

Memo

Date	1 August 2018
To	OTOP Zone Committee
CC	
From	Dan Clark

Updated FAWP hydrology evaluation to include pro-rata partial restrictions

An evaluation of the hydrological impacts was carried out to assess the change in flows and water availability for abstractors under each of the Current, ZIPA step 1, ZIPA step 2, COMAR and FAWP proposed flow regimes. This evaluation is documented in the attached memo dated 28 June 2018

On 3 July 2018 ECan staff met with the FAWPs technical advisors to discuss the evaluation of the flow regimes in the ZIPA and the regime proposed by the FAWP. (This evaluation showed that the regime proposed by the FAWP does not set partial restrictions in a way which protects the minimum flow from being breached.) It was agreed at this meeting that the hydrological modelling methodology used by ECan in the evaluation of flow regimes was more robust than that previously presented by the FAWP and that it captures the detail of how dual minimum flows and partial restrictions could impact abstractors. ECan and the FAWP advisors agreed that using this modelling approach to evaluate all flow regimes allows the different impacts of the flow regimes to be shown and this should be the purpose of discussions rather than debating different modelling methodology.

As the FAWP has spent significant time working on their proposed flow regime, it was agreed that ECan would model the FAWP minimum flows with partial restrictions applied in a way which prevents the minimum flow from being breached. These partial restrictions have been applied as pro-rata as this provides the most allocation to be available for abstraction. As discussed in the original paper, a stepped regime must be set at a higher level than pro-rata restrictions to prevent the minimum flow being breached. In this assessment pro-rata restrictions have been applied for the top of the A allocation block (sum of AA, BA and AN) on each tributary.

Results from this assessment are as would be expected with this scenario, residual flows are generally improved from the FAWP proposal but not as much improvement as ZIPA step 1, availability for abstractors is reduced from the FAWP proposal but not as much reduction as in ZIPA step 1. Details of each of the sub-catchments follow.

North Opuha

No further evaluation was required as FAWP plus pro-rata partial restrictions is the same as the ZIPA recommendations.

South Opuha

Applying pro-rata restrictions to the FAWP minimum flows in the South Opuha results in low flows which are lower than those in the ZIPA step 1 scenarios but higher than those in the original FAWP proposal and what could occur under the current plan rules. Figure 1 shows that adding pro-rata partial restriction to the FAWP minimum flows reduces the potential flat-lining of flows which could occur under the original FAWP proposal which manages the South Opuha as a residual flow and allows users to take all of the available water above this.

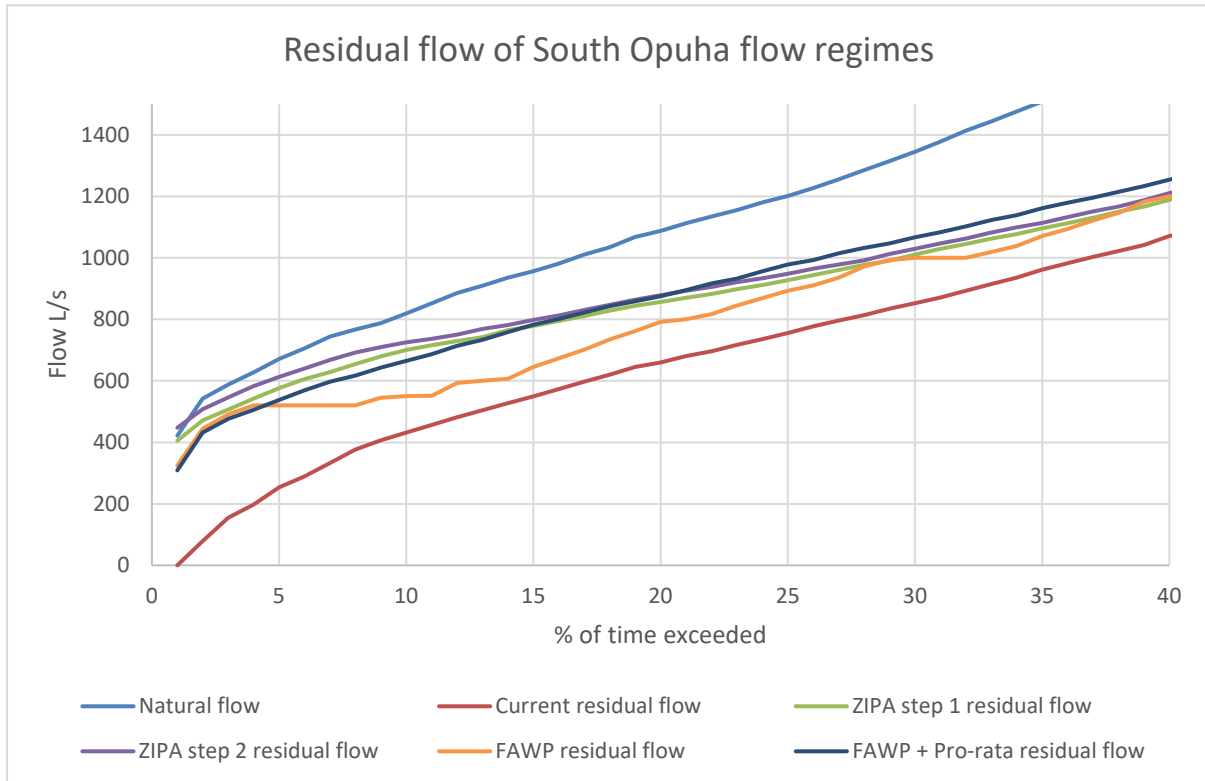


Figure 1 Flow duration curve of flows in the South Opuha under each of the evaluated flow regimes.

Under the FAWP plus pro-rata regime the percent availability is reduced from that of the original FAWP proposal. Table 1 shows this change in availability compared to the previously assessed flow regimes. Appendix 1 breaks this down to monthly availability.

Table 1 Summary of average reliability for allocation blocks in the South Opuha under different flow regimes

	Percent availability
Average of Current AA +BA	80
Average of Current AN	62
Average of Current BN	25
Average of ZIPA 1 AA + BA	64
Average of ZIPA 1 AN	54
Average of ZIPA 1 BN	23

Average of ZIPA 2 AA +BA	62
Average of ZIPA 2 AN	53
Average of ZIPA 2 BN	22
Average of FAWP BN	25
Average of FAWP Cascade	71
FAWP + Pro-rata BN	23
FAWP + Pro-Rata Cascade	61

Upper Opihi

Figure 2 shows the FAWP regime has lower summer minimum flows than the other flow regimes evaluated and when pro-rata restrictions are applied there is an improvement in low flows from the original FAWP proposal. This is due to the original FAWP regime allowing the minimum flow to be breached due to a stepped regime where the step was set too low. When pro-rata restrictions are applied this regime has lower summer low flows but higher mid-range flows than ZIPA step 1 due to the higher minimum flows outside the peak irrigation season.

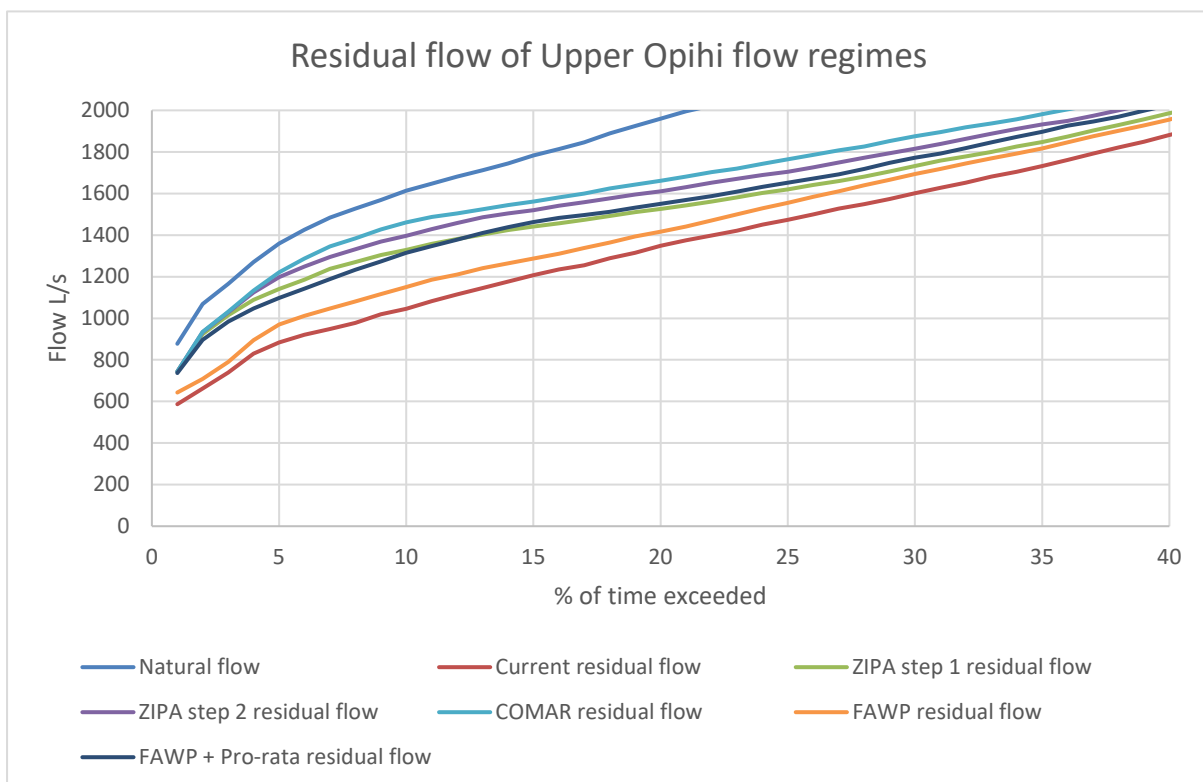


Figure 2 Flow duration curve of flows in the Upper Opihi under each of the evaluated flow regimes.

Table 2 shows that applying pro-rata restrictions to the FAWP minimum flows in the Upper Opihi reduced availability for abstractors from that in the original FAWP proposal. This reduction in

availability is highest for AA and BA consent holders. The resulting availability for these AA and BA consent holders in the FAWP plus pro-rata regime is similar to that under the ZIPA step 1 regime.

Table 2 Summary of average reliability for allocation blocks in the Upper Opihi under different flow regimes

	Percent availability
Average of Current AA + BA	87
Average of Current AN	67
Average of Current BN	26
Average of ZIPA 1 AA + BA	75
Average of ZIPA 1 AN	65
Average of ZIPA 1 BN	26
Average of ZIPA 2 AA + BA	70
Average of ZIPA 2 AN	61
Average of ZIPA 2 BN	26
Average of COMAR AA + BA	67
Average of COMAR AN	59
Average of COMAR BN	26
Average of FAWP AA+ BA	84
Average of FAWP AN	66
Average of FAWP BN	26
FAWP + Pro-rata AA +BA	74
FAWP + Pro-rata AN	64
FAWP + Pro-rata BN	26

Te Ana A Wai

The original FAWP proposal for the Te Ana a Wai Catchment had a stepped partial restriction regime which allowed minimum flows to be breached. As the minimum flow monitoring point is located in the middle of the catchment with abstractions upstream and downstream, much of the abstraction can occur without having a feedback effect on the minimum flow site. Setting pro-rata restrictions

reduces this risk and ensures that only the quantum of water above the minimum flow is available for abstraction. Figure 3 shows that by applying pro-rata partial restrictions to the FAWP minimum flows the residual low flows at the recorder are improved over the original FAWP proposal. The mid-range flows remain higher than those in the ZIPA step 1 regime due to higher minimum flows outside the peak irrigation season.

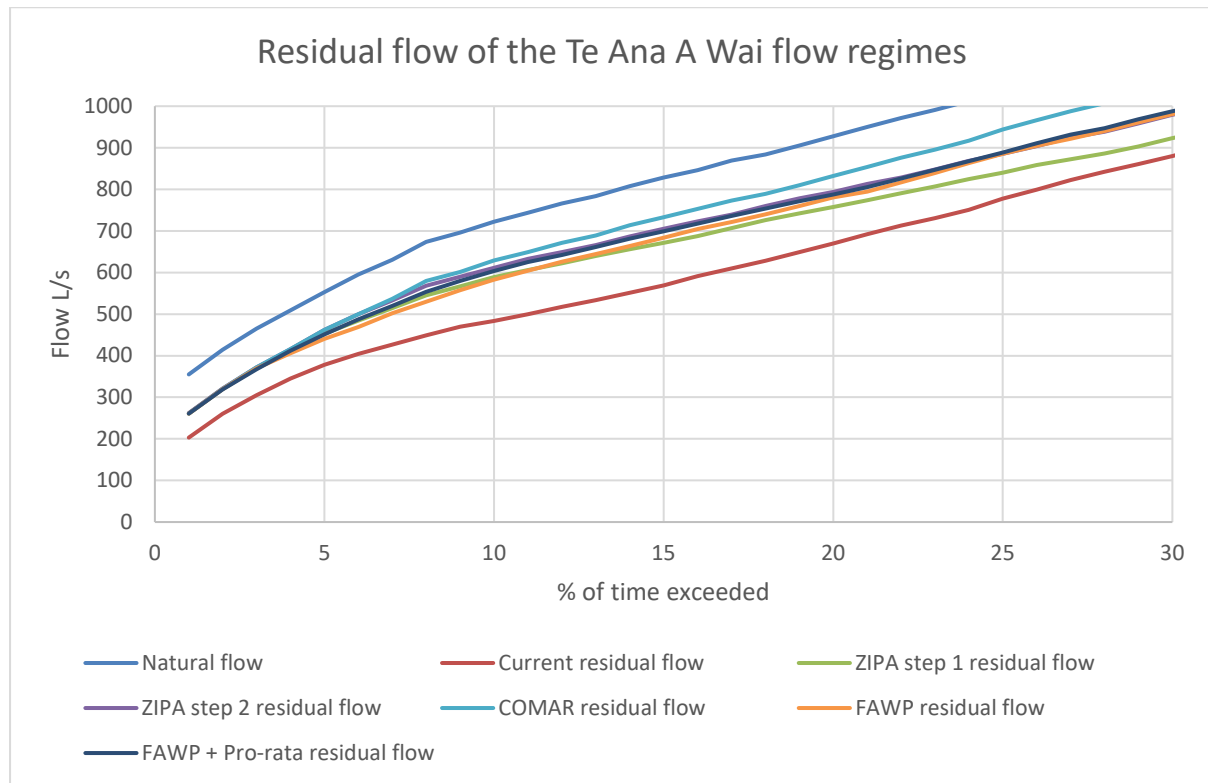


Figure 3 Flow duration curve of flows in the Te Ana A Wai under each of the evaluated flow regimes.

By adding pro-rata restrictions to the FAWP minimum flows the availability is reduced for the affiliated consent holders from that is the original FAWP proposal. However, adding these partial restrictions to the whole A allocation block the availability for AN consents improves to a level similar to that in ZIPA step 1. This is due to the original FAWP proposal prioritising the affiliated consent holders and the FAWP regime resulting in the AN consent holders facing the largest loss in water availability. Table 1 shows the changes in the availability for each allocation block under the evaluated flow regimes.

Table 3 Summary of average reliability for allocation blocks in the Te Ana A Wai under different flow regimes

	Percent availability
Average of Current AA + BA	91
Average of Current AN	68
Average of Current BN	26
Average of ZIPA 1 AA + BA	74
Average of ZIPA 1 AN	62

Average of ZIPA 1 BN	25
Average of ZIPA 2 AA + BA	70
Average of ZIPA 2 AN	60
Average of ZIPA 2 BN	25
Average of COMAR AA + BA	53
Average of COMAR AN	46
Average of COMAR BN	25
Average of FAWP AA+ BA	78
Average of FAWP AN	37
Average of FAWP BN	24
FAWP + Pro-rata AA + BA	71
FAWP + Pro-rata AN	61
FAWP + Pro-rata BN	25

Summary

Out of the regimes evaluated the original FAWP proposal provided abstractors with the least reduction in water availability, this regime also provided the smallest improvement in low flows from the current flow regime and did not protect the minimum flows from being breached because of abstraction. Adding pro-rata partial restrictions to the FAWP minimum flows provides an improvement in low flows and a consequent loss in availability from the original FAWP proposal but does protect the minimum flows being breached due to abstraction. The FAWP plus pro-rata partial restrictions regime sits between the original FAWP proposal and ZIPA step 1 regimes in terms of flow improvements and loss in water availability.

Appendix 1: Monthly summaries of water availability under each of the evaluated flow regimes

South Opuha average monthly percent availability

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Current AA +BA	84	75	70	64	73	71	69	72	83	97	100	96
Current AN	54	59	47	45	54	48	51	57	67	87	93	81
Current BN	28	19	19	16	32	33	23	23	23	29	28	28
ZIPA 1 AA + BA	70	57	49	46	56	53	50	53	55	93	99	87
ZIPA 1 AN	51	52	41	39	46	40	37	42	51	85	92	78
ZIPA 1 BN	27	17	17	15	29	28	19	19	19	29	28	28
ZIPA 2 AA +BA	61	54	46	43	56	53	50	53	55	92	98	86
ZIPA 2 AN	45	50	39	36	46	40	37	42	51	85	92	77
ZIPA 2 BN	25	16	16	14	29	28	19	19	19	29	28	28
FAWP BA	84	76	69	51	57	56	49	56	73	98	100	98
FAWP BN	28	18	19	16	32	33	23	23	23	29	28	29
FAWP Cascade	84	76	66	49	57	56	49	56	68	96	100	96
FAWP + Pro-rata BA	74	61	51	38	47	46	40	44	54	90	98	89
FAWP + Pro-rata BN	27	18	18	15	29	8	18	17	21	29	28	28
FAWP + Pro-Rata Cascade	74	61	51	38	47	46	40	44	54	90	98	89

Upper Ophi average monthly percent availability

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Current AA + BA	87	89	82	64	83	81	91	93	85	91	98	95
Current AN	56	66	53	45	62	54	66	72	70	84	91	81
Current BN	28	19	19	16	32	33	25	26	23	29	28	29
ZIPA 1 AA + BA	72	73	63	54	73	70	81	86	73	86	89	85
ZIPA 1 AN	55	64	51	46	62	55	66	72	67	81	85	77
ZIPA 1 BN	27	19	19	16	32	33	25	26	23	29	28	29
ZIPA 2 AA + BA	67	67	57	48	67	64	75	81	67	82	84	80
ZIPA 2 AN	52	63	49	41	57	51	63	69	62	77	80	74
ZIPA 2 BN	27	19	19	16	32	33	25	26	23	29	28	29
COMAR AA + BA	60	59	48	48	67	64	75	81	67	82	76	74
COMAR AN	46	56	43	41	57	51	63	69	62	77	72	68
COMAR BN	27	19	19	16	32	33	25	26	23	29	27	29
FAWP AA+ BA	87	89	80	59	78	76	86	91	79	91	97	94
FAWP AN	56	66	53	43	60	53	65	71	67	84	91	81
FAWP BN	28	19	19	16	33	33	25	26	23	29	28	29
FAWP + Pro-rata AA +BA	77	78	67	48	68	65	76	82	67	84	91	88
FAWP + Pro-rata AN	57	66	53	41	58	51	63	70	63	79	86	80
FAWP + Pro-rata BN	28	19	19	16	32	33	25	26	23	29	28	29

Te Ana A Wai average monthly percent availability

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Current AA + BA	80	79	72	78	100	100	100	100	95	97	96	91
Current AN	55	65	51	48	65	58	68	74	73	87	89	79
Current BN	28	19	19	16	33	33	25	26	23	29	28	29
ZIPA 1 AA + BA	69	66	57	61	64	61	75	90	90	90	83	82
ZIPA 1 AN	51	59	46	46	55	48	61	73	71	82	79	74
ZIPA 1 BN	27	18	19	16	30	33	25	26	23	29	27	29
ZIPA 2 AA + BA	67	64	55	58	57	50	65	82	91	89	82	81
ZIPA 2 AN	50	58	45	45	50	41	55	69	72	81	78	73
ZIPA 2 BN	27	18	19	16	29	32	25	26	23	29	27	29
COMAR AA + BA	47	41	33	33	57	52	65	83	50	63	54	60
COMAR AN	35	38	28	31	50	42	55	69	45	58	51	54
COMAR BN	27	17	19	16	29	32	25	26	23	29	26	28
FAWP AA+ BA	80	79	69	58	62	58	71	92	85	91	94	91
FAWP AN	32	35	25	26	37	31	38	45	32	49	43	46
FAWP BN	26	17	18	16	26	29	24	25	23	28	26	27
FAWP + Pro-rata AA + BA	73	72	60	51	58	52	66	88	73	85	87	86
FAWP + Pro-rata AN	53	63	48	42	51	42	55	72	63	78	82	77
FAWP + Pro-rata BN	27	19	19	16	29	33	25	26	23	29	27	29

