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CITY OF **VANCOUVER**

POLICY REPORT
DEVELOPMENT AND BUILDING

Report Date:	April 3, 2007
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VanRIMS No.:	11-2000-14
Meeting Date:	April 17, 2007

TO: Vancouver City Council

FROM: Subdivision Approving Officer and Chief Building Official, in consultation with the General Manager of Engineering Services

SUBJECT: Flood-Proofing Policies

RECOMMENDATION

A. THAT the existing Flood-Proofing Policies, referenced in establishing conditions of subdivision or building permit approval, initially established by resolution on January 5, 1988 and amended on February 28, 1995, be amended to modify the requirements for non-residential development and clarify the survey datum for establishing flood construction levels.

B. THAT the existing Flood-Proofing Policies be further amended to incorporate provisions pertaining to lands adjacent Still Creek, as detailed in Appendix C, to increase by 0.5 m the Flood Construction Level (FCL) for the False Creek Flats, and to increase by 0.3 m the FCL for lands adjacent the Fraser River east of the Oak Street Bridge.

C. THAT Council adopt the revised "Flood-Proofing Policies" as presented in Appendix D.

GENERAL MANAGER'S COMMENTS

The General Manager of Community Services RECOMMENDS approval of A, B and C.

CITY MANAGER'S COMMENTS

The City Manager RECOMMENDS approval of A, B and C.

COUNCIL POLICY

By resolution of Council, Provincial flood-proofing standards were previously adopted by the City to establish setback and elevation requirements for construction on lands subject to flooding adjacent the Fraser River, False Creek, Burrard Inlet and English Bay. The current Council policy also contains specific flood-proofing policies for the Southlands flood plain.

In 1990, Still Creek development guidelines were adopted by Council and subsequently updated in 2002.

SUMMARY

The Province has now delegated to municipalities the jurisdiction and responsibility to manage development on lands that may be subject to flooding. The City's previous approach was to adopt Provincial flood-proofing standards (i.e., building setbacks and construction elevations) for lands adjacent the Fraser River, False Creek, Burrard Inlet and English Bay. This was appropriately deferential and responsible in terms of risk management.

Given the Provincial delegation of its jurisdiction, continuation of the setback and elevation requirements is seen as appropriate. However, review has indicated current needs to revise the requirements in some circumstances and clarify the survey references. Review has also identified flood potential for lands adjacent Still Creek east of Renfrew Street, as well as the potential for ponding of run-off in the False Creek Flats, and the need for Council adoption of suitable flood-proofing policy to address these situations.

This report responds to immediate needs to clarify the City's flood-proofing role, but not to long term policy changes. Staff expect that additional revisions to the City's flood-proofing policies will be required to adapt to climate change. Current estimates of climate change impacts, such as sea level rise and increased storm intensities, vary widely. Staff will be closely monitoring the emerging scientific understanding of climate change impacts and will recommend appropriate policy changes in future Council reports, as more specific local estimates are developed.

Review of the current standards has also led to creation of a more complete data base of properties that should trigger further site-specific analysis regarding the imposition of flood-proofing standards as a condition of subdivision approval or building permit issuance.

PURPOSE

This report reviews existing City flood-proofing policy and its administration in light of expanded City responsibility. It recommends that existing policy generally be reaffirmed but amended to incorporate several clarifications. It also recommends Council approval of appropriate flood-proofing policy for lands that may be prone to flooding adjacent portions of Still Creek and in the False Creek Flats. In addition, it informs Council of recent map preparation to identify the geographic extent of lands in Vancouver that may be subject to flood-proofing standards by virtue of their elevation and proximity to the natural boundary of the Pacific Ocean, Fraser River or Still Creek.

BACKGROUND

On April 12, 1986, City Council endorsed specific flood-proofing policies for the Southlands flood plain. On January 27, 1987, City Council indicated its support for the existing Provincial flood-proofing standards and its extension to all new construction within the lands prone to flooding and erosion along the Fraser River, False Creek, Burrard Inlet and English Bay. The *Vancouver Charter* was subsequently amended to enable City implementation of the flood-proofing policies via the City's building permit process. Consequently, the imposition of flood-proofing requirements is managed as a condition of building permit issuance.

The requirements, reflected in a legal agreement registered on title at the time of subdivision approval or building permit issuance, establish the minimum elevation for construction of habitable space and protection of construction against erosion. The legal agreement also indemnifies the Province and the City.

The Greater Vancouver Regional District completed a study in 1998 on the risk of flooding in the Still Creek-Brunette River Basin. In Vancouver, it found that certain areas along the stream corridor between Renfrew Street and Boundary Road were prone to flooding. Additional studies have recommended implementing flood-proofing measures for new development in the Still Creek flood zone.

The imposition of flood-proofing requirements at the building permit stage suitably addresses existing legal parcels. However, requirements may also be imposed, well in advance of construction, if lands are being subdivided.

Under the *Land Title Act "(the LTA)"*, an Approving Officer must consider the physical attributes of lands to be subdivided and their suitability for development. The *LTA* provides for refusal of a subdivision where the lands may be subject to flooding, erosion, land slip or avalanche. For subdivisions in Vancouver involving lands that may be subject to flooding, the nature of the flood potential is not as dramatic as might be expected elsewhere in the province. Nonetheless, the *LTA* compels the Approving Officer to establish appropriate requirements to eliminate or suitably mitigate the risks, prior to final subdivision approval. In these instances the Approving Officer has historically required a flood plain covenant, to the satisfaction of the Province, previously being the authority having jurisdiction regarding flood proofing standards. These covenants have reflected the Provincial flood proofing standards (as adopted by the City), and incorporated indemnification of both the Province and the City.

In 2004, the Province delegated to municipalities its responsibility respecting flood-proofing standards. In doing this, the Province provided a 'model' covenant for use by municipalities, incorporating Provincial indemnity in a manner desired by the Province. The Province also published "Flood Hazard Area Land Use Managements Guidelines", dated May 2004, to assist municipalities in assuming this responsibility.

Flood Mechanisms

Two major flood events occurred in British Columbia, in 1894 and 1948. The 1894 flood of the Fraser River is estimated to have reached a peak flow of 17,000 m^3/sec, the largest flood of record, while the 1948 flood reached a peak flow of 15,000 m^3/sec in the Fraser River at Hope. The current design standard for a flood in British Columbia is based on the 1894 flood event which affected a broad area of southern British Columbia. This standard was also adopted by the Fraser River Flood Control Program (FRFCP). Adjacent the Fraser River in Vancouver, the Flood Construction Level (FCL) of 3.5 m is based on a 1:200 year water level with the addition of "freeboard", to accommodate uncertainties such as wave action.

Flooding risk in Vancouver is caused by a combination of tidal levels (high tides), storm surges, wave action and Fraser River freshet flows.

Tide levels may be unusually high during Strait of Georgia storm surges associated with low pressure systems and high winds. This is illustrated by the highest tide recorded at Point Atkinson which was 2.7 m above geodetic datum in 1982, established by the federal government through the Geodetic Survey Division, and referred to as GSC datum. These levels are still well below the 3.5 m FCL in the current City standards.

Downstream of Oak Street, and elsewhere around the Burrard peninsula, flood potential is primarily affected by tidal levels (high tides) and storm surges, which are increased water elevations caused by storm events and westerly storm activity causing wind generated waves. Consequently, during a combined high tide and Fraser River flood event as experienced in 1894, water levels downstream of Oak Street would be at the 'normal' high tide level in English Bay, which is typically 1.9 m above geodetic datum. The current 3.5 m FCL (3.0 m when more than 300 metres from the water boundary) reflect a suitably conservative approach to flood-proofing.

Upstream of Oak Street, Fraser River levels are decreasingly affected by the tidal zone and increasingly affected by freshet flooding, noting that the elevation of the water increases with the rising elevation of the river bed. Consequently, a single FCL may not adequately protect areas of the City upstream of Oak Street that may be subject to flooding.

Quite apart from flood potential, as a result of proximity to a river or water body, flooding can also be caused by "ponding" of run-off when these storm waters cannot escape by gravity at times when there are concurrently high levels in an adjoining river or water body to which they would normally discharge. This situation has historically existed in parts of the Dunbar Flats (West Southlands) and the Blenheim Flats, where current FCL requirements have responded to ensure construction is at a suitable elevation.

DISCUSSION

Appropriate Flood-Proofing Standards

The current City standards, being the standards previously established by the Province, are viewed as generally appropriate in responding to the nature of the flood potential in Vancouver adjacent the Fraser River, False Creek, Burrard Inlet and English Bay. These standards are outlined in Appendix A. In very simplified terms, the standards establish varying setback requirements and a minimum 3.0 m to 3.5 m flood construction level (FCL), depending on distance from the natural boundary.

These standards are applied by the Chief Building Official in dealing with building permits for properties subject to flooding. These standards have also guided the Approving Officer when considering subdivision applications involving lands subject to flooding in these identified areas.

With the delegation of authority from the Province to municipalities, there are no longer any Provincial flood proofing "standards". In the absence of Provincial standards which formed the basis for current City standards, the City needs to establish standards.

In the absence of a Provincial standards process, the Fraser Basin Council commissioned a Lower Fraser River Hydraulic Model to provide an up-to-date evaluation of the design flood profile for the lower Fraser River (from Hope downstream), given current river and floodplain conditions. The model is based on the estimated 1894 Fraser River flood combined with high spring tide conditions (termed the "Fraser freshet profile"), as well as the 200-year winter storm surge with high tide combined with a Fraser River winter flow condition (termed the "winter storm surge profile"). The "Fraser freshet profile" and "winter storm surge profile" were overlaid and the higher of the two profiles, or worst case scenario, was used to develop an overall design flood profile.

The study results, released in a December 2006 final report, confirm earlier understanding in that the "winter storm surge profile" results in water levels in the estuary that are virtually independent of the discharge from the Fraser River; it is governed primarily by the ocean level. Hence, downstream of Burnaby the new model projects findings that closely mirror the design flood profile calculated in 1969. The Lower Fraser River Hydraulic Model predicts a winter storm surge flood, with the specified 200-year frequency, to result in a total water level in the estuary estimated at 2.9 m GSC datum. This is consistent with the earlier Provincially-established FCL of 3.0 m which was increased to 3.5 m in the late 1980s early 90s in response to sea level rise.

Upstream, where the "Fraser freshet profile" is more of a determinant, the model predicts higher flood levels. The information from the Lower Fraser River Hydraulic Model is expected to lead to future recommended changes to the FCLs established for lands along the Fraser River upstream of Vancouver.

Climate Change

The predictions of the impacts of climate change over the next 100 years have ranged from modest to extreme. The Intergovernmental Panel on Climate Change was established by the World Meteorological Organization and the United Nations Environment Program to assess information and improve the understanding about climate change. Natural Resources Canada (NRCAN) has been heavily involved in the climate change discussions and is continuously reviewing and assessing climate information. Information has been collected and developed from numerous climate models, but estimates of sea level rise are very preliminary and currently vary by more than a factor of ten.

Global estimates are not directly convertible to local impacts and the scientific community is just starting to localize the climate models. The currently available information related to the Lower Mainland indicates that the combination of sea level rise, delta subsidence and tectonic uplift could result in a relative sea level rise of between 0.23 m and 1.02 m by the year 2100. For the purpose of the Lower Fraser River Hydraulic Model, after reviewing available literature the model incorporated a potential net rise of 0.6 m over the next century. While some experts predict much greater global sea level changes, these are the current local estimates that have been adopted by the Fraser Basin Council.

Staff believe that the City and the Region will need to take steps to address the impacts of climate change related to sea level rise. The change will be slow, at a few millimetres per year, and there is time to strategically assess the appropriate actions to take based on more specific local estimates and emerging scientific understanding. Therefore the recommendations in this report on the flood construction levels along the shorelines are based on Provincial information which raised the FCL from 3.0 m to 3.5 m.

Inland, in areas such as Still Creek and the False Creek Flats, higher intensity storms will more frequently result in localized flooding which the new FCLs are designed to alleviate.

Pending completion of further work by organizations such as the Intergovernmental Panel on Climate Change and Environment Canada, it would be premature for the City to substantially revise the former Provincial flood-proofing standards as previously adopted by Council, pertaining to the Fraser River and coastal areas.

It is therefore recommended that the prevailing City standards be reaffirmed as appropriate, subject to five amendments:

1. incorporation of flood-proofing requirements for the Still Creek drainage basin;
2. incorporation of higher FCLs for the False Creek Flats;
3. incorporation of minor updates to FCLs adjacent to the Fraser River upstream of Oak Street;
4. revision of the requirements for construction of non-residential, habitable space and other considerations included in the 2004 Provincial Guidelines;
5. clarification of the survey datum to be referenced in the measurement of FCLs.

1. Still Creek

Over the past 60 years, urbanization in the Still Creek drainage basin has significantly increased the flooding risk along this watercourse. The lands adjacent Still Creek east of Renfrew Street (and farther east into Burnaby) are subject to flooding. This has been reported to Council in July, 2002 in the context of proposed stream rehabilitation and enhancement study in the Grandview Boundary Industrial Area. It is also detailed in new Integrated Stormwater Management Plan for the Still Creek Watershed study which was reported to Council in December, 2006.

The most extensive geographic extent of the flooding is presented in Appendix B. Appendix C details the recommended policy to prudently address flood-proofing.

The proposed policy would establish flood-proofing standards that would set the minimum FCL for habitable space along the Still Creek corridor. As the grade of the creek and the adjacent lands vary by about eight metres between Renfrew Street and Boundary Road, FCLs have been set on a block-by-block basis, as shown in Appendix C. These elevations represent flood protection from the 200 year flood event.

In addition, a 5.0 metre setback from top of bank is recommended for new developments to avoid restriction of the flow capacity of the flood waters. Keeping the floodway clear of buildings can reduce the risk of damage to neighbouring properties. This setback has already been established in development guidelines for conditional approval development applications along the Still Creek corridor. A 3.0 metre setback was first established in the late 1990s and was increased to 5.0 metres in 2002 as a result of increased knowledge of stream enhancement and stormwater management in urban areas.

In the event that the 5.0 metre setback imposes a serious hardship to the property owner, such that the setback and size of the lot severely restricts the building development, the development guidelines provide for a reduced setback, at the discretion of the Director of Planning.

2. False Creek Flats

The potential for ponding is increasing in the False Creek Flats. Since these lands are more than 300 metres from False Creek, a minimum 3.0 m FCL currently applies. This is less than the 3.5 m FCL applicable to lands to the west, within 300 metres of False Creek. Due to the large upstream area tributary to False Creek Flats, a combination of wave action, winter storm surges, and major rainfall events, could result in significant ponding of waters to the east. Therefore, an increase in the FCL for lands in the False Creek Flats is warranted. To ensure that new construction is suitably above the ponding that might occur in future, an increased FCL of 3.5 m is recommended.

3. Fraser River Upstream of Oak Street

Starting at Oak Street and increasing upstream to a point 1.4 km downstream of the Alex Fraser Bridge, the influence of the Fraser freshet profile increasingly becomes the dominant consideration in flood elevations in combination with diminishing effects of the winter storm surge profile. While a FCL of 3.5 m may be appropriate adjacent the Fraser River west of Oak Street, a FCL of 3.8 m is more reflective of the rise in elevation of the river bed when it is nearing Boundary Road. This is reinforced by the Lower Fraser River Hydraulic Model which predicts a flood level of 3.03 m at the Vancouver/Burnaby border. It is therefore recommended that the proposed flood-proofing policy incorporate this increase for lands along the Fraser River east of Oak Street.

4. Non-Residential Habitable Space

Under the existing City policies (see Appendix A), minimum FCLs are established, measured to the underside of the floor system, for residential, commercial, industrial and institutional buildings used for habitation, business or storage of goods damageable by flood waters. An explicit exception is provided: "*Flood-proofing of local commercial and industrial service commercial buildings will be left to the discretion of the developer following notification of the flood risk. Major shopping centres will be expected to be floodproofed to the Floor Construction Level.*"

The origins of this exception are not clear but it does enable non-residential construction below the flood construction level provided the owner/developer is notified of the risk and enters into a suitable agreement assuming all life safety and property risks, and liability for doing so. For property adjacent the shoreline, this approach effectively puts a "hole in the dike" and can be the source of water entering a low-lying area protected by a higher level shoreline. This may be appropriate in less developed areas of the Province, but not in Vancouver. This factor has resulted in water previously entering both the Fraser industrial area to Kent Avenue, and the Southlands.

In 2004, the Provincial Ministry of Water, Land and Air Protection published "Flood Hazard Area Land Use Management Guidelines" which address a variety of land uses and elevation construction requirements in different flood plain situations. There are various exceptions noted. These are generally consistent with the current City policies but there are differences in several aspects. For example, the Provincial guidelines do **not** accommodate the above-noted exception for local commercial and industrial service commercial buildings. Furthermore, they provide for some relief from FCLs otherwise applicable when undertaking additions to an existing building that is below the FCL.

The Chief Building Official has been applying the 2004 Provincial guidelines in detailing the minimum FCL to be required on building permits issued for specific occupancies and construction circumstances in floodplain areas. The subdivision Approving Officer has not had much cause to reference these guidelines due to the infrequency of non-residential subdivision in areas subject to flooding. Nonetheless, both officials agree it would be advantageous to incorporate applicable provisions from the 2004 Ministry Guidelines into the City's "Floodproofing Policies" to create a consolidated policy document, in order to reduce the potential for interpretation difficulties. This consolidated document, recommended for Council adoption by resolution, is attached as Appendix D.

5. Survey Datum Reference

Historically, provincial flood datum has referenced a vertical datum known as "Geodetic Survey of Canada" datum. Consequently, for ease of reference, the City's "Floodproofing Policies" referenced Geodetic Survey of Canada (GSC) datum.

The City never adopted the Geodetic Survey of Canada datum in its daily infrastructure work because it was not a consistent datum within a small area like the City of Vancouver but was rather consistent across the country. Instead, the City has had its own datum known as "City Datum", which preceded the federal datum. The difference between the two vertical datums is small, generally less than 5 centimetres, but important for precise surveying tasks because inconsistencies within the local area in the Geodetic Survey of Canada datum were noticed in local infrastructure work.

In 2005 the GVRD completed a High Precision survey of horizontal and vertical monuments within the GVRD. This has resulted in a new datum known as "GVRD Datum". The GVRD Datum is very similar to both the old Geodetic Survey of Canada Datum and the old City Datum, falling within the 5 centimetre range described above.

The 5 centimetre difference is minor and is not perceptible except through precise survey. The City now bases all of its infrastructure work on the new GVRD Datum and as such this report recommends amending the City's flood-proofing policies to reference to the new GVRD Datum.

The small differences in the datums are such that it unnecessary to adjust the FCLs, as there will be no material impact, but the change in reference to the new GVRD Datum is appropriate at this time.

Lands Subject to Flooding

Using contour data and VanMap, Engineering Services has generated a map that identifies lands that would be subject to current flood-proofing requirements, based on the current City Flood-Proofing Policies and the Still Creek Flood Study. The map differentiates those lands that may be subject to flood-proofing requirements by virtue of their elevation, as compared to those that may be within the specified proximity to the Pacific Ocean/Fraser River.

Under the current Flood-Proofing Policies, the proximity criteria establish building setback restrictions that vary depending on whether the lands are adjacent the Pacific Ocean (a 7.5 metre setback) or the Fraser River (a 30.0 metre setback), but in both cases the intent is to reduce the potential for flooding due to erosion. For this reason, the current Flood-Proofing Policies provide for a reduction in the proximity setback criteria where appropriate erosion protection works have been constructed. The map does not identify lands on which buildings may have been permitted to construct within close proximity to the Pacific Ocean/Fraser River as a consequence of approved construction of erosion protection works (e.g., Deering Island), but these situations are rare.

By far, the more encompassing criteria relate to minimum floor elevations for construction (FCLs) of habitable space within specified distances of the Pacific Ocean/Fraser River. The specified distances vary from 15 to more than 300 metres from the "natural boundary" of the water body. The map identifies those properties having elevations that would clearly identify the need for detailed review to determine whether FCL requirements would be applicable even for slab-on-grade construction. However, immediately adjacent upland properties may also need consideration to confirm the accuracy of the elevational data, and determine if proposed construction entails any excavation for below-grade space. The map therefore cannot be read as a definitive identification of whether lands will or will not be subject to FCL requirements. Nonetheless, and with that caveat, the map is a very good starting point, both for staff and the public, in understanding the general geographic extent of current flood-proofing policies.

With regard to the Still Creek flood zone, Appendix C shows the flood-proofing elevations to prevent flooding during a 200 year flood. These elevations are based on the GVRD's Still Creek-Brunette River Basin flooding study. A 5.0 metre setback is also recommended in the Still Creek area.

RISK MANAGEMENT IMPLICATIONS

Council establishment of a policy pertaining to flood-proofing will assist in managing the City's liability and the liability of officials who then rely on this policy in exercising their responsibilities.

ENVIRONMENTAL IMPLICATIONS

In Vancouver's urban context it is not practicable to preclude development on lands that may be subject to flooding. A prudent flood-proofing policy will therefore suitably address the risks associated with potential flooding, and reasonably mitigate personal and property damage that might otherwise arise. The policy will consequently entail some modifications to flood plain areas, either by attempting to reduce the geographic extent of flood waters via diking, and/or by changing the way in which development is permitted to occur within these areas.

Flooding is principally a natural occurrence within the environment and is not predictable with any real precision. Policy development is therefore dependent upon historical data analysis and contemporary scientific exploration to better anticipate an unpredictable future. As the impacts of climate change are more fully understood through continued scientific analysis, Vancouver's flood-proofing policies should be reviewed for possible revision. Appropriate caution in the form of conservative, protective flood-proofing measures is warranted. However, conservatism must be balanced with practicality and consideration of the adverse environmental and financial implications of regulatory requirements.

CONCLUSION

Since the Province has delegated to municipalities its responsibility for managing development in areas subject to flooding, the previous Provincial flood-proofing standards are no longer in effect. These standards had previously been adopted by the City. Although the City now has greater autonomy in establishing appropriate flood-proofing requirements, the existing City policies are seen as representing a suitably prudent approach. Subject to some up-dating and augmentation to address Still Creek and False Creek Flats, the existing "Flood-Proofing Policies" should be carried forward in a revised policy document, attached as Appendix D for Council adoption by resolution.

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City of Vancouver *Planning - By-law Administration Bulletins*
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planning@city.vancouver.bc.ca

FLOODPROOFING POLICIES

Authority - City Council Resolution of January 5, 1988
Effective January 5, 1988
Amended February 28, 1995

On April 15, 1986, City Council endorsed specific floodproofing policies for the Southlands flood plain. On January 27, 1987, City Council indicated its support for the existing Provincial floodproofing standards and its extension to all new construction within the lands prone to flooding and erosion along the Fraser River, False Creek, Burrard Inlet, and English Bay. Legislative changes have subsequently been made to the **Vancouver Charter** so that the City can require implementation of the floodproofing policies.

Compliance with this policy is now mandatory, in accordance with Section 2.3.6 (Buildings on Lands Subject to Flooding), of the Vancouver Building By-law.

Provincial Floodproofing Standards
The Provincial Government defined **floodproofing** as the alteration of land or a building either physically or in use to reduce or eliminate flood hazard. It includes the use of setbacks from water bodies to maintain a flood-way and to allow for potential land erosion.

The Provincial floodproofing standards, which are a requirement of subdivision approval in lands prone to flooding and erosion, specify:

(a) Setback Requirements
No building shall be constructed or located:
i) within seven point five (7.5) metres of the natural boundary of the sea; and
ii) within thirty (30) metres of the natural boundary of the Fraser River.

(b) Elevation Requirements
No residential, commercial[1] or institutional building shall be constructed with the underside of a floor system or top of concrete slab of any area used for habitation, business, or storage of goods damageable by flood waters:
i) For the Fraser River and False Creek:
- No lower than three point five (3.5) metres Geodetic Survey of Canada datum (102.9 feet Vancouver City datum) for buildings within three hundred (300) metres of the natural boundary.No lower than three point zero (3.0) metres Geodetic Survey of Canada datum (101.2 feet Vancouver City datum) for buildings farther than three hundred (300) metres from the natural boundary.

[1] Floodproofing of local commercial and industrial and service commercial buildings will be left to the discretion of the developer following notification of the flood risk. Major shopping centres will be expected to be floodproofed to the Floor Construction Level.

ii) For Burrard Inlet and English Bay:
- No lower than three point five (3.5) metres Geodetic Survey of Canada datum (102.9 feet Vancouver City datum) plus an additional elevation allowance for wave run-up as determined by a Professional Engineer, for buildings within fifteen (15) metres of the natural boundary[2].
- No lower than three point five (3.5) metres Geodetic Survey of Canada datum (102.9 feet Vancouver City datum) for buildings farther than fifteen (15) metres from the natural boundary.

The setback and elevation requirements do not apply to on-loading and off-loading facilities associated with water-oriented industry. Furthermore, the setback requirement may be reduced subject to the completion of appropriate engineering studies, the construction of any necessary erosion protection works as designed by a Professional Engineer, and the approval of the City Engineer. If required, technical advice can be obtained from the Regional Water Manager, Ministry of Environment and Parks.

For **industrial**[1] buildings, the critical elevations in the floodproofing standards are the same as above less zero point six (0.6) metres.

For **non-habitable** buildings (i.e. carports, open-sided livestock buildings, etc., that are not used for storage of goods damageable by flood-waters), there is no floodproofing standard.

Any construction materials used below these elevations should be concrete masonry, corrosion-protected steel or pressure-treated wood. Heating and electrical appliances (including switches and outlets, which are not of the submersible type) should be installed above the critical elevations in the above-noted floodproofing standards.

Methods of Floodproofing
There are three basic ways of complying with the floodproofing standards:

(a) Building on fill, provided such fill does not interfere with flood flows of the water course, and is adequately protected against flood water erosion; or
(b) Building raised by structural means such as foundation walls, columns, etc.; or
(c) A combination of fill and structural means.

Southlands
City Council has approved specific floodproofing policies for **Southlands**:

For Blenheim Flats:
(a) Land filling (on any existing or subdivided lot) should be a minimum of zero point nine (0.9) metre above the street fronting the site. This filling standard need only extend to four point five (4.5) metres beyond the foundation wall and includes an area sufficient to contain the required septic field.
(b) To protect the amenity of the low-lying area, it is considered advisable to meet the floodproofing policy by structural means above elevation two point six (2.6) metres Geodetic Survey of Canada datum (100 feet Vancouver City datum). However, where adjacent streets are above elevation two point five (2.5) metres Geodetic Survey of

[2] Where the natural boundary can be determined, the additional elevation for wave run-up can be allowed for by taking the flood construction level to be one point five (1.5) metres above the natural boundary. In all cases, however, the coastal flood construction level should not be less than 3.5 metres Geodetic Survey of Canada datum. **Natural Boundary** means the visible high water mark of any lake, river, stream or other body of water where the presence and action of the water are so common and usual upon the soil of the bed of the lake, river, stream or the banks thereof, in respect to vegetation, as well as in respect to the nature of the soil itself. In addition, the natural boundary includes the best estimate of the edge of dormant or old side channels or marsh areas.

Canada datum (99.5 feet Vancouver City datum), the full floodproofing policy could be achieved totally by filling.

(c) Run-off from development sites are to be retained during rainstorms and not be discharged onto adjacent lands at any greater rate than it was prior to development.

For Dunbar Flats (West Southlands):

(a) Land filling (on any existing or subdivided lot) should be a minimum of zero point four six (0.46) metres above the street fronting the property.

(b) The underside of any floor system or top of any concrete slab of any area used for habitation, business, or storage of goods damageable by flood waters shall be no lower than elevation three (3.0) metres Geodetic Survey of Canada datum (101.2 feet Vancouver City datum).

(c) To protect the amenity of the low-lying area, and at the same time not to deny adequate flood protection, the floodproofing policy should be met by structural means above elevation two point six (2.6) metres Geodetic Survey of Canada datum (100 feet Vancouver City datum) and the maximum height of fill should be limited to elevation two point six (2.6) metres Geodetic Survey of Canada datum. However, where adjacent streets are above elevation two point five (2.5) metres Geodetic Survey of Canada datum (99.5 feet Vancouver City datum), the full floodproofing policy could be achieved totally by filling.

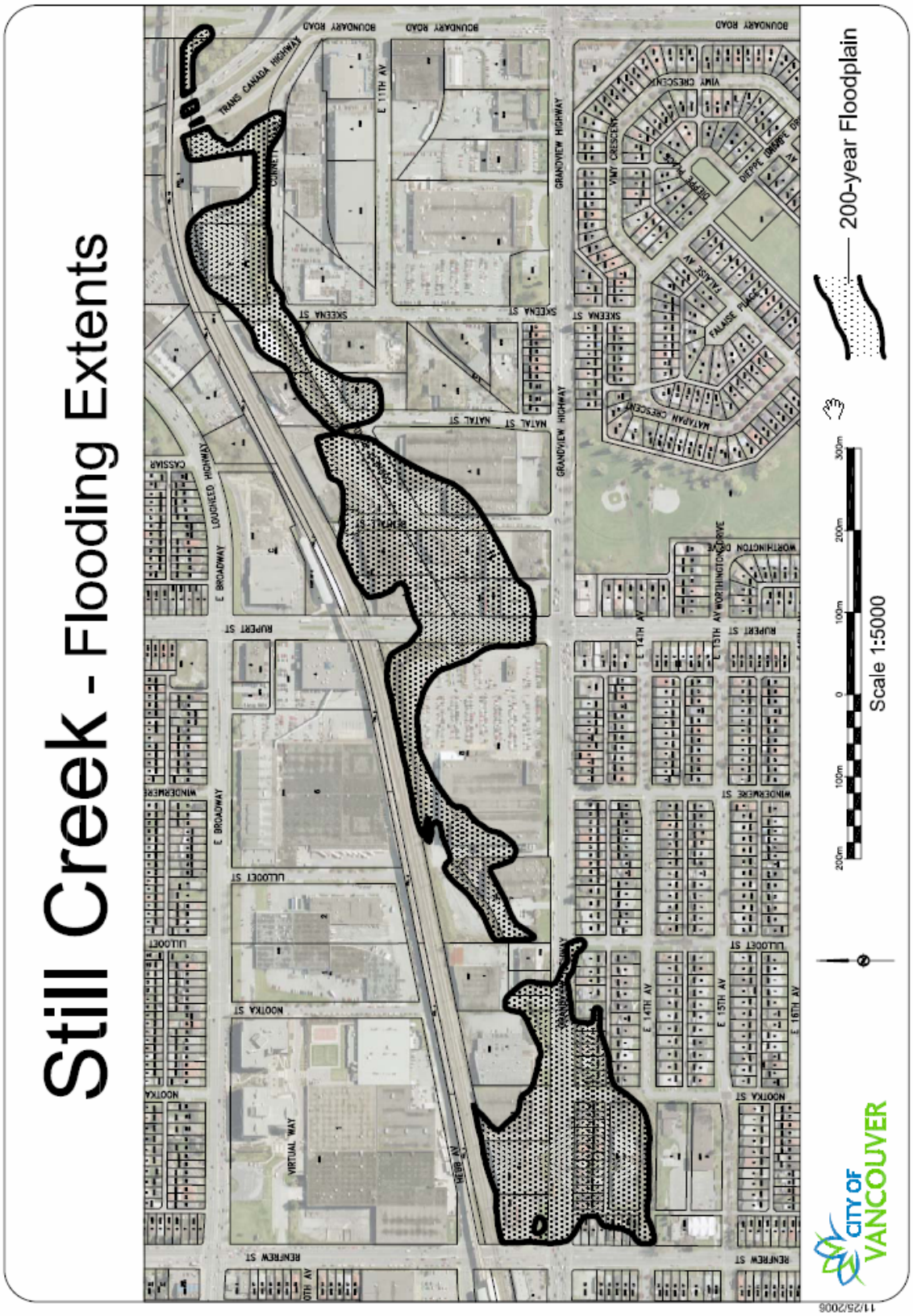
Verification of Flood Construction Setbacks and Elevations

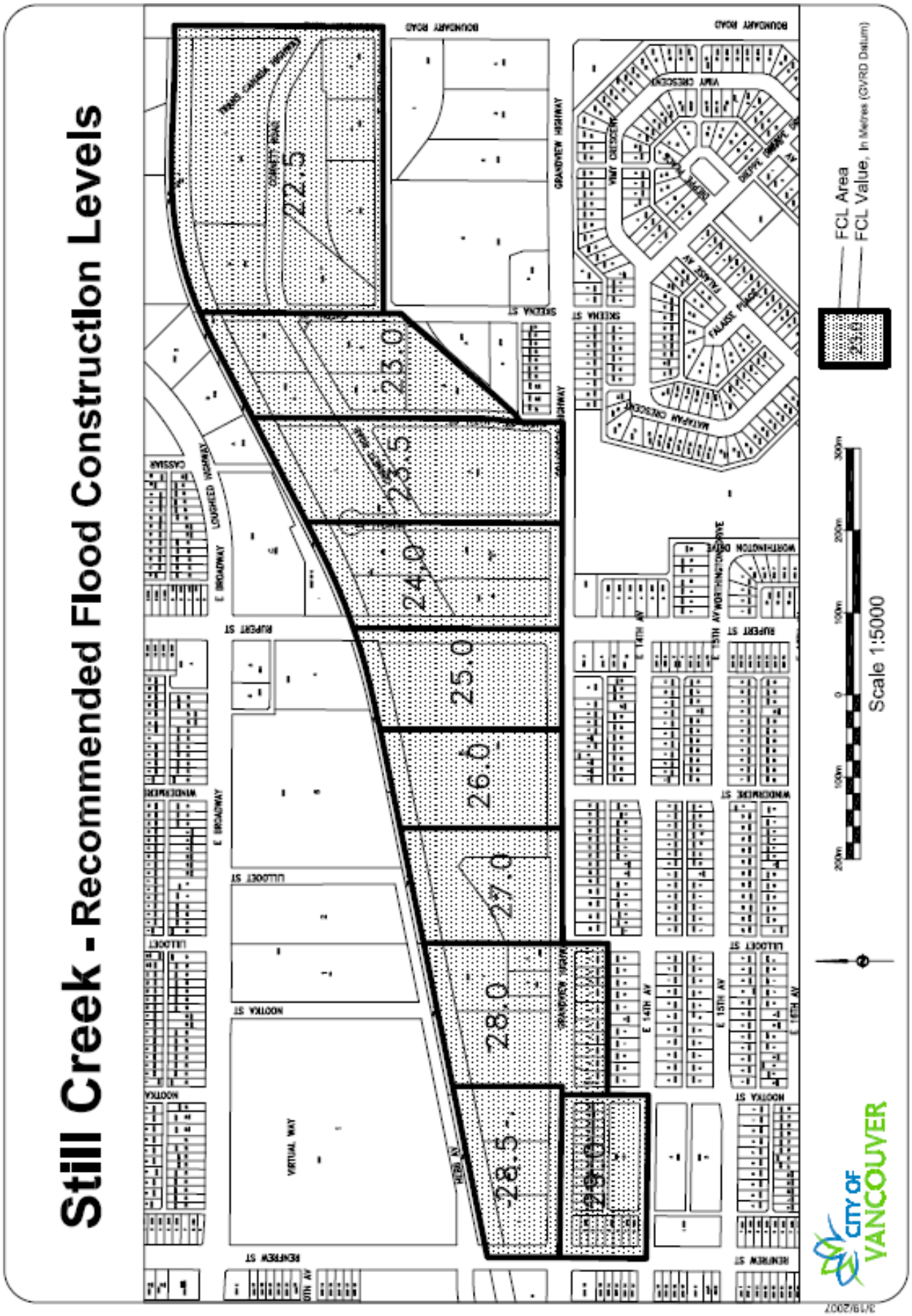
Where construction is undertaken in compliance with the above-noted floodproofing policies, a Survey Certificate prepared by a B.C. Land Surveyor is recommended to verify the floodproofing standard setbacks and elevations prescribed in this bulletin.

For More Information

For further information about the floodproofing policies in the City of Vancouver, please call the Engineering Department at 873-7316. Technical advice can also be obtained from the Regional Water Manager, Ministry of Environment and Parks at 584-8822.

For the construction of new buildings in the RA-1 zoning district, the City's Southlands RA-1 District Schedule and RA-1 Guidelines should also be consulted.


Still Creek - Flooding Extents
200-year Floodplain
Scale 1:5000
CITY OF VANCOUVER
11/25/2006


Still Creek - Recommended Flood Construction Levels
FCL Area
FCL Value, In Metres (GVRD Datum)
Scale 1:5000
CITY OF VANCOUVER
BOUNDARY ROAD
GRANDVIEW HIGHWAY
E BROADWAY
LOUGHEED HIGHWAY
VIRTUAL WAY
22.5
23.0
23.5
24.0
25.0
26.0
27.0
28.0
28.5

COMMUNITY SERVICES GROUP
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FLOOD-PROOFING POLICIES

Authority - City Council Resolution of January 5, 1988
Effective January 5, 1988
Amended February 28, 1995
Amended _____, 2007

On April 15, 1986, City Council endorsed specific flood-proofing policies for the Southlands flood plain. On January 27, 1987, City Council indicated its support for the existing Provincial flood-proofing standards and its extension to all new construction within the lands prone to flooding and erosion along the Fraser River, False Creek, Burrard Inlet, and English Bay. Legislative changes were subsequently made to the **Vancouver Charter** so the City could require implementation of the flood-proofing policies through its building permit process.

Compliance with these policies is mandatory, in accordance with Section 2.3.6 (Buildings on Lands Subject to Flooding) of Vancouver's Building By-law.

On _____, 2007, City Council substantively amended the policies to:

(i) incorporate pertinent elements of the Provincial "Flood Hazard Land Use Management Guidelines" (2004);
(ii) establish policies regarding flood-proofing in the lower sections of Still Creek and False Creek Flats; and,
(iii) make adjustments due to information provided by the Fraser Basin Council's "Lower Fraser River Hydraulic Model" (2006).

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Introduction

These Council policies seek to reduce or prevent injury, human trauma and loss of life, and to minimize property damage during flooding events. Experience has shown that regulating land development to keep people out of harm's way is the most practical and cost effective way of achieving these goals.

The policies draw upon provincial policies and procedures established and refined over the life of the provincial flood hazard management program.

The document is divided into five sections:

1.0 Administration – Flood Hazard Land Use Management
2.0 Application – By Hazard Type
3.0 Application – Land Use Specific
4.0 Application – Implementation Measures
5.0 Appendix – Definitions

Readers might find it advantageous to review the Appendix Definitions before reading Sections 1 through 4.

The Administration section details when decision-makers can manage flood hazards during the subdivision and/or building permit process.

The Application sections provide the flood proofing requirements for different types of flooding hazards and different land uses in Vancouver. These are **minimum** requirements that may be increased by the Subdivision Approving Officer or Chief Buiding Official, in exercising their jurisdiction. Site-specific studies containing professional evaluation and recommendations, including mapping, may be required.

The Council policies will be subject to revision as future information becomes available. For example, climate change is anticipated to result in a sea level rise. Various studies have been completed on this or are in process. A review of this work by the Fraser Basin Council, combined with continuing subsidence of the delta, led it to suggest a potential net rise of 0.6 metres over the next century. However, some experts predict much greater global sea level changes, which have not yet been translated into potential local impacts in the Fraser Basin. This suggests the current FCL of 3.5 m within 300 metres of the natural boundary (3.0 m when beyond 300 metres,) will need future review and possible revision as more conclusive scientific study is completed on climate change.

1.0 Administration - Flood Hazard Land Use

1.1 Subdivision Approval Process

Under the provisions of section 86 of the *Land Title Act*, the Subdivision Approving Officer - when approving a subdivision which may be subject to flooding or erosion - may require a Professional Engineer's report certifying that the land may be used safely for the intended purpose and/or require the owner of the property to enter into a covenant under section 219 of the *Land Title Act* to establish flood plain requirements. Similar provisions are available under the *Strata Property Act* and the Bare Land Strata Regulations.

Where the land proposed to be subdivided may not be used safely the Subdivision Approving Officer may refuse to approve a proposed subdivision.

1.2 Building Permit Application Process

Under the provisions of Section 2.3.6 (Buildings on Lands Subject to Flooding) of the Building By-law, the Chief Building Official – when approving a building permit on previously subdivided lands which may be subject to flooding or erosion – shall require that a building permit comply with the policies contained in this document or as otherwise superceded by Council resolution.

1.3 Covenant Measures

Where, on flood prone land, consent for approval of subdivision or approval of a building permit is sought, the proponent may be required to register a restrictive covenant against the title of the property under section 219 of the Land Title Act. The covenant may specify conditions that would enable the land to be safely used for the use intended. In addition, the following conditions should be included:

1.3.1 Waiver of Liability

Where, on flood prone land, the Subdivision Approving Officer gives consent for approval of subdivision or the Chief Building Official gives consent to construction, the owner of the land should expect to be required to enter into a covenant, prior to final subdivision approval or building permit issuance, respectively. The covenant is to be registered against the land title, requiring flood-proofing of buildings and a waiver of liability in favour of the City in the event of any damage caused by flooding or erosion.

Where a situation arises in which consent to subdivision and/or a building permit would normally be refused due to a high flooding hazard, but it is nevertheless deemed appropriate to allow the subdivision and/or building permit due to extenuating circumstances, the owner may also be required to include in the 'waiver' clause a provision to cover existing buildings that are to be retained on the property.

1.3.2 Priority Charge

Covenant conditions are to be registered with priority over all other charges requested against the property, save for those in favour of the City.

1.4 Requests for Modification of Flood-Proofing Covenants

Subject to review by and if acceptable to the Subdivision Approving Officer and/or the Chief Building Official and all parties signatory to the covenant, a covenant may be modified. The Subdivision Approving Officer and/or Chief Building Official may modify any covenant to best match the flood hazard provided the level of protection is not altered. This discretion extends to the reduction of elevation requirements by the freeboard, where flood plain mapping exists, provided the subject property is in the flood plain fringe area and there are no major erosion or channel avulsion hazards in the immediate vicinity.

Review by the Subdivision Approving Officer and/or Chief Building Official may not support relaxation on technical grounds but the applicant may nevertheless have demonstrated a hardship. Setback requirements should not be reduced unless a serious hardship exists and no other reasonable option is available. A valid hardship should only be recognized where the physical characteristics of the lot (e.g., exposed bedrock, steep slope, the presence of a watercourse, etc.) and size of the lot are such that building development proposals, consistent with the City's land use and zoning by-laws, cannot occur unless the requirements are reduced.

In order to avoid setting difficult precedents these site characteristics should be unique to the subject property and environs. The economic circumstances or design and siting preferences of the owner should not be considered as grounds for hardship.

1.5 Miscellaneous Administrative Measures

Where the Subdivision Approving Officer and/or Chief Building Official considers a geodetic elevation necessary, the installation of benchmarks may be a condition of consent to subdivision approval or building permit approval, respectively, in order to assist in the on-site determination of the Flood Construction Level. Alternatively, a Survey Certificate, prepared by a B.C. Land Surveyor, may be incorporated as a post-construction submission requirement in the restrictive covenant, to verify compliance with the flood-proofing setbacks and elevations required.

2.0 Application - By Hazard Type

Flood plain setbacks are established to keep development away from areas of potential erosion and avoid restricting the flow capacity of the floodway. Keeping the floodway clear of development can reduce the risk of damage to neighbouring properties and reduce disruptions to natural river processes, leading to a more balanced and economical approach to managing flood prone areas. Setbacks are measured from the natural boundary unless otherwise specified.

Flood Construction Levels (FCLs) are used to keep living spaces and areas used for the storage of goods damageable by floodwaters above flood levels. The designated flood, and the designated flood level, are used in determining the FCL.

The designated flood means a flood which may occur in any given year, of such magnitude as to equal a flood having a 200-year recurrence interval, based on a frequency analysis of unregulated historic flood records or by regional analysis where there is inadequate streamflow data available.

A designated flood level is the observed or calculated water surface elevation for the designated flood and is used to determine the Flood Construction Level.

2.1 Bluffs

Setback –
Where the building site is at the top of a steep bluff and where the toe of the bluff is subject to erosion and/or is closer than 15 metres from the natural boundary, the setback should be a horizontal distance equal to 3.0 times the height of the bluff as measured from the toe of the bluff.

For practical application, this setback condition will require site-specific interpretation and could result in the use of a minimum distance measured back from the crest of the bluff. This setback may be reduced provided the reduction is supported by a report prepared by a suitably qualified professional.

2.2 Watercourses

2.2.1 Standard requirements for ordinary watercourses

Setback –
Buildings should be setback at least 30 metres from the natural boundary of any Watercourse that may flood, such as the Fraser River. Buildings may be permitted a lesser setback than cited above, subject to:

i) the completion of appropriate engineering studies;
ii) the construction of any necessary erosion protection works as designed by a Professional Engineer;
iii) the certification of the constructed works by a Professional Engineer;
iv) the approval of the City Engineer; and
v) the approval of the City Building Inspector.

Where non-Standard Dikes exist, setbacks should be established in consultation with the City Engineer to provide right-of-way for any future dike improvements and/or access.

FCL where a designated flood level has been determined –
Areas used for habitation, business, or storage of goods damageable by floodwaters should be constructed within any building at an elevation such that the underside of the floor system thereof is no less than the Flood Construction Level.

The FCL for lands adjacent the Fraser River and west of the Oak Street Bridge shall be at least 3.5 m GVRD datum for any building within 300 metres of the natural boundary, and at least 3.0 m GVRD datum for any building farther than 300 metres from the natural boundary.

The FCL for lands adjacent the Fraser River and east of the Oak Street Bridge shall be at least 3.8 m GVRD datum for any building within 300 metres of the natural boundary, and at least 3.3 m GVRD datum for any building farther than 300 metres from the natural boundary.

2.2.2 Requirements for Smaller Streams

The requirements for small streams may be reduced where the following conditions exist:

- Sufficient discharge records are available to establish the designated flood and/or the designated flood can be otherwise estimated as less than 80 cubic metres per second, and
- The watercourse has no significant history of flooding and/or bank erosion, and/or
- It is deemed appropriate by the Subdivision Approving Officer and/or Chief Building Official.

Setback –

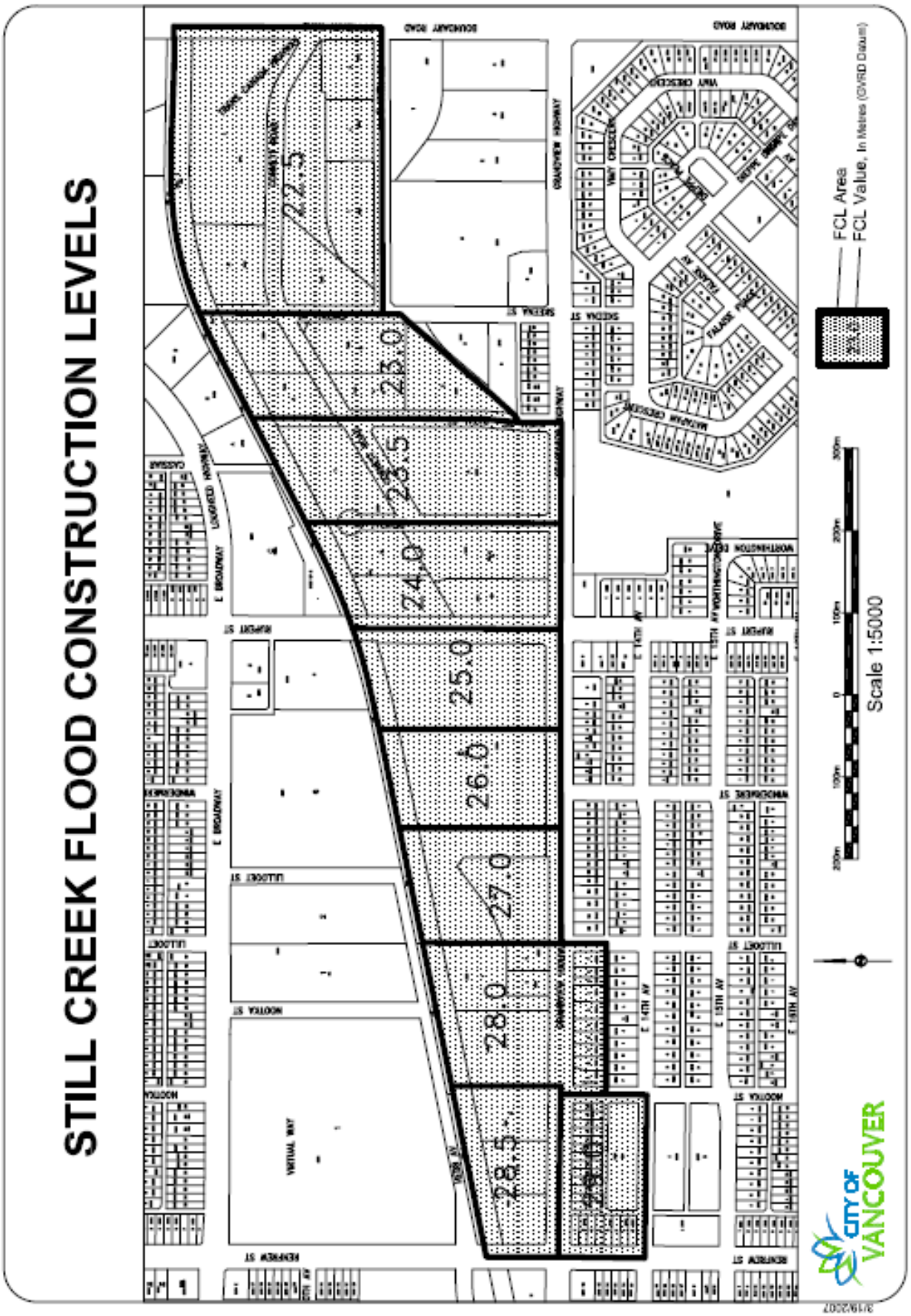
The setback requirement may be reduced to 15 metres from the natural boundary of the watercourse provided the floodway is not obstructed.

For lands within the lower sections of Still Creek as illustrated on Map 1 below, buildings should be setback at least 5 metres from the natural boundary.

FCL –

The elevation of areas used for habitation, business, or storage of goods damageable by floodwaters should be established within any building at an elevation greater than 1.5 metres above the natural boundary of the watercourse.

The FCL for lands within the lower sections of Still Creek shall be no less than the applicable elevation, expressed in GVRD datum, as illustrated on Map 1 below.


STILL CREEK FLOOD CONSTRUCTION LEVELS
FCL Area
FCL Value, In Metres (GVRD Datum)
Scale 1:5000
CITY OF VANCOUVER
BOUNDARY ROAD
E BROADWAY
VIRTUAL WAY
22.5
23.0
23.5
24.0
25.0
26.0
27.0
28.0
28.5

Map 1

2.3 Straight of Georgia (The Sea)

The natural boundary for coastal areas includes the natural limit of permanent terrestrial vegetation.

2.3.1. Standard Requirements

Setback –

Buildings should be setback 15 metres from the natural boundary of the sea.

Landfill or structural support for a coastal development or type of development shall be permitted a setback of 7.5 metres from the natural boundary of the sea where the sea frontage is protected from erosion by a natural bedrock formation or subject to:

i) the completion of appropriate engineering studies;
ii) the construction of any necessary erosion protection works as designed by a Professional Engineer;
iii) the certification of the constructed works by a Professional Engineer;
iv) the approval of the City Engineer; and
v) the approval of the City Building Inspector.

The setback may be increased on a site-specific basis such as for exposed erodible beaches and/or in areas of known erosion hazard.

FCL –

The FCL for lands adjacent False Creek shall be at least 3.5 m GVRD datum for any building within 300 metres of the natural boundary, and at least 3.0 m GVRD datum for any building farther than 300 metres from the natural boundary. (See also Section 2.4.1)

The FCL for lands adjacent Burrard Inlet and English Bay shall be at least 3.5 m GVRD datum, plus an additional elevation for wave run-up as determined by a professional engineer for any building within 15 metres of the natural boundary, and at least 3.5 m GVRD datum for any building farther than 300 metres from the natural boundary.

2.3.2 Requirements for Coastal Bluffs

Setback –

Where a proposed subdivision will create a building site at the top of a steep coastal bluff and where the toe of the bluff is subject to erosion and/or is closer than 15 metres from the natural boundary of the sea, the setback shall be a horizontal distance equal to 3.0 times the height of the bluff as measured from the toe of the bluff.

For practical application, this setback condition will require site-specific interpretation and could result in the use of a minimum distance measured back from the crest of the bluff. This setback may be reduced provided the reduction is supported by a report prepared by a suitably qualified professional.

2.3.3 Requirements for Existing Coastal Lots

Setback –

In the case of existing lots, where the above setback distances prevent construction, and where it is not possible to provide sufficient protection through works designed by a suitably qualified professional, the City Building Inspector may agree to modify setback requirements to permit construction provided this is augmented through a restrictive covenant stipulating the hazard, building requirements, and liability disclaimer.

2.4 Areas Protected by Dikes

Although very rare in Vancouver (currently only applicable to Deering Island), residential, commercial and institutional developments in areas protected by Standard Dikes are required to comply with full flood proofing requirements for their respective categories.

Setback –
Buildings should be located a minimum of 7.5 metres away from any structure for flood protection or seepage control or any dike right-of-way used for protection works. In addition, fill for floodproofing should not be placed within 7.5 metres of the inboard toe of any structure for flood protection or seepage control or the inboard side of any dike right-of-way used for protection works.

Any change to these conditions requires the approval of the Inspector of Dikes.

FCL –
Buildings in areas protected by Standard Dikes should meet minimum FCLs prescribed for the river or sea adjacent to the dike and the FCL requirements for any internal drainage (minimum ponding elevations).

2.4.1 Secondary sources of flooding

Where there are secondary sources of flooding, such as heavy rainfall, within (i.e., behind) diked areas, the appropriate requirements should be applied. These should include consideration of minimum ponding elevations behind the dike and suitable FCL to protect against internal drainage.

The FCL for lands in the False Creek Flats shall be at least 3.5 m GVRD datum, to provide for drainage of water that may otherwise pond during heavy rainfall due to an inability to drain during high tide and a winter storm surge.

Subject to advice from the City Engineer regarding ponding elevation, this may require that the FCL for any building in portions of Southlands located more than 300 metres from the natural boundary be increased to at least 3.5 m GVRD datum.

3.0 Application - Land Use Specific

The following minimum requirements should be considered to guide development away from high hazard areas and to allow development to proceed in a safe manner. These minimum requirements should be placed in the form of a covenant against land titles at the time of subdivision and/or building permit issuance.

3.1 Agriculture

3.1.1 Farm Dwellings

Whether or not the area is diked, the following apply:

Setback –
Setback requirements, based on hazard type as identified in section 2.0, shall apply.

FCL –
Farm dwelling units on parcel sizes 8.0 hectares, or greater, located within the Agricultural Land Reserve, shall be located with the underside of a wooden floor system or the top of the pad of any habitable area no lower than 1.0 metre above the natural ground elevation taken at any point on the perimeter of the building.

3.1.1.1 *Where required flood proofing is impractical*
When establishing conditions for areas within the Agricultural Land Reserve, where required flood-proofing is impractical (i.e., greater than 2.5 metres elevation) and where protection is provided by Standard Dikes, owners of existing parcels of land may be given the option of adopting full flood-proofing or adopting an elevation which will provide protection against drainage problems associated with storm conditions (minimum ponding elevation). In return owners must agree to a waiver of financial assistance in the case of flood damage to be registered as a covenant against the land title.

Subdivision in areas of flooding depth greater than 2.5 metres requires that the applicant demonstrate how full flood proofing can be achieved.

3.1.2 Livestock Housing

Setback –
Setback requirements, based on hazard type as identified in section 2.0, shall apply.

FCL -
Open-sided livestock structures do not require flood proofing by elevation.

Closed-sided livestock housing not behind Standard Dikes shall be located with the underside of the wooden floor system or the top of the pad no lower than the FCL minus freeboard. Main electrical switchgear shall be no lower than the FCL.

3.1.3 Other Farm Buildings

Setback –
Setback requirements, based on hazard type as identified in section 2.0, shall apply.

FCL –
Flood proofing by elevation is left to discretion of the owner.

3.2 Public Recreation, Institutional Buildings, Parks and Open Space

Setback –
Setback requirements, based on hazard type as identified in section 2.0, shall apply to all structures in this category.

FCL –
Institutional and closed-sided recreational buildings and/or equipment damageable by floodwaters require full flood proofing.

Recreation shelters, stands and other outdoor facilities susceptible to only marginal damage by floodwaters do not require flood proofing by elevation.

3.3 Industrial Areas

Setback –
Setback requirements, based on hazard type as identified in section 2.0, shall apply.

Industrial buildings may be granted special relief from this requirement. Setback requirements for certain industrial activities, such as on-loading and off-loading facilities, where the use of the waterfront is a necessary subsidiary part of the operation and would not adversely affect a floodway or significantly increase flood elevations, may be reduced.

FCL –
Industrial uses, other than main electrical switchgear, shall be located with the underside of a wooden floor system or the top of the pad no lower than the FCL minus freeboard. Main electrical switchgear shall be no lower than the FCL.

Elevations noted should be used for the installation of fixed equipment susceptible to damage by floodwaters. An exception may be approved, by the Subdivision Approving Officer reviewing a proposed subdivision plan or the Chief Building Official reviewing a building permit application, if a suitably qualified professional determines that appropriate measures can be and are taken to provide protection against damage by flooding and erosion.

On-loading and off-loading facilities associated with water-oriented industry do not require flood-proofing. Heavy industrial development located behind a standard dike does not require flood-proofing.

3.4 Ancillary Buildings, Carports, Garages, Entryways and Renovations to Existing Buildings

FCL –
Requirements for flood-proofing through the use of elevation may be waived, at the discretion of the Chief Building Official, for:

- A renovation of an existing building or structure that does not involve an addition,
- That portion of a building or structure that is to be used as a carport, garage or entryway,
- Other minor buildings such as storage buildings, porches and domestic greenhouses.

3.5 Additions to Existing Buildings

Where a building or structure is legally non-conforming with the floodproofing requirements set out in this policy and/or established in a covenant applicable to the property, the Chief Building Official may allow an addition, at the original non-conforming floor elevation, that would increase the size of the building or structure by less than 25 percent of the floor area existing at the time of enactment of such flood-proofing requirements, provided that the degree of non-conformity regarding setback is not increased.

4.0 Application - Implementation Measures

In addition to the requirements set out in sections 2.0 and 3.0, the following general conditions should apply and be included in a subdivision or building permit covenant, where applicable.

4.1 Furnaces, Electrical and Other Fixed Equipment

FCL –
Areas below the FCL shall not be used for the installation of furnaces, major electrical switchgear, or other fixed equipment susceptible to damage by floodwater.

4.2 Parking

Setback–
Setback requirements, based on hazard type as identified in section 2.0, shall apply.

FCL –
As vehicles can be moved to higher ground, flood-proofing may not be necessary to prevent damage from floodwater for parking areas, including enclosed underground parking areas, except that, in the case of an enclosed underground parking area, an unobstructed means of pedestrian ingress and egress must be provided above the FCL. In addition, signs must be posted at all points of entry notifying users that the parking garage is not protected from inundation by floodwaters.

4.3 Elevation by Landfill

Where landfill is used to raise the natural ground elevation, it should be adequately compacted and the toe of the landfill slope should be no closer to the natural boundary than the prescribed setback. In addition, the face of the landfill slope should be adequately protected against erosion from flood flows, wave action, ice or other debris.

The fill must not adversely impact neighbouring properties by increasing the surface water elevation or directing flows toward those properties.

4.3.1 Blenheim Flats

- Land filling (on any existing or newly created parcel) should be a minimum of 0.9 m above the elevation of the street fronting the site. This filling standard need only extend horizontally 4.5 metres beyond the foundation wall and includes an area sufficient to contain the required septic field.
- To protect the amenity of the low-lying area, it is considered advisable to meet the FCL by structural means above elevation 2.6 m GVRD datum. However, where adjacent streets are above elevation 2.5 m GVRD datum, the FCL could be achieved totally by filling.
- Run-off from development sites is to be retained during rainstorms and not be discharged onto adjacent lands at any greater rate than it was prior to development.

4.3.2 Dunbar Flats (West Southlands)

- Land filling (on any existing or newly created parcel) should be a minimum of 0.46 m above the elevation of the street fronting the property.
- The underside of any floor system or top of any concrete slab of any area used for habitation, business, or storage of goods damageable by flood waters shall be no lower than elevation 3.0 m GVRD datum.
- To protect the amenity of the low-lying area, and at the same time not to deny adequate flood protection, the FCL should be met by structural means above elevation 2.6 m GVRD datum, and the maximum height of fill should be limited to elevation of 2.6 m GVRD datum. However, where adjacent streets are above elevation 2.5 m GVRD datum, the FCL could be achieved totally by filling.

4.4 Depth of Flooding

Subdivision in areas of flooding depth greater than 2.5 metres requires that the applicant demonstrate how full flood-proofing can be achieved and how safe ingress and egress can be achieved during the flood.

4.5 Flood Velocities

Subdivision in areas where flood velocities are in excess of 1.0 metre per second requires that the applicant demonstrate how safe ingress and egress can be achieved during the flood.

4.6 Training Works

Works are to be designed by a professional engineer. A professional engineer must certify constructed works.

4.6.1 Training Works to Protect One Property

An ongoing maintenance program may be assured through the addition of relevant requirements to the standard flood proofing covenant registered under section 219 of the Land Title Act, if the training works are:

- Built on private property, and
- Intended to protect only the property of the person (including a strata corporation) owning the training works and the property on which they are located.

4.6.2 Training Works to Protect Multiple Properties

If the training works, when constructed, will protect multiple properties of more than one person, then an ongoing operation and maintenance program and registered easements and access to structures must be assured. In addition, the training works require the approval of the Inspector of Dikes.

Approvals under the provincial Water Act and federal Fisheries Act are also normally required.

An approved Operation and Maintenance manual for the training works is to be prepared as a condition of subdivision approval and a copy is to be sent to the Inspector of Dikes.

4.7 Erosion Protection Works

Where erosion protection works are required, the approving officer should require details of the design, construction, operation and maintenance of erosion protection works prior to final approval of a subdivision or a relaxation of the requirements in a covenant. Works are to be designed by a professional engineer. A professional engineer must certify constructed works.

4.7.1 Erosion Protection Works to Protect One Property

An ongoing maintenance program may be assured through the addition of relevant requirements to the standard flood proofing covenant registered under section 219 of the Land Title Act, if the erosion protection works are:

- Built on private property, and
- Intended to protect only the property of the person (including a strata corporation) owning the erosion protection works and the property on which they are located.

4.7.2 Erosion Protection Works to Protect Multiple Properties

If the erosion protection works, when constructed, will protect multiple properties of more than one person, then an ongoing operation and maintenance program and registered easements and access to structures must be assured by the local government.

Approvals under the provincial Water Act and federal Fisheries Act are also normally required.

An approved Operation and Maintenance manual for the local government is to be prepared as a condition of approval.

5.0 Appendix – Definitions

Commercial Use - A use providing for the sale or rental of goods or services, for personal services, or for the servicing and repair of goods; and includes retail sales, wholesaling in conjunction with retail sales, commercial and government offices, personal services, commercial schools, household services and household repairs.

Debris Flow - The rapid downslope movement descending steep pre-existing drainage channels of water-saturated soil and debris by true flow processes.

Designated Flood - A flood, which may occur in any given year, of such magnitude as to equal a flood having a 200-year recurrence interval, based on a frequency analysis of unregulated historic flood.

Designated Flood Level - The observed or calculated elevation for the Designated Flood and is used in the calculation of the Flood Construction Level.

Disposition - Disposition of Crown land by certificate of purchase, grant, lease, licence of occupation, right-of-way, or easement under the *Land Act*.

Flood Construction Level - The Designated Flood Level plus the allowance for freeboard, used to establish the elevation of the underside of a wooden floor system or top of concrete slab for habitable buildings.

Flood plain - A lowland area, whether diked, flood proofed, or not which, by reasons of land elevation, is susceptible to flooding from an adjoining watercourse, ocean, lake or other body of water and for administration purposes is taken to be that area submerged by the Designated Flood plus freeboard.

Flood-proofing - The alteration of land or structures either physically or in use to reduce flood damage and includes the use of building setbacks from water bodies to maintain a floodway and to allow for potential erosion. Flood-proofing may be achieved by all or a combination of the following:

1. building on fill, provided such fill does not interfere with flood flows of the watercourse, and is adequately protected against floodwater erosion;
2. building raised by structural means such as foundation walls, columns, etc.;
3. a combination of fill and structural means.

Floodway - The channel of the watercourse and those portions of the flood plains that are reasonably required to discharge the flood flow of a Designated Flood. A minimum required floodway shall be equal to the width of the channel within the natural boundary plus a minimum setback of thirty metres from the natural boundary on each side of the channel or channels unless otherwise approved.

Freeboard - A vertical distance added to the Designated Flood Level (used to establish the Flood Construction Level).

Habitable Area - Any room or space within a building or structure that is or can be used for human occupancy, commercial sales, or storage of goods, possessions or equipment (including furnaces) which would be subject to damage if flooded.

Heavy Industry - Includes such uses as manufacturing or processing of wood and paper products, metal, heavy electrical, non-metallic mineral products, petroleum and coal products, industrial chemicals and by-products, and allied products.

Inspector of Dikes - An official of the Ministry of Water, Land and Air Protection as defined under the *Dike Maintenance Act*, RSBC 1996, chapter 95.

Institutional Use - A use providing for public functions and includes federal, provincial, regional and municipal offices, schools, churches, colleges, hospitals, community centres, libraries, museums, jails, courts of law and similar facilities; and specifically excludes public storage and works yards, and public utility uses.

Light or Service Industry - Includes such uses as assembly, fabrication and light manufacturing, warehousing, wholesaling and food processing.

Minimum Ponding Elevation - A minimum construction level assigned to reduce possible flood damage due to ponding of local drainage during a severe local storm.

Natural Boundary - The visible high watermark of any lake, river, stream or other body of water where the presence and action of the water are so common and usual and so long continued in all ordinary years as to mark upon the soil of the bed of the lake, river, stream or other body of water a character distinct from that of the banks thereof, in respect to vegetation, as well as in respect to the nature of the soil itself (*Land Act,* section 1). For coastal areas, the natural boundary shall include the natural limit of permanent terrestrial vegetation.

Non-conforming - Any existing building located on flood prone land that does not meet flood proofing requirements set out in this policy.

Professional Engineer - A person who is registered or licensed under the provisions of the Engineers and Geoscientists Act, RSBC 1996, chapter 116.

Recreation Use - A use providing for indoor or outdoor recreation and includes parks, playgrounds, and sports facilities.

Recreation Vehicle - Any structure, trailer or vehicle used or designed to be used for living or sleeping purposes and which is designed or intended to be mobile on land, whether or not self-propelled.

Setback - A withdrawal of a building or landfill from the natural boundary or other reference line to maintain a floodway and to allow for potential land erosion.

Standard Dikes - Those dikes built to a minimum crest elevation equal to the Flood Construction Level and meeting standards of design and construction approved by the Ministry of Water, Land and Air Protection and maintained by an ongoing authority such as a local government body.

Subdivision Approving Officer - The appropriate person appointed under the *Land Title Act.*

Training Works - Any wall, dike or protective structure used to prevent a stream from leaving its channel at a given location. This includes any debris flow training structures including basins, trash racks, or other works.

Watercourse - Any natural or man-made depression with well defined banks and a bed 0.6 metres or more below the surrounding land serving to give direction to a current of water at least six (6) months of the year or having a drainage area of 2 square kilometres or more upstream of the point of consideration.