

Chapter 5. Floodplain Management

5.0 Introduction

This chapter summarizes the County's rules and regulations regarding floodplain management and development. The requirements presented in this chapter should be used by the design engineer or applicant to determine the appropriate procedures, regulations, and limitations for development within the limits of a floodplain.

5.0.1 Floodplain Philosophy. Nature has claimed a prescriptive easement for floods, via its floodplains, that cannot be denied without public and private cost (White 1945). Flooding can result in loss of life, increased threats to public health and safety, damage to public and private property, damage to public infrastructure and utilities, and economic impacts to the residents of the County. In contrast, natural floodplains provide many benefits to the citizens of the County, including natural attenuation of flood peaks, water quality enhancement, groundwater recharge, wildlife habitat and movement corridors, and opportunities for recreation.

5.1 Douglas County Comprehensive Master Plan

The Douglas County Comprehensive Master Plan identifies several environmental constraints that affect or reduce the capability of the land to accommodate growth. Floodplains are classified as Class 3 constraints or hazards. Class 3 areas are considered a very high to extreme threat to public safety where potential loss of life is significant enough to warrant preservation of their natural states. These environmental hazard areas are encouraged to maintain non-urban land uses. The Master Plan specifically identifies a goal of limiting land uses in floodplains, to preclude damage to life and property and to maintain floodplains as open space.

5.2 Floodplain Management and Regulation

Section 18 of the *Douglas County Zoning Resolution* is the governing regulation for the Floodplain Overlay District in Douglas County, as discussed in Section 5.2.6 of this chapter. The detailed requirements outlined in Section 18 of the *Douglas County Zoning Resolution* are not reproduced in this chapter.

5.2.1 Floodplain Management. Floodplain management is generally defined as a comprehensive program of preventative and corrective measures to reduce losses associated with flooding. Floodplain management measures may include, but are not limited to, land use regulations (including new development and construction policy), construction of flood control projects, flood-proofing, floodplain preservation, acquisition of flood prone properties, education, and implementation of early warning systems. These measures must be implemented in a consistent manner to be of value.

5.2.2 Standard Level of Protection. The standard of practice, as defined by the Federal Emergency Management Agency (FEMA), the Urban Drainage and Flood Control District (UDFCD), and the County, requires implementation of

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floodplain management criteria within the 100-year floodplain. The 100-year floodplain is the land area that will be inundated or flooded, based on the stormwater runoff produced by the 100-year storm event. The 100-year storm event is defined as the rainfall event that has a 1% probability of being equaled or exceeded in any given year. Discharge flow rates in excess of the 100-year estimate will occur, but with lower probability. In those instances, typically the depth of flow and floodplain width would be greater than indicated on the floodplain maps provided by FEMA and UDFCD.

5.2.3 Higher Level of Protection. In some cases, a higher level of protection should be provided for flooding events that are produced by storm events in excess of the 100-year storm event. A higher level of protection should be considered for facilities and access routes that are critical for the protection of public health, safety, and welfare, or where flooding in excess of the 100-year storm event flooding could result in loss of life, significant damage to utilities and infrastructure, or result in hazardous materials being transported in flood waters.

5.2.4 National Flood Insurance Program. The National Flood Insurance Program is a federal program enabling property owners to purchase insurance protection against losses from flooding. Participation in the National Flood Insurance Program is based on an agreement between local communities and the federal government, which states that if a community will implement and enforce measures to reduce future flood risks to new construction in Special Flood Hazard Areas or designated floodplains, the federal government will make flood insurance available within the community. In the past, the national response to flooding disasters was generally limited to constructing flood control projects and providing disaster relief to flood victims after a flood occurred. This did not reduce losses or discourage unwise development in flood prone areas. Additionally, the public could not buy flood coverage from insurance companies. Faced with mounting flood losses and escalating costs to the general taxpayers, Congress created the National Flood Insurance Program. Douglas County entered the Regular Program of the National Flood Insurance Program in 1980 and the County has agreed to adopt and enforce floodplain development regulations that meet or exceed the minimum outlined in 44 Code of Federal Regulations, Part 60. If the community does not enforce the regulations that have been adopted, that community can be put on probation or suspended from the program. If suspended, our community would become non-participating and flood insurance policies could not be written or renewed in Douglas County.

5.2.5 Colorado Water Conservation Board. The Colorado Water Conservation Board is the State Coordinating Agency of the National Flood Insurance Program. The Flood Protection Program of the Colorado Water Conservation Board assists in the prevention of and recovery from flood disasters. The Colorado Water Conservation Board is responsible for technical review and approval of all reports and maps that are normally used by local governments for regulatory, floodplain administration, and insurance purposes. The Colorado Water Conservation Board review and approval process is officially known as floodplain designation. Designation and approval of the existing floodplain

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mapping enhances a community's ability to regulate 100-year floodplains more effectively. State enabling law for local zoning and subdivision regulation requires that technical information used for regulation of flood-prone areas be designated and approved by the Colorado Water Conservation Board.

5.2.6 Floodplain Development Regulations. The floodplain development regulations that have been adopted by the County are incorporated in the *Douglas County Zoning Resolution*, Section 18, Floodplain - Overlay District. The Floodplain Overlay District is applied as a supplemental regulation on existing zoned areas where potential flooding hazards have been identified. The regulations generally identify uses that are permitted within the Floodplain Overlay District, uses that are prohibited within the Floodplain Overlay District, standards for development in flood prone areas, and it outlines the Floodplain Development Permit process. A Floodplain Development Permit is required for any development proposed in the Floodplain Overlay District. FEMA defines development as “any man-made change to improved or un-improved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations, or storage of equipment and materials”. A Floodplain Development Permit is required for any change of land use or proposed development in the Floodplain Overlay District. The Floodplain Development Permit is in addition to other required permits and shall be acquired prior to the issuance of any other County permits, after the issuance of required State and Federal permits, and prior to approval of any construction drawings.

The Public Works Engineering Director or designated representative, as the Douglas County Floodplain Administrator, administers and implements the Floodplain Development Permit process, provides review of technical information that is required to ensure compliance with the regulations, and makes determinations regarding the boundaries of the Floodplain Overlay District. The Public Works Engineering Director will evaluate the application and submittal information and approve the permit, approve the permit with conditions or deny the permit.

The boundaries of the Floodplain Overlay District are generally defined by the Special Flood Hazard Areas shown on Flood Insurance Rate Maps (FIRMs), which are produced by FEMA, by the 100-year floodplain limits shown on Flood Hazard Area Delineation studies, produced by UDFCD, and other floodplain delineations or studies that have been approved for designation by the Colorado Water Conservation Board.

Requirements outlined in the *Douglas County Zoning Resolution* are enforced by the Director of Community Development or authorized representative. Failure to comply with the requirements of the Floodplain Overlay District or the conditions of an approved Floodplain Development Permit is considered a violation of these *Regulations*.

5.2.7 Unstudied or Unmapped Floodplains. There are numerous channels and streams in Douglas County that do not have FEMA-designated Special Flood

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Hazard Areas. A large portion of the County is outside of the Urban Drainage and Flood Control District, therefore no FHAD studies have been completed for those areas. The potential for loss of life and/or property along these streams exists, just as it does along those channels or streams within the Floodplain Overlay District, where floodplain limits or Special Flood Hazard Areas have been identified. In general, Douglas County will regulate these unstudied floodplains in the same manner as floodplains within the Floodplain Overlay District

5.3 Sources of and Use of Existing Floodplain Information

5.3.1 FEMA Flood Insurance Rate Maps (FIRMs) and Flood Insurance Study. The FIRMs are generally based on existing watershed conditions at the time the engineering analyses and accompanying survey were completed. In addition, detailed contour mapping may not have been available or used in the preparation of the original FIRMs. The purpose of these maps is to identify floodprone areas, by approximate or more detailed methods, and to establish flood risk zones for insurance rate purposes, within those floodprone areas. Typically, the information provided on the FIRMs and in the Flood Insurance Study is not based on consideration of changes that may occur due to future development in the watershed. Therefore, this information should not be solely relied upon as the actual limits of the 100-year floodplain. Further investigation of the assumptions, methodologies, and mapping that was used to produce the flood information on the FIRM should be performed by a Professional Engineer registered in the State of Colorado. In some cases, the FIRM maps are the only source of information available, and can be used as an aid, but it is likely that additional investigation and analyses will be required to define the actual floodplain limits.

The FIRM maps, however, are the official regulatory maps published by FEMA, and therefore must be used when determining limits of the Special Flood Hazard Area, and for complying with the floodplain regulations, as discussed previously in Section 5.2.6.

1. Detailed Studies. The FIRM maps generally contain Special Flood Hazard Area designations that were developed through a detailed study or by approximate methods. For drainageways that have a detailed study, Base Flood Elevations are provided on the maps and information is available in the Flood Insurance Study regarding floodplain and floodway widths, drainage areas, and peak discharges at select locations. In most cases, the Base Flood Elevations can be used in conjunction with detailed topographic information to produce a reasonable estimate of the floodplain limits on a particular site, as long as it can be verified that the topographic information and the Base Flood Elevations are referenced to the same vertical datum.
2. Approximate Zones. Special Flood Hazard Area designations that were developed by approximate methods (Zone A) are generally less accurate and Base Flood Elevations are not provided. Typically, there is no published information regarding peak flow rates. As a result, making floodplain

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determinations and correctly delineating the floodplain on a specific property is more difficult. Floodplain limits must be developed using topographic mapping and an acceptable level of hydrologic and hydraulic analysis. The level of analysis required may vary depending on the proposed activity or land use proposal and the County should be consulted as to what level of analysis is acceptable. FEMA has published guidance that can be utilized to help determine elevation information in Special Flood Hazard Areas developed by approximate methods. Procedures for making floodplain estimations in Zone A areas are outlined in the FEMA publication *Managing Floodplain Development in Approximate Zone A Areas*, however, the applicant's engineer should consult with the Public Works Engineering Department prior to selection of methodology or level of detail to confirm that they are reasonable and appropriate.

3. Map Revisions. FIRM maps are often updated due to development or construction projects, changes in hydrology, the use of better topographic information, or other factors that affect the accuracy of the current Special Flood Hazard Area limits. In most cases, the updates occur through a process called a Letter of Map Revision (LOMR). A LOMR provides revised floodplain information for a particular area, which supercedes the previous information and becomes the effective Special Flood Hazard Area designation. However, the LOMR is a separate document and the FIRM maps are not re-published with the changes resulting from every revision. When reviewing FIRM maps, it is important to determine whether any LOMRs have been completed for the area in question.
4. Map Availability. Current copies of the FIRM maps and LOMR information are available for review in the Douglas County Public Works Engineering Department. Maps can also be acquired through the FEMA Region 8 Office in Denver, or on-line at www.fema.gov.

5.3.2 UDFCD Flood Hazard Area Delineation Studies. The UDFCD's Flood Hazard Area Delineation studies and maps are prepared by UDFCD and participating local governments. Mapping used to define flooding limits is typically developed using aerial photogrammetric methods from aerial photography and the contour interval for the mapping is generally 2-feet. Flood Hazard Area Delineation studies provide relatively accurate representations of the floodplain limits. In many cases, Flood Hazard Area Delineation studies have been used as the basis for updating the FIRM maps.

1. Existing and Future Watershed Conditions. The Flood Hazard Area Delineations generally contain floodplain information for projected future land use conditions. The future conditions are based on the projected land use and associated impervious percentages within the basin.
2. Verify Assumptions. When relying on Flood Hazard Area Delineation information, it is important to verify that the current land use conditions and projections are consistent with the assumptions made in the Flood Hazard

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Area Delineation study. Existing topographic conditions must also be compared to mapping used to define the floodplain limits in the Flood Hazard Area Delineation study. Topography can change through natural erosive processes, grading, or construction of physical improvements. The construction of improvements upstream or downstream of a particular site or channel reach can also impact the floodplain limits and elevations that were previously defined.

3. Flood Hazard Area Delineation Revision. The process to revise a Flood Hazard Area Delineation study generally consists of the UDFCD and the local jurisdictions participating in a project to update the Flood Hazard Area Delineation, when necessary, due to significant changes in development or other assumptions, on which the original Flood Hazard Area Delineation study was based. Modifications to the floodplain, resulting from adjacent development, construction of road crossings or improvements, should generally be documented in drainage reports, floodplain studies, or construction drawings, which are submitted to the County during the development process. The County or UDFCD should be consulted when questions arise regarding the validity of floodplain limits or elevations presented in Flood Hazard Area Delineation studies.
4. Flood Hazard Area Delineation Availability. Flood Hazard Area Delineation studies are generally available for purchase or review through the UDFCD. Flood Hazard Area Delineation studies are also available for review at the Douglas County Public Works Engineering Department.

5.3.3 Other Floodplain Information. Floodplain data may be obtained from other sources, including the Colorado Water Conservation Board, special districts that have completed floodplain studies and mapping for their respective districts, County or other local government initiated studies, and studies that have been prepared by private property owners or developers. In some cases, the information may be used as a basis for floodplain delineation for permitting and land development purposes, but the accuracy of all such information will be required to be verified and the use of the information approved by the County's Floodplain Administrator.

5.3.4 Confirmation of Floodplain Data. Prior to using any published floodplain information for design or planning purposes, the source of the data, accuracy, modeling methodology, assumptions, etc. must be investigated. Numerous factors can change floodplain limits. Therefore, floodplain data is periodically updated to reflect changes due to floodplain modifications or the use of better technical data. The applicant is solely responsible for acquiring or developing accurate floodplain information for design and planning purposes.

5.4 Floodplain Information Unavailable

Floodplain limits or information has not been developed for many of the major drainageways in the County. Floodplain limits and elevations must be determined for

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these unstudied drainageways when development, including but not limited to, home construction, channel modification, grading and earthmoving, other construction activities, or storage is proposed. In general, where floodplain information is unavailable, the applicant will be responsible for delineating the floodplain, based on fully-developed conditions in the watershed, consistent with the requirements outlined in Sections 6.7 through 6.9 of these *Criteria*. It is understood that the resources available for providing this information are varied, and the methodology and level of detail may also vary, depending on the proposed activity and the need for accurate representations of the floodplain limits. If discrepancies or questions regarding the level of effort arise, the Floodplain Administrator will be responsible for determining the level of effort necessary for delineating the floodplain on a specific property. The determination will be made based on County, UDFCD, FEMA, and Colorado Water Conservation Board requirements, as applicable, as well as potential impacts and type of development or activity proposed. For floodplain determination regarding individual structures, consideration will be given to the proximity of the structure to the drainageway, the topography of the land between the drainageway and the structure, and the height of the finished floor (including basement) with respect to the adjacent topography and drainage channel.

5.5 Construction in or Development Adjacent to Floodplains

5.5.1 General. The following sections identify the two areas within the floodplain that are generally defined for regulatory purposes and discuss additional issues related to development adjacent to floodplains.

5.5.2 Floodway. The floodway is defined as the stream channel and that portion of the floodplain that must be reserved in order to discharge the base flood without cumulatively increasing the water surface more than a designated height. In Douglas County, the floodway is based on a maximum increase in the flood elevation of 0.5-feet. The floodway limits are typically generated through hydraulic modeling by assuming equal encroachment on both sides of the floodplain. The floodway can't be identified by visual inspection on a specific site or stream reach. The floodway is defined for regulatory purposes and development in or use of the floodway is severely restricted. It should not be assumed that there is an inherent right to fill in the flood fringe, if a floodway has been identified.

5.5.3 Floodplain Fringe. The floodplain fringe is the portion of the 100-year floodplain that is not within the floodway, and in which development and other forms of encroachment may be considered. In simple terms, the County may permit encroachments within the floodplain fringe to the extent that no more than a 0.5-foot rise in the Base Flood Elevation occurs. This is more restrictive than the 1-foot floodway restriction imposed by FEMA.

5.5.4 Floodplain Fringe Encroachments. In many cases, it can be demonstrated that encroachment into the floodplain fringe has little or no impact on the base flood elevations at a specific location, because the encroachment is occurring in a backwater or ineffective flow area. This practice, however, reduces or

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eliminates valuable floodplain storage areas and the cumulative effect can have significant impacts on downstream properties. Reduction of floodplain storage areas can increase peak flow rates and associated base flood elevations downstream, even though there may be little impact at the site where the encroachment occurs. For that reason, this practice may be contrary to the County objective of precluding damage to life and property and it is contrary to the objective of maintaining floodplains as open space. For those reasons, encroachments into the floodplain fringe will be considered on a case-by-case basis. When considering requests involving floodplain fringe encroachment, the County shall consider, at a minimum, the following:

- Impacts to adjacent properties. If the encroachment creates a rise in the Base Flood Elevation on properties other than that of the applicant, the applicant will be required to obtain floodplain easements for the additional floodplain property.
- Channel hydraulics and design. If the encroachment creates a significantly narrow channel, with steep side slopes and undesirable velocities, the County may require mitigating channel improvements, or not support the floodplain encroachment.
- Channel aesthetics and land use. If the fringe encroachment significantly impacts the aesthetics of the natural drainageway, and the resulting channel improvements create a drainageway that is not deemed compatible with the surrounding land uses, the County may not support the floodplain fringe encroachment.

5.5.5 Subdivision Platting and Floodplains. In general, platted lots must be located outside of the 100-year floodplain limits. That being the minimum criteria, subdivision layout should also consider the size of the tributary watershed and higher degrees of protection where 500-year floodplains have been identified, the stability of the drainageway and anticipated improvements in the floodplain, access and trail requirements adjacent to the floodplain, the proximity of steep or vertical banks relative to the location of lot lines, the potential for the channel to migrate horizontally over time, topography of the proposed lots, and the differences in elevation between the flooding elevation and potential structure locations. The County will not allow lot lines to be placed immediately adjacent to the floodplain limits without consideration of all these factors.

The County may consider allowing lots to be platted within the limits of the floodplain in the Estate Residential, Rural Residential, and Large Rural Residential Zoning Districts where individual residential lot sizes vary from 2.5-acres to 34.9-acres. Within these large lot zoning districts it may be feasible to use floodplain easements and defined building envelopes to ensure that proposed structures are located well outside of the floodplain limits and that uses are restricted in the floodplain portion of the lot.

1. Actual Floodplain Limits. The floodplain limits used for subdivision layout must be based on existing or proposed floodplain information that has been verified for accuracy or floodplain limits must be developed through detailed

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hydrologic and hydraulic analyses, based on fully developed conditions in the upstream watershed.

2. **FEMA Special Flood Hazard Areas.** In addition to the physical floodplain limits, FEMA-designated Special Flood Hazard Area boundaries must be considered in subdivision layout, where applicable. When the Special Flood Hazard Area boundary accurately represents the proposed floodplain limits, lots can be platted as discussed in the previous sections. There are many cases, however, where the Special Flood Hazard Area is much wider than the actual or proposed floodplain. This situation frequently arises in locations where the Special Flood Hazard Area was delineated using approximate methods or where improvements are proposed to confine the floodplain. In this case, platted lots must be outside of the Special Flood Hazard Area and the actual floodplain, whichever is more restrictive. Alternatively, subdivision layout can be based on the actual or proposed floodplain, with the other considerations outlined in this section. All lots that are affected by the Special Flood Hazard Area will be plat restricted to deny conveyance of lots or issuance of building permits on those lots until a LOMR has been issued by FEMA and the LOMR appeal period has expired. In some cases, a CLOMR may be required prior to acceptance of the final plat, to ensure that FEMA will issue a LOMR after improvements are constructed. The LOMR and other FEMA map revision processes are discussed in further detail in Section 5.7 of this chapter. Although outside of the actual floodplain, if lots are partially or totally within the Special Flood Hazard Area, owners can be burdened with mandatory flood insurance purchase requirements, which is not acceptable to Douglas County.

- 5.5.6 Freeboard Requirements.** A minimum clearance, or freeboard shall be provided between the 100-year base flood elevation and structures and other applicable facilities which may be impacted by the floodplain. Freeboard is required to allow for uncertainty in the floodplain modeling, changes to the drainageway (i.e., increased invert due to sedimentation), and to provide an additional factor of safety for structures and facilities which would result in damages or hazards during inundation. A minimum of 2-feet of freeboard shall be provided between the 100-year base flood elevation and the lowest finished floor elevation of all structures (this includes basements). For facilities which are not structures (typically not requiring a building permit) such as roadways, utility cabinets, parks and trails structures, etc., a minimum of 1-foot of freeboard is acceptable. Where possible the required freeboard should be contained within the floodplain tract and/or easement.

5.6 FEMA Map Revisions and Amendments

- 5.6.1 General.** FEMA FIRM maps are the official regulatory maps that Douglas County must use for implementation and enforcement of the floodplain development regulations, which are generally discussed in Section 5.2.6 of this chapter. In addition, the maps show projected flooding elevations, flood velocities, floodway dimensions, and flood risk zones used for insurance

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purposes. It is important, and required, that the maps be updated to correct non-flood-related features, include analyses based on better ground elevation data, reflect changes in ground elevations within the floodplain, revised flooding data, and to reflect flood control projects or other construction in the floodplain. Detailed information, revision request forms, technical requirements for map revisions or amendments, and construction requirements are included in the National Flood Insurance Program Regulations in 44 Code of Federal Regulations or are available through FEMA. The following sections provide brief descriptions of the various types of map revisions or amendments and how the requirements impact proposed projects.

- 5.6.2 Conditional Letter of Map Revision (CLOMR).** A CLOMR is FEMA's comment on a proposed project or the use of better data that would affect the hydrologic or hydraulic characteristics of a flooding source and thus result in the modification of the existing regulatory floodway, Base Flood Elevations, or limits of the Special Flood Hazard Area. A CLOMR is required by FEMA, prior to construction, for projects or construction in the floodway that will result in an increase in the Base Flood Elevations. The County may also require processing of a CLOMR for other projects when it is important to ensure that the Special Flood Hazard Area will be revised, based on a proposed project or the use of better data.
- 5.6.3 Conditional Letter of Map Revision Based on Fill (CLOMR-F).** A CLOMR-F is FEMA's comment on whether a proposed project involving the placement of fill outside of the regulatory floodway, would exclude an area from the Special Flood Hazard Area. The County may require processing of a CLOMR-F for a project when it is important to ensure that the Special Flood Hazard Area will be revised, based on a proposed project which involves fill in the flood fringe
- 5.6.4 Letter of Map Revision (LOMR).** A LOMR is an official revision, by letter, to an effective FIRM map. A LOMR may change flood insurance risk zones, floodplain and/or floodway boundary delineations, planimetric features, and/or Base Flood Elevations. The LOMR may be based on the use of better data or as-built conditions reflecting flood control or other construction projects. The LOMR must be completed and issued in order to revise the effective Special Flood Hazard Area.
- 5.6.5 Letter of Map Revision Based on Fill (LOMR-F).** A LOMR-F is a document issued by FEMA that officially removes a property and/or structure from the Special Flood Hazard Area. A LOMR-F provides FEMA's determination concerning whether a structure or parcel has been elevated on fill above the Base Flood Elevation and excluded from the Special Flood Hazard Area.
- 5.6.6 Conditional Letter of Map Amendment (CLOMA).** A CLOMA is FEMA's comment on a proposed structure or group of structures that would, upon construction, be located on existing natural ground above the Base Flood Elevation. Generally, a CLOMA involves parcels, portions of parcels, or individual structures that were inadvertently included in the Special Flood Hazard Area.

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5.6.7 Letter of Map Amendment (LOMA). A LOMA is a document issued by FEMA that officially removes a property and/or structure from the Special Flood Hazard Area. A LOMA establishes a property or structure's location in relation to the Special Flood Hazard Area.

5.7 Floodplain Modification Study

5.7.1 Requirement. A Floodplain Modification Study is required when development or other activities are proposed that require modification of, or construction in, the existing floodplain, the FEMA Special Flood Hazard Area, or when proposals involve use of property within the floodplain limits. Activities or projects that may potentially affect floodplains are not limited to new development. Some other activities include, but are not limited to, bridge or culvert construction, utility installation, channel stabilization projects, trail crossing construction, and proposed storage of equipment or materials. This requirement applies to all proposed activities within the Floodplain Overlay District and proposed activities along any major drainageway associated with development projects.

5.7.2 Incorporation Into Other Submittals. The Floodplain Modification Study will be required in support of Floodplain Development Permit applications and in some cases it will be an independent document. Often, the Floodplain Modification Study requirements could be incorporated into the Phase II or Phase III drainage reports for development projects, or form the basis for CLOMR or LOMR submittals to FEMA.

5.7.3 Floodplain Modification Study Outline. The Floodplain Modification Study must be certified by a Professional Engineer registered in the State of Colorado and it must address the following items through detailed analysis or through reference to adopted drainage master plans:

1. A description of the site consistent with the outline for a Phase III drainage report.
2. A description of the major drainage basin in accordance with the outline for a Phase III drainage report.
3. The identification of drainage master plan reports, Flood Hazard Area Delineation studies, or Flood Insurance Studies with a discussion of the applicability of published information or data to the proposed activity or modification and the Floodplain Modification Study.
4. Hydrologic analysis. This section should include a narrative on the source of peak flow rates used for design. The flow rates used should be those generated by the 100-year event under future development conditions for the entire watershed, unless the floodplain modification study is for a CLOMR/LOMR application, in which case, the Flood Insurance Study discharges should be used.

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5. Characteristics of the proposed channel including, but not limited to, slope, roughness, depth, velocity, Froude Number, centerline alignment and stationing, and cross sections. Existing topographic mapping may be utilized if it has been field verified to determine if changes have occurred. The profile and plan shall be given for existing condition and for the proposed channel alignment including the cross section locations.
6. A description of the method of hydraulic analysis (HEC-2 or HEC-RAS) and its application in the study.
7. Identification and discussion of all input parameters and basis for input parameters.
8. Discussion of the results and conclusions of the hydraulic analysis. This shall include a narrative summary of the results, printed comprehensive output file free of modeling errors, and an electronic file of the modeling effort for County review.
9. The delineation of the existing and proposed 100-year floodplain and water surface profiles for both conditions, including cross-section locations.
10. A description of potential impacts to other properties, in the vicinity of the modification or activity, and to downstream properties adjacent to the floodplain.
11. A description of measures proposed to mitigate potential impacts.
12. A conceptual design for the channel including bank protection, drop structures, culverts, bridges, and hardened trickle channel or low flow channel.
13. If appropriate, an analysis of sediment transport and fluvial morphology.

The report should be prepared using the drawing size, map scale, and engineer certification requirements that are outlined in Section 4.5 for a Phase III drainage report.

5.7.4 Agency Review Requirements. Requests to modify the floodplain must be reviewed by several agencies, depending on the existing mapping of the flood hazard area and the extent of the modifications proposed, but in general conformance with the following:

1. County. The County has land use control and authority and is responsible for regulating use of or modification of floodplain areas. The County will review all floodplain modification submittals and determine requirements regarding review or approval of the proposed modification or activity by the other agencies. The initial submittal of any Floodplain Modification Study shall be to the County.

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2. Urban Drainage and Flood Control District. The UDFCD develops Flood Hazard Area Delineation studies for major drainageways within the UDFCD boundaries. The UDFCD is involved in the review of all the floodplain modifications in the County that fall within their boundaries. Within the UDFCD, all floodplain modifications to major drainageways, that have or have not been mapped with Flood Hazard Area Delineation studies, will be submitted to the UDFCD for review and approval.
3. Colorado Water Conservation Board. As discussed in Section 5.2.5, the Colorado Water Conservation Board is the State Coordinating Agency of the National Flood Insurance Program. The Colorado Water Conservation Board is responsible for technical review and approval of all reports and maps that are normally used by local governments for regulatory, floodplain administration, and insurance purposes.
4. FEMA. This agency administers the National Flood Insurance Program. FEMA publishes Flood Hazard Boundary Maps and Flood Insurance Rate Maps that show floodplain boundaries for major drainageways. FEMA reviews applications to modify these FEMA designated floodplains. The County will require that all floodplain modifications that impact a FEMA-designated floodplain be submitted to FEMA for review and approval via a CLOMR/LOMR process.

5.7.5 Conceptual Approval. Floodplain modifications must be permitted by the County and approved by the agencies listed previously, depending on the proposed modification and site location. All projects or proposed modifications should be discussed with the County, in concept, prior to commencement of efforts required to produce the Floodplain Modification Study.