Agenda

City of Plymouth
Special City Council Meeting

Tuesday, May 8, 2007
5:30 p.m.

Medicine Lake Room

1. Call to Order

2. Preliminary 2008-2009 Budget discussion

3. Discuss Street Sweeping Program

4. Set future Study Sessions

4. Adjourn

Agenda Number: 2

CITY OF PLYMOUTH

CITY COUNCIL AGENDA REPORT

TO: Laurie Ahrens, City Manager

FROM: Jean McGann, Administrative Services Director

SUBJECT: 2008 Budget Process

DATE: April 30, 2007 for Study Session on May 8, 2007

1. **PROPOSED ACTION**
   Council is requested to review and discuss the 2008 budget objectives, challenges, and format.

2. **BACKGROUND**
   As part of the Council's 2007 Goals and items for study, Council indicated interest in forecasting General Fund revenues at least two years beyond the current budget year and review revenue sources. For 2008, staff is proposing to prepare a 2-year or biennial budget for all budgeted funds. By statute, the Council must formally adopt a budget each year. When approving a biennial budget, the first year would be formally adopted and the second year accepted in concept. In subsequent years, staff will extend the forecasting to include an additional one to three years based on direction from Council.

   Each year challenges are identified prior to the start of the budget process. Staff has outlined some of those challenges below;

   Wages and Benefits – this category of the budget comprises approximately 60% of the general fund budget. For 2008, there will be additional increases in the PERA contribution required by the City as well as the employee. In addition, the City is anticipating the health insurance premium increase to be significant. Increases in wages are difficult to predict as there are several union contracts up for negotiation however, staff does have settlement history from other cities.

   Fire Duty Crew – During the first quarter of 2007, the Fire department modified the Duty Crew program, on a test basis, to include coverage on Sundays. This modification was a great success however, due to funding concerns, the program has been returned to the original level of service. Staff would like to review future staffing levels, considering the possibility of a 7-day duty crew, and levels of service for the Department.

Market Value Homestead Credit – If the current rules related to the Market Value Homestead Credit remain, the City will receive approximately $507,000 in 2008. This is a reduction of $53,000 from 2007. This revenue source will continue to decline as home values increase.

Software Conversion – On May 22, 2007, staff will be bringing forward a request to go out for bid on a new financial, payroll, human resource, budget, and utility billing software packages. These software packages are well beyond their replacement dates. The software acquisition is part of the 2007 and 2008 Capital Improvement Program. This is a significant expenditure and time commitment.

Police Records Management System – The Police Department is currently utilizing a records management system through LOGIS. This system has not proven beneficial to the operations of the Police Department and the technology improvements promised have not come to fruition. Additional clerical hours were added into the 2007 budget due to the redundancy of data entry required. The 2-year fulltime temporary position was added to give the City time to evaluate options related to this software. Staff is in the process of preparing an informational document outlining the current software and identifying some possible alternatives.

City Center Option – Council has been discussing options for the City Center area. If the Council decides to make significant changes within this area then funding options need to be identified. One possible funding source would be the Community Improvement Fund.

3. DISCUSSION

Council is requested to consider the following questions;

1. Does the proposed biennial budget meet the Council objectives and goals?
2. Are there challenges identified above that Council would like to discuss?
3. Has the Council identified other challenges or initiatives that need to be addressed?
4. Would the Council like to set budget study sessions for August and possibly September?

4. CONCLUSION

The following chart identifies key dates for the 2008 budget process. Staff has identified possible study session dates that are shown in bold.

Date	Description
May 8, 2007	Council Study Session to review budget goals and priorities
June 25, 2007	Budget Submissions due from Departments
July 10, 2007	Distribution of overall proposed budget to Directors
July 17 - 19, 2007	Budget Review by Directors and Budget Team
August 10, 2007	Distribute Proposed City Manager's Budget to Council
August 21, 2007	**Council Study Session (Subject to Council Approval)**
August 28, 2007	**Council Study Session (Subject to Council Approval)**
September 4, 2007	**Council Study Session (Subject to Council Approval)**
September 11, 2007	City Council adopts preliminary property tax levy and budget
December 3, 2007	Public Hearing on Budget (Truth in Taxation Hearing)
December 11, 2007	Council adoption of 2008 budget and approval of 2009 budget

OFFICIAL CITY MEETINGS

August 2007

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Jul 2007 S M T W T F S 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 27 28 29 30 31 Sep 2007 S M T W T F S 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 27 28 29 30			1 7:00 PM PLANNING COMMISSION, Council Chambers	2	3	4
5	6	7 2:30 PM -5:00 PM NATIONAL NIGHT OUT KICK OFF EVENT, Fire Station III 6:30 PM -9:30 PM NATIONAL NIGHT OUT	8 7:00 PM ENVIRONMENTAL QUALITY COMMITTEE (EQC), Medicine Lake Rooms A & B	9 7:00 PM PARK & REC ADVISORY COMMISSION (PRAC), Council Chambers	10	11
12	13	14 7:00 PM REGULAR COUNCIL MEETING, Council Chambers	15 7:00 PM PLANNING COMMISSION, Council Chambers	16 7:00 PM HOUSING & REDEVELOPMENT AUTHORITY (HRA), Medicine Lake Room A	17	18
19	20	21	22 7:00 PM PLYMOUTH ADVISORY COMMITTEE ON TRANSIT (PACT) , Medicine Lake Room A	23	24	25
26	27	28 7:00 PM REGULAR COUNCIL MEETING, Council Chambers	29	30	31	

modified on 5/1/2007

OFFICIAL CITY MEETINGS

September 2007

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1
2	*3* LABOR DAY - City Offices Closed	*4*	*5* 7:00 PM PLANNING COMMISSION, Council Chambers	*6* 7:00 PM HUMAN RIGHTS COMMISSION, Parkers Lake Room	*7*	*8*
9	*10*	*11* 7:00 PM REGULAR COUNCIL MEETING, Council Chambers	*12* 7:00 PM ENVIRONMENTAL QUALITY COMMITTEE (EQC), Medicine Lake Rooms A & B ROSH HASHANAH BEGINS AT SUNSET	*13* 7:00 PM PARK & REC ADVISORY COMMISSION (PRAC), Council Chambers	*14*	*15* 10:00 AM -5:00 PM AUTUMN ART FAIR, Parkers Lake Room
16	*17*	*18*	*19* 7:00 PM PLANNING COMMISSION, Council Chambers	*20* 9:00 AM -3:30 PM PLYMOUTH CLEAN-UP DAY, Public Works Maintenance Facility 7:00 PM HOUSING & REDEVELOPMENT AUTHORITY (HRA), Medicine Lake Room A	*21* YOM KIPPUR BEGINS AT SUNSET	*22*
23	*24*	*25* 7:00 PM REGULAR COUNCIL MEETING, Council Chambers	*26* 7:00 PM PLYMOUTH ADVISORY COMMITTEE ON TRANSIT (PACT) , Medicine Lake Room A	*27*	*28*	*29* 1:00 PM Plymouth on Parade Celebration, City Center Area
30						

Aug 2007

S	M	T	W	T	F	S
			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	27	28	29	30	31	

Oct 2007

S	M	T	W	T	F	S
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14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

modified on 5/1/2007

MEMO

CITY OF PLYMOUTH

3400 Plymouth Boulevard
Plymouth, MN 55447

DATE: April 26, 2007

TO: Laurie Ahrens, City Manager

FROM: Doran Cote, P.E., Director of Public Works

SUBJECT: STREET SWEEPING STUDY SESSION
CITY PROJECT NO. 7113E

For most of Plymouth's most recent history, the Public Works Department, Street Maintenance Division has provided street sweeping services for the City of Plymouth. The program consisted mainly of a spring sweep, focusing on critical areas around lakes and other sensitive environmental areas followed by routine sweeping of "problem" areas, especially after large storm events. Sweeping was also performed on mill and overlay and seal coat projects. The sweeper was also dispatched to address complaints on an as-needed basis. This program was documented in 2003 when the City purchased the current Elgin Pelican SE mechanical sweeper.

In 2001, the City evaluated the option of expanding the street sweeping program to include leaf collection. It was concluded at that time that a City-wide leaf collection was not economically feasible.

In 2003, the street sweeping program funding was moved to the Water Resources Fund. It was concluded that not only did street sweeping have an aesthetic and functional value, the program offered environmental benefits as well. Street sweeping was further identified as a Best Management Practice (BMP) for improving water quality by reducing phosphorus and total suspended solids (tss) from stormwater run-off entering the City's lakes, streams and wetlands. In 2004, the program was expanded to include a City-wide spring sweep and in 2005 the program was further expanded to include a City-wide mechanical sweep followed by two City-wide regenerative air sweeps. Data was collected on the material collected that demonstrated the environmental benefits of the program (see attached staff reports and analysis).

Attached for your consideration are several articles and reports regarding the state of the practice of street sweeping.

attachments

Agenda Number 6.12

CITY OF PLYMOUTH

CITY COUNCIL AGENDA REPORT

DATE: December 29, 2006 for the City Council Meeting of January 9, 2007

TO: Laurie Ahrens, City Manager through
Doren Cote, P.E., Director of Public Works

FROM: Dave Taylor, Senior Engineering Technician

SUBJECT: 2007 STREET SWEEPING PROGRAM
CITY PROJECT NO 7113E

ACTION REQUESTED: Make a motion to adopt the attached resolution approving specifications and ordering advertisement for bids for a 2007 Mechanical and Regenerative Street Sweeping Program.

BACKGROUND: The program covers about 277 miles of City streets with a mechanical sweep to remove larger dirt and sand particles and then with three follow up passes of regenerative sweeps to pick up the finer particles.

The 2006 Combined Street Sweeping contract was awarded to Reliakor Services on March 14, 2006 for $80,351.42. This contract also required regenerative air sweepers that pick up many of the fine sediments missed by mechanical broom sweepers. Although the mechanical portion of the work was acceptable, the regenerative work did not meet specification. After investigation, it was determined that the equipment used, although within the written specification, did not perform as expected. Therefore, by mutual consent, that contract was terminated per City Council resolution on August 8, 2006, with a total contract payment of $30,112.67, of which $25,958 was for mechanical sweeping.

The third and final regenerative street sweeping work was then awarded to Carefree Services, who had performed similar work for the City of Plymouth in the past. Carefree Services used Tymco and Swartz regenerative air sweepers that met this requirement, for a one-time cost of $31,336.80. The cost of this one time sweep was more than typical due to the greater amount of materials missed on the previous sweeps.

Reliakor collected material during their combined sweeps, while Carefree Services collected with their single regenerative sweep. The total material picked up, for all combined contracts, was equivalent to over 135 dump trucks. The materials collected during the mechanical sweep were stored, sifted, transferred and disposed of outside city limits by Dirt Devils, Inc. for a one-time cost of $29,256.00. Materials collected during the regenerative sweeps were hauled out of the City, as required by their contracts.

Based on available data, staff had estimated that one pound of total phosphorus per mile would be collected by a regenerative street sweeping The quantities of the street sweeping in 2006 were as

follows (with 2005 quantities listed for reference), including the projected amount of total phosphorus removed:

	2006 (277 miles of street with 19 parking lots)	2005 (193 miles of street with 17 parking lots)
Mechanical Sweepings (cubic yard: CY)	1,100 CY	1,240 CY
Mechanical Sweeping collected per mile	3.38 CY	5.46 CY
Regenerative Sweeps:		
First sweep (around May)	34 CY	189 CY
Second Sweep (around Aug.)	72 CY	133 CY
Third Sweep (around mid-Sept.)	280 CY	142 CY
Total Regenerative Sweeps collected; (excluding parking lots, 15% of total)	386 CY	464 CY
Regenerative Sweeping collected per mile:	0.84 CY/mile	2.04 CY/mile
Estimated, lbs. of TP collected by Regenerative Sweepings (est. 1 lb of TP/CY/mile X street miles X CY collected/mile)	232.7 lbs.	393.7 lbs.

In 2006, staff also sampled and tested some of the street sweeping materials to collect additional information. Samples were collected during each sweep and were sent to the University of Minnesota Soil Laboratory for analysis. However, as stated previously, the first two regenerative sweeps in 2006 were not meeting the City goals and the contractor was changed. The following are summaries of the 2006 street sweeping total phosphorus (TP) rate and cost analysis:

	Mechanical	Regenerative	Total
2006 Materials Collected	1,100 CY	386 CY	1,486 CY
Total TP removed	550 lbs	208 lbs	758 lbs
Average TP per CY, as tested	0.5 lb/CY	0.54 lb/CY	0.51 lb/CY
Cost of sweeping	$ 25,958	$ 35,491	$ 61,449
Cost of material removal	$29,256	Included	$ 29,256
Cost of sweeping & removal	$55,214	$ 35,491	$ 90,705
Average cost of TP removed	$ 100 / lb	$170 / lb	$ 120 / lb

Therefore, in 2006 we have prevented about 758 pounds of TP from entering our drainage systems. In addition, we have also prevented the accumulation of nearly 1,500 CY of sediment in City ponds and wetlands. The average cost per pound of TP removed by the City's street sweeping program fairs very well compared to other best management practices (BMP). For example, in the Medicine Lake Watershed and Management Plan, the Plymouth Phosphate Free Fertilizer Ordinance was estimated to annually reduce at least 84 lbs of phosphorous in Plymouth Creek Watershed at a cost of $12 per pound. The proposed Wood Creek Erosion Repair Project is estimated to remove about 95 pounds of TP by eliminating channel erosion at a projected cost of $290 per pound ($550,000 total cost in 20 years). Similarly, the two recently constructed Medicine lake Water Quality ponds are estimated to remove about 175 pounds of TP per year at a cost of $275 per pound.

Considering the cost, total phosphorous removal and sediment prevention, mechanical and regenerative sweepings are very effective programs and should continue to be implemented in the City of Plymouth. The initial mechanical sweeping is needed to remove large debris and winter sand particles from the roadways. It also improves the effectiveness of the regenerative sweeping. Combining both programs improves coordination and sweeping effectiveness. This program also helps the City to comply with anticipated requirements Federal, State, and local rules.

The all-City mechanical sweep, working closely with City Maintenance and broom crews, occurs typically during the last week in March. In 2007, it will be followed immediately by the first regenerative sweep to pick up fine materials that mechanical sweepers can not collect. The objective is to get the materials off the street before spring rain washes these sediments into the City's storm sewer system. Two more Citywide regenerative sweepings will occur through the summer, and will be timed to avoid the dropping of leaves in September. The City will also coordinate all such sweepings to avoid streets that have received recent road improvements (seal coat, reconstruction, temporary overlay plus mill and overlay), to avoid damage to these renewed surfaces. See attached map for anticipated road improvement locations.

BUDGET IMPACT: The cost for the one-year program is estimated at $130,000, and will be financed by the Water Resources Fund. Funding for the first year is included in the approved 2007 Budget. The bids will be based on a one-year contract, and paid on an actual per mile cost.

SUMMARY: Street sweeping is one of the most cost effective best management practices in the City of Plymouth. Street sweeping fulfills the implementation goals of the Water Resources Management Plan, Environmental Protection Agency Phase II Permit and City's lake management plans.

RECOMMENDATIONS: I recommend that the City Council adopt the attached resolution approving specifications for the combined Mechanical and Regenerative Street Sweeping Program and ordering advertisements for bids.

Attachments: City Map including Street Repairs
Resolution

CITY OF PLYMOUTH

RESOLUTION NO. 2007-123
APPROVING PLANS AND SPECIFICATIONS AND ORDERING ADVERTISEMENT FOR BIDS
2007 STREET SWEEPING PROGRAM
CITY PROJECT NO. 7113E

WHEREAS, plans and specifications have been prepared by the City's Engineering Staff, for the 2007 Street Sweeping Program in the City of Plymouth and said plans and specifications have been presented to the Council for approval;

NOW, THEREFORE, BE IT HEREBY RESOLVED BY THE CITY COUNCIL OF THE CITY OF PLYMOUTH, MINNESOTA:

1. Such plans and specifications, a copy of which is on file in the City Engineer's office and made a part hereof, are hereby approved.

2. The City Clerk shall prepare and cause to be inserted in the official paper and in The Construction Bulletin an advertisement for bids upon the making of such improvement under such approved plans and specifications. The advertisement shall be published twice, shall specify the work to be done, shall state that bids will be received by the City Clerk until 10:00 a.m. on February 16, 2007 at which time they will be publicly opened in the Council Chambers of the Plymouth City Center building at 3400 Plymouth Boulevard, Plymouth, Minnesota, by the City Engineer and that no bids will be considered unless sealed and filed with the City Clerk and accompanied by a cash deposit, cashier's check, bid bond or certified check payable to the City Clerk for five percent of the amount of such bid.

Adopted by the City Council on January 9, 2007.

CITY OF PLYMOUTH

CITY COUNCIL AGENDA REPORT

DATE: January 17, 2007 for the City Council Meeting of January 23, 2007

TO: Laurie Ahrens, City Manager

FROM: Doran Cote, Director of Public Works

SUBJECT: 2007 STREET SWEEPING PROGRAM
CITY PROJECT NO. 7113E

ACTION REQUESTED: Review the attached information related to the proposed 2007 Street Sweeping Program, City Project No. 7113E, and provide staff direction.

BACKGROUND: On January 9, 2007, staff provided the City Council with a staff report and resolution regarding the 2007 Street Sweeping Program. The City Council tabled action on the item pending receipt of additional information.

As requested by City Councilmember Willis, staff has investigated the opportunity to include an additional city-wide sweep to the proposed sweeping program in order to pick-up leaves. We also examined the cost effectiveness, and explored the option of including a leaf pick-up as a bid alternate. We were also able to recover the 2006 Street Sweeping Program sampling data Councilmember Willis previously requested (copy attached). According to the samples tested, the first (mechanical) sweep yielded approximately 2 lb/mile of phosphorous removal and expectedly, the last (regenerative) sweep yielded a lesser amount of approximately 0.5 lb/mile of phosphorous removal.

In order to determine the effectiveness of phosphorous removal via leaf removal, in 2004 staff contacted the University of Minnesota to find out if data were available regarding phosphorous content in leaves. Attached is an email response from the University of Minnesota. Using this data and making some very basic assumptions that all streets are tree-lined, that half of the leaves would end up in the street, and that there would be no homeowner "contribution" to the leaf collection, we can expect a removal rate of approximately 0.35 lb/mile (see attached rudimentary analysis).

Staff also contacted a street sweeping contractor to determine an approximate cost to include a city-wide leaf removal sweeping (see attached emails). The contractor indicated that based on the anticipated collection of 24,900 cubic yards of leaves used in the above analysis, the estimated cost to perform a leaf pick-up sweep would be $80,000, excluding disposal.

Based on this information, including a city-wide leaf removal sweep would contribute to phosphorous removal, but at an expected lower removal rate than traditional sweeping.

Including the leaf removal sweep would also exceed the budget for this project unless other portions of the sweeping program were eliminated. If the City Council desires to add the leaf sweep and remain within the budget, we could eliminate the second and third regenerative sweeps, or bid an alternate to include either the second and third regenerative sweep or a leaf removal sweep at the City's discretion.

Currently, the 2007 Water Resources Budget includes $130,000 for the 2007 Street Sweeping Program. All other sweeping is funded out of the Street Maintenance operating budget with one mechanical sweeper. The Street Maintenance Division sweeps leaves on a complaint or as needed basis. Staff could examine the costs of providing a leaf removal program as part of preparing the 2008 Budget.

RECOMMENDATIONS AND CONCLUSIONS: Staff is seeking direction from the City Council on how they wish to proceed with the 2007 Street Sweeping Program. The City Council could proceed with the 2007 Street Sweeping Program as originally proposed. The resolution provided with the original staff report has been revised to reflect new publication and bid opening dates. Alternatively, the City Council could direct staff to proceed with one of the options described above and revise the resolution and specifications accordingly.

attachments: Email Messages
2006 Street Sweeping Program sampling data
Resolution

Dates (completed)	Materials CY	Cost $	RUNS / Sweeps		pH	Bray-P (ppm)	Olson-P (ppm)	TP (ppm)	K (ppm)	O.M. % by LOI	Cl (ppm)
15-Mar	30	-	Mechanical, spot	Sample Area							
				1	7.9	10	5	306.5	34	1.6	1374.5
				1 dup	7.9	9	6	358	40	1.6	1429.7
				2	8.0	9	5	347.8	28	1.7	1066.7
				3	7.3	55	62	879.9	183	15.1	10.9
				min	7.3	9.0	5.0	306.5	28.0	1.6	10.9
				max	8.0	55.0	62.0	879.9	183.0	15.1	1429.7
				ave	7.8	20.8	19.5	473.1	71.3	5.0	970.5
CY*(764.56L/CY)*(Ave ppm)*(kg/ppm 1e-6)*(2.205 Lbs/Kg)				sd	0.3	22.8	28.3	272.1	74.7	6.7	659.3
764.56	1.00E-06	2.205		n	4	4	4	4	4	4	4
			Whole City, 277 miles Street (85%) + 39 acres Parking lots								
15-Apr	1,100	26,000	IM, Mech Sweeper	Sample Area							
				3A1	7.9		8	329.8	43		161.2
				2B1	7.8		6	318.6	49		195.9
				3B1	8.0		6	261.7	42		125.3
				6A1	8.0		6	253.2	34		370.2
				5B1(n=2)	7.8		9	377.5	44.5		90.35
				min	7.8		6.0	253.2	34.0		90.4
				max	8.0		9.0	377.5	49.0		370.2
				ave	7.9		7.0	308.2	42.5		188.6
				sd	0.1		1.4	51.4	5.5		108.9
				n	5		5	5	5		5
20-May	34	2,100	1V, Vacuume (S) Schwrze Model S small	1V2B				317		1.8	46.1
				1V3B				390		1.4	32.8
				1V4B				191		0.6	58.3
				1V5B				526		8.5	300
				1VCP				225		1.8	86.4
				1VFP				230		2.2	9.2
				1VPP				263		0.6	11.3
				1VWP				269		2.3	9.8
				min				191.0		0.6	9.2
				max				526.0		8.5	300.0
				ave				301.4		2.4	69.2
				sd				109.7		2.5	97.1
				n				8		8	8
1-Aug	72	2,100	2V, Vacuume (S) Schwrze Model S small	2V2B				642		11.2	263
				2V3B				603		23.3	433
				2V4B				767		15.8	105
				2V5B				1349		25.8	231
				min				603.0		11.2	105.0
				max				1349.0		25.8	433.0
				ave				840.3		19.0	258.0
				sd				346.3		6.7	135.1
				n				4		4	4
18-Sep	280	31,000	3V, Vacuume (A) Schwrze Model A much bigger	3V2B				354.6		1.85	32.75
				3V3B				260		2.2	69.8
				3V4B				319		2.85	35.3
				3V5B				391.7		1.5	12
				min				260.0		1.5	12.0
				max				391.7		2.9	69.8
				ave				331.3		2.1	37.5
				sd				56.1		0.6	24.0
				n				4		4	4

Cl lbs/CY	1.6
TP lbs/CY	0.8
Total TP, lbs	23.9
TP $/lbs	-

Cl lbs/CY	0.3
TP lbs/CY	0.5
Total TP, lbs	571.5
TP $/lbs	$ 45.50

Cl lbs/CY	0.1
TP lbs/CY	0.5
Total TP, lbs	17.3
TP $/lbs	$ 121.57

Cl lbs/CY	0.43
TP lbs/CY	1.42
Total TP, lbs	102.0
TP $/lbs	$ 20.59

Cl lbs/CY	0.06
TP lbs/CY	0.56
Total TP, lbs	156.4
TP $/lbs	$ 198.21

Average stats:

		TP ppm	O.M. (%) by L.O.I.	Cl (ppm)
Cl lbs/CY	0.51	min	301.4	2.1	37.5
TP lbs/CY	0.76	max	840.3	19.0	970.5
Total TP, lbs	853.8	ave	450.8	7.1	304.7
TP $/lbs	$ 71.68	sd	228.6	8.0	382.7

FALL LEAF SWEEP

Is it a BMP to let leaves collect in the street gutters over the late Fall and Winter, or would it be appropriate to schedule additional sweepings to collect the materials before they decay and/or otherwise enter our storm water system?

Based on phosphorus removal estimates, projected cost, and expected changes in citizen involvement it would not be considered a BMP to initiate such a late fall leaf sweeping program. A study by Ron Struss of the University of Minnesota Extension shows if 28 trees are assumed per city block, and half of the tree leaves end up in the street, then the "P" load is .04 lbs/block. If 277 miles of Plymouth roads are swept it would equal **97.5 lbs of TP or .352 lbs P/mile.**

The estimated cost to sweep 277 miles for such a regenerative late-fall leaf sweep is $80,000 (738 hours), plus $29,000 for transportation/disposal, for **a total of $109,000**. Comparing this information with the U of M Extension data, the expense would equal **$1,118 per pound of TP removed.**

Regenerative (vacuum-assist) sweeping needs be used rather than mechanical sweeping. Mechanical sweeping tends to move loose leaves around more, while regenerative sweeping picks them up more efficiently and compresses them for better handling.

Presently, residents have been good stewards in collecting their own leaves, keeping them out of the road and taking them to composting sites. This is usually done by the resident or their refuse company after on-site bagging. Further, experience has shown that, once regular fall leaf sweeping programs are expected, more leaves tend to end up in the street for disposal.

FORMULA

$$\frac{277 \text{ miles} \times 5{,}280' = 1{,}462{,}560'}{600' \text{ /block/planning}} \times .04 \text{ lbs P/block} = \mathbf{97.5 \text{ lbs TP City Wide}}$$

or **.352 lbs TP per City mile**

$80,000 sweeping estimate from Carefree Services, who have done several City-wide sweeps for the City of Plymouth.

$26,000 hauling/handling based on final payment to Dirt Devils, Inc. for similar work in 2006.

Connie (and Shane from last year's request!):

P in Grass Clippings:

From a Carl Rosen, UM Dept Soil, Water, Climate: Grass clippings contain about 0.13 lbs P per 1,000 sq ft during the growing season. A typical yard is 5,000 sq ft, so you can do the math.

From a Penn State Publication "Land Application of Leaves and Grass Clippings" (http://www.age.psu.edu/extension/factsheets/c/C2.pdf) are these figures on FRESH grass clippings:

Moisture: 16.7%
Density: 8.3 lbs / cu ft
N: 54.7 lbs / ton
P 18.7 lbs / ton
K: 45.9 lbs / ton

Since a bushel is 1.24 cu ft, there is 0.096, or 0.1 pound of P in a bushel of fresh clippings. So, if someone blowing grass clipping out into the street puts about a bushel of clippings on the pavement (a reasonable guess), they are putting 0.1 lbs of P in the street.

P in Tree Leaves:

I have figures on this, but they were hobbled together from several sources of information - Frankenstein style. It is the best I have, but I'm looking for other sources.

A paper titled: "Phosphorus budget of a 70-year-old northern hardwood forest" by Ruth Yanai (Yale and Cornell) gives the following figures on the Hubbard Brook Experimental Forest (New Hampshire):

1.9 kg P / ha in leaves
0.8 kg P / ha in buds, flowers, fruit, frass
0.9 kg P / ha in twigs, stems, bark

Another paper titled "Wisconsin Forest Inventory Data", says a northern hardwood stand 66-75 years has a tree

density of 1,573 trees / ha, so combining info from the two papers we are getting 1.2 g P per tree in leaf fall, or 0.003 lbs. P per tree.

I did a count on the trees on city streets in Highland Park, St. Paul, and came up with 28 street trees per city block. If half the leaves from these trees fall in the street, the P load would be 0.04 lbs P / block / year.

Double check my figures and see if you come up with the same!

What is worse???

If these figures are correct, a "grass blowing homeowner" can put more P in the street in one mowing than all the trees on the block can in 2.5 years.

- Ron

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Co-located with MN Board of Water & Soil Resources
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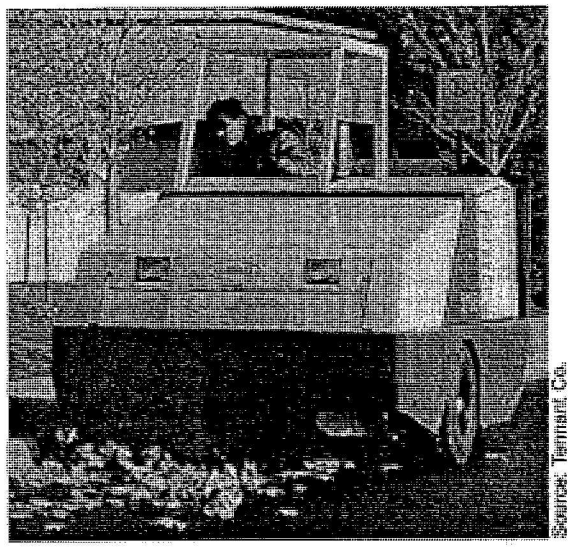
Housekeeping
Pavement Management


Source: Tennant Co.

Description

Streets and parking lots make up a significant portion of the total impervious area within a developed watershed, and most, if not all of these areas are directly connected to the storm drain system. Pollutants accumulate on these surfaces and are washed off during storm events, particularly during spring snowmelt. A 1993 study in Wisconsin indicated that streets and parking lots were responsible for 54 percent of total runoff volume in residential areas and 80 percent in commercial areas. The same study found that streets and parking lots were significant sources of runoff pollutants, including suspended solids, phosphorus, copper, zinc and fecal coliform.

This document focuses on applications appropriate for sites of five acres or less. For more in-depth discussion of municipal-level street sweeping, see *Best Practices for Street Sweeping* (Metropolitan Council, 1994).

Three main pavement-related maintenance strategies can help prevent these problems:

- *Sweeping.* When properly designed and implemented, sweeping programs can significantly reduce street and parking lot contributions to pollutant loads.
- *Alternative Products and Application Rates.* Minimizing sand and salt application rates and/or using alternative deicing products can help protect waterways and potentially reduce costs.

Purpose

Water Quantity	
Flow attenuation	N/A
Runoff volume reduction	N/A
Water Quality	
Pollution prevention	
Soil erosion	N/A
Sediment control	* ■
Nutrient loading	* ■
Pollutant removal	
Total suspended sediment (TSS)	* ■
Total phosphorus (P)	* ■
Nitrogen (N)	* ◧
Heavy metals	* ■
Floatables	* ■
Oil and grease	* ■
Other	
Fecal coliform	* ■
Biochemical oxygen demand (BOD)	* ■

* *Depends on timing and frequency of sweeping, and extent to which other measures are employed*

■ Primary design benefit
◧ Secondary design benefit
□ Little or no design benefit

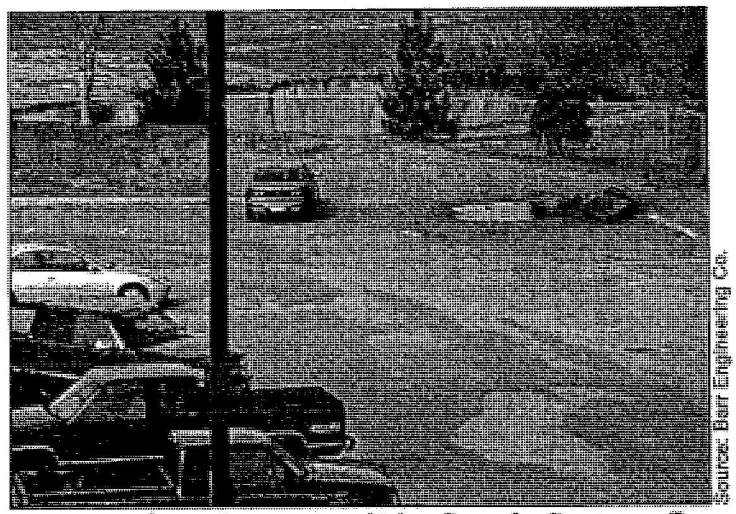
- *Other Prevention Measures.* A variety of measures will prevent accumulation of sediments, salts and other pollutants on pavement and stop them from washing off into storm drains and water bodies. These measures include prompt pavement repair, spill cleanup and appropriate snow management.

Sweeping

Sweeping is a common maintenance activity, often done primarily for aesthetic reasons. Sweeping has important water quality ramifications, however, and should be done in ways that increase its effectiveness for preventing sediment loading of runoff and, whenever possible, decreasing costs. Sweeping is most effective for removing coarse particles, leaves and trash.

Timing

- At minimum, pavement should be swept twice yearly: in early spring, to collect sand, salt and winter debris, and in fall, to capture leaves and other debris.
- Sweep as early in spring as possible (after snow has melted from an area) in order to capture sediment before it is washed away by spring rains.
- An additional sweeping in June, after trees drop seeds and flowers, will prevent a fair amount of phosphorus-laden runoff.
- Sweep after activities or in locations that generate debris, such as at construction entry points.
- When loading or unloading salt, sand, gravel or other granular materials, sweep the loading/unloading areas at the end of each day, as well as along the paths that the trucks use.


Source: Barr Engineering Co.

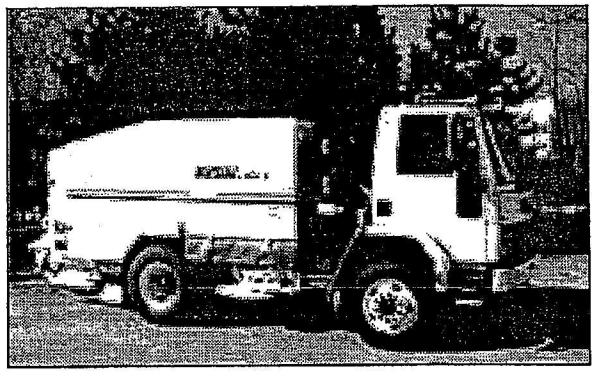
Excessive winter sanding can mean high sediment loading to runoff.

Figure 1

Equipment

- Broom sweepers are effective at picking up large particulate matter and cleaning wet street surfaces. They also cost less to operate than vacuum sweepers. Broom sweepers generally create airborne dust during their operation, which increases atmospheric loading.
- Vacuum sweepers are more effective for removing fine particles, which is important because many pollutants are adsorbed to them. However, vacuum sweepers have the disadvantage of being ineffective at cleaning wet street surfaces. For heavy loads, use a mechanical sweeper for large particles followed by regenerative-air cleaner.
- Consider equipment that can be converted to other uses, such as sanding and plowing in winter.

- Install an automatic greasing system on sweepers to decrease maintenance time and reduce wear on critical parts, which can cause unscheduled maintenance and missed sweeping opportunities.


Source: American Sweeper Online

Techniques

- Sweep in a pattern that keeps spilled material from being pushed toward catch basin inlets
- Locate storage and disposal sites for the material collected during sweeping so it will not get back to the storm sewer systems.
- Before sweeping, manually rake sand from any adjacent turf areas onto the surface to be swept.
- Use a small pool of highly trained operators.

Residual Material

- Street sweepings may be reused by cleaning out leaves and other debris then mixing the sweepings with new salt/sand mixture for winter application to roads, parking lots or sidewalks. When screening sweepings for reuse in this way, use a small mesh for the final screening to ensure that all of the larger debris has been removed. (A 3/4-inch mesh will screen out much of the debris.)
- Recycle fall leaf sweepings by finding a composting or agricultural facility that will use them.
- Street sweepings may also be reused as daily cover material on sanitary or demolition landfills, but only those that have ground water monitoring systems. While sweeping residuals are not considered hazardous waste, a wide array of inorganic and organic pollutants are contained, so use caution in disposal.

Alternative Products and Application Rates

The sand and salt compounds applied to icy roads are easily carried into storm drain systems and receiving streams, especially during snowmelt. High salt concentrations are harmful to streams. Furthermore, road salt contains cyanide as an anti-caking agent; cyanide may cause acute or chronic toxicity to aquatic organisms. Since salts are soluble and mobile, they may run off before sweeping can begin. So in areas where salts pose a problem, alternative deicing products may help. However, these alternative products are usually more expensive than salt, and may have other environmental impacts, which need to be carefully weighed.

- Consider alternative deicers, such as calcium magnesium acetate (CMA), which, when used instead of road salt, has been shown to decrease sodium levels in groundwater. Be sure to consider their expense and potential environmental impacts prior to purchase.
- Use a deicer additive or replacement in order to reduce rate of application. A liquid organic product called Ice Ban,* derived from fermenting and distillation industries, has been shown to be cost-effective used as an additive (it can also be used alone). However, it has raised some concerns about BOD loading. If used alone, it must be applied prior to snowfall.

> * *This mention does not constitute an endorsement of product.*

- Apply deicers at the appropriate time to reduce rate of application. Applying before snow falls, based on forecasts, means less material is needed to melt snow. The drawback: if the forecast is inaccurate, the deicer will have been applied needlessly.
- Store salt and deicers on an impervious surface and protected from rainfall to eliminate contamination of runoff.
- Use clean sand, that is, sand free of fines, which are difficult to collect via sweeping and are more troublesome when they reach water bodies.
- Train operators to apply the minimum amount of sand necessary

Other Prevention Measures

Commercial and retail operators can help reduce and prevent accumulation of pollutants by:

- limiting exposure of materials and equipment to rain and snowfall by storing indoors or covering
- promptly cleaning up spills using dry instead of wet cleanup techniques.
- promptly repairing potholes and other pavement damage to help prevent erosion of subbase material.
- training workers about these principles

Snow Storage

Snow piles containing sand and salt that build up over the winter months, generate concentrated releases of sand and salt during spring snow melt conditions. Also, trash and debris usually accumulate in snow piles during snow plowing operations. Therefore, five months of potential pollution accumulation may occur over the winter months for rapid release in the spring.

- Plowed snow should not be directly discharged to lakes, streams or wetlands. Storage locations should be flat and well-drained in order to avoid direct drainage into surface waters.
- Pay attention to the location of snow piles, avoiding nearby surface runoff discharge points and impervious surfaces.
- Install berms, skimmers and detention ponds to settle sediment and trap debris.
- Place snow piles so as to avoid or divert surface water run-on from areas outside the snow piles.
- During spring melt conditions, visually observe the snow piles for runoff/run-on conditions and debris contained in the snow that may be subject to blowing.
- Do not pile snow into wooded areas, around trees or into vegetative buffers. The equipment operators usually try to get the snow as far into the area as possible and wind up striking the tree trunks. These injuries eventually lead to rotting of the trunks and premature tree death.

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Chapter 9

Contrary to Conventional Wisdom, Street Sweeping Can be an Effective BMP

Roger C. Sutherland and Seth L. Jelen

Recent work suggests that street sweeping programs can be optimized to significantly reduce pollutant washoff from urban streets. The abilities of several different sweeping technologies to pick up accumulated sediment of various sizes were evaluated. In addition, the expected reductions in average annual washoff loads were evaluated using calibrated model simulations of the Simplified Particulate Transport Model (Sutherland and Jelen, 1993) for two stormwater sites in Portland, Oregon.

Results suggest that reductions of up to 80% in annual TSS and associated pollutant washoffs might be achieved using bimonthly to weekly sweepings. Frequencies and associated reductions would vary with patterns of precipitation sediment accumulation and resuspension, but it is clear that sweeping technology can have a profound effect on sweeping results and achieve meaningful runoff quality benefits.

These results stand in sharp contrast to earlier conclusions dating back to December 1983. At that time, street sweeping had been found to be generally ineffective as a technique for improving the quality of urban runoff. This conclusion resulted from the United States Environmental Protection Agency sponsored Nationwide Urban Runoff Program (NURP) in which over 30 million dollars was expended in an intensive three-year investigation of urban runoff quality at 28 locations throughout the United States (USEPA, 1983).

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9.1 Previous Research

The NURP studies of street sweeping effects on stormwater quality (USEPA, 1983) concluded that street sweeping was largely ineffective at reducing the event mean concentration (EMC) of pollutants in urban runoff. This conclusion was reached mainly because the street sweepers tested were not able to effectively pick up very fine accumulated sediments that can often be highly contaminated.

In general, street sweeping equipment of the era was unable to effectively pick up the very fine, highly contaminated, sediments that accumulate on impervious areas such as streets, driveways and parking lots. These same sediments, located on paved areas that are directly connected to a city's storm drainage system, have been identified over and over again as the primary source of urban nonpoint pollutants entering the receiving waters of the United States.

Broom sweepers of that era removed litter and large dirt particles well, but contaminants are known to concentrate primarily in the fine particle sizes (e.g. less than 63 microns). However, these finer and much more pollutant-laden particles were largely left behind, and moreover, they were left exposed to be even more readily entrained in washoff since their armoring shelter by larger sediment particles was removed.

However, recent studies by the authors over a period of four years show clearly that the NURP conclusions from the early 80's are no longer valid today. This is largely because of the considerable increase in street sweeping's effectiveness at removing the smallest particles. Examples of this improvement include the following:

1. Even most mechanical sweepers (i.e. broom and conveyor belt) now available are much more effective at picking up fine sediments.
2. Tandem sweeping operations (i.e. mechanical sweeping followed immediately by a vacuum-assisted machine) have been found to be even more effective at fine sediment pickup.
3. Regenerative air sweepers have been refined considerably since their infancy during the NURP era, have also been found to be effective at fine sediment pickup.
4. A revolutionary new vacuum-assisted dry sweeper has greatly advanced the technology of fine sediment pickup and containment.

These considerable advances in sweeping technologies result in a need to re-evaluate the NURP conclusions and incorporate new performance data and benefits that result from more demanding and water-quality-driven sweeping programs.

9.2 Sweeping Technologies

The pickup performance for the NURP era sweepers show typical values based on the authors' previous analysis (Sutherland, 1990) of the Bellevue, Washington NURP data, as summarized by Pitt (1985). Having been a consultant to the City of Bellevue during the NURP study, the author had direct access to the street sweeper pickup performance data collected as part of that study. The sweeper tested at that time was a *Mobil* standard mechanical broom street sweeper, probably manufactured around 1978. It provides the baseline against which several modern street sweeping technologies are compared for immediate pickup rate and expected long-term washoff load reduction.

Against this, the performance of a newer mechanical (i.e. broom and conveyor) sweeper was compared, in order to establish the level of improvement achieved in types of sweepers still in wide use. Data for this comparison was obtained when the authors measured the pickup performance of a newer mechanical sweeper, which was a 1988 *Mobil*, as a result of a Portland study mentioned later.

Research by the authors has identified three promising technologies that may provide significant improvements in performance beyond that observed for NURP era or mechanical sweepers. For each, the sediment pickup from sweepings by each technology was measured in the field by the authors under a variety of conditions. Resulting removals were obtained for each of eight particle size ranges. These show significantly greater removals for each of these new technologies than those typical for sweepers from the early 1980's.

The first technology is the use of a tandem sweeping operation. A tandem operation involves two successive cleaning passes, first by a mechanical (i.e. broom and conveyor belt) sweeper, then immediately followed by a vacuum-assisted sweeper. The pickup performance of a tandem operation using the *Mobil* broom sweeper followed by a *TYMCO* vacuum sweeper was monitored for over a year in a medium-density residential area located in Southeast Portland, Oregon. The detailed description of this study and its results can be found in HDR (1993) and were briefly summarized in Alter (1995).

The second technology is the stand-alone use of a regenerative air sweeper. Regenerative air sweepers blow air onto the pavement and immediately vacuum it back in order to entrain and filter out accumulated sediments. Regenerative air machines were just in their infancy during the NURP era, and to the author's knowledge were not extensively tested at any of the NURP sites. Regenerative air sweepers are generally considered to be good at removing fine sediment, if the accumulated loading is not too great. The authors measured the pickup performance of the Elgin Crosswind regenerative air sweeper in and near Seatac International Airport on April 21, 1995.

The third technology is the stand-alone use of a new, highly effective, vacuum-assisted dry sweeper called the Enviro Whirl I developed and manufactured by Enviro Whirl Technologies Inc., located in Centralia, Illinois. This sweeper applies technology developed and still used to remove spilled coal and coal dust along railroad tracks. The technology has also been applied to clean similar materials from industrial sites where complete removal without leakage of airborne particles is important.

From these demands have evolved a technology that is extremely efficient at removing the finest particles and preventing their escape into the air. In contrast, most other units, especially mechanical types, trail a visible cloud of dust behind in the air and on the street.

The Enviro Whirl I combines the important elements of tandem sweeping into a single unit. It uses rotating sweeper brooms within the powerful vacuum head to provide both mechanical and aerodynamic particulate removal. Data comparing the sweeping performance of this technology to others was measured by the authors on an April 24, 1995 test prepared by the City of Las Vegas, Nevada (during an air quality conference) and in Centralia, Illinois during September 1995.

This data reveals marked improvements in the street sweeping technology that result in much more effective pickup of accumulated sediments. Using the NURP-era broom sweepers as a baseline, performances are compared for improved mechanical sweepers and promising sweeping technologies. As a result, it becomes clear that street sweeping is now capable of removing significant pollutant loads from urban surfaces and effecting significant reductions in urban pollutant washoff.

9.3 Evaluation Procedure

The ability of street sweeping to reduce overall pollutant washoff loads depends on several things. First is the street sweeper's innate ability to remove accumulated sediment. Another is the environmental dynamics of sediment accumulation and resuspension, and of sediment washoff during storm events plus suspended sediment removal by downstream water quality controls.

The Simplified Particulate Transport Model (SIMPTM) can accurately simulate this complicated interaction of accumulation, washoff, and street sweeper pickup that occurs over a period of time (Sutherland, and Jelen, 1993). The remainder of this chapter presents the issues involved in applying the SIMPTM model to successfully evaluate the overall effectiveness of street sweeping technologies and programs as a water quality management practice. The following are addressed:

1. how to model street sweeper pickup performance;
2. how the SIMPTM model compares to real pickup performance data;
3. how various technologies can be compared using their calibrated SIMPTM model parameters; and
4. how technologies can be best compared using their average annual pollutant reductions, as simulated for two example stormwater basin sites in Portland, Oregon.

9.4 Pickup Performance Model

The street sweeping component of the SIMPTM model was based on the results of Pitt's street sweeping study conducted for the USEPA in San Jose, California (Pitt, 1979). This model was confirmed in additional studies conducted in Alameda County, California (Pitt and Shawley, 1982) and in Washoe County, Nevada (Pitt and Sutherland, 1982).

These studies found that sweeping removes little, if any, material below a certain base residual which was found to vary by particle size. Above that base residual, the street sweeper's removal effectiveness was described as a straight line percentage which varied by particle size.

Figure 9.1 illustrates the street cleaning component and equations used by SIMPTM. For each of eight size groups, the amount removed (*Prem*) is related linearly to the initial accumulation (*Po*) using two parameters - a base residual (*SSmin*) and a sweeping efficiency (*SSeff*):

$$Prem = SSeff \times (Po - SSmin) \; for \; Po > SSmin$$

Therefore, to describe a unique street sweeping operation, one simply needs to know the operations *SSmin* and *SSeff* values for each of the eight particle size ranges simulated by SIMPTM. Note that *SSeff* is dimensionless, while that for *SSmin* must match that for accumulation, usually either pounds per curb mile or pounds per paved acre. The initial accumulation *(Po)* is a simulated parameter, or may be measured in the field (from a similar surface near that swept) in order to evaluate the *SSmin* and *SSeff* parameters.

Figure 9.2 shows an example of how this model component actually compares to real pickup performance data for each of the eight particle size groups. The plotted points are the data obtained from monitoring the tandem street sweeping operation on Portland's Sellwood drainage basin (HDR, 1993). Note that the correlation coefficients (R^2) for the fits of the eight particle size

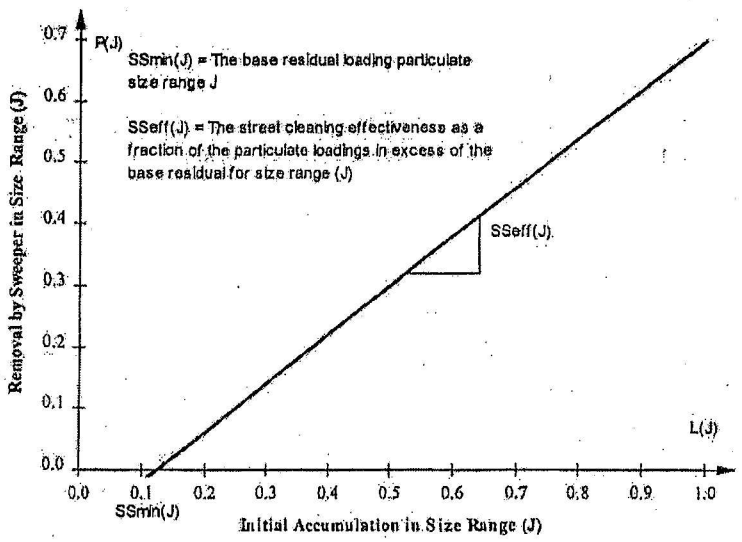

Figure 9.1 Street sweeping model component of SIMPTM.

groups ranged from 94.3% to 99.9%, so the model is doing an excellent job of reproducing the observations. These high R^2 values were typical of all of the model fits to the pickup data from the various sweeping technologies.

Table 9.1 compares the SSmin sweeping parameters calibrated to model each of the five sweeping technologies. It shows dramatic improvements in reducing residual loadings for all the newer technologies when compared to the NURP sweepers. While both tandem sweeping and the Elgin Crosswind regenerative air are very impressive, the across-the-board zero residual loadings for the Enviro Whirl I is the best possible.

Table 9.2 compares the corresponding marginal sweeping rate, SSeff, for sweeping loads that exceed the threshold SSmin. They were also calibrated to model each of the five sweeping technologies. The results mirror those for the SSmin parameter, and show impressive removal efficiencies above the residential loadings. Dramatic improvements are again evident since the NURP era. It must be recognized that this table shows only marginal removal rates. The overall removals must also incorporate the residual loading that always remains after sweeping. Thus although the rates of the Elgin Crosswind (regenerative air) and the Enviro Whirl I for the finer particle size groups may not be impressive, their residual loadings are very low, or even zero, resulting in overall removal efficiencies that are essentially the same as the rate shown. Other technologies with larger SSmin's would be significantly less efficient.

Table 9.1 Calibrated SSmin sweeping residuals for alternative technologies.

Particle Size Group	Size Range *microns*	*Street Sweeping Technology*				
		NURP Mech.	Newer Mech.	Tandem Sweeping	Regenerative Air	Enviro-Whirl
1	<63	9.0	5.8	2.0	0.0	0.0
2	-125	12.0	5.8	2.0	0.0	0.0
3	-250	18.0	5.3	2.3	0.9	0.0
4	-600	18.0	2.5	2.3	1.9	0.0
5	-1000	12.0	0.4	0.8	0.7	0.0
6	-2000	4.2	0.5	0.6	0.7	0.0
7	-6370	3.6	0.3	0.5	0.0	0.0
8	>6370	1.8	0.0	0.0	0.0	0.0

Data from various studies, minimum pounds per paved acre remaining after street sweeping.

Table 9.2 Calibrated SSeff - marginal sweeping efficiencies for alternative technologies.

Particle Size Group	Size Range *microns*	*Street Sweeping Technology*				
		NURP Mech.	Newer Mech.	Tandem Sweeping	Regenerative Air	Enviro-Whirl
1	<63	44%	100%	93%	32%	70%
2	-125	52%	100%	95%	71%	77%
3	-250	47%	92%	93%	94%	84%
4	-600	50%	57%	89%	100%	88%
5	-1000	55%	48%	84%	100%	90%
6	-2000	60%	59%	88%	100%	91%
7	-6370	78%	81%	98%	94%	92%
8	>6370	79%	70%	87%	92%	96%

Data from various studies, marginal removal rate *only* for accumulations *greater* than SSmin.

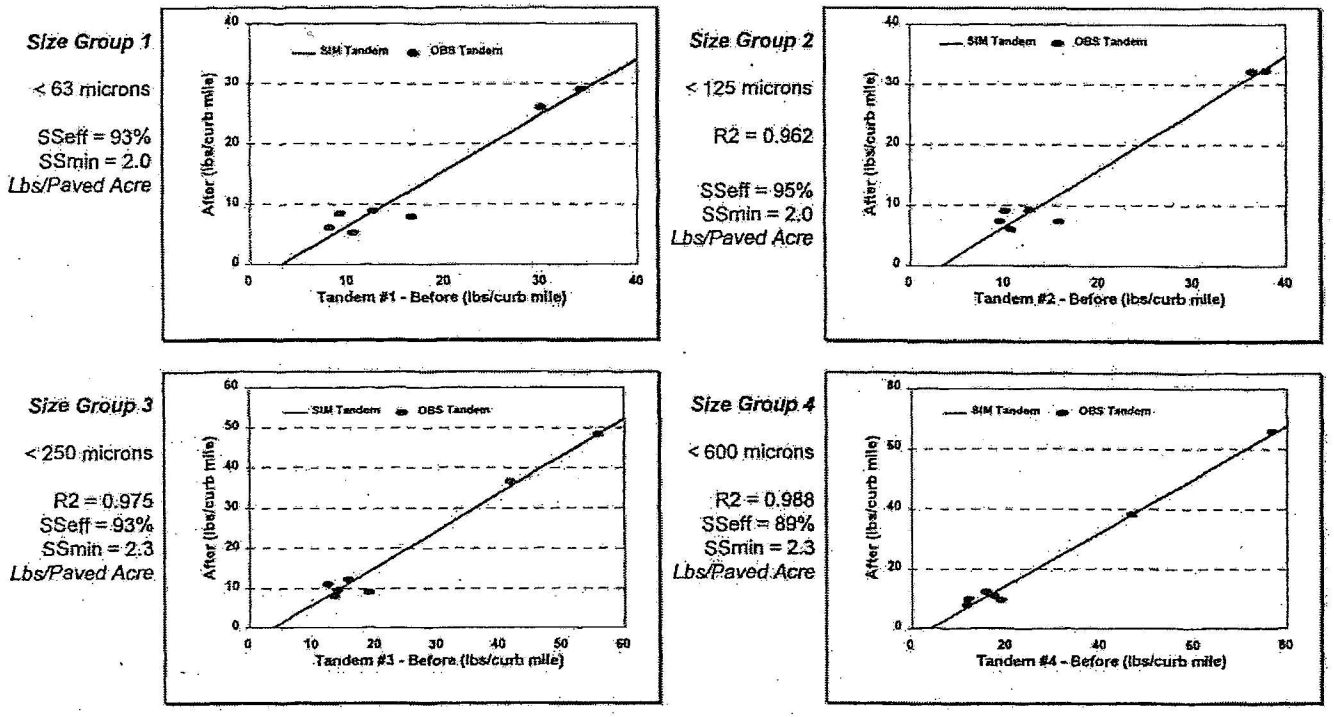

Figure 9.2 Tandem street sweeping model in SIMPTM, size groups 1-4.

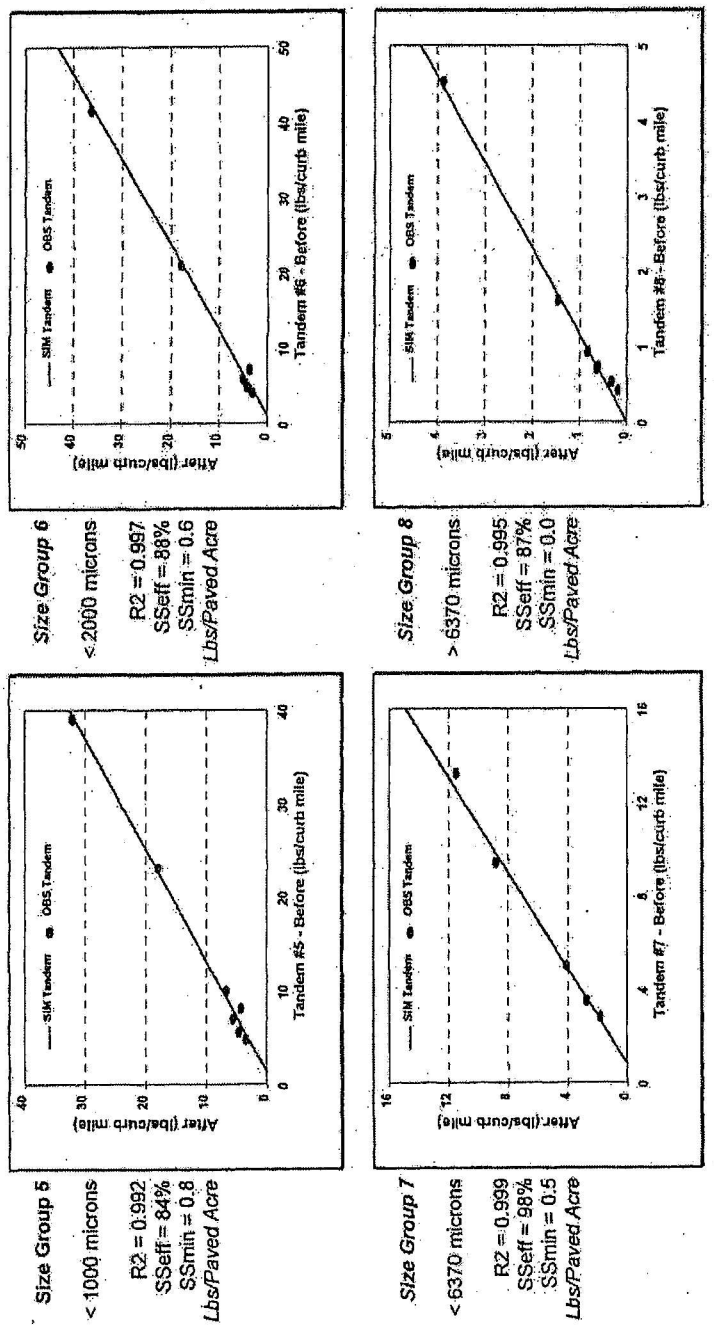

Figure 9.2 (continued) Tandem street sweeping model in SIMPTM, size groups 5-8.

9.5 Pollutant Washoff Reduction Comparison

Working with a calibrated version of the SIMPTM program, the average annual expected reduction in total suspended solids (TSS) washoff from two of Portland's NPDES stormwater sites were projected for varying sweeping frequencies using the NURP era sweepers, the new mechanical sweeper and the three promising sweeping technologies. (For a more detailed description of the SIMPTM program and its calibration to the City of Portland's NPDES monitoring sites, the reader is referred to the program documentation or the study report (Sutherland and Jelen, 1995).

Figure 9.3 shows the resulting curves of expected annual washoff reductions for varied intensity of street sweeping in residential areas by each of the alternative technologies. It clearly shows that all of the newer sweeping technologies would be significantly more effective than the NURP era sweepers in reducing TSS washoff from single family residential areas with curb and gutter drainage in Portland, Oregon. Note that the Enviro Whirl is the best, followed by the Elgin regenerative air and the tandem operation. Even the newer mechanical sweepers will provide reductions in the 20% to 30% range. Also note that weekly or biweekly sweeping appears to be optimum for this type of land use in Portland, Oregon.

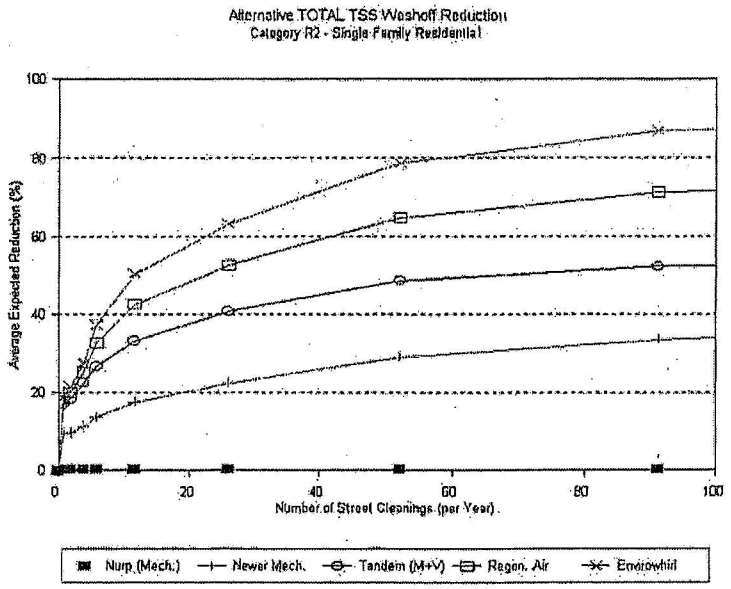

Figure 9.3 Alternative washoff reductions by sweeping residential streets.

Figure 9.4 shows how results change significantly when sweeping is applied to major arterials instead. It even more clearly demonstrates the superiority of the Enviro Whirl I sweeper in reducing TSS washoff from highly impervious major arterials with curb and gutter drainage in Portland, Oregon. The Elgin regenerative air provides some TSS reduction, whereas the other technologies appear to be largely ineffective on this type of land use. This same land use was found to provide the highest pollutant washoffs on a pound per paved acre basis of the six homogenous land uses studied (Sutherland and Jelen, 1995).

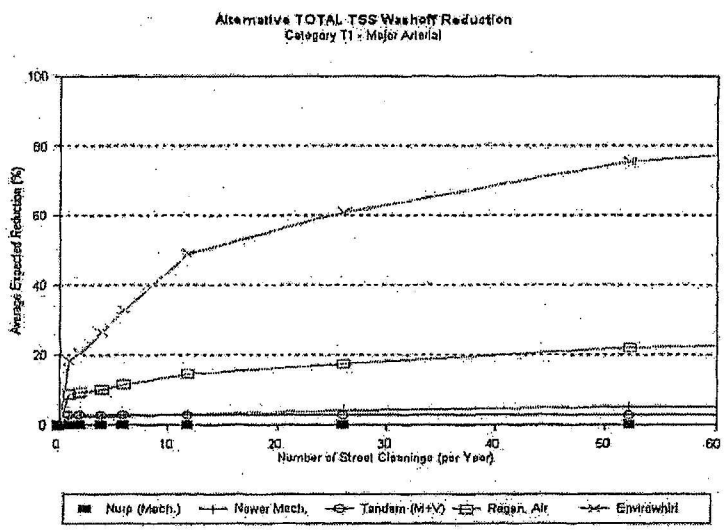

Figure 9.4 Alternative washoff reductions by sweeping major arterials.

Clearly, though, both figures show that the NURP era sweepers were almost totally ineffective in their ability to reduce TSS washoffs from either of the basins simulated. So this confirms the earlier conclusions of the NURP in regard to sweeper performance, while suggesting that significant benefits could now be expected.

9.6 Conclusions

Contrary to conventional wisdom, this chapter clearly demonstrates that street sweeping can be an effective best management practice (BMP). The actual pollutant reduction effectiveness of any given street sweeping operation will

depend on characteristics of land use, precipitation, and the accumulation dynamics of contaminated sediments.

The SIMPTM program has been used successfully to account for all of those issues in order to project the potential performance of various street sweeping programs. It was used to evaluate the optimal level of effort to be implemented. Finally, it was used to evaluate the effect of employing updated technologies. In this regard, the Enviro Whirl I sweeper was found to be far superior to the other promising technologies reviewed.

Given the increased concern about the water quality related impacts of urban stormwater pollution throughout the country and the difficulty of identifying and implementing cost-effective BMP's to address them, the pollutant reduction benefits possible from a cost effective street sweeping program must be re-evaluated.

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by Ranger Kidwell-Ross

Sweepers Remove Stormwater Pollutants

Designers of sweeping programs need to learn about the relatively inexpensive role sweeping has in removing pollutants from the runoff stream.

Street cleaning has the broadest potential for reducing stormwater pollution in the urban environment. That's because half of all the rain that falls on impervious surfaces connected to urban stormwater collection systems is falling on pavement.

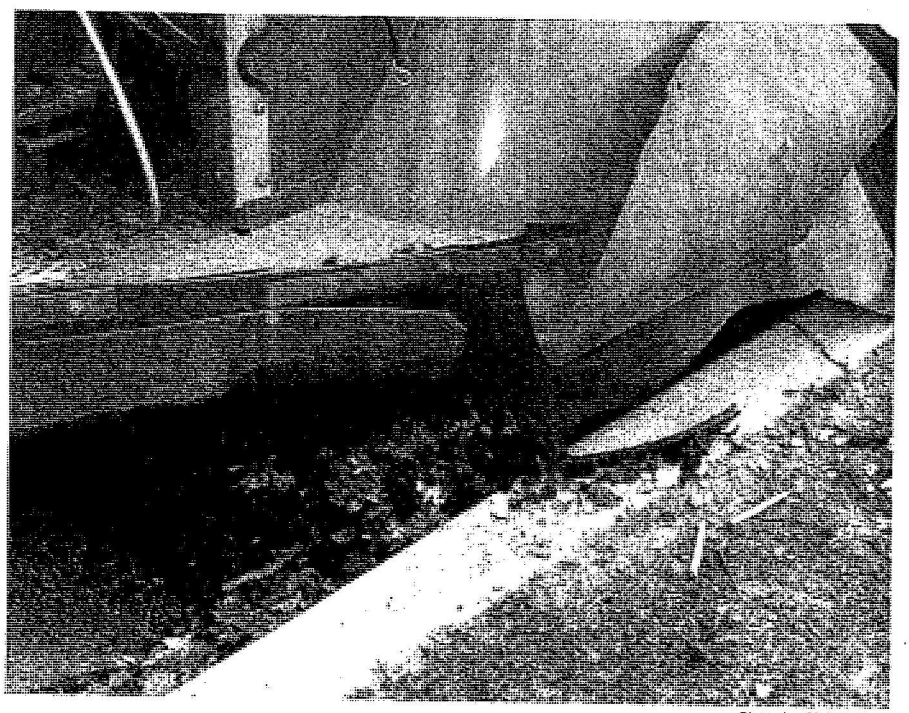


Photo by Gini McKain

This close-up shot shows how a sweeper picks up leaves before they enter stormwater drains.

In the past five years, updated sweeper designs that are much more efficient at picking up accumulated contaminants have entered the market.

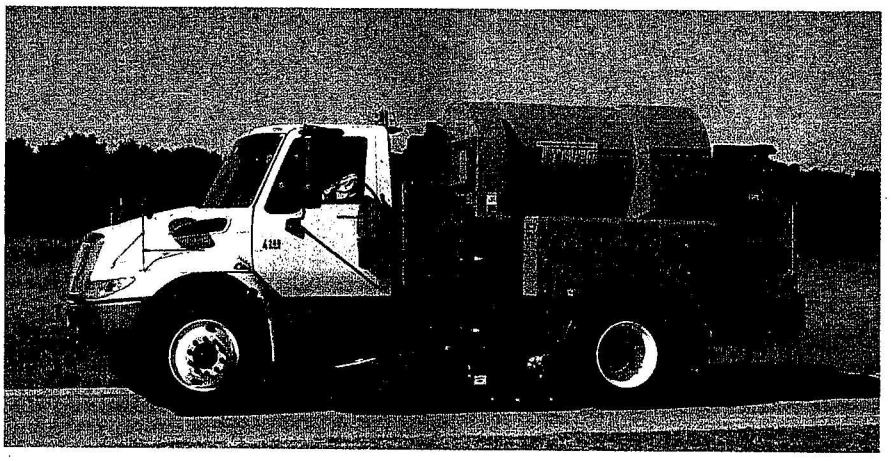
Yet, many jurisdictions that are now imposing stormwater runoff taxes and spending high dollars in an attempt to reduce their runoff pollution have, at the same time, cut back on their sweeping efforts. The only rational reason can be that they lack knowledge about the positive, relatively cost-effective impact a well-planned environmental sweeping program now can attain.

CWA requirements

Wherever Clean Water Act compliance is required, sweeping program designers need to learn about the role newer sweepers can have in removing pollutants from the runoff stream.

Studies confirm the real-world pickup efficiency of today's broom sweepers is probably only between 20 and 35%. Despite this fact, mechanical broom sweepers continue to be the leading type used by municipalities in the United States.

As municipalities struggle to



A Tymco 500X gets set to remove debris that might otherwise pollute water.

reduce non-point source pollutants and meet the Best Management Practices requirements of Phase I and II, newer technologies of regenerative air and vacuum sweeper models are clearly a better choice. These have both been shown to raise pickup efficiencies into the 60 to 90% and above range.

A study of structural BMPs by the California Department of Transportation indicates the cost per pound of pollutant removed (as Total Suspended Solids) runs $10 to $60, not including land costs. In contrast, sweeping industry studies by well-known researcher, Roger Sutherland, of Oregon-based Pacific Water Resources, indicate that newer mechanical broom sweepers reduce TSS in stormwater at a cost of $5 to $10 per pound. Regenerative air and vacuum-assisted sweepers offer an even higher level of efficiency, removing TSS at a cost of $2 to $5 per pound.

Regenerative air and vacuum-assisted sweepers offer an even higher level of efficiency, removing TSS at a cost of $2 to $5 per pound.

Sutherland's company has also developed modeling software that uses historic rainfall data, which in most locales spans over 50 years, to accurately predict sweeping efficiencies for watersheds. This has aided a number of municipalities in determining relative pickup volume at given sweeping frequency intervals without having to conduct costly studies of their own.

Sutherland's Livonia, Michigan, study found the optimal frequency (during the nine months when sweeping can occur in snowbelt areas) for residential areas was about once every three weeks. Every two weeks is typically reasonable for higher-density residential and general commercial. In major traffic areas, like arterials, optimal sweeping was determined to be once per week. Optimal frequency depends, however, upon accumulation of the contaminated material typically called *street dirt.* Monitoring accumulation can be of great value, as well as determining the chemical component of what is collecting on given roadways.

Not only can a correctly designed sweeping program remove a significant amount of targeted chemicals; correct sweeping also has a positive impact on the gross pollutants that contribute sediment, silt, and organic debris to streams and other waterways.

Another efficiency sweeping offers is that it prolongs the operational efficiency of structural-based devices, as well as reduces the ongoing maintenance they require. Although by no means a silver bullet, widespread agreement is developing that sweeping should begin taking a more central role in stormwater runoff plans.

Charging off costs

Well-informed NPDES managers, aware of how cost-effective sweeping is when compared to infrastructure-based solutions, are now making an increase in air sweeping frequency a foundation of their stormwater runoff plans. The problem they're faced with is that, even in the face of the EPA mandates, their budgets are still largely based on the frequency of sweeping needed to provide a pleasing aesthetic value and, to a lesser extent, keep storm drains flowing.

Because of sweeping's now-demonstrated lower-cost-per-pound of pollutant removal, jurisdictions under Phase I or II mandates clearly should develop an optimal sweeping frequency designed to minimize the overall cost of meeting their non-point pollutant reduction goals.

Only by comparing sweeping to end-of-the-pipe solutions, like sedimentation tanks and filters, grassy swales, detention ponds, and all the other infrastructure-based solutions now emerging, can the most cost-effective mix of sweeping and other technologies be attained.

Once an optimal, least overall cost for achieving TMDL limits (or attainment of other goals) has been established for a given watershed, the next question is figuring out how to pay for that mixture of solutions. Some cities are now including the sweeping department within the overall budget for stormwater runoff reduction. That way, if a stormwater utility fee is being collected through NPDES mandates, the cost of sweepers and sweeping can be funded as a component. BR

Ranger Kidwell-Ross heads up the world's largest information resource dedicated to power sweeping, www.WorldSweeper.com. E-mail him at editor@worldsweeper.com.

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Street Sweeping – Report No. 1
State of the Practice

Ramsey-Washington Metro Watershed District

2346 Helen Street

North St. Paul, Minnesota 55109

651.704.2089

http://www.rwmwd.org

June 2005

Executive Summary

The Street Sweeping Project is organized into the following three reports:

1. Street Sweeping – Report No. 1, State of the Practice
2. Street Sweeping – Report No. 2, Survey Questionnaire, Results and Conclusions; and
3. Street Sweeping – Report No. 3, Policy Development and Future Implementation Options for Water Quality Improvement.

The reports are the information base for the Ramsey-Washington Metro Watershed District to advance efforts to improve water quality within its jurisdictional boundaries. In addition, the reports serve as an education tool for members of the Ramsey–Washington Public Works Forum and other public works staff within Minnesota and across the United States and Canada. The Ramsey-Washington Public Works Forum is a monthly discussion group focused on increasing communications and collaboration related to stormwater quality improvement concerns of the city and county governments within the Ramsey-Washington Metro Watershed District.

Street Sweeping – Report No. 1, State of the Practice summarizes and analyzes recent literature, WEB search reviews, personal communications with pertinent industry experts and yet-to-be-completed street sweeping research projects.

Street sweeping equipment has evolved significantly in the last 15 years and will continue to do so as two aspects relating to the practice move forward. First, Phase 1 and 2 storm water permits and associated Storm Water Pollution Prevention Plans (SWPPP) will likely become more comprehensive as regulatory agencies require further controls on non-point source pollution. With Total Maximum Daily Load (TMDL) studies being completed over the next ten years, these same permits will contain more stringent requirements. Street sweeping equipment and the associated practice will be looked at more favorably as a cost-effective non-point source control measure.

Second, additional research studies may shed information on street sweeping as a practice that improves water quality. Subsequently, this may result in equipment and operational upgrading that may produce more fuel-efficient sweepers, greater use of waterless sweepers or implementing new technology (e.g. captive hydrology). Regulatory requirements and research findings may drive street sweeper manufacturers to respond to an increasing market for newer technologies.

Mechanical brush sweepers are effective at removing coarse materials and gross pollutants. They are less effective removing fine materials often associated with various pollutants and may expose such materials to wash-off. High-efficiency street sweepers and associated operations may increase the percent of total solids removal from 30 – 70+%. Street sweeping frequencies approximately monthly to biweekly and varied depending upon land use and transportation features have been shown as being most effective for pollutant removal.

As a pollution control practice, street sweeping is cost-effective when compared to structural best management practices such as detention ponds, and settling or filtering devices and prolongs their operational efficiency and required maintenance. As a pollution prevention or source control measure when integrated with other structural and non-structural BMPs, high-efficiency street sweeping improves water quality and reduces ongoing habitat deterioration.

Report No. 1 has not identified definitive studies pointing to receiving water quality improvement as a direct result of street sweeping alone. However, as a pollution prevention or source control measure when integrated with other structural and non-structural BMPs, high-efficiency street sweeping improves water quality and reduces ongoing habitat deterioration.

A 2004 mathematical optimization study for BMPs provided information on which storm water management strategies are likely to be cost-effective in reducing non-point pollution and which are not. Sweeping of commercial areas will likely be a priority while residential areas will not. The optimization model study shows insensitivity to a reasonable range of street sweeping costs, but sensitivity to sediment removal effectiveness. This suggests it is more important to address sediment removal effectiveness for street sweeping rather than cost.

The following are suggested topic areas for further research as it relates to street sweeping:

- **High-efficiency sweeping and water quality improvement;**
- **Street sweeping as a component in subwatershed modeling;**
- **Disposal of street sweepings and recycling practices;**
- **Life cycle costing of street sweeping practices; and**
- **Integration of street sweeping practices into local government MS4 permits.**

Conclusions

1. Streets need to be clean of sediment, trash and dissolvable pollutants. With emerging new technologies, cities and watershed management organizations may shift water quality improvement efforts from structural Best Management Practices to implementing non-structural practices directed at pollutant source control on street surfaces. Street sweeping equipment technology and practices have reached a level of sophistication that is it now possible to come close to accomplishing a goal of significantly cleaner street surfaces before major rain or snowmelt events.
2. Mechanical brush sweepers are effective at removing coarse materials and gross pollutants. They are less effective removing fine materials often associated with various pollutants and may expose such materials to wash-off. High-efficiency street sweepers and associated operations may increase the percent of total solids removal from 30 – 70+%.
3. Street sweeping frequencies approximately monthly to biweekly and varied depending upon land use and transportation features have been shown as being most effective for pollutant removal.
4. Street sweeping equipment has evolved significantly in the last 15 years and will continue to do so as two aspects relating to the practice move forward. First, Phase 1 and 2 storm water permits and associated Storm Water Pollution Prevention Plans (SWPPP) will likely become more comprehensive as regulatory agencies require further controls on non-point source pollution. With TMDL studies being completed over the next ten years, these same permits will contain more stringent requirements. Street sweeping equipment and the associated practice will be looked at more favorably as a cost-effective non-point source control measure.
5. Second, additional research studies may shed more information upon street sweeping as a practice that alone improves water quality. Subsequently, this may result in equipment and operational upgrading that may produce more fuel-efficient sweepers, greater use of waterless sweepers or implement new technology (e.g. captive hydrology). Regulatory requirements and research findings may drive street sweeper manufacturers to respond to an increasing market for newer technologies.
6. As a pollution control practice, street sweeping is cost-effective when compared to structural best management practices such as detention ponds, and settling or filtering devices and prolongs their operational efficiency and required maintenance.
7. As a pollution prevention or source control measure when integrated with other structural and non-structural BMPs, high-efficiency street sweeping improves water quality and reduces ongoing habitat deterioration.
8. Report No. 1 has not identified definitive studies pointing to receiving water quality improvement as a direct result of street sweeping alone. However, as a pollution prevention or source control measure when integrated with other structural and non-structural BMPs, high-efficiency street sweeping improves water quality and reduces ongoing habitat deterioration.

9. A 2004 mathematical optimization study for BMPs provided information on which storm water management strategies are likely to be cost-effective in reducing non-point pollution and which are not. Sweeping of commercial areas will likely be a priority while residential areas will not. The optimization model study shows insensitivity to a reasonable range of street sweeping costs, but sensitivity to sediment removal effectiveness. This suggests it is more important to address sediment removal effectiveness for street sweeping rather than cost.
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- **High-efficiency sweeping and water quality improvement;**
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- **Disposal of street sweepings and recycling practices;**
- **Life cycle costing of street sweeping practices; and**
- **Integration of street sweeping practices among local governments.**

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Street Sweeping – Report No. 2
Survey Questionnaire Results and Conclusions

Ramsey-Washington Metro Watershed District

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June 2005

Executive Summary

The Street Sweeping Project is organized into the following three reports:

1. Street Sweeping – Report No. 1, State of the Practice
2. Street Sweeping – Report No. 2, Survey Questionnaire, Results and Conclusions; and
3. Street Sweeping – Report No. 3, Policy Development and Future Implementation Options for Water Quality Improvement

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Street Sweeping – Report No. 2, Survey Questionnaire, Results and Conclusions summarizes and analyzes the 120 responses to a WEB-based survey of 16 questions soliciting public works practitioners in local governments across Minnesota, other states and Canadian provinces. Report No. 2 was developed to augment the Ramsey-Washington Metro Watershed District (RWMWD) report: Street Sweeping - Report No. 1, State of the Practice. It also provided additional information for establishing future policy recommendations within Report No. 3. The survey response file of 120 local governments was divided into two groups: 57 Minnesota respondents (47.5%) and 63 Greater U.S./Canada respondents (52.5%) in 32 states and four Canadian local governments. The 57 respondents from Minnesota governments included 53 cities or 6.2% of cities statewide.

Survey results from Question #7 indicate a wide disparity by Minnesota respondents in street sweeping equipment type (mechanical brush vs. regenerative-air or vacuum) usage with respect to the local governments in other states and Canadian provinces. When looking at all sweepers in use by local governments, the mechanical brush sweeper is much more common in Minnesota (70%) versus Greater U.S./Canada (41%). In addition, Minnesota respondents are twice as likely (61.8% versus 30.2%) to use mechanical brush sweepers only, rather than vacuum or regenerative-air sweepers. However, the reverse is true, within the Greater U.S./Canada group where vacuum or regenerative-air are nearly twice as likely to be used (69.8% versus 38.2%) than mechanical sweepers only.

Results of street sweeping frequencies from Question #9 contrasted significantly between the two groups. Minnesota respondents swept streets at a twice (2x) per year frequency (response range of 58, 62 and 72% of the respondents for arterial streets, commercial/industrial areas and residential areas). Adding the three - six times per year frequency percentages reflects a combined response of 84, 81, and 95% for these areas. With response percentages of 76, 66 and 76%, the Greater U.S./Canada respondents swept arterial streets, commercial/industrial areas and residential areas: three - six times, more frequently than three – six times per year or biweekly. For Central Business Districts, sweeping frequency differences continued with 75% of Minnesota respondents sweeping twice, three – six times or more frequently per year. In contrast, the Greater U.S./Canada respondents reflected 86% either swept more frequently than three – six times per year, biweekly or weekly.

Within both groups, handling leaves is distinctly different. More than 75% of the respondents in both groups conduct normal sweeping operations. However, with respect to a specific leave collection and pick-up program, Minnesota respondents were much more likely (36% versus 16%) to request or require residents to bag and take leaves to a city or county compost facility. In contrast, the Greater U.S./Canada respondents request or require residents (43% versus 16%) to bag leaves for a collection program. Thus, having a separate bag and collection program for leaves may cause the Greater U.S./Canada group to use specialized pick-up equipment (41% versus 14%) than Minnesota local governments.

Both the Minnesota and Greater U.S./Canada groups rate keeping materials out of the storm sewer system as important to very important (96 – 98%). However, both groups indicate street sweeping when part of a Phase I or II permit requirement (87 – 83%) is least important as a reason for the program.

A majority in both groups (62% versus 57%) would increase street sweeping frequency with adequate funding if it resulted in improved water quality. Response results are similar to Question #2 with both groups showing slight skew to their distributions. For the Minnesota respondents, fifty percent (50%) of the local governments have street-sweeping expenses between $50,001 – $250,000 per year with forty percent (40%) falling within an expense range of <$10,000 to $50,000. For the Greater U.S./Canada respondents, fifty percent (50%) of the local governments had expenses within the range of $100,001 to >$1,000,000 with twenty-three percent (23%) of the respondents falling within the $250,000 - $500,000 expense range. Similar to the Minnesota group, thirty-four percent (34%) of the respondents had annual street and roadway expenses from <$10,000 - $50,000.

Conclusions

Overall Survey

1. A WEB-based survey was completed, during a month-long period [January to February 2005] asking 16 questions of public works staff on the street sweeping state of the practice.
2. A filtering effort for errors and duplications produced a usable file of 120 respondents of local governments in 32 states and 4 Canadian provinces. Most respondents were represented from Minnesota [53 (44.2%)] resulting from the solicitation method, followed by six each from California (5%) and Illinois (5%) and smaller numbers from other locations.
3. More than half (54.1%) the respondents were represented by directors of public works, street superintendents, and public works superintendents.
4. Nearly half (47.5%) the respondents represented local governments of 25,000 to 100,000 population with the majority (56.7%) maintaining 100 – 500 miles of streets or roadways.
5. Three-quarters (77.5%) of the respondents use city or county equipment or labor to conduct street sweeping operations with a similar percentage (71.7%) using brush mechanical sweepers.
6. Sweeping of sediment accumulation areas three to six times per year was identified by 44% of the respondents with the next highest level being residential areas at a twice per year frequency by 41%.
7. Most respondents (82.5%) performed a fall sweeping, usually as a normal operation (73.3%). None of the specific leaf pick-up programs were identified by a majority of respondents.
8. While keeping materials out of the storm water system was the most important reason for three-quarters of the respondents. Nearly all felt (89.7%) observed street or roadway cleanliness was the best method to determine if the sweeping program was meeting objectives.
9. Street sweeping expenditures nearly followed a normal distribution with the highest response level for 24.8% being $50,000 to $100,000 per year.

Minnesota and Greater U.S./Canada Groups

1. The survey respondent population was divided geographically in two nearly equal groups as follows: Minnesota, 57 respondents (47.5%) and Greater U.S./Canada, 63 respondents (52.5%).
2. Minnesota respondents were somewhat more likely from smaller governments (10,000 – 25,000) and conversely within the Greater U.S./Canada distribution, somewhat more likely from larger local governments (50,000 – 100,000).
3. The majority of local governments in both groups (70% versus 85.7%) use their own equipment and labor. However, Minnesota respondents use private (equipment and labor) contractors (26.5%) at a higher percentage to conduct street sweeping operations than the Greater U.S./Canada respondents (3.2%).
4. With respect to all sweepers used by local governments, the mechanical brush sweeper is more common in Minnesota (70%) versus Greater U.S./Canada (41%). Minnesota respondents are twice as

likely (61.8% versus 30.2%) to use mechanical brush sweepers only rather than vacuum or regenerative-air sweepers. However, the reverse is true, within the Greater U.S./Canada group who are nearly twice as likely (69.8% versus 38.2%) to use vacuum or regenerative-air sweepers than only mechanical brush sweepers.

5. The majority of Minnesota respondents swept arterial streets (58%), commercial & industrial areas (62%) and residential areas (72%) at a frequency of twice per year. Central Business Districts were swept by a majority of Minnesota respondents (64%) at rates of either twice per year (39%) to three – six times per year (25%).
6. With respect to arterial streets, more than half the respondents (52%) either swept more frequently than three - six times per year or biweekly. Commercial/industrial areas reflected a range of sweeping frequencies by a majority of respondents: three – six times per year by 28%, weekly by 23% or more frequently by 21%. Higher sweeping frequencies were seen in residential streets with 56% of the respondents indicating either three - six times per year or more frequently. Central Business Districts were swept by the Greater U.S./Canada respondents at higher frequencies with 86% of the respondents sweeping weekly (37%), "more frequent" than three – six times (31%) or biweekly (18%).
7. With respect to leaf pick-up programs, three quarters of the respondents in both groups conduct normal sweeping operations. Minnesota respondents (36% versus 16%) are more likely to request or require residents to take their leaves to a city or county compost facility. In contrast, the Greater U.S./Canada respondents are more likely (43%) to request or require their residents to bag leaves for a collection program than the Minnesota group (16%). The Greater U.S./Canada group is more likely (41% versus 14%) to have special equipment for leaf pick-up.
8. Both the Minnesota and Greater U.S./Canada groups rate keeping materials out of the storm sewer system as important to very important (96 – 98%). However, both groups indicate street sweeping as part of a Phase I or II permit requirement (87 – 83%) was the least important reason for the program.
9. Overwhelmingly, both groups (95% versus 81%) identify "observed street or roadway cleanliness" as the method the city or county determines its street sweeping program was meeting objectives.
10. A majority in both groups (62% versus 57%) would increase street sweeping frequency with adequate funding if it resulted in improved water quality.
11. The Minnesota distribution reflects 49% of the local government respondents have street-sweeping expenses between $50,001 – $250,000 per year. Forty percent (40%) fell within an expense range of <$10,000 to $50,000. Fifty percent (50%) of the Greater U.S./Canada local government respondents had expenses within the range of $100,001 to >$1,000,000. Twenty-three percent (23%) of the respondents fell within a higher expense range of $250,000 - $500,000.

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Street Sweeping – Report No. 3
Policy Development
And
Future Implementation Options
For
Water Quality Improvement

Ramsey-Washington Metro Watershed District

2346 Helen Street

North St. Paul, Minnesota 55109

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June 2005

Executive Summary

The Street Sweeping Project is organized into the following three reports:

1. Street Sweeping – Report No. 1, State of the Practice
2. Street Sweeping – Report No. 2, Survey Questionnaire, Results and Conclusions; and
3. Street Sweeping – Report No. 3, Policy Development and Future Implementation Options for Water Quality Improvement

The reports are the information base for the Ramsey-Washington Metro Watershed District to advance efforts to improve water quality within its jurisdictional boundaries. In addition, the reports serve as information sharing tools for members of the Ramsey – Washington Public Works Forum and other public works staff within Minnesota and across the United States and Canada. The Ramsey-Washington Public Works Forum is a monthly discussion group focused on increasing communications and collaboration related to stormwater quality improvement concerns of the city and county governments within the Ramsey-Washington Metro Watershed District.

Report No. 3: Street Sweeping - Policy Development and Future Implementation Options for Water Quality Improvement discusses and incorporates pertinent conclusions from Reports No. 1 and 2.. It further examines the street sweeping practice as policy issues are formulated and makes recommendations for the local government units of Ramsey-Washington Metro Watershed District. Conclusions and Recommendations from Report No. 3 are incorporated into the Executive Summary.

Conclusions

1. Survey results in **Report No. 2** indicate a wide disparity by Minnesota respondents in street sweeping equipment types (mechanical brush versus vacuum or regenerative-air) used compared to Greater U.S./Canada respondents. Minnesota respondents are twice as likely (61.8% versus 30.2%) to use mechanical brush sweepers only, rather than vacuum or regenerative-air sweepers. Within the Greater U.S./Canada group where vacuum or regenerative-air are nearly twice as likely to be used (69.8% versus 38.2%) than mechanical sweepers only.

2. Results from **Report No. 1** reveal mechanical brush sweepers are effective at removing coarse materials and gross pollutants, but less effective removing fine materials often associated with various pollutants and may expose such materials to wash-off. High-efficiency street sweepers and associated operations may increase the percent of total solids removal from 30 – 70+%.

3. Street sweeping frequencies in **Report No. 1** were approximately monthly to biweekly and varied depending upon land use and transportation features have been shown as being most effective for pollutant removal.

4. **Report No. 2** indicates street sweeping at low frequencies of twice or three to six times per year for all land-uses and special areas is practiced by a large majority of Minnesota respondents (80%). In contrast, a small minority (33%) of the Greater U.S./Canada group swept the same areas and low frequencies.

5. A subgroup of eight cities from the Greater U.S./Canada group representative of severe winter climate conditions swept streets at similar frequencies as the larger group. To the degree that these eight cities are representative, results suggest climate or reduced operational season is not a valid basis for the observed lower street sweeping frequency in Minnesota.

6. It appears seasonal or climate conditions do not prevent Minnesota local governments from conducting more than two or three-six street sweepings per season.

7. Results of street sweeping frequencies from **Report No. 2**, Question #9 contrasted significantly between the two groups. Minnesota respondents swept streets at a twice (2x) or three - six times per year for arterial streets, commercial/industrial areas and residential areas. Greater U.S./Canada respondents swept arterial streets, commercial/industrial areas and residential areas: three - six times, more frequently than three – six times per year or biweekly. For Central Business Districts, 75% of Minnesota respondents swept twice, three – six times or more frequently per year. In contrast, the Greater U.S./Canada respondents reflected 86% either sweeping more frequently than three – six times per year, biweekly or weekly.

8. Recommending street sweeping frequencies based upon land-use and special area type is a reasonable and defendable approach based upon Reports No. 1 and 2 as well as the WEB survey results in Appendix A. Table 2 below depicts proposed street sweeping frequencies by area.

Table 2 Proposed Street Sweeping Frequencies

Area	Minimum Frequency	Maximum Frequency
Arterials	9 times per year	16 times per year
Commercial	9 times per year	16 times per year
Light Industrial	6 times per year	9 times per year
Heavy Industrial	9 times per year	16 times per year
Residential	6 times per year	9 times per year
Central Business District*	Biweekly	2x/week
"Hot Spot Areas"**	6 times per year	9 times per year

*Frequency dependent upon business community and local government expectations.
**Hypothetically, such implementation frequencies may reduce sweeping in other land-uses.

9. Leaf disposal by pick-up is an inefficient operation, whether private or public from a volume versus weight perspective, thus, specialized equipment may be a more efficient long-term solution to this effort. However, further survey analysis and discussion of leaf pick-up and disposal methods appears to be warranted and recommended by the results.

10. Keeping materials out of a local government's storm sewer system is the basis for conducting a street sweeping program and is recommended this continue as the **primary** reason for a street sweeping program.

11. Establishing a Water Quality Incentive Grant Program will facilitate local governments within the Ramsey-Washington Metro Watershed District to move ahead in amending their street sweeping programs through the purchase of high-efficiency street sweepers.

Recommendations

In completing the 3rd generation Watershed Management Plan, the following policies are recommended as options for the Board of Managers of the Ramsey-Washington Metro Watershed District:

1. Encourage and support the acquisition and use of technologically advanced, high-efficiency street sweepers (vacuum or newer technology) by local governments within its boundaries.

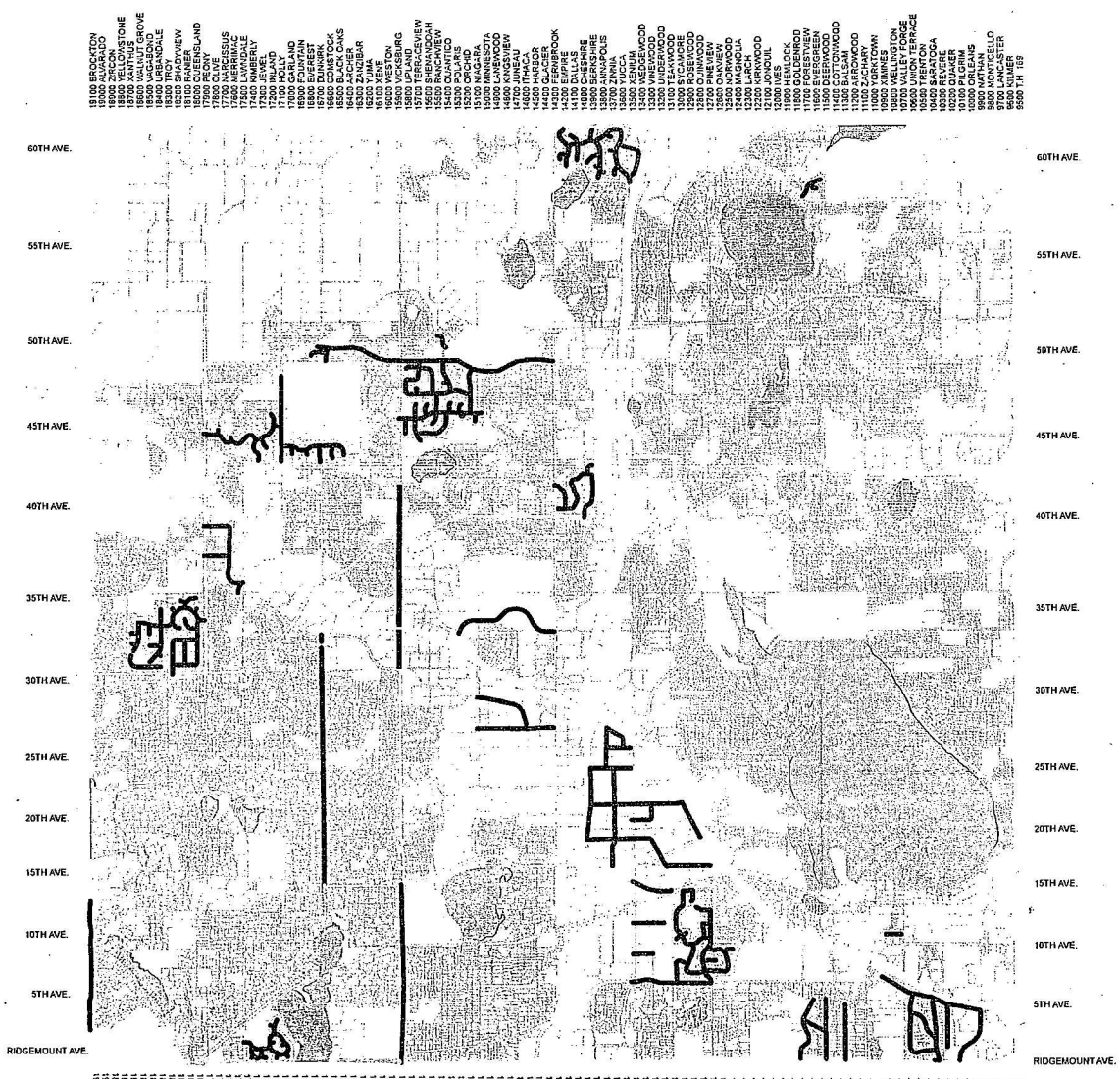
2. Recommend local governments within the District revise existing street sweeping operational programs and adopt the proposed street sweeping frequencies enumerated within Table 2.

3. Work with local governments within the District's boundaries by further examining leaf collection and disposal operations.

4. Recommend local governments within the District's boundaries revise existing local water management plans to identify existing street sweeping operational programs as a high priority for keeping materials out of the municipal separate storm sewer systems and improving water quality.

5. Establish a Water Quality Incentive Grant Program for $750,000 to $1,000,000 allowing local governments within its boundaries to facilitate the purchase of high-efficiency street sweepers.

2007 Street Projects
Contract Street Sweeping



2007 Reconstruction Projects
2007 Seal Coat
2007 Mill & Overlay

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City of Plymouth, Minnesota

December 13, 2006
2007streetsweeping11X17.mxd

Agenda Number:

CITY OF PLYMOUTH

CITY COUNCIL AGENDA REPORT

TO: Mayor and City Council
FROM: Laurie Ahrens, City Manager
SUBJECT: Set Future Study Sessions
DATE: May 1, 2007, for Council study session of May 8, 2007

1. **ACTION REQUESTED:** Review the pending study session topics list and set study sessions or amend the topics list if desired.

2. **BACKGROUND:** Attached is the list of pending study session topics, as well as calendars to assist in scheduling.

Pending Study Session Topics

(at least 3 Council members have approved the following study items on the list)

- Special Assessment Policy (Council; early fall)

Other requests for study session topics:

- Possible ordinance on feeding of wildlife (Black)
- Discuss sign enforcement (Slavik)
- Discuss variances on nonconforming lots, i.e. lake situations (Slavik)
- Presentation on post-secondary campus proposal (Black)

OFFICIAL CITY MEETINGS

May 2007

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Apr 2007 S M T W T F S 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 27 28 29 30		1	2 7:00 PM PLANNING COMMISSION, Council Chambers	3 7:00 PM HUMAN RIGHTS COMMISSION, Parkers Lake Room	4	5
6	7	8 5:30 PM CITY COUNCIL STUDY SESSION - STREET SWEEPING PROGRAM AND PRELIM. 2008-2009 BUDGET DISCUSSION, Medicine Lake Conference Room 7:00 PM REGULAR COUNCIL MEETING, Council Chambers	9 7:00 PM ENVIRONMENTAL QUALITY COMMITTEE (EQC), Medicine Lake Rooms A & B	10 7:00 PM PARK & REC ADVISORY COMMISSION (PRAC), Council Chambers	11	12
13	14 6:30 PM YOUTH ADVISORY COUNCIL, Council Chambers	15	16 3:00 PM ARBOR DAY PLANTING, Pilgrim Lane School 7:00 PM PLANNING COMMISSION, Council Chambers	17 7:00 PM HOUSING & REDEVELOPMENT AUTHORITY (HRA), Medicine Lake Room A	18	19 9:00 AM -3:30 PM RECYCLING DROP-OFF EVENT, Maintenance Facility, 14900-23rd Avenue North
20	21	22 5:30 PM CITY COUNCIL STUDY SESSION - ORGANIZED GARBAGE COLLECTION AND UPDATE WITH THE CITY MANAGER, Medicine Lake Conference Room 7:00 PM REGULAR COUNCIL MEETING, Council Chambers	23 7:00 PM PLYMOUTH ADVISORY COMMITTEE ON TRANSIT (PACT), Medicine Lake Room A	24	25	26
27	28 MEMORIAL DAY (Observed) - City Offices Closed	29	30	31	Jun 2007 S M T W T F S 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 27 28 29 30	

modified on 5/2/2007

OFFICIAL CITY MEETINGS

June 2007

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	May 2007 S M T W T F S 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 27 28 29 30 31	Jul 2007 S M T W T F S 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 27 28 29 30 31			1	2
3	4	5	6 7:00 PM PLANNING COMMISSION, Council Chambers	7	8	9
10	11	12 6:00 PM CITY COUNCIL STUDY SESSION - 2006 AUDIT PRESENTATION, Medicine Lake Conference Room 7:00 PM REGULAR COUNCIL MEETING, Council Chambers	13 7:00 PM ENVIRONMENTAL QUALITY COMMITTEE (EQC), Medicine Lake Rooms A & B	14 7:00 PM PARK & REC ADVISORY COMMISSION (PRAC), Council Chambers Flag Day	15	16
17	18	19	20 7:00 PM PLANNING COMMISSION, Council Chambers	21 7:00 PM HOUSING & REDEVELOPMENT AUTHORITY (HRA), Medicine Lake Room A	22	23
24	25	26 6:00 PM CITY COUNCIL STUDY SESSION - SPECIAL ASSESSMENT POLICY, Medicine Lake Conference Room 7:00 PM REGULAR COUNCIL MEETING, Council Chambers	27 7:00 PM PLYMOUTH ADVISORY COMMITTEE ON TRANSIT (PACT) , Medicine Lake Room A	28	29	30

modified on 5/2/2007

OFFICIAL CITY MEETINGS

July 2007

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4 INDEPENDENCE DAY, City Offices closed	5 5:15 PM MUSIC IN PLYMOUTH, Hilde Performance Center	6	7
8	9	10 7:00 PM REGULAR COUNCIL MEETING, Council Chambers	11 7:00 PM ENVIRONMENTAL QUALITY COMMITTEE (EQC), Medicine Lake Rooms A & B	12 7:00 PM PARK & REC ADVISORY COMMISSION (PRAC), Council Chambers	13	14
15	16	17	18 7:00 PM PLANNING COMMISSION, Council Chambers	19 7:00 PM HOUSING & REDEVELOPMENT AUTHORITY (HRA), Medicine Lake Room A	20	21
22	23	24 7:00 PM REGULAR COUNCIL MEETING, Council Chambers	25 7:00 PM PLYMOUTH ADVISORY COMMITTEE ON TRANSIT (PACT) , Medicine Lake Room A	26	27	28
29	30	31				

Jun 2007

S	M	T	W	T	F	S
					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	27	28	29	30

Aug 2007

S	M	T	W	T	F	S
			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	27	28	29	30	31	

modified on 5/2/2007

OFFICIAL CITY MEETINGS

August 2007

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Jul 2007 S M T W T F S 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 27 28 29 30 31		Sep 2007 S M T W T F S 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 27 28 29 30	1 7:00 PM PLANNING COMMISSION, Council Chambers	2	3	4
5	6	7 2:30 PM -5:00 PM NATIONAL NIGHT OUT KICK OFF EVENT, Fire Station III 6:30 PM -9:30 PM NATIONAL NIGHT OUT	8 7:00 PM ENVIRONMENTAL QUALITY COMMITTEE (EQC), Medicine Lake Rooms A & B	9 7:00 PM PARK & REC ADVISORY COMMISSION (PRAC), Council Chambers	10	11
12	13	14 7:00 PM REGULAR COUNCIL MEETING, Council Chambers	15 7:00 PM PLANNING COMMISSION, Council Chambers	16 7:00 PM HOUSING & REDEVELOPMENT AUTHORITY (HRA), Medicine Lake Room A	17	18
19	20	21	22 7:00 PM PLYMOUTH ADVISORY COMMITTEE ON TRANSIT (PACT) , Medicine Lake Room A	23	24	25
26	27	28 7:00 PM REGULAR COUNCIL MEETING, Council Chambers	29	30	31	

modified on 5/2/2007

OFFICIAL CITY MEETINGS

September 2007

Aug 2007

S	M	T	W	T	F	S
			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	27	28	29	30	31	

Oct 2007

S	M	T	W	T	F	S
	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	27
28	29	30	31			

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1
2	3 LABOR DAY - City Offices Closed	4	5 7:00 PM PLANNING COMMISSION, Council Chambers	6 7:00 PM HUMAN RIGHTS COMMISSION, Parkers Lake Room	7	8
9	10	11 7:00 PM REGULAR COUNCIL MEETING, Council Chambers	12 7:00 PM ENVIRONMENTAL QUALITY COMMITTEE (EQC), Medicine Lake Rooms A & B ROSH HASHANAH BEGINS AT SUNSET	13 7:00 PM PARK & REC ADVISORY COMMISSION (PRAC), Council Chambers	14	15 10:00 AM -5:00 PM AUTUMN ART FAIR, Parkers Lake Room
16	17	18	19 7:00 PM PLANNING COMMISSION, Council Chambers	20 9:00 AM -3:30 PM PLYMOUTH CLEAN-UP DAY, Public Works Maintenance Facility 7:00 PM HOUSING & REDEVELOPMENT AUTHORITY (HRA), Medicine Lake Room A	21 YOM KIPPUR BEGINS AT SUNSET	22
23	24	25 7:00 PM REGULAR COUNCIL MEETING, Council Chambers	26 7:00 PM PLYMOUTH ADVISORY COMMITTEE ON TRANSIT (PACT) , Medicine Lake Room A	27	28	29 1:00 PM Plymouth on Parade Celebration, City Center Area
30						

modified on 5/2/2007