



Flood Study

Cherry Street Upland Depressional Area Flood Study

Wheaton, IL

Prepared for:

***City of Wheaton
303 W. Wesley St
Wheaton, IL 60187***

ERA Project # 110511

October 2011



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LOCATION AND INTENT OF STUDY

The Cherry Street Upland Depressional Area (CSUDA) is located within an approximately 47 acre drainage sub-basin in the City of Wheaton. The sub-basin is bound generally by Prairie Avenue on the north, Santa Rosa Avenue on the west, Stoddard Avenue on the east, and Harrison Street on the south. The depression covers approximately 4.2 acres in an area centered near the intersection of Cherry Street and Forest Avenue (see Exhibit 1).

The area was developed in the 1950s as a moderately dense single-family residential subdivision. Relatively lax stormwater design regulations and drainage conveyance requirements at the time of development resulted in undersized storm sewer and a lack of positive overland flow paths. Existing overland flow paths are significantly higher in elevation than many of the secondary and several primary structures. As a result of flooding complaints from the October 2006, September 2008, and July 2010 storm events a flood questionnaire was sent to area residents in November 2010 in which it was determined that significant flooding has occurred. This Cherry Street Upland Depressional Area Flood Study is a result of the questionnaire.

The existing deficiencies in drainage were analyzed using the stormwater modeling program, XPSWMM. The program performs the hydrologic and hydraulic computations of conveyance, storage, and flood level parameters within the stormwater drainage system. The results of the model were used to evaluate the existing drainage of the CSUDA.

GENERAL WATERSHED CHARACTERISTICS

The sub-basin tributary to the CSUDA consists of a moderately dense single-family neighborhood. The sub-basin consists of developed lots between 1/8 and 1/4 acre in size. The sub-basin drains in general towards the depressional area centered along Cherry Street. Due to the age of the neighborhood, clearly defined overland flow routes do not exist between residences. Instead, runoff sheet flows down the undefined slopes of the residences side and rear yards until it is collected in the City-owned stormwater sewer system present mostly in roadway. No surface waterways exist within the sub-basin.

The primary outlet for the sub-basin is via storm sewer that serves the streets within the sub-basin. This primary storm sewer flows south toward the Spring Brook Watershed. The secondary outlet for the sub-basin is via storm sewer through an inlet that serves the rear-yards at the northern end of Cherry Street. This storm sewer flows north toward the Winfield Creek Watershed. These are shown on the tributary area Exhibit 2. Due to the rim elevation, this storm sewer drains the sub-basin only after there is a significant level of ponding within the depression.

The tertiary outlet for the sub-basin is through an overland flow route to the north near the cul-de-sac on Howard Street. This overland flow route is at an elevation that is even higher than the storm sewer draining this location. Thus for this overflow to become engaged, there is a significant corresponding level of flooding within the adjacent CSUDA. Storm sewer is the primary outlet for runoff within the sub-basin.

LIMITATIONS OF STUDY / ASSUMPTIONS

The Cherry Street Upland Depressional Area Flood Study did not include the following items:

- Groundwater analysis
- Detailed topographic study of the project area
- Inlet capacity analysis

- Risk/Cost analysis of potential flood damages

The capacity of the sewer system assumes that all structures and pipes, with a few exceptions in areas known to need maintenance, are clean and unobstructed. The Cherry Street Depressional Area hydraulic and hydrologic model was developed using the best available information from the City of Wheaton's storm sewer atlas, as-built plans, and two foot County topography. The Drainage Study's accuracy is limited to the information found in these resources.

EVALUTION OF EXISTING DRAINAGE SYSTEM

DATA COLLECTION AND ANALYSIS

Model Setup

Various sources were used to identify the location and determine the extent and frequency of stormwater drainage problems within the Cherry Street Depression watershed. Readily available information was used to compile a computer model and assess the existing conditions of the Cherry Street Depression drainage network. The computer model which performed the Hydrologic and Hydraulic computations used the proprietary software program called XPSWMM.

The following resources were used to construct a stormwater model in XPSWMM:

- City of Wheaton 2-ft contours
- DuPage County 2-ft contours
- Survey data (see Exhibit 4)
 - Rim/invert information for storm sewer
 - Overland flow route cross-sections
 - Topographic shots of relevant building elevations, roadways, and rear yard grades
- Aerial Maps

To construct the XPSWMM model, all the storm sewer and overland flow routes geometries within the CSUDA subbasin were input into the model. These were modeled using the 2-ft contour maps, the field survey rim / invert data, and the updated topographic information. Since free flow conditions don't exist in the sewer directly at the sub-basin outlets, modeling of the storm sewer was continued for a considerable distance for both the north and south sewer outlets. To the north, storm sewer was modeled past Wakeman Avenue to a manhole in the north end of Hawthorne Junction Park. To the south, storm sewer was modeled to a manhole just north of University Avenue. The area tributary to the storm sewer was broken down into sub-areas tributary to specific manholes within the system (see Exhibit 2). Please see the Appendix for time of concentration and curve number calculations.

The hydraulic models developed for this study utilized the main trunk lines to identify where in the storm sewer network there were deficiencies in conveyance. The hydraulic models often represented multiple pipe segments as a single segment, and often combined several locations with stormwater runoff inflow into a single inflow point.

Once the above-ground and underground physical parameters of the model were established, typical rainfall amounts were applied and distributed across the watershed. Hydrologists classify rainfall events according to the statistical probability that the given amount of rainfall would occur at a geographic location over a given duration of time. For example, the 5-year storm has a 20% probability of

occurrence during any given year. In this study, the Cherry Street Depressional Area is evaluated in terms of its capacity to handle the 5-, 10-, 25-, 50-, and 100-yr storm events.

A critical duration analysis was performed to determine what storm duration is critical for Cherry Street Depressional Area. The duration that produced the greatest flow within the storm system was the 2-hour storm. For all analysis, the Cherry Street Depressional Area was evaluated for the 2-hour, as well as the 24-hr storm event.

Resident Feedback

As a result of flooding complaints from the October 2006, September 2008, and July 2010 storm events a flood questionnaire was sent to area residents in November 2010. The questionnaire requested information from the residents on the type of flooding they may have experienced on their property. The resident responses were very helpful to provide anecdotal evidence of ponding concerns and overland flow route issues. Tabulation of the responses from the questionnaire can be found in the Appendix. Typical drainage problems reported by residents included flooding in the back, front, and side yards, basements, detached garages, streets, and intersections. This information was also used as a “reality check”, in order to calibrate the computer model of the existing drainage system.

PROBLEM AREA IDENTIFICATION

The XPSWMM model was used to determine the extent of drainage issues within the CSUDA. After evaluating the entire sub-basin using the model results, there are three areas within the Cherry Street Depressional Area where drainage issues exist. The flooding/drainage issues due to the existing stormwater drainage system are shown in Exhibit 3 and are listed and described in detail below:

Problem Area 1: Cherry Street North Depression

Approximately 200 ft north of the intersection of Cherry Street and Forest Avenue a depressional area exists that is centered on the storm catch basin at this location (Manhole 9, Exhibit 2). This catch basin is connected to the storm sewer flowing south toward the Spring Brook Watershed and is the primary means of draining the depressional area. This catch basin surcharges during the 5-yr critical duration storm event and above. Once the storm sewer is surcharged during the 10-yr critical duration storm event, water begins to pond upon residential lots east and west of the street near this catch basin. Ponding in the area occurs during the 10-yr event and increases in depth during storm events of greater intensity. During the 100 yr critical duration event, the model indicates ponding to an elevation of 765.52 ft which encompasses 3.42 acres as illustrated in Exhibit 3.

Contributing to the flooding issues at this location, there are two additional inefficient outlets. The first outlet is through a structure in the rear yard of 1135 Howard Avenue. This inlet is connected to the storm sewer flowing north toward the Winfield Creek Watershed and has a rim elevation of 763.66' (Manhole 28, Exhibit 2). In the same yard and downstream of Manhole 28, another inlet has a rim elevation of 764.19' (Manhole 21, Exhibit 2). This storm system does not have adequate downstream capacity and surcharges during the 50-yr event and above, which effectively adds to the volume of stormwater in the depressional area. The dynamic analysis mode within XPSWMM shows that these inlets actually contribute to flooding of the depression during early portions of the storm (50-yr and 100-yr event), but eventually start draining the depression once the storm subsides and downstream tailwater conditions are reduced.

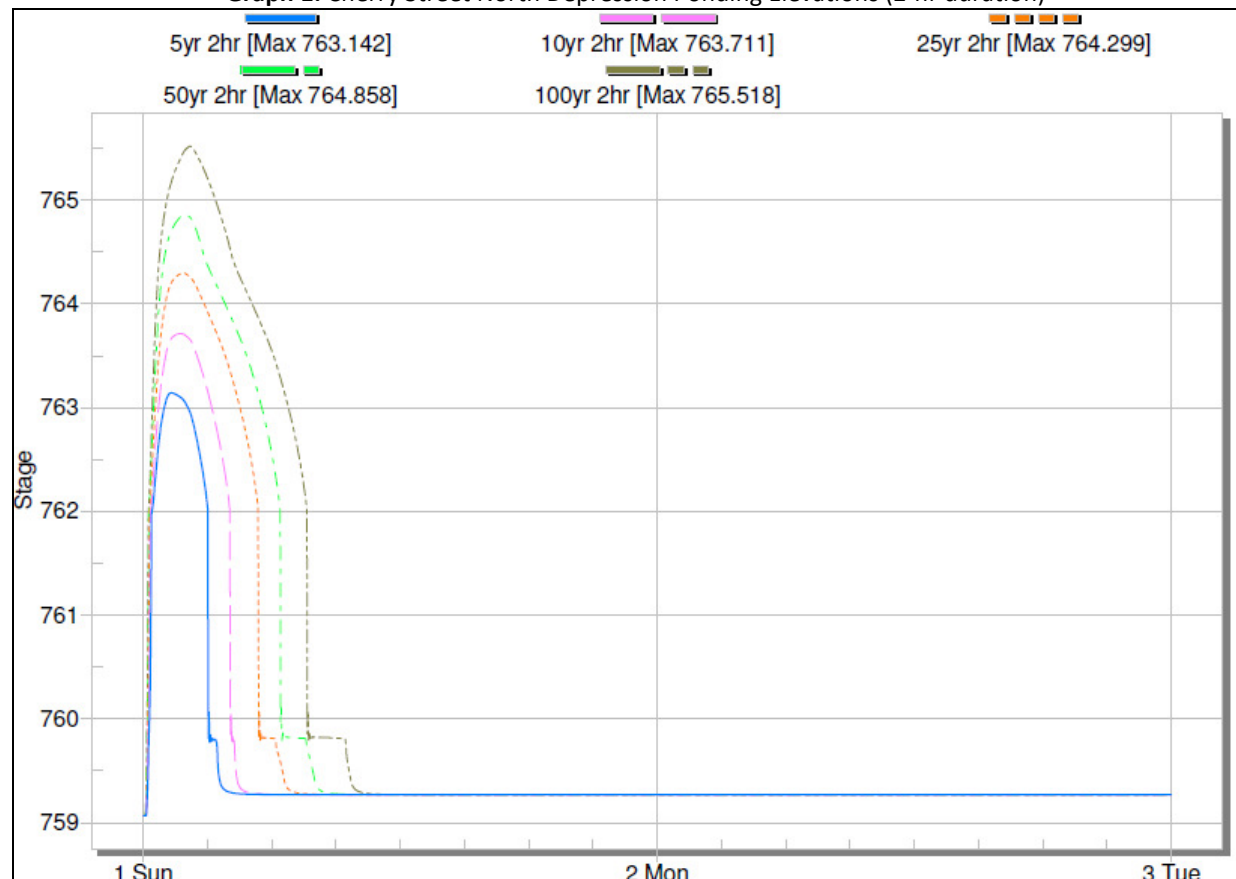
The overland flow route for this depression exists in the front yard of 1135 Howard Avenue at an elevation of 766.46 ft. This elevation is greater than the elevation of ponding reached during the 100 yr critical duration event of 765.52 ft. Therefore it cannot be determined when, if ever, this overland flow route is engaged during storm events.

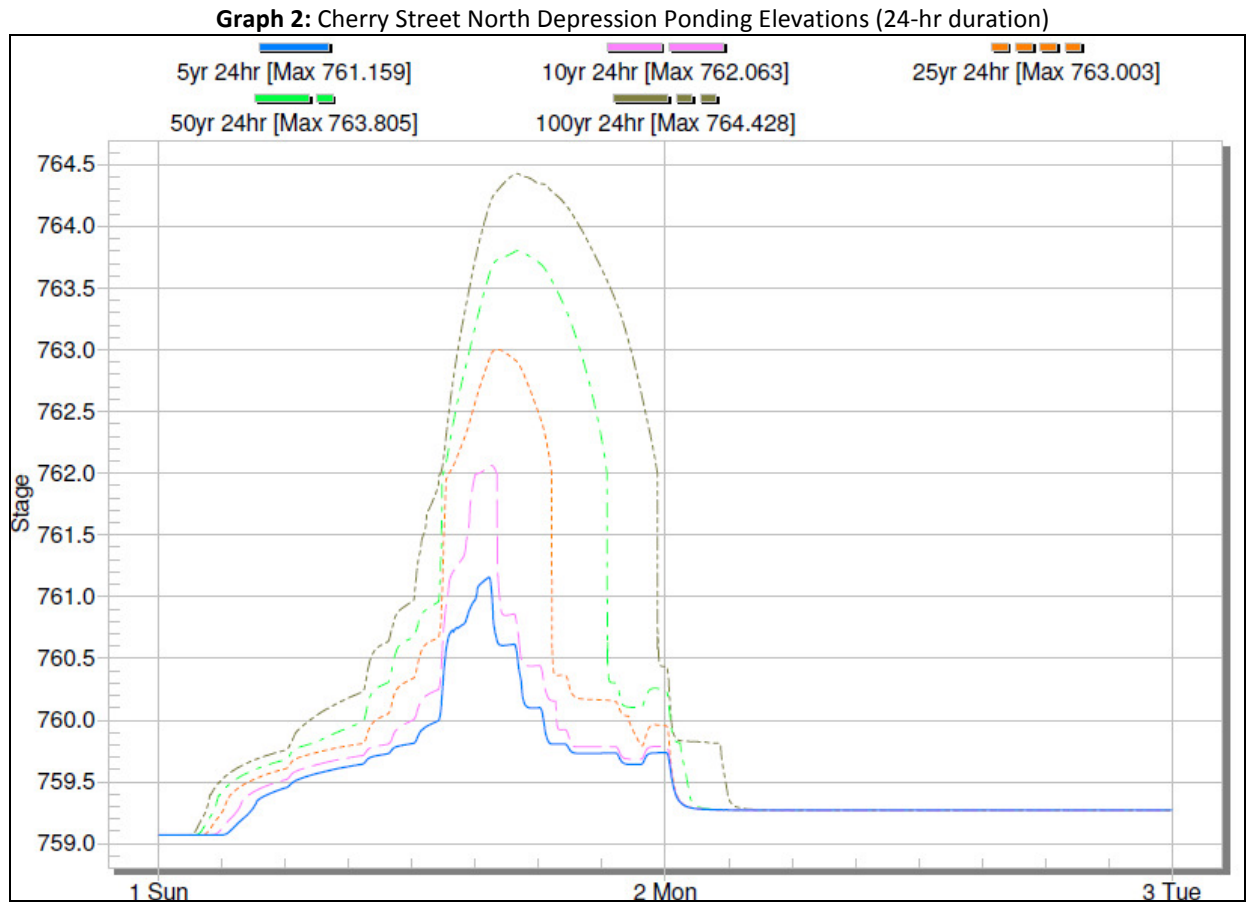
Table 1: Cherry Street North Depression Ponding Summary (2-hr and 24-hr duration)

Storm Event	2-hr Duration		24-hr Duration	
	Max Elevation (ft)	Volume (ac-ft)	Max Elevation (ft)	Volume (ac-ft)
5-yr	763.142	0.9138	761.159	0.0000
10-yr	763.711	1.6072	762.063	0.2190
25-yr	764.299	2.7919	763.003	0.6142
50-yr	764.858	4.4320	763.805	1.7414
100-yr	765.518	6.0114	764.428	2.8387

Below are graphs for the elevation of ponding present in the north depressional area during the 2-hr critical duration as well as the 24-hr duration for different storm events.

Graph 1: Cherry Street North Depression Ponding Elevations (2-hr duration)





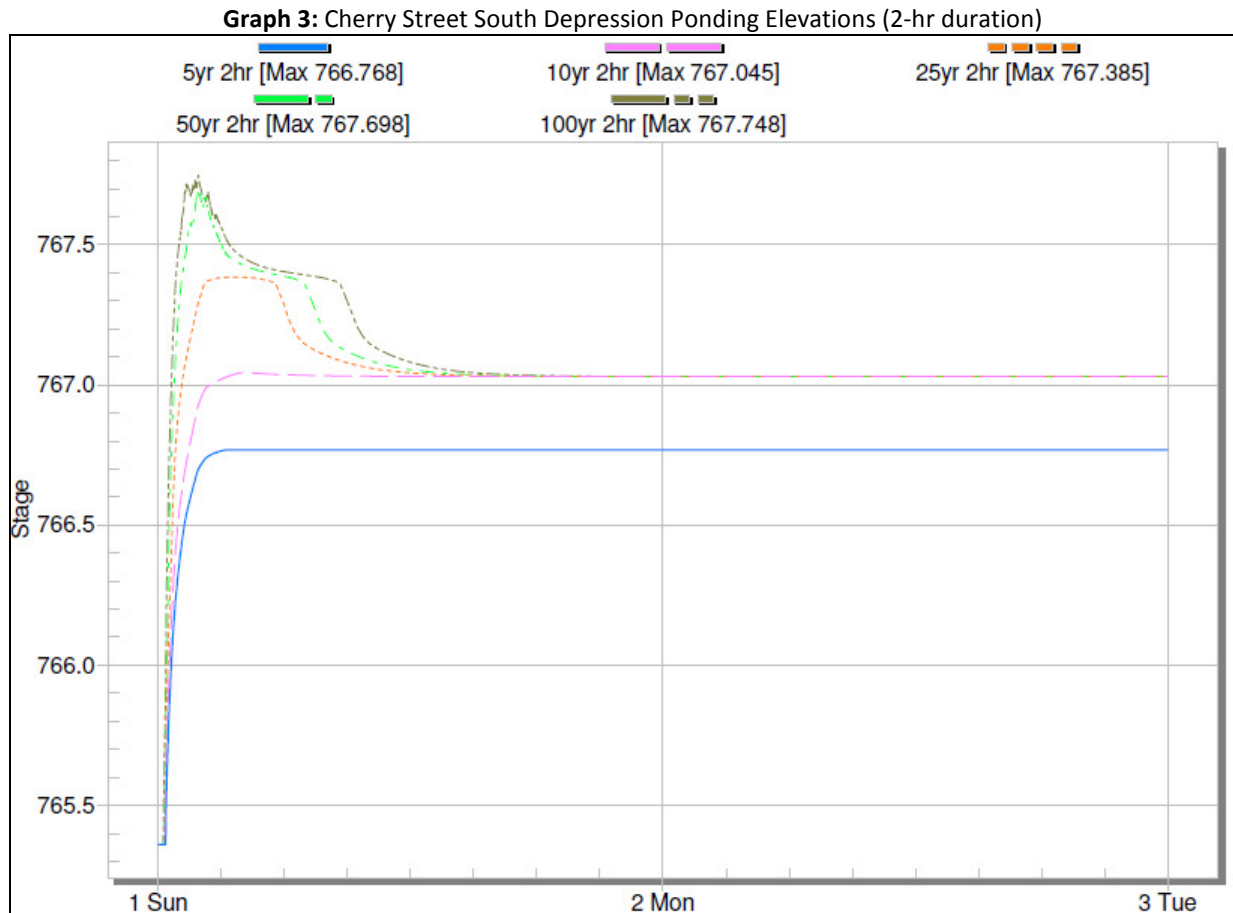
Problem Area 2: Cherry Street South Depression

Another depressional area is located approximately 260 ft south of Forest Avenue, in the rear yards of properties on the block located between Cherry Street and Webster Avenue (see Exhibit 3). The catch basin located mid-block along Webster Avenue surcharges during the 5-yr event (Manhole 20, Exhibit 2). Surcharging runoff from this catch basin on Webster Avenue is routed west overland into the rear-yard depressional area at this location. No storm sewer provides drainage for this depressional area, however overland flow continues through residential side yards towards Cherry Street at an overflow elevation of 767.36 ft. Ponding in the area occurs during the 5-yr event and increases in depth during storm events of greater intensity. During the 100-yr critical duration event, the water ponds to an elevation of 767.75 ft which encompasses 0.80 acres as illustrated in Exhibit 3.

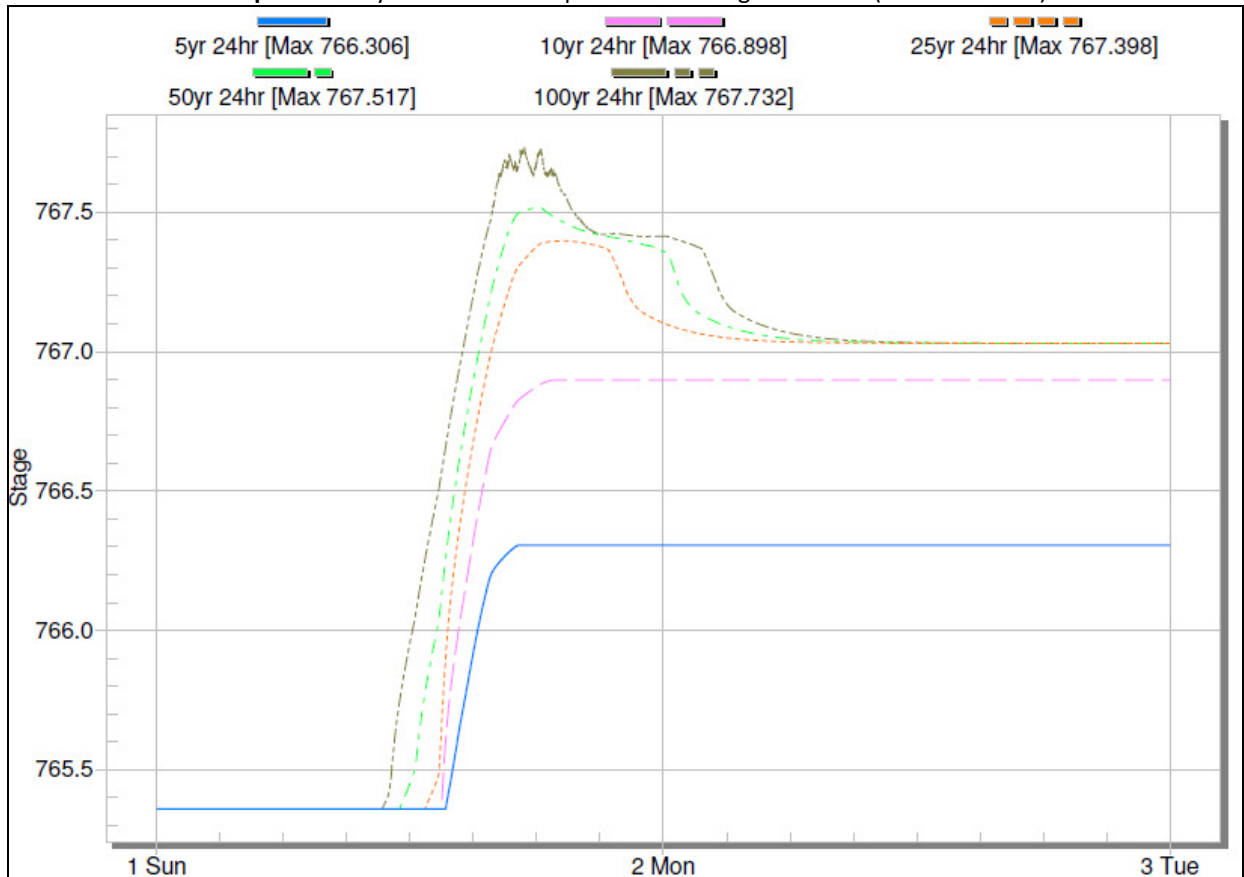
Table 2: Cherry Street South Depression Ponding Summary (2-hr and 24-hr duration)

Storm Event	2-hr Duration		24-hr Duration	
	Max Elevation (ft)	Volume (ac-ft)	Max Elevation (ft)	Volume (ac-ft)
5-yr	766.768	0.1348	766.306	0.0223
10-yr	767.045	0.2478	766.898	0.1836
25-yr	767.385	0.4312	767.398	0.4392
50-yr	767.698	0.6429	767.517	0.5155
100-yr	767.748	0.6805	767.732	0.0668

Below are graphs for the elevation of ponding present in the south depressional area during the 2-hr critical duration as well as the 24-hr duration for different storm events



Graph 4: Cherry Street South Depression Ponding Elevations (24-hr duration)



Problem Area 3: Webster Avenue North of Forest Avenue Overland Flow

Each overland flow route within the CSUDA sub-basin was input into the model. One overland flow route of concern is located on the block north of Forest Avenue between Webster Avenue and Cherry Street (see Exhibit 3). When the catch basin approximately 140 feet north of Forest Avenue surcharges, runoff is directed overland through the residential side and rear yards toward Cherry Street. During the 100-yr storm event a flow of 18.34 cfs is directed through the residential yards and corresponds to a flowing depth of 0.5 to 1.0 ft in the rear yards. Even though stillwater ponding does not occur at this location, poorly defined overland flow routes may be allowing water to lap over low-entry points of residences and likely explains reported flooding.

FLOODING IMPACTS

Private Property Impacts

Below is a summary of elevations surveyed for properties with the greatest potential for flood impacts within the two depressional areas described within CSUDA sub-basin. The lowest entry-point, top of foundation, lowest rear yard, and, if possible, garage-floor elevations were surveyed for the potential flood-risk present for the properties.

Cherry Street Depression North of Forest Avenue:

Address	Residential Structures			Garages			Sheds		
	T/F	LEP	LAG	T/F	LEP	LAG	T/F	LEP	LAG
1010 Cherry St	766.71	766.71	766.42	766.23	766.23	765.69	-	-	-
1028 Cherry St	765.90	765.90	764.91	-	-	-	-	-	-
1032 Cherry St	764.37	764.37	763.44	763.85	763.85	762.90	-	-	-
1033 Cherry St	765.57	765.57	764.96	-	-	-	-	-	-
1103 Cherry St	765.07	765.07	764.69	-	-	-	764.65	764.65	764.05
1104 Cherry St	765.55	764.10	763.24	763.35	763.35	762.40	-	-	-
1106 Cherry St	764.60	764.10	764.08	763.33	763.33	762.58	-	-	-
1107 Cherry St	766.45	766.45	764.83	-	-	-	764.47	764.47	764.47
1110 Cherry St	765.40	763.37	763.37	-	-	-	761.16	761.16	761.16
1111 Cherry St	767.80	767.80	766.94	-	-	-	764.95	764.95	764.95
1114 Cherry St	764.71	763.96	763.10	763.35	763.32	762.19	761.81	762.60	761.81
1118 Cherry St	766.05	765.30	764.86	-	-	-	-	-	-
1122 Cherry St	766.15	766.15	765.78	766.15	766.15	764.95	-	-	-
1128 Cherry St	767.29	767.29	765.85	-	-	-	-	-	-
1007 Howard St	767.50	767.50	766.69	-	-	-	-	-	-
1033 Howard St	771.10	767.20	767.16	-	-	-	-	-	-
1103 Howard St	768.75	768.50	768.23	768.86	768.86	766.55	-	-	-
1107 Howard St	766.30	766.30	765.05	763.65	763.65	762.85	-	-	-
1111 Howard St	769.55	768.05	765.79	765.05	764.50	762.10	-	-	-
1117 Howard St	764.75	764.75	764.09	-	-	-	-	-	-
1119 Howard St	769.40	765.40	764.64	762.80	762.80	762.25	-	-	-
1125 Howard St	768.90	767.60	766.39	-	-	-	-	-	-
1131 Howard St	767.05	766.50	766.98	-	-	-	-	-	-
1135 Howard St	766.67	765.83	765.33	-	-	-	-	-	-
1030 Webster Ave	769.70	769.70	769.29	-	-	-	769.14	769.54	769.14
1102 Webster Ave	768.71	768.71	768.56	765.65	765.65	764.89	-	-	-
1106 Webster Ave	770.11	770.11	768.91	-	-	-	764.64	764.64	764.64
1110 Webster Ave	770.41	770.41	769.39	765.60	765.60	764.53	-	-	-
706 Forest Ave	767.10	766.90	766.62	-	-	-	-	-	-
707 Forest Ave	769.20	767.70	767.70	766.48	766.48	765.28	-	-	-
717 Forest Ave	766.60	765.60	765.58	765.73	765.73	765.27	765.31	765.31	765.31
718 Forest Ave	768.23	768.23	767.72	765.94	765.90	765.39	-	-	-
803 Forest Ave	767.53	767.53	767.33	-	-	-	-	-	-

For the addresses listed above in the north depression, most experience yard flooding of various degrees. Some areas of yard flooding, especially the rear yards, will pond to relatively high elevations (+3 ft) and will retain the water for long durations due to the absence of storm sewer at the lowest elevations of the depressional areas. The only means for water to dissipate in these areas is through ground infiltration and evaporation. For the 100-year 2-hour critical duration event 9 residential structures, 7 garage structures, and 7 sheds have low-entry points at an elevation lower than the

maximum elevation level of ponding within the depressional area. For the 100-year 24-hour duration event 5 residential structures, 6 garage structures, and 2 sheds have low-entry points at an elevation lower than the maximum elevation level of ponding within the depressional area. During these storm events, there is a high potential that these structures will receive interior flooding. Additionally, residential structures with lowest adjacent grades below the flooding elevation will have water lapping against the building foundation and thus have the potential for flooding through seepage or a compromised foundation.

Cherry Street Depression South of Forest Avenue:

		Residential Structures			Garages			Sheds		
Address		T/F	LEP	LAG	T/F	LEP	LAG	T/F	LEP	LAG
922	Webster Ave	768.70	767.01	767.72	768.92	768.92	765.82	-	-	-
930	Webster Ave	768.50	767.35	767.27	-	-	-	-	-	-
1002	Webster Ave	770.00	770.00	768.83	-	-	-	-	-	-
919	Cherry St	769.50	769.50	765.59	-	-	-	-	-	-
921	Cherry St	768.20	768.20	768.07	767.01	767.00	766.03	-	-	-
925	Cherry St	768.15	768.15	768.12	766.61	766.61	765.89	-	-	-
1003	Cherry St	769.05	767.75	767.70	767.72	767.69	766.81	766.77	766.77	766.54
1007	Cherry St	769.05	767.95	767.70	768.06	768.06	767.21	-	-	-
1011	Cherry St	770.93	769.43	769.37	-	-	-	-	-	-
1015	Cherry St	770.67	769.67	769.24	-	-	-	-	-	-

For the addresses listed above in the south depression, most experience yard flooding of various degrees. Some areas of yard flooding, especially the rear yards, will pond to relatively high elevations (+2 ft) and will retain the water for long durations due to the absence of storm sewer at the lowest elevations of the depressional areas. The only non-mechanical means for water to dissipate in these areas is through ground infiltration and evaporation. For the 100-year 2-hour critical duration event 3 residential structures, 3 garages, and 1 shed have low-entry points at an elevation lower than the maximum elevation level of ponding within the depressional area. For the 100-year 24-hour duration event 2 residential structures, 3 garage structures, and 1 shed have low-entry points at an elevation lower than the maximum elevation level of ponding within the depressional area. During these storm events, there is a high potential that these structures will receive interior flooding.

Additional properties located within the CSUDA sub-basin, but not within the depressional area boundaries may also experience flood impacts. Poorly defined overland flows routes are the most likely cause of reported flooding for properties outside of the depressional areas. Additionally, the level of ponding that exists within the depressional area, as well as the age of the infrastructure would also suggest that sanitary sewer is being surcharged through infiltration and inflow. Sanitary sewer backups will generally occur at residences located at lower elevations, but could impact structures well outside of the depressional area boundaries.

Public Right-of-Way Impacts

Cherry Street North of Forest Avenue (Manhole 9):

The manhole north of Forest Avenue on Cherry Street has the most severe flooding within the CSUDA sub-basin. It surcharges at and above the 5-year critical duration storm events and surcharges at

and above the 25-year 24 hour duration storm events. For both durations (2hr and 24hr) for the 100 year event the street ponds to a depth of 3 feet. This level of ponding blocks vehicular traffic for residents as well as emergency personnel. Since Cherry Street dead ends north of Forest Avenue, the flooding at this level block emergency access to approximately 20 residential properties north of the flooding epicenter.

Webster Street South (Manhole 20):

The manhole south of Forest Avenue on Webster Avenue also has R.O.W. flood impacts. It surcharges at and above the 5-year critical duration storm events and surcharges at and above the 5-year 24 hour duration storm events. For the critical duration for the 100 year event the street ponds to a depth of 1.25 feet. This level of ponding blocks vehicular traffic for residents, although most likely emergency vehicles would still be able to pass. Approximately 8 properties near the epicenter of this manhole lose access to their driveway. Since the flooding occurs at a mid-block location, through traffic can be routed around the blockage via alternate routes.

Minor Street Flood Locations:

The manholes at the intersection Cherry Street and Forest Avenue (Manhole 10), as well as the manhole on Webster Avenue north of Forest Avenue (Manhole 8) pond to a depth of 6 inches during the 100 year critical duration event. This provides a traffic hazard that is passable to most vehicles. Residential driveway access may be blocked for properties in close proximity to the surcharged manholes.

SUMMARY OF EXISTING DRAINAGE SYSTEM CONCERNS

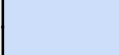

There are numerous factors causing problems within the Cherry Street Upland Depressional Area sub-basin. Storm sewer within basin provides drainage for the depressional areas. The sewer present within the basin does not have capacity above the 10-yr storm event. Storm sewer is typically designed for the 10-year storm event. For storms above the 10-yr intensity, inlets within the sub-basin become surcharged and runoff gets routed overland. Undefined overland flow routes within the system contribute to the flood impacts of upstream residential structures. Surcharged flows continue to get routed overland to lower elevations within the sub-basin until they reach the depressional areas.

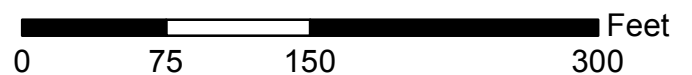
The topography of the CSUDA sub-basin has two major depressional areas. The depressional areas within the sub-basin must pond to a substantial depth prior to reaching the overland flow routes. At the elevation required for overland flow, numerous properties are put into a substantial flood risk. With storm-sewer providing the primary means for drainage for the depressional areas, properties will continue to be at a flood-risk for storm events of the 10-yr intensity or greater.

Due to the existing drainage conditions within the Cherry Street Upland Depressional Area sub-basin there are 12 residential structures with high probability for interior structure flooding during the 100-yr critical duration event. During the same event, at least 28 properties have restricted vehicular access to their driveways, 20 of which may also become inaccessible to emergency vehicles. Additionally, during the same event, 43 properties experience yard flooding of varying degrees.



Legend

-  Problem Areas
-  Cherry Street Upland Depression Area Sub-Basin

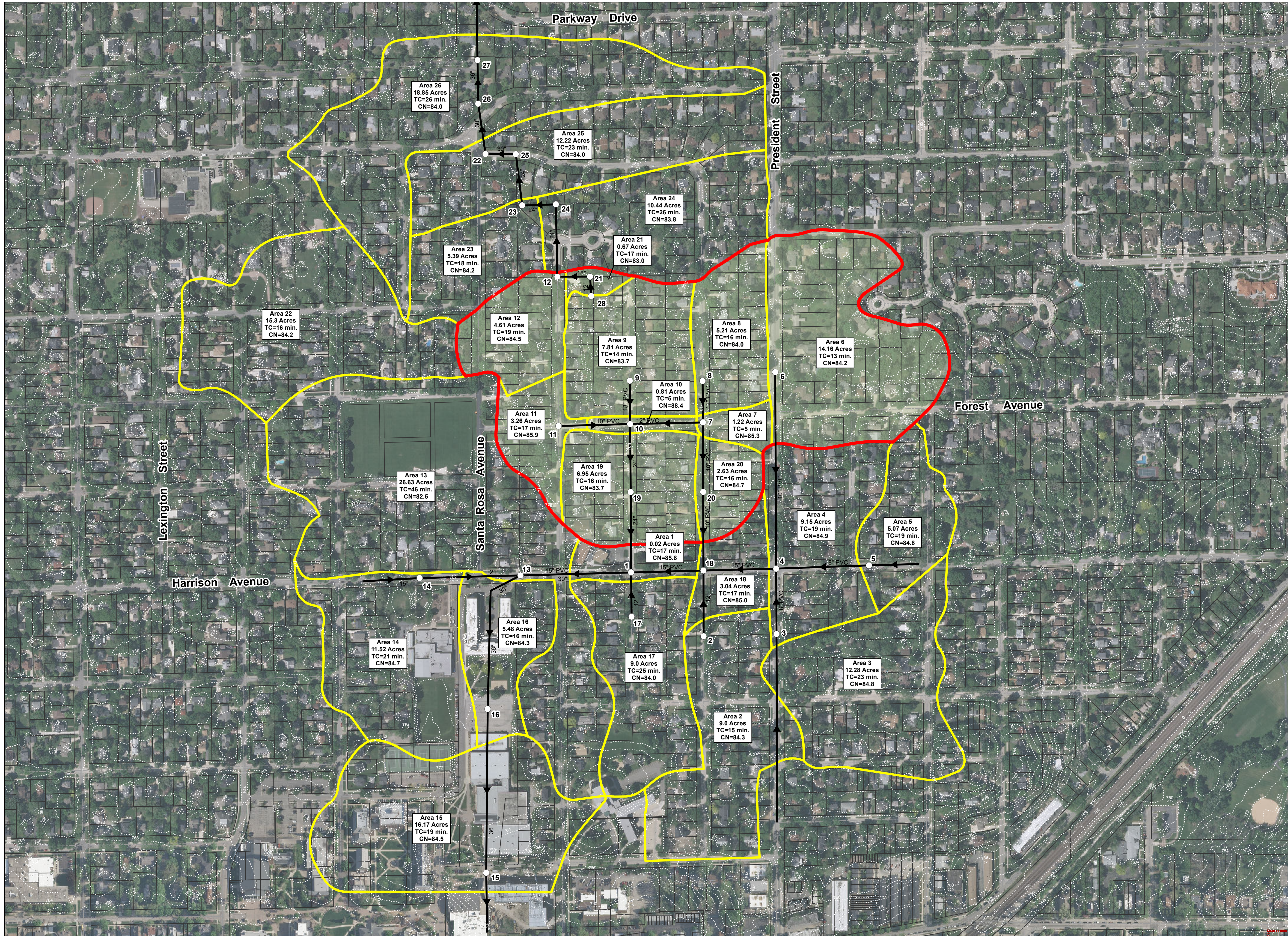


Project No: 110511
Date: September 2011

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**Exhibit 1
Location Map**

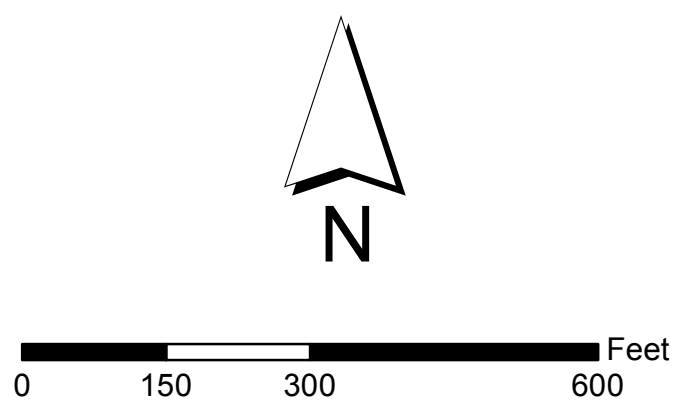


Legend

- Existing Storm Manhole
- Main Storm Line
- Cherry Street Upland Depression Area Sub-Basin
- Tributary Area

1. RIM= 767.50' INV= 757.84' (N) INV= 759.95' (S) INV= 757.48' (W, 30°) INV= 758.75' (W, 15°)	10. RIM= 765.27' INV= 759.27' (N) INV= 760.19' (E) INV= 759.27' (S) INV= 760.32' (W)	19. RIM= 767.36' INV= 758.45' (N, S)
2. RIM= 770.21' INV= 761.56' (N)	11. RIM= 769.46' INV= 764.36' (E)	20. RIM= 769.62' INV= 762.28' (N) INV= 761.58' (S)
3. RIM= 779.70' INV= 770.00' (N)	12. RIM= 766.46' INV= 756.63' (N, E)	21. RIM= 764.19' INV= 757.41' (W) INV= 757.89' (S)
4. RIM= 772.51' INV= 760.25' (N) INV= 764.61' (E) INV= 760.21' (S) INV= 760.16' (W)	13. RIM= 764.26' INV= 755.16' (S) INV= 756.36' (E, 30°) INV= 757.31' (E, 15°) INV= 755.99' (W)	22. RIM= 761.34' INV= 748.86' (N) INV= 750.11' (E)
5. RIM= 783.21' INV= 774.21' (W)	14. RIM= 761.68' INV= 756.98' (E)	23. RIM= 762.63' INV= 753.68' (N) INV= 753.53' (E)
6. RIM= 776.00' INV= 770.16' (S)	15. RIM= 758.76' INV= 747.11' (N)	24. RIM= 762.42' INV= 754.15' (S, W)
7. RIM= 769.90' INV= 764.70' (N) INV= 763.93' (S) INV= 764.62' (W)	16. RIM= 766.41' INV= 753.49' (N, S)	25. RIM= 761.96' INV= 750.73' (S) INV= 750.72' (W)
8. RIM= 769.99' INV= 765.12' (S)	17. RIM= 764.51' INV= 760.68' (N)	26. RIM= 758.03' INV= 748.79' (N, S)
9. RIM= 762.29' INV= 759.07' (S)	18. RIM= 767.50' INV= 760.19' (N) INV= 759.60' (E) INV= 759.65' (S) INV= 759.60' (W)	27. RIM= 758.49' INV= 747.30' (N, S)
		28. RIM= 763.66' INV= 758.36' (N)

Note:
Storm Pipes are RCP unless marked as PVC.



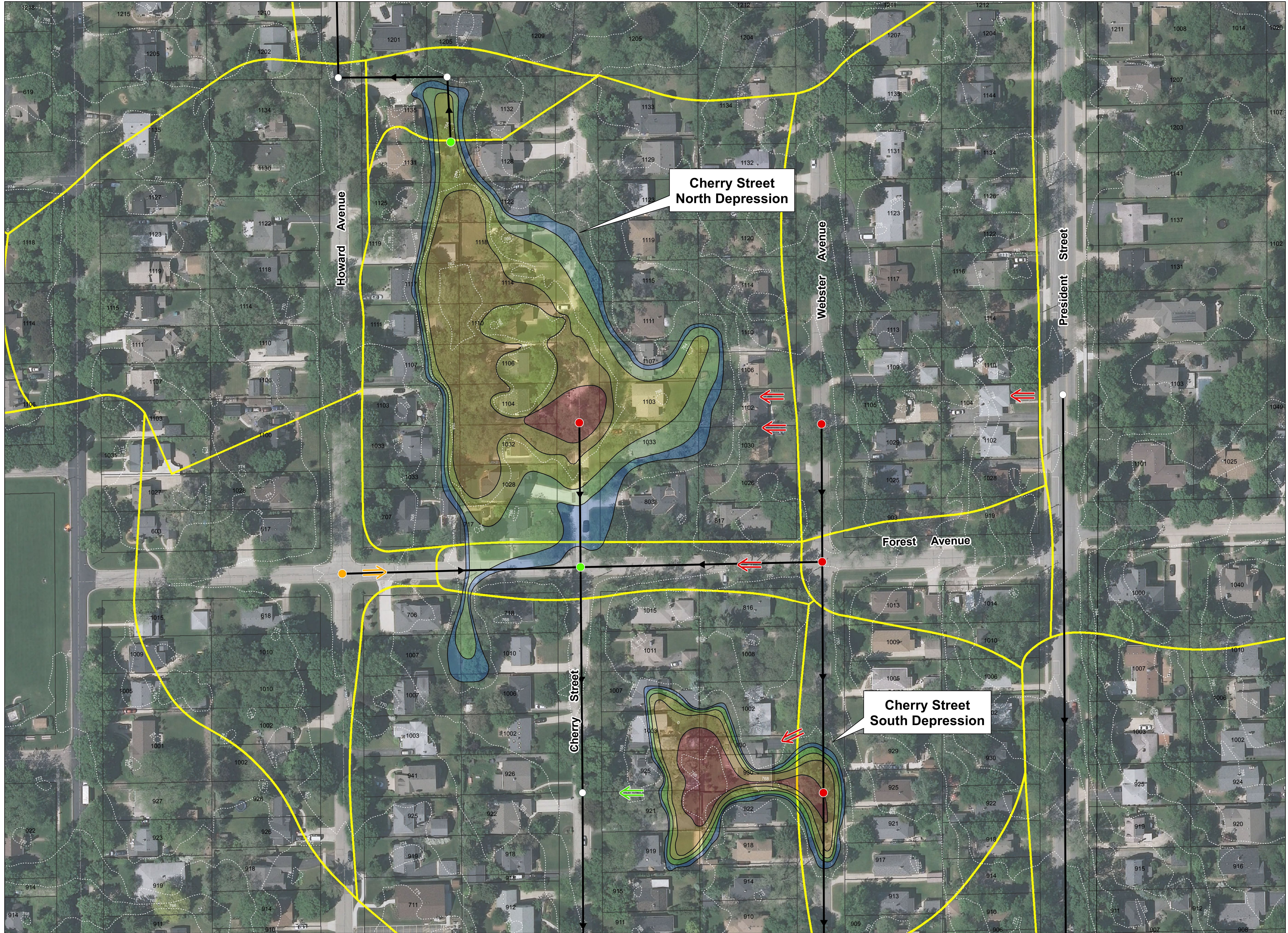
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Date: September 2011



**ENGINEERING
RESOURCE
ASSOCIATES, INC.**
CONSULTING ENGINEERS, SCIENTISTS & SURVEYORS

35701 WEST AVENUE, SUITE 150
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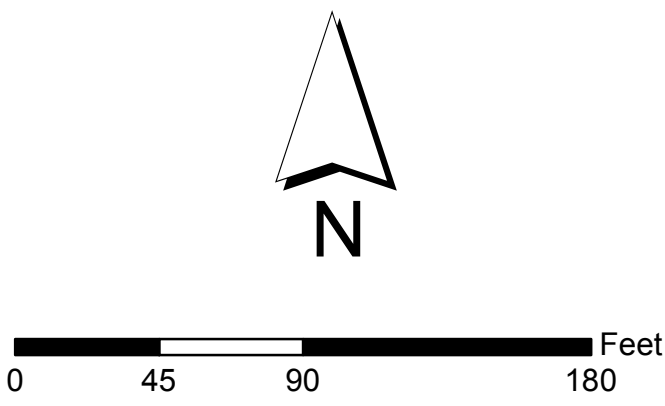
Exhibit 2 Tributary Map



Legend

- >5 Yr. Surge
- >10 Yr. Surge
- >50 Yr. Surge
- Existing Manhole
- Main Storm Line
- 5 Yr. Flood Limits
- 10 Yr. Flood Limits
- 25 Yr. Flood Limits
- 50 Yr. Flood Limits
- 100 Yr. Flood Limits
- 5 Yr. Overflow Route
- 10 Yr. Overflow Route
- 50 Yr. Overflow Route

NOTE:
Flooding conditions shown are for the 2hr. critical duration event.



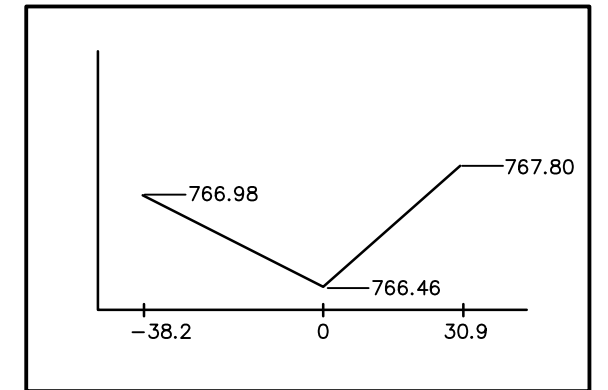
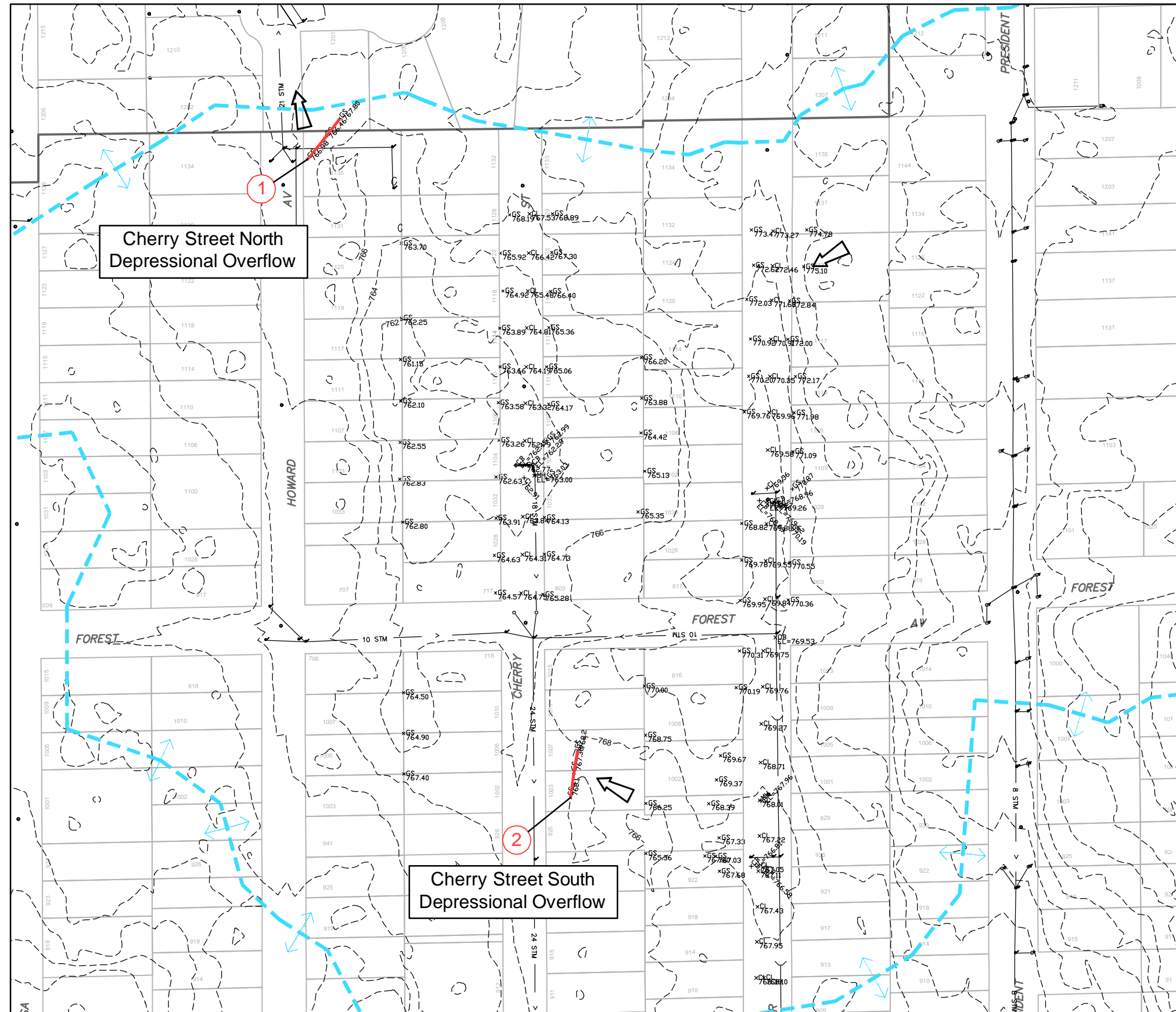
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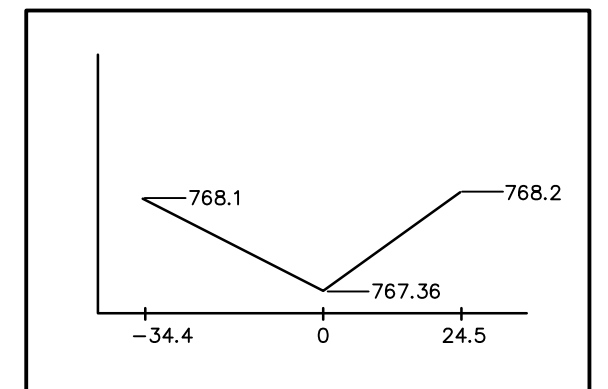
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**Exhibit 3
Existing Flooding
Conditions**



① NORTH DEPRESSIONAL OVERFLOW CROSS SECTION



② SOUTH DEPRESSIONAL OVERFLOW CROSS SECTION

LEGEND

- 768--- CONTOUR
- WATERSHED LIMITS

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Exhibit 4
Survey of
Depressional Areas



ENGINEERING RESOURCE ASSOCIATES, INC.
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35701 West Avenue, Suite 150
Warrenville, Illinois 60555

phone 630.393.3060
fax 630.393.2152

PROJECT: Cherry Street Depression Flood Study
DESCRIPTION: CN Calculations
PROJECT #: 110511

MGM
08/24/2011

CN Calculations					
Sub-area Name	Pavement Area (98)	Residential 1/4 acre (83)	Open Spaces (74)	Area (ac.)	CN
	acres	acres	acres		
Area 1	0.40	1.73	0.00	2.13	85.8
Area 2	0.79	8.21	0.00	9.00	84.3
Area 3	1.47	10.81	0.00	12.28	84.8
Area 4	1.13	8.02	0.00	9.15	84.9
Area 5	0.60	4.47	0.00	5.07	84.8
Area 6	1.11	13.05	0.00	14.16	84.2
Area 7	0.19	1.03	0.00	1.22	85.3
Area 8	0.36	4.85	0.00	5.21	84.0
Area 9	0.36	7.45	0.00	7.81	83.7
Area 10	0.29	0.52	0.00	0.81	88.4
Area 11	0.62	2.64	0.00	3.26	85.9
Area 12	0.45	4.16	0.00	4.61	84.5
Area 13	2.34	18.96	5.33	26.63	82.5
Area 14	1.29	10.23	0.00	11.52	84.7
Area 15	1.61	14.56	0.00	16.17	84.5
Area 16	0.48	5.00	0.00	5.48	84.3
Area 17	0.58	8.42	0.00	9.00	84.0
Area 18	0.41	2.63	0.00	3.04	85.0
Area 19	0.32	6.63	0.00	6.95	83.7
Area 20	0.29	2.34	0.00	2.63	84.7
Area 21	0.00	0.67	0.00	0.67	83.0
Area 22	1.20	14.10	0.00	15.30	84.2
Area 23	0.43	4.96	0.00	5.39	84.2
Area 24	0.56	9.88	0.00	10.44	83.8
Area 25	0.78	11.44	0.00	12.22	84.0
Area 26	1.31	17.54	0.00	18.85	84.0

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PROJECT: Cherry Street Depression Flood Study

DESCRIPTION: Time of Concentration Calculations

PROJECT #: 110511

MGM

08/24/2011

ASSUMPTIONS:

Manning's Roughness Coeff., n

grass areas: 0.24

paved areas: 0.011

Unit		Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Sheet Flow																											
Manning's Roughness Coeff., n		0.24	0.24	0.24	0.24	0.24	0.24	0.01	0.24	0.24	0.01	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	
Flow Length, L (L ≤ 300 ft)	ft	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	
2-yr 24-hr Rainfall, P ₂	in	3.04	3.04	3.04	3.04	3.04	3.04	3.04	3.04	3.04	3.04	3.04	3.04	3.04	3.04	3.04	3.04	3.04	3.04	3.04	3.04	3.04	3.04	3.04	3.04	3.04	
Upstream Elevation	ft	770.00	782.00	787.00	796.00	796.00	800.00	782.00	711.00	775.00	769.90	775.00	779.00	774.00	771.00	773.00	770.00	777.00	775.00	771.00	781.00	770.00	772.00	779.00	781.00	777.00	777.00
Downstream Elevation	ft	768.00	780.00	786.00	794.00	794.00	794.00	778.00	709.00	771.00	768.00	773.00	777.50	773.00	769.00	770.00	767.00	776.00	773.00	768.00	779.00	768.00	770.00	777.00	780.00	775.00	776.00
Land Slope, s	ft/ft	0.0200	0.0200	0.0100	0.0200	0.0200	0.0600	0.0400	0.0200	0.0400	0.0190	0.0200	0.0150	0.0100	0.0200	0.0300	0.0300	0.0100	0.0200	0.0300	0.0200	0.0200	0.0200	0.0200	0.0100	0.0200	0.0100
T _i = [0.007 (nL) ^{0.8}] / [P ₂ ^{0.5} s ^{0.4}]	hr	0.24	0.24	0.32	0.24	0.24	0.16	0.01	0.24	0.18	0.02	0.24	0.27	0.32	0.24	0.21	0.21	0.32	0.24	0.21	0.24	0.24	0.24	0.24	0.32	0.24	0.32

Shallow Concentrated Flow

Surface Description (u or p)		u	u	u	u	u	p	p	p	u	p	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u
Flow Length, L	ft	200	95	480	800	640	540	200	320	420	371	300	400	1800	680	700	180	740	340	200	240	280	240	560	880	1000	920
Upstream Elevation	ft	768.00	780.00	786.00	794.00	794.00	794.00	778.00	709.00	771.00	768.00	773.00	777.50	773.00	769.00	770.00	767.00	776.00	773.00	768.00	779.00	768.00	770.00	777.00	780.00	775.00	776.00
Downstream Elevation	ft	766.16	776.00	776.00	772.51	783.21	781.00	769.90	702.43	763.40	765.27	769.46	770.00	764.26	761.68	758.76	766.41	764.51	767.50	767.36	767.67	763.66	763.00	762.63	762.42	761.96	758.03
Watercourse Slope, s	ft/ft	0.0092	0.0421	0.0208	0.0269	0.0169	0.0241	0.0405	0.0205	0.0181	0.0074	0.0118	0.0188	0.0049	0.0108	0.0161	0.0033	0.0155	0.0162	0.0032	0.0472	0.0155	0.0292	0.0257	0.0200	0.0130	0.0195
Average Velocity, V	fps	1.55	3.31	2.33	2.64	2.09	3.15	4.09	2.91	2.17	1.74	1.75	2.21	1.12	1.67	2.04	0.92	2.01	2.05	0.91	3.51	2.01	2.76	2.58	2.28	1.84	2.25
T _t = L / 3600 V	hr	0.04	0.01	0.06	0.08	0.08	0.05	0.01	0.03	0.05	0.06	0.05	0.05	0.44	0.11	0.10	0.05	0.10	0.05	0.06	0.02	0.04	0.02	0.06	0.11	0.15	0.11

Channel Flow

		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Cross Sectional Flow Area, a	ft ²																									
Wetted Perimeter, p _w	ft																									
Hydraulic Radius, r = ^a /p _w	ft	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Channel Slope, s	ft/ft																									
Manning's Roughness Coeff., n	ft/ft																									
Velocity, v = (1.49*r ^(2/3) *s ^(1/2))/n	fps	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Flow Length, L																										
T _t = L / 3600 V	hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

T _c = T _t + T _t + T _t	hr	0.28	0.25	0.38	0.32	0.32	0.21	0.02	0.27	0.23	0.08	0.29	0.32	0.76	0.35	0.31	0.26	0.42	0.29	0.27	0.26	0.28	0.26	0.30	0.43	0.39	0.43
Use in Model (5 min. minimum)	min	17	15	23	19	19	13	5	16	14	5	17	19	46	21	19	16	25	17	16	16	17	16	18	26	23	26



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PROJECT: Cherry Street Upland Depression Area Flood Study
LOCATION: Wheaton
PROJECT #: 110511

BY: MM
DATE: 09/16/2011

STAGE, STORAGE RELATIONSHIP

Cherry Street North of Forest Avenue Depression

STAGE ELEV. (ft)	AREA (sf)	AVE. END AREA (sf)	VOLUME (ac-ft)	CUM. VOLUME (ac-ft)
761.15	0.00			
		7,000	0.13659	0.13659
762.00	14,000.00			
		41,400	1.90083	2.03742
764.00	68,800.00			
		128,400	5.89532	7.93274
766.00	188,000.00			

Cherry Street South of Forest Avenue Depression

STAGE ELEV. (ft)	AREA (sf)	AVE. END AREA (sf)	VOLUME (ac-ft)	CUM. VOLUME (ac-ft)
766.00	213.30			
		9,894	0.22714	0.22714
767.00	19,575.00			
		26,513	0.46257	0.68971
767.76	33,450.00			