ENVIRONMENTAL IMPACT ASSESSMENT

Alto High-Speed Rail Project

Potential Impacts of High-Speed Rail on the Moira River Watershed

1. Executive Summary

This analysis evaluates the potential environmental effects of the proposed Alto High-Speed Rail (HSR) Project on the Moira River Watershed. The Alto project, proposes approximately 1,000 kilometres of HSR connecting Toronto and Québec City.

Between Ottawa and Peterborough both corridors currently under study traverse the Moira River Watershed. This assessment focuses specifically on the watershed impacts within Hastings County and adjacent portions of Lennox and Addington and Frontenac counties.

The Moira River Watershed encompasses approximately 2,860 km² in southeastern Ontario, flowing from the Canadian Shield highlands near Madoc southward to the Bay of Quinte at Belleville. Administered by the Quinte Conservation Authority, the watershed supports diverse aquatic and terrestrial ecosystems, provides municipal drinking water, and serves as a critical corridor for migratory species. Belleville City Council, in its February 23, 2026 motion opposing the southern corridor, specifically cited impacts to “prime agricultural land, Moira watershed and some densely-populated residential areas.”

The northern corridor follows a direct alignment across the Canadian Shield through Lanark, Frontenac, and Hastings counties, broadly paralleling Highway 7. Within the watershed, it traverses the upper headwaters zone near Madoc, crossing Precambrian bedrock, drumlin formations, and regionally significant groundwater recharge areas that feed the Moira River system.

The southern corridor swings from Ottawa southwest through Perth/Smiths Falls, then through portions of Lanark, Frontenac, Leeds and Grenville, Lennox and Addington, and Hastings counties before veering north to Peterborough. The study corridor passes approximately 10 km north of Belleville, potentially affecting Foxboro, Halloway, Plainfield, and Chatterton—communities situated within the Moira River Watershed along or near the river’s mainstem and floodplain.

Both corridors present significant environmental risks to the watershed. The northern corridor poses greater risks to headwater ecosystems, groundwater recharge, and upland forest habitat in the upper watershed. The southern corridor presents more direct threats to the Moira River mainstem and floodplain, Provincially Significant Wetlands, prime agricultural land, and species at risk in the mid-to-lower watershed.

Assessment Parameter	Northern Route	Southern Route
Watershed Overlap Zone	Upper watershed (Madoc headwaters)	Mid/lower watershed (Foxboro–Plainfield)
Terrain Within Watershed	Canadian Shield bedrock, drumlin, forest	Agricultural floodplain, settlement areas
Watercourse Interactions	Headwater tributaries, Moira Lake area	Moira River mainstem, floodplain
Wetland Areas at Risk	Chapman’s Creek complex (indirect)	Latta Marsh, floodplain wetlands (direct)
Groundwater Recharge Impact	High (kame moraine disruption)	Moderate

Assessment Parameter	Northern Route	Southern Route
Species at Risk Overlap	3 species (upper watershed)	7 species (mainstem and floodplain)
Agricultural Land Impact	Minimal (Shield terrain)	High (prime agricultural land)
Communities Affected	Madoc, Tweed area	Foxboro, Halloway, Plainfield, Chatterton
Overall Watershed Risk Rating	Moderate	Moderate–High

2. Project Description

2.1 Project Overview

The Alto HSR Project is managed by the Crown corporation Alto, with the Cadence consortium (CDPQ Infra, AtkinsRéalis, Keolis, SYSTRA Canada, Air Canada, SNCF Voyageurs) as private development partner. The project proposes approximately 1,000 km of dedicated electrified track connecting Toronto and Québec City, with intermediate stations at Peterborough, Ottawa, Montréal, Laval, and Trois-Rivières. Trains will operate at up to 300 km/h on fully grade-separated, fenced track requiring a minimum curve radius of approximately 7 km. The estimated cost is $60–$90 billion (2024 dollars). The project is in a four-year pre-construction phase (through 2029–2030), with public consultation running January 15 to March 29, 2026.

2.2 Route Alternatives – Intersection with the Moira River Watershed

2.2.1 Northern Route – Upper Watershed

The Northern Route follows a direct alignment across the Canadian Shield through Lanark, Frontenac, and Hastings counties, broadly paralleling Highway 7. Within the Moira watershed, it traverses the upper headwaters zone near Madoc, where the Moira River system originates in Precambrian bedrock terrain with mixed forest, drumlin formations, and sparse settlement. The Municipality of Centre Hastings has advocated for a future station at Madoc (Highway 7 / Highway 62 intersection). Alto has described this route as more direct but involving complex construction in remote Shield terrain.

2.2.2 Southern Route – Mid-to-Lower Watershed

The Southern Route swings from Ottawa through Perth/Smiths Falls, cutting through Lanark, Frontenac, Lennox and Addington, and Hastings counties before veering north to Peterborough. Within the watershed, the study corridor passes approximately 10 km north of Belleville, potentially affecting Foxboro (on the Moira River at Highway 62), Halloway, Plainfield, and Chatterton—communities in the mid-to-lower watershed where the Moira River is a well-established watercourse with an extensive regulatory floodplain.

On February 23, 2026, Belleville City Council unanimously opposed the southern route, citing impacts to ecosystems, environmentally-sensitive areas, prime agricultural land, and the Moira watershed. Councillor Brown noted the corridor would divide farmland and create dead-end roads with no local HSR stops to offset impacts. On February 25, 2026, the local MP issued a statement opposing both routes based on unresolved environmental and community concerns.

2.3 Construction Timeline

The development phase runs through 2029–2030. Construction will proceed in 8–10 year phases, with the Ottawa–Montréal segment first. The Ottawa–Peterborough segment that intersects the Moira watershed will follow. Alto aims to follow existing corridors where possible to limit impacts.

3. Moira River Watershed – Baseline Conditions

3.1 Watershed Geography

The Moira River Watershed drains approximately 2,860 km², flowing from Canadian Shield highlands near Madoc to the Bay of Quinte at Belleville. The watershed spans a striking physiographic gradient: the northern reaches lie on Precambrian bedrock with thin soils, forest cover, and cold-water headwater streams; the central and southern reaches transition to limestone plains, glacial till, and deep agricultural soils. The Northern Route intersects the Shield headwaters zone; the Southern Route intersects the agricultural and settlement zone of the mid-to-lower watershed.

3.2 Hydrology

Mean annual discharge at Belleville (Station 02HL003) is approximately 24.5 m³/s. The Moira River is susceptible to ice-jam flooding in late winter and spring freshet flooding. The watershed contains 14 sub-basins, 26 named tributaries, and over 180 km of permanent watercourses. Groundwater recharge through the kame moraine between Tweed and Madoc provides critical baseflow, sustaining cold-water tributaries and summer flows. The most extensive regulatory floodplain occurs between Foxboro and Belleville—directly within the Southern Route corridor.

3.3 Ecological Features

Ecological Feature	Description	Watershed Zone	Route Overlap
Moira Lake and Headwaters	Lake and cold-water stream system	Upper (Madoc)	Northern
Skootamatta River Headwaters	Cold-water Brook Trout habitat, ANSI	Upper	Northern
Thomasburg Forest	Mature mixed forest, 120+ year stands, ANSI	Upper–Mid	Northern
Chapman's Creek Wetland	580 ha marsh/swamp, PSW	Upper–Mid	Northern (nearby)
Stoco Lake Fen Complex	Rare calcareous fen, PSW	Upper	Northern (nearby)
Moira River Mainstem (Foxboro–Plainfield)	Walleye, Bass, Muskie fishery	Mid–Lower	Southern
Latta Marsh	340 ha riverine wetland, PSW	Mid	Southern

Ecological Feature	Description	Watershed Zone	Route Overlap
Moira River Floodplain	Regulatory floodplain, riparian forest	Mid–Lower	Southern

3.4 Species at Risk

Species	Status (SARA/ESA)	Watershed Habitat	Route Overlap
Blanding's Turtle	Threatened	Wetland, upland nesting (throughout)	Both
Eastern Whip-poor-will	Threatened	Semi-open Shield forest (upper)	Northern
Butternut Tree	Endangered	Riparian, forest edge (throughout)	Both
Barn Swallow	Threatened	Open foraging, farm structures	Both
Lake Sturgeon	Endangered	Mainstem spawning (mid–lower)	Southern
Eastern Meadowlark	Threatened	Agricultural fields (mid–lower)	Southern
Silver Shiner	Threatened	Clear warm stream reaches (mid)	Southern

4. Impact Assessment – Northern Route (Upper Watershed)

The Northern Route traverses the upper Moira River Watershed through Canadian Shield terrain near Madoc, along the Highway 7 corridor.

4.1 Headwater Streams

The corridor crosses multiple headwater tributaries draining into Moira Lake and the upper Moira River. These small, cold-water streams are sensitive to sedimentation. Thin Shield soils offer limited infiltration, so construction runoff travels rapidly to watercourses. However, the headwater position means impacts remain localised and do not directly affect the mainstem downstream.

4.2 Groundwater Recharge

This is the Northern Route's most significant watershed-level impact. The corridor traverses the kame moraine and drumlin complexes between Tweed and Madoc, regionally important recharge zones sustaining baseflow throughout the Moira system. Bedrock blasting could alter fracture-flow groundwater systems delivering cold-water inputs to Moira Lake. Tunnel or deep-

cut construction through drumlins may intercept shallow groundwater, and temporary dewatering could create drawdown cones affecting wells and surface features.

4.3 Terrestrial Ecosystems

A fenced, grade-separated corridor through Shield forest would fragment habitat between Thomasburg Forest ANSI, Stoco Lake wetlands, and Chapman's Creek PSW. Interior forest supporting Eastern Whip-poor-will would be reduced. Chapman's Creek (580 ha) could experience indirect impacts from altered drainage and construction disturbance.

4.4 Aquatic Ecosystems

Headwater streams support Brook Trout, sensitive to sedimentation and thermal change. The Skootamatta River headwaters ANSI lies within or near the corridor. Blanding's Turtle habitat is present in the upper watershed wetlands.

4.5 Impact Summary

Watershed Impact	Construction	Operation	Overall
Headwater Stream Quality	Moderate–High	Low	**Moderate**
Groundwater Recharge / Baseflow	High	Moderate	**High**
Wetland Function (indirect)	Moderate	Low–Moderate	**Moderate**
Forest / Shield Habitat	High	N/A (permanent)	**High**
Wildlife Corridors	High	High	**High**
Aquatic Habitat (tributaries)	Moderate	Low	**Moderate**
Species at Risk (3 species)	Moderate	Low–Moderate	**Moderate**
Bedrock Blasting / Vibration	High	N/A	**Moderate**

5. Impact Assessment – Southern Route (Mid-to-Lower Watershed)

The Southern Route traverses the Moira watershed's most productive zone: the agricultural floodplain and settlement lands between Foxboro and Plainfield, approximately 10 km north of Belleville.

5.1 Moira River Mainstem

The corridor crosses or approaches the Moira River mainstem in the Foxboro–Plainfield reach. Bridge construction would require in-water work generating sediment, flow disruption, and habitat disturbance. The regulatory floodplain here is the watershed's most extensive. Flood-proofed embankments could displace flood storage, increasing upstream stages. The Moira's

susceptibility to ice-jam flooding compounds this risk, a qualitatively different profile than the Northern Route's headwater crossings.

5.2 Wetland Impacts

The corridor intersects or approaches Latta Marsh (340 ha PSW). Impacts could include direct construction disturbance or indirect effects from altered drainage. Additional floodplain wetlands between Foxboro and Plainfield are also at risk. With 65–70% of the watershed's pre-settlement wetlands already lost, any further loss is ecologically significant.

5.3 Agricultural Land and Communities

The corridor traverses prime agricultural land in Thurlow Ward and Hastings County. The fenced HSR line would divide farmland, create dead-end roads, and permanently alter watershed communities—with no local stops. Foxboro, situated directly on the Moira River, and surrounding communities serve as stewards of the watershed landscape. Emergency services and agricultural operations would be disrupted.

5.4 Aquatic Ecosystems and Species at Risk

The Foxboro–Plainfield reach supports Walleye, Smallmouth Bass, Muskellunge, and Endangered Lake Sturgeon. Seven species at risk overlap this corridor (vs. three for the Northern Route). Blanding's Turtle nesting and Eastern Meadowlark habitat are present. Mainstem crossings, floodplain disturbance, and wetland impacts make regulatory permitting significantly more complex.

5.5 Impact Summary

Watershed Impact	Construction	Operation	Overall
Moira River Mainstem Quality	High	Low–Moderate	**Moderate–High**
Flood Regime / Floodplain	Moderate	High	**High**
Wetland Function (Latta + floodplain)	High	Moderate–High	**High**
Agricultural Land	High	High (permanent)	**High**
Riparian Habitat	High	N/A (permanent)	**High**
Aquatic Habitat (mainstem)	High	Moderate	**High**
Species at Risk (7 species)	High	Moderate–High	**High**
Community / Watershed Stewardship	High	Moderate	**Moderate–High**

6. Comparative Analysis – Watershed Impacts

The matrix below compares both routes' effects specifically within the Moira River Watershed, assuming standard mitigation.

Watershed Impact	Northern	Southern	Greater Impact
Headwater / Tributary Quality	Moderate	Low	**Northern**
Mainstem River Quality	Low	Moderate–High	**Southern**
Groundwater Recharge / Baseflow	High	Moderate	**Northern**
Flood Regime	Low	High	**Southern**
Wetland Impacts	Moderate (indirect)	High (direct)	**Southern**
Forest / Upland Habitat	High	Moderate	**Northern**
Agricultural Land	Low	High	**Southern**
Riparian / Floodplain	Low	High	**Southern**
Aquatic Ecosystems	Moderate	High	**Southern**
Species at Risk	Moderate (3 spp)	High (7 spp)	**Southern**
Wildlife Corridors	High	Moderate	**Northern**
Community Disruption	Moderate	High	**Southern**

The Southern Route presents higher watershed risk in 8 of 12 categories, concentrated on the Moira's most ecologically productive zone—the mainstem, floodplain, and surrounding agricultural and wetland landscape. The Northern Route's impacts concentrate on the upper headwaters, where groundwater recharge disruption is the principal concern. While recharge impacts could propagate downstream through reduced baseflow, they are more amenable to monitoring and adaptive management than the Southern Route's direct mainstem and floodplain disturbance.

7. Mitigation Framework

7.1 General Watershed Protection (Both Routes)

Erosion and Sediment Control: Multi-barrier systems conforming to the GGH Conservation Authorities guideline (2006), with continuous turbidity monitoring at all watershed watercourse crossings.

Stormwater Management: Post-construction water balance targets maintaining pre-development runoff volumes and quality. Low Impact Development measures maximised.

Species at Risk: Pre-construction surveys for all 14 documented species. Avoidance plans with MNRF/ECCC. Offsetting at 2:1 (Threatened) or 3:1 (Endangered) within the Moira watershed.

Wildlife Crossings: Dedicated structures at intervals determined by corridor-specific wildlife movement mapping, essential given the fully fenced design.

7.2 Northern Route – Upper Watershed

Groundwater Protection: Grouting and waterproofing in kame moraine/drumlin construction. Monitoring network (20+ wells) established one year pre-construction. Adaptive triggers at 2% baseflow reduction.

Bedrock Management: Controlled blasting to minimise fracture propagation. Continuous vibration monitoring at cold-water streams and wetlands.

Wildlife Corridors: Large-span underpasses (30+ m) and vegetated overpasses connecting Thomasburg Forest, Chapman's Creek, and Stoco Lake complexes.

7.3 Southern Route – Mid-to-Lower Watershed

Floodplain Compensation: All displaced storage compensated at 1.5:1 ratio. Hydraulic modelling including ice-jam dynamics must confirm no increase in flood stages.

Lake Sturgeon Protection: Avoidance of spawning (May–July) and staging (Sept–Nov) periods. Bubble curtains and real-time hydroacoustic monitoring with automatic work stoppages.

Latta Marsh Protection: Elevated structures with 40+ m pier spacing if alignment intersects PSW. Wetland offsetting at 3:1 within the watershed. Single matted access corridor with full restoration.

Agricultural Mitigation: Grade-separated farm crossings. Road over/underpasses at all public crossings. Federal expropriation compensation for severed land.

8. Monitoring and Adaptive Management

A watershed-specific monitoring program shall begin one year pre-construction and continue 10+ years post-operations.

Component	Parameters	Frequency	Duration
Surface Water Quality	TSS, turbidity, nutrients, temperature, DO	Continuous / Monthly	Construction + 10 yr
Groundwater	Water table, baseflow contributions	Continuous	Construction + 10 yr
Moira River Flow	Discharge, flood stages, ice dynamics	Continuous	Construction + 10 yr
Fish Community	Species, abundance, spawning	Semi-annual	Pre-constr. + 10 yr
Benthic Invertebrates	Biomass, diversity, tolerance	Annual	Pre-constr. + 10 yr

Component	Parameters	Frequency	Duration
Wetland Hydrology	Water levels, hydroperiod	Continuous	Pre-constr. + 15 yr
Species at Risk	Population surveys, nesting	Annual (seasonal)	Pre-constr. + 10 yr
Wildlife Crossings	Usage by species	Continuous (camera)	Years 1–10 ops
Agricultural Impacts	Drainage, soil, crop yield	Annual	Construction + 5 yr

An Environmental Monitoring Committee—comprising Alto, the Quinte Conservation Authority, provincial and federal agencies, and the Mohawks of the Bay of Quinte—shall oversee the program.

9. Cumulative Effects on the Moira River Watershed

Cumulative pressures on the watershed include agricultural intensification, rural development, existing transportation infrastructure (Highways 401, 7, 62), and climate change. Climate projections indicate increased winter rainfall and flood frequency, compounding the Southern Route's floodplain risks and the Northern Route's baseflow reduction effects.

With 65–70% of pre-settlement wetlands already lost, any additional loss undermines watershed resilience. Net positive wetland outcomes through offsetting ratios exceeding 1:1 are essential.

Councillor Brown's comparison to Highway 401 construction is instructive: the 401 bisected rural lands but provided local access. The Alto HSR line would be a fenced corridor with no stops between Ottawa and Peterborough—producing watershed impacts without commensurate local benefits.

10. Conclusions and Recommendations

1. Both routes present significant impacts to the Moira River Watershed, but differ in nature and severity. The Northern Route affects the upper headwaters; the Southern Route affects the mid-to-lower watershed's most ecologically productive and hydrologically significant zone.
2. The Northern Route presents a lower overall watershed risk profile. Its principal impacts—groundwater recharge disruption and forest fragmentation near Madoc—are significant but more amenable to monitoring and adaptive management than the Southern Route's direct disturbance of the Moira River mainstem, floodplain, and wetlands.
3. The Southern Route poses higher risks to the watershed's most sensitive features: the mainstem between Foxboro and Plainfield, the regulatory floodplain, Latta Marsh, Lake Sturgeon habitat, and prime agricultural land sustaining watershed communities.
4. Municipal opposition from Belleville City Council, citing Moira watershed impacts specifically, reflects local consensus that the Southern Route presents unacceptable risks to this watershed system.
5. If the Northern Route is selected, groundwater protection must be the overriding priority, with comprehensive monitoring and adaptive management to prevent cascading baseflow reductions throughout the watershed.

6. If the Southern Route is selected, floodplain compensation (including ice-jam modelling), Lake Sturgeon protection, and wetland offsetting must be demonstrated as feasible before construction authorisation.
7. Regardless of route, a minimum 10-year watershed monitoring program is essential. The Quinte Conservation Authority and Mohawks of the Bay of Quinte shall be partners in monitoring and stewardship.
8. Given the 10-km corridor width and absence of a final alignment, detailed site-specific watershed studies must accompany corridor narrowing.

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