

LARIMER COUNTY
ENGINEERING DEPARTMENT



FLOODPLAIN DEVELOPMENT GUIDE



TABLE OF CONTENTS

- 1. INTRODUCTION..... 4
- 2. ACKNOWLEDGEMENTS..... 4
- 3. FLOODPLAIN REGULATIONS..... 4
- 4. FLOODPLAINS & FLOOD ZONES 5
 - Regulatory Floodplains in Larimer County 5
 - How Can I View the Floodplains in Larimer County? 6
 - What are Flood Zones and How Do They Impact My Property? 6
 - How are the Flood Zones Displayed on the Online Floodplain Map?..... 9
- 5. FLOODPLAIN PERMITS..... 12
 - What Activities Need a Floodplain Development Permit? 12
 - What is the Process for Obtaining a Floodplain Development Permit? 13
 - What Submittals are Needed to Obtain a Floodplain Permit? 14
- 6. CONSTRUCTION PLANS..... 17
 - Structural Plan Requirements 17
 - Non-Structural Plan Requirements 18
- 7. HYDRAULIC STUDIES..... 19
 - No-Rise Analysis 19
 - Floodway Delineation 24
 - Floodplain Project Reviews 27
 - Map Amendments..... 31
- 8. CERTIFICATES 41
 - No-Rise and No Adverse Impact Certificate Requirements 42
 - FEMA Elevation Certificates 42
- 9. WET FLOODPROOFING 44
 - Floodproofing Requirements 45
- 10. REMODELS, REPAIRS, & IMPROVEMENTS..... 46
 - Substantial Improvement/Repair Requirements 46
 - Inclusions & Exclusions 47
- 11. FLOOD REVIEW BOARD..... 47

Variance Requests	49
Code Interpretation Requests	53
Map Amendments.....	53
Floodplain Project Reviews	54
12. RESOURCES.....	56

FIGURES AND TABLES

Figure 1. FEMA Floodplain on the Larimer County Online Floodplain Map	10
Figure 2. Best Available Floodplain on the Larimer County Online Floodplain Map	11
Figure 3. Floodplain Development Permit Flowchart.....	14
Figure 4. Map Amendment Flowchart	40
Figure 5. Floodplain Layer Symbology & Naming Conventions	41
Figure 6. No-Rise Certificate Example	43
Figure 7. No Adverse Impact Certificate Example.....	44
Figure 8. Flood Review Board Flowchart	48

1. INTRODUCTION

These guidelines have been prepared to aid in understanding the processes and submittal documentation necessary for the review and approval of floodplain development activity occurring in the Larimer County Floodplain Overlay (FPO) District. These guidelines are not intended to replace any requirements for floodplain submittals to the Federal Emergency Management Agency (FEMA) or the Colorado Water Conservation Board (CWCB). This is a living document and will be updated as necessary by County staff.

2. ACKNOWLEDGEMENTS

The information contained in this document was adapted from several sources, including the City of Fort Collins, the Colorado Department of Transportation (CDOT), the Federal Emergency Management Agency (FEMA), and the Colorado Water Conservation Board (CWCB).

3. FLOODPLAIN REGULATIONS

Larimer County floodplain regulations exist to (1) help preserve, protect, and improve the safety, health, and property of Larimer County residents from the adverse impacts of flooding and (2) meet or exceed minimum federal and state standards for floodplain regulation which qualify Larimer County property owners for flood insurance under the National Flood Insurance Program (NFIP).

The NFIP was created through the National Flood Insurance Act of 1968 (NFIA). The purpose of the program was to reduce flood damage and losses through the enforcement of floodplain regulations and management practices. Under the NFIP, local communities agree to adopt and enforce federal and state floodplain regulations in addition to their own local ordinances. In exchange, community residents and property owners become eligible to purchase subsidized federal flood insurance and the County becomes eligible to receive federal disaster aid. Floodplain regulations which govern floodplain development in Larimer County include:

1. Article 12 of the Larimer County Land Use Code (LCLUC)
2. National Flood Insurance Act of 1968
3. 44 Code of Federal Regulations §65.3 (44 CFR §65.3)
4. Section 2 Colorado Code of Regulations 408-1 (2 CCR 408-1)
5. CWCB Rules and Regulations for Regulatory Floodplains in Colorado (CWCB Rules and Regulations)

Article 12 of the LCLUC can be viewed by navigating to the Larimer County Floodplains Website at www.larimer.org/engineering/floodplains.

4. FLOODPLAINS & FLOOD ZONES

Regulatory Floodplains in Larimer County

Floodplains are areas which are prone to flooding and typically located along river corridors or other water bodies. Regulatory floodplains are those for which Larimer County enforces regulations for various forms of development and are often associated with a specific level of flood risk. In Larimer County, regulatory floodplains generally include the areas which would be inundated during flood events associated with a 1% annual chance of occurrence (1% ACE) and a 0.2% annual chance of occurrence (0.2% ACE), commonly referred to as the 100-year and 500-year floods, respectively.

For purposes of regulation, Larimer County has established a zoning district which includes all its regulatory floodplains called the “Floodplain Overlay District,” or FPO District. There are several different regulatory floodplains in the FPO District, including: the FEMA Floodplain, Best Available Floodplain, Municipal Floodplain, Poudre GMA Floodplain, and Larimer County Flood-Prone Areas. These floodplains have been established by different sources and often contain unique floodplain regulations. A brief description of each is provided below:





1. FEMA Floodplain: this floodplain includes the areas within the Special Flood Hazard Areas (SFHAs) designated by FEMA on its Flood Insurance Rate Maps (FIRMs).
2. Best Available Floodplain: this floodplain includes the areas within the 1% ACE or 0.2% ACE flood zones identified by a new floodplain study which has not yet been formally approved by FEMA. These areas are defined by draft or preliminary flood hazard information which meet the following criteria:
 - a. The draft or preliminary flood hazard information is supplied by FEMA, the Colorado Water Conservation Board (CWCB), or another source.
 - b. The draft or preliminary flood hazard information is more restrictive than the FEMA Floodplain.
 - c. The draft or preliminary information has been approved by CWCB
3. Municipal Floodplain: this floodplain includes areas within flood zones identified by incorporated cities and towns within Larimer County.
4. Cache La Poudre Growth Management Area Floodplain (Poudre GMA Floodplain): The Poudre GMA Floodplain includes the areas within the FEMA Floodplain and Best

Available Floodplain for which the Cache La Poudre River is the flooding source and within the Fort Collins Growth Management Area (GMA).

5. Larimer County Flood-Prone Areas (FPAs): this floodplain includes other areas in Larimer County which are designated as prone to flooding by resolution of the Larimer County Board of Commissioners (BCC).

How Can I View the Floodplains in Larimer County?

Regulatory floodplains can be viewed using Larimer County's online floodplain map. Follow the instructions below to view the floodplain information for your property:

1. Navigate to the Larimer County Floodplains Website at www.larimer.org/engineering/floodplains
2. Click the "Online Floodplain Map – Larimer County Land Information Locator" button near the top of the screen.
3. Type your address in the search bar at the top right of the screen and click the search icon . The search results will appear on the left side of the screen. If your search has multiple results or your parcel does not automatically appear on the map, click the appropriate parcel from the list and the map will zoom into your property.
4. Click the "Flood" button  near the top of the screen if floodplain information is not already displayed.
5. Click the "Layer List" icon  near the top left of the screen. A list of map layers will appear below.
6. Scroll down to the "Floodplain" layer. Check the box next to "2021 FEMA (Preliminary)" to see the preliminary floodplain layer for your area. You can compare this to the current floodplain for your property by checking the "FEMA Floodplain (Current Effective)" on or off.
7. To view the flood zone legend, click the "+" to the left of the "2021 FEMA (Preliminary)" layer or the "FEMA Floodplain (Current Effective)" layer. Scroll down to the "FEMA Floodplains" sublayer and click the  button. The flood zone legend will appear below.

What are Flood Zones and How Do They Impact My Property?

Each floodplain includes a variety of flood zones which have unique floodplain regulations and requirements. The following descriptions provide a short summary of each flood zone and typical regulations which may apply within them:

Zone AE (Floodway), 1% Annual Chance Floodway

This zone is associated with the highest flood risk in Larimer County and often carries the greatest flooding depths & velocities. This zone must be reserved from development and typically experiences the greatest flooding depths and velocities. New structures are prohibited in this zone and other forms of development are highly restricted. Base flood elevations (BFEs) are determined in these zones.

Typical floodplain regulations in this zone may include:

- New structures are prohibited
- Most uses are prohibited
- No-rise hydraulic analysis and PE certification required

Zone AE (Flood Fringe), 1% Annual Chance Flood Hazard

This zone includes areas that would be flooded if a 100-year flood occurred but does not fall within the floodway zone. This zone is typically on the “fringe” of the 100-year floodplain (hence the name) and is determined using detailed survey and hydraulic analyses. Base flood elevations (BFEs) are determined in these zones.

Typical floodplain regulations in this zone may include:

- Structures must be designed to reasonably protect from flood damage
- Lowest floor of structures and mechanical equipment must be elevated at least 18” above BFE
- FEMA Elevation Certificate(s) may be required during and/or after construction
- Use restrictions exist if within the Poudre GMA

Zone A, 1% Annual Chance Flood Hazard

This zone includes areas that would be flooded if a 100-year flood occurred but does not typically have a delineated floodway. This floodplain is determined using approximate methods of hydraulic analysis and without the use of manual surveying techniques. Base flood elevations often have not been determined in these areas.

Typical floodplain regulations in this zone may include:

- Structures must be designed to reasonably protect from flood damage
- Floodway delineation required if a structure is proposed within 100’ from channel centerline
- BFE must be determined by a professional engineer (PE) or County Engineer

- Lowest floor of structures and mechanical equipment must be elevated at least 18" above BFE
- FEMA Elevation Certificate(s) may be required during and/or after construction
- Use restrictions exist if within Poudre GMA

Zone AH, 1% Annual Chance Flood Hazard

This zone includes areas that would be flooded if a 100-year flood occurred but mainly experiences shallow flooding depths (1-3 feet). Base flood elevations have been determined in these areas at selected intervals.

Typical floodplain regulations in this zone may include:

- Structures must be designed to reasonably protect from flood damage
- Lowest floor of structures and mechanical equipment must be elevated at least 18" above BFE
- FEMA Elevation Certificate(s) may be required during and/or after construction
- Use restrictions exist if within Poudre GMA

Zone AO, 1% Annual Chance Flood Hazard

This zone includes areas that would be flooded if a 100-year flood occurred but mainly experiences shallow flooding depths (1-3 feet). Flooding depths are usually provided in lieu of base flood elevations.

Typical floodplain regulations in this zone may include:

- Structures must be designed to reasonably protect from flood damage
- Lowest floor of structures must be elevated at least 18" above the flooding depth
- FEMA Elevation Certificate(s) may be required during and/or after construction
- Use restrictions exist if within Poudre GMA

Zone X, 0.2% Annual Chance Flood Hazard [a.k.a. Zone X (Shaded)]

This zone includes areas that would be flooded if a 500-year flood occurred.

Typical floodplain regulations in this zone may include:

- Structures must be designed to reasonably protect from flood damage
- Use restrictions exist if within Poudre GMA

- Critical facility regulations apply in Poudre GMA for essential service facilities and at-risk population facilities

Zone X, Area with Reduced Risk Due to Levee [a.k.a. Zone X (Shaded Protected by a Levee)]

This zone includes areas that would be flooded if a 500-year flood occurred but has a reduced risk of flooding due to levee protection.

Typical floodplain regulations in this zone may include:

- Structures must be designed to reasonably protect from flood damage
- Use restrictions exist if within Poudre GMA
- Critical facility regulations apply in Poudre GMA for essential service facilities and at-risk population facilities

Zone X, 1% Depth Less Than 1 Foot

This zone includes areas that would be flooded if a 100-year flood occurred but mainly experiences a depth less than 1 foot.

Typical floodplain regulations in this zone may include:

- Structures must be designed to reasonably protect from flood damage
- Lowest floor of structures and mechanical equipment must be elevated at least 18" above BFE
- FEMA Elevation Certificate(s) may be required during and/or after construction
- Use restrictions exist if within Poudre GMA

Zone X, Area of Minimal Flood Hazard

This area does not have a FEMA-designated floodplain.

Area Not Included

This area does not have a FEMA-designated floodplain.

How are the Flood Zones Displayed on the Online Floodplain Map?

The County's Online Floodplain Map uses a variety of colors and patterns to show the different flood zones in a particular area. Examples of a typical floodplain and associated flood zone legend you may encounter when viewing the County's online floodplain map are provided below. Instructions for viewing the online map and associated flood zones are provided in the section titled "How Can I View the Floodplains in Larimer County?".

Figure 1. FEMA Floodplain on the Larimer County Online Floodplain Map

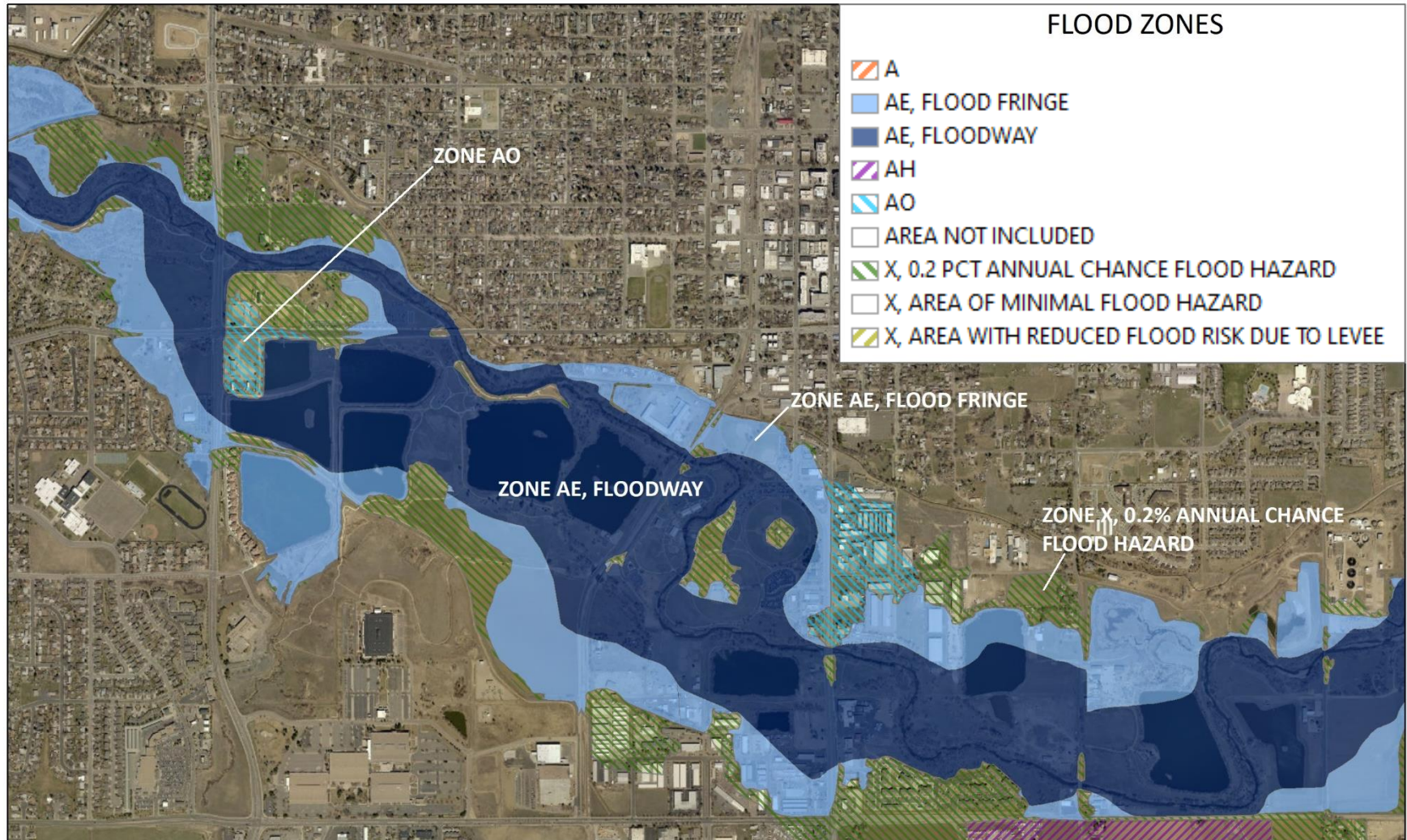
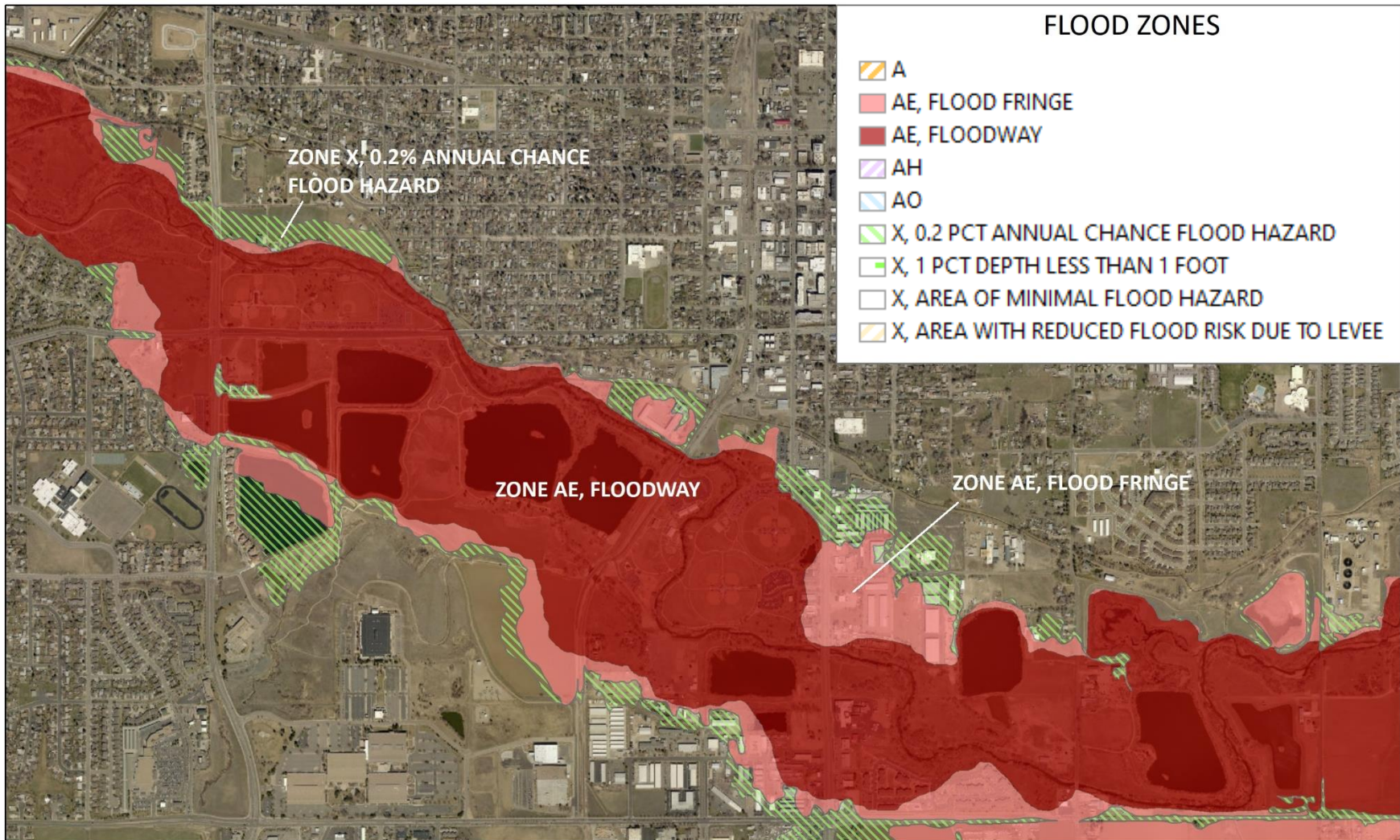


Figure 2. Best Available Floodplain on the Larimer County Online Floodplain Map



5. FLOODPLAIN PERMITS

What Activities Need a Floodplain Development Permit?

In Larimer County, **all floodplain development is required to obtain a Floodplain Development Permit (FDP)** unless it meets the exceptions described below. This is true even if a building permit or other permit is not required. Floodplain development is defined as “any manmade change to improved and unimproved real estate, including, but not limited to, buildings or other structures, mining, dredging, filling, grading, paving, excavating or drilling operations” within the FPO district.

Floodplain Development Permit Exceptions

Exceptions to the requirement for an FDP include the following:

1. Routine Maintenance of Buildings

- FDPs are required for routine maintenance of buildings. However, requirements may be modified for routine maintenance of buildings at the discretion of the County Engineer. Competent evidence may be required by the County Engineer for routine maintenance activities within the FPO District which demonstrates reasonable costs of labor and materials associated with routine maintenance activities. Such evidence may include, but is not limited to, an itemized cost estimate and affidavit(s) attesting to the truth and validity of the cost estimate. Competent evidence shall be submitted in accordance with the Larimer County Floodplain Development Guide. The County Engineer shall determine if the costs of labor and materials for a floodplain development project are reasonable.

Routine maintenance of buildings includes repairs or work necessary to keep an existing building in a safe and habitable condition and for which the total cost does not exceed \$10,000. Such repairs include reroofing or replacing roof tiles, replacing siding, painting, wallpapering, tiling, carpeting, replacing, or repairing windowpanes, replacing, or repairing plumbing systems, electrical systems, or heating and air conditioning systems, basement sealing, or repairing wells or septic systems. Routine maintenance does not include repairs associated with flood damage.

3. Routine Maintenance of Infrastructure

FDPs are not required for routine maintenance of infrastructure which does not result in modifications to the hydraulic characteristics of a floodplain, the FPO District, or the Base Flood Elevations (BFEs) as determined by the County Engineer. Routine maintenance of infrastructure includes repairs or work or necessary to keep existing

infrastructure such as roads, bridges, ditches, headgates, pipelines, or utilities in a safe and usable condition as determined by the County Engineer.

Routine maintenance of infrastructure must not result in, or have potential to result in, modifications to the hydraulic characteristics of a floodplain, FPO District, or the Base Flood Elevations (BFEs) as determined by the County Engineer. The County Engineer may require an FDP for maintenance activities at his or her discretion if it appears an activity may impact the hydraulic characteristics of a floodplain, the FPO District, or the Base Flood Elevations (BFEs).

4. No Fill, Excavation, or Grading

FDPs are not required for activities such as gardening, plowing, and similar practices that do not involve filling, excavation, or grading.

5. Accessory Materials

FDPs are not required for the placement of furniture and other accessory materials which are not fixed to the ground or structure, used routinely by the occupants of a structure, and can be moved quickly in event of a flood as determined by the County Engineer. This exemption does not include materials which are determined to be outdoor storage materials per this Code or by the County Engineer.

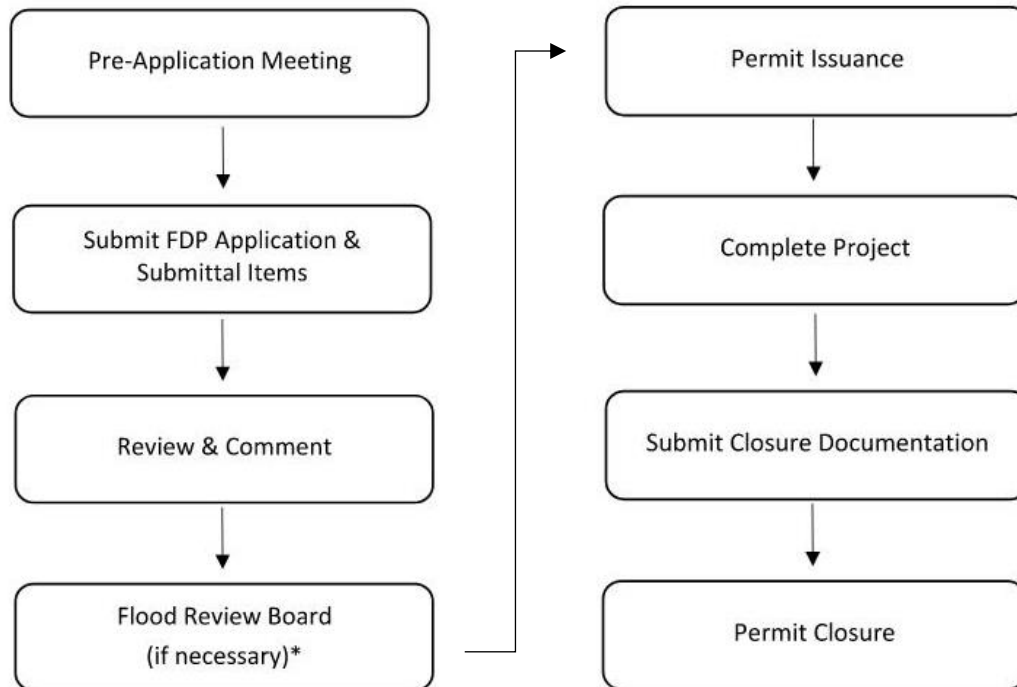
6. 500-Year Floodplain Outside of Fort Collins Growth Management Area

FDPs are not required for floodplain development within a flood zone designated as a FEMA Floodplain Zone X (Shaded), FEMA Floodplain Zone X (Shaded Protected by a Levee), Best Available Floodplain Zone X (Shaded), or a Best Available Floodplain Zone associated with 0.2% annual chance of flooding which is not located within the Poudre GMA Floodplain.

What is the Process for Obtaining a Floodplain Development Permit?

The process for obtaining a Floodplain Development Permit (FDP) begins with the submittal of a Floodplain Development Permit Application (FDP Application) and other submittal items needed to evaluate whether floodplain requirements are adequately met by the project. Floodplain development projects are categorized by structural or non-structural projects and may need to be evaluated by Larimer County's Flood Review Board depending on the nature of the project. The process for obtaining an FDP is shown in Figure 3.

Figure 3. Floodplain Development Permit Flowchart



*The Flood Review Board process is discussed in further detail in the Flood Review Board section of this guide.

What Submittals are Needed to Obtain a Floodplain Permit?

Several items need to be provided to the County before issuance of a Floodplain Development Permit (FDP). The following sections briefly describe the submittals which are required to obtain an FDP. Further information on several items is provided in later sections of this guide.

✓ **Floodplain Development Permit Application**

To get a Floodplain Development Permit, the project applicant and/or engineer will begin by completing a FDP Application which can be downloaded through the Larimer County Floodplains website (<https://www.larimer.org/engineering/floodplains>). This application will provide basic information regarding the nature of the project, location, and how various floodplain requirements will be met. Along with the FDP Application, the applicant or engineer will need to provide additional materials to support the application as described below.

✓ **Construction Plans**

Construction plans must be provided with the FDP Application. FDP Applications can be submitted for structural or non-structural projects. In Larimer County, structural projects include (but are not limited to) buildings with at least two walls or a roof, gas and liquid storage

tanks, electrical facilities (e.g. cellular towers, transformers, solar panels, etc.), and fixed accessory structures (decks, fences, carports, gazebos, pergolas, etc.). Non-structural projects include (but are not limited to) earthwork activities, stream restoration, bank stabilization, bridges, culverts, roads, and utility projects. For non-structural projects, construction plans must be certified by a licensed Colorado Professional Engineer (PE). Further discussion on the requirements for construction plans is provided in the Construction Plans section of this guide.

Hydraulic Study

A hydraulic study is required for:

- Floodplain development and variance requests within a floodway zone including existing, unpermitted development or change of use applications,
- Floodplain development within 100' of a channel centerline in a Zone A floodplain or as determined by the County Engineer,
- Variance requests where hydraulic conditions need to be evaluated by Larimer County Flood Review Board (FRB) or at the discretion of the County Engineer,
- Floodplain Project Reviews, and
- Map Amendments

Hydraulic studies must be prepared by a licensed Colorado Professional Engineer (PE) and include a hydraulic report along with all supporting data, files, and documentation needed to prepare the study. Often, supporting files will include hydraulic modeling files, technical data (e.g. survey or topographic data), maps, tables, and figures. Further discussion on the requirements for hydraulic studies is provided in the Hydraulic Studies section of this guide.

Certificates

Various certificates may be required with the FDP Application. Certificates that may apply to floodplain development include:

- No-Rise Certificate
- No Adverse Impact Certificate
- FEMA Elevation Certificate

If the floodplain development is within a regulatory floodway, a No-Rise Certificate and No Adverse Impact Certificate (signed and stamped by a licensed Colorado Professional Engineer) must be submitted to the County prior to FDP issuance. If an applicant is seeking an FDP for a structure, at least one FEMA Elevation Certificate (signed and stamped by a licensed Colorado Professional Engineer or Land Surveyor) will be required. Elevation certificates may be required by the County Engineer at any point during or after construction. Typically, these are required

immediately after the foundation is completed and/or after construction is complete. If an existing structure is being permitted to come into compliance with code requirements, the County Engineer may require an elevation certificate prior to issuance of the FDP.

Forms for these the No-Rise and No Adverse Impact certificates can be downloaded from the Larimer County Floodplains website (<https://www.larimer.org/engineering/floodplains>).

Elevation certificates can be downloaded from FEMA's website. Further discussion on the requirements for these certificates is provided in the Certificates section of this guide.

Floodproofing Design Specifications

Floodproofing is a design alternative to reasonably protect certain buildings from structural failure when the lowest floor elevation is below the flood protection elevation. Dry floodproofing is a method which prevents the entry of floodwaters into the building, while wet floodproofing allows the entry and exit of floodwaters to reduce the effects of static (stationary) flood forces on the structure.

If an applicant is seeking to floodproof a structure, the design details and specifications must be submitted to the County prior to FDP issuance. These must follow FEMA guidelines and LCLUC requirements for approval and will require the certification of a licensed Colorado Professional Engineer (PE) if determined by the County Engineer. In Larimer County, non-habitable structures which are used solely for parking, access, storage, or agriculture may be wet floodproofed if a variance is granted by the County Engineer. In such cases, the applicant and/or engineer will need to complete the wet floodproofing section of the FDP Application. Further discussion on the requirements for wet floodproofing is provided in the Wet Floodproofing section of this guide.

Repair or Improvement Submittals

A structure which requires repairs or to which improvements are proposed, including reconstruction, rehabilitation, addition, or other improvements, of which the cumulative cost over a five-year period equals or exceeds 50 percent of the structure's valuation is considered a "Substantially Damaged" or "Substantially Improved" structure. A Substantially Damaged or Substantially Improved structure is required to meet all applicable floodplain regulations under Article 12 of the LCLUC in effect at the time that the repairs or improvements are proposed.

To determine whether a structure is Substantially Damaged or Substantially Improved, the applicant and/or engineer will need to submit several items prior to FDP issuance, including a cost estimate, affidavits, and structure valuation. Forms related to the submittal items listed above can be downloaded from the Larimer County Floodplains website (<https://www.larimer.org/engineering/floodplains>). Further discussion on the requirements for these certificates is provided in Remodels, Repairs, and Improvements section of this guide.

Ownership Documentation or Right-of-Access Agreements

Prior to FDP issuance, documentation demonstrating ownership and/or the right to access the property on which the floodplain development will be performed must be submitted to the County. Examples of documentation which may be used to meet this requirement include deeds, easement records, assessor records, and legal agreements.

Federal, State, and Local Permits

It is the responsibility of the project applicant and/or owner to obtain all approvals necessary for the work. Permits and approvals from other entities or departments which are required in addition to the FDP for the floodplain development must be submitted prior to the start of construction.

Other Requirements

The County Engineer reserves the right to require additional materials as needed to meet the requirements of Article 12 of the LCLUC.

6. CONSTRUCTION PLANS

Construction plans must be submitted with an FDP Application. FDP Applications can be submitted for structural or non-structural projects. In Larimer County, structural projects include (but are not limited to) a building with at least two walls or a roof, gas and liquid storage tanks, electrical facilities (e.g. cellular towers, transformers, solar panels, etc.), and fixed accessory structures (decks, fences, carports, gazebos, pergolas, etc.). Non-structural projects include (but are not limited to) earthwork activities, stream restoration, bank stabilization, bridges, culverts, roads, and utility projects. For non-structural projects, construction plans must be certified by a licensed Colorado Professional Engineer (PE). The following sections describe the requirements for structural and non-structural projects.

Structural Plan Requirements

The following information is required in the plans for structural projects unless waived by the County Engineer:

- Plan view showing footprints of existing and proposed structures, the channel centerline, and all FPO District boundaries. The plan view must provide a scale, north arrow, and legend corresponding to all linework and hatching (including flood zones). The plan view should provide the horizontal datum and all survey control points.
- Grading plans showing existing and proposed contours and the total area of disturbed land for projects where grading will occur. The plans should provide the vertical and horizontal datum.

- Ground cross-sections showing the existing and proposed ground elevations (spaced at no more than 100') within the disturbed area for projects where grading will occur
- Building cross-section(s) showing finished floor elevations for each floor of the structure and the elevation(s) of any mechanical equipment
- Foundation design
- Flood vent size, location, and design details
- Floodproofing design details
- Erosion control measures necessary to prevent sediment from leaving from the site
- Mechanical equipment elevations (e.g. HVAC, air conditioning, etc.)
- Lowest floor elevation of any proposed structures, in feet referenced to the North American Vertical Datum of 1988 (NAVD 88)
- Base flood elevations (BFEs), in feet referenced to the NAVD 88, determined for the structure(s) by the County Engineer or licensed Colorado Professional Engineer (PE)
- Flood protection elevations (FPEs), in feet referenced to the NAVD 88, determined for the structure(s) by the County Engineer or licensed Colorado Professional Engineer

Non-Structural Plan Requirements

For non-structural projects, construction plans must be certified by a licensed Colorado Professional Engineer (PE). The following information is required in the plans for non-structural projects unless waived by the County Engineer:

- Construction plans must be certified by a licensed Colorado Professional Engineer (PE)
- Plan view showing the project elements, channel centerline, and all FPO District boundaries. The plan view must provide a legend corresponding to all linework and hatching (including flood zones). The plan view should provide the horizontal datum and all survey control points.
- Grading plans showing existing and proposed contours and the total area of disturbed land for projects where grading will occur. The plans should provide the vertical and horizontal datum.
- Ground cross-sections showing the existing and proposed ground elevations (spaced at no more than 100') within the disturbed area
- Vertical profile for proposed roads, bridges, utilities, or other applicable project elements. Profiles must include the existing and proposed ground elevations for utilities or other underground features.

- Erosion control plan showing the required temporary and permanent best management practices (BMPs) to prevent sediment from leaving from the site
- Base flood elevations (BFEs), in feet referenced to the NAVD 88, for the area affected by the project

7. HYDRAULIC STUDIES

Many forms of floodplain development will require the submittal of a hydraulic study prior to permitting. The following are examples of floodplain development for which a hydraulic study is required:

- Floodplain development and variance requests within a floodway zone including existing, unpermitted development or change of use applications,
- Floodplain development within 100' of a channel centerline in a Zone A floodplain or as determined by the County Engineer,
- Variance requests where hydraulic conditions need to be evaluated by Larimer County Flood Review Board (FRB) or at the discretion of the County Engineer,
- Floodplain Project Reviews, and
- Map Amendments

This section will summarize some of the main requirements for hydraulic studies in these cases. This section does not replace or remove any requirements for floodplain submittals to the Federal Emergency Management Agency (FEMA) or the Colorado Water Conservation Board (CWCB). Additional requirements from FEMA or CWCB must be met along with these standards.

No-Rise Analysis

If floodplain development is proposed or has occurred within a floodway zone, a hydraulic study is required to determine its impact on the base flood elevations (BFEs) and floodway elevations. The base flood elevation is the water surface elevation associated with the 1% Annual Chance Event (1% ACE, or 100-year flood) and the floodway elevation is the water surface elevation of the regulatory floodway after completing a floodplain encroachment analysis. The hydraulic study must be stamped and signed by a licensed Colorado Professional Engineer (PE) and demonstrate that the floodplain development has not resulted in an increase the BFEs or floodway elevations.

The following components must be included for a hydraulic study to be considered complete unless it is determined that a component is not necessary by the County Engineer:

Hydraulic Study Requirements for No-Rise Analyses

A No-Rise Hydraulic Study requires the submittal of a hydraulic report (PE Certified) and appendices as which include the following components:

Hydraulic Report

- Table of Contents: all sections, figures, tables, and appendices must be listed with page numbers.
- Project Description: provide a description regarding the purpose and nature of the work, the project location, location and condition of bridges and culvert crossings at or near the project site, location of any insurable structures at or near the project site, project participants, and any special hydraulic considerations.
- Background: provide the name of the flooding source (e.g. Big Thompson River) and the associated Flood Insurance Rate Map (FIRM) panel. The background must describe any previous hydraulic studies which have been completed for the project site and reference all map revisions (CLOMRs/LOMRs) which impact the project site.
- Location Maps: provide at least two maps showing the project location. One map must have a scale no smaller than what is required to show the extents of the project site (vicinity map) and the other must have a scale no larger than 1:12,000 to show the broader area surrounding the project site (location map). Both maps must be annotated to show the project site, study limits, roads (with road names labeled), bridges, culvert crossings, and access routes.
- Survey Information: provide the source of topographic and survey data along with the horizontal and vertical datums.
- Hydrology: identify the source of the discharge information used during the hydraulic analysis. Provide a table of discharge values for the 10-year, 50-year, and 100-year flood events resulting from the hydrologic study. If an independent hydrologic study was completed for the project, that study must be submitted separately from the hydraulic study.
- Hydraulic Modeling:
 - Hydraulic Model Description: describe the purpose of the study, the study limits, the location of bridges, roads, and culvert crossings, along with any other special hydraulic considerations.
 - Modeling Software: provide the name and version of the hydraulic modeling software used for the analysis.

- Plan Description & Table: provide a description for, and table showing, all the hydraulic plans used in the analysis. The table should include the plan names along with the associated geometry and flow files used in the plan. Hydraulic plans typically include the effective, duplicate effective, corrected-effective, existing, proposed, and post-project or as-built conditions. A separate floodway plan is also typically required to perform a floodway analysis.
- Cross-Sections: describe the location of the hydraulic cross-sections, cross-section spacing, Manning's roughness coefficients, bank stations, and contraction & expansion coefficients. If the project proposes to physically modify the geometry of any cross sections from the base condition, describe the nature of the changes and which cross-sections will be impacted. A table and cross-section plots for each cross-section are required as appendices to the report as described below.
- Hydraulic Parameters: describe how the hydraulic parameters were determined and reasons for any changes from the base condition. The description should include, at minimum, discussion of Manning's roughness coefficients, bank stations, and contraction & expansion coefficients.
- Ineffective Flow Areas: describe how the ineffective flow areas were determined and reasons for any changes from the base condition. Ineffective flow areas must be clearly shown on the cross-section plots in the appendices.
- Base Flood Elevations (BFEs) & Flood Profile: describe the 1% ACE flood profile and flow conditions along the study reach. How do bridges and crossings impact the water surface elevations? How does the project impact the hydraulic characteristics? Explain any differences in the BFEs between the base condition and the other model conditions (e.g. existing, proposed, as-built).
- Floodway Encroachment Analysis: describe the encroachment method and associated parameters used in the analysis. If the modeling software or version used for the floodway analysis varies from that used in the hydraulic analysis, state the software and version used for the floodway analysis and why it has been chosen.
- Scour Analysis: describe the method used to estimate the anticipated scour depth(s) and the design for any protection measures which are needed to protect from scour. Scour protection measures must be shown in the construction plans.

- Results: provide a general discussion of the hydrologic and hydraulic modeling results. Discuss any changes in flood discharges, water surface elevations (BFE and floodway elevations), and floodplain/floodway boundaries. Discuss any adverse impacts due to the project on structures or lands, including scour impacts. Describe any mitigation measures that will be incorporated such as floodproofing or channel/bank stabilization.
- Errors: explain any modeling errors which impact the study limits and address how those errors have been resolved.
- Approval Criteria: list the applicable approval criteria from the LCLUC and address how each criteria has been adequately met by the project. Refer to LCLUC Section 12.1.4.E.3 for approval criteria.

Hydraulic Appendices

In addition to the report, several items must be submitted as appendices as described below:

- Hydraulic Model: provide a digital copy of the hydraulic model used for the analysis.
- FDP submittal requirements applicable to the request (see Floodplain Development Permit section above)
 - Floodplain Development Permit (FDP) Application
 - Construction Plans (PE Certified)
 - Certificates
 - Floodproofing Design
 - Repair or Improvement Submittals
 - Ownership Documentation
 - Other Permits & Approvals
- No-Rise Certificate (PE Certified): the engineer must provide a signed and stamped copy of a No-Rise Certificate which certifies that the project will not increase the BFEs. A copy of this form can be downloaded through the Larimer County Floodplains website (<https://www.larimer.org/engineering/floodplains>).
- No Adverse Impact Certificate (PE Certified): the engineer must provide a signed and stamped copy of a No Adverse Impact Certificate which certifies that the project will not adversely impact a structure. A copy of this form can be downloaded through the Larimer County Floodplains website (<https://www.larimer.org/engineering/floodplains>).
- Cross-Section Table: provide a table showing the river station, downstream reach lengths, Manning's roughness coefficients, bank stations, ineffective flow areas, and

contraction & expansion coefficients for each cross-section affected by the project. If the project proposes to physically modify the geometry of any cross sections from the base condition, provide a column stating the nature of the changes for each modified cross-section. The table should include these values for each geometry file (e.g. existing, proposed, as-built) and highlight values which have been modified from the base model (e.g. effective or existing).

- Base Flood Elevation (BFE) Comparison Table: provide a table showing the BFEs for all model conditions along with the differences between the model conditions.
- Cross-Section Plots: provide cross-section plots for each cross-section affected by the project. Plots should be submitted showing the ground elevation data, water surface elevation data, ineffective flow areas, flow obstructions, and floodway encroachments for each geometry and discharge frequency.
- Scour Calculations (PE Certified): provide detailed calculations for the estimated scour depth and protection which are stamped and signed by a licensed Colorado Professional Engineer (PE).
- Other requirement(s) as determined by the County Engineer to be necessary to allow the review criteria to be adequately evaluated.

All required submittal items must be provided in **three (3) hard copies** and **one (1) digital copy**.

Alternative Approaches to a No-Rise Analysis

A detailed hydraulic model may not be warranted to justify a no-rise in every circumstance where floodplain development is proposed in a floodway zone. In certain cases, alternative methods may be used as determined by the County Engineer. Such methods may include:

- **Maintain Existing Grade:** a no-rise condition may be justified by maintaining the existing ground elevations in the disturbed area. This method must be supported by pre-project and post-project ground surveys which are stamped by a licensed Colorado Professional Land Surveyor (PLS) and show no substantial deviations as determined by the County Engineer.
- **Conveyance Shadowing:** a no-rise condition may be justified by utilizing conveyance shadows in accordance with FEMA guidelines. This method must be supported by a figure showing the building footprint in relation to the conveyance shadow. The figure must show the floodplain development to be entirely within the conveyance shadow and be certified by a licensed Colorado Professional Engineer (PE).

Floodway Delineation

If floodplain development is proposed within 100 feet of a channel centerline in a Zone A floodplain, the applicant will be required to hire a licensed Colorado Professional Engineer (PE) to complete a floodway delineation showing the location of the floodway in relation to the development. A floodway delineation may also be required if deemed necessary by the County Engineer. If the floodway delineation shows that a proposed structure is within a floodway, the structure will need to be relocated outside of the floodway before issuance of an FDP.

The following components must be included for a hydraulic study to be considered complete unless it is determined that a component is not necessary by the County Engineer:

Hydraulic Study Requirements for Floodway Delineations

A floodway delineation requires the submittal of a hydraulic report (PE Certified) and appendices which include the following components:

Hydraulic Report

- Table of Contents: all sections, figures, tables, and appendices must be listed with page numbers.
- Project Description: provide a description regarding the purpose and nature of the work, the project location, location and condition of bridges and culvert crossings at or near the project site, location of any insurable structures at or near the project site, project participants, and any special hydraulic considerations.
- Background: provide the name of the flooding source (e.g. Big Thompson River) and the associated Flood Insurance Rate Map (FIRM) panel. The background must describe any previous hydraulic studies which have been completed for the project site and reference all map revisions (CLOMRs/LOMRs) which impact the project site.
- Location Maps: provide at least two maps showing the project location. One map must have a scale no smaller than what is required to show the extents of the project site (vicinity map) and the other must have a scale no larger than 1:12,000 to show the broader area surrounding the project site (location map). Both maps must be annotated to show the project site, study limits, roads (with road names labeled), bridges, culvert crossings, and access routes.
- Survey Information: provide the source of topographic and survey data along with the horizontal and vertical datums.
- Hydrology: identify the source of the discharge information used during the hydraulic analysis. Provide a table of discharge values for the 10-year, 50-year, and 100-year flood events resulting from the hydrologic study. If an independent hydrologic study was

completed for the project, that study must be submitted separately from the hydraulic study.

Hydraulic Modeling:

- Hydraulic Model Description: describe the purpose of the study, the study limits, the location of bridges, roads, and culvert crossings, along with any other special hydraulic considerations.
- Modeling Software: provide the name and version of the hydraulic modeling software used for the analysis.
- Plan Description & Table: provide a description for, and table showing, the hydraulic plan(s) used in the analysis. The table should include the plan name(s) along with the associated geometry and flow files used in the plan. For a floodway delineation, hydraulic plans are typically developed for the 1% ACE and the floodway encroachment analysis.
- Cross-Sections: describe the location of the hydraulic cross-sections, cross-section spacing, Manning's roughness coefficients, bank stations, and contraction & expansion coefficients. A table and cross-section plots for each cross-section are required as appendices to the report as described below.
- Hydraulic Parameters: describe how the hydraulic parameters were determined. The description should include, at minimum, discussion of Manning's roughness coefficients, bank stations, and contraction & expansion coefficients.
- Ineffective Flow Areas: describe how the ineffective flow areas were determined. Ineffective flow areas must be clearly shown on the cross-section plots in the appendices.
- Base Flood Elevations (BFEs) & Flood Profile: describe the 1% ACE flood profile and flow conditions along the study reach. How do bridges and crossings impact the water surface elevations?
- Floodway Encroachment Analysis: describe the encroachment method and associated parameters used in the analysis. Floodway encroachments and elevations must be clearly shown on the cross-section plots and in the floodway data table in the appendices. Floodway surcharge may not exceed 0.5 feet.

- Results: describe the results for the floodway encroachment analysis. State whether the proposed structure is within the delineated floodway. Describe any mitigation measures that will be incorporated.

- Errors: explain any modeling errors which impact the study limits and address how those errors have been resolved.
- Approval Criteria: list the applicable approval criteria from the LCLUC and address how each criteria has been adequately met by the project. Refer to LCLUC Section 12.1.4.E.3 for approval criteria.

Hydraulic Appendices

In addition to the report, several items must be submitted as appendices as described below:

- Hydraulic Model: provide a digital copy of the hydraulic model used for the analysis.
- FDP submittal requirements applicable to the request (see Floodplain Development Permit section above)
 - Floodplain Development Permit (FDP) Application
 - Construction Plans (PE Certified)
 - Certificates
 - Floodproofing Design
 - Repair or Improvement Submittals
 - Ownership Documentation
 - Other Permits & Approvals
- Floodway Workmap (PE Certified): provide a workmap showing the floodway delineated by the study. The workmap must show the following components:
 - Floodplain and floodway boundaries for each model condition (1% ACE)
 - Study Limits
 - Hydraulic Cross-Sections
 - Base Flood Elevations
 - Ineffective Flow Areas
 - Stream Profile
 - Area(s) of Disturbance
 - Structures
 - Roads and Hydraulic Structure Alignments (Bridges, Culvert Crossings, etc.)
 - Property Boundaries

- Horizontal and Vertical Datums (NAD83, NAVD88)
 - Date & Source of Aerial Photography
 - Date and Source of Survey & Topographic Information
 - Legend
- No-Rise Certificate (PE Certified): the engineer must provide a signed and stamped copy of a No-Rise Certificate which certifies that the project will not increase the BFEs. A copy of this form can be downloaded through the Larimer County Floodplains website (<https://www.larimer.org/engineering/floodplains>).
- No Adverse Impact Certificate (PE Certified): the engineer must provide a signed and stamped copy of a No Adverse Impact Certificate which certifies that the project will not adversely impact a structure. A copy of this form can be downloaded through the Larimer County Floodplains website (<https://www.larimer.org/engineering/floodplains>).
- Cross-Section Table: provide a table showing the river station, downstream reach lengths, Manning's roughness coefficients, bank stations, ineffective flow areas, and contraction & expansion coefficients for each cross-section included in the study.
- Floodway Data Table: provide a table showing each cross-section included in the study and its associated floodway width, cross-sectional area, mean velocity, and a water surface elevation comparison. The water surface elevation comparison should provide the base flood elevations, the floodway elevations, and the differences between the BFEs and floodway elevations for each cross-section. The differences between the BFEs and floodway elevations should not exceed 0.5 foot at any given cross-section.
- Cross-Section Plots: provide cross-section plots for each section affected by the project. Plots should be submitted showing the ground elevation data, water surface elevation data, ineffective flow areas, flow obstructions, and floodway encroachments.
- Spatial Data Files: provide digital copies of geographic data files (e.g. shapefiles) for the floodplain and floodway boundaries delineated by the study.
- Other requirement(s) as determined by the County Engineer to be necessary to allow the review criteria to be adequately evaluated.

All required submittal items must be provided in **three (3) hard copies** and **one (1) digital copy**.

Floodplain Project Reviews

Floodplain Project Reviews (FPRs) include the following:

- New or replacement bridges, roads, or other infrastructure which cross a stream channel, as determined by the County Engineer.
- New or replacement water control structures which are determined to be hydraulically significant by the County Engineer.
- New or replacement marinas, docks, piers, wharves, or other floodplain development determined by the County Engineer to require special consideration by the FRB.

The following components must be included for a hydraulic study to be considered complete unless it is determined that a component is not necessary by the County Engineer:

Hydraulic Study Requirements for Floodplain Project Reviews

A Floodplain Project Review requires the submittal of a hydraulic report (PE Certified) and appendices which include the following components:

Hydraulic Report

- Table of Contents: all sections, figures, tables, and appendices must be listed with page numbers.
- Project Description: provide a description regarding the purpose and nature of the work, the project location, location and condition of bridges and culvert crossings at or near the project site, location of any insurable structures at or near the project site, project participants, and any special hydraulic considerations.
- Background: provide the name of the flooding source (e.g. Big Thompson River) and the associated Flood Insurance Rate Map (FIRM) panel. The background must describe any previous hydraulic studies which have been completed for the project site and reference all map revisions (CLOMRs/LOMRs) which impact the project site.
- Location Maps: provide at least two maps showing the project location. One map must have a scale no smaller than what is required to show the extents of the project site (vicinity map) and the other must have a scale no larger than 1:12,000 to show the broader area surrounding the project site (location map). Both maps must be annotated to show the project site, study limits, roads (with road names labeled), bridges, culvert crossings, and access routes.
- Survey Information: provide the source of topographic and survey data along with the horizontal and vertical datums.
- Hydrology: identify the source of the discharge information used during the hydraulic analysis. Provide a table of discharge values for the 10-year, 50-year, and 100-year flood events resulting from the hydrologic study. If an independent hydrologic study was

completed for the project, that study must be submitted separately from the hydraulic study.

Hydraulic Modeling:

- Hydraulic Model Description: describe the purpose of the study, the study limits, the location of bridges, roads, and culvert crossings, along with any other special hydraulic considerations.
- Modeling Software: provide the name and version of the hydraulic modeling software used for the analysis.
- Plan Description & Table: provide a description for, and table showing, all the hydraulic plans used in the analysis. The table should include the plan names along with the associated geometry and flow files used in the plan. Hydraulic plans typically include the effective, duplicate effective, corrected-effective, existing, proposed, and post-project or as-built conditions. A separate floodway plan is also typically required to perform a floodway analysis.
- Cross-Sections: describe the location of the hydraulic cross-sections, cross-section spacing, Manning's roughness coefficients, bank stations, and contraction & expansion coefficients. If the project proposes to physically modify the geometry of any cross sections or structures from the base condition, describe the nature of the changes and which cross-sections will be impacted. A table and cross-section plots for each cross-section are required as appendices to the report as described below.
- Hydraulic Parameters: describe how the hydraulic parameters were determined and reasons for any changes from the base condition. The description should include, at minimum, discussion of Manning's roughness coefficients, bank stations, and contraction & expansion coefficients.
- Ineffective Flow Areas: describe how the ineffective flow areas were determined and reasons for any changes from the base condition. Ineffective flow areas must be clearly shown on the cross-section plots in the appendices.
- Base Flood Elevations (BFEs) & Flood Profile: describe the 1% ACE flood profile and flow conditions along the study reach. How do bridges and crossings impact the water surface elevations? How does the project impact the hydraulic characteristics? Explain any differences in the BFEs between the base condition and the other model conditions (e.g. existing, proposed, as-built).

- Floodway Encroachment Analysis: describe the encroachment method and associated parameters used in the analysis. If the modeling software or version used for the floodway analysis varies from that used in the hydraulic analysis, state the software and version used for the floodway analysis and why it has been chosen.
- Scour Analysis: describe the method used to estimate the anticipated scour depth(s) and the design for any protection measures which are needed to protect from scour. Scour protection measures must be shown in the construction plans.
- Results: provide a general discussion of the hydrologic and hydraulic modeling results. Discuss any changes in flood discharges, water surface elevations (BFE and floodway elevations), and floodplain/floodway boundaries. Discuss any adverse impacts due to the project on structures or lands, including scour impacts. Describe any mitigation measures that will be incorporated such as floodproofing or channel/bank stabilization.
- Errors: explain any modeling errors which impact the study limits and address how those errors have been resolved.
- Approval Criteria: list the applicable approval criteria from the LCLUC and address how each criteria has been adequately met by the project. Refer to LCLUC Section 12.1.6.H.2 for approval criteria.

Hydraulic Appendices

In addition to the report, several items must be submitted as appendices as described below:

- Hydraulic Model: provide a digital copy of the hydraulic model used for the analysis.
- FDP submittal requirements applicable to the request (see Floodplain Development Permit section above)
 - Floodplain Development Permit (FDP) Application
 - Construction Plans (PE Certified)
 - Certificates
 - Floodproofing Design
 - Repair or Improvement Submittals
 - Ownership Documentation
 - Other Permits & Approvals

- No-Rise Certificate (PE Certified): unless FEMA has approved a CLOMR for the project, the engineer must provide a signed and stamped copy of a No-Rise Certificate which certifies that the project will not increase the BFEs. A copy of this form can be downloaded through the Larimer County Floodplains website (<https://www.larimer.org/engineering/floodplains>).
- No Adverse Impact Certificate (PE Certified): the engineer must provide a signed and stamped copy of a No Adverse Impact Certificate which certifies that the project will not adversely impact a structure. A copy of this form can be downloaded through the Larimer County Floodplains website (<https://www.larimer.org/engineering/floodplains>).
- Cross-Section Table: provide a table showing the river station, downstream reach lengths, Manning's roughness coefficients, bank stations, ineffective flow areas, and contraction & expansion coefficients for each cross-section affected by the project. If the project proposes to physically modify the geometry of any cross sections from the base condition, provide a column stating the nature of the changes for each modified cross-section. The table should include these values for each geometry file (e.g. existing, proposed, as-built) and highlight values which have been modified from the base model (e.g. effective or existing).
- Base Flood Elevation (BFE) Comparison Table: provide a table showing the BFEs for all model conditions along with the differences between the model conditions.
- Cross-Section Plots: provide cross-section plots for each cross-section affected by the project. Plots should be submitted showing the ground elevation data, water surface elevation data, ineffective flow areas, flow obstructions, and floodway encroachments for each geometry and discharge frequency.
- Scour Calculations (PE Certified): provide detailed calculations for the estimated scour depth and protection which are stamped and signed by a licensed Colorado Professional Engineer (PE).
- Other requirement(s) as determined by the County Engineer to be necessary to allow the review criteria to be adequately evaluated.

All required submittal items must be provided in **three (3) hard copies** and **one (1) digital copy**.

Map Amendments

Map amendments are proposals to revise the regulatory floodplain boundaries or associated floodplain data (such as base flood elevations) within the FPO District. Under the National Flood Insurance Program (NFIP), Larimer County requires that map amendments are submitted under the following circumstances:

- A Conditional Letter of Map Revision (CLOMR) must be submitted if floodplain development is proposed within the FPO District that would, upon construction, affect the hydrologic and hydraulic characteristics of a flooding source and result in the modification of the floodway zone, the Base Flood Elevations (BFEs), or FEMA's Special Flood Hazard Areas (SFHAs, a.k.a. FEMA Floodplain).
- A Letter of Map Revision (LOMR) must be submitted if development has occurred which:
 - Received a Conditional Letter of Map Revision (CLOMR) from FEMA before the start of construction,
 - Results in an increase in the 1% annual chance (100-year) water surface elevation,
 - Results in a decrease in the 1% annual chance (100-year) water surface elevation greater than 0.3 foot, or
 - Involves alteration(s) of a watercourse which will relocate the channel.

The County Engineer may also require that a CLOMR and/or LOMR be submitted for projects at his or her discretion. CLOMRs and LOMRs must be reviewed by the Flood Review Board (FRB) prior to County approval.

The process for CLOMR/LOMR submittals is shown in Figure 4. Typically, a project which will modify the regulatory floodplain boundaries or elevations will require the submittal of both a CLOMR and a LOMR. These will need to be reviewed by the Larimer County Flood Review Board (FRB) and FEMA before and after construction. In the case of a locally administered floodplain (such as those established by the City of Fort Collins), the local authority will review the map amendment instead of FEMA.

Hydraulic Report

A map amendment requires the submittal of a hydraulic report (PE Certified) and appendices which include the following components:

- Table of Contents: all sections, figures, tables, and appendices must be listed with page numbers.
- Project Description: provide a description regarding the purpose and nature of the work and map amendment proposal, the project location, condition of bridges and culvert crossings at or near the project site, location of any insurable structures at or near the project site, project participants, and any special hydraulic considerations.
- Background & Study Limits: describe the proposed revision reach and provide the name of the flooding source (e.g. Big Thompson River), the impacted Flood Insurance Rate Map (FIRM) panels, effective FIRM dates, and the river stations of the cross-sections

that will tie into the effective study. The background must describe any previous hydraulic studies which have been completed for the project site and reference all map revisions (CLOMRs/LOMRs) which impact the project site.

- Location Maps: provide at least two maps showing the project location. One map must have a scale no smaller than what is required to show the extents of the project site (vicinity map) and the other must have a scale no larger than 1:12,000 to show the broader area surrounding the project site (location map). Both maps must be annotated to show the project site, study limits, roads (with road names labeled), bridges, culvert crossings, and access routes.
- Mapping & Survey Information: describe the source of the survey data and topographic mapping used for the project including the survey or mapping company, collection date, scale, contour interval, vertical datum using the North American Vertical Data of 1988 (NAVD88), and control point data. This section should also reference the horizontal datum (North American Datum of 1983, or NAD 83) and mapping projection (Colorado State Plane North) used for the base mapping. If the mapping uses ground coordinates, please provide the conversion factor to grid coordinates or a table showing XY values for several known points in both grid and ground coordinates.
- Hydrology: identify the source of the discharge information used during the hydraulic analysis. Provide a table of discharge values for the 10-year, 50-year, and 100-year flood events resulting from the hydrologic study. If an independent hydrologic study was completed for the project, that study must be submitted separately from the hydraulic study.
- Hydraulic Modeling:
 - Hydraulic Model Description: describe the purpose of the study, methodology, study limits, the location of bridges, roads, and culvert crossings, along with any other special hydraulic considerations.
 - Modeling Software: provide the name and version of the hydraulic modeling software used for the analysis.
 - Plan Description & Table: provide a description for, and table showing, all the hydraulic plans used in the analysis. The table should include the plan names along with the associated geometry and flow files used in the plan. Hydraulic plans typically include the effective, duplicate effective, corrected-effective, existing, proposed, and post-project or as-built conditions. A separate floodway plan is also typically required to perform a floodway analysis.

- Cross-Sections: describe the location of the hydraulic cross-sections, cross-section spacing, Manning’s roughness coefficients, bank stations, and contraction & expansion coefficients. If the project proposes to physically modify the geometry of any cross sections or structures from the base condition, describe the nature of the changes and which cross-sections will be impacted. A table and cross-section plots for each cross-section are required as appendices to the report as described below.
 - Hydraulic Parameters: describe how the hydraulic parameters were determined and reasons for any changes from the base condition. The description should include, at minimum, discussion of Manning’s roughness coefficients, bank stations, and contraction & expansion coefficients.
 - Ineffective Flow Areas: describe how the ineffective flow areas were determined and reasons for any changes from the base condition. Ineffective flow areas must be clearly shown on the cross-section plots in the appendices.
 - Base Flood Elevations (BFEs) & Flood Profile: describe the 1% ACE flood profile and flow conditions along the study reach. How do bridges and crossings impact the water surface elevations? How does the project impact the hydraulic characteristics? Explain any differences in the BFEs between the base condition and the other model conditions (e.g. existing, proposed, as-built).
 - Floodway Encroachment Analysis: describe the encroachment method and associated parameters used in the analysis. If the modeling software or version used for the floodway analysis varies from that used in the hydraulic analysis, state the software and version used for the floodway analysis and why it has been chosen.
 - Tie-Ins: describe the boundary conditions, horizontal tie-ins, and vertical tie-ins to the effective study. Provide the magnitude of any deviations from the effective data at the tie-in locations.
 - Scour Analysis: describe the method used to estimate the anticipated scour depth(s) and the design for any protection measures which are needed to protect from scour. Scour protection measures must be shown in the construction plans.
- Results: provide a general discussion of the hydrologic and hydraulic modeling results. Discuss any changes in flood discharges, water surface elevations (BFE and floodway elevations), and floodplain/floodway boundaries. Discuss any adverse impacts due to

the project on structures or lands, including scour impacts. Describe any mitigation measures that will be incorporated such as floodproofing or channel/bank stabilization.

- Errors: explain any modeling errors which impact the study limits and address how those errors have been resolved.
- Approval Criteria: list the approval criteria for map amendments from the LCLUC and describe how each criteria or requirement has been adequately met by the project. Refer to LCLUC Section 12.1.6.G.2 for approval criteria.
- References: list all references used during the preparation of the hydraulic study along with the modeling software programs and version(s).

Hydraulic Appendices

In addition to the report, several items must be submitted as appendices as described below:

- Hydraulic Model: provide a digital copy of the hydraulic model used for the analysis.
- FDP submittal requirements applicable to the request (see Floodplain Development Permit section above)
 - Floodplain Development Permit (FDP) Application
 - Construction Plans (PE Certified)
 - Certificates
 - Floodproofing Design
 - Repair or Improvement Submittals
 - Ownership Documentation
 - Other Permits & Approvals
- Floodplain Workmaps (PE Certified): provide floodplain workmaps showing the following comparisons as applicable:
 - Effective Condition vs. Corrected-Effective Condition
 - Corrected-Effective Condition vs. Existing Condition
 - Effective and Existing Conditions vs. Proposed Condition
 - Effective and Existing Conditions vs. As-Built Condition
 - Proposed Condition vs. As-Built Condition

The floodplain workmaps must show the following components:

- Floodplain and floodway boundaries for each model condition (1% ACE and 0.2% ACE)
- Topographic contours (up to 2' contour interval)
- Study Limits
- Hydraulic Cross-Sections
- Base Flood Elevations
- Ineffective Flow Areas
- Stream Profile
- Area(s) of Disturbance
- Structures
- Roads and Hydraulic Structure Alignments (Bridges, Culvert Crossings, etc.)
- Property Boundaries
- Horizontal and Vertical Datums (NAD 83, NAVD88)
- Date & Source of Aerial Photography
- Date and Source of Survey & Topographic Information
- Legend

Floodplain information should follow a logical naming and appearance convention to identify the flood hazard features from the geographic or background data. Additionally, a map legend or labels for the pertinent floodplain information should be included. Recommended symbology and naming conventions are presented in Figure 5.

- Cross-Section Table: provide a table showing the river station, downstream reach lengths, Manning's roughness coefficients, bank stations, ineffective flow areas, and contraction & expansion coefficients for each cross-section affected by the project. If the project proposes to physically modify the geometry of any cross sections from the base condition, provide a column stating the nature of the changes for each modified cross-section. The table should include these values for each geometry file (e.g. existing, proposed, as-built) and highlight values which have been modified from the base model (e.g. effective or existing).
- Base Flood Elevation (BFE) Comparison Table: provide a table showing the BFEs for all model conditions along with the differences between the model conditions.

- Annotated Flood Profiles: provide a comparison profile in FEMA FIS format to identify changes in BFEs. Comparison profiles should contain the effective and proposed/post-project condition profile, as well as a box noting the area of revision. There are any number of ways to generate and present this comparison profile, however, the profile should utilize a common stationing system, like what is shown in the comparison table and effective FIS profile (if applicable). HEC-RAS profile plots will not be accepted. Free software is available for download from FEMA's website to generate FIS formatted profiles from HEC-RAS. These programs can be found at the following link:

FEMA Flood Mapping Software:

<https://www.fema.gov/flood-maps/software>

- Annotated Floodway Data Table: provide an annotated floodway data table indicating which effective cross-sections are being revised as part of the submittal and display the revised floodway data for the revised cross-sections. Since the annotated floodway data table references the stream stationing, some sort of correlation must also be provided when cross-section labels are different than the corresponding stream stationing. FEMA FIS format must be used for all annotated floodway data tables.
- Annotated FIRM Panels: annotated FIRM exhibits are required for all impacted FIRM panels. The annotated FIRM must show the boundaries of the modified floodplain and floodway within the revised reach and how they tie into the effective information at the upstream and downstream tie-in locations. For requests within a Municipal Floodplain, an annotated floodplain map for the affected floodplain should be prepared in place of the FIRM exhibit and included as part of the submittal.
- Agreement Tables: provide an agreement table which correlates the following information in the hydraulic model, floodplain work map, and floodway data:
 - Distance between hydraulic cross-sections along channel centerline
 - Cumulative channel distance along channel centerline
 - 1% annual-chance (100-year) floodplain top width
 - Regulatory floodway top width (if applicable)

The acceptable tolerance is plus or minus 5% between the model and map data. For detailed 1% ACE floodplain areas, the revised BFEs plotted on the work maps should also correlate with the profile in the hydraulic model. The revised BFEs shown on the work maps should adhere to the following guidelines:

- BFEs should be placed and labeled in the correct location along the channel centerline as compared to the adjacent hydraulic cross-sections,

- BFEs should intersect the location where the proposed floodplain crosses the whole foot contour value indicated by the BFE,
 - Shape and orientation of BFEs should follow the shape and orientation of nearby hydraulic cross-sections and the general flow patterns, and
 - BFEs should not cross nearby hydraulic cross-sections.
- Cross-Section Plots: provide cross-section plots for each cross-section affected by the project. Plots should be submitted showing the ground elevation data, water surface elevation data, ineffective flow areas, flow obstructions, and floodway encroachments for each geometry and discharge frequency.
- Scour Calculations (PE Certified): provide detailed calculations for the estimated scour depth and protection which are stamped and signed by a licensed Colorado Professional Engineer (PE).
- Notifications: notifications of the forthcoming map amendment are required (1) before advertisement of the FRB meeting and (2) during the FEMA review process.
- Initial Notifications: at least three (3) weeks prior to the FRB meeting, the engineer must submit individual notification letters to the County for each property impacted by the map revision. These letters must be written in layman's terms so that they are easily understandable by the public. After review and approval by the County, the engineer and/or applicant must send these notification letters to each impacted property owner and provide written confirmation to the County that they have been sent and received. If there is not adequate information available to notify certain property owners (e.g. address information is not available), the engineer must send written confirmation to the County that due diligence has been taken to notify these property owners before a determination was made that they cannot be reached.
 - FEMA Notifications: following County approval of the map amendment, the engineer must send individual notifications and/or publish a newspaper notification per FEMA's requirements as indicated during their review process. The County must review and approve these notifications prior to sending or publishing. The engineer and/or applicant, not the County, shall send and/or publish these notifications at their expense.
- Spatial Data Files: provide digital copies of geographic data files (e.g. shapefiles) for the floodplain and floodway boundaries delineated by the study. Recommended symbology and naming conventions are presented in .

- Model Error Report or Table: provide a report or table showing all errors indicated by the error assessment tool in the modeling software (e.g. cHECK-RAS) which impact the study limits and provide a short description of how the errors have been resolved.
- FEMA MT-2 Form: provide one copy of the required FEMA MT-2 form. The form must be filled out and submitted with all required signatures including the requester and a licensed Colorado Professional Engineer (PE). Upon approval of the map amendment, the County Engineer or his designee will sign the form. The signed forms will then be returned to the applicant and/or engineer for submittal to FEMA.
- No Adverse Impact Certificate (PE Certified): the engineer must provide a signed and stamped copy of a No Adverse Impact Certificate which certifies that the project will not adversely impact a structure. A copy of this form can be downloaded through the Larimer County Floodplains website (<https://www.larimer.org/engineering/floodplains>).
- Other requirement(s) as determined by the County Engineer to be necessary to allow the review criteria to be adequately evaluated. These may include:
 - Additional calculations or figures
 - Copies of previous studies or reports
 - Correspondence

All required submittal items must be provided in **three (3) hard copies** and **one (1) digital copy**.

Figure 4. Map Amendment Flowchart

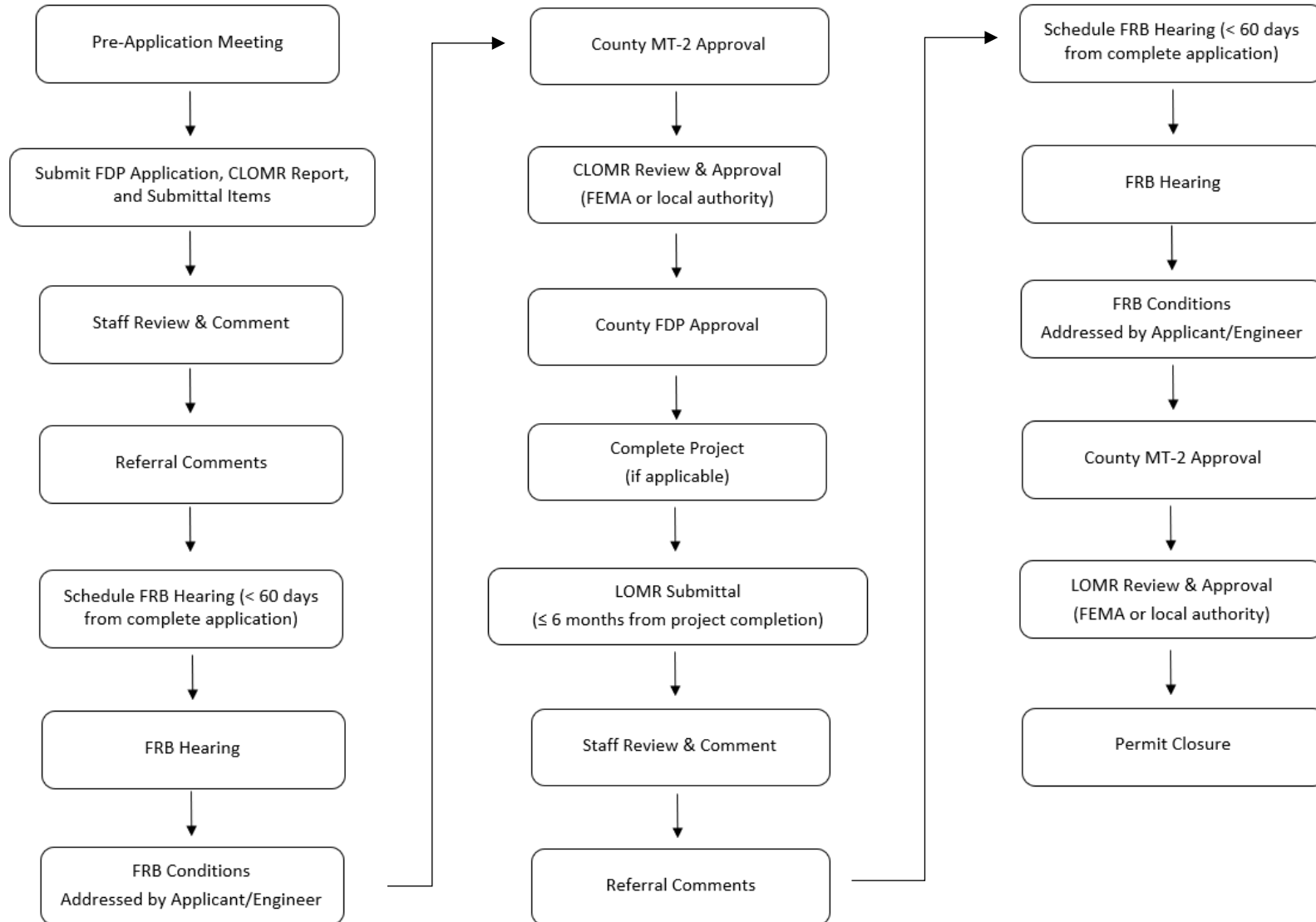


Figure 5. Floodplain Layer Symbology & Naming Conventions

Feature	Layer/Shape Name	Color	Line Type
Effective 100-YR Floodplain	100-YEAR-EFF	Light Blue	Continuous
Corrected Effective 100-YR Floodplain	100-YEAR-CE	Light Orange	Continuous
Existing 100-YR Floodplain	100-YEAR-EX	Green	Continuous
Proposed 100-YR Floodplain	100-YEAR-PP	Dark Blue	Continuous
Effective 500-YR Floodplain	500-YEAR-EFF	Light Blue	Dashed
Corrected Effective 500-YR Floodplain	500-YEAR-CE	Light Orange	Dashed
Existing 500-YR Floodplain	500-YEAR-EX	Green	Dashed
Proposed 500-YR Floodplain	500-YEAR-PP	Dark Blue	Dashed
Effective Regulatory 0.5-ft Floodway	HALF-FT-FLDWY-EFF	Light Blue	Hidden
Corr. Eff. Regulatory 0.5-ft Floodway	HALF-FT-FLDWY-CE	Light Orange	Hidden
Existing Regulatory 0.5-ft Floodway	HALF-FT-FLDWY-EX	Green	Hidden
Proposed Regulatory 0.5-FT Floodway	HALF-FT-FLDWY-PP	Dark Blue	Hidden
Hydraulic Cross-Section	XSECTION	Black	Continuous
Effective Base Flood Elevation (BFE)	BFE-EFF	Black	Zigzag
Corr. Eff. Base Flood Elevation (BFE)	BFE-CE	Light Grey	Zigzag
Existing Base Flood Elevation (BFE)	BFE-EX	Dark Grey	Zigzag
Proposed Base Flood Elevation (BFE)	BFE-PR	Red	Zigzag
Stream Centerline	CHANNEL	Black	Center
Culvert	CULVERT	Black	Continuous
Bridge	BRIDGE	Black	Continuous
Footbridge	FOOTBRIDGE	Black	Continuous
Community Boundaries	BNDRY-COMMUN	Thick Black	Phantom
Property Boundaries	BNDRY-PROP	Grey	Phantom

8. CERTIFICATES

If floodplain development is proposed or has occurred within a floodway zone, a hydraulic study is required to determine its impact on the base flood elevations (BFEs) and floodway elevations. The hydraulic study must be accompanied by a No-Rise Certificate and No Adverse Impact Certificate which are signed and stamped by a licensed Colorado Professional Engineer (PE) prior to FDP issuance. A No Adverse Impact Certificate may also be required for map amendment proposals at the discretion of the County Engineer. Forms for these certificates can be downloaded from the Larimer County Floodplains website (<https://www.larimer.org/engineering/floodplains>).

No-Rise and No Adverse Impact Certificate Requirements

For projects where these certifications are required, the licensed Colorado Professional Engineer (PE) responsible for the design and/or hydraulic study must provide the following information:

- Project name associated with the floodplain development activities or hydraulic study
- Flooding source (e.g. stream name)
- Documents which support the certification (construction plans, hydraulic report, modeling files, etc.)
- Date of certification
- Engineer's name, title, stamp, and signature

Please refer to the Hydraulic Studies section of this guide which describes the requirements for a no-rise analysis. Examples showing a typical No-Rise Certificate and No Adverse Impact Certificate are provided in Figure 9 and Figure 10.

FEMA Elevation Certificates

If an applicant is seeking an FDP for a structure, at least one FEMA Elevation Certificate (signed and stamped by a PE or a licensed Colorado Professional Land Surveyor) will be required. Elevation certificates may be required by the County Engineer at any point during or after construction. Typically, these are required immediately after the foundation is completed and/or after construction is complete. If an existing structure is being permitted to meet code requirements, the County Engineer may require an elevation certificate prior to issuance of the FDP.

Elevation certificate forms may be downloaded through FEMA's website. FEMA has also provided training videos for completing elevation certificates which can be viewed through a link on the Larimer County Floodplains website (<https://www.larimer.org/engineering/floodplains>).

Figure 6. No-Rise Certificate Example

CERTIFICATION OF NO-RISE

This is to certify that I am a duly qualified registered Professional Engineer licensed to practice in the State of Colorado. It is to further certify that the proposed or as-built floodplain development activities in the floodway referred to as:

Larimer Development

for the floodplain associated with the following flooding source(s):

Cache La Poudre River

will not create an increase in the base flood elevations, floodway elevations, or impact the floodway widths in accordance with Article 12 of the Larimer County Land Use Code. This certification includes, but is not limited to, published and unpublished cross-sections in the Flood Insurance Study (FIS) dated December 19, 2006, and any revisions thereto. This certification also includes all published and unpublished cross-sections within the Floodplain Overlay District (FPO District) in Larimer County.

The following documents are provided with this certification which support my findings:


Construction Plans
 Hydraulic Report
 Hydraulic Modeling Files
 Base Flood Elevation (BFE) Comparison Table
 Hydraulic Cross-Sections

Date: 5/24/2021

Signature: John Doe

Printed Name: John Doe

Title: Civil Engineer



{SEAL}

Figure 7. No Adverse Impact Certificate Example

CERTIFICATION OF NO ADVERSE IMPACT	
<p>This is to certify that I am a duly qualified registered Professional Engineer licensed to practice in the State of Colorado. It is to further certify that the floodplain development activities or map amendment proposal referred to as:</p>	
<div style="border: 1px solid black; padding: 2px; min-height: 20px;">Larimer Development</div>	
<p>for the floodplain associated with the following flooding source(s):</p>	
<div style="border: 1px solid black; padding: 2px; min-height: 20px;">Cache La Poudre River</div>	
<p>will not create an adverse impact, including:</p>	
<ul style="list-style-type: none"> • Increasing in the base flood elevation on a structure • Increasing the floodway elevation on a structure • Modifying the extent of the floodway or floodplain so as to create an adverse impact to a structure • Creating a hazard related to scour, erosion, or sedimentation 	
<p>The following documents are provided with this certification which support my findings:</p>	
<div style="border: 1px solid black; padding: 2px; min-height: 40px;"> Construction Plans Hydraulic Report Hydraulic Modeling Files Base Flood Elevation (BFE) Comparison Table Floodplain Workmaps Scour Calculations </div>	
<p>Date: 5/24/2021</p>	
<p>Signature: _____</p>	
<p>Printed Name: John Doe</p>	
<p>Title: Civil Engineer</p>	
<div style="border: 1px solid black; width: 150px; height: 100px; margin: 0 auto; display: flex; align-items: center; justify-content: center;"> </div> <p style="text-align: center;">{SEAL}</p>	

9. WET FLOODPROOFING

Enclosures, additions or attached structures, accessory or detached structures, and agricultural structures in the FPO District which do not meet elevation requirements may be eligible for an administrative variance to be wet floodproofed if the following requirements are met:

- Non-agricultural structures are only eligible if used solely for parking of vehicles, building access, or storage of materials.
- Agricultural structures are only eligible if used solely for the production, harvesting, storage, drying, or raising of agricultural commodities (including livestock).

If an applicant is seeking to wet floodproof a structure, the design details and specifications must be submitted to the County prior to FDP issuance. These must follow FEMA guidelines and LCLUC requirements for approval and will require the certification of a licensed Colorado Professional Engineer (PE) if determined by the County Engineer. Prior to approval, the applicant and/or engineer will need to complete the wet floodproofing section of the FDP Application and meet the requirements listed below. The County's FDP Application can be downloaded from the Larimer County Floodplains website (<https://www.larimer.org/engineering/floodplains>).

Floodproofing Requirements

For buildings or structures which are permitted to be wet floodproofed, floodproofing designs must meet the following requirements:

- FEMA Requirements: Buildings and structures which are wet floodproofed must follow FEMA Guidance (e.g. FEMA Technical Bulletin 7) and other applicable Floodplain Development Standards.
- Flood Forces: Wet floodproofing measures must be designed to withstand the hydrostatic and hydrodynamic flood forces on exterior walls by allowing for the entry and exit of floodwaters.
- Flood-Resistant Materials: Buildings and structures which are wet floodproofed must provide flood-resistant materials to an elevation at or above the flood protection elevation (FPE).
- Flood Venting: A minimum of two flood vents must be installed on at least two separate walls and meet the following requirements:
 - Have a combined area of at least one square inch of open area for every square foot of enclosed area. The minimum opening requirement may be reduced if engineered venting is provided and certified by a PE.
 - The bottom of all openings must be no higher than one foot above grade.
 - Openings must permit the automatic entry and exit of floodwaters.
 - Required openings may be installed in garage doors. However, the garage door itself does not qualify as an opening for wet floodproofing purposes.

- No Appliances: The structure must have no permanently affixed appliances including, but not limited to, furnaces, heaters, washers, and dryers.
- PE Certification: The County Engineer may require a wet floodproofing design to be certified by a licensed Colorado Professional Engineer (PE) at his or her discretion.
- Non-Conversion Agreement: The County Engineer may require that the property owner execute and record a Non-Conversion Agreement stating that the use of the structure or applicable portion of the structure will not be modified in the future prior to issuance of the Certificate of Occupancy. The agreement must run with the land and bind successors in perpetuity.

10. REMODELS, REPAIRS, & IMPROVEMENTS

A structure which requires repairs or to which improvements are proposed, including reconstruction, rehabilitation, addition, or other improvements, of which the cost equals or exceeds 50% of the structure's valuation is considered a "Substantially Damaged" or "Substantially Improved" structure. A Substantially Damaged or Substantially Improved structure is required to meet all applicable floodplain regulations under Article 12 of the LCLUC in effect at the time that the repairs or improvements are proposed.

For example, a home may have originally been built at the flood protection elevation in effect at the time of construction. Over time, however, the flood protection elevation may have been increased at the location of the home due to updated floodplain data. If a substantial improvement is proposed on the home (which is now below the current flood protection elevation), the home would be required to elevate the lowest floor and any mechanical equipment to a level which is at or above the current flood protection elevation. Similarly, a structure which was originally built in an area that was not in a floodway zone at the time of construction, but now is, would need to mitigate any hydraulic impacts caused by the structure at the time of a substantial improvement. That may include removal of the structure from the floodway zone altogether.

Substantial Improvement/Repair Requirements

To determine whether a structure is Substantially Damaged or Substantially Improved, the applicant and/or engineer will need to submit several items prior to FDP issuance, including:

- Itemized costs for labor and materials required for the repairs or improvements. Labor costs must include labor, profit, overhead, and supervision and material costs must include all materials required in the work. The County Engineer shall make the final

determination as to whether the costs of labor and materials for a floodplain development project are reasonable.

- Contractor affidavit certifying that all costs have been included and are reasonable in accordance with fair-market value. The affidavit must be signed and notarized.
- Owner affidavit certifying that all costs have been included and are reasonable in accordance with fair-market value. The affidavit must be signed and notarized.
- Valuation of the structure being repaired or improved. The valuation must be supported by an appraisal from a licensed Colorado Real Estate Appraiser or Larimer County Assessor records and be current within one year of the work.

Affidavit forms can be downloaded from the Larimer County Floodplains website (<https://www.larimer.org/engineering/floodplains>).

Inclusions & Exclusions

The costs for labor and materials involved in an improvement or repair project must be included in the Substantial Improvement or Repair of Substantial Damage determination unless work meets the exclusion criteria listed below:

- Repairs and/or improvements which are not associated with flood damage and are made to correct existing violations of state or local health, sanitary, or building or safety code specifications which have been identified by the County Engineer and which are the minimum necessary to assure safe living conditions.
- Repairs and/or improvements which are made to a historic structure which has been designated by the National Register of Historic Places or State of Colorado and will not preclude the structure's continued designation as a historic structure. Entitlement to such an exemption requires that the applicant provide documentation that:
 - The building or structure is designated as a historic structure and
 - Confirms that the proposed work will not preclude the structure's continued historic designation.

11. FLOOD REVIEW BOARD

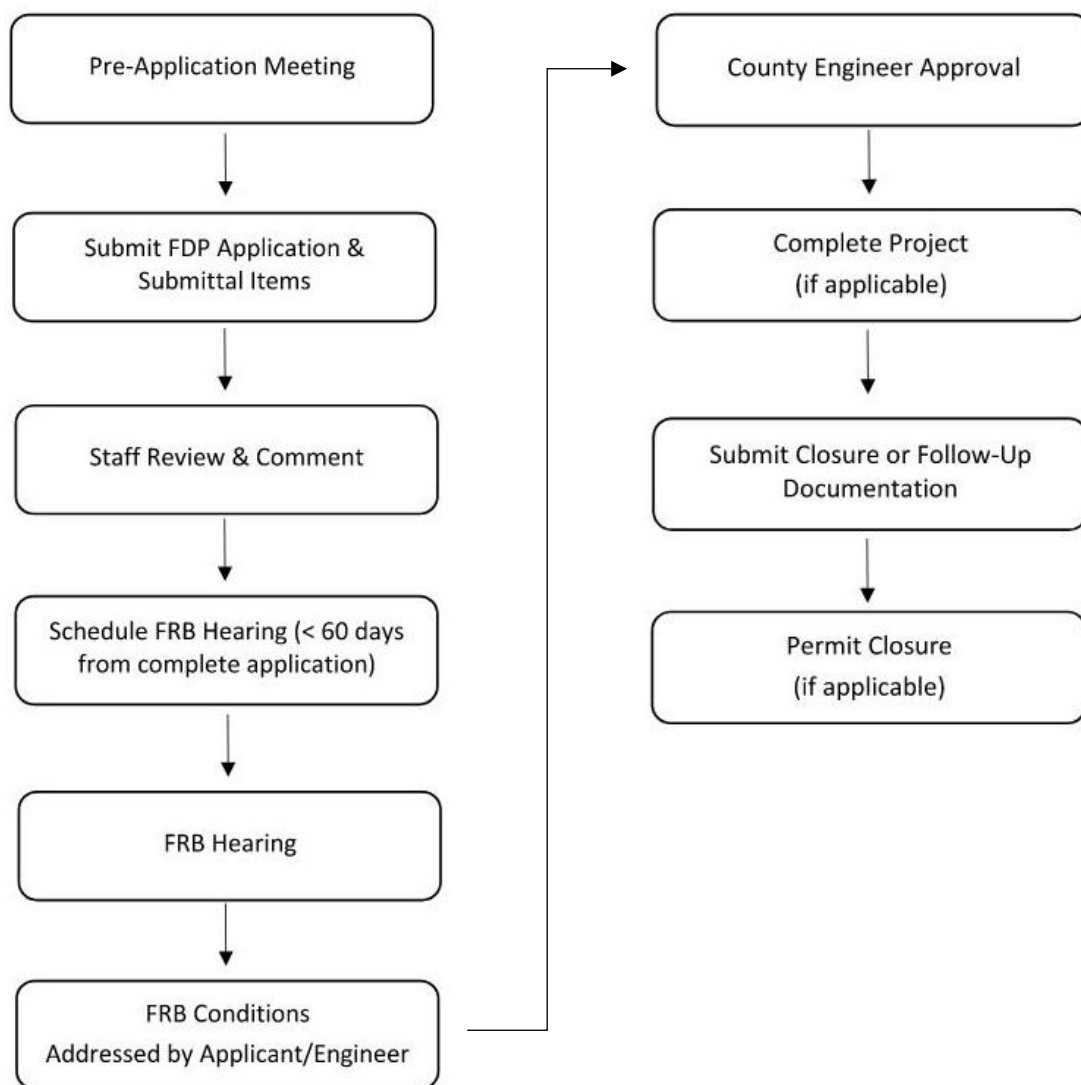
The Flood Review Board (FRB) is appointed by the Board of County Commissioners and makes recommendations to the County Engineer regarding:

1. Variance requests to Article 12 of the Larimer County Land Use Code (LCLUC),
2. Interpretations of Article 12 of the (LCLUC),

3. Map amendment proposals
4. Floodplain Project Reviews, and
5. Guidance related to floodplain development, floodplain construction methods, flood safety, or other flood-related topics.

The FRB also provides guidance related to floodplain development, floodplain construction methods, flood safety, or other flood-related topics. The process to have an item reviewed by the FRB is shown in Figure 8.

Figure 8. Flood Review Board Flowchart



The following sections describe the submittals which are required for each type of request or proposal to the FRB.

Variance Requests

If an applicant wishes to obtain a variance from a requirement in Article 12 of the LCLUC, he or she may submit a variance request to the FRB. The FRB will review the request and make a recommendation to the County Engineer.

Variance Submittal Requirements

Prior to FRB review, the applicant and/or engineer must submit the following items to the County prior to a hearing:

- Variance Request Narrative which provides the following:
 - Section(s) of Article 12 of the LCLUC for which a variance is requested
 - Reason for the request and why the applicant is not able to meet the LCLUC requirement(s)
 - Project description
 - List of all variance approval criteria in Article 12 of the LCLUC with a description for how each is adequately met by the request. Refer to LCLUC Section 12.1.6.E.2 for approval criteria.
- Location map showing the area of interest
- FDP submittal requirements applicable to the request (see Floodplain Development Permit section above)
 - Floodplain Development Permit (FDP) Application
 - Construction Plans (PE Certified)
 - Hydraulic Study
 - Certificates
 - Floodproofing Design
 - Repair or Improvement Submittals
 - Ownership Documentation
 - Other Permits & Approvals
- Fee in the amount applicable for a variance request (\$200)

- Other requirement(s) as determined by the County Engineer to be necessary to allow the review criteria to be adequately evaluated

Variance Approval Criteria

The FRB will review the request and make a recommendation to the County Engineer based on the approval criteria in the LCLUC as shown below.

- The completeness and technical adequacy of the variance request and associated materials in accordance with:
 - Article 12.0 of this Code
 - Larimer County Floodplain Development Standards
 - Sound engineering judgment of FRB members
- The probability that granting the variance will result in unreasonable risk of harm to people or property, both onsite and in the surrounding area
- The safety of access to and from the subject property during flood events
- The availability of alternatives having a reduced risk of flooding impacts.
- Exceptional or undue hardship which would be experienced by the property owner through strict application of Article 12.0.
- Impacts due to scour and erosion.
- The impacts that approval of the variance will have on the:
 - Flood profile and flood heights (1% ACE)
 - Floodway
 - Stability of the channel and/or sedimentation
 - Existing structures, roads, bridges, or other infrastructure
 - Lands upstream, downstream, and in the immediate vicinity of the floodplain development
 - Ecosystem(s) associated with the watercourse, including the streambank and streamside vegetation.

Variance Request for Short-Term Rentals in a Floodway

The popularity of short-term rental properties (STRs) along river corridors has led to the establishment of floodplain requirements to help achieve flood safety for such properties. While STRs are allowable in most flood zones, they are prohibited within a regulatory floodway.

To gain approval for an STR in a floodway zone, the applicant and/or engineer must be granted a variance through the FRB.

Short-Term Rental Variance Submittal Requirements

The submittals required for the STR variance differ from a standard variance request and include:

- Variance Request Narrative which provides the following:
 - Section(s) of Article 12 of the LCLUC for which a variance is requested
 - Reason for the request and why the applicant is not able to meet the LCLUC requirement(s)
 - Project description which addresses the following questions
 - If approved, how many guests will the property accommodate per visit?
 - Will the operation be seasonal or year-round?
 - What damage occurred to the property during previous flood events?
 - How is the building accessed? Are there any bridge or culvert crossings used to access the property? If so, where are they located?
 - If approved, where will signs be located on the property to warn guests of flood risk? Where will the Emergency Operation Plan be located?
 - List of all variance approval criteria in Article 12 of the LCLUC with a description for how each is adequately met by the request. Refer to LCLUC Section 12.1.6.E.2 for approval criteria.
- Location map showing the STR property, access route(s), adjacent stream channel, proposed flood risk sign locations, and nearby bridges and culvert crossings used to access the property
- FDP submittal requirements applicable to the request (see Floodplain Development Permit section above)
 - Floodplain Development Permit (FDP) Application
 - Construction Plans (PE Certified)
 - Hydraulic Study
 - Certificates
 - Floodproofing Design

- Repair or Improvement Submittals
 - Ownership Documentation
 - Other Permits & Approvals
- Structural stability analysis and report verifying the stability of the structure with regard to anticipated flood forces
- Emergency Operation Plan (EOP): Provide an emergency plan for how guests will be notified and should respond in event of a flood. The County provides a standard notice for flood safety practices per FEMA guidance at [Ready.gov](https://www.ready.gov). Provide the locations of where signage will be placed notifying guests of the flood risk and where to access the EOP.
- Access Bridges: if the access road to the property has a bridge, the following information must be provided:
 - Building permit for the bridge (if available)
 - Bridge load rating
 - Visual inspection report
 - Concurrence from the emergency district that services the property that emergency services can be provided
- Emergency Notifications: confirmation that a form of emergency notification is available (such as reverse-911 alerts) and setup for a landline. Alternatively, a signed commitment letter may be submitted from staff that guests will be notified in event of a flood.
- Historic Use Records: records verifying the use of the structure if it has been used historically as a short-term rental must be provided
- Photos of the property which include:
 - Photos on each side of structures involved in the application
 - Ingress/egress routes
 - Riverbank adjacent to the structure
 - Structure location in relation to the stream channel, and
 - Any historic photos in the vicinity of the structure, especially during or after flooding events if available
- Fee in the amount applicable for a variance request (\$200)

- Other requirement(s) as determined by the County Engineer to be necessary to allow the review criteria to be adequately evaluated

The FRB will review the request and make a recommendation to the County Engineer based on the approval criteria in the LCLUC as shown above.

Code Interpretation Requests

If an applicant would like the FRB to make a formal interpretation of a code section in Article 12 of the LCLUC, he or she may do so by submitting the items listed below.

Code Interpretation Submittal Requirements

Prior to an FRB hearing, the applicant and/or engineer must submit the following items to the County:

- Interpretation Request Narrative which provides the following:
 - Section(s) of Article 12 of the LCLUC for which an interpretation is requested
 - Reason for the request
- Fee in the amount applicable for a variance request (\$200)
- Other requirement(s) as determined by the County Engineer to be necessary

Map Amendments

The FRB must review proposals to amend the regulatory floodplain boundaries in the FPO District prior to approval by the County Engineer. Such proposals may include Conditional Letters of Map Revision (CLOMRs) and Letters of Map Revision (LOMRs).

Map Amendment Submittal Requirements

For the FRB to review a map amendment proposal, the applicant and/or engineer must submit the following items to the County prior to the hearing:

- Floodplain Development Permit (FDP) Application
- FDP submittal requirements applicable to the request (see Floodplain Development Permit section above)
 - Floodplain Development Permit (FDP) Application
 - Construction Plans (PE Certified)
 - Hydraulic Study (see section on Hydraulic Studies for details on CLOMR/LOMR submittals)
 - Certificates

- Ownership Documentation
- Other Permits & Approvals
- Fee in the amount applicable for a map amendment proposal (\$200)
- Other requirement(s) as determined by the County Engineer to be necessary to allow the review criteria to be adequately evaluated

Map Amendment Approval Criteria

The FRB will review the proposal and make a recommendation to the County Engineer based on the approval criteria in the LCLUC as shown below.

- The completeness and technical adequacy of the map amendment request and associated materials submitted with the request in accordance with the:
 - FEMA Guidelines and Specifications for Flood Hazard Mapping Partners
 - Article 12.0 of this Code
 - Larimer County Floodplain Development Standards
 - Sound engineering judgment of FRB members
- The impacts that approval of the map amendment request will have on the:
 - Flood profile, flood heights, and floodplain boundaries (1% ACE)
 - Floodway
 - Existing structures, roads, bridges, or other infrastructure
 - Lands upstream, downstream, and in the immediate vicinity of the study limits of the map amendment request

Floodplain Project Reviews

Floodplain Project Reviews (FPRs) include the following:

- New or replacement bridges, roads, or other infrastructure which cross a stream channel, as determined by the County Engineer.
- New or replacement water control structures which are determined to be hydraulically significant by the County Engineer.
- New or replacement marinas, docks, piers, wharves, or other floodplain development determined by the County Engineer to require special consideration by the FRB.

The FRB must review such proposals in the FPO District prior to approval by the County Engineer.

Floodplain Project Review Submittal Requirements

Prior to FRB review, the applicant and/or engineer must submit the following items to the County:

- Floodplain Development Permit (FDP) Application
- FDP submittal requirements applicable to the variance request (see Floodplain Development Permit section above)
 - Floodplain Development Permit (FDP) Application
 - Construction Plans (PE Certified)
 - Hydraulic Study (see section on Hydraulic Studies for details on CLOMR/LOMR submittals)
 - Certificates
 - Ownership Documentation
 - Other Permits & Approvals
- Fee in the amount applicable for a Floodplain Project Review (\$400)
- Other requirement(s) as determined by the County Engineer to be necessary to allow the review criteria to be adequately evaluated

Floodplain Project Review Approval Criteria

The FRB will review the proposal and make a recommendation to the County Engineer based on the approval criteria in the LCLUC as shown below:

- The completeness and technical adequacy of the FPR in accordance with:
 - Article 12.0 of this Code
 - Larimer County Floodplain Development Standards
 - Sound engineering judgment of FRB members
- The probability that granting approval of the FPR will result in unreasonable risk of harm to people or property, both onsite and in the surrounding area
- The safety of access to and from the subject property during flood events
- The availability of alternatives having a reduced risk of flooding impacts.
- Impacts due to scour and erosion.
- The impacts that approval of the FPR will have on the:

- Flood profile and flood heights (1% ACE)
- Floodway
- Stability of the channel and/or sedimentation
- Existing structures, roads, bridges, or other infrastructure
- Lands upstream, downstream, and in the immediate vicinity of the study limits of the floodplain development
- Ecosystem(s) associated with the watercourse, including the streambank and streamside vegetation.

12. RESOURCES

A variety of resources exist to help understand floodplains, flood risk, and development regulations. A list of recommended resources is provided below for further learning:

- **Larimer County Floodplains Website**

<https://www.larimer.org/engineering/floodplains>

Description: The County's website pertaining to floodplains and floodplain regulations in Larimer County.

- **Larimer County Land Use Code**

https://www.larimer.org/sites/default/files/uploads/2021/larimer_luc_adoptiondraft_final_1.pdf

Description: Regulations which apply to development in Larimer County. Article 12 contains the County's floodplain regulations.

- **Larimer County Flood Review Board**

<https://www.larimer.org/boards/flood-review-board>

Description: Website describing the purpose, schedule, and members of the Larimer County Flood Review Board

- **Larimer County Engineering Standards**

<https://www.larimer.org/engineering/standards-and-guides>

Description: Engineering design standards for development within Larimer County.

- **FEMA Map Service Center**

<https://msc.fema.gov/portal/home>

Description: FEMA's website where federal regulatory floodplain maps can be viewed. This website does not contain maps for local floodplains not recognized by FEMA.

- **FEMA Technical Bulletins**

<https://www.fema.gov/emergency-managers/risk-management/building-science/national-flood-insurance-technical-bulletins>

Description: Technical documents describing design and standards for development within a regulatory floodplain. These guidelines must be followed where applicable.

- **FEMA National Flood Insurance Program (NFIP)**

<https://www.fema.gov/flood-insurance>

Description: Website containing information and links pertaining to FEMA flood insurance and the NFIP.

- **Floodsmart.gov**

<https://www.floodsmart.gov/>

Description: Website containing information and links pertaining to FEMA flood insurance and flood safety.

- **Local Floodplain Maps**

Fort Collins Floodplain Maps

<https://gisweb.fcgov.com/HTML5Viewer/Index.html?viewer=FCMaps&LayerTheme=floodplains>

Loveland Floodplain Maps

<https://maps.cityofloveland.org/Apps/?viewer=Floodplain>

Description: Online maps showing floodplains administered by local municipalities within Larimer County.

- **Colorado Hazard Mapping and RiskMAP Portal**

<https://coloradohazardmapping.com/>

Description: Online portal for information pertaining to flood risk mapping updates throughout the State of Colorado.