APPENDIX 6.2.7-B

Source Files

Memo

To	**Ian Judd-Henrey**	From	**Sukru Sumer**
Company	**17 December 2010**	Direct Tel.	**403-387-1783**
File No.	**SX0373302**	c.	**Bruce Ott, Dave Simms**
Subject	**Saskatchewan River Dispersion Modeling – Diffuser Plume Estimate**		

The Saskatchewan River flow and transport model was prepared in August 2010 to assist with project design and the preparation of permitting for the Shore Gold Mine. The model addressed the prediction of chloride concentrations in the river that are expected to result from the discharge of groundwater to the river from the end of an outfall pipe. The model construction details and the predictions of chloride concentrations in the Saskatchewan River that are expected to result from the discharge of well field groundwater to the river are summarized in the AMEC (2010). Shore Gold has decided to investigate the diffuser option for the outfall; and, in order to help in the preliminary evaluation, asked AMEC Earth and Environmental (AMEC) to estimate the chloride concentrations in the Saskatchewan River using the existing Far Field model.

This technical memorandum summarizes the results of simulation of chloride plume generated at the proposed diffuser pipe location during the low river flow 14,602,000 m^3/d (7Q10). The diffuser pipe is assumed to extend across the entire width of the river and has ports which are 10 m apart. The model used is a 2D flow and transport model designed to analyze far field mixing of point, areal and/or line sources in rivers. The source of the chloride plume in this model was represented with a depth averaged point source at a short distance downstream of each port of the diffuser. This is an approximation of the source concentration which occurs at a short distance downstream of the diffuser pipe and/or the port. Over this distance the turbulent jet velocities reduces down to ambient river velocities. The length of this distance is also called the near field length. The plume behavior in the near field is analyzed with turbulent jet momentum equations which include the initial velocity of the jet at the diffuser port and some other flow parameters. The detailed hydraulic design of the diffuser was not attempted during this preliminary evaluation.

The diffuser located along the low flow width of the Saskatchewan River at the previously selected discharge location was assumed to have 20 ports. The total well field discharge, 199,000 m^3/d, and its chloride concentration, 1725 mg/l, were distributed across the width of the river. Model mesh refinement and the simulations of the low flow in the river were done to update the model hydraulic flow regime integrating the diffuser discharge configuration. Initially, the flow rates at each port were selected equal to 1/20 of the total discharge. Later on, the flow rates at each port, roughly adjusted to allow less discharge in the shallow and more discharge in the deeper locations. The simulated discharge from each port in the model is given in Figure 1.

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Transport model runs indicated that the chloride concentrations in the river width, reduce to values varying between approximately 18 to 40 mg/l above background at 40 m downstream of the source (shown in Figure 1). The variability in concentrations in lateral direction is a function of river water depth and the rate of discharge through the port. The transport model results and the summary of chloride concentrations along a lateral line at the source, and at 40 m downstream of the source were illustrated in Figures 2 and 3. Figure 4 illustrates the longitudinal chloride concentration along a line perpendicular to the diffuser in the middle of the river.

The two dimensional far field model simulations for a diffuser generated plume indicated that the chloride concentrations in low flow in the river reaches 23 mg/l above background (condition of full mixing of the discharge with the river low-flow) at approximately 40 m downstream of the source location. It should be noted that the source location for the far field model is the location at which the diffuser turbulent jet velocities slows down reaching river flow velocities and also where the vertical mixing is complete. This location is a short distance downstream from the diffuser pipe and can be determined with near field analysis.

Modeling has shown that extending the outfall pipe into the river will improve the longitudinal dispersion of the chloride plume in the river. Furthermore, discharging through a diffuser located in the deeper and faster moving middle section of the river would result increased mixing and lower plume concentrations.

Please contact Sukru Sumer at (403) 387-1783, if you have any questions regarding this technical memorandum.

Yours truly,

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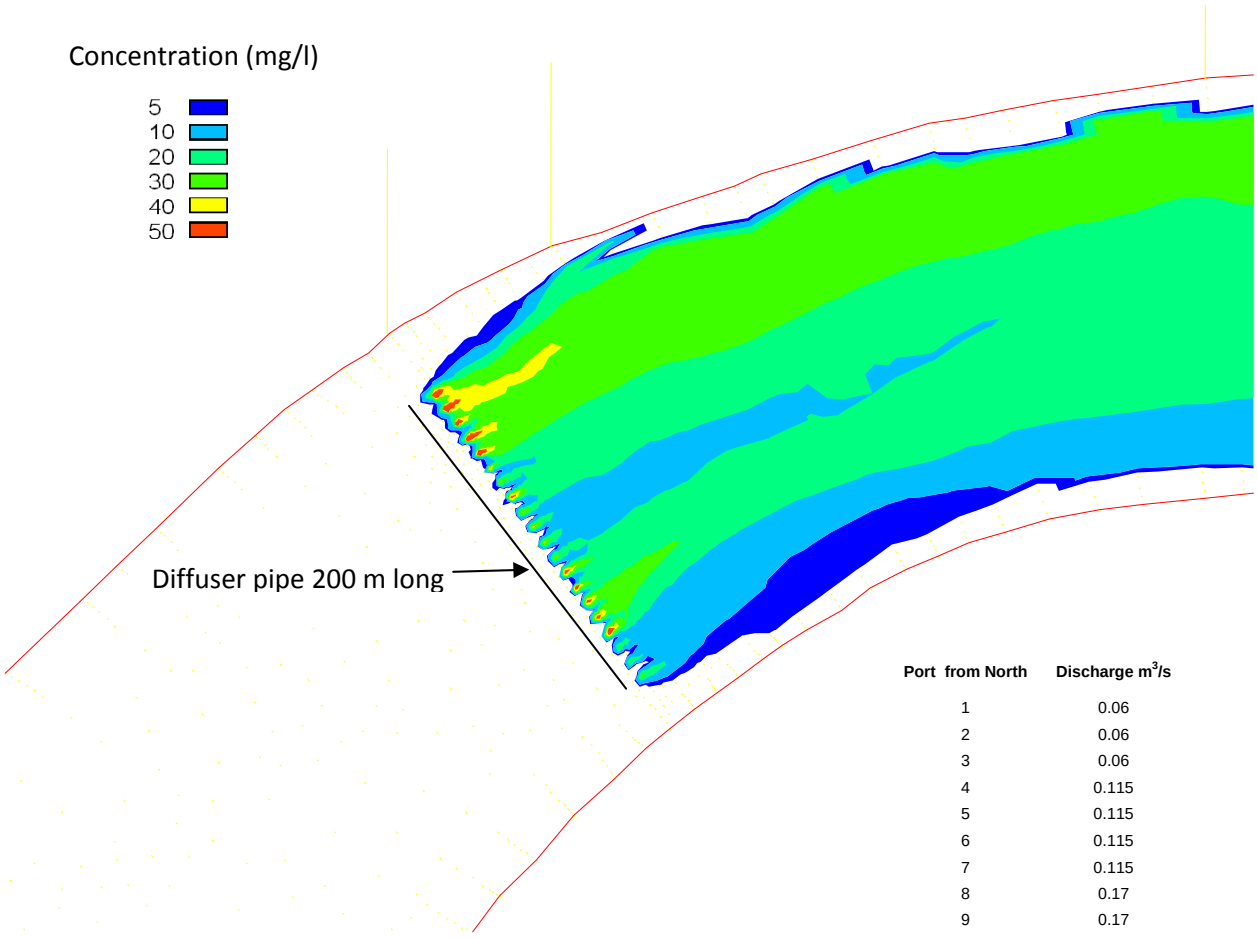
SS/cf

Figures



Port from North	Discharge m^3/s
1	0.06
2	0.06
3	0.06
4	0.115
5	0.115
6	0.115
7	0.115
8	0.17
9	0.17
10	0.17
11	0.17
12	0.17
13	0.17
14	0.115
15	0.115
16	0.115
17	0.115
18	0.06
19	0.06
20	0.06

FIGURE 1 – Chloride Concentrations Downstream of the Diffuser Represented in the model

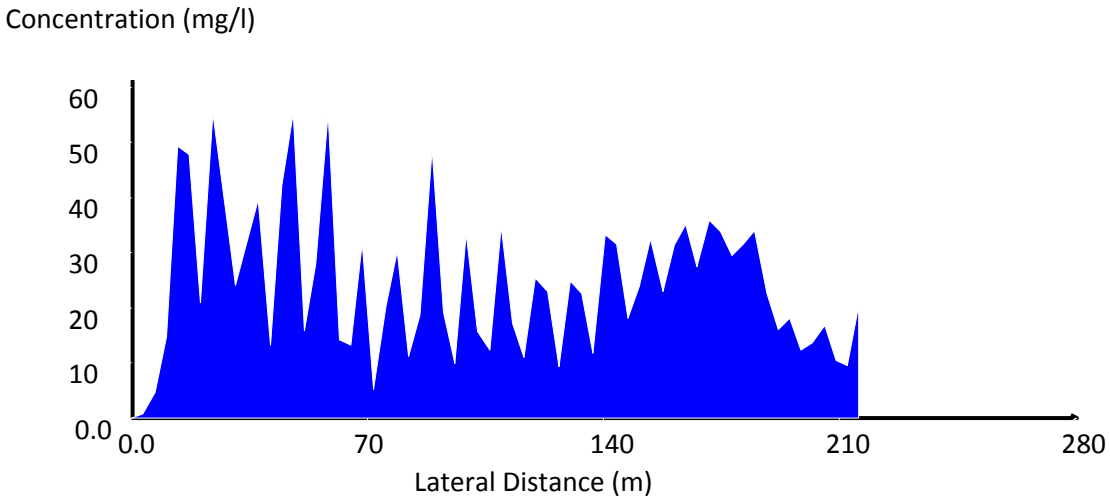


FIGURE 2 – Chloride Concentration in the River at the Location of the Source

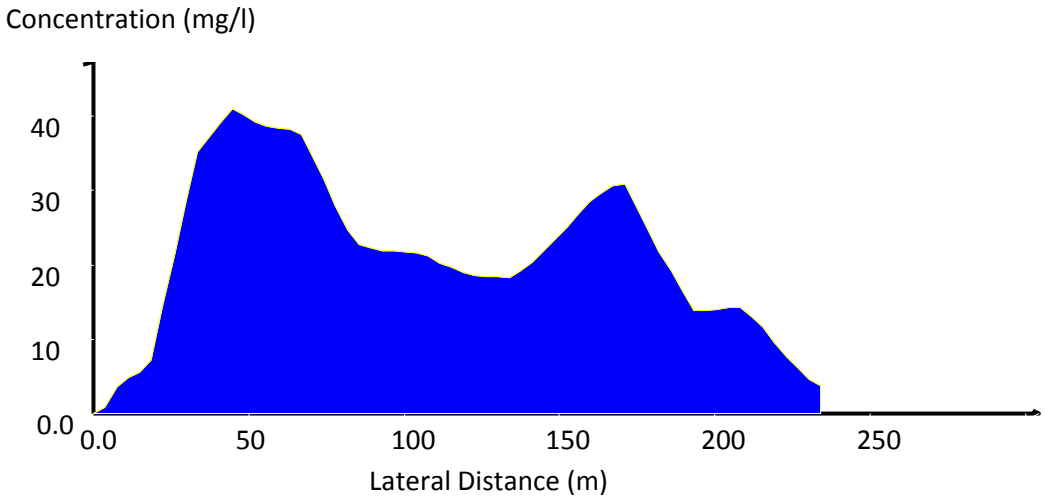


FIGURE 3 – Chloride Concentration at 40 m Downstream of the Source

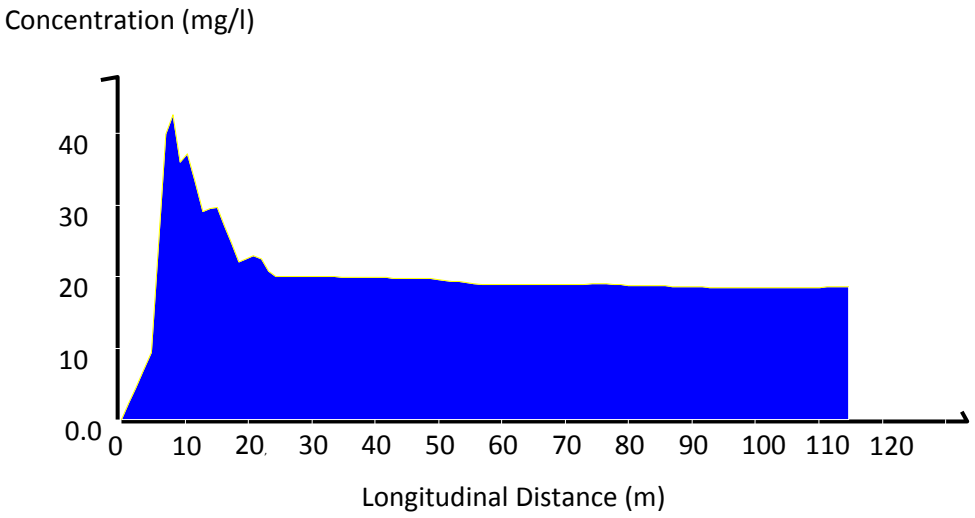


FIGURE 4 – Longitudinal Chloride Concentration along a Line Perpendicular to the Diffuser in the Middle of the River (Note that the complete vertical mixing is assumed to occur approximately 10 m downstream of the diffuser pipe for illustration purposes only)