

4- Combined Sewer Area Solutions

Shorewood's combined sewer area has experienced several severe basement backup and street flooding episodes in the last two decades. Previous floods are likely to have occurred, though evidence and first hand experience is sparse. The Village most recently addressed basement backups through the "Bottleneck Project" in 1997, though subsequent years brought more damage and more studies. ATTACHMENT 3 summarizes post-bottleneck work and suggests that additional work is necessary to meet the design criteria of a 5 year recurrence rainfall.

ATTACHMENT 3 was submitted to MMSD in 2000, which then formed the basis of a comprehensive wet weather flow reduction program in Shorewood. The result was the disconnection of hundreds of downspouts from the combined sewers, and construction of storm sewers that reduced the flow in the combined system. The Wet Weather Management and Peak Management Project Report is included as ATTACHMENT 4.

During this period, Shorewood strongly advocated for the upgrading of the MIS segment between the NS4 drop shaft and the intersection of Edgewood and Oakland. ATTACHMENT 5 summarizes this proposal.

Combined Area Basement Backup Problem Definition

- Cramer, Murray, and Maryland at Kensington
- Ridgefield, Richland, Harcourt at Capitol Drive
- Lake Drive, north and south of Capitol
- Shorewood, Newton, Menlo, and Stratford between Downer and Prospect
- Along Edgewood and areas to the immediate north, between Downer and Oakland
- Affecting approximately 225 properties in rains of less than **2 inches-1 hour**

Combined Area Drainage Problem Definition

- Shorewood, Prospect to Downer
- Beverly, Prospect to Downer
- Maryland, Stratford to Edgewood
- Hackett, Menlo to Edgewood
- Summit
- Edgewood and Lake
- Oakland And Edgewood

The solutions alternatives for the combined sewer service area have been assigned to Ruekert Mielke (combined area south of Capitol Drive) and Clark Dietz (central combined area and combined north). Previous work on expanding the storm sewer pipe network has been

completed by Bonestroo, and implemented in 2011 as part of the annual street reconstruction program.

4.1 – Combined Area NORTH

Basement backup problems in the northern half of the combined sewer service area will be addressed through improvements and size upgrades in existing combined sewers in the area. Two trunk sewers serve this area on Oakland Avenue and Prospect Avenue. Capacity increases in these two pipes (or systems) will increase basement backup protection in the area.

Combined Area (North) Basement Backup Problem Definition

- Cramer, Murray, and Maryland at Kensington
- Ridgefield, Richland, Harcourt at Capitol Drive

4.1.1 – Combined Area (North) Sewer Improvement Alternative 1

<p>HYDRAULIC IMPROVEMENT BY UPSIZING OF COMBINED SEWERS</p> <p>Modeling has shown that the performance of the system can be improved by upsizing several segments of existing pipe.</p> <p>Two segments are proposed in the north west side of the area. These segments add capacity to the Kensington Sewer and eliminate the need for bypassing at Maryland and Kensington.</p> <p>Alternative 1 accomplishes this by upsizing sewers on Kensington, Cramer, Farwell, and Lake Bluff as shown.</p>	 <p>Alternate 1 Combined Sewer Upgrades</p>
---	--

- Upsize existing 15-inch combined sewer to a new 24-inch combined sewer on Kensington from Frederick to Murray

- Upsize existing 15-inch combined sewer to a new 30-inch combined sewer on Kensington from Murray to Cramer
- Upsize existing 15-inch combined sewer to a new 30-inch combined sewer on Cramer from Kensington to Lake Bluff
- Upsize existing 18-inch combined sewer to a new 30-inch combined sewer on Lake Bluff from Cramer to Oakland; connecting to existing 30-inch combined sewer on Oakland.
- Upsize existing 15-inch combined sewer to a new 18-inch combined sewer on Kensington from Frederick to Maryland.
- Upsize existing 15-inch combined sewer to a new 24-inch combined sewer on Kensington from Frederick to Farwell.
- Upsize existing 15-inch combined sewer to a new 24-inch combined sewer on Farwell from Kensington to Lake Bluff.
- Upsize existing 12"x18" combined sewer to a new 24-inch combined sewer on Lake Bluff from Farwell to Prospect; connecting to existing 30-inch combined sewer on Prospect.
- These improvements will provide additional capacity to the combined sewer in this area by increasing service from a 1.5 inch rain to a 2.0 inch rain in the west side and a 2.5 inch rain on the east side of the project area.
- Proposed alignment follows Cramer and Farwell, both recently reconstructed. Accordingly, street reconstruction is not recommended. Instead, we would recommend trench restoration with this alternative.

Alternate 1 – Street condition summary

Kensington = completed in 1997; rated 7 in 2007; not slated for replacement

Cramer = completed in 2006; rated 10 in 2007; not slated for replacement

Farwell = completed in 1998; rated 7 in 2007; not slated for replacement

Lake Bluff = west of Maryland completed in 2006 and east of Maryland completed prior to 1993; rated 10 west of Maryland and rated 3-2 east of Maryland; slated for replacement east of Maryland in 2010

4.1.2 – Combined Area (North) Improvement Alternative 2

HYDRAULIC IMPROVEMENT BY UPSIZING OF COMBINED SEWERS

Modeling has shown that the performance of the system can be improved by upsizing several segments of existing pipe.

Two segments are proposed in the north west side of the area. These segments add capacity to the Kensington Sewer and eliminate the need for bypassing at Maryland and Kensington.

Alternative 2 accomplishes this by upsizing sewers on Kensington, Murray, Prospect, and Lake Bluff as shown.

Project alignment follows OLDER streets, therefore integrates with the Pavement Management objectives.

Project alignment REPLACES smaller pipes on Murray and Prospect, leaves existing larger pipes on Cramer and Farwell in place.



Alternate 2
Combined Sewer Upgrades

- Upsize existing 15-inch combined sewer to a new 24-inch combined sewer on Kensington from Frederick to Murray.
- Reverse flow on Murray and upsize existing 12-inch combined sewer to a new 30-inch combined sewer on Murray from Kensington to Lake Bluff.
- Construct new 30-inch combined sewer on Lake Bluff from Murray flowing west to existing combined sewer and upsizing existing 12-inch combined sewer to a new 30-inch combined sewer on Lake Bluff to Cramer.
- Upsize existing 18-inch combined sewer to a new 30-inch combined sewer on Lake Bluff from Cramer to Oakland; connecting to existing 30-inch combined sewer on Oakland.

- Upsize existing 15-inch combined sewer to a new 18-inch combined sewer on Kensington from Frederick to Maryland.
- Upsize existing 15-inch combined sewer to a new 24-inch combined sewer on Kensington from Maryland to Farwell.
- Reverse flow and upsize existing 15-inch combined sewer to a new 24-inch combined sewer on Kensington from Farwell to Prospect.
- Upsize existing 12-inch combined sewer to a new 24-inch combined sewer on Prospect from Kensington to Lake Bluff; connecting to existing 30-inch combined sewer on Prospect at Lake Bluff.
- Connect the proposed westerly flowing 24-inch combined sewer with the proposed easterly flowing 18-inch combined sewer on Kensington at Frederick with a 15-inch combined sewer in lieu of a proposed bypass connection to the existing storm sewer at that location.
- Connect the existing combined sewer at the corner of Stowell and Lake Bluff to the intersection of Prospect and Lake Bluff to relieve the capacity issues at the area between Stowell and North Lake Drive.
- These improvements will provide additional capacity to the combined sewer in this area by increasing service from a 1.5-inch rain to a 2.5-inch rain on the west side and 3.0 inch rain on the east side of the project area.
- Proposed alignment avoids Cramer, stays on Murray, scheduled for reconstruction in 2016, and follows Prospect, scheduled for maintenance in 2013.

Alternate 2 – Street condition summary

Kensington = same as Alt. 1

Murray = completed prior to 1993; rated 3 in 2007; slated for replacement in 2016

Prospect = completed in 2005; rated 9 in 2007; not slated for replacement

Lake Bluff = same as Alt. 1

4.1.3 – Combined Area (North) Opinion of Estimated Cost

The two alternatives were considered with and without street reconstruction options. In order to extract greater value from the combined sewer reconstruction project, the proposed alternative must be the one yielding the biggest road improvement for the area.

	Cost Estimate	
	Pavement Patch	Road Reconstruct
Alternate 1	\$2.3 million	\$3.6 million
Alternate 2	\$2.6 million	\$3.9 million

Village of Shorewood
Opinion of Estimated Cost
Prepared By: Clark Dietz Engineers, Inc.
Combined Sewer System North Improvements - Alternative 1
Date: 3/23/11

Item No.	Item Description	Quantity	Unit	Unit Price	Total Price	
					Option A (*)	Option B (**)
Sanitary Sewer						
	18-IN PVC SDR-26 Sanitary Sewer (5 to 10 feet deep)	275	LF	\$ 200.00	\$ 55,000.00	\$ 55,000.00
	24-IN PVC SDR-26 Sanitary Sewer (5 to 10 feet deep)	290	LF	\$ 225.00	\$ 65,250.00	\$ 65,250.00
	24-IN PVC SDR-26 Sanitary Sewer (10 to 15 feet deep)	1570	LF	\$ 250.00	\$ 392,500.00	\$ 392,500.00
	30-IN PVC SDR-26 Sanitary Sewer (5 to 10 feet deep)	545	LF	\$ 250.00	\$ 136,250.00	\$ 136,250.00
	30-IN PVC SDR-26 Sanitary Sewer (10 to 15 feet deep)	745	LF	\$ 275.00	\$ 204,875.00	\$ 204,875.00
	30-IN PVC SDR-26 Sanitary Sewer (15 to 20 feet deep)	360	LF	\$ 300.00	\$ 108,000.00	\$ 108,000.00
	4-FT DIA Sanitary MH w/ Casting (5 to 10 feet deep)	6	EA	\$ 3,000.00	\$ 18,000.00	\$ 18,000.00
	4-FT DIA Sanitary MH w/ Casting (10 to 15 feet deep)	14	EA	\$ 4,000.00	\$ 56,000.00	\$ 56,000.00
	5-FT DIA Sanitary MH w/ Casting (5 to 10 feet deep)	6	EA	\$ 4,000.00	\$ 24,000.00	\$ 24,000.00
	5-FT DIA Sanitary MH w/ Casting (10 to 15 feet deep)	6	EA	\$ 5,625.00	\$ 33,750.00	\$ 33,750.00
	5-FT DIA Sanitary MH w/ Casting (15 to 20 feet deep)	4	EA	\$ 7,875.00	\$ 31,500.00	\$ 31,500.00
	By-pass Pumping	1	LS	\$ 25,000.00	\$ 25,000.00	\$ 25,000.00
	Sewer Televising	4000	LF	\$ 2.00	\$ 8,000.00	\$ 8,000.00
	Lateral Televising	115	EA	\$ 200.00	\$ 23,000.00	\$ 23,000.00
	PVC Sanitary Service Lateral Replacement (Main to House)	40	EA	\$ 7,500.00	\$ 300,000.00	\$ 300,000.00
Sub-Total for Sanitary Sewer Work:					\$ 1,481,125.00	\$ 1,481,125.00
Storm Sewer						
	8-IN PVC Storm Lateral Collection System	4000	LF	\$ 45.00	N/A	\$ 180,000.00
	6-IN Storm Laterals	1725	LF	\$ 40.00	N/A	\$ 69,000.00
Sub-Total for Storm Sewer Work:					\$ -	\$ 249,000.00
Roadway						
***	Asphalt Street Reconstruction	4000	LF	\$ 200.00	N/A	\$ 800,000.00
	Trench Restoration	4000	LF	\$ 40.00	\$ 160,000.00	N/A
Sub-Total for Roadway Work:					\$ 160,000.00	\$ 800,000.00
Sub-Total for Construction Cost (Before Contingencies):					\$ 1,641,125.00	\$ 2,530,125.00
	25% Construction Contingency		LS		\$ 410,281.25	\$ 632,531.25
Sub-Total for Construction Cost (WITH Contingencies):					\$ 2,051,406.25	\$ 3,162,656.25
Engineering						
	Engineering Services (Survey, Design and Construction Management) - 15% of Construction Cost		LS		\$ 307,710.94	\$ 474,398.44
TOTAL ESTIMATED PROJECT COST:					\$ 2,359,117.19	\$ 3,637,054.69

* - Option A includes trench restoration within the street

** - Option B includes street reconstruction (asphalt)

*** - Includes common excavation, asphalt, base aggregate, geotextile fabric, curb and gutter, driveway aprons, sidewalk replacement at lateral replacement locations.

Village of Shorewood
Opinion of Estimated Cost
Prepared By: Clark Dietz Engineers, Inc.
Combined Sewer System North Improvements - Alternative 2
Date: 3/23/11

Item No.	Item Description	Quantity	Unit	Unit Price	Total Price	
					Option A (*)	Option B (**)
Sanitary Sewer						
	15-IN PVC SDR-26 Sanitary Sewer (5 to 10 feet deep)	130	LF	\$ 185.00	\$ 24,050.00	\$ 24,050.00
	18-IN PVC SDR-26 Sanitary Sewer (5 to 10 feet deep)	275	LF	\$ 200.00	\$ 55,000.00	\$ 55,000.00
	24-IN PVC SDR-26 Sanitary Sewer (5 to 10 feet deep)	575	LF	\$ 225.00	\$ 129,375.00	\$ 129,375.00
	24-IN PVC SDR-26 Sanitary Sewer (10 to 15 feet deep)	1465	LF	\$ 250.00	\$ 366,250.00	\$ 366,250.00
	30-IN PVC SDR-26 Sanitary Sewer (5 to 10 feet deep)	280	LF	\$ 250.00	\$ 70,000.00	\$ 70,000.00
	30-IN PVC SDR-26 Sanitary Sewer (10 to 15 feet deep)	580	LF	\$ 275.00	\$ 159,500.00	\$ 159,500.00
	30-IN PVC SDR-26 Sanitary Sewer (15 to 20 feet deep)	730	LF	\$ 300.00	\$ 219,000.00	\$ 219,000.00
	4-FT DIA Sanitary MH w/ Casting (5 to 10 feet deep)	7	EA	\$ 3,000.00	\$ 21,000.00	\$ 21,000.00
	4-FT DIA Sanitary MH w/ Casting (10 to 15 feet deep)	13	EA	\$ 4,000.00	\$ 52,000.00	\$ 52,000.00
	4-FT DIA Sanitary MH w/ Casting (Outside Drop Manhole)	1	EA	\$ 6,000.00	\$ 6,000.00	\$ 6,000.00
	5-FT DIA Sanitary MH w/ Casting (Outside Drop Manhole)	1	EA	\$ 7,000.00	\$ 7,000.00	\$ 7,000.00
	5-FT DIA Sanitary MH w/ Casting (5 to 10 feet deep)	2	EA	\$ 4,000.00	\$ 8,000.00	\$ 8,000.00
	5-FT DIA Sanitary MH w/ Casting (10 to 15 feet deep)	7	EA	\$ 5,625.00	\$ 39,375.00	\$ 39,375.00
	5-FT DIA Sanitary MH w/ Casting (15 to 20 feet deep)	5	EA	\$ 7,875.00	\$ 39,375.00	\$ 39,375.00
	By-pass Pumping	1	LS	\$ 25,000.00	\$ 25,000.00	\$ 25,000.00
	Sewer Televising	4050	LF	\$ 2.00	\$ 8,100.00	\$ 8,100.00
	Lateral Televising	115	EA	\$ 200.00	\$ 23,000.00	\$ 23,000.00
	PVC Sanitary Service Lateral Replacement (Main to House)	40	EA	\$ 7,500.00	\$ 300,000.00	\$ 300,000.00
	By-pass Lift Station	1	EA	\$ 100,000.00	\$ 100,000.00	\$ 100,000.00
Sub-Total for Sanitary Sewer Work:					\$ 1,652,025.00	\$ 1,652,025.00

Storm Sewer						
	8-IN PVC Storm Lateral Collection System	4050	LF	\$ 45.00	N/A	\$ 182,250.00
	6-IN Storm Laterals	1725	LF	\$ 40.00	N/A	\$ 69,000.00
Sub-Total for Storm Sewer Work:					\$ -	\$ 251,250.00

Roadway						
***	Asphalt Street Reconstruction	4050	LF	\$ 200.00	N/A	\$ 810,000.00
	Trench Restoration	4050	LF	\$ 40.00	\$ 162,000.00	N/A
Sub-Total for Roadway Work:					\$ 162,000.00	\$ 810,000.00

Sub-Total for Construction Cost (Before Contingencies): **\$ 1,814,025.00** **\$ 2,713,275.00**

	25% Construction Contingency		LS		\$ 453,506.25	\$ 678,318.75
--	------------------------------	--	----	--	---------------	---------------

Sub-Total for Construction Cost (WITH Contingencies): **\$ 2,267,531.25** **\$ 3,391,593.75**

Engineering						
	Engineering Services (Survey, Design and Construction Management) - 15% of Construction Cost		LS		\$ 340,129.69	\$ 508,739.06

TOTAL ESTIMATED PROJECT COST: **\$ 2,607,660.94** **\$ 3,900,332.81**

* - Option A includes trench restoration within the street

** - Option B includes street reconstruction (asphalt)

*** - Includes common excavation, asphalt, base aggregate, geotextile fabric, curb and gutter, driveway aprons, sidewalk replacement at lateral replacement locations.

4.1.4 – Combined Area (North) Recommended Solution

The recommended solution is to follow the improvements included in Alternative 2, with modified road reconstruction selection based on current conditions and anticipated progress of Shorewood's street program. The recommendation is based on the following factors:

- Greater number of basement backups reported along the alignment, therefore Alternative 2 addresses more vulnerable properties directly.
- Leaves larger existing pipes in place on Cramer and Farwell, replaces smaller pipes on Murray and Prospect. Increases total available capacity more than Alternative 1, larger incremental benefit compared to existing system.
- Provides higher hydraulic capacity than Alternative 1, especially for the east half of the project service area.
- Alignment follows roads in worse condition compared to Alternate 1 routing, provides opportunity to combine street program with sewer construction. As a summary of street condition considerations, we note the following reconstruction schedule:

Kensington = Trench Restoration
Murray = Full Street Reconstruction
Prospect = Trench Restoration
Lake Bluff = Trench Restoration

4.1.5 – Combined Area NORTH Water Quality Impacts

The proposed project does not affect the stormwater quality conditions in the area. Previously, the water quality impacts of each storm sewer segment that removed flow from the combined sewers was mitigated by the construction of 59 rain gardens and installation of 289 rain barrels.

4.1.5 – Combined Area (North) Recommended Solution Opinion of Estimated Cost

**Village of Shorewood
Opinion of Estimated Cost**

Prepared By: Clark Dietz Engineers, Inc.

Combined Sewer System North Improvements - Recommended Alternative

Item No.	Item Description	Quantity	Unit	Unit Price	Total Price
Sanitary Sewer					
	15-IN PVC SDR-26 Sanitary Sewer (5 to 10 feet deep)	130	LF	\$ 185.00	\$ 24,050.00
	18-IN PVC SDR-26 Sanitary Sewer (5 to 10 feet deep)	275	LF	\$ 200.00	\$ 55,000.00
	24-IN PVC SDR-26 Sanitary Sewer (5 to 10 feet deep)	575	LF	\$ 225.00	\$ 129,375.00
	24-IN PVC SDR-26 Sanitary Sewer (10 to 15 feet deep)	1465	LF	\$ 250.00	\$ 366,250.00
	30-IN PVC SDR-26 Sanitary Sewer (5 to 10 feet deep)	280	LF	\$ 250.00	\$ 70,000.00
	30-IN PVC SDR-26 Sanitary Sewer (10 to 15 feet deep)	580	LF	\$ 275.00	\$ 159,500.00
	30-IN PVC SDR-26 Sanitary Sewer (15 to 20 feet deep)	730	LF	\$ 300.00	\$ 219,000.00
	4-FT DIA Sanitary MH w/ Casting (5 to 10 feet deep)	7	EA	\$ 3,000.00	\$ 21,000.00
	4-FT DIA Sanitary MH w/ Casting (10 to 15 feet deep)	13	EA	\$ 4,000.00	\$ 52,000.00
	4-FT DIA Sanitary MH w/ Casting (Outside Drop Manhole)	1	EA	\$ 6,000.00	\$ 6,000.00
	5-FT DIA Sanitary MH w/ Casting (Outside Drop Manhole)	1	EA	\$ 7,000.00	\$ 7,000.00
	5-FT DIA Sanitary MH w/ Casting (5 to 10 feet deep)	2	EA	\$ 4,000.00	\$ 8,000.00
	5-FT DIA Sanitary MH w/ Casting (10 to 15 feet deep)	7	EA	\$ 5,625.00	\$ 39,375.00
	5-FT DIA Sanitary MH w/ Casting (15 to 20 feet deep)	5	EA	\$ 7,875.00	\$ 39,375.00
	By-pass Pumping	1	LS	\$ 25,000.00	\$ 25,000.00
	Sewer Televising	4050	LF	\$ 2.00	\$ 8,100.00
	Lateral Televising	115	EA	\$ 200.00	\$ 23,000.00
	PVC Sanitary Service Lateral Replacement (Main to House)	40	EA	\$ 7,500.00	\$ 300,000.00
Sub-Total for Sanitary Sewer Work:					\$ 1,552,025.00
Storm Sewer					
	8-IN PVC Storm Lateral Collection System	1000	LF	\$ 45.00	\$ 45,000.00
	6-IN Storm Laterals	600	LF	\$ 40.00	\$ 24,000.00
Sub-Total for Storm Sewer Work:					\$ 69,000.00
Roadway					
*	Asphalt Street Reconstruction	1000	LF	\$ 200.00	\$ 200,000.00
	Trench Restoration	3050	LF	\$ 40.00	\$ 122,000.00
Sub-Total for Roadway Work:					\$ 322,000.00
Sub-Total for Construction Cost (Before Contingencies):					\$ 1,943,025.00
	25% Construction Contingency		LS		\$ 485,756.25
Sub-Total for Construction Cost (WITH Contingencies):					\$ 2,428,781.25
Engineering					
	Engineering Services (Survey, Design and Construction Management) - 15% of Construction Cost		LS		\$ 364,317.19
TOTAL ESTIMATED PROJECT COST:					\$ 2,793,098.44

* Includes common excavation, asphalt, base aggregate, geotextile fabric, curb and gutter, driveway aprons, sidewalk replacement at lateral replacement locations.

4.2 – Combined Area EAST CENTRAL

An area bound by Lake Drive, Shorewood Boulevard, Downer Avenue and Jarvis Street has had on-going basement backup problems due to the configuration and hydraulic properties of the combined sewers in this area.

Many residences in the area have experienced extensive basement backups in both July 15 and July 22, 2010, shown in yellow in the map below. Specifically, residences on Richland Court and Ridgeland Circle have been historically prone to basement backups over the years.



Basement Backups Reported in the Central East of the Combined Sewer Service Area

Hydraulic modeling indicates that capacity increase in this area will reduce backup risks to acceptable levels. The benefits of improvements will also extend to residences of Lake Drive, in

the stretch between Capitol Drive and Olive Avenue. Due to the relatively large benefit realized by these improvements, new pipe construction alternatives have been developed.

4.2.1 - Combined Area EAST CENTRAL Alternative 1 – Pipe replacement on Richland Court and Ridgefield Circle

HYDRAULIC IMPROVEMENT BY UPSIZING OF COMBINED SEWERS

Modeling has shown that the performance of the system can be improved by upsizing two segments of existing pipe combined sewer pipe.

These segments add capacity to the Richland Court, Lake Drive, and Ridgefield Circle.

In addition to the combined sewer relay on Ridgefield Circle, a new storm sewer will be installed.

The storm sewer will eventually be attached to a future storm sewer system in the area.



Both streets involved in Alternative 1 are currently scheduled for full reconstruction. The larger pipes on Richfield would eventually be connected to the newer larger pipes on Ridgefield Circle, to divert central east flows around the Downer Avenue Bottleneck at Capitol Drive.

The larger benefits of the proposed improvements will only be realized when the additional combined sewers in the area are constructed.

The improved system would then be connected to the upstream end of the Bottleneck Project as it was constructed in the mid-1990s. Once completed, the overall capacity of the combined sewer system would be sufficient to meet our design criteria of basement backup protection from a 3 inch rainfall.

4.2.2 - Combined Area EAST CENTRAL Alternative 2 – New Pipe on Jarvis Street, Pipe Replacement on Ridgefield Circle

HYDRAULIC IMPROVEMENT BY UPSIZING OF COMBINED SEWERS AND CONSTRUCTING NEW COMBINED SEWERS

The addition of a segment of combined sewer pipe on Jarvis (between Richland and Downer) changes the system performance dramatically.

This alternative isolates Richland Court from the rest of the system and increases backup protection levels.

This alternative maintains the Ridgefield Circle combined sewer relay of Alternative 1.

In addition to the combined sewer relay on Ridgefield Circle, a new storm sewer will be installed.

The storm sewer will eventually be attached to a future storm sewer system in the area.



Both streets involved in Alternative 2 are currently scheduled for full reconstruction. The new combined sewer on Jarvis will effectively re-route Lake Drive flows around the Richland Court sewer, and therefore realize immediate basement backup risk reduction.

This alternative maintains the Ridgefield Circle combined sewer relay of Alternative 1. In addition to the combined sewer relay on Ridgefield Circle, a new storm sewer will be installed. The storm sewer will eventually be attached to a future storm sewer system in the combined sewer service area.

4.2.3 - Combined Area EAST CENTRAL Opinion of Estimated Cost

Village of Shorewood					
Opinion of Estimated Cost					
Prepared By: Clark Dietz Engineers, Inc.					
Combined Sewer System Central East Improvements - Alternative 1					
Date: June 13, 2011					
Item No.	Item Description	Quantity	Unit	Unit Price	Total Price
Combined Sewer					
	18-IN PVC SDR-26 Sanitary Sewer (5 to 10 feet deep)	800	LF	\$ 200.00	\$ 160,000.00
	24-IN PVC SDR-26 Sanitary Sewer (5 to 10 feet deep)	750	LF	\$ 225.00	\$ 168,750.00
	5-FT DIA Sanitary MH w/ Casting (5 to 10 feet deep)	8	EA	\$ 4,000.00	\$ 32,000.00
	By-pass Pumping	1	LS	\$ 20,000.00	\$ 20,000.00
	Sewer Televising	1500	LF	\$ 2.00	\$ 3,000.00
	Lateral Televising	80	EA	\$ 200.00	\$ 16,000.00
Sub-Total for Sanitary Sewer Work:					\$ 399,750.00
Storm Sewer					
	24-IN PVC SDR-26 Storm Sewer (5 to 10 feet deep)	700	LF	\$ 225.00	\$ 157,500.00
	6-IN Storm Laterals	20	EA	\$ 750.00	\$ 15,000.00
Sub-Total for Storm Sewer Work:					\$ 172,500.00
Miscellaneous					
	Erosion Control	1	LS	\$ 5,000.00	\$ 5,000.00
	Traffic Control	1	LS	\$ 15,000.00	\$ 15,000.00
Sub-Total for Miscellaneous Work:					\$ 20,000.00
Sub-Total for Construction Cost (Before Contingencies):					\$ 592,250.00
	15% Construction Contingency		LS		\$ 88,837.50
Sub-Total for Construction Cost (WITH Contingencies):					\$ 681,087.50
Engineering					
	Engineering Services (Survey, Design and Construction Management) - 15% of Construction Cost		LS		\$ 102,163.13
TOTAL ESTIMATED PROJECT COST:					\$ 783,250.63

Village of Shorewood
Opinion of Estimated Cost
Prepared By: Clark Dietz Engineers, Inc.
Combined Sewer System Central East Improvements - Alternative 2
Date: June 13, 2011

Item No.	Item Description	Quantity	Unit	Unit Price	Total Price
Combined Sewer					
	18-IN PVC SDR-26 Sanitary Sewer (5 to 10 feet deep)	330	LF	\$ 200.00	\$ 66,000.00
	24-IN PVC SDR-26 Sanitary Sewer (5 to 10 feet deep)	750	LF	\$ 225.00	\$ 168,750.00
	5-FT DIA Sanitary MH w/ Casting (5 to 10 feet deep)	4	EA	\$ 4,000.00	\$ 16,000.00
	By-pass Pumping	1	LS	\$ 20,000.00	\$ 20,000.00
	Sewer Televising	1000	LF	\$ 2.00	\$ 2,000.00
	Lateral Televising	50	EA	\$ 200.00	\$ 10,000.00
Sub-Total for Sanitary Sewer Work:					\$ 282,750.00
Storm Sewer					
	24-IN PVC SDR-26 Storm Sewer (5 to 10 feet deep)	700	LF	\$ 225.00	\$ 157,500.00
	6-IN Storm Laterals	20	EA	\$ 750.00	\$ 15,000.00
Sub-Total for Storm Sewer Work:					\$ 172,500.00
Miscellaneous					
	Erosion Control	1	LS	\$ 5,000.00	\$ 5,000.00
	Traffic Control	1	LS	\$ 15,000.00	\$ 15,000.00
Sub-Total for Miscellaneous Work:					\$ 20,000.00
Sub-Total for Construction Cost (Before Contingencies):					\$ 475,250.00
	15% Construction Contingency		LS		\$ 71,287.50
Sub-Total for Construction Cost (WITH Contingencies):					\$ 546,537.50
Engineering					
	Engineering Services (Survey, Design and Construction Management) - 15% of Construction Cost		LS		\$ 81,980.63
TOTAL ESTIMATED PROJECT COST:					\$ 628,518.13

4.2.4 - Combined Area EAST CENTRAL Recommended Alternative – New Pipe on Jarvis Street, Pipe Replacement on Ridgefield Circle

The recommended solution is to follow the improvements included in Alternative 2. The recommendation is based on the following factors:

- Achieves desired backup risk reduction on Richland Court without depending on future projects.

- Leaves existing Richland Court pipe in place. The large pipe will increase protection against backups.
- Involves less pipe construction than Alternative 1, and is therefore less costly.
- Addresses Ridgefield Circle basement backup and drainage issues, while partially depending on the future construction of the storm sewers in the combined area.
- Alignment follows roads currently in the 2011 road reconstruction program, does not increase the construction area.

4.2.5 – Combined Area EAST CENTRAL Water Quality Impacts

Despite the proposed storm sewer, there will be no changes to the water quality conditions in the area because the storm sewer will discharge into the existing combined sewer. The stormwater quality concerns associated with the establishment of a new outfall to Milwaukee River will be addressed as part of the overall separation plan for the combined sewer SOUTH area.

4.3 – Combined Area SOUTH

4.3.1 – Alternative 1 – New Sanitary Sewer Construction in the Combined Area

- COMBINED SEWER capacity increase with upsizing of existing pipe or construction of new pipes in the southwest side of the combined area.
- UNCOUPLE MILWAUKEE combined sewers from Shorewood combined sewers at Edgewood and Maryland.
- UPSIZED MMSD pipe from Oakland to the deep tunnel 1,100 feet of 72 to 96 inch.
- NEW DRAINAGE-WAY from Oakland to Milwaukee River – prevents Oakland/Edgewood ponding.
- VIRTUAL SEPARATION in the southeast corner of the combined sewer area.
- Eventual complete separation.

This alternative consists of combined sewer capacity increases and virtual separation in the southeast corner of the combined sewer. These improvements will provide basement back-up protection for the 2 inch rain in one hour. Additionally, MMSD pipe upsizing and a new drainage-way from Oakland Avenue to the Milwaukee River will provide a minimum of 2 feet freeboard during a 3 inch per hour rainfall. Finally, complete separation will provide back-up protection against a minimum of 4 inch per hour rainfall.

4.3.2 – Alternative 2 – New Storm Sewer Construction in the Combined Area

- New 72" storm sewer outlet on Menlo from Prospect Avenue to the Milwaukee River.
- New storm trunk sewer in Murray Avenue from Menlo storm sewer to Beverly Road.
- New storm trunk sewer in Prospect Avenue from Menlo storm sewer to East Shorewood Boulevard.

- Conveyance of "first flush" storm water in original combined trunk sewer to MIS for treatment of suspended solids.
- New temporary flood control relief point at Murray Avenue and Beverly Avenue.
- New temporary flood control relief point at Prospect Avenue and East Shorewood Boulevard.
- New temporary flood control relief point at East Wood Place and Downer Avenue plus outlet storm sewer on East Wood Place to the Lake Michigan outlet.
- New drainage-way from Oakland and Edgewood to Menlo storm outlet.
- New storm sewers in "virtual" separation area.
- New storm sewer laterals and storm lateral collection system in virtual separation area.
- Uncouple Milwaukee combined sewers from Shorewood combined sewers at Edgewood and Maryland.
- Eventual virtual separation in the area north of Menlo Boulevard or complete sewer separation.

This alternative consists of the installation of a new major storm trunk sewer to provide an outlet for the "virtual" separation of much of the south combined area. On a short term basis, it will also allow the construction of two new temporary flood control relief points to relieve hydraulic surcharging and it will provide an outlet to relieve overland flooding in three topographic depressions plus the ponding at Oakland and Edgewood. Construction of this new storm outlet will negate the need to upsize the combined sewers and MIS connection in Alternative 1. However, uncoupling of Milwaukee combined sewers from Shorewood combined sewers at Edgewood and Maryland should still be pursued.

In addition to the conventional storm sewer system, a secondary collection system is proposed to be installed under the curb to provide a discharge location for potential future foundation drain disconnections in Shorewood.

This alternative will provide relief from a 3 inch rain in one hour which is consistent with Goal 4 of the Facility Plan. Eventual separation or virtual separation of the entire combined area by 2035 will provide protection against a 4 inch rain in one hour which is consistent with Goal 3 of the Facility Plan.

4.3.3 – Proposed Temporary Flood Control Relief Points Locations and Benefits

There are three temporary flood control relief points proposed to be constructed to relieve hydraulic surcharging in the combined trunk sewer system. All three are located in areas that are topographically depressed. As a result, the sewer system is overloaded during extreme weather events. These overflows will act as "safety valves" to reduce hydraulic surcharging and the resulting basement back-ups in the system during catastrophic precipitation events. The use and need for these overflows will gradually diminish as the combined sewer system is virtually or completely separated.

The three are proposed to be located at:

1. Beverly Avenue and Murray Avenue
2. East Shorewood Boulevard and Prospect Avenue
3. East Wood Place and Downer Avenue

All three will require the construction of storm sewer outlets to allow gravity flow operation. Gravity flow operation was chosen over pump operation because of the large flows that the system is subject to during extreme weather events. Construction of pumped bypasses for the high flows experienced during previous flow events would be cost prohibitive. Plus the pump infrastructure would become obsolete as the system is separated as opposed to the gravity overflow sewer system which can be used as part of "virtual" separation solution.

4.3.4 – Opinion of Estimated Cost

Cost estimates for the elements in Alternative 1 (original Facility Plan proposal) were adjusted to reflect more detailed costs that were developed by the engineering consortium. Costs were then estimated for Alternative 2 (Storm Drainage Solution) elements for comparison with Alternative 1. Tables 1, 2 and 3 summarize the costs for Alternative 1 (original Facility Plan proposal), Alternative 2 (Storm Drainage Solution) and for the construction of combined sewer overflows. The costs for complete sewer separation alternative for the area centrally bounded by Capital Drive, Oakland Avenue, Edgewood Avenue and Lake Michigan was also revised to include engineering and construction contingencies to allow comparison with Alternatives 1 and 2.

Table 4 shows the additional cost for construction of the gravity temporary flood control relief points.

In summary, Alternative 2 costs for the "storm drainage solution" are over 20% less than Alternative 1, the original Facility Plan which makes it the preferred alternative.

4.3.5 – Recommended Plan

Alternative 2 is the recommended plan for several reasons:

1. It is less expensive than Alternative 1.
2. It provides a storm water outlet to the Milwaukee River for the eventual virtual separation of the area north of Menlo Boulevard and south of Jarvis Street.
3. It reduces storm flows in the combined trunk sewers which negates the need to increase the capacity of the combined sewer system and that of the downstream MIS.
4. Immediate hydraulic relief to the combined sewers will be achieved by the construction of the three new temporary flood control relief points. The discharge to surface waters will meet pollution standards by keeping low flows in the combined sewer and diverting high flows greater than the six month recurrence interval to the temporary flood control relief points.
5. The volume of water directed to the MMSD during a major precipitation event and to the existing Milwaukee River CSO will be greatly reduced.

6. It provides immediate major storm water relief to four topographical depressions at Murray and Beverly, East Shorewood and Prospect, Menlo Boulevard and Prospect, and East Wood and Downer.
7. Virtual separation can be phased to coincide with the street rehabilitation program. Complete separation can be held off until the current infrastructure uses up its useful life.
8. The decision to disconnect foundation drains and roof drains can be phased based on the performance of the new public infrastructure.

A disadvantage of Alternative 2 compared to Alternative 1 is that initially there is the need to construct temporary flood control relief points to operate during catastrophic flood events (i.e. 50 year recurrence interval events and larger). However, that concern will be mitigated by always conveying the low flows (up to a six month recurrence interval storm) to the MIS for eventual treatment by the MMSD. The need for these relief points will also diminish as the virtual separation of the combined sewer system is completed.

This alternative requires "Advanced Facility Planning" to investigate the pipe-jacking (tunnel) route along Menlo Boulevard. This additional study will review soils geology, groundwater, utility conflicts and constructability to refine the costs and to reduce the construction risks before proceeding with final design and construction.

4.3.6 – Combined Area SOUTH Water Quality Impacts

The combined sewer service area of the Village of Shorewood is exempt from NR 216 water quality standards because this area is not part of the Municipal Separate Storm Sewer System as defined in the administrative code:

"Municipal separate storm sewer system" or "MS4" means a conveyance or system of conveyances including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, constructed channels or storm drains, which meets all the following criteria:

1. Owned or operated by a municipality.
2. Designed or used for collecting or conveying storm water.
- 3. Is not a combined sewer conveying both sanitary and stormwater.**
4. Is not part of a publicly owned wastewater treatment works that provides secondary or more stringent treatment.

Because the runoff in this area is discharged to the MMSD system and treated at the Jones Island sewage treatment plant before discharge to Lake Michigan, the Village is given runoff treatment credits towards the current 20 percent TSS reduction criteria contained in NR 216. As a consequence of this credit, the Village of Shorewood has only performed water quality analyses (SLAMM) on the separated sewer service area, i.e., western half of the Village, draining to Milwaukee River. No SLAMM or water quality modeling currently exists for the combined sewer service area.

The intent of the proposed storm sewer project is to continue to provide first flush discharges to the MMSD system, just as it occurs presently. Together with the Department of Natural Resources Stormwater Specialist staff, the Village will determine the minimum amount of flow to

direct to the Jones Island treatment plant to continue to realize the stormwater treatment and TSS reduction benefits at similar levels to the current levels.

Therefore, the water quality impacts of the proposed new outlet to the Milwaukee River will be mitigated by the continued direction of first flush runoff to the MMSD system for treatment. Because of this feature of the proposed project, the Village does not anticipate performing a SLAMM model of pollutants in the combined service area.

ALTERNATIVE 2

**RELIEF OF COMBINED SEWER
FLOWS BY STORM SEWER
CONSTRUCTION**

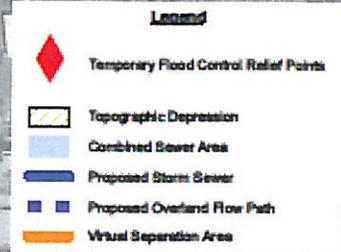
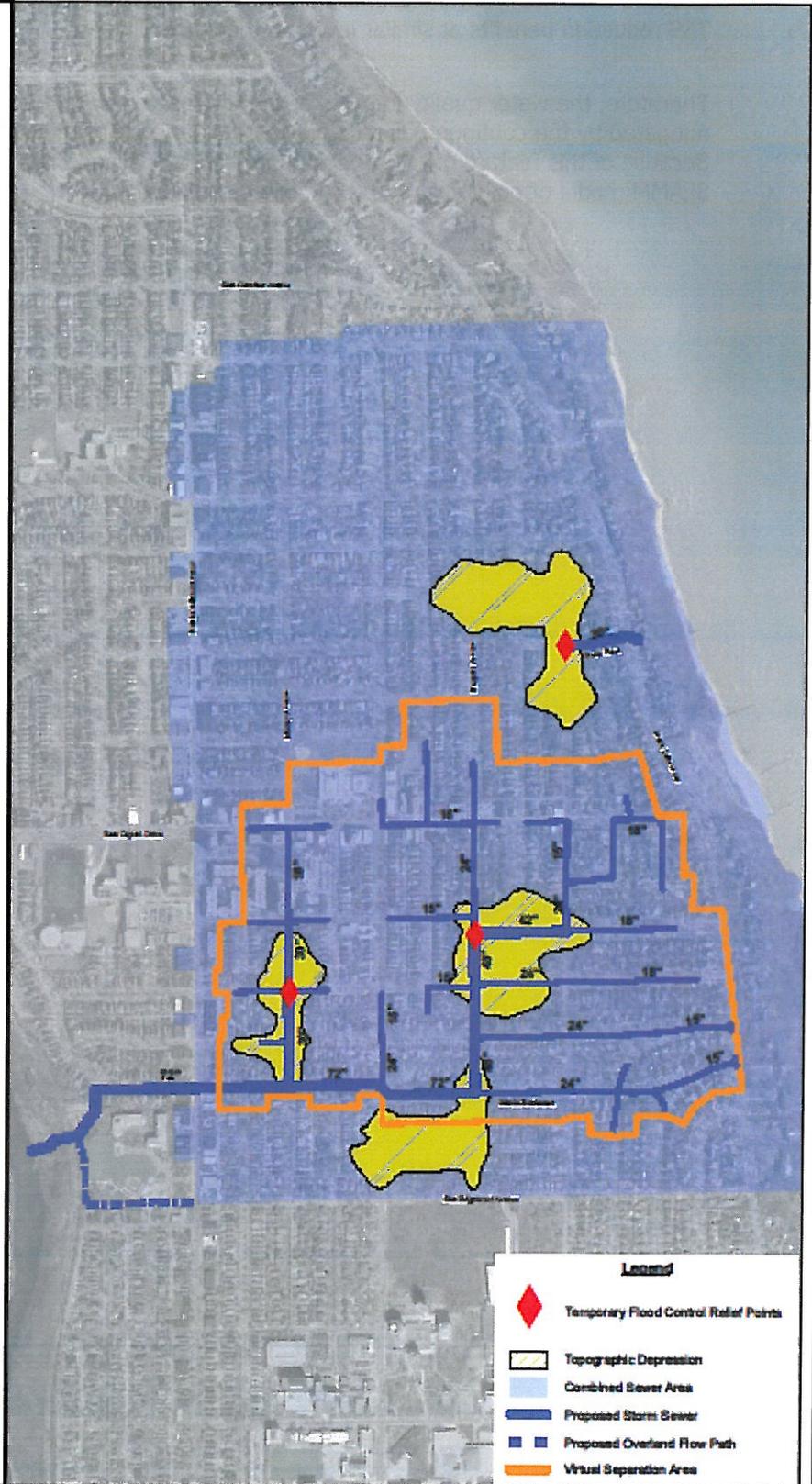
AKA

VIRTUAL SEPARATION

The Village is proposing to construct new storm outfall at Menlo and the Milwaukee River to capture street runoff from the south east corner of the combined area. The "first flush" stormwater will be directed to the original combined sewer for treatment of suspended solids.

New overland flow path to relieve the potential ponding at Oakland/Edgewood interstecion is proposed.

This separation eliminates the need to improve the MMSD MIS west of Oakland Avenue.

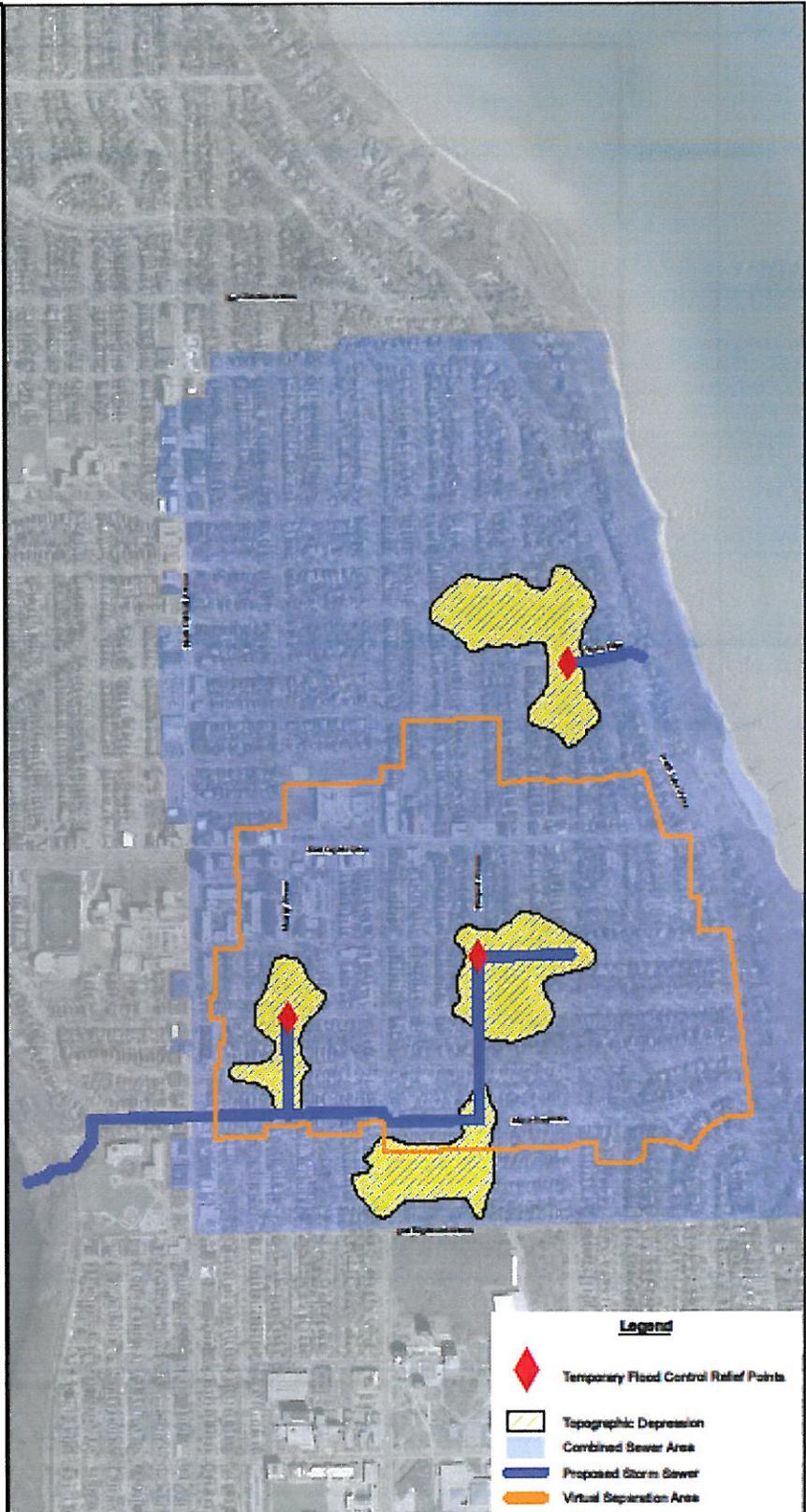


09-22-2010 10:00:00 AM
09-22-2010

ALTERNATIVE 2

**HYDRAULIC IMPROVEMENT BY
CONSTRUCTION OF STORM
SEWER OUTLETS**

Virtual separation of the combined area between Menlo Boulevard and Capital Drive and construction of combined sewer overflows on Prospect Avenue, Murray Avenue and east Wood Place eliminates the need for combined sewer improvements south of east Jarvis Street and MIS improvements in Edgewood Avenue.



Legend

- ◆ Temporary Flood Control Relief Points
- Topographic Depression
- Combined Sewer Area
- Proposed Storm Sewer
- Virtual Separation Area

