

Part III

Neighborhood- Level Tools and Techniques

Part I of this guide notes that actions to solve localized flooding problems can be taken at three different levels: at the community level, at the neighborhood level, and by individual structure. Part II discusses the community-level approaches.

Part III focuses on the specific neighborhood or block where the flooding takes place. Chapter 7 reviews the area analysis, a process that determines whether flood protection approaches should be pursued at the area (or neighborhood) level. There are two types of area-wide approaches: making improvements to the drainage system, or redeveloping one or more parcels. Chapter 8 covers drainage system techniques that are appropriate at the neighborhood scale, and Chapter 9 describes redevelopment options.

Part III:

Chapter 7. Area Analysis

Chapter 8. Drainage Improvements

Chapter 9. Redevelopment



Area Analysis

In order to determine whether one of the neighborhood-level approaches (discussed in the remaining two chapters of Part III) would successfully resolve localized flood problems, an area analysis needs to be conducted. The area analysis is a scaled-down plan that focuses on a relatively small portion of the community. If it concludes that there are no feasible or appropriate drainage or redevelopment projects that would resolve the localized flooding problem, the community would pursue protection measures on an individual building basis (covered in Part IV).

The “Area”

Delineating Areas

The first step in an area analysis is to determine the boundaries of the area, watershed, or neighborhood to be reviewed. There is no standard or optimal size area or typical number of buildings involved. An area for analysis can have 1 building or 100 or 1,000, as long as it is an area of contiguous properties subject to the same source of flooding. Areas subject to local drainage problems and flooding outside the mapped Special Flood Hazard Area (SFHA) usually will be relatively small.

The ideal approach is to start with the most frequently flooded sites and delineate the drainage basin or subwatershed that drains to them. This can be done if adequate topographic maps are available. Sometimes, such as in flat areas or neighborhoods subject to sewer backup, this can be difficult.

An important part of an area analysis is to work with the property owners. Therefore, the area should be delineated, where possible, to include existing neighborhoods or neighborhood organizations, even if this means extending the boundaries of the area to be analyzed beyond the drainage basin boundaries.

Prioritizing Areas

The community can conduct an area analysis for areas that have requested it or that have been flooded recently. Or, it can delineate all localized flood problem areas and set priorities to analyze each in turn. It is a good idea to prioritize all action items, expenditures, and projects, and document why certain items are given precedence. Documenting the prioritization process can help keep planners impartial and justify funding for projects. The following factors can be considered when prioritizing areas:

- Start with areas with properties that are on the Federal Emergency Management Agency (FEMA) severe repetitive loss or repetitive loss list and are priorities for FEMA mitigation funding programs. Contact your local floodplain coordinator or Regional FEMA Office for assistance.
- Start with smaller areas that will be easier to analyze. It is a good idea to begin a program by tackling the smaller, more manageable problems and then move on to the larger problems as procedures and expertise are improved.
- Start with the areas where the residents are actively requesting assistance or that have been recently flooded. These areas are most likely to have motivated, interested property owners who will be willing to cooperate with the community's effort.
- Start with the areas that have the greatest flooding threat to health and safety, such as areas subject to flash floods or fast-moving flood waters.

Conducting the Analysis

The objective of the analysis is to determine if there is a feasible and appropriate way to reduce flood damage at the area or neighborhood level. The analysis can be informal or highly organized. In either case, it is important to involve the owners of the affected properties. A written report is also recommended, showing the process that was followed and the rationale for the conclusions.

The following five steps are suggested:

1. Advise the neighborhood about the upcoming analysis.
2. Determine the cause and extent of the problem.
3. Review alternative area-level approaches.
4. Contact other parties about their activities and possible coordination of efforts.
5. Document the findings.

Step 1. Advise the neighborhood.

Residents and owners of the properties in the area should be told that the community plans to initiate the analysis. This notification can be done through the mail or at a public meeting. The notice should include the following:

- Review the reasons for the analysis and the process that will be followed.
- Request information on the causes and impacts of past flooding. Use a form to facilitate review and summary. An example of a request for this information is shown on the next page.
- Inform residents that all information is voluntary.
- Advise that field crews or surveyors will be in the area and include the dates, if known. Explain that community staff have identification cards.
- Provide the name and telephone number of someone who can answer questions.
- Provide the date, time, and place of a meeting that will review the results of the analysis.

Step 2. Determine the problem.

The community's engineer should review available data, such as:

- The community's Flood Insurance Rate Map (FIRM) and Flood Insurance Study;
- Other flood studies and reports;
- Stormwater management plans;
- A topographic map or other source with more detailed contour data than the map used to prepare the FIRM (see the Gurnee and Conway examples in Chapter 4);
- Questionnaires and information provided by the residents;
- Flood insurance claims data that provide the location and dates of flood events and the extent of damage (see Where to Get Help); and
- Field investigations to locate or confirm channel obstructions or other reported causes of flooding.

A hydrologic and hydraulic study is not necessarily warranted at this step, nor are detailed flood elevations needed. Step 2 can be performed using engineering judgment and staff experience. The product of Step 2



FEMA has developed a useful software application to collect information on flood problems and building conditions. The National Flood Mitigation Data Collection Tool provides a step-by-step process to gather information on each building in the area to be analyzed. If the area analysis concludes that site-specific approaches should be pursued, the data and the software can be very helpful in determining which measures would be most appropriate.

Village of Gurnee/Lake County, Illinois Stormwater Management Commission Flood Protection Questionnaire

Property address: _____

1. Has your home or property ever been flooded or had a water problem? Yes No
If "yes," please complete this entire questionnaire.
If "no," please complete questions 6 – 9.

2. In what years did it flood? _____

3. Where did you get water and how deep did it get?
 - In basement: _____ deep.
 - In crawl space: _____ deep.
 - Over first floor: _____ deep.
 - Water kept out of house by sandbagging, sewer valve or other protective measure.
 - In yard only.

4. What do you feel was the cause of your flooding? Check all that affect your building.
 - Storm sewer backup Sanitary sewer backup
 - Sump pump failure/power failure Saturated ground/leaks in basement walls
 - Standing water next to house
 - Overbank flooding from _____ River/Lake
 - Other: _____

5. Have you installed any flood protection measures on your property?
 - Sump pump Backup power system/generator
 - Overhead sewers or sewer backup valve Sewer plug or standpipe
 - Waterproofed walls Moved things out of the basement
 - Regraded yard to keep water away from building
 - Other: _____

6. When did you move into the building? _____

7. What type of foundation does your building have?
 - Slab Crawlspace Basement _____

8. Do you have flood insurance or a sewer/basement flood rider to your homeowner's insurance?
 - Yes No

9. Do you want information on protecting your house from flooding or sewer backup?
 - Yes No If yes, please include your full mailing address.

Please include any comments you may have about flooding in your area.

*This questionnaire was sent to residents of a flood-prone area in Gurnee, Illinois.
[The reverse side had the Village Hall address and a stamp so the form could be folded and mailed after it was filled out.]*

would be a narrative and/or map. Examples of findings from a community's investigation are listed in the table below. It is important to remember that if a drainage modification project looks feasible as an alternative, a hydrologic and hydraulic analysis will be needed to make sure the improvement is properly sized. Too often a community goes forward with a poorly conceived solution that is destined to fail, is under-sized for the job, or worsens flooding elsewhere.

Examples of Flood Problems and Possible Approaches to Resolve Them

Problem Statement	Approaches to Investigate
<p>On four occasions in the last 5 years, local storms overloaded the ditch along County Road 14 and flooded nearby houses. The ditch has filled in with sediment over time and can no longer carry flows from a severe storm.</p>	<ul style="list-style-type: none"> • Dredge the ditch • Enlarge the ditch • Initiate a drainage maintenance program • Install an underground sewer
<p>The storm sewer system was designed and installed in 1950. At that time, it could handle the 10-year storm from the upstream drainage basin. Since then, the basin has been urbanized and the amount of runoff has substantially increased. The storm sewers have deteriorated over time and now surcharge once every 2 years on the average.</p>	<ul style="list-style-type: none"> • Install an upstream storage basin • Install larger storm sewers
<p>Intense storms in June 2000 and July 2001 resulted in overland flow over construction sites on Vine and Race Streets. Lumber, trash, and other loose items were washed into the ditch. The debris caught at the culvert under Broadway and plugged the pipe, resulting in a 3-foot backwater which flooded eight houses.</p>	<ul style="list-style-type: none"> • Enlarge the culvert • Install a trash rack • Initiate a drainage maintenance program • Enforce a construction-site housekeeping program
<p>The houses at 103, 105, and 107 Elm Street are bi-levels with garages below grade. Approximately once each year, stormwater runoff flows onto Elm Street to a level higher than the sidewalk. The water flows over the sidewalk and down the driveways. Only these three properties have been affected.</p>	<ul style="list-style-type: none"> • Improve the storm sewers • Raise the sidewalk • Install an upstream storage basin • Acquire the three homes
<p>Flood insurance records show damage to 12 houses and one business on July 1, 1990, August 3, 1995, July 26, 1999, and July 17, 2002. A review of the area shows that there are 15 similarly situated homes and businesses that either were not insured or did not have enough damage to warrant a claim, but are likely to have been flooded on these dates. The area is very flat and poorly drained. Construction of homes and streets in a grid pattern has cut the drainageways that existed before development. This is an area that should not have been developed without construction of new drainage ditches and pumps.</p>	<ul style="list-style-type: none"> • Improve drainage • Acquire the lowest properties and redevelop the site as a storage basin

Step 3. Review alternative approaches.

The objective of the area analysis is to determine if an area- or neighborhood-level approach is feasible and appropriate. Chapters 8 and 9 discuss specific techniques under these approaches. Here are some examples of neighborhood-level approaches.

- Drainage modifications, such as removing obstructions or enlarging culverts, ditches or storm sewers, to carry the floodwaters away from the area;
- Storage basins to hold the water upstream from the area and/or release it over time;
- Levees, floodwalls, berms, and other structures to divert floodwaters away from flooded properties;
- Better maintenance of the drainage system to remove obstructions to low flows; and
- Acquisition of some or all of the flood-prone properties and conversion to open areas that will not be damaged when flooded or to other appropriate uses.

Some approaches will be obvious while others will take some time to investigate. If residents have voiced a strong opinion about one or two approaches, these should be studied, even if the professional engineer thinks they are not feasible. The success of this program depends on local support; resident interests should be pursued and the advantages and disadvantages of each approach should be clearly explained.

Examples of approaches that could be explored for different problem scenarios are shown in the table on the preceding page. Although these solutions may appear simple, the engineer will need to review their pros and cons and determine if they effectively reduce the flood problem and are also affordable.

The area analysis process can be abbreviated

if the problem is small or the solutions are obvious. In the first example in the table on page 7-5, it may be that neighbors and the analyst agree that cleaning out the ditch would alleviate the flooding problem. Such a project could be conducted by a public works crew in a day. All that would be needed is a memorandum for the record that explains the problem and recommended solution.

The more formal step-by-step process is recommended for:

- Larger problems;
- Problems that have resulted in resident complaints over the years;
- Problems with no obvious solution; and
- Problems that will be expensive or disruptive to the neighborhood.

For example, installing larger storm sewers appears to be the answer to overloaded storm sewers. However, replacing existing sewers can be very expensive and the impact of increased flows onto downstream properties would need to be considered. Such an approach may be readily ruled out as infeasible by an experienced engineer. If so, the analyst needs to provide a rough cost estimate, rather than summarily state that it is too expensive.

Step 4. Contact other parties.

Other agencies or organizations may have plans that could affect the cause or impacts of the flooding. For example, if the roadside ditch is along a State or county highway, are there plans to work on the road or improve the ditch? Key agencies and organizations that should be contacted include the following:



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Sometimes a minor ditch-clearing project can stop flooding and drainage problems.

- Drainage, levee, sewer, or sanitary district responsible for flood, drainage, or sewer problems;
- Local or State street or highway department that may improve a ditch, bridge, or culvert or construct a project that will affect drainage;
- Parks department or school district that may be interested in expanding open space lands or athletic fields;
- An adjacent landowner or a developer or economic development agency that may be interested in acquiring, clearing, and redeveloping some properties;
- State emergency management or State National Flood Insurance Program coordinating office, council of government, or regional planning agency that would know of ongoing mitigation efforts, funding sources, and their priorities; and
- Environmental or open space organizations, such as the Nature Conservancy or the Trust for Public Land, that might be interested in converting problem areas into open space.

The analyst should discuss the findings from Step 3 with the agency or organization to determine if there are opportunities for cooperation, coordination, cost sharing, or modifying the approach to gain support from the agency or organization.

Step 5. Document the findings.

The analyst should prepare a short report that includes the following items:

- A summary of the process that was followed;
- A summary of residents' comments and/or a tally of the questionnaires;
- The problem statement with a map of the area affected and/or the drainage basin, if possible;
- The alternatives reviewed and their advantages and disadvantages;
- Relevant activities by other agencies and organizations; and
- Conclusions and recommendations.

The document should be reviewed, either by another engineer or by the community's upper management. Upper management or an elected official (e.g., the council member for the area being analyzed) can verify that the recommendations are politically acceptable.

Follow-Up Activities

A draft report will be the likely product at the end of Step 5. Before it is officially adopted as the way to reduce flood damage for the area, three follow-up activities should be pursued.

Neighborhood Review

Neighborhood support is vital, especially if the proposed project depends on access onto private property, obtaining easements, or voluntary sales of property. The analysis findings should be reviewed with the residents and property owners of the affected area.

There may be many cases in which the area analysis concludes that there is no appropriate or feasible drainage, flood control, or redevelopment project. In these situations, community staff should begin looking at site-specific projects, such as retrofitting.

The meeting to review the findings of the area analysis can be used to introduce the concept of site-specific approaches and to schedule appointments with the property owners.

If it is not too long, the document could be sent to everyone. An alternative is to send a notice to everyone with a Web link to where the document can be read.

There should also be a meeting with the neighbors. The author of the analysis can review the problem, the alternatives, and the conclusions and recommendations. The community can gauge support for the recommendations at the meeting. Unanimous support may not be necessary, but if there is strong opposition, the recommendations may need revision or extra time may be needed with the concerned parties.

Detailed Plans

If the recommended project proves appropriate (i.e., it will reduce flood losses and has resident support), it should be verified that it is also feasible (i.e., it is cost-effective and can be funded). The analyst should have estimated the cost and reviewed cost-

effectiveness during Step 3. Some level of hydraulic and hydrologic analysis will probably be needed.

For small projects, such as cleaning out a ditch, no further details may be needed. For larger projects, a formal cost estimate may need to be prepared. If FEMA funds will be sought, a formal benefit-cost analysis (BCA) should be conducted, preferably using FEMA software, because it will be required when application is made. The community may opt to contract out this work for very large projects.

Funding

The final activity is to schedule and fund the recommended project. Small projects, such as ditch cleaning, may just be a work order for the public works department. Larger projects may have to be funded or budgeted individually.

There are usually four sources of funds for a flood mitigation project:

- Local funds;
- State funds;
- Federal funds; or
- The benefiting properties.

Typically, larger projects use a combination of sources. For example, most State and Federal programs will only fund a percentage of a project's cost and require a local cost-share to make up the difference.

Local Funds

Most communities have operating budgets and capital budgets. Operating budgets fund routine activities and capital budgets fund one-time-only construction projects. Smaller flood mitigation projects can often be funded from an operating budget account, while larger ones are considered capital improvement projects.

Typically, operating budgets are funded by taxes, such as property or sales taxes. There are usually limits to how much can be raised, so flood projects compete with other community concerns for the limited funds available.

Capital budgets are often funded by bond issues. Some bond issues require a referendum that sets the purpose and the amount of funds to be made available. Again, there may be a limited amount of money available.

Increasingly, communities are turning to sources other than their limited general-purpose taxes. Sometimes special revenue sources can be used. For example, if a roadside drainage ditch is causing a localized flooding problem, the community

The CRS provides credit under Activity 540 (Drainage System Maintenance), if the community has an ongoing program,

such as a capital improvements plan, "to eliminate or correct problem sites or to construct 'low maintenance' channels or other facilities." There is no credit for this item if the community does not spend money on a regular basis on such improvement projects (a one-time-only project would not be credited). More information can be found in *CRS Credit for Drainage System Maintenance*.



may be able to use its share of the State gasoline tax to make improvements that also reduce street flooding. Projects to relieve or prevent sewer backup are often funded by sewer utility revenues.

The most promising new source of local funding is the **stormwater utility**. Stormwater utilities charge each property according to how much it uses the stormwater system (i.e., how much stormwater runoff it generates). As with a water or sewer utility, everyone pays according to how much they use the system. Unlike some taxes, no properties are exempt. Utility bills are sent to all properties, or the stormwater fee is included in the water or sewer bill.

Typically, each single-family home pays a base rate, usually \$2 to \$5 per month. Other properties pay according to their “equivalent residential unit” amount of impervious surface. A five-acre shopping center with a parking lot would pay more than a five-acre lot with one building and a lawn. Often credits are provided for good stormwater management practices, so a shopping center with a storage basin would pay a lower utility fee.

Stormwater utilities have proven to be a dependable source of funds for both operating and capital expenses. A set amount of money is raised each year for flood mitigation that is not subject to diversion to other uses. Communities with stormwater utilities have greatly improved their stormwater and flood protection programs.

State Funds

Some States have special appropriations to fund local flood protection, acquisition, and retrofitting projects. Some examples include:

- Washington’s Flood Control Assistance Account Program receives \$4 million from the State legislature every two years.
- Minnesota’s Flood Damage Reduction Grant Program provides 50% of the local cost of flood mitigation projects.
- Virginia collects surcharges on insurance policies and places the funds in a State mitigation fund.
- Florida has several dedicated State funds that can be used for flood mitigation, including the Emergency Management Preparedness Assistance Trust Fund, the Residential Construction Mitigation Program, and the Communities Trust Program.

More information on State programs can be obtained from the State National Flood Insurance Program (NFIP) Coordinator. A directory of State NFIP coordinators can be found at <http://www.floods.org/StatePOCs/map.asp>.

Federal Funds

Several Federal agencies can provide funding support for certain types of flood protection projects. This section identifies the programs and where more information can be obtained.

FEMA has several grant programs for acquisition, retrofitting, and small drainage improvement projects. The Hazard Mitigation Grant Program, Flood Mitigation Assistance, and Pre-Disaster Mitigation program are explained on pages 9-9 and 9-10. For more information, contact the FEMA Regional Office (see <http://www.fema.gov>).

The **U.S. Army Corps of Engineers** can help design and fund flood control projects. For the local Corps of Engineers district, see <http://www.usace.army.mil>.

The **Department of Housing and Urban Development** administers the Community Development Block Grant program. Larger cities and counties receive entitlement grants; smaller communities apply to their county or State community development agency. Funds may be limited to projects that benefit low- and moderate-income families or economic development. Block Grant funds can also be used to help cover the non-Federal match required by other Federal programs. For more information, see <http://www.hud.gov/offices/cpd/communitydevelopment/programs/index.cfm>.

Benefiting Properties

A fourth source of funding for a project to reduce flood damage is the owner of the property who benefits from the project. In many communities, the **property owner** has paid the 25% non-FEMA cost share for an acquisition or retrofitting project. Sources of assistance to help these people are summarized on pages 10-20 through 10-21.

Many communities have the authority to create **special service districts** or levy **special assessments**. In these situations, owners of the benefiting area pay an additional property tax. The additional tax revenue is used to retire the bonds that funded the project. Each State has its own procedures for using these tools.

Impact fees are contributions from developers. They are designed to offset the cost a new development will add to the community's expenses. For example, if a new subdivision increases the amount of runoff that drains into the community's storm sewer system, the developer might be charged an amount sufficient to pay for increasing the capacity of that system.

In Fairfax County, Virginia, for example, developers are required to contribute to the cost of handling the increased stormwater runoff produced by their developments. The fees are put into a fund for drainage projects. The fund can pay for a retrofitting project where it is shown to be an economical way to handle a drainage problem. The project illustrated on page 10-7 was funded under this program.

Where to Get Help

- There are no special programs to help fund an area analysis, although such work is primarily staff time, which may not need outside funding support.
- Federal Emergency Management Agency Regional Offices.
- FEMA has a benefit-cost (BCA) helpline at 1-866-222-3580 to answer questions regarding the benefit-cost procedures.

Additional resources are listed in Appendixes A and B.