POLICY NO.: Technical Policy, TECH-006

EFFECTIVE DATE: March 23, 2006
REVISED: 8/31/2009, 11/2/2015

POLICY NAME: Erosion Protection of Fill Pads in Floodway Fringe Areas

PURPOSE: To clarify Section 16.26.040.B of the Ordinance regarding the protection of the fill pads from erosion in order to establish consistent permitting requirements that are sufficiently protective of the fill pad and structure for the flood and erosion hazards that have been identified.

BACKGROUND:

The Floodplain and Erosion Hazard Management Ordinance (Ordinance) Section 16.26.040.B requires that any fill placed in a floodway fringe be adequately protected from erosion by rip-rap, vegetative cover, bulk-heading, or other approved method, but does not establish appropriate levels of erosion protection based on the hazards that may be encountered due to the erosive forces of moving water. In addition, the Ordinance encourages the placement of the least amount of fill necessary to achieve the purpose.

Historically, the need for erosion protection has not been strictly addressed at the time of permitting and therefore, erosion protection may not have been provided. The March 23, 2006 version of the policy addressed this deficiency with reference to the following publications:

2) The 2005 draft of FEMA85.

Refer to the March 23, 2006 version of the policy for a discussion regarding about these publications.

Since 2006, new requirements have been promulgated and new information has become available, both of which affect this policy. The new requirements and information are as follows:

1) In October 2008, the State of Arizona’s Office of Manufactured Housing (OMH) informed the District of new federal installation requirements for Manufactured Homes. One of these new requirements was for engineered foundations in all floodplains. These new requirements would become effective on January 1, 2009.

2) On January 3, 2009, the Chief Engineer approved Technical Policy TECH-003 which established construction standards for manufactured home foundations. These were considered by the District to be engineered foundations that were compliant with OMH requirements.

3) On February 19, 2009, the Arizona Housing Association requested that the District reevaluate the standards for fill pads in an effort to reduce the fill pad dimension to 10 feet around the exterior
wall of a structure from 25 feet in order to reduce construction costs while offering the same level
of protection.

4) The District commenced an evaluation of the flooding effects on fill pads using FLO-2D modeling. This reanalysis provided significant insights regarding the flow of water around fill pads, demonstrating that the previous policy may not offer sufficient protection at the upstream edge and corners of fill pads, and may be over protective at the downstream edge of fill pads.

POLICY:

This policy may be used to determine erosion protection for fill pads, including toe down depths, rip-rap size, and pad side slope, as long as the following conditions are met:

1) The fill pad does not encroach into an Erosion Hazard Setback, a study area that establishes a requirement for an engineering analysis or an area that the District has determined that, due to unusual conditions, engineering is required. If a fill pad is proposed in these areas, the engineering analysis requirements supersede this policy.

2) The fill pads are constructed according to the appropriate tables. Tables have been provided for a 40 foot wide fill pad and an 80 foot wide fill pad. Table 006-A may be used for fill pads that are 40 feet wide or less, but Table 006-B shall be used for fill pads with widths greater than 40 feet, up to and including 80 feet.

3) Fill pad erosion protection shall be constructed at the following locations as prescribed below:
   a. When the fill pad is surrounded by floodwaters:
      i. A toe-down depth is prescribed along the entire upstream edge of the fill pad and at least 10 feet along the sides of the fill pad extending from the upstream corners,
      ii. A second toe-down depth is prescribed along the remaining perimeter of the fill pad,
      iii. The rip-rap diameter sizing table shall apply to the entire fill pad.
   b. When the fill pad is not surrounded by floodwaters:
      i. One toe-down is prescribed along the upstream edge and at least 10 feet along the side of
         the fill pad that are located within the 100-year floodplain,
      ii. A second toe-down depth is prescribed along the remaining perimeter of the fill pad that
         experience flood flows,
      iii. The rip-rap diameter sizing table shall apply to all portions of the fill pad that are located
         within the 100-year floodplain,
      iv. The portions of the fill pad that are not exposed to floodwaters do not require erosion
         protection.

4) The fill pad is oriented with the long axis parallel to the direction of flow. This will minimize the flow obstruction and reduce the anticipated scour depths to those presented in the attached Tables.

5) The fill pad shall be constructed at or above the BFE and shall extend at that elevation a minimum of 10 feet from the perimeter of the structure.
   a. The top of the fill pad shall be sloped a minimum of 2% in order to provide positive drainage away from the structure. As a result, the portion of fill pad adjacent to the structure will be a minimum of 0.2 feet (2.4") above the BFE.
b. Once the fill pad extends 10 feet beyond the exterior walls of the structure, it may be sloped down to natural grade,
   i. The side slopes shall be no steeper than 3:1 when no erosion protection or dumped rock rip-rap erosion protection is proposed.
   ii. The side slopes may be as steep as 1:1 when grouted rip-rap or gunite slope erosion protection is proposed.

6) Erosion protection shall be constructed pursuant to the following description, and shall be considered the minimum amount necessary unless an alternative is justified by an Arizona registered engineer:

   a. Toe-down – The toe-down refers to the depth below natural grade of the erosion protection and may be constructed in one of two ways. Either the rip-rap can be continued at the same side slope below natural grade until the upper surface of the rip-rap reaches the required toe-down depth, or the below grade portion may be constructed as a 12-inch thick vertical concrete cut-off wall that extends below natural grade to the toe-down depth. It is NOT acceptable to place the rip-rap vertically below natural grade. See Figures 006 A, b, and C for fill pad construction for additional requirements.

   b. Rip-rap sizing - The site plan shall specify the diameter \((D_{50})\) of the rip-rap from the appropriate Table and shall contain a note that states that the rip-rap is angular, durable, free of organic material, and meets the requirements provided on the construction detail. In addition, the site plan shall specify that the fill be protected by the use of geo-textile filter fabric underlying rock rip-rap, that the minimum rip-rap blanket thickness be twice the diameter of the minimum rip-rap diameter \((D_{50})\), and extend below natural grade to the required toe-down depth. See Figure for fill pad construction for additional requirements.

7) Fill pad details and specifications shall either be shown on the site plan, or the appropriate Figure(s) referenced on the site plan.

APPROVED BY:

Suzanne Shields
Director Date

Original Policy Approved: March 23, 2006
Date(s) Revised: 8/31/2009, 11/2/2015
# TABLE 006-A

40 Foot Wide Fill Pad

RIP-RAP SIZE & TOE-DOWN DEPTH REQUIREMENTS FOR EROSION PROTECTION OF FILL PADS

PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT TECHNICAL POLICY TECH-006

## TOE-DOWN DEPTH BELOW NATURAL GRADE FOR UPSTREAM EDGE AND CORNERS OF 40 FOOT WIDE FILL PAD

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* no toe-down required, see below for rip-rap size for exposed slopes

24 inches

24 inch toe-down required, see below for rip-rap size

36 inches

36 inch toe-down required, see below for rip-rap size

48 inches

48 inch toe-down required, see below for rip-rap size

= Engineering required

## TOE-DOWN DEPTH BELOW NATURAL GRADE FOR SIDES AND DOWNSTREAM EDGE OF 40 FOOT WIDE FILL PAD

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* no toe-down required, see below for rip-rap size for exposed slopes

24 inches

= 24 inch toe-down required, see below for rip-rap size

36 inches

= 36 inch toe-down required, see below for rip-rap size

48 inches

= 48 inch toe-down required, see below for rip-rap size

= Engineering required

## RIP-RAP SIZE (D50)

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* No rip-rap on sides, back; 6 inch rip-rap on front and upstream corners

None/6 in.

6 inches

= 6 inch rip-rap

9 inches

= 9 inch rip-rap

= Engineering required
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**TOE-DOWN DEPTH BELOW NATURAL GRADE FOR SIDES AND DOWNSTREAM EDGE OF 80 FOOT WIDE FILL PAD**

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**RIP-RAP SIZE (D50)**

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* DV^2 greater than 18

* No toe-down required, see below for rip-rap size for exposed slopes
* 24 inches
* 36 inches
* 48 inches
* Engineering required

* No rip-rap on sides, back; 6 inch rip-rap on front and upstream corners
* None/6 in.
* 6 inches
* 9 inches
* Engineering required
3:1 (H:V) STEEPEST BANK SLOPE FOR DUMPED RIPRAP.

TOP OF FILL PAD
GRADE TO DRAIN @ 2% SLOPE

WEAVE FABRIC INTO RIPRAP MIN 2 FT UPSLOPE END OF BLANKET

MINIMUM BLANKET THICKNESS = 20"G

COMPACTED OR UNDISTURBED SOIL

FILTER FABRIC PER REF IN NOTE 2, SECTION 913 BANK PROTECTION AND SECTION 1014 GEOSYNTHETICS. MIRAFI 180N MEETS MIN MATL SPECS OUTLINED IN SECTION 1014-5 BANK PROTECTION FABRIC

WEAVE FABRIC INTO RIPRAP MIN 2 FT DOWN SLOPE END OF BLANKET

ROCK RIPRAP: HARD, DURABLE ANGULAR STONE PER GRADATION BELOW & NOTE 1. MIN SP. GRAVITY=2.6

TOE-DOWN TO maximum anticipated SCOUR DEPTH (SEE NOTE 1)

COMPACTED SOIL

WRAP FABRIC MIN 2 FT AROUND BASE OF BLANKET ON DOWN-SLOPE END

OPTION A
EXTENSION OF DUMPED RIPRAP BLANKET BELOW GRADE

OPTION B
CONCRETE CUTOFF WALL BELOW GRADE

COMPACTED OR UNDISTURBED SOIL, TYP

#3 REBAR @ 6" OR #4 REBAR @ 12" BOTH WAYS

NATURAL GRADE

CUTOFF WALL
3000 PSI CONCRETE
(SEE NOTE 3)

12" MIN.

FILTER FABRIC PER REF IN NOTE 2, SECTION 913 BANK PROTECTION AND SECTION 1014 GEOSYNTHETICS. MIRAFI 180N MEETS MIN MATL SPECS OUTLINED IN SECTION 1014-5 BANK PROTECTION FABRIC

NOTES
1. Dso AND TOE-DOWN DEPTH FROM TABLE TITLED: "RIPRAP AND TOE-DOWN REQUIREMENTS FOR EROSION PROTECTION OF FILLPADS IN FLOODWAY FRINGE AREAS":
   TABLE 006-A 40-FOOT WIDE FILL PAD, AND
   TABLE 006-B 80-FOOT WIDE FILL PAD

2. UNLESS NOTED OTHERWISE HERIN, ALL MATERIAL & INSTALLATION PER "STANDARD SPECIFICATIONS FOR PUBLIC IMPROVEMENTS", CURRENT ED.

3. CONCRETE CUTOFF WALL (OPTION B) MAY BE SUBSTITUTED FOR TOE-DOWN OF DUMPED RIPRAP BLANKET (OPTION A) BELOW GRADE. (OPTIONS A AND B SHOWN ABOVE REFER ONLY TO THE BELOW GRADE PORTION OF THE EROSION PROTECTION. SELECTED OPTION MUST BE USED EXCLUSIVELY. A HYBRID OF THE TWO OPTIONS IS NOT ALLOWED.)

DUMPED/HAND-PLACED RIPRAP GRADATION

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<th>% PASSING</th>
<th>SIZE</th>
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<tbody>
<tr>
<td>100 - 90</td>
<td>2.00 Dso</td>
</tr>
<tr>
<td>85 - 70</td>
<td>1.50 Dso</td>
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<tr>
<td>50 - 30</td>
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<tr>
<td>15 - 5</td>
<td>0.67 Dso</td>
</tr>
<tr>
<td>5 - 0</td>
<td>0.33 Dso</td>
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</table>

FIGURE 006-A
DUMPED RIPRAP EROSION PROTECTION OF FILL PADS IN FLOODWAY FRINGE AREAS
SCALE: NONE
DRAWN BY: sak
DATE: AUG 2009
GROUTED RIPRAP GRADATION

<table>
<thead>
<tr>
<th>% PASSING</th>
<th>SIZE</th>
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<tbody>
<tr>
<td>100</td>
<td>1.50 D₅₀</td>
</tr>
<tr>
<td>0</td>
<td>0.67 D₅₀</td>
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</tbody>
</table>

CONSTRUCT 2x4 KEY, EXTEND REBAR MIN. 12 INCHES ABOVE KEY, BEND REBAR AND TIE TO WWF

OPTION A
EXTENTION OF GROUTED RIPRAP BLANKET BELOW GRADE

1. TOE-DOWN DEPTH FROM TABLE TITLED: "RIPRAP AND TOE-DOWN REQUIREMENTS FOR EROSION PROTECTION OF FILL PADS IN FLOODWAY FRINGE AREAS":
   TABLE 006-A 40-FOOT WIDE FILL PAD, AND TABLE 006-B 80-FOOT WIDE FILL PAD

2. FOR D₅₀=6 INCHES, USE W3.5xW3.5. FOR D₅₀=9 INCHES, USE W5.5 x W5.5.

OPTION B
CUTOFF WALL BELOW GRADE

3. UNLESS NOTED OTHERWISE HEREIN, ALL MATERIAL & INSTALLATION PER STANDARD SPECIFICATIONS FOR PUBLIC IMPROVEMENTS*, CURRENT ED.

4. CONCRETE CUTOFF WALL (OPTION B) MAY BE SUBSTITUTED FOR TOE-DOWN OF GROUTED RIPRAP BLANKET (OPTION A) BELOW GRADE. (OPTIONS A AND B SHOWN ABOVE REFER ONLY TO THE BELOW GRADE PORTION OF THE EROSION PROTECTION. SELECTED OPTION MUST BE USED EXCLUSIVELY. A HYBRID OF THE TWO OPTIONS IS NOT ALLOWED.)

FIGURE 006-B
GROUTED RIPRAP EROSION PROTECTION OF FILL PADS IN FLOODWAY FRINGE AREAS

SCALE: NONE
DRAWN BY: sjak
DATE: AUG 2009
FIGURE 006-C
GROUTED OR DUMPED RIPRAP EROSION PROTECTION OF FILL PADS IN FLOODWAY FRINGE AREAS

SCALE: NONE
DRAWN BY: sak
DATE: AUG 2009

NOTES:
1. EXAMPLE SHOWN: 100 YR FLOW
   DEPTH = 1 FT, HANG = 2001.5 FT EL.
   LAND SLOPE = 0.022, 16 FT BY 80 FT
   MHL FILL PAD WIDTH = 36 FT, FROM
   TABLE 006-A (FOR 40-WIDE FILL PAD):
   D50 = 9 IN, TOE-DOWN US EDGE,
   CORNERS = 3 FT, TOE-DOWN SIDES,
   D/S EDGE CORNERS = 2 FT.