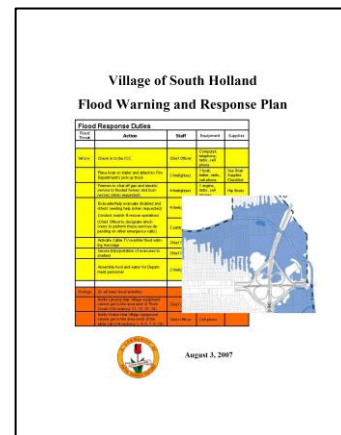


NAI How-to Guide for Flood Warning & Response Case Study: South Holland, Illinois—Inundation Mapping for a Flood Response Plan



The village of South Holland, Illinois was built on what was the bottom of Lake Michigan in geological times. It has a history of flooding from the Little Calumet River and its tributaries.

The repeated flood levels are shown in the graphic on the next page. Flooding at the Cottage Grove Ave. gauge on the Little Calumet was recorded in river stage. The graphic converts the stages to feet above sea level. Although the village had experienced many floods, none of them approached the 50-year flood, let alone the 100-year flood level.



Village leaders were concerned about two things:

1. Local flood response efforts were not formalized, and relied on memories of those involved in previous response efforts, and
2. The village was not ready for a larger flood.

The maps: In 2006 the village tasked its consulting engineering firm to prepare a series of flood inundation maps. Rather than plan for arbitrary 50- or 100-year floods, the village selected five flood response levels: flood stages of 19, 20, 21, 23 and 25 feet (594, 595, 596, 598 and 600 feet above sea level). While 1-foot differences may not sound like much, 1 foot in flat South Holland can extend a floodplain boundary by two to three blocks.

Using river stages facilitated relating the maps to flood levels predicted by the National Weather Service. An example of a NWS flood statement appears below (see the red box).

The five levels were given color codes, an effort to get people to stop thinking every flood was a 100-year flood.

The five levels were extrapolated upstream and downstream, and the boundaries were plotted on five separate maps using LIDAR topographic information. Four of the maps are shown on page 3.

NATIONAL WEATHER SERVICE CHICAGO IL
810 AM CST MON FEB 14 2005

FOR THE LITTLE CALUMET RIVER...INCLUDING MUNSTER AND SOUTH HOLLAND...
MINOR FLOODING IS FORECAST.

WITH RAINFALL AMOUNTS RANGING FROM ONE HALF OF AN INCH, TO NEAR ONE
INCH ACROSS THE AREA SINCE SUNDAY...QUICK RISES ON THE LITTLE CALUMET
RIVER ARE EXPECTED THIS AFTERNOON AND EVENING.

ON THE LITTLE CALUMET RIVER AT SOUTH HOLLAND, THE LATEST STAGE IS 10.5
FEET AT 7 AM MONDAY. FLOOD STAGE IS 13.0 FEET. MINOR FLOODING IS
FORECAST, WITH A CREST OF 14.5 FEET EXPECTED THIS EVENING, WHICH IS
1.5 FEET ABOVE FLOOD STAGE. WATER LEVELS ARE EXPECTED TO RISE ABOVE
THE FLOOD STAGE OF 13.0 FEET THIS AFTERNOON. AT 15.0 FEET, WATER
ENTERS VETERANS PARK.

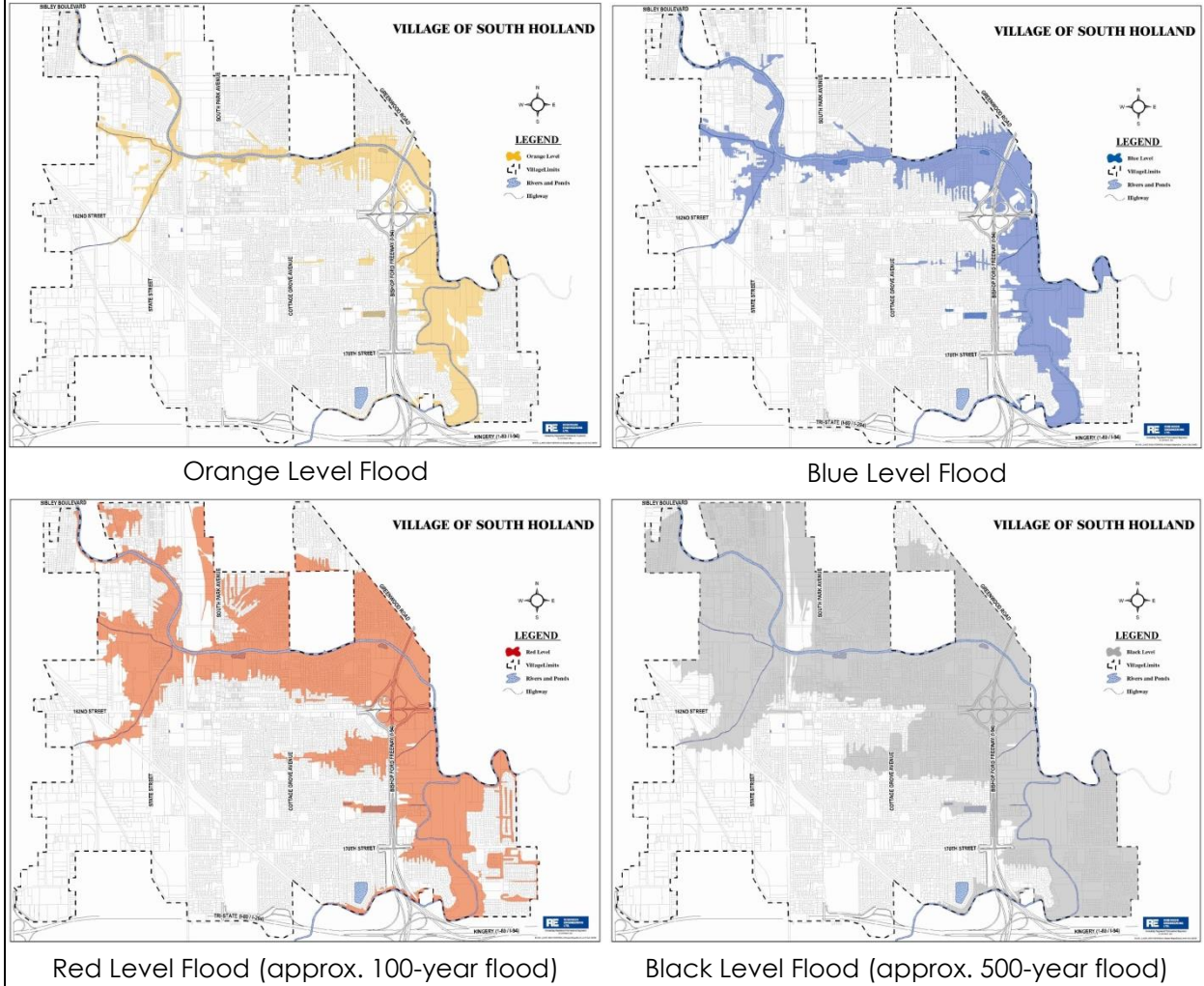
THE FOLLOWING RIVER FORECASTS ARE BASED ON OBSERVED PRECIPITATION AND
FORECAST PRECIPITATION FOR THE NEXT 24 HOURS:

FLD OBSERVED LOCATION	FORECAST 7AM						
	STG	STG	DAY	TIME	TUE	WED	THU
LITTLE CALUMET RIVER							
MUNSTER	12	9.6	MON	7 AM	12.3	9.9	8.0
SOUTH HOLLAND	13	10.5	MON	7 AM	12.8	10.7	9.2

Little Calumet Flood Levels

	Stage	Elevation	Event	Flood Response Levels
<p>Flood heights have been recorded since 1947 on a river gage that is currently located at the Cottage Grove Avenue bridge over the Little Calumet. Recorded flood heights can be shown in stage or in elevation. Stage is measured in feet above an arbitrary starting point that was set when the gage was first installed. Elevations are in feet above sea level. Stage of zero on this gage is the same as an elevation of 575.0 feet above sea level.</p> <p>“Flood stage” is the elevation where the rising river starts to damage property. Yards and parks are flooded when the river reaches an elevation of approximately 590 feet above sea level. Buildings are affected at approximately 593 feet.</p> <p>Using the 2000 Cook County Flood Insurance Study, the 10-year flood at Cottage Grove would reach a stage of 19.4 and an elevation of 594.4. The 100-year flood figures are 23.0 and 598.0.</p> <p><i>Village of South Holland Floodplain Management Plan, 1996, Page 2-3</i></p> <p><i>Note: in 2005, the National Weather Service issued a new “flood stage” level – 16.5 feet or an elevation of 591.5.</i></p> <p><i>The Weather Service also provides real time stage data for the upstream river gauges on the Little Calumet River at Munster, Indiana, and on Thorn Creek at Thornton. The Munster readings can be accessed from the South Holland gage site and there is direct link to the Thorn Creek gage from the Village’s website.</i></p>	26.5 --	-- 601.5	500-year flood	← 600.0 – Black level
	23.0 --	-- 598.0	100-year flood	← 598.0 – Red level
	22.0 --	-- 597.0	50-year flood	
	20.8 --	-- 595.8	11/27/90	
	20.2 --	-- 595.2	6/14/81	
	20.1 --	-- 595.1	7/14/57	
	20.0 --	-- 595.0	7/20/96	← 595.0 – Orange level
	19.6 --	-- 594.6	12/3/82	
	19.4 --	-- 594.4	10-year flood	
	19.2 --	-- 594.2	4/6/47	
19.1 --	-- 594.1	2/21/97		
19.0 --	-- 594.0	Water reaches buildings on Drexel	↖ 594.0 – Green level	
18.6 --	-- 593.6	6/2/89		
18.2 --	-- 593.3	10/10/54		
18.0 --	-- 593.0	Thorn Creek begins to cover 170th Street		
17.9 --	-- 592.9	2/24/85, Water covers Riverview and Drexel		
17.7 --	-- 592.7	12/27/65		
17.0 --	-- 592.0	Flood warning issued		
16.0 --	-- 591.0	Flood watch starts		
15.0 --	-- 590.0	Water enters Veterans Park		

South Holland's Flood Inundation Maps



The data: As soon as the maps were prepared, the village developed an inventory of the impact of the five levels: how many buildings, other structures, roads and critical facilities were affected. The inventories are in an appendix to the Flood Response Plan. The totals for each of the five levels appear in the table below.

Flood Response Levels					
	Green	Orange	Blue	Red	Black
Stage	19.0	20.0	21.0	23.0	25.0
Elevation	594.0	595.0	596.0	598.0	600.0
Frequency (2000 FIS) *	10-year	1996	1990	100-year	
Number of homes affected **	21	83	284	1,925	4,514
Other structures affected **	11	21	30	120	239
Critical facilities affected **	0	1	3	14	38
Streets to be closed **	32	57	84	170	193
<p>* The flood response levels do not change when new studies produce new 100-year flood levels. ** Summary data taken from Attachment D.</p>					

The plan: The village administrator asked each department to review the maps and detailed inventory to determine what they needed to do to support the flood-response effort. The various reports were collated and coordinated in the *Flood Warning and Response Plan*.

The bulk of the document is a description of what each department does year-round, during a flood, and after a flood. These were displayed as lists for each department. An example is shown to the right.

The flood: The plan was adopted by the village Board of Trustees in 2007. In 2009, the Little Calumet River flooded to river stage 20.11, approximately a 25-year flood and one-tenth of a foot above the "Orange" level flood in the plan.

The village was prepared, but no plan is perfect. An after-action critique was prepared. Some excerpts:

Public Works				
Primary areas of responsibility: closing off flooded streets, protecting critical facilities, clean up, non-building damage assessment				
Flood Response Duties				
Flood Threat	Action	Staff	Equipment	Supplies
Green	Check in to the ICC	Director, Deputy Director, Water Foreman	Computer, telephone	
	Check flap valves on the riverbank for operability	1 employee	1 truck, binoculars	
	Set out barricades at designated locations (see Attachment E *)	3 two-person crews	3 trucks and trailers	Barricades for 32 streets
Orange	Do all lower level activities			
	Set out barricades at designated locations (see Attachment E *)	4 two-person crews	4 trucks and trailers	Barricades for 57 streets
	Contact Eisenhower School to determine if help is needed	Deputy Director	Cell phone	
Blue	Set out sand and sandbags on public property at (in order): — Pacesetter Park — Gowans Park — Veterans Park	1 operator 2 drivers	Wheel loader 2 dump trucks	8 yards of sand, 100 bags per truck
	Do all lower level activities			
	Set out barricades at designated locations (see Attachment E *)	4 two-person crews	4 trucks and trailers	Barricades for 84 streets
Blue	Contact Gibson Chevrolet and Truck O Matic to determine if help is needed	Deputy Director	Cell phone	

7. Damage prevented by the flood warning system and response plan: This is difficult to measure. There are anecdotal accounts of property protected by sandbags. It is assumed that one reason no one was hurt is because of the advance notice provided by the National Weather Service and the village.
8. Lessons learned and changes needed in the warning program and response plan: The following recommendations were submitted by department heads:
 - The plan’s sections on flood-response duties need the following changes:
 - Police: include the role of the command van.
 - Public Works: Provide specific instructions and protection heights for the emergency berm at 170th and Van Dam.



South Holland is a CRS Class 5. It receives 235 points for its Flood Warning and Response Plan under Activity 610 (Flood Warning and Response).