The NPD Group

Custom Research Services

Graywater Awareness & Usage Study

Prepared For:

THE SOAP AND DETERGENT ASSOCIATION

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Background and Objectives

The Soap and Detergent Association (SDA) is a national trade organization representing over 130 companies that formulate cleaning products or supply the ingredients and packaging used for those formulations. Residential graywater reuse/disposal is expected to become increasingly widespread. The SDA is interested in better understanding the frequency and circumstances under which this practice may discharge cleaning product ingredients into the environment.

Methodology

Sample:
A quarter page mail survey was sent to a nationally representative sample of 100,000 households, utilizing the Home Testing Institute monthly consumer omnibus, Insta-Vue. The questionnaires were mailed between April 1 - April 3, 1998 and the field period closed on May 5, 1998. Total usable returns were 61,377, at a return rate of 61%. (Additional returns which were blank, unanswered or filled incorrectly are not included in this number).

The questionnaire covered:

- Incidence of graywater reuse
- When last reused graywater
- Frequency of reusing graywater

Questionnaire:
A follow-up mail survey was conducted among a representative sample of past year graywater reusers identified via the Insta-Vue screening. A questionnaire asking 36 questions was mailed out on June 10, 1998. To ensure a return that was statistically reliable, total outgo was 650, with a total return of 491 (return rate of 79%). A drawing for two $500 U.S. Savings Bonds was used as incentive to return completed questionnaires.

Key areas of questioning included:

- Frequency of graywater disposal/reuse
- Length of time disposing/reusing graywater
- Uses for graywater
- Graywater sources/volume
- Graywater disposal/distribution methods
- Seasonality differences
- Reasons for using/not using graywater (perceived advantages/disadvantages)
- Compositions of graywater
- Sources of information on graywater
- Demographic profile

Reporting Notes

- All data were statistically tested (t-tested) within sub-groups at the 95% confidence level. (95% confidence level = result is likely to be duplicated 95 times out of 100.) Significant differences within sub-groups are identified with ABCD or EF on each chart.
  - When the notations ABCD are utilized on a chart, it indicates that the four lettered columns are statistically tested against each other (A vs. B; A vs. C; A vs. D; B vs. C; B vs. D; C vs. D). The significantly higher number will have the statistical testing identification next to it. (e.g. 88^{AC} means that 88% is significantly higher than the percentages in columns A and C)
  - When the notations EF are utilized on a chart, this indicates that column E and F were statistically tested against each other. The significantly higher number will have the statistical testing identification next to it. (e.g. 11^{F} means that 11% is significantly higher than the percentage in column F)
- Totals on pages may add to more than 100% due to multiple responses per respondent.
- A "net" is defined as like responses grouped together into one code. Multiple responses by one respondent are counted as one response. Nets are labeled (Net).
- The follow-up mail survey was balanced to graywater reusers identified in the screening phase - balancing is a statistical procedure utilizing weighting to match a sample to a population based on demographics. All figures (except Figure 1 - Incidence) are based on graywater reusers (that is based among the 7% of households who reuse graywater).

Reporting Notes

- Indexing is utilizing a numerical scale to compare a variable with some reference number to reveal relative differences between variables. 100 represents the expected average of comparing two sets of variables; therefore the greater the difference from 100, the larger relative difference between the two variables being compared. Differences are notable when their index is 130 or larger/70 or smaller.
  - (e.g. From figure 2) - The % of households reusing graywater are indexed to the % of US households to understand regional graywater reuse when normalized for population density. For the Southwest, 17% is divided by 10% to give a 170 index. This means that the Southwest region has proportionally higher graywater reusing households than expected given the region's population size.

Reporting Notes

On certain tables, the data are dissected into different sub-groups for comparative analysis.

- Subgroups may not add up to the total number of respondents due to some respondents not answering sub-group questions. (e.g. In Figure 6, the sum of the bases of columns A-D (419) is less than the total base of 464 because the difference did not give an answer to the volume of graywater reused monthly question.)

The following defines each subsection:

- "Volume of Graywater Reused Monthly" - number of gallons reused each month per household.
  - Less than 10 gallons
  - 10-49 gallons
  - 50-199 gallons
  - 200+ gallons
- "System Types" are identified as follows:
  - Surface System - graywater distribution system is above ground for outside uses of graywater
  - Subsurface System - graywater distribution system is under ground for outside uses of graywater
- "Regions" are defined as follows:
  - New England - MA, ME, NH, VT, CT, RI
  - Mid-Atlantic - NY, NJ, PA, DE, MD
  - Southeast - VA, WV, TN, KY, NC, SC, GA, FL, AL, MS, LA, AR
  - Great Lakes - MN, WI, OH, IN, MI, IL
  - Midwest - MO, ND, SD, IA, NE, KS
  - Southwest - TX, OK, NM, AZ, NV
  - Rocky Mountains - UT, CO, WY, ID, MT
  - West - CA, OR, WA

Summary of Key Findings

Who Reuses Graywater?

- Overall, only a relatively small portion (7%) of those U.S. households surveyed are currently reusing graywater. (Figure 1)
  - The regions that have the greatest concentration of graywater reuse are the Southwest and Western areas of the country. (Figure 2)
  - Graywater reusers tend to own a single-family house, have households sizes 4 or less and do not use mechanical water softener (Figure 4). High volume users are more likely to have private wells and septic tanks. (Figures 4, 6)

What is the Graywater Cycle?

- Graywater comes most frequently from laundry washing machines and hand dishwashing in sinks. Most sources that require special plumbing systems installed for graywater are utilized primarily by higher volume reuser groups. (Figure 8)
- Average frequency of reusing graywater is three out of four weeks per month overall. (Figure 9)
- The overwhelming majority of reusers (82%) do not store graywater. (Figure 11)
- Less than a third of graywater reusers own a handling or treatment system for graywater. 93% of reusers are not treating the graywater before disposal. (Figure 12)
- 70% of graywater reusers collect graywater before it enters the household plumbing system. (Figure 14)

Summary of Key Findings

- The few graywater reusers that have handling and treatment systems requiring special plumbing are higher volume reusers and subsurface system households. (Figure 13)
  - However, treatment features such as filtration, aeration, disinfection, circulation and coagulation are not utilized by many households including high volume reusers or those with subsurface systems. (Figure 13)
- Graywater reusers recognize that they do not have complex systems in place for graywater treatment and disposal. (Figure 16)
  - High volume reusers and subsurface system households rate their graywater system as significantly more complex. (Figure 16)
- Vegetables and fruit gardens are watered via graywater by almost half of households reusing graywater. This is notable as most of graywater reusers do not treat their graywater prior to distribution. (Figure 17)
- Toilet flushing and driveway/street cleaning are the primary non-soil watering reuses for graywater. (Figure 17)
- The volume of graywater reused averages 188 gallons per month per household reusing graywater. (Figure 19)
  - A notable volume of graywater that is reused is not treated. (Figure 20)
  - The Southwest region has a high incidence of graywater reuse and reuses a large volume of graywater per month (271 gallons). (Figures 2,21)
  - Reusers with subsurface distribution systems, although small in number, reuse a larger amount of graywater monthly than those with surface disposal systems. (Figure 21)
  - Households who reuse graywater from automatic dishwashers, laundry washing machines and other sources that require plumbing or hook-ups generally reuse a greater volume of graywater than sources that typically require manual disposal. (Figure 22)

Summary of Key Findings

Why is graywater reused?

- People begin reusing graywater for water conservation, to use for watering plants/lawn, and due to dry, hot weather conditions. (Figure 25)
- The cost of water bills and septic tank flow problems also play roles in why households started to reuse graywater, especially among higher volume users. (Figure 25)
- Overall, reusers perceive few disadvantages to reusing graywater. (Figure 28)
- Graywater reusers strongly believe that reusing graywater is safe, especially higher volume reusers. (Figure 29)

When is graywater reused?

- Graywater reuse is most frequent during the spring and summer months. (Figure 31)
  - Higher volume reusers tend to reuse graywater more on a year round basis. (Figure 32)
  - Graywater reusers from the Southwest and Western regions reuse graywater significantly more during the winter and fall months than other regions. (Figure 32)
- Of current graywater reusers, 85% intend to continue reusing in the future. Higher volume groups (50 gallons or more per month) are most likely to continue reusing graywater in the future. (Figure 33)

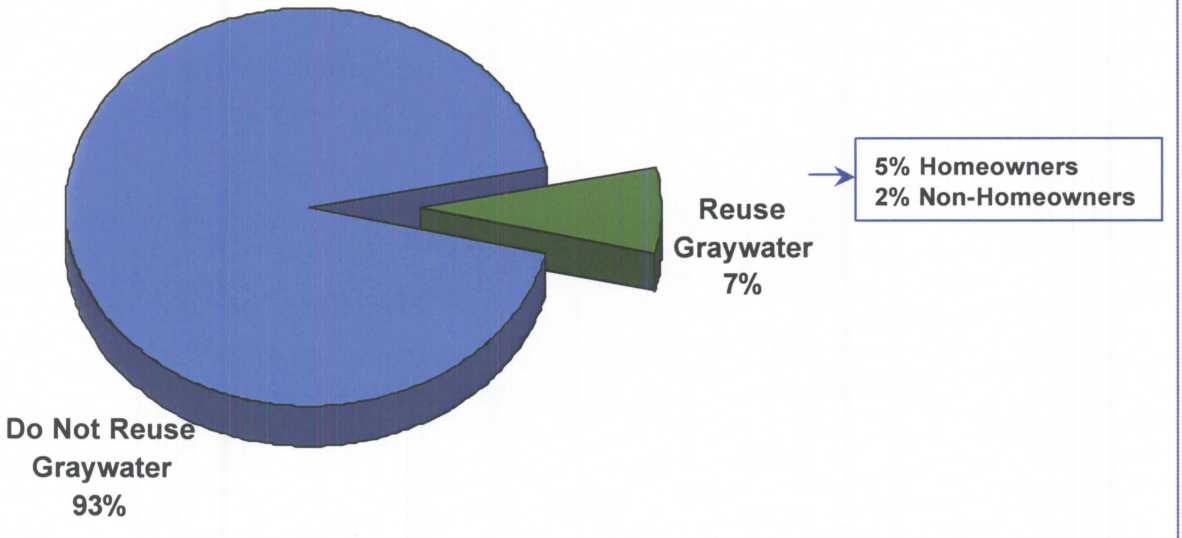
WHO REUSES GRAYWATER?

Who Reuses Graywater?

- Graywater is currently being reused by only a relatively small segment of those households surveyed (7%).

Figure 1

INCIDENCE OF GRAYWATER REUSE



NOTE: This chart references US household incidence data from the screening phase of this research. Every chart after this refers to graywater reusers.

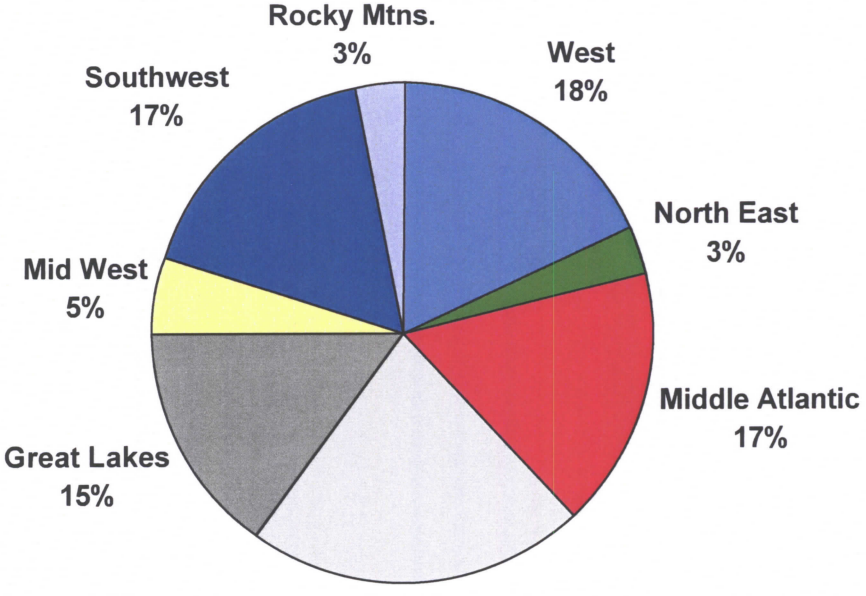
Base: Total Answering Screener (61,377)

Who Reuses Graywater?

- Of graywater reusers, the largest numbers are from the Southeast, followed by the West, Southwest and Middle Atlantic regions. However, the Southwest and Western areas have significantly higher proportions of graywater reusers, when normalized for population density.

Figure 2

REGIONAL GRAYWATER REUSE AMONG GRAYWATER REUSERS



	% of Households Reuse Graywater	% US Households	% of Households Reusing Graywater Indexed to US Households*
Southwest	17%	10%	170
West	18%	13%	138
Rocky Mtns.	3%	3%	100
South East	22%	24%	92
Middle Atlantic	17%	19%	89
Mid West	5%	6%	83
Great Lakes	15%	20%	75
North East	3%	4%	75

Base: Total Reusers Answering Screener (2,416)

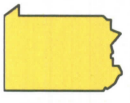
** Refer to reporting notes for Indexing definition*

Who Reuses Graywater?

- Of those reusing graywater, households in California and Texas reuse graywater the most, followed by Pennsylvania and Florida. Households in all four states utilize graywater at a higher proportion than US households in these areas.

Figure 3

STATES WITH HIGHEST GRAYWATER REUSAGE

	% Households Reuse Graywater	% US Households	% Of Households Reusing Graywater Indexed To US Households*
 California	13.9%	9.7%	143
 Texas	11.0%	6.0%	183
 Pennsylvania	7.9%	6.2%	127
 Florida	6.1%	5.1%	120
 Arizona	3.6%	1.7%	212
New York	4.9%	6.8%	72
Ohio	4.0%	4.6%	87
Washington	2.6%	2.1%	124
Michigan	2.6%	4.0%	65

Base: Total Reusers Answering Screener (2,416)

* Refer to reporting notes for Indexing definition

** See Appendix for all states (Figure 37)

Who Reuses Graywater?

- High volume reusers (200+ gallons/month) tend to own single family houses in rural areas. Household size, income and age do not appear to dictate the amount of graywater reused.

Figure 4 **DEMOGRAPHIC PROFILE OF GRAYWATER REUSERS**

		Volume of Graywater Reused Monthly				System Type	
Base: Total Respondents	Total (491)	Less Than 10 Gals. (86) A	10-49 Gals. (150) B	50-199 Gals. (116) C	200+ Gals. (90) D	Surface System (347) E	Sub-surface System (88) F
	%	%	%	%	%	%	%
Market Size							
Urban	41	48[D]	46[D]	38	31	40	39
Suburban	29	23	31	35	26	29	24
Rural	30	29	23	27	43[BC]	31	38
Type of Residence							
Single family house	86	72	87[A]	92[A]	92[A]	86	88
Multiple family house	4	8	4	4	2	5	2
Apartment	5	15[BC]	4	2	--	4	5
Other	5	5	6	3	6	5	5
Household Size							
1-2 members	59	72[BD]	53	66[BD]	50	61	57
3-4 members	30	19	37[A]	26	33[A]	29	30
5 or more members	11	9	11	9	17	10	14
Mean	*2.6*	*2.4*	*2.8[AC]*	*2.4*	*3[AC]*	*2.5*	*2.8*
Household Income							
Under $15,000	25	26	21	28	27	27	22
$15,000 - $34,999	33	42[C]	36	28	31	31	34
$35,000 or more	42	33	43	43	42	42	44
Median (X $1,000)	*30.2*	*26.1*	*31.7*	*28.6*	*29.5*	*29.7*	*30.8*
Age of Respondent							
18-34	17	28[BD]	13	19[D]	9	18	24
35-49	37	33	41	32	44	37	30
50-64	28	27	31	25	34	28	29
65+	19	13	16	24	14	18	16
Mean Age	*49.8*	*46.5*	*49.8*	*51*	*50.1*	*49.4*	*48.6*
Mechanical Water Softening System							
Yes	11	10	11	10	11	14	15
No	89	91	89	90	89	86	85

ABCD, EF - *Significantly higher at the 95% confidence level*

Who Reuses Graywater?

- Graywater reusers tend to be from rural markets, are employed as farmers and are retired/unemployed at a higher rate than what is seen in US Households.

Figure 5

GRAYWATER REUSERS VS US HOUSEHOLDS

Base: Total Respondents	% Households Reuse Graywater (491) %	% U.S. Households %	% Of Households Reusing Graywater Indexed to US Households*
Market Size			
Urban	41	48	85
Suburban	29	31	94
Rural	30	21	143
Household Size			
1-2 members	59	55	107
3-4 members	30	33	91
5 or more members	11	12	92
Mean	*2.6*	*2.7*	*96*
Household Income			
Under $15,000	25	21	119
$15,000 - $34,999	33	31	106
$35,000 or more	42	49	86
Median (X $1,000)	*30.2*	*34.3*	*88*
Occupation of Head of Household			
Professional	13	15	87
Proprietors/Managers/Officials	13	14	93
Craftsman/Foreman (skilled)	10	11	91
Operative (semi-skilled)	9	9	100
Service workers/ Private HH Workers	5	6	83
Clerical	4	6	67
Farm	4	1	400
Sales	3	5	60
Laborers	2	2	100
Student	1	2	50
Military	.4	1	40
Retired/Unemployed	32	22	145

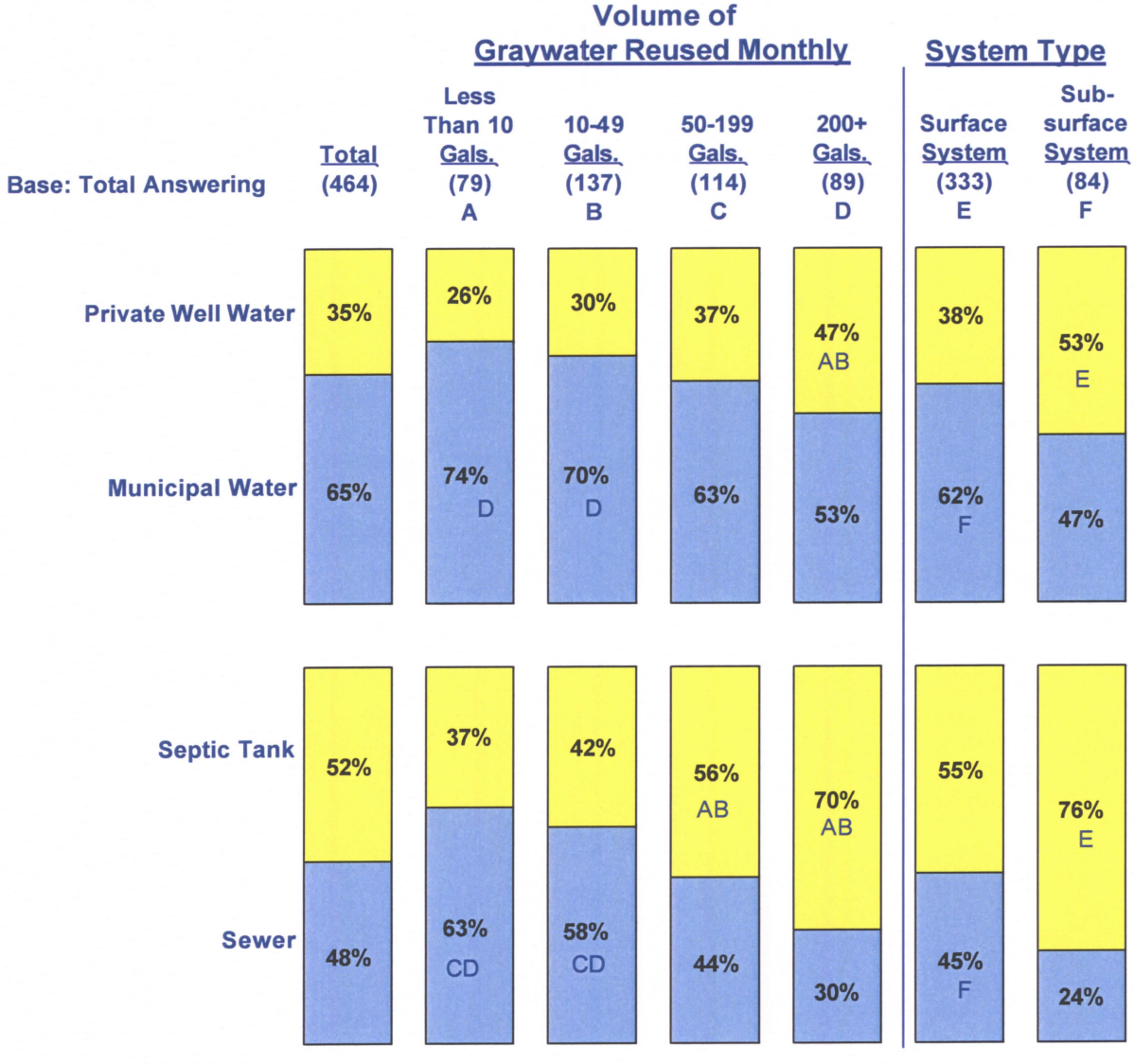
** Refer to reporting notes for Indexing definition*

Who Reuses Graywater?

- Having private well water and septic tanks are indicators of the amount of graywater reused and the type of system owned.

Figure 6

TYPES OF WATER SUPPLY/DISPOSAL



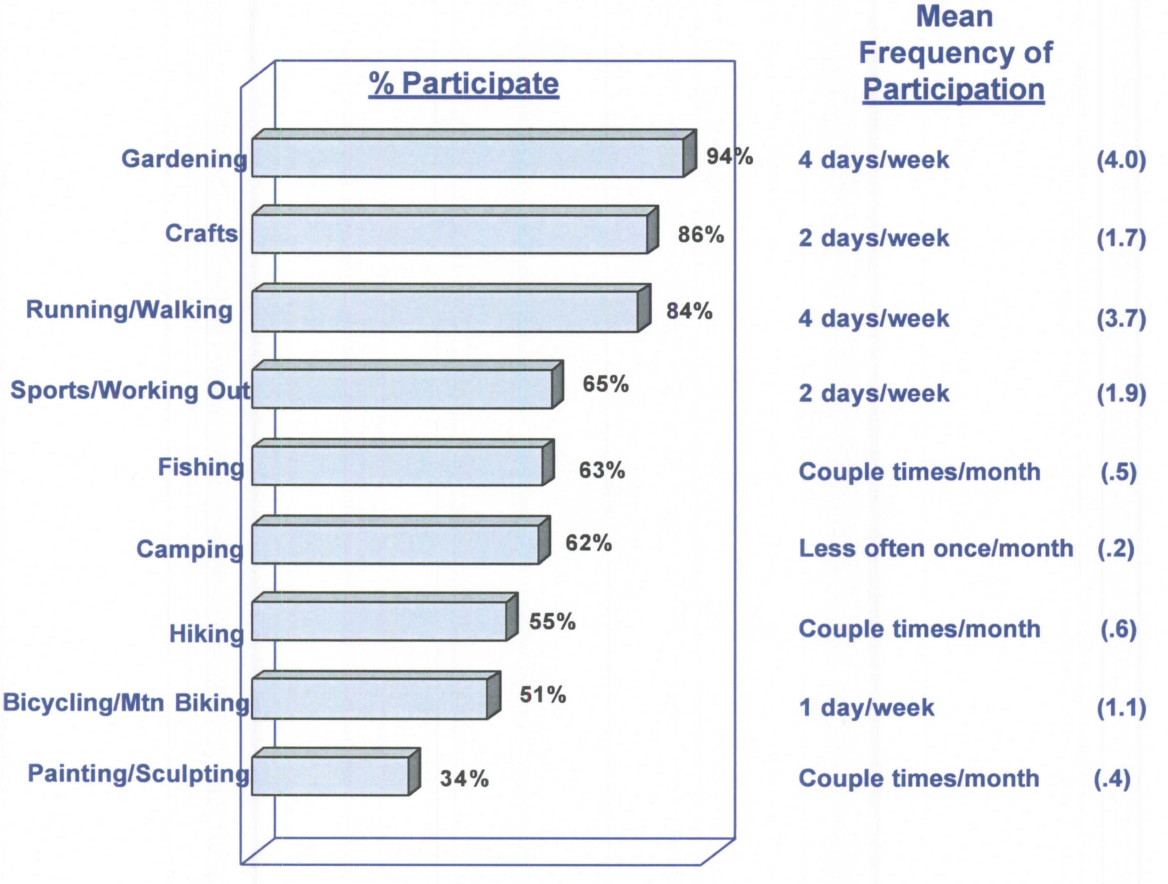
ABCD, EF - *Significantly higher at the 95% confidence level*

Who Reuses Graywater?

- Virtually all homeowners garden, on average four days a week.

Figure 7

HOUSEHOLD LEISURE ACTIVITY PARTICIPATION



Base: Total Answering/Varies by Activity

WHAT IS THE GRAYWATER CYCLE?

What is the Graywater Cycle?

- The primary sources of graywater are laundry washing machines and dish water from the sink. Sources that involve plumbing, such as laundry washing machines and automatic dishwashers, are utilized significantly more by higher volume graywater reusers.

Figure 8

SOURCE OF GRAYWATER
% Reuse Graywater From Source

		Volume of Graywater Reused Monthly				System Type	
	Total	Less Than 10 Gals.	10-49 Gals.	50-199 Gals.	200+ Gals.	Surface System	Sub-Surface System
	(379)	(56)	(108)	(94)	(83)	(277)	(73)
		A	B	C	D	E	F
	%	%	%	%	%	%	%
Laundry washing machine	73	38 BCD	63 CD	85	89	79	78
Hand dishwashing in sink	71	66 B	79	76	69	74	68
Car washing (at home)	60	51 B	67	63	57	61	59
House cleaning water	59	55 B	72	60	47 B	56	51
Bath/Shower	52	35 CD	50 C	67	61	51 E	65
Automatic dishwasher	20	6 BD	24	13 D	33	19	17
In sink garbage disposal	14	17	16	14	9	15	14

Base: Total Answering/Varies by Source

ABCD, EF = Significantly higher at the 95% confidence level

What is the Graywater Cycle?

- The majority of respondents (61%) reuse graywater at least once a week. High volume reusers and subsurface system households utilize graywater once a week or more.

Figure 9

FREQUENCY OF REUSING GRAYWATER

		Volume of Graywater Reused Monthly				System Type	
	Total	Less Than 10 Gals.	10-49 Gals.	50-199 Gals.	200+ Gals.	Surface System	Sub-Surface System
	(481)	(82)	(146)	(116)	(89)	(347)	(88)
	%	%	%	%	%	%	%
At least once a week	61	28	51 A	78 AB	83 AB	64	77 E
Couple times/month	16	13	25 ACD	14	11	15	12
Once/month	8	26 BCD	6	3	5	8	4
Less than once/month	15	33 CD	18 CD	6 D	1	13	8
Mean # of Weeks Per Year	*36.7*	*21.8*	*33.9 A*	*44.2 AB*	*46.5 AB*	*38.3*	*43.3 E*

ABCD, EF = Significantly higher at the 95% confidence level

What is the Graywater Cycle?

- Graywater is reused most often from hand dishwashing, occurring a little more than every other day (3.6 days/week). Slightly less frequently, water is reused from laundry washing machines and baths/showers.
- Higher volume graywater reusers tend to reuse more frequently on average, including dishwater, laundry washing machines, baths/showers, automatic dishwashers and car washes at home.

Figure 10

FREQUENCY OF REUSING GRAYWATER FROM SOURCE
(Mean # Days/Week)

		Volume of Graywater Reused Monthly				System Type	
	Total	Less Than 10 Gals. A	10-49 Gals. B	50-199 Gals. C	200+ Gals. D	Surface System E	Sub-Surface System F
Hand dishwashing in sink	3.6	1.8	3.3 A	4.9 AB	4.7 AB	3.8	4.5
Laundry washing machine	2.7	.5	1.3 A	3.4 AB	4.6 ABC	3.0	3.8
Bath/Shower	2.1	.6	1.4	3.0 AB	4.0 AB	2.2	3.7 E
House cleaning water	1.2	1.0	1.2	1.6	1.2	1.2	1.5
Automatic dishwasher	.8	.1	.7 A	.5	1.8 ABC	.9	1.6
Car washing (at home)	.8	.5	.5	1.1	1.2 B	.8	1.2
In sink garbage disposal	.7	.6	.6	1.0	.7	.9	.8

Base: Total Answering/Varies by Source

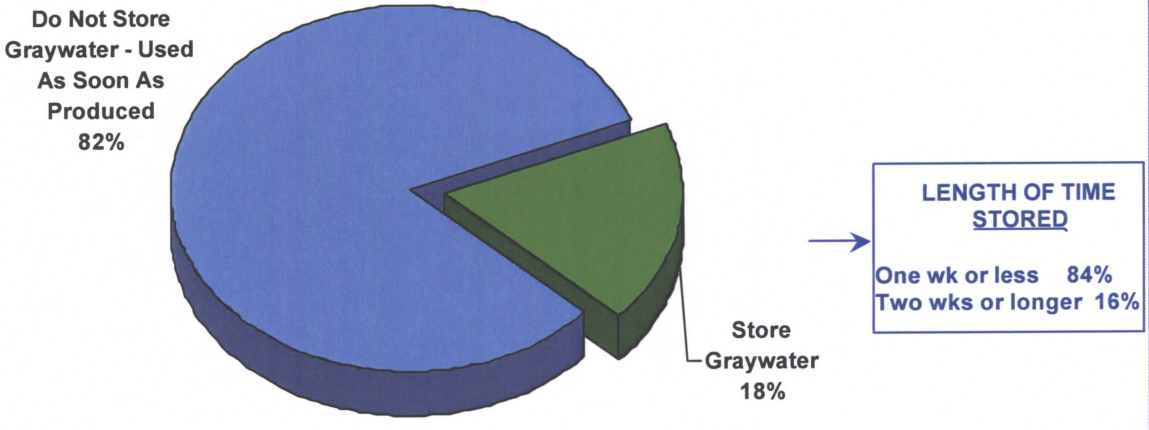
ABCD, EF = Significantly higher at the 95% confidence level

What is the Graywater Cycle?

- Only 18% of reusers store graywater, typically for one week or less. The majority of graywater reusers dispose of the graywater as soon as it is generated.

Figure 11

GRAYWATER STORAGE



MEAN # OF GALLONS GRAYWATER TREATMENT SYSTEM STORES = 230 GALLONS

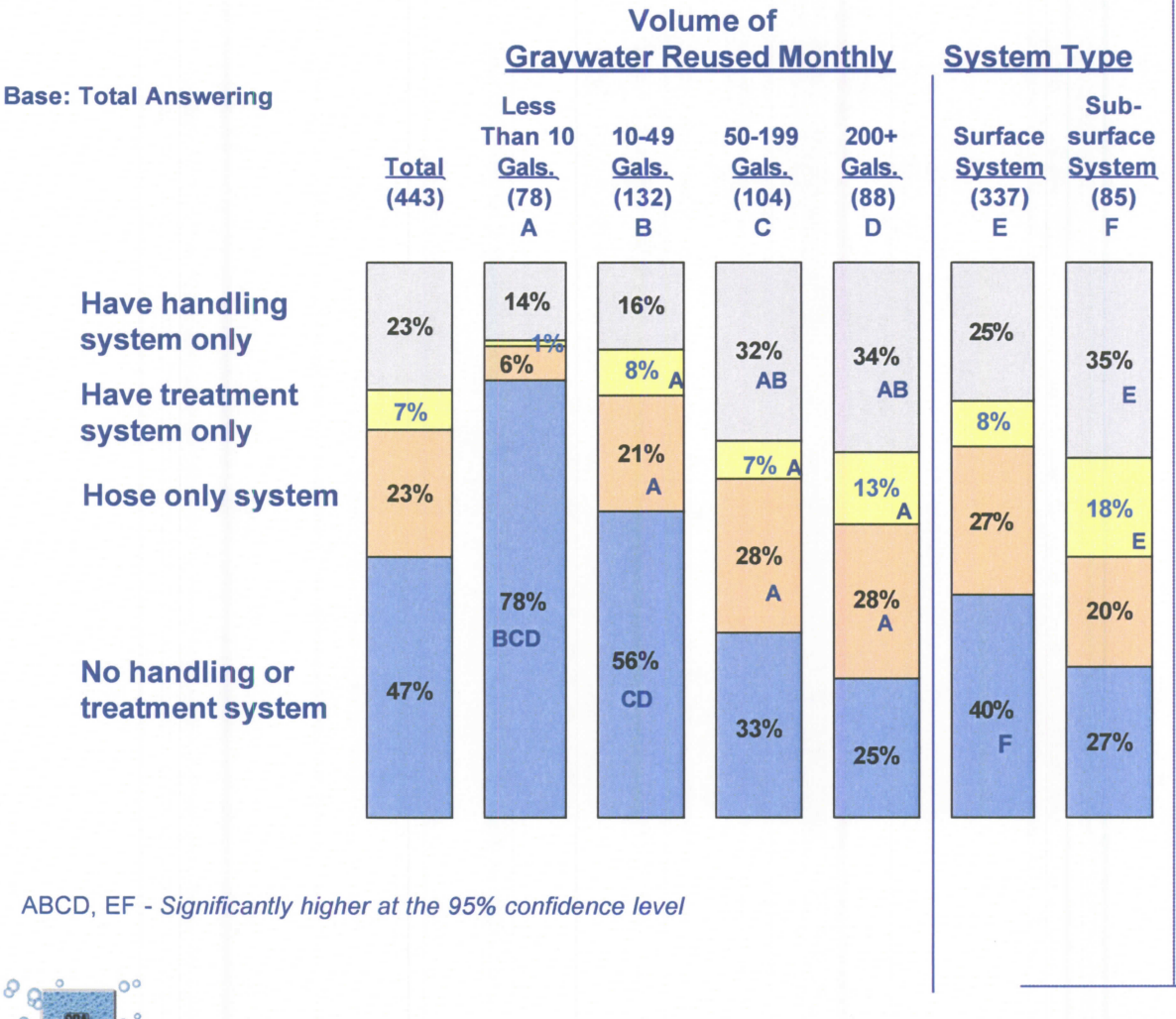
Base: Total Answering (419)

What is the Graywater Cycle?

- 93% of graywater reusers do not have treatment systems.
- Although high volume reusers (200+ gallons) and subsurface system households have significantly more complex handling/ treatment systems, 13% and 18%, respectively, are treating graywater before disposal.

Figure 12

TYPE OF HANDLING/TREATMENT SYSTEMS



ABCD, EF - *Significantly higher at the 95% confidence level*

What is the Graywater Cycle?

- About one in ten households have systems with separate plumbing, holding or collection tanks.
- Graywater reusers of 200+ gallons or subsurface system households have separate plumbing more often than other groups, but many do not utilize treatment features.

Figure 13

FEATURES OF GRAYWATER HANDLING/TREATMENT SYSTEM

		Volume of Graywater Reused Monthly				System Type	
Base: Total Answering	Total (443)	Less Than 10 Gals. (78) A	10-49 Gals. (132) B	50-199 Gals. (104) C	200+ Gals. (88) D	Surface System (337) E	Sub-surface System (85) F
	%	%	%	%	%	%	%
Have Any Features (Net)	53	22	44 A	67 AB	75 AB	60	73 E
Handling							
Hose connected to source of graywater	35	8	26 A	45 AB	55 AB	40	41
Separate plumbing	10	1	6	9 A	25 ABC	11	31 E
Storage/Holding tank	9	5	10	12	11	10	18
Collection tank	9	4	9	11	13 A	10	20 E
Cistern	2	--	--	2	3	1	8 E
Recirculating pump	2	--	2	3	3	2	6 E
Treatment							
Filtration	5	1	6	3	8 A	5	14 E
Aeration	3	--	2	2	8 B	3	6
Disinfection	2	--	2	3	1	2	4
Coagulation	#	--	--	--	1	#	--

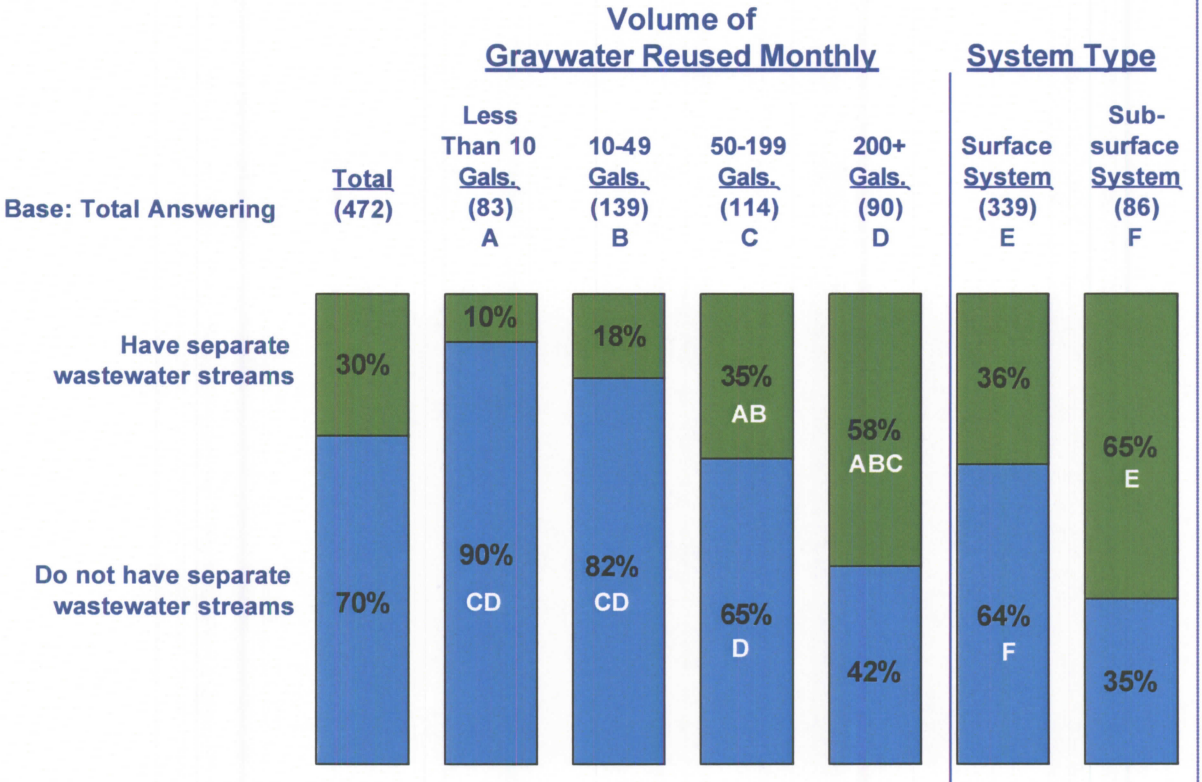
Less Than 0.5%
ABCD, EF - *Significantly higher at the 95% confidence level*

What is the Graywater Cycle?

- Most graywater reusers do not have separate wastewater streams for gray and black water, and are therefore collecting graywater before it enters the household plumbing system. Households with higher volume reuse of graywater have wastewater stream separation significantly more often.

Figure 14

SEPARATE WASTEWATER STREAMS FOR GRAYWATER VS. TOILETS



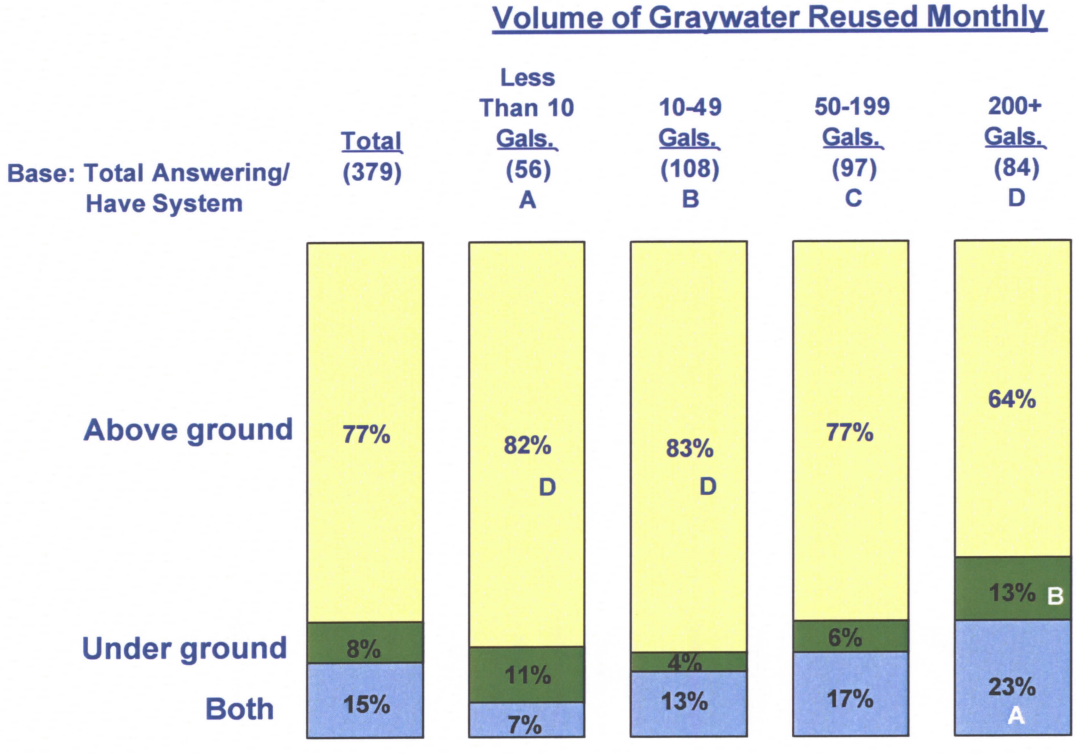
ABCD, EF - *Significantly higher at the 95% confidence level*

What is the Graywater Cycle?

- Distribution systems are primarily above ground because most dispose of graywater by hand or by running a hose directly from the graywater source.

Figure 15

GRAYWATER DISTRIBUTION SYSTEM



ABCD - *Significantly higher at the 95% confidence level*

What is the Graywater Cycle?

- Lower volume graywater reusers indicate that they do not have complex systems for graywater treatment and disposal. High volume reusers and subsurface system households rate their graywater systems as significantly more complex.

Figure 16

COMPLEXITY RATING OF GRAYWATER REUSE SYSTEM

		Volume of Graywater Reused Monthly				System Type	
	Total	Less Than 10 Gals.	10-49 Gals.	50-199 Gals.	200+ Gals.	Surface System	Sub-Surface System
Base: Total Answering	(445)	(76) A	(134) B	(110) C	(88) D	(332) E	(79) F
Complex (Separate plumbing/ treatment system)	%	%	%	%	%	%	%
5	3	--	1	5	9 AB	3	9 E
4	3	1	2	2	5	3	10 E
3	7	1	5	7	14 AB	7	14
2	12	1	5	18 AB	24 B	15	20
1	75	96 CD	88 CD	68 D	49	72	47
Basic (Dispose of Graywater by hand)							

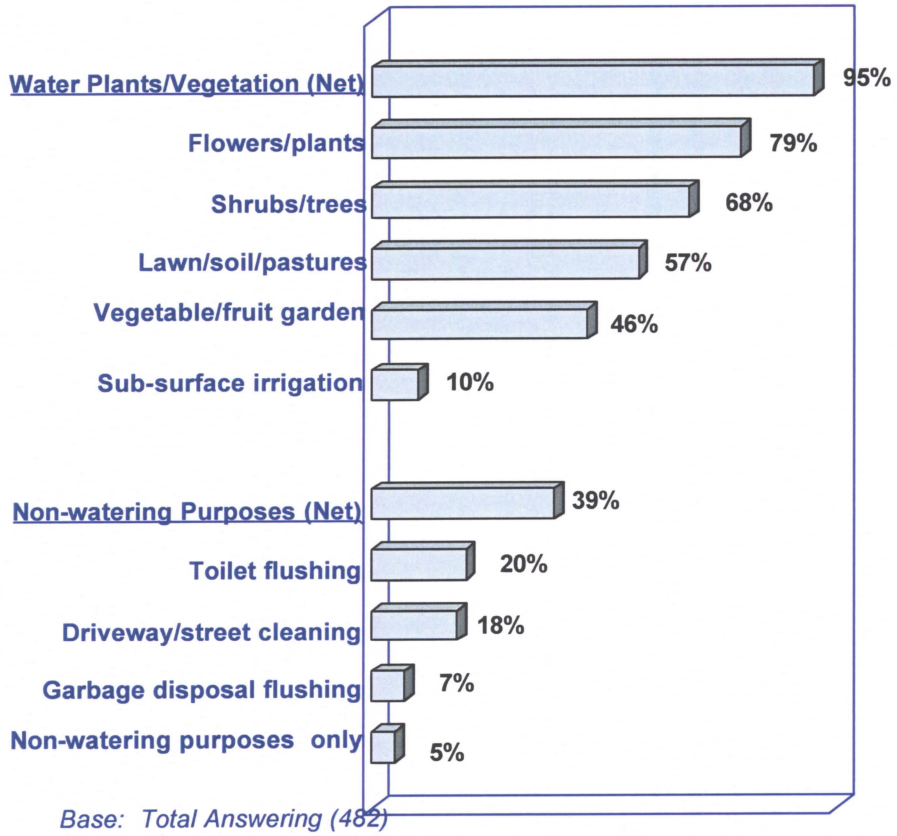
ABCD, EF - *Significantly higher at the 95% confidence level*

What is the Graywater Cycle?

- Graywater is discharged to the soil by 95% of graywater reusers. While low volume reusers (<10 gals.) use graywater mostly on flowers/plants, high volume reusers (200+ gallons) use graywater significantly more on other vegetation.
- Almost half reuse graywater on vegetable/fruit gardens.
- Graywater is also utilized for non-watering purposes by 39% of users (toilet flushing and driveway/street cleaning, etc.).

Figure 17

GRAYWATER REUSE PURPOSES



	Less Than 10 Gals. A %	10-49 Gals. B %	50+ Gals. C %
Water Plants/Vegetation (Net)	93	96	97
Flowers/plants	89 C	86	74
Shrubs/trees	47	72	77 A
Lawn/soil/pastures	29	59	67 A
Vegetable/fruit garden	37	50	53 A
Sub-surface irrigation	1	7	15 AB
Non-watering Purposes (Net)	39	49	32
Toilet flushing	21	25	16
Driveway/street cleaning	14	24	16
Garbage disposal flushing	7	8	6
Non-watering purposes only	7	4	2
Base: Total Answering (482)	*(85)*	*(148)*	*(204)*

ABC = Significantly higher at the 95% confidence level

What is the Graywater Cycle?

- Graywater reusers do not distinguish between recycling graywater on flowers/plants compared to vegetables and fruit gardens. Almost 80% of those who reuse graywater on flowers/plants and/or fruits/vegetables do so once a week or more.

Figure 18

FREQUENCY OF REUSING GRAYWATER ON VEGETATION

	Volume of Graywater Reused Monthly					System Type	
Base: Total Answering/ Water Flowers/Plants	Total (368)	Less Than 10 Gals. (72) A	10-49 Gals. (125) B	50-199 Gals. (89) C	200+ Gals. (60) D	Surface System (265) E	Sub-Surface System (55) F
	%	%	%	%	%	%	%
Water Flowers/Plants							
Once a day or more	24	3	21	36	35	25	33
Few times a week	40	29	42	47 [A]	38	41	40
Once a week	15	21	15	9	15	13	18
Less than once a week	21	47 [C]	22	8	12	20	9
Base: Total Answering/ Water Vegetable/Fruit Gardens	(216)	(31) A	(71) B	(65) C	(40) D	(158) E	(39) F
	%	%	%	%	%	%	%
Water Vegetable/Fruit Gardens							
Once a day or more	25	3	23	35	28	27	39
Few times a week	39	29	39	39	50	39	36
Once a week	15	10	16	19	10	12	15
Less than once a week	21	58	23	8	13	22	10

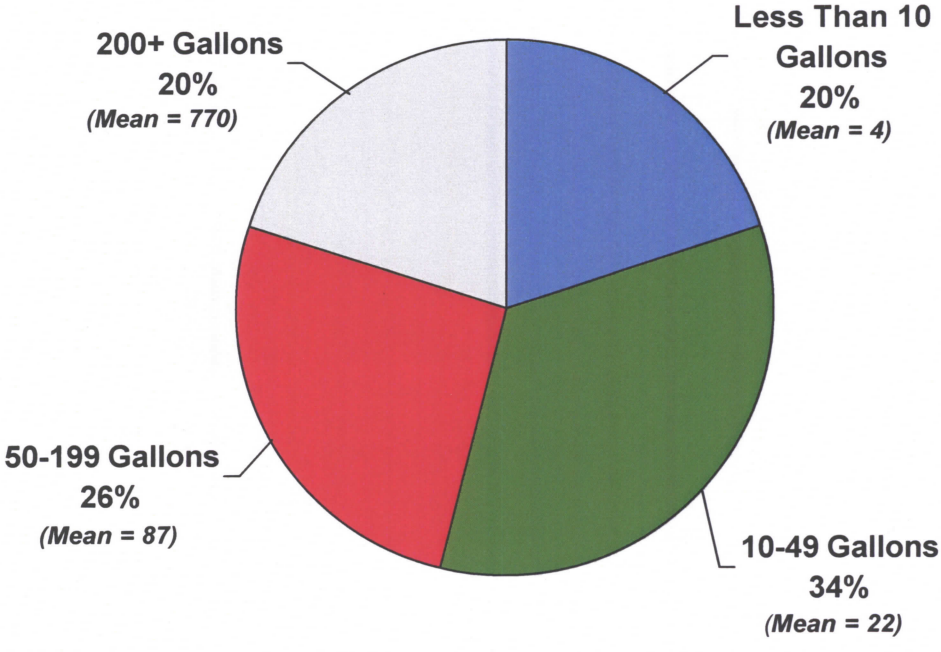
ABCD, EF - *Significantly higher at the 95% confidence level*

What is the Graywater Cycle?

- The volume of graywater reused averages 188 gallons per month. There is disparity in amount of graywater reused, as the low and high volume segments are sizable at 20%. Nearly half of those surveyed reuse between 10 and 200 gallons per month.
- The total volume of graywater reused (extrapolated from 433 survey respondents) per year is 11.5 billion gallons.

Figure 19

VOLUME OF GRAYWATER REUSED
NUMBER OF GALLONS/MONTH



MEAN # OF GALLONS/MONTH	*188 GALLONS*

TOTAL GRAYWATER VOLUME/YEAR:

98 Million U.S. Households	X	7% Graywater incidence	X	188 Gallons/ month	X	Graywater = Reusage Each Month*	11.5 Billion Gallons/Year

Base: Total Answering (442)

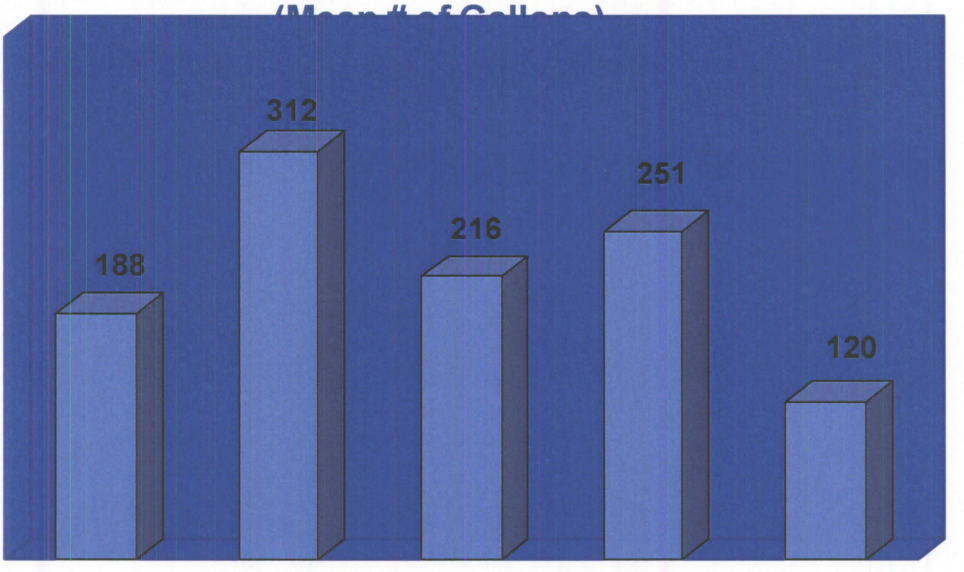
** - Due to seasonality, each month has different reusage levels. These seasonal percentages were taken from Figure 34. Total graywater volume/year calculations are in the Appendix - Figure 38.*

What is the Graywater Cycle?

- There is a substantial volume of graywater reused that comes from untreated sources (hose only and non-handling/treating households).

Figure 20

VOLUME OF GRAYWATER REUSED MONTHLY



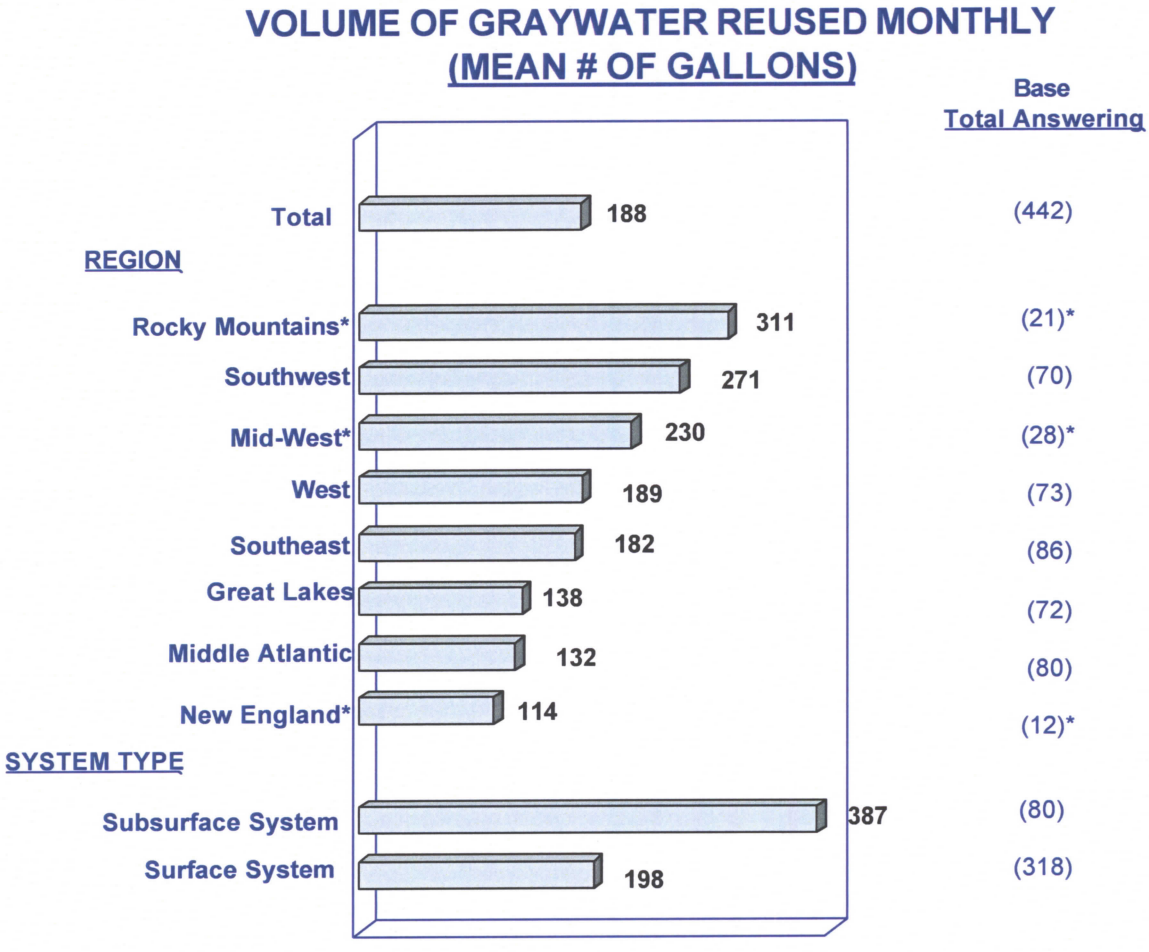
	Total	Have Handling Features Only	Have Treatment Features Only	Hose Only	No Handling or Treatment System
% of Graywater Households	100%	23%	7%	23%	47%
Base: Total Answering	*(442)*	*(97)*	*(30)**	*(86)*	*(191)*

** Caution: Extremely Small Base Size*

What is the Graywater Cycle?

- Of all regions, the Southwest has a high incidence of graywater reuse (Figure 2) and reuses the second largest volume of graywater among regions surveyed. Sub-surface system households reuse a larger volume of graywater than surface system reusers.

Figure 21



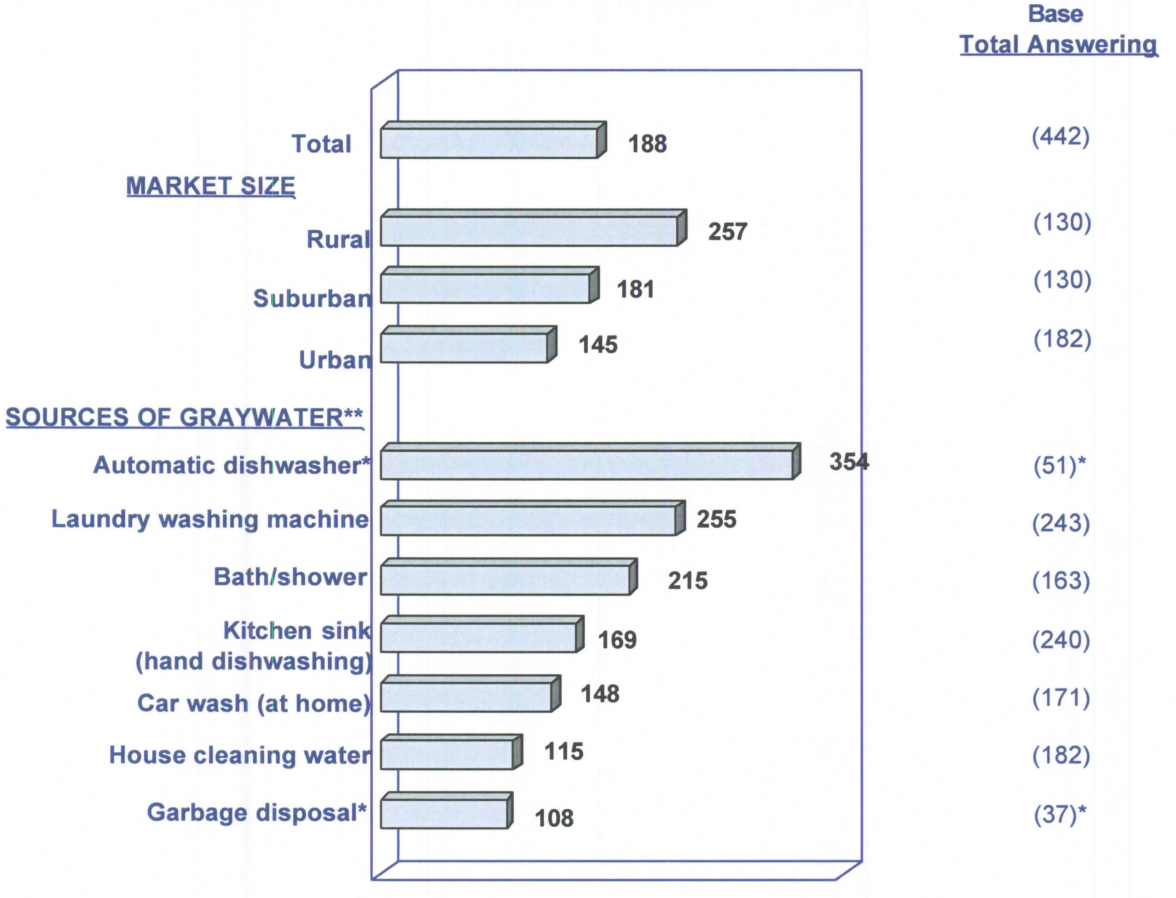
** Caution: Extremely Small Base Size*

What is the Graywater Cycle?

- Rural areas reuse significantly more graywater than suburban or urban areas. Sources of graywater such as automatic dishwashers and laundry washing machines produce a greater volume of graywater that is reused than other sources.

Figure 22

VOLUME OF GRAYWATER REUSED MONTHLY (MEAN # OF GALLONS)



** Caution: Extremely Small Base Size*

*** Respondents may use more than one source of graywater.*

What is the Graywater Cycle?

- About two-thirds of households discharge graywater containing laundry (69%) or dishwashing cleaning (62%) products.

Figure 23

PERCENTAGE OF HOUSEHOLDS REUSING GRAYWATER CONTAINING CLEANING PRODUCTS

		Volume of Graywater Reused Monthly				System Type	
Base: Total Answering	Total (463)	Less Than 10 Gals. (80) A	10-49 Gals. (142) B	50-199 Gals. (114) C	200+ Gals. (87) D	Surface System (340) E	Sub-surface System (85) F
	%	%	%	%	%	%	%
Laundry Products (Net)	69	40	59 A	79 AB	90 ABC	73	84 E
Detergent	62	30	51 A	74 AB	85 AB	67	79 E
Bleach	40	21	31	44 AB	61 ABC	42	64 E
Fabric Softener	26	16	18	38 AB	28	26	37 E
Prewashes/stain remover	19	9	13	23 A	31 AB	20	31 E
Presoaks	9	8	8	11	8	9	15
Boosters	6	4	4	7	10 B	5	6
Dishwashing (Net)	62	68	68	61	60	61	73 E
Hand dishwashing liquid	60	68	66	60	54	59	67
Automatic dishwasher detergent	8	6	6	4	20 ABC	8	19 E
Rinse agents for dishwashers	4	1	2	2	10 ABC	4	11 E
Film and spot remover	2	1	1	2	2	2	5

ABCD, EF - *Significantly higher at the 95% confidence level*

What is the Graywater Cycle?

- Half of households reuse graywater containing household cleaning products and hand or body soaps.

Figure 23 (Continued)

PERCENTAGE OF HOUSEHOLDS REUSING GRAYWATER CONTAINING CLEANING PRODUCTS (CONTINUED)

		Volume of Graywater Reused Monthly				System Type	
Base: Total Answering	Total (463)	Less Than 10 Gals. (80) A	10 -49 Gals. (142) B	50-199 Gals. (114) C	200+ Gals. (87) D	Surface System (340) E	Sub-surface System (85) F
	%	%	%	%	%	%	%
Household Cleaners (Net)	51	56	57 C	44	53	49	54
All purpose cleaner	23	25	27	22	21	21	29
Baking soda	22	23	25	21	21	22	20
Tub/tile/sink cleaner	14	13	12	13	22 B	13	28 E
Disinfectant cleaner	13	14	18 C	7	16 C	13	21 E
Multi-surface cleaner	11	15 C	13 C	5	12	9	18 E
Floor/furniture cleaner	8	10	10	6	6	7	17 E
Ammonia	8	10	8	10	5	8	13
Borax	7	5	6	6	10	7	7
Carpet Cleaner	3	3	4	4	2	2	4
Hand or body soap	51	49	52	51	55	48	64 E
Car washing liquid	19	21	18	19	18	20	24
Drain opening liquid	4	4	4	2	3	3	8 E
Packaged water softeners	2	3	2	--	1	2	2

ABCD, EF - *Significantly higher at the 95% confidence level*

What is the Graywater Cycle?

- More laundry detergent and bleach are used than any other soap and detergent type product. Although washing dishes by hand is the source of a lot of graywater, minimal amounts of hand dishwashing liquid are being disposed.

Figure 24

AMOUNT OF PRODUCTS USED
(Per Usage Occasion)

	Mean # Cups Used	Standard Deviation
Laundry detergent	.48	.29
Bleach	.43	.32
Floor/Furniture Cleaner	.30	.22
Fabric Softener	.25	.21
All Purpose Household Cleaner	.24	.20
Ammonia	.23	.23
Disinfectant Cleaner	.23	.20
Car Washing Liquid	.23	.20
Automatic Dishwasher Detergent	.21	.23
Baking Soda	.21	.22
Laundry Presoaks	.20	.25
Multi-surface Cleaners	.17	.15
Tub/Tile/Sink Cleaners	.17	.15
Hand/Body Soap	.14	.23
Hand Dishwashing Liquid	.09	.15
Laundry Pre-wash/Stain Remover	.07	.09

Unclassified
(Not used by large enough base)

- Laundry Boosters
- Borax
- Carpet Cleaner
- Film & Spot Remover
- Rinse Agents for Dishwashers
- Drain Opening Liquid
- Packaged Water Softeners

Base: Total Using Products/Varies by Product

WHY IS GRAYWATER REUSED?

Why is Graywater Reused?

- People begin reusing graywater to conserve water, to use for watering vegetation and due to dry, hot weather conditions.
- Cost of water bills and reducing flow to septic tanks also play a role as to why households initially start reusing graywater, especially among higher volume reusers.

Figure 25

WHY HOUSEHOLDS BEGIN REUSING GRAYWATER

		Volume of Graywater Reused Monthly				System Type	
Base: Total Answering	Total (475)	Less Than 10 Gals. (84) A	10-49 Gals. (145) B	50-199 Gals. (115) C	200+ Gals. (88) D	Surface System (338) E	Sub-surface System (85) F
	%	%	%	%	%	%	%
Water Conservation	27	31	32	24	25	26	20
Watering Vegetation	26	27	23	22	30	27	31
Watering plants flowers/garden	20	26	20	17	18	20	21
Watering lawn/yard	7	–	3	7 A	17 ABC	9	12
Weather conditions (Dry/Hot)	21	24	27	19	15	21	15
Price/cost of bills	17	8	17	22 A	19 A	16	18
Trying to reduce hydr. load to septic tank	10	1	3	10 AB	25 ABC	13	17
Concern for the environment	7	10	5	10	2	7	4
Something a family member always did	6	11 CD	8 CD	2	1	4	4

ABCD, EF - *Significantly higher at the 95% confidence level*

Why is Graywater Reused?

- Environmental considerations are the primary reason households currently reuse graywater. Water bill costs and septic system hydraulic loading issues are also motivating factors for graywater reuse.
- Regulations and legislation do not appear to be strong influences at this point.

Figure 26

WHY HOUSEHOLDS CURRENTLY REUSE GRAYWATER

Base: Total Answering	Total (478)	Volume of Graywater Reused Monthly: Less Than 10 Gals. (82) A	10-49 Gals. (149) B	50-199 Gals. (115) C	200+ Gals. (89) D	System Type: Surface System (343) E	Sub-surface System (85) F
	%	%	%	%	%	%	%
Environmental considerations	64	74 C	66	58	64	63	53
Cost of water/water bills	41	33	45	45	39	38	32
Trying to reduce flow to septic system	33	9	24	42	55	36	55
Water supply restrictions	18	24	19	14	19	19	11
Cost of sewage treatment	10	4	10	13 A	11	10	6
No sewer hook-up	9	2	8	11 A	11 A	11	12
Local regulations	2	2	3	1	3	3	2

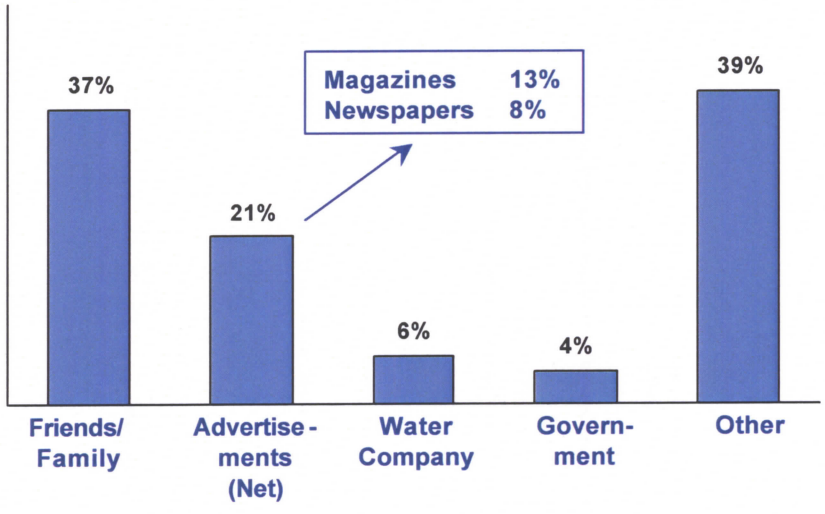
ABCD, EF - *Significantly higher at the 95% confidence level*

Why is Graywater Reused?

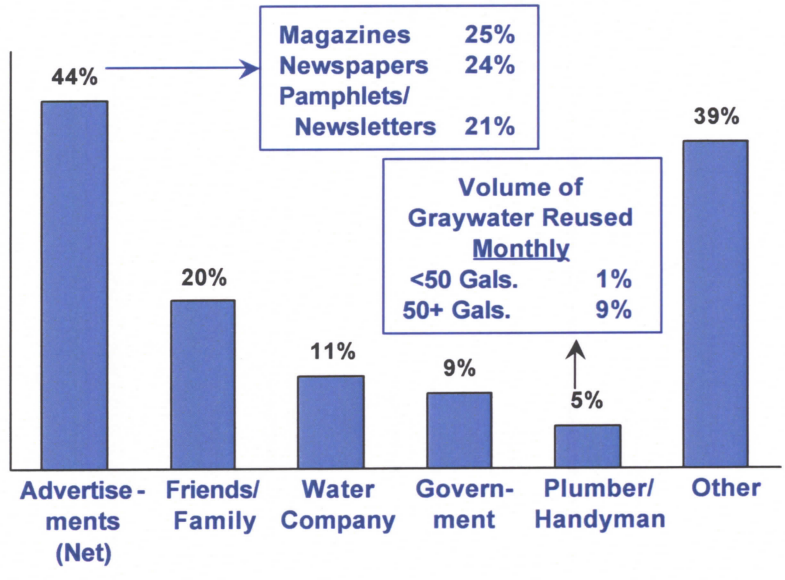
- Personal referrals generate the most initial awareness, but advertisements surpass friends/family as a current information vehicle. Plumbers are also consulted by larger volume graywater reusers (50+ gallons) once the system is in place.

Figure 27

INITIAL SOURCE OF GRAYWATER AWARENESS



CURRENT GRAYWATER INFORMATION SOURCES



Base: Total Answering (446/306)

Why is Graywater Reused?

- Half of graywater reusers believe there are no disadvantages to recycling graywater, otherwise, maintenance/labor is the biggest perceived disadvantage, especially among surface system owners.

Figure 28

PERCEIVED DISADVANTAGES IN GRAYWATER REUSE

		Volume of Graywater Reused Monthly				System Type	
Base: Total Answering	Total (477)	Less Than 10 Gals. (85) A	10-49 Gals. (148) B	50-199 Gals. (113) C	200+ Gals. (88) D	Surface System (342) E	Sub-surface System (84) F
	%	%	%	%	%	%	%
Maintenance/labor	21	17	21	24	19	21 F	10
Health concerns	13	17	16	12	13	13	12
Odors	12	14	12	12	13	12	13
Disappointing cost savings in water bill	9	13	12	5	9	9	2
Environmental concerns	9	11	13	8	3	9	4
Government regulations	8	9	7	9	9	9	13
Cost of collection/ distribution system	6	6	7	6	5	7	5
No disadvantages	48	41	41	51	56	49	61

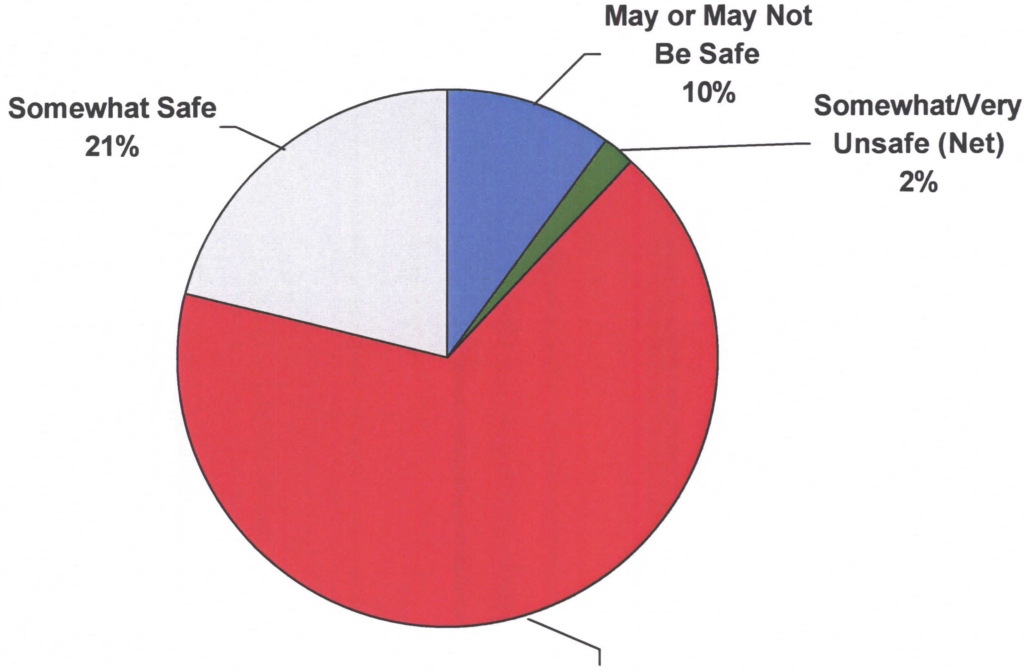
ABCD, EF - *Significantly higher at the 95% confidence level*

Why is Graywater Reused?

- Graywater reusers strongly believe that reusing graywater is safe. This is especially true among higher volume reusers (50+ gallons).

Figure 29

PERCEIVED SAFETY OF REUSED GRAYWATER



Volume of Graywater Reused Monthly	
<10 Gals.	53%
10-49 Gals.	65%
50+ Gals.	73%

Base: Total Answering (482)

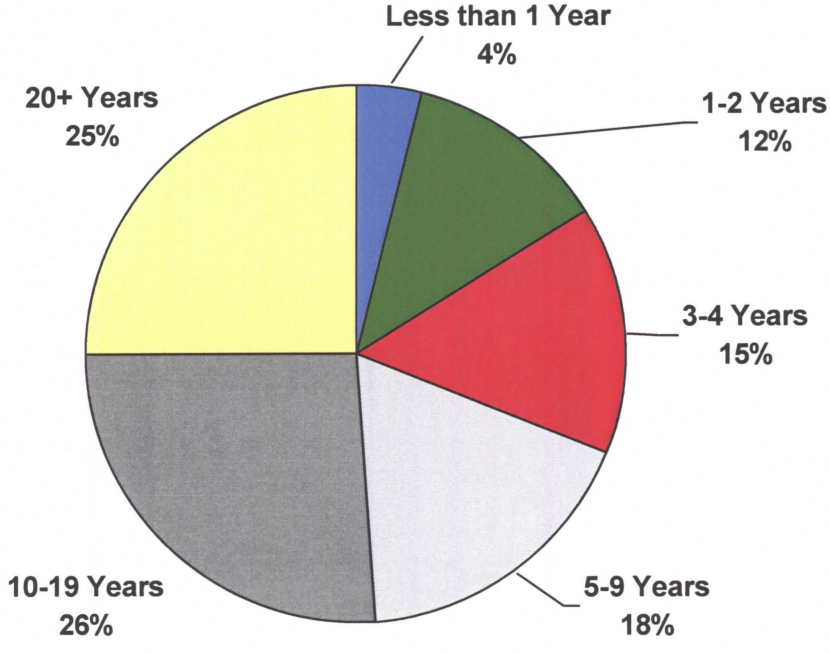
WHEN IS GRAYWATER REUSED?

When is Graywater Reused?

- Graywater reusers are not new to the process. Most reusers have been recycling graywater for about 13 years on average.

Figure 30

OF YEARS HOUSEHOLD HAS REUSED GRAYWATER



MEAN # OF YEARS = 12.7 YEARS

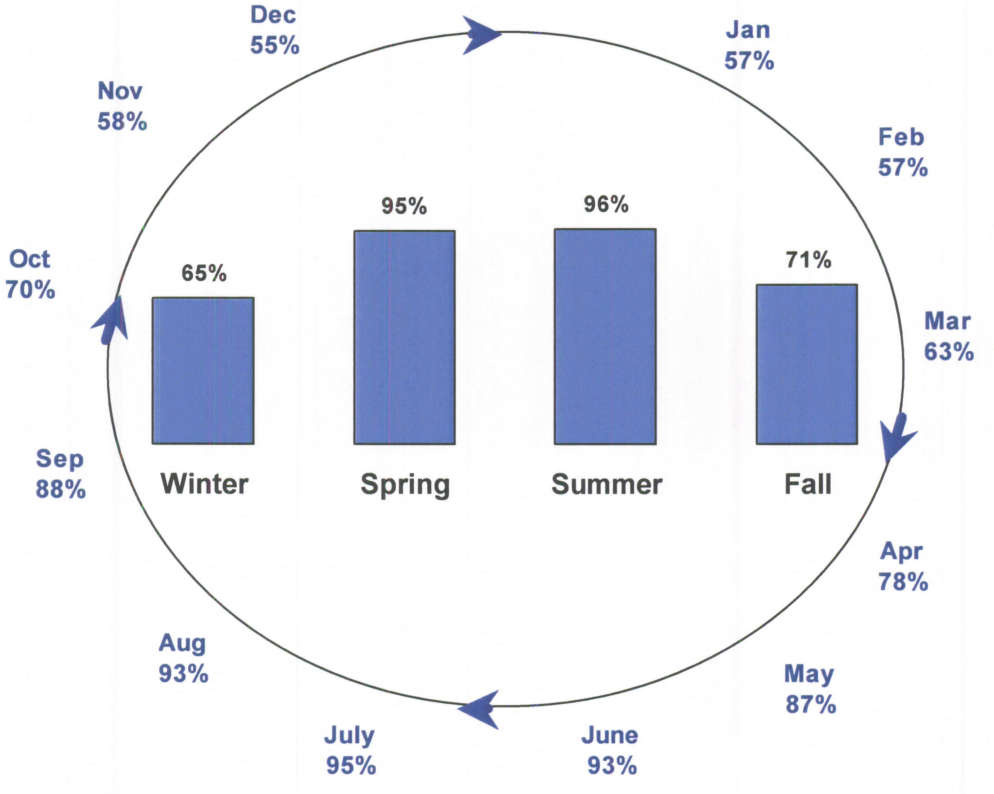
Base: Total Answering (477)

When is Graywater Reused?

- The season for most significant reuse of graywater is during the warmer months, May through September. This corresponds to survey respondents' desire to conserve water.

Figure 31

MONTHLY GRAYWATER REUSE



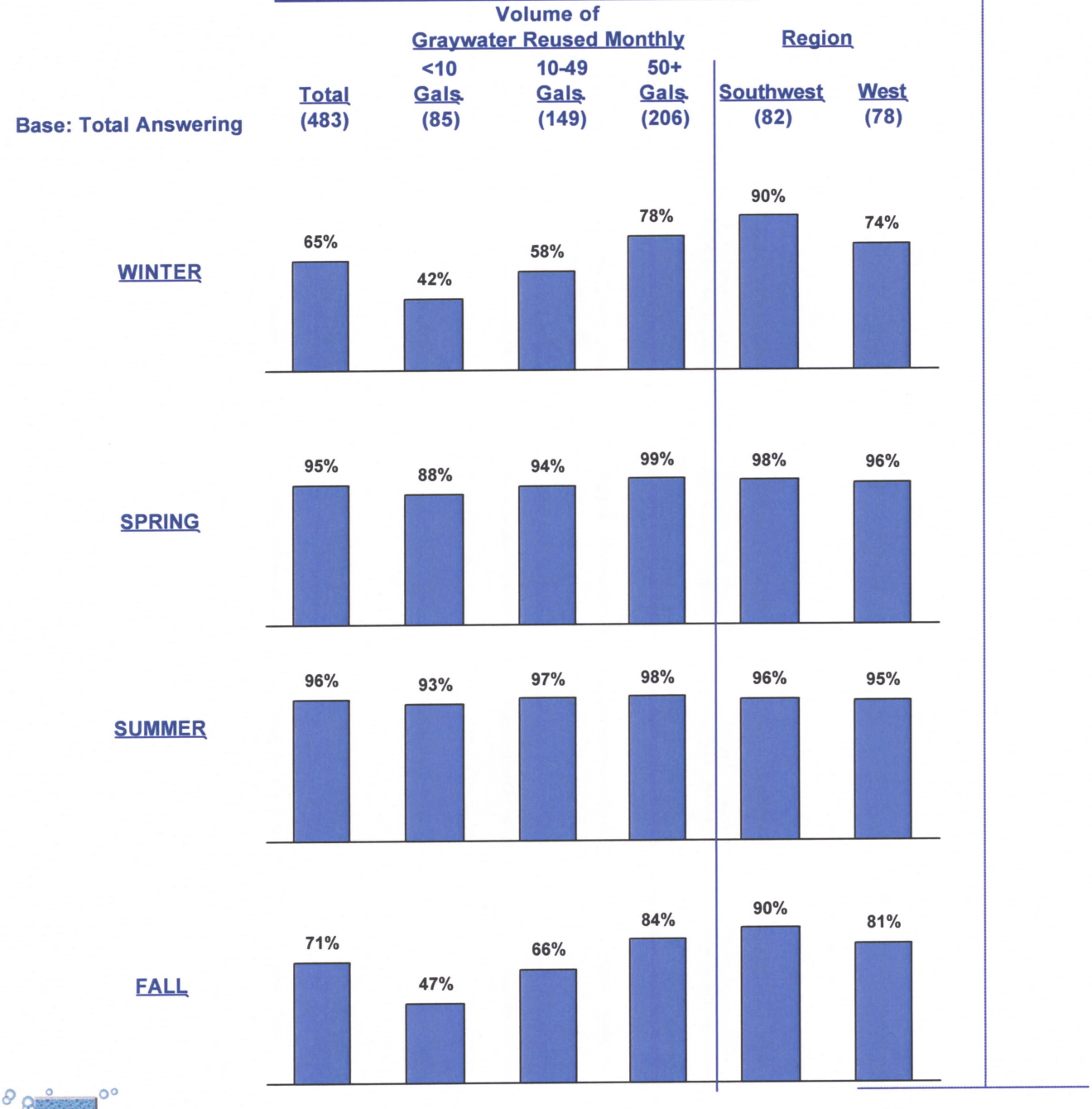
Base: Total Answering (483)

When is Graywater Reused?

- Higher volume graywater reusers tend to recycle graywater more on a year round basis. The Southwest and Western regions also reuse graywater significantly more often during the winter and fall months compared to total graywater reusing households.

Figure 32

SEASONAL GRAYWATER REUSE

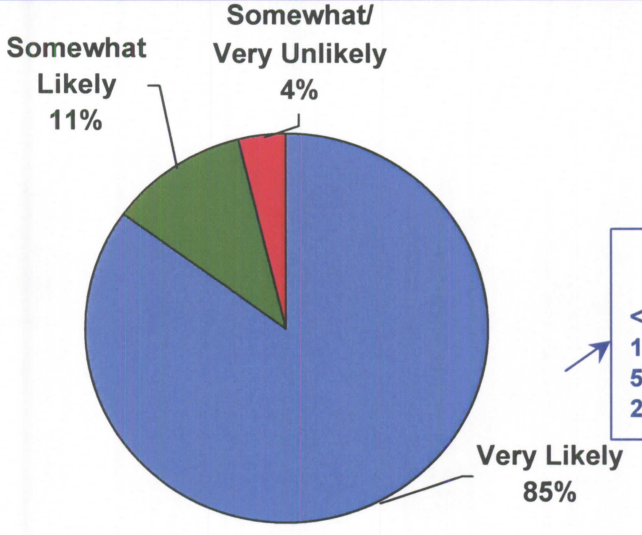


When is Graywater Reused?

- A substantial number of those surveyed are very likely to reuse graywater in the future, especially higher volume reusers who may have more invested in graywater reuse systems. The majority of graywater reusers will reuse the same amount as this year, however 15% claim that they plan to reuse more in the future.

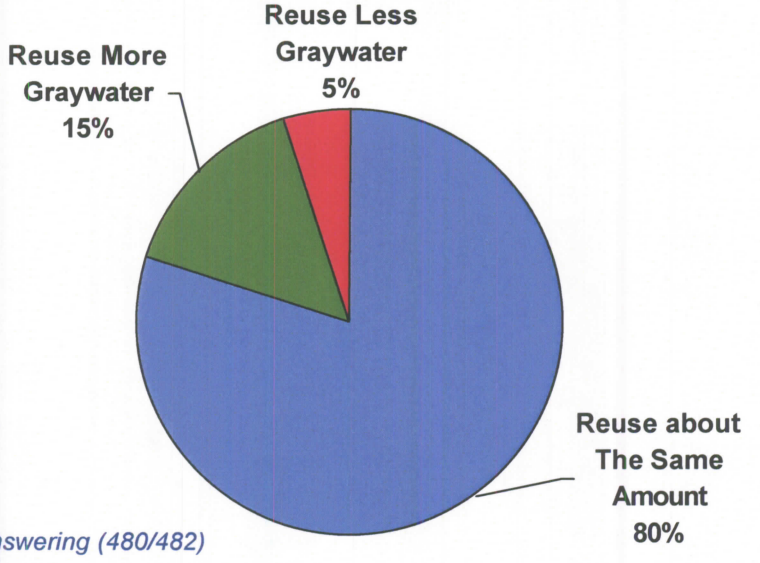
Figure 33

LIKELIHOOD OF CONTINUED GRAYWATER REUSE



Volume of Graywater Reused Monthly	
<10 Gals.	66%
10-49 Gals.	79%
50-199 Gals.	93%
200+ Gals.	100%

AMOUNT OF REUSE IN NEXT YEAR



Base: Total Answering (480/482)

APPENDIX

Appendix

Figure 34

% HOUSEHOLDS REUSING GRAYWATER BY STATE VS TOTAL US HOUSEHOLDS

	% of Households Reusing Graywater*	US Households	Indexed to US Households
	%	%	
Alabama	1.3	1.5	87
Arizona	3.6	1.7	212
Arkansas	1.5	1.1	136
California	13.9	9.7	143
Colorado	1.6	1.4	114
Connecticut	0.4	0.9	44
Delaware	0.1	0.3	33
District of Columbia	0.2	0.3	67
Florida	6.1	5.1	120
Georgia	2.2	2.2	100
Idaho	0.4	0.6	67
Illinois	2.4	4.4	55
Indiana	1.6	2.2	73
Iowa	0.9	1.2	75
Kansas	0.5	0.9	56
Kentucky	1.7	1.8	94
Louisiana	1.1	1.8	61
Maine	0.8	0.6	133
Maryland	2.2	2.6	85
Massachusetts	1.2	1.8	67
Michigan	2.6	4.0	65
Minnesota	1.6	2.1	76
Mississippi	0.9	1.0	90
Missouri	1.7	2.0	85

** Based on Screener data - Total Reusers Answering Screener (2,416)*

Appendix

% HOUSEHOLDS REUSING GRAYWATER BY STATE VS TOTAL US HOUSEHOLDS

	% of Households Reusing Graywater*	US Households	Indexed to US Households
	%	%	
Montana	0.2	0.4	50
Nebraska	0.8	0.7	114
Nevada	0.4	0.6	67
New Hampshire	0.5	0.4	125
New Jersey	1.8	2.6	69
New Mexico	0.9	0.5	180
New York	4.9	6.8	72
North Carolina	1.6	2.5	64
North Dakota	0.3	0.3	100
Ohio	4.0	4.6	87
Oklahoma	1.2	1.4	86
Oregon	1.6	1.6	100
Pennsylvania	7.9	6.2	127
Rhode Island	0.04	0.3	13
South Carolina	1.1	1.2	92
South Dakota	0.3	0.3	100
Tennessee	2.0	2.2	91
Texas	11	6.0	183
Utah	0.5	0.8	63
Vermont	0.2	0.2	100
Virginia	1.8	2.7	67
Washington	2.6	2.1	124
West Virginia	1.1	1.1	100
Wisconsin	2.4	2.8	86
Wyoming	0.2	0.2	100

** Based on Screener data - Total Reusers Answering Screener (2,416)*

Appendix

Figure 35

TOTAL GRAYWATER VOLUME/YEAR

US Households	X	Graywater Incidence	X	Volume Graywater Reused/Month	X	% Households Reusing Graywater Each Month		Total
98 Million		7%		188 gallons		Jan	0.57	735,117,600
						Feb	0.57	735,117,600
						Mar	0.63	812,498,400
						Apr	0.78	1,005,950,400
						May	0.87	1,122,021,600
						Jun	0.93	1,199,402,400
						Jul	0.95	1,225,196,000
						Aug	0.93	1,199,402,400
						Sep	0.88	1,134,918,400
						Oct	0.7	902,776,000
						Nov	0.58	748,014,400
						Dec	0.55	709,324,000
							TOTAL	**11,529,739,200**