



Water T&D Construction Standard

COMPACTION OF BACKFILL MATERIAL

APPLICATION: Reference on compacting requirements for approval of applicable governmental agencies and successful site restoration.

GENERAL

Proper compaction of backfill materials must be performed in conjunction with all work requiring excavation. It is especially important when the work requires; removal of a road surface, is in the influence of the road surface or crosses beneath an existing buried utility. Compaction tests are performed at random during the course of the backfilling operation. It is necessary that all levels of the backfill be performed as specified within this Standard so that any tests taken will indicate the proper compaction. Undue settling must not occur.

The BOARD utilizes outside engineering firms to perform compaction tests. These firms are on blanket purchase orders with the BOARD so that they can be on site to test, when requested by the BOARD's Engineer or the Contractor's "Person In Charge". On occasion, the BOARD and the applicable agency will allow the contracted engineering firm to perform the compaction tests provided they are certified for this type of testing.

Compaction tests are submitted by the testing entity, to the applicable governing agency, i.e. City Of Lansing, any of the County Road Commissions and Michigan Department of Transportation. If MDOT work is being performed in the City Of Lansing, the compaction test results shall be forwarded to the City of Lansing prior to being sent to MDOT for approval. Based on successful compaction test results, the applicable agency(s) will approve the final site restoration requirements. This will include subgrade & subbase restoration, re-paving, and all other road surface materials except for common road gravel. When gravel roads are restored, the Water T&D Resource Center personnel will be responsible for restoring the road surface, unless otherwise stated on permit. Excavations being restored within the jurisdiction of the City of Lansing, shall adhere to the requirements set forth by the City Of Lansing Public Service Department Utility Cut Policy.

Subgrade backfill materials to be used, are stated as "Granular Class IIIA" material, "Granular Class III" material, "Granular Class II" material, MDOT Coarse aggregate 6A. "Suitable excavated material" and occasionally "Cement". The granular materials (sand) and aggregate are acquired from various gravel companies throughout the Lansing area. Concrete is available through several cement companies.

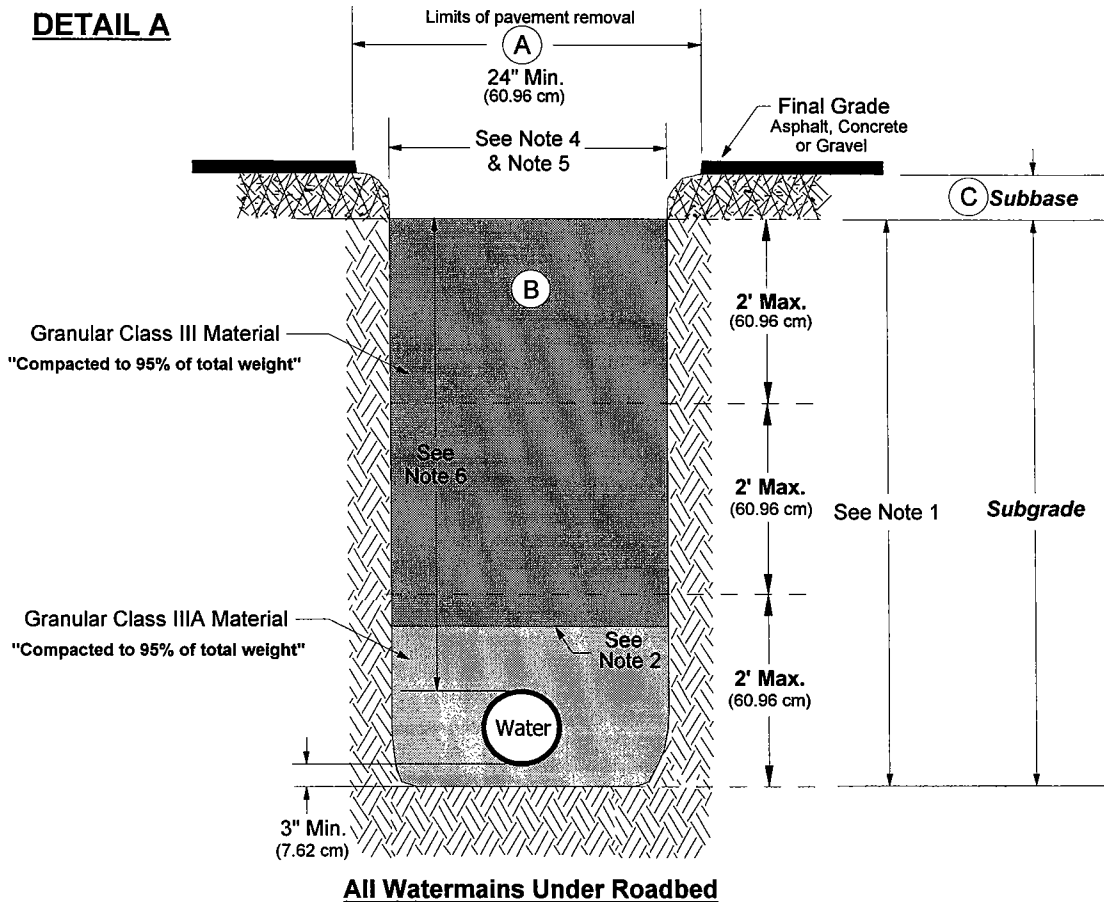
Subbase will be replaced by the BOARD or the Contractor. Subbase must be identical to the existing road construction to provide a uniform restoration. Construction plans should be referenced when possible. If no construction plans are available, existing sub-base shall be duplicated. Pavement will be restored by an asphalt or concrete company on blanket P.O. with the BOARD. On occasion, BWL will install a temporary patch and MDOT or Ingham County Road Commission will restore road surfaces upon acceptance of proper compaction by the applicable agency.

The proper compaction equipment must be used in relation to the desired lift increments. Typical plate compactors can compact in 6" (15.24 cm) to 9" (22.86 cm) lifts. Larger compacting unit's, designed to be operated from the arm of a backhoe or excavator, are capable of compacting in 2' (60.96 cm) lifts if properly sized. **Compacting equipment shall be used within it's rated lift capability.**

SPECIAL NOTES:

- For the purpose of this Standard, Details "A" through "D" depict a shored trench wall. The preferred BWL method of trench is the sloped wall trench which will not require shoring if sloped within the limits stated in the Department Of Labor Construction Safety Standards Commission Safety Standards, Part 9 Excavation, Trenching, and Shoring. pg.1 through 13, (R 408.40901 through R 408.40953).
- General Installation Notes 1 through 6 can be referenced on page 6 of 6 in this Standard. Table 1 can be referenced on page 6 of 6 in this Standard.
- Installation (Balloons) will be referenced on each page with the construction detail.

Manager, System Integrity & Customer Projects DK Wood Date: 9/19/01
 Manager, Water T&D Resource Center B. McLeod Date: 10/1/01



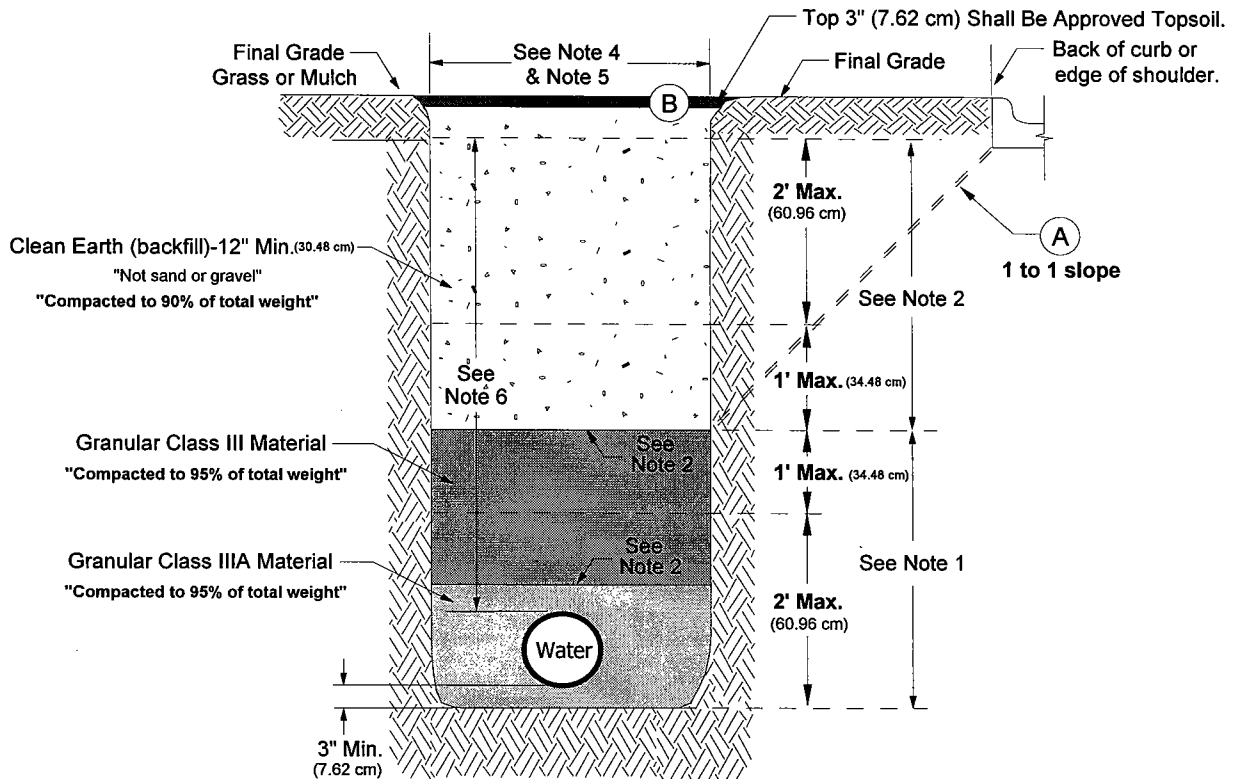
General installation notes; 1, 4, 5, & 6 apply to detail "A". Reference page 6 of 6 for descriptions.

INSTALLATION REQUIREMENTS

- (A) The 24" limit is based on the backhoe's small bucket width. Limits of removal of pavement or concrete roads, within the jurisdiction of the City Of Lansing, shall comply with the requirements stated in the "City Of Lansing Public Service Department Utility Cut Policy". In all other instances, the appropriate jurisdictional agencies policies shall be adhered to.
- (B) When watermain is placed in proposed roadbed area, it shall be backfilled with selected excavation material above future subgrade to existing ground line.
- (C) Subbase shall be replaced as specified on engineering drawings (plans). If plans are not available, subbase shall be rebuilt to duplicate existing subbase.

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DETAIL B



Watermains Under The Influence Of Roadbed

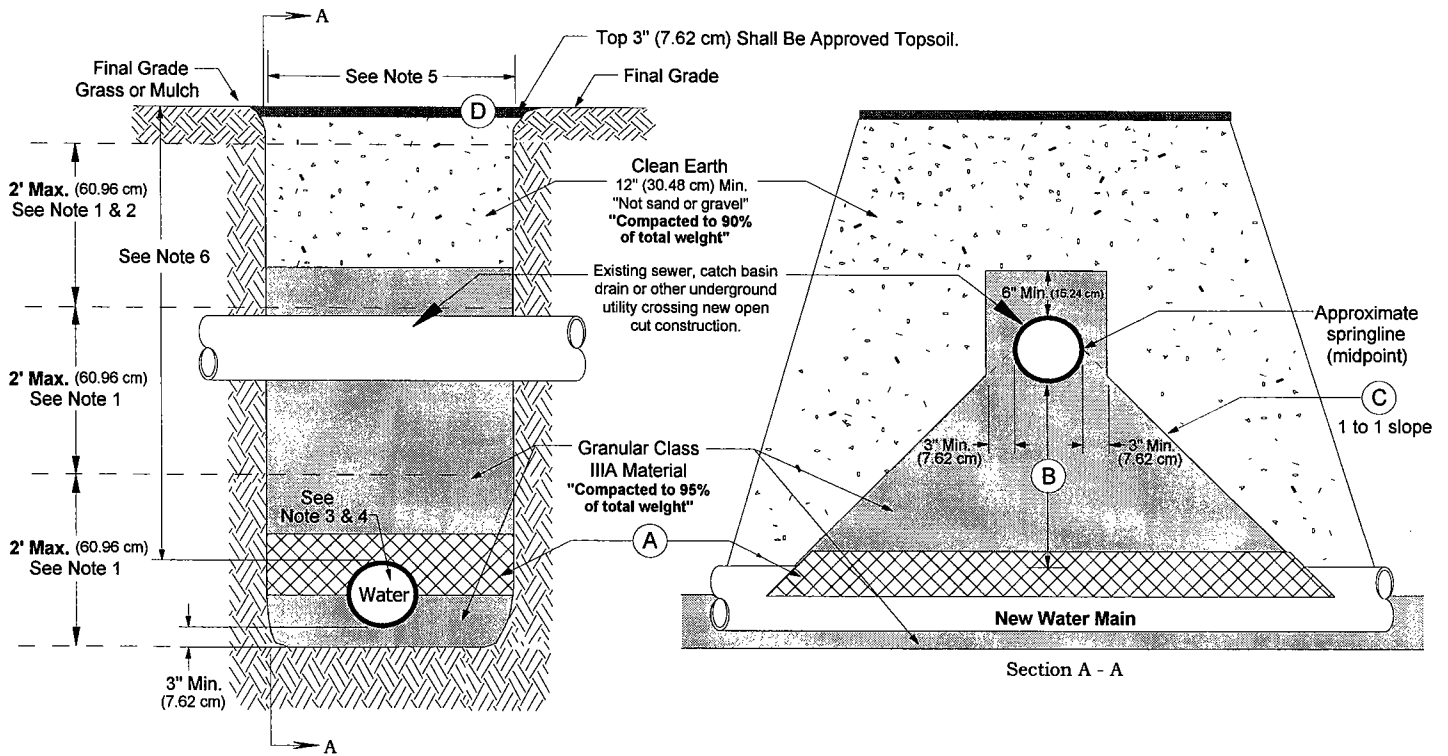
General Installation Notes; 1, 2, 4, 5, & 6 apply to Detail "B". Reference page 6 of 6 for descriptions.

INSTALLATION REQUIREMENTS

- (A) 95 % compaction of the Class III granular material shall be maintained within a 1 to 1 slope to any curb or shoulder to prevent settling of the undisturbed soils within the influence of the roadway.
- (B) 90% compaction required prior to application of 3" (7.62 cm) layer of topsoil.

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DETAIL C



Watermains Crossing Under Existing Utilities - Open Cut

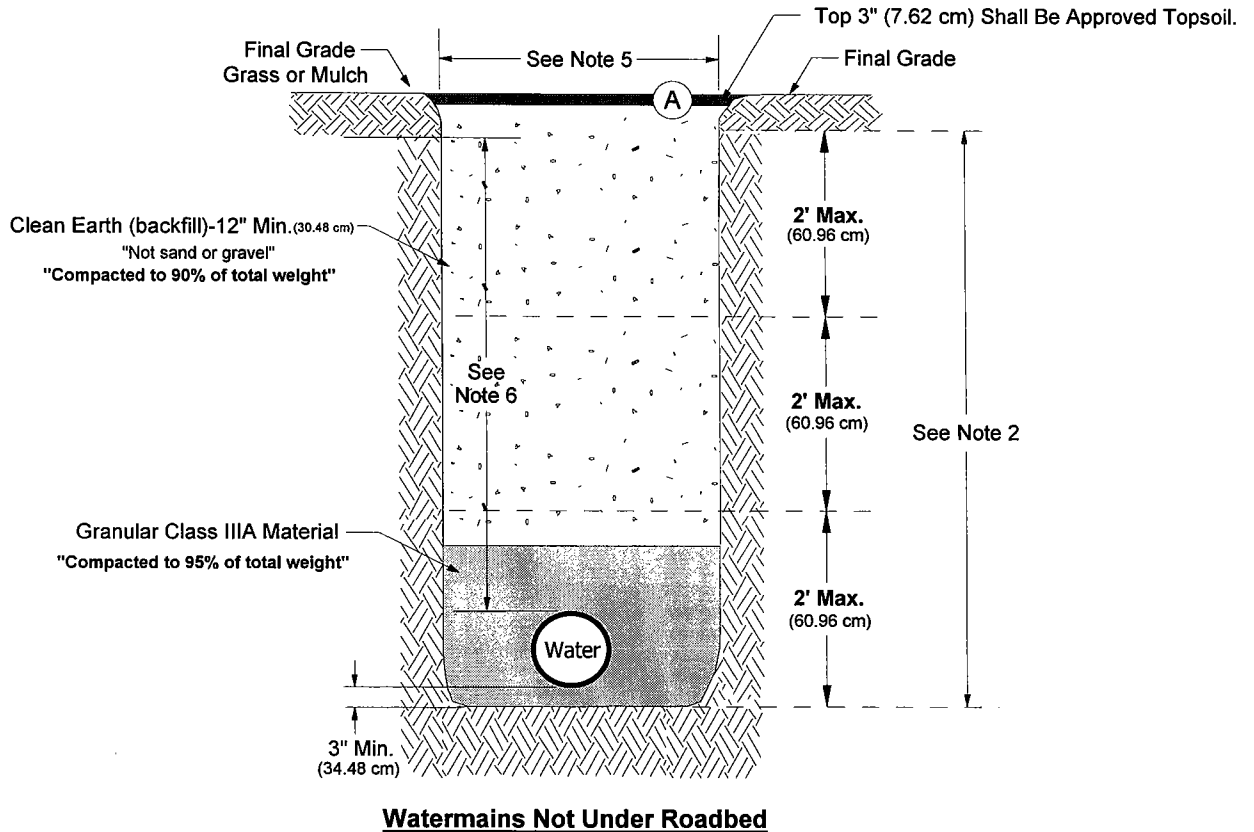
General Installation Notes; 1, 2, 3, 4, 5, & 6 apply to Detail "C". Reference page 6 of 6 for descriptions.

INSTALLATION REQUIREMENTS

- (A)** Backfill with a dry mix of one bag of cement per cubic meter (cubic feet divided by 35.3145) of Class II granular material.
- (B)** Minimum clearance between a water main and sewer system crossing shall be 18" (45.72 cm). Minimum clearance between all other utility crossings shall be 12" (30.48 cm) unless otherwise directed by the Engineer.
- (C)** Starting from the springline (midpoint) of the upper utility pipe, granular Class IIIA material shall follow a 1 to 1 slope (45° Angle) to the top of the watermain pipe. This material shall be compacted to 95%.
- (D)** Replace surface according to plans. If seed or sod restoration is to be performed, 90% compaction is required prior to application of 3" layer of topsoil. If asphalt or concrete restoration is to be performed, 95% compaction is required prior to re-surfacing.

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DETAIL D



General Installation Notes; 2, 5, & 6 apply to Detail "D". Reference page 6 of 6 for descriptions.

INSTALLATION REQUIREMENTS

- (A) 90% compaction required prior to application of 3" (7.62 cm) layer of topsoil.

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GENERAL INSTALLATION NOTES:

- 1) Compaction shall be performed in two (2) foot increments using a backhoe operated power driven compactor unless otherwise specified and accepted by the LBWL Water T&D Resource Center. Class IIIA Class III & Class II materials shall be compacted to no less than 95% of the maximum weight unit. All compacting must be performed using the proper depth increments as necessary per the rating of the compacting equipment.
- 2) Excavated soils which contain rocks or trash shall not be used for backfill. Backfill must be clean and free of large debris and shall be compacted to 90% of its maximum unit weight. Clay shall not be used in any backfill situations as it is unsuitable for compaction. Do not change compaction material within a given depth increment (lift). Compact the necessary material to the specified maximum weight unit before changing to a different class of material.
- 3) Per Michigan Department of Environmental Quality (MDEQ) and the "Recommended Standards For Water Works", also know as "The 10 State Standard"; Whenever it becomes necessary for the watermain to cross existing sewer lines the watermain shall have a minimum separation of 18" (45.72 cm) between the outside of the watermain pipe and the outside of the sewer line. When site conditions allow, it is preferred that watermains cross over the top of the sewer lines. Whenever it becomes necessary for the watermain to cross existing gas or electric, the watermain shall always be installed below the other utilities with a minimum separation of 12" (30.48 cm) between the top of the watermain and the bottom of the other utility.
- 4) When water main is placed in proposed roadbed area, it shall be backfilled with selected excavation material above future subgrade to existing ground line.
- 5) Sufficient trench width shall be provided to allow free working space and to permit compacting the backfill around the pipe. Refer to Table 1, on page 6 of 6, of this Standard. **Table 1 is only applicable for Horizontal wall trenching requiring shoring. Does not apply for Slope wall trenching.**
- 6) Unless otherwise stated by the Engineer, top of watermain shall be a minimum of 5' (1.55 m), and a maximum of 6' (1.86 m), below grade.

Table 1

Trench Width Based On Pipe Inner Diameter

I.D. Pipe Size - Inches (cm)	12" or less (30.48 cm)	14" (35.56 cm)	16" (40.64 cm)	20" (50.80 cm)
"W" Trench Width - Inches (cm)	24" (60.96 cm)	28" (71.12 cm)	32" (81.28 cm)	40" (101.60 cm)
I.D. Pipe Size - Inches (cm)	24" (60.96 cm)	28" (66.04 cm)	30" (76.20 cm)	36" (91.44 cm)
"W" Trench Width - Inches (cm)	48" (121.92 cm)	56" (142.24 cm)	60" (152.4 cm)	72" (182.88 cm)

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