Chapter 4. Flood Control

As noted by their name, flood control measures control floodwaters and keep them from reaching damageable property. They are also called "structural" measures because they involve construction of man-made structures to affect surface water flows. There are seven general categories of flood control projects which were reviewed by the Flood Liaison Committee:

4.1 Levees and floodwalls
4.2 Reservoirs
4.3 Diversions
4.4 Channel improvements
4.5 Sewer improvements
4.6 Control gates
4.7 Runoff controls

There have been several flood control studies on the Little Calumet River system and on South Holland's sewer problems. They include the 1975 Little Calumet River Floodwater Management Plan, by the Little Calumet River Steering Committee, Dolton-South Holland Flood Study, by Robinson Engineering, Ltd. in 1992, Village of South Holland Sewer System Evaluation Report, by Robinson Engineering, Ltd. in 1987 and updated in 1992 and Little Calumet Detailed Watershed Plan (DWP), by MWRDGC in 2010. Most parts of the 1975 Little Calumet plan and the 1987 sewer system report have been or are being implemented.

This section reviews the seven flood control alternatives and what these studies have concluded about the feasibility of their use in South Holland.

4.1 Levees and Floodwalls

4.1.1 General: Probably the most common flood control measure is to erect a barrier of earth (levee) or concrete (floodwall) between the river and the property to be protected. Levees and walls must be well designed to account for large floods, underground seepage, pumping of internal drainage, and erosion and scour.

Levees and floodwalls are appropriate for protecting existing development without disrupting it. Where a levee or floodwall protects more than one property, it should be publicly owned. Levees required a lot of room to fit between the river and the area to be protected. If space is a constraint, more expensive floodwalls are used. Both must be set back out of the floodway so they will not push floodwater onto other properties.

Large floods can overtop levees or floodwalls and inundate properties thought to be protected. If a levee or floodwall fails, the sudden rush of flood water can endanger lives and may cause greater damage than having no flood barrier at all. They can be barriers to access and views, too. There are continued operation and maintenance costs to ensure the pumps work and that the levees do not slump or develop holes from animals or roots.

Larger levees or floodwalls usually cost so much that they cannot be built without state or federal aid. Flood control agencies require that the benefits of a major project exceed the cost. This allows them to protect the major concentrations of flooded property in urban areas. However, where development is scattered or aligned in narrow strips along the river, the cost often exceeds the benefits of protecting a smaller number of properties.

4.1.2 Use in the Area: The 1975 Little Cal plan reviewed the feasibility of levees and floodwalls. It was concluded that they would only be cost effective in Indiana where there was more room between the channel and the buildings. The U.S. Army Corps of Engineers has subsequently completed construction of approximately 25 miles of levees and floodwalls along the Little Cal to protect Gary, Griffith, Hammond, Highland and Munster. Other projects were recommended for protecting the Illinois portion (see discussion in 4.2 Reservoirs and 4.4 Channel Improvements).

In the late 1980's neighboring Lansing and Calumet City constructed small levees on the Little Cal to protect their floodplains. They were successful during subsequent floods, although there were reports of some water splashing over the tops in 1990. In 2016 Lansing invested in extensive floodwall repairs and earthen berm restoration along 1.5 miles of their existing system.

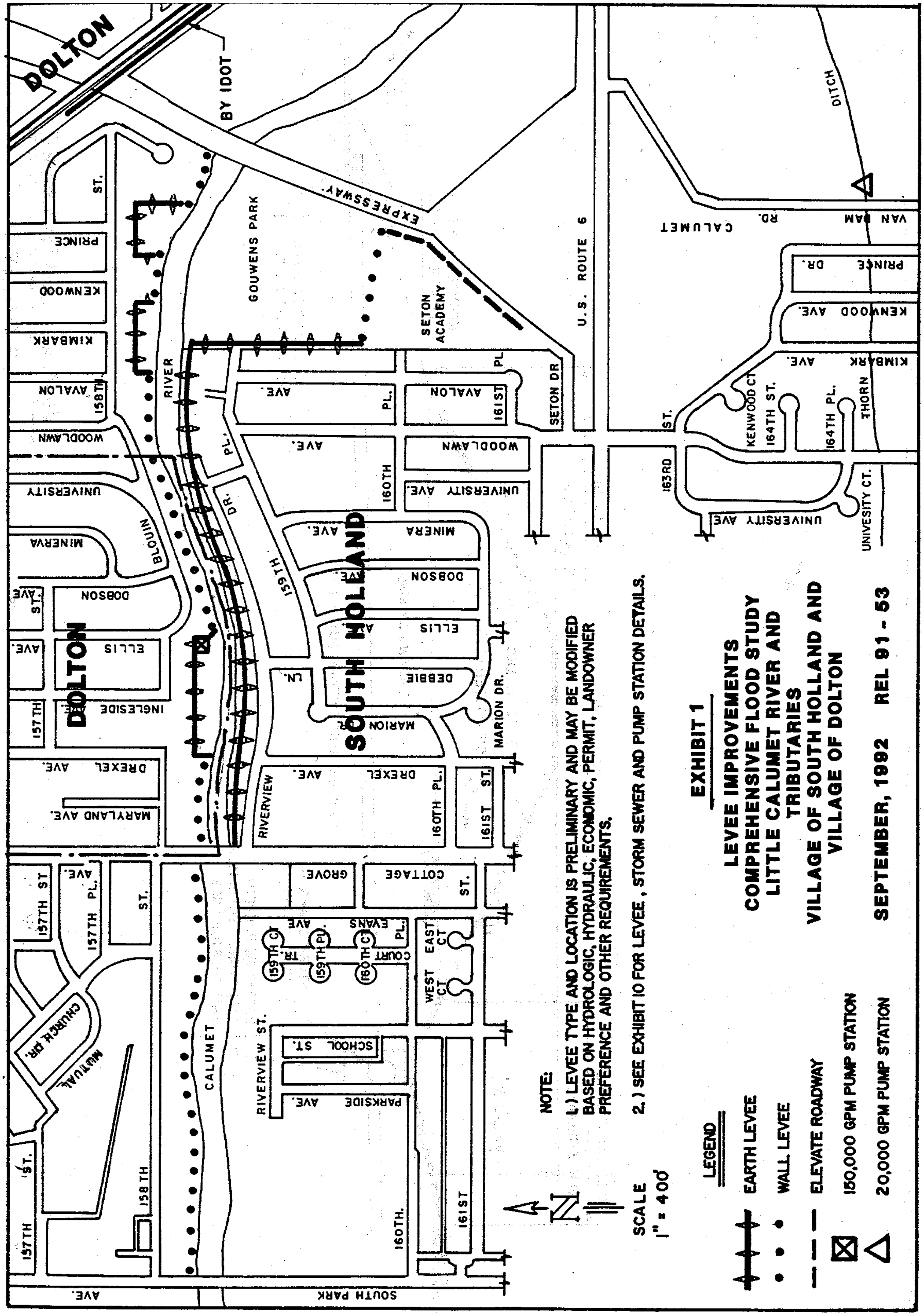
The Illinois Department of Transportation, Division of Water Resources, was planning to assist Dolton with raising an abandoned railroad embankment. The result would act as a levee and protect 80 homes across the Little Calumet River from South Holland. However, this project is not expected to be pursued. As with the Calumet City and Lansing levees, this one would not provide 100-year flood protection.

4.1.3 1992 Levee Proposal: The 1992 Robinson study looked at three levels of levee protection: 500-year, 100-year and 50-year. The most cost effective would be a less than 100-year earthen levee to protect the Riverview Drive residents in South Holland. At its ends, it would be tied to elevated roadways at Cottage Grove and the Calumet Expressway frontage road. Levees and floodwalls (where there is no room for a levee) would protect South Holland and Dolton residents on the north side of the river. The proposed alignment is shown in Figure 4-1.

The proposed levee would protect the areas hardest hit by the 1990 flood from a recurrence of a flood of that level. As seen in Figure 4-1, the plans account for internal drainage and backflow under the levee through the storm sewers. However, the proposal had the following concerns noted by Robinson:

- Many property owners would need to provide easements.
- Lack of room would mandate slow progress and possible removal of porches, decks, etc.
- Some of the natural scenic areas along the river would be altered.
- Permits would be required from many agencies.
- Residents may falsely believe that they are protected from any flood and would not continue to take needed flood protection precautions.
- It would not provide 100-year protection nor would its construction result in a change to the Flood Insurance Rate Map. Flood insurance would still be required as a condition of a loan and floodplain regulations would still be in effect in the protected area.
- The reduction in flood damage could affect the benefit-cost calculations needed to justify the Thornton Transitional Reservoir (see Section 4.2.3). For this reason, it was opposed by the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC).

Figure 4-1 Proposed Levee and Floodwall



Source: Dolton-South Holland Flood Study, Robinson Engineering, Ltd., 1992

The cost of this proposal and related pump stations and backflow gates was estimated to be $5.3 million. There would also be continued maintenance expenses. The benefits derived from the project would be negated when the Thornton Transitional Reservoir was built (see Section 4.2.3). It was calculated that if the Reservoir was built before 2012, then the levee would cost more than it would be worth when only direct economic costs are counted.

4.2 Reservoirs

4.2.1 General: Reservoirs control flooding by holding high flows behind dams or in basins. After the flood peaks, water is let out slowly at a rate that the river can handle. The lake created may provide recreational or water supply benefits and dry basins can double as parks or other open space uses.

Reservoirs are appropriate for protecting existing development without disrupting it. They are most efficient in deeper valleys where there is more room to store water or on smaller rivers where there is less water to store. They are often infeasible in flat areas because so much land is needed.

As with levees and floodwalls, reservoirs usually cost so much that they cannot be built without state or federal aid. There are also continued operation and maintenance costs. Higher dams become safety hazards if poorly maintained or when upstream flood flows exceed design capacity.

4.2.2 Use in the Area: Reservoirs were the most popular recommendation in the 1975 Little Calumet plan. All four of the reservoirs proposed by the plan have been built. One of them, the Edward C. Howell structure in Markham, was completed in 1987. It reduces the flood flows into the Calumet Union Drainage Ditch. It cost $5.6 million.

4.2.3 Thornton Transitional Reservoir: One way to save money on a reservoir is to obtain a storage basin that has already been dug. The Thornton Quarry was proposed for purchase in the 1975 Little Calumet plan. Due to its proximity to Thorn Creek, just upstream of South Holland, it would provide a ready-made storage reservoir. It was the most expensive part of the Little Cal plan with an estimated acquisition and construction cost of over $77 million.

The quarry was subsequently proposed as a storage basin to support the MWRDGC's Deep Tunnel in the U.S. Army Corps of Engineers' Chicago Underflow Plan. The project combined the Little Cal plan's surface flood protection program with the Deep Tunnel sewer system program.

This project was built in several stages by the MWRDGC with funding support from the Corps and the US Natural Resources Conservation Service. The first stage included construction of the Thorn Creek overflow and conveyance system to direct floodwater to the West Lobe of Thornton Quarry. This transitional reservoir came online in 2003 and provides storage of up to 3.1 billion gallons of floodwater. Following a storm event, the reservoir is drained through an 8-foot diameter tunnel for pumping to the Calumet Water Reclamation Plant for treatment and eventual discharge to the Little Calumet River.

Figure 4-2 Thornton Transitional Reservoir

High flows from Thorn Creek flow through a diversion inlet structure, drop 230 feet down a 24-foot diameter shaft, and flow through an 8,000-foot long, 22-foot diameter diversion tunnel into the west lobe reservoir.

The intake structure, normal flow on Thorn Creek

The intake structure, high flow on Thorn Creek

The west lobe of the Thornton Quarry,
home of the Transitional Reservoir

The west lobe, half full of floodwater in 2003

Photos courtesy of MWRDGC

The Thornton Transitional Reservoir provides overbank flood relief for 9 communities and has captured 36 BG of flood water during 56 fill events. The Corps of Engineers estimated that the Thornton Transitional Reservoir would reduce $135,000 average annual damage to $300.

The second stage of this project included the construction of the Thornton Composite Reservoir, a permanent 7.9 billion gallon reservoir, located in the North Lobe of the Thornton Quarry. This reservoir was completed in the fall of 2015 and is estimated to provide $40 million per year in benefits to 556,000 people in 14 communities. In its first year of operation, it captured more than 4.5 BG of polluted water.

4.3 Diversions

4.3.1 General: A diversion is simply a new channel that sends water to a different location. Where a stream runs near a large body of water, such as a lake, the ocean, or a larger river, a diversion of high flows to that body can be a cost-effective flood control measure. Diversions can be surface channels, overflow weirs, or tunnels.

Diversions are limited by topography; they won't work everywhere. The receiving body has to be relatively close to the river and the land in between should be low and vacant. Otherwise, the cost can be prohibitive. Where topography and land use are not favorable, a more expensive tunnel is required.

4.3.2 Use in the Area: The South Suburbs' flatness and numerous ditches make diversions feasible in the watershed. The 1975 Little Calumet plan included two diversion channels to connect ditches to the Cal-Sag channel. However, the projects were replaced by larger storm sewer projects.

4.3.3 1992 Diversion Tunnel Proposal: The 1992 Robinson study looked at a diversion tunnel as an alternative to the levee discussed in Section 4.1.3. Two options were proposed. They would run from the northeast of the Calumet Expressway - 159th Street interchange north to the North Branch of the Little Calumet. The North Branch channel is ten times larger than the South Branch which flows through South Holland so it would be able to absorb the diverted flows. The project would be 12,000 feet long and carry 5,000 cubic feet per second.

The first option would utilize the relatively open area along the Calumet Expressway/Bishop Ford to provide a 4,000-foot surface channel. An 8,000-foot tunnel would be needed to complete the diversion under railroad tracks and other development. The second option would be a 12,000-foot tunnel to minimize disruption to the neighborhoods and make for easier maintenance. In both cases, the tunnels would be 75 feet deep and 25 feet in diameter. Siphons would negate the need for pumps, except to dewater the tunnel for maintenance.

The proposed diversion tunnel had several advantages over the levee:

- There would be less disruption during and after construction.
- It is not prone to catastrophic failure. If it is overloaded, the Little Cal would just continue to rise gradually.
- It would provide protection to Dolton, Calumet City, and Lansing as well as South Holland.

– It would still provide a reserve capacity for high flows after the Thornton Transitional Reservoir is on line.

The major disadvantage of the diversion tunnel was the cost. In 1992, Option 1 was estimated at $19,570,000 and option 2 at $22,060,000. South Holland's share would be $10 million provided the other three communities contributed $10 million. As with the levee proposal, the benefits would exceed the costs only if the Thornton Transitional Reservoir was not operational until 2012.

A second disadvantage of the tunnel proposal was the need for permits from many agencies. This would require a study of the effects of diverting floodwaters to another area, which would increase the cost and, possibly, the complexity of the project.

A third disadvantage was the impact of this project on the Thornton Transitional Reservoir project. The flood damage reduction benefits could have affected the economic justification for the Quarry, reducing the chances that it would be funded. An outside source of funding would be the same as the Thornton Transitional Reservoir's funding sources. The project would, in effect, be competing with another Village flood control priority. For this reason, it was opposed by the Metropolitan Water Reclamation District of Greater Chicago.

4.4 Channel Improvements

<u>4.4.1 General:</u> A channel can be made wider, deeper, straighter, or smoother so it will carry more water and/or carry it downstream faster. Some smaller channels can be lined with concrete or even put in underground pipes. Channel improvements are appropriate for smaller streams and ditches in developed areas, particularly if there is no room for a levee.

"Channel maintenance" is an ongoing program to clean out blockages caused by overgrowth or debris. This work is usually done by a community's public works crew. Communities also pass ordinances prohibiting dumping and making riverfront owners responsible for maintaining their areas.

Dredging is one form of channel maintenance. It is usually cost prohibitive because the dredged material must be air dried and disposed in an approved area somewhere and the river will usually fill back in with sediment in a few years. Dredging is usually conducted only to maintain a navigation channel.

Channel improvements and their continual maintenance can be expensive. They can damage or destroy wildlife habitats and create new erosion problems. Straightening a stream is only temporary because it tries to eliminate meanders and other features that nature will continually work to recreate. Sending water faster downstream may aggravate a flood problem downstream.

<u>4.4.2 Use in the Area:</u> Channel improvements have been implemented on the Little Calumet system since the 1930's. Projects have included dredging various sections of the Little Cal, widening its receiving stream, the Calumet-Sag Channel, and clearing debris by an "army" of volunteers on "clean up day," May 8, 1971. While helpful, the benefits from these projects were relatively short-lived as debris and sediment returned to the channel over the years.

The 1975 Little Calumet plan proposed two channel improvement projects. The first involved two miles of the Calumet Union Drainage ditch, 1.75 miles of channel improvements and 0.25 miles of concrete lining. This project was completed in 1988 at a cost of $4.4 million, most of it borne by the Natural Resources Conservation Service.

The other project was a proposal to clear debris and snags and dredge 4.5 miles of the Little Calumet River in Lansing and Calumet City. It would have cost up to $2 million in state funds. However, after many years of attempting to obtain rights of way from adjacent property owners, the project was dropped. It was designed primarily for environmental and aesthetic improvements and did not have flood control benefits.

The 1986 "Final Project Planning Report" stated "The permitted action will have only a minimal effect (in general, less than 0.3 feet) on lowering flood elevations in the Little Calumet River. The largest reductions in flood elevations were simulated to occur in floods of a two-year recurrence interval or less. Larger floods showed a smaller reduction in flood elevations." (Page VI-6). After many years of attempting to obtain rights of way from adjacent property owners, the project was dropped.

4.4.3 Corps' Clearing and Snagging: The U.S. Army Corps of Engineers' Chicago District looked into interim solutions that would help alleviate flood losses until the Thornton Transitional Reservoir became operational. It proposed a "clearing and snagging" project on the Little Calumet River between Thorn Creek and the northwest Village limits. The project was to remove sediment that collected under bridges and debris that collected in the channel and along the banks.

During the planning process, it was found that the sediment contained materials that would have to be hauled to a special landfill. This increased the project's costs so that they outweighed the benefits. Because of this, the Corps had to stop its involvement in the project.

4.4.4 Stream Maintenance: Unlike the one-time only channel improvement projects, this is a routine, periodic activity to prevent debris and overgrowth from clogging the stream. Individual state permits are not needed provided the maintenance work remains small enough to stay within parameters set by a regional state permit. Stream maintenance has its greatest impact during smaller storms that may go out of bank due to obstructions.

As a participant in the Little Calumet plan, South Holland signed a stream preservation agreement with the Illinois Department of Transportation, Division of Water Resources in 1984. Under the agreement the Village inspects and maintains the channels to reduce flooding and enhance the appearance of the streams. In 2003, this work was turned over to the Department of Natural Resources' Office of Water Resources. Once each year, Village and DNR staff conducted a joint stream preservation maintenance inspection of the Little Calumet River, Thorn Creek, and the Calumet Union Drainage Ditch.

In 2008, MWRDGC began a stream maintenance program that has superseded DNR's. The Village does inspections twice a year and in response to inquiries. If a problem is found, it's reported to MWRDGC which does its own inspection. The Village gets any needed permissions to go on private property. MWRDGC works on the three main stem streams and three ditches.

4.4.5 Cal Union Channel Improvements.

During the late 1990's, the Village constructed a major channel improvement project along the Cal Union Drainage Ditch. By funding a small piece each year, the Village could rework the channel banks for over a third of a mile from State Street to the confluence with the Little Calumet River. Extensive rip rap (large rocks, properly placed) and appropriate ground cover reduce or eliminate channel erosion problems, increase the channel's carrying capacity, and protect neighboring properties from bank erosion.

4.5 Sewer Improvements

4.5.1 General: As discussed in Section 2.5, many South Holland buildings suffer from sewer backup. There are four basic ways to correct this:

1. Make the sewers large enough to handle the excess flows,
2. Provide safe storage for overflows,
3. Seal the leaks that let stormwater into the sanitary system, and
4. Prevent overloaded sewers from backing up into basements.

Each of these approaches has been investigated and each has its own shortcomings. The common problem with all four approaches is the expense. There are 68 miles of sewers under South Holland. To dig them up and replace them with larger pipes would be a tremendous cost. Further, MWRDGC must treat all the water and cannot handle the increased flows that larger pipes would bring.

Storing the excess flows and sealing the leaks are also very expensive alternatives. They are discussed in the next section. The fourth approach, preventing backflow into basements, has been implemented by many property owners through backflow check valves, overhead sewers, and floor drain standpipes. This approach is discussed in more detail in Chapter 4. Property Protection.

4.5.2 ICAP: The Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) is responsible for treating sanitary sewage. It is naturally greatly concerned with infiltration and inflow ("I/I"). MWRDGC has required its communities to participate in an I/I Corrective Action Program, known as "ICAP." A limit of 150 gallons per capita per day was set for the sanitary sewer lines. Anything over that is considered excessive I/I. South Holland's flows were estimated to be ten times that amount.

Accordingly, South Holland began inspecting its sewers for problems. With 68 miles of sanitary sewer, the work proceeded one section of town at a time. The work included televising sewer mains, using dye to check for downspout connections, and even digging up the lines to see what the problems were. The initial findings were reported in 1987 in Village of South Holland Sewer System Evaluation Report, by Robinson Engineering.

The report was updated in 1990. Robinson's surveys found that it was possible to reduce the sewer flows to 611 gallons per capita per day by correcting selected I/I problems. The total cost was estimated to be $4,943,000. Approximately 20% would be borne by property owners and the remaining cost would be shared by the Illinois Environmental Protection Agency and the Village. This project did not include any work on the combined sewers.

By 1992, over 1,500 manholes and numerous sewer main lines had been repaired. Most of the downspout, sump pump and driveway drains had been disconnected by the owners. Additional sewer main work is proposed each year to incrementally reduce the excess flows. However, the 1990 plan included only those projects that were cost effective in reducing I/I. It was projected to lower the flow to 611 gallons per capita per day, short of the MWRDGC's goal of 150. Additional work would cost more than the resulting dollar benefit."

A dependable source of income for this work was initiated by the Village when it added a sewer user charge to its water bills. The results have already been seen. Village staff noticed that there were fewer calls and complaints from residents after the 1992 work. MWRD enacted an I/I Program for communities in 2015, mandating annual reports, evaluation of sanitary sewers, prioritization of repairs, and documentation of work by 2019. The Village of South Holland is complying with this mandate. In 2016 sonar testing was used to evaluate sanitary sewers 18" and larger throughout the Village. This information is the basis for prioritizing repairs on the system.

4.6 Control Gates

4.6.1 General: Many smaller ditches and pipes can have gates or valves installed to keep water from backing up. Some are operated manually but others, such as "flap gates," can be automatic. This prevents a larger river above flood stage from backing floodwater into tributaries or sewer lines. Gates and valves are appropriate for smaller channels and at storm sewer outfall pipes.

Unless there is a pump system installed, the ditch or pipe will not be able to drain. Local rains could then cause upstream flooding. Debris can sometimes get caught in gates and valves, preventing them from closing, thereby making them useless. This can be prevented with proper monitoring and maintenance.

4.6.2 Use in the Area: Automatic duck bill gates were installed for four outfalls into the Little Calumet River along Riverview Drive. A fifth was installed on Thorn Ditch at Van Dam Road or Prince Drive on either side of the Calumet Expressway (Figure 4-3). Thorn Ditch backwater flooding could be prevented by controlling flows at the pipes under the road.

Figure 4-3: Outfall to the Little Cal River

As recommended in the 1994 *Floodplain Management Plan*, the Village Engineer submitted a request to the Department of Natural Resources for funding of the Thorn Ditch backwater valve. After an on-site investigation, IDNR found that there are several other sources of flooding into the area. A backwater valve on Thorn Ditch would not keep the area dry during a flood on Thorn Creek. The project has proved to be cost-prohibitive and was not pursued.

4.7 Runoff Controls

4.7.1 General: The runoff of rain water can be slowed down on the ground by vegetation, terraces, contour plowing, no-till farm practices, and other measures. Delaying surface water on its way to the channel increases infiltration into the soil and controls the loss of topsoil from erosion. These measures are appropriate for steeper slopes, especially in agricultural watersheds.

Runoff controls must be implemented by owners of property far from the flood problem, usually at their expense. They must be done on many properties over a wide area to have an impact.

4.7.2 Use in the Area: The Little Calumet plan has a “land protection program” element which has resulted in most of the watershed’s communities having enacted erosion and sediment control ordinances. These ordinances regulate soil loss from construction projects to minimize sedimentation in channels and reservoirs. Erosion and sediment control and stormwater management regulations are discussed in Chapter 5, Regulations.

The state’s soil and water conservation districts have an ongoing program to encourage farmers to preserve their topsoil using conservation tillage methods, such as no-till planting and other erosion control practices. The Will-South Cook Soil and Water Conservation District estimated that 60% - 70% of the agricultural land in the Little Calumet watershed has some form of conservation tillage or erosion control practice used. Other than the District’s and the development regulations, there is no special runoff control program for the 200 square miles of the Little Calumet watershed.

4.8 Conclusions and Recommendations

4.8.1 Conclusions:

a. After 30 years of planning, searching for funding, and design work, the Thornton Transitional Reservoir came on line in 2003. It provides a great deal of flood protection and resulted in a revised Flood Insurance Rate Map for south Cook County. It does not stop flooding, as the events of September 2008 showed. However, that flood that would have flooded a larger area than the 1990 level had it not been for the Reservoir.

b. Other large scale flood control projects, particularly the levee and the diversion tunnel, proved too expensive and were not pursued.

c. Some small-scale flood control projects, such as clearing and snagging and flap gates on storm sewers, are relatively inexpensive and they provide protection from smaller, more frequent flooding.

d. The stream maintenance program provides benefits in both the appearance and the low flow carrying capacity of the channels.

e. The Village’s programs to reduce overloading of the sanitary sewers (ICAP and I/I) have proceeded well and produced certain benefits. However, 2016 heavy rains resulted in sewer backups into basements, again putting emphasis on the importance of a comprehensive I/I Program.

f. Other approaches to flood control, such as runoff controls, require a great deal of intergovernmental cooperation with other communities throughout the watershed.

4.8.2 Recommendations:

a. The Department of Public Works has updated its approach to stream cleanup to work with current MWRDGC policies that address stream maintenance. Where appropriate, this has included working with volunteer resident groups.

b. The Village should continue to explore alternative property protection measures as discussed in Chapter 7 which are more useful for localized, smaller scale flooding.

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