RIPPLE
Natural Resources LLC

FROM: Matt Murawski, PE
TO: Hinesburg DRB
DATE: October 4, 2022

SUBJECT: **Hinesburg Center II – Additional Hydraulic Information**

This memorandum provides additional hydraulic information for the Hinesburg Center II application, as requested in the September 30, 2022 staff report. It is intended to augment in-person discussion at tonight's (10/4/22) DRB hearing.

1. **Need for a Plan.** Exhibit 1 shows the cross sections on the project Site Plan.
2. **Cross Section Scale and Vertical Exaggeration.** Exhibit 2 shows a "zoomed in" cross section 1875 which is the location of the largest difference in water surface elevation between Existing and Proposed Conditions. At most cross sections, Existing and Proposed appear as a single line because the difference in elevations is so small, and thus the other zoomed in sections are not presented.
3. **Existing Conditions Modeling.** Existing Conditions – reflecting topographic conditions on the ground today – have been modeled. Exhibit 3 shows the Profile down the river of both Existing and Proposed Conditions, and Exhibit 4 is an annotated table presenting the same results.
4. **XS 2457.** This cross section is from the FEMA model and is located immediately downstream of Rte 116, near cross section 2657 in the current model. ANR seems to suggest that the elevation reported by FEMA should match the results of the current modeling. That is not correct, for a few reasons:
    a. The FEMA model reflects pre-HCI conditions, whereas the current modeling reflects post HCI conditions. HCI would have raised flood levels, and thus existing conditions under the current modeling would be expected to differ from FEMA results.
    b. Even if the models reflected the same on-the-ground conditions, the FEMA model and the current model are based on very different topographic data. FEMA used limited field survey data. The current model uses high resolution topographic data that is significantly better at reflecting flow patterns than the FEMA model.
    c. There have been changes in the channel – ANR's basis for recent enlargement of the River Corridor for Patrick Brook – between the time of the FEMA model and the current model, and computed elevations should be different.

    We note that there is no requirement at the Federal, State, or local level for an analysis such as this to match FEMA results as a starting point, and nor is it standard engineering practice. It is only in cases in which a Letter of Map Revision is being requested (to formally adjust published FEMA Baseflood Elevations) that matching FEMA results is required before evaluating proposed development.

5. **Full Flow of Patrick Brook.** The current model uses the same flood flows as the FEMA model. For the 100-year event, this includes 162 cfs flows coming directly down Patrick Brook, plus 109 cfs diverted from the Canal, for a total of 271 cfs. This is the applicable regulatory flows on which the project is required to be evaluated. ANR Floodplain Management staff confirmed this in a video call on March 31, 2022; evaluation of higher flows is a recommendation, but not a requirement.

   However, for informational purposes, we have analyzed the effect of additional flows from the canal reaching the project area. Specifically, we have modeled a flow of 348 cfs, which assumes that all flow in the Canal is diverted back into Patrick Brook, representing a 28% increase in flow for the 100-year event. The results (Existing vs Proposed) are similar to the current 100-year flow: modest increases in water surface elevations are computed adjacent to HCII and extending upstream to locations adjacent to HCI, but not extending to the Rte 116 crossing. Importantly, the results show that the proposed culvert handles this larger flow: the larger flow passes with headspace remaining between the WSEL and top of culvert remaining, and the 25-year flow (215 cfs) increased 28% to 275 cfs passes through the culvert with a full 1' of headspace.

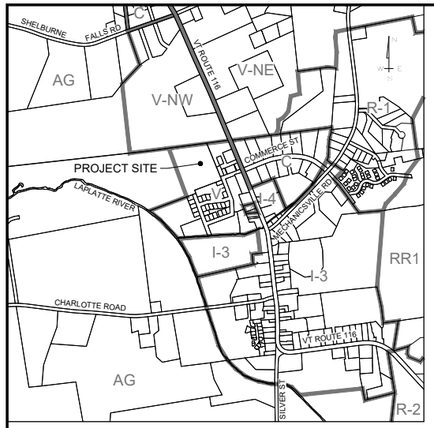
6. **Overall Floodplain Impact.** The modeling presented in the July 2022 report and augmented today includes Patrick Brook from the LaPlatte River up to Rte 116. The project does not cause undue adverse impacts as required by HZR 6.12.1(5). Specifically,
   a. **Upstream and Downstream Properties**: The maximum increase in 100-year water surface elevation upstream of the subject property is 0.03' (less than half an inch), adjacent to the HCI development. There is no impact at all at the Rte 116 culvert. Downstream of HCII, there is no increase in 100-yr water surface elevations.

      Channel velocities change where there are differences in water surface elevation, but the typically are lower. I detailed 2-Dimensional hydraulic analysis performed and shared with ANR as part of initial Act 250 consultation demonstrated that channel velocities were below erosive thresholds.

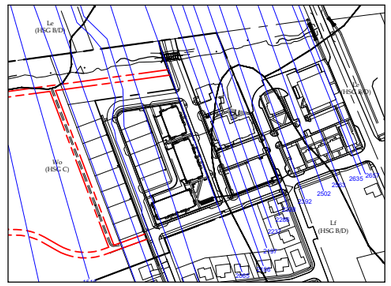
   b. **Public and Private Infrastructure**: The project has no river-related impacts on public or private infrastructure.

   c. **Water Quality.** The project as no undue effect on water quality. Runoff is directed to a stormwater treatment system. The channel itself is buffered by a River Corridor that ANR expanded in early 2022. With the exception of roadway approaches for the new stream crossing, the HCII proposal keeps all fill out of this corridor. Thus, the channel is afforded room to move and adjust with no undue impacts on adjacent property. Further, the proposed crossing is larger than natural bankfull channel width and larger in fact than required by ANR, and will have a natural stream bottom. It will in effect be a stream channel with a lid over the top, thereby maintaining sediment transport continuity and stream ecological functions.

Exhibit 1

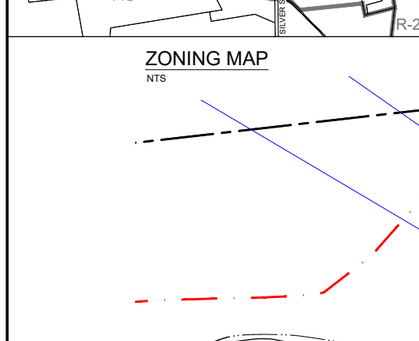


ZONING MAP
NTS



SOIL MAP
SCALE: 1" = 250'

SOIL KEY:
Le LIMERICK SILT LOAM
Lf LIMERICK SILT LOAM, VERY WET
Wo WINOOSKI VERY FINE SANDY LOAM



LOCATION MAP
NTS

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NOTES:
1. THIS IS NOT A BOUNDARY SURVEY. BOUNDARY LINES ARE SHOWN BASED ON PLANS PREPARED BY BUTTON PROFESSIONAL LAND SURVEYORS, PC, TITLED "SUBDIVISION PLAT, CREEKSIDE, ROUTE 116, HINESBURG, VT.", LAST REVISED 6-27-05, "PERIMETER BOUNDARY PLAT CREEKSIDE, ROUTE 116, HINESBURG, VT." DATED 4-7-03, AND "SUBDIVISION PLAT OF LANDS OF HINESBURG CENTER, ROUTE 116, HINESBURG, VT, SHEETS 1 AND 2 OF 2, LAST REVISED 7-9-14, AS RECORDED IN THE TOWN OF HINESBURG LAND RECORDS IN SLIDES 142B, 142C, 142D, 150C, 211C AND 211D RESPECTIVELY.
2. ALL ON-SITE WETLANDS WERE DELINEATED PURSUANT TO CURRENT STATE AND FEDERAL GUIDELINES BY PETER SPEAR OF NATURAL RESOURCE CONSULTING SERVICES (95 SILVER LAKE ROAD, TILTON, NH 03276, 603-729-0214) IN AUGUST 2020 AND APPROVED BY JULIE FOLLENSBEE, VTANR, ON NOVEMBER 25, 2020.
3. WETLAND DELINEATION LOCATED VIA GPS BY NRCS.
4. THE PATRICK BROOK CROSSING IS A REQUIREMENT OF THE HINESBURG TOWN PLAN ADOPTED 7/7/2021.

LANDOWNER:
DAVID F LYMAN REVOCABLE TRUST
368 READ LANE WEST
ST ALBANS, VT 05478

APPLICANT:
HINESBURG CENTER INVESTMENTS, LLC
32 SEYMOUR STREET
WILLISTON, VT 05495

GRAPHIC SCALE
100 0 100 200 400
(IN FEET)

STATE OF VERMONT
ROGER J. DICKINSON
No. 3945
Civil
LICENSED
PROFESSIONAL ENGINEER

Date	Revision	By
08/08/22	REV. PATRICK BRK XING	RD
04/01/22	REV. LOT NUMBERING	NDS
11/05/21	REV. LAYOUT AND PATRICK BROOK RIVER CORRIDOR	NDS
12/14/20	ADDED CLASS 2 WETLAND & BUFFER	NDS
10/20/20	REVISED STORMWATER DESIGN & SITE GRADING	NDS
09/08/20	REVISED ROAD DIMENSIONS	NDS
06/16/20	ADDED STORMWATER FACILITIES	NDS

These plans shall only be used for the purpose shown below:
- ☐ Sketch/Concept
- ☐ Preliminary
- ■ Final
- ☐ Act 250 Review
- ☐ Construction
- ☐ Record Drawing

LANDS OF
HINESBURG CENTER, LLC
VT Route 116 Hinesburg, VT

OVERALL SITE PLAN

Lamoureux & Dickinson
Consulting Engineers, Inc.
14 Morse Drive, Essex, VT 05452
802-878-4450 www.LDengineering.com

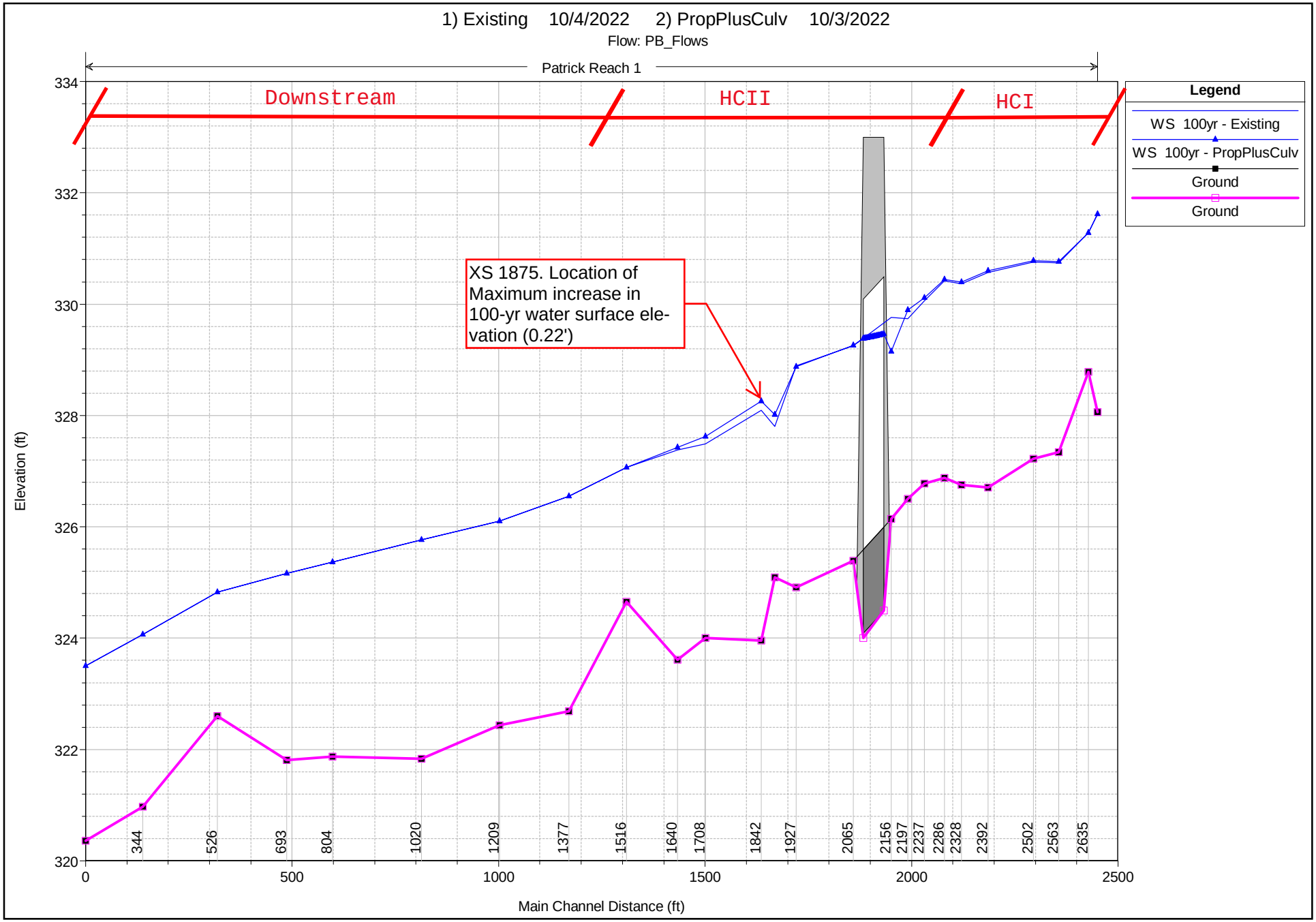
Project No.	19054
Survey	N/A
Design	NDS/RD
Drawn	DLH
Checked	RJD
Date	5/11/22
Scale	AS NOTED
Sheet number	1

S:_TCE DRAWINGS\2022\534-Milot-HCII-Hinesburg\19054-1.dwg, 10/3/2022 3:18:04 PM

Hinesburg Center II
Existing vs Proposed
100yr Flow
10/4/22

Exhibit 2

Exhibit 3


1) Existing 10/4/2022 2) PropPlusCulv 10/3/2022
Flow: PB_Flows
Patrick Reach 1
Downstream
HCII
HCI
XS 1875. Location of Maximum increase in 100-yr water surface elevation (0.22')
Legend
WS 100yr - Existing
WS 100yr - PropPlusCulv
Ground
Ground
Elevation (ft)
Main Channel Distance (ft)
334
332
330
328
326
324
322
320
0
500
1000
1500
2000
2500
344
526
693
804
1020
1209
1377
1516
1640
1708
1842
1927
2065
2156
2197
2237
2286
2328
2392
2502
2563
2635

Hinesburg Center II
Existing vs Proposed
100yr Flow
10/4/22

Exhibit 4

Existing and Proposed at each cross section

Water Surface Elev

HEC-RAS River: Patrick Reach: Reach 1 Profile: 100yr

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	2657	100yr	Existing	271.0	328.1	331.62	330.1	331.7	0.001691	2.5	163.4	201.8	0.3
Reach 1	2657	100yr	PropPlusCulv	271.0	328.1	331.62	330.1	331.7	0.001691	2.5	163.4	201.8	0.3
Reach 1	2635	100yr	Existing	271.0	328.8	331.28	331.3	331.(					
Reach 1	2635	100yr	PropPlusCulv	271.0	328.8	331.28	331.3	331.(					
Reach 1	2563	100yr	Existing	271.0	327.3	330.74	329.4	330.9					
Reach 1	2563	100yr	PropPlusCulv	271.0	327.3	330.77	329.4	330.9					
Reach 1	2502	100yr	Existing	271.0	327.2	330.76	328.6	330.8	0.000642	1.7	165.8	184.4	0.2
Reach 1	2502	100yr	PropPlusCulv	271.0	327.2	330.78	328.6	330.8	0.000625	1.7	167.8	187.5	0.2
Reach 1	2392	100yr	Existing	271.0	326.7	330.57	329.3	330.7	0.002238	2.9	121.3	192.2	0.3
Reach 1	2392	100yr	PropPlusCulv	271.0	326.7	330.60	329.3	330.7	0.002139	2.9	124.0	195.1	0.3
Reach 1	2328	100yr	Existing	271.0	326.8	330.37	329.4	330.5	0.003142	3.3	110.6	273.2	0.4
Reach 1	2328	100yr	PropPlusCulv	271.0	326.8	330.40	329.4	330.5	0.003116	3.3	113.4	276.3	0.4
Reach 1	2286	100yr	Existing	271.0	326.9	330.42	328.6	330.4	0.000486	1.4	264.7	327.8	0.2
Reach 1	2286	100yr	PropPlusCulv	271.0	326.9	330.45	328.6	330.5	0.000466	1.4	268.3	329.4	0.1
Reach 1	2237	100yr	Existing	271.0	326.8	330.06	329.3	330.4	0.005772	4.5	74.2	196.2	0.5
Reach 1	2237	100yr	PropPlusCulv	271.0	326.8	330.12	329.3	330.4	0.005249	4.3	78.4	206.8	0.5
Reach 1	2197	100yr	Existing	271.0	326.5	329.74	329.5	330.1	0.008093	5.2	76.2	309.2	0.6
Reach 1	2197	100yr	PropPlusCulv	271.0	326.5	329.89	329.5	330.2	0.006183	4.7	88.5	326.1	0.5
Reach 1	2156 Br US	100yr	Existing	271.0	326.1	329.76	329.2	329.9	0.002172	3.0	164.2	599.7	0.3
Reach 1	2156 Br US	100yr	PropPlusCulv	271.0	326.1	329.15	328.8	329.8	0.013804	6.3	45.0	74.6	0.8
Reach 1	2065 Br DS	100yr	Existing	271.0	325.4	329.26	328.1	329.6	0.004534	4.5	79.0	719.6	0.5
Reach 1	2065 Br DS	100yr	PropPlusCulv	271.0	325.4	329.26	328.1	329.6	0.004712	4.6	68.9	76.7	0.5
Reach 1	1927	100yr	Existing	271.0	324.9	328.89	327.6	329.0	0.002669	3.4	182.3	765.5	0.4
Reach 1	1927	100yr	PropPlusCulv	271.0	324.9	328.87		329.0	0.002849	3.5	114.5	137.7	0.4
Reach 1	1875	100yr	Existing	271.0	325.1	327.80	327.7	328.7	0.022097	7.5	37.1	532.3	0.9
Reach 1	1875	100yr	PropPlusCulv	271.0	325.1	328.02	327.7	328.7	0.015323	6.7	43.9	61.1	0.8
Reach 1	1842	100yr	Existing	271.0	324.0	328.09	326.8	328.2	0.003022	3.4	105.6	100.4	0.4
Reach 1	1842	100yr	PropPlusCulv	271.0	324.0	328.26	326.8	328.4	0.002252	3.0	124.3	121.8	0.3
Reach 1	1708	100yr	Existing	271.0	324.0	327.49	327.4	327.7	0.006519	4.4	114.3	694.4	0.5
Reach 1	1708	100yr	PropPlusCulv	271.0	324.0	327.63	327.4	327.9	0.007095	4.8	90.6	98.1	0.5
Reach 1	1640	100yr	Existing	271.0	323.6	327.38	326.9	327.4	0.001955	2.4	207.4	726.9	0.3
Reach 1	1640	100yr	PropPlusCulv	271.0	323.6	327.43	326.8	327.5	0.003135	3.1	126.1	106.7	0.4
Reach 1	1516	100yr	Existing	271.0	324.7	327.06	326.8	327.1	0.003908	3.1	184.6	754.8	0.4
Reach 1	1516	100yr	PropPlusCulv	271.0	324.7	327.06	326.8	327.1	0.003908	3.1	184.6	754.8	0.4
Reach 1	1377	100yr	Existing	271.0	322.7	326.55	326.3	326.6	0.003268	3.2	188.7	759.2	0.4
Reach 1	1377	100yr	PropPlusCulv	271.0	322.7	326.55	326.3	326.6	0.003268	3.2	188.7	759.2	0.4
Reach 1	1209	100yr	Existing	271.0	322.4	326.10	325.8	326.2	0.002485	2.8	215.6	893.7	0.3
Reach 1	1209	100yr	PropPlusCulv	271.0	322.4	326.10	325.8	326.2	0.002485	2.8	215.6	893.7	0.3
Reach 1	1020	100yr	Existing	271.0	321.8	325.76	324.6	325.8	0.001517	2.4	233.5	527.4	0.3
Reach 1	1020	100yr	PropPlusCulv	271.0	321.8	325.76	324.6	325.8	0.001517	2.4	233.5	527.4	0.3
Reach 1	804	100yr	Existing	271.0	321.9	325.37	324.3	325.5	0.002282	2.8	188.4	583.1	0.3
Reach 1	804	100yr	PropPlusCulv	271.0	321.9	325.37	324.3	325.5	0.002282	2.8	188.4	583.1	0.3
Reach 1	693	100yr	Existing	271.0	321.8	325.17	324.6	325.2	0.001986	2.2	220.7	637.1	0.3
Reach 1	693	100yr	PropPlusCulv	271.0	321.8	325.17	324.6	325.2	0.001986	2.2	220.7	637.1	0.3
Reach 1	526	100yr	Existing	271.0	322.6	324.82	324.5	324.9	0.003819	2.6	224.6	751.6	0.4
Reach 1	526	100yr	PropPlusCulv	271.0	322.6	324.82	324.5	324.9	0.003819	2.6	224.6	751.6	0.4
Reach 1	344	100yr	Existing	271.0	321.0	324.06	323.4	324.2	0.004097	3.0	144.4	702.1	0.4
Reach 1	344	100yr	PropPlusCulv	271.0	321.0	324.06	323.4	324.2	0.004097	3.0	144.4	702.1	0.4
Reach 1	206	100yr	Existing	271.0	320.4	323.50	323.3	323.6	0.004624	3.1	164.0	361.0	0.4
Reach 1	206	100yr	PropPlusCulv	271.0	320.4	323.50	323.3	323.6	0.004624	3.1	164.0	361.0	0.4

Increased WSEL:
*Max of 0.03' adjacent to HCI.
*Max of 0.22' adjacent to HCII (XS 1875)
*No change downstream of HCII

HCI

HCII

Downstream