

# California Waste Tire Market Report: 2014



California Department of Resources Recycling and Recovery

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# Section 1

## Introduction

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### ***Background***

Under the California Tire Recycling Act of 1989 and subsequent amendments, the Department of Resources Recycling and Recovery (CalRecycle) has two main strategies: 1) providing a strong and fair regulatory framework to protect public health and safety and the environment while not stifling waste tire flow and processing; and 2) supporting expansion and diversification of the business and government market infrastructure for producing and using tire-derived products (TDPs). CalRecycle has long had a goal of diverting at least 90 percent of waste tires generated in California from landfills. CalRecycle is now also focused on implementing programs to achieve a statewide 75 percent recycling goal (as opposed to diversion) for all discarded materials, as required under AB 341 (Chesbro, Chapter 476, Statutes of 2011), and is consequently focusing on recycling tires through reuse, civil engineering (CE) and crumb rubber, as opposed to diversion through export, alternative daily cover (ADC), or tire-derived fuel (TDF).

CalRecycle's Five-Year Plan for the Waste Tire Recycling Management Program, which is revised every two years, guides efforts to reach a 90 percent diversion goal by 2015. The latest version of the [Five-Year Plan](#) was approved on May 1, 2015. For the first time, this new Five-Year Plan includes a vision statement outlining CalRecycle's intention to consider implementation of an expanded incentive payment system to drive expansion of tire recycling volumes. This vision statement is discussed in more detail under Section 5, Conclusions.

This report summarizes waste tire recycling and market trends in 2014, with additional information on trends to date in 2015. The information on 2015 trends is based on research conducted from January through April 2015. The report was prepared under CalRecycle contract by Louis Berger Group, with research, analysis, and writing support provided by Boisson Consulting and DK Enterprises.

Following this introduction, Section 2 provides a snapshot of key findings on diversion activities and markets for California waste tires. Section 3 describes detailed market trends by category. Section 4 analyzes the outlook for increased diversion and implications for CalRecycle's market development activities. Finally, Appendix A provides a glossary of key terms, and Appendix B summarizes the report methodology and limitations.

### ***Interpreting and Using Report Findings***

As detailed in Appendix B, findings in this report are based on numerous information sources, including surveys of firms involved in waste tire management, discussion with CalRecycle Staff and industry stakeholders, analysis of data from CalRecycle's Waste Tire Manifest System (WTMS), and other sources. The following are a few key points to consider when interpreting and using the report's findings:

**Reasonably Accurate Trend Information:** Estimating California waste tire flows is challenging due to numerous data gaps, poor data quality, and conflicting sources of information.

Nevertheless, the authors believe this report estimates flows with an accuracy of approximately plus or minus 10 percent (based on qualitative and quantitative considerations), and that the results can reasonably be used to evaluate trends over time. The level of uncertainty associated

with waste tire bale exports and used tires, in particular, is somewhat higher than for other categories, due to these issues.

**Use of California-Generated Waste Tires, Not Total Market Size:** The report estimates the quantity of California-generated waste tires flowing into each market segment, not the quantity of tire-derived material or products entering California from outside the state. Consequently, the report generally does not estimate total market size. Also, while some information on buffings generated by retreaders is provided, the report does not comprehensively analyze buffings use. (Buffings refers to clean tire rubber that is produced as a by-product of the tire retreading process.)

**Estimates Based on Documented Shipments:** Market segment estimates are based on the delivery of whole tires to facilities, and the shipment of tire-derived material (TDM), mainly to and from processors and other recipients of whole tires, with some adjustments made to account for undocumented flows, especially for used tires and exported tires. Detailed information on flows between firms is analyzed to avoid double-counting. Tires and TDM stored as inventory during the study year are not necessarily captured by this methodology.

**The Tire Recycling and Diversion Rates are Not Adjusted for Residuals:** As with other tire market studies, tire diversion and recycling rates are not adjusted for steel and fiber residuals generated by TDM producers. However, in 2014, the vast majority of these tire wire and rims were recycled, and most tire fiber was combusted at California cement kilns.

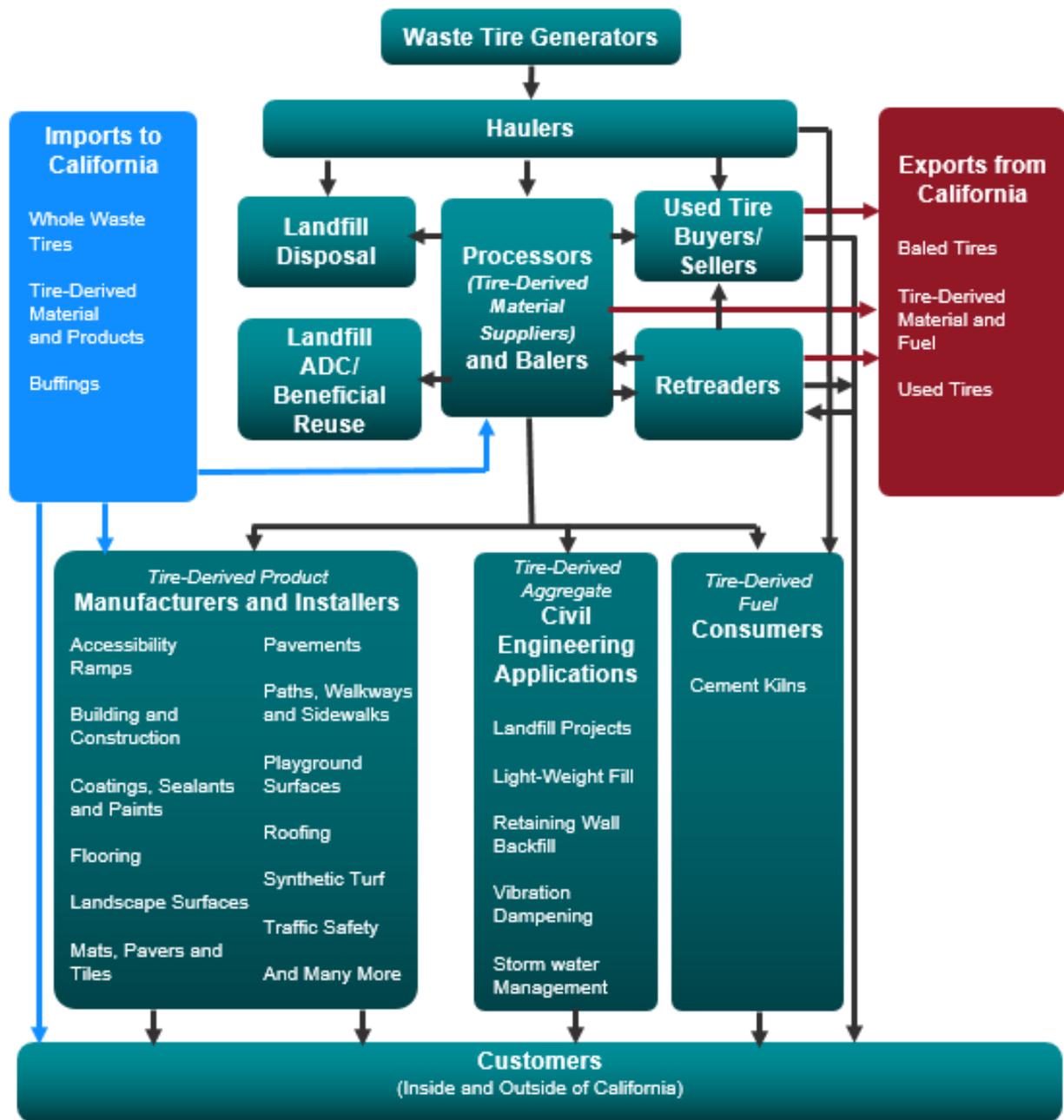
## ***Industry Overview***

Figure 1 on the following page illustrates California waste tire flows and identifies the types of firms involved in California waste tire management. To analyze 2014 waste tire flows, research focused on the following California facilities:

- Fifteen “processors” that in 2014 received significant quantities of whole waste tires and that shipped used tires and TDM to a variety of market segments;
- Eight “balers” that in 2014 received whole waste tires, primarily for the purpose of exporting baled and/or used tires;
- Twenty-four firms that manufacture, market and/or install TDPs made from tire-derived materials;
- Four cement kilns that combust processed TDF or baled waste tires;
- Fifteen landfills that accept significant quantities of tires or tire-derived aggregate (TDA) for use in civil engineering projects, or as ADC, or for disposal; and
- Thirty-one retreaders that retread truck tires, and that generate buffings which are sold as TDM for use in a variety of products and end uses.

A thorough description of the many types of tire-derived products is available in CalRecycle’s California Tire-Derived Product Catalog, available online at [www.calrecycle.ca.gov/Tires/Products/Catalog/](http://www.calrecycle.ca.gov/Tires/Products/Catalog/).

Figure 1  
California Waste Tire Recycling Industry Flow Chart



## Section 2

# Market Snapshot

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This section provides a snapshot of California waste tire markets in 2014 and identifies trends as of spring 2015. More detailed, segment-specific information is provided in Section 3.

### **2014 Diversion and Recycling Rates**

Table 1 on the following page lists the number of passenger tire equivalents (PTE)<sup>1</sup> flowing to each market segment and the percentage of the total quantity managed for 2012 through 2014. After reaching an all-time high of 92.9 percent in 2012 (and exceeding CalRecycle's 90 percent goal), the overall waste tire diversion rate dipped to 87.3 percent in 2013 and is estimated at 85.9 percent in 2014. Since the adoption of AB 341 (Chesbro, Chapter 476, Statutes of 2011) CalRecycle has focused on achieving a 75 percent statewide recycling goal. CalRecycle has emphasized that this new goal is framed around recycling materials into new products rather than the broader concept of diversion, which includes such activities as conversion through waste-to-energy and use of certain materials as alternative daily cover at landfills. Consequently, this report now separately reports a waste tire diversion rate (including all uses outside of landfill disposal) and a waste tire recycling rate, defined to exclude exports, alternative daily cover, and tire-derived fuel. This report also excludes from recycling the category of "Other Diversion," which includes small, temporary uses such as use of tires to weigh down agricultural film. Based on this definition, the 2014 waste tire recycling rate is estimated at 38.5 percent, slightly less than the 2013 rate of 38.6 percent, and significantly down from the 2012 recycling rate of 44.3 percent.

### **Synopsis of Trends**

Figure 2 on page 10 shows waste tire end-use trends by broad market category since 2002.<sup>2</sup>

**Exports:** After rising rapidly beginning in 2009, exports of TDF and baled waste tires peaked in 2012 at 13.5 million PTE before dropping to 11.0 million PTE in both 2013 and 2014. In 2014, 7.4 million PTE of processed TDF and 3.6 million PTE of waste tire bales were exported; however, prior to 2014, these categories were combined. The quantity of California waste tires flowing to balers may be under-stated due to inconsistent waste tire manifest reporting and a poor survey response in this sector. Also, based on numerous credible reports, a large but unknown quantity of baled and loose waste tires is being warehoused as a result of a severe port slowdown, shifts in export pricing and demand, and associated shifts in baler business operations and locations. Exporting is reportedly going strong in early 2015, although the backup caused by port

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<sup>1</sup> PTE stands for passenger tire equivalent, which is defined by the State of California to equal 20 pounds of tire rubber. Data for 2012 and 2013 are from the "California Waste Tire Market Report: 2013" and "Waste Tire Market Report: 2012."

<sup>2</sup> Data for 2002–2006 are from CalRecycle's annual "California Waste Tire Generation, Markets, and Disposal" reports. Data for 2007 are from annual California Tire Market Reports. Methodological differences complicate direct comparisons between 2002 and 2006 and later statistics. See Appendix A for details.

labor issues may take some time to be resolved. An estimated 1.8 million PTE of culled, used tires were also exported in 2014, 38 percent higher than in 2013.

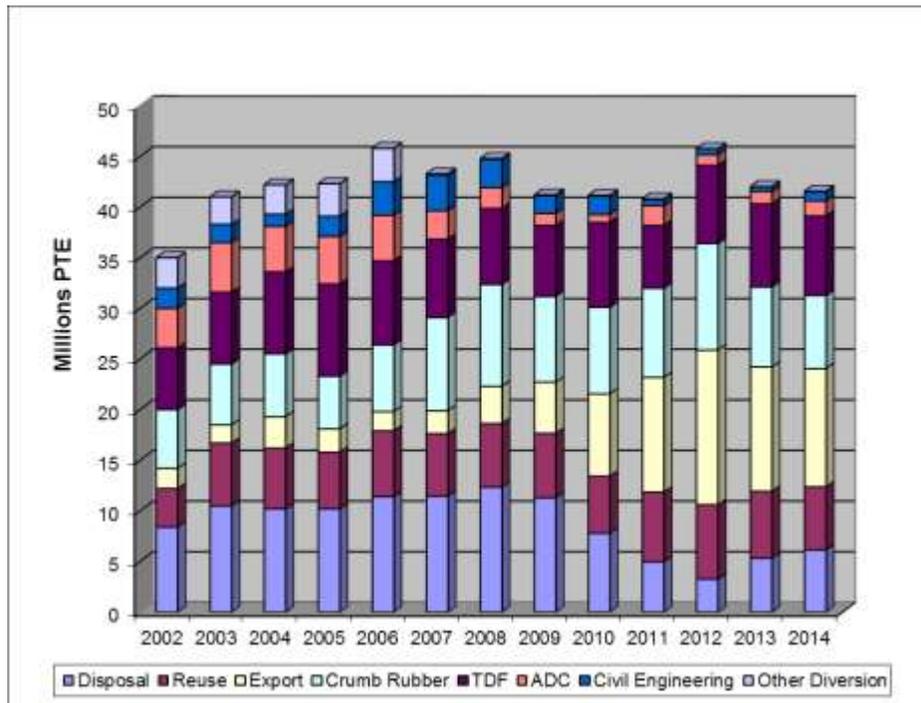
**Reuse:** In 2014, an estimated 4.2 million PTE were culled from tire flows and graded for sale as used tires, with an estimated 1.8 million PTE of these being exported, mainly to Mexico (and reported in Table 1 under exports). Retreading in 2014 was estimated at 4.2 million PTE, 4 percent higher than in 2013. When the 38 percent increase in exported used tires (shown under exports in Table 1) is taken into account, tire reuse category as a whole was up by 5 percent. Reuse is a consistently strong and profitable market segment, but is very mature and little growth is projected. Some warned that the increasing quantity of imported tires, with uncertain composition and varying standards, could potentially compromise reuse and retreading over the long term. This issue was not further researched for this report.

**Table 1**  
**Estimated End-Uses for California-Generated Waste Tires, 2012–2014<sup>3</sup>**

Category	Sub-Category	2012		2013		2014		Percent change '13 - '14
		Million PTE	Percent of Total	Million PTE	Percent of Total	Million PTE	Percent of Total	
Export	Processed TDF	13.5	29.4%	11.0	26.2%	7.4	16.7%	0%
	Baled Waste Tires					3.6	8.2%	
	Used Tires (Export)	1.8	4.0%	1.3	3.0%	1.8	4.1%	38%
	<b>Subtotal</b>	<b>15.3</b>	<b>33.4%</b>	<b>12.3</b>	<b>29.2%</b>	<b>12.8</b>	<b>29.0%</b>	<b>4%</b>
Reuse	Retread	4.0	8.7%	4.1	9.7%	4.2	9.6%	4%
	Used Tires (Domestic)	3.3	7.3%	2.5	6.0%	2.4	5.5%	-3%
	<b>Subtotal</b>	<b>7.3</b>	<b>16.0%</b>	<b>6.6</b>	<b>15.7%</b>	<b>6.7</b>	<b>15.1%</b>	<b>2%</b>
Crumb Rubber	Paving	5.2	11.3%	3.5	8.4%	3.5	7.8%	-2%
	Turf & Athletic Fields	2.2	4.7%	2.0	4.8%	1.7	3.8%	-16%
	Loose-Fill Playground/Mulch/Equestrian	1.8	3.9%	1.4	3.4%	1.1	2.6%	-20%
	Molded & Extruded	1.3	2.9%	0.9	2.1%	0.8	1.8%	-12%
	Other	0.1	0.1%	0.0	0.1%	0.2	0.5%	376%
	<b>Subtotal</b>	<b>10.5</b>	<b>23.0%</b>	<b>7.9</b>	<b>18.8%</b>	<b>7.3</b>	<b>16.5%</b>	<b>-8%</b>
Civil Engineering	Landfill Applications	0.6	1.3%	0.3	0.6%	0.9	2.0%	237%
	Non-Landfill Applications	0.0	0.0%	0.2	0.5%	0.4	0.9%	NA
	<b>Subtotal</b>	<b>0.6</b>	<b>1.3%</b>	<b>0.5</b>	<b>1.1%</b>	<b>1.3</b>	<b>2.9%</b>	<b>177%</b>
<b>Alternative Daily Cover</b>		<b>1.0</b>	<b>2.3%</b>	<b>1.2</b>	<b>2.9%</b>	<b>1.5</b>	<b>3.3%</b>	<b>19%</b>
<b>Other Diversion</b>		<b>0.0</b>	<b>0.0%</b>	<b>0.0</b>	<b>0.0%</b>	<b>0.1</b>	<b>0.1%</b>	<b>NA</b>
<b>Tire-Derived Fuel</b>		<b>7.7</b>	<b>16.9%</b>	<b>8.2</b>	<b>19.5%</b>	<b>8.4</b>	<b>19.0%</b>	<b>2%</b>
<b>Landfill Disposal</b>		<b>3.3</b>	<b>7.1%</b>	<b>5.3</b>	<b>12.7%</b>	<b>6.3</b>	<b>14.1%</b>	<b>17%</b>
<b>Estimated Total Managed</b>		<b>45.8</b>	<b>100.0%</b>	<b>42.0</b>	<b>100.0%</b>	<b>44.2</b>	<b>100.0%</b>	<b>5%</b>
<b>Total Diverted from Landfill</b>		<b>42.5</b>	<b>92.9%</b>	<b>36.7</b>	<b>87.3%</b>	<b>38.0</b>	<b>85.9%</b>	<b>4%</b>
<b>Total Recycled</b>		<b>20.3</b>	<b>44.3%</b>	<b>16.2</b>	<b>38.6%</b>	<b>17.0</b>	<b>38.5%</b>	<b>5%</b>
Imports		0.7	1.6%	1.2	3.0%	1.3	2.9%	2%

<sup>3</sup> Table 1 Notes: a) The quantity of tires flowing to balers may be understated due to reporting gaps, while an unknown quantity of baled waste tires are reportedly currently being warehoused; b) Exports and used tires estimates are subject to higher uncertainty than other categories; c) Diversion and recycling numbers do not account for processing residuals; however, the vast majority of wire, rims, and fiber residual from California processing operations were diverted from landfill in 2014; d) Market size estimates are adjusted to remove estimated imported tires entering each market, and the estimate of imports excludes culled used tires entering California for resale or export purposes; e) Numbers may not sum to subtotals or totals exactly due to rounding; f) 2012 paving estimates were revised in 2013, which affected 2012 total flows and percentages slightly.

**Figure 2  
Twelve-Year Trend in California Waste Tire End Uses**



**Crumb Rubber:**<sup>4</sup> Overall, use of California waste tires to produce crumb rubber declined by 8 percent in 2014, to 7.3 million PTE. This comes after a 25 percent annual decline in 2013 on the heels of a spike to 10.5 million PTE, an all-time high, in 2012. The decline in crumb rubber use in 2014 affected the four major crumb market segments, with paving down approximately 2 percent, turf infill down 16 percent, ground rubber markets (i.e., loose-fill playground, landscape mulch, and equestrian material) down 20 percent, and a 12 percent decline in the molded & extruded category. Reasons cited for these declines include generally flat or weakened markets, reduced CalRecycle grant funding, and competition with relatively low-priced imported crumb rubber. For the first time, this report estimates the amount of buffings flowing to California processors, who either brokered to other firms or directly used themselves an estimated 19.4 million pounds of buffings (some of which may have been imported), compared to an estimated 98.4 million pounds of crumb rubber produced in California in 2014. Buffings are used extensively in pour-in-place, molded rubber and landscape mulch applications, and to some extent in all crumb market segments. While imported crumb rubber continues to offset some sales of California material, some California TDM producers reported that the glut of such material that has been available over the prior few years has subsided somewhat.

**Civil Engineering:** Use of TDA in civil engineering applications rose in 2014 by 177 percent to 1.3 million PTE, with 0.9 million PTE of this being used at nine landfills in gas collection

<sup>4</sup> In this report crumb rubber refers to tire-derived material ¼ inch or smaller, and is distinguished from ground rubber which is ¼ - 1 inch in size. For simplicity, crumb rubber is also used as the general market category that includes both crumb rubber and ground rubber segments.

systems, and with the remaining TDA used largely in one project by Bay Area Rapid Transit (BART). The increased number of landfills using TDA is a result of CalRecycle's TDA grant program. An uptick in grant awards to both landfill and non-landfill projects means that this category is projected to increase in 2015.

**Alternative Daily Cover:** In 2014 four landfills reported use of a total of 1.5 million PTE as ADC, a 19 percent increase over the amount in 2013. This amount is expected to stay flat into 2015, although a decision to begin or stop using ADC by even a single landfill has the potential to significantly impact the total use of ADC.

**Tire-Derived Fuel:** Consumption of California whole waste tires and processed TDF by four California cement kilns totaled 8.4 million PTE in 2014, a 2 percent increase compared to 2013. These cement plants actually consumed an additional 462,000 PTE in TDF derived from tires imported to California-based processors serving these plants. TDF continues to provide a strong, stable market and is projected to grow in 2015 by about 600,000 PTE. Demand is strongly dependent on changes in the construction industry and the cost of alternative fuels.

**Disposal:** Waste tire disposal increased in 2014 by 17 percent to 6.3 million PTE. This was partly due to disruptions at one large processor, and may have also been influenced by disruptions in export flows. Disposal in 2015 may be declining based on monthly WTMS data and reports of strong export activity in early 2015. However, as the past few years have shown, such trends are subject to abrupt and surprising shifts.

Taking all of the above into account, the overall outlook in 2015 is mixed. There is a good chance that the diversion rate will increase somewhat, due to expected growth in civil engineering and TDF, and the possibility of growth in exports. The recycling rate trend is more difficult to predict, as media reports on concerns over crumb rubber's health risks appear to be impacting sales to the turf market in 2015. Also, demand for landscape mulch and loose-fill playground surfacing using ground rubber is down, reportedly in part due to reduced CalRecycle TDP grant awards. The paving market segment holds the potential to help crumb rubber grow; however, Caltrans representatives report that overall paving levels are sharply down. On the other hand, the paving that is occurring is largely in maintenance (which is favorable to use of crumb rubber using the field blend process) as opposed to new construction (which is not).

## Section 3

# Key Trends by Market Segment

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This section describes key market trends for each market segment in more detail, beginning with the current balance between supply and demand.

### ***Supply and Demand Balance***

In any commodity market, the balance between supply and demand is constantly in flux, influencing pricing, competitive pressures and, generally, the profitability and resiliency of firms operating in the market. In the case of tire recycling, there are two sets of supply and demand issues: those involving whole tires, and those involving tire-derived materials used to make products. Shifts in these supply-demand dynamics directly influence the ability to increase and sustain recycling and diversion levels.

#### **Supply and Demand for Whole Tires**

Research for this report included analyzing the 2014 shipments of 15 processors serving a variety of recycling, diversion, and disposal markets (sometimes including export) and eight balers that were set up mainly to export only (with some also culling used tires). To varying degrees, these firms, and the haulers that supply them, compete for the limited supply of California waste tires and the associated collection fee revenues.

The rapid rise in baled waste tire exports in recent years greatly disrupted the supply and demand balance for whole tires in California. Balers have relatively simple operations with low capital requirements (and in some cases have operated without permits), and are able to start up and/or change operations rapidly. As exports increased over the past several years, a number of balers quickly established operations to bale and ship large quantities of containers to foreign markets, mainly Vietnam. These operations competed aggressively to secure accounts from waste tire generators, and this in turn reduced access to supply and collection-related revenues of established processors, which operate under a much different business model than the balers.

Since 2012, baler operations have continued to be very dynamic and erratic. During 2014 and into 2015, waste tire export volumes experienced abrupt peaks and valleys due to port slowdowns, changes in demand and pricing, increasing competition globally, and enforcement actions and fines imposed by CalRecycle. Based on numerous credible reports, large quantities of baled and loose whole waste tires are currently being warehoused due to these factors. Of the eight balers analyzed in 2014, one shut down entirely, at least two had changes in ownership, location and/or company name, two started up operations, and one shifted from export to other markets (including disposal) late in the year due to turmoil in the export market.

Some established processors have taken advantage of surging export demand by producing large quantities of processed TDF for sale, mainly to Japan and Korea. But many processors suffered severe negative impacts in access to tire supply and reduced pickup revenues as a result of the export boom. Several cited lingering impacts and continuing challenges in 2014 and early 2015, including one large processor and crumb rubber producer that experienced major operational disruptions in 2014, and another that stopped business, with their tire flows shifting to a new operator. Two processors began operations anew.

## **Supply and Demand for Tire-Derived Materials and Products**

Production of crumb rubber was down by an estimated 8 percent in 2014, using 7.3 million PTE, while production of TDA increased 177 percent, using 1.3 million PTE.

The demand for crumb rubber in the major markets of paving, turf applications, playground/landscape and equestrian surfacing, and molded products was flat or down in 2014, as was the case in 2013. For the past several years, abundant supplies of crumb rubber have far exceeded demand and put downward pressure on pricing. But while the crumb rubber capacity still exceeds demand in California and across North America, this situation appeared to be moderating somewhat in 2014 and into 2015 compared to previous years. Industry stakeholders have reported that they do not see other new large users or uses coming on line in the near future. Some California crumb rubber producers report that supplies are no longer being imported from Europe and that competitive pressure from out-of-state suppliers may be moderating to a degree.

CalRecycle has made expansion of molded/extruded products a priority, including the use of fine-mesh material. However, this segment has seen continuing low demand, as yet insufficient to trigger investments in capacity for dedicated fine-mesh crumb rubber production. California crumb producers are currently capable of producing limited quantities of 50 mesh material only.

For the first time, this annual market report also includes information on the use of buffings generated by retread operations, with more than 9,700 tons (19.4 million pounds) being used or brokered by California processors. Much of this material is used to a degree in all crumb rubber segments, and therefore reduces use of crumb rubber to an extent.

The bottom line is that, with the outlook for crumb rubber demand remaining uncertain, a resurgence in California production may still be some years away.

For TDA, potential supply exceeds demand substantially, with at least five processors supplying TDA to California civil engineering projects in 2014, and at least one other saying they are prepared to do so. However, supply constraints are still a challenge in this segment due to tire storage barriers, which complicate delivery of large volumes. CalRecycle technical assistance and grant funding continues to overcome these barriers in targeted projects.

## **Reuse**

Reuse, including retreading and sale of partially worn used tires, remains strong in California. Overall, reuse is estimated to be up about 5 percent in 2014 (including used tires sold both domestically and internationally, as shown under “Export” in Table 1 in Section 2).

Both retreading and sale of used tires are very strong, profitable market segments that are relatively mature and not expected to grow substantially. However, some industry representatives cited concern over the growing quantity of imported tires that sometimes may not meet U.S. design and performance standards, and therefore may not be able to be directly reused or retreaded at the same rate as U.S.-made tires.

### **Retread Tires**

The quantity of truck and specialty tires retread in California was estimated to be up very slightly to 4.2 million PTE in 2014, compared to 4.1 million PTE in 2013. The 2014 estimate is based on a relatively strong retreader survey response, with 23 of 31 facilities reporting, and with the remaining facility volumes estimated based on past responses combined with documented WTMS deliveries.

Retreaders mostly reported operations were stable in 2014, although one facility closed. Six of 14 retreaders who reported specifically on 2015 growth trends said they expected volumes to rise, although a good portion of this may be through gaining market share, as the industry is highly competitive. Some retreaders cited concerns over future growth, including:

- As mentioned above, the growing share of imported tires from China and elsewhere sometimes have lower quality and could reduce the potential for multiple retreading or may not be suitable for retreading at all;
- The ongoing California drought could severely impact agricultural shipments which constitute a large share of California trucking;
- California Air Resources Board (CARB) policies are increasing costs of diesel trucks significantly, with some haulers getting out of business altogether; and
- The relatively low cost of imported truck tires may reduce demand for retreads.

Notwithstanding these concerns, overall truck tire retreading is expected to remain a steady, strong market for years to come.

### **Used Tires**

Used tires on the whole were estimated to be up about 5 percent to a total of 4.0 million PTE, including used tires sold domestically and internationally (which are reported in Table 1 under “Export”). The analysis shows used tires sold domestically down 3 percent from 2.5 million to 2.4 million PTE, and those sold internationally (mainly Mexico) up 38 percent, at 1.8 million PTE. However, as mentioned elsewhere, the uncertainty associated with used tire estimates, including the breakdown between domestic and exported sales, is subject to higher uncertainty than other waste tire markets reported on in this report. While some processors specialize in used tires, others are increasingly de-emphasizing grading of used tires, with more culling occurring earlier in the stream by haulers. For this reason, unlike other categories, used tire estimates are based on a combination of direct reporting and an estimation factor designed to capture used tires culled by many haulers across the state. In addition, where necessary, we estimate the portion exported vs. sold domestically. For the portion estimated to be culled by haulers, we first subtract out flows to processors that actively grade and ship used tires and that reported firm estimates for the number of used tires culled and shipped. We then multiply the remainder by 7 percent, and assume that 60 percent of this volume is exported. These estimates are based on information from several industry representatives, and are revisited annually as conditions change.

Given the increasing role of haulers in culling used tires, the overall trend is difficult to gauge. While some haulers said used tire volumes are significantly up, some processors said they were down. As with retreading, some voiced concern over whether some imported tires not made to U.S. design and performance standards may negatively impact reuse rates in the future. However, barring such a development, used tires are expected to remain a strong, profitable market segment for years to come. And while volumes shift with the economy, substantial growth or decline is not expected.

## Crumb Rubber

### Overview

In 2014, approximately 7.3 million PTE of California-generated tires were used to produce crumb rubber, 8 percent less than in 2013, which in turn was down by 25 percent from the all-time high of 10.5 million PTE used to make crumb rubber in 2012. These estimates exclude the portion of feedstock used by California crumb rubber producers that was derived from non-California tires imported from other states, which in 2014 was an estimated 69,300 PTE, or less than 1 percent of the total number of California tires used to produce crumb rubber. While a complete estimate is not available for the quantity of tire wire and fiber generated in 2014, the vast majority of both were diverted, with 9,911 tons of fiber being consumed as fuel at two of the four California cement kilns consuming TDF (this amount is excluded from the TDF estimates presented in this report).

The main reason for the decline in crumb production appears to be flat or reduced demand in each of the main crumb rubber market segments, as described further in this report. However, some crumb producers continue to cite competitive pressures from out-of-state suppliers, who they say often offer crumb rubber at relatively low prices and benefit from government incentives, lower operating costs, or favorable state tire management contracts. Some crumb producers, conversely, say such pressure is beginning to subside, with less low-price crumb rubber on the market now compared to recent years. Some crumb rubber producers cited reduced allocation of funds by CalRecycle to the TDP grant program for a portion of reduced sales. This was not extensively researched for this report, but according to the CalRecycle TDP grants manager, total CalRecycle TDP grant awards are down somewhat. But as importantly, there is often a lag of up to one year between award and project completion, and the timing of awards may have also contributed to a dip in crumb rubber use in 2014. Local government budget constraints also were an issue, impacting the ability of some grantees to complete projects due to lack of funds to complete other aspects of the project and loss of local staff to oversee/implement the project, whether with or without grant funds. A final contributing reason to lower crumb rubber production is the continuing impacts of export-caused disruptions to some crumb rubber producers.

Many are looking to new product development and feedstock conversion (i.e., shifting part of the feedstock used to make established products to crumb rubber) as important opportunities to strengthen crumb rubber markets. CalRecycle has invested in feedstock conversion through the Tire-Derived Product Business Assistance Program (2006–2013) and product promotion and outreach through the Tire Outreach and Market Analysis project (starting in 2013). And in 2014 CalRecycle launched the Tire Incentive Program (TIP), a pilot incentive program that provides per pound payments of 10 to 40 cents per pound to TDP manufacturers, depending on the type of product, size of crumb rubber used, and whether the projects constitute feedstock conversion. In June 2014 the program made its first awards to seven firms, with total potential funding of more than \$2.6 million. In June 2015, CalRecycle received 11 TIP applications, and of these, eight applications totaling \$1.9 million are being recommended for approval. Combined, these applicants would use a total of 12.8 million pounds of California crumb rubber.

Table 2 summarizes estimated volumes of crumb rubber shipped to each market segment in 2014. An estimated 98.4 million pounds of crumb rubber was shipped, down from 110.7 million pounds in 2013. Almost half flowed to paving applications, including Caltrans and local government-sponsored projects, some of which were funded by CalRecycle grants. The second-largest crumb market is the Turf & Athletic Fields segment, followed by the ground rubber market segment

(i.e., loose-fill playground, landscape mulch, and equestrian material) and molded products. Trends in these market segments are discussed in more detail on the next page.

**Table 2**  
**Estimated Sales of Crumb Rubber Made from California-Generated Tires<sup>5</sup>**

Category	2013		2014	
	Millions of Pounds	Percent of Total	Millions of Pounds	Percent of Total
Paving	49.6	45%	45.8	47%
Turf & Athletic Fields	28.1	25%	22.4	23%
Pour-in-Place Playgrounds	0.0	0%	0.0	0%
Loose-Fill Playground/ Landscape Mulch/Equestrian	19.8	18%	15.4	16%
Molded & Extruded	12.5	11%	12.0	12%
Other/Unidentified	0.6	1%	2.8	3%
<b>Total</b>	<b>110.7</b>	<b>100%</b>	<b>98.4</b>	<b>100%</b>

For the first time, this California Waste Tire Market Report gathered information on the use of retreader-generated buffings by California tire processors. As shown in Table 3 on the following page, an estimated 19.4 million pounds of buffings were used or brokered by California processors. As shown in the table, buffings flowed to all market segments to varying degrees, and in some cases may offset the use of crumb rubber.

The outlook for growth in California crumb rubber production is uncertain. As detailed below, the use of crumb rubber as synthetic turf infill is expected to decline in 2015, with the ground rubber and molded product segments expected to be flat or down. While there is potential for growth in paving, the 2015 trend is not yet clear. Moreover, the reasons cited for crumb rubber decline in 2014 may again impact production in 2015, suggesting it may be likely that crumb rubber will remain flat at best in 2015.

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<sup>5</sup> The yield rate (i.e., the amount of crumb rubber produced per PTE) varies by crumb rubber producer, so reported PTEs flowing to each crumb market segment may not correlate exactly with reported volumes of crumb rubber produced.

**Table 3**  
**Estimated Volumes of Retreader-Generated Buffings Used or Brokered by California Processors<sup>6</sup>**

Category	2013		2014	
	Millions of Pounds	Percent of Total	Millions of Pounds	Percent of Total
Paving	NA	NA	2.0	10%
Turf & Athletic Fields	NA	NA	0.4	2%
Pour-in-Place Playgrounds	NA	NA	5.7	29%
Loose-Fill Playground/ Landscape Mulch/ Equestrian	NA	NA	1.2	6%
Molded & Extruded	NA	NA	2.9	15%
Other/Unidentified	NA	NA	7.3	37%
<b>Total</b>	<b>NA</b>	<b>NA</b>	<b>19.4</b>	<b>100%</b>

### Paving

In 2014, use of California-produced crumb rubber in paving applications was down slightly by 2 percent compared to 2013, at 3.5 million PTE. This is significantly down from the estimated 5.2 million PTE that were used to produce crumb rubber for the paving market segment in 2012.

The main reason for the slight decline appears to be reduced paving activity by Caltrans. While Caltrans has not yet released its annual report on its use of waste tires, in 2013 the report showed a reduction in the number of tires used to generate crumb rubber for paving from 4.6 million PTE in 2013 to 2.6 million PTE in 2014, an amount that translates to use of approximately 31 million pounds of crumb rubber.<sup>7</sup> (A small portion of crumb rubber supplied to Caltrans may be imported from other states, as their procurement policies require U.S.-made, but not California-made, crumb rubber). According to Caltrans representatives, the total amount of paving has been substantially reduced over the last few years as federal stimulus funding was exhausted, and this trend is continuing in 2015 and beyond. However, the paving that is occurring is mainly maintenance-related as opposed to new pavements, which favors the use of rubber asphalt products.

Caltrans is renewing its policies and efforts to use crumb rubber in paving, partly due to a new commitment to sustainability and in part to meet the department’s legislatively mandated usage levels. AB 338 requires that a minimum of 35 percent of Caltrans paving mixture contain crumb rubber, a requirement that Caltrans suggests equates to a minimum average use of 11.58 pounds of crumb rubber per metric ton of the total amount of asphalt paving materials used. Prior to 2015 this statute specifically required use of rubber asphalt or “field blend,” (also referred to as the “wet process”). But as of January 2015, Caltrans may use any paving technology to achieve the

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<sup>6</sup> While the vast majority of buffings used by California processors were generated by California-based retreaders, an unknown portion may have been imported from other states.

<sup>7</sup> “2013 Annual Report on Caltrans’ Use of Waste and Used Tires.” Available online at: <http://www.dot.ca.gov/hq/oppd/rescons/sb876/2013-Waste-Tire-Usage-Report.pdf>.

required levels. To date, Caltrans has used other paving technologies incorporating crumb rubber, such as the “terminal blend” process, far less than field blend applications. However, terminal blend material containing crumb rubber is increasingly being used in a range of products, including hot mix, warm mix, slurry seals, and chip seals.

In 2013, Caltrans switched the methodology used to estimate the amount of crumb rubber used in projects from basing it on awarded contracts to basing it on actual crumb rubber purchased and used. In 2013, this adjustment resulted in a significantly lower amount than in previous years, with only 22 percent of paving projects using crumb rubber. Data for 2014 has not yet been released, but Caltrans representatives say use is trending upward.

Caltrans’ new policies include requiring Caltrans district directors to explain in writing why they are not using rubber asphalt in situations where established specifications exist that would appear to meet the need.

Importantly, Caltrans has initiated a committee process designed to develop recommendations on how the department can greatly increase its use of crumb rubber in paving in future years. The so-called *PG+5* committee began by considering a new policy that would require a minimum of 5 percent crumb rubber in all performance-grade (PG) binders used by the department. The committee has also identified additional options that are currently being considered by Caltrans. While the options have the potential to substantially increase and even maximize the use of crumb rubber in Caltrans paving projects, the most far-reaching proposals would require a minimum of five years to conduct research and pilot projects, and possibly much longer.

Local agencies also use rubber asphalt products, often but not always with CalRecycle grant funding. While data on local use of crumb rubber in paving is not available, an analysis presented in CalRecycle’s 2013 Waste Tire Market Report showed that, over a four-year period, based on completed grant reports, CalRecycle paving grants to local agencies resulted in an average combined use of 9.2 million pounds per year of crumb rubber.

Generally, the cost of hot mix asphalt has declined significantly over the last year as crude oil pricing has sunk. However, while rubber asphalt may not have the advantage it did in recent years, it is still cost-competitive when costs are considered over the life cycle of the product.

Overall, Caltrans representatives were not able to predict whether there would be a net increase or decrease in the amount of rubber asphalt projects in 2015, although some asphalt industry representatives and crumb rubber producers suggested use of crumb rubber in paving applications may be up in 2015 compared to 2014.

### **Synthetic Turf and Athletic Fields**

Use of California crumb rubber as infill in synthetic turf applications was down 16 percent in 2014 compared to 2013, to 1.7 million PTEs, and down by 23 percent compared to the 2.2 million PTEs used in 2012 to produce crumb rubber infill. Because the synthetic turf market—except for CalRecycle grant-funded projects—is served by a number of out-of-state firms, the use of out-of-state crumb rubber infill is reportedly more common than in some other applications. As a result, it is unclear whether the entire market was down or just the portion served with California-produced crumb rubber.

Going forward, this market segment is being driven in part by the ongoing and severe California drought, which increases the attractiveness of the significant water savings offered by synthetic turf fields compared to natural turf. This is in addition to a number of other benefits, such as

reduced maintenance and increased play time. Synthetic turf used in residential and some other landscaping applications does not always use crumb rubber infill.

However, the most significant issue that may impact crumb rubber demand in this market segment is the perceived environmental and human health risks. Beginning with a news story in October 2014, this topic has received national attention on numerous networks and major print publications. Legislation has been proposed that would ban the use of crumb rubber in synthetic turf fields and playgrounds in select circumstances and require CalRecycle to prepare new studies analyzing the issue. This legislation was still under consideration at the time of writing this report.

Certain state agencies, companies, and industry trade associations have responded by conducting new research, with numerous studies and technical reports now available. CalRecycle has sponsored a variety of studies in the past, including a study on crumb rubber use in synthetic turf in 2010 by the Office of Environmental Health Hazard Assessment (OEHHA), and has tracked this issue closely. After reviewing the range of past research in the public Request for Approval distributed in connection with approval of TDP grants at its April 21, 2015, public meeting, CalRecycle summed up its position:<sup>8</sup>

“CalRecycle and OEHHA continue to objectively evaluate the entirety of scientific studies and evidence on this issue, but are unaware of any new scientific studies indicating that adverse health impacts from such exposures are likely. Accordingly, CalRecycle believes that the use of recycled tires in playgrounds or crumb rubber used as infill for artificial sports fields is appropriate. . . . CalRecycle will continue to provide funding for these projects, as well as other uses for waste tires, in an effort to divert this material from landfills in a responsible and sustainable manner, unless credible scientific evidence is obtained that would warrant a change in this policy.”

In its new Five-Year Plan adopted in April 2015, CalRecycle describes a new, very broad study to be conducted in conjunction with OEHHA in an effort to comprehensively address these concerns.

Industry predictions on how this issue may impact demand for crumb rubber in this market segment in 2015 are mixed. One California crumb rubber producer said that, overall, the number of turf fields expected to be built in California is up, although they expected the number that will use crumb rubber infill will be down. Others have suggested there may not be a noticeable impact in the total amount of crumb rubber used, and that the market will move past the issue. It was reported that many bids for new synthetic turf fields in California are now requiring respondents to provide a quote for alternative infill materials, in addition to crumb rubber. Available alternative infills are reportedly several times higher and may offer inferior performance and a reduced life-time, increasing life-cycle costs compared to fields made with crumb rubber infill. One way or another, it is likely that 2015 may be an indicator for how crumb rubber demand in the turf industry will fare over the long term.

Finally, another issue of importance to use of crumb rubber in synthetic turf fields over the long term is end-of-life management. As synthetic turf fields installed over the past decade are replaced, there is considerable interest in reusing the materials, including the crumb rubber,

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<sup>8</sup> This document is available online at:  
<http://www.calrecycle.ca.gov/Actions/Documents%5C45%5C20152015%5C1305%5CTDP%20Awards.pdf>.

whether in new turf installations or in other applications. It is possible that this reused crumb rubber may affect demand for newly produced crumb rubber. However, it is too early to determine how this trend may play out over the long term.

### **Loose-Fill Playground Surfacing, Landscape Mulch, and Equestrian Material**

This segment includes three very different markets with unique dynamics. They are grouped together because they all use ground rubber (i.e., tire-derived material of ¼ inch to ¾ inch in size), and grouping them simplifies the surveys used to gather information for the purpose of this report. In 2014, this market category consumed approximately 1.1 million PTE, 20 percent less than in 2013, which in turn was 23 percent less than the 1.8 million PTE consumed in 2012.

One major producer of landscape mulch closed down in 2014, and research indicates demand in this segment was generally flat or declining. Some cited reduced budgets allocated to CalRecycle TDP grants as a cause for the reduced demand, especially for loose-fill playground surfacing.

The outlook for these ground rubber products is unclear in 2015, as this segment may be impacted by the negative media attention described above in the “Synthetic Turf and Athletic Fields” section.

### **Molded Products**

In 2014, use of California-produced crumb rubber by molded product manufacturers dropped by 12 percent to 0.8 million PTE, compared to 2013. This was on the heels of a 30 percent drop in 2013 from the 1.3 million PTE used in 2012. This market segment is by far the most diverse of all markets for California tire-derived materials. As detailed in CalRecycle’s California Tire-Derived Product Catalog (available online at [www.calrecycle.ca.gov/Tires/Products/Catalog/](http://www.calrecycle.ca.gov/Tires/Products/Catalog/)), molded products include a variety of products used in the flooring, roofing, landscaping, building construction, transportation, cleaning supply, and agricultural industries, among others. This category also includes tiles used in playgrounds and other outdoor surfacing applications.

In 2014, one producer of molded mats temporarily stopped production, and several other firms involved in feedstock conversion (i.e., reformulating established products to use crumb rubber as part of the feedstock mix) continued to use very low volumes of crumb rubber as they work toward maximizing production and expanded sales. Other reasons cited for low volumes in the molded category include reductions in CalRecycle TDP grants, flat or declining demand, and competition with relatively low-cost crumb rubber and molded TDPs produced in other states.

This market segment holds the promise of further diversifying crumb rubber demand and thereby increasing the resiliency of markets to withstand disruptions. However, the long-term potential for the segment to consume large quantities of crumb rubber remains to be seen. CalRecycle-sponsored research suggests potential demand could approach 52 million pounds,<sup>9</sup> while current volumes are estimated at 12.5 million pounds for the molded products segment as a whole, which peaked at 16.6 million pounds in 2012. In 2014, a new molding operation started up, which may help support growth in this segment.

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<sup>9</sup> “The Outlook for Crumb Rubber Feedstock Conversion,” 2013. Available on the CalRecycle website at <http://www.calrecycle.ca.gov/publications/Documents/1510%5C20141510.pdf>.

Barriers to increased demand in the molded products segment include:

- While feedstock conversion may be a significant business opportunity, in some cases the volume of crumb rubber consumed may be small;
- Implementing feedstock conversion and new product development requires a sustained investment of time and money over a long period of time. Most manufacturers find it difficult to sustain focus without occasional setbacks as they confront a variety of related challenges related to manufacturing operations, sales and marketing, supply chain issues production costs, and others;
- Product development requires, in response to customer needs, developing specific raw material and product formulation specifications and product performance standards, among many other factors. This requires diligence to ensure that customer needs and desires drive the process, with a need for manufacturers to closely collaborate across their supply chain, including crumb rubber producers, compounders, and suppliers of other raw materials such as binders or colorants;
- The inherent material characteristics of crumb rubber limit its use in many manufacturing environments;
- California has a relatively small rubber manufacturing industry, and therefore relatively few candidates for feedstock conversion (compared to, for instance, the Midwest); and
- While California crumb rubber producers have supplied material to a variety of molded product manufacturers, they have not made growth in this segment a priority due to the relatively low volumes to date. Some feedstock conversion firms require fine-mesh material of 50 mesh or smaller. While no California crumb producers have invested in dedicated production capacity for fine-mesh crumb rubber, they are able to produce limited quantities by processing the range of sieve sizes produced in their current production systems. At least one California TDP manufacturer continue to access out-of-state supplies of finer mesh materials due to cost and time required to shift to lower mesh size crumb rubber in their product formulations.

## ***Civil Engineering***

After three essentially flat years, the use of shredded tires in civil engineering applications was up 177 percent in 2014 to 1.3 million PTE. The outlook in 2015 is for continued increases in total use and in the number of projects using TDA, both for landfill civil engineering projects mainly involving gas collection systems and for non-landfill projects involving lightweight fill, vibration dampening in light rail systems, storm water management, and other engineering projects. This trend was supported by CalRecycle's TDA grant program as well as ongoing outreach, research, and technical assistance activities.

Some processors continue to cite concerns over waste tire storage regulations as a barrier to supplying large TDA projects, as well as what some say is inadequate pricing of TDA. However, overall, based on recent CalRecycle grants and projections from landfill operators surveyed for this report, TDA use is expected to grow in 2015, and there is cause for optimism that this use will remain steady if not continue to grow.

## **Landfill Civil Engineering Applications**

CalRecycle's TDA Grant Program helped to catalyze use of about 0.9 million PTE of TDA by nine landfills in 2014, far more landfills than have used TDA in past years, with most of these supported by CalRecycle grants. Although some of these are using low volumes currently, combined they hold the potential to establish TDA as a consistent market. California landfills generally report using TDA in connection with gas collection systems.

## **Non-Landfill Civil Engineering Applications**

In 2014, about 400,000 PTE of TDA were used in non-landfill civil engineering applications in a vibration dampening application, outside of the grant program. Over the last year CalRecycle funded three additional non-landfill TDA projects with the potential to use about 900,000 PTE. These include two lightweight fill projects estimated to use 845,000 PTE, and a storm water management project estimated to use 50,000 PTE. While the storm water management project is relatively small, it could help fortify a trend toward a larger number of TDA projects using relatively small amounts that, combined, provide an ongoing, steady use of TDA. There is still a continued potential for very large projects on occasion.

## ***Alternative Daily Cover***

Tire shreds are used as ADC at some landfills to cover disposed waste at the end of each day. Tire ADC replaces dirt and can substitute for other ADC materials such as ground yard debris. The landfill's operating permit must allow for this use, the shreds must meet specifications, and use of ADC is limited to dry weather conditions. Tire ADC can sometimes provide landfills with a cost advantage if the landfill would be required to purchase other materials for use as cover; however, materials such as green waste are readily available onsite at most landfills, while operational hurdles to using tires as ADC limit their use. (As of January 1, 2020, the use of green material as ADC does not constitute diversion through recycling and shall be considered disposal pursuant to PRC Section 41781.3.(2)(A).) Landfills that do use tire ADC can potentially consume large quantities of waste tires. Processors typically must pay a tip fee or, at best, may have zero cost for delivering tire shreds to landfills for use as ADC.

In 2014, four landfills reported they used a total of 1.5 million PTE (15,000 tons) of tire shreds as ADC, a 19 percent increase from the three landfills that reported about 1.2 million PTE (12,000 tons) in 2013.

## ***Other Diversion***

Products in this "Other Diversion" category may include rings cut from truck tires used to weigh down construction traffic barrels, weights for agricultural film plastic, or other uses. While in 2012 and 2013 no processors reported such uses, in 2014 a total of 564 tons was reported.

## ***Tire-Derived Fuel***

Four California cement kilns continue to use significant quantities of processed TDF or baled waste tires, providing a strong, steady market that thrives without government support. (CalRecycle is precluded from promoting TDF markets by statute.) In 2014, these plants consumed 8.4 million California PTEs, 2 percent more than in 2013. We estimate that these plants also used an additional 462,000 PTEs that were supplied by California processors but that were imported from outside the state (based on allocation of imports across the market segments served by California processors receiving imported tires). One plant's TDF use increased

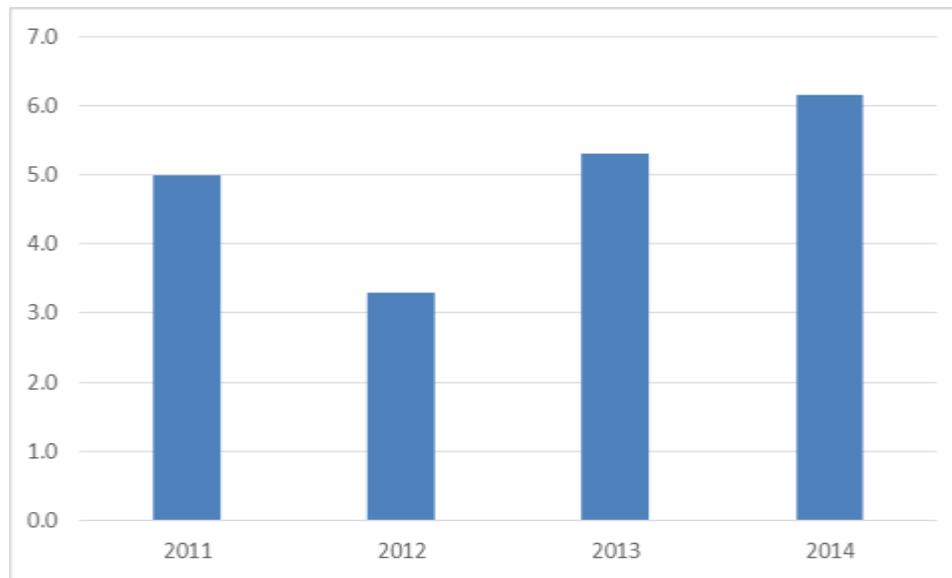
significantly compared to 2013, while another reported a decline due to unexpected equipment down time over several weeks. In addition to these volumes, two of the plants also consumed a combined total of 9,919 tons of tire fiber, a slight increase over 2013, comprising the majority of fiber generated by California crumb rubber producers. In contrast to the situation two years ago, cement kilns reported no difficulty in obtaining adequate supplies of whole tires or TDF, although one reported difficulty obtaining supplies of tire fiber.

Looking ahead, two cement plants report that they are already using near the maximum portion of waste tires in their fuel mix currently allowed under their permits. And while one plant reported it is already operating at near full capacity, others said they could use more TDF in 2015 due to increasing demand. Overall, the plants reported the potential to use a combined total of 600,000 PTE over and above the amount consumed in 2014. One of the four plants reports that they have tentative plans to invest in a feed system that could handle tire chips and/or tire fiber, but these plans are currently on hold.

## Disposal

As shown in Figure 3, waste tire disposal increased in 2014 by 17 percent compared to 2013, from 5.3 million PTE to 6.3 million PTE. This is on the heels of a 60 percent increase in 2013 compared to the record low California tire disposal of 3.3 million PTE reported in 2012. It should be noted that an additional 143,000 imported PTEs were disposed in California landfills in 2014, based on a pro-rating of flows from processors reporting they imported a share of their tire supplies from out-of-state sources. (See the following “Imports and Exports” section for more details.)

**Figure 3**  
**Four-Year Trend in Total California Waste Tire Disposal (Million PTE)**



One factor leading to higher disposal in 2014 was operational disruptions at one large processor. Another factor is shifts in export volumes. As discussed in more detail in the following “Imports and Exports” section, in 2014, as in 2013, exports of processed TDF and baled waste tires were erratic, with abrupt increases and decreases. When exports decline, some processors tend to

dispose an increased portion of their tires. This relationship is strongest for established processors that export TDF, and that have established relationships with disposal facilities and no other more attractive market outlets available. For balers, WTMS data does show shipments to disposal facilities, but based on numerous reputable accounts, a significant portion of baled waste tires are currently being stored in warehouses, as balers wait for the opportunity to export them.

In 2014, according to WTMS data and limited baler survey responses, slowdowns at west coast ports, combined with CalRecycle enforcement activities, reduced pricing, and increased competition with other exporting countries were major contributors to the increased disposal rate. However, based on numerous reputable observations, an unknown but significant quantity of baled and whole tires are also stored in warehouses until more favorable market and port conditions improve.

Figure 4 illustrates the four-year disposal trend in detail, showing monthly deliveries of waste tires to six California landfills from 2011 to February 2015: Azusa, American Avenue, L&D, Forward, Merced, and Avenal. In 2014, these six landfills accounted for the vast majority of California tire disposal. (Note: Total annual disposal in this report is estimated based on consideration of WTMS data as well as landfill operator and processor surveys. However, the figure below illustrates deliveries to the landfills based on only on WTMS data. Consequently totals in the figure may not correlate directly with reported annual tire disposal.)

**Figure 4**  
**Historical Monthly Flows to Six Landfills Receiving the Majority of Disposed California Waste Tires (PTE/Month)**

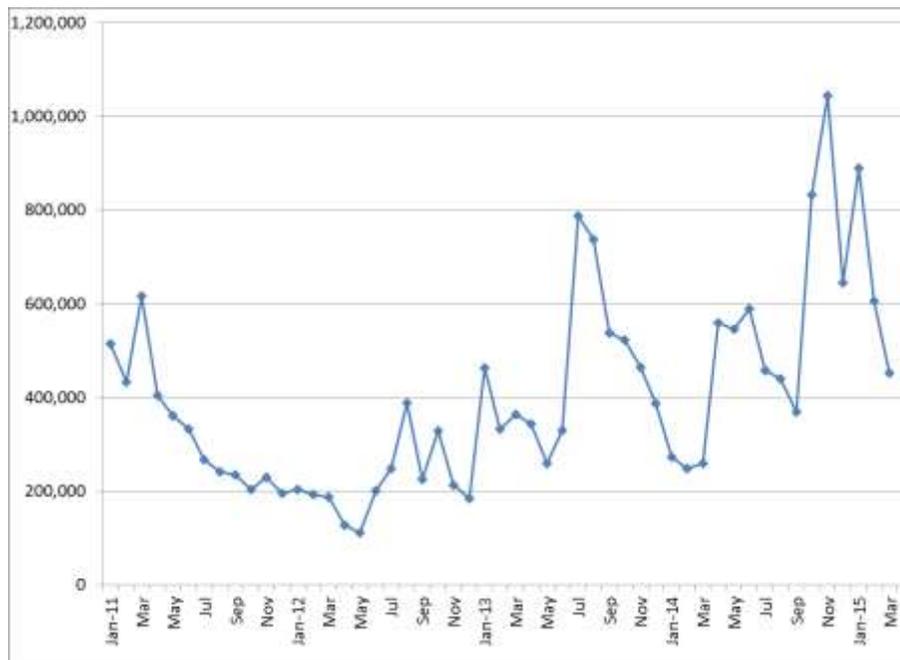


Figure 4 shows the sharp decline in tire disposal throughout 2011 as the exports of TDF and baled waste tires steadily increased and reached their peak in spring 2012. Exports moderated somewhat in mid-2013, albeit somewhat erratically, as pricing and demand were reduced as fossil fuel prices declined. This helped lead to corresponding spikes and a general uptick in 2013 tire disposal. The chart shows the continuing erratic trend in 2014, but with a clear uptick in disposal as export volumes declined due to port slowdowns and other factors. In early 2015, declining disposal appears to confirm reports of once-again increasing export volumes.

## **Imports and Exports**

### **Used Tire Imports and Exports**

Used tires that have been culled and graded depending on their type and quality have long been a staple export from California and other U.S. states. Though most California used tires are shipped to Mexico, they also are shipped to other parts of the world, including other Latin American countries, India, and Asia. No estimate of the number of used tires imported into California is available, although significant quantities are reportedly sent through California to export in Mexico or elsewhere.

In 2014 used tire exports from California were estimated at 1.8 million PTEs, a 38 percent increase over 2013. However, as discussed previously in the “Reuse” section, there is higher uncertainty in the estimates of used tires (and exports) than for the other market segments. The 2014 estimate is based on reports from several processors on the amount shipped directly to exporters (as opposed to domestic processors or end-users), as well as a conservative estimate of additional exported used tire volumes. Consequently, estimated used tire exports may be

somewhat under-reported. Also, the 2014 used tire estimates include an estimate to account for the growing share of used tires culled prior to loads reaching processors. While this estimate, and the share of used tires flowing to exporters, is based on information from many in the industry, it is still an estimate subject to relatively high uncertainty. Nevertheless, it is beyond doubt that the export of used tires is a strong, stable, and profitable market.

### **Waste Tire Imports**

In 2014, an estimated 1.3 million PTE of waste tires were imported from out of state and flowed to three California processors. This estimate does not include culled used tires imported into California directly for the purpose of sale or export, as discussed above. The processors importing waste tires, in turn, shipped TDM to a variety of end-use markets and/or crumb rubber producers, and this share of their shipments was subtracted from the market segment estimates presented in this report for California-generated tires. The amount subtracted from the flows from California processors to each market segment is shown in Table 4.

**Table 4**  
**Estimated Market Disposition of Waste Tires Imported to California Processing Facilities**

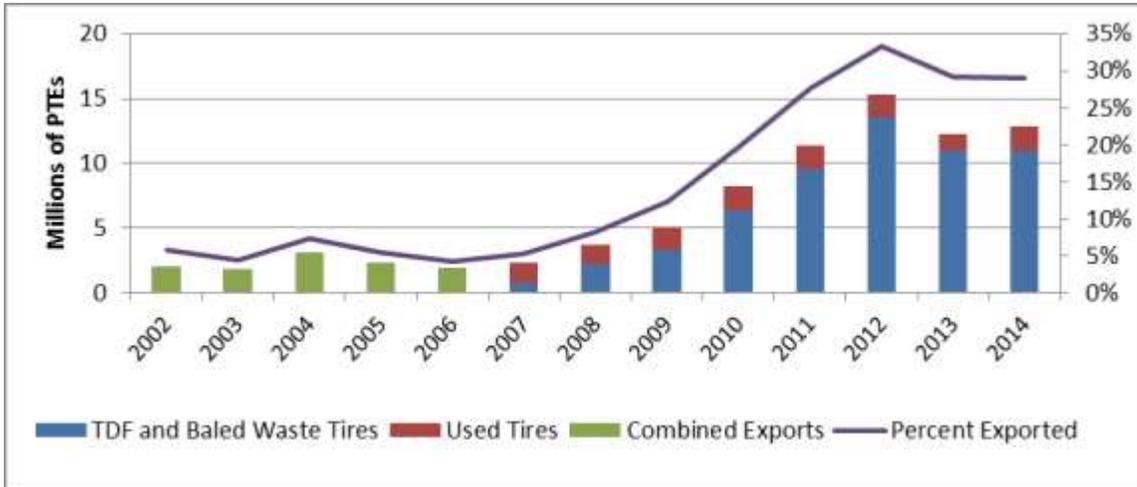
Category	Sub-Category	Adjustments Made to Shipments from California Processors to Account for Imported Tires (Tons)
<b>Export</b>	Processed TDF	4,245
	Baled Waste Tires	0
	Used Tires (Exported)	535
	<b>Subtotal</b>	<b>4,780</b>
<b>Reuse</b>	Retread	0
	Used Tires (Domestic)	861
	<b>Subtotal</b>	<b>861</b>
<b>Crumb Rubber</b>	Paving	508
	Turf & Athletic Fields	61
	Loose-Fill Playground/ Mulch/Equestrian	83
	Molded & Extruded	41
	Other	0
	<b>Subtotal</b>	<b>693</b>
<b>Civil Engineering</b>	Landfill Applications	17
	Non-Landfill Applications	255
	<b>Subtotal</b>	<b>272</b>
<b>Alternative Daily Cover</b>		0
<b>Other Diversion</b>		0
<b>Tire-Derived Fuel</b>		4,623
<b>Landfill Disposal</b>		1,433
<b>Total Imports</b>		<b>12,661</b>

### **TDF and Baled Waste Tire Exports**

As shown in Figure 5 on the next page, after a rapid and consistent rise beginning in 2007, export of TDF and baled waste tires peaked in 2012 at an estimated 13.5 million PTE. (This trend and the impact on established waste tire processors is discussed at the beginning of Section 3 under “Supply and Demand Balance.”) This amount then declined to 11.0 million PTE in both 2013 and 2014. In 2014, an estimated 7.4 million PTE of processed TDF was exported, primarily to Japan and Korea, and an estimated 3.6 million PTE of baled waste tires was exported, primarily to Vietnam. Prior to 2014, this report did not separately break out exports of processed TDF and exports of baled waste tires. It must be noted that the estimate of baled tire exports may be understated as it is based on WTMS data that may miss certain exporter flows, and survey responses from only three of eight identified balers operating during all or part of 2014. Also, based on comments from several reputable sources, an unknown but large quantity of baled and loose waste tires are being warehoused. It should also be mentioned here, as already noted in Table 4, that an additional 4,245 tons of processed TDF, and 535 tons of used tires, were exported by California processors but derived from imported tires from out of state. This is in addition to the unknown but significant quantity of culled used tires imported to California directly to ports

for the sole purpose of being exported or directly for sale within California. This quantity is not included in the estimate of California-generated tires exported.

**Figure 5**  
**Trends in Export of TDF, Baled Waste Tires, and Used Tires**



The drop in exports was caused by several factors. West coast ports experienced at least two protracted slowdowns in 2014 and into early 2015 which severely limited export volumes. The price of fossil fuels has declined significantly since early 2014, reducing demand for alternative fuels such as TDF in Japan and Korea, the two largest consumers of processed TDF from California. This also affected pricing, which is currently down by more than a third from early 2014, according to one exporter. Moreover, according to one large producer of TDF for export, there is growing competition from other countries that export waste tires and TDF, especially Australia and India. Finally, CalRecycle enforcement actions and fines have also reportedly had a detrimental impact on certain balers. As a result of these trends, several balers closed down, changed ownership and/or company names and reduced the volume of their operations. Faced with an inability to move their material, some balers have reportedly chosen to warehouse the material in ever-growing volumes.

Currently, since the resolution of port labor issues in early 2015, some exporters now report they are once again moving large amounts of material. One exporter reports that they are accepting material from haulers that had been warehoused, but it was estimated it will take many months to ship the material that had been warehoused.

Another result of these trends is that some established processors report that the severe disruptions in access to their tire supplies, and the reduction in revenue from tire pick-ups that they experienced in 2012, have subsided somewhat, although pricing has not returned to the pre-export boom levels. According to some reports, some waste tire generators have become frustrated with the on-and-off practices of certain balers and are now willing to pay somewhat higher prices to secure consistent pick-up services from established processors.

### **Crumb Rubber and TDPs Imported into California**

In 2014, crumb rubber from other states, Canadian provinces, and from Europe was sold in California at competitive prices, despite transportation costs. This is in part possibly due to the

incentive payment subsidies and/or favorable operating conditions in some of these jurisdictions. California crumb rubber producers have often complained of imported crumb rubber being offered at very low prices, reducing what they believe to be fair market prices. However, according to two crumb rubber producers, the severe glut of crumb rubber that had exacerbated this situation has subsided somewhat, although this could change as market conditions evolve in 2015 and beyond. One firm that had been importing crumb rubber from Europe has reportedly stopped this practice. Moreover, reportedly no major, new crumb rubber capacity has come on-line in North America over the past two years. As a result, while there are still concerns over low-priced imported crumb rubber in California, the impacts to the state's crumb rubber producers may be lower than in previous years. Similarly, some TDPs have been imported into California, including mats and tiles, from as far away as Canada's eastern provinces.

# Section 4

## Outlook for Increasing Waste Tire Diversion and Recycling

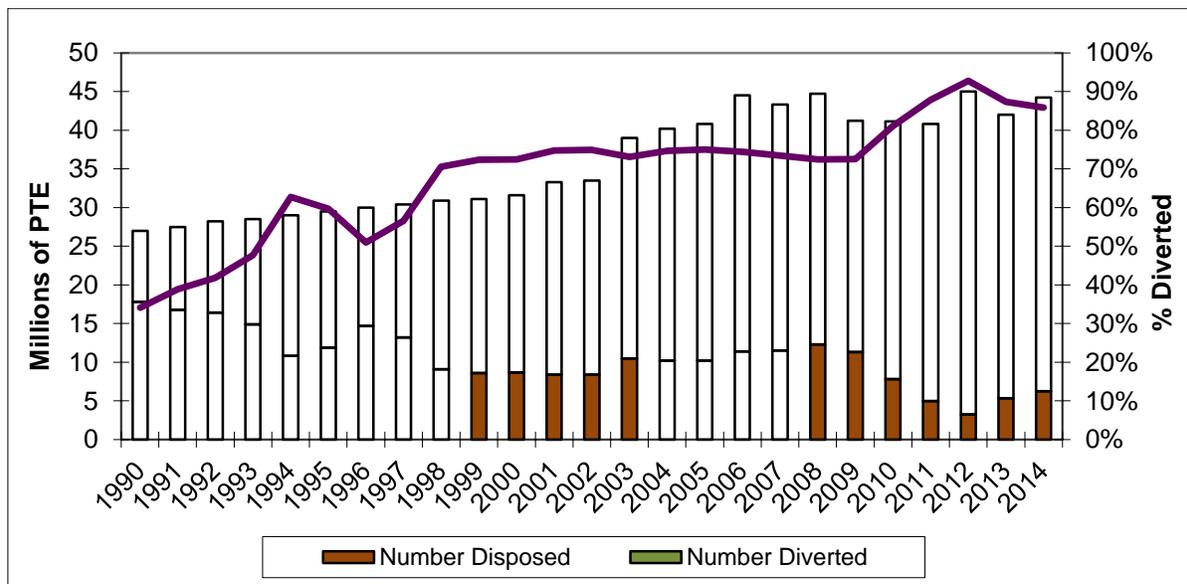
This section begins with a historical look at waste diversion and recycling trends. This is followed by an overview of the short-term and long-term outlook for increasing diversion and recycling levels, including identifying key barriers impeding expansion. The final section discusses implications for California waste tire market development efforts in the context of CalRecycle’s planned shift to an incentive-payment based strategy.

### Historical Waste Tire Diversion and Recycling Trends

As shown in Figure 6, total California waste tire diversion steadily increased from about 31 percent in 1990 to about 75 percent in 2001, and then hovered between 72 and 75 percent throughout the 2000s. Driven by surging export demand, in 2012 the rate exceeded CalRecycle’s 90 percent diversion goal for the first time, at 92.9 percent, before declining to 87.3 percent in 2013 and 85.9 percent in 2014, due largely to shifts in exports.

CalRecycle has shifted its focus to recycling in recent years, as opposed to diversion. The recycling-based measurement is defined in this report to exclude waste tire exports (but not used tire exports), ADC, and TDF, which CalRecycle is statutorily prohibited from promoting. This report also excludes the “Other Diversion” category, which includes small uses of waste tires such as weighting down agricultural film on farms. Excluding these segments, the 2014 recycling rate was 38.5 percent, down slightly from 38.6 percent in 2013, but down from the 2012 level of 43.3 percent.

**Figure 6**  
Waste Tire Diversion and Disposal Trends



## ***Diversion and Recycling Outlook***

Table 5 on the next page lists some of the key barriers impeding expansion of the waste tire recycling market segments. Current CalRecycle programs aim to help the industry overcome these barriers through a variety of funding, research, technical assistance, outreach, and direct business assistance activities.

Drawing on specific information gleaned during research for this report, Table 6 summarizes projections for short- and long-term recycling and diversion of California waste tires. In the short term, the overall outlook for 2015 and 2016 is mixed. There is a good chance that the diversion rate will increase somewhat, due to expected growth in civil engineering and TDF, and the possibility of growth in exports. The recycling rate trend, however, is more difficult to predict, as media reports on concerns over crumb rubber environmental health risks appear to be impacting sales to the turf market in 2015, and the ground rubber market segment appears to be down, reportedly in part due to reduced CalRecycle grant activity. The paving market segment holds the potential to help crumb rubber grow; however, Caltrans representatives report that overall paving levels are sharply down. On the other hand, the paving that is occurring is largely in maintenance as opposed to new construction, which, along with a renewed Caltrans policy commitment, is favorable to the use of crumb rubber. Absent a major change in these crumb markets or the emergence of one or more large civil engineering projects, it therefore appears likely that the California tire recycling rate will remain near its current level.

In the long term, diversion through export, TDF, and ADC appears likely to remain at current levels or to grow, offering the potential for sustained high diversion above 90 percent, provided that recycling volumes are sustained or increased.

Long-term recycling projections are difficult to make, as some segments have significant potential for growth, while others are facing barriers that could reduce volumes. An optimistic scenario would include: continuing strong reuse markets that are not disrupted by lower-quality imported tires as some have suggested may happen; significant expansion of paving and molded product markets for crumb rubber, including use of crumb rubber in a wide variety of new and established products; and growing, consistent use of TDA in a wide variety of civil engineering applications in both the government and private sectors, and in both landfills and a wide variety of other non-landfill applications. A more pessimistic scenario would involve, at worst: reduced reuse due to lower-quality imported tires; continuing deterioration of turf and playground markets as a result of perceived environmental health risks; and continuing sporadic use of TDA in civil engineering projects. The nagging issue of end-of-life management regarding installed tire-derived products may also begin to erode some current markets as more rubberized playground surfaces and synthetic turf fields require replacement and are either disposed, or processed and recycled again, potentially displacing the use of newly produced crumb rubber. Ideally, one or more new or reinvigorated, robust market segments will emerge with the capacity for both high volume, economical waste tire use that also offers clear environmental benefits. Without such a development, this analysis suggests that a significant increase in tire recycling volumes is not likely over the next three to seven years.

The “wild card” in the long-term analysis is the potential impacts of CalRecycle’s shifting waste tire market development strategy and programs, which is discussed below in the final section of this report.

**Table 5  
Key Barriers to Expansion of Waste Tire Recycling**

Barrier	Crumb Rubber Production	Reuse		Crumb Rubber Demand				Civil Engineering	
		Retread	Used Tires	Paving	Turf	Play/Mulch	Molded	Non-Landfill	Landfill
<b>Competition with conventional or alternative materials/products</b> with favorable pricing or performance	X	X	X	X	X	X	X	X	X
<b>Lack of awareness</b> of tire-derived products, performance or pricing benefits, and past experience	X	X		X	X	X	X	X	X
<b>Government agency budget constraints</b> and low resources forcing purchasers to rely solely on the alternatives with the lowest initial bid instead of basing purchases on life-cycle savings over time				X	X	X	X		
<b>Barriers to entry in use of TDM and TDPs</b> , including lack of experience regarding use of TDM by manufacturers and TDA by engineering, and the need for research, development and testing	X			X			X	X	X
<b>Insufficient quality standards and practices</b> , or inadequate implementation and adoption	X			X		X	X		
<b>Tire storage regulations</b> and concerns impede ability to supply projects with tire-derived materials				X		X		X	
<b>Perceived concerns over environmental, health or safety risks</b>		X	X		X	X			
<b>Concerns over increasing imports of tires not made to U.S. design and performance specifications</b> with uncertain composition and potential for reuse and retreading		X	X		X	X	X		
<b>Concerns over insufficient quantity or quality of raw materials</b>							X	X	
<b>Long lead time</b> for feedstock conversion and new product development				X		X	X	X	
<b>Inherent material characteristics</b> of tire rubber limit potential applications				X		X	X		
<b>California has a relatively small rubber manufacturing industry</b> that may limit the potential for increasing demand through feedstock conversion							X		
<b>The amount of tire rubber generated far exceeds the amount of non-tire rubber products produced</b> , which leads to the need for large volume, non-traditional markets for recycled tires	X								
<b>Competition from out-of-state suppliers</b> of low-priced tire-derived materials and products, sometimes with subsidies or operational cost advantages	X			X	X	X	X		
<b>Disruptions in waste tire supply and pricing</b> caused by baled tire exporters with the ability to begin and/or shift operations rapidly due to low start-up costs	X								

**Table 6  
The Outlook for Diversion and Recycling**

Category		2014 Volumes		Short-Term Outlook (2015-2016)	Long-Term Outlook (2017 – 2022 and Beyond)
		Million PTEs	Per-cent		
Recycling	Reuse (Inc. Used Tire Export)	8.5	19.2%	<b>Flat</b> As culling of used tires shifts from processors to haulers, overall volumes fluctuate within historic ranges. Some retreaders report the potential for modest growth over time.	<b>Flat or Potential Decline</b> Some cite concerns over imported tires with variable composition and performance standards. Baring this, reuse should remain strong and stable.
	Crumb Rubber	7.3	16.5%	<b>Uncertain</b> Perceived concerns over environmental, health and safety risks could reduce turf and playground volumes, while growth in paving and molded/extruded products may be modest.	<b>Uncertain or Potential Increase</b> New Caltrans policies could greatly expand crumb use; feedstock conversion could diversify and expand demand, but may not have a significant market impact.
	Civil Engineering	1.3	2.9%	<b>Growth Expected</b> Ongoing or planned projects, many CalRecycle-funded, should expand use in 2014 and beyond.	<b>Continued Steady but Modest Growth</b> With continued CalRecycle funding, the number of projects and TDA specifiers seems likely to grow.
	Overall "Recycling"	17.0	38.5%	<b>Uncertain, Modest Growth at Best</b> With reuse holding steady and modest growth in civil engineering and molded products expected, recycling growth depends on sustained turf volumes and growth in paving.	<b>Uncertain; Potential for Growth or Decline</b> New Caltrans policies and expanding civil engineering and molded products could significantly increase demand, while the turf outlook is unclear.
Diversion	ADC	1.5	3.3%	<b>Flat</b> No major changes projected by landfills, although shifts at even one landfill can significantly impact total volumes.	<b>Flat</b> Experience indicates at least one or two landfills will continue to use significant amounts of tire ADC.
	TDF	8.4	19.0%	<b>Modest Growth Expected</b> California cement kilns are near capacity but report expectations of using about 0.6 million more PTE in 2014.	<b>Flat or Additional Modest Growth</b> One plant reports it may invest in new TDF capacity. Several plants do not use TDF but potentially could.
	Export (TDF & Baled Waste Tires)	11.0	24.9%	<b>Growth Expected</b> Anecdotal information supported by declining monthly tire disposal data suggests exports are again increasing.	<b>Erratic but Sustained High Volumes</b> Strong global demand, even with low fossil fuel prices; likely continuing peaks and valleys.
	Overall Diversion	38.0	85.9%	<b>Flat or Modest Growth</b> Increasing export, TDF, and civil engineering appear likely to boost total diversion barring a significant decline in crumb rubber.	<b>Continued High Diversion Near or Above 90 Percent</b> Despite risks, market size, diversity, and growth potential should maintain high diversion levels.

## Section 5

# Concluding Remarks: Implications for CalRecycle Market Development Efforts

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CalRecycle's waste tire market development program is perhaps the best funded and most expansive in the nation. The program has helped to spur the establishment of a strong waste tire collection and processing infrastructure. And, the program was instrumental in the expansion of rubberized paving and playground applications and, prior to the change in policy, expansion of TDF markets.

CalRecycle's goals and strategies have evolved steadily over the years, and currently the department is focused on expanding and diversifying waste tire recycling through reuse, crumb rubber, and civil engineering. CalRecycle's strategies currently include research and direct technical assistance to promote the use of tire-derived materials in paving and civil engineering applications; direct business assistance and outreach to expand awareness and procurement of waste tire-derived products; and funding through grants and incentive programs supporting all of the above markets.

CalRecycle's latest Five-Year Tire Plan, adopted on May 1, 2015, includes a vision statement outlining CalRecycle's intention to consider implementation of an expanded incentive payment system to drive expansion of tire recycling volumes, excluding TDF, landfill ADC and exports. CalRecycle's long-term vision also would entail other legislative changes to augment this approach:

- “1) Mandate that State agencies, universities/colleges, and local governments procure tire-derived products, where such products meet specifications and are economically feasible;
- 2) Prohibit, with a phased-in ban over a reasonable time period and if sufficient processing capacity is available, tire disposal and the use of tire-related ADC;
- 3) Require that waste tires be processed with at least a minimal level of shredding to discourage disposal and to ensure an adequate supply of processed tires for recycling, and;
- 4) Support source reduction by requiring a minimum tire life of 60,000 miles; tires meeting this standard would be subject to the normal new tire fee, while tires with a lower life would be subject to higher fees.”

As part of this long-term approach, CalRecycle also proposes to increase supporting research, consolidate its tire cleanup grant programs into a more efficient set of programs, eliminate some market development grant programs, and provide for the required emergency reserve through an escrow account or contract. It would continue the current level of support for inspection and enforcement activities, hauler manifest system, market trend analysis and targeted outreach, and consolidated technical support for rubberized asphalt concrete and tire-derived aggregate projects. Proposed legislation has recently been introduced (AB 1329, Gordon and Atkins) that would authorize an expanded incentive program compared to the current Tire Incentive Program, along with a variety of related policy changes.

CalRecycle's 2012 report, "[Evaluation of Tire Incentives and EPR Policies](#)" describes the potential benefits and important pitfalls to avoid related to incentive approaches, which the Legislature and CalRecycle may wish to consider as the new vision moves forward. In short, while incentives hold the promise of moving more tires into top-priority market segments, they potentially can trigger overproduction, a disruptive aggressive competitive environment, and/or subsidization of market segments that might thrive without incentives.

Aside from the very important details of any new incentive system, this report suggests that the following issues may be critical to long-term expansion in waste tire recycling markets:

- Will new research show conclusively in a timely manner that crumb rubber used as infill and playground surfacing is safe to humans and the environment, and will the perceived risks subside to the point where this issue no longer represents a market risk?
- Will new state procurement policies effectively trigger substantial increases in demand for California-made tire-derived materials and products? CalRecycle discusses the need to significantly strengthen state procurement of TDPs in the vision included in the new [Five Year Tire Plan adopted in May 2015](#). The [Department of General Services](#) has a variety of green purchasing policies. Caltrans has adopted a [Sustainable Highways policy](#), and its *PG+5* Committee is exploring options to significantly increase the amount of crumb rubber used in asphalt paving applications.
- Will stronger incentives be able to trigger substantial, sustained increases in demand for key, high-volume market segments like paving and civil engineering? To the extent that incentive programs shift funding from the established TDP grants program, will that have a net detrimental or positive impact on overall crumb rubber use?
- Will new incentives speed and strengthen the process of building demand through feedstock conversion and new product development, which typically requires long development times of several years to reach their full potential? And will these emerging markets be fully supported during their incubation period when recycled volumes may not be very high?
- Will CalRecycle research funding help to develop new products or markets with the potential to use large quantities of tire-derived material in economical, profitable, and environmentally sound ways?
- Will markets emerge that contribute to, and benefit from, California's broad sustainable materials management policies goals such as greenhouse gas reductions, strong end-of-life management practices, and minimization of environmental impacts across the product life cycle? Or, will the statutes and regulations associated with these goals serve as barriers to waste tire market development?

The answers to these questions are presently uncertain and will emerge over time. But it is clear that the decisions made in the coming few years by state decision makers, as well as the waste tire management and recycling industry, will strongly influence the future of California's tire recycling practices.

# Appendix A Glossary

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<b>ADC</b>	Alternative daily cover used at landfills instead of soil
<b>Buffings</b>	Tire rubber produced as a by-product of the tire retreading process.
<b>Caltrans</b>	California Department of Transportation
<b>CARB</b>	California Air Resources Board
<b>CE</b>	Civil engineering
<b>Crumb rubber</b>	Tire-derived material less than ¼ inch in size, free of wire and fiber.
<b>Feedstock conversion</b>	The process whereby a manufacturer of an existing, commercially proven product converts a portion of the raw materials used to make the product from existing one (e.g., virgin rubber, plastic or other materials) to crumb rubber made from recycled tires.
<b>Ground rubber</b>	Tire-derived material ¼ inch to 1 inch in size, free of wire and fiber
<b>OEHHA</b>	California Office of Environmental Health Hazard Assessment
<b>PTE</b>	Passenger Tire Equivalent, defined as 20 pounds of tire rubber for the purposes of making consistent comparisons in this and other reports. (The actual weight of waste passenger tires may vary considerably.)
<b>Tire-derived aggregate (TDA)</b>	Tire-derived material used to replace conventional aggregates like rock in civil engineering applications
<b>Tire-derived fuel (TDF)</b>	Whole waste tires or tire-derived material consumed as fuel (referred to as processed TDF in this report)
<b>Tire-derived material (TDM)</b>	Tires processed to meet market specifications, for example, crumb rubber, ground rubber, tire-derived aggregate, and tire-derived fuel
<b>Tire-derived product (TDP)</b>	Product made entirely or in part from tire-derived material
<b>Tire Incentive Program (TIP)</b>	A CalRecycle program launched in June 2014 to promote feedstock conversion and the use of crumb rubber as feedstock by California manufacturers
<b>WTMS</b>	Waste Tire Manifest System

# Appendix B

## Methodology and Data Limitations

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This Appendix briefly summarizes the methodology used for this report, including the presumed level of accuracy, sources of uncertainty, and differences with previous CalRecycle reports.

The market flow estimates presented in Tables 1 and 2 are thought to be accurate to within plus or minus 10 percent, which may be an upper bound on the potential accuracy of waste tire flow studies generally. For this 2013 report, the level of uncertainty associated with used tires and baled waste tire exports are somewhat higher levels of uncertainty.

The estimates cited in this report are based on surveys, interviews, analysis of data in CalRecycle's Waste Tire Manifest System (WTMS), and review of written information. Because these sources are generally incomplete and conflicting, the study team evaluated them for accuracy, double-counting issues, and overall consistency, and selected the best available estimate for the facilities and market categories analyzed.

Data limitations include:

- **Conversion Factors:** Firms and CalRecycle typically use a standard conversion factor of 20 pounds per tire, even though waste tire weights vary significantly. According to the Rubber Manufacturers Association, based on national average statistics, passenger tires weigh approximately 22.5 pounds; commercial/truck tires weigh 110 pounds; mixed loads of passenger and light truck tires average 32.8 pounds per tire; and medium truck tires and off-road tires may weigh hundreds or even thousands of pounds. WTMS data in particular can be subject to large errors as data may be entered in tons, pounds, number of tires, or cubic yards. CalRecycle converts weight and volume measures to tons in the WTMS system, but these conversions are subject to error. In this study, WTMS data alone is not used to estimate tire flows, but is considered along with several other data sources to develop the best estimates possible of tires flowing to each market segment.
- **Data Entry:** A significant portion of WTMS entries have errors, illegible comprehensive trip logs, and other data entries that may impact estimates considered in this report. A number of quality control checks are used during data analysis to identify and address potential data entry errors.
- **Un-Manifested Flows and Off-the-Books Transactions:** Some tire flows are not manifested, either due to CalRecycle-approved exemptions or through failure to submit required comprehensive trip logs. And some flows, especially of used tires, are sometimes treated as off-the-books transactions and are not reported in surveys or tracked by generators, haulers, and/or processors.
- **Discrepancies Between Inputs and Outputs, and End-of-Year Inventories:** Manifest information based on deliveries to facilities provides data on inputs to facilities, while surveys provide data on outputs sent to market uses. Output data is often based on shipping information or facility estimates that do not reflect stored inventories that were received in a previous year. This study reports all data on the basis of incoming tire equivalents (i.e., whole tire inputs) associated with reported product sales. It utilizes average yield factors for this

conversion for ground rubber producers unless a producer provides its specific yield factor (yields reflect the removal of tire wire, polyester “fluff,” rims, and rubber loss from incoming waste tires). In 2013, due to competitive pressures and lingering influences from the export surge, certain processors may have had higher than usual on-the-ground inventories at the end of 2013, potentially resulting in a somewhat lower estimate of the total number of tires managed.

- **Data Gaps and Inconsistencies:** The project team had to confront a number of data gaps in developing this report, including inconsistent survey responses and the failure of some companies to report data. Generally, the team followed up with respondents as needed and/or consulted past survey data and manifest records to develop estimates. In the vast majority of cases, the team was able to reconcile data concerns directly with respondents.
- **Interpretation of Market Segment Definitions and Requested Data:** While every attempt is made to clearly explain data requested through surveys, it is possible that in some instances respondents interpret categories or units differently. For example, some recyclers also convert rubber buffings from tire retreaders into products, which may also be counted as “recycled” at the retreader stage, or they may recycle rubber from non-tire sources.
- **Waste Tire Generation vs. Documented Flow:** It should be noted that this report does not attempt to explicitly estimate waste tire generation. Rather, the information in Table 1 represents the total documented flow of waste tires, which is thought to represent a very high percentage of actual generation in the study years.
- **Tire Diversion Rate Not Adjusted for Residuals:** As with many other state and national tire recycling market studies, in this report the tire diversion rate is not adjusted for steel and fiber residuals that occur as a result of producing ground rubber. However, in 2013, the vast majority of wire, rims, and fiber residuals from processing and ground rubber operations were recycled, so consideration of these residuals would not appreciably impact the estimated diversion rate.

The methodology used for this California Waste Tire Market Report is very similar to that used for the annual reports prepared for 2007–2013, which are available on CalRecycle’s web site. However, some changes were made in this year’s report:

- This report describes diversion from landfill and recycling (which excludes TDF, ADC, and exports of baled waste tires and TDF and other diversion) separately.
- The “Waste Tires and Processed TDF” category used in previous reports was broken into two categories: “Processed TDF” and “Baled Waste Tires.”
- Terminology for market categories was changed:
  - Previous reports referred to operations set up to mainly or exclusively export baled waste tires as “exporters.” In this report they are referred to as waste tire balers, and “exporter” refers to any company that exports TDM or TDP abroad.
  - RAC and other Paving was changed to simply “Paving,” reflecting the growing range of TDPs in that category.
  - The term “crumb rubber” is now used to refer to TDM of ¼ inch or smaller, with “ground rubber” used to refer to TDM of ¼ inch or larger. “Crumb rubber” is

also used generically to refer to the crumb rubber and ground rubber category. Previously, “ground rubber” was used to refer to all of the above.

- The loose-fill/mulch category was changed to “Loose-Fill Playground/Landscape Mulch/Equestrian Material” to more specifically refer to the main products and markets for ground rubber.
- The “Other Recycling” category was changed to “Other Diversion,” as this category primarily refers to such uses of tire pieces as weights for agricultural film, assumed to count as diversion, not recycling in this report.
- The volume of retread tires was estimated based on a survey combined with extrapolation and estimation of non-respondents based on prior responses and other available information. In previous years, estimates were sometimes based on average rate of growth or decline in the segment based on limited survey responses.
- Estimates of used tires are based both on direct survey responses by processors, and an estimate that an additional 7 percent of certain flows are culled for reuse (not including retreads, documented used tires, and shipments to certain processors who haul and cull used tires from most shipments reaching them). We further estimate that, of these estimated used tire flows, 60 percent are exported and 40 percent are sold domestically. These assumptions may be changed annually based on feedback from haulers and processors.
- For the first time, this year’s market report gathered information on use of buffings from retreaders by California processors. The information is not comprehensive, and efforts will be made to refine it in future years.