

Reducing Fall P Loads - Three Pathways to a Final Answer



Quantifying Benefits of Selected Leaf Management Benefits

1. Measure P Loads by Season.
2. Monitor Changes in P Load for Selected Leaf Management Approaches

Source	Load (lb/yr)	Concentration (mg/L)	Volume (gal/yr)	Flow (gpm)	Flow (MGD)	Flow (MGD)
Stormwater	100	1.0	100	1.0	1.0	1.0
Street Sweeping	100	1.0	100	1.0	1.0	1.0
Leaf Collection	100	1.0	100	1.0	1.0	1.0
Leaf Bagging	100	1.0	100	1.0	1.0	1.0
Leaf Mulch	100	1.0	100	1.0	1.0	1.0
Leaf Compost	100	1.0	100	1.0	1.0	1.0
Leaf Incineration	100	1.0	100	1.0	1.0	1.0
Leaf Landfill	100	1.0	100	1.0	1.0	1.0
Leaf Recycling	100	1.0	100	1.0	1.0	1.0
Leaf Energy	100	1.0	100	1.0	1.0	1.0
Leaf Landfill	100	1.0	100	1.0	1.0	1.0
Leaf Recycling	100	1.0	100	1.0	1.0	1.0
Leaf Energy	100	1.0	100	1.0	1.0	1.0
Leaf Landfill	100	1.0	100	1.0	1.0	1.0
Leaf Recycling	100	1.0	100	1.0	1.0	1.0
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Leaf Landfill	100	1.0	100	1.0	1.0	1.0
Leaf Recycling	100	1.0	100	1.0	1.0	1.0
Leaf Energy	100	1.0	100	1.0	1.0	1.0

Extrapolate Measured Values to Determine Average Benefits Using WinSLAMM

Demonstrate Potential for Social Marketing to Help Keep Leaves Out of Street

1. Keep Leaves on Terrace
2. Put Leaves in Bags



Leaves Out of the Street Campaign – Encouraging People to Use Leaf Bags

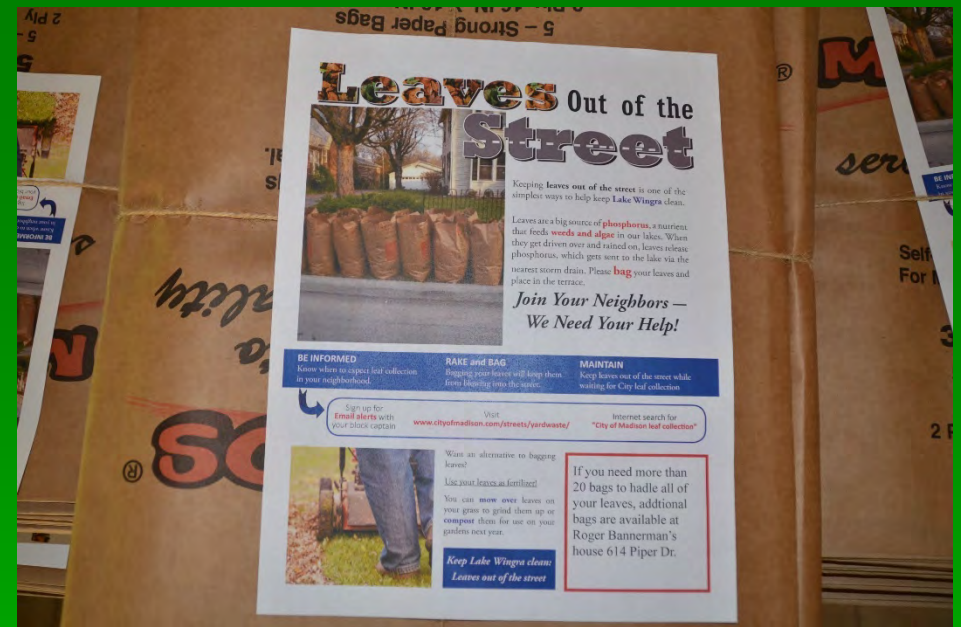


Social Marketing Effort in 2015

1. Letters sent to homes in both areas
2. Volunteers distributed free leaf bags to all homeowners in pilot study area.
3. Volunteers went door to door in control area encouraging people to buy bags and use them.

Demonstration of Social Marketing on a Pilot Project Scale





Jane Bannerman
Jim Baumann
Laura Brown
Gary Poulson
Judy Skog





Oct 5 -Orchard



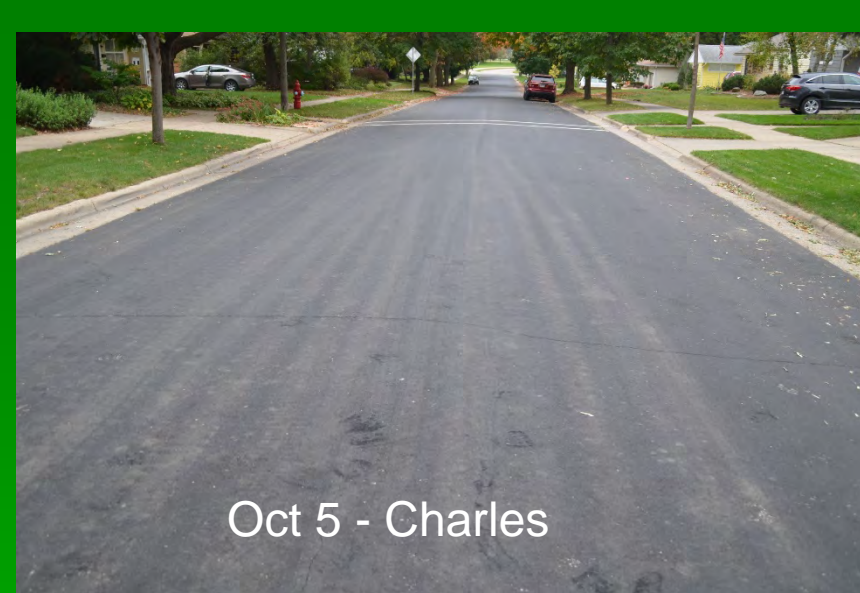
Oct 26 - Orchard



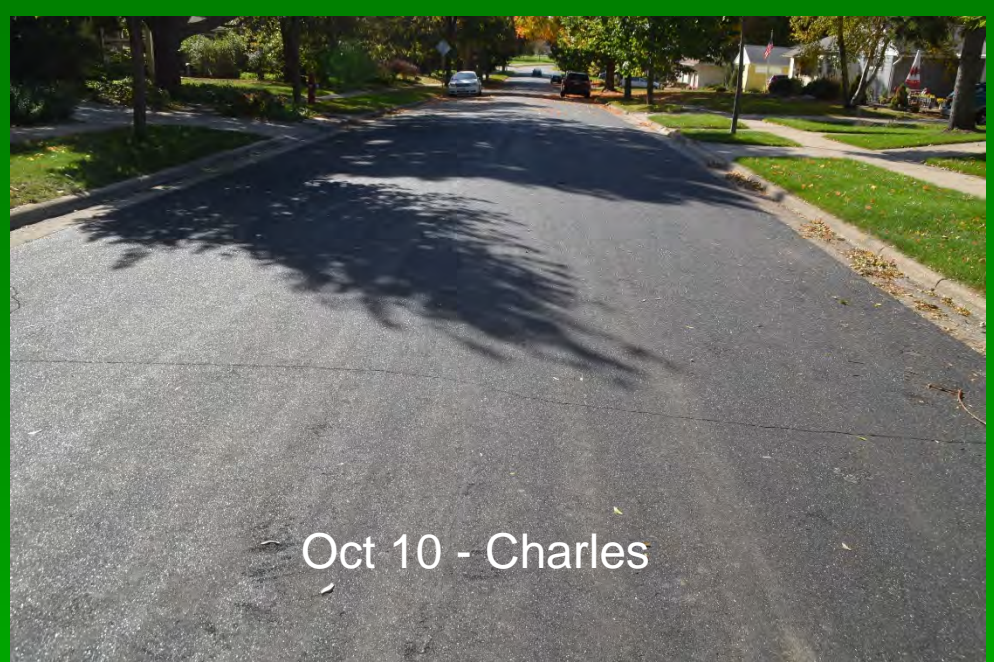
Nov 16 - Orchard



Dec 11 - Orchard



Oct 5 - Charles



Oct 10 - Charles



Oct 26 - Charles



Nov 16 - Charles

Goal of Survey Before Every Pickup – Missed One

Date	Leaf Pickup Date	Date of Survey	Days Before Pickup
Oct. 16	Pickup		
Oct 17		Survey	3
Oct 20	Pickup		
Oct 26		Survey	
Nov 4		Survey	0
Nov 4	Pickup		
Nov 10		Survey	2
Nov 12	Pickup		
Nov 16		Survey	3
Nov 19	Pickup		
Dec 7		Survey	1
Dec 8	Pickup		

Up and Down Each Street Twice – Number of Bags and Then Type of Curb

(Spread Sheet – Susan Frett)

Address	Leaves in Street	# of Bags on Terrace
602 Piper	0	8
606 Piper	0	17
610 Piper	1	11
614 Piper	0	17
618 Piper	0	25
622 Piper	0	
626 Piper	0	
630 Piper	0	
634 Piper	0	
4709 Sherwood	0	20
645 Piper	0	0











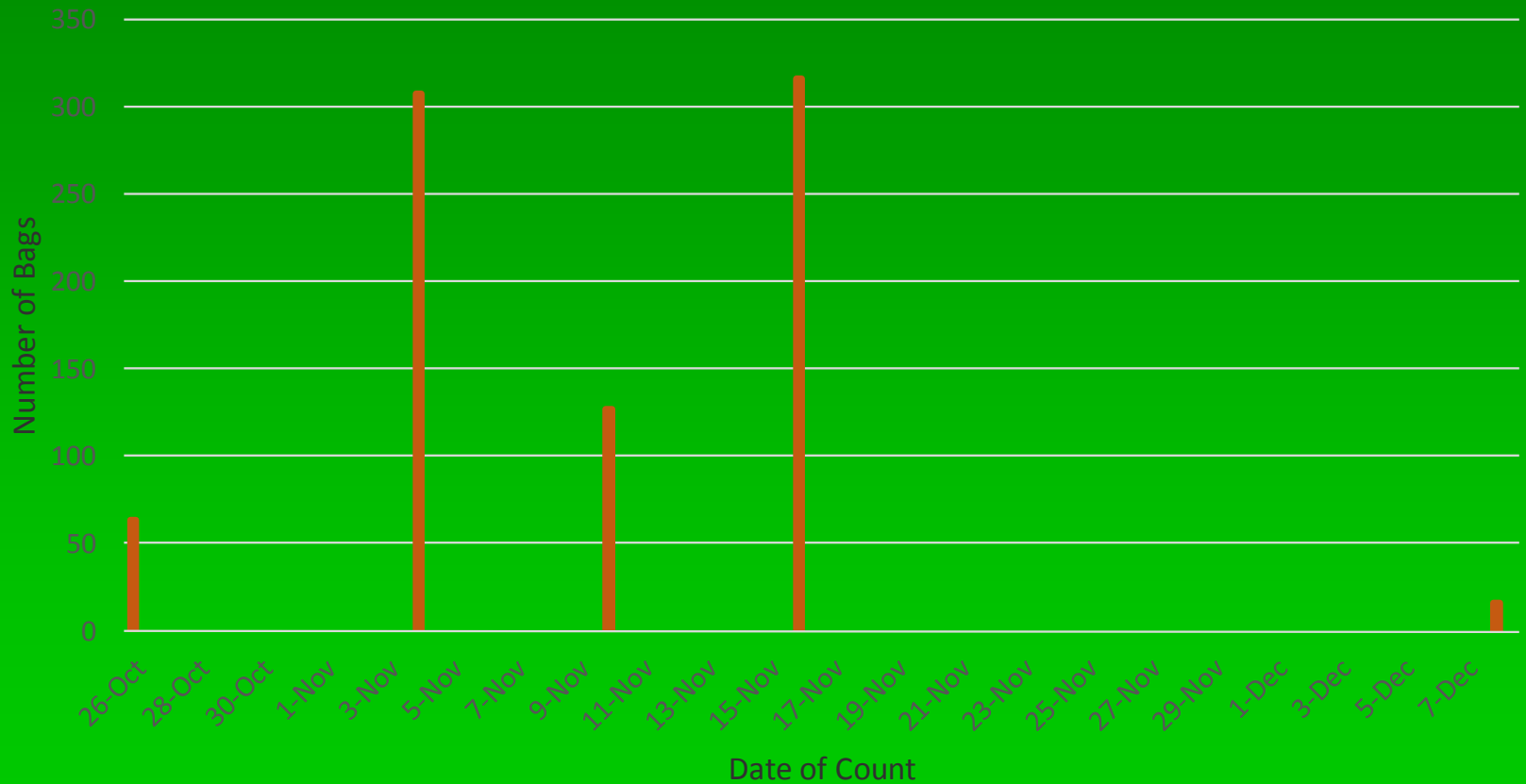
Nov 4, 2015



Street Name	Total Number of Homes on Each Block	Number of Homes Bagging Their Leaves	Percent of Homes Participating
Piper Dr.	23	16	70
Orchard Dr.	32	19	59
Charles Ln.	29	18	62
Totals	84	53	63



Total Number of Bags for Each Counting Event



Before We Could Calculate Leachable P for Leaves On the Streets, We Had to Develop a Visual Method for Estimating Weight of the Leaves in Curbs



Work Done By Badger Volunteers

1. Tare compostable bags with plastic chute
2. Select curbs with different amounts of leaves.
3. Rake and broom leaves into piles
4. Transfer leaves into compostable leaf bags
5. Weigh bags with postal scale.

Badger Volunteers at Work



A Value of “0” Put in Spread Sheet



**Zero or Very
Little Amount
of Leaves in
Curb**



A Value of “1” Put in Spread Sheet



**Some Leaves in
Curb – Curb Type
1. Leaves Weigh
About 5 lbs.**

**A Value of “2” Put in
Spread Sheet**



**Leaves Fill
Curb – Type 2
Curb. About 14
lbs.**

**A Value of 3 Put
in Spread Sheet**



**Overflowing Curb
– Type 3 Curb.
About 26 lbs.**

Estimate of the Amount of Phosphorus Leached from Leaves in the Pilot Area During the Fall of 2015

Leachable P for Each Type of Leaf, ug/gm

- Silver Maple – 233
- Green Ash – 188
- Norway Maple – 80
- **Average – 167**

(Dorney, 1986)

Leachable P for Each Curb Type, gm

Number of grams.

$$5 \text{ lbs} \times 453.6 \text{ gm/lb} = 2268$$

Amount of Leachable P

$$2268 \text{ gm} \times 167 \text{ ug/gm} = 0.38 \text{ gm}$$

Estimates of Leachable P in Streets

Type Curb	Net Weight of Leaves by Site, lbs.			Average Net Weight, lbs.	Leachable P in Curbs, gm
	Site 1	Site 2	Site 3		
Type 1	4.3	5.3	NA	5	0.38
Type 2	15.7	10.3	15.9	14	1.06
Type 3	25.5	NA	NA	26	1.97



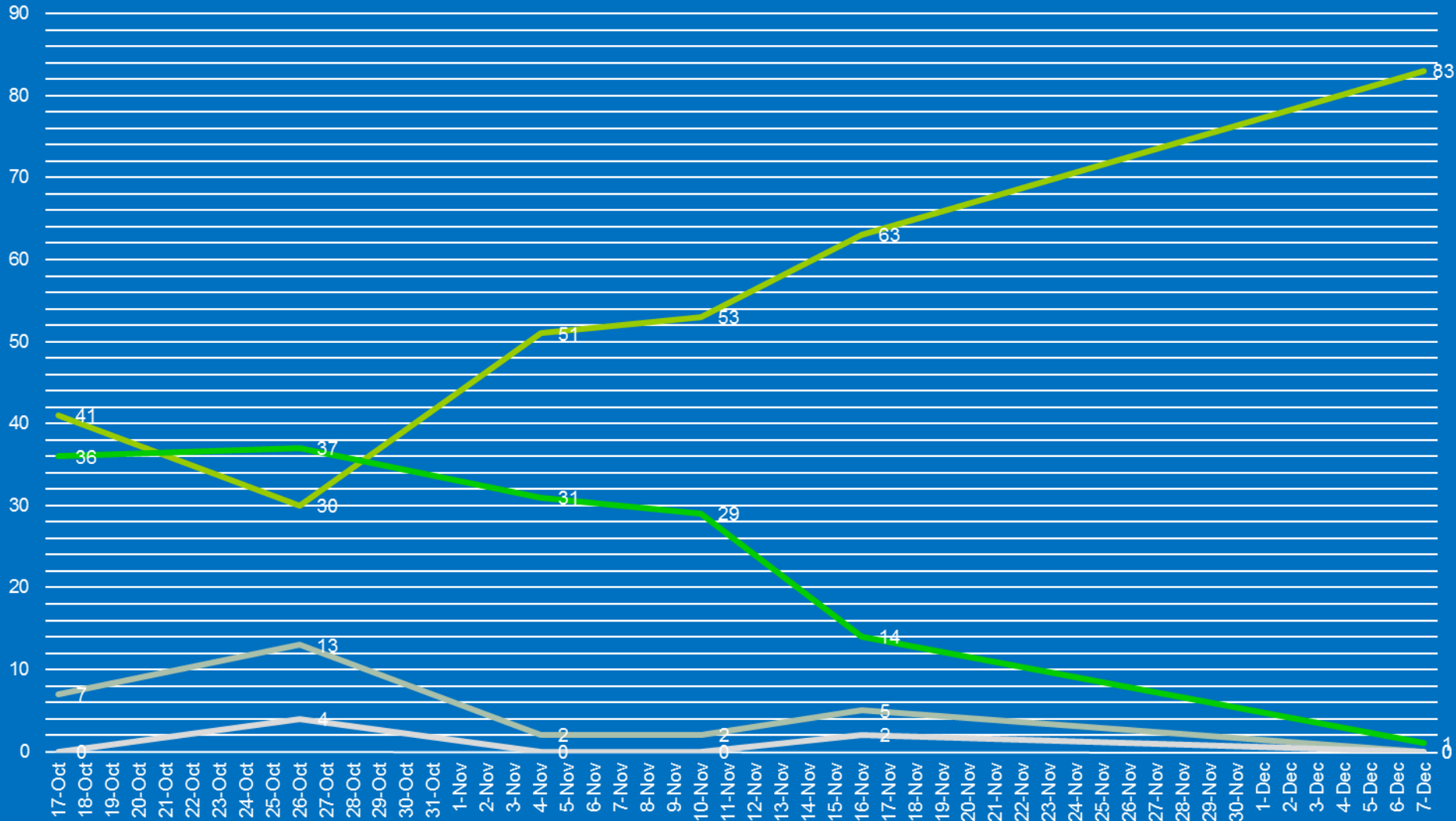
Type 1



Type 2

Number of Each Curb Type

Type 0 Type 1 Type 2 Type 3

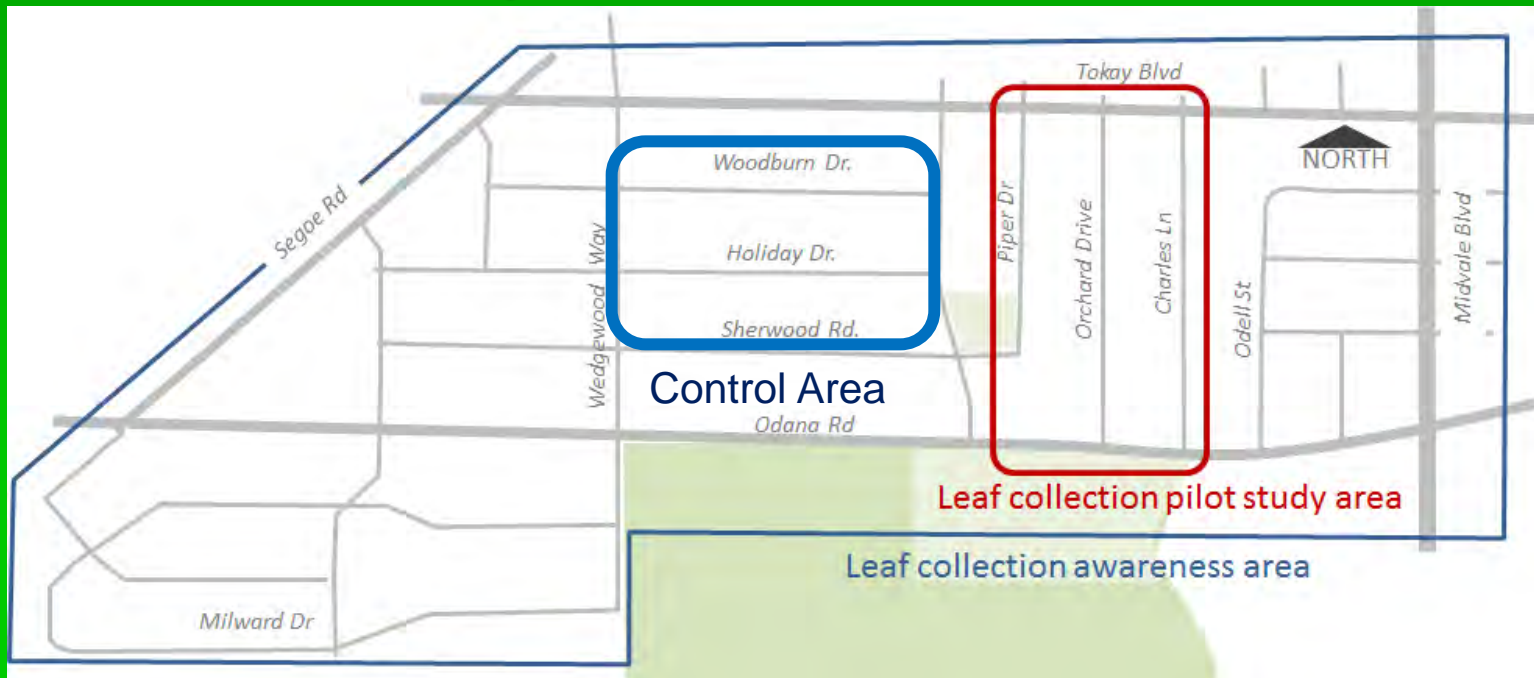


Estimate of Phosphorus Leached from Leaves in the Pilot Area During the Fall of 2015

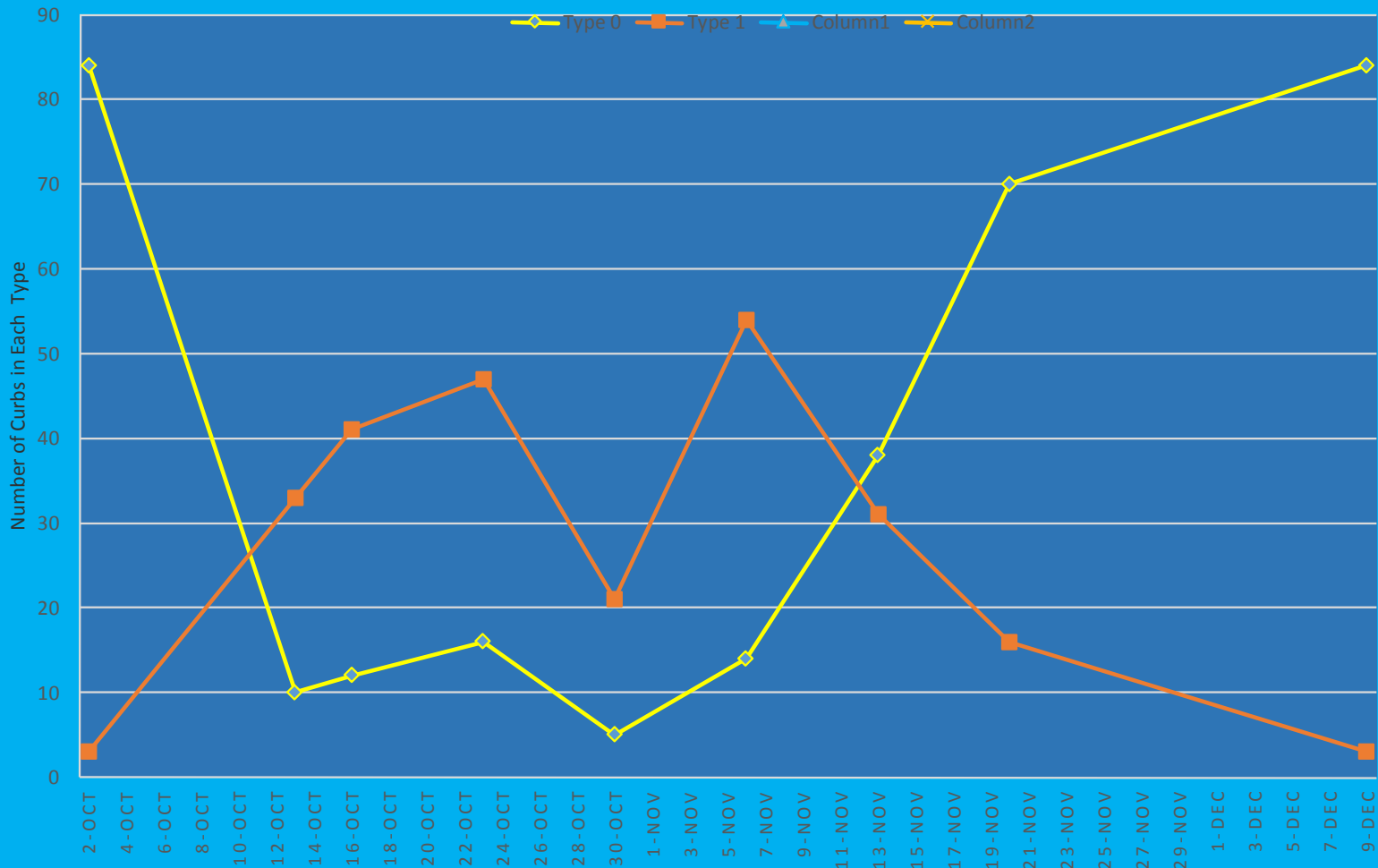
Rain Date	Survey Data	Leachable P by Curb Types, grams			Total Leachable P	
		Type 1	Type 2	Type 3	Grams	Pounds
Oct 23	Oct 26	14	14	8	36	0.08
Oct 24	Oct 26	14	14	8	36	0.08
Oct 27	Oct 26	14	14	8	36	0.08
Oct 31	Oct 26	14	14	8	36	0.08
Nov 5	Nov 4	12	2	0	14	0.03
Nov 11	Nov 10	11	2	0	13	0.03
Nov 17	Nov 16	5	5	4	14	0.03
Nov 23	Dec 7	0.4	0	0	0.4	0
Totals		84	65	36	185	0.41

Demonstration of Social Marketing on a Pilot Project Scale

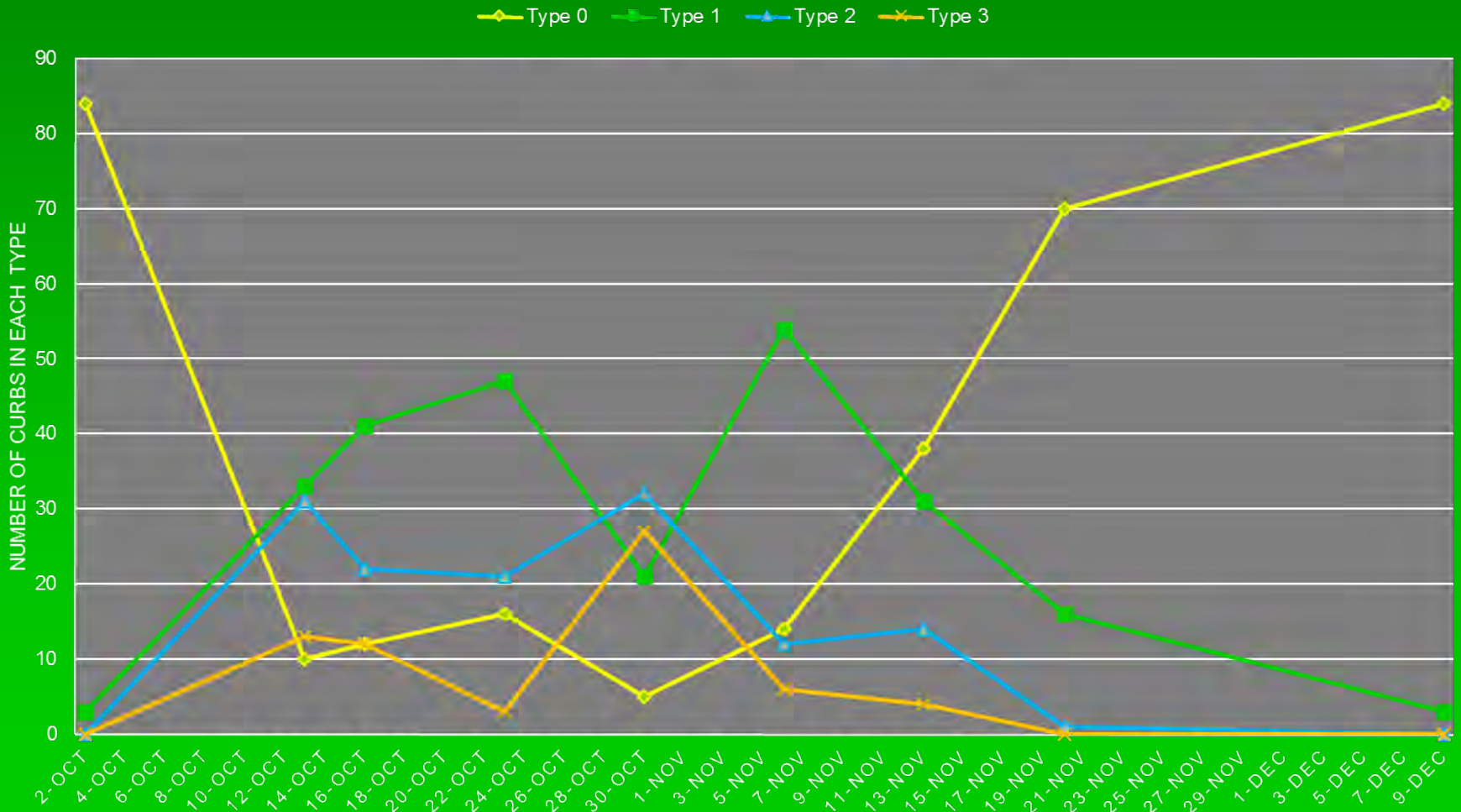
- About 16% of the 87 homes used bags in the control area as compared to an average of 63% for the 84 Homes in the pilot study area.
- They used a total of 56 bags as compared to 829 for the pilot study area.



Number of Each Curb Type for the Control Area by Date



Number of Each Curb Type for the Control Area by Date



Pilot Study Area

Oct 5 - Orchard

Oct 26 - Orchard

Nov 16 - Orchard

Dec 11 - Orchard

Control Area



10/23



10/30



11/06



11/20

Estimate of Phosphorus Leached from Leaves in the Control Area During the Fall of 2015

Rain Date	Survey Data	Leachable P by Curb Types, grams			Total Leachable P	
		Type 1	Type 2	Type 3	Grams	Pounds
Oct 23	Oct 23	18	22	6	46	0.1
Oct 24	Oct 23	18	22	6	46	0.1
Oct 27	Oct 23	18	22	6	46	0.1
Oct 31	Oct 30	8	34	53	95	0.2
Nov 5	Nov 6	20	13	12	45	0.1
Nov 11	Nov 6	20	13	12	45	0.1
Nov 17	Nov 13	12	15	8	35	0.08
Nov 23	Nov 20	6	1	0	7	0.02
Totals		120	142	103	365	0.80



Conclusions for Social Marketing

1. A large number of people appear to be willing to bag their leaves after an intensive social marketing effort and the city provides free bags.
2. Lower levels of participation can be expected with only a minimal social marketing effort and the homeowners are asked to buy their own bags.
3. When a large number of homeowners put their leaves in bags, it appears to reduce the number of leaves in the curbs.
4. Homeowners can play an important role in reducing the amount of leaves in the street.
5. Efforts should continue improve homeowner participation and the most beneficial pickup methods for the city.

Reducing Fall P Loads - Three Pathways to a Final Answer



Quantifying Benefits of Selected Leaf Management Benefits

1. Measure P Loads by Season.
2. Monitor Changes in P Load for Selected Leaf Management Approaches

Pollutant	Concentration (mg/L)	Volume (L)	Load (kg)
Ammonia Nitrogen	0.0001	1000000	0.01
Orthophosphate	0.0001	1000000	0.01
Total Phosphorus	0.0001	1000000	0.01
Total Nitrogen	0.0001	1000000	0.01
Total Suspended Solids	0.0001	1000000	0.01
Chlorophyll a	0.0001	1000000	0.01
Chlorophyll b	0.0001	1000000	0.01
Chlorophyll c	0.0001	1000000	0.01
Chlorophyll d	0.0001	1000000	0.01
Chlorophyll e	0.0001	1000000	0.01
Chlorophyll f	0.0001	1000000	0.01
Chlorophyll g	0.0001	1000000	0.01
Chlorophyll h	0.0001	1000000	0.01
Chlorophyll i	0.0001	1000000	0.01
Chlorophyll j	0.0001	1000000	0.01
Chlorophyll k	0.0001	1000000	0.01
Chlorophyll l	0.0001	1000000	0.01
Chlorophyll m	0.0001	1000000	0.01
Chlorophyll n	0.0001	1000000	0.01
Chlorophyll o	0.0001	1000000	0.01
Chlorophyll p	0.0001	1000000	0.01
Chlorophyll q	0.0001	1000000	0.01
Chlorophyll r	0.0001	1000000	0.01
Chlorophyll s	0.0001	1000000	0.01
Chlorophyll t	0.0001	1000000	0.01
Chlorophyll u	0.0001	1000000	0.01
Chlorophyll v	0.0001	1000000	0.01
Chlorophyll w	0.0001	1000000	0.01
Chlorophyll x	0.0001	1000000	0.01
Chlorophyll y	0.0001	1000000	0.01
Chlorophyll z	0.0001	1000000	0.01

Extrapolate Measured Values to Determine Average Benefits Using WinSLAMM

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Questions?

