APPENDIX:

1. Channel and overbank 'n' values:

In the post-development hydraulic model, considerably lower 'n' values have been assigned for the full length of the channel (0.035 compared to an existing value of 0.0525 to 0.06) and for approximately 50% of the total overbank length of the restoration reach (0.04 compared to existing values ranging from 0.06 to 0.09) – see **Table A1** for a comparison of existing and future condition 'n' values for the whole reach. The 'n' value reductions in the future condition are not documented in the TPR report but from a review of the restoration plan it appears that the lower overbank 'n' values were applied where the future SWM ponds and numerous habitat ponds are to be located. While there may be some justification for minor adjustments, I am at a loss to understand the rationale for the significant decreases in 'n' values proposed. Specifically:

i) The 'n' values are lowered for the complete overbank area and do not reflect SWM pond setbacks from the channel that will be planted, nor the effect of SWM pond landscaping that will cover a considerable area of the pond footprints (i.e., from the upland area down to below the permanent water level with emergent vegetation); the lowered 'n' values likewise do not account for slope areas of the habitat ponds that will be planted, emergent vegetation, etc.;

ii) While there has been a reduction of 'n' values to apparently reflect the proposed SWM and habitat ponds, there has been no comparable increase in 'n' value anywhere else to reflect the significant increase in riparian cover that is proposed for the restoration and eventual natural succession (increased riparian cover being a key objective of the restoration as the existing corridor is generally bereft of significant vegetation – see the attached **Figure 1**);

iii) The channel 'n' value has been reduced in the restoration reach by a factor of 1.5 to 1.7 although the proposed conceptual design shows approximately half the bankfull channel with increased riparian plantings (compared to no vegetation in the existing bankfull width). The proposed channel is also meandered/winding compared to a comparably straight existing channel.

Note: in my opinion, the existing condition 'n' values are quite high. As you may recall, the original assigned values were increased by a factor of 1.5 to improve water level calibration. These higher existing condition 'n' values have been carried forward in the TPR model of record and I have not revised them in the model runs to ensure an "apples to apples" comparison.

2. Bridge 'n' values:

Further, in the future condition model, the 'n' values for the internal bridge sections (Hazeldean to Richardson) have almost all been increased above the values used in the existing condition, some quite substantially. (The 'n' values at the internal bridge sections are meant to reflect the roughness of the channel through the bridge and should therefore be comparable to the 'n' values assigned to the adjacent channel sections, if not lower). For example, at Hazeldean Road the 'n' value assigned is 0.187 and at Palladium 0.100 – values reflective of stands of timber in a floodplain, not a relatively smooth channel beneath a bridge structure. The attached **Table A2** compares existing and future condition 'n' values at all crossings.

3. Revised model run results:

Some revised model runs show the combined effect of these increased 'n' values at the bridges and the lowered 'n' values for the channel and overbanks. A detailed summary of results is provided in the attached **Table A3**. Four scenarios are included:

i) Existing conditions: unchanged from the modeling received Nov.09 - these results reflect the "Fernbank ex. conditions" (existing geometry);
ii) Future conditions: unchanged from the modeling received Nov.09 - these results reflect the "Fernbank future conditions" (Kanata West and Fernbank built out, future geometry);
iii) Future conditions revised: 'n' values for channel and overbanks revised to match existing conditions. Note: in order to compare "apples to apples," channel and overbank 'n' values throughout the reach were made equivalent to existing condition model 'n' values, i.e., no reductions made at habitat/SWM ponds and no increases to reflect future increased riparian cover;
iv) Future conditions revised: scenario iii) with 'n' values at bridge faces revised to match existing conditions (generally decreased).

Note: **Table 1** referred to in the cover letter is a simplified version of the above scenarios. **Table A3** includes an additional scenario, where only the channel/overbank values are changed (i.e., high bridge 'n' values are not revised.) Table A3 also provides times to peak which demonstrate the lagging effect of the high 'n' values at the bridges.

4. Routing behind structures:

I also have concerns that the unsteady modeling approach has not accounted for future enlargement of road crossings. **Table A4** indicates the difference in headwater and tailwater levels for all bridge structures in the reach. For those with small differences this should not be a concern. However, there is a considerable difference at Richardson. According to the MNR's Technical Guide, the unrouted flow should be used downstream of crossings, recognizing the difficulty, if not the practical impossibility guaranteeing that future structures will not be

enlarged. This is not to suggest that the unsteady modeling approach is not appropriate for this reach but there is no indication that the modeling completed to date has accounted for this requirement of the Technical Guide.