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SECTION 4 – ~~TRENCH EXCAVATION, TRENCHING BEDDING AND BACKFILL~~ (REVISE? TBD 2025) SPECIFICATIONS AND INSTALLATION

4.01 SCOPE

- .1 This specification refers to excavation, trenching, and backfill and all work pertaining thereto. Only those aggregates and granular materials approved by the City Engineer will be accepted for installation. ~~(REVISED MAY 2020)~~
- .2 Utility trenches shall be excavated only as far in advance of the pipe laying operation as safety, traffic, and weather conditions permit. Caution shall be exercised with respect to structures, piping, or other ~~man-made~~ obstacles that may exist within the working area and due consideration given to the protection and support of such properties and structures. (REVISE? TBD 2025) ~~(REVISED MAY 2020)~~

4.02 TESTING

- .1 For testing requirements, refer to Section 9.21 ~~[]~~. ~~(REVISED MAY 2020)~~

4.03 -NOT USED-

4.04 PRECUTTING PAVED SURFACES

- .1 When trenching along or across a paved surface, pavement shall first be sawn or cut by methods approved by the City Engineer in straight lines parallel to the trench centerline. The total cut width of pavement shall not be greater than the specified maximum trench width at the ground surface shown on the drawings. Concrete curbs and sidewalks shall be sawn at existing joints. (REVISE? TBD 2025)
- .2 Where, ~~in the opinion of the Engineer, the~~ existing pavement is in poor condition, ~~pavement~~ it may be cut by hand, mechanical means, or trenching equipment, following approval from the City Engineer. (REVISE? TBD 2025)
- .3 When asphalt cutting around a manhole is required to repair the manhole frame and cover, it shall be done in accordance with Standard Drawing No. T-4B ~~[]~~.
- .4 Pavement that has been cut and removed to permit trenching shall be disposed of as waste material and shall not be placed in the trench backfill. ~~(REVISED MAY 2020)~~
- .5 Pavement Restoration shall be done in accordance with Section 4.29 – Pavement Restoration ~~[→]~~. ~~(REVISED MAY 2020)~~

4.05 SITE PREPARATION

- .1 Remove all brush, weeds, grasses and accumulated debris from the trench width and working area.

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- .2 ~~Where directed by the Engineer for~~ For trenchwork in existing lawns, carefully cut and remove sod prior to excavation. *(REVISE? TBD 2025)*
 - .3 For trenchwork in landscaped statutory rights-of-way, carefully removed fences, shrubs, small ~~tress~~ trees and other items for replacement after backfilling is completed. ~~If, in the opinion of the Engineer, removed trees are too large to be replaced, the Contractor shall not be responsible for his/her replacement unless otherwise noted on the construction drawings.~~ *(REVISE? TBD 2025)*
 - .4 For trenchwork in landscaped boulevards, the Contractor shall provide 14 days' notice to all property owners for the removal of all fences, shrubs, small trees or other structures or plantings within the road rights-of-way that the property owner wishes to retain. Plantings and structures listed above, not be removed by the property owner upon expiration of the 14 day notice, shall be removed and disposed of by the Contractor.
 - .5 Remove all topsoil within the trench width and where required in the working area, and stockpile for replacement at locations approved by the City Engineer. Stumps, boulders and other deleterious material shall be removed from the topsoil and disposed of as specified in Section 4.11 – Disposal of Excavated Material [→]. Do not handle topsoil while it is wet or frozen. *(REVISE? TBD 2025)*
 - .6 Cut pavement, sidewalks and curbs in accordance with Section 4.04 – Precutting Paved Surfaces.
 - .7 Provide temporary drainage control to protect construction area and adjacent properties. Provide erosion and siltation controls to protect natural watercourse or existing storm drainage systems. *(REVISE? TBD 2025)*
- 4.06 TRENCH ALIGNMENT AND DEPTH
- .1 The trench shall be excavated so that the pipe can be laid to the established alignment and depth with allowance made for specified trench wall clearances and bedding as required.
 - .2 Prior to, or at the commencement of construction, the Contractor shall check existing mains for line and elevation at the point of connection. If they are different than what is shown on the construction drawings, the Contractor shall immediately report the difference to the ~~Engineer~~ Professional of Record and cease construction pending direction from the ~~Engineer~~ Professional of Record. *(REVISE? TBD 2025)*
- 4.07 TRENCH EXCAVATION
- .1 Trench excavation shall be classified as common or rock excavation.

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- .2 Trenches shall be excavated to the section and dimensions as shown on the drawings. Trench stability and safety procedures shall conform to WorkSafeBC *Regulations*.
- .3 Large rock, boulders, and large stones shall be removed to provide a clearance of at least 150 mm around all sides of pipe, fittings and appurtenances.
- .4 In road rights -of-way, the trench width shall be kept to a minimum and the trench width be such that at least one-way traffic can be maintained at all times unless otherwise *approved* by the *City Engineer*.
- .5 To prevent damage to existing utilities, excavate the last 300 mm above the utility by hand.
- .6 If, in the opinion of the ~~Engineer~~ *Professional of Record*, trench width exceeds the maximum allowable for pipe support, the *Contractor* may be required to provide a higher class of bedding, a pipe with a higher strength class or concrete encasement at no extra cost to the *owner*. (REVISE? TBD 2025)
- .7 Excavation for manholes shall be dimensions which will permit assembly of the sections in accordance with these specifications.
- .8 Excavate trenches only as far in advance of pipe laying operation as safety, traffic and weather conditions permit. In no case shall open trenches exceed 30 m.
- .9 All excavations left unattended shall be adequately protected with *approved* fencing and barricades and with flashing lights where required.

4.07A COMMON EXCAVATION

- .1 Common excavation is the excavation and removal of all material encountered which is not classified as rock.
- .2 All material classified as common excavation shall be removed, to the design subgrade cross-section, or as otherwise established by the ~~Engineer~~ *Professional of Record*. (REVISE? TBD 2025) ~~(REVISED MAY 2020)~~
- .3 Material which, in the opinion of the *City Engineer*, is not suitable for use as earth fill or rock fill, or not required for the works as shown on the construction drawings, shall be disposed of as specified in Section 4.11 – Disposal of Excavated Material ~~[→]~~. (REVISE? TBD 2025) ~~(REVISED MAY 2020)~~
- .4 Material which is suitable for earth fill or rock fill shall be placed and compacted in those areas requiring filling to the design subgrade cross-section, as per Section 9.26 ~~[↑]~~. ~~(REVISED MAY 2020)~~

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4.07B ROCK EXCAVATION

- .1 Rock excavation is:
- (a) The removal of detached masses of rock including single boulders, and pieces of concrete or masonry having individual volumes in excess of one cubic metre, or solid rock which requires drilling and blasting or breaking with a power-operated tool for its removal.
 - (b) Removal of soft or disintegrated rock which can be removed with a hand pick or power-operated excavator or shovel, or previously blasted or broken stone in rock fills or elsewhere with individual volumes less than one cubic metre, or boulders or pieces of fractured rock which do not occur naturally within the excavated volume but fall into the excavation from the adjacent area, shall not be classified as rock excavation. Hardpan (glacial till) shall not be classified as rock excavation.
 - (c) Overbreak, is that portion of solid rock which is excavated, displaced or loosened outside the limits used to calculate the volume of rock excavation and will be classified as unauthorized overexcavation.

~~(REVISED MAY 2020)~~

- .2 Rock excavation for trenches:
- (a) Where rock is encountered in the trench or pit, the method of removal shall be agreed with the **City Engineer** before its removal. *(REVISE? TBD 2025)*
 - (b) When blasting is required during excavation, the **Contractor** ~~shall exercise extreme care and shall limit the use of explosives to such charges that shall not cause damage to existing pipelines, other utilities or private property. must exercise extreme care and must not damage existing pipelines, other utilities, or private property.~~ Blasting ~~shall must~~ be done by experienced persons, qualified for the work. ~~The compliance~~ **Compliance** with regulations regarding the use and storage of explosives ~~shall be~~ is the responsibility of the **Contractor**. ~~The Contractor is and he/she shall be~~ responsible for any accidents or injury, loss and/or damage ~~which that~~ might occur as a result of ~~his/her~~ blasting. *(REVISE? TBD 2025)*
 - (c) Overbreak shall be removed as ~~directed~~ **approved** by the **City Engineer** and replaced with **approved** granular material, placed and compacted as specified herein at no additional cost to the **Owner**. *(REVISE? TBD 2025)* ~~(REVISED MAY 2020)~~
 - (d) Rock excavation shall be carried out to the design subgrade cross-section. No points or pinnacles of rock shall be left protruding above the rock cut cross-section. Subgrade rock shall be shattered at least 300 mm below the subgrade. ~~(REVISED MAY 2020)~~
 - (e) In rock cuts, care shall be exercised to ensure no damage is caused to the supporting rock below the roadway. Damage so caused, shall be repaired to a condition ~~acceptable to~~ **approved by** the **City Engineer** at no additional cost to the **Owner**. *(REVISE? TBD 2025)* ~~(REVISED MAY 2020)~~

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4.08 -NOT USED-

4.09 HAND EXCAVATION

- .1 Mechanical trenching and backfilling equipment shall be used except where by so doing, damage to trees, buildings, sidewalks, curbs, piping, or other existing structures or ~~man-made~~ obstacles above or below ground cannot be avoided. Trenches shall be hand excavated and backfilled where such obstacles prevent the use of mechanical equipment. *(REVISE? TBD 2025)*
- .2 Authorized hand excavation shall be restricted to trench excavation in statutory rights-of-way and only in those locations which, in the opinion of the ~~Engineer~~ **Professional of Record**, necessitate hand excavation methods. *(REVISE? TBD 2025)*
- .3 The following and similar circumstances shall not be considered as authorized hand excavation:
 - (a) Crossing of existing structures and utility works;
 - (b) Where lighter or smaller mechanical equipment could be used;
 - (c) Where, by the use of close sheeting, timber support, equipment pads, or other facilities, mechanical equipment could be used; or
 - (d) Where the presence of timbering, sheeting, well pointing equipment, or other **Contractor** placed obstacles restrict the use of mechanical equipment.

4.09A AUTHORIZED OVEREXCAVATION ~~*(REVISED MAY 2020)*~~

- .1 Authorized overexcavation is that excavation requested by the **City Engineer** as a result of unsuitable foundation conditions not resulting from the **Contractor's** operation. *(REVISE? TBD 2025)* ~~*(REVISED MAY 2020)*~~
- .2 Authorized overexcavation shall be replaced with earth fill, rock fill, **approved** granular material, sub base material or base course as ~~directed~~ **approved** by the **City Engineer**. Replacement fill shall be placed as specified elsewhere herein. *(REVISE? TBD 2025)* ~~*(REVISED MAY 2020)*~~

4.09B UNAUTHORIZED OVEREXCAVATION ~~*(REVISED MAY 2020)*~~

- .1 Unauthorized overexcavation is that excavation required as a result of the **Contractor's** operation as determined by the **City Engineer**. *(REVISE? TBD 2025)* ~~*(REVISED MAY 2020)*~~
- .2 Replacement of unauthorized excavation shall be as specified in Section 4.09A.2 – Authorized Overexcavation and shall be at no additional cost to the **Owner**. ~~*(REVISED MAY 2020)*~~

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4.10 STOCKPILING OF EXCAVATED TRENCH MATERIAL ~~*(REVISED MAY 2020)*~~

- .1 Common excavation *approved* by the *City Engineer* for reuse as *approved* granular backfill, may be stockpiled along the trench in accordance with WorkSafeBC regulations and provided the working space is adequate for this purpose and provided that by doing the backfill material does not spill onto private properties adjacent to the line of the trench thereby disturbing fenced, buildings, shrubs, lawns, or other items of value. *(REVISE? TBD 2025)*
- .2 Stockpiling of excavated material along the trench shall not unduly restrict cross traffic at ~~road~~-*roadway* intersections. Material shall be cleared from ~~road~~-*roadway* intersections and provision made for use of the cross ~~road~~-*street* by traffic as soon as possible after excavation has taken place. Pedestrian traffic to individual properties shall be maintained at all times and timber bridges shall be provided where it is necessary to cross open trenches. Roadways, driveways, and drainage facilities shall not be blocked unnecessarily. The spoil pile shall be located such that hindrance to local traffic is minimal. *(REVISE? TBD 2025)*
- .3 In order that excavated material may be stockpiled along the trench, the ~~road~~ *roadway* may be temporarily closed to traffic with the permission of the *City of Nanaimo* and providing that adequate detour traffic routes can be established to move traffic around the construction area, and providing also that street entrances to driveways are not blocked from vehicular traffic for periods in excess of one day. One lane shall be kept open at all times for emergency vehicles unless otherwise *approved* by the *City Engineer*. *(REVISE? TBD 2025)*
- .4 Where excavated material cannot be stockpiled along the trench in compliance with the above restrictions, it shall be trucked to locations where backfilling is taking place or trucked to stockpile for return to the trench at the time of backfilling. Alternatively, subject to *approval* of the *City Engineer*, excavated material may be wasted and replaced with approved material at the time of backfilling. *(REVISE? TBD 2025)*
- .5 The *Contractor* shall retain sufficient *approved* granular backfill material for the backfilling of the trench. Surplus *approved* granular backfill material shall be taken to and used at other locations within the project site suitable for material placement. ~~*(REVISED MAY 2020)*~~
- .6 The *Contractor* shall take all measures required to protect *approved* granular backfill from contamination, segregation and weather. ~~*(REVISED MAY 2020)*~~

4.11 DISPOSAL OF EXCAVATED MATERIAL

- .1 Surplus of waste excavated material shall be removed from the trench area during the excavation or backfilling operations and shall not be left along the trench following the completion of backfilling the trench.

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- .2 Surplus excavated material which is not required for the works, as shown on the drawings or specified elsewhere herein, shall be disposed of at the sites obtained by the Contractor. Waste material shall not be dumped on private property without the written permission of the ~~property owner of the property~~ and a fill permit obtained from the ~~City of Nanaimo~~. *(REVISE? TBD 2025)*
- .3 The Contractor shall exercise particular care to avoid spillage on paved roadways over which excavated material is hauled, and any such spillage shall be cleaned up promptly by sweeping.
- .4 Failure to immediately begin cleanup of spillage from roadways when required by the ~~City of Nanaimo~~ Inspector will result in the Contractor being charged all costs accrued by the ~~City of Nanaimo~~ to do the cleanup work. *(REVISE? TBD 2025)*
- .5 Care shall also be exercised to avoid spreading the excavated material over a wide area and rutting or otherwise damaging unnecessarily adjacent property when side casting of excavated material is permitted. ~~*(REVISED MAY 2020)*~~

4.12 BRACING AND SHEETING

- .1 Trenches shall be excavated, sheeted and braced in accordance with WorkSafeBC regulations or as may be necessary to protect life, property, and structures adjacent to the work, the work itself, or to maintain trench widths within the specified limits. Trench sheeting and bracing shall be located no closer than 150 mm to the widest section of any installed pipe.
- .2 Whenever possible, vertical trench timber or sheeting shall be placed so that it does not extend below the springline of the pipe being installed. When it is necessary to place sheeting or timber below the pipe springline, as in the case of overexcavation for trench bottom stabilization, sheeting shall be raised in 600 mm lifts and all backfill placed below the level of the pipe springline shall be thoroughly compacted on each lift to fill the void left by the raised sheeting.
- .3 Trench sheeting and bracing shall be removed, except in situations where the removal of trench sheeting and bracing will result in damage to adjacent structures. When sheeting and bracing is left in place, it shall be cut off above springline.
- .4 Where sheeting or timber is removed from a trench in which backfill is to be compacted, it shall be removed in a manner which permits compaction of the backfill in the manner specified.
- .5 WorkSafeBC approved cages may also be used in place of sheeting.

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4.13 DEWATERING

- .1 During construction, ground and surface water shall be controlled to the extent that excavation and pipe installation can proceed in the specified manner and such that the trench bottom is not disturbed to the detriment of the pipe installation. Trench water shall not be permitted to enter the pipe being installed unless ~~approval is received from approved by~~ the ~~Engineer~~ Professional of Record. *(REVISE? TBD 2025)*
- .2 Pumps, well points, or other equipment shall be employed to keep excavations free of water. Caution shall be exercised to make sure that the foundation problems with existing structures and works under construction do not result from the selected method of dewatering excavations.
- .3 Discharge from pumps, well points, or other dewatering equipment shall be located and controlled such that loss, damage, nuisance, or injury does not result.
- .4 The Contractor shall be responsible for any claims or actions resulting from the dewatering operation.

4.14 TRENCH BOTTOM CONDITIONS

- .1 Trenches shall be maintained such that pipe can be installed without allowing water, muck, silt, gravel, or other foreign material into the pipe. Material remaining in the trench bottom on completion of machine excavating which has been disturbed or softened by workmen or trench water shall be removed before bedding material is placed. The trench bottom shall be firm and capable of supporting the pipe to be installed.
- .2 When, in the opinion of the ~~Engineer~~ Qualified Registered Professional, the material in the trench bottom is found to be unstable or otherwise unsuitable for pipe support or the support of appurtenant structures, the ~~Engineer~~ Qualified Registered Professional shall direct the Contractor to utilize the most suitable of the following stabilization methods: *(REVISE? TBD 2025)*
 - (a) Overexcavate to suitable subgrade and backfill with base gravel and compact to 95% Modified Proctor Density (ASTM D1557). Use of approved granular material, subbase gravel, ~~drainrock~~ drain rock or bedding material shall be at approved by the ~~discretion of the City Engineer~~ Professional of Record. *(REVISE? TBD 2025) (REVISED MAY 2020)*
 - (b) Use of concrete bedding as directed by the ~~Engineer~~ Professional of Record. *(REVISE? TBD 2025)*
 - (c) Other methods as proposed by the ~~Engineer~~ Professional of Record and approved by the City Engineer. *(REVISE? TBD 2025)*

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4.15 AUGERING

- .1 Augering shall be performed with hand- or power-operating equipment, ~~subject to if~~ approved by the ~~approval of the~~ City Engineer. *(REVISE? TBD 2025)*
- .2 Auger holes shall terminate in open trench.
- .3 Augering shall be performed such that undermining or displacement of the roadway structure does not result and the completed auger hole is not more than ~~50mm-50~~ mm larger in diameter than the maximum outside diameter of the casing pipe or pipe to be augured.
- .4 The augured hole shall be to the correct line and grade. If an obstruction is encountered that will cause deviation from the correct line and grade, a new hole shall be augured.

4.16 CASING PIPES

- .1 Casing pipes shall be as shown in the construction drawings and shall be laid to the grade alignment shown.
- .2 The same bedding and backfill criteria shall be used for casing pipe as required for the main piping.
- .3 All pipe joints within the pipe casing shall be fully restrained with approved mechanical restrainers and shall be approved by the City Engineer. *(REVISE? TBD 2025)*

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4.17 BEDDING WITHIN PIPE ZONE

- .1 Bedding materials shall be granular in nature, free of organic material, silt or clay, and shall conform to the following gradation limits when tested in accordance with ASTM C136/C136M: ~~(REVISED MAY 2020)~~

Gradation Limits (Percent by Weight Passing)		
<u>Sieve Designation</u>	<u>Type 1</u>	<u>Type 2</u>
19.000 mm	100	90-100
12.550 mm		65-85
9.550 mm	85-100	50-75
4.75075 mm	70-100	25-50
2.36 mm		10-35
1.18 mm	20-65	
0.85085 mm		5-20
0.660 mm	0-45	
0.425 mm		0-15
0.48018 mm		0-8
0.15 mm	0-10	
0.075 mm	0-5	0-5

- .2 Type 1 is the standard acceptable bedding material. Type 2 shall be used where specified by the ~~Professional of Record-Engineer~~. (REVISE? TBD 2025)
- .3 Other acceptable bedding materials, for use only where shown on the construction drawings or as ~~approved~~ by the ~~City Engineer~~, are ~~drainrock or native material clear crush or pea gravel~~. (REVISE? TBD 2025)
- .4 The bedding material shall cover the full width of the trench bottom and have a minimum depth of 100 mm on completion of compaction. In rock excavation, the minimum depth of bedding below the pipe shall be 150 mm after completion of compaction.
- .5 Bedding material shall be compacted in maximum 150 mm lifts to 95% of Modified Proctor Density (ASTM D1557).
- .6 Bedding material shall be placed in such a manner that the pipe is evenly supported throughout its length by the pipe bedding material.

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- .7 Placement and compaction of the bedding material shall not damage or displace the pipe.
- .8 Bedding material shall be leveled across the full width of the trench to an elevation of 300 mm above the crown of the pipe.

4.18 TRENCH DAMS

- .1 Trench dams shall be constructed on all utility main lines where grades are ten percent (10%) or greater, or when indicated on the construction drawings.
- .2 All trench dams on utility mains shall be constructed in accordance with Standard Drawing No. T-8 [\[1\]](#). Trench dams on storm sewer gravity mains as per Standard Drawing No. T-8A [\[1\]](#) requires [approval](#) by the [City Engineer](#).
- .3 All trench dam drain pipes shall be capped at the highest end of the run.
- .4 Trench dam spacing shall be as follows:

Sanitary and storm gravity sewers		Watermains and forcemains	
Slope	Maximum spacing	Slope	Maximum spacing
10% - 15%	30 m	10% - 29%	40m 10 m (upon approval of City Engineer)
15% - 20%	25 m		
20% - 35%	20 m		
35% - 50%	15 m	30% - Over	See Section 4.18.5
50% - Over	10 m		

- .5 Where the slope of the watermain is 30% or greater, a geotechnical study shall be submitted to assess slope stability. Geotechnical studies shall be completed in accordance with the “*Guidelines for Legislated Landslide Assessments for Proposed Residential Development in British Columbia*” published by EGBC. Additionally, the [City Engineer](#) may request a geotechnical study regardless of the pipe grade if the stability of the adjacent slope is in question. ~~(REVISED MAY 2020)~~
- .6 If [approved](#) by the [City Engineer](#), concrete trench dams may be constructed of wetted sandbag sacks filled with wet pre-mixed concrete for areas inaccessible by construction equipment. Sacked concrete shall be laid in courses such that joints in succeeding courses are staggered. Courses shall be a minimum of nine (9) per vertical metre and shall be placed around the pipe and keyed into the trench walls to form a water tight dam. (REVISE? TBD 2025)

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- .7 Relief drains shall be installed on all trench dams to an acceptable watercourse or storm sewer system.

4.19 BACKFILL AND COMPACTION

- .1 Backfill material shall be:

- (a) Road Sub Base as per Section 9.30 – Road Sub-Base Gravel Course []. ~~(REVISED MAY 2020)~~
- (b) Road Base as per Section 9.31 – Road Base Gravel Course []. ~~(REVISED MAY 2020)~~
- (c) Approved Granular Material as per Section 9.29 – Approved Granular Backfill []. ~~(REVISED MAY 2020)~~
- (d) Recycled Aggregate Material (RAM) as per Section 9.32 – Recycled Aggregate Material []. ~~(REVISED MAY 2020)~~
- (e) Controlled Density Fill as per Section 4.24 – Controlled Density Fill [→].

- .2 General:

- (a) Placement and compaction of backfill material shall not damage or displace the pipe.
- (b) Remove shoring or cages in such a manner as to allow proper compaction and to prevent trench walls from collapsing.
- (c) Place backfill in lifts of maximum of 300 mm (200 mm for Approved Granular Backfill) in loose thickness. ~~(REVISED MAY 2020)~~
- (d) Crushed, granular, imported materials shall be used for backfill unless native soils are suitable and approved by the Engineer Professional of Record, and are specified on the construction drawings. *(REVISED TBD 2025)* ~~(REVISED MAY 2020)~~
- (e) Deficiencies in the quantities of approved granular backfill material which are the result of the Contractor's operation shall be replaced with imported granular fill at no additional cost to the Owner. ~~(REVISED MAY 2020)~~
- (f) Trenches shall be backfilled to a depth to allow for surface restoration in accordance with Section 4.27 – Surface Restoration [→].

- .3 Travelled Surfaces: *(REVISED TBD 2025)*

- (a) Travelled surfaces are roadways, lanes, driveways, road shoulders, sidewalks, walkways or other surfaces on which vehicular or pedestrian traffic normally travels. The ultimate extent of the travelled surface must be considered. *(REVISED TBD 2025)*
- (b) Under no circumstances shall a trench in a travelled area be left in a hazardous condition. *(REVISED TBD 2025)*

SECTION 4 – ~~TRENCH EXCAVATION, TRENCHING BEDDING AND BACKFILL~~ (REVISE? TBD 2025) SPECIFICATIONS AND INSTALLATION

- (c) Trenches in travelled surfaces shall be backfilled with material specified in Section 4.19 [→]. RAM and Approved Granular Material requires specific approval by the City Engineer, and may only be used up to the bottom of the sub-base layer. ~~Trenches located in existing arterial, collector or commercial/industrial roads shall be backfilled with controlled density backfill in accordance with Section 4.24. (REVISED MAY 2020)~~ (REVISED TBD 2025)
- (d) All backfill materials shall be compacted to 95% Modified Proctor Density (ASTM D1557), and field tested in accordance with ASTM D6938). ~~(REVISED MAY 2020)~~

.4 Untravelled Surfaces: (REVISED TBD 2025)

- (a) Untravelled surfaces are all other surfaces not classified as travelled surfaces. (REVISED TBD 2025)
- (b) Untravelled surfaces shall be backfilled with approved ~~native excavated~~ backfill or material specified in Section 4.19.1 [→] and compacted to 90% Modified Proctor Density (ASTM D1577). ~~(REVISED MAY 2020)~~

4.20 -NOT USED- ~~(REVISED MAY 2020)~~

4.21 CONCRETE

- .1 Concrete for pipe base, encasement or backfill shall have a minimum compressive strength of 32MPa at twenty-eight (28) days and be in accordance with Section 11.31 – Concrete [→]. ~~(REVISED MAY 2020)~~
- .2 Backfill material shall not be placed over the concrete until the concrete has obtained its initial set but in no case shall time be less than one hour.

4.22 -NOT USED- ~~(REVISED MAY 2020)~~

4.22A -NOT USED- ~~(REVISED MAY 2020)~~

4.23 -NOT USED- ~~(REVISED MAY 2020)~~

4.24 CONTROLLED DENSITY FILL

- .1 All materials and methods shall conform to CAN/CSA A23.1 and A23.2.
- .2 Materials:
 - (a) Portland cement: Type 10 to CAN/CSA A3000, for winter conditions Type 30 may be used.
 - (b) Fly Ash: Type F to CAN/CSA A23.5.
 - (c) Water: To CAN/CSA A23.1.
 - (d) Aggregate: To CAN/CSA A23.1.
 - (e) Air entraining admixture: To CAN3 – A266.2.

SECTION 4 – ~~TRENCH EXCAVATION, TRENCHING BEDDING AND BACKFILL~~ (REVISE? TBD 2025)

SPECIFICATIONS AND INSTALLATION

- (f) Chemical admixtures: To CAN3 – A266.2. Use of admixtures to accelerate or retard curing as directed by the ~~Engineer~~ Professional of Record. (REVISE? TBD 2025)

.3 Mix Design:

- (a) Compressive strength: 0.5MPa at twenty-eight (28) days.
- (b) Cement content: 25kg per m³.
- (c) Slump: 150 – 200 mm.
- (d) Air entertainment: 4 – 6%.

.4 Formwork:

- (a) Formwork, if required, shall conform to CSA S269.3.

.5 Placement:

- (a) Provide the City Engineer with twenty-four (24) hours' notice prior to placing controlled density backfill. (REVISE? TBD 2025)
- (b) Segregation of the material during placement shall not be permitted. Pumping of controlled density fill is permitted if approved by the City Engineer. (REVISE? TBD 2025)
- (c) Internal vibrators or other methods of consolidation may be used to ensure undercut areas of pavement are fully supported.
- (d) When using controlled density fill to bed and surround the pipe, material shall be placed so as not to damage or displace the pipe.
- (e) Begin placement of controlled density fill at the high end of sloping trenches.
- (f) Do not place load on the controlled density backfill until ~~authorized by the Engineer~~ approved by the Professional of Record. (REVISE? TBD 2025)
- (g) Steel road plates or other approved means of supporting traffic shall be used until surface restoration can proceed.

4.25 -NOT USED- (REVISED MAY 2020)

SECTION 4 – ~~TRENCH EXCAVATION, TRENCHING BEDDING AND BACKFILL~~ (REVISE? TBD 2025) SPECIFICATIONS AND INSTALLATION

4.26 ~~FISH HABITAT GRAVEL -NOT USED-~~ (REVISE? TBD 2025 Moved to Section 9.0)

~~.1 Gravel shall be composed of inert, non-fractured smooth washed aggregate.~~

~~.2 Gradation:~~

GRADATION LIMITS (Percent by Volume & Percent by Weight)		
US STANDARD SIEVE SIZE	GRADATION LIMITS (PERCENT BY WEIGHT PASSING)	PERCENT BY VOLUME
100 mm	100	0
75 mm	95	5
50 mm	80	15
37.5 mm	60	20
19 mm	25–30	30–35
9.5 mm	10–15	10–20
6.3 mm	0–15	0–5

4.27 SURFACE RESTORATION

.1 General:

- (a) Surface restoration shall be completed immediately following the backfilling operation.
- (b) Restore all disturbed surfaces to a condition equal to or better than the condition that existed prior to construction to the satisfaction of the [City Engineer](#) unless otherwise specified. (REVISE? TBD 2025)
- (c) Repair any damage to adjacent lands or improvements.
- (d) Damage to paved surfaces shall be seal coated, patched or replaced in an [approved](#) manner to the satisfaction of the [City Engineer](#). (REVISE? TBD 2025)
- (e) Damage to graveled surfaces shall be restored by scarifying, re-grading, and compacting the surface, or if required, re-gravelling the surface with base gravel or [approved](#) equivalent to the satisfaction of the [City Engineer](#). (REVISE? TBD 2025)

SECTION 4 – ~~TRENCH EXCAVATION~~, ~~TRENCHING BEDDING~~ AND BACKFILL (REVISE? TBD 2025) SPECIFICATIONS AND INSTALLATION

.2 Travelled Surfaces:

- (a) Restoration of travelled surfaces shall conform to the following minimum requirements, or shall match the existing road structure, whichever is greater, unless otherwise noted on the construction drawings. ~~(REVISED MAY 2020)~~

Location	Sub-Base	Base	Surface TREATMENT Treatment <small>(Revise? TBD 2025)</small>
Gravel Shoulders	300 mm	50 mm	-
Asphalt Roads (Existing)			Refer to Section 9.02.1 □
Asphalt Roads (With CDF)	CDF	100 mm	75 mm Asphalt
Gravel Driveways	-	100 mm	-
Asphalt Driveways	-	100 mm	50 mm Asphalt
Concrete Driveways			Refer to Standard Drawings in Section 8.0 □
Concrete Sidewalks & Walkways			Refer to Standard Drawings in Section 8.0 □
Asphalt Paths & Walkways			Refer to Standard Drawings in Section 8.0 □

~~(REVISED MAY 2020)~~

- (b) Place sub-base and base in 300 mm lifts (unless otherwise specified) and compact to 95% modified Proctor Density (ASTM D1557). Field compaction testing to be conducted in accordance with ASTM D6938 and at the frequencies referred to in Section 9.21 □. ~~(REVISED MAY 2020)~~
- (c) Restore asphalt road surfaces in accordance with Section 4.29 – Pavement Restoration [→]. ~~(REVISED MAY 2020)~~
- (d) Concrete shall be in accordance with Section 8.0 – Transportation □ and Section 11.0 – Cast In Place Concrete Works □. ~~(REVISED MAY 2020)~~

.3 Ditches:

- (a) Reshape ditches to the original lines, grades and sections as existed prior to construction unless otherwise shown on the construction drawings.
- (b) Restore ditch with a minimum of 300 mm of approved granular material, or other material specified of the ~~Engineer~~ Professional of Record where stability of ditch slopes and bottom cannot be maintained. (REVISE? TBD 2025)
- (c) Compact to 95% Modified Proctor Density (ASTM D1557).

SECTION 4 – ~~TRENCH EXCAVATION, TRENCHING BEDDING AND~~ BACKFILL (REVISE? TBD 2025) SPECIFICATIONS AND INSTALLATION

.4 Boulevards, Statutory Rights-of-Way and Private Property:

Surface restoration in untravelled boulevard areas shall be limited to the replacement of topsoil, grass, gravel, rock chips or bark mulch (subject to drainage conditions) unless otherwise stated in the construction drawings or contact documents.

- (a) Surface restoration shall be a minimum depth of 100 mm, or to meet pre-construction conditions, whichever is greater, unless otherwise noted on the construction drawings.
- (b) Restore unimproved areas with materials equivalent to the surface conditions prior to construction.
- (c) Restore gardens with materials **approved** by the **City Engineer** including topsoil, bark mulch, rock chips or other materials required to match pre-construction conditions. (REVISE? TBD 2025)
- (d) Restore lawns with sod removed prior to construction, otherwise restore lawn with topsoil **approved** by the **City Engineer** and seed or sod to match existing lawn. (REVISE? TBD 2025)
- (e) Restore gravel surfaces with equivalent granular materials.
- (f) Restore driveways in accordance with Section 4.27.2 [→].
- (g) Restore landscaped areas in accordance with Section 4.27.5 [→].
- (h) Surface restoration in statutory rights-of-way shall also be in accordance with the rights-of-way condition sheet. (REVISE? TBD 2025)
- (i) Prior to acceptance of the work, the **Contractor** shall obtain and submit, in duplicate to the **City Engineer**, a written release from each **property owner-of property**, where works were constructed or damaged, certifying that the **property owner** is satisfied with the completed works. (REVISE? TBD 2025)

.5 Landscaped Areas:

- (a) Topsoil, shrubs, small trees, fences and other items removed prior to, or during construction shall be replaced to the satisfaction of the **property owner**.
- (b) Replacement shrubs, trees and plants shall be planted at a suitable time of the year in accordance with good horticultural practice to provide a maximum assurance of survival.
- (c) During the maintenance period, any trees, shrubs or plants which show signs of dying as a result of the **Contractor's** operation shall be replaced with new plantings of a similar variety, age and size at no extra cost to the **owner**.




4.28 FINAL CUTTING PAVED SURFACES

- .1 All final pavement cuts shall be sawn in accordance with Section 4.29 – Pavement Restoration [→].
- .2 All final cuts shall be a minimum of 300 mm from the trench wall.

SECTION 4 – ~~TRENCH EXCAVATION, TRENCHING BEDDING AND~~ BACKFILL *(REVISE? TBD 2025)* SPECIFICATIONS AND INSTALLATION

- .3 All longitudinal pavement cuts in ~~streets~~ **roadway** shall lie outside a vehicle wheel path, unless otherwise directed by the **City Engineer**. *(REVISE? TBD 2025)*
- .4 If the edge of the trench is within 1 m of the edge of the ~~road~~ **roadway**, curb, or gutter, the **Contractor** is required to remove and replace the asphalt to the edge of pavement. *(REVISE? TBD 2025)*

4.29 PAVEMENT RESTORATION

- .1 All permanent restorations will require a minimum 75 mm asphalt thickness and shall be constructed in accordance with Standard Drawing No. T-4A  or as **approved** by the **City Engineer**. *(REVISE? TBD 2025)*
- .2 All pavement restorations where asphalt cutting around a manhole is required, shall be done in accordance with Standard Drawing No. T-4B .
- .3 All excavations in travelled paved areas shall be patched on the same day as the excavation with a temporary or permanent patch, or with approved steel plates, unless otherwise directed by the **City Engineer**. *(REVISED TBD 2025)*
- .4 Temporary Pavement Patching:
 - (a) All temporary patching and steel road plates shall be installed and maintained to ensure safe and smooth conditions.
 - (b) Temporary patching shall consist of cold or hot mix asphaltic concrete as **approved** by the **City Engineer** and placed to a minimum compacted thickness of 50 mm. **Refer to Section 4.29.5(a) for the maximum time allowable prior to permanent asphaltic concrete restoration. If the temporary cold mix is raveling, the Contractor has five calendar (5) days to provide a suitable remediation plan. Failure to provide the plan may result in City forces completing the work and recovering the costs.** *(REVISED TBD 2025)*
 - (c) On Local roads, with specific **approval** by the **City Engineer**, compacted granular material as specified in Section 4.19  may be used as temporary restoration for a maximum 5 day period as per the contract documents.
~~**(REVISED MAY 2020)**~~
 - (d) Use of steel road plates shall require **approval** from the **City Engineer** and shall only be used where the specifications or drawings require the trench to be left open (i.e. to allow curing of concrete or controlled density fill). Steel plates shall be rated to meet traffic loading requirements. *(REVISED TBD 2025)*
- .5 Permanent Asphaltic Concrete Pavement Patching:
 - (a) Install the permanent pavement patch within 15 calendar days of excavation, unless **an extension** is **approved** by the **City Engineer**. *(REVISED TBD 2025)*
 - (b) Remove and dispose of all broken, cracked, damaged or temporary pavement as well as paved areas showing settlement. All edges are to be saw cut or milled. ~~**(REVISED MAY 2020)**~~

SECTION 4 – ~~TRENCH EXCAVATION~~, ~~TRENCHING BEDDING~~ AND BACKFILL (REVISE? TBD 2025) SPECIFICATIONS AND INSTALLATION

- (c) All pavement outside the allowable trench width, as shown on Standard Drawing No. T-1 [\[\]](#) that is damaged as a result of the Contractor's operation shall be removed; all backfill beneath the damaged pavement re-compacted; and the pavement reinstated in accordance with these specifications at no additional cost to the Owner.
- (d) If required, re-cut existing pavement so that the location and alignment of the patch is in accordance with Section 4.28 – Final Cutting Paved Surfaces [\[→\]](#), and so that the pavement edge is a minimum of 300 mm from the trench wall. ~~(REVISED MAY 2020)~~
- (e) Excavate patch, as required, to ensure placement of the specified thickness of road base. Road base material and placement shall be in accordance with Section 9.0 – Aggregate and Granular Material [\[\]](#). ~~(REVISED MAY 2020)~~
- (f) Pavement edges shall be thoroughly cleaned. Tack coat, in accordance with Section 12.27 [\[\]](#), and Section 12.45 [\[\]](#), ~~shall must~~ be applied to completely cover all pavement edges. (REVISE? TBD 2025)
- (g) Minimum compacted pavement thickness shall be equal to the existing pavement thickness or 75 mm, whichever is greater. ~~(REVISED MAY 2020)~~
- (h) Material and placement of pavement shall be in accordance with Section 12.0 – Asphaltic Concrete Paving [\[\]](#). Attention must be given to the atmospheric temperature in accordance with Section 12.47.1 [\[\]](#). (REVISE? TBD 2025)
- (i) Finished permanent pavement patch must be free from bumps, depressions or other irregularities and must be within 6 mm of the design grade and cross-section, but not uniformly high or low, when measured with a 3.0 m straight edge in any direction. ~~shall be smooth and match adjacent pavement grades and be free of humps, depressions or ridges and within 6mm of the existing pavement grades when measured with a 3.0 m straightedge, but not uniformly high or low. Acceptance is in accordance with Asphaltic Concrete Acceptance Requirements - Section 12.51.1 []. (REVISE? TBD 2025)~~
- (j) The Contractor shall maintain all pavement patches in complete repair during the warranty period. Should a dangerous situation arise, the pavement patch shall be repaired immediately upon notification by the City Engineer, unless otherwise ~~directed~~ approved by the City Engineer. (REVISE? TBD 2025)
- (k) The City recognizes there are times when a gravel surface on an existing road must be capped prior to the pavement plant winter shutdown but atmospheric temperature in accordance with Section 12.47.1 [\[\]](#) cannot be met. The City Engineer may accept the installation of this 50 mm base lift of asphalt under the following conditions: (REVISE? TBD 2025)
 - (i) The base lift is tested and meets the specified density standards accordance with Asphaltic Concrete Acceptance Requirements - Section 12.51.4 [\[\]](#) (REVISE? TBD 2025)
 - (ii) If the base lift does not meet the specified density standards, and a remediation strategy is submitted by a Qualified Registered Professional for review and approval by the City Engineer. (REVISE? TBD 2025)

SECTION 4 – ~~TRENCH EXCAVATION, TRENCHING BEDDING AND BACKFILL~~ (REVISE? TBD 2025) SPECIFICATIONS AND INSTALLATION

1. One remediation attempt may be approved the following season prior to the installation of a minimum 35 mm surface lift. (REVISE? TBD 2025)
2. If the remediation attempt is not successful, subsequent remediation attempts will not be approved, and the base lift will be required to be removed and replaced. (REVISE? TBD 2025)

4.30 TRENCH SETTLEMENT DURING GUARANTEE PERIOD

- .1 The Contractor shall replace materials and rectify all failures that occur as a result of settlement of trench backfill or collapse of trench walls during the guarantee period.
- .2 Trenches in which backfill settles shall be refilled with the specified backfill material, and paved surfaces that are adjacent to trenches or on trench backfill, which fail during this period, shall be replaced or repaired in an approved manner.

4.31 PRIVATE UTILITIES IN CITY RIGHTS-OF-WAY

- .1 Private utilities within City of Nanaimo road rights-of-way generally shall follow the alignments shown on Standard Drawings No. T-9 [] and T-10 []. (REVISED TBD 2025)
- .2 All private utilities shall be traceable electronically.
- .3 Installation of private utilities shall require prior approval by the City Engineer.