

**DILLON**  
CONSULTING

*CITY OF CALGARY*  
**BASELINE RISK  
ASSESSMENT OF LAND  
DEVELOPMENT WITHIN  
PROXIMITY OF FREIGHT  
RAIL CORRIDORS**



## Summary

*The catastrophic train derailment that took place in Lac-Mégantic in 2013 claimed 47 lives and brought the issue of rail proximity safety to the forefront for Canadian municipalities. Recommended guidelines restricted development within 30 m of a rail corridor, however the City of Calgary asked Dillon Consulting Limited and Fjord Consulting Limited to develop a method to assess the risks so that future development can take place while protecting public safety.*

## Innovation

The City of Calgary recognized that tragic events such as Lac-Mégantic were calling into question the safety of building next to freight rail corridors. Given the need to balance the conflicting needs of public safety, the national interest of moving goods by freight rail, and local developer/land owners' expectations, a standardized, systematic and transparent risk assessment process was developed by Dillon called the Baseline Risk Assessment (BRA). The BRA was first piloted and tested within the downtown core in the City of Calgary where the greatest development pressures were taking place, and from there it was expanded to cover all freight rail corridors within City limits.

Dillon conducted statistical analysis and data correlations between historical Transportation Safety Board of Canada (TSB) freight rail accidents across Canada, historical freight rail traffic (including number of trains, length of trains, speed, tonnage of goods hauled) and local site conditions including land use zoning, track geometry, track speed and local topography. Using historical freight train derailment studies completed in the United States, Dillon cross-referenced this analysis to come up with an innovative means to measure the risk of a moving hazard called the Rail Proximity Envelope (RPE).

The RPE allowed Dillon to estimate the level of exposure to adjacent lands based on the width and depth of the parcel and the height associated with any buildings to determine how many floors would be at risk. Using geo-spatial analysis, the size of the RPE can be customized to be either larger or smaller, depending on the local topography for each parcel of land.

The BRA also needed to take into consideration future growth of freight rail traffic. Dillon developed a financial model that cross-referenced GDP growth to freight traffic and based on future economic projects by Finance Canada, we were able to downscale these projections to estimate the growth of freight rail traffic in the city.

The BRA and the accompanying Parcel-Specific Risk Assessment Framework is the first of its kind to be developed in Canada. The BRA informed the City of Calgary's *Development Next to Freight Rail Corridors Policy* that will guide development proposals in the future. A key innovation Dillon brought to this project was the development of an interactive GIS portal that allows the public to access parcel-specific information about what development can be achieved, and an internal access portal with additional details on risks to facilitate parcel-specific development applications.

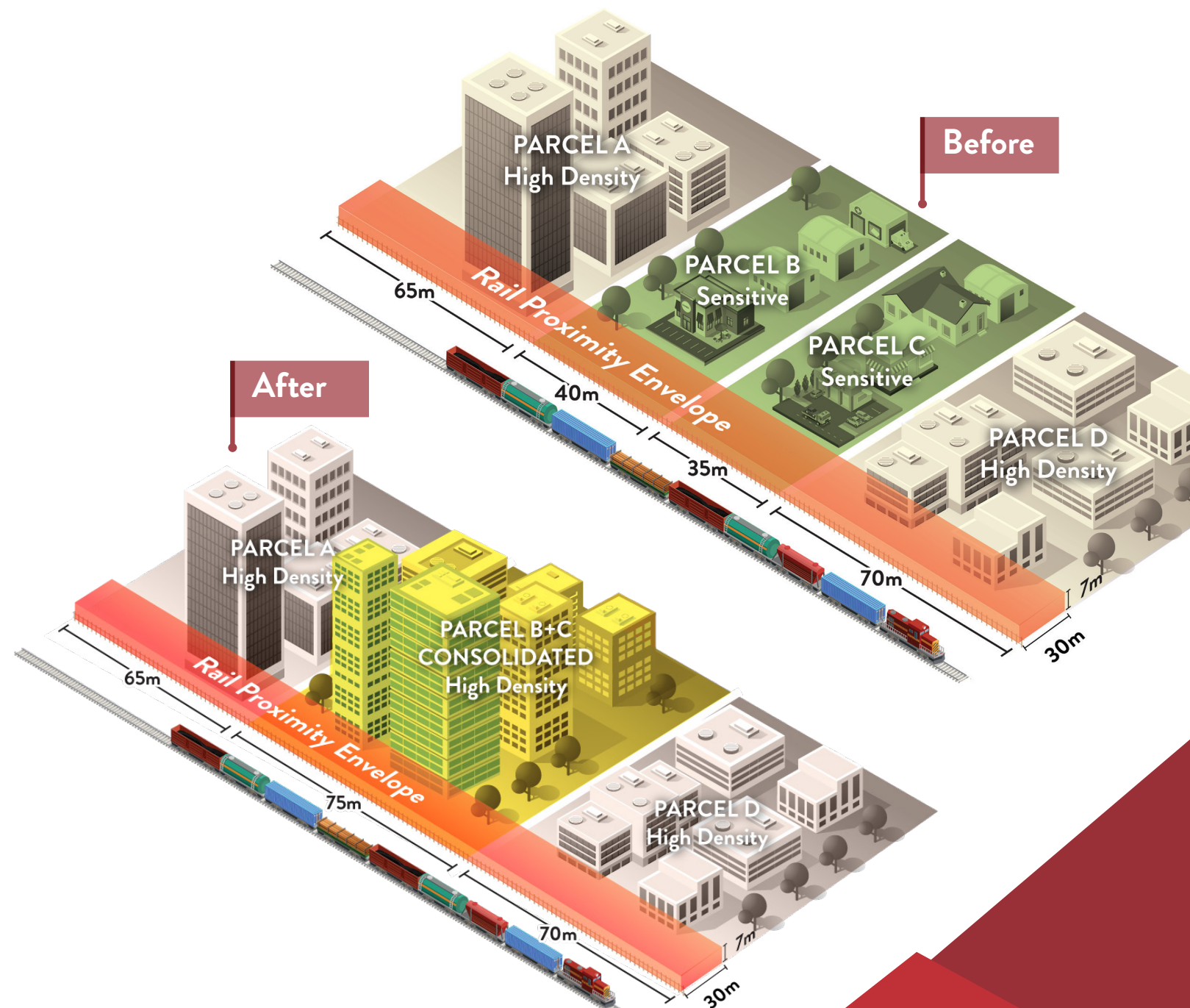
## Complexity

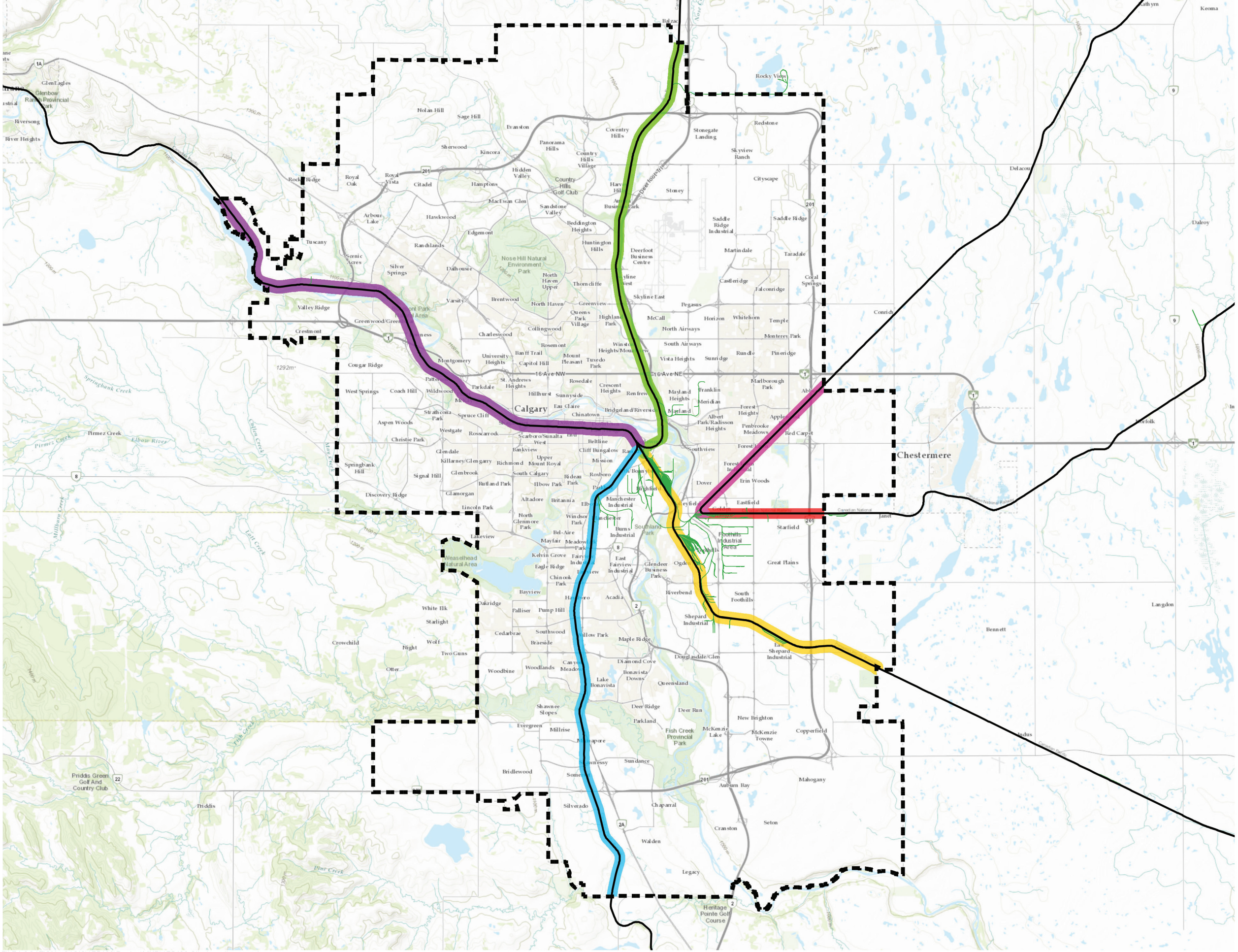
The biggest challenge with this project was down-scaling national freight rail accident statistics and applying them to local conditions. Detailed statistical analysis of freight rail accident data from the TSB determined which factors, either the root causes of the accident or the magnitude of the accident (i.e. number of fatalities), were applicable to Calgary.

In addition, estimating the risks of land development, which is fixed based on a moving object (the train), proved to be challenging to overcome given that the level of risk was directly proportional to the length of the parcel; the longer the parcel, the bigger the target, the greater the risk. This required detailed analysis to determine the size of a train accident that could occur based on local conditions, which has never been done before

in Canada. We utilized US-based research of train accidents to cross-reference our analysis and identify key local factors used in the BRA.

A means to measure the "acceptability" of the risks was the third biggest challenge, as it needed to take into consideration occupancy and land-use zoning of adjacent parcels. National and international research was completed to determine comparable standards and risk criteria to be used. A Canadian-based criteria was selected that looked at the annual individual fatality risks based on four generalized land-uses - Manufacturing/Open Space, Low Density Residential, High Density Residential and Sensitive Uses. Dillon converted these criteria so it was applicable to land use zoning and occupancy designations in Calgary.





**CITY OF CALGARY**  
 DEVELOPMENT AND RAIL POLICY:  
 BASELINE RISK ASSESSMENT

**FIGURE 1. Identified Study Areas**

- LEGEND**
- Main Track
  - Non-Main Track
  - City of Calgary Limits
  - Brooks Subdivision Study Area
  - Drumheller Subdivision Study Area
  - Three Hills Subdivision Study Area
  - Red Deer Subdivision Study Area
  - Laggan Subdivision Study Area
  - Macleod/Aldersyde Subdivision Study Area



MAP DRAWING INFORMATION:  
 DATA PROVIDED BY CITY OF CALGARY,  
 TRANSPORT CANADA, ESRI BASEMAPS

MAP CREATED BY: NR  
 MAP CHECKED BY: LG  
 MAP PROJECTION: Calgary 3TM WGS 1984 W114



PROJECT: 17-5499  
 STATUS: FINAL  
 DATE: MARCH 2018

## Social and/or Economic Benefits

The City of Calgary recognized that economic growth, both in freight rail traffic through the city and the desire to densify land development within proximity of freight rail corridors to accommodate population growth, comes with risk. In this case a catastrophic train derailment resulting in public fatalities. Dillon held multiple stakeholder engagement sessions with land developers, freight rail companies and internal groups such as the Calgary Fire Department so they had a voice in the design of a methodology that balanced their priorities. The “design-with” approach enabled the social “buy-in” to the methodology. In fact, Canadian Pacific Railway and BILD Calgary Region submitted letters of endorsement to Calgary Council to support the Policy.

The BRA will increase the development potential and increase property values. In the downtown core, it is anticipated to be as high as 400% for underdeveloped parcels, which will increase the property tax base. For land owners and developers, the BRA will

increase the value of their lands and enhance the ability to increase development potential. In over 90% of the parcels, the risks can be easily managed through the configuration of buildings and occupancy type, thereby avoiding unnecessary costs of crash walls.

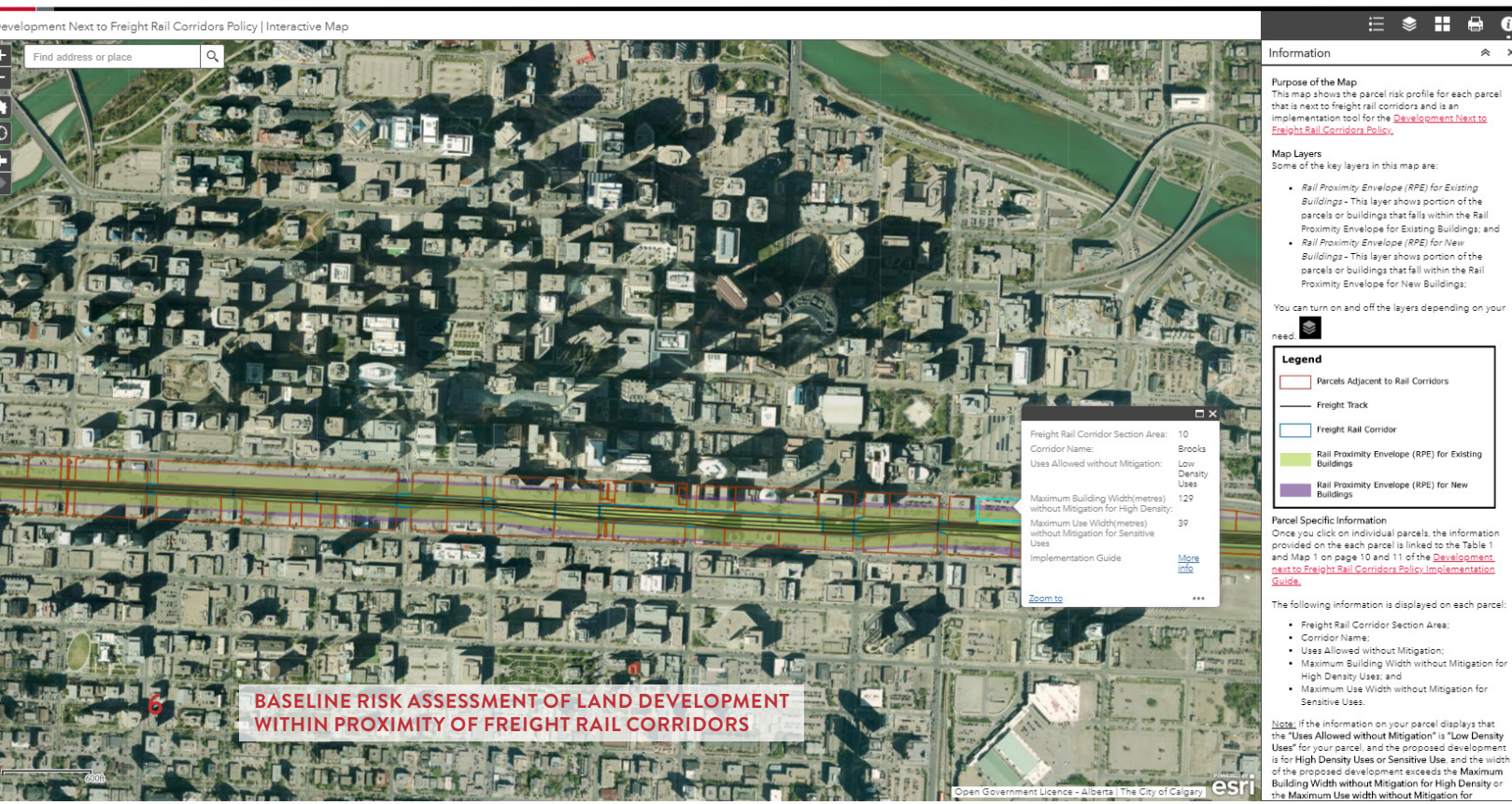
The freight rail companies will only deal with the City for land development and not field inquiries by individual land owners and developers. This will alleviate the administrative costs and allow the freight rail companies to meet their Federal legislative level of service obligations while not being constrained by adjacent land development pressures.

## Environmental Benefits

The BRA enables the sustainable development of lands within proximity of freight rail corridors, maximizing the usage of 30m of lands as opposed to urban and suburban sprawl where the City’s “environmental footprint” would increase. There will be a decreased need to build new infrastructure such as roads and municipal services and less land will be taken out of agricultural production. Instead, the BRA informed the *Development Next to Freight Rail Policy* which will promote a “build up, not out” approach to maximize the usage of existing serviceable lands.

This aligns with the City’s Municipal Development Plan (MDP) goals of: a) build a globally competitive city that supports a vibrant, diverse and adaptable local economy, maintains a sustainable municipal financial system and does not compromise the quality of life for current and future Calgarians; and b) make Calgary a livable, attractive, memorable and functional city by recognizing its unique setting and dynamic urban character and creating a legacy of quality public and private developments for future generations.

City of Calgary Interactive GIS Map - Development Next to Freight Rail Corridors Policy



## Meeting the City of Calgary's Needs

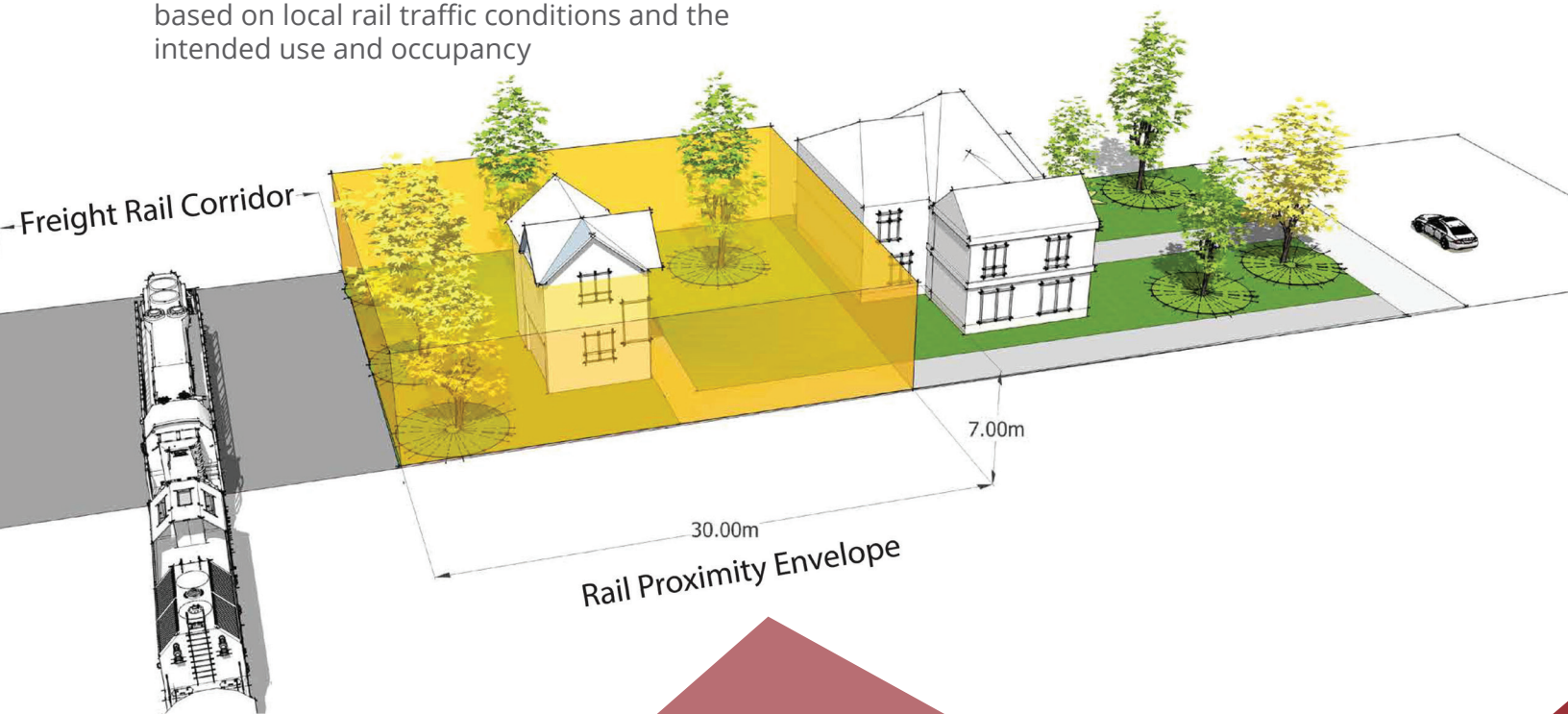
The City's goal was to create a standardized, systematic and transparent risk assessment process to manage the risks for land development along rail corridors so that: a) lands adjacent to rail corridors can be developed to its highest, best and safe use, and support its policies and objectives for densification of land development; b) ensure consistency in the management of the risk; and c) the railway can continue to conduct rail operations to fulfill its obligations under federal legislation.

The BRA allows developers to maximize the utilization of an additional 30m of lands that were previously underdeveloped, and ensure that the risks are properly managed based on local rail traffic conditions and the intended use and occupancy

within the RPE. By using the BRA to determine the risks for each

parcel adjacent to the rail corridors there is a consistency in the methodology. Previously, individual property owners had that responsibility which resulted in contradictory analysis and findings due to the varying knowledge and expertise utilized.

By engaging the railway industry to develop the BRA methodology, their interests were taken into consideration, not only in terms of current freight rail traffic, but also accounting for future economic growth. This allows the rail industry to continue to conduct rail operations to meet national economic growth without being burdened and constricted by the densification of the adjacent lands.





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