**Memo**

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| To | Chad Yunge<br>Whatcom County Planning and Development Services | File no | 0-915-15338-C |
| From | Melinda Gray, M.S. | cc | Ari Steinberg, P.E. Pacific International Terminals |
| Tel | 425-368-0967 | | |
| Date | March 29, 2012 | | |

Subject **Gateway Pacific Terminal – Ordinary High Water Mark Determination**

This memorandum summarizes results and the methods used to determine the Ordinary High Water Mark (OHWM) in the Gateway Pacific Terminal project area. The memorandum has been produced at a request from Whatcom County for an explanation of how Ordinary High Water Mark was determined.

AMEC staff delineated the OHWM along Stream 1 and Stream 2 within the Project Area boundaries, and the OHWM of the Strait of Georgia within the project area boundaries.

The OHWM of the two streams was delineated in conjunction with the wetland determination and delineation that was conducted for the project from 2006 through 2008. A *Wetland Determination and Delineation Report* (AMEC 2008) was submitted to the U.S. Army Corps of Engineers on February 18, 2008, and the USACE issued a Jurisdictional Determination including a boundary verification within the Project Area on March 6, 2009.

The OHWM of the Strait of Georgia was determined in December 2006 following a series of spring (extreme high) tides.

## 1.0 APPROACH

### 1.1 STREAMS

AMEC delineated OHWM in the field according to methods described by the Department of Ecology (Olson and Stockdale 2008). The ordinary high water mark is defined in the State's Hydraulic Code Rules, WAC 220-110-020(31) as follows:

> The mark on the shores of all waters that will be found by examining the bed and banks and ascertaining where the presence and action of waters are so common and usual and so long

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> continued in ordinary years, as to mark up on the soil or vegetation a character distinct from that of the abutting upland.

Indicators in determining the OHWM for streams include differences in soils above and below the OHWM, presence or absence of wetland or hydric vegetation, aerial photos, interviews with residences, markings on pilings and docks, and records of water levels (Olson and Stockdale, 2008). Ordinary high water mark determinations for streams rely on the use of field indicators of criteria for several aspects of the riparian system: geomorphic conditions, soils, and vegetation. Indicators of ordinary high water are summarized in Table 1, below.

Fieldwork included walking the stream channels and marking the OHWM with flagging. Conventional survey by a registered surveyor was used to map the flag locations.

**Table 1 Ordinary High Water Mark Indicators**

| | Soil and geomorphic Indicators | Vegetative Indicators | Other Indicators |
|---|---|---|---|
| Below OHWM | Sediment bars, scour line, clean cobbles/ boulders, bank erosion/channel scour. | Hydrophytic vegetation (obligate, facultative wetland vegetation) | Lack of soil development, exposed roots/root scour, drainage patterns |
| At OHWM | Top of bank, toe of lowest terrace, benches | Facultative vegetation | Sediment lines on vegetation change from flood deposits to older alluvium, Stain lines on persistent vegetation, flood, or overbank deposits. |
| Above OHWM | Hill slope toe, terraces with organic soil, relic floodplain surface | Upland vegetation | Organic matter accumulation, little staining on persistent vegetation, overbank deposits. |

Source: Olson and Stockdale, 2008

## 1.2 MARINE SHORELINE

For high-energy environments such as the proposed Gateway Pacific Terminal site, the WAC provides the following guidance:

> In high-energy environments where the action of waves or currents is sufficient to prevent vegetation establishment below mean higher high tide, the ordinary high water mark is coincident with the line of vegetation. Where there is no vegetative cover for less than one hundred feet parallel to the shoreline, the ordinary high water mark is the average tidal elevation of the adjacent lines of vegetation. Where the ordinary high water mark cannot be found, it is the elevation of mean higher high tide.

Further, Mean Higher High Tide is defined as the arithmetic mean of the higher of two daily high tides calculated from the most recent 19-year tidal lunar cycle, which is equivalent to Mean Higher High Water (MHHW).

Where applicable, vegetation lining the shoreline was used to define OHWM. However, where there was no vegetative cover for less than one hundred feet parallel to shore, the OHWM was delineated based on the accumulation of drift algae and driftwood that correspond with the highest high tide as described below. Because of the dynamic nature of the tidal environment, the OHWM is best determined during a period of relatively stable weather and extreme weather events avoided.

In addition, for those areas along the beach without perennial vegetation, determination following a series of a spring high tides is helpful. Spring tides (the very highest tides of the year) occur when the earth, moon, and sun are aligned; this occurs for approximately three months during the summer, and three months during the winter. During these months, the high tides are higher than the average highest tides for three or four days.

In the field, flagging was placed to mark the OHWM and conventional survey was used to locate and map the locations by a registered surveyor.

## 2.0 RESULTS

The OHWM for marine and freshwater environments are shown in the plan sheets submitted for review on March 19, 2012. Please refer to Sheet 143166-A100-WC004 for the OHWM along the Strait of Georgia, and Sheet 143166-A100-WC011 for the OHWM for Stream 1 and Stream 2.

### 2.1 STREAM 1 AND STREAM 2

The OHWM along Stream 1 and Stream 2 followed the methods described above. In general, the OHWM along both streams was delineated based on differences in soils above and below the OHWM, and the presence or absence of wetland or hydric vegetation. Below the OHWM, both streams channel areas were characterized by hydrophytic vegetation, such as skunk cabbage *(Lysichiton americanus*), slough sedge (*Carex obnupta*), and twinberry (*Lonicera involucrate*). The beds of the streams below the OHWM were generally characterized by the presence of sediment bars, and scour lines—indicators of erosion and flowing water. Above the OHWM, the vegetation was characteristic of uplands at the site (for example, snowberry [*Symphoricarpos albus*], vine maple [*Acer circinatum]*, and Douglas fir *[Pseudotsuga menziesii*]).

Further characteristics of Stream 1 and Stream 2 are provided in the Wetland Determination and Delineation Report for the Gateway Pacific Terminal Property (AMEC 2008).

### 2.2 STRAIT OF GEORGIA

The OHWM in the marine environment was delineated in December 2006, corresponding with a series of high-tide events. Therefore, where there was no vegetative cover for less than one hundred

feet parallel to the shoreline, the ordinary high water mark was delineated based on the accumulation of drift algae and driftwood deposited by such high tide events.

Following field determination, survey, and mapping, we compared the results to data measured by NOAA on tidal elevations and frequency. NOAA determined for the Cherry Point reach that the Mean Higher High Water (MHHW) line is at +2.788 feet (MLLW; NOAA 2011) using data collected over 19 years (January 1983 – December 2001). The MHHW line coincides almost exactly with the field delineated OHWM for this reach, and would overlay the delineated OHWM. Because MHHW is calculated as an average over several years, variations due to small beach elevation changes are resolved; however, the field delineation of OHWM is sensitive to local micro-topographic dips and rises, and the OHWM line reflects this.

## 3.0 REFERENCES


AMEC Earth & Environmental (AMEC). 2008. Wetland Determination and Delineation for the Gateway Pacific Terminal Property. Prepared for Pacific International Terminals.

National Oceanic and Atmospheric Administration (NOAA). 2011. Tides and Currents: Tidal Datums at Cherry Point, Strait of Georgia, Washington. Available online at http://tidesandcurrents.noaa.gov/data_menu.shtml?stn=9449424%20Cherry%20Point,%20WA&type=Bench%20Mark%20Sheets.

Olson, P., and E. Stockdale. 2010. Determining the Ordinary High Water Mark on Streams in Washington State. Second Review Draft. Washington State Department of Ecology, Shorelands & Environmental Assistance Program, Lacey, WA. Ecology Publication # 08-06-001.

Thurman, H V (1994). Introductory Oceanography (7 ed.). New York, NY: Macmillan. pp. 252–276.