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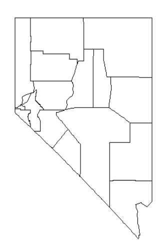
A MARKET AND TECHNICAL FEASIBILITY STUDY OF RECYCLING OPPORTUNITIES IN NORTHEASTERN NEVADA



UNIVERSITY OF NEVADA, RENO

A MARKET AND TECHNICAL FEASIBILITY STUDY OF RECYCLING OPPORTUNITIES IN NORTHEASTERN NEVADA

Frederick A. Steinmann

and

Kathryn L. Muzzin

and

Thomas R. Harris

Frederick Steinmann is an Assistant Research Professor with the University Center for Economic Development, College of Business at the University of Nevada, Reno.

Kathryn Muzzin is a Graduate Student in the College of Business and a Graduate Assistant with the Nevada Small Business Development Center at the University of Nevada, Reno.

Thomas Harris is a Professor of Economics and Director of the University Center for Economic Development, College of Business at the University of Nevada, Reno.

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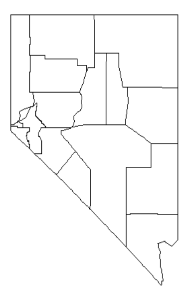
Frederick A. Steinmann, DPPD
University Center for Economic Development
University of Nevada, Reno
The College of Business
Mail Stop 204
Reno, Nevada 89557
Phone: 775.784.1655



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1.0 Introduction, Overview and Executive Summary

In September 2019, representatives from the Northeastern Nevada Regional Development Authority contracted with the University Center for Economic Development, part of the College of Business at the University of Nevada, Reno, to complete a market and technical feasibility study of recycling opportunities for the five-county Northeastern Nevada area. This University Center for Economic Development technical report summarizes the results of this market and technical feasibility study.

The Northeastern Nevada Regional Development Authority was established in 2012 as a result of the development of the state of Nevada's comprehensive statewide economic development plan, *Moving Nevada Forward: A Plan for Excellence in Economic Development 2012-2014*. Initially, the Northeastern Nevada Regional Development Authority's footprint consisted only of Elko County and the incorporated cities held therein. Between 2014 and 2016, Humboldt County, Eureka County, Lander County, and White Pine County joined the Northeastern Nevada Regional Development Authority followed by Pershing County in 2019. This market and technical feasibility study of recycling opportunities for Northeastern Nevada covers the development of a new recycling industry sector for the five counties of Humboldt County, Elko County, Eureka County, Lander County, and White Pine County and was developed in concert with the Northeastern Nevada Regional Development Authority's new five-year Comprehensive Economic Development Strategy for 2020 through 2025.

1.1 Overview and Executive Summary

Based upon the results of the analysis completed and presented throughout this University Center for Economic Development technical report, it is concluded that market and technical feasibility for the development of a new recycling industry in Northeastern Nevada does **not** currently exist. However, various recycling opportunities, and the potential for a future recycling industry in Northeastern Nevada **does** exist given the appropriate use and combination of targeted public-sector policies and incentives and improved support and championing by key private-sector stakeholders.

The successful development of a growing and sustainable recycling industry is largely dependent upon two critical conditions. First, there must be a substantial and growing source of potentially recyclable materials (inputs) to support ongoing and expanded recycling processes including in the production of new component parts, materials and finished goods that utilize various recycled commodities. Second, regional and national market prices for the recycled commodities must be great enough to cover the financial costs of collecting and processing the potentially recyclable materials (outputs) in order to support and grow the profitability of individual firms involved in the production of the recycled commodities. In order to effectively and efficiently take advantage of these conditions, a region must also have the requisite infrastructure to support the collection and sorting of industrial and municipal wastes and the requisite private-sector firm structure and presence to conduct the processing and production of recyclable commodities. General public support, support from the private-sector, and public-sector regulatory and policy support must each exist for any recycling industry sector to be successful in both the short-term and long-term.

Regarding the first condition, the existence of a substantial and growing source of potentially recyclable materials (inputs), the amount of industrial waste (generated by individual firms and industries) and the amount of municipal solid waste (generated mainly by individual households) is a direct function of the levels of economic activity, personal consumption patterns, and population growth levels measured for a defined geographic area. While general levels of economic activity have increased substantially throughout the Northeastern Nevada region over the last several years, total population has grown at a rate measurably slower than that of the entire state of Nevada, 2.9 percent growth in Northeastern Nevada compared to 5.8 percent statewide, between 2013 and 2017. The total number of households in Northeastern Nevada and the overall size of the region's civilian workforce, growing by 1.4 percent and 3.6 percent respectively between 2013 and 2017, have also lagged behind the rate of growth in the state's total number of households and the state's overall civilian workforce, growing by 5.3 percent and 6.9 respectively between 2013 and 2017.

Total employment opportunities created within the region's primary industry sectors, including the Mining, Quarrying, and Oil and Gas industry sector, the Accommodation and Food Services industry sector, the Retail Trade industry sector, and the Construction industry sector, have all declined in recent years, declining by -6.0 percent, -7.0 percent, -1.0 percent, and -15.0 percent respectively between 2013 and 2018. Only has growth in the Government industry sector (the region's second largest industry sector) been positive, increasing by 1.0 percent between 2013 and 2018. Overall growth in the region's Administrative and Support and Waste Management and Remediation industry sector, measured in the total number of employment opportunities created by firms within the industry sector, also declined between 2013 and 2018, declining by 219 total employment opportunities or -19.0 percent.

While significant variation in the amount of total industrial waste and total municipal solid waste collected by landfills located within the five Northeastern Nevada counties existed between 2013 and 2018 and while there was also significant variation in the year-to-year amount of total industrial waste and total municipal solid waste collected at each individual landfill, regional totals of both sources of waste declined significantly between 2013 and 2018. Between 2013 and 2018, the total amount of industrial waste collected by landfills operating within the Northeastern Nevada region decreased by approximately 9,448 total metric tonnes, or by -5.7 percent. Between 2013 and 2018, the total amount of municipal solid waste collected by landfills operating within the Northeastern Nevada region decreased by approximately 3,907 total metric tonnes, or by -4.4 percent. The total amount of industrial waste and municipal solid waste combined and collected by landfills operating within the Northeastern Nevada region decreased by approximately 13,355 metric tonnes, or by -5.2 percent, between 2013 and 2018.

Annually, there was considerable year-to-year variability in the growth or decrease of both industrial waste and municipal solid waste collected by individual landfills operating throughout

Northeastern Nevada. Between 2013 and 2014, the total amount of all waste (industrial and municipal solid combined) collected by all area landfills increased by just 0.7 percent and then decreased by -9.9 percent between 2014 and 2015 followed by a further decrease of -5.0 percent between 2015 and 2016. Between 2016 and 2017, the total amount of all waste collected by area landfills increased by 68.3 percent followed by a decrease of -34.6 percent between 2017 and 2018. Similar year-to-year volatility was observed for just the amount of total industrial waste and for just the amount of total municipal solid waste collected by landfills operating throughout the region. Additional similar year-to-year volatility in the total amount of industrial waste, in the total amount of municipal solid waste, and in the total amount of all waste (industrial and municipal solid combined) collected by each individual landfill operating in Humboldt County, Elko County, Eureka County, Lander County, and White Pine County were observed.

Regarding the second condition, the prevalence of relatively high and increasing regional and national market prices for recycled commodities (outputs), the regional and national prices for recycled plastic commodities, recycled metal commodities, and recycled paper commodities have generally trended downward between 2016 and 2020 and, in some cases, have trended downward at a significantly negative rate. For the three separate recycled plastic commodities examined as part of this study, only one had observable and predicated increases in both regional and national market prices. For PET Baled plastics, the regional market price declined by -51.6 percent and the national market price declined by -14.2 percent between 2016 and 2020 and the predicated future regional and national market prices are expected to decline by -\$0.0001 per pound and -\$0.0003 per pound. For Colored HDPE plastics, the regional market price remained unchanged between 2016 and 2020 and the national market price declined by -16.5 percent between 2016 and 2020. The anticipated future regional and national market prices for Colored HDPE plastics are predicted to decline by -\$0.0001 per pound and -\$0.0002 per pound respectively.

For the six separate recycled metal commodities examined as part of this study, only the national price for Aluminum Cans Loose and only the regional price of Steel Cans Sorted Baled saw increases between 2016 and 2020. Steel Cans Sorted Baled was the only recycled metal commodity to have a predicted future increase. For Aluminum Cans Sorted, the regional price declined by -9.8 percent and the national price declined by -8.3 percent and the predicted future regional and national prices are expected to decline by -\$0.0004 per pound and by -\$0.0004 per pound respectively. For Aluminum Cans Loose, there was no growth in the regional price between 2016 and 2020 and a minor increase in the national price of just 3.4 percent between 2016 and 2020. The predicated future regional price for Aluminum Cans Loose is expected to remain unchanged and the predicted future national price of Aluminum Cans Loose is expected to decline by -\$0.0007 per pound. For Steel Cans Sorted Baled, the regional price increased by 78.3 percent between 2016 and 2020 and the future predicted regional price is expected to increase by \$0.11 per ton. For Steel Cans Sorted Baled, the national price decreased by -11.1 percent between 2016 and 2020 and the future predicted national price is expected to decrease by -\$0.02 per ton.

For Steel Cans Sorted Densified, the regional price remained unchanged between 2016 and 2020 and future predicted regional prices are expected to remain unchanged with no measurable growth. The national price for Steel Cans Sorted Densified decreased by -45.5 percent between

2016 and 2020 and the future predicted national price is expected to decrease by -$0.04 per ton. For Steel Cans Loose, the regional price remained unchanged between 2016 and 2020 and future predicted regional prices are expected to remain unchanged with no measurable growth. The national price for Steel Cans Loose decreased by -40.0 percent between 2016 and 2020 and the future predicted national price is expected to decrease by -$0.01 per ton. For White Goods Loose (discarded household appliances), both the regional and national price between 2016 and 2020 remained unchanged. The future predicted regional and national price for White Goods Loose are both expected to remain unchanged with no measurable growth in either price.

Change in the regional and national prices for each of the four recycled paper commodities and for the predicated future change of the four recycled paper commodities examined in this study were all significantly negative. For Mixed Paper, the regional price declined by -101.0 percent between 2016 and 2020 and the future predicted regional price is expected to decline by -$1.39 per ton. The national price for Mixed Paper declined by -102.5 percent between 2016 and 2020 and the future predicted national price is expected to decline by -$1.21 per ton. For Sorted Residential Paper, the regional price declined by -92.3 percent between 2016 and 2020 and the future predicated regional price is expected to decline by -$1.32 per short ton. The national price for Sorted Residential Paper declined by -92.3 between 2016 and 2020 and the future predicted national price is expected to decline by -$1.19 per short ton.

For Paper Corrugated Containers, the regional price declined by -89.1 percent between 2016 and 2020 and the future predicted regional price is expected to decline by -$1.66 per short ton. The national price for Paper Corrugated Containers declined by -76.7 percent between 2016 and 2020 and the future predicted national price is expected to decline by -$1.46 per short ton. For Sorted Office Paper, the regional price declined by -43.8 percent between 2016 and 2020 and the future predicted regional price is expected to decline by -$0.60 per short ton. The national price for Sorted Office Paper declined by -42.9 percent between 2016 and 2020 and the future predicated national price is expected to decline by -$0.52 per short ton.

Despite the largely unfavorable observed and predicted conditions of the required inputs and expected outputs needed to support a sustainable and growing recycling industry in Northeastern Nevada, there continues to be ongoing and expanded use of the various recycle commodities examined in this study in the production of new component parts, materials and finished goods both nationally and globally. These uses, detailed in Section 4.0 of this University Center for Economic Development technical report, represent possible opportunities for a future recycling industry in Northeastern Nevada if the observed and predicted conditions of the required inputs and expected outputs improve. The development and implementation of new recycling programs and projects in Nevada and the potential to model and use other recycling programs and projects developed in other states, each detailed in Section 5.0 of this University Center for Economic Development technical report, can provide guidance for both public-sector and private-sector initiated economic development efforts employed and designed to support a future recycling industry in Northeastern Nevada.

2.0 Anticipating Future Growth in Waste Levels in Northeastern Nevada

According to the U.S. Environmental Protection Agency, the amount of municipal solid waste and other waste products produced by individuals and private-sector firms is directly influenced by the levels of economic activity, personal consumption patterns, and population growth. Developed societies, including industrial and post-industrial economies such as the United States, generally generate and produce large amounts of municipal solid waste (food wastes, packaged goods, disposable goods, used electronics, etc.) and commercial and industrial wastes (demolition debris, incineration residues, refinery sludges, etc.).

For individual communities and economic regions such as the Northeastern Nevada Regional Development Authority region, as population levels and economic activity levels increase, the total amount of municipal solid waste and commercial and industrial wastes generated throughout the region will likely increase as well. This section presents a general overview of the Northeastern Nevada economy including an analysis of the waste management and recycling industry within the region. The purpose of this section is to demonstrate the potential for growing the waste management and recycling industry within the Northeastern Nevada region as part of a larger economic development strategy.

2.1 General Socio-Demographic and Economic Data for the Northeastern Nevada Regional Development Authority Area

This section presents general trends in a variety of socio-demographic and economic categories for the Northeastern Nevada Regional Development Authority's area, including changes in total population, total number of households, median household income, median family income, per capita (mean) income, the size of the civilian workforce, and changes in the civilian unemployment rate for Elko County, Eureka County, Humboldt County, Lander County, and White Pine County. When possible, comparisons between each individual county, the five-county region as a whole, the state of Nevada, and the United States is provided.

2.1.a Total Population

Table 2.1 presents the change in total population for each county within the Northeastern Nevada Regional Development Authority area, for the region as a whole, for the state of Nevada, and for the United States between 2013 and 2017.

Between 2013 and 2017, the total residential population for the entire Northeastern Nevada region (including Elko County, Eureka County, Humboldt County, Lander County, and White Pine County) increased from an estimated 84,494 total individuals in 2013 to an estimated 86,938 total individuals in 2017, a net increase of 2,444 total individuals or 2.9 percent. Comparatively, the total population for the entire state of Nevada increased from an estimated

2.7 million total individuals in 2013 to an estimated 2.9 million total individuals in 2017, a net increase of approximately 157,659 total individuals or 5.8 percent. The total population for the entire United States increased from an estimated 311.5 million total individuals in 2013 to an estimated 321.0 million total individuals in 2017, a net increase of approximately 9.5 million total individuals or 3.0 percent.

Table 2.1 – Total Population Communities within the Northeastern Nevada Regional Development Authority				
Community	**2013**	**2017**	**2013-2017 Actual Change**	**2013-2017 Percent Change**
Elko County	50,023	52,377	2,354	4.7%
Eureka County	1,804	1,728	-76	-4.2%
Humboldt County	16,800	17,088	288	1.7%
Lander County	5,844	5,887	43	0.7%
White Pine County	10,023	9,858	-165	-1.6%
Northeastern Nevada Region	**84,494**	**86,938**	**2,444**	**2.9%**
State of Nevada	2,730,066	2,887,725	157,659	5.8%
United States	311,536,594	321,004,407	9,467,813	3.0%

Source: U.S. Census Bureau; American Community Survey, 5-Year Estimates; 2013 and 2017

Within the Northeastern Nevada region, Elko County saw the largest population growth between 2013 and 2017, increasing from an estimated 50,023 total individuals in 2013 to an estimated 52,377 total individuals in 2017, a net increase of 2,354 total individuals or 4.7 percent. Humboldt County had the second largest growth in total population between 2013 and 2017, increasing from an estimated 16,800 total individuals in 2013 to an estimated 17,088 total individuals in 2017, a net increase of 288 total individuals or 1.7 percent. In Lander County, the total population increased by just 43 total individuals, or by 0.7 percent, between 2013 and 2017, increasing from an estimated 5,844 total individuals in 2013 to an estimated 5,887 total individuals in 2017.

Both Eureka County and White Pine County experienced measurable declines in total population between 2013 and 2017. In Eureka County, the total population decreased from an estimated 1,804 total individuals in 2013 to an estimated 1,728 total individuals in 2017, a net decrease of 76 total individuals or -4.2 percent. In White Pine County, total population decreased from an estimated 10,023 total individuals in 2013 to an estimated 9,858 total individuals in 2017, a net decrease of 165 total individuals or -1.6 percent.

2.1.b Total Number of Households

Table 2.2 presents the change in the total number of households for each county within the Northeastern Nevada Regional Development Authority area, for the region as a whole, for the state of Nevada, and for the United States between 2013 and 2017.

Table 2.2 – Total Number of Households Communities within the Northeastern Nevada Regional Development Authority				
Community	**2013**	**2017**	**2013-2017 Actual Change**	**2013-2017 Percent Change**
Elko County	17,599	17,882	283	1.6%
Eureka County	416	434	18	4.3%
Humboldt County	6,314	6,261	-53	-0.8%
Lander County	2,010	2,183	173	8.6%
White Pine County	3,357	3,343	-14	-0.4%
Northeastern Nevada Region	**29,696**	**30,103**	**407**	**1.4%**
State of Nevada	999,016	1,052,249	53,233	5.3%
United States	115,610,216	118,825,921	3,215,705	2.8%

Source: U.S. Census Bureau; American Community Survey, 5-Year Estimates; 2013 and 2017

Between 2013 and 2017, the total number of households for the entire Northeastern Nevada region increased from an estimated 29,696 total households in 2013 to an estimated 30,103 total households in 2017, a net increase of 407 total households or 1.4 percent. Across the entire state of Nevada, the total number of households increased from an estimated 999,016 total households in 2013 to an estimated 1.1 million total households in 2017, a net increase of 53,244 total households or 5.3 percent. Nationwide, the total number of households in the United States increased from an estimated 115.6 million total households in 2013 to an estimated 118.8 million total households in 2017, a net increase of approximately 3.2 million total households or 2.8 percent.

Within the Northeastern Nevada region, Elko County, Eureka County, and Lander County each saw growth in the total number of households within each county between 2013 and 2017. Between 2013 and 2017, the total number of households in Elko County increased from an estimated 17,599 total households in 2013 to an estimated 17,882 total household in 2017, a net increase of 283 total households or 1.6 percent. Between 2013 and 2017, the total number of households in Eureka County increased from an estimated 416 total households in 2013 to an estimated 434 total households in 2017, a net increase of 18 total households or 4.3 percent. In

Lander County, the total number of households increased from an estimated 2,010 total households in 2013 to an estimated 2,183 total households in 2017, a net increase of 173 total households or 8.6 percent.

Between 2013 and 2017, the total number of households in both Humboldt County and White Pine County decreased. In Humboldt County, the total number of households decreased slightly, decreasing from an estimated 6,314 total households in 2013 to an estimated 6,261 total households in 2017, a net decrease of just 53 total households or -0.8 percent. In White Pine County, the total number of households also decreased slightly, decreasing from an estimated 3,357 total households in 2013 to an estimated 3,343 total households in 2017, a net decrease of just 14 total households or -0.4 percent.

2.1.c Median Household Income

Table 2.3 presents the change in median household income for each county within the Northeastern Nevada Regional Development Authority area, for the region as a whole, for the state of Nevada, and for the United States between 2013 and 2017.

Table 2.3 – Median Household Income (2017 Inflation-Adjusted Dollars)
Communities within the Northeastern Nevada Regional Development Authority

Community	2013	2017	2013-2017 Actual Change	2013-2017 Percent Change
Elko County	$70,238	$76,178	$5,940	8.5%
Eureka County	$64,632	$67,159	$2,527	3.9%
Humboldt County	$59,472	$69,324	$9,852	16.6%
Lander County	$72,742	$79,865	$7,123	9.8%
White Pine County	$48,586	$60,358	$11,772	24.2%
Northeastern Nevada Region (Average)	**$63,134**	**$70,577**	**$7,443**	**11.8%**
State of Nevada	$52,800	$55,434	$2,634	5.0%
United States	$53,046	$57,652	$4,606	8.7%

Source: U.S. Census Bureau; American Community Survey, 5-Year Estimates; 2013 and 2017

Between 2013 and 2017, the estimated median household income for the entire Northeastern Nevada region increased significantly, increasing from an estimated $63,134 in 2013 to an estimated $70,577 in 2017, a net increase of approximately $7,443 or 11.8 percent. For the entire state of Nevada, median household income increased from $52,800 in 2013 to $55,434 in

2017, a net increase of $2,634 or 5.0 percent. Nationwide, median household income for the entire United States increased from $53,046 in 2013 to $57,652 in 2017, a net increase of $4,606 or 8.7 percent.

Throughout the entire Northeastern Nevada region, median household income levels increased significantly for each of the five member counties. In Elko County, median household income increased from $70,238 in 2013 to $76,178 in 2017, a net increase of $5,940 or 8.5 percent. In Eureka County, median household income increased from $64,632 in 2013 to $67,159 in 2017, a net increase of $2,527 or 3.9 percent. In Humboldt County, median household income increased from $59,472 in 2013 to $69,324 in 2017, a net increase of $9,852 or 16.6 percent. In Lander County, median household income increased from $72,742 in 2013 to $79,865 in 2017, a net increase of $7,123 or 9.8 percent. In White Pine County, median household income increased from $48,586 in 2013 to $60,358 in 2017, a net increase of $11,772 or 24.2 percent.

2.1.d Median Family Income

Table 2.4 presents the change in median family income for each county within the Northeastern Nevada Regional Development Authority area, for the region as a whole, for the state of Nevada, and for the United States between 2013 and 2017.

Table 2.4 – Median Family Income (2017 Inflation-Adjusted Dollars)
Communities within the Northeastern Nevada Regional Development Authority

Community	2013	2017	2013-2017 Actual Change	2013-2017 Percent Change
Elko County	$75,231	$86,421	$11,190	14.9%
Eureka County	$94,648	$109,085	$14,437	15.3%
Humboldt County	$74,433	$80,884	$6,451	8.7%
Lander County	$75,857	$96,250	$20,393	26.9%
White Pine County	$63,982	$69,481	$5,499	8.6%
Northeastern Nevada Region (Average)	**$76,830**	**$88,424**	**$11,594**	**15.1%**
State of Nevada	$61,359	$65,469	$4,110	6.7%
United States	$64,719	$70,850	$6,131	9.5%

Source: U.S. Census Bureau; American Community Survey, 5-Year Estimates; 2013 and 2017

The estimated median family income for the entire Northeastern Nevada region increased from an estimated $76,830 in 2013 to an estimated $88,424 in 2017, a significant increase of approximately $11,594 or 15.1 percent. Comparatively, median family income for the entire state of Nevada increased from $61,359 in 2013 to $65,469 in 2017, a net increase of $4,110 or 6.7 percent. Nationwide, median family income for the entire United States increased from $64,719 in 2013 to $70,850 in 2017, a net increase of $6,131 or 9.5 percent.

Like median household income, median family income for each of the five counties within the Northeastern Nevada region increased between 2013 and 2017. In Elko County, median family income increased from $75,231 in 2013 to $86,421 in 2017, a net increase of $11,190 or 14.9 percent. In Eureka County, median family income increased from $94,648 in 2013 to $109,085 in 2017, a net increase of $14,437 or 15.3 percent. In Humboldt County, median family income increased from $74,433 in 2013 to $80,884 in 2017, a net increase of $6,451 or 8.7 percent. In Lander County, median family income increased from $75,857 in 2013 to $96,250 in 2017, a net increase of $20,393 or 26.9 percent. In White Pine County, median family income increased from $63,982 in 2013 to $69,481 in 2017, a net increase of $5,499 or 8.6 percent.

2.1.e Per Capita (Mean) Income

Table 2.5 presents the change in per capita (mean) income for each county within the Northeastern Nevada Regional Development Authority area, for the region as a whole, for the state of Nevada, and for the United States between 2013 and 2017.

Table 2.5 – Per Capita (Mean) Income, Individuals (2017 Inflation-Adjusted Dollars)
Communities within the Northeastern Nevada Regional Development Authority

Community	2013	2017	2013-2017 Actual Change	2013-2017 Percent Change
Elko County	$28,358	$32,498	$4,140	14.6%
Eureka County	$28,056	$35,606	$7,550	26.9%
Humboldt County	$26,515	$29,215	$2,700	10.2%
Lander County	$29,800	$30,256	$456	1.5%
White Pine County	$24,435	$25,350	$915	3.7%
Northeastern Nevada Region (Average)	**$27,433**	**$30,585**	**$3,152**	**11.5%**
State of Nevada	$26,589	$28,450	$1,861	7.0%
United States	$28,155	$31,177	$3,022	10.7%

Source: U.S. Census Bureau; American Community Survey, 5-Year Estimates; 2013 and 2017

Like median household income and median family income, per capita income for the entire Northeastern Nevada region increased between 2013 and 2017, increasing from an estimated $27,433 in 2013 to an estimated $30,585 in 2017, a net increase of approximately $3,152 or 11.5 percent. Statewide, per capita income for the entire state of Nevada increased from $26,589 in 2013 to $28,450 in 2017, a net increase of $1,861 or 7.0 percent. Nationwide, per capita income for the entire United States increased from $28,155 in 2013 to $31,177 in 2017, a net increase of $3,022 or 10.7 percent.

Per capita income for each of the five counties within the Northeastern Nevada region also increased between 2013 and 2017. In Elko County, per capita income increased from $28,358 in 2013 to $32,498 in 2017, a significant net increase of $4,140 or 14.6 percent. In Eureka County, per capita income increased from $28,056 in 2013 to $35,606 in 2017, a significant increase of $7,550 or 26.9 percent. In Humboldt County, per capita income increased from $26,515 in 2013 to $29,215 in 2017, a significant net increase of $2,700 or 10.2 percent. In Lander County, per capita income increased from $29,800 in 2013 to $30,256 in 2017, a marginal increase of $456 or 1.5 percent. In White Pine County, per capita income increased from $24,435 in 2013 to $25,350 in 2017, a net increase of $915 or 3.7 percent.

2.1.f Civilian Workforce (Individuals 16 Years or Older)

Table 2.6 presents the change in the relative size of the civilian workforce (individuals living in the community that are 16 years of age or older) for each county within the Northeastern Nevada Regional Development Authority area, for the region as a whole, for the state of Nevada, and for the United States between 2013 and 2017.

Between 2013 and 2017, the total civilian workforce living throughout the entire Northeastern Nevada region increased by 2,324 total individuals or 3.6 percent, increasing from 63,925 total individuals in 2013 to 66,249 total individuals in 2017. Statewide, the total civilian workforce living throughout the entire state of Nevada increased from approximately 2.1 million total individuals in 2013 to approximately 2.3 million total individuals in 2017, a net increase of 148,945 total individuals or 6.9 percent. Nationwide, the total civilian workforce for the entire United States increased from approximately 246.2 million total individuals in 2013 to approximately 255.8 million total individuals in 2017, a net increase of approximately 9.6 million total individuals or 3.9 percent.

Except for White Pine County, the civilian workforce for each individual county within the Northeastern Nevada region increased between 2013 and 2017. In Elko County, the civilian workforce living throughout the county increased from 37,364 total individuals in 2013 to 39,478 total individuals in 2017, a net increase of 2,114 total individuals or 5.7 percent. In Eureka County, the civilian workforce living throughout the county increased from 1,339 total individuals in 2013 to 1,393 total individuals in 2017, a marginal increase of 54 total individuals or 4.8 percent. In Humboldt County, the civilian workforce living throughout the county increased from 12,697 total individuals in 2013 to 12,924 total individuals in 2017, a net increase of just 227 total individuals or 1.8 percent. In Lander County, the civilian workforce living throughout the county increased from 4,397 total individuals in 2013 to 4,422 total individuals in 2017, a marginal increase of just 25 total individuals or 0.6 percent.

Table 2.6 – Civilian Workforce (Individuals 16 Years or Older) Communities within the Northeastern Nevada Regional Development Authority				
Community	**2013**	**2017**	**2013-2017 Actual Change**	**2013-2017 Percent Change**
Elko County	37,364	39,478	2,114	5.7%
Eureka County	1,339	1,393	54	4.0%
Humboldt County	12,697	12,924	227	1.8%
Lander County	4,397	4,422	25	0.6%
White Pine County	8,128	8,032	-96	-1.2%
Northeastern Nevada Region	**63,925**	**66,249**	**2,324**	**3.6%**
State of Nevada	2,143,541	2,292,486	148,945	6.9%
United States	246,191,954	255,797,692	9,605,738	3.9%

Source: U.S. Census Bureau; American Community Survey, 5-Year Estimates; 2013 and 2017

In White Pine County, the only county to see a net decline in the existing civilian workforce between 2013 and 2017, the total civilian workforce decreased marginally by 96 total individuals or by -1.2 percent. Between 2013 and 2017, the total civilian workforce living throughout White Pine County decreased from 8,128 total individuals in 2013 to 8,032 total individuals in 2017.

2.1.g Civilian Unemployment Rate (Individuals 16 Years or Older)

Table 2.7 presents the change in the civilian unemployment rate (for individuals living in the community that are 16 years of age or older) for each county within the Northeastern Nevada Regional Development Authority area, for the region as a whole, for the state of Nevada, and for the United States between 2013 and 2017. Note that the civilian unemployment rate for Eureka County for 2017 was not available at the time of publication of this University Center for Economic Development technical report.

Between 2013 and 2017, the estimated civilian unemployment rate for the entire Northeastern Nevada region decreased significantly, decreasing from an estimated 8.3 percent in 2013 to an estimated 6.4 percent in 2017, a net decrease of 1.9 percent or 22.8 percent. Statewide, the civilian unemployment rate for the entire state of Nevada decreased significantly, decreasing from 12.5 percent in 2013 to 8.0 percent in 2017, a dramatic net decrease of 4.5 percent or percentage decrease of -36.0 percent. Nationwide, the civilian unemployment rate for the entire United States decreased significantly as well, decreasing from 9.7 percent in 2013 to 6.6 percent in 2017, a substantial net decrease of 3.1 percent or -32.0 percent.

Table 2.7 – Civilian Unemployment Rate (Individuals 16 Years or Older) Communities within the Northeastern Nevada Regional Development Authority				
Community	**2013**	**2017**	**2013-2017 Actual Change**	**2013-2017 Percent Change**
Elko County	5.7%	4.4%	-1.3%	-22.8%
Eureka County	5.4%	-	-	-
Humboldt County	9.1%	7.3%	-1.8%	-19.8%
Lander County	11.2%	7.6%	-3.6%	-32.1%
White Pine County	9.9%	6.2%	-3.7%	-37.4%
Northeastern Nevada Region (Average)	**8.3%**	**6.4%**	**-1.9%**	**-22.8%**
State of Nevada	12.5%	8.0%	-4.5%	-36.0%
United States	9.7%	6.6%	-3.1%	-32.0%

Source: U.S. Census Bureau; American Community Survey, 5-Year Estimates; 2013 and 2017

The civilian unemployment rate for each county within the Northeastern Nevada region, that data was available for, decreased significantly between 2013 and 2017. In Elko County, the civilian unemployment rate decreased from 5.7 percent in 2013 to 4.4 percent in 2017, a net decrease of 1.3 percent or -22.8 percent overall. The civilian unemployment rate for Eureka County in 2013 was 5.4 percent and, given the trend in the civilian unemployment rate for the entire Northeastern Nevada region, it is likely that the civilian unemployment rate of Eureka County also declined between 2013 and 2017.

In Humboldt County, the civilian unemployment rate decreased from 9.1 percent in 2013 to 7.3 percent in 2017, a net decrease of 1.8 percent or -19.8 percent overall. In Lander County, the civilian unemployment rate decreased from 11.2 percent in 2013 to 7.6 percent in 2017, a net decrease of 3.6 percent or -32.1 percent overall. In White Pine County, the civilian unemployment rate decreased from 9.9 percent in 2013 to 6.2 percent in 2017, a net decrease of 3.7 percent or -37.4 percent overall.

2.2 Industry and Occupation Sector Data for the Northeastern Nevada Regional Development Authority Area

Table 2.8 presents the ten largest industry sectors for the five-county Northeastern Nevada Regional Development Authority area measured by the total number of jobs the industry sector, as a whole, generated in 2018. The total number of jobs generated by each individual industry sector for 2013 and 2018 is presented along with the location quotient and the industry sector's contribution to Gross Regional Product for 2018. Similar data for the Administrative and Support and Waste Management and Remediation Services industry sector is highlighted for comparison.

Table 2.8 – Top Ten Industry Sectors for the Northeastern Nevada Regional Development Authority Area 2013 and 2018

Industry Sector	Total Jobs 2013	Total Jobs 2018	Change in Total Jobs	Percent Change in Total Jobs	Location Quotient 2018	Gross Regional Product 2018
Mining, Quarrying, and Oil and Gas	12,267	11,498	-769	-6.0%	61.97	$3.86 Billion
Government	7,606	7,713	107	1.0%	1.15	$685.97 Million
Accommodation and Food Services	7,278	6,792	-486	-7.0%	1.77	$370.68 Million
Retail Trade	4,100	4,070	-30	-1.0%	0.90	$273.44 Million
Construction	2,687	2,291	-396	-15.0%	0.92	$203.43 Million
Health Care and Social Assistance	1,967	2,151	184	9.0%	0.38	$133.41 Million
Wholesale Trade	1,394	1,466	72	5.0%	0.89	$621.18 Million
Other Services (Except Public Administration)	1,415	1,370	-45	-3.0%	0.64	$84.83 Million
Transportation and Warehousing	1,207	1,191	-16	-1.0%	0.74	$101.17 Million
Agriculture, Forestry, Fishing and Hunting	1,119	1,170	51	5.0%	2.22	$118.28 Million
Admin. and Support and Waste Mgt. and Remediation	**1,168**	**949**	**-219**	**-19.0%**	**0.34**	**$57.62 Million**
Total, Northeastern Nevada Area	**42,208**	**40,661**	**-1,547**	**-4.0%**	**-**	**$6.51 Billion**

Source: Nevada Governor's Office of Economic Development, Northeastern Nevada Regional Development Authority Aggregate Report, Emsi Q2 2019 Data Set

Between 2013 and 2018, the total number of jobs created and provided by the ten largest industry sectors within the Northeastern Nevada area plus the total number of jobs created and provided within the Administrative and Support and Waste Management and Remediation Services industry sector decreased from an estimated 42,208 total jobs in 2013 to an estimated 40,661 total jobs in 2018, a net decrease of 1,547 or -4.0 percent. The total contribution to Gross Regional Product (the total amount of economic output generated by all industry sectors within the Northeastern Nevada area) by these 11 industry sectors in 2018 was an estimated $6.51 billion.

In 2018, the Administrative and Support and Waste Management and Remediation industry sector generated an estimated 949 total jobs, a net decrease of 219 total jobs or -19.0 percent from the 1,168 total jobs generated within this industry sector in 2013. This accounted for just 2.3 percent of the 40,661 total jobs generated by the 11 industry sectors listed in Table 2.8. The Administrative and Support and Waste Management and Remediation industry sector generated an estimated total of approximately $57.62 million in economic output in 2018, accounting for just 0.9 percent of the five-county Northeastern Nevada area's Gross Regional Product for the 11 industry sectors listed in Table 2.8 of approximately $6.51 billion.

Comparatively, the five-county area's largest industry sector, the Mining, Quarrying, and Oil and Gas Extraction industry sector, generated an estimated 11,498 total jobs in 2018, a net decrease of 769 total jobs or -6.0 percent from the 12,267 total jobs generated by this industry sector in 2013. This accounted for approximately 28.3 percent of the 40,661 total jobs generated by the 11 industry sectors listed in Table 2.8. The Mining, Quarrying, and Oil and Gas Extraction industry sector generated an estimated total of approximately $3.86 billion in economic output in 2018, accounting for 59.3 percent of the five-county Northeastern Nevada area's Gross Regional Product for the 11 industry sectors listed in Table 2.. In-terms of total jobs generated and total economic output, the Mining, Quarry, and Oil and Gas Extraction industry sector was the single largest industry sector within the five-county Northeastern Nevada area in 2018.

A location quotient greater than 1.0 indicates that the industry sector in the local geographic area is a *net exporter*, in that the total production and output of all firms within the industry sector in the geographic area produces more goods and services than can be consumed locally. Surplus goods and services are *exported* out of the local geographic area and cash is imported into the local geographic area. A location quotient less than 1.0 indicates that the industry sector in the local geographic area is a *net importer*, in that total production and output of all firms within the industry sector in the geographic area does not produce enough goods and services to satisfy local consumption meaning that goods and services have to *imported* into the local geographic area and, subsequently, cash is exported out of the local geographic area.

In 2018, the location quotient for the Mining, Quarrying, and Oil and Gas Extraction industry sector was 61.97, indicating that the Mining, Quarrying, and Oil and Gas Extraction industry sector was a significant ***net exporter*** of goods and services. Of the 11 industry sectors listed in Table 2.8, this industry sector had the single largest location quotient in 2018. The Agriculture, Forestry, Fishing and Hunting industry had the second largest location quotient, 2.22, in 2018 and the Accommodation and Food Services industry sector had the third largest location quotient, 1.77, in 2018. While these three industry sectors ***export*** a significant portion of their products and services and generate ***positive cash flows*** into the five-county Northeastern Nevada area, the Administrative and Support and Waste Management and Remediation Services industry sector was a ***net importer*** in 2018 with a location quotient of just 0.34. The location quotient of 0.34 for the Administrative and Support and Waste Management and Remediation Services industry sector suggests that, in 2018, waste products generated within the five-county area had to be shipped to processing, recycling and/or waste storage facilities outside the Northeastern Nevada area thereby creating a ***negative cash flow*** of dollars moving outside the area to cover the processing, recycling and/or waste storage service costs. In order to reverse this negative cash flow within the Administrative and Support and Waste Management and Remediation

Services industry sector, the area will have to develop processing, recycling and/or waste storage facilities capable of managing and using waste products generated within the five-county Northeastern Nevada area.

Table 2.9 presents the ten largest occupation sectors for the five-county Northeastern Nevada Regional Development Authority area measured by the total number of people employed by the occupation sector in 2018. The total number of people employed within each occupation sector for 2013 and 2018 is presented along with the location quotient and the 2017 median hourly earning per worker for each individual occupation sector. There is no directly comparable occupation sector for the Administrative and Support and Waste Management and Remediation Services industry sector for the existing occupational sectors within the Northeastern Nevada Regional Development Authority area. Comparable and analogue occupation sectors are, however, highlighted for the Mining, Quarrying, and Oil and Gas Extraction industry sector.

Table 2.9 – Top Ten Occupation Sectors for the Northeastern Nevada Regional Development Authority Area 2013 and 2018

Industry Sector	Total Jobs 2013	Total Jobs 2018	Change in Total Jobs	Percent Change in Total Jobs	Location Quotient 2018	Median Hourly Earning 2018
Construction and Extraction	6,796	6,223	-573	-8.0%	3.04	$27.38
Office and Administrative Services	4,835	4,576	-259	-5.0%	0.70	$16.21
Installation, Maintenance, and Repair	4,666	4,563	-103	-2.0%	2.61	$28.86
Transportation and Material Moving	3,949	3,909	-40	-1.0%	1.28	$23.07
Food Preparation and Serving Related	4,288	3,884	-404	-9.0%	1.04	$9.78
Sales and Related	3,521	3,483	-38	-1.0%	0.79	$11.74
Management	2,368	2,347	-21	-1.0%	0.93	$33.92
Education, Training, and Library	1,831	2,017	186	10.0%	0.79	$22.52
Production	2,103	2,007	-96	-5.0%	0.77	$25.04
Building and Grounds Cleaning and Maintenance	2,100	1,940	-160	-8.0%	1.18	$25.04
Total, Northeastern Nevada Area	**36,457**	**34,949**	**-1,508**	**-4.0%**	**-**	**$22.36 (Average)**

Source: Nevada Governor's Office of Economic Development, Northeastern Nevada Regional Development Authority Aggregate Report, Emsi Q2 2019 Data Set

The comparable occupation sectors to the Mining, Quarrying, and Oil and Gas industry sector for the Northeastern Nevada area are the Construction and Extraction occupation sector and Transportation and Material Moving occupation sector. Between 2013 and 2018, the total number of people employed across the top ten occupation sectors listed in Table 2.9 for the

Northeastern Nevada area decreased from an estimated 36,457 total people employed in 2013 to an estimated 34,949 total people employed in 2018, a net decrease of 1,508 total people employed or -4.0 percent. In 2017, the average median wage paid to workers within the largest ten occupation sectors listed in Table 2.9 was $22.36 per worker. Comparatively, the highest median hourly wage paid in 2017 was $33.92 in the Management occupation sector and the lowest median hourly wage paid in 2017 was $9.78 in the Food Preparation and Serving Related occupation sector.

Between 2013 and 2018, the total number of people employed in the Construction and Extraction occupation sector decreased from an estimated 6,796 total people employed in 2013 to an estimated 6,223 total people employed in 2018, a significant net decrease of 573 total people employed or -8.0 percent. The median hourly earning paid to individual employees in 2017 in the Construction and Extraction occupation sector was $27.38 and the location quotient for this occupation sector in 2018 was 3.04, indicating that the Construction and Extraction occupation sector was a ***net exporter*** and generated positive cash flows of financial resources into the five-county Northeastern Nevada area. In-terms of total employment in 2018, the Construction and Extraction occupation sector was the single largest occupation sector in the Northeastern Nevada area, paid the third highest median hourly wage in 2017, and had the single largest location quotient in 2018 among the top ten occupation sectors within the Northeastern Nevada area.

Between 2013 and 2018, the total number of people employed in the Transportation and Material Moving occupation sector decreased from an estimated 3,949 total people employed in 2013 to an estimated 3,909 total people employed in 2018, a net decrease of just 40 total people employed or -1.0 percent. The median hourly earning paid to individual employees in 2017 in the Transportation and Material Moving occupation sector was $23.07 and the location quotient for this occupation sector in 2018 was 1.28, indicating that the Transportation and Material Moving occupation sector was a ***net exporter*** and generated positive cash flows of financial resources into the five-county Northeastern Nevada area. In-terms of total employment in 2018, the Transportation and Material Moving occupation sector was the fourth largest occupation sector in the Northeastern Nevada area, paid the fifth highest median hourly wage in 2017, and had the third largest location quotient in 2018 among the top ten occupation sectors within the Northeastern Nevada area.

Combined, the total number of people employed in the Construction and Extraction occupation sector and the Transportation and Material Moving occupation sector decreased from an estimated 10,745 total people employed in 2013 to an estimated 10,132 total people employed in 2018, a net decrease of 613 total people employed or -5.7 percent. In 2018, the total number of people employed in the Construction and Extraction occupation sector and the Transportation and Material Moving occupation sector combined accounted for 29.0 percent of the 34,949 total people employed and working in all ten of the occupation sectors listed in Table 2.9. As the closest comparable and analogue occupation sectors to the Mining, Quarrying, and Oil and Gas Extraction industry sector, the Construction and Extraction occupation sector and the Transportation and Material Moving occupation sector both account for a significant portion of total employment within the five-county Northeastern Nevada area and are collectively responsible for a significant portion of the area's overall economic base as is the Mining, Quarrying, and Oil and Gas Extraction industry sector examined previously in Table 2.8.

2.3 Waste Levels for the Northeastern Nevada Regional Development Authority Area

This sub-section presents a general estimation of potential recyclable waste generated by mines operating within the Northeastern Nevada Regional Development Authority as well as a general estimation of the total amount of waste collected by landfills operating within the Northeastern Nevada Regional Development Authority area. Because the single largest industry sector within the Northeastern Nevada Regional Development Authority area is the Mining, Quarrying, and Oil and Gas Extraction industry sector, and by proxy the Construction and Extraction occupation sector and the Transportation and Material Moving occupation sector, it is assumed that the Mining, Quarry, and Oil and Gas Extraction industry sector would be the single largest ***single point source*** of commercial and industrial wastes generated within the five-county Northeastern Nevada area. Non-single point sources of municipal solid waste, largely generated by residential properties and individual residents, likely remain the single largest total source of overall waste materials being disposed of in area landfills located within the five-county Northeastern Nevada area.

<u>2.3.a Potential Recyclable Waste Generated by Mines Operating within the Northeastern Nevada Regional Development Authority Area</u>

Nevada Gold Mines is a joint venture between Barrick Gold Corporation and the Newmont Corporation operating within the state of Nevada that operates seven separate mining operations in the five-county Northeastern Nevada area including Long Canyon, the Carlin Complex (Barrick Legacy), the Carlin Complex (Newmont Legacy), Cortez, Phoenix, TC, and TR. Using recyclable waste data provided by Nevada Gold Mines, Table 2.10 presents the combined total amount of recyclable waste for all of Nevada Gold Mines' seven sites operating within the Northeastern Nevada area for 2018. Appendix A of this University Center for Economic Development technical report presents the total amount of waste produced for each of Nevada Gold Mines' seven operating sites in Northeastern Nevada.

In 2018, Nevada Gold Mines' seven individual operating mine sites within the five-county Northeastern Nevada area generated approximately 41,981.60 metric tonnes of potentially recyclable waste. Metal was the single largest type of recyclable waste, generating an estimated 35,191.67 metric tonnes of waste and accounting for approximately 83.8 percent of all waste measured in metric tonnes generated by Nevada Gold Mines' seven individual operating mine sites within the Northeastern Nevada area. Paper was the second largest type of recyclable waste in 2018, generating an estimated 2,771.45 metric tonnes of waste and accounting for approximately 6.6 percent of all waste measured in metric tonnes generated by Nevada Gold Mines. Plastic was the third largest type of recyclable waste in 2018, generating an estimated 1,847.10 metrics tonnes of waste and Cardboard was the fourth largest type of recyclable waste in 2018, generating an estimated 1,847.10 metric tonnes of waste. Both Plastic and Cardboard accounted for approximately 4.4 percent of all waste measured in metric tonnes generated by Nevada Gold Mines' various mine sites operating within the Northeastern Nevada area.

Table 2.10 – Recyclable Waste Types and Amounts Produced Nevada Gold Mines – Long Canyon, Carlin Complex (Barrick Legacy), Carlin Complex (Newmont Legacy), Cortez, Phoenix, TC, and TR Combined 2018	
Recyclable Waste Type	**Amount Produced (in Number of Units, Kilograms, Cubic Meters or Metric Tons/Tonnes)**
Plastic	1,847.23 (Metric Tonnes)
Paper	2,771.45 (Metric Tonnes)
Pallets	8.26 (Metric Tonnes)
Cardboard (Onsite)	1,847.10 (Metric Tonnes)
Cardboard (Offsite)	52.83 (Metric Tonnes)
HDPE Pipe/Liner	112.72 (Metric Tonnes)
Used Oil	4,352.48 (Cubic Meters)
Used Antifreeze	186.04 (Cubic Meters)
Batteries (Lithium)	0.18 (Metric Tonnes)
Batteries (Lead)	4.35 (Metric Tonnes)
Batteries (Alkaline)	-
Batteries	67.49 (Metric Tonnes)
Electronics	20.44 (Metric Tonnes)
Lamps/Bulbs	0.882 (Metric Tonnes)
Ink Cartridges	234.00 (Number of Units)
Ink Cartridges	-
Food Waste	54.15 (Metric Tonnes)
Tires – Large (Onsite)	1,663.00 (Number of Units)
Tires – Large	1,000.00 (Number of Units)
Tires – LV	4,102.07 (Number of Units)
Tires – LV	3,206.37 (Number of Units)
Metal	35,191.67 (Metric Tonnes)
Totes/Containers	2.75 (Metric Tonnes)
Aluminum Cans	0.10 (Metric Tonnes)
TOTAL (of Just Metric Tonnes)	**41,981.60 (Metric Tones)**

Source: Nevada Gold Mines, 2019

Other notable types of potentially recyclable materials generated by Nevada Gold Mines' seven individual operating mine sites within the Northeastern Nevada area combined in 2018 included 4,102.07 total units of Tires-LV and an additional 3,2016.37 total units of Tires-LV. An additional 1,663.00 total units of Tires – Large (Onsite) and an additional 1,000.00 total units of Tires – Large were also generated from operations managed by Nevada Gold Mines in Northeastern Nevada in 2018. A total of 4,352.48 cubic meters of Used Oil and 186.04 total cubic meters of Used Antifreeze were also generated by Nevada Gold Mines' seven individual operating mine sites within the Northeastern Nevada area combined in 2018.

2.3.b Generation of Waste Collected by Landfills Operating within the Northeastern Nevada Regional Development Authority Area

Table 2.11 presents the total amount of both municipal solid waste (MSW) and industrial waste collected by landfills operating within each of the five counties within the Northeastern Nevada area for each year between 2013 and 2018 measured in metric tonnes.

Table 2.11 – Total Municipal Solid Waste (MSW) and Industrial Waste Collected by Landfills within the Northeastern Nevada Regional Development Authority Area In Metric Tonnes, 2013 through 2018

Jurisdiction and Type	2013	2014	2015	2016	2017	2018	2013-2018 Total Change	2013-2018 Percent Change
Humboldt Industrial	119,612.75	125,237.14	105,474.28	93,760.81	155,063.41	90,293.26	-29,319.49	-24.5%
Humboldt MSW	19,177.15	19,207.66	19,792.73	19,308.25	26,753.15	24,465.50	5,288.35	27.6%
Humboldt Total	**138,789.90**	**144,444.81**	**125,267.01**	**113,069.06**	**181,816.56**	**114,758.76**	**-24,031.14**	**-17.3%**
Elko Industrial	13,364.25	8,555.47	16,319.38	16,959.81	16,198.60	18,476.81	5,112.56	38.3%
Elko MSW	60,248.36	58,714.28	47,319.82	48,267.83	49,248.19	51,565.59	-8,682.77	-14.4%
Elko Total	**73,612.61**	**67,269.75**	**63,639.20**	**65,227.64**	**65,446.78**	**70,042.40**	**-3,570.21**	**-4.8%**
Eureka Industrial	7,427.62	10,286.12	3,595.99	6,833.87	7,566.88	11,124.13	3,696.51	49.8%
Eureka MSW	1,005.32	1,080.06	988.09	983.25	861.58	657.85	-347.48	-34.6%
Eureka Total	**8,432.95**	**11,366.18**	**4,584.08**	**7,817.12**	**8,428.46**	**11,781.97**	**3,349.03**	**39.7%**
Lander Industrial	20,660.63	19,559.62	24,468.23	20,831.30	101,291.80	31,086.10	10,425.47	50.5%
Lander MSW	1,847.12	1,712.27	1,640.42	1,765.06	2,124.45	2,218.61	371.49	20.1%
Lander Total	**22,507.75**	**21,271.88**	**26,108.65**	**22,596.36**	**103,416.25**	**33,304.71**	**10,796.96**	**48.0%**
White Pine Industrial	6,142.93	6,750.29	6,010.81	5,424.01	6,116.39	6,779.92	636.99	10.4%
White Pine MSW	7,001.16	7,088.97	7,048.76	6,876.83	6,744.63	6,464.42	-536.75	-7.7%
White Pine Total	**13,144.09**	**13,839.26**	**13,059.57**	**12,300.84**	**12,861.02**	**13,244.34**	**100.24**	**0.8%**
NNRDA Industrial	167,208.18	170,388.64	155,868.69	143,809.80	286,237.07	157,760.22	-9,447.97	-5.7%
NNRDA MSW	89,279.11	87,803.24	76,789.82	77,201.23	85,731.99	85,371.97	-3,907.15	-4.4%
NNRDA Total	**256,487.30**	**258,191.88**	**232,658.51**	**221,011.02**	**371,969.06**	**243,132.18**	**-13,355.11**	**-5.2%**

Source: Nevada Division of Environmental Protection, Bureau of Waste Management

Note that the estimations of waste collected by landfills operating within the Northeastern Nevada Regional Development Authority area presented in Table 2.11 do not provide any information regarding the *source* of the waste produced. It is possible that municipal solid waste and commercial and industrial waste being generating from locations outside the five-county Northeastern Nevada area are being disposed of in landfills operating within the five-county Northeastern Nevada area. The estimations provided here only illustrate how much total waste, including both municipal solid waste and commercial and industrial waste, has been and is currently making its way into landfills operating within the five-county Northeastern Nevada area regardless of the waste's geographic source location.

For the entire five-county Northeastern Nevada area, the total amount of industrial waste and municipal solid waste collected by area landfills combined decreased from an estimated 256,487.30 metric tonnes of total waste collected in 2013 to an estimated 243,132.18 metric tonnes of total waste collected in 2018, a net decrease of 13,355.11 metric tonnes or -5.2 percent. The amount of just industrial waste collected by area landfills decreased from an estimated 167,208.18 metrics tonnes of total waste collected in 2013 to an estimated 157,760.22 metric tonnes of total waste collected in 2018, a net decrease of 9,447.97 metric tonnes or -5.7 percent. The amount of just municipal solid waste collected by area landfills decreased from an estimated 89,279.11 metrics tonnes of total waste collected in 2013 to an estimated 85,371.97 metric tonnes of total waste collected in 2018, a net decrease of 3,907.15 metric tonnes or -4.4 percent. For the entire five-county Northeastern Nevada area, industrial waste represented a significant majority of total waste collected by area landfills. Between 2013 and 2018, 67.5 percent, on average per year, of all waste entering Northeastern Nevada area landfills was industrial waste and just 32.5 percent, on average per year, of all waste entering Northeastern Nevada area landfills was municipal solid waste.

In Humboldt County, the total amount of industrial waste and municipal solid waste collected by landfills operating within Humboldt County decreased from 138,789.90 metric tonnes of total waste collected in 2013 to 114,758.76 metric tonnes of total waste collected in 2018, a net decrease of 24,031.14 metric tonnes or -17.3 percent. The amount of just industrial waste collected by landfills operating within Humboldt County decreased from 119,612.75 metric tonnes of total waste collected in 2013 to 90,293.26 metric tonnes of total waste collected in 2018, a net decrease of 29,319.49 metric tonnes or -24.5 percent. The amount of just municipal solid waste collected by landfills operating within Humboldt County increased from 19,177.15 metric tonnes of total waste collected in 2013 to an estimated 24,465.50 metric tonnes of total waste collected in 2018, a net increase of 5,288.35 metric tonnes or 27.6 percent. For just Humboldt County, industrial waste represented a significant majority of total waste collected by landfills operating within Humboldt County. Between 2013 and 2018, 84.0 percent, on average per year, of all waste entering Humboldt County landfills was industrial waste and just 16.0 percent, on average per year, of all waste entering Humboldt County landfills was municipal solid waste.

In Elko County, the total amount of industrial waste and municipal solid waste collected by landfills operating within Elko County decreased from an estimated 73,612.61 metric tonnes of total waste collected in 2013 to an estimated 70,042.40 metric tonnes of total waste collected in

2018, a net decrease of 3,570.21 metric tonnes or -4.8 percent. The amount of just industrial waste collected by landfills operating within Elko County increased from an estimated 13,364.25 metric tonnes of total waste in 2013 to an estimated 18,476.81 metric tonnes of total waste in 2018, a net increase of 5,112.56 metric tonnes or 38.3 percent. The amount of just municipal solid waste collected by landfills operating within Elko County decreased from an estimated 60,248.36 metric tonnes of total waste in 2013 to an estimated 51,565.59 metric tonnes of total waste in 2018, a net decrease of 8,682.77 metric tonnes or -14.4 percent. For just Elko County, municipal solid waste represented a significant majority of total waste collected by landfills operating within Elko County. Between 2013 and 2018, 77.7 percent, on average per year, of all waste entering Elko County landfills was municipal solid waste and just 22.3 percent, on average per year, of all waste entering Elko County landfills was industrial waste.

In Eureka County, the total amount of industrial waste and municipal solid waste collected by landfills operating within Eureka County increased from an estimated 8,432.95 metric tonnes of total waste collected in 2013 to an estimated 11,781.97 metric tonnes of total waste collected in 2018, a net increase of 3,349.03 metric tonnes or 39.7 percent. The amount of just industrial waste collected by landfills operating within Eureka County increased from an estimated 7,472.62 metric tonnes of total waste in 2013 to an estimated 11,124.13 metric tonnes of total waste in 2018, a net increase of 3,696.51 metrics tonnes or 49.8 percent. The amount of just municipal solid waste collected by landfills operating within Eureka County decreased from an estimated 1,005.32 metric tonnes of total waste in 2013 to an estimated 657.85 metric tonnes of total waste in 2018, a net decrease of 347.48 metric tonnes or -34.6 percent. For just Eureka County, industrial waste represented a significant majority of total waste collected by landfills operating within Eureka County. Between 2013 and 2018, 88.1 percent, on average per year, of all waste entering Eureka County landfills was industrial waste and just 11.9 percent, on average per year, of all waste entering Eureka County landfills was municipal solid waste.

In Lander County, the total amount of industrial waste and municipal solid waste collected by landfills operating within Lander County increased from an estimated 22,507.75 metric tonnes of total waste collected in 2013 to an estimated 33,304.71 metric tonnes of total waste collected in 2018, a net increase of 10,796.96 metric tonnes or 48.0 percent. The amount of just industrial waste collected by landfills operating within Lander County increased from an estimated 20,660.63 metric tonnes of total waste in 2013 to an estimated 31,086.10 metric tonnes of total waste in 2018, a net increase of 10,425.47 total metric tonnes or 50.5 percent. The amount of just municipal solid waste collected by landfills operating within Lander County increased from an estimated 1,874.12 metric tonnes of total waste in 2013 to an estimated 2,218.61 metric tonnes of total waste in 2018, a net increase of 371.49 metric tonnes or 20.1 percent. For just Lander County, industrial waste represented a significant majority of total waste collected by landfills operating within Lander County. Between 2013 and 2018, 93.5 percent, on average per year, of all waste entering Lander County landfills was industrial waste and just 6.5 percent, on average per year, of all waste entering Lander County landfills was municipal solid waste.

In White Pine County, the total amount of industrial waste and municipal waste collected by landfills operating within White Pine County increased from an estimated 13,144.09 metric tonnes of total waste in 2013 to an estimated 13,244.34 metric tonnes of total waste, a slight increase of just 100.24 metric tonnes or 0.8 percent. The amount of just industrial waste collected by landfills operating within White Pine County increased from an estimated 6,412.93 metric tonnes of total waste in 2013 to an estimated 6,779.92 metric tonnes of total waste in 2018, a net increase of 636.99 metric tonnes or 10.4 percent. The amount of just municipal solid waste collected by landfills operating within White Pine County decreased from an estimated 7,001.16 metric tonnes of total waste in 2013 to an estimated 6,464.42 metric tonnes of total waste in 2018, a net decrease of 536.75 metric tonnes or -7.7 percent. For just White Pine County, municipal solid waste represented a slight majority of total waste collected by landfills operating within White Pine County. Between 2013 and 2018, 52.6 percent, on average per year, of all waste entering White Pine County landfills was municipal solid waste and 47.4 percent, on average per year, of all waste entering White Pine County landfills was industrial waste.

Table 2.12 presents the average annual growth rate for both the amount of municipal solid waste (MSW) and industrial waste collected by landfills operating within each of the five counties within the Northeastern Nevada area for each year between 2013 and 2018.

Table 2.12 – Annual Average Growth Rate of Municipal Solid Waste (MSW) and Industrial Waste Collected by Landfills within the Northeastern Nevada Regional Development Authority Area 2013 through 2018

Jurisdiction and Type	2013	2014	2015	2016	2017	2018	2013-2018 Average
Humboldt Industrial	-	4.7%	-15.8%	-11.1%	65.4%	-41.8%	0.3%
Humboldt MSW	-	0.2%	3.0%	-2.4%	38.6%	-8.6%	6.2%
Humboldt Total	**-**	**4.1%**	**-13.3%**	**-9.7%**	**60.8%**	**-36.9%**	**1.0%**
Elko Industrial	-	-36.0%	90.7%	3.9%	-4.5%	14.1%	13.7%
Elko MSW	-	-2.5%	-19.4%	2.0%	2.0%	4.7%	-2.6%
Elko Total	**-**	**-8.6%**	**-5.4%**	**2.5%**	**0.3%**	**7.0%**	**-0.8%**
Eureka Industrial	-	38.5%	-65.0%	90.0%	10.7%	47.0%	24.2%
Eureka MSW	-	7.4%	-8.5%	-0.5%	-12.4%	-23.6%	-7.5%
Eureka Total	**-**	**34.8%**	**-59.7%**	**70.5%**	**7.8%**	**39.8%**	**18.7%**
Lander Industrial	-	-5.3%	25.1%	-14.9%	386.2%	-69.3%	64.4%
Lander MSW	-	-7.3%	-4.2%	7.6%	20.4%	4.4%	4.2%
Lander Total	**-**	**-5.5%**	**22.7%**	**-13.5%**	**357.7%**	**-67.8%**	**58.7%**
White Pine Industrial	-	9.9%	-11.0%	-9.8%	12.8%	10.8%	2.6%
White Pine MSW	-	1.3%	-0.6%	-2.4%	-1.9%	-4.2%	-1.6%
White Pine Total	**-**	**5.3%**	**-5.6%**	**-5.8%**	**4.6%**	**3.0%**	**0.3%**
NNRDA Industrial	-	1.9%	-8.5%	-7.7%	99.0%	-44.9%	8.0%
NNRDA MSW	-	-1.7%	-12.5%	0.5%	11.1%	-0.4%	-0.6%
NNRDA Total	**-**	**0.7%**	**-9.9%**	**-5.0%**	**68.3%**	**-34.6%**	**3.9%**

Source: Nevada Division of Environmental Protection, Bureau of Waste Management

Despite year-to-year fluctuation in the annual growth rate in the total amount of industrial waste and municipal solid waste combined entering landfills located throughout the five-county Northeastern Nevada area, the total amount of industrial waste and municipal waste entering landfills in Northeastern Nevada increased at an average annual rate of 3.9 percent per year between 2013 and 2018. The amount of just industrial waste entering landfills located throughout the five-county Northeastern Nevada area increased at an average annual rate of 8.0 percent per year and the amount of just municipal solid waste entering landfills located throughout the five-county Northeastern Nevada area decreased at an average annual rate of -0.6 percent per year. Each of the five counties within the Northeastern Nevada area exhibited a somewhat similar pattern as average annual rates of growth in the total amount of waste entering county-level landfills were largely driven by a positive average annual rate of growth in the amount of industrial waste entering area landfills with generally moderate or negative average annual rates of growth in the amount of municipal solid waste entering area landfills.

In Humboldt County, the total amount of industrial waste and municipal waste entering landfills operating within Humboldt County increased at an average annual rate of just 1.0 percent between 2013 and 2018. Unlike the larger five-county Northeastern Nevada area, the total amount of just industrial waste entering landfills operating within Humboldt County increased only slightly by an average annual rate of just 0.3 percent between 2013 and 2018 while the amount of just municipal solid waste entering landfills operating within Humboldt County increased at average annual rate of 6.2 percent per year between 2013 and 2018.

Unlike the larger five-county Northeastern Nevada area, the total amount of industrial waste and municipal waste entering landfills operating within Elko County decreased at an average annual rate of -0.8 percent per year between 2013 and 2018. The total amount of just industrial waste entering landfills operating within Elko County increased at an average annual rate of 13.7 percent between 2013 and 2018 and the total amount of just municipal solid waste entering landfills operating within Elko County decreased at an average annual rate of -2.6 percent between 2013 and 2018. Although the growth patterns in the average annual growth rate in the amount of industrial waste and municipal solid waste entering landfills operating within Elko County followed similar patterns for the entire five-county Northeastern Nevada area, the dominance of municipal solid waste as a source of total waste entering landfills in Elko County drove the negative average annual growth rate in the amount of total waste entering landfills operating within the county.

In Eureka County, the total amount of industrial waste and municipal waste entering landfills operating within Eureka County increased at an average annual rate of 18.7 percent between 2013 and 2018. Similar to the pattern found for the larger five-county Northeastern Nevada area, the total amount of just industrial waste entering landfills operating within Eureka County increased at an average annual rate of 24.2 percent between 2013 and 2018 while the amount of just municipal solid waste entering landfills operating within Eureka County decreased by an average annual rate of -7.5 percent between 2013 and 2018.

In Lander County, the total amount of industrial waste and municipal waste entering landfills operating within Lander County increased at an average annual rate of 58.7 percent between 2013 and 2018. Similar to the pattern observed for the larger five-county Northeastern Nevada area, the total amount of just industrial waste entering landfills operating within Lander County increased at an average annual rate of 64.4 percent between 2013 and 2018. However, unlike the pattern observed for the larger five-county Northeastern Nevada area, the total amount of just municipal solid waste entering landfills operating within Lander County increased at an average annual rate of 4.2 percent between 2013 and 2018.

Similar to the pattern found in the larger five-county Northeastern Nevada area, the total amount of industrial waste and municipal waste entering landfills operating within White Pine County increased at an average annual rate of 0.3 percent between 2013 and 2018. The total amount of just industrial waste entering landfills operating within White Pine County increased at an average annual rate of 2.6 percent between 2013 and 2018 and the total amount of just municipal solid waste entering landfills operating within White Pine County decreased by an average annual rate of -0.6 percent between 2013 and 2018.

2.3.c Discussion Regarding the Relationship Between Recyclable Waste Generated and Waste Collected by Landfills Operating within the Northeastern Nevada Regional Development Authority Area

As previously noted, the amount of municipal solid waste and commercial and industrial waste generated and transferred to community landfills is largely influenced by changes in the levels of economic activity, personal consumption patterns, and population growth. This section has presented an overview of the five-county Northeastern Nevada Regional Development Authority's area socio-demographic, economic, and industry sector and occupational sector characteristics in order to understand the drivers of municipal solid waste and commercial and industrial waste being generated throughout the area. Understanding these characteristics and the various patterns in what types of and how much waste is entering area landfills is the first step in determining the overall feasibility of developing a comprehensive recycling industry sector in Northeastern Nevada.

Generally, continued positive growth in a community's or region's total population, total number of households, median household income levels, median family income levels, per capita income levels, and total civilian workforce combined with decreases in a community's or region's civilian unemployment rate correlates positively with an increase in the amount of total waste produced by that community or region. Improved socio-demographic, economic, and industry sector and occupational sector characteristics lead to increased consumption and increased production and these increases in-turn lead to increases in the amount of waste produced by individuals who live in and firms that operate within that community or region. The specific characteristics of a community's or region's economic base will also significantly impact the quantity of and type of waste produced within that community or region. A community's or region's economic base that is dominated by a single firm or just a few individual firms or industry and occupational sectors will tend to become the largest single-point source(s) of waste. Recycling industry sectors can be established and customized to target the specific types and quantities of waste generated from the dominate firm(s) or industry and occupation sector(s). Ultimately, however, a community or region must generate enough total waste, or enough municipal solid waste and/or commercial and industrial waste, to produce enough potentially recycled materials to justify the creation of that recycling industry.

The various socio-demographic, economic, and industry sector and occupational sector characteristics of the entire Northeastern Nevada Regional Development area over the past several years, coupled with the overall growth in the amount of total municipal solid waste and commercial and industrial waste making its way into area landfills, suggests that the five-county Northeastern Nevada area could potentially support the development of a new recycling industry. As previously discussed in this section, the total population of the entire Northeastern Nevada Regional Development Authority area grew by 2,444 total individuals or 2.9 percent between 2013 and 2017 and the total number of households within this five-county area grew by 407 total households or 1.4 percent over the same 2013 to 2017 period. Median household income increased by $7,443 or 11.8 percent between 2013 and 2017, median family income increased by $11,594 or 15.1 percent between 2013 and 2017, and per capita income increased by $3,152 or 11.5 percent between 2013 and 2017 throughout the Northeastern Nevada area. Between 2013 and 2017, the five-county area's total civilian workforce increased by 2,324 total workers or 3.6 percent while the Northeastern Nevada Regional Development Authority area's total civilian unemployment rate decreased by a total of 1.9 percent or -22.8 percent overall between 2013 and 2017.

The positive improvements in these various socio-demographic and economic conditions for the entire Northeastern Nevada Regional Development Authority area suggest that total amounts of potentially recyclable waste materials will continue to increase for the foreseeable future for the entire area. Between 2013 and 2018, the total amount of municipal solid waste and commercial and industrial waste combined and collected by landfills operating throughout the entire five-county Northeastern Nevada area increased at an annual average rate of 3.9 percent per year between 2013 and 2018. However, the actual total amount of municipal waste and commercial and industrial waste combined and collected by landfills operating throughout the entire five-county Northeastern Nevada area decreased from an estimated 256,487.30 metric tonnes of total waste collected in 2013 to 243,132.18 metric tonnes of total waste collected in 2018, a net decrease of 13,335.11 metric tonnes of total waste or -5.2 percent.

In fact, both total commercial and industrial waste and total municipal solid waste levels being collected by area landfills decreased between 2013 and 2018. Combined total commercial and industrial waste levels collected by area landfills within the Northeastern Nevada area decreased from an estimated 167,208.18 metric tonnes of total waste in 2013 to an estimated 157,760.22 metric tonnes of total waste in 2018, a net decrease of 9,447.97 metric tonnes or -5.7 percent. Total municipal solid waste levels collected by area landfills within the Northeastern Nevada area decreased from an estimated 89,279.11 metric tonnes of total waste in 2013 to an estimated 85,371.97 metric tonnes of total waste in 2018, a net decrease of 3,907.15 metric tonnes or -4.4 percent.

The apparent inconsistency in the behavior of the annual average growth rate in total municipal solid waste and total commercial and industrial waste, in total municipal solid waste alone, and in total commercial and industrial waste alone and in the behavior of the actual total amounts of waste generated area-wide is likely due to significant variation in the annual average levels of growth in the total amounts of waste being collected by landfills located throughout the Northeastern Nevada area. For example, between 2013 and 2014, the total amount of municipal solid waste and commercial and industrial waste combined and collected by area landfills grew by 0.7 percent but declined by -9.9 percent between 2014 and 2015 and then by -5.0 percent between 2015 and 2016. The total amount of municipal solid waste and commercial and industrial waste combined and collected by area landfills then grew substantially, by 68.3 percent, between 2016 and 2017 and then declined substantially, by -34.6 percent, between 2017 and 2018.

The individual year-by-year annual average growth rates of just total commercial and industry waste and just total municipal solid waste collected by area-wide landfills within the Northeastern Nevada area show a similar inconsistent pattern of growth and decline. Between 2013 and 2014, the total amount of just commercial and industrial waste collected by area landfills increased by 1.9 percent and then decreased by -8.5 percent between 2014 and 2015 and then by -7.7 percent between 2015 and 2016. The annual average growth rate in the total amount of commercial and industrial waste collected by area-wide landfills increased dramatically between 2016 and 2017, increasing by 99.0 percent, followed by a significant decline of -44.9 percent between 2017 and 2018. Between 2013 and 2014, the total amount of just municipal solid waste collected by area landfills decreased by 1.7 percent followed by a more significant decrease of -12.5 percent between 2014 and 2015. The annual average growth rate in the total amount of just municipal solid waste collected by area-wide landfills within the five-county Northeastern Nevada area increased slightly by 0.5 percent between 2015 and 2016 followed by a significant increase of 11.1 percent between 2016 and 2017 and then followed by a slight decrease of -0.4 percent between 2017 and 2018.

A successful recycling industry sector for the five-county Northeastern Nevada area will depend upon a steady and reliable source of potential recyclable materials as a key input into production. Future growth of any future recycling industry sector will further depend on a growing source of potential recyclable materials from both within and potentially from outside the five-county area. The past six years of available landfill receiving data for landfills operating within the five-county Northeastern Nevada area suggests that a reliable source and future growing source of potential recyclable materials is <u>not</u> available at this time despite continued growth and improvement in the region's various underlying socio-demographic and economic conditions. However, it may be possible to build a new recycling industry for the five-county Northeastern Nevada area on commercial and industrial waste sources and from identifiable single point sources of waste materials. Between 2013 and 2018, as previously mentioned, total commercial and industrial waste materials collected by area-wide landfills within the Northeastern Nevada area grew at an annual average rate of 8.0 percent per year while total municipal waste materials collected by area-wide landfills decreased by -0.6 per year. Over this same six-year period, commercial and industrial waste accounted for, on average, 67.5 percent of all waste collected on an annual basis by area landfills while municipal solid waste accounted for, on average, 32.5 percent of all waste collected on an annual basis by area landfills.

The economic dominance of the Mining, Quarrying, and Oil and Gas Extraction industry sector within the Northeastern Nevada Regional Development Authority area, generating 11,498 total jobs in 2018 alone with a location quotient of 61.97 and generating approximately $3.86 billion in total annual economic output in 2018, suggests that firms within this industry sector are the primary single point source of commercial and industrial waste materials within the five-county area. A new recycling industry sector in Northeastern Nevada could potentially benefit from being able to tailor their, at least, initial and start-up processes to serve this primary industry sector by focusing on efforts to recycle potential recyclable materials being generated by firms operating within the Mining, Quarrying, and Oil and Gas Extraction industry sector. Furthermore, the current condition of the Administrative and Support and Waste Management and Remediation Services industry sector, generating 949 totals jobs in 2018 alone with a location quotient of 0.34 and generating approximately $57.62 million in total annual economic output in 2018, suggests that there is room for economic growth within the Northeastern Nevada Regional Development Authority area for the Administrative and Support and Waste Management and Remediation Services industry sector.

The next step in determining the overall feasibility of developing a comprehensive recycling industry sector in Northeastern Nevada involves assessing the change in prices for recycled waste materials within regional and national recycled waste material markets. The results of the analysis for this next step is presented in the next section of this University Center for Economic Development technical report.

3.0 Price Model of Recycled Materials Generated in Northeastern Nevada

Prevailing and predicted prices for recycled materials is a critical element in determining the overall market and technical feasibility for establishing a new recycling industry in Northeastern Nevada. If prices are too low, individual recycling firms will be unable to generate sufficient revenue to support commercial activity. If prices are too high, individual firms may lose market share to firms producing non-recycled substitute products. This section presents regional (defined as states located within the Southwestern United States) and national (including all of the United States and parts of Canada) pricing data for various recycled materials. The selection of recycled materials included in the following price models was made using the list of potentially recyclable waste generated by current mining operations located in Northeastern Nevada and listed in Table 2.11 in Section 2.0 of this University Center for Economic Development technical report.

3.1 Methodology in Developing Price Models of Recyclable Commodities

All historical pricing data was obtained from public sources available from www.secondarypricingmaterials.com and the prices for individual recyclable materials were sorted into three primary categories including: (1) plastics, (2) metals, and (3) paper. Price data for individual recyclable materials for each of these three primary categories were then analyzed and estimated. Polyethylene Terephthalate (PET) Baled, Natural High Density Polyethylene (HDPE), and Colored High Density Polyethylene (HDPE) were examined individually for the plastics category. Aluminum Cans Sorted, Aluminum Cans Loose, Steel Cans Sorted Baled, Steel Cans Sorted Densified, Steel Cans Loose, and White Goods Loose were examined individually for the metals category. Mixed Paper, Sorted Residential, Corrugated Containers, and Office Paper were examined individually for the paper category. A total of 13 separate finished recyclable commodities were examined in the development of a larger price model for recyclable commodities that could potentially be developed from waste generated in Northeastern Nevada.

Noticeably absent from these three primary categories are recyclable commodities produced from various types of glass and recyclable commodities produced from various types of rubber. In general, pricing data for recyclable glass and rubber at a regional or national level was unavailable given the high variability in local prices or the general lack of data that is collected on these types of recyclable commodities. Upon interviews with representatives from the Nevada Division of Environmental Protection and the University of Nevada, Reno's Business Environmental Program, it was decided to forgo any estimation of historical, current, or predicted future prices for recycled glass and rubber commodities due to the high degree of error or missing market price data for these two potential recyclable commodities. While reliable price data was unavailable, the potential recycling of glass and rubber in a Northeastern Nevada recycling industry is addressed to some degree in Section 4.0 and Section 5.0 of this University Center for Economic Development technical report.

Both regional and national prices for the 13 selected recyclable commodities were examined and considered. The regional average prices presented in this section refer to the Southwestern United States, defined as Region 9 by the U.S. Environmental Protection Agency. U.S. Environmental Protection Agency Region 9 includes the states of Arizona, California, Hawaii, and Nevada. The national average prices presented in this section include all ten U.S. Environmental Protection Agency regions which includes all 50 states plus America Samoa, the District of Columbia, the Northern Mariana Islands, Puerto Rico, the Trust Territories, and the U.S. Virgin Islands. The national average prices presented in this section also include parts of Canada including the provinces of Ontario and Quebec.

Determining a suitable time period for the analysis presented in this section was difficult as the available price data was collected and published on a weekly basis in some cases and on a day-to-day basis. Because of this inconsistency, a specific time period (i.e. price per week or price per day) was not specified. While this inconsistency does not invalidate the long-term trend analysis presented in this section, it is important to note that price fluctuations in recyclable commodities tend to vary daily and weekly and this fluctuation could potentially impact day-to-day operations of firms producing recyclable materials from generated waste. Whenever possible, the time period of August 26, 2016 to January 10, 2020 was used in the analysis presented in this section. If price data for specific recyclable commodities were not available from August 26, 2016, the earliest available date for the specific recyclable commodity was used as the starting part in the analysis.

3.2 Historical and Current Prices for Recycled Plastics

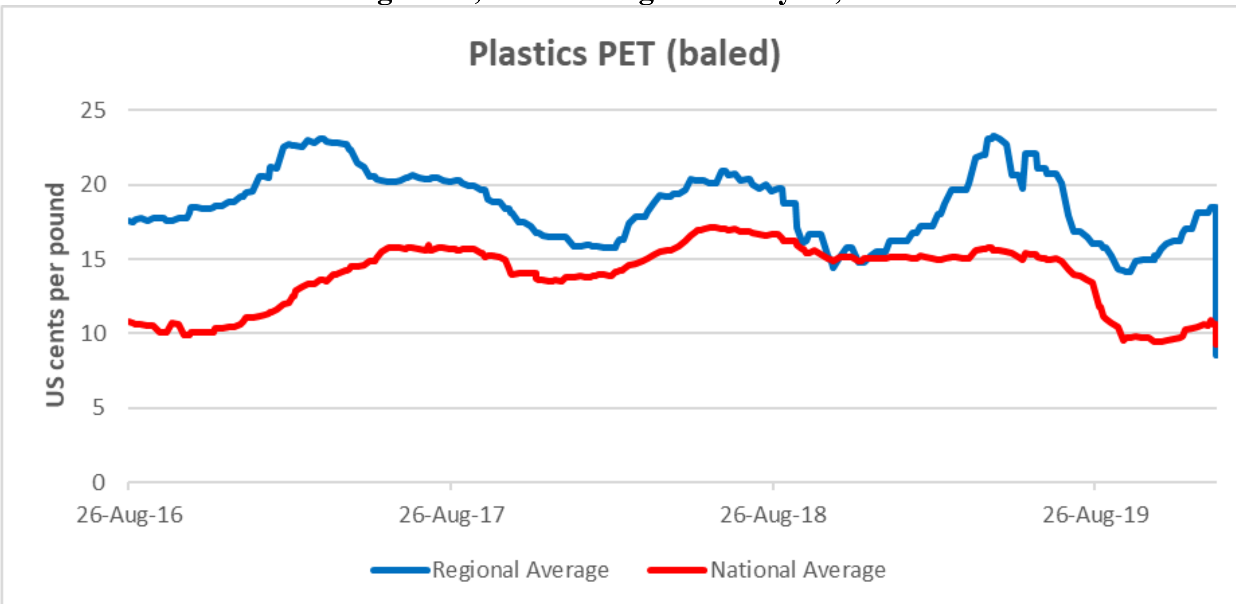
For the plastics primary recycling commodity category, the commodities of Polyethylene Terephthalate (PET) Baled, Natural High Density Polyethylene (HDPE), and Colored High Density Polyethylene (HDPE) were examined and the resulting price models are presented in this sub-section.

3.2.a Polyethylene Terephthalate (PET) Baled Plastics

Figure 3.1 presents both the regional and national modeled analysis and changes in prices for PET Baled plastics. The results are presented in U.S. cents per pound.

Since August 26, 2016, the average regional price of PET Baled plastics has decreased from an estimated $0.1757 per pound to an estimated $0.0850 per pound, a net decrease of $0.0907 per pound or -51.6 percent. The average regional price per pound over this nearly three and a half year period was $0.1859 per pound (with a reported standard deviation of $0.0245 per pound). Over the same time period, the average national price of BET Baled plastics has decreased from an estimated $0.1082 per pound to an estimated $0.0928 per pound, a net decrease of $0.0154 per pound or -14.2 percent. The average national price per pound over this nearly three and a half year period was $0.1381 per pound (with a reported standard deviation of $0.0240).

Figure 3.1 – Regional and National Average Historical Prices of PET Baled Plastics August 26, 2016 through January 10, 2020



Source: Regional and National Price Data, PET Baled Plastics, [*www.secondarypricingmaterials.com*](http://www.secondarypricingmaterials.com)

Table 3.1 presents the estimated summary statistics for regional and national prices for PET Baled plastics for the trend lines presented in Figure 3.1.

Table 3.1 – Summary Descriptive Statistics PET Baled Plastics, Regional and National Price Data August 26, 2016 through January 10, 2020

Variable	No. of Observations	Average	Standard Deviation	Coefficient of Variation	Minimum	Maximum
Regional Average	258	18.59	2.45	13.17%	8.5	23.25
National Average	258	13.81	2.24	16.23%	9.28	17.11

Source: Regional and National Price Data, PET Baled Plastics, [*www.secondarypricingmaterials.com*](http://www.secondarypricingmaterials.com)

Using the resulting summary descriptive statistics presented in Table 3.1, two separate regression models, one for the regional average price of PET Baled plastics and one for the national average price of PET Baled plastics, were developed. In both Equation 1 and Equation 2, price is regressed on time. Equation 1 predicts the regional average price of PET Baled plastics and Equation 2 predicts the national average price of PET Baled plastics. As Equation 1 demonstrates, the predicted regional price of PET Baled plastics will decrease by an estimated $0.0001 per pound for each subsequent time period and, as Equation 2 demonstrates, the predicted national price of PET Baled plastics will decrease by an estimated \$0.0003 per pound for each subsequent time period.

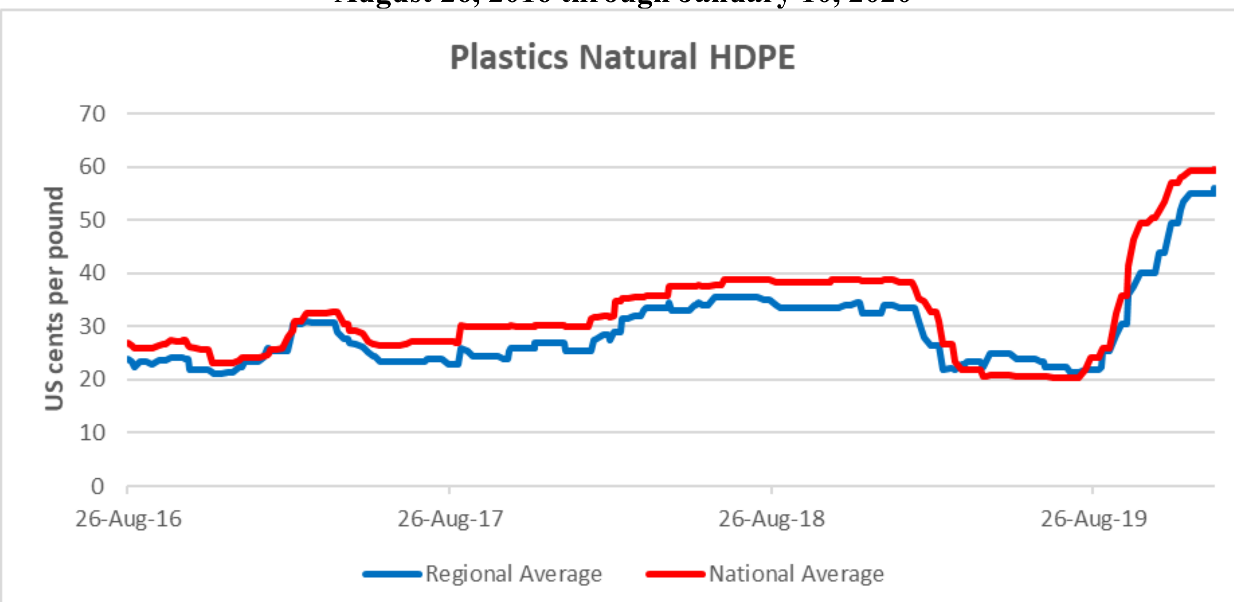
$$(1)\ Regional\ Average\ Price\ of\ Plastics\ PET(blaled) = \underset{(0.289)^{***1}}{19.99} - \underset{(0.002)^{***}}{0.01}time,\ R^2 = 0.105$$

$$(2)\ National\ Average\ Price\ of\ Plastics\ PET\ (baled) = \underset{(0.279)^{***}}{13.44} + \underset{(0.002)}{0.003}time,\ R^2 = 0.005$$

3.2.b Natural High Density Polyethylene (HDPE) Plastics

Figure 3.2 presents both the regional and national modeled analysis and changes in prices for Natural HDPE plastics. The results are presented in U.S. cents per pound.

Figure 3.2 – Regional and National Average Historical Prices of Natural HDPE Plastics August 26, 2016 through January 10, 2020



Source: Regional and National Price Data, Natural HDPE Plastics, [*www.secondarypricingmaterials.com*](http://www.secondarypricingmaterials.com)

Since August 26, 2016, the average regional price of Natural HDPE plastics has increased from an estimated \$0.2400 per pound to an estimated \$0.5600 per pound, a net increase of \$0.3200 per pound or 133.3 percent. The average regional price per pound over this nearly three and a half year period was \$0.2913 per pound (with a reported standard deviation of \$0.0737 per pound). Over the same period, the average national price of Natural HDPE plastics has also increased,

[1] No* = p-value > 0.10
* = 0.05 < p-value < 0.10
** = 0.01 < p-value < 0.05
*** = p-value < 0.01

increasing from an estimated $0.2694 per pound to an estimated $0.5947 per pound, a net increase of $0.3253 per pound or 120.8 percent. The average national price per pound over this nearly three and a half year period was $0.3210 per pound (with a reported standard deviation of $0.0897).

Table 3.2 presents the estimated summary statistics for regional and national prices for Natural HDPE plastics for the trend lines presented in Figure 3.2.

Table 3.2 – Summary Descriptive Statistics Natural HDPE Plastics, Regional and National Price Data August 26, 2016 through January 10, 2020						
Variable	**No. of Observations**	**Average**	**Standard Deviation**	**Coefficient of Variation**	**Minimum**	**Maximum**
Regional Average	258	29.13	7.37	25.29%	21	56
National Average	258	32.10	8.97	27.95%	20.34	59.47

Source: Regional and National Price Data, Natural HDPE Plastics, *www.secondarypricingmaterials.com*

Using the resulting summary descriptive statistics presented in Table 3.2, two separate regression models, one for the regional average price of Natural HDPE plastics and one for the national average price of Natural HDPE plastics, were developed. In both Equation 3 and Equation 4, price is regressed on time. Equation 3 predicts the regional average price of PET Baled plastics and Equation 4 predicts the national average price of Natural HDPE plastics. As Equation 3 demonstrates, the predicted regional price of Natural HDPE plastics will increase by an estimated $0.0005 per pound for each subsequent time period and, as Equation 4 demonstrates, the predicted national price of Natural HDPE plastics will increase by an estimated $0.0005 per pound for each subsequent time period.

$$(3)\ Regional\ Average\ Price\ of\ Plastics\ Natural\ HDPE = \underset{(0.81)^{***}}{22.92} + \underset{(0.01)^{***}}{0.05}time,\ R^2 = 0.236$$

$$(4)\ National\ Average\ Price\ of\ Plastics\ Natural\ HDPE = \underset{(1.02)^{***}}{25.73} + \underset{(0.01)^{***}}{0.05}time,\ R^2 = 0.168$$

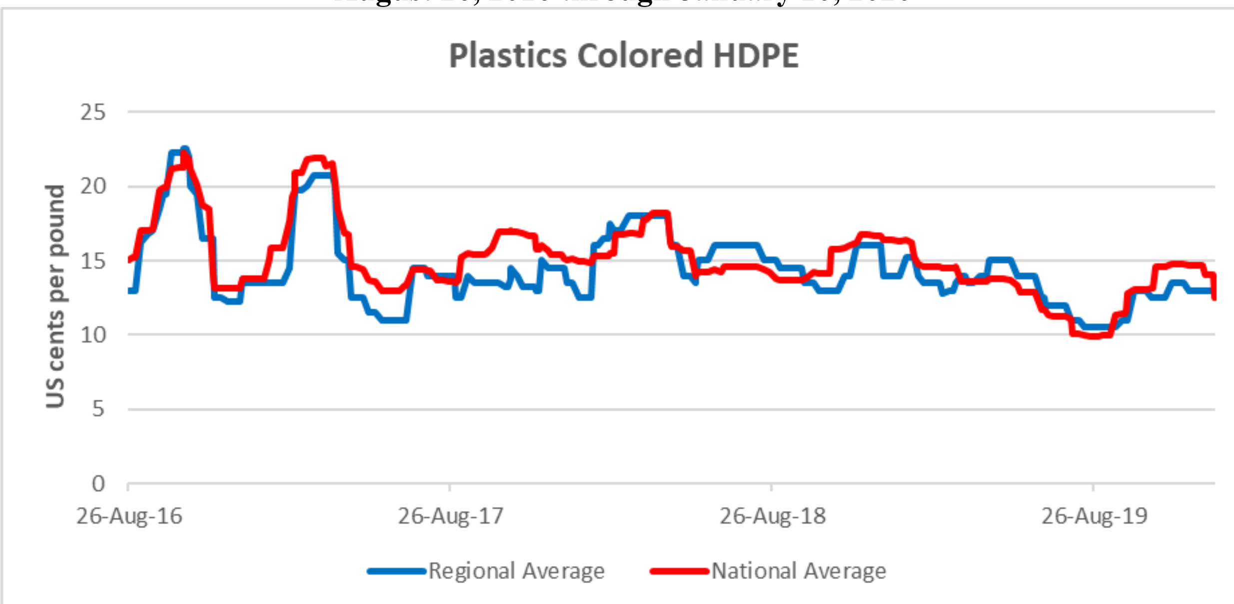
3.2.c Colored High Density Polyethylene (HDPE) Plastics

Figure 3.3 presents both the regional and national modeled analysis and changes in prices for Colored HDPE plastics. The results are presented in U.S. cents per pound.

The average regional price of HDPE Plastics remained unchanged with an estimated $0.1300 per pound on August 26, 2016 and with an estimated $0.1300 per pound on January 10, 2020. The average regional price per pound over this nearly three and a half year period was $0.1448 per pound (with a reported standard deviation of $0.0253). Between August 16, 2016 and January

10, 2020, the average national price of HDPE Plastics decreased from an estimated $0.1500 per pound to an estimated $0.1253, a net decrease of $0.0247 per pound or -16.5 percent. The average national price per pound over this nearly three and a half year period was $0.1506 (with a reported standard deviation of $0.0252).

Figure 3.3 – Regional and National Average Historical Prices of Colored HDPE Plastics August 26, 2016 through January 10, 2020



Source: Regional and National Price Data, Colored HDPE Plastics, *www.secondarypricingmaterials.com*

Table 3.3 presents the estimated summary statistics for regional and national prices for Colored HDPE plastics for the trend lines presented in Figure 3.3.

Table 3.3 – Summary Descriptive Statistics Colored HDPE Plastics, Regional and National Price Data August 26, 2016 through January 10, 2020						
Variable	**No. of Observations**	**Average**	**Standard Deviation**	**Coefficient of Variation**	**Minimum**	**Maximum**
Regional Average	258	14.48	2.53	17.46%	10.5	22.5
National Average	258	15.06	2.52	16.76%	9.92	22.31

Source: Regional and National Price Data, Colored HDPE Plastics, *www.secondarypricingmaterials.com*

Using the resulting summary descriptive statistics presented in Table 3.3, two separate regression models, one for the regional average price of Colored HDPE plastics and one for the national average price of Colored HDPE plastics, were developed. In both Equation 5 and Equation 6, price is regressed on time.

$$(5)\ Regional\ Average\ Price\ of\ Plastics\ Colored\ HDPE = 16.36 - 0.01 time$$
$$(0.29)^{***}\ (0.002)^{***}$$

$$(6)\ National\ Average\ Price\ of\ Platics\ Colored\ HDPE = 17.55 - 0.02 time$$
$$(0.26)^{***}\ (0.002)^{***}$$

Equation 5 predicts the regional average price of Colored HDPE plastics and Equation 6 predicts the national average price of Colored HDPE plastics. As Equation 5 demonstrates, the predicted regional price of Colored HDPE plastics will decrease by an estimated $0.0001 per pound for each subsequent time period and, as Equation 6 demonstrates, the predicted national price of Colored HDPE plastics will decrease by an estimated $0.0002 per pound for each subsequent time period.

3.3 Historical and Current Prices for Recycled Metals

For the metals primary recycling commodity category, the commodities of Aluminum Cans Sorted, Aluminum Cans Loose, Steel Cans Sorted Baled, Steel Cans Sorted Densified, Steel Cans Loose, and White Goods Loose were examined and the resulting price models are presented in this sub-section.

3.3.a Aluminum Cans Sorted

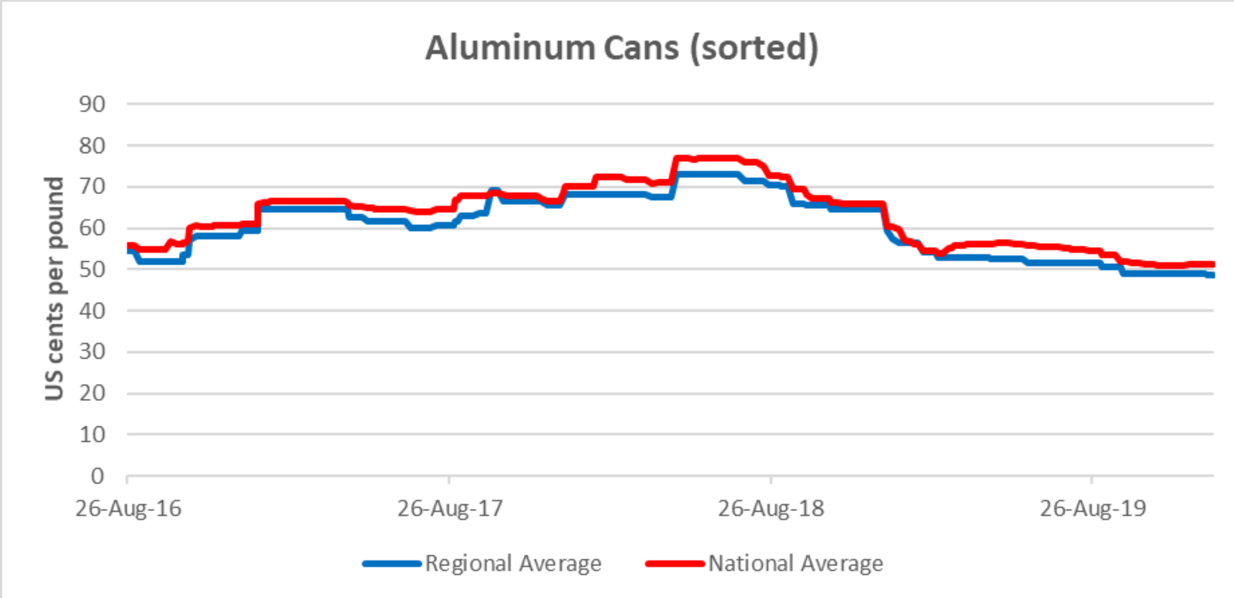
Figure 3.4 presents both the regional and national modeled analysis and changes in prices for Aluminum Cans Sorted for the period between August 26, 2016 and January 10, 2020. The results are presented in U.S. cents per pound.

Between August 26, 2016 and January 10, 2020, the average regional price of Aluminum Cans Sorted has decreased from an estimated $0.6041 per pound on August 26, 2016 to an estimated $0.5450 per pound on January 10, 2020, a net decrease of $0.0591 per pound or -9.8 percent. The average regional price per pound for Aluminum Cans Sorted over this nearly three and a half year period was $0.6041 per pound (with a reported standard deviation of $0.0745 per pound).

Over the same August 26, 2016 to January 10, 2020 time period, the average national price of Aluminum Cans Sorted has decreased from $0.5581 per pound on August 26, 2016 to $0.5119 per pound on January 10, 2020, a net decrease of $0.0462 per pound or -8.3 percent. The average national price per pound for Aluminum Cans Sorted over this nearly three and a half year period was $0.6314 per pound (with a reported standard deviation of $0.0758).

Following Figure 3.4, Table 3.4 presents the estimated summary statistics, including the estimated total number of observations, the average, the standard deviation, the coefficient of variation, and the minimum and maximum for regional and national prices of Aluminum Cans Sorted for the trend lines presented in Figure 3.4.

Figure 3.4 – Regional and National Average Historical Prices of Aluminum Cans Sorted August 26, 2016 through January 10, 2020



Source: Regional and National Price Data, Aluminum Cans Sorted, www.secondarypricingmaterials.com

Table 3.4 – Summary Descriptive Statistics Aluminum Cans Sorted, Regional and National Price Data August 26, 2016 through January 10, 2020

Variable	No. of Observations	Average	Standard Deviation	Coefficient of Variation	Minimum	Maximum
Regional Average	258	60.41	7.45	12.33%	48.5	73
National Average	258	63.14	7.58	12.00%	51.06	76.81

Source: Regional and National Price Data, Aluminum Cans Sorted, www.secondarypricingmaterials.com

Using the resulting summary descriptive statistics presented in Table 3.4, two separate regression models, one for the regional average price of Aluminum Cans Sorted and one for the national average price of Aluminum Cans Sorted, were developed.

$$(7)\ Regional\ Average\ Price\ of\ Aluminum\ Cans\ (Sorted) = \underset{(0.85)^{***}}{65.72} - \underset{(0.01)^{***}}{0.04}time$$

$$(8)\ National\ Average\ Price\ of\ Aluminum\ Cans\ (Sorted) = \underset{(0.87)^{***}}{68.38} - \underset{(0.01)^{***}}{0.04}time$$

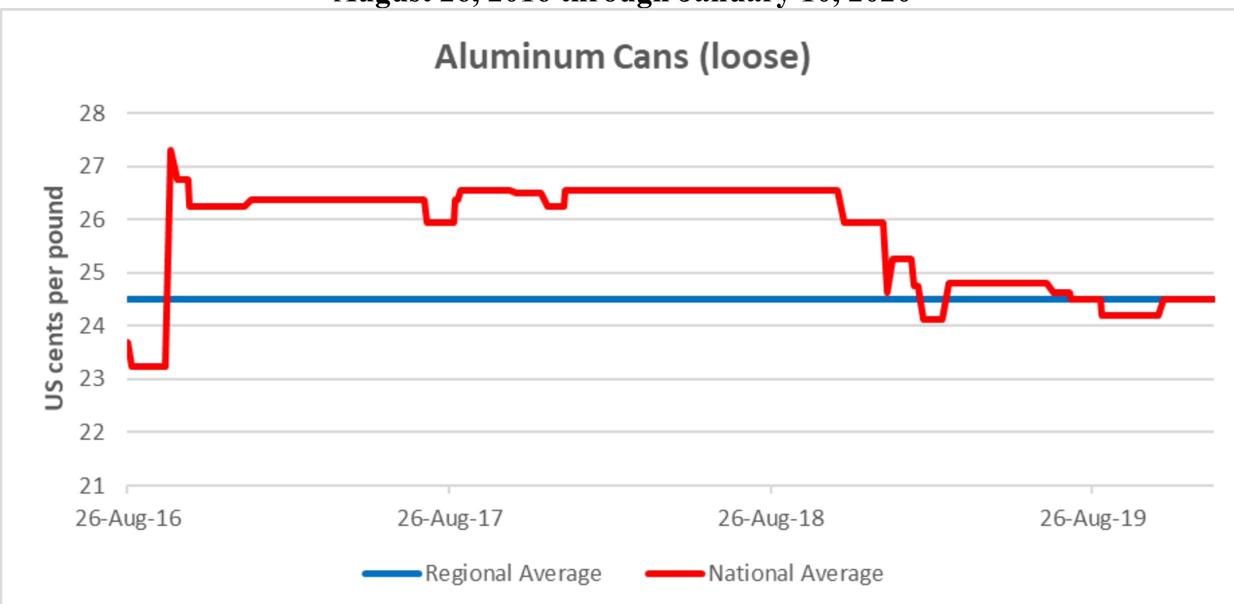
In both Equation 7 and Equation 8, price is regressed on time. Equation 7 predicts the regional average price of Aluminum Cans Sorted and Equation 8 predicts the national average price of

Aluminum Cans Sorted. As Equation 7 demonstrates, the predicted regional price of Aluminum Cans Sorted will decrease by an estimated $0.0004 per pound for each subsequent time period and, as Equation 8 demonstrates, the predicted national price of Aluminum Cans Sorted will decrease by an estimated $0.0004 per pound for each subsequent time period.

3.3.b Aluminum Cans Loose

Figure 3.5 presents both the regional and national modeled analysis and changes in prices for Aluminum Cans Loose for the period between August 26, 2016 and January 10, 2020. The results are presented in U.S. cents per pound.

Figure 3.5 – Regional and National Average Historical Prices of Aluminum Cans Loose August 26, 2016 through January 10, 2020



Source: Regional and National Price Data, Aluminum Cans Loose, *www.secondarypricingmaterials.com*

Between August 26, 2016 and January 10, 2020, the average regional price of Aluminum Cans Loose remained unchanged with an estimated average price of $0.2450 per pound on August 26, 2016 and with an estimated average price of $0.2450 per pound on January 10, 2020. The average regional price per pound for Aluminum Cans Loose over this nearly three and a half year period was $0.2450 per pound (with a reported standard deviation of $0.0000). Over the same August 26, 2016 to January 10, 2020 time period, the average national price of Aluminum Cans Loose has increased from an estimated $0.2369 per pound on August 26, 2016 to an estimated $0.2450 per pound on January 10, 2020, a net increase of $0.0081 per pound or 3.4 percent. The average national price per pound for Aluminum Cans Loose over this nearly three and a half year period was $0.2574 per pound (with a reported standard deviation of $0.0100).

Table 3.5 presents the estimated summary statistics for regional and national prices for Aluminum Cans Loose for the trend lines presented in Figure 3.5.

Table 3.5 – Summary Descriptive Statistics Aluminum Cans Loose, Regional and National Price Data August 26, 2016 through January 10, 2020						
Variable	**No. of Observations**	**Average**	**Standard Deviation**	**Coefficient of Variation**	**Minimum**	**Maximum**
Regional Average	258	24.50	0.00	0.00%	24.5	24.5
National Average	258	25.74	1.00	3.88%	23.25	27.31

Source: Regional and National Price Data, Aluminum Cans Loose, *www.secondarypricingmaterials.com*

Using the resulting summary descriptive statistics presented in Table 3.5, two separate regression models, one for the regional average price of Aluminum Cans Loose and one for the national average price of Aluminum Cans Loose, were developed.

$$(9)\ Regional\ Avergae\ Price\ of\ Aluminum\ Cans\ (loose) = 24.5 + 0time$$

$$(10)\ National\ Average\ Price\ of\ Aluminum\ Cans\ (loose) = \underset{(0.11)^{***}}{26.64} - \underset{(0.001)^{***}}{0.007}time$$

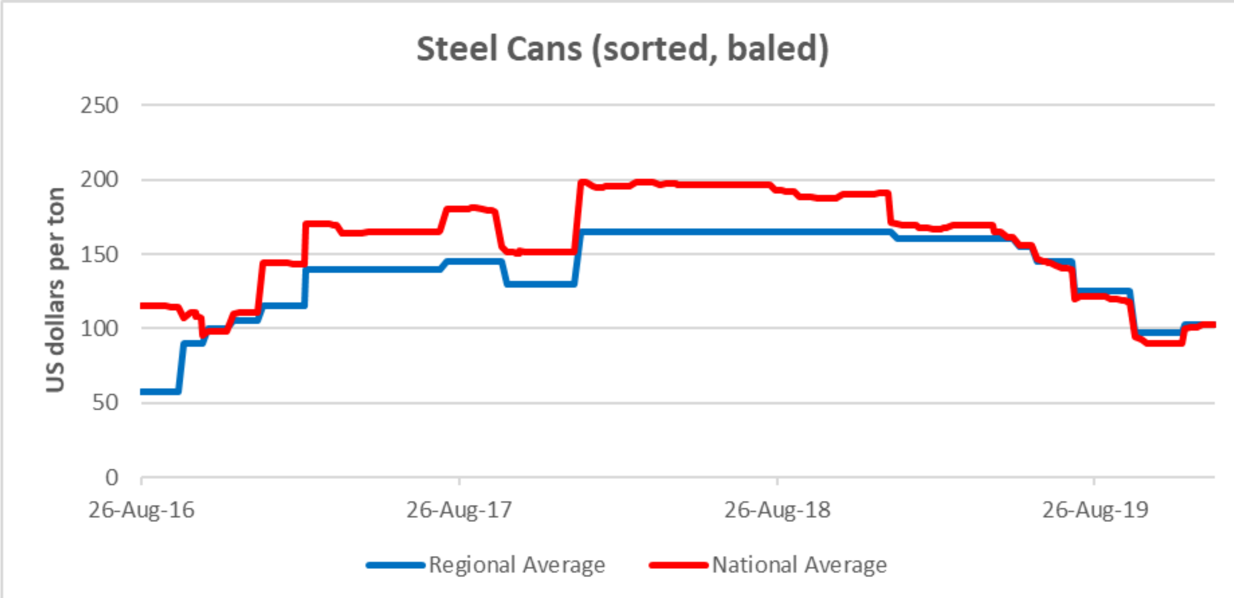
In both Equation 9 and Equation 10, price is regressed on time. Equation 9 predicts the regional average price of Aluminum Cans Loose and Equation 10 predicts the national average price of Aluminum Cans Loose. As Equation 9 demonstrates, the predicted regional price of Aluminum Cans Loose will remain unchanged in each subsequent time period and, as Equation 10 demonstrates, the predicted national price of Aluminum Cans Loose will decrease by an estimated $0.0007 per pound for each subsequent time period.

3.3.c Steel Cans Sorted Baled

Figure 3.6 presents both the regional and national modeled analysis and changes in prices for Steel Cans Sorted Baled for the period between August 26, 2016 and January 10, 2020. The results are presented in U.S. dollars per ton.

Between August 26, 2016 and January 10, 2020, the average regional price of Steel Cans Sorted Baled increased from an estimated $57.50 per ton to an estimated $102.50 per ton, an increase of approximately $45.00 or 78.3 percent. The average regional price per ton for Steel Cans Sorted Baled over this nearly three and a half year period was $138.36 per ton (with a reported standard deviation of $27.88). Over the same August 26, 2016 to January 10, 2020 time period, the average national price of Steel Cans Sorted Baled has decreased from an estimated $115.63 per ton on August 26, 2016 to an estimated $102.81 per ton on January 10, 2020, a net decrease of $12.82 per ton or -11.1 percent. The average national price per ton for Steel Cans Sorted Baled over this nearly three and a half year period was $157.29 per ton (with a reported standard deviation of $33.13).

Figure 3.6 – Regional and National Average Historical Prices of Steel Cans Sorted Baled August 26, 2016 through January 10, 2020



Source: Regional and National Price Data, Steel Cans Sorted Baled, *www.secondarypricingmaterials.com*

Table 3.6 presents the estimated summary statistics for regional and national prices for Steel Cans Sorted Baled for the trend lines presented in Figure 3.6.

Table 3.6 – Summary Descriptive Statistics Steel Cans Sorted Baled, Regional and National Price Data August 26, 2016 through January 10, 2020

Variable	No. of Observations	Average	Standard Deviation	Coefficient of Variation	Minimum	Maximum
Regional Average	258	138.36	27.88	20.15%	57.5	165
National Average	258	157.29	33.13	21.06%	90.31	198.44

Source: Regional and National Price Data, Steel Cans Sorted Baled, *www.secondarypricingmaterials.com*

Using the resulting summary descriptive statistics presented in Table 3.6, two separate regression models, one for the regional average price of Steel Cans Sorted Baled and one for the national average price of Steel Cans Sorted Baled, were developed.

$$(11)\ Regional\ Average\ Price\ of\ Steel\ Cans\ (baled) = \underset{(3.319)^{***}}{123.49} + \underset{(0.022)^{***}}{0.11}time,\ R^2 = 0.095$$

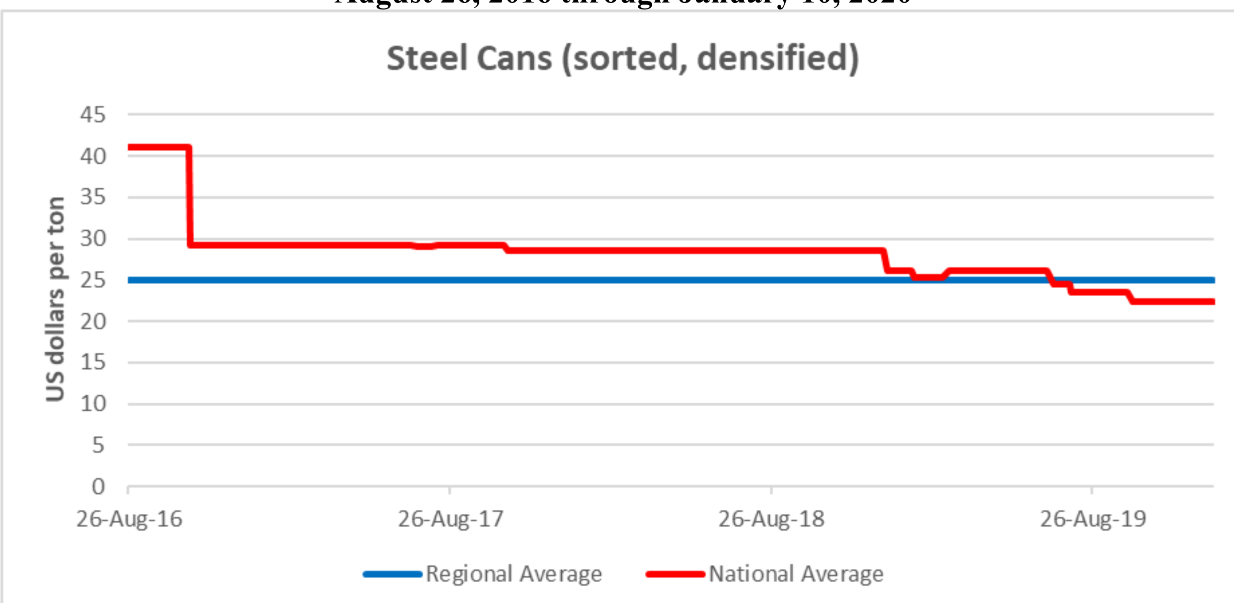
$$(12)\ National\ Average\ Price\ of\ Steel\ Cans\ (baled) = \underset{(4.141)^{***}}{159.9} - \underset{(0.028)}{0.02}time,\ R^2 = 0.002$$

In both Equation 11 and Equation 12, price is regressed on time. Equation 11 predicts the regional average price of Steel Cans Sorted Baled and Equation 12 predicts the national average price of Steel Cans Sorted Baled. As Equation 11 demonstrates, the predicted regional price of Steel Cans Sorted Baled will increase by an estimated $0.11 per ton in each subsequent time period and, as Equation 12 demonstrates, the predicted national price of Steel Cans Sorted Baled will decrease by an estimated $0.02 per ton for each subsequent time period.

3.3.d Steel Cans Sorted Densified

Figure 3.7 presents both the regional and national modeled analysis and changes in prices for Steel Cans Sorted Densified for the period between August 26, 2016 and January 10, 2020. The results are presented in U.S. dollars per ton.

Figure 3.7 – Regional and National Average Historical Prices of Steel Cans Sorted Densified
August 26, 2016 through January 10, 2020



Source: Regional and National Price Data, Steel Cans Sorted Densified, [*www.secondarypricingmaterials.com*](http://www.secondarypricingmaterials.com)

Between August 26, 2016 and January 10, 2020, the average regional price of Steel Cans Sorted Densified remained unchanged with an average regional price of $25.00 per ton on both August 26, 2016 and on January 10, 2020. The average regional price per ton for Steel Cans Sorted Densified over this nearly three and a half year period was $25.00 per ton (with a reported standard deviation of $0.00). Over the same August 26, 2016 to January 10, 2020 time period, the average national price of Steel Cans Sorted Densified has decreased from an estimated $41.00 per ton on August 26, 2016 to an estimated $22.33 per ton on January 10, 2020, a net decrease of $18.67 per ton or -45.5 percent. The average national price per ton for Steel Cans

Sorted Densified over this nearly three and a half year period was $28.19 per ton (with a reported standard deviation of $3.86).

Table 3.7 presents the estimated summary statistics for regional and national prices of Steel Cans Sorted Densified for the trend lines presented in Figure 3.7.

Table 3.7 – Summary Descriptive Statistics
Steel Cans Sorted Densified, Regional and National Price Data
August 26, 2016 through January 10, 2020

Variable	No. of Observations	Average	Standard Deviation	Coefficient of Variation	Minimum	Maximum
Regional Average	258	138.36	27.88	20.15%	57.5	165
National Average	258	157.29	33.13	21.06%	90.31	198.44

Source: Regional and National Price Data, Steel Cans Sorted Densified, *www.secondarypricingmaterials.com*

Using the resulting summary descriptive statistics presented in Table 3.7, two separate regression models, one for the regional average price of Steel Cans Sorted Densified and one for the national average price of Steel Cans Sorted Densified, were developed.

$$(13)\ Regional\ Average\ Price\ of\ Steel\ Cans\ (densified) = \underset{(0)}{25} + \underset{(0)}{0}time,\ R^2 = 1$$

$$(14)\ National\ Average\ Price\ of\ Steel\ Cans\ (densified) = \underset{(0.303)^{***}}{33.4} - \underset{(0.002)^{***}}{0.04}time,\ R^2 = 0.605$$

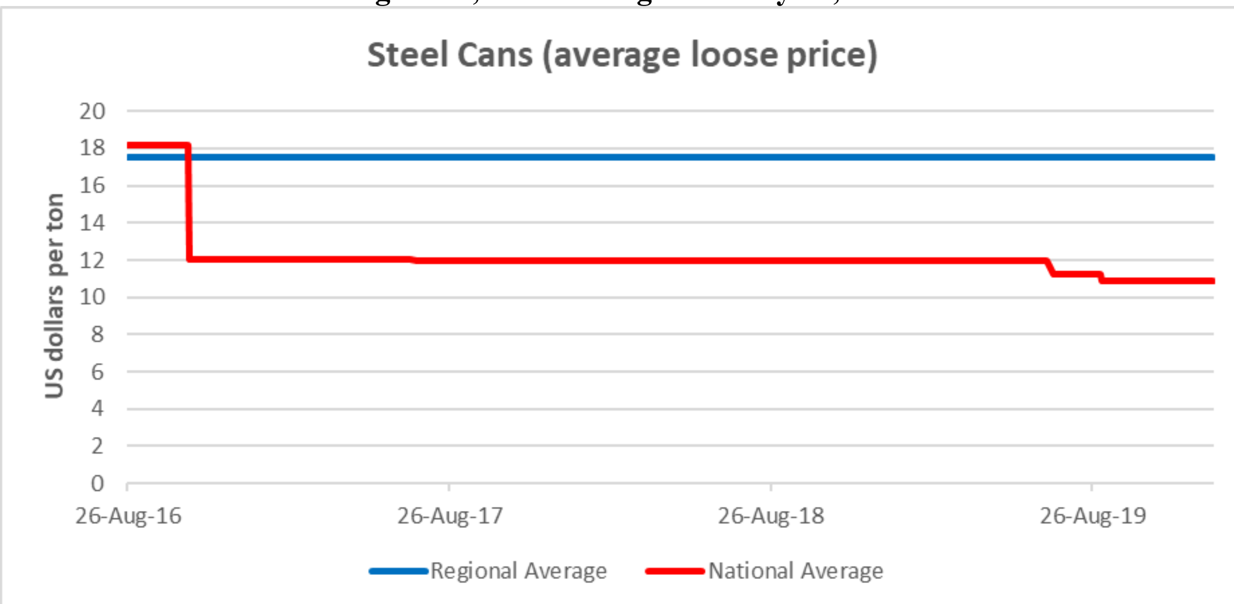
In both Equation 13 and Equation 14, price is regressed on time. Equation 13 predicts the regional average price of Steel Cans Sorted Densified and Equation 14 predicts the national average price of Steel Cans Sorted Densified. As Equation 13 demonstrates, the predicted regional price of Steel Cans Sorted Densified will remain unchanged in each subsequent time period and, as Equation 14 demonstrates, the predicted national price of Steel Cans Sorted Densified will decrease by an estimated $0.04 per ton for each subsequent time period.

3.3.e Steel Cans Loose

Figure 3.8 presents both the regional and national modeled analysis and changes in prices for Steel Cans Loose for the period between August 26, 2016 and January 10, 2020. The results are presented in U.S. dollars per ton.

Between August 26, 2016 and January 10, 2020, the average regional price of Steel Cans Loose remained unchanged with an average regional price of $17.50 per ton on August 26, 2016 and with an average regional price of $17.50 per ton on January 10, 2020. The average regional price per ton for Steel Cans Loose over this nearly three and a half year period was $17.50 per ton (with a reported standard deviation of $0.00). Over the same August 26, 2016 to January 10, 2020 time period, the average national price of Steel Cans Loose has decreased from an estimated $18.21 per ton on August 26, 2016 to an estimated $10.86 per ton on January 10, 2020, a net decrease of $7.35 per ton or -40.4 percent. The average national price per pound for Steel Cans Loose over this nearly three and a half year period was $12.16 per ton (with a reported standard deviation of $1.55).

Figure 3.8 – Regional and National Average Historical Prices of Steel Cans Loose August 26, 2016 through January 10, 2020



Source: Regional and National Price Data, Steel Cans Loose, www.secondarypricingmaterials.com

Table 3.8 presents the estimated summary statistics for regional and national prices of Steel Cans Sorted Densified for the trend lines presented in Figure 3.8.

Table 3.8 – Summary Descriptive Statistics Steel Cans Loose, Regional and National Price Data August 26, 2016 through January 10, 2020						
Variable	**No. of Observations**	**Average**	**Standard Deviation**	**Coefficient of Variation**	**Minimum**	**Maximum**
Regional Average	258	17.50	0.00	0.00%	17.5	17.5
National Average	258	12.16	1.55	12.73%	10.86	18.21

Source: Regional and National Price Data, Steel Cans Loose, www.secondarypricingmaterials.com

Using the resulting summary descriptive statistics presented in Table 3.8, two separate regression models, one for the regional average price of Steel Cans Loose and one for the national average price of Steel Cans Loose, were developed.

$$(15)\ Regional\ Average\ Price\ of\ Steel\ Cans\ (loose) = \underset{(0)}{17.5} + \underset{(0)}{0}time,\ R^2 = 1$$

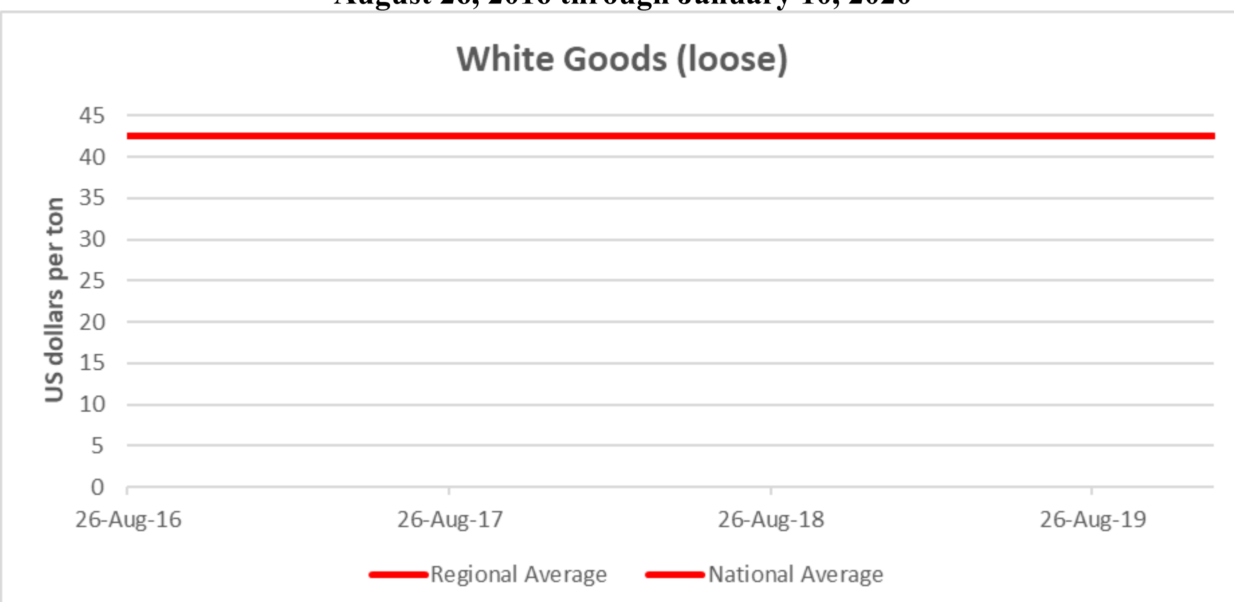
$$(16)\ National\ Average\ Price\ of\ Steel\ Cans\ (loose) = \underset{(0.163)^{***}}{13.61} - \underset{(0.001)^{***}}{0.01}time,\ R^2 = 0.289$$

In both Equation 15 and Equation 16, price is regressed on time. Equation 15 predicts the regional average price of Steel Cans Loose and Equation 16 predicts the national average price of Steel Cans Loose. As Equation 15 demonstrates, the predicted regional price of Steel Cans Loose will remain unchanged in each subsequent time period and, as Equation 16 demonstrates, the predicted national price of Steel Cans Loose will decrease by an estimated $0.01 per ton for each subsequent time period.

3.3.f White Goods Loose

Figure 3.9 presents both the regional and national modeled analysis and changes in prices for White Goods Loose, typically comprising discarded appliances, for the period between August 26, 2016 and January 10, 2020. The results are presented in U.S. dollars per ton. Note that the pricing data and subsequent analysis for both regional and national prices for White Goods Loose were identical.

Figure 3.9 – Regional and National Average Historical Prices of White Goods Loose August 26, 2016 through January 10, 2020



Source: Regional and National Price Data, White Goods Loose, [*www.secondarypricingmaterials.com*](http://www.secondarypricingmaterials.com)

Between August 26, 2016 and January 10, 2020, the average regional price of White Good Loose remained unchanged with an average regional price of $42.50 per ton on both August 26, 2016 and on January 10, 2020. The average regional price per ton for White Goods Loose over this nearly three and a half year period was also $42.50 per ton (with a reported standard deviation of $0.00). Over the same August 26, 2016 to January 10, 2020 time period, the average national price of White Goods Loose remained unchanged with an average national price of $42.50 per ton. The average national price per pound for White Goods Loose over this nearly three and a half year period was also $42.50 per ton (with a reported standard deviation of $0.00).

Table 3.9 presents the estimated summary statistics for regional and national prices Steel Cans Sorted Densified for the trend lines presented in Figure 3.9.

Table 3.9 – Summary Descriptive Statistics White Goods Loose, Regional and National Price Data August 26, 2016 through January 10, 2020						
Variable	**No. of Observations**	**Average**	**Standard Deviation**	**Coefficient of Variation**	**Minimum**	**Maximum**
Regional Average	258	42.5	0	0.00%	42.5	42.5
National Average	258	42.5	0	0.00%	42.5	42.5

Source: Regional and National Price Data, White Goods Loose, [*www.secondarypricingmaterials.com*](http://www.secondarypricingmaterials.com)

Using the resulting summary descriptive statistics presented in Table 3.9, two separate but identical regression models, one for the regional average price of White Goods Loose and one for the national average price of White Goods Loose, were developed.

$$(17)\ Regional\ Average\ Price\ of\ White\ Goods\ (loose) = \underset{(0)}{42.5} + \underset{(0)}{0}time,\ R^2 = 1$$

$$(18)\ National\ Average\ Price\ of\ White\ Goods\ (loose) = \underset{(0)}{42.5} + \underset{(0)}{0}time,\ R^2 = 1$$

In both Equation 17 and Equation 18, price is regressed on time. Equation 17 predicts the regional average price of White Goods Loose and Equation 18 predicts the national average price of White Goods Loose. As Equation 17 demonstrates, the predicted regional price of White Goods Loose will remain unchanged in each subsequent time period and, as Equation 18 demonstrates, the predicted national price of White Goods Loose will also remained unchanged in each subsequent time period.

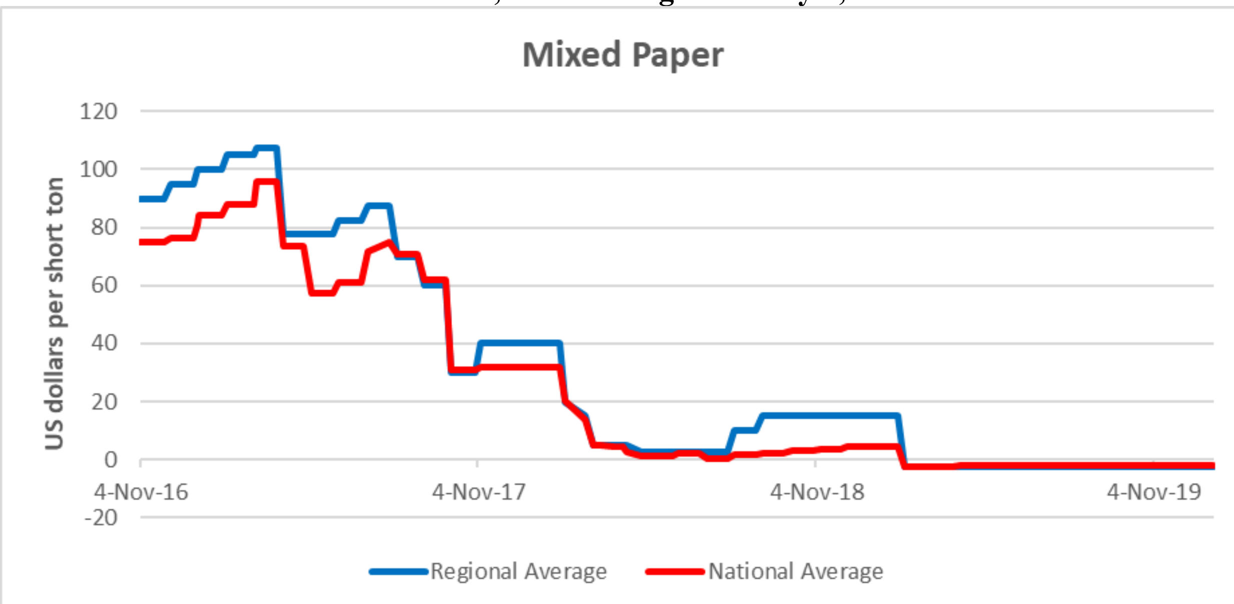
3.4 Historical and Current Prices for Recycled Paper

For the metals primary recycling commodity category, the commodities of Mixed Paper, Sorted Residential, Corrugated Containers, and Office Paper were examined and the resulting price models are presented in this sub-section.

3.4.a Mixed Paper

Figure 3.10 presents both the regional and national modeled analysis and changes in prices for Mixed Paper for the period between November 4, 2016 and January 7, 2020. The results are presented in U.S. dollars per short ton.

Figure 3.10 – Regional and National Average Historical Prices of Mixed Paper November 4, 2016 through January 7, 2020



Source: Regional and National Price Data, Mixed Paper, www.secondarypricingmaterials.com

Between November 4, 2016 and January 7, 2020, the average regional price of Mixed Paper decreased from an estimated $90.00 per short ton on November 4, 2016 to an estimated -$2.50 per short ton on January 7, 2020, a net decrease of $92.50 per short ton or -101.0 percent. The average regional price per short ton for Mixed Paper over this nearly three year period was $31.47 per short ton (with a reported standard deviation of $33.84).

Over the same November 4, 2016 to January 7, 2020, the average national price of Mixed Paper decreased from an estimated $75.00 per short ton on November 4, 2016 to an estimated -$1.88 per short ton on January 7, 2020, a net decrease of $76.88 per short ton or -102.5 percent. The average national price per short ton for Mixed Paper over this nearly three year period was $25.77 per short ton (with a reported standard deviation of $33.84).

Table 3.10 presents the estimated summary statistics, including the estimated total number of observations, the average, the standard deviation, the coefficient of variation, and the minimum and maximum for regional and national prices Mixed Paper for the trend lines presented in Figure 3.10 for Mixed Paper.

Table 3.10 – Summary Descriptive Statistics Mixed Paper, Regional and National Price Data November 4, 2016 through January 7, 2020						
Variable	**No. of Observations**	**Average**	**Standard Deviation**	**Coefficient of Variation**	**Minimum**	**Maximum**
Regional Average	85	31.47	38.72	123.03%	-2.5	107.5
National Average	85	25.77	33.84	131.27%	-2.5	95.94

Source: Regional and National Price Data, Mixed Paper, www.secondarypricingmaterials.com

Using the resulting summary descriptive statistics presented in Table 3.10, two separate regression models, one for the regional average price of Mixed Paper and one for the national average price of Mixed Paper, were developed.

(19) $Regional\ Average\ Price\ of\ Mixed\ Paper = 91.45 - 1.39time$, $R^2 = 0.791$
(3.902)*** (0.079)***

(20) $National\ Average\ Price\ of\ Mixed\ Paper = 77.9 - 1.21time$, $R^2 = 0.782$
(3.482)*** (0.07)***

In both Equation 19 and Equation 20, price is regressed on time. Equation 19 predicts the regional average price of Mixed Paper and Equation 20 predicts the national average price of Mixed Paper. As Equation 19 demonstrates, the predicted regional price of Mixed Paper will decrease by an estimated $1.39 per short ton for each subsequent time period and, as Equation 20 demonstrates, the predicted national price of Mixed Paper will decrease by an estimated $1.21 per short ton for each subsequent time period.

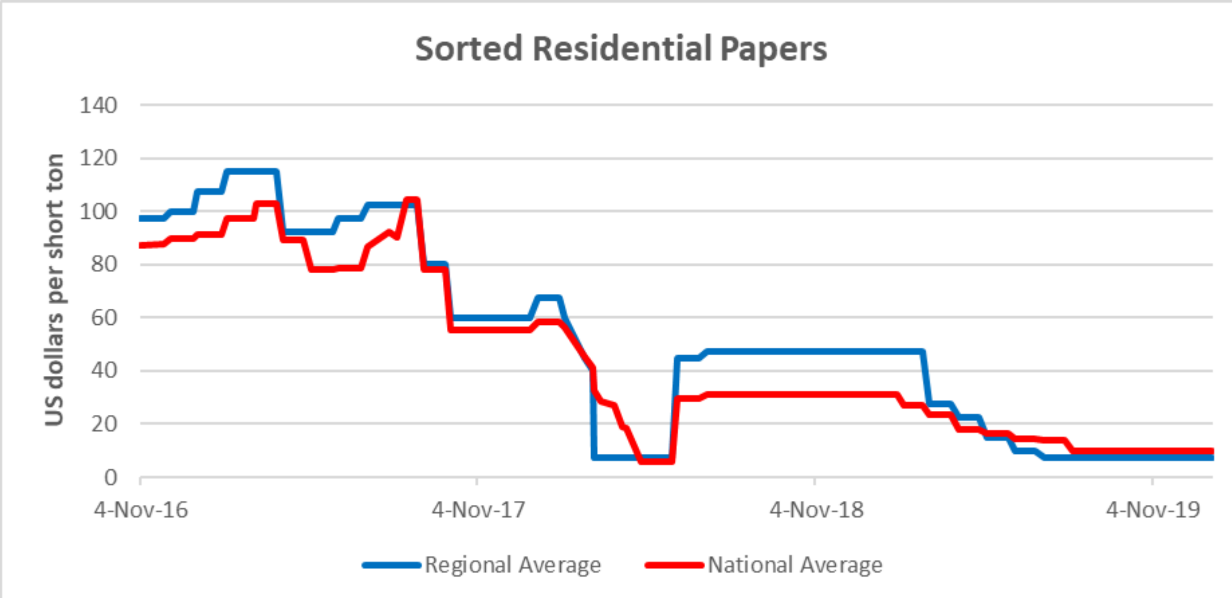
3.4.b Sorted Residential Paper

Figure 3.11 presents both the regional and national modeled analysis and changes in prices for Sorted Residential Paper for the period between November 4, 2016 and January 7, 2020. The results are presented in U.S. dollars per short ton.

Between November 4, 2016 and January 7, 2020, the average regional price of Sorted Residential Paper decreased from an estimated $97.50 per short ton on November 4, 2016 to an estimated $7.50 per short ton on January 7, 2020, a net decrease of $90.00 per short ton or -92.3 percent. The average regional price per short ton for Sorted Residential Paper over this nearly three year period was $51.09 per short ton (with a reported standard deviation of $37.65).

Over the same nearly three year period, the average national price of Sorted Residential Paper decreased from an estimated $87.19 per short ton on November 4, 2016 to an estimated $10.00 per short ton on January 7, 2020, a net decrease of $77.19 per short ton or -88.5 percent. The average national price per short ton for Sorted Residential Paper over this nearly three year period was $45.11 per short ton (with a reported standard deviation of $32.46).

Figure 3.11 – Regional and National Average Historical Prices of Sorted Residential Paper November 4, 2016 through January 7, 2020



Source: Regional and National Price Data, Sorted Residential Paper, [*www.secondarypricingmaterials.com*](http://www.secondarypricingmaterials.com)

Table 3.11 presents the estimated summary statistics, including the estimated total number of observations, the average, the standard deviation, the coefficient of variation, and the minimum and maximum for regional and national prices Sorted Residential Paper for the trend lines presented in Figure 3.11.

Table 3.11 – Summary Descriptive Statistics Sorted Residential Paper, Regional and National Price Data November 4, 2016 through January 7, 2020						
Variable	**No. of Observations**	**Average**	**Standard Deviation**	**Coefficient of Variation**	**Minimum**	**Maximum**
Regional Average	85	51.09	37.65	73.70%	7.5	115
National Average	85	45.11	32.46	71.95%	5.94	104.38

Source: Regional and National Price Data, Sorted Residential Paper, [*www.secondarypricingmaterials.com*](http://www.secondarypricingmaterials.com)

Using the resulting summary descriptive statistics presented in Table 3.11, two separate regression models, one for the regional average price of Sorted Residential Paper and one for the national average price of Sorted Residential Paper, were developed.

(21) $Regional\ Average\ Price\ of\ Sorted\ Residential\ Paper = 107.82 - 1.32time$, $R^2 = 0.748$

(4.162)*** (0.084)***

(22) $National\ Average\ Price\ of\ Sorted\ Residential\ Paper = 96.1 - 1.19time$, $R^2 = 0.813$

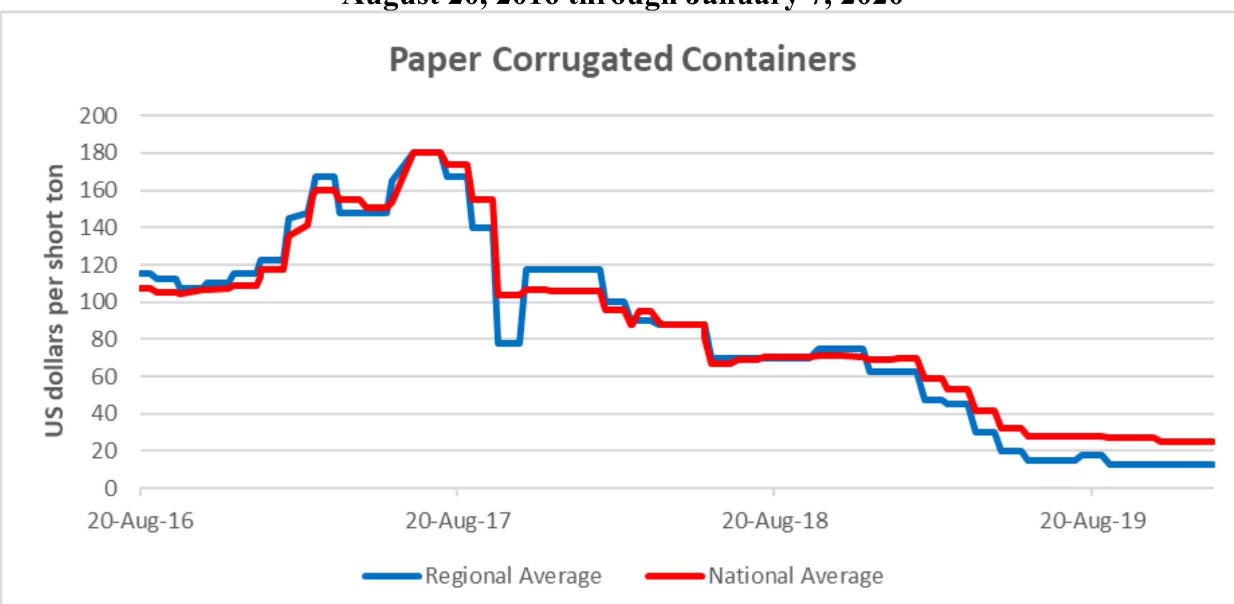
(3.091)*** (0.062)***

In both Equation 21 and Equation 22, price is regressed on time. Equation 21 predicts the regional average price of Sorted Residential Paper and Equation 22 predicts the national average price of Sorted Residential Paper. As Equation 21 demonstrates, the predicted regional price of Sorted Residential Paper will decrease by an estimated $1.32 per short ton for each subsequent time period and, as Equation 22 demonstrates, the predicted national price of Sorted Residential Paper will decrease by an estimated $1.19 per sorted ton for each subsequent time period.

3.4.c Paper Corrugated Containers

Figure 3.12 presents both the regional and national modeled analysis and changes in prices for Paper Corrugated Containers for the period between August 20, 2016 and January 7, 2020. The results are presented in U.S. dollars per short ton.

Figure 3.12 – Regional and National Average Historical Prices of Paper Corrugated Containers
August 20, 2016 through January 7, 2020



Source: Regional and National Price Data, Paper Corrugated Containers, *www.secondarypricingmaterials.com*

Between August 20, 2016 and January 7, 2020, the average regional price of Paper Corrugated Containers decreased from $115.00 per short ton on August 20, 2016 to $12.50 per short ton on January 7, 2020, a net decrease of $102.50 per short ton or -89.1 percent. The average regional price per short ton for Paper Corrugated Containers over this nearly three and a half year period was $86.95 per short ton (with a reported standard deviation of $50.18).

Over the same nearly three and a half year period, the average national price of Paper Corrugated Containers decreased from an estimated $107.19 per short ton on August 20, 2016 to an estimated $25.00 per short ton on January 7, 2020, a net decrease of $82.19 per short ton or -76.7 percent. The average national price per short ton for Paper Corrugated Containers over this nearly three and a half year period was $89.45 per short ton (with a reported standard deviation of $45.60).

Table 3.12 presents the estimated summary statistics, including the estimated total number of observations, the average, the standard deviation, the coefficient of variation, and the minimum and maximum for regional and national prices for Paper Corrugated Containers for the trend lines presented in Figure 3.12.

Table 3.12 – Summary Descriptive Statistics
Paper Corrugated Containers, Regional and National Price Data
August 20, 2016 through January 7, 2020

Variable	No. of Observations	Average	Standard Deviation	Coefficient of Variation	Minimum	Maximum
Regional Average	91	86.95	50.18	57.71%	12.5	180
National Average	91	89.45	45.60	50.98%	24.69	180

Source: Regional and National Price Data, Paper Corrugated Containers, www.secondarypricingmaterials.com

Using the resulting summary descriptive statistics presented in Table 3.12, two separate regression models, one for the regional average price of Paper Corrugated Containers and one for the national average price of Paper Corrugated Containers, were developed.

(23) $Regional\ Average\ Price\ of\ Paper\ Corrugated\ Containers = 163.43 - 1.66time$, $R^2 = 0.766$

(5.162)*** (0.097)***

(24) $National\ Average\ Price\ of\ Paper\ Corrugated\ Containers = 156.57 - 1.46time$, $R^2 = 0.715$

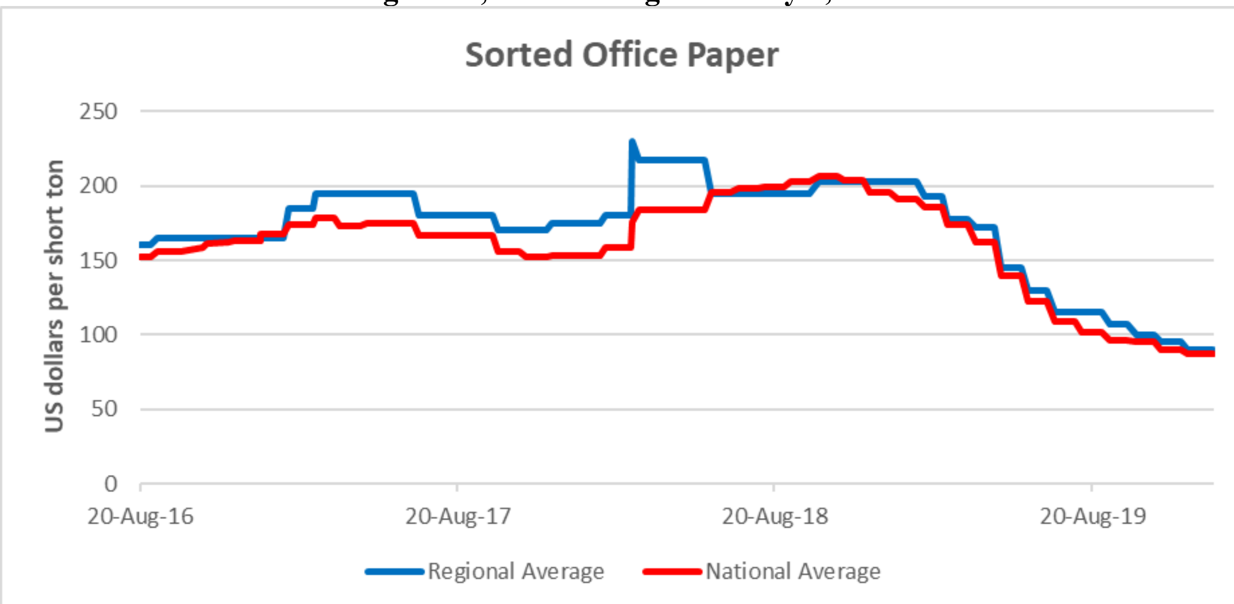
(5.179)*** (0.098)***

In both Equation 23 and Equation 24, price is regressed on time. Equation 23 predicts the regional average price of Paper Corrugated Containers and Equation 24 predicts the national average price of Paper Corrugated Containers. As Equation 23 demonstrates, the predicted regional price of Paper Corrugated Containers will decrease by an estimated $1.66 per short ton for each subsequent time period and, as Equation 24 demonstrates, the predicted national price of Paper Corrugated Containers will decrease by an estimated $1.46 per sorted ton for each subsequent time period.

3.4.d Sorted Office Paper

Figure 3.13 presents both the regional and national modeled analysis and changes in prices for Sorted Office Paper for the period between August 20, 2016 and January 7, 2020. The results are presented in U.S. dollars per short ton.

Figure 3.13 – Regional and National Average Historical Prices of Sorted Office Paper August 20, 2016 through January 7, 2020



Source: Regional and National Price Data, Sorted Office Paper, [*www.secondarypricingmaterials.com*](http://www.secondarypricingmaterials.com)

Between August 20, 2016 and January 7, 2020, the average regional price of Sorted Office Paper decreased from an estimated $160.00 per short ton on August 20, 2016 to an estimated $90.00 per short ton on January 7, 2020, a net decrease of $70.00 per short ton or -43.8 percent. The average regional price per short ton for Sorted Office Paper over this nearly three and a half year period was $171.87 per short ton (with a reported standard deviation of $33.02).

Over the same nearly three and a half year period, the average national price of Sorted Office Paper decreased from an estimated $152.19 per short ton on August 20, 2016 to an estimated $86.88 per short ton on January 7, 2020, a net decrease of $65.31 per short ton or -42.9 percent. The average national price per short ton for Sorted Office Paper over this nearly three and a half year period was $160.41 per short ton (with a reported standard deviation of $33.02).

Table 3.13 presents the estimated summary statistics, including the estimated total number of observations, the average, the standard deviation, the coefficient of variation, and the minimum and maximum for regional and national prices for Sorted Office Paper for the trend lines presented in Figure 3.13.

Table 3.13 – Summary Descriptive Statistics Sorted Office Paper, Regional and National Price Data August 20, 2016 through January 7, 2020						
Variable	**No. of Observations**	**Average**	**Standard Deviation**	**Coefficient of Variation**	**Minimum**	**Maximum**
Regional Average	91	86.95	50.18	57.71%	12.5	180
National Average	91	89.45	45.60	50.98%	24.69	180

Source: Regional and National Price Data, Sorted Office Paper, www.secondarypricingmaterials.com

Using the resulting summary descriptive statistics presented in Table 3.13, two separate regression models, one for the regional average price of Sorted Office Paper and one for the national average price of Sorted Office Paper, were developed.

$$(25)\ Regional\ Average\ Price\ of\ Sorted\ Office\ Paper = \underset{(6.77)^{***}}{199.65} - \underset{(0.128)^{***}}{0.60}time,\ R^2 = 0.201$$

$$(26)\ National\ Average\ Price\ of\ Sorted\ Office\ Paper = \underset{(6.385)^{***}}{184.3} - \underset{(0.121)^{***}}{0.52}time,\ R^2 = 0.173$$

In both Equation 25 and Equation 26, price is regressed on time. Equation 25 predicts the regional average price of Sorted Office Paper and Equation 26 predicts the national average price of Sorted Office Paper. As Equation 25 demonstrates, the predicted regional price of Sorted Office Paper will decrease by an estimated \$0.60 per short ton for each subsequent time period and, as Equation 26 demonstrates, the predicted national price of Sorted Office Paper will decrease by an estimated \$0.52 per sorted ton for each subsequent time period.

3.5 Historical and Predicated Future Prices for Recycled Plastics, Metals, and Paper Summarized

A summary of the 13 separate finished recycled commodities for each of the three primary categories, plastics, metals, and paper, is presented in this sub-section.

3.5.a Historical and Predicted Future Prices for Recycled Plastics

Table 3.14 presents a general summary for the historical regional and national average prices and for the predicted regional and national average future prices for the three commodities of recycled plastics, including Polyethylene Terephthalate (PET) Baled, Natural High Density Polyethylene (HDPE), and Colored High Density Polyethylene (HDPE). The estimated historical actual change, the estimated historical percentage change, and the predicted increase or decrease in regional and national prices based upon the completed regression estimates for each individual recycled plastic commodities are presented. Those individual recycled plastic commodities with predicated future increases are highlighted.

Table 3.14 – Recycled Plastics Summarized Historical and Predicted Future Prices			
Commodity	**Historical Actual Change**	**Historical Percentage Change**	**Predicated Future Actual Change**
PET Baled			
Regional	-$0.0907 per pound	-51.6%	-$0.0001 per pound
National	-$0.0154 per pound	-14.2%	-$0.0003 per pound
Natural HDPE			
Regional	$0.3200 per pound	133.3%	$0.0005 per pound
National	$0.3253 per pound	120.8%	$0.0005 per pound
Colored HDPE			
Regional	$0.0000 per pound	0.0%	-$0.0001 per pound
National	-$0.0247	-16.5%	-$0.0002 per pound

Of the three separate recycled plastics commodities analyzed, only the average regional price for Natural HDPE plastics and the average national price for Natural HDPE plastics is predicted to increase, with the average regional price and the average national price of Natural HDPE plastics increasing only slightly by just $0.0005 per pound. The average regional price and the average national price for PET Baled plastics are predicted to decline, by $0.0001 per pound and $0.0003 per pound respectively. The average regional price and the average national price for Colored HDPE plastics are also predicted to decline, by $0.0001 per pound and by $0.0002 per pound respectively. Based on just the historical changes and the predicated future change in regional and national prices, there does not appear to be enough appreciable growth in the recycled plastics regional and national markets to support a recycling industry in Northeastern Nevada at the time of publication of this University Center for Economic Development technical report.

3.5.b Historical and Predicted Future Prices for Recycled Metals

Table 3.15 presents a general summary for the historical regional and national average prices and for the predicted regional and national average future prices for the six commodities of recycled metals, including Aluminum Cans Sorted, Aluminum Cans Loose, Steel Cans Sorted Baled, Steel Cans Sorted Densified, Steel Cans Loose, and White Goods Loose. The estimated historical actual change, the estimated historical percentage change, and the predicted increase or decrease in regional and national prices based upon the completed regression estimates for each individual recycled metal commodities are presented. Those individual recycled metal commodities with predicated future increases are highlighted.

Table 3.15 – Recycled Metals Summarized Historical and Predicted Future Prices			
Commodity	**Historical Actual Change**	**Historical Percentage Change**	**Predicated Future Actual Change**
Aluminum Cans Sorted			
Regional	-$0.0591 per pound	-9.8%	-$0.0004 per pound
National	-$0.0462 per pound	-8.3%	-$0.0004 per pound
Aluminum Cans Loose			
Regional	$0.00 per pound	0.0%	$0.00 per pound
National	$0.0081 per pound	3.4%	-$0.0007 per pound
Steel Cans Sorted Baled			
Regional	$45.00 per ton	78.3%	$0.11 per ton
National	-$12.82 per ton	-11.1%	-$0.02 per ton
Steel Cans Sorted Densified			
Regional	$0.00 per ton	0.0%	$0.00 per ton
National	-$18.67 per ton	-45.5%	-$0.04 per ton
Steel Cans Loose			
Regional	$0.00 per ton	0.0%	$0.00 per ton
National	-$7.35 per ton	-40.4%	-$0.01 per ton
White Goods Loose			
Regional	$0.00 per ton	0.0%	$0.00 per ton
National	$0.00 per ton	0.0%	$0.00 per ton

Of the six separate recycled metal commodities analyzed, only the average regional price for Steel Cans Sorted Baled is predicted to increase, with the average regional price for Steel Cans Sorted Baled expected to increase slightly by $0.11 per ton. However, the average national price for Steel Cans Sorted Baled is predicted to decrease, decreasing by an anticipated $0.02 per ton. Comparatively, the average regional and average national prices for Aluminum Cans Sorted are predicted to decline, each by an estimated $0.0004 per pound. The estimated average regional price for Aluminum Cans Loose is expected to remain unchanged and the estimated average national price for Aluminum Cans Loose is expected to decline slightly by $0.0007 per pound. The estimated regional average price for Steel Cans Sorted Densified is expected to remain unchanged and the estimated national average price for Steel Cans Sorted Densified is expected to decline by an estimated $0.04 per ton. The estimated regional price for Steel Cans Loose is expected to remain unchanged and the estimated national average price for Steel Cans Loose is expected to decline by an estimated $0.01 per ton. The estimated regional average price and the estimated national average price for White Goods Loose are both expected to remain unchanged. Based on just the historical changes and the predicated future change in regional and national prices, there does not appear to be enough appreciable growth in the recycled metals regional and national markets to support a recycling industry in Northeastern Nevada at the time of publication of this University Center for Economic Development technical report.

3.5.c Historical and Predicted Future Prices for Recycled Paper

Table 3.16 presents a general summary for the historical regional and national average prices and for the predicted regional and national average future prices for the four commodities of recycled paper, including Mixed Paper, Sorted Residential, Corrugated Containers, and Office Paper. The estimated historical actual change, the estimated historical percentage change, and the predicted increase or decrease in regional and national prices based upon the completed regression estimates for each individual recycled paper commodity are presented. Those individual recycled metal commodities with predicated future increases are highlighted.

Table 3.16 – Recycled Paper
Summarized Historical and Predicted Future Prices

Commodity	Historical Actual Change	Historical Percentage Change	Predicated Future Actual Change
Mixed Paper			
Regional	-$92.50 per ton	-101.0%	-$1.39 per ton
National	-$76.88 per ton	-102.5%	-$1.21 per ton
Sorted Residential Paper			
Regional	-$90.00 per short ton	-92.3%	-$1.32 per short ton
National	-$77.19 per short ton	-88.5%	-$1.19 per short ton
Paper Corrugated Containers			
Regional	-$102.50 per short ton	-89.1%	-$1.66 per short ton
National	-$82.19 per short ton	-76.7%	-$1.46 per short ton
Sorted Office Paper			
Regional	-$70.00 per short ton	-43.8%	-$0.60 per short ton
National	-$65.31 per short ton	-42.9%	-$0.52 per short ton

Of the four separate recycled paper commodities analyzed, none of the average regional prices and none of the average national prices were predicted to increase. The average regional price and the average national price for Mixed Paper are predicted to decline, declining by an estimated $1.39 per ton and by an estimated $1.21 per ton respectively. The average regional price and the average national price for Sorted Residential Paper are predicted to decline, declining by an estimated $1.32 per short ton and by an estimated $1.19 per short ton respectively. The average regional price and the average national price for Paper Corrugated Containers are predicted to decline, declining by an estimated $1.66 per short ton and by an estimated $1.46 per short ton respectively and the average regional price and the average national price for Sorted Office Paper are also predicted to decline, declining by an estimated $0.60 per short ton and by an estimated $0.52 per short ton respectively. Based on just the historical changes and the predicated future change in regional and national prices, there does not appear to be enough appreciable growth in the recycled paper regional and national markets to support a recycling industry in Northeastern Nevada at the time of publication of this University Center for Economic Development technical report.

4.0 Market Demand and Use of Recycled Materials from Waste Generated in Northeastern Nevada

Despite significant technological improvements and improvements in the processing and production of recycled commodities, the potential use of recycled commodities in component parts or finished products have remained relatively limited. This limitation in the use of recycled commodities in component parts or finished products has been generally attributed to significantly falling prices of recycled commodities (detailed in Section 3.0 of this University Center for Economic Development technical report). This section presents a general overview of the primary ways in which recycled commodities have been used in component parts or finished products. While there is a significant variety of end uses for recycled commodities, this section focuses on the primary ways in which specific recycled commodities, generated from the Northeastern Nevada region, could potentially be used. The potential uses outlined in this section are sorted by primary recycling category and the individual recycling commodities for each primary category as outlined previously in Section 3.0.

4.1 Uses for Recycled Plastics

The potential uses of Polyethylene Terephthalate (PET) Baled, Natural High Density Polyethylene (HDPE), and Colored High Density Polyethylene (HDPE) were examined individually for the plastics category. The most common individual component parts, materials and finished goods for PET Baled plastics is presented separately and the most common individual components parts, materials and finished goods for both Natural HDPE plastics and Colored HDPE plastics are presented together.

<u>4.1.a Uses of PET Baled Plastics</u>

PET Baled plastics, in their non-recycled form, carry the number "1" symbol stamped or printed on the bottom of the plastic container using PET Baled plastics. PET Baled plastics is primarily recycled into new PET plastic containers due to its generally lighter weight and relatively more affordable cost when compared to both Natural HDPE plastics and Colored HDPE plastics. These characteristics have generally limited the use of PET Baled recycled plastics in the manufacturing, production and use of new component parts, materials and finished products.

However, in addition to its use in the production of new PET plastic containers, new manufacturing processes have expanded the overall use of PET Baled recycled plastics in component parts, materials and finished products. With increasing commonality, PET Baled recycled plastics are used in the manufacturing of the following additional items:

- Athletic Shoes
- Automotive Parts

- Fabric Uses in T-Shirt Production
- Industrial Strapping
- Luggage and Upholstery
- Plastic Sheeting and Film Production
- Production of Long Underwear
- Polyester Carpet Fiber
- Sweaters and Fiberfill for Sleeping Bags and Winter Coats

Use of PET Baled recycled plastics has grown throughout a number of various industry sectors and continued use of PET Baled recycled plastics in the production of component parts, materials and finished goods is likely to increase as individual firms expand internal supply chain recycling and their corporate social responsibility programs in response to increased government regulations requiring higher percentage uses of recycled materials in the production of component parts, materials and finished goods and as individual end-use consumer preferences become increasingly insistent that and comfortable with PET Baled recycled plastics being used in the production of end-use consumer goods.

4.1.b Uses of Natural HDPE and Colored HDPE Plastics

Both Natural HDPE and Colored HDPE plastics, in their non-recycled form, carry the number "2" stamped or printed on the bottom of the plastic container using both Natural HDPE and Colored HDPE plastics. Both Natural HDPE and Colored HDPE plastics have higher densities than that of PET Baled plastics, making recycled Natural HDPE and Colored HDPE plastics more suitable for component parts, materials and finished products that require more durability. This higher density, however, often means that the recycling process of Natural HDPE and Colored HDPE plastics requires specialized processing that tends to drive up the cost of both recycled Natural HDPE plastics and Colored HDPE plastics which, in-turn, drives up the cost of the component parts, materials and finished products that contained recycled Natural HDPE and Colored HDPE plastics.

Despite the relatively involved process and higher costs associated with recycled Natural HDPE and Colored HDPE plastics, individual firms and manufactures have begun the process of expanding the overall use of Natural HDPE and Colored HDPE recycled plastics in component parts, materials and finished products. With increasing commonality, Natural HDPE and Colored HDPE recycled plastics are used in the manufacturing of the following additional items:

- Crates for Shipping or Retail Display
- Floor Tiles
- Hardscape Materials (for example, Flowerpots and Gardening Tools)
- Non-Food Bottles and Plastic Containers (for example, Anti-Freeze, Motor Oil, Laundry Cleaners, Various Cleaning Products, Conditioner and Shampoo Products)
- Pipes
- Plastic Lumber (used in Playground Equipment, Outdoor Picnic Tables, and Outdoor Patio Decking Materials)
- Plastic Sheeting and Film Production
- Recycling Bins

Similar to the increased use of PET Baled recycled plastics, the use of both Natural HDPE and Colored HDPE recycled plastics has grown throughout a number of various industry sectors and continued use of Natural HDPE and Colored HDPE recycled plastics in the production of component parts, materials and finished goods is likely to increase as individual firms further expand internal supply chain recycling and their corporate social responsibility programs in response to increased government regulations requiring higher percentage uses of recycled materials in the production of component parts, materials and finished goods and as individual end-use consumer preferences become increasingly insistent that and comfortable with Natural HDPE and Colored HDPE recycled plastics being used in the production of end-use consumer goods.

4.2 Uses for Recycled Metals

The potential uses of Aluminum Cans Sorted, Aluminum Cans Loose, Steel Cans Sorted Baled, Steel Cans Sorted Densified, Steel Cans Loose, and White Goods Loose (discarded household appliances) recycled metals were each examined individually for the metals category. The most common component parts, materials and finished goods for Aluminum Cans Sorted and Aluminum Cans Loose were examined together and the most common component parts, materials and finished goods for Steel Cans Sorted Baled, Steel Cans Sorted Densified, and Steel Cans Loose were also examined together. The potential uses of recycled White Goods Loose are examined separately.

4.2.a Uses of Aluminum Cans Sorted and Aluminum Cans Loose

The use of recycled Aluminum Cans Sorted and Aluminum Cans Loose has largely been limited to the production of new aluminum cans. While automobile manufacturers have continued to explore the use of recycled aluminum in the production of automobile body component parts, the overall strength and utility of aluminum used in various cans decreases significantly during the recycling process and further decreases after each iteration of the recycling process. This limitation on the overall strength and utility of recycled aluminum, using current recycling processes, has generally limited the overall use of recycled aluminum in new component parts, materials and finished goods that require relatively high levels of strength and durability.

Another primary drawback of using recycled aluminum is the typical requirement that used Aluminum Cans Sorted and used Aluminum Cans Loose must be separated from steel, plastic, and other industrial or municipal waste. This initial sorting process is often labor intensive and drives up the eventual price of finished component parts, materials and finished goods which, in-turn, makes the use of recycled Aluminum Cans Sorts and recycled Aluminum Cans Loose largely financially and economically unviable in further downstream supply chain manufacturing and production processes. Unlike increased consumer support for the use of recycled PET Baled plastics and recycled Natural HDPE and Colored HDPE plastics, consumers have generally not supported increased costs of finished end-user goods resulting from the use of recycled Aluminum Cans Sorted and used Aluminum Cans Loose.

4.2.b Uses of Steel Cans Sorted Baled, Steel Cans Sorted Densified, and Steel Cans Loose

The various uses of recycled Steel Cans Sorted Baled, Steel Cans Sorted Densified, and Steel Cans Loose is significantly greater and more diverse than the potential uses of recycled Aluminum Cans Sorted and recycled Aluminum Cans Loose. This is largely due to the fact that steel can be recycled an infinite number of times without losing its overall strength and durability and the process of recycling steel carries a significantly lower labor cost. Rising steel prices in the United States and across global industrial markets due to rising protectionist trade policies have also made the use of recycled steel in new component parts, materials and finished products increasingly affordable and cost effective.

As a result of the physical properties of recycled steel and the overall cost effectiveness of using recycled steel, individual firms and manufacturers have continued to expand the overall use of recycled Steel Cans Sorted Baled, Steel Cans Sorted Densified, and Steel Cans Loose in the production of a wide variety of component parts, materials and finished products ranging from relatively trivial consumer goods to large-scale industrial and finished good products. With increasing commonality, recycled Steel Cans Sorted Baled, Steel Cans Sorted Densified, and Steel Cans Loose are specifically used in the manufacturing of the following additional items:

- Automobiles
- Bicycle Frames
- Bridges
- Food and Drink Cans
- Paperclips
- Ship Hulls
- Steel Pipes
- Train Tracks

While at least some recycled steel is certainly used in almost any component part, material or finished good that requires the use of steel, the production of automobiles, bicycle frames, bridges, food and drink cans, paperclips, ship hulls, steel pipes, and train tracks especially have seen increased quantities of steel acquired through the specific recycling of Steel Cans Sorted Baled, Steel Cans Sorted Densified, and Steel Cans Loose over the past several decades. The relatively high amount of availability of these sources of steel, along with the ability to recycle steel without compromising its underlying strength and the general increase in raw steel national and global prices, have made these specific sources of recycled steel ideal for the production of the above listed component parts, materials and finished products.

4.2.c Uses of White Goods Loose (Discarded Household Appliances)

Including discarded dishwashers, refrigerators, stovetop ranges, clothes washers and dryers, and other discarded household appliances, the use of recycled White Goods Loose typically involves the dismantling and subsequent recovery, sorting and recycling of individual component metals, plastics and other component materials. The final recovery, sorting and recycling of these various component parts can then be used in other recycling processes and the underlying component recycled materials and commodities are further processed and used in the production of eventual component parts, materials and finished goods including the already identified uses of recycled plastic materials and recycled metal materials.

A primary concern regarding the overall market and economic feasibility of utilizing recycled components of White Goods Loose is the high amount of labor used in the recycling of White Goods Loose and the subsequently high labor costs. In addition to the individual dismantlement of the individual discarded household appliance required to separate the various component plastic and metal materials, individual White Goods Loose items may also contain hazardous and potentially dangerous materials that require specialized handling and long-term disposal and storage. These conditions subsequently increase the overall cost of recycling White Goods Loose and the continued decline in the prices for finished recycled plastic and metal commodities have increasingly driven down the overall market and economic feasibility of using the collected recycled commodities from White Goods Loose items in the further downstream production of component parts, materials and finished goods.

4.3 Uses for Recycled Paper

The potential uses of Mixed Paper, Sorted Residential Paper, Paper Corrugated Containers, and Sorted Office Paper were each examined separately. Despite the significant decline in the price of recycled Mixed Paper, Sorted Residential Paper, Paper Corrugated Containers, and Sorted Office Paper over the last several years in both regional and national markets, the use of recycled paper in component parts, materials and finished goods have increased significantly for each of these four recycled paper commodities. However, the various new component parts, materials and finished goods that have used these four recycled paper commodities are of generally low value and generate, on a per unit produced and sold basis, little income for the producer or manufacturer.

4.3.a Uses of Mixed Paper

The use of recycled Mixed Paper spans a variety of component parts, materials and finished goods as the paper recycling industry has become increasingly efficient. Component parts, materials and finished goods that most commonly use recycled Mixed Paper in the United States include:

- New Paperboard
- Paper Backing of Roof Shingles used in Residential Building Construction
- Paper Bathroom Tissue and Paper Towel Rolls

Similar to growing government regulation requiring minimal levels of recycled plastics in the production of new component parts, materials and finished products and to the growing expectation recycled plastics be used in the production of new component parts, materials and finished products by individual consumers, the use of Mixed Paper in the production of new paperboard, new paper backing of roof shingles, and new paper bathroom tissue and paper towel rolls has increased significantly over the past few decades due to similar governmental regulations and consumer preferences. The largely mature Mixed Paper recycling process has also created significant economies of scale for individual manufacturers that make the use of recycled Mixed Paper in these specific finished goods increasingly economically feasible.

4.3.b Uses of Sorted Residential Paper

The uses of Sorted Residential Paper in the production of new component parts, materials and finished products is significantly more varied than the uses of recycled Mixed Paper, recycled Paper Corrugated Containers, and recycled Sorted Office Paper. Component parts, materials and finished goods that most commonly use recycled Sorted Residential Paper in the United States include:

- Berry Boxes (for both Display and Consumer Consumption)
- Building Insulation
- Construction Paper
- Countertops
- Egg Cartons
- Kitty Litter
- Newspaper
- Paperboard
- Paper Plates
- Sheetrock
- Telephone Directories

Again, due to growing government regulation requiring minimal levels of recycled paper in the production of new component parts, materials and finished products coupled with the growing expectation that recycled paper be used in the production of new component parts, materials and finished products by individual consumers, the use of Sorted Residential Paper in the production of various new component parts, materials and finished products has increased significantly over the past few decades. Similar to the relatively mature recycling processes of other types of discarded paper, the relatively mature Sorted Residential Paper recycling process has created significant economies of scale for individual manufacturers that ultimately make the use of recycled Sorted Residential Paper in various component parts, materials and finished goods increasingly economically feasible.

4.3.c Uses of Paper Corrugated Containers

The unique characteristics of recycled Paper Corrugated Containers has generally limited the use of this specific recycled commodity in the production of new component parts, materials and finished goods. Relative to Mixed Paper sources, Sorted Residential Paper, and Sorted Office Paper, the overall amount of recycled Paper Corrugated Containers is relatively limited and collection and recycling processes are somewhat specialized. Component parts, materials and finished goods that most commonly use recycled Paper Corrugated Containers in the United States include:

- New Cardboard and Cardboard Containers
- Paper Bags

- Paperboard
- Various New Cardboard Mediums (Boxes and other Packaging Products)

While additional specialized labor and specialized recycled processes are required to recycle used Paper Corrugated Containers, the use of recycled Paper Corrugated Containers in new component parts, materials and finished products has begun to increase in recent years. Improvements in the recycling process of Paper Corrugated Containers, additional increased government regulation regarding the component levels of recycled materials, and increased consumer expectation have each driven new expanded uses of recycled Paper Corrugated Container materials in new component parts, materials and finished goods. Individual recyclers of Paper Corrugated Containers have also seen recent improvements in their individual economies of scale largely due to recent improvements being made in the recycling process of Paper Corrugated Containers and, as a result of these improved economies of scale, have begun to find new economically feasible ways to use recycled Paper Corrugated Containers in the production of new component parts, materials and finished goods.

4.3.d Use of Sorted Office Paper

The uses of Sorted Office Paper in the production of new component parts, materials and finished products is significantly more varied than the uses of recycled Mixed Paper and recycled Paper Corrugated Containers but slightly less varied than the uses of Sorted Residential Paper in the production of new component parts, materials and finished products. Component parts, materials and finished goods that most commonly use recycled Sorted Office Paper in the United States include:

- Bathroom Tissue
- Computer and Printing Paper
- Facial Tissue
- Notebook Paper
- Paper Napkins
- Paper Towels

Increased government regulation requiring the use of recycled paper in the production of these new component parts, materials and finished goods, and increased individual consumer expectation that and acceptance of recycled paper will be used in these new component parts, materials and finished goods, has steadily increased the overall usage of recycled Sorted Office Paper in the production of new bathroom tissue, computer and printing paper, facial tissue, notebook paper, paper napkins, and paper towels. Similar to the recycling of Mixed Paper and Sorted Residential Paper, a fairly mature Sorted Office Paper recycling process has created significant economies of scale for individual manufacturers that, ultimately, make the use of recycled Sorted Office Paper in these specific finished goods increasingly economically feasible despite a relatively low per unit value and per unit of revenue generated from sales for these new component parts, materials and finished goods.

4.4 Uses for Recycled Glass and Rubber

While various uses for varied recycled glass commodities and recycled rubber commodities do presently exist, the overall market and economic feasibility of glass and rubber recycling is difficult to accurately estimate given the general lack of historical regional and national market price data for each recycled commodity. However, despite the uncertainty in market price data, the production of discarded glass and rubber, from both industrial waste sources and municipal solid waste sources, in Northeastern Nevada could potentially be used in the production of new component parts, materials and finished goods. This subsection looks at the potential uses of discarded and then recycled glass and rubber commodities.

4.4.a Uses of Recycled Glass

According to the Glass Packaging Institute, originally founded in 1919 as the Glass Container of Association of America, the general properties of glass materials makes it an excellent source of recycled commodities that can be used in the further production of new component parts, materials and finished goods. Glass is 100 percent recyclable and, unlike other recyclable commodities, can endlessly be recycled without any loss in the quality or purity of the glass itself. In 2017 alone, according to the Glass Packaging Institute, approximately 40.0 percent of glass beer and soft drink bottles, approximately 40.0 percent of glass wine and liquor bottles, approximately 15.0 percent of food jars, and approximately 34.0 percent of all other glass container types were recycled in the United States. In certain states, like the state of California that has significantly stricter recycling regulatory requirements and significantly more developed recycling financial incentives, even greater overall percentages of used glass beer and soft drink bottles, glass wine and liquor bottles, foods jars, and other glass container types are recycled. Throughout the United States, various recycled glass commodities are increasingly used in the manufacturing and production of the following items:

- Agriculture and Landscape Applications (Top Dressing, Root Zone Materials, Bunker Sand for Golf Courses)
- Astroturf
- Ceramic Sanitary Ware Production
- Fiberglass Installation Products
- Flux in the Production of Bricks (Construction)
- Glass Containers
- Glass Countertops
- Various Abrasives
- Water Filtration Media

Despite the varied use of recycled glass commodities from various food and beverage glass containers in the production of new component parts, materials and finished goods, largely due the underlying characteristics of these specific recycled glass commodities, the use of disposed glass collected from discarded windows, ovenware, Pyrex and crystal has been limited due to the specific characteristics of these types of glass. Overall, the limitation of using discarded food and beverage glass containers in the production of new component parts, materials and finished goods has, to a degree, limited the overall market and economic feasibility of wide-spread glass recycling operations. Successful glass recycling industries have largely been limited to specific geographic locations (municipalities or mid-sized regions) were single-stream recycling is most efficient (the ability to sort out discarded glass from other waste products) or targeted financial incentives, such as the use of deposits on disposable food and beverage glass containers, can be employed. The use of single-stream recycling and financial incentives to encourage the recycling of food and beverage glass containers typically, however, works best in relatively high-density large population centers. The use of financial incentives, in particular, will typically require government investment at either the local or state government level. This has resulted in further limiting the development of wide-spread glass recycling operations.

4.4.b Uses of Recycled Rubber

According to the Institute of Scrap Recycling Industries Inc., a Washington, D.C. based advocacy organization, recycled rubber commodities have been used and continued to be used in a wide variety of applications and in the production of various new component parts, materials and finished goods. Specifically, discarded tires and the recycled rubber commodities that can be produced from discarded rubber tires have been used in a number of industry sectors to produce the following list of new component parts, materials and finished goods:

- Agriculture: Bumpers, Feeders, Livestock Mats, Sheds, and Vegetation Protectors and Windbreaks
- Home and Garden: Benches, Flowerpots, Garden Hoses, Landscaping Mulch, Molded Products (for example, Railroad Ties), and Door Mats.
- Infrastructure: Rubberized Asphalt for Roadway Construction and Maintenance
- Medical: Hospital Floor Surfaces and Tiles
- Playground Surfaces: Mats and Mulch
- Sports: Fitness Mats, Indoor and Outdoor Running Tracks, and Infill for Synthetic Turf Fields

Despite the historical use of recycled rubber commodities in the production of new component parts, materials and finished goods and the overall development of rubber recycling processes in the United States for over the last century, the market for recycled rubber commodities has increased significantly over just the past few decades. Recent rising prices and increased scarcity for raw natural resources for the production of rubber-based component parts, materials and finished products has helped spur this recent growth in the market for recycled rubber commodities. Increased government regulation regarding the disposal of used rubber tires (primarily automobile tires for individual consumer, commercial and industrial uses) and the mandate to recycle disposed of and used rubber tires has also significantly increased the use of recycled rubber commodities in a variety of innovative production processes.

In the United States, most recycled rubber commodities come from the recycling of disposed of and used rubber tires that, again, are generated primarily from discarded and used rubber automobile tires for individual consumer, commercial and industrial uses. The process by which discarded and used rubber is recycled employs two main approaches. First, through ambient shredding, powerful and interlocking knives are used to shred the discarded and used rubber tires into smaller pieces that can be further refined and processed to produce recycled rubber commodities that can then be used in the production of new component parts, materials and finished goods. Second, by using a cryogenic process, liquid nitrogen is used to freeze the discarded and used rubber tires to sub-zero temperatures. The frozen tires become extremely brittle and the tire is then placed in an enclosure where they are smashed into smaller pieces for future recycling.

Both the ambient shredding approach and the cryogenic approach to recycling discarded and used rubber tires do not change the chemical composition and make-up of the rubber used in the discarded and used rubber tire. Both approaches also facilitate the removal of non-rubber materials added to the rubber tire at the time of the rubber tire's initial production. Added plastic and metal (mostly steel) materials can be safely and efficiently extracted using both approaches and these added plastic and metal materials can be further recycled and used in the production of other new component parts, materials and finished goods that utilize recycled plastic and metal commodities. The resulting recycled rubber commodities can then be further processed and used in the production of various new component parts, materials and finished goods produced in a variety of industry and commercial sectors.

Similar, however, to the limitations on the wide-spread adoption and use of glass recycling processes, the overall process of recycling rubber and, primarily, discarded and used tires works most efficiently in high-density large population centers. This is mostly due to the specialized recycling process of collected and disposed of rubber and the need for large quantities of collected and disposed of rubber to support these recycling processes. The transportation costs associated with transporting discarded and used rubber tires as well as the finished recycled rubber commodities to and from a centralized rubber recycling facility typically exceed the anticipated revenue that can be earned from the recycled rubber commodities itself. Relatively short transportation distances of both the input (the discarded and used rubber tires) and the output (the finished recycled rubber commodity) from the source and to the end user is typically needed to improve the overall economic feasibility of any rubber recycling process.

Furthermore, single-stream recycling of discarded and used rubber tires have proved largely ineffective and infeasible in the rare instances that single-stream recycling processes in which discarded and used rubber tires have been included in. The development and employment of strict government regulations that control and require the disposal of discarded and used rubber tires with the included use of 'reverse' financial incentives, where the individual user of the now discarded and used rubber tire is required to pay a recycling or disposal fee, are often both needed in tandem to support the recycling and proper and safe disposal of discarded and used rubber tires.

5.0 Outline and Overview of a Recycling Industry in Northeastern Nevada

At the time of publication of this University Center for Economic Development technical report, strictly private-sector based recycling of various industrial waste materials and municipal waste materials within the Northeastern Nevada region is neither technically or economically feasible. The current amount of industrial waste materials and municipal waste materials generated within the Northeastern Nevada region is not sufficient to provide high enough quantities to support wide-scale recycling within the region and current regional and national prices of various recycled commodities, including the prices for plastic, metal and paper recycled commodities, are too low to support profitable wide-scale private-sector recycling. However, the continued economic and population growth of the region, combined with the continued expanded use of recycled commodities in the production of various new component parts, materials and finished goods, indicates that a private-sector based recycling industry in Northeastern Nevada may be feasible in the future. In the meantime, public-sector support of a new recycling industry in Northeastern Nevada will be needed.

This section presents an overview of several recycling programs created and initially managed by a public-sector entity or organization that could either be employed in Northeastern Nevada or modeled to develop a future recycling industry for the region. Two programs piloted by the Nevada Division of Environmental Protection, including a new hub and spoke rural recycling program and a new rural landfill reduction, diversion, and household hazardous waste collection program, are first presented. Details of the Pennsylvania Recycling Markets Center, the New Mexico Rubberized Asphalt Concreate Pavements Program, and the New Mexico Tire-Bale Erosion Control and Bank Stabilization Program are also presented in this section.

5.1 Nevada Division of Environmental Protection Hub and Spoke Rural Recycling Program

The Nevada Division of Environmental Protection is currently exploring the potential development of a hub and spoke rural recycling program that could be employed in Nevada and, specifically, within the Northeastern Nevada region. Nevada's potential hub and spoke rural recycling program is largely modeled off of the hub and spoke recycling program developed by the state of New Mexico and the New Mexico Recycling Coalition. The New Mexico hub and spoke recycling program has been specifically designed to overcome the various barriers to rural (or non-metro) recycling initiatives that often exist including a lack of sufficient quantities of recyclable industrial waste and municipal solid waste and the high transportation requirements that erode overall recycling program efficiency.

Efficient collection and basic processing of materials is achieved through the hub and spoke model by creating regional recycling collection and processing centers that are located in larger yet still non-metro communities. These recycling collection and processing centers serve as ‘hubs’ and individual smaller communities, the ‘spokes’, deliver their recyclable industrial waste and municipal solid waste to the hubs. The hubs are responsible for developing the required capital equipment and infrastructure needed to create and store high density bales of recycled commodities that remanufacturing markets can then utilize. The spokes are, in-turn, responsible for purchasing and using the recycling collection trailers and containers. Mobile drop-off stations located in the smaller spoke communities can then be transported to the nearby recycling hubs for further sorting and processing. In New Mexico, this hub and spoke rural recycling program has proven capable of significantly reducing associated transportation costs and in successfully collecting enough recyclable industrial waste and municipal solid waste to increase the overall efficiency of recycling operations in rural or non-metro communities and regions.

The New Mexico hub and spoke rural or non-metro recycling program has also proven capable of providing individuals, firms, and entire communities reliable and continued access to recycling of waste, has proven to be a replicable design that has been successfully employed throughout the state, capable of overcoming limiting transportation issues present in rural and non-metro communities and regions, capable of consolidating marketable volumes of recyclable waste, and capable for generating sufficient revenues to generally cover the cost of operations. However, the New Mexico Recycling Coalition has found it necessary to provide specific grants to individual communities and hub and spoke recycling programs throughout the state to support development and eventual implementation of this program. In December 2010, the New Mexico Recycling Coalition awarded three separate $309,820 grants to three individual hub and spoke communities (Torrance County with a population of 16,269 total individuals, Otero County with a population of 62,776 total individuals, and the City of Deming with a surrounding regional population of 32,137 total individuals) for a total of $929,460 awarded. In April 2011, the New Mexico Recycling Coalition awarded a total of $385,060 to four additional counties and communities to start-up a hub and spoke recycling program and, in February 2012, awarded an additional $590,303 to eight separate counties and communities for various ‘spoke’ equipment purchases and various ‘hub’ improvement processes.

A typical sample hub project as part of the hub and spoke program in New Mexico requires significant upfront capital investment, mostly in the purchase of equipment as well as the securing of a physical location where various ‘hub’ recycling processes can be implemented and completed. In general, the required ‘hub’ equipment includes the following items with an estimation of potential costs per item:

- Horizontal Baler with In-Pit Conveyor, Excel EX63 with 3-Phase Converter (est. cost of $97,689)
- Fork Lift (est. cost of $24,817)
- Portable Loading Dock (est. cost of $11,019)
- Roll-Off Collection Equipment (est. cost of $50,473)
- Structure, approx. 3,000 square feet (est. cost of $125,822)

Total cost of this required ‘hub’ equipment is $309,820 and does not include acquisition and potential demolition and remediation of an appropriate physical site for the ‘hub’ recycling processes or associated direct and indirect labor costs. The New Mexico Environment Department’s ‘Balers and Trailers’ program is sufficiently down-sized from the much more developed hub and spoke recycling program developed by the New Mexico Recycling Coalition. This 'Balers and Trailers' program, that is designed to utilize either an existing city or county-owned empty warehouse or building already located at a landfill or transfer station, is estimated to cost $150,000 (again, excluding direct and indirect labor costs) with an estimated $87,738 allocated for acquisition of a Horizontal Baler with In-Pit Conveyor (Gemini EX), $3,102 for required Electrical and Concrete Work, and $59,160 for the acquisition of needed Roll-Off Collection Equipment.

'Spoke' community needed equipment generally consists of Roll-Off Containers and Recycling Trailers that can be transported to the 'hub' community where the contents can then be unloaded and further processed. Typical 'spoke' activities associated with the hub and spoke recycling program generally consist of hauling, locating, right-sizing, security, unloading, and switch-out of the Roll-Off Containers and Recycling Trailers. Individual costs will vary and both direct and indirect labor costs must also be estimated.

In New Mexico, this hub and spoke rural or non-metro recycling program has proven itself as a useful template suitable for smaller non-metro communities interested in economically developing a regional recycling processing facility. The infrastructure and equipment needed to stand-up a hub and spoke recycling program has been purposefully designed for simplicity in order to minimize total investment costs. The experience in New Mexico has proven generally successful although existing hub and spoke recycling programs have found it recently necessary to plan for and develop additional storage of both loose and baled input and output materials. Having cross-trained staff onsite at the 'hub' recycling center has also proven important for the hub and spoke recycling program's overall success.

5.2 Nevada Division of Environmental Protection Rural Landfill Reduction, Diversion, and Household Hazardous Waste Collection Program

The Nevada Division of Environmental Protection has recently enacted a new rural landfill reduction, diversion, and household hazardous waste collection pilot program thanks in part to a U.S. Department of Agriculture Solid Waste Management Grant. This pilot program is part of a larger Rural Water Protection Project developed and administered by the Nevada Division of Environment Protection. Begun in late 2019, the program is anticipated to run through September 2020 where the pilot program will be reviewed and evaluated. Note that the full implementation of this pilot program has been disrupted and somewhat delayed due to the current impacts of the COVID-19 global pandemic that has resulted in stay-at-home orders and restriction on travel and commercial activity in Nevada since March 2020.

The pilot communities selected for this initial trial program and project include the town Goldfield (Esmeralda County), the town of Eureka (Eureka County), the town of Battle Mountain (Lander County), the town of Hawthorne (in Mineral County), and the town of Tonopah (Nye County). It should be noted that the town of Eureka and Eureka County and the town of Battle Mountain and Lander County are each located within the existing boundaries of the Northeastern Nevada Regional Development Authority.

The primary goal of this pilot program is, according to the Nevada Division of Environmental Protection, to educate and support five initial rural communities in developing and implementing a household hazardous waste diversion and disposal program which can then serve as a model for the remaining counties in Nevada. Two specific objectives have also been developed as part of this pilot program, including: (1) assistance to landfills in reevaluating their standard operating procedures which may lead to securing additional sustainable funding for a county-located household hazardous waste collection event, and (2) reduction of the risk of infiltration and contamination of rural water sources. As a state, the protection of water resources is critical to the long-term survival and growth of Nevada's communities. In rural Nevada especially, household hazardous waste collection services tend to be limited or even non-existent. The collection and proper disposal of household hazardous materials through this pilot program is designed to help protect the state's existing water resources from pollution by reducing the threat of contamination at the landfill and to the surrounding environment from illegal dumping and improper disposal of household hazardous materials.

The work plan for the initial pilot program consists of four separate and interrelated components including: (1) landfill operator training and on-site evaluation, (2) public outreach and education, (3) collection event preparation, and (4) household hazardous waste collection event and program assessment. The first component, landfill operating training and on-site evaluation, generally consists of the development of a curriculum that will be developed in conjunction with pilot program management in order to establish a salvaging and diversion program at each targeted landfill facility in Esmeralda County, Eureka County, Lander County, Mineral County, and Nye County. This training will include, but is not limited to, educating the targeted landfill facility and facility operator(s) on the potential markets for salvaged materials and recyclables and how to hold a household hazardous waste collection event.

The second component, public outreach and education, will be completed by the individual participating county in cooperation with representatives from the Nevada Division of Environmental Protection. Outreach and education will consist of information about the salvaging program and the individual household hazardous waste collection event that will be developed for and conducted in each initially targeted landfill facility. Identification of the effects household hazardous waste has on the environment and how the community can implement selected best management practices to manage their waste, including proper prescription drug disposal, will also be included in the public outreach and education component.

The third component, collection event preparation, will be done in conjunction with the Nevada Division of Environmental Protection and the University of Nevada, Reno's Business Environmental Program in order to verify that each of the targeted landfill facilities is prepared for the household hazardous waste collection event. Representatives from the Nevada Division of Environmental Protection and the Business Environment Program will work with each of the five selected pilot program counties to develop a household hazardous waste collection event plan. Personal protection, Nevada regulatory overview, proper handling techniques, collection and disposal methods, prescription drug disposal, and community involvement and participation are a few of the various topics that will be included in this third component.

The fourth and final component of this pilot Rural Water Protection Project, household hazardous waste collection event and program assessment, will generally require that Nevada Division of Environmental Protection and Business Environmental Program representatives to be on site during each of the five household hazardous waste collection events held at each of the targeted landfill facilities to provide support and guidance. Once each event has been completed, the Nevada Division of Environmental Protection will evaluate each individual event using feedback provided by the participating landfill operators and county personnel. The overall success of achieving this pilot project's goal and the individual objectives will be evaluated and, based upon the results of this evaluation, the Nevada Division of Environmental Protection and the Business Environmental Program will further update and refine the curriculum and approaches to further develop a statewide program for landfills operating throughout the entire state.

Again, it should be noted that the initial completion of this pilot Rural Water Protection Project was scheduled for September 2020. However, the recent impacts of the COVID-19 global pandemic in Nevada has delayed implementation of certain parts of the above outlined work plan. As the pilot project has not been completed and because no definitive evaluation results were available at the time of publication of this University Center for Economic Development technical report, the effectiveness of this program's potential for helping stand-up and build a recycling industry in Northeastern Nevada is currently unknown. The Northeastern Nevada Regional Development Authority should, however, work closely with both the Nevada Division of Environmental Protection and the University of Nevada, Reno's Business Environmental Program to evaluate the final results of this pilot project and evaluate the overall potential of the program to further support the development of a recycling industry in Northeastern Nevada.

5.3 Pennsylvania Recycling Markets Center

The Pennsylvania Recycling Markets Center's, organized as a 501c(3) corporation, stated mission is to be:

> *"…a leader in developing and expanding recycling markets in Pennsylvania. In a competitive global marketplace, the RMC (Recycling Markets Center) is the keystone clearing house of environmental, economic development, and manufacturing resources for end use support of recycled commodities and products. The RMC is headquartered at Penn State Harrisburg with satellite offices near Pittsburgh. The Mission of the RMC is to expand and develop more secure and robust markets for recovered (recycled) materials by helping to overcome market barriers and inefficiencies."*

While the Pennsylvania Recycling Markets Center is not an actual recycling program, in that the Pennsylvania Recycling Markets Center does not operate any direct waste collection and recycling facility, the Center accomplishes their mission through the performance and activity and provision of technical assistance in four primary areas, including: (1) economic development, (2) accelerated commercialization, (3) general technical assistance, and (4) recycling markets intelligence through the Center's Outreach Portal. Success in each of these four areas is measured through direct and indirect job creation, the amount of total waste collected and diverted from area landfills and successfully recycled, and in the amount of measured energy savings generated these activities. Overall, the Pennsylvania Recycling Markets Center reports on both the environmental and economic impacts of their activities in each of these four primary areas. In the area of economic development, the Pennsylvania Recycling Markets Center focuses on increasing the use of recycled materials and commodities for the production of future component parts, materials and finished goods in order to generate and create new employment opportunities throughout the state of Pennsylvania.

In the area of accelerated commercialization, the Pennsylvania Recycling Markets Center utilizes their existing partnership with Pennsylvania State University and other public and private research partners to assist with the overall design of products made from recycled commodities and provide the needed information on design and development processes to individual Pennsylvania-based businesses. In the area of technical assistance, the Pennsylvania Recycling Markets Center works with various private-sector and non-profit partners to provide specific point-of-service based, pre-emergence, and existing business consultative assistance. In the area of recycling markets intelligence through the Center's Outreach Portal, the Pennsylvania Recycling Markets Center leverages its various research partnerships to provide requested information and analysis on a variety of topics to recycling markets and Pennsylvania-based businesses.

Key programs that the Pennsylvania Recycling Markets Center current administers are the Center of Excellence, the Commodity Pricing Program, and GreenCircle Certified Program. The Center of Excellence is a partnership between the Pennsylvania Recycling Markets Center and the Ben Franklin Technology Partners of Northern and Central Pennsylvania. The Center for Excellence itself is a network for individual processors of recycled materials, end-users of recycled materials, and various non-profit organizations to influence materials markets throughout the state of Pennsylvania. The Pennsylvania Recycling Markets Center uses the resources and relationships of the Center of Excellence to execute their goal of connecting with individual businesses and providing them with requested technical support and with emerging business opportunities.

The Commodities Pricing Program is an online commodities pricing index that provides real-time changes in regional and national recycled commodities and materials prices. The Commodities Pricing Program is maintained and administered by the Pennsylvania Recycling Markets Center. Recycled commodity information is available to registered Pennsylvania County Recycling Coordinators through the strategic partnership formed between the Pennsylvania Recycling Markets Center and RecyclingMarkets.net. The Pennsylvania Recycling Markets Center partnered with GreenCircle Certified, LLC to develop and implement the GreenCircle Certified Program for Pennsylvania. This program certifies the production of component parts, materials and finished goods made with recycled materials. The GreenCircle Certified Program helps the Pennsylvania Recycling Markets Center enhance its mission of building functioning, sustainable and growing recycling markets throughout the state by driving an increase in the use of recycled raw materials and commodities in the manufacturing and sale of more products with verified recycled materials content.

5.4 New Mexico Rubberized Asphalt Concrete Pavements Program

In June 2011, Dr. Paola Bandi, P.E. with the Department of Civil Engineering at New Mexico State University, published *Rubberized Asphalt Concrete Pavements in New Mexico: Market Feasibility and Performance Assessment*, prepared for the New Mexico Environmental Department and the South Central Solid Waste Authority. The purpose of this market feasibility and performance assessment study was to evaluate the performance of pavements with rubberized open-graded friction course (ROGFC) overlays used throughout the state of New Mexico and develop a preliminary feasibility evaluation of the crumb rubber modified market within the state.

Crumb rubber is generally produced by shredding and grinding discarded and used rubber tires after other added materials, including plastics and metal, are removed. Small particles of recycled rubber are produced in this process and crumb rubber of different gradation and particle size can be used to produce asphalt-rubber binders and rubberized asphalt binders. These binders are typically referred to as crumb rubber modifiers (CRM). Using a 'wet process', the resulting crumb rubber modifiers can be combined with asphalt cement and other additives and eventually used in road construction and repair activities. Spearheaded by the New Mexico Department of Transportation and the New Mexico Environmental Department, the resulting mixture of crumb rubber modifiers, asphalt cement and other additives have been used over the past two decades in road construction and repair with early trials beginning in the 1980's and 1990's and with wide-scale usage beginning in the early 2000's. In 2002 and 2007, the New Mexico Department of Transportation completed two separate road construction projects utilizing a thin rubberized open-graded friction course overlay, one for U.S. Highway 54 and one for U.S. Highway 62/New Mexico State Highway 180. Over the past decade, various local municipal and county governments throughout the state of New Mexico have employed the use of rubberized asphalt in various street rehabilitation on a limited basis.

The evaluation of the U.S. Highway 54 and U.S. Highway 62/New Mexico State Highway 180 New Mexico Department of Transportation projects completed by Dr. Paola Bandi in June 2011 found good performance in the early life of the utilized pavement structure with no rutting and either very minor distress or no premature cracking in the pavement. For the U.S. Highway 54 project, the resulting statistical analysis and assessment provided an indication of better pavement performance, in-terms of distress rate, when compared to a selected set of traditional, or non-rubberized open-graded friction course overlays, sampled projects located on the same highway and general geographic areas. While the assessment completed by Dr. Paola Bandi of the U.S. Highway 54 and U.S. Highway 62/New Mexico State Highway 180 projects did not include control sections was not part of a comprehensive experimental program, the preliminary assessment indicated that the rubberized open-graded friction course overlays, produced by combined crumb rubber with asphalt concrete and other additives, proved promising indications of better performance in both the short-term and long-term than similar non-rubberized open-graded friction course overlays.

Dr. Paola Bandi's economic assessment of the production and use of crumb rubber modifiers in pavement applications in the state of New Mexico showed initial economic and environmental benefits. The main components of this economic and environmental assessment included the identification and analysis of the necessary processing and manufacturing equipment, current material producers, suppliers of crumb rubber modifier materials, sources of discarded and used rubber tires, and initial investment costs. Dr. Paola Bandi found that the development and completion of a facility needed to produce the rubberized open-graded friction course overlays required a high initial capital investment, produced a constant annual demand for approximately 9,000 tons of crumb rubber modifier, and a reliable source of approximately 1.25 million discarded and used rubber tires annually.

For Northeastern Nevada, the New Mexico rubberized asphalt concrete pavements program may be suitable for trial projects at the community level and for large scale industrial and commercial firms with generally restricted access but with significantly high demand for generally inexpensive pavement materials. Possible state and local government regulatory statutes may require modification and controlled study and evaluation of the use of rubberized open-graded friction course overlays will have to be conducted, completed and analyzed in order to evaluate the potential effectiveness of this type of course overlay in Nevada. However, the development of specialized facilities and the purchasing of specialized equipment and materials to first produce the crumb rubber modifier and then the rubberized open-graded friction course overlays may be possible through the development and execution of a public-private partnership between the Northeastern Nevada Regional Development Authority and a single or set of large industrial or commercial private-sector firms willing to utilize these materials.

5.5 New Mexico Tire-Bale Erosion Control and Bank Stabilization Projects

In July 2012, the New Mexico Department of Transportation published an investigatory and research project, *Standards for Tire-Bale Erosion Control and Bank Stabilization Projects: Validation of Existing Practice and Implementation*. This investigatory and research project was designed as part of a larger statewide initiative to promote the use of a growing stockpile of discarded and used rubber tires in the state and meet the growing demand for needed backfill material in highway construction. This investigatory and research project was further designed to determine whether or not compressed tire-bales could be used as a cost-effective alternative to traditional fill materials for erosion control and bank stabilization projects in the state.

While the production of tire-bales does not require specific recycling processes, including the removal of plastic and metal additives and the production of crumb rubber modifiers, the resulting investigatory and research project completed by the New Mexico Department of Transportation concluded that the tire-bale structure itself requires that the structure remain stable under possibly unpredictable load conditions during the life span of the resulting structure. Initial concern about using tire-bales for erosion control and bank stabilization projects was the potential intrusion of water behind the structure and the possible failure of the structure itself. Further concerns regarding the use of tire-bales for erosion control and bank stabilization projects was the contact between the soil itself and the tire-bale fill structure. Scouring at the contact point between a stream and the tire-bale structure has been found to potentially allow water to get in behind the structure, eventually leading to failure.

Using proper and recommended guidelines for the construction of tire-bale structures and their proper placement and use in erosion control and bank stabilization projects was determined to be an acceptable approach to erosion control and bank stabilization. The authors of this New Mexico Department of Transportation investigatory and research project found that the development of failure in tire-bale erosion control and bank stabilization structures could likely be traced to a faulty structural design in the tire-bale structures themselves or in an inadequate and incomplete understanding and control of site-specific surface and subsurface water infiltration.

For Northeastern Nevada, the New Mexico Department of Transportation's approach to the use of tire-bales in erosion control and bank stabilization projects may be suitable for trial projects at the community level and for large scale industrial and commercial firms with generally restricted access but with significantly high demand for inexpensive fill materials. Possible state and local government regulatory statutes may require modification and controlled study and evaluation of the use of discarded and used tires in the production of relatively inexpensive tire-bale structures for use in erosion control and bank stabilization projects will have to be conducted, completed and analyzed in order to evaluate the potential effectiveness of this approach.

For Northeastern Nevada, this approach and the use of discarded and used rubber tires in the construction of tire-bale structures could quickly and affordably solve the region's need for addressing a growing supply of discarded and used tires with minimal upfront capital investment. Beyond the use of these tire-bales in erosion control and bank stabilization projects for large-scale industrial and commercial use, there are possible applications of this approach in the region's relatively large agricultural industry sector and even possibly in the stabilization of mine tailing piles located throughout the region. Possible future public-private partnerships between the Northeastern Nevada Regional Development Authority and a single or set of large industrial or commercial private-sector firms willing to test the of use tire-bale structures in a limited piloted setting may be required.

Appendix A – Recyclable Waste Types and Amount of Waste for Individual Mine Sites Operated by Nevada Gold Mines within the Northeastern Nevada Regional Development Authority Area

Table A.1 – Recyclable Waste Types and Amounts Produced Nevada Gold Mines – Long Canyon 2018	
Recyclable Waste Type	**Amount Produced (in Number of Units, Kilograms, Cubic Meters or Metric Tons/Tonnes)**
Plastic	33.1 (Metric Tonnes)
Paper	49.7 (Metric Tonnes)
Pallets	-
Cardboard (Onsite)	-
Cardboard (Offsite)	33.1 (Metric Tonnes)
HDPE Pipe/Liner	-
Used Oil	79.76 (Cubic Meters)
Used Antifreeze	23.32 (Cubic Meters)
Batteries (Lithium)	-
Batteries (Lead)	-
Batteries (Alkaline)	-
Batteries	6.7 (Metric Tonnes)
Electronics	1.0 (Metric Tonnes)
Lamps/Bulbs	1.0 (Metric Tonnes)
Ink Cartridges	50.0 (Number of Units)
Ink Cartridges	-
Food Waste	49.7 (Metric Tonnes)
Tires – Large (Onsite)	52.0 (Number of Units)
Tires – Large	-
Tires – LV	224.0 (Number of Units)
Tires – LV	-
Metal	52.9 (Metric Tonnes)
Totes/Containers	2.3 (Metric Tonnes)
Aluminum Cans	-

Source: Nevada Gold Mines, 2019

Table A.2 – Recyclable Waste Types and Amounts Produced Nevada Gold Mines – Carlin Complex (Barrick Legacy) 2018	
Recyclable Waste Type	**Amount Produced (in Number of Units, Kilograms, Cubic Meters or Metric Tons/Tonnes)**
Plastic	-
Paper	-
Pallets	-
Cardboard (Onsite)	-
Cardboard (Offsite)	17.5 (Metric Tonnes)
HDPE Pipe/Liner	-
Used Oil	520.48 (Cubic Meters)
Used Antifreeze	27.22 (Cubic Meters)
Batteries (Lithium)	-
Batteries (Lead)	-
Batteries (Alkaline)	-
Batteries	1.52 (Metric Tonnes)
Electronics	4.75 (Metric Tonnes)
Lamps/Bulbs	-
Ink Cartridges	-
Ink Cartridges	-
Food Waste	-
Tires – Large (Onsite)	-
Tires – Large	1,000.0 (Number of Units)
Tires – LV	-
Tires – LV	-
Metal	3,206.37 (Metric Tonnes)
Totes/Containers	-
Aluminum Cans	-

Source: Nevada Gold Mines, 2019

Table A.3 – Recyclable Waste Types and Amounts Produced Nevada Gold Mines – Carlin Complex (Newmont Legacy) 2018	
Recyclable Waste Type	**Amount Produced (in Number of Units, Kilograms, Cubic Meters or Metric Tons/Tonnes)**
Plastic	-
Paper	-
Pallets	-
Cardboard (Onsite)	-
Cardboard (Offsite)	2.23 (Metric Tonnes)
HDPE Pipe/Liner	56.49 (Metric Tons)
Used Oil	1,068.55 (Cubic Meters)
Used Antifreeze	116.13 (Cubic Meters)
Batteries (Lithium)	-
Batteries (Lead)	-
Batteries (Alkaline)	-
Batteries	46.96 (Metric Tonnes)
Electronics	12.16 (Metric Tonnes)
Lamps/Bulbs	-
Ink Cartridges	-
Ink Cartridges	-
Food Waste	-
Tires – Large (Onsite)	-
Tires – Large	-
Tires – LV	1,000.0 (Number of Units)
Tires – LV	-
Metal	3,482.25 (Metric Tonnes)
Totes/Containers	-
Aluminum Cans	-

Source: Nevada Gold Mines, 2019

Table A.4 – Recyclable Waste Types and Amounts Produced Nevada Gold Mines – Cortez 2018	
Recyclable Waste Type	**Amount Produced (in Number of Units, Kilograms, Cubic Meters or Metric Tons/Tonnes)**
Plastic	-
Paper	-
Pallets	-
Cardboard (Onsite)	-
Cardboard (Offsite)	-
HDPE Pipe/Liner	-
Used Oil	1,060.0 (Cubic Meters)
Used Antifreeze	-
Batteries (Lithium)	0.18 (Metric Tonnes)
Batteries (Lead)	4.35 (Metric Tonnes)
Batteries (Alkaline)	-
Batteries	-
Electronics	1.1 (Metric Tonnes)
Lamps/Bulbs	164.2 (Metric Tonnes)
Ink Cartridges	136.0 (Number of Units)
Ink Cartridges	-
Food Waste	-
Tires – Large (Onsite)	700.0 (Number of Units)
Tires – Large	-
Tires – LV	1,500.0 (Number of Units)
Tires – LV	-
Metal	24,000.0 (Metric Tonnes)
Totes/Containers	-
Aluminum Cans	-

Source: Nevada Gold Mines, 2019

Table A.5 – Recyclable Waste Types and Amounts Produced Nevada Gold Mines – Phoenix 2018	
Recyclable Waste Type	**Amount Produced (in Number of Units, Kilograms, Cubic Meters or Metric Tons/Tonnes)**
Plastic	1,814.0 (Metric Tonnes)
Paper	2,721.0 (Metric Tonnes)
Pallets	8.26 (Metric Tonnes)
Cardboard (Onsite)	1,814.0 (Metric Tonnes)
Cardboard (Offsite)	-
HDPE Pipe/Liner	56.23 (Metric Tonnes)
Used Oil	1,211.0 (Cubic Meters)
Used Antifreeze	3.13 (Cubic Meters)
Batteries (Lithium)	-
Batteries (Lead)	-
Batteries (Alkaline)	-
Batteries	8.04 (Metric Tonnes)
Electronics	1.36 (Metric Tonnes)
Lamps/Bulbs	246.75 (Metric Tonnes)
Ink Cartridges	48 (Number of Units)
Ink Cartridges	-
Food Waste	4.45 (Metric Tonnes)
Tires – Large (Onsite)	114.0 (Number of Units)
Tires – Large	-
Tires – LV	269.0 (Number of Units)
Tires – LV	-
Metal	3,317.0 (Metric Tonnes)
Totes/Containers	0.45 (Metric Tonnes)
Aluminum Cans	-

Source: Nevada Gold Mines, 2019

Table A.6 – Recyclable Waste Types and Amounts Produced Nevada Gold Mines – TC 2018	
Recyclable Waste Type	**Amount Produced (in Number of Units, Kilograms, Cubic Meters or Metric Tons/Tonnes)**
Plastic	-
Paper	-
Pallets	-
Cardboard (Onsite)	-
Cardboard (Offsite)	-
HDPE Pipe/Liner	-
Used Oil	314.50 (Cubic Meters)
Used Antifreeze	16.24 (Cubic Meters)
Batteries (Lithium)	-
Batteries (Lead)	-
Batteries (Alkaline)	-
Batteries	3.9 (Metric Tonnes)
Electronics	-
Lamps/Bulbs	244.94 (Metric Tonnes)
Ink Cartridges	-
Ink Cartridges	-
Food Waste	-
Tires – Large (Onsite)	257.0 (Number of Units)
Tires – Large	-
Tires – LV	9.07 (Number of Units)
Tires – LV	-
Metal	479.0 (Metric Tonnes)
Totes/Containers	-
Aluminum Cans	-

Source: Nevada Gold Mines, 2019

Table A.7 – Recyclable Waste Types and Amounts Produced Nevada Gold Mines – TR 2018	
Recyclable Waste Type	**Amount Produced (in Number of Units, Kilograms, Cubic Meters or Metric Tons/Tonnes)**
Plastic	0.127 (Metric Tonnes)
Paper	0.753 (Metric Tonnes)
Pallets	-
Cardboard (Onsite)	-
Cardboard (Offsite)	-
HDPE Pipe/Liner	-
Used Oil	98.19 (Cubic Meters)
Used Antifreeze	-
Batteries (Lithium)	-
Batteries (Lead)	-
Batteries (Alkaline)	-
Batteries	0.37 (Metric Tonnes)
Electronics	0.07 (Metric Tonnes)
Lamps/Bulbs	143.34 (Metric Tonnes)
Ink Cartridges	-
Ink Cartridges	-
Food Waste	-
Tires – Large (Onsite)	540.0 (Number of Units)
Tires – Large	-
Tires – LV	1,100.0 (Number of Units)
Tires – LV	-
Metal	654.15 (Metric Tonnes)
Totes/Containers	-
Aluminum Cans	0.10 (Metric Tonnes)

Source: Nevada Gold Mines, 2019