



July 10, 2015

San Francisco Regional Water Quality Control Board
Attn: Mr. Dale Bowyer
1515 Clay Street, Ste. 1400
Oakland, CA 94612

Submitted via email: mrp.reissuance@waterboards.ca.gov

**Subject: Municipal Regional Stormwater Permit Reissuance
(May 11, 2015 Draft)**

Dear Mr. Bowyer:

These comments are submitted on behalf of the Partnership for Sound Science in Environmental Policy (“PSSEP”) on the proposed Municipal Regional Stormwater Permit Reissuance (May 11, 2015 Draft) (hereafter, “Draft MRP”). PSSEP is an association of municipal, industrial, and trade association entities in California whose members are regulated by the State and Regional Water Boards under their joint, Federal Clean Water Act and Porter-Cologne Water Quality Control Act authorities.

At the outset, we wish to acknowledge the work of Regional Board staff in developing the revised MRP as it relates to trash reduction in the region’s waters. PSSEP and its members support the Regional Board’s goal of reducing trash throughout the region’s waters, and we also appreciate the need to provide reasonable flexibility for local communities to comply with the new standards. PSSEP appreciates the opportunity to provide these comments on the Draft MRP.

As you know, PSSEP has been actively engaged over the past few years on the issue of trash reduction strategies presented on behalf of the Bay Area Municipal Separate Storm Sewer System (“MS⁴”) agencies. Our comments before the Regional Board have been consistent and focused: in order for MS⁴ agencies to claim “credit” for achieving trash reductions in their respective jurisdictions as a result of adopting ordinances that would ban certain products and packaging materials, the agencies should be required to affirmatively demonstrate specific reductions attributable to those ordinances. Similarly, where MS⁴ agencies seek credit toward their trash reduction obligations under the MRP for merely adopting product and packaging bans, they must affirmatively demonstrate that banning one type of product or packaging doesn’t result in a proliferation of *substitute litter* that takes its place.

1. Credits and “Offsets” for One-Off Product and Packaging Bans

Last year, at the State Water Board workshop on its proposed statewide Trash Policy, State Board Member Doduc asked for specific comments on whether “institutional controls” such as product bans are effective and can be relied on to meet the State Board’s proposed “zero trash” standard. The short answer is, “no.”

Product bans are “feel-good” measures that provide a misplaced – if not false - sense of security for communities feeling the ever-growing pressure of reducing trash loading to California’s waterways. As such, many cities in the Bay Area passed these product bans, yet there has been no empirical data to show that the volume of trash reaching Bay Area waterways has been reduced. In fact, the only known trash survey performed by a city both before and after the adoption of such product bans demonstrated that people simply discarded replacement products at or about the same rate as they did the banned products. (See, City of San Francisco Streets Litter Re-Audit, 2008. Prepared by HDR, Born, Vence & Associates, Inc., and MGM Management. July 4, 2008.)

The issue of “substitution litter” caused by banning one type of product or packaging material is one which the State Water Resources Control Board addressed in adopting its statewide Trash Policy earlier this year. Specifically, the State Water Board realized that adopting local ordinances that ban specific product or packaging frequently result in a substitute taking their place, which is just as likely to be discarded by the end-user, and find its way into the MS⁴ agencies’ stormwater. For this reason, the statewide Trash Policy adopted by the State Water Board just a few months ago ***rejected*** the notion of allowing credits or offsets to MS4 agencies that adopt such ordinances. (See, *Staff Report Including the Substitute Environmental Documentation, Amendments to the Statewide Water Quality Control Plans for the Ocean Waters of California to Control Trash and Part 1 Trash Provisions of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California*, March 26, 2015, at p. 171. (hereafter, “Statewide Trash Policy”))

The reality is: product bans have not been shown to result in measurable reductions in litter surveys. People who are prone to senselessly throw a polystyrene foam cup on the ground are equally likely to throw the replacement paper cup on the ground, and the same can be said for nearly any other product targeted for local bans. As long as there is a replacement for the banned product, logic dictates that it, too, will find its way into the state’s storm drains. For a more thorough technical analysis of why product bans are ineffective at reducing overall trash loading via storm drain runoff, we commend the work of Dr. Steven Stein of Environmental Resources Planning LLC,

detailed in the comments submitted by the American Chemistry Council on the proposed Trash Control Policy, and dated August 4, 2014. (Attached.)

While PSSEP takes no position on the appropriateness or advisability of individual cities and other jurisdictions adopting product bans on items such as plastic bags or polystyrene foam food containers, we continue to believe it's inappropriate for the Regional Board to provide regulatory incentives for MS⁴ agencies to adopt these types of "institutional" or source controls simply as a means of avoiding the costly installation and maintenance of full-capture structural controls. If individual cities and other MS⁴ agencies wish to adopt plastic bag and polystyrene foam food container bans, that is certainly their prerogative. But the Regional Board's MRP should neither suggest nor codify that these purely feel-good measures will achieve real reductions in trash found in our waterways.

2. The MRP's Reference to "Substantial Evidence" is Vague

We appreciate Regional Board staff's consideration of our previous comments on the propriety of granting credits to MS⁴ agencies who wish to claim "credits" toward their trash reduction goals by simply adopting product or packaging bans. We appreciate staff's efforts to both limit the availability of credits, as well as to require MS⁴ agencies claiming such credits to make an affirmative and verifiable demonstration that such "institutional controls" (like product and packaging bans) are actually reducing litter in a given jurisdiction. PSSEP believes this is a major improvement and supports staff's approach. Specifically, Provision C.10.b.iv of the Draft MRP provides that, in order to claim a load percentage reduction value, MS⁴ agencies "must provide substantial evidence that these actions reduce trash by the claimed value." (Draft MRP at p. C.10-5.)

While PSSEP supports this requirement of making an affirmative and verifiable demonstration that such "institutional controls" (like product and packaging bans) are actually reducing litter in a given jurisdiction, we believe the phrase "substantial evidence" is vague and confusing, and should be replaced with more appropriate language so that the MS⁴ agencies and the general public know what information must be produced to verify trash reductions. PSSEP suggests replacing the phrase, "substantial evidence" with something like, "substantive and credible information" to avoid confusion with an unrelated legal concept known as the "substantial evidence test."¹

¹ The substantial evidence test is a very deferential standard that applies to judicial review of certain agency actions. Under this standard, as long as the MS⁴ agencies submit "some evidence" that the product bans reduce trash, the Regional Board would arguably be forced to grant the credit. Even the "uncorroborated testimony of one witness" could constitute substantial evidence. (*Plastic Pipe & Fittings Assn. v. California*)

In sum, the Regional Board should revise Provision C.10.b.iv to make clear the following:

- Permittees must demonstrate that their baseline trash calculation methods - - as well as trash reduction calculation methods - - have been peer reviewed and are generally accepted in the field.
- Permittees must demonstrate that a proposed ban will result in net trash reduction, and that that merely banning one type of litter doesn't result in substitute litter taking its place.
- Permittees cannot meet their evidentiary burden merely by referencing studies in other jurisdictions.

3. Funding Structural Trash Capture Devices.

At the Regional Board workshop yesterday on the draft MRP, many comments were offered by various local elected officials and city staff about the unreasonable and exorbitant cost of installing and maintaining full-capture structural control devices. Several even cited the "near impossibility" of raising stormwater fees to pay for these full-capture devices due to Proposition 218 and the ability of local taxpayers to overturn any new fees.

There is little doubt that pervasive installation and adequate maintenance of full-capture structural devices throughout an MS⁴ agency's jurisdiction is the only reliable way to achieve the Regional Board's ultimate goal of "zero discharge" of trash in the region's waterways. Anyone familiar with the background and history of the State and Regional Water Boards' efforts to address trash discharges to California's waterways understands that the major impediment to achieving the "zero discharge" goal is finding adequate financial resources to enable local communities to install,

Building Standards Commission (2004) 124 Cal.App.4th 1390, 1407.) The Regional Board would be prohibited from weighing the available evidence. (*Laurel Heights Improvement Assn. v. Regents of University of California* (1988) 47 Cal.3d 376, 393.) And the Regional Board would be required to accept the MS⁴ agencies' argument that bans reduce trash even if "an opposite conclusion would have been equally or more reasonable." (*Id.*) The substantial evidence test doesn't belong in the MRP for several reasons.. First, it is inconsistent with the Porter-Cologne Act. Under the Porter Cologne Act, courts review permitting decisions by the Regional Board under the independent judgment standard. (Cal. Water Code § 13320(e).) Under this standard, the trier of fact (which is the Regional Board here) is required to weigh the evidence and uphold a decision only if it is supported by the weight of the evidence. (Cal. Code Civ. Proc. § 1094.5(c).) In other words, the trier of fact can uphold a decision only if the evidence shows that it is probably (more likely than not) correct. Applying the substantial evidence test here would clearly conflict with the Legislature's determination that permitting decisions under the Porter Cologne act must be supported the weight of the evidence. Second, the reason that Courts often review agency decisions under the substantial evidence test is that they lack the scientific and technical expertise to scrutinize factual disputes on technical issues. (*Laurel Heights Improvement Assn.*, 47 Cal.3d at 393.) But here, the Regional Board is well equipped to evaluate whether, and to what extent claimed by the MS⁴ agencies, specific product and packaging bans reduce trash.

operate and maintain structural trash capture devices. As such, PSSEP believes now is the time to become more creative in finding ways to identify local funding sources for California's MS⁴ agencies to meet this challenge.

According to the economic analysis prepared for the Statewide Trash Policy by the Office of Research, Planning and Performance (Appendix C to the Statewide Trash Policy), the average incremental cost to install and maintain full capture devices throughout California is **\$12.03 per person, per year – or about \$1 each month.** (See, Appendix C, Table 13 at p. C-24.)

Many local governments are understandably reluctant to impose new stormwater fees on their citizens for a variety of reasons. Chief among them may be concern that any new fees or taxes imposed could be subject to Propositions 218/26 challenges from ratepayers. Perhaps it is time to view this dilemma from a different perspective, and recognize that new local storm water fees are not needed.

Most local governments are familiar with garbage franchise agreements as a means of contracting for services provided to a community that achieve a common good. Why not consider using the garbage franchise agreement as a means of efficiently installing full capture devices, as well as contracting with the franchisees to maintain and clean-out the full capture devices on a routine basis? While many private garbage franchise companies may not currently have the expertise to provide these services, logic dictates that if there is profit to be made by expanding the services they offer to local communities, private garbage franchise companies will quickly develop the expertise. Further, the list of California-based companies that manufacture and provide maintenance services for full capture devices is growing steadily. Promoting partnerships among these companies, the garbage franchisees, and the MS⁴ agencies to identify creative financing mechanisms for installing and maintaining full capture devices could break the log-jam of historical reluctance on the part of MS⁴ agencies of pursuing full capture devices.

The benefits of combining storm drain trash control services with the typical garbage franchise contract are several. First, what is storm drain trash control if not quintessentially “garbage handling and removal”? By definition, installing the infrastructure for storm drain trash control – as well as maintaining them – would appropriately be considered within a garbage franchise agreement. Second, by including these services within a garbage franchise, the capital costs of the full capture devices can be appropriately amortized over several years, thus reducing what would otherwise be large, up-front costs to local MS⁴ agencies. Third, including these services within a garbage franchise would avert the need for local MS⁴ agencies to take-on large numbers of new employees to install and maintain the full capture systems. Fourth,

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garbage franchise fees are not subject to voter approval under Propositions 218 and 26 because they are not “incident to property ownership” – the test of whether a local government fee is subject to voter approval. Because Proposition 218 imposes no limit on private fees charged for services provided to a municipal government, the only limitation on the MS⁴ agency would be in properly negotiating the garbage franchise agreement terms.

At a minimum, the MRP should require Bay Area MS⁴ agencies to report annually on their **individual** efforts to either: (1) adopt new stormwater fees to fund full-capture structural controls, or (2) pursue other means of funding such structural controls, such as garbage franchise agreements noted above.

Thank you for the opportunity to provide these comments on the draft MRP.

Sincerely,



Craig S.J. Johns
Program Manager

Attachment:

“Technical Assessment Report: California Statewide Water Quality Control Plans to Control Trash – June 2014 Draft,”
ERP Planning. August 2014.

Technical Assessment Report

California Statewide Water Quality Control Plans to Control Trash – June 2014 Draft

Conducted for

American Chemistry Council

by

Environmental Resources Planning, LLC
Gaithersburg, MD

August 2014



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Acknowledgments

Thanks to the communities and study authors for providing copies of the cited litter surveys as well as details about the methodologies and findings of these studies. The litter surveys cited in this report can be obtained either online, through the communities for which they were conducted or from the study authors themselves. Citations for each survey are included in the References section of this report.



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Background

Littered items can easily find their way into stormwater systems. Rain can move these items into waterways causing aesthetic and functional issues.

California's State Water Resources Control Board and Regional Water Quality Control Boards (Water Boards) manage trash in stormwater primarily through Total Maximum Daily Loads (TMDLs) and permits.

The State Water Resources Control Board (State Water Board) has now proposed amendments to Statewide Water Quality Control Plans to Control Trash (Trash Amendments).

The provisions proposed in the Trash Amendments include six elements:

- (1) Water quality objective,
- (2) Prohibition of discharge,
- (3) Implementation provisions,
- (4) Time schedule,
- (5) Time extension options for State Water Board consideration, and
- (6) Monitoring and reporting requirements.

As proposed, the Trash Amendments would apply to all surface waters of the state, with the exception of waters under the jurisdiction of the Los Angeles Water Board that have trash TMDLs in effect prior to the effective date of the Trash Amendments.

Environmental Resources Planning, LLC (ER Planning), subject matter experts in the field of litter surveys and studies, conducted an evaluation of these documents at the request of the American Chemistry Council. ER Planning is the only private U.S. firm focusing exclusively on litter surveys and litter-related research studies. Field crews under our direction have surveyed more than 21 million square feet of roadways and recreational areas, including cities in California.

Although the time available to provide this analysis was limited, it is hoped that this examination of the Trash Amendments and the subsequent recommendations provided will be useful in helping stakeholders in California to craft programs that reduce the amount of litter and trash entering California stormwater systems and waterways more effectively.

Technical Assessment

Trash Characterization Methodologies

Litter can be measured by using weight, volume or counts. Counts can be either fresh litter counts or Visible Litter Survey tallies. Determining the most accurate and precise method of measuring litter and stormwater trash is of prime importance. An overview of each methodology is provided below.

1. Weight

Weight-based surveys require that all items are dried to the same level of moisture content to ensure consistency in weight measurements. Weights do not always reflect the offensiveness or impacts of littered items, nor do they lend themselves to baseline comparisons since advances in lighter packaging and thin-walling of products has been ongoing since the early 1990s. Weights are naturally biased toward heavier items such as metal construction debris and wood. Measuring litter accurately by weight has proven to be expensive for municipalities.

2. Volume

Volumetric surveys do not always account for the fact that the collection and removal of the components of litter tend to be similar and do not always correlate to size. Measuring litter accurately by volume has also proven to be inordinately expensive for municipalities.

Volumetric measures should also be avoided due to significant errors of accuracy measuring stormwater trash, as occurred with BASMAA in 2012 (Environmental Resources Planning, [ERP], 2012).¹

Caltrans has recognized that measuring materials by volume noticeably increased the proportion of lightweight materials due to material densities.

"Another observation is the increased proportion of styrofoam [sic] compared to weight, due to its low density, and the reverse trend for the dense moldable plastics." (Caltrans, 2000, p. 6-6)

In fact, this applies to all light, low-density components of litter and can be misleading when tallies are not also provided.

The Institute for Applied Research, a California firm that led more than 60 litter surveys, noted that volume is the least precise method of measuring litter.

¹ The contractor used by BASMAA characterized trash by placing items in buckets measured by fullness without accounting for air space. This significantly overstated the volume and percentage of light materials such as PS foam food ware items and PR Bags in stormwater trash (Cascadia Consulting, email communications, February 28-29, March 1, 2012).

"The standard deviation of repeated measurements of the same litter measured by volume is 21.2% compared to 3-6% for all other methods of litter measurement". (Institute for Applied Research [IAR], 2007)

While this variability can decline as sample sizes grow, it always tends to be greater than with item counts (IAR, 2007).

Reproducible Field Measurements of Trash Load Volume

If volume is used as a measurement tool, it should always be accompanied by a tally to confirm accurate measurement. In addition, volume should always be measured using natural density to ensure accurate measurement.

Natural density is another term for bank density, a concept that has been historically used in the construction and landfill industries. Natural density is a more descriptive and intuitive term for a concept that addresses the problem of accurately measuring the volume of lighter materials.

One landfill engineer used the following example. Soil in its natural state would weigh about 3,400 pounds per bank cubic yard. When soil is excavated, it is in a less dense state than it was in its bank condition and only would weigh about 2,800 pounds per loose cubic yard. Once soil has been compacted, such as when it has been prepared for use as a clay liner, it becomes much denser and would weigh about 4,100 pounds per compacted cubic yard (Bolton, 1998).

Our firm conducted a pilot test using 2-gallon buckets to illustrate how this concept would have affected the volumetric measure of plastic retail bags (PR bags).

Figure 1 shows that when measuring loose or uncompressed volume, two plastic bags could be deemed as filling the bucket. The firm that conducted the first measure of trash for BASMAA Permittees indicated that they used this method to determine trash volume, which significantly overstates the portion of litter attributable to PR bags.

Figure 2 shows that, by compacting these bags, as many as 50 plastic bags could fit in the same bucket. This would understate the portion of litter attributable to PR bags.

Figure 3 shows that, using the natural volume or bank density of these items, 10 plastic bags fit in the same bucket. Notice how intuitive this method is and how it yields an accurate measure that avoids the two errors of precision shown in Figures 1 and 2.

The natural state for lighter, low-density components of trash consists of placing these items into a bucket and stopping at the point that compacting would be required to add more items.

Figures 1-3: Reproducible Field Measurements of Trash Loads

Figure 1



**Loose
(2)**

Figure 2



**Compacted
(50)**

Figure 3



**Natural Density
(10)**

The characterization methodology used by BASMAA Permittees in 2012 measured volume by placing trash in buckets measured by fullness with no effort to address the significant amount of airspace present (Cascadia Consulting, email communications, February 28-29, March 1, 2012). This means the volume measured would have included a significant amount of air space that would cause the volumes and percentages of light materials such as polystyrene (PS) foam food service items and plastic bags to be overstated considerably. While in ER Planning's pilot, the volume would have been overstated by 500 percent, it is equally possible that, had there been just one loose bag counted, volume may have been overstated by 900 percent.

Others have documented the problems of trying to measure litter accurately and consistently using this type of methodology.

For example, when the Water Research Commission (WRC) of South Africa retained the Department of Civil Engineering at the University of Cape Town (UCT) to study the measurement of litter entering stormwater drainage systems, the study authors identified specific issues with the volume measurements of stormwater trash they observed (Marais).

1. The fullness of traps was inconsistently recorded.
2. The degree of fullness recorded was found in many cases to be almost completely arbitrary.
3. The volume derived from the degree of fullness of the trap was found to be an unreliable indicator of mass as the densities of the litter varied so widely.

Another pitfall of depending solely on volume measurements is that it creates a situation analogous to dead reckoning. The errors caused by allowing use of a flawed trash characterization methodology will be compounded if the State Water Board also allows Permittees to ban materials that are minute portions of litter. This will mislead Permittees into expecting significant reductions in litter that mathematically cannot occur from instituting such bans.

3. Fresh Litter Count

Fresh litter counts depend on collecting and bagging accumulated litter followed by a second survey which seeks to measure fresh litter that has accumulated over a given time period at each specific site. Without accounting for and differentiating the smaller sized items, the resulting data can be misleading. This method has also proved to be problematic as it cannot account for the inconsistent effect of winds, which can move littered items onto a site being surveyed from an area that was not being surveyed and had not been cleaned. Additionally, the level of winds in any given period of time may vary unpredictably, precluding the ability to produce credible data. This method requires two sets of surveys as well, usually 30 to 45 days apart, adding unnecessary project costs that are avoidable.

4. Visible Litter Survey (VLS)

The VLS methodology uses a stratified random site selection process that is scientifically rigorous and reproducible. Littered items are identified and counted, but are not physically removed from the sample site. Large items are tallied separately from small items. This methodology makes better use of Permittees' resources by not requiring a second survey.

When dealing with issues similar to those in California, the Anacostia Watershed Society in Washington, D.C. noted the importance of a visible tally of littered items to supplement other data measurements.

"The tally count is an important indicator of trash impairment and should be used in conjunction with the total score to assist in site comparisons."
(Anacostia, p.8-5)

The WRC study authors noted the value of tallying littered items.

"Litter counts do however give a better indication of the aesthetic impact of lighter materials such as plastic bags and packaging..." (Marais, 2003)

Trash Characterization Methodologies – Conclusion

VLS tallies have emerged as the de facto standard in California and across the U.S. and Canada. Keep America Beautiful utilized this method for their National Litter Survey (Keep America Beautiful [KAB], 2009). The State of Florida conducted six litter surveys between 1994 and 2001, all of them using the VLS methodology (Florida, 2002, p.10).

Every private firm whose work focuses on conducting litter surveys uses VLS tallies to do so, as did the Cities of San Francisco (2007, 2008 and 2009) and San Jose (2008 and 2009). This survey methodology, selected and used by California’s own cities, is the only standard universally recognized by experts in this field.

Major Components of San Francisco Litter: 2007-2009

Table 1 shows the top 15 components of San Francisco litter by count as listed in Table 9 of the 2009 San Francisco Litter Survey. Neither PR bags nor PS foam cups were in the top 15 components of San Francisco litter (HDR, 2009).

Table 1 – Components of San Francisco Litter: 2007-2009

#	Large Litter	2009	2008	2007
1	Misc. Paper	552.5	317	570
2	No Brand Name Towels / Napkins	438.5	664	494.5
3	Printed material (newspapers, flyers, books etc.)	373.5	380	287
4	Misc. Plastic	219	185.5	342
5	Candy bar wraps	203	100	152
6	Tobacco other (packs, matches, cellophane)	177	144	109
7	Construction debris	169.5	102.5	31.5
8	Receipts (business forms, bus transfers, etc.)	167	166.5	203
9	Cup Lids, Pieces lids	160.5	96	100.5
10	Home Articles	151	127.5	145
11	Paper Food Wrap	122	51	32.5
12	Plastic packaging other	111.5	55.5	27.5
13	Gum wrappers	105.5	131	32
14	Foil materials / foil pieces	95.5	55.5	104.5
15	Paper Cups (Hot)	87	56.5	36

PS Foam Food Service Products in Litter

This section examines all litter surveys conducted in North America since 2000 that separately tallied PS foam food service products to determine the extent to which they are found in litter. Surveys included in this review met the following criteria:

1. Statistically-based quantification and characterization methodologies were used.
2. PS foam food service product components were specifically quantified.
3. Only surveys using VLS tallies were included to ensure comparability of results. The results from other studies are discussed separately.
4. Only surveys conducted since 2000 were included to ensure that the data evaluated is relevant.²

Table 2 – PS Foam Food Service Products in Large Litter

Survey	Year	Percent
Rhode Island	2014	1.7%
Edmonton	2013	0.8%
Texas	2013	2.8%
Toronto	2012	1.1%
Edmonton	2012	1.1%
Edmonton	2011	0.1%
Edmonton	2010	0.7%
Alberta	2009	0.7%
San Jose	2008	0.8%
Edmonton	2009	0.2%
KAB National	2009	1.7%
San Francisco	2008	1.1%
San Jose	2008	0.8%
San Francisco	2007	1.7%
Edmonton	2007	0.4%
Alberta	2007	1.1%
Toronto	2006	1.1%
Toronto	2004	1.0%
Peel	2003	0.5%
Durham	2003	0.6%
York	2003	0.3%
Toronto	2002	1.5%
Florida	2002	2.3%
Florida	2001	2.2%
Median Value		1.1%

² The 1980-81 California Litter Survey is referenced in the "Other Pertinent Litter Surveys" section since it represents the first statistically-based litter survey that tallied what it termed as "Styrofoam" items in California litter statewide.

Table 2 shows each of the 24 litter surveys evaluated by year and the percentage of items identified as PS foam food service products in large litter. These items were rarely observed in small litter, as discussed later in this report. The studies consistently show that PS foam food service products make up a small fraction of litter.

The 2009 KAB National Litter Survey characterized and quantified roadside litter on 288 sites nationwide using 65 separate categories. This survey concluded that all PS foam food service products constituted just 0.6 percent of roadside litter nationwide (KAB, 2009).

Street litter audits conducted in San Francisco showed that PS foam food service products constituted just 1.7 percent of large litter in 2007 (HDR, 2007) and just 1.1 percent in 2008 (HDR, 2008). Those items were not identified as components of small litter.

The most recent comprehensive street litter audit of Toronto in 2012 surveyed 298 randomly selected sites and showed that PS foam food service products constituted just 1.1 percent of large litter (ERP, 2012).

A comprehensive statewide roadside litter study, funded by Florida Department of Environmental Protection, was conducted using 670 randomly selected sites in Florida and showed that all PS foam food service products constituted only 2.3 percent of litter in 2002 (Florida, 2002) and just 2.2% in 2001 (Florida, 2001). Those items were not identified as components of small litter.

PS Foam Food Service Products in Large Litter - Conclusion

Since the data in Table 2 consists of percentages from surveys representing a variety of population sizes and areas, the median is the appropriate measure for determining an average value. For the 24 VLS studies included, the median percentage of PS foam food service products in litter is 1.1 percent. Additional studies come to the same conclusion and are discussed below.

Ocean Conservancy – PS Food Service Items in Beach Litter

Ocean Conservancy sponsors beach cleanup days throughout the U.S. and internationally each year. Based on data from 2,609 U.S. sites surveyed in 44 states in 2013, PS food service items comprised 2.1 percent of all U.S. beach litter (Ocean Conservancy, 2014).

Other Pertinent Litter Studies

Other statistically based litter surveys quantified PS foam products in general, while not specifically identifying the food service portion. While these surveys are not directly comparable to those that broke out the food service portion, they still indicate that PS foam products in general comprise a small portion of litter. Therefore, by extension, the food service portion comprises even less.

2010 Northeast Litter Survey

The 2010 Northeast Litter Survey consisted of three separate and comprehensive statewide litter surveys conducted in Maine, New Hampshire and Vermont. A total of 288 sites were surveyed. All types of PS foam products were tallied, including food service products and packaging. Items specifically tracked included packaging peanuts and blocks; beverage cups, clamshells and plates; ice chests and other food insulating products; construction-related insulation sheets and pieces from retail, commercial and industrial sources.

The percentage of all PS foam products as components of litter in each state was identified:

- Maine: 1.3 percent
- New Hampshire: 1.4 percent
- Vermont: 1.5 percent (ERP 2010)

California 1980-81 Litter Survey

California's 1980-81 litter survey provides important insights into the contribution of PS foam materials to the litter stream in California over time. The California State Solid Waste Management Board underwrote the survey, which was led by Dr. Bruce Bechtol and Dr. Jerry Williams, Professors of Geography at California State University in Chico.

One-third of sites were monitored for large items only. The remaining sites were audited for all litter items larger than one square centimeter in size and formed the basis of litter composition in California. That study characterized PS food service and packaging items together and showed that all of these items, which it termed "Styrofoam", comprised between 2.1 percent and 2.6 percent of all litter (California Geographical Society, 1984).

PS Food Service Items in Litter - Survey Notes

Florida's litter surveys included a separate category for miscellaneous PS foam in large litter. The survey author noted that these items were chunks of PS, not food service items, which were categorized separately (John Schert, personal communications, 2012).

"Other PS Pieces", a minor portion of small litter, consisted primarily of broken pieces of items such as packaging materials or ice chest lids (Personal communications with John Schert, 2012), although it may have also included some pieces of PS foam food service products (Emy Mendoza/San Jose and Allan Mazur/Toronto, personal communications, 2012).

Toronto's 2004 survey noted that small litter is manufactured, in part, by mowing along roadsides before litter is removed, turning several larger pieces of litter into numerous small pieces (Toronto, 2004).

The 2010 Northeast Litter Survey, which surveyed all expanded PS products (packaging and food service) together, made similar observations (ERP, 2010). Thus, cleaning up litter before mowing can significantly reduce the amount of floatable items in litter.

Since the percentage of PS foam food service products in litter is low, the considerable time and financial resources expended to pursue this control measure is unlikely to achieve significant reductions of materials since they are not likely to exist at the levels implied.



ERP PLANNING

PR Bags in Litter

PR Bag Data in Statewide and Citywide Litter Surveys

Statewide litter surveys that characterize litter using statistically based sampling methodologies consistently show that PR bags constitute a small portion of litter. This section relies on the same litter surveys and criteria as the PS foam food service section above.

Table 3 – PR Bags in Large Litter

<i>Study</i>	<i>Year</i>	<i>Percent</i>
Rhode Island	2014	0.5%
Edmonton	2013	0.0%
Texas	2013	2.0%
Toronto	2012	0.8%
Edmonton	2012	0.3%
Edmonton	2011	1.1%
Edmonton	2010	0.5%
Alberta	2009	0.0%
San Francisco	2009	1.5%
Edmonton	2009	0.3%
KAB National	2009	0.6%
San Francisco	2008	0.6%
San Jose	2008	0.4%
San Francisco	2007	0.6%
Edmonton	2007	0.4%
Alberta	2007	2.0%
Toronto	2006	0.1%
Toronto	2004	0.2%
Peel	2003	0.1%
Durham	2003	0.3%
York	2003	0.4%
Toronto	2002	0.6%
Florida	2002	0.5%
Florida	2001	0.7%
Median Value		0.5%

Table 3 shows each of the 24 litter surveys evaluated by year and the percentage of items identified as PR bags in large litter, typically less than 1.0 percent.

The 2009 KAB National Litter Survey characterized and quantified roadside litter on 288 sites nationwide using 65 separate categories. This survey concluded that all type of plastic bags constituted just 0.6 percent of roadside litter nationwide (KAB, 2009).

Percentages for categories such as plastic bags of all types constituted such a minute portion of roadside litter that they were not specifically addressed in the survey report.

Comprehensive citywide street litter audits were conducted in San Francisco before and after *PR Bag* use had been banned by the City at certain retail merchants. These surveys showed that PR grocery bags constituted only 0.59 percent of litter in 2007 (HDR, 2007) and 0.64 percent in 2008 (HDR, 2008). The percentage of PR grocery bags in litter actually increased slightly after the ban had been put into effect.

A comprehensive street litter audit conducted using 298 randomly selected survey sites in Toronto showed that PR grocery bags constituted only 0.1 percent of litter (MGM, 2006).

A comprehensive statewide roadside litter study, funded by Florida Department of Environmental Protection, was conducted using 670 randomly selected sites in Florida and showed that PR grocery bags constituted only 0.7 percent of litter in 2001 and just 0.5 percent of litter in 2002 (Florida, 2002). Similar surveys had been conducted in Florida in 1994, 1995, 1996 and 1997. In each of those years, PR bags constituted less than 1.0 percent of litter (Florida, 2002).

Litter surveys showing unusually high rates of littered items such as PR bags tend to be conducted by volunteers rather than professional staff. These surveys typically lacked stratified random sampling and standard statistical methods. At times, material categories were not consistent. While such studies have helped create the awareness of litter's impacts, their limitations have, in some cases, resulted in erroneous depictions of PR bags as a significant component of the overall litter stream.

Ocean Conservancy – PR Grocery Bags in Beach Litter

Ocean Conservancy sponsors beach cleanup days throughout the U.S. and internationally each year. For the first time, PR grocery bags were tallied separately in 2013. Based on data from 2,609 U.S. sites surveyed in 44 states, PR grocery bags comprised 2.1 percent of all U.S. beach litter (Ocean Conservancy, 2014).

For 35 of the 44 states, PR grocery bags comprised 2.9 percent or less. For 25 of the 44 states, plastic grocery bags comprised 1.9 percent or less (Nicholas Mallos, email communications, June 10, 2014) including California (1.7 percent), Oregon (1.4 percent) and Washington (0.9 percent).

Other states also showing that PR grocery bags comprised 1.9 percent or less of litter include: Alaska, Colorado, Connecticut, Delaware, Georgia, Hawaii, Kentucky, Maine, Massachusetts, Mississippi, New Hampshire, Nevada, Pennsylvania, Rhode Island, South Carolina, South Dakota, Texas, Vermont and Wisconsin (Nicholas Mallos, Personal communication, June 10, 2014).

PR Bags in Large Litter – Conclusion

Since the percentage of single-use plastic bags in litter is low, the considerable time and financial resources expended to pursue bans of this material as a regulatory source control will not achieve significant reductions of litter in large part because the litter surveys by California’s own cities have proven that these items do not exist at the levels implied.



ER PLANNING

ER Planning 2013 Paper and Plastic Bag Litter Study

Characterization of All Plastic Bags in Litter

To accurately determine the types of plastic and paper bags found in litter, ER Planning conducted three separate citywide litter surveys between December 2011 and January 2012 in two California cities (Oakland and San Francisco) and in Washington, D.C. Each of these cities has taken a different approach to managing bag litter.

Field crews physically surveyed 180 sites (60 in each city), covering a total of 6.48 million square feet. In each city, field crews collected data for all types of plastic and paper bags including the source (e.g., convenience store) and brand label on each bag found in litter.

PR bags from grocery stores, pharmacies, convenience stores and take-out food outlets were each categorized separately. PR bags from all other retail stores such as Dollar Tree and Home Depot were categorized as *Other Retail Bags*.

Plastic bags were characterized by type, noting the source. Following discussions with the City of San Francisco Public Works and Environmental Health Departments, the following five guidelines were used:

1. Full and Properly Secured Trash Bags

Some full trash bags were properly tied. While they may not have met the requirement for a proper trash set-out, they were not deemed to have been littered and were excluded from this tally for that reason.

2. Empty Trash Bags

Empty or near-empty bags were deemed to have been littered since none of them were observed to be part of, or in close proximity to, a bona fide trash set-out. In addition, most of them were at least partially opened and/or seemed to have been blown about.

3. Partially Open Trash Bags

Several trash bags observed were open and had created litter. Field crews observed bags blowing about from similar set-outs. Thus, these bags were counted as litter.

4. Improperly Secured Trash Bags

In other cases, plastic bags filled with trash were left open and the contents were falling or blowing out, which created more litter. The bags themselves were not considered litter as they were substantially filled. However, if not collected and disposed of properly, they would continue to produce litter. In addition, they could very well become litter themselves, but had not done so yet. Inappropriate trash set-outs are a known cause of negligent litter.

5. Loose Trash Bags

Other bags, however, were carelessly set out in a manner that created opportunities for wind-blown litter, but were not littered yet. Other items from these set-outs had already become and were counted as litter.

Plastic Bags in Litter by Source and Type

Table 4 shows that sandwich bags were the most littered type of plastic bag in San Francisco (43 percent), while plastic bags from Other Retail stores were the highest in D.C. (24 percent) and Oakland (34 percent). Full and empty trash bags were a noticeable portion of littered plastic bags in all three cities (38 percent in San Francisco, 26 percent in D.C. and 12 percent in Oakland), averaging 19 percent overall.

Table 4 – All Littered Plastic Bags by Source and Type

Category	SF	DC	Oak	All
Trash - Full	18%	14%	7%	10%
Trash - Empty	20%	12%	5%	9%
Grocery	2%	10%	4%	5%
Other Retail	8%	24%	34%	29%
Pharmacy	0%	2%	4%	3%
Conv. Store	0%	5%	8%	7%
Take-out Food	8%	11%	6%	7%
Sandwich	43%	0%	6%	9%
Bulk Food	0%	22%	24%	21%
Subtotal	100%	100%	100%	100%

PR Bags in Litter – Branded and Unbranded

Some communities have chosen to exempt smaller and independent stores when crafting ordinances restricting the use of PR bags. The high percentage of unbranded PR bags observed in all three cities surveyed suggests that smaller, independent stores are the likely source for a significant number of these bags. Unbranded or “Thank You” bags are frequently used by smaller stores. Most large chains use bags with their logos.

Table 5 shows the percentage of PR bags in each city that were unbranded. The highest percentage of unbranded PR bags was observed in San Francisco (78 percent). Approximately half of the PR bags littered in Oakland (50 percent) and Washington D.C. (49 percent) were unbranded.

Cities that implement bag ordinances while exempting independent stores do so at their own peril, since more than half of all PR bags surveyed in these three cities represented bags used by independent stores (unbranded).

Table 5 – Unbranded PR Bags in Litter

City	Unbranded PR Bags	All PR Bags	Percent Unbranded
Oakland	75	149	50%
San Francisco	7	9	78%
Washington, D.C.	24	49	49%
All Cities	106	207	51%



ER PLANNING

Material Bans

The State Water Board notes that California communities have implemented numerous local ordinances banning certain consumer products, implying that those ordinances are effective in reducing overall littering in California (State Water Board [SWB], p. 7). The State Water Board goes further to specifically encourage bans of single-use carryout bags and PS foam food service products (SWB, p. 16) and highlights these bans throughout the document without providing any evidence that these bans are effective in reducing litter (SWB, p. 79).

The State Water Board even proposes to extend the compliance deadlines for Permittees who put these product bans in place (SWB, p. 158) as though material bans will automatically reduce litter effectively when all evidence from litter surveys conducted by California cities clearly prove that these bans have not reduced overall litter.

The State Water Board notes that the City of San Francisco banned the use of single-use plastic bags in grocery stores and pharmacies in 2006 (SWB, p. A-18). The City of San Francisco conducted three statistically-based litter surveys in 2007, 2008 and 2009. These surveys showed that PR bags and PS food service products were insignificant portions of litter. The City of San Jose conducted a statistically-based litter survey in 2008 and the results were virtually identical to those conducted in San Francisco.

No statistically-credible visible litter survey ever conducted in California or anywhere else supports the notion that material bans reduce overall litter.³

In fact, statistically-based surveys that have been conducted by cities in California prove precisely the opposite and prove two facts clearly:

1. PR bags and PS food service products are both insignificant portions of litter in these California cities, and
2. Material bans have never been shown to reduce overall litter.

Regarding the effect of San Francisco's ban on single-use plastic bags, "the city hasn't collected any litter data since the 2009 survey", according to Guillermo Rodriguez, a spokesman for the city's environment department (Santa Cruz, 2013). However, surveys conducted in 2008 and 2009 had shown no change in response to the ban.

³ A San Jose memorandum implied that single-use plastic bags in the City's litter was reduced since the City's ban went into effect, citing post-ordinance data apparently collected by city staff in 2012. But their post-ordinance study only surveyed 31 sites, while the pre-ordinance study surveyed 107 sites (San Jose, 2012). Thus, results from these two surveys are not statistically comparable. San Jose further estimated an 11.9 percent reduction in stormwater trash and attributed this estimate solely to the City's ban on single-use plastic bags (San Jose, 2012b, p. 10-7), but the City's data used the flawed BASMAA trash characterization (San Jose, 2012a, p.5) and significantly overstated the volume of single-use plastic bags in its stormwater trash.

"San Francisco's ban effected no measurable change in plastic bag litter, at least in the first two years." (Santa Cruz, 2013)

The State Water Board admits that product bans simply change the type of litter and that San Francisco's litter surveys showed "no overall reduction in litter (or trash to the waterways)" (SWB, p. A-18). It goes on to admit that such bans could double the amount of greenhouse gas emissions, double energy use and quadruple the amount of waste caused by material substitutions (SWB, p. A-18).

Oddly, the State Water Board cites a University of California study and notes that

"Similarly, bans on polystyrene food containers would cause a shift to materials with other significant environmental impacts." (University of California at San Diego [UC-SD], 2006)

In fact, the University of California study goes on to state that:

"...Styrofoam cups are better than paper from an environmental standpoint..." (UC-SD, 2006)

Yet, despite acknowledging these risks and the significant environmental impacts they will likely have, the State Water Board proposes to encourage Permittees to enact these ineffective ordinances. The State Water Board should be able to reasonably foresee that material bans are an ineffective method of compliance.

ER PLANNING

Analysis of Litter Rates and Material Bans in Place

A statistical analysis of BASMAA’s 2012 trash characterization showed that city bans on plastic grocery bags and PS foam food and beverage (F&B) products had statistically insignificant effects on the volume of PS foam F&B products in stormwater trash (ERP, 2012).

In these tables, sample size refers to the number of sites where trash was counted. The mean values represent the average amount, in gallons, of plastic grocery bags or PS foam F&B found at these sites measured in gallons without accounting for air space (i.e. uncompressed volumes) (ERP, 2012).

As shown in Table 6, the average volume of plastic grocery bags was only slightly lower where a city ban existed (0.14 gallons) than where one did not exist (0.19 gallons), and this difference was statistically insignificant.

The same was true for PS foam F&B, where the values were even closer (0.1 gallons where a ban existed and 0.15 gallons where no ban existed).⁴

If material bans had been effective, these values would have been much further apart.

Table 6 – Statistical Analysis: City Bans vs. No Bans

Value	Plastic Grocery Bags		PS Foam F&B	
	Yes	No	Yes	No
Sample Size (# of Sites)	110	105	110	105
Mean Value (gallons)	0.14	0.19	0.14	0.19

High Litter Rates in Cities with Bans in Place

Some of the sites with the highest volumes of plastic grocery bags and PS FF&B products were in cities that had bans of these items in place at the time that BASMAA’s trash characterizations were conducted.

As shown in Table 7, half of the six sites with the highest volumes of PS FF&B products in litter had citywide bans in place at the time these characterizations were conducted.

⁴ The highest trash volume, found on site RI01, was 42.84 gallons, while the second highest trash volume, found on site SP01 was only 18.27. Thus, site RI01 constituted an extreme outlier and, in accordance with good statistical practice, was excluded from the analysis.

Table 7 – High Litter Volumes with City Bans – PS Foam F&B Products

#	BASMAA Site ID	PS Foam F&B (gallons)	City	County	PS Foam F&B Ban (y/n)
1	RI01	3.56	Richmond	Contra Costa	y
2	SM07	1.67	San Mateo	San Mateo	
3	RI03	1.33	Richmond	Contra Costa	y
4	SL25	1.22	San Leandro	Alameda	
5	BR04	1.00	Brentwood	Contra Costa	
6	OK02	1.00	Oakland	Alameda	y

Similarly, as shown in Table 8, half of the six sites with the highest volumes (measured in gallons) of PR bags in litter also had citywide bans in place at the time these characterizations were conducted. These sites showed no relationship between the litter rates of PR bags or PS foam food service products and citywide bans that had been put into effect.

Table 8 – High Litter Volumes with City Bans – Plastic Grocery Bags

#	BASMAA Site ID	Plastic Grocery Bags (gallons)	City	County	Plastic Grocery Bag Ban (y/n)
1	RI01	4.00	Richmond	Contra Costa	y
2	SM12	1.33	San Mateo	San Mateo	
3	SP01	1.11	San Pablo	Contra Costa	y
4	SJ08	1.11	San Jose	Santa Clara	
5	SJ22	1.11	San Jose	Santa Clara	
6	SJ38	1.11	San Jose	Santa Clara	y

Substitution Effect

Since littering is a behavioral based problem, banning one material only means that another material will be used instead, but the littering problem is unaffected. This is clearly shown in litter survey data from three comprehensive litter surveys conducted in San Francisco (2007-2009).

PS food service items were banned by a November 2006 ordinance that took effect in June 2007. Since the 2007 field survey was conducted in April 2007, before the ban became effective since and trash accumulates over time, the 2007 data fairly represents pre-ban conditions.

Notice in each of the categories that litter was not reduced following the ordinance. In fact, litter for each category of food service item actually increased noticeably.

PS Foam Food Service Items and Substituted Materials

Table 9 summarizes the impact of substituting other materials for PS food service items by count. While the number of PS components was reduced by 30 percent, the number of paper components increased by 163 percent and the number of items made of other materials or other plastics increased by 253 percent.

Overall, the ban on PS food service items corresponded to an increase of 59 percent in the number of littered food service items as shown in Table 9.

Table 9 – PS Foam Food Service Items in San Francisco Litter

Littered Food Service Items	2007	2008	2009	Change	% Change
Polystyrene	67.5	45	47	-20.5	-30%
Paper	44.5	73.5	117	72.5	163%
Other Plastics/Other Materials	7.5	20	26.5	19	253%
Total	119.5	138.5	190.5	71	59%

PS Foam and Substituted Materials – Hot Beverage Cups

While the number of littered PS hot beverage cups was reduced by 36 percent, the number of littered paper hot beverage cups increased by 142 percent resulting in an overall increase of 45 percent in all littered hot beverage cups as shown in Table 10.

Table 10 – Hot Beverage Cups in San Francisco Litter

Littered Hot Cups	2007	2008	2009	Change	% Change
Polystyrene cups (foam)	43	31	27.5	-15.5	-36%
Paper Cups (Hot)	36	56.5	87	51	142%
Total	79	87.5	114.5	35.5	45%

The amount of fast food plates, clamshells and trays tallied were too small to analyze meaningfully by component.

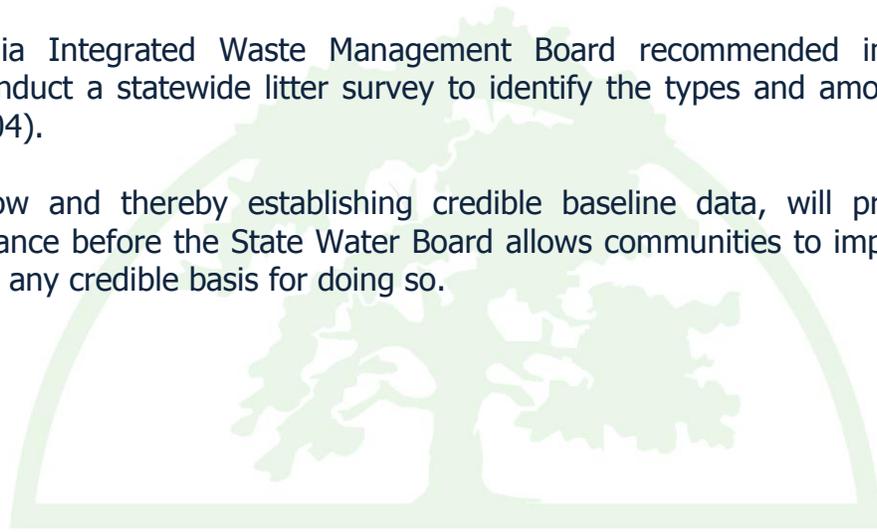
Material Bans - Conclusion

If the State Water Board decides to allow material bans, despite the clear evidence that they are not effective in reducing overall litter, then such material bans should require rigorous demonstration, monitoring, and testing to assess whether the bans are effective at all in reducing litter.

Permittees must provide annual reports to their Water Board demonstrating, through the use of statistically credible surveys, that any material bans put in place have resulted in an actual net reduction of overall litter and stormwater trash.

The California Integrated Waste Management Board recommended in 2004 that California conduct a statewide litter survey to identify the types and amounts of litter (CIWMB, 2004).

Doing so now and thereby establishing credible baseline data, will provide sorely needed guidance before the State Water Board allows communities to impose material bans without any credible basis for doing so.



ER PLANNING

Compliance Monitoring

Proposed Tracks

Track 1 provides a clear trash abatement strategy requiring the use of full-capture systems, which have proven very effective in Los Angeles. Although it is clear and unambiguous, it demands full reporting by Permittees.

Track 2 is much more ambiguous, allowing Permittees to propose various regulatory controls, including material bans that have never been proven to effectively reduce litter. Despite the risk-laden and unstructured approach, there is no specific monitoring or testing required - only vague direction that Permittee demonstrate that its approach is effective.

Track 2 should require much stricter and more extensive monitoring, testing and reporting than Track 1 simply because Track 2 is innately ambiguous and therefore vulnerable to deficiencies and limitations that would not be present with Track 1.

How could compliance be credibly determined? Using the combination of controls described in the Trash Amendments would require more complex monitoring and more rigorous reporting than Track 1, rather than less.

If the State Water Board decides to go further and allow the use of material bans as an institutional control, then the Board must require Permittees to put a rigorous monitoring system in place to ensure that Permittees are achieving the mandated trash reduction and that those reductions are attributable to the material bans.

Such a monitoring system would be based on special surveys that would be conducted on an annual basis by independent third party professional firms with significant expertise in litter and/or stormwater trash. These firms should be selected by the State Water Board. The litter and/or stormwater surveys should utilize the methodology employed by both San Francisco (2007-2009) and San Jose (2008) with a similar reporting format to provide consistency.

In addition, if multiple controls are put in place such as material bans and enhanced street sweeping, Permittees must validate the effectiveness of each control and to help determine which components of their controls are driving any changes in the system. This would require a characterization and quantification survey of the materials captured by street sweeping equipment.

This will help the State Water Board and the Permittees ensure the credible data monitoring and reporting that Track 2, by its very nature, requires. To do less would constitute an abdication of responsibility on the part of the State Water Board and a failure to provide the guidance needed that will lead to the abatement of litter entering stormwater systems.

Los Angeles Exemption

The Trash Amendments propose to exempt waters within the jurisdiction of the Los Angeles Water Board (LAWB). LAWB adopted fifteen TMDLs with a numeric target of zero trash (SWB, p.22).

The LAWB has put significant controls in place using a clear strategy that has already proven to be extremely effective achieving a 90 percent reduction in trash well ahead of schedule.

As of March 2012, the City has retrofitted 22,133 catch basins with trash capture or deflecting devices in the Los Angeles River Watershed as well as three netting systems certified as full capture devices have been installed strategically in the Watershed. With these structural devices alone, the City has reduced its trash discharge to the Los Angeles River by approximately 90%, several years ahead of the final TMDL compliance milestone (Los Angeles, 2012).

The successful trash reductions in Los Angeles demonstrate that full-capture structural controls are a proven method of significantly reducing trash discharges.



ER PLANNING

Other Institutional Controls

Certain aspects of the proposed Trash Amendments will help California communities address litter and stormwater trash more effectively.

High Density Generation Areas

The focus of efforts on high-density generation areas will help Permittees to apply their funding to areas that are most problematic and will likely provide the best opportunity to reduce littering efficiently and make the best use of their funding.

Anti-Littering and Illegal Dumping Enforcement

Enforcement of anti-littering and illegal dumping ordinances is a significant key to reducing litter. For example, States and communities can impose fines for vehicles traveling with untarped loads. Solid waste management facilities can also add surcharges for untarped loads.

Both of these strategies can help achieve significant reductions in litter. The State Water Board should encourage its communities and Permittees to enact and enforce such discharge-focused ordinances which direct their efforts to the specific sources of litter that each community seeks to reduce.

In an effort to reduce littering from untarped vehicle loads, waste management facilities in New York State institute surcharges for untarped vehicles. In addition, drivers are subject to fines of up to \$1,000 by the New York State Department of Environmental Conservation for these violations. This best management practice can help reduce this source of litter.

George L. Kelling, Professor in the School of Criminal Justice at Rutgers University and a Research Fellow in the Kennedy School of Government at Harvard University, called attention to importance of enforcement with his landmark *Broken Windows* theory (Kelling, 1996).

Kelling was able to prove the correlation between enforcement and reductions in crime under the auspices of the Manhattan Institute (Sousa and Kelling, 2002). Kelling later applied that theory to the importance of enforcing anti-littering ordinances (Kelling, 2006).

An ongoing challenge of litter reduction strategies is the perceived reluctance of enforcement officials and courts to consider litter offenses a priority. Enforcement officers are tasked with significant responsibilities and littering is not commonly observed. However, when officers do observe littering, having programs and training in place can benefit enforcement officials.

In a speech given at the 2006 Governor's Litter Summit in Georgia, Kelling noted that people who commit offenses such as jumping subway turnstiles and littering have a higher than average rate of outstanding warrants. Thus, enforcement of anti-littering ordinances can provide useful tools to enforcement officers.

In a 1971 survey of 1,035 police departments across the U.S., 86 percent believed that enforcement could be effective if enforcement agencies and courts were trained on the implications of litter in their communities.

This sentiment was echoed in 2006 at Georgia's litter summit. When implemented with public education and cleanup efforts, enforcement can serve as an effective tool. Sentencing offenders to clean up litter was recommended.

Effective enforcement cannot be dependent on signs alone. Anti-litter signage without enforcement can result in higher litter rates as it tends to empower violators, sending a message that a community is powerless to control littering (KAB, 2007).

One factor in successful enforcement is the use of courts specifically designed to handle environmental offenses. The City of Memphis and Shelby County, TN is considered to be the national leader in the environmental court movement. The court handles caseloads relating to illegal dumping, littering and other environmental property issues, that might have otherwise fallen thru the cracks of the criminal justice system. This type of court is more supportive of environmental crimes and has higher conviction rates. More than 70 similar courts have been put in place nationwide (US Conference of Mayors, 1999).

The California Integrated Waste Management Board (CIWMB) recommended elevating littering to a civil offense:

"The Legislature should consider making litter a civil offense, to facilitate issuing litter tickets. Legislation could authorize financial incentives, perhaps from proceeds of violation tickets, to individuals and/or organizations that identify violators with appropriate proof (such as videotape or witness testimony) that results in tickets being issued." (CIWMB, 2004)

Improved Trash Bin/Container Management

The effectiveness of improved trash receptacles was proven in several studies conducted by William C. Finnie, Ph.D. One study, testing the effect of decorated litter receptacles placed on each block of an urban area in Richmond, VA, found that litter was reduced by a statistically significant 16.7 percent (Finnie, 1973). A similar study of attractive receptacles in St. Louis found that liter was reduced by 14.7 percent (Finnie, 1973).

Finnie also found that conspicuously decorated trash receptacles at rest areas along highways reduced litter by 28.6 percent and that these reductions were apparent six miles from the receptacles. Similar results were obtained in subsequent studies by Dr. Scott Geller (Geller, 1982) as well as Cone and Hayes (Cone and Hayes, 1980).

Appropriately placed litter receptacles in commercial and public areas can also reduce littering rates. The City of Long Beach, CA used strategically placed receptacles to reduce litter in storm-water runoff. Receptacles were placed in business areas, bus stop and recreational areas (Long Beach, 2001).

According to the City's Storm Water Management Program Manual, approximately 1,000 litter receptacles were placed along public street frontage and serviced at least once per week. The city also placed approximately 2,100 litter receptacles in recreational areas and ensured that they were serviced regularly (Long Beach, 2001).

For litter receptacles to effectively reduce litter, internal municipal procedures must clearly ensure they are maintained in a timely manner. Since properly maintaining and emptying trash and litter receptacles can be time-consuming and expensive, public/private partnerships can help to alleviate these costs, provided there is proper oversight by the local government.

Overfilled receptacles that are not properly maintained create precisely the type of litter that is likely to enter stormwater systems.

Enhanced Street Sweeping in HD Areas

Focusing more extensive street sweeping efforts on high-density generation areas can help reduce litter entering stormwater systems.

"Frequent street cleaning can dramatically reduce the quantity of street litter reaching the drainage system – even where there is a generally adequate refuse removal service" (Armitage, 2001).

A New York City study of street cleaning practices found that augmenting baseline street cleaning (mechanical sweeps twice per week) with manual sweeping of each block face once per day, six days a week reduced floatable litter 42 percent by count, 51 percent by volume and 64 percent by weight (HydroQual, 1996). Swedish scientists, evaluating the efficacy of street sweeping, found that the optimal efficiency was achieved by sweeping twice per week (German and Svensson, 2001).

Enhanced street cleaning should be implemented regardless of other reduction measures used since it can reduce the required maintenance of other technology-based controls.

Alternative Control Measures

In addition to the institutional controls identified in the State Water Board's proposal, we have identified a number of additional opportunities to reduce trash discharges that have been proved effective in other contexts.

Insufficient Securing of Collection Vehicle Loads

A nationwide litter survey found that insufficiently secured trash and recycling collection vehicles are a significant source of litter (ERP, 2010). Such vehicles along with untarped pickup trucks were estimated to be the source of 16.4 percent of the 51.2 billion pieces of roadside litter identified nationwide (KAB, 2009, p. 3-8). That study also found a significantly higher rate of litter on roadways within two to five miles of solid waste and recycling facilities than on other roadways (KAB, 2009, p. 3-21).

A pilot study of spillage from rear-loading trash collection vehicles in 2007 found that spills occurred at 202 (14.6 percent) of the crews' 1,385 residential trash collection stops. However, only 102 (slightly more than half) of these spills were cleaned up by the collection crew. The remaining 100 spills were left as litter. This meant that 7.2 percent of trash collection pickups resulted in litter that rains could wash into stormwater drains (ERP, 2009).

Other researchers confirm that trash collection vehicles deal with this problem.

"Even under ideal conditions, collecting hundreds of tons of refuse can be a messy business. A certain amount of spillage is unavoidable. However, in most situations collectors are able to 'clean up their mess.' Sometimes, inclement weather causes problems on collection day—wind is the primary culprit. In order to reduce litter, the local government should require that refuse containers have lids. Each collection vehicle should be required to carry a shovel, broom, and dust pan and remove litter associated with the refuse/recycling operation (Scarlett and Sloan, 1996)."

The State of Florida, which conducted statewide litter surveys in 1994-1997 and 2001-2002, documented litter due to spills from front-loading trash collection vehicles in 2003. Researchers observed the collection of 337 commercial dumpsters over 1,277 miles and found that littering spills occurred at 28.8 percent spills at collection sites and on public streets or highways after 20.8 percent of trash pickups (Florida, 2003). Recycling collection vehicles were also found to be a source of litter for precisely the same reason (Florida, 1999).

San Francisco's departments of Public Works and Environmental Health reported in 2012 that, while collection vehicles are inspected, collection routes are not monitored for this type of spillage although this was discussed as a known source of litter nationwide (Dept. of Public Works and Dept. of Environmental Health, personal communications, 2012).

Recommendations

- Since the City of Los Angeles has achieved a 90 percent reduction in litter entering its stormwater system, it should be considered a model to be emulated by other California communities so other communities can achieve similarly successful litter abatement.
- Track 2 should be modified to preclude material bans due to a lack of credible evidence demonstrating their effectiveness in reducing overall trash.
- Track 2 should be less ambiguous overall and should require a level of reporting and monitoring at least equivalent to Track 1.
- Communities should focus their efforts on high-density generation areas when fiscal constraints preclude their ability to address stormwater controls community-wide.
- Due to known problems using volume-based quantification methodologies, the VLS methodology, considered by all experts in the field to be the standard for measuring litter, should always be used when quantifying litter and stormwater trash.
- Litter and stormwater trash surveys should always be performed by trained professionals and the methodologies used should always be transparent.
- Trash and recycling collection vehicle routes should be monitored to determine the extent to which they employ practices that contribute to litter that could enter stormwater systems.
- Innovative options for financing stormwater technology-based controls should be explored in order to assist Permittees that may have budgeting constraints.

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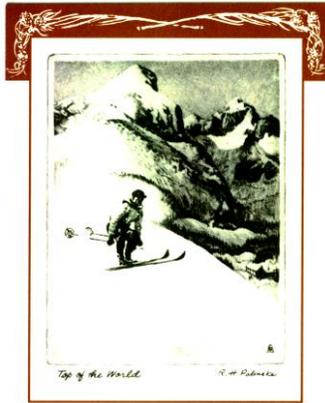
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Appendix A - CV Brief

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Steven R. Stein is Principal of Environmental Resources Planning LLC (ER Planning), North America's most experienced private firm in the field of litter-related and commodity characterization studies and litter's effects on our communities.

ER Planning's roots in the environmental field go back to the 1800s when Mr. Stein's grandfather worked in forestry and then, in 1913, in recycling. Steven has worked in the fields of recycling and solid waste management since 1972 for public, private, trade association and consulting.

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His work with litter, which began in 1987, has been featured on ABC's Good Morning America and NPR as well as in the New York Times, National Geographic Magazine and Time Magazine. Field crews under his direction have physically surveyed litter along more than 21 million square feet of roadways and recreational areas.

ER Planning organized and sponsored the 2011 National Litter Forum, which focused on the role of litter abatement on restoring our nation's communities. Mr. Stein's firm provides pro-bono time to organizations such as Ocean Conservancy, assisting with projects regarding litter and marine debris.

Mr. Stein has worked on a considerable number of litter-related projects including the *Litter: Literature Review*, for which he was lead author in 2007. He led the design and implementation of Keep America Beautiful's National Litter Survey and Cost Study (2009) and the development of their Community Appearance Index, which focused on the impact of illegal signage, excessive outside storage, abandoned/junk vehicles and graffiti on local communities.

Mr. Stein has taught *Environmental Science* and *Ethics in Management* at the university level and was invited, as a subject matter expert on environmental issues and community dynamics, to participate in a study commissioned by the President in 2010.

Education

B.Sc., cum laude – *Environmental Studies*, Syracuse University and SUNY College of Environmental Science and Forestry (Joint Program). Focus of Studies: Waste Management and Environmental Law. Teaching assistant for Dr. Allen Lewis's Introduction to Environmental Studies course. Internship with New York State Department of Environmental Conservation.

M.Sc. – *Natural Resource Policy and Management*, Syracuse University and SUNY College of Environmental Science and Forestry (Joint Program). Focus of Studies: Macroeconomic relationship of Asian/U.S. recycling industries and evaluation of sustainable policy initiatives. Awarded New York SWANA Annual Scholarship Award for his research examining the implications of public policy intervention on the establishment of sustainable domestic recycling markets.

Ph.D. Coursework – Mr. Stein began a Ph.D. program in *Environmental Science* at SU/SUNY–ESF focusing on the influence of cultural archetypes on littering behavior and litter abatement, authoring a literature review of behavioral and litter quantification/characterization studies conducted between 1968 and 2006 and a paper evaluating the influence of cultural archetypes in America.

Selected Projects

- ✚ Technical Assessment Report: Analysis of California Statewide Water Quality Control Plans to Control Trash (June 2014 Trash Amendments) - Author (2014)
- ✚ 2014 Rhode Island Litter Survey – Project Manager, Author of subsequent report (2014)
- ✚ Maryland State Legislature – Testimony to the State Senate and House on the components of litter (2014)
- ✚ Paper, Plastic or Neither – Time magazine (2014)
- ✚ San Francisco Water Board – Measuring Compliance and Trash Load Reductions (2013)
- ✚ 2013 Texas Litter Survey – Project Manager, Author of subsequent report (2013)
- ✚ World Ocean Council – Research on food waste, carpet and mattress recovery (2012)
- ✚ 2012 Toronto Streets Litter Audit – Project Manager, Author of subsequent report (2012)
- ✚ Contribution of Polystyrene Foam Food Service Products to Litter – Author (2012)
- ✚ Our Beaches and Seas: Mechanics of Risk – Author, Speaker (2012)
- ✚ Multi-City Paper and Plastic Bag Litter Survey – Project Manager, Author of subsequent report (2012)
- ✚ World Ocean Council – Research on differentiation of Material Flows Methodology (2012)
- ✚ Technical Assessment Report: Analysis of BASMAA MS4s Stormwater Trash Reports - Author (2012)
- ✚ Sustainable Consumption Expert Roundtable, Johnson Foundation (2012)
- ✚ Ocean Conservancy: Beach Litter Survey Methodology Enhancements (2011)
- ✚ FoLAR: Los Angeles County Trash Biography – Peer Review (2011)
- ✚ National Litter Forum: Restoring Our Communities – Organizer and Sponsor (2011)
- ✚ Confidential Client – Expert witness research and report regarding litter and marine debris (2010)
- ✚ President’s National Infrastructure Advisory Council: Optimization of [Community] Resources – Contributor (2010)
- ✚ 2010 Northeast Litter Survey – Three statewide litter surveys (Maine, New Hampshire, Vermont) – Project Manager, Author of subsequent report (2011)

- ✚ KAB National Affiliates Webinar: Litter – The Next Steps (2010)
- ✚ Bottled Water Study –Municipal Water Systems and Growth of the Bottled Water Industry (2010)
- ✚ Syngress/Elsevier Publishing – Honorariums (three) for Reviews to Publisher of Digital Forensics and Security Book Proposals (2010)
- ✚ Forensics Levels I,II and III – Towson University (2009-2010)
- ✚ KAB National Litter Survey/ Litter Cost Study – Project Manager, Lead Report Author (2009)
- ✚ BBC Advisor for planned series dealing with greenhouse gas emissions from landfills and other sources (2009)
- ✚ KAB Community Appearance Index Development – Project Manager (2007-2008)
- ✚ KAB National Litter Survey and Cost Study – Project Manager, Lead Author of subsequent report (2008–2009)
- ✚ KAB National Conference: 2009 National Litter Survey Results – Speaker (2009)
- ✚ KAB Campaign Partners Conference: National Litter Survey Results – Speaker (2009)
- ✚ National Geographic Magazine, Trash Register [Litter on Maryland Highways] (December 2008)
- ✚ The Impacts of Litter on Greenhouse Gas Emissions – Speaker, WASTECON (2008)
- ✚ Addressing Litter in a Changing World – Speaker, International Adopt-a-Highway Conference (2008)
- ✚ KAB: International Litter Research Forum, Invited Participant (2007)
- ✚ Litter: Literature Review –Lead Author (2007)
- ✚ Litter and Its Implications for Solid Waste Managers, WASTECON – Speaker (2007)
- ✚ Roadside Litter: Hazards on the Road, MSW Management Magazine – Co-Author (2007)
- ✚ Garbage, Litter & Trash, Kojo Nnamdi Show, WAMU – Interview (2007)
- ✚ State of Tennessee – Project Manager for statewide litter survey, Author of subsequent report (2007)
- ✚ The Truth about Recycling, The Economist – Contributor (2007)
- ✚ The New Gold Rush: Mining the Plastics Markets, Resource Recycling Magazine – Author (2007)
- ✚ State of Georgia – Project Manager for statewide litter survey, Author of subsequent report (2007)
- ✚ State of Georgia – Subject Matter Expert for litter-related web tool design team (2007)
- ✚ Debris Wreaks Havoc on the Road, ABC’s Good Morning America – Interview (2007)
- ✚ Debris Wreaks Havoc on the Road, www.abcnews.com – Website Article (2007)
- ✚ Worsening U.S. Road Litter Threatens Lives, Voice of America – Interview (2007)
- ✚ Road Debris Causes 25,000 Accidents Annually, Urban Transportation Monitor – Interview (2007)
- ✚ Wake Up and Smell the Trash, Potomac Watershed Trash Summit Roundtable (2007)
- ✚ Highway Debris, Long an Eyesore, Grows as Hazard, New York Times – Interview (2007)
- ✚ US–Government Accountability Office – Assisted with GAO-07-37 report “Recycling: Additional Efforts Could Increase Municipal Recycling” (2007)

- ✦ Developed RFP for Tempe, AZ covering MSW and sludge disposal and recyclables processing (2007)
- ✦ New York State Dept. of Economic Development – Analysis of New York Scrap Tire Markets Update Reports (2006–07)
- ✦ Seattle Public Utility – White Paper: Mobilizing Resources for Disaster Response (2006)
- ✦ Potomac Watershed Initiative Trash Monitoring Protocol Subcommittee – Advisor, Led design of Potomac River trash survey (2006–2007)
- ✦ Ocean Conservancy’s National Marine Debris Monitoring Program – Survey Director for Chincoteague Island, VA Site (2006–2007)
- ✦ American Plastics Council – Evaluated the impact of materials bans on environmental quality in California (2006–07)
- ✦ American Plastics Council – Evaluated the impact of “All-Plastic Bottles” and “Rural Recycling” initiatives on plastic recovery rates (2006)
- ✦ Confidential Client – Litter life-cycle research (2005–06)
- ✦ California Litter Survey of 77 Beaches – Project Manager (2005)
- ✦ Sweating the Litter Things: Recent Litter Survey Results, KAB National Conference – Speaker (2005)
- ✦ Sweating the Litter Things, Resource Recycling Magazine – Author (2005)
- ✦ What Litter Surveys Reveal about Bottle Bills, Federation of New York Solid Waste Associations Conference – Speaker (2005)
- ✦ Single-Stream (Compilation contributor), Resource Recycling Magazine (2005)
- ✦ Booz Allen – Lead Author for white paper on improving recycling measurements (2005)
- ✦ Alexandria, VA – Solid Waste Management Plan – Author (2005)
- ✦ Confidential Client – Expert Witness project – Comprehensive recycling facility audit (2005)
- ✦ Arlington, VA – Developed waste generation projections to support of flow-control issues (2005)
- ✦ Coca-Cola – Led the design team for development of a recycling program web tool (2004)
- ✦ Single-Stream: A Recycling Method That Cuts Both Ways, Resource Recycling Magazine (2004)
- ✦ Single-Stream: Shards and the Damage Done – Unanticipated Consequences of Single-Stream Recycling, NRRRA Recycling Conference (2004)
- ✦ Single-Stream: Glass vs. Paper, New York Federation of Solid Waste Associations (2004)
- ✦ Who’s Messing with New Jersey: Litter Survey Results, New Jersey Clean Communities Council (2004)
- ✦ What Litter Surveys Reveal About Bottle Bills, New Jersey Clean Communities Council (2004)
- ✦ New Jersey Litter Study – Project Manager, Author of subsequent report (2004)
- ✦ Recycled Paper Mill – Measured the impacts of contamination from incoming single-stream recyclables to the mill’s landfill and maintenance costs (2004)
- ✦ Single-Stream Recycling: Capture & Residue, Maryland Department of the Environment (2003)

- ✦ Does Single-Stream Recycling Make Sense, NRRA Recycling Conference and Exposition (2003)
- ✦ Glass and Single-Stream Recycling, New York Federation of Solid Waste Organizations (2003)
- ✦ Pontiac, MI – Led development of collection RFP and on evaluation committee (2003)
- ✦ Presenting Recycling Economics to Public Officials and the Media, Maryland Recyclers Coalition Annual Conference (2003)
- ✦ Alexandria–Arlington Waste Disposal Trust Fund – Wrote Memo on Pending Federal Legislation and the Oneida–Herkimer Solid Waste Authority Flow Control Case – Author (2002)
- ✦ Recycling collection, processing and transport services RFPs – City of Fort Worth (2002)
- ✦ Issues Facing Paper Recycling, New York Federation of Solid Waste Organizations (2002)
- ✦ Fort Worth, TX – Developed recycling RFP and multi–year recycling revenue projection model (2002)
- ✦ GBB (Fairfax, VA) – Administrator of Windows Small Business Server and Microsoft Exchange Email Server (2001-2005)
- ✦ North Carolina Litter Study – Co-Author (2001)
- ✦ Metro–Nashville Government – Developed multi–year recycling revenue projection model (2001)
- ✦ Metro–Nashville Government –Transfer and disposal RFP and proposal evaluation (2001)
- ✦ Arlington County, VA Wastewater Treatment Plant – Analysis of Biosolids Management Practices and Alternatives Evaluations (2001)
- ✦ AF&PA (Washington, D.C.) – Developed and Published Flash Fax Summary Reports for 12 Leading Economic Indicators (2000-01)
- ✦ AF&PA – Worked with Dept. of Commerce to improve procedures for reporting Wood Industry Data (2001)
- ✦ Mass. State Legislature – Testified on the impact of container deposits on municipal recycling program revenues (2000)
- ✦ Creating a Successful Recycling Program, U.S. Conference of Mayors (2000)
- ✦ Municipal Curbside Recycling: Analyzing the Obstacles to Sustainability – Master’s Thesis (1999)
- ✦ Municipal Recovery: A Success Story, International Recovered Paper IX (1998)
- ✦ Residential Mixed Paper Usage, New York State Federation Conference – Organizer (1998)
- ✦ Onondaga County, NY – Oversight for 30 recyclables and trash haulers and three MRFs (1990-1999)
- ✦ Onondaga County, NY – Site manager for Household Hazardous Waste Days (1992-1999)
- ✦ The Thinning Phenomena – Impact of Thinner Containers on Municipal Recycling Revenues, New York State Recycling Conference (1997)

- ✦ Curbing the Bottle Bill – Impact of Bottle Bills on Municipal Recycling Revenues, Bottle Bill: Sense or Cents Conference (1997)
- ✦ Onondaga County – Developed MRF Contingency Plan (1996)
- ✦ Auditing MRF Recyclables, New York State Recycling Conference (1996)
- ✦ Curbside Counting Lessons – Curbside Recyclables Characterization, New York SWANA (1996)
- ✦ Onondaga County, NY – Developed and implemented a stratified curbside recycling quantification and characterization study countywide (1996)
- ✦ Social Costs of Recycling – Indirect costs and benefits of curbside recycling, New York State Recycling Conference (1996)
- ✦ WiNet Waste and Recycling Information Software Workshop, New York State Dept. of Environmental Conservation Conference (1995)
- ✦ Onondaga County, NY – Designed and implemented “WiNet”, an online recycling and solid waste information system (1995)
- ✦ Onondaga County, NY – Industrial and Medical Waste Audit. Project manager for three survey teams, documenting and analyzing the generation, handling and recovery of various components of all industrial process and medical waste facilities in Onondaga County, NY (1991-1992)
- ✦ Onondaga County, NY – Administrator and tech support for all agency workstations and network (1990-1999)
- ✦ CNY Environment – Research and analysis of drinking water quality in upstate New York comparing contamination issues from tap, well and filtered water sources (1989)
- ✦ New York State Dept. of Environmental Conservation – Organize and research FOIA data and requests as intern (1989)
- ✦ US–EPA Small Business Innovation Research Solicitation – Recovery and Reprocessing of Solid Municipal Wastes (1987)
- ✦ Plastic Recycling – Created one of the South’s first all-plastic container recycling programs, accepting and grinding consumer and commercial plastic containers for recycling (1986)
- ✦ Developed program to sort out and recover recyclable materials from trash collected on “Trash–Bash Day” (1987)
- ✦ AT&T – Consultant to help increase recycling at AT&T’s manufacturing plants (1987)
- ✦ Bossier City Clean Community Council – Developed newspaper recovery program in area 7-11 stores to benefit local Keep America Beautiful affiliate (1986)
- ✦ U.S. Air Force – Developed prototype drop–off recycling program to benefit the Air Force’s Welfare and Morale Fund (1986)
- ✦ Assisted SWEPCO (Southwestern Electric Power Co.) with fund–raising recycling program to benefit St. Jude's Hospital (1986)
- ✦ Created markets for polycoated diaper liner trims from Kimberly–Clark plant (1986)
- ✦ Caddo Waste Trading – Primary broker and supplier of a variety of recycled paper grades to dry–felt roofing mill (1984-88)
- ✦ Managed Recycling Facility Operations that handled all grades of fiber as well as glass, aluminum and plastics for 7 years (1972-73, 1976-1979, 1984-88)

- ✦ American Bank –Design and implementation for one of the first U.S. online banking software systems (1984)
- ✦ American Bank – Computer programmer and Data Processing Manager (1982-84)
- ✦ American Bank – Author, Data Processing Security and Procedures Manual (1983)



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