In the MPDM, a Best Management Practice (BMP) is... a structural or non-structural practice that minimizes water quality and/or quantity (peak flow or volume reduction) impacts within a public drainage system or its watershed and/or downstream.
TWO KINDS OF BMP

- On-system
- Off-system
On-system

On-system BMPs are used within a Chapter 103E drainage system and are aligned with the statute based authorities and responsibilities of the drainage authority. These can include any statute-allowed, or required practice.

- vegetated buffer strips,
- grade control structures,
- side inlets,
- erosion control,
- multi-stage ditch,
- water storage,
- restored wetland,
- culvert sizing,
- resloping,
- tile repair, etc.
TWO KINDS OF BMP

- **Off-system**
  - Other BMPs are located off the Chapter 103E drainage system, and consequently, not within the traditional purview of the drainage authority. However, as a result of efforts related to Chapter 103E.015, a drainage authority may find that there are practices that can be applied on fields and farms in the watershed of the system which will provide significant benefits downslope to the drainage system.

- **Structural**
  - Water and sediment control basins,
  - Grass waterways,
  - Grade stabilization structures, and
  - Drainage Water Management, etc.

- **Non-structural**
  - Nutrient management,
  - Cover crops, and
  - Conservation tillage, etc.
SELECTING A BMP…3 STEPS

STEP 1: OBSERVE AND IDENTIFY PROBLEMS & OPPORTUNITIES

STEP 2: DETERMINE CAUSE OF PROBLEM

STEP 3: SELECT AN APPROPRIATE BMP SOLUTION
SELECTING A BMP…3 STEPS

**STEP 1: OBSERVE AND IDENTIFY PROBLEMS & SYMPTOMS**

Based on field observations, and review of inspector or engineer’s reports, studies, local water plans or strategies defining what is happening in the watershed of the public drainage system.

Problems/symptoms are the physical issues identified along a public drainage system.

Examples might include:

a. Headcut on adjacent fields
b. reduced water quality in nearby or downstream receiving waters
c. sediment plumes
d. channel erosion
e. ditch incision
f. fish kills
g. sediment plugged tile
h. erosion on near-ditch field
i. high concentrations of pollutants in system waters
j. failed side slope
SELECTING A BMP…3 STEPS

STEP 1: OBSERVE AND IDENTIFY PROBLEMS & SYMPTOMS
SELECTING A BMP

STEP 1: OBSERVE AND IDENTIFY PROBLEMS & OPPORTUNITIES

STEP 2: DETERMINE CAUSE OF PROBLEM
SELECTING A BMP...3 STEPS

STEP 2: DETERMINE CAUSE OF PROBLEM

Examples might include:

a. open tile inlets
b. lack of buffers
c. Excessive use of nitrogen fertilizers or manure
d. lack of cover crops
e. Excessive phosphorus loss through tile systems creating impaired downstream waterbodies.
f. altered hydrology due to climate change or man-made changes
g. excessive phosphorus build-up in the soil
h. downstream channel straightening or maintenance
i. Ground subsidence may cause old tile to separate, shift, and plug
j. excessive bank slope
k. excessive bottom slope
SELECTING A BMP... 3 STEPS

STEP 1: OBSERVE AND IDENTIFY PROBLEMS & OPPORTUNITIES

STEP 2: DETERMINE CAUSE OF PROBLEM

STEP 3: SELECT AN APPROPRIATE BMP SOLUTION
BMP Table

**Minnesota Drainage Manual**

**BMP Table**

**Main Page** > Chapter 5 > II. Best Management Practices > BMP Table

**BMP Table**

<table>
<thead>
<tr>
<th>Symptom/Issue To be Addressed</th>
<th>Cause</th>
<th>On-System: Ditch System</th>
<th>On-System: Tile System</th>
<th>Off-System</th>
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<tr>
<td>Erosion</td>
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<td>Excessive Sediment (Aggradation)</td>
<td>Excessive sediment transport from field and upstream ditch bottom and side slopes.</td>
<td>Open Channel (NRCS CP 582) - Natural Channel/Two-stage Channel Design</td>
<td>Tile Replacement (NRCS CP 606)</td>
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OFF-SYSTEM BMP
GRASSED WATERWAY

CP 412 – Grassed Waterway  (Photo Source: USDA NRCS)
OFF-SYSTEM BMPS

CP 340 Cover Crops
Source: USDA NRCS

CP 600 Terrace
Source: USDA NRCS

CP 330 Contour Farming
Source: USDA NRCS

CP 329, 345, 346
Conservation Tillage
Source: USDA NRCS
OFF-SYSTEM BMP
DENITRIFYING BIOREACTOR
DWM is the process of managing the timing and the amount of water that discharges from agricultural drainage systems. A structure for water control is installed in the tile line, which allows for management of the tile outlet elevation.
ON-SYSTEM BMP
MANDATED BY STATUTE

- Vegetated Buffer
THE BMP – MANDATED BY STATUTE

Vegetated Buffer

Buffer measurement for a public drainage ditch

Purpose and Considerations
This guidance is for local government units charged with implementing, advising and reviewing buffer measurement compliance for properly maintained 103E public drainage ditch.

Statutory References

Buffer Law
The buffer law requires buffer widths based on the classification of the public drainage ditch. For example, the buffer measurement requirement for public drainage ditch law highlighted:

M.S. 103E.48, Subd. 3, Water resources riparian protection and drainage systems.
(a) Except as provided in paragraph (b), landowners owning or possessing property abutting a buffer protection map must maintain a buffer strip as provided in this subdivision.
(b) For public drainage systems established under chapter 101, landowners owning or possessing property abutting a buffer as provided in section 103E.021, subdivision 1, must maintain the buffer strip as provided in this subdivision.

Drainage Law
Drainage law includes the following requirement for buffer strip maintenance:

M.S. 103E.021, Subd. 1, Soil banks must be spread and perennial vegetation shall be maintained on the banks at least 10 feet from the top edge of the constructed channel resulting from the proceedings of the drainage district.

Because the buffer law does not involve “proceedings” like drainage districts, “resulting from the proceeding” does not apply for the buffer law.

Measuring Buffer Width
The following diagrams provide a visual representation of the buffer strip for a public drainage ditch. These diagrams are adapted from Minnesota Statutes, Section 103F.48 (buffer law) and Minnesota Statutes, Section 103E.021 (drainage law).
DITCH CLEAN-OUT TYPICAL SECTION

NOTE: EXCAVATION TO BE LIMITED TO THE BOTTOM OF THE CHANNEL. NO EXCAVATION TO BE DONE ON SLOPES.
ON-SYSTEM BMP
SIDE INLET STRUCTURE

TYPICAL SIDE INLET SEDIMENT CONTROL SECTION
NOT TO SCALE
ON-SYSTEM BMP
SIDE INLET STRUCTURE

TYPICAL FIELD INLET SECTION
NOT TO SCALE
ON-SYSTEM BMP
SIDE INLET STRUCTURE
ON-SYSTEM BMP
SEDIMENT CONTROL
ON-SYSTEM BMP
ALTERNATIVE TILE INLET
ON-SYSTEM BMP
ROCK DROP STRUCTURE

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NOTES:
1. REFER TO THE DIMENSION TABLE ON THIS SHEET FOR DIMENSIONS DESIGNED WITH A LETTER. THESE DIAMETERS ARE UNIQUE TO EACH DROP STRUCTURE LOCATION.
2. ALL COSTS ASSOCIATED WITH CONSTRUCTION OF THE DROP STRUCTURES WILL BE INCLUDED WITH BID ITEM RANDOM RIPRAP CLASS III.
Problem/Symptom: Channel Backcutting causing Slope Failure

Cause: Too much drop, Excessive Slope

BMP Solution: Install a Series of Rock Drop Structures to control grade line

ON-SYSTEM BMP ROCK DROP STRUCTURE
ON-SYSTEM BMP
TOE WOOD SOD MAT

- AKA Wood Debris Bench

*General design details are credited to Dave Rosgen of Wildland Hydrology.
ON-SYSTEM BMP
TOE WOOD SOD MAT
ON-SYSTEM BMP
TOE WOOD SOD MAT
ON-SYSTEM BMP
ROCK RIFFLE GRADE CONTROL
THE BMP – ON SYSTEM ROCK DROP STRUCTURE
Problem/Symptom: Insufficient Channel Capacity

Cause: Limited space, insufficient channel cross-section

BMP Solution: Install a concrete Channel liner to improve channel capacity.
ON-SYSTEM BMP
SEDIMENT POND
ON-SYSTEM BMP DAM (ON-CHANNEL)
ON-SYSTEM BMP
WETLAND CREATION
A TALE OF TWO DITCHES
A TALE OF TWO DITCHES
ON-SYSTEM BMP
TWO-STAGE/NATURAL CHANNEL

May 4, 2016 Aerial
BMP SELECTION

- Few Closing Thoughts
  - Ideal Solution May Be A Combination Of On- And Off-system BMPs
  - May Want/Need To Address On-system BMPs
    - Off-system BMPs Can Take More Time To Implement Due To Their Voluntary Nature
  - The MPDM Wiki BMP table Provides Some Guidance
  - The BMP Selected May Open Funding Doors.

- All BMPs Require Professional Judgement

QUESTIONS?
MORE INFORMATION:
drainage.pca.state.mn.us
houstoneng.com

THANK YOU