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Proposed Change 2137

Code Reference(s):	**NPC25 Div.B 2.4.6.4. (first printing)**
Subject:	Drainage Systems
Title:	Installation of a Backwater Valve for Plumbing Fixtures Located Below the Upstream Sanitary Manhole
Description:	This proposed change clarifies requirements for the installation of a backwater valve to protect plumbing fixtures from backflow.
Related Code Change Request(s):	CCR 817

This change could potentially affect the following topic areas:

- ☐ Division A
- ☐ Division C
- ☐ Building operations
- ☑ Small Buildings
- ☐ Fire Protection
- ☐ Accessibility
- ☐ Building Envelope
- ☐ Heating, Ventilating and Air Conditioning
- ☑ Division B
- ☑ Design and Construction
- ☑ Housing
- ☑ Large Buildings
- ☐ Occupant safety in use
- ☐ Structural Requirements
- ☐ Energy Efficiency
- ☑ Plumbing
- ☐ Construction and Demolition Sites

Problem

Article 2.4.6.4. in Division B of the National Plumbing Code of Canada (NPC) requires the installation of a backwater valve where a building drain or branch may be subject to backflow, especially for plumbing fixtures (including retention pits, sumps or running traps) located below the level of the adjoining street. However, the wording currently used in the Code lacks specificity regarding elevation relative to the upstream sanitary manhole, which leads to inconsistent interpretation and enforcement across jurisdictions.

Fixtures located below the upstream manhole cover are highly vulnerable to sewer surcharge events, particularly during periods of extreme rainfall or flooding. Authorities having jurisdiction may interpret the NPC narrowly, requiring backwater valves only in particular situations, which may result in insufficient protection for at-risk fixtures.

Without a clear requirement based on elevation relative to the upstream manhole cover, properties remain exposed to sewer backup risks, contributing to costly damage, insurance claims and health hazards. Clarifying this requirement would promote consistent application and improve lot-side protection against flooding and sewer surcharging.

If the requirement is not made clearer in the NPC, some new houses could continue to be built without adequate backflow prevention, which would increase exposure to sewer backup and impose burdens on homeowners and municipalities that are avoidable. By requiring backwater valves to be installed for fixtures located below the upstream sanitary manhole cover, the Code would ensure that fixtures subject to backflow are protected.

Justification

The NPC already requires a backwater valve to be installed on every fixture drain connected to the building drain or branch when it is located below the level of the adjoining street. This proposed change would extend this protection from backflow to residential buildings served by a public sanitary sewer where fixtures are located below the elevation of the upstream sanitary manhole cover in buildings served by a public sanitary sewer or a private sewage disposal system. Although the number of such properties is relatively small, they remain at significant risk of sanitary sewer backup events and would therefore benefit from this additional protective measure.

As defined in the NPC, a “private sewage disposal system” is a privately owned plant for the treatment and disposal of sewage, such as a septic tank with an absorption field. This broad term also includes private sanitary sewers serving that system. The intent of this proposed change is to minimize the risk to properties where plumbing fixtures are located below the elevation of the upstream sanitary manhole cover, for buildings served by either a public sanitary sewer or a private sewage disposal system.

As outlined in the Problem statement, the NPC lacks clear direction regarding the installation of backwater valves for fixtures located below the upstream sanitary manhole cover, leading to inconsistent application and increased risk of sewer backup. By identifying this condition as the trigger for backwater valve installation, this proposed change would provide a clear and consistent way to address a well-known vulnerability of drainage systems.

This proposed change would add a connector line in Figure A-2.4.6.4.(3) to clearly illustrate the physical point where the branch connects with the stack, ensuring unambiguous identification of the flow path and the appropriate placement of the backwater valve, as the branch and stack are always connected as part of the continuous drainage path leading to the building drain and sewer.

Explanatory Note A-2.4.6.4.(3) would be revised to improve clarity and accuracy by removing subjective wording and aligning the text with the technical criteria used in the NPC. The updated wording focuses directly on the physical condition that triggers the

requirement, i.e., fixtures located below the adjoining street or upstream manhole cover, and therefore ensures consistent interpretation and application by Code users and authorities.

This proposed change would improve protection from backflow for at-risk fixtures, reduce the likelihood of flood-related damage to residential buildings and promote enforcement of backflow prevention measures across jurisdictions.

PROPOSED CHANGE

[2.4.6.4.] 2.4.6.4. Protection from Drainage Backflow

[1] 3) A *subsoil drainage pipe* that drains into a *sanitary drainage system* ~~that is subject to surcharge~~ shall be connected in such a manner that *sewage* cannot back up into the *subsoil drainage pipe*. ~~(See Note A-2.4.6.4.(1).)~~

[2] --) Where a *building drain* or *branch* may be subject to *backflow*, a *backwater valve* shall be installed in accordance with Sentences (3) to (6).

[3] 1) Except as provided in Sentences (4) and (5), the *backwater valve* required by Sentence (2) shall be installed on every *fixture drain* connected to the *building drain* or *branch* where the *plumbing fixture* is located below the level of

[a] --) the adjoining street, or

[b] --) the upstream sanitary manhole cover where a *building* is served by a public *sanitary sewer* or a *private sewage disposal system*.

(See Note A-2.4.6.4.(3).)

[4] 2) Where two or more *plumbing fixtures* located on a *storey* are connected to the same *branch*, the *backwater valve* required by Sentence (2) is permitted to be installed on the *branch*.

[5] 5) Except as provided in Sentence (6), the *backwater valve* required by Sentence (2) is permitted to be installed in the *building drain*, provided the *backwater valve*

[a] b) does not serve more than one *dwelling unit*, and

[b] a) has a “normally open” design conforming to

[i] i) CSA B70, "Cast iron soil pipe, fittings, and means of joining",

[ii] ii) CSA B181.1, "Acrylonitrile-butadiene-styrene (ABS) drain, waste, and vent pipe and pipe fittings",

[iii] iii) CSA B181.2, "Polyvinylchloride (PVC) and chlorinated polyvinylchloride (CPVC) drain, waste, and vent pipe and pipe fittings", or

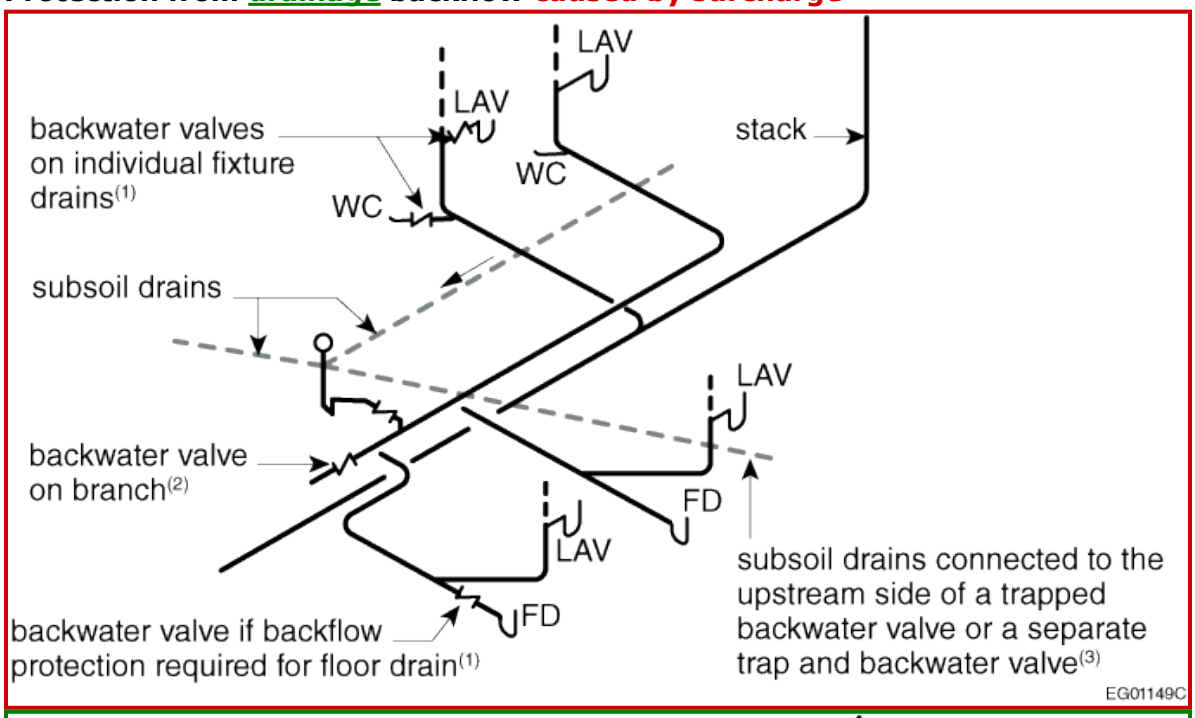
[iv] iv) CSA B182.1, "Plastic drain and sewer pipe and pipe fittings".

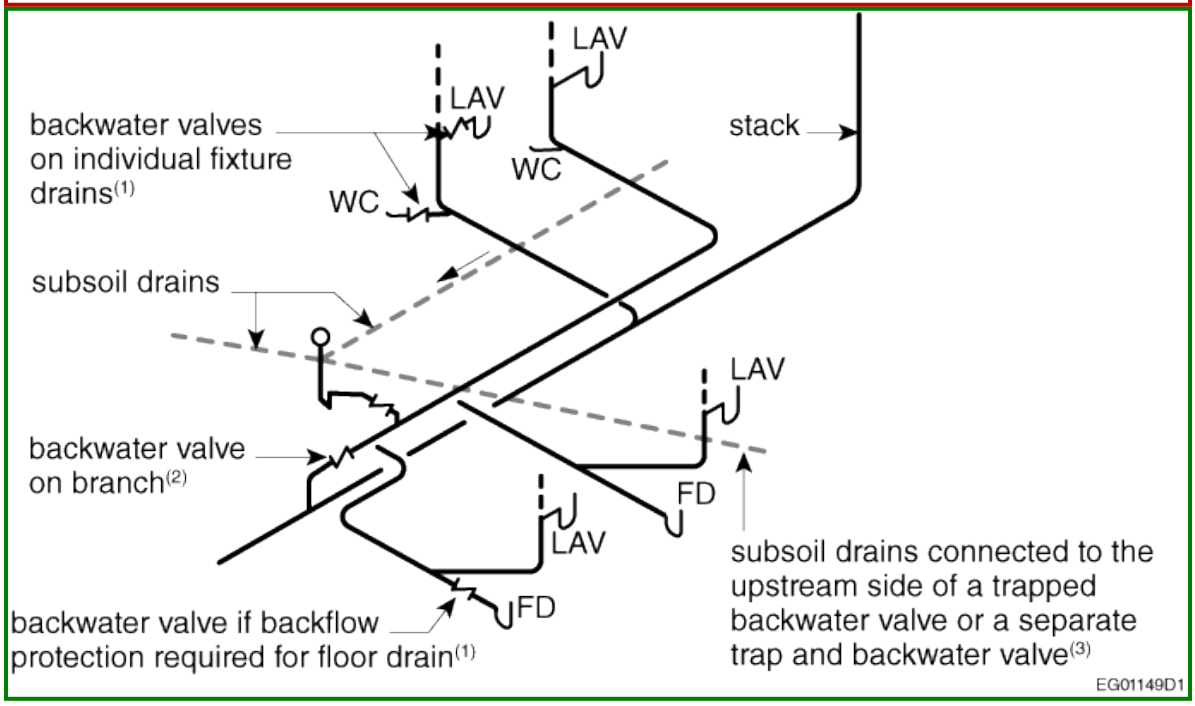
[6] 4) A *backwater valve* or a gate valve that would prevent the free circulation of air shall not be installed in a *building drain* or in a *building sewer*.

Note A-2.4.6.4.(~~1~~3) Protection from Drainage Backflow ~~Caused by Surcharge~~.

The requirement in Sentence 2.4.6.4.(~~1~~3) is intended to apply when~~, in the opinion of the authority having jurisdiction, there is danger of backup from a public sewer~~ plumbing fixtures are located below the level of the adjoining street or upstream manhole cover for a public sanitary sewer or a private sewage disposal system and are, therefore, subject to backflow.

Figure [A-2.4.6.4.(13)] A-2.4.6.4.(3)
Protection from drainage backflow ~~caused by surcharge~~





Notes to Figure A-2.4.6.4.(3):

(1) See Sentence 2.4.6.4.(3).

(2) See Sentence 2.4.6.4.(4).

(3) See Sentence 2.4.6.4.(1).

Impact analysis

The installation of backwater valves is considered a key preventative measure for avoiding sanitary sewer backflow during surcharge events, which is a growing concern in Canadian municipalities due to climate change and urban intensification. On a national scale, insurance payouts related to water damage and sewer backup average approximately $1.7 billion annually [1]. The financial impact on individual homeowners is also significant, with claim values typically ranging from $19,000 to $80,000, depending on the severity of the damage.

In response to this persistent risk, municipalities such as Toronto, Windsor and Edmonton have implemented mandatory backwater valve installation policies. These proactive measures have resulted in higher adoption rates of backflow prevention devices and have been associated with reduced damage severity during extreme storm events.

In general, the cost of the backwater valve itself is relatively consistent across regions; however, labour costs can vary depending on factors such as local labour rates, availability of qualified trades and the accessibility of the plumbing system. Additional variation may arise from whether the installation occurs in new construction or as a retrofit, the age and type of building, and other site-specific conditions. While these factors cannot be individually quantified here, general considerations including regional labour variation, system accessibility and installation conditions were assessed when evaluating the overall cost implications.

The estimated range of costs and impacts associated with the installation of backwater valves were evaluated based on labour and material costs, including those associated with backwater valve installation, and compared with recent RSMeans pricing to ensure that current labour rates and material costs are appropriately reflected. This comparison indicates that the estimated total labour and material costs are consistent with the range of values reported by the Institute for Catastrophic Loss Reduction [1].

Tables 1 and 2 represent the total estimated cost, including labour and materials, of installing a backwater valve in new and existing houses, respectively. The lower cost range reflects regions with lower labour rates, good trade availability and installations with straightforward system access (typically found in newer houses). The upper cost range reflects regions with higher labour rates, limited trade availability or installations with restricted access (as found in older buildings or more complex retrofit conditions).

Table 1. Estimated Costs for Backwater Valve Installation in a New House

Category	Cost Range (CAD)	Description
Labour cost	$150–$250	Cost of installing a backwater valve during initial plumbing work
Material cost	$100–$150	Cost of a normally open, full-port backwater valve and associated fittings
Estimated total cost	$250–$400	Total cost of labour and materials

Table 2. Estimated Costs for Retrofit Backwater Valve Installation in an Existing House

Category	Cost Range (CAD)	Description
Labour cost	$800–$1,500	Cost of retrofitting a backwater valve
Material cost	$200–$300	Cost of backwater valve and fittings plus restoration materials (e.g., concrete, piping)
Estimated total cost	$1,000–$1,800+	Total cost varies with layout of existing house and scope of modifications

Overall construction costs have increased since the reference data were published in 2013 [1], and the potential damage resulting from sanitary sewer backflow during surcharge events has also increased, leading to higher costs to remedy and restore affected building components. However, the proportional relationship between initial installation costs and costs of repairing sewer backup damage has remained relatively consistent over time as material, labour and repair cost increases tend to follow similar trends.

Table 3. Ratio of Cost of Installing a Backwater Valve to Cost of Repairing Sewer Backup Damage in New and Existing Houses

Category	Ratio of Estimated Total Initial Cost/National Average for Damage Repair (CAD)	Percentage (Ratio × 100)%
New house	$400/($19,000–$80,000)	0.5–2.1
Existing house	$1,800/($19,000–$80,000)	3.1–13.1

Table 3 shows that the cost of installing a backwater valve in new construction (~$400) represents approximately 0.5%–2.1% of the estimated cost to repair damage from a sewer backup event ($19,000–$80,000). For retrofit installations (~$1,800), the cost represents approximately 3.1%–13.1% of the expected damage repair cost. These percentages highlight that preventative installation, particularly during new construction, is a highly cost-effective mitigation measure compared to post-event restoration.

The initial cost of installing a backwater valve differs significantly between new and existing houses. Installation during new construction is relatively inexpensive (~$400), whereas retrofit installation in existing houses costs much more (~$1,800) due to additional labour, plumbing alterations and on-site access constraints. At the same time, the likelihood of experiencing a sanitary sewer backup event varies widely depending on regional conditions and individual property characteristics. Houses in low-risk areas generally face a minimal chance of experiencing a backup, whereas properties in high-risk areas may experience such events frequently.

When these factors are considered together, the substantially lower installation cost in new houses makes the inclusion of a backwater valve a practical and economic measure across all risk categories, whether the property is classified as low, medium or high risk

based on the expected frequency of backup events. In existing houses, however, the much higher retrofit cost means that installation is typically most justifiable in medium- and high-risk areas, where the likelihood of a sewer backup event is greater and the potential for recurring damage is more significant, whereas the benefit may be limited for houses classified as low risk.

Houses with fixtures located below the elevation of the upstream sanitary manhole cover are particularly vulnerable during surcharge conditions, making backwater valve installation an essential preventative measure. Including a valve during new construction greatly reduces the risk of costly property damage and associated health impacts, whereas failing to install one at that stage may lead to expensive retrofits or substantial losses during future flooding events.

Reference
[1] Sandink, D. “Urban flooding in Canada: Lot-side risk reduction through voluntary retrofit programs, code interpretation and by-laws.” Institute for Catastrophic Loss Reduction, February 2013.

Enforcement implications

This proposed change could be enforced by the existing Code enforcement infrastructure without requiring additional resources. The requirement for authorities having jurisdiction to verify compliance with backwater valve installation would not change. This proposed change would facilitate more consistent interpretation of the Code requirements without adding new enforcement responsibilities or altering existing inspection practices.

Who is affected

This proposed change might affect a broad range of stakeholders involved in the design, specification, manufacture, approval, construction and operation of drainage systems, including, but not limited to, designers, specification writers, manufacturers, building owners, contractors and building officials.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[2.4.6.4.] 2.4.6.4. ([1] 3)[F81-OH2.1]

[2.4.6.4.] -- ([2] --)[F81-OH2.1]

[2.4.6.4.] 2.4.6.4. ([3] 1)[F81-OH2.1]

[2.4.6.4.] 2.4.6.4. ([4] 2)no attributions

[2.4.6.4.] 2.4.6.4. ([5] 5)[F81-OH1.1]

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