CONSTRUCTION SPECIFICATIONS

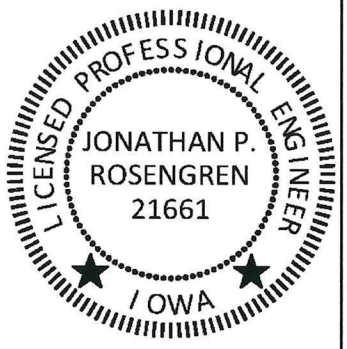
SUPPLEMENTAL MEASUREMENT PAYMENT / ITEMS OF WORK AND CONSTRUCTION DETAILS

FOR

KOOP CREP WETLAND PROJECT

SITE NO. BUT901622D

BUTLER COUNTY, IOWA



I hereby certify that this engineering document was prepared by me or under my direct supervision and that I am a duly licensed Professional Engineer and Land Surveyor under the laws of the State of Iowa.

Jonthan P. Rosengren (Signature) August 29, 2023 (Date)

Printed or typed name: Jonthan P. Rosengren, P.E.

My renewal date is: December 31, 2022

License Number is: 21661

Pages or sheets covered by this seal: Entire Document

NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATION

IA-1 SITE PREPARATION

1. SCOPE

Site preparation work shall consist of clearing, grubbing, stripping, refuse removal, bank sloping and structure removal on the site as necessary to rid the site of all undesirable materials on or near the surface and prepare the site for the structure. All woody growth within the construction area shall be cleared and all stumps and roots one inch in diameter or larger shall be grubbed from the site. In addition, all areas within 25 feet of the footprint of the structure shall be cleared and grubbed except as directed by NRCS. The work shall also consist of the removal and disposal of structures (including fences) that must be removed to perform other items of work.

For wetland restoration, enhancement, or creation projects, the wetland area shall be disturbed as little as possible and existing naturally vegetated spillway areas shall not be disturbed.

2. FOUNDATION PREPARATION

The construction areas shall be stripped a minimum of 12 inches to remove all unsuitable materials such as organic matter, grasses, weeds, sod, debris, and stones larger than 6 inches in diameter.

In an earth embankment foundation area, all channel banks and sharp breaks shall be sloped to no steeper than 1.5 horizontal to 1 vertical.

The foundation area shall be thoroughly scarified before placement of fill material. The surface shall have moisture added or shall be compacted if necessary so that the first layer of fill material can be compacted and bonded to the foundation.

3. STRIPPED MATERIAL DISPOSAL

Suitable soil material shall be stockpiled for use as topsoil. The other stripped materials shall be buried, removed from the site, or disposed of as directed by the owner or NRCS. Whenever possible, material shall not be disposed of in the pool area created by the structure.

Stockpiled materials around a construction site should be placed so as not to hinder subsequent construction operations.

4. DISPOSAL OF REFUSE MATERIALS

Waste materials from clearing and structure removal shall be burned or buried at locations approved by the owner. Buried materials shall be covered with a minimum of 2 feet of earthfill. Whenever possible, material shall not be disposed of in any pool area created by the structure.

All refuse shall be disposed of in a manner which complies with all local and state regulations.

5. SALVAGE

Items to be salvaged shall be as shown on the drawings. Structures and fencing materials that are designated to be salvaged shall be carefully removed and neatly placed in the specified storage areas.

6. SPECIAL SPECIFICATIONS

A. Measurement and Payment

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For items of work which lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for each item will be made at the contract lump sum price and will constitute full compensation for completion of the work.

For items of work for which specific unit prices are established in the contract, the payment will be made based on the approved quantity measured by the engineer or weight tickets. Payment will constitute full compensation of the work completed as defined by each work item.

B. Items of Work and Construction Details

1. Bid Item No. 1. Site Stripping & Preparation

This item will consist of work to remove and dispose of existing material to remove vegetation on areas to be excavated or filled. Total depth of vegetative stripping and topsoil stripping shall equal a combined depth of 12". The topsoil replacement quantity shall be paid separately.

This item will also include any tree and brush removal along with any fences. These shall be considered incidental to site stripping.

2. Bid Item No. 2. Crop Damage

This item consists of crop damage that results from construction activities. It is recommended the contractor remove corn residue rather than knock it down.

Payment for crop damage will be made to the nearest 0.1 acre as measured by the Engineer or their representative. The unit rate for crop damage will be determined by the Division near the completion of construction and added to the contract with a Change Order. Payment will be made to the contractor who will pay the landowner.

3. Subsidiary Item: Pollution Control

This item will consist of applying and performing all construction activities \in a manner that will minimize water pollution, air pollution, and soil erosion.

No separate payment will be made for Pollution Control. Compensation for this item will be incidental to other Items of work.

NATURAL RESOURCES CONSERVATION SERVICE

CONSTRUCTION SPECIFICATION

IA-5 POLLUTION CONTROL

1. SCOPE

The work shall consist of installing measures or performing work to control erosion and minimize the production of sediment and other pollutants to water and air during construction operations.

2. MATERIALS

All materials furnished shall meet the requirements shown on the drawings or in the specifications.

3. EROSION AND SEDIMENT CONTROL MEASURES AND WORKS

The measures and works shall include, but are not limited to, the following:

Staging of Earthwork Activities: The excavation and moving of soil materials shall be scheduled so that areas unprotected from erosion will be minimized. These areas will be unprotected for the shortest time feasible.

Seeding: Structures and disturbed areas shall be seeded as soon as possible after construction is completed.

Temporary seedings may be used as an alternative to other stabilization measures as approved by NRCS.

Mulching: Construction areas that have been disturbed but have no construction activity scheduled for 21 days or more shall have erosion protection measures applied by the 14th day. This erosion protection may be mulching or other approved temporary measures. Construction areas shall not be left open during a winter shutdown period and shall be protected by mulching.

All seeding and mulching shall be completed in accordance with the seeding plan and Iowa Construction Specification IA-6, Seeding and Mulching for Protective Cover.

The following works may be temporary. If they are installed as a temporary measure, they shall be removed and the area restored to its original state when they are no longer needed or when permanent measures are installed.

Diversions: Diversions may be required to divert clean runoff water away from work areas and to collect runoff from work areas for treatment and safe disposition.

Stream Crossings: Culverts or bridges may be required where construction equipment must cross streams.

Sediment Basins: Sediment basins may be required to settle and filter out sediment from eroding areas to protect properties and streams below the construction site.

Sediment Filters: Straw bale filters, geotextile sediment fences, or other equivalent methods may be used to trap sediment from areas of limited runoff. Sediment filters shall be properly anchored to prevent erosion under them.

Waterways: Waterways may be required for the safe removal of runoff from fields, diversions, and other structures or measures.

4. CHEMICAL POLLUTION

The Contractor shall provide watertight tanks or barrels or construct a sump sealed with plastic sheets to be used to dispose of chemical pollutants, such as drained lubricating or transmission oils, greases, soaps, concrete mixer wash water, asphalt, etc., produced as a by-product of the construction work. At the completion of the construction work, sumps shall be removed and the area restored without causing pollution.

Sanitary facilities such as chemical toilets or septic tanks shall not be placed adjacent to live streams, wells, or springs. They shall be located at a distance sufficient to prevent contamination of any water sources. At the completion of construction work, facilities shall be disposed of without causing pollution.

5. AIR POLLUTION

The burning of brush or trash or disposal of other materials shall adhere to local and state regulations.

Fire prevention measures shall be taken to prevent the start or the spreading of wild fires, which result from project work. Fire breaks or guards shall be constructed at locations shown on the drawings.

All public access or haul roads used by the contractor during construction of the project shall be sprinkled or otherwise treated to fully suppress dust. All dust control methods shall insure safe operations at all times. If chemical dust suppressants are used, the material shall be a commercially available product specifically designed for dust suppression and the application shall follow manufacturer's requirements and recommendations. A copy of the product data sheet and manufacturer's recommended application procedures shall be provided to the Engineer five working days before use.

6. MAINTENANCE, REMOVAL, AND RESTORATION

All pollution control measures and works shall be adequately maintained in a functional condition as long as needed during the construction operation. All temporary measures shall be removed and the site restored to as near original conditions as practical.

7. SPECIAL SPECIFICATIONS

A. Measurement and Payment

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B. Items of Work and Construction Details

NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATION

IA-6 SEEDING AND MULCHING FOR PROTECTIVE COVER

1. SCOPE

The work shall consist of seeding, mulching, and fertilizing all disturbed areas and other areas as indicated on the drawings or otherwise designated.

2. SEEDBED PREPARATION AND APPLICATION

The entire area to be seeded shall be reasonably smooth and all washes and gullies shall be filled to conform to the desired cross-section before actual seedbed preparation is begun. At this stage of the operation, the required fertilizer and lime shall be applied uniformly and incorporated into the top 3 inches of the soil with suitable tillage equipment. The seedbed preparation operation shall be suspended when the soil is too wet or too dry. The seedbed shall be loosened to a depth of at least three inches.

On side slopes steeper than 2-1/2 horizontal to1 vertical, the 3 inch minimum depth of seedbed preparation is not required, but the soil shall be worked enough to insure sufficient loose soil to provide adequate seed cover.

Unless otherwise specified, the seeding operation shall be performed immediately after preparation of the seedbed. The seed shall be drilled or broadcast by equipment that will insure uniform distribution of the seed.

3. MATERIALS

The seeding, fertilizing, and mulching requirements are as specified on Form IA-CPA-4.

Straw from cereal grains or hay will be used as mulching material. It shall be relatively free of weeds.

4. MULCH APPLICATION

The required mulching shall be performed as soon as possible after seeding unless otherwise specified. The mulch shall be applied uniformly over the area. The type and rate shall be as specified. When mulching is required, all areas seeded during any one day shall be mulched within 24 hours. The mulch may be spread by any means that results in a uniform cover.

The mulch shall be anchored. Anchoring of the mulch may be performed by a mulch anchoring tool or regular farm disk weighted and set nearly straight, by installation of mulch netting, or by other methods approved by NRCS.

5. SPECIAL SPECIFICATIONS

A. Measurement and Payment

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B. Items of Work and Construction Details

1. Bid Item No. 3. Structure & Channel Seeding

This item will consist of seeding the dike except the upstream side slope below the weir elevation, auxiliary spillway, the tile outlet channel side slopes and any other disturbed areas noted on the plans or as determined by engineer.

All seed must be clean and weed free. Seeding rates are expressed in bulk pounds per acre. Seed quality shall not drop below 70% Pure Live Seed (PLS) where PLS = (percent germination plus percent dormant seed) times percent purity.

Seeding rates are as follows:

Smooth Brome grass	25 pounds/acre

Seed shall be applied with a drill and placed at ¼ to ½ inch deep.

Fertilizer shall be applied on the entire seeding area at the following rate:

Nitrogen (N)	30 pound/acre
Phosphorus (P_2O_5)	30 pounds/acre
Potassium (K_2O)	40 pounds/acre

Straw mulch shall be applied at a rate of 2 tons per acre on all areas receiving structure and channel seeding.

Seeding shall be completed during the following seeding periods:

Spring	March 1 to May 15
Summer	August 1 to September 15
Fall	November 15 to Freeze-up

If construction is completed during any other time of the year, the seeding shall be performed at the next seeding period.

If seeding is completed during the spring seeding period, a companion crop of oats shall be seeded at a rate of 1-1/2 bushels per acre.

Measurement will be based on the areas successfully seeded to the nearest 0.1 acre.

2. Bid Item No. 4. Buffer Seeding

This item will consist of seeding the areas designated on the plans as buffer seeding and include borrow areas, disturbed areas not seeded as part of structural seeding, and other areas within the easement. Buffer seeding is not required in area below normal pool elevation established by the weir elevation.

Some areas of the site may have existing CRP vegetation or steep slopes with existing vegetation. Local NRCS personnel will determine if these areas will be included as part of the buffer seeding areas for this project or will be left as is. This may affect the bid quantity and Contractor will verify with Engineer the number of acres that will require buffer seeding.

All seed must be clean and weed free. Seeding rates are expressed in pounds of pure live seed per acre. All seed must be yellow-tagged Iowa ecotype unless approved otherwise by IDALS-DSCWQ.

Seeding mixture shall include a minimum of 5 native grasses and 10 native forbs. The mixture shall provide a minimum of 30 grass seeds per square foot and 10 forbs seeds per square foot. Number of seeds will be based on Iowa Conservation Practice 327 “Native Species for Wildlife”. Contractor’s proposed seed mix shall be submitted to Engineer and local NRCS office for approval at least 2 weeks before seed is to be applied.

Seeding shall be completed during the following seeding periods:

Spring	April 1 to June 30
Fall	November 15 to Freeze-up

The seed bed shall be properly prepared prior to seeding:

(a) Any weed control measures shall be completed prior to seeding. If spraying is used, then a span of two weeks shall be allowed between spraying and seeding.

(b) If the land was in soybeans, no additional tillage is required. If the land was in corn or other vegetation, areas to be seeded shall be disked to thoroughly loosen and pulverize the soil to a depth of 3 inches. This may require multiple passes of equipment. If the land was used for pasture and has a smooth surface, the preparation in non-disturbed areas to be seeded shall include mowing any vegetation taller than 12 inches and applying an appropriate herbicide at the labeled rates to emergent growth 2 to 4 weeks after mowing. After the vegetation has died, the area shall be disked thoroughly loosen and pulverize the soil depth of 3 inches. If emergent growth occurs prior to seeding, the areas shall receive a second application of herbicide. Seeding shall not occur until the existing vegetation has died (about 1 week).

(c) If deeper disking is used at the site, a lighter disk or spring harrow shall be used to remove deep furrows.

(d) After disking operations and prior to seed application, the seedbed shall be firmed with a cultipacker or similar piece of equipment.

(e) No lime or fertilizer is to be applied.

Sow seed with contour using a grassland or rangeland drill set for the specified seeding rates. The drill shall be equipped with double coulter furrow openers. The drill shall be subject to acceptance by Engineer. Overlap each successive seeding pass to ensure complete coverage.

Plant seed not more than 1/4 inch deep; some seed may be seen on the surface after seeding.

Broadcasting by centrifugal-type or hydroseeder broadcasters, or by hand shall be allowed in areas not accessible to drills or other equipment. Once broadcast, the seed must be covered with soil to a depth no greater than 1/4 inch by means of hand rakes or other approved methods.

Upon completion of the seeding operation, cultipack the seedbed to provide a positive seed-soil contact. If the drill seeder is equipped with an approved cultipacker or press wheels, separate operations shall not be necessary. The type of cultipacker/seeder to be used shall be subject to acceptance by Engineer.

No mulch shall be required.

Measurement will be based on the area successfully seeded and measured to the nearest 0.1 acre.

3 Subsidiary Item: Weed Control

Weed control may be needed in portions of this site depending upon the start date of the contract, the initiation of grading, and the seeding dates.

Weed control will be added to the contract with a change order to be negotiated between Contractor and Division based on conditions observed and the type of weed control used and will be paid only once. If delays require additional weed control, this will be paid for at Contractor's own expense.

Weed control may include placement of a cover crop such as oats or rye, spraying with appropriate chemicals, or disking. If thistles are present, only spraying is allowed for weed control and shall include appropriate chemicals designed to control thistles.

NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATION

Construction Specification 8—Mobilization and Demobilization

1. SCOPE

The work consists of the mobilization and demobilization of the contractor's forces and equipment necessary for performing the work required under the contract. It does not include mobilization and demobilization for specific items of work for which payment is provided elsewhere in the contract. Mobilization will not be considered as work in fulfilling the contract requirements for commencement of work.

2. EQUIPMENT AND MATERIAL

Mobilization shall include all activities and associated costs for transportation of contractor's personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary general facilities for the contractor's operations at the site; premiums paid for performance and payment bonds including coinsurance and reinsurance agreements as applicable; and other items specified in section 4 of this specification.

Demobilization shall include all activities and costs for transportation of personnel, equipment, and supplies not required or included in the contract from the site; including the disassembly, removal, and site cleanup of offices, buildings, and other facilities assembled on the site specifically for this contract.

This work includes mobilization and demobilization required by the contract at the time of award. If additional mobilization and demobilization activities and costs are required during the performance of the contract as a result of changed, deleted, or added items of work for which the contractor is entitled to an adjustment in contract price, compensation for such costs will be included in the price adjustment for the item or items of work changed or added.

3. PAYMENT

Payment will be made as the work proceeds, after presentation of paid invoices or documentation of direct costs by the contractor showing specific mobilization and demobilization costs and supporting evidence of the charges of suppliers, subcontractors, and others. When the total of such payments is less than the lump sum contract price, the balance remaining will be included in the final contract payment. Payment of the lump sum contract price for mobilization and demobilization will constitute full compensation for completion of the work.

Payment will not be made under this item for the purchase costs of materials having a residual value, the purchase costs of materials to be incorporated in the project, or the purchase costs of operating supplies.

4. ITEMS OF WORK AND CONSTRUCTION DETAILS

A. Measurement and Payment

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B. Items of Work and Construction Details

1. Bid Item No. 5 Mobilization and Demobilization

This item shall consist of mobilizing and demobilizing personnel and equipment in preparation to perform the work within the scope of this contract.

Any work that is necessary to provide access to the site including, but not limited to, grading, temporary culverts, and clearing will be included in this item. When construction is completed access areas will be restored, as close as practical, to its original condition.

Any fence removed for access and /or to provide work area shall be replaced with same or like materials as approved by the engineer.

The Contractor shall exercise caution to minimize the amount of damage caused by the grading and clearing operations.

Portable toilets shall be provided at the construction site and used for the sanitary facilities.

This item shall not include transportation of personnel, equipment and operating supplies within the work limits areas of this contract.

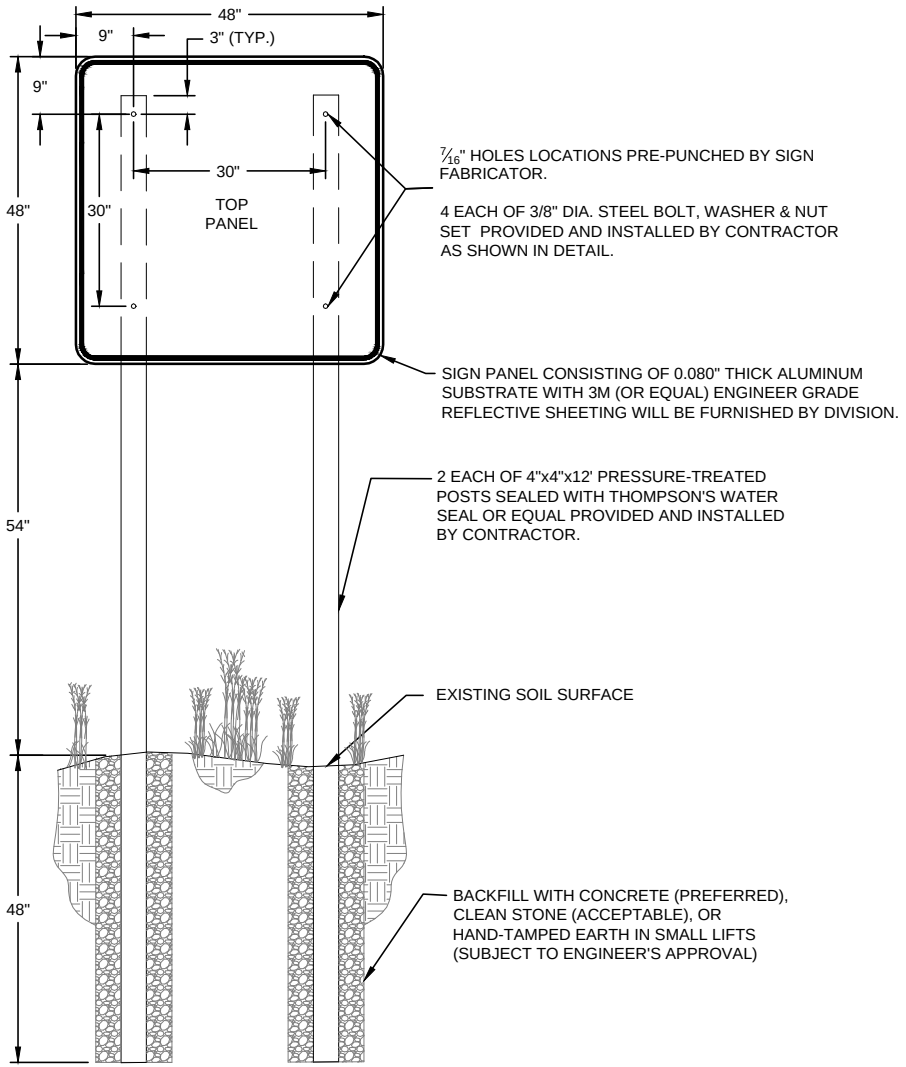
Payment will constitute full compensation for related subsidiary item, Pollution Control.

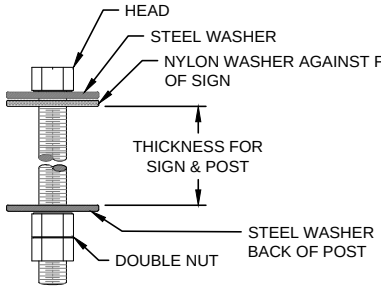
Payment will be made as the work proceeds and will paid out on the percent of the project complete as the work progresses. Payment of the lump sum contract price for mobilization and demobilization will constitute full compensation for the completion of the work.

Contractor is to contact “Iowa One Call” for utility locations a minimum of two (2) days prior to any excavation/construction. The ticket number must be provided to Engineer.

2. Subsidiary Item: Sign Installation

This item shall include all labor, materials, equipment and Iowa One Call notifications to install sign provided by Iowa Department of Agriculture and Land Stewardship, as shown on the plans or on next page.





BOLT, WASHER, & NUT FASTENER DETAIL

NOT TO SCALE

SIGNAGE NOTES:

1. DIVISION WILL FURNISH SIGN PANEL. CONTRACTOR IS RESPONSIBLE FOR PROVIDING POSTS, HARDWARE, AND INSTALLATION .

2. ALL EXPOSED WOOD SHALL BE SEALED WITH THOMPSON'S WATER SEAL OR EQUAL MEETING ASTM D-4446-08.

3. ALL STEEL HARDWARE PIECES SHALL BE GALVANIZED OR RUST RESISTANT.

4. NYLON AND STEEL WASHERS SHALL BE USED AS SHOWN ON THE BOLT, WASHER, NUT FASTENER DETAIL ABOVE.

5. CLEAR UTILITIES WITH IOWA ONE-CALL AT 811 OR (800) 292-8989 BEFORE EXCAVATING FOR POSTS.

6. SECURE DIVISION AND LANDOWNERS APPROVAL FOR SIGN LOCATION BEFORE INSTALLATION.

7. COSTS FOR POSTS, HARDWARE, WOOD SEALANT AND SIGN INSTALLATION SHALL BE INCIDENTAL TO MOBILIZATION.

8. CONTRACTOR SHALL INSTALL SIGN POSTS USING A PLYWOOD OR OTHER SUITABLE TEMPLATE TO MAINTAIN ACCURATE POST SPACING AND ALIGNMENT DURING BACKFILLING OF THE POST HOLES. TO AVOID BENDING OF THE SIGN PANELS, POSTS SHALL NOT BE INSTALLED OR BACKFILLED WITH SIGN PANELS ATTACHED.

9. ONE (1) PROJECT SIGN SHALL BE INSTALLED UNLESS NOTED OTHERWISE.

STANDARD DETAIL FOR SIGN INSTALLATION

DIVISION OF SOIL CONSERVATION AND WATER QUALITY

NATURAL RESOURCES CONSERVATION SERVICE

CONSTRUCTION SPECIFICATION

IA-9 SUBSURFACE DRAIN INVESTIGATION, REMOVAL, AND REPAIR

1. SCOPE

This work shall consist of investigation, location, repair, and/or removal of subsurface drains (tile) near new or existing animal waste storage facilities or in wetland restoration, enhancement, or creation project areas, or other situations where subsurface drains may be present.

2. INVESTIGATION AND LOCATION

An inspection trench at least 10 inches wide shall be dug at the location shown on the drawings or as directed by the Engineer or his representative. The trench shall be at least 6 feet deep measured from the original ground line, unless otherwise shown on the plans. The Engineer or his representative shall examine the trench and excavated material to identify tile lines.

Size, material, operating condition and direction of flow of each conduit shall be documented. Location and flow line elevation of each conduit shall be surveyed with horizontal and vertical control based on benchmarks shown on the plans.

The inspection trench shall be documented by surveying the natural ground and trench bottom location and elevations at the beginning, end, and every 50 feet for trenches longer than 50 feet.

Backfilling shall not be started without approval of the Engineer. See Section 5 for backfill specifications.

Trench shields, shoring and bracing, or other methods necessary to safeguard the workers and work, and to prevent damage to the existing improvements shall be furnished, placed, and subsequently removed by the contractor.

3. TILE REPAIR

Unless designated for removal, replace damaged conduit with new conduit having equal or greater capacity using material specified in Section 6 or 7. When replacing short sections of clay or concrete tile with single-wall corrugated polyethylene pipe, use the next larger nominal size.

Make connections with manufactured fittings and tight joints. Where joints have gaps that would allow soil to enter, cover the joint with a permanent type material such as coal tar pitch treated roofing paper, fiber glass sheet or mat, or plastic sheet.

If the investigation trench has been excavated below the existing drain grade, backfill the trench with gravel or well-pulverized soil in layers not over four (4) inches thick and tamp by hand or manually directed power tamper to provide a firm foundation for the conduit at the existing grade. Do not backfill with any soil containing broken tile fragments.

Using selected soil free of hard clods, rocks, or frozen soil, hand tamp the backfill material around the haunch of the pipe in layers not over four (4) inches thick to provide support. Hold the conduit in place mechanically while placing excavated material around and over the conduit to ensure proper alignment and grade is maintained. Complete the backfill operation according to Section 5.

4. TILE REMOVAL

Remove conduits as shown on the plans or directed by the Engineer or his representative, including envelope filter material or other flow enhancing material when present.

Cap or plug the open ends of the disconnected conduit to prevent soil entry when the conduit will continue to function downstream, or otherwise shown on the plans. For a minimum distance of two feet around each sealed conduit end, backfill in layers not over four (4) inches thick and tamp by hand or manually directed power tamper to a density equal to or greater than the surrounding undisturbed soil. Do not backfill with any soil containing broken tile fragments, large stones, frozen material, or large dry clods.

Where tile are located beneath an existing animal waste facility, remove the tile or fill the entire length of tile with concrete or Portland cement grout as shown on the plans. When tile removal is specified, the owner shall contact the Iowa Department of Natural Resources (IDNR) for permission to remove the drainage tile under the structure. The structure shall be emptied of waste or lowered to a point below the tile prior to its removal. The structure must be retested for percolation and the results submitted to IDNR and approval received prior to reusing the structure.

If shown on the plans or directed by the Engineer, reroute upstream drain lines so the capacity of the upstream drainage system is maintained. Install conduit in accordance with Iowa Construction Specification IA-46, Tile Drains for Land Drainage.

5. BACKFILL

Compact soil around disturbed tile as specified in Section 3 (Tile Repair) and Section 4 (Tile Removal). Keep the backfill within 5 feet of the conduit free from large stones, frozen material, and large dry clods. Unless otherwise shown on the plans, backfill the remainder of the trench as follows:

For trenches located under or near structures, backfill in 12 inch layers and compact each layer to a density equal to or greater than the surrounding undisturbed soil.

For other locations, backfill the remainder of each trench with the excavated soil material which shall extend above the ground surface and be well rounded over the trench.

6. MATERIALS

Unless otherwise shown on the plans, conduit and fittings used for repair shall conform to the specifications listed in Table 1. Perforated pipe shall have a water inlet area of at least 1 square inch per foot, provided by perforations spaced uniformly along the long axis of the pipe. The perforations shall be circular or slots. Circular perforations shall not exceed 3/16 inch in diameter. Slots shall not be more than 1/8 inch wide.

Table 1. Acceptable pipe for subsurface drain repair.

Kind of Pipe°	Specification
Corrugated Polyethylene (PE) Pipe and Fittings, 3 to 6 inch	ASTM F 405
Corrugated Polyethylene (PE) Pipe and Fittings, 3 to 24 inch	ASTM F 667
Corrugated Profile Wall (Dual Wall) Polyethylene (PE) Pipe, 2 to 60 inch	ASTM F 2648*
Corrugated Profile Wall (Dual Wall) Polyethylene (PE) Pipe, 12 to 60 inch	ASTM F 2306*
Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80 and 120	ASTM D 1785
PVC Pressure-Rated Pipe (SDR Series)	ASTM D 2241
Clay Drain Tile	ASTM C 4
Concrete Drain Tile	ASTM C 412

°Pipe sizes are nominal and the ranges are inclusive.
*Pipe conforming to AASHTO M 252 (3 to 10 inch), or AASHTO M 294 (12 to 60 inch) is acceptable.

7. SPECIAL SPECIFICATIONS

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B. Items of Work and Construction Details

1. Bid Item No. 6. Drain Tile Investigation and Removal

This item will consist of the excavation necessary to locate and remove all tile under the embankment and to locate and determine the tie-in locations for the tile locations shown on the plans or directed by the Engineer. This item shall also include backfilling of the trenches.

This item does not include the additional excavation required to excavate the embankment core trench, if included in the project. Excavation of the core trench is covered under Specification IA-21, Excavation.

The investigation should reveal where the tile crosses the embankment footprint or where it is located if it does not cross the embankment footprint

Payment for Drainage Tile Investigation and removal shall be made as noted in the plans.

NATURAL RESOURCES CONSERVATION SERVICE

CONSTRUCTION SPECIFICATION

IA-11 REMOVAL OF WATER

1. SCOPE

The work shall consist of the removal of surface water and ground water as needed to perform the required construction in accordance with the plans and specifications.

2. DIVERTING SURFACE WATER

The Contractor shall build, maintain and operate all cofferdams, channels, diversions, flumes, sumps, and other temporary protective works needed to divert surface water away from the construction site while construction is in progress.

3. DEWATERING THE CONSTRUCTION SITE

Foundations, cutoff trenches, borrow areas and other parts of the construction site shall be dewatered as needed for proper execution of the construction work. The Contractor shall furnish, install, operate and maintain all works and equipment needed to perform the dewatering.

4. EROSION AND POLLUTION CONTROL

Removal of water from the construction site, including the borrow areas shall be accomplished in such a manner that erosion and the transmission of sediment and other pollutants are minimized.

5. REMOVAL OF TEMPORARY WORKS

After temporary works have served their purposes and before the Contractor leaves the site, they shall be removed.

6. SPECIAL SPECIFICATIONS

A. Measurement and Payment

Compensation for any work item described in the contract documents but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and bid items to which they are made subsidiary are identified in Items of Work and Construction Details section of this specification.

For items of work which lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for each item will be made at the contract lump sum price and will constitute full compensation for completion of the work.

For items of work for which specific unit prices are established in the contract, the payment will be made based on the approved quantity measured by the engineer or weight tickets. Payment will constitute full compensation of the work completed as defined by each work item.

B. Items of Work and Construction Details

1. Subsidiary Item : Dewatering

This item shall include all costs to divert, pump, dam or other means to dewater the site as needed to complete construction activities.

No separate payment will be made for Removal of Water. Compensation for this item shall be made subsidiary to other bid items requiring removal of water in order to complete.

NATURAL RESOURCES CONSERVATION SERVICE

CONSTRUCTION SPECIFICATION

IA-21 EXCAVATION

1. SCOPE

The work shall consist of the excavation required by the drawings and specifications and disposal of the excavated materials. The cutoff trench and any other required excavations shall be dug to the lines and grades shown on the drawings or as staked in the field. Structure or trench excavations will conform to all safety requirements of OSHA.

2. USE OF EXCAVATED MATERIALS

Suitable materials from the specified excavations shall be used in the construction of required permanent earthfill. The suitability of materials for specific purposes shall be determined by the NRCS Inspector.

3. DISPOSAL OF WASTE MATERIAL

All surplus or waste material shall be disposed of in areas shown on the drawings or as approved by the NRCS Inspector. The waste material shall be smoothed and sloped to provide drainage.

4. STRUCTURE AND TRENCH EXCAVATION

Structure or trench excavations will conform to all safety requirements of OSHA.

5. BORROW EXCAVATION

When the quantities of suitable materials obtained from specified excavations are insufficient to construct the specified fills, additional materials shall be obtained from the designated borrow areas as shown on the drawings or as approved by NRCS and the landowner. On wetland projects, borrow shall not be taken from the wetland area within 10 feet of the embankment or as shown on the drawings.

Borrow areas shall be excavated and grading completed in a manner to eliminate steep or unstable side slopes or hazardous or unsightly conditions.

6. OVER-EXCAVATION

Excavation beyond the specified lines and grades shall be corrected by filling the resulting voids with compacted earthfill, except that if the earth is to become the subgrade for riprap, sand or gravel bedding or drainfill, the voids shall be filled with material conforming to the specifications for the riprap, bedding or drainfill, as appropriate.

7. SPECIAL SPECIFICATIONS

A. Measurement and Payment

Compensation for any work item described in the contract documents but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such

items and bid items to which they are made subsidiary are identified in Items of Work and Construction Details section of this specification.

For items of work which lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for each item will be made at the contract lump sum price and will constitute full compensation for completion of the work.

For items of work for which specific unit prices are established in the contract, the payment will be made based on the approved quantity measured by the engineer or weight tickets. Payment will constitute full compensation of the work completed as defined by each work item.

The volume of excavation as provided in the bid quantities has been determined from the topographic information shown on the Drawings using a computer program. Payment will be made based on the planned quantities provided unless additional excavation is directed by the Engineer. Excavation resulting from the contractor's improper construction operations, as determined by the Engineer, is not included for measurement and payment.

B. Items of Work and Construction Details

"Excavation (General)":

1. Bid Item No. 7 Excavation (General)

This item will consist of excavation and grading of material needed for the following typical items as shown in the plans:

Removal of material in wetland to daylight existing tile and provide material for embankment.

Excavations required for the placement of toe drain, tile exploration, new tile installation, riprap placement, are not included in this bid quantity and will not be measured for payment. The cost of excavation for these items are incidental and should be included as part of their corresponding bid items.

This item includes the hauling of excavated material to be used as earthfill or spoil.

Suitable excess excavated material shall be disposed of along top of banks for tile outlet channels or in designated areas by Engineer or Engineer's Representative.

Payment will constitute full compensation for the following related Subsidiary item Structure Excavation.

Measurement and Payment for Topsoiling shall be plan quantity. No additional measurements shall be made. The quantities of excavation on the drawings and Contract represent the final quantity of excavation for completed work.

NATURAL RESOURCES CONSERVATION SERVICE

CONSTRUCTION SPECIFICATION

IA-23 EARTHFILL

1. SCOPE

The work shall consist of the construction of earthfills required by the drawings and specifications. The completed work shall conform to the lines, grades, and elevations shown on the drawings or as staked in the field.

2. MATERIALS

All fill materials shall be obtained from required excavations and designated borrow areas. Fill materials shall contain no sod, brush, roots or other bio-degradable materials. Rocks larger than 6 inches in diameter shall be removed prior to compaction of the fill.

3. FOUNDATION PREPARATION

Foundations for earthfill shall be stripped a minimum of 12 inches to remove vegetation and other unsuitable materials. Foundation surfaces shall be scarified to a minimum depth of 2 inches prior to placing fill material.

Foundation and abutment surfaces shall not be sloped steeper than 1.5 horizontal to 1 vertical unless otherwise shown on the drawings.

4. PLACEMENT

Fill shall not be placed until the required excavation and foundation preparation have been completed and the foundation has been inspected and approved by NRCS. Fill shall not be placed upon a frozen surface, nor shall snow, ice, or frozen material be incorporated in the fill.

Adjacent to structures or pipes, fill shall be placed in a manner which will prevent damage. The height of the fill adjacent to structures or pipes shall be increased at approximately the same rate on all sides.

The materials used throughout the earthfill shall be essentially uniform. Selective placement shall be as shown on the drawings or approved by NRCS.

If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified to a minimum depth of 2 inches before the next layer is placed.

The top surfaces of embankments shall be maintained approximately level during construction, except that a cross-slope of approximately 2% shall be maintained to ensure effective drainage.

When moving fill material from the borrow area(s) to the embankment by use of bulldozers only, the following steps shall be followed:

- Immediately after the borrow material is pushed to the embankment, it shall be spread in horizontal lifts placed parallel to the centerline of the embankment.
- Compactive effort will then be applied by operating equipment parallel to the centerline of the fill or embankment.
- Lift thicknesses shall be in strict compliance with Clause 6, below.

Sectional fills are not allowed unless they are shown on the construction drawings.

5. CONTROL OF MOISTURE CONTENT

The moisture content of the fill material shall be adequate for obtaining the required compaction. Material that is too wet shall be dried to meet this requirement, and material that is too dry shall have water added and mixed until the requirement is met.

The moisture content of the fill material shall be such that a ball formed with the hands does not crack or separate when struck sharply with a pencil and will easily ribbon out between the thumb and finger.

Earth foundations under and adjacent to concrete structures shall be prevented from drying and cracking before concrete and backfill are placed.

The application of water to the fill materials shall be accomplished at the borrow areas insofar as possible.

6. COMPACTION

Earthfill shall be compacted by one of the following methods as specified on the plans or in Section 8, Special Specifications. If no method is specified, compaction will be in accordance with Method 1.

- Method 1 - Earthfill shall be placed so that the wheels or tracks of the loaded hauling equipment, traveling in a direction parallel to the centerline of fill, pass over the entire surface of each layer being placed. Low ground pressure vehicles shall not be used for this purpose.
- Method 2 – Two (2) complete passes of a tamping-type roller will be made over each layer. The roller shall be capable of exerting a minimum force of two hundred (200) pounds per square inch.
- Method 3 - Minimum density shall be 90% of the maximum density as determined by ASTM D 698 and as shown on the plans.

The maximum thickness of a lift of fill before compaction shall be 9 inches, unless otherwise indicated on the drawings.

Fill adjacent to structures, pipe conduits, and appurtenances shall be placed in layers not more than 4 inches thick and compacted to a density equivalent to that of the surrounding fill. Methods used to obtain compaction for fine or coarse grained materials are as follows:

- For fine grained materials, hand tamping or manually directed power tampers may be used. Hand compaction only shall be used to compact the earthfill under the bottom half of circular pipes. Manually directed power tampers shall not be used in tight spaces where applying full compactive effort will result in direct contact of the tamper plate with the pipe. Care should be taken so that compaction around the spillway pipe does not cause uplift of the pipe resulting in a void beneath the pipe.
- For coarse grained materials (sands and gravels), vibratory plate compactors shall be used for obtaining compaction. However, hand tamping shall be used to compact the material under the bottom half of circular pipes.

In all cases, follow manufacturer instructions for the specific compaction equipment being used. Heavy equipment shall not be operated within 2 feet of any structure or pipe.

Compacting of fill adjacent to concrete structures shall not be started until the concrete is 7 days old.

7. ISLANDS, MOUNDS, AND LOAFING AREAS ON WETLAND RESTORATION, ENHANCEMENT, OR CREATION PROJECTS

Islands shall be randomly located within the wetland area at locations shown on the drawings or as staked in the field. The orientation of island shorelines shall be random with attention given to prevailing winds to limit wave damage. In general, the side of the island with the longest dimension shall be parallel to the prevailing wind direction. Side slopes of islands shall be as shown on the drawings, but in no case shall be steeper than 6 horizontal to 1 vertical. Island shapes shall be irregular.

Loafing areas shall be constructed in the areas shown on the drawings or as staked in the field and shall be graded to

drain runoff water. The elevation of at least one loafing area should be above the maximum water level whenever possible.

Excavated material not suitable for embankments, wetland dikes, or islands can be used to create mounds or blended into surrounding topography to create a natural appearance. Spoil material shall not be spread on existing wetland areas.

Organic soils shall not be sued to construct islands, loafing areas, dikes, or embankments.

8. SPECIAL SPECIFICATIONS

A. Measurement and Payment

For items of work which specific unit prices are established in the contract, the volume of earthfill will be computed to the nearest cubic yard by the method of average cross-sectional end areas. No deduction in volume will be made for embedded items, such as, conduits inlet structures and their appurtenances. The pay limits for computation shall be as shown on the drawings with the further provisions that earthfill voids resulting from over excavation of the foundation, outside specified lines and grades, will be included in the measurement for payment only under the following conditions:

- Where such over excavation is directed by the engineer to remove unsuitable material, and
- Where the unsuitable condition is not a result of the contractor's improper construction operations as determined by the engineer.

Earthfill beyond the specified lines and grades to backfill excavation required for compliance with OSHA requirements will be considered subsidiary to the earthfill bid item(s).

Payment for each type and compaction class of earthfill and earth backfill is made at the contract unit price for that type and compaction class of earthfill. Such payment will constitute full compensation for all labor, material, equipment, and all other items necessary and incidental to the performance of the work.

Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in this specific section.

B. Items of Work and Construction Details

1. Subsidiary Item Backfill Required Excavation

This item shall consist of backfilling the areas excavated to install the other components related to the project such as piping or structures and to locate and remove the tile lines.

Compaction adjacent to the structures shall be as indicated above. All other compaction shall be Method 1 or equivalent.

No separate payment will be made for Backfill of Structure Excavation. Compensation for this item will be included in payment for Corrugated Metal Pipe; CMP Drawdown Structure; Riser Inlet Structure, Tile Investigation and Removal and Dual Wall HDPE.

NATURAL RESOURCES CONSERVATION SERVICE

CONSTRUCTION SPECIFICATION

IA-26 TOPSOILING

1. SCOPE

The work shall consist of salvaging topsoil from borrow areas or required excavations and spreading it on the exposed disturbed areas.

2. QUALITY OF TOPSOIL

Topsoil shall consist of friable surface soil reasonably free of grass, roots, weeds, sticks, stones, or other foreign materials.

3. EXCAVATION

After the site has been cleared and grubbed, the topsoil shall be removed from borrow areas and required excavation areas to the depth as shown on the drawings. Topsoil shall be stockpiled at locations approved by NRCS.

4. SPREADING

Spreading shall not be done when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to the work. Surfaces designated to be covered shall be lightly scarified just prior to the spreading operation. Where compacted fills are designated to be covered by topsoil, the topsoil shall be placed concurrently with the fill and shall be bonded to the compacted fill with the equipment.

Topsoil shall be placed to the minimum depth shown on the drawings. After the spreading operation is completed, the surface shall be finished to a reasonably smooth surface.

5. SPECIAL SPECIFICATIONS

A. Measurement and Payment

Compensation for any work item described in the contract documents but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and bid items to which they are made subsidiary are identified in Items of Work and Construction Details section of this specification.

For items of work which lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for each item will be made at the contract lump sum price and will constitute full compensation for completion of the work.

For items of work for which specific unit prices are established in the contract, the payment will be made based on the approved quantity measured by the engineer or weight tickets. Payment will constitute full compensation of the work completed as defined by each work item.

B. Items of Work and Construction Details

1. Bid Item No. 1. Topsoil Placement

This item will consist of excavating, spreading salvaged and stockpiled topsoil as the surface layer of all excavations and spoil areas that will be seeded. The topsoil shall be stripped to a depth of 12 inches and respread to a depth of 6 inches. Topsoil shall be placed as final lift.

Top soil will be respread on all areas to be excavated or filled. Areas to receive a minimum of 6-inch layer of topsoil include areas of disturbed embankment that are do not have riprap, borrow, spoil area and additional fill placed over new tile and any other areas noted in the plans.

Measurement and payment for Topsoiling shall be on a plan quantity. No additional measurements will be made. The quantities of excavation on the drawings and in the Contract represent the final quantity of excavation for the completed work.

Grading areas with less than 6 inches of cut will not require topsoil respreading unless required by engineer.

NATURAL RESOURCES CONSERVATION SERVICE

CONSTRUCTION SPECIFICATION

IA-46 TILE DRAINS FOR LAND DRAINAGE

1. SCOPE

The work shall consist of furnishing and installing drainage pipe (tubing) and tile and the necessary fittings and appurtenances.

2. MATERIALS

Concrete drain tile shall conform to the requirements of ASTM C 412 and clay drain tile shall conform to the requirements of ASTM C 4.

Corrugated polyethylene (PE) pipe (tubing) and fittings shall conform to ASTM F 405 (3" to 6") or F 667 (3" to 24"), as appropriate. Corrugated profile wall (dual wall) polyethylene (PE) pipe shall meet or exceed the requirements of ASTM F 2648 (2" to 60") or ASTM F 2306 (12" to 60"). Pipe conforming to AASHTO M 252 (3" to 10"), or AASHTO M 294 (12" to 60") is acceptable. Perforated tubing shall have a water inlet area of at least 1 square inch per foot, provided by perforations spaced uniformly along the long axis of the tubing. The perforations shall be circular or slots. Circular perforations shall not exceed 3/16 inch in diameter. Slots shall not be more than 1/8 inch wide.

3. EXCAVATION

Unless otherwise specified, excavation for and subsequent installation of each drain line shall begin at the outlet end and progress upstream.

The trench or excavation for the conduit shall be constructed to the line, depth, cross-section, and grade shown on the drawings, or as directed by the NRCS Inspector. The trench bottom shall be smooth and free of exposed rock. If rock is encountered in the trench bottom, over-excavate the trench and place at least 6 inches of compacted earth or sand bedding in the trench to bring it up to the conduit grade.

If not otherwise shown on the drawings, trench width at the top of the conduit shall be the minimum required to permit installation and provide bedding conditions suitable to support the load on the conduit, but with not less than three (3) inches of clearance on each side of the conduit. Maximum trench width shall be the conduit diameter plus 12 inches measured at the top of the conduit, unless approved bedding is installed.

Trench shields, shoring and bracing, or other methods, necessary to safeguard the workers and work, and to prevent damage to the existing improvements shall be furnished, placed, and subsequently removed by the contractor.

Plow installation is allowed. Minimum trench width shall be two (2) inches wider than the conduit on each side. Grade control and bedding conditions shall be closely inspected during plow installation. Boulders, cobbles, or cemented soils can cause the plow to jump and lose grade. These hard points can also puncture or dimple and deform the pipe.

4. PREPARING THE BEDDING

Unless otherwise specified, no filter or envelope is required. In stable soils, the bottom of the trench shall be shaped to form a semicircular, trapezoidal, or 90-degree "V" groove in its center. The groove shall be shaped to fit the size of tile. The 90-degree "V" groove shall not be used on conduits greater than 6 inches in diameter.

If the bottom of the trench does not provide a sufficiently stable or firm foundation for the drain tile, a sand-gravel mix or other approved materials shall be used to stabilize the bottom of the trench.

5. FILTER OR ENVELOPE MATERIAL

When a filter is specified, the shape of the bottom of the trench, gradation and the thickness of the filter or envelope material to be placed around the conduit will be as shown on the drawings. The envelope or filter material shall be placed in the bottom of the trench just prior to the laying of the conduit. The conduit shall then be laid and the envelope or filter material placed over the conduit.

6. PLACEMENT AND JOINT CONNECTIONS

All drains shall be laid to grade.

Joints between lateral concrete and clay drain tiles shall vary with soil type as follows:

a. Peat and muck - 1/4 inch preferred, 3/8 inch maximum;

b. Clay - 1/8 inch preferred, 1/4 inch maximum;

c. Silt and loam - 1/16 inch preferred, 1/8 inch maximum;

d. Sand - tightest possible fit.

Joints between main drain tile, which serve only to collect and transport drainage water from lateral tile lines, should be the tightest fit possible.

Where the joint width exceeds the maximum above, the joint shall be covered with a permanent type material such as coal tar pitch treated roofing paper, fiber glass sheet or mat, or plastic sheet.

After placement and blinding of plastic tubing, but prior to backfilling, sufficient time shall elapse to allow the tubing to reach the ambient temperature of the trench. All split fittings shall be securely tied with nylon cord before backfill is placed. When corrugated plastic tubing is used, no more than 5% stretch will be allowed.

7. CONNECTIONS

Lateral connections will be made with manufactured appurtenances (wyes, tees, etc.) comparable in strength and durability with the specified conduit unless otherwise shown on the drawings.

Existing drain lines not shown on the drawings but encountered during installation shall be bridged across the trench or connected into the new line, as directed by NRCS.

Connections with the outlet pipe shall be made watertight.

8. OUTLETS

A continuous section of non-perforated conduit at least 20 feet long shall be used at the outlet. At least two-thirds of the outlet pipe shall be buried in the ditch bank, and the cantilever section must extend to the toe of the ditch side slope or the side slope protected from erosion. Acceptable materials for use at the outlet include the following:

a. Corrugated metal pipe, galvanized or aluminum, 16 gauge minimum;

b. Smooth steel pipe with a minimum wall thickness of 3/16 inch;

c. Smooth plastic pipe, polyvinyl chloride (PVC), with a SDR of 26 or less or schedule 40 or heavier; or

d. Corrugated profile wall (dual wall) polyethylene pipe (PE).

All plastic (PVC) and polyethylene pipe (PE) outlets shall include ultra-violet stabilizer. PVC and PE pipe outlets shall not be used where burning vegetation on the outlet ditch bank is likely to create a fire hazard.

The outlet shall be equipped with a flap-gate type rodent guard.

9. BLINDING

After the conduit is placed in the excavated groove, friable material from the sides of the trench shall be placed around the conduit, completely filling the trench to a depth of not less than six (6) inches over the top of the conduit. For material to be suitable it must not contain hard clods, rocks, frozen soil, or fine material which will cause a silting hazard to the drain. Conduit placed during any one day shall be blinded by the end of the day's work.

10. BACKFILLING

The backfilling of the trench shall be completed as rapidly as consistent with the soil conditions. Automatic backfilling machines may be used. Backfill shall extend above the ground surface and be well rounded over the trench.

Unless otherwise shown on the plans, in mineral soils, the minimum depth of cover over subsurface drains shall be 2.4 feet. In organic soils, the minimum depth of cover after initial subsidence shall be 3.0 feet.

11. SPECIAL SPECIFICATIONS

11. SPECIAL SPECIFICATIONS

A. Measurement and Payment

Compensation for any work item described in the contract documents but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and bid items to which they are made subsidiary are identified in Items of Work and Construction Details section of this specification.

For items of work which lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for each item will be made at the contract lump sum price and will constitute full compensation for completion of the work.

For items of work for which specific unit prices are established in the contract, the payment will be made based on the approved quantity measured by the engineer or weight tickets. Payment will constitute full compensation of the work completed as defined by each work item.

B. Items of Work and Construction Details

"Other: Reinforced Concrete Pipe (RCP)":

1. Bid Item No. 8 RCP, 12" Diameter
2 Bid Item No 9. RCP, 30" Diameter
3 Bid Item No 12 Apron, RCP, 30", Diameter

This item will consist of furnishing and installing reinforced concrete pipe (RCP) used as a drain tile as shown on the drawings.

Measurement and payment for the reinforced concrete pipe (RCP) shall be on an installed linear foot basis, and shall include all necessary fittings and adapters.

Payment will also include all subsidiary items required for installation such as trench excavations, backfill, site preparation, and removal of water, and concrete collar at joint. Additional fill required to provide adequate cover as needed is included in Earthfill, General.

NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATION IA-

IA-61 LOOSE ROCK RIPRAP

1. SCOPE

The work shall consist of the construction of loose rock riprap revetments, structures and blankets, including filter layers or bedding where specified.

2. MATERIALS

Rock for loose rock riprap, filter layers or bedding shall come from sources approved by NRCS. The rock shall be excavated, selected and handled as necessary to meet the quality and grading requirements of this specification and the construction drawings.

Individual rock fragments shall be dense, sound and free from cracks, seams and other defects conducive to accelerated weathering. The rock fragments shall be angular to sub rounded in shape. The least dimension of an individual rock fragment shall not be less than 1/3 the greatest dimension of the fragment unless otherwise specified on the construction drawings.

3. SUBGRADE PREPARATION

The subgrade surfaces on which the riprap or bedding is to be placed shall be cut or filled and graded to the lines and grades shown on the drawings. When fill to subgrade lines is required, it shall consist of approved materials and shall be compacted to a density equal to the adjacent existing soil material.

Rock materials shall not be placed until the foundation preparation is completed and the subgrade surfaces have been inspected and approved by NRCS.

4. EQUIPMENT-PLACED ROCK RIPRAP

Rock shall be placed by equipment on the surfaces and to the depths specified. The riprap shall be constructed to the full thickness in one operation and in such a manner as to avoid serious displacement of the underlying materials. The rock shall be delivered and placed in a manner that will insure that the riprap in place shall be reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact, one to another, with the smaller rocks and spalls filling the voids between the larger rocks. Placement of rock shall begin at the bottom of the slope or downstream end of the structure.

Riprap shall be placed in a manner to prevent damage to structures. Hand placing will be required to the extent necessary to prevent damage to adjacent structures.

5. HAND-PLACED RIPRAP

Rock shall be placed by hand on the surfaces and to the depths specified. It shall be securely bedded with the larger rocks firmly in contact, one to another. Spaces between the larger rocks shall be filled with smaller rocks and spalls. Smaller rocks shall not be grouped as a substitute for larger rock. Flat slab rock shall be laid on edge unless otherwise specified. Placement of rock shall begin at the bottom of the slope or downstream end of the structure.

6. FILTER LAYERS OR BEDDING

When the drawings specify filter layers or bedding beneath riprap, the filter or bedding material shall be spread uniformly on the prepared subgrade surfaces to the depth specified. Compaction of filter layers or bedding will not be required, but the surface of such layers shall be finished reasonably free of mounds, dips or windrows.

7. Special Specifications

A. Measurement and Payment

Compensation for any work item described in the contract documents but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and bid items to which they are made subsidiary are identified in Items of Work and Construction Details section of this specification.

For items of work which lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for each item will be made at the contract lump sum price and will constitute full compensation for completion of the work.

For items of work for which specific unit prices are established in the contract, the payment will be made based on the approved quantity measured by the engineer or weight tickets. Payment will constitute full compensation of the work completed as defined by each work item.

B. Items of Work and Construction Details

This item shall consist of furnishing and placing the rock riprap in the locations as shown on the drawings.

Rock shall be Class E Revetment Stone as defined by Iowa Department of Transportation (DOT).

This material shall be placed at the outlet for the 30" RCP Apron. Riprap and geotextile fabric are incidental to the item for Apron, 30" Diameter.

1. Subsidiary Item - Geotextile Fabric

Geotextile Fabric, IA-95

Construction Specification
000 IA-95 Geotextile

1. SCOPE

This work shall consist of furnishing all materials, equipment, and labor necessary for the installation of geotextile.

2. MATERIAL QUALITY

Geotextile shall be manufactured from synthetic long chain or continuous polymeric filaments or yarns, having a composition of at least 95 percent, by weight, of polypropylene, polyester or polyvinylidene chloride. The geotextile shall be formed into a stable network of filaments or yarns that retain their relative position to each other, are inert to commonly encountered chemicals and are resistant to ultraviolet light, heat, hydrocarbons, mildew, rodents and insects. Unless otherwise specified, the class and type of geotextile shall be as shown on the drawings and shall meet the requirements for materials that follow:

1. Woven Geotextile shall conform to the physical properties listed in Table 1. The woven geotextile shall be manufactured from monofilament yarns that are woven into a uniform pattern with distinct and measurable openings. The geotextile shall be manufactured so that the yarns will retain their relative position with regard to each other. The yarns shall contain stabilizers and/or inhibitors to enhance their resistance to ultraviolet light or heat exposure. The edges of the material shall be salvaged or otherwise finished to prevent the outer yarn from unraveling.
2. Nonwoven Geotextile shall conform to the physical properties listed in Table 2. Nonwoven geotextile shall be manufactured from randomly oriented fibers that have been mechanically bonded together by the needle-punched process. In addition, one side may be slightly heat bonded. Thermally bonded, nonwoven geotextile, in addition to mechanically bonded, nonwoven geotextile, may be used for Road Stabilization. The filaments shall contain stabilizers and/or inhibitors to enhance their resistance to ultraviolet light or heat exposure.
3. The geotextile shall be shipped in rolls wrapped with a protective covering to keep out mud, dirt, dust, debris and direct sunlight. Each roll of geotextile shall be clearly marked to identify the brand, type and production run.

3. STORAGE

Prior to use, the geotextile shall be stored in a clean dry place, out of direct sunlight, not subject to extremes of either hot or cold, and with the manufacturer's protective cover in place. Receiving, storage, and handling at the job site shall be in accordance with the requirements in ASTM D 4873.

4. SURFACE PREPARATION

The surface on which the geotextile is to be placed shall be graded to the neat lines and grades as shown on the drawings. The surface shall be reasonably smooth and free of loose rock and clods, holes, depressions, projections, muddy conditions and standing or flowing water (unless otherwise shown on the drawings).

5. PLACEMENT

Prior to placement of the geotextile, the soil surface will be inspected for quality assurance of design and construction. The geotextile shall be placed on the approved prepared surface at the locations and in accordance with the details shown on the drawings. The geotextile shall be unrolled along the placement area and loosely laid (not stretched) in such a manner that it will conform to the surface irregularities when material is placed on or against it. The geotextile may be folded and overlapped to permit proper placement in the designated area.

The geotextile shall be joined by overlapping a minimum of 18 inches (unless otherwise specified), and secured against the underlying foundation material. Securing pins, approved and provided by the geotextile manufacturer, shall be placed along the edge of the panel or roll material to adequately hold it in place during installation. Pins shall be steel or fiberglass formed as a “U”, “L”, or “T” shape or contain “ears” to prevent total penetration. Steel washers shall be provided on all but the “U” shaped pins. The upstream or up-slope geotextile shall overlap the abutting down-slope geotextile. At vertical laps, securing Natural Resources Conservation Service pins shall be inserted through both layers along a line through approximately the midpoint of the overlap. At horizontal laps and across slope laps, securing pins shall be inserted through the bottom layer only. Securing pins shall be placed along a line approximately 2 inches in from edge of the of the placed geotextile at intervals not to exceed 12 feet unless otherwise specified. Additional pins shall be installed as necessary and where appropriate, to prevent any undue slippage or movement of the geotextile. The use of securing pins will be held to the minimum necessary. Pins are to be left in place unless otherwise specified.

Should the geotextile be torn or punctured, or the overlaps disturbed, as evidenced by visible geotextile damage, subgrade pumping, intrusion, or grade distortion, the backfill around the damaged or displaced area shall be removed and restored to the original approved condition. The repair shall consist of a patch of the same type of geotextile being used, overlaying the existing geotextile. The patch shall extend a minimum of 2 feet from the edge of any damaged area.

The geotextile shall not be placed until it can be anchored and protected with the specified covering within 48 hours or protected from exposure to ultraviolet light. Geotextile shall be placed in accordance with the following applicable specification according to the use indicated in drawings:

Slope protection – Class I or II as indicated in Tables 1 and 2.

The geotextile shall not be placed until it can be anchored and protected with the specified covering within 48 hours or protected from exposure to ultraviolet light. Rock shall not be pushed or rolled over the geotextile.

Class I, unprotected – limit height for dropping stone onto bare geotextile to 3 feet.

Class II, protected – require the use of 6 inches a clean pit-run gravel over the geotextile to cushion the stone and limit the height of drop to 3 feet.

On slopes with strong seepage flow, the geotextile must be in intimate contact with the soil to prevent erosion of the soil surface. Use 6 inches of a clean pit-run gravel over the geotextile to hold it in place and minimize voids under the riprap. Embedment of the geotextile in a trench to form a cutoff at regular intervals down the slope will prevent erosion under the fabric. Place cutoffs more closely together in highly erodible soils and wider apart in more stable soils

Subsurface drains – Class III as indicated in Tables 1 and 2.

The geotextile shall not be placed until drainfill or other material can be used to provide cover within the same working day. Drainfill material shall be placed in a manner that prevents damage to the geotextile. In no case shall material be dropped on uncovered geotextile from a height of more than 5 feet.

Road stabilization – Class IV as indicated in Tables 1 and 2.

The geotextile shall be unrolled in a direction parallel to the roadway centerline in a loose manner permitting conformation to the surface irregularities when the roadway fill material is placed on its surface. In no case shall material be dropped on uncovered geotextile from a height of more than 5 feet. Unless otherwise specified, the minimum overlap of geotextile panels joined without sewing shall be 24 inches. The geotextile may be temporarily secured with pins recommended or provided by the manufacturer, but they shall be removed before the permanent covering material is placed.

Table 1. Requirements for Woven Geotextiles[1/]

Property	Test Method	Class I	Class II	Class III	Class IV
Grab tensile strength (pounds)	ASTM D4632	247 minimum	180 minimum	180 minimum	315 minimum
Elongation at failure (%)	ASTM D4632	< 50	< 50	< 50	< 50
Trapezoidal tear strength (pounds)	ASTM D4533	90 minimum	67 minimum	67 minimum	112 minimum
Puncture strength (pounds)	ASTM D6241	495 minimum	371 minimum	371 minimum	618 minimum
Ultraviolet light (% retained strength)	ASTM D4355	50 minimum	50 minimum	50 minimum	70 minimum
Permittivity (sec^{-1})	ASTM D4491	as specified			
Apparent opening size (AOS)[2/]	ASTM D4751	as specified			
Percent open area (POA)(%)	USACE [3/]CWO-02215-86	as specified			

[1/] All values are minimum average roll values (MARV) in the weakest principal direction, unless otherwise noted.

[2/] Maximum average roll value.

[3/] Note: CWO is a USACE reference.

Table 2. Requirements for Nonwoven Geotextiles[1/]

Property	Test Method	Class I[2/]	Class II[2/]	Class III[2/]	Class IV[2/]
Grab tensile strength (pounds)	ASTM D4632 grab test	202 minimum	157 minimum	112 minimum	202 minimum
Elongation at failure (%)	ASTM D4632	50 minimum	50 minimum	50 minimum	50 minimum
Trapezoidal tear strength (pounds)	ASTM D4533	79 minimum	56 minimum	40 minimum	79 minimum
Puncture strength (pounds)	ASTM D6241	433 minimum	309 minimum	223 minimum	433 minimum
Ultraviolet light (% retained strength)	ASTM D4355	50 minimum	50 minimum	50 minimum	50 minimum
Permittivity (sec^{-1})	ASTM D4491	0.7 minimum or as specified			
Apparent opening size (AOS)[3/]	ASTM D4751	0.22 minimum or as specified			

[1/] All values are minimum average roll values (MARV) in the weakest principal direction, unless otherwise noted.

[2/] Needle punched geotextiles may be used for all classes. Heat-bonded or resin-bonded geotextiles may be used for class IV only.

[3/] Maximum average roll value.

6. SPECIFIC SITE REQUIREMENTS

A. Measurement and Payment

Compensation for any work item described in the contract documents but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and bid items to which they are made subsidiary are identified in Items of Work and Construction Details section of this specification.

For items of work which lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for each item will be made at the contract lump sum price and will constitute full compensation for completion of the work.

For items of work for which specific unit prices are established in the contract, the payment will be made based on the approved quantity measured by the engineer or weight tickets. Payment will constitute full compensation of the work completed as defined by each work item.

B. Items of Work and Construction Details

This item shall consist of furnishing and placing geotextile on all surfaces that contact the rock riprap as shown on the drawings and at concrete aprons.

Geotextiles shall conform to the requirements of IDOT Engineering Fabric for embankment erosion control.

Geotextile fabric is incidental to the bid item for Apron, RCP, 30” diameter.

STRUCTURES FOR SANITARY AND STORM SEWERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Manholes and Intakes for Storm Sewers

B. Manholes for Sanitary Sewers

C. Adjustment of Existing Manholes and Intakes

D. Connection to Existing Manholes and Intakes

E. Removal of Manholes and Intakes

F. Special Structures for Storm Sewers

G. Excavation and Backfill of Structures

1.02 DESCRIPTION OF WORK

A. Construct sanitary and storm sewer manholes to provide access to sewer systems for maintenance and cleaning purposes.

B. Construct storm sewer intakes for collection of surface water and conveyance to the storm sewer system.

C. Modify existing manholes and intakes as necessitated by other improvements adjacent to the manholes or intakes.

1.03 SUBMITTALS

Comply with Division 1 - General Provisions and Covenants, as well as the following:

A. Shop drawings of steel reinforcement, showing sizes, lengths, bends, and counts, if required.

B. Concrete mix design, if required by Engineer.

C. Shop drawing schedule of new manholes and/or intakes showing total depth, relative elevations of all connecting sanitary or storm sewer lines, all drops, and orientation of connecting lines.

D. Results of required testing.

E. Catalog cuts of iron castings and sewer line connection gaskets.

F. Gradation and soil classification reports for structure bedding and backfill materials.

G. Dewatering plan.

1.04 SUBSTITUTIONS

Comply with Division 1 - General Provisions and Covenants.

1.05 DELIVERY, STORAGE, AND HANDLING

Comply with Division 1 - General Provisions and Covenants, as well as the following:

A. Store reinforcing steel only on pallets or lagging.

B. Follow the aggregate storage and concrete transport requirements in Iowa DOT Article 2301.02, C.

1.06 SCHEDULING AND CONFLICTS

Comply with Division 1 - General Provisions and Covenants.

1.07 SPECIAL REQUIREMENTS

A. Do not place concrete when stormy or inclement weather will prevent good quality work.

B. Cold weather placement is restricted per Iowa DOT Article 2403.03, F.

1.08 MEASUREMENT AND PAYMENT

A. Manhole:

1. **Measurement:** Each type and size of manhole will be counted.

2. **Payment:** Payment will be at the unit price for each type and size of manhole.

3. **Includes:** Unit price includes, but is not limited to, excavation; furnishing and installing pipe; lining (if specified); furnishing, placing, and compacting bedding and backfill material; base; structural concrete; reinforcing steel; precast units (if used); concrete fillets; pipe connections; infiltration barriers (sanitary sewer manholes only); castings; and adjustment rings.

B. Intake:

1. **Measurement:** Each type and size of intake will be counted.

2. **Payment:** Payment will be at the unit price for each type and size of intake.

3. **Includes:** Unit price includes, but is not limited to, excavation; furnishing and installing pipe; furnishing, placing, and compacting bedding and backfill material; base; structural concrete; reinforcing steel; precast units (if used); concrete fillets; pipe connections; castings; and adjustment rings.

C. Drop Connection:

1. **Internal Drop Connection:**
   a. **Measurement:** Each size of internal drop connection will be counted.
   b. **Payment:** Payment will be at the unit price for each size of internal drop connection.
   c. **Includes:** Unit price includes, but is not limited to, cutting the hole and installing a flexible watertight connector, providing and installing the receiving bowl, flexible coupler between the bowl and the drop pipe, the PVC drop pipe, pipe brackets and bolts, the bottom elbow, repair of fillet if required, and a splash guard if required.

2. **External Drop Connection:**
   a. **Measurement:** Each size of external drop connection will be counted.
   b. **Payment:** Payment will be at the unit price for each size of external drop connection.
   c. **Includes:** Unit price includes, but is not limited to, the connection to the manhole and all pipe; fittings; concrete encasement; and furnishing, placing, and compacting bedding and backfill material.

1.08 MEASUREMENT AND PAYMENT (Continued)

D. Casting Extension Rings:

1. **Measurement:** Each casting extension ring will be counted.

2. **Payment:** Payment will be at the unit price for each casting extension ring.

3. **Includes:** Unit price includes, but is not limited to, furnishing and installing each casting extension ring and reinstalling the casting lid.

E. Manhole or Intake Adjustment, Minor:

1. **Manhole Adjustment, Minor:**
   a. **Measurement:** Each existing manhole adjusted to finished grade by addition or removal of adjustment rings or adjustment of adjustable casting will be counted.
   b. **Payment:** Payment will be made at the unit price for each minor manhole adjustment.
   c. **Includes:** Unit price includes, but is not limited to, removing existing casting and existing adjustment rings, furnishing and installing adjustment rings, furnishing and installing new casting, and installing new infiltration barrier (sanitary sewer manholes only).

2. **Intake Adjustment, Minor:**
   a. **Measurement:** Each existing intake adjusted to finished grade by addition or removal of adjustment rings or adjustment of adjustable casting will be counted.
   b. **Payment:** Payment will be made at the unit price for each minor intake adjustment.
   c. **Includes:** Unit price includes, but is not limited to, removing existing casting and existing adjustment rings, furnishing and installing adjustment rings, and furnishing and installing new casting.

F. Manhole or Intake Adjustment, Major:

1. **Manhole Adjustment, Major:**
   a. **Measurement:** Each existing manhole adjusted to grade by addition or removal of riser, cone or flat top sections, or the exchange of existing riser sections with sections having different vertical dimensions will be counted.
   b. **Payment:** Payment will be at the unit price for each major adjustment.
   c. **Includes:** Unit price includes, but is not limited to, removal of existing casting, adjustment rings, top sections, and risers; excavation; concrete and reinforcing steel or precast sections; furnishing and installing new casting; installing new infiltration barrier (sanitary sewer manholes only); placing backfill material; and compaction.

2. **Intake Adjustment, Major:**
   a. **Measurement:** Each existing intake adjusted to grade by addition or removal of riser, cone or flat top sections, or the exchange of existing riser sections with sections having different vertical dimensions will be counted.
   b. **Payment:** Payment will be at the unit price for each major adjustment.
   c. **Includes:** Unit price includes, but is not limited to, removal of existing casting, adjustment rings, top sections, and risers; excavation; concrete and reinforcing steel or precast sections; furnishing and installing new casting; placing backfill material; and compaction.

1.08 MEASUREMENT AND PAYMENT (Continued)

G. Connection to Existing Manhole or Intake:

1. Connection to Existing Manhole:
- **a. Measurement:** Each connection made to an existing manhole will be counted.
- **b. Payment:** Payment will be made at the unit price for each sewer connection.
- **c. Includes:** Unit price includes, but is not limited to, coring or cutting into the existing manhole or intake, pipe connections, grout, and waterstop (when required).

2. Connection to Existing Intake:
- **a. Measurement:** Each connection made to an existing intake will be counted.
- **b. Payment:** Payment will be made at the unit price for each sewer connection.
- **c. Includes:** Unit price includes, but is not limited to, coring or cutting into the existing manhole or intake, pipe connections, grout, and waterstop (when required).

H. Remove Manhole or Intake:

1. Remove Manhole:
- **a. Measurement:** Each manhole removed will be counted.
- **b. Payment:** Payment will be made at the unit price for each manhole.
- **c. Includes:** Unit price includes, but is not limited to, removal of casting, concrete, and reinforcement; plugging pipes; filling remaining structure with flowable mortar; and placing compacted fill over structure to finished grade.

2. Remove Intake:
- **a. Measurement:** Each intake removed will be counted.
- **b. Payment:** Payment will be made at the unit price for each intake.
- **c. Includes:** Unit price includes, but is not limited to, removal of casting, concrete, and reinforcement; plugging pipes; filling remaining structure with flowable mortar; and placing compacted fill over structure to finished grade.

PART 2 - PRODUCTS

2.01 MANHOLE AND INTAKE TYPES

Table 6010.01: Manhole and Intake Types

	Figure No.	Type	Description
Sanitary Sewer Manholes	6010.301	SW-301	Circular Sanitary Sewer Manhole
	6010.302	SW-302	Rectangular Sanitary Sewer Manhole
	6010.303	SW-303	Sanitary Sewer Manhole Over Existing Sewer
	6010.304	SW-304	Rectangular Base/Circular Top Sanitary Sewer Manhole
	6010.305	SW-305	Tee-section Sanitary Sewer Manhole
Storm Sewer Manholes	6010.401	SW-401	Circular Storm Sewer Manhole
	6010.402	SW-402	Rectangular Storm Sewer Manhole
	6010.403	SW-403	Deep Well Rectangular Storm Sewer Manhole
	6010.404	SW-404	Rectangular Base/Circular Top Storm Sewer Manhole
	6010.405	SW-405	Tee-section Storm Sewer Manhole
	6010.406	SW-406	Shallow Rectangular Storm Sewer Manhole
Intakes	6010.501	SW-501	Single Grate Intake
	6010.502	SW-502	Circular Single Grate Intake
	6010.503	SW-503	Single Grate Intake with Manhole
	6010.504	SW-504	Single Grate Intake with Flush-top Manhole
	6010.505	SW-505	Double Grate Intake
	6010.506	SW-506	Double Grate Intake with Manhole
	6010.507	SW-507	Single Open-throat Intake, Small Box
	6010.508	SW-508	Single Open-throat Intake, Large Box
	6010.509	SW-509	Double Open-throat Intake, Small Box
	6010.510	SW-510	Double Open-throat Intake, Large Box
	6010.511	SW-511	Rectangular Area Intake
	6010.512	SW-512	Circular Area Intake
	6010.513	SW-513	Open-sided Area Intake
	6010.515	SW-515	Triple Rectangular Area Intake
	6010.541	SW-541	Open-Throat Curb Intake Under Pavement
	6010.542	SW-542	Extension Unit for Open-Throat Curb Intake Under Pavement
	6010.545	SW-545	Single Open-Throat Curb Intake with Extended Opening

2.02 PRECAST

Comply with ASTM C 478 (circular) and ASTM C 913 (rectangular).

2.03 CAST-IN-PLACE

A. Concrete: Use Class C concrete. Comply with the following Iowa DOT Specifications and Materials I.M.s.

1. Iowa DOT Specifications Sections:

a. 2403 – Structural Concrete
b. 4101 – Portland Cement
c. 4102 – Water for Concrete and Mortar
d. 4103 – Liquid Admixtures for Portland Cement Concrete
e. 4104 – Burlap for Curing Concrete
f. 4106 – Plastic Film and Insulating Covers for Curing Concrete
g. 4108 – Supplementary Cementitious Materials
h. 4109 – Aggregate Gradations
i. 4110 – Fine Aggregate for Portland Cement Concrete
j. 4115 – Coarse Aggregate for Portland Cement Concrete

2.03 CAST-IN-PLACE (Continued)

2. Iowa DOT Materials I.M.s:
a. 316 – Flexural Strength of Concrete
b. 318 – Air Content of Freshly Mixed Concrete by Pressure
c. 403 – Chemical Admixtures for Concrete
d. 528 – Structural Concrete Plant Inspection
e. 529 – Portland Cement Concrete Proportions
f. 534 – Mobile Mixture Inspection

B. Reinforcement: Comply with Iowa DOT Section 4151 for epoxy coated reinforcement.

2.04 NON-SHRINK GROUT

Comply with Iowa DOT Materials I.M. 491.13.

2.05 PRECAST RISER JOINTS

A. Joint Ends:

1. Use tongue and groove ends.

2. If cast-in-place base is used, provide bottom riser with square bottom edge.

B. Joint Sealant:

1. Sanitary Sewers:
a. Rubber O-ring or Profile Gasket: Flexible joint, complying with ASTM C 443.
b. Bituminous Jointing Material: Use a cold-applied mastic sewer joint sealing compound recommended by the manufacturer for the intended use and approved by the Engineer. Comply with ASTM C 990.
c. Butyl Sealant Wrap: Comply with ASTM C 877.

2. Storm Sewers: All joint sealants used on sanitary sewers may also be used for storm sewers. The following may also be used.
a. Rubber Rope Gasket Jointing Material: Comply with ASTM C 990.
b. Engineering Fabric Wrap: If specified in the contract documents, supply engineering fabric wrap complying with Iowa DOT Article 4196.01, B.

2.06 MANHOLE OR INTAKE TOP

A. Capable of supporting HS-20 loading.

B. Use eccentric cone on sanitary sewer manholes unless otherwise specified or allowed.

2.07 BASE

A. Sanitary Sewer Manhole:

1. Circular Manhole: Integral base and lower riser section according to ASTM C 478.

2. All Other Manholes: Use precast or cast-in-place concrete base.

B. Storm Sewer Manhole: Use precast or cast-in-place concrete base.

C. Intake: Use precast or cast-in-place concrete base.

2.08 PIPE CONNECTIONS

A. Flexible, Watertight Gasket: Comply with ASTM C 923.

B. Non-Shrink Grout: Comply with Section 6010, 2.04.

C. Waterstop: Provide elastomeric gasket that surrounds pipe and attaches with stainless steel bands and is designed to stop the movement of water along the interface between a pipe and a surrounding concrete collar.

D. Concrete Collar: Comply with Section 6010, 2.02 and 2.03.

2.09 MANHOLE OR INTAKE ADJUSTMENT RINGS (Grade Rings)

A. Use one of the following materials for grade adjustments of manhole or intake frame and cover assemblies:

1. Reinforced Concrete Adjustment Rings: Comply with ASTM C 478. Provide rings free from cracks, voids, and other defects.

2. High Density Polyethylene Adjustment Rings: Comply with ASTM D 1248 for recycled plastic.
   a. Test and certify material properties by the methods in the following table.

Table 6010.02: Test Methods

Property	Test Method	Acceptable Value
Melt Flow Index	ASTM D 1238	0.30 to 30 g/10 min.
Density	ASTM D 792	0.94 to 0.98 g/cm^3
Tensile Strength	ASTM D 638	2,000 to 5,000 lb/in^2

   b. Do not use polyethylene grade adjustment rings when they are exposed to heat shrink infiltration barriers.
   c. When used in a single configuration, provide tapered adjustment ring with thickness that varies from 1/2 inch to 3 inches.
   d. Install adjustment rings on clean, flat surfaces according to the manufacturer's recommendations. Comply with ASTM D 36 with minimum 350°F softening point for butyl rubber sealant.

3. Expanded Polypropylene Adjustment Rings: Comply with ASTM D 4819 for expanded polypropylene when tested according to ASTM D 3575.
   a. Use adhesive meeting ASTM C 920, Type S, Grade N5, Class 25.
   b. Provide finish rings with grooves on the lower surface and flat upper surface.
   c. Do not use when heat shrinkable infiltration barrier is used.

B. Ensure the inside diameter of the adjustment ring is not less than the inside diameter of the manhole frame or not less than the inside dimension of the intake grate opening.

2.10 CASTINGS (Ring, Cover, Grate, and Extensions)

A. Gray Cast Iron: AASHTO M 306.

B. Ductile Iron: ASTM A 536, Grade 80-55-06 or 70-50-05.

2.10 CASTINGS (Ring, Cover, Grate, and Extensions) (Continued)

C. Composite: AASHTO M 306.

1. Hardware: Attach lid to frame with 316 stainless steel hardware.

2. Slip Resistance: Greater than 0.6 when tested according to ASTM C 1028.

3. Ultraviolet Resistance: Meet ASTM G 154 Cycle 1 for a minimum of 1,000 hours.

4. Detection: Must be detectable using standard detection equipment.

D. Load Capacity: Standard duty unless otherwise shown on the casting figures.

1. Standard Duty: Casting certified for 40,000 pound proof-load according to AASHTO M 306.

2. Light Duty: Casting certified according to requirements of AASHTO M 306 for a 16,000 pound proof-load (HS-20). 40,000 pound proof-load is not required.

E. Casting Types:

1. Manholes: The following table lists the manhole casting types.

Table 6010.03: Manhole Casting Types

	Figure No.	Casting Type	Number of Pieces	Ring/ Cover	Bolted Frame	Bolted Cover (Floodable)	Gasket
Sanitary Sewer	6010.601	SW-601, A	2	Fixed	Yes	No	Yes[1]
	6010.601	SW-601, B	3	Adjustable	No	No	Yes[1]
	6010.601	SW-601, C	2	Fixed	Yes	Yes	Yes[1]
	6010.601	SW-601, D	3	Adjustable	No	Yes	Yes[1]
Storm Sewer	6010.602	SW-602, E[2]	2	Fixed	Yes	No	No
	6010.602	SW-602, F[2]	3	Adjustable	No	No	No
	6010.602	SW-602, G[2]	2	Fixed	No	No	No

[1] Machine bearing surfaces required.

[2] Storm sewer casting may include environmental symbols and/or messages such as “DUMP NO WASTE, DRAINS TO RIVER.”

2. Intakes:

a. Comply with Figures 6010.602, 6010.603, 6010.604, and the contract documents.

b. Castings may include environmental symbols and/or messages such as “DUMP NO WASTE, DRAINS TO RIVER.”

3. Manhole Casting Extension Ring:

a. Match the dimensions of the existing ring and cover with an allowable diameter tolerance of -1/4 inch for the frame ridge and +1/4 inch for the cover recess.

b. Provide extension ring with height as required to raise the top of the casting to make it level or no more than 1/4 inch below the finished pavement surface. Maximum ring height is 3 inches.

2.11 ADDITIONAL MATERIALS FOR SANITARY SEWER MANHOLES

A. Infiltration Barrier:

1. External Chimney Seal:

a. Rubber Sleeve and Extension:

1) Corrugated; minimum thickness of 3/16 inches, according to ASTM C 923.
2) Minimum allowable vertical expansion of at least 2 inches.

b. Compression Bands:

1) One-piece band assembly to compress sleeve or extension against manhole and casting surfaces.
2) 16 gauge ASTM C 923, Type 304 stainless steel, minimum 1 inch width, minimum adjustment range of 4 inches more than the manhole outside diameter.
3) For standard two-piece castings, shape top band to lock sleeve to manhole frame's base flange. For three-piece adjustable castings, shape top band to lock sleeve to upper piece of adjustable frame.
4) Stainless steel fasteners complying with ASTM F 593 and 594, Type 304.

2. Internal Chimney Seal:

a. Rubber Sleeve and Extension:

1) Double pleated, minimum thickness 1/8 inch thick, according to ASTM C 923.
2) Minimum allowable vertical expansion of at least 2 inches.
3) Integrally formed expansion band recess top and bottom with multiple sealing fins.

b. Expansion Bands:

1) One-piece band assembly to compress sleeve or extension against manhole and casting surfaces to make a watertight seal.
2) 16 gauge ASTM C 923, Type 304 stainless steel, minimum 1 inch width, minimum adjustment range of 2 inches more than the manhole inside diameter.
3) Positive stainless steel locking mechanism permanently securing the band in its expanded position after tightening.

3. Molded Shield:

a. Barrier Shield:

1) Medium density polyethylene, according to ASTM D 1248.
2) Certified for 40,000 pound proof-load according to AASHTO M 306.
3) Diameter to match cone section and internal dimension of casting.

b. Sealant: Butyl material meeting ASTM C 990.

4. Heat Shrink Sleeve: Heat-shrinkable wrap around sleeve designed for protection of buried and exposed sanitary sewer manholes. Do not use with polypropylene or polyethylene adjustment rings.

a. Primer: Compatible with concrete, ductile and cast iron, and sleeve material.

b. Sleeve and Backing:

Property	Standard	Value
Water Absorption	ASTM D 570	0.05% maximum
Low Temperature Flexibility	ASTM D 2671	-40° F
Tensile Strength	ASTM D 638	2,900 psi minimum
Elongation	ASTM D 638	600% minimum
Hardness	ASTM D 2240	Shore D: 46
Shrink Factor	---	40% minimum
Thickness	---	0.1 inch minimum

c. Adhesive: Softening point of 212° F maximum meeting ASTM E 28.

2.11 ADDITIONAL MATERIALS FOR SANITARY SEWER MANHOLES (Continued)

B. Riser Section Coating:

1. Exterior: When exterior waterproof coating is specified, provide bituminous or coal tar coating.

2. Interior: When interior manhole lining is specified, provide lining according to Section 4010, 2.01 (lined, reinforced concrete pipe).

2.12 CONCRETE FILLET

A. Cast-in-place Base: Provide a cast-in-place concrete fillet with concrete complying with the requirements of Section 6010, 2.03.

B. Precast Base Section:

1. For sanitary sewers, provide a precast concrete fillet, unless otherwise allowed by the Engineer. Comply with Section 6010, 3.01.

2. For storm sewers, provide a cast-in-place concrete fillet with concrete complying with the requirements of Section 6010, 2.03.

2.13 STEPS

A. Depths:

1. For manholes and intakes less than 20 feet deep, do not install steps unless otherwise specified in the contract documents.

2. For manholes and intakes deeper than 20 feet, install steps to meet OSHA regulations.

B. Requirements:

1. ASTM C 478.

2. Manufacture using polypropylene encased steel.

3. Uniformly space steps at 12 to 16 inches.

4. Align with vertical side of eccentric top section.

5. Place first step no more than 36 inches from top of casting.

2.14 PRECAST CONCRETE TEE

A. Tee and Eccentric Reducers: ASTM C 478.

B. Composite Tee: Comply with Figure 6010.305. May be substituted for pipe diameters less than 48 inches.

2.15 CASTING ANCHOR BOLTS AND WASHERS

A. Material: Stainless steel or hot-dipped galvanized.

B. Diameter: Provide bolts and washers 1/8 inch smaller than hole or slot in the casting frame, but no less than 1/2 inch diameter.

C. Bolt Length: As required to pass through adjustment rings and into manhole or intake structure to embedment depth recommended by anchor manufacturer.

2.16 DROP CONNECTION

A. Internal:

1. Receiving Bowl: Marine grade fiberglass meeting ASTM D 790, ASTM D 638, and ASTM D 2583 with non-magnetic stainless steel anchor bolts meeting the manufacturer's recommendation.

2. Flexible Coupler: Provide flexible couple matching the size of the receiving bowl and the drop pipe.

3. Drop Pipe and Bottom Elbow: Provide drop pipe an equivalent diameter of the influent pipe. Limit pipe size to maintain space available for maintenance activities. Provide solid wall SDR 35 PVC pipe and elbow complying with Section 4020, 2.01, A or Schedule 40 PVC pipe and elbow complying with ASTM D 1785.

4. Pipe Brackets: ASTM A 240, Type 304 or Type 316 stainless steel with stainless steel nuts and bolts.

B. External:

1. Pipe and Fittings: Comply with Section 5010, 2.01, B for ductile iron pipe and Section 5010, 2.03 for fittings.

2. Concrete Encasement: Comply with Section 7010, 2.02.

3. Embedment Material: Comply with Section 3010, 2.02, A or 2.06 for backfill material from the top of the elbow to the bottom of the sewer main.

2.17 EXCAVATION AND BACKFILL MATERIAL

Comply with Section 3010 for bedding and backfill materials.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS FOR INSTALLATION OF MANHOLES AND INTAKES

A. Excavation: Excavate according to Section 3010.

B. Subgrade Preparation:

1. **Cut Sections (Undisturbed Soil):** Prepare subgrade to accurate elevation required to place subbase.

2. **Fill Sections:** Compact to 95% of maximum Standard Proctor Density and hand grade to accurate elevation required to place subbase, or install stabilization material as directed by the Engineer.

3. **Unstable Soil:** Install stabilization material as directed by the Engineer.

C. Subbase: Install 8 inch thick pad of Class I bedding material a minimum of 12 inches outside footprint of the structure.

D. Installation of Manhole or Intake Structure: When necessary, adjust wall height and depth of base to provide a minimum of 48 inches between form grade elevation and top of base. Form walls and construction joints for cast-in-place intakes or install precast intake boxes to ensure intake lids are set to match the longitudinal slope of the adjacent street unless otherwise specified in the contract documents.

1. **Cast-in-place:** Comply with Section 6010, 3.02.

2. **Precast:** Comply with Section 6010, 3.03.

E. Pipes: Install and bed pipes and connect to manhole or intake. Install pipe flush with inside wall of structure. Place bedding and pipe embedment material according to Section 3010.

1. **Cast-in-place Structures:**
   a. **Storm:** Form structure walls around pipe.
   b. **Sanitary:** Form or core circular opening and install flexible, watertight gasket according to Section 6010, 2.08. Keep void between pipe and manhole section free of debris and concrete.

2. **Precast Storm Sewer Manholes or Intakes:** If annular space between pipe and structure is less than 2 inches, fill with non-shrink grout. If annular space is 2 inches or greater, construct a concrete collar around the pipe according to Section 6010, 3.05.

3. **Precast Sanitary Sewer Manholes:** Connect to structure with flexible, watertight gasket according to Section 6010, 2.08. Keep void between pipe and manhole section free of debris and concrete.

4. **Sanitary Sewer Manholes on Existing Pipe:** Install waterstop according to Section 6010, 2.08.

F. Joint Sealant:

1. **Sanitary Sewer Manholes:**
   a. Install rubber O-ring or profile gasket (precast structures).
   b. Apply bituminous jointing material or butyl sealant wrap to exterior of all sanitary sewer manhole joints.

3.01 GENERAL REQUIREMENTS FOR INSTALLATION OF MANHOLES AND INTAKES (Continued)

2. Storm Sewer Manhole and Intakes:
a. Apply bituminous jointing material or install rubber rope gasket.
b. If indicated in the contract documents, apply engineering fabric wrap to joints.

G. Fillet:

1. Construct manhole or intake fillet up to one-half of pipe diameter to produce a smooth half-pipe shape between pipe inverts.

2. Slope fillet top toward pipe 1/2 inch per foot perpendicular to flow line.

3. For sanitary sewer, keep void between pipe and structure wall free of debris and concrete.

4. For precast fillets, remove any projections and repair any voids to provide a hydraulically smooth channel between ends of pipes.

H. Top Sections: Install manhole eccentric cone or flat top section or install intake top.

I. Adjustment Ring(s):

1. Bed each concrete ring with bituminous jointing material in trowelable or rope form.

2. Bed each polyethylene or expanded polypropylene ring with manufacturer's approved product and according to manufacturer's recommended installation procedure.

3. Construct manholes and intakes with the following adjustment ring stack heights:
a. Minimum: 4 inches for new manholes and intakes. No minimum for rehabilitation projects.
b. Maximum: 12 inches for new manholes and intakes; 16 inches for existing manholes and intakes.

4. For greater adjustment, modify lower riser section(s).

J. Casting:

1. Install the type of casting specified in the contract documents and adjust to proper grade.

2. Where a manhole or intake is to be in a paved area, adjust the casting to match the slope of the finished surface.

3. Three-piece Castings:
a. Attach the frame to the structure with four anchor bolts.
b. Set initial position of movable portion of the casting in the center of the adjustment range.
c. Remove height-adjustment bolts or mechanism after the paving is completed.

3.01 GENERAL REQUIREMENTS FOR INSTALLATION OF MANHOLES AND INTAKES (Continued)

K. Infiltration Barrier: Install on sanitary sewer manholes.

1. Internal or External Chimney Seal:

a. Do not use external chimney seal if seal will be permanently exposed to sunlight.
b. Extend seal 3 inches below the lowest adjustment ring.
c. Extend seal to 2 inches above the flange of the casting for a standard two-piece casting, or 2 inches above the top of the base section of the casting for an adjustable three-piece casting.
d. Use multiple seals, if necessary.
e. Install compression bands (external chimney seal) or expansion bands (internal chimney seal) to lock the rubber sleeve or extension into place and to provide a positive watertight seal. Once tightened, lock the bands into place. Use only manufacturer recommended installation tools and sealants.

2. Molded Shield:

a. Clean surface of structure cone section.
b. Apply sealant to the top surface of the cone section. Use sufficient sealant to accommodate flaws in the surface of the cone section.
c. Cut molded shield to height by adding the dimensions of the adjustment rings and casting height. Be sure not to interfere with seating of the lid into the casting frame.
d. Seat the molded shield against the sealant on the cone section.
e. Add adjustment rings and casting to meet final grade.

3. Heat Shrink Sleeve:

a. Ensure all surfaces are clean, dry, and free of foreign objects and sharp edges.
b. Warm the surface to drive off any moisture.
c. Cut sleeve to required length per manufacturer's requirements.
d. Apply primer to manhole and casting surface.
e. Place sleeve according to manufacturer's requirements.
f. Apply heat to the sleeve, smooth out wrinkles, and remove trapped air.
g. Cut the sleeve at the casting gussets. Reheat to place the sleeve onto the casting.
h. Trim off any excess material.

L. Backfill and Compaction:

1. Place suitable backfill material after concrete in structure has reached at least 3,000 psi compressive strength or 550 psi flexural strength. If concrete strength is not determined, place backfill at least 14 calendar days after initial concrete placement.

2. Place backfill material simultaneously on all sides of walls and structures so the fill is kept at approximately the same elevation at all times.

3. Compact the 3 feet closest to all walls using pneumatic or hand tampers only. Ensure proper and uniform compaction of backfill around structure.

3.02 ADDITIONAL REQUIREMENTS FOR CAST-IN-PLACE CONCRETE STRUCTURES

A. Forms:

1. Comply with Iowa DOT Article 2403.03, B.

2. Form all cast-in-place manholes and intakes on both the inside and the outside face above the base. Do not form against excavated earthen surface.

3.02 ADDITIONAL REQUIREMENTS FOR CAST-IN-PLACE CONCRETE STRUCTURES (Continued)

B. Reinforcing Steel:

1. Comply with Iowa DOT Section 2404.

2. Lap bars a minimum of 36 diameters, unless otherwise specified in the contract documents.

3. Provide a minimum of 3 inches of clearance for structure bases and 2 inches of clearance for walls and tops.

C. Concrete Mixing:

1. Comply with Iowa DOT Article 2403.02, D.

2. When using ready-mixed concrete, comply with ASTM C 94.

D. Concrete Placing:

1. Comply with Iowa DOT Article 2403.03, C.

2. Do not place concrete when the air temperature is less than 40°F without the approval of the Engineer. When placement of concrete below 40°F is allowed, comply with Iowa DOT Article 2403.03, F.

3. Place concrete continuously in each section until complete. Do not allow more than 30 minutes to elapse between depositing adjacent layers of concrete within each section.

4. Comply with Iowa DOT Article 2403.03, D for concrete vibration.

5. Form 1 1/2 inch by 3 inch keyed construction joints at locations shown in the contract documents.

6. Provide a broom finish on portions of structure that are to become part of exposed pavement.

E. Stripping and Cleaning:

1. Remove forms for manhole and intake walls and tops according to Iowa DOT Article 2403.03, M. References to culverts include all sanitary and storm structures. When allowed by the Engineer, compressive strengths at six times the stated flexural strengths may be used in determining concrete strength of structure tops.

2. Finish surfaces according to Iowa DOT Article 2403.03, P. Give exposed surfaces a Class 2 finish.

F. Curing:

1. Comply with Iowa DOT Article 2403.03, E.

2. For surfaces visible to the public, use only curing compounds complying with ASTM C 309, Type 1-D or Type 2.

3.02 ADDITIONAL REQUIREMENTS FOR CAST-IN-PLACE CONCRETE STRUCTURES (Continued)

G. Exterior Loading:

1. Restrict exterior loads on concrete according to Iowa DOT Article 2403.03, N.

2. When allowed by the Engineer, compressive strengths at six times the stated flexural strengths may be used.

H. Repairs: After visual inspection of the completed manhole or intake, repair honeycomb areas, visible leaks, tie holes, or other damaged areas. Remove concrete webs or protrusions.

I. Concrete Testing: The Engineer will conduct testing.

3.03 ADDITIONAL REQUIREMENTS FOR PRECAST CONCRETE STRUCTURES

A. Substitutions: If approved by the Engineer, precast structures may be substituted for designated cast-in-place structures. Comply with the requirements of Section 6010, 3.02 or Iowa DOT Materials I.M. 445.

B. Cast-in-place Base:

1. Comply with Section 6010, 3.02 for placement of concrete.

2. Ensure proper vertical and horizontal alignment of base riser section.

C. Precast Base or Base with Integral Riser Section: Place base or base with integral riser section and ensure proper vertical and horizontal alignment.

D. Additional Riser Sections: Install additional riser sections as required.

E. Lift Holes: Install rubber plug in lift holes. Cover plug and hole with non-shrink grout.

3.04 ADJUSTMENT OF EXISTING MANHOLE OR INTAKE

A. Casting Extension Rings:

1. Install casting extension rings only when specified in the contract documents, and only in conjunction with pavement overlays.

2. Install according to the manufacturer's recommendation and adjust for proper alignment.

B. Minor Adjustment (Adding or Removing Adjustment Rings):

1. Remove casting.

2. Modify adjustment ring stack height by one of the following methods:
   a. Add adjustment rings as necessary to adjust existing manhole or intake to finished pavement grade or finished topsoil grade, to a maximum ring stack height of 16 inches. Bed each concrete ring with bituminous jointing material. Bed each polyethylene ring with manufacturer's approved product.
   b. Remove one or more adjustment rings, as appropriate, to reduce casting elevation.

3. Install new casting on modified adjustment ring stack. Existing casting may be reinstalled when specified in the contract documents.

3.04 ADJUSTMENT OF EXISTING MANHOLE OR INTAKE (Continued)

4. Replace infiltration barrier for sanitary sewer manhole using only new materials.

C. Major Adjustment (Adding, Removing, or Modifying Riser or Cone Section): When adjustment is greater than can be accomplished through adding or removing adjustment rings, a major adjustment will be required.

1. Remove casting.

2. Remove top.

3. Remove and replace or modify existing riser section and/or top section according to the method approved by the Engineer.

4. Install new frame and cover or grate. Existing casting may be reinstalled when specified in the contract documents.

5. Replace infiltration barrier for sanitary sewer manhole using only new materials.

3.05 CONNECTION TO EXISTING MANHOLE OR INTAKE

A. General:

1. Remove existing fillet as necessary to install pipe at required elevation and develop hydraulic channel.

2. Insert pipe into structure and trim end flush with inside wall of structure.

3. Place backfill material according to Section 3010.

B. Concrete Collar:

1. For new pipes 12 inches or smaller, install two number 4 steel reinforcing hoops in collar around pipe. Pour concrete collar around pipe/structure junction to a minimum thickness and width of 6 inches, providing a minimum of 4 inches of concrete extending beyond the pipe opening.

2. For new pipes larger than 12 inches, install two number 4 steel reinforcing hoops in collar around pipe. Pour concrete collar around pipe/structure junction to minimum thickness and width of 9 inches, providing a minimum of 4 inches of concrete extending beyond the pipe opening.

C. Sanitary Sewer:

1. General:
a. Core new openings in existing manholes unless otherwise specified in the contract documents.
b. Divert flow as necessary. Obtain approval of the diversion plan from the Engineer. Maintain sanitary sewer service at all times unless otherwise specified in the contract documents.

2. Cored Opening:
a. Insert flexible watertight connector into new opening.
b. Install and tighten internal expansion sleeve to hold flexible connector in place.
c. Insert pipe through flexible connector and tighten external compression ring.
d. Do not install grout or concrete collar for cored opening with flexible connector.

3.05 CONNECTION TO EXISTING MANHOLE OR INTAKE (Continued)

3. Cut and Chipped Opening (Knock-out): Use only when specified or allowed.
a. Saw opening to approximate dimensions with a masonry saw. Saw to depth sufficient to sever reinforcing steel.
b. Remove concrete and expand opening to a diameter at least 6 inches larger than the outside diameter of the new pipe.
c. Cut off all reinforcing steel protruding from the structure wall.
d. Install waterstop around new pipe centered within structure wall.
e. Fill opening between structure and pipe with non-shrink grout.
f. Construct concrete collar around pipe and exterior manhole opening.
g. Provide pipe joint, non-shear coupling, or other approved flexible coupling within 2 feet of structure wall to allow for differential settlement between the new sewer and the structure.

D. Storm Sewer:

1. Cut and Chipped Opening:
a. Use for pipe sizes 12 inches in diameter or larger.
b. Saw opening to approximate dimensions with a masonry saw. Saw to depth sufficient to sever reinforcing steel.
c. Remove concrete and expand opening to a diameter at no more than 4 inches larger than the outside diameter of the new pipe.
d. Leave a minimum of 6 inches of manhole or intake wall above and on the sides of the pipe.
e. Cut off all reinforcing steel protruding from the structure wall.

2. Cored Opening:
a. Core new openings in existing manholes or intakes for all pipes less than 12 inches in diameter.
b. Opening to be no greater than 2 inches larger than the outside diameter of the pipe.
c. Leave a minimum of 6 inches of manhole or intake wall above and on the sides of the pipe.

3. Fill Opening: Fill opening between manhole or intake wall and outside of pipe with non-shrink grout or construct a concrete collar around the pipe according to Section 6010, 3.05, B.

3.06 DROP CONNECTION TO SANITARY SEWER MANHOLE

A. Internal:

1. Core opening in existing manhole wall and install flexible watertight connector.

2. Cut incoming pipe so a maximum of 2 inches extends into the manhole.

3. Allow 1 inch clearance between bottom of incoming pipe and top of the receiving bowl. Connect receiving bowl to manhole with stainless steel anchor bolts as recommended by the manufacturer.

4. Install flexible coupler connecting the receiving bowl and the drop pipe.

5. Mount drop pipe on the side of the manhole with stainless steel brackets spaced a maximum of 4 feet apart. Provide a minimum of two brackets per pipe segment.

6. Remove existing concrete fillet as required to accommodate bottom elbow.

3.06 DROP CONNECTION TO SANITARY SEWER MANHOLE (Continued)

7. Install elbow at bottom of drop pipe to match concrete fillet and create a smooth flow transition. Align elbow so discharge is directed at outlet pipe or at 45 degrees to manhole flow.

8. Repair fillet according to Section 6010, 3.01, G.

9. Comply with Figure 6010.308.

B. External:

1. Core opening in existing manhole wall and install flexible watertight connector, if required.

2. Install ductile iron pipe and fittings according to Section 5010, 3.01 and 3.02.

3. Place concrete from the base of the manhole to the top of the elbow.

4. Comply with Section 3010, 3.05 for bedding and backfill of the external drop piping.

5. Comply with Figure 6010.307.

3.07 REMOVAL OF MANHOLE OR INTAKE

A. Unless otherwise specified, remove the entire structure to a minimum of 10 feet below top of subgrade in paved areas or 10 feet below finished grade in other areas.

B. Pipes:

1. Contact the Engineer to verify the sewer line is not in use.

2. Construct sewer plug by completely filling the end of the pipe with concrete. Force concrete into the end of the pipe for a distance of 16 inches, or one-half the pipe diameter, whichever is greater.

3. If specified in the contract documents, fill the line to be abandoned with flowable mortar or CLSM (comply with Section 3010) by gravity flow or pumping.

C. Fill remaining structure using flowable mortar.

D. Place compacted backfill over remaining structure as required for embankment or compacted backfill.

3.08 CLEANING, INSPECTION, AND TESTING

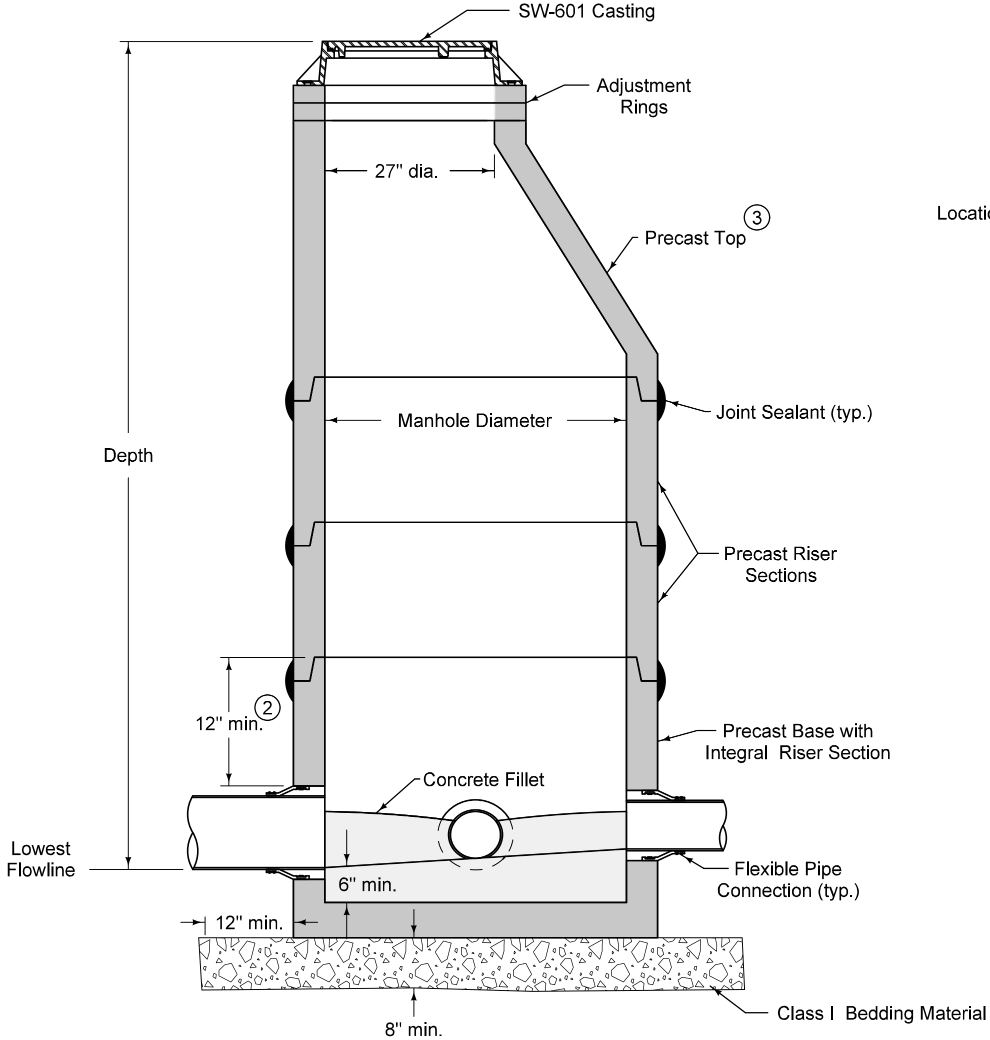
Clean, inspect, and test structures according to Section 6030.

END OF SECTION

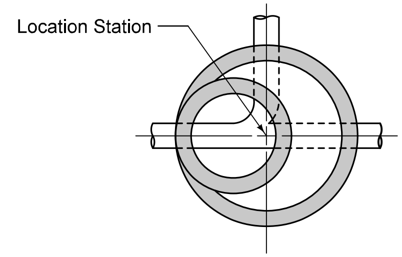
If manhole depth exceeds 20 feet, install steps.

Install infiltration barrier.

1. For additional configurations, maintain a minimum of 12 inches of concrete between vertical edges of pipe openings.
2. 12 inch minimum riser height above all pipe openings.
3. When specified, provide an eccentric flat top In Lieu of eccentric cone section.



TYPICAL SECTION



PLAN

Manhole Diameter (inches)	Maximum Pipe Diameter (inches) for 2 Pipes ①	
	At 180° Separation	At 90° Separation
48	24	18
60	36	24
72	42	30
84	48	36
96	60	42

SUDAS | IOWADOT | REVISION 5 10-18-22

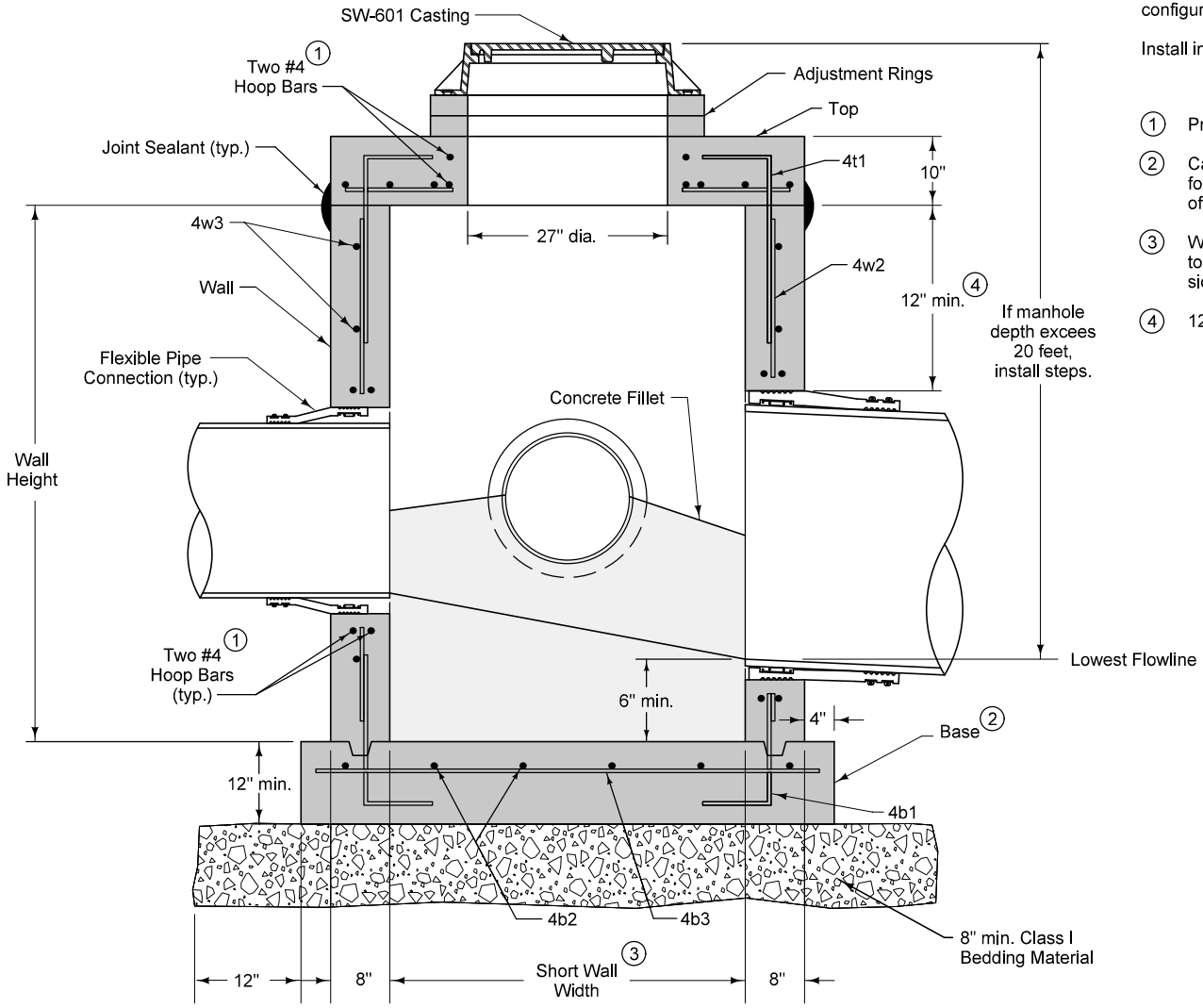
FIGURE 6010.301 | STANDARD ROAD PLAN | SW-301 SHEET 1 of 1

REVISIONS: Added circle note 3.

SUDAS DIRECTOR | DESIGN METHODS ENGINEER

CIRCULAR SANITARY SEWER MANHOLE

FIGURE 6010.301 SHEET 1 OF 1



TYPICAL SECTION

Adjacent walls may have different widths based upon pipe configuration, but structure must be rectangular.

Install infiltration barrier.

1. Provide two #4 hoop bars at top opening and at all pipe openings.
2. Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.
3. Wall widths vary with pipe diameter and range from 4 feet minimum to 9 feet maximum. Provide 12 inches of wall width (minimum) each side of pipe opening.
4. 12 inch minimum wall height above all pipe openings.

FIGURE 6010.302 | SHEET 1 OF 2

SUDAS	IOWADOT	REVISION 3	04-20-21
FIGURE 6010.302	STANDARD ROAD PLAN	SW-302	SHEET 1 of 2

REVISIONS: Added infiltration barrier note.

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SUDAS DIRECTOR

Stuart Nicholson
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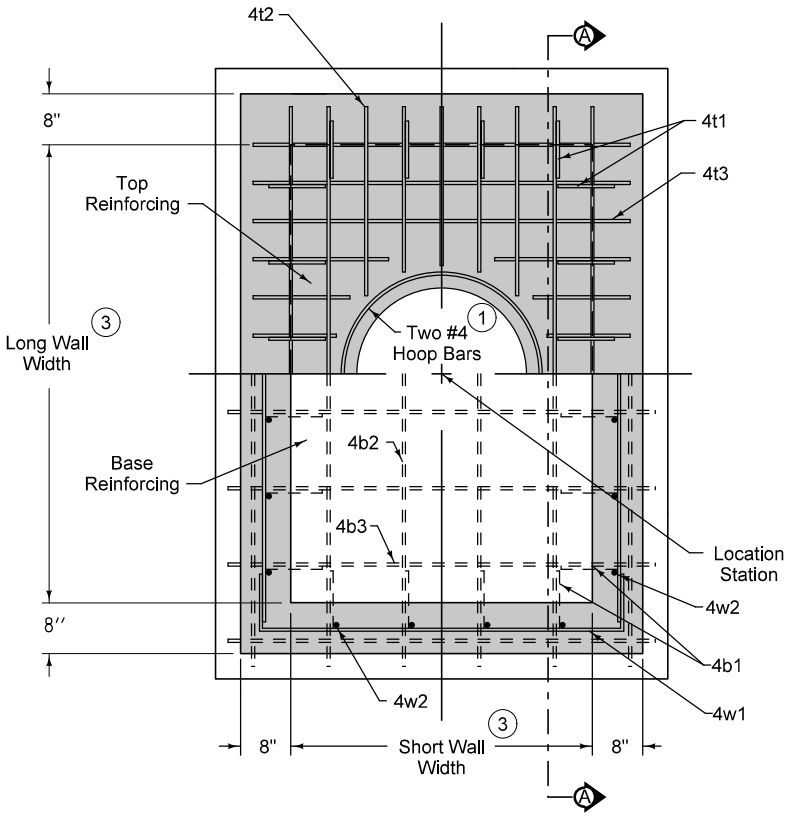
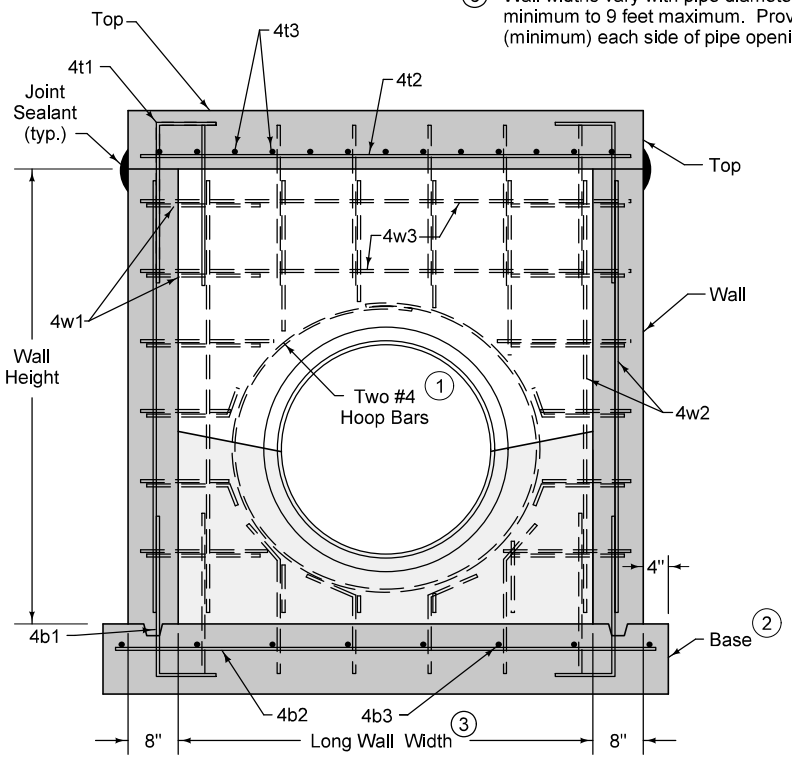
RECTANGULAR SANITARY SEWER MANHOLE

1. Provide two #4 hoop bars at top opening and at all pipe openings.
2. Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.
3. Wall widths vary with pipe diameter and range from 4 feet minimum to 9 feet maximum. Provide 12 inches of wall width (minimum) each side of pipe opening.

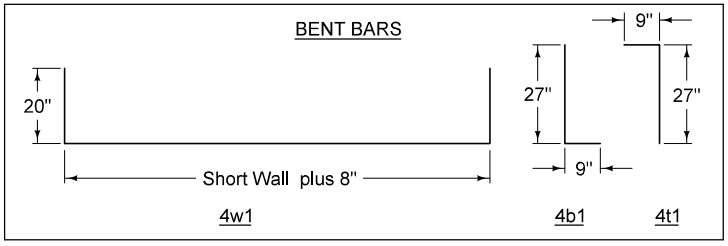


PLAN



SECTION A-A

REINFORCING BAR LIST					
Mark	Size	Location	Shape	Length	Spacing
4b1	4	Base	⌟	36"	12"
4b2	4	Base	—	Long Wall plus 18"	12"
4b3	4	Base	—	Short Wall plus 18"	12"
4t1	4	Top	⌜	36"	12"
4t2	4	Top	—	Long Wall plus 12"	6"
4t3	4	Top	—	Short Wall plus 12"	6"
4w1	4	Wall	⌐¬	Short Wall plus 48"	12"
4w2	4	Wall	—	Wall Height minus 4"	12"
4w3	4	Wall	—	Long Wall plus 12"	12"



SUDAS | IOWADOT | REVISION 3 04-20-21

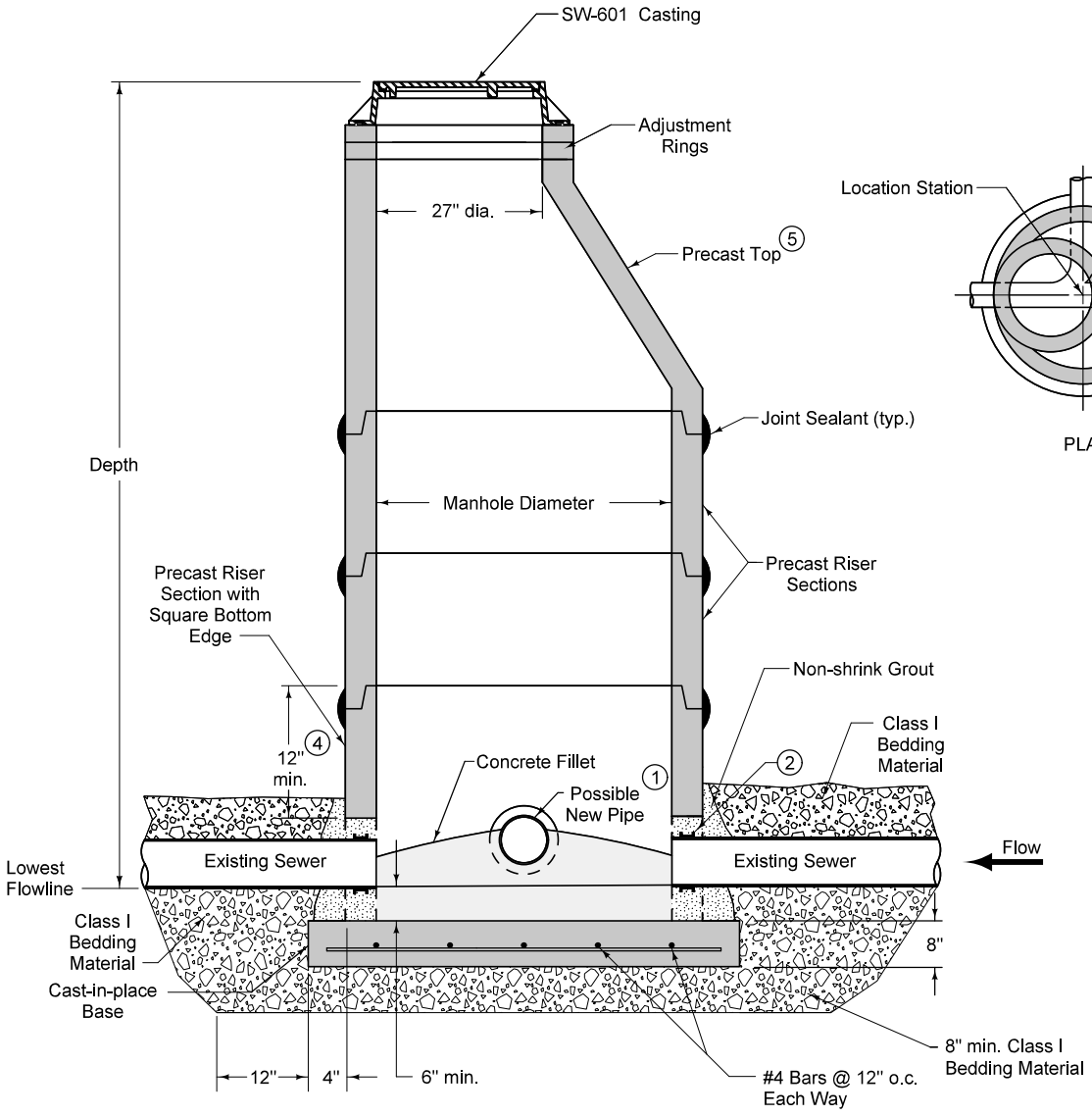
FIGURE 6010.302 | STANDARD ROAD PLAN | SW-302 | SHEET 2 of 2

REVISIONS: Added Infiltration barrier note.

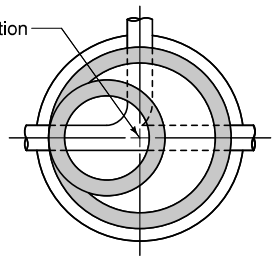
Paul D. Wigand, SUDAS DIRECTOR | DESIGN METHODS ENGINEER

RECTANGULAR SANITARY SEWER MANHOLE

FIGURE 6010.302 SHEET 2 OF 2



TYPICAL SECTION



PLAN

If manhole depth exceeds 20 feet, install steps.

Install infiltration barrier.

(1) For new pipe connections, provide cored opening with flexible pipe connector.

(2) For existing pipe connections, provide an arched opening with a diameter up to 6 inches larger than outside diameter of pipe. Install waterstop around existing pipe. Fill void between pipe and opening with non-shrink grout.

(3) For additional configurations, maintain a minimum of 12 inches of concrete between vertical edges of pipe openings.

(4) 12 inch minimum riser height above all pipe openings.

(5) When specified, provide an eccentric flat to In Lieu of eccentric cone section.

Manhole Diameter (inches)	Maximum Pipe Diameter (inches) for 2 Pipes (3)	
	At 180° Separation	At 90° Separation
48	24	18
60	36	24
72	42	30
84	48	36
96	60	42

FIGURE 6010.303 SHEET 1 OF 1

SUDAS | IOWA DOT

REVISION 5 10-18-22

FIGURE 6010.303 | STANDARD ROAD PLAN | SW-303

SHEET 1 of 1

REVISIONS: Added circle note 5.

Paul D. Wigand
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Steven Nichols
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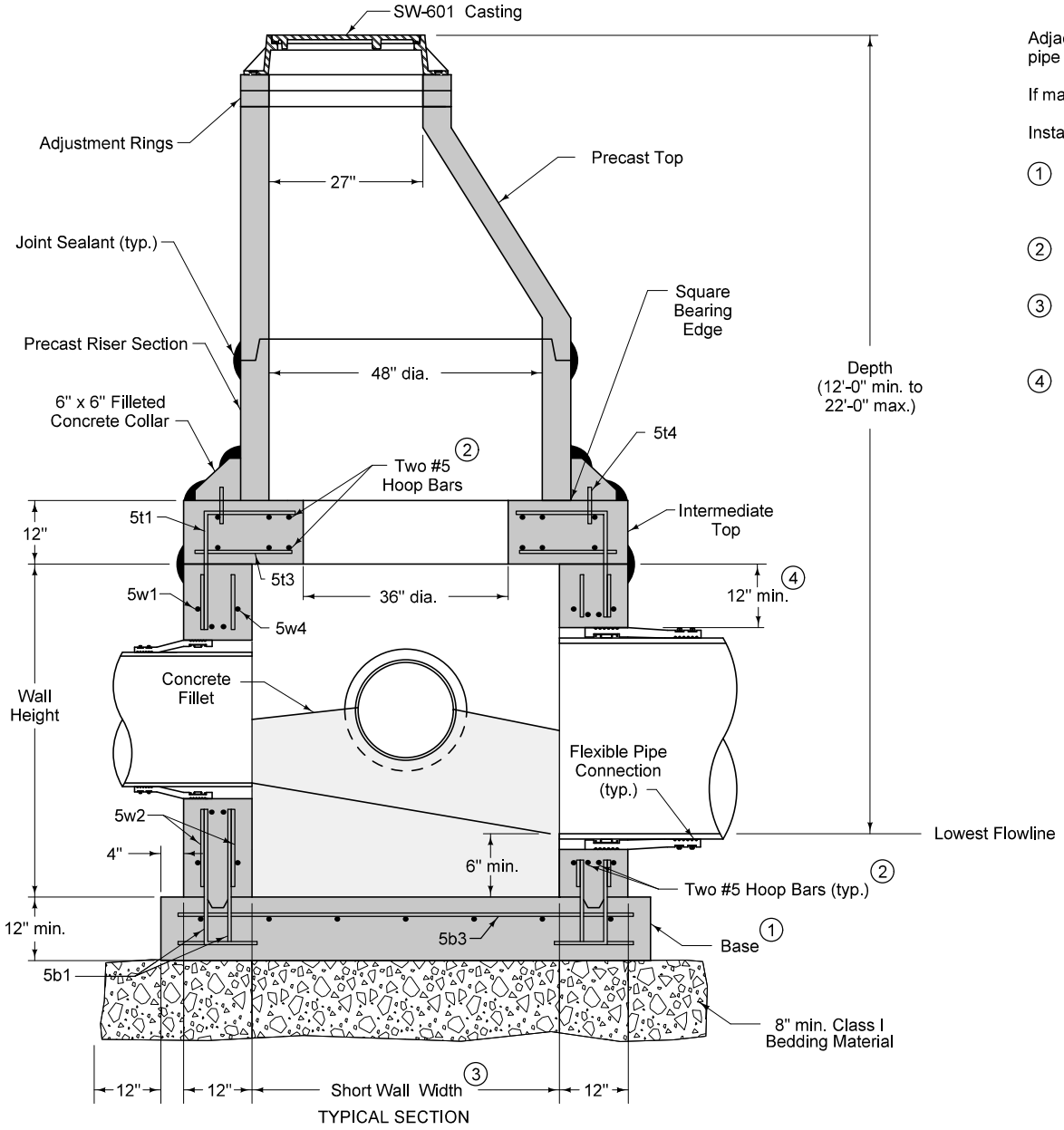
SANITARY SEWER MANHOLE OVER EXISTING SEWER



TYPICAL SECTION

Adjacent walls may have different widths based upon pipe configuration, but structure must be rectangular.

If manhole depth exceeds 20 feet, install steps.

Install infiltration barrier.

(1) Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.

(2) Provide two #5 hoop bars at intermediate top opening and at all pipe openings.

(3) Wall widths vary with pipe diameter and range from 4 feet minimum to 12 feet maximum. Provide 12 inches of wall width (minimum) each side of pipe opening.

(4) 12 inch minimum wall height above all pipe openings.

FIGURE 6010.304 SHEET 1 OF 2

SUDAS | IOWADOT | REVISION 4 04-20-21

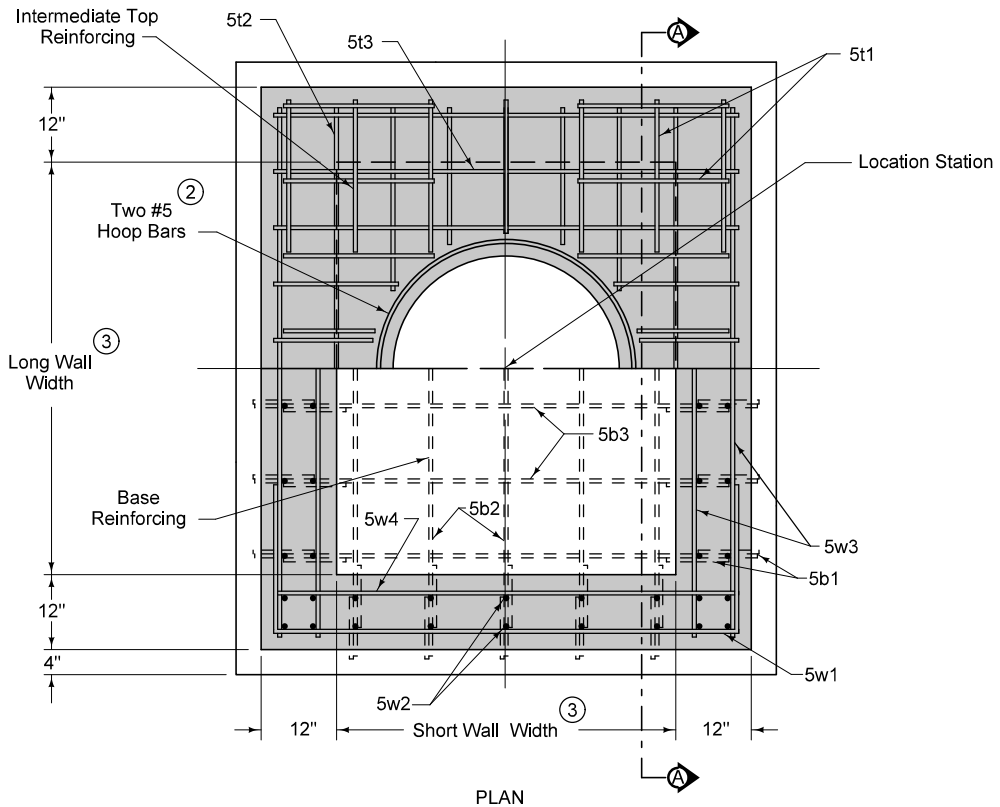
FIGURE 6010.304 | STANDARD ROAD PLAN | SW-304 | SHEET 1 of 2

REVISIONS: Added manhole depth note and infiltration barrier note.

Paul D. Wigand, SUDAS DIRECTOR

DESIGN METHODS ENGINEER

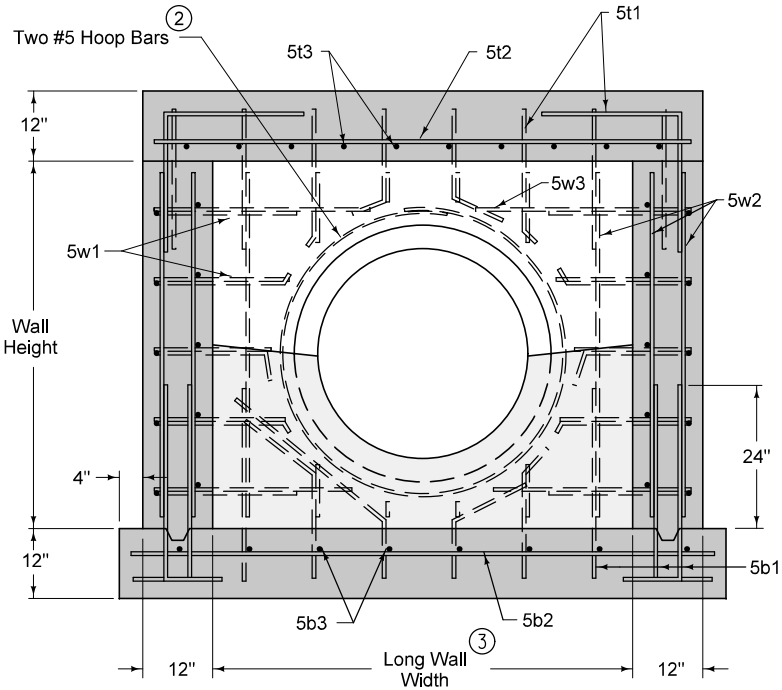
RECTANGULAR BASE/ CIRCULAR TOP SANITARY SEWER MANHOLE



PLAN

2 Provide two #5 hoop bars at intermediate top opening and at all pipe openings.

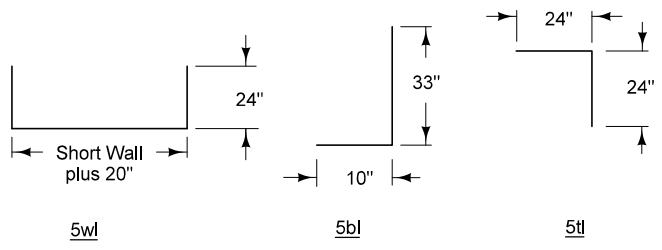
3 Wall widths vary with pipe diameter and range from 4 feet minimum to 12 feet maximum. Provide 12 inches of wall opening (minimum) each side of pipe opening.



SECTION A-A

REINFORCING BAR LIST					
Mark	Size	Location	Shape	Length	Spacing
5t1	5	Top	L	48"	12"
5t2	5	Top	—	Long Wall plus 20"	9"
5t3	5	Top	—	Short Wall plus 20"	9"
5t4	5	Top	—	8"	12"
5b1	5	Base	L	43"	12"
5b2	5	Base	—	Long Wall plus 26"	12"
5b3	5	Base	—	Short Wall plus 26"	12"
5w1	5	Top	⌐	Short Wall plus 68"	12"
5w2	5	Top	—	Wall Height minus 4"	12"
5w3	5	Top	—	Long Wall plus 20"	12"
5w4	5	Top	—	Short Wall plus 20"	12"

BENT BARS



SUDAS | IOWADOT | REVISION 4 04-20-21

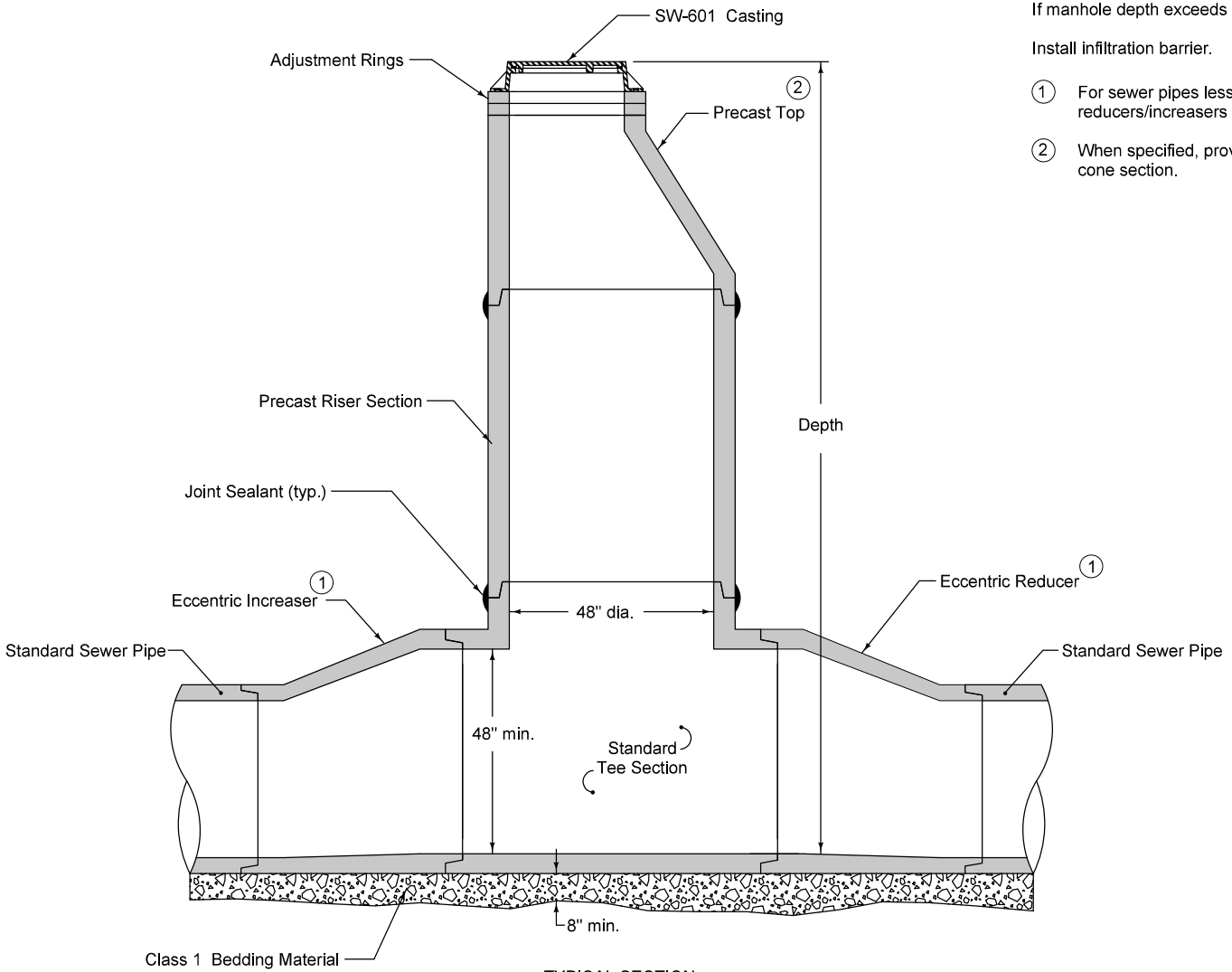
FIGURE 6010.304 | STANDARD ROAD PLAN | SW-304 | SHEET 2 of 2

REVISIONS: Added manhole depth note and Infiltration barrier note.

Paul D. Wigand, SUDAS DIRECTOR — DESIGN METHODS ENGINEER

RECTANGULAR BASE/ CIRCULAR TOP SANITARY SEWER MANHOLE

FIGURE 6010.304 SHEET 2 OF 2



TYPICAL SECTION

1

STANDARD TEE

If manhole depth exceeds 20 feet, install steps.

Install infiltration barrier.

1. For sewer pipes less than 48 inches in diameter, install eccentric reducers/increasers with a standard tee or utilize a composite tee.

2. When specified, provide an eccentric flat top In Lieu of eccentric cone section.

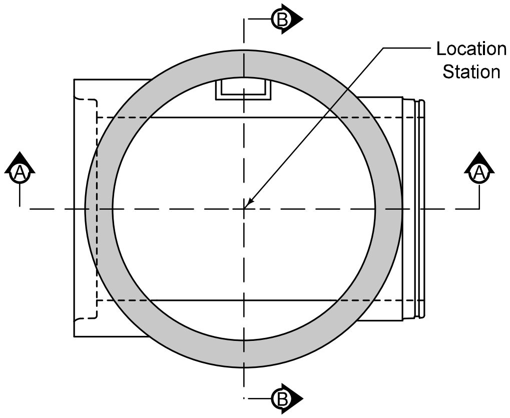
SUDAS	IOWA DOT	REVISION 4 10-18-22
FIGURE 6010.305	STANDARD ROAD PLAN	SW-305
		SHEET 1 of 2

REVISIONS: Added circle note 2.

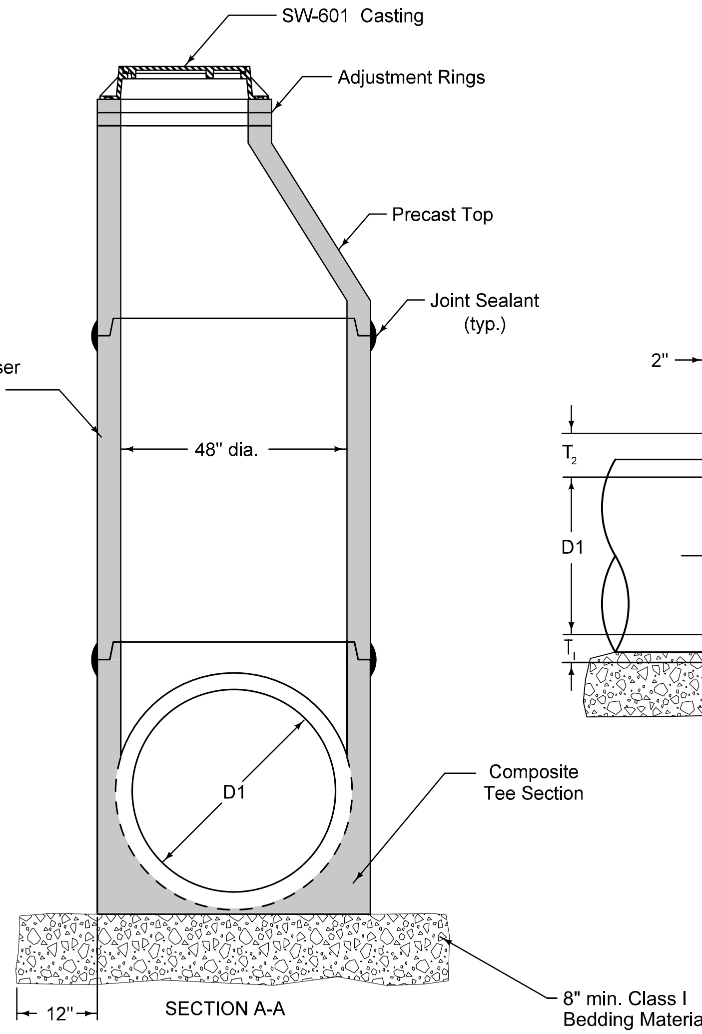
Paul D. Wigard, SUDAS DIRECTOR — DESIGN METHODS ENGINEER

TEE-SECTION
SANITARY SEWER MANHOLE

FIGURE 6010.305 SHEET 1 OF 2

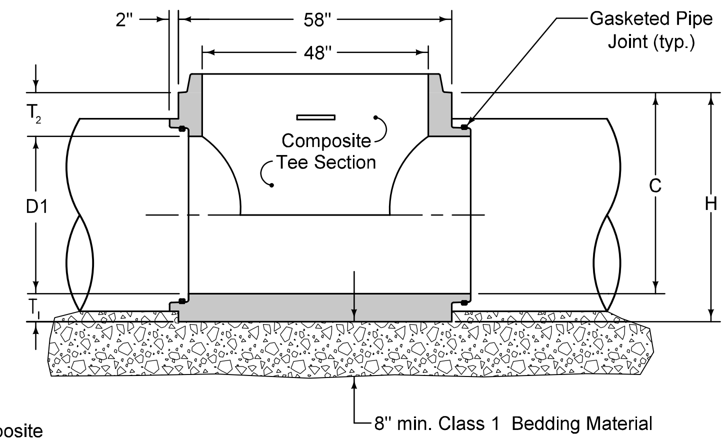


PLAN



SECTION A-A

Install infiltration barrier.



SECTION B-B

COMPOSITE TEE DIMENSIONS						
Size	D1	H	T_1	T_2	C	Weight
48" on 12"	12"	50"	8½"	29½"	41½"	5600 lbs.
48" on 15"	15"	50"	7"	28"	43"	5400 lbs.
48" on 18"	18"	50"	5½"	26½"	44½"	5200 lbs.
48" on 21"	21"	48"	9½"	17½"	38½"	5800 lbs.
48" on 24"	24"	48"	8"	16"	40"	5600 lbs.
48" on 27"	27"	48"	9½"	11½"	38½"	5900 lbs.
48" on 30"	30"	48"	8"	10"	40"	5300 lbs.
48" on 33"	33"	54"	9½"	11½"	44½"	6600 lbs.
48" on 36"	36"	54"	8"	10"	46"	6100 lbs.

COMPOSITE TEE

Alternate to standard tee with eccentric reducer (for pipes 36" and smaller).

SUDAS | IOWADOT | REVISION 4 10-18-22

FIGURE 6010.305 | STANDARD ROAD PLAN | SW-305 | SHEET 2 of 2

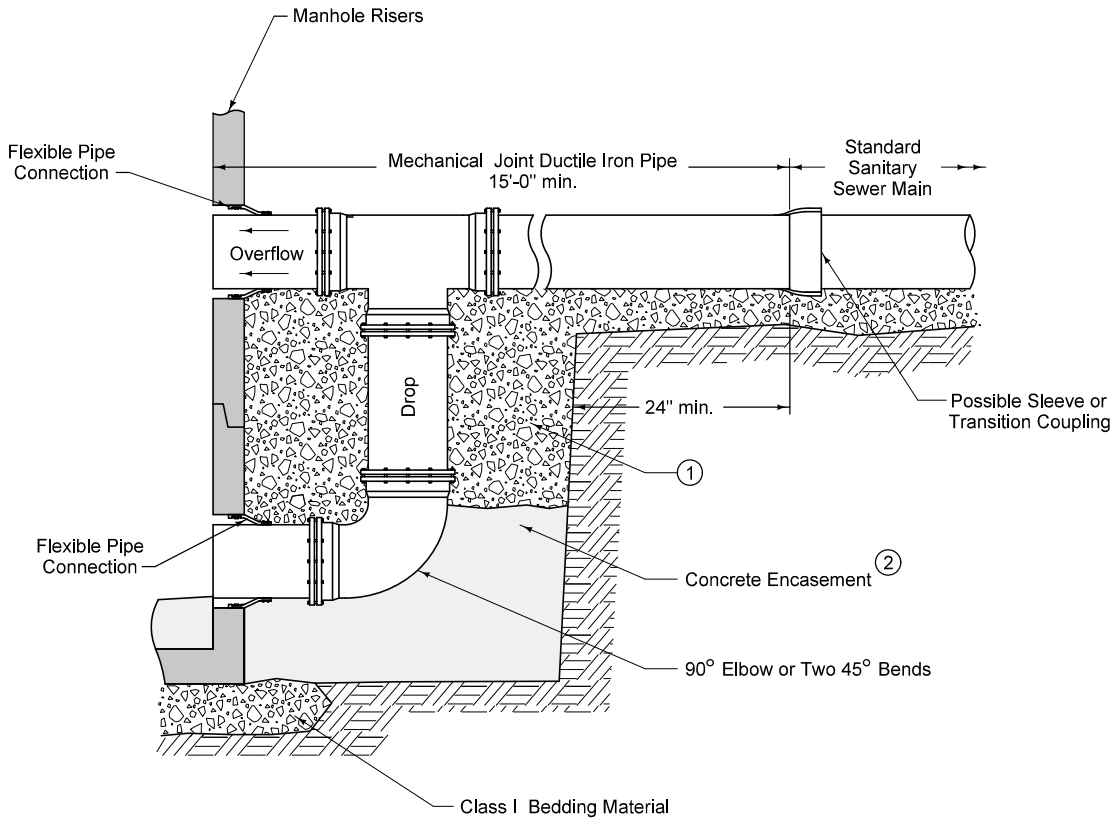
REVISIONS: Added circle note 2.

SUDAS DIRECTOR | DESIGN METHODS ENGINEER

TEE-SECTION
SANITARY SEWER MANHOLE

Figure 6010.306

RESERVED FOR FUTURE USE



Construct drop and overflow from ductile iron pipe of same diameter specified for sewer main. Provide mechanical joints for all ductile iron pipe and fittings.

1. Place Class I bedding material, CLSM, flowable mortar, or concrete from top of elbow to bottom of sewer main.

2. Encase elbow in concrete. 12 inches minimum on all sides.

SUDAS	IOWADOT	REVISION 2 04-21-20
FIGURE 6010.307	STANDARD ROAD PLAN	SW-307
		SHEET 1 of 1

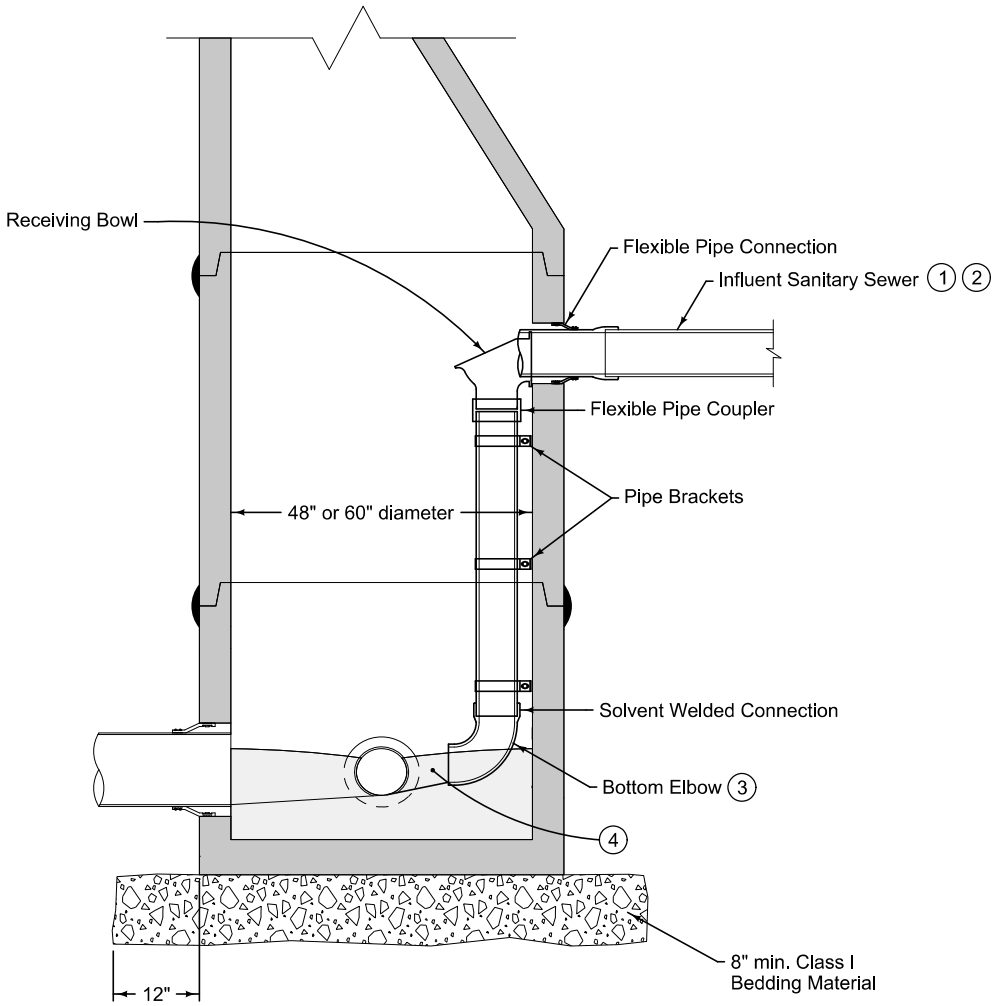
REVISIONS: Changed 1 to I on Bedding Material in Note 1. Added EXTERNAL to title.

Paul D. Wigand
SUDAS DIRECTOR

Stuart Nicholson
DESIGN METHODS ENGINEER

EXTERNAL DROP CONNECTION FOR SANITARY SEWER MANHOLE

FIGURE 6010.307 SHEET 1 OF 1



1. Core drill openings at least 12 inches from existing manhole joints.
2. Install flexible pipe coupler or pipe joint on new sanitary sewer 18 to 24 inches from outside of manhole wall.
3. Align elbow so discharge is directed at outlet pipe or at 45 degrees to manhole flow.
4. Reshape fillet to provide a smooth transition and to direct flow to outlet.

FIGURE 6010.308 | SHEET 1 OF 1

SUDAS | IOWADOT

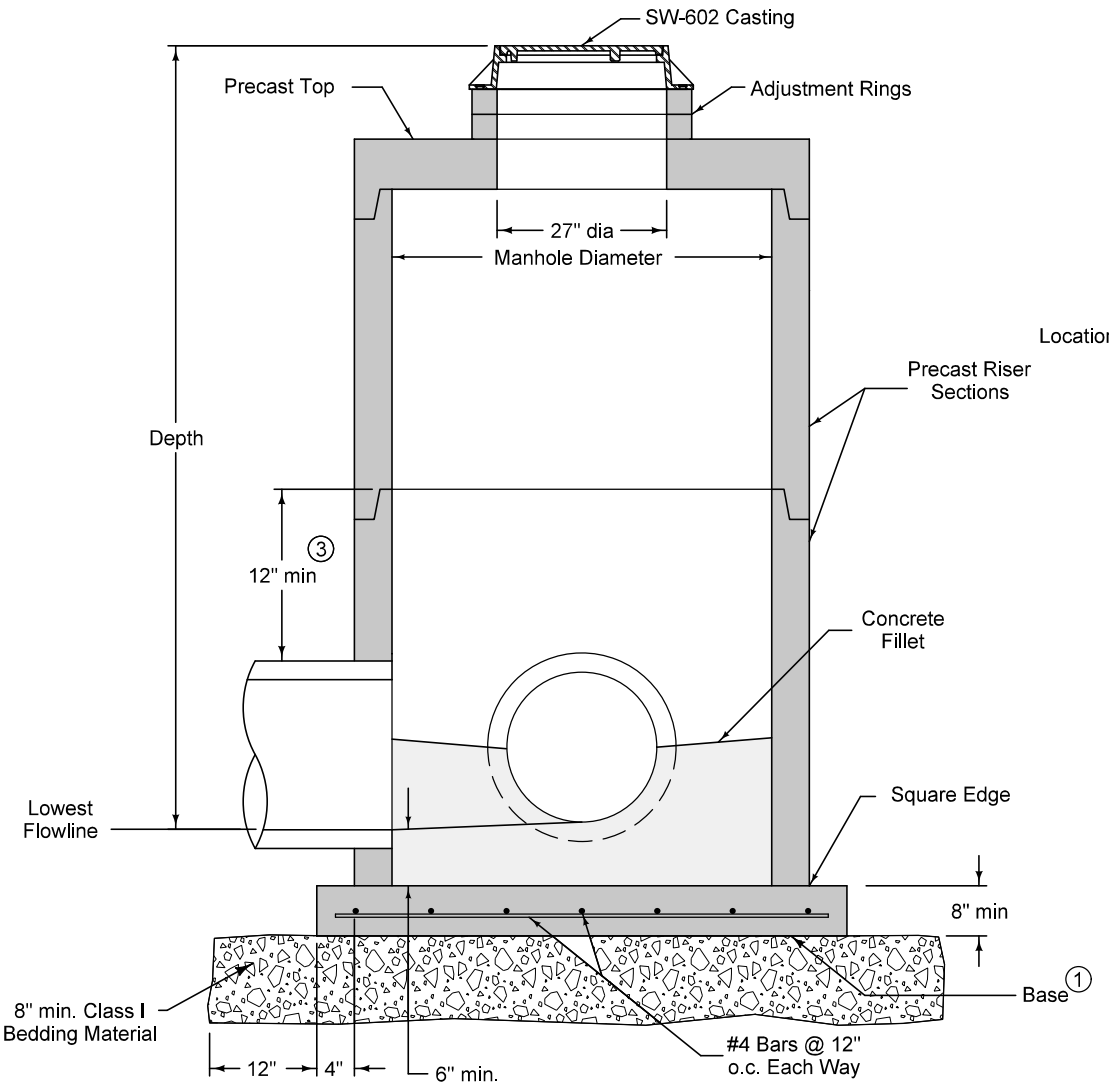
REVISION	
1	04-20-21

FIGURE 6010.308 | STANDARD ROAD PLAN | SW-308 | SHEET 1 of 1

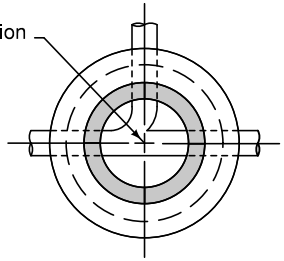
REVISIONS: Deleted top of manhole.

Paul D. Wigand, SUDAS DIRECTOR | Stuart Nicholson, DESIGN METHODS ENGINEER

INTERNAL DROP CONNECTION FOR SANITARY SEWER MANHOLE



TYPICAL SECTION



PLAN

If manhole depth exceeds 20 feet, install steps.

①Cast-in-place base shown. If base is precast integral with bottom riser, the footprint of the base is not required to extend beyond the outer edge of the riser.

②For additional configurations, maintain a minimum of 12 inches of concrete between vertical edges of pipe openings.

③12 inch minimum riser height above all pipe openings.

Manhole Diameter (inches)	Maximum Pipe Diameter② (inches) for 2 Pipes	
	At 180° Separation	At 90° Separation
48	24	18
60	36	24
72	42	30
84	48	36
96	60	42

FIGURE 6010.401 SHEET 1OF 1

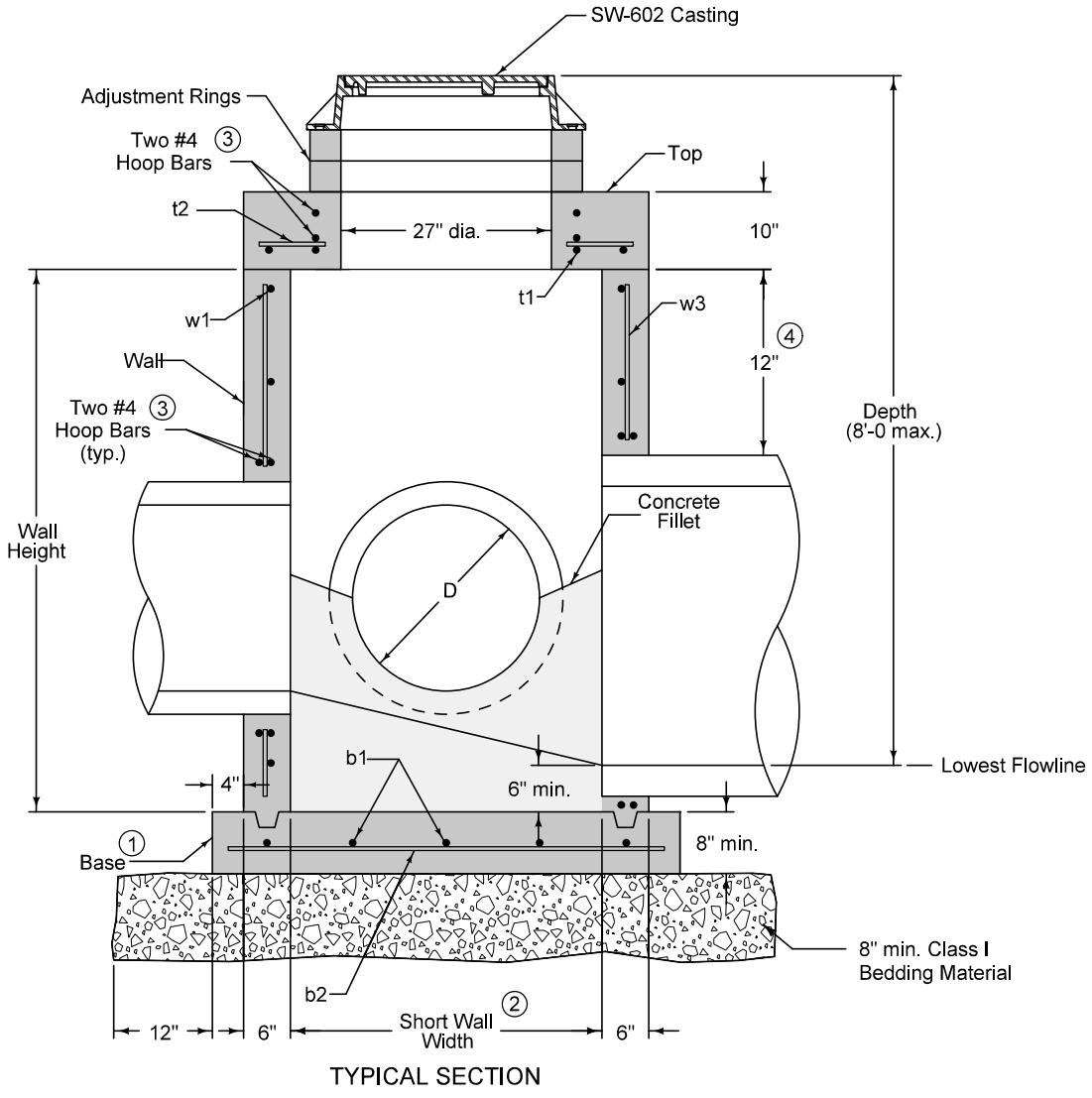
SUDAS | IOWADOT | REVISION 3 04-20-21

FIGURE 6010.401 | STANDARD ROAD PLAN | SW-401 | SHEET 1 of 1

REVISIONS: Added manhole depth note.

Paul D. Wigand, SUDAS DIRECTOR — Stuart Nicholson, DESIGN METHODS ENGINEER

CIRCULAR STORM SEWER MANHOLE



TYPICAL SECTION

Adjacent walls may have different widths based upon pipe configuration, but structure must be rectangular.

① Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.

② Wall widths vary with pipe diameter and range from 40 inches minimum to 77 inches maximum. Provide 6 inches of wall width (minimum) each side of pipe opening.

③ Provide two #4 hoop bars at top opening and at all pipe openings.

④ 12 inch minimum wall height above all pipes.

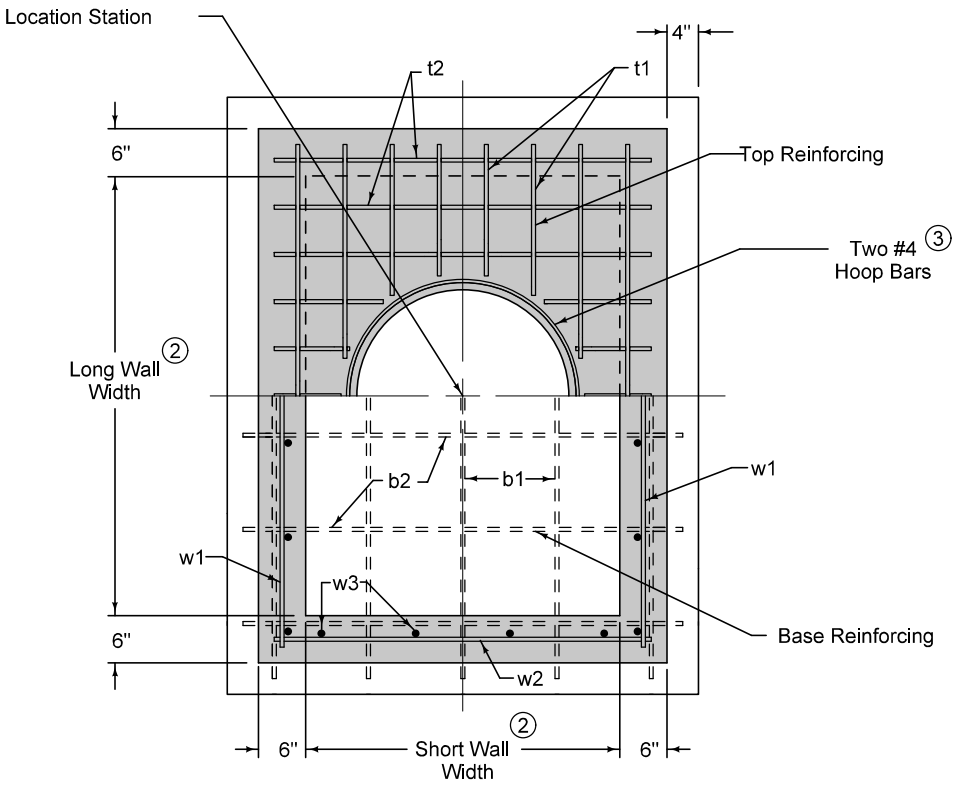
FIGURE 6010.402 SHEET 1 OF 2

SUDAS	IOWA DOT	REVISION 2 04-21-20
FIGURE 6010.402	STANDARD ROAD PLAN	SW-402
		SHEET 1 of 2

REVISIONS: Added Class I Bedding Material.

Paul D. Wigant — SUDAS DIRECTOR
Stuart Nielsen — DESIGN METHODS ENGINEER

RECTANGULAR STORM SEWER MANHOLE



PLAN

② Wall widths vary with pipe diameter and range from 40" minimum to 77" maximum. Provide 6" of wall width (minimum) each side of pipe opening.

③ Provide two #4 hoop bars at top opening and at all pipe openings.

REINFORCING BAR LIST					
Mark	Size	Location	Shape	Length	Spacing
t1	See Table	Top	——	Long Wall plus 8"	6"
t2	See Table	Top	——	Short Wall plus 8"	6"
b1	See Table	Base	——	Long Wall plus 14"	12"
b2	See Table	Base	——	Short Wall plus 14"	12"
w1	See Table	Walls	——	Long Wall plus 8"	12"
w2	See Table	Walls	——	Short Wall plus 8"	12"
w3	See Table	Walls	——	Wall Height minus 4"	12"

Diameter of Largest Pipe, D	Minimum Bar Size
48" or 54"	6
33" to 42"	5
30" or smaller	4

FIGURE 6010.402 SHEET 2 OF 2

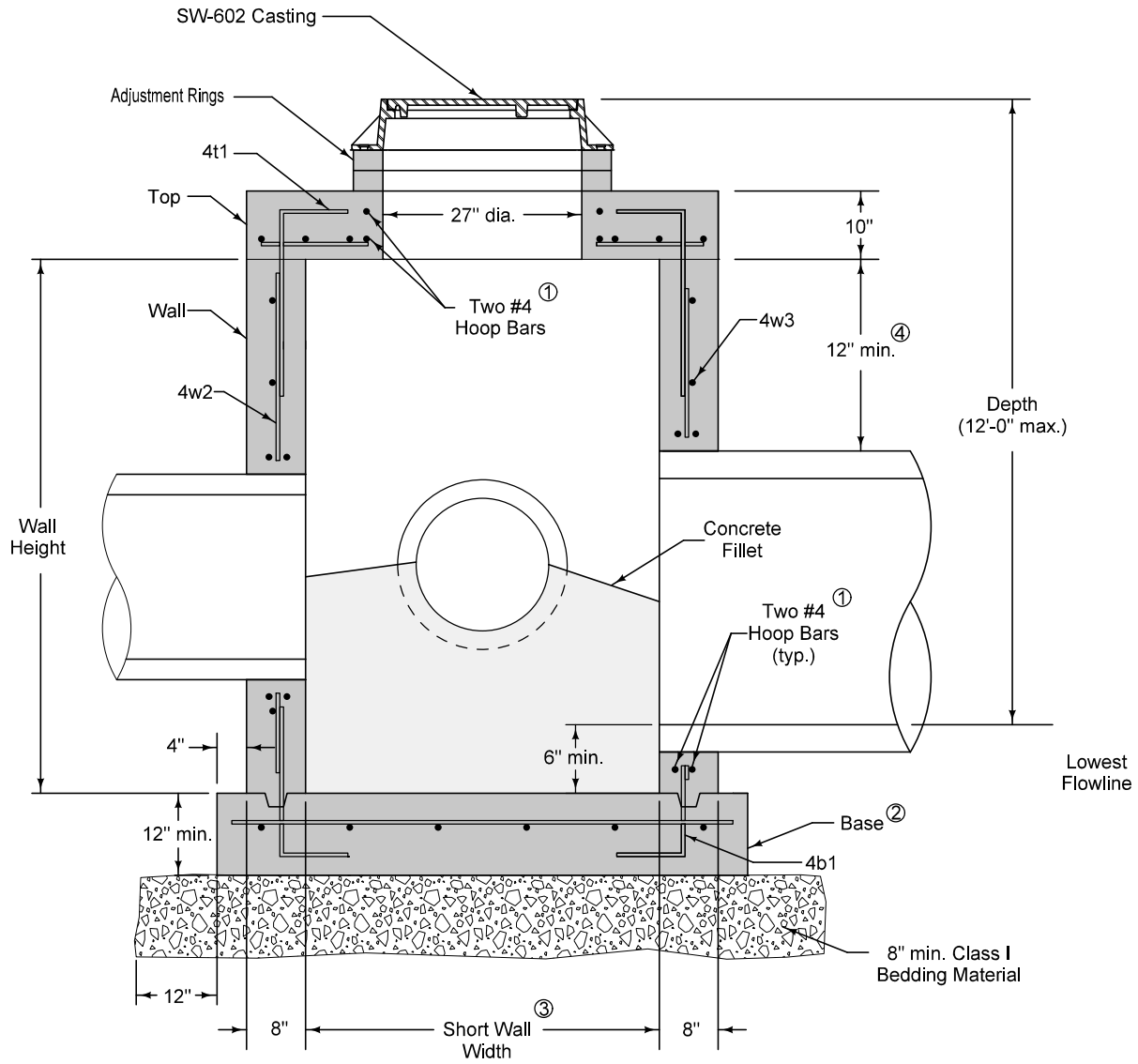
SUDAS | IOWADOT | REVISION 2 04-21-20

FIGURE 6010.402 | STANDARD ROAD PLAN | SW-402 | SHEET 2 of 2

REVISIONS: Added Class I Bedding Material.

SUDAS DIRECTOR | DESIGN METHODS ENGINEER

RECTANGULAR STORM SEWER MANHOLE



TYPICAL SECTION

Adjacent walls may have different widths based upon pipe configuration, but structure must be rectangular.

① Provide two #4 hoop bars at top opening and at all pipe openings.

② Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.

③ Wall widths vary with pipe diameter and range from 4 feet minimum to 9 feet maximum. Provide 12 inches of wall width (minimum) each side of pipe opening.

④ 12 inch minimum wall height above all pipes.

SUDAS	IOWA DOT	REVISION 2	04-21-20
FIGURE 6010.403	STANDARD ROAD PLAN	SW-403	SHEET 1 of 2

REVISIONS: Added Class I Bedding Material.

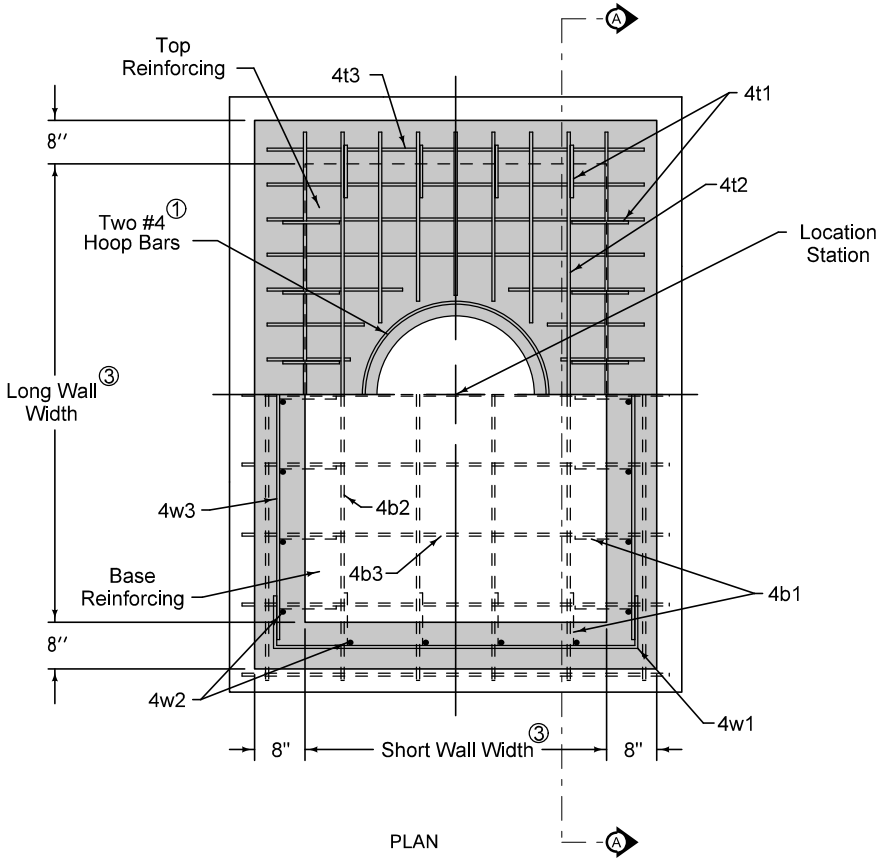
Paul D. Wigand — SUDAS DIRECTOR
Stuart Nielsen — DESIGN METHODS ENGINEER

DEEP WELL RECTANGULAR STORM SEWER MANHOLE

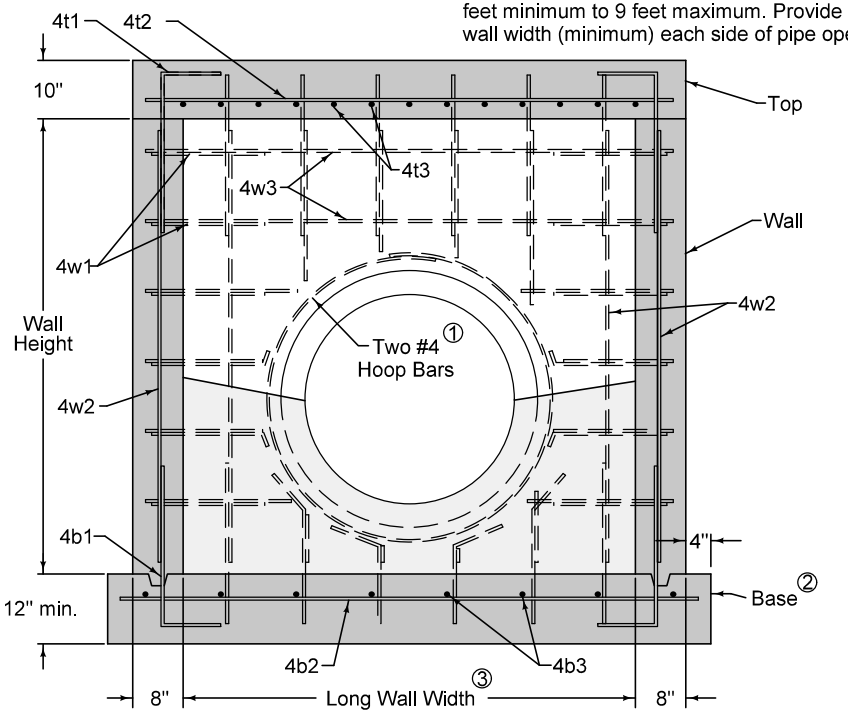
① Provide two #4 hoop bars at top opening and at all pipe openings.

② Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of walls.

③ Wall widths vary with pipe diameter and range from 4 feet minimum to 9 feet maximum. Provide 12 inches of wall width (minimum) each side of pipe opening.



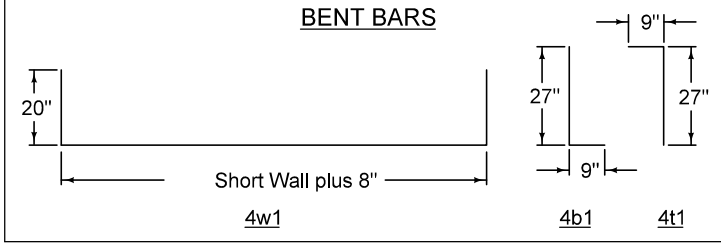
PLAN



SECTION A-A

REINFORCING BAR LIST					
Mark	Size	Location	Shape	Length	Spacing
4t1	4	Top	⌐	36"	12"
4t2	4	Top	—	Long Wall plus 12"	6"
4t3	4	Top	—	Short Wall plus 12"	6"
4b1	4	Base	⌊	36"	12"
4b2	4	Base	—	Long Wall plus 18"	12"
4b3	4	Base	—	Short Wall plus 18"	12"
4w1	4	Walls	⌐ ⌐	Short Wall plus 48"	12"
4w2	4	Walls	—	Wall Height minus 4"	12"
4w3	4	Walls	—	Long Wall plus 12"	12"

BENT BARS



SUDAS | IOWA DOT | REVISION 2 04-21-20

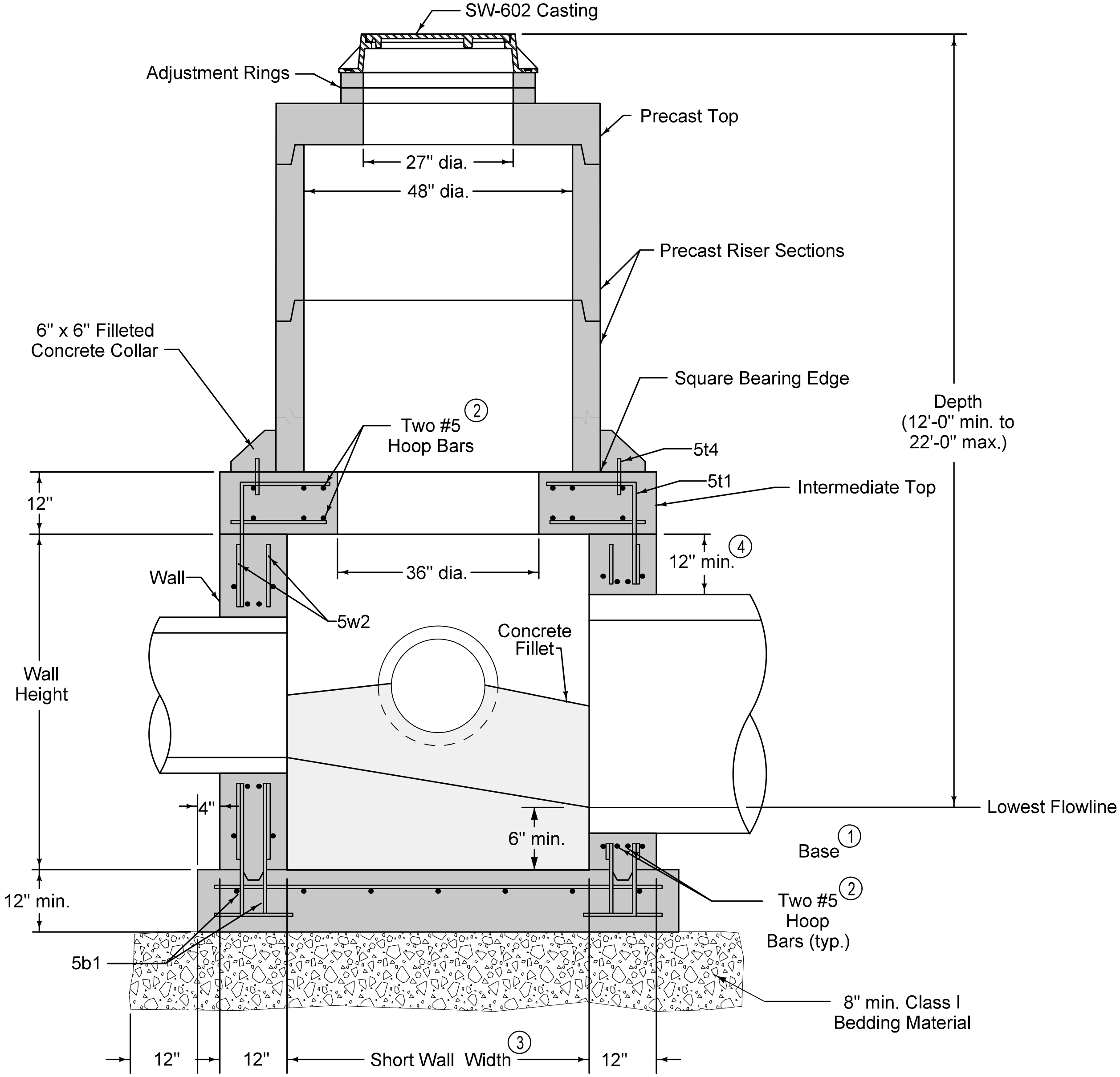
FIGURE 6010.403 | STANDARD ROAD PLAN | SW-403 | SHEET 2 of 2

REVISIONS: Added Class I Bedding Material.

Paul D. Wigand, SUDAS DIRECTOR — Stuart Nicholson, DESIGN METHODS ENGINEER

DEEP WELL RECTANGULAR STORM SEWER MANHOLE

FIGURE 6010.403 SHEET 2 OF 2



TYPICAL SECTION

Adjacent walls may have different widths based upon pipe configuration, but structure must be rectangular.

If manhole depth exceeds 20 feet, install steps.

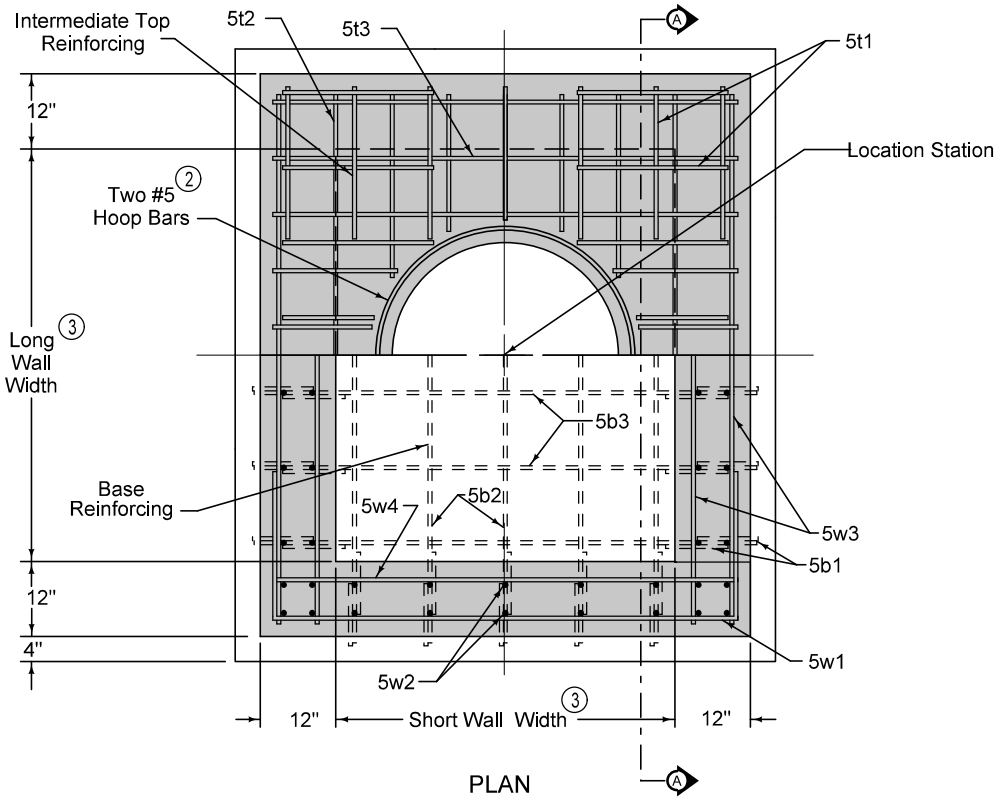
1. Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.
2. Provide two #5 hoop bars at intermediate top opening and at all pipe openings.
3. Wall widths vary with pipe diameter and range from 4 feet minimum to 12 feet maximum. Provide 12 inches of wall width (minimum) each side of pipe opening.
4. 12 inch minimum wall height above all pipes.

SUDAS	IOWADOT	REVISION 4 04-20-21
FIGURE 6010.404	STANDARD ROAD PLAN	SW-404 SHEET 1 of 2

REVISIONS: Added manhole depth note.

SUDAS DIRECTOR — DESIGN METHODS ENGINEER

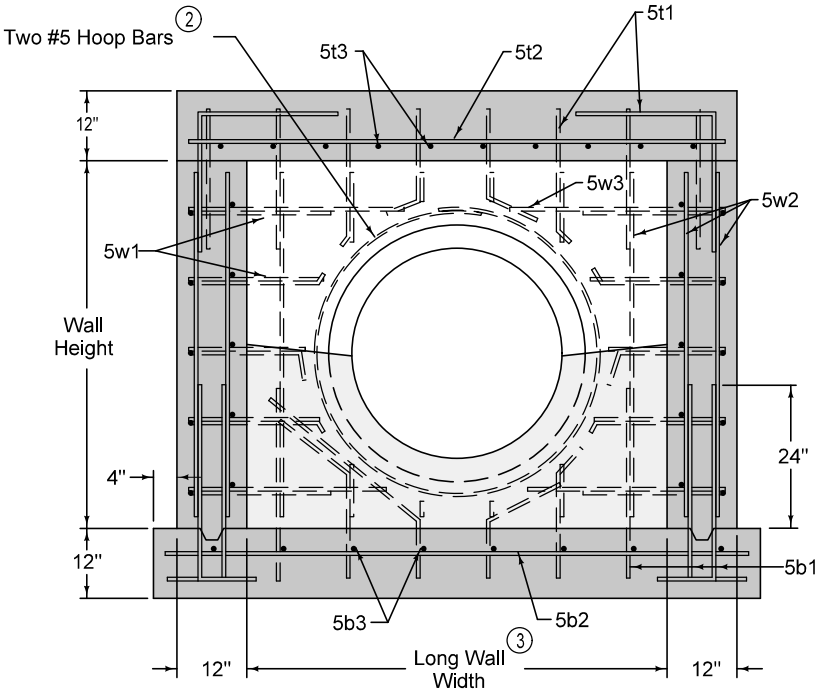
RECTANGULAR BASE/ CIRCULAR TOP STORM SEWER MANHOLE



PLAN

② Provide two #5 hoop bars at intermediate top opening and at all pipe openings.

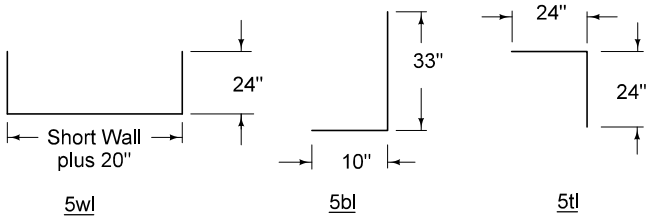
③ Wall widths vary with pipe diameter and range from 4 feet minimum to 12 feet maximum. Provide 12 inches of wall width (minimum) each side of pipe opening.



SECTION A-A

REINFORCING BAR LIST					
Mark	Size	Location	Shape	Length	Spacing
5t1	5	Top	L	48"	12"
5t2	5	Top	—	Long Wall plus 20"	9"
5t3	5	Top	—	Short Wall plus 20"	9"
5t4	5	Top	—	8"	12"
5b1	5	Base	L	43"	12"
5b2	5	Base	—	Long Wall plus 26"	12"
5b3	5	Base	—	Short Wall plus 26"	12"
5w1	5	Wall	⌐	Short Wall plus 68"	12"
5w2	5	Wall	—	Wall Height minus 4"	12"
5w3	5	Wall	—	Long Wall plus 20"	12"
5w4	5	Wall	—	Short Wall plus 20"	12"

BENT BARS



SUDAS | IOWADOT | REVISION 4 04-20-21

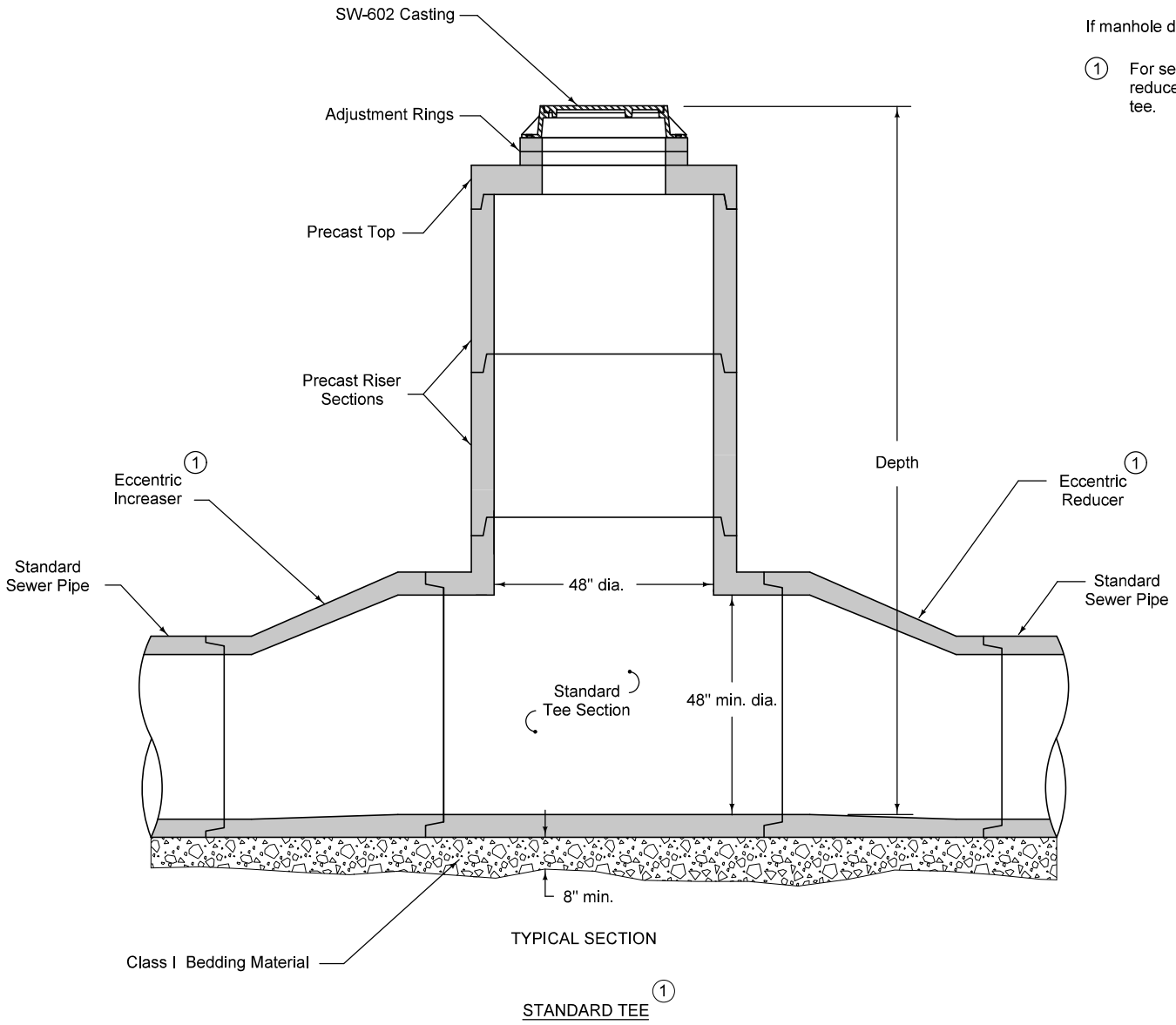
FIGURE 6010.404 | STANDARD ROAD PLAN | SW-404 | SHEET 2 of 2

REVISIONS: Added manhole depth note.

Paul D. Wigand, SUDAS DIRECTOR — Stuart Nicholson, DESIGN METHODS ENGINEER

RECTANGULAR BASE/ CIRCULAR TOP STORM SEWER MANHOLE

FIGURE 6010.404 | SHEET 2 OF 2



TYPICAL SECTION

STANDARD TEE (1)

If manhole depth exceeds 20 feet, install steps.

(1) For sewer pipes less than 48 inch diameter, install eccentric reducers/increasers with a standard tee or utilize a composite tee.

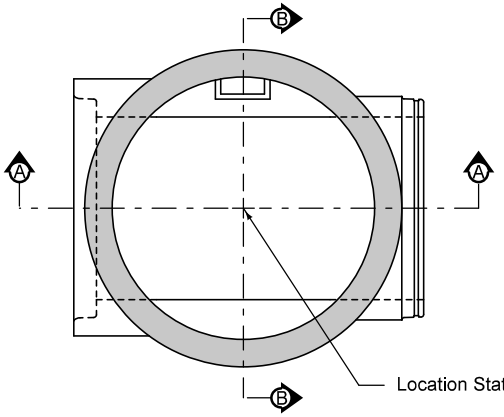
SUDAS	IOWA DOT	REVISION 4 04-20-21
FIGURE 6010.405	STANDARD ROAD PLAN	SW-405
		SHEET 1 of 2

REVISIONS: Added manhole depth note.

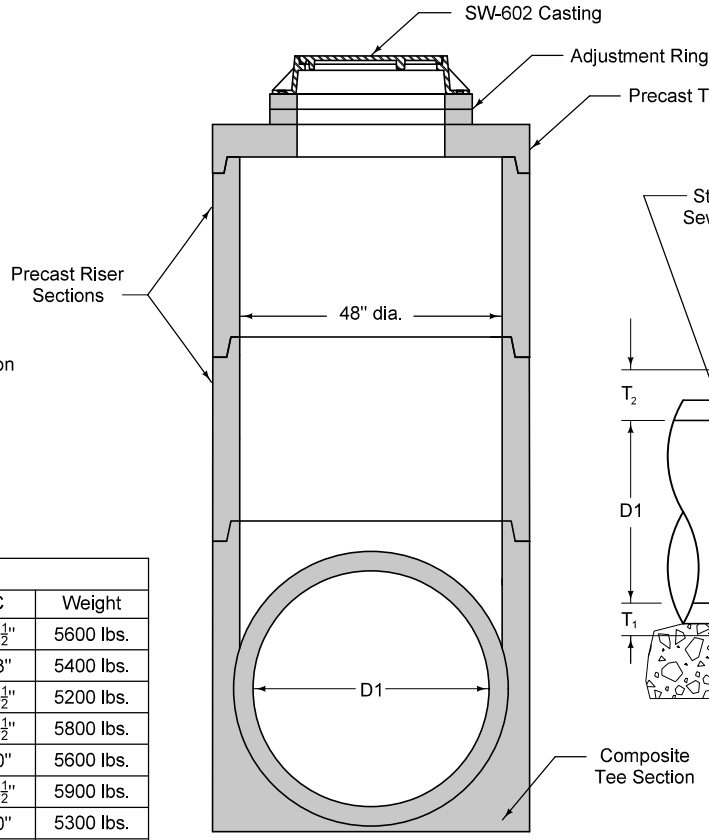
Paul D. Wigard, SUDAS DIRECTOR — DESIGN METHODS ENGINEER

TEE-SECTION
STORM SEWER MANHOLE

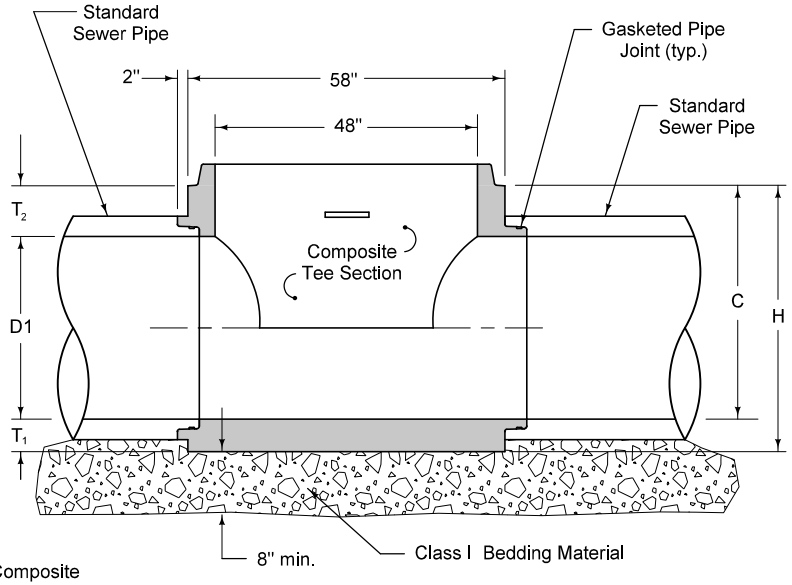
FIGURE 6010.405 SHEET 1 OF 2



PLAN



SECTION B-B



SECTION A-A

COMPOSITE TEE DIMENSIONS						
Size	D1	H	T_1	T_2	C	Weight
48" on 12"	12"	50"	$8\frac{1}{2}$"	$29\frac{1}{2}$"	$41\frac{1}{2}$"	5600 lbs.
48" on 15"	15"	50"	7"	28"	43"	5400 lbs.
48" on 18"	18"	50"	$5\frac{1}{2}$"	$26\frac{1}{2}$"	$44\frac{1}{2}$"	5200 lbs.
48" on 21"	21"	48"	$9\frac{1}{2}$"	$17\frac{1}{2}$"	$38\frac{1}{2}$"	5800 lbs.
48" on 24"	24"	48"	8"	16"	40"	5600 lbs.
48" on 27"	27"	48"	$9\frac{1}{2}$"	$11\frac{1}{2}$"	$38\frac{1}{2}$"	5900 lbs.
48" on 30"	30"	48"	8"	10"	40"	5300 lbs.
48" on 33"	33"	54"	$9\frac{1}{2}$"	$11\frac{1}{2}$"	$44\frac{1}{2}$"	6600 lbs.
48" on 36"	36"	54"	8"	10"	46"	6100 lbs.

COMPOSITE TEE

Alternate to standard tee with eccentric reducer (for pipes 36" and smaller).

FIGURE 6010.405 SHEET 2 OF 2

SUDAS | IOWADOT | REVISION 4 04-20-21

FIGURE 6010.405 | STANDARD ROAD PLAN | SW-405 | SHEET 2 of 2

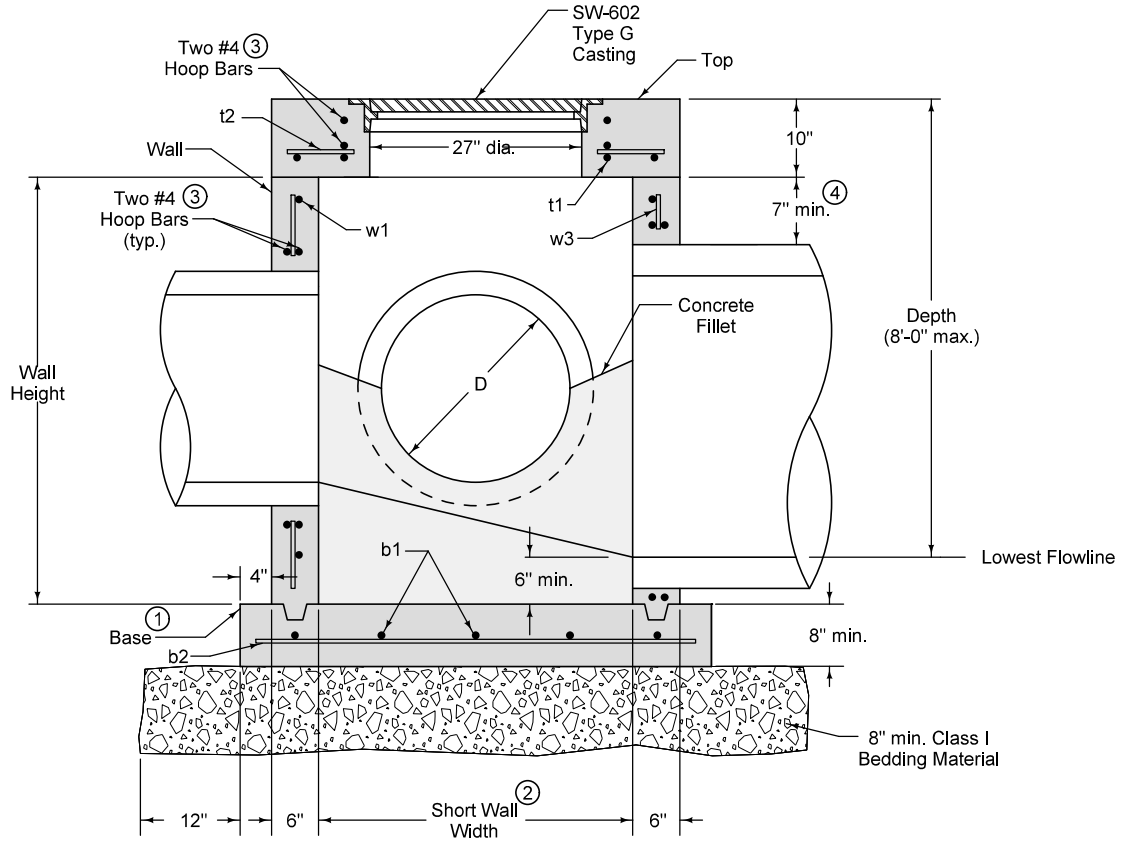
REVISIONS: Added manhole depth note.

Paul D. Wigand, SUDAS DIRECTOR

Stuart Nicholson, DESIGN METHODS ENGINEER

TEE-SECTION
STORM SEWER MANHOLE

Adjacent walls may have different widths based upon pipe configuration, but structure must be rectangular.



TYPICAL SECTION

① Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.

② Wall widths vary with pipe diameter and range from 40 inches minimum to 77 inches maximum. Provide 6 inches of wall width (minimum) each side of pipe opening.

③ Provide two #4 hoop bars at top opening and at all pipe openings.

④ 7 inch minimum wall height above all pipes.

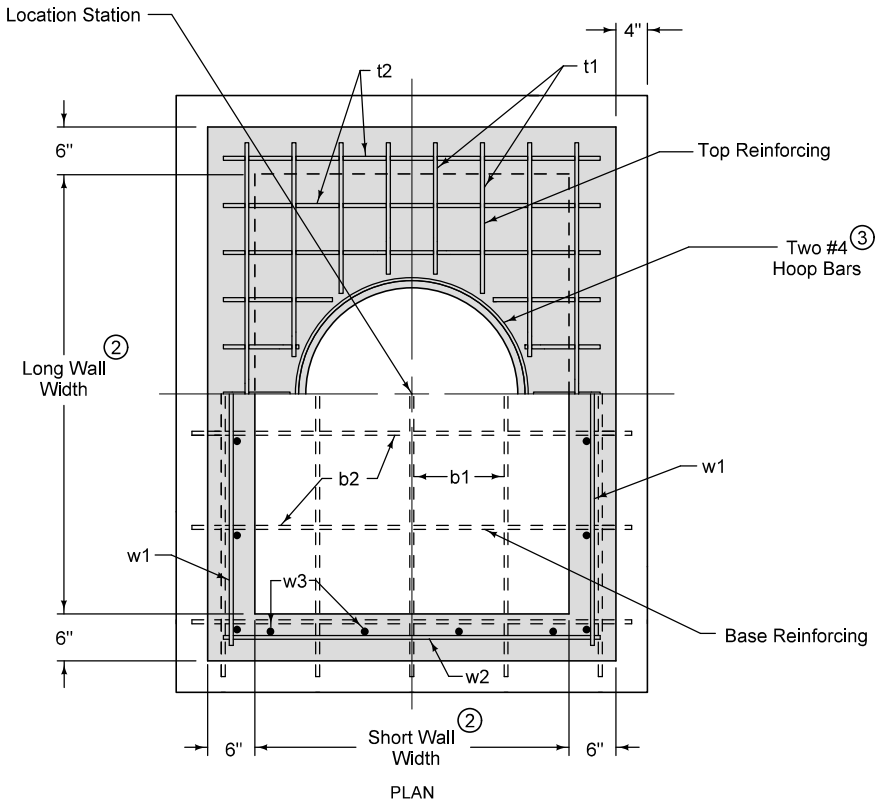
FIGURE 6010.406 SHEET 1 OF 2

SUDAS	IOWA DOT	REVISION 2 04-21-20
FIGURE 6010.406	STANDARD ROAD PLAN	SW-406
		SHEET 1 of 2

REVISIONS: Added Class I Bedding Material.

Paul D. Wigard — SUDAS DIRECTOR
Stuart Nicholson — DESIGN METHODS ENGINEER

SHALLOW RECTANGULAR STORM SEWER MANHOLE



PLAN

② Wall widths vary with pipe diameter and range from 40 inches minimum to 77 inches maximum. Provide 6 inches of wall width (minimum) each side of pipe opening.

③ Provide two #4 hoop bars at top opening and at all pipe openings.

REINFORCING BAR LIST					
Mark	Size	Location	Shape	Length	Spacing
t1	See Table	Top	——	Long Wall plus 8"	6"
t2	See Table	Top	——	Short Wall plus 8"	6"
b1	See Table	Base	——	Long Wall plus 14"	12"
b2	See Table	Base	——	Short Wall plus 14"	12"
w1	See Table	Walls	——	Long Wall plus 8"	12"*
w2	See Table	Walls	——	Short Wall plus 8"	12"
w3	See Table	Walls	——	Wall Height minus 4"	12"

*Place a minimum of one w1 bar above each pipe opening

Diameter of Largest Pipe, D	Minimum Bar Size
48" or 54"	6
33" to 42"	5
30" or smaller	4

FIGURE 6010.406 SHEET 2 OF 2

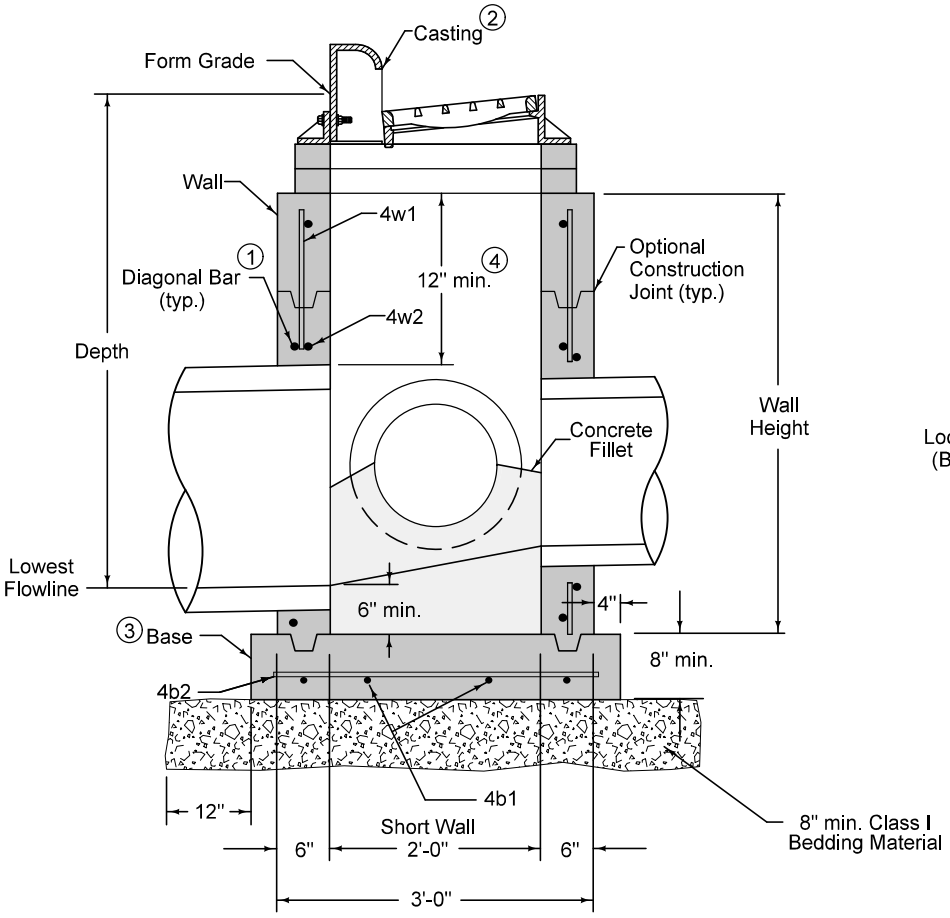
SUDAS | IOWADOT | REVISION 2 04-21-20

FIGURE 6010.406 | STANDARD ROAD PLAN | SW-406 | SHEET 2 of 2

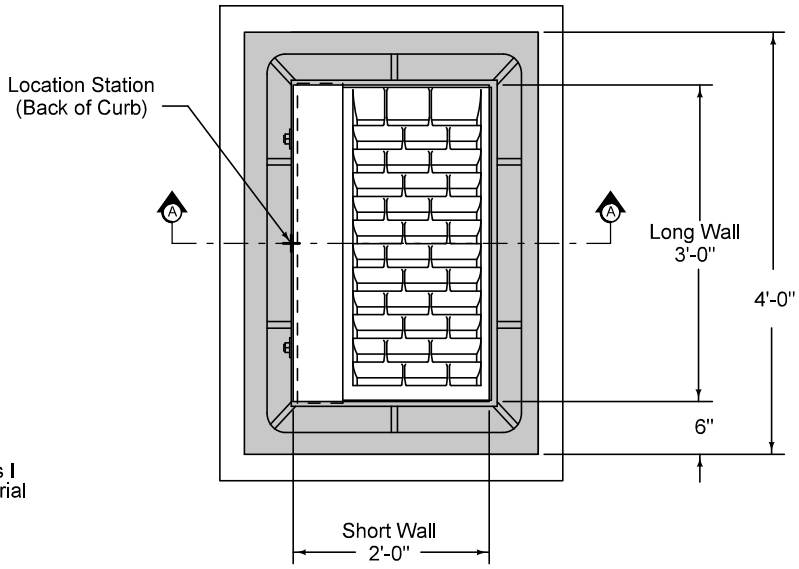
REVISIONS: Added Class I Bedding Material.

Paul D. Wigand, SUDAS DIRECTOR — Stuart Nicholson, DESIGN METHODS ENGINEER

SHALLOW RECTANGULAR STORM SEWER MANHOLE



SECTION A-A



PLAN

Refer to SW-514 for boxout details.

1. Install four #4 diagonal bars at all pipe openings.
2. SW-603 Type R unless Type Q is specified in the contract documents.
3. Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.
4. 12 inch minimum wall height above all pipes.

REINFORCING BAR LIST						
Mark	Size	Location	Shape	Length	Count	Spacing
4w1	4	Walls	———	Wall Height minus 4"	14	12"
4w2	4	Long Walls	———	3'-8"	Varies	12"
4w3	4	Short Walls	———	2'-8"	Varies	12"
4b1	4	Base	———	4'-2"	4	10"
4b2	4	Base	———	3'-2"	5	10"

MAXIMUM PIPE DIAMETERS		
Pipe Location	Precast Structure	Cast-in-place Structure
Short Wall	15"	18"
Long Wall	24"	30"

SUDAS | IOWA DOT | REVISION 3 04-21-20

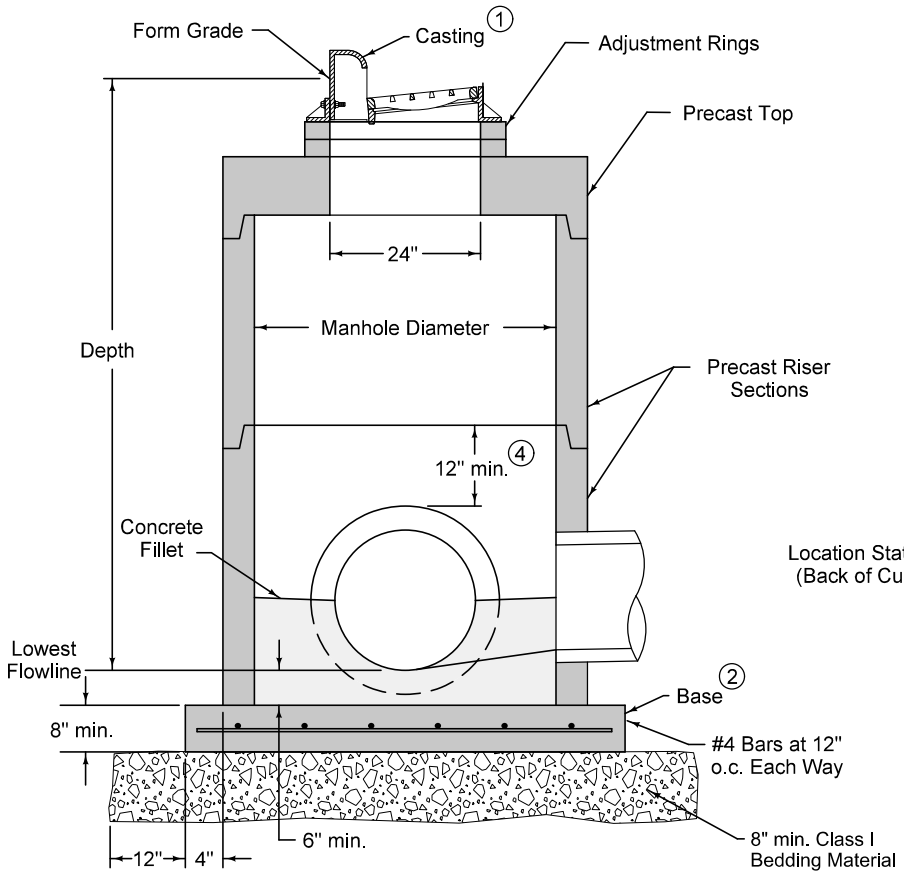
FIGURE 6010.501 | STANDARD ROAD PLAN | SW-501 | SHEET 1 of 1

REVISIONS: Added Class I Bedding Material.

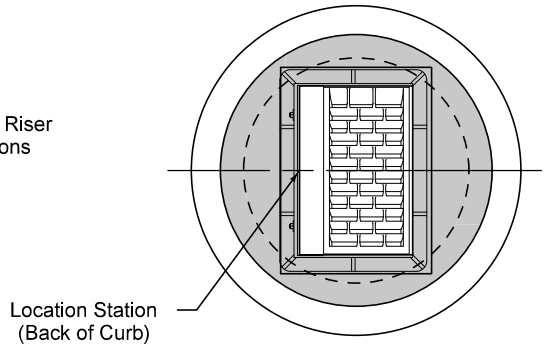
Paul D. Wigand, SUDAS DIRECTOR | Stuart Nicholson, DESIGN METHODS ENGINEER

SINGLE GRATE INTAKE

FIGURE 6010.501 | SHEET 1 OF 1



TYPICAL SECTION



PLAN

Refer to SW-514 for boxout details.

① SW-603 Type R unless Type Q is specified in the contract documents.

② Cast-in-place base shown. Base may be square. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.

③ For additional configurations, maintain a minimum of 12 inches of concrete between vertical edges of pipe openings.

④ 12 inch minimum riser height above all pipes.

Manhole Diameter (inches)	Maximum Pipe Diameter ③ (inches) for 2 Pipes	
	at 180° Separation	at 90° Separation
48	24	18
60	36	24
72	42	30
84	48	36
96	60	42

SUDAS | IOWA DOT | REVISION 1 04-21-20

FIGURE 6010.502 | STANDARD ROAD PLAN | SW-502 | SHEET 1 of 1

REVISIONS: Added Class I Bedding Material.

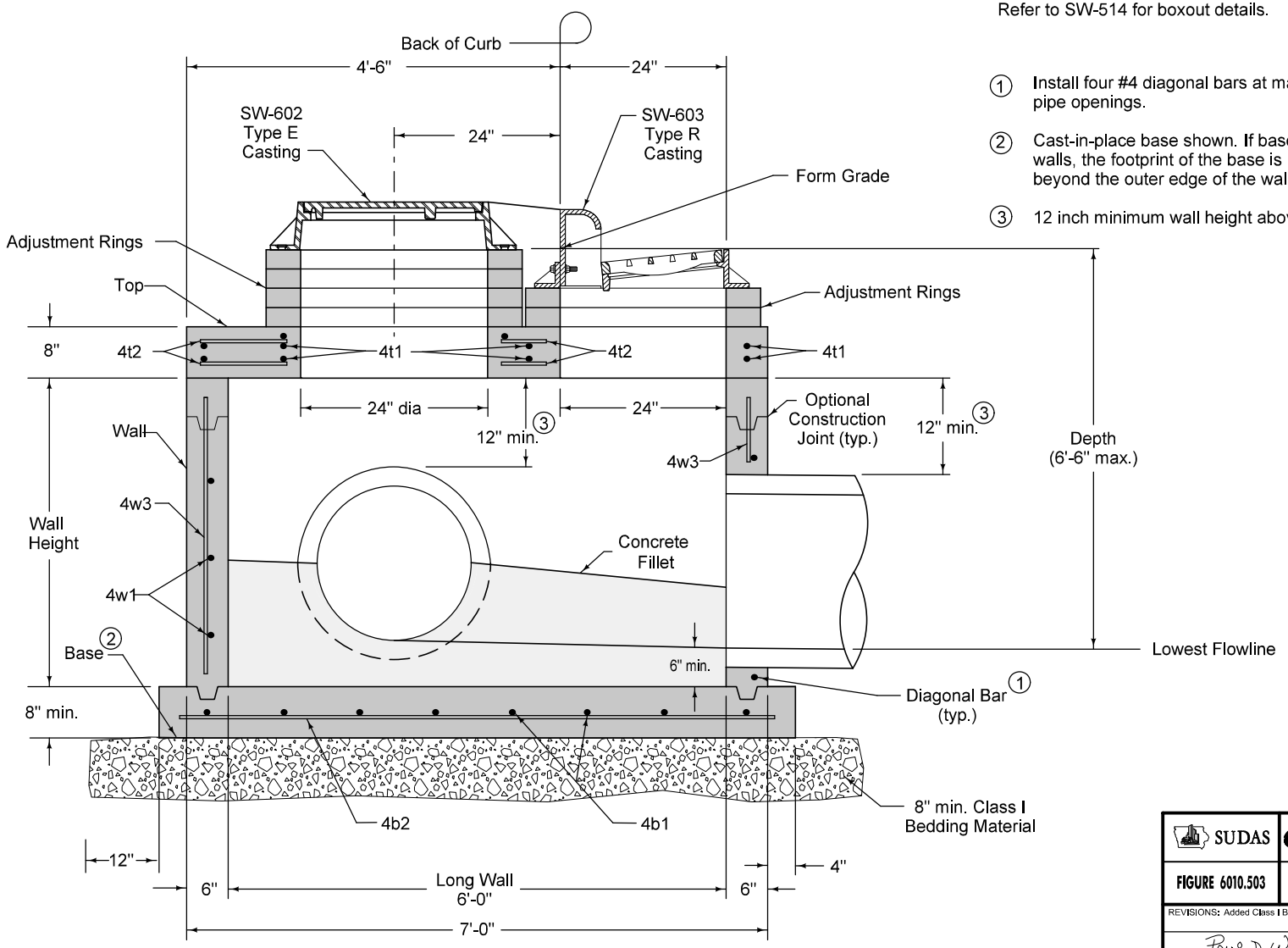
Paul D. Wigand, SUDAS DIRECTOR | Stuart Nicholson, DESIGN METHODS ENGINEER

CIRCULAR SINGLE GRATE INTAKE

FIGURE 6010.502 SHEET 1 OF 1

Refer to SW-514 for boxout details.

1. Install four #4 diagonal bars at manhole opening and at all pipe openings.
2. Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.
3. 12 inch minimum wall height above all pipes.



TYPICAL SECTION

SUDAS	IOWA DOT	REVISION 3 04-21-20
FIGURE 6010.503	STANDARD ROAD PLAN	SW-503
		SHEET 1 of 2

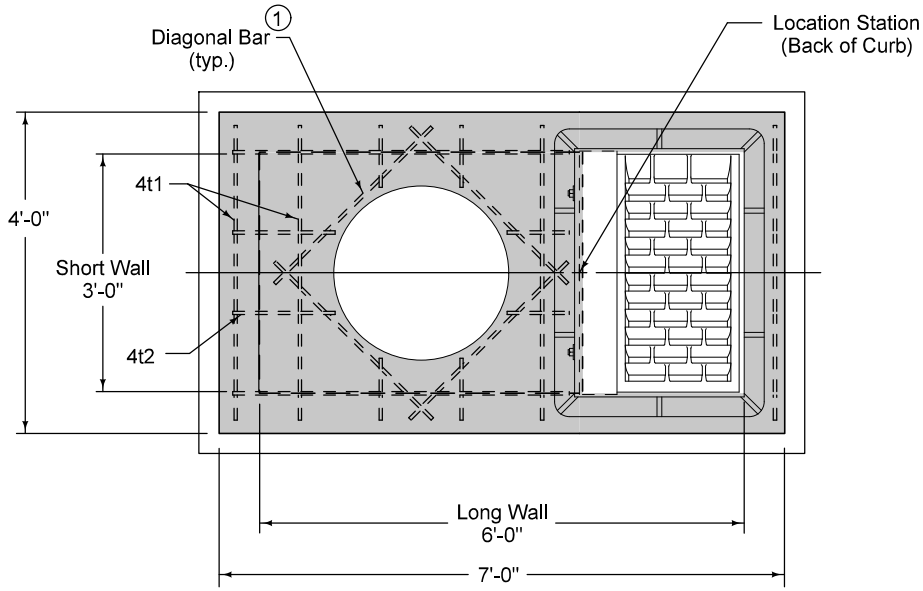
REVISIONS: Added Class I Bedding Material.

Paul D. Wigand — SUDAS DIRECTOR
Stuart Nicholson — DESIGN METHODS ENGINEER

SINGLE GRATE INTAKE WITH MANHOLE

FIGURE 6010.503 SHEET 1 OF 2

① Install four #4 diagonal bars at manhole opening and at all pipe openings.



PLAN

REINFORCING BAR LIST						
Mark	Size	Location	Shape	Count	Length	Spacing
4t1	4	Top	——	12	3'-8"	12"
4t2	4	Top	——	8	4'-2"	12"
4b1	4	Base	——	7	4'-2"	13"
4b2	4	Base	——	5	7'-2"	10"
4w1	4	Short Walls	——	Varies	3'-8"	12"
4w2	4	Long Walls	——	Varies	6'-8"	12"
4w3	4	Walls	——	18	Wall Height minus 4"	13"

MAXIMUM PIPE DIAMETERS		
Pipe Location	Precast Structure	Cast-in-place Structure
Short Wall	24"	30"
Long Wall	30"	36"

SUDAS | IOWA DOT | REVISION 3 04-21-20

FIGURE 6010.503 | STANDARD ROAD PLAN | SW-503 | SHEET 2 of 2

REVISIONS: Added Class I Bedding Material.

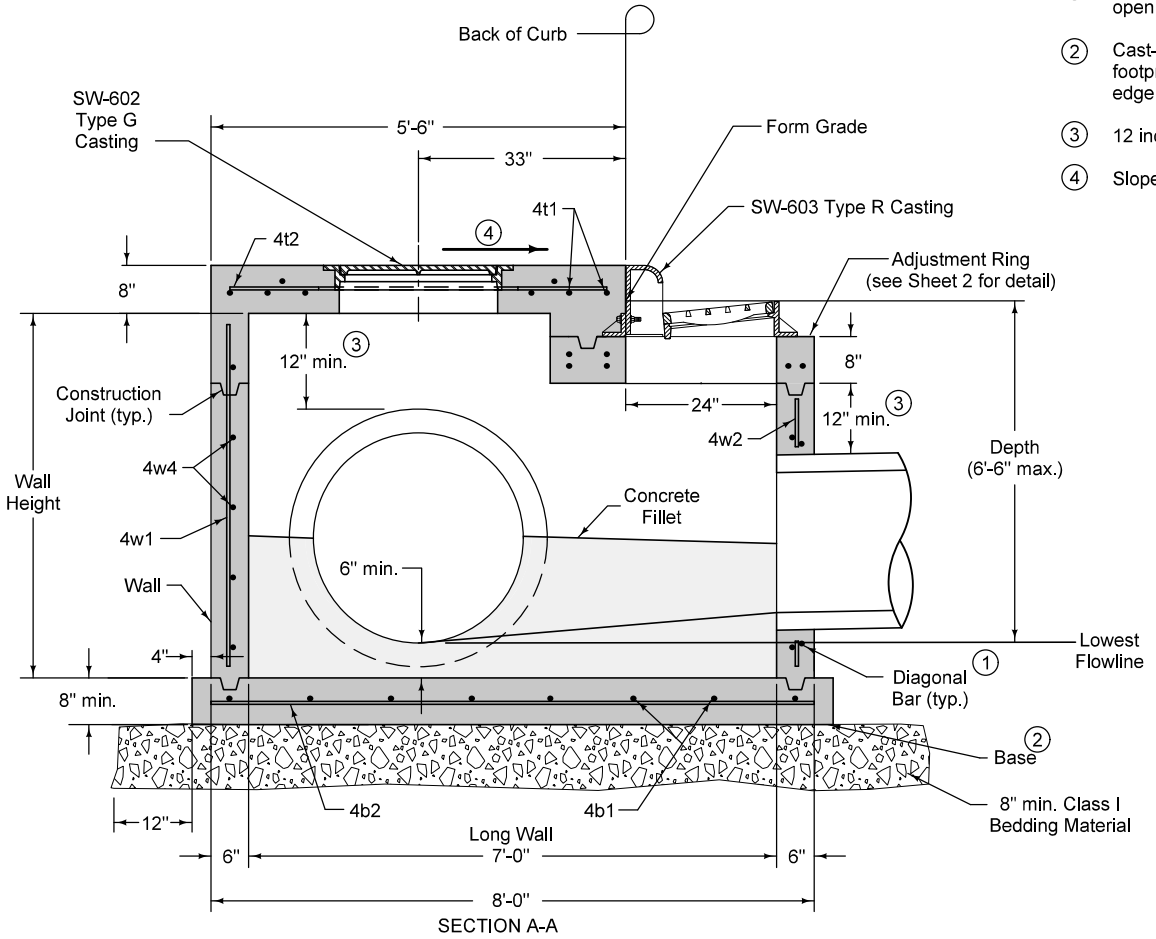
Paul D. Wigand, SUDAS DIRECTOR — Stuart Nicholson, DESIGN METHODS ENGINEER

SINGLE GRATE INTAKE WITH MANHOLE

FIGURE 6010.503 SHEET 2 OF 2

Refer to SW-514 for boxout details.

1. Install four #4 diagonal bars at manhole opening and at all pipe openings.
2. Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.
3. 12 inch minimum wall height above all pipes.
4. Slope of 1.5% or as specified in the contract documents.



SECTION A-A

FIGURE 6010.504 | SHEET 1 OF 2

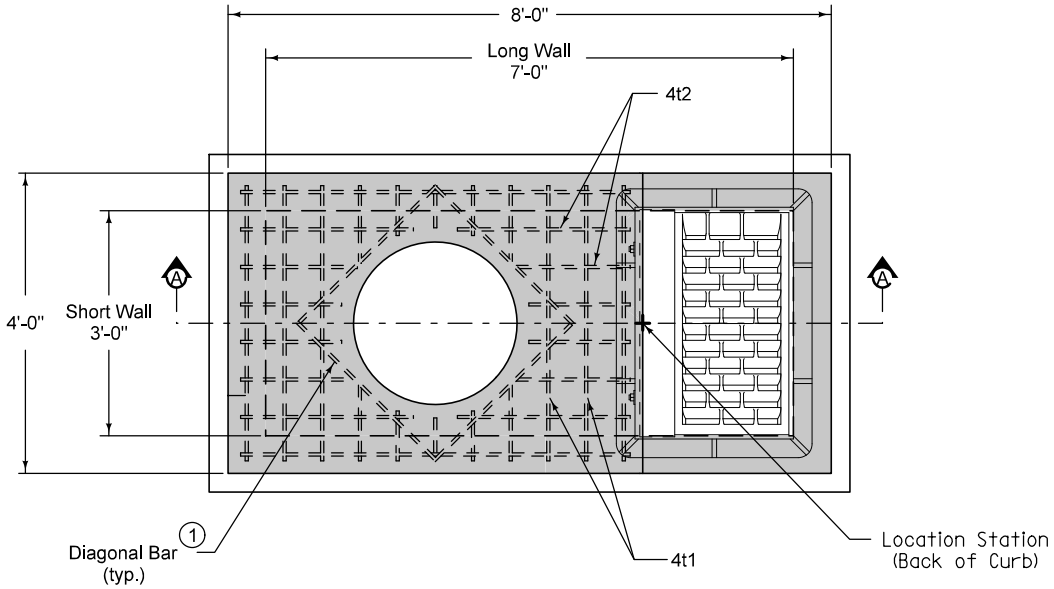
SUDAS	IOWA DOT	REVISION 4 04-21-20
FIGURE 6010.504	STANDARD ROAD PLAN	SW-504 SHEET 1 of 2

REVISIONS: Added Class I Bedding Material.

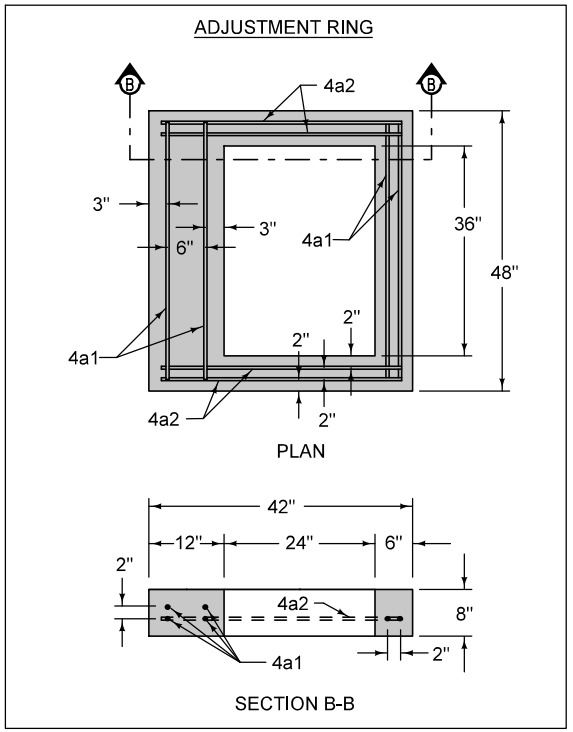
Paul D. Wigard, SUDAS DIRECTOR — DESIGN METHODS ENGINEER

SINGLE GRATE INTAKE WITH FLUSH-TOP MANHOLE

① Install four #4 diagonal bars at manhole opening and at all pipe openings.



PLAN



REINFORCING BAR LIST						
Mark	Size	Location	Shape	Count	Length	Spacing
4t1	4	Top	——	1 1	3'-8"	6"
4t2	4	Top	——	8	5'-2"	6"
4b1	4	Base	——	8	4'-2"	13"
4b2	4	Base	——	5	8'-2"	10"
4a1	4	Adj. Ring	——	6	3'-8"	See Adj. Ring Plan
4a2	4	Adj. Ring	——	4	3'-2"	See Adj. Ring Plan
4w1	4	Walls	——	13	Wall Height minus 4"	12"
4w2	4	Walls	——	1 1	Wall Height minus 16"	12"
4w3	4	Long Walls	——	Varies	7'-8"	12"
4w4	4	Short Walls	——	Varies	3'-8"	12"

MAXIMUM PIPE DIAMETERS		
Pipe Location	Precast Structure	Cast-in-place Structure
Short Wall	18"	24"
Long Wall	30"	36"

FIGURE 6010.504 SHEET 2 OF 2

SUDAS | IOWADOT

REVISION 4 04-21-20

FIGURE 6010.504 | STANDARD ROAD PLAN | SW-504 | SHEET 2 of 2

REVISIONS: Added Class I Bedding Material.

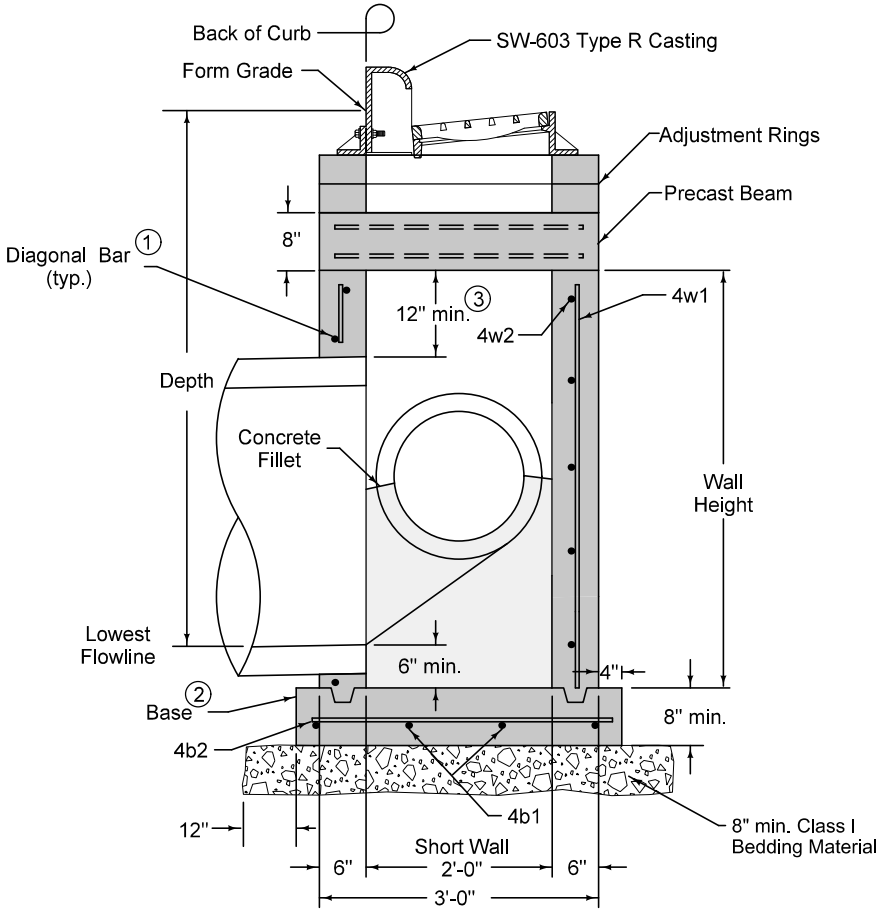
Paul D. Wigand
SUDAS DIRECTOR

Stuart Nicholson
DESIGN METHODS ENGINEER

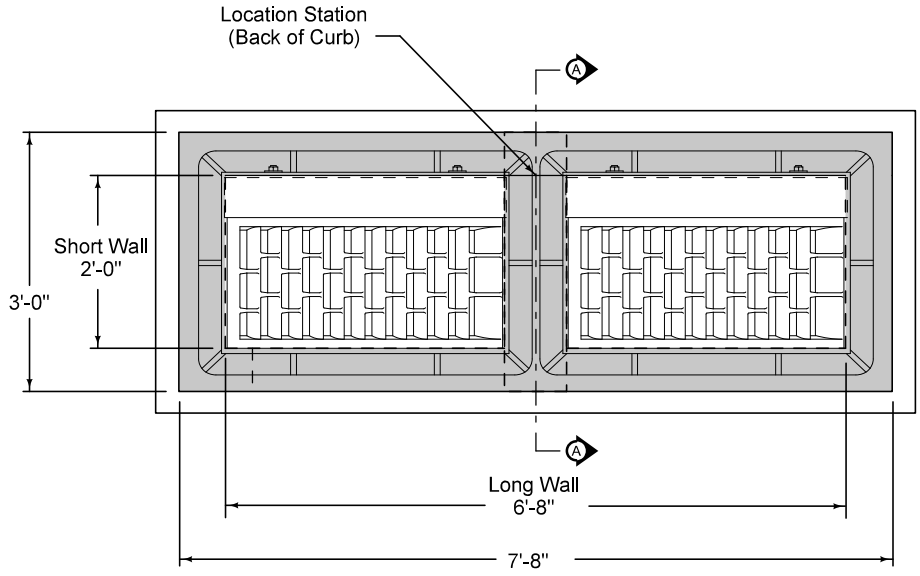
SINGLE GRATE INTAKE WITH FLUSH-TOP MANHOLE

Refer to SW-514 for boxout details.

1. Install four #4 diagonal bars at all pipe openings.
2. Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.
3. 12 inch minimum wall height above all pipes.



SECTION A-A



PLAN

FIGURE 6010.505 SHEET 1OF 2

SUDAS	IOWA DOT	REVISION 3 04-21-20
FIGURE 6010.505	STANDARD ROAD PLAN	SW-505
		SHEET 1 of 2

REVISIONS: Added Class I Bedding Material.

Paul D. Wigand — SUDAS DIRECTOR

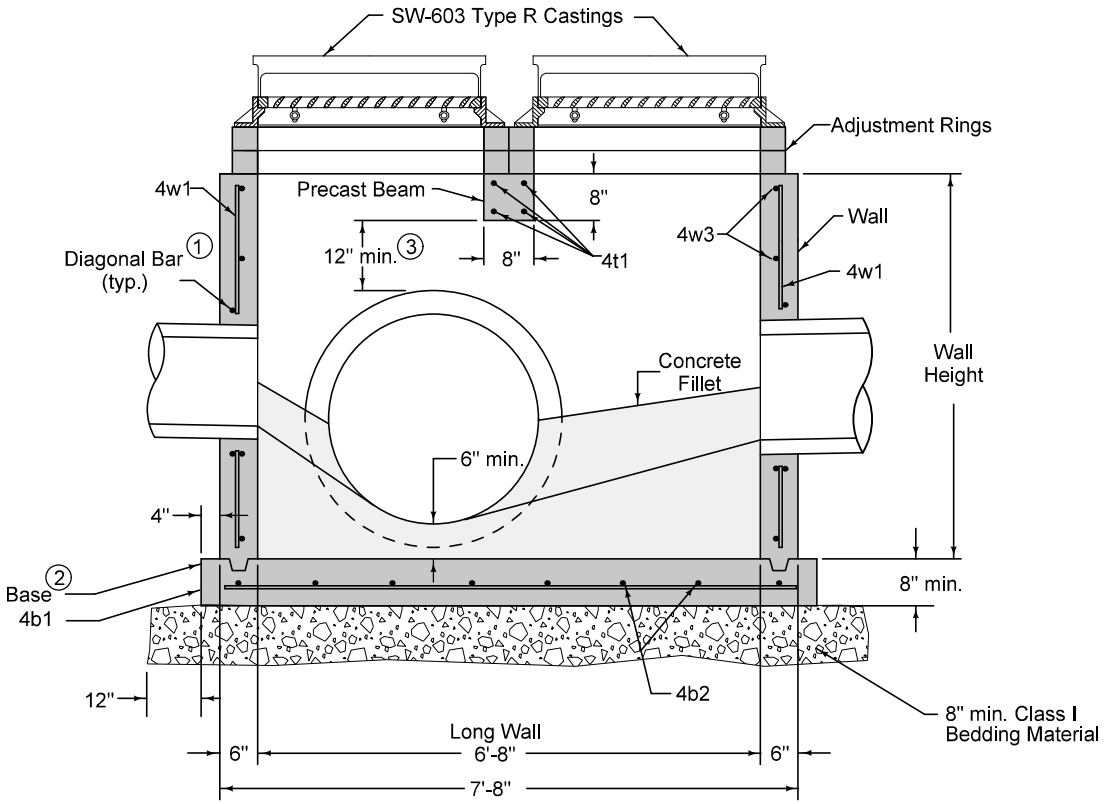
DESIGN METHODS ENGINEER

DOUBLE GRATE INTAKE

① Install four #4 diagonal bars at all pipe openings.

② Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.

③ 12 inch minimum wall height above all pipes.



TYPICAL SECTION

REINFORCING BAR LIST						
Mark	Size	Location	Shape	Count	Length	Spacing
4t1	4	Beam	——	4	2'-8"	4"
4b1	4	Base	——	4	7'-10"	10"
4b2	4	Base	——	8	3'-2"	12"
4w1	4	Walls	——	20	Wall Height minus 4"	12"
4w2	4	Long Walls	——	Varies	7'-4"	12"
4w3	4	Short Walls	——	Varies	2'-8"	12"

MAXIMUM PIPE DIAMETERS		
Pipe Location	Precast Structure	Cast-in-place Structure
Short Wall	15"	18"
Long Wall	60"	66"

SUDAS | IOWADOT | REVISION 3 04-21-20

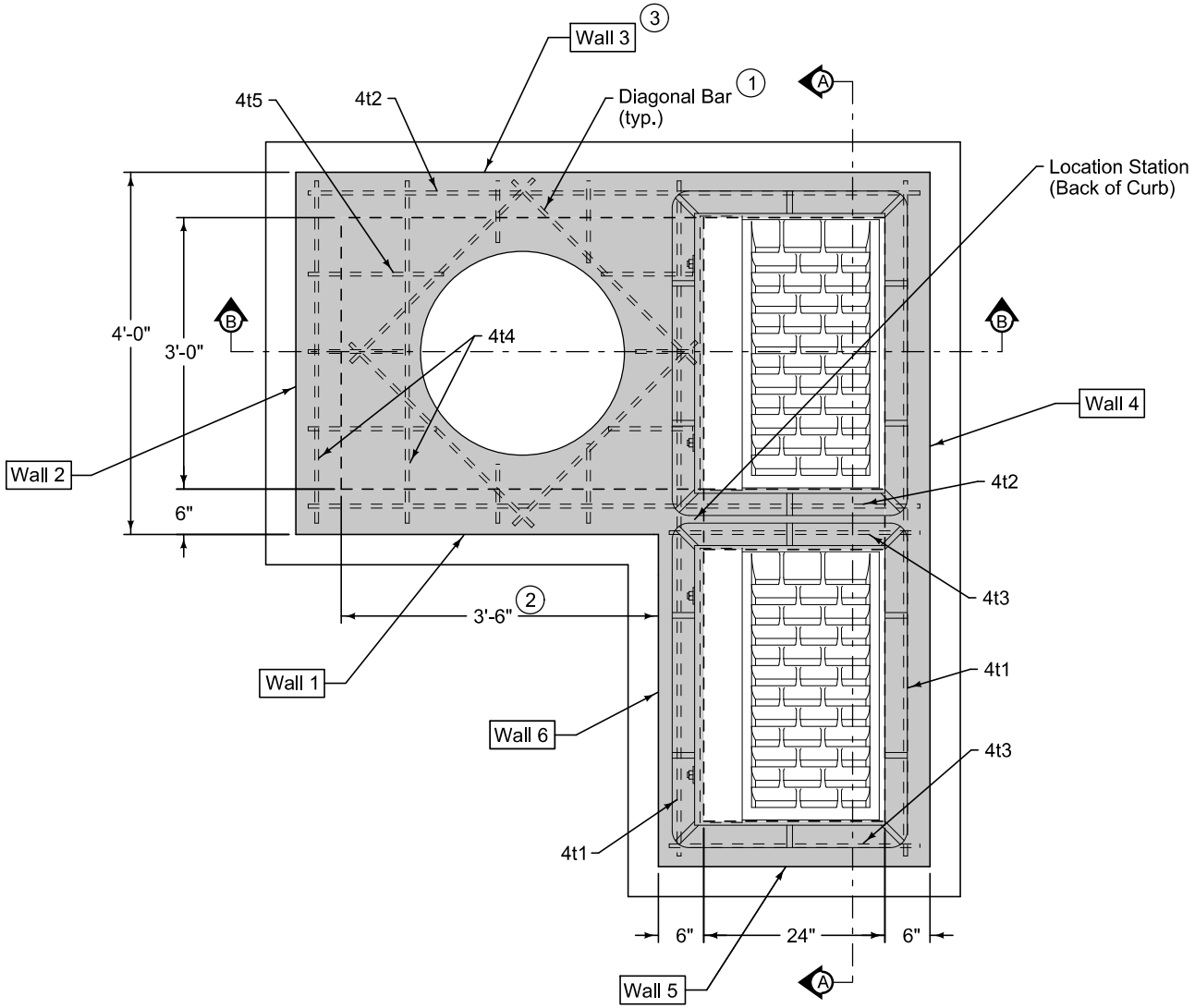
FIGURE 6010.505 | STANDARD ROAD PLAN | SW-505 | SHEET 2 of 2

REVISIONS: Added Class I Bedding Material.

Paul D. Wigand, SUDAS DIRECTOR — Stuart Nicholson, DESIGN METHODS ENGINEER

DOUBLE GRATE INTAKE

FIGURE 6010.505 SHEET 2 OF 2



PLAN

Maximum pipe diameters are set based on maximum structure depth of 6 feet-6 inches and the objective of placement of the centerline of the pipe on the centerline of the manhole opening for maintenance purposes.

Refer to SW-514 for boxout details.

(1) Install four #4 diagonal bars at manhole opening and at all pipe openings.

(2) If Wall 1 is widened to 4 feet, the maximum pipe diameter can be increased to 36 inches.

(3) If Wall 1 is widened to 4 feet, the maximum pipe diameter in Wall 3 can be increased to 42 inches.

MAXIMUM PIPE DIAMETERS	
Wall	Max. Dia.
1	30" (2)
2	24"
3	36" (3)
4	42"

FIGURE 6010.506 | SHEET 1 OF 2

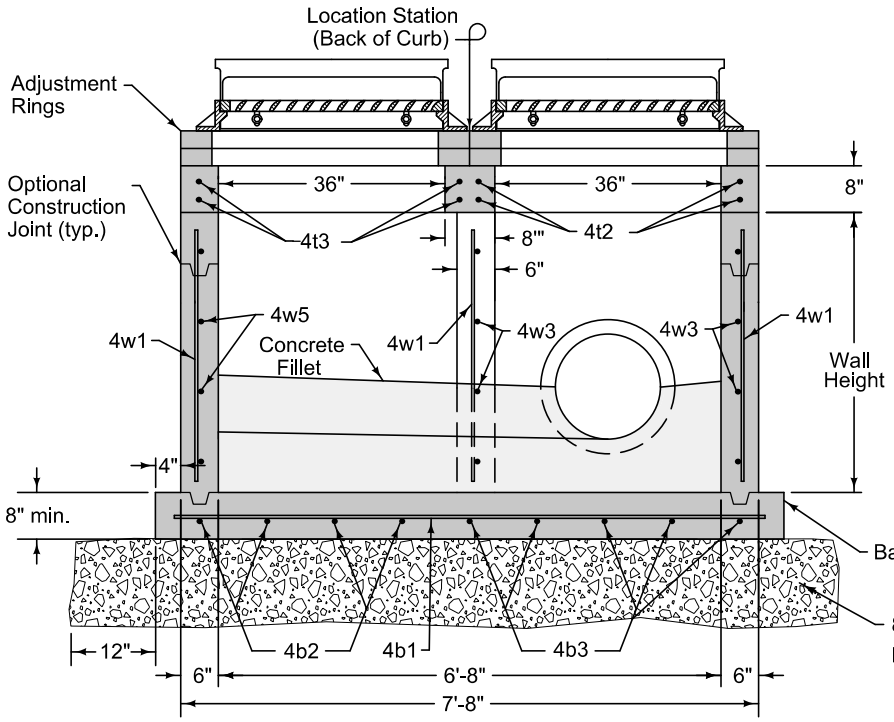
SUDAS | IOWA DOT | REVISION 4 04-21-20

FIGURE 6010.506 | STANDARD ROAD PLAN | SW-506 | SHEET 1 of 2

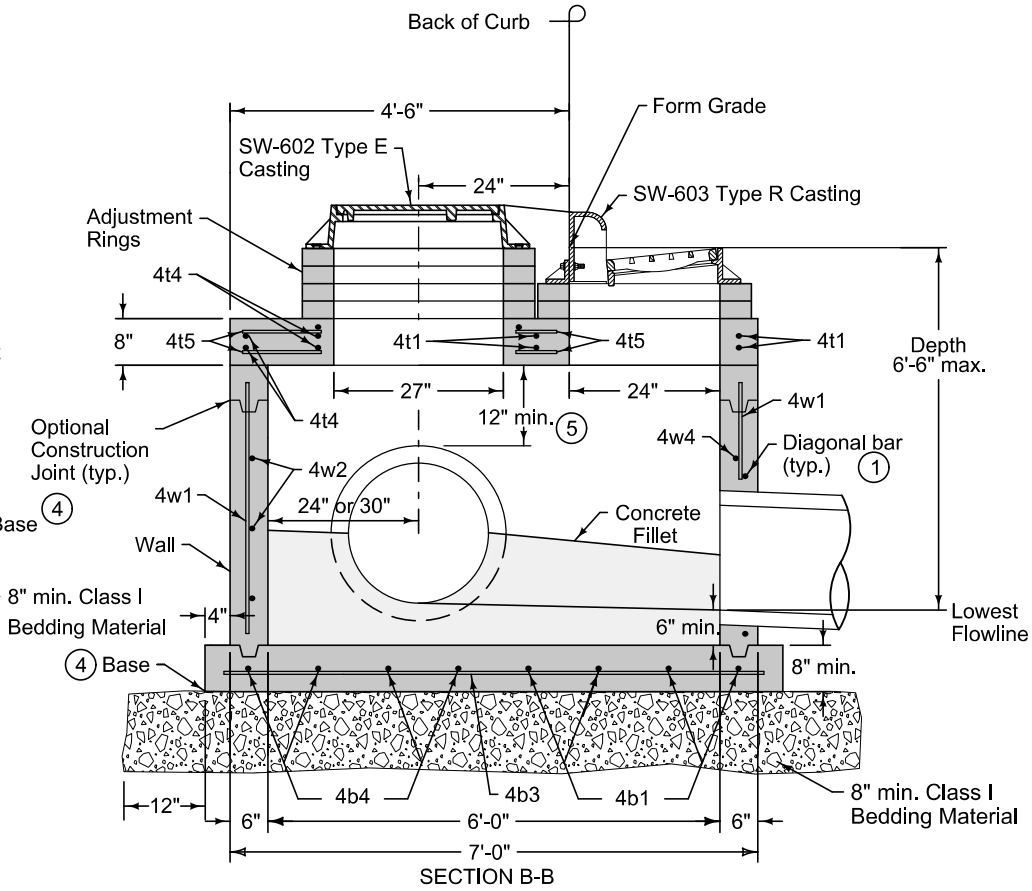
REVISIONS: Added Class I Bedding Material.

Paul D. Wigant, SUDAS DIRECTOR | DESIGN METHODS ENGINEER

DOUBLE GRATE INTAKE WITH MANHOLE



SECTION A-A



SECTION B-B

REINFORCING BAR LIST						
Mark	Size	Location	Shape	Count	Length	Spacing
4t1	4	Top	——	4	7'-4"	See Detail
4t2	4	Top	——	4	6'-8"	See Detail
4t3	4	Top	——	4	2'-8"	See Detail
4t4	4	Top	——	8	3'-8"	12"
4t5	4	Top	——	6	4'-2"	12"
4b1	4	Base	——	4	7'-10"	12"
4b2	4	Base	——	4	3'-2"	12"
4b3	4	Base	——	5	7'-2"	12"
4b4	4	Base	——	4	4'-2"	12"
4w1	4	Walls	——	29	Wall Height minus 4"	12"
4w2	4	Wall 2	——	Varies	3'-8"	12"
4w3	4	Walls 1 and 3	——	Varies	6'-8"	12"
4w4	4	Wall 4	——	Varies	7'-4"	12"
4w5	4	Wall 5	——	Varies	2'-8"	12"
4w6	4	Wall 6	——	Varies	3'-10"	12"

(1) Install four #4 diagonal bars at manhole opening and at all pipe openings.

(4) Cast-in-place base shown. If base is precast integral with walls, the footprint of base is not required to extend beyond the outer edge of the walls.

(5) 12 inch minimum wall height above all pipes.

SUDAS | IOWA DOT

REVISION: 4 | 04-21-20

FIGURE 6010.506 | STANDARD ROAD PLAN | SW-506

SHEET 2 of 2

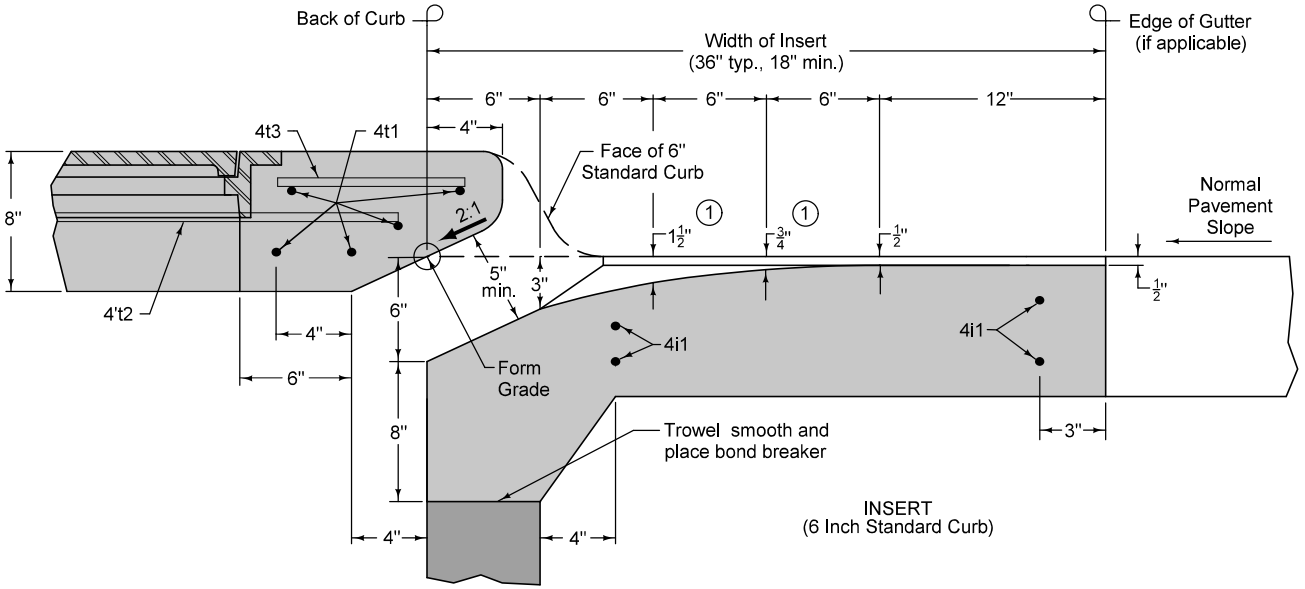
REVISIONS: Added Class I Bedding Material.

Paul D. Wigand
SUDAS DIRECTOR

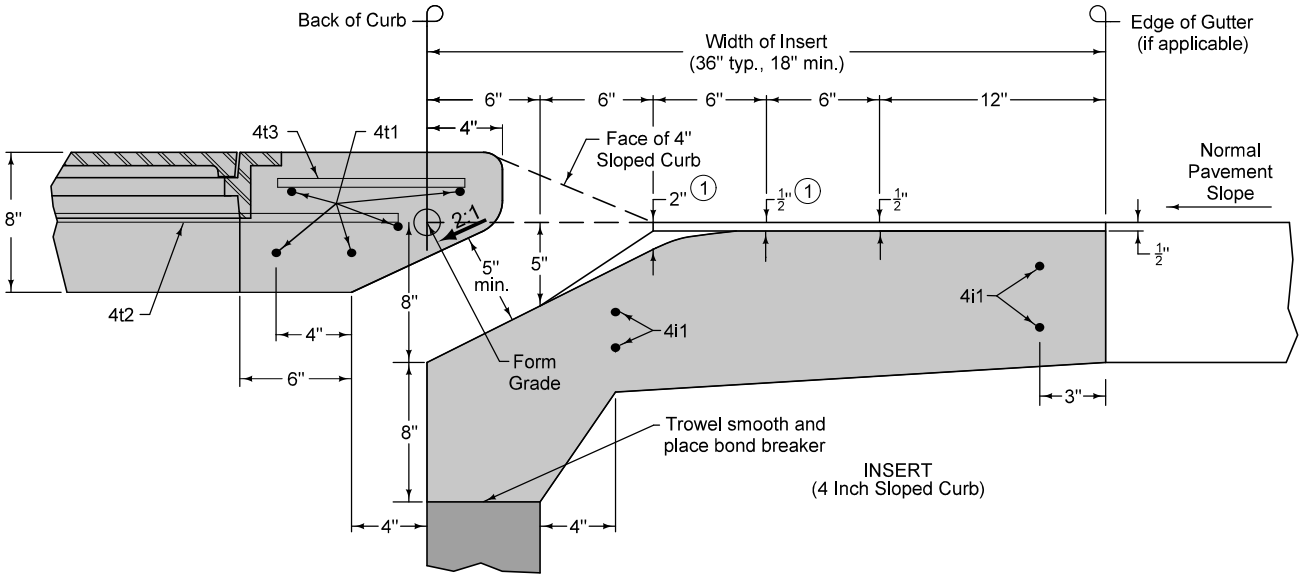
Stuart Nicholson
DESIGN METHODS ENGINEER

DOUBLE GRATE INTAKE WITH MANHOLE

FIGURE 6010.506 | SHEET 2 OF 2



INSERT
(6 Inch Standard Curb)



INSERT
(4 Inch Sloped Curb)

① Insert shaping may be modified for insert widths less than 36 inches. For an 18 inch insert, reduce dimensions indicated by ½ inch.

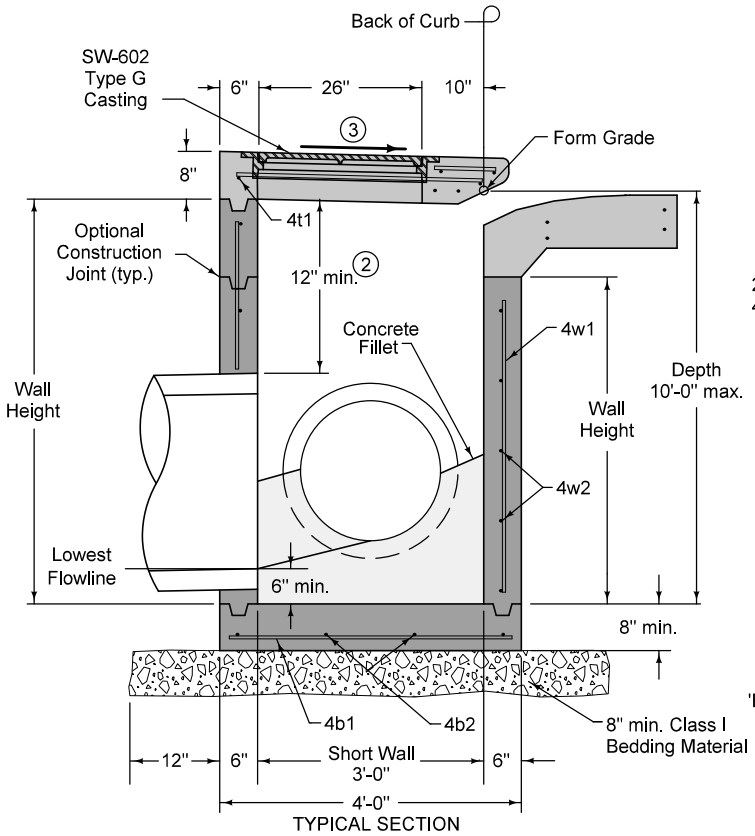
FIGURE 6010.507 SHEET 1 OF 2

SUDAS	IOWA DOT	REVISION 4 04-21-20
FIGURE 6010.507	STANDARD ROAD PLAN	SW-507
		SHEET 1 of 2

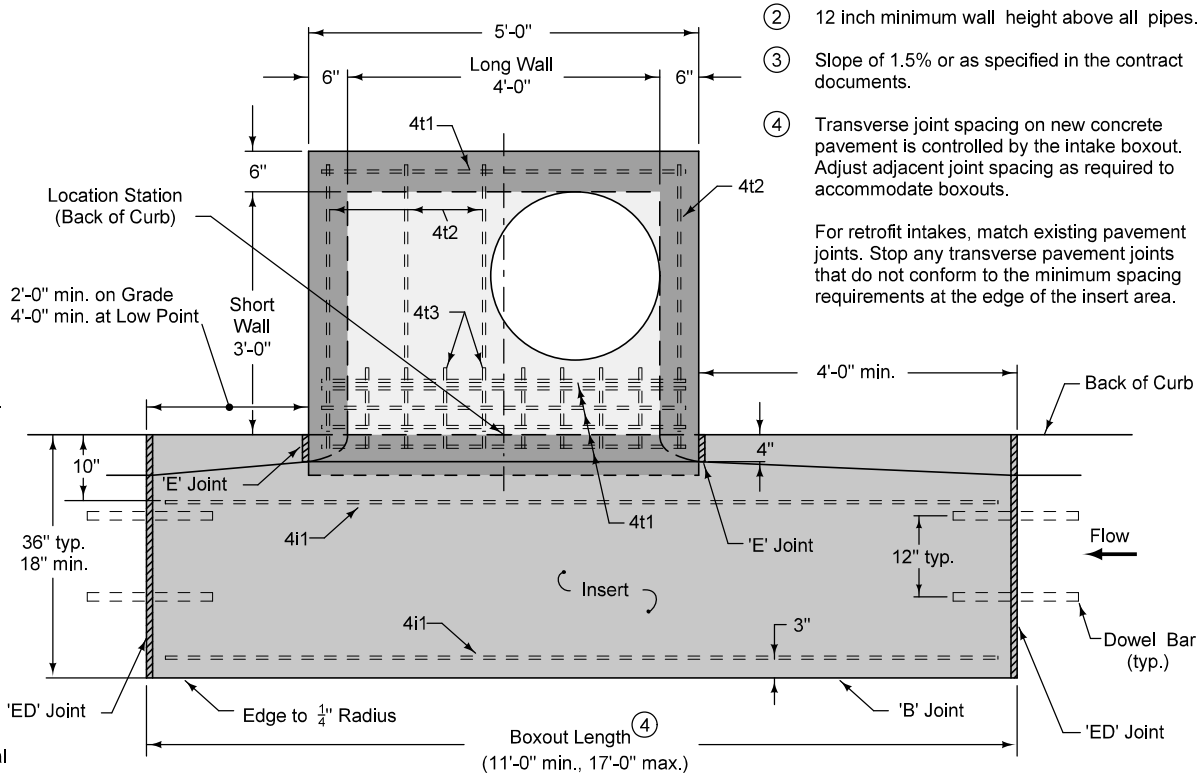
REVISIONS: Added Class I Bedding Material and changed maximum box out length to 17'.

Paul D. Wigand — SUDAS DIRECTOR
Stuart Nicholson — DESIGN METHODS ENGINEER

SINGLE OPEN-THROAT CURB INTAKE, SMALL BOX



TYPICAL SECTION



PLAN

2 12 inch minimum wall height above all pipes.

3 Slope of 1.5% or as specified in the contract documents.

4 Transverse joint spacing on new concrete pavement is controlled by the intake boxout. Adjust adjacent joint spacing as required to accommodate boxouts.

For retrofit intakes, match existing pavement joints. Stop any transverse pavement joints that do not conform to the minimum spacing requirements at the edge of the insert area.

MAXIMUM PIPE DIAMETERS		
Pipe Location	Precast Structure	Cast-in-place Structure
Short Wall	24"	30"
Long Wall	30"	36"

REINFORCING BAR LIST						
Mark	Size	Location	Shape	Count	Length	Spacing
4t1	4	Top	——	6	4'-8"	See Insert
4t2	4	Top	——	4	3'-6"	12"
4t3	4	Top	——	10	10"	6"
4b1	4	Base	——	6	3'-6"	1 1"
4b2	4	Base	——	5	4'-6"	10"
4i1	4	Insert	——	4	Boxout Length minus 8"	See Plan
4w1	4	Walls	——	14	Wall Height minus 4"	14"
4w2	4	Long Walls	——	Varies	4'-8"	12"
4w3	4	Short Walls	——	Varies	3'-8"	12"

SUDAS | IOWA DOT

REVISION 4 04-21-20

FIGURE 6010.507 | STANDARD ROAD PLAN | SW-507 | SHEET 2 of 2

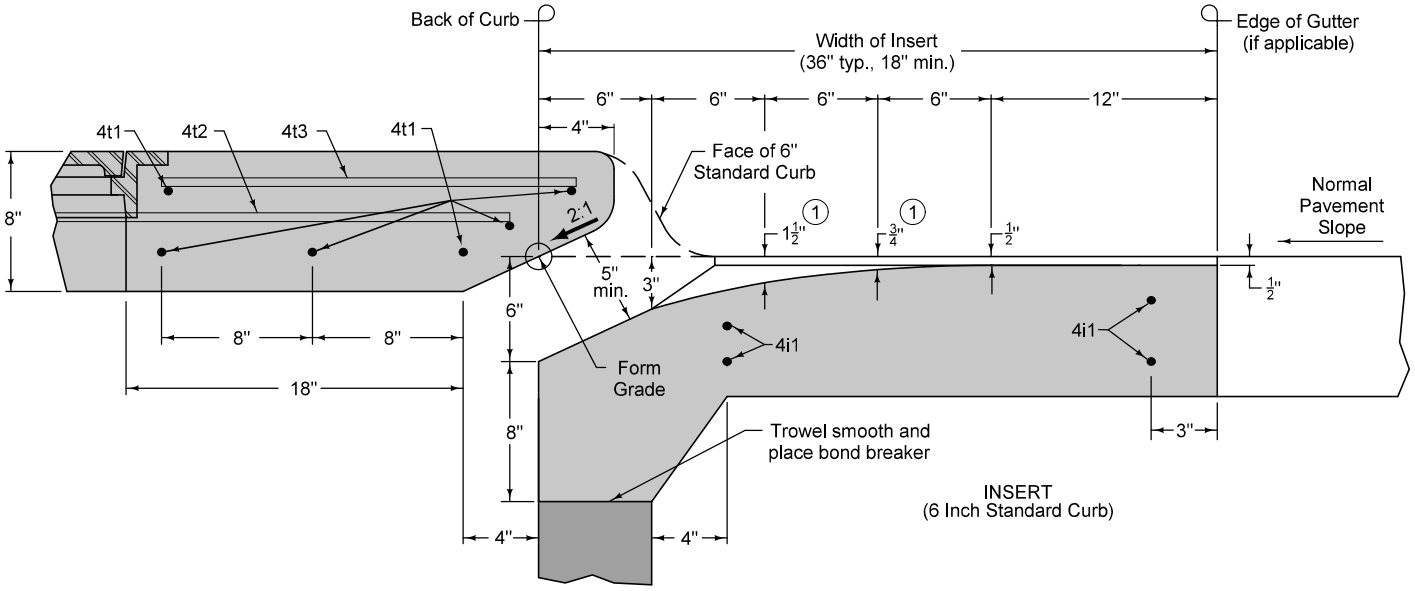
REVISIONS: Added Class I Bedding Material and changed maximum box out length to 17'.

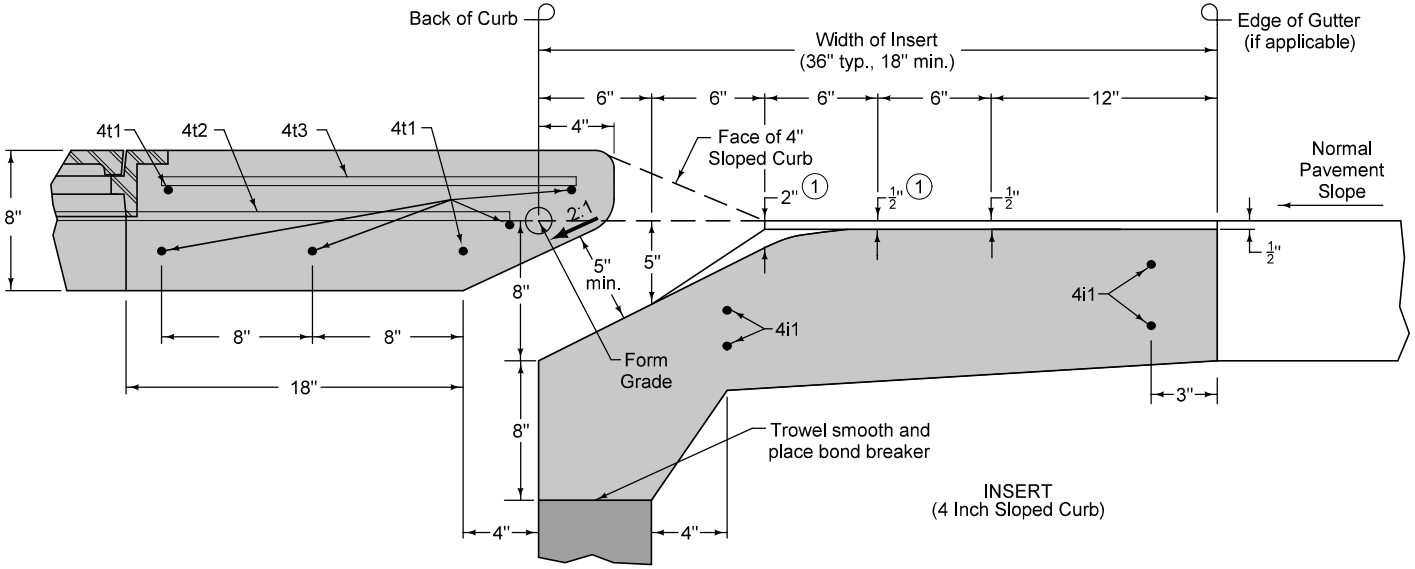
Paul D. Wigand
SUDAS DIRECTOR

Stuart Nicholson
DESIGN METHODS ENGINEER

SINGLE OPEN-THROAT CURB INTAKE, SMALL BOX

FIGURE 6010.507 SHEET 2 OF 2





① Insert shaping may be modified for insert widths less than 36 inches. For an 18 inch insert, reduce dimensions indicated by ½ inch.

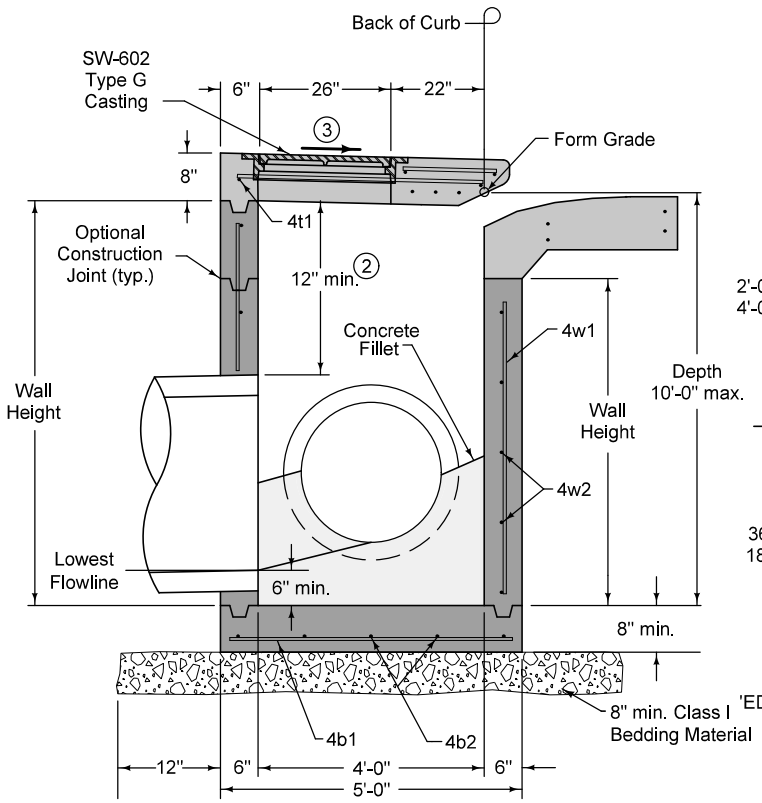
FIGURE 6010.508 SHEET 1 OF 2

SUDAS	IOWA DOT	REVISION 4	04-21-20
FIGURE 6010.508	STANDARD ROAD PLAN	SW-508	
		SHEET 1 of 2	

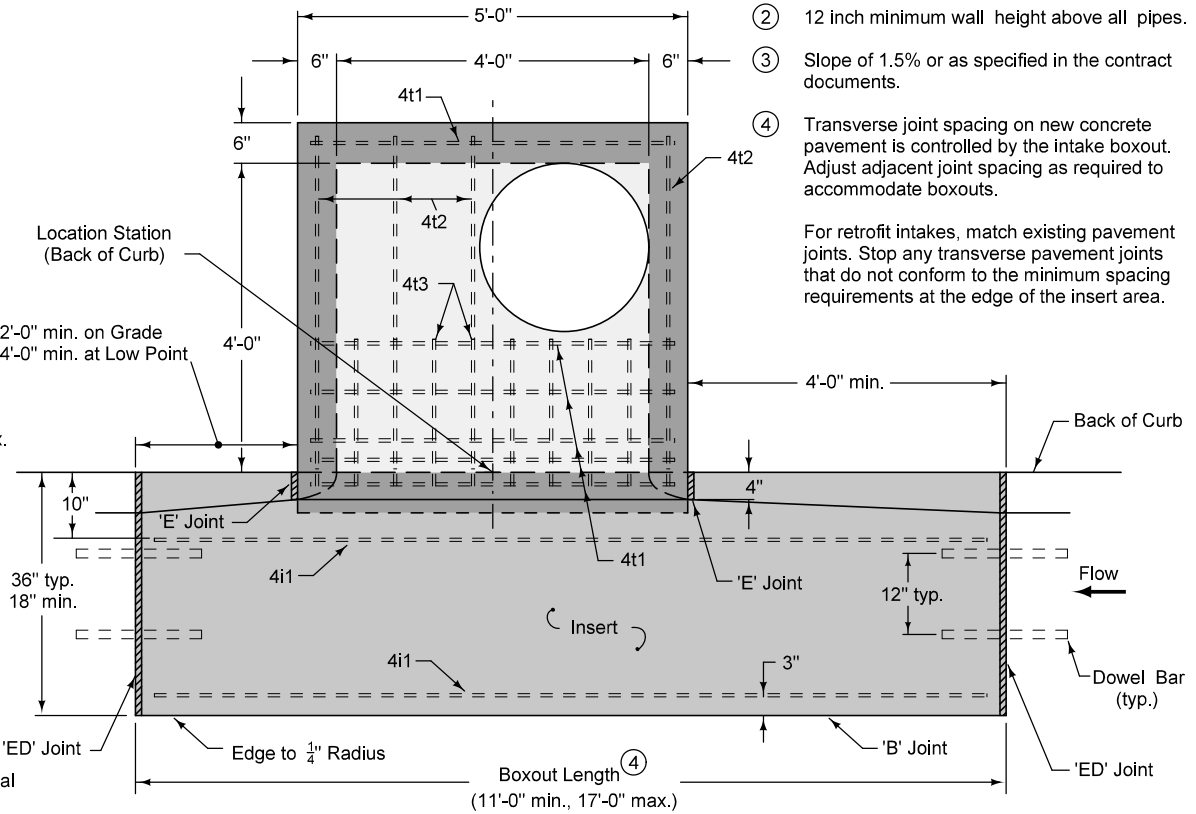
REVISIONS: Added Class I Bedding Material and changed maximum box out length to 17'.

Paul D. Wigant — SUDAS DIRECTOR
Stuart Nicholson — DESIGN METHODS ENGINEER

SINGLE OPEN-THROAT CURB INTAKE, LARGE BOX



TYPICAL SECTION



PLAN

2 12 inch minimum wall height above all pipes.

3 Slope of 1.5% or as specified in the contract documents.

4 Transverse joint spacing on new concrete pavement is controlled by the intake boxout. Adjust adjacent joint spacing as required to accommodate boxouts.

For retrofit intakes, match existing pavement joints. Stop any transverse pavement joints that do not conform to the minimum spacing requirements at the edge of the insert area.

MAXIMUM PIPE DIAMETERS	
Precast Structure	Cast-in-place Structure
30"	36"

REINFORCING BAR LIST						
Mark	Size	Location	Shape	Count	Length	Spacing
4t1	4	Top	———	7	4'-8"	See Insert
4t2	4	Top	———	4	4'-6"	12"
4t3	4	Top	———	10	1'-10"	6"
4b1	4	Base	———	6	4'-6"	11"
4b2	4	Base	———	6	4'-6"	11"
4i1	4	Insert	———	4	Boxout Length minus 8"	See Plan
4w1	4	Walls	———	16	Wall Height minus 4"	14"
4w2	4	Walls	———	Varies	4'-8"	12"
4w3	4	Walls	———	Varies	4'-8"	12"

SUDAS | IOWADOT | REVISION 4 04-21-20

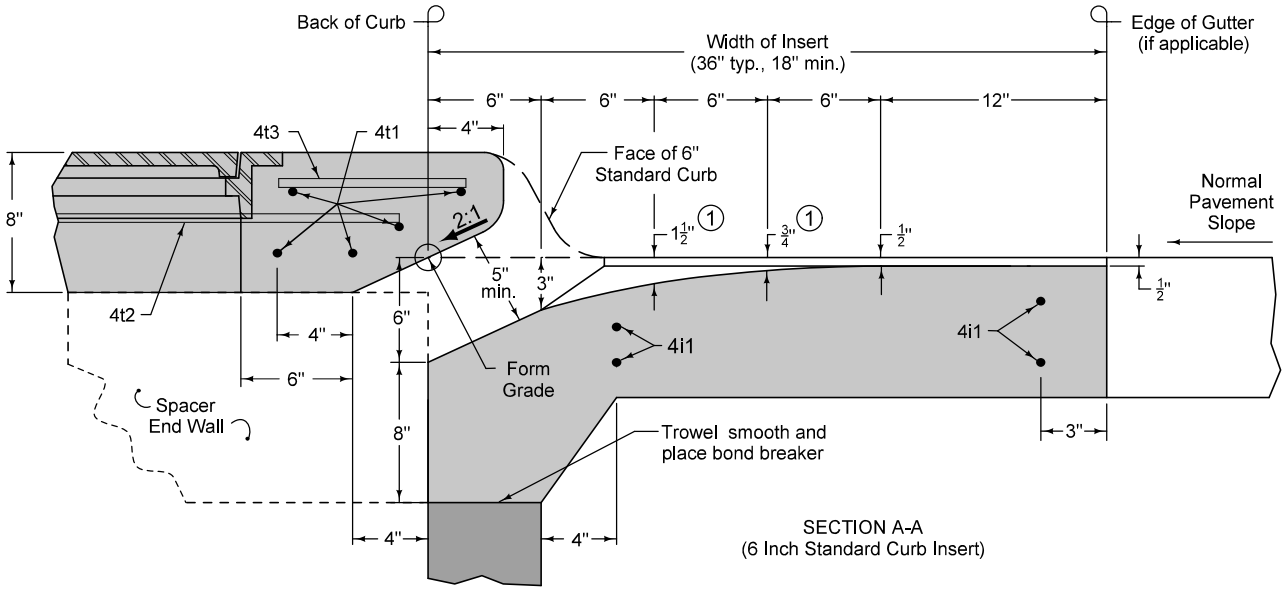
FIGURE 6010.508 | STANDARD ROAD PLAN | SW-508 | SHEET 2 of 2

REVISIONS: Added Class I Bedding Material and changed maximum box out length to 17'.

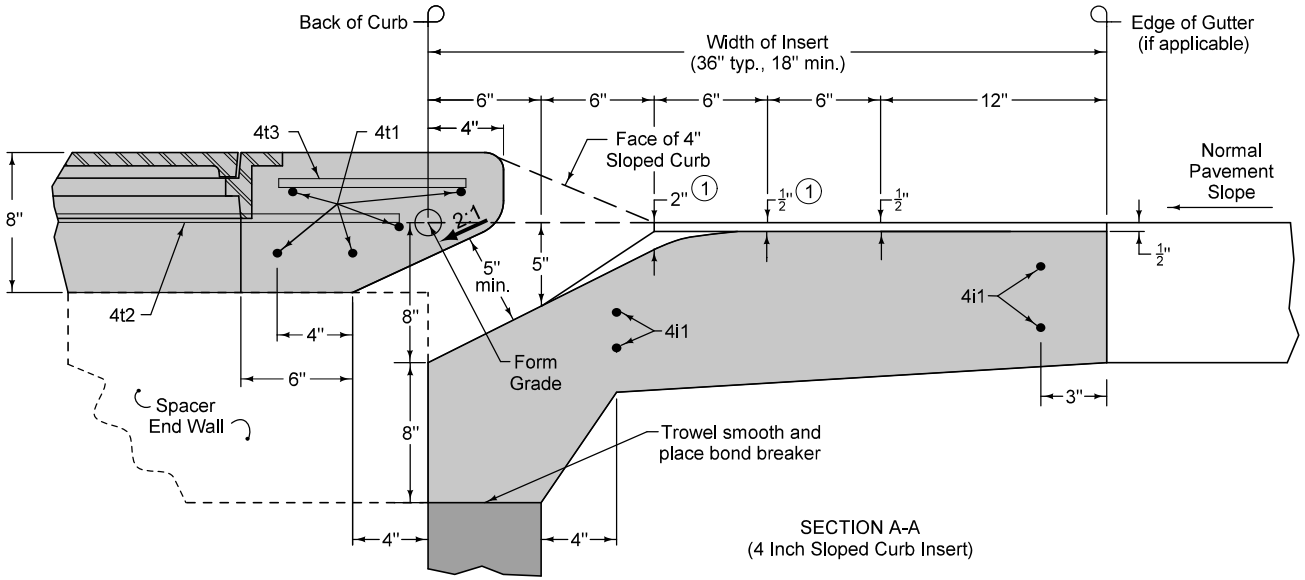
Paul D. Wigand, SUDAS DIRECTOR — Stuart Nicholson, DESIGN METHODS ENGINEER

SINGLE OPEN-THROAT CURB INTAKE, LARGE BOX

FIGURE 6010.508 | SHEET 2 OF 2



SECTION A-A
(6 Inch Standard Curb Insert)



SECTION A-A
(4 Inch Sloped Curb Insert)

(1) Insert shaping may be modified for insert widths less than 36 inches. For an 18 inch insert, reduce dimensions indicated by $\frac{1}{4}$ inch.

SUDAS	IOWADOT	REVISION 6	04-21-20
FIGURE 6010.509	STANDARD ROAD PLAN	SW-509	SHEET 1 of 3

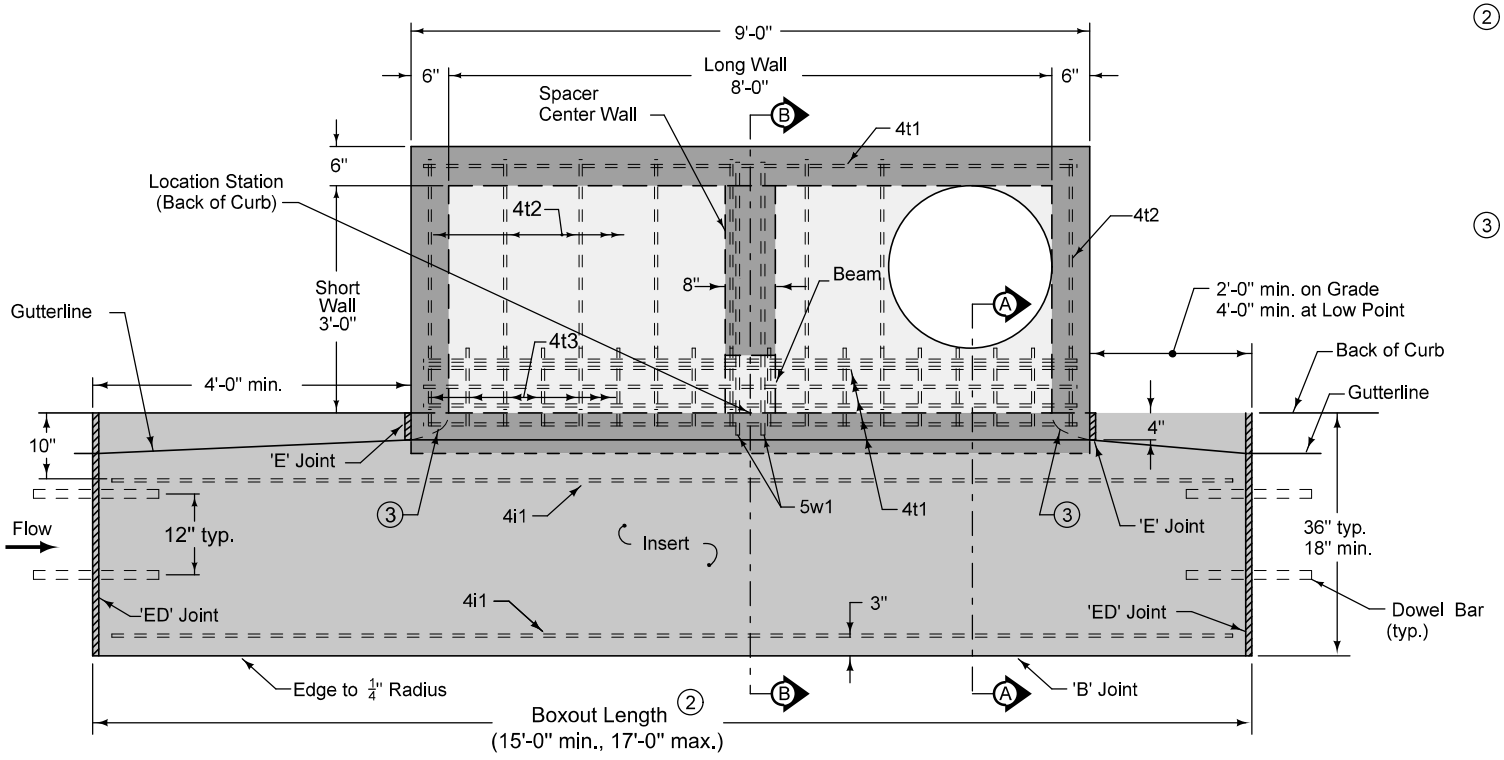
REVISIONS: Added Class I Bedding Material and changed maximum box out length to 17'.

Paul D. Wigand
SUDAS DIRECTOR

Stuart Nicholson
DESIGN METHODS ENGINEER

DOUBLE OPEN-THROAT CURB INTAKE, SMALL BOX

FIGURE 6010.509 | SHEET 1 OF 3



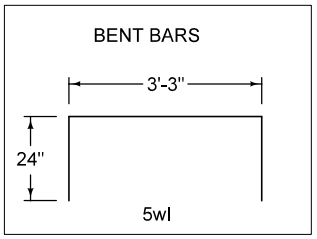
PLAN

2 Transverse joint spacing on new concrete pavement is controlled by the intake boxout. Adjust adjacent joint spacing as required to accommodate boxouts.

For retrofit intakes, match existing pavement joints. Stop any transverse pavement joints that do not conform to the minimum spacing requirements at the edge of the insert area.

3 Rounded shaping at inlet.

REINFORCING BAR LIST						
Mark	Size	Location	Shape	Count	Length	Spacing
4b1	4	Base	——	9	3'-6"	12"
4b2	4	Base	——	5	8'-6"	10"
4i1	4	Insert	——	4	Boxout Length minus 8"	See Insert
4t1	4	Top	——	6	8'-6"	See Plan
4t2	4	Top	——	8	3'-6"	12"
4t3	4	Top	——	18	10"	6"
4w1	4	Walls	——	22	Wall Height minus 4"	13"
4w2	4	Long Walls	——	Varies	4'-8"	12"
4w3	4	Short Walls	——	Varies	3'-8"	12"
5w1	5	Beam	⌐¬	2	7'-3"	4"



SUDAS | IOWA DOT

REVISION 6 04-21-20

FIGURE 6010.509 | STANDARD ROAD PLAN | SW-509

SHEET 2 of 3

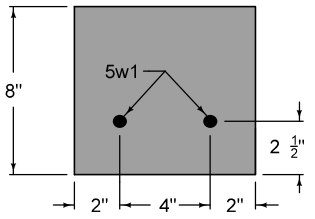
REVISIONS: Added Class I Bedding Material and changed maximum box out length to 17'.

Paul D. Wigand
SUDAS DIRECTOR

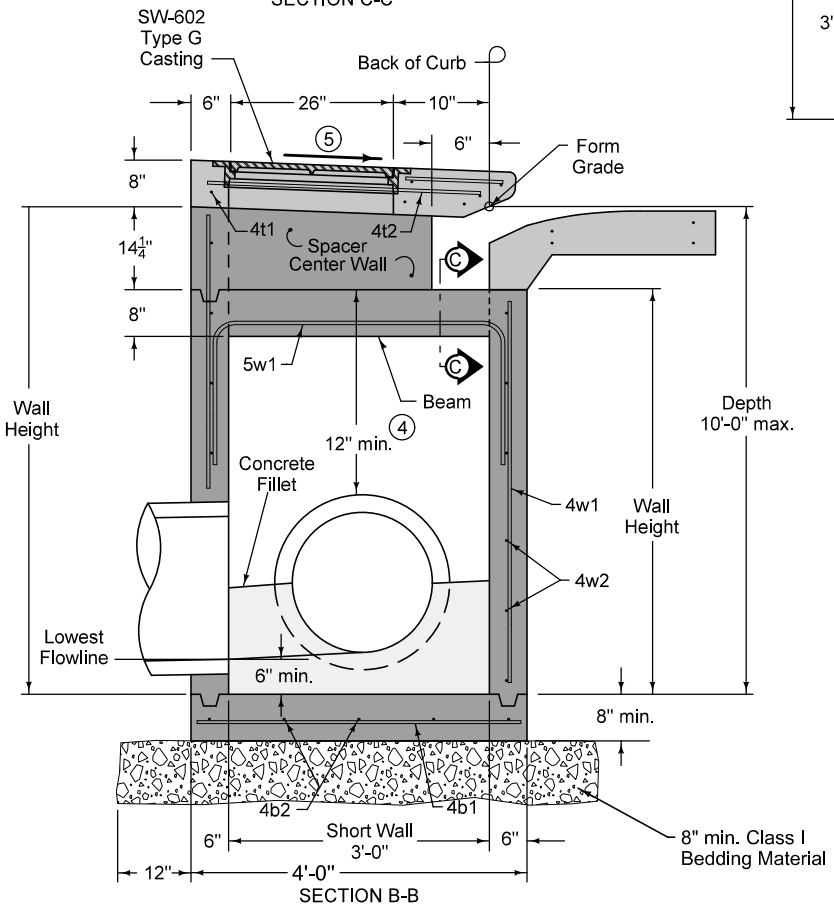
DESIGN METHODS ENGINEER

DOUBLE OPEN-THROAT CURB INTAKE, SMALL BOX

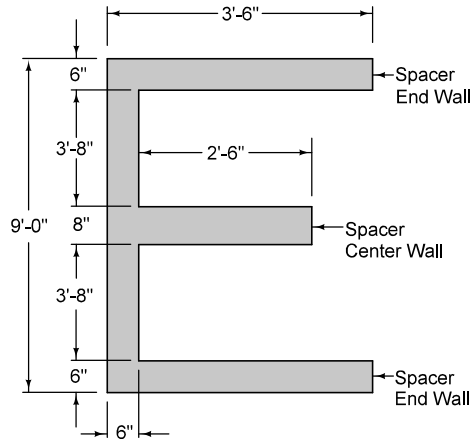
FIGURE 6010.509 SHEET 2 OF 3



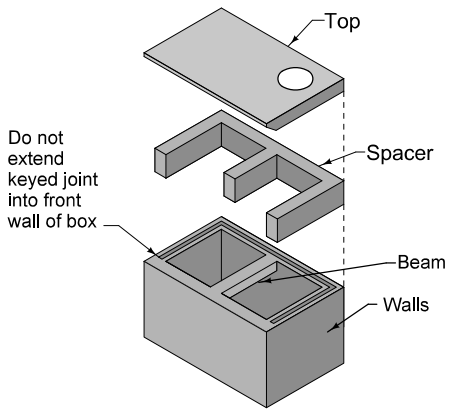
SECTION C-C



SECTION B-B



PLAN
(SPACER)



ISOMETRIC
(Refer to SECTION B-B for
alignment of Top with Spacer)

(4) 12 inch minimum wall height above all pipes.

(5) Slope of 1.5% or as specified in the contract documents.

MAXIMUM PIPE DIAMETERS		
Pipe Location	Precast Structure	Cast-in-place Structure
Short Wall	24"	30"
Long Wall	60"	66"

SUDAS | IOWADOT | REVISION 6 04-21-20

FIGURE 6010.509 | STANDARD ROAD PLAN | SW-509 | SHEET 3 of 3

REVISIONS: Added Class I Bedding Material and changed maximum box out length to 17'.

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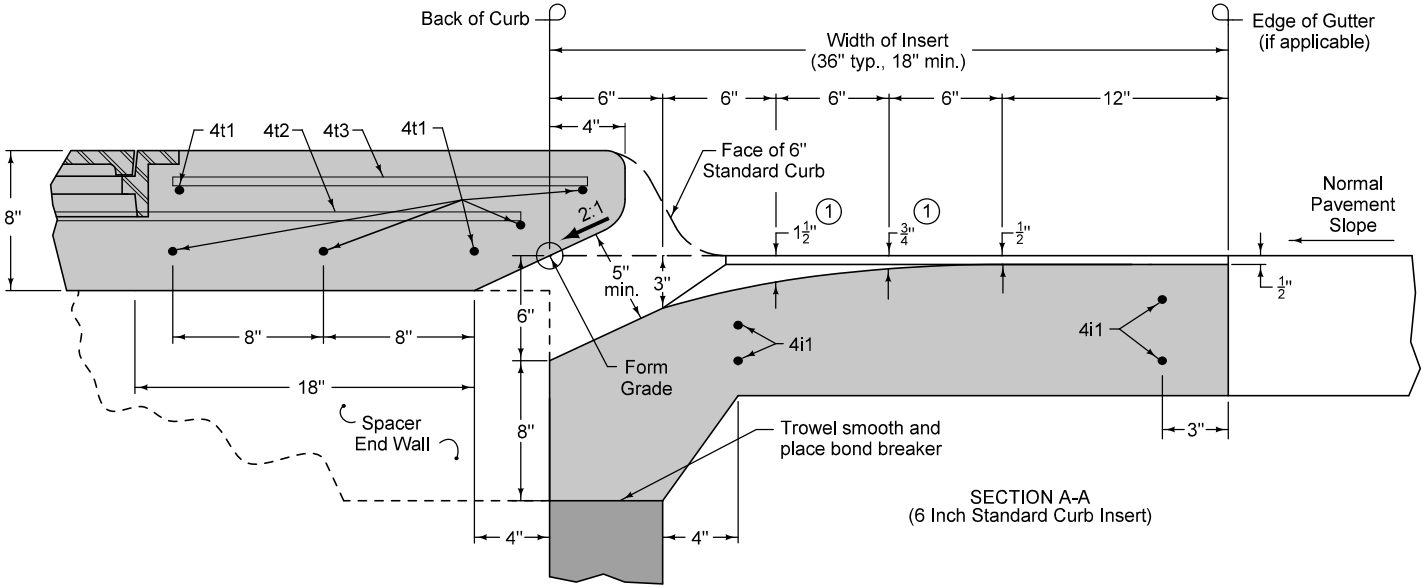
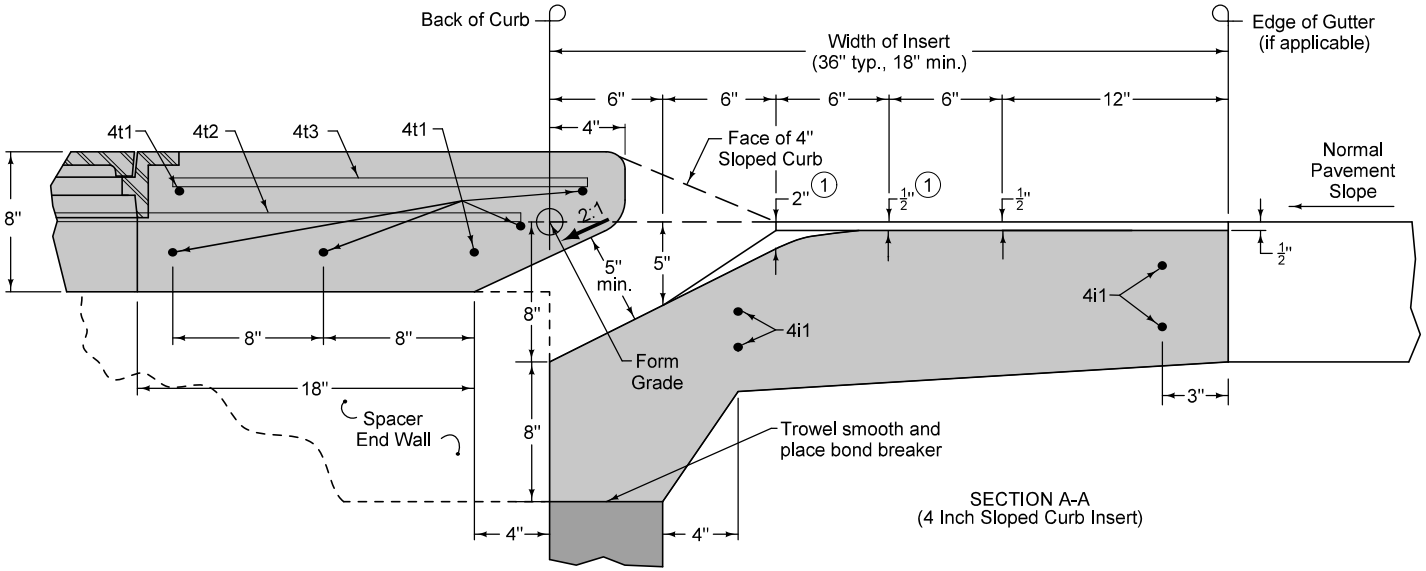
Stuart Nicholson
DESIGN METHODS ENGINEER

DOUBLE OPEN-THROAT CURB INTAKE, SMALL BOX

FIGURE 6010.509 | SHEET 3 OF 3



SECTION A-A
(6 Inch Standard Curb Insert)



SECTION A-A
(4 Inch Sloped Curb Insert)

① Insert shaping may be modified for insert widths less than 36 inches. For an 18 inch insert, reduce dimensions indicated by $\frac{1}{4}$ inch.

FIGURE 6010.510 | SHEET 1 OF 3

SUDAS | IOWA DOT

REVISION	
6	04-21-20

FIGURE 6010.510 | STANDARD ROAD PLAN | SW-510 | SHEET 1 of 3

REVISIONS: Added Class I Bedding Material and changed maximum box out length to 17'.

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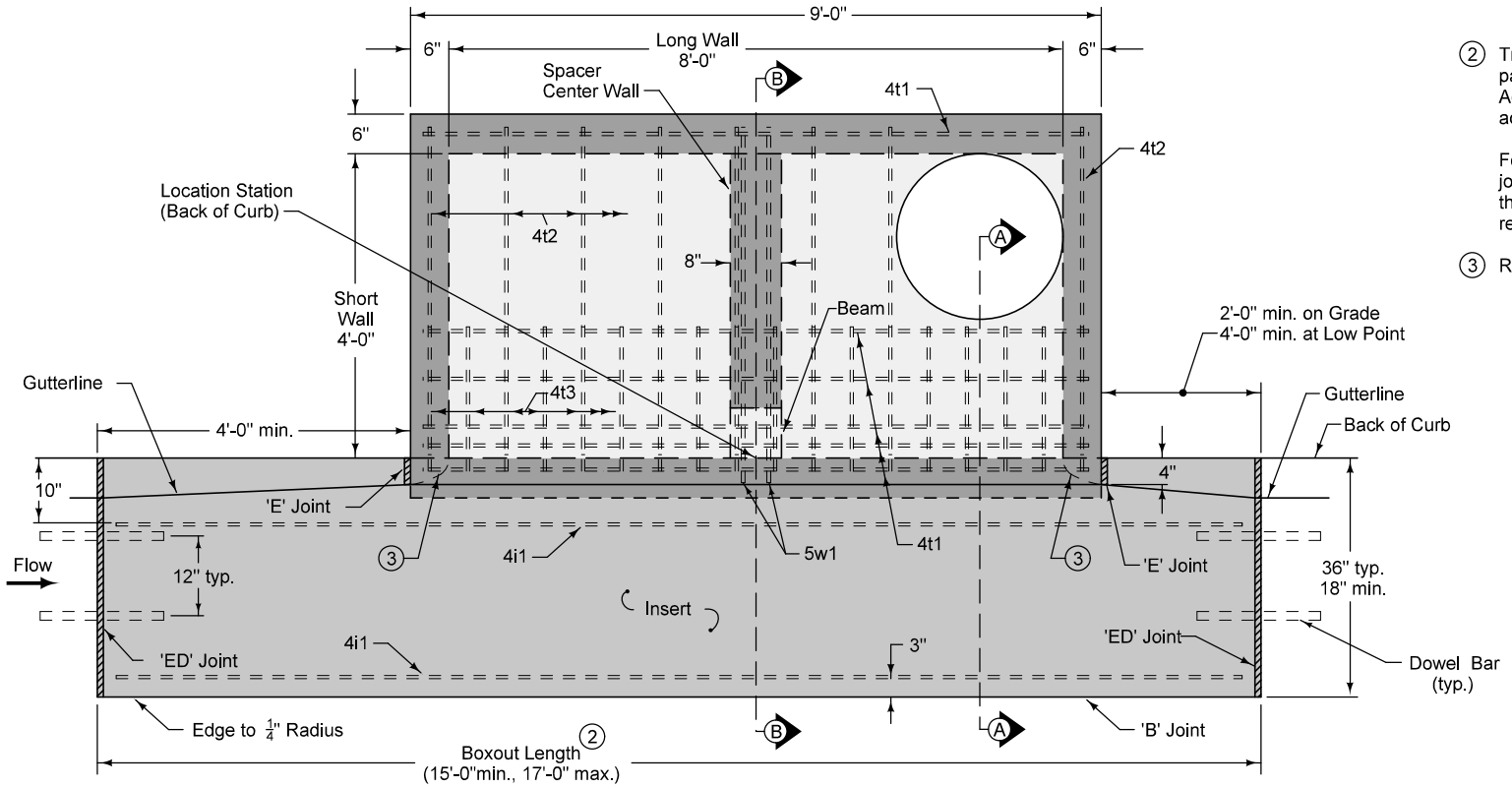
DOUBLE OPEN-THROAT CURB INTAKE, LARGE BOX



PLAN

② Transverse joint spacing on new concrete pavement is controlled by the intake boxout. Adjust adjacent joint spacing as required to accommodate boxouts.

For retrofit intakes, match existing pavement joints. Stop any transverse pavement joints that do not conform to the minimum spacing requirements at the edge of the insert area.

③ Rounded shaping at inlet.

REINFORCING BAR LIST						
Mark	Size	Location	Shape	Count	Length	Spacing
4b1	4	Base	——	9	4'-6"	12"
4b2	4	Base	——	6	8'-6"	11"
4i1	4	Insert	——	4	Boxout Length minus 8"	See Insert
4t1	4	Top	——	7	8'-6"	See Plan
4t2	4	Top	——	8	4'-4"	12"
4t3	4	Top	——	18	1'-10"	6"
4w1	4	Walls	——	24	Wall Height minus 4"	13"
4w2	4	Long Walls	——	Varies	4'-8"	12"
4w3	4	Short Walls	——	Varies	8'-8"	12"
5w1	5	Beam	⌐¬	2	8'-3"	4"

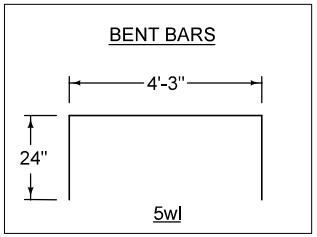


FIGURE 6010.510 SHEET 2 OF 3

SUDAS | IOWA DOT

REVISION 6 04-21-20

SW-510

FIGURE 6010.510 | STANDARD ROAD PLAN

SHEET 2 of 3

REVISIONS: Added Class I Bedding Material and changed maximum box out length to 17'.

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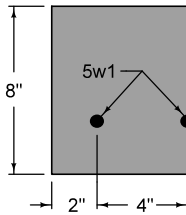
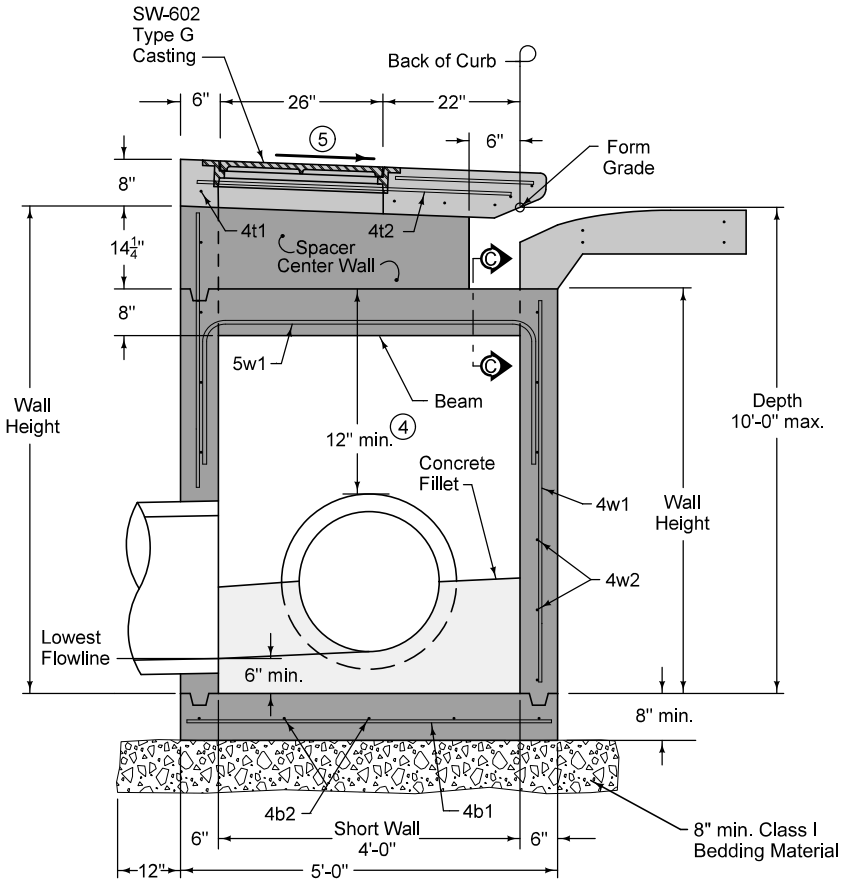
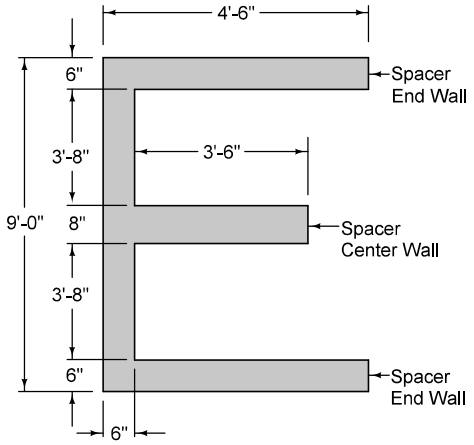
DOUBLE OPEN-THROAT CURB INTAKE, LARGE BOX



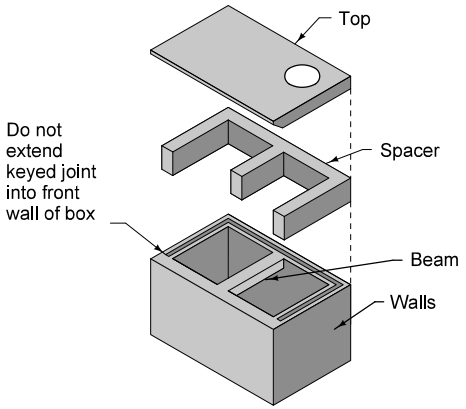
SECTION C-C



SECTION B-B



PLAN
(SPACER)



ISOMETRIC
(Refer to Section B-B
for alignment of Top
with Spacer)

④ 12 inch minimum wall height above all pipes.

⑤ Slope of 1.5% or as specified in the contract documents.

MAXIMUM PIPE DIAMETERS		
Pipe Location	Precast Structure	Cast-in-place Structure
Short Wall	30"	36"
Long Wall	60"	66"

SUDAS | IOWADOT | REVISION 6 04-21-20

FIGURE 6010.510 | STANDARD ROAD PLAN | SW-510 | SHEET 3 of 3

REVISIONS: Added Class I Bedding Material and changed maximum box out length to 17'.

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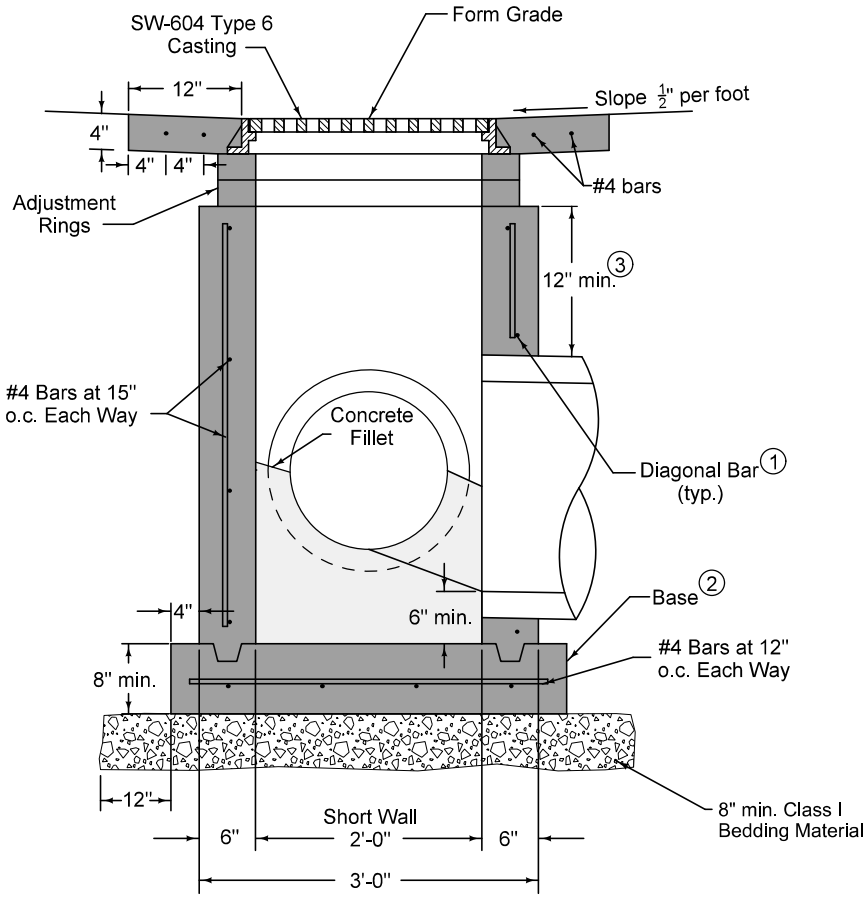
Stuart Nicholson
DESIGN METHODS ENGINEER

DOUBLE OPEN-THROAT CURB INTAKE, LARGE BOX

FIGURE 6010.510 | SHEET 3 OF 3

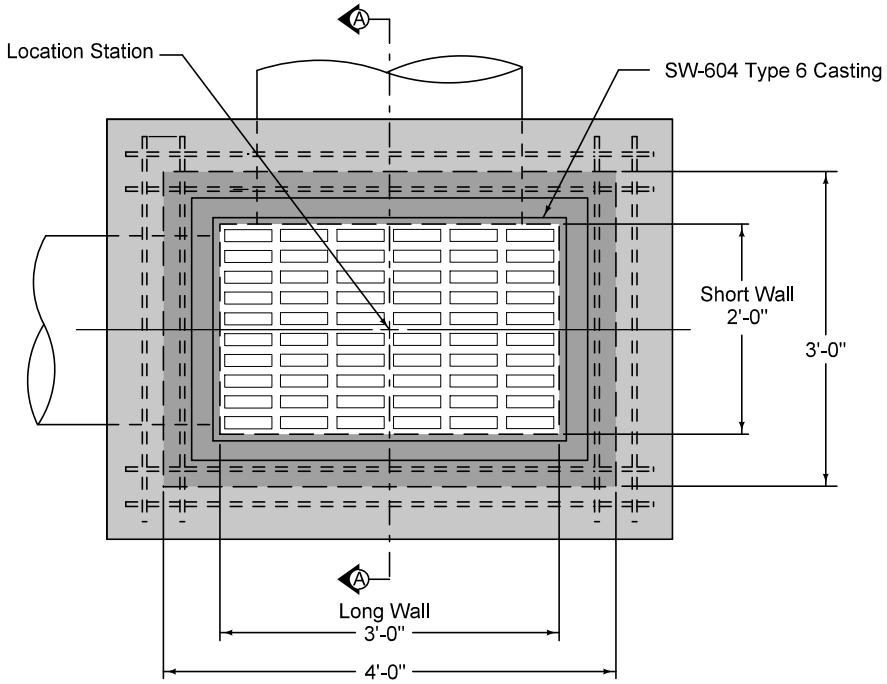


SECTION A-A

① Install four #4 diagonal bars at all pipe openings.

② Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.

③ 12 inch minimum wall height above all pipes.



PLAN

MAXIMUM PIPE DIAMETERS		
Pipe Location	Precast Structure	Cast-in-place Structure
Short Wall	15"	18"
Long Wall	24"	30"

FIGURE 6010.511 | SHEET 1 OF 1

SUDAS | IOWA DOT | REVISION 2 | 04-21-20

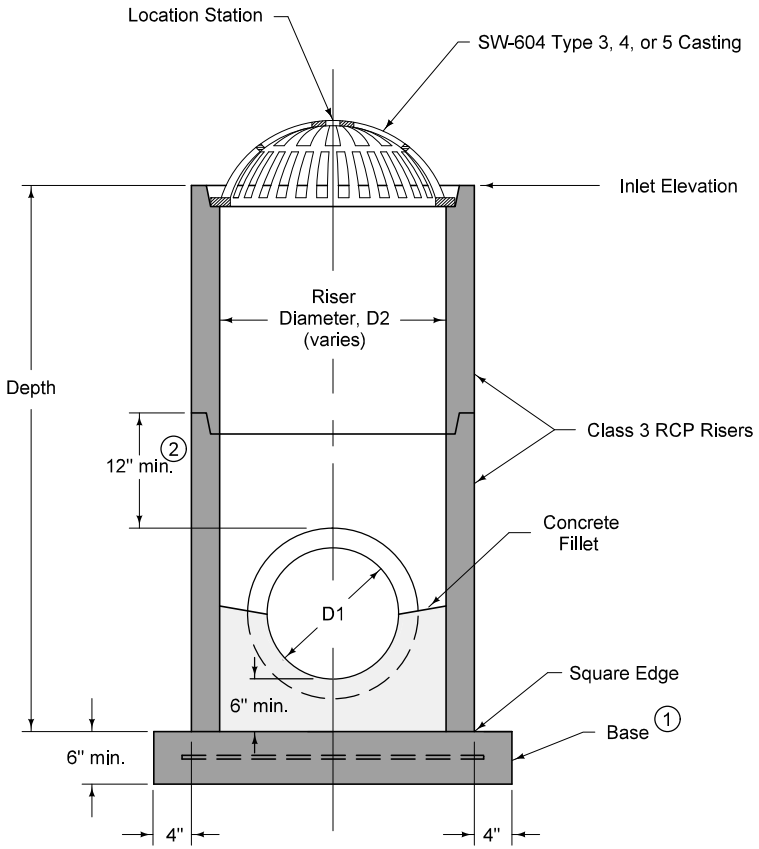
FIGURE 6010.511 | STANDARD ROAD PLAN | SW-511 | SHEET 1 of 1

REVISIONS: Added Class I Bedding Material.

Paul D. Wigand, SUDAS DIRECTOR

Stuart Nicholson, DESIGN METHODS ENGINEER

RECTANGULAR AREA INTAKE



TYPICAL SECTION

CASE 1

1. Precast (shown) or cast-in-place base:
   - Precast: 6 inch thick concrete with #6 welded wire mesh on 4 inch centers (WWF 4" x 4"). Center mesh vertically within base.
   - Cast-in-place: 8 inch thick non-reinforced concrete.
2. 12 inch minimum riser height above all pipes.

INTAKE SIZE - CASE 1	
Outlet Pipe Diameter, D1	Minimum Riser Diameter, D2
12"	18"
15"	24"
18"	24"
21"	30"
24"	30"
27"	36"

FIGURE 6010.512 | SHEET 1 OF 2

SUDAS | IOWA DOT

REVISION 4 04-21-20

FIGURE 6010.512 | STANDARD ROAD PLAN | SW-512

SHEET 1 of 2

REVISIONS: Changed 1 to I on Bedding Material

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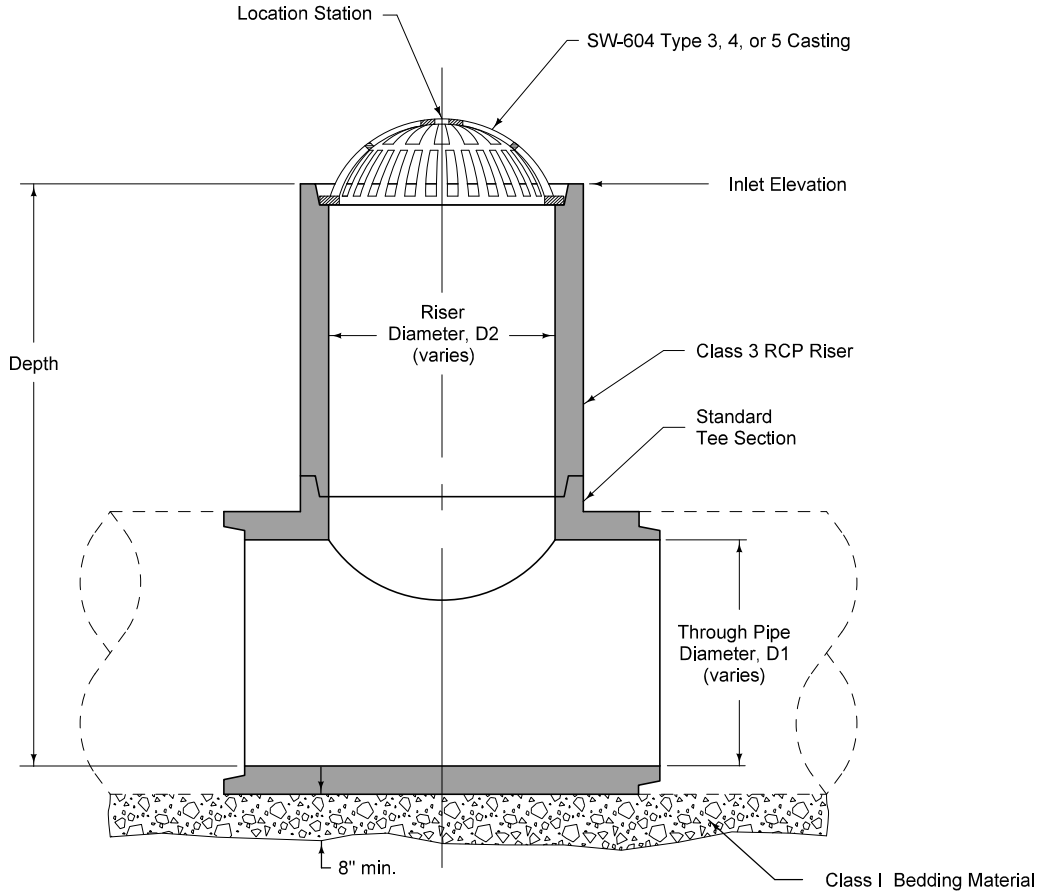
SUDAS DIRECTOR

DESIGN METHODS ENGINEER

CIRCULAR AREA INTAKE

③ Minimum riser diameter is 18 inches.



TYPICAL SECTION

CASE 2

INTAKE SIZE - CASE 2	
Through Pipe Diameter, D1	Maximum ③ Riser Diameter, D2
18"	18"
21"	18"
24"	24"
27"	24"
30"	30"
36" or more	36"

SUDAS | IOWA DOT | REVISION 4 04-21-20

FIGURE 6010.512 | STANDARD ROAD PLAN | SW-512 | SHEET 2 of 2

REVISIONS: Changed 1 to I on Bedding Material.

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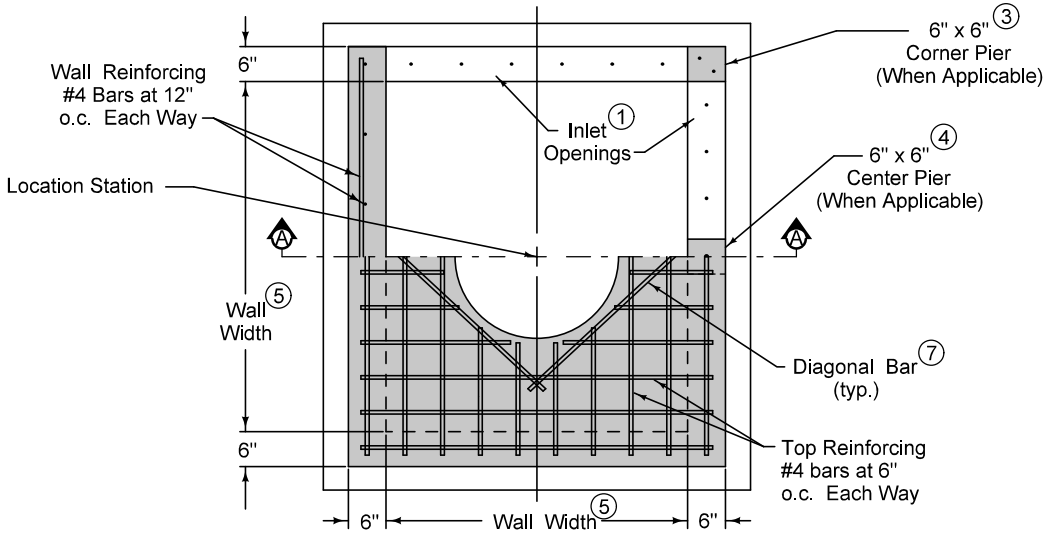
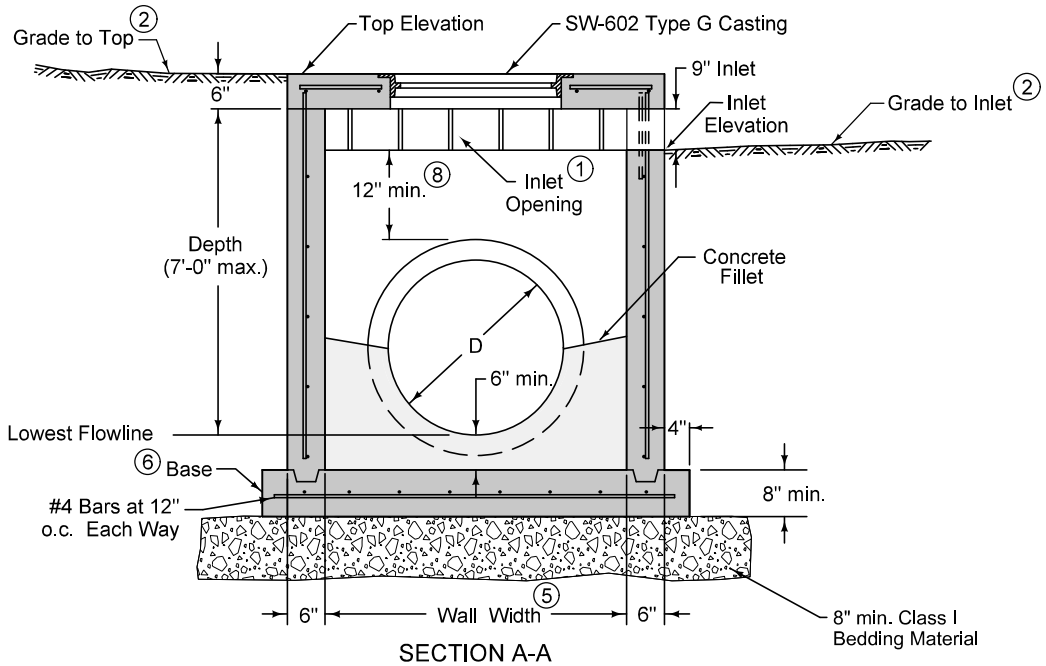
Stuart Nicholson
DESIGN METHODS ENGINEER

CIRCULAR AREA INTAKE

FIGURE 6010.512 SHEET 2 OF 2



PLAN



SECTION A-A

Structure may be built with openings on any or all sides. Provide openings and orientation as specified in the contract documents.

Adjacent walls may have different widths based upon pipe configuration, but structure must be rectangular.

① Construct inlet openings with 15 inch #4 epoxy coated bars at 8 inches on center. Embed bars a minimum of 3 inches into walls and top at all openings.

② Grade to inlet elevation on open sides. Grade to top elevation on closed sides.

③ Corner pier required between openings of two adjacent walls. Extend wall reinforcing vertically through pier. Install one additional 15 inch #4 bar in pier.

④ Center pier required at center of any inlet opening with length of 5 feet or greater. Extend wall reinforcing vertically through pier. Install one additional 15 inch #4 bar in pier.

⑤ Wall widths vary with pipe diameter. Provide 6 inches of wall width (minimum) each side of pipe opening. Minimum wall width is 36 inches. Maximum wall width is 72 inches.

⑥ Cast-in-place base shown. If base is precast integral with walls, the footprint of base is not required to extend beyond the outer edge of the walls.

⑦ Install four #4 diagonal bars at all pipe openings.

⑧ 12 inch minimum wall height above all pipes.

SUDAS	IOWADOT	REVISION 3	04-20-21
FIGURE 6010.513	STANDARD ROAD PLAN	SW-513	SHEET 1 of 1

REVISIONS: Modified circle notes 1, 3, 4 and 8.

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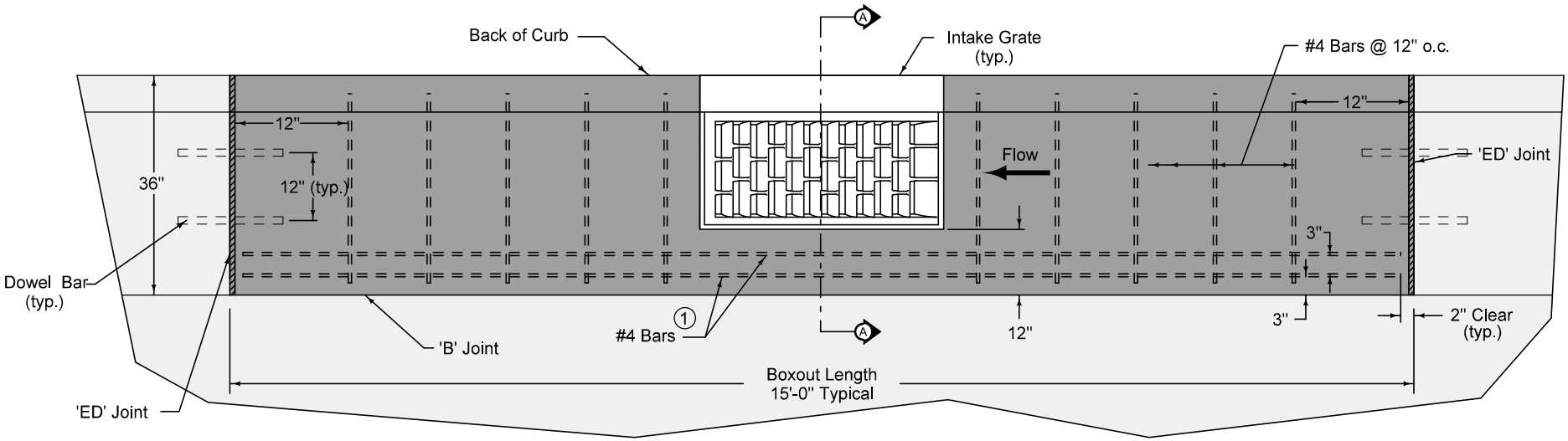
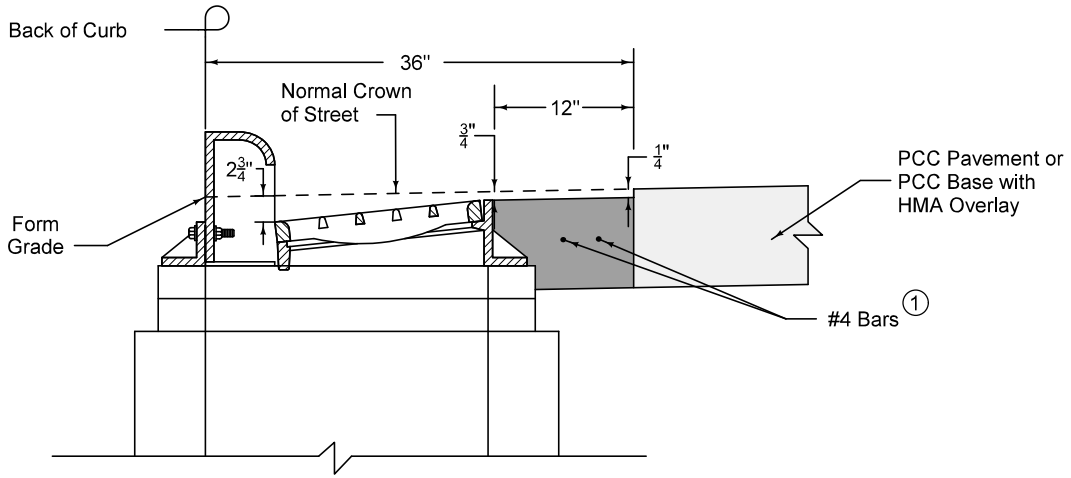
Stuart Nicholson
DESIGN METHODS ENGINEER

OPEN-SIDED AREA INTAKE

FIGURE 6010.513 SHEET 1 OF 1



BOXOUT IN PCC PAVEMENT AND PCC BASE WITH HMA OVERLAY



SECTION A-A

Transverse joint spacing on new concrete pavement is controlled by the intake boxout. Adjust adjacent joint spacing as required to accommodate boxouts.

For retrofit intakes, match existing concrete pavement joints. Stop any transverse pavement joints that do not conform to the minimum spacing requirements at the edge of the boxout.

(1) Center bars vertically within slab.

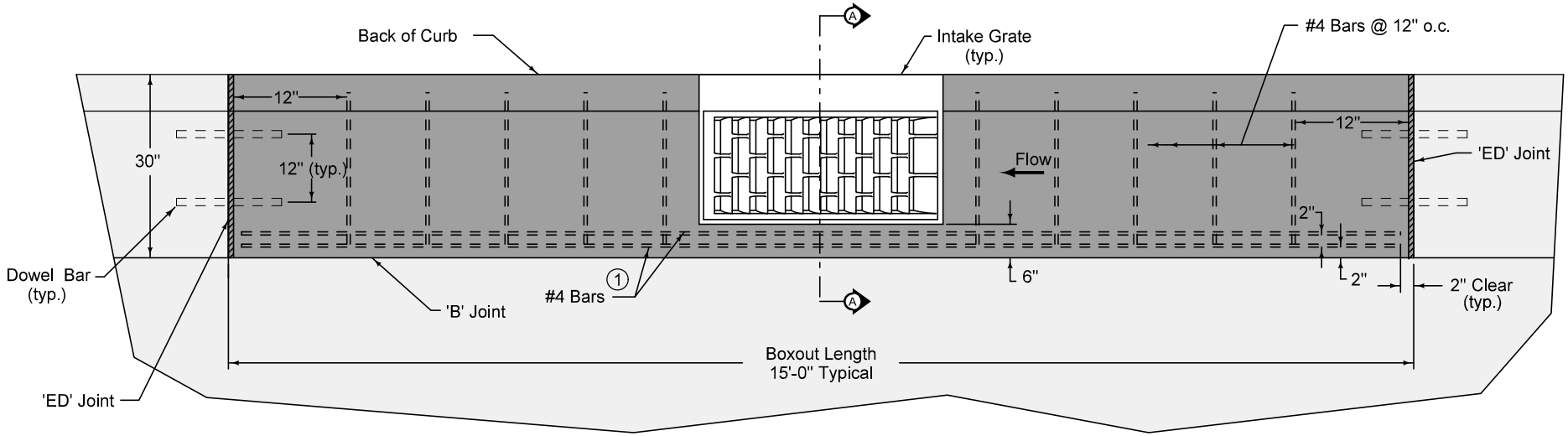
SUDAS	IOWA DOT	REVISION 1 04-17-18
FIGURE 6010.514	STANDARD ROAD PLAN	SW-514
		SHEET 1 of 3

REVISIONS: Added dimension to back of grate. Updated line work and Iowa DOT and SUDAS logo.

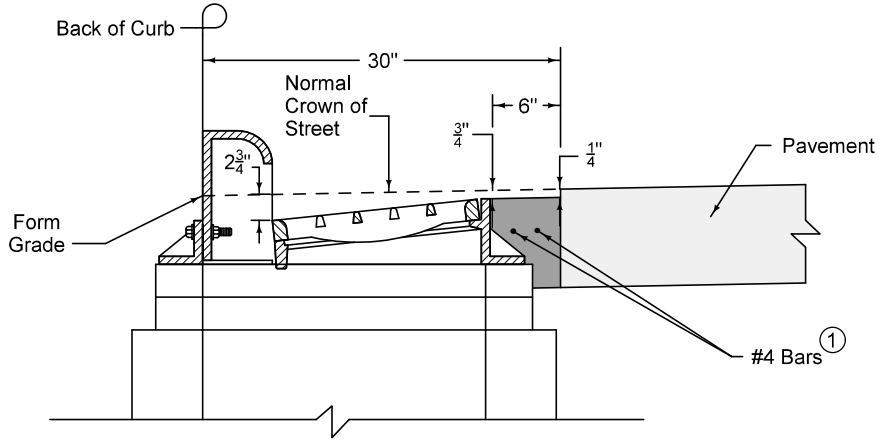
Paul D. Wigand, SUDAS DIRECTOR — Brian Smith, DESIGN METHODS ENGINEER

BOXOUT FOR GRATE INTAKES

FIGURE 6010.514 SHEET 1 OF 3



BOXOUT IN PCC CURB AND GUTTER



SECTION A-A

1 Center bars vertically within slab.

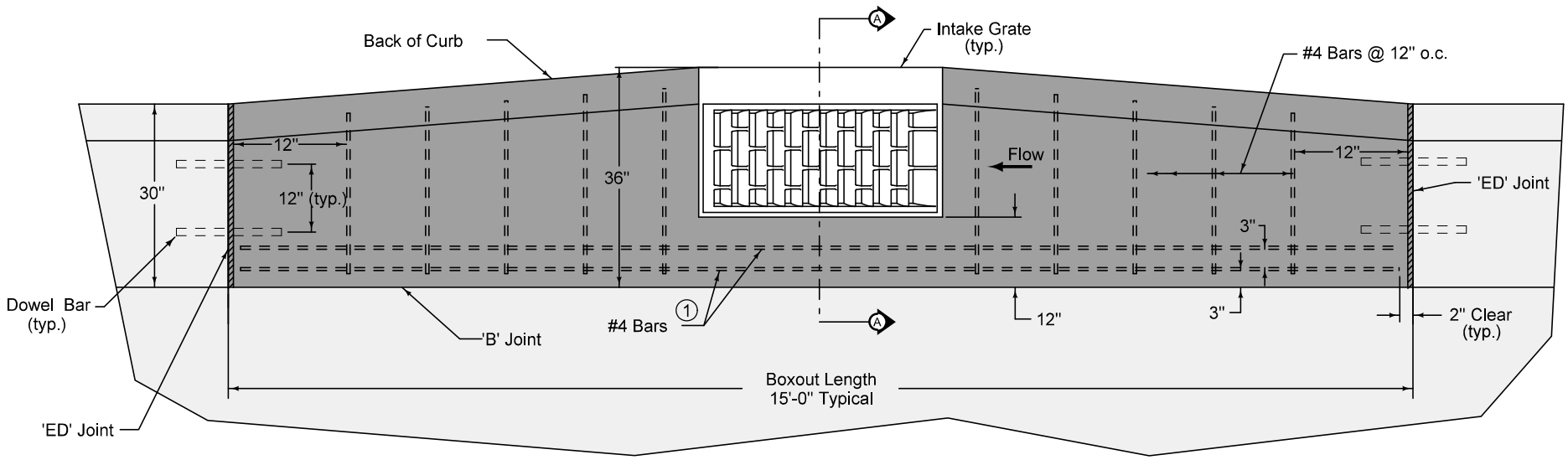
FIGURE 6010.514 SHEET 2 OF 3

SUDAS	IOWA DOT	REVISION 1 04-17-18
FIGURE 6010.514	STANDARD ROAD PLAN	SW-514
		SHEET 2 of 3

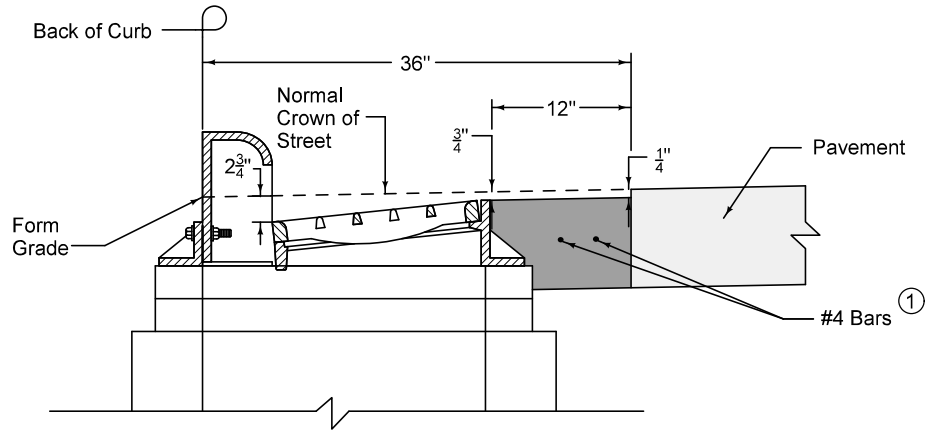
REVISIONS: Added dimension to back of grate. Updated line work and Iowa DOT and SUDAS logo.

Paul D. Wigand, SUDAS DIRECTOR — Brian Smith, DESIGN METHODS ENGINEER

BOXOUT FOR GRATE INTAKES



ALTERNATE BOXOUT IN PCC CURB AND GUTTER



SECTION A-A

Transverse joint spacing on new concrete pavement is controlled by the intake boxout. Adjacent joint spacing may need to be field adjusted to fit boxouts.

For retrofit intakes, match existing concrete pavement joints. Stop any transverse pavement joints that do not conform to the minimum spacing requirements at the edge of the boxout.

(1) Center bars vertically within slab.

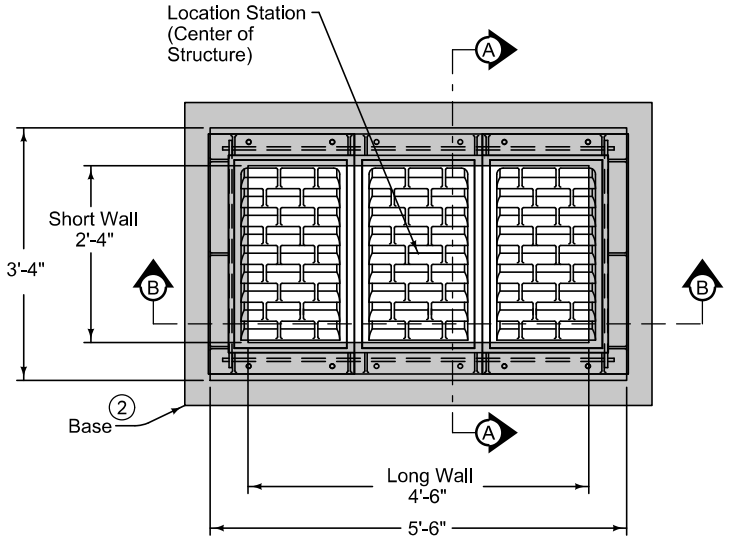
SUDAS	IOWA DOT	REVISION 1 04-17-18
FIGURE 6010.514	STANDARD ROAD PLAN	SW-514
		SHEET 3 of 3

REVISIONS: Added dimension to back of grate. Updated line work and Iowa DOT and SUDAS logo.

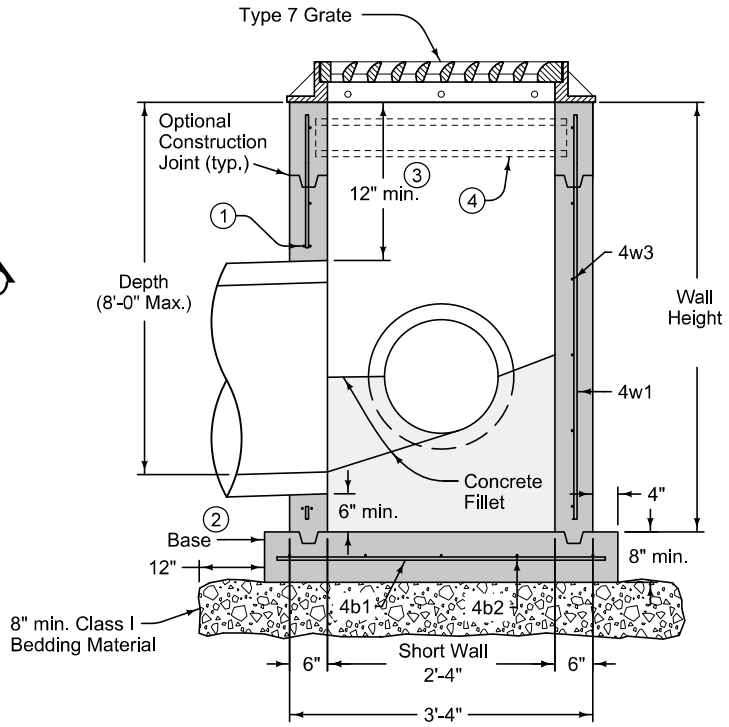
Paul D. Wigand, SUDAS DIRECTOR — Brian Smith, DESIGN METHODS ENGINEER

BOXOUT FOR GRATE INTAKES

FIGURE 6010.514 SHEET 3 OF 3



PLAN



SECTION A-A

1. Provide two #4 hoop bars at all pipe openings.
2. Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.
3. 12 inch minimum wall height above all pipes.
4. If required by casting manufacturer, provide support beam under all frame joints. Modify structure walls as required to provide pocket for beam.

FIGURE 6010.515 | SHEET 1 OF 2

SUDAS	IOWA DOT	REVISION: New 04-21-20
FIGURE 6010.515	STANDARD ROAD PLAN	SW-515
		SHEET 1 of 2

REVISIONS: New.

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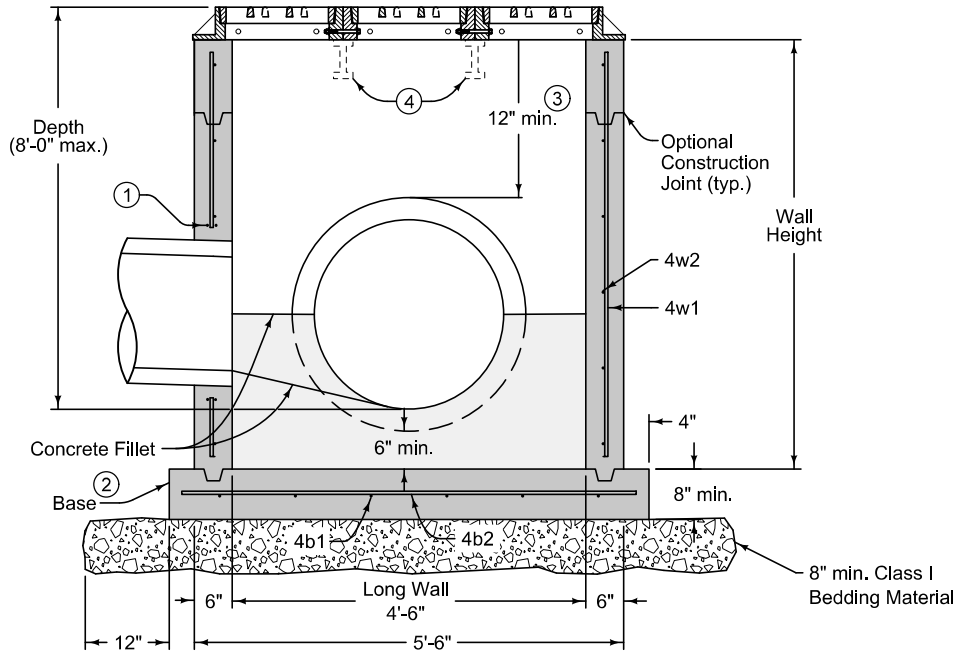
TRIPLE RECTANGULAR AREA INTAKE



SECTION B-B

1. Provide two #4 hoop bars at all pipe openings.
2. Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.
3. 12 inch minimum wall height above all pipes.
4. If required by casting manufacturer, provide support beam under all frame joints. Modify structure walls as required to provide pocket for beam.

MAXIMUM PIPE DIAMETERS		
Pipe Location	Precast Structure	Cast-in-place Structure
Short Wall	18"	21"
Long Wall	36"	42"

REINFORCING BAR LIST						
Mark	Size	Location	Shape	Count	Length	Spacing
4b1	4	Base	——	6	3'-6"	12"
4b2	4	Base	——	4	5'-8"	12"
4w1	4	Walls	——	20	Wall Height minus 4"	12"
4w2	4	Short Wall	——	Varies	3'-0"	12"
4w3	4	Long Wall	——	Varies	5'-2"	12"

SUDAS | IOWADOT

REVISION: New 04-21-20

FIGURE 6010.515 | STANDARD ROAD PLAN | SW-515

SHEET 2 of 2

REVISIONS: New.

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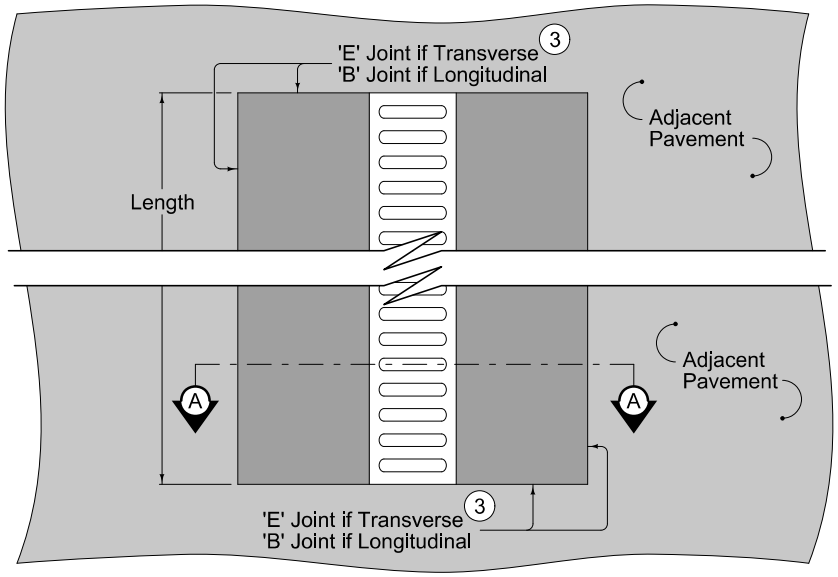
SUDAS DIRECTOR

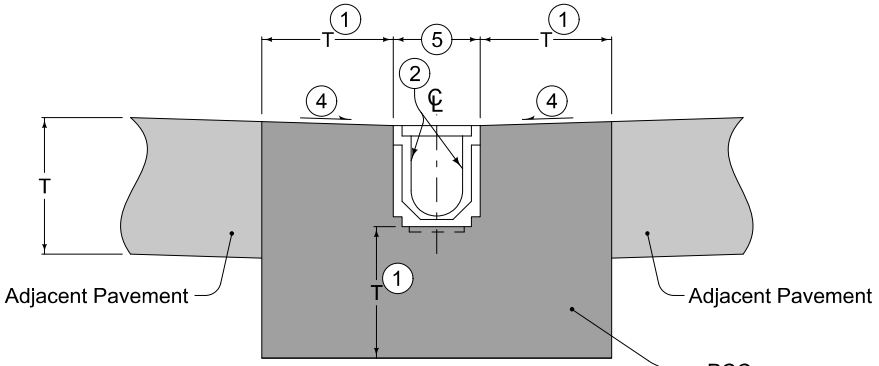
Stuart Nicholson
DESIGN METHODS ENGINEER

TRIPLE RECTANGULAR AREA INTAKE

FIGURE 6010.515 | SHEET 2 OF 2



PLAN



SECTION A-A

1. 6 inches or same as thickness of adjacent pavement, whichever is greater.
2. Linear Trench Drain.
3. For joint details, see PV-101.
4. Slope same as adjacent pavement.
5. Width as determined by manufacturer. Minimum 6 inches.

SUDAS	IOWA DOT	REVISION 2 04-21-20
FIGURE 6010.521	STANDARD ROAD PLAN	SW-521
		SHEET 1 of 2

REVISIONS: Converted to joint standard. Modified circle note 1.

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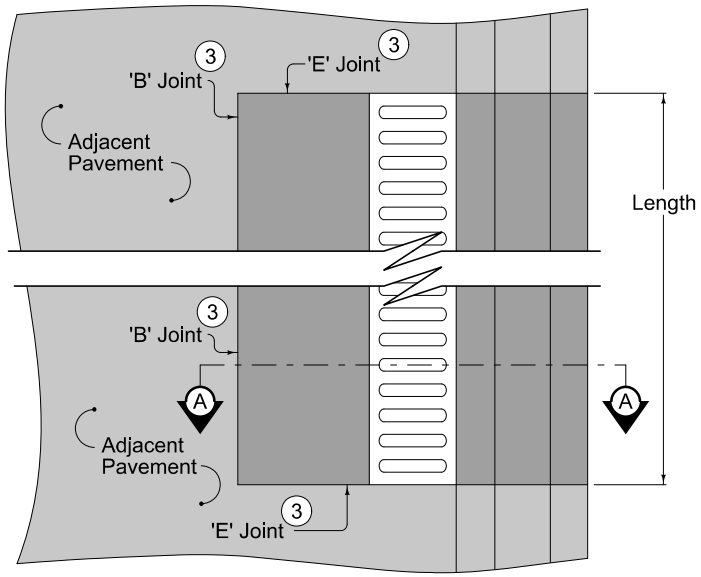
SUDAS DIRECTOR

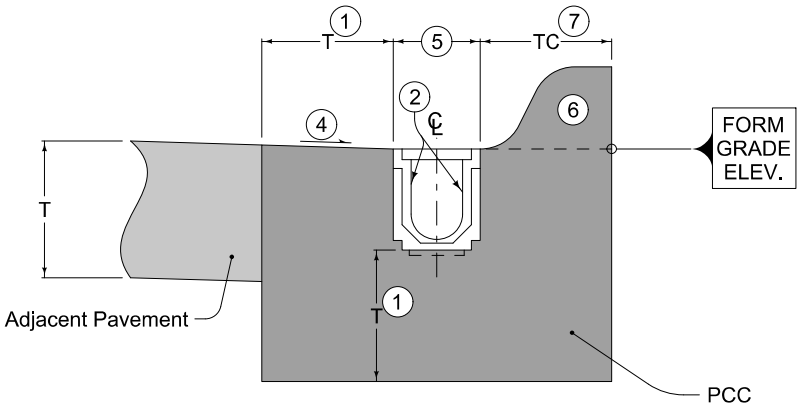
DESIGN METHODS ENGINEER

LINEAR TRENCH DRAIN

FIGURE 6010.521 SHEET 1 OF 2



PLAN



SECTION A-A

1. 6 inches or same as thickness of adjacent pavement, whichever is greater.
2. Linear Trench Drain.
3. For joint details, see PV-101.
4. Slope same as adjacent pavement.
5. Width as determined by manufacturer. Minimum 6 inches.
6. Standard or sloped curb. For curb details, see PV-102.
7. Minimum thickness same as thickness of adjacent pavement or curb width, whichever is greater.

FIGURE 6010.521 | SHEET 2 OF 2

SUDAS | IOWADOT

REVISION	
2	04-21-20

FIGURE 6010.521 | STANDARD ROAD PLAN | SW-521 | SHEET 2 of 2

REVISIONS: Converted to joint standard. Modified circle note 1.

Paul D. Wigand
SUDAS DIRECTOR

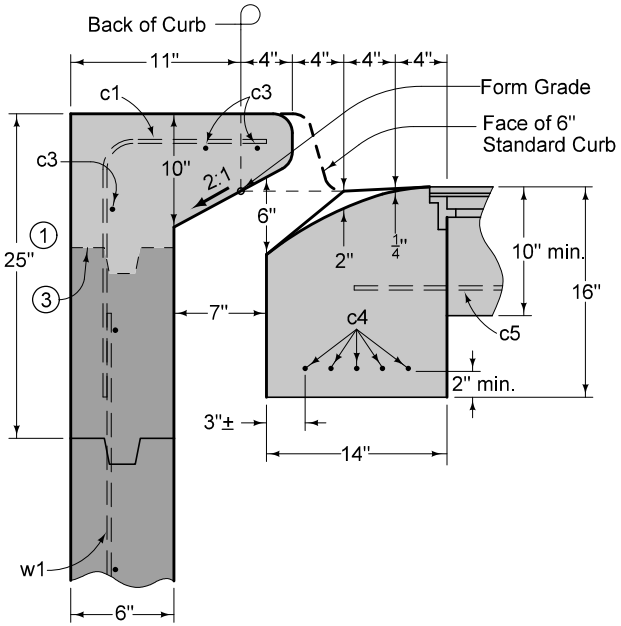
Stuart Nicholson
DESIGN METHODS ENGINEER

LINEAR TRENCH DRAIN

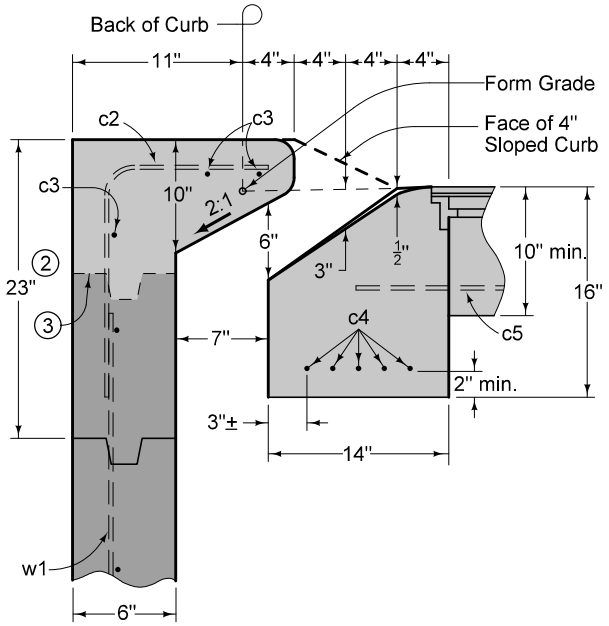
(1) 39 inches when attaching the SW-542 extension unit.

(2) 37 inches when attaching the SW-542 extension unit.

(3) Additional keyed construction joint when attaching the SW-542 extension unit.



INSERT
(6 Inch Standard Curb)



INSERT
(4 Inch Sloped Curb)

FIGURE 6010.541 | SHEET 1 OF 2

SUDAS	IOWA DOT	REVISION 5 04-21-20
FIGURE 6010.541	STANDARD ROAD PLAN	SW-541
		SHEET 1 of 2

REVISIONS: Changed wall walls to 6 inch reinforced. Modified TYPICAL SECTION and c1 and c2 bar lengths. Added note 4. Added Class I bedding material.

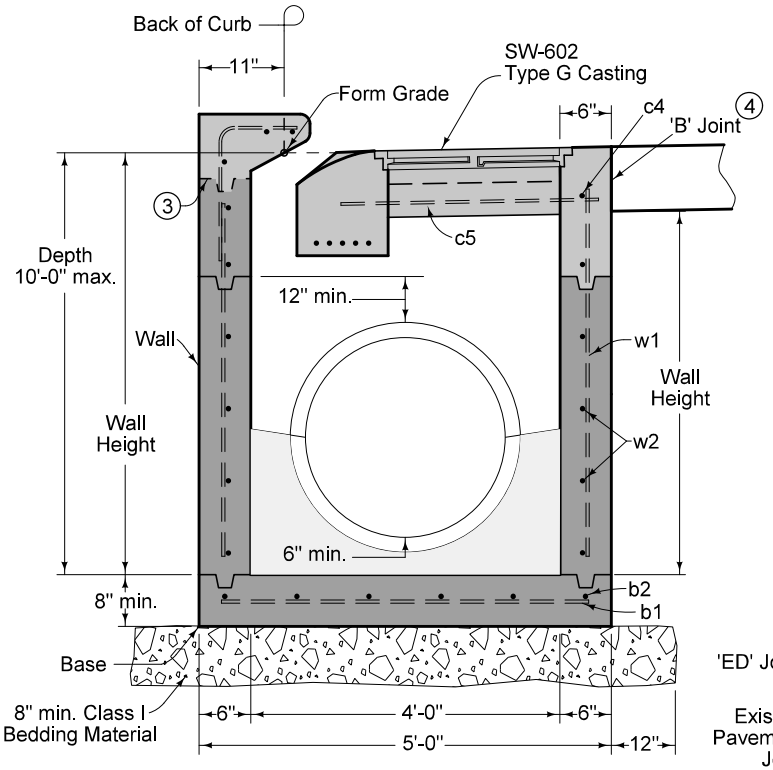
Paul D. Wigand — SUDAS DIRECTOR
Stuart Nicholson — DESIGN METHODS ENGINEER

OPEN-THROAT CURB INTAKE UNDER PAVEMENT

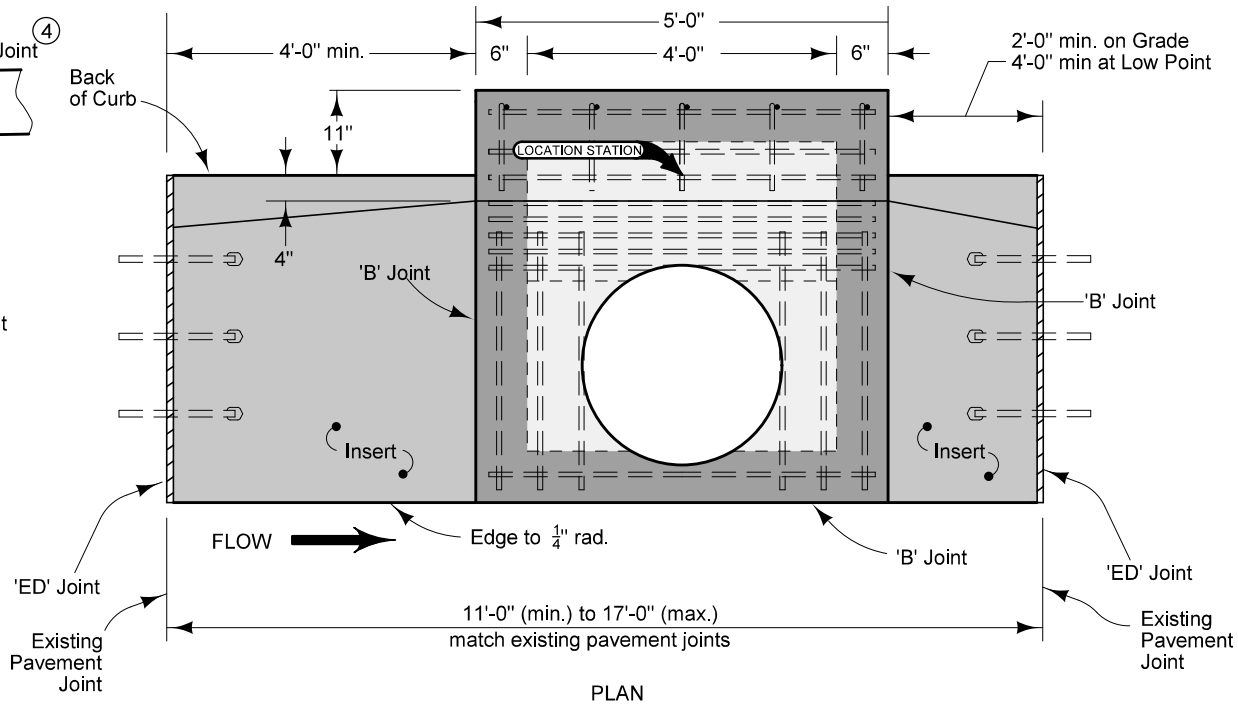
For joint details, refer to PV-101.

③ Additional keyed construction joint when attaching the SW-542 extension unit.

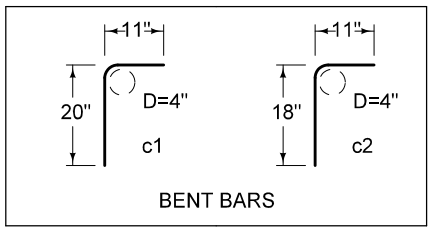
④ Top of well flush with pavement.



TYPICAL SECTION



PLAN



BENT BARS

REINFORCING BAR LIST					
Mark	Size	Location	Shape	Length	Spacing
b1	4	Base	——	4'-6"	11"
b2	4	Base	——	4'-6"	11"
w1	4	Wall	——	Wall Height minus 4"	14"
w2	4	Wall	——	4'-8"	12"
c1	4	Top	⌜	2'-7"	14"
c2	4	Top	⌜	2'-5"	14"
c3	4	Top	——	4'-8"	See Detail
c4	4	Top	——	4'-8"	See Detail
c5	4	Top	——	3'-2"	See Detail

MAXIMUM PIPE DIAMETER	
Precast	30"
Cast-in-Place	36"

FIGURE 6010.541 | SHEET 2 OF 2

SUDAS | IOWADOT | REVISION 5 04-21-20

FIGURE 6010.541 | STANDARD ROAD PLAN | SW-541 | SHEET 2 of 2

REVISIONS: Changed wall walls to 6 Inch reinforced. Modified TYPICAL SECTION and c1 and c2 bar lengths. Added note 4. Added Class I bedding material.

Paul D. Wigand
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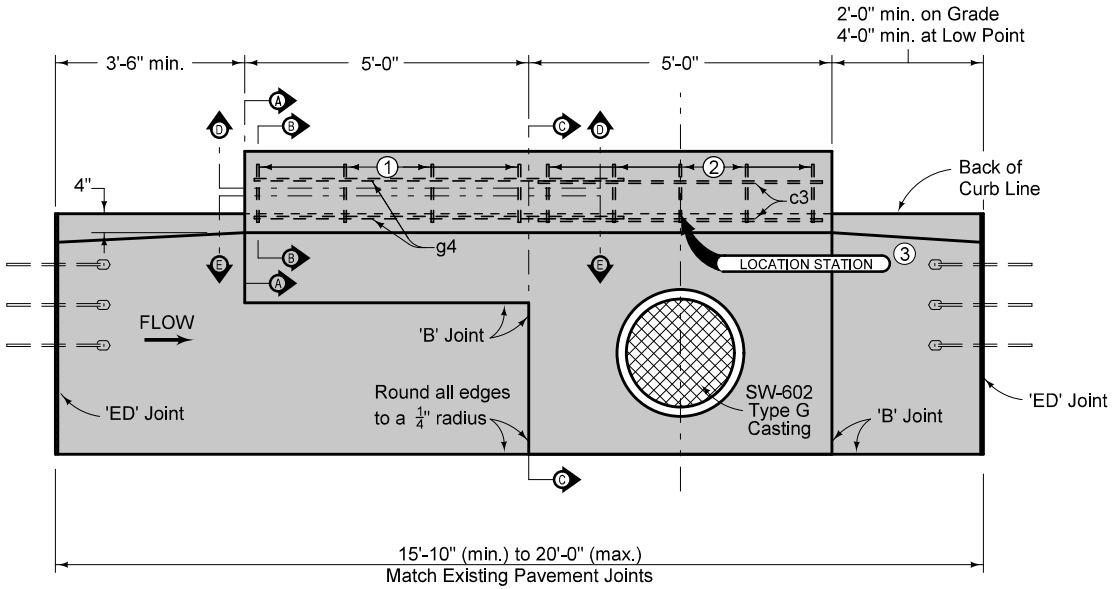
Stuart Nicholson
DESIGN METHODS ENGINEER

OPEN-THROAT CURB INTAKE UNDER PAVEMENT



PLAN
(SW-542 EXTENSION AND SW-541 INTAKE)

Extension unit may be used on either or both sides of SW-541 intakes. Details are similar when extension unit is on the opposite side.

① g3 for 6 inch standard curb; g5 for 4 inch sloped curb.

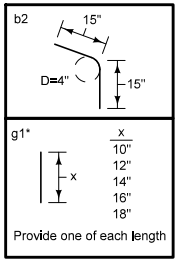
② c1 for 6 inch standard curb; c2 for 4 inch sloped curb. See SW-541 for reinforcing.

③ The location station is where the centerline of intake meets the back of the curb line.

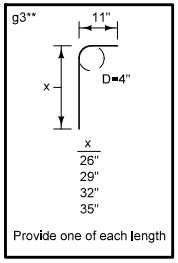
Placing sequence: 1. Base; 2. Walls and Extension; 3. Top; 4. Insert

REINFORCING BAR LIST

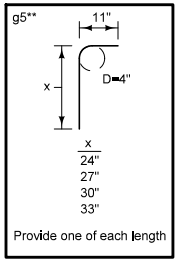
BAR	SIZE	LOCATION	SHAPE	NO.	LENGTH	WEIGHT	SPACING
b2	4	Intake Wall	⌐	3	2'-6"	5.0	9"
f1	4	Bottom	—	3	4'-9"	9.5	9"
f2	4	Bottom	—	4	1'-7"	4.2	18"
g1	4	Wall	—	5	Varies*	Varies*	12"
g2	4	Wall	—	1	4'-8"	3.1	-
g3	4	Top	⌐	4	Varies**	Varies**	18"
g4	4	Top	—	3	6'-4"	12.7	-
g5	4	Top	⌐	4	Varies**	Varies**	18"



Provide one of each length



Provide one of each length



Provide one of each length

SUDAS IOWA DOT

REVISION	
5	10-20-20

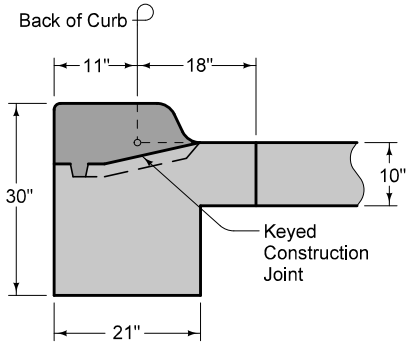
FIGURE 6010.542 | STANDARD ROAD PLAN | SW-542 | SHEET 1 of 4

REVISIONS: Removed Interim from standard.

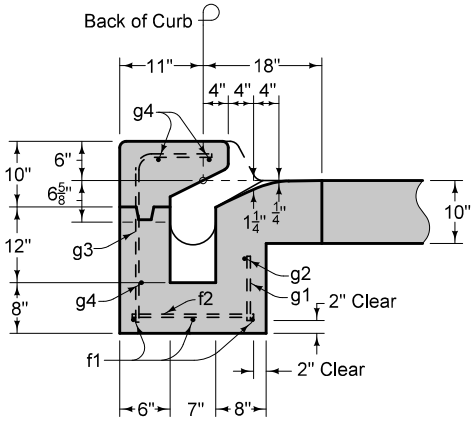
Paul D. Wigard, SUDAS DIRECTOR | Stuart Nicholson, DESIGN METHODS ENGINEER

EXTENSION UNIT FOR OPEN-THROAT CURB INTAKE UNDER PAVEMENT

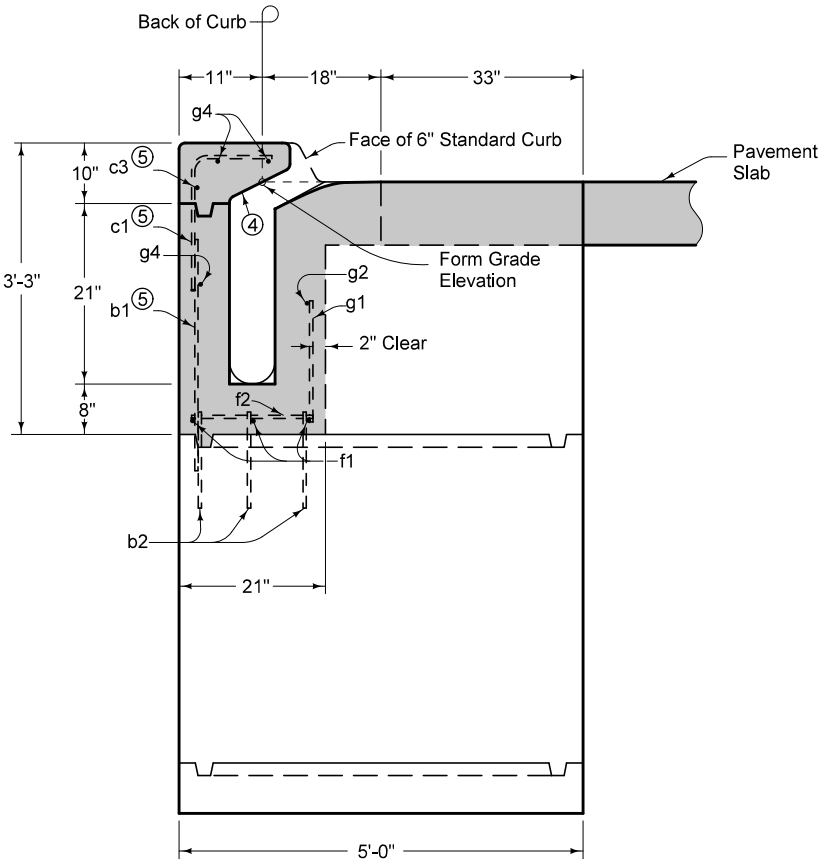
FIGURE 6010.542 | SHEET 1 OF 4



SECTION A-A



SECTION B-B



SECTION C-C

④ 2:1 Slope (Horizontal:Vertical)

⑤ See SW-541 for reinforcing.

6 INCH STANDARD CURB

FIGURE 6010.542 SHEET 2 OF 4

SUDAS IOWADOT

REVISION	
5	10-20-20

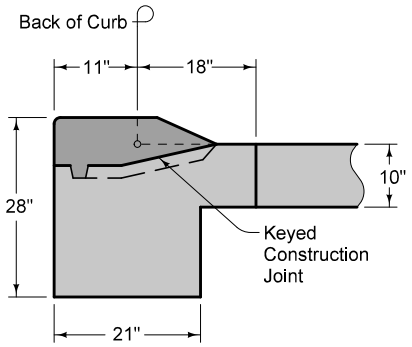
FIGURE 6010.542 | STANDARD ROAD PLAN | SW-542 | SHEET 2 of 4

REVISIONS: Removed Interim from standard.

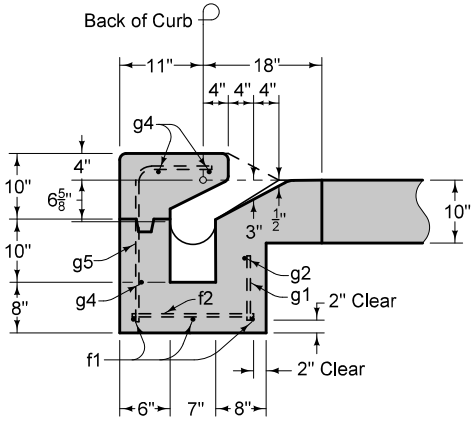
Paul D. Wigand
SUDAS DIRECTOR

Stuart Nicholson
DESIGN METHODS ENGINEER

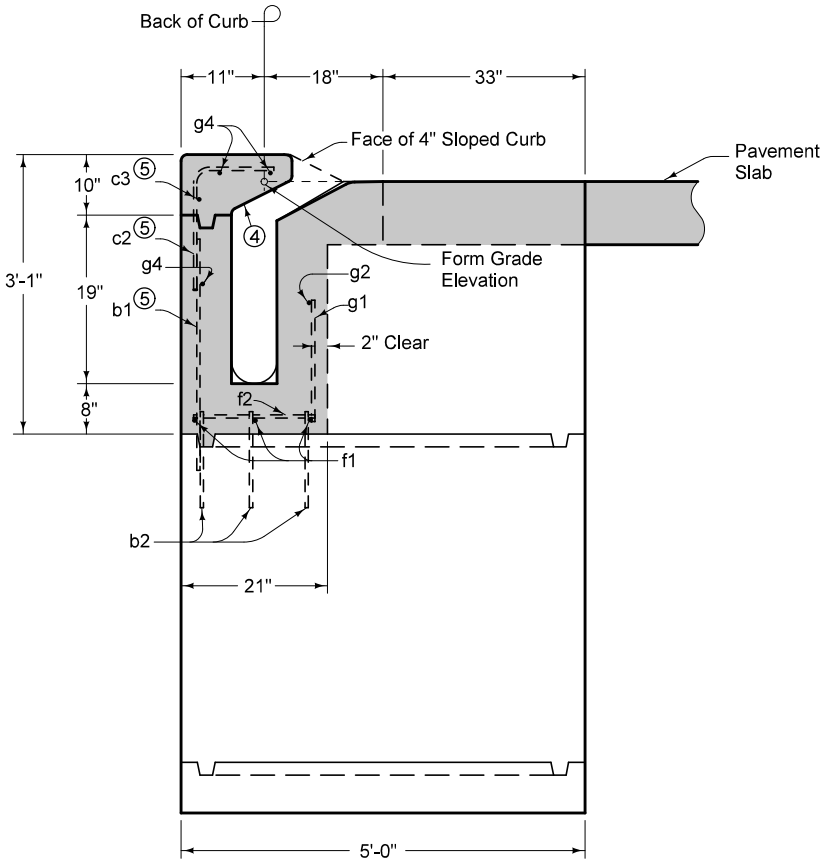
EXTENSION UNIT FOR OPEN-THROAT CURB INTAKE UNDER PAVEMENT



SECTION A-A



SECTION B-B



SECTION C-C

④ 2:1 Slope (Horizontal:Vertical)

⑤ See SW-541 for reinforcing.

4 INCH SLOPED CURB

FIGURE 6010.542 SHEET 3 OF 4

SUDAS IOWA DOT

REVISION	
5	10-20-20

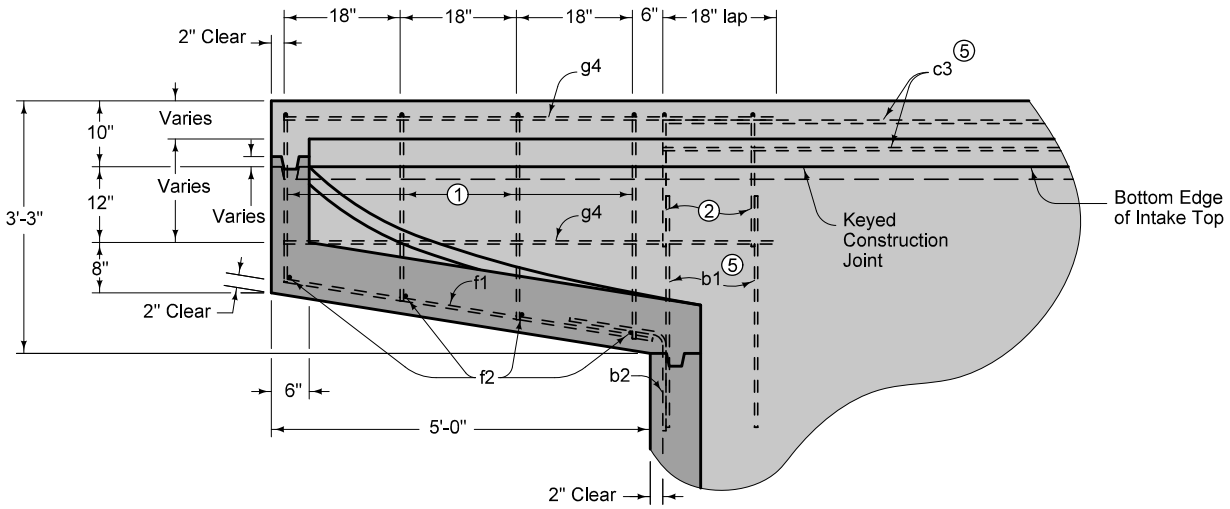
FIGURE 6010.542 | STANDARD ROAD PLAN | SW-542 | SHEET 3 of 4

REVISIONS: Removed Interim from standard.

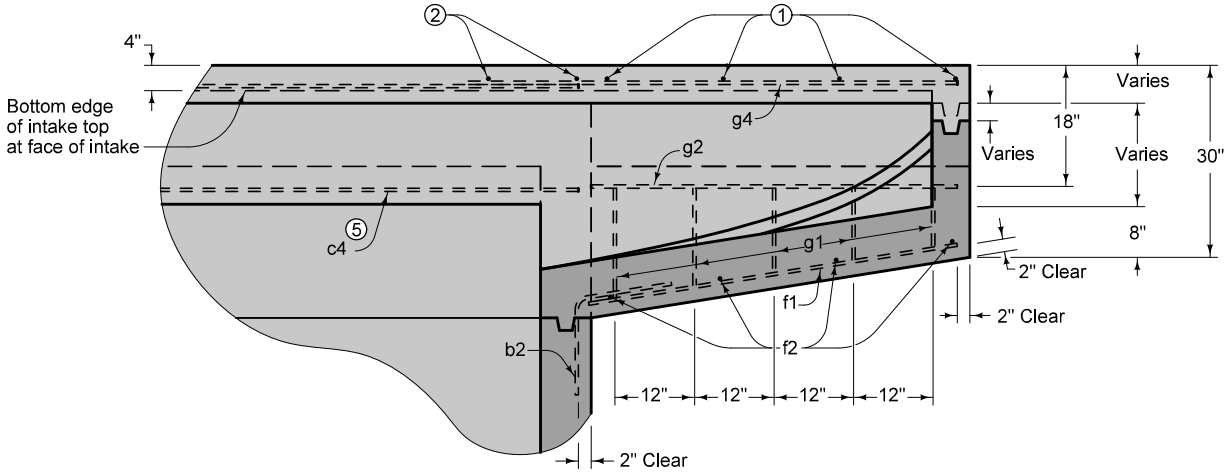
Paul D. Wigand — SUDAS DIRECTOR

Stuart Nicholson — DESIGN METHODS ENGINEER

EXTENSION UNIT FOR OPEN-THROAT CURB INTAKE UNDER PAVEMENT



SECTION D-D



SECTION E-E

① g3 for 6 inch standard curb; g5 for 4 inch sloped curb.

② c1 for 6 inch standard curb; c2 for 4 inch sloped curb. See SW-541 for reinforcing.

⑤ See SW-541 for reinforcing.

FIGURE 6010.542 SHEET 4 OF 4

SUDAS IOWADOT

REVISION	
5	10-20-20

FIGURE 6010.542 | STANDARD ROAD PLAN

SW-542

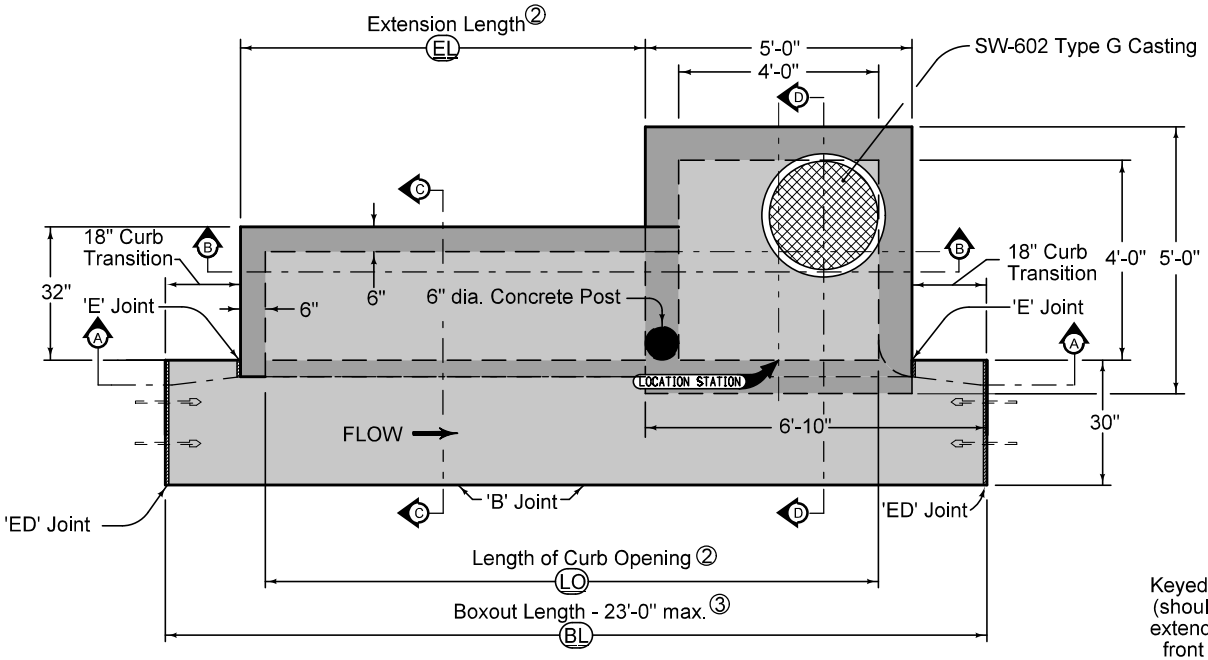
SHEET 4 of 4

REVISIONS: Removed Interim from standard.

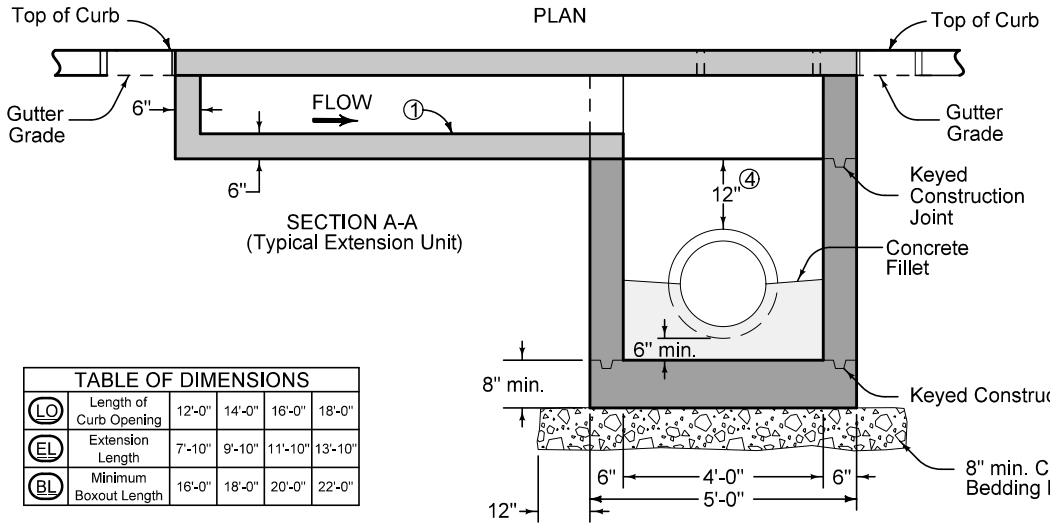
Paul D. Wigant
SUDAS DIRECTOR

Stuart Nicholson
DESIGN METHODS ENGINEER

EXTENSION UNIT FOR OPEN-THROAT CURB INTAKE UNDER PAVEMENT

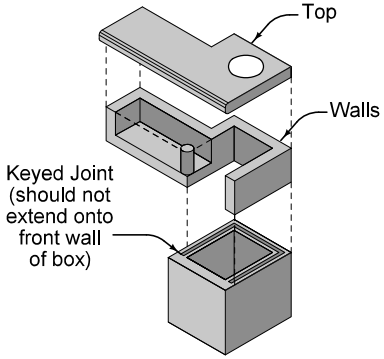


PLAN



SECTION A-A
(Typical Extension Unit)

SECTION B-B
(Typical Intake Well)



ISOMETRIC
INTAKE WELL, WALLS AND TOP

TABLE OF DIMENSIONS					
LO	Length of Curb Opening	12'-0"	14'-0"	16'-0"	18'-0"
EL	Extension Length	7'-10"	9'-10"	11'-10"	13'-10"
BL	Minimum Boxout Length	16'-0"	18'-0"	20'-0"	22'-0"

Extension unit may be used on either or both sides of intake. Details are similar when extension unit is on the opposite side. For joint details, refer to PV-101.

① Match gutter slope. Drain to well.

② Other lengths of opening may be constructed by varying the length of the extension and the rebar.

③ Includes 2 inches for 'ED' Joints.

④ 12 inch minimum wall height above all pipes.

MAXIMUM PIPE DIAMETERS	
Precast Structure	Cast-in-place Structure
30"	36"

FIGURE 6010.545 SHEET 1 OF 4

SUDAS | IOWA DOT

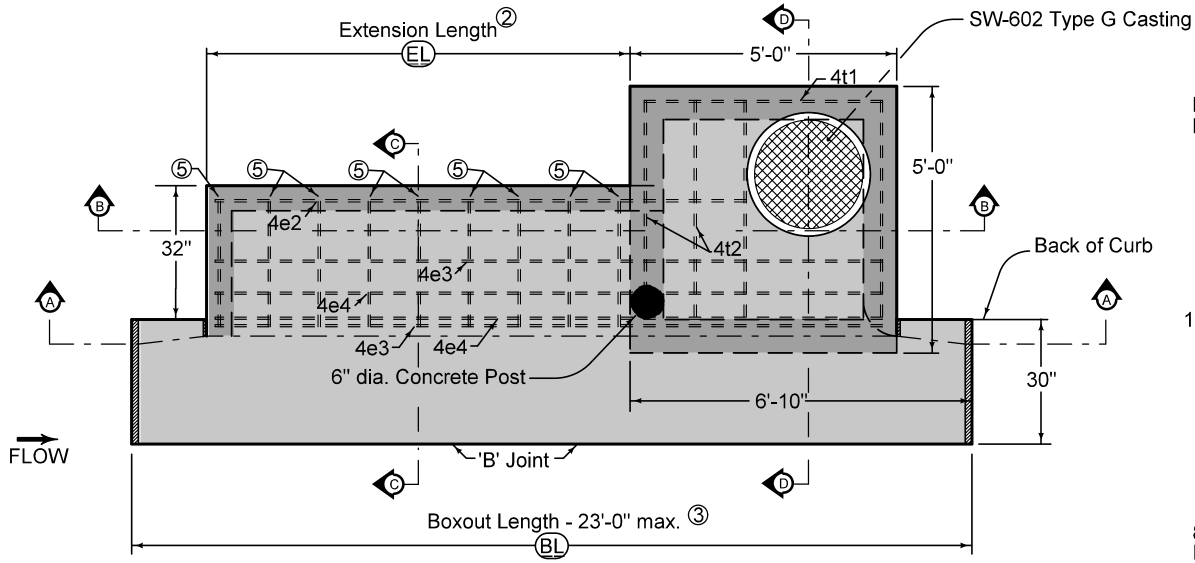
REVISION 6 04-19-22

FIGURE 6010.545 | STANDARD ROAD PLAN | SW-545 | SHEET 1 of 4

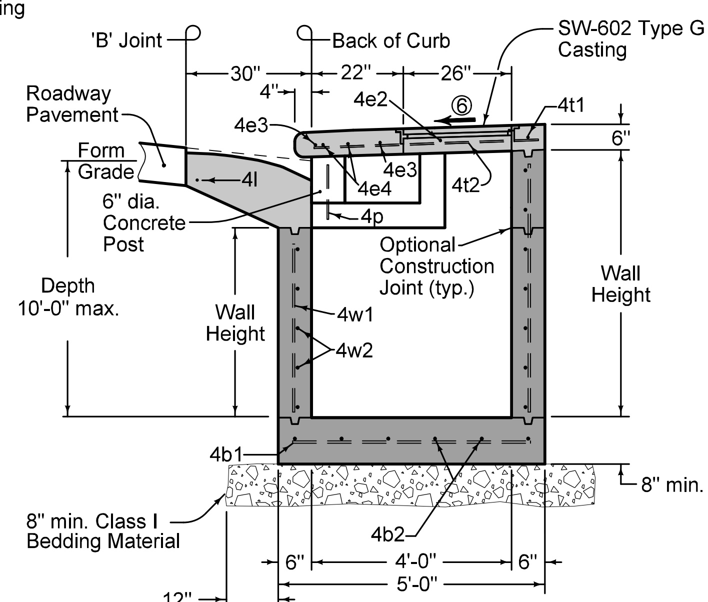
REVISIONS: Clarified labeling of rebar.

Paul D. Wigard, SUDAS DIRECTOR | DESIGN METHODS ENGINEER

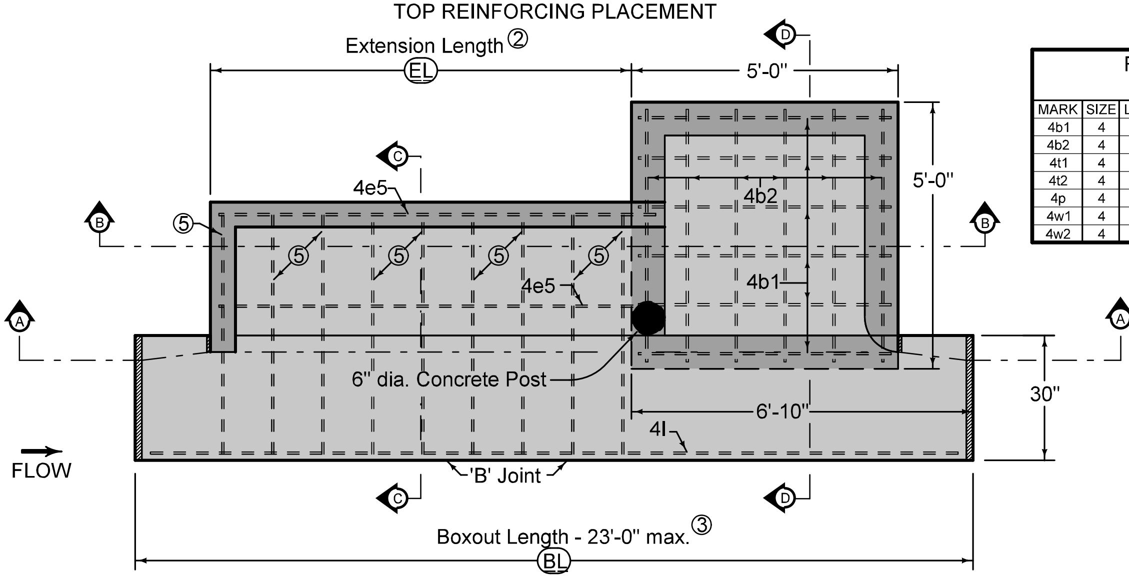
SINGLE OPEN-THROAT CURB INTAKE WITH EXTENDED OPENING



PLAN
TOP REINFORCING PLACEMENT



SECTION D-D



PLAN
BOTTOM REINFORCING PLACEMENT

REINFORCING BAR LIST
Intake Well

MARK	SIZE	LOCATION	NO.	LENGTH	SPACING
4b1	4	Base	6	4'-6"	11"
4b2	4	Base	6	4'-6"	11"
4t1	4	Top	1	4'-8"	12"
4t2	4	Top	4	4'-3"	See Detail
4p	4	Post	1	13"	
4w1	4	Walls	16	Wall Height minus 4"	14"
4w2	4	Walls	Varies	4'-8"	12"

② Other lengths of opening may be constructed by varying the length of the extension and the rebar.

③ Includes 2 inches for 'ED' Joints.

⑤ 4e1 or 4e6. See Sheets 3 and 4.

⑥ Slope of 1.5% or as specified in the contract documents.

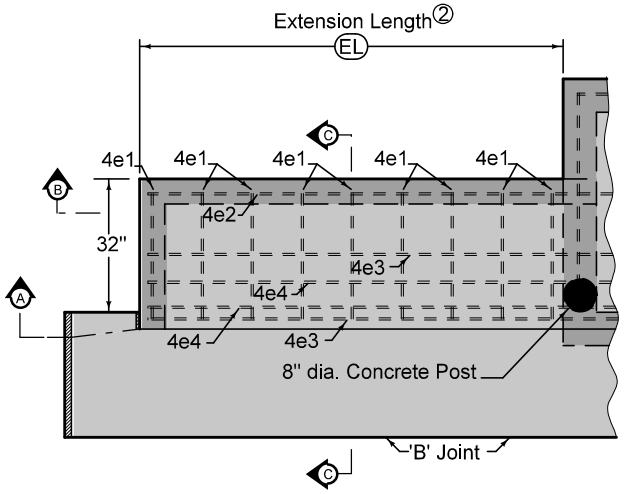
SUDAS | IOWADOT | REVISION 6 04-19-22

FIGURE 6010.545 | STANDARD ROAD PLAN | SW-545 SHEET 2 of 4

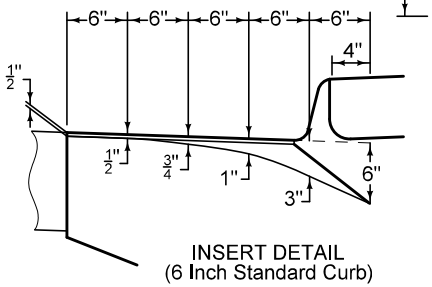
REVISIONS: Clarified labeling of rebar.

SUDAS DIRECTOR | DESIGN METHODS ENGINEER

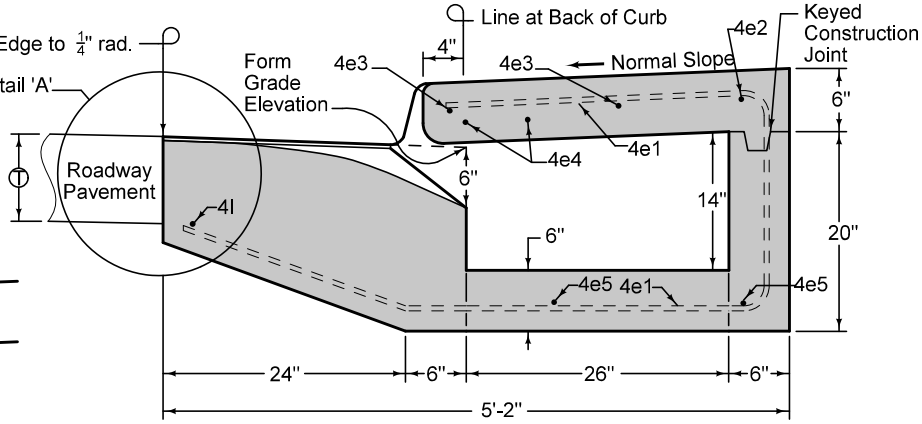
SINGLE OPEN-THROAT CURB INTAKE WITH EXTENDED OPENING



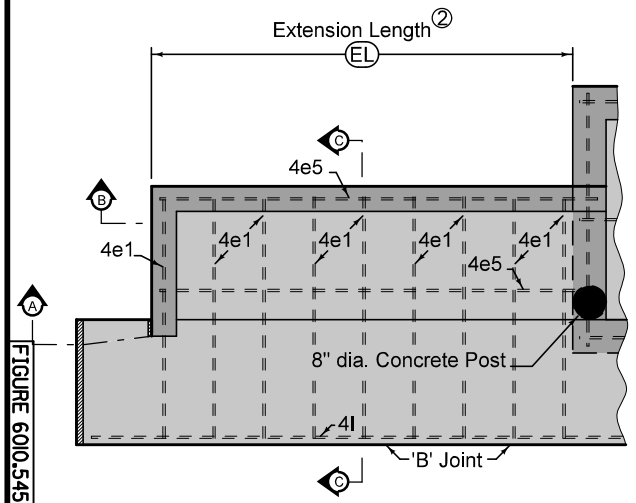
PLAN
TOP OF EXTENSION REINFORCING PLACEMENT



INSERT DETAIL
(6 Inch Standard Curb)



SECTION C-C
(6 Inch Standard Curb)



PLAN
BOTTOM OF EXTENSION REINFORCING PLACEMENT

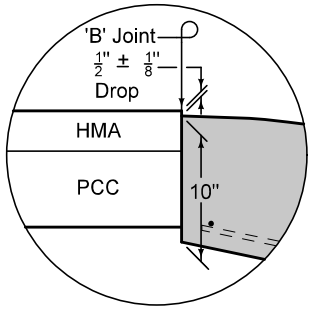
REINFORCING BAR LIST (LO) = 12'-0"						
MARK	SIZE	LOCATION	NO.	LENGTH	WEIGHT	SPACING
4e1	4	Top/Base	9	9'-5½"	56.9	12"
4e2	4	Top	1	10'-0"	6.7	
4e3	4	Top	2	12'-9"	17.0	15½"
4e4	4	Top	2	12'-9"	17.0	6"
4e5	4	Base	2	8'-2"	10.9	22"
4l*	4	Insert	1	15'-10"	10.6	
* With 16'-6" Boxout.				Total	119.1 lbs.	

REINFORCING BAR LIST (LO) = 14'-0"						
MARK	SIZE	LOCATION	NO.	LENGTH	WEIGHT	SPACING
4e1	4	Top/Base	11	9'-5½"	69.5	12"
4e2	4	Top	1	12'-0"	8.0	
4e3	4	Top	2	14'-9"	19.7	15½"
4e4	4	Top	2	14'-9"	19.7	6"
4e5	4	Base	2	10'-2"	13.6	22"
4l*	4	Insert	1	17'-10"	11.9	
* With 18'-6" Boxout.				Total	142.4 lbs.	

REINFORCING BAR LIST (LO) = 16'-0"						
MARK	SIZE	LOCATION	NO.	LENGTH	WEIGHT	SPACING
4e1	4	Top/Base	13	9'-5½"	82.1	12"
4e2	4	Top	1	14'-0"	9.3	
4e3	4	Top	2	16'-9"	22.4	15½"
4e4	4	Top	2	16'-9"	22.4	6"
4e5	4	Base	2	12'-2"	16.2	22"
4l*	4	Insert	1	19'-10"	13.2	
* With 20'-6" Boxout.				Total	165.6 lbs.	

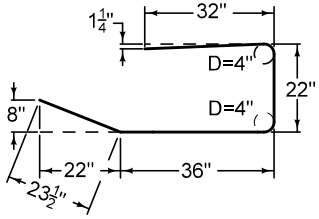
REINFORCING BAR LIST (LO) = 18'-0"						
MARK	SIZE	LOCATION	NO.	LENGTH	WEIGHT	SPACING
4e1	4	Top/Base	15	9'-5½"	94.8	12"
4e2	4	Top	1	16'-0"	10.7	
4e3	4	Top	2	18'-9"	25	15½"
4e4	4	Top	2	18'-9"	25	6"
4e5	4	Base	2	14'-2"	18.9	22"
4l*	4	Insert	1	21'-10"	14.6	
* With 22'-6" Boxout.				Total	189.0 lbs.	

6 INCH STANDARD CURB



DETAIL 'A'
Use when adjacent pavement is HMA or composite.

BENT BAR DETAILS



4e1

NOTE: ALL DIMENSIONS ARE OUT TO OUT
D = PIN DIAMETER

② Other lengths of opening may be constructed by varying the length of the extension and the rebar.

SUDAS | IOWA DOT

REVISION	
6	04-19-22

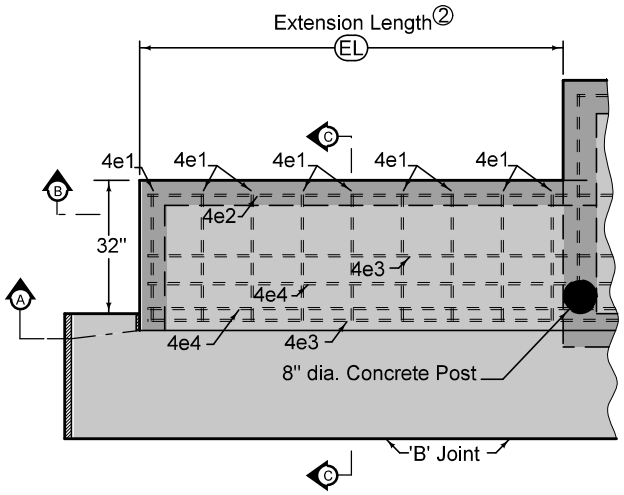
FIGURE 6010.545 | STANDARD ROAD PLAN | SW-545 | SHEET 3 of 4

REVISIONS: Clarified labeling of rebar.

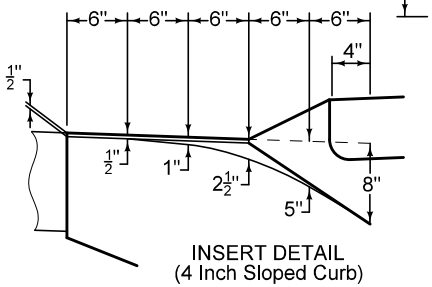
Paul D. Wigard, SUDAS DIRECTOR
Stuart Nicholson, DESIGN METHODS ENGINEER

SINGLE OPEN-THROAT CURB INTAKE WITH EXTENDED OPENING

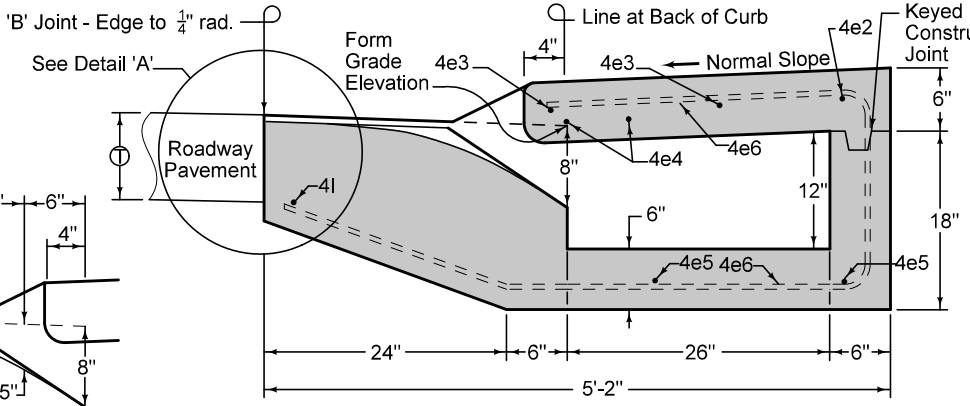
FIGURE 6010.545 | SHEET 3 OF 4



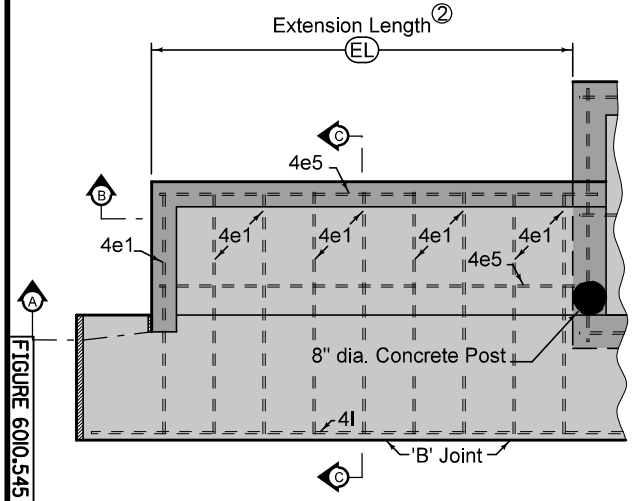
PLAN
TOP OF EXTENSION REINFORCING PLACEMENT



INSERT DETAIL
(4 Inch Sloped Curb)



SECTION C-C
(4 Inch Sloped Curb)



PLAN
BOTTOM OF EXTENSION REINFORCING PLACEMENT

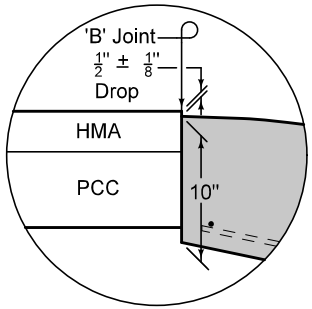
REINFORCING BAR LIST (LO) = 12'-0"						
MARK	SIZE	LOCATION	NO.	LENGTH	WEIGHT	SPACING
4e2	4	Top	1	10'-0"	6.7	
4e3	4	Top	2	12'-9"	17.0	15½"
4e4	4	Top	2	12'-9"	17.0	6"
4e5	4	Base	2	8'-2"	10.9	22"
4e6	4	Top/Base	9	9'-3½"	56.9	12"
4l*	4	Insert	1	15'-10"	10.6	
* With 16'-6" Boxout.				Total	119.0 lbs.	

REINFORCING BAR LIST (LO) = 14'-0"						
MARK	SIZE	LOCATION	NO.	LENGTH	WEIGHT	SPACING
4e2	4	Top	1	12'-0"	8.0	
4e3	4	Top	2	14'-9"	19.7	15½"
4e4	4	Top	2	14'-9"	19.7	6"
4e5	4	Base	2	10'-2"	13.6	22"
4e6	4	Top/Base	11	9'-3½"	69.5	12"
4l*	4	Insert	1	17'-10"	11.9	
* With 18'-6" Boxout.				Total	142.3 lbs.	

REINFORCING BAR LIST (LO) = 16'-0"						
MARK	SIZE	LOCATION	NO.	LENGTH	WEIGHT	SPACING
4e2	4	Top	1	14'-0"	9.3	
4e3	4	Top	2	16'-9"	22.4	15½"
4e4	4	Top	2	16'-9"	22.4	6"
4e5	4	Base	2	12'-2"	16.2	22"
4e6	4	Top/Base	13	9'-3½"	82.1	12"
4l*	4	Insert	1	19'-10"	13.2	
* With 20'-6" Boxout.				Total	165.5 lbs.	

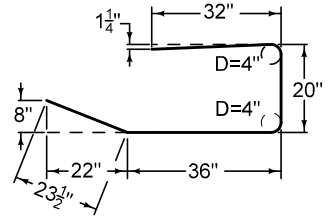
REINFORCING BAR LIST (LO) = 18'-0"						
MARK	SIZE	LOCATION	NO.	LENGTH	WEIGHT	SPACING
4e2	4	Top	1	16'-0"	10.7	
4e3	4	Top	2	18'-9"	25	15½"
4e4	4	Top	2	18'-9"	25	6"
4e5	4	Base	2	14'-2"	18.9	22"
4e6	4	Top/Base	15	9'-3½"	94.8	12"
4l*	4	Insert	1	21'-10"	14.6	
* With 22'-6" Boxout.				Total	188.9 lbs.	

4 INCH SLOPED CURB



DETAIL 'A'
Use when adjacent pavement
is HMA or composite.

BENT BAR DETAILS



4e6

NOTE: ALL DIMENSIONS ARE OUT TO OUT
D = PIN DIAMETER

② Other lengths of opening may be constructed by varying the length of the extension and the rebar.

SUDAS | IOWADOT

REVISION 6 04-19-22

FIGURE 6010.545 | STANDARD ROAD PLAN | SW-545

SHEET 4 of 4

REVISIONS: Clarified labeling of rebar.

Paul D. Wigand
SUDAS DIRECTOR

Stuart Nicholson
DESIGN METHODS ENGINEER

SINGLE OPEN-THROAT CURB INTAKE WITH EXTENDED OPENING

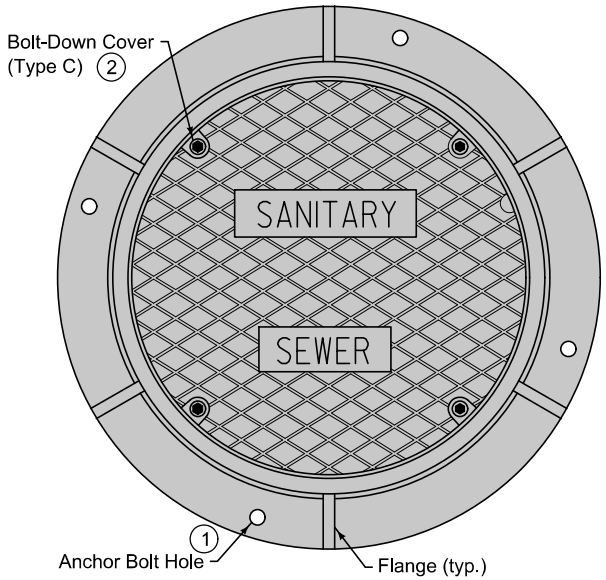
FIGURE 6010.545 SHEET 4 OF 4

TYPE A

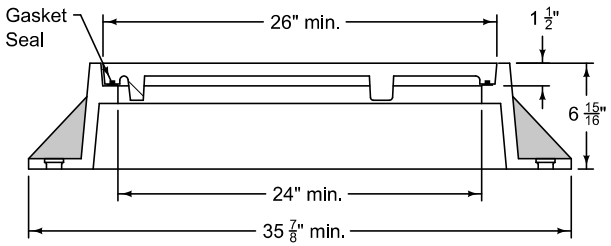
Two-piece fixed casting

TYPE C

Two-piece fixed casting with bolt-down cover (2)



PLAN



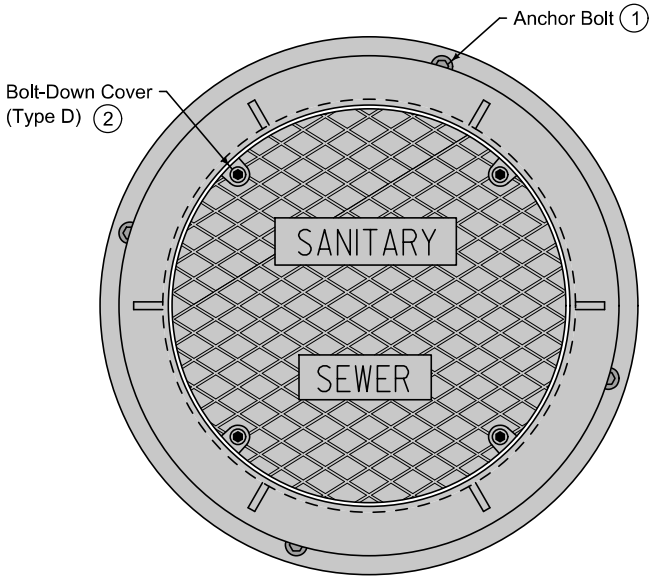
TYPICAL SECTION

TYPE B: HMA

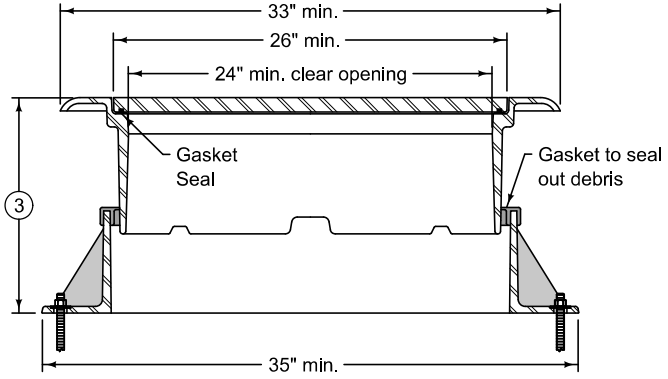
Three-piece floating casting for use in HMA paving

TYPE D: HMA

Three-piece floating casting with bolt-down cover for use in HMA paving (2)



PLAN



TYPICAL SECTION

Frame Notes:
Size, spacing, and number of lugs and flanges may vary.

Cover Notes:
Roughness pattern and text style may vary.
Minimum one concealed pickhole.

(1) Anchor the lower frame of all three-piece castings to the manhole structure. When specified in the contract documents, anchor the frame of two-piece castings to the manhole structure. If casting frame does not include anchor holes or slots, drill four 7/8 inch diameter holes, equally spaced around the frame.

(2) If specified, furnish bolt down frame and cover with four 1/2 inch minimum diameter stainless steel, hex nut, recessed cap screws. Secure cover with screws, washers, and rubber gasket seals.

(3) Casting height varies. Minimum adjustment range of 4 inches.

SUDAS	IOWA DOT	REVISION 4	04-21-20
FIGURE 6010.601	STANDARD ROAD PLAN	SW-601	SHEET 1 of 2

REVISIONS: Add option for 3-piece HMA casting

Paul D. Wigard
SUDAS DIRECTOR

Stuart Nicholson
DESIGN METHODS ENGINEER

CASTINGS FOR SANITARY SEWER MANHOLES

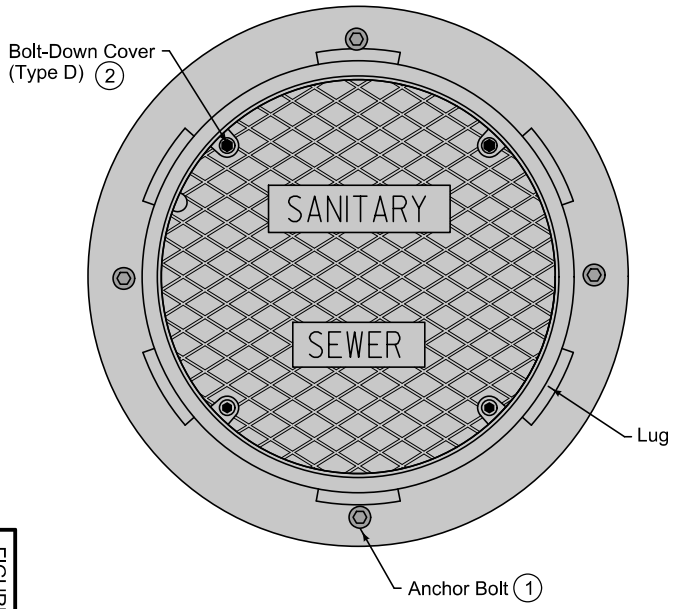
FIGURE 6010.601 | SHEET 1 OF 2

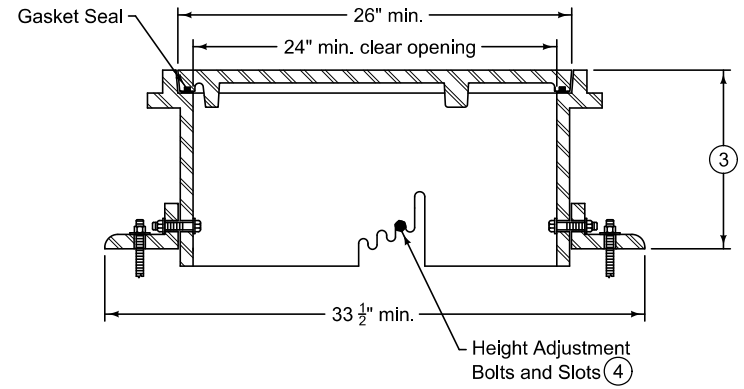
TYPE B: PCC

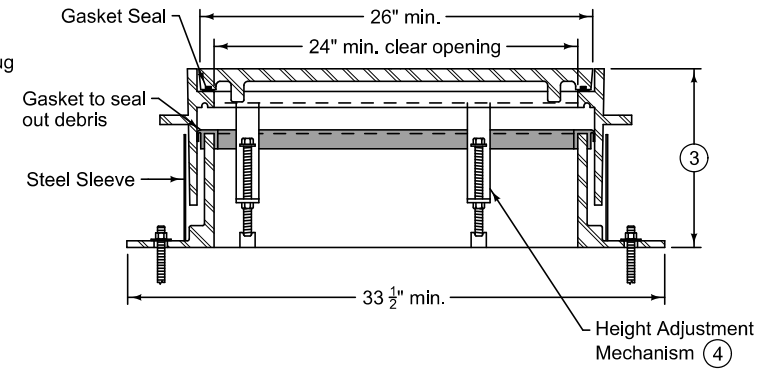
Three-piece floating casting for use in PCC paving and PCC boxouts

TYPE D: PCC

Three-piece floating casting with bolt-down cover for use in PCC paving and PCC boxouts







TYPICAL SECTION 5

Frame Notes:
Size, spacing, and number of lugs and flanges may vary.

Cover Notes:
Roughness pattern and text style may vary.
Minimum one concealed pickhole.

1. Anchor the lower frame of all three-piece castings to the manhole structure. When specified in the contract documents, anchor the frame of two-piece castings to the manhole structure. If casting frame does not include anchor holes or slots, drill four 7/8 inch diameter holes, equally spaced around the frame.
2. If specified, furnish bolt down frame and cover with four 1/2 inch minimum diameter stainless steel, hex nut, recessed cap screws. Secure cover with screws, washers, and rubber gasket seals.
3. Casting height varies. Minimum adjustment range of 4 inches.
4. Set casting at proper grade using the adjustment slots or adjustment mechanism. Remove bolts or mechanism upon completion of paving.
5. Height adjustment method may vary; two options are shown.

FIGURE 6010.601 | SHEET 2 OF 2

SUDAS	IOWADOT	REVISION 4	04-21-20
FIGURE 6010.601	STANDARD ROAD PLAN	SW-601	SHEET 2 of 2

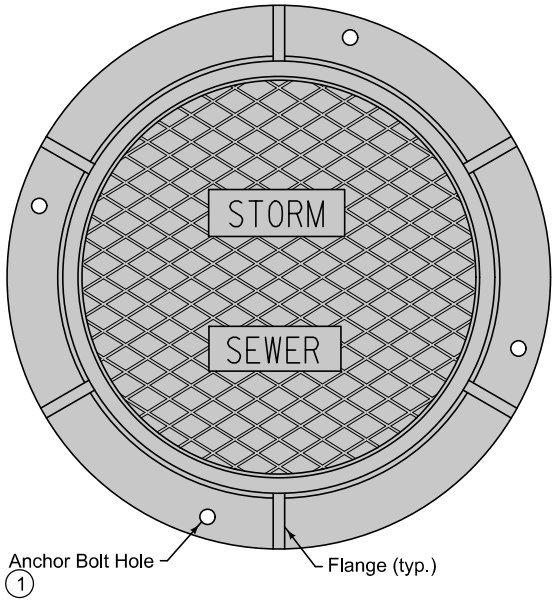
REVISIONS: Add option for 3-piece HMA casting

Paul D. Wigand — SUDAS DIRECTOR
Stuart Nicholson — DESIGN METHODS ENGINEER

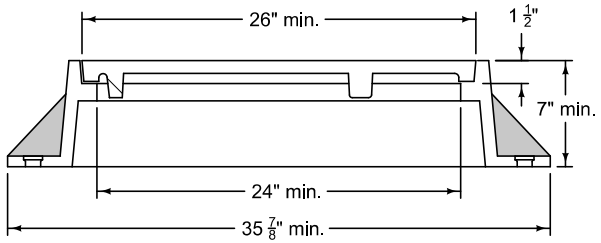
CASTINGS FOR SANITARY SEWER MANHOLES

TYPE E

Two-piece fixed casting



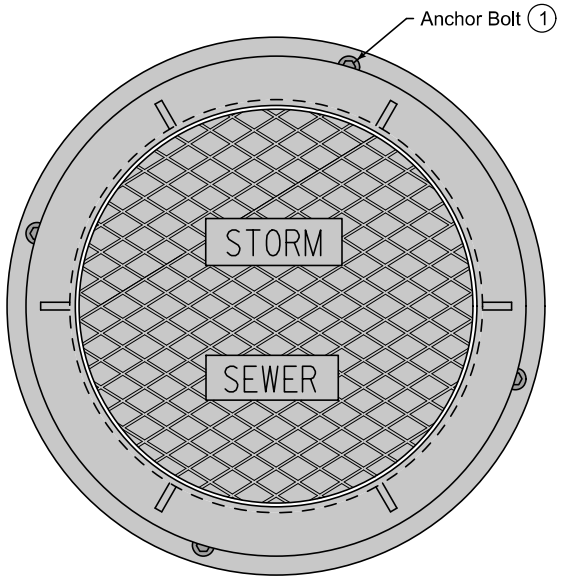
PLAN



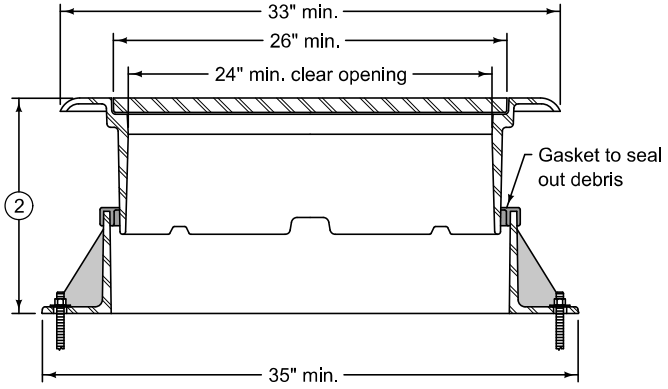
TYPICAL SECTION

TYPE F: HMA

Three-piece floating casting for use in HMA paving



PLAN



TYPICAL SECTION

Frame Notes:
Size, spacing, and number of lugs and flanges may vary.

Cover Notes:
Roughness pattern and text style may vary.
Minimum one pickhole.

(1) Anchor the lower frame of all three-piece castings to the manhole structure. When specified in the contract documents, anchor the frame of two-piece castings to the manhole structure. If casting frame does not include anchor holes or slots, drill four 7/8 inch diameter holes, equally spaced around the frame.

(2) Casting height varies. Minimum adjustment range of 4 inches.

FIGURE 6010.602 | SHEET 1 OF 3

SUDAS	IOWADOT	REVISION 4	04-21-20
FIGURE 6010.602	STANDARD ROAD PLAN	SW-602	
		SHEET 1 of 3	

REVISIONS: Add option for 3-piece HMA casting

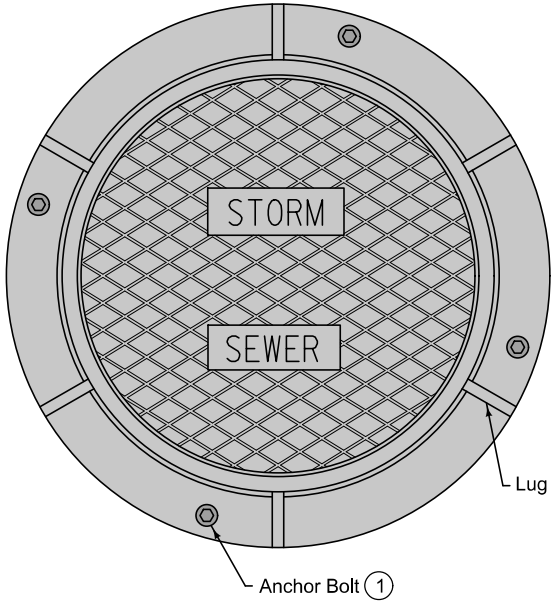
Paul D. Wigand
SUDAS DIRECTOR

Stuart Nicholson
DESIGN METHODS ENGINEER

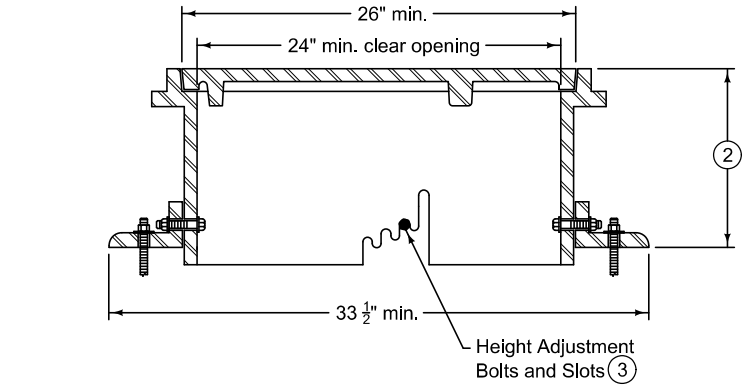
CASTINGS FOR STORM SEWER MANHOLES

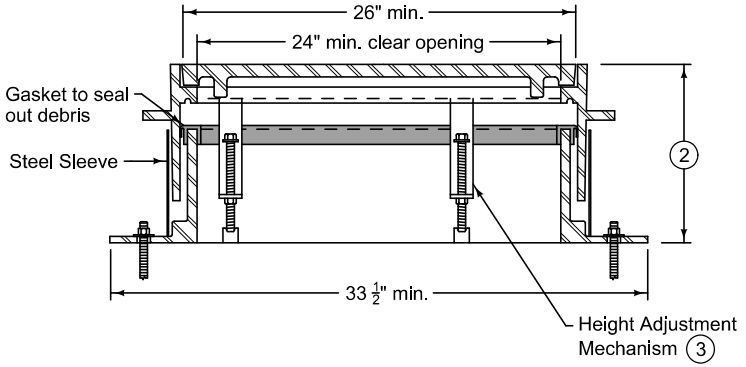
TYPE F: PCC

Three-piece floating casting for use in PCC paving and PCC boxouts



PLAN





TYPICAL SECTION (4)

Frame Notes:
Size, spacing, and number of lugs and flanges may vary.

Cover Notes:
Roughness pattern and text style may vary.
Minimum one pickhole.

(1) Anchor the lower frame of all three-piece castings to the manhole structure. When specified in the contract documents, anchor the frame of two-piece castings to the manhole structure. If casting frame does not include anchor holes or slots, drill four 7/8 inch diameter holes, equally spaced around the frame.

(2) Casting height varies. Minimum adjustment range of 4 inches.

(3) Set casting at proper grade using the adjustment slots or adjustment mechanism. Remove bolts or mechanism upon completion of paving.

(4) Height adjustment method may vary; two options are shown.

SUDAS	IOWADOT	REVISION 4	04-21-20
FIGURE 6010.602	STANDARD ROAD PLAN	SW-602	SHEET 2 of 3

REVISIONS: Add option for 3-piece HMA casting

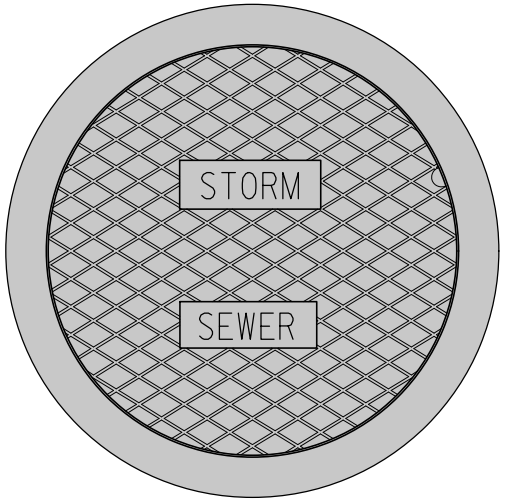
Paul D. Wigand, SUDAS DIRECTOR — Stuart Nicholson, DESIGN METHODS ENGINEER

CASTINGS FOR STORM SEWER MANHOLES

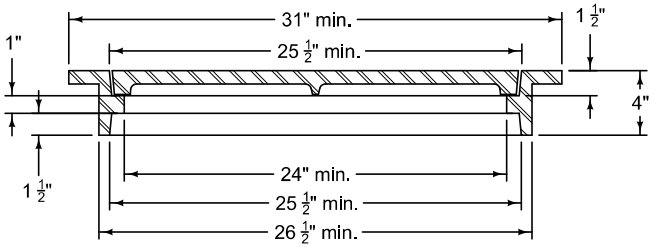
FIGURE 6010.602 | SHEET 2 OF 3

TYPE G

Two piece fixed casting



PLAN



TYPICAL SECTION

Cover Notes:
Roughness pattern and text style may vary.
Minimum one pickhole.

SUDAS	IOWA DOT	REVISION 4 04-21-20
FIGURE 6010.602	STANDARD ROAD PLAN	SW-602
		SHEET 3 of 3

REVISIONS: Add option for 3-piece HMA casting

Paul D. Wigand
SUDAS DIRECTOR

Stuart Nicholson
DESIGN METHODS ENGINEER

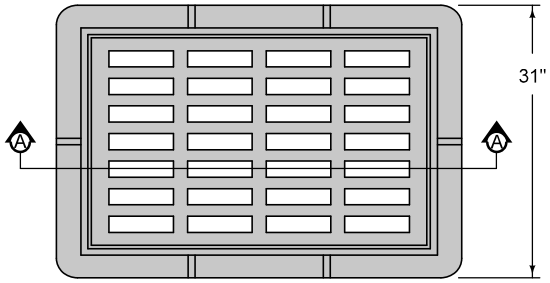
CASTINGS FOR STORM SEWER MANHOLES

FIGURE 6010.602 | SHEET 3 OF 3

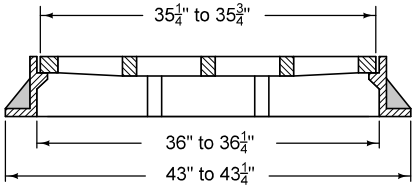
TYPE Q ①

Driveway Grate

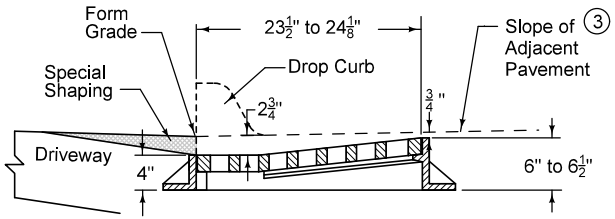
(Minimum open area 370 in^2)



PLAN



SECTION A-A

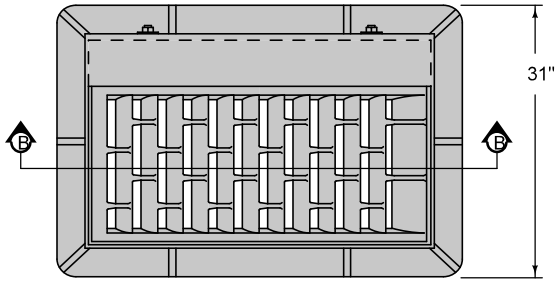


TYPICAL SECTION

TYPE R ②

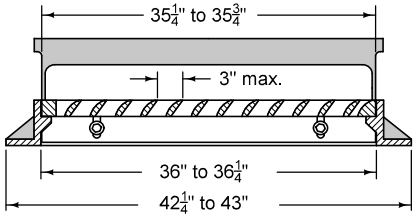
Curb Inlet Grade

(Minimum open area 180 in^2)

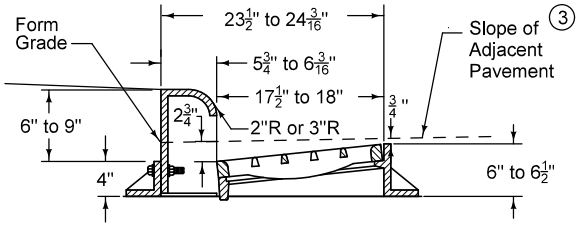


PLAN

Flow



SECTION B-B



TYPICAL SECTION

① For use at curb drops for driveways. Use only when specified in the contract documents.

② Provide bicycle-safe vane-style grate. At low points, grates with vanes facing both directions of flow are allowed.

③ For details of boxout pavement, refer to SW-514.

SUDAS	IOWA DOT	REVISION 6 10-16-18
FIGURE 6010.603	STANDARD ROAD PLAN	SW-603
		SHEET 1 of 2

REVISIONS: Corrected typo on page two that said SHEET 1 of 2.

Paul D. Wigant — SUDAS DIRECTOR

Brian Smith — DESIGN METHODS ENGINEER

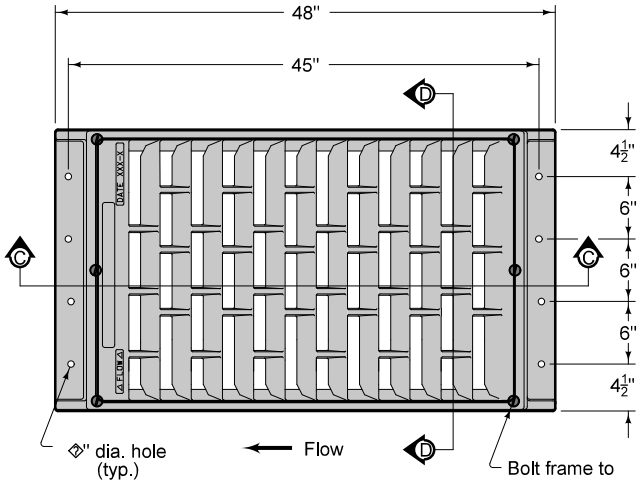
CASTINGS FOR GRATE INTAKES

FIGURE 6010.603 SHEET 1 OF 2

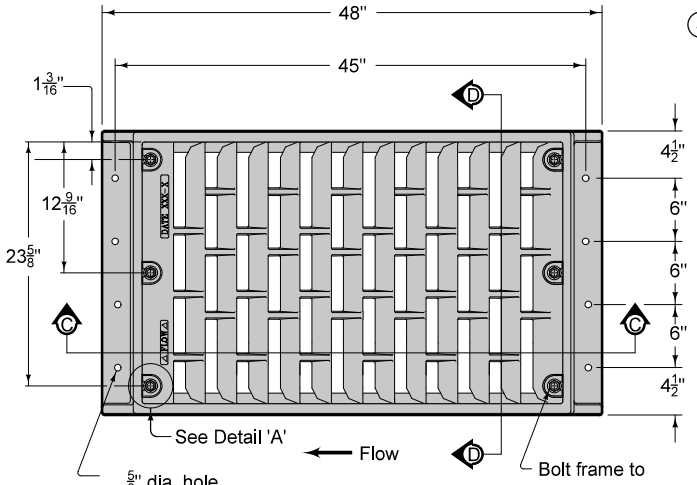
TYPE S ②④

Barrier Intake Grate

(Minimum open area 300 in^2)



PLAN

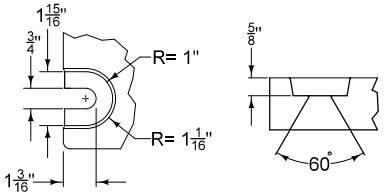


PLAN

② Provide bicycle-safe vane-style grate. At low points, grates with vanes facing both directions of flow are allowed. The Contractor has the choice of which Type S Grate to use.

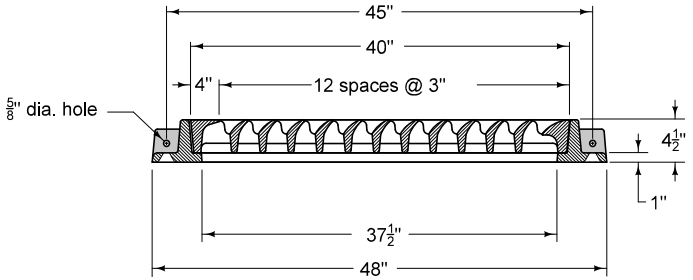
④ Use ductile iron frame castings meeting the requirements of ASTM A 536.

Frame minimum weight = 220 lbs.
Grate minimum weight = 340 lbs.

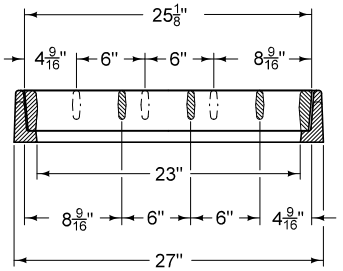


DETAIL'A'

Bolt Slot Detail



SECTION C-C



SECTION D-D

SUDAS	IOWADOT	REVISION 6 10-16-18
FIGURE 6010.603	STANDARD ROAD PLAN	SW-603 SHEET 2 of 2

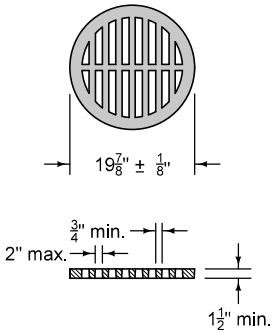
REVISIONS: Corrected typo on page two that said SHEET 1 of 2.

Paul D. Wigand, SUDAS DIRECTOR — Brian Smith, DESIGN METHODS ENGINEER

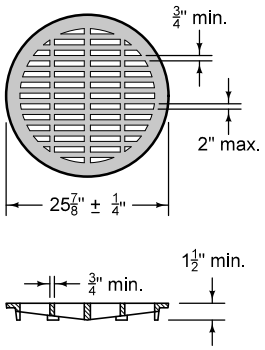
CASTINGS FOR GRATE INTAKES

FIGURE 6010.603 SHEET 2 OF 2

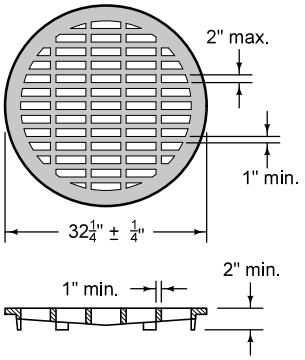
TYPE 4



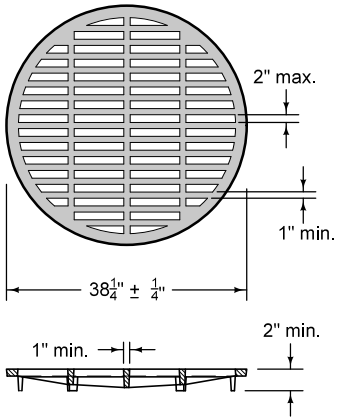
TYPE 4A
For Placement on 18" RCP



TYPE 4B
For Placement on 24" RCP

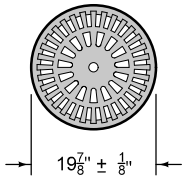


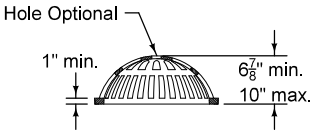
TYPE 4C
For Placement on 30" RCP



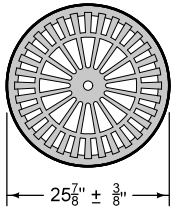
TYPE 4D
For Placement on 36" RCP

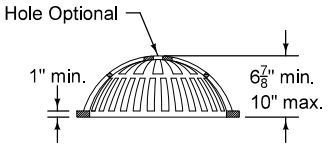
TYPE 3
(Light Duty)





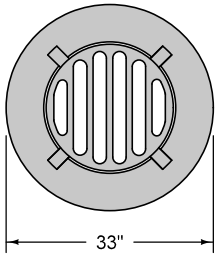
TYPE 3A
For Placement on 18" RCP





TYPE 3B
For Placement on 24" RCP

TYPE 5
(Light Duty)
For Placement on 24" to 30" RCP



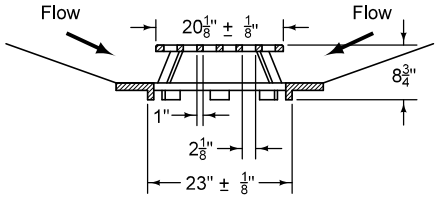


FIGURE 6010.604 SHEET 1 OF 2

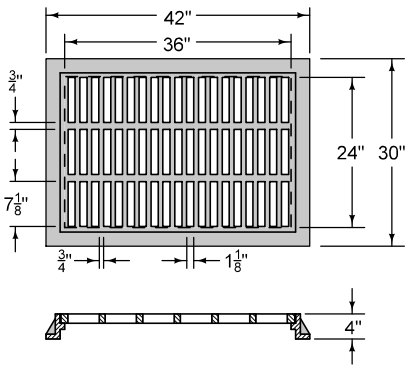
SUDAS	IOWA DOT	REVISION 3 04-21-20
FIGURE 6010.604	STANDARD ROAD PLAN	SW-604
		SHEET 1 of 2

REVISIONS: Added Type 7 casting. Modified circle notes.

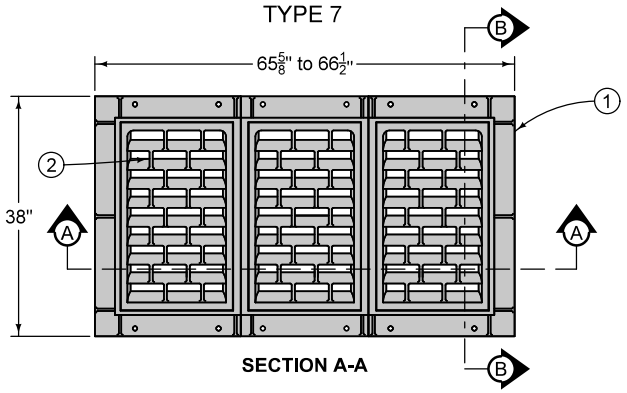
Paul D. Wigard, SUDAS DIRECTOR — DESIGN METHODS ENGINEER

CASTINGS FOR AREA INTAKES

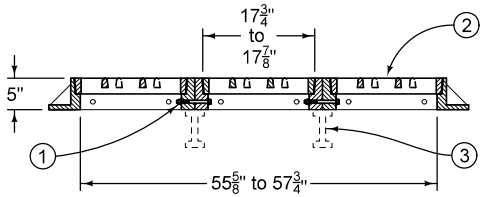
TYPE 6



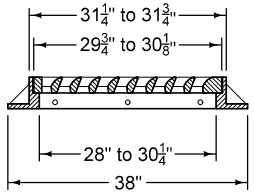
TYPE 7



SECTION A-A



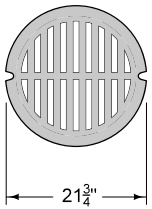
SECTION A-A

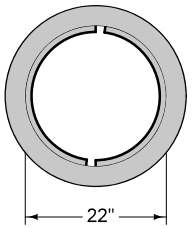


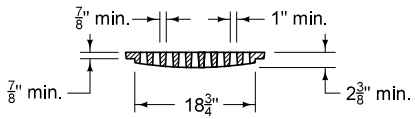
SECTION B-B

TYPE 9

(Light Duty)

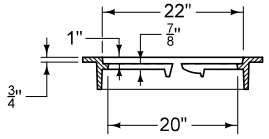






GRATE (4)

Minimum Weight = 85 lbs.



FRAME

Minimum Weight = 75 lbs.

(1) Frame provided in three segments (two ends and one center). Bolt segments together as specified by the casting manufacturer.

(2) Provide bicycle safe, vane style grates with a minimum open area of 4 square feet. At low points, grates with vanes facing both directions will be allowed.

(3) If required by casting manufacturer, provide support beam under all frame joints. Modify structure walls as required to provide pocket for beam.

(4) Cast grate without locking lugs so it may be used in an inverted position.

FIGURE 6010.604 SHEET 2 OF 2

SUDAS | IOWA DOT

REVISION	
3	04-21-20

FIGURE 6010.604 | STANDARD ROAD PLAN | SW-604

SHEET 2 of 2

REVISIONS: Added Type 7 casting. Modified circle notes.

Paul D. Wigand
SUDAS DIRECTOR

Stuart Nicholson
DESIGN METHODS ENGINEER

CASTINGS FOR AREA INTAKES

PIPE CULVERTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe Culverts

B. Pipe Aprons and Beveled Ends

C. Footings for Concrete Pipe Aprons

D. Pipe Apron Guards

1.02 DESCRIPTION OF WORK

Construct pipe culverts, beveled ends, pipe aprons, and associated appurtenances.

1.03 SUBMITTALS

Comply with Division 1 - General Provisions and Covenants.

1.04 SUBSTITUTIONS

Comply with Division 1 - General Provisions and Covenants.

1.05 DELIVERY, STORAGE, AND HANDLING

Comply with Division 1 - General Provisions and Covenants.

1.06 SCHEDULING AND CONFLICTS

Comply with Division 1 - General Provisions and Covenants.

1.07 SPECIAL REQUIREMENTS

None.

1.08 MEASUREMENT AND PAYMENT

A. Pipe Culverts:

1. Trenched:

a. Measurement: Each type and size of pipe installed in a trench will be measured in linear feet from end of pipe to end of pipe along the centerline of pipe, exclusive of aprons. Lengths of elbows and tees will be included in length of pipe measured.

b. Payment: Payment will be made at the unit price of each type and size of pipe.

c. Includes: Unit price includes, but is not limited to, trench excavation; dewatering; furnishing and installing pipe; furnishing, placing, and compacting bedding and backfill material; connectors; testing; and inspection.

2. Trenchless:

a. Measurement: Each type and size of pipe installed by trenchless methods will be measured in linear feet along the centerline of the casing pipe.

b. Payment: Payment will be made at the unit price for each type and size of pipe.

c. Includes: Unit price includes, but is not limited to, furnishing and installing pipe; trenchless installation materials and equipment; pit excavation, dewatering, and placing and compacting backfill material; pipe connections; testing; and inspection.

1.08 MEASUREMENT AND PAYMENT (Continued)

B. Pipe Aprons:

1. **Measurement:** Each type and size of pipe apron will be counted.

2. **Payment:** Payment will be made at the unit price for each type and size of pipe apron.

3. **Includes:** Unit price includes, but is not limited to, trench excavation; dewatering; furnishing and installing pipe; furnishing, placing, and compacting bedding and backfill material; connectors; and other appurtenances.

C. Footings for Concrete Pipe Aprons:

1. **Measurement:** Each type and size of footing installed on a concrete pipe apron will be counted.

2. **Payment:** Payment will be made at the unit price for each type and size of footing.

3. **Includes:** Unit price includes, but is not limited to, excavation; dewatering; reinforcing steel; concrete; furnishing and installing apron; furnishing, placing and compacting bedding and backfill material.

D. Pipe Apron Guards:

1. **Measurement:** Each type and size of pipe apron guard will be counted.

2. **Payment:** Payment will be made at the unit price for each type and size of pipe apron guard.

3. **Includes:** Unit price includes, but is not limited to, furnishing and installing the apron guard and repairing any damage to the apron from the installation process.

PART 2 - PRODUCTS

2.01 PIPE CULVERTS

A. Roadway Pipe Culverts: All storm sewer pipe materials specified for use in right-of-way in Section 4020 may be used within right-of-way as a roadway pipe culvert.

B. Entrance Pipe Culverts: The following pipe culvert types described in Section 4020 may be used within right-of-way as entrance pipe culverts:

1. Reinforced Concrete Pipe (RCP).
2. Reinforced Concrete Arch Pipe (RCAP).
3. Reinforced Concrete Elliptical Pipe (RCEP).
4. Reinforced Concrete Low Head Pressure Pipe (RCPP).
5. Corrugated Metal Pipe (CMP).
6. Spiral Rib Pipe.
7. Coated Corrugated Metal Pipe.
8. Corrugated Metal Arch Pipe.

C. Structural Plate Culverts: Structural plate culverts may be used in the right-of-way as roadway or entrance pipe culverts.

1. Use a galvanized steel structural plate complying with AASHTO M 167.
2. Use bolts and nuts complying with ASTM A 449 and galvanized per ASTM A 153, Class C.
3. Assemble the structure according to the manufacturer's recommendations. Tighten the bolts using an applied torque of between 100 and 300 foot-pounds.
4. Install the structure according to the contract documents, the manufacturer′s recommendations, and AASHTO Standard Specifications for Highway Bridges, Division II, Section 26.
5. Conform the gage of the structure to Iowa DOT Standard Road Plan DR-104 or as specified in the contract documents.

D. Aluminum Structural Plate Culverts: Aluminum structural plate culverts may be used in the right-of-way as roadway or entrance pipe culverts.

1. Comply with AASHTO M 219.
2. Use a corrugation profile of 9 inches by 2 1/2 inches.
3. Use aluminum complying with ASTM B 209.
4. Use a minimum thickness of 0.100 inch. Gage of structure complying with manufacturer's requirements.
5. Use bolts and nuts meeting ASTM A 307 or ASTM A 449 and galvanize per ASTM A 153.

2.01 PIPE CULVERTS (Continued)

6. Assemble the structure according to the manufacturer's recommendations. Tighten the bolts using an applied torque of between 100 and 300 foot-pounds.

7. Install the structure according to the contract documents, the manufacturer's recommendations, and AASHTO Standard Specifications for Highway Bridges, Division II, Section 26.

8. Meet or exceed the AASHTO Standard Specifications for Highway Bridges, Division I, Section 12.8 for HS 20 loading.

2.02 PIPE APRONS

Comply with the requirements of Section 4020, 2.01 and Section 4030, 2.01 for the pipe material of which the apron is constructed. Supply concrete pipe aprons according to Figure 4030.222 and Figure 4030.223. Supply CMP pipe aprons according to Figure 4030.225.

2.03 APRON FOOTINGS

Comply with the requirements of Figure 4030.221 and Section 6010 for reinforcing steel and structural concrete used in apron footings.

2.04 APRON GUARD

Use smooth or deformed steel bars, ASTM A 615, Grade 40 or merchant quality, in the construction of the apron guard. Hot dip galvanize the apron guard according to ASTM A 123.

PART 3 - EXECUTION

3.01 PIPE CULVERT INSTALLATION

A. Trenched:

1. Install pipe in a trench per Section 4020.

2. For culvert pipe installed in embankment, pipe may be installed at the Contractor's option per the contract documents and the following Iowa DOT Specifications sections:
   a. Reinforced Concrete Pipe (circular, arched, and elliptical): Section 2416.
   b. Corrugated Metal and Corrugated Plastic Pipe: Section 2417.
   c. Structural Plate Culverts: Section 2420.

B. Trenchless: For trenchless installations, comply with Section 3020.

3.02 APRONS

A. Install pipe aprons where specified in the contract documents. Use the same installation methods as used on the pipe to which the apron is being attached. Dewater area as necessary to prevent installing the apron in water or on saturated soil or bedding. Do not allow water to rise around the apron prior to backfilling the area.

B. Install apron footings where specified. Construct per Section 6010 and the contract documents. Dewater area as necessary to prevent installing the apron footing in water or on saturated soil or bedding. Do not allow water to rise around the apron footing prior to backfilling the area.

C. Anchor the last three concrete pipe sections and the apron together with two pipe connections per joint. Comply with Iowa DOT Standard Road Plan DR-121.

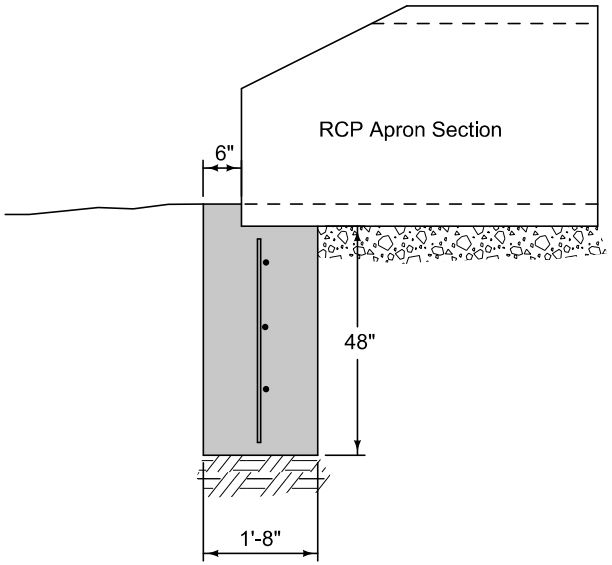
D. Attach corrugated metal aprons to the culvert pipe with a manufacturer's approved bolt, weld, or clamp to fasten directly to the culvert.

E. Install apron guard where specified. Construct according to Figure 4030.224 or 4030.225. Repair any damage to the galvanized coating that occurs due to storage, handling, or installation.

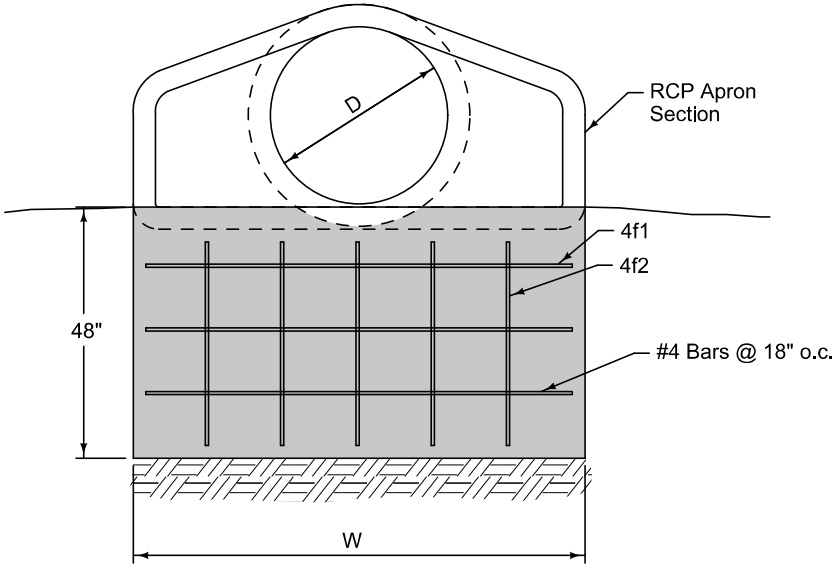
3.03 CLEANING, INSPECTION, AND TESTING

Clean, inspect, and test culverts per Section 4060.

END OF SECTION



TYPICAL SECTION



ELEVATION

REINFORCING BAR LIST

D	W	Mark	Size	Length	Count
12"	2'-4"	4f1	4	2'-0"	3
		4f2	4	3'-8"	2
15"	2'-10 ½"	4f1	4	2'-6 ½"	3
		4f2	4	3'-8"	2
18"	3'-5"	4f1	4	3'-1"	3
		4f2	4	3'-8"	3
24"	4'-6"	4f1	4	4'-2"	3
		4f2	4	3'-8"	3
30"	5'-7"	4f1	4	5'-3"	3
		4f2	4	3'-8"	4
36"	6'-8"	4f1	4	6'-4"	3
		4f2	4	3'-8"	5
42"	7'-3"	4f1	4	6'-11"	3
		4f2	4	3'-8"	5

D	W	Mark	Size	Length	Count
48"	7'-10"	4f1	4	7'-6"	3
		4f2	4	3'-8"	6
54"	8'-5"	4f1	4	8'-1"	3
		4f2	4	3'-8"	6
60"	8'-11"	4f1	4	8'-7"	3
		4f2	4	3'-8"	6
66"	8'-11"	4f1	4	8'-7"	3
		4f2	4	3'-8"	6
72"	10'-0"	4f1	4	9'-8"	3
		4f2	4	3'-8"	7
78"	10'-7"	4f1	4	10'-3"	3
		4f2	4	3'-8"	7
84"	11'-1"	4f1	4	10'-9"	3
		4f2	4	3'-8"	8

FIGURE 4030.221 | SHEET 1 OF 1

SUDAS

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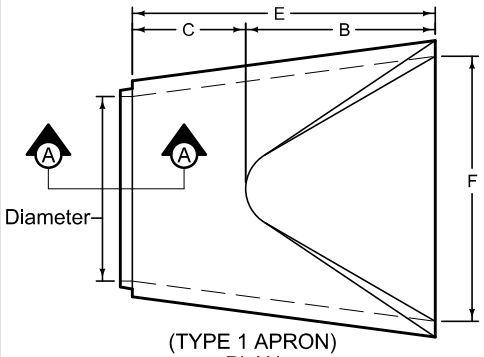
1	10-21-14

4030.221

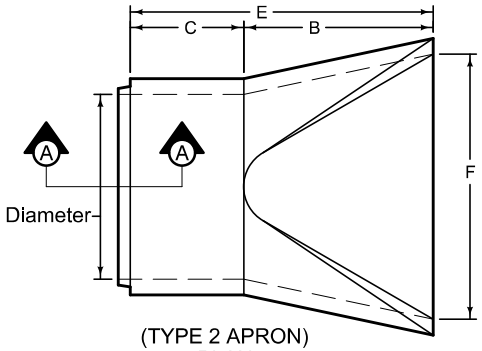
SHEET 1 of 1

SUDAS Standard Specifications

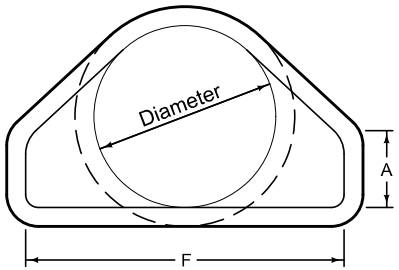
RCP APRON SECTION FOOTING



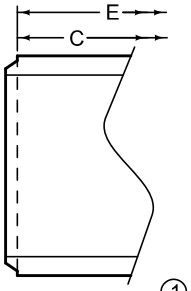
(TYPE 1 APRON)
PLAN



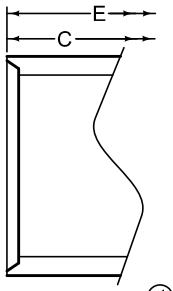
(TYPE 2 APRON)
PLAN



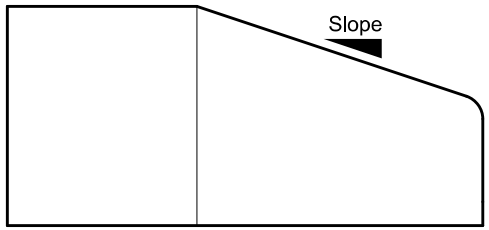
(TYPE 1 AND TYPE 2 APRONS)
END VIEW



SECTION A-A ①
TONGUE END DETAIL



SECTION A-A ①
GROOVE END DETAIL



SIDE VIEW

Dimension 'E' shown is the minimum and is considered the design length. Adjust for any difference between the actual length of concrete apron installed and the length indicated below for the length of concrete culvert pipe furnished.

① Tongue end used on inlet end section. Groove end used on outlet end section.

TYPE 1 APRONS						
DIAM.	SLOPE	A	B	MINIMUM		F
				C	E	
12"	2.4:1	4"	2'-0"	4'-⅞"	6'-⅞"	2'-0"
15"	2.4:1	6"	2'-3"	3'-10"	6'-1"	2'-6"
18"	2.3:1	9"	2'-3"	3'-10"	6'-1"	3'-0"
21"	2.4:1	9"	3'-0 "	3'-1½"	6'-1½"	3'-5"
24"	2.5:1	9½"	3'-7½"	2'-6"	6'-1½"	4'-0"
27"	2.5:1	10½"	4'-1 "	2'-0"	6'-1½"	4'-4"
30"	2.5:1	12"	4'-6"	1'-7¾"	6'-1¾"	5'-0"
36"	2.5:1	15"	5'-3"	2'-9"	8'-0"	6'-0"
42"	2.5:1	21"	5'-3"	2'-9"	8'-0"	6'-6"
48"	2.5:1	24"	6'-0"	2'-0"	8'-0"	7'-0"
54"	1.8:1	27"	5'-0"	3'-0"	8'-0"	7'-6"
60"	1.6:1	29½"	5'-0"	3'-0"	8'-0"	8'-0"
66"	1.7:1	30"	6'-0"	2'-3"	8'-3"	8'-0"
72"	1.6:1	30"	6'-6"	1'-9"	8'-3"	9'-0"
78"	1.8:1	36"	7'-6"	1'-9"	9'-3"	9'-6"
84"	1.3:1	29½"	6'-9"	2'-6½"	9'-3½"	10'-0"

TYPE 2 APRONS						
DIAM.	SLOPE	A	B	MINIMUM		F
				C	E	
12"	2.4:1	4"	2'-0"	4'-⅞"	6'-⅞"	2'-0"
15"	2.4:1	6"	2'-3"	3'-10"	6'-1"	2'-6"
18"	2.3:1	9"	2'-3"	3'-10"	6'-1"	3'-0"
21"	2.4:1	9"	3'-0"	3'-1½"	6'-1½"	3'-5"
24"	2.5:1	9½"	3'-7½"	2'-6"	6'-1½"	4'-0"
27"	2.5:1	10½"	4'-1 "	2'-0"	6'-1½"	4'-4"
30"	2.5:1	12"	4'-6"	1'-7¾"	6'-1¾"	5'-0"
36"	2.5:1	15"	5'-3"	2'-9"	8'-0"	6'-0"
42"	2.5:1	21"	5'-3"	2'-9"	8'-0"	6'-6"
48"	2.5:1	24"	6'-0"	2'-0"	8'-0"	7'-0"
54"	1.9:1	24½"	5'-5"	2'-7"	8'-0"	7'-6"
60"	1.4:1	24½"	5'-0"	3'-0"	8'-0"	8'-0"
66"	1.7:1	30"	6'-0"	2'-3"	8'-3"	8'-0"
72"	1.4:1	24"	6'-6"	1'-9"	8'-3"	9'-0"
78"	1.8:1	36"	7'-6"	1'-9"	9'-3"	9'-6"
84"	1.5:1	23½"	7'-6½"	1'-9"	9'-3½"	10'-0"

FIGURE 4030.222 | SHEET 1 OF 1

SUDAS

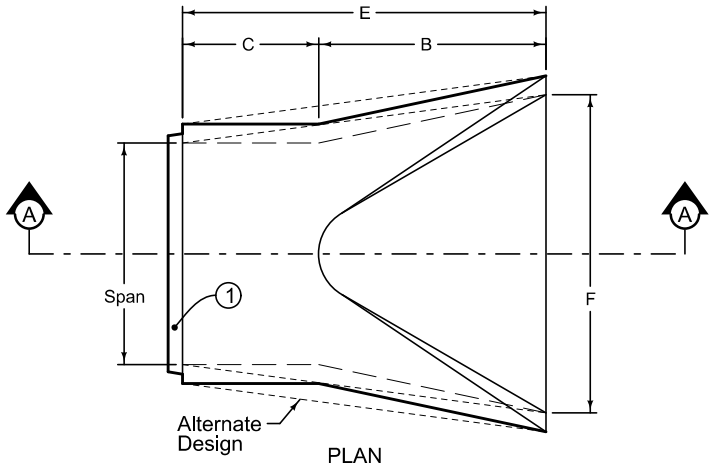
REVISION
New 10-18-16

4030.222

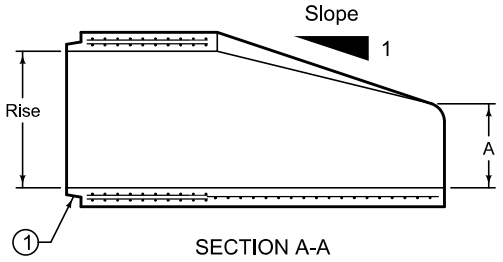
SHEET 1 of 1

SUDAS Standard Specifications

CIRCULAR CONCRETE APRONS



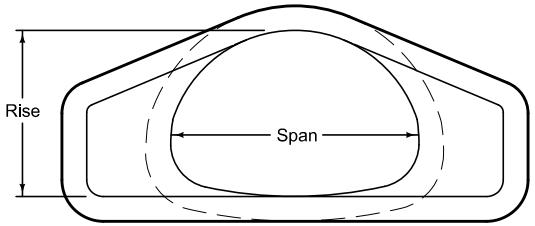
PLAN



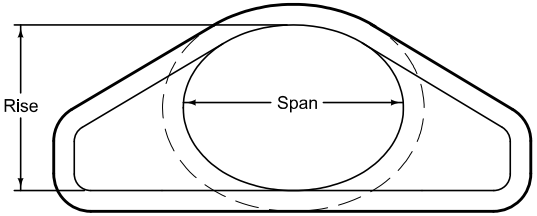
SECTION A-A

Dimension 'E' shown is the minimum and is considered the design length. Adjust for any difference between the actual length of concrete apron installed and the length indicated below for the length of concrete culvert pipe furnished.

(1) Tongue end used on inlet end section. Groove end used on outlet end section.



END (ARCH)



END (ELLIPTICAL)

EQUIVALENT DIAMETER Inches	SLOPE	APPROXIMATE DIMENSIONS Inches				
		A	B	C	E	F
18	3:1	7	27	45	72	36
24	3:1	$8\frac{1}{2}$	39	33	72	48
30	3:1	$9\frac{1}{2}$	50	46	96	60
36	3:1	$11\frac{1}{8}$	60	36	96	72
42	3:1	$15\frac{13}{16}$	60	36	96	78
48	3:1	21	60	36	96	84
54	3:1	$25\frac{1}{2}$	60	36	96	90
60	3:1	31	60	36	96	96
72	2:1	31	60	39	99	120
84	2:1	$21\frac{1}{2}$	83	19	102	144

ARCH PIPE

EQUIVALENT DIAMETER Inches	SLOPE	APPROXIMATE DIMENSIONS Inches				
		A	B	C	E	F
18	3:1	$7\frac{1}{2}$	27	45	72	36
24	3:1	$8\frac{1}{2}$	39	33	72	48
30	3:1	$9\frac{1}{2}$	54	18	72	60
36	2.5 to 1	$11\frac{1}{8}$	60	24	84	72
42	2.5 to 1	$15\frac{3}{4}$	60	36	96	78
48	2.5 to 1	21	60	36	96	84
54	2.5 to 1	$25\frac{1}{2}$	60	36	96	90
60	2.5 to 1	30	60	36	96	96
72	2.5 to 1	36	63	33	96	108
90	1.6 to 1	$36\frac{1}{2}$	58	38	96	113

ELLIPTICAL PIPE

FIGURE 4030.223 | SHEET 1 OF 1

SUDAS

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New 10-18-16

4030.223

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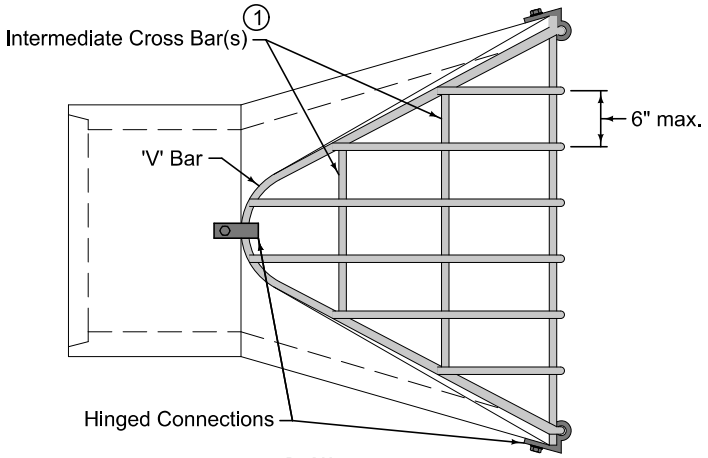
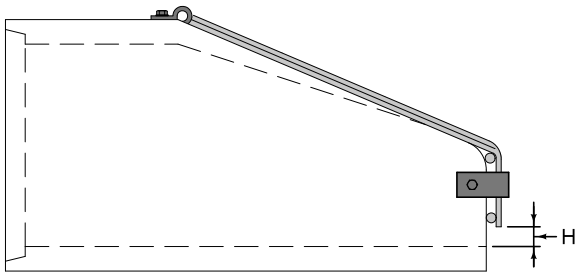
SUDAS Standard Specifications

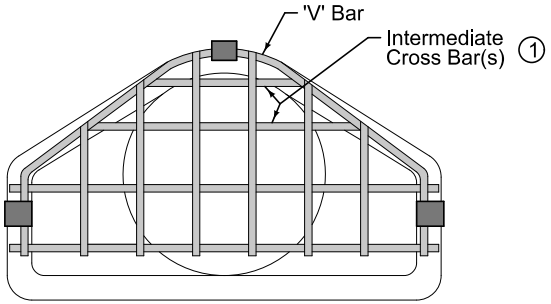
ARCH AND ELLIPTICAL CONCRETE PIPE APRONS



PLAN



PROFILE



FRONT

Provide guard dimensions to fit with type of apron provided. Ensure 'V' Bar completely rests on apron.

① All guards must include at least one intermediate cross bar. If pipe diameter, or equivalent diameter, is 60 inches or greater, use two intermediate cross bars equally spaced.

ROUND		ARCH		ELLIPTICAL	
PIPE SIZE	H	EQUIVALENT DIAMETER	H	EQUIVALENT DIAMETER	H
12"	$2\frac{1}{2}$"	18" to 24"	4"	18"	3"
15"	3"	30" to 36"	5"	24"	4"
18" - 24"	4"	42" to 54"	6"	30" to 36"	5"
27" - 36"	5"	60" to 72"	7"	42" to 54"	6"
42" - 54"	6"			60"	7"
60" - 72"	7"				
78" - 90"	8"				

BAR SIZES				
	PIPE SIZE (DIA. or EQUIV.)	HOLE DIA. REQ'D.	BOLT DIA.	BAR SIZE
ROUND	12" - 24"	$\frac{3}{4}$"	$\frac{5}{8}$"	$\frac{3}{4}$"
	27" - 48"	$\frac{7}{8}$"	$\frac{3}{4}$"	1"
	54" - 90"	$1\frac{1}{8}$"	1"	$1\frac{1}{4}$"
ARCH	up to 24" eq.	$\frac{3}{4}$"	$\frac{5}{8}$"	$\frac{3}{4}$"
	30" to 48"	$\frac{7}{8}$"	$\frac{3}{4}$"	1"
	54" to 72"	$1\frac{1}{8}$"	1"	$1\frac{1}{4}$"
ELLIPTICAL	up to 24" eq.	$\frac{3}{4}$"	$\frac{5}{8}$"	$\frac{3}{4}$"
	30" to 48"	$\frac{7}{8}$"	$\frac{3}{4}$"	1"
	54" to 60"	$1\frac{1}{8}$"	1"	$1\frac{1}{4}$"
BOLT LENGTH = PIPE WALL THICKNESS + $2\frac{1}{2}$"				

FIGURE 4030.224 | SHEET 1 OF 1

SUDAS

REVISION: New 10-18-16

4030.224

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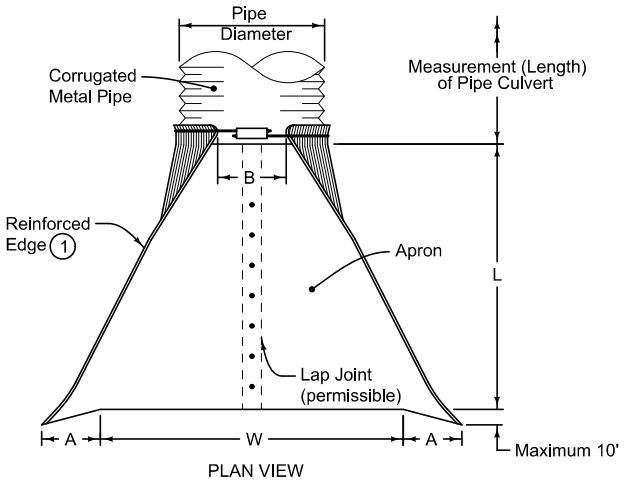
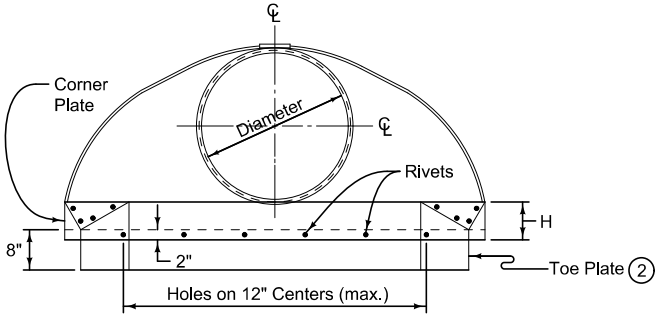
SUDAS Standard Specifications

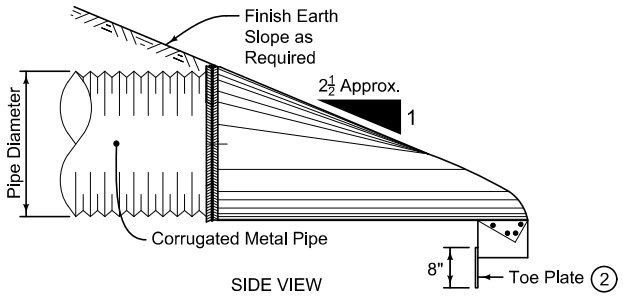
CONCRETE PIPE APRON GUARD



PLAN VIEW

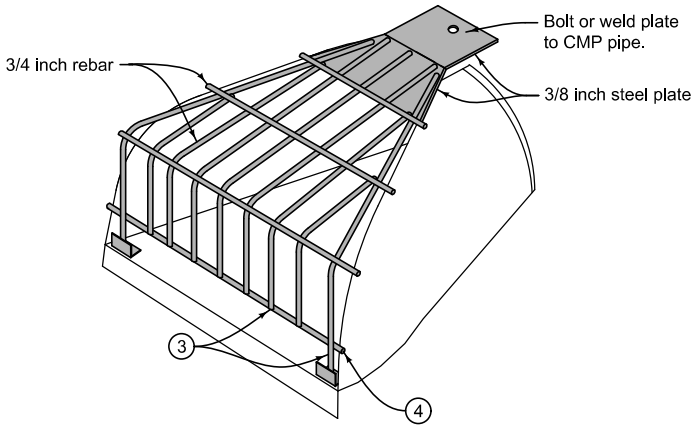


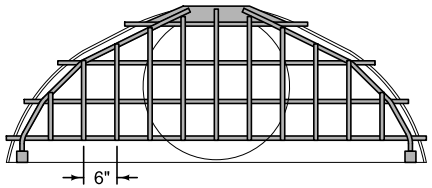
END VIEW



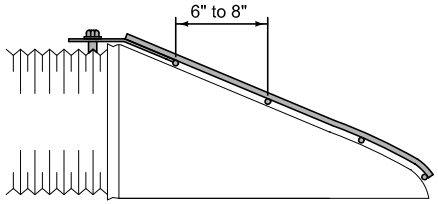
SIDE VIEW

METAL PIPE APRON





END VIEW



SIDE VIEW

METAL APRONS GUARD

1. On sizes 60 inches and larger, supplement the reinforced edge with a galvanized stiffener angle attached with bolts.
2. Install a galvanized toe plate (of the same gage metal as apron) on all aprons 24 inch diameter and larger.
3. Hold inside bars up 3 inches off bottom of apron. Extend outside bars to bottom of apron and attach to 2 inch by 2 inch by 1/4 inch steel angle.
4. When specified, extend bottom cross bar through apron.

DIMENSIONS					
PIPE DIAM.	A (±1")	B MAX.	H (±1")	L (±1½")	W (±2")
6"	4½"	1"	3"	8¾"	12"
8"	5⅞"	3"	4"	14¼"	16"
10"	7½"	6"	6"	21"	24"
12"	4¾"	6"	6"	21"	24"
15"	6"	8"	6"	26"	30"
18"	7"	9"	6"	31"	36"
21"	8¼"	11"	6"	36"	42"
24"	9½"	12"	6"	42"	48"
30"	12"	15"	7½"	52½"	60"
36"	14"	18"	9"	63"	72"
42"	16"	21"	10½"	73½"	84"
48"	18"	27"	12"	84"	90"
54"	18"	30"	12"	84"	102"
60"	18"	33"	12"	87"	114"
66"	18"	36"	12"	87"	120"
72"	18"	39"	12"	87"	126"
78"	18"	42"	12"	87"	132"
84"	18"	45"	12"	87"	138"
90"	24"	37"	11"	87"	144"
96"	25"	35"	12"	87"	150"

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New 10-18-16

4030.225

SHEET 1 of 1

SUDAS Standard Specifications

METAL PIPE APRONS AND APRON GUARDS

FIGURE 4030.225

SHEET 1 OF 1

EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. NPDES General Permit No. 2

B. Stormwater Pollution Prevention Plan (SWPPP)

C. Erosion Control Measures

D. Velocity and Flow Control Measures

E. Sediment Control Measures

F. Application/Installation of Measures

G. Removal/Replacement of Measures

1.02 DESCRIPTION OF WORK

A. Furnish all materials; install, construct, maintain, and remove specified erosion control devices; at locations specified in the contract documents, or where specified by the Engineer.

B. Complete the required construction work on this project, while minimizing soil erosion and controlling water pollution. Maintain these features as specified, from initial construction stages to final completion of the project.

1.03 SUBMITTALS

Comply with Division 1 - General Provisions and Covenants, as well as the following:

Upon request, provide copies of all records and documentation related to compliance with the Iowa DNR NPDES Permit.

1.04 SUBSTITUTIONS

Comply with Division 1 - General Provisions and Covenants.

1.05 DELIVERY, STORAGE, AND HANDLING

Comply with Division 1 - General Provisions and Covenants.

1.06 SCHEDULING AND CONFLICTS

Comply with Division 1 - General Provisions and Covenants, as well as the following:

A. Implement erosion and sediment control measures at the appropriate time(s).

B. Coordinate construction to minimize damage to erosion and sediment control devices.

PIPE CULVERTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe Culverts

B. Pipe Aprons and Beveled Ends

C. Footings for Concrete Pipe Aprons

D. Pipe Apron Guards

1.02 DESCRIPTION OF WORK

Construct pipe culverts, beveled ends, pipe aprons, and associated appurtenances.

1.03 SUBMITTALS

Comply with Division 1 - General Provisions and Covenants.

1.04 SUBSTITUTIONS

Comply with Division 1 - General Provisions and Covenants.

1.05 DELIVERY, STORAGE, AND HANDLING

Comply with Division 1 - General Provisions and Covenants.

1.06 SCHEDULING AND CONFLICTS

Comply with Division 1 - General Provisions and Covenants.

1.07 SPECIAL REQUIREMENTS

None.

1.08 MEASUREMENT AND PAYMENT

A. Pipe Culverts:

1. Trenched:

a. Measurement: Each type and size of pipe installed in a trench will be measured in linear feet from end of pipe to end of pipe along the centerline of pipe, exclusive of aprons. Lengths of elbows and tees will be included in length of pipe measured.

b. Payment: Payment will be made at the unit price of each type and size of pipe.

c. Includes: Unit price includes, but is not limited to, trench excavation; dewatering; furnishing and installing pipe; furnishing, placing, and compacting bedding and backfill material; connectors; testing; and inspection.

2. Trenchless:

a. Measurement: Each type and size of pipe installed by trenchless methods will be measured in linear feet along the centerline of the casing pipe.

b. Payment: Payment will be made at the unit price for each type and size of pipe.

c. Includes: Unit price includes, but is not limited to, furnishing and installing pipe; trenchless installation materials and equipment; pit excavation, dewatering, and placing and compacting backfill material; pipe connections; testing; and inspection.

1.08 MEASUREMENT AND PAYMENT (Continued)

B. Pipe Aprons:

1. **Measurement:** Each type and size of pipe apron will be counted.

2. **Payment:** Payment will be made at the unit price for each type and size of pipe apron.

3. **Includes:** Unit price includes, but is not limited to, trench excavation; dewatering; furnishing and installing pipe; furnishing, placing, and compacting bedding and backfill material; connectors; and other appurtenances.

C. Footings for Concrete Pipe Aprons:

1. **Measurement:** Each type and size of footing installed on a concrete pipe apron will be counted.

2. **Payment:** Payment will be made at the unit price for each type and size of footing.

3. **Includes:** Unit price includes, but is not limited to, excavation; dewatering; reinforcing steel; concrete; furnishing and installing apron; furnishing, placing and compacting bedding and backfill material.

D. Pipe Apron Guards:

1. **Measurement:** Each type and size of pipe apron guard will be counted.

2. **Payment:** Payment will be made at the unit price for each type and size of pipe apron guard.

3. **Includes:** Unit price includes, but is not limited to, furnishing and installing the apron guard and repairing any damage to the apron from the installation process.

PART 2 - PRODUCTS

2.01 PIPE CULVERTS

A. Roadway Pipe Culverts: All storm sewer pipe materials specified for use in right-of-way in Section 4020 may be used within right-of-way as a roadway pipe culvert.

B. Entrance Pipe Culverts: The following pipe culvert types described in Section 4020 may be used within right-of-way as entrance pipe culverts:

1. Reinforced Concrete Pipe (RCP).
2. Reinforced Concrete Arch Pipe (RCAP).
3. Reinforced Concrete Elliptical Pipe (RCEP).
4. Reinforced Concrete Low Head Pressure Pipe (RCPP).
5. Corrugated Metal Pipe (CMP).
6. Spiral Rib Pipe.
7. Coated Corrugated Metal Pipe.
8. Corrugated Metal Arch Pipe.

C. Structural Plate Culverts: Structural plate culverts may be used in the right-of-way as roadway or entrance pipe culverts.

1. Use a galvanized steel structural plate complying with AASHTO M 167.
2. Use bolts and nuts complying with ASTM A 449 and galvanized per ASTM A 153, Class C.
3. Assemble the structure according to the manufacturer's recommendations. Tighten the bolts using an applied torque of between 100 and 300 foot-pounds.
4. Install the structure according to the contract documents, the manufacturer′s recommendations, and AASHTO Standard Specifications for Highway Bridges, Division II, Section 26.
5. Conform the gage of the structure to Iowa DOT Standard Road Plan DR-104 or as specified in the contract documents.

D. Aluminum Structural Plate Culverts: Aluminum structural plate culverts may be used in the right-of-way as roadway or entrance pipe culverts.

1. Comply with AASHTO M 219.
2. Use a corrugation profile of 9 inches by 2 1/2 inches.
3. Use aluminum complying with ASTM B 209.
4. Use a minimum thickness of 0.100 inch. Gage of structure complying with manufacturer's requirements.
5. Use bolts and nuts meeting ASTM A 307 or ASTM A 449 and galvanize per ASTM A 153.

2.01 PIPE CULVERTS (Continued)

6. Assemble the structure according to the manufacturer's recommendations. Tighten the bolts using an applied torque of between 100 and 300 foot-pounds.

7. Install the structure according to the contract documents, the manufacturer's recommendations, and AASHTO Standard Specifications for Highway Bridges, Division II, Section 26.

8. Meet or exceed the AASHTO Standard Specifications for Highway Bridges, Division I, Section 12.8 for HS 20 loading.

2.02 PIPE APRONS

Comply with the requirements of Section 4020, 2.01 and Section 4030, 2.01 for the pipe material of which the apron is constructed. Supply concrete pipe aprons according to Figure 4030.222 and Figure 4030.223. Supply CMP pipe aprons according to Figure 4030.225.

2.03 APRON FOOTINGS

Comply with the requirements of Figure 4030.221 and Section 6010 for reinforcing steel and structural concrete used in apron footings.

2.04 APRON GUARD

Use smooth or deformed steel bars, ASTM A 615, Grade 40 or merchant quality, in the construction of the apron guard. Hot dip galvanize the apron guard according to ASTM A 123.

PART 3 - EXECUTION

3.01 PIPE CULVERT INSTALLATION

A. Trenched:

1. Install pipe in a trench per Section 4020.

2. For culvert pipe installed in embankment, pipe may be installed at the Contractor's option per the contract documents and the following Iowa DOT Specifications sections:
   a. Reinforced Concrete Pipe (circular, arched, and elliptical): Section 2416.
   b. Corrugated Metal and Corrugated Plastic Pipe: Section 2417.
   c. Structural Plate Culverts: Section 2420.

B. Trenchless: For trenchless installations, comply with Section 3020.

3.02 APRONS

A. Install pipe aprons where specified in the contract documents. Use the same installation methods as used on the pipe to which the apron is being attached. Dewater area as necessary to prevent installing the apron in water or on saturated soil or bedding. Do not allow water to rise around the apron prior to backfilling the area.

B. Install apron footings where specified. Construct per Section 6010 and the contract documents. Dewater area as necessary to prevent installing the apron footing in water or on saturated soil or bedding. Do not allow water to rise around the apron footing prior to backfilling the area.

C. Anchor the last three concrete pipe sections and the apron together with two pipe connections per joint. Comply with Iowa DOT Standard Road Plan DR-121.

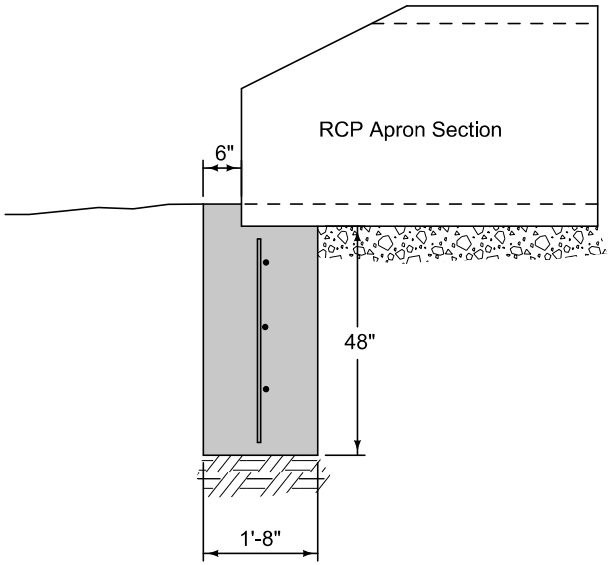
D. Attach corrugated metal aprons to the culvert pipe with a manufacturer's approved bolt, weld, or clamp to fasten directly to the culvert.

E. Install apron guard where specified. Construct according to Figure 4030.224 or 4030.225. Repair any damage to the galvanized coating that occurs due to storage, handling, or installation.

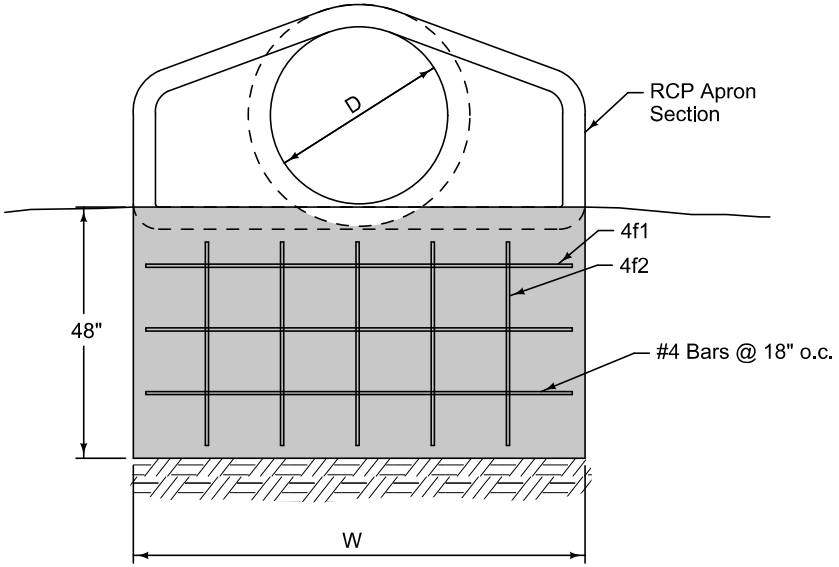
3.03 CLEANING, INSPECTION, AND TESTING

Clean, inspect, and test culverts per Section 4060.

END OF SECTION



TYPICAL SECTION



ELEVATION

REINFORCING BAR LIST

D	W	Mark	Size	Length	Count
12"	2'-4"	4f1	4	2'-0"	3
		4f2	4	3'-8"	2
15"	2'-10 ½"	4f1	4	2'-6 ½"	3
		4f2	4	3'-8"	2
18"	3'-5"	4f1	4	3'-1"	3
		4f2	4	3'-8"	3
24"	4'-6"	4f1	4	4'-2"	3
		4f2	4	3'-8"	3
30"	5'-7"	4f1	4	5'-3"	3
		4f2	4	3'-8"	4
36"	6'-8"	4f1	4	6'-4"	3
		4f2	4	3'-8"	5
42"	7'-3"	4f1	4	6'-11"	3
		4f2	4	3'-8"	5

D	W	Mark	Size	Length	Count
48"	7'-10"	4f1	4	7'-6"	3
		4f2	4	3'-8"	6
54"	8'-5"	4f1	4	8'-1"	3
		4f2	4	3'-8"	6
60"	8'-11"	4f1	4	8'-7"	3
		4f2	4	3'-8"	6
66"	8'-11"	4f1	4	8'-7"	3
		4f2	4	3'-8"	6
72"	10'-0"	4f1	4	9'-8"	3
		4f2	4	3'-8"	7
78"	10'-7"	4f1	4	10'-3"	3
		4f2	4	3'-8"	7
84"	11'-1"	4f1	4	10'-9"	3
		4f2	4	3'-8"	8

FIGURE 4030.221 | SHEET 1 OF 1

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1	10-21-14

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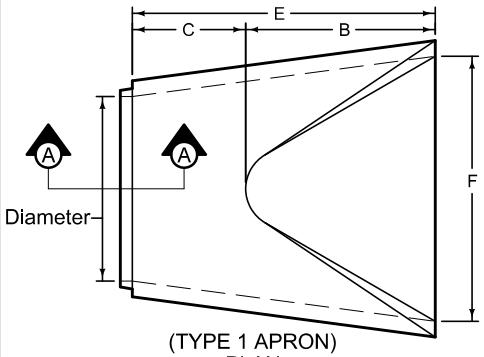
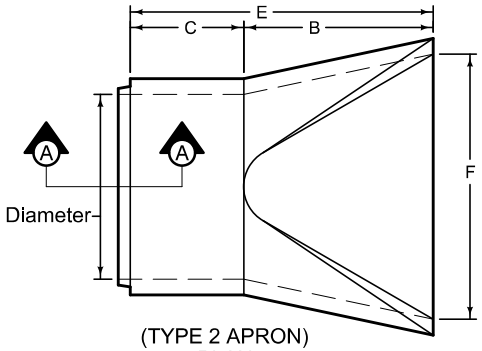
SUDAS Standard Specifications

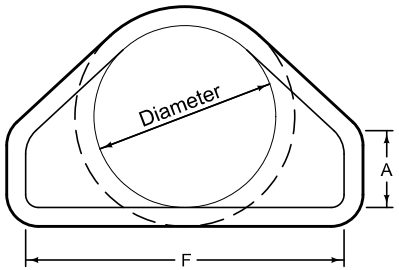
RCP APRON SECTION FOOTING



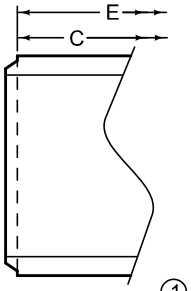
(TYPE 1 APRON)
PLAN



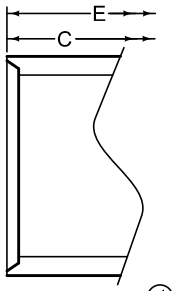
(TYPE 2 APRON)
PLAN



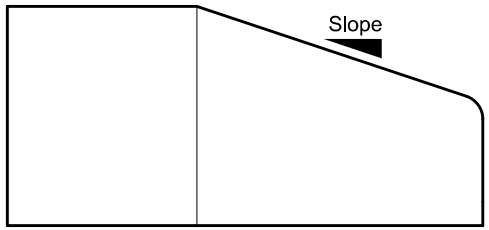
(TYPE 1 AND TYPE 2 APRONS)
END VIEW



SECTION A-A ①
TONGUE END DETAIL



SECTION A-A ①
GROOVE END DETAIL



SIDE VIEW

Dimension 'E' shown is the minimum and is considered the design length. Adjust for any difference between the actual length of concrete apron installed and the length indicated below for the length of concrete culvert pipe furnished.

① Tongue end used on inlet end section. Groove end used on outlet end section.

TYPE 1 APRONS						
DIAM.	SLOPE	A	B	MINIMUM		F
				C	E	
12"	2.4:1	4"	2'-0"	4'-⅞"	6'-⅞"	2'-0"
15"	2.4:1	6"	2'-3"	3'-10"	6'-1"	2'-6"
18"	2.3:1	9"	2'-3"	3'-10"	6'-1"	3'-0"
21"	2.4:1	9"	3'-0 "	3'-1½"	6'-1½"	3'-5"
24"	2.5:1	9½"	3'-7½"	2'-6"	6'-1½"	4'-0"
27"	2.5:1	10½"	4'-1 "	2'-0"	6'-1½"	4'-4"
30"	2.5:1	12"	4'-6"	1'-7¾"	6'-1¾"	5'-0"
36"	2.5:1	15"	5'-3"	2'-9"	8'-0"	6'-0"
42"	2.5:1	21"	5'-3"	2'-9"	8'-0"	6'-6"
48"	2.5:1	24"	6'-0"	2'-0"	8'-0"	7'-0"
54"	1.8:1	27"	5'-0"	3'-0"	8'-0"	7'-6"
60"	1.6:1	29½"	5'-0"	3'-0"	8'-0"	8'-0"
66"	1.7:1	30"	6'-0"	2'-3"	8'-3"	8'-0"
72"	1.6:1	30"	6'-6"	1'-9"	8'-3"	9'-0"
78"	1.8:1	36"	7'-6"	1'-9"	9'-3"	9'-6"
84"	1.3:1	29½"	6'-9"	2'-6½"	9'-3½"	10'-0"

TYPE 2 APRONS						
DIAM.	SLOPE	A	B	MINIMUM		F
				C	E	
12"	2.4:1	4"	2'-0"	4'-⅞"	6'-⅞"	2'-0"
15"	2.4:1	6"	2'-3"	3'-10"	6'-1"	2'-6"
18"	2.3:1	9"	2'-3"	3'-10"	6'-1"	3'-0"
21"	2.4:1	9"	3'-0"	3'-1½"	6'-1½"	3'-5"
24"	2.5:1	9½"	3'-7½"	2'-6"	6'-1½"	4'-0"
27"	2.5:1	10½"	4'-1 "	2'-0"	6'-1½"	4'-4"
30"	2.5:1	12"	4'-6"	1'-7¾"	6'-1¾"	5'-0"
36"	2.5:1	15"	5'-3"	2'-9"	8'-0"	6'-0"
42"	2.5:1	21"	5'-3"	2'-9"	8'-0"	6'-6"
48"	2.5:1	24"	6'-0"	2'-0"	8'-0"	7'-0"
54"	1.9:1	24½"	5'-5"	2'-7"	8'-0"	7'-6"
60"	1.4:1	24½"	5'-0"	3'-0"	8'-0"	8'-0"
66"	1.7:1	30"	6'-0"	2'-3"	8'-3"	8'-0"
72"	1.4:1	24"	6'-6"	1'-9"	8'-3"	9'-0"
78"	1.8:1	36"	7'-6"	1'-9"	9'-3"	9'-6"
84"	1.5:1	23½"	7'-6½"	1'-9"	9'-3½"	10'-0"

FIGURE 4030.222 | SHEET 1 OF 1

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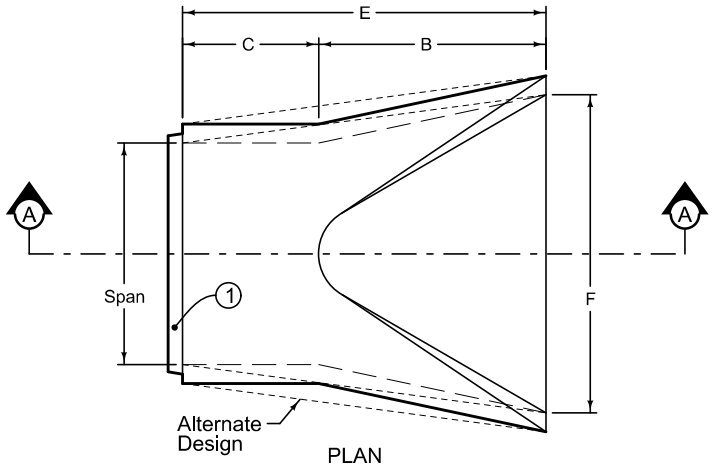
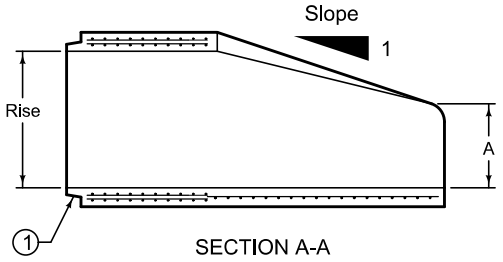
CIRCULAR CONCRETE APRONS



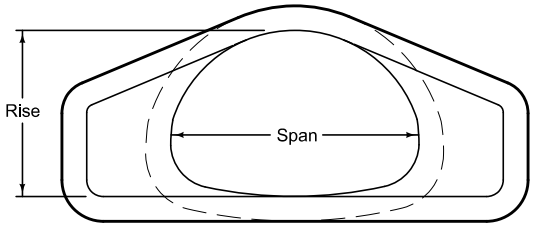
PLAN



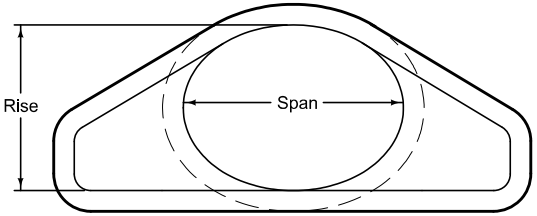
SECTION A-A

Dimension 'E' shown is the minimum and is considered the design length. Adjust for any difference between the actual length of concrete apron installed and the length indicated below for the length of concrete culvert pipe furnished.

(1) Tongue end used on inlet end section. Groove end used on outlet end section.



END (ARCH)



END (ELLIPTICAL)

EQUIVALENT DIAMETER Inches	SLOPE	APPROXIMATE DIMENSIONS Inches				
		A	B	C	E	F
18	3:1	7	27	45	72	36
24	3:1	$8\frac{1}{2}$	39	33	72	48
30	3:1	$9\frac{1}{2}$	50	46	96	60
36	3:1	$11\frac{1}{8}$	60	36	96	72
42	3:1	$15\frac{13}{16}$	60	36	96	78
48	3:1	21	60	36	96	84
54	3:1	$25\frac{1}{2}$	60	36	96	90
60	3:1	31	60	36	96	96
72	2:1	31	60	39	99	120
84	2:1	$21\frac{1}{2}$	83	19	102	144

ARCH PIPE

EQUIVALENT DIAMETER Inches	SLOPE	APPROXIMATE DIMENSIONS Inches				
		A	B	C	E	F
18	3:1	$7\frac{1}{2}$	27	45	72	36
24	3:1	$8\frac{1}{2}$	39	33	72	48
30	3:1	$9\frac{1}{2}$	54	18	72	60
36	2.5 to 1	$11\frac{1}{8}$	60	24	84	72
42	2.5 to 1	$15\frac{3}{4}$	60	36	96	78
48	2.5 to 1	21	60	36	96	84
54	2.5 to 1	$25\frac{1}{2}$	60	36	96	90
60	2.5 to 1	30	60	36	96	96
72	2.5 to 1	36	63	33	96	108
90	1.6 to 1	$36\frac{1}{2}$	58	38	96	113

ELLIPTICAL PIPE

FIGURE 4030.223 | SHEET 1 OF 1

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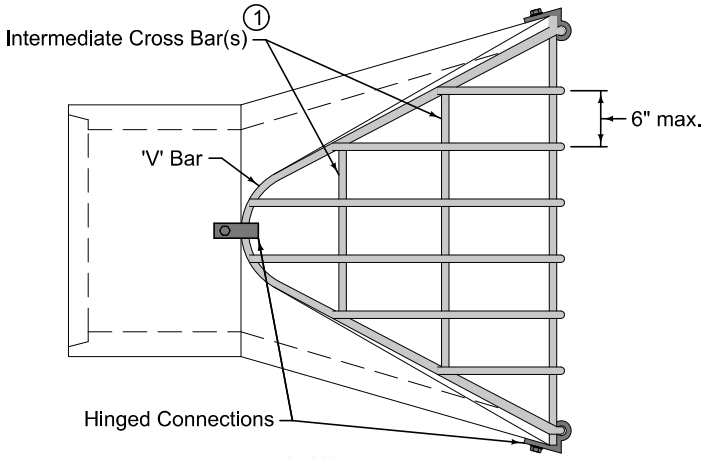
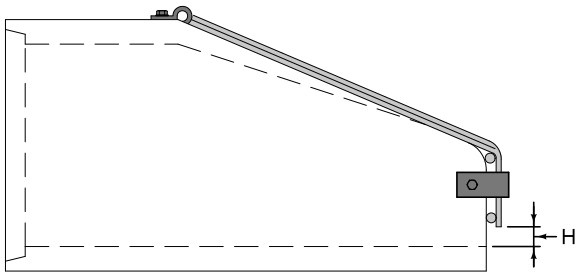
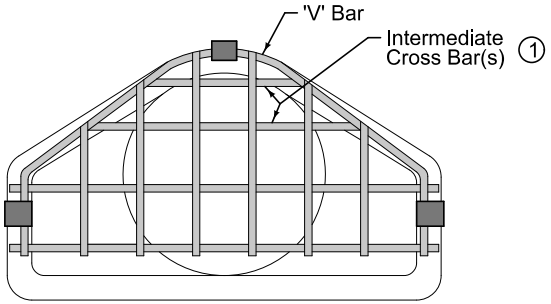
ARCH AND ELLIPTICAL CONCRETE PIPE APRONS



PLAN



PROFILE



FRONT

Provide guard dimensions to fit with type of apron provided. Ensure 'V' Bar completely rests on apron.

① All guards must include at least one intermediate cross bar. If pipe diameter, or equivalent diameter, is 60 inches or greater, use two intermediate cross bars equally spaced.

ROUND		ARCH		ELLIPTICAL	
PIPE SIZE	H	EQUIVALENT DIAMETER	H	EQUIVALENT DIAMETER	H
12"	$2\frac{1}{2}$"	18" to 24"	4"	18"	3"
15"	3"	30" to 36"	5"	24"	4"
18" - 24"	4"	42" to 54"	6"	30" to 36"	5"
27" - 36"	5"	60" to 72"	7"	42" to 54"	6"
42" - 54"	6"			60"	7"
60" - 72"	7"				
78" - 90"	8"				

BAR SIZES				
	PIPE SIZE (DIA. or EQUIV.)	HOLE DIA. REQ'D.	BOLT DIA.	BAR SIZE
ROUND	12" - 24"	$\frac{3}{4}$"	$\frac{5}{8}$"	$\frac{3}{4}$"
	27" - 48"	$\frac{7}{8}$"	$\frac{3}{4}$"	1"
	54" - 90"	$1\frac{1}{8}$"	1"	$1\frac{1}{4}$"
ARCH	up to 24" eq.	$\frac{3}{4}$"	$\frac{5}{8}$"	$\frac{3}{4}$"
	30" to 48"	$\frac{7}{8}$"	$\frac{3}{4}$"	1"
	54" to 72"	$1\frac{1}{8}$"	1"	$1\frac{1}{4}$"
ELLIPTICAL	up to 24" eq.	$\frac{3}{4}$"	$\frac{5}{8}$"	$\frac{3}{4}$"
	30" to 48"	$\frac{7}{8}$"	$\frac{3}{4}$"	1"
	54" to 60"	$1\frac{1}{8}$"	1"	$1\frac{1}{4}$"
BOLT LENGTH = PIPE WALL THICKNESS + $2\frac{1}{2}$"				

FIGURE 4030.224 | SHEET 1 OF 1

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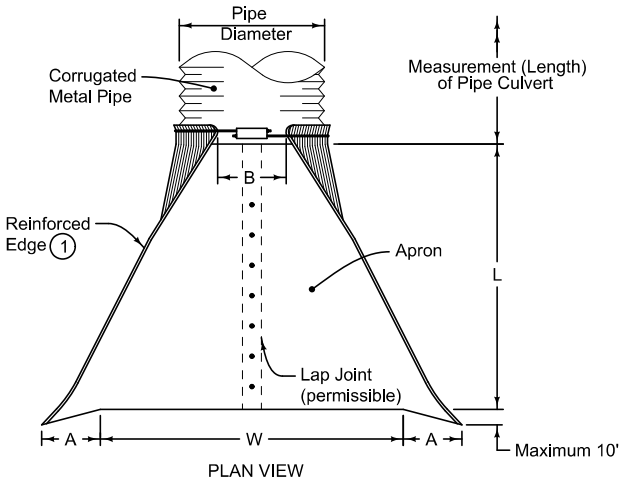
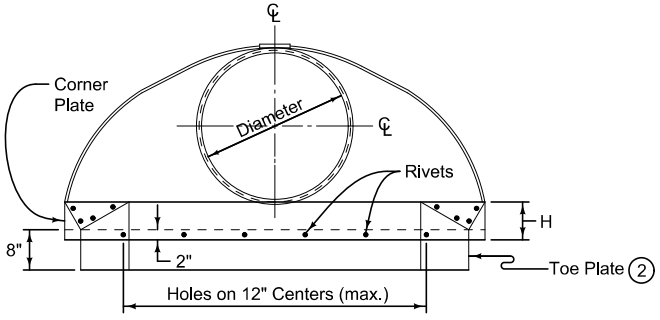
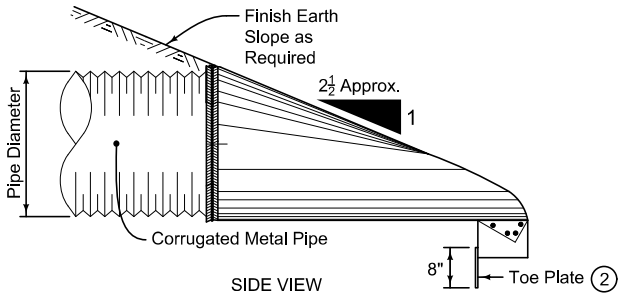
CONCRETE PIPE APRON GUARD



PLAN VIEW

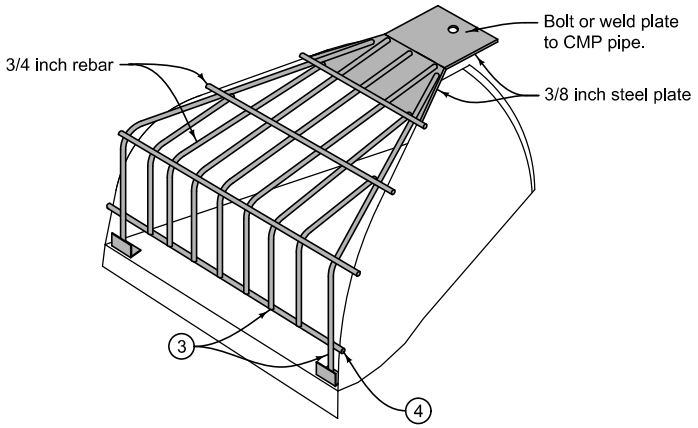


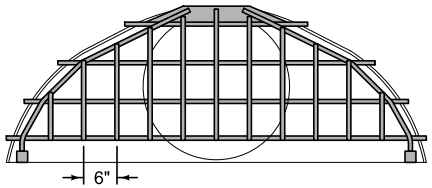
END VIEW



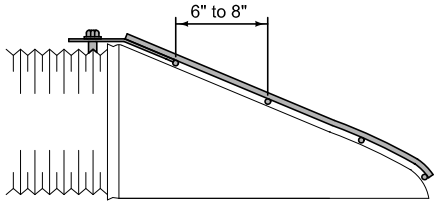
SIDE VIEW

METAL PIPE APRON





END VIEW



SIDE VIEW

METAL APRONS GUARD

1. On sizes 60 inches and larger, supplement the reinforced edge with a galvanized stiffener angle attached with bolts.
2. Install a galvanized toe plate (of the same gage metal as apron) on all aprons 24 inch diameter and larger.
3. Hold inside bars up 3 inches off bottom of apron. Extend outside bars to bottom of apron and attach to 2 inch by 2 inch by 1/4 inch steel angle.
4. When specified, extend bottom cross bar through apron.

DIMENSIONS					
PIPE DIAM.	A (±1")	B MAX.	H (±1")	L (±1½")	W (±2")
6"	4½"	1"	3"	8¾"	12"
8"	5⅞"	3"	4"	14¼"	16"
10"	7½"	6"	6"	21"	24"
12"	4¾"	6"	6"	21"	24"
15"	6"	8"	6"	26"	30"
18"	7"	9"	6"	31"	36"
21"	8¼"	11"	6"	36"	42"
24"	9½"	12"	6"	42"	48"
30"	12"	15"	7½"	52½"	60"
36"	14"	18"	9"	63"	72"
42"	16"	21"	10½"	73½"	84"
48"	18"	27"	12"	84"	90"
54"	18"	30"	12"	84"	102"
60"	18"	33"	12"	87"	114"
66"	18"	36"	12"	87"	120"
72"	18"	39"	12"	87"	126"
78"	18"	42"	12"	87"	132"
84"	18"	45"	12"	87"	138"
90"	24"	37"	11"	87"	144"
96"	25"	35"	12"	87"	150"

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4030.225

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SUDAS Standard Specifications

METAL PIPE APRONS AND APRON GUARDS

FIGURE 4030.225

SHEET 1 OF 1

1.07 SPECIAL REQUIREMENTS

A. Permit:

1. When applicable, comply with the requirements of the Iowa Department of Natural Resources, *NPDES (National Pollutant Discharge Elimination System) General Permit No. 2 for Stormwater Discharge Associated with Industrial Activity for Construction Activities*, and the Stormwater Pollution Prevention Plan.

2. For projects covered under the Iowa DNR General Permit No. 2, sign on as a co-permittee with the owner and any other contractors or subcontractors.

3. When applicable, comply with the local jurisdiction's permitting requirements.

B. Protection of Property: Prevent accumulation of soil, sediment, or debris from project site onto adjoining public or private property. Remove any accumulation of soil or debris immediately, and take remedial actions for prevention.

C. Permit Compliance: When applicable, conduct all operations in compliance with the Iowa DNR NPDES General Permit No. 2. Labor, equipment, or materials not included as a bid item, but necessary to prevent stormwater contamination from construction related sources, are considered incidental. Incidental work related to compliance with the permit may include, but is not limited to: hazardous materials protection, fuel containment, waste disposal, and providing employee sanitary facilities.

D. Project Staging: Replacing erosion and sediment control practices that are damaged or removed by the contractor in a manner that is inconsistent with the current project staging or SWPPP is the Contractor's responsibility and will be at the Contractor's expense.

1.08 MEASUREMENT AND PAYMENT

A. Stormwater Pollution Prevention Plan (SWPPP):

1. Preparation:
- **a. Measurement:** Lump sum item; no measurement will be made.
- **b. Payment:** Payment will be at the lump sum price for SWPPP preparation.
- **c. Includes:** Lump sum price includes, but is not limited to, development of a SWPPP by the Contractor meeting local and state agency requirements, filing the required public notices, filing a Notice of Intent for coverage of the project under the Iowa DNR NPDES General Permit No. 2, and payment of associated NPDES permit fees.
- **d. Other:** Item will be paid for upon approval of the SWPPP by the Engineer, and after the Notice of Intent has been filed by the Contractor.

2. Management:
- **a. Measurement:** Lump sum item; no measurement will be made.
- **b. Payment:** Payment will be at the lump sum price for SWPPP management.
- **c. Includes:** Lump sum price includes all work required to comply with the administrative provisions of the Iowa DNR NPDES General Permit No. 2; including record keeping, documentation, updating the SWPPP, filing the Notice of Discontinuation, etc. Item also includes weekly inspections required to satisfy the provisions of General Permit No. 2, unless otherwise specified in the contract documents.
- **d. Does Not Include:** Unit price does not include installation or maintenance of erosion and sediment control practices.
- **e. Other:** The Engineer may make partial payments based on estimates of the project completion. Final payment will be made when the site reaches final stabilization and the Notice of Discontinuation is filed.

1.08 MEASUREMENT AND PAYMENT (Continued)

B. Compost Blankets:

1. **Measurement:** Measurement will be in square feet for each thickness of compost blanket.

2. **Payment:** Payment will be at the unit price per square foot for each thickness of compost blanket.

3. **Includes:** Unit price includes, but is not limited to, furnishing and spreading compost over the designated area.

C. Filter Berms:

1. **Measurement:** Measurement will be in linear feet for each size of filter berm, measured longitudinally along the top of the berm.

2. **Payment:** Payment will be at the unit price per linear foot for each size of berm.

3. **Includes:** Unit price include, but is not limited to, furnishing material and constructing the filter berm, including vegetation if specified.

D. Filter Socks:

1. **Installation:**
   a. **Measurement:** Measurement will be in linear feet for each size of filter sock.
   b. **Payment:** Payment will be at the unit price per linear foot for each size of filter sock.
   c. **Includes:** Unit price includes, but is not limited to, anchoring stakes.

2. **Removal:**
   a. **Measurement:** Measurement will be in linear feet of filter sock removed.
   b. **Payment:** Payment will be at the unit price per linear foot of filter sock removed.
   c. **Includes:** Unit price includes, but is not limited to, restoration of the area to finished grade and off-site disposal of filter socks and accumulated sediment.

E. Temporary Rolled Erosion Control Products (RECP):

1. **Measurement:** Measurement will be in square yards, based on the width specified in the contract documents and actual measured length, for each type of temporary RECP.

2. **Payment:** Payment will be at the unit price per square yard for each type of temporary RECP.

3. **Includes:** Unit price includes, but is not limited to, excavation, staples, anchoring devices, and material for anchoring slots.

F. Wattles:

1. **Installation:**
   a. **Measurement:** Measurement will be in linear feet for each type and size of wattle.
   b. **Payment:** Payment will be at the unit price per linear foot for each type and size of wattle.
   c. **Includes:** Unit price includes, but is not limited to, anchoring stakes.

1.08 MEASUREMENT AND PAYMENT (Continued)

2. Removal:
- **a. Measurement:** Measurement will be in linear feet of wattle removed.
- **b. Payment:** Payment will be at the unit price per linear foot of wattle removed.
- **c. Includes:** Unit price includes, but is not limited to, restoration of the area to finished grade and off-site disposal of wattle and accumulated sediment.

G. Check Dams:

1. Rock Check Dams:
- **a. Measurement:** Measurement will be in ton of stone installed.
- **b. Payment:** Payment will be at the unit price per ton of stone installed.
- **c. Includes:** Unit price includes, but is not limited to, engineering fabric.

2. Manufactured Check Dams:
- **a. Installation:**
  - **1) Measurement:** Measurement will be in linear feet for each type and size of manufactured check dam.
  - **2) Payment:** Payment will be at the unit price per linear foot for each type and size of manufactured check dam.
  - **3) Includes:** Unit price includes, but is not limited to, anchoring stakes.
- **b. Removal:**
  - **1) Measurement:** Measurement will be in linear feet for each type of manufactured check dam removed.
  - **2) Payment:** Payment will be at the unit price per linear foot for each type of manufactured check dam removed.
  - **3) Includes:** Unit price includes, but is not limited to, restoration of the area to finished grade and off-site disposal of manufactured check dam and accumulated sediment.

H. Temporary Earth Diversion Structures:

1. Measurement: Measurement will be in linear feet for each type and size of temporary earth diversion structure.

2. Payment: Payment will be at the unit price per linear foot of temporary earth diversion structure.

3. Includes: Unit price includes, but is not limited to, removal of the structure upon completion of the project.

I. Level Spreaders:

1. Measurement: Measurement will be in linear feet of level spreaders.

2. Payment: Payment will be at the unit price per linear foot of level spreader.

3. Includes: Unit price includes, but is not limited to, maintaining the spreader during the period of construction and removal upon completion of the project, unless otherwise specified in the contract documents.

1.08 MEASUREMENT AND PAYMENT (Continued)

J. Rip Rap:

1. **Measurement:** Measurement will be in tons for each type of rip rap.

2. **Payment:** Payment will be at the unit price per ton of rip rap.

3. **Includes:** Unit price includes, but is not limited to, engineering fabric.

K. Temporary Pipe Slope Drains:

1. **Measurement:** Measurement will be in linear feet for each type and size of temporary pipe slope drain, measured from end of apron to end of apron.

2. **Payment:** Payment will be at the unit price per linear foot for each type and size of pipe.

3. **Includes:** Unit price includes, but is not limited to, excavation, furnishing and installing pipe and pipe aprons, grading, and removal of the slope drain upon completion of the project.

L. Sediment Basin:

1. **Outlet Structure:**
   a. **Measurement:** Each size of sediment basin outlet structure will be counted.
   b. **Payment:** Payment will be at the unit price for each sediment basin outlet structure.
   c. **Includes:** Unit price includes, but is not limited to, concrete base, dewatering device, anti-vortex device, outlet pipe, and anti-seep collars (if specified).
   d. **Does Not Include:** Unit price does not include earthwork required for construction of the sediment basin.

2. **Removal of Sediment:**
   a. **Measurement:** Each occurrence of sediment removal will be counted.
   b. **Payment:** Payment will be at the unit price for each occurrence of sediment removal.
   c. **Includes:** Unit price includes, but is not limited to, dewatering and removal and off-site disposal of accumulated sediment.

3. **Removal of Outlet Structure:**
   a. **Measurement:** Each sediment basin outlet structure removed will be counted.
   b. **Payment:** Payment will be at the unit price for each sediment basin outlet structure removed.
   c. **Includes:** Unit price includes, but is not limited to, dewatering and off-site disposal of the outlet structure, concrete base, emergency spillway, and accumulated sediment.
   d. **Does Not Include:** Unit price does not include earthwork required to remove the sediment basin and restoration of the area to finished grade.

M. Sediment Trap Outlet:

1. **Installation:**
   a. **Measurement:** Measurement will be in tons of crushed stone placed.
   b. **Payment:** Payment will be at the unit price per ton of crushed stone.
   c. **Includes:** Unit price includes, but is not limited to, engineering fabric.
   d. **Does Not Include:** Unit price does not include earthwork required for construction of the sediment trap.

1.08 MEASUREMENT AND PAYMENT (Continued)

2. Removal of Sediment:
- **a. Measurement:** Each occurrence of sediment removal will be counted.
- **b. Payment:** Payment will be at the unit price for each occurrence of sediment removal.
- **c. Includes:** Unit price includes, but is not limited to, dewatering and removal and off-site disposal of accumulated sediment.

3. Removal of Device:
- **a. Measurement:** Each sediment trap outlet removed will be counted.
- **b. Payment:** Payment will be at the unit price for each sediment trap outlet removed.
- **c. Includes:** Unit price includes, but is not limited to, dewatering and off-site disposal of sediment trap outlet and accumulated sediment.
- **d. Does Not Include:** Unit price does not include earthwork required to remove the sediment trap outlet and restoration of the area to finished grade.

N. Silt Fence or Silt Fence Ditch Check:

1. Installation:
- **a. Measurement:** Measurement will be in linear feet of silt fence or silt fence ditch check.
- **b. Payment:** Payment will be at the unit price per linear foot of silt fence or silt fence ditch check.
- **c. Includes:** Unit price includes, but is not limited to, anchoring posts.

2. Removal of Sediment:
- **a. Measurement:** Each occurrence of sediment removal will be counted.
- **b. Payment:** Payment will be at the unit price for each occurrence of sediment removal.
- **c. Includes:** Unit price includes, but is not limited to, dewatering and removal and off-site disposal of accumulated sediment.

3. Removal of Device:
- **a. Measurement:** Measurement will be in linear feet of silt fence removed.
- **b. Payment:** Payment will be at the unit price per linear foot of silt fence removed.
- **c. Includes:** Unit price includes, but is not limited to, restoration of the area to finished grade and off-site disposal of fence, posts, and accumulated sediment.

O. Stabilized Construction Entrance:

1. Stabilized Construction Entrance by Square Yard:
- **a. Measurement:** Measurement will be in square yards of material placed.
- **b. Payment:** Payment will be at the unit price per square yard of material placed.
- **c. Includes:** Unit price includes, but is not limited to, subgrade stabilization fabric.

2. Stabilized Construction Entrance by Ton:
- **a. Measurement:** Measurement will be in tons of material placed.
- **b. Payment:** Payment will be at the unit price per ton of material placed.
- **c. Includes:** Unit price includes, but is not limited to, subgrade stabilization fabric.

1.08 MEASUREMENT AND PAYMENT (Continued)

P. Dust Control:

1. **Water for Dust Control:**
   a. **Measurement:** Measurement will be by metering of water applied to haul roads and other areas to control dust. If metering is not available, measurement will be by counting the loads from a transporting tank of known volume and gauging the contents of the transporting truck for partial loads.
   b. **Payment:** Payment will be at the unit price per 1,000 gallons of water used.
   c. **Includes:** Unit price includes, but is not limited to, furnishing, transporting, and distributing water to the haul road.

2. **Dust Control Product:**
   a. **Measurement:** Measurement will be in square yards of the treated area.
   b. **Payment:** Payment will be at the unit price per square yard of product applied.
   c. **Includes:** Unit price include, but is not limited to, furnishing and incorporating the dust control product to the haul road.

Q. Erosion Control Mulching:

1. **Conventional Mulching:**
   a. **Measurement:** Measurement will be in acres of conventional mulch.
   b. **Payment:** Payment will be at the unit price per acre of conventional mulch.
   c. **Includes:** Unit price includes, but is not limited to, furnishing and incorporating mulch in the area designated in the contract documents.

2. **Hydromulching:**
   a. **Measurement:** Measurement will be in acres for each type of hydromulch.
   b. **Payment:** Payment will be at the unit price per acre for each type of hydromulch.
   c. **Includes:** Unit price includes, but is not limited to, furnishing mulch and tackifier (if applicable), providing equipment specific to hydromulching, and applying the mulch to the specified area.

R. Turf Reinforcement Mats (TRM):

1. **Measurement:** Measurement will be in squares for each type of turf reinforcement mat, each square containing 100 square feet.

2. **Payment:** Payment will be at the unit price per square for each type of turf reinforcement mat.

3. **Includes:** Unit price includes, but is not limited to, excavation, staples, anchoring devices, and material for anchoring slots.

S. Surface Roughening:

1. **Measurement:** Measurement will be in square feet of surface roughening, including directional tracking or grooving/furrowing.

2. **Payment:** Payment will be at the unit price per square foot of surface roughening.

3. **Includes:** Unit price includes, but is not limited to, providing equipment to complete directional tracking or grooving/furrowing and completing surface roughening of slopes specified in the contract documents.

1.08 MEASUREMENT AND PAYMENT (Continued)

T. Inlet Protection Device:

1. **Installation:**
   a. **Measurement:** Each type of inlet protection device will be counted.
   b. **Payment:** Payment will be at the unit price for each inlet protection device.
   c. **Includes:** Unit price includes, but is not limited to, removal of the device upon completion of the project.

2. **Maintenance:**
   a. **Measurement:** Each inlet protection device maintenance occurrence will be counted.
   b. **Payment:** Payment will be at the unit price for each inlet protection device maintenance occurrence.
   c. **Includes:** Unit price includes, but is not limited to, removal and off-site disposal of accumulated sediment.

U. Flow Transition Mat:

1. **Measurement:** Measurement will be in square feet of flow transition mat.

2. **Payment:** Payment will be at the unit price per square foot of flow transition mat.

3. **Includes:** Unit price includes, but is not limited to, anchoring devices.

V. End of Season Temporary Erosion Control:

1. **Measurement:** Measurement will be in acres of end of season temporary erosion control applied.

2. **Payment:** Payment will be at the unit price per acre for end of season temporary erosion control.

3. **Includes:** Unit price includes, but is not limited to, furnishing, placing, and maintaining the end of season temporary erosion control throughout the winter season.

PART 2 - PRODUCTS

2.01 COMPOST BLANKETS

Comply with Section 9010, 2.07, C for compost material requirements for compost blankets.

2.02 COMPOST BLANKET AND FILTER BERM TACKIFIER

A. Use a biodegradable, organic binding agent or polyacrylamide that can be mixed with, or injected into, compost or filter material as it is placed, which is not detrimental to the establishment of vegetation.

B. Use in filter berms or compost blankets when specified in the contract documents.

C. Apply at the rate recommended by the manufacturer.

2.03 FILTER MATERIAL

Material for use in filter socks, filter berms, and other areas, as specified in the contract documents.

A. Use material derived from wood, bark, or other, non-toxic vegetative feedstocks.

B. Use material with no visible admixture of refuse or other physical contaminants, nor any material toxic to plant growth.

C. Use material meeting the following particle sizes:

Sieve Size	Percent Passing[1]
2”	100
1”	90-100
3/8”	0-30

[1]The target flow rate of in-place material is 10 gal/min/lf. The Engineer may approve use of alternate materials meeting the target flow rate.

2.04 FILTER SOCK

A. For slope and sediment control applications, use a continuous, tubular, knitted, mesh netting with 3/8 inch openings, constructed of 5 mil thickness, photodegradable HDPE.

B. For inlet protection, use a continuous, tubular, knitted, mesh netting with 3/8 inch openings, constructed of 500 denier polypropylene.

C. Use 1 inch by 2 inch (minimum) hardwood stakes or stakes of equivalent strength.

2.05 TEMPORARY ROLLED EROSION CONTROL PRODUCTS (RECP)

Use temporary rolled erosion control products that are classified and have material properties according to the Erosion Control Technology Council’s (ECTC) guidelines as follows:

A. Material Classification:

1. **RECP Type 1 (Ultra Short-term):** Functional longevity of 3 months or less and classified as follows:
   a. **RECP Type 1.A:** Mulch control net, consisting of a photodegradable synthetic mesh or woven biodegradable natural fiber netting.
   b. **RECP Type 1.B:** Netless rolled erosion control blankets, consisting of natural and/or polymer fibers, mechanically interlocked and/or chemically adhered together to form a RECP.

2.05 TEMPORARY ROLLED EROSION CONTROL PRODUCTS (RECP) (Continued)

c. **RECP Type 1.C:** Single-net erosion control blankets and open weave textiles, consisting of processed degradable natural and/or polymer fibers, mechanically bound together by a single rapidly-degrading, synthetic or natural fiber netting, or an open weave textile of processed rapidly-degrading natural or polymer yarns or twines woven into a continuous matrix.
d. **RECP Type 1.D:** Double-net erosion control blankets, consisting of processed degradable natural and/or polymer fibers, mechanically bound together between two rapidly-degrading, synthetic or natural fiber nettings.

2. **RECP Type 2 (Short-term):** Functional longevity between 3 and 12 months and classified as follows:
   a. **RECP Type 2.A:** Mulch control net, consisting of a photodegradable synthetic mesh or woven biodegradable natural fiber netting.
   b. **RECP Type 2.B:** Netless rolled erosion control blankets, consisting of natural and/or polymer fibers, mechanically interlocked and/or chemically adhered together to form a RECP.
   c. **RECP Type 2.C:** Single-net erosion control blankets and open weave textiles, consisting of an erosion control blanket composed of processed degradable natural or polymer fibers, mechanically bound together by a single degradable synthetic or natural fiber netting to form a continuous matrix, or an open weave textile composed of processed degradable natural or polymer yarns or twines woven into a continuous matrix.
   d. **RECP Type 2.D:** Double-net erosion control blanket, consisting of processed degradable natural and/or polymer fibers, mechanically bound together between two degradable synthetic or natural fiber nettings.

3. **RECP Type 3 (Extended Term):** Functional longevity between 12 and 24 months and classified as follows:
   a. **RECP Type 3.A:** Mulch control nets, consisting of a slow-degrading synthetic mesh or woven natural fiber netting.
   b. **RECP Type 3.B:** Erosion control blankets and open weave textiles, consisting of processed slow-degrading natural or polymer fibers, mechanically bound together between two slow-degrading synthetic or natural fiber nettings to form a continuous matrix, or an open weave textile composed of processed slow-degrading natural or polymer yarns or twines woven into a continuous matrix.

4. **RECP Type 4 (Long Term):** Functional longevity of 36 months and classified as follows: Erosion control blankets and open weave textiles, consisting of processed slow-degrading natural or polymer fibers, mechanically bound together between two slow degrading synthetic or natural fiber nettings to form a continuous matrix, or an open weave textile composed of processed slow-degrading natural or polymer yarns or twines woven into a continuous matrix.

B. Properties and Performance:

1. Testing performed according to the ECTC's Testing Procedures for Rolled Erosion Control Products. Verify manufacturer's test results by independent testing.

2.05 TEMPORARY ROLLED EROSION CONTROL PRODUCTS (RECP) (Continued)

2. Material properties meeting the Erosion Control Technology Council's (ECTC) Standard Specifications for Rolled Erosion Control Products as follows:

Classification	Slope Application Max. Grade*	Channel Application Permissible Shear Stress	Min. Tensile Strength
RECP Type 1.A	5:1 (H:V)	0.25 lb/ft^2	5 lb/ft
RECP Type 1.B	4:1 (H:V)	0.50 lb/ft^2	5 lb/ft
RECP Type 1.C	3:1 (H:V)	1.50 lb/ft^2	50 lb/ft
RECP Type 1.D	2:1 (H:V)	1.75 lb/ft^2	75 lb/ft
RECP Type 2.A	5:1 (H:V)	0.25 lb/ft^2	5 lb/ft
RECP Type 2.B	4:1 (H:V)	0.50 lb/ft^2	5 lb/ft
RECP Type 2.C	3:1 (H:V)	1.50 lb/ft^2	50 lb/ft
RECP Type 2.D	2:1 (H:V)	1.75 lb/ft^2	75 lb/ft
RECP Type 3.A	5:1 (H:V)	0.25 lb/ft^2	25 lb/ft
RECP Type 3.B	1.5:1 (H:V)	2.00 lb/ft^2	100 lb/ft
RECP Type 4	1:1 (H:V)	2.25 lb/ft^2	125 lb/ft

*Product tested according to ECTC Test Method No. 2 and meeting the ECTC Standard Specifications for "C" factor.

C. RECP Anchors: Stakes or staples as recommended by manufacturer, with a minimum length of 6 inches.

2.06 WATTLES

A. Netting: Open weave, degradable netting. Nominal diameter of 9 inches, or as specified.

B. Fill Material: Straw, wood excelsior, coir, or other natural materials approved by the Engineer.

C. Stakes: 1 inch by 1 inch (minimum) wooden stakes, or stakes of equivalent strength.

2.07 CHECK DAMS

A. Synthetic Permeable Check Dam (HDPE):

1. Ditch Berm:
a. Installed height of 9 to10 inches.
b. Manufactured check dam constructed from sheets of perforated, UV-stabilized High Density Polyethylene (HDPE).
c. Perforations of 30 to 40% open area.

2. RECP for Permeable Check Dam (when specified): RECP Type 4, 4 feet wide.

3. Anchors: As recommended by the manufacturer.

B. Triangular Foam Check Dam: Triangular-shaped device with a height of 8 to 10 inches and a base of 16 to 20 inches.

1. Inner Support Material: Urethane foam.

2. Outer Cover: Woven geotextile material shaped to fit around the inner support material, extending 2 to 3 feet beyond the bottom edge of the triangular-shaped inner support.

3. Length: 7 feet.

2.07 CHECK DAMS (Continued)

C. Rock Check Dam:

1. Aggregate: Erosion stone complying with Iowa DOT Article 4130.04.

2. Engineering Fabric: Comply with Section 9040, 2.20.

2.08 LEVEL SPREADERS

A. Provide 2 inch by 8 inch (minimum) pressure-treated timber of the length specified.

B. Use timbers that are relatively straight and have a minimum length of 5 feet each.

2.09 RIP RAP

A. Class A Revetment: Comply with Iowa DOT Section 4130.

B. Class B Revetment: Comply with Iowa DOT Section 4130.

C. Class D and E Revetment: Comply with Iowa DOT Section 4130.

D. Erosion Stone: Comply with Iowa DOT Section 4130.

2.10 TEMPORARY PIPE SLOPE DRAINS

A. PVC, HDPE, and metal pipes as specified in Section 4020, 2.01.

B. HDPE, Type C (corrugated interior).

C. All pipes listed are allowed for use within the right-of-way.

2.11 SEDIMENT BASIN OUTLET STRUCTURES

A. Base: Class C concrete unless otherwise specified in the contract documents.

B. Riser: CMP complying with Section 4020; diameter as specified in the contract documents.

C. Dewatering Device:

1. Drill holes in the riser of the number, diameter, and at the elevation specified in the contract documents.

2. 1/4 inch by 1/4 inch or 1/2 inch by 1/2 inch wire mesh for hardware cloth.

D. Barrel: CMP complying with Section 4020; diameter as specified in the contract documents.

E. Anti-Vortex Device: CMP complying with Section 4020; diameter according to Figure 9040.116 and riser diameter as specified in the contract documents.

F. Anti-Seep Collar:

1. Corrugated metal sheet of same material and gage as barrel section.

2. Size according to Figure 9040.117.

2.12 SEDIMENT TRAPS

A. Erosion Stone: Comply with Section 9040, 2.09.

B. Engineering Fabric: Comply with Section 9040, 2.20.

2.13 SILT FENCE

A. Fabric: Comply with Iowa DOT Article 4196.01.

B. Posts: 4 foot minimum steel (T-section) weighing at least 1.25 pounds per foot, exclusive of anchor plate. Painted posts are not required.

C. Fastener: Wire or plastic ties with a minimum tensile strength of 50 pounds.

2.14 STABILIZED CONSTRUCTION ENTRANCE

A. Entrance Stone: Comply with Iowa DOT Section 4122, Gradation 13, Macadam crushed stone.

B. Subgrade Stabilization Material: Use woven, UV-stabilized geotextile with a minimum tensile strength of 135 lb/ft.

2.15 DUST CONTROL

A. Water: Use potable water or water from a source approved by the engineer.

B. Calcium Chloride: Comply with Iowa DOT Article 4194.01.

C. Lignosulfonate (Tree Sap): Use a commercially-available product with known lignin content.

D. Soapstock (Soybean Oil):

1. Use a commercially-available, undiluted, soybean oil soapstock emulsion.

2. Comply with manufacturer's recommendations for storage, transportation, temperature, and application equipment requirements.

2.16 EROSION CONTROL MULCH

A. Conventional Mulch:

1. Use dry cereal straw (oats, wheat, barley, or rye) or native grass straw.

2. Use material that is free of noxious weeds, seed-bearing stalks, or roots, and will be inspected and approved by the Engineer prior to use.

3. Other materials, subject to the approval of the Engineer, may be used.

B. Hydromulch:

1. Wood Cellulose Mulch: Comply with Section 9010, 2.07.

2. Bonded Fiber Matrix (BFM): Comply with Section 9010, 2.07.

3. Mechanically Bonded Fiber Matrix (MBFM): See Section 9010, 2.07.

2.17 TURF REINFORCEMENT MATS (TRM)

A. Material Classification:

1. **TRM Type 1:** Use a TRM that is constructed of a web of mechanically or melt-bonded polymer netting, monofilaments, or fibers that are entangled to form a strong and dimensionally stable mat. Bonding methods include polymer welding, thermal or polymer fusion, or the placement of synthetic fibers between two high-strength, biaxially-oriented nets, mechanically bound by parallel stitching with polyolefin thread. Products may contain a degradable component.

2. **TRM Type 2 and 3:** Use a TRM that is constructed of a web of mechanically or melt-bonded polymer netting, monofilaments, or fibers that are entangled or woven to form a strong and dimensionally stable mat. Non-woven bonding methods include polymer welding, thermal or polymer fusion, or the placement of fibers between two high-strength, biaxially oriented nets, mechanically bound by parallel stitching with polyolefin thread. Use only components that are 100% synthetic and resistant to biological, chemical, and ultraviolet degradation.

3. **TRM Type 4:** Use a high performance/survivability TRM that is composed of monofilament yarns woven into a resilient uniform configuration. Use a mat that has a matrix that exhibits very high interlock and reinforcement capacities with both soil and root systems and demonstrate a high tensile modulus. TRMs manufactured from discontinuous or loosely held together by stitched or glued, netting, or composites are not allowed in this category. Use only components that are 100% synthetic and resistant to biological, chemical, and ultraviolet degradation. Use this category when field conditions exist with high loading and/or high survivability requirements.

B. Properties and Performance:

Meet the minimum material and performance requirements contained in the following table:

	Property[1]	Test Method	Type 1	Type 2	Type 3	Type 4
Material	Thickness	ASTM D 6525	0.25 in	0.25 in[5]	0.25 in[5]	0.25 in[5]
Material	Tensile Strength[2]	ASTM D 6818	125 lb/ft	240 lb/ft	750 lb/ft	3,000 lb/ft
Material	UV Resistance[3]	ASTM D 4355	80% @ 500 hrs	80% @ 1,000 hrs	80% @ 1,000 hrs	90% @ 3,000 hrs
Performance	Maximum Shear Stress[4] (Channel Applications)	ASTM D 6460	7 lb/ft^2	10 lb/ft^2	12 lb/ft^2	15 lb/ft^2

1 For TRMs containing degradable components, all values must be obtained on the non-degradable portion of the matting.
2 Minimum Average Roll Values, machine direction only.
3 Tensile strength of structural components retained after UV exposure.
4 Minimum shear stress that fully-vegetated TRM can sustain without physical damage or excess erosion (0.5 in soil loss) during a 30 minute flow event in large scale testing. Acceptable large scale testing protocol includes ASTM D 6460 or independent testing conducted by the Texas Transportation Institute, Colorado State University, Utah State University, or other approved testing facility. Bench scale testing is not acceptable.
5 Type 2, 3, and 4 TRM may include additional degradable components as long as material and performance requirements are met by the 100% synthetic components.

2.18 INLET PROTECTION

A. Drop-in Intake Protection:

1. Use a manufactured device that is inserted into the intake and is capable of trapping or filtering sediment from runoff prior to entering the storm sewer.

2. All components must be contained entirely below the surface of the intake grate.

3. Incorporate means of emergency outflow to prevent flooding if plugged with sediment.

B. Surface-applied Intake Protection:

1. Use devices or filter socks, placed around or over the intake, that are capable of trapping or filtering sediment from runoff prior to entering the storm sewer.

2. Do not allow the device to completely block or plug the intake, preventing inflow.

2.19 FLOW TRANSITION MATS

Comply with the following and Iowa DOT Materials I.M. 469.10.

A. Mat:

1. Constructed of 85% minimum UV resistant material with a maximum ground cover of 80%.

2. Meet the requirements of the following table:

Property	Test Method	Value
Mass/Unit Area (max.)	ASTM D 6566	3 lbs/SF
Minimum Thickness	ASTM D 6525	0.4 inch
Maximum Thickness	ASTM D 6525	1.1 inch
Tensile Strength	ASTM D 6818	550 lbs/ft
Minimum Percent Open Area	ASTM D 6567	20%
UV Stability	ASTM D 4355	85%

B. Anchoring Devices:

1. Furnish bullet tip style anchors made of a metal alloy attached to a wire rope.

2. Anchors capable of withstanding a minimum 300 pounds (136 kg) of pull out resistance in cohesive soils.

3. Wire rope a minimum of 30 inches (762 mm) in length with a minimum breaking strength of at least 300 pounds (136 kg).

4. The top washer a minimum of 3 inches (76 mm) in diameter and constructed of a UV resistant plastic.

5. Each anchor equipped to allow the retightening of the anchor when deemed necessary by the Engineer.

2.20 ENGINEERING FABRIC

Comply with Iowa DOT Article 4196.01, B, 3.

PART 3 - EXECUTION

3.01 SWPPP PREPARATION

A. Prepare a SWPPP according to the requirements of the Iowa DNR NPDES General Permit No. 2.

B. Ensure that controls utilized in the SWPPP conform to the type and quantity of erosion and sediment controls specified in the contract documents.

C. Submit the completed SWPPP to the Engineer for review and approval prior to filing the Notice of Intent.

D. Upon approval of the Engineer, file public notices, as required by the NPDES General Permit No. 2.

E. File the Notice of Intent and fee, as required by the NPDES General Permit No. 2.

3.02 SWPPP MANAGEMENT

Coordinate and carry out all requirements of Iowa DNR NPDES General Permit No. 2 and any local ordinance requirements, including:

A. Update the SWPPP according to the requirements of the NPDES General Permit No. 2.

B. Revise the SWPPP and implement changes, as necessary, to prevent sediment or hazardous materials from being transported off the site.

C. Submit all SWPPP revisions to the Engineer for review and approval.

D. Perform and maintain records of weekly erosion and sediment control site inspections, unless otherwise specified in the contract documents.

E. Maintain records of transfer of responsibility under the NPDES General Permit No. 2.

F. Retain all records on-site, or as required by the NPDES General Permit No. 2.

G. After final stabilization, file a Notice of Discontinuation, according to the NPDES General Permit No. 2.

H. Provide all records and documentation to the Engineer upon completion of the project. Retain a copy of all records for the period required under the Permit.

I. Continue to perform the work required under this item throughout the duration of the project, and until final stabilization is achieved and a Notice of Discontinuation is filed.

3.03 EROSION AND SEDIMENT CONTROL INSPECTION

A. Perform inspections according to and at frequency required by the Iowa DNR NPDES General Permit No. 2.

B. Schedule necessary maintenance or improvements for items that are included in the contract documents.

C. Notify the Engineer immediately of situations requiring attention beyond that provided for in the contract documents.

3.03 EROSION AND SEDIMENT CONTROL INSPECTION (Continued)

D. Provide copies of the inspection reports to the Engineer.

3.04 EQUIPMENT

Comply with Iowa DOT Article 2601.03.

3.05 COMPOST BLANKETS (Figure 9040.101)

A. Loosen the ground surface to a minimum depth of 1 inch.

B. Evenly spread compost, as specified in the contract documents, or as directed by the Engineer.

C. Divert concentrated flows away from the slope.

D. Do not operate heavy equipment over the compost blanket after placement, or throughout the required period of protection.

E. Inspect the ground under the blanket at regular intervals for signs of erosion.

3.06 FILTER BERMS (Figure 9040.102)

A. Install filter berm along the contour as specified in the contract documents, or as directed by the Engineer.

B. Turn the ends of the filter berm uphill to prevent runoff from flowing around the end of the berm.

C. When a vegetated berm is specified, apply seed to the surface of the berm.

D. Replace the berm when sediment accumulation reaches one-half of the height of the berm.

3.07 FILTER SOCKS (Figure 9040.102)

A. Installation:

1. Fill mesh filter sock with filler material to the size and length specified in the contract documents.

2. Place the filter sock along the contour as specified in the contract documents, or as directed by the Engineer.

3. Construct a “J-hook” at each end of a continuous run of filter sock, by turning the end of the sock uphill, as necessary to prevent runoff from flowing around the ends when water behind the sock ponds up to a level even with the top of the sock.

4. Drive stakes into the ground at a maximum spacing of 10 feet, and as required to secure the sock and prevent movement.

5. Repair or replace non-functioning filter socks that allow water to flow under the sock, are torn, or are otherwise damaged, due to inadequate installation.

6. Remove filter material from damaged socks that are located along streambanks, around intakes, in ditches, or in other locations where the material may be carried to surface waters.

3.07 FILTER SOCKS (Continued)

B. Removal: When specified in the contract documents, or as directed by the Engineer; remove the filter sock upon completion of the project, and after final stabilization is achieved; or as indicated in the SWPPP, if applicable.

1. Upon completion of the project, completely remove socks and filter material that are located along streambanks, around intakes, in ditches, or in other locations where the filter material may be carried to surface waters if the sock degrades and/or tears.

2. Slice the sock longitudinally. Remove and dispose of the filter sock material and stakes.

3. Spread the filter material and accumulated sediment to match finished grade and to ensure proper drainage.

4. If the site has been brought to finished grade and prepared for permanent seeding, spread and incorporate the filter material into the surface by tilling, or as required to break up any large particles and provide a finished surface suitable for permanent seeding.

C. Replacement:

1. When accumulated sediment reaches a level one-half the height of the sock, or when the sock becomes clogged with sediment and no longer allows runoff to flow through, remove the sock as described above, and replace according to the installation instructions above.

2. At the Engineer's option, the existing filter sock and accumulated sediment may be left in place, and a new filter sock installed up-slope from the existing filter sock.

3.08 TEMPORARY ROLLED EROSION CONTROL PRODUCTS (RECP) (Figures 9040.103 and 9040.104)

Install temporary RECPs according to the manufacturer's published installation recommendations, subject to the following minimum requirements:

A. Slope Application:

1. Grade and smooth surface. Remove all rocks, clods, vegetation, or other obstructions that will prevent direct contact between the RECP and the soil surface.

2. When specified, prepare seedbed and place seed and fertilizer according to Section 9010 prior to placing RECP.

3. Install anchor trench at top of slope. Seed and fertilize trench after backfill and compaction, if seeding is specified.

4. Unroll the RECP down or horizontally across the slope.

5. Place consecutive blankets down the slope end-over-end, shingle style.

6. Overlap ends of consecutive rolls a minimum of 3 inches, and install anchors at a maximum spacing of 18 inches along all overlaps.

7. Overlap edges of adjacent rolls a minimum of 2 inches.

8. Install anchors at edge seams between rows.

3.08 TEMPORARY ROLLED EROSION CONTROL PRODUCTS (RECP) (Continued)

B. Channel/Ditch Application:

1. When specified, prepare seedbed and place seed and fertilizer according to Section 9010, prior to placing RECP.

2. Place end of first roll in the anchor slot at the center of the upstream channel and secure with anchors.

3. Position adjacent rolls in the anchor slot, overlapping adjacent rolls a minimum of 3 inches.

4. Place backfill material in anchor slot and compact. Unroll RECP over compacted slot and secure with anchors.

5. Unroll RECP downstream. Maintain a minimum 3 inch overlap between adjacent rolls. Secure edge lap with anchors.

6. Install intermittent staple check slots every 30 feet.

7. Construct end lap at end of roll and beginning of new roll. Overlap roll ends with upstream RECP on top.

8. Excavate longitudinal trench along both sides of the channel at the outside edges of installation. Place outer edges of RECP into longitudinal slot. Install anchors, place backfill material, and compact.

9. Terminate installation at downstream end with staple check.

10. Install anchors in a regular pattern over entire area covered according to manufacturer's published recommendations (minimum three anchors per square yard).

3.09 WATTLES (Figure 9040.105)

A. Installation:

1. Construct a shallow trench, 2 to 4 inches deep, matching the width and contour of the wattle.

2. Install wattle along contour of slope.

3. Turn ends of wattle uphill to prevent water from flowing around ends.

4. Place and compact excavated soil against the wattle, on the uphill side.

5. Drive stakes through the center of the wattle, into the ground at a maximum spacing of 4 feet along the length of the wattle, and as needed to secure the wattle and prevent movement.

6. Abut ends of adjacent wattles tightly. Wrap joint with a 36 inch wide section of silt fence and secure with stakes.

B. Removal: When specified in the contract documents, or as directed by the Engineer, remove the wattle upon completion of the project, and after final stabilization is achieved; or as indicated in the SWPPP, if applicable.

3.09 WATTLES (Continued)

1. Completely remove the wattle netting, filler material, and stakes.

2. Spread the accumulated sediment to match finished grade and to ensure proper drainage.

3. When allowed by the Engineer, the wattle netting may be sliced open and the filler material spread out over the ground. Removal of netting and stakes and spreading of sediment is still required.

C. Replacement:

1. When accumulated sediment reaches a level one-half the height of the wattle, or when the wattle becomes clogged with sediment and no longer allows runoff to flow through, remove the wattle as described above, and replace according to the installation instructions above.

2. At the Engineer's option, the existing wattle and accumulated sediment may be left in place, and a new wattle installed up-slope from the existing wattle.

3.10 CHECK DAMS (Figure 9040.106)

A. Synthetic Permeable Check Dam (HDPE):

1. Install according to the manufacturer's recommendations.

2. When specified, provide an RECP under the check dam, installed according to the manufacturer's recommendations.

B. Triangular Foam Check Dam: Install according to the manufacturer's recommendations.

C. Rock Check Dam: Construct according to Figure 9040.107.

D. Removal: When specified in the contract documents, or as directed by the Engineer, remove check dams upon completion of the project, and after final stabilization is achieved; or as indicated in the SWPPP, if applicable.

1. Remove the check dam and dispose of materials, or salvage to the contractor.

2. Remove the accumulated sediment or spread to match finished grade; ensure proper drainage.

3. Stabilize the area disturbed by removal operations.

3.11 TEMPORARY EARTH DIVERSION STRUCTURES (Figure 9040.108)

A. Ensure positive drainage along the diversion toward the outlet area.

B. Adequately compact fill to prevent failures or seepage.

C. Outlet the diversion to undisturbed and/or stabilized areas only.

D. Stabilize the surface of the earth diversion with temporary erosion control seeding, as specified in Section 9010.

3.12 LEVEL SPREADERS (Figure 9040.109)

A. Butt multiple timbers together, as necessary to provide the required length.

B. Ensure the spreader is installed level in all directions. Adjust as necessary during construction to maintain spreader in a level condition.

C. Excavate a depression behind the spreader to the depth specified in the contract documents. The depression may be over-excavated up to 1 foot to provide an area for sediment accumulation.

D. Grade as required to prevent flow around the ends of spreader.

E. Remove the accumulated sediment from the depression when the depth is reduced below that specified in the contract documents.

3.13 RIP RAP (Figures 9040.110 and 9040.111)

Install rip rap (revetment stone or erosion stone) as shown on Figures 9040.110 and 9040.111.

3.14 TEMPORARY PIPE SLOPE DRAINS (Figure 9040.112)

A. Place slope drain on undisturbed soil or well compacted fill.

B. Carefully compact cohesive soils around inlet ends of the drain in 6 inch lifts.

C. Discharge slope drain to a stable outlet or to a sediment retention device.

3.15 SEDIMENT BASIN OUTLET STRUCTURES (Figures 9040.113 and 9040.114)

A. Concrete Base: Construct the concrete base and anchor riser section, as shown on Figure 9040.115.

B. Dewatering Device:

1. Drill holes in the riser section. The number, diameter, and configuration will be specified in the contract documents.

2. Wrap the perforated section of the riser pipe with metal hardware cloth.

C. Anti-vortex Device: If required by the contract documents, firmly attach the cylinder to the top of the riser by welding or other means. Comply with Figure 9040.116.

3.16 ANTI-SEEP COLLAR (Figure 9040.117)

A. General: Place backfill material and compact over-excavation areas to a minimum of 95% Standard Proctor Density per Section 3010.

B. Concrete Collar:

1. Place collars a minimum of 2 feet from pipe joints.

2. Provide Class C concrete per Section 6010.

3.16 ANTI-SEEP COLLAR (Continued)

C. CMP Collar:

1. Provide collar of same gage as the pipe barrel on which it is used.
2. Paint or tag unassembled collars to identify matching pairs.
3. Furnish each collar with two 1/2 inch diameter rods with tank lugs for connecting collars to pipe.
4. Install collar with corrugations vertical.
5. Seal the tap between the two half sections and between the pipe and connecting band with a bituminous jointing compound at the time of installation.

3.17 SEDIMENT TRAPS (Figure 9040.118)

Construct the storage area to the size and elevations specified in the contract documents.

3.18 SILT FENCES (Figure 9040.119)

A. Installation:

1. Install material along the contour of the ground, as specified in the contract documents, or as directed by the Engineer.
2. Install silt fence with a mechanical soil slicing machine that creates a slit in the ground while simultaneously installing the fabric. The trenching method may be used when situations will not allow soil slicing, as determined by the Engineer.
3. Construct a “J-hook” at each end of a continuous run of silt fence, by turning the end of the silt fence uphill, as necessary to prevent runoff from flowing around ends when water behind the fence ponds to a level even with the top of the fence.
4. Insert 12 inches of fabric to a minimum depth of 6 inches (fabric may be folded below the ground line).
5. Compact installation by driving along each side of the silt fence, or by other means, as necessary to adequately secure the fabric in the ground, to prevent pullout and water flow under the fence.
6. Drive steel posts into the ground alongside the silt fence, to a minimum depth of 20 inches, unless otherwise specified by the Engineer. Space posts as shown on Figure 9040.119 or as required to adequately support silt fence.

B. Maintenance: Repair or replace non-functioning silt fence that allows water to flow under the fence, is torn, or is otherwise damaged, due to inadequate installation, at no additional cost to the Contracting Authority.

C. Removal:

1. Remove the silt fence upon final stabilization of the project area, or according to the staging indicated in the SWPPP.
2. Remove and dispose of silt fence and posts.
3. Remove sediment or spread to match finished grade; ensure proper drainage.
4. Stabilize the area disturbed by removal operations.

3.18 SILT FENCES (Continued)

D. Replacement:

1. When accumulated sediment reaches a level one-half the height of the fence, remove the silt fence as described above, and replace according to the installation instructions above.

2. At the Engineer's option, the existing silt fence and accumulated sediment may be left in place, and a new silt fence installed up-slope from the existing silt fence.

3. When allowed by the Engineer, the existing silt fence may be left in place and the accumulated sediment removed to the original ground line and within 6 inches of the silt fence. Carefully inspect the existing silt fence for structural integrity and signs of undermining. Make any necessary repairs.

3.19 STABILIZED CONSTRUCTION ENTRANCE (Figure 9040.120)

A. Install a stabilized construction entrance at all locations where construction traffic leaving the site presents the potential for sediment track-out.

B. Remove vegetation and excavate soft soils from entrance area. Thoroughly compact subgrade prior to placing stone.

C. Install culvert under entrance if necessary to maintain drainage.

D. Grade entrance to prevent runoff from flowing onto street. Direct all runoff from entrance to a sediment retention device.

E. When specified, install subgrade stabilization fabric prior to placing crushed stone.

F. Install layer of crushed stone to the thickness (6 inches minimum) and dimensions specified in the contract documents.

G. Remove the accumulated sediment and install new stone, as required to prevent track-out.

3.20 DUST CONTROL

A. Water: Apply frequent light watering to ground surface, as required to control dust.

B. Calcium Chloride: Apply according to Iowa DOT Section 2314.

C. Lignosulfonate (Tree Sap):

1. Loosen the top 1 to 2 inches of the roadway surface.

2. Apply solution with a 50% residual concentration, at a rate of 0.50 gal/yd^2, to deliver a 25% residual. For diluted solutions, increase the application rate, as required, to deliver an equivalent 25% residual.

3. Allow product to penetrate through the loosened material.

4. Tight-blade road surface.

D. Soapstock (Soybean Oil):

1. Loosen the top 1 to 2 inches of the roadway surface.

2. Apply undiluted soapstock at a rate of 0.70 gal/yd^2.

3.20 DUST CONTROL (Continued)

3. Allow product to penetrate through the loosened material.

4. Tight-blade road surface.

3.21 EROSION CONTROL MULCHING

A. Conventional Mulching:

1. Use conventional mulching when the surface cannot be stabilized by seeding, due to season or ground conditions.

2. Uniformly distribute mulch over the required areas, at a rate of 2 tons/acre for dry cereal straw, or 2.5 tons/acre for prairie hay.

3. Work the mulch into the soil with a mulch tucker, designed to anchor the mulch into the soil, by means of dull blades or disks.

B. Hydromulching:

1. Place mulch and tackifier (if applicable) in equipment specifically manufactured for hydraulic mulching.

2. Mix materials with fresh, potable water using a combination of re-circulation through the equipment's pump and mechanical agitation to form a homogeneous slurry.

3. If necessary, dampen any dry, dusty soil as required to prevent balling of the material during application.

4. Apply hydromulch in multiple layers from opposing directions, where possible.

5. Apply the slurry evenly over all specified areas, at the minimum component material rates specified:
   a. Wood Cellulose Mulch:
      1) Mulch: Minimum 3,000 lb/acre dry weight.
      2) Tackifier: Minimum 50 lb/acre.
   b. Bonded Fiber Matrix: Minimum 3,000 lb/acre dry weight.
   c. Mechanically Bonded Fiber Matrix: Minimum 3,000 lb/acre dry weight.

6. Retain and count empty bags of mulch to ensure final application rate.

3.22 TURF REINFORCEMENT MATS

Install according to the manufacturer's published installation literature for the product specified and application (slope or channel).

3.23 SURFACE ROUGHENING

A. Directional Tracking:

1. Do not use on slopes steeper than 3:1.

2. Operate tracked equipment up and down exposed slope to create ridges perpendicular to the slope.

3. Continue operation until the entire surface has been tracked.

3.23 SURFACE ROUGHENING (Continued)

B. Grooving/Furrowing:

1. May be used on all slopes.

2. Use rippers, disks, harrows, chisel plows, or other equipment capable of operating on the slope and creating grooves a maximum of 15 inches apart and 3 inches deep.

3. Operate equipment along the contour of the slope to create grooves that are perpendicular to the slope.

4. Perform over all exposed slopes as specified.

3.24 INLET PROTECTION

A. Install inlet protection devices according to the manufacturer's recommendations.

B. Remove the accumulated sediment, as required to maintain the inlet protection device in working order. Remove any accumulated sediment from streets open to traffic if it encroaches into the traveled roadway.

3.25 FLOW TRANSITION MATS

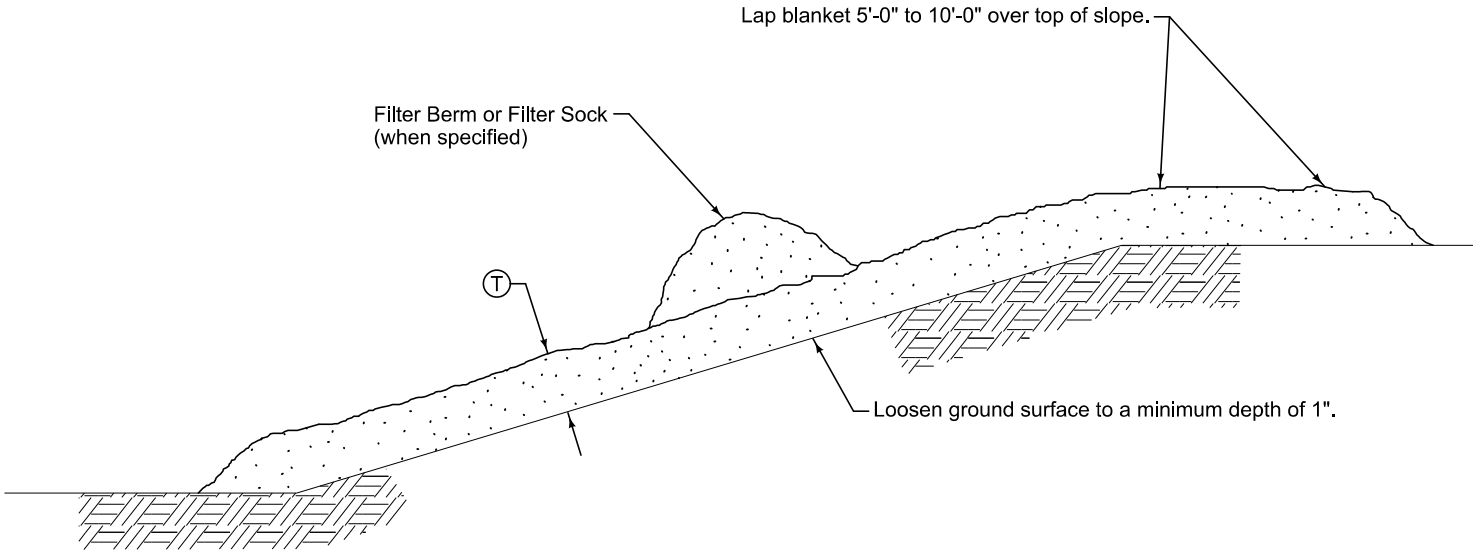
Install according to the manufacturer's published recommendations.

3.26 TEMPORARY EROSION CONTROL SEEDING

Comply with Section 9010.

END OF SECTION

Compost blanket may be vegetated or unvegetated as specified in the contract documents.



COMPOST BLANKET DETAIL

MINIMUM COMPOST BLANKET THICKNESS

SLOPE	BLANKET THICKNESS Ⓣ
3:1	3"
≤ 4:1	2"

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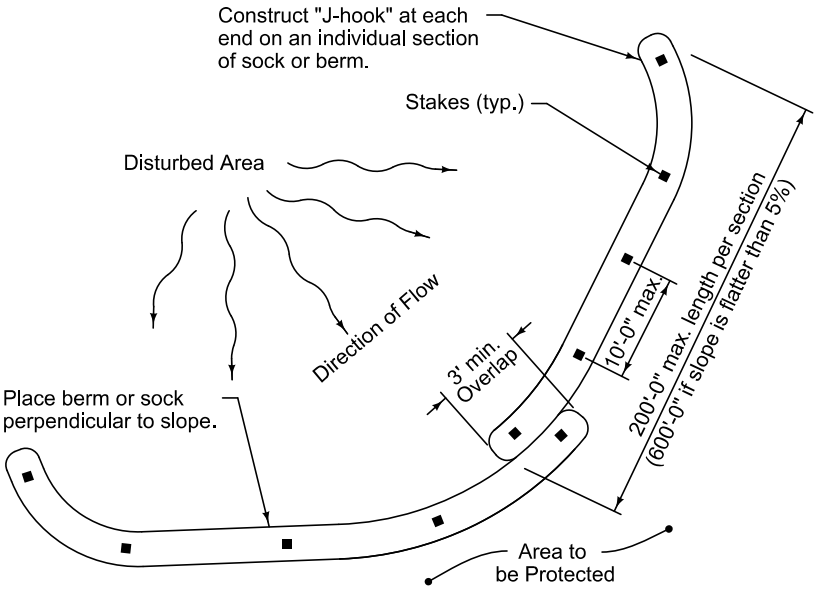
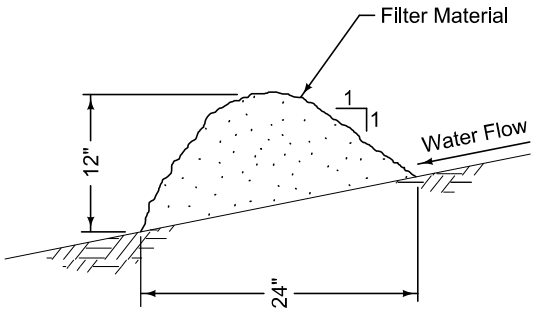
COMPOST BLANKET

FIGURE 9040.101

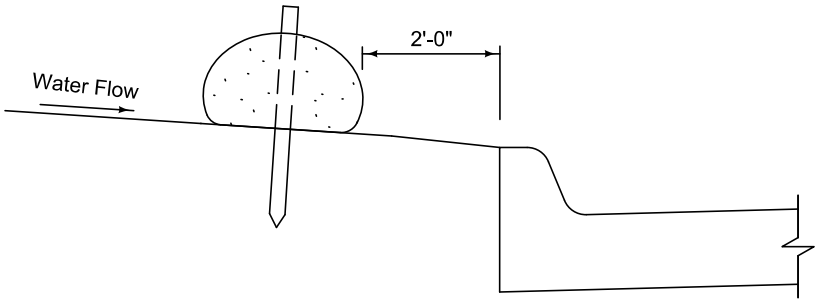
SHEET 1 OF 1



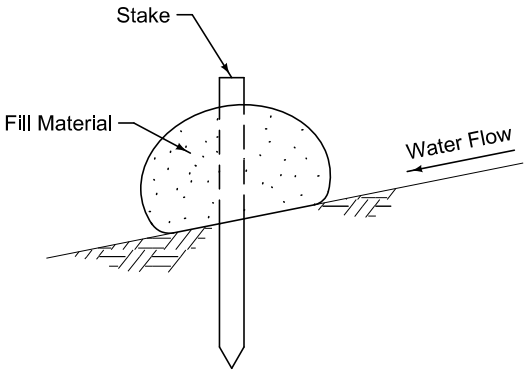
PLAN VIEW OF SLOPE
(for sediment and slope control)



FILTER BERM



SECTION VIEW AT STREET
(for perimeter control along street)



FILTER SOCK

Berm shown is typical for slopes flatter than 3:1. For steeper slopes, increase berm size as directed by the Engineer.

Place berm in uncompacted windrow perpendicular to the slope at locations specified in the contract documents.

Filter sock diameter as specified in the contract documents.

TYPICAL PLACEMENT OF BERM OR SOCK

FIGURE 9040.102

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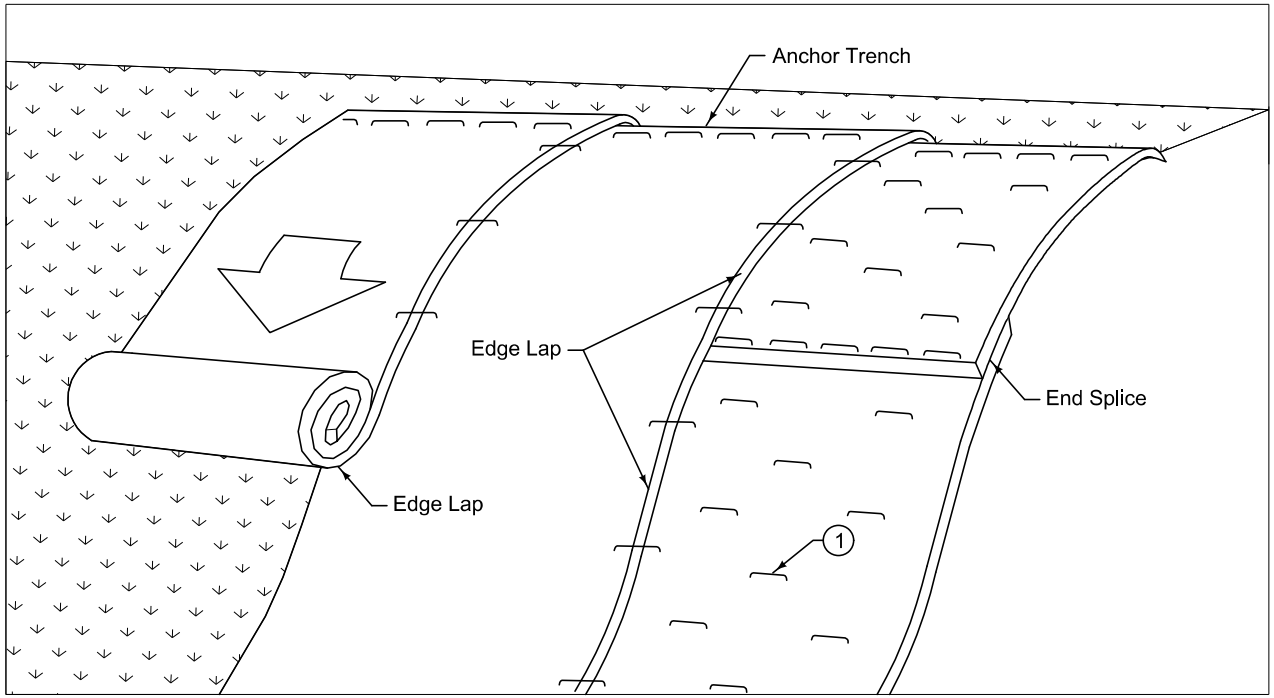
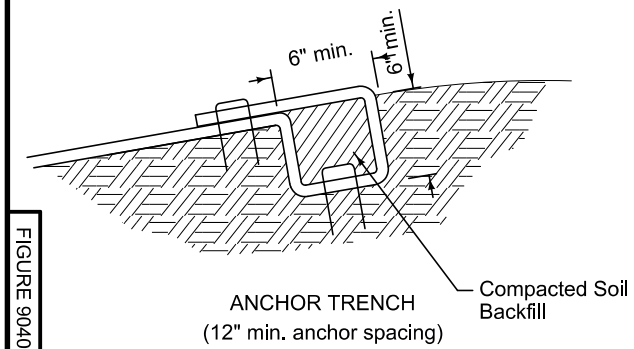
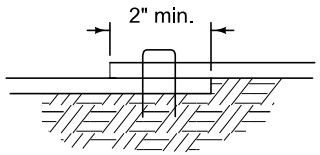
FILTER BERM AND FILTER SOCK



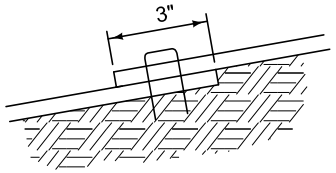
1. Secure blanket to ground according to manufacturer's recommended anchoring pattern and minimum shown in Table 1.



ANCHOR TRENCH
(12" min. anchor spacing)



EDGE LAP
(4'-0" min. anchor spacing)



END SPLICE
(18" min. anchor spacing)

TABLE 1

Max. slope	Min. anchors
≤ 3:1	1.5/yd²
2:1	2/yd²
1:1	2.5/yd²

FIGURE 9040.103

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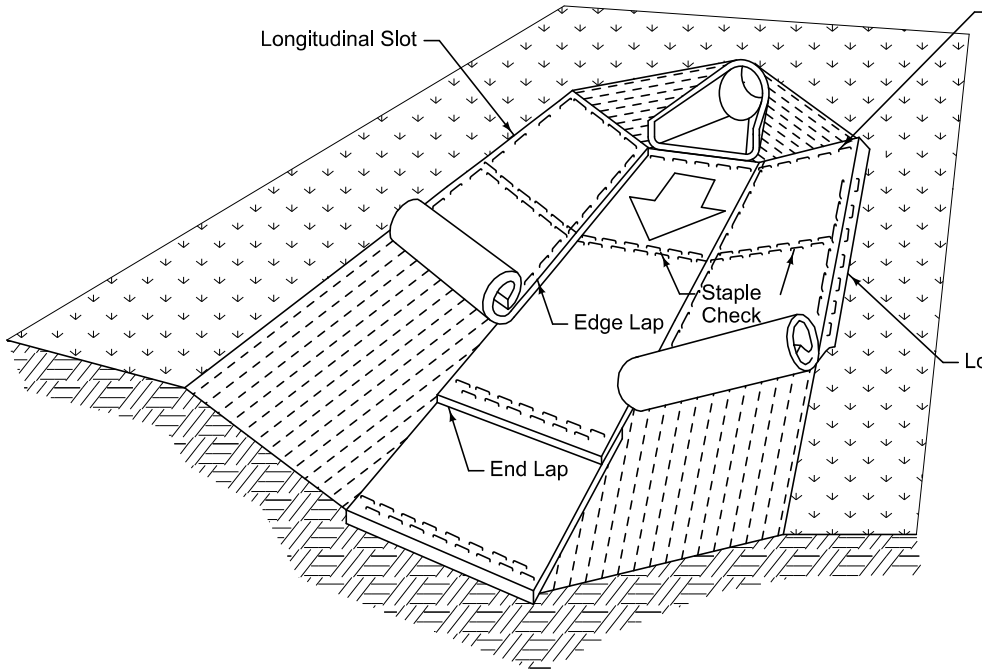
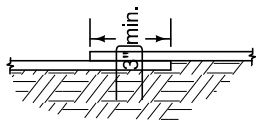
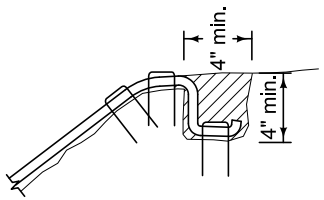
ROLLED EROSION CONTROL PRODUCT (RECP) INSTALLATION ON SLOPES

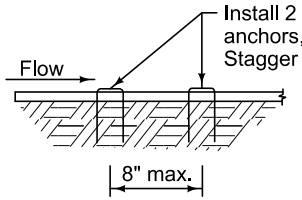




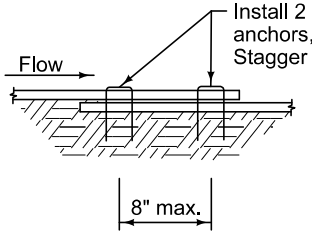
EDGE LAP
(4'-0" max. anchor spacing)



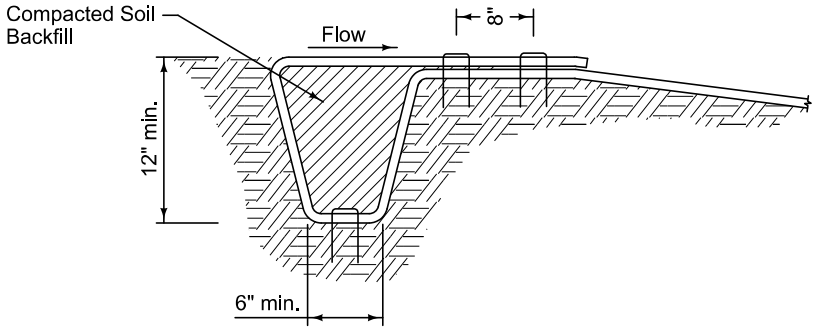
LONGITUDINAL SLOT
(3'-0" max. anchor spacing)



STAPLE CHECK



END LAP



ANCHOR SLOT
(1'-0" max. anchor spacing)

FIGURE 9040.104

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SUDAS Standard Specifications

ROLLED EROSION CONTROL PRODUCT (RECP) INSTALLATION IN CHANNEL

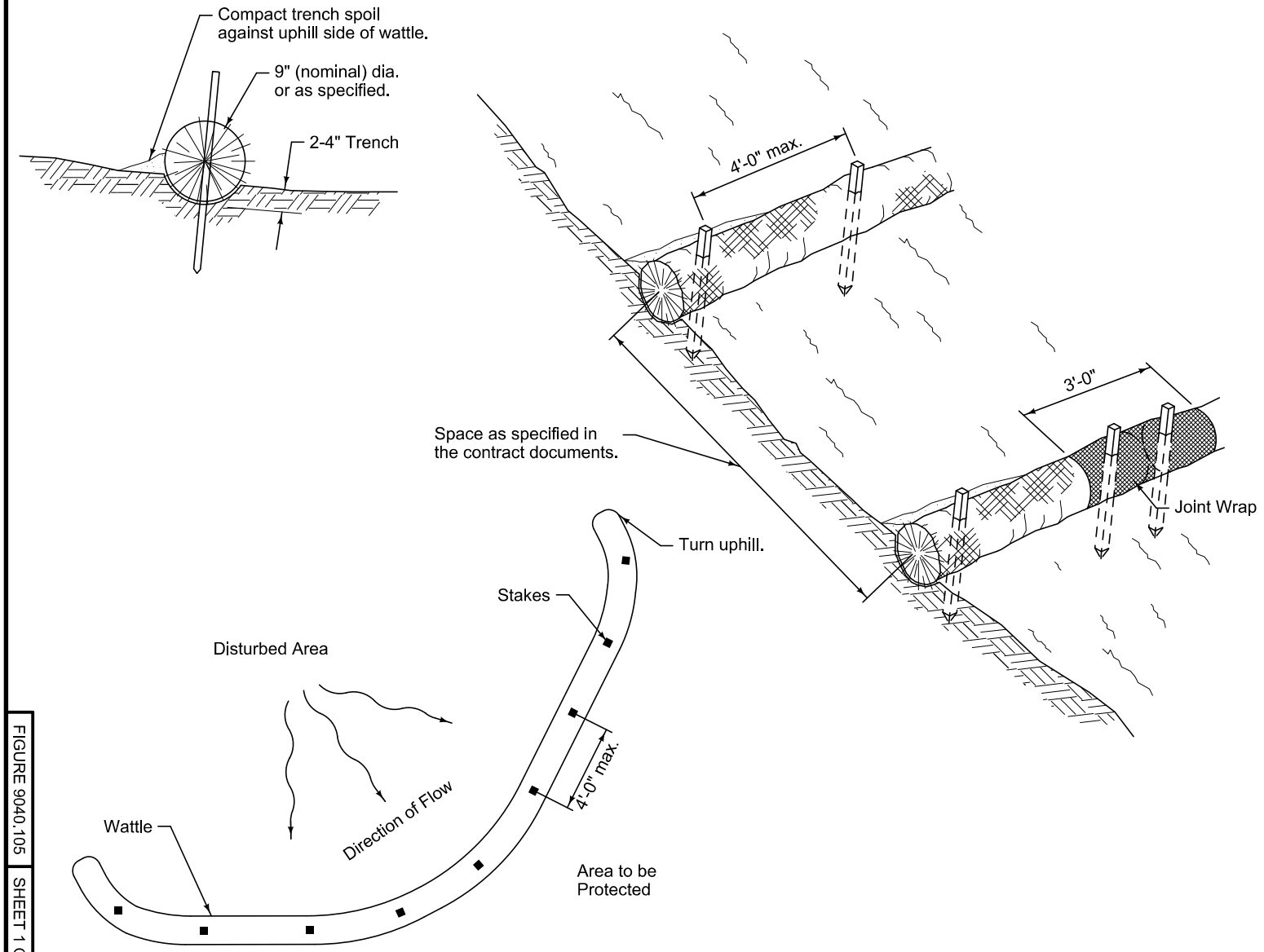

FIGURE 9040.105

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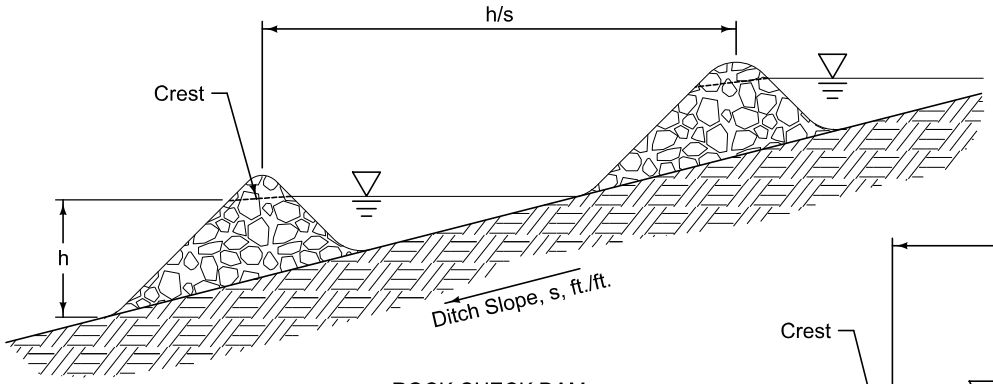
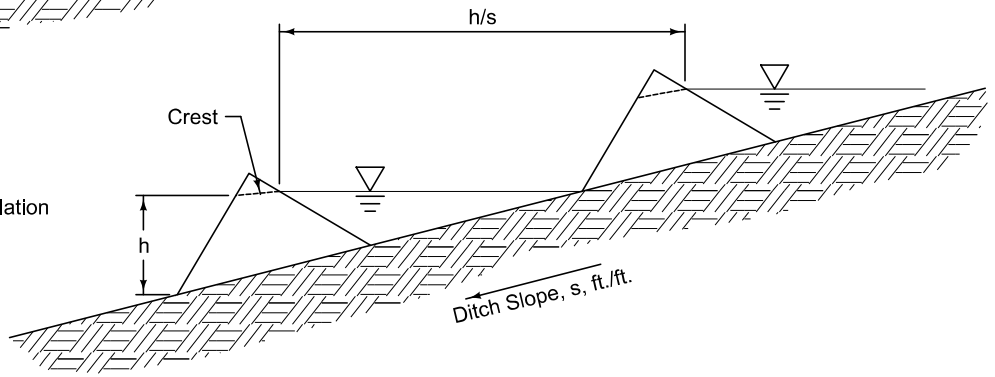
SUDAS Standard Specifications

WATTLE



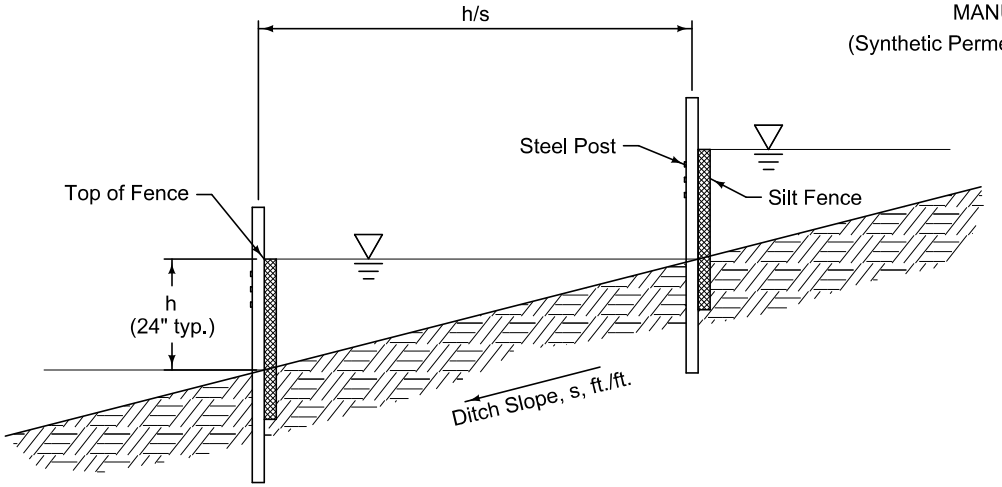
ROCK CHECK DAM

(See Figure 9040.107 for installation of Rock Check Dams.)



MANUFACTURED CHECK DAM

(Synthetic Permeable and Triangular Foam Check Dam)



SILT FENCE CHECK DAM (DITCH CHECK)

(See Figure 9040.119 for installation of Silt Fence Ditch Checks.)

FIGURE 9040.106

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SUDAS

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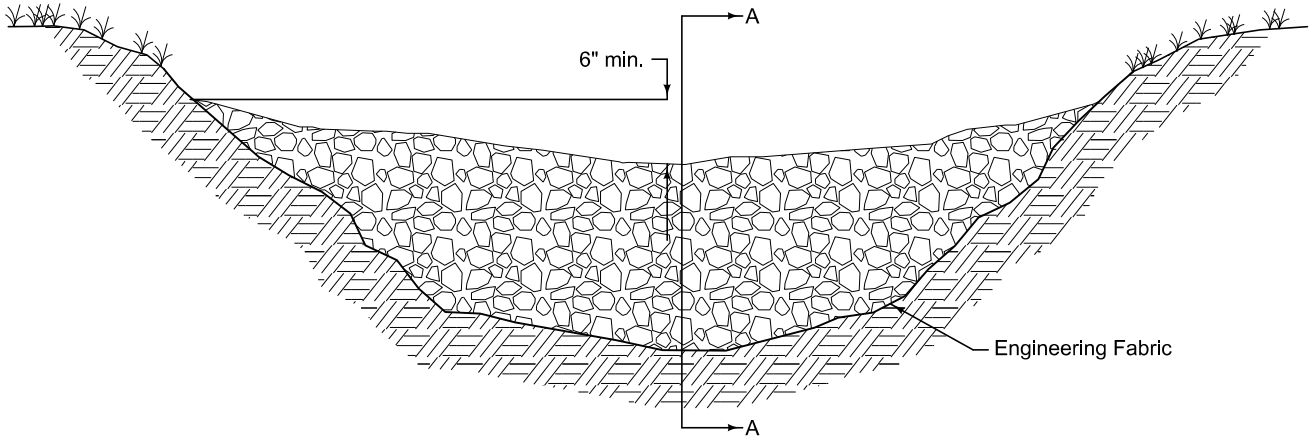
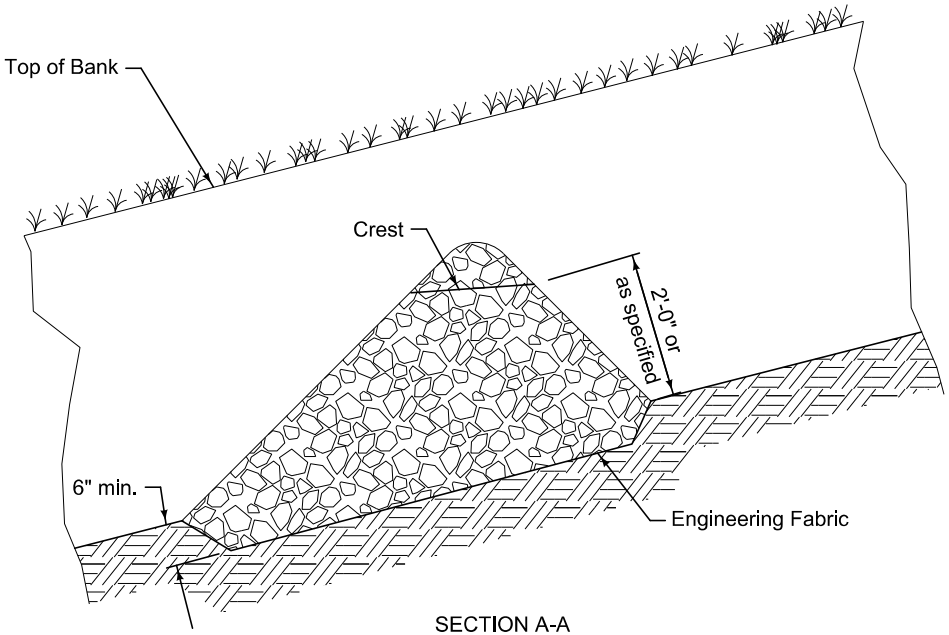
SUDAS Standard Specifications

CHECK DAM SPACING



DITCH CROSS-SECTION



SECTION A-A

FIGURE 9040.107

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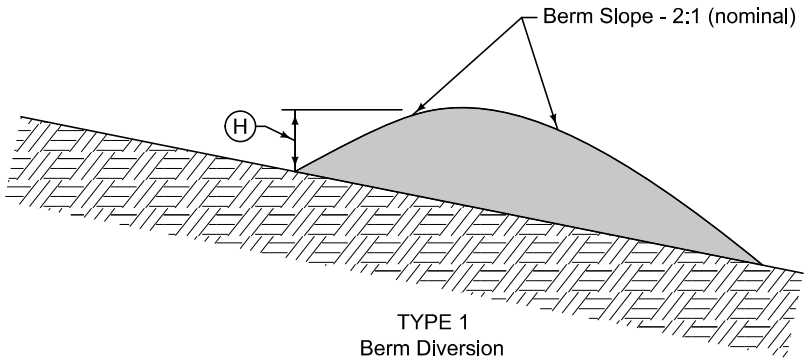
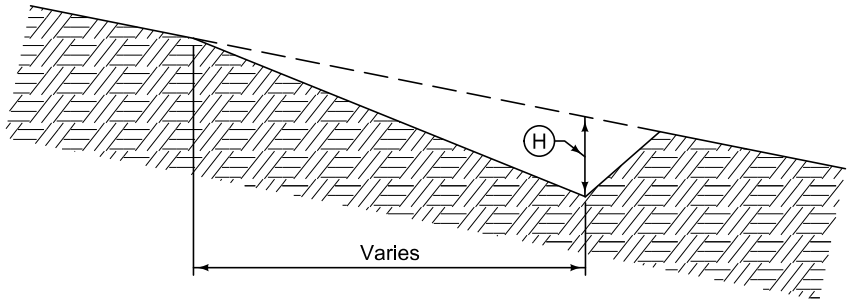
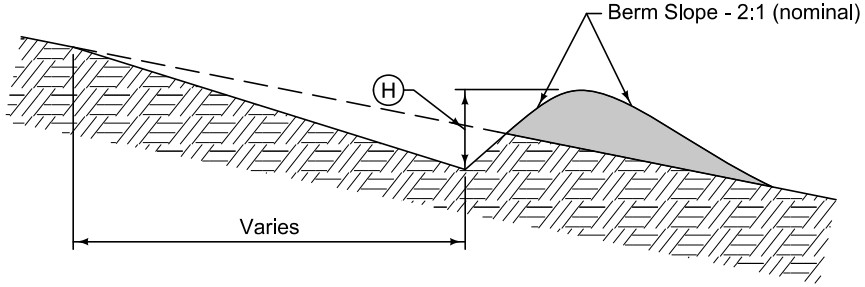
ROCK CHECK DAM



TYPE 1
Berm Diversion



TYPE 2
'V' Ditch Diversion



TYPE 3
Ditch/Berm Diversion

Diversion Types 1, 2, and 3 may be used interchangably unless otherwise specified in the contract documents.

Alternate configurations may be used upon approval from the Engineer.

(H) Total height of diversion (swale and berm): 18 inch minimum or as specified.

FIGURE 9040.108

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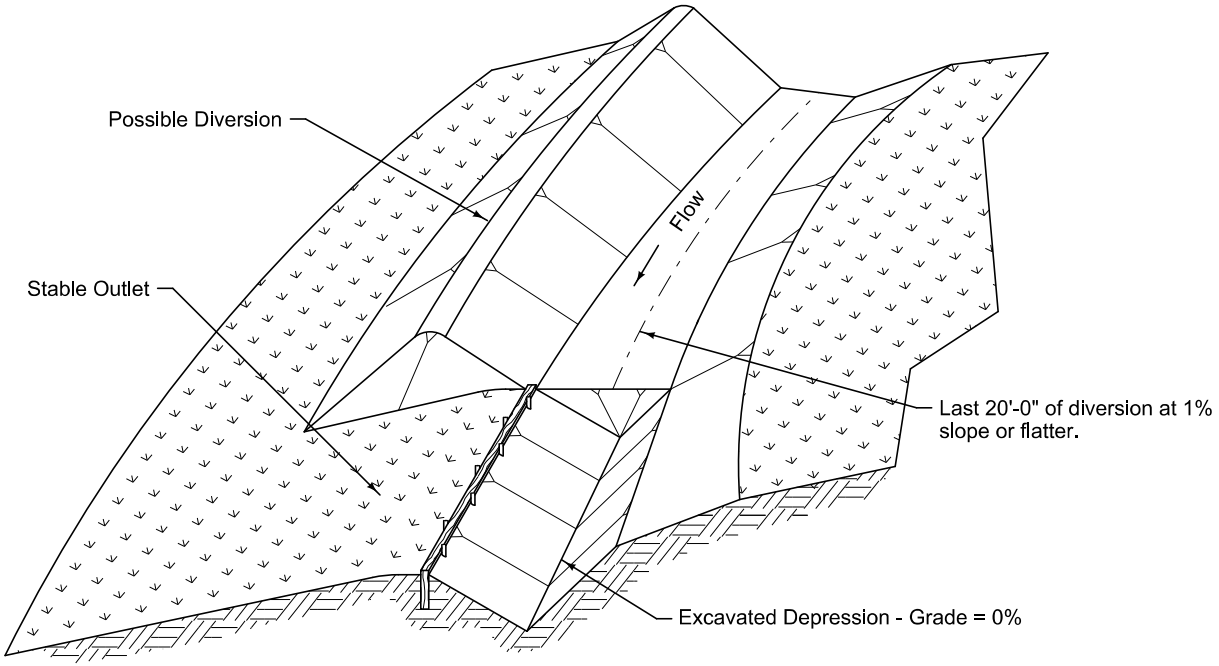
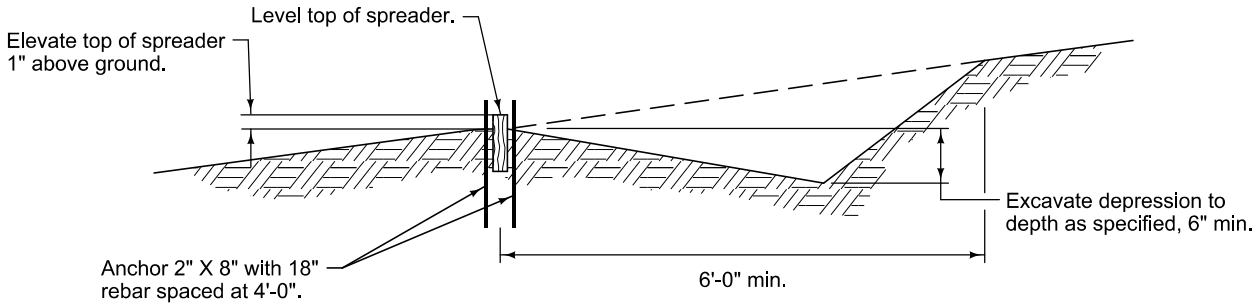
TEMPORARY EARTH
DIVERSION STRUCTURES



PERSPECTIVE VIEW



CROSS-SECTION

FIGURE 9040.109

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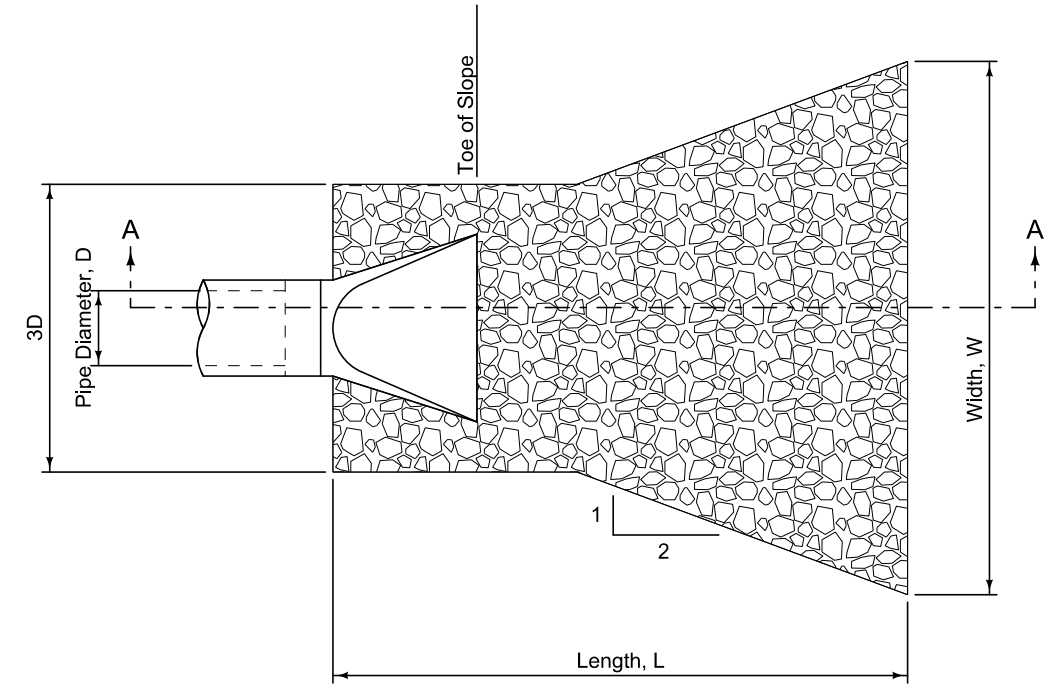
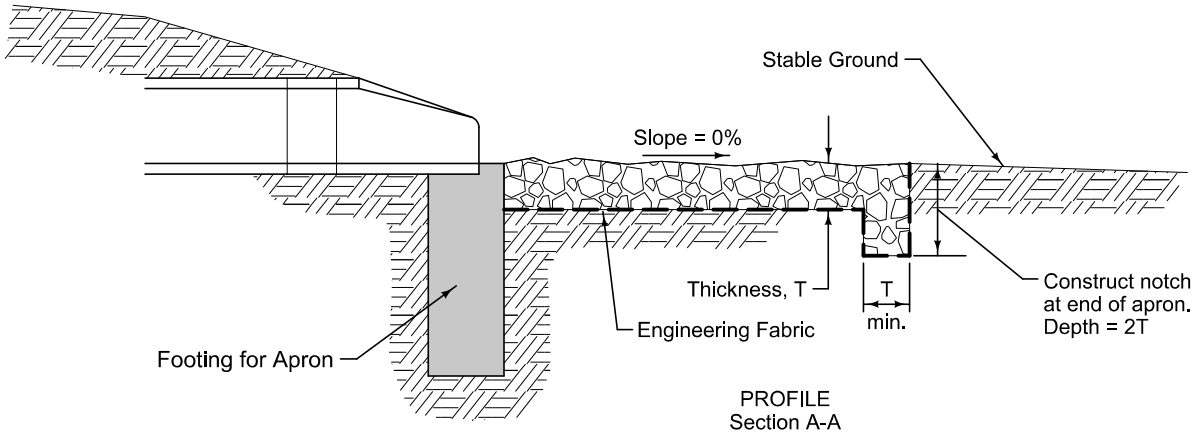
LEVEL SPREADER



PLAN



PROFILE
Section A-A

FIGURE 9040.110 | SHEET 1 OF 1

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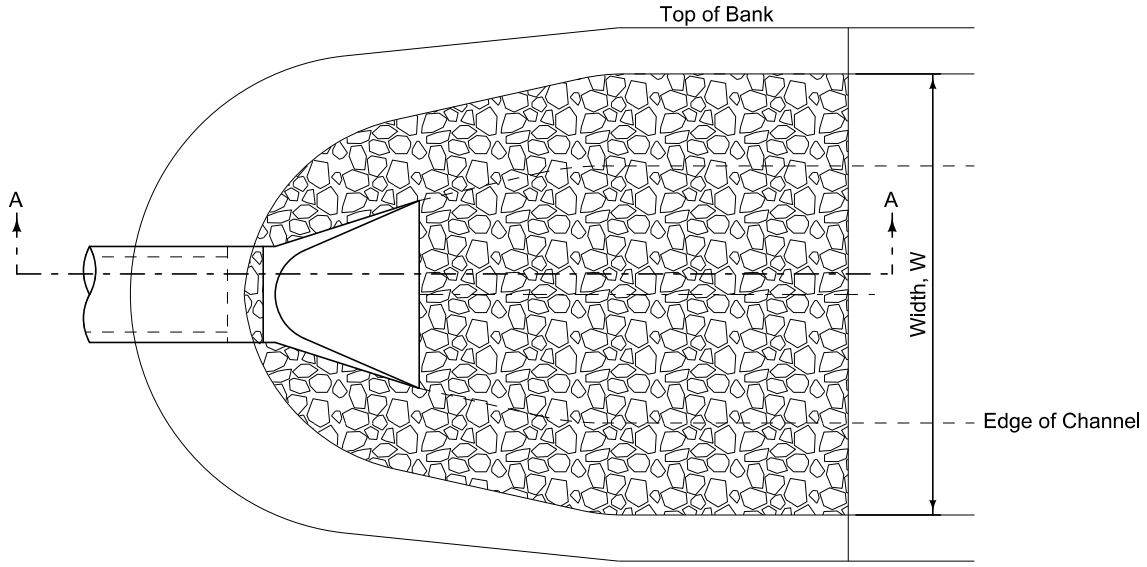
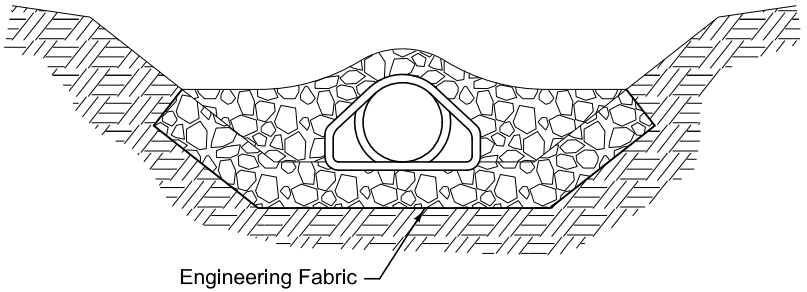
SUDAS Standard Specifications

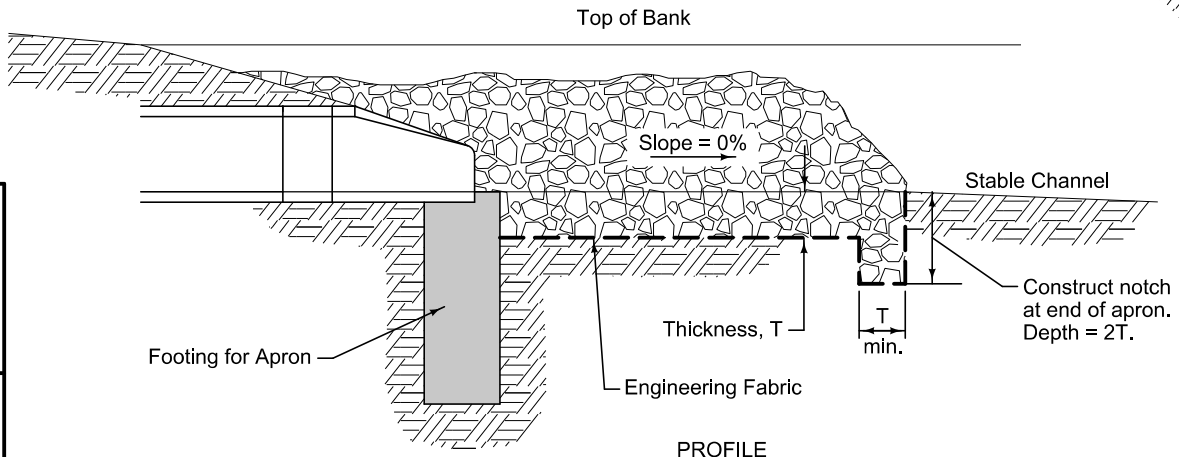
RIP RAP FOR PIPE OUTLET
ONTO FLAT GROUND



PLAN



CROSS-SECTION



PROFILE
Section A-A

FIGURE 9040.111 | SHEET 1 OF 1

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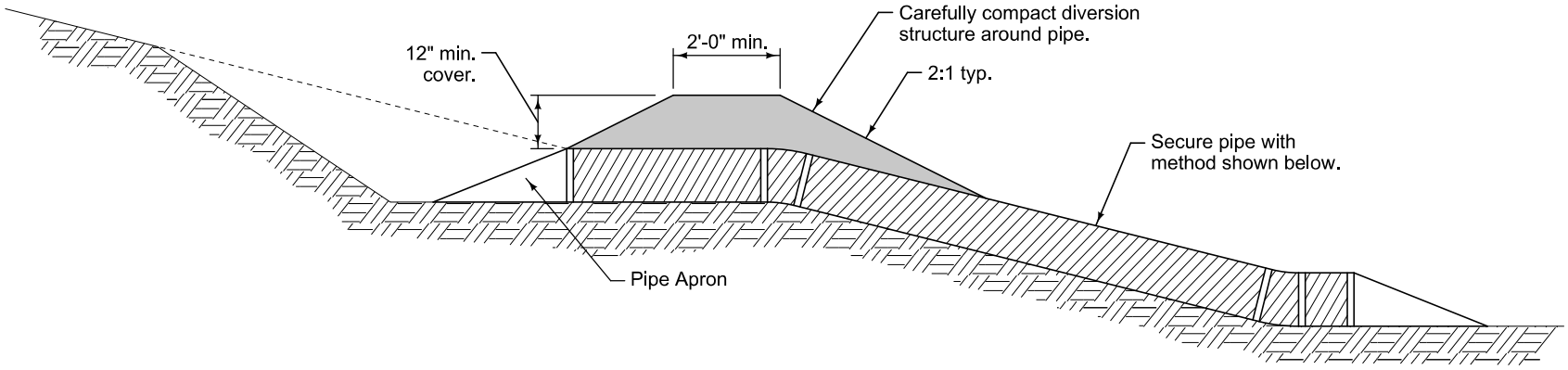
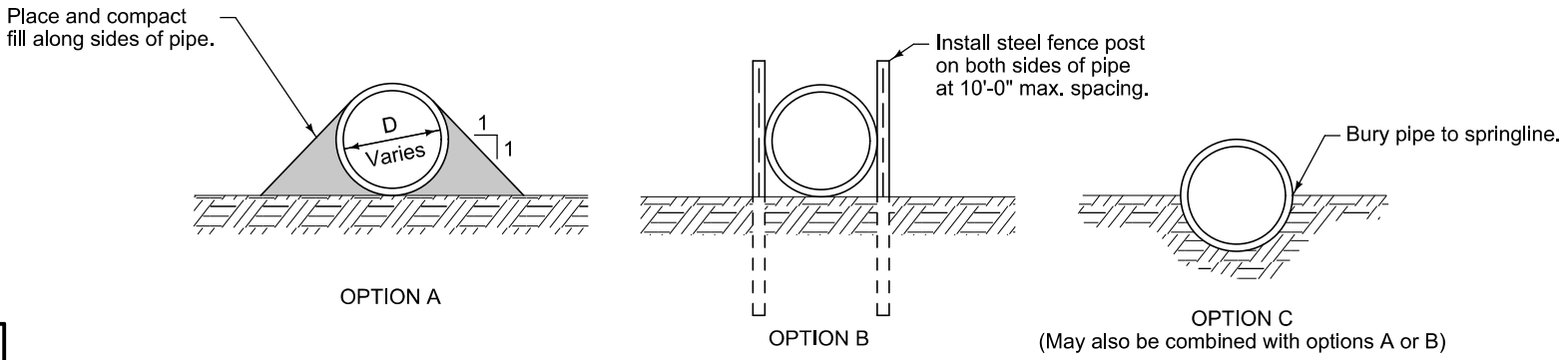
SUDAS Standard Specifications

RIP RAP APRON FOR PIPE
OUTLET INTO CHANNEL





OPTION A

OPTION B

OPTION C
(May also be combined with options A or B)

SLOPE DRAIN ANCHORING OPTIONS
(Options A, B, and C are interchangable unless otherwise specified in the contract documents)

FIGURE 9040.112

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TEMPORARY PIPE SLOPE DRAIN

1. Barrel length and diameter as specified in the contract documents.
2. Riser pipe and base/dewatering device: See Figure 9040.115.
3. Anti-vortex device: See Figure 9040.116.

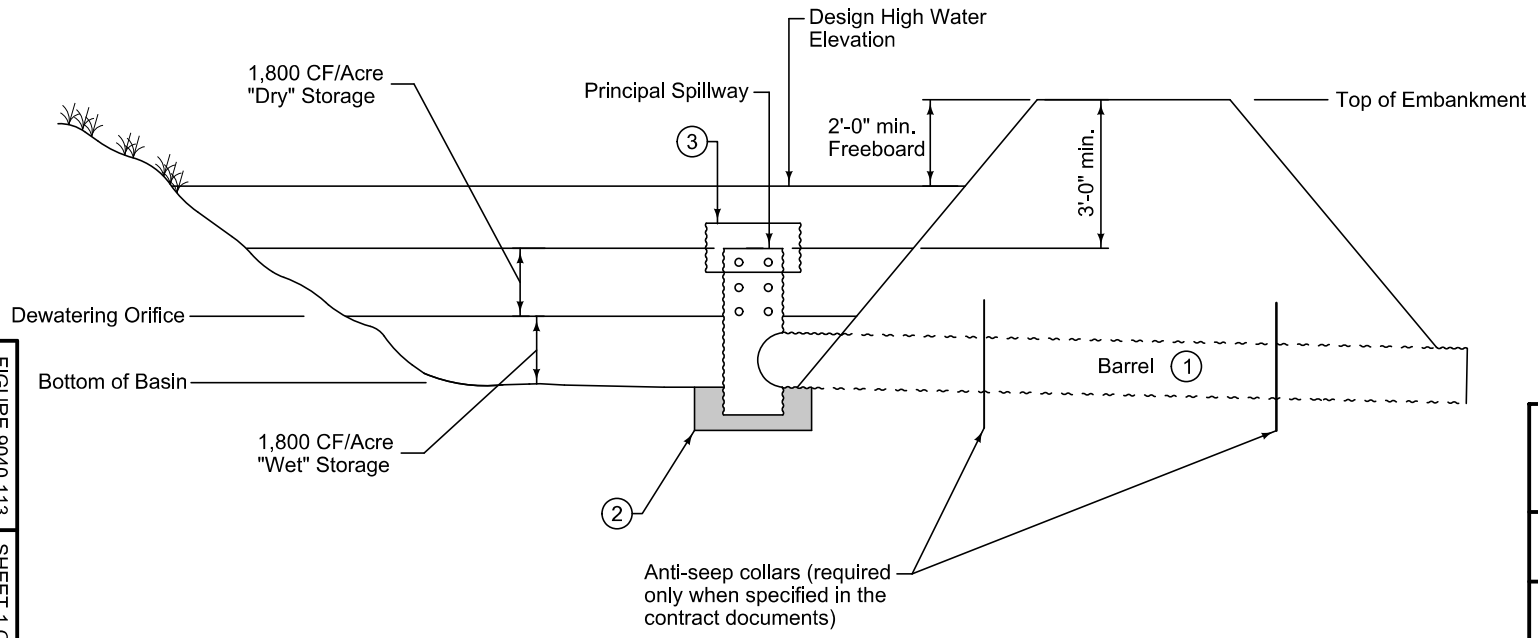

FIGURE 9040.113

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SUDAS Standard Specifications

SEDIMENT BASIN WITHOUT EMERGENCY SPILLWAY

1. Barrel length and diameter as specified in the contract documents.
2. Riser pipe and base/dewatering device: See Figure 9040.115.
3. Anti-vortex device: See Figure 9040.116.

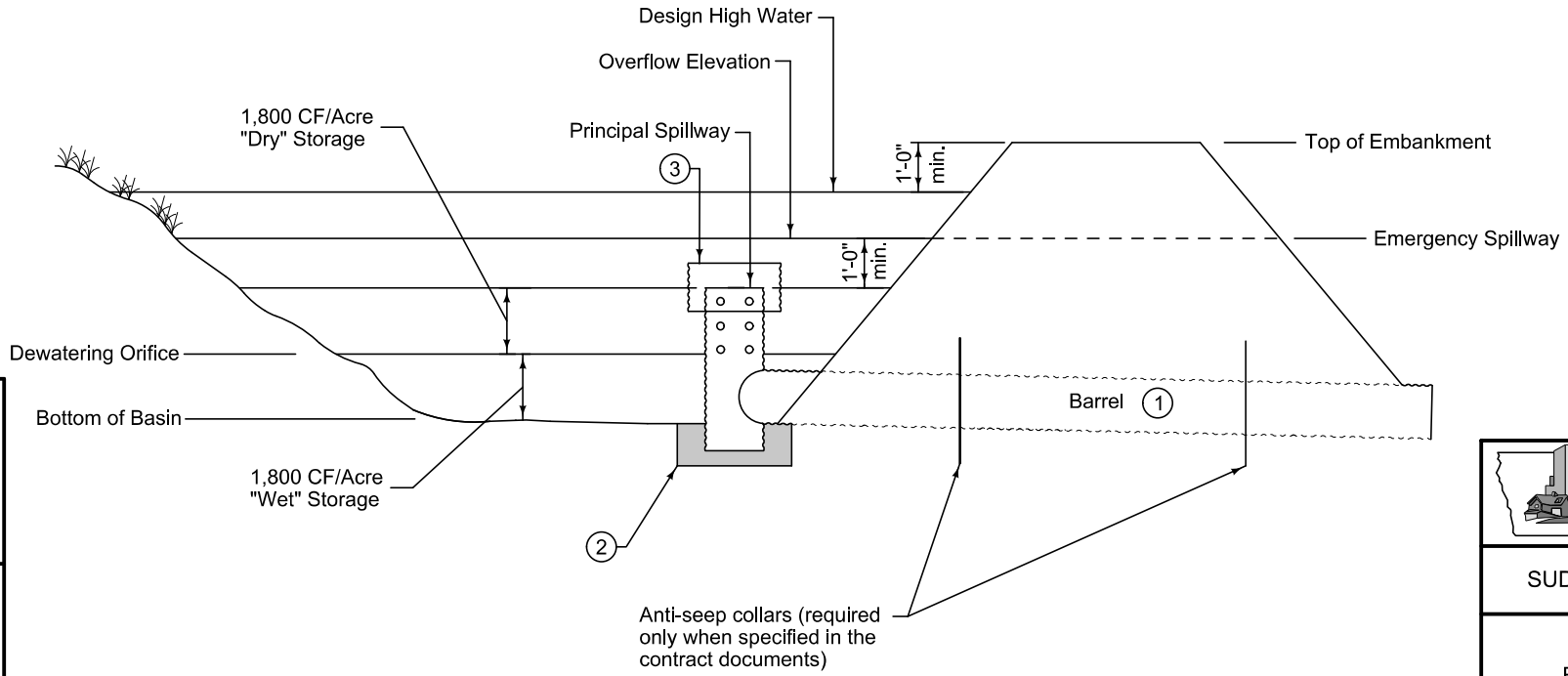

FIGURE 9040.114

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SUDAS Standard Specifications

SEDIMENT BASIN WITH EMERGENCY SPILLWAY

Elevations and dimensions not given are as specified in the contract documents.

(1) Drill four, 5/8 inch diameter holes, 3 inches from bottom of riser pipe and insert two, #4 bars in an "X" configuration.
Length of bars = D+16 inches

(2) Provide perforation configuration as specified in the contract documents.

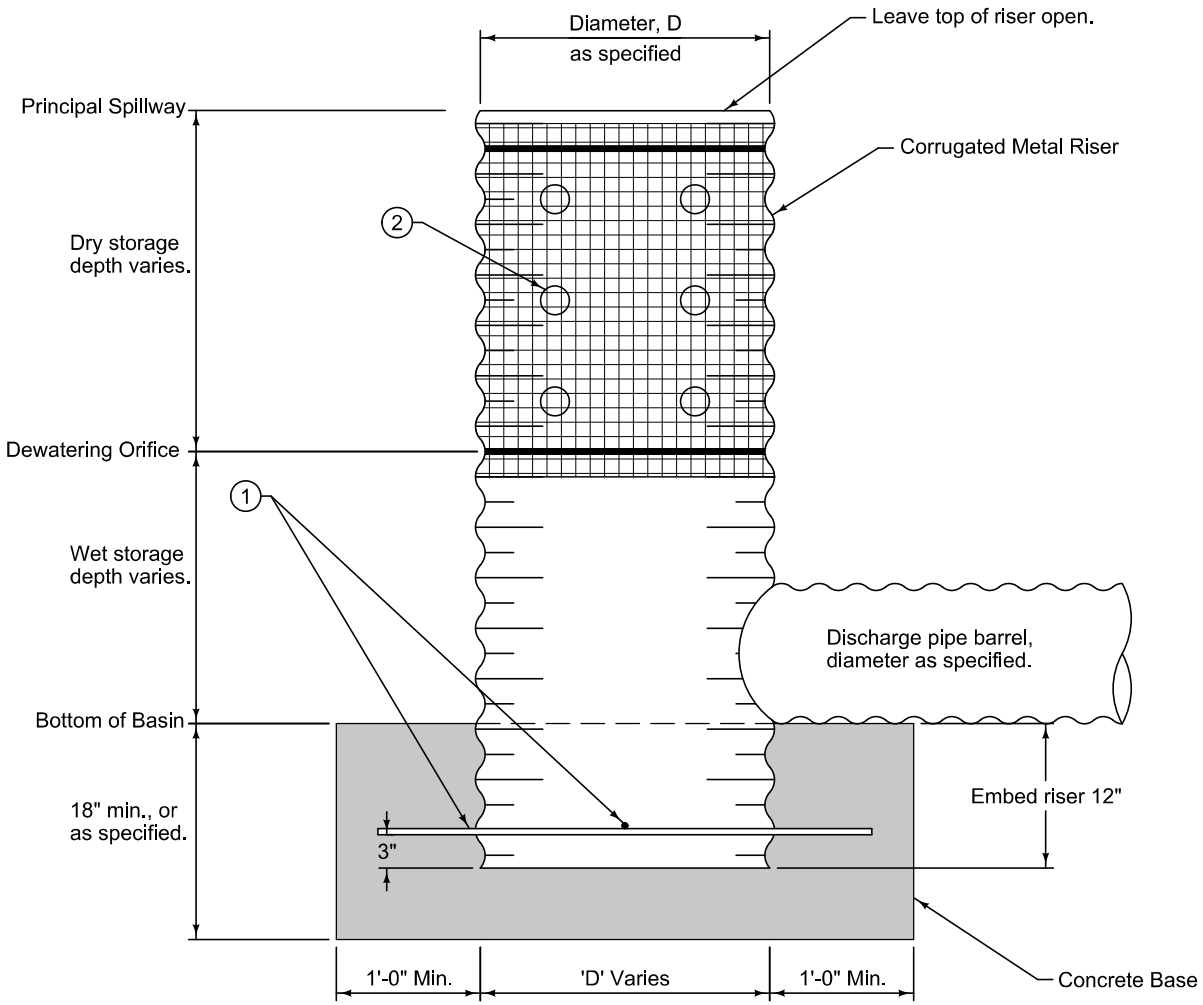

FIGURE 9040.115

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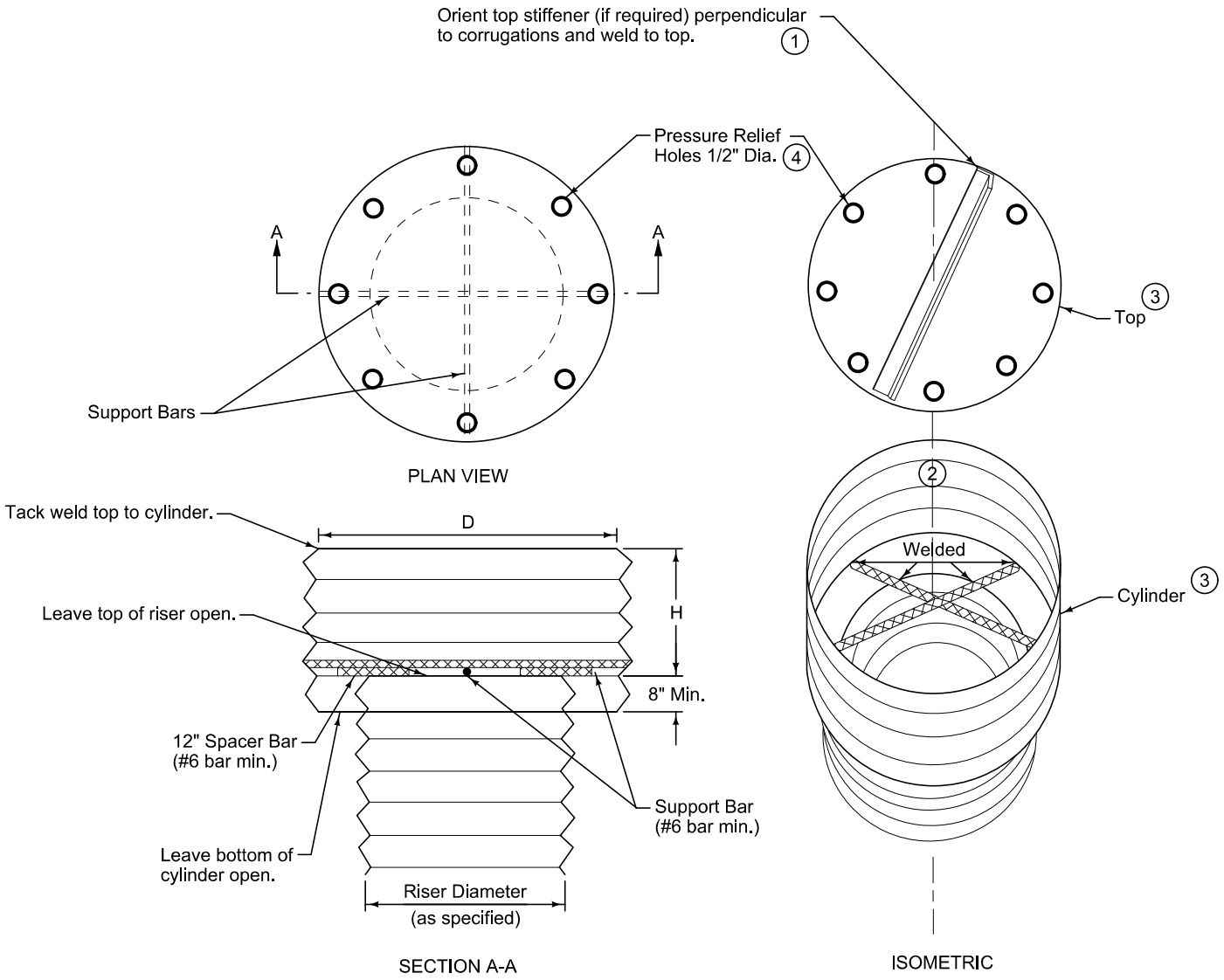
SEDIMENT BASIN
DEWATERING DEVICE
(PERFORATED RISER)



Alternate anti-vortex device configurations may be utilized upon approval of the Engineer.

1. See sheet 2 for dimensions of cylinder support bars, top plate, and top stiffener.
2. Firmly attach the anti-vortex cylinder to the top of the riser by welding or other means.
3. Corrugated metal or 1/8 inch steel plate cylinder and top.
4. Pressure relief holes may be omitted if ends of corrugations are left fully open when the top is attached.

FIGURE 9040.116

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ANTI-VORTEX DEVICE

RISER	CYLINDER				MINIMUM TOP	
Diameter (in.)	Diameter (in.)	Thickness (gage)	Height (H) (in.)	Minimum Size Support Bar	Thickness	Stiffener
12	18	16	6	#6 rebar or 1 1/2" X 3/16" angle	16 ga F & C	----
15	21	16	7	#6 rebar or 1 1/2" X 3/16" angle	16 ga F & C	----
18	27	16	8	#6 rebar or 1 1/2" X 3/16" angle	16 ga F & C	----
21	30	16	11	#6 rebar or 1 1/2" X 3/16" angle	16 ga (C), 14 ga (F)	----
24	36	16	13	#6 rebar or 1 1/2" X 3/16" angle	16 ga (C), 14 ga (F)	----
27	42	16	15	#6 rebar or 1 1/2" X 3/16" angle	16 ga (C), 14 ga (F)	----
36	54	16	17	#8 rebar	14 ga (C), 12 ga (F)	----
42	60	16	19	#8 rebar	14 ga (C), 12 ga (F)	----
48	72	16	21	1 1/4" pipe or 1 1/4" X 1 1/4" X 1/4" angle	14 ga (C), 10 ga (F)	----
54	78	16	25	1 1/4" pipe or 1 1/4" X 1 1/4" X 1/4" angle	14 ga (C), 10 ga (F)	----
60	90	14	29	1 1/2" pipe or 1 1/2" X 1 1/2" X 1/4" angle	12 ga (C), 8 ga (F)	----
66	96	14	33	2" pipe or 2" X 2" X 1/4" angle	12 ga (C), 8 ga (F)	2" X 2" X 1/4" angle
72	102	14	36	2" pipe or 2" X 2" X 1/4" angle	12 ga (C), 8 ga (F)	2 1/2" X 2 1/2" X 1/4" angle
78	114	14	39	2 1/2" pipe or 2" X 2" X 1/4" angle	12 ga (C), 8 ga (F)	2 1/2" X 2 1/2" X 1/4" angle
84	120	12	42	2 1/2" pipe or 2" X 2" X 1/4" angle	12 ga (C), 8 ga (F)	2 1/2" X 2 1/2" X 5/16" angle

Notes:

1. The criterion for sizing the cylinder is that the area between the inside of the cylinder and the outside of the riser is equal to or greater than the area inside the riser. Therefore, the above table is invalid for use with concrete pipe risers.

2. C - Corrugated F - Flat.

FIGURE 9040.116 | SHEET 2 OF 2

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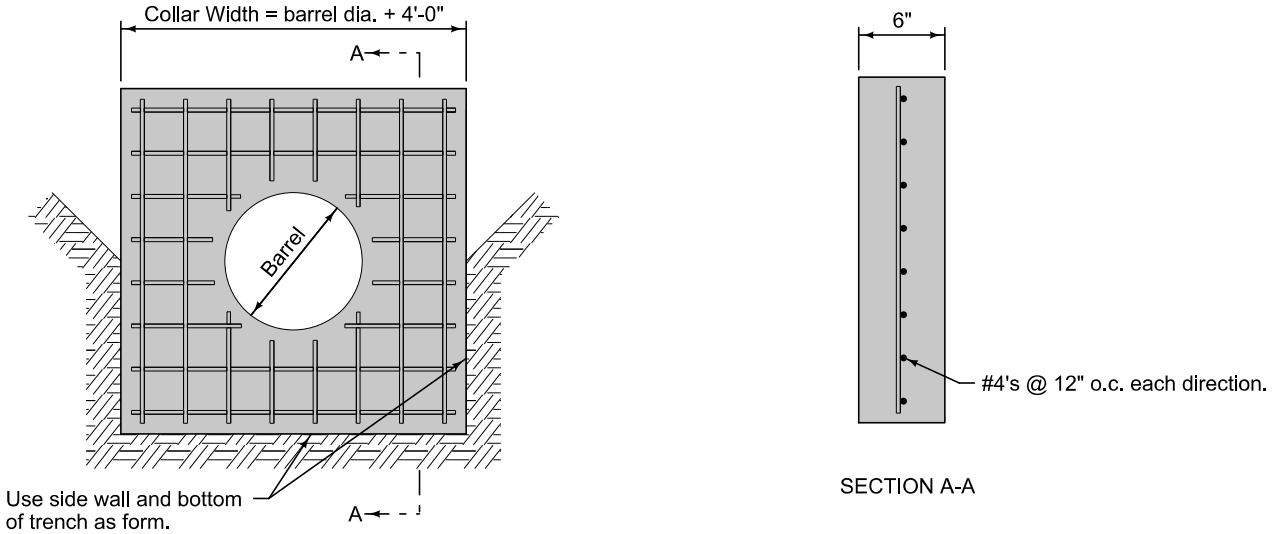
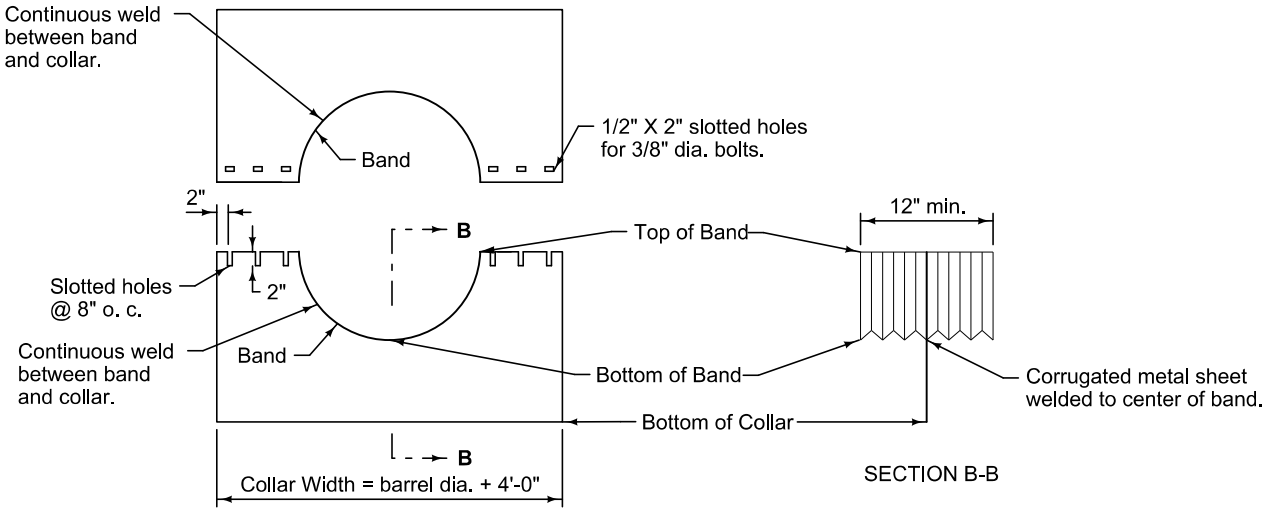
ANTI-VORTEX DEVICE

Anti-seep collars are not required unless specified in the contract documents.



CONCRETE COLLAR



CMP COLLAR

FIGURE 9040.117

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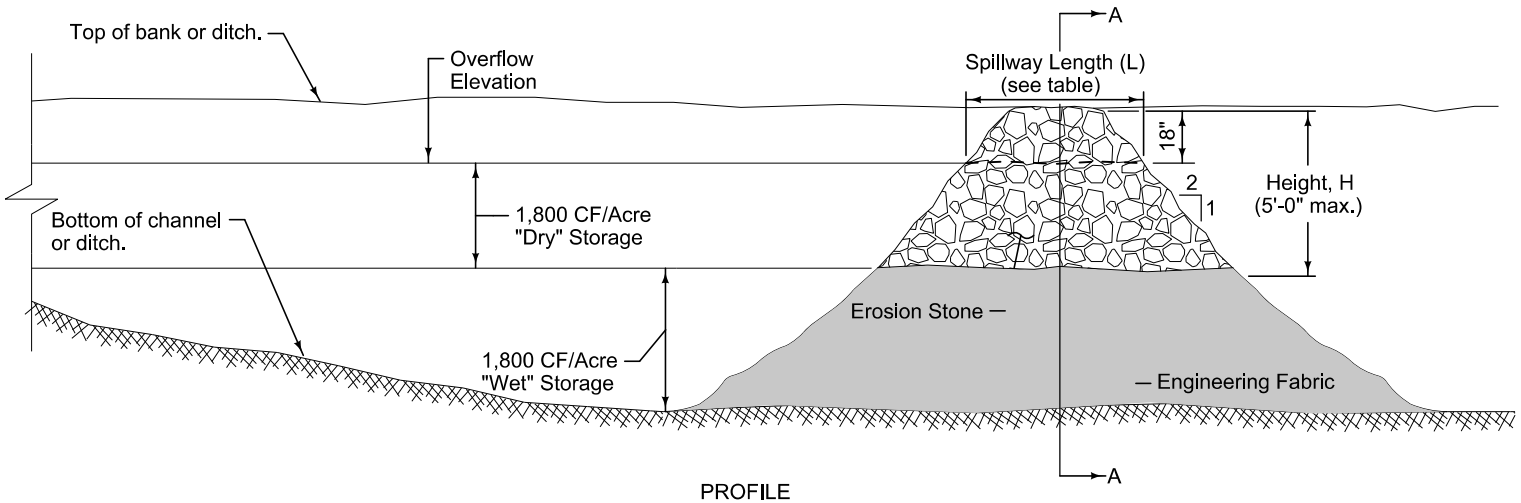
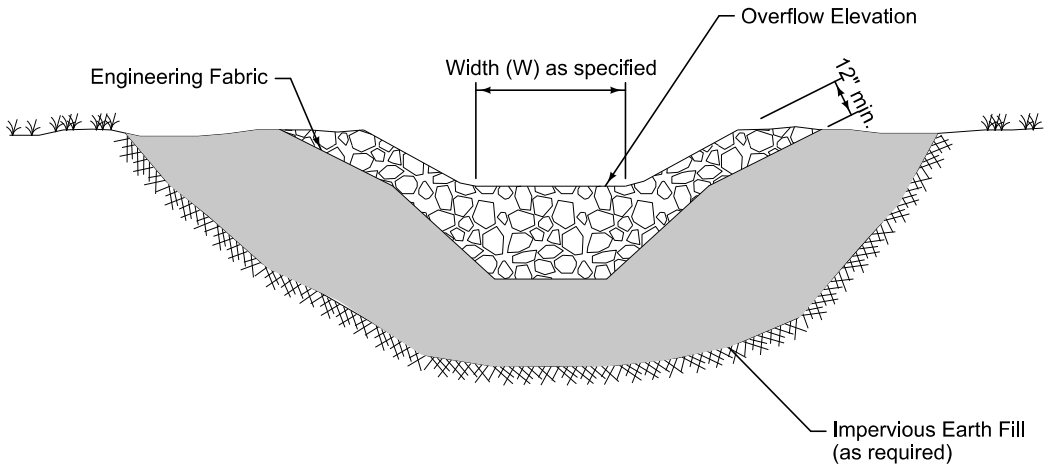
ANTI-SEEP COLLAR

Remove accumulated sediment when level reaches one-half the height of the wet storage.



PROFILE



SECTION A-A

Spillway Length

H (ft.)	L (ft.)
1.5	2.0
2.0	2.0
2.5	2.5
3.0	2.5
3.5	3.0
4.0	3.0
4.5	4.0
5.0	4.5

FIGURE 9040.118

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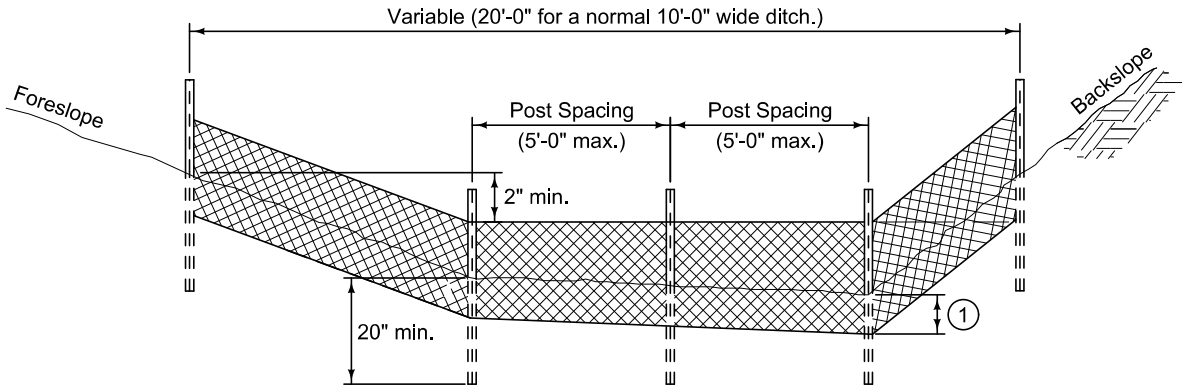
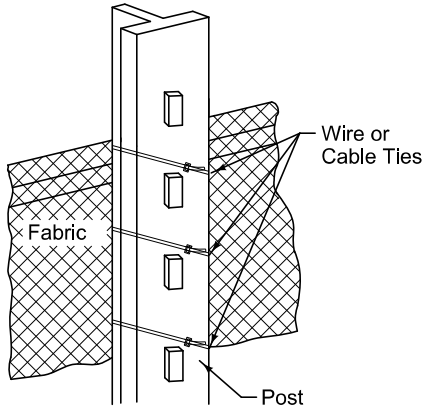
SEDIMENT TRAP



TYPICAL SILT FENCE DITCH CHECK



ATTACHMENT TO POST

(1) Insert 12 inches of fabric a minimum of 6 inches deep (fabric may be folded below the ground line).

FIGURE 9040.119

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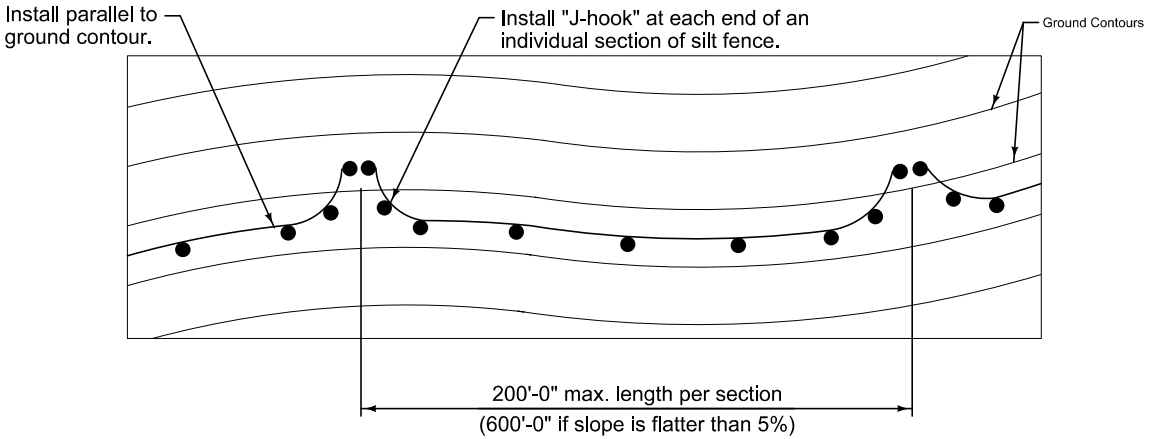
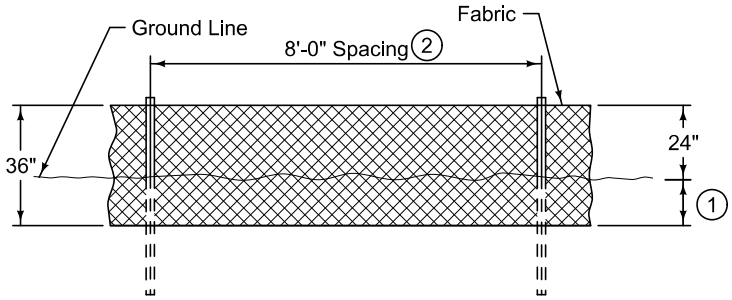
SILT FENCE

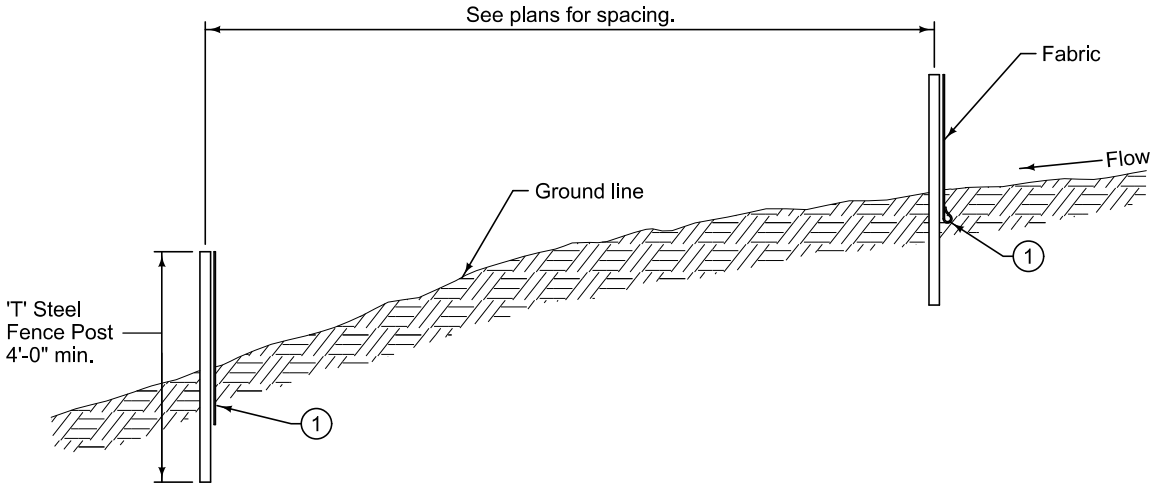


TYPICAL SILT FENCE INSTALLATION ON LONGITUDINAL SLOPES
(Plan View)

1. Insert 12 inches of fabric a minimum of 6 inches deep (fabric may be folded below the ground line).
2. Reduce post spacing to 5'-0" at water concentration areas, or as required to adequately support fence.



DETAILS OF SILT FENCE ON LONGITUDINAL SLOPES



TYPICAL SILT FENCE INSTALLATION ON LONGITUDINAL SLOPES
(Profile View)

FIGURE 9040.119
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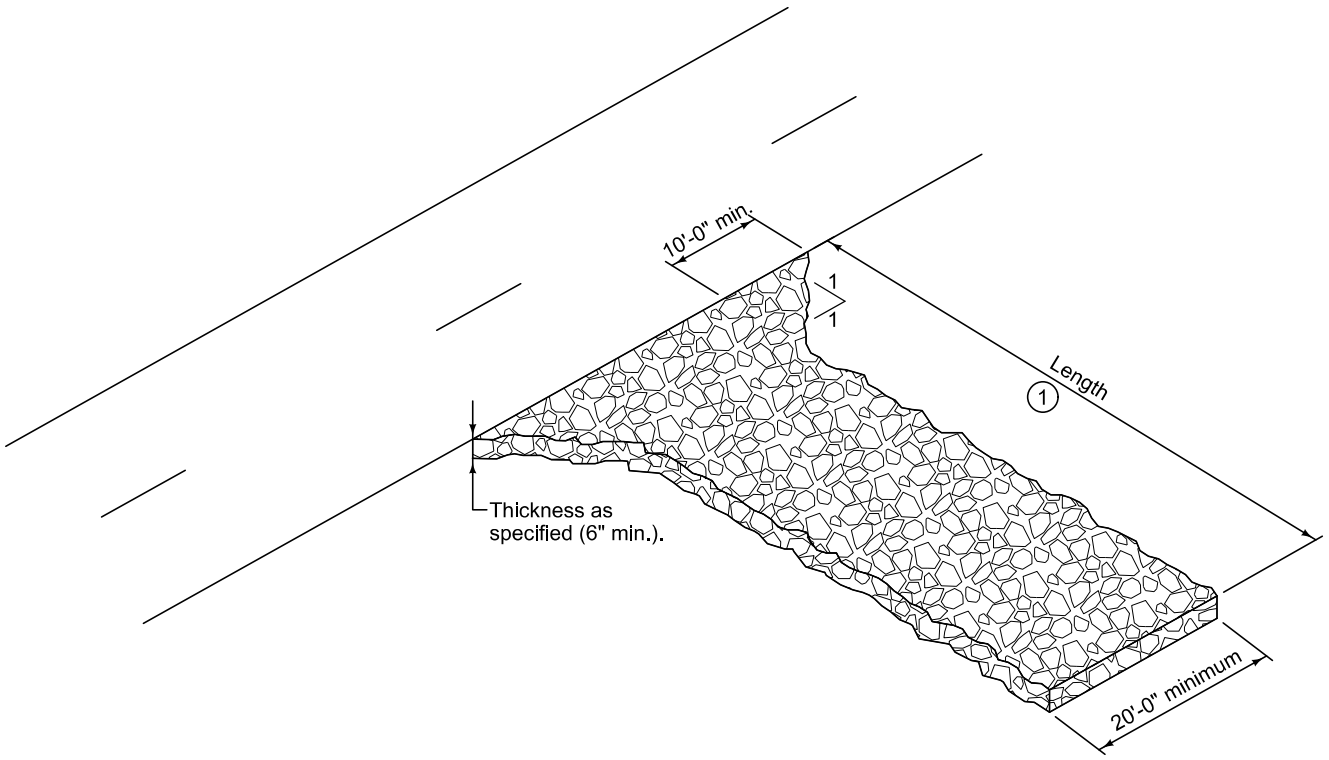
SILT FENCE



(1) Entrance length: 50 foot minimum (30 foot for single family residential), or as specified in the contract documents. Length of entrance may be increased if sediment track-out occurs.

FIGURE 9040.120 | SHEET 1 OF 1

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SUDAS Standard Specifications

STABILIZED
CONSTRUCTION ENTRANCE