DEPARTM	Republic of the Philippines ENT OF PUBLIC WORKS AND HIGHWAYS OFFICE OF THE SECRETARY Bonifacio Drive, Port Area Manila	5 CATT-13 DPW H 02.15.2024 BAGONG PILIPINAS
FEB 12 2024 DEPARTMENT ORDER) 18 NO. 18 Series of 2024 $d_V 2 15 2024$	SUBJECT: Revised DP Specification for CULVERTS, STOI LINED CANAL	WH Standard Item 500 – PIPE RM DRAINS AND

In line with the continuing efforts of the Department to update standard specifications, the attached revised **DPWH Standard Specification for Item 500 - Pipe Culverts and Storm Drain**, renamed as **Item 500 - Pipe Culverts**, **Storm Drains and Lined Canal**, is hereby prescribed for adoption in Government infrastructure projects.

The revised Pay Items are now included in the Project and Contract Management Application (PCMA) and shall form part of the DPWH Standard Specifications for Highways, Bridges and Airports, Volume II.

This Order supersedes the following Department issuances and shall take effect immediately:

- 1. Standard Specification for Item 500 Pipe Culverts and Storm Drain of the DPWH Standard Specifications for Highways, Bridges and Airports, Volume II (2012 Edition);
- 2. Memo 097.7_010722_DPWH Standard Specification for Item 500(3) Lined Canal; and,
- 3. Memo 097.7_030222_Revised Pay Item Subscripts under Item 500(3) Lined Canal.

MANUEL M. BONOA Secretary

14.1.2 MLL/JDV/RPF

Department of Public Works and Highways WIN4U01938



DPWH Standard Specification for ITEM 500 – PIPE CULVERTS, STORM DRAINS AND LINED CANAL

.

500.1 Description

This Item shall consist of the construction or reconstruction of pipe culverts and storm drains, hereinafter referred to as "conduit", and lined canal made of reinforced concrete or stone masonry in accordance with this Specification and in conformity with the lines and grades shown on the Plans or as established during staking as approved by the Engineer.

500.2 Material Requirements

500.2.1 Pipe Culverts and Storm Drains

500.2.1.1 Pipes

Materials shall conform to the requirements of Item 706, Pipes.

500.2.1.2 Bedding

Bedding material shall conform to the requirements of Subsection 500.3.1.2, Bedding.

500.2.1.3 Joints

Joints shall be made with cement mortar, rubber gaskets, oakum and mortar, oakum and joint compound, plastic sealing compound or, by a combination of these types, or any other type, as may be specified. It shall conform to the requirements of Item 705, Joint Materials.

500.2.1.4 Backfill Materials

It shall conform to the requirements of Subsection 500.3.1.6, Backfilling.

500.2.2 Lined Canal

500.2.2.1 Lean Concrete

The Contractor shall prepare the design mix based on the absolute volume method or as outlined in the American Concrete Institute (ACI) Standard 211.1, Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete.

500.2.2.2 Reinforcing Steel

It shall conform to the applicable requirements of Item 710, Reinforcing Steel and Wire Rope.

500.2.2.3 Stone Masonry

It shall conform to the requirements Subsection 506.2 Material Requirements of Item 506, Stone Masonry.

500.2.2.4 Concrete

It shall conform to the requirements prescribed in Section 405.2, Material Requirements of Item 405, Structural Concrete.

500.2.2.5 Curing Materials

It shall conform to the applicable requirements of Subsection 405.2.7, Curing Materials of Item 405, Structural Concrete.

For lean concrete to be placed prior to placing of reinforcing steel bar or any prefabricated structure shall have a minimum compressive strength of 80% of the required strength of 13.8 MPa at 7 days. Slump shall be 25 mm to 75 mm and determined using AASHTO T 119, Standard Method of Test for Slump of Hydraulic Cement Concrete.

Lean concrete shall conform to the dimensions shown as per approved Plans.

500.2.2.6 Forms and Falseworks

It shall conform to the applicable requirements of Item 414, Forms and Falseworks.

500.3 Construction Requirements

500.3.1 Pipe Culverts and Storm Drains

500.3.1.1 Trenches Excavation

Trenches shall be excavated in accordance with the applicable requirements of Item 103, Structure Excavation, to a width sufficient to allow for proper jointing of the conduit and thorough compaction of the bedding and backfill materials under and around the conduit. Where feasible, trench wall shall be vertical.

The completed trench bottom shall be firmed for its full length and width. Where required, in the case of crop drains, the trench shall have a minimum slope of 0.50% or as indicated on the Plan. The width of the trench shall be at least 300 mm (on both sides) greater than the horizontal outside diameter of the pipe.

If specified on the Plan, the excavation for conduits placed in embankment fill shall be made after the embankment has been completed 300 mm above the designed top slope of the conduit.

500.3.1.2 Bedding

The bedding shall be provided to the full width of the trench required and shall conform to one of the following classes specified. Unless otherwise specified, the requirements for Class C bedding shall apply.

1. Class A bedding shall consist of a continuous concrete cradle of concrete Class B with a minimum compressive strength of 16.50 MPa when tested at 28 days in accordance with provisions of Item 405, Structural Concrete.

- 2. Class B bedding shall consist of bedding the conduit to a depth of not less than 30% of the vertical outside diameter of the conduit. The minimum thickness of bedding material beneath the pipe shall be 100 mm. The bedding material shall be sand or selected sandy soil all of which passes a 9.5 mm sieve and not more than 10% of which passes a 0.075 mm sieve. The layer of the bedding material shall be shaped to fit the conduit for at least 15% of its total height. Recesses in the trench bottom shall be shaped to accommodate the bell when bell and spigot type conduit is used.
- 3. Class C bedding shall consist of grading of foundation surface after excavation to fit the conduit and shall have recesses shaped to receive the bells, if any.
- 4. Class D bedding shall consist of gravel material having a maximum nominal size of 19 mm or as prescribed by the Engineer.

For flexible pipe, the bed shall be shaped and a bedding blanket of Class B bedding as specified above shall be provided as follows:

Pipe Corrugation Depth	Minimum Bedding Depth
10 mm	25 mm
25 mm	50 mm
50 mm	75 mm

For large diameter structural plate pipes, the shaped bed shall not exceed the width of bottom plate.

500.3.1.3 Laying Conduit

The conduit shall be laid such that the longitudinal center line coincides with the flow line and shall begin at the downstream end of the conduit line. The lower segment of the conduit shall be in contact with the shaped bedding throughout its full length. Bell or groove ends of rigid conduits and outside circumferential laps of flexible conduits shall be placed facing upstream. Flexible conduit shall be placed with longitudinal laps or seams at the sides.

Paved or partially-lined conduit shall be laid such that the longitudinal center line of the paved segment coincides with the flow line. Elliptical and elliptically reinforced conduits shall be placed with the major axis within five (5) degrees of a vertical plane through the longitudinal axis of the conduit.

500.3.1.4 Jointing Conduit

Rigid conduits design may either be bell and spigot or tongue and groove unless another type is specified. The method of joining conduit sections shall be such that the ends are fully entered and the inner surfaces are reasonably flushed and even with mortar. The outside joint of the reinforced concrete pipe culverts shall be joined with a collar 300 mm wide and 150 mm thick mortar to form a continuous seal around the joint.

Mortar joints shall be made with an excess of mortar to form a continuous bead outside and around the conduit and smooth finished on the inside. For grouted joints, molds or runners shall be used to retain the poured grout. Rubber ring gaskets shall be installed so as to form

a flexible water-tight seal. If oakum material is used, the oakum joint shall be called with this material and then sealed with the specified material.

When cement mixtures are used, the completed joints shall be protected against rapid drying by any suitable covering material.

Flexible conduits shall be firmly joined by coupling bands.

Conduits shall be inspected before any backfilling works. Any pipe found to be out of alignment, unduly settled, or damaged shall be taken up and re-laid or replaced.

500.3.1.5 Field Strutting

If required by the Plans, vertical diameter of round flexible conduit shall be increased 5% by shop elongation or by means of jacks applied after the entire line of conduit has been installed on the bedding but before backfilling works. The vertical elongation shall be maintained by means of sills and struts or by horizontal ties used on paved invert pipe.

Ties and struts shall be 300 mm in-placed until the embankment is completed and compacted, unless otherwise shown on the Plans.

These construction specifications shall also apply in the case of re-laid conduits. In addition, all conduits salvaged for relaying shall be cleaned of all foreign materials prior to reinstallation.

500.3.1.6 Backfilling

Materials for backfilling on each side of the conduit for the full trench width and to an elevation of 300 mm above the top of the conduit shall be fine, readily compactible soil or granular material selected from excavation or from a source approved by the Engineer, and shall not contain stones that would be retained on a 50 mm sieve, chunks of highly plastic clay, or other objectionable material. Granular backfill material shall have not less than 95% passing a 12.5 mm sieve and not less than 95% retained on a 4.75 mm sieve.

When the top of the conduit is flushed with or below the top of the trench, backfill material shall be placed and compacted in layers not exceeding 150 mm on both sides to an elevation 300 mm above the top of the conduit. Care shall be exercised to thoroughly compact the backfill under the haunches of the conduit. The backfill shall be brought up evenly on both sides of the conduit for the full required length. Except where negative projecting embankment-type installation is specified, the backfill material shall be placed and compacted for the full depth of the trench.

When the top of the conduit is above the top of the trench, backfill shall be placed and compacted in layers not exceeding 300 mm. It shall be brought up evenly on both sides of the conduit for its full length to an elevation 300 mm above the top of the conduit. The width of the backfill on each side of the conduit for the portion above the top of the trench shall be twice the diameter of the conduit or 3.5 m, whichever is lesser. The backfill material used in the trench section and the portion above the top of the trench for a distance on each side of the conduit shall conform to the requirements for backfill materials in this Subsection. The remainder of the backfill shall consist of materials from excavation and borrow that is suitable for embankment construction.

Compaction to the density specified in Item 104, Embankment, shall be achieved by the use of mechanical tampers or by rolling.

All conduits after being bedded and backfilled as specified in this Subsection shall be protected by 1 m cover of fill before heavy equipment is permitted to cross during construction of the roadway.

500.3.1.7 Imperfect Trench

Imperfect trench method is used to reduce the load on the culvert under a high embankment. Under this method, for rigid conduit, the embankment shall be completed as described in Subsection 500.3.1.6, Backfilling, to a height above the conduit equal to the vertical outside diameter of the conduit plus 300 mm. A trench equal in width to the outside horizontal diameter of the conduit and to the length shown on the Plans or as directed by the Engineer shall then be excavated to within 300 mm of the top of the conduit, trench walls being as nearly vertical as possible. The trench shall be loosely filled with suitable soil. Construction of embankment above shall then proceed in a normal manner.

500.3.2 Lined Canal

500.3.2.1 Trenches Excavation

Trenches excavation shall be excavated in accordance with Subsection 500.3.1.1, Trenches Excavation

500.3.2.2 Trimming Foundation for Canal Lining

Trimming work consist of excavating and removing earth materials bounded by the exposed upper and underside surfaces of canal for concrete lining.

The Contractor must exercise extra care in order that trimming work will not extend beyond the net lines of the underside of canal lining. Over excavation or trimming work will not be permitted unless otherwise directed by the Engineer where the foundation materials have been disturbed or loosened before trimming operations.

In such case, the foundation materials shall be compacted or removed and replaced with selected materials as directed by the Engineer. Selected materials placed on side slopes shall be placed in layers that run parallel to the foundation surfaces or in horizontal layers. Selected materials shall conform to the requirements of Item 104, Embankment.

500.3.2.3 Formwork Construction

It shall conform to the applicable requirements of Subsection 407.3.13 Formwork Construction of Item 407 - Concrete Structure.

500.3.2.4 Structure Foundation

A. Gravel bedding

Gravel bedding shall be placed at a prepared subgrade as shown in the Plans.

B. Lean Concrete

Lean Concrete shall be placed after gravel bedding or as shown in the Plans in conformance to the applicable requirements of Subsection 407.3.1, Handling and Placing of Concrete.

500.3.2.5 Furnishing, Cutting, Bending and Placing of Reinforcing Steel

It shall conform to the applicable requirements of Subsection 404.3, Construction requirements of Item 404, Reinforcing Steel.

500.3.2.6 Batching of Concrete

It shall conform to the applicable requirements of Subsection 405.4.3 Batching.

500.3.2.7 Mixing and Delivery of Concrete

It shall conform to the applicable requirements of Subsection 405.4.4 Mixing and Delivery.

500.3.2.8 Handling and Placing Concrete: General

It shall conform to the applicable requirements of Subsection 407.3.1 Handling and Placing Concrete: General of Item 407, Concrete Structures.

500.3.2.9 Curing

Curing of concrete structures and mortar for stone masonry structures shall conform to the applicable requirements of Subsection 407.3.8, Curing Concrete of Item 407, Concrete Structures.

500.3.2.10 Removal of Forms

It shall conform to the applicable requirements of Subsection 407.3.14 Removal of Forms and Falsework.

500.3.2.11 Selection and Placing of Stone

It shall conform to the applicable requirements of Subsection 506.3.1 Selection and Placing.

500.3.2.12 Beds and Joints

It shall conform to the applicable requirements of Subsection 506.3.2 Bed and Joints.

500.3.3 Acceptance

With the approval of the Engineer, the plants shall be inspected periodically for compliance with specified manufacturing methods, and material samples shall be obtained for laboratory testing for compliance with materials quality requirements. This shall be the basis for acceptance of manufacturing lots as to quality.

Prior to and during incorporation of materials in the work, these materials will be subjected to the latest inspection and approval of the Engineer.

500.4 Method of Measurement

Pipes and storm drains of the different types and sizes, both new and re-laid, shall be measured by the linear meter in place. Pipes and storm drains with sloped or skewed ends shall be measured along the invert.

Branch connection and elbows shall be included in the length measurement, or be measured by the number of units installed.

Bedding material in-placed and approved shall be measured by the cubic meter.

When the Bid Schedule contains an estimated quantity for "Furnishing and Placing Backfill Material, Pipe Culvert", the quantity to be paid shall be the number of cubic meter completed in place and accepted, measured in final position between limits as follows:

- 1. Measurement shall include backfill material in the trench up to the top of the original ground line but will not include any material placed outside of vertical planes 300 mm up outside of the pipe wall.
- 2. If the original ground line is less than 300 mm measured from the top of the pipe, the measurement will also include the placing of all backfill materials, above the original ground line adjacent to the pipe for a height of 300 mm above the top of pipe and for a distance on each side of the pipe not greater than the widest horizontal dimension of the pipe.
- 3. The measurement shall include the placing of backfill material in all trenches of the imperfect trench method. Materials re-excavated for imperfect trench construction shall be measured for payment under Item 103, Structure Excavation.

The quantity of lined canal of the different types and sizes, shall be measured by the number of linear meters or cubic meters placed and accepted by the Engineer as shown on the approved Plans.

500.5 Basis of Payment

The accepted quantities of pipe culverts and storm drains, determined as provided in Section 500.4, Method of Measurement, shall be paid at the Contract Unit Price per linear meter for the specified types and sizes complete in place. End sections, when so specified, branch connections and elbows, shall be paid for at the Contract Unit Price per piece for the specified kind and size completed and in-placed.

The accepted quantities for lined canal of the types and sizes specified, complete in place, which price and payment shall be full compensation for furnishing and placing all materials including formwork, reinforcing steel, concrete, stone masonry, all necessary excavation, labor, tools, equipment, and other incidentals necessary to complete the work prescribed in this Item.

Excavation for culverts, storm drains and lined canals, including excavation below flow line grade and for imperfect trench, shall be measured and paid for as provided in Item 103, Structure Excavation.

Concrete for Class A bedding shall be paid under Item 405, Structural Concrete.

When the Bid Schedule does not contain an estimated quantity for "Furnishing and Placing Backfill Material, Pipe Culvert" payment for placing backfill material around pipe culverts shall be considered and included in the payment for excavation of the backfill material.

Payment Item Number	Description	Unit of Measurement
500 (1)a	Pipe Culvert, Class I, RCPC	Linear Meter
500 (1)b	Pipe Culvert, Class II, RCPC	Linear Meter
500 (1)c	Pipe Culvert, Class III, RCPC	Linear Meter
500 (1)d	Pipe Culvert, Class IV, RCPC	Linear Meter
500 (1)e	Pipe Culvert, Class V, RCPC	Linear Meter
500 (2)a	Pipe Culvert, Class I, Non- Reinforced	Linear Meter
500 (2)b	Pipe Culvert, Class II, Non- Reinforced	Linear Meter
500 (2)c	Pipe Culvert, Class III, Non- Reinforced	Linear Meter
500 (2)d	Pipe Culvert, Class IV, Non- Reinforced	Linear Meter
500 (2)e	Pipe Culvert, Class V, Non- Reinforced	Linear Meter
500 (3) a	Lined Canal, Rectangular, Reinforced Concret	e Linear Meter
500 (3) b	Lined Canal, V-Shape, Reinforced Concrete	Linear Meter
500 (3) c	Lined Canal, Trapezoidal, Reinforced Concrete	e Linear Meter
500 (3)d	Lined Canal, Rectangular, Stone Masonry	Linear Meter
500 (3)e	Lined Canal, V-Shape, Stone Masonry	Linear Meter
500 (3)f	Lined Canal, Trapezoidal, Stone Masonry	Linear Meter
500 (3)g	Lined Canal, Stone Masonry	Cubic Meter
500 (4)	Storm Drain	Linear Meter
500 (5)	Precast Pipe Culverts	Linear Meter
500 (6)	Clay Drain and Perforated Clay Drain Tile	Linear Meter
500 (7)	Vitrified Clay Lined Reinforced Concrete Pipe	Linear Meter

Payment shall be made under:

Payment Item Number	Description	Unit of Measurement
500 (8)	Perforated Vitrified Clay Pipe	Linear Meter
500 (9)	Vitrified Clay Pipe	Linear Meter
500 (10)	Acrylonitrile-Butadiene-Styrene (ABS) Composite Sewer Pipe	Linear Meter
500 (11)	Plastic and Polyethylene Corrugated Drainage Pipe or Tubing	Linear Meter
500 (12)	High-Density Polyethylene Pipe (Solid Wall Pressure Pipes)	Linear Meter
500 (13)	High-Density Polyethylene Pipe (Structured Wall Pipe)	Linear Meter
500 (14)	Polyvinyl Chloride (PVC) Sewer Pipe and Drain Pipe	Linear Meter
500 (15)	Cast Iron Pipe	Linear Meter
500 (16)a	Corrugated Iron or Steel Pipe and Pipe Arches, Riveted Pipe and Pipe Arches	Linear Meter
500 (16)b	Corrugated Iron or Steel Pipe and Pipe Arches, Welded Pipe and Pipe Arches	Linear Meter
500 (16)c	Corrugated Iron or Steel Pipe and Pipe Arches, Helical Pipe	Linear Meter
500 (17)	Bituminous Coated Corrugated Iron or Steel Pipe and Pipe Arches	Linear Meter
500 (18)	Corrugated Aluminum Alloy Culvert Pipe	Linear Meter
500 (19)	Bituminous Coated Corrugated Aluminum Alloy Culvert Pipe	Linear Meter
500 (20)	Structural Plate for Pipe, Pipe Arches and Arches	Linear Meter
500 (21)	Full Bituminous Coated Structural Plate Pipe, Pipe Arches and Arches	Linear Meter
500 (22)	Aluminum Alloy Structural Plate for Pipe, Pipe Arches and Arches	Linear Meter
500 (23)	Full Bituminous Coated Aluminum Alloy Structural Plate Pipe, Pipe Arches and Arches	Linear Meter