



Labovitz School
OF BUSINESS AND ECONOMICS

Bureau of Business and
Economic Research

Consulting Report

Economic Impact of Orvana's Copperwood Project Upper Peninsula, Michigan

September 2011

For

Orvana Resources US Corp

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Executive Summary

The University of Minnesota Duluth Labovitz School’s Bureau of Business and Economic Research (BBER) studied and estimated the economic impacts of construction and operations of activity from the Copperwood project in the non-ferrous mining industry for a study region consisting of Gogebic, Houghton and Ontonagon Counties in Michigan, and Iron and Ashland Counties in Wisconsin. The economic modeling data and software used was IMPLAN. The study used IMPLAN’s economic multiplier analysis and input-output modeling, Version 3.0, created in Minnesota by the Minnesota IMPLAN Group, Inc. Data were the most recent IMPLAN data, which is for year 2009.

Regional data for the impact models for value added, employment, and output measures was supplied by IMPLAN for this impact. From these data, Social Accounts, Production, Absorption, and Byproducts information were generated from the national level data, and were incorporated into the model. All region study definitions and impact model assumptions were agreed on before work with the models began. BBER worked closely with Orvana USA to gather the most accurate input data for modeling as well as checking and review of modeling results.

SUMMARY: ORVANA COPPERWOOD PROJECT, CONSTRUCTION AND OPERATIONS IMPACTS ON GOGEBIC, HOUGHTON AND ONTONAGON COUNTIES IN MICHIGAN, AND IRON AND ASHLAND COUNTIES IN WISCONSIN

Years	Value Added Totals	Output Totals	Employment Totals
Construction			
2012	\$69,861,238	\$138,257,381	491
2013	\$71,238,122	\$140,982,267	491
Ongoing	\$7,699,681	\$15,237,887	14
Operations			
Peak Year*	\$150,881,517	\$222,136,829	443
Typical Year	\$111,095,603	\$163,672,700	456
Grand Total**	\$1,423,269,696	\$2,096,803,711	NA

*Note: Peak year is determined by the highest value in the grade of metals produced.

**Also note: BBER estimates a total of all 14 years of operations, including 11 years of typical operations, one year of peak operations, and two years of startup. Finally, employment total cannot be summed without double counting recurring jobs.

Construction Impacts: The IMPLAN model used in this study estimates that in the first year of construction, for every construction job created in the non-ferrous mining sector, another 0.5 job will be created in other sectors of the five-county economy. In the same way, for year 2 and also during ongoing construction for the 14 years of Copperwood operations, multipliers for value added and output measures range from 1.36 to

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1.44. Therefore, during year 2 of construction, for every dollar of construction, another \$0.44 will be created in other sectors of the five-county economy. (Ongoing construction will add \$0.56 per dollar of activity.)

Copperwood Project Construction Impacts , 2012and 2013

<i>Source: IMPLAN</i>	<i>Direct Effect</i>	<i>Indirect Effect</i>	<i>Induced Effect</i>	<i>Total</i>
Year One (2012)				
Value Added	\$48,386,792	\$8,463,314	\$13,011,132	\$69,861,238
Output	\$101,477,309	\$14,871,958	\$21,908,114	\$138,257,381
Employment	326	63	102	491
Year Two (2013)				
Value Added	\$49,340,441	\$8,630,115	\$13,267,566	\$71,238,122
Output	\$103,477,304	\$15,165,066	\$22,339,897	\$140,982,267
Employment	326	63	102	491

Note: Employment impacts from construction cannot be summed for a total over the two year construction period as this employment may be from recurring jobs.

Operations Impacts: The model also estimates that for every job created during a typical year of operations, 1.87 jobs will be created in other sectors of the economy of the five counties. In the same way, multipliers for value added and output measures, during peak and typical years of operation, range from 1.19 to 1.23.

Note: Peak year is determined by the highest value in the grade of metals produced. Therefore, although employment is somewhat higher for the typical year's impact, output is considerably higher and is the measure determining which impact is defined as the peak year.

Copperwood Project Operations Impacts, Peak Year and Typical Year

<i>Source: IMPLAN</i>	<i>Direct Effect</i>	<i>Indirect Effect</i>	<i>Induced Effect</i>	<i>Total</i>
Peak Year				
Value Added	\$126,820,052	\$13,738,655	\$10,322,811	\$150,881,517
Output	\$182,263,994	\$22,484,969	\$17,387,866	\$222,136,829
Employment	157	122	164	443
Typical Year				
Value Added	\$92,797,314	\$10,588,575	\$7,709,714	\$111,095,603
Output	\$133,366,997	\$17,320,100	\$12,985,602	\$163,672,699
Employment	243	93	120	456

The secondary jobs created will be in sectors closely related to the mining industry. IMPLAN identifies the top sectors for indirect employment as the following: computer programming, food

services and drinking places, power generation, hospitals, architectural and engineering services, retail stores, nursing and residential care, civic organizations, real estate, monetary authorities, and more. (See tables in the full report.)

Tax Impacts: Tax impacts tables in this report show that in a typical year of operations, Copperwood mining activity federal taxes are estimated to total more than \$8.5 million, and state and local taxes are estimated to total more than \$14.6 million. In total, in a typical year, the Copperwood project is estimated to pay more than \$23.1 million in taxes to federal, and to state and local government.

<i>Source: IMPLAN</i>	<i>Employee Compensation</i>	<i>Proprietor Income</i>	<i>Indirect Business Taxes</i>	<i>Households</i>	<i>Corporations</i>	<i>Total</i>
PEAK YEAR:						
Federal Government Non-Defense	\$5,092,104	\$517,064	\$1,589,365	\$1,093,815	\$3,110,201	\$11,402,549
State/Local Non-Education	\$195,026	\$0	\$15,504,580	\$745,314	\$3,364,082	\$19,809,002
Totals	\$5,287,130	\$517,064	\$17,093,945	\$1,839,129	\$6,474,283	\$31,211,551
TYPICAL YEAR:						
Federal Government Non-Defense	\$3,796,878	\$386,427	\$1,168,226	\$815,919	\$2,354,682	\$8,522,132
State/Local Non-Education	\$145,419	\$0	\$11,396,278	\$555,959	\$2,546,891	\$14,644,547
Totals	\$3,942,297	\$386,427	\$12,564,504	\$1,371,878	\$4,901,573	\$23,166,679

In a typical year of operations, the IMPLAN model estimates that the Copperwood project will generate a total of more than \$23 million in federal, and state and local taxes. In the peak year of operations, IMPLAN estimates that the Copperwood project will generate a total of more than \$31 million in federal, and state and local taxes.

Economic Impact of Orvana's Copperwood Project, Upper Peninsula, Michigan

I. PROJECT DESCRIPTION

Orvana's Copperwood project is the development of an underground copper mine in the Upper Peninsula of Michigan, near the Bessemer, Ironwood, Wakefield, Hurley, Houghton and Ashland communities. The University of Minnesota Duluth Labovitz School's Bureau of Business and Economic Research (BBER) was asked to provide an economic impact study for this project.¹

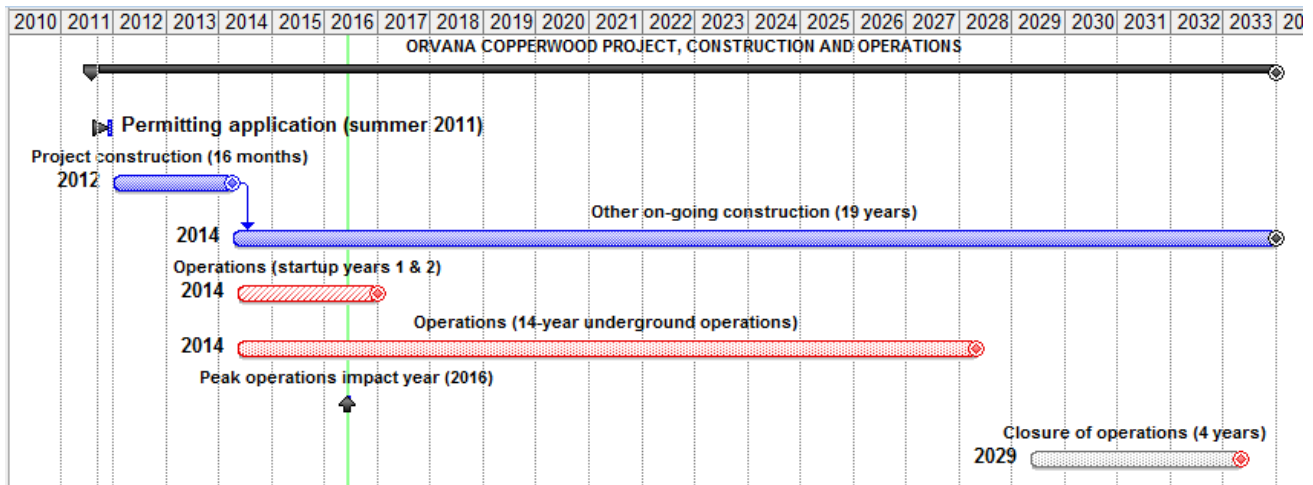
BBER's impact study assessed the economic impact of the Copperwood project on counties of the Upper Peninsula of Michigan and northern Wisconsin. (These included Gogebic, Houghton and Ontonagon Counties in Michigan, and Iron and Ashland Counties in Wisconsin, including the towns of Bessemer, Ironwood, Wakefield, Hurley, Houghton and Ashland.) The Copperwood study used IMPLAN's economic multiplier analysis and input-output modeling, Version 3.0, created in Minnesota by the Minnesota IMPLAN Group, Inc. Data used were the most recent IMPLAN data, which is for year 2009. BBER studied the economic impact of construction and operations activity of the non-ferrous mining industry in designated counties of the Upper Peninsula of Michigan. Impacts reported include jobs, payroll, and sales, reported as value added, employment, and output measures.

The projected time line for the Copperwood project includes two years of construction, fourteen years of operations, and four years of closure of operations. It is assumed that permitting will be accomplished in the summer of 2011 and that construction can begin in 2012. The first and second startup years of operations are assumed to be 2014 and 2015, with the peak operation impact year occurring in 2016.

¹The BBER has previously studied and reported the economic impact of mining construction and operations in such projects as *The Economic Impact of Ferrous and Non-Ferrous Mining on the State of Minnesota and on the Arrowhead Region and Douglas County, WI, March 2009*, and *Economic Impacts of PolyMet's NorthMet Project and Other Industrial Projects of Minnesota's East Range Communities 2006*. These reports and others of interest for this industry from the Labovitz School's research bureau are available at <https://lsbe.d.umn.edu/bber.php>.

FIGURE 1. COPPERWOOD PROJECTED TIME LINE.

SOURCE: ORVANA, UMD BBER



THE STUDY AREA

This impact study will assess the economic impact of the Copperwood project on relevant counties of the Upper Peninsula of Michigan and Wisconsin. (Gogebic, Houghton and Ontonagon Counties in Michigan, and Iron and Ashland Counties in Wisconsin, including the towns of Bessemer, Ironwood, Wakefield, Hurley, Houghton and Ashland.)

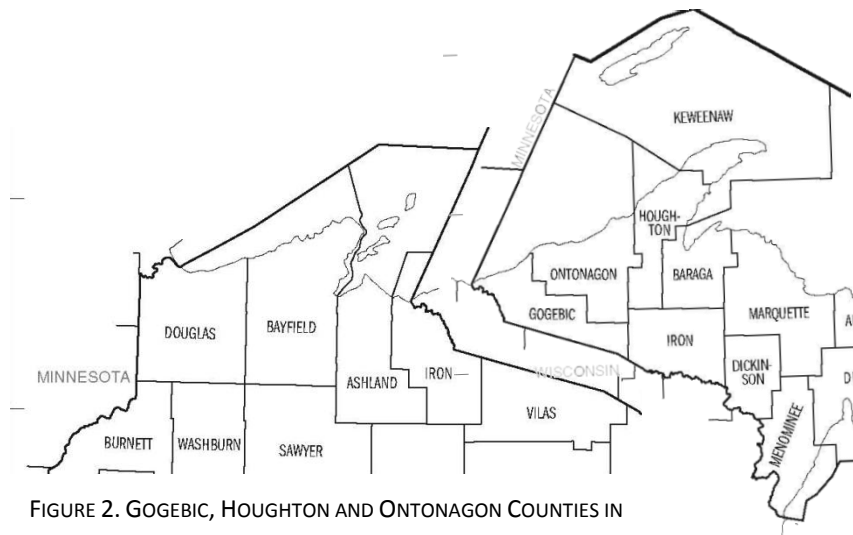


FIGURE 2. GOGEBIC, HOUGHTON AND ONTONAGON COUNTIES IN MICHIGAN, AND IRON AND ASHLAND COUNTIES IN WISCONSIN.

SOURCE: US CENSUS

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II. Impact Procedures and Input Assumptions

IMPLAN Models

There are two components to the IMPLAN system—the software and databases. The databases provide all information to create regional IMPLAN models. The software performs the calculations and provides an interface for the user to make final demand changes. IMPLAN software Version 3.0 was used in this analysis.

IMPLAN provides comprehensive and detailed data coverage of the study areas by county, and the ability to incorporate user-supplied data at each stage of the model building process. IMPLAN also provides a high degree of flexibility both in terms of geographic coverage and model formulation— in this case definition of the counties of Michigan and Wisconsin, and the definition of specific models for construction and operations. Using the IMPLAN software and data, BBER identified the industry’s proposed expenditures in terms of the sectoring scheme for the model, producer prices, historical dollars based on the year of the model, and applied those dollars spent within the study area definition given for the impact analysis.

IMPLAN data files use federal government data sources including:

- US Bureau of Economic Analysis Benchmark I/O Accounts of the US
- US Bureau of Economic Analysis Output Estimates
- US Bureau of Economic Analysis REIS Program
- US Bureau of Labor Statistics County Employment and Wages (CEW) Program
- US Bureau of Labor Statistics Consumer Expenditure Survey
- US Census Bureau County Business Patterns
- US Census Bureau Decennial Census and Population Surveys
- US Census Bureau Economic Censuses and Surveys
- US Department of Agriculture Crop and Livestock Statistics

IMPLAN data files consist of the following components: employment, industry output, value added, institutional demands, national structural matrices and inter-institutional transfers. Impacts for this model use the most recent IMPLAN data available which is for the year 2009. The impact is reported in 2011 dollars.

Economic impacts are made up of direct, indirect, and induced impacts. The following comments are suggested cautions for accepting the impact model:

- IMPLAN input-output is a production based model.
- Local or export based purchases that represent transfers from other potential local purchases are not counted.

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- The numbers (from U.S. Department of Commerce secondary data) treat both full and part-time individuals as being employed.

Definitions Used in This Report

The IMPLAN models for both operations and construction use the following definitions for the three measures and three effects of the impact reports:

Measures

- Value Added – A measure of the impacting industry’s contribution to the local community; it includes wages, rents, interest and profits.
- Output – Represents the value of local production required to sustain activities.
- Employment – Estimates are in terms of jobs, not in terms of full-time equivalent employees. Hence, these may be temporary, part-time or short-term jobs.

Effects

- Direct – Initial spending in the study area resulting from the project
- Indirect – The additional inter-industry spending from the direct impact
- Induced – The impact of additional household expenditure resulting from the direct and indirect impact.

Industry Definitions

IMPLAN models for this study used the industrial sector 23 (which includes copper, nickel, lead, and zinc mining) to model the impact of non-ferrous mining. Construction impacts are modeled using industrial sector 36.

TABLE 1. INDUSTRY DEFINITIONS

IMPLAN Sector	Description	BEA Equivalent	NAICS Equivalent
23	Copper, nickel, lead, and zinc mining	21223	21223
36	Construct other new nonresidential structures	23	2362

Model Assumptions

- Although the current economic downturn may affect the estimates of project start dates and other timeline assumptions, BBER assumes in this study that non-ferrous mining is attempting to emerge from the downturn without losing years of momentum. Delays in permitting application and approval can also affect the proposed start dates.
- Construction years are assumed to include activity between 2012 and 2013.
- Operation year impacts for a "peak year" and for a "typical year" (2016 is suggested as the full capacity year) are provided.
- Impacts are reported in 2011 dollars.
- Special considerations for interpreting these impact numbers include the following cautions: Regional indirect and induced effects are driven by assumptions in the model. One problem is that the assumptions can mask the true multiplier. This is especially true of the assumption of constant returns to scale: This assumption most affects induced effects and says that if I drink coffee, and my income increases, I will drink proportionally more than before. The amount of weight placed on the induced effects (the percentage of the total induced effect you would want to use) could be further analyzed with an in-depth impact study, involving much more specific data collection and more detailed analysis.
- BBER suggests caution in regard to the interpretation of the tax impacts from this project: Tax law changes frequently and can be difficult to forecast through the years proposed as operations for this project.
- Readers should also note that estimated changes in production technology and employee productivity for industry sectors can differ, for example, although this impact study assumes drill blast technology for mine development, continuous mining and drill blast technology have both been suggested and studied for the Copperwood project.
- Finally, and most importantly, the relationship of Output to Employment has been set for the model by data provided by our clients to the BBER. It can be noted that, for purposes of research and with more resources, the modeling methodology can be driven by data collected from surveys and post-construction values. This survey data can provide greater accuracy in regional impact assessments for the linkage between core and peripheral labor market areas, and deliver better estimates of local vs. regional purchases.

III. Findings: Copperwood Project Economic Impacts

In this section, BBER reports the direct, indirect, and induced economic impacts of construction and operations activities of the Orvana Copperwood project in counties in Michigan and Wisconsin. These impacts are measured in terms of employment, output, and value added. A special sub-section of these findings covers the results of modeling non-ferrous mining tax impacts.

Construction Impacts

Construction expenditures have been estimated by project personnel to be more than \$101 million in 2012, more than \$103 million in 2013 and more than \$11 million for ongoing construction over the 14 years of operations.

TABLE 2. SUMMARY: ORVANA COPPERWOOD PROJECT, CONSTRUCTION IMPACTS ON GOGEBIC, HOUGHTON AND ONTONAGON COUNTIES IN MICHIGAN, AND IRON AND ASHLAND COUNTIES IN WISCONSIN

<i>Years</i>	<i>Value Added Totals</i>	<i>Output Totals</i>	<i>Employment Totals</i>
2012	\$69,861,238	\$138,257,381	491
2013	\$71,238,122	\$140,982,267	491
Ongoing	\$7,699,681	\$15,237,887	14

*

Source: IMPLAN

*Note, employment should not be summed. Although the construction investment adds up over time, employment does not; consider, for instance, that a construction project truck driver employed during 2012 may be continuing in the same job in 2013.

TABLE 3: VALUE ADDED CONSTRUCTION IMPACTS ON GOGEBIC, HOUGHTON AND ONTONAGON COUNTIES IN MICHIGAN, AND IRON AND ASHLAND COUNTIES IN WISCONSIN

<i>Years</i>	<i>Direct</i>	<i>Indirect</i>	<i>Induced</i>	<i>Total</i>
Year 1	\$48,386,792	\$8,463,314	\$13,011,132	\$69,861,238
Year 2	\$49,340,441	\$8,630,115	\$13,267,566	\$71,238,122
Ongoing	\$5,332,898	\$932,775	\$1,434,008	\$7,699,681

Source: IMPLAN

TABLE 4: OUTPUT CONSTRUCTION IMPACTS ON GOGEBIC, HOUGHTON AND ONTONAGON COUNTIES IN MICHIGAN, AND IRON AND ASHLAND COUNTIES IN WISCONSIN

Years	<i>Direct</i>	<i>Indirect</i>	<i>Induced</i>	<i>Total</i>
Year 1	\$101,477,309	\$14,871,958	\$21,908,114	\$138,257,381
Year 2	\$103,477,304	\$15,165,066	\$22,339,897	\$140,982,267
Ongoing	\$11,184,211	\$1,639,097	\$2,414,579	\$15,237,887

Source: IMPLAN

TABLE 5. EMPLOYMENT CONSTRUCTION IMPACTS ON GOGEBIC, HOUGHTON AND ONTONAGON COUNTIES IN MICHIGAN, AND IRON AND ASHLAND COUNTIES IN WISCONSIN

Years	<i>Direct</i>	<i>Indirect</i>	<i>Induced</i>	<i>Total</i>
Year 1	326	63	102	491
Year 2	326	63	102	491
Ongoing	9	2	3	14

Source: IMPLAN

TABLE 6. EMPLOYMENT YEAR ONE CONSTRUCTION IMPACTS ON GOGEBIC, HOUGHTON AND ONTONAGON COUNTIES IN MICHIGAN, AND IRON AND ASHLAND COUNTIES IN WISCONSIN, TOP 25 INDIRECT JOBS BY INDUSTRY SECTOR

Source: IMPLAN

<i>IMPLAN Sector</i>	Projected Employment Impacts			
	<i>Direct</i>	<i>Indirect</i>	<i>Induced</i>	<i>Total</i>
Construct other new nonresidential structures	326	0	0	326
Architectural- engineering- and related services	0	20	0	20
Food services and drinking places	0	3	16	18
Private hospitals	0	0	8	8
Retail Stores - Food and beverage	0	2	5	7
Automotive repair and maintenance	0	5	2	6
Retail Stores - General merchandise	0	2	4	6
Nursing and residential care facilities	0	0	5	5
Wholesale trade businesses	0	3	2	5
Civic- social- professional- and similar organizations	0	2	3	5
Retail Stores - Motor vehicle and parts	0	2	3	4
Real estate establishments	0	1	3	4
Offices of physicians- dentists	0	0	4	4
Private household operations	0	0	4	4
Monetary authorities and depository credit	0	1	2	3
Retail Stores - Miscellaneous	0	1	2	3
Private junior colleges- colleges- universities	0	0	3	3
Retail Stores - Clothing and clothing accessories	0	1	2	3
Retail Stores - Building material and garden	0	1	2	2

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Transport by truck	0	2	1	2
Individual and family services	0	0	2	2
Legal services	0	1	1	2
Accounting- tax preparation- bookkeeping	0	2	1	2
Child day care services	0	0	2	2
Home health care services	0	0	2	2
As well as additional full and part-time jobs in another 63 various sectors of the economy . . .				43
Total				491

Operations Impacts

To estimate the on-going impact of mining activity when full operations are reached, BBER has used the term “Peak Year” for the year when estimated revenue reaches its maximum, 2016. BBER has used the term “Typical Year” to suggest the impact for each year following the “Peak Year.” This was found by calculating the average revenue over the 11 years of operations following 2016.

It has been estimated by project personnel that in the peak year, 2016, operations will directly employ 157 workers. For the typical year operations will directly employ 243 workers. The impacts of operations employment and revenue are shown below.

TABLE 7. SUMMARY: OPERATIONS IMPACTS ON GOGEBIC, HOUGHTON AND ONTONAGON COUNTIES IN MICHIGAN, AND IRON AND ASHLAND COUNTIES IN WISCONSIN

<i>Years</i>	<i>Value Added Totals</i>	<i>Output Totals</i>	<i>Employment Totals</i>
Peak Year	\$150,881,517	\$222,136,829	443
Typical Year	\$111,095,603	\$163,672,700	456

Source: IMPLAN

TABLE 8. VALUE ADDED OPERATIONS IMPACTS ON GOGEBIC, HOUGHTON AND ONTONAGON COUNTIES IN MICHIGAN, AND IRON AND ASHLAND COUNTIES IN WISCONSIN

<i>Years</i>	<i>Direct</i>	<i>Indirect</i>	<i>Induced</i>	<i>Total</i>
Peak Year	\$126,820,052	\$13,738,655	\$10,322,811	\$150,881,518
Typical Year	\$ 92,797,314	\$10,588,575	\$7,709,714	\$111,095,603

Source: IMPLAN

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TABLE 9. OUTPUT OPERATIONS IMPACTS ON GOGEBIC, HOUGHTON AND ONTONAGON COUNTIES IN MICHIGAN, AND IRON AND ASHLAND COUNTIES IN WISCONSIN

<i>Years</i>	<i>Direct</i>	<i>Indirect</i>	<i>Induced</i>	<i>Total</i>
Peak Year	\$182,263,994	\$22,484,969	\$17,387,866	\$222,136,829
Typical Year	\$133,366,997	\$17,320,100	\$12,985,602	\$163,672,699

Source: IMPLAN

TABLE 10. EMPLOYMENT OPERATIONS IMPACTS ON GOGEBIC, HOUGHTON AND ONTONAGON COUNTIES IN MICHIGAN, AND IRON AND ASHLAND COUNTIES IN WISCONSIN

<i>Years</i>	<i>Direct</i>	<i>Indirect</i>	<i>Induced</i>	<i>Total</i>
Peak Year	157	122	164	443
Typical Year	243	93	120	456

Source: IMPLAN

TABLE 11. EMPLOYMENT TYPICAL YEAR OPERATIONS IMPACTS ON GOGEBIC, HOUGHTON AND ONTONAGON COUNTIES IN MICHIGAN,
AND IRON AND ASHLAND COUNTIES IN WISCONSIN, TOP 25 INDIRECT JOBS BY INDUSTRY SECTOR

Source: IMPLAN

<i>IMPLAN Sector</i>	Projected Employment Impacts			
	<i>Direct</i>	<i>Indirect</i>	<i>Induced</i>	<i>Total</i>
Mining copper- nickel- lead- and zinc	243	0	0	243
Custom computer programming services	0	45	0	45
Food services and drinking places	0	3	18	22
Electric power generation- transmission	0	10	1	11
Private hospitals	0	0	9	9
Architectural- engineering- and related services	0	7	0	7
Retail Stores - Food and beverage	0	0	6	6
Nursing and residential care facilities	0	0	6	6
Civic- social- professional- and similar organizations	0	2	3	5
Real estate establishments	0	2	3	5
Retail Stores - General merchandise	0	0	5	5
Monetary authorities and depository credit	0	2	2	5
Offices of physicians- dentists	0	0	4	4
Private household operations	0	0	4	4
Retail Stores - Motor vehicle and parts	0	0	4	4
Wholesale trade businesses	0	1	2	3
Private junior colleges- colleges- universities	0	0	3	3
Individual and family services	0	0	3	3
Other state and local government enterprises	0	1	1	3
Automotive repair and maintenance- except car	0	1	2	2
Child day care services	0	0	2	2
Home health care services	0	0	2	2
Retail Stores - Miscellaneous	0	0	2	2
Medical and diagnostic labs and outpatient an	0	0	2	2
Management of companies and enterprises	0	0	2	2
As well as additional full and part-time jobs in another 62 various sectors of the economy . . .				52
Total				457

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To estimate the grand total for all years of Copperwood operations, BBER estimates a total of all 14 years of operations, including 11 years of typical operations, one year of peak operations, and two years of startup. Employment total cannot be summed without double counting recurring jobs

TABLE 12. GRAND TOTALS, OPERATIONS IMPACTS ON GOGEBIC, HOUGHTON AND ONTONAGON COUNTIES IN MICHIGAN, AND IRON AND ASHLAND COUNTIES IN WISCONSIN 2014-2028

<i>Years*</i>	<i>Value Added Totals</i>	<i>Output Totals</i>	<i>Employment Totals</i>
Grand Total	\$1,595,124,356	\$ 2,349,881,929	NA**

Source: IMPLAN

* BBER estimates a total of all 14 years of operations, including 11 years of typical operations, one year of peak operations, and two years of startup.

** Employment total cannot be summed without double counting recurring jobs.

Tax Impacts

According to the IMPLAN model, the impact on taxes from changes in economic activities can be modeled as follows: Income information can be combined with other social accounts tax information to make estimates of the taxes generated by a change in final demand. Although this is a simple ratio estimate, it gives a good first estimate of tax impact. The IMPLAN model also estimates business tax impacts in this way.

Taxes are paid out of labor income and limit disposable income. Tax policies can be examined with regard to individual tax burdens on different income groups. In input-output modeling, such as IMPLAN, a social accounts matrix allows you to examine the actual magnitude of taxes and transfer payments.

The following estimates of the tax impacts of non-ferrous mining in the five counties of the Upper Peninsula of Michigan and Northern Wisconsin are based on inputs from the employment in a peak and typical year of operations. The impacts are summarized in the following tables as federal, and state and local taxes.

Tax impacts tables in this report show that in a typical year of operations, Copperwood mining activity federal taxes are estimated to total more than \$8.5 million, and state and local taxes are estimated to total more than \$14.6 million. In total, in a typical year, the Copperwood project is estimated to pay more than \$23.1 million in taxes to federal, and to state and local government.

TABLE 13. COPPERWOOD OPERATIONS FEDERAL AND STATE TAX IMPACTS, PEAK YEAR

<i>Source: IMPLAN</i>	<i>Employee Compensation</i>	<i>Proprietor Income</i>	<i>Indirect Business Taxes</i>	<i>Households</i>	<i>Corporations</i>
Federal Government Non-Defense	\$5,092,104	\$517,064	\$1,589,365	\$1,093,815	\$3,110,201
State/Local Non-Education	\$195,026	\$0	\$15,504,580	\$745,314	\$3,364,082
Totals	\$5,287,130	\$517,064	\$17,093,945	\$1,839,129	\$6,474,283

TABLE 14. COPPERWOOD OPERATIONS FEDERAL AND STATE TAX IMPACTS, TYPICAL YEAR

<i>Source: IMPLAN</i>	<i>Employee Compensation</i>	<i>Proprietor Income</i>	<i>Indirect Business Taxes</i>	<i>Households</i>	<i>Corporations</i>
Federal Government Non-Defense	\$3,796,878	\$386,427	\$1,168,226	\$815,919	\$2,354,682
State/Local Non-Education	\$145,419	\$0	\$11,396,278	\$555,959	\$2,546,891
Totals	\$3,942,297	\$386,427	\$12,564,504	\$1,371,878	\$4,901,573



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References

For more on the Copperwood project and estimates on construction and operations activity, see:

Orvana's Copperwood Prefeasibility Study, as posted at
http://sedar.com/search/search_form_pc_en.htm

For discussion of IMPLAN and input output modeling, see:

Maki, Wilbur R., and Richard W. Lichty. *Urban Regional Economics: Concepts, Tools, Applications*. February 2000. Iowa State Press.

Miernyk , Willam. *Elements of Input Output Analysis*, New York, Random House, 1966.

Miller, Ronald E., and Peter D. Blair. *Input-output Analysis: Foundations and Extensions*, Englewood Cliffs, N.J. PrenticeHall, 1985 (out of print).

Olson, Doug and Scott Lindall, "IMPLAN Professional Software, Analysis, and Data Guide," Minnesota IMPLAN Group, Inc., 1725 Tower Drive West, Suite 140, Stillwater, MN 55082, www.implan.com.

Appendix A: Modeling Assumptions

For the IMPLAN modeling inputs, BBER studied Orvana's July 29, 2011 Prefeasibility Study and other documents provided by Orvana USA.

Given that Copperwood will see some (flat) ongoing construction during operations, BBER proposed three scenarios for construction impacts, as follows: Year 1, with inputs for output (or costs) and employment; Year 2, with inputs for output (or costs) and employment; and ongoing construction, with inputs for output (or costs) and employment.

In order to arrive at a total value for Year 1 construction cost, BBER consulted Table 1.8 of the Prefeasibility Study and assumed that "Pre-Production Capital," plus the cost of road construction for values for City of Ironwood and Township of Ironwood equals the total for Year 1. Road construction employment, plus project construction employment equals total construction employment for this model.

Startup Operations Year 1 and Startup Year 2: From table 22.2 on page 315 of the Prefeasibility Study we see the Startup Year 1 with production at 80, and revenue at \$4,946, in millions of \$. From previous discussions, and from Table 16.14 we estimate employment at 47. From this same table, we see the Startup Year 2 with production at 904, and revenue at \$54,667, in millions of \$. From previous discussions, and from Table 16.14 we estimate employment at 47.

Peak Year: From table 22.2 on page 315 of the Prefeasibility Study we see the Peak Year as Year 3 with production at 2,620 (copper), revenue at \$182,264, in millions of \$. From previous discussions, we estimate employment at 157.

Typical Year: From this same table, we estimate an average of years 3 through 13 as the Typical Year, with production at 2,620 (copper), and revenue at \$137,786, in millions of \$. From previous discussions, we estimate employment at 243.

Grand Totals: From this same table, we estimate a total of all 14 years of operations, including 11 years of typical operations, one year of peak operations, and two years of startup. Employment cannot be totaled in this model without double counting from year to year, so in the report employment impacts are only reported by year.