Q. Please provide tables or lists indicating Hydro's transmission and distribution conductor ratings and explain the bases for those ratings.

A. The Hydro transmission line conductor ratings are calculated using IEEE Std 738 "IEEE Standard for Calculating the Current-Temperature of Bare Overhead Conductors". The ruling ground clearance (sag) curve for many of Hydro's transmission lines constructed in the 1960s and 1970s was the 50 °C "hot" conductor sag curve as the meteorological loading conditions considered ice thicknesses of between 0.5 to 1.5 inches of radial ice for the ice load sag curve. Consequently, the majority of Hydro transmission line conductor ratings are based upon a maximum conductor temperature of 50 °C. Operating experience revealed larger ice load conditions for 230 kV transmission lines on the Avalon Peninsula. The rebuild of steel tower 230 kV transmission lines on the Avalon Peninsula between 1999 and 2002 utilized a larger radial ice thickness, which, in turn, became the ruling ground clearance sag curve for these transmission lines. Calculations utilizing the sag – tension programs revealed that the equivalent "hot" conductor sag curve for the rebuilt transmission lines limited the maximum conductor temperature to 80 °C.

Hydro calculates three transmission line conductor ratings for three separate ambient air temperatures at maximum conductor temperature. These three conductor ratings are:

- Rate A (30 °C ambient temperature) for summer operation;
- Rate B (15 °C ambient temperature) for spring/fall operation; and
- Rate C (0 °C ambient temperature) for winter operation.

In its use of IEEE Std 738, Hydro sets the line latitude at 49° N, the elevation above sea level at 0 feet, the solar absorptivity at 0.5, emissivity at 0.5, local solar time at 11 am, and assumes a clear atmosphere given the lack of heavy industry near transmission line routes. With respect to wind speed, Hydro assumes a 2 ft/sec wind to account for sheltered spans and wind directions parallel to the conductor.

Table 1 provides a listing of existing Hydro transmission line conductors and their associated ratings.

Table 1
Hydro Transmission Line Conductor ratings in Amperes

Size (kcmil)	Stranding	Type	Code Name	Current Rating - Amperes			Usage
				Rate A	Rate B	Rate C	
4/0	6/1	ACSR	PENGUIN	219	315	387	66 kV
266.8	26/7	ACSR	PARTRIDGE	264	382	470	66 & 138 kV
266.8	7/1	ACSR	OWL	218	315	387	138 kV
312.8	19	AAAC	BUTTE	265	383	471	138 kV
397.5	26/7	ACSR	IBIS	372	546	675	138 kV
562.5	36/19	ACSR/EHS[1]		385	572	708	230 kV
559.5	19	AAAC[2]	DARIEN	372	547	676	138 kV
559.5	19	AASC[2]		371	544	672	138 kV
636	26/7	ACSR	GROSBEAK	440	653	809	230 kV
636	30/19	ACSR	EGRET	444	659	817	230 kV
795	26/7	ACSR	DRAKE	500	747	927	230 kV
804	23/19	AACSR/TW[3,4]		893	1033	1153	230 kV
1192.5	54/19	ACSR	GRACKLE	624	946	1178	230 kV
1376.6	61	AAAC		619	939	1171	230 kV
1431	54/19	ACSR	PLOVER	689	1053	1314	230 kV

Notes:
1. 562.5 kcmil is an ACSR conductor with extra high strength steel core having limited application on the 230 kV system in heavy load zones.
2. 559.5 kcmil is the electrical equivalent of 477 kcmil 26/7 ACSR “HAWK”. AAAC is the American alloy 6201-T81 while AASC is the Canadian alloy 6101-T81.
3. The 804 kcmil conductor is an electrical equivalent to 795 kcmil 26/7 ACSR “DRAKE” but with twice the tensile strength. The conductor consists of two aluminum layers of trapezoidal (formed) wire, each layer being a different aluminum alloy. Used on the Avalon Peninsula Upgrade Project.
4. Ratings are calculated with an 80 °C maximum conductor temperature.

Similar to transmission lines, Hydro makes a number of assumptions to obtain the ampere rating of a particular sized conductor depending on its construction and geographic location. Generally, the rated capacity of the lines is based on the maximum allowable operating temperature, which is affected by climate. Hydro has also adopted the IEEE Std 738 for determining the rating of distribution line conductors. For distribution systems, Hydro uses a maximum conductor rating of 75 °C for distribution conductors. In its use of IEEE Std 738 for distribution conductors, Hydro sets the line latitude at 50 ° N, the elevation at sea level, the solar absorptivity at 0.5, emissivity at 0.5, and assumes a clear atmosphere. Cooling of the conductors during normal operation due to light cross winds is assumed (2ft/s).

Distribution line conductor ratings are further based on the time of the year in which the peak load occurs on that particular feeder and its location; whether it is located on the Island or in Labrador. For a winter peaking system in Labrador, the ambient temperature is assumed to be -20 °C, where the same system on the Island is assumed to experience an ambient temperature of 0 °C. A summer peaking system is assumed to experience an ambient temperature of 30 °C across all distribution systems.

Table 2 provides a listing of existing Hydro distribution line conductors and their associated ratings. The underlined and bolded conductors (Montreal, Vancouver and Cosmos) in Table 2 have become the standard conductor sizes used by Hydro on their distribution system.

Table 2 **Hydro Distribution Line Conductor ratings in Amperes**					
Size	**Type**	**Code Word**	**Planning**		
			Ratings (Amperes)		
			Winter -20 °C	**Winter 0 °C**	**Summer 30 °C**
559.5	AAAC	Darien	939	830	627
#2	AASC	Halifax	265	235	179
1/0	**AASC**	**Montreal**	**358**	**317**	**242**
4/0	**AASC**	**Vancouver**	**557**	**493**	**374**
266.8	AASC	19-Strand	645	570	432
336.4	AASC	Tulip	747	661	500
#2	ACSR	Pickerel	244	213	155
1/0	ACSR	Raven	341	302	230
2/0	ACSR	Quail	389	345	262
266.8	ACSR	Partridge	646	571	433
336.4	ACSR	Linnet	747	661	500
477	ACSR	Hawk	931	824	622
477	ACSR	Pelican	915	809	612
477	**ASC**	**Cosmos**	**904**	**800**	**605**
636	ASC	Orchid	1085	959	724
#4	Copper	7 Strand	223	196	145
1/0	Copper	7 Strand	400	349	253
2/0	Copper	7 Strand	437	437	359