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**CSA W204:19**
National Standard of Canada

# Flood resilient design of new residential communities



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*National Standard of Canada*

# *CSA W204:19*

# ***Flood resilient design of new residential communities***





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# Preface

This is the first edition of CSA W204, *Flood resilient design of new residential communities.*

It should be noted that this Standard, by itself, does not have the force of law unless it is officially adopted by a regulatory authority. Since regulatory authorities can adopt the Standard with certain exceptions or additional requirements, the regulatory authority of the relevant jurisdiction should be consulted in order to establish the extent to which this Standard has been adopted.

Where this Standard conflicts with regulatory requirements, the regulatory requirements take precedence.

CSA Group acknowledges that the development of this Standard was made possible, in part, by the financial support of Standards Council of Canada, as part of the Standards to Support Resilience in Infrastructure Program.

This Standard was prepared by the Technical Committee on Flood Resilient Design in Communities under the jurisdiction of the Strategic Steering Committee on Natural Resources and has been formally approved by the Technical Committee.

This Standard has been developed in compliance with Standards Council of Canada requirements for National Standards of Canada. It has been published as a National Standard of Canada by CSA Group.

**Notes:**

1) *Use of the singular does not exclude the plural (and vice versa) when the sense allows.*
2) *Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.*
3) *This Standard was developed by consensus, which is defined by* CSA Policy governing standardization — Code of good practice for standardization *as "substantial agreement. Consensus implies much more than a simple majority, but not necessarily unanimity". It is consistent with this definition that a member may be included in the Technical Committee list and yet not be in full agreement with all clauses of this Standard.*
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   b) *provide an explanation of circumstances surrounding the actual field condition; and*
   c) *where possible, phrase the request in such a way that a specific "yes" or "no" answer will address the issue.*

   *Committee interpretations are processed in accordance with the* CSA Directives and guidelines governing standardization *and are available on the* Current Standards Activities *page at* ***standardsactivities.csa.ca****.*
5) *This Standard is subject to review within five years from the date of publication. Suggestions for its improvement will be referred to the appropriate committee. To submit a proposal for change, please send the following information to* ***inquiries@csagroup.org*** *and include "Proposal for change" in the subject line:*
   a) *Standard designation (number);*
   b) *relevant clause, table, and/or figure number;*
   c) *wording of the proposed change; and*
   d) *rationale for the change.*

# *CSA W204:19*
# *Flood resilient design of new residential communities*

## 0 Introduction

### 0.1 The need for flood resilience in Canada

The number of weather-related natural catastrophes in Canada has increased in the last few decades. Water-related damages from floods and rainstorms comprised a significant portion of the financial cost associated with these natural catastrophes. There are several factors contributing to this trend, including the high number of properties located in flood-prone areas, increasing property values, loss of pervious surfaces due to urbanization, aging infrastructure, and, in some regions, changes in the intensity, frequency, or duration of precipitation events thought to be due to climate change. Though damages are prominent in older communities (largely built with limited design capacity to accommodate extreme weather), some damages do occur in new communities as well.

Considering this, there is a broad consensus among stakeholders of the need to make Canadian communities more resilient to flooding. Increased flood resilience will improve public safety, reduce potential flood damages, help alleviate mental distress among those impacted by floods, and allow the community to deliver essential services during flood events and return to normal functions more quickly after flood events. Increased resilience will also reduce flood-related financial impacts on homeowners (due to property damage, retrofits, flood insurance premium increase, and flood exposure-related property value reduction), as well as reduce costs to municipalities, provinces, and federal government for flood-related response activities.

Incorporating additional flood-resilient design measures into the planning and development of new residential communities will also help avoid costly future infrastructure replacement and remedial work, as well as potential liability related to inadequate design standards.

The need to better protect Canadians from flooding has motivated a broad range of stakeholders to take action. This includes all levels of government, watershed/conservation authorities, utilities, developers and homebuilders, not-for-profit organizations, businesses, and other organizations. Actions have included expanding and accelerating educational campaigns, infrastructure retrofit programs, and subsidy programs aimed at flood resilience.

The development of this Standard is to complement these efforts. This Standard was developed to provide requirements and guidance on flood-resilient design for new residential communities built in Canada and is intended to serve as a useful instrument by all levels of government, watershed/ conservation authorities, utilities, developers, homebuilders, and others. It is inspired by the foundational report "*Preventing Disaster before It Strikes: Developing a Canadian Standard for New Flood Resilient Residential Communities"* developed by the Intact Centre on Climate Adaptation at the University of Waterloo. The full list of potential users and beneficiaries is provided below.

For the purpose of the Standard, flood resilience is defined as the ability of the system (both natural and built infrastructure) to recover from an extreme event with minimal damages, functionality disruptions, and socio-economic impacts during and after an extreme flooding event. Flood resilience



  

also includes the siting of new residential communities beyond natural flood hazard areas and the incorporation of features in new housing developments that both reduce their susceptibility to flood risks and mitigate against flood-related damages.

It is understood that measures to increase flood resilience can carry significant costs and a proper design standard must therefore strike a reasonable balance between the lifecycle costs of engineering measures and the expected value of averted damages they provide. It would not be economically feasible to eliminate flood risk, as there will always be conditions and events that will exceed the design capacity of storm and sanitary infrastructure, as well as overland drainage systems, or that will extend natural hazards beyond regulated limits. These conditions will result in flood damages. The intent of flood-resilient community design is to aid in reducing the probability and the impacts of these conditions and events, as well as to improve the recovery process following the event.

The frequency and magnitude of damage to property resulting from flood events are likely to increase in some regions due, in part, to climate change. This Standard will help in ensuring that new residential communities are built in a flood-resilient manner, which in turn will reduce future costs and socio-economic impacts resulting from flood damage.

## 0.2 Potential users of this Standard

The potential users of this Standard include the following:

a) banks/credit unions/mortgage lenders: Flood-related loss can impact the value of a home and the capacity of homeowners to service their mortgage debt. Mortgage lenders can use this Standard to better assess the flood resilience of homes they finance, both to determine whether to approve a mortgage application where flood risk is a factor, and to set mortgage interest rates to reflect any underlying risk involved.

b) building inspectors: Qualified professionals delegated by a government agency to perform assessments as to whether a building meets building code requirements. The Standard, in conjunction with related building standards and codes, can assist inspectors in verifying compliance as required by authorities having jurisdiction.

c) consultants: Qualified professionals who provide expert advice in a particular area relating to flood-resilient planning, design, and construction can be engaged to ensure that aspects of a residential development comply with this Standard.

d) credit rating agencies: Increasingly, credit rating agencies are factoring the potential impacts of severe weather into the credit ratings of local governments, provinces, and publicly traded companies. This Standard provides direction on factors that enhance the flood resilience of communities, which in turn can be incorporated into credit rating analysis.

e) developers/home builders: Increasingly, builders and developers are required to incorporate flood resilience into community design and construction. This Standard provides a direction to builders and developers on specific measures and practices that will result in developing more flood-resilient communities and houses.

f) educational institutions: Universities (e.g., engineering and planning departments), colleges, and other educational institutions will find this Standard of direct relevance to educating students on the fundamentals of flood-resilient community design.

g) governments: Governments at all levels need to be concerned about the increasing risk that flooding presents to their constituents as well as the risk of diminished capacity to extend services to communities due to flooding. This Standard provides a foundation for informed decision making on flood preparedness and flood-resilient community design.

h) home buyers: Home owners are increasingly impacted by flooding. This Standard will help homebuyers purchase homes that are located in more flood-resilient communities, giving them increased peace of mind and financial security.
i) home inspectors: Increasingly, home inspectors are being asked to provide more detailed assessments pertaining to the vulnerability of homes to flooding. This Standard will help home inspectors to provide better insights into the flood resilience of new homes and communities.
j) institutional investors: Large-scale flooding could affect institutional investments in residential real estate. This Standard will help to inform institutional investors in relation to flood risks related to residential holdings.
k) lawyers: Legal cases pertaining to how the construction and design of new communities can affect flood risk are increasing. This Standard provides direction to legal professionals regarding the fundamentals of flood-resilient community design, as well as nationally accepted benchmarks, against which they can assess the fulfilment of duty of care.
l) property and casualty insurers: Property and casualty insurers can use this Standard to better assess the flood resilience of new subdivision design. They can determine that compliance with this Standard justifies lower flood insurance premiums for homes located in communities designed in accordance to this Standard.
m) real estate brokers/agents: In localities where real estate brokers/agents are being asked questions related to flood potential, this Standard will help them provide more informed responses to such inquiries.
n) securities commissions: The 13 Canadian securities commissions require full disclosure of environmental risks that could influence a decision of a reasonable investor whether or not to invest in the stock or bond of a publicly traded company. This Standard will inform securities commissions in reference to how flood-preparedness should factor into residential community design, construction, and flood risk disclosure by publicly traded companies.
o) trades persons: Trades persons (e.g., drainage contractors, plumbers) asked to provide input to builders, homeowners, and municipalities on flood risk mitigation can use this Standard to better serve their clientele.
p) Water and wastewater utilities: Water and wastewater utilities, either separate organizations or municipal departments, are concerned about the increasing risk that flooding presents to their customers as well as the diminished capacity to support response during flooding events. This Standard provides a foundation for informed decision making around flood resilient planning, design and construction and inspection of new infrastructure in their service area.

# 1 Scope

## 1.1 Inclusions of the Standard

### 1.1.1 Purpose of this Standard

The purpose of this Standard is to provide compliance criteria and guidance on the design of flood-resilient new residential communities as it relates to greenfield development only.

### 1.1.2 Building types

This Standard is applicable to the following building types:
a) detached homes;
b) semi-detached homes;
c) row houses (including stacked and back-to-back townhomes); and

  

d) mixed-use residential development (residential, small commercial, and institutional use).

**Note:** *Garages (attached and detached) and non-habitable accessory buildings (e.g., porches, gazebos) located on the residential lots are considered within the scope of this Standard.*

### 1.1.3 Design elements

This Standard covers the following considerations:

a) design for resilience to address extreme weather events and operational uncertainties;
b) storm sewer system design (minor drainage system considerations);
c) street design (major overland drainage system considerations);
d) sanitary sewer design (wastewater drainage system considerations);
e) wastewater pumping station design; and
f) considerations for preservation of natural infrastructure and low impact development measures.

### 1.1.4 Flood hazards

The types of flood hazards considered by this Standard include

a) riverine flooding;
b) overland flooding;
c) storm and sanitary sewer surcharge;
d) drainage system failures (e.g., inlet, ice, and debris blockages); and
e) groundwater seepage.

## 1.2 Exclusions of the Standard

### 1.2.1 Other types of development

This Standard does not cover flood resilience considerations as they relate to existing development, infill, intensification, or redevelopment.

### 1.2.2 Types of flood hazards

Types of flood hazards that are outside the scope of this Standard include

a) sea level rise;
b) storm surges;
c) unique flood hazards (e.g., dam failures); and
d) flood risk specific to alluvial fans.

### 1.2.3 Geographic limitations

This Standard includes requirements and recommendations expected to be relevant across Canada. Its application could be insufficient in the areas with permafrost, such as Yukon, Northwest Territories, and Nunavut, as well as in areas subject to coastal and lake flooding, where sea level rise and storm surges pose additional flood risk that is not addressed by the Standard.

## 1.3 Requirements of local jurisdictions

This Standard provides requirements and recommendations for the design of flood-resilient greenfield community developments. In the application of this Standard, it should be noted that local jurisdictions might have criteria or requirements beyond what is provided in this Standard. The intent of this Standard is to provide minimum acceptable criteria. In the event that a local jurisdiction requirement is more stringent than that required by this Standard, the more stringent requirement takes precedence over the requirement stipulated in this Standard. It is the responsibility of the user of this Standard to be aware of any discrepancies and to determine the manner in which it can be resolved.

  

### 1.4 Climate uncertainty considerations

This Standard provides a dynamic approach to the design of flood-resilient new residential communities. This includes the use of data that anticipates future climate changes, including changes in the frequency of extreme rainfall events. Such data is currently the subject of intense research but is not yet available with adequate confidence. In the absence of such predictive climate data, the users of this Standard should consider applying appropriate adjustments to current intensity-duration-frequency (IDF) values to account for climate uncertainties. For information on the use and interpretation of IDF information, see CSA PLUS 4013:2019.

### 1.5 Terminology

In this Standard, "shall" is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the Standard; "should" is used to express a recommendation or that which is advised but not required; and "may" is used to express an option or that which is permissible within the limits of the Standard.

Notes accompanying clauses do not include requirements or alternative requirements; the purpose of a note accompanying a clause is to separate from the text explanatory or informative material.

Notes to tables and figures are considered part of the table or figure and may be written as requirements.

Annexes are designated normative (mandatory) or informative (non-mandatory) to define their application.

## 2 Reference publications

This Standard refers to the following publications, and where such reference is made, it shall be to the edition listed below.

**CSA Group**

PLUS 4013:19
*Technical guide: Development, interpretation and use of rainfall intensity-duration-frequency (IDF) information: Guideline for Canadian water resources practitioners*

S6:19
*Canadian Highway Bridge Design Code*

CAN/CSA-W202-18
*Erosion and sediment control inspection and monitoring*

Z800-18
*Guideline on basement flood protection and risk reduction*

**National Research Council Canada**

*National Plumbing Code of Canada,* 2015

**Other publications**

Ball, J., Babister, M., Nathan, R., Weeks, W., Weinmann, E., Retallick, M., and Testoni, I., eds. 2019. *Australian Rainfall and Runoff: A Guide to Flood Estimation.* Commonwealth of Australia.

  