

# CHAPTER 24 FLOODPLAINS

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## 24. FLOODPLAINS

### 24-1 OVERVIEW

Protection of floodplains and floodways is required by *Executive Order 11988, "Floodplain Management", USDOT Order 5650.2, "Floodplain Management and Protection", and Federal-Aid Policy Guide 23 CFR 650A*. The intent of these regulations is to avoid or minimize highway encroachments within the 100 year (base) floodplains, where practicable, and to avoid supporting land use development which is incompatible with floodplain values. Where encroachment is unavoidable, the regulations require the Department to take appropriate measures to minimize impacts.

This chapter, along with the *Federal Highway Administration's (FHWA) Technical Advisory T6640.8A, "Guidance for Preparation and Processing Environmental and Section 4(f) Documents"*, provides guidelines for assessing highway impacts on base floodplains and regulatory floodways to comply with *23 CFR 771* and the regulations cited above. The District is responsible for assessing project impacts on base floodplains and regulatory floodways, and for incorporating that evaluation into the *Project Development Summary Report (PDSR)* of the Type 2 Categorical Exclusions (Type 2 CEs), Environmental Assessments (EAs), Environmental Impact Statements (EISs), and State Environmental Impact Reports (SEIRs).

During plan development, the proposed project is entered into the Environmental Screening Tool (EST) by the Efficient Transportation Decision Making (ETDM) Coordinator (See the *ETDM Planning and Programming Manual*). The Purpose and Need for the project is identified, and logical termini are located on a GIS based map. The results of this GIS review, agency comments, and the results of any preliminary field reviews conducted by the District's Environmental Management Office Staff are used to determine the Class of Action for the project.

The District Drainage Engineer, or the District Project Development Engineer, or designee prepares a *Location Hydraulic Report* to address each base floodplain encroachment and or action which would support base floodplain development. This report is provided to the Manager of the District EMO for use in assessing the impacts of the project on each base floodplain and documenting compliance with all applicable regulations in the Type 2 CE, EA, EIS, or SEIR.

### 24-2 PROCEDURE

#### 24-2.1 Location Hydraulic Studies

Location hydraulic studies are required by the *Federal-Aid Policy Guide 23 CFR 650A Sec. 650.111*. These studies shall include discussion of the following, commensurate with the significance of the flood risk or environmental impact, for all alternatives containing

floodplain encroachments and for those actions which would support base floodplain development:

- a) The practicability of alternatives to any longitudinal encroachments.
- b) The risks associated with implementation of the action.
- c) The impacts on natural and beneficial floodplain values.
- d) The support of incompatible floodplain development.
- e) The measures to minimize floodplain impacts.
- f) The measures to restore and preserve the natural and beneficial floodplain values impacted.

The magnitude of the study will vary depending on the level of significance of the base floodplain encroachments as determined in the Class of Action Determination from the ETDM Programming Screen. The levels of significance for floodplain encroachments are defined as follows:

**Significant Encroachments:** These encroachments may result in a high probability of loss of human life, will likely cause future damage that could be substantial in cost or extent (including interruption of service or loss of vital transportation facilities), or will cause a notable adverse impact on natural and beneficial floodplain values. Note, that even though the amount of floodplain involvement could be small, the impacts may be important or notable enough to be considered a significant encroachment.

Although detailed designs are not normally necessary to determine whether there is a significant encroachment, hydraulic evaluations and risk evaluations (see Figure 24.2) must be performed to evaluate alternatives that could result in a significant adverse impact on floodplains.

Alternatives on new alignment will usually require a preliminary evaluation to determine hydraulic capacity. The possibility of decreased hydraulic performance of existing structures on an existing alignment requires an evaluation to determine the resultant change in flood heights upstream (and downstream where appropriate). In either case, the expected change in flood elevations must be estimated to aid in determining and performing the appropriate level of risk evaluation.

If the hydraulic evaluation determines that flood elevations will not change significantly, no further evaluation is needed and the encroachment should be considered to be minimal (see below). If the hydraulic evaluation shows that flood elevations will increase either upstream or downstream, a floodplain study must be performed on the area impacted to evaluate the potential for flood impacts. The floodplain study should consist of an inspection of the floodplain to determine any increase in the number of flood receptors and the increase in damage to present flood receptors that will result from any increase in flood

elevations. If necessary, consultation with local natural resource and floodplain management agencies should be initiated to adequately assess flood impacts.

If the proposed drainage structures are predicted to result in significant adverse impacts, a complete hydraulic analysis, a risk analysis (see Figure 24.2), and a floodplain study must be performed.

When new alignments are classified as longitudinal encroachments, they should be analyzed to determine any increase in flood height. The impact of the increase should be assessed in accordance with the preceding discussion. Alternatives to avoid the longitudinal encroachment of the floodplain shall include evaluation and discussion of the practicality of the alternatives.

A proposed alternative which includes a significant encroachment shall not be adopted unless it is the only practicable alternative.

**Minimal Encroachments:** Minimal encroachments on a floodplain occur when there is a floodplain involvement but the impacts on human life, transportation facilities, and natural and beneficial floodplain values are not significant and can be resolved with minimal efforts. Normally, these minimal efforts to address the impacts will consist of applying the Department's drainage design standards and following the Water Management District's procedures to achieve results that will not increase or significantly change the flood elevations and/or limits. If the conditions are such that, even after following the standards and procedures, flood elevations and or flood limits are predicted to significantly change, a risk evaluation including an assessment comparing capital costs and risks associated with the proposed improvements must be done.

Projects with minimal encroachments may include, but are not limited to, projects which will not involve replacement or modification of existing drainage structures, projects which will involve replacement or modification of existing structures but are not expected to result in significant impacts, or projects involving replacement of drainage structures in heavily urbanized areas.

**None:** When encroachments are classified as "none", this means that there are floodplains in the vicinity of the proposed alternatives, but there is no floodplain encroachment.

**No Involvement:** No involvement means that there are no floodplains in the vicinity of the proposed alternatives.

## 24-2.2 Location Hydraulic Report

A **Location Hydraulic Report (LHR)** shall be prepared for all projects requiring a Type 2 CE, EA, EIS, or SEIR to support the conclusions drawn in these documents concerning base floodplains and regulatory floodways. The **LHR** is prepared by the District Drainage Engineer or the District Project Development Engineer, or designee (in consultation with the District Drainage Engineer). This consultation with the District

Drainage Engineer ensures that all base floodplains are identified. This is true regardless of how small the involvement may be.

The information contained in the **LHR** is site specific, but the level of effort and engineering detail involved is dependent upon, and commensurate with, the flood risk associated with each type of encroachment. Use of detailed calculations for every drainage structure associated with a project is not necessary and should be avoided. Usually a design level survey and other drainage information are not available to perform a detailed design.

It is likely that a project will involve more than one type of encroachment as discussed in **Section 24-2.1**. When this occurs, it is necessary to include information that addresses each of the encroachment types in the LHR.

Every wetland and crossdrain has an associated floodplain; however, it is not necessary to evaluate the hydraulic impacts of each one. The impacts to flood elevations and limits are minimized by appropriately designing these facilities in accordance with the Florida Department of Transportation Drainage standards and procedures. Only those alternatives or features that may create substantial differences in flood elevations and limits should be evaluated; otherwise, a statement indicating that the drainage features will be developed in accordance with the Department's drainage standards and procedures, and that the impacts to floodplains will be minimal.

Whenever it is determined that the proposed project will involve a regulatory floodway, the District Drainage Engineer, or designee, must work with local agencies and the Federal Emergency Management Agency (FEMA), as required, to ensure the project is developed consistent with local floodway plans and floodplain management programs. This coordination effort and all associated drainage work must be documented in the **LHR** and summarized in the **PDSR** of the Type 2 CE, EA, EIS, or SEIR.

The impacts of each encroachment on natural floodplain values (i.e., flora, fauna, open space, water quality, etc.), must be evaluated to determine the feasibility and prudence of any alternative avoiding the floodplain. After evaluating the impacts to the floodplain, a statement explaining the significance of any encroachments shall be included in the **LHR** for each type of construction activity in the floodplain. That is similar types of floodplain construction activities are grouped together and the significance of their floodplain encroachments are addressed accordingly. Figure 24.1 provides suggested statements based on the flood risk identified in the **LHR**.

If the project involves a bridge structure, and if a separate **Bridge Hydraulic Report (BHR)** is not prepared during Project Development, the following items must be addressed in the **LHR**:

1. Conceptual bridge length.
2. Conceptual scour considerations.

### 3. Preliminary vertical grade requirements.

Once the **LHR** is complete, the information contained within is summarized in the **PDSR**, EA, EIS, or SEIR. FHWA may request a copy of this report be sent with the PDSR and environmental document. The **LHR** is included in the project file for later reference during design.

#### 24-2.2.1 Report Preparation

As defined in Section 24-2.1, there are four categories of encroachments as they pertain to base floodplain involvement; significant, minimal, none and no involvement. As a result of early field and document reviews, a preliminary determination of impact is made as to the level of significance of the encroachment. This preliminary determination is made by the District Project Development Engineer (or designee) in coordination with the District Drainage Engineer and the FHWA Area Transportation Engineer. Based on the preliminary determination through the ETDM Programming Screen, the type of documentation necessary for the floodplains studies is determined. If, however, during subsequent analysis it is determined that the level of impact to the floodplains is different from what was preliminarily determined, and after coordination and concurrence with the appropriate ETAT members, the documentation required will reflect the new level of impact. The following describes the requirements necessary for the completion of the location hydraulic report for each level of significance of encroachment.

##### a. Significant Encroachments

The following items must be included in the **LHR** for all alternatives containing significant encroachments and for those actions which would support base flood development. Each item should be discussed and calculations performed only as needed commensurate with the amount of risk or environmental impact:

1. Measures to minimize floodplain impacts associated with the project;
2. The practicability of avoidance alternatives to significant encroachments or support of incompatible floodplain development;
3. The hydraulic adequacy of existing structures;
4. The frequency of traffic interruption due to flooding for the existing facility;
5. When replacing structures and for structures proposed as alternatives on new alignments, discuss the requirements to meet hydraulic needs for the proposed project;
6. Drainage problems which would result from extending or replacing existing structures;
7. Impact of the proposed improvement on emergency services and evacuation;

8. Impacts of the proposed improvement on the base flood, likelihood of flood risk, overtopping, location of overtopping, backwater, etc;
9. Estimate both the existing floodplain volume (capacity) and the volume of the encroachment (this information can be estimated based on **USGS Maps, FIRM Maps**, existing drainage maps, etc.);
10. Determination of whether the encroachment is a transverse or a longitudinal encroachment, and if it is a longitudinal encroachment an evaluation and discussion of practicable avoidance alternatives;
11. Determination of the impact of the proposed improvements on regulatory floodways if any;
12. Documentation of coordination with FEMA and local agencies to determine project's consistency with the regulatory floodway if any;
13. The impacts on natural and beneficial floodplain values and measures to restore and preserve these values (this information may also be addressed as part of the wetland impact evaluation and recommendations);
14. The consistency of the proposed drainage improvements with the local floodplain development plan or the land use elements in the **Comprehensive Plan**;
15. The potential for encouraging development in the base floodplain;
16. A map showing the project location and copies of the applicable FIRM maps;
17. Documentation of risk evaluations performed;

#### b. Minimal Encroachments

If a project has minimal impacts due to floodplain encroachments the report should describe the types of floodplain construction activities and a commitment to perform drainage design during the project's design phase in accordance with Department's drainage standards and procedures. The following items must be included in the **Location Hydraulic Report** for all alternatives containing minimal encroachments. Each item should be discussed to a level that adequately addresses the environmental impacts and risks:

1. The history of flooding of the existing facilities and/or measures to minimize any impacts due to the proposed improvements;
2. Determination of whether the encroachment is longitudinal or transverse, and if it is a longitudinal encroachment an evaluation and discussion of practicable avoidance alternatives;

3. The practicability of avoidance alternatives and/or measures to minimize impacts;
4. Impact of the proposed improvement on emergency services and evacuation;
5. Impacts of the proposed improvement on the base flood, likelihood of flood risk, overtopping, location of overtopping, backwater, etc.;
6. Determination of the impact of the proposed improvements on regulatory floodways, if any, and documentation of coordination with FEMA and local agencies to determine the project's consistency with the regulatory floodway;
7. The impacts on natural and beneficial floodplain values, and measures to restore and preserve these values (this information may also be addressed as part of the wetland impact evaluation and recommendations);
8. Consistency of the proposed improvements with the local floodplain development plan or the land use elements in the **Comprehensive Plan**, and the potential of encouraging development in the base floodplain;
9. A map showing project, location, and impacted floodplains. Copies of applicable **FIRM maps** should be included in the appendix;
10. Results of any risk assessments performed;

c. None or No Involvement

For projects where the level of significance for the floodplain encroachment is “none” or “no involvement”, a formal location hydraulic study is not necessary and the findings of the review of the alternatives may consist of documentation in the project file.

### 24-2.3 Bridge Hydraulic Report

**Bridge Hydraulic Reports (BHR)** are not normally completed during the PD&E phase of a project. However, a **BHR** may be prepared to determine the “hydraulic length” of the bridge or the length necessary to meet the hydraulic requirements. If bridge alternatives will be developed to avoid or minimize wetland impacts, then a **BHR** will be needed to analyze the costs and benefits of the additional bridge length.

At the District's option, the **BHR** may be prepared during the PD&E study. The project manager should coordinate with the drainage and structures sections early in the development of the project to determine when it will be necessary to perform a complete **BHR**. The **BHR** is addressed in **Chapter 4 of the FDOT Drainage Manual**.

If the entire project consists of a bridge replacement with no other cross drains, then the requirements of the **LHR** may be included in the draft **BHR** (this is project/scope specific).

## 24-2.4 Risk Evaluation

The **Location Hydraulic Report** serves as a resource document to EMO. This report is an engineering analysis of the water surface levels which will allow the District EMO staff to address flood risk in environmental documents.

It is the responsibility of the District Drainage Engineer, in consultation with the District EMO Engineer, or designee, to determine, based on the data provided in the **LHR**, the significance of each floodplain encroachment. In reaching this determination, the factors discussed in **Federal-Aid Policy Guide CFR 650A** concerning significant encroachments must be considered. These are:

Does the proposed project's encroachments create:

- a. A significant potential for interruption or termination of a transportation facility which is needed for emergency vehicles or provides a community's only evacuation route?
- b. A significant flood risk, or
- c. A significant adverse impact on natural and beneficial floodplain values.

The impacts evaluated to determine the significance of each encroachment should include both primary and secondary effects. The analyst must keep in mind that in evaluating risk, that risk is related to the potential for property loss and hazard to life. It must include consideration of:

1. Risks to highway users - loss of life, service disruption.
2. Risks to residents - damages, service disruption, property loss.

Once impacts on a project have been identified, the District Drainage Engineer may have to perform a risk assessment or a risk analysis (see Figure 24.2) based on engineering information and professional judgment.

Finally, in assessing the significance of each encroachment on natural floodplain values, the District Drainage Engineer, or the District Project Development Engineer, or designee, in consultation with District EMO staff, must evaluate the potential for loss or gain to beneficial values as a result of project impacts. Some of these values include:

1. Natural moderation of floods,
2. Water quality maintenance,
3. Groundwater recharge,

4. Fish and wildlife habitat,
5. Plants,
6. Open space and natural beauty,
7. Recreation,
8. Agriculture and Aquaculture, and
9. Forestry.

In addressing significant encroachments in an EIS, the District EMO staff must consult with the Drainage Engineer to determine if appropriate design options exist to mitigate the impact of the encroachment. Site specific environmental recommendations should be made and included in the risk analysis performed by the District Drainage Engineer, or designee.

All of the above determinations must be completely documented in the ***Location Hydraulic Report***.

## **24-2.5 Documenting Floodplain Impacts**

### **24-2.5.1 Advance Notification**

The Advance Notification (AN) package is distributed electronically as part of the programming screening event on the EST (Part 1, Chapter 3 Advance Notification). Floodplain information is included in the Floodplain\_section of the ***AN Fact Sheet*** and includes the results of GIS analysis for Floodplains using available GIS data and applicable maps including the ***Flood Insurance Rate Map***. If the project went through a Planning Screen this section will also include a summary of agency comments, and if available a list of permits that may be required and a list of technical studies needed. The AN should identify the proximity of the proposed action to Floodplains and identify any potential impact.

The FHWA, USEPA, FDEP and the Water Management Districts may respond to the AN in the “AN Feedback Summary” section of the ***Final Programming Screen Summary Report***. It is **important** to contact the applicable agency to confirm their recommendations made during the EST screening events and to ensure that all issues are addressed. FDOT and FHWA, for Federally funded projects, will determine the project's involvement with Floodplains from information included in the ***Final Programming Screen Summary Report***.

### **24-2.5.2 Class of Action Determination**

The Class of Action Determination (Part 1, Chapter 2) is determined during the final stages of the Programming Screen. Upon completion of the Class of Action Determination

and approval by FHWA (or other Lead Federal Agency), the document selected will be a Type 2 CE, an EA, or an EIS depending on the level and anticipated significance of the total project involvement.

### 24-2.5.3 Categorical Exclusion

. If there is regulatory floodway involvement then the ***Project Development Summary Report*** must address the project's consistency with the regulatory floodway and demonstrate coordination with the FEMA and local floodway management agencies on the consistency issue.

### 24-2.5.4 Environmental Assessment (EA) and Draft Environmental Impact Statement (DEIS)

For Environmental Assessments and Draft Environmental Impact Statements, the Floodplain section is prepared as outlined below. The Floodplain section must include:

1. Identification of the geographic area of the base floodplain and a determination of whether or not the proposed action will encroach upon the base floodplain through the use of available reference maps. The potential references include:
  - a. ***Federal Insurance Administration (FIA) maps*** and studies, including ***Flood Insurance Rate Maps (FIRM)*** and ***Flood Hazard Boundary Maps (FHBM)***, must be used, if available. The map reference number shall be provided in the document. If the project is not in a FEMA-identified hazard area, ***FIA maps*** will not be available and other sources should be used.
  - b. Other maps, (i.e., USGS., Corps of Engineers, Soil Conservation Service, Bureau of Land Management, Forest Service, etc.), may be used.
  - c. Appropriate maps shall be developed by the Drainage Engineer if no other data is available.
2. An exhibit showing the relationship of each project alternative under study with each base floodplain and regulatory floodway involved.
3. If there is no encroachment on a base floodplain and the proposed action will not support development in the base floodplain, a statement to that effect shall be provided (see Figure 24.1 for sample statements).
4. If the proposed project encroaches or supports base floodplain development within a base floodplain, discuss the following information for each proposed alternative that causes the impacts:

- a. Flood risks associated with, or resulting from, the proposed action.
- b. Impacts on natural and beneficial floodplain values.
- c. Degree to which the action provides direct or indirect support for incompatible development in the base floodplain (i.e., the development which is not consistent with the community's floodplain development plan).
- d. The potential for significant interruption or termination of community's only evacuation route or facility for emergency vehicles.
- e. Measures to minimize floodplain impacts associated with each alternative.
- f. Measures to restore and preserve the natural and beneficial floodplain values that are impacted (this information may also be addressed as part of the wetland impact evaluation and recommendations).

The discussion provided in the text should be commensurate with the level of impacts.

The EA or DEIS should briefly summarize the results of the ***Location Hydraulic Report***. The summary should identify the number of encroachments and any support of incompatible base floodplain developments and their potential impacts. Where an encroachment results in substantial impacts or supports incompatible floodplain development, the EA or DEIS should provide more information on the location, impacts, and appropriate mitigation measures. In addition, if any proposed alternative:

- a. supports incompatible floodplain development or results in floodplain encroachments that significantly affect the human environment (EIS only) or impacts for which the significance is not clearly established (EA), or
- b. requires a commitment to a minimum structure size or type,

then the EA or DEIS should also include an evaluation and discussion of practicable alternatives to proposed structure or to significant encroachments (DEIS only) to avoid or eliminate such involvements or commitments.

Finally, if a particular alternative encroaches upon a regulatory floodway, the following questions must be addressed:

1. Can the highway encroachment be located so that it is consistent with the regulatory floodway? or

2. Can the regulatory floodway be revised to accommodate the proposed project (i.e., the regulatory floodway moved or changed but still meets National Flood Insurance Program (NFIP) standards)? or
3. Can the regulatory floodway elevation be exceeded (i.e., is it cost effective to mitigate flood damages associated with a rise greater than one foot)?

For each alternative encroaching a designated or proposed regulatory floodway, the EA or DEIS should provide a preliminary indication of whether or not the encroachment would be consistent with or require a revision to the regulatory floodway. Engineering and environmental analyses should be undertaken, commensurate with the level of encroachment, to permit the consistency evaluation and identify impacts. Coordination with the FEMA and appropriate State and local governmental agencies should be undertaken for each regulatory floodway encroachment.

#### **24-2.5.5 Finding Of No Significant Impact (FONSI) and Final Environmental Impact Statement (FEIS)**

If the preferred alternative includes significant encroachments that significantly affect the human environment, the FEIS must include an "Only Practicable Alternative Finding" required by ***Federal-Aid Policy Guide 23 CFR 650A Sec. 650.113***. This finding must also be provided in a FONSI when the preferred alternative includes significant encroachments but the human environment is not significantly affected. The finding should:

- a. reference ***Executive Order 11988*** and ***Federal-Aid Policy Guide 23 CFR 650A***;
- b. state the reasons why the proposed action must be located in the floodplain;
- c. discuss the alternatives considered and why they were not practicable; and
- d. provide a statement indicating whether or not the action conforms to applicable State or local floodplain protection standards.

If the preferred alternative encroaches on a regulatory floodway, the FONSI or FEIS should discuss the consistency of the action with the regulatory floodway. If a regulatory floodway revision is necessary, the FONSI or FEIS should include evidence from FEMA and local or State agency indicating that such revision is acceptable.

#### **24-2.6 Public Notification / Hearing Presentation**

In accordance with ***Executive Order 11988***, the District must include in its public hearing advertisements in local newspapers, a statement that the project involves encroachments on base floodplains and ,if applicable, involvement with a regulatory floodway. The presentation at the public hearing must also mention these involvements.

### **24-3 REFERENCES**

1. Presidential Executive Order 11988 “Floodplain Management and Protection”
2. Federal-Aid Policy Guide 23 CFR 650A
3. U.S. Department of Transportation Order 5650.2.
4. U.S. Department of Transportation, Federal Highway Administration, October 30, 1987. “Guidance for Preparing and Processing Environmental and Section 4(f) Documents”, FHWA Technical Advisory T6640.8A.
5. ETDM Planning and Programming Manual, FDOT  
<http://www.dot.state.fl.us/emo/pubs/etdm/etdmman.htm>

The following statements may be used for common types of base floodplain construction activities not resulting in significant floodplain impacts. These statements should be used in the summary of the location hydraulics report and the environmental document, whenever possible, to summarize the findings of the location hydraulic studies for the appropriate construction activities and project conditions. These can be modified to “fit” specific base floodplain involvements.

1- PROJECTS WHICH WILL NOT INVOLVE ANY WORK BELOW THE 100 YEAR FLOOD ELEVATION

The following statement is used when the 100 year flood elevation is available from existing information, and it is evident that project improvement will not involve any work below the 100-year flood elevation.

*"Although this involves work within the horizontal limits of the 100-year floodplain, no work is being performed below the 100-year flood elevation and, as a result, this project does not encroach upon the base floodplain."*

2- PROJECTS WHICH WILL NOT INVOLVE THE REPLACEMENT OR MODIFICATION OF ANY DRAINAGE STRUCTURES

These projects must be on existing alignment. They may involve a change in the profile grade elevation of a magnitude normally associated with resurfacing. There are no known drainage problems within the limits of the project, or other factors that override the need for concurrent drainage improvements.

*"This project will not involve the replacement or modification of any existing structures, or the addition of any new drainage structures. As a result, this project will not affect flood heights or base floodplain limits. This project will not result in increased or new adverse environmental impacts. It will not increase flood risks or damage; and there will be no significant change in the potential for interruption or termination of emergency service or emergency evacuation routes. Therefore, it has been determined that this encroachment is not significant."*

3- PROJECTS INVOLVING MODIFICATION TO EXISTING DRAINAGE STRUCTURES

Work under this type of project will not involve the replacement of any existing drainage structures or the construction of any new drainage structures. Work will only involve modification of existing structures (e.g., extending cross drains, adding headwalls, or extending bridge piers). Projects that affect flood heights and flood limits, even minimally, may require further evaluation to support statements that emphasize the insignificance of the modifications.

*"The modifications to drainage structures included in this project will result in an insignificant change in their capacity to carry floodwater. This change will cause*

**FIGURE 24.1 “Floodplain” Statements**

*minimal increases in flood heights and flood limits. These minimal increases will not result in any significant adverse impacts on the natural and beneficial floodplain values or any significant change in flood risks or damage. There will not be a significant change in the potential for interruption or termination of emergency service or emergency evacuation routes. Therefore, it has been determined that this encroachment is not significant."*

4- PROJECTS ON EXISTING ALIGNMENT INVOLVING REPLACEMENT OF EXISTING DRAINAGE STRUCTURES WITH NO RECORD OF DRAINAGE PROBLEMS

This type of work excludes replacement activities that would reduce the hydraulic performance of existing facilities. Also, there should be no record of drainage problems and no unresolved complaints from residents in the area.

*"The proposed structure will perform hydraulically in a manner equal to or greater than the existing structure, and backwater surface elevations are not expected to increase. As a result, there will be no significant adverse impacts on natural and beneficial floodplain values. There will be no significant change in flood risk, and there will not be a significant change in the potential for interruption or termination of emergency service or emergency evacuation routes. Therefore, it has been determined that this encroachment is not significant."*

5- PROJECTS ON EXISTING ALIGNMENT INVOLVING REPLACEMENT OF DRAINAGE STRUCTURES IN HEAVILY URBANIZED FLOODPLAINS

These projects include work in flood sensitive, heavily urbanized floodplains, where the conditions of flooding are largely attributable to the low lying terrain. The work does not include those replacement structures that will reduce the hydraulic performance of existing facilities or a change in the profile grade when the existing grade is overtopped by an event below the 100 year storm. Replacement drainage structures are limited to hydraulically equivalent structures in most instances.

*"Replacement drainage structures for this project are limited to hydraulically equivalent structures. The limitations to the hydraulic equivalency being proposed are basically due to restrictions imposed by the geometrics of design, existing development, cost feasibility, or practicability. An alternative encroachment location is not considered in this category since it defeats the project purpose or is economically unfeasible. Since flooding conditions in the project area are inherent in the topography or are a result of other outside contributing sources, and there is no practical alternative to totally eradicate flood impacts or even reduce them in any significant amount, existing flooding will continue, but not be increased. The proposed structure will be hydraulically equivalent to or greater than the existing structure, and backwater surface elevations are not expected to increase. As a result, the project will not affect existing flood heights or*

**FIGURE 24.1 "Floodplain" Statements**

*floodplain limits. This project will not result in any new or increased adverse environmental impacts. There will be no significant change in the potential for interruption or termination of emergency service or emergency evacuation routes. Therefore, it has been determined that this encroachment is not significant."*

6- PROJECTS ON NEW ALIGNMENT, AND PROJECTS ON EXISTING ALIGNMENT WITH POTENTIALLY SIGNIFICANT CHANGES IN 100 YEAR FLOOD ELEVATIONS

Work on this type of project will cause changes in flood stage and flood limits.

*"The construction of the drainage structure(s) proposed for this project will cause changes in flood stage and flood limits. These changes will not result in any significant adverse impacts on the natural and beneficial floodplain values or any significant changes in flood risk or damage. These changes have been reviewed by the appropriate regulatory authorities who have concurred with the determination that there will be no significant impacts. There will not be significant change in the potential for interruption or termination of emergency service or emergency evacuation routes. Therefore, it has been determined that this encroachment is not significant."*

In addition to the above statements, for those projects which do not involve regulatory floodways and do not support incompatible base floodplain development, the following positive statement can be added:

*"It has been determined, through consultation with local, state, and federal water resources and floodplain management agencies that there is no regulatory floodway involvement on the proposed project and that the project will not support base floodplain development that is incompatible with existing floodplain management programs."*

**FIGURE 24.1 "Floodplain" Statements**

All designs with floodplain encroachments should include an evaluation of the inherent flood related risks to the highway facility and to the surrounding property. Two methods are available to quantify risks on projects that involve facilities that will encroach within limits of a floodplain. These are risk assessment and risk analysis.

Risk assessment is a subjective analysis of the risks resulting from various design alternatives, without detailed quantification of flood risks and losses. It may consist of developing the construction costs for each alternative, and subjectively comparing the risks associated with each alternative. A risk assessment is usually more appropriate for small structures, or for structures whose size is not influenced by hydraulic constraints.

Risk analysis encompasses an economic comparison of alternatives using expected total costs (construction costs plus risks costs) to determine the alternative with the least total expected cost to the public. It shall include probable flood related costs during the service life of the facility for highway operation, maintenance, and repair, for highway aggravated flood damage to other property, and for additional or interrupted highway travel. The level of expense and effort required for a risk analysis is considerably higher than for a risk assessment. Selection of the process to be used should be based on the size of the project and potential risk involved.

There are no well defined procedures or criteria for performing risk assessments. Details of the risk analysis process and procedures for using it have been documented in HEC-17 (USDOT, FHWA, 1981).

## **FIGURE 24.2. Risk Evaluation Guidelines**

*Base Flood* - the flood or tide having a 1% change of being exceeded in any given year (commonly known as a 100-year flood).

*Base Floodplain* - the area subject to flooding by the base flood.

*Floodplain* - the lowland areas adjoining inland and coastal waters which are periodically inundated by flood waters, including flood prone areas of offshore islands.

*Encroachment* - an action within the limits of the base floodplain.

*Impact* - the effect of an encroachment upon the human or natural environment.

*Natural and Beneficial Floodplain Values* - shall include but are not limited to fish, wildlife, plants, open space, natural beauty, scientific study, outdoor recreation, agriculture, aquaculture, forestry, natural moderation of floods, water quality maintenance, and groundwater recharge.

*Regulatory Floodway* - the floodplain area that is reserved in an open manner by federal, state or local requirements, i.e., unconfined or unobstructed either horizontally or vertically, to provide for the discharge of the base flood so that the cumulative increase in water surface elevation is no more than a designated amount (not to exceed 1 foot as established by the Federal Emergency Management Agency (FEMA) for administering the National Flood Insurance Program).

*Risk* - the consequences associated with the probability of flooding attributable to an encroachment. It shall include the potential for property loss and hazard to life during the service life of the facility (highway).

*Support Base Floodplain Development* - to encourage, allow, serve, or otherwise facilitate additional base floodplain development. Direct support results from an encroachment, while indirect support results from an action out of the base floodplain.

### **FIGURE 24.3. Definitions**