The HINA Blueprint

Flood Susceptibility Analysis

Methodology

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1 OVERVIEW

This document describes the methodology used to estimate the number of parcels, dwelling units, and residents located in areas of varying flood susceptibility across a defined geography. The analysis links parcel-level Flood Susceptibility Index (FSI) values to 2021 Census dissemination block (DB) population and dwelling counts, then aggregates results to census subdivisions (CSDs), census divisions (CDs), and provinces.

2 FLOOD SUSCEPTIBILITY INDEX

The Flood Susceptibility Index (FSI) is a national raster dataset produced by the Government of Canada as part of its broader flood risk mapping program. It assigns each 30-metre grid cell a relative susceptibility score from 0 to 100, derived from terrain morphology (slope, curvature, and topographic wetness), soil drainage class, land cover, and contributing drainage area. Higher values indicate greater susceptibility to surface water accumulation and flooding. The FSI does not represent the probability of a specific flood event or a modelled flood extent for a given return period; rather, it characterizes the inherent physical conditions that make a location more or less prone to flooding under typical precipitation inputs.

The FSI was developed to support national-scale screening and prioritization. It is intended as a relative indicator for comparing susceptibility across areas, not as a site-specific flood hazard assessment. At the national scale, it provides consistent, comparable results where detailed local flood mapping does not exist.

3 SCORING

For this analysis, FSI scores are classified into three equal-intervals based on a 0 to 100 scale:

Bracket	Interpretation	FSI Range
Low	Limited physical susceptibility to surface flooding	0 – 33.3
Moderate	Moderate susceptibility; site conditions may amplify flood exposure	33.4 – 66.6
High	High susceptibility; terrain and soil conditions strongly favour flooding	66.7 – 100

4 DATA SOURCES

File	Description	Source	Reference year
FS-national-2015-index.tif	National Flood Susceptibility Index raster (30 m resolution)	Government of Canada	2015
lcsd000a25p_e.gpkg	Census Subdivision (CSD) digital boundary file	Statistics Canada	2025

File	Description	Source	Reference year
ldb_000a21a_e.shp	Dissemination Block (DB) digital boundary file	Statistics Canada	2021
2021_92-151_X.csv	Geographic Attribute File: DB-level population and total dwelling counts	Statistics Canada	2021
File provided by user	Parcel data (or civic address points used as parcel-level proxies)	Local or provincial government	Current

5 METHODOLOGY

Step 1: Extract FSI Values to Parcels

Parcel polygons were reprojected to match the coordinate reference system of the FSI raster. To reduce processing time, the raster was cropped to the spatial extent of the parcel layer before extraction. A mean FSI value was then extracted to each parcel by averaging all raster cells whose centroids fall within the parcel boundary. The resulting value represents the average flood susceptibility across the footprint of each parcel. Alternative statistics (such as the maximum FSI within a parcel or the proportion of parcel area above a given threshold) were considered but not used; mean FSI was selected to produce a single comparable score per parcel consistent with the aggregation approach in later steps.

Step 2: Assign Parcels to Census Subdivisions

Each parcel was spatially joined to the 2022 CSD boundary file using a containment test, assigning the CSD UID, name, type, and province to parcels that fell entirely within a single CSD. Where a parcel straddled a CSD boundary (most commonly for large rural parcels near municipal limits) a fallback intersection join was applied to ensure full coverage. In these cases, the parcel was assigned to the CSD with which it intersected; no area-weighted apportionment was performed. This simplification may marginally misattribute a small number of boundary parcels, but the effect on community-level totals is expected to be negligible.

Step 3: Assign Parcels to Dissemination Blocks and Allocate Population and Dwellings

The 2021 Geographic Attribute File was joined to the DB boundary file to attach population and total dwelling counts to each block. Parcels were then spatially joined to the DB layer using polygon intersection, associating each parcel with the DB it falls within.

Population and dwellings were distributed equally across all parcels within each DB. For a given block containing n parcels with a total population of P and total dwellings of D, each parcel was assigned a share of P/n residents and D/n dwellings. An area-weighted distribution (allocating population and dwellings in proportion to each parcel's share of the DB's total parcel area) would better reflect density variation within a block and could be applied as a refinement where parcel size varies substantially. Equal distribution was used here for simplicity and consistency across all communities. Where communities have detailed parcel data that includes dwelling counts, that is best to use.

Step 4: Classify FSI and Summarise by Geography

With each parcel carrying both a mean FSI value and a proportional share of population and dwellings, results were aggregated across three geographic levels: CSD, CD, and province. For each level, the following were calculated:

- Mean and median FSI across all parcels in the unit
- Count of parcels in each FSI bracket (low, moderate, high)
- Total estimated dwelling units in each FSI bracket
- Total estimated residents in each FSI bracket

The three geographic summaries were combined into a single output file, with the common field DGUID carrying UIDs at the CSD, CD, or provincial level depending on the row.

6 LIMITATIONS

Several limitations of the FSI bear on the interpretation of results from this analysis:

- **Parcel as unit of analysis**
  Parcels are treated as the unit of analysis, but parcel boundaries do not always correspond neatly to individual dwelling units. Large parcels containing multiple residential buildings, strata-titled units, or mixed-use structures will carry a single mean FSI score and a single population and dwelling share, which may obscure internal variation.

- **Population and dwelling distribution**
  Population and dwelling counts are distributed equally across all parcels within a Dissemination Block. This does not account for variation in parcel size, unit type, or occupancy rates within a block. An area-weighted distribution would reduce this error in blocks where parcel sizes vary substantially.

- **Boundary parcels**
  Parcels that straddle a CSD boundary are assigned to a single CSD based on intersection rather than area apportionment. This may marginally misattribute population and dwellings for large boundary parcels.

- **Geographic vintage inconsistencies**
  Dissemination Block and Census Subdivision boundaries and population counts are from the 2021 Census; CSD boundaries are from 2021. Minor geographic inconsistencies between vintages are possible.

- **Infrastructure is not reflected**
  The FSI is based solely on physical terrain and soil characteristics. It does not account for stormwater infrastructure, retention ponds, ditches, culverts, dikes, or other flood control works that materially affect actual flood exposure in developed areas. A location with a high FSI score may carry limited real-world flood risk if adequate drainage infrastructure is in place, and vice versa.

- **The index is not a flood hazard designation**
  The FSI is not equivalent to a floodplain map and should not be interpreted as one. It does not identify regulatory floodplains, flood fringe areas, or lands subject to specific flood return periods (e.g., 1-in-100-year events). Users requiring regulatory or insurance-grade flood hazard data should consult provincial or municipal floodplain mapping where available.

- **Spatial resolution is 30 metres**
  At this resolution, fine-scale variation within a parcel or block (such as differences in elevation between a building pad and an adjacent low spot) is not captured. Results are most reliable when interpreted at the community or neighbourhood scale rather than the individual property level.

- **Reference year is 2015**
  Land cover, drainage patterns, and development conditions may have changed since the index was produced. Areas that have been developed, regraded, or drained since 2015 may carry FSI scores that no longer accurately reflect current conditions.

- **Climate change is not incorporated**
  The FSI reflects susceptibility under historical terrain and soil conditions. It does not incorporate projected changes in precipitation intensity or frequency associated with climate change, which are expected to increase surface flood risk in many parts of Canada over coming decades.

- **Fluvial and coastal flooding are not distinguished**
  The FSI is primarily a terrain-based surface flooding index. It is not specifically designed to capture fluvial (riverine) or coastal flooding dynamics, though low-lying areas near watercourses or coastlines may score highly based on their topographic features alone.

Given these limitations, FSI-based results in this analysis are best understood as an indicator of where flood susceptibility warrants further investigation, rather than a definitive characterization of flood risk. The findings should be read alongside any available provincial floodplain mapping, municipal stormwater studies, or infrastructure assessments.