintain the approximate balance of owned and rental properties in the PRRD as reflected in the 2006 Census (CMHC 2012). Eighty-five percent of owned dwellings were assumed to be single or semi-detached houses, 5% multi-family dwellings and 10% movable dwellings. Fifteen percent of rental dwellings were assumed to be single or semi-detached homes, 75% apartments and 15% mobile homes. These assumptions, however, do not affect the projected total rental and owned housing stock, which is assumed to remain in proportion to past Census data for the PRRD.

[1] The BC Northern Board Area covers all of northern B.C., including the Cariboo, Fraser-Fort George, Peace River, Northern Rockies, Bulkley-Nechako, Kitimat-Stikine, Skeena-Queen Charlotte and Stikine regional districts, excluding the Northern Lights Board Area of the South Peace. The Northern Lights Board Area includes that portion of the Peace River Regional District south of the Peace River. The Fort St. John area covers the City of Fort St. John, Districts of Hudson's, Taylor, and Area C of the PRRD.

3.1.3 Base case supply available

The base case supply of available housing was derived by applying the following assumptions to the base case projections (described above).

- **Owned housing** - The projection of the owned housing stock that would be available for absorption without creating a housing shortage was based on Fort St. John and Northern Lights Real Estate Board MLS data for the 2006-2010 period (BCREA 2011). The data for this period captured a sellers' market leading up to the 2008-2009 recession, a buyers' market in the two years that followed as sales activity and prices declined and a short period of recovery in 2010. The following three key assumptions were used to estimate availability:
    - Average monthly listing for the Fort St. John area between 2006 and 2010 was 456 units. The same ratio of listings to total housing stock is applied in this model.
    - Average annual sales for the Fort St. John area between 2006 and 2010 were 709 units. The same sales level is assumed for the 2014 to 2022 period.
    - As noted in the Housing assessment, the BCREA considers a sales to listing ratio of less than 25% to be indicative of a balanced or buyer's market where a housing shortage would not exist (Yu 2012, pers. comm.). For this assessment, a more conservative 18% ratio was adopted as the threshold.
    - A similar set of inputs to the above were made for the South Peace region based on data from the Northern Lights Real Estate Board (BCREA 2011)
- **Rented dwellings** - The lowest vacancy rate in Fort St. John between 2007 and 2011 was 4% while the average rate was 9% and the high 18% (CMHC 2008-2010). A sensitivity analysis was conducted showing availability at both the 4% and 9% vacancy rates.
- **Temporary accommodation** - The average occupancy~~vacancy~~ rate among the six largest hotels in Fort St. John was 70% in 2011. An average 85% occupancy rate was applied in the model.
- **RVs** - The average vacancy rate among RV parks and campgrounds was estimated to be 20% in 2011 and factored down to account for partial operating years of some properties (Dempsey and Dempsey 2011, pers. comm.). An average 13% vacancy was applied in the model.

3.1.4 Project case demand

The inputs and assumptions for estimating the housing preferences of workers directly and indirectly employed by the Project are as follows:

- Marital status (i.e., number of singles, couples, and children) and number of spouses available to work are based on the population model (Volume 4 Appendix A Social Assessment, Part 3 Population Effects Model).
- Based on travel time and cost considerations, and access to the proposed work sites, 90% of in-migrants are estimated to prefer living in communities north of the Peace River. This assumption is based on a study of mobile workers in Fort McMurray and discussions with a Suncor representative in Fort McMurray and a Kitimat Modernization Project representative in Kitimat. At major Suncor constructions projects, workers are asked to stay in camp if the total commute time from a non-camp place of residence is longer than 1 hour, one way (Kowalik 2012). A review of mobile workers in Fort McMurray showed that the percent of mobile

workers working on a construction project would increase in proportion to the distance from the community (Nichols Applied Management 2007). This behaviour is a reflection of travel time and costs considerations and employment policy. Because communities south of the Peace River are at least an hour away from the Project, the large majority of workers deciding to live outside camp facilities would elect to reside in North Peace communities.

- Preference for in-community versus on-site housing and owned versus rental housing are shown in Table 2. The preference for non-camp housing by workers was outlined in the population model (Volume 4 Appendix A Social Assessment, Part 3 Population Effects Model). The distribution of owned versus rental housing for displaced, indirect and induced workers who were couples is assumed to be identical to the PRRD baseline, which in 2006 indicated that 73% of all dwellings were owned and the other 27% rented. Single workers were assumed to have the opposite preference. The housing preferences for trades, contract supervisors and BC Hydro management were determined in discussion with BC Hydro engineers, and the Fort McMurray mobile worker study (Nichols Applied Management 2007). Consideration was also given to the average length of employment of worker groups, under the assumption that the longer the employment the greater the preference for owned housing and rental housing versus fixed-roof (e.g., hotel, motel) and RV housing. A review of the monthly work schedule during construction shows that variability in the number of trades workers employed would be much greater than for contract supervisors and BC Hydro management. In other words, trades workers would be on the job for much shorter periods or terms than the other two worker groups, while BC Hydro management would have the longest employment term.

Table 2 Housing preferences among worker group, percent preferring

Worker Group	Non-camp	Owned Housing	Rental Housing	Fixed-roof and RV Rental
Trades	15%	N/A	N/A	N/A
Single	N/A	0%	50%	50%
Couple	N/A	20%	50%	30%
Contract Supervisors	15%	N/A	N/A	N/A
Single	N/A	0%	50%	50%
Couple	N/A	40%	40%	20%
BCH Management	85%	N/A	N/A	N/A
Single	N/A	10%	70%	20%
Couple	N/A	60%	30%	10%
Displaced Employees	100%	N/A	N/A	N/A
Single	N/A	27%	73%	0%
Couple	N/A	73%	27%	0%
Indirect and Induced	100%	N/A	N/A	N/A
Single	N/A	27%	73%	0%
Couple	N/A	73%	27%	0%

4 RESULTS

A summary of available supply and project-related demand for housing is presented in Table 3.

Of the three market components (owned dwellings, rented dwellings and temporary accommodation, which includes RV rentals), the projected demand for housing by the Project for the North Peace and the South Peace areas are well below availability levels, with one exception.

The only component where demand may outstrip the available supply is rented dwellings in the North Peace. However, the model assumed that the vacancy rate would average 4% which is the lowest quarterly rate experienced during the 2007 to 2011 period.

A sensitivity analysis was conducted to determine the available supply if the vacancy rate was 9%, the average rate for the North Peace between 2007 and 2011. The results of this scenario showed that the net vacancy rate after Project-related demand would remain above 4% for all years but Year 5 (Table 4).

Table 3 Comparison of available supply and project demand for housing, 2014-2022

Accommodation Type	2014	2015	2016	2017	2018	2019	2020	2021	2022
Summary of Availability (no.)									
North Peace									
Dwellings for sale	273~~271~~	279 ~~276~~	285 ~~282~~	288~~286~~	292 ~~289~~	295 ~~292~~	298 ~~295~~	303 ~~300~~	308 ~~305~~
Dwellings for rent	143	146	149	150	152	154	155	158	161
Temporary accommodation for rent[a]	336~~333~~	344 ~~340~~	351 ~~347~~	355 ~~352~~	359 ~~356~~	363 ~~359~~	367 ~~363~~	373 ~~369~~	379 ~~375~~
Total dwellings available	752~~746~~	768~~762~~	784~~778~~	794~~788~~	803~~797~~	811~~805~~	820~~814~~	834~~827~~	848~~841~~
South Peace									
Dwellings for sale	75	76	77	78	79	79	80	80	81
Dwellings for rent	42	42	43	44	44	44	44	45	45
Temporary accommodation for rent[a]	341	347	353	357	360	362	364	367	370
Total dwellings available	457	466	474	479	482	486	488	492	497
Summary of Demand (no.)									
North Peace									
Owned dwellings	47	121	153	161	206	233	219	177	79
Rented dwellings	58	155	199	205~~196~~	260	317	295~~307~~	230	98~~108~~
Temporary accommodation[a]	14	39	52	52	63	91	85~~150~~	64	25~~30~~
Total dwellings	120	315	404	418~~409~~	528	642	599~~677~~	471	203~~217~~
South Peace									
Owned dwellings	5	13	17	18	23	26	24	20	9
Rented dwellings	6	17	22	23~~22~~	29	35	33~~34~~	26	11~~12~~
Temporary accommodation[a]	2	4	6	6	7	10	9~~17~~	7	3
Total dwellings	13	35	45	46~~45~~	59	71	67~~75~~	52	23~~24~~

NOTE:
a includes RVs

Table 4 Total rental demand in North Peace in low and high vacancy scenarios[a]

Vacancy Scenario	2014	2015	2016	2017	2018	2019	2020	2021	2022
Project Rental Demand (number of units)	42	111	142	147	186	226	210	164	70
Low Vacancy Scenario									
Without Project 4% (number of available units)	143	146	149	150	152	154	155	158	161
With Project Vacancy Rate	3%	1%	0%	0%	-1%	-2%	-1%	0%	2%
Average Vacancy Scenario									
Without Project 9% (number of available units)	321	328	334	338	342	346	350	355	361
With Project Vacancy Rate	8%	6%	5%	5%	4%	3%	4%	5%	7%

NOTE:
[a] Total rental demand includes direct, indirect and induced workers and apartments as monitored by CMHC; private homes, mobile homes and temporary accommodation are not included

5 LIMITATIONS

The limitations to the projections made by the housing model include the following:

- The future state of the housing market is tied to numerous interacting factors, most of which cannot be included in this model. All projections follow a linear path, even though future conditions will fluctuate over time.
- The structure of the future housing supply is assumed to be the same as that reflected in the 2011 Census (for housing type) and the 2006 Census (for housing ownership. Past data may not accurately reflect future conditions.

The validity of the model output is associated with the following factors:

- The model's assumptions are fixed over time and based on average annual values. This approach is suitable given the design stage of the Project.
- Assumptions about the future values of housing availability are conservatively assessed and designed to identify imbalances at peak interactions of supply and demand.
- Baseline data and base case household projections are drawn from the best available published sources.
- The inputs are considered credible from the perspective of the LAA housing market. The public's perceptions of changes in the market (including the effects of the 2008 recession) are accurately reflected in the baseline data.
- The model can be transferred to other jurisdictions and for other projects using the same data sources and methodology

6 REFERENCES

6.1 Literature Cited

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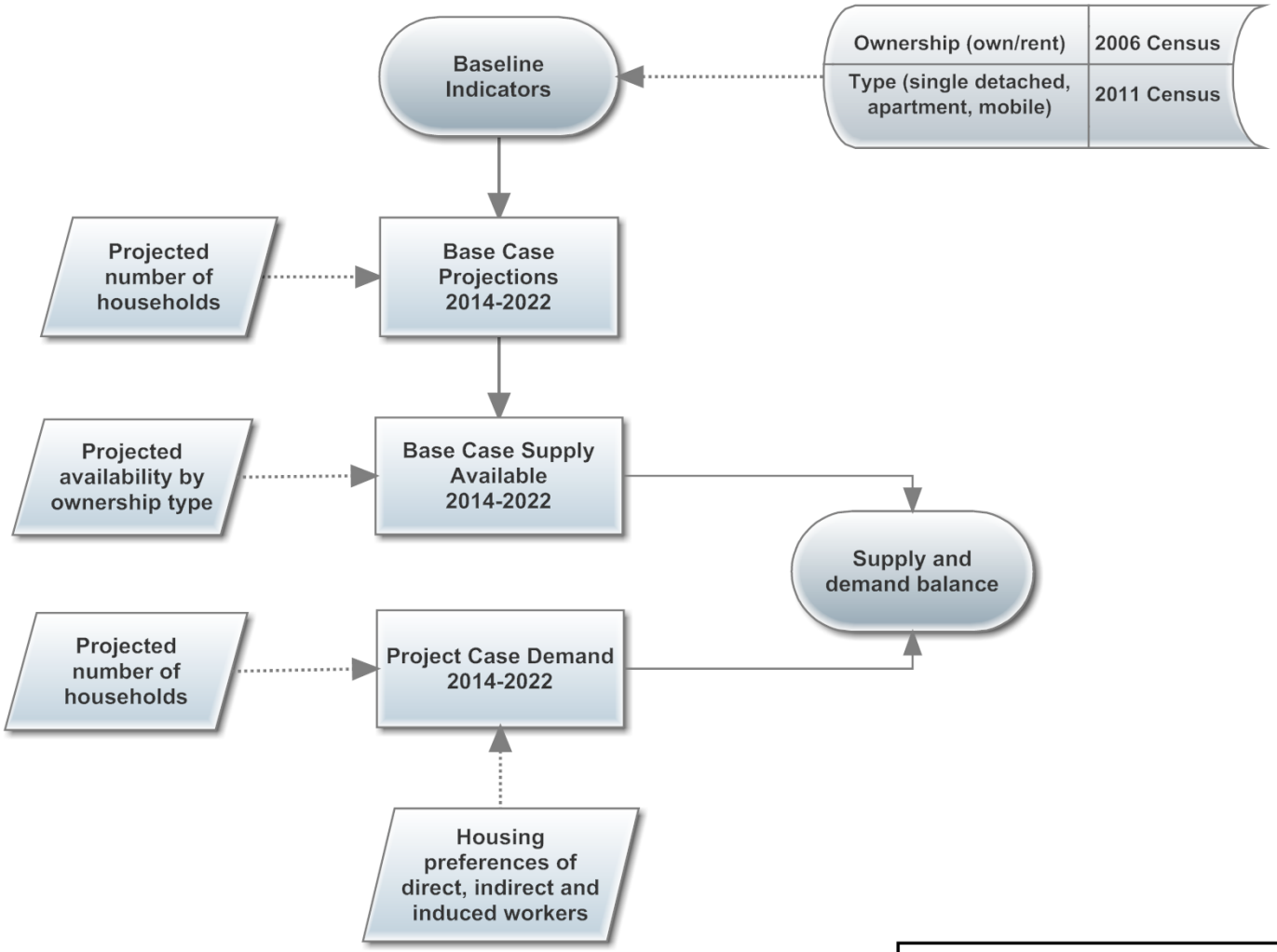

BC hydro

SITE C CLEAN ENERGY PROJECT

Figure 1 Housing Model

Construction of the Site C Clean Energy Project is subject to required regulatory approvals including environmental certification