FLOOD DAMAGE DATA COLLECTION PRIMER

Prepared by:

The Institute for Water Resources (IWR)
And
the Field Review and Advisory Group
For the Flood Damage Data Collection Program

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INTRODUCTION

Purpose & Scope

The purpose of this *Flood Damage Data Collection Primer* is to provide clear direction to field staff for meeting the data collection requirements described in ER-1105-2-100, the Planning Guidance Notebook. The field is encouraged to use the Hydrologic Engineering Center's Flood Damage Analysis (HEC-FDA) package for calculating flood damages and estimating flood damage reduction. To use HEC-FDA, certain data need to be collected in order to estimate the extent that a project area will be damaged under various levels of flooding. These data include number of structures and the use of those structures (e.g. residential, commercial), first floor elevation, location in the floodplain, depreciated replacement costs, and depth-damage curves for both structure and contents.

This primer is a companion document to the Corps of Engineers Flood Inventory Tool (CEFIT) that has been developed by Marshall and Swift/Boeckh for IWR. CEFIT will assist field staff in collecting, managing and generating the necessary data elements required for use in the HEC-FDA. At this time, CEFIT has capabilities to generate depth damage curves and depreciated replacement costs for residential structures only. Additional capabilities for other structure uses are under consideration. CEFIT requires a set of data elements collected by the user to generate the depreciated replacement costs and the depth-damage curves for each residential structure in the floodplain. The data needed to use CEFIT include structure identifier, occupancy type, county, state, zip code, number of stories, style of structure, quality, foundation type, construction type, exterior wall, effective age, and total square footage of structure.

Intended Audience

The primary audience for this primer includes the planners whose assignments are to conduct flood risk reduction studies and/or to implement post-flood surveys under the Flood Damage Data Collection Program administered by IWR. The reader should already be familiar with accepted methods of estimating flood damage, but need not have extensive, direct experience in collecting, interpreting and analyzing floodplain inventory data. The primer will be useful to others as well, including technical reviewers, non-Federal sponsors, other Federal agencies, and those who have an interest in how the Corps analyzes the benefits of proposed flood damage reduction projects.

INVENTORY DATA NEEDS

Each flood risk reduction study has its own unique set of problems. Thus, each study also has its own set of data needs. Generally, all flood risk reduction studies will rely on information describing the inventory of structures and infrastructure that are at risk of being damaged by flooding.

Existing USACE guidance and accepted methods of estimating the economic losses caused by flood risk call for knowledge about the number and types of structures in the inventory; their depreciated replacement costs; their first floor elevations and the locations of those structures relative to the source of the flood risk. Information describing past flood events is also needed to support potential flood damage estimates.

Number and Types of Structures in the Inventory

An accurate count of structures is critical to the success of the study. A reliable determination of the structure types is also important. The depth-damage functions the planner will use to estimate flood damage vary greatly among the various residential structure types. If the study area is large and study funding is insufficient to support a complete count and identification of the affected structures, statistically valid sampling procedures can be used to estimate the number and types of structures affected.[i] Another option is to use prior studies of the affected area, and adding to or updating the information collected by the analyst who prepared the report. A third option is to rely on secondary data sources (discussed later in this document). Regardless of the method used, the analyst must have confidence in the estimate of the number and type of structures within the study area.

Depreciated Replacement Cost

Estimating depreciated replacement cost as the basis for evaluating flood damage reduction analysis is mandated in ER-1105-2-100. By using depreciated replacement costs, the actual loss that can be attributed to the flood is captured. Using replacement costs without depreciation introduces a "betterment," i.e. replacing a 15 year old television with a new one is not an accurate measurement of the lost utility of the 15 year old set. The depreciated replacement cost of a residential structure is a function of many variables. The most influential of these, and the ones planners are most interested in, are depreciation, effective age, current condition, and original quality. In the Square

Foot Method of estimating value, these four factors are used to estimate depreciated replacement cost per square foot of the structure. In the simplest application of this method the analyst multiplies this value by the estimated square footage of the structure (or components thereof) to determine the depreciated replacement cost.

The Marshall & Swift Residential Cost Handbook explains the Square Foot Method in detail**.** The pages that follow present information that is based on the Residential Cost Handbook. The reader is urged to obtain a copy of the Handbook.[ii]

Depreciation

Depreciation is a reduction in the value of a structure due to *physical deterioration*, *functional obsolescence or external factors*. Depreciation can be seen as the difference between the original cost of producing the structure (in current dollars) and the cost of replacing the structure in its condition at the time of valuation. It should be noted that because of exceptionally good original workmanship or sound maintenance, the depreciated replacement cost of a structure could be greater than the original cost.

Physical deterioration is a loss of value caused by normal wear and tear, abuse or neglect. Curable deterioration is a loss of function, value or usefulness of short-lived features, including paint and wall coverings, carpeting, water heaters, etc. Generally speaking, these are the features of the structure that are periodically replaced throughout the useful life of the structure. Incurable deterioration is a loss of function or value of long-lived, major features of the structure. These are the features such as walls, floors and roof structures, utility systems, foundations, etc. The features are essential to the safety and habitability of the structure and are not usually replaced in a typical maintenance program, and their deterioration can only be corrected through major reconstruction.

When evaluating physical deterioration, attention should be given to the following indicators:

Roof -- Obvious signs of leaking, rusting metal, missing, split or curling shingles or tiles, deteriorating roof structure, water or insect damage to eaves and cornice components, etc.

Exterior Walls -- Peeling, cracked, blistered or oxidized paint, loose mortar, out of plumb framing, decaying, loose or missing wood siding, loose or missing ornamentation, excessive mildew, moss or other vegetative growth, broken, stuck, rusted, missing or damaged screens, deteriorating or missing window shutters.

Foundation -- Obvious signs of undermining, unleveled floor line, cracked slab, piers or pilings out of plumb, sticking exterior doors, visible cracks in exterior masonry, signs of separation at joints, signs of structural instability.

Functional obsolescence is a loss of value caused by a lack of improvements in the utility or desirability of the structure. Functional obsolescence is also divided into two types, curable or incurable.

Loss of function exists when some feature or element of a structure does not meet current market expectations. For example, a home without central heat and air conditioning in a study area where that feature is standard has a functional deficiency. A home without municipal water and sewer service in an area where the service is available has an incurable deficiency, whereas a home with insufficient ceiling insulation has a curable deficiency.

External factors are factors that are not specific to the structure being evaluated. External factors that may be causing depreciation in a community include weather extremes such as temperature, humidity and precipitation, but may also include economic, social and even geologic irregularities such as earthquakes and volcanic eruptions.

Determining Depreciated Replacement Cost

In order to determine depreciated replacement cost specific information about the structures is required. The Marshall and Swift Residential Estimator program is very sensitive to changes in variables such as effective age, condition and quality.

Effective Age

Effective age can be seen as that part of the structure's useful life that has elapsed because of use and depreciation. It is the chronological age of the structure adjusted to account for the cosmetic and structural renovation, elimination of functional deficiencies, modernization of equipment, etc. An older well-maintained building may have a very low effective age. Life expectancy minus effective age results in a reliable estimate of the remaining useful life of the structure.

Effective age is governed significantly by the expected future use of the structure. Expected future use may be radically different from the intended use when it was originally built. For example, two-story townhouses in the Old Town sections of Alexandria, VA were originally constructed as residences, but many of these have been converted for use as shops and restaurants, which result in a changes in life expectancy. Thus, it is imperative that the future use of a structure be considered when determining effective age. In many cases it is likely that the effective age would be significantly "younger" than the chronological age due to the changes in use and overall life expectancy.

Table 1 - Sample Correlation of Condition to Remaining Life

	Typical Remaining Life by Structure Type	
Condition	Single Family Residential	Multi-Family Residential
Excellent	55	60
Very Good	50	55
Good	40	45
Average	30	35
Fair	20	25
Poor	10	10

Source: Adapted from Marshall & Swift, Marshall Valuation Service (Los Angeles, 1991 with 1994 update),pp. Sect 97, 3-11

Condition

The condition of a structure is an evaluation of the structure's current state of repair. It includes such factors as wear from use, deterioration caused by exposure to the elements, damage from natural and man-made events, etc.

Condition has a profound impact on effective age, and the assessment of a structure's condition accounts for the impact that depreciation has had on the newness of the structure. Condition should not be confused with quality. A badly worn structure that was originally constructed with quality materials and workmanship is still a good quality structure in bad condition. A "like new" building that was built cheaply and quickly is still a low quality building in good condition. While quality may have some impact on the wear ability (and thus the condition) of a particular structure, condition never has any influence on the quality of the structure. The following paragraphs provide discrete indicators of condition, when in fact condition is continuous. Hence, the analyst must employ sound judgement and objectivity when assessing the condition of a structure.

Condition Rating Indicators:

Excellent Condition: All items that can normally be repaired or refinished have recently been corrected, such as new roofing, new paint, HVAC overhaul, latest model components, etc. With no functional inadequacies of any consequence and all major short-lived components in like-new condition, the overall effective age has been substantially reduced upon complete revitalization of the structure regardless of the actual chronological age.

Very Good Condition: All items are well maintained, many having been overhauled and repaired as they have showed signs of wear, increasing the life expectancy and lowering the effective age with little deterioration or obsolescence evident with a high degree of utility.

Good Condition: No obvious maintenance required but neither is everything new. Appearance and utility are above the standard, and the overall effective age will be lower than the typical property.

Average Condition: Some evidence of deferred maintenance and normal obsolescence with age in that a few minor repairs are needed, along with some refinishing. But with all major components still functional and contributing toward an extended life expectancy, effective age and utility is standard for like properties of its class and usage.

Fair Condition (Badly Worn): Many repairs needed. Many items need refinishing or overhauling, deferred maintenance obvious, inadequate building utility and services all shortening the life expectancy and increasing the effective age.

Poor Condition (Worn Out): Repair and overhaul needed on painted surfaces, roofing, plumbing, heating, numerous functional inadequacies, substandard utilities, etc. (found only in extraordinary circumstances). Excessive deferred maintenance and abuse, limited value-in-use, approaching abandonment or major reconstruction, reuse or change in occupancy is imminent. Effective age is near end of the scale regardless of the actual chronological age.

Table 2- Condition Classification Definitions

Condition	Description
Excellent	Representative of a structure which is newly or nearly newly constructed with a remaining life equal to the average life expectancy
Very Good	Representative of a structure which is relatively newer construction or containing significant rehabilitation resulting in a remaining life of approximately 90% of the average life expectancy
Good	Representative of a structure in which no obvious maintenance is required neither is everything new. The resulting remaining life is approximately 70-75% of the average life expectancy.
Average	Representative of a structure that has some evidence of deferred maintenance and normal obsolescence with age. Few minor repairs and refinishing required. Resulting remaining life is approximately 50-60% of the average life expectancy.
Fair	Representative of a structure which has several noticeable immediate needed repairs evident such as peeling paint on siding, damaged roofing, etc. Resulting remaining life is approximately 30-40% of the average life expectancy
Poor	Representative of a structure with numerous immediate repairs required. Many items need refinishing or overhauling, obvious deferred maintenance and inadequate building utility and services. Resulting remaining life is approximately15-20% of the average life expectancy
Source: Adapted from Marshall & Swift, Marshall Valuation Service (Los Angeles, 1991 with 1994 update), p. Sect. 97, 3	

Quality

The Average Quality building is representative of the majority of buildings of a particular occupancy and class, and the depreciated replacement cost of the Average Quality building should come very close to buildings of the same class and occupancy on a national basis. The valuator as well as the reviewer must consider this. It is very easy for an estimator working mainly on low-cost structures to tend to over-classify the Average Quality building, as it is easy for the estimator who is chiefly working on better properties to under-classify the same structure. This occurs because their ideas of average buildings are often biased by their frame of reference. Usually, in cities with strong building codes, the Average Quality building is the "Standard Code" building with some extra trim and refinement. In an area with less exacting code provisions, the Average building could be the best building in the community, depending on the occupancy. Also, certain occupancies in some areas may have stringent code requirements or funding agency constraints, which can drive the overall costs up, so that the local standard building for pricing purposes is rated "Good."

Determining Quality

First, to judge quality the cheapness or expensiveness of materials or components should be observed. Thickness, density and wearability of the materials used may influence comparative cost variations. Observe the methods of application or attachment, the type of ornamentation, the intricacy of design, and the color of the finish.

Second, determine whether workmanship is at a level consistent with the type and grade of materials used. If the materials and other features generally fit a specific quality level, it usually follows that quality of workmanship will be equivalent. One or two components of a different quality are normal and should be disregarded as influencing the overall classification of general quality.

Third, and most important, the evaluator should consider the amount of the various components typical for the class. For example, a building may give evidence of only average workmanship and materials. The fixtures and trim may not be of the best quality. However, it may have more than the average number of windows and doors and there may be more than the average number of plumbing fixtures. Even though these items are not of the best quality, the extra quantity causes the building to have above average cost, and for pricing purposes, it may be rated as "Good Quality." Another similar building may be plain without a great deal of ornamentation, but still give evidence of excellent workmanship. The hardware, lighting fixtures, interior and exterior trim, while not fancy, may be of very good quality. Such a building would be priced as "Good Quality" although materials and workmanship may be excellent but of limited quantity.

Lastly, the overall size as well as the complexity of the structure should be considered. That is, small structures will tend to have higher unit costs than very large ones. It must be remembered that "Low Quality" quality does not mean the lowest-cost building that can be found, nor does "Excellent Quality" mean the most expensive building possible. These classifications are merely the median averages of many buildings fitting the same general category. The relative quality of a building that has stood for some time usually can be well gauged by its appearance. Cracks occur in a sub-standard, Low Cost or even Average building. The hardware and fixtures show definite signs of wear, doors and windows stick, fixtures become loose and tarnished, floors creak underfoot. The Good or Excellent Quality building, though old, will retain its soundness and substantial appearance. Joined woodwork will stay together and fixtures will retain much of their original luster and stability.

Quality Rating Indicators:

Low Quality: Buildings in this category are generally constructed to minimum code requirements often with little regard for architectural appearance or other amenities. They are built with minimum investment in mind. Little ornamentation is used and interior partitioning and finish is minimal or of low quality. In general, most low cost dwellings are houses built to conform to minimum building codes.

Average Quality: Average-quality buildings constitute approximately fifty percent of all buildings. These are generally buildings designed for maximum economic potential without some of the pride of ownership or prestige amenities of higher–quality construction. They are of good standard code construction with simple ornamentation and finishes.

The typical average-quality dwelling changes through the years, with today's dwellings generally, having more electric outlets and services and more plumbing fixtures. At the same time, the quality of exterior and interior finishes has been lowered to compensate for the total cost of the house.

An average, conventional frame dwelling should have joists and wall framing that will conform to all Federal, state and local building codes. Wall construction varies in different localities and modular homes may deviate in many respects.

Good Quality: Buildings designed for good appearance, comfort and convenience, as well as an element of prestige, constitute the Good Quality category. Ornamental treatment is usually of higher quality and interiors are designed for upper-class rentals. The amenities of better lighting and mechanical work are primary items in their costs.

The Good residence is generally built to cater to the young executive or move-up market. It will generally be much the same construction as the Average, with more detail and higher mechanical and electrical costs and may be the standard construction in the so-called move-up community.

Excellent Quality: Excellent dwellings are generally built for the established professional or those with higher incomes and will have some expensive finishes and fixtures.

The Excellent Quality dwelling will normally have more ornamentation, special design, and top quality materials.

First Floor Elevations

Perhaps the most critical piece of information, and sometimes the information that is most difficult and costly to obtain, is the first floor elevation of the structure. First floor elevations are critical because the methods used to estimate risk of flood damage rely on this elevation vis-à-vis the elevations of floods within the water surface profile to determine the frequency of damaging events. A one-half foot error in the estimate of first floor elevation can often have profound impacts on the economic benefits of a given alternative.

Methods to Estimate First Floor Elevations

Surveying

The method of obtaining first floor elevations that results in the least uncertainty is to have a team of competent surveyors "shoot" the elevations using surveying equipment. This is a time consuming and costly method, because the process requires a high level of expertise in using the equipment. In many Corps planning offices, one, perhaps two individuals have sufficient technical expertise to survey first floor elevations. Other considerations are the geographical size of the floodplain, the number of structures contained in the inventory and the availability of reliable benchmarks. If the floodplain is small enough and funding is sufficient, surveying the first floors is the preferred method. However, such ideal situations are rare and other methods must be employed.

Windshield Survey—Use of Contour Maps

One way to reduce the time and cost of surveying first floor elevations is a "windshield" survey. A team of field personnel drives through the floodplain, estimating and recording the first floor elevations of the structures using contour mapping. Determination of the first floor elevation with this method introduces considerable uncertainty into your database. The following methods have been employed by Corps planning offices to reduce the level of uncertainty:

- A front entrance to a structure typically has steps leading up to it. Each step to the entrance is approximately 6 to 8 inches in height. If there are 3 steps leading up to the door, the elevation of the structure from the ground is 1-1/2 to 2 feet. The surveyor must keep in mind that there may also be a slope up (or down) towards the structure, in which case the rise (or fall) of the slope must be accounted for in the final estimation of the elevation.
- Use of road elevations. In many parts of the country, detailed mapping with sufficient contour resolution is not available. However, most county and city engineering offices have the elevations of thoroughfares through their jurisdiction. These elevations may be available for various points along streets or roads, or may just be available at major intersections. Depending on the availability and quantity of these data, field personnel may be able to get very good estimates of first floor elevations by estimating the elevation of the structure with reference to the road. If the field personnel can use surveying equipment, shooting the elevations can fill in missing data points. If the topography of the area is relatively flat, the analyst can interpolate elevations.

Contour Mapping and GIS

A competent analyst can estimate first floor elevations using contour mapping quickly and accurately without ever seeing the floodplain. However, since the analyst will not visit the study area, considerable care must be taken in both the preparation and the process. Detailed topographical mapping of the study area is necessary. Detailed mapping is now often available even in smaller communities, especially with the increased use of Geographic Information Systems (GIS). If detailed mapping is not available for the study area, other options such as land surveying or using Global Positioning Systems (GPS), could be explored. As GPS accuracy for vertical elevations improves, their use becomes a more viable option. USGS 7.5-minute topographic maps are available for any U.S. location. However, these typically have 5- or 10-foot contours, which leads to less accurate estimates of structure elevations.

Opportunities to Verify or Refine First Floor Estimates

- Contact the non-Federal sponsor or Planning Commission for the city or county of the study area to determine if structure elevations are readily available. These may already be established because of the flood-prone nature of the area.
- Some commercial and industrial facilities have elevations of their structures that may be obtained during interviews. The reference datum used should be recorded to assure consistent use of the data.

Incorporating First Floor Information into the HEC-FDA Program

Estimate ground elevation at structure

- The structure elevations for the HEC-FDA program may either be input for the first floor or the ground at the structure. The foundation height from the ground to the first floor or the beginning damage depth (i.e. for basement windowsills) also needs to be provided. In either case, the first step is to estimate the ground elevation at the structure.
- In some cases contour lines and points on the maps are inconsistent when compared to the property. Mistakes are often made during map-making. Conversely, contour lines and spot elevations in well-established

neighborhoods are usually good. If an area has had additional development after the date of the mapping, spot elevations in the area may not be reliable. Excavation, grading and lot leveling are likely to have affected spot elevations. In this case, base the elevation estimate on the nearest reliable contour or spot elevation, probably in the road, sidewalk, or an adjacent established property.

- Find the nearest reliable contour line or spot elevation to the structure. Estimate the ground elevation based on that data accounting for elevation changes of the ground from this point to the structure. A contour line often touches the footprint of the structure or a spot elevation is often adjacent to the structure, giving the ground elevation at that point.
- If the structure has a walkout basement, make the estimate of ground elevation at the threshold of the basement exit.

Estimate foundation height

- Establish frames of reference for estimating heights of first floors above ground elevations. A concrete block, lying on its side, is 8 inches tall without mortar lines, which are about ½ inch each. A brick is about 2 ¼ to 3 inches tall plus mortar lines; normal steps are 6 to 8 inches tall; a typical kitchen counter is 3 feet tall. If you are not confident in the estimate, measure the foundation height with a measuring tape.

EVALUATING HISTORIC STRUCTURES

Depreciated replacement costs of historic structures are not readily classified using the Square Foot Method previously discussed.

There are two different approaches to calculating replacement value of historic structures: The Marshall & Swift Segregated Cost Method and the Expert Elicitation. Both are briefly described in the following paragraphs.

Marshall & Swift Segregated Cost Method.

The Segregated Cost Method considers each of the major components of a structure. It is most useful in producing costs for unique or unusual structures that defy classification using the Square Foot Method. While it does not require excessive counting and measuring, Segregated Costing does require at least an estimate of the following:

- Square footage of all finished floors, including upper story floors. The Segregated Cost Method also calls for the inclusion of garage area, which are rarely parts of historic homes.
- Square footage of the basement and the cubic feet of excavation.
- Square footage of basement walls.
- Linear feet of perimeter and height of exterior walls.
- Square footage of exterior gable walls.
- Square foot area of each porch and balcony.
- Linear feet of roof dormers measured across the face.
- If access to the interior is available, stairways, electrical and plumbing fixtures, built-in appliances and fireplaces can be counted and priced individually.
- If access to the interior is not available, plumbing and electrical fixtures can be estimated at 3 plumbing fixtures and 20 to 30 electrical fixtures per 1,000 square feet of floor space.
- Descriptions and dimensions of special or unusual features, such as cupolas, parapets, turrets and ironwork.

For a detailed explanation of the Segregated Cost Method, please refer to the Marshall and Swift Residential Estimator Handbook.

Expert Elicitation:

The Expert Elicitation Method involves obtaining estimates of the construction cost from local contractors with experience in the replication or renovation of historic homes. The following steps should be taken to estimate the replication cost of a historic structure:

- Have discussions with local contractors regarding their experience with replication cost of historic structures.
- Include a discussion of the type of materials required to replace a historic structure to its original specifications. If possible, fax or mail pictures of the historic structures in question to the contractor so they can provide a reliable estimate.
- Ask the contractor to provide a replacement cost based on square footage.
- Obtain costs from a number of contractors within the area to derive a good cost curve.
- If Risk and Uncertainty are to be included in the analysis, consider the number of contractors you spoke to and incorporate that into the risk analysis.

IMPROMPTU DISSCUSSIONS WITH THE PUBLIC

While you are collecting data in the field for a specific flood study, people who work or live in the community will show an interest in what you are doing. They will flag you down, ask questions and volunteer information about the perceived flooding problem. Contacts with area residents provide an opportunity to:

- Verify or correct assumptions about the flooding problems in the area, providing a reality check of what you believe about the study area.
- Fill in information gaps.
- Identify additional flood issues that should be explored further.
- Get a better appreciation of the difficulties and costs that flooding imposes on the community.
- Identify additional people that can provide input into the study.
- Provide an opportunity to increase public awareness of the Corps' ongoing efforts

Pre-trip planning is important if field personnel are to take advantage of these opportunities. At a minimum, pre-trip planning should include the following:

- Coordinate with the entire team before going to the field. Be aware of issues and data gaps that exist for analyses other than the economics.
- A good understanding of the history of flooding in the area.
- Have some form of identification or documentation such as a letter that verifies who you are and why you are there.
- Have a good map of the area to discuss flood issues with community members.
- Take advantage of invitations to get a personal "tour" of the flood problem area and see where the water really goes, how deep it gets, how fast it flows, and what problems it really causes.

- Have a good understanding of the issues and data gaps where additional information would be helpful.

Successful impromptu discussions will include:

- Asking about what happened to the individual when it flooded.
- Finding out specifics such as how deep the water got inside their home.
- Letting them tell you where the floodwater originated from, where it went, and how long it stayed.
- Making the person feel comfortable about sharing information by keeping the discussion conversational in tone. Briefly describe what you are doing in non-technical terms and then be sure to let them talk without interruption—they are the experts about flooding in their neighborhood.
- Taking some notes, if appropriate and the interviewee is comfortable with you jotting down some information.
- Once you are back in the office, be sure to provide copies of your notes to the other team members, particularly hydrologic and hydraulic engineers.

SOURCES OF DATA

Numerous state, local, and regional entities may have already compiled and organized data that would be useful. The data that these organizations might have could include: databases with structure information, structure elevations, aerial photographs, hydrologic models, points of contacts for local businesses, et cetera. The following list represents a few sources that have been successfully used by USACE districts:

- Regional Planning Agencies: Regional Planning Agencies typically prepare grant proposals and requests for program funding which usually requires them to prepare and maintain data sets concerning structures and land use that are at least similar to the data needed.

- City or County Tax Assessors: Tax Assessors are often required by state law to maintain records of property values and make those records available to the public. However, many parts of the country, particularly rural areas, are likely to have those records on index cards or similarly low-tech storage systems. Urban and metropolitan areas are more likely to maintain the data in electronic databases. If there is sufficient local interest in the study and coordination between jurisdictions is good, it may be possible to get much of the data needed from a single source.
- City or County Engineer Office: Local engineering offices are primarily responsible for maintaining the roads and bridges within their jurisdictions. As a result, they are less likely to have structure inventory data. However, they are likely to have road and street elevations for the area, and they are also likely to have established benchmarks that surveyors can use to shoot first floor elevations.
- State or Local Emergency Management Office: Following a flood or other natural disaster, emergency management officials are required to do an estimate of the damage caused by the event. This usually involves recording the addresses and types of structures affected, as well as an estimate of the damage caused to each one. State or local emergency management officials may also be tasked with establishing the high water marks for flood events.
- City or County Urban Development or Land Use Office (building permits): If the community is participating in the FEMA Federal Flood Insurance Program, these officials will have records that include the first floor elevation of structures constructed after the community

began participating. State or local law may also require them to record structure type, size and value as well.

- Waterway or Watershed Management Districts: In many cases, a water management district may be the non-Federal sponsor for the study. As part of their cost share, they can provide in-kind services. Those services can include collecting the structure inventory data. However, the planner must proceed with caution in agreeing to allow the non-Federal sponsor to collect a substantial portion of the data. Few know enough about Corps regulations and guidance to deliver the specific types of data needed. Further, the offices' staffing and budgeting considerations may prevent the delivery of the data when it is needed. If the study schedule or budget relies heavily on the non-Federal sponsor collecting the inventory data, considerable coordination will be needed to insure that the data are both timely *and* adequate.
- Tax data resale companies. There are a number of companies with that acquire tax data and package the in consumer-accessible databases for resale to licensed online users. These data often include detailed structure information, such as square feet and building material, that can be used for estimating depreciated replacement values.

PRE-FIELD WORK CHECKLIST

As any experienced field planner can attest to, there are several steps that can be taken before the planner goes out to collect data that will make their effort easier. Below is a list of tasks that should be reviewed and considered before resources are spent on data collection.

- Check for previous reports (i.e. USACE, Federal Emergency Management Agency (FEMA), or consultant's studies).
- Check newspaper articles for historic flood information.
- Talk to experienced personnel in the USACE district office about the flooding problem.
- Talk to local points of contact about the flooding problems and available data and maps.
- Find available mapping: Flood Insurance Rate Maps, USACE maps, local sources.
- Check for available GIS data (mapping and structure data).
- Check for available aerial photos
- Coordinate with Hydraulics and Hydrology staff to determine their data needs.
- Research USGS gage locations and data.
- Review historical flooding events, magnitude and high water marks.
- Research historic flooding characteristics i.e. velocities, duration, sediment.
- Obtain existing condition water surface profiles and determine if these are expected to change for the study.
- Delineate water surface profiles on structure inventory maps.
- Obtain stream mileage of the hydraulics and mark on structure inventory maps.
- Estimate the accuracy needed for first floor elevations -- perhaps the Flood Hazard Factor (FHF) may be used as a guide. The FHF is the difference in the 1% and 10% chance flood elevations. If this difference is small, there is a need for greater accuracy.

(This is not consistent with current guidance. Structural and nonstructural solutions are evaluated using the same procedures)

LEVEL OF DETAIL

Before heading out to the field to collect detailed economic information determine the level of detail that is required for the job. In other words, is economic data needed for a preliminary appraisal such as a reconnaissance level study or for a detailed analysis such as a feasibility level study? Is the study a Continuing Authority Program (CAP) Study, or a General Investigation (GI) Study?

Continuing Authority Program Study

(We don't do reconnaissance studies anymore, only in very limited exceptions. We do Section 905(B) Analyses. The information presented in this section does not apply to a 905(B), districts don't even do econ analysis. Either delete this section or tie it to a discussion related to scope, size and cost of study/project (i.e., CAP vs. GI)

Reconnaissance level investigations are intended to "define the Federal interest based on a preliminary appraisal consistent with Army policies, costs, benefits and environmental impacts of identified potential project alternatives." However, because of limited funding and shorter time frames in the reconnaissance phase, the schedule and the budget may preclude more than a cursory site visit. Nonetheless, good planning and good use of the time in the field can result in enough information about the floodplain inventory to determine whether a Federal interest exists. Depending on the size of the area and the estimated number of structures, sufficient funding, time and data may exist to support the development of a rough order of magnitude estimate of damages under existing and future without project conditions. It is unlikely that the schedule or the budget will support an analysis of structural alternatives. However, with a ballpark idea of the magnitude of the damages that could be reduced, the reconnaissance phase goal of identifying the Federal interest is achievable.

Determine if prior studies produced by the Corps contained estimates of first floor elevations. Determine if topographic mapping exists in sufficient resolution to estimate first floor elevation. Prior studies may also contain considerable data on the floodplain inventory at the time the report was prepared. Prior studies are also likely to contain estimated water surface profiles. It should be noted that water surface profiles that were produced many years ago are unlikely to represent current conditions. However, the quality of the data may be sufficient to allow the H&H team members to improve the profiles to the point where they are usable in a rough order of magnitude estimate.

The field reconnaissance process should begin by contacting the non-Federal officials you believe to be the most knowledgeable about the floodplain itself. Specific questions should be asked about the approximate number, type and value of the structures in the floodplain, and whether significant new development has occurred in the area since the date of the most recent report. Information about the affluence of the affected areas is helpful to determine, on a very broad scale, the quality and condition of the homes. Average lot size will help determine the approximate number of the affected structures if the boundaries of the study area are well delineated.

Researching their records and answering these kinds of questions are time-consuming affairs for officials who already have enough demands placed on their time. It is important to remember that the reconnaissance phase is 100% federally funded. By getting a ballpark idea of the magnitude of the problem, you are reducing the risk that a feasibility study will result in a recommendation of no action. Communicate this goal to the local official to improve both the usefulness and the timeliness of the information.

If the study area or the number of affected structures is sufficiently small, a windshield survey may be a viable option. As many as 200 structures can be identified, described, and rated as to condition and quality in two full days in the field, depending on housing density and floodplain geography. If topography is favorable and the mapping is good, first floor elevations can be estimated also. Otherwise, one to two additional days will be needed to obtain reasonable first floor elevations. A large number of homogenous structures or a densely developed area can increase the total number that can be evaluated quickly. A sparsely developed area with many heterogeneous structures can decrease the total number of structures that can be inventoried each day. Plan the trip accordingly. If other members of the study team are also going on the trip, you need to clearly identify the amount of time you need to collect your data. If logistics or trip goals of the other team members are not likely to allow them all to accompany you on your field reconnaissance, separate vehicles or separate trips may be warranted.

If a usable set of water surface profiles are also available, then by the end of the trip the analyst should have all of the data needed to produce a broad-brushed picture of the flooding problem.

Feasibility Level GI Study

Feasibility investigations for GI studies require a much greater level of detail than a CAP study. Ideally, adequate funding and time was negotiated in discussions with the

non-Federal sponsor during the 905(b) process that allows for a thorough and accurate analysis of the floodplain inventory. When possible, it is advisable that the team visits the project area to determine the extent of the floodplain and the nature and composition of the inventory. If an exhaustive inventory of the floodplain is not viable, a well-executed and well thought-out sample will provide adequate information for a thorough economic analysis of the project alternatives.
Be sure to do all of the pre-field trip preparation work that has been recommended for a CAP study field trip. Review old reports, gather existing information, and make telephone calls to the local points of contact to assure their availability to go over local resources and information. Have a good understanding of the data requirements of the other team members so that you will be able to provide input to the overall team effort.

Obtain any available mapping, particularly if the there is a GIS for the project area to use in identifying any changes in land use and variations in topography that could impact estimates of the first floor elevations.

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[i] A good basic explanation of sampling methods can be found n Loether and McTavsh, *Descriptive and Inferential Statistics – An Introduction*, Allyn and Bacon

[ii] Marshall and Swift, Residential Replacement Cost Handbook