

6 Environmental Review Scope and Methods

This section of the ESR describes the methods used to support the assessment of potential effects of the Project on environmental and socio-economic values within the Project area (see Section 7.0), including the methods used to:

- select the environmental and socio-economic aspects to be assessed in the review (referred to as “Review Elements”)
- define the scope of assessment for each Review Element
- assess the potential effects of the Project on each Review Element following the application of management or mitigation measures.

The assessment follows the 4-step process outlined in Figure 6-1, with Step 1 methods described in Sections 6.1 through 6.3, Step 2 methods outlined in Section 6.4, Step 3 methods provided in Section 6.5, and Step 4 methods detailed in Section 6.6.

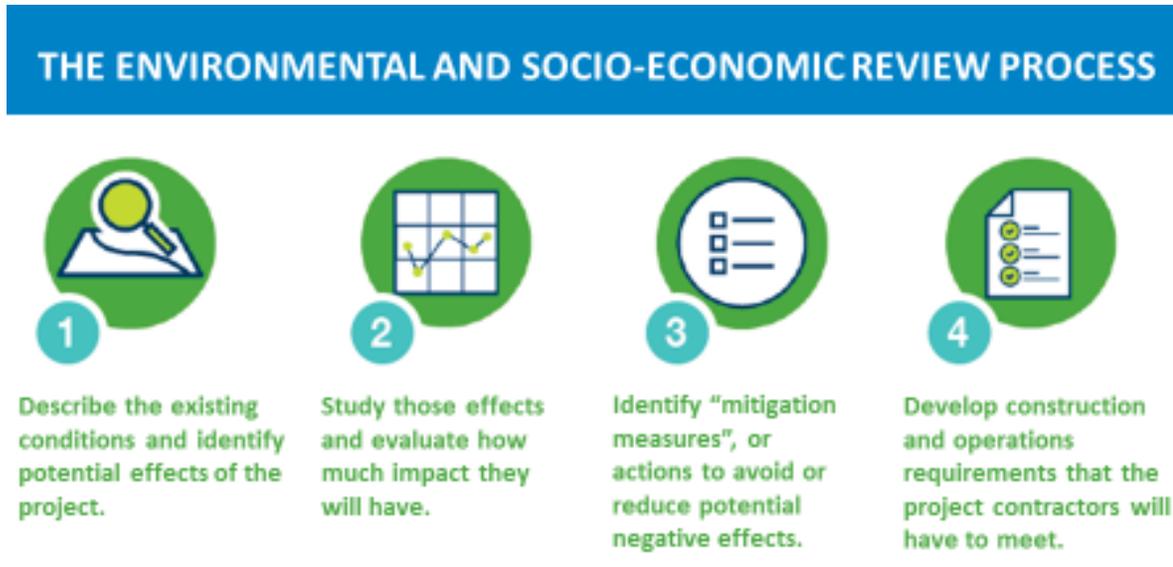


Figure 6-1: Environmental and Socio-economic Review Process

Any refinements to the methods outlined in this section, to support the assessment of a specific Review Element, are provided in the relevant Review Element subsection of Section 7.0. Section 7.1 of the ESR provides an overview of the general environmental and socio-economic setting for the review area, including geographical and biophysical features, built environment, and land use. Methods for addressing and describing existing conditions specific to each of the Review Elements are described in Section 6.3. Anticipated benefits of the proposed Project are described in Section 3.0 (Project Benefits) of the ESR.

6.1 Selection of Review Elements

Review Elements were selected to focus the assessment on aspects of the biophysical and socio-economic environment that are considered important or of value, and that may be affected by the Project. This was done by considering the following:

- Relevant environmental policies, regulations, or guidance
- Potential for effects based on the Project description
- What was assessed in similar projects (e.g., Evergreen Line)
- Interests and issues identified by First Nations, government agencies, stakeholders, and the public.

Feedback on the candidate Review Elements was obtained from the public and Aboriginal Groups through review and comment provided on the draft Terms of Reference (TOR) for the ESR, which was undertaken in the Fall of 2017. Following the comment period and revisions of the draft TOR to reflect input obtained, the ESR TOR were finalized.

A number of comments received related to socio-economic considerations. To address these comments, the candidate Socio-economic Review Element was split into three distinct Review Elements: Traffic and Transportation; Housing, Residential Properties and Commercial Businesses; and Community and Emergency Services. This facilitates fulsome consideration of potential effects and concerns on these aspects of the socio-economic environment. Noise and vibration are treated as separate Review Elements in the final TOR to provide additional clarity to the reader, whereas in the draft TOR they were combined.

The selected Review Elements, as per the final TOR, are as follows:

- Traffic and Transportation
- Housing, Residential Properties, and Commercial Businesses
- Community and Emergency Services
- Archaeological and Heritage Resources
- Fisheries and Aquatic Resources
- Vegetation and Wildlife Resources
- Noise
- Vibration
- Air Quality and Greenhouse Gases
- Contaminated Sites and Excavated Materials
- Electric and Magnetic Fields (EMF)

Section 7 of the ESR assesses potential effects on each of these Review Elements following the approach outlined in Sections 6.2 through 6.7.

6.2 Scoping of Review Element Assessment

This section of the ESR provides the methods for defining the scope of assessment of potential effects on each Review Element. The Review Element assessments in Section 7.0 outline the scope of the assessment of potential effects for each Review Element.

6.2.1 Regulatory and Policy Setting

For each Review Element, the assessment outlines relevant regulatory requirements, policy, and guidance for assessment of potential effects. This may include municipal, provincial, federal and/or Aboriginal considerations that are relevant to the management of the Review Element.

6.2.2 Influence of Consultation on the Assessment

Sections 4.0 (Aboriginal Engagement) and 5.0 (Public Engagement and Information Distribution) of the ESR describe information collected through consultation with government agencies, stakeholders, community members, and Aboriginal Groups. The Review Element assessments in Section 7.0 (Assessment of Potential Effects) describe how this information is used to inform the scoping of the assessment and any relevant analyses.

6.2.3 Identification of Potential Effects and Indicators

For each Review Element, the assessment identifies potential effects that could result from the proposed Project and that are of concern to regulators, public, stakeholders and Aboriginal Groups. These effects are measured using “indicators” that represent types of changes that could occur, relative to current conditions. The indicators enable quantitative or qualitative representation of the potential changes to the Review Elements.

The draft TOR proposed potential effects and indicators for each Review Element included in the assessment, in consideration of information and concerns identified through consultation activities. Input was solicited from the public and First Nation Groups during the Fall 2017 review period. This input was incorporated into the final TOR and is summarized in Table 6-1.

Table 6-1: Potential Effects and Indicators

Review Element	Potential Effect	Indicators
Traffic and Transportation	Change in traffic and transportation from baseline due to the Project	<ul style="list-style-type: none"> Roadway description (e.g., number of lanes, traffic flow characteristics) Change in parking Change in accessibility to the corridor and adjacent neighbourhoods Change in vehicle volume (vehicles/day, vehicles-km travelled) Passenger vehicle travel time (selected Origin/Destinations) Transit (travel time, ridership) Pedestrian/cyclist information
Housing, residential Properties, and Commercial Business	Change in housing, residential properties and commercial businesses from baseline due to the Project	<ul style="list-style-type: none"> Change in access to properties Population change Number and type of residential properties affected by the Project Housing availability and cost metrics Number of businesses potentially affected by the Project and description of the anticipated effects
Community and Emergency Services	Change in emergency access, community amenities, and public safety from baseline due to the Project	<ul style="list-style-type: none"> Public access to emergency services (qualitative) Emergency medical services, fire rescue, and police response routes (qualitative) Potential change in public safety and security Changes to community infrastructure, services and amenities, including parks and green space
Archaeological and Heritage Resources	Alterations to archaeological site contents or context (known and unknown sites)	<ul style="list-style-type: none"> Number and description of archaeological sites with potential to be altered as a result of Project activities Areas with high archaeological potential that could be affected by the Project
	Alterations to heritage buildings, landscapes, or other sites of heritage value (known and unknown sites)	<ul style="list-style-type: none"> Number and description of heritage sites with potential to be altered as a result of Project activities
Fisheries and Aquatics	Change in fish habitat from baseline due to the Project	<ul style="list-style-type: none"> Net changes (losses and gains) (m²) to instream habitat Net changes (losses and gains) (m²) to riparian habitat
	Change in fish mortality or health	<ul style="list-style-type: none"> Potential for mortality risk (all life stages) due to extent, duration, or timing of instream works; changes in water quality (including changes in Total Suspended Solids)

Review Element	Potential Effect	Indicators
Vegetation and Wildlife Resources	Change in abundance of species of management concern from baseline due to the Project	<ul style="list-style-type: none"> Change to potential occurrence of species at risk (plant and animal) Change to potential occurrence and locations of invasive species (plant and animal)
	Change in abundance of ecological communities or abundance/quality of wildlife habitat from baseline due to the Project	<ul style="list-style-type: none"> Areal extent of provincially-listed ecological communities at risk and wetlands Change in habitat availability for focal species at risk Change in the availability of wildlife habitat features
	Change in quantity, quality, or connectivity of green space from baseline due to the Project	<ul style="list-style-type: none"> Areal extent of forest canopy cover Areal extent of Green Infrastructure Network elements and potential for changes to connectivity Areal extent of permeable and impermeable surfaces Change in number and type of trees within the Project alignment, including heritage or protected trees
	Change in injury or mortality of wildlife from baseline due to the Project	<ul style="list-style-type: none"> Potential for injury or mortality risk to wildlife due to extent, duration or timing of construction and operation activities
Noise	Change in Noise Levels	<p>Estimated noise level during construction and operation phases quantified using the following parameters compared to noise baseline:</p> <ul style="list-style-type: none"> Overall equivalent continuous A-weighted (dBA) daytime and nighttime sound level (Ld and Ln) A-weighted (dBA) daytime and nighttime equivalent sound level (Ldn)
Vibration	Change in Vibration Levels	<p>Estimated ground vibration levels at specific receptors during construction and operation phases quantified using the following parameters compared to vibration baseline:</p> <ul style="list-style-type: none"> Peak particle velocity (PPV) in mm/s Root mean square (RMS) velocity in mm/s Estimated vibration levels will be presented in context of potential effects to receptors (e.g., human perception, building damage)
Air Quality and GHGs	Change in the ambient concentration of CACs from baseline due to the Project	<ul style="list-style-type: none"> Estimated change in emissions of CACs (SO₂, NO₂, CO, PM₁₀, PM_{2.5}, VOCs) relative to ambient CACs PM_{2.5})
	Emissions of GHGs from baseline due to the Project	<ul style="list-style-type: none"> Estimated changes in emissions of GHGs (CO₂, CH₄, N₂O, reported as CO_{2e})

Review Element	Potential Effect	Indicators
Contaminated Sites and Excavated Materials	Release of contaminants from contaminated soils or water encountered during construction	<ul style="list-style-type: none"> • Existence and location of contaminated sites • Nature of contaminated materials • Nature of excavated materials and disposal waste
EMF	Change in EMF levels from baseline due to the Project	<p>Potential change in EMF during construction and operation phases due to the Project (including the OMF, vehicles and control systems) using the following parameters compared to baseline:</p> <ul style="list-style-type: none"> • Electric field (V/m) • Magnetic field (mG) • Stray current

6.2.4 Assessment Boundaries

The Review Element assessments presented in Section 7.0 incorporate spatial and temporal boundaries as described below.

Spatial boundaries encompass areas with higher potential for adverse effects. The draft TOR outlined proposed spatial boundaries for each Review Element. This was subject to review and comment by the public and Aboriginal Groups. Input received was integrated into the final TOR and is presented by Review Element in Table 6-2.

Table 6-2: Spatial Boundaries

Review Element	Spatial Boundaries	Justification for Spatial Boundaries
Traffic and Transportation	City of Surrey communities and travel routes near the Project.	Represents an area large enough to establish context for estimating Project effects relative to baseline conditions and where Project-related activities could be attributed to a direct, estimatable, and measurable adverse change to Traffic and Transportation.
Housing, Residential Properties, and Commercial Businesses	City of Surrey communities and travel routes near the Project.	Represents an area large enough to establish context for estimating Project effects relative to baseline conditions and where Project-related activities could be attributed to a direct, estimatable, and measurable adverse change to Housing, Residential Properties, and Commercial Businesses.
Community and Emergency Services	City of Surrey communities and travel routes near the Project.	Represents an area large enough to establish context for estimating Project effects relative to baseline conditions and where Project-related activities could be attributed to a direct, estimatable, and measurable adverse change to Community and Emergency Services.
Archaeological and Heritage Resources	Within 100 m of the Project centreline	Representative of the area where direct and indirect Project effects (e.g., ground disturbance) could potentially affect archaeological and heritage resources.
Fisheries and Aquatics	Watercourses located within 100 m of the Project centreline, as well as instream habitat located 300 m downstream of instream works.	The 50 m buffer is to evaluate watercourses, including riparian habitat, that fall within the area of potential influence of construction activities. The instream habitat 300m downstream of instream works is included to evaluate potential for downstream effects.
Vegetation and Wildlife Resources	All urban and green space (including Green Infrastructure Network, parks, street trees, residential areas and other vegetated sites) within 100 m of the Project centreline	Represents the area where direct and indirect Project effects (e.g., vegetation clearing, change in green space connectivity, sensory disturbance from noise, vibration, and light) could potentially affect vegetation and wildlife resources.
Noise	Within 300 m of the Project centreline	Represents the area that encompasses the nearest receptor location to the rail alignment
Vibration	Within 300 m of the Project centreline	Represents the area which encompasses the nearest receptor location to the rail alignment
Air Quality and GHGs	City of Surrey Lower Fraser Valley airshed is considered the regional boundary.	Represents the urban areas of Surrey as baseline emission estimates are only available at the city scale. Air emissions from Surrey contribute to the LFV airshed, which is considered the regional boundary for this review.

Review Element	Spatial Boundaries	Justification for Spatial Boundaries
Contaminated Sites and Excavated Materials	Within 100 m of the Project centreline	Represents an area where it is possible that existing contamination at neighbouring properties could migrate to the Project Alignment through soil and/or groundwater. Factors including groundwater flow velocity, biodegradation, adsorption to soil particles, and physical degradation are not expected to cause contaminants to migrate to the Alignment from properties greater than 100 m away
Electric and Magnetic Fields	Within 100 m of the Project centreline and power sub-stations	Based on the electromagnetic field strengths generated by the Project, 100 m is the furthest distance that electromagnetic interference with other systems can reasonably be expected.

Temporal boundaries provide the timeframe within which potential effects are assessed in relation to Project phases and activities. Temporal boundaries are based on the timing and duration of Project activities (i.e., during construction and operation) that may interact with a Review Element. Based on the current Project schedule, the temporal boundaries for the assessment are as follows:

- Construction: A three to five-year construction and commissioning period.
- Operation: 30+ years.

6.3 Existing Conditions

The description of existing conditions of specific to each Review Element is based on data collected during desktop review and, where applicable, field programs. Where information is available, pre-Project conditions are described to provide context for the assessment of specific Review Elements. The description of existing conditions is guided by the spatial boundary established each Review Element (see Table 6-2).

6.4 Project Interactions

The assessment evaluates the potential interactions between each Review Element and proposed Project activities and physical works. These potential interactions are outlined by Project phase in Table 6-3.

Table 6-3: Overview of Potential Project Interactions with Review Elements

Project Activities and Physical Works	Review Elements										
	Traffic and Transportation	Housing, Properties, and Commercial	Community and Emergency Services	Archaeological and Heritage Resources	Fisheries and Aquatic Resources	Vegetation and Wildlife Resources	Noise	Vibration	Air Quality and GHG	Contaminated Sites and Excavated Materials	Electric and Magnetic Fields
Construction											
Property acquisition	-	✓	✓	-	-	-	-	-	-	-	-
Site preparation (e.g., clearing, grading, and set up of temporary facilities), and utility relocation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-
Roadworks; construction of transitway/guideway, system structures (e.g., substations, power and communication lines), exchanges and stops, excavation, and operations and maintenance building	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-
Vehicle traffic (e.g., road use and construction traffic)	✓	✓	✓	-	-	✓	✓	✓	✓	✓	-
Management and disposal of waste and excavated materials	✓	-	-	-	✓	✓	✓	-	-	✓	-
Commissioning and start-up	✓	-	-	-	-	-	-	✓	-	✓	✓
Operation-											
Train operation, including wayside and power	✓	✓	✓	-	-	✓	✓	✓	✓	✓	✓
Train or track maintenance, administration, transit police	-	-	✓	-	✓	-	-	-	✓	✓	-
Traffic function (i.e., change in roadways and intersection functions)	✓	✓	✓	-	-	-	-	✓	✓	✓	-
NOTES:											
✓ Potential interactions that may cause an effect to the Review Element											
- No or negligible potential for interaction to result in an effect to the Review Element											

Where it is determined that interactions may result in potential effects, they are carried forward in table form to the Review Element assessments in Section 7.0. These interactions are then further refined to focus on the specific potential effect(s).

The Review Element assessments presented in Section 7.0 begin with a brief description of the mechanism by which a Project activity or physical work could affect a Review Element. Project effect mechanisms are provided for each Project phase, where applicable. Where activities and physical works are not anticipated to interact with the Review Element in a manner resulting in a potential effect, justification is provided.

For interactions between a Review Element and the Project that may cause a potential effect, the assessment proceeds with identifying appropriate mitigation measures (see Section 6.5), and discussing the Project effects (see Section 6.6) following the application of these mitigation measures.

6.5 Mitigation Measures

The Review Element assessments in Section 7.0 identify Project- and site-specific, and industry-standard mitigation measures, as necessary, to avoid or limit the potential effects of the Project on each Review Element and to comply with relevant regulatory or policy guidance. These measures may also include planning considerations, and other measures applicable to the Project. Linkages between the Project interactions and potential effects are identified and discussed, as applicable.

6.6 Discussion of Review Results

The Review Element assessment in Section 7.0 provide an analysis of effects on each Review Element that result from interactions with Project activities or physical works. The analysis will be supported by the use of applicable analytical methods. Relevant criteria such as magnitude, geographical extent, and duration are used to describe the effects. Where effects cannot be characterized quantitatively, they will be discussed qualitatively.

This section also discusses the effectiveness of mitigation measures in managing potential effects and outlines any recommendations for ongoing monitoring or management requirements, as appropriate. This may include reference to applicable environmental management plans (EMPs) (as described in Section 9 of the ESR).

6.7 Conclusion

The assessment provides a concise statement of the conclusions of the Review Element assessment.