NOVA SCOTIA WATERCOURSE ALTERATIONS STANDARD

NOVA SCOTIA
Environment

For Watercourse Alterations under Notification Process

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PART ONE – INTRODUCTION

1.0 Preamble

1.1. Purpose

The purpose of this document is to set out the minimum requirements that apply to watercourse alteration activities for which notification is required to be provided under the *Activities Designation Regulations* made under the *Environment Act*.

Some or all of the requirements in this document may become conditions of an approval for a watercourse alteration.

1.2. Authority

Nova Scotia Environment (NSE) has been designated as the lead agency to take such measures as are reasonable to promote sustainable management of water resources and to promote the health and integrity of aquatic ecosystems, to protect habitats for animals and plants (*Environment Act*, clauses 104 (a) and (d)). The Act further authorizes the making of regulations and standards to implement and enforce this mandate.

2.0 Definitions

2.1. Terminology

a) Terms used in these standards and defined in the Activities Designation Regulations made under the Environment Act have the same meaning as defined in those regulations, except as otherwise defined in these standards.

2.2. In these standards

a) “bank full” means the maximum height that water flows in a watercourse without overtopping the banks;

b) “cofferdam” means a temporary structure constructed in a watercourse to allow work in the watercourse to be carried out in isolation of water flow;

c) “downstream” means in the direction of the normal flow of a watercourse;

d) “energy dissipation pool” means a rip-rap-lined basin constructed at the outlet of a pipe or box culvert designed to reduce the exit velocity of stream flow and prevent the erosion of the downstream control;

e) “floodplain” means land areas adjacent to rivers and streams that are subject to recurring inundation;

f) “in isolation of water flow” means that the work area in a watercourse is separated from the wetted portion of the watercourse;

g) “invert” means the floor or bottom of a pipe, pipe arch, closed bottom culvert, or artificial channel;

h) “lagoon” means a watercourse that is located behind a barrier beach and may or may not be subject to intrusion by marine waters but generally exhibits brackishness;

i) “machinery” means any vehicle consistent with Motor Vehicle Act R.S., c. 293, 1(ca);

j) “meander” means a bend, loop or curve in a watercourse formed by the action of flowing water;

k) “modification” means a change to a watercourse alteration including, but not limited to, the replacement, removal, expansion or reduction of the alteration;

l) “riffle” means shallow water extending across the bed of a flowing watercourse with rapid current and with surface flow broken into waves by submerged obstructions such as gravel and cobble;

m) “riparian” means relating to or situated on the bank of a watercourse;

n) “rip-rap” means rock, cobbles, boulders, or broken stone placed along the bank or bed of a watercourse as protection against erosion by water or the elements. Rip-rap must be a well-graded mixture that consists of clean, hard, sound, durable rock;

o) “runoff” means water that flows overland prior to reaching a watercourse;

p) “stream flow” means a body of running water moving under the influence of gravity to lower levels in a narrow, clearly defined natural channel;

q) “thalweg” means the line joining the lowest points lengthwise of the bed of a watercourse defining its deepest channel;

r) “upstream” means towards the source or against the current of a watercourse;

s) “watercourse slope” means the vertical drop from the upstream control to the downstream control divided by the length between these two points and is usually expressed in percentages or degrees,

Slope = ((A-B)/L)*100

where,

A is the upstream control, located at the thalweg elevation of the existing watercourse at the proposed culvert inlet.
B is the downstream control, located at the thalweg elevation at the first natural undisturbed riffle located at a distance of 3 times the culvert diameter/width plus a minimum of 3.5 m downstream of the culvert outlet.
L is the distance between A and B.

PART TWO – GENERAL CONDITIONS

3.0 All Watercourse Alteration Activities under clause 5B(1) of the Activities Designation Regulations

3.1. Design

a) The alignment of all watercourse crossing structures built after October 1, 2014 must be as close as possible to perpendicular to the watercourse channel.

b) Watercourse crossing structures must only be located where the natural watercourse channel is straight (i.e. not at meanders).

3.2. Machinery and Equipment

a) Machinery must not enter the watercourse unless the work area has been isolated from the stream flow.

b) Machinery and equipment required to work in a watercourse area must not leak fuel or fluids.

c) On-site machinery, equipment, fuels, and any hazardous materials or fluids must be stored in an area above the floodplain limits.

d) Fuel storage and refueling or lubrication of machinery or equipment must not be conducted within 30 m of a watercourse, with the exception of refueling pumps being used to control water at the work site.

e) An emergency spill-kit must be kept on site when vehicles (including machinery) or equipment is used in a watercourse.

3.3. Construction

a) All activities below the ordinary high water mark must be carried out in isolation of water flow.

b) Excavated material, construction debris, and all fill material must be handled, stored and disposed so as to minimize the possibility of their entering the watercourse.

c) Upon completion of construction, modification, or maintenance work all debris resulting from the work must be removed from the work site.

d) The disturbed area around the watercourse must be restricted to the area required to complete the construction or modification of the alteration.

e) Construction, modification, or maintenance work must commence immediately after soils in the area of activity have been exposed.

f) Removal of vegetation situated on and/or above the bank of the watercourse must be restricted to the area needed to complete the construction, modification, or maintenance activity.

g) Grubbing on watercourse banks must be restricted to the area required for construction, modification, or maintenance of the activity and for backfills to reach slope stability.

h) Concrete used in a watercourse that has not been isolated from water flow must be pre-cast and cured away from the watercourse.

i) Concrete used in a watercourse that has been isolated from water flow must be permitted to cure long enough prior to releasing water flow so that it does not contaminate the water after the flow is released.

j) Lumber treated with creosote or pentachlorophenol (PCP) must not be used in the construction, modification, or maintenance of any part of a structure.

k) The following wood materials can be used below the ordinary high water mark of a watercourse:
   - Untreated rot-resistant timber, such as hemlock, tamarack, juniper, or cedar; and,
   - Pressure treated Alkaline Copper Quaternary (ACQ) or Chromated Copper Arsenate (CCA) treated wood, if treated in accordance with CAN/CSA-O80 SERIES-08 (R2012) and as described in the Wood Preservation Specification Guide (Ottawa, Ontario. Wood Preservation Canada, 2014), as may be updated from time to time.

l) All rock used for construction purposes must be obtained from a non-watercourse source and must be clean, non-ore bearing and non-toxic.

m) All off-site fill material must be obtained from a non-watercourse source and not from below the ordinary high water mark of any watercourse.

n) Effective on and after October 1, 2016, each activity designated in clause 5A(a) and Section 5B of the Activities Designation Regulations must be carried out by a Watercourse Alteration Installer or under the direct supervision of a Watercourse Alteration Installer. A person who is directly supervising watercourse alteration work on site is responsible for all work occurring, recognizes when something goes wrong and has the authority to correct any mistakes.

3.4. Water Control Measures

a) Downstream flow must be maintained at 100% at all times during the course of the activity carried out under notification.

b) A watercourse must not be permanently diverted to accommodate construction or modification.

c) Work below the ordinary high water mark must not take place in a watercourse until water control measures have been installed so as to allow work in isolation of water flow.

d) A temporary diversion channel must be stabilized with protective rock or plastic sheeting before any water flow is diverted from a natural channel into a diversion channel.

e) Excavation of temporary diversion channels must be conducted in isolation of water flow.

f) The bed or bank of a watercourse outside the isolated area must not be excavated or altered.

g) The intake for a pump must be screened to prevent the entrainment or impingement of fish. Entrainment occurs when a fish is drawn into a water intake and cannot escape. Impingement occurs when an entrapped fish is held in contact with the intake screen and is unable to free itself.

h) Cofferdams must be of sufficient height and strength to hold back the bank full flow velocity of a 1:2 year return rainfall event.

i) Cofferdams must be manufactured cofferdam systems, or constructed of bags filled with pea gravel faced with plastic and sheet piling or plywood.

j) Placement and removal of water control measures must prevent water control structure material and silted water from entering a watercourse.

k) Any residual water from the isolated area of a watercourse must be pumped into a settling area such as a constructed pond, behind filter fabric dams or

into a vegetated area in a manner that prevents the release of silt-laden water into a watercourse.

3.5. Erosion and Sediment Control

a) Sediment control measures must be installed prior to a watercourse alteration and maintained during the course of the alteration.

b) All exposed soils must be covered in a manner as to prevent erosion and sedimentation (e.g. grass seed and hay or straw, rock, or hydroseed).

c) Re-vegetation of disturbed areas in and around the worksite should be done immediately following completion of alteration activity.

d) Exposed soils must be managed to prevent erosion and sedimentation until all erodible soils are permanently revegetated or stabilized with rock.

e) Silt-laden water must not be pumped directly into a watercourse.

f) The turbidity and total suspended solid levels of runoff from a construction area must not exceed the levels immediately upstream by 25 mg/l unless levels immediately upstream are greater than 250 mg/l, in which case construction area runoff turbidity and total suspended solid levels must not exceed levels immediately upstream by more than 10%.

g) Any upslope sheet runoff or overland flow drainage must be temporarily diverted away from an alteration site if it could cause erosion or sedimentation.

h) Work site runoff that flows over exposed soils must be dispersed through natural vegetation or sediment control devices before it reaches any watercourse.

i) Any ditches required for an alteration must be stabilized following erosion control measures set out in *Erosion and Sedimentation Control Handbook for Construction Sites*, published by Nova Scotia Environment, as may be updated from time to time.

j) Excavation spoils must be stabilized, immediately upon placement, following measures set out in *Erosion and Sedimentation Control Handbook for*

Construction Sites, published by Nova Scotia Environment, as may be updated from time to time.

k) Excavation wastes and spoils may only be stored temporarily on a flood plain and must be removed prior to project completion.

l) Stabilization of fill must be at a maximum 2 horizontal to 1 vertical slope unless headwalls are used.

PART THREE – ACTIVITY-SPECIFIC CONDITIONS

4.0 Single culvert or other single closed-bottom crossing structure installed with a watercourse slope less than or equal to 0.5%

(In this section the term 'culvert' shall stand to include a single culvert or other single closed-bottom crossing structure)

4.1. Design

a) The minimum pipe culvert diameter permitted in a watercourse is 450 mm.

b) The hydraulic capacity of a culvert used in a watercourse must be calculated based on a minimum of 1:100 year estimated storm flow.

c) The culvert outlet invert elevation must be set at a depth equal to 20% of the culvert diameter/height, to a maximum of 0.4m, below the downstream control elevation (the first natural undisturbed riffle downstream).

d) The culvert inlet invert elevation must be set at the thalweg elevation of the existing watercourse.

e) A culvert must have an energy dissipation pool at its outlet.

f) An energy dissipation pool must be stabilized to prevent scour and erosion.

g) The center line of an energy dissipation pool must align with the center line of a culvert barrel.

h) The width at the bottom of the energy dissipation pool must be at least 2 times the culvert diameter/width.

i) The length at the bottom of the energy dissipation pool must be at least 3 times the culvert diameter/width.

j) The energy dissipation pool must be a minimum of 1 m deep.

k) A stable slope not exceeding 2 horizontal to 1 vertical from the bottom of the energy dissipation pool to the elevation of the natural streambed must be constructed.

l) The energy dissipation pool outlet must not disturb the downstream control riffle.

m) The energy dissipation pool outlet elevation must be equal to the natural streambed elevation.

n) The width of the energy dissipation pool outlet must be equal to the width of the natural stream bed at that location.

o) A minimum of three boulders must be placed in an energy dissipation pool in a triangle pattern in order to create resting areas for fish, and the boulders must be at least:

   (i) 0.75 m for culverts with a diameter/width 1.5 m or less; and

   (ii) 1 m for all other culverts.

p) The size of rip-rap stone in an energy dissipation pool must be sufficiently large to withstand velocities produced by a 1:100 year storm flow.

q) Following completion of the energy dissipation pool, shrubs, bushes/or trees, interspersed with willow, dogwood or alder live stakes must be planted, at 1 m (40 in) spacing along the sides of the energy dissipation pool. These plantings will be located within the 3 m (10 ft) wide zone bordering the shoulder of the pool.

4.2. **Construction**

a) Disturbance to a watercourse must be restricted to the area needed to complete the construction and modification of the culvert, energy dissipation pool and erosion protection.

b) Filter fabric and geotextile must not be used in the construction of an energy dissipation pool

c) A culvert must extend a minimum of 0.3 m beyond the upstream and downstream toe of the fill and rip-rap placed around both ends of the culvert.

d) When more than one length of culvert is required to be used for the construction or modification in a watercourse, the sections of culvert must be connected using the couplings/materials recommended by the manufacturer of the culvert.

e) Couplers used to connect culvert sections must include gaskets or geotextile wrap to reduce the infiltration or exfiltration of water and fine backfill materials.

4.3. Erosion Control

a) The road fill at each end of a culvert must be stabilized to prevent erosion or collapse.

b) Rip-rap or headwalls and wingwalls must be placed at both ends of a culvert to an elevation of at least one-half of the culvert diameter/height above the top of the pipe and a minimum of one culvert diameter/width on each side of the culvert immediately upon completion of a culvert installation.

c) Rip-rap must be sized to withstand 1:100 year flows in the watercourse.

d) Rip-rap sizing must follow the chart in Table 1:

Table 1: Rip-rap stone size chart.

Class 1 1:100 year flow velocity up to and including 3 m per second	Class 1 At least 70% of the rip-rap must be between 0.3 m and 0.45 m
Class 2	Class 2

1:100 year flow velocity greater than 3 m per second and up to 4 m per second	At least 70% of the rip-rap must be between 0.3 m and 0.75m
Class 3 1:100 year flow velocity above and including 4 m per second	Class 3 At least 70% of the rip-rap must be between 0.5m and 1.2m

5.0 Single culvert or other single closed-bottom crossing structure installed with a watercourse slope greater than 0.5% but less than 8.0%

(In this section the term 'culvert' shall stand to include a single culvert or other single closed-bottom crossing structure)

5.1. Design

a) Construction or modification of a culvert must be carried out in accordance with ***Guidelines for the Design of Fish Passage for Culverts in Nova Scotia***, Fisheries Protection Program, Maritimes Region, February, 2015, as may be updated from time to time.

6.0 Bridge or other open-bottom structure

6.1. Design

a) Construction or modification of a bridge that includes the application or removal of protective coatings must be carried out in accordance with the *Guidelines for the Application and Removal of Structural Steel Protective Coatings*, as published by Nova Scotia Environment, as may be updated from time to time.

b) Bridge decking must be enclosed such that it prevents debris, soil or other contaminants from entering a watercourse.

c) Bolted corrugated steel sheet or structural plate arches used in the construction of bridges or other open-bottom structures must meet the requirements of CSA G401-14 *Corrugated Steel Pipe Products*.

6.2. Capacity and Size

a) Bridges and other open-bottom structures must be designed with a hydraulic capacity large enough to ensure a maximum velocity of 1.8 m/s during a 1:100 year return period storm event.

6.3. Construction

a) Footings and abutments must be designed and installed such that the bed of the watercourse is not disturbed.

b) A watercourse must not be permanently diverted to accommodate the construction or modification of a bridge or open-bottom structure.

c) No part of a bridge or open-bottom structure may permanently disturb the flow of the watercourse.

d) Open-bottom arches must be assembled and backfilled in accordance with the manufacturer's specifications, unless site specific installation specifications are provided by a professional engineer licensed to practice under the *Engineering Profession Act*.

e) A bridge or other open-bottom structure must be supported by abutments or footings that extend below the thalweg depth.

f) Abutments and footings for bridges or other open-bottom structures must be stone, rock, concrete, steel or wood that is rot-resistant.

g) An arch or open-bottom box culvert must be secured on continuous footings.

h) The area excavated for placement of an abutment shall be backfilled up to the elevation of the bottom of the watercourse bed with unshrinkable fill, which must be installed in compacted lifts of not more than 0.3m at a time.

i) Infilling of a watercourse must not occur during or after the construction or modification of a bridge or other open-bottom structure except to allow for the encroachment of erosion protection material in accordance with clause 6.4(c).

6.4. Erosion Control

a) A buffer strip of undisturbed vegetation at least 30 m wide must be maintained between the watercourse and construction activity until watercourse crossing construction has commenced.

b) The faces and ends of abutments must be protected from erosion and scour.

c) Erosion protection materials must not encroach upon a watercourse bed beyond the thickness of the largest material required for erosion protection.

d) Erosion protection material must be placed on a watercourse bank at a maximum 2 horizontal to 1 vertical slope, unless headwalls/wingwalls are used.

e) Rip-rap must be sized to withstand 1:100 year flows in the watercourse (see Table 1).

f) Erosion protection materials must be installed below the thalweg of a watercourse, sized based on the calculated velocity of the stream (see table 1) and installed to a minimum thickness of 1.5 times the maximum stone size.

7.0 Wharf or dock

7.1. Construction

a) The bed of a watercourse must not be infilled, excavated or disturbed.

b) The altered shore must be stabilized with rock or other material to prevent erosion.

c) No part of the pole or support footing of a seasonal wharf may be embedded in the bed of a watercourse.

d) Poles resting on the bed of a watercourse must be a minimum of 1.2m apart.

e) Floating structures must be prevented from grounding.

f) Access ramps and walkways must be elevated above the surface of a watercourse and must not be more than 1.5m wide.

8.0 Permanent water intake or dry hydrant

8.1. Construction

a) No in-stream excavation, such as the creation of a sump, may take place.

b) The intake for a pump must be screened to prevent the entrainment or impingement of fish. Entrainment occurs when a fish is drawn into a water intake and cannot escape. Impingement occurs when an entrapped fish is held in contact with the intake screen and is unable to free itself.

c) No part of the installation, other than the pipe and intake screen, may extend into the watercourse.

d) The watercourse must not be infilled to accommodate construction.

e) The water intake structure must not obstruct the free passage of fish or constrict the channel width.

9.0 Removal of material from the bank for a boat launch or slipway

9.1. Construction

a) The approach to the boat launch must be at right angles to the watercourse.

b) The approach to the boat launch must be no steeper than 5 horizontal to 1 vertical.

c) The approach must be stabilized by adding clean gravel, concrete slabs or planks above the ordinary high water mark.

10.0 Erosion protection of bank of watercourse

a) Prior to the placement of erosion protection material (rip rap), banks are to be graded to a uniform slope not to exceed a 2:1 horizontal to vertical slope. Erosion protection materials must be installed, after preparation of the bank, below the thalweg of the watercourse, sized based on the calculated velocity

of the stream (see table 1), and installed to minimum thickness of 1.5 times the maximum stone size.

b) Erosion protection material (rip rap) must not encroach upon the channel or be placed on the bed of the watercourse beyond the thickness of the largest rip-rap size required.

c) The placement of the erosion protection material shall be carried out starting at the upstream end.

d) Rip-rap must be placed by hand or by machinery that is positioned outside the watercourse or in isolation of stream flow. Rip-rap shall be carefully fitted along the watercourse to prevent scouring and bank failure.

11.0 Removal of beaverdam

11.1. Design Considerations

a) Beaverdam removal must adhere to the "Beaverdam Removal Code of Practice" (Nova Scotia Environment/Department of Natural Resources, 2005), as may be updated from time to time.

12.0 Removal of foreign material

12.1. Construction

a) Only material that is foreign to the composition of the watercourse may be removed.

b) The original watercourse bed and bank material must not be removed.

13.0 Utility crossing

13.1. Design Considerations

a) A utility crossing constructed to pass under a watercourse must be installed at least 1m below the thalweg of the watercourse.

14.0 Decommissioning

14.1. Design Considerations

a) On removal of a structure that is no longer required, the watercourse must be restored as closely as possible to its original condition prior to the installation of the structure.