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**MARKET ANALYSIS FOR DRIED
DISTILLERS GRAINS IN INDIANA^a**

by

Dr. Frank J. Dooley

Working Paper # 08-11

December 2008

Dept. of Agricultural Economics

Purdue University

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Abstract

The rapid expansion of the ethanol industry in Indiana has saturated the local market for the principal co-product, distillers grains with solubles (DDGS). In the near term, Indiana's livestock industry can be expected to consume up to 895,000 tons of DDGS per year. But given production of 2.7 million tons, Indiana's ethanol producers will rely on railroads and barges to ship excess production to out-of-state destinations. Livestock producers will have a ready access to DDGS across the state.

Keywords: market potential, distillers grains, Indiana, livestock

JEL codes: Q10, Q13

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Overview

The recent declines in oil and commodity prices have led to declining ethanol margins. Combined with the rapid expansion in capacity, the ethanol market has become very competitive. Despite these challenges, the renewable fuels mandates are still in place, calling for 10.5 billion gallons of ethanol in 2009, and 12 billion gallons by 2010. Thus, the Indiana ethanol industry is still expected to grow to over 900 million gallons by 2009.

This analysis considers the effects of the expansion in Indiana ethanol production on the market for the main co-product of ethanol, dried distillers grains with solubles (DDGS).¹ The remainder of this report is organized in two parts. First, the available supply of ethanol and DDGS in Indiana are tracked. Second, the potential consumption of DDGS by different classes of livestock is estimated for Indiana.

Indiana Ethanol and DDGS Production

Ethanol has been produced by New Energy in South Bend since 1985 at a 100 million gallon per year (MGY) plant (Table 1). In 2007, five plants opened adding 355 MGY, while four more plants opened an additional 335 MGY in 2008. As of December 2008, 10 plants around the state have the capacity to produce 790 million gallons of ethanol. An additional 198 MGY is under construction near Mount Vernon. Indiana's production ranks third in the country behind Iowa and Nebraska, comprising 9.0 percent of US dry grind ethanol mill production.

Table 1. Indiana Ethanol Plants, by Year, Location, and Capacity, November 2008

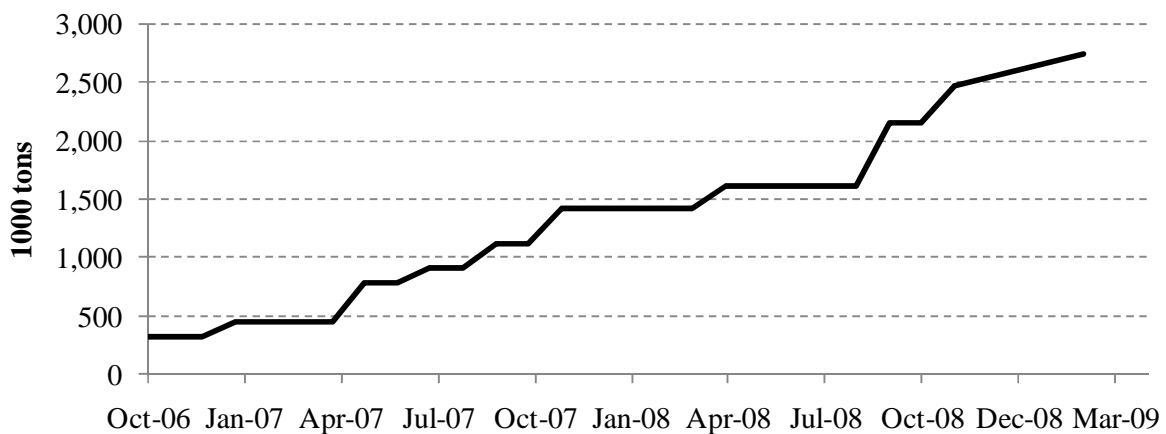
Company	Year	City/County	Million Gallons	
			Operating	New
New Energy Corp.	1985	South Bend/ St. Joseph	100	
Iroquois Bio-Energy Co.	Jan 2007	Rensselaer/Jasper	40	
The Andersons Clymers	May 2007	Clymers/Cass	110	
Central Indiana Ethanol	July 2007	Marion/Grant	40	
POET	Sept 2007	Portland/Jay	65	
Verasun Energy Co.	Nov 2007	Linden/Montgomery	100	
POET	Apr 2008	Alexandria/Madison	60	
POET	Sept 2008	N Manchester/Wabash	65	
Indiana Bio-Energy	Sept 2008	Bluffton/Wells	110	
Cardinal Ethanol	Nov 2008	Harrisville/Randolph	<u>100</u>	
Aventine Renewable		Mt. Vernon /Posey		110
Abengoa Bioenergy		Mt. Vernon /Posey		<u>88</u>
Indiana Total			790	198

Source: [Indiana State Department of Agriculture](#). 2008.

¹A companion analysis, U.S. Market Potential For Dried Distillers Grain With Solubles considers the expansion of DDGS for the United States.

The level of DDGS production is a direct factor of ethanol production. Each bushel of corn is assumed to produce 17.5 pounds of DDGS. Thus, the distribution of DDGS is identical to that of dry grind corn ethanol mills. Tracking the expansion in ethanol, the volume of Indiana's production of DDGS grew from 312,000 tons in 2006 to 2.47 million tons in November 2008 (Figure 1). When the plants under construction come on line in 2009, the volume of DDGS will reach 2.74 million tons per year in Indiana. DDGS contribute 16 to 20 percent of an ethanol plant's total revenue. Historically, dairy and beef cattle have been the most important markets for DDGS.

Figure 1 . Indiana DDGS Production, Capacity, 2006 to 2009



State Level DDGS Demands for Indiana

A nationwide estimate of DDGS was constructed by considering animal populations for dairy, beef, cattle on feed, other cattle, breeding and market swine, broilers, layers, pullets, and turkeys, and the associated DDGS inclusion rates for each class of livestock. Animal populations from the 2002 Census of Agriculture were updated to 2007 levels using NASS (2008) data (Table 2). Animal populations for 2007 are reported for all animals and large farms. Most likely DDGS will only be fed on larger sized farms because small farms encounter problems with infrastructure and handling, lack of knowledge, operation is too small, transportation, and shelf life. DDGS inclusion rates were adapted from Berger and Good (2007) and a NASS (2007) report about DDGS feeding practices being used by Midwestern farmers.

Results are reported for four scenarios. The scenario for *Long Term Upper Limit*, which feeds the upper limit of DDGS to all animals in the state, estimates that Indiana livestock can consume as much as 995,700 tons of DDGS per year (Table 3). However this scenario is very unlikely because actual feeding rates are much lower than upper limits and not all farms can be expected to use DDGS. A more reasonable short term scenario - *2008 Most Likely* - suggests that 280,900 tons of DDGS were consumed in 2008, with a current upper bound of 755,600 tons (*Long Term Likely* scenario). Finally, the *2009 Expected Demand* scenario reflects that DDGS

Table 2. DDGS Inclusion Rates and Indiana Herd Populations, 2007

Class of Livestock	Annual DDGS Inclusion Rate (lbs/year/head)		Indiana Animal Population (million)		
	Current Practice (NASS)	Upper Limit (Berger & Good)	2002 Census of Agriculture	Large Farms Only	All Animals
Dairy Cows	1,002.00	1,642.50	144.8	112.1	166.0
Beef Cows	396.00	720.00	230.4	35.1	234.0
Other Cattle	346.50	630.00	486.9	269.5	490.0
Cattle on Feed	916.00	2,555.00	145.0	110.0	110.0
Breeding Swine	105.53	372.00	336.2	297.0	330.0
Market Swine	51.77	182.50	3,142.3	1,688.0	2,110.0
Broilers	0.33	1.1574	25,385.8	18,144.7	24,553.1
Layers	3.37	11.87	21,952.1	24,511.7	24,885.0
Pullets	1.03	3.63	5,764.8	7,226.2	7,663.0
Turkeys	1.80	6.35	13,848.1	14,834.7	15,900.0

consumption will grow from 2008 to 2009 simply because of greater availability. In 2009, Indiana state level demand of DDGS will climb to 349,000 tons, representing about 1.2 percent of the nation's consumption of DDGS.

In Indiana, no one class of livestock is dominant in terms of consumption of DDGS. Dairy, cattle on feed, other cattle, market swine, and layers are all expected to consume about the same amount of DDGS in 2009, between 51,000 and 70,000 tons (Table 3). Consumption is dispersed across the state, with the greatest usage across the northern tier of counties.

County Level DDGS Demands for Indiana

An alternative approach is to base animal populations from confined feeding operations (CFO) and concentrated animal feeding operation (CAFO) data, which are associated with larger sized farms. Permits date to the early 1970s for nine classes of animals. Beef, dairy, swine, chickens, and turkeys can be compared with the USDA data, while veal calves, ducks, sheep, and horses are ignored in this analysis. In 2002, there were permits for 37,000 beef cows, 49,000 dairy cattle, 3.2 million hogs, 21.1 million chickens, and 3.7 million turkeys (Table 4). By 2008, animals covered by permits increased for all five classes. Data for CFOs and CAFOs are used to establish county level animal populations (Appendix A).

The IDEM data are more current than animal population numbers derived from the 2002 Census of Agriculture, and more reflective of production practices at the county level. Based on CFO/CAFO farms, the likely DDGS market consumption for DDGS in Indiana in 2008 was 308,865 tons, which will probably grow to 383,725 tons in 2009 (Table 5). The upper bound of DDGS market potential is 895,398 tons. The estimates from the IDEM data are 10 percent higher than those from USDA data, and 19 percent higher for the Long Term Likely scenario.

Table 3. Estimates of Indiana DDGS Market Potential, for Four Scenarios

Scenario:	2008 Most Likely	Long Term Likely	2009 Expected Demand	Long Term Upper Limit
Inclusion Rate	Current Practice	Upper Limit	Grow Current	Upper Limit
Population	Large Farms	Large Farms	Large Farms	All Animals
Class	Thousand tons			
Dairy Cows	56.1	92.0	69.7	136.3
Beef Cows	6.9	12.6	8.6	84.2
Other Cattle	46.7	84.9	58.0	154.4
Cattle on Feed	50.4	140.5	62.6	140.5
Breeding Swine	15.7	55.2	19.5	61.4
Market Swine	43.7	154.0	54.3	192.5
Broilers	3.0	10.5	3.7	14.2
Layers	41.3	145.5	51.3	147.7
Pullets	3.7	13.1	4.6	13.9
Turkeys	<u>13.4</u>	<u>47.1</u>	<u>16.6</u>	<u>50.5</u>
State Total	280.9	755.6	349.0	995.7
Crop Reporting District				
Northwest	36.1	86.5	44.9	113.0
North Central	52.2	137.8	64.8	175.4
Northeast	40.9	103.3	50.8	134.0
West Central	20.2	59.3	25.1	77.9
Central	41.7	127.3	51.8	157.5
East Central	20.0	55.3	24.9	72.3
Southwest	31.8	89.9	39.5	120.3
South Central	22.4	55.0	27.9	85.4
Southeast	<u>15.6</u>	<u>41.2</u>	<u>19.4</u>	<u>59.8</u>
State Total	280.9	755.6	349.0	995.7

Table 4. IDEM CFO and CAFO Livestock Population, by Class, by Year

Year	Beef	Dairy	Swine	Chickens	Turkeys
2002	37,177	49,125	3,163,661	21,121,686	3,672,700
2003	38,613	59,000	3,311,559	27,574,066	4,039,640
2004	40,564	68,414	3,423,360	34,999,560	4,612,040
2005	40,929	91,578	3,672,436	39,879,900	4,929,640
2006	47,260	107,791	4,381,471	41,140,496	5,319,940
2007	49,821	161,960	4,828,346	43,084,404	5,814,940
2008	55,137	188,517	5,076,415	45,991,642	6,033,940
USDA	196,439	143,237	3,454,459	52,843,347	3,471,036
CAFO as % of USDA Census	18.9%	34.3%	91.6%	40.0%	105.8%

Table 5. Estimates of Indiana DDGS Market Potential Based on IDEM Data, by Scenarios

Scenario:	2008 Most Likely	Long Term Likely	2009 Expected Demand
	----- Thousand tons -----		
Dairy Cows	93.9	153.9	116.7
Beef Cattle	13.2	30.1	16.3
Hogs	151.8	535.1	188.6
Poultry	44.2	155.9	54.9
Turkeys	<u>5.8</u>	<u>20.4</u>	<u>7.2</u>
State Total	308.9	895.4	383.7
Crop Reporting District			
Northwest	70.0	165.7	86.9
North Central	64.3	188.9	79.8
Northeast	38.3	97.8	47.6
West Central	14.9	47.1	18.5
Central	41.6	132.9	51.7
East Central	29.4	96.6	36.5
Southwest	29.0	95.4	36.0
South Central	15.6	50.9	19.3
Southeast	<u>5.9</u>	<u>20.2</u>	<u>7.3</u>
State Total from CAFO	308.9	895.4	383.7
State Total from NASS	280.9	755.6	349.0

Thus, the DDGS consumption based on the IDEM data can be considered as a new upper bound on the market potential for DDGS consumption in Indiana. In Appendix A, animal populations, 2009 forecast DDGS consumption, and long run forecasts are provided by county. No consumption is expected in Dearborn, Monroe, Ohio, and Scott counties. Eleven counties have potential demand over 25,000 tons - Jasper (47,658 tons), Carroll (46,127), Jay (42,908), Wabash (40,971), White (39,116), Dubois (38,976), Kosciusko (33,868), Newton (29,566) Randolph (28,949), Jackson (25,171), and Decatur (25,151).

Summary

The rapid expansion of the ethanol industry in Indiana has saturated the local market for DDGS. Indiana's livestock industry can consume up to 895,000 tons of DDGS per year. But given production of 2.9 million tons, ethanol producers will rely on railroads and barges to ship excess production to out-of-state destinations. Livestock producers will have a ready access to DDGS across the state.

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Appendix A. IDEM Livestock Populations and DDGS Consumption, by County, by Class of Livestock, in Indiana, 2008

County	Number of Animals based on IDEM					2009 DDGS forecast (tons)					Long Term DDGS forecast (tons)				
	Beef	Dairy	Swine	Poultry	Turkeys	Beef	Dairy	Swine	Poultry	Turkey	Beef	Dairy	Swine	Poultry	Turkeys
Adams	941	2,770	106,310	1,235,520	0	293	1,724	3,950	1,476	0	540	2,275	11,208	4,189	0
Allen	725	1,091	51,646	60,000	0	226	679	1,919	72	0	416	896	5,445	203	0
Bartholomew	0	330	28,964	0	0	0	205	1,076	0	0	0	271	3,054	0	0
Benton	850	9,950	33,152	0	0	265	6,193	1,232	0	0	488	8,171	3,495	0	0
Blackford	0	2,000	33,773	0	0	0	1,245	1,255	0	0	0	1,643	3,561	0	0
Boone	0	0	47,536	0	89,800	0	0	1,766	0	107	0	0	5,012	0	304
Brown	0	1,120	0	0	0	0	697	0	0	0	0	920	0	0	0
Carroll	609	8,171	366,960	111,880	0	190	5,086	13,635	134	0	350	6,710	38,687	379	0
Cass	0	8,977	100,104	0	0	0	5,588	3,720	0	0	0	7,372	10,554	0	0
Clark	0	0	0	172,000	0	0	0	0	206	0	0	0	0	583	0
Clay	0	720	36,488	0	0	0	448	1,356	0	0	0	591	3,847	0	0
Clinton	803	0	181,496	1,245,270	0	250	0	6,744	1,488	0	461	0	19,135	4,222	0
Crawford	0	0	0	350,000	0	0	0	0	418	0	0	0	0	1,187	0
Daviess	797	465	64,094	139,000	1,184,600	248	289	2,382	166	1,416	458	382	6,757	471	4,016
Dearborn	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Decatur	910	2,412	214,821	0	0	284	1,501	7,982	0	0	523	1,981	22,648	0	0
DeKalb	0	6,212	15,763	0	0	0	3,867	586	0	0	0	5,102	1,662	0	0
Delaware	0	0	25,073	0	0	0	0	932	0	0	0	0	2,643	0	0
Dubois	3,750	2,350	85,508	5,601,298	2,031,300	1,169	1,463	3,177	6,693	2,427	2,153	1,930	9,015	18,991	6,887
Elkhart	0	4,259	62,106	234,800	0	0	2,651	2,308	281	0	0	3,498	6,548	796	0
Fayette	0	0	27,301	0	0	0	0	1,014	0	0	0	0	2,878	0	0
Floyd	0	0	0	63,300	0	0	0	0	76	0	0	0	0	215	0
Fountain	0	3,385	13,992	0	0	0	2,107	520	0	0	0	2,780	1,475	0	0
Franklin	693	0	21,347	0	0	216	0	793	0	0	398	0	2,251	0	0
Fulton	1,550	347	45,124	62,000	0	483	216	1,677	74	0	890	285	4,757	210	0
Gibson	0	2,000	53,461	0	142,000	0	1,245	1,986	0	170	0	1,643	5,636	0	481
Grant	0	820	49,317	84,000	0	0	510	1,832	100	0	0	673	5,199	285	0
Greene	0	0	48,441	0	497,900	0	0	1,800	0	595	0	0	5,107	0	1,688
Hamilton	0	0	20,120	0	0	0	0	748	0	0	0	0	2,121	0	0
Hancock	1,119	396	79,166	0	0	349	246	2,942	0	0	643	325	8,346	0	0
Harrison	0	300	5,892	697,000	0	0	187	219	833	0	0	246	621	2,363	0
Hendricks	0	0	17,574	0	0	0	0	653	0	0	0	0	1,853	0	0

County	Number of Animals based on IDEM					2009 DDGS forecast (tons)					Long Term DDGS forecast (tons)				
	Beef	Dairy	Swine	Poultry	Turkeys	Beef	Dairy	Swine	Poultry	Turkey	Beef	Dairy	Swine	Poultry	Turkeys
Henry	0	2,300	47,940	0	0	0	1,432	1,781	0	0	0	1,889	5,054	0	0
Howard	570	0	85,339	0	0	178	0	3,171	0	0	327	0	8,997	0	0
Huntington	0	8,848	63,867	44,000	0	0	5,507	2,373	53	0	0	7,266	6,733	149	0
Jackson	0	1,350	62,364	5,157,842	0	0	840	2,317	6,163	0	0	1,109	6,575	17,488	0
Jasper	6,570	38,463	98,315	570,000	0	2,048	23,940	3,653	681	0	3,772	31,588	10,365	1,933	0
Jay	1,402	905	270,187	3,747,942	49,500	437	563	10,039	4,479	59	805	743	28,485	12,707	168
Jefferson	0	0	5,324	0	0	0	0	198	0	0	0	0	561	0	0
Jennings	0	0	24,359	2,683,660	0	0	0	905	3,207	0	0	0	2,568	9,099	0
Johnson	0	1,173	6,931	0	0	0	730	258	0	0	0	963	731	0	0
Knox	0	0	44,110	0	380,700	0	0	1,639	0	455	0	0	4,650	0	1,291
Kosciusko	3,411	3,286	90,128	5,812,820	0	1,063	2,045	3,349	6,946	0	1,959	2,699	9,502	19,708	0
LaGrange	1,360	5,481	31,167	293,000	0	424	3,412	1,158	350	0	781	4,501	3,286	993	0
Lake	500	0	4,602	0	0	156	0	171	0	0	287	0	485	0	0
LaPorte	3,005	4,295	55,561	0	0	937	2,673	2,064	0	0	1,725	3,527	5,858	0	0
Lawrence	0	0	8,100	99,600	67,500	0	0	301	119	81	0	0	854	338	229
Madison	1,161	6,000	23,790	0	0	362	3,735	884	0	0	667	4,928	2,508	0	0
Marion	0	0	7,100	0	0	0	0	264	0	0	0	0	749	0	0
Marshall	1,123	3,615	27,938	56,000	0	350	2,250	1,038	67	0	645	2,969	2,945	190	0
Martin	0	0	54,434	299,000	671,100	0	0	2,023	357	802	0	0	5,739	1,014	2,275
Miami	1,620	500	167,915	0	0	505	311	6,239	0	0	930	411	17,703	0	0
Monroe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Montgomery	830	0	105,441	0	0	259	0	3,918	0	0	477	0	11,116	0	0
Morgan	0	0	10,452	0	0	0	0	388	0	0	0	0	1,102	0	0
Newton	0	24,460	37,804	1,620,000	0	0	15,225	1,405	1,936	0	0	20,088	3,986	5,493	0
Noble	0	3,212	58,230	82,000	0	0	1,999	2,164	98	0	0	2,638	6,139	278	0
Ohio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Orange	0	0	18,705	697,400	87,000	0	0	695	833	104	0	0	1,972	2,365	295
Owen	0	0	3,154	0	0	0	0	117	0	0	0	0	333	0	0
Parke	0	0	13,066	0	0	0	0	485	0	0	0	0	1,378	0	0
Perry	500	600	18,889	0	36,000	156	373	702	0	43	287	493	1,991	0	122
Pike	0	0	16,054	0	122,300	0	0	597	0	146	0	0	1,693	0	415
Porter	0	0	4,629	0	0	0	0	172	0	0	0	0	488	0	0
Posey	500	0	26,707	0	76,000	156	0	992	0	91	287	0	2,816	0	258
Pulaski	3,758	1,350	86,607	2,990,560	0	1,171	840	3,218	3,574	0	2,158	1,109	9,131	10,140	0

County	Number of Animals based on IDEM					2009 DDGS forecast (tons)					Long Term DDGS forecast (tons)				
	Beef	Dairy	Swine	Poultry	Turkeys	Beef	Dairy	Swine	Poultry	Turkey	Beef	Dairy	Swine	Poultry	Turkeys
Punam	0	0	42,181	0	0	0	0	1,567	0	0	0	0	4,447	0	0
Randolph	0	1,800	257,348	100,000	0	0	1,120	9,562	119	0	0	1,478	27,131	339	0
Ripley	0	415	35,811	0	0	0	258	1,331	0	0	0	341	3,775	0	0
Rush	1,810	600	167,427	0	0	564	373	6,221	0	0	1,039	493	17,651	0	0
Scott	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shelby	725	0	51,792	0	0	226	0	1,924	0	0	416	0	5,460	0	0
Spencer	719	0	37,421	0	270,800	224	0	1,390	0	324	413	0	3,945	0	918
St. Joseph	0	3,500	29,682	361,000	0	0	2,178	1,103	431	0	0	2,874	3,129	1,224	0
Starke	0	0	21,627	0	0	0	0	804	0	0	0	0	2,280	0	0
Steuben	0	1,600	5,760	0	0	0	996	214	0	0	0	1,314	607	0	0
Sullivan	0	0	22,273	0	188,000	0	0	828	0	225	0	0	2,348	0	637
Switzerland	0	0	6,056	0	0	0	0	225	0	0	0	0	638	0	0
Tiptecanoe	1,280	540	105,751	51,850	0	399	336	3,929	62	0	735	443	11,149	176	0
Tipton	1,180	0	71,508	480,254	0	368	0	2,657	574	0	678	0	7,539	1,628	0
Union	0	0	24,257	0	0	0	0	901	0	0	0	0	2,557	0	0
Vanderburgh	0	0	2,280	0	0	0	0	85	0	0	0	0	240	0	0
Vermillion	0	0	33,775	0	0	0	0	1,255	0	0	0	0	3,561	0	0
Vigo	0	0	5,900	0	0	0	0	219	0	0	0	0	622	0	0
Wabash	968	4,105	186,740	5,119,296	0	302	2,555	6,939	6,117	0	556	3,371	19,687	17,357	0
Warren	0	425	33,962	0	0	0	265	1,262	0	0	0	349	3,581	0	0
Warrick	0	535	3,381	0	0	0	333	126	0	0	0	439	356	0	0
Washington	0	625	9,093	2,744,400	132,000	0	389	338	3,279	158	0	513	959	9,305	448
Wayne	0	0	42,756	0	0	0	0	1,589	0	0	0	0	4,508	0	0
Wells	0	8,219	150,080	300,000	0	0	5,116	5,577	358	0	0	6,750	15,822	1,017	0
White	5,483	619	252,729	2,600,000	0	1,709	385	9,391	3,107	0	3,148	508	26,644	8,815	0
Whitley	1,204	544	61,021	0	0	375	339	2,267	0	0	691	447	6,433	0	0