STORMWATER MASTER PLAN

Prepared for

CITY OF DES PLAINES
1420 MINER STREET
DES PLAINES, IL 60016

July 2003

CBBEL Project No. 02-73

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EXECUTIVE SUMMARY

During the storm event that occurred on October 13, 2001, significant flooding occurred throughout the City of Des Plaines. Because of this storm event, the City of Des Plaines hired Christopher B. Burke Engineering, Ltd. (CBBEL) to prepare a Stormwater Master Plan for 12 problem areas identified by the City staff. The location of the 12 problem areas follows:

- Problem Area #1 – Subdivision located south of Central Avenue, west of Wolf Road and north of Rand Road (Ward 7).
- Problem Area #2 – Radcliffe Avenue between Wisconsin Drive on the north and Cranbrook Drive on the south (Ward 7).
- Problem Area #3 – Subdivision located east of Mt. Prospect Road and north of Golf Road (Ward 7).
- Problem Area #4 – Subdivision located west of Mt. Prospect Road, south of Golf Road and north of Thacker/Dempster Street (Ward 4).
- Problem Area #5 – Leahy Circle East and Leahy Circle South (Ward 3).
- Problem Area #6 – Third Avenue between Thacker/Dempster Street and Algonquin Road (Ward 3).
- Problem Area #7 – Walnut Avenue west of Lee Street (Ward 2).
- Problem Area #8 – Marshall Drive north of Oakton Street (Ward 8).
- Problem Area #9 – Pennsylvania Avenue from Lancaster Lane to Oakton Street (Ward 8).
- Problem Area #10 – Subdivision located north of Touhy Avenue, south of Jarvis Avenue, east of Wolf Road and west of Lake Opeka (Ward 5).
- Problem Area #11 – Spruce Avenue south of Howard Street (Ward 5).
- Problem Area #12 – Washington Street (Ward 1).

The 1986 Stormwater Master Plan presented 24 recommended projects for a 20-year implementation plan. According to City Engineering staff, 17 of the recommended projects have been completed. The remaining projects, which include combined sewer separation and the installation of relief sewers will be completed during scheduled street rehabilitation work.

The City of Des Plaines sent out a Flood Protection Questionnaire to all homeowners. During the October 13, 2001 storm event, the City of Des Plaines Public Works Department received telephone calls reporting basement flooding/sewer backup and street flooding. Tables ES-1 and ES-2 summarized the Flood Protection Questionnaire responses and the telephone calls received by the 12 problem areas, respectively.

The flooding problems were quantified and there causes determined using the information in Tables ES-1 and ES-2, discussions with City staff, site visits, review of available documents and hydrologic and hydraulic modeling.

Table ES-1
Flood Protection Questionnaire Summary

	Number of Respondents											
Problem Area =>	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
Location of Flooding												
Basement Flooding	7	17	16	50	4	0	0	7	0	0	7	0
Crawl Space Flooding	0	1	1	14	0	0	0	2	1	0	6	0
First Floor Flooding	1	0	1	3	1	0	0	1	0	0	1	0
Yard Flooding	0	3	4	12	1	0	0	2	0	2	2	0
No Flooding	3	0	1	12	1	1	0	1	0	1	3	0
Cause of Flooding												
Storm Sewer Backup	5	15	9	44	3	0	0	5	1	0	5	0
Sanitary Sewer Backup	1	13	4	23	2	0	0	1	0	0	3	0
Sump Pump Failure/Power Failure	4	1	2	11	1	0	0	0	0	0	0	0
Basement Wall Seepage	1	4	4	25	2	0	0	2	0	0	5	0
Standing Water Next to House	1	3	1	11	0	0	0	2	0	0	3	0
Overbank Flooding	0	0	9	0	0	0	0	0	0	0	0	0

Table ES-2
October 13, 2001 Storm Event Summary

	Number of Respondents											
Problem Area =>	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
Flooding Type												
Basement Flooding/Sewer Backup	0	4	1	8	1	1	1	3	1	1	0	0
Street Flooding	0	2	5	22	1	7	6	2	1	0	3	0

Based on cause of the flooding problems, flood mitigation projects were developed and analyzed using the hydrologic and hydraulic models. The flood mitigation projects were designed to handle the greater of the 10-year critical duration storm event or the October 13, 2001 storm event. Table ES-3 summarizes for the 12 problem areas the Drainage Problem, Drainage Problem Cause, Flood Mitigation Project and Opinion of Probable Cost. The Opinion of Probable Cost includes a 30% contingency factor and includes an estimate for future engineering fees. Land acquisition costs have not been included in the Opinion of Probable Costs.

The City of Des Plaines has an ongoing program to address reported rear yard flooding problems throughout the City. Using micro-tunneling techniques, new storm sewers are installed in the affected rear yards. Inlets are then installed to allow drainage into the new storm sewers. For the Citywide reported incidents of rear yard flooding, it is estimated the cost of the program would be $1,800,000. The reported rear yard flooding we completed on a yearly basis based on available funds.

The returned Flood Protection Questionnaires indicate that 491 incidences of basement flooding were caused by combined and sanitary sewer backup. This type of flooding can be based addressed by the homeowner. Therefore it is recommended that homeowners be encouraged to install overhead sewers. This measure will significantly reduce the number of reported sewage backup in basements.

The following priority list by problem area was developed based on a weighted ranking for reported structure first floor flooding, street flooding and yard flooding. The structure flooding was assigned a weight of 0.50, whereas the street flooding and yard flooding were assigned a weight of 0.25.

Priority List

Problem Area	Reported Incidences of Flooding			Weighted Score	Opinion of Probable Cost
	Structure	Street	Yard		
4	3	22	33	15.25	$4,815,000-$6,585,000
3	1	5	5	3.00	$1,285,000-$1,655,000
11	1	3	5	2.50	$410,000-$486,000
8&9	1	3	4	2.25	$535,000
2	0	5	3	2.00	$1,065,000-$1,090,000
6	0	7	0	1.75	$205,000
7	0	6	0	1.50	$470,000
5	1	1	1	1.00	$340,000
1	1	0	1	0.75	$70,000-$275,000
10	0	0	2	0.50	$385,000-$1,435,000
12	0	0	0	0.00	$415,000

Table ES-3
Master Stormwater Plan Summary

Problem Area	Drainage Problem	Drainage Problem Cause	Flood Mitigation Project	Design Storm Event	Opinion of Probable Cost
#1	Structure first floor, street, yard and basement flooding on Clayton Lane and Berkshire Lane.	Inadequate overland flow route over existing outlet sewer.	Installation of 24-inch relief sewer parallel to existing 27-inch outlet sewer and additional inlets at the southern end of Clayton Lane. Underground Storage (If required).	10-year, 2-hour	$70,000-$275,000
#2	Basement flooding from sanitary sewer and combined sewer backups, street flooding and rear yard flooding.	The existing 21-inch storm sewer that drains the northern portion of Radcliffe Avenue and the combined sewer that drains the southern portion of Radcliffe Avenue do not have sufficient capacity to convey the runoff from the 10-year, 2-hour storm event.	For the northern portion of Radcliffe Avenue, a 12-inch to 15-inch relief storm sewer is proposed with additional inlets. In addition, 12-inch storm sewers are proposed to replace the existing 10-inch storm sewers that drain rear yards. Underground storage (If required). For the southern portion of Radcliffe Avenue, a 12-inch to 18-inch combined sewer is proposed. This new combined sewer would discharge to a new 24-inch to 27-inch combined sewer along Mt. Prospect Road that will discharge into to the MWRDGC TARP drop shaft near Weller Creek.	10-year, 2-hour 10-year, 2-hour	$255,000-$280,000 $810,000
#3	Basement flooding from sanitary sewer backups caused by street flooding. Rear yards along Cumberland Parkway and Fletcher Drive are subject to overbank flooding from Weller Creek.	Westgate Road and Cumberland Parkway/Warrington Road storm sewers do not have adequate capacity to convey the runoff from the 10-year, 1-hour.	Westgate Road area project involves the installation of a 12-inch storm sewer along Westgate Road north of Fletcher Drive and a 12-inch to 15-inch relief storm sewer parallel to existing Mt. Prospect Road storm sewer. Underground storage (If required). An 18-inch – 36-inch relief storm sewer is proposed to be installed parallel to the existing storm sewer along Warrington Road and Cumberland Parkway. A new outfall to Weller Creek would be installed. A 15-inch to 24-inch relief storm sewer is proposed along Meyer Ct., Warrington Rd., Davis Ct. and Cumberland Parkway. A new outfall is to Weller Creek is proposed. Underground storage (If required).	10-year, 1-hour 10-year, 1-hour	$430,000-$450,000 $855,000-$1,205,000
#4	Basement flooding from sanitary sewer backup caused by street flooding. Yard flooding also reported throughout problem area.	The existing storm sewer system does not have sufficient capacity to convey runoff from an October 13, 2001 storm event.	Alternative 1 – Relief storm sewers (15-inch to 72-inch) are proposed parallel to existing storm sewers with high capacity inlets. Stormwater Storage Basins (If required).	October 13, 2001	$4,815,000-$6,585,000

Problem Area	Drainage Problem	Drainage Problem Cause	Flood Mitigation Project	Design Storm Event	Opinion of Probable Cost
			Alternative 2 – Similar to Alternative except two stormwater basins are proposed within the linear park adjacent to the ComEd Transmission lines. The use of stormwater storage will reduce the diameters of the proposed parallel relief storm sewers. Stormwater Storage Basins (If required).	October 13, 2001	$3,750,000-$5,075,000
#5	Basement, first floor, street and yard flooding	Existing combined sewer system does not have sufficient capacity to convey the October 13, 2001 storm event flows.	A 15-inch to 24-inch relief storm sewer is proposed to be installed along Leahy Circle South and Leahy Circle East that will discharge to the existing 36-inch storm sewer located along Leahy Circle East between Walnut Avenue and Thacker/Dempster Street. Additional high capacity inlets will be installed to reduce levels of street and yard flooding. The existing combined sewer will remain to handle the sanitary flow.	October 13, 2001	$340,000
#6	Street flooding on Third Avenue between Oakwood Avenue and Thacker Street.	No existing storm sewer.	A 21-inch storm sewer is proposed to be installed along Third Avenue from Oakwood Avenue to the existing Thacker Street storm sewer. Inlets will be installed as appropriate.	October 13, 2001	$205,000
#7	Basement flooding and street flooding reported.	Existing storm sewer discharges to existing combined sewer.	A 15-inch to 30-inch storm discharging to existing 120-inch Oakwood Avenue storm sewer.	October 13, 2001	$470,000
#8 & #9	Street flooding on Marshall Drive causes water to spill down the driveways into the below ground level garages. Street flooding at Pennsylvania Avenue/Dover Drive.	Marshall Drive storm sewer has insufficient capacity to convey the runoff from the October 13, 2001 storm event. Pennsylvania Avenue storm sewer does not have adequate capacity to convey the runoff October 13, 2001 storm event due to the surcharging of the Oakton Street storm sewer.	A 30-inch relief storm sewer is proposed along Marshall Drive from Courtesy Lane southward to Wille Road where it will discharge to a new storm sewer being installed by a developer. The new relief storm sewer will outlet to the ditch located along the Northwest Tollway. This ditch discharges to Higgins Creek. Since the Marshall Drive runoff will be removed from the Oakton Street storm sewer system, the Pennsylvania Avenue storm sewer will be able drain better. Additional inlets will be installed along Marshall Drive and Pennsylvania Avenue.	October 13, 2001	$535,000
#10	Street and yard flooding.	There is no main sewer located along Jarvis Avenue that would serve the area to the south.	Installed a new main 18-inch to 27-inch storm sewer along Jarvis Avenue form Elmira Avenue to Lake Opeka. As the streets located south of Jarvis Avenue are reconstructed with a curb/gutter cross-section, the new street storm sewers can discharge to the proposed Jarvis Avenue main storm sewer. Underground storage (If required).	October 13, 2001	$385,000-$1,435,000

Problem Area	Drainage Problem	Drainage Problem Cause	Flood Mitigation Project	Design Storm Event	Opinion of Probable Cost
#11	Basement, crawl space, first floor, yard and street flooding reported.	No Spruce Street storm sewer is located south of Fargo Avenue and the existing Spruce Street combined sewer located between Fargo Avenue and Howard Street has inadequate capacity to convey the runoff from the 10-year, 1-hour.	A 21-inch to 24-inch relief storm sewer is proposed along Fargo Avenue from Spruce Avenue to Lake Opeka. A 15-inch storm sewer will be installed along Spruce Street from a point 200 feet north of Fargo Avenue. This storm sewer will drain to the proposed Fargo Avenue relief storm sewer. A 12-inch to 15-inch storm sewer will be installed along the portion of Spruce Street located south of Fargo Avenue. This storm sewer will also drain to the proposed Fargo Avenue relief storm sewer. Inlets to the proposed storm sewer and relief storm sewer will be installed as required. Underground storage (If required). The combined sewer area of Spruce Avenue located between Fargo Avenue and Howard Street will be separated. A 12-inch to 21-inch storm sewer will be installed along Spruce Avenue and will discharge to the existing Howard Street storm sewer.	10-year, 1-hour 10-year, 1-hour	$240,000-$316,000 $170,000
#12	Flooding of below level garages along Washington Street.	Existing Washington Street storm sewer has inadequate capacity to convey the runoff from the 10-year, 1-hour storm event.	A 24-inch relief storm sewer is proposed along Washington Street, Laurel Avenue and Perry Street outleting to the existing relief storm sewer located at Graceland Avenue. High capacity Inlets will be installed were needed.	10-year, 1-hour	$415,000
	Reported Citywide yard flooding.	No existing drainage system and blocked overland flow routes.	Using microtunneling, new storm sewers with inlets installed.		$1,800,000
TOTAL					$10,730,000-$15,291,000

INTRODUCTION

In 2001, the City of Des Plaines experienced three storm events that resulted in flooding in various areas of the City. The October 13, 2001 storm event, which produced approximately 3.8-inches of rainfall during a 3-4 hour period, produced significant flooding throughout the City. During the October 2001 event, the City's Public Works and Engineering Departments were very active in responding to telephone calls from distressed residents and implementing emergency measures to help reduce local flooding throughout the City. Because of the saturated soil conditions from small rains during the previous 72-hours, the runoff entering most storm sewers was greater than expected and exceeded the sewer's capacity and resulted in surcharging, manhole lids popping, numerous street and backyard flooding. The 1986 Stormwater Master Plan presented 24 recommended projects with a 20-year implementation plan. The City of Des Plaines has completed 17 of the recommended projects. The remaining projects, which include combined sewer separation and the installation of relief storm sewers will be completed during scheduled street rehabilitation work. Because of this storm and previous historical flooding in the City, the City has decided to update the 1986 plan to identify new problem areas, revisit the projects recommended in the 1986 plan, assess the cause of any new problems, and recommend possible solutions.

As a result of their efforts and observations during that evening, the city identified and targeted 12 areas that this new study should focus on. On March 8, 2002, the City hired Christopher B. Burke Engineering, Ltd. (CBBEL) to update the 1986 Stormwater Master Plan by studying 12 City identified problem areas. This report documents for each problem area the location, Flood Protection Questionnaire results, existing drainage patterns, drainage problems, cause(s) of the drainage problems and the development of mitigation measures. The mitigation measures were designed to handle the October 13, 2001 storm event rainfall, which for most of the problem areas is greater than the 10-year, critical duration design storm event. During the August 22, 2002 storm event CBBEL visited the problem areas to document any observed street flooding. The O'Hare International Airport precipitation gage recorded 4.5-inches of rain over a nine hour period during this storm event. A majority of the rainfall occurred during a 6-hour period.

FLOODING PROBLEM INVENTORY AND ASSESSMENT

The City of Des Plaines sent out a Flood Protection Questionnaire to all homeowners. The Flood Protection Questionnaire, which is attached, requested information from the homeowner including the years flooding occurred, where the water was and the depth, what caused the flooding and what type of flood protection measures have been installed. The City received 697 completed Flood Protection Questionnaires. Table 1 summarizes the returned Flood Protection Questionnaire

results.

Table 1
Flood Protection Questionnaire Summary

Location of Flooding	Number of Respondents
Basement Flooding	452
Crawl Space Flooding	107
First Floor Flooding	29
Yard Flooding	120
No Flooding	155
Cause of Flooding	
Storm Sewer Backup	311
Sanitary Sewer Backup	180
Sump Pump Failure/Power Failure	86
Basement Wall Seepage	180
Standing Water Next to House	98
Overbank Flooding	73

Exhibit 1 shows the general location of the flood protection questionnaire reported flooding problems.

Table 2 summarizes the basement flooding/sewer backup and street-flooding telephone calls the City of Des Plaines Public Works Department received during the October 13, 2001 storm event.

Table 2
October 13, 2001 Storm Event Complaint Telephone Calls

Flooding Type	Number of Respondents
Basement Flooding/Sewer Backup	87
Street Flooding	146

EXHIBIT 1

PROBLEM AREA #1

Location

Problem Area #1 is located south of Central Road, west of Wolf Road and north of Rand Road.

Flood Protection Questionnaire

The results of the returned Flood Protection Questionnaires are summarized in Table 3. Exhibit 2 shows the location of the reported drainage problems within Problem Area #1.

Table 3
Problem Area #1 Flood Protection Questionnaire Summary

Location of Flooding	Number of Respondents
Basement Flooding	7
Crawl Space Flooding	0
First Floor Flooding	1
Yard Flooding	0
No Flooding	3
Cause of Flooding	
Storm Sewer Backup	5
Sanitary Sewer Backup	1
Sump Pump Failure/Power Failure	4
Basement Wall Seepage	1
Standing Water Next to House	1
Overbank Flooding	0

Table 4 summarizes basement flooding/sewer backup and street flooding telephone calls that the City of Des Plaines Public Works Department received during the October 13, 2001 storm event for Problem Area #1.

Table 4
Problem Area #1 October 13, 2001 Storm Event Summary

Flooding Type	Number of Respondents
Basement Flooding/Sewer Backup	0
Street Flooding	0

EXHIBIT 2

Existing Drainage Pattern

The surface runoff from Nelson Lane, Jon Lane, Patricia Lane and Berkshire Lane is conveyed westward to Clayton Lane via storm sewers and overland flow. At the southern end of Clayton Lane, two catchbasins collect the overland flow. A 27-inch storm sewer conveys the collected flow westward and then southward to a 54-inch storm sewer located along Rand Road. A portion of the Tracy Terrace surface runoff that is collected by two catchbasins is conveyed by 12-inch storm sewer northward into an underground detention storage facility located in the rear yard of 400 & 404 Tracy Terrace. The 1977 engineering plans for the Windy Point subdivision prepared by Fletcher Engineering Co., indicate a restrictor was placed at the outlet of the underground detention storage facility. The outflow from the underground detention storage facility also enters the 27-inch storm sewer located at the southern end of Clayton Lane.

Drainage Problem

Surface runoff collects in Clayton Lane at its southern dead end resulting in street inundation northward to Berkshire Lane. South of the Clayton Lane is Sioux Park. The returned Flood Protection Questionnaires reported basement flooding for homes along Clayton Lane and Berkshire Lane caused by storm sewer backup and sump pump/ power failure.

Drainage Problem Causes

The results of the returned Flood Protection Questionnaires, a field reconnaissance of the problem area and hydrologic and hydraulic calculations were used to determine the cause of the drainage problem. The southern end of Clayton Lane is a “bowl” were surface runoff can collect because there is an inadequate overland flow route. Once the catchbasins and or the storm sewer reach capacity, surface runoff will pond in this “bowl” resulting in street flooding that causes sewer backup into basements.

PROBLEM AREA #2

Location

Radcliffe Avenue between Wisconsin Drive on the north and Cranbrook Drive on the south.

Flood Protection Questionnaire

The results of the returned Flood Protection Questionnaires are summarized in Table 5. Exhibit 3 shows the location of the reported drainage problems within Problem Area #2.

Table 5
Problem Area #2 Flood Protection Questionnaire Summary

Location of Flooding	Number of Respondents
Basement Flooding	17
Crawl Space Flooding	1
First Floor Flooding	0
Yard Flooding	3
No Flooding	0
Cause of Flooding	
Storm Sewer Backup	15
Sanitary Sewer Backup	13
Sump Pump/Power Failure	1
Basement Wall Seepage	4
Standing Water Next to House	3
Overbank Flooding	0

Table 6 summarizes basement flooding/sewer backup and street flooding telephone calls that the City of Des Plaines Public Works Department received during the October 13, 2001 storm event for Problem Area #2.

Table 6
Problem Area #2 October 13, 2001 Storm Event Summary

Flooding Type	Number of Respondents
Basement Flooding/Sewer Backup	4
Street Flooding	2

EXHIBIT 3

Existing Drainage Pattern

A portion of Radcliffe Avenue drains north and another portion drains south. For the area draining north, Radcliffe Avenue drains northward from a point north of Princeton Street to Wisconsin Drive. Midway between Princeton Street and Harvard Street there are two catchbasins on the west and east sides of Radcliffe Avenue. These catchbasins collect the tributary surface runoff into a 12-inch storm sewer. Another 12-inch storm sewer from the west conveys rear yard flows to this point. The Radcliffe Avenue 12-inch storm sewer drains northward changing to a 21-inch storm sewer at Harvard Street. At the Radcliffe Avenue/Harvard Street intersection, four catchbasins collect surface runoff into the storm sewer. Two catchbasins are located at the Radcliffe Avenue/Wisconsin Drive intersection. The City's Sanitary and Storm Sewer Map shows additional 12-inch storm sewers that convey rear yard surface runoff from the homes located on the west side of Radcliffe Avenue between Harvard Street and Wisconsin Drive. The Radcliffe Avenue 21-inch storm sewer discharges to the west to east flowing 24-inch storm sewer on Wisconsin Drive. This storm sewer eventually discharges to the 54-inch Rand Road storm sewer.

For the area draining south, Radcliffe Avenue drains southward from a point north of Princeton Street to Cranbrook Drive through an 18-inch combined sewer according to the City's Sanitary and Storm Sewer Map. A 21-inch combined sewer along Cranbrook Drive conveys the collected flow westward to a 27-inch combined sewer flowing north to south located along Mt. Prospect Road. A portion of Princeton Street flows into the Radcliffe Avenue combined sewer. A catchbasin is located at the southeast corner of the Princeton Street/Radcliffe Avenue intersection. Two catchbasins are north of Cranbrook Street on the east and west sides of Radcliffe Avenue. A catchbasin is also located at the northeast corner of the Cranbrook Street/Radcliffe Avenue intersection. These four catchbasins are the only way that Radcliffe Avenue surface runoff can enter the combined sewer system.

Drainage Problem

The properties on the eastern side of Radcliffe Avenue between Harvard Street and Wisconsin Drive report basement flooding from storm sewer and sanitary sewer backup. Yard flooding was also reported on the west side of Radcliffe Avenue from Princeton Street northward past Harvard Street. Basement flooding caused by the surcharging of the combined sewer was reported for homes along Radcliffe Avenue between Cranbrook Street and Princeton Street. Basement flooding was also reported along the eastside of Mt. Prospect Road. During the October 13, 2001 storm event, basement backup and street flooding was reported along Radcliffe Avenue and Mt. Prospect Road.

Drainage Problem Causes

The results of the returned Flood Protection Questionnaires, a field reconnaissance of the problem area and hydrologic and hydraulic modeling were used to determine the cause of the drainage problem. The 21-inch storm sewer along the northern portion of Radcliffe Avenue does not have sufficient capacity to convey the tributary flow generated by 10-year, 2-hour storm event. This results in street inundation at the location of the catchbasins causing the basement flooding of adjacent homes. The combined sewer system that serves the southern portion of the Radcliffe Avenue also does not have sufficient capacity to convey the tributary runoff generated by a 10-year, 2-hour storm event.

PROBLEM AREA #3

Location

The problem area is located east of Mt. Prospect Road, south of Northwest Highway and north of Golf Road. Streets within this subdivision include Warrington Road, Meyer Court, Davis Court, Cumberland Parkway, Fletcher Drive and Westgate Road.

Flood Protection Questionnaire

The results of the returned Flood Protection Questionnaires are summarized in Table 7. Exhibit 4 shows the location of the reported drainage problems within Problem Area #3.

Table 7
Problem Area #3 Flood Protection Questionnaire Summary

Location of Flooding	Number of Respondents
Basement Flooding	16
Crawl Space Flooding	1
First Floor Flooding	1
Yard Flooding	4
No Flooding	1
Cause of Flooding	
Storm Sewer Backup	9
Sanitary Sewer Backup	4
Sump Pump/Power Failure	2
Basement Wall Seepage	4
Standing Water Next to House	1
Overbank Flooding	9

Table 8 summarizes basement flooding/sewer backup and street flooding telephone calls that the City of Des Plaines Public Works Department received during the October 13, 2001 storm event for Problem Area #3.

Table 8
Problem Area #3 October 13, 2001 Storm Event Summary

Flooding Type	Number of Respondents
Basement Flooding/Sewer Backup	1
Street Flooding	5

Existing Drainage Pattern

This subdivision drains to Weller Creek, which is a tributary of the Des Plaines River, through two outfalls according to the City's Sanitary and Storm Sewer Map. Westgate Road drains north to south towards Weller Creek. The street is served by a 12-inch to 15-inch storm sewer, which discharges to an 18-inch storm sewer flowing east to west located along Fletcher Drive. The 18-inch storm sewer connects to a 30-inch storm sewer flowing south near Mt. Prospect Road. This storm sewer outfall is to Weller Creek. Warrington Road, Meyers Court, Davis Court and Cumberland Parkway drain by storm sewers and overland flow to the Cumberland Parkway/Davis Court intersection. The storm sewers vary in diameter from 10-inch to 15-inch. The surface runoff collected at the Cumberland Parkway/Davis Court intersection is discharged to Weller Creek through a 24-inch storm sewer according to the City's Sanitary and Storm Sewer Map.

Drainage Problem

The drainage problems reported within this problem area include overbank flooding associated with Weller Creek and basement flooding caused by storm sewer and sanitary sewer backup. During the August 22, 2002 storm event a portion of Warrington Road was inundated between Cumberland Parkway and Davis Court. During the October 13, 2001 storm event, street flooding was reported on Warrington Road, Westgate Road, and Cumberland Parkway.

Drainage Problem Causes

The results of the returned Flood Protection Questionnaire, a field reconnaissance of the problem area and hydrologic and hydraulic modeling were used to determine the cause of the drainage problem. The upper portion of the Cumberland Parkway storm sewer system does not have adequate capacity to convey the runoff from the 10-year, 1-hour storm event. The Westgate Road storm sewer system also has inadequate capacity to convey the 10-year, 1-hour storm event. The rear yards of homes along Cumberland Parkway and Fletcher Drive are subject to overbank flooding from Weller Creek.

EXHIBIT 4

PROBLEM AREA #4

Location

The problem area is located east of Elmhurst Road, west of Mt. Prospect Road, south of Golf Road and north of Dempster Street. Streets within this subdivision include Ambleside Drive, Bennett Lane, Beau Drive, Bell Drive, Bradley Street, Brentwood Drive, Cavan Lane, Dara James Road, Debra Drive, Dulles Road, Easy Street, Kathleen Drive, Lance Drive, Lawn Lane, Leahy Circle East, Marshall Street, Millers Road, Norman Court, Sandy Lane, Westmere Road, and Wilkins Drive.

Flood Protection Questionnaire

The results of the returned Flood Protection Questionnaires are summarized in Table 9. Exhibit 5 shows the location of the reported drainage problems within Problem Area #4.

Table 9
Problem Area #4 Flood Protection Questionnaire Summary

Location of Flooding	Number of Respondents
Basement Flooding	50
Crawl Space Flooding	14
First Floor Flooding	3
Yard Flooding	12
No Flooding	12
Cause of Flooding	
Storm Sewer Backup	44
Sanitary Sewer Backup	23
Sump Pump/Power Failure	11
Basement Wall Seepage	25
Standing Water Next to House	11
Overbank Flooding	0

Table 10 summarizes basement flooding/sewer backup and street flooding telephone calls that the City of Des Plaines Public Works Department received during the October 13, 2001 storm event for Problem Area #4.

Table 10
Problem Area #4 October 13, 2001 Storm Event Summary

Flooding Type	Number of Respondents
Basement Flooding/Sewer Backup	8
Street Flooding	22

Existing Drainage Pattern

The main storm sewer for this subdivision is located along Millers Road and flows west to east. The Millers Road storm sewer diameter varies from 12- to 48-inch when it reaches Mt. Prospect Road. The flow is then conveyed northward in the 48-inch Mt. Prospect storm sewer until it turns eastward in a 60-inch storm sewer, which discharges to Weller Creek. Located on Beau Drive, Marshall Street, Dara James Road and Leahy Circle are submain storm sewers with diameters of 36-inch, 34-inch, 21-inch and 24-inch, respectively that discharge to the Millers Road main storm sewer from the north and from the south.

Drainage Problem

Basement flooding caused by storm sewer and sanitary sewer backup have been reported throughout the problem area. During the October 13, 2001 storm event street flooding was reported on many of the streets within the subdivision (Ambelside Road, Bradley Street, Beau Drive, Debra Drive, Easy Street, Kathleen Drive, Lance Drive, Leahy Circle East, Marshall Drive, Millers Road, Sandy Lane, and Westmere Road resulting in basement and yard flooding to various degrees.

Drainage Problem Causes

The results of the returned Flood Protection Questionnaires, a field reconnaissance of the problem area and hydrologic and hydraulic modeling were used to determine the cause of the drainage problem. The hydrologic and hydraulic modeling indicates that over 420 acres are drained by the Millers Road storm sewer system. The submains and main storm sewer system has conveyance capacity less than the surface runoff from the October 13, 2001 historic storm event. The storm sewer diameters that drain to the various submain storm sewers range from 12-inch to 36-inch. In addition to the limited capacity of the Millers Road storm system (conveyance capacity is inadequate to handle the runoff from the October 13, 2001 historic storm event), there are a limited number of catchbasins that allow the surface runoff to enter the storm sewer system. A typical catchbasin has limited inflow capacity that can be severely impacted by debris blockage (i.e. leafs, etc.).

EXHIBIT 5

PROBLEM AREA #5

Location

The problem area is Leahy Circle East and Leahy Circle South located south of Thacker Street and west of Mt. Prospect Road.

Flood Protection Questionnaire

The results of the returned Flood Protection Questionnaires are summarized in Table 11. Exhibit 6 shows the location of the reported drainage problems within Problem Area #5.

Table 11
Problem Area #5 Flood Protection Questionnaire Summary

Location of Flooding	Number of Respondents
Basement Flooding	4
Crawl Space Flooding	0
First Floor Flooding	1
Yard Flooding	1
No Flooding	1
Cause of Flooding	
Storm Sewer Backup	3
Sanitary Sewer Backup	2
Sump Pump/Power Failure	1
Basement Wall Seepage	2
Standing Water Next to House	0
Overbank Flooding	0

Table 12 summarizes basement flooding/sewer backup and street flooding telephone calls that the City of Des Plaines Public Works Department received during the October 13, 2001 storm event for Problem Area #5.

Table 12
Problem Area #5 October 13, 2001 Storm Event Summary

Flooding Type	Number of Respondents
Basement Flooding/Sewer Backup	1
Street Flooding	1

EXHIBIT 6

Existing Drainage Pattern

The City's Sanitary and Storm Sewer Map indicates that a 36-inch storm sewer that connects to a storm sewer along Thacker Street drains Leahy Circle East between Walnut Avenue and Thacker Street. Leahy Circle East south of Walnut Avenue is served by an 8-inch to a 36-inch combined sewer that connects to a 42-inch combined sewer located along Thacker Street. The 42-inch combined sewer flows northward on Mt. Prospect Road to the MWRDGC Interceptor Sewer located on the north side of Weller Creek. Leahy Circle South is drained by an 8-inch combined sewer to a 15-inch combined sewer located on Stark Place, which connects to an 18-inch combined sewer located on Anderson Terrace, and then connects to a 30-inch combined sewer on Kincaid Court, which drains to the 33-inch combined sewer located on Leahy Circle East.

Drainage Problem

The returned Flood Protection Questionnaires indicate basement, first floor and yard flooding caused by combined sewer backup. During the August 22, 2002 storm event, Leahy Circle South was inundated west of Stark Place.

Drainage Problem Cause

The results of the returned Flood Protection Questionnaires, a field reconnaissance of the problem area and hydrologic and hydraulic modeling indicates that the Leahy Circle East combined sewer system conveyance capacity is less than the surface runoff from the October 13, 2001 historic storm event. There are a limited number of catchbasins that allow the surface runoff to enter the combined sewer system. A typical catchbasin has limited inflow capacity that can be severely impacted by debris blockage (i.e. leafs, etc.).

PROBLEM AREA #6

Location

The problem area is located on Third Avenue between Thacker Street and Algonquin Road.

Flood Protection Questionnaire

The results of the returned Flood Protection Questionnaires are summarized in Table 13. Exhibit 7 shows the location of the reported drainage problems within Problem Area #6.

Table 13
Problem Area #6 Flood Protection Questionnaire Summary

Location of Flooding	Number of Respondents
Basement Flooding	0
Crawl Space Flooding	0
First Floor Flooding	0
Yard Flooding	0
No Flooding	1
Cause of Flooding	
Storm Sewer Backup	0
Sanitary Sewer Backup	0
Sump Pump/Power Failure	0
Basement Wall Seepage	0
Standing Water Next to House	0
Overbank Flooding	0

Table 14 summarizes basement flooding/sewer backup and street flooding telephone calls that the City of Des Plaines Public Works Department received during the October 13, 2001 storm event for Problem Area #6.

Table 14
Problem Area #6 October 13, 2001 Storm Event Summary

Flooding Type	Number of Respondents
Basement Flooding/Sewer Backup	1
Street Flooding	7

EXHIBIT 7

Existing Drainage Pattern

Third Avenue from Algonquin Road to a point south of Oakwood Avenue drains to a storm sewer system that varies in diameter from 10-inch to 15-inch. The Third Avenue storm sewer conveys flows to the Walnut Street 18-inch to 24-inch storm sewer flowing west to east eventually discharging to a 24-inch combined sewer at Lee Street according to the City's Sanitary and Storm Sewer Map. The northern portion of Third Avenue from a point south of Oakwood Avenue to Thacker Street drains via a combined sewer 12-inch combined sewer whose flow eventually discharges to the MWRDGC Interceptor Sewer located along River Road.

Drainage Problems

No responses from the Flood Protection Questionnaire reported flooding along Third Avenue. During the October 13, 2001 storm event, The City of Des Plaines Public Works Department received one report of basement flooding and street flooding. During the August 22, storm event, Third Avenue between Thacker Street and Oakwood Avenue was flooded. During this storm event the Third Avenue storm sewer that connects to the Walnut Street storm sewer was conveying the tributary runoff with minor ponding above the catchbasins.

Drainage Problem Causes

Because the northern portion of Third Avenue has no storm sewer system, street flooding results. The Third Avenue storm sewer system near the Third Avenue/Walnut Avenue intersection has high capacity inlets installed that can handle the tributary surface runoff.

PROBLEM AREA #7

Location

The problem area is located on Walnut Avenue west of Lee Street.

Flood Protection Questionnaire

The results of the returned Flood Protection Questionnaires are summarized in Table 15. Exhibit 7 shows the location of the reported drainage problems within Problem Area #7.

Table 15
Problem Area #7 Flood Protection Questionnaire Summary

Location of Flooding	Number of Respondents
Basement Flooding	0
Crawl Space Flooding	0
First Floor Flooding	0
Yard Flooding	0
No Flooding	0
Cause of Flooding	
Storm Sewer Backup	0
Sanitary Sewer Backup	0
Sump Pump/Power Failure	0
Basement Wall Seepage	0
Standing Water Next to House	0
Overbank Flooding	0

Table 16 summarizes basement flooding/sewer backup and street flooding telephone calls that the City of Des Plaines Public Works Department received during the October 13, 2001 storm event for Problem Area #7.

Table 16
Problem Area #7 October 13, 2001 Storm Event Summary

Flooding Type	Number of Respondents
Basement Flooding/Sewer Backup	1
Street Flooding	6

EXHIBIT 8

Existing Drainage Pattern

A 24-inch storm sewer flowing west to east along Walnut Avenue discharges to a 24-inch combined sewer at Lee/Mannheim Road Street. An 18-inch combined sewer flowing west to east discharges to the 24-inch combined sewer at Lee/Mannheim Road Street.

Drainage Problem

During the October 13, 2001 storm event, basement flooding from sewer backup was reported at two locations on Walnut Avenue between Jeanette Street an Lee/Mannheim Road.

Drainage Problem Causes

The receiving 24-inch combined sewer does not have sufficient capacity to handle the Walnut Avenue storm sewer flow causing the reported surcharging.

PROBLEM AREA #8

Location

The problem area is located on Marshall Drive north of Oakton Street.

Flood Protection Questionnaire

The results of the returned Flood Protection Questionnaire are summarized in Table 17. Exhibit 9 shows the location of the reported drainage problems within Problem Area #8.

Table 17
Problem Area #8 Flood Protection Questionnaire Summary

Location of Flooding	Number of Respondents
Basement Flooding	7
Crawl Space Flooding	2
First Floor Flooding	1
Yard Flooding	2
No Flooding	1
Cause of Flooding	
Storm Sewer Backup	5
Sanitary Sewer Backup	1
Sump Pump/Power Failure	0
Basement Wall Seepage	2
Standing Water Next to House	2
Overbank Flooding	0

Table 18 summarizes basement flooding/sewer backup and street flooding telephone calls that the City of Des Plaines Public Works Department received during the October 13, 2001 storm event for Problem Area #8.

Table 18
Problem Area #8 October 13, 2001 Storm Event Summary

Flooding Type	Number of Respondents
Basement Flooding/Sewer Backup	3
Street Flooding	2

EXHIBIT 9

Existing Drainage Pattern

An 18-inch to 24-inch storm sewer flowing north to south drains Marshall Drive to a 48-inch storm sewer flowing west to east located along Oakton Street. The 48-inch storm sewer discharges to the Oakton Street detention facility that is located south of the Oakton Street/Pennsylvania Avenue intersection.

Drainage Problems

During the October 13, 2001 storm event, the City of Des Plaines received complaints from residents that live along this portion of Marshall Drive of street flooding and basement flooding. Specifically, Marshall Drive flooded and spilled down driveways with below grade garages. The residents have attempted to control the flooding by installing back up or a second sump pump and other flood control measures such as temporary stop logs at the high point of the driveway.

Drainage Problems Causes

The results of the returned Flood Protection Questionnaires, a field reconnaissance of the problem area and hydrologic and hydraulic modeling it was determined that the existing Marshall Drive storm sewer has insufficient capacity to convey the tributary October 13, 2001 historic storm event runoff.

PROBLEM AREA #9

Location

The problem area consists of Pennsylvania Avenue from Lancaster Lane to Oakton Street.

Flood Protection Questionnaire

The results of the returned Flood Protection Questionnaires are summarized in Table 19. Exhibit 9 shows the location of the reported drainage problems within Problem Area #9.

Table 19
Problem Area #9 Flood Protection Questionnaire Summary

Location of Flooding	Number of Respondents
Basement Flooding	0
Crawl Space Flooding	1
First Floor Flooding	0
Yard Flooding	0
No Flooding	0
Cause of Flooding	
Storm Sewer Backup	1
Sanitary Sewer Backup	0
Sump Pump/Power Failure	0
Basement Wall Seepage	0
Standing Water Next to House	0
Overbank Flooding	0

Table 20 summarizes basement flooding/sewer backup and street flooding telephone calls that the City of Des Plaines Public Works Department received during the October 13, 2001 storm event for Problem Area #9.

Table 20
Problem Area #9 October 13, 2001 Storm Event Summary

Flooding Type	Number of Respondents
Basement Flooding/Sewer Backup	1
Street Flooding	1

EXHIBIT 10

Existing Drainage Pattern

The tributary runoff is conveyed southward to the Oakton Street detention facility through a 42-inch to 48-inch storm sewer located along Pennsylvania Avenue.

Drainage Problems

During the October 13, 2001 storm event, street flooding was reported at the Pennsylvania Avenue/Dover Drive intersection.

Drainage Problems Causes

The results of the returned Flood Protection Questionnaires, a field reconnaissance of the problem area and hydrologic and hydraulic modeling it was determined that the Pennsylvania Avenue storm sewer does not have adequate capacity to convey the October 13, 2001 historic storm event runoff.

PROBLEM AREA #10

Location

The problem area is located north of Touhy Avenue, west of Lake Opeka, east of Wolf Road and south of Jarvis Avenue. Streets within this area include Elmira Avenue, Sprucewood Avenue, Jarlath Avenue, Jarvis Avenue, Douglas Avenue, Westview Drive, Webster Lane and Eastview Drive.

Flood Protection Questionnaire

The results of the returned Flood Protection Questionnaires are summarized in Table 21. Exhibit 11 shows the location of the reported drainage problems within Problem Area #10.

Table 21
Problem Area #10 Flood Protection Questionnaire Summary

Location of Flooding	Number of Respondents
Basement Flooding	0
Crawl Space Flooding	0
First Floor Flooding	0
Yard Flooding	2
No Flooding	1
Cause of Flooding	
Storm Sewer Backup	0
Sanitary Sewer Backup	0
Sump Pump/Power Failure	0
Basement Wall Seepage	0
Standing Water Next to House	0
Overbank Flooding	0

Table 22 summarizes basement flooding/sewer backup and street flooding telephone calls that the City of Des Plaines Public Works Department received during the October 13, 2001 storm event for Problem Area #10.

Table 22
Problem Area #10 October 13, 2001 Storm Event Summary

Flooding Type	Number of Respondents
Basement Flooding/Sewer Backup	1
Street Flooding	0

Existing Drainage Pattern

The streets in this area have a rural section with no gutters but with grass swales along the roadside. Some small diameter (12-inch & 15-inch) storm sewers drain some of the streets northward to the Jarvis Avenue storm sewer, which conveys surface runoff eastward into Lake Opeka. The Jarvis Avenue storm sewer also conveys the surface runoff captured by storm sewers for the area north of the road. A portion of the area drains southward to Touhy Avenue.

Drainage Problems

The reported drainage problems include inundation at low areas along the streets.

Drainage Problem Causes

The results of the returned Flood Protection Questionnaires, a field reconnaissance of the problem area and hydrologic and hydraulic modeling was used to assist in drainage problem assessment. The area is undergoing redevelopment. Older homes are being demolished and newer homes being constructed resulting in the need to install appropriate drainage systems.

EXHIBIT 11

PROBLEM AREA #11

Location

The problem area is located on Spruce Avenue south of Howard Street.

Flood Protection Questionnaire

The results of the returned Flood Protection Questionnaires are summarized in Table 23. Exhibit 12 shows the location of the reported drainage problems within Problem Area #11.

Table 23
Problem Area #11 Flood Protection Questionnaire Summary

Location of Flooding	Number of Respondents
Basement Flooding	7
Crawl Space Flooding	6
First Floor Flooding	1
Yard Flooding	2
No Flooding	3
Cause of Flooding	
Storm Sewer Backup	5
Sanitary Sewer Backup	3
Sump Pump/Power Failure	0
Basement Wall Seepage	5
Standing Water Next to House	3
Overbank Flooding	0

Table 24 summarizes basement flooding/sewer backup and street flooding telephone calls that the City of Des Plaines Public Works Department received during the October 13, 2001 storm event for Problem Area #11.

Table 24
Problem Area #11 October 13, 2001 Storm Event Summary

Flooding Type	Number of Respondents
Basement Flooding/Sewer Backup	0
Street Flooding	3

EXHIBIT 12

Existing Drainage Pattern

A 12-inch to 15-inch storm sewer serves Fargo Avenue from Ash Street to Lake Opeka where the conveyed stormwater is discharged. The portion of Spruce Street located south of Fargo Avenue has no storm sewer system or inlets. Surface runoff flows northward along the gutters to Fargo Avenue. At the Spruce Avenue/Fargo Avenue intersections there are catchbasins located at the four corners. These catchbasins will collect Fargo Avenue surface runoff along with the surface runoff from Spruce Avenue. Spruce Avenue north of Fargo Avenue is conveyed northward through a combined sewer to the Howard Street combined sewer, which conveys the flow eastward to the MWRDGC Interceptor Sewer located along of River Road.

Drainage Problems

The returned Flood Protection Questionnaires reported basement, crawl space and first floor flooding associated with storm sewer and sanitary sewer backup and basement wall seepage.

Drainage Problems Causes

The results of the returned Flood Protection Questionnaires, a field reconnaissance of the problem area and hydrologic and hydraulic modeling was used to assist in drainage problem assessment. The reported drainage problems are caused by the lack of a storm sewer system along Spruce Street south of Fargo Avenue and because the existing Spruce Street combined sewer located north of Fargo Avenue has inadequate capacity to convey the runoff from the 10-year, 1-hour storm event.

PROBLEM AREA #12

Location

The problem area is located at the west end of Washington Street.

Flood Protection Questionnaire

The results of the returned Flood Protection Questionnaires are summarized in Table 25. Exhibit 13 shows the location of Problem Area #12.

Table 25
Problem Area #12 Flood Protection Questionnaire Summary

Location of Flooding	Number of Respondents
Basement Flooding	0
Crawl Space Flooding	0
First Floor Flooding	0
Yard Flooding	0
No Flooding	0
Cause of Flooding	
Storm Sewer Backup	0
Sanitary Sewer Backup	0
Sump Pump/Power Failure	0
Basement Wall Seepage	0
Standing Water Next to House	0
Overbank Flooding	0

As shown in Table 26, no telephone calls reporting basement flooding/sewer backup or street flooding were received by the City of Des Plaines Public Works Department during the October 13, 2001 storm event for Problem Area #12.

Table 26
Problem Area #12 October 13, 2001 Storm Event Summary

Flooding Type	Number of Respondents
Basement Flooding/Sewer Backup	0
Street Flooding	0

EXHIBIT 13

Existing Drainage Pattern

A 12-inch to 15-inch storm sewer drains west to east along Washington Street. This storm sewer discharges to a south flowing 24-inch to 27-inch storm sewer located along Laurel Avenue. The conveyed storm sewer flow is eventually discharged to the Weller Creek via a relief storm sewer located along Perry Street that was recently installed by the City of Des Plaines based on the 1986 Stormwater Master Plan recommendations.

Drainage Problem

The City has reported that below grade garages located at the western end of Washington Street are at risk from street flooding.

Drainage Problem Causes

A field reconnaissance of the problem area and hydrologic and hydraulic modeling were used to determine the cause of the drainage problem. As previously stated, the Washington Street storm sewer drains to the Perry Street storm sewer system. The hydrologic and hydraulic modeling indicates that the available conveyance capacity of the Laurel Avenue storm sewer system is less than the surface runoff from a 10-year, 1-hour storm event. Based on this existing condition, temporary ponding of stormwater in the low areas of Washington Street will occur.

FLOOD MITIGATION PROJECT ANALYSIS

STORM EVENTS SIMULATED

Design Storm Event

The critical duration 10-year storm event was simulated since this a standard storm event for the design of storm sewer systems. The rainfall intensities were obtained from the Illinois State Water Survey Bulletin 70 publication. For the Problem Areas studied, the critical duration was either the 1-hour or 2-hour. The rainfall depths for the 1-hour and 2-hour 10-year storm event are 2.10-inches and 2.64-inches, respectively.

October 13, 2001 Storm Event

The City of Des Plaines requested that CBBEL analyze the flooding conditions that occurred during the October 13, 2001 storm event that led to flood complaints throughout the City. The October 13, 2001 storm event rainfall distribution was obtained from the National Oceanic and Atmospheric Administration (NOAA) Hourly Precipitation Data for the Chicago O'Hare WSO AP rain gage station. The October 13, 2001 storm event, which produced approximately 3.8-inches of rain in a 3-4 hour time period over previously saturated ground, resulted in significant flooding levels throughout the City.

The larger of the critical 10-year storm event or the October 13, 2001 storm event was used to size the evaluated flood mitigation alternatives.

HYDROLOGIC AND HYDRAULIC MODELING

Several hydrologic and hydraulic models were used to analyze the existing storm sewers or existing combined sewers along with the flood mitigation projects. The hydrologic and hydraulic models used included the TR-20 hydrologic model and the XP-SWMM 2000 Storm Water Management Model Version 8.0 (SWMM). The TR-20 hydrologic model is a rainfall-runoff model that utilizes two parameters; Runoff Curve Number (RCN) and Time of Concentration (T_c) to convert rainfall to runoff for the delineated subareas.

The TR-20 hydrologic model was used to produce the critical 10-year storm event and October 13, 2001 storm event peak discharges to the existing storm sewers or existing combined sewers along with the flood mitigation projects. The Culvert Nomographs published in the Illinois Department of Transportation (IDOT) Drainage Manual were then used to evaluate the capacity of the conveyance systems.

SWMM is a comprehensive computer model for analysis of quantity and quality problems associated with urban runoff. Both single-event and continuous simulation can be performed on catchments having storm sewers, or combined sewers and natural drainage, for prediction of flows, stages and pollutant concentrations. Hydrologic simulation is performed in the Runoff Block, which uses drainage area, imperviousness, slope, roughness, width, depression storage, and infiltration parameters for the delineated subareas. Extran Block solves complete dynamic flow routing equations (St. Venant equations) for accurate simulation of backwater, looped connections, surcharging, and pressure flow. SWMM was used to evaluate the complex drainage systems within the problem areas.

PROBLEM AREA #1

Surface runoff collects in Clayton Lane at its southern dead end resulting in street inundation northward to Berkshire Lane. South of the Clayton Lane is Sioux Park. The southern end of Clayton Lane is a "bowl" were surface runoff can collect because there is an inadequate overland flow route. Once the catchbasins and or the storm sewer reach capacity, surface runoff will pond in this "bowl" resulting in street flooding that causes sewer backup into basements.

Watershed Description

The Problem Area 1 watershed drains to the Rand Road sewer system. Based on the City of Des Plaines storm sewer atlas and 1-foot contour interval aerial topography, CBBEL determined that approximately 26.0 acres are tributary to the existing 27-inch storm sewer located along the north property line of Sioux Park, and the inflow points are the two catchbasins located at the southern end of Clayton Lane. The land use, based on field visits and the 2001 aerial photography, is residential, recreational and roadways. The existing watershed was subdivided into 3 subareas based on the City's storm sewer atlas, street improvement plans and topography obtained from the City. Based on the supplied information, CBBEL determined the tributary area to the catchbasins located at the end of Clayton Lane and the catchbasins located in front of 400 Tracy Lane to be 2.58 acres and 1.62 acres, respectively. The areas were determined assuming all upstream structures capture the 10-year, 2-hour critical duration storm event runoff, and no by-pass flows make it down to these catch basins.

The description of the drainage system given below is based on our review of the engineering plans and a site visit. However, not all the details such as the restrictor size of the existing underground detention storage basin outlet are known. The underground detention storage basin restrictor located behind 400 Tracy Terrace was conservatively assumed to be 3-inches in diameter. The majority of overland and storm sewer flows come from Clayton Lane, Patricia Lane, Berkshire Lane and a portion of Jon Lane and are conveyed towards the two existing catchbasins located at the southern end of Clayton Lane and are eventually conveyed to the Rand Road storm sewer system by the 27-inch storm sewer. A small amount of area along Tracy Terrace is conveyed overland and by storm sewers into the existing underground detention storage basin located in the rear of 400 Tracy Terrace which discharges to the 27-inch storm sewer.

Existing Conditions Analysis

The hydrologic parameters developed for each subarea were input into the TR-20 hydrologic model to determine the flow rates tributary to the existing 27-inch storm sewer associated with the 10-year, 2-hour critical duration design storm event and the October 13, 2001 storm event. The Runoff Curve Number (RCN) and time of concentration were computed for the total watershed tributary area and input into a TR-20 hydrologic model. Based on the model results, the Critical and the October 13, 2001 flow rates were computed to be 18.8 cfs and 18.2 cfs, respectively. Therefore the 10-year, 2-hour storm event was chosen as the design event for Problem Area 1. The existing underground detention storage basin was analyzed in the TR-20 hydrologic model. The tributary area of 1.62 acres, the elevation-storage and elevation-discharge rating curves developed from the supplied construction plans were input into the hydrologic model. The modeling and hydraulic calculations are located in Appendix 1.

CBBEL analyzed the capacity of the existing 27-inch storm sewer system conveying flows from the end of Clayton Lane to the Rand Road storm sewer system. The sewer capacity was determined by using the Culvert Selection Graph obtained from the Illinois Department of Transportation (IDOT) Drainage Manual. Based on the City of Des Plaines storm sewer atlas and invert/elevation information from construction plans supplied by the City, CBBEL determined that the existing 27-inch storm sewer has a maximum full pipe capacity of 12 cfs at a 0.1% slope. Therefore the 27-inch storm sewer does not have sufficient capacity to convey the tributary Critical or October 13, 2001 storm events flow rates.

The model results also indicate that the underground detention storage basin does have sufficient volume during the 10-year, 2-hour design storm event assuming no backwater condition but does not have sufficient volume during the 10-year, 2-hour design storm event with the backwater impact.

Flood Mitigation Project Analysis

CBBEL analyzed possible alternatives in order to provided flood relief in the indicated flood problem areas. The analysis considers flood protection for the 10-year, 2-hour design storm event. Measures considered included the installation of relief storm sewers and installing additional storm sewer inlets.

CBBEL proposes the installation of a 24-inch relief sewer paralleling the existing 27-inch storm sewer from the end of Clayton Lane to Rand Road. Based on the IDOT Culvert Selection Graph, the full pipe capacity of the proposed 24-inch pipe is approximately 8 cfs. The proposed 24-inch relief sewer in conjunction with the

existing 27-inch storm sewer has sufficient capacity to convey the 10-year, 2-hour design storm event runoff flow of 18.8 cfs. The proposed alternative is shown on Exhibit 14. This alternative will require approval from the IDOT, since it will discharge to their storm sewer. Depending on the existing 27-inch storm sewer easement width, an additional easement might be required. The concept level opinion of probable costs associated with this alternative is approximately $70,000 (excluding any required land acquisition costs). Appendix 1 contains the detailed opinion of probable cost.

This alternative proposes to increase flows to the existing IDOT Rand Road storm sewer. The IDOT storm sewer has not been evaluated to determine if capacity is available to accept the additional flows. If a future study determines that the IDOT storm sewer does not have sufficient capacity to handle the proposed additional flows, storage volume will be required to reduce the proposed discharge into the IDOT storm sewer at a level agreeable to IDOT. Assuming the worst-case scenario of providing sufficient storage to meet the existing conditions discharge, approximately 0.88 acre-feet of storage volume would be required for the 10-year, 2-hour design storm event. The concept level opinion of probable costs associated with providing the storage volume is approximately $265,000. It was conservatively assumed that the storage volume would have to be provided underground due to land constraints. Appendix 1 contains the detailed opinion of probable cost.

Summary

The recommended flood mitigation project will provide sufficient flood relief for the 10-year, 2-hour design storm event. Additional high capacity inlets are also proposed the end of Clayton Lane to capture storm water surcharge from the manhole immediately downstream of the existing underground detention storage basin.

EXHIBIT 14

PROBLEM AREA #2

The properties on the eastern side of Radcliffe Avenue between Harvard Street and Wisconsin Drive report basement flooding from storm sewer and sanitary sewer backup. Yard flooding was also reported on the west side of Radcliffe Avenue from Princeton Street northward past Harvard Street. Basement flooding caused by the surcharging of the combined sewer was reported for homes along Radcliffe Avenue between Cranbrook Street and Princeton Street. Basement flooding was also reported along the eastside of Mt. Prospect Road. During the October 13, 2001 storm event, basement backup and street flooding was reported along Radcliffe Avenue and Mt. Prospect Road.

Watershed Description

The Problem Area 2 was divided into two watersheds. The North watershed is Radcliffe Avenue north of Princeton Avenue that is served by a storm sewer that drains into the Rand Road storm sewer system. Based on the City of Des Plaines storm sewer atlas and 1-foot contour interval aerial topography, CBBEL determined that approximately 33.4 acres are tributary to the existing 27-inch storm sewer that conveys runoff flows from Wisconsin Drive into the Rand Road storm sewer system. The existing conditions watershed area tributary to the existing 27-inch Wisconsin Drive storm sewer was subdivided into 11 subareas based on the City's storm sewer atlas, street improvement plans and topography.

The South watershed is Radcliffe Avenue south of Princeton Avenue, which is served by a combined sewer that drains into the Mount Prospect Road combined sewer. CBBEL determined that approximately 15.7 acres are tributary to the existing combined sewer located at the intersection of Mount Prospect Road and the Northwest Highway. The South watershed area was subdivided into 7 subareas based on the City's storm sewer atlas (combined sewer), street improvement plans and topography. The land use for both areas, based on field visits and the 2001 aerial photography, is mainly residential.

The description of the drainage system provided below is based on the engineering plans and a site visit. However, not all the details for the existing storm sewer rim and invert elevations are known. For the North watershed, the Harvard Street, Vassar Lane, Radcliffe Avenue (from Wisconsin Drive to Princeton Street) and Wisconsin Drive storm sewers convey runoff flows north into the existing 27-inch Wisconsin Drive storm sewer. For the South watershed, CBBEL's analysis included area tributary to the Radcliffe Avenue 18-inch combined sewer from Princeton Street to Cranbrook Street and the area tributary to 18-inch Mount Prospect Road combined sewer from just north of Cranbrook Street to the Northwest Highway.

Existing Conditions Analysis

SWMM was used to simulate the North watershed's storm sewer system located on Radcliffe Avenue, Wisconsin Drive and Harvard Street. The hydrologic parameters developed for each subarea and the existing storm sewer information were input into the SWMM model to determine the flooding associated with the 10-year, 2-hour design storm event. The model results indicate the existing storm sewers along Radcliffe Avenue and Harvard Street surcharge during the 10-year, 2-hour design storm event as a result of insufficient pipe capacity. Street Flooding occurs at locations along Radcliffe Avenue, north of Princeton Street. Residents that live along Radcliffe Avenue reported flooding from storm sewer surcharge. The support calculations are located in Appendix 1 and the SWMM model is located in Appendix 2. Since it is proposed to provide a new combined sewer for the Radcliffe Avenue, Cranbrook Street and Mt. Prospect Road combined sewer system, an existing conditions analysis was not performed.

Flood Mitigation Project Analysis

CBBEL analyzed possible flood mitigation projects in order to provided flood relief in the indicated flood problem areas. The analysis considers flood protection for the 10-year, 2-hour design storm event. Measures considered included the installation of relief sewers, installing additional storm sewer inlets and providing a new combined sewer for existing combined sewer area. Based on the SWMM model results, combinations of these measures were needed to provide flood relief for the problem area.

Alternative 2-North Watershed: Alternative 2-North watershed proposes flood relief for the residents in Problem Area 2, north of Princeton Street. This alternative proposes a relief parallel storm sewer along Radcliffe Avenue and Wisconsin Drive, which varies in size from 12-inch to 15-inch. Also, 12-inch storm sewers are proposed to replace the existing 10-inch storm sewers that drain the rear yards of the residences along the west side of Radcliffe Avenue. Alternative 2-North watershed was modeled using the SWMM model to determine the flood reduction that is provided for the 10-year, 2-hour design storm event. Based on the model results, the proposed parallel relief storm sewer along with the addition of high capacity inlets will provide relief in the areas that experienced flooding under existing conditions. By increasing the pipe capacity and inlet capacity in North watershed the model results indicate that storm sewer surcharging would no longer occur for storm events similar in magnitude to the 10-year, 2-hour design storm event. The Alternative 2 - North watershed improvements are shown on Exhibit 15. The conceptual level opinion of probable costs associated with this alternative is approximately $255,000. Appendix 1 contains the detailed opinion of probable cost.

EXHIBIT 15

This alternative proposes to increase flows to the existing IDOT 54-inch Rand Road storm sewer system. The IDOT storm sewer has not been evaluated to determine if capacity is available to accept the additional flows. If a future study determines that the IDOT storm sewer does not have sufficient capacity to handle the additional flows, storage volume will be required to reduce the proposed discharge into the IDOT storm sewer to a level acceptable to IDOT. Assuming the worst-case scenario of providing sufficient storage volume to meet the existing conditions discharge, approximately 0.11 acre-feet of storage volume would be required for the 10-year, 2-hour design storm event. The concept level opinion of probable costs associated with providing underground storage for the 10-year, 2-hour event is approximately $33,000. Appendix 1 contains the detailed opinion of probable cost.

Alternative 2-South Watershed: The Problem Area 2 south watershed is located within an area tributary to the MWRDGC Tunnel and Reservoir Plan (TARP). TARP consists of a series of deep tunnels that drain to a terminal reservoir. The deep tunnels, which vary in diameter from 9- to 16-foot, are located approximately 180 feet below ground. TARP was designed to handle combined sewer flows that previously overflowed into the areas watercourses when the interceptor sewers reached capacity. Within the Chicagoland area there are four TARP systems; Mainstream, Des Plaines, Calumet and O'Hare. The Problem Area 2 combined sewer area is located within the O'Hare TARP service area. The TARP system provides both water quality and flood reduction benefits. The United States Environmental Protection Agency (USEPA) funded the deep tunnels because their primary objective is to provide water quality benefits. The terminal reservoirs are being funded by the United States Army Corps of Engineers (COE) because they provide the flood reduction benefits. The 1,000 acre-feet O'Hare terminal reservoir is located Southwest of the Northwest Tollway and Elmhurst Road. The combined sewer flow that is conveyed to the terminal reservoir is pumped to the James C. Kirie Water Reclamation Plant where the combined sewage is treated and discharged to Higgins Creek. The combined sewer flow enters the TARP deep tunnel via drop shafts. The closest drop shaft to the Problem Area 2 combined sewer area is located at Mt. Prospect Road and Weller Creek.

Alternative 2-South watershed consists of installing a new combined sewer on Radcliffe Avenue (south of Princeton Street), on Cranbrook Street (west of Radcliffe Avenue) and running a new combined sewer down Mt. Prospect Road to the MWRDGC TARP drop shaft located near Weller Creek. A new 12- to 18-inch combined sewer would be installed on Radcliffe Avenue from just north of Princeton Street to Cranbrook Street and along Cranbrook Street to Mt. Prospect Road. A proposed 24-inch to 27-inch Mt. Prospect Road combined sewer will convey the Radcliffe Avenue, Cranbrook Street and Mt. Prospect Road flows south of Northwest Highway discharging to the MWRDGC TARP drop shaft located near Weller Creek. Alternative 2-South watershed was modeled using the SWMM model to determine the flood reduction that is provided for the 10-year, 2-hour design storm event. Based on the model results, the proposed combined sewer will provide sufficient capacity for the areas served by the existing

combined sewers. The Alternative 2-South improvements are shown on Exhibits 15. The concept level opinion of probable costs associated with this alternative is approximately $810,000. Appendix 1 contains the detailed opinion of probable cost.

Summary

The recommended flood mitigation projects will provide sufficient flood relief for the 10-year, 2-hour design storm event. High capacity inlets are also included in the recommended plans.

PROBLEM AREA #3

The drainage problems reported within this problem area include street flooding, overbank flooding associated with Weller Creek and basement flooding caused by storm sewer and sanitary sewer backup. During the August 22, 2002 storm event a portion of Warrington Road was inundated between Cumberland Parkway and Davis Court. During the October 13, 2001 storm event, street flooding was reported on Warrington Road, Westgate Road, and Cumberland Parkway. Mitigation for Weller Creek overbank flooding is a regional issue and is therefore not addressed in this study. The COE is currently studying flood mitigation measures for the Des Plaines River Tributaries.

Watershed Description

The Problem Area 3 watershed was divided into two subareas. The first subarea (Westgate Road Area) evaluated is the area west of Cumberland Parkway, which includes Westgate Road, Fletcher Drive and Mt. Prospect Road. Based on the City of Des Plaines storm sewer atlas and 1-foot contour interval aerial topography, CBBEL determined approximately 23.2 acres are tributary to the existing 30-inch storm sewer that outlets to Weller Creek along Mt. Prospect Road south of Fletcher Drive. The second subarea (Cumberland Parkway Area) evaluated is the area east of Westgate Road and north Golf Road, which includes Cumberland Parkway, Fletcher Drive, Warrington Road, Davis Court and Meyer Court. CBBEL determined approximately 45.6 acres are tributary to the existing 24-inch storm sewer that outlets to Weller Creek from Davis Court. The land use is based on field visits and the 2001 aerial photography. The existing watershed for both areas consists of mainly residential land use. The existing Westgate Road watershed was subdivided into 12 subareas based on the City's storm sewer atlas, street improvement plans and topography. The existing Cumberland Parkway watershed was subdivided into 16 subareas based on the City's storm sewer atlas, street improvement plans and topography. Exhibit 4 shows the existing drainage patterns for each area.

Existing Conditions Analysis

SWMM was used to simulate the existing Westgate Road Area and Cumberland Parkway Area storm sewer systems. The hydrologic parameters developed for each subarea and the existing storm sewer information were input in the model to determine the existing flooding that occurs during 10-year, 1-hour storm event and October 13, 2001 storm event. It was determined that the 10-year, 1-hour produced the larger flow rates and therefore was chosen as the design storm event. For the Westgate Road Area, the model results indicate storm sewer surcharge occurring mainly along Mt. Prospect Road. The models results indicate that the existing storm sewers for both the Westgate Road Area have insufficient capacity during the 10-

year, 1-hour design storm event. For the Cumberland Parkway Area, the model results indicate storm sewer surcharge occurring along Cumberland Parkway, Mount Prospect Road, Warrington Road and Meyer Court. The flooding that occurs during the 10-year, 1-hour storm event is a result of a combination of insufficient pipe capacity and inlet capacity.

Another SWMM was developed to simulate the existing Westgate Road Area and Cumberland Parkway Area storm sewer systems with a 10-year flood event backwater affect from Weller Creek. The model results indicate additional storm sewer surcharge along Westgate Road, Mount Prospect Road, Cumberland Parkway, Meyer Court and Warrington Road for the 10-year, 1-hour storm event. The existing conditions storm sewers are shown on Exhibit 4. The SWMM models are located in Appendix 2.

Flood Mitigation Project Analysis

CBBEL analyzed possible flood mitigation projects in order to provided flood relief in the indicated flood problem areas. The analysis considers flood protection up to the 10-year, 1-hour design storm event. Measures considered included installing additional storm sewer inlets, relief storm sewers and additional outlets. Based on the SWMM model results, combinations of these measures are needed to provide flood relief for the problem area.

Alternative 3 - Westgate Road Area: The Westgate Road Area alternative proposes flood relief for the residents along Mt. Prospect Road and Westgate Road. This alternative proposes a parallel 12-inch storm sewer along Westgate Road from Fletcher Drive to a point approximately 426-feet north. Also, to provide relief for the residents along Mt. Prospect Road, a 12-inch to 15-inch storm sewer is proposed between Warrington Road and Fletcher Drive. The Westgate Road Area alternative was modeled using the SWMM model to determine the flood reduction that is provided for the 10-year, 1-hour design storm event including backwater conditions from Weller Creek. Based on the model results, the proposed storm sewers provide relief in the areas that experienced flooding under existing conditions. By increasing the pipe capacity and inlet capacity in the Westgate Road Area, the model results indicate that surcharging in manholes no longer occurs for the 10-year, 1-hour design storm event. The Westgate Road Area alternative improvements are shown on Exhibit 16. The concept level opinion of probable costs associated with this alternative is approximately $430,000. Appendix 1 contains the detailed opinion of probable cost.

The proposed flood reduction plan will result in a slight increase in discharge to Weller Creek. The Weller Creek watershed area at Golf Road is 13.2 square miles. Depending on the areal extent and magnitude of storm event over the Weller Creek watershed, the flood peak of will many hours after the start of the rain. The April 1984 COE Chicagoland Underflow Plan Phase I General Design Memorandum – O'Hare System Interim Report analyzed in detail two 1982 storm events that had a 2- to 5-year recurrence interval. For these events, the Weller Creek flood peak reached Golf Road at 6 and 21-hours, respectively. The flow from Problem Area 2 will reach Weller Creek within a 1-hour after the rain begins. Therefore, the peak discharge from Problem Area 2 will not coincide with the Weller Creek flood peak. It has been assumed that in the next phase of engineering, further study on the proposed increase discharges to Weller Creek will be performed in order to determine if mitigation storage volume will be required and if so how much. For this concept level study, it was determined that 0.08 acre-feet of storage volume would be required to match the existing conditions discharge for the 10-year, 1-hour design storm event. Assuming underground storage, concept level opinion of probable costs associated with this alternative is approximately $20,000. Appendix 1 contains the detailed opinion of probable cost.

EXHIBIT 16

Alternative 3 - Cumberland Parkway Area: The first part of the flood mitigation project (Cumberland Parkway North) proposes a parallel storm sewer on Warrington Road west to Cumberland Parkway, on Meyer Court west to Cumberland Parkway and on Cumberland Parkway to the intersection of Fletcher Drive. The existing sewer connecting the catch basin located at the intersection of Cumberland Parkway and Fletcher Drive to the Cumberland Parkway storm sewer system is to be replaced and pitched to convey flows to the northwest. Also, the existing storm sewer flowing south from intersection is to be plugged so that storm sewer flows north of the intersection do not reach the southern outlet into Weller Creek. A relief sewer and additional high capacity inlets are proposed from the existing catch basin located at the intersection of Cumberland Parkway and Fletcher Drive extending 300-feet west along Cumberland Parkway and then discharging into Weller Creek. An easement between the homes along Cumberland Parkway will be required for the outlet pipe into Weller Creek. The concept level opinion of probable costs associated with this portion of the Alternative 3 - Cumberland Parkway North Area improvements are approximately $535,000. Appendix 1 contains the detailed opinion of probable cost.

The second part of the Cumberland Parkway Area (Cumberland Parkway South) flood mitigation project includes the installation of a parallel storm sewer on Warrington Road south to Davis Road, on Meyer Court south to Davis Road and on Davis Road to the Weller Creek outlet. Also, a relief storm sewer is proposed to extend approximately 150 feet south of the intersection between Davis Road and Cumberland Parkway along Cumberland Parkway. The Cumberland Parkway South Area flood mitigation project was modeled using the SWMM model to determine the flood reduction that is provided for the 10-year, 1-hour storm event, which included the backwater influence from Weller Creek. Based on the model results, the proposed storm sewers provide sufficient capacity for all areas served by the existing sewers. The Cumberland Parkway Area alternative improvements are shown on Exhibit 16. The concept level opinion of probable costs associated with this portion of the Alternative 3 - Cumberland Parkway South Area improvements are approximately $320,000. Appendix 1 contains the detailed opinion of probable cost.

For this concept level study, it was determined that 1.52 acre-feet of storage volume would be required to match the existing conditions discharge for the 10-year, 1-hour design storm event. Assuming underground storage, concept level opinion of probable costs associated with this alternative is approximately $350,000. Appendix 1 contains the detailed opinion of probable cost.

Summary

The recommended flood mitigation project will provide sufficient flood relief for the 10-year, 1-hour design storm event. The proposed improvement plans will include high capacity inlets or catch basins be installed in place of the existing inlets or catch basins in areas of frequent flooding.

PROBLEM AREA #4

The returned Flood Protection Questionnaires indicate basement, first floor, street and yard flooding caused by storm sewer backup, sanitary sewer backup, seepage, sump pump power failure and standing water. During the October 13, 2001 storm event, street flooding was reported on many of the streets within the subdivision. These areas were analyzed in detail and include Millers Road, Leahy Circle East, Westmere Road, Easy Street, Kathleen Drive, Lance Drive, Sandy Lane and Dara James Road. The results of the returned Flood Protection Questionnaires, a field reconnaissance of the problem area and hydrologic and hydraulic modeling performed indicates that the existing storm sewers conveyance capacities are less than the October 13, 2001 historic storm event.

Watershed Description

The Problem Area 4 watershed was determined to be part of the tributary area that drains to the Millers Road and Mount Prospect Road storm sewer systems, which eventually drains to Weller Creek. Based on street improvement plans obtained from the City dated August 13, 2001 and field reconnaissance, storm sewers and high capacity inlets were installed in several locations with Problem Area 4. CBBEL determined that approximately 420 acres of area is immediately tributary to the Millers Road and Mount Prospect Road existing storm sewers. The Problem Area 4 watershed area tributary to the existing storm sewers was subdivided into 77 subareas, based on the City's storm sewer atlas, street improvement plans and topography obtained from the City. The land use is based on field visits and the 2001 aerial photography. The existing watershed consists of mainly residential land use, commercial area, park area, impervious roadway surfaces and pervious grass areas. The existing drainage patterns are shown on Exhibit 5.

Existing Conditions Analysis

The hydrologic parameters developed for each subarea and the existing storm sewer information were used to determine if the existing storm sewers have sufficient capacity to convey the tributary runoff from the October 13, 2001 design storm event. The existing conditions storm sewers are shown on Exhibit 5.

The XP-SWMM 2000 Storm Water Management Model Version 8.0 (SWMM) was used to simulate the existing Millers Road storm sewers and its tributary sewers. The hydrologic parameters developed for each subarea and the existing storm sewer information were input in the model to determine if the existing sewers have sufficient capacity to convey the October 13, 2001 design storm event.

Another XP-SWMM 2000 Storm Water Management Model Version 8.0 (SWMM)

was used to simulate the existing sewer system with a backwater condition. The 10-year flood elevation of 641.0 were taken from the Flood Insurance Study (FIS) flood profiles for Weller Creek and input into the model as starting water elevations or tailwater conditions on the existing outlet pipes. The hydrologic parameters developed for each subarea and the existing storm sewer information were input in the model. The model results indicate the existing storm sewer system conveying runoff flows from Millers Road and its tributary storm sewers have increased flooding depths with a Weller Creek backwater condition.

Flood Mitigation Project Analysis

CBBEL analyzed possible flood mitigation projects in order to provided flood relief in the indicated floodprone areas of Problem Area 4. The analysis considers flood protection up to the October 13, 2001 design storm event. Measures considered installing parallel relief storm sewers and the creation of stormwater storage volume.

Alternative 1: Alternative 1 proposes flood relief for the residents within Problem Area 4. This alternative proposes relief parallel storm sewers along many of the streets within the problem area and the construction of new storm sewers where there are no existing storm sewers. The proposed parallel relief sewers vary size from 15-inches to 72-inches. The proposed relief storm sewers will provide flood protection up to the October 13, 2001 design storm event under tailwater conditions. Alternative 1 was modeled using the SWMM model to determine the flood reduction that is provided for the October 13, 2001 design storm event. Based on the model results, the proposed relief storm sewers along with the addition of high capacity inlets will provide relief in the areas that experienced flooding under existing conditions. The model results indicate that with the addition of the proposed relief sewers surcharging will no longer occur in the floodprone areas. The Alternative 1 flood mitigation project improvements are shown on Exhibit 17A. The conceptual level opinion of probable costs associated with this alternative is approximately $4,815,000. It should be noted that the probable costs do not include any costs associated with unforeseen conflicts with the installation of the proposed sewers.

Alternative 2: Alternative 2 proposes flood relief for the residents within Problem Area 4. This alternative proposes relief parallel storm sewers along many of the streets within the problem areas, the construction of new storm sewers where there are no existing storm sewers and the creation of stormwater basins. The creation of stormwater basins is proposed within the existing park areas located adjacent to the ComEd transmission lines. The first stormwater basin (Detention Facility 1) would be located west of Beau Drive and north of Kathleen Drive. This basin would provide relief for the October 13, 2001 design storm event runoff flows for the area tributary to the Beau Drive storm sewer system. The existing Beau Drive storm sewer approximately 272-feet north of Kathleen Drive would outlet into the proposed

facility through a 42-inch pipe. The facility would be drained by a 24-inch pipe, which would convey flows back into the existing Beau Drive storm sewer system. Detention Facility 1 would provide approximately 1.75 acre-feet of storage volume. The assumed high water level (HWL) and normal water level (NWL) for the proposed facility are 651.5 and 647.0, respectively. The HWL and NWL elevations were set such that the existing Beau Drive storm sewers can be routed into the basin and storm sewer surcharging will no longer occur.

The second stormwater basin (Detention Facility 2) is located west of Dara James Road and north of Kathleen Drive. Detention Facility 2 provides relief for the October 13, 2001 design storm event runoff flows for the area tributary to the Dara James Road and Marshall Drive storm sewer systems. A 36-inch pipe is proposed to connect the Marshall Drive storm sewer system to the proposed basin. The proposed 36-inch pipe will intercept Marshall Drive flows at a manhole located approximately 350-feet north of Kathleen Drive and convey the flows directly into the proposed stormwater basin. The runoff flows tributary to Dara James Road from approximately 265-feet north of Kathleen Drive are proposed to outlet directly into the proposed stormwater basin through a 24-inch pipe. Detention Facility 2 is drained by an 18-inch pipe, which conveys flows back into the existing Dara James Road storm sewer system. The facility would provide approximately 5.0 acre-feet of detention storage volume between the proposed HWL and NWL of 651.8 and 645.3, respectively. The HWL and NWL elevations were set such that the existing Beau Drive storm sewers can be routed into the basin and storm sewer surcharging will no longer occur.

The proposed stormwater basin would provide runoff flow attenuation prior to discharging to the Millers Road storm sewer system. By reducing the rate of flow into the existing Millers Street storm sewer system, the stormwater basins also provide flood relief for other areas within the problem area watershed. Since the stormwater basins would be located within the park, an intergovernmental would be required. The opinion of probable cost for this alternative does not include fees or the costs associated with using or acquiring the land needed for the proposed stormwater basins.

In addition to the proposed detention facilities, parallel relief sewers that vary in size from 15-inches to 72-inches are proposed in many of the flood prone areas within Problem Area 4. The use of the stormwater basins reduces the diameters of the relief storm sewers compared to alternative 1. The proposed relief storm sewers will provide flood protection up to the October 13, 2001 design storm event under tailwater conditions. The Alternative 2 watershed was modeled using the SWMM model to determine the flood reduction that is provided for the October 13, 2001 design storm event. The Alternative 2 flood mitigation plan improvements are shown on Exhibit 17B. The conceptual level opinion of probable costs associated with this

alternative is approximately $3,750,000. It should be noted that the probable costs do not include any costs associated with unforeseen conflicts with the installation of the proposed sewers.

As discussed in Problem Area 3, it has been assumed that in the next phase of engineering, further study on the proposed increase discharges to Weller Creek will be performed in order to determine if mitigation storage volume will be required and if so how much. For this concept level study, it was determined that 26.9 acre-feet and 20.1 acre-feet of storage volume would be required to match the existing conditions discharge for the October 13, 2001 design storm event for Alternatives 1 and 2, respectively. As discussed in Problem Area 3, this level of storage volume will probably not be needed do to difference in timing of the Problem Area 4 discharge compared to the Weller Creek peak flood timing. Assuming the worst-case scenario, concept level opinion of probable costs associated with providing this storage volume within the ComEd ROW is approximately $1,770,000 and $1,325,000 for Alternatives 1 and 2, respectively. Appendix 1 contains the detailed opinion of probable cost. Appendix 2 contains the SWMM models.

Summary

The alternative flood mitigation projects provide sufficient flood relief for the October 13, 2001 design storm event.

EXHIBIT 17 (A)

EXHIBIT 17 (B)

PROBLEM AREA #5

The returned Flood Protection Questionnaires indicate basement, first floor, street and yard flooding caused by combined sewer backup. During the August 22, 2002 storm event, Leahy Circle South was inundated west of Stark Place. The results of the returned Flood Protection Questionnaires, a field reconnaissance of the problem area and hydrologic and hydraulic modeling performed indicates that the Leahy Circle East combined sewer system conveyance capacity is less than the surface runoff from the October 13, 2001 design storm event.

Watershed Description

The Problem Area 5 watershed was determined to be part of the tributary area that drains to the Thacker Street storm sewer system, which eventually drains to Weller Creek. Based on street improvement plans obtained from the City dated August 13, 2001 and field reconnaissance, a 36-inch relief storm sewer has been installed on Leahy Circle East south of Thacker Street to Walnut Avenue. CBBEL determined that approximately 20.2 acres of area is immediately tributary to the recently installed storm sewer on Leahy Circle East and 12.7 acres are tributary to the Leahy Circle South combined sewer, which ends just east of Clark Lane. The watershed area tributary to the recently installed storm sewer was subdivided into 4 subareas and the area tributary to the combined sewer on Leahy Circle South was subdivided into 7 subareas, based on the City's storm sewer atlas, street improvement plans and topography obtained from the City. The land use is based on field visits and the 2001 aerial photography. The existing watershed consists of mainly residential land use, impervious roadway surfaces and pervious grass areas. The existing drainage patterns are shown on Exhibit 6. The 10-year storm events (1-hr and 2-hr) along with the October 13, 2001 historic storm event were simulated with the TR-20 hydrologic model. The October 13, 2001 storm event produced the highest flow rate and therefore was used as the design storm event.

Existing Conditions Analysis

The hydrologic parameters developed for each subarea and the existing storm sewer information were used to determine if the Thacker Street storm sewer has sufficient capacity to convey the tributary runoff from the October 13, 2001 design storm event. The existing conditions storm sewers are shown on Exhibit 6.

SWMM was used to simulate the existing Leahy Circle East Area sewer system. The hydrologic parameters developed for each subarea and the existing storm sewer information were input in the model to determine if the existing sewers have sufficient capacity to convey the October 13, 2001 design storm event. The model results indicate that 36-inch Leahy Circle relief storm sewer has sufficient capacity to

convey the October 13, 2001 design storm event flow rate from Leahy Circle South combined sewer area. The modeling and hydraulic calculations are located in Appendix 1.

Flood Mitigation Project Analysis

CBBEL analyzed possible flood mitigation projects in order to provided flood relief in the indicated flood problem area on Leahy Circle South. The analysis considers flood protection up to the October 13, 2001 historic storm event. Measures considered installing a relief storm sewer along Leahy Circle South to separate the existing combined sewers and connecting to the existing 36-inch relief storm sewer located on Leahy Circle East, south of Walnut Avenue.

Alternative: This flood mitigation project proposes flood relief for the residents on Leahy Circle South, between Clark Lane and Walnut Avenue. This project proposes a relief storm sewer along Leahy Circle South connecting to the existing Leahy Circle East 36-inch relief storm sewer. The proposed relief sewer varies in size from 15-inches to 24-inches. The proposed storm sewer will separate the existing combined sewers. The Alternative 5 watershed was modeled using the SWMM model to determine the flood reduction that is provided for the October 13, 2001 design storm event. Based on the model results, the proposed relief storm sewer along with the addition of high capacity inlets will provide relief in the areas that experienced flooding under existing conditions. By separating the combined sewers and increasing inlet capacity in the flood prone areas, the model results indicate that storm sewer surcharging would no longer occur for the October 13, 2001 design storm event. The Alternative 5 improvements are shown on Exhibit 18. The conceptual level opinion of probable costs associated with this alternative is approximately $340,000. Appendix 1 contains the detailed opinion of probable cost.

EXHIBIT 18

This alternative proposes to increase flows to the existing City of Des Plaines (City) Thacker Street storm sewer system. The City storm sewers have been evaluated to determine if capacity is available to accept the additional flows. The study indicates that the City's Thacker Street storm sewers do have sufficient capacity to handle the additional flows.

Summary

The recommended flood mitigation project will provide sufficient flood relief for the October 13, 2001 storm event. The proposed improvement plan includes the installation of additional high capacity inlets.

PROBLEM AREA #6

The City of Des Plaines Public Works Department received one report of basement flooding and street flooding that occurred along Third Avenue during the October 13, 2001 storm event. Based on field observation during the August 22, 2002 storm event, CBBEL found that street flooding was prominent on Third Avenue, between Thacker Street and Oakwood Court. Also during the August 22, 2002 storm event, CBBEL observed that the Third Avenue storm sewer that connects to the Walnut Street storm sewer was conveying the tributary runoff with minor ponding above the catchbasins.

Watershed Description

The Problem Area 6 watershed was determined to be part of the tributary area that naturally drains to the Thacker Street storm sewer system, which eventually drains to Des Plaines River. The Thacker Street storm sewer system begins with a 30-inch sewer at the Chicago Northwestern Railroad and outlets into the Des Plaines River through a 54-inch sewer. CBBEL determined that approximately 414 acres of area is tributary to the Thacker Street storm sewer system. The existing Thacker Street watershed was subdivided into 3 subareas, based on the City's storm sewer atlas, street improvement plans and topography obtained from the City. The land use is based on field visits and the 2001 aerial photography. The existing watershed consists of mainly residential land use, commercial or industrial land use, impervious roadway surfaces and pervious grass areas. The existing drainage patterns are shown on Exhibit 7.

Existing Conditions Analysis

The hydrologic parameters developed for each subarea and the existing storm sewer information were used to determine if the Thacker Street storm sewer has sufficient capacity to convey the tributary runoff from the October 13, 2001 design storm event. The existing conditions storm sewers are shown on Exhibit 7. A TR-20 hydrologic model was developed to determine the October 13, 2001 design storm event runoff flow rate tributary to the existing 48-inch storm sewer. The Runoff Curve Numbers (RCN) and times of concentration were computed for the watershed area tributary to the Thacker Street storm sewer and input into a TR-20 hydrologic model. Based on the model results, the October 13, 2001 design storm flow rate tributary to the existing Thacker Street 48-inch storm sewer were computed to be 63 cfs, respectively. The modeling and hydraulic calculations are located in Appendix 1.

CBBEL analyzed the capacity of the existing Thacker Street 48-inch storm sewer system conveying runoff flows from Thacker Street, west of Third Avenue, to the

Des Plaines River. The sewer capacity was determined by using the Culvert Selection Graph obtained from the Illinois Department of Transportation (IDOT) Drainage Manual. Based on the City of Des Plaines storm sewer atlas and invert/elevation information from construction plans supplied by the City, CBBEL determined that the existing 48-inch storm sewer has a maximum full pipe capacity of approximately 74 cfs at a 0.2% slope. The existing Thacker Street Storm sewer has sufficient capacity to handle the October 13, 2001 design storm event.

Flood Mitigation Project Analysis

CBBEL analyzed possible alternatives in order to provided flood relief in the indicated flood problem area. The analysis considers flood protection up to the October 13, 2001 design storm event. Measures considered installing a relief storm sewer along Third Avenue to separate the existing combined sewers.

Alternative 6 – Third Avenue: CBBEL proposes a storm sewer from the intersection of Third Avenue and Thacker Street south to the intersection of Third Avenue and Oakwood Avenue. The existing TR-20 hydrologic model results determined that approximately 7.0 cfs of overland flow is tributary to this area during the October 13, 2001 design storm event. Based on the IDOT Culvert Selection Graph, CBBEL proposes a 21-inch relief storm sewer between Thacker Street and Oakwood Avenue, connecting to the Thacker Street storm sewer system. The proposed storm sewers have sufficient capacity to convey the October 13, 2001 design storm event flows. The proposed alternative is shown on Exhibit 19. The concept level opinion of probable costs associated with this alternative is approximately $205,000. Appendix 1 contains the detailed opinion of probable cost.

Summary

The recommended flood mitigation project will provide sufficient flood relief for the October 13, 2001 design storm event.

EXHIBIT 19

PROBLEM AREAS #7

Problem Area 7 consists of Walnut Avenue between Jeanette Street and Lee Street. During the October 13, 2001 storm event, basement and street flooding was reported.

Watershed Description

Walnut Avenue is drained by an 18-inch combined sewer that flows west to east into the 24-inch combined sewer at Lee Street. A west to east flowing 24-inch storm sewer also is located along Walnut Avenue. The storm sewer also discharges into the Lee Street 24-inch combined sewer.

Existing Conditions Analysis

The receiving 24-inch combined sewer does not have sufficient capacity to handle the surface runoff from the Walnut Street storm sewer system. This results in surcharging for the October 13, 2001 design storm event.

Flood Mitigation Project Analysis

The City of Des Plaines has constructed a 120-inch relief sewer along Oakwood Avenue east of the Wisconsin Central Railroad tracks. A 15-inch to 30-inch storm sewer is proposed to convey westward along Walnut Avenue to Jeannette Street, then northward to Oakwood Avenue and then eastward to the existing terminus of the 120-inch storm sewer.

The proposed improvements are shown on Exhibit 20. The concept level opinion of probable costs associated with this proposed improvement is approximately $470,000. Appendix 1 contains the detailed opinion of probable cost.

Summary

The recommended flood mitigation project will provide sufficient flood relief for the October 13, 2001 storm event.

EXHIBIT 20

PROBLEM AREAS #8 & 9

Problem Area 8 consists of Marshall Drive between Cordial Drive and Oakton Street, including the intersections with Courtesy Lane, Dover Drive and Pleasant Lane. During the October 13, 2001 storm event, the City received complaints from residents that live along this portion of Marshall Drive of street flooding and basement flooding. Specifically, Marshall Drive flooded and water spilled down driveways with below grade garages. The residents have attempted to control the flooding by installing back-up or a second sump pump and other flood control measures such as temporary stop logs at the high point of the driveway. Problem Area 9 consists of Pennsylvania Avenue from Lancaster Lane to Oakton Street, including the intersection with Dover Drive. The flooding in this area during the October 13, 2001 storm event was mostly contained in the street. Because of the current design work for Wille Road being done by SPACECO, Inc. for the City of Des Plaines and for Norwood Builders, the City requested SPACECO, Inc. to consult with CBBEL to determine if any proposed drainage improvements for the two areas can be included in the design of Willie Road to provide flood relief for the flooded areas along Marshall Drive (Problem Area 8) and Pennsylvania Avenue (Problem Area 9). Exhibits 9 and 10 show the locations of the problem areas. As documented by the City, residents in these areas complained of street flooding, which spilled over onto existing below grade garages, on October 13, 2001.

Watershed Description

Both Problem Areas 8 and 9 are in the same local watershed and are drained by the sewer system along Oakton Street. Where Pennsylvania Avenue intersects Oakton Street there is a diversion pipe/weir that diverts flows above elevation 648.5 into an existing detention facility on the south side of Oakton Street. Approximately 165 acres are tributary to the Oakton Street Detention Facility, which includes all the area served by the storm sewers connected to the pond. The existing watershed consists of residential land use, recreational land use, commercial land use, impervious roadway surfaces and pervious grass areas. The existing watershed was subdivided into 15 subareas based on the City's storm sewer atlas, street improvement plans and topography obtained from the City. The land use is based on field visits and 2001 aerial photography.

The description of the drainage system given below is based on the engineering plans and a site visit. However, not all the details such as the float elevations for the detention facility's pump station are known. The Marshall Drive storm sewer system from Cordial Lane to Oakton Street drains south into the Oakton Street storm sewer system. The 24-inch and 48-inch Oakton Street storm sewer concrete pipes flow east, from just east of Elmhurst Road to the Oakton Street Detention Facility. The Pennsylvania Avenue storm sewer system from Algonquin Road to Oakton Street

drains south also towards the Oakton Street 24-inch and 48-inch storm sewers. The Oakton Street storm sewers located east of the Oakton Street Detention Facility and west of Mount Prospect Road are pitched to drain west (slope is fairly flat), but if the hydraulic gradient is to the east, then water would flow east. Stormwater collects in the pump station wet wells and the surrounding storm sewers until reaching elevation 644.88 and 648.5. At elevation 644.88 and above and if there is a positive gradient toward the east, flows are conveyed east by the Oakton Street storm sewer into the Des Plaines River. When the water surface elevations reach elevation 648.5, the flows spill over two sluice gates located in the pump station wet wells and into the Oakton Street Detention Facility. All stormwater stored in the detention facility is pumped back into the Oakton Street storm sewer system which empties into the Des Plaines River. Due to the inverts, there will always be standing water along the Oakton Street sewer system (unless it evaporates during a long dry period). However, it should be noted that prior to the sewer improvements, this watershed area was tributary to Higgins Creek. The existing approximate storm sewer system locations are shown on Exhibits 9 and 10.

The float elevations for the Oakton Street Pump Station to turn on and off the pump automatically could not be obtained after contacting SRS Crisafulli (manufacturer) and Tomas Pump Company, Inc. Therefore, the pump was conservatively assumed to be shut off at all times in the modeling.

Existing Conditions Analysis

SWMM was used to simulate the existing Marshall Drive, Pennsylvania Avenue and Oakton Street storm sewer systems. The hydrologic parameters developed for each subarea and the existing storm sewer information were input the model to determine the critical event for the 10-year storm event frequency, which was found to be the 2-hour duration and the October 13, 2001 storm event. The model results indicate the existing storm sewers along Marshall Drive surcharge during the critical 10-year storm event and October 13, 2001 storm event as a result of insufficient pipe capacity. The October 13, 2001 storm event modeling results indicated that additional flooding occurs along Marshall Drive and Pennsylvania Avenue. Flooding occurs at the intersection between Marshall Drive and Courtesy Lane (Problem Area 8). The existing conditions analysis results are summarized in Table 27. The SWMM models are located in Appendix 2. Since no information regarding when the pump turns on and off was available, a second SWMM model was developed to determine if there are any impacts to the system if the pump is automatically turned on at elevation 642.0. The SWMM model results indicate the pump has little affect on the existing storm sewer system when activated.

Flood Mitigation Project Analysis

CBBEL analyzed six separate alternatives in order to provided flood relief in the indicated flood problem areas. The analysis considers flood protection up to the October 13, 2001 design storm event. Measures considered included up-sizing the existing storm sewers, installing additional storm sewer inlets, bypass or relief storm sewers and created storage. Based on the SWMM model results, combinations of these measures were needed to provide flood relief for the problem areas.

Alternative 1A: Alternative 1A proposes flood relief for the residents in Problem Area 8. This alternative maintains the existing storm sewer along Marshall Drive and places a parallel sewer running from Cordial Drive to Oakton Street. The proposed parallel storm sewer will have the same invert elevations as the existing sewer; however, the pipes will be larger. A 30-inch pipe is proposed from Cordial Drive to Oakton Street, where it will tie into the existing Oakton Street storm sewer system. Alternative 1A was modeled using the SWMM model to determine the flood reduction in Problem Area 8. Based on the model results, the addition of the parallel storm sewer lowers the flood elevations in Problem Area 8 and eliminates overtopping into the existing depressed driveways for the 2-hour critical 10-year design storm event and during the October 13, 2001 storm event. However, by increasing the pipe capacity and conveying more flow towards the existing detention facility worsens the flooding in Problem Area 9 during the 10-year, 2-hour design storm event. The results are shown in Table 27. Therefore, additional measures to the system were found necessary. The Alternative 1A improvements are shown on Exhibit 21. In conjunction with additional parallel storm sewer, inlets or catch basins are needed along Marshall Drive and Pennsylvania Avenue. The concept level opinion of probable costs associated with this alternative is approximately $295,000. Appendix 1 contains the detailed opinion of probable cost.

Alternative 1B: Alternative 1B consists of a diversion pipe at the Oakton Street and Marshall Drive intersection directing flows towards the south. This alternative diverts flow away from the existing system. A proposed 30” pipe is proposed to run south along Marshall Drive and connect to the proposed Wille Road storm sewer system, which drains directly into Higgins Creek. SPACECO, Inc. has indicated that the lowest pipe invert feasible at Wille Road and Marshall Drive is 650.48 because of the ditch inverts at the outfall to Higgins Creek. Therefore, this constraint limits the elevation at which diversion can begin. The minimum invert elevation at the Wille Road manhole should be 650.48 because of the invert elevation of the connection to the Oakton Street manhole. Alternative 1B is proposed to work in conjunction with Alternative 1A. The Alternative 1B improvements were input into the Alternative 1A SWMM model and the results indicate that flood protection is achieved up to the 10-year, 2-hour design storm event for Problem Areas 8 and 9. During the October 13,

2001. storm event, flood protection is achieved on Marshall Drive and acceptable flood levels of 4.1 inches are still occurring at the intersection of Pennsylvania Avenue and Oakton Street. The SWMM model results are summarized in Table 27. The Alternative 1B improvements are shown on Exhibit 20. This alternative requires drainage easements south of Oakton Street to Marshall Drive. Approval from the Illinois State Toll Highway Authority (ISTHA) is required for placing the proposed discharge pipes in the their easement. Also, considerable costs are expected with this alternative as a result of utility conflicts at the Wille Road crossing. The SPACECO, Inc. survey shows two gas mains, a water main, a force main and a storm sewer at this location. The concept level opinion of probable costs associated with this alternative is $240,000. The combined concept level opinion of probable costs associated with these alternatives is approximately $535,000. Appendix 1 contains the detailed opinion of probable cost.

Alternative 2: Installing an outlet pipe from the existing Oakton Street Detention Facility connecting to the proposed Wille Road storm sewer was analyzed. This alternative does not seem practical due to the pipe cover constraints under Wille Road. Based on the SPACECO, Inc. plans, the minimum invert elevation that can be placed under gravity flow to tie-in to the Wille Road storm sewer is 654.0. This elevation is above the 10-year high water elevation of the facility and will not provide any flood relief for Problem Areas 8 and 9 for events up to the 10-year storm.

Alternative 3: Alternative 3 considers the creation of storage volume in Friendship Park, which is owned by the Mount Prospect Park District. A majority of the parks overland runoff naturally flows toward the Algonquin Road storm sewer system. This alternative would result in excessive costs associated with routing the Marshall Drive storm sewer system towards Friendship Park, excavation costs and costs associated with purchasing land from the Park District to create the storage. This alternative does not seem practical due to not only the costs but the storage area is located upstream of Marshal Drive.

Buyouts: This alternative considers purchasing the individual homes that receive floodwaters through below grade garages. There are approximately 5 homes located in Problem Areas 8 and 9 with below grade garages. Once purchased, the City will have the option of demolishing the existing home and selling the lot to the Park District for the creation of a park area, selling the lot to a private developer or simply maintaining the vacant lot. This alternative is not recommended as a result of the extreme costs associated with the purchasing of each home at a fair market value. The approximate costs associated this alternative (purchase of homes only) is approximately $1.43 million ($285,000 per house).

Buyouts/Creation of Storage: This alternative considers the purchasing of multiple homes located at the intersection of Marshall Drive and Courtesy Lane or Marshall Drive and Dover Drive and creating a stormwater management facility in their place. This alternative is not recommended as a result of the extreme costs associated with the purchasing of each home at a fair market value. A large number of houses are required in order to provided a sufficient amount of storage. Also, existing storm sewers will have to be routed into the created facility and an outfall pipe will have to be installed from the facility to the Oakton Street storm sewer system.

Summary

Alternatives 1A and 1B are recommended to alleviate flooding at the two problem areas. The components of each are summarized in Table 27.

Table 27
Problem Areas 8 & 9 - Summary of Alternatives

Node ID & Location	Existing RIM Elevation (ft)	October 13, 2001 Event WSEL (ft)	Existing 10-yr, 1-hr WSEL (ft)	Alternative			
				1A		1B	
				Oct 13	10-yr	Oct 13	10-yr
CB100 (NW Corner of Courtesy Ln. & Marshall Dr.)	655.58	658.00	655.77	655.58	654.44	655.53	653.13
CB101 (East of Courtesy Ln. on Marshall Dr.)	655.56	657.47	655.8	655.56	654.49	655.56	653.13
CB102 (SW Corner of Courtesy Ln. & Marshall Dr.)	655.53	658.01	655.84	655.56	654.50	655.53	655.14
CB124 (NW of Dover Dr. on Pennsylvania Ave.)	653.28	653.76	652.58	653.63	652.90	653.58	652.90
CB125 (SW of Dover Dr. on Pennsylvania Ave.)	653.23	653.75	652.5	653.63	652.87	653.57	652.88
PND 1 Oakton St. Detention Facility	N/A	653.66	650.50	653.65	652.15	653.57	651.08

EXHIBIT 21

PROBLEM AREA #10

Problem Area 10 consists of residencies located north of Touhy Avenue, east of Wolf Road, west of Lake Opeka and south of Jarvis Avenue. A majority of the area south of Jarvis Avenue is unsewered and there are no defined drainage ditches or swales. In the unsewered areas, it appears that water ponds mainly in the front yards and in the Right-of-Ways (ROW).

Watershed Description

A major portion of Problem Area 10 watershed drains to the Jarvis Avenue storm sewer system, which outlets into Lake Opeka. To analyze the existing Jarvis Avenue storm sewer, the entire tributary watershed is required. The existing watershed was subdivided into 4 subareas based on the City's storm sewer atlas, street improvement plans and topography obtained from the City. CBBEL determined approximately 71.6 acres are tributary to the existing 30-inch Jarvis Avenue storm sewer, from north of Jarvis Avenue. The area tributary to the Jarvis Avenue storm sewer at the intersection between Jarvis Avenue and Sprucewood Avenue is 9.0 acres. The tributary area south of Jarvis Avenue, from Sprucewood Avenue to Westview Avenue was determined to be 8.5 acres. The tributary area south of Jarvis Avenue, from Westview Avenue to Eastview Avenue was determined to be 19.0 acres. The land use is based on field visits and the 2001 aerial photography. The existing watershed consists of mainly residential land use, impervious roadway surfaces and pervious grass areas. The remaining area south of Jarvis Avenue drains towards Touhy Avenue and is captured and conveyed by Illinois Department of Illinois (IDOT) storm sewers into the Des Plaines River. The existing drainage patterns are shown on Exhibit 11.

Existing Conditions Analysis

The hydrologic parameters developed for each subarea and the existing storm sewer information were used to determine if the Jarvis Avenue storm sewer has sufficient capacity to convey the tributary runoff from the greater of the 10-year, 2-hour critical storm or the October 13, 2001 historic storm event. It was determined that the October 13, 2001 historic storm event should be the design storm event for Problem Area 10. The existing conditions storm sewers are shown on Exhibit 11. A TR-20 hydrologic model was developed to determine the October 13, 2002 design storm event runoff flow rates tributary to the existing 30-inch storm sewer. The Runoff Curve Numbers (RCN) and times of concentration were computed for the watershed area tributary to the Jarvis Avenue storm sewer and input into a TR-20 hydrologic model. Based on the model results, the October 13, 2001 design storm event flow rate were computed to be 55 cfs. The modeling and hydraulic calculations are located in Appendix 1.

CBBEL analyzed the capacity of the existing 30-inch storm sewer system conveying runoff flows from Jarvis Avenue to Lake Opeka. The sewer capacity was determined by using the Culvert Selection Graph obtained from the Illinois Department of Transportation (IDOT) Drainage Manual. Based on the City of Des Plaines storm sewer atlas and invert/elevation information from construction plans supplied by the City, CBBEL determined that the existing 30-inch storm sewer has a maximum full pipe capacity of approximately 28 cfs at a 0.38% slope. The October 13, 2001 design storm event flow rate would exceed the capacity of the existing 30-inch storm sewer.

Flood Mitigation Project Analysis

As the streets south of Jarvis Avenue become upgraded with curb/gutter and storm sewers, an additional main storm sewer along Jarvis Avenue should be installed.

Alternative: CBBEL proposes the installation of a parallel storm sewer from the western end of Jarvis Avenue to the Lake Opeka outlet in order to convey the October 13, 2001 design storm event tributary flow rate from the area located south of Jarvis Avenue, once curb/gutter and storm sewers are provided for area south of Jarvis Avenue. Based on the existing TR-20 hydrologic model results, a parallel sewer between Wolf Road and Sprucewood Avenue should be sized to convey 6.7 cfs, a parallel sewer between Sprucewood Avenue and Westview Avenue should be designed to convey 12.8 cfs and a parallel sewer between Westview Avenue and Eastview Avenue should be designed to convey 20.1 cfs. Based on the IDOT Culvert Selection Graph, CBBEL proposes a parallel 21-inch sewer between Wolf Road and Sprucewood Avenue, a parallel 24-inch sewer between Sprucewood Avenue and Westview Avenue and a parallel 27-inch sewer from Westview to the Lake Opeka Outlet. The proposed parallel sewer has sufficient capacity to convey the October 13, 2001 design storm event flow. The proposed alternative is shown on Exhibit 22. The concept level opinion of probable costs associated with this alternative is approximately $385,000. Appendix 1 contains the detailed opinion of probable cost.

This alternative would result in increased flows to Lake Opeka, it is our understanding that concerns have been express by the Park District that future increases in the high water elevation of the lake could impact their facilities. Based on the City of Des Plaines aerial topographic map, no additional runoff will be diverted to Lake Opeka that is not already naturally tributary to the lake. However, by installing storm sewers south of Jarvis Avenue, runoff flows will get to Lake Opeka at a faster rate, which will result in slightly higher water surface elevations. CBBEL believes that these increases in elevations are not significant. If the Park District is already experiencing flooding within the structures located around Lake

Opeka, documentation should be presented such that flood-proofing measures can be made to accommodate the increased water surface elevations. If storage volume is required to meet the existing storm sewer flow into Lake Opeka then approximately 4.55 acre-feet of would be required to meet the October 13, 2001 design storm event. The concept level opinion of probable costs associated with providing the additional storage volume (assuming that underground storage would be used) for the October 13, 2001 design storm event is approximately $1,047,000, respectively. Due to this large cost, it is recommended that floodproofing of any impacted Park District facilities be completed instead of providing underground storage. Appendix 1 contains the detailed opinion of probable cost.

Summary

The recommended flood mitigation project will provide sufficient capacity for the October 13, 2001 design storm event flow rate that would be expected for the tributary area south of Jarvis Avenue. The proposed Jarvis Avenue storm sewer will provide an outlet for future roadway storm sewers that will be installed south of Jarvis Avenue. It is also recommended that for future storm sewers to be constructed south of Jarvis Avenue, high capacity inlets be included.

EXHIBIT 22

PROBLEM AREA #11

The returned Flood Protection Questionnaires reported basement, crawl space and first floor flooding associated with storm sewer and sanitary sewer backup and basement wall seepage. The reported drainage problems are caused by the lack of a storm sewer system along Spruce Street south of Fargo Avenue and because the existing Spruce Street combined sewer located north of Fargo Avenue has inadequate capacity to convey the runoff from the 10-year, 1-hour design storm event.

Watershed Description

The Problem Area 11 watershed was divided into an area that drains to the Spruce Avenue combined sewer located between Fargo Avenue and Howard Street and Spruce Avenue area tributary to the Fargo Avenue storm sewer system that drains to Lake Opeka. CBBEL determined that approximately 15.7 acres of area is tributary to the Fargo Avenue Storm Sewer system west of Ash Street and approximately 10.5 acres of area is tributary to the Spruce Avenue combined sewer south of Howard Avenue. The existing Fargo Avenue watershed was subdivided into 8 subareas and the Spruce Avenue watershed was subdivided into 3 subareas based on the City's storm sewer atlas, street improvement plans and topography obtained from the City. The land use is based on field visits and the 2001 aerial photography. The existing watershed consists of mainly residential land use, impervious roadway surfaces and pervious grass areas. The existing drainage patterns are shown on Exhibit 12.

Existing Conditions Analysis

The hydrologic parameters developed for each subarea and the existing storm sewer information were used to determine if the Fargo Avenue storm sewer has sufficient capacity to convey the tributary runoff from either the 10-year, 1-hour storm event or the October 13, 2001 historic storm event. Since the 10-year, 1-hour produce greater flow rates it was chosen as the Problem Area 11 design event. The existing conditions storm sewers are shown on Exhibit 12. A TR-20 hydrologic model was developed to determine the 10-year, 1-hour design storm event runoff flow rate tributary to the existing 24-inch storm sewer. The Runoff Curve Numbers (RCN) and times of concentration were computed for the watershed area tributary to the Fargo Avenue storm sewer and input into a TR-20 hydrologic model. Based on the model results, the 10-year, 1-hour design storm event flow rate was computed to be 14.9 cfs. The TR-20 hydrologic model also determine the existing conditions 10-year, 1-hour design storm flow rate tributary to the Spruce Avenue combined sewers to be 10.1 cfs. The modeling and hydraulic calculations are located in Appendix 1.

CBBEL analyzed the capacity of the existing Fargo Avenue 24-inch storm sewer system conveying runoff flows from Ash Street to Lake Opeka. The sewer capacity was determined by using the Culvert Selection Graph obtained from the Illinois Department of Transportation (IDOT) Drainage Manual. Based on the City of Des Plaines storm sewer atlas and invert/elevation information from construction plans supplied by the City, CBBEL determined that the existing 24-inch storm sewer has a maximum full pipe capacity of approximately 8 cfs at a 0.1% slope. The 10-year, 1-hour design storm event flow rate exceeds the capacity of the existing 24-inch storm sewer.

Flood Mitigation Project Analysis

CBBEL analyzed possible flood mitigation projects in order to provided flood relief in the indicated flood problem areas. The analysis considers flood protection up to the 10-year, 1-hour design storm event. Measures considered installing a relief storm sewer along Fargo Avenue, installing storm sewer along Spruce Avenue and Ash Street south of Fargo and to separate the combined sewers along Spruce Avenue north of Fargo Avenue and south of Howard Avenue.

Alternative 11 - Fargo Avenue: CBBEL proposes a parallel storm sewer from the intersection of Fargo Avenue and Spruce Avenue to the Lake Opeka outlet. Also, a relief storm sewer is proposed to extend north to south from Fargo Avenue on Spruce Avenue and Ash Street to provide relief in those areas. Based on the existing TR-20 hydrologic model results, the proposed sewer between Lee Street and Spruce Avenue must convey 3.8 cfs and the proposed sewer between Lee Street and Lake Opeka must convey 7.2 cfs. Based on the IDOT Culvert Selection Graph, CBBEL proposes a parallel 21-inch storm sewer between Spruce Avenue and Lee Street and a 24-inch storm sewer from Lee Street to the Lake Opeka Outlet. A 15-inch relief sewer along Spruce Avenue is also proposed to connect to the Fargo Avenue system extending 200 feet north of Fargo Avenue/Spruce Avenue intersection. A 12-inch to 15-inch storm sewer is proposed to drain the south end of Spruce Avenue and connects to the proposed Fargo Avenue relief storm sewer. Also, a storm sewer is proposed to extend approximately 380-feet down Ash Street, south of Fargo Avenue. The proposed storm sewers have sufficient capacity to convey the 10-year, 1-hour design storm event flows. The proposed alternative is shown on Exhibit 23. The concept level opinion of probable costs associated with this alternative is approximately $240,000. Appendix 1 contains the detailed opinion of probable cost.

EXHIBIT 23

As with the Problem Area 10 flood mitigation project, this flood mitigation project would result in increased flows to Lake Opeka, however the Park District has made concerns on future increases in high water elevation of the lake. Based on the City of Des Plaines aerial topographic map, no additional runoff will be diverted to Lake Opeka that is not already naturally tributary to the lake. However, runoff flows will get to Lake Opeka at a faster rate, which will result in slightly higher water surface elevations. CBBEL believes that these increases in elevations are not significant. If the Park District is already experiencing flooding within the structures located around Lake Opeka, documentation should be presented such that flood-proofing measures can be made to accommodate the increased water surface elevations. If storage volume is required to meet the existing storm sewer flow into Lake Opeka then approximately 0.33 acre-feet meet the 10-year, 1-hour design storm event. The concept level opinion of probable costs associated with providing the additional storage volume to meet the existing 10-year, 1-hour design storm event is approximately $76,000 assuming underground storage. Appendix 1 contains the detailed opinion of probable cost.

Alternative 11 - Spruce Avenue: The Spruce Avenue flood mitigation project consists of a installing a storm sewer system allowing the existing combined sewer to solely convey sanitary flows. The new storm sewer will be on Spruce Avenue, south of Howard Avenue, north of Fargo Avenue, and connecting to the Howard Avenue storm sewer system. The proposed new sewer along Spruce Avenue will provide relief for residences in Problem Area 11 along Spruce Avenue. Based on the existing TR-20 hydrologic model results, the proposed sewer 200 feet south of the intersection between Spruce Avenue and Highland must convey 1.2 cfs, the proposed sewer 300-feet north of the intersection between Highland Avenue and Spruce Avenue must convey 7.4 cfs and the proposed sewer approximately 300-feet south of the intersection between Howard Avenue and Spruce Avenue must convey 10.2 cfs. Based on the IDOT Culvert Selection Graph, CBBEL proposes a 12-inch sewer south of the Spruce Avenue and Highland Avenue intersection, a 15-inch sewer south through the intersection of Spruce Avenue and Highland Avenue, and a 21-inch sewer between Highland Avenue and Howard Avenue on Spruce Avenue. The proposed sewer has sufficient capacity to convey the computed 10-year, 1-hour design storm event flow rate. The proposed flood mitigation project is shown on Exhibit 23. The concept level opinion of probable costs associated with this alternative is approximately $170,000. Appendix 1 contains the detailed opinion of probable cost.

This flood mitigation project proposes to increase flows to the existing Howard Street storm sewer system. An analysis of the Howard Street storm sewer indicates that sufficient capacity is available to handle the proposed additional flows.

Summary

The recommended flood mitigation project will provide sufficient flood relief for the 10-year, 1-hour design storm event. The recommended improvement project includes the installation of high capacity inlets along the route of the proposed storm sewers.

PROBLEM AREA #12

The results of the returned Flood Protection Questionnaires reported no flooding problems. Field reconnaissance of the problem area during the August 22, 2002 storm event revealed no street flooding. During the October 13, 2001 storm event, the City of Des Plaines Public Works Department received no telephone calls reporting basement flooding, sewer back-up or street flooding. The City of Des Plaines has reported that below grade garages at the western end of Washington Street are at risk from street flooding. Hydrologic and hydraulic modeling performed that indicates that the Laurel Avenue storm sewer system conveyance capacity is less than the surface runoff from the 10-year, 1-hour design storm event. Based on this existing condition, temporary ponding of stormwater in the low areas of Washington Street will occur.

Watershed Description

The Problem Area #12 watershed was determined to be part of the tributary area that drains to the Perry Street storm sewer system, which eventually drains to the Weller Creek. Based on street improvement plans obtained from the City and conversations with the City, a 48-inch relief storm sewer was installed on Perry Street extending from Graceland Avenue to Weller Creek. The 48-inch storm sewer provides relief for area tributary to Perry Street, east of Graceland Avenue. The existing 36-inch storm sewer along Perry Street now only conveys runoff flows south of Perry Street, west of Graceland Avenue and north of the Union Pacific Railroad. However, based on the Perry Street improvement plans obtained from the City, there are two inlets on Perry Street, between Graceland Avenue and Mannheim Road, near the existing alley, continue to convey flows from Perry Street to the existing 36-inch storm sewer. Therefore, CBBEL determined that approximately 59.8 acres of area is tributary to the existing 36-inch Perry Street storm sewers. The watershed area tributary to the Perry Street to the existing 36-inch storm sewer was subdivided into 12 subareas, based on the City's storm sewer atlas, street improvement plans and topography obtained from the City. The land use is based on field visits and the 2001 aerial photography. The existing watershed consists of single-family residential, multi-family residential, commercial, industrial, impervious roadway surfaces and pervious grass areas. The existing drainage patterns are shown on Exhibit 13.

Existing Conditions Analysis

The hydrologic parameters developed for each subarea and the existing storm sewer information were used to determine if the Perry Street storm sewer and the tributary Washington Street storm sewer has sufficient capacity to convey the

tributary runoff from the 10-year, 1-hour design storm event. The existing conditions storm sewers are shown on Exhibit 13.

SWMM was used to simulate the existing sewer system. The hydrologic parameters developed for each subarea and the existing storm sewer information were input in the model to determine if the existing sewers have sufficient capacity to convey the 10-year, 1-hour design.

SWMM was used to simulate the existing sewer system with a tailwater condition. The 10-year flood elevation of 634.0 was taken from the Flood Insurance Study (FIS) flood profiles for Weller Creek and input into the model as a starting water elevation or tailwater condition. The hydrologic parameters developed for each subarea and the existing storm sewer information were input in the model.

The model results indicate the existing storm sewer system conveying runoff flows from Washington Street does not have sufficient capacity to convey the 10-year, 1-hour design storm event.

The model results indicate the existing storm sewer system conveying runoff flows from Washington Street does not have sufficient capacity to convey the 10-year, 1-hour design storm event the flooding depths are increased over the no-backwater condition.

Flood Mitigation Project Analysis

CBBEL analyzed possible flood mitigation projects in order to provided flood relief in the indicated flood problem area on Washington Street. The analysis considers flood protection up to the 10-year, 1-hour design storm event. Measures considered installing a relief parallel storm sewers and replacing the existing storm sewers.

Alternative: The flood mitigation project proposes flood relief for the residents on Washington Street, west of Laurel Avenue. This alternative also provides the option of future improvements in the area. CBBEL proposes a 24-inch parallel relief storm sewer along Washington Street, Laurel Avenue, and Perry Street ending at Graceland Avenue. The proposed alternative watershed was modeled using the SWMM model to determine the flood reduction that is provided for the 10-year, 1-hour design storm event considering tailwater from Weller Creek. Based on the model results, the proposed relief storm sewer along with the addition of high capacity inlets will provide relief in the areas that experienced flooding under existing conditions. The model results indicate that storm sewer surcharging would still occur for the 10-year, 1-hour design. Under no tailwater conditions, the depth of flooding above the catchbasin RIM elevation along Washington Street decreased on an average of 42%. The alternative improvements are shown on Exhibit 24. The

conceptual level opinion of probable costs associated with this alternative is approximately $415,000. Appendix 1 contains the detailed opinion of probable cost.

Summary

The recommended flood mitigation project provides sufficient flood relief up to the 10-year, 1-hour storm event.

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EXHIBIT 24