



TABLE 1
LIST OF STANDARD SPECIFICATIONS REFERENCED IN REPORT

DOCUMENT	TITLE
OPSS 120	General Specification for the Use of Explosives
OPSS 206	Construction Specification for Grading
OPSS 422	Construction Specification for Precast Reinforced Concrete Box Culverts and Box Sewers in Open Cut
OPSS 501	Construction Specification for Compacting
OPSS 511	Construction Specification for Rip-Rap, Rock Protection and Granular Sheeting
OPSS 802	Construction Specification for Topsoil
OPSS 803	Construction Specification for Sodding
OPSS 804	Construction Specification for Seed and Cover
OPSS 902	Excavation and Backfilling of Structures
OPSS 1004	Material Specification for Aggregates – Miscellaneous
OPSS 1010	Material Specification for Aggregates, Base, Subbase, Select Subgrade and Backfill Material
OPSS 1860	Material Specification for Geotextiles
SP 105S10	Construction Specification for Compaction
SP 206S03	Construction Specification for Grading
SP 422S01	Construction Specification for Precast Reinforced Concrete Box Culverts and Box Sewers
SP 999S26	Design, Installation and Testing of Pre-Stressed Anchors in Soil and Rock
OPSD 803.010	Backfill and Cover for Concrete Culverts
OPSD 810.010	Rip-Rap Treatment for Sewer and Culvert Outlets
OPSD 3090.101	Foundation Frost Depth for Southern Ontario
OPSD 3121.150	Minimum Granular Backfill Requirements – Retaining Walls



TABLE 2
SETTLEMENT OF SOILS UNDER CULVERTS
AS PER THE MTO "POST-CONSTRUCTION ROCK FILL SETTLEMENT AND GUIDELINES FOR ESTIMATING ROCK FILL QUANTITY" (APRIL 12, 2010)

CULVERT	LOCATION	RECOMMENDED SWAMP TREATMENT	COHESIVE SOIL HEIGHT (m)	COHESIONLESS SOIL HEIGHT (m)	ROCKFILL HEIGHT (m)	ESTIMATED MAXIMUM SETTLEMENT (mm)						REMAINING SETTLEMENT (mm)		RECOMMENDATIONS AND REMARKS
						PRIMARY CONSOLIDATION OF COHESIONLESS AND COHESIVE SOILS	TOTAL ROCKFILL SETTLEMENT		TOTAL	DURING FIRST 6 MONTHS FOLLOWING FULL HEIGHT OF FILL PLACEMENT	DURING FIRST 12 MONTHS FOLLOWING FULL HEIGHT OF FILL PLACEMENT	REMAINING SETTLEMENT (mm)		
							COMPACTED	DUMPED				AFTER 6 MONTHS	AFTER 12 MONTHS	
FA-4 (Forest Access Road) Sta. 12+347 Mowat Twp.	FA-4 -1 (outlet)	Surcharging for 20 months without removal of compressible soils	17.9	1.5	5.6	430	0	95	525	150	195	375	330 (280 after 20 months)	Differential settlement between centre inlet / outlet will be about 45 to 70 mm after 12 months and 40 to 60 mm after 20 months. Expansion/intermediate joints should be added to accommodate differential settlement
	314-11 (centre)		19.8	0	4.6	490	0	55	545	125	170	420	375 (320 after 20 months)	
	FA-4-2 (inlet)		13.4	2.9	5.4	395	0	90	485	140	180	345	305 (260 after 20 months)	
SX (SBL) Sta. 19+000 Mowat Twp. Concrete Box	SX-1 (west)	Full excavation of compressible clayey soils and 6 months preloading	N/A	0.6	7.4	5	20	95	120	95	105	25	15	Culvert may be installed after 6 months preloading
	SX-AP-2 (west)			3.6	1.7	15	10	0	25	18	22	7	3	
	301-1 (centre)			1.2	0	10	0	0	10	10	0	0	0	
	SX-2 (east)			0.1	0	0	0	0	0	0	0	0	0	
SX (NBL) Sta. 19+000 Mowat Twp. Concrete Box	SX-AP-1 (west)	Full excavation of compressible clayey soils and 6 months preloading	N/A	5.1	2.2	25	0	30	55	45	50	10	5	Culvert may be installed after 6 months preloading
	SX-3 (west)			2.7	5.8	10	0	100	110	90	100	20	10	
	301-2 (centre)			3.9	2.2	15	0	30	45	35	40	10	5	
	SX-4 (east)			3.3	5.4	10	0	95	105	85	95	20	10	
SX (SBL) Sta. 19+000 Mowat Twp. Open Footing	SX-1 (west)	Full excavation of compressible clayey soils and 6 months preloading	N/A	0.6	5.9	15 (*)	7	83	105	75 (**)	98	30	7	Culvert may be installed after 6 months preloading of rockfill at the west end of culvert. Differential settlement between centre west end/east end will be about 0 to 20 mm
	SX-AP-2 (west)			3.6	0	25 (*)	0	0	25	0 (**)	25	25	0	
	301-1 (centre)			0.2	0	10 (*)	0	0	10	0 (**)	10	10	0	
	SX-2 (east)			0	0	10 (*)	0	0	10	0 (**)	10	10	0	
SX (NBL) Sta. 19+000 Mowat Twp. Open Footing	SX-AP-1 (west)	Full excavation of compressible clayey soils and 6 months preloading	N/A	5.1	0.7	35 (*)	0	10	45	32 (**)	43	13	2	Culvert may be installed after 6 months preloading of the rockfill. Differential settlement between centre west end/east end will be about 9 to 11 mm
	SX-3 (west)			2.7	4.3	20 (*)	0	55	75	51 (**)	66	24	9	
	301-2 (centre)			3.9	0.7	25 (*)	0	10	35	22 (**)	33	13	2	
	SX-4 (east)			3.3	3.9	20 (*)	0	50	70	48 (**)	62	22	8	



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SETTLEMENT OF SOILS UNDER CULVERTS
AS PER THE MTO "POST-CONSTRUCTION ROCK FILL SETTLEMENT AND GUIDELINES FOR ESTIMATING ROCK FILL QUANTITY" (APRIL 12, 2010)

CULVERT	LOCATION	RECOMMENDED SWAMP TREATMENT	COHESIVE SOIL HEIGHT (m)	COHESIONLESS SOIL HEIGHT (m)	ROCKFILL HEIGHT (m)	ESTIMATED MAXIMUM SETTLEMENT (mm)						REMAINING SETTLEMENT (mm)		RECOMMENDATIONS AND REMARKS		
						PRIMARY CONSOLIDATION OF COHESIONLESS AND COHESIVE SOILS	TOTAL ROCKFILL SETTLEMENT		TOTAL	DURING FIRST 6 MONTHS FOLLOWING FULL HEIGHT OF FILL PLACEMENT	DURING FIRST 12 MONTHS FOLLOWING FULL HEIGHT OF FILL PLACEMENT	AFTER 6 MONTHS			AFTER 12 MONTHS	
							COMPACTED	DUMPED								
C7-1 (SBL) Sta. 19+378 Mowat Twp.	C7-1-1 (west)	Full excavation of compressible clayey soils and 6 months preloading	N/A	0	0	0.0	0	0	0	0	0	0	0	Culvert may be installed after 6 months preloading		
	C7-1-AP-1 (centre)			0	6.2	0.0	0	105	105	85	95	20	10			
	C7-1-2 (east)			0	8.0	0.0	0	135	135	110	120	30	15			
C7-1 (NBL) Sta. 19+378 Mowat Twp.	C7-1-3 (west)	Full excavation of compressible clayey soils	N/A	0	2.3	0.0	0	30	30	20	25	10	5	Culvert may be installed during embankment construction. Differential settlement between centre and west/east end will be about 0 to 30 mm. Expansion/intermediate joints should be added to accommodate differential settlement.		
	C7-1-AP-2 (centre)			0	0	0.0	0	0	0	0	0	0	0			
	C7-1-4 (east)			0	0	0.0	0	0	0	0	0	0	0			

Notes: (*) Estimated settlements of Granular B Type II structural fill are included. Granular B Type II should be selected due to potentially wet conditions.
(**) Granular B Type II foundation pad will be placed during installation of culvert (after 6 months of preloading of rockfill).