

Appendix J: Water Quality Assessment

**Arterial Traffic Study
Evaluation of Best Arterial Route Options:
Water Quality & Aquatic Ecology**

Prepared for Nelson City Council

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1 Introduction

Stage 1 of the Nelson Arterial Study included an evaluation of the potential water quality and aquatic ecology impacts of the existing arterial routes, these being Rocks Road and Waimea Road / Rutherford Street. That evaluation provided a base case assessment of current and predicted future traffic volumes on the existing routes, against which the best arterial route options can be compared.

The Stage 1 evaluation noted that construction and operation of a main arterial route may affect water quality and aquatic ecology where it:

- a) crosses or impinges on a watercourse;
- b) alters the natural flow regime by channel straightening, widening, armouring or increasing the area of impermeable surfaces within the upstream catchment;
- c) impairs habitat provision including the types, amount, and quality of habitats that the water body reach provides for flora and fauna;
- d) creates a barrier to the upstream migrations of fish via culvert or weir;
- e) reduces shade and temperature control; and
- f) discharges stormwater runoff and associated contaminants from road surfaces to the water body.

These effects are normally associated with the loss of vegetation cover and the development of infrastructure within the catchment. Ecological functioning tends to become progressively impaired as the extent and intensity of urban development in the catchment increases.

2 Existing Effects on Water Quality and Ecology

2.1 Current Situation

All of the freshwater bodies within the Nelson study area have suffered some impairment of ecological functions, but these effects are largely associated with the wider urbanisation of the catchment, of which the major roads are but one component.

Effects which can be attributed specifically to the existing arterial routes include the following:

- a) Bridge crossing of Maitai River estuary and associated erosion protection work, including rip-rap armouring may contribute to the channelization of the lower river and its separation from the flood plain, but this effect is minor.
- b) The seawall protecting Wakefield Quay and The Rocks Road extends into the intertidal zone of Tasman Bay. The southern 400m length of wall beginning at Tahunanui Beach lies within a sand dominated environment. Further north the mobile sand gives way to distinctive rocky outcrops. The original construction of the seawall resulted in the loss of some rocky shore habitat, but a considerable expanse of intertidal rocky shore remains. The ecological functions provided by this habitat are now partially provided by the hard surfaces of the seawall. The little black mussel, limpet and rock oyster are common on the rocky outcrops and abundant on the seawall.
- c) A minor unnamed watercourse is piped under Tahunanui Drive near Tamaki Street, and remains culverted for much of its length downstream of this point. Culverting has removed most of the aquatic habitat from the stream. It is noted however that native fish (banded kokopu and koaro) have been recorded in the estuarine reach downstream of Beach Road.
- d) A minor unnamed watercourse is piped under Tahunanui Drive near Maire Street, and remains culverted downstream as far as Bolt Street. This has removed much of the aquatic habitat from the

lower stream. The culvert under Tahunanui Drive contributes to the loss of ecological performance of the stream.

- e) Jenkins Creek passes under a bridge on Waimea Road at Enner Glynn and under Annesbrooke Drive near Douglas Road. It is also culverted for a 50m reach beside Whakatu Drive. These structures contribute to the channelization of the stream and its separation from the flood plain. However, most of the lower stream is constrained, channelized and otherwise modified to protect adjacent residential and commercial areas. Much of the catchment surface area is impervious (roads, carparks, roofs etc) which will have some impact on the hydraulic function of the stream. It is noted that Jenkins Stream supports at least 6 species of native fish.
- f) York Stream is culverted under Waimea Drive at Bishopdale Reserve and remains piped for much of its length downstream. It appears for short reaches downstream of Tukutuka Street and at Vanguard Street. It then eventually reappears again in the estuarine reach beside Haven Road where it has been channelized and straightened, removing much of the estuarine habitat. The Waimea Road culvert includes a vertical weir which may impede the upstream migration of fish. As much of middle and lower stream is either piped or heavily channelized, its ecological functions are significantly impaired. The existing arterial route (at Waimea Drive and Haven Road) makes a minor or moderate contribution to this loss of ecological performance.
- g) Stormwater runoff from the existing arterial routes discharge to these watercourses or directly to Tasman Bay. Stormwater runoff from road surfaces typically carries elevated concentrations of copper, zinc, lead and PAH's which are potentially toxic to aquatic organisms. Studies in Nelson and elsewhere in New Zealand (i.e., Waitamata Harbour, Wellington Harbour) highlight the risk of these contaminants accumulating in riverine and marine sediments and eventually reaching concentrations which adversely affect the benthic ecology. The risk is highest where high traffic volumes occur next to a low energy receiving environment (semi enclosed estuary or sheltered embayment). The modest traffic volumes in Nelson compared with Auckland and Wellington coupled with the moderately exposed characteristics of Tasman Bay would suggest that the risk of toxicity in Tasman Bay is relatively low. However, there is already evidence that contaminants in the lower reaches of the Maitai River and some of Nelsons urban streams are at levels that may adversely affect the benthic biota (Cawthron 2006).

2.2 Future Situation under a Do-Minimum Scenario

Traffic volumes (private car trips) on the existing road network through Nelson are projected to increase by 26-28% for 2036 compared to 2006. These modelling predictions incorporate a number of proposed roading improvements that are considered necessary to retain a reasonable level of service for motorists (refer *Evaluation of Existing Arterial Routes*, MWH 2010). However as none of these improvements include significant new infrastructure they are unlikely to cause future adverse effects on watercourses beyond those that currently occur.

General urban development in Nelson over this period will increase the proportion of impervious surfaces, causing further incremental impairment of hydraulic functions of watercourses. Nevertheless the Do-minimum arterial routes will not greatly alter the road footprint and will not contribute significantly to future development within these catchments.

While the surface area of arterial roads is not likely to change significantly, the 26-28% increase in traffic volumes will increase contaminant loads washed from road surfaces to watercourses by stormwater runoff. It is difficult to quantify the level of increase in contaminant loads from road runoff because of potential changes in traffic behaviour, fuel and road surface specifications, and vehicle emissions, but it could be conservatively assumed to be roughly in line with the growth in vehicle numbers.

3 Short listed Arterial Route Options

Stage 2 of this study included the selection of four options for further investigation (refer *Selection of Best Arterial Route Options*, MWH 2010). These are:

- Option A: Part-time Clearways
- Option B: Southern Arterial
- Option H: Rocks Road Four Lane
- Option I: Waimea Road / Rutherford Street Four Lane

4 Comparison with the Do-minimum Scenario

4.1 Option A: Part Time Clearways

Option A proposes to install part time clearways on Rocks Road and Waimea Road. Along the waterfront the footpath on the seaward side at the seawall would be widened, with piles or by cantilevered construction. Stream crossings elsewhere on the route will not be significantly modified. This option is not likely to increase traffic volumes beyond those projected for the future Do-minimum scenario. Potential adverse effects compared with the Do-minimum option are:

- Depending of the construction method selected for seawall construction, the impact on the seashore ecology is likely to be minor or less than minor.

4.2 Option B: Southern Arterial

Option B would involve the construction of a new Southern Arterial route beside Beatson Road, along the Railway Reserve and up Vincent Street. This would be a two-lane two-way road with at grade intersections (possibly not at grade at Beatson Road end). A separate 3m wide footpath/cycleway would be provided along the Railway Reserve. Road construction works would be undertaken in the York Stream and Jenkins Creek catchments. A new or significantly modified crossing of Jenkins Creek would be required at Beatson Road. This option would shift traffic from Rocks Road and Waimea Road onto the new arterial route but would not greatly change traffic volumes through the Jenkins Creek catchment because all three routes run across this catchment. It would increase traffic volumes in the York Stream catchment by 27% over the next 30 years compared with 13% for the future Do-minimum scenario. Potential adverse effects compared with the Do-minimum option are:

- Greenfields road construction in York Stream and Jenkins Creek catchments will increase suspended solids loads in stormwater runoff to these watercourses during the construction phase, with potential adverse effects on benthic ecology and fish populations. These effects can be appropriately mitigated by the implementation of an erosion and sediment control management plan.
- Increased traffic volumes in the York Stream catchment could lead to increased loads of toxicants (primarily copper, zinc, lead and PAH's) in stormwater runoff from road surfaces. This could potentially accelerate the accumulation of contaminants in the lower reaches of the Stream where fine sediments settle and accumulate. Contaminant levels are already significantly elevated in sediments in the middle reaches of York Stream (Bennett 2006). Options to minimise further increases in contaminant loads include the use stormwater treatment devices and the incorporation of low impact urban design features such swales or filter strips (ARC TP10, 2003).
- Increased area of impervious surfaces in the York Stream and Jenkins Creek catchments due to the construction of a new road is likely to further modify the hydraulic function of these streams (reduced groundwater recharge, reduced stream base flow and increased peak flow) , with potentially adverse effects on the stream ecology. However, as the new road footprint is small compared with the total area of the stream catchments, the magnitude of these effects is likely to be minor. Options to

mitigate these effects include various methods to reduce runoff rates and increase groundwater recharge (refer ARC TP10, 2003).

- A new or modified crossing of Jenkins Creek at Beatson Road may cause further loss of aquatic habitat, however the scale of this modification is likely to be small compared to the existing culverting beside Waimea Road.

4.3 Option H: Rocks Road Four Lane

Option H would involve widening the existing SH6 route between Annesbrook roundabout and the Haven Road roundabout to provide four lanes; two in each direction. Along the Rocks Road section of the route this would include a new seawall to be constructed approximately 10m northwest of the existing one. Minor streams already piped under Tahunanui Drive will not be affected by new structures. However the Annesbrook Drive crossing of Jenkins Creek would need to be widened. Modelling indicates that this option would not increase total traffic volumes on the Rocks Road. It would therefore not cause any increase in contaminant loads in stormwater runoff from the road surface compared with the future Do-minimum scenario. Potential adverse effects compared with the Do-minimum option are:

- Construction of a new seawall some 10m seaward of the existing wall will result in the loss of some 4,800m² of intertidal sandy shore habitat and 17,000m² of intertidal rocky shore. While the benthic communities found in the footprint of the expanded seawall are not unusual or rare the loss of habitat on this scale is a significant issue.
- Modifications to the Annesbrook Drive crossing of Jenkins Creek will be required, but this is unlikely to significantly affect ecological functioning of the Creek due to the already highly modified character of this reach.
- Increased area of impervious surfaces in the Jenkins Creek catchments due to the widening of the existing route may further modify the hydraulic function of this stream. However, as the increase in road surface area is small compared with the total area of the stream catchment, the magnitude of these effects is likely to be minor and a range of mitigation options are available.

4.4 Option I: Waimea Road / Rutherford Street Four Lane

Option I would provide four lanes on the existing Waimea Road and Rutherford Street route from the Annesbrook Drive roundabout to the Haven Road roundabout. This option does not involve any additional encroachment on waterways, except possibly where existing crossings of Jenkins Creek and York Stream need to be modified or widened. Traffic volumes are predicted to increase on this route by 19% over 30 years compared with 13% for the future Do-minimum scenario. Potential adverse effects compared with the Do-minimum option are:

- Potential modification to the crossing of Jenkins Creek at Enner Glynn and of York Stream at Bishopdale may be required, but these modifications are unlikely to significantly affect ecological functioning of these watercourses due to their already highly modified character.
- Increased traffic volumes in the York Stream catchment may lead to increased loads of toxicants in stormwater runoff from road surfaces. This could potentially accelerate the accumulation of contaminants in the lower reaches of the Stream as already discussed for options B and I. Options available to minimise further increases in contaminant loads are described in ARC TP10 (2003).
- Increased area of impervious surfaces in the York Stream and Jenkins Creek catchments due to the widening of the existing route is likely to further modify the hydraulic function of these streams (reduced groundwater recharge, reduced stream base flow and increased peak flow), with potentially adverse effects on the stream ecology. However, as the increase road surface area is small compared with the total area of the stream catchments, the magnitude of these effects is likely to be minor and a range of mitigation options are available.

5 Summary and Conclusion

The potential adverse effects of Option A: 'Part time clearways' are probably little different from the 'Dominant scenario' in that very little change to the road footprint is required and traffic is spread over both of the existing arterial routes rather than being concentrated on one route.

Option B: 'Southern Arterial' requires construction of a new 'green-fields' road which will increase the total area of impervious surface, and consequently affect the hydraulic functions of Jenkins Creek and York Stream, albeit by a small amount. Short term construction impacts include likely increases in sediment loads discharged in stormwater runoff to both streams. In the longer term this option will also increase traffic and contaminant run-off in the York Stream catchment. On balance these effects will probably be minor provided appropriate mitigation measures are implemented during both construction and operational phases.

Option H: 'Rocks Four Lane' requires a new seawall and reclamation of intertidal seashore, including approximately 17,000m² of rocky shore habitat. While the benthic biota of this area is relatively sparse the rocky outcrops supports a simple benthic community typical of Tasman Bay, including the barnacle, little black mussel, limpet, tubeworm and a number of algae and sponges. The benthic communities found in the footprint of the expanded seawall are not unusual or rare. Nevertheless the loss of habitat on this scale is a significant issue.

Option I: 'Waimea/Rutherford Four Lane' will require widening of existing roadways and modifications of existing stream crossings and will tend to increase traffic and contaminant run-off in the York Stream catchment. Road widening will increase the total area of impervious surface, and consequently affect the hydraulic functions of Jenkins Creek and York Stream, albeit by a small amount. These effects can be mitigated by a variety of methods to reduce runoff rates, increase groundwater recharge and reduce contaminant loads to the Stream.

On the basis of existing information, Option A: 'Part time clearways' has the least potential for causing adverse effects on water quality and aquatic ecology. The three other options all have some potential to cause adverse effects, but most can be mitigated by engineering design and careful management. The loss of rocky shoreline caused by Option H is the most significant of the adverse effect identified.

References

ARC TP10 (2003): Auckland Regional Council Stormwater Management Design Manual.

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