

FLOODPLAIN MODELING REPORT

SUBMITTAL REQUIREMENTS

January 2021

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1. INTRODUCTION

These guidelines have been prepared in order to assist engineering consultants and requestors, (herein referred to as applicants) in the preparation of a floodplain modeling report submittal for review by the City of Beaverton (City). Guidelines presented herein serve as a framework for compiling technical content and supporting documentation necessary for the review and approval of any proposed floodplain development activity occurring in FEMA floodplains.

These guidelines are not intended to replace any requirements for FEMA Letter of Map Revision (LOMR) or Conditional Letter of Map Revision (CLOMR) submittal (referred to collectively as Letters of Map Change or LOMC). In turn, the structure of these guidelines is intended to closely conform to the LOMC submittal format while incorporating applicable City-specific requirements. The use of these guidelines in preparing a LOMC submittal for FEMA floodplains or floodplain modeling report in support of development in a FEMA regulated floodplain is intended to streamline the preparation and review process, provide quality control checks, reduce additional data requests during the review, and ultimately reduce time and expense to both the requestor and reviewer. *This is a living document and will be updated on a periodic basis to be determined by City staff on an as-needed basis.*

2. ACKNOWLEDGEMENTS

This document is adapted from the City of Fort Collins, CO.

3. OVERVIEW OF REQUIREMENTS

The National Flood Insurance Program (NFIP) was created by Congress as part of the National Flood Insurance Act of 1968. The main purpose of the program was directed towards reducing future flood damage and losses through the proactive enforcement of local floodplain regulations and management practices. Under the NFIP, local communities agreeing to adopt and enforce these regulations are eligible for financial protection from flood loss through the purchase of flood insurance.

As an active participant in the NFIP, the City maintains and enforces a floodplain management program consistent with both State and Federal (Title 44 of the Code of Federal Regulations, or 44 CFR) requirements and through implementation of standards outlined in Chapter 60 of the City Development Code, Chapter 9.05 of the City Code, and Chapter 5, Section 5.10 of Clean Water Services Design & Construction Standards. Under these regulations, the City is responsible for the review and approval of all proposed floodplain development projects and ensuring that permits required by Federal and State law have been received. The City is also responsible for submitting all revised flood hazard information and data to FEMA in order to update affected Flood Insurance Rate Map (FIRM) panels to reflect the present condition of flood risk in all FEMA basins within City limits.

44 CFR can be viewed using the following link:
<https://ecfr.federalregister.gov/current/title-44>

Chapter 60 of the City Development Code can be viewed using the following link:
<https://www.beavertonoregon.gov/DocumentCenter/View/4970/Chapter-60---Special-Requirements?bidId=>

Chapter 9.05 of the City Code requirements are available at the following link:

<https://www.codepublishing.com/OR/Beaverton/html/Beaverton09/Beaverton0905.html#9.05>

Chapter 5, Section 5.10 of Clean Water Services Design & Construction Standards are available at the following link:

<https://www.cleanwaterservices.org/media/2529/final-chapter-5.pdf>

The floodplain modeling report is a key component to the City's review and approval process for any proposed development project in a floodplain. This report allows the requestor to clearly document that all proposed floodplain development activities comply with local, state, and federal (FEMA) floodplain regulations. *The floodplain modeling report is a stand-alone document that is different from the Drainage Report for a proposed project or activity.*

In general, CLOMRs, LOMRs, or floodplain modeling reports will be required by the City for any of the following activities within an effective FEMA regulated floodplain:

- Proposed development, as defined in City Code section 9.05.060, within a designated floodway or floodplain and subject to the no-rise requirements of City Code, or;
- FEMA Conditional Letter of Map Revision (CLOMR) and Letter of Map Revision (LOMR) submittals for areas previously studied under detailed and approximate methods, or;
- Proposed development within a FEMA regulated floodplain resulting in any change to the floodplain and/or floodway boundaries or base flood elevation outlined in City Code, or;
- Proposed activities that alter a natural floodplain
- Other unique special hazard projects.

3.1 Initial Meeting

An initial meeting with the City Floodplain Administrator, Site Development Division Manager and City Engineer concerning the proposed project is **required** prior to initiating any hydrologic and/or hydraulic modeling analyses. The purpose of this meeting is to allow the applicant and City to discuss the proposed project, required approach, acceptable modeling methodology, available mapping, etc. In order to avoid any potential technical or administrative issues which may arise during the project analysis phase, the City is available to periodically meet with the applicant to discuss any questions/issues. *The City reserves the right to reject any submittals delivered without an initial meeting.*

4. SUBMITTAL PROCEDURES

All submittals must include an electronic copy of the following items:

- Report text,
- Construction plans or as-built survey information,
- Regulation requirements or required notifications,
- Floodplain work maps,
- Annotated FIRM(s)
- Flood profiles,
- Annotated floodway data tables,
- Comparison tables,
- Agreements tables

- Model output reports, and
- Cross-section plots.

Hydrologic models, hydraulic models, and digital data may be required for review.

4.1 Permits for Development in Floodplain

A City issued permit is required for **any** development work as defined in section 9.05.020 City Code in a FEMA regulated floodplain. The permit must be approved by the City **before** the start of construction. Please refer to section 9.05.060 in City Code for floodplain permit requirements.

The required application fee for development in floodplain, and the review of floodplain analyses must be received before a request can be reviewed or processed. The current fee schedule information can be found at the following web address: <https://www.beavertonoregon.gov/DocumentCenter/View/687/Fee-Schedule?bidId=>

4.2 FEMA Submittals

As noted in in Section 3 of these guidelines, NFIP regulations require the City to submit all floodplain map revisions to FEMA for projects which propose floodway revisions, changes in a BFE, watercourse or waterway alteration, or changes using a Corrected Effective or Existing Conditions model within a FEMA SFHA. As part of a floodplain modeling report submittal to the City, the applicant should include all appropriate [FEMA MT-2 Forms](#) for review. Upon approval of the floodplain analysis and modeling report, the City will sign the MT-2 application, return the application to the applicant for submittal to FEMA, and retain copy of the report for City records.

Site grading or any other construction activities **cannot** begin in the floodway until a CLOMR application is approved by FEMA, a floodplain development permit and no-rise certification are approved by the City Floodplain Administrator. *Building permits will also not be issued until floodplain development permit and no-rise certifications are approved by the same.*

The LOMR submittal will be required immediately after a project is constructed. As part of the LOMR submittal, the floodplain modeling report must be revised to include as-built information. A complete submittal package will be required for review by the City. Similar to the CLOMR application process, the City will review and approve the analysis and report, then sign the MT-2 application form. The City will retain copy of the report for City records. *Certificates of occupancy will not be issued and collateral held will not be released until the LOMR is issued by FEMA, all outstanding enforcement actions of City Code resolved, and all floodplain permits are deemed substantially complete and no-rise re-certifications are approved by the City.* Please note that the Flood Insurance Rate Maps (FIRMs) are not revised until the approved LOMR is issued by FEMA.

For FEMA LOMC submittals, the applicant is responsible for submitting the report, supporting technical information, MT-2 forms (signed by City Floodplain Administrator), and the appropriate fee to the address listed on MT-2 Form 7 – Payment Information. *The City is **not** responsible for submitting LOMC applications, reports or fees on behalf of the applicant.*

5. SUBMITTAL ITEMS

The following items must be included with a floodplain modeling report submittal. A copy of all final approved LOMC reports and supporting documents will be retained by the City for record keeping purposes. The title page of the report must be signed by a professional engineer (P.E.) licensed to practice in the State of Oregon.

5.1 Report Text

Specific sections that should be included in the floodplain modeling report (as applicable) and can be found on the submittal checklist in **Attachment 6**. In general, the text of the floodplain modeling report must describe the following:

- **Project Description:** This section describes the purpose of the request and must include a detailed description of the proposed project and project site. Any pertinent project elements must be described as well as listing the stakeholders and/or requestors. Applicants should also describe any special requirements of the desired outcome (e.g. does the requestor want the LOMR to be effective immediately or do they want the current FEMA zone designation changed in any way).
- **Background:** Describe the background and pertinent history of the watershed and flooding source. This section should also mention any previous studies (i.e. Master Plans, etc.) and include a description of any effective LOMRs or approved CLOMRs which impact the project's revision reach.
- **Study Limits:** List the impacted FIRM panels, effective dates, impacted areas, and describe the proposed revision reach.
- **Mapping:** Describe the source of the topographic mapping used for the project including the mapping company, date mapped or flown, scale, contour interval, vertical datum using the National Geodetic Vertical Datum of 1929 (NGVD29), NAVD88 and control point data from the City of Beaverton.
Primary Horizontal control for City projects shall be referenced to the coordinate system listed below.
The Oregon Coordinate Reference System of 2011, Portland Zone (NAD 83) shown as NAD 83 (2011) epoch 2010.0 or revisions;
- **Hydrology:** This section identifies the source of the discharge information used during the hydraulic analysis. If the project hydrology has been changed or differs from the adopted FEMA discharges in any way, the methodology, details, and results or changes should be summarized here. Provide a summary of peak discharges for all modeled recurrence intervals and hydrologic models. All revised hydrologic analyses should be performed in accordance with the latest version of FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners.

- **Hydraulics:** The hydraulics section outlines the hydraulic modeling effort completed in support of the proposed project starting with the Effective model and ending with the Proposed (CLOMR), or Post-Project (LOMR) hydraulic models. Methodology used in the hydraulic modeling analysis should be discussed. This section should also include the source of the Effective model (e.g. Master Plan, FEMA Flood Insurance Study (FIS), previous LOMR, new study, etc.) and can include discussions related to the relevant changes and development of the: Duplicate Effective, Corrected Effective, Existing, and Proposed hydraulic models. FEMA’s MT-2 Form Instructions should be referenced for a detailed description and purpose of the different model runs (i.e. Duplicate Effective, Corrected Effective, etc.). Depending on the request, this section may also be required to document and justify changes to the regulatory floodway, Manning’s ‘n’ values, weir coefficients, tie-ins to the effective information, contraction and expansion ratios, hydraulic structure information, additional cross-sections added to the models, cross section relocations, reach length changes, and any other hydraulic parameters affected. All revised hydraulic analyses should be performed in accordance with the latest version of FEMA’s Guidelines and Specifications for Flood Hazard Mapping Partners.
- **Discussion of Results:** Provide a general discussion of the hydrologic and/or hydraulic modeling results. Discuss City code section 9.05.060 requirements of no rise analysis, any changes in flood discharges, water- surface elevations or floodplain/floodway boundaries. Depending on the nature of the proposed project, items that may need to be discussed in this section include any impacts to structures or upstream/downstream properties, any mitigation measures that will be incorporated, flood proofing, channel bed or bank stabilization, etc.
- **Regulation Compliance:** Describe City Code and National Flood Insurance Program (NFIP) regulations required to be met with the request (e.g. tie- in requirements, [Section 65.12 regulations](#), public notification, LOMR notifications, [Endangered Species Act \(ESA\) compliance](#), etc.) and how they were satisfied. Projects occurring in FEMA-regulated floodplains are subject to all applicable requirements of City Code. See City Code and 44 CFR for complete regulations
- **References:** Lists all references used during the preparation of the floodplain modeling and report submittal as well as what hydrologic and/or hydraulic programs were used (including the program version).

5.2 Hydrologic and/or Hydraulic Models

Executable copies of all hydrologic and/or hydraulic models used in the analysis should be included in electronic form. In order to simplify and standardize the review process, a logical file structure should be used for all submittals. An example of the recommended file structure for submitting hydrologic and hydraulic models is shown in **Figure 5.2.1**. The structure shown in this figure could change depending on the submittal, but it is recommended that a similar structure be used.

All Duplicate Effective, Corrected Effective, Existing, and Proposed hydraulic models must be compiled into a single HEC-RAS project file using different plan files for each respective model run rather than separate HEC-RAS project files. HEC-RAS reports must be prepared and submitted electronically for all model runs included in the analysis. These reports should be generated using the general recommended settings shown in **Figure 5.2.2** and organized following the same file structure shown in **Figure 5.2.1**. Output tables in addition to those shown in **Figure 5.2.2** may be applicable depending on the specific hydraulic model. Model output reports can be submitted in their original format, as a PDF, or using Microsoft Word. Hydraulic cross-section plots must also be provided electronically (in PDF format) and should be placed in the Reports folder along with the HEC-RAS output report files. HEC-RAS output reports and cross-section plots submitted in paper format **will not** be accepted.

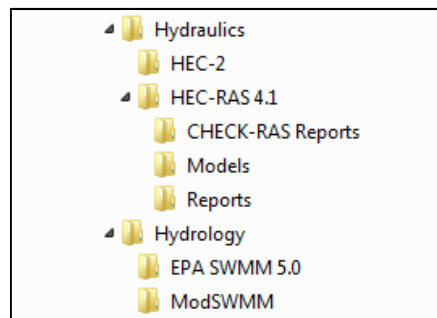


Figure 5.2.1 – Recommended Model File Structure

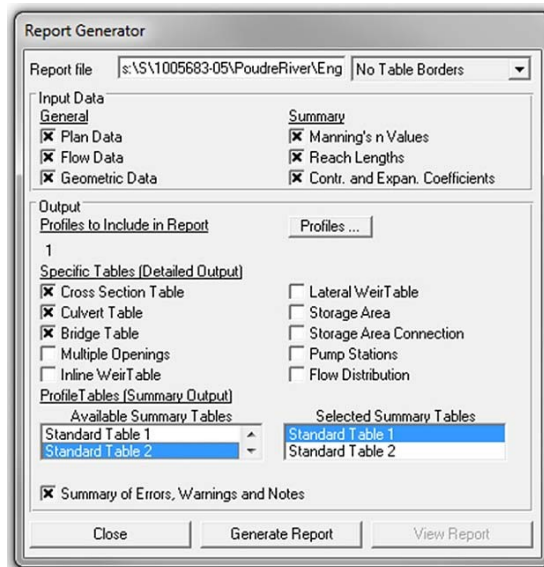


Figure 5.2.2 – Recommended HEC-RAS Report Generator Settings

All hydraulic models requiring at least a Corrected Effective analysis must be updated to the latest non- beta version of HEC-RAS, which can be downloaded from the US Army Corps of Engineers at the following link: <https://www.hec.usace.army.mil/software/hec-ras/download.aspx> For all submittals, the full effective model must be kept in its original format with revisions incorporated into the geometry data as appropriate. Models truncated to a specific study area will not be accepted.

All detailed floodplain modeling analyses submitted to the City are required to be verified with the CHECK-2 or CHECK-RAS program. CHECK-2 and CHECK-RAS are review tools that confirm hydraulic estimates and assumptions contained in the model are consistent with the assumptions and limitations of HEC-2 and HEC-RAS respectively. These programs will identify any areas of potential concern that should be evaluated before submitting for review. Note that the CHECK-2 or CHECK-RAS programs do not replace engineering judgment, so any comment messages believed to be invalid may be explained by the engineer in an attachment (Microsoft Word document) or annotated fashion (PDF format). The CHECK-2 and CHECK-RAS programs are available for download from FEMA at the following link: <https://www.fema.gov/flood-maps/tutorials/check-ras>

5.3 Proposed Construction Plans and/or As-Built Survey Information

Proposed construction plans certified by the seal of a P.E. licensed to practice in the State of Oregon must be submitted as part of the floodplain modeling report for a floodplain development permit or CLOMR application. Certified as-built drawings and/or certified survey information is required for a LOMR submittal. Topographic information and other survey materials supporting a flood map study must be prepared by and certified by a registered professional land surveyor (P.L.S.) licensed to practice in the State of Oregon. All hydraulic information associated with a submitted analysis must be tied to certified land survey information before it can be reviewed by the City or FEMA. Survey information must be certified by a P.L.S.

Floodplain development Permits and CLOMRs, signed and wet-stamped, proposed construction plans

should be submitted in PDF format on a CD or thumb drive. A single file containing multiple sheets (preferred method) or multiple PDF files can be included.

LOMRs, as-built-drawings and/or survey information must be submitted in PDF format per City submittal guidelines. A signed P.E. seal must be visible on the submitted PDF file(s).

5.4 FEMA MT-2 Forms

For a LOMC submittal in a FEMA-regulatory basin, the required FEMA MT-2 Forms must be filled out and submitted in PDF format with all required signatures including the requester and a PE. Upon approval of the floodplain analysis and modeling report by the City, the City Floodplain Administrator or his designee will provide their signature in the appropriate box on MT-2 Form 1 Section D. *The applicant is responsible for submittal to FEMA.* Please refer back to the previous Section 4.2 of this document for additional detail on FEMA submittals.

5.5 NFIP Regulation Requirements/Notifications

Meeting specific NFIP regulation requirements is necessary for any LOMC submittal. This section of the guidelines highlights some of these requirements and where more information and assistance on fulfilling the NFIP regulations can be obtained. Please note that these regulations apply to all proposed projects occurring in a FEMA floodplain.

All LOMC submittals must meet the specific tie-in requirements set forth by FEMA for tying into the effective information. For detailed study areas, the revised BFEs must tie-in at both the upstream and downstream ends of the revised reach within 1 foot of the effective profile elevations. The width of the SFHA must have a tie-in top-width within 5% of the effective FIRM map's scale (e.g. 25 feet for a 1 inch = 500 feet scale FIRM Master Plan Panel). For Zone AE areas which include a regulatory floodway, the floodway elevations must also be within the 1.0-foot profile requirement and the floodway encroachment stations at both the upstream and downstream limits must match the effective encroachment stations. For areas not studied by detailed methods, or an area designated as Zone A, the revised BFEs must be within 1 foot of the pre- project conditions model (either Corrected Effective or Existing) at both the upstream and downstream revision limits, and the width of the SFHA must also tie-in within 5% of the effective FIRM's scale.

MT-2 Form 2, Section D, lists some of the most common regulatory requirements for FEMA-regulatory basin LOMC submittals and must be filled out completely and included with all submittals. The MT-2 Form Instructions contain some useful guidance for filling out Section D as well as a more detailed explanation regarding regulatory requirements. The MT-2 Forms and Instructions can be downloaded at the following location: <https://www.fema.gov/flood-maps/change-your-flood-zone/paper-application-forms/mt-2>

For CLOMRs, Section 65.12 of NFIP regulations requires several conditions be met including individual legal notification to all impacted property owners (if floodway boundaries change due to the proposed project, or increases in the BFE would occur when compared to the effective), and a certified statement indicating that "no insurable structures are impacted by the proposed project changes." FEMA's MT-2 Form Instructions document also contains an example of a certified statement regarding insurable structures. **Attachment 1** contains an example property owner notification letter. An example insurable structure certification letter can be found in **Attachment 2**. All CLOMRs must also show compliance with Federal, State and Local threatened and endangered species requirements (ESA compliance) before they can be reviewed

by the City or FEMA.

For LOMRs, notifications are required for all property owners experiencing any adverse impacts due to the proposed changes (i.e. increases in BFE or SFHA width when compared to the effective). The MT-2 Form Instructions also contain sample LOMR notification letters which fulfill this obligation. In addition to the required notifications, the submitting engineer must also provide certification that all property owners experiencing adverse impacts have, in fact, have been notified of the changes and that no insurable structures are impacted from increased BFEs. **Attachment 3** contains a sample of a certification letter which meets this requirement. It should be noted that neither this section of the Guidelines nor MT-2 Form 2, Section D, contain all the regulations governing FEMA, the NFIP, or City Code. Section 44 of the Code of Federal Regulations (44 CFR) contains the policies and procedures governing FEMA and parts [60](#) and [65](#) of that section contains the regulatory requirements of the NFIP.

44 CFR can be viewed using the following link:
<https://ecfr.federalregister.gov/current/title-44>

44CFR- 65.12 Revision of flood insurance rate maps to reflect base flood elevations caused by proposed encroachments. <https://ecfr.federalregister.gov/current/title-44/chapter-I/subchapter-B/part-65/section-65.12>

MT-2 Application Form- <https://www.fema.gov/flood-maps/change-your-flood-zone/paper-application-forms/mt-2>

Chapter 60 of the City Development Code can be viewed using the following link:
<https://www.beavertonoregon.gov/DocumentCenter/View/4970/Chapter-60---Special-Requirements?bidId=>

Chapter 9.05 of the City Code requirements are available at the following link:
<https://www.codepublishing.com/OR/Beaverton/html/Beaverton09/Beaverton0905.html#9.05> Chapter 5, Section 5.10 of Clean Water Services Design & Construction Standards are available at the following link:
<https://www.cleanwaterservices.org/media/2529/final-chapter-5.pdf>

5.6 Floodplain Work Maps

One PDF copy set of the full-scale certified topographic floodplain work maps showing relevant portions of the effective, corrected effective, existing (or pre-project for a LOMR), and proposed (or post-project for a LOMR) floodplains and floodways must be submitted. Accepted electronic formats for the work maps must use AutoCAD and GIS unless prior authorization is given by the City in advance of the submittal. For AutoCAD formats, the digital submittal must include the .dwg file and pertinent associated files; for GIS formats, the digital submittal must include the .mxd file with relative references.

For City GIS formats, the digital submittal must include a polygon shapefile or ESRI feature class of the corrected floodplain. See City GIS Requirements below.

Three floodplain work maps should be submitted for all areas within the revision reach comparing the following floodplain boundaries:

Map 1 - Effective vs. Corrected Effective floodplains

Map 2 – Corrected Effective vs. Existing Condition floodplains

Map 3 – Effective and Existing vs. Proposed Condition floodplains

At a minimum, the work maps (digital versions) must contain all applicable information stated in FEMA's MT-2 Forms which is summarized below:

- Effective floodplain boundaries (1% and 0.2% annual-chance),
- Existing/Corrected Effective floodplain boundaries (1% annual-chance),
- Proposed/Post-Project floodplain boundaries (1% and 0.2% annual-chance), Effective floodway boundaries,
- Corrected Effective floodway boundaries,
- Existing Condition floodway boundaries,
- Proposed/Post-Project floodway boundaries,
- Proposed/Post-Project BFEs,
- Location and alignment of all hydraulic cross-sections with stationing control,
- Location and alignment of all ineffective flow areas,
- Stream centerlines and stationing which correlate with the submitted hydraulic models,
- Road and hydraulic structure alignments (e.g. bridges, culverts, dams, levees, lateral structures, etc.),
- Current community easements and boundaries,
- Adjacent property boundaries,
- Boundaries of the requester's property,
- Registered P.E. and P.L.S. certifications,
- Referenced vertical datum (typically NGVD29),
- Referenced horizontal datum and mapping projection
- Date and source of aerial photography and survey information.

A signed seal of an Oregon registered P.E. must be visible on the submitted work map(s).

Flood hazard information contained in the CAD and GIS work maps should follow a logical naming and appearance convention in order to identify the flood hazard features from the geographic or background data. Additionally, a map legend or labels for the pertinent flood hazard information should be included. Recommended layer/shape naming and appearance conventions are presented in **Table 5.6.1**.

Feature	Layer/Shape Name	Color	Line Type
Effective 10-YR Floodplain	10-YEAR-EFF	Light Blue	Line type 1
Corrected Effective 10-YR Floodplain	10-YEAR-CE	Light Orange	Line type 1
Existing 10-YR Floodplain	10-YEAR-EX	Green	Line type 1
Proposed 10-YR Floodplain	10-YEAR-PP	Dark Blue	Line type 1
Effective 25-YR Floodplain	25-YEAR-EFF	Light Blue	Line type 2
Corrected Effective 25-YR Floodplain	25-YEAR-CE	Light Orange	Line type 2
Existing 25-YR Floodplain	25-YEAR-EX	Green	Line type 2
Proposed 25-YR Floodplain	25-YEAR-PP	Dark Blue	Line type 2
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 1.0-ft Floodway	ONE-FT-FLDWY-EFF	Light Blue	Hidden
Corr. Eff. Regulatory 1.0-ft Floodway	ONE-FT-FLDWY-CE	Light Orange	Hidden
Existing Regulatory 1.0-ft Floodway	ONE-FT-FLDWY-EX	Green	Hidden
Proposed Regulatory 1.0-FT Floodway	ONE-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

Table 5.6.1 – Required Layer/Shape Naming and Appearance Conventions

City GIS Requirements

Include one polygon shapefile or ESRI feature class that delineates areas by floodplain probability type, floodway and zone designation. It needs to include the following fields in its table schema and use the spatial reference below.

Spatial Reference- The Oregon Coordinate Reference System of 2011, Portland Zone (NAD 83) shown as NAD 83 (2011) epoch 2010.0

Field Name	Description	Field type	Required
FLOODPLAIN	Type of floodplain probability	Text	Y
	Values 10 Year 25 Year 100 Year 500 Year		
ZONE	Zone Description	Text	Y
	Values A A1 AE X OTH		
FLOODWAY	Is the area a floodway?	Text	Y
	Values Y N		
STUDY_NAME	Name of the study	Text	Y
CONSULTANT	Consultant who created study	Text	Y

Table 5.6.2 – City GIS Requirements

Once the review of the submittal is complete, the City may ask the applicant to provide updated versions of the work maps (both hardcopy and digital) which reflect changes that may have developed over the course of the review period.

An important part of being able to review the data produced for a floodplain use permit, no-rise certification, or LOMC request is knowing how the data is positioned horizontally and vertically on the surface of the earth. Therefore, the submitted electronic work map files must use and identify the horizontal datum used (e.g. NAD83), and vertical datum (NGVD29 and NAVD88) in order to orient the work map’s location with the location of the effective data.

All data submitted to the City as part of a floodplain modeling analysis within FEMA basins must use the NGVD29 vertical datum.

5.7 Annotated FIRM Panels

For any LOMC request within a FEMA basin, annotated FIRM exhibits are required for all impacted FIRM panels. The annotated FIRM shows the boundaries of the modified floodplains and regulatory floodway within the revised reach and how they tie into the effective information at the upstream and downstream tie-in locations.

5.8 Flood Profiles

For all submittals, a comparison profile in FEMA FIS format is required to identify changes in BFE resulting

from the modeling progression. 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, similar to 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 or HEC-2. These programs can be found at the following links:

FEMA RASLOT program:

https://www.floodmaps.fema.gov/fhm/scripts/counter_proc.asp?id=2

5.9 Comparison Tables

A BFE comparison table is required for all floodplain modeling analyses submitted to the City. The purpose of the comparison table is to demonstrate the hydraulic model progression and any impacts the proposed project has on the studied flooding source. The comparison table(s) should be included in electronic format (PDF of Microsoft Excel) with all submittals. **Attachment 4** contains a standardized comparison table (blank version and a filled-out example are included) which provides a common format for all submittals intended to reduce review time. *Please note that the values shown in the example version of the **Attachment 4** table are for illustrative purposes only and do not represent actual values used in a LOMC submittal.* The Excel version of this table is available for download on the City's website at the following link: <https://www.beavertonoregon.gov/DocumentCenter/View/29854/BFE--Map-Model-Agreement-Tables>

Being able to track the progression of submitted hydraulic models is an important step in understanding how the project affects the existing channel and also how the channel has changed since the original effective analysis was completed. For example, the BFE differences between the Effective and Duplicate Effective models indicate any changes associated with obtaining a copy of the effective model and re-running the model on the user's computer using either an updated version of the hydraulic model used when the effective model was created, or a different hydraulic program (e.g. HEC-2 to HEC-RAS). Another example is the BFE differences between the Pre-Project (Existing or Corrected Effective) model and the Post-Project or Proposed Conditions model. These differences isolate the changes in BFE due to the project and are important in determining if NFIP regulations Section 65.12 apply, or if City Code requirements are being met. Additionally, for CLOMR requests, the information presented in the BFE Comparison Table is used directly to prepare the CLOMR approval letter. FEMA's MT-2 Form Instructions should be consulted when determining which models should be used for each case, as the instructions explain the differences between the various models.

During the preparation of a detailed floodplain modeling submittal, the consultant or requestor typically has several hydraulic cross-sections which are not common to all prepared models. For example, there are usually multiple cross-sections used in the proposed conditions model which are not present in the effective or duplicate effective models. Additionally, there might also be cross-sections used in the effective model which do not apply for the proposed conditions model. Finally, when the channel stationing differs between models, comparing common cross-sections can be difficult. In these instances, interpolated values should be used in order to complete the required comparison table. In the case of the effective BFEs, these values may be obtained by either interpolation or by obtaining the BFE value directly from the effective FIS profile at the approximate location. Similarly, existing or proposed elevations can be interpolated at the original effective locations from the updated profile. Please note that interpolated values must be clearly identified on the submitted comparison table in similar fashion to what is shown in **Attachment 4**. In instances in which the cross-section identification/label differs from the stream stationing, a correlation must also be provided in the comparison table information.

5.10 Annotated Floodway Data Table

For a submittal which proposes floodplain development activities within an effective regulatory floodway, an annotated floodway data table is required. The annotated floodway data table should be submitted in electronic format (Microsoft Excel or Adobe PDF is recommended for the electronic version). Similar to the annotated FIRM panel the annotated floodway data table should indicate 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.

5.11 Agreement Tables

Hydraulic agreement tables are required for the Proposed - or Post-Project - models and work maps in a detailed floodplain modeling analysis submittal. The purpose of these tables is to correlate the information presented by the consultant (or requester) between the hydraulic model, floodplain work map, and floodway data. A blank version and an example of a completed agreement table are presented in **Attachment 5**. [The Excel version is also available for download on the City's website.](#)

This table ensures the following information matches between the submitted work map and hydraulic model:

- Distance between hydraulic cross-sections along channel centerline
- Cumulative channel distance along channel centerline
- 1% annual-chance (100-year) floodplain topwidth
- Regulatory floodway top width (if applicable)

In order to complete the table, the requester must first list all hydraulic cross-section locations and corresponding stream stationing on the table. For requests where the number of cross-sections exceeds the available rows, additional pages should be used. Next, the requester must fill in the channel distances according to the hydraulic model for each cross-section. The model channel distances can easily be accessed in HEC-RAS under the Geometry Data window using the "Tables" menu and selecting "Reach Lengths." Next, the Channel Distances for the floodplain work map can be filled out by measuring the corresponding value for each cross-section. The acceptable tolerance is listed below the Channel Distance column as plus or minus 5% of the model channel distance value. This tolerance is checked automatically in the "% Difference" column when using the Excel version of the table. If the Excel version is not used, the "% Difference" will need to be filled in manually. Once the map channel distances are completed, any discrepancies greater than the 5% tolerance - which the Excel version highlights in red - should be corrected or explained in the comments column or an attached document. The Cumulative

Channel Distance column will automatically fill in as the Channel Distance column is completed. Again, note the tolerance for this item listed below the column (plus or minus 5% of model distance). Any discrepancies exceeding this tolerance should be explained or corrected.

Completing the Base Floodplain Width and Floodway Width columns should be done in much the same way as the Channel Distance column. The floodplain - or floodway (if applicable) - widths from the hydraulic model should be filled in next to the values measured from the submitted floodplain work maps. The tolerance for these values is 25 feet. The top-width used is the total section top-width including high ground

or ineffective flow areas. One way to obtain this value directly from the HEC-RAS hydraulic model is to use the Profile Output Tables - Encroachment Table 3 - and modify to add the three columns necessary to calculate the correct top-width required. Using the Define Table option under the Options menu, the user can add the following variables to the table: "Sta W.S. Rgt", "Sta W.S. Lft", and "Diff". The resulting value presented in the "Diff" column is the correct top-width to report in the Agreement Tables.

For detailed Zone AE areas, the revised BFEs plotted on the submitted work maps should also correlate well with the submitted profile in the hydraulic model. A BFE column has not been included with the agreement tables but revised BFEs plotted 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.

5.12 Other Items

Any other items that are required in the floodplain modeling report submittal can be included in digital form. This includes but is not limited to:

- Pertinent additional hydraulic and/or hydrologic calculations
- Hydrologic Figures (e.g. Connectivity Diagrams, Basin Maps, etc.)
- Copies of previous studies or reports
- Correspondence

5.13 Electronic Submittal

The final item required for a floodplain modeling report or LOMC submittal is a CD or thumb drive containing all the items noted above (e.g. hydraulic models, floodplain work maps, report, etc.). The recommended file structure for the report appendices can be found on the submittal checklist. This directory structure should be modified accordingly for different types of submittals.

Attachment 1

Example Property Owner Notification Letter

(Date)

(Affected property owner name)
(Affected property owner mailing address)

RE: Notification of Increases in 1% (100-Year) Annual-Chance Water Surface Elevations

Dear **(Affected property owner)**:

The Flood Insurance Rate Map (FIRM) for a community depicts land which has been determined to be subject to a 1% (100-year) or greater chance of flooding in a given year. The FIRM is used to determine flood insurance rates and to help the community with floodplain management.

(Revision Requestor) is applying for a Conditional Letter of Map Revision from the Federal Emergency Management Agency (DHS-FEMA) on behalf of **(Revision Requestor's client)** to revise FIRM **(insert FIRM #, panel #and suffix)** for **(insert community name and state)** along **(insert name of flooding source)**. **(Revision Requestor's client)** is proposing **(describe project)** as part of **(explain project purpose)**.

The proposed project will result in increases **(and decrease if applicable)** in the 1% annual chance water-surface elevations for **(insert flooding source)** with a maximum increase of **(enter maximum increase)** feet at a point approximately **(location of maximum increase)** and a maximum decrease in the 1% annual chance water-surface elevation of **(enter maximum decrease)** feet at a point approximately **(location of maximum decrease)**.

This letter is to inform you of the proposed increases in the 1% annual chance water-surface elevations on your property at **(insert physical address)**.

If you have any questions or concerns about the proposed project or its effect on your property, you may contact **(name of appropriate community official)** of **(name of community)** at **(community official contact information)**.

Sincerely,

**(INSERT
ENGINEER)
(TITLE)**

(INSERT COMPANY)

Attachment 2

Example Insurable Structure Certification Letter

(Date)

Floodplain
Administrator City
of Beaverton

RE: Insurable Structure Certification Letter For (Insert Project Name/Identifier)

Dear Floodplain Administrator:

With this letter, we hereby certify that no insurable structures are negatively impacted due to the proposed floodplain development project along **(INSERT FLOODING SOURCE)**. Please contact us should you have any questions or concerns regarding this certification.

Sincerely,

**(INSERT
ENGINEER)
(TITLE)**

(INSERT COMPANY)

Example Insurable Structure Certification Letter (Required for submittals in FEMA floodplains)

Attachment 3

Example LOMR Certification Statement for Adverse Impact Notification

(Date)

Floodplain
Administrator City
of Beaverton

RE: LOMR Certification Statement For (Insert Project Name/Identifier)

Dear Floodplain Administrator:

With this letter, we hereby certify that all property owners who are adversely impacted by any increases in and/or shifting of the 1%-annual-chance floodplain top-width and/or impacted by increased 1%-annual-chance water-surface elevations between the post-project an defective conditions for (INSERT FLOODING SOURCE) have been individually notified of the proposed changes. In addition, we certify that no insurable structures are negatively impacted due to the revisions. Please contact us should you have any questions or concerns regarding these certifications.

Sincerely,

**(INSERT
ENGINEER)
(TITLE)**

(INSERT COMPANY)

Example LOMR Certification Letter for Adverse Impact Notification (Required for submittals in FEMA floodplains)

Attachment 4

BFE Comparison Table

BFE Comparison Table

Project Name:		Example Creek CLOMR													
Flooding Source:		Example Creek													
Company:		Example Engineering													
Completed By:		Example Engineer, P.E.													
SOURCE DATA											COMPARISONS				
HYDRAULIC CROSS-SECTION INFO.						BASE FLOOD ELEVATIONS (NAVD88)									
Effective Cross-Section ID (Letter)	Corrected Effective Cross-Section ID	Corrected Effective Stream Station	Existing Cross-Section ID	Proposed Cross-Section ID	Proposed Stream Station	Effective	Duplicate Effective	Corrected Effective	Existing	Proposed	DUP. EFF vs. EFF.	COR. EFF. vs. EFF.	EX. vs. COR. EFF.	PP. vs. COR. EFF.	PP. vs. EFF.
						BFE	BFE	BFE	BFE	BFE	BFE	BFE	BFE	BFE	BFE
400 (A)	400	400	--	400	400	5205.50	5205.50	5205.50	--	5205.50	0.00	0.00	--	0.00	0.00
--	550	550	--	550	550	5207.10	5207.16	5206.25	--	5206.25	0.06	-0.85	--	0.00	-0.85
--	710	710	--	710	710	5208.10	5208.13	5208.17	--	5208.17	0.03	0.07	--	0.00	0.07
805 (B)	805	805	--	805	805	5208.40	5208.46	5208.80	--	5208.80	0.06	0.40	--	0.00	0.40
--	--	--	--	875	875	5208.52	5208.52	5209.05	--	5209.05	0.00	0.53	--	0.00	0.53
--	--	--	--	910	910	5208.60	5208.62	5209.18	--	5209.18	0.02	0.58	--	0.00	0.58
--	--	--	--	980	980	5209.94	5209.95	5209.98	--	5210.25	0.01	0.04	--	0.27	0.31
1000	1020	1020	--	1020	1020	5210.12	5210.08	5210.42	--	5210.71	-0.04	0.30	--	0.29	0.59
1350	1370	1370	--	1370	1370	5211.20	5211.12	5211.14	--	5212.01	-0.08	-0.06	--	0.87	0.81
--	--	--	--	1410	1410	5212.63	5212.53	5211.80	--	5212.90	-0.10	-0.83	--	1.10	0.27
--	--	--	--	1500	1500	5212.68	5212.62	5212.44	--	5212.92	-0.06	-0.24	--	0.48	0.24
--	--	--	--	--	--	5213.80	5213.78	5213.72	--	5213.81	-0.02	-0.08	--	0.09	0.01
1650 (C)	1680	1680	--	1680	1680	5214.57	5214.56	5216.97	--	5217.05	-0.01	2.40	--	0.08	2.48
1710	--	--	--	--	--	5217.21	5217.21	5218.66	--	5218.69	0.00	1.45	--	0.03	1.48
1790	--	--	--	--	--	5219.30	5219.30	5220.63	--	5220.64	0.00	1.33	--	0.01	1.34
2000	2030	2030	--	2030	2030	5220.30	5220.30	5221.27	--	5221.27	0.00	0.97	--	0.00	0.97
2250	2280	2280	--	2280	2280	5222.56	5222.64	5222.41	--	5222.41	0.08	-0.15	--	0.00	-0.15
2300	2330	2330	--	2330	2330	5224.60	5224.71	5224.62	--	5224.62	0.11	0.02	--	0.00	0.02
2350 (D)	2380	2380	--	2380	2380	5225.34	5225.34	5226.20	--	5226.20	0.00	0.86	--	0.00	0.86
--	--	--	--	2401	2401	5225.98	5225.99	5227.71	--	5227.71	0.01	1.73	--	0.00	1.73
--	--	--	--	2460	2460	5227.46	5227.46	5228.43	--	5228.43	0.00	0.97	--	0.00	0.97
--	--	--	--	2557	2557	5232.47	5232.46	5232.88	--	5232.88	-0.01	0.41	--	0.00	0.41
2700	2730	2730	--	2730	2730	5234.54	5234.54	5233.12	--	5233.12	0.00	-1.42	--	0.00	-1.42
2906	--	--	--	--	--	5236.20	5236.20	5233.46	--	5233.46	0.00	-2.74	--	0.00	-2.74
3105	3135	3135	--	3135	3135	5237.48	5237.48	5237.20	--	5237.20	0.00	-0.28	--	0.00	-0.28
3250	--	--	--	--	--	5239.40	5239.40	5238.77	--	5238.77	0.00	-0.63	--	0.00	-0.63
3580	3610	3610	--	3610	3610	5240.80	5240.80	5240.16	--	5240.16	0.00	-0.64	--	0.00	-0.64
3701	--	--	--	--	--	5245.20	5245.20	5244.62	--	5244.62	0.00	-0.58	--	0.00	-0.58
3900 (E)	3930	3930	--	3930	3930	5248.24	5248.44	5248.10	--	5248.10	0.20	-0.14	--	0.00	-0.14

-- = Not applicable or no direct comparison available
 -- = Interpolated value or value pulled directly from the effective FIS profile

Attachment 5

Map-Model Agreement Table

MAP-MODEL AGREEMENT TABLE (FEMA-REGULATED FLOODPLAINS)

Project Name:															
Company:															
Completed By:															
Flooding Source(s):															
Sheet Number:															
Model Run:															
Reference Location	Stream Station	Cross-Section #	Channel Distance (ft)			Cumulative Channel Distance (ft)			Base Floodplain Width (ft)			Floodway Width (ft)			Comments
			Model	Map	% Difference	Model	Map	% Difference	Model	Map	Difference (ft)	Model	Map	Difference (ft)	
					#DIV/0!	0	0	#DIV/0!			0			0	
					#DIV/0!	0	0	#DIV/0!			0			0	
					#DIV/0!	0	0	#DIV/0!			0			0	
					#DIV/0!	0	0	#DIV/0!			0			0	
					#DIV/0!	0	0	#DIV/0!			0			0	
					#DIV/0!	0	0	#DIV/0!			0			0	
					#DIV/0!	0	0	#DIV/0!			0			0	
					#DIV/0!	0	0	#DIV/0!			0			0	
					#DIV/0!	0	0	#DIV/0!			0			0	
					#DIV/0!	0	0	#DIV/0!			0			0	
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					#DIV/0!	0	0	#DIV/0!			0			0	
					#DIV/0!	0	0	#DIV/0!			0			0	
					#DIV/0!	0	0	#DIV/0!			0			0	
					#DIV/0!	0	0	#DIV/0!			0			0	
ACCEPTABLE TOLERANCES =			+/- 5% of Model			+/- 5% of Model			+/- 25 Feet						

MAP-MODEL AGREEMENT TABLE (FEMA-REGULATED FLOODPLAINS)

Project Name:		Example Creek CLOMR													
Company:		Example Engineering													
Completed By:		Example Engineer, P.E.													
Flooding Source(s):		Example Creek													
Sheet Number:		1 of 3													
Model Run:		Corrected Effective													
Reference Location	Stream Station	Cross-Section #	Channel Distance (ft)			Cumulative Channel Distance (ft)			Base Floodplain Width (ft)			Floodway Width (ft)			Comments
			Model	Map	% Difference	Model	Map	% Difference	Model	Map	Difference (ft)	Model	Map	Difference (ft)	
D/S Tie-in	400.0	400	400	400	0%	400	400	0%	41	41	0	41	41	0	
	550.0	550	150	152	1%	550	552	0%	58	60	2	58	60	2	
	710.0	710	160	164	2%	710	716	1%	87	94	7	62	60	2	
	805.0	805	95	95	0%	805	811	1%	65	65	0	65	65	0	
D/S Xsec College Ave Bridge	875.0	875	70	70	0%	875	881	1%	41	35	6	41	40	1	
U/S Xsec College Ave Bridge	910.0	910	35	35	0%	910	916	1%	68	68	0	50	50	0	
	980.0	980	70	72	3%	980	988	1%	91	91	0	60	55	5	
	1020.0	1020	40	40	0%	1020	1028	1%	98	107	9	65	67	2	
	1370.0	1370	350	352	1%	1370	1380	1%	104	132	28	70	72	2	island not plotted on work map
	1410.0	1410	40	42	5%	1410	1422	1%	112	109	3	78	85	7	
	1500.0	1500	90	90	0%	1500	1512	1%	85	85	0	62	65	3	
	1680.0	1680	180	181	1%	1680	1693	1%	71	71	0	50	51	1	
D/S Xsec For Ped. Bridge	2030.0	2030	350	350	0%	2030	2043	1%	63	60	3	40	40	0	
Bridge	2280.0	2280	250	250	0%	2280	2293	1%	49	50	1	49	49	0	
	2330.0	2330	50	52	4%	2330	2345	1%	58	60	2	50	55	5	
	2380.0	2380	50	51	2%	2380	2396	1%	62	58	4	46	58	12	
	2401.0	2401	21	21	0%	2401	2417	1%	82	89	7	51	51	0	
	2460.0	2460	59	60	2%	2460	2477	1%	89	95	6	60	60	0	
	2557.0	2557	97	97	0%	2557	2574	1%	91	95	4	63	65	2	
	2730.0	2730	173	174	1%	2730	2748	1%	101	104	3	68	72	4	
	3135.0	3135	405	405	0%	3135	3153	1%	115	115	0	72	72	0	
ACCEPTABLE TOLERANCES =			+/- 5% of Model			+/- 5% of Model			+/- 25 Feet						