

Appendix C9B.07

Road De-icing Examination

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Aquatic Ecology Road De-icing Water Quality Examination

TEN-T Priority Route Improvement Project, Donegal



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To provide an overview of baseline and potential impact of road de-icing (winter maintenance) on watercourses within the catchment of the Proposed Development, an examination was undertaken of records provided by Donegal County Council for winter road maintenance conducted within the county (including existing N13, N14 and N15 which covers Sections 1, 2 and 3 of the proposed development). During each winter season a maintenance log is kept by the council, recording date and type of de-icing activity. **Table 9B.07.1** summarises number of days of Winter Maintenance (WM) recorded for winter seasons between 2019 and 2025 (data for 2022-2023 period was unavailable when this analysis was conducted).

Table 9B.07.1 Summary of Winter Maintenance (WM) (Donegal County Council records)

WM Season	No days WM in season	WM start-stop date per winter season [total days]	%WM Days during winter season	%WM Days Annually
2019-2020	85	24 Oct 2019 - 13 April 2020 [171]	50%	23%
2020-2021	75	18 Nov 2020 - 30 April 2021 [163]	46%	21%
2021-2022	58	10 Nov 2021 - 8 April 2022 [149]	39%	16%
2023-2024	53	3 Nov 2023 - 26 April 2024 [175]	30%	15%
2024-2025	51	17 Nov 2024 - 23 March 2025 [126]	40%	14%

Winter maintenance includes snow-ploughing, road gritting and (to a much lesser extent) brine application. "Gritting" (sodium chloride salt and grit) is the most common de-icing application. Note that number of winter maintenance days listed in **Table 9B.07.1** is conservative because many days reported an instruction to "hold off in showers", and/or "carry out patrols and Grit Where Necessary" (GWN). Therefore, not all days counted in the above record involved actual salting of road surfaces.

Conservatively, therefore, the median number of days per winter season (2019 - 2025) that de-icing was undertaken was 58 (range: 51-85 days). The WM season generally starts in November and ends in March/April. In these years, between 70% and 50% of days within winter seasons involved no de-icing activity. Between 86% and 77% of days annually involved no de-icing activity.

Chloride concentrations are monitored only at selected EPA national river monitoring stations. To provide an overview of existing baseline river chloride concentrations (which include effects of the current de-icing regime) three representative river stations, where chloride results are available in the EPA water chemistry dataset, were examined as follows:

- Chloride is monitored in the Finn_070 river water body at water sampling station RS01F010900 (Bridge S. of Killygordon); main channel approximately 8 km downstream of Ballybofey/Stranorlar;
- Chloride is monitored in the Deelee (Donegal)_030 at water sampling station RS01D010500 (Bridge 1.5 km S.E. of Convoy); River Deelee main channel, 11 km upstream of the proposed Section 3 bridge.
- Chloride is not monitored in the Swilly_010 river water body in proximity to the proposed development near Letterkenny owing to proximity to tidal saline influence. Chloride is, however, monitored on the freshwater River Swilly main channel at water sampling station RS39S020200 (Bridge at Newmills), 4.5 km upstream of Letterkenny.

Figures 9B.07.1, 9B.07.2, 9B.07.3 illustrate the chloride (mg/l) trends at each river station covering years for which there was a broadly continuous annual record. Sampling tends to be carried out for this parameter approximately 5 times per annum at broadly 2-to-3-month intervals at each station. Sampling station locations are shown on **Figure 9B.07.4**. Red bars in the below graphs denote samples taken in the winter season (i.e., when de-icing salt is being deployed in winter maintenance).

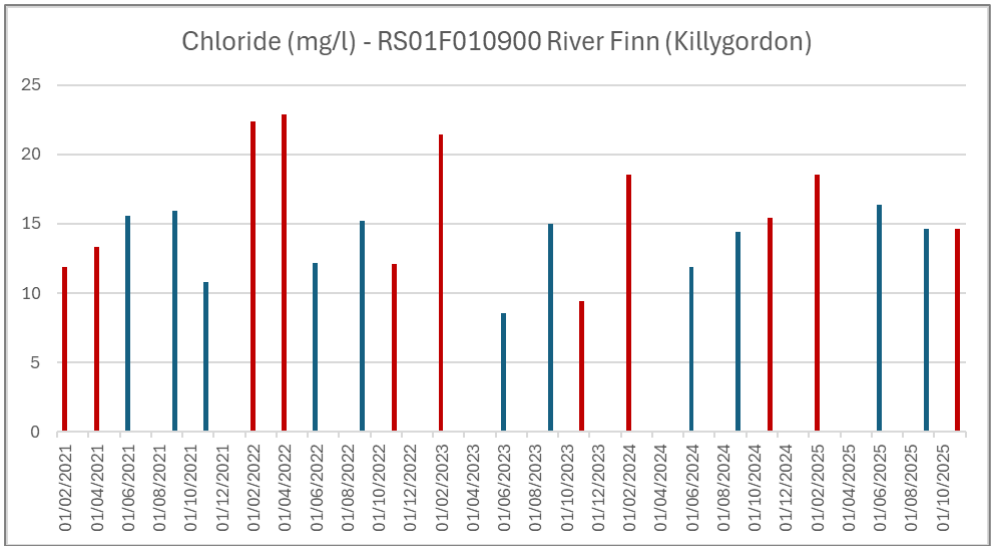


Figure 9B.07.1 River Finn – Chloride (mg/l) trends 2021-2025

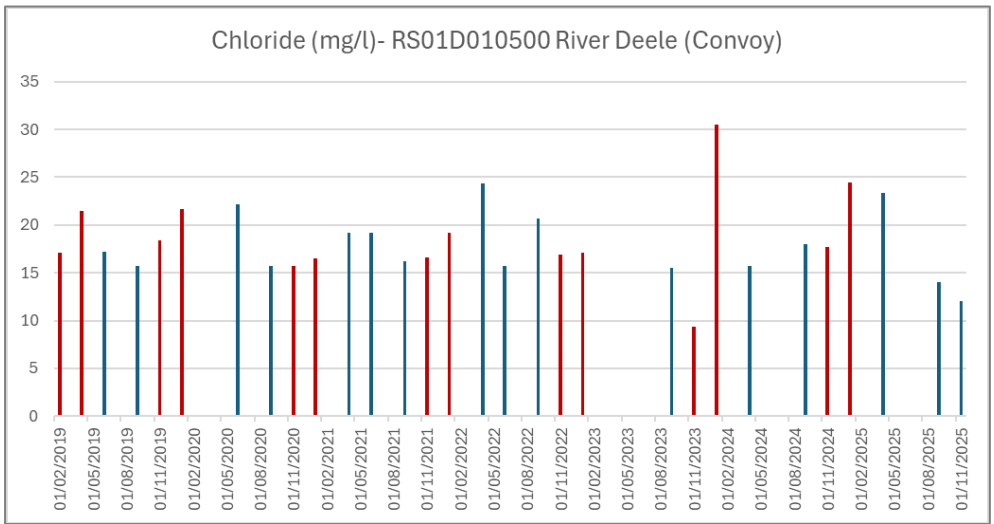


Figure 9B.07.2 River Deelee – Chloride (mg/l) trends 2019-2025

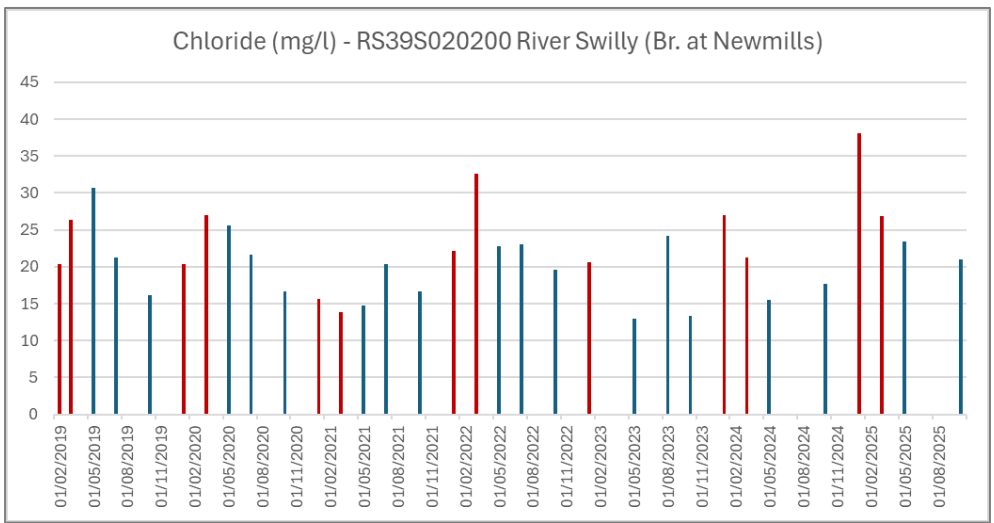


Figure 9B.07.3 River Swilly – Chloride (mg/l) trends 2019-2025

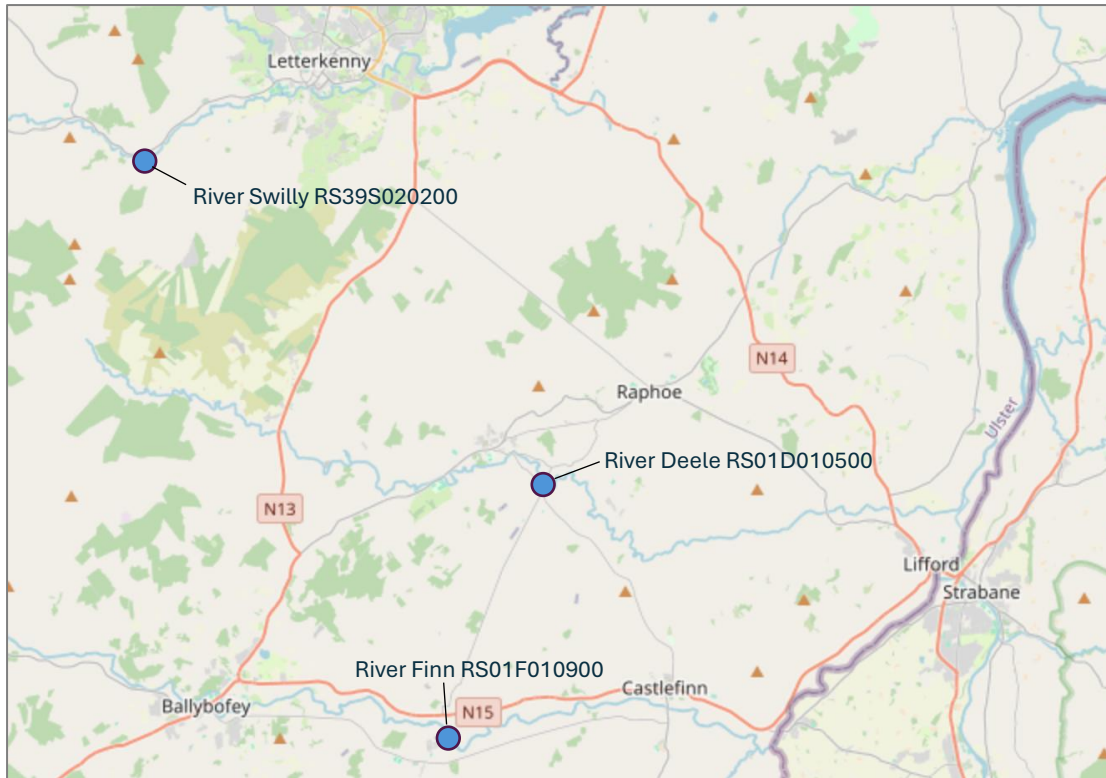


Figure 9B.07.3 Location of relevant EPA National Water Monitoring Stations with chloride data

Table 9B.07.2 summarises mean and median concentration; and range for chloride concentration (mg Cl/l) at each monitoring station. Normal chloride concentrations for natural waters in Ireland is circa 15-35 mg/l Cl, depending on local rock type and coastal (sea spray) influence. Mean (and even maximum) chloride is generally within, or close to within, this range at each of the three stations.

Table 9B.07.2 Summary of chloride concentration (mg/l) at EPA river stations

Chloride (mg/l)	River Finn RS01F010900	River Deelee RS01D010500	River Swilly RS39S020200
No. samples in date range	22	30	32
Median	14.8	17.2	21.2
Mean	15.0	18.2	21.5
Min.	8.6	9.3	12.9
Max.	22.9	30.5	38.1

Slightly elevated chloride levels occurred on occasion. Figures 9B.07.1, 9B.07.2, 9B.07.3 show that at each station, the maximum concentration occurred during the winter season, but that wasn't true for every winter season and there were times outside winter that concentrations showed spikes. There is a faint seasonal signal at the River Finn and River Swilly stations, but a less obvious seasonal trend on the River Deelee. The River Deelee station is just over 1 km downstream of Convoy wastewater treatment plant discharge; sewage being a rich source of chloride, which may explain the results.

Other anthropomorphic sources chloride are industrial effluents, agricultural fertilizer (potassium chloride salt) and animal slurry. The chloride signals in the EPA monitoring record at these stations, each of which have a dominance of agricultural land use in the upstream catchments may well be linked to these latter two sources. This could also explain a trend of slightly elevated chloride in winter

months when there is strong hydrological connectivity from agricultural fields, slatted sheds and farmyards.

The aim of this examination is not to provide an exhaustive review of tolerances of freshwater organisms to chloride concentrations. That data is extensively reviewed in the international literature for ecosystem function (e.g., ¹Hintz & Relyea, 2019) and underpinning of chloride water quality standards for aquatic life (CCME, 2011, Hong *et al.*, 2023). There is also agreement across Europe that further study is required with regards to effects and management of road de-icing salts (²Revitt *et al.*, 2023), especially in climates subject to long hard winters (i.e., unlike Ireland). However, the following standards currently set internationally for chloride concentrations, place the above results for main stem County Donegal rivers in broad context:

- In Canada, the short-term threshold for chloride for aquatic organisms derived from lethality studies, is 640 mg/l. The long-term threshold for chloride (as no effect concentrations for aquatic organisms) is 120 mg/l (³CCME, 2011)
- U.S. Environmental Protection Agency stipulates acute and chronic chloride thresholds of 860 mg/l and 230 mg/l, respectively, for protection of aquatic life in freshwaters (⁴US EPA, 1988).
- The Water Quality Standard (WQS) put forward for chloride for protection of freshwater organisms in China is: 'less than 200 mg/l'. This was derived through review of international studies of chloride toxicity to aquatic organisms and a species sensitivity distribution method to reach the recommended WQS (⁵Hong *et al.*, 2023)
- The designated limit for chloride in the EU drinking water directive, and in ⁶Ireland, is 250mg/l, but there is no environmental quality standard (EQS) for chloride for freshwater organisms.

Based on the above established criteria, the available EPA water sampling evidence from the main stem rivers shows low chloride concentrations (certainly in the context of rivers that are within 30 km of the coast). There is no obvious evidence that routine winter maintenance (de-icing salts) has a notable effect on main stem concentrations that could adversely affect aquatic organisms. This is notwithstanding that smaller channels (less dilution) may experience higher chloride concentrations during winter seasons. However, any brief spikes in chloride concentration in the available dataset cannot, at these relatively low concentrations, be reliably decoupled from wider catchment sources such as agricultural point and diffuse sources and sewage discharges.

The proposed 47 km of new dual carriageway for the Donegal PRIPD across two water catchments (Finn/Foyle and Swilly) will increase the winter maintenance road salt usage requirement proportionate to surface area. However, the run-off will largely be attenuated in the series of purpose-built constructed wetlands. It cannot be ruled out that salinity may seasonally fluctuate in the ponds to some extent, and that habitats within may adapt to that influence. It would be useful to monitor representative ponds and adjoining receiving waters post-construction to provide additional information which could be used in adapting the ongoing Winter Maintenance schedule as more research emerges on this topic across Europe (Revitt *et al.*, 2023).

¹ Hintz, W. D. and Relyea, R. A. (2019) A review of the species, community, and ecosystem impacts of road salt salinisation in fresh waters. *Freshwater Biol.*; 64: 1081–1097. <https://doi.org/10.1111/fwb.13286>

² Revitt, M., Lundy, L. and Ellis, B. (2023) Call 2016 Water Quality Final Programme Report. CEDR Contractor Report 2023-01. Environmentally Sustainable Roads: Surface- and Groundwater. CEDR Transnational Road Research Programme.

³ CCME (2011) Canadian water quality guidelines for the protection of aquatic life: Chloride. Canadian Council of Ministers of the Environment. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

⁴ US EPA (1988) National Recommended Water Quality Criteria - Aquatic Life Criteria Table. Available at: <https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table> (Accessed November 2025).

⁵ Hong Y, Zhu Z, Liao W, Yan Z, Feng C, Xu D. (2023) Freshwater Water-Quality Criteria for Chloride and Guidance for the Revision of the Water Quality Standard in China. *Int J Environ Res Public Health*: 20 (4): 2875.

⁶ S.I. No. 99/2023 - European Union (Drinking Water) Regulations 2023