DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

REPLY TO
ATTENTION OF

Environmental and Cultural Resources Branch

DEC 15 2014

Allyson Brooks, Ph.D.
Washington State Historic Preservation Officer
Department of Archaeology and Historic Preservation
P.O. Box 48343
Olympia, WA 98504

Dear Dr. Brooks:

The United States Army Corps of Engineers (Corps) is conducting a Feasibility Study to analyze alternatives for navigation improvements to the East and West Waterways of Seattle Harbor. The Port of Seattle has asked the Corps to study the feasibility of a potential deepening project in order to meet the draft requirements of today's fleet of container ships, provide for safe transit of vessels, and to improve transportation cost efficiencies at Seattle Harbor. The Corps has determined and documented the Area of Potential Effect (APE) for the undertaking and is consulting with your office under Section 106 as provided for at 36 CFR § 800.4(a). This letter also summarizes efforts that the Corps has taken to date to identify historic properties that may be affected by the undertaking.

a. *Project Location:* The authorized project begins at Elliott Bay and extends upstream approximately five miles to the head of the federal navigation channel which lies in the lower Duwamish River and includes the East, West and Duwamish Waterways. However, the Seattle Harbor Navigation Improvement project area only includes the East and West Waterways (Enclosure 1 and 2).The West Waterway is located in Section 12 of Township 24 North; Range 3 East. The East Waterway is located in Section 7 of Township 24 North; Range 3 East.

b. *Project Background:* Seattle Harbor is a federally-authorized navigation project consisting of the East, West, and Duwamish Waterways. As early as 1895 the tidal flats and salt water marshes around Seattle began to fill. As a consequence, in 1903 city leaders and others began the construction of Harbor Island and dredging the East and West Waterways, and the Duwamish navigation channel. Both the East and West waterway have been repeatedly dredged since the early 1900's. In 1918, the United States government assumed the maintenance responsibilities of the East and West Waterways, and the Duwamish Waterway. A review of nautical charts indicates that both the East and West waterway have been dredged to various depths over the years. The 1918 nautical map shows that the West Waterway ranged in depth between -5 to -8 feet mean lower low water (MLLW) and the East Waterway ranged in depth from -5 ½ to -8

feet MLLW (U.S. Coast and Geodetic Map 1918). By 1934, the depth of the East Waterway ranged from -30 to -48 feet MLLW and the depth of the West Waterway ranged in depth from -32 to -52 feet MLLW (U.S. Coast and Geodetic Survey 1934).

c. *Project Description:* The Corps will identify and evaluate a full range of alternatives in the East and West Waterways, including several new deepening alternatives ranging between -51 to -55 feet below MLLW.

d. *East Waterway:* Currently, the East Waterway ranges in depth from -30 to -53 feet MLLW. High spots exist within the East Waterway with associated navigational access impediments and safety risk concerns.

e. *West Waterway*: Currently, the West Waterway ranges in depth from -34 to -60 feet MLLW. The majority of the Waterway is at a depth of below -51 feet MLLW. However, high spots exist at the entrance of the West Waterway. The current bathymetry has only a narrow "key way" at all times creating safety concerns during transit.

f. *Area of Potential Effects:* The Corps has determined the Area of Potential Effect (APE) for both the East and West Waterways to be the vertical and horizontal limits of the authorized limits for each waterway. The horizontal limit for the East Waterway is 7,232 feet which is the maximum length of the waterway. The maximum width from berth to berth is 750 feet. The horizontal limits for the West Waterway are 6,106 feet which is the maximum length of the waterway. The maximum width from berth to berth is 750 feet (See Enclosure 2). The vertical extent for each waterway would be up to 55 feet below MLLW. Dredged material would be disposed of at either existing open-water disposal sites or existing upland disposal sites.

The Corps has reviewed existing cultural resources information available for the area and prior environmental studies conducted for Seattle Harbor, including the East and West Waterways. The Corps has conducted navigation and/or operation and maintenance projects within Seattle Harbor since the 1970's and has consulted with the Washington State Historic Preservation Officer (SHPO) on these projects over this course of time. This past consultation history information is summarized below:

a. In 1974 the Corps prepared an Environmental Impact Statement (EIS) for ongoing operations and maintenance within the Seattle Harbor project. The Corps consulted with the Washington SHPO who commented that they were unaware of any historic or archaeological resources located in the project area in a letter dated September 7, 1973;
b. In 1979 a Supplemental Environmental Impact Statement (SEIS) was published that evaluated the use of open-water disposal for project maintenance. The Corps consulted with the Washington SHPO who concurred with the Corps findings of no resources present in the project area in a letter dated March 1978;

c. In 1979 the Corps prepared a Supplemental EIS for operations and maintenance of the Seattle Harbor project. The Corps consulted with the Washington SHPO who concurred with the Corps that no resources were present within the Seattle Harbor in a letter dated March 1978; and
d. In 1983 the Corps prepared a Final EIS for the East, West, and Duwamish Waterways Navigation Improvement Study for modifications in the Federal project and to bridges within the area. The Corps consulted with the SHPO who recommended monitoring of the project area during construction in a letter dated August 30, 1979. However, a local sponsor was never identified for this project so it was never implemented.

For the current Seattle Harbor Navigation Improvement Project, the Corps has conducted a Washington Information System Architectural and Archaeological Records Data search. No archaeological sites or other cultural resources have been identified within the APE. A review of nautical charts indicates that both the East and West Waterways have been dredged to various depths over the past 100 years. The 1918 nautical map shows that the West Waterway ranged in depth between 5 to 8 feet and the East Waterway ranged in depth from 5 ½ to 8 feet (U.S. Coast and Geodetic Map 1918). By 1934, the depth of the East Waterway ranged from 30 to 48 feet and the depth of the West Waterway ranged from 32 to 52 feet (U.S. Coast and Geodetic Survey 1934). More recently, data from a Corps' Multi-beam Hydro Survey and the Duwamish Delta Seafloor Mapping Multi-beam Survey do not indicate the presence of any shipwrecks within either the East or West Waterway.

The Corps is also notifying the Muckleshoot Tribe of Indians and the Suquamish Tribe about the project to identify properties to which they may attach religious or cultural significance or other concerns with historic properties that may be affected.

The Corps requests your review and agreement with our determination of the APE. If you have specific questions or we can provide any clarification, please contact, Ms. Kara Kanaby, Lead Archaeologist by telephone at (206) 764-6857 or by email at kara.m.kanaby@usace.army.mil.

Sincerely,

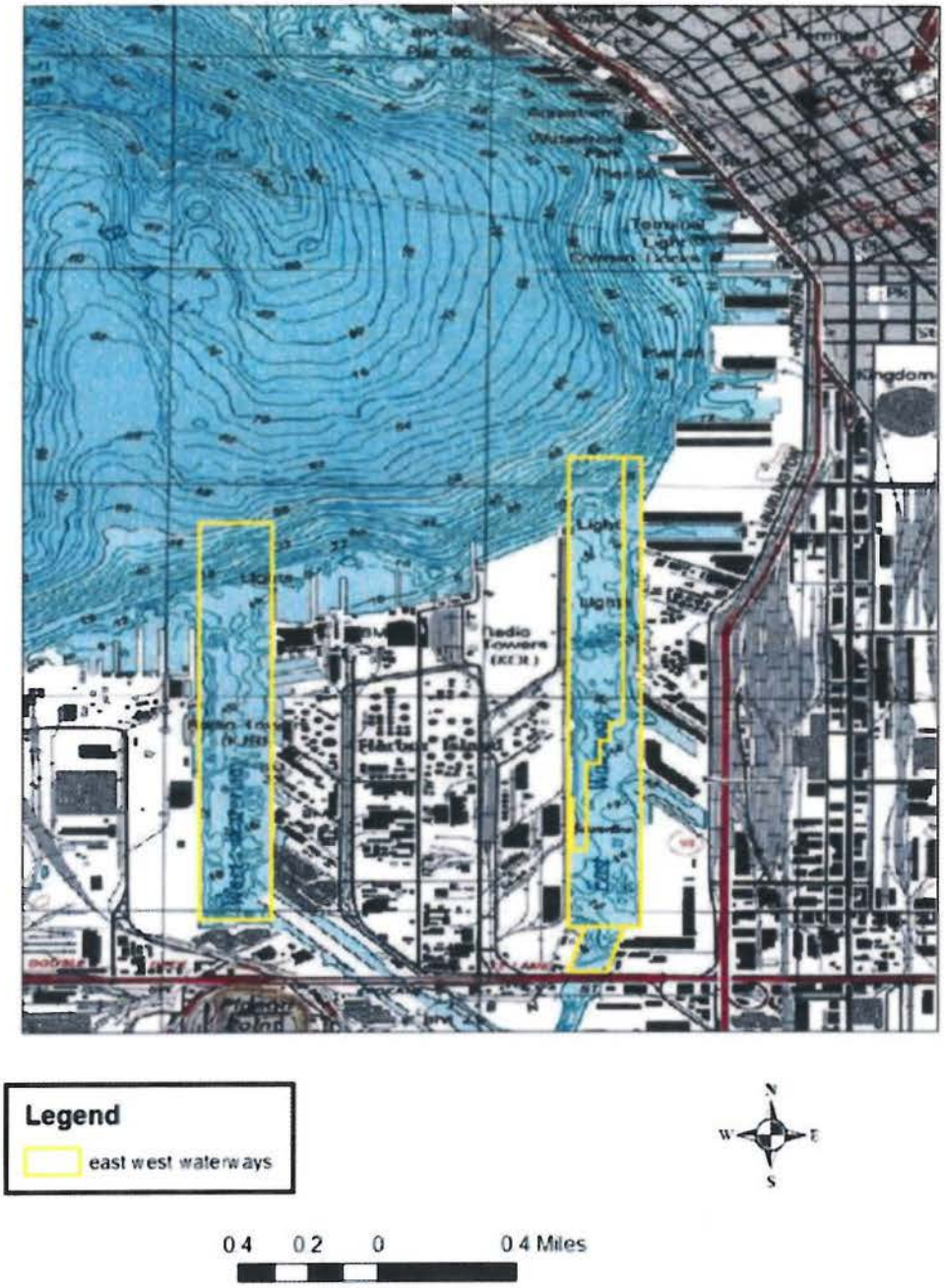
Evan Lewis
Chief, Environmental and Cultural
Resources Branch

Enclosures

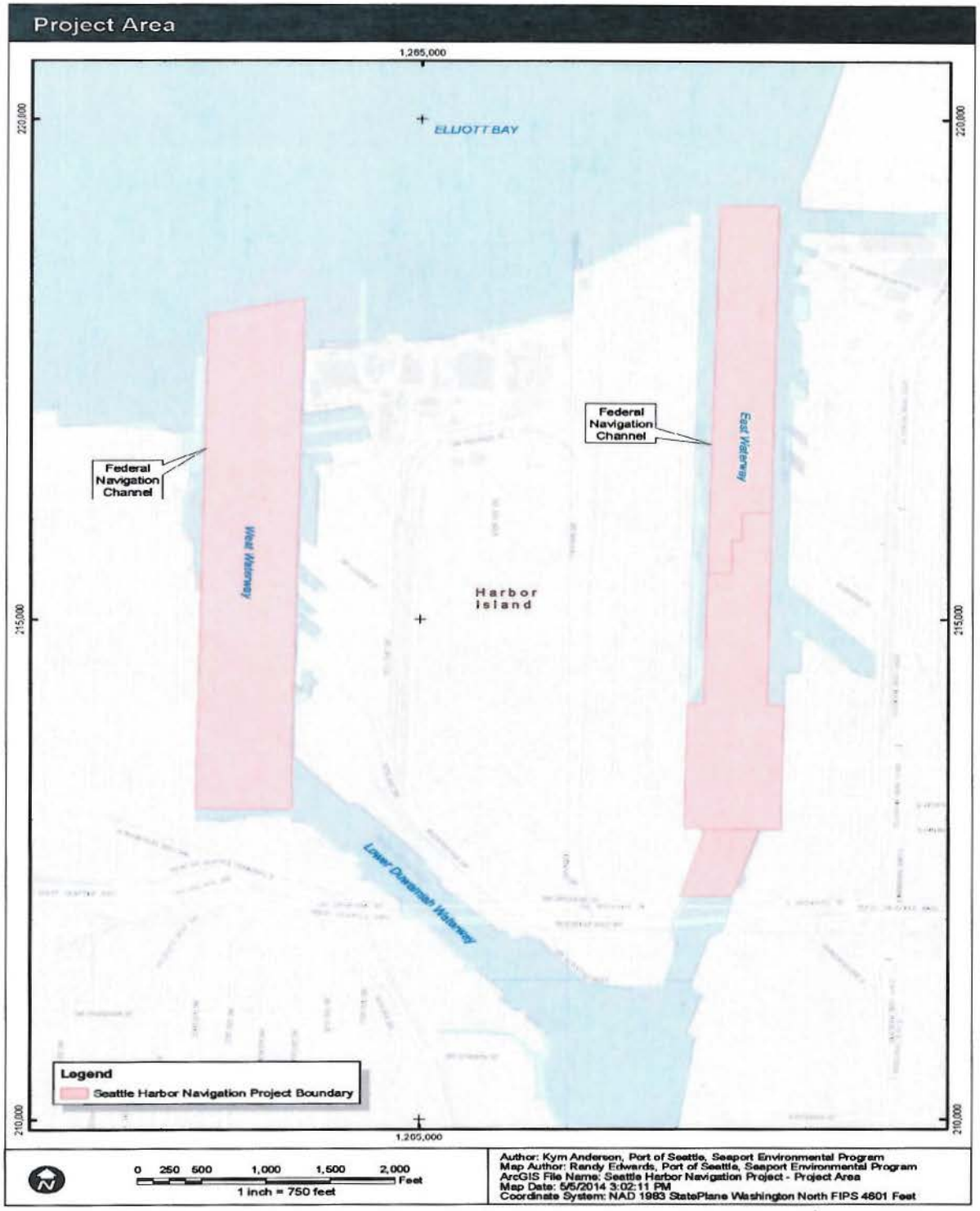
References:

U.S. Coast and Geodetic Survey. 1918. Seattle Harbor.
http://historicalcharts.noaa.gov/historicals/search#searchInput. Chart Number 6445

U.S. Coast and Geodetic Survey. 1934. Seattle Harbor and Lake Washington.
http://historicalcharts.noaa.gov/historicals/search#searchInput. Chart Number 6449



Enclosure 1: Area of potential effects for Seattle Harbor Project



Enclosure 2: Seattle Harbor Project Area

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

REPLY TO
ATTENTION OF

Environmental and Cultural Resources Branch

DEC 15 2014

The Honorable Virginia Cross
Chair, Muckleshoot Indian Tribe
39105-172th Avenue Southeast
Auburn, Washington 98092

Subject: Section 106 Review for the Seattle Harbor Navigation Improvement Project, Seattle, Washington.

Dear Madam Chair:

The United States Army Corps of Engineers (Corps) is conducting a Feasibility Study to analyze alternatives for navigation improvements to the East and West Waterways of Seattle Harbor. The Port of Seattle has asked the Corps to study the feasibility of a potential deepening project in order to meet the draft requirements of today's fleet of container ships, provide for safe transit of vessels and to improve transportation cost efficiencies at Seattle Harbor. To assist in our review of the proposed project under Section 106 of the National Historic Preservation Act (NHPA), we are notifying the Muckleshoot Indian Tribe (Tribe) about the project, requesting your assistance in identifying any issues or concerns the Tribe might have, and seeking information to identify properties that may be affected by the project which may be of religious or cultural significance to the Tribe (see 36 CFR 800.4(a)(4)).

a. *Project Location:* The authorized project begins at Elliott Bay and extends upstream approximately five miles to the head of the federal navigation channel which lies in the lower Duwamish River and includes the East, West and Duwamish Waterways. However, the Seattle Harbor Navigation Improvement project area only includes the East and West Waterways (Enclosure 1 and 2).The West Waterway is located in Section 12 of Township 24 North; Range 3 East. The East Waterway is located in Section 7 of Township 24 North; Range 3 East.

b. *Project Background:* Seattle Harbor is a federally-authorized navigation project consisting of the East, West, and Duwamish Waterways. As early as 1895 the tidal flats and salt water marshes around Seattle began to fill. As a consequence, in 1903 city leaders and others began the construction of Harbor Island and dredging the East and West Waterways, and the Duwamish navigation channel. Both the East and West waterway have been repeatedly dredged since the early 1900's. In 1918, the United States government assumed the maintenance responsibilities of the East and West Waterways, and the Duwamish Waterway. A review of nautical charts indicates that both

both the East and West waterway have been dredged to various depths over the years. The 1918 nautical map shows that the West Waterway ranged in depth between -5 to-8 feet mean lower low water (MLLW) and the East Waterway range in depth from -5 ½ to -8 feet MLLW (U.S. Coast and Geodetic Map 1918). By 1934, the depth of the East Waterway ranged from --30 to -48 feet below MLLW and the depth of the West Waterway ranged in depth from -32 to -52 feet below MLLW (U.S. Coast and Geodetic Survey 1934).

c. *Project Description:* The Corps will identify and evaluate a full range of alternatives in the East and West Waterways, including several new deepening alternatives ranging between -51 to -55 feet below MLLW.

d. *East Waterway:* Currently, the East Waterway dredging ranges in depth from -30 to -53 feet MLLW. High spots exist within the East Waterway with associated navigational access impediments and safety risk concerns.

e. *West Waterway*: Currently, the West Waterway dredging ranges in depth from -34 to -60 feet MLLW. The majority of the waterway is at a depth of below -51 feet MLLW however, high spots exist at the entrance of the West Waterway and the current bathymetry has only a narrow "key way" at all times creating safety concerns during transit.

f. *Area of Potential Effects:* The Corps has determined the Area of Potential Effect (APE) for both the East and West Waterways to be the vertical and horizontal limits of the authorized limits for each waterway. The horizontal limit for the East Waterway is 7,232 feet which is the maximum length of the waterway. The maximum width from berth to berth is 750 feet. The horizontal limits for the West Waterway are 6,106 feet which is the maximum length of the waterway. The maximum width from berth to berth is 750 feet (See Enclosure 2). The vertical extent for each waterway would be up to 55 feet below MLLW. Dredged material would be disposed of at either existing open-water disposal sites or existing upland disposal sites.

The Corps has reviewed existing cultural resources information available for the area and prior environmental studies conducted for Seattle Harbor, including the East and West Waterways. The Corps has conducted navigation and/or operation and maintenance projects within Seattle Harbor since the 1970's and has consulted with the Washington State Historic Preservation Officer (SHPO) on these projects over this course of time. This past consultation history information is summarized below:

a. In 1974 the Corps prepared an Environmental Impact Statement (EIS) for ongoing operations and maintenance within the Seattle Harbor project. The Corps consulted with the Washington SHPO who commented that they were unaware of any historic or archaeological resources located in the project area in a letter dated September 7, 1973;
b. In 1979 a Supplemental Environmental Impact Statement (SEIS) was published that evaluated the use of open-water disposal for project maintenance. The Corps consulted

c. In 1979 the Corps prepared a Supplemental EIS for operations and maintenance of the Seattle Harbor project. The Corps consulted with the Washington SHPO who concurred with the Corps that no resources were present within the Seattle Harbor in a letter dated March 1978; and
d. In 1983 the Corps prepared a Final EIS for the East, West, and Duwamish Waterways Navigation Improvement Study for modifications in the Federal project and to bridges within the area. The Corps consulted with the SHPO who recommended monitoring of the project area during construction in a letter dated August 30, 1979. However, a local sponsor was never identified for this project so it was never implemented.

For the current Seattle Harbor Navigation Improvement Project, the Corps has conducted a Washington Information System Architectural and Archaeological Records Data search. No archaeological sites or other cultural resources have been identified within the APE. Similarly, data from a Corps multi-beam hydro survey and the Duwamish delta seafloor mapping multi-beam survey do not indicate the presence of any shipwrecks within either the East or West Waterways.

If the Muckleshoot Indian Tribe has concerns with the proposed project or has information or concerns regarding properties which may be of religious or cultural significance that you believe may be affected by this project, please contact us as soon as possible so that we may consult with you and ensure consideration of your views and comments in a timely manner.

For more information about this project, clarification about this request, or to request a formal government-to-government meeting for Section 106 or other concerns with this project please contact Ms. Kara Kanaby (Lead Archaeologist) by telephone at (206) 764-6857 or by email at Kara.M.Kanaby@usace.army.mil. You may also contact Ms. Lori Morris (Tribal Liaison) at (206) 764-3625 or by email at frances.morris@usace.army.mil.

Sincerely,

Evan Lewis
Chief, Environmental and Cultural
Resources Branch

Enclosures

CC: Laura Murphy, Archaeologist
Muckleshoot Indian Tribe
39105-172th Ave. SE
Auburn, WA 98092

References:

U.S. Coast and Geodetic Survey. 1918. Seattle Harbor.
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DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

REPLY TO
ATTENTION OF

Environmental and Cultural Resources Branch

DEC 15 2014

The Honorable Leonard Forsman
Chair, Suquamish Tribe
Post Office Box 498
Suquamish, Washington 98392

Subject: Section 106 Review for the Seattle Harbor Navigation Improvement Project, Seattle, Washington.

Dear Chairman Forsman:

The United States Army Corps of Engineers (Corps) is conducting a Feasibility Study to analyze alternatives for navigation improvements to the East and West Waterways of Seattle Harbor. The Port of Seattle has asked the Corps to study the feasibility of a potential deepening project in order to meet the draft requirements of today's fleet of container ships, provide for safe transit of vessels and to improve transportation cost efficiencies at Seattle Harbor. To assist in our review of the proposed project under Section 106 of the National Historic Preservation Act (NHPA), we are notifying the Suquamish Tribe (Tribe) about the project, requesting your assistance in identifying any issues or concerns the Tribe might have, and seeking information to identify properties that may be affected by the project which may be of religious or cultural significance to the Tribe (see 36 CFR 800.4(a)(4)).

a. *Project Location:* The authorized project begins at Elliott Bay and extends upstream approximately five miles to the head of the federal navigation channel which lies in the lower Duwamish River and includes the East, West and Duwamish Waterways. However, the Seattle Harbor Navigation Improvement project area only includes the East and West Waterways (Enclosure 1 and 2).The West Waterway is located in Section 12 of Township 24 North; Range 3 East. The East Waterway is located in Section 7 of Township 24 North; Range 3 East.

b. *Project Background:* Seattle Harbor is a federally-authorized navigation project consisting of the East, West, and Duwamish Waterways. As early as 1895 the tidal flats and salt water marshes around Seattle began to fill. As a consequence, in 1903 city leaders and others began the construction of Harbor Island and dredging the East and West Waterways, and the Duwamish navigation channel. Both the East and West waterway have been repeatedly dredged since the early 1900's. In 1918, the United States government assumed the maintenance responsibilities of the East and West Waterways, and the Duwamish Waterway. A review of nautical charts indicates that

both the East and West waterway have been dredged to various depths over the years. The 1918 nautical map shows that the West Waterway ranged in depth between -5 to-8 feet mean lower low water (MLLW) and the East Waterway range in depth from -5 ½ to -8 feet MLLW (U.S. Coast and Geodetic Map 1918). By 1934, the depth of the East Waterway ranged from --30 to -48 feet below MLLW and the depth of the West Waterway ranged in depth from -32 to -52 feet below MLLW (U.S. Coast and Geodetic Survey 1934).

c. *Project Description:* The Corps will identify and evaluate a full range of alternatives in the East and West Waterways, including several new deepening alternatives ranging between -51 to -55 feet below MLLW.

d. *East Waterway:* Currently, the East Waterway dredging ranges in depth from -30 to -53 feet MLLW. High spots exist within the East Waterway with associated navigational access impediments and safety risk concerns.

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The Corps has reviewed existing cultural resources information available for the area and prior environmental studies conducted for Seattle Harbor, including the East and West Waterways. The Corps has conducted navigation and/or operation and maintenance projects within Seattle Harbor since the 1970's and has consulted with the Washington State Historic Preservation Officer (SHPO) on these projects over this course of time. This past consultation history information is summarized below:

a. In 1974 the Corps prepared an Environmental Impact Statement (EIS) for ongoing operations and maintenance within the Seattle Harbor project. The Corps consulted with the Washington SHPO who commented that they were unaware of any historic or archaeological resources located in the project area in a letter dated September 7, 1973;
b. In 1979 a Supplemental Environmental Impact Statement (SEIS) was published that evaluated the use of open-water disposal for project maintenance. The Corps consulted

with the Washington SHPO who concurred with the Corps findings of no resources present in the project area in a letter dated March 1978;

c. In 1979 the Corps prepared a Supplemental EIS for operations and maintenance of the Seattle Harbor project. The Corps consulted with the Washington SHPO who concurred with the Corps that no resources were present within the Seattle Harbor in a letter dated March 1978; and
d. In 1983 the Corps prepared a Final EIS for the East, West, and Duwamish Waterways Navigation Improvement Study for modifications in the Federal project and to bridges within the area. The Corps consulted with the SHPO who recommended monitoring of the project area during construction in a letter dated August 30, 1979. However, a local sponsor was never identified for this project so it was never implemented.

For the current Seattle Harbor Navigation Improvement Project, the Corps has conducted a Washington Information System Architectural and Archaeological Records Data search. No archaeological sites or other cultural resources have been identified within the APE. Similarly, data from a Corps multi-beam hydro survey and the Duwamish delta seafloor mapping multi-beam survey do not indicate the presence of any shipwrecks within either the East or West Waterways.

If the Suquamish Tribe has concerns with the proposed project or has information or concerns regarding properties which may be of religious or cultural significance that you believe may be affected by this project, please contact us as soon as possible so that we may consult with you and ensure consideration of your views and comments in a timely manner.

For more information about this project, clarification about this request, or to request a formal government-to-government meeting for Section 106 or other concerns with this project please contact Ms. Kara Kanaby (Lead Archaeologist) by telephone at (206) 764-6857 or by email at Kara.M.Kanaby@usace.army.mil. You may also contact Ms. Lori Morris (Tribal Liaison) at (206) 764-3625 or by email at frances.morris@usace.army.mil.

Sincerely,

Evan Lewis
Chief, Environmental and Cultural
Resources Branch

Enclosures

CC: Dennis Lewarch, Tribal Historic Preservation Officer
Suquamish Tribe
Post Office Box 498
Suquamish, Washington 98392

DEPARTMENT OF
ARCHAEOLOGY &
HISTORIC PRESERVATION
Protect the Past, Shape the Future

Allyson Brooks Ph.D., Director
State Historic Preservation Officer

December 16, 2014

Mr. Evan R. Lewis
Environmental Resources Section
Corps of Engineers – Seattle District
PO Box 3755
Seattle, Washington 98124-3755

Re: East & West Waterways of Seattle Harbor Project
Log No.: 121514-14-COE-S

Dear Mr. Lewis:

Thank you for contacting our department. We have reviewed the materials you provided for the Area of Potential Effect (APE) for the proposed East & West Waterways of Seattle Harbor Project, King County, Washington

We concur with your definition of the Area of Potential Effect (APE).

We look forward to receiving the results of your identification efforts and professional cultural resources review, the results of tribal consultation, and the Determination of Effect.

We would also appreciate receiving any correspondence or comments from concerned tribes or other parties that you receive as you consult under the requirements of 36CFR800.4(a)(4).

These comments are based on the information available at the time of this review and on behalf of the State Historic Preservation Officer in compliance with the Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations 36CFR800.4. Should additional information become available, our assessment may be revised.

Thank you for the opportunity to comment and we look forward to receiving the report on the results of your efforts.

Sincerely,

Robert G. Whitlam, Ph.D.
State Archaeologist
(360) 586-3080
email: *rob.whitlam@dahp.wa.gov*

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

REPLY TO
ATTENTION OF

Environmental and Cultural Resources Branch

Allyson Brooks, Ph.D.
Washington State Historic Preservation Officer
Department of Archaeology and Historic Preservation
P.O. Box 48343
Olympia, WA 98504

APR 27 2016

Subject: Section 106 Review for the Seattle Harbor Navigation Improvement Project, Seattle, Washington. Log #121514-14-COE-s

Dear Dr. Brooks:

The United States Army Corps of Engineers (Corps) is continuing consultation on the proposed Seattle Harbor Navigation Improvement Project in Seattle, Washington. In our letter dated December 15, 2014, the Corps provided a project description and documented the area of potential effects (APE). Your office agreed to the APE on December 16, 2014. This letter provides a brief project description, a revised APE, summarizes the efforts to identify historic properties, and identifies agency determinations and findings as provided for at 36 C.F.R. § 800.4 and 5. We request your agreement with our finding that there will be no historic properties affected by the proposed undertaking.

The Corps is conducting a feasibility study to analyze alternatives for navigation improvements to the federally authorized East and West Waterways of Seattle Harbor.

Project Location: The Seattle Harbor Navigation Improvement project area includes the East and West Waterways (Enclosure 1 and 2). The West Waterway is located in Section 12 of Township 24 North; Range 3 East. The East Waterway is located in Section 7 of Township 24 North; Range 3 East.

Project Background: Seattle Harbor is a federally-authorized navigation project consisting of the East, West, and Duwamish Waterways. As early as 1895, the tidal flats and salt water marshes around Seattle began to fill in. As a consequence, in 1903 city leaders and others began the construction of Harbor Island and dredging the East and West Waterways, and the Duwamish navigation channel. Both the East and West waterway have been repeatedly dredged since the early 1900's. In 1918, the United States government assumed the maintenance responsibilities of the East and West

Waterways, and the Duwamish Waterway. A review of nautical charts indicates that both the East and West Waterway have been dredged to various depths over the years. The 1918 nautical map shows that the West Waterway ranged in depth between -5 to -8 feet mean lower low water (MLLW) and the East Waterway range in depth from -5 ½ to -8 feet MLLW (U.S. Coast and Geodetic Map 1918). By 1934, the depth of the East Waterway ranged from -30 to -48 feet MLLW and the depth of the West Waterway ranged in depth from -32 to -52 feet MLLW (U.S. Coast and Geodetic Survey 1934).

Project Description: Currently, the Corps is evaluating different deepening alternatives for the East and West Waterways. Alternatives include a maximum allowable dredge depth of -57 MLLW with two feet of allowable over dredge.

East Waterway: Currently, the East Waterway dredging ranges in depth from -30 to -53 feet MLLW. High spots exist within the East Waterway with associated navigational access impediments and safety risk concerns.

West Waterway: Currently, the West Waterway dredging ranges in depth from -34 to -60 feet MLLW. The majority of the waterway is at a depth of below -51 feet MLLW; however, high spots exist at the entrance of the West Waterway. The current bathymetry has only a narrow "key way" at all times creating safety concerns during transit.

Revised Area of Potential Effects: The Corps has revised the vertical extent of the APE for both the East and West Waterways. The maximum vertical extent for dredging both the East and West Waterways is -57 MLLW with two feet of allowable over dredge. However, due to site conditions and current dredging practices it is more likely that only one foot of over dredging would occur. The horizontal limits for both the East and West Waterways would remain the same and as described in our previous letter. Dredged material would be disposed of at either existing open-water disposal sites or existing upland disposal sites.

Tribal Consultation Efforts: The Corps has notified and requested information from the Muckleshoot Indian Tribe and the Suquamish Indian Tribe in a letter dated December 15, 2014. To date, neither the Muckleshoot Indian Tribe nor the Suquamish Indian Tribe have identified any concerns with the project or resources within the APE to date.

The Corps has reviewed existing cultural resources information available for the area and prior environmental studies conducted for Seattle Harbor, including the East and West Waterways. The Corps has conducted navigation and/or operation and maintenance projects within Seattle Harbor since the 1970's and has consulted with the Washington State Historic Preservation Officer (SHPO) on these projects. This past consultation history information is summarized below:

- In 1974, the Corps prepared an Environmental Impact Statement (EIS) for ongoing operations and maintenance within the Seattle Harbor project. The Corps consulted with the Washington SHPO who commented that they were

unaware of any historic or archaeological resources located in the project area in a letter dated September 7, 1973.

- In 1979, the Corps published two supplemental EIS's evaluating the use of open-water disposal for project maintenance and for operations and maintenance of the Seattle Harbor. Each time, the Washington SHPO concurred with Corps findings that no resources were present in letters dated March 1978.
- In 1983, the Corps prepared a Final EIS for the East, West, and Duwamish Waterways Navigation Improvement Study for modifications in the federal project and to bridges. The Corps consulted with the SHPO who recommended monitoring of the project area during construction in a letter dated August 30, 1979. Due to the lack of a local sponsor this project was never implemented.

For the current Seattle Harbor Navigation Improvement Project, the Corps has conducted a Washington Information System Architectural and Archaeological Records Data search. No archaeological sites or other cultural resources have been identified within the revised APE. In addition, historic geo-referenced T-sheets and historic maps were reviewed. The East and West Waterways of Seattle Harbor are located in what was the mouth of the Duwamish River where it flowed into Elliott Bay. An 1854 U.S. Coast Survey map of Duwamish Bay shows the tidal flats that occupied the mouth of the Duwamish River and several channels meandering through the tidal flats into Elliott Bay. A review of nautical charts indicates that both the East and West waterway have been dredged to various depths over the years. More recently, data from a Corps multi-beam hydro survey and the Duwamish delta seafloor mapping multi-beam survey do not indicate the presence of any shipwrecks or other cultural resources within either the East or West Waterway. In 2015, a sediment characterization investigation was conducted for the West Waterway. A total of 27 Vibracores were placed within the boundary of the west waterway navigation channel and ranged in depth between -51.5 to -59 MLLW. When assembled with the core tube, Vibracores are used to collect underwater sediment samples by driving the tube into the sediment which is enhanced by vibration energy. A review of the Vibracore sediment logs and photographs of each Vibracore do not indicate the presence of any submerged cultural resources with the West Waterway. Vibracores were not completed in the East Waterway; however, data from a Corps multi-beam hydro survey do not indicate the presence of any shipwrecks or other cultural resources within this waterway.

The Corps has made a reasonable and good faith effort to identify historic properties that might be affected by the undertaking. Both the East and West Waterways have been repeatedly dredged since the early 1900s and it is extremely unlikely that cultural resources would have survived a century of dredging. Based on the results of the literature review, our efforts to identify historic properties, consultation with your office on past activities related to the East and West Waterways, and our consultations with Indian Tribes, the Corps has found that there is no historic properties within the APE and that there will be *no historic properties affected* by the undertaking.

At this time, the Corps is requesting the Washington SHPO's review and agreement with our finding that there will be no historic properties affected by the project. We appreciate your consideration of our request. If you have specific questions or we can provide any clarification, please contact Ms. Kara Kanaby (Lead Archaeologist) by telephone at (206) 764-6857 or by email at Kara.M.Kanaby@usace.army.mil.

Sincerely,

Evan Lewis,
Chief, Environmental and Cultural
Resources Branch

References:

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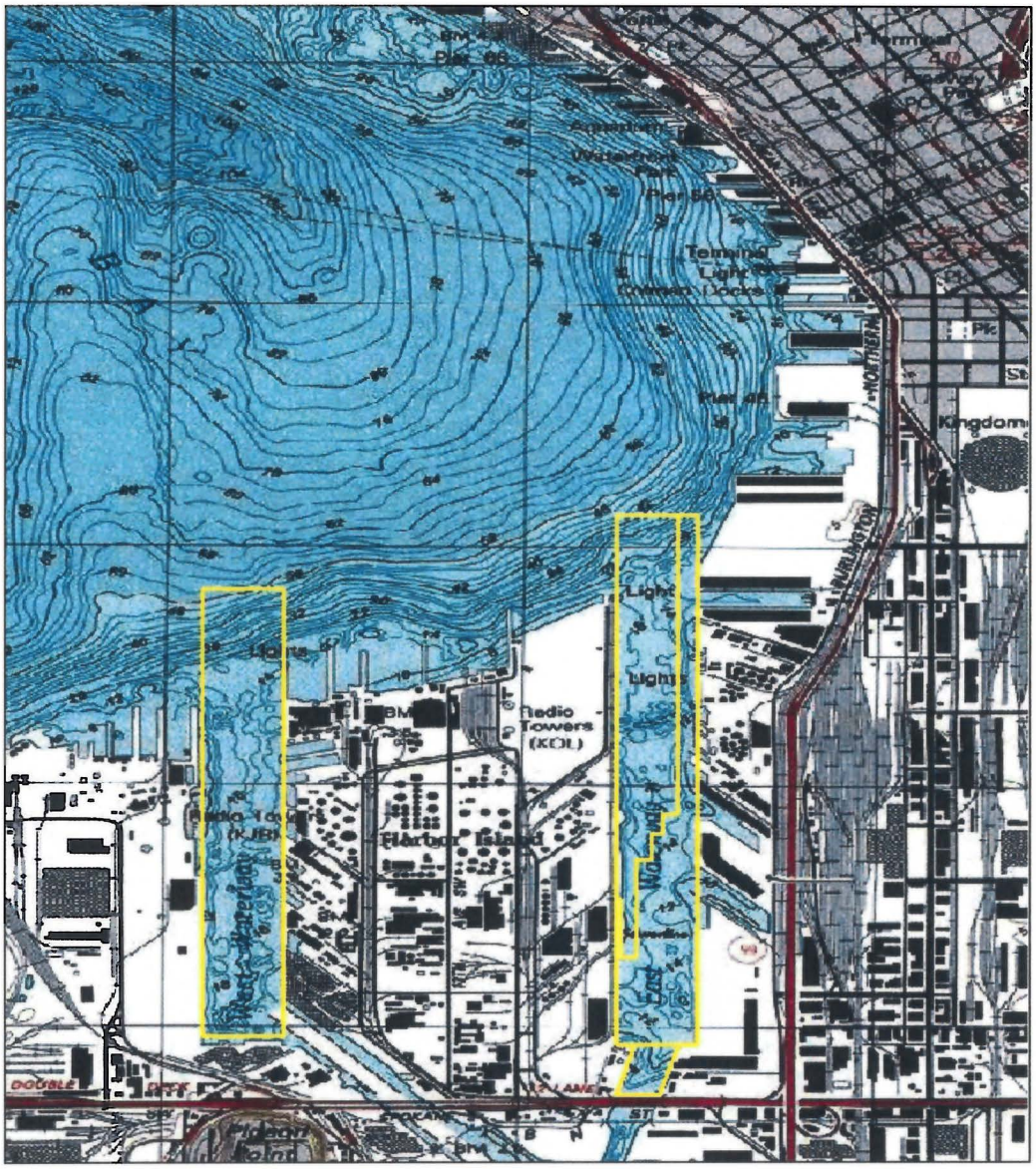

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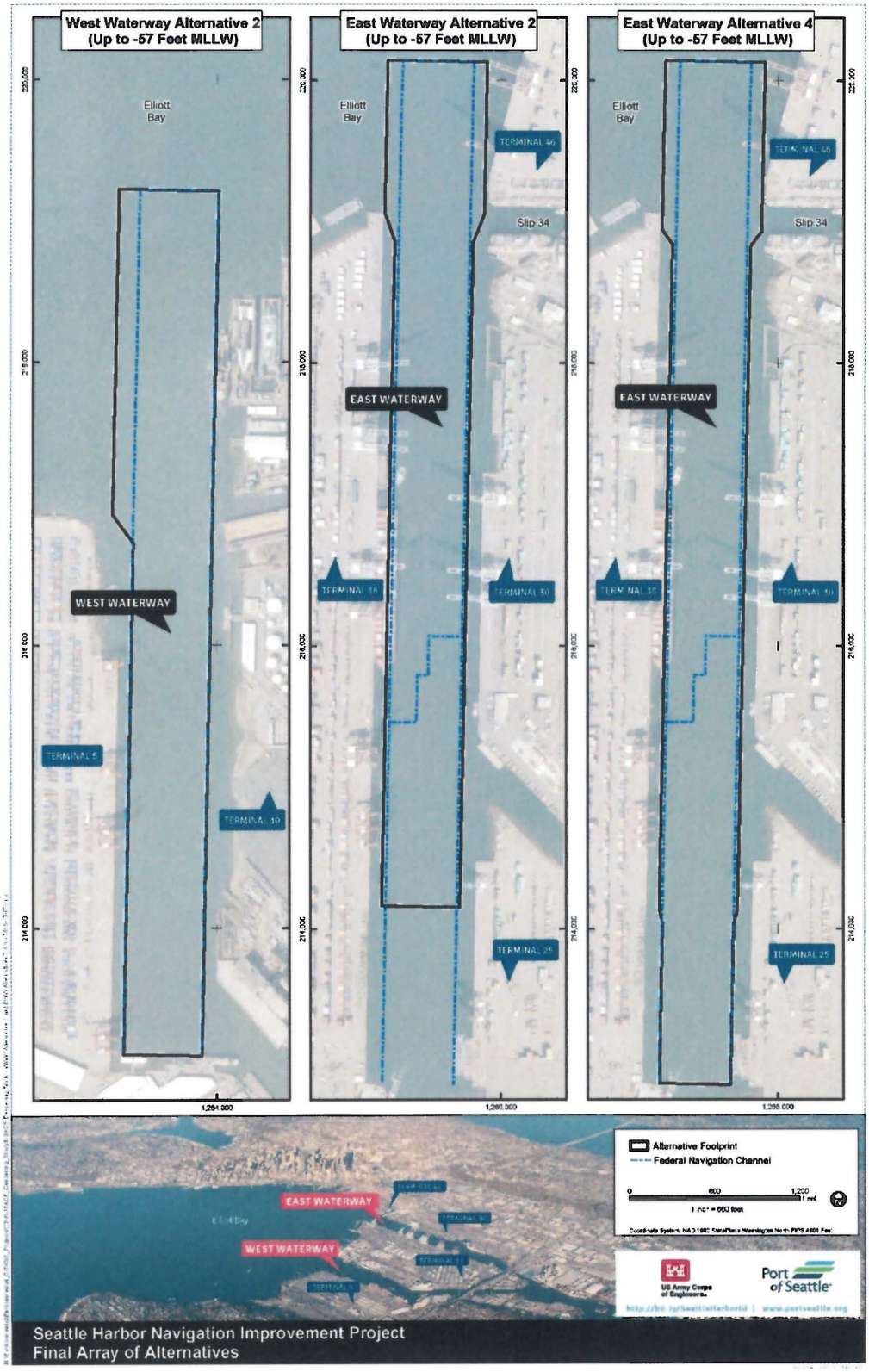
Enclosure 1: APE for Seattle Harbor Project



Enclosure 2: East and West Waterway

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

REPLY TO
ATTENTION OF

Environmental and Cultural Resources Branch

APR 27 2016

The Honorable Virginia Cross
Chairwoman, Muckleshoot Indian Tribe
39105-172th Avenue Southeast
Auburn, Washington 98092

Subject: Section 106 Review for the Seattle Harbor Navigation Improvement Project, Seattle, Washington.

Dear Madam Chair:

The United States Army Corps of Engineers (Corps) is continuing consultation on the proposed Seattle Harbor Navigation Improvement Project in Seattle, Washington. In our letter dated December 14, 2014, the Corps described the proposed project and asked the Muckleshoot Indian Tribe for any information or concerns that the Tribe might have. This letter provides a brief project description, a revised area of potential effect (APE), and summarizes the efforts to identify historic properties, and project agency determinations and findings at 36 C.F.R. § 800.4 and 5. The Corps has determined that there will be *no historic properties affected* by this proposed undertaking.

The Corps is conducting a feasibility study to analyze alternatives for navigation improvements to the federally authorized East and West Waterways of Seattle Harbor.

Project Location: The Seattle Harbor Navigation Improvement project area includes the East and West Waterways (Enclosure 1 and 2). The West Waterway is located in Section 12 of Township 24 North; Range 3 East. The East Waterway is located in Section 7 of Township 24 North; Range 3 East.

Project Background: Seattle Harbor is a federally-authorized navigation project consisting of the East, West, and Duwamish Waterways. As early as 1895 the tidal flats and salt water marshes around Seattle began to fill in. As a consequence, in 1903 city leaders and others began the construction of Harbor Island and dredging the East and West Waterways, and the Duwamish navigation channel. Both the East and West waterway have been repeatedly dredged since the early 1900's. In 1918, the United States government assumed the maintenance responsibilities of the East and West Waterways, and the Duwamish Waterway. A review of nautical charts indicates that both the East and West Waterway have been dredged to various depths over the years. The 1918 nautical map shows that the West Waterway ranged in depth between -5 to -8

feet mean lower low water (MLLW) and the East Waterway range in depth from -5 ½ to -8 feet MLLW (U.S. Coast and Geodetic Map 1918). By 1934, the depth of the East Waterway ranged from -30 to -48 feet MLLW and the depth of the West Waterway ranged in depth from -32 to -52 feet MLLW (U.S. Coast and Geodetic Survey 1934).

Project Description: Currently, the Corps is evaluating different deepening alternatives for the East and West Waterways. Alternatives include a maximum allowable dredge depth of -57 MLLW with two feet of allowable over dredge.

East Waterway: Currently, the East Waterway dredging ranges in depth from -30 to -53 feet MLLW. High spots exist within the East Waterway with associated navigational access impediments and safety risk concerns.

West Waterway: Currently, the West Waterway dredging ranges in depth from -34 to -60 feet MLLW. The majority of the waterway is at a depth of below -51 feet MLLW; however, high spots exist at the entrance of the West Waterway. The current bathymetry has only a narrow "key way" at all times creating safety concerns during transit.

Revised Area of Potential Effects: The Corps has revised the vertical extent of the APE for both the East and West Waterways. The maximum vertical extent for dredging both the East and West Waterways is -57 MLLW with two feet of allowable over dredge. However, due to site conditions and current dredging practices it is more likely that only one foot of over dredging would occur. The horizontal limits for both the East and West Waterways would remain the same and as described in our previous letter. Dredged material would be disposed of at either existing open-water disposal sites or existing upland disposal sites.

The Corps has reviewed existing cultural resources information available for the area and prior environmental studies conducted for Seattle Harbor, including the East and West Waterways. The Corps has conducted navigation and/or operation and maintenance projects within Seattle Harbor since the 1970's and has consulted with the Washington State Historic Preservation Officer (SHPO) on these projects. This past consultation history information is summarized below:

- In 1974, the Corps prepared an Environmental Impact Statement (EIS) for ongoing operations and maintenance within the Seattle Harbor project. The Corps consulted with the Washington SHPO who commented that they were unaware of any historic or archaeological resources located in the project area in a letter dated September 7, 1973.
- In 1979, the Corps published two supplemental EIS's evaluating the use of open-water disposal for project maintenance and for operations and maintenance of the Seattle Harbor. Each time, the Washington SHPO concurred with the Corps findings that no resources were present in letters dated March 1978.
- In 1983, the Corps prepared a Final EIS for the East, West, and Duwamish Waterways Navigation Improvement Study for modifications in the federal project and to

bridges. The Corps consulted with the SHPO who recommended monitoring of the project area during construction in a letter dated August 30, 1979. Due to the lack of a local sponsor this project was never implemented.

For the current Seattle Harbor Navigation Improvement Project, the Corps has conducted a Washington Information System Architectural and Archaeological Records Data search. No archaeological sites or other cultural resources have been identified within the revised APE. In addition, historic geo-referenced T-sheets and historic maps were reviewed. The East and West Waterways of Seattle Harbor are located in what was the mouth of the Duwamish River where it flowed into Elliott Bay. An 1854 U.S. Coast Survey map of Duwamish Bay shows the tidal flats that occupied the mouth of the Duwamish River and several channels meandering through the tidal flats into Elliott Bay. A review of nautical charts indicates that both the East and West waterway have been dredged to various depths over the years. More recently, data from a Corps multi-beam hydro survey and the Duwamish delta seafloor mapping multi-beam survey do not indicate the presence of any shipwrecks or other cultural resources within either the East or West Waterway. In 2015, a sediment characterization investigation was conducted for the West Waterway. A total of 27 Vibracores were placed within the boundary of the west waterway navigation channel and ranged in depth between -51.5 to -59 MLLW. When assembled with the core tube, Vibracores are used to collect underwater sediment samples by driving thetube into the sediment which is enhanced by vibration energy. A review of the Vibracore sediment logs and photographs of each Vibracore do not indicate the presence of any submerged cultural resources with the West Waterway. Vibracores were not completed in the East Waterway; however, data from a Corps multi-beam hydro survey do not indicate the presence of any shipwrecks or other cultural resources within this waterway.

The Corps has made a reasonable and good faith effort to identify historic properties that might be affected by the undertaking. Both the East and West Waterways have been repeatedly dredged since the early 1900's and it is extremely unlikely that cultural resources would have survived a century of dredging. Based on the results of the literature review, our efforts to identify historic properties, and information gathered through consultation, the Corps has found that there are no historic properties within the APE and that there will be no *historic properties affected* by the undertaking.

If you have specific questions or any other concerns please contact Ms. Kara Kanaby (Lead Archaeologist) by telephone at (206) 764-6857 or by email at Kara.M.Kanaby@usace.army.mil. Should you wish to consult more with us on this please call Lori Morris at 425-764-3625 or by email at Frances.L.Morris@usace.army.mil.

Sincerely,

Evan Lewis
Chief, Environmental and Cultural
Resources Branch

Enclosures

CC: Laura Murphy, Archaeologist
Muckleshoot Indian Tribe
39105-172th Ave. SE
Auburn, WA 98092

References:

U.S. Coast and Geodetic Survey. 1918. Seattle Harbor. http://historicalcharts.noaa.gov/historicals/search#searchInput. Chart Number 6445

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DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

REPLY TO
ATTENTION OF

Environmental and Cultural Resources Branch

The Honorable Leonard Forsman
Chair, Suquamish Tribe
Post Office Box 498
Suquamish, Washington 98392

APR 27 2016

Subject: Section 106 Review for the Seattle Harbor Navigation Improvement Project, Seattle, Washington.

Dear Chairman Forsman:

The United States Army Corps of Engineers (Corps) is continuing consultation on the proposed Seattle Harbor Navigation Improvement Project, in Seattle, Washington. In our letter dated December 14, 2014, the Corps described the proposed project and asked the Suquamish Indian Tribe for any information or concerns that the Tribe might have. This letter provides a brief project description, a revised area of potential effect (APE), and summarizes the efforts to identify historic properties, and project agency determinations and findings at 36 C.F.R. § 800.4 and 5. The Corps has determined that there will be *no historic properties affected* by this proposed undertaking.

The Corps is conducting a feasibility study to analyze alternatives for navigation improvements to the federally authorized East and West Waterways of Seattle Harbor.

Project Location: The Seattle Harbor Navigation Improvement project area includes the East and West Waterways (Enclosure 1 and 2). The West Waterway is located in Section 12 of Township 24 North; Range 3 East. The East Waterway is located in Section 7 of Township 24 North; Range 3 East.

Project Background: Seattle Harbor is a federally-authorized navigation project consisting of the East, West, and Duwamish Waterways. As early as 1895 the tidal flats and salt water marshes around Seattle began to fill. As a consequence, in 1903 city leaders and others began the construction of Harbor Island and dredging the East and West Waterways, and the Duwamish navigation channel. Both the East and West waterway have been repeatedly dredged since the early 1900's. In 1918, the United States government assumed the maintenance responsibilities of the East and West Waterways, and the Duwamish Waterway. A review of nautical charts indicates that both the East and West Waterway have been dredged to various depths over the years. The 1918 nautical map shows that the West Waterway ranged in depth between -5 to -8

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Revised Area of Potential Effects: The Corps has revised the vertical extent of the APE for both the East and West Waterways. The maximum vertical extent for dredging both the East and West Waterways is -57 MLLW with two feet of allowable over dredge. However, due to site conditions and current dredging practices it is more likely that only one foot of over dredging would occur. The horizontal limits for both the East and West Waterways would remain the same and as described in our previous letter. Dredged material would be disposed of at either existing open-water disposal sites or existing upland disposal sites.

The Corps has reviewed existing cultural resources information available for the area and prior environmental studies conducted for Seattle Harbor, including the East and West Waterways. The Corps has conducted navigation and/or operation and maintenance projects within Seattle Harbor since the 1970's and has consulted with the Washington State Historic Preservation Officer (SHPO) on these projects. This past consultation history information is summarized below:

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The Corps has made a reasonable and good faith effort to identify historic properties that might be affected by the undertaking. Both the East and West Waterways have been repeatedly dredged since the early 1900's and it is extremely unlikely that cultural resources would have survived a century of dredging. Based on the results of the literature review, our efforts to identify historic properties, and information gathered through consultation, the Corps has found that there are no historic properties within the APE and that there will be *no historic properties affected* by the undertaking.

If you have specific questions or any other concerns please contact Ms. Kara Kanaby (Lead Archaeologist) by telephone at (206) 764-6857 or by email at Kara.M.Kanaby@usace.army.mil. Should you wish to consult more with us on this please call Lori Morris at 425-764-3625 or by email at Frances.L.Morris@usace.army.mil.

Sincerely,

Evan Lewis
Chief, Environmental and Cultural
Resources Branch

Enclosures

CC: Dennis Lewarch, Tribal Historic Preservation Officer
Suquamish Tribe
Post Office Box 498
Suquamish, Washington 98392

References:

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U.S. Coast and Geodetic Survey. 1934. Seattle Harbor and Lake Washington. http://historicalcharts.noaa.gov/historicals/search#searchInput. Chart Number 6449

Allyson Brooks Ph.D., Director
State Historic Preservation Officer

April 27, 2016

Mr. Evan Lewis
Environmental & Cultural Resources
Seattle District
Corps of Engineers
PO Box 3755
Seattle, Washington 98124

Re: Seattle Harbor Navigation Improvement Project
Log No.: 121514-14-COE-S

Dear Mr. Lewis:

Thank you for contacting our department. We have reviewed the materials you provided for the proposed Seattle Harbor Navigation Improvement Project, Seattle, King County, Washington.

We concur with your Determinations of No Historic Properties Affected.

We would appreciate receiving any correspondence or comments from concerned tribes or other parties that you receive as you consult under the requirements of 36CFR800.4(a)(4).

In the event that archaeological or historic materials are discovered during project activities, work in the immediate vicinity must stop, the area secured, and the concerned tribe's cultural staff and cultural committee and this department notified.

These comments are based on the information available at the time of this review and on behalf of the State Historic Preservation Officer in compliance with the Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations 36CFR800.4. Should additional information become available, our assessment may be revised, including information regarding historic properties that have not yet been identified. Thank you for the opportunity to comment and a copy of these comments should be included in subsequent environmental documents.

Sincerely,

Robert G. Whitlam, Ph.D.
State Archaeologist
(360) 890-2615
email: *rob.whitlam@dahp.wa.gov*

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Washington Fish and Wildlife Office
510 Desmond Dr. SE, Suite 102
Lacey, Washington 98503

APR 29 2015

In Reply Refer To:
01EWFW00-2015-CPA-0024

Evan Lewis
Chief, Environmental and Cultural Resources Branch
Corps of Engineers, Seattle District
P.O. Box 3755
Seattle, Washington 98124-3755

Dear Mr. Lewis:

Thank you for the opportunity to provide comments and preliminary analysis on your proposed Seattle Harbor Navigation Improvement Project General Investigation. Enclosed is the U.S. Fish and Wildlife Service's (Service) Fish and Wildlife Coordination Act Planning Aid Letter for the project. The Service coordinated with National Oceanic and Atmospheric Administration's Restoration Center, Washington Department of Fish and Wildlife, and the Muckleshoot Tribe.

The Service appreciates the opportunity to provide early input into the project. If you have any questions on this letter, please contact Jim Muck at (206) 526-4740 or email jim_muck@fws.gov or Martha Jensen at (360) 753-9000 or martha_l_jensen@fws.gov.

Sincerely,

For Eric V. Rickerson, State Supervisor
Washington Fish and Wildlife Officer

cc:
NOAA Restoration Center, Seattle, WA (J. Kern)
WDFW, Mill Creek, WA (L. Arber)
Muckleshoot Tribe, Auburn, WA (G. St. Amant)
NMFS, Lacey, WA (M. Longenbaugh)
NMFS, Portland, OR (K. Kratz)

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Seattle Harbor Navigation Improvement Project
General Investigation

Planning Aid Letter

Fish and Wildlife Coordination Act

U.S. Fish and Wildlife Service Reference Number:
01EWFW00-2015-CPA-0024

Prepared for
U.S. Army Corps of Engineers
Seattle District
Seattle, Washington

Prepared by

U.S. Fish and Wildlife Service
Washington Fish and Washington Office
Lacey, Washington

April 29, 2015

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LIST OF ACROYNMS AND ABBREVIATIONS

Corps	U.S. Army Corps of Engineers
DIP	demographically independent populations
DPS	Distinct Population Segment
EPA	U.S. Environmental Protection Agenc
ESA	Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*)
ESU	Evolutionarily Significant Unit
FWCA	Fish and Wildlife Coordination Act
MLLW	mean lower low water
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
PAH	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyls
PCE	Primary Constituent Element
Port	Port of Seattle
PSTRT	Puget Sound Technical Recovery Team
RM	river mile
USFWS	U.S. Fish and Wildlife Service

INTRODUCTION

The United States Army Corps of Engineers (Corps), Seattle District is proposing to conduct a General Investigation on deepening the navigational shipping channel in East and West Waterways of the lower Duwamish River. This Planning Aid Letter, written under the Fish and Wildlife Coordination Act (FWCA), provides the U.S. Fish and Wildlife Service's (USFWS) comments and analysis on the Seattle Harbor Navigation Improvement Project General Investigation. The purpose of the FWCA is to recognize the vital contribution of our wildlife resources to the Nation and to ensure that wildlife conservation receives equal consideration in planning and evaluation for water resource development programs (Smalley and Mueller 2004). The FWCA provides a basic framework for the orderly consideration of fish and wildlife conservation and enhancement measures in federally constructed, permitted, or licensed water development projects. The FWCA allows the USFWS to assess project impacts to fish and wildlife resources and to make recommendation to protect and enhance these resources.

Under the FWCA, the effects of the project are analyzed by comparing future conditions as they are projected to occur in the absence of the project with conditions expected to occur with the project in place. The comparison is to measure project effects and determine whether the project will cause damages which must be mitigated and whether the project will or can be designed to fully mitigate resource losses and/or enhance these resources. Section 2(b) of the FWCA states that reports provided by the resource agencies should contain information addressing fish and wildlife resources present in the project area, problems and opportunities, impacts of a project and its alternatives, and means and measures for mitigation, including any needed compensation measures and, if applicable, enhancement opportunities to protect natural resources.

This letter provides an analysis of the project to the existing conditions and provides recommendations to address potential impacts to fish and wildlife resource and well as opportunities to enhance these resources, especially species listed under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (ESA).

Coordination with Federal and State Agencies and Tribal Governments

The USFWS participated in numerous discussions related to the Seattle Harbor General Investigation and coordinated with relevant resource agencies and the Tribes. The information provided in this letter is based on conversations with the Muckleshoot Tribe, National Oceanic and Atmospheric Administration's (NOAA) Restoration Center, and the Washington Department of Fish and Wildlife. Many of the same concerns, conclusions, and recommendations are shared by the USFWS, the Tribe, and these agencies.

This Planning Aid Letter highlights concerns regarding potential risks and damages to fish, wildlife, and tribal trust resources associated with the Seattle Harbor channel deepening project. In the context of this and other federal water resource development proposals, we emphasize the necessity of improving government-to-government relations and communication, and the necessity of upholding treaty fishing rights and other/related tribal trust responsibilities.

PROJECT DESCRIPTION

The project involves the deepening of the East and West Waterways of the lower Duwamish River. The federally authorized navigation channel consists of the East Waterway, which is currently maintained at a depth of -39 to -51 feet mean lower low water (MLLW); the West Waterway, which is maintained to -34 feet MLLW; and the Duwamish Waterway, which ranges in depth from -30 feet MLLW to -15 feet MLLW to the head of navigation channel at the Turnaround Basin. Actual dimensions of the waterways vary, in some cases, from their federally authorized depths and widths. These three waterways, the East Waterway, West Waterway, and the Duwamish River, provide over 7 miles of navigation channels for cargo vessels coming from Elliott Bay, Puget Sound, and the Pacific Ocean. The project area only includes the East and West Waterways, as these two waterways have been identified by the Port of Seattle (Port) as the areas of critical importance for deepening to allow larger vessels to access the Port docks.

Project Authority, Purpose and Scope

The Corps and the Port recognized that channel deepening is essential to maintaining the Port's competitive position as a premier international trade gateway, particularly relative to Canadian ports. Navigational challenges have been identified in both the East and West Waterways of the Seattle Harbor and authorized depths do not meet the draft requirements of today's fleet of larger container ships. The Port exports more cargo by weight than it imports and is a last port of call for several of the Asian – West Coast routes. The Seattle Harbor is a major gateway for containerized traffic and the channels must have sufficient depth for partially loaded vessels to call, take on additional cargo, and leave fully loaded. Tide restrictions, light loading, or other operational inefficiencies created by inadequate channel depth currently limits the Port's competitiveness, especially when competing with nearby and naturally deep harbors in British Columbia and the outer coast.

Alternatives under consideration include deepening both the East and West Waterways to either -51, -53, or -55 feet MLLW (Corps and Port 2014, p. 32; Gleason in litt. 2015). Authorized depth of the West Waterway is 34 feet and the East Waterway ranges in depth from 34 to 51 feet (Figure 1). The proposed alternatives would include:

- West Waterway – Deepening the navigation channel for a length of 6,109 feet to a depth of -51, -53, or -55 feet MLLW, and maintaining a width of 750 feet.

- East Waterway – Deepening the navigation channel for a length of 7,232 feet to a depth of -51, -53, or -55 feet MLLW, and maintaining a width of 750 feet.

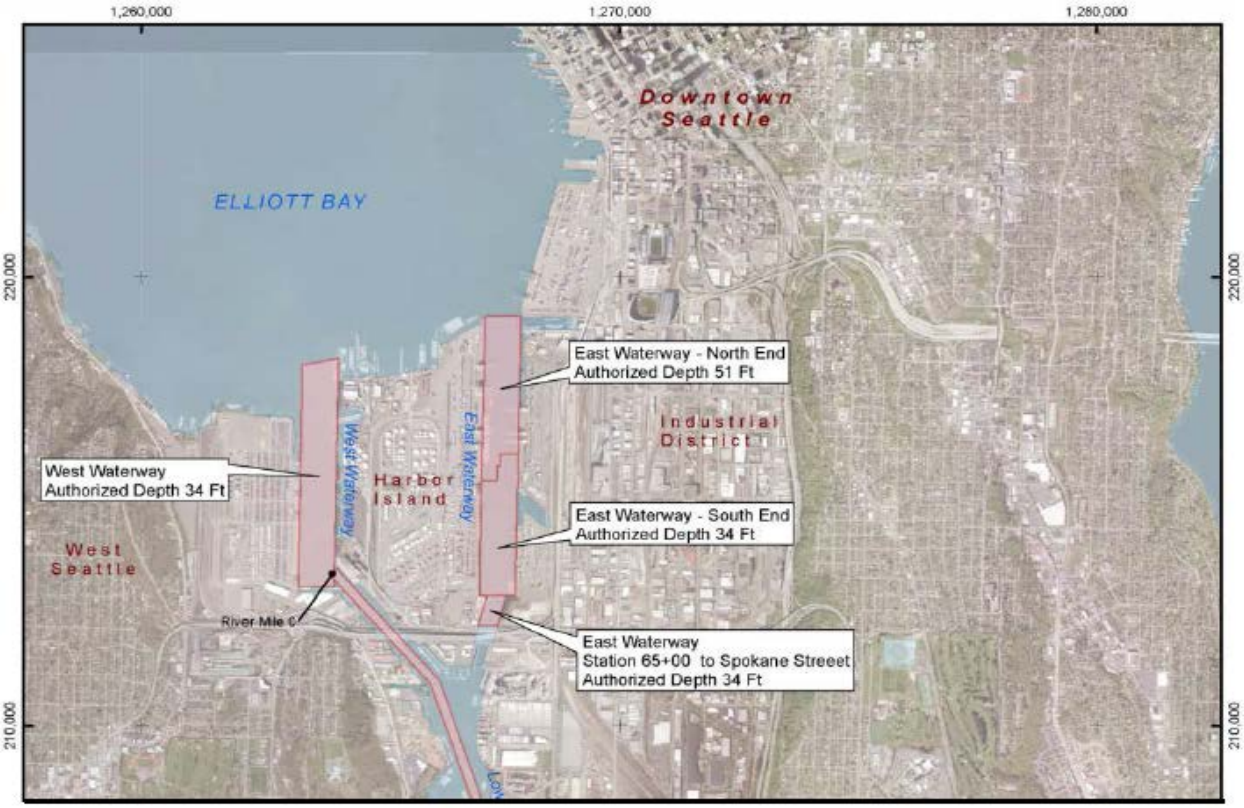

Figure 1. The project area and the authorized depths of the East and West Waterways of the Duwamish River.

DESCRIPTION OF THE PROJECT AREA

The federally authorized Seattle Harbor navigation project, consisting of the East, West, and Duwamish Waterways, is located in Puget Sound's Elliott Bay at Seattle, Washington. The authorized project is located from Elliott Bay upstream approximately five miles to the head of the Federal navigation channel which lies in the lower Duwamish River. However, proposed dredging activities would only be conducted in the East and West Waterways of the Duwamish River (Figure 1).

EXISTING CONDITIONS

Lingering effects of more than a century of human development combined with numerous ongoing activities in the industrial waterways have contributed to the currently degraded environmental baseline conditions in the lower Duwamish River, including the East and West Waterways. These activities included expanding urban development, railroads, shipping, logging, agriculture, and other industries. These activities have resulted in the permanent loss and conversion of the historic estuary to an industrial waterfront with industrial waste discharges, storm water runoff from impervious surfaces, freshwater diversions for industrial and domestic use, shoreline armoring and levees, overwater structures, and flood control structures (Howard Hanson Dam in the upper watershed).

Development began to affect the lower Duwamish River in the early 1900s. Diversion of tributaries reduced the river's drainage basin by 71 percent and its average flow by more than 70 percent. At about the same time, the river was dredged and channelized to create the Duwamish Waterway, replacing nine meandering miles of river with a straight, deep, 4-mile-long navigation channel (EBDRP 1994).

Of the shoreline between the mouth and River Mile (RM) 6.5 (about 1.3 RM above the limit of navigation at the south end of the Duwamish Waterway), 44 percent is riprapped, 34 percent is covered by large docks and pier aprons and 7 percent has been faced with vertical sheet piling (derived from data by Tanner 1991). Furthermore, a considerable portion of the remaining intertidal and shallow subtidal portions of the lower Duwamish Waterway is covered by barges and large vessels (Muckleshoot Indian Tribe Fisheries Department [MITFD], unpub. data). The effects of eliminating natural shorelines were compounded by the filling of marshes and mudflats, the creation of steep bulkhead and riprap banks, the removal of vegetation, and the construction of buildings, piers, and impervious pavement. Altogether, these actions eliminated about 98 percent of the lower Duwamish River's emergent marshes and intertidal mudflats and 100 percent of its tidal swamps (Blomberg *et al*. 1988). The highly modified waterways and shorelines generally provide poor habitat for salmon (Spence *et al*. 1996).

The Duwamish River was a major river estuary before 1853. Estuaries provide habitat elements necessary for the survival of juvenile salmonids by providing osmoregulatory transitions (conversion from freshwater to saltwater habitats) and rearing habitats as well as holding habitats for adult salmon waiting to ascend the river to spawning grounds. Juvenile salmonids normally use side channels for feeding, avoiding predators, and resting while undergoing their physiological change to salt water. Rapid growth also occurs in estuaries due to the abundance of preferred food. The historical migration routes of anadromous salmonids into off-channel distributary channels and sloughs have largely been eliminated, and historical saltwater transition zones have been severely reduced in most of the rivers that drain into Puget Sound (Kerwin 1999). Bull trout (*Salvelinus confluentus*), like other anadromous salmonids, use the estuarine environment as holding habitat before ascending the river to spawn and for feeding and rearing.

In the lower Duwamish Waterway, the riverbanks have been straightened, steepened, hardened, and denuded of riparian vegetation. Warner and Fritz (1995) found the greatest abundance of juvenile salmon using shallow, sloping, soft mud beaches compared with sites having sand, gravel, or cobble substrates. The Kellogg Island area has both remnant intertidal shallows (Terminal 107 and Kellogg Island Reserve) and restored upper intertidal habitats (Herring House Park) combined with extensive riparian zones that are available for salmonid use. The shorelines around Kellog Island provide the majority of the remaining functional intertidal wetlands in the Duwamish estuary (Simenstad *et al*. 1991). Restoration activities have also occurred in the upper turning basin, and various smaller locations throughout the Duwamish River.

Additionally, the chemical contamination of sediments in certain areas of the Duwamish River has compromised the effectiveness of the small amount of remaining habitat. Chemicals of concern found at elevated concentrations include: polynuclear aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCBs), metals (arsenic, mercury and zinc), phthalates, phenols, and pesticides (DDT, DDE, DDD). Varanasi *et al*. (1993) found juvenile Chinook salmon

(*Oncorhyncus tschawytscha*) from the Duwamish River displayed a lower immune system response compared with juvenile Chinook salmon from the Nisqually River, a comparable size estuary that does not have any significant industrial contaminants and has recently been restored to near-historic conditions. Salmon and other fish species often spend several weeks in urban estuaries where they can be exposed to urban-related contaminants that reside in the sediments and accumulate in the prey species. There is concern that these contaminants could bioaccumulate to levels that may impact the ability of the individual salmon to grow and mature properly (NMFS 2002).

The U.S. Environmental Protection Agency (EPA) listed the lower Duwamish River as a Federal Superfund site in 2001, and the clean-up of contaminants has been a high priority. To further investigate the contamination and evaluate cleanup alternatives, the EPA and Washington State Department of Ecology signed an Administrative Order of Consent with four of the major property owners on the waterway with potential liability for cleanup of their sites. An attachment to the order, the Statement of Work, outlines the tasks necessary to achieve these goals. Some of the contaminants surrounding Harbor Island have already been cleaned up or capped, but contaminated sediments still remain throughout the Duwamish River and are a major concern.

Duwamish River Restoration

The Corps identifies 45 potential restoration projects, five that have been constructed, within the Green/Duwamish River watershed (Corps website 2015). Based on the information provided, the USFWS was unable to determine how many of those restoration projects are in the Duwamish River. In 2003, seven early action or fast track cleanup and restoration projects were identified (Ecology 2013, p. 1-2). The City of Seattle and the Port of Seattle have completed the T117 restoration and cleanup projects. Other projects have also been completed, are in development, or are being planned for the Duwamish River. Many of these restoration projects will include cleanup and capping of remaining areas with contaminated sediments.

EXISTING FISH AND WILDLIFE RESOURCES

Invertebrates

The Duwamish River is highly developed which limits maconvertebrate taxa and densities. In a review of nine studies conducted in the Duwamish River, 187 taxa, representing 46 families in 10 phyla were found (WindWard 2003, p. 32). The invertebrate community is dominated by annelid worms, mollusks, and arthropods.

Invertebrate densities within the Duwamish River are influenced by salinity, water depth, percent fines, and organic carbon content (WindWard 2003, p. 38), which are all affected by ongoing dredging of the navigation channel. Restoration sites provide complex habitat with shallow water, vegetation, and large woody debris (organic matter) that increases macroinvertebrate diversity (Cordell et al 2008, p. 46). Worms, including oligochaetes (earthworms), nematodes (roundworms), and polychaete (bristle worms) were the most abundant invertebrates (Cordell et al

2008, p. 32). Amphipods, *Americorophium* spp., and polychaetes, *Americorophium* spp. are important prey species for juvenile salmonids. Larger invertebrates include various mollusks (clams and mussels), crustaceans (crabs), and echinoderms (starfish)(WindWard 2003, p. 39).

Fish

Sixty-one different species of fish were found within the Duwamish River (WindWard 2003, pp. 43-47). All eight species of native anadromous salmonids occur in the Duwamish River and are known to utilize the estuarine environment to transition from freshwater to saltwater or vice versa as both juveniles and adults. These include Chinook salmon, chum salmon (*O. keta*), pink salmon (*O. gorbuscha*), sockeye salmon (*O. nerka*), coho salmon (*O. kisutch*), steelhead trout (*O. mykiss*), bull trout, and sea-run coastal cutthroat trout (*O. clarki*). The emigration and residence timing of juvenile and adult salmonids in the project area varies for each species.

The most abundant non-salmonid fish in the Duwamish River are snake prickleback (*Lumpenus saggita*), shiner surfperch (*Cymatogaster aggregata*), English sole (*Parophrys vetulus*), Pacific staghorn sculpin (*Leptocottus armatus*), starry flounder (*Platichthys stellatus*), and longfin smelt (*Spirinchus thaleichthys*)(WindWard 2003, p. 49). Locations and abundance of these fish varied based on salinity and season of the year.

Birds

Many bird species, up to 83 species, occur in and use the project area throughout the year (WindWard 2003, p. 51). These species include a diverse mix of waders, shorebirds, waterfowl, seabirds, passerines, and raptors. Thirty-two species of passerine and upland birds, eight species of raptors, ten species of shorebirds and wading birds, 17 species of waterfowl, and 16 species of seabirds were recorded in the area. Common waterbirds include the herring gull (*Larus argentatus*), California gull (*Larus californicus*), ring-billed gull (*Larus delawarensis*), double-crested cormorant (*Phalacrocorax auritus*), pigeon guillemot (*Cepphus columba*), common goldeneye (*Bucephala clangula*), surf scoter (*Melanitta perspicillata*), common merganser (*Mergus merganser americanus*), and western grebe (*Aechmophorus occidentalis*). During the winter, the red-necked grebe (*Podiceps grisegena*), lesser scaup (*Aythya affinis*), American wigeon (*Anas americana*), hooded merganser (*Lyphodytes cucullatus*), glaucus-winged gull (*Larus glaucescens*), , common murre (*Uria aalge*), rhinoceros auklet (*Cerorhinca monocerata*), and Canada goose (*Branta canadensis*) may also be present in the project area.

Terrestrial birds include the house sparrow (*Passer domesticus*), European starling (*Sturnus vulgaris*), rock pigeon (*Columba livia*), American crow (*Corvus brachyrhynchos*), Northwestern crow (*Corax caurinus*), Brewer's blackbird (*Euphagus cyanocephalus*) belted kingfisher (*Ceryle alcyon*) great blue heron (*Ardea herodias*), black-capped chickadee (*Parus atricapillus*), purple martin (*Progne subis*) and violet-green swallow (*Tachycineta thalassina*), to name just a few. Four raptor species are also periodically seen in the study area; bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), osprey (*Pandion haliaetus*), and red-tailed hawk (*Buteo jamaicensis*).

Mammals

A variety of semi-aquatic and terrestrial mammals are present in the project area (WindWard 2003, p. 54). Semi-aquatic mammals include raccoons (*Procyon lotor*), muskrats (*Ondatra zibethicus*), and river otters (*Lontra canadensis*). Three marine mammals (harbor seals [*Phoca vitulina*], California sea lions [*Zalophus californianus*], and harbor porpoise [*Phocoena phocoena*]) may occasionally enter the lower Duwamish River. Terrestrial mammals that may be present include the black rat (*Rattus rattus*), Norway rat (*Rattus norvegicus*), house mouse (*Mus musculus*), and eastern gray squirrel (*Sciurus carolinensis*). Domesticated animals such as dogs and cats may also be present. Other species include the opossum (*Didelphis virginiana*), and eight species of bats including the Townsend's big-eared bat (*Plecotus townsendii*) and the big brown bat (*Eptesicus fuscus*).

ENDANGERED SPECIES ACT COMPLIANCE

In accordance with Section 7(c) of the ESA, the following federally listed species and designated critical habitat may occur in the project area[1].

USFWS Species:

Coastal-Puget Sound Bull Trout	Threatened
Coastal-Puget Sound Bull Trout Critical Habitat	

National Marine Fisheries Service (NMFS) Species:

Puget Sound Chinook Salmon	Threatened
Puget Sound Chinook Salmon Critical Habitat	
Puget Sound Steelhead	Threatened

Coastal-Puget Sound Bull Trout

Bull trout were listed as threatened on November 1, 1999 (64 FR 58910). Bull trout populations exhibit 4 distinct life-history types: resident, fluvial, adfluvial, and anadromous. Resident, fluvial, and adfluvial forms exist throughout the range of the bull trout (Rieman and McIntyre 1993) and spend their entire life in freshwater. The only known anadromous form within the coterminous United States occurs in the Coastal-Puget Sound region (Volk 2000, Kraemer 1994, Mongillo 1993). For all life-history types, juveniles rear in tributary streams for 1 to 3 years before migrating downstream into a larger river, lake, or estuary and/or nearshore marine area to mature (Rieman and McIntyre 1993).

[1] The project area consists of the East and West Waterways of the Duwamish River and does not extend into Elliott Bay. The listed species and designated critical habitat are those that would be found within the project area and not those that may be found within Elliott Bay and potentially impacted by the project, such as marbled murrelets (*Brachyramphus marmoratus*).

Green/Duwamish Foraging, Migration and Over-Wintering Habitat

The lower Green/Duwamish River is used by bull trout for foraging, migration and overwintering. This foraging, migration and overwintering habitat may be used by individuals from several nearby bull trout core areas such as the Puyallup and Snohomish Rivers. There are no known bull trout spawning locations within the Green/Duwamish River.

Number and Distribution of Local Populations

There are no local bull trout populations within the Green/Duwamish River.

Connectivity

Bull trout are presumed to utilize the Green/Duwamish River from Elliott Bay upstream to the City of Tacoma's Headworks Diversion Dam at RM 61, which is a total barrier to upstream migration. As no local populations exist in the Green/Duwamish River, connectivity between local populations within a watershed is not a concern. As foraging, migration, and over-wintering habitat, the Green/Duwamish River may be used by bull trout from several core areas. No physical barriers exist within the Green/Duwamish River downstream of the Diversion Dam. High water temperatures and water quality concerns may impede bull trout use of the river during the summer months.

Changes in Environmental Conditions and Population Status

Since the bull trout listing, federal actions occurring in the Green/Duwamish River have caused harm to, or harassment of, bull trout. These actions include statewide federal restoration programs that include riparian restoration, replacement of fish passage barriers, and fish habitat improvement projects; and federally funded or authorized projects involving repair and protection of roads and bridges, levees, infrastructures and facilities.

The number of non-Federal actions occurring in the Green/Duwamish River since the bull trout listing is unknown. However, activities conducted on a regular basis, such as emergency flood control, development, and infrastructure maintenance, impact riparian and instream habitat and often negatively affect bull trout and designated critical habitat for bull trout and other listed salmonids.

Threats

Threats to bull trout in the Green/Duwamish River include:

- Heavy industry, bank armoring, and loss of wetlands and shallow subtidal habitats.

- Water quality has been degraded by municipal and industrial effluent discharges and development.

Puget Sound Bull Trout Critical Habitat

The USFWS designated critical habitat for the Coastal-Puget Sound bull trout on October 18, 2010 (75 FR 63898). The final rule identified nine primary constituent elements (PCEs) essential for the conservation of bull trout.

The lower Duwamish River supports eight of the nine PCEs of bull trout critical habitat:

PCE 1: Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.

PCE 2: Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.

PCE 3: An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

PCE 4: Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.

PCE 5: Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.

PCE 7: A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.

PCE 8: Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.

PCE 9: Sufficiently low levels of occurrence of nonnnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

Puget Sound Chinook Salmon

This Evolutionarily Significant Unit (ESU) was listed as a threatened species in 1999; its threatened status was reaffirmed in 2005. The NMFS issued results of a five-year review on August 15, 2011 (76 FR 50448), and concluded that this species should remain listed as threatened.

The NMFS adopted the recovery plan for Puget Sound Chinook on January 19, 2007 (72 FR 2493). The recovery plan consists of two documents: the Puget Sound Salmon Recovery Plan prepared by the Shared Strategy for Puget Sound and NMFS' Final Supplement to the Shared Strategy Plan. The recovery plan adopts ESU and population level viability criteria recommended by the Puget Sound Technical Recovery Team (PSTRT) (Ruckelhaus et al. 2002). The PSTRT's Biological Recovery Criteria will be met when the following conditions are achieved:

1. All watersheds improve from current conditions, resulting in improved status for the species;

2. At least two to four Chinook salmon populations in each of the five biogeographical regions of Puget Sound attain a low risk status over the long-term;

3. At least one or more populations from major diversity groups historically present in each of the five Puget Sound regions attain a low risk status;

4. Tributaries to Puget Sound not identified as primary freshwater habitat for any of the 22 identified populations are functioning in a manner that is sufficient to support an ESU-wide recovery scenario;

5. Production of Chinook salmon from tributaries to Puget Sound not identified as primary freshwater habitat for any of the 22 identified populations occurs in a manner consistent with ESU recovery.

Spatial Structure and Diversity. The PSTRT determined that 22 historical populations currently contain Chinook salmon and grouped them into five major geographic regions, based on consideration of historical distribution, geographic isolation, dispersal rates, genetic data, life history information, population dynamics, and environmental and ecological diversity. Ruckelshaus et al. (2002) recommended at least two viable populations per geographic region were needed for the recovery of Chinook salmon. Based on genetic and historical evidence reported in the literature, the PSTRT also determined that there were 16 additional spawning aggregations or populations in the Puget Sound Chinook Salmon ESU that are now thought to be extinct[2] (Ruckelshaus et al. 2006). This ESU includes all naturally spawned populations of Chinook salmon from rivers and streams flowing into Puget Sound including the Straits of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, the South Sound, North Sound and the Strait of Georgia in Washington, as well as the progeny of 26

[2] It was not possible in most cases to determine whether these Chinook salmon spawning groups historically represented independent populations or were distinct spawning aggregations within larger populations.

artificial propagation programs. Indices of spatial distribution and diversity have not been developed at the population level, though diversity at the ESU level is declining. Abundance is becoming more concentrated in fewer populations and regions within the ESU. Abundance has increased particularly within the Whidbey Basin Region (Ford 2011).

Abundance and Productivity. Most Puget Sound Chinook populations are well below escapement levels (number of adults returning to freshwater to spawn) identified as required for recovery to low extinction risk. All populations are consistently below productivity goals identified in the recovery plan. Although trends vary for individual populations across the ESU, most populations have declined in total natural origin recruit abundance (prior to harvest) since the last status review. However, most populations exhibit a stable or increasing growth rate in natural-origin escapement (after harvest). No clear patterns in trends in escapement or abundance are evident among the five major regions of Puget Sound. No trend was notable for total ESU escapements. Trends in growth rate of natural-origin escapement are generally higher than growth rate of natural-origin abundance indicating some stabilizing influence on escapement from past reductions in fishing-related mortality. Survival and recovery of the Puget Sound Chinook salmon ESU will depend, over the long term, on necessary actions in all "4 H" sectors (hatcheries, habitat, harvest and hydro). Many of the habitat and hatchery actions identified in the Puget Sound Chinook salmon recovery plan are likely to take years or decades to be implemented and to produce significant improvements in natural population attributes, and these trends are consistent with these expectations and reiterated in Ford (2011).

Limiting factors. Limiting factors described in NMFS (2007) and NMFS (2011a) include:

- Degraded nearshore and estuarine habitat: Residential and commercial development has reduced the amount of functioning nearshore and estuarine habitat available for salmon rearing and migration. The loss of mudflats, eelgrass meadows, and macroalgae further limits salmon foraging and rearing opportunities in nearshore and estuarine areas.

- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large wood supply, stream substrate, and water quality have all been degraded as a result of cumulative impacts of agriculture, forestry, and development. Degraded conditions in the upper watershed can affect spawning habitat for salmonids, embryo development and rearing conditions for juvenile salmonids.

- Anadromous salmonid hatchery programs: Salmon and steelhead (*O. mykiss*) released from Puget Sound hatcheries operated for harvest augmentation purposes pose ecological, genetic, and demographic risks to natural-origin Chinook salmon populations. Salmon harvest management: Total fishery exploitation rates have decreased 14 to 63 percent from rates in the 1980s, but weak natural-origin Chinook salmon populations in Puget Sound still require enhanced protective measures to reduce the risk of overharvest.

Puget Sound Chinook Salmon Critical Habitat

The NMFS designated critical habitat for Puget Sound Chinook salmon on September 2, 2005 (70 FR 52630). In the Duwamish River, critical habitat is defined by the stream channel with the lateral extent being the ordinary high water line. Two of the six PCEs of Chinook salmon critical habitat may be affected by the proposed project:

PCE 3: Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

PCE 4: Estuarine areas free of obstruction and excessive predation with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fish, supporting growth and maturation.

Puget Sound Steelhead

The NMFS listed Puget Sound steelhead as threatened on June 11, 2007 (72 FR 26722).

Abundance and Productivity

For all but a few demographically independent populations (DIPs) of steelhead in Puget Sound, estimates of mean population growth rates obtained from observed spawner or redd counts are declining, typically 3 to 10 percent annually. Extinction risk within 100 years for most populations of steelhead in the Puget Sound Distinct Population Segment (DPS) is estimated to be moderate to high, especially for populations in the South Sound and Olympic major population groups. Collectively, these analyses indicate that steelhead in the Puget Sound DPS remain at risk of extinction throughout all or a significant portion of their range in the foreseeable future, but are not currently in danger of imminent extinction (NMFS 2011b). From 2005 to 2009, geometric means of natural spawners indicate relatively low abundance (4 of 15 populations with fewer than 500 spawners annually) and declining trends (6 of 16 populations) in natural escapement of winter-run steelhead throughout Puget Sound, particularly in southern Puget Sound and on the Olympic Peninsula (Ford 2011).

Spatial Structure and Diversity

The Puget Sound Steelhead DPS includes naturally spawning steelhead stocks below natural and manmade impassable barriers, in streams and rivers ranging from the Canadian border (Nooksack River basin), south through Puget Sound and Hood Canal, and northwest to the Elwha River, which empties into the eastern Strait of Juan de Fuca. The Puget Sound steelhead DPS tentatively includes 32 DIPs within three major population groups of summer- and winter-run fish, the latter being the most widespread and numerous of the two run types (Hard et al. 2012). The metrics and benchmarks for evaluating the adequacy of a DIP's spatial structure include: quantity, quality,

connectivity, dynamics, and catastrophic risks. Analyses by Scott and Gill (2008) estimate that 8 to 26 percent of the historic range has been lost for summer steelhead in the Puget Sound, and 3 to 21 percent of the historic range for winter steelhead had been lost. The DPS is likely to be at elevated risk due to reduced complexity of spatial structure of its steelhead populations, and consequently, diminishing connectivity among them. Because of their limited distribution in upper tributaries, summer-run steelhead may be at higher risk than winter-run steelhead from habitat degradation in larger, more complex watersheds.

Resident steelhead occur within the range of Puget Sound steelhead but are not part of the DPS due to marked differences in physical, physiological, ecological, and behavioral characteristics (71 FR 15666; March 29, 2006). Genetic diversity can enable fish to adapt to regular and cyclic changes due to natural dynamics, such as ocean conditions. However, naturally produced steelhead interbreeding with hatchery steelhead may be contributing to reduced productivity of natural fish (Hard et al. 2007). The Puget Sound Steelhead TRT has analyzed potential reduction in diversity for each DIP from hatchery effects (Hard et al 2012). Declines in natural abundance for most populations, coupled with large numbers of anthropogenic barriers such as impassable culverts reduce opportunities for movement and migration between steelhead aggregations in different watersheds. The reduction in escapement of natural steelhead to the centrally located Lake Washington watershed in recent years is also of concern.

Bull Trout and Chinook Recovery Plan Actions

In analyzing the project and to provide recommendations to benefit the fish and wildlife resources, the USFWS reviewed the bull trout and Chinook salmon recovery plans (FWS 2004, NMFS 2007). Both plans provided recovery actions that would reduce threats to the species and provide opportunities for restoring habitat and access that benefits both species.

The following are specific bull trout recovery actions identified for the Lower Duwamish River:

1.6 Identify impaired estuarine and nearshore marine habitats and implement actions to restore their appropriate functions.

1.6.1 Identify and remediate contaminant sites in estuarine and nearshore marine areas. Identify estuarine and nearshore marine sites with contaminated sediments and structures (e.g., treated wood piles) that pose a significant exposure risk to bull trout or their forage species, and address contaminant exposure by site capping or other remediation. High priority sites include those in close proximity to known and potential marine forage fish spawning areas and bull trout subadult and adult foraging habitats. High priority locations include Commencement Bay, Lower Duwamish and Elliott Bay, and Bellingham Bay.

5.2 Conduct research evaluating relationships among bull trout distribution and abundance, bull trout habitat, and recovery actions.

5.2.5 Determine the extent of effects from contaminant exposure. Evaluate the significance of contaminant (*e.g.*, herbicides, pesticides, heavy metals, polyaromatic hydrocarbons, estrogenic compounds) exposure to bull trout in freshwater, estuarine, and marine habitats. Assess contaminant levels within individuals across age classes, evaluate lethal and sublethal effects and pathways of exposure, and assess potential overall effect to individual core areas. Also evaluate significance of contaminant exposure on their prey base, such as Cherry Point herring population. Current high priority areas include Bellingham Bay, Snohomish River estuary, Commencement Bay, and the Duwamish River/Elliott Bay.

The recommended policies and actions from the Puget Sound Chinook Salmon Recovery Plan for the Duwamish Estuary subwatershed addresses issues that will expand and enhance the estuary and protect and restore habitat and water quality within the Duwamish Estuary. Specific recovery actions identified for Chinook salmon include:

Policy DU1: Endorse the Comprehensive Environmental Response, Compensation, and Liability Act (Superfund) assessment and cleanup of contaminated sediments in the Lower Duwamish Waterway superfund area by the responsible parties and regulatory agencies because it will improve ecosystem health and increase the quality of existing salmon habitat.

Policy DU2: Encourage the natural resource trustees, agencies involved in habitat restoration and sediment clean-up in the Duwamish River and Elliott Bay, to develop Natural Resources Damages Assessment approaches that allow habitat creation/restoration concurrent with Superfund cleanup of the Lower Duwamish Waterway. This will accelerate the rate at which mitigation occurs and be more efficient.

Program D-4: Develop improvements in dredging and sediment use criteria.

- Encourage the Corps to identify strategies for maintenance dredging at Turning Basin #3 that:
  - Minimize harmful impacts to salmon habitat in the dredged area; and
  - Improve salmon habitat both in the dredged area and elsewhere in the Duwamish and marine nearshore subwatersheds (e.g., through the use of clean dredged sediment to expand/improve shallow water habitat).

POTENTIAL PROJECT IMPACTS TO FISH AND WILDLIFE RESOURCES

The proposed project as described above (Description of the Project section) involves deepening the navigational channel by dredging the East and West Waterways of the Duwamish River to accommodate loading and unloading of larger container ships. The Corps has indicated that deepening the navigational shipping channel to accommodate larger container ships is the only viable alternative to meet the business needs of the Port of Seattle. Other alternatives or measures are available or are currently being used, but these measures over the long-term do not solve the Port's issues on cost savings and reducing navigation challenges for larger ships entering the Port. Other alternatives or measures include:

- **Tug Assists:** Use additional tug assists to help larger vessels and vessels with limited maneuverability transit the harbor.

- **High-Tide Transiting:** Time transits to use high tide to allow for the current fleet to transit the harbor under existing project conditions.

- **Light-Loading:** Light-load the larger vessels to allow the current fleet (which are larger and exceed the current navigation channel design specifications) to transit the harbor under existing project conditions.

- **Lightering:** Transfer cargo between vessels of different sizes to allow vessels to enter and transit the harbor.

Water Quality

The Corps' in-water work window for the Duwamish River is October 1 to February 15 for the protection of ESA listed species. Potential construction-related impacts associated with dredging both the West and East Waterways of the Duwamish River would include water quality impacts due to increased turbidity, suspended sediments, and contaminants. The variety of effects of increased turbidity and suspended sediment may be characterized as lethal, sublethal or behavioral (Bash et al. 2001; Newcombe and MacDonald 1991; Waters 1995). Lethal effects include gill trauma (physical damage to the respiratory structures), severely reduced respiratory function and performance, and smothering and other effects that can reduce egg-to-fry survival (Bash et al. 2001). Sublethal effects include physiological stress reducing the ability of a fish to perform vital functions (Cederholm and Reid 1987), increased metabolic oxygen demand and susceptibility to disease and other stressors (Bash et al. 2001), and reduced feeding efficiency (Bash et al. 2001; Berg and Northcote 1985; Waters 1995). Sublethal effects can act separately or cumulatively to reduce growth rates and increase fish mortality over time. Behavioral effects include avoidance, loss of territoriality, and related secondary effects to feeding rates and efficiency (Bash et al. 2001). Fish may be forced to abandon preferred habitats and refugia, and may enter less favorable conditions and/or be exposed to additional hazards (including predators) when seeking to avoid elevated concentrations of suspended sediment.

Increased turbidity and suspended solids can also cause impacts or alterations to the macroinvertebrate communities or populations (Anderson et al. 1996) by reducing primary productivity by decreasing light penetration through the water column (Anderson et al. 1996; Henley et al. 2000; Suren and Jowett 2001), altering habitat by filling of interstitial space and rendering attachment sites unsuitable, causing abrasion of respiratory surfaces and interference with food uptake for filter-feeders (Anderson et al. 1996; Birtwell 1999; Shaw and Richardson 2001; Suren and Jowett 2001; Berry et al. 2003), and clog feeding structures and reduce feeding efficiencies (Newcombe and MacDonald 1991). These impacts can result in changes in species densities, diversity, and structure, cause invertebrates to seek less favorable habitat (Rosenberg and Snow 1975), and result in reduced growth rates, increased stress, or death of the invertebrates.

Anchor (2003) conducted a review of the literature to determine the effects of suspended sediments due to dredging operations. The resuspension of sediments from dredging depends on site and sediment characteristics (Anchor 2003, pp. 7-8). These characteristics include waterway shape, water depth, presence of structures (bridges, piers, etc.), sediment grain size, water content, density, specific gravity, organic/detritus content, debris content, dredge type and size, production rate, dredge method (dredge cut depth, swing of cutterhead, etc.), currents, tides, vessel wakes, waves, salinity, temperature, background suspended sediment concentrations, and background water chemistry. The resuspension of sediments from dredging are greatest near the bottom of the water column, rapidly decreases with the distance from the dredge, dependent on sediment size (smaller particles travel further), and currents (Anchor 2003, p. 8).

Water currents determine the shape and size of sediment plumes resulting from dredging. The West and East Waterways of the Duwamish River are tidally influenced. Therefore, dispersal of the sediment plume during dredging operations will depend on tidal currents, which results in varying current flows and different salinity concentrations throughout the water column. Water quality monitoring of dredging operations in the Snohomish River found higher turbidity in the lower marine waters and at mid-depth and the marine-freshwater interface (Jones and Stokes 2005, p. 12). Elevated turbidly levels were also found during strong ebb tides.

Dredging of the Duwamish Waterways also has the potential to cause the release or resuspension of contaminants. The Duwamish Waterways are federal superfund sites, and removal of sediments likely will release contaminates. Mercury, silver, lead, and zinc have been found in the project area, including upland areas, and the sediments adjacent to the seawall. These chemicals have been found to exceed Washington State Department of Ecology's sediment cleanup screening levels, with mercury being the most widespread chemical of concern. Other chemicals found, but in lower levels, include metals, volatile organic compounds, creosote-related compounds, petroleum compounds, and PCBs.

Several of the contaminants such as PAHs and PCBs may cause adverse effect to invertebrates, fish, and wildlife. Metal, PAHs, and PCBs, as groupings of related contaminants, present a risk of additive or synergistic effects. Potential effects of bioaccumulation include inhibited reproduction, delayed fry emergence, liver disease or malfunction, morphological abnormalities, immune system impairment, and mortality.

Channel Modifications

In most cases, dredging occurs to modify a river for flood control. In lower rivers and estuaries, as in the Duwamish River, dredging is conducted specifically to deepen or maintain the depth of the waterway for navigation. Dredging impacts to fish include loss of spawning substrates (higher up in the rivers) and decreased food supply, cover and shelter (Shoof 1980, p. 698). In estuaries or estuarine channels, deepening the channel results in changes in tidal amplification, increased estuarine circulation, and increased flood-dominance of tidal asymmetry (van Maren et al 2015, p. 1). Tidal amplification increases either the ebb or flood tide and increases the dominance of that tide cycle. Increased estuarine circulation leads to additional sediment transport up the waterway.

The proposed action is to deepen or maintain depths within the East and West Waterways of the Duwamish River to -51, -53, or -55 feet MLLW. The current depths of the East Waterway ranges from -30 to -53 feet MLLW, and the West Waterway ranges from -34 to over -60 feet MLLW (Corps and Port 2014, p. 11). Depths at the entrances to both the East and West Waterways are significantly shallower and limit larger ships from entering both waterways (Figures 2 and 3). The proposed alternatives will maintain the existing degraded estuarine channels of the Duwamish River.

Estuaries provide important functions for numerous fish species from deep water marine fish that migrate into estuaries to spawn to anadromous species, like salmon, that spawn in freshwater and migrate through the estuary to marine water. As salmon migrate through the estuary, the time spent in the tidal influence zone varies depending on the species but can range from days to weeks. Habitat used also varies, from shallow, nearshore or nearbank, to deep mid-channel waters.

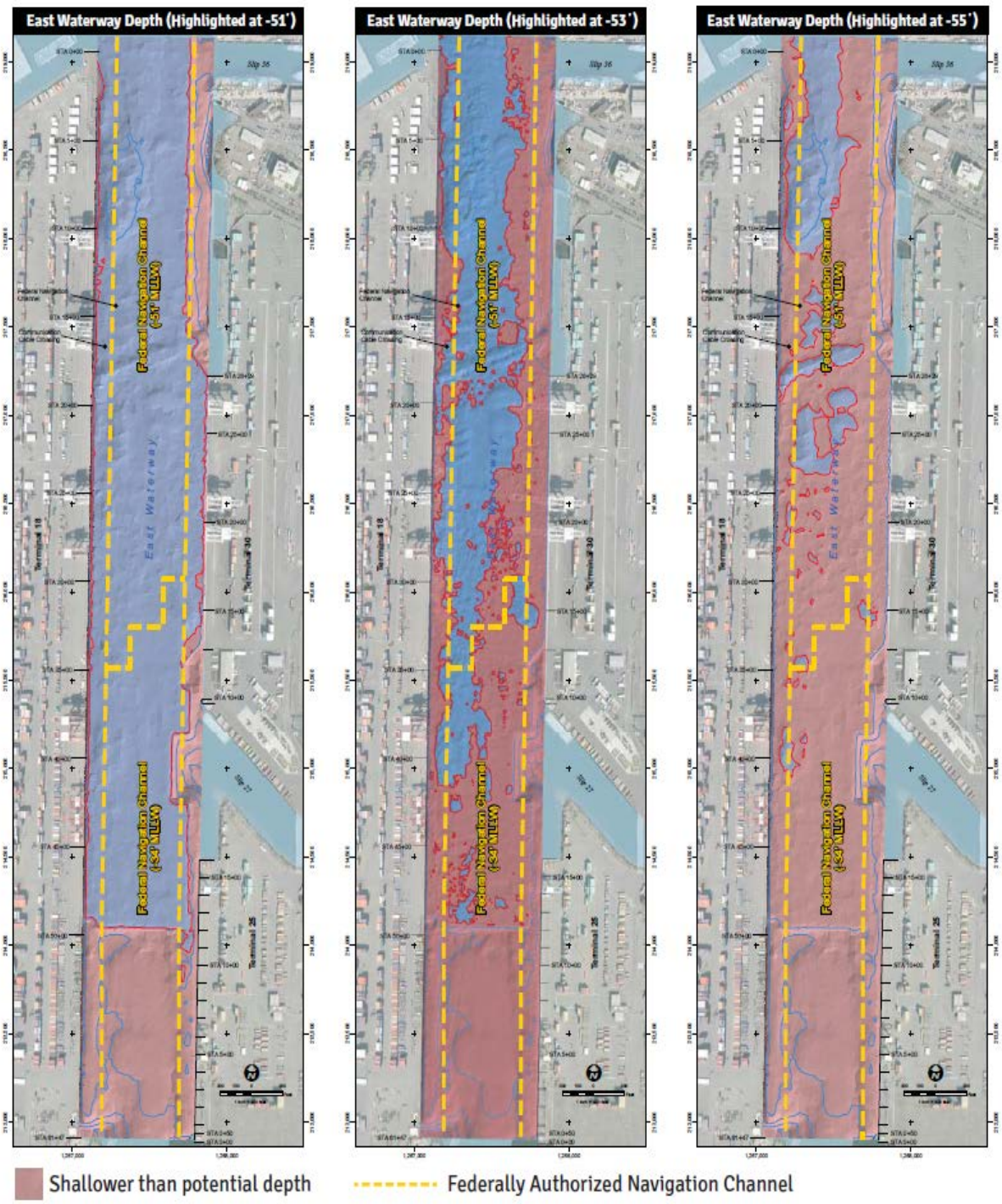

Figure 2. Dredging areas within the East Waterway of the Duwamish River (outlined by dashed yellow lines) and the areas that are shallower than the proposed dredging depths (-51, -53, or -55 feet MLLW in pink).

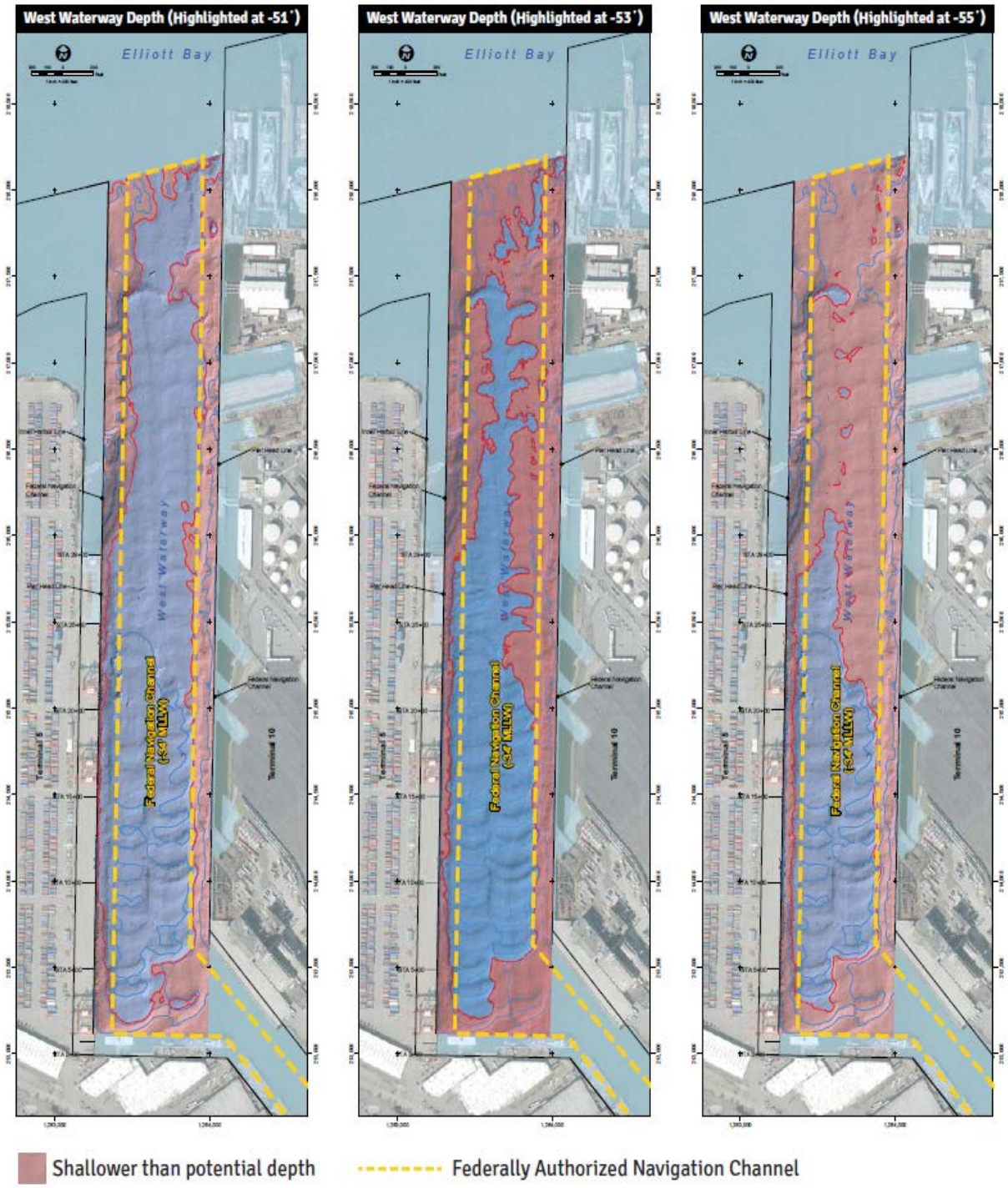

Figure 3. Dredging areas within the West Waterway of the Duwamish River (outlined by dashed yellow lines) and the areas that are shallower than the proposed dredging depths (-51, -53, or -55 feet MLLW in pink).

As stated in the existing conditions section above, the Duwamish River has been developed and modified over the past century. Dredging within the Duwamish River occurs throughout the navigation channel from Elliott Bay up to the Turning Basin at RM 5.3. Within this area, the banks are heavily armored and there are numerous overwater structures (piers, boats). Shallow water is extremely limited, but restoration sites along the Duwamish River are providing a few sites with shallow water and marsh habitat.

Bull Trout and Chinook Salmon Critical Habitat

Dredging of the East and West Waterways of the Duwamish River will impact some of the PCEs of bull trout and Chinook salmon critical habitat. Dredging activities will result in temporary degradation of water quality due to increased turbidity and suspended sediments which may temporarily impede migration through the area and reduce foraging opportunities. Deepening and widening the navigation channel will also alter the tidal hydrology and flows in both waterways.

Interrelated and Interdependent Actions

The proposed action will be conducted within the navigation channel of the East and West Waterways. The areas adjacent to the navigation channel are owned by public and private companies. These companies, like the Port of Seattle, also dredge the channels on either side of the federal navigation channel and maintain depths at berths and piers for loading and unloading of container ships and other activities. The cumulative effects of both the privately conducted and federal dredging creates uniformly deep water throughout the East and West Waterways. Any shallow water that exists in these areas are under the piers, which migrating salmon have been found to avoid and rarely go under (Munsch et al. 2013). The lack of shallow water forces both adult and juvenile salmonids out into the deeper water where preferred prey is limited and exposure to predators increases.

The dredging of the navigation channel will result in larger vessels (container ships) utilizing the Duwamish River to load and unload at Port facilities and privately owned industrial docks. This results in the Port building or strengthening their system to move additional freight and for larger ships to stay at the terminal for longer periods of time versus the alternatives currently being used (see Potential Project Impacts to Fish and Wildlife Resources section above). The effects of this will be loss of shallow water habitat as larger cranes need additional support and therefore, loss of potential habitat under the piers with more and larger piles being installed. Currently proposed pier replacements do not take into consideration designs and new technologies to improve light penetration under the piers, like along the Seattle seawall, to encourage juvenile salmonids to use the only areas of shallow water for migration. The piers and larger boats unloading and loading will result in increased shade which will force juvenile salmonids further out into the middle of the shipping lane and deeper water.

Larger ships may also result in increased contamination due to propeller scour as the ships arrive and leave the harbor. As stated above, the Duwamish River is an EPA designated superfund site, and prop wash can result in resuspension of contaminants in the sediments.

RECOMMENDATIONS

The USFWS has concerns regarding adverse effects to fish and wildlife resources associated with the proposed deepening of the navigation channel within the East and West Waterways of the Duwamish River and the continued dredging within the Duwamish River as a whole. Among these concerns are: (1) dredging-related impacts to fish and diving or piscivorous birds related to increased turbidity, suspended solids, contaminants, and habitat modifications; (2) continued degradation of the existing conditions through loss of shallow waters; and (3) loss of restoration opportunities in the lower Duwamish.

The USFWS provides the following recommendations to assist the Corps in analyzing and mitigating dredging impacts and enhancing the aquatic resources in the Duwamish River.

1) The Corps should work with NOAA's Northwest and Alaska Restoration Center to determine restoration actions to mitigate for project impacts as well as impacts associated with interrelated and interdependent action such as long-term habitat loss, increased shade, changes in vessel sizes and numbers, and propeller wash. The Restoration Center will be able to assist in identifying and developing mitigation opportunities which may include the development of an in lieu fee program to pay for current or future mitigation or conservation banks within the Duwamish River. Mitigation should meet the objectives of the current Recovery Plans for both bull trout and Puget Sound Chinook salmon.

2) The Corps should coordinate with land owners adjacent to the navigation channel in both the East and West Waterways of the Duwamish River to discuss measures to provide a shallow-water migratory corridor for salmonids through the waterways. Measures may include creating habitat benches under the piers and installing light-penetrating surface panels similar to those being installed along the Seattle Seawall.

3) Coordinate with the USFWS and the NMFS (collectively the Services) throughout the development of the alternatives and design of the project to expedite the ESA section 7 consultation. Early coordination can (1) provide an opportunity for the Service(s) to suggest conservation measures that can be incorporated into the project to avoid, reduce, or minimize potential adverse effects to listed species; (2) identify design alternatives or mitigation opportunities that can benefit the recovery of listed species; and (3) provide technical assistance on specific species habitat requirements that could be incorporated into the project.

CONCLUSION

Dredging of the East and West Waterways of the Duwamish River will maintain the degraded condition of habitat in the lower Duwamish River estuary that has been impacted for the past 100 years. Environmental effects of the Duwamish River dredging includes water quality degradation and continued channel modifications to the river. The dredging of the Duwamish River, in combination with adjacent landowner activities, has resulted in degraded habitat and impacts to the migratory corridor for numerous aquatic species as well as listed species such as Chinook salmon, steelhead, and bull trout.

The USFWS recommends that the Corps work with NOAA's Restoration Center to develop restoration actions to mitigate for long-term habitat loss and other project impacts. Restoration activities may include in lieu fees to be applied to current or future mitigation or conservation banks within the Duwamish River.

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

Washington Fish and Wildlife Office
510 Desmond Dr. SE, Suite 102
Lacey, Washington 98503

APR 29 2016

In Reply Refer To:
01EWFW00-2015-CPA-0024

Evan Lewis
Chief, Environmental and Cultural Resources Branch
Corps of Engineers, Seattle District
P.O. Box 3755
Seattle, Washington 98124-3755

Dear Mr. Lewis:

Enclosed is the U.S. Fish and Wildlife Service's (Service) Draft Fish and Wildlife Coordination Act (FWCA) Report for the Seattle Harbor Navigation Improvement Project General Investigation. This report provides our comments and recommendations on the three proposed alternatives for this project: Alternative 1 – No Action, Alternative 2 – National Economic Development Plan, and Alternative 3 – Extended Depth Plan. The Service assumes that Alternative 3 is the Preferred Alternative as there is little difference in project impacts between Alternatives 2 and 3.

Our comments have been prepared under the authority of and according to the provisions of the FWCA (48 Stat. 401, as amended 16 U.S.C. 661, *et seq.*) and fulfill section 2(b) of the FWCA. The purpose of the FWCA is to recognize the vital contribution of our wildlife resources to the Nation and to ensure that wildlife conservation receives equal consideration in planning and evaluation for water resource development programs (Smalley and Mueller 2004, p. I-21). The FWCA provides a basic framework for the orderly consideration of fish and wildlife conservation and enhancement measures in federally constructed, permitted, or licensed water development projects. The FWCA also allows the Service to assess project impacts to fish and wildlife resources and to make recommendations to protect and enhance these resources.

We have based our comments, analysis, and recommendations on documents prepared by the U.S. Army Corps of Engineers (Corps), conversations and emails with the National Oceanic and Atmospheric Administration's Restoration Center, Washington Department of Fish and Wildlife, and the Muckleshoot Tribe. The recommendations included in the report are provided to assist you in meeting your obligation, under sections 7(a)(l) of the Endangered Species Act and 2(a) of the FWCA, to use your authorities to promote the conservation of fish and wildlife, including listed species and their habitats.

The Service appreciates the opportunity to provide input into the project. If you have any questions on this letter, please contact Jim Muck at (206) 526-4740 or email jim_muck@fws.gov or Martha Jensen at (360) 753-9000 or martha_l_jensen@fws.gov.

Sincerely,

Carolyn Scafuri

for Eric V. Rickerson, State Supervisor
Washington Fish and Wildlife Officer

cc:
NOAA Restoration Center, Seattle, WA (J. Kern)
WDFW, Mill Creek, WA (L. Arber)
Muckleshoot Tribe, Auburn, WA (G. St. Amant)
NMFS, Lacey, WA (M. Longenbaugh)
NMFS, Portland, OR (K. Kratz)

Seattle Harbor Navigation Improvement Project
General Investigation

Draft Fish and Wildlife Coordination Act Report

U.S. Fish and Wildlife Service Reference Number:
01EWFW00-2015-CPA-0024

Prepared for
U.S. Army Corps of Engineers
Seattle District
Seattle, Washington

Prepared by

U.S. Fish and Wildlife Service
Washington Fish and Washington Office
Lacey, Washington

April 29, 2016

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Figure 3. Dredging areas within the West Waterway of the Duwamish River (outlined by dashed yellow lines) and the areas that are shallower than the proposed dredging depths (-51, -53, or -55 feet MLLW in pink). 20

LIST OF ACROYNMS AND ABBREVIATIONS

Corps	U.S. Army Corps of Engineers
DIP	demographically independent populations
DPS	Distinct Population Segment
EPA	U.S. Environmental Protection Agenc
ESA	Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*)
ESU	Evolutionarily Significant Unit
FWCA	Fish and Wildlife Coordination Act
MLLW	mean lower low water
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
PAH	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyls
PCE	Primary Constituent Element
Port	Port of Seattle
PSTRT	Puget Sound Technical Recovery Team
RM	river mile
Service	U.S. Fish and Wildlife Service

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INTRODUCTION

The United States Army Corps of Engineers (Corps), Seattle District is proposing to conduct a General Investigation on deepening the navigational shipping channel in East and West Waterways of the lower Duwamish River. This Draft Fish and Wildlife Coordination Act (FWCA) Report, provides the U.S. Fish and Wildlife Service's (Service) comments and analysis on the Seattle Harbor Navigation Improvement Project General Investigation. The purpose of the FWCA is to recognize the vital contribution of our wildlife resources to the Nation and to ensure that wildlife conservation receives equal consideration in planning and evaluation for water resource development programs (Smalley and Mueller 2004). The FWCA provides a basic framework for the orderly consideration of fish and wildlife conservation and enhancement measures in federally constructed, permitted, or licensed water development projects. The FWCA allows the Service to assess project impacts to fish and wildlife resources and to make recommendation to protect and enhance these resources.

Under the FWCA, the effects of the project are analyzed by comparing future conditions as they are projected to occur in the absence of the project with conditions expected to occur with the project in place. The comparison is to measure project effects and determine whether the project will cause damages which must be mitigated and whether the project will or can be designed to fully mitigate resource losses and/or enhance these resources. Section 2(b) of the FWCA states that reports provided by the resource agencies should contain information addressing fish and wildlife resources present in the project area, problems and opportunities, impacts of a project and its alternatives, and means and measures for mitigation, including any needed compensation measures and, if applicable, enhancement opportunities to protect natural resources.

This FWCA Report provides an analysis of the project to the existing conditions and provides recommendations to address potential impacts to fish and wildlife resource and well as opportunities to enhance these resources, especially species listed under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (ESA).

Coordination with Federal and State Agencies and Tribal Governments

The Service participated in numerous discussions related to the Seattle Harbor General Investigation and coordinated with relevant resource agencies and the Tribes. The information provided in this FWCA Report is based on conversations with the Muckleshoot Tribe, National Oceanic and Atmospheric Administration's (NOAA) Restoration Center, and the Washington Department of Fish and Wildlife. The Service coordinated with these agencies and the Muckleshoot Tribe prior to completing the FWCA Planning Aid Letter, which was submitted to the Corps on April 29, 2015. Many of the same concerns, conclusions, and recommendations are shared by the Service, the Tribe, and these agencies.

This Draft FWCA Report highlights concerns regarding potential risks and damages to fish, wildlife, and tribal trust resources associated with the Seattle Harbor channel deepening project. In the context of this and other federal water resource development proposals, we emphasize the necessity of improving government-to-government relations and communication, and the necessity of upholding treaty fishing rights and other/related tribal trust responsibilities.

PROJECT DESCRIPTION

The project involves the deepening of the East and West Waterways of the lower Duwamish River. The federally authorized navigation channel consists of the East Waterway, which is currently maintained at a depth of -39 to -51 feet mean lower low water (MLLW); the West Waterway, which is maintained to -34 feet MLLW; and the Duwamish Waterway, which ranges in depth from -30 feet MLLW to -15 feet MLLW to the head of navigation channel at the Turnaround Basin. Actual dimensions of the waterways vary, in some cases, from their federally authorized depths and widths. These three waterways, the East Waterway, West Waterway, and the Duwamish River, provide over 7 miles of navigation channels for cargo vessels coming from Elliott Bay, Puget Sound, and the Pacific Ocean. The project area only includes the East and West Waterways, as these two waterways have been identified by the Port of Seattle (Port) as the areas of critical importance for deepening to allow larger vessels to access the Port docks.

Project Authority, Purpose and Scope

The Corps and the Port recognized that channel deepening is essential to maintaining the Port's competitive position as a premier international trade gateway, particularly relative to Canadian ports. Navigational challenges have been identified in both the East and West Waterways of the Seattle Harbor and authorized depths do not meet the draft requirements of today's fleet of larger container ships. The Port exports more cargo by weight than it imports and is a last port of call for several of the Asian – West Coast routes. The Seattle Harbor is a major gateway for containerized traffic and the channels must have sufficient depth for partially loaded vessels to call, take on additional cargo, and leave fully loaded. Tide restrictions, light loading, or other operational inefficiencies created by inadequate channel depth currently limits the Port's competitiveness, especially when competing with nearby and naturally deep harbors in British Columbia and the outer coast.

The FWCA Planning Aid Letter on the Seattle Harbor Navigation Improvement Project General Investigation that was submitted to the Corps in 2015 analyzed proposed project effects to fish and wildlife from four alternatives: the No Action Alternative and three alternatives proposing deepening the East and West Waterways to -51, -53, and -55 feet MLLW. Since then, the Corps is no longer considering the 3 original alternatives to deepening the East and West Waterways, and has developed two new alternatives. The length of the West Waterway is currently 6,109 feet and the length of the East Waterway is 7,232 feet. Authorized depth of the West Waterway is 34 feet and the East Waterway ranges in depth from 34 to 51 feet (Figure 1). The currently proposed alternatives include:

- Alternative 1 – No Action Alternative – Continue maintenance activities to authorized depth of 34 feet in the West Waterway and 34 to 51 feet in the East Waterway.

- Alternative 2 – Deepening the West Waterway (6,109 feet) and East Waterway (6,000 feet) to a depth of -56 feet MLLW. Approximately 2,500 feet and 1,200 feet of the northern portions of the West Waterway and East Waterway, respectively, would be widened to 750 feet and the remaining portion would remain at the existing 550 foot width. The 1,232-foot-long section at the southern end of the East Waterway will be maintained at the currently authorized width of 500 feet and depth of -34 MLLW.

- Alternative 3 – Deepening the West Waterway (6,109 feet) and East Waterway (6,000 feet) to a depth of -57 feet MLLW. Approximately 2,500 feet and 1,200 feet of the northern portions of the West Waterway and East Waterway, respectively would be widened to 750 feet and the remaining portion will be maintained at the existing 550 foot width. The 1,232-foot-long section at the southern end of the East Waterway will be maintained at the currently authorized width of 500 feet and depth of -34 MLLW.

  The Service assumes that Alternative 3 (deepening both the East and West Waterways) to -57 feet is the Preferred Alternative. There is little difference in project impacts between Alternatives 2 and 3 except for an additional foot of dredging depth in both waterways.

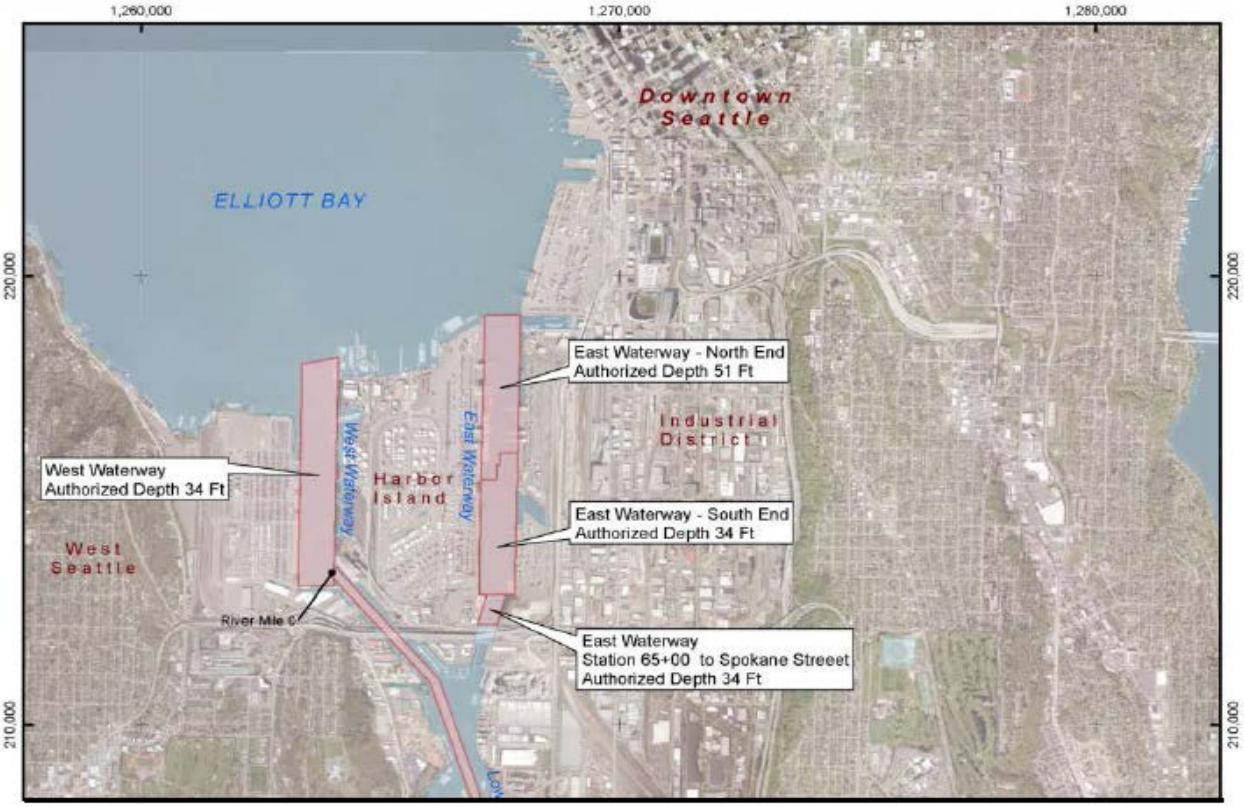

Figure 1. The project area and the authorized depths of the East and West Waterways of the Duwamish River.

DESCRIPTION OF THE PROJECT AREA

The federally authorized Seattle Harbor navigation project, consisting of the East, West, and Duwamish Waterways, is located in Puget Sound's Elliott Bay at Seattle, Washington. The authorized project is located from Elliott Bay upstream approximately five miles to the head of the Federal navigation channel which lies in the lower Duwamish River. However, proposed dredging activities would only be conducted in the East and West Waterways of the Duwamish River (Figure 1).

EXISTING CONDITIONS

Lingering effects of more than a century of human development combined with numerous ongoing activities in the industrial waterways have contributed to the currently degraded environmental baseline conditions in the lower Duwamish River, including the East and West Waterways. These activities included expanding urban development, railroads, shipping, logging, agriculture, and other industries. These activities have resulted in the permanent loss and conversion of the historic estuary to an industrial waterfront with industrial waste discharges, storm water runoff from impervious surfaces, freshwater diversions for industrial and domestic use, shoreline armoring and levees, overwater structures, and flood control structures (Howard Hanson Dam in the upper watershed).

Development began to affect the lower Duwamish River in the early 1900s. Diversion of tributaries reduced the river's drainage basin by 71 percent and its average flow by more than 70 percent. At about the same time, the river was dredged and channelized to create the Duwamish Waterway, replacing nine meandering miles of river with a straight, deep, 4-mile-long navigation channel (EBDRP 1994).

Of the shoreline between the mouth and River Mile (RM) 6.5 (about 1.3 RM above the limit of navigation at the south end of the Duwamish Waterway), 44 percent is riprapped, 34 percent is covered by large docks and pier aprons and 7 percent has been faced with vertical sheet piling (derived from data by Tanner 1991). Furthermore, a considerable portion of the remaining intertidal and shallow subtidal portions of the lower Duwamish Waterway is covered by barges and large vessels (Muckleshoot Indian Tribe Fisheries Department [MITFD], unpub. data). The effects of eliminating natural shorelines were compounded by the filling of marshes and mudflats, the creation of steep bulkhead and riprap banks, the removal of vegetation, and the construction of buildings, piers, and impervious pavement. Altogether, these actions eliminated about 98 percent of the lower Duwamish River's emergent marshes and intertidal mudflats and 100 percent of its tidal swamps (Blomberg et al. 1988). The highly modified waterways and shorelines generally provide poor habitat for salmon (Spence et al. 1996).

The Duwamish River was a major river estuary before 1853. Estuaries provide habitat elements necessary for the survival of juvenile salmonids by providing osmo-regulatory transitions (conversion from freshwater to saltwater habitats) and rearing habitats as well as holding habitats for adult salmon waiting to ascend the river to spawning grounds. Juvenile salmonids normally use side channels for feeding, avoiding predators, and resting while undergoing their physiological change to salt water. Rapid growth also occurs in estuaries due to the abundance of preferred

food. The historical migration routes of anadromous salmonids into off-channel distributary channels and sloughs have largely been eliminated, and historical saltwater transition zones have been severely reduced in most of the rivers that drain into Puget Sound (Kerwin 1999). Bull trout (*Salvelinus confluentus*), like other anadromous salmonids, use the estuarine environment as holding habitat before ascending the river to spawn and for feeding and rearing.

In the lower Duwamish Waterway, the riverbanks have been straightened, steepened, hardened, and denuded of riparian vegetation. Warner and Fritz (1995) found the greatest abundance of juvenile salmon using shallow, sloping, soft mud beaches compared with sites having sand, gravel, or cobble substrates. The Kellogg Island area has both remnant intertidal shallows (Terminal 107 and Kellogg Island Reserve) and restored upper intertidal habitats (Herring House Park) combined with extensive riparian zones that are available for salmonid use. The shorelines around Kellogg Island provide the majority of the remaining functional intertidal wetlands in the Duwamish estuary (Simenstad et al. 1991). Restoration activities have also occurred in the upper turning basin, and various smaller locations throughout the Duwamish River.

Additionally, the chemical contamination of sediments in certain areas of the Duwamish River has compromised the effectiveness of the small amount of remaining habitat. Chemicals of concern found at elevated concentrations include: polynuclear aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCBs), metals (arsenic, mercury and zinc), phthalates, phenols, and pesticides (DDT, DDE, DDD). Varanasi et al. (1993) found juvenile Chinook salmon (*Oncorhyncus tschawytscha*) from the Duwamish River displayed a lower immune system response compared with juvenile Chinook salmon from the Nisqually River, a comparable size estuary that does not have any significant industrial contaminants and has recently been restored to near-historic conditions. Salmon and other fish species often spend several weeks in urban estuaries where they can be exposed to urban-related contaminants that reside in the sediments and accumulate in the prey species. There is concern that these contaminants could bio-accumulate to levels that may impact the ability of the individual salmon to grow and mature properly (NMFS 2002).

The U.S. Environmental Protection Agency (EPA) listed the lower Duwamish River as a Federal Superfund site in 2001, and the clean-up of contaminants has been a high priority. To further investigate the contamination and evaluate cleanup alternatives, the EPA and Washington State Department of Ecology signed an Administrative Order of Consent with four of the major property owners on the waterway with potential liability for cleanup of their sites. An attachment to the order, the Statement of Work, outlines the tasks necessary to achieve these goals. Some of the contaminants surrounding Harbor Island have already been cleaned up or capped, but contaminated sediments still remain throughout the Duwamish River and are a major concern.

Duwamish River Restoration

The Corps identifies 45 potential restoration projects, five that have been constructed, within the Green/Duwamish River watershed (Corps website 2015). Based on the information provided, the Service was unable to determine how many of those restoration projects are in the Duwamish River. In 2003, seven early action or fast track cleanup and restoration projects were identified (Ecology 2013, p. 1-2). The City of Seattle and the Port have completed the T117 restoration and

cleanup projects. The Port has designed another project that is currently under environmental review to convert approximately 10 acres of uplands into intertidal marsh habitat on the T117 property. Other projects have also been completed, are in development, or are being planned for the Duwamish River. Many of these restoration projects will include cleanup and capping of remaining areas with contaminated sediments.

EXISTING FISH AND WILDLIFE RESOURCES

Invertebrates

The Duwamish River is highly developed which limits macroinvertebrate taxa and densities. In a review of nine studies conducted in the Duwamish River, 187 taxa, representing 46 families in 10 phyla were found (WindWard 2003, p. 32). The invertebrate community is dominated by annelid worms, mollusks, and arthropods.

Invertebrate densities within the Duwamish River are influenced by salinity, water depth, percent fines, and organic carbon content (WindWard 2003, p. 38), which are all affected by ongoing dredging of the navigation channel. Restoration sites provide complex habitat with shallow water, vegetation, and large woody debris (organic matter) that increases macroinvertebrate diversity (Cordell et al 2008, p. 46). Worms, including oligochaetes (earthworms), nematodes (roundworms), and polychaete (bristle worms) were the most abundant invertebrates (Cordell et al 2008, p. 32). Amphipods, *Americorophium* spp., and polychaetes, *Americorophium* spp. are important prey species for juvenile salmonids. Larger invertebrates include various mollusks (clams and mussels), crustaceans (crabs), and echinoderms (starfish)(WindWard 2003, p. 39).

Fish

Sixty-one different species of fish were found within the Duwamish River (WindWard 2003, pp. 43-47). All eight species of native anadromous salmonids occur in the Duwamish River and are known to utilize the estuarine environment to transition from freshwater to saltwater or vice versa as both juveniles and adults. These include Chinook salmon, chum salmon (*O. keta*), pink salmon (*O. gorbuscha*), sockeye salmon (*O. nerka*), coho salmon (*O. kisutch*), steelhead trout (*O. mykiss*), bull trout, and sea-run coastal cutthroat trout (*O. clarki*). The emigration and residence timing of juvenile and adult salmonids in the project area varies for each species.

The most abundant non-salmonid fish in the Duwamish River are snake prickleback (*Lumpenus saggita*), shiner surfperch (*Cymatogaster aggregata*), English sole (*Parophrys vetulus*), Pacific staghorn sculpin (*Leptocottus armatus*), starry flounder (*Platichthys stellatus*), and longfin smelt (*Spirinchus thaleichthys*)(WindWard 2003, p. 49). Locations and abundance of these fish varied based on salinity and season of the year.

Birds

Many bird species, up to 83 species, occur in and use the project area throughout the year (WindWard 2003, p. 51). These species include a diverse mix of waders, shorebirds, waterfowl, seabirds, passerines, and raptors. Thirty-two species of passerine and upland birds, eight species of raptors, ten species of shorebirds and wading birds, 17 species of waterfowl, and 16 species of seabirds were recorded in the area. Common water birds include the herring gull (*Larus argentatus*), California gull (*Larus californicus*), ring-billed gull (*Larus delawarensis*), double-crested cormorant (*Phalacrocorax auritus*), pigeon guillemot (*Cepphus columba*), common goldeneye (*Bucephala clangula*), surf scoter (*Melanitta perspicillata*), common merganser (*Mergus merganser americanus*), and western grebe (*Aechmophorus occidentalis*). During the winter, the red-necked grebe (*Podiceps grisegena*), lesser scaup (*Aythya affinis*), American wigeon (*Anas americana*), hooded merganser (*Lyphodytes cucullatus*), glaucus-winged gull (*Larus glaucescens*), , common murre (*Uria aalge*), rhinoceros auklet (*Cerorhinca monocerata*), and Canada goose (*Branta canadensis*) may also be present in the project area.

Terrestrial birds include the house sparrow (*Passer domesticus*), European starling (*Sturnus vulgaris*), rock pigeon (*Columba livia*), American crow (*Corvus brachyrhynchos*), Northwestern crow (*Corax caurinus*), Brewer's blackbird (*Euphagus cyanocephalus*) belted kingfisher (*Ceryle alcyon*) great blue heron (*Ardea herodias*), black-capped chickadee (*Parus atricapillus*), purple martin (*Progne subis*) and violet-green swallow (*Tachycineta thalassina*), to name just a few. Four raptor species are also periodically seen in the study area; bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), osprey (*Pandion haliaetus*), and red-tailed hawk (*Buteo jamaicensis*).

Mammals

A variety of semi-aquatic and terrestrial mammals are present in the project area (WindWard 2003, p. 54). Semi-aquatic mammals include raccoons (*Procyon lotor*), muskrats (*Ondatra zibethicus*), and river otters (*Lontra canadensis*). Three marine mammals (harbor seals [*Phoca vitulina*], California sea lions [*Zalophus californianus*], and harbor porpoise [*Phocoena phocoena*]) may occasionally enter the lower Duwamish River. Terrestrial mammals that may be present include the black rat (*Rattus rattus*), Norway rat (*Rattus norvegicus*), house mouse (*Mus musculus*), and eastern gray squirrel (*Sciurus carolinensis*). Domesticated animals such as dogs and cats may also be present. Other species include the opossum (*Didelphis virginiana*), and eight species of bats including the Townsend's big-eared bat (*Plecotus townsendii*) and the big brown bat (*Eptesicus fuscus*).

ENDANGERED SPECIES ACT COMPLIANCE

In accordance with Section 7(c) of the ESA, the following federally listed species and designated critical habitat may occur in the project area[1].

SERVICE Species:

Coastal-Puget Sound Bull Trout	Threatened
Coastal-Puget Sound Bull Trout Critical Habitat	

National Marine Fisheries Service (NMFS) Species:

Puget Sound Chinook Salmon	Threatened
Puget Sound Chinook Salmon Critical Habitat	
Puget Sound Steelhead	Threatened
Puget Sound Steelhead Critical Habitat	

Coastal-Puget Sound Bull Trout

Bull trout were listed as threatened on November 1, 1999 (64 FR 58910). Bull trout populations exhibit 4 distinct life-history types: resident, fluvial, adfluvial, and anadromous. Resident, fluvial, and adfluvial forms exist throughout the range of the bull trout (Rieman and McIntyre 1993) and spend their entire life in freshwater. The only known anadromous form within the coterminous United States occurs in the Coastal-Puget Sound region (Volk 2000, Kraemer 1994, Mongillo 1993). For all life-history types, juveniles rear in tributary streams for 1 to 3 years before migrating downstream into a larger river, lake, or estuary and/or nearshore marine area to mature (Rieman and McIntyre 1993).

Green/Duwamish Foraging, Migration and Over-Wintering Habitat

The lower Green/Duwamish River is used by bull trout for foraging, migration and overwintering. This foraging, migration and overwintering habitat may be used by individuals from several nearby bull trout core areas such as the Puyallup and Snohomish Rivers. There are no known bull trout spawning locations within the Green/Duwamish River.

<u>Number and Distribution of Local Populations</u>

There are no local bull trout populations within the Green/Duwamish River.

[1] The project area consists of the East and West Waterways of the Duwamish River and does not extend into Elliott Bay. The listed species and designated critical habitat are those that would be found within the project area and not those that may be found within Elliott Bay and potentially impacted by the project, such as marbled murrelets (*Brachyramphus marmoratus*).

Connectivity

Bull trout are presumed to utilize the Green/Duwamish River from Elliott Bay upstream to the City of Tacoma's Headworks Diversion Dam at RM 61, which is a total barrier to upstream migration. As no local populations exist in the Green/Duwamish River, connectivity between local populations within a watershed is not a concern. As foraging, migration, and over-wintering habitat, the Green/Duwamish River may be used by bull trout from several core areas. No physical barriers exist within the Green/Duwamish River downstream of the Diversion Dam. High water temperatures and water quality concerns may impede bull trout use of the river during the summer months.

Changes in Environmental Conditions and Population Status

Since the bull trout listing, federal actions occurring in the Green/Duwamish River have caused harm to, or harassment of, bull trout. These actions include statewide federal restoration programs that include riparian restoration, replacement of fish passage barriers, and fish habitat improvement projects; and federally funded or authorized projects involving repair and protection of roads and bridges, levees, infrastructures and facilities.

The number of non-Federal actions occurring in the Green/Duwamish River since the bull trout listing is unknown. However, activities conducted on a regular basis, such as emergency flood control, development, and infrastructure maintenance, impact riparian and instream habitat and often negatively affect bull trout and designated critical habitat for bull trout and other listed salmonids.

Threats

Threats to bull trout in the Green/Duwamish River include:

- Heavy industry, bank armoring, and loss of wetlands and shallow subtidal habitats.
- Water quality has been degraded by municipal and industrial effluent discharges and development.

Puget Sound Bull Trout Critical Habitat

The Service designated critical habitat for the Coastal-Puget Sound bull trout on October 18, 2010 (75 FR 63898). The final rule identified nine primary constituent elements (PCEs) essential for the conservation of bull trout.

The lower Duwamish River supports eight of the nine PCEs of bull trout critical habitat:

PCE 1: Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.

PCE 2: Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.

PCE 3: An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

PCE 4: Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.

PCE 5: Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.

PCE 7: A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.

PCE 8: Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.

PCE 9: Sufficiently low levels of occurrence of nonnnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

Puget Sound Chinook Salmon

This Evolutionarily Significant Unit (ESU) was listed as a threatened species in 1999; its threatened status was reaffirmed in 2005. The NMFS issued results of a five-year review on August 15, 2011 (76 FR 50448), and concluded that this species should remain listed as threatened.

The NMFS adopted the recovery plan for Puget Sound Chinook on January 19, 2007 (72 FR 2493). The recovery plan consists of two documents: the Puget Sound Salmon Recovery Plan prepared by the Shared Strategy for Puget Sound and NMFS' Final Supplement to the Shared Strategy Plan. The recovery plan adopts ESU and population level viability criteria recommended by the Puget Sound Technical Recovery Team (PSTRT) (Ruckelhaus et al. 2002). The PSTRT's Biological Recovery Criteria will be met when the following conditions are achieved:

1. All watersheds improve from current conditions, resulting in improved status for the species;

2. At least two to four Chinook salmon populations in each of the five biogeographical regions of Puget Sound attain a low risk status over the long-term;

3. At least one or more populations from major diversity groups historically present in each of the five Puget Sound regions attain a low risk status;

4. Tributaries to Puget Sound not identified as primary freshwater habitat for any of the 22 identified populations are functioning in a manner that is sufficient to support an ESU-wide recovery scenario;

5. Production of Chinook salmon from tributaries to Puget Sound not identified as primary freshwater habitat for any of the 22 identified populations occurs in a manner consistent with ESU recovery.

Spatial Structure and Diversity. The PSTRT determined that 22 historical populations currently contain Chinook salmon and grouped them into five major geographic regions, based on consideration of historical distribution, geographic isolation, dispersal rates, genetic data, life history information, population dynamics, and environmental and ecological diversity. Ruckelshaus et al. (2002) recommended at least two viable populations per geographic region were needed for the recovery of Chinook salmon. Based on genetic and historical evidence reported in the literature, the PSTRT also determined that there were 16 additional spawning aggregations or populations in the Puget Sound Chinook Salmon ESU that are now thought to be extinct[2] (Ruckelshaus et al. 2006). This ESU includes all naturally spawned populations of Chinook salmon from rivers and streams flowing into Puget Sound including the Straits of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, the South Sound, North Sound and the Strait of Georgia in Washington, as well as the progeny of 26 artificial propagation programs. Indices of spatial distribution and diversity have not been developed at the population level, though diversity at the ESU level is declining. Abundance is becoming more concentrated in fewer populations and regions within the ESU. Abundance has increased particularly within the Whidbey Basin Region (Ford 2011).

[2] It was not possible in most cases to determine whether these Chinook salmon spawning groups historically represented independent populations or were distinct spawning aggregations within larger populations.

Abundance and Productivity. Most Puget Sound Chinook populations are well below escapement levels (number of adults returning to freshwater to spawn) identified as required for recovery to low extinction risk. All populations are consistently below productivity goals identified in the recovery plan. Although trends vary for individual populations across the ESU, most populations have declined in total natural origin recruit abundance (prior to harvest) since the last status review. However, most populations exhibit a stable or increasing growth rate in natural-origin escapement (after harvest). No clear patterns in trends in escapement or abundance are evident among the five major regions of Puget Sound. No trend was notable for total ESU escapements. Trends in growth rate of natural-origin escapement are generally higher than growth rate of natural-origin abundance indicating some stabilizing influence on escapement from past reductions in fishing-related mortality. Survival and recovery of the Puget Sound Chinook salmon ESU will depend, over the long term, on necessary actions in all "4 H" sectors (hatcheries, habitat, harvest and hydro). Many of the habitat and hatchery actions identified in the Puget Sound Chinook salmon recovery plan are likely to take years or decades to be implemented and to produce significant improvements in natural population attributes, and these trends are consistent with these expectations and reiterated in Ford (2011).

Limiting factors. Limiting factors described in NMFS (2007) and NMFS (2011a) include:

- Degraded nearshore and estuarine habitat: Residential and commercial development has reduced the amount of functioning nearshore and estuarine habitat available for salmon rearing and migration. The loss of mudflats, eelgrass meadows, and macroalgae further limits salmon foraging and rearing opportunities in nearshore and estuarine areas.

- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large wood supply, stream substrate, and water quality have all been degraded as a result of cumulative impacts of agriculture, forestry, and development. Degraded conditions in the upper watershed can affect spawning habitat for salmonids, embryo development and rearing conditions for juvenile salmonids.

- Anadromous salmonid hatchery programs: Salmon and steelhead (*O. mykiss*) released from Puget Sound hatcheries operated for harvest augmentation purposes pose ecological, genetic, and demographic risks to natural-origin Chinook salmon populations. Salmon harvest management: Total fishery exploitation rates have decreased 14 to 63 percent from rates in the 1980s, but weak natural-origin Chinook salmon populations in Puget Sound still require enhanced protective measures to reduce the risk of overharvest.

Puget Sound Chinook Salmon Critical Habitat

The NMFS designated critical habitat for Puget Sound Chinook salmon on September 2, 2005 (70 FR 52630). In the Duwamish River, critical habitat is defined by the stream channel with the lateral extent being the ordinary high water line. Two of the six PCEs of Chinook salmon critical habitat may be affected by the proposed project:

PCE 3: Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

PCE 4: Estuarine areas free of obstruction and excessive predation with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fish, supporting growth and maturation.

Puget Sound Steelhead

The NMFS listed Puget Sound steelhead as threatened on June 11, 2007 (72 FR 26722).

Abundance and Productivity

For all but a few demographically independent populations (DIPs) of steelhead in Puget Sound, estimates of mean population growth rates obtained from observed spawner or redd counts are declining, typically 3 to 10 percent annually. Extinction risk within 100 years for most populations of steelhead in the Puget Sound Distinct Population Segment (DPS) is estimated to be moderate to high, especially for populations in the South Sound and Olympic major population groups. Collectively, these analyses indicate that steelhead in the Puget Sound DPS remain at risk of extinction throughout all or a significant portion of their range in the foreseeable future, but are not currently in danger of imminent extinction (NMFS 2011b). From 2005 to 2009, geometric means of natural spawners indicate relatively low abundance (4 of 15 populations with fewer than 500 spawners annually) and declining trends (6 of 16 populations) in natural escapement of winter-run steelhead throughout Puget Sound, particularly in southern Puget Sound and on the Olympic Peninsula (Ford 2011).

Spatial Structure and Diversity

The Puget Sound Steelhead DPS includes naturally spawning steelhead stocks below natural and manmade impassable barriers, in streams and rivers ranging from the Canadian border (Nooksack River basin), south through Puget Sound and Hood Canal, and northwest to the Elwha River, which empties into the eastern Strait of Juan de Fuca. The Puget Sound steelhead DPS tentatively includes 32 DIPs within three major population groups of summer- and winter-run fish, the latter being the most widespread and numerous of the two run types (Hard et al. 2012). The metrics and benchmarks for evaluating the adequacy of a DIP's spatial structure include: quantity, quality,

connectivity, dynamics, and catastrophic risks. Analyses by Scott and Gill (2008) estimate that 8 to 26 percent of the historic range has been lost for summer steelhead in the Puget Sound, and 3 to 21 percent of the historic range for winter steelhead had been lost. The DPS is likely to be at elevated risk due to reduced complexity of spatial structure of its steelhead populations, and consequently, diminishing connectivity among them. Because of their limited distribution in upper tributaries, summer-run steelhead may be at higher risk than winter-run steelhead from habitat degradation in larger, more complex watersheds.

Resident steelhead occur within the range of Puget Sound steelhead but are not part of the DPS due to marked differences in physical, physiological, ecological, and behavioral characteristics (71 FR 15666; March 29, 2006). Genetic diversity can enable fish to adapt to regular and cyclic changes due to natural dynamics, such as ocean conditions. However, naturally produced steelhead interbreeding with hatchery steelhead may be contributing to reduced productivity of natural fish (Hard et al. 2007). The Puget Sound Steelhead TRT has analyzed potential reduction in diversity for each DIP from hatchery effects (Hard et al 2012). Declines in natural abundance for most populations, coupled with large numbers of anthropogenic barriers such as impassable culverts reduce opportunities for movement and migration between steelhead aggregations in different watersheds. The reduction in escapement of natural steelhead to the centrally located Lake Washington watershed in recent years is also of concern.

Puget Sound Steelhead Critical Habitat

The NMFS designated critical habitat for Puget Sound steelhead on February 24, 2016 (81 FR 9252). In the Duwamish River, critical habitat is defined by the stream channel with the lateral extent being the ordinary high water line. Two of the six PCEs of steelhead critical habitat may be affected by the proposed project:

PCE 3: Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

PCE 4: Estuarine areas free of obstruction and excessive predation with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fish, supporting growth and maturation.

Bull Trout and Chinook Recovery Plan Actions

In analyzing the project and to provide recommendations to benefit the fish and wildlife resources, the Service reviewed the bull trout and Chinook salmon recovery plans (FWS 2004, NMFS 2007). Both plans provided recovery actions that would reduce threats to the species and provide opportunities for restoring habitat and access that benefits both species.

The following are specific bull trout recovery actions identified for the Lower Duwamish River:

1.6 Identify impaired estuarine and nearshore marine habitats and implement actions to restore their appropriate functions.

1.6.1 Identify and remediate contaminant sites in estuarine and nearshore marine areas. Identify estuarine and nearshore marine sites with contaminated sediments and structures (e.g., treated wood piles) that pose a significant exposure risk to bull trout or their forage species, and address contaminant exposure by site capping or other remediation. High priority sites include those in close proximity to known and potential marine forage fish spawning areas and bull trout subadult and adult foraging habitats. High priority locations include Commencement Bay, Lower Duwamish and Elliott Bay, and Bellingham Bay.

5.2 Conduct research evaluating relationships among bull trout distribution and abundance, bull trout habitat, and recovery actions.

5.2.5 Determine the extent of effects from contaminant exposure. Evaluate the significance of contaminant (*e.g.*, herbicides, pesticides, heavy metals, polyaromatic hydrocarbons, estrogenic compounds) exposure to bull trout in freshwater, estuarine, and marine habitats. Assess contaminant levels within individuals across age classes, evaluate lethal and sublethal effects and pathways of exposure, and assess potential overall effect to individual core areas. Also evaluate significance of contaminant exposure on their prey base, such as Cherry Point herring population. Current high priority areas include Bellingham Bay, Snohomish River estuary, Commencement Bay, and the Duwamish River/Elliott Bay.

The recommended policies and actions from the Puget Sound Chinook Salmon Recovery Plan for the Duwamish Estuary subwatershed addresses issues that will expand and enhance the estuary and protect and restore habitat and water quality within the Duwamish Estuary. Specific recovery actions identified for Chinook salmon include:

Policy DU1: Endorse the Comprehensive Environmental Response, Compensation, and Liability Act (Superfund) assessment and cleanup of contaminated sediments in the Lower Duwamish Waterway superfund area by the responsible parties and regulatory agencies because it will improve ecosystem health and increase the quality of existing salmon habitat.

Policy DU2: Encourage the natural resource trustees, agencies involved in habitat restoration and sediment clean-up in the Duwamish River and Elliott Bay, to develop Natural Resources Damages Assessment approaches that allow habitat creation/restoration concurrent with Superfund cleanup of the Lower Duwamish Waterway. This will accelerate the rate at which mitigation occurs and be more efficient.

Program D-4: Develop improvements in dredging and sediment use criteria.

- Encourage the Corps to identify strategies for maintenance dredging at Turning Basin #3 that:
  - Minimize harmful impacts to salmon habitat in the dredged area; and
  - Improve salmon habitat both in the dredged area and elsewhere in the Duwamish and marine nearshore subwatersheds (e.g., through the use of clean dredged sediment to expand/improve shallow water habitat).

POTENTIAL PROJECT IMPACTS TO FISH AND WILDLIFE RESOURCES

The proposed project as described above (Description of the Project section) involves deepening the navigational channel by dredging the East and West Waterways of the Duwamish River to accommodate loading and unloading of larger container ships. The Corps has indicated that deepening the navigational shipping channel to accommodate larger container ships is the only viable alternative to meet the business needs of the Port. Other alternatives or measures are available or are currently being used, but these measures over the long-term do not solve the Port's issues on cost savings and reducing navigation challenges for larger ships entering the Port. Other alternatives or measures include:

- **Tug Assists:** Use additional tug assists to help larger vessels and vessels with limited maneuverability transit the harbor.
- **High-Tide Transiting:** Time transits to use high tide to allow for the current fleet to transit the harbor under existing project conditions.
- **Light-Loading:** Light-load the larger vessels to allow the current fleet (which are larger and exceed the current navigation channel design specifications) to transit the harbor under existing project conditions.
- **Lightering:** Transfer cargo between vessels of different sizes to allow vessels to enter and transit the harbor.

Water Quality

The Corps' in-water work window for the Duwamish River is October 1 to February 15 for the protection of ESA listed species. Potential construction-related impacts associated with dredging both the West and East Waterways of the Duwamish River would include water quality impacts due to increased turbidity, suspended sediments, and contaminants. The variety of effects of increased turbidity and suspended sediment may be characterized as lethal, sublethal or behavioral (Bash et al. 2001; Newcombe and MacDonald 1991; Waters 1995). Lethal effects include gill

trauma (physical damage to the respiratory structures), severely reduced respiratory function and performance, and smothering and other effects that can reduce egg-to-fry survival (Bash et al. 2001). Sublethal effects include physiological stress reducing the ability of a fish to perform vital functions (Cederholm and Reid 1987), increased metabolic oxygen demand and susceptibility to disease and other stressors (Bash et al. 2001), and reduced feeding efficiency (Bash et al. 2001; Berg and Northcote 1985; Waters 1995). Sublethal effects can act separately or cumulatively to reduce growth rates and increase fish mortality over time. Behavioral effects include avoidance, loss of territoriality, and related secondary effects to feeding rates and efficiency (Bash et al. 2001). Fish may be forced to abandon preferred habitats and refugia, and may enter less favorable conditions and/or be exposed to additional hazards (including predators) when seeking to avoid elevated concentrations of suspended sediment.

Increased turbidity and suspended solids can also cause impacts or alterations to the macroinvertebrate communities or populations (Anderson et al. 1996) by reducing primary productivity by decreasing light penetration through the water column (Anderson et al. 1996; Henley et al. 2000; Suren and Jowett 2001), altering habitat by filling of interstitial space and rendering attachment sites unsuitable, causing abrasion of respiratory surfaces and interference with food uptake for filter-feeders (Anderson et al. 1996; Birtwell 1999; Shaw and Richardson 2001; Suren and Jowett 2001; Berry et al. 2003), and clog feeding structures and reduce feeding efficiencies (Newcombe and MacDonald 1991). These impacts can result in changes in species densities, diversity, and structure, cause invertebrates to seek less favorable habitat (Rosenberg and Snow 1975), and result in reduced growth rates, increased stress, or death of the invertebrates.

Anchor (2003) conducted a review of the literature to determine the effects of suspended sediments due to dredging operations. The resuspension of sediments from dredging depends on site and sediment characteristics (Anchor 2003, pp. 7-8). These characteristics include waterway shape, water depth, presence of structures (bridges, piers, etc.), sediment grain size, water content, density, specific gravity, organic/detritus content, debris content, dredge type and size, production rate, dredge method (dredge cut depth, swing of cutterhead, etc.), currents, tides, vessel wakes, waves, salinity, temperature, background suspended sediment concentrations, and background water chemistry. The resuspension of sediments from dredging are greatest near the bottom of the water column, rapidly decreases with the distance from the dredge, dependent on sediment size (smaller particles travel further), and currents (Anchor 2003, p. 8).

Water currents determine the shape and size of sediment plumes resulting from dredging. The West and East Waterways of the Duwamish River are tidally influenced. Therefore, dispersal of the sediment plume during dredging operations will depend on tidal currents, which results in varying current flows and different salinity concentrations throughout the water column. Water quality monitoring of dredging operations in the Snohomish River found higher turbidity in the lower marine waters and at mid-depth and the marine-freshwater interface (Jones and Stokes 2005, p. 12). Elevated turbidly levels were also found during strong ebb tides.

Dredging of the Duwamish Waterways also has the potential to cause the release or resuspension of contaminants. The Duwamish Waterways are federal superfund sites, and removal of sediments likely will release contaminates. Mercury, silver, lead, and zinc have been found in the project area, including upland areas, and the sediments adjacent to the seawall. These chemicals

have been found to exceed Washington State Department of Ecology's sediment cleanup screening levels, with mercury being the most widespread chemical of concern. Other chemicals found, but in lower levels, include metals, volatile organic compounds, creosote-related compounds, petroleum compounds, and PCBs.

Several of the contaminants such as PAHs and PCBs may cause adverse effect to invertebrates, fish, and wildlife. Metal, PAHs, and PCBs, as groupings of related contaminants, present a risk of additive or synergistic effects. Potential effects of bioaccumulation include inhibited reproduction, delayed fry emergence, liver disease or malfunction, morphological abnormalities, immune system impairment, and mortality.

Channel Modifications

In most cases, dredging occurs to modify a river for flood control. In lower rivers and estuaries, as in the Duwamish River, dredging is conducted specifically to deepen or maintain the depth of the waterway for navigation. Dredging impacts to fish include loss of spawning substrates (higher up in the rivers) and decreased food supply, cover and shelter (Shoof 1980, p. 698). In estuaries or estuarine channels, deepening the channel results in changes in tidal amplification, increased estuarine circulation, and increased flood-dominance of tidal asymmetry (van Maren et al 2015, p. 1). Tidal amplification increases either the ebb or flood tide and increases the dominance of that tide cycle. Increased estuarine circulation leads to additional sediment transport up the waterway.

The proposed action is to deepen or maintain depths within the East and West Waterways of the Duwamish River to -56 or -57 feet MLLW. The current depths of the East Waterway ranges from -30 to -53 feet MLLW, and the West Waterway ranges from -34 to over -60 feet MLLW (Corps and Port 2014, p. 11). Depths at the entrances to both the East and West Waterways are significantly shallower and limit larger ships from entering both waterways (Figures 2 and 3). The proposed alternatives will maintain the existing degraded estuarine channels of the Duwamish River.

Estuaries provide important functions for numerous fish species from deep water marine fish that migrate into estuaries to spawn to anadromous species, like salmon, that spawn in freshwater and migrate through the estuary to marine water. As salmon migrate through the estuary, the time spent in the tidal influence zone varies depending on the species but can range from days to weeks. Habitat used also varies, from shallow, nearshore or nearbank, to deep mid-channel waters.

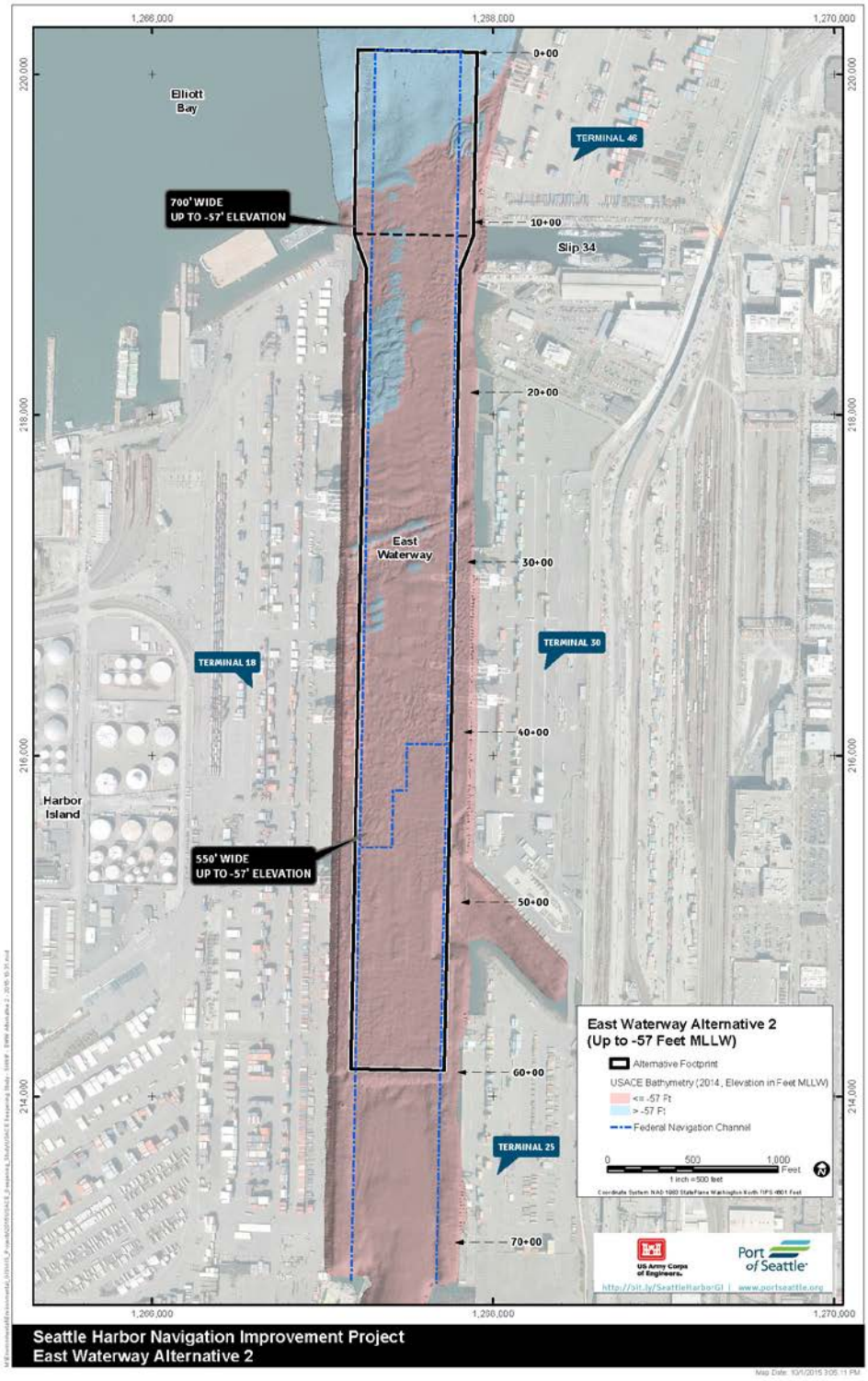

Figure 2. Dredging area within the East Waterway of the Duwamish River (outlined by black lines) and the areas that are shallower than the proposed dredging depth (-57 feet MLLW in pink).

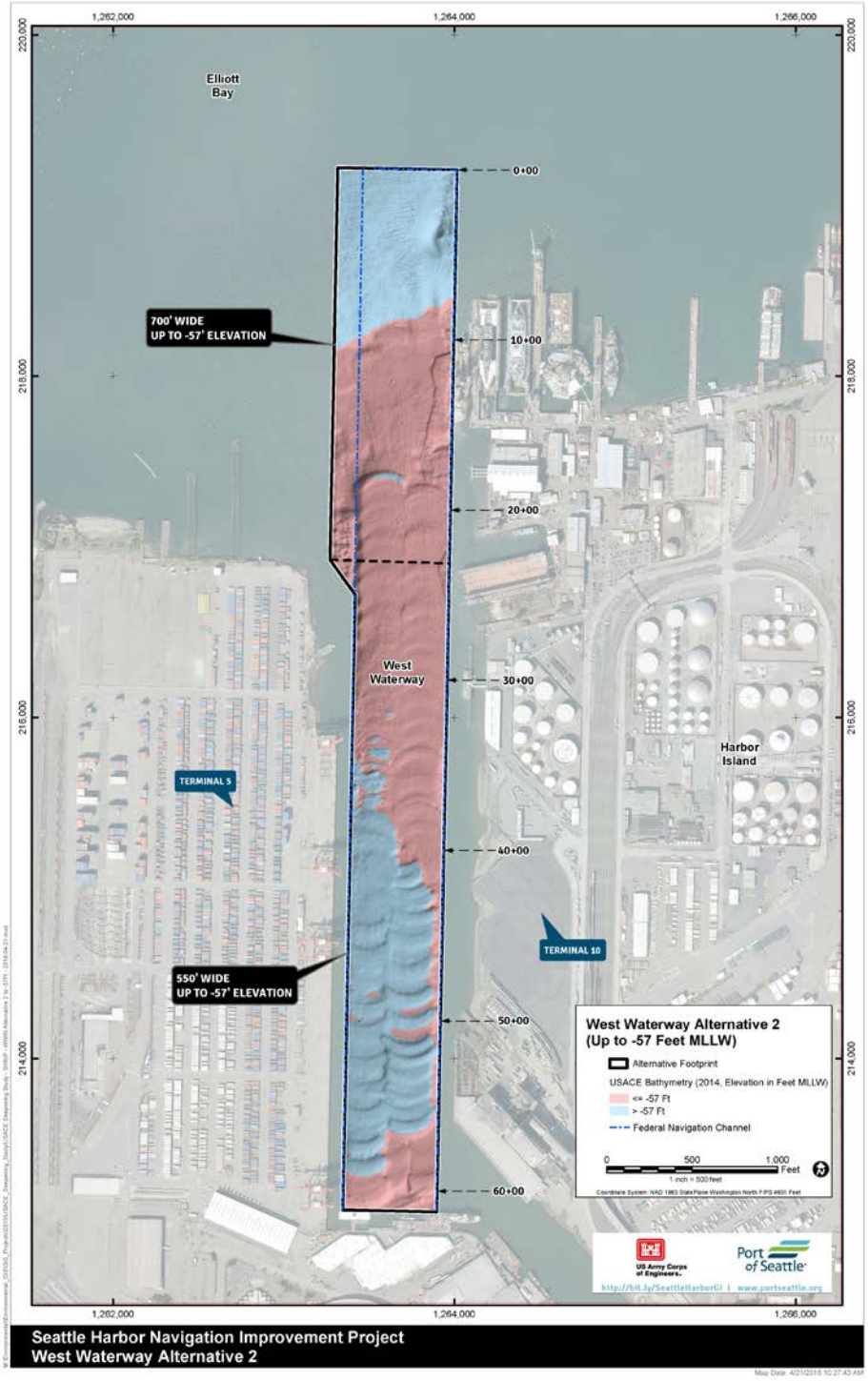

Figure 3. Dredging area within the West Waterway of the Duwamish River (outlined by black lines) and the areas that are shallower than the proposed dredging depth (-57 feet MLLW in pink).

As stated in the existing conditions section above, the Duwamish River has been developed and modified over the past century. Dredging within the Duwamish River occurs throughout the navigation channel from Elliott Bay up to the Turning Basin at RM 5.3. Within this area, the banks are heavily armored and there are numerous overwater structures (piers, boats). Shallow water is extremely limited, but restoration sites along the Duwamish River are providing a few sites with shallow water and marsh habitat.

Bull Trout, Chinook Salmon, and Steelhead Critical Habitat

Dredging of the East and West Waterways of the Duwamish River will impact some of the PCEs of bull trout, Chinook salmon, and steelhead critical habitat. Dredging activities will result in temporary degradation of water quality due to increased turbidity and suspended sediments which may temporarily impede migration through the area and reduce foraging opportunities. Deepening and widening the navigation channel will also alter the tidal hydrology and flows in both waterways.

Interrelated and Interdependent Actions

The proposed action will be conducted within the navigation channel of the East and West Waterways. The areas adjacent to the navigation channel are owned by public and private companies. These companies, like the Port, also dredge the channels on either side of the federal navigation channel and maintain depths at berths and piers for loading and unloading of container ships and other activities. The cumulative effects of both the privately conducted and federal dredging creates uniformly deep water throughout the East and West Waterways. Any shallow water that exists in these areas are under the piers, which migrating salmon have been found to avoid and rarely go under (Munsch et al. 2013). The lack of shallow water forces both adult and juvenile salmonids out into the deeper water where preferred prey is limited and exposure to predators increases.

The dredging of the navigation channel will result in larger vessels (container ships) utilizing the Duwamish River to load and unload at Port facilities and privately owned industrial docks. This results in the Port building or strengthening their system to move additional freight and for larger ships to stay at the terminal for longer periods of time versus the alternatives currently being used (see Potential Project Impacts to Fish and Wildlife Resources section above). The effects of this will be loss of shallow water habitat as larger cranes need additional support and therefore, loss of potential habitat under the piers with more and larger piles being installed. Currently proposed pier replacements do not take into consideration designs and new technologies to improve light penetration under the piers, like along the Seattle seawall, to encourage juvenile salmonids to use the only areas of shallow water for migration. The piers and larger boats unloading and loading will result in increased shade which will force juvenile salmonids further out into the middle of the shipping lane and deeper water.

Larger ships may also result in increased contamination due to propeller scour as the ships arrive and leave the harbor. As stated above, the Duwamish River is an EPA designated superfund site, and prop wash can result in resuspension of contaminants in the sediments.

RECOMMENDATIONS

The Service has concerns regarding adverse effects to fish and wildlife resources associated with the proposed deepening of the navigation channel within the East and West Waterways of the Duwamish River and the continued dredging within the Duwamish River as a whole. Among these concerns are: (1) dredging-related impacts to fish and diving or piscivorous birds related to increased turbidity, suspended solids, contaminants, and habitat modifications; (2) continued degradation of the existing conditions through loss of shallow waters; and (3) loss of restoration opportunities in the lower Duwamish.

The Service provides the following recommendations to assist the Corps in analyzing and mitigating dredging impacts and enhancing the aquatic resources in the Duwamish River.

1) The Corps should work with NOAA's Northwest and Alaska Restoration Center to determine restoration actions to mitigate for project impacts as well as impacts associated with interrelated and interdependent action such as long-term habitat loss, increased shade, changes in vessel sizes and numbers, and propeller wash. The Restoration Center will be able to assist in identifying and developing mitigation opportunities which may include the development of an in lieu fee program to pay for current or future mitigation or conservation banks within the Duwamish River. Mitigation should meet the objectives of the current Recovery Plans for both bull trout and Puget Sound Chinook salmon.

2) The Corps should coordinate with land owners adjacent to the navigation channel in both the East and West Waterways of the Duwamish River to discuss measures to provide a shallow-water migratory corridor for salmonids through the waterways. Measures may include creating habitat benches under the piers and installing light-penetrating surface panels similar to those being installed along the Seattle Seawall.

3) Coordinate with the Service and the NMFS (collectively the Services) throughout the development of the alternatives and design of the project to expedite the ESA section 7 consultation. Early coordination can (1) provide an opportunity for the Service(s) to suggest conservation measures that can be incorporated into the project to avoid, reduce, or minimize potential adverse effects to listed species; (2) identify design alternatives or mitigation opportunities that can benefit the recovery of listed species; and (3) provide technical assistance on specific species habitat requirements that could be incorporated into the project.

CONCLUSION

Dredging of the East and West Waterways of the Duwamish River will maintain the degraded condition of habitat in the lower Duwamish River estuary that has been impacted for the past 100 years. Environmental effects of the Duwamish River dredging include water quality degradation and continued channel modifications to the river. The dredging of the Duwamish River, in combination with adjacent landowner activities, has resulted in degraded habitat and impacts to the migratory corridor for numerous aquatic species as well as listed species such as Chinook salmon, steelhead, and bull trout.

The Service recommends that the Corps work with NOAA's Restoration Center to develop restoration actions to mitigate for long-term habitat loss and other project impacts. Restoration activities may include in lieu fees to be applied to current or future mitigation or conservation banks within the Duwamish River.

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Seattle Harbor Navigation Improvement Project
Feasibility Study
Seattle, King County, Washington

Substantive Compliance for
Clean Water Act Section 404

1. Introduction. The purpose of this document is to record the Corps' evaluation and findings regarding this project pursuant to Section 404 of the Clean Water Act (CWA).

The following action is covered by this document: disposal of material dredged from the East and West Waterways in the Port of Seattle at the Elliott Bay Open Water Disposal Site. Per 33 CFR Part 323.2(d)(iii), incidental fallback during the dredging process is not considered a discharge of dredged material; therefore, it is not discussed in the following analysis.

The information contained in this document reflects the findings of the project record. Specific sources of information included the following:

a. U.S. Army Corps of Engineers. 1988. Final Environmental Impact Statement – Unconfined, Open-Water Disposal Sites for Dredged Material, Phase I (Central Puget Sound). Puget Sound Dredge Disposal Analysis. Cooperatively prepared by (in alphabetical order) U.S. Army Corps of Engineers, Seattle District; U.S. Environmental Protection Agency, Region 10; Washington State Department of Ecology; and Washington State Department of Natural Resources. 285pp+ Appendices.
b. U.S. Army Corps of Engineers. 2015. Biological Evaluation. Continued use of Multiuser Dredged Material Disposal Sites in Puget Sound and Grays Harbor. 111pp+Appendices.
c. 404(b)(1) Evaluation (see below).
d. Public Interest Review (see below).

This document addresses the substantive compliance issues of the Clean Water Act 404(b)(1) Guidelines [40 CFR §230.12(a)] and the Regulatory Programs of the Corps of Engineers [33 CFR §320.4(a)].

2. Project Background. The Port of Seattle's seaport is one of the most diverse in the United States (U.S.). It is home to a wide range of maritime activities that bring trade to the region. The seaport is made up of 1,543 acres of waterfront land and nearby properties including container terminals, general purpose/cargo terminals, break-bulk cargo, and refrigerated cargo and storage.

The proposed action is for navigation improvements at Seattle Harbor. For analysis of potential environmental impacts of the range of alternatives, the Corps is analyzing a range of length, width, and depth of improvements, including an economically optimized plan that would require less total dredging than the maximum considered. The proposed action is to deepen the East and West Waterways up to -57 MLLW for the authorized length of each channel with an approach reach at each waterway to improve safety, and an authorization of the south end of East Waterway to its current depth of -40 MLLW.

Deepening the waterways would require dredging up to approximately 777,000 cubic yards (cy) from the West Waterway and approximately 341,000 cy from the East Waterway. These quantities assume the greatest proposed depth of -57 MLLW, an accumulation of approximately 10% of the material between the channel survey and the initiation of construction, and that the contractor removes half of the 2-foot allowable overdepth while dredging the channels. Disposal of dredged material would occur at authorized open-water placement sites for a portion of the total quantity with upland disposal for the remainder of the material that does not meet criteria for open-water disposal. Disposal at the Elliott Bay open-water disposal site is estimated at approximately 594,000 cy from the West Waterway and 307,000 cy from the East Waterway. The resulting channel depths would accommodate the largest ships that are anticipated to call at the Port of Seattle over the 50-year study period. Maintenance dredging is expected to be required every 10 years.

3. **Project Need**. This project is needed because existing authorized depths for the East and West Waterways do not meet the draft requirements of today's fleet of container ships. Ships often light load or experience tidal restrictions, causing lost transportation efficiencies and lost cost efficiencies at Seattle Harbor. Ships departing Seattle are not realizing economies of scale afforded by the larger ships currently being deployed and even larger ships in the future.

4. **Project Purpose**. The purpose of the proposed Federal action is to achieve transportation cost savings (increased economic efficiencies) at the East and West Waterways of Seattle Harbor. This project will improve navigation in the deep draft navigation channels to facilitate the commercial shipping traffic that is important for supporting the local and regional economy.

5. **Availability of Less Environmentally Damaging Practicable Alternatives to Meet the Project Purpose**. The alternatives evaluated for this project were as follows:

a. *Alternative 1 (No Action)*. The No-Action Alternative is analyzed as baseline conditions and the future without-project conditions as a reference condition for comparison of the action alternatives. Taking no action in this case would mean continuing standard operations at the Port of Seattle with no improvements to the navigation channel. All physical conditions existing at the time of this analysis are assumed to remain, and it is assumed that standard and routine maintenance operations would be executed to maintain access for ships to reach the Port terminals.

b. *Alternative 2 (National Economic Development Plan)*. The plan that reasonably maximizes economic net benefits is the National Economic Development Plan. Under this alternative, the proposal analyzed is the following:

West Waterway

- Deepen the existing channel from an authorized depth of -34 MLLW to -56 MLLW (6,109 feet long)
- Widen the approach reach to 700 feet wide (2,500 feet long)
- Widen the inner reach to 550 feet wide (3,609 feet long)

East Waterway

- Deepen the existing channel from an authorized depth of -34 MLLW or -51 MLLW to -56 MLLW (6,000 feet long)
- Widen the approach reach to 700 feet wide (1,200 feet long)
- Widen the inner reach to 550 feet wide (4,800 feet long)
- The 1,232 feet at southern end of the East Waterway would maintain its currently authorized width of 500 feet and depth of -34 MLLW

The quantities of sediment that would need to be dredged to achieve this improvement are approximately 653,000 cubic yards (cy) from the West Waterway and approximately 251,000 cy from the East Waterway. These quantities assume the proposed depth of -56 MLLW, an accumulation of approximately 10% of the material between the channel survey and the initiation of construction, and that the contractor removes half of the 2-foot allowable overdepth while dredging the channels. Disposal of dredged material would occur at authorized open-water placement sites. The quantity estimated for open-water disposal is approximately 500,000 cy from the West Waterway and 227,000 cy from the East Waterway. The remaining 153,000 in the West Waterway and 25,000 cy in the East Waterway that does not meet open water disposal criteria would be disposed upland. The dredging is estimated to take 2 years to complete both waterways, partly due to limiting the work to the in-water work windows for protection of early life stages of sensitive fish species.

c. *Alternative 3 (Locally Preferred Plan).* Within the range of depths analyzed for improving the East and West Waterways, the Corps and Port of Seattle determined the deepest channel that is still economically justified is -57 MLLW. Under this alternative, the proposal analyzed is the following:

West Waterway

- Deepen the existing channel from an authorized depth of -34 MLLW to -57 MLLW (6,109 feet long)
- Widen the approach reach to 700 feet wide (2,500 feet long)
- Widen the inner reach to 550 feet wide (3,609 feet long)

East Waterway

- Deepen the existing channel from an authorized depth of -34 MLLW or -51 MLLW to -57 MLLW (6,000 feet long)
- Widen the approach reach to 700 feet wide (1,200 feet long)
- Widen the inner reach to 550 feet wide (4,800 feet long)
- The 1,232 feet at southern end of the East Waterway would maintain its currently authorized width of 500 feet and depth of -34 MLLW

The quantities of sediment that would need to be dredged to achieve this improvement are up to approximately 777,000 cy from the West Waterway and approximately 341,000

cy from the East Waterway. These quantities assume the proposed depth of -57 MLLW, an accumulation of approximately 10% of the material between the channel survey and the initiation of construction, and that the contractor removes half of the 2-foot allowable overdepth while dredging the channels. Disposal of dredged material would occur at authorized open-water placement sites. The quantity estimated for open-water disposal is approximately 594,000 cy from the West Waterway and 307,000 cy from the East Waterway. The remaining 183,000 in the West Waterway and 34,000 cy in the East Waterway that does not meet open water disposal criteria would be disposed upland. The dredging is estimated to take 2 years to complete both waterways, partly due to limiting the work to the in-water work windows for protection of early life stages sensitive fish species.

Findings. The Corps rejected Alternative 1 because it would not meet the project purpose and need. Alternative 2 is the least environmentally damaging practical alternative that meets the purpose and need; however, the incremental difference between Alternatives 2 and 3 is so minimal that they can be considered equivalent in terms of environmental impacts; therefore either could be considered the least environmentally damaging practical alternative. Alternative 2 was not selected due to the opportunity to further improve safety, reduce risk of grounding, and gain greater transportation efficiency with Alternative 3. Alternative 3 is the Locally Preferred Plan and the Tentatively Selected Plan; this alternative meets the purpose and need for action, provides economic benefits to the region and nation, and reduces risk of grounding or the need for light-loading.

6. Significant Degradation, Either Individually or Cumulatively, to the Aquatic Environment

a. *Impacts on Ecosystem Function*. Benthic habitat in the Elliott Bay Dredged Material Management Program (DMMP) open water disposal site will be disturbed by the disposal of dredged material onto the substrate within the footprint of the disposal site. Current velocities are slow enough at this site that material will not distribute beyond the site. The Corps has assessed potential effects from open water disposal and determined that they will generally be localized to previously-disturbed areas solely within the footprint of the disposal site, short in duration (occur when disposal occurs and since disposal takes only minutes per episode, the disposal site will sustain a short duration effect), and minor in spatial scope. Turbidity has been determined to be a negligible effect according to DMMP documents. Disposal at the multi-user site means that any benthic species present are at risk of displacement and potential smothering; however, organisms re-populate the area within days to weeks and the habitat characteristics remain stable according to DMMP monitoring. Effects of disposal operations on salmonids will be reduced and/or avoided through implementation of timing restrictions. Due to these measures, negative effects to the Endangered Species Act listed species would not be significant either individually or cumulatively.

b. *Impacts on Recreational, Aesthetic and Economic Values*. No significant adverse effects on recreation, aesthetics, or the economy are anticipated.

Findings. The Corps has determined that there would be no significant adverse effects to aquatic ecosystem functions and values.

7. Appropriate and Practicable Measures to Minimize Potential Harm to the Aquatic Ecosystem

a. *Impact Avoidance Measures*. Potential effects of disposal operations on juvenile salmonids will be avoided through implementation of timing restrictions. Disposal of dredged material will only occur during July 16 through February 15, to avoid the outmigration period of Chinook salmon (*Oncorhynchus tshawytscha*), a species listed as threatened under the Endangered Species Act. This timing restriction, designated by the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS), is protective of bull trout (*Salvelinus confluentus*) foraging in the lower portion of the Duwamish River watershed (subadults and adults moving into and out of the estuary) and migrating juvenile Chinook salmon and steelhead (*O. mykiss*). All dredged materials disposed at the Elliott Bay open water site must meet rigorous testing requirements according to the DMMP standards. This avoids impacts that may be caused by contaminated sediments.

b. *Impact Minimization Measures*. The Elliott Bay open water site was initially chosen because deposition of dredged material in that location would have minimal impacts to the aquatic environment and represents the shortest transport distance. In addition, the dredged material is generally disposed of at a time when ESA-listed species are not likely to be present.

c. *Compensatory Mitigation Measures*. There will be no mitigation measures because the work will not have more than a negligible change to any habitat characteristics.

Findings. The Corps has determined that all appropriate and practicable measures have been taken to minimize potential harm.

8. Other Factors in the Public Interest.

a. *Fish and Wildlife*. The Corps is coordinating with State and Federal agencies, as well as Tribes, to assure careful consideration of fish and wildlife resources. The Corps will prepare a Biological Evaluation in accordance with the ESA. The Corps will assure full compliance with the ESA prior to and during project implementation.

b. *Water Quality*. The Corps will obtain a Section 401 Water Quality Certification from the Department of Ecology (Ecology). The Corps will abide by the conditions in the Water Quality Certification to ensure compliance with State water quality standards.

c. *Historic and Cultural Resources*. Since the proposed dredging is confined to the removal of recently deposited sediments within the previously dredged channel width and depth boundaries, no submerged cultural resources will be affected by the project.

d. *Activities Affecting Coastal Zones*. The Corps will prepare a Coastal Zone Management Act Consistency Determination for the Seattle Harbor Navigation Improvement Project during feasibility-level design phase. The Corps anticipates that the evaluation will show the proposed work complies with the policies, general conditions, and general activities specified in the King County Shoreline Management Master Plan. The proposed action is

expected to be consistent to the maximum extent practicable with the State of Washington Shoreline Management Program.

e. *Environmental Benefits*. The long-term benefit of this action is a 15 percent reduction in the number of large ships calling at the Port of Seattle by reducing annual ship calls from 671 at present to 571 by the year 2034. This will reduce total Greenhouse Gas emissions and pollutants that are factors for regional air quality.

f. *Navigation*. A minor, temporary disruption of navigation traffic may result from dredging and disposal operations. A Notice to Mariners will be issued before dredging and disposal operations are initiated. The action will improve the channels for use by deep draft vessels and improve safety by enlarging the entrance reaches to the East and West Waterways.

Findings. The Corps has determined that this project is within the public interest.

9. **Conclusions**. Based on the analyses presented in the Draft Feasibility Report and Environmental Assessment, as well as the following 404(b)(1) Evaluation and General Policies analysis, the Corps finds that this project complies with the substantive elements of Section 404 of the Clean Water Act.

404(b)(1) Evaluation [40 CFR §230] and General Regulatory Policies Analysis [33 CFR §320.4]

404(b)(1) Evaluation [40 CFR§230]

Potential Impacts on Physical and Chemical Characteristics (Subpart C)

1. **Substrate [230.20]** The surface substrate at the Elliott Bay open water disposal site consists of fine grain materials of marine and freshwater origin. Materials disposed of at the Elliott Bay open water disposal site are of similar particle size and larger. The Elliott Bay open water disposal site is a non-dispersive site and therefore bathymetric surveys are conducted to monitor the accumulation of dredged material.

2. **Suspended Particulate/Turbidity [230.21]** The discharge of dredged material at the Elliott Bay open water disposal site will result in a temporary increase in turbidity and suspended particulate levels in the water column, particularly in near-bottom waters. The material will rapidly sink to the bottom, while a small percentage of finer material is expected to remain in suspension. Increases in turbidity associated with disposal operations will be minimal (confined to the areas in the immediate vicinity of the disposal sites) and of short duration (currents will disperse any suspended material within hours of disposal).

3. **Water Quality [230.22]** No significant water quality effects are anticipated. During disposal operations, a localized turbidity plume may persist for a short period during the descent of dredged material through the water column. A minor reduction in dissolved oxygen may be associated with this plume, primarily during disposal of silty sediments. Since disposal operations consist of a series of instantaneous, discrete discharges over the dredging schedule, any water quality effects should be short lived (hours) and localized (immediate vicinity). All of the sediments will have been tested and approved for open water disposal under the guidelines of the DMMP administered by the Corps, U.S. Environmental Protection Agency, Ecology, and Washington Department of Natural Resources. Material that does not meet DMMP guidelines will be disposed of in an approved upland disposal site and thus will not impact water quality.

4. **Current Patterns and Water Circulation [230.23]** The disposal of material dredged from the East and West Waterways will not obstruct flow, change the direction or velocity of water flow/circulation, or otherwise change the dimensions of the receiving water body. Most dredged material placed at the disposal site will remain in the disposal site and not re-enter the water column.

5. **Normal Water Fluctuations [230.24]** The disposal of material dredged from the East and West Waterways will not impede normal tidal fluctuations. The Elliott Bay open water disposal site is located in water deeper than 200 feet. This site is in deep enough water (> 200 feet) that currents and tidal flows will not be affected.

6. **Salinity Gradients [230.25]** The disposal of material dredged from the East and West Waterways will not divert or restrict tidal flows and thus will not affect salinity gradients.

Potential Impacts on Biological Characteristics of the Aquatic Ecosystem (Subpart D)

1. **Threatened and Endangered Species [230.30]** Pursuant to Section 7 of the ESA, the Corps prepared a Programmatic Biological Evaluation in December 2015 to assess potential effects of disposal at the DMMP multiuser sites on protected species. This document concluded that continued disposal at the multiuser disposal sites, including Elliott Bay, is not likely to adversely affect ESA-listed species. The National Marine Fisheries Service (NMFS) concurred with the finding with the exception of the three ESA-listed rockfish species. NMFS provided a Biological Opinion to conclude the ESA consultation process for the multiuser disposal sites. USFWS provided a letter of concurrence with the Corps' findings. This programmatic consultation under Section 7 of the ESA fulfills the consultation requirements for aquatic disposal of sediments dredged for the proposed action in the Seattle Harbor Navigation Improvement Project feasibility study.

2. **Aquatic Food Web [230.31]** Turbidity associated with disposal operations may interfere with feeding and respiratory mechanisms of benthic, epibenthic, and planktonic invertebrates. Some sessile invertebrates at the disposal site will suffer mortality from disposal of dredged material. Species characteristic of these sites are opportunistic species, often small, tube-dwelling, surface-deposit feeders that exhibit patchy distribution patterns in space and time. Several studies have found that benthic infauna recolonize disposal sites quickly (several months), but that they may never reach mature equilibrium because of the frequent burying of organisms during disposal of dredged material. More mobile epibenthic organisms are expected to escape the immediate area without significant injury. Potential effects of disposal operations on salmonids will be reduced and/or avoided through implementation of timing restrictions.

3. **Wildlife [230.32]** Noise associated with disposal operations may have an effect on bird and marine mammals in the project area. The effects of any sound disturbance would likely result in displacement of animals, but not injury. Increases in turbidity associated with dredged material disposal could reduce visibility directly below and for a short distance downcurrent form the bottom-dump barge, thereby reducing foraging success for any animals in the area. Any reduction in availability of food would be highly localized and would subside rapidly upon completion of the disposal operations. Disposal operations are not expected to result in a long-term reduction in the abundance and distribution of prey items. No breeding or nesting areas will be directly affected.

Potential Impacts to Special Aquatic Sites (Subpart E)

1. **Sanctuaries and Refuges [230.40]** Not applicable

2. **Wetlands [230.41]** Dredged material will not be discharged in wetlands. Use of the designated disposal site will not alter the inundation patterns of wetlands in the project area.

3. **Mudflats [230.42]** Dredged material will not be discharged onto mudflats. Use of the designated disposal site will not alter the inundation patterns of nearby mudflats.

4. **Vegetated Shallows [230.43]** Dredged material will not be discharged onto or directly adjacent to vegetated shallows.

5. **Coral Reefs [230.44**] Not applicable.

6. **Riffle and Pool Complexes [230.45]** Not applicable.

Potential Effects on Human Use Characteristics (Subpart F)

1. **Municipal and Private Water Supplies [230.50]** Not applicable.

2. **Recreational and Commercial Fisheries [230.51]** Some sport fishing for shrimp and salmon occurs near the disposal site. Work is timed and located to minimize effects to fishing seasons in the disposal area, as well as critical migration periods for salmonids.

3. **Water-related Recreation [230.52]** Elliott Bay is approximately nine square miles with the disposal site centrally located. Therefore, the presence of the disposal barge would not pose an obstruction to recreational vessel traffic and would have no appreciable effect on recreational vessel traffic.

4. **Aesthetics [230.53]** Disposal operations will not change the appearance of the project area. Localized, temporary increases in noise, lighting, and turbidity will occur while equipment is operating, but are not expected to be significant.

5. **Parks, National and Historic Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves [230.54]** Not applicable.

Evaluation and Testing (Subpart G)

1. **General Evaluation of Dredged or Fill Material [230.60]** The material to be disposed is predominantly sand and silty sand. The areas to be dredged have been tested in accordance with DMMP guidelines and only material that is within those guidelines would be disposed of in water. Those materials that do not meet DMMP guidelines will be disposed of in an approved upland disposal site.

2. **Chemical, Biological, and Physical Evaluation and Testing [230.61]** The sediments in the footprint of the proposed dredging areas in the East and West Waterways will undergo additional testing conducted in accordance with DMMP procedures. It is anticipated that the majority of material in the dredge area will meet DMMP guidelines and most of the dredged material will be suitable for open-water disposal. Testing of the material to be dredged will occur immediately preceding dredging and disposal actions. Any material determined not suitable for open water disposal will be disposed of in an approved upland site. Only material that meets DMMP guidelines will be disposed of in the Elliott Bay open water disposal site.

Action to Minimize Adverse Effects (Subpart H)

1. **Actions Concerning the Location of the Discharge [230.70]** The effects of the discharge are minimized by the choice of disposal site. The disposal site has been designated for dredged material discharge. The discharge will not disrupt tidal flows. The location of the proposed discharge has been planned to minimize negative effects to the environment.

2. **Actions Concerning the Material to be Discharged [230.71]** Since concentrations of chemicals of concern in the materials to be discharged at the Elliott Bay open water disposal site are low, no treatment substances nor chemical flocculates will be added before disposal. The potency and availability of any pollutants present in the dredged material should be maintained.

3. **Actions Controlling the Material after Discharge [230.72]** Since only the dredged materials that have been approved for non-confined open water disposal by the inter-agency DMMP will be placed at the disposal site, no containment levees or capping are necessary.

4. **Actions Affecting the Method of Dispersion [230.73]** The disposal site has been selected by taking into account currents and circulation patterns to minimize dispersion of the discharge.

5. **Actions Related to Technology [270.74]** Appropriate machinery and methods of transport of the material for discharge will be employed. All machinery will be properly maintained and operated.

6. **Actions Affecting Plant and Animal Populations [270.75]** The Corps has coordinated with the local Native American Tribes and the State and Federal resource agencies to assure there will be no greater than minimal effects to fish and wildlife resources.

7. **Actions Affecting Human Use [230.76]** The discharge will not result in damage to aesthetically pleasing features of the aquatic landscape. The discharge will not increase incompatible human activity in remote fish and wildlife areas.

8. **Other actions [230.77]** Not applicable.

General Policies for the Evaluation of Permit Applications [33 CFR §320.4]

1. **Public Interest Review [320.4(a)]** The Corps finds these actions to be in compliance with the 404(b)(1) guidelines and not contrary to the public interest.

2. **Effects on Wetlands [320.4(b)]** No wetlands will be altered by the disposal of material from dredging operations.

3. **Fish and Wildlife [320.4(c)]** The Corps has coordinated with the local Native American Tribes and the State and Federal resource agencies to assure there will be no greater than minimal effects to fish and wildlife resources.

4. **Water Quality [320.4(d)]** The Corps will obtain a 401 Water Quality Certification during feasibility-level design phase and will abide by the conditions of the Section 401 Water Quality Certification issued by Ecology to ensure compliance with Washington water quality standards.

5. **Historic, Cultural, Scenic, and Recreational Values [320.4(e)]** The U.S. Army Corps of Engineers has consulted with representatives of interested Tribes, the State Historic Preservation Office, and other parties and has determined that the planned undertaking will have no effect on historic properties. No wild and scenic rivers, historic properties, National Landmarks, National Rivers, National Wilderness Areas, National Seashores, National Recreation Areas, National Lakeshores, National Parks, National Monuments, estuarine and marine sanctuaries, or archeological resources will be adversely affected by the proposed work.

6. **Effects on Limits of the Territorial Sea [320.4(f)]** Not applicable.

7. **Consideration of Property Ownership [320.4(g)]** Not applicable.

8. **Activities Affecting Coastal Zones [320.4(h)]** The Corps will prepare a Coastal Zone Management Act Consistency Determination for the Seattle Harbor Navigation Improvement Project during feasibility-level design phase. The Corps anticipates that the proposed work will comply with the policies, general conditions, and general activities specified in the King County Shoreline Management Master Plan. The proposed action is expected to be consistent to the maximum extent practicable with the State of Washington Shoreline Management Program.

9. **Activities in Marine Sanctuaries [320.4(i)]** Not applicable.

10. Other Federal, State, or Local Requirements [320.4(J)]

a. *National Environmental Policy Act (NEPA).* A Draft Integrated Feasibility Report and Environmental Assessment (FR/EA) has been prepared to satisfy the documentation requirements of NEPA. Following a 30-day public review period for the Draft FR/EA, the Corps will determine whether an Environmental Impact Statement is warranted for the project.

b. *Endangered Species Act*. In accordance with Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended, federally funded, constructed, permitted, or licensed projects must take into consideration effects to federally listed or proposed threatened or endangered species. A Programmatic Biological Evaluation (PBE) was submitted to USFWS and NMFS in May 2015 for continued disposal at the DMMP multiuser sites. The Corps received a letter from USFWS on 28 July 2015 concurring

with the determinations made in the PBE and a Biological Opinion from NMFS on 17 December 2015, which concludes the requirements for Section 7 consultation.

c. *Clean Water Act*. The Corps must demonstrate compliance with the substantive requirements of the Clean Water Act. The Corps will request a Water Quality Certification from Ecology during feasibility-level design phase. The Corps will abide by the conditions in the Water Certification to ensure compliance with State water quality standards.

d. *Coastal Zone Management Act*. The Coastal Zone Management Act of 1972, as amended, requires Federal agencies to carry out their activities in a manner which is consistent to the maximum extent practicable with the enforceable policies of the approved Washington Coastal Zone Management Program. The Corps will prepare a Coastal Zone Management Act Consistency Determination for the Seattle Harbor Navigation Improvement Project during feasibility-level design phase. The Corps anticipates that the evaluation will show the proposed work complies with the policies, general conditions, and general activities specified in the King County Shoreline Management Master Plan. The proposed action is expected to be consistent to the maximum extent practicable with the State of Washington Shoreline Management Program.

e. *Marine Protection, Research, and Sanctuaries Act.* Not applicable

f. *National Historic Preservation Act*. The National Historic Preservation Act (16 USC 470) requires that the effects of proposed actions on sites, buildings, structures, or objects included or eligible for the National Register of Historic Places must be identified and evaluated. Since the proposed dredging is confined to the removal of recently deposited sediments within the previously dredged channel width and depth boundaries, and disposal will occur in a previously used disposal site, no submerged cultural resources will be affected by the project. On April 27, 2016, the Corps sent a letter to the Washington State Historic Preservation Officer (SHPO) detailing the Corps' finding of "no historic properties affected". The Corps also sent letters to the Muckleshoot and the Suquamish detailing the finding of no historic properties affected. The SHPO responded on April 27, 2016, concurring with the Corps' determination of "no historic properties affected". To date no response has been received from the Tribes.

g. *Fish and Wildlife Coordination Act*. The Fish and Wildlife Coordination Act (16 USC 470) requires that wildlife conservation receive equal consideration and be coordinated with other features of water resource development projects. The Corps initiated coordination for consideration of fish and wildlife species in July 2015 and by hosting a meeting with all relevant natural resource agencies on August 12, 2015. Further coordination has occurred through informal emails and via phone with NMFS and USFWS and will continue throughout feasibility level design phase. The Corps received a PAL and Draft CAR from USFWS and a final CAR is expected prior to finalizing this FR/EA.

11. Safety of Impoundment Structures [320.4(k)] Not applicable.

12. **Floodplain Management [320.4(l)]** Disposal operations will not alter any floodplain areas.

13. **Water Supply and Conservation [320.4(m)]** Not applicable.

14. **Energy Conservation and Development [320.4(n)]** Not applicable.

15. **Navigation [320.4(o)]** This project will maintain and improve the navigability of the East and West Waterways for use by deep draft vessels. The disposal activities at the Elliott Bay open water disposal site will not impede navigation.

16. **Environmental Benefits [320.4(p)]** The long-term benefit of this action is a 15 percent reduction in the number of large ships calling at the Port of Seattle by reducing annual ship calls from 670 at present to 570 by the year 2034. This will reduce total Greenhouse Gas emissions and pollutants that are factors for regional air quality.

17. **Economics [320.4(q)]** The economic benefits of the proposed action are important to the local and regional economies and the action contributes to the National Economic Development Plan. The economic analysis is documented in the FR/EA.

18. **Mitigation [320.49(r)]** Potential effects of disposal operations will be avoided and minimized through implementation of timing restrictions. No compensatory mitigation is required for the project.