ADDITIONAL INFORMATION FOR EROSION CONTROL STRUCTURES

Bank Stabilization

a) Bank Shaping

- Projects must be approved by other appropriate agencies prior to construction.
- Only existing private ditches/streams will be considered—NOT Municipal Drains.
- Bank slopes shall be 2:1 (two horizontal to one vertical) or flatter, depending on soil type, water table or lateral seepage conditions.
- As construction proceeds, all ditch banks/ stream banks shall be seeded daily, with a recommended seed mixture for ditch bank erosion control in Ontario.

b) Tile Outlet Protection

- A rigid outlet pipe with a minimum length of 10 feet (3 m.) with a rodent guard needs to be sized to the field tile, and the joint sealed and secured
- Prevention of concentrated flow from adjacent cropland entering the ditch or stream at the tile outlet
- Riprap stone or equivalent material installed below the outlet
- Suitable filter material secured under stone

Drop Structures and Gully Stabilization

- Projects must obtain approval from other appropriate agencies prior to construction.
- The following bank stabilization structures and practices will be allowed where erosion problems exist:
  - Ditch bank Seeding to establish a vigorous vegetative cover. Contractor's time, seed and fertilizer are eligible costs. Seeding should only take place when sufficient moisture is present and the ditch bank is rough enough to hold the seed.
  - Spillway Drop Structures placed on a ditch bank where bankslopes are 2:1 or flatter. These structures are constructed of rock riprap or equivalent materials placed on the bank slope at locations where surface flows cause, or may cause, ditch bank erosion.
  - Drop Pipe Inlets can also be used to introduce surface flows into an open ditch or stream. The trash guard, riser pipe size, outlet pipe size and outlet protection are all important components that should be considered when installing a drop pipe inlet system. Maximum length of horizontal pipe will be no more than 100 feet (30 m.). More than 100 feet requires special approval.
  - Berms along the top of ditch banks concentrate surface flows, allowing water to enter the ditch at protected locations. Most ditch bank structures require the inclusion of a berm to direct surface water toward the structure. The berm itself is a raised area of soil sufficiently high to intercept surface flows and assist in directing these flows to a safe outlet. On very flat land the berm may exist on both sides of the ditch.
  - Channel Protection is used to protect the channel from erosion and scouring at locations where vegetation alone may not offer sufficient protection. Rock riprap is the most common material used to armour critical areas along the channel or at channel bends.
  - Culvert Protection in ditches and streams to prevent erosion and scouring at both upstream and downstream ends. Rock riprap is the most common material used for this protection.

In-Channel Structures

- Projects must be approved by other appropriate agencies prior to construction
- Structures are designed to control erosion within the channel and may also provide suitable habitat for selected aquatic species
- The following in-channel structures are eligible:
  - Spillways – rock lining of a watercourse is a form of chute spillway that will safely allow water to drop in elevation in a channel or allow for high water velocities in the watercourse. The appropriate section of the channel must be lined with rock riprap or other suitable material. Grade control structures can be installed at intervals along the watercourse bottom in such a manner that reaches of the channel are flattened between structures with the drop being sudden at these protected locations.
  - Riffles and Pools

Grassed Waterways

- Grassed waterways are wide, shallow, parabolic or trapezoidal channels that conduct surface flows to a safe outlet without causing erosion. They are also used as outlets for strip cropping and terrace systems and are often a necessary system component for closed drains.
- Includes cost of shaping, cuts and fills, smoothing, seedbed preparation, seed, fertilizer, mulch, temporary diversion of water from the channel, drainage tile beneath waterway, any associated surface inlets, and the outlet structure. This excludes systematic or random tile drainage projects.
- The type and application of vegetative seeding for grassed waterways is critical to the success of the structure and should be properly specified, implemented and maintained.
- Every consideration should be given to temporarily diverting water from newly- constructed waterways and/or to mulching the centre portion during vegetative establishment.

Water Diversions

- These structures control sheet and rill erosion and/or divert clean water flows from potentially large areas away from sources of possible contamination.
- These structures often require extensive cut and fill operations and require careful design, layout and construction.
- Often other erosion control structures form a component of these systems

Field Contour Terracing

- Field terraces control sheet and rill erosion on erodible slopes. Terraces slow the velocity of surface water and divert the flow laterally to waterway outlets or below ground through tile inlets. Projects must be designed to handle 1 in 10 year storms. Terraces may be permanently vegetated, broad-based to permit cropping, or a combination with only the back slope grassed.
- These structures require extensive cut and fill operations and require careful design, layout and construction

Water and Sediment Control Basins

- Water and sediment control basins can be used to control many types of erosion problems such as:
  - rill/gully erosion in low draws
  - bank erosion problems
  - in-field rill erosion
- Water and sediment control basins can sometimes be used in place of grassed waterways.

Drop Structures

- Drop structures allow concentrated flows of surface water to drop in elevation in a controlled manner.
- Maximum length of horizontal pipe will be no more than 100 feet (30 m.); over 100 feet lengths requires special approval.
- Drop structures are used at locations where vegetation cannot withstand the eroding forces of water due to sudden changes in elevation - e.g. at fence lines, at open drains, beside natural watercourses and at the heads of large gullies.
- Projects proposed within Municipal drain channels are eligible only if they are intended to outlet an erosion control structure that enters the drain at right angles. Written approval from the Municipality is required.
- Types of drop structures include rock chute spillways, drop pipe inlets, and grade control structures.
- Projects must be approved by other agencies, where required, prior to construction.

a) Rock Chute Spillway

- Rock Chute Spillways are often located at outlets of grassed waterways, at fence lines or at entrance points to ditches and streams.
- Rock Chute Spillways carry a concentrated flow of surface water down an inclined slope. They are constructed of rock, gabion baskets, interlocking concrete blocks or other suitable materials.
- Rock Chute Spillways, as opposed to other types of drop structures, can provide a high flow capacity.

b) Grade Control Structures

- Grade control structures are designed for small vertical drops and are often used at drop changes in elevation between fields, edges of fields or at outlets into ditches.
- Grade control structures are sized so that the design flow passes through the notched weir in the structure.
- Gabion baskets filled with rock riprap are commonly used for this type of drop structure.

MITIGATION GUIDELINES

Program participants are responsible for applying appropriate mitigation.

EROSION CONTROL WORK:	
Project Component	**Description of Effect Mitigation**
Air Quality	*Decreased ambient air quality due to dust and other particulate matter.* • Avoid site preparation or construction during windy and prolonged dry periods. • Cover and contain fine particulate materials during transportation to and from the site • Instruct workers and equipment operators on dust control methods. • Minimize cutting of vegetation and maintain windbreaks. • Restore disturbed areas as soon as possible to minimize duration of soil exposure • Spray water to minimize dust off paved areas or exposed soils. Use dust suppressants only over material. • Stabilize high traffic areas with a clean gravel surface layer or other suitable covering • Stabilize stored and stockpiled construction materials, debris and excavated material • Minimize operation and idling of vehicles and gas-powered equipment • Use well-maintained equipment and machinery within operating specifications.
Fauna	*Disruption to wildlife migration and movement patterns, breeding, nesting or hibernation.* • Avoid activities during sensitive periods of wildlife migration, staging, nesting, breeding, hibernation or nursing. • Avoid creating major obstructions at important wildlife crossing and movement points. • Establish vegetated buffer strips between construction zones and areas containing sensitive vegetation and wildlife. *Possible disease, mortality or decline in populations of wildlife due to exposure to disease bearing organisms (e.g. mosquitoes carrying West Nile Virus).* • Avoid creating still water or stagnant wet areas that may attract and/or propagate disease-bearing organisms that may negatively affect wildlife. (Note: If the project involves natural wetlands, once established, the wetland ecosystem will likely mitigate potential effects of disease bearing organisms.) *Wildlife injury or mortality from entanglement in silt fences.* • Avoid using heavy-duty silt fences, particularly those reinforced with wide mesh, in areas where large-bodied amphibians and reptiles (e.g. large snakes) are found. • Survey the area for active nests, dens, burrows, etc. and avoid

	disturbing them.
Flora	*Introduction of non-native species, including opportunistic species.* • Clean heavy machinery and equipment prior to transporting to new location.
Surface Water Quality	• Operate heavy machinery from above the top of the stream bank or on the shore above the normal water level. • Ensure that refueling and handling of contaminants is conducted off-site, where possible, and away from any water body or from ditches and drains connecting to a water body. • Minimize use and discharge of chemicals and cleaning agents. • Refuel equipment off slopes and well away from water bodies. • Securely contain and store all oils, lubricants, fuels and chemicals. If necessary, use impermeable pads or provide berms.
Groundwater Quality and Quantity	• Where possible, conduct activities in the dry, above the actual water level and above any expected rises in water level that may occur during a rainfall or snowmelt event.
Humans	*Personal injuries to public and workers during construction activities due to exposure to disease bearing organisms (e.g. mosquitoes carrying West Nile Virus).* • Remove standing water from equipment and containers. • Wear protective clothing and insect repellent if working in areas where mosquitoes are breeding.
Soil Quality	*Disturbance to microscopic organisms in the soil.* • Limit size of stockpiles to avoid anaerobic conditions. • Protect stockpiled soils from exposure to and sterilization by solar radiation (or stockpile in an uncovered shaded area). *Reduced soil capability through compaction and rutting, and mixing of topsoil and layers below.* • Avoid working during wet conditions and/or confine operation to paved or gravel surfaces. • Whenever possible, strip and store topsoil separately from the layers below and return to excavation in sequence.
Surface Water Hydrology	*Adverse modifications to surface drainage patterns, affecting storm water runoff rates and volumes.* • Ensure that earthworks do not exacerbate flood hazards nor create undesired obstructions to drainage into natural water bodies. • Maintain effective surface drainage upon completion of the project, which may include re-establishment of, or improvement to, the original site drainage. • Minimize changes to the ground surface and vegetation cover that would affect infiltration and runoff characteristics. • Whenever possible, limit construction time in flood prone areas and any low-lying shoreline areas to 72 hours or less.
Surface Water Quality	*Reduced water quality and clarity due to increased erosion and sedimentation, and transport of debris.*

	• Apply wet weather restrictions to construction activity. • Backfill and compact excavations as soon as possible. *Optimize degree of compaction to minimize erosion and allow for revegetation.* • Comply with any local regulations, policies and guidelines that stipulate a minimum acceptable buffer width (the allowable distance from a water body). Maximum buffer widths are desirable. • Create interceptor swales to divert runoff from the top of slopes that are susceptible to erosion. • Ensure that all materials placed below the high water mark of the water body are clean and free of silt and clay sized particles. All materials must meet the applicable regulations governing the placement of fill in water bodies. • If possible, direct surface drainage away from working areas and areas of exposed soils. To the maximum extent possible, promote overland sheet flow to well vegetated areas. • Install and maintain silt curtains, sedimentation ponds, check dams, coffer dams or drainage swales, and silt fences around soil storage sites and elsewhere, as required. • Securely contain and store all oils, lubricants, fuels and chemicals. If necessary, use impermeable pads or provide berms. • Stabilize slopes as appropriate for local site conditions. Possible methods include hard and soft designs or combinations of designs using crib walls, revetments, gabions, erosion control blankets, live fascines, or brush bundles.
Terrain and Topography	*Ground subsidence from soil thaw and poor excavation and backfilling practices; ground surface mounding or structure movement due to frost heave from inappropriate backfill material or shallow foundation depth.* • Ensure that backfilling is undertaken using suitable materials free of ice and frozen soils, and that adequate soil compaction is conducted to avoid ground subsidence. Provide additional backfill where subsidence has occurred. • In areas with high groundwater levels, ensure that soils susceptible to frost heave (generally fine sands and silty soils) are not used for backfill. Increased soil exposure resulting in erosion, sedimentation, slope instability and risk of mudslides, slumping, rock falls, etc. • Create interceptor swales to divert runoff from the top of slopes that are susceptible to erosion. • Direct runoff and overland flow away from working areas and areas of exposed soils. Promote overland sheet flow to the maximum extent possible. • On steep slopes that do not require grading, hand clear, without grubbing. • If necessary, install sediment and erosion controls prior to commencing the work and maintain them until the site has been stabilized. • If slope stabilization is not a project objective, avoid high-risk areas with unstable slopes (e.g. steep slopes, soil liquefaction risk areas). • Keep site clearing to a minimum to maintain sufficient vegetated cover and windbreaks. • Phase work to minimize duration of exposure of disturbed areas at

	risk. • Stabilize slopes as appropriate for local site conditions. Possible methods include hard and soft designs or combinations of designs using crib walls, revetments, gabions, erosion control blankets, live fascines, or brush bundles.
Species at Risk - Terrestrial	*Disturbance to terrestrial species at risk and/or their critical habitat.* • If any species at risk are known or expected to be present at any time within or adjacent to the project area, consult with Environment Canada specialists or the relevant provincial authority regarding measures to avoid harmful disturbance to these species.
Wildlife Habitat (terrestrial and aquatic)	*Physical damage and loss of habitat (terrestrial, riparian and/or wetland).* • Avoid or minimize trampling vegetation with equipment. • Minimize physical damage to vegetation by avoiding push-outs and avoiding the placement of slash onto living vegetation.