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January 14, 2002

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Hand-Delivered -- Urgent

Col. Ralph Graves
Ms. Muffy Walker
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U.S. Army Corps of Engineers
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P. O. Box 3755
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Exhibit 406
Date 2/19/02
Witness Kavazanjian
Diana Mills Court Reporter

Re: Corps Ref. No. 1996-4-02325: Port of Seattle Third Runway and Related Master Plan Update Projects: **GeoSyntec Comments on *Geotechnical Summary Report, Third Runway Embankment Fill and West MSE Wall, Seattle Tacoma International Airport Project*, by Hart Crowser, Inc., dated 4 November 2001**

Dear Col. Graves, Ms. Walker and Ms. Terzi:

Attached please find comments by GeoSyntec Consultants related to Hart Crowser's November 2001 "*Geotechnical Summary Report, Third Runway Embankment Fill and West MSE Wall, Seattle Tacoma International Airport Project.*" Please include these comments in the Corps' record of decision on the Port's application; the original letter is being mailed to you directly from GeoSyntec.

Geosyntec's review discloses that the Port has now radically revised its construction approach, opting to excavate up to three million cubic yards below the proposed MSE wall location instead of using *in situ* ground improvement, as was previously proposed to minimize impacts to Miller Creek and adjacent wetlands.[1] This massive excavation and replacement create the potential for significant

[1] The November 2001 Hart Crowser report acknowledges that one-hundred stone columns were installed on the site to test whether the *in situ* approach would work, but the results of that testing were not included in the report. Apparently, however, the results were unsatisfactory, resulting in the Port's switch to the massive excavation now proposed. ACC has asked the Port to provide us with the actual results of the stone column testing. The Port's "test" raises serious questions about what harm was caused when the Port installed one-hundred stone columns at the site of protected streams and wetlands. ACC urgently requests that the Corps investigate this and verify that no CWA violations occurred as a result of this testing, prior to any decision on the Port's § 404 application.

dewatering and other impacts on the creek and wetlands, yet apparently no attempt has been made to analyze, quantify or mitigate these impacts.[2]

GeoSyntec's comments also identify continuing technical deficiencies in the November 2001 Hart Crowser report, such as the level of seismic loading and stability analyses which are being used by Hart Crowser. GeoSyntec also points out a series of misleading and undocumented claims regarding the seismic design of the MSE wall.

GeoSyntec's comments are not just routine comments pointing to minor technical deficiencies in the Port's analysis. Instead, Geosyntec points to a significant change by the Port in approach and direction. While the change in foundation plans is overdue (acknowledging problems which GeoSyntec pointed out long ago), the Port has made the change as if it were operating at a site where there are not overriding environmental constraints. Compensating for seismic safety issues while ignoring what it may do to the hydrology and wetlands is not an acceptable trade-off, nor is it legal under the Clean Water Act. It is not ACC's fault -- nor the Corps' -- that the Port waited until now to address issues that should have been addressed years ago.

The Corps should give the changes the Port has made careful scrutiny in light of their serious implications to wetlands and Miller Creek. Additionally, the Corps should ask the Port to follow acceptable technical standards, and to correct and substantiate its misleading and undocumented claims. The November 2001 Hart Crowser report lends no support for approval of the Port's CWA Section 404 permit application, but rather undercuts even further the Port's ongoing attempts to justify its proposal.

Very truly yours,

HELSELL FETTERMAN LLP

Kevin L. Stock

Enclosure

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[2] Wetlands scientist Amanda Azous also discussed this issue in her December 28, 2001, letter to the Corps. *See* 12/28/01 Azous letter at pp. 8-9.

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14 January 2002

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ATTN: Muffy Walker/Gail Terzi

Subject: Comments on *Geotechnical Summary Report*
Third Runway Embankment Fill and West MSE Wall
Seattle Tacoma International Airport Project
by Hart Crowser, Inc., dated 4 November 2001

Introduction

As part of our continuing work on behalf of the Airport Communities Coalition, GeoSyntec Consultants (GeoSyntec) has reviewed the *Geotechnical Summary Report, Third Runway Embankment Fill and West MSE Wall, Seattle Tacoma International Airport* prepared by Hart Crowser, Inc., dated 4 November 2001 (the 4 November GSR). Our review of this report indicates that significant changes have been made to the project that potentially impact Miller Creek and adjacent wetlands. These impacts have neither been documented nor subject to public scrutiny. Our review has also identified additional deficiencies in the technical approach to the project and indicates that project proponents continue to make misleading statements about the state of practice with respect to seismic design of mechanically stabilized earth (MSE) walls and the adequacy of their technical approach. These issues are discussed in detail in the subsequent sections of this letter.

Changes to the Project that Potentially Impact Miller Creek

The 4 November GSR indicates that, to enhance stability, foundation preparation for the MSE wall will now include excavation and replacement of up to 20 ft of unsuitable (soft and/or potentially liquefiable) material. Excavation and replacement of unsuitable foundation material is a significant change in the project, as previous project documents indicated that, to minimize the disturbance to Miller Creek and adjacent wetlands, in situ ground improvement (e.g. stone columns) would be used

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for foundation preparation beneath the wall in lieu of excavation and replacement. The total quantity of excavated material appears to total approximately 3,000,000 cubic yards (based upon the total excavation quantity cited in the Executive Summary). However, neither the limits of the area designated for excavation and replacement nor the quantity of material that will be excavated and replaced are explicitly addressed in the document. The 4 November GSR indicates that excavation and replacement will now be used because of the extent of foundation material that is potentially liquefiable according to the "Chinese criteria".

We are gratified that, consistent with past GeoSyntec comments, project proponents are employing the Chinese criteria to identify potentially liquefiable material rather than to characterize material as non-liquefiable. Given that some of the foundation material has been identified as potentially liquefiable, excavation and replacement is clearly technically superior to in situ ground improvement for mitigation of liquefaction potential and undoubtedly will enhance the stability of the foundation. Unfortunately, excavation and replacement has the potential to create significant impacts to Miller Creek and the adjacent wetlands. However, no attempt has been made to quantify these impacts. It is unlikely that compacted fill can be replaced in an excavation up to 20 ft deep at the site without significant dewatering. Dewatering of an excavation up to 20 ft deep may have significant impacts upon the ecosystem of the adjacent creek and wetlands. Neither the need for dewatering, potential impacts of dewatering, nor methods to mitigate these impacts are discussed in the 4 November GSR. Additional undocumented potential impacts from excavation and replacement of unsuitable foundation material that may affect the adjacent creek and wetlands include disturbance due to access and egress, stockpiling of materials, and other construction activities.

Technical Deficiencies in the Project Approach

Our review of the 4 November GSR has identified continuing deficiencies in the technical approach to the project. We continue to question the seismic design basis for the project. The 4 November GSR states that, while the Port "recognizes the project is significant", the wall is being designed "as a structure of ordinary importance" "similar to large bridges and other transportation infrastructure" for a seismic loading with a 10 percent probability of being exceeded in a 50-year period. We find this approach deficient in several respects. Contrary to statements made in the report, this level of seismic loading is not consistent with current practice for large bridges. For instance,

we understand that the new Tacoma Narrow Bridges was designed to withstand earthquake ground motions with a 2 percent probability of being exceeded in a 50-year period. The use of a loading with a 10 percent probability of being exceeded in 50 years also ignores proposed changes in the design standard for ordinary facilities and does not account for potential impacts on the adjacent wetlands in that it implies the facility is classified as a structure of ordinary importance.

While the current American Association of State Highway and Transportation Officials (AASHTO) specifications do call for the use of the 10 percent in 50 years criterion as a minimum standard for seismic design of transportation facilities, "large" bridges (e.g., bridges across the East River in New York, the new Savannah River Crossing in South Carolina, the major toll bridges in California) are usually designed to a higher standard. Furthermore, the draft of the proposed new AASHTO seismic design guidance being prepared by the Multidisciplinary Center for Earthquake Engineering Research (MCEER) under AASHTO National Cooperative Highway Research Program (NCHRP) funding, calls for use of a design earthquake with a 3 percent probability of not being exceeding in 75 years (roughly equal to a 2 percent probability of not being exceeded in 50 years loading)[1]. The MCEER/NCHRP project team suggested the use of a 75-year exposure period as the basis for bridge design because a 50-year exposure period was considered to underestimate the useful life of a bridge. Using this logic, it is questionable whether even 75 years is appropriate for a large earthfill that may be expected to remain serviceable for one hundred years or more. Similarly, a probability of exceedance of 3 percent is employed in the draft guidance because 10 percent was considered inadequate for a life-safety standard. Furthermore, neither current nor draft AASHTO specifications address ecological risks. As none of the existing seismic design standards address ecological impacts; we believe public discussion and comment is warranted before classifying this facility, the failure of which would have significant ecological impacts, as a structure of ordinary importance.

Another significant deficiency identified in our review of the 4 November GSR is the use of the Consolidated Undrained (CU) Shear Strength of cohesive soils, without reduction for cyclic loading, in pseudo-static stability analyses. The report states that reductions in the CU shear strength due to cyclic loading are offset by increases in the CU strength due to strain rate effects. However, the current state of practice in geotechnical engineering is to reduce CU strengths in cohesive soils by 15 percent (i.e.,

[1] "Recommended LRFD Guidelines for Seismic Design of Highway Bridges; based on NCHRP Project 12-49, FY '98 'Comprehensive Specification for the Seismic Design of Bridges'," prepared under MCEER Highway Project 094, Task F3-1, April 9, 2001

to use 85 percent of the static strength) to account for potential strength decreases due to cyclic loading. This strength reduction, first recommended by Makdisi and Seed in1978, is contained in current seismic design guidance documents developed by the Corps of Engineers, the Federal Highway Administration, and other recognized authorities. Unless there is some site-specific evidence to the contrary that has been subjected to review and scrutiny, we do not believe it is warranted to use more than 85 percent of the CU strength of a cohesive soil in a pseudo-static stability analysis, in accordance with the current state of practice.

Misleading and Undocumented Claims

In addition to statements regarding the appropriateness of the chosen seismic loading criterion discussed above, the 4 November GSR makes a series of other misleading and undocumented claims with respect to seismic design of the MSE wall. The report continues to suggest that there is nothing special about the 135 ft high wall MSE section as many similar projects have been designed and constructed using "the same technology." While it is true that two walls of similar height have been constructed using similar technology, neither of these walls has been subjected to significant seismic loading. The report says that the design was based upon "a rigorous code for design of MSE walls based upon the experience of numerous state transportation agencies, other engineering organizations, and research by the Federal Highway Administration" developed by AASHTO. However, the experience relied upon to develop the AASHTO code does not include seismic loading of these structures. Furthermore, with respect to AASHTO seismic design criteria, the Governor's Board of Inquiry appointed following the 1989 Loma Prieta earthquake in California, found that "Current federal criteria, when used for California transportation projects, may not be sufficiently conservative and inclusive of seismic concerns to meet the seismic safety needs of the State of California."[2] Professor I.M. Idriss, a member of the Port's Engineering Technical Review Board, was also a member of this blue-ribbon panel.

The report claims that researchers at the University of Washington established the "reasonableness" of the computer program FLAC used for seismic analysis of the wall by comparison with shaking table and centrifuge testing results. However, no

[2] "Competing Against Time," report to Governor George Deukmejian from the Governor's Board of Inquiry on the 1989 Loma Prieta Earthquake, State of California Department of General Services Publications Services, May, 1990

documentation (e.g., citations for research reports or technical papers) is provided to substantiate this claim. Most of the previous studies cited as evidence of the reasonableness of "FLAC" did not involve reinforced earth structures and appear to have used different constitutive models than used in analyzing the Third Runway MSE wall. The one previous study that did evaluate the seismic response of MSE walls (the Bathurst and Hatami study) produced some very anomalous results, yielding amplification factors of five between the base of the wall and the top of the wall. The report states that the design ground motion is characterized by three earthquake time histories, apparently affirming GeoSyntec's earlier contention that the single time history used in earlier analyses was inadequate. However, most of the references to these time histories are to internal Hart Crowser reports and they have never been compared to the target spectra or duration in documents provided to us for review.

Conclusion

The 4 November 2001 Geotechnical Summary Report indicates that, as stated in the report, design of the MSE wall is an iterative process that continues to evolve. The evolution of the design continues to result in design changes that have the potential to cause significant, undocumented impacts to Miller Creek and the surrounding wetlands. These impacts have neither been evaluated nor subjected to public scrutiny. We also continue to have significant concerns regarding the appropriateness of the design criteria and seismic design methodology employed to evaluate the seismic performance of the wall. The community has never had the opportunity to comment on the appropriateness of the seismic design criteria, as the Port's choice of seismic design criteria was made after the public comment period had ended. The claim that the seismic design criteria are consistent with criteria used for large bridges is inaccurate and the suggestion that the design criteria is beyond reproach because it is consistent with current AASHTO standards is overstated. Claims that the seismic design methodology is "verified" are unsubstantiated. Changes in either the design criteria or design methodology have the potential for creating additional significant changes in the project and associated significant impacts. Until it is established that the scope of the project and its associated impacts have been established to a reasonable degree of certainty, we believe that approval of the project is premature.

Sincerely,

Edward Kavazanjian, Jr., Ph.D., P.E.
Principal

Patrick C. Lucia, Ph.D., P.E.
Principal

cc: Peter Eglick, Helsell Fetterman LLP
Kelly Evans, Airport Communities Coalition