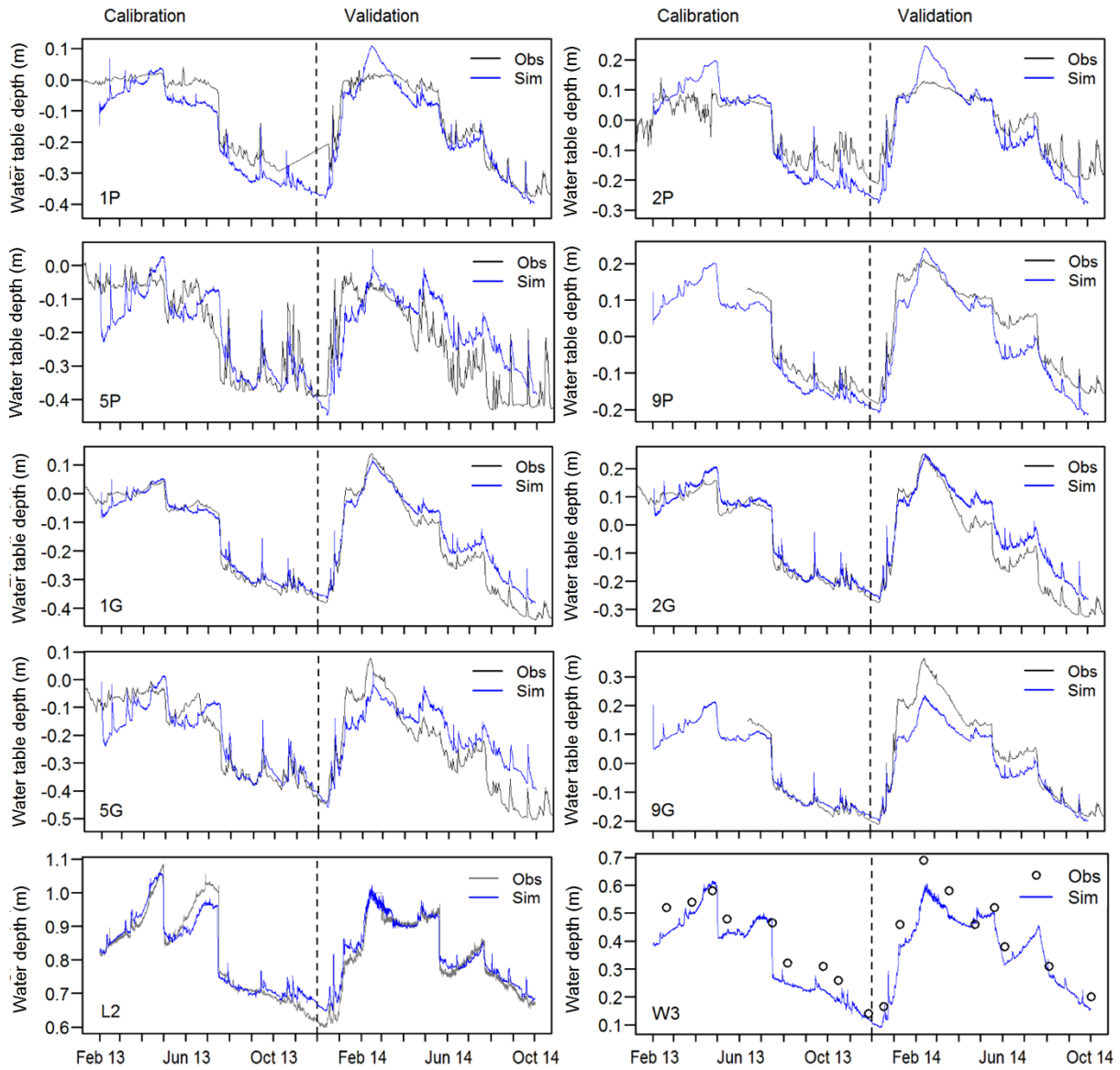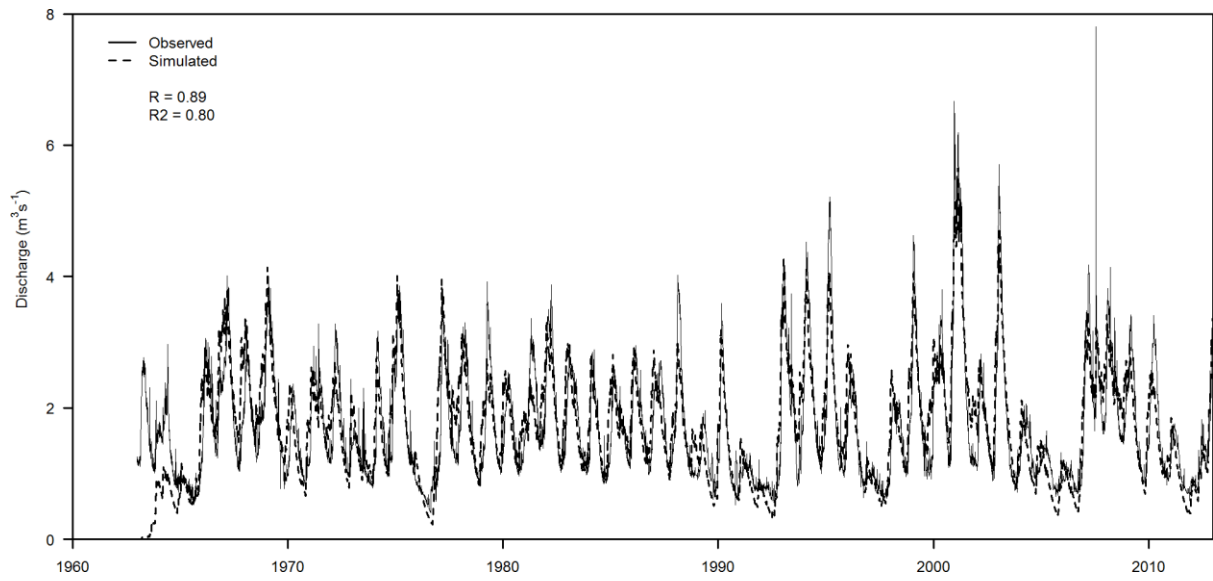# Supplementary material
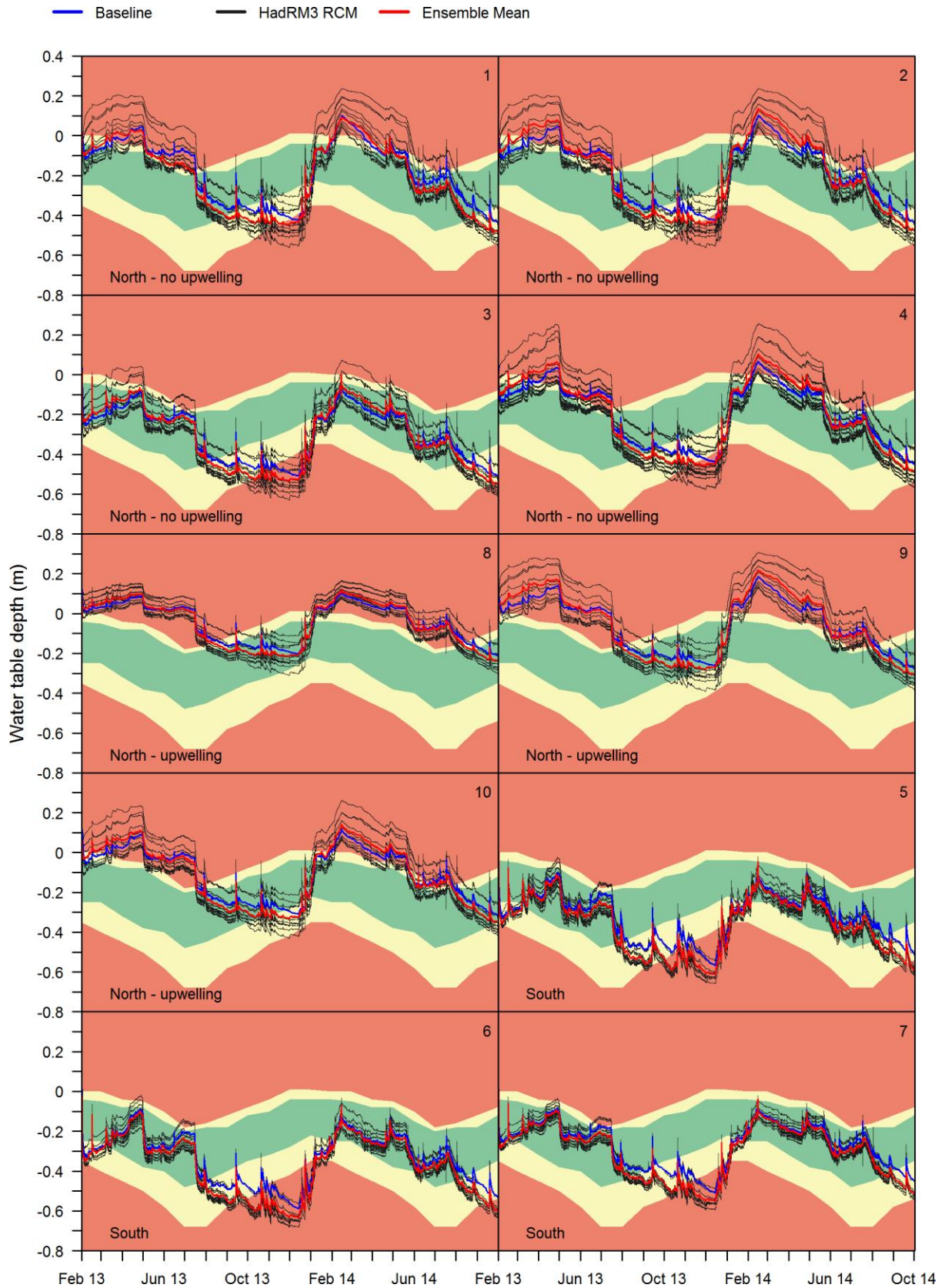

Figure S1. Observed and simulated peat water table depths (1P, 2P, 5P, 6P), gravel groundwater heads (1G, 2G, 5G, 9G) and channel stages (L2, W3)

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Figure S2. Observed and simulated discharge of the Lambourn catchment at Shaw gauging station for the period 1963-2012

Figure S3. Simulated baseline, projected ensemble member and mean wetland water table depths for all piezometer locations superimposed over the MG8 vegetation community water level requirements zone diagrams. Red - intolerable; Amber - tolerable for limited periods; Green - desirable
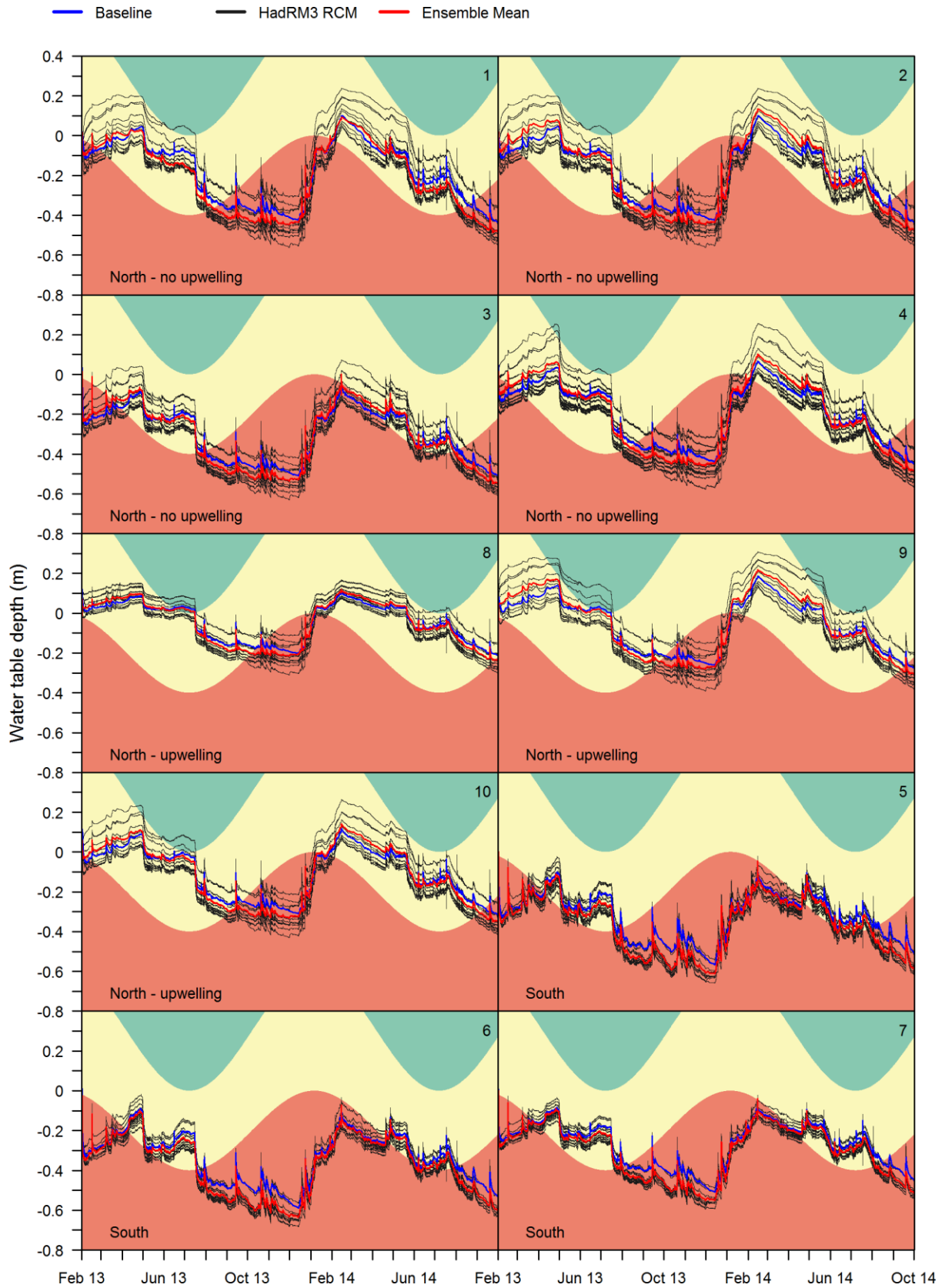
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Figure S4. Simulated baseline, projected ensemble member and mean wetland water table depths for all piezometer locations superimposed over the Desmoulin's whorl snail (*Vertigo moulinsiana*) water level requirements zone diagrams. Red - intolerable; Amber - tolerable for limited periods; Green - desirable

4
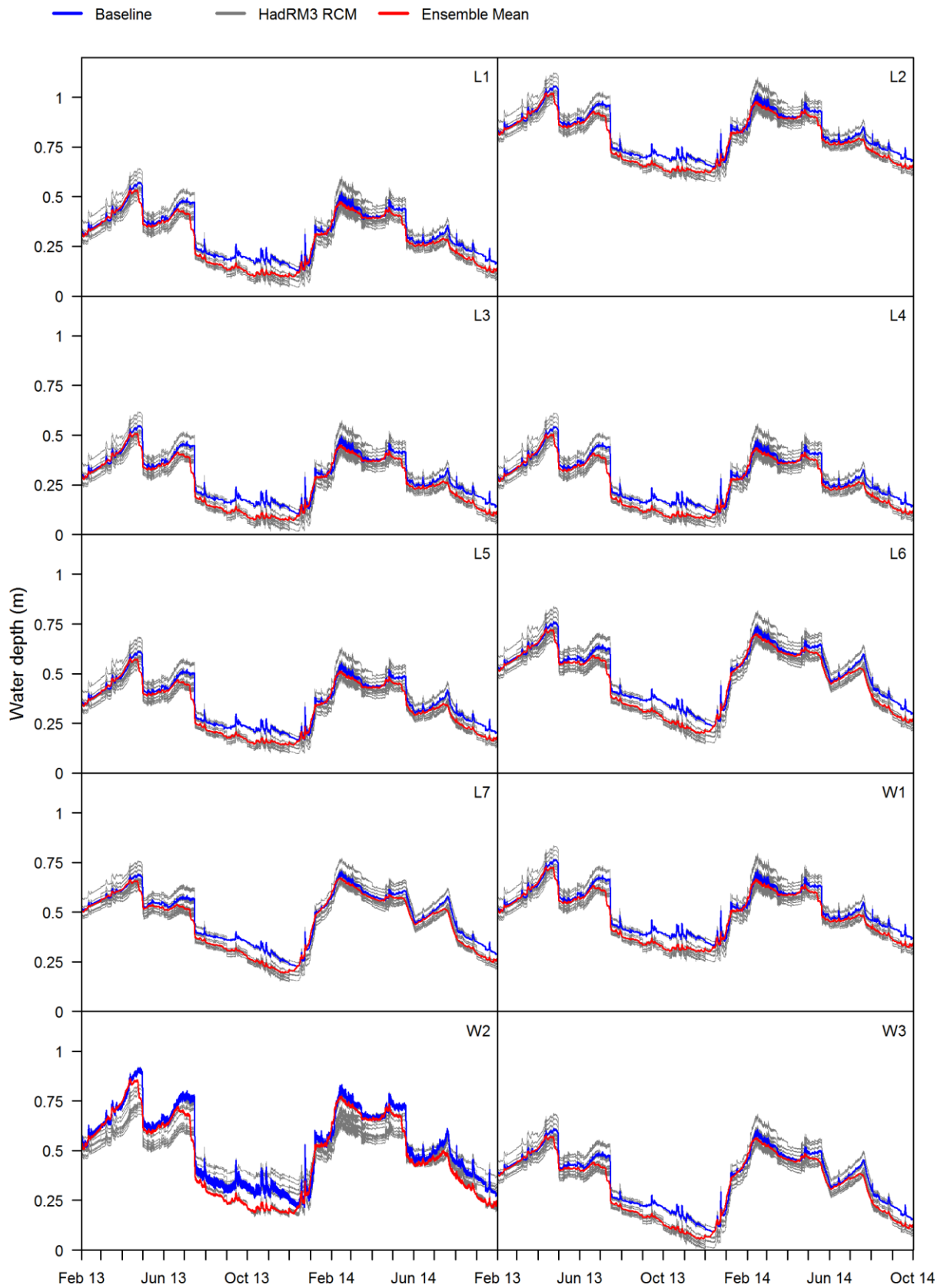
Figure S5. Simulated baseline, projected ensemble member and mean channel stages for all stage board locations

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19
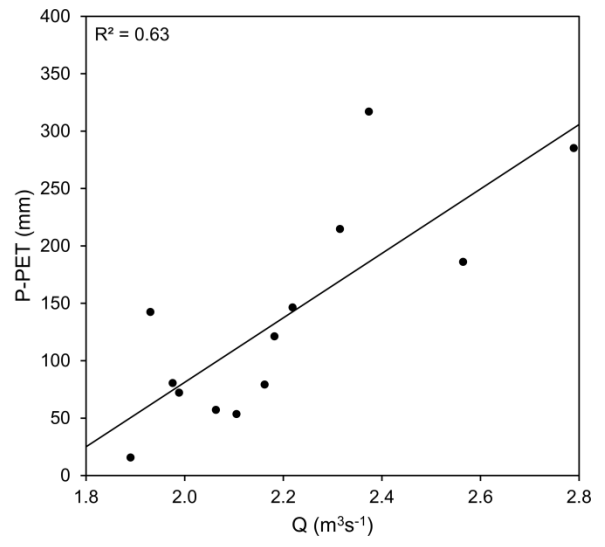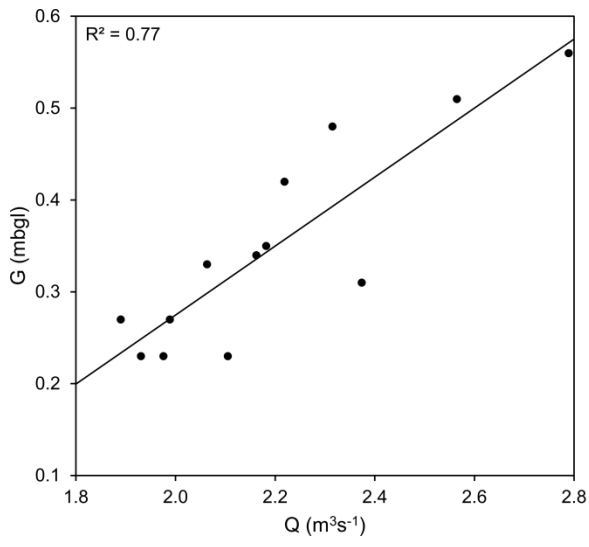
Figure S6. Relationships between changes in discharge inputs (Q) and those in the groundwater head boundary (G) and precipitation minus potential evapotranspiration (P-PET)

Table S1. Model performance statistics for the calibration (01 Feb 2013 – 01 Dec 2013) and validation periods (01 Dec 2013 – 01 Oct 2014). Model performance indicators are adapted from Henriksen et al. (2008)

Observation sites	Calibration						Validation					
	RMSE (m)		R		R2		RMSE (m)		R		R2	
1G	0.020	*****	0.99	*****	0.98	*****	0.057	****	0.98	*****	0.86	*****
1P	0.055	****	0.98	*****	0.78	****	0.037	*****	0.97	*****	0.92	*****
2G	0.026	*****	0.99	*****	0.97	*****	0.075	****	0.97	*****	0.75	****
2P	0.082	****	0.87	*****	0.35	**	0.059	****	0.96	*****	0.67	****
3G	0.067	****	0.98	*****	0.78	****	0.080	****	0.98	*****	0.66	****
3P	0.047	*****	0.96	*****	0.86	*****	0.070	****	0.93	*****	0.57	***
4G	0.047	*****	0.98	*****	0.90	*****	0.030	*****	0.98	*****	0.96	*****
4P	0.122	***	0.92	*****	0.57	***	0.106	***	0.92	*****	0.70	****
5G	0.059	****	0.91	*****	0.82	****	0.094	****	0.87	*****	0.66	****
5P	0.069	****	0.86	*****	0.74	****	0.099	****	0.76	****	0.46	**
6G	0.076	****	0.95	*****	0.74	****	0.072	****	0.92	*****	0.76	****
6P	0.100	****	0.92	*****	0.61	***	0.082	****	0.85	*****	0.70	****
7P	0.095	****	0.81	****	0.63	***	0.093	****	0.85	*****	0.68	****
8G	0.034	*****	0.99	*****	0.91	*****	0.079	****	0.98	*****	0.82	****
8P	0.029	*****	0.94	*****	0.80	****	0.058	****	0.89	*****	0.31	**
9G	0.021	*****	0.99	*****	0.97	*****	0.056	****	0.99	*****	0.85	*****
9P	0.034	*****	0.99	*****	0.88	*****	0.059	****	0.96	*****	0.72	****
10P	0.035	*****	0.98	*****	0.74	****	0.034	*****	0.96	*****	0.87	*****
11G	0.036	*****	0.99	*****	0.89	*****	0.027	*****	0.99	*****	0.97	*****
12G	0.041	*****	0.97	*****	0.84	****	0.088	****	0.89	*****	0.72	****
L1	0.078	****	0.87	*****	0.71	****	0.052	****	0.97	*****	0.85	*****
L2	0.035	*****	0.97	*****	0.91	*****	0.027	*****	0.98	*****	0.92	*****
L3	0.086	****	0.84	****	0.69	****	0.048	*****	0.97	*****	0.87	*****
L4	0.082	****	0.84	****	0.68	****	0.062	****	0.97	*****	0.79	****
L5	0.072	****	0.86	*****	0.72	****	0.049	*****	0.94	*****	0.86	*****
L6	0.075	****	0.88	*****	0.64	***	0.061	****	0.98	*****	0.85	*****
L7	0.064	****	0.88	*****	0.73	****	0.032	*****	0.98	*****	0.96	*****
W1	0.078	****	0.85	*****	0.67	****	0.047	*****	0.97	*****	0.86	*****
W2	0.110	***	0.87	*****	0.63	***	0.101	***	0.87	*****	0.73	****
W3	0.086	****	0.93	*****	0.63	***	0.069	****	0.98	*****	0.81	****

Performance indicators			
Excellent *****	<0.05	>0.85	>0.85
Very good ****	0.10-0.05	0.65-0.85	0.65-0.85
Fair ***	0.15-0.10	0.50-0.65	0.50-0.65
Poor **	0.20-0.15	0.20-0.50	0.20-0.50
Very poor *	>0.20	<0.20	<0.20

Table S2. Percentage of full simulation period (01 Feb 2013 – 01 Oct 2014) simulated baseline, ensemble member and mean water levels are within each water depth zone (WDZ) for the MG8 plant community at all piezometer locations. UI, Upper Intolerable; UT, Upper Tolerable; D, Desirable; LT, Lower Tolerable; LI, Lower Intolerable

Run ID	WDZ	North - no upwelling				North - upwelling			South		
		1	2	3	4	8	9	10	5	6	7
baseline	UI	5.3	16.0	0.1	12.6	71.3	60.7	39.9	0.0	0.0	0.0
	UT	9.2	13.7	0.0	9.5	10.8	6.2	17.6	0.0	0.1	0.1
	D	69.3	57.4	72.4	62.5	17.9	33.1	41.9	62.6	58.8	80.5
	LT	16.1	12.9	22.5	15.4	0.0	0.0	0.6	30.8	32.8	15.3
	LI	0.0	0.0	5.0	0.0	0.0	0.0	0.0	6.6	8.2	4.1
A	UI	22.2	43.5	0.1	31.0	74.4	65.2	53.5	0.0	0.0	0.0
	UT	23.2	6.7	3.3	16.7	6.7	5.8	6.8	0.0	0.1	0.1
	D	40.4	35.7	70.5	36.5	18.9	29.0	39.6	55.2	53.6	70.3
	LT	14.3	14.0	21.0	15.8	0.0	0.0	0.0	33.8	31.7	22.4
	LI	0.0	0.0	5.1	0.0	0.0	0.0	0.0	11.0	14.6	7.2
B	UI	0.1	2.4	0.1	0.2	48.3	31.2	14.1	0.0	0.0	0.1
	UT	1.8	6.4	0.0	6.7	12.8	20.5	12.4	0.0	0.1	0.0
	D	69.2	64.2	47.4	64.3	38.8	45.2	65.0	37.1	35.1	62.4
	LT	23.5	22.1	40.0	22.8	0.0	3.1	8.5	48.0	46.8	29.7
	LI	5.4	4.9	12.4	6.0	0.0	0.0	0.0	14.9	18.0	7.8
C	UI	51.5	55.4	5.4	49.2	82.7	78.4	68.1	0.0	0.0	0.0
	UT	7.3	6.6	12.4	10.2	8.1	6.1	5.5	2.3	2.8	5.2
	D	35.3	32.5	64.0	34.0	9.1	15.5	26.4	61.5	59.6	75.8
	LT	6.0	5.5	16.5	6.5	0.0	0.0	0.0	30.3	29.2	14.8
	LI	0.0	0.0	1.7	0.0	0.0	0.0	0.0	5.9	8.3	4.2
D	UI	52.5	56.6	17.9	54.0	84.5	78.9	68.8	0.7	1.1	0.1
	UT	6.7	5.9	13.2	6.2	9.9	8.4	5.6	3.4	4.7	6.9
	D	40.8	37.4	51.7	37.9	5.7	12.8	25.5	68.4	62.1	75.9
	LT	0.0	0.1	17.2	1.8	0.0	0.0	0.0	22.8	24.7	14.0
	LI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	7.3	3.2
E	UI	46.5	50.1	4.3	44.6	74.9	69.6	58.9	0.0	0.0	0.0
	UT	4.3	3.0	10.0	6.4	7.2	3.0	5.6	0.2	1.1	0.9
	D	35.8	34.0	60.1	33.3	17.9	27.3	35.5	57.5	55.7	70.7
	LT	13.4	12.9	21.2	15.6	0.0	0.0	0.0	33.1	29.7	21.9
	LI	0.0	0.0	4.4	0.0	0.0	0.0	0.0	9.1	13.5	6.5
F	UI	10.6	18.6	0.0	13.6	60.7	51.8	40.2	0.0	0.0	0.0
	UT	8.8	13.6	0.1	9.1	7.2	7.2	10.3	0.0	0.0	0.0
	D	56.9	45.6	63.3	52.6	32.0	41.0	42.9	41.9	40.7	66.5
	LT	22.8	21.1	27.5	21.1	0.0	0.0	6.6	43.7	42.7	25.6
	LI	0.8	1.2	9.1	3.7	0.0	0.0	0.0	14.4	16.6	7.9
G	UI	6.5	16.1	0.1	10.8	52.4	46.1	29.5	0.0	0.0	0.0
	UT	10.1	5.9	0.0	6.9	10.0	6.7	14.4	0.0	0.1	0.1
	D	53.9	51.2	54.2	54.1	37.6	38.5	42.5	41.6	41.8	68.8
	LT	20.5	18.8	30.2	18.6	0.0	8.8	13.6	44.9	41.9	22.4
	LI	9.0	8.1	15.4	9.5	0.0	0.0	0.0	13.5	16.2	8.7
H	UI	1.8	9.4	0.1	5.9	57.0	48.4	22.0	0.0	0.0	0.0
	UT	6.3	8.0	0.0	5.1	7.8	6.3	21.5	0.0	0.0	0.1
	D	66.0	57.7	56.0	63.3	35.2	44.1	48.4	39.6	36.9	66.3
	LT	21.0	20.2	31.8	20.2	0.0	1.1	8.1	45.9	45.3	25.9
	LI	5.0	4.7	12.0	5.6	0.0	0.0	0.0	14.4	17.8	7.8
I	UI	0.7	5.7	0.1	1.9	54.5	43.0	16.9	0.0	0.0	0.0
	UT	3.9	6.7	0.0	6.7	10.6	12.0	19.4	0.0	0.0	0.1
	D	71.1	65.5	52.9	66.3	34.9	44.6	56.4	35.6	32.3	64.4
	LT	19.7	17.7	36.9	19.7	0.0	0.4	7.2	49.7	50.1	27.5
	LI	4.6	4.3	10.1	5.4	0.0	0.0	0.0	14.6	17.6	8.0
J	UI	16.2	21.4	0.0	16.2	64.3	55.9	44.5	0.0	0.0	0.0
	UT	6.6	17.0	0.1	14.8	7.8	5.6	8.6	0.0	0.0	0.0
	D	56.5	42.0	67.1	47.8	27.9	38.5	42.1	50.2	47.7	69.6
	LT	20.5	19.4	25.0	19.2	0.0	0.0	4.7	37.7	36.9	23.5
	LI	0.3	0.1	7.8	2.1	0.0	0.0	0.0	12.1	15.4	6.9
K	UI	0.1	4.0	0.1	1.6	49.9	36.5	15.8	0.0	0.0	0.1
	UT	2.3	6.7	0.0	6.2	13.4	16.0	17.8	0.0	0.1	0.0
	D	69.4	63.6	51.3	65.5	36.7	41.7	56.5	42.8	41.0	65.7
	LT	21.8	19.4	36.4	20.1	0.0	5.9	9.9	42.1	41.2	24.9
	LI	6.4	6.3	12.2	6.7	0.0	0.0	0.0	15.1	17.7	9.3
mean	UI	16.3	25.9	0.0	16.9	67.9	60.5	46.6	0.0	0.0	0.0
	UT	8.0	15.6	0.6	17.5	7.2	6.1	9.7	0.0	0.0	0.0
	D	53.6	38.6	65.6	43.1	24.9	33.4	39.8	52.4	49.8	65.4
	LT	21.8	19.9	24.7	21.8	0.0	0.0	3.9	34.0	32.4	26.1
	LI	0.3	0.0	9.2	0.7	0.0	0.0	0.0	13.6	17.7	8.5

Table S3. Percentage of full simulation period (01 Feb 2013 – 01 Oct 2014) simulated baseline, ensemble member and mean water levels are within each water depth zone (WDZ) for Desmoulin's whorl snail (*Vertigo moulinsiana*) at all piezometer locations. D, Desirable; T, Tolerable; I, Intolerable

Run ID	WDZ	North - no upwelling			North - upwelling				South		
		1	2	3	4	8	9	10	5	6	7
baseline	D	0.0	0.0	0.0	0.0	5.0	3.7	0.0	0.0	0.0	0.0
	T	58.1	61.8	39.3	59.7	82.1	78.8	75.0	35.0	32.7	44.3
	I	41.9	38.2	60.7	40.3	12.9	17.5	25.0	65.0	67.3	55.7
A	D	0.0	0.0	0.0	0.0	5.3	7.5	0.9	0.0	0.0	0.0
	T	64.8	68.6	51.2	64.7	81.8	75.3	77.6	33.1	31.8	42.0
	I	35.2	31.4	48.8	35.3	12.9	17.2	21.5	66.9	68.2	58.0
B	D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	T	50.2	53.4	21.9	51.5	79.9	70.6	63.7	21.0	20.0	34.5
	I	49.8	46.6	78.1	48.5	20.1	29.4	36.3	79.0	80.0	65.5
C	D	0.0	4.9	0.0	4.0	12.4	22.6	8.8	0.0	0.0	0.0
	T	75.3	71.7	56.5	71.3	77.3	65.6	74.4	39.0	37.8	48.2
	I	24.7	23.4	43.5	24.6	10.3	11.8	16.8	61.0	62.2	51.8
D	D	0.0	6.4	0.0	4.9	12.5	24.3	9.9	0.0	0.0	0.0
	T	75.6	70.5	60.1	70.5	79.1	65.4	74.0	44.5	42.2	53.0
	I	24.4	23.2	39.9	24.6	8.4	10.4	16.1	55.5	57.8	47.0
E	D	0.0	0.0	0.0	0.0	7.0	17.0	3.5	0.0	0.0	0.0
	T	69.5	70.7	53.7	69.3	80.8	66.0	75.1	34.4	33.8	44.1
	I	30.5	29.3	46.3	30.7	12.1	16.9	21.3	65.6	66.2	55.9
F	D	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0
	T	56.4	59.2	36.4	56.7	81.9	78.1	70.2	23.1	22.7	35.9
	I	43.6	40.8	63.6	43.3	17.2	21.9	29.8	76.9	77.3	64.1
G	D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	T	53.1	55.8	29.3	54.5	80.1	72.0	67.3	23.2	23.9	37.2
	I	46.9	44.2	70.7	45.5	19.9	28.0	32.7	76.8	76.1	62.8
H	D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	T	53.4	54.7	26.7	53.7	81.9	76.3	67.4	22.4	22.1	35.2
	I	46.6	45.3	73.3	46.3	18.1	23.7	32.6	77.6	77.9	64.8
I	D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	T	53.0	54.7	25.2	53.8	82.5	77.5	66.1	18.8	19.3	34.2
	I	47.0	45.3	74.8	46.2	17.5	22.5	33.9	81.2	80.7	65.8
J	D	0.0	0.0	0.0	0.0	2.6	0.2	0.0	0.0	0.0	0.0
	T	58.8	60.6	42.4	59.0	81.2	79.0	72.0	29.1	27.9	38.6
	I	41.2	39.4	57.6	41.0	16.2	20.7	28.0	70.9	72.1	61.4
K	D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	T	51.0	53.8	25.3	52.3	79.2	71.7	64.7	25.5	24.3	36.2
	I	49.0	46.2	74.7	47.7	20.8	28.3	35.3	74.5	75.7	63.8
mean	D	0.1	0.1	0.0	0.1	5.5	3.6	1.1	0.0	0.0	0.0
	T	59.4	61.0	44.1	59.3	78.8	76.4	72.8	31.3	28.8	39.8
	I	40.5	38.9	55.9	40.6	15.7	20.0	26.1	68.7	71.2	60.2