1. Personnel safety grates (PSG) shall only be installed on the inlets of storm water pipes 12" (300) or larger in diameter that are not straight from the inlet to the open outlet, regardless of the length.

2. The grate shall be made to fit the outside perimeter of the flared end section (FES) ± 1/16" (13).

3. All bolt holes are to be drilled in the field.

4. A stiffener is to be installed where two or more bars are used.

5. Bottom bar shall be 6" (150) above invert of FES.

6. All hardware attached to concrete shall be attached using approved tamper proof anchors.

NOTE: 6" (150) O.C.
**Type 1 Joint Detail**
- Dimensions will vary
- Joint sealant as per specifications
- Only between 2 precast units

**Type 2 Joint Detail**
- 2" (50mm) temporary drainage opening
- Cast-in-place concrete flow channel (typ.)
- Top unit
- Gutter flow line
- Top unit (cast-in-place)
- Type 1 joint (typ.)
- Type 3 joint (typ.)
- Cast-in-place concrete flow channel (typ.)

**Type 3 Joint Detail**
- Cover slab
- Inlet box (pre-cast)
- Type 1 joint (typ.)
- Type 3 joint (typ.)
DRAINAGE INLET FRAME AND GRATES

NOTES:
1. THE TYPE 2 DRAINAGE INLET GRATE SHALL NOT BE USED WHERE BICYCLE TRAFFIC MAY BE PRESENT.
2. THE TOP OF ALL DRAINAGE INLET GRATES SHALL BE LABELED "ONLY RAIN DOWN THE STORM DRAIN". ALSO, DRAINAGE INLET GRATES TYPE 1 AND TYPE 4 SHALL BE LABELED WITH "WATER FLOW" AND AN ARROW INDICATING FLOW DIRECTION AS SHOWN IN THE EXAMPLE DETAIL.
3. THE TYPE 1 DRAINAGE INLET GRATE SHALL BE LABELED WITH "CORRISIDE" AS SHOWN ON THE EXAMPLE DETAIL. ALL LABELING ON THE TYPE 1 SHALL BE ON BOTH TOP AND BOTTOM SIDES DUE TO THE TYPE 1 BEING REVERSIBLE.
4. THE TYPE 5 FRAME AND GRATE COMBINATIONS ARE TO BE USED IN CONJUNCTION WITH LAWN INLET BOXES ONLY. SEE SCHEDULE ON DETAIL D-4, SHEET 1 OF 1, FOR WHICH BOX SIZES ARE CONSIDERED LAWN INLET BOXES.
5. THE TYPE 6 FRAME AND GRATE COMBINATION SHOWN IS THE NEW HAM FOUNDRY FRAME AND GRATE COMBINATION MODEL NF-9764-ASG. AN ACCEPTABLE ALTERNATIVE IS THE EAST JORDAN IRON WORKS FRAME AND GRATE COMBINATION MODEL V-9622.
**TYPE A**

**TYPE B**

**TYPE C**

**INLET TOP UNIT APPLICATIONS**

<table>
<thead>
<tr>
<th>TOP UNIT</th>
<th>CURB</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE A</td>
<td>USE IN DRAINAGE SWALE</td>
</tr>
<tr>
<td>TYPE B</td>
<td>INTEGRAL PCC CURB &amp; GUTTER, TYPE 1 &amp; 3, PCC CURB TYPE 1</td>
</tr>
<tr>
<td>TYPE C</td>
<td>INTEGRAL PCC CURB &amp; GUTTER, TYPE 4, PCC CURB TYPE 3</td>
</tr>
<tr>
<td>TYPE D</td>
<td>INTEGRAL PCC CURB &amp; GUTTER, TYPE 2</td>
</tr>
<tr>
<td>TYPE E</td>
<td>PCC CURB TYPE 3</td>
</tr>
</tbody>
</table>

**SS01 BENDING DIAGRAM**

SS01 is not required to be one continuous bar. If more than one bar is used, there must be a 12" (305) overlap between bars.

**ISOMETRIC VIEW**

**TYPE B TOP UNIT SHOWN WITH INTEGRAL CURB & GUTTER TYPE 3**
NOTES:
1. RELOCATE ENCROACHING REINFORCING BARS WHEN USING TYPE B UNIT.
2. COVER SLABS SHALL BE PRECAST AND MUST BE SIZED TO FIT INLET BOX DIMENSIONS.
3. ALL BARS ARE TO BE #5 (16#) SPACED @ 6" (150) UNLESS NOTED OTHERWISE. TOP REINFORCEMENT SHALL BE 0.11 IN²/FT² (700 mm²) HORIZONTAL REINFORCEMENT PER FOOT IN BOTH DIRECTIONS.
4. MINIMUM BAR COVER = 1 1/2" (38).

* - DIMENSIONS TO MATCH OUTSIDE TO OUTSIDE DIMENSIONS OF BOX.
**NOTES:**

1. REFER TO PREVIOUS SHEETS FOR REINFORCEMENT REQUIREMENTS.
2. THE HEIGHT OF THIS INLET IS LIMITED TO 4' (1220) MAXIMUM, THEREFORE STEPS WILL NOT BE REQUIRED AND SHOULD NOT BE INSTALLED ON THIS INLET.
3. REFER TO DETAIL D-5, SHEET 3 OF 9 FOR INLET TOP UNIT APPLICATION.

**SS04 BENDING DIAGRAM**

SS04 is not required to be one continuous bar. If more than one bar is used, there must be a 12" (3000) overlap between bars.
NOTE: TOP UNIT IS TO BE CAST IN PLACE TO GRADE AS SPECIFIED ON PLAN SHEETS OR AS DIRECTED BY ENGINEER.
1. COVER SLABS SHALL BE PRE-CAST.
2. ALL BARS SHALL BE #5 (#16) SPACED AT 6" (150) UNLESS NOTED OTHERWISE.
3. MINIMUM BAR COVER = 1/2" (38).

* DIMENSIONS TO MATCH OUTSIDE TO OUTSIDE DIMENSIONS OF BOX.
JUNCTION BOX COVER SLAB DETAILS

NOTES:
1. COVER SLABS ARE TO BE PRE-CAST.
2. ALL BARS ARE TO BE #5 (#16) SPACED @ 12" (305) ± UNLESS NOTED OTHERWISE.
3. MINIMUM BAR COVER = 1" (25).
4. DIMENSIONS TO MATCH OUTSIDE TO OUTSIDE DIMENSIONS OF BOX.

SECTION A-A

SECTION B-B

JUNCTION BOX DETAILS

STANDARD NO. D-7 (2007) SHT. 2 OF 2

APPROVED

DELAWARE DEPARTMENT OF TRANSPORTATION

RECOMMENDED

DATE

08/01/2007

DATE

10/23/07
NOTE:
1. USE CLASS C BEDDING UNLESS OTHERWISE INDICATED.
2. FOR CLASS A BEDDING, WEED PIPE IN CONCRETE 6" (152) FOR PIPES SMALLER THAN 24" (600), 10" (250) FOR PIPES 24" (600) TO 60" (1525), AND FOR PIPES LARGER THAN 60" (1525) SEE PROJECT DETAILS.
NOTES:
0. THE PERFORATED PIPE UNDERDRAIN SHALL BE LOCATED AS SHOWN ON THE TYPICAL SECTIONS OF THE CONSTRUCTION PLANS.
1. GOSETEXILE FILTER FABRIC SHALL BE PLACED ENTIRELY OVER THE TOP OF UNDERDRAIN TRENCH AND LAPPED AS SHOWN.
2. SLOPE OF UNDERDRAINS SHALL MATCH ROADWAY GRADE, UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
3. OUTLET PIPE CONFIGURATIONS SHALL USE 45 DEGREE ELBOWS OR SHALL USE STRAIGHT PIPE WITH A MINIMUM RADIUS OF 3'
   (900) TO DIRECT UNDERDRAIN PIPE INTO SIDE OF DRAINAGE INLET OR TO POSITIVE GRADE. PIPE SHALL ALSO BE NON-PERFORATED
   AND HAVE A SMOOTH INTERIOR.
4. RODENT SCREEN SHALL SMOOTHLY FIT THE PROVIDED SLOT WITH THE SCREEN UP FITTING TIGHT TO THE BOTTOM FLOW LINE.
5. A #4 (1200) FLEXIBLE DELINEATOR SHALL BE FURNISHED AND INSTALLED AT THE DIRECTION OF THE ENGINEER TO MARK THE
   LOCATION OF THE CONCRETE HEADWALL.
6. WHEN TWO LINES OF PIPE UNDERDRAIN DRAIN TO A LOW POINT, EACH PIPE MUST HAVE ITS OWN OUTLET.
7. PERFORATED PIPE UNDERDRAIN SHALL NOT BE PLACED UNDER GUARDRAIL, IN ORDER TO AVOID PUNCTURING.
The contractor shall furnish material and plug abandoned drainage pipes with concrete as directed by the engineer.

NOTE:
PIPE PLUGGING DETAIL

CONCRETE PLUG

SECTION

ELEVATION

9" (300) MIN

NOTE:
The contractor shall furnish material and plug abandoned drainage pipes with concrete as directed by the engineer.
**CUT SECTION**

- Limit of construction
- Existing ground
- Phase 1 excavation
- Intermediate Phases
- Final phase excavation
- Perimeter/one swale used as a clean water diversion, see standard sheet
- Break in cross slope may be eliminated to direct surface flow left or right or as directed by the engineer.
- Edge berm to be placed at the end of each work day and used until slope is completely stabilized.

**FILL SECTION**

- Final phase embankment
- Intermediate phase embankment
- Phase 1 embankment
- Existing ground
- Temporary swale, see standard sheet

**NOTES:**
1. Edge berms and temporary slope drains shall be constructed along the top of all slopes to intercept runoff and convey it down the slope faces without creating gullies or washouts.
2. Slope faces shall be tracked with cleated equipment such that the cleat marks are oriented horizontally.
3. All cut and fill slopes of the highway embankment shall be permanently stabilized as the work progresses in increments not to exceed 10' (3000) measured along the slope.
4. Cross slopes shall be 2%. Minimum, 6%. Maximum.

**DELaware**

**Department of Transportation**

**Incremental Stabilization**

**Approved**

**Standard No.** E-1 (2001)  **Sh.** 1  **Of** 1  **Recommended**

**05/31/2001**
NOTES:
1. THIS DEVICE IS INTENDED TO CONTROL SHEET FLOW ONLY. IT SHALL NOT BE USED IN AREAS OF CONCENTRATED FLOW.
2. SILT FENCE ENDS SHALL BE TURNED UPSLOPE TO CONTAIN RUNOFF.
3. REINFORCING STRIP IS TO BE ONE COMPLETE STRIP COVERING ALL GEOTEXTILE FABRIC AT POST.
ISOMETRIC VIEW

2" x 4" x 60 x 100 (Nominal) Frame, nailed at joints

1/2" x 2" x 1/8" x 3019 Case (U2)

GEOTEXTILE

EXISTING GROUND

EXCAVATE AND RE-COMPACT SOIL

POST DRIVEN INTO GROUND

SECTION A-A

IF THE INLET IS NOT AT A LOW POINT, INSTALL SEDIMENT CONTROL EARTH Dike downstream from inlet.

DELWARE
DEPARTMENT OF TRANSPORTATION

DRAINAGE INLET SEDIMENT CONTROL

STANDARD NO. E-3 (2006) SHT. 1 OF 1

APPROVED By: Andrew Welch 12/5/05

RECOMMENDED By: 11/9/06

01/9/2006
NOTES:

1. FOR DITCHES LESS THAN 30" (750) IN DEPTH, PLACE DAM AS DIRECTED BY THE ENGINEER.
2. THE CHECK DAM HEIGHT MUST NOT EXCEED 2' (600) AT THE CENTER OF THE WEIR.
3. THE CHECK DAM IS TO BE CONSTRUCTED SO THAT THE CENTER IS 6' (1800) MIN.
4. GEOTEXTILE FABRIC IS TO BE INSTALLED UNDERNEATH RPPAP ON PERMANENT CHECK
   DAMS ONLY.
5. THE MAXIMUM SPACING BETWEEN DAMS SHALL BE THE DISTANCE IN THE DITCH WHERE
   THE TOE OF THE UPSTREAM DAM IS AT THE SAME ELEVATION AS THE TOP OF THE
   DOWNSTREAM DAM AT THE CENTER OF THE WEIR.
**NOTES:**

1. SEDIMENT TRAPS ARE INTENDED FOR USE IN EXISTING, PROPOSED, AND TEMPORARY DITCHES OF ALL TYPES WITH A MAXIMUM DRAINAGE AREA OF 16 ACRES (6 HECTARES), AS SHOWN ON PLANS OR AS DIRECTED BY THE ENGINEER.

2. SIDE SLOPES SHALL BE STABILIZED WITH "TEMPORARY GRASS SEEDING, DRY GROUND" AND STRAW MULCH.

3. AN OUTLET STRUCTURE IS REQUIRED, STONE CHECK DAMS, PERFORATED RISER PIPES, SEWER Dewatering DEVICES, OR DRAINAGE INLETS MAY BE USED. SEE APPROPRIATE STANDARD SHEET FOR ADDITIONAL INFORMATION.

4. FOR SIZE, LOCATION, ETC. OF SEDIMENT TRAP, SEE CONSTRUCTION PHASING, M.O.T., AND EROSION CONTROL PLANS.

5. ALL FALL SLOPES SHALL BE 2:1.

6. A 2:1 LENGTH TO WIDTH RATIO SHOULD BE ACHIEVED WHERE POSSIBLE. IF THIS IS NOT POSSIBLE, THE USE OF BAFFLES OR OTHER SPECIAL DESIGNS SHOULD BE INCORPORATED TO INCREASE FLOW TIME.
NOTES:
1. THE WORK SHALL CONSIST OF THE CONSTRUCTION OF A SEDIMENT TRAP AROUND A DRAINAGE INLET TO ALLOW SEQUENTIATION TO OCCUR BEFORE RUNOFF ENTERS THE DRAINAGE INLET.
2. DRAINAGE INLET SEDIMENT TRAPS SHALL BE LIMITED TO A THREE (3) ACRE (0.2 HECTARE) MAXIMUM DRAINAGE AREA.
3. THE DIMENSIONS OF THE DRAINAGE INLET SEDIMENT TRAP ARE TO BE AS INDICATED ON THE PLANS OR AS DIRECTED BY THE ENGINEER.
ELEVATION

NOTES:
1. THIS DEVICE IS INTENDED TO BE USED AS AN OUTLET FOR SEDIMENT TRAPS.
2. THE PIPE OUTLET SHOWN SHALL ONLY BE USED WITH SEDIMENT TRAPS WITH DRAINAGE AREAS OF 5 ACRES (20 HECTARES) OR LESS. LARGER DRAINAGE AREAS REQUIRE AN ENGINEERED DESIGN.
3. THE HEIGHT OF THE SKIMMER DEMATERING DEVICE SHALL BE SPECIFIED BY THE ENGINEER IN THE FIELD.
STABILIZATION OF EMBANKMENTS

NOTES:
1. STAPLES TO BE STAGGERED AT 8" (450) SPACING.
2. TOPSOIL UNDER EROSION CONTROL BLANKET IS TO BE TRACED AND SEEDED.
3. WHEN OFFSITE RUNOFF OCCURS, ADDITIONAL MEASURES AS DIRECTED BY THE ENGINEER SHALL BE USED TO ENSURE STABILITY OF EMBANKMENT.

STABILIZATION OF DITCHES

PLAN

NOTES:
1. ADDITIONAL STAPLES NOT SHOWN ARE REQUIRED AT OVERLAPS.
2. SEE OVERLAP DETAIL FOR STAPLE PLACEMENT.
3. TOPSOIL UNDER EROSION CONTROL BLANKET IS TO BE TRACED AND SEEDED.

EROSION CONTROL BLANKET APPLICATIONS

DELAWARE DEPARTMENT OF TRANSPORTATION

STANDARD NO. E-9 (2005) SHT. 1 OF 1

APPROVED RECOMMENDED

12/5/05 11/5/06

08/10/05
SECTION A-A

SECTION B-B

PLAN

NOTES:
1. SECURING PINS ARE TO BE PLACED AT LOCATIONS SHOWN AND AT 24" (600) LONGITUDINAL AND LATERAL SPACING.
2. SEE PLANS FOR LOCATION, DIMENSIONS, GRADES, ETC.
3. USE OF R-7 RIPRAP WILL REQUIRE A SEPARATE PROFESSIONAL ENGINEERING DESIGN FOR SIGHT SPECIFIC CONDITIONS.

DELWARE DEPARTMENT OF TRANSPORTATION

RIPRAP DITCH

STANDARD NO. E-10 (2005) SHT. 1 OF 1

APPROVED: 

RECOMMENDED: 

08/10/2005
CHART A - STABILIZATION

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>SWALE GRADE</th>
<th>TYPE OF TREATMENT</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>0.5-2.0%</td>
<td>SEED USED WITH</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EROSION CONTROL BL.</td>
</tr>
<tr>
<td>2</td>
<td>2.0-6.0%</td>
<td>R-4 RRAP</td>
</tr>
<tr>
<td>3</td>
<td>8.0-20%</td>
<td>ENGINEERED DESIGN</td>
</tr>
</tbody>
</table>

CHART B - SWALE DIMENSIONS

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>SWALE A</th>
<th>SWALE B</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>F'(5000 min.)</td>
<td>F'(5000 min.)</td>
</tr>
<tr>
<td>D</td>
<td>F'(4000 min.)</td>
<td>F'(8000 min.)</td>
</tr>
</tbody>
</table>

NOTES:
1. Diverted runoff from a disturbed area shall be conveyed to a sediment trapping device.
2. Diverted runoff from an undisturbed area shall outlet directly into an undisturbed stabilized area at non-erosive velocity.
3. If temporary swales or clean water diversions are to be operational for more than 14 days, they shall be stabilized in accordance with Chart A prior to becoming operational.
4. If temporary swales or clean water diversions are to be operational for less than 14 days, they shall be stabilized with geotextile in accordance with the standard detail "geotextile-lined channel diversion".
CHART A - SWALE STABILIZATION

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>SLOPE GRADE</th>
<th>TYPE OF TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1</td>
<td>0.5-2.0%</td>
<td>SEED AND EROSION CONTROL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BLANKET</td>
</tr>
<tr>
<td>A-2</td>
<td>2.0-4.0%</td>
<td>LINED R-4 RIPRAP</td>
</tr>
<tr>
<td>A-3</td>
<td>8.0-20.0%</td>
<td>ENGINEERED DESIGN</td>
</tr>
</tbody>
</table>

MAXIMUM DRAINAGE AREA: 2 ACRES (0.8 ha)

NOTES:
1. DIVERTED RUNOFF FROM A DISTURBED AREA SHALL BE CONVEYED TO A SEDIMENT TRAPPING DEVICE.
2. DIVERTED RUNOFF FROM AN UNDISTURBED AREA SHALL OUTLET INTO AN UNDISTURBED STABILIZED AREA AT NON-EROSIVE VELOCITY.
3. IF PERIMETER DIKE SWALES ARE TO BE OPERATIONAL FOR MORE THAN 45 DAYS, THEY SHALL BE STABILIZED IN ACCORDANCE WITH CHART A PRIOR TO BECOMING OPERATIONAL.
4. IF TEMPORARY SWALES OR CLEAN WATER DIVERSIONS ARE TO BE OPERATIONAL FOR LESS THAN 45 DAYS, THEY SHALL BE STABILIZED WITH GEOTEXTILE IN ACCORDANCE WITH THE STANDARD DETAIL "GEOTEXTILE-LINED CHANNEL DIVERSION".

DELAWARE DEPARTMENT OF TRANSPORTATION

PERIMETER DIKE / SWALE

STANDARD NO. E-12 (2005) SHT. 1 OF 1

APPROVED

RECOMMENDED

12/15/05

09/02/2005
SECTION A-A

PLAN

CUT OR FILL SLOPE

NOTE:
1. If desired, top width may be wider and side slopes may be flatter to facilitate crossing by construction traffic.
2. Field location should be adjusted as needed to insure a stabilized outfall.
DISCHARGE INTO A STABILIZED DITCH - (GEOTEXTILE, STONE OR GRADED) OR A SEDIMENT TRAP.

FLOW

R-4 RIPRAP
(3 SY (3 m³) MIN)

TOE OF SLOPE

CORRUGATED PIPE - SEE PLANS FOR LOCATIONS OR AS DIRECTED BY THE ENGINEER.

TOP OF FILL SLOPE AS EMBANKMENT IS CONSTRUCTED

EDGE Berm AT TOP OF FILL SLOPE

INTERCEPTOR Berm, 36'(1000) MIN.
HEIGHT LENGTH AS REQUIRED TO CONTAIN SURFACE DRAINAGE AND DIRECT INTO TEMP SLOPE DRAIN.

FLOW

ANTI-SEEP COLLAR

TEMPORARY FLOW LINE

PLAN

SLOPE DRAIN PROFILE

FOR FILL SLOPES

CORRUGATED PIPE

36'(1000) MIN.

EMBANKMENT

COMPACT SOIL AROUND END OF PIPE

ANTI-SEEP COLLAR

PHASE I DRAIN

PHASE I FILL

R-4 RIPRAP

FILL SLOPE

EDGE Berm

NOTE:
1. ALL TEMPORARY SLOPE DRAINS SHALL DISCHARGE INTO THE BACK OF SEDIMENT TRAPS INTO SEDIMENT BASINS OR DITCHES DISCHARGING INTO TRAPS OR BASINS.
2. TEMPORARY SLOPE DRAINS SHALL BE USED AT THE TOP OF FILL SLOPES AS EMBANKMENT S CONSTRUCTED TO PREVENT EXCESSIVE EROSION UNTIL SHOULDERS ARE CONSTRUCTED AND THE SLOPES ARE SEEDED AND MULCHED.

DELaware
DEPARTMENT OF TRANSPORTATION

TEMPORARY SLOPE DRAIN


SH. 1 OF 1

APPROVED

RECOMMENDED

09/02/2005

09/02/2005