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MEMORANDUM

TO: Vicki Sutton – Department of Ecology

FROM: Matt Dalton

DATE: June 9, 2021

SUBJECT: Revisions to Draft RI Figures
ICS Remedial Investigation Report – February 2020

REF. NO: SUM-008-03 FS (ICS Revision memo 6-6-21.docx)

CC: Ralph Palumbo
Steve Thiele
Ken Bloch
Adam Trotsky
Dave Cooper
Raleigh Farlow
Joel Massmann

In reviewing and preparing responses to Ecology comments concerning the draft Feasibility Study (March 2020), it became evident that several figures in the DOF February 2020 draft RI report required revision to be representative of the site conditions. The specific figures addressed by this memorandum are as follows:

- Figure 4-19a – Groundwater Flow Directions – ICS Upper Zone, High Tide (+11.8’ MLLW) – February 6, 2018.
- Figure 4-19b - Groundwater Flow Directions – ICS Upper Zone, Low Tide (+2.5’ MLLW) – February 6, 2018.
- Figure 4-10 – Geologic Section I-I’

REVISIONS TO FIGURES 4-19a and 4-19b

Figures 4-19a and 4-19b illustrate groundwater flow directions in the Upper Zone that lies between the Water Table Zone and the Deeper Zone. Wells that are screened in each of these zones are shown on draft RI Figures 4-12a,b,c. As shown on these figures, there are no Upper Zone wells located east of the former settling lagoon and flow directions were estimated without benefit of water level elevation data east of the ICS upland property as requested by Ecology. While the high tide flow direction estimates appear reasonable (flow inward to the property), low tide flow directions do not appear representative based on the estimated flow directions using data collected in 2016 (Figure 4-17b in the draft RI), the magnitude of the water level changes

between high and low tides that occur east of the ICS Upland property (see Figures 4-20a and 4-20b in draft RI), and what would be expected.

Upper zone water level elevations at any given location would be expected to lie between those measured in Water Table wells and those measured in Lower Zone wells to correct for vertical gradients. The high and low tide monitoring well water-level elevations calculated using data collected in February 2018 are summarized in Attached Table A4.3 of the draft RI. Elevations for high and low tide conditions for Water Table and Lower Zone wells east of the property are summarized in Tables 1 and 2 below.

Table 1 – Low Tide (+2.5' MLLW) Water Level Elevations

Well Location	Water Table Well Water Elevation (ft)	Lower Zone Well Water Elevation (ft)	Difference (ft)	Est. Upper Zone Water Level Elevation (ft) (a)
MW-F	2.58	2.26	(-) 0.32	2.42
MW-G	4.12	2.70	(-) 1.42	3.41
MW-K	3.19	3.07	(-) 0.12	3.13
MW-L	7.27	3.40	(-) 3.87	5.33
MW-Eu/ HCB1	6.38	6.02	(-) 0.36	6.20

Note: Water level elevation data in feet NAVD88; (a) mid-point water level elevation.
MLLW – Mean Lower Low Water; (-) – downward gradient, (+) upward gradient.

Table 2 – High Tide (+11.8' MLLW) Water Level Elevations

Well Location	Water Table Water Elevation (ft)	Lower Zone Water Elevation (ft)	Difference (ft)	Est. Upper Zone Water Level Elevation (ft) (a)
MW-F	7.44	8.15	(+) 0.71	7.80
MW-G	6.43	7.92	(+) 1.49	7.18
MW-K	7.58	7.75	(+) 0.17	7.67
MW-L	8.45	7.54	(-) 0.91	8.00
MW-Eu/ HCB1	6.23	6.59	(+) 0.36	6.41

Note: Water level elevation data in feet NAVD88; (a) mid-point water level elevation.
MLLW – Mean Lower Low Water; (-) – downward gradient, (+) upward gradient.

The estimated Upper Zone water level elevations (Tables 1 and 2) were combined with the Upper Zone elevations from wells located on the ICS upland property to prepare water level elevation contour maps to estimate groundwater flow gradients. The revised contour maps (Figures 4-19a and 4-19b) are attached.

The revised high tide flow gradients are similar to those estimated in the February 2020 draft RI and show that the gradients are inward to the property. The east well high tide elevations did not significantly change the flow gradient patterns. However, using the estimated low tide Upper Zone water level elevations, the gradients beneath the western portions of the site are towards the head of the embayment, while those beneath the eastern portion of the site are in an easterly direction towards the LDW. A ground water divide separates the two areas.

REVISION TO SECTION I-I'

In July 2018, the ICS upland shoreline and the embayment were resurveyed by Bush, Roed, & Hitchings, Inc. (BRH) to ensure a consistent survey between the upland and the embayment and to locate significant site features along the shoreline. Past survey information appeared inconsistent and was not deemed suitable for engineering designⁱ. The survey map (Attachment A) was forwarded to DOF in August 2018.

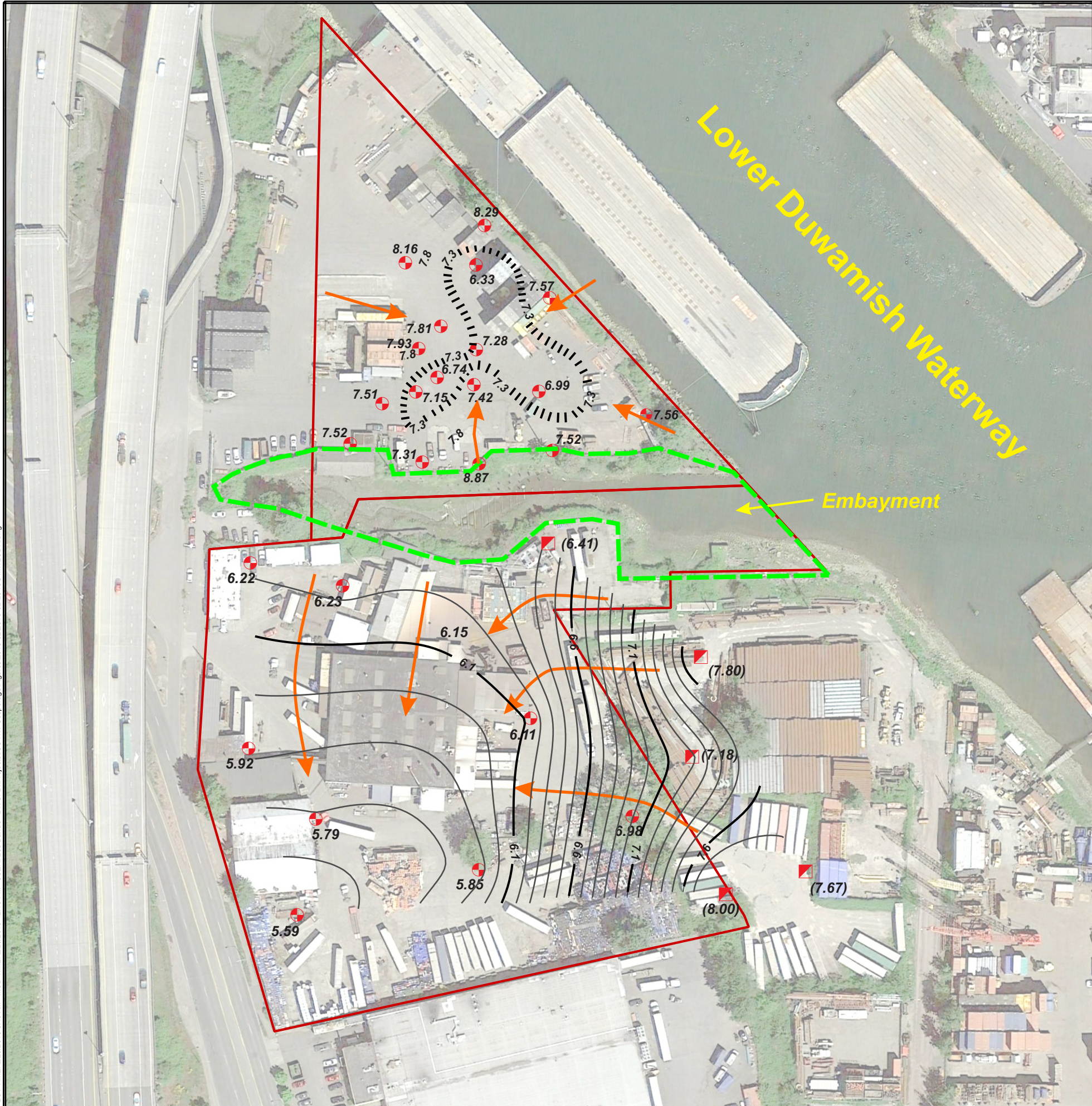
Section I-I' in the draft RI (Figure 4-10) illustrates subsurface conditions beneath the embayment. The section uses MLLW as an elevation reference datum. The section was modified to show the subsurface conditions to the NAVD88 datum. This section also provides the basis to include the fine-grained stratum beneath the embayment in Layer 3 of the base groundwater model for the site.

Attachments

Attachment A – July 2018 Survey Map by BRH
Revised Figure 4-19a
Revised Figure 4-19b
Revised Figure 4-10

ⁱ Recent revisions to the base groundwater model for the site by Keta Waters incorporated this updated survey information.

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- Monitoring Well (Upper Zone)
- 7.33** Water Level Elevation (ft. NAVD88)
- Monitoring Location w/ Water Table and Lower Zone Wells
- (7.33)** Interpolated Water Level Elevation (ft. NAVD88)
- ⤵ 8.0 Groundwater Contour (ft. NAVD88)
- ➔ Estimated High Tide Flow Gradient Direction
- Property Boundary

1) Water level measurements were made on February 6, 2018 during a predicted high tide of +9.4 feet NAVD88 (11.8 feet MLLW) at 0923 hours between 0852 hours and 0940 hours.

2) The water table and upper zones are not differentiated on the Douglas property.

Feb 18 Flow Directions rev 6-1-21.cdr

ICS/NW Cooperage Site
Seattle, Washington



Groundwater Flow Directions - ICS Upper Zone
High Tide (+11.8' MLLW) - February 6, 2018

FIGURE
4-19a

March 2018

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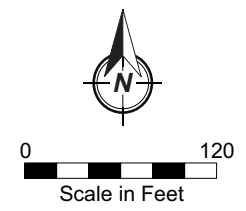


- Monitoring Well (Upper Zone)
- 7.33** Water Level Elevation (ft. NAVD88)
- Monitoring Location w/ Water Table and Lower Zone Wells
- (7.33)** Interpolated Water Level Elevation (ft. NAVD88)
- ⤵ **8.0** Groundwater Contour (ft. NAVD88)
- ➔ Estimated Low Tide Flow Gradient Direction
- Property Boundary

1) Water level measurements were made on February 6, 2018 during a predicted high tide of +0.1 feet NAVD88 (+2.5 feet MLLW) at 1609 hours between 1541 hours and 1632 hours.

2) The water table and upper zones are not differentiated on the Douglas property.

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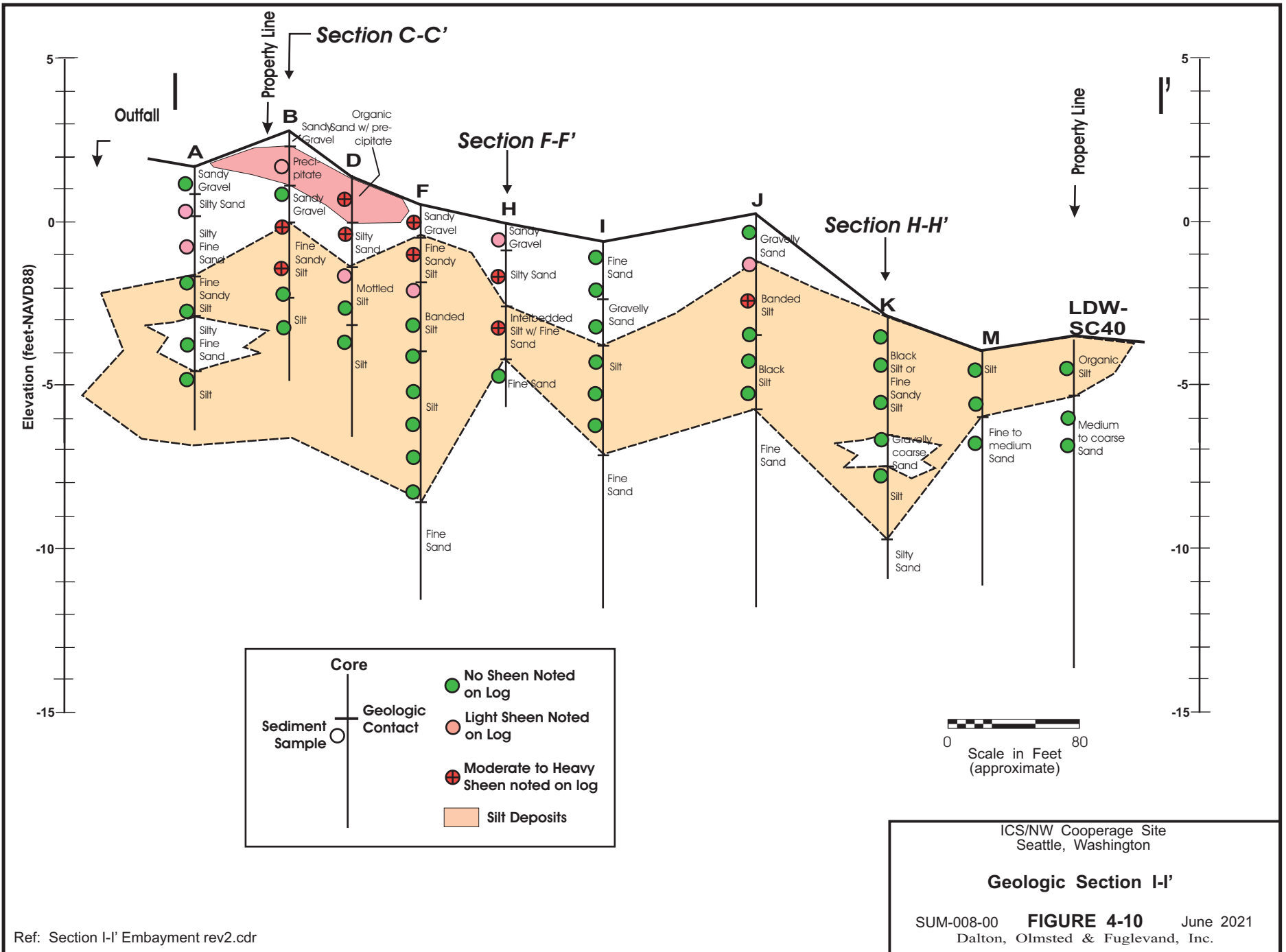


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Groundwater Flow Directions - ICS Upper Zone
Low Tide (+2.5' MLLW) - February 6, 2018



FIGURE
4-19b
June 2021



**ATTACHMENT A
BRH SURVEY MAP
August 2018**

**ICS/NWC RI/FS
SEATTLE, WASHINGTON**
