BEFORE THE STATE OF WASHINGTON
ENERGY FACILITY SITE EVALUATION COUNCIL

In the Matter of Application No. 99-1:

SUMAS ENERGY 2 GENERATION FACILITY

EXHIBIT ___ (HC-RT)

APPLICANT'S PRE-FILED REBUTTAL TESTIMONY

WITNESS: HSUEH-JU CHANG

Q. Please re-introduce yourself to the Council.

A. My name is Hsueh-Ju (Sherrie) Chang. I am a Water Resources Engineer with URS Corporation where I work as a flood modeler. I have been performing hydrologic and hydraulic modeling for watershed planning, alternative analysis, and permit review for the past 15 years, including work with Delbert Franz, the creator of the existing Whatcom County region unsteady state flood model.

Q. What issues will you address in this rebuttal testimony?

A. My rebuttal testimony will address issues related to flood modeling raised in the written testimony of Paula Cooper and Yarosloav Shumuk, both of which were filed

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on October 1, 2001 by, respectively, Whatcom County and the Province of British Columbia.

Nooksack River Overflows

Q. Mr. Shumuk's testimony seems to suggest that the phenomenon of the Nooksack River overflowing into the Johnson Creek/Sumas River basin during large floods is not being properly recognized or taken into account in SE2's studies of the possible impacts from filling the SE2 site. Is that suggestion correct?

A. No. This phenomenon is one of the principal reasons for the complexity of the modeling being done by SE2. Two different flows drain into the Everson-Sumas overflow corridor: the relatively small local drainage from Johnson Creek and the overflow of the Nooksack River which occurs at Main Street in Everson, Washington, during large floods on the Nooksack River. These two flows behave quite differently, thereby making numerous aspects of the work more complicated than in other modeling projects. In other words, far from not being recognized or taken into account, the Nooksack River overflows are a central feature of the analysis.

Frequency Returns

Q. Mr. Shumuk says that the modeling proposed by SE2 is inadequate because it does not include longer return periods, for example, the 200-year flood event. Do you agree?

A. No. The modeling we are doing is based on the selected storms approach instead of a storm frequency approach. Under the former approach, the modeler selects actual historical storm events as the basis for the model and applies various factors to these

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selected storms to encompass a wide range of flow conditions that may cause impacts within the watershed. For the SE2 project, we are using two of the largest recorded flood events that have occurred during the past two decades for this area, namely, the floods that occurred in November 1990 and November 1995. Although other severe floods occurred on Nooksack River prior to 1980s, information related to the overflow was not documented as well as the floods in the 1990s. During the largest 1990s floods, the volume of water over-flowing at Main Street in Everson from the Nooksack River into the Johnson Creek/Sumas River basin reached peaks of approximately 8,000 cubic feet per second ("cfs").

In contrast, the storm frequency approach focuses on identifying the largest magnitude of a storm that can be expected to occur at certain intervals of time, for example, once every 25, 50, 75 or 100 years. This approach looks to historical data regarding the frequency of such storms and then proceeds on the assumption that future storms will follow the same frequency pattern. The difficulty with using such a method for this project is that we simply do not have sufficient historical data to reliably predict the longer frequency returns. That is, since the number of years for which we have storm records for this part of the world is relatively short, we do not know what the "200-year" storm event or the "500-year" storm event might be. Even for the 100-year event, predicted flood volumes vary widely on Nooksack River. For example, the 100-year event at the flood gage near Deming, Washington (the "Deming gage") is estimated to be between 36,000 cfs and 81,000 cfs.

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The selected storm approach avoids this problem by using data from real flood events. In this case, as mentioned, we have selected the two of largest known floods for this area, the November 1990 and November 1995 floods. To account for the possibility of even larger floods, we will run the model using flows that are roughly 150% of the peak rates at the Deming gage on the Nooksack River. In my opinion, this is a conservative approach to assessing the possible impacts from especially severe flood events since this volume of overflow, *i.e.*, 150% of the peak overflow rates, may well exceed longer frequency rates such as the 200-year storm event. We have discussed this approach with Ms. Cooper, and she concurs that it is appropriate

Model Types

Q. Both Ms. Cooper and Mr. Shumuk raise the issue of cumulative impacts from other fill projects. Are these being taken into account in the flood modeling you are performing for SE2?

A. Yes. We are collecting data regarding recent fills at other sites in the area, and we will be including this information in the base condition model.

Q. What is the "base condition" model?

A. The base condition model is one of three models that will be created to evaluate the potential impacts on flooding from the proposed fill at the SE2 site. First, we will create a "calibration" model. This model involves essentially recreating the 1990 flood conditions in the Sumas area. Topographical information for the area is entered, the model is run using the November 1990 flood volumes, and the model results are then compared to observed high water marks during the actual 1990 flood

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event to ensure that the model is properly "calibrated." One wrinkle in this process is that our most accurate topographical information for the early-1990s dates from 1993, not 1990. We will therefore use the 1993 topographical information combined with the November 1990 flood information. Refinements will be made to the flood model developed by Delbert Franz of Linsley, Kraeger Assosicates, Ltd., which is also calibrated off the November 1990 flood, by incorporating additional cross-sections in the vicinity of the proposed SE2 site.

Once the calibration model is established, we will then create the "base condition" model. This involves revising the calibration model to reflect major fills that have occurred in the vicinity since 1993. The various flood volumes will then be run through the base condition model to determine the flood conditions with the SE2 site in its current state. Finally, a "proposed condition" model will be created by revising the base condition model to account for the filling of the SE2 site. The flood volumes will then be run on this model to predict what the flood conditions will be after filling the SE2 site. We will thus be able to evaluate the potential impacts on flooding as a result of the project by comparing the "before and after" flood conditions.

Model Runs

Q. In her testimony, Ms. Cooper states that she "would like to see URS run the calibrated model based on the 1993 topography for the same range of flood events they run the base model . . . ." What does SE2 plan to do in this regard?

A. We have been planning to do just as Ms. Cooper suggests, *i.e.*, we will be running the calibration model for the same range of flood events as we run for the base model.

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Q. What are the flood events that will be run on the three models?

A. As mentioned, we will run the 1990 flood event which had a peak flow at the Deming gage of about 49,000 cfs[1] and peak overflow at Main Street in Everson into the Johnson Creek/Sumas River basin of 8,000 cfs. A second run will simulate a Main Street, Everson overflow that is 50% of the 1990 event, *i.e.*, 4,000 cfs, and a third run will be made at approximately 150% of the 1990 event, *i.e.*, 75,000 cfs at the Deming gage.

In addition, we will do runs at 50%, 100% and 150% of the November 1995 flood. Although the estimated peak discharge of this event were similar to the 1990 event as measured at the Deming gage based on the recorded flood stage, the shape of the hydrographs are quite different. For example, whereas the November 1990 event continued for several days, the flood levels during November 1995 event rose and fell relatively quickly.

Thus, we will be running six different flood scenarios on each of the three models keyed off of two severe historical flood events. This will enable us to evaluate what if any impacts the SE2 project might have on flooding based on a wide range of potential flood events and hydrographic profiles.

[1] This is a revised figure which we obtained from the USGS. The new figure has not yet been published by the USGS. Therefore, the currently published figures show the peak rate at the Deming gage during the 1990 flood as being 37,900 cfs.

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Complexity of the Model

Q. One of Mr. Shumuk's concerns is that the potential for rerouting of flows must be addressed. In addition, he states that "[t]he model must be sufficiently detailed to be able to reliably account for the impacts of the proposed fill in this hydraulically complex area." Shumuk PFT, p. 7:7. What is your opinion as to whether the model SE2 is developing will meet these concerns?

A. In my opinion, the model we are developing more than meets such concerns. In fact, it is the very sort of model that he refers to in his testimony. As described in my earlier testimony, this model will be an adaptation of the unsteady state flood model created by Delbert Franz for Whatcom County. It is the model that generates the flow hydrograph to be used as the upstream boundary condition for the unsteady flow model developed for the Sumas River downstream of US border, *i.e.*, in British Columbia. The model is quite complex and addresses a range of issues, including loss of overbank storage and rerouting of flows due to increases in flood levels. I therefore consider that the model is more than sufficiently detailed to "account for the impacts of the proposed fill in this hydraulically complex area." In fact, it is extremely unusual to have a model as complex as this developed to assess the flood impacts from such a relatively small site.

Mitigation Proposals

Q. Ms. Cooper states that if it is determined that there will be adverse impacts to flood levels and adjacent properties from the SE2 fill, the model should be used to evaluate whether the proposed mitigation will be effective. Do you agree?

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A. Yes. Although I consider the possiblity of adverse impacts from the SE2 fill to be very unlikely, it has been our intention that in such an event, the model will be used to assess the effectiveness of any contemplated mitigation.

Q. Ms. Cooper also states that the determination as to whether any mitigation is reasonable should be in the hands of those impacted, not SE2. Do you agree?

A. No. I do not believe that the final decision about the reasonableness of any proposed mitigation should be determined by either SE2 or the impacted parties. Such a decision should be made by a neutral third party, and it has been my understanding that the Council would be fulfilling that role. That is, in the unlikely event that mitigation should be needed, SE2 would study the various mitigation options and then present a proposal to the Council for its approval.

END OF TESTIMONY

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