

Wave-Current interaction experiments: comparison with non-linear analytical models

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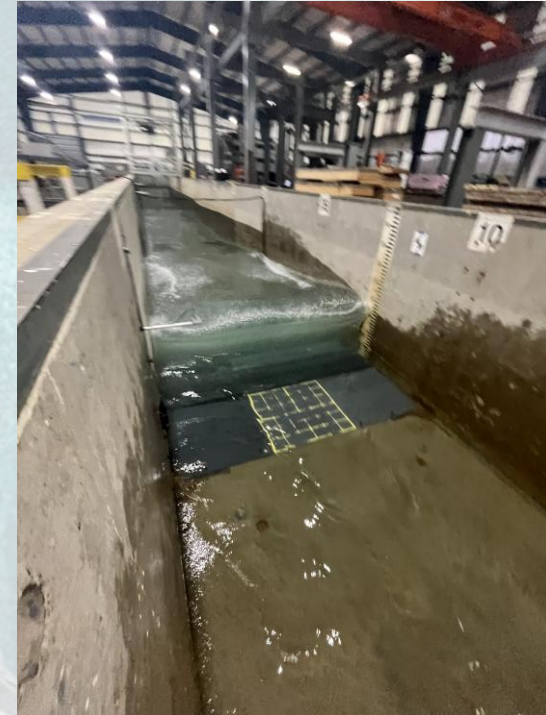
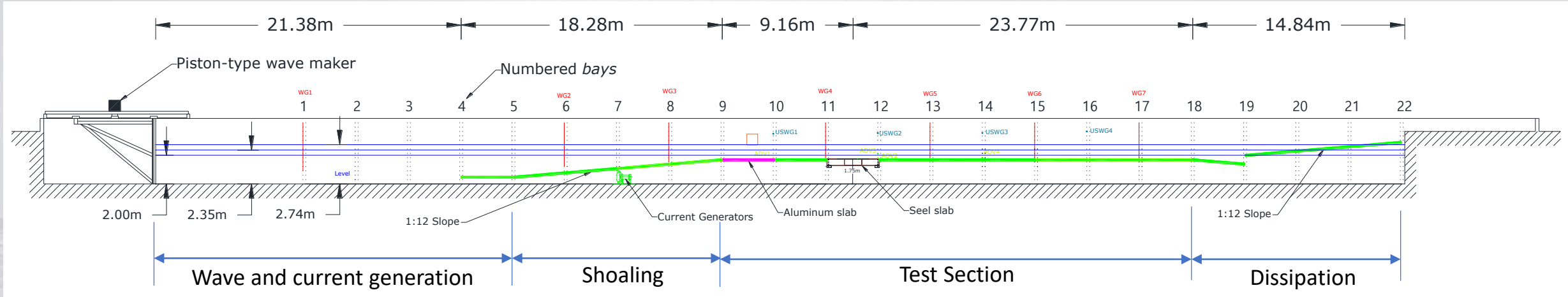
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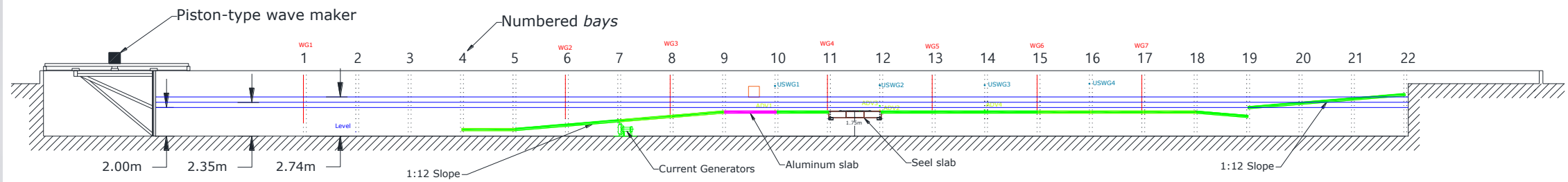
- Wave-current interaction is found in almost all coastal and ocean processes
- It is a highly non-linear process and two-way interactions are observed
- Accurate and representative physical modeling of wave-current interactions remains a challenge
- Experiments conducted at HWRL to compare shallow water waves with strong following currents and available non-linear analytical models



Experiments of wave-current interactions in the Large Wave Flume



Wave and current conditions tested



(a) - Current Only

h @Generation (m)	h @Test Section (m)	Current (%)	Number of Mixers	Horizontal Velocity (m/s) @Test Section	Froude Number @ Test Section
2	0.26	0 - 100	1 - 3	0.2615 - 1.402	0.1637 - 0.8777
2.35	0.61	0 - 100	1 - 3	0.1288 - 0.6733	0.0526 - 0.2752
2.74	1	0 - 100	3	0.0770 - 0.4052	0.0246 - 0.1294

(b) - Waves Only

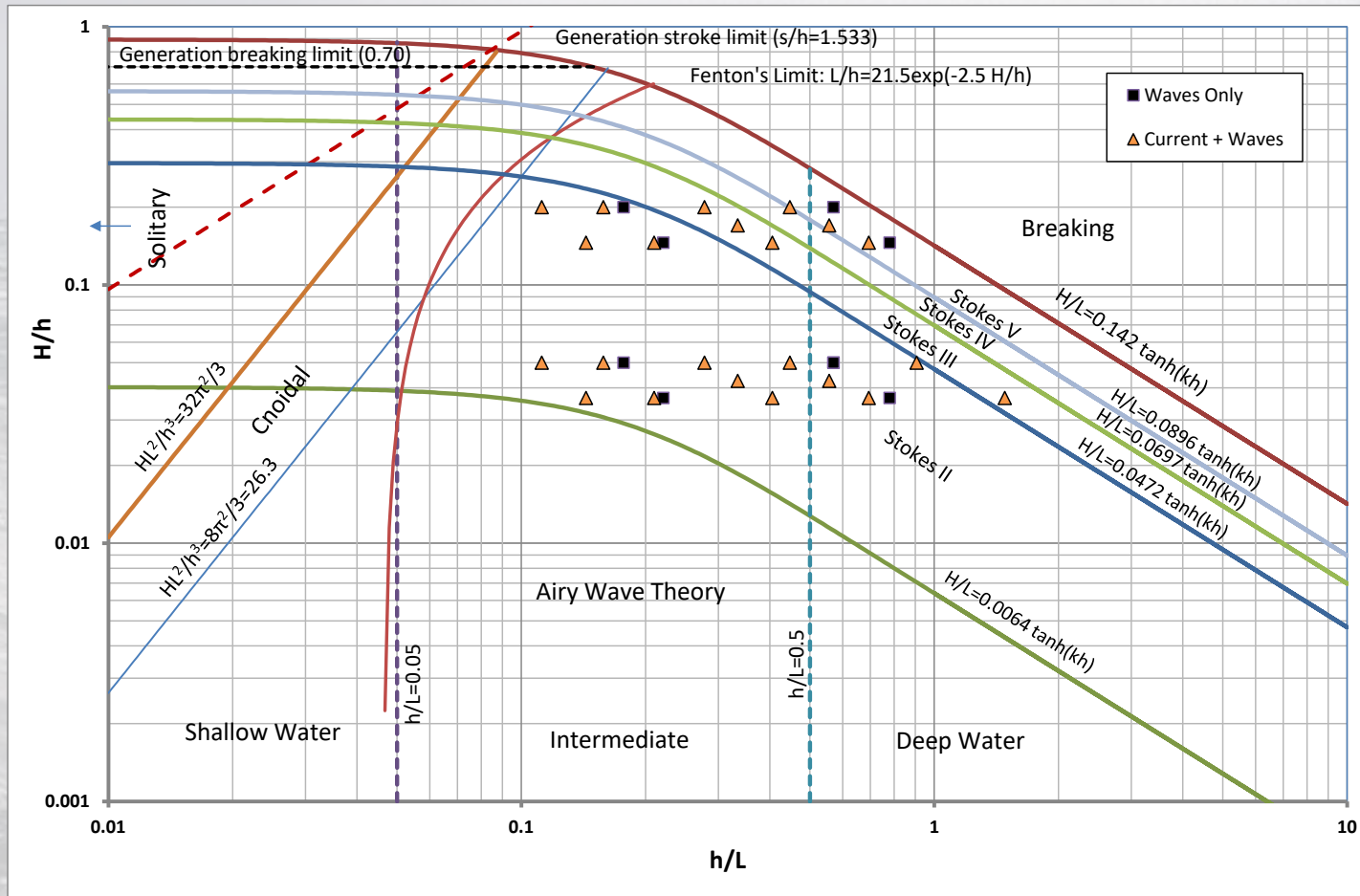
Wave Form	h @Generation (m)	h @Test Section (m)	Wave Height (m)	Wave Period (s)	Wavelength (m)	Ursell Number
Regular	2	0.26	0.1 – 0.4	1 - 4	1.561 – 16.226	0.030 – 13.164
	2.35	0.61	0.1 – 0.4	1.5 - 2	3.511 - 6.144	0.095 - 1.163
	2.74	1	0.1 - 0.4	1 - 4	1.561 - 18.347	0.012 - 6.546
Random	2	0.26	0.1 - 0.4	1.5 - 3	3.507 – 11.306	0.154 – 6.391
	2.74	1	0.1 - 0.4	1.5 - 3	3.513 – 12.404	0.060 – 2.992
Solitary	2	0.26	0.6, 1.2			

(c) - Current + Waves

Wave Form	h @Generation (m)	h @Test Section (m)	Current (%)	Wave Height (m)	Wave Period (s)	Wavelength (m)	Ursell Number
Regular	2	0.26	0-100	0.1 - 0.4	1 - 4	1.561 – 16.967	0.030 – 14.394
	2.35	0.61	50, 100	0.1 - 0.4	1.5 - 2	3.758 – 6.745	0.109 – 1.402
	2.74	1	0-100	0.1 - 0.4	1 - 4	1.707 – 19.090	0.014 – 7.086
Random	2	0.26	50, 100	0.1 - 0.4	1.5 - 3	3.738 – 11.932	0.175 – 7.119
	2.74	1	50, 100	0.1 - 0.4	1.5 - 3	3.732 – 13.055	0.068 – 3.314
Solitary	2	0.26	50, 100	0.6 - 1.2			

Sample wave and current conditions tested. Regular waves

Conditions at generation



Local conditions

