**GRANULAR BLANKET TYPE 1**

- **Material for "Granular Blanket" shall be Granular Material Class II.**
- **SOD and Topsoil or Topsoil, Seed, and Mulch as specified on plans.**

**OPTION 1**

- **Proposed Ditch.**
- **Bank Underdrain (Alternate Location).**
- **Pipe shall be wrapped with Geotextile.**
- **Possible Seepage Plane (Typ.):**
- **Possible Drainage Layer:**
- **Possible Pervious Soil Cap:**

**OPTION 2**

- **Proposed Ditch.**
- **Bank Underdrain:**
- **Pipe shall be wrapped with Geotextile.**

**OPTION 3**

- **Proposed Ditch.**
- **Prefabricated Drainage Geocomposite with Geotextile on both sides.**

**GRANULAR BLANKET TYPE 2**

- **Material for "Granular Blanket" shall be Granular Material Class II.**
- **SOD and Topsoil or Topsoil, Seed, and Mulch as called for on plans.**

**NOTE:** Option 1, 2, or 3 will be determined by the engineer based on the project conditions.
BANK UNDERDRAIN OUTLET

EXISTING DRAINAGE STRUCTURE

SEWER - TO BE REMOVED
SEWER - TO BE ABANDONED
SEWER - TO REMAIN IN SERVICE

CAP UNDERDRAIN PIPE WITH A GEOTEXTILE MATERIAL. NOT PAID FOR SEPARATELY, BUT INCLUDED IN UNDERDRAIN OUTLET.

LENGTH OF BULKHEAD SHALL EQUAL 1/3 DIAMETER OF EXISTING SEWER BUT NOT LESS THAN 1'-0”

* BANK UNDERDRAIN (PIPE SHALL BE WRAPPED WITH GEOTEXTILE)

WEPPER UNDERDRAIN AND BULKHEADING SEVERED SEWER

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR
GRANULAR BLANKET, UNDERDRAINS, OUTLET ENDINGS FOR UNDERDRAINS, AND SEWER BULKHEADS

1-25-2013 F.H.W.A. APPROVAL 6-13-2012 R-80-E SHEET 2 OF 8
BANK UNDERDRAINS

BANK UNDERDRAIN, OPEN-GRADED

PIPE DIA. + 1/2 PIPE DIA. EACH SIDE MIN.
8" MIN., 12" MAX. FOR 4" DIA. PIPE
12" MIN., 16" MAX. FOR 6" DIA. PIPE

DISTANCE AS DIRECTED

SLOPE AS SPECIFIED
ON PLANS

PERVIOUS SOIL

GRANULAR MATERIAL
CLASS II AA

SEEPAGE PLANE

EXISTING GROUND

TRENCH TO BE PLACED IN
SLOPE IF THIS DIMENSION
EXCEEDS 6'-0" (SEE SLOPE POSITION)

BANK UNDERDRAIN
(PIPE SHALL BE WRAPPED
WITH GEOTEXTILE)

GRANULAR BLANKET, UNDERDRAINS,
OUTLET ENDINGS FOR UNDERDRAINS,
AND SEWER BULKHEADS

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT
STANDARD PLAN FOR

SOD AND TOPSOIL OR TOPSOIL,
SEED, AND MULCH AS SPECIFIED
ON PLANS. (TYP.)

OVERLAP

6" MINIMUM

DISTANCE AS DIRECTED

BY THE ENGINEER

TOP OF SLOPE

6'-0" MAX.

PERVERIOUS SOIL

GRANULAR MATERIAL
CLASS II AA

SEEPAGE PLANE

EXISTING GROUND

TRENCH SHALL BE LINED WITH
GEOTEXTILE BLANKET

BANK UNDERDRAIN
(PIPE SHALL BE WRAPPED
WITH GEOTEXTILE)

PIPE DIA. + 1/2 PIPE DIA. EACH SIDE MIN.
8" MIN., 12" MAX. FOR 4" DIA. PIPE
12" MIN., 16" MAX. FOR 6" DIA. PIPE

DISTANCE AS DIRECTED

BY THE ENGINEER

TOP OF SLOPE

6'-0" MAX.

OPEN-GRADED AGGREGATE 34-R

TRENCH SHALL BE LINED WITH
GEOTEXTILE BLANKET

BANK UNDERDRAIN
(PIPE NOT WRAPPED)

BANK UNDERDRAIN (SLOPE POSITION)
(PIPE SHALL BE WRAPPED WITH
GEOTEXTILE)

6'-0" MAX.

1'-0"

1'-0"

1'-0"

6'-0" MAX.

1'-0"

1'-0"

1'-0"

1'-0"

1'-0"

1'-0"

1'-0"
SUBGRADE UNDERDRAIN

EDGE OF PAVEMENT  4'-0" UNLESS OTHERWISE SPECIFIED

DENSE GRADED AGGREGATE

SUBBASE (DEPTH AS SPECIFIED ON PLANS)

SLOPE AS SPECIFIED ON PLANS

OPEN-GRADED AGGREGATE 34-R

TRENCH SHALL BE LINED WITH GEOTEXTILE BLANKET

SUBGRADE UNDERDRAIN (PIPE SHALL NOT BE WRAPPED)

PIPE DIA. + ½ PIPE DIA. EACH SIDE MIN.
8" MIN., 12" MAX. FOR 4" DIA. PIPE
12" MIN., 16" MAX. FOR 6" DIA. PIPE

1/2 OF LANE WIDTH

4'-0" UNLESS OTHERWISE SPECIFIED

DENSE GRADED AGGREGATE

SUBBASE (DEPTH AS SPECIFIED ON PLANS)

SLOPE AS SPECIFIED ON PLANS

GRANULAR MATERIAL CLASS II AA

SUBGRADE UNDERDRAIN (PIPE SHALL BE WRAPPED WITH GEOTEXTILE)

PIPE DIA. + ½ PIPE DIA. EACH SIDE MIN.
8" MIN., 12" MAX. FOR 4" DIA. PIPE
12" MIN., 16" MAX. FOR 6" DIA. PIPE

SUBBASE UNDERDRAIN

WHEN ADDITIONAL SUBBASE UNDERDRAINS ARE REQUIRED, THEY SHALL BE PLACED IN THE CENTER OF A LANE

EDGE OF PAVEMENT  3'-0" OR AS SPECIFIED ON PLANS

DENSE GRADED AGGREGATE

SUBBASE (DEPTH AS SPECIFIED ON PLANS)

SLOPE AS SPECIFIED ON PLANS

GRANULAR MATERIAL CLASS II AA

FLOW LINE ELEVATION NORMALLY A MAXIMUM OF 10" BELOW TOP OF SUBGRADE OR AS SPECIFIED ON PLANS

PIPE DIA. + ½ PIPE DIA. EACH SIDE MIN.
8" MIN., 12" MAX. FOR 4" DIA. PIPE
12" MIN., 16" MAX. FOR 6" DIA. PIPE

SUBBASE UNDERDRAIN

GRANULAR BLANKET, UNDERDRAINS, OUTLET ENDINGS FOR UNDERDRAINS, AND SEWER BULKHEADS

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

1-25-2013  6-13-2012  R-80-E  SHEET 4 OF 8

F.H.W.A. APPROVAL  PLAN DATE
* THE OPEN-GRADED UNDERDRAIN PIPE SHALL NOT BE WRAPPED WITH GEOTEXTILE.

**OPEN-GRADED UNDERDRAIN PIPE**
**WITH GEOTEXTILE SEPARATOR**

(MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR
GRANULAR BLANKET, UNDERDRAINS, OUTLET ENDINGS FOR UNDERDRAINS, AND SEWER BULKHEADS)

1-25-2013       6-13-2012       R-80-E       SHEET 5 OF 8
WITH GEOTEXTILE SEPARATOR

OPEN-GRADED UNDERDRAIN (PDS)

WITH DENSE GRADED AGGREGATE SEPARATOR COURSE

OPEN-GRADED UNDERDRAIN (PDS)

WITH DENSE GRADED AGGREGATE SEPARATOR COURSE

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT

GRANULAR BLANKET, UNDERDRAINS,
OUTLET ENDINGS FOR UNDERDRAINS,
AND SEWER BULKHEADS

1-25-2013
F.H.W.A. APPROVAL

6-13-2012
PLAN DATE

R-80-E
SHEET

6 OF 8
PLAN SHOWING OUTLETS FOR UNDERDRAINS

MAXIMUM OUTLET SPACING 300' (TYP.)

ADDITIONALLY, LOCATE OUTLETS AT THE LOWEST ELEVATION OF ALL VERTICAL CURVES.

STEEL END SECTION FOR 4" OR 6" PIPE

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT

GRANULAR BLANKET, UNDERDRAINS, OUTLET ENDINGS FOR UNDERDRAINS, AND SEWER BULKHEADS
CONCRETE RING FOR 4" OR 6" PIPE

CONCRETE END SECTION FOR 4" OR 6" PIPE

RODENT SCREEN

NOTES:

POSITIVE DRAINAGE SHALL BE PROVIDED FOR UNDERDRAINS AND UNDERDRAIN OUTLETS.

UNDERDRAIN PIPE SIZES SHALL BE AS SPECIFIED ON THE PLANS.

CONNECTIONS BETWEEN UNDERDRAIN PIPE AND UNDERDRAIN OUTLET PIPE SHALL BE CONSTRUCTED ACCORDING TO THE CURRENT STANDARD SPECIFICATIONS AND AS APPROVED BY THE ENGINEER.

CONNECTIONS, IF REQUIRED WITHIN THE OUTLET PIPE, SHALL BE ACCORDING TO APPLICABLE ASTM SPECIFICATIONS REFERENCED IN THE CURRENT STANDARD SPECIFICATIONS. THEY SHALL BE WATER TIGHT, AND OF THE SAME MATERIAL AS THE OUTLET PIPE.

OUTLET CONNECTIONS TO DRAINAGE STRUCTURES SHALL BE ACCORDING TO CURRENT STANDARD SPECIFICATIONS FOR DRAINAGE STRUCTURES.

UNDERDRAIN OUTLET PIPE SHALL BE RIGID PVC OR CORRUGATED METAL ONLY.

THE CONCRETE RING OR CONCRETE END SECTION SHALL BE CAST AROUND THE SAME TYPE OF PIPE AS THAT USED FOR UNDERDRAIN OUTLET PIPE.

STEEL END SECTIONS SHALL BE ATTACHED TO THE ENDS OF CORRUGATED METAL PIPE AS SPECIFIED ON THIS STANDARD PLAN, BY STANDARD METAL BANDS, OR BY OTHER CONNECTING DEVICES AS APPROVED BY THE ENGINEER.

STEEL END SECTIONS MAY ALSO BE ATTACHED TO THE ENDS OF PVC OUTLET PIPE AS APPROVED BY THE ENGINEER BY USING A PVC ADAPTER THAT PROVIDES SIMILAR RESISTANCE TO MOVEMENT OF THE CONNECTION DEVICE AS THAT PROVIDED BY STEEL PIPE CORRUGATIONS. DIRECT ATTACHMENT OF THE STEEL END SECTION TO END OF STANDARD PVC OUTLET PIPE IS NOT ACCEPTABLE.

HELICALLY CORRUGATED PIPE (EXCEPT PERFORATED PIPE) SHALL HAVE THE ENDS OF THE PIPE REROLLED TO FORM ANNULAR CORRUGATIONS FOR CONNECTING THE END SECTION.

GRANULAR BLANKET, UNDERDRAINS, OUTLET ENDINGS FOR UNDERDRAINS, AND SEWER BULKHEADS

Michigan Department of Transportation
Bureau of Highway Development Standard Plan for

R-80-E

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