The Dublin MetroLink Project

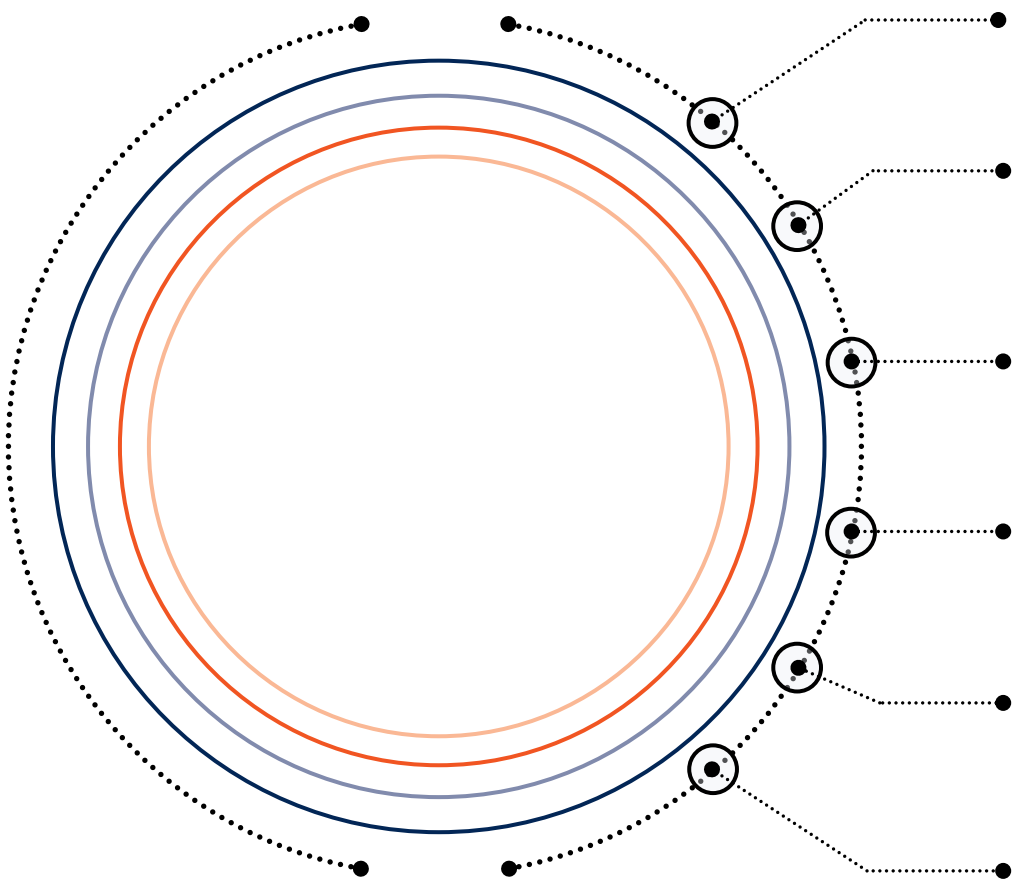
Environmental and Socio-Economic Impacts: Insights and Recommendations

Fundamentals on Environment and Sustainability

Group 6

7th of May 2025

Agenda



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1. Project Overview

MetroLink Dublin: A Landmark Public Transport Initiative Under Project Ireland 2040

Project:
- **First metro system in Ireland**
- High-capacity metro line from Swords (north Dublin) to Charlemont (south city centre) via Dublin Airport

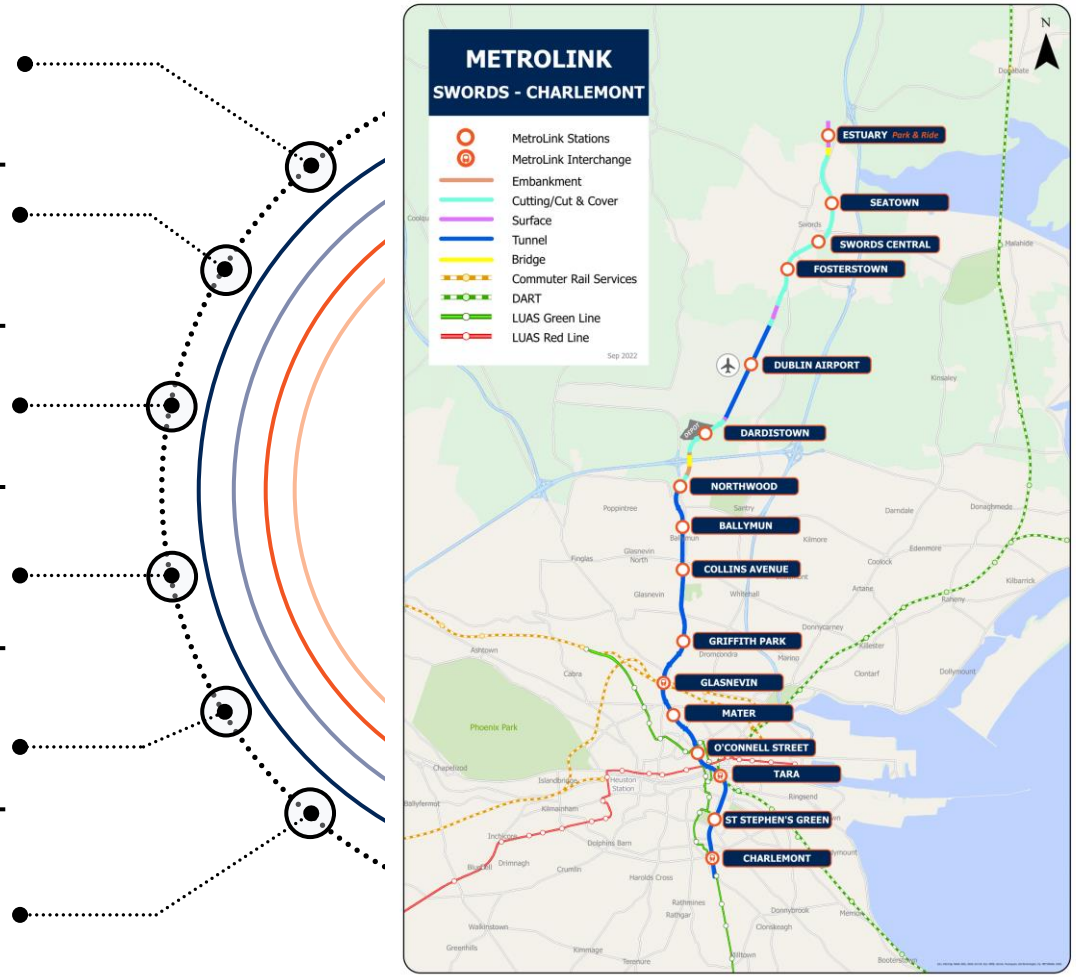
Purpose:
- Improve **connectivity** by linking major destinations (city centre, airport, universities, hospitals)
- **Integrating** with existing rail, tram (Luas) and bus networks

Project Authorities:
- Delivered by **Transport Infrastructure Ireland (TII)** with oversight by the National Transport Authority (NTA)
- Funded by the Irish Government (Project Ireland 2040)

Scale:
- **~19 km** mostly-underground line with **16 new stations**
- Fully automated (driverless) metro system with high-frequency, high-capacity service

Cost:
- Latest official capital cost estimate is **~€9.5 billion** (Dept. of Transport, 2023)
- **Largest transport infrastructure investment in Irish history**

Timeline:
- Railway Order (planning application) submitted in Sep 2022
- Construction is expected to take **~6–8 years** once approved, with service launch projected by the **mid-2030s**



2. Air

Air Impact Assessment and MetroLink Mitigation Measures

The Importance of Air

- Clean air is critical for maintaining human health and environmental quality
- In urban environments like Dublin, **transport-related emissions** are a leading contributor to air pollution
- The emissions impact **respiratory health**, **cardiovascular conditions**, and overall **public well-being**
- MetroLink presents an opportunity to shift away from polluting modes of transport, supporting Ireland's climate and public health objectives

Construction Phase Impacts

Impact Category	Description	Impact
Noise Levels	*Construction activities will generate elevated noise levels, reaching up to 85 dB in residential and institutional zones.*	
Vibration Levels	*Generate perceptible vibration impacts during tunneling and piling. Will disturb but unlikely to cause structural damage.*	
Air Pollution	*Construction equipment and heavy vehicles will emit pollutants such as NO_2, PM_{10}, and $PM_{2.5}$.*	

Operational Phase Impacts

Impact Category	Description	Impact
Emissions Reduction	*MetroLink will be fully electric and projected to reduce nitrogen dioxide levels by 17.5% in high-traffic zones.*	
Operational Noise & Vibration	*Although most of the line runs underground, surface sections may generate noise.*	
Air Quality Benefit	*MetroLink is expected to reduce car use, lowering emissions and congestion while supporting Ireland's climate goals.*	

Mitigation Strategies

- Deploy a **real-time monitoring system** for noise, vibration, and particulate matter at key construction sites
- **Water spraying, dust screens, and wheel-washing systems** to control dust
- Application of a **Life Cycle Assessment** to evaluate the embodied emissions of construction materials and select lower-carbon alternatives where feasible

Mitigation Strategies

- Install **noise barriers** in surface segments and apply **vibration-absorbing rail fastenings**.
- Regularly **monitor air quality** and **maintain the fleet** to ensure clean, low-noise operation.

3. Water

Water Impact Assessment and MetroLink Mitigation Measures

The Importance of Water

- Water systems in Dublin face pressure from **urbanisation** and **climate change**
- Runoff, pollution, and altered groundwater flows **threaten ecosystems**, **flood control**, and **drinking water quality**

- MetroLink intersects several key rivers and aquifers, requiring strict protection of **surface and groundwater integrity**

Construction Phase Impacts

Impact Category	Description	Impact
Soil Erosion & Sedimentation	*Excavation and tunneling expose soils; runoff with high sediment loads harms rivers and ecosystems*	
Groundwater Disruption	*Dewatering lowers water tables; tunnel/station structures may block flow, affecting wetlands*	
Pollution Risk (Surface/ Ground)	*Leaks (fuels, wash water, PFAS); contaminated wastewater may enter streams or aquifers*	

Operational Phase Impacts

Impact Category	Description	Impact
Stormwater Runoff	*Impermeable surfaces increase runoff, pressuring drainage and raising flood risks*	
Runoff Pollution	*Surfaces collect oils, metals, and chemicals (especially at depot); pollutants enter rivers in rain*	
Groundwater Flow Changes	*Tunnels and stations may alter aquifer flow, reducing water feeding into wetlands or streams*	

Mitigation Strategies

- **Real-time groundwater monitoring** and installation of **observation wells** near sensitive zones (e.g., PFAS sites)
- **Erosion controls** (silt fences, sediment basins) and treatment of all TBM and site wastewater before discharge

Mitigation Strategies

- Use of **Sustainable Drainage Systems (SuDS)** such as retention basins, oil interceptors, and infiltration zones
- Strict **runoff pollution controls** at depot and stations, with shut-off valves and containment for spill emergencies

4. Soil

Soil Impact Assessment and MetroLink Mitigation Measures

The Importance of Soil

- Soil provides **vital ecosystem services** like climate regulation
- It supports **biodiversity**, **human well-being**, and helps reduce **disaster risks**, especially in urban settings

- Human activities are degrading soils globally, with about 33% already affected by **erosion**, **contamination**, and **loss of organic matter**
- Soil protection is vital for MetroLink, which cross sensitive soil areas

Construction Phase Impacts

Impact Category	Description	Impact
Soil Erosion & Sedimentation	*Excavation and clearance increase erosion and sediment risks*	
Soil Contamination	*Machinery, spills, and existing pollution raise contamination risks*	
Soil Compaction & Sealing	*Machinery compacts soil; sealing reduces infiltration and raises run-off*	
Excavation, Waste & Material Management	*Excavation may cause erosion or pollution; reuse of materials planned*	

Operational Phase Impacts

Impact Category	Description	Impact
Long-Term Soil Compaction & Sealing	*Infrastructure and access roads cause permanent sealing and localized compaction, reducing soil function*	
Soil Contamination	*Maintenance activities may lead to small-scale spills and leaks (e.g. oils)*	
Ecosystem Fragmentation	*Above-ground structures may fragment green space and reduce soil biodiversity*	

Mitigation Strategies

- Use of **sediment barriers**, **drainage systems**, and **controlled vegetation clearance** to reduce erosion
- Implementation of **spill prevention** measures and **refuelling areas** to limit contamination
- Adoption of an **Excavated Materials Strategy** to safely handle soil and waste

Mitigation Strategies

- **Spill containment systems** and regular **monitoring** to prevent soil contamination
- **Re-vegetation** and **landscape integration** to reduce ecosystem fragmentation
- Use of green infrastructure to maintain ecological connectivity

5. Socio-Economics

Socio-Economics Impact Assessment and MetroLink Mitigation Measures

The Importance of Socio-Economics

- MetroLink is a major national investment with potential to **generate thousands of jobs**, stimulate **local economies**, and enhance access to employment, services, and education
- However, construction can **cause business disruption**, **displacement risks**, and **economic stress for local communities**
- Key to improving long-term regional equity, accessibility, and urban regeneration

Construction Phase Impacts

Impact Category	Description	Impact
Employment Generation	*Project expected to create over 4,000 direct and 3,000–5,000 indirect jobs*	
Impact on Local Businesses	*Temporary access, noise, and dust may reduce footfall and retail turnover*	
Land Acquisition & Displacement	*Site clearance may affect residents or SMEs near station/shafts*	

Operational Phase Impacts

Impact Category	Description	Impact
Improved Mobility & Productivity	*Commute times reduced by up to 25 mins; better access to jobs and services*	
Land Value & Urban Regeneration	*Property values near stations may rise 10–20%, attracting investment*	
Social Inclusion & Affordability	*Enhances access for low-income and underserved areas; integrated ticketing supports equity*	
Tourism & Connectivity	*Airport link expected to boost visitor flows and support local economies*	

Mitigation Strategies

- Implement **compensation frameworks** for affected SMEs and residents
- Prioritise **local hiring** and **training programs** to maximise employment benefit

Mitigation Strategies

- **Monitor affordability** and prevent fare increases that exclude vulnerable users
- Promote **inclusive urban planning** to avoid gentrification
- Coordinate with tourism agencies to optimise airport connectivity benefits

6. Recommendations and Tools

Our Recommendations to Reduce Environmental Impact on Air and Water

Air

Real-Time Monitoring System
Deploy continuous monitoring for noise, vibration, and particulate matter, with dashboards and rapid-response protocols; this addresses noise levels reaching up to 85 dB LAeq and dust deposition exceeding 350 mg/m²/day near sensitive sites.

Comprehensive Life Cycle Assessment (LCA)
Conduct an LCA to quantify and minimize embodied carbon from materials like concrete and steel; this fills a current gap as no long-term carbon footprint analysis exists in the present EIA.

Enhanced Dust and Air Quality Management Plan (DAQMP)
Strengthen dust mitigation near sensitive areas by adding fabric enclosures and offering temporary relocation, responding to projected dust levels that can surpass 350 mg/m²/day posing risks of respiratory and eye irritation.

Noise and Vibration Controls
Apply adaptive strategies such as daylight-only noisy operations and temporary noise insulation, this mitigates impacts like 65 dB noise levels at schools (vs. WHO's 35 dB indoor standard) and up to 75 - 80 dB at hospitals.

Water

Monitor and Protect Groundwater Throughout the Project
Install observation wells along the route to track water table changes and detect pollution, especially in sensitive areas like near Dublin Airport

Use Sustainable Drainage Systems (SuDS) to Control Stormwater
Apply SuDS features such as retention basins and oil interceptors at stations and the depot to manage runoff volume and prevent water pollution

Treat All Construction Wastewater Before Discharge
Ensure TBM water and site runoff are treated for sediments and chemicals before entering natural water bodies

Prevent Soil Erosion During Subsurface Construction
Stabilize exposed soil with fencing, covers, and bunds to keep sediment out of streams and maintain water quality

6. Recommendations and Tools

Our Recommendations to Reduce Environmental Impact on Soil and Socio-Economic Factors

Soil

Erosion and Sedimentation Control
Integrating nature-based solutions like vegetative buffers and real-time turbidity monitoring could strengthen erosion control and ecosystem benefits

Soil Contamination Prevention and Management
Piloting electrokinetic remediation and using real-time digital contaminant mapping would optimize soil pollution control and remediation planning

Soil Compaction and Sealing Mitigation
Smart compaction monitoring systems and long-term soil health plots could better prevent over-compaction and track soil recovery post-construction

Excavation and Spoil Management
Partnering with local land restoration projects to reuse clean surplus soil would improve environmental outcomes

Operational Phase Considerations
Community-led soil stewardship and a public soil health dashboard would enhance engagement, transparency, and environmental monitoring

Socio-Economics

Support Local Business Resilience During Construction
Launch targeted grants and advisory programs to help SMEs near construction sites adapt (e.g. marketing support, digital visibility, temporary relocation subsidies)

Implement Fair and Transparent Land Acquisition Procedures
Ensure early engagement with affected residents and businesses, with fair compensation frameworks and grievance mechanisms aligned with international best practice (e.g. World Bank ESS5)

Prevent Gentrification Through Inclusive Development Policies
Embed affordable housing quotas and rent control incentives in station-area planning to ensure that regeneration benefits all social groups

Leverage MetroLink for Tourism Growth
Coordinate with Fáilte Ireland and Dublin Airport Authority to develop joint campaigns and infrastructure (e.g. real-time info in arrivals area, metro-tourist pass bundles)

6. Recommendations and Tools

Environmental Impact Assessment (EIA) and Strategic Sustainability Assessment (SEA)

Why the EIA is used

- **Preventive** Tool that identifies, predicts, and assesses environmental and socio-economic impacts before decisions are made
- **Required** under EU and Irish law (e.g. EU EIA Directive)

Why the SEA is used

- **Proactive** planning tool used at early stage to ensure environmental considerations influence policy, plans, and program decisions
- **Required** under EU law for transport infrastructure strategies

Why the EIA is important for us

- Provides a structured foundation for analyzing project impacts across **multiple environmental and social domains**.
- Supports **compliance**, **transparency**, and **integration of sustainability** into infrastructure decisions
- Informed the development of targeted, **evidence-based recommendations** to enhance project outcomes

Why the SEA is important for us

- Provides **a high-level environmental overview**, helping us anticipate and mitigate potential environmental risks before detailed project planning
- **Ensures alignment of MetroLink with broader sustainability goals**, climate action objectives, and urban planning strategies
- **Facilitates early stakeholder engagement**, transparency, and environmental responsibility, enhancing public trust and acceptance

Where we used the EIA

- **Water:** Assessed risks to groundwater and surface water, especially near tunneling sites like the River Liffey.
- **Soil:** Evaluated contamination risks, excavation effects, and recommended erosion control and soil reuse strategies.
- **Air:** Analyzed emissions and dust; proposed real-time monitoring and cleaner construction practices
- **Socio-economic:** Examined community impacts and proposed fair land acquisition, local hiring, and transport equity measures

Where we used the SEA

- **Air**: Evaluated project's alignment with city-wide emissions reduction targets
- **Soil**: Reviewed strategic soil management concerns across the Greater Dublin Area, ensuring alignment with the EU Soil Strategy 2030
- **Water**: Integrated strategic-level assessments of regional hydrological systems, guiding MetroLink to avoid long-term negative impacts on critical groundwater and surface water resources
- **Socio-economic**: Evaluated broader socio-economic implications, aligning MetroLink with various of Dublin's policies, employment goals and objectives

The Dublin MetroLink Project

Thank you.

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