Attachment A

FLO-2D (V. 2009, Pro) Technical Guidance for Hydrologic and Hydraulic modeling in Unincorporated Pima County, Arizona

Effective Date: April 20, 2021

This version of the guidance document *has not* been adopted by the Pima County Board of Supervisors. Effective this date, it is to be implemented in its draft form and utilized on a case-by-case basis.

Purpose: To provide guidance for and standards regarding floodplain modeling using the FLO-2D (versions 2009, Pro) software package, with the intent of improving the consistency of modeling results generated by Pima County Regional Flood Control District (District) staff and modeling submitted to the County by qualified applicants.

The following guidance document is provided as **Attachment A** to the District's Technical Policy, TECH-033: *Criteria for Two Dimensional Modeling*.

Background: FLO-2D is a proprietary computer software program that conducts two-dimensional rainfall-runoff models. Two-dimensional models like FLO-2D provide an analytical environment suitable for mapping distributary flow conditions common to the southern Arizona terrain. FLO-2D (versions 2009, Pro) is FEMA approved to support hydrologic and hydraulic analyses in Pima County, Arizona.

Suzanne Shields, P.E. Date
Director

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11. OUTFLOW.DAT
    a. NODDC(I) (Grid Elements with Outflow)
12. FPXSEC.DAT
    a. NODX(N,J) (Grid Elements of Cross Section)
    b. IFLO(N) (Direction of Expected Flow)
13. CHAN.DAT
14. STREET.DAT
15. LEVEE.DAT

Technical Guidance

1. **Application**
    a. Written justification for the use of a FLO-2D model to support a hydrologic and/or hydraulic analysis submittal to the District shall be provided.
    b. It is recommended to discuss the use of FLO-2D with the District prior to conducting any significant modeling efforts.
    c. The latest version/build number of FLO-2D should be used for analyses submitted to the District.

2. **Verification**
    a. To verify the accuracy of the FLO-2D modeling results, the District may request the submittal of additional information. Data requests may include, but are not limited to comparisons to other modeling processes and/or observed data sets, including:
        i. Gauge data
        ii. NextRAD data
        iii. Regression equations
        iv. Volumetric comparisons
        v. HEC-HMS , HEC-RAS
        vi. Aerial photography
        vii. TR-55 travel time

3. **Grid Element Size (ft.)**
    a. Grid size should be a function of the purpose of the model. The following provides guidelines for selecting the appropriate grid size.
        i. If possible, grid element size should be equal to or greater than twice the average DTM point spacing.
        ii. For hydraulic modeling, the grid size shall be no greater than 30 ft.
        iii. For hydrologic modeling, the grid size area (square-feet) should be no greater than one-tenth of the peak discharge (cfs) being modeled.
        iv. In order to properly simulate travel times through well-defined or visible (sand bed) channels and linear features (street) for accurate hydrologic modeling, the modeling effort should maximize the faithful reproduction of the channel/street geometry. Where two or more grids fit within the bottom of the channel or street, no 1-D channel/street segments are required. However, where geometry of street/visible channels cannot be faithfully simulated with the grid, then inclusion of 1-D channel/street segments is recommended, or application of other methods to correct the overland flow times for the slower velocity due to the poor reproduction of channel geometry.
    b. Written documentation stating the origin and specifics of the DTM data used for modeling shall be provided. In particular, provide at a minimum the date the elevation data was collected, the vertical and horizontal datum that was used to collect the data, the method of collection, and a statement of both horizontal and vertical accuracy and average sampling size.
    c. The District recommends that the applicant pursue and receive approval of grid size selection prior to initiating substantial modeling efforts.

Input Files (*.DAT Files)

4. CONT.DAT

a. SIMULT (Simulation Time, hours)
   i. Simulation time shall be set to capture the maximum depth condition for all grid cells.
   ii. Simulation time should, at minimum, extend into the receding limb of the hydrograph being modeled, capturing the peak discharge conditions throughout the areas of interest.
   iii. Should flood volume be of interest to the analysis, the simulation time should extend until minimal flooding occurs through the areas of interest.

b. TOUT (Output Time Interval, hours)
   i. The output time interval shall be set small enough for the model to construct accurate output hydrographs.

c. AMANN (Manning's n Coefficient Increment)
   i. The AMANN parameter should be turned off (set to -99). Written justification is required for AMANN values not set to -99 (see SHALLOWN guidance).

d. FROUDL (Limiting Froude Number)
   i. A global Limiting Froude Number should be used, typically within the range of 0.90-0.95.
   ii. For grid cells with steep slopes or smooth, armored surfaces where supercritical flow may occur, FROUDL may be set at 1.2 or higher.
   iii. FROUDL may be spatially variable.
   iv. For Limiting Froude Number for Channels (FROUDC) and for Streets (STRFNO), see CHAN.DAT and STREET.DAT, respectively.
   v. Review of the ROUGH.OUT and TIME.OUT output files is recommended to aid verification of proper roughness selections against resulting Froude numbers.

e. SHALLOWN (Shallow Manning's n Coefficient)
   i. SHALLOWN should be not be used unless written justification is provided that demonstrates roughness varies by depth.
   ii. The SHALLOWN parameter is not used when AMANN is turned off (set to -99).
   iii. The SHALLOWN parameter may be set to a value between 0 and 0.2 for watersheds that are predominately natural when it is determined that roughness varies by depth.
   iv. Unless otherwise justified, the SHALLOWN parameter should not be used for highly urbanized watersheds when unreasonably low velocities occur over smooth impervious surfaces compared to normal depth calculations.

5. TOLER.DAT

a. TOLGLOBAL (Surface Detention, ft)
   i. The TOLGLOBAL parameter should be set to 0.01 ft (0.12 in) for rainfall-runoff modeling.
   ii. The TOLGLOBAL parameter may be spatially variable, implementing the TOLSPATIAL.DAT file.

iii. A written description of the TOLGLOBAL parameter used in the model shall be provided. Justification shall be provided when the TOL parameter is not set to the default value of 0.01 ft (0.12 in), and/or when spatially variable.

b. DEPTOL (Tolerance Value for Percent Change in Flow Depth)
   i. The DEPTOL parameter shall be set to zero (turned off).
   ii. Written justification shall be provided when the DEPTOL parameter is not set to zero.

c. COURANT (Numerical Stability Coefficient)
   i. COURANT should be set to the default value of 0.6.
   ii. If the model is stable, increase COURANT by increments of 0.1, to a maximum of 0.8, to decrease model runtime. If the model is unstable, reduce COURANT by increments of 0.1, to a minimum of 0.3, until model stability is reached.

d. TIME_ACCEL (Coefficient to increase the rate if incremental timestep)
   i. TIME_ACCEL should be set to the default value of 0.1, creating a more stable simulation.
   ii. TIME_ACCEL set to a value of 0.2 or greater may result in faster simulations and should be accompanied by a statement ensuring model run stability and output accuracy.

6. INFIL.DAT

a. INFMETHOD (Infiltration Method)
   i. Hydrologic modeling shall employ the SCS Curve Number Method, consistent with Technical Policy TECH-018: *Acceptable Model Parameterization for Determining Peak Discharges*.

b. SCSN(N) (Spatially Variable SCS Curve Number)
   i. The Curve Number shall be spatially variable to match soil, vegetation, and land use conditions specific to the individual grid cells. Impervious surfaces providing flood storage (i.e. roads, parking lots) should be simulated with a modified curve number.

c. ABSTSCS (Initial Abstraction, inches)
   i. ABSTSCS shall be set to zero, which will trigger F2D to automatically calculate the initial abstraction per the SCS method.

7. ARF.DAT

a. ARF (Area Reduction Factors)
   i. For hydrologic models, ARF values should be used to simulate impervious surfaces that do not provide flood storage (i.e. buildings with roofs). ARF values for individual grid cells shall be consistent with *Table D-3: Summary of Approximate Impervious Cover Percentages for Various Land Development Types*, from Pima County's current PC-Hydro User Guide.

b. WRF (Width Reduction Factor)
   i. Any use of the WRF parameter shall include a written justification.

8. RAIN.DAT

a. Application (-)

i. For a hydrologic-only model, the RAIN.DAT file shall be used.
ii. For a hydraulic-only model, the RAIN.DAT file shall not be used.
iii. For a hydrologic-hydraulic mixed model, the RAIN.DAT file shall be used.

b. IRAINBUILDING
    i. When using ARF.DAT to simulate the impervious cover of buildings' roofs,
        1. IRAINBUILDING shall be set to zero (0) if the roofs convey stormwater directly to the storm drain system, through which it is eliminated as runoff.
        2. IRAINBUILDING shall be set to one (1) if the roofs convey stormwater to the ground and contributes to runoff.
        3. A written statement shall be provided regarding the setting of IRAINBUILDING.
c. RTT (Rainfall Depth, Total, inches)
    i. The total rainfall depth shall be consistent with Technical Policy TECH-010: *Rainfall Input for Hydrologic Modeling*.
d. RAINABS (Rainfall interception and abstraction, inches)
    i. RAINABS shall be set to zero. Infiltration of rainfall shall be modeled with INFIL.DAT.
    ii. A written justification shall be provided when the interception and abstraction of rainfall is being modeled.
e. R_TIME(I) (Rainfall Time, hours)
    i. The rainfall distribution shall be consistent with Technical Policy TECH-018: *Acceptable Model Parameterization for Determining Peak Discharge*, and equivalent to any inflow hydrographs (see INFLOW.DAT) within the model.
f. R_DISTR(I) (Rainfall Depth, cumulative percentage)
    i. See "R_TIME(I)" above.
g. RAINARF(I) (Rainfall Depth Area Reduction)
    i. Rainfall depth may be spatially variable, while maintaining consistency with Technical Policies TECH-010: *Rainfall Input for Hydrologic Modeling* and TECH-033: *Criteria for Two-Dimensional Modeling*.
    ii. RAINARF, a value between 0 and 1, is multiplied against the total rainfall depth, RTT, to calculate and assign the reduced rainfall depth to the coordinating grid cells, IRGRID(I).

9. MANNINGS_N.DAT

a. FP(I,J) (Manning's n Roughness Coefficient)
    i. The Manning's n roughness coefficient shall be spatially variable to match the surface roughness conditions specific to the individual grid cells.
    ii. Table 1 (below), Table 1 in the *FLO-2D Reference Manual*, and Table 8.1 of the *Standards Manual for Drainage Design and Floodplain Management* provide suggested Manning's n values for various land use conditions:

Table 1: Suggested Manning's n roughness coefficients for specific land use conditions

n	*Land Use*
0.020	*Streets, Concrete Channels*
0.025	*Open Space, Lawn*
0.030	*Right of way (clear area beside pavement)*
0.035	*Commercial*
0.035	*Earth channels, constructed*
0.035	*Roadside swale*
0.040	*Office, Retail*
0.045	*Open Space, Light to Medium Brush*

n	*Land Use*
0.055	*Retail, Warehousing*
0.055	*Natural Vegetated Channels*
0.065	*Manufacture, Salvage*
0.065	*Open Space, dense and Densely Vegetated Natural Channels*
0.065	*Residential*
0.070	*Industrial*
0.100	*Agriculture*
0.100	*Detention Basin*

iii. Manning's n roughness coefficients obtained from other sources shall be identified and supported with a written justification.

10. INFLOW.DAT

a. IHOURDAILY (Inflow Hydrograph Time Unit)
   i. The time unit for inflow hydrographs shall be hourly (IHOURDAILY set to 0).
b. KHIN(I) (Grid Elements with Inflow Hydrograph)
   i. An inflow hydrograph should be evenly divided among the adjacent grid cells that represent an estimated top-width of the main-channel at the location of the inflow hydrograph. A normal depth calculation of the peak discharge at the location of the inflow hydrograph may be requested.
   ii. If multiple models occur in series (upstream to downstream), the outflow hydrograph of the upstream model shall equal the inflow hydrograph of the downstream model.
   iii. All inflow hydrographs shall be generated from the same rainfall distribution. For a hydrologic-hydraulic mixed model, the rainfall distribution used to generate the inflow hydrographs shall equal the rainfall distribution of RAIN.DAT.

11. OUTFLOW.DAT

a. NODDC(I) (Grid Elements with Outflow)
   i. To avoid boundary condition influence, outflow elements should be placed a minimum of five (5) grid cells downstream of the area of interest.
   ii. Grid cells assigned as outflow nodes should not be assigned other cell node functions, including but not limited to ARF/WRF nodes, hydraulic structure nodes, inflow nodes, and levee nodes.

12. FPXSEC.DAT

a. NODX(N,J) (Grid Elements of Cross Section)
    i. Discharge recording cross sections should be placed throughout the model at points of interest. Cross sections should be aligned perpendicular to the direction of the expected flow.

b. IFLO(N) (Direction of Expected Flow)
    i. The general direction of expected flow should be assigned to the cross section with a positive integer, corresponding to one of the eight cardinal directions, to account for flow occurring in the neighboring directions:

1. North	5. Northeast
2. East	6. Southeast
3. South	7. Southwest
4. West	8. Northwest

    ii. Written justification shall be provided if discharge in a specific single direction, obtained by using a negative integer, is collected at a discharge recording cross section.

13. CHAN.DAT

a. A written justification shall be provided for any use of the CHAN.DAT input file.

14. STREET.DAT

a. A written justification shall be provided for any use of the STREET.DAT input file.

15. LEVEE.DAT

a. A written justification shall be provided for any use of the LEVEE.DAT input file.

PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT'S
TECHNICAL POLICY

POLICY NO: Technical Policy, TECH-033 **EFFECTIVE DATE:** August 1, 2013
REVISION DATE: 5/18/21

POLICY NAME: Criteria for Two-Dimensional Modeling

PURPOSE: To standardize Two-Dimensional Modeling for hydrologic and /or hydraulic studies in Pima County, Arizona.

BACKGROUND: Two-Dimensional (2-D) flood routing modeling is typically used in those areas where flows are distributary and/or non-uniform and where the terrain is too complex to be modeled accurately by one-dimensional models designed for riverine floodplains. The changes in flow patterns associated with such runoff make it necessary to utilize 2-D models that react both to the terrain and hydraulic fluctuations through the duration of the flood hydrograph. A 2-D model can include rainfall and/or runoff modeling. This policy outlines the Pima County Regional Flood Control District's (District) standards for 2-D model submittals ~~for watersheds less than 10 square miles~~.

POLICY:

Two-Dimensional (2-D) modeling reports submitted to the District for review shall adhere to the following procedures:

A. The report shall state the name, ~~and the~~ version and build number of the 2-D model used. Be aware some models and versions may not be considered a hydrologic and/or hydraulic numerical model meeting the minimum requirements to be acceptable for remapping a floodplain through the Federal Emergency Management Agency (FEMA). The 2-D model submitted to the District must be in a version the District is able to review.

B. Unless otherwise approved by the District, the 2-D model and subsequent map products shall contain digitally projected data with the following projection control:

- Projection: ~~=~~ State Plane, Arizona Central Zone
- Horizontal Datum : ~~=~~ NAD83-92(HARN)
- Units: ~~=~~ International Feet
- Vertical Datum: -NAVD-88

C. The digital elevation data shall be incorporated into the 2-D model using the following criteria:

1. The ~~selected~~ grid size must ~~be able to~~ capture the detail required for the project, and digital elevation data must be adequate to support the selected grid resolution. The engineer shall provide justification for the size of the grid elements. It is

recommended the engineer discuss the grid element size with the District before conducting the study.

2. Two dimensional models allow for flow to spread out across the Digital Elevation Model (DEM). Therefore it is often necessary to extend the limits of the DEM upstream and downstream from the project site to allow for the natural expansion and contraction of the flow through the duration of the hydrograph.

3. An electronic copy of the DEM in ASCII format is to be supplied to the District if the data does not come from an accessible public source. If from a public source, the source shall be identified in the report.

D. Hydrology can be modeled with some 2-D modeling software although the software may limit the type of hydrologic methods used. When using 2-D software to perform hydrologic modeling, the following criteria shall be followed:

1. Watershed delineation may be difficult due to the distributary nature of the ~~watershed~~terrain. The watershed delineation shall include all potential contributing drainage areas and locations of interest. In addition to the DEM, the use of aerial photography, including historical aerial photography is recommended to discern watershed boundaries. Preliminary models may be useful to determine the location of breakout flows from the contributing watershed.

2. Modeling criteria shall follow District *Technical Policies TECH-010, TECH-015 and TECH-018*.

3. The rainfall values are not to be aerially-reduced unless approved otherwise by the District.

4. In order to reduce the size of or otherwise limit the upstream modeling extent of the 2-D model, hydrologic modeling of portions of the watershed upstream of the project may be accomplished by methods presented in *Technical Policy TECH-018*, and the resulting flood hydrograph may be input into the 2-D model as inflow hydrographs. Rainfall shall be added to the model downstream of inflow hydrographs, unless the engineer justifies that adding rainfall will not have any significant impact to the total inundation maps or the total flow volume. The rainfall distribution shall be the same as the design storm used to produce the inflow hydrograph.

   The following criteria shall be applied to create rainfall distribution for cases where PC-Hydro is used to create the inflow hydrographs:

   a. When the watershed is less than one square mile, or results in a PC-Hydro time of concentration of less than one hour, the NOAA Atlas 14 Point Precipitation Values from the Upper 90% confidence limit values for the 5, 10, 15, 30 and 60 minute storms are to be used to create a rainfall distribution. These rainfall Intensity-Duration-Frequency (IDF) values are to be used with the peak intensity rainfall value centered in the Isohyetal graph for a total duration of one hour.

~~b. When the watershed modeled by PC-Hydro has a time of concentration of between one hour and two hours, the NOAA Atlas 14 Point Precipitation Values from the Upper 90% confidence limit values for the 5, 10, 15, 30, 60 and 120 minute storms are to be used to create a rainfall distribution. These rainfall Intensity-Duration-Frequency (IDF) values are to be used with the peak intensity rainfall value centered in the Isohyetal graph for a total duration of two hours.~~

~~c.~~b. If other hydrological criteria are to be used other than that described above, the hydrological methodology is to be discussed with and approved by the District prior to report submittal.

5. Hydraulic modeling of 2-D models are to follow the following guidelines:

   a. Multiple runs may be necessary in dynamic distributary areas. Dynamic distributary areas are regions in which there is a greater chance of flow redistribution overtime. Dynamic distribution areas are subject to channel avulsion and sedimentation. Such areas may also be susceptible to debris changing the discharge distribution. Multiple floodplain models may be necessary to account for flow re-distribution. Multiple runs may include but are not necessarily limited to creating channel blockage (or levee) situations to force more flow into other paths, or increasing the discharge values along each flow path. The multiple runs are to be combined to create a map from the maximum depths, water surface elevations and flows. Careful examination of the site conditions, soils, historical aerial photography and hydraulic conditions are warranted prior to developing the flow variables. Consultation with District staff is recommended prior to mapping flows in active distributary areas.

   b. Hydraulic structures such as culverts, detention basins, levees, constructed channels or natural channels be modeled following the guidelines within the user's manual for the software program. The engineer is to provide a narrative description of the hydraulic structures modeled.

6. The output of a 2-D model is to include the following:

   a. The output data <u>for the entire modeling domain, in the form of gridded shapefile or raster image</u> is to include:

      <u>i. Grid identification (#)</u>
      <u>ii. Ground elevation (ft. above mean sea level in the vertical datum currently used by the District)</u>
      ~~i.~~<u>iii.</u> Maximum ~~F~~<u>f</u>low <u>d</u>~~D~~<u>D</u>epth <u>(ft.)</u>
      ~~ii.~~<u>iv.</u> Maximum <u>w</u>~~W~~<u>W</u>ater <u>s</u>~~S~~<u>S</u>urface <u>e</u>~~E~~<u>E</u>levation <u>(ft. above mean sea level)</u>
      ~~iii.~~<u>v.</u> Maximum <u>v</u>~~V~~<u>V</u>elocity <u>(ft/s)</u>
      ~~Peak Discharge~~

b. Unique output data may be required depending on type of project. Such output data may include but is not necessarily limited to:

i. Flow vectors (direction)
ii. Duration of inundation (hrs.)
iii. flow depth > 3 feet

iv. Momentum computations such as
1. velocity * depth (ft^2/s)
2. velocity-squared * depth (ft^3/s^2)

~~velocity times depth of flow or the square of the velocity times depth of flow~~
~~Duration of inundation~~

c. If floodplain flow-recording cross sections are generated, the placement of the cross sections are to ~~include peak discharge values which will be the summation of discharge values from grid cells across the cross section. When practicable, the placement of the cross section is to~~ be perpendicular to the flow path as determined at the moment of maximum inundation. Output generated from the flow recording cross sections shall include:

i. ~~–~~Cross Section identification number (#)
ii. Peak discharge (cfs)
iii. Total volume (acre-ft)
iv. Hydrograph

~~c. Shape file data is required by the District with 2-D models. Data is to include:~~
~~d.~~
~~e. Separate grid shape files for:~~
~~f. Grid identification~~
~~g. Ground elevation~~
~~h. Maximum flow depth from data output~~
~~i. Maximum water surface elevation from data output~~
~~j. Maximum velocity from data output~~
~~k.~~
~~l.~~
~~m. Unique shape file data may be required depending on type of project. Such output data may include but is not necessarily limited to:~~
~~n. Flow vectors~~
~~o. Momentum data such as velocity times depth of flow or the square of the velocity times depth of flow~~
~~p. Duration of inundation~~
~~q.~~
~~r.~~d. When practicable, water surface contours generated from maximum water surface elevation data.

e. Floodplain inundation feature classes may be requested by the District. In order to generate a useful floodplain management tool, polygon shapefiles should have:

i. Vertices reduced to simplify the data management stress on GIS platforms.
ii. Smooth boundary limits to match the digital terrain and aerial photography.
iii. Disconnected floodplain polygons reduced or eliminated.
iv. Isolated non-inundation areas within the greater floodplain area reduced or eliminated.

f. The engineer shall include point or line shapefiles for the hydraulic structures.

~~B. The engineer is also to include point or line shape files for the hydraulic structures.~~

7. ~~In addition to traditional hydrologic and hydraulic map products, reports submitted with 2-D models shall include paper and/or PDF map(s) with the grid elements shown with grid identification numbers. When~~H~~ h~~ydrologic and hydraulic work maps ~~are provided they s~~shall be prepared in conformance with *District Standard DS-305.*

8. The report is to include the digital 2-D model input and output data on disk, ~~or~~ portable hard drive, or an FTP shared access website.

9. Technical guidance for hydrologic and hydraulic modeling utilizing the FLO-2D (V. 2009, Pro) software is provided as Attachment A.

APPROVED BY:

_____ _____

Suzanne Shields, P.E. **Date**
Director and Chief Engineer

Original Policy Approved: 8/1/13
Date(s) Revised: 5/18/2021

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    a. Grid size should be a function of the purpose of the model. The following provides guidelines for selecting the appropriate grid size.
        i. If possible, grid element size should be equal to or greater than twice the average DTM point spacing.
        ii. For hydraulic modeling, the grid size shall be no greater than 30 ft.
        iii. For hydrologic modeling, the grid size area (square-feet) should be no greater than one-tenth of the peak discharge (cfs) being modeled.
        iv. In order to properly simulate travel times through well-defined or visible (sand bed) channels and linear features (street) for accurate hydrologic modeling, the modeling effort should maximize the faithful reproduction of the channel/street geometry. Where two or more grids fit within the bottom of the channel or street, no 1-D channel/street segments are required. However, where geometry of street/visible channels cannot be faithfully simulated with the grid, then inclusion of 1-D channel/street segments is recommended, or application of other methods to correct the overland flow times for the slower velocity due to the poor reproduction of channel geometry.
    b. Written documentation stating the origin and specifics of the DTM data used for modeling shall be provided. In particular, provide at a minimum the date the elevation data was collected, the vertical and horizontal datum that was used to collect the data, the method of collection, and a statement of both horizontal and vertical accuracy and average sampling size.
    c. The District recommends that the applicant pursue and receive approval of grid size selection prior to initiating substantial modeling efforts.

Input Files (*.DAT Files)

4. CONT.DAT

a. SIMULT (Simulation Time, hours)
   i. Simulation time shall be set to capture the maximum depth condition for all grid cells.
   ii. Simulation time should, at minimum, extend into the receding limb of the hydrograph being modeled, capturing the peak discharge conditions throughout the areas of interest.
   iii. Should flood volume be of interest to the analysis, the simulation time should extend until minimal flooding occurs through the areas of interest.

b. TOUT (Output Time Interval, hours)
   i. The output time interval shall be set small enough for the model to construct accurate output hydrographs.

c. AMANN (Manning's n Coefficient Increment)
   i. The AMANN parameter should be turned off (set to -99). Written justification is required for AMANN values not set to -99 (see SHALLOWN guidance).

d. FROUDL (Limiting Froude Number)
   i. A global Limiting Froude Number should be used, typically within the range of 0.90-0.95.
   ii. For grid cells with steep slopes or smooth, armored surfaces where supercritical flow may occur, FROUDL may be set at 1.2 or higher.
   iii. FROUDL may be spatially variable.
   iv. For Limiting Froude Number for Channels (FROUDC) and for Streets (STRFNO), see CHAN.DAT and STREET.DAT, respectively.
   v. Review of the ROUGH.OUT and TIME.OUT output files is recommended to aid verification of proper roughness selections against resulting Froude numbers.

e. SHALLOWN (Shallow Manning's n Coefficient)
   i. SHALLOWN should be not be used unless written justification is provided that demonstrates roughness varies by depth.
   ii. The SHALLOWN parameter is not used when AMANN is turned off (set to -99).
   iii. The SHALLOWN parameter may be set to a value between 0 and 0.2 for watersheds that are predominately natural when it is determined that roughness varies by depth.
   iv. Unless otherwise justified, the SHALLOWN parameter should not be used for highly urbanized watersheds when unreasonably low velocities occur over smooth impervious surfaces compared to normal depth calculations.

5. TOLER.DAT

a. TOLGLOBAL (Surface Detention, ft)
   i. The TOLGLOBAL parameter should be set to 0.01 ft (0.12 in) for rainfall-runoff modeling.
   ii. The TOLGLOBAL parameter may be spatially variable, implementing the TOLSPATIAL.DAT file.

iii. A written description of the TOLGLOBAL parameter used in the model shall be provided. Justification shall be provided when the TOL parameter is not set to the default value of 0.01 ft (0.12 in), and/or when spatially variable.

b. DEPTOL (Tolerance Value for Percent Change in Flow Depth)
   i. The DEPTOL parameter shall be set to zero (turned off).
   ii. Written justification shall be provided when the DEPTOL parameter is not set to zero.

c. COURANT (Numerical Stability Coefficient)
   i. COURANT should be set to the default value of 0.6.
   ii. If the model is stable, increase COURANT by increments of 0.1, to a maximum of 0.8, to decrease model runtime. If the model is unstable, reduce COURANT by increments of 0.1, to a minimum of 0.3, until model stability is reached.

d. TIME_ACCEL (Coefficient to increase the rate if incremental timestep)
   i. TIME_ACCEL should be set to the default value of 0.1, creating a more stable simulation.
   ii. TIME_ACCEL set to a value of 0.2 or greater may result in faster simulations and should be accompanied by a statement ensuring model run stability and output accuracy.

6. INFIL.DAT

a. INFMETHOD (Infiltration Method)
   i. Hydrologic modeling shall employ the SCS Curve Number Method, consistent with Technical Policy TECH-018: *Acceptable Model Parameterization for Determining Peak Discharges*.

b. SCSN(N) (Spatially Variable SCS Curve Number)
   i. The Curve Number shall be spatially variable to match soil, vegetation, and land use conditions specific to the individual grid cells. Impervious surfaces providing flood storage (i.e. roads, parking lots) should be simulated with a modified curve number.

c. ABSTSCS (Initial Abstraction, inches)
   i. ABSTSCS shall be set to zero, which will trigger F2D to automatically calculate the initial abstraction per the SCS method.

7. ARF.DAT

a. ARF (Area Reduction Factors)
   i. For hydrologic models, ARF values should be used to simulate impervious surfaces that do not provide flood storage (i.e. buildings with roofs). ARF values for individual grid cells shall be consistent with *Table D-3: Summary of Approximate Impervious Cover Percentages for Various Land Development Types*, from Pima County's current PC-Hydro User Guide.

b. WRF (Width Reduction Factor)
   i. Any use of the WRF parameter shall include a written justification.

8. RAIN.DAT

a. Application (-)

i. For a hydrologic-only model, the RAIN.DAT file shall be used.
ii. For a hydraulic-only model, the RAIN.DAT file shall not be used.
iii. For a hydrologic-hydraulic mixed model, the RAIN.DAT file shall be used.

b. IRAINBUILDING
    i. When using ARF.DAT to simulate the impervious cover of buildings' roofs,
        1. IRAINBUILDING shall be set to zero (0) if the roofs convey stormwater directly to the storm drain system, through which it is eliminated as runoff.
        2. IRAINBUILDING shall be set to one (1) if the roofs convey stormwater to the ground and contributes to runoff.
        3. A written statement shall be provided regarding the setting of IRAINBUILDING.
c. RTT (Rainfall Depth, Total, inches)
    i. The total rainfall depth shall be consistent with Technical Policy TECH-010: *Rainfall Input for Hydrologic Modeling*.
d. RAINABS (Rainfall interception and abstraction, inches)
    i. RAINABS shall be set to zero. Infiltration of rainfall shall be modeled with INFIL.DAT.
    ii. A written justification shall be provided when the interception and abstraction of rainfall is being modeled.
e. R_TIME(I) (Rainfall Time, hours)
    i. The rainfall distribution shall be consistent with Technical Policy TECH-018: *Acceptable Model Parameterization for Determining Peak Discharge*, and equivalent to any inflow hydrographs (see INFLOW.DAT) within the model.
f. R_DISTR(I) (Rainfall Depth, cumulative percentage)
    i. See "R_TIME(I)" above.
g. RAINARF(I) (Rainfall Depth Area Reduction)
    i. Rainfall depth may be spatially variable, while maintaining consistency with Technical Policies TECH-010: *Rainfall Input for Hydrologic Modeling* and TECH-033: *Criteria for Two-Dimensional Modeling*.
    ii. RAINARF, a value between 0 and 1, is multiplied against the total rainfall depth, RTT, to calculate and assign the reduced rainfall depth to the coordinating grid cells, IRGRID(I).

9. MANNINGS_N.DAT

a. FP(I,J) (Manning's n Roughness Coefficient)
    i. The Manning's n roughness coefficient shall be spatially variable to match the surface roughness conditions specific to the individual grid cells.
    ii. Table 1 (below), Table 1 in the *FLO-2D Reference Manual*, and Table 8.1 of the *Standards Manual for Drainage Design and Floodplain Management* provide suggested Manning's n values for various land use conditions:

Table 1: Suggested Manning's n roughness coefficients for specific land use conditions

n	*Land Use*
0.020	*Streets, Concrete Channels*
0.025	*Open Space, Lawn*
0.030	*Right of way (clear area beside pavement)*
0.035	*Commercial*
0.035	*Earth channels, constructed*
0.035	*Roadside swale*
0.040	*Office, Retail*
0.045	*Open Space, Light to Medium Brush*

n	*Land Use*
0.055	*Retail, Warehousing*
0.055	*Natural Vegetated Channels*
0.065	*Manufacture, Salvage*
0.065	*Open Space, dense and Densely Vegetated Natural Channels*
0.065	*Residential*
0.070	*Industrial*
0.100	*Agriculture*
0.100	*Detention Basin*

iii. Manning's n roughness coefficients obtained from other sources shall be identified and supported with a written justification.

10. INFLOW.DAT

a. IHOURDAILY (Inflow Hydrograph Time Unit)
   i. The time unit for inflow hydrographs shall be hourly (IHOURDAILY set to 0).
b. KHIN(I) (Grid Elements with Inflow Hydrograph)
   i. An inflow hydrograph should be evenly divided among the adjacent grid cells that represent an estimated top-width of the main-channel at the location of the inflow hydrograph. A normal depth calculation of the peak discharge at the location of the inflow hydrograph may be requested.
   ii. If multiple models occur in series (upstream to downstream), the outflow hydrograph of the upstream model shall equal the inflow hydrograph of the downstream model.
   iii. All inflow hydrographs shall be generated from the same rainfall distribution. For a hydrologic-hydraulic mixed model, the rainfall distribution used to generate the inflow hydrographs shall equal the rainfall distribution of RAIN.DAT.

11. OUTFLOW.DAT

a. NODDC(I) (Grid Elements with Outflow)
   i. To avoid boundary condition influence, outflow elements should be placed a minimum of five (5) grid cells downstream of the area of interest.
   ii. Grid cells assigned as outflow nodes should not be assigned other cell node functions, including but not limited to ARF/WRF nodes, hydraulic structure nodes, inflow nodes, and levee nodes.

12. FPXSEC.DAT

a. NODX(N,J) (Grid Elements of Cross Section)
    i. Discharge recording cross sections should be placed throughout the model at points of interest. Cross sections should be aligned perpendicular to the direction of the expected flow.

b. IFLO(N) (Direction of Expected Flow)
    i. The general direction of expected flow should be assigned to the cross section with a positive integer, corresponding to one of the eight cardinal directions, to account for flow occurring in the neighboring directions:

1. North	5. Northeast
2. East	6. Southeast
3. South	7. Southwest
4. West	8. Northwest

    ii. Written justification shall be provided if discharge in a specific single direction, obtained by using a negative integer, is collected at a discharge recording cross section.

13. CHAN.DAT

a. A written justification shall be provided for any use of the CHAN.DAT input file.

14. STREET.DAT

a. A written justification shall be provided for any use of the STREET.DAT input file.

15. LEVEE.DAT

a. A written justification shall be provided for any use of the LEVEE.DAT input file.

PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT
TECHNICAL PROCEDURE

PROCEDURE NO.: Technical Procedure, TECH-108 **EFFECTIVE DATE: March 3, 2008**
REVISED: 5/18/2021

PROCEDURE TITLE: Permitting Improvements to Nonconforming Uses

BACKGROUND: The Code of Federal Regulations (CFR) and the Pima County Floodplain and Erosion Hazard Management Ordinance (Ordinance) establish limitations on the extent of repairs or improvements to structures that do not conform to current floodplain management regulations before these nonconforming structures must be brought into compliance. Often called the Substantial Improvement/Substantial Damage Rules, the purpose of limiting the extent of improvements to nonconforming structures is to minimize the overall flood damage potential and to limit the number and size of claims against the National Flood Insurance Program. Per 44 CFR 59.1. Definitions: "Substantial improvement" means any reconstruction, rehabilitation, addition or other improvement to a structure, the total cost of which equals or exceeds 50 percent of the market value of the structure before the start of construction of the improvement. The Ordinance further stipulates that the District shall ensure that the cumulative costs of all improvements are less than 50 percent of the market value of the structure over the life of the structure.

If floodprone structures are improved without limitation, the risk and cost of flood damage is increased, which is contrary to the stated purpose of the National Flood Insurance Program. Although federal implementation guidelines exist, additional guidance is necessary to determine when the substantial improvement threshold has been reached and to address specific situations, some of which are related to the fact that the Ordinance imposes a higher regulatory standard than the CFR.

PURPOSE: The purpose of this procedure is to establish a clear and consistent approach for permitting repairs and improvements to nonconforming structures in order to establish when a substantial improvement has occurred, to establish a methodology for calculating cumulative improvements, and to establish an acceptable level of reporting and documentation to demonstrate the value of existing structures and the cost of repairs and/or improvements.

This procedure is available to the public to provide information and assistance to individuals making repairs and/or improvements to nonconforming use structures.

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PROCEDURE:

1 Basics of Improvements to Nonconforming Uses

For the purpose of this Technical Procedure, an improvement is any attached addition or interior or exterior alteration to a structure that increases the value of the existing structure or any repair of, or damage to, a structure. Such alterations include, but are not limited to, any remodeling, attached decks/porches, upgraded electrical systems, foundation repair and additions, including second floor additions. In general, anything that adds value to a nonconforming structure falls into this category. Proposed new accessory structures or improvements such as free-standing garages, detached decks/porches, pools, fences, landscape walls, sheds, etc. are not subject to this procedure as they must be constructed in conformance with the Ordinance. This policy does apply to commercial structures and detached accessory structures such as garages, workshops and guest houses that are themselves modified, improved, damaged or repaired.

The Ordinance limits nonconforming improvements to less than 50% of the value of the original nonconforming structure unless work is performed to bring the structure into compliance with current regulations. This limit is commonly referred to as the "50% rule." Improvements are considered cumulatively, meaning that the total costs of all nonconforming improvements and repairs/damages must be less than 50% of the value of the original structure. For this reason, it is necessary for the District to track the cost of all improvements, whether or not each individual improvement equals or exceeds 50% of the value of the original structure. Any cumulative combination of improvements and/or damages to a structure that equals or exceeds 50% is considered to be a substantial improvement or substantial damage.

Increased Cost of Compliance (ICC) coverage on a flood insurance policy and/or "law and regulations" coverage on a homeowner's insurance policy may provide financial assistance to individuals who must bring structures into compliance with current regulations.

This policy doesn't apply structures built in violation of the Ordinance. Pursuant to Section 16.12.060 of the Ordinance, this policy doesn't apply in the event that a nonconforming use is discontinued for 12 consecutive months or is deemed non-habitable by an authorized building official.

1.1 Applicability

1.1.1 Structures Constructed in Violation of the Ordinance

Structures that were not constructed in accordance with applicable rules and regulations at the time of construction are not nonconforming uses. These structures are considered violations and are not covered by this policy.

1.1.2 Basic Rule

A structure may be nonconforming due to flood or erosion hazards. If an applicant proposes to improve an existing, nonconforming structure, and the cost of the improvement, when combined with the cost of any previous improvements, equals or exceeds 50% of the fair market value of the structure, then the improvements, and possibly the entire building, must be brought into conformance with current floodplain requirements. This may mean elevating the finished floor elevation to the regulatory flood elevation, providing erosion protection, or meeting other provisions of the Ordinance.

For the purpose of this Technical Procedure, a nonconforming use is a structure that was constructed in accordance with applicable floodplain management rules and regulations at the time of construction, but which does not conform to current applicable rules and regulations due to revised floodplain and/or erosion hazard information or due to revised floodplain management rules and regulations. Nonconforming use rules apply uniquely to replacement manufactured homes. Please refer to Section 3.3 for details on how to apply nonconforming use rules to manufactured home replacements.

Improvements made to a nonconforming use that are cumulatively less than 50% of the value of the nonconforming use may not have to conform to the Ordinance, but conformance to the ordinance is highly recommended in order to limit the potential damage to the improved structure. In addition, the Ordinance stipulates that the improvement cannot create a situation that puts the existing structure or the proposed improvement at greater risk of flooding than that which existed for the existing structure. Constructing improvements with floodproof materials is also highly recommended. Floodproofing (flood walls, flood resistant materials, flood openings) cannot be used to bring an existing residential structure into compliance, but flood resistant materials and flood openings may be used to bring non-residential and commercial structures into compliance.

If the finished floor of a lateral addition is not elevated at or above the RFE and the cumulative value of all improvements does not equal or exceed 50% of the value of the structure, the common wall between the existing structure and the proposed addition may be substantially modified, however, this may limit future options should additional improvements be proposed.

1.1.3 Cumulative Substantial Improvement/Substantial Damage

Substantial improvement and substantial damage provisions were in the first Floodplain Management Ordinance, but it wasn't until 2005 that there was any consideration of cumulative substantial improvement/damage. Even then, Ordinance 2005 FC2 added a definition of cumulative substantial improvement which stated that improvements are counted cumulatively for at least 5 years, but it didn't follow up with that by mentioning cumulative substantial damage in the rule. This was corrected with Ordinance 2010 FC5, which not only established a rule for addressing cumulative substantial improvement/damage, but also removed the time-limiting language of ". . . at least 5 years . . ." As such, cumulative substantial improvement/damage shall be considered to be for the life of the structure for all improvements/damage after the effective date of Floodplain Management Ordinance 2010 FC5, June 3, 2010.

1.2 Exceptions to the Substantial Improvement Rule

Improvements that are made to correct building code, health or safety violations are not affected by this rule, nor are improvements to registered historic buildings provided the improvements or repairs will not preclude the structure's continued designation as a historic structure.

1.2.1 Conforming Lateral Additions

A lateral addition does not count towards the 50% rule if the addition:

1) Conforms to current floodplain requirements, and
2) Is not structurally connected as defined in Section 1.3, and
3) The only modification to the existing structure is to add a three foot maximum width opening doorway in the common wall. There can be no interior or other modifications to the existing structure, such as remodeling, roofing, etc.

See Section 4.2 for exceptions related to the addition of attached garages.

1.2.2 Code, Health and Safety Violations Exemptions

There are restrictions to exempting certain repairs from the Substantial Improvement and Substantial Damage Rule in regards to code, health and safety violations. They are as follows:

1) The violations must have been known and recognized as such by the appropriate regulatory official such as a building official, code enforcement officer, fire marshal or health officer.
2) Such deficiencies in code must be documented previous to the remodel or repair of the structure.
3) Costs to remedy violations which existed prior to the application for improvements or repair that were undocumented cannot be exempted from the cost estimate.

Costs to remedy violations cannot be exempted from the cost estimate merely because undertaking the improvement project would create or reveal violations. For instance, if during the remodeling process, it is discovered that the electrical systems no longer meet code standards, the cost to replace or repair them cannot be deducted from the cost estimate.

The amount exempted from the Substantial Improvement and Substantial Damage Rule can only be for those specific documented items, and only in like-kind replacement. For instance, if one tread of a stairway needs to be repaired, the cost of one tread may be deducted from the amount calculated as substantial improvement or repair. If the owner chooses to replace the entire stairway, for whatever reason, the cost of the entire stairway minus one tread is added to the cost estimate. If the owner wishes to replace wood treads with platinum treads, only the cost of one wood tread may be deducted from the cost estimate.

1.2.3 Historical Structure Exemption

There are a few known registered historical structures in unincorporated Pima County. To verify if a structure is registered as historical, contact the following office:

Arizona Historic Preservation Society Arizona State Parks Department
1300 West Washington Street
Phoenix, Arizona 85007

Note that this exemption to the Substantial Improvement and Substantial Damage Rule only applies to registered historic structures or those that have a Determination of Eligibility approved by the Arizona State Historic Preservation Office. A structure with an approved Determination of Eligibility has essentially the same restrictions and protections as a fully designated historic structure. Also note that if the proposed improvements or repairs would cause the structure to lose its historical status, then an exemption is not allowed. While an exemption may be granted, the permittee should still be encouraged to use other flood-proofing methods that do not interfere with the historic value, status, or look of the structure. Refer to the retrofitting manual for guidance. For example, a perimeter berm can protect a structure without touching it.

1.3 Structural Connection and Common Walls

Due to concerns about additions transferring flood loads to the existing building, it may be necessary for a lateral addition to be constructed so that it is not structurally connected to the existing structure. For an addition to be considered not structurally connected it must meet the following criteria:

1) The load-bearing structure of the existing building is not altered.
2) The addition is attached to the existing building with minimal (i.e. breakaway) connection. For example, the roof of the addition can be constructed so that there is a continuous surface to repel rain, but cannot transfer loads (dead or live loads) to the existing structure. Dead loads for the addition must be borne completely by the addition. The addition must also be constructed so that any potential live loads (i.e. shear load), such as might be caused by either the original structure or the addition collapsing, will not be transferred between the original structure and the addition.
3) The only allowable modification to the common wall is the addition of a doorway. A doorway is considered to be a 3 foot opening.
4) Per FEMA 480-Floodplain Management Requirements, ". . . if one building is attached to another through a covered breezeway or similar connection, it is a separate building and not an addition."

Applying the Substantial Improvement Rule: A flow chart

Does the existing structure conform to the Ordinance?
YES—New improvements must conform too; rule does not apply **NO**

↓

Is the improvement a lateral addition that meets the requirements of section 1.2.1?
YES—New improvement conforms; rule does not apply **NO**

↓

Is the improvement something that adds value to existing structure?
(include anything attached, such as a: porch, deck, room, repair, renovation, or remodel; do not include anything detached, such as a: pool, fence, landscaping, or detached structure)
NO—Rule does not apply **YES**

↓

Is the work to correct code, health or safety violations OR is the structure registered as historic?
YES—rule does not apply, but refer to Sections 1.2.2 and1.2.3 **NO**

↓

Has the structure been improved, added on to, replaced, repaired, renovated, etc. in the past?
YES—See Section 3.2 on cumulative improvements **NO**

↓

Is this a manufactured home?
YES—See section 3.3 **NO**

↓

Is the structure commercial?
YES—See Section 3.4 **NO**

↓

See Section 3

2 Special Cases

2.1 Roof Mounted Solar Arrays

Since roof mounted solar arrays or panels add to the value of the structure, the cost of this type of improvement must be considered towards the total allowable nonconforming use value, with the following exceptions:

1) Leased systems, as they are not real property and are owned by the lessor.
    a. For leased systems requiring an FPUP, a copy of the lease agreement and a cost estimate for the solar system is required at the time of permitting, but the cost will not be applied towards the 50% rule unless the solar system is subsequently purchased.
    b. For leased solar systems permitted through the Pima County Development Services SolarAPP permitting process it is not required to submit a copy of the lease agreement, cost estimate, or any other information to the District, though the District may conduct audits to ensure compliance. The SolarAPP process is only available to licensed solar contractors, who must attest that the District requirements for use of the SolarAPP process are met.
2) Systems installed on structures within locally mapped sheetflow floodplains with a flow depth of 6 inches or less.
3) Systems installed on detached structures that are completely or partially open-sided, such as shade structures, carports, etc.

See Technical Policy TECH-032 for more information on permitting roof mounted solar panels.

2.2 Structures Within Erosion Hazard Areas

Structures may also be nonconforming uses due to their location within an erosion hazard area. For structures within an erosion hazard area for which improvements are proposed, the following shall apply:

1) Improvements that do not increase the footprint of the structure shall be counted towards the cumulative improvement value.
2) Lateral additions that are located at least partially within the erosion hazard area shall be counted towards the cumulative improvement value.
3) Lateral additions that are located entirely outside the erosion hazard area shall not be counted towards the cumulative improvement value.
4) Lateral additions shall not be located closer to the source of the erosion risk than the original structure, except that:
    a. Any addition so proposed shall be supported by an approved engineering analysis that either designs erosion protection for the addition sufficient to protect the addition from the erosion hazard or reduces the erosion hazard area so that the entire addition is outside the erosion hazard area.
    b. The analysis in 4a above shall remove the addition from being subject to the nonconforming use rules and may also allow the addition and/or original structure to be considered a conforming use, on a case-by-case basis.

2.3 Open-sided Additions

Open-sided additions such as covered patios, decks and carports may be constructed to conform to the Ordinance and therefore may be permitted without consideration of the 50% rule provided the open-sided addition meets the following criteria:

1) The open-sided addition is within a locally mapped shallow sheetflow floodplain with a base flood elevation of 6 inches or less and is constructed of floodproof materials up to the RFE,
2) In all other floodplains, the open-sided addition is not structurally connected to the nonconforming use (see Section 1.3) and is constructed of floodproof materials up to the RFE.

2.4 Basements

Per FEMA P-758-Substantial Improvement/Substantial Damage Desk Reference, basements in non-residential structures may be dry floodproofed.

3 Calculation of Improvement Percentage

The calculation to determine substantial improvement depends on whether the improvement is the first improvement, or a subsequent improvement.

3.1 Improvement Percentage Calculation for First Improvement

For the first improvement to a nonconforming use structure, the formula for determining the improvement percentage is:

$$C_i / V_s = R$$

where C_i is the cost of the improvement, V_s is the value of the existing structure, and R is the relative percentage of the cost of the improvement to the value of the structure. If R equals or exceeds 50%, the improvement is a substantial improvement and additional requirements apply, as discussed below.

3.2 Improvement Percentage Calculation for Subsequent Improvements

When applying the 50% improvement rule to subsequent improvements, one must consider the change in home value over time in order to avoid scenarios in which a structure is improved upon indefinitely and in excess of 50% of the value of the original structure. As an example, suppose the value of a structure is $100,000 and an improvement costing $25,000 is made. The percent remaining for future improvements would then be 25%. If at some point in the future the home is worth $250,000, by applying 25% to that new value, the property owner

at that time would then have $62,500 to spend on an improvement at that time; a value that includes an increase in value due to the first improvement as well as the increase in value of the improvement over time. This is clearly a violation of the intent and spirit of the law. In order to rectify this problem, the following formula shall be used to calculate cumulative improvements. The methodology by which the formula was derived is presented in Attachment A.

To calculate the cumulative value of the structure and discount the value of previous improvements, use:

$$0.5 \leq p_1+p_2(1+ p_1)+p_3(1+ p_1)(1+ p_2) \ldots$$

where p_1 is the ratio of the value of the first improvement to the initial value of the structure, p_2 is the ratio of the value of the second improvement to the new value of the structure minus the initial value of the first improvement, and so forth.

By allowing the value of the structure to increase over time, the formula allows for more improvements to be made while remaining compliant with the 50% rule, as opposed to limiting the value of the structure to its value at the time of the first improvement. However, by discounting any increase in the value of the structure due to previous improvements, the formula ensures that extent of improvements is related to the original structure only. It adjusts for inflation as well as appreciating home values, higher prices, etc.

An Excel calculation worksheet has been created at the following location to assist in performing these calculations: Z:_Shared Data\Rules_Procedures_etc\Technical Policies and Procedures\Tech 108 supporting docs/Tech 108- calculation worksheet.xls

3.3 Manufactured Home Replacements

Replacement of a nonconforming manufactured home is often a simple matter because the new manufactured home is considered to be new construction and can be elevated to conform to the Ordinance, and thus the nonconforming use rule does not apply. However, there are locations where new habitable structures of any kind are not permitted, but where existing structures are allowed to remain as nonconforming uses, such as floodways, erosion hazard areas, or areas that exceed the flow depth or DV^2 provisions found in Section 16.26.050.G of the Ordinance. A replacement manufactured home permitted in these areas under the nonconforming use rules must conform to current floodplain management regulations with respect to construction standards for elevation and foundation.

Replacing an existing manufactured home where a new manufactured home would otherwise not be allowed constitutes a "reconstruction" or "rehabilitation" and as such is allowed under the substantial improvement rule. The substantial improvement rule can be used in these cases to replace a manufactured home, as long as the value of the new manufactured home and the cost of installing the manufactured home does not equal or exceed 150% of the value of the replaced home.

Value of existing Manufactured Home x 1.5 = amount available for a replacement Manufactured Home.

Example: Current manufactured home value: $50,000.00
Allowable improvements under the substantial improvement rule (50% of MH): $25,000
Allowable value of replacement home (1.5x original value) including installation costs: $75,000

3.3.1 Determining the Value of a Manufactured Home

Assessor's data or an appraisal may be used to establish the value of a manufactured home. If the manufactured home has already been removed from the property and cannot be appraised for value, the applicant/owner must provide:

1) per Section 16.12.060 of the Ordinance, documentation that the manufactured home was removed from the property within the past 12 months, and

2) documentation that specifies the make, model and construction year of the manufactured home that was removed from the property, and
3) a book value from an appraiser or valuation company like NADA or Kelley Blue Book.
    a. The value of a home that is estimated through a valuation tool must assume the home to be in average condition unless justification can be provided for a valuation using a better condition category.
    b. If photographs, including aerial photographs, demonstrate that the structure was in a fair or poor condition prior to being removed from the property, the valuation must take this into account. An appraiser may be required in these situations.

3.3.2 Basic Procedure

1. Regardless of value, replacement manufactured homes are considered new structures and, as such, must comply with the Ordinance. Nonconforming use rules should only be applied to manufactured home replacements where new structures would otherwise be prohibited, such as those mentioned in Section 3.3 above. If this does not apply, permit normally. If this does apply, proceed to the next step.
2. If any previous manufactured home replacements have taken place since the structure became nonconforming, use the cumulative substantial improvement rules.
3. Obtain receipts of value for both existing and replacement homes; these must be included in the Floodplain Use Permit file. A Title Certificate that lists the home's value can also be used or one of the methods outlined for fair market value in Section 3.3.1 can be used.
4. In cases where new structures are not normally allowed by the Ordinance, multiply the value of the existing (to be replaced) manufactured Home by 150% (1.50). Any amount under this number can be used for the installation of a replacement Manufactured Home.
5. In all cases, the replacement Manufactured Homes shall be installed per the provisions of the Ordinance. These provisions may require the applicant to provide an engineered foundation design for the home. The cost of the engineering analysis and design shall not be included in the amount available for the 50% rule.

Future additions or improvements to the new manufactured home will be limited by whatever is left of the 50% value originally calculated. In this case, see the Section3.2.

Additional requirements, such as re-orienting the structure parallel to flow or prescribing specific construction techniques may be placed on the replacement manufactured home.

3.4 Commercial Structures

Commercial properties are bound by the same rules for substantial improvement as non-commercial buildings, with two notable exceptions.

3.4.1 Dry Floodproofing

In some cases, commercial buildings may use dry flood-proofing (making the structure watertight) as a means of conforming to the Ordinance. A flood-proofing certificate is required if this option is chosen. The flood-proofing certificate must show that all doors and the common wall between the existing structure and improvements are also made watertight. If a second floor is added and is a substantial improvement, then the entire building must be brought into compliance by either elevating or flood-proofing, both of which require the completion of the applicable FEMA Certificate.

3.4.2 Tenant Improvements

Some commercial structures are designed to be modified internally to meet a specific tenants needs. When these improvements do not materially change the value of the structure, the improvements do not need to be counted against the 50% rule. A single project may include improvements that are considered tenant improvements that do not count towards the 50% rule and also include improvements that materially affect the

value of the structure and which therefore do need to be counted as part of the 50% rule. An example of this is an addition which materially adds value to the structure combined with the removal, addition or relocation of partitions or product shelving units within the existing structure that do not add value to the structure.

3.5 Information Required to Calculate Nonconforming Use Rule

In order to accurately determine the value of the improvements in relation to the value of the existing structure, it is necessary to determine the value of the existing structure and obtain a cost estimate of the improvements.

If the improvement is an addition, information regarding the common wall between new and existing improvements is necessary. With respect to substantial improvements, FEMA Bulletin 480, page 8-12 states, "If the common wall is demolished as part of the project, then the entire structure must be elevated. If only a doorway is knocked through it and only minimal finishing is done [to the existing structure], then only the addition has to be elevated." For the purposes of this procedure, a doorway is defined as an opening not to exceed three feet in width.

The value of any and all improvements initiated after the adoption of Floodplain Management Ordinance 2010 FC5 on June 3, 2010 are also required, whether or not the improvement(s) were permitted. It is the responsibility of the property owner to provide satisfactory values for unpermitted improvements.

3.5.1 Determining the Value of the Existing Structure

It is necessary to establish the "Fair market value" for the structure, before improvements. Fair Market Value applies only to the value of the structure being improved; not the land, other structures on the property, location of the property, or other improvements on the property, such as pools, landscaping, etc. Fair market value can be obtained in a number of ways:

- An appraisal of the structure performed by a licensed appraiser or other qualified professional. The appraisal cannot be completed by the property owner or someone related to the property owner.
- Assessed value of the structure as listed in the Pima County Assessor's Office. In most cases involving site built homes, this value shall be calculated by multiplying the latest assessed full cash value of the parcel by 0.65 (65%). It may be necessary to use other Assessor's data for manufactured homes and site built structures other than the primary residence.
- A value of the structure based on NFIP claims data.

3.5.2 Determining the Cost of the Proposed Improvements (Cost Estimate)

A complete cost estimate is required. The cost estimate must be completed by a registered contractor or construction estimator not related to the property owner. Property owners cannot prepare their own cost estimate, even if a licensed contractor. The cost estimate shall include the fair market value/costs of all materials and labor separately. If any materials or labor is donated, performed by the property owner, or offered at a reduced rate, the fair market value of those items shall be used in the cost estimate. Fair market value is the value that the average person would have to pay for materials and labor based on the normal going rate in the local market.

<u>Items to include in calculating the cost of the project:</u>

a) All structural elements
    i. Spread or continuous foundation footings and pilings
    ii. Monolithic or other types of concrete slabs
    iii. Bearing walls, tie beams, and trusses
    iv. Floors and ceilings
    v. Attached decks and porches
    vi. Interior partition walls
    vii. Exterior wall finishes
    viii. Windows and doors

ix. Reshingling or retiling a roof
x. Hardware

b) All interior and exterior finishing elements
   i. Tiling, linoleum, stone, or carpet over subflooring
   ii. Bathroom tiling and fixtures
   iii. Wall finishes (paint)
   iv. Kitchen utility and bathroom cabinets
   v. Built-in bookcases, cabinets and furniture
   vi. Built-in appliances
   vii. Hardware
   viii. Drywall
   ix. Paint

c) All utility and service equipment
   i. HVAC equipment
   ii. Plumbing and electrical services
   iii. Light fixtures and ceiling fans
   iv. Security systems
   v. Built-in kitchen appliances
   vi. Central vacuum systems
   vii. Water filtration, conditioning and/or recirculation systems
   viii. For alternative energy systems, the full cost of materials and labor must be provided without the inclusion of any rebates or tax incentives.

d) Overhead, profits and taxes

e) Cost to demolish storm-damaged building components

f) Labor and other costs associated with moving or altering undamaged building components to accommodate improvements or additions

<u>Items to be excluded in calculating the cost of the project:</u>

i. Plans and specifications
ii. Survey costs
iii. Permit fees
iv. Post-storm debris removal and cleanup (Example: If a tree falls on a roof and smashes it, the cost to remove the tree is not included in the cost estimate, but the cost to demolish and replace the damaged roof is.)
v. Outside improvements
vi. Landscaping and irrigation
vii. Sidewalks
viii. Fences
ix. Yard lights
x. Swimming pools
xi. Screen pool enclosures
xii. Detached structures

A sample cost estimate can be found in Attachment A. The sample cost estimate may include items that are not relevant to certain projects and may not include items that are relevant to certain projects. The District shall review cost estimates and plan sets to ensure that cost estimates are complete.

4 Rules Applicable to Substantial and Non-Substantial Improvements to Nonconforming Use Structures

The following rules are applicable to substantial and non-substantial improvements to nonconforming use structures.

4.1 No Increase of Hazard

In addition to the application of the 50% rule to improvements to nonconforming uses, the District requires that all such improvements be constructed in a manner which does not increase the flood or erosion damage potential of the structure. This means that the improvements shall have a finished floor elevation that is at least as high as the lowest adjacent floor of the nonconforming use, and shall have at least the same level of erosion/scour protection as the nonconforming use, as determined by the location of the improvement(s) with respect to the erosion hazard and the depth of footing of the existing structure. In accordance with this policy:

a) The floor of any proposed lateral addition must be elevated to provide at least the same level of flood protection as the existing structure, as demonstrated by the site plan and/or building plans.
    i. An Elevation Certificate shall be required to demonstrate that the improvements have been constructed in accordance with this standard.
    ii. A lateral addition that extends uphill or upstream from the footprint of the original structure could, if the finished floor of the addition matched the original structure, be at an increased risk of flooding because the BFE becomes higher the further upstream the addition extends. As such, the finished floor of a lateral addition on the upstream or uphill side of a structure must be elevated at least as high above grade as the floor of the existing structure. For example, if natural grade at the upstream edge of a lateral addition is 8 inches higher than natural grade at the upstream edge of the original structure, the finished floor of the addition must be raised at least 8 inches above the finished floor of the original structure.
    iii. A lateral addition that extends into a higher depth floodplain must be raised by that increased depth, over and above the requirements of 4.1.ii.
b) If a structure is only partially within a regulatory floodplain, the addition must be placed outside of the floodplain if practicable.
c) If the improvement(s) include an attached garage, the garage may be flood-vented and wet floodproofed to the regulatory flood elevation. Flood openings shall be on at least two exterior walls with the bottom of the openings within one foot of natural grade. The total area of flood openings shall be equal to at least one square inch of opening per square foot of enclosed area. Floodproof materials are those that can be inundated by floodwaters with little or no damage, such as concrete, stone, masonry, lumber, and epoxy paint. Vented and/or floodproofed areas or structures must remain non-habitable unless brought into compliance. The size and location of flood openings shall be shown on the site plan and/or building plans.
d) It is necessary to locate or construct the proposed improvements such that they do not increase the potential for erosion damage.
    i. A lateral addition shall not further encroach into an erosion hazard area than the existing structure.
    ii. Alternatively, to address the erosion concerns, a report by an Arizona Registered Civil Engineer may be submitted that either demonstrates that the improvements are not at increased hazard from erosion or to design erosion protection for the proposed improvements. This report requires review and approval by the District.
    iii. The footing of the proposed improvement must extend below grade to a depth that is at least equal to the maximum extension below grade of the footing of the existing structure, as demonstrated by the site plan and/or building plans.

iv. Additions that increase the obstructive width of the structure or that are built on the upstream side of the structure may be required to be constructed with foundations that exceed the depth of the footer of the existing structure, at the discretion of the District.

e) A zero-rise analysis/certification is required for structures in the floodway demonstrating that the new improvements will not increase water surface elevations. The analysis may need to include the design of compensatory storage.

4.2 Attached Garage Additions

Attached garages are considered to be compliant when they are constructed with flood openings and constructed out of flood damage resistant materials to or above the RFE. Attached garages that conform to the Ordinance, either by flood venting and wet flood proofing or by elevating, do not count towards the 50% rule. Expansion of existing garages may require modification of the existing garage to make it flood damage resistant.

As with habitable additions, garage additions may not create conditions that increase the hazard to the proposed or existing improvements.

4.3 Lateral Additions in Minimal Risk Local Flood Hazard Areas

Additions to structures within a local approximate sheetflow floodplain with flood depths of six inches or less, are subject to the following exceptions.

a) If the finished floor of the addition is elevated at or above the RFE, the addition will not be counted towards the 50% rule for the structure, regardless of whether the original structure is otherwise remodeled or rehabilitated, though the cost of any remodeling or rehabilitation of the nonconforming structure shall be counted towards the 50% rule.

b) If the finished floor of the addition is not elevated at or above the RFE and the cumulative value of all improvements does not equal or exceed 50% of the value of the structure, the common wall between the existing structure and the proposed addition may be substantially modified, e.g. an opening may be made that is wider than 3 feet.

5 Substantial Improvement

If any nonconforming improvement to a nonconforming use equals or exceeds 50% of the value of the structure, as determined using the methods above, the improvement, any future improvements, and in some cases, the entire existing structure, shall be constructed or brought into compliance with the current floodplain requirements.

5.1 Remodeling and Rehabilitation

Any improvements that are substantial and include remodeling or rehabilitating the existing structure requires that both the proposed and existing improvements comply with current floodplain requirements. In most cases, that means that the existing structure must be raised so that the lowest floor is elevated at or above the Regulatory Flood Elevation. Protection of the foundation of the proposed and existing structure is also required.

5.2 Impact of Lateral Additions on the Nonconforming Use Structure

For a lateral addition that is a substantial improvement, the treatment of the existing structure depends on whether work is being done to the original structure and whether the addition is structurally connected (see Section 1.3).

a) If work is being done to the original structure and the addition is structurally connected, the proposed addition and the existing structure must be made compliant with current floodplain requirements.

b) If the addition is not structurally connected, only the addition must be made compliant with current floodplain regulations.

c) If the proposed work includes work in the nonconforming use structure or structural modification of the nonconforming use structure, regardless of the structural connection, the addition and the nonconforming use structure must be made to conform with current floodplain regulations.

5.3 Unusual Cases: Second Floors, Footprints, Erosion Hazard Areas, Multiple Structures

The following examples apply to improvements that constitute a substantial improvement, that is, the cost of repairs or improvement equals or exceeds 50% of the value of the original structure.

d) If a second floor is being added, the whole structure must be elevated if the improvements are substantial. This is true regardless of whether changes to the footprint are made.
e) If improvements do not add square footage to a structure but are substantial (like a remodeling, refurbishing or renovation), the entire structure must be brought into compliance.
f) If a substantially improved structure does not conform to the Ordinance because it is within an erosion hazard area, then the structure must either be relocated or otherwise demonstrated to be outside of the erosion hazard area or be protected from erosion by measures designed and as-built by an Arizona registered civil engineer prior to the construction of any substantial improvement.
g) If multiple nonconforming structures exist on the property, and owners wish to substantially improve them, each is counted separately. An appraisal must be obtained for each separate structure, and the allowable improvements are based on 50% of the value of each respective structure.

6 Substantial Damage Rule

The Code of Federal Regulations defines substantial damage as follows:
"Substantial damage means damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred." (44 CFR 59.1)

Any proposed rebuilding of a structure in a regulatory floodplain or erosion hazard area that is substantially damaged must comply with the Floodplain Ordinance regardless of the reason for the damage.

a) The damage can be from any source: flood, fire, termites, tornado, crime, war, etc.
b) The substantial damage rule applies to all structures in regulated floodplains, regardless of whether or not the structure was covered by flood insurance.
c) A structure that is considered to be substantially damaged is automatically a substantial improvement, regardless of how much repair is actually done to the structure.

6.1 Substantial Damage - Exceptions and Variances

Exceptions for bringing a damaged structure into compliance with the Floodplain Ordinance are the same as for substantial improvements. That is, exceptions are only granted to registered historic buildings (as long as the building will maintain its historic status through the repairs) and code violations which were on record before the damage occurred. See Section 1.2 for details. The same items that can be left off the cost estimate for substantial improvements apply to cost estimates for substantial damage (see Section 3.5.2).

Variances are rarely, if ever, issued in post-disaster situations. The same criteria that apply to non-disaster variance applications apply to disaster-related variance applications. The purpose of this document is not to cover the specifics of variance cases, however let it suffice to say that "FEMA considers it highly unlikely that variance requests can meet the criteria" necessary to qualify for a variance. (From FEMA publication 213/May 1991, Answers to Questions About Substantially Damaged Buildings, page 19.)

6.2 Substantial Damage - How to process a permit for a damaged building

The formula is similar to the formula for improvements. If the cost to repair the structure equals or exceeds 50% of the value of the structure before it was damaged, then the damage is substantial and the entire structure

must be brought into conformance, regardless of whether or not the owner chooses to restore the structure to the pre-damage condition.

The process for determining whether or not a building is substantially damaged, and therefore whether or not it must be brought into compliance with the Ordinance, is as follows:

a) Determine a value for the structure before the damage occurred. See Section 3.5 for details.
b) Determine a cost to repair the structure to before-damaged condition. This can be obtained from:
    i. A licensed general contractor, not related to the applicant
    ii. A professional construction estimator, not related to the applicant
    iii. Insurance adjustment papers, excluding damage to personal contents (this method is only useful as an estimation tool, rarely as a precise figure)
c) Check for previous permits. Any previous improvements to nonconforming uses must be added to the total cost. It is possible that even though the damage from the current event is not substantial, when added to the cost of all previous improvements, the project becomes a substantial improvement.
d) If this number is equal to or greater than 50%, then it is a substantial improvement and all substantial improvement rules apply. See the section on substantial improvements for the applicable structure type. If it is not substantially damaged, keep the cost estimate on record for future improvements or repairs; at some point it may become a substantial improvement.

The cost estimate must be for what is needed to return the structure to before damaged condition, no matter what the owner may choose to do at this or another time. The owner may choose to do the minimum amount of work to re-occupy the structure, but this amount is irrelevant to the cost estimate. If new improvements are done with the repair, they must be included in the cost estimate and count toward substantial improvements.

If work is done to improve the damaged structure beyond pre-damage condition, that value must be included and counted in the determination of whether the total of damage and improvements meets or exceeds the 50% threshold.

6.3 Substantial Damage - Cost Estimates

Cost estimates for damaged structures are required when the amount of damage is unknown and the owner does not wish to bring the building into compliance with the Floodplain Ordinance. Cost estimates for substantial damage must be supplied by a third party licensed contractor or professional construction estimator, or from insurance adjustment papers, though insurance adjustment papers may not be adequate (see Section 3.5.2). If damage is from a flood, then the following items are likely to also be a part of the total estimate:

- new wall board and insulation and new paint
- replacement of sub- floor and new floor coverings
- new appliances, new doors, new furnace and water heater
- cleaning of duct work
- porch repair, and repair to other attached improvements (but not detached improvements)
- cleaned and/or repaired and inspected plumbing and electrical systems and fixtures

Keep in mind that the cost to repair a flood-damaged structure is usually much higher than expected, since major flood damage can occur from only a few inches of water. Since much of the damage may occur out of sight, it is important to ensure that the cost estimate for repair is complete. Damage such as mold may not be visible at all.

6.4 Damage that is Not Substantial

If the value of the damage is less than 50%, the cost of the damage must be kept on file and counted against any future improvements or subsequent damage.

6.5 Damage and Improvements that are Substantial

It is possible that an owner may choose to take the opportunity of a damaged building to renovate the building, remodel a part or all of it, or add a second floor. Any and all improvements above and beyond the cost to repair the structure must be added to the cost estimate at this time, since they might well constitute a substantial improvement. Example: $30,000 in damage is done to a house valued at $100,000. The owners decide to also put on a second story which will cost $25,000. The total of repairs and improvements is now $55,000, and the structure is a substantial improvement and must now comply with all provisions of the Ordinance and approved policies and procedures.

6.6 Disaster - What to do When Many Structures are Damaged at Once

After a catastrophe, many buildings will need to be repaired or outright re-built. Those that are substantially damaged must be built in compliance with the Ordinance.

After a catastrophic flood or other event, an emergency response team would be created and would coordinate the department's investigation of affected areas. Whether or not those investigations would include any assessment of buildings' level of damage is not known. However, in light of the Substantial Damage rule, it is good to have some general knowledge in mind before such an event occurs.

At such a time, many homeowners will be applying for permits to re-build right away. The department will be faced with the processing of perhaps hundreds of permits. To waive the determination of whether or not a building's damage is substantial is not an option, as it would be allowing structures to violate the Ordinance, and in the case of a flood, would also be placing those very structures back into the danger which they have just sustained. However, note that owners wishing to repair and/or rebuild in compliance with the Ordinance can be processed simply as new construction.

For all substantial improvements, the plans must show the building will comply with the Ordinance. Structures are placed into one of two categories:

a) Buildings that have obviously sustained more than substantial damage: When a building has structural damage such as collapsed walls, a roof ripped off, the structure is dislodged from its foundation, or when more than three feet of flooding has occurred, it is likely to be substantially damaged. As it will be some time before the structure can be re-built and re-occupied, and the funds for doing so may not be readily available, these permits may have less priority. However, if the owner is ready to re-build and the plans show it will be in compliance with the Ordinance, then a cost estimate is irrelevant and such permits can be processed as new construction.
b) Buildings for which substantial damage is not easily determined or that have sustained damage that is clearly less than 50% of the value of the structure: If the owner does not wish to bring the structure into compliance with the Ordinance, such permits will have to depend on a detailed cost estimate to justify further non-compliance with the Ordinance. Compliance with the Ordinance is always the preferred alternative.

7 Definitions

Cumulative substantial damage – See the Ordinance for the current definition.
Cumulative substantial improvement – See the Ordinance for the current definition.
Nonconforming use – See the Ordinance for the current definition.
Non-Residential – This term is not defined by FEMA, but is generally regarded to mean any structure in which people do not sleep, either permanently or temporarily.

Not structurally connected - A lateral addition is “not structurally connected” if it involves no alteration of the load-bearing structure of the original building, is attached to the original building with minimal connection, and has a doorway as the only modification to the common wall. The use of a breezeway between two buildings is also considered not structurally connected. An addition that is below the BFE

and "not structurally connected" is expected to sustain damage, but should not transfer loads to the original building.

Residential – This term is not defined by FEMA, but is generally regarded to mean any structure in which people sleep, either permanently or temporarily. Examples include homes, apartments, hotels, assisted living facilities, jails, hospitals, dormitories, etc.

Structurally connected - A lateral addition is "structurally connected" if it has its load-bearing structure connected to the load-bearing structure of the original building.

Substantial damage – See the Ordinance for the current definition.
Substantial improvement - See the Ordinance for the current definition.

8 References

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Floodplain and Erosion Hazard Management Ordinance No. 2005-FC2. Pima County Regional Flood Control District, October 28, 2005.

Handbook for Arizona Communities. On Floodplain Management and the National Flood Insurance Program. October 1, 2000.

National Flood Insurance Program (NFIP) Floodplain Management Requirements: A Study Guide and Desk Reference for Local Officials, FEMA 480, February 2005.

APPROVED BY:

_____ _____

Suzanne Shields, P.E. **Date**
Director and Chief Engineer

Original Policy Approved: 3/3/2008
Date(s) Revised: 11/2/2015, 5/18/2021

ATTACHMENT A:
EXAMPLE - MINIMUM REQUIREMENT FOR COST ESTIMATE FOR NON-CONFORMING USE CALCULATION

COMPANY LETTERHEAD AND CONTRACTORS LICENCE NUMBER

Detailed Cost Estimate

Item	Labor Cost	Material Cost	Total Cost	Description
Pemits fees	$500.00	NA	$500.00	
Plans and drawings	$500.00	$100.00	$600.00	
Demolition and removal	$5,000.00	NA	$5,000.00	Includes labor and fees
Foundation concrete	$2,000.00	$15,000.00	$17,000.00	400 sq. ft., includes concrete and materials
Foundation Pretreat	$1,000.00	NA	$1,000.00	
Plumbing	$1,000.00	$1,500.00	$2,500.00	Pipes and materials
Plumbing fixtures	$500.00	$1,000.00	$1,500.00	Double sink and toilet
Roofing	$5,000.00	$15,000.00	$20,000.00	Ceramic tile roofing, 450 sq. ft.
Windows	$1,500.00	$6,000.00	$7,500.00	10 double pane windows, 7 slider windows
Electrical (wiring)	$750.00	$1,500.00	$2,250.00	Electrical to addition
Electrical Fixtures	(included above)	$300.00	$300.00	Ceiling fan, 2 flood lights, porch light
Mechanical	$1,000.00	$6,000.00	$7,000.00	12 Seer A/C unit and ductwork installation
Doors	$700.00	$2,000.00	$2,700.00	5 interior doors, 1 exterior french door, includes hardware
Framing	$3,500.00	$10,500.00	$14,000.00	
Insulation	$200.00	$1,200.00	$1,400.00	Batt Insulation for roof and walls
Sheetrock	$900.00	$2,800.00	$3,700.00	Material, tape and texture
Stucco	$1,000.00	$3,500.00	$4,500.00	Two coat system
Paint	$750.00	$1,250.00	$2,000.00	Paint for addition
Cabinets	$1,000.00	$3,000.00	$4,000.00	
Countertops	$500.00	$1,500.00	$2,000.00	Granite countertops, 50 sq. ft.
Tile	$200.00	$300.00	$500.00	For shower, 30 sq. ft.
Carpeting	$400.00	$800.00	$1,200.00	400 Sq. ft. Carpet for addition. Includes padding.
Miscellaneous fixtures	$50.00	$200.00	$250.00	Bathroom mirror, vents, etc.
Jobsite cleanup	$1,000.00	NA	$1,000.00	
Miscellaneous cost	$600.00	NA	$600.00	General Contractor profit
TOTALS	$29,550.00	$73,450.00	$103,000.00	
	$1,000.00	$100.00	$1,100.00	Deduct cost of Permit fees, Plans/Drawings
FINAL ESTIMATED COSTS	**$28,550.00**	**$73,350.00**	**$101,900.00**	

NOTE: The above example may include costs not associated with your project. There may be costs associated with your project that are not listed above that must be included. All costs must use fair market value for both materials and labor. Donated materials or labor must be included at fair market value. The costs of permit fees, and the creation of plans and drawings shall be included in the cost estimate, but can be subtracted from the value used to calculate the value of the improvement(s).

NOTE: As the value of the improvement(s) approach 50% of the value of the existing structure, the cost estimate must be more detailed, including such things as the number/type of windows and doors, the square footage of each flooring type, the number of plumbing and electrical fixtures, etc.

New Implementation of Cumulative Substantial Improvement for Noncompliance with NFIP Standards

Eric Shepp, Manager Flood Plain Management Division, Pima County Flood Control District, and
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Abstract The federal guideline on grandfathered upgrades to building codes requires conformity when the total cost of improvements to the building exceeds 50%. As an example, suppose a new local law in a given flood region states that a new house must be placed on pylons; some pre-code buildings are not on pylons. If improvements are made which exceed $\frac{1}{2}$ the value of the property then the new code must be enforced, according to the federal law (National Flood Insurance Program, 44 CFR 60.3):

A problem with this rule is that it is ambiguous; an unscrupulous owner can evade the spirit of the law by making piecemeal improvements. As the property increases in value, one can indefinitely postpone the day when the building is brought up to code under one interpretation of the federal law. As a concrete example, suppose the value is \$100,000 and a first improvement is made costing just under \$50,000; the owner need not bring the property up to code. Suppose that, after some time, the property doubles in value. Then it is worth \$300,000, and *it might be argued* that under the federal law, the owner can spend an additional \$100,000 on improvements, *again* without having to comply with the new code. Continuing this strategy, the owner can avoid ever bringing the property up to code, which is against the intent and spirit of the law. We rectify this problem with a new interpretation of the 50% rule.

A new look at the federal statute.

Here we interpret the federal statute in a way that the ambiguity is made precise and so that this loophole is eliminated. We suppose that at various times, $t_1, t_2, \ldots$, piecemeal improvements costing $I_1, I_2, \ldots$ are made to the building which was originally worth V_1 just before the time, t_1, of the first improvement. The ratio, ρ_1, of the value of the improvement to the initial value of the building must satisfy the inequality,

$\rho_1 = \frac{I_1}{V_1} < \frac{1}{2}$,

in conformity with the federal law.

Just before the second improvement, at time t_2, is made, assuming that each dollar in the value of the building at time t_1 is now worth $\$R$, the building is worth $V_2 = (V_1 + I_1)R_1$. At time t_2, the building is again improved at a cost I_2, but we argue that one should regard the base, or the denominator, of the ratio of the improvement to be not $V_1 + I_1$, but *the original value*, V_1. Thus we should interpret the federal guideline at time t_2 as

$\rho_1 + \rho_2^* < \frac{1}{2}$,

where $\rho_2^* = \frac{I_2}{V_2^*}$, where $V_2^* = V_1 R_1$ instead of using $(V_1 + I_1)R_1$, as in the example, where one *benefits* from the cost of the repair. This interpretation of the federal law is consistent with the wording and is in the true spirit of the law. If we define $\rho_2 = \frac{I_2}{V_2}$, then we propose requiring that

$\rho_1 + \frac{I_2}{V_2^*} = \rho_1 + \frac{I_2}{V_1 \frac{V_2}{V_1 + I_1}} = \rho_1 + \rho_2(1 + \rho_1)$. Note we have eliminated the unknown rate

of interest R_1 and have estimated it as $R_1 = \frac{V_2}{V_1+I_1}$ to calculate how much V_1 would have increased to V_2^* without the improvement, I_1. This gives $R_1 = \frac{V_2^*}{V_1}$.

Similarly, if at time t_3 we improve the property by I_3, where we set $V_3 = (V_2+I_2)R_2$, and if V_3^* is the value at time t_3 due solely to the value V_1 and not to the improvements, then $V_3^* = V_2^* R_2$, and we define $\rho_3 = \frac{I_3}{V_3}$, $\rho_3^* = \frac{I_3}{V_3^*}$, then the law requires that $\rho_1 + \rho_2^* + \rho_3^* < \frac{1}{2}$. Note that *adding* $\rho_1^* = \rho_1$ to ρ_2^*, etc. is in the spirit of the law which refers to *cumulative* improvements.

In terms of the ratios $\rho_n = \frac{I_n}{V_n}$, we require that

$\rho_1 < \frac{1}{2}$,

$\rho_1 + \rho_2(1+\rho_1) < \frac{1}{2}$,

$\rho_1 + \rho_2(1+\rho_1) + \rho_3(1+\rho_1)(1+\rho_2) < \frac{1}{2}$,

and in general,

$\sum_{i=1}^{n} \rho_i \prod_{j=1}^{i-1}(1+\rho_j) < \frac{1}{2}$.

The loss of piecemeal improvements is not so great.

We next note that the owner who cannot afford to make all his improvements at one time need not regret so much as a consequence of the new rule in that the sum of the *unstarred* ratios,

$\rho_1 + \ldots + \rho_n \geq n((\frac{3}{2})^{\frac{1}{n}} - 1) = r_n$.

We will see that $r_2 = \sqrt{6} - 2 = .445\ldots$, and r_n decreases in n to $r_\infty = \log \frac{3}{2} = .405\ldots$. That is, if one's richer neighbor makes all his improvements at once and gets a sum of improvement ratios $\rho_1 = .5$ the poorer neighbor who makes improvements piecemeal can do norse than a sum of improvement ratios,

$\rho_1 + \rho_2 + \ldots \geq \log \frac{3}{2} = .405\ldots$.

Thus in the worst case, the poorer owner has a cumulative sum at worst only about 20% smaller than that of the richer neighbor who gets the full fraction $\frac{1}{2} = .5$, before having to bring his property up to code.

It is clear that one can only lose if one makes piecemeal improvements because one needs to bring the building up to code earlier than if one made all the improvements at a single time, as follows from the inequality

$\sum_{i=1}^{n} \rho_i \leq \sum_{i=1}^{n} \rho_i \prod_{j<i}(1+\rho_j)$.

We argue above that one does not lose all that much (less than 20%) if economic necessity forces one into making piecemeal improvements. This is because we can prove, as we do below, that the smallest that the left side of the last inequality can be under any choice of n and any choice of ρ_i, $i = 1, \ldots, n$ for which the right side is (greater than or equal to $\frac{1}{2}$ is $\log \frac{3}{2} = .405$. We show that for any fixed n the smallest value that the left side can be, if the right side reaches $\frac{1}{2}$ at time t_n, is when all the ρ's are equal to a common value which is $(\frac{3}{2})^{\frac{1}{n}} - 1$, in which case the sum of the equal ρ's is

$n((\frac{3}{2})^{\frac{1}{n}} - 1) \downarrow \log \frac{3}{2}$.

This shows that the new interpretation of the federal law should be reasonable and acceptable to reasonable people.

Proof that the loss due to piecemeal improvements is limited.

We prove the above assertion about the minimum value of the sum of the ρ's given that the sum of the ρ^*'s is greater than a given value. To that end, for $r \geq 0$ and $n = 1, 2, \ldots$, let $f_n(r)$ denote the infimum of $\rho_1 + \ldots + \rho_n$ given that the sum

$\rho_1 + \rho_2(1+\rho_1) + \ldots + \rho_n(1+\rho_1)(1+\rho_2)\ldots(1+\rho_{n-1}) \geq r$.

We prove by induction that $f_n(r) = n((1+r)^{\frac{1}{n}} - 1)$ and this value is *uniquely* achieved when

$\rho_1 = \rho_2 = \ldots = \rho_n = (1+r)^{\frac{1}{n}} - 1$.

Note that this holds for $n = 1$ and all $r \geq 0$. Suppose it is true for n and all $r \geq 0$. To prove it for $n+1$, note that

$f_{n+1}(r) \geq \min_{0 \leq \rho_1 \leq r}[\rho_1 + f_n(\frac{r-\rho_1}{1+\rho_1}]$,

because for any $\rho_1 \leq r$, if we set $r' = \frac{r-\rho_1}{1+\rho_1}$,

we have, $\rho_2 + \ldots + \rho_{n+1} \leq f_n(r')$, since

$\rho_2 + \rho_3(1+\rho_2) + \ldots + \rho_{n+1}(1+\rho_2)\ldots(1+\rho_n) \geq \frac{r-\rho_1}{1+\rho_1} = r'$ if

$\rho_1 + \rho_2(1+\rho_1) + \ldots + \rho_{n+1}(1+\rho_1)\ldots(1+\rho_n) \geq r$.

By induction, since $2, 3, \ldots, n+1$ has $n+1-1 = n$ elements, the minimum of $f_n(r') = f_n(\frac{r-\rho_1}{1+\rho_1})$ is achieved when

$\rho_2 = \ldots = \rho_{n+1} = (1+r')^{\frac{1}{n}} - 1 = (\frac{1+r}{1+\rho_1})^{\frac{1}{n}} - 1$,

and then

$f_n(r') = n((1+r')^{\frac{1}{n}} - 1) = n((\frac{1+r}{1+\rho_1})^{\frac{1}{n}} - 1)$.

But next we observe that the minimum (infimum) of

$\rho_1 + n((\frac{1+r}{1+\rho_1})^{\frac{1}{n}} - 1)$,

occurs uniquely at that unique point, ρ_1, where the derivative with respect to ρ_1 is zero, namely where

$1 - (\frac{1+r}{1+\rho_1})^{\frac{1}{n}-1}\frac{1+r}{(1+\rho_1)^2} = 0$,

or where $(1+\rho_1)^{\frac{1}{n}+1} = (1+r)^{\frac{1}{n}}$, i.e., where $\rho_1 = (1+r)^{\frac{1}{n+1}} - 1$, which is the same valu as the other ρ's, $\rho_2, \ldots, \rho_{n+1}$, when ρ_1 has this value. Moreover, then we see that

$f_{n+1}(r) = (1+r)^{\frac{1}{n+1}} - 1 + n((\frac{1+r}{1+\rho_1})^{\frac{1}{n}} - 1)$

$= (1+r)^{\frac{1}{n+1}} - 1 + n((1+r)^{\frac{n}{n+1}\frac{1}{n}} - 1) = (n+1)((1+r)^{\frac{1}{n+1}} - 1)$.

The induction step is complete and the assertion is proved. It is easy to check that for fixed r, $f_n(r)$ decreases in n to the limiting value

$f_\infty(r) = \log(1+r)$,

as was claimed above for $r = \frac{1}{2}$.

PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT
TECHNICAL PROCEDURE

PROCEDURE NO.: Technical Procedure, TECH-108 **EFFECTIVE DATE: March 3, 2008**
REVISED: ~~November 2, 2015~~5/18/2021

PROCEDURE TITLE: ~~Guidelines for~~Permitting Improvements to Nonc~~-C~~onforming Uses

BACKGROUND: The Code of Federal Regulations (CFR) and the Pima County Floodplain and Erosion Hazard Management Ordinance (Ordinance) establish limitations on the extent of repairs or improvements to structures that do not conform to current flood ~~hazard~~plain management regulations~~,~~ before these non-conforming structures must be brought into compliance. Often called the Substantial ~~Damage~~Improvement/Substantial ~~Improvement~~ Damage Rules, the purpose of limiting the extent of improvements to non-conforming structures is to minimize the overall flood damage potential and to limit the number and size of claims against the National Flood Insurance Program ~~after a significant flood event~~. Per 44 CFR 59.1. Definitions: "Substantial improvement" means any reconstruction, rehabilitation, addition or other improvement to a structure, the total cost of which equals or exceeds 50 percent of the market value of the structure before the start of construction of the improvement. The Ordinance further stipulates that the District shall ensure that the cumulative costs of all improvements are less than 50 percent of the market value of the structure over the life of the structure.

If floodprone structures are improved without limitation, the risk and cost of flood damage is increased, which is contrary to the stated purpose of the National Flood Insurance Program. Although ~~some~~ federal implementation guidelines exist, additional guidance is necessary to determine when the substantial improvement threshold has been reached and to address specific situations, some of which are related to the fact that the Ordinance imposes a higher regulatory standard than the CFR.

PURPOSE: The purpose of this procedure is to establish a clear and consistent approach for permitting repairs and improvements to non-conforming structures in order to establish when a substantial improvement has occurred, to establish a methodology for calculating cumulative improvements, and to establish an acceptable level of reporting and documentation to demonstrate the value of existing structures and the cost of repairs and/or improvements.

This procedure is available to the public to provide information and assistance to individuals making repairs and/or improvements to non-conforming use structures.

PROCEDURE TABLE OF CONTENTS:

PROCEDURE:

1 Basics of Improvements to Nonc~~-C~~onforming Uses

For the purpose of this Technical Procedure, an improvement is any attached addition or interior or exterior alteration to a structure that increases the value of the existing structure or any repair of, or damage to, a structure. Such alterations include, but are not limited to, any remodeling, attached decks/porches, upgraded electrical systems, foundation repair and additions, including second floor additions. In general, anything that adds value to a non-conforming structure falls into this category. ~~Detached items~~Proposed new accessory structures or improvements such as free-standing garages, detached decks/porches, pools, fences, landscape walls, sheds, etc. are not subject to this procedure as they must be constructed in conformance with the Ordinance. This policy does apply to commercial structures and detached accessory structures such as garages, workshops and guest houses that are themselves modified, improved, damaged or repaired.

~~Substantial improvement, as defined in 44 CFR 59.1, means:~~

> ~~*"any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the 'start of construction' of the improvement. This term includes structures which have incurred 'substantial damage', regardless of the actual repair work performed. The term does not, however, include either:*~~
>
> > ~~*(1) Any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official and which are the minimum necessary to assure safe living conditions or (2) Any alteration of a 'historic structure', provided that the alteration will not preclude the structure's continued designation as a 'historic structure'."*~~

The Ordinance ~~This limit, commonly referred to as the "50% rule," ~~limits non-conforming improvements to less than 50% of the value of the original non-conforming structure unless work is performed to bring the structure into compliance with current regulations. This limit is commonly referred to as the "50% rule." Improvements are considered cumulatively, meaning that the total costs of all non-conforming improvements and repairs/damages must be less than 50% of the value of the original structure. For this reason, it is necessary for the District to track the cost of all improvements, whether or not ~~they ~~each individual improvement equals~~meet~~ or exceeds 50% of the value of the original structure. Any cumulative combination of improvements and/or damages to a structure that equals or exceeds 50% is considered to be a substantial improvement or substantial damage.

Increased Cost of Compliance (ICC) coverage on a flood insurance policy and/or "law and regulations" coverage on a homeowner's insurance policy may provide financial assistance to individuals who must bring structures into compliance with current regulations.

This policy doesn't apply structures built in violation of the Ordinance. Pursuant to Section 16.12.060 of the Ordinance, this policy doesn't apply in the event that a nonconforming use is discontinued for 12 consecutive months or is deemed non-habitable by an authorized building official.

~~1.1 Structures Constructed in Violation of the Ordinance~~

~~Structures that were not constructed in accordance with applicable rules and regulations at the time of construction are not non-conforming uses. These structures are considered violations and are not covered by this policy.~~

1.1 Applicability

1.1.1 Structures Constructed in Violation of the Ordinance

Structures that were not constructed in accordance with applicable rules and regulations at the time of construction are not nonconforming uses. These structures are considered violations and are not covered by this policy.

1.1.2 Basic Rule~~:~~

A structure may be non-conforming due to flood or erosion hazards. If an applicant proposes to improve an existing, non-conforming structure, and the cost of ~~such improvements~~the improvement, when combined with the cost of any previous improvements, equals or exceeds 50% of the fair market value of the structure, then the improvements, and possibly the entire building, must be brought into conformance with current floodplain requirements. This may mean elevating the finished floor elevation to the regulatory flood elevation, ~~or~~ providing erosion protection, or meeting other provisions of the Ordinance.

For the purpose of this Technical Procedure, a non-conforming use is a structure that was constructed in accordance with applicable floodplain management rules and regulations at the time of construction, but which does not conform to current applicable rules and regulations due to revised floodplain and/or erosion hazard information or due to revised floodplain management rules and regulations. Nonconforming use rules apply uniquely to replacement manufactured homes. Please refer to Section 3.3 for details on how to apply nonconforming use rules to manufactured home replacements.

Improvements made to a non-conforming use that ~~do not exceed~~ are cumulatively less than ~~the~~ 50% ~~rule~~ of the value of the nonconforming use ~~do~~ may not have to conform to the Ordinance, but conformance to the ordinance is highly recommended in order to limit the potential damage to the improved structure. In addition, the Ordinance stipulates that the improvement cannot create a situation that puts the existing ~~improvement~~ structure or the proposed improvement at greater risk of flooding than that which existed for the existing ~~improvement~~structure. Constructing improvements with floodproof materials is also highly recommended. Flood-proofing (flood walls, flood resistant materials, flood ~~venting~~openings) cannot be used to bring an existing residential structure into compliance, but flood resistant materials and flood openings may be used to bring ~~a~~ non-residential and commercial structures into compliance.

If the finished floor of a lateral addition is not elevated at or above the RFE and the cumulative value of all improvements does not equal or exceed 50% of the value of the structure, the common wall between the existing structure and the proposed addition may be substantially modified, however, this may limit future options should additional improvements be proposed.

1.1.3 Cumulative Substantial Improvement/Substantial Damage

Substantial improvement and substantial damage provisions were in the first Floodplain Management Ordinance, but it wasn't until 2005 that there was any consideration of cumulative substantial improvement/damage. Even then, Ordinance 2005 FC2 added a definition of cumulative substantial improvement which stated that improvements are counted cumulatively for at least 5 years, but it didn't follow up with that by mentioning cumulative substantial damage in the rule. This was corrected with Ordinance 2010 FC5, which not only established a rule for addressing cumulative substantial improvement/damage, but also removed the time-limiting language of ". . . at least 5 years . . ." As such, cumulative substantial improvement/damage shall be considered to be for the life of the structure for all improvements/damage after the effective date of Floodplain Management Ordinance 2010 FC5, June 3, 2010.

~~**1.1.1 Roof Mounted Solar Arrays**~~

~~Since roof mounted solar arrays or panels add to the value of the structure, the cost of this type of improvement must be considered towards the total allowable non-conforming use value, with the following exceptions:~~

~~a) Leased systems, as they are not real property and are owned by the lessor.~~

~~i. If a leased system is subsequently purchased, it does count towards the 50% rule, therefore a cost estimate for the solar system is required at the time of permitting, but the cost will not be applied towards the 50% rule unless the solar system is purchased.~~

~~b) Systems installed on structures within locally mapped sheetflow floodplains with a flow depth of 6 inches or less.~~

~~c) Systems installed on structures that are completely or partially open-sided, such as shade structures, carports, etc.~~

~~See Technical Policy 032 for more information on permitting roof mounted solar panels.~~

1.2 Exceptions to the Substantial Improvement Rule~~:~~

Improvements that are made to correct building code, health or safety violations are not affected by this rule, nor are improvements to registered historic buildings provided the improvements or repairs will not preclude the structure's continued designation as a historic structure.

1.2.1 Conforming Lateral Additions

A lateral addition does not count towards the 50% rule if the addition:

1) ~~c~~Conforms to current floodplain requirements, and
2) ~~i~~Is not structurally connected as defined in Section 1.3~~1.4~~, and
3) T~~t~~he only modification to the existing structure is to add a three foot maximum width opening doorway in the common wall. There can be no interior or other modifications to the existing structure, such as remodeling, roofing, etc.

See Section 4.2 for exceptions related to the addition of attached garages.

1.2.2 Code, Health and Safety Violations Exemptions~~:~~

There are restrictions to exempting certain repairs from the Substantial Improvement and Substantial Damage Rule in regards to code, health and safety violations. They are as follows:

1) The violations must have been known and recognized as such by the appropriate regulatory official such as a building official, code enforcement officer, fire marshal or health officer.
2) Such deficiencies in code must be documented previous to the remodel or repair of the structure.
3) Costs to remedy violations which existed prior to the application for improvements or repair that were undocumented cannot be exempted from the cost estimate.

Costs to remedy violations cannot be exempted from the cost estimate merely because undertaking the improvement project would create or reveal violations. For instance, if during the remodeling process, it is discovered that the electrical systems no longer meet code standards, the cost to replace or repair them cannot be deducted from the cost estimate.

The amount exempted from the Substantial Improvement and Substantial Damage Rule can only be for those specific documented items, and only in like-kind replacement. For instance, if one tread of a stairway needs to be repaired, the cost of one tread may be deducted from the amount calculated as substantial improvement or repair. If the owner chooses to replace the entire stairway, for whatever reason, the cost of the entire stairway minus one tread is added to the cost estimate. If the owner wishes to replace wood treads with platinum treads, only the cost of one wood tread may be deducted from the cost estimate.

1.2.3 Historical Structure Exemption~~:~~

There are a few known registered historical structures in unincorporated Pima County. To verify if a structure is registered as historical, contact the following office:

Arizona Historic Preservation Society Arizona State Parks Department
1300 West Washington Street

Note that ~~an~~ this exemption to the Substantial Improvement and Substantial Damage Rule only applies to registered historic structures or those that have a Determination of Eligibility approved by the Arizona State Historic Preservation Office. A structure with an approved Determination of Eligibility has essentially the same restrictions and protections as a fully designated historic structure. Also note that if the proposed improvements or repairs would cause the structure to lose its historical status, then an exemption is not allowed. While an exemption may be granted, the permittee should still be encouraged to use other flood-proofing methods that do not interfere with the historic value, status, or look of the structure. Refer to the retrofitting manual for guidance. ~~A~~For example, a perimeter berm can protect a structure without touching it.

1.3 Structural Connection and Common Walls

Due to concerns about additions transferring flood loads to the existing building, it may be necessary for a lateral addition to be constructed so that it is not structurally ~~un~~connected to the existing structure. For an addition to be considered not structurally ~~un~~connected it must meet the following criteria:

1) The load-bearing structure of the existing building is not altered.
2) The addition is attached to the existing building with minimal (i.e. breakaway) connection. For example, the roof of the addition can be constructed so that there is a continuous surface to repel rain, but cannot transfer loads (dead or live loads) to the existing structure. Dead loads for the addition must be borne completely by the addition. The addition must also be constructed so that any potential live loads (i.e. shear load), such as might be caused by either the original structure or the addition collapsing, will not be transferred between the original structure and the addition.~~, so while the roof of the addition may be connected to the existing building, the addition must include structural support for the roof.~~
3) The only allowable modification to the common wall is the addition of a doorway. A doorway is considered to be a 3 foot opening.
~~3)~~4) Per FEMA 480-Floodplain Management Requirements, ". . . if one building is attached to another through a covered breezeway or similar connection, it is a separate building and not an addition."

Applying the Substantial Improvement Rule: A flow chart

Does the existing ~~improvements~~ structure conform to the Ordinance?
YES—New improvements must conform too; rule does not apply **NO**

↓

Is the improvement a lateral addition that meets the requirements of section 1.2.1?
YES—New improvement~~s~~ conforms; rule does not apply **NO**

↓

Is ~~an applicant applying for a permit~~the improvement something that adds value to existing ~~improvements~~structure?
(include anything attached, such as a: porch, deck, room, repair, renovation, or ~~major~~ remodel; do not include anything detached, such as a: pool~~s~~, fence~~s~~, landscaping, or detached structure)
NO—Rule does not apply **YES**

↓

Is the work to correct code, health or safety violations OR is the structure registered as historic?
YES—rule does not apply, but refer to Sections ~~1.3.1~~1.2.2 and ~~1.3.3~~1.2.3 **NO**

↓

Has the ~~property~~ structure been improved, added on to, replaced, repaired, renovated, etc. in the past?
YES—See Section 3.2 on cumulative improvements **NO**

↓

Is this a manufactured home?
YES—See section 3.3 **NO**

↓

Is the structure commercial?
YES—See Section 3.4 **NO**

↓

See Section 3

2 Special Cases

2.1 Roof Mounted Solar Arrays

Since roof mounted solar arrays or panels add to the value of the structure, the cost of this type of improvement must be considered towards the total allowable nonconforming use value, with the following exceptions:

1) Leased systems, as they are not real property and are owned by the lessor.
    a. For leased systems requiring an FPUP, a copy of the lease agreement and a cost estimate for the solar system is required at the time of permitting, but the cost will not be applied towards the 50% rule unless the solar system is subsequently purchased.
    b. For leased solar systems permitted through the Pima County Development Services SolarAPP permitting process it is not required to submit a copy of the lease agreement, cost estimate, or any other information to the District, though the District may conduct audits to ensure compliance. The SolarAPP process is only available to licensed solar contractors, who must attest that the District requirements for use of the SolarAPP process are met.
2) Systems installed on structures within locally mapped sheetflow floodplains with a flow depth of 6 inches or less.
3) Systems installed on detached structures that are completely or partially open-sided, such as shade structures, carports, etc.

See Technical Policy TECH-032 for more information on permitting roof mounted solar panels.

2.2 Structures Within Erosion Hazard Areas

Structures may also be nonconforming uses due to their location within an erosion hazard area. For structures within an erosion hazard area for which improvements are proposed, the following shall apply:

1) Improvements that do not increase the footprint of the structure shall be counted towards the cumulative improvement value.
2) Lateral additions that are located at least partially within the erosion hazard area shall be counted towards the cumulative improvement value.
3) Lateral additions that are located entirely outside the erosion hazard area shall not be counted towards the cumulative improvement value.
4) Lateral additions shall not be located closer to the source of the erosion risk than the original structure, except that:
    a. Any addition so proposed shall be supported by an approved engineering analysis that either designs erosion protection for the addition sufficient to protect the addition from the erosion hazard or reduces the erosion hazard area so that the entire addition is outside the erosion hazard area.
    b. The analysis in 4a above shall remove the addition from being subject to the nonconforming use rules and may also allow the addition and/or original structure to be considered a conforming use, on a case-by-case basis.

2.3 Open-sided Additions

Open-sided additions such as covered patios, decks and carports may be constructed to conform to the Ordinance and therefore may be permitted without consideration of the 50% rule provided the open-sided addition meets the following criteria:

1) The open-sided addition is within a locally mapped shallow sheetflow floodplain with a base flood elevation of 6 inches or less and is constructed of floodproof materials up to the RFE,
2) In all other floodplains, the open-sided addition is not structurally connected to the nonconforming use (see Section 1.3) and is constructed of floodproof materials up to the RFE.

2.4 Basements

Per FEMA P-758-Substantial Improvement/Substantial Damage Desk Reference, basements in non-residential structures may be dry floodproofed.

~~2~~3 Calculation of Improvement Percentage

The calculation to determine substantial improvement depends on whether the improvement is the first improvement, or a subsequent improvement.

~~2.1~~3.1 Improvement Percentage Calculation for First Improvement

For the first improvement to a non-conforming use structure, the formula for determining the improvement percentage is:

$$C_i / V_s = R$$

where C_i is the cost of the improvement, V_s is the value of the existing structure, and R is the relative percentage of the cost of the improvement to the value of the structure. If R equals or exceeds 50%, the improvement is a substantial improvement and additional requirements apply, as discussed below.

~~2.2~~3.2 Improvement Percentage Calculation for Subsequent Improvements

When applying the 50% improvement rule to subsequent improvements, one must consider the change in home value over time in order to avoid scenarios in which a structure is improved upon indefinitely and in excess of 50% of the value of the original structure. As an example, suppose the value of a structure is $100,000 and an improvement costing $25,000 is made. The percent remaining for future improvements would then be 25%. If

at some point in the future the home is worth $250,000, by applying 25% to that new value, the property owner at that time would then have $62,500 to spend on an improvement at that time; a value that includes an increase in value due to the first improvement as well as the increase in value of the improvement over time. This is clearly a violation of the intent and spirit of the law. In order to rectify this problem, the following formula shall be used to calculate cumulative improvements. The methodology by which the formula was derived is presented in Attachment A.

To calculate the cumulative value of the structure and discount the value of previous improvements, use:

$$0.5 \leq p_1+p_2(1+ p_1)+p_3(1+ p_1)(1+ p_2) \ldots$$

where p_1 is the ratio of the value of the first improvement to the initial value of the structure, p_2 is the ratio of the value of the second improvement to the new value of the structure minus the initial value of the first improvement, and so forth.

By allowing the value of the structure to increase over time, the formula allows for more improvements to be made while remaining compliant with the 50% rule, as opposed to limiting the value of the structure to ~~it's~~its value at the time of the first improvement. However, by discounting any increase in the value of the structure due to previous improvements, the formula ensures that extent of improvements is related to the original structure only. It adjusts for inflation as well as appreciating home values, higher prices, etc.

An Excel calculation worksheet has been created at the following location to assist ~~Area Hydrologists~~ in performing these calculations: Z:_Shared Data\Rules_Procedures_etc\Technical Policies and Procedures\Tech 108 supporting docs/Tech 108- calculation worksheet.xls

~~2.3~~3.3 Manufactured Home Replacements

Replacement of a nonconforming ~~M~~manufactured home ~~replacement~~ is often a simple matter because the ~~entire new structure~~ new manufactured home is considered to be new construction and can be elevated to conform to the Ordinance, and thus the non-conforming use rule does not apply. However, there are locations where new habitable structures of any kind are not permitted, but where existing structures are allowed to remain as non-conforming uses, such as floodways, erosion hazard areas, or areas that exceed the flow depth or DV^2 provisions found in Section 16.26.050.G of the Ordinance. A replacement manufactured home permitted in these areas under the nonconforming use rules must conform to current floodplain management regulations with respect to construction standards for elevation and foundation.

~~Because r~~Replacing an existing manufactured home where a new manufactured home would otherwise not be allowed constitutes a "reconstruction~~,~~" or "rehabilitation" ~~it~~ and as such is allowed under the substantial improvement rule. The substantial improvement rule can be used in these cases to replace a manufactured home, as long as the value of the ~~replacing structure~~new manufactured home and the cost of installing the manufactured home does not equal or exceed 150% of the value of the replaced home.

Value of existing Manufactured Home x 1.5 = amount available for a replacement Manufactured Home.

Example: Current manufactured home value: $50,000.00
Allowable improvements under the substantial improvement rule (50% of MH): $25,000
Allowable value of replacement home (1.5x original value) including installation costs: $75,000

3.3.1 Determining the Value of a Manufactured Home

Assessor's data or an appraisal may be used to establish the value of a manufactured home. If the manufactured home has already been removed from the property and cannot be appraised for value, the applicant/owner must provide:

1) per Section 16.~~26~~12.060 of the Ordinance, documentation that the manufactured home was removed from the property within the past 12 months, and
2) documentation that specifies the make, model and construction year of the manufactured home that was removed from the property, and
3) a book value from an appraiser or valuation company like NADA or Kelley Blue Book.
    a. The value of a home that is estimated through a valuation tool must assume the home to be in average condition unless justification can be provided for a valuation using a better condition category.
    ~~a.~~b. If photographs, including aerial photographs, demonstrate that the structure was in a fair or poor condition prior to being removed from the property, the valuation must take this into account. An appraiser may be required in these situations.

~~2.3.1~~3.3.2 Basic Procedure~~:~~

1. Regardless of value, replacement manufactured homes are considered new structures and, as such, must comply with the Ordinance. Nonconforming use rules should only be applied to manufactured home replacements where new structures would otherwise be prohibited, such as those mentioned in Section 3.3 above. If this does not apply, permit normally. If this does apply, proceed to the next step.
~~1.~~2. ~~Check the database for previous Mobile Home Replacement permits.~~ If any previous manufactured home replacements have taken place since the structure became non-conforming, use the cumulative substantial improvement rules.
~~2.~~3. Obtain receipts of value for both existing and replacement homes; these must be included in the Floodplain Use Permit ~~F~~file. A Title Certificate that lists the home's value can also be used or one of the methods outlined for fair market value ~~on the previous page~~in Section 3.3.1 can be used. ~~In all cases, newly placed Manufactured Homes must be elevated to at or above the Regulatory Flood Elevation and require an Elevation Certificate.~~
4. In cases where new structures are not normally allowed by the Ordinance, multiply the value of the existing (to be replaced) manufactured Home by 150% (1.50). Any amount under this number can be used for the installation of a replacement Manufactured Home.
~~3.~~5. In all cases, the replacement Manufactured Homes shall be installed per the provisions of the Ordinance. These provisions may require the applicant to provide an engineered foundation design for the home. The cost of the engineering analysis and design shall not be included in the amount available for the 50% rule.

~~If the customer wishes in the f~~Future ~~to~~ additions ~~onto~~ or improvements to the new manufactured home~~, they~~ will be limited by whatever is left of the 50% value originally calculated. In this case, see the Section ~~2.2~~3.2.

~~In all cases, the replacement Manufactured Home shall be elevated at or above the Regulatory Flood Elevation, as demonstrated by an Elevation Certificate completed by a registered land surveyor or civil engineer.~~

Additional requirements, such as re-orienting the structure parallel to flow or prescribing specific construction techniques may be placed on the replacement manufactured home.

~~2.4~~3.4 Commercial Structures~~:~~

Commercial properties are bound by the same rules for substantial improvement as non-commercial buildings, with ~~one~~ two notable exceptions.

3.4.1 Dry Floodproofing

~~C~~In some cases, commercial buildings ~~can~~ may use dry flood-proofing (making the structure watertight) as a means of conforming to the Ordinance. -A flood-proofing certificate is required if this option is chosen. The flood-proofing certificate must show that all doors and the common wall between the existing structure and improvements are also made water-tight. If a second floor is added and is a substantial improvement, then the

entire building must be brought into compliance by either elevating or flood-proofing, both of which require the completion of the applicable FEMA Certificate.

~~However, commercial structures may not be allowed to use floodproofing as a means of retrofitting in all cases.~~

3.4.2 Tenant Improvements

Some commercial structures are designed to be modified internally to meet a specific tenants needs. When these improvements do not materially change the value of the structure, the improvements do not need to be counted against the 50% rule. A single project may include improvements that are considered tenant improvements that do not count towards the 50% rule and also include improvements that materially affect the value of the structure and which therefore do need to be counted as part of the 50% rule. An example of this is an addition which materially adds value to the structure combined with the removal, addition or relocation of partitions or product shelving units within the existing structure that do not add value to the structure.

~~2.5~~3.5 Information Required to Calculate Nonc~~C~~onforming Use Rule

In order to accurately determine the value of the improvements in relation to the value of the existing structure, it is necessary to determine the value of the existing structure~~,~~ and obtain a cost estimate of the improvements.

If the improvement is an addition, information regarding the common wall between new and existing improvements is necessary. With respect to substantial improvements, FEMA Bulletin 480, page 8-12 states, "If the common wall is demolished as part of the project, then the entire structure must be elevated. If only a doorway is knocked through it and only minimal finishing is done [~~(~~to the existing structure~~)~~], then only the addition has to be elevated." For the purposes of this procedure, a doorway is defined as an opening not to exceed three feet in width.

~~Values of past improvements from previous FPUPs, if any, are also required.~~

The value of any and all improvements initiated after the adoption of Floodplain Management Ordinance 2010 FC5 on June 3, 2010 are also required, whether or not the improvement(s) were permitted. It is the responsibility of the property owner to provide satisfactory values for unpermitted improvements.

~~2.5.1~~3.5.1 Determining the Value of the Existing Structure

It is necessary to establish the "Fair market value" for the structure, before improvements. Fair Market Value applies only to the value of the structure being improved; not the land, other structures on the property, location of the property, or other improvements on the property, such as pools, landscaping, etc. Fair market value can be obtained in a number of ways:

- An appraisal of the structure performed by a licensed appraiser or other qualified professional. The appraisal cannot be completed by~~, not~~ the property owner or someone related to the property owner.
- Assessed value of the structure as listed in the Pima County Assessor's Office. In most cases involving site built homes, this value shall be calculated by multiplying the latest assessed full cash value of the parcel by 0.65 (65%). It may be necessary to use other Assessor's data for manufactured homes and site built structures other than the primary residence.
- A value of the structure based on NFIP claims data.

~~2.5.2~~3.5.2 Determining the Cost of the Proposed Improvements (Cost Estimate)

A complete cost estimate is required. The cost estimate must be completed by a registered contractor or construction estimator not related to the property owner. ~~(~~Property owners cannot prepare their own cost estimate, even if a licensed contractor.~~)~~ The cost estimate shall ~~indicate~~ include the fair market value/costs of all materials and labor separately~~ and shall include all costs associated with the project at fair market value for both materials and labor~~. If any materials or labor is donated, performed by the property owner, or offered at a reduced rate, the fair market value of those items shall be used in the cost estimate. Fair market value is the value that the average person would have to pay for materials and labor based on the normal going rate in the local market.

Items to include in calculating the cost of the project:

a) All structural elements
   i. Spread or continuous foundation footings and pilings
   ii. Monolithic or other types of concrete slabs
   iii. Bearing walls, tie beams, and trusses
   iv. Floors and ceilings
   v. Attached decks and porches
   vi. Interior partition walls
   vii. Exterior wall finishes
   viii. Windows and doors
   ix. Reshingling or retiling a roof
   x. Hardware

b) All interior and exterior finishing elements
   i. Tiling, linoleum, stone, or carpet over subflooring
   ii. Bathroom tiling and fixtures
   iii. Wall finishes (paint)
   iv. Kitchen utility and bathroom cabinets
   v. Built-in bookcases, cabinets and furniture
   vi. Built-in appliances
   vii. Hardware
   viii. Drywall
   ix. Paint

c) All utility and service equipment
   i. HVAC equipment
   ii. Plumbing and electrical services
   iii. Light fixtures and ceiling fans
   iv. Security systems
   v. Built-in kitchen appliances
   vi. Central vacuum systems
   vii. Water filtration, conditioning and/or recirculation systems
   viii. For alternative energy systems, the full cost of materials and labor must be provided without the inclusion of any rebates or tax incentives.

d) Overhead, profits and taxes

e) Cost to demolish storm-damaged building components

f) Labor and other costs associated with moving or altering undamaged building components to accommodate improvements or additions

Items to be excluded in calculating the cost of the project:

   i. Plans and specifications
   ii. Survey costs
   iii. Permit fees
   iv. Post-storm debris removal and cleanup (Example: If a tree falls on a roof and smashes it, the cost to remove the tree is not included in the cost estimate, but the cost to demolish and replace the damaged roof is.)

v. Outside improvements
vi. Landscaping and irrigation
vii. Sidewalks
viii. Fences
ix. Yard lights
x. Swimming pools
xi. Screen pool enclosures
xii. Detached structures

A sample cost estimate can be found in Attachment A. The sample cost estimate may include items that are not relevant to certain projects and may not include items that are relevant to certain projects. The District shall review cost estimates and plan sets to ensure that cost estimates are complete.

~~3~~4 Rules Applicable to Substantial and Non-Substantial Improvements to Nonc~~-C~~onforming Use Structures

The following rules are applicable to substantial and non-substantial improvements to non-conforming use structures.

~~3.1~~4.1 No Increase of Hazard

In addition to the application of the 50% ~~percent~~ rule to improvements to nonconforming uses, the District requires that all such improvements be constructed in a manner which does not increase the flood or erosion damage potential of the structure. This means that the improvements shall have a finished floor elevation that is at least as high as the lowest adjacent floor of the nonconforming use, and shall have at least the same level of erosion/scour protection as the non-conforming use, as determined by the location of the improvement(s) with respect to the erosion hazard and the depth of footing of the existing structure. In accordance with this policy:

a) The floor of ~~the~~ any proposed ~~improvement~~ lateral addition must be elevated~~, at minimum, to~~ to provide at least the same~~the~~ level of flood protection as the existing structure, as demonstrated by the site plan and/or building plans.
   i. An Elevation Certificate shall be required to demonstrate that the improvements have been constructed in accordance with this standard.
   ii. A lateral addition that extends uphill or upstream from the footprint of the original structure could, if the finished floor of the addition matched the original structure, be at an increased risk of flooding because the BFE becomes higher the further upstream the addition extends. As such, the finished floor of a lateral addition on the upstream or uphill side of a structure must be elevated at least as high above grade as the floor of the existing structure. For example, if natural grade at the upstream edge of a lateral addition is 8 inches higher than natural grade at the upstream edge of the original structure, the finished floor of the addition must be raised at least 8 inches above the finished floor of the original structure.
   ~~i.~~iii. A lateral addition that extends into a higher depth floodplain must be raised by that increased depth, over and above the requirements of 4.1.ii.

~~a)~~b) If a structure is only partially within a regulatory floodplain, the addition must be placed outside of the floodplain if practicable.

~~b)~~c) If the improvement(s) include an attached garage, the garage may be flood-vented and wet-floodproofed to ~~a height of 1 foot above the base~~ the regulatory flood elevation. Flood ~~venting~~ openings shall be on at least two exterior walls with the bottom of the ~~vents~~ openings within one foot of natural grade. The total area of flood ~~vents~~ openings shall be equal to at least one square inch of ~~venting~~ opening per square foot of enclosed area. Flood-proof materials are those that can be inundated by floodwaters with little or no damage, such as concrete, stone, masonry, ~~pressure-treated~~ lumber, and epoxy paint. Vented and/or flood-proofed areas or structures must remain non-habitable unless brought

into compliance. The size and location of flood ~~vents~~ openings shall be shown on the site plan and/or building plans.

d) It is necessary to locate or construct the proposed improvements such that they do not increase the potential for erosion damage.

i. A lateral addition shall not further encroach into ~~the~~an erosion hazard area than the existing structure.

ii. Alternatively, to address the erosion concerns, a report by an Arizona Registered Civil Engineer may be submitted that either demonstrates that the improvements are not at increased hazard from erosion or to design erosion protection for the proposed improvements. This report requires review and approval by the District.

iii. The footing of the proposed improvement must extend below grade to a depth that is at least equal to the maximum extension below grade of the footing of the existing structure, as demonstrated by the site plan and/or building plans.

~~ii.~~iv. Additions that increase the obstructive width of the structure or that are built on the upstream side of the structure may be required to be constructed with foundations that exceed the depth of the footer of the existing structure, at the discretion of the District.

~~c) Alternatively, to address the erosion concerns, a report by an Arizona Registered Civil Engineer may be submitted that either demonstrates that the improvements are not at increased hazard from erosion or to design erosion protection for the proposed improvements. This report requires review and approval by the District.~~

~~d)~~e) A zero-rise ~~demonstration~~ analysis/certification is required for structures in the floodway~~, showing~~ demonstrating that the new improvements will not increase water surface elevations ~~at all~~. The analysis may need to include the design of compensatory storage.

~~3.2~~4.2 Attached Garage Additions

Attached garages are considered to be compliant when they are constructed with flood openings and constructed out of flood damage resistant materials to or above the RFE. Attached garages that conform to the Ordinance, either by flood venting and wet flood proofing or by elevating, do not count towards the 50% rule. Expansion of existing garages may require modification of the existing garage to make it flood damage resistant.

As with habitable additions, garage additions may not create conditions that increase the hazard to the proposed or existing improvements.

4.3 Lateral Additions in Minimal Risk Local Flood Hazard Areas

Additions to structures within a local approximate sheetflow floodplain with flood depths of six inches or less, are subject to the following exceptions.

a) If the finished floor of the addition is elevated at or above the RFE, the addition will not be counted towards the 50% rule for the structure, regardless of whether the original structure is otherwise remodeled or rehabilitated, though the cost of any remodeling or rehabilitation of the nonconforming structure shall be counted towards the 50% rule.

~~a)~~b) If the finished floor of the addition is not elevated at or above the RFE and the cumulative value of all improvements does not equal or exceed 50% of the value of the structure, the common wall between the existing structure and the proposed addition may be substantially modified, e.g. an opening may be made that is wider than 3 feet.

45 Substantial Improvement

If any non-conforming improvement to a non-conforming use equals or exceeds 50% of the value of the structure, as determined using the methods above, the improvement, any future improvements, and in some cases, the entire existing structure, shall be constructed or brought into compliance with the current floodplain requirements.

~~4.1~~5.1 Remodeling and Rehabilitation

Any improvements that are substantial and include remodeling or rehabilitating the existing structure requires that both the proposed and existing improvements comply with current floodplain requirements. In most cases, that means that the existing structure must be raised so that the lowest floor is elevated at or above the Regulatory Flood Elevation. Protection of the foundation of the proposed and existing structure is also ~~likely to be~~ required.

~~4.2~~5.2 Impact of Lateral Additions on the Non~~-~~c~~-C~~onforming Use Structure

For a lateral addition that is a substantial improvement, the treatment of the existing structure depends on whether work is being done to the original structure and whether the addition is structurally connected (see Section 1.3).

a) If work is being done to the original structure and the addition is structurally connected, the proposed addition and the existing structure must be made compliant with current floodplain requirements.

b) If the addition is not structurally connected, only the addition must be made compliant with current floodplain regulations.

~~a)~~c) If the proposed work includes work in the non-conforming use structure or structural modification of the non-conforming use structure, regardless of the structural connection, the addition and the non-conforming use structure must be made to conform with current floodplain regulations.

~~4.3~~5.3 Unusual ~~c~~Cases: ~~s~~Second ~~f~~Floors, ~~f~~Footprints, ~~set-backs~~Erosion Hazard Areas, ~~m~~Multiple ~~s~~Structures

The following examples apply to improvements that constitute a substantial improvement, that is, the cost of repairs or improvement equals or exceeds 50% of the value of the original structure.

~~b)~~d) If a second floor is being added, the whole structure must be elevated if the improvements are substantial. This is true regardless ~~of how much or how little the footprint changes. Even if no~~ of whether changes to the footprint are made~~, the value of the structure, and thus the amount of value at risk, would still increase. Additionally, even if only the first floor of a two-story home is damaged, such damage can endanger the structural integrity of the entire house.~~

~~c)~~e) If improvements do not add square footage to a structure but are substantial (like a remodeling, refurbishing or renovation), the entire structure must be brought into compliance. ~~Value is being added to the structure, and therefore more value is at risk of flood damage.~~

~~d)~~f) If a substantially improved structure does not conform to the Ordinance because it is within an erosion hazard area, then the structure must either be relocated or otherwise demonstrated to be outside of the erosion hazard area or be protected from erosion by measures designed and as-built by an Arizona registered civil engineer prior to the construction of any substantial improvement.

~~e)~~g) If multiple non-conforming structures exist on the property, and owners wish to substantially improve them, each is counted separately. An appraisal must be obtained for each separate structure, and the allowable improvements are based on 50% of the value of each respective structure.

~~5~~6 Substantial Damage Rule

The Code of Federal Regulations defines substantial damage as follows:
"Substantial damage means damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred." (44 CFR 59.1)

Any proposed rebuilding of a structure in a regulatory floodplain or erosion hazard area that is substantially damaged must comply with the Floodplain Ordinance regardless of the reason for the damage.

a) The damage can be from any source: flood, fire~~, arson~~, termites, tornado, crime, war, etc.

b) The substantial damage rule applies to all structures in regulated floodplains, regardless of whether or not the structure was covered by flood insurance.
c) A structure that is considered to be substantially damaged is automatically a substantial improvement, regardless of how much repair is actually done to the structure.

~~5.1~~6.1 Substantial Damage - Exceptions and Variances~~:~~

Exceptions for bringing a damaged structure into compliance with the Floodplain Ordinance are the same as for substantial improvements. That is, exceptions are only granted to registered historic buildings (as long as the building will maintain its historic status through the repairs) and code violations which were on record before the damage occurred. See Section 1.2 for details. The same items that can be left off the cost estimate for substantial improvements apply to cost estimates for substantial damage (see Section 3.5.2).

Variances are rarely, if ever, issued in post-disaster situations. The same criteria that apply to non-disaster variance applications apply to disaster-related variance applications. The purpose of this document is not to cover the specifics of variance cases, however let it suffice to say that "FEMA considers it highly unlikely that variance requests can meet the criteria" necessary to qualify for a variance. (From FEMA publication 213/May 1991, Answers to Questions About Substantially Damaged Buildings, page 19.)

~~5.2~~6.2 Substantial Damage - How to process a permit for a damaged building

The formula is similar to the formula for improvements. If the cost to repair the structure ~~is~~ equals or exceeds 50% ~~or more~~ of the value of the structure before it was damaged, then the damage is substantial and the entire structure must be brought into conformance, regardless of whether or not the owner chooses to restore the structure to the pre-damage condition.

The process for determining whether or not a building is substantially damaged, and therefore whether or not it must be brought into compliance with the Ordinance, is as follows:

a) Determine a value for the structure before the damage occurred. See Section 3.5 for details.
b) Determine a cost to repair the structure to before-damaged condition. This can be obtained from:
    i. A licensed general contractor, not related to the applicant
    ii. A professional construction estimator, not related to the applicant
    iii. Insurance adjustment papers, excluding damage to personal contents (this method is only useful as an estimation tool, rarely as a precise figure)
c) Check for previous permits. Any previous improvements to non-conforming uses must be added to the total cost. It is possible that even though the damage from the current event is not substantial, when added to the cost of all previous improvements, the project becomes a substantial improvement.
d) ~~Add #2 + #3 and divide by #1.~~ If this number is equal to or greater than 50%, then it is a substantial improvement and all substantial improvement rules apply. See the section on substantial improvements for the applicable structure type. If it is not substantially damaged, keep the cost estimate on record for future improvements or repairs; at some point it may become a substantial improvement ~~and records must be kept for 15 years~~.

The cost estimate must be for what is needed to return the structure to before damaged condition, no matter what the owner may choose to do at this or another time. The owner may choose to do the minimum amount of work to re-occupy the structure, but this amount is irrelevant to the cost estimate. If new improvements are done with the repair, they must be included in the cost estimate and count toward substantial improvements.

If work is done to improve the damaged structure beyond pre-damage condition, that value must be included and counted in the determination of whether the total of damage and improvements meets or exceeds the 50% threshold.

~~5.3~~6.3 Substantial Damage - Cost Estimates

Cost estimates for damaged structures are required when the amount of damage is unknown and the owner does not wish to bring the building into compliance with the Floodplain Ordinance. Cost estimates for substantial damage must be supplied by a third party licensed contractor or professional construction estimator, or from insurance adjustment papers, though insurance adjustment papers may not be adequate (see Section 3.5.2). If damage is from a flood, then the following items are likely to also be a part of the total estimate:

- new wall board and insulation and new paint
- replacement of sub- floor and new floor coverings
- new appliances, new doors, new furnace and water heater
- cleaning of duct work
- porch repair, and repair to other attached improvements (but not detached improvements)
- cleaned and/or repaired and inspected plumbing and electrical systems and fixtures

Keep in mind that the cost to repair a flood-damaged structure is usually much higher than expected, since major flood damage can occur from only a few inches of water. Since much of the damage may occur out of sight, it is important to ensure that the cost estimate for repair is complete. Damage such as mold may not be visible at all.

~~5.4~~6.4 ~~Repairs~~ Damage that ~~are NOT~~ is Not s~~S~~ubstantial

If the ~~cost to repair~~value of the damage is less than 50%, the cost of the ~~repair~~ damage must be kept on file and counted against any future improvements or subsequent damage ~~repairs~~.

~~5.5~~6.5 ~~Repairs~~ Damage and Improvements that are S~~s~~ubstantial

It is ~~also~~ possible that an owner may choose to take ~~this~~ the opportunity of a damaged building to renovate the ~~house~~building, remodel a part or all of it, or add a second floor. Any and all improvements above and beyond the cost to repair the structure must be added to the cost estimate at this time, since they might well constitute a substantial improvement. Example: $30,000 in damage is done to a house valued at $100,000. The owners decide to also put on a second story which will cost $25,000. The total of repairs and improvements is now $55,000, and the structure is a substantial improvement and must now comply with all provisions of the ~~Floodplain~~ Ordinance and approved policies and procedures.

~~5.6~~6.6 Disaster - What to do ~~w~~When ~~m~~Many s~~S~~tructures are ~~d~~Damaged at ~~o~~Once~~:~~

After a catastrophe, many buildings will need to be repaired or outright re-built. Those that are substantially damaged must be built in compliance with the ~~Floodplain~~ Ordinance.

After a catastrophic flood or other event, an emergency response team would be created and would coordinate the department's investigation of affected areas. Whether or not those investigations would include any assessment of buildings' level of damage is not known. However, in light of the Substantial Damage rule, it is good to have some general knowledge in mind before such an event occurs.

At such a time, many homeowners will be applying for permits to re-build right away. The department will be faced with the processing of perhaps hundreds of permits. To waive the determination of whether or not a building's damage is substantial is not an option, as it would be allowing structures to violate the Ordinance, and in the case of a flood, would also be placing those very structures back into the danger which they have just sustained. However, note that owners wishing to repair and/or rebuild in compliance with the Ordinance can be processed simply as new construction.

For all substantial improvements, the plans must show the building will comply with the Ordinance. Structures are placed into one of two categories:

a) Buildings that have obviously sustained more than substantial damage: When a building has structural damage such as collapsed walls, a roof ripped off, the structure is dislodged from its foundation, or

when more than three feet of flooding has occurred, it is likely to be substantially damaged. As it will be some time before the structure can be re-built and re-occupied, and the funds for doing so may not be readily available, these permits may have less priority. However, if the owner is ready to re-build and the plans show it will be in compliance with the ~~Floodplain~~ Ordinance, then a cost estimate is irrelevant and such permits can be processed as new construction.

b) Buildings for which substantial damage is not easily determined or that have sustained damage that is clearly less than 50% of the value of the structure: If the owner does not wish to bring the structure into compliance with the Ordinance, such permits will have to depend on a detailed cost estimate to justify further non-compliance with the Ordinance. Compliance with the Ordinance ~~should~~ is always ~~be encouraged~~the preferred alternative.

7 Definitions

Cumulative substantial damage – See the Ordinance for the current definition.

Cumulative substantial improvement – See the Ordinance for the current definition.

Nonconforming use – See the Ordinance for the current definition.

Non-Residential – This term is not defined by FEMA, but is generally regarded to mean any structure in which people do not sleep, either permanently or temporarily.

Not structurally connected - A lateral addition is "not structurally connected" if it involves no alteration of the load-bearing structure of the original building, is attached to the original building with minimal connection, and has a doorway as the only modification to the common wall. The use of a breezeway between two buildings is also considered not structurally connected. An addition that is below the BFE and "not structurally connected" is expected to sustain damage, but should not transfer loads to the original building.

Residential – This term is not defined by FEMA, but is generally regarded to mean any structure in which people sleep, either permanently or temporarily. Examples include homes, apartments, hotels, assisted living facilities, jails, hospitals, dormitories, etc.

Structurally connected - A lateral addition is "structurally connected" if it has its load-bearing structure connected to the load-bearing structure of the original building.

Substantial damage – See the Ordinance for the current definition.

Substantial improvement - See the Ordinance for the current definition.

~~6~~8 References

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Handbook for Arizona Communities. On Floodplain Management and the National Flood Insurance Program. October 1, 2000.

National Flood Insurance Program (NFIP) Floodplain Management Requirements: A Study Guide and Desk Reference for Local Officials, FEMA 480, February 2005.

APPROVED BY:

Suzanne Shields, P.E. **Date**
Director and Chief Engineer

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Date(s) Revised: 11/2/2015, 5/18/2021

ATTACHMENT A:
EXAMPLE - MINIMUM REQUIREMENT FOR COST ESTIMATE FOR NON-CONFORMING USE CALCULATION

COMPANY LETTERHEAD AND CONTRACTORS LICENCE NUMBER

Detailed Cost Estimate

Item	Labor Cost	Material Cost	Total Cost	Description
Pemits fees	$500.00	NA	$500.00	
Plans and drawings	$500.00	$100.00	$600.00	
Demolition and removal	$5,000.00	NA	$5,000.00	Includes labor and fees
Foundation concrete	$2,000.00	$15,000.00	$17,000.00	400 sq. ft., includes concrete and materials
Foundation Pretreat	$1,000.00	NA	$1,000.00	
Plumbing	$1,000.00	$1,500.00	$2,500.00	Pipes and materials
Plumbing fixtures	$500.00	$1,000.00	$1,500.00	Double sink and toilet
Roofing	$5,000.00	$15,000.00	$20,000.00	Ceramic tile roofing, 450 sq. ft.
Windows	$1,500.00	$6,000.00	$7,500.00	10 double pane windows, 7 slider windows
Electrical (wiring)	$750.00	$1,500.00	$2,250.00	Electrical to addition
Electrical Fixtures	(included above)	$300.00	$300.00	Ceiling fan, 2 flood lights, porch light
Mechanical	$1,000.00	$6,000.00	$7,000.00	12 Seer A/C unit and ductwork installation
Doors	$700.00	$2,000.00	$2,700.00	5 interior doors, 1 exterior french door, includes hardware
Framing	$3,500.00	$10,500.00	$14,000.00	
Insulation	$200.00	$1,200.00	$1,400.00	Batt Insulation for roof and walls
Sheetrock	$900.00	$2,800.00	$3,700.00	Material, tape and texture
Stucco	$1,000.00	$3,500.00	$4,500.00	Two coat system
Paint	$750.00	$1,250.00	$2,000.00	Paint for addition
Cabinets	$1,000.00	$3,000.00	$4,000.00	
Countertops	$500.00	$1,500.00	$2,000.00	Granite countertops, 50 sq. ft.
Tile	$200.00	$300.00	$500.00	For shower, 30 sq. ft.
Carpeting	$400.00	$800.00	$1,200.00	400 Sq. ft. Carpet for addition. Includes padding.
Miscellaneous fixtures	$50.00	$200.00	$250.00	Bathroom mirror, vents, etc.
Jobsite cleanup	$1,000.00	NA	$1,000.00	
Miscellaneous cost	$600.00	NA	$600.00	General Contractor profit
TOTALS	$29,550.00	$73,450.00	$103,000.00	
	$1,000.00	$100.00	$1,100.00	Deduct cost of Permit fees, Plans/Drawings
FINAL ESTIMATED COSTS	**$28,550.00**	**$73,350.00**	**$101,900.00**	

NOTE: The above example may include costs not associated with your project. There may be costs associated with your project that are not listed above that must be included. All costs must use fair market value for both materials and labor. Donated materials or labor must be included at fair market value. The costs of permit fees, and the creation of plans and drawings shall be included in the cost estimate, but can be subtracted from the value used to calculate the value of the improvement(s).

NOTE: As the value of the improvement(s) approach 50% of the value of the existing structure, the cost estimate must be more detailed, including such things as the number/type of windows and doors, the square footage of each flooring type, the number of plumbing and electrical fixtures, etc.

New Implementation of Cumulative Substantial Improvement for Noncompliance with NFIP Standards

Eric Shepp, Manager Flood Plain Management Division, Pima County Flood Control District, and
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Abstract The federal guideline on grandfathered upgrades to building codes requires conformity when the total cost of improvements to the building exceeds 50%. As an example, suppose a new local law in a given flood region states that a new house must be placed on pylons; some pre-code buildings are not on pylons. If improvements are made which exceed $\frac{1}{2}$ the value of the property then the new code must be enforced, according to the federal law (National Flood Insurance Program, 44 CFR 60.3):

A problem with this rule is that it is ambiguous; an unscrupulous owner can evade the spirit of the law by making piecemeal improvements. As the property increases in value, one can indefinitely postpone the day when the building is brought up to code under one interpretation of the federal law. As a concrete example, suppose the value is \$100,000 and a first improvement is made costing just under \$50,000; the owner need not bring the property up to code. Suppose that, after some time, the property doubles in value. Then it is worth \$300,000, and *it might be argued* that under the federal law, the owner can spend an additional \$100,000 on improvements, *again* without having to comply with the new code. Continuing this strategy, the owner can avoid ever bringing the property up to code, which is against the intent and spirit of the law. We rectify this problem with a new interpretation of the 50% rule.

A new look at the federal statute.

Here we interpret the federal statute in a way that the ambiguity is made precise and so that this loophole is eliminated. We suppose that at various times, $t_1, t_2, \ldots$, piecemeal improvements costing $I_1, I_2, \ldots$ are made to the building which was originally worth V_1 just before the time, t_1, of the first improvement. The ratio, ρ_1, of the value of the improvement to the initial value of the building must satisfy the inequality,

$\rho_1 = \frac{I_1}{V_1} < \frac{1}{2}$,

in conformity with the federal law.

Just before the second improvement, at time t_2, is made, assuming that each dollar in the value of the building at time t_1 is now worth $\$R$, the building is worth $V_2 = (V_1 + I_1)R_1$. At time t_2, the building is again improved at a cost I_2, but we argue that one should regard the base, or the denominator, of the ratio of the improvement to be not $V_1 + I_1$, but *the original value*, V_1. Thus we should interpret the federal guideline at time t_2 as

$\rho_1 + \rho_2^* < \frac{1}{2}$,

where $\rho_2^* = \frac{I_2}{V_2^*}$, where $V_2^* = V_1 R_1$ instead of using $(V_1 + I_1)R_1$, as in the example, where one *benefits* from the cost of the repair. This interpretation of the federal law is consistent with the wording and is in the true spirit of the law. If we define $\rho_2 = \frac{I_2}{V_2}$, then we propose requiring that

$\rho_1 + \frac{I_2}{V_2^*} = \rho_1 + \frac{I_2}{V_1 \frac{V_2}{V_1 + I_1}} = \rho_1 + \rho_2(1 + \rho_1)$. Note we have eliminated the unknown rate

of interest R_1 and have estimated it as $R_1 = \frac{V_2}{V_1+I_1}$ to calculate how much V_1 would have increased to V_2^* without the improvement, I_1. This gives $R_1 = \frac{V_2^*}{V_1}$.

Similarly, if at time t_3 we improve the property by I_3, where we set $V_3 = (V_2+I_2)R_2$, and if V_3^* is the value at time t_3 due solely to the value V_1 and not to the improvements, then $V_3^* = V_2^* R_2$, and we define $\rho_3 = \frac{I_3}{V_3}$, $\rho_3^* = \frac{I_3}{V_3^*}$, then the law requires that $\rho_1 + \rho_2^* + \rho_3^* < \frac{1}{2}$. Note that *adding* $\rho_1^* = \rho_1$ to ρ_2^*, etc. is in the spirit of the law which refers to *cumulative* improvements.

In terms of the ratios $\rho_n = \frac{I_n}{V_n}$, we require that

$\rho_1 < \frac{1}{2}$,

$\rho_1 + \rho_2(1+\rho_1) < \frac{1}{2}$,

$\rho_1 + \rho_2(1+\rho_1) + \rho_3(1+\rho_1)(1+\rho_2) < \frac{1}{2}$,

and in general,

$\sum_{i=1}^{n} \rho_i \prod_{j=1}^{i-1}(1+\rho_j) < \frac{1}{2}$.

The loss of piecemeal improvements is not so great.

We next note that the owner who cannot afford to make all his improvements at one time need not regret so much as a consequence of the new rule in that the sum of the *unstarred* ratios,

$\rho_1 + \ldots + \rho_n \geq n((\frac{3}{2})^{\frac{1}{n}} - 1) = r_n$.

We will see that $r_2 = \sqrt{6} - 2 = .445\ldots$, and r_n decreases in n to $r_\infty = \log \frac{3}{2} = .405\ldots$. That is, if one's richer neighbor makes all his improvements at once and gets a sum of improvement ratios $\rho_1 = .5$ the poorer neighbor who makes improvements piecemeal can do norse than a sum of improvement ratios,

$\rho_1 + \rho_2 + \ldots \geq \log \frac{3}{2} = .405\ldots$.

Thus in the worst case, the poorer owner has a cumulative sum at worst only about 20% smaller than that of the richer neighbor who gets the full fraction $\frac{1}{2} = .5$, before having to bring his property up to code.

It is clear that one can only lose if one makes piecemeal improvements because one needs to bring the building up to code earlier than if one made all the improvements at a single time, as follows from the inequality

$\sum_{i=1}^{n} \rho_i \leq \sum_{i=1}^{n} \rho_i \prod_{j<i}(1+\rho_j)$.

We argue above that one does not lose all that much (less than 20%) if economic necessity forces one into making piecemeal improvements. This is because we can prove, as we do below, that the smallest that the left side of the last inequality can be under any choice of n and any choice of ρ_i, $i = 1, \ldots, n$ for which the right side is (greater than or equal to $\frac{1}{2}$ is $\log \frac{3}{2} = .405$. We show that for any fixed n the smallest value that the left side can be, if the right side reaches $\frac{1}{2}$ at time t_n, is when all the ρ's are equal to a common value which is $(\frac{3}{2})^{\frac{1}{n}} - 1$, in which case the sum of the equal ρ's is

$n((\frac{3}{2})^{\frac{1}{n}} - 1) \downarrow \log \frac{3}{2}$.

This shows that the new interpretation of the federal law should be reasonable and acceptable to reasonable people.

Proof that the loss due to piecemeal improvements is limited.

We prove the above assertion about the minimum value of the sum of the ρ's given that the sum of the ρ^*'s is greater than a given value. To that end, for $r \geq 0$ and $n = 1, 2, \ldots$, let $f_n(r)$ denote the infimum of $\rho_1 + \ldots + \rho_n$ given that the sum

$\rho_1 + \rho_2(1+\rho_1) + \ldots + \rho_n(1+\rho_1)(1+\rho_2)\ldots(1+\rho_{n-1}) \geq r$.

We prove by induction that $f_n(r) = n((1+r)^{\frac{1}{n}} - 1)$ and this value is *uniquely* achieved when

$\rho_1 = \rho_2 = \ldots = \rho_n = (1+r)^{\frac{1}{n}} - 1$.

Note that this holds for $n = 1$ and all $r \geq 0$. Suppose it is true for n and all $r \geq 0$. To prove it for $n+1$, note that

$f_{n+1}(r) \geq \min_{0 \leq \rho_1 \leq r}[\rho_1 + f_n(\frac{r-\rho_1}{1+\rho_1}]$,

because for any $\rho_1 \leq r$, if we set $r' = \frac{r-\rho_1}{1+\rho_1}$,

we have, $\rho_2 + \ldots + \rho_{n+1} \leq f_n(r')$, since

$\rho_2 + \rho_3(1+\rho_2) + \ldots + \rho_{n+1}(1+\rho_2)\ldots(1+\rho_n) \geq \frac{r-\rho_1}{1+\rho_1} = r'$ if

$\rho_1 + \rho_2(1+\rho_1) + \ldots + \rho_{n+1}(1+\rho_1)\ldots(1+\rho_n) \geq r$.

By induction, since $2, 3, \ldots, n+1$ has $n+1-1 = n$ elements, the minimum of $f_n(r') = f_n(\frac{r-\rho_1}{1+\rho_1})$ is achieved when

$\rho_2 = \ldots = \rho_{n+1} = (1+r')^{\frac{1}{n}} - 1 = (\frac{1+r}{1+\rho_1})^{\frac{1}{n}} - 1$,

and then

$f_n(r') = n((1+r')^{\frac{1}{n}} - 1) = n((\frac{1+r}{1+\rho_1})^{\frac{1}{n}} - 1)$.

But next we observe that the minimum (infimum) of

$\rho_1 + n((\frac{1+r}{1+\rho_1})^{\frac{1}{n}} - 1)$,

occurs uniquely at that unique point, ρ_1, where the derivative with respect to ρ_1 is zero, namely where

$1 - (\frac{1+r}{1+\rho_1})^{\frac{1}{n}-1}\frac{1+r}{(1+\rho_1)^2} = 0$,

or where $(1+\rho_1)^{\frac{1}{n}+1} = (1+r)^{\frac{1}{n}}$, i.e., where $\rho_1 = (1+r)^{\frac{1}{n+1}} - 1$, which is the same valu as the other ρ's, $\rho_2, \ldots, \rho_{n+1}$, when ρ_1 has this value. Moreover, then we see that

$f_{n+1}(r) = (1+r)^{\frac{1}{n+1}} - 1 + n((\frac{1+r}{1+\rho_1})^{\frac{1}{n}} - 1)$

$= (1+r)^{\frac{1}{n+1}} - 1 + n((1+r)^{\frac{n}{n+1}\frac{1}{n}} - 1) = (n+1)((1+r)^{\frac{1}{n+1}} - 1)$.

The induction step is complete and the assertion is proved. It is easy to check that for fixed r, $f_n(r)$ decreases in n to the limiting value

$f_\infty(r) = \log(1+r)$,

as was claimed above for $r = \frac{1}{2}$.

PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT
TECHNICAL PROCEDURE

PROCEDURE NO.: Technical Procedure, TECH-110 **EFFECTIVE DATE:** May 18, 2021

PROCEDURE NAME: Using Certificates of Coverage to Reduce Certain Important Riparian Area (IRA) Mitigation Requirements under *Watercourse and Riparian Habitat Protection and Mitigation Requirements* (16.30)

PURPOSE: To allow for the reduction of certain Important Riparian Area (IRA) Mitigation Requirements under *Watercourse and Riparian Habitat Protection and Mitigation Requirements* for developments that participate in the Certificate of Coverage Program.

BACKGROUND: In July 2016, Pima County and the Pima County Regional Flood Control District (collectively, County) received an Endangered Species Act Incidental Take Permit (TE84356A) from the U.S. Fish and Wildlife Service. This permit allows certain public and private development projects (Covered Activities) to proceed in compliance with the Endangered Species Act in exchange for the County's fulfillment of conservation measures identified in the Multi-Species Conservation Plan (MSCP). Under the MSCP, the County is obligated to provide mitigation for Covered Activities' impacts to IRAs at a 5:1 mitigation ratio.

Separately, under the *Regulated Riparian Habitat Mitigation Standards and Implementation Guidelines,* a private development that disturbs more than 1/3 of an acre of IRA is required to mitigate that disturbance at a 1.5:1 ratio; when the underlying classification of the riparian habitat is Xeroriparian and there is no IRA classification, the mitigation ratio is 1:1. Additionally, IRA mitigation areas must be maintained and monitored for five calendar years following installation, and submittal of a monitoring report is required annually; when the underlying classification of the riparian habitat is Xeroriparian and there is no IRA classification, monitoring reports are required only in years 1, 3, and 5.

In an effort to leverage coverage under the MSCP as a mechanism to ease the regulatory burden on private development without diminishing the County's ability to achieve its conservation objectives, this procedure allows private developments that seek a Certificate of Coverage to rely on that coverage to reduce certain mitigation requirements for disturbance to IRAs with underlying Xeroriparian habitat.

Private developments have two options for seeking coverage under the MSCP. The mitigation requirements subject to reduction under this procedure are determined by which option is used:

- **Residential single-lot developments:** Eligible for a Certificate of Coverage when applying for a building permit authorizing the grading of 14,000 sq. ft. or more. These developments receive a Certificate of Coverage unless they opt-out of the program, and coverage is free.
- **Subdivision, commercial, or industrial projects:** Eligible for a Certificate of Coverage when applying for a site construction permit. These developments must apply, or opt in, to the program and pay minimal associated fees.

PROCEDURE: The reduced mitigation requirements for private developments that receive a Certificate of Coverage are as follows:

1. For Residential Single Lot Developments: Submittal of monitoring reports for IRA mitigation areas with underlying Xeroriparian habitat will be required in years 1, 3 and 5. To receive this reduction in mitigation requirements, the applicant is required to:

A. Confirm eligibility for Certificate of Coverage. Applicants must confirm their eligibility by contacting the Office of Sustainability and Conservation (OSC), which administers the Certificate of Coverage Program, at 520-724-6940 or S10PrivateLandAdmin@pima.gov. OSC staff will provide written confirmation of eligibility upon request. Projects must meet the following requirements to be eligible:

- Located on private property in unincorporated Pima County; and
- Need a building permit authorizing the grading of 14,000 sq. ft. or more.

B. Note Certificate of Coverage eligibility on RHMP. Applicants must include a general note on their RHMP that: 1) confirms their eligibility for a Certificate of Coverage; 2) indicates that because they will receive coverage they will be submitting the required monitoring reports in years 1, 3 and 5 instead of annually; and 3) includes an agreement that, in the event a Certificate of Coverage is not obtained, the applicant will submit monitoring reports annually as otherwise required by the *Regulated Riparian Habitat Mitigation Standards and Implementation Guidelines*.

C. Provide proof of authorized coverage prior to RRH disturbance. Building permit applicants will receive confirmation of authorized coverage as a note on the building permit itself.

2. For Subdivision, Commercial and Industrial Developments: Impacts to IRA with underlying Xeroriparian habitat will be mitigated at a 1:1 ratio. To receive this reduction in mitigation requirements, the applicant is required to:

A. Confirm eligibility for Certificate of Coverage. Applicants must confirm their eligibility by contacting the Office of Sustainability and Conservation (OSC), which administers the Certificate of Coverage Program, at 520-724-6940 or S10PrivateLandAdmin@pima.gov. OSC staff will provide written confirmation of eligibility upon request. Projects must meet the following requirements to be eligible:

- Located on private property in unincorporated Pima County; and
- Need a site construction permit to develop a subdivision or commercial or industrial facility.

B. Request Certificate of Coverage at time of Site Construction Permit Submittal. The opportunity to request a Certificate of Coverage occurs when an application for a site construction permit is submitted to Development Services. Coverage cannot be issued once the applicant's site construction permit has been issued, so coverage should be requested early in the permitting process. It is the applicant's responsibility to request coverage in a timely manner and to meet any Certificate of Coverage application requirements that may apply.

C. Express intent to seek Certificate of Coverage on RHMP. A general note on the RHMP that 1) indicates their intent to seek a Certificate of Coverage; 2) confirms eligibility for Certificate of Coverage; 3) indicates that the 1:1 mitigation ratio for underlying riparian classification instead of the 1.5:1 IRA mitigation ratio; 4) includes an agreement that, in the event a Certificate of Coverage is not obtained, the applicant will provide the additional mitigation for their IRA disturbances to satisfy the

1.5:1 mitigation ratio required under the *Regulated Riparian Habitat Mitigation Standards and Implementation Guidelines*.

D. Provide proof of authorized coverage prior to RRH disturbance. Site construction applicants will receive confirmation of authorized coverage via email to the applicant on record.

APPROVED BY:

_____ _____

Suzanne Shields Date
Director

Original Policy Approved:
Date(s) Revised: