

Hydrological effects of afforestation of the Taiko Stream

Prepared for Forest Management Limited

December 2022

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NIWA CLIENT REPORT No: 2022353CH
Report date: December 2022
NIWA Project: SCJPRO235 FML MD TAIKO

Revision	Description	Date
Version 1.0	Final Report	8 December 2022

Quality Assurance Statement		
	Reviewed by:	Jim Griffiths
	Formatting checked by:	Rachel Wright
	Approved for release by:	Charles Pearson

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Executive summary

- The Taiko Stream catchment is categorised as a flow-sensitive catchment so the effects of new afforestation on abstractors and the environment are a consideration when Environment Canterbury decides whether or not to grant a consent for this discretionary activity.
- This report uses calculations by Evans and Evans (2022) on the effect of the proposed plantation and currently consented forests, or those that have consents pending, for new plantation forest on the 7-day mean annual low flow (7-day MALF) and mean flow.
- Evans (2022) reports the combined “new” forest area is 488 ha and is estimated to not to reduce the 7-day MALF and to reduce the mean flow by 3.4 L/s (3.4%).
- The flow reductions attributable to “new” afforestation for the Taipo Stream are so small, especially at very low flows, that any effects on the extent, frequency and duration of drying reaches is unlikely to be discernible.
- The flow reductions attributable to “new” afforestation for the Taipo Stream are so small that they would be undetectable at the Pareora River at Huts, so that no matter what trigger level for reduction of abstractions, there would be no reduction in water availability.

1 Introduction

Thomas Forbes of Forest Management Limited asked NIWA to assist with hydrological aspects of a resource consent application to plant a new forest in the flow-sensitive Taiko Stream catchment. Evans and Evans (2022) assessed the effect of this proposed forest on the 7-day mean annual low flow (7-day MALF) and mean flow. This report examines how the calculated flow reductions will affect the extent, frequency, and duration of dry reaches in the Taiko Stream and the water availability at the Pareora River at Huts, down-stream where abstraction is affected by minimum flows.

2 Background

The Canterbury Regional Council, or Environment Canterbury (ECan) is concerned about the impacts of new forestry in short grassland catchments (for which the hydrographs exhibit steep recession curves) on instream values and the reliability of the water supply to existing resource consent holders. Plan Change 7 (PC7) of the Canterbury Land and Water Regional Plan (ECan 2018) has recently become operative, and its Rules 5.189 and 5.190 (ECan 2021, Appendix A) state that new plantation forestry in flow sensitive catchments is a “discretionary” activity. An assessment of the effect of flow changes resulting from new afforestation, and the effect on abstractors and the environment will help in the decision as to whether the new plantation is consented or not.

The Taiko River is listed as a flow sensitive catchment in Section 14.7 of ECan (2018). There are no changes to this section as a result of PC7.

3 Assessment of the effects of afforestation

Evans and Evans (2022) assessed the effects of “new” (planted since November 2012) consented, pending, and proposed afforestation in the Taiko Stream catchment at its confluence with the Pareora River, on 7-day mean annual low flows (7-day MALF) and mean flow. Evans and Evans (2022) determined that the proposed forest has no effect of the 7-day MALF, and the mean flow will reduce by 0.7 L/s or 0.7% of the total catchment flow. The proposed forest together with other post-2012 consented forests are estimated to reduce the 7-day MALF and mean flows in the Taiko Stream by 0% and 3.4% (3.1 L/s) respectively (Evans and Evans 2022).

The effect on the extent, frequency, and duration of dry reaches in the Taiko Stream will be assessed by considering the effect of the relative magnitude of flows with and without the afforestation.

To determine the effect of any of these flow reductions on the flow regime at the Pareora River at Huts, flow statistics at that site, with and without, the effect of the Taiko catchment “new” forests will be examined to see if there were any discernible changes that would affect water availability there. As there are flow reductions in the Taiko Stream at mean flow and not at the 7-day MALF, the contributions of the Taiko Stream to the Pareora River at Huts will be scaled so that flows greater than the mean are reduced by 3.4% of the mean flow of the Taiko Stream and reduced to zero between the mean flow and the highest annual low flow.

4 Results and conclusion

4.1 Effects on drying reaches on the Taiko Stream

Evans and Evans (2022) determined that the proposed forest together with other post-2012 consented forests is estimated to reduce the 7-day MALF and mean flows in the Taiko Stream by 0% and 3.4% respectively. As the extent, frequency and duration of drying reaches are affected primarily by low flows and the new forests have no effect on the 7-day MALF, there is unlikely to be any effect on drying reaches of the Taiko Stream. Even if higher flows are reduced, any reduction of flow as low as 3.4% (3.1 L/s) cannot be measured and is unlikely to have any discernible effect.

4.2 Effects on water availability at the Pareora River at Huts

To examine the effect of reduced flows on flows in the Pareora River at Huts the 20-year record of flows was compared with the record modified by reducing that record with reduced inflows from the Taiko Stream according to the effects found by Evans and Evans (2022). The following assumptions were made:

1. Both catchment respond similarly to rainfall inputs.
2. Taiko Stream inputs to the Pareora River were reduced by 3.1 L/s for flow greater than the mean (flows less than the mean flow are of most concern).
3. Flows less than the maximum 7-day annual low flow in the Pareora River were not affected as the Taiko forests did not affect the Taiko Stream 7-day MALF.
4. The 3.1 L/s flow reduction in the Taipo Stream inflow was prorated between the Pareora River mean flow and maximum annual low flow.

The results are shown in Table 4-1. The differences in flow between the two records are very small in both discharge (0-18 L/s) and percentage terms (maximum reduction 0.16%). Accordingly, regardless of the trigger level for cessation of abstraction, there would be no reduction in water availability.

Table 4-1: Flow statistics from the Pareora River at Huts and the Pareora at Huts less inputs from a forested Taiko Stream.

Site	Minimum (L/s)	Maximum (L/s)	Mean (L/s)	Std. Devi.	Median (L/s)	Lower quartile (L/s)	Upper quartile (L/s)	95% exceedance
Pareora at Huts	240	682509	3585	15126	1261	743	2584	10073
Pareora less Taiko	240	682506	3580	15113	1259	742	2581	10055
Percent reduction	Nil	0.0004	0.1395	0.0859	0.1586	0.1346	0.1161	0.1787

In conclusion, the flow reductions attributable to “new” afforestation in the Taipo Stream catchment are so small, especially at very low flows, that any effects on the extent, frequency and duration of drying reaches are unlikely to be discernible.

With regards to the water availability at the Pareora River at Huts, the flow reductions attributable to “new” afforestation for the Taipo Stream are so small that they would be undetectable at the Pareora River at Huts, so no matter what trigger level for reduction of abstractions, there would be no reduction in water availability.

5 References

Environment Canterbury (2021) Decision on provisions of Proposed Plan Change 7 to the Canterbury Land and Water Regional Plan.

Environment Canterbury (2018) Canterbury Land and Water Regional Plan, Volume 1.

Evans, M.J., Evans, P.H. (2022) Effects of a proposed forest on the Taiko Stream flow sensitive catchment. Forest Management Ltd. 13 p.

Appendix A PC7 Plantation Forestry extract

Taken from Environment Canterbury (2021) Decision on provisions of Proposed Plan Change 7 to the Canterbury Land and Water Regional Plan.

- 5.189 Any plantation forestry activity regulated by the Resource Management (National Environmental Standards for Plantation Forestry) Regulations including:
- A. the use, excavation, deposition or disturbance of land, including land¹⁴¹ in the bed of a lake or river, or in a wetland; or
 - B. the planting, replanting or clearance of vegetation, including in, on, or under the bed of a lake or river, or in a wetland; or
 - C. the taking or diverting of water; or
 - D. the discharge of contaminants into water or onto or into land in circumstances where it may enter water;

is a permitted activity, provided the following conditions are met:

- 1. Planting of new areas does not occur within any Flow Sensitive Catchment listed in Sections 6 to 15 of this Plan; and
- 2. Replanting within any Flow Sensitive Catchment listed in Sections 6 to 15 of this Plan:
 - A. the total area replanted does not exceed the area of harvest; and
 - B. the replanting occurs in the same location or within the same area used as part of the rotation of the forestry operation as at 1 November 2010; and
 - C. any replanting occurs within five years of the removal of the previous forest cover; and
- 3. The concentration of total suspended solids in the discharge does not exceed:
 - A. 50 g/m³ where the discharge is to any spring-fed river, Banks Peninsula River, or to a lake, except when the background total suspended solids in the waterbody is greater than 50 g/m³ in which case the Schedule 5 visual clarity standards shall apply; or
 - B. 100 g/m³ where the discharge is to any other river or to an artificial watercourse except when the background total suspended solids in the waterbody is greater than 100 g/m³ in which case the Schedule 5 visual clarity standards shall apply; and
- 4. The activity is not undertaken in any Indigenous Freshwater Species Habitat Critical Habitat or in a salmon spawning site listed in Schedule 17; and
- 5. The activity is not undertaken in any inanga spawning habitat during the inanga spawning season of 1 March to 1 June inclusive; and
- 6. The activity does not reduce the area of a wetland; and

7. Any portable container used to store a hazardous substance (including fuel) is not located within:
 - A. 20 m of a surface water body or a bore; or
 - B. a Community Drinking-water Protection Zone as set out in Schedule 1; and
8. The activity does not occur within an area identified as a Rock Art Management Area on the Planning Maps.¹⁴⁶

5.190 Any plantation forestry activity regulated by the Resource Management (National Environmental Standards for Plantation Forestry) Regulations including:

- A. the use, excavation, deposition or disturbance of land, including in the bed of a lake or river, or in a wetland; or
- B. the planting, replanting or clearance of vegetation, including in, on, or under the bed of a lake or river, or in a wetland; or
- C. the taking or diverting of water; or
- D. the discharge of water or contaminants into or onto land in circumstances where it may enter water;

that does not meet one or more of the conditions of Rule 5.189 is a discretionary activity.