APPENDIX C

SURFACE USE DETERMINATION

UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE

SURFACE USE DETERMINATION FOR THE PROPOSED PLAN OF OPERATIONS OF WALTER B. FREEMAN FOR THE NICORE PROJECT SISKIYOU NATIONAL FOREST

LANDS INVOLVED

T. 40 S., R. 9 W., WM, Josephine County, Oregon
Secs 4, 8, 9, 10, 11, 14, 15, 16, 22

Prepared by:

R.J. Gauthier-Warinner
Area Mining Geologist
October 1, 1996

Technical Review:

Regional Mining Engineer

Management Acknowledgement:

Forest Supervisor

TABLE OF CONTENTS

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A request was made by the Illinois Valley District Ranger for me to conduct a Surface Use Determination of a proposal submitted in the form of a Plan of Operations by Mr. Walter B. Freeman on December 17, 1992 for two-phase development of a mine to remove nickel-bearing laterite. The proposal includes construction/reconstruction of approximately 14 miles of road for access and hauling the material to an offsite stockpile facility not on Forest lands. This entails crossing of Rough and Ready Creek in six locations and five crossings of its tributaries. Rough and Ready Creek has been determined eligible by the Siskiyou National Forest for inclusion to the National Wild and Scenic River System.

Selected items discussed in this Surface Use Determination are based on information provided by Mr. Freeman which I believe to be proprietary in nature; therefore, I have edited this copy of the report to delete reference to them.

I believe the proposal to remove a bulk sample of nickel-bearing laterite for use in developing an offsite pilot-prototype smelting facility for direct reduction to stainless steel is reasonable for this stage of Mr. Freeman's proposed operations.

The laterite within the subject lands appears to contain satisfactory nickel to meet specifications for a lower grade stainless steel; however, it appears to lack sufficient chromium for this purpose. This does not entirely discount the value of this material for production of stainless steel; but identifies an apparent need for additional sources of chromium.

Overall, the Plan of Operations submitted by Mr. Freeman does not provide an adequate basis for conducting a detailed analysis of the effects of the proposal on Forest surface resources. I recommend that the Plan of Operations be returned to Mr. Freeman for the following reasons accompanied by a statement of his right to appeal:

- There are no development plans for the four sites where the bulk laterite sample is proposed for removal.
- There is no plan discussing construction/reconstruction of roads on Forest lands.
- There is no road maintenance plan.
- There is no plan detailing construction and maintenance of proposed washed rock crossings of Rough and Ready Creek.
- There is no evidence of the existence of a facility to smelt 5,000-ton (4,535 tonnes) sample of nickel-bearing laterite. Alternately, there is no evidence of a signed contract with a smelter for this purpose.
- The incorporation of a proposal for large-scaled production is unreasonable for this stage of the operation and should not be included in the Plan of Operation. More properly, the Plan of Operation should be amended to address this proposal if the results of bulk testing are determined to favor development of a mine.

I recommend that Mr. Freeman submit a Plan of Operations addressing these deficiencies and limiting the scope to that of bulk sampling. Additionally, the amended Plan of Operations should address the following problems noted in the current Plan of Operations:

- Forest engineers believe that 6-wheel drive articulated haul trucks will require a

larger road width than 10 feet.

- How many 25-ton (22.7 tonne) articulated haul trucks will be utilized during Phase 1 of the proposed operation?
- How much material is expected to be excavated to obtain 5,000 tons (4,535 tonnes) of 1"-minus laterite material for smelting?
- Will a 1 cubic yard (0.75 cubic meter) or 2 cubic yard (1.5 cubic meter) excavator be utilized in the proposed operations?
- Petroleum products will be needed for excavation site equipment. There is no discussion of use and storage of fuel, lubrication, hydraulic fluid, etc. in Item H of the Plan of Operations. Will these be hauled to the site on a daily basis? A spill plan should be included as part of the Plan of Operations.
- Will nickel-bearing saprolite be scrubbed from +6-inch (+15.25 cm) boulders before discarding them. If so, presumably it would be done at the mine site. How will it be done?
- Can refinement of the metallurgical process for the available grade of laterite and determination of the feasability of a production-scaled operation be achieved using a smaller than 5,000 ton (4,535 tonnes) laterite sample?
- What facilities will be utilized for reduction of the bulk sample of nickel-bearing laterite? Are they currently available?

When a Plan of Operations has been received from Mr. Freeman, I recommend that it be immediately reviewed by the Forest for satisfactory content of information. When the Plan of Operations is accepted by the Forest, I recommend beginning work on the EIS. Dependent on the success of Phase 1, Mr. Freeman may amend the Plan of Operations to address full-scale development of the mine.

In his original Plan of Operations dated March 16, 1992, Mr. Freeman proposed to remove 10,000 tons of nickel-bearing laterite from the single location in Section 22. In his current Plan of Operations, he proposes to remove 5,000 tons of this material from that location and three other locations. There appears to be ample sample data on the grade of the nickel-bearing laterite in all four locations and there is no proposal in Phase 2 to mine and reduce laterites from all four sites simultaneously, so it does not appear that the material from the four locations will be blended before reduction. I recommend that he substantiate the need to remove laterite from the added three locations in such an environmentally sensitive area.

There is no information to suggest that Mr. Freeman currently has a pilot-prototype direct reduction facility for smelting 5,000 tons (4,535 tonnes) of nickel-bearing laterite. Forest approval of any activities associated with road construction/reconstruction, excavation of the sample, and hauling of the sample to the stockpile facility is based on the assumption that the sample will be smelted within a reasonable period of time after excavation. If smelting of the sample does not occur, there is no need for its removal. Consequently, I recommend that the Forest require information in the Plan of Operations regarding the location of this facility and when it will be constructed and available for the proposed use. I recommend, that prior to acceptance of the Plan of Operations and beginning work on the EIS, the Forest consider the liklihood that the facility will be available for this purpose. I recommend that the facility be available and ready for reduction of nickel-bearing laterite or a signed contract with a smelter be executed as a condition for approval of the Plan of Operations.

I recommend that the proposed leg of the Alberg Road that parallels and is nearly level with the

creek be relocated higher onto the hill to the east. As evident in Photo 4, this leg of the road almost entirely consists of boulders and no fine material. To make this leg of road usable for travel would entail annual incorporation of a large amount of fine material into its surface. Because the road appears to be within the high-water channel of the creek, any introduced fine material would be flushed during high water events and increase the amount of scouring and sedimentation in downstream Rough and Ready Creek.

I recommend that the Forest consider authorization of any activities under the Plan of Operations be limited to beginning work within one or two years of issuance of the Decision Notice. After that, the authorization would no longer be effective.

INTRODUCTION

The purpose of this report is to determine whether surface disturbing activities proposed by Mr. Walter B. Freeman in his Plan of Operations dated December 17, 1992 are reasonably incident to the overall development of a mine to remove nickel-bearing laterite for production of high-nickel, high-chrome steel.

The Plan of Operation is twofold in purpose. In Phase 1, Mr. Freeman proposes to remove 5,000 tons (4,535 tonnes) of nickel-bearing laterite and haul it to an offsite stockpile area not on Forest lands. He proposes to remove this material from four sites, each approximately 0.2 acres in size, located within the Chance 13 (ORMC 020327), Chance 83 (ORMC 020396), Ace 3 (ORMC 020207), Ace 72 (ORMC 020274), and Ace103 (ORMC 020298) placer mining claims, part of a 9,840-acre (98.4 hectare) claim group. The material will be excavated and stockpiled utilizing a 1 cubic yard (0.75 cubic meter) hydraulic excavator, then loaded by a five cubic yard rubber-tired loader into a diesel-powered portable screening plant. It will then be hauled over a period of 20 days by one or two 25 ton (22.7 tonne) six-wheel-drive articulated dump trucks to a millsite on nearby BLM land and stockpiled for use in developing a pilot-prototype operation. Access to the excavation sites, as proposed by Mr. Freeman, will entail construction/reconstruction of approximately 14 miles (22.5 km) of road suitable for hauling nickel-bearing laterite, crossing of Rough and Ready Creek in six locations, and five crossings of its tributaries. All will occur on Forest lands.

Contingent on the success of Phase 1, Phase 2 would entail mining 40,000 tons (36,287 tonnes) of nickel-bearing laterite per year between June 15 and October 15 from at least one of the four locations over an unidentified amount of time.

Mr. Freeman was notified by the District Ranger in a letter dated July 12, 1993 that the preparation of an Environmental Impact Statement is necessary to analyze the affects of his proposal on: 1) Wild and Scenic River eligibility of Rough and Ready Creek, 2) numerous rare or sensitive plant species that occur in the area, and 3) fisheries habitat and water quality of Rough and Ready Creek.

Opinions and conclusions in this report are based upon a review of available literature as well as upon field observations. This report should not be used for purposes other than that for which it was prepared.

LANDS INVOLVED

The proposed activity will be conducted within the the following described lands of the Illinois Valley Ranger District, Siskiyou National Forest and are depicted in the Buckskin Peak and O'Brien 7½' quadrangles:

T. 40 S., R. 9W., WM, Josephine County, Oregon
Secs. 4, 8-11, 13-16, 22

The subject lands, located approximately 3 miles (4.8 km) northwest of O'Brien, Oregon, are presently accessed by unimproved road beginning at U.S. Highway 199 immediately south of the bridge over Rough and Ready Creek and crossing BLM, Forest Service, State, and private lands. There is no right-of-way across private lands and general travel over them is restricted by locked gates.

General land uses are residential, recreation, and timber management.

In 1993, a Wild and Scenic River Eligibility Study of Rough and Ready Creek was completed by the Siskiyou National Forest. The mainstem Rough and Ready Creek from the National Forest boundary in Section 13 to the confluence of North Fork Rough and Ready Creek and South Fork Rough and Ready Creek was determined to be free-flowing. Botanical, ecological, wildlife, geological, and hydrologic resources were identified to be its Outstanding Remarkable Values. The segment from the National Forest boundary to the junction of roads 441 and 442 was determined to be eligible for a highest level of classification of Recreation. The segment from the junction of roads 441 and 442 to the confluence of North Fork Rough and Ready Creek and the South Fork Rough and Ready Creek was determined to be eligible for a highest level of classification of Scenic.

North Fork Rough and Ready Creek from its confluence with the mainstem upstream to its headwaters including both unnamed forks and Rough and Ready Lakes was determined to be free-flowing. Botanical and ecological resources were identified to be its Outstanding Remarkable Values. A one-quarter mile (0.4 km) segment just upstream from its confluence with South Fork Rough and Ready Creek was determined to be eligible for a highest level of classification of Scenic. The remainder of the North Fork Rough and Ready Creek was determined to be eligible for a highest level of classification of Wild.

A Wild and Scenic River Suitability Study of Rough and Ready Creek has not been prepared.

STATUS RECORD DATA

The following information regarding the subject lands was taken from BLM records:

October 2, 1975	Location of Chance #83 (ORMC 020396)
September 14, 1974	Location of Ace #72 PMC (ORMC 020274)
September 4, 1974	Location of Ace #3 PMC (ORMC 020207)
September 3, 1974	Location of Chance #13 (ORMC 020327)
September 1, 1974	Location of Ace #103 PMC (ORMC 020298)
December 27, 1961	PL 167 determination completed, OR 011506. Surface managed by U.S. Forest Service.
October 5, 1906	Proclamation withdrawing Siskiyou National Forest
April 29, 1903	GLO Order Temporary Withdrawal of Forest Reserve

PHYSIOGRAPHY

From the apex of the fan to a point about 3.4 miles (5.5 km) upstream, the subject lands are characterized by a well-confined, relatively wide flood plain in which the stream is moderately sinuous. Upstream the channel straightens as its grade significantly increases. Lateral drainages are generally straight and range in grade from about 10% to 20%. Confining slopes tend to gradually steepen as they rise from the valley floor to about 35% to 45% in the steepest segments and quickly taper to elongated narrow ridges. Elevations range from approximately 1,570 ft (480 m) above mean sea level (MSL) where Rough and Ready canyon opens into the Illinois River plain to approximately 4,000 ft (1,220 m) above MSL to the north on the divide between Rough and Ready Creek and Josephine Creek. Steep canyons flattening to broad deeply weathered ridges with lateritic soils suggest relatively rapid uplift of a mature erosion surface formed under humid conditions.

The area is located in the rain shadow of the coastal Klamath Mountains. The climate is characterized as maritime with fairly hot, dry summers and warm, wet winters. It has a mean winter temperature of about 39EF (4EC). During the summer and early fall, maximum daily temperatures often exceed 98EF (37EC). Annual precipitation averages 30 in (75 cm) - 45 in (115 cm).

Rough and Ready Creek is one of the most diverse areas of the Forest in terms of rare plants, hosting about 22 sensitive plants and an additional 8 plants on the watch list. The Illinois Valley District Botanist reported that several rare plant sightings near the creek crossings and along the proposed haul route have been documented. *Hastingsia bracteosa*, the rarest plant found on the Siskiyou National Forest has been observed in this area.

GEOLOGIC SETTING

The subject lands are situated within the Western Jurassic terrane of the Klamath Mountain geologic province. This province is a west-facing arcuate region spanning a distance of approximately 320 km from near Red Bluff, California to near Roseburg, Oregon. It is the result of tectonic accretion of Paleozoic-aged and Mesozoic-aged fragments of oceanic crust and island arcs forming a series of eastward-dipping imbricate slices of marine arc-related meta-volcanic and meta-sedimentary rocks intermingled with ultramafic and other opiolitic rocks. This is depicted in Figure 3.

The Klamath Mountains originated as an island archipelago that extended from British Columbia through Washington, Idaho, Nevada, and into California during the upper Paleozoic and into Early Jurassic (175 Ma). They were accreted to the North American continent during the Middle Jurassic (165 Ma). At that time, a subduction zone between the oceanic plate and the continental plate created a series of volcanoes atop of the older accreted terrains and subsequent development of the Western Hayfork Terrane and related plutons. About 160 Ma, the active volcanic arc began to shift westward, leaving a remnant arc. This was followed by a period of strong extensional tectonics and emplacement of a mafic dike swarm within the remnant arc. Continued rifting opened a narrow back-arc basin and subsequent formation of the Josephine ophiolite within it (157 Ma). The Rogue Formation and Chetco mafic intrusive complex developed on the active arc as it continued to migrate westward from the remnant arc. Contemporaneously, the Galice Formation, the product of erosion of the remnant arc and and its basement rocks, was deposited as a submarine fan which prograded across the basin and out onto the flanks of the active volcanic arc. At approximately 153 Ma, arc magmatism began to migrate eastward,

resulting in widespread emplacement of calc-alkaline dikes and sills in the Josephine ophiolite and overlying Galice Formation and intrusion of the Bear Mountain plutonic complex east of the back-arc basin. At approximately 150 Ma to 145 Ma during the Nevadan Orogony, the active arc, back-arc basin, and the remnant arc were accreted to the North American continent and imbricated into a series of east-dipping underthrust sheets accompanied by intense deformation, regional metamorphism, and the intrusion of four northeasterly-trending belts of granitic plutons (Harper, et al, 1984). Until about 140 Ma, the end of the Jurassic Period, extensive erosion nearly leveled the province, exposing the Galice metasediments and intrusive rocks (Broeker, 1994).

During the Cretaceous Period, the sea transgressed eastward, covering much of Oregon. In the Klamath province, this is represented by deposition of the clastic sediments of the Humbug Mountain Conglomerate, Rocky Point Formation, and Hornbrook Formation. This defines a major unconformity with the underlying Late Jurassic rocks. About 70 Ma, there was a rapid northwestward regression of the Cretaceous seas.

By early Eocene time (55 Ma) the southern end of the shoreline lapped against the northern edge of the Klamath Mountains. Well-developed river systems carried sands and silts into the forearc basin along the margin of the mountains. Rejuvenated uplift during Miocene times (25 to 5 Ma) and continuing to the present has caused intensive erosion of the province, creating the steep landscape visible today.

LOCAL GEOLOGY

The subject lands are underlain by harzburgite of the Josephine ultramafic sheet. Along the east face of Rough and Ready Ridge the peridotite has been completely serpentinized and somewhat sheared. Soils occur as residual patches of an uplifted mature erosion surface formed under humid conditions. Slumping is common.

MINERAL DEPOSITS

Nickel-bearing laterite deposits have formed in many of the residual soils on ridge tops and on benches and generally increase in grade with depth. Deposits on the steeper slopes are generally more rocky and lower in grade.

The laterite is a soil that is reddish at the surface, becoming a dark brown mottled clay at depth and finally an olive-colored or blue gray-colored clay and saprolite at greater depth. It is comprised of heavily iron-oxide stained fine soil and loose boulders with surface accumulations of hematite-magnetite pellets, quartz boxwork at depth, and the nickel-enriched mineral garnierite. Generally, the nickel content increases with depth to the saprolite; then rapidly decreases when reaching fresh peridotite.

Deposits proposed for sampling by Mr. Freeman in his Plan of Operations are on Parker Ridge, on South flank Rough Mountain, in the Rough and Ready Creek area, and on Rough and Ready Ridge. According to Ramp, 1978, the deposit on Parker Ridge comprises an area of 37 acres (0.37 hectares) having an estimated maximum depth of 16 ft (4.9 m) and an estimated average depth of 6 ft (1.8 m). Average arithmetic grade of soil and saprolite based on limited sampling by Oregon Department of Geology and Mineral Industries is about 1.00% Ni, 0.1% Co, and 2.0% Cr. Estimated quantity of unweathered rock in soil is 45% by volume.

The deposit of south flank Rough Mountain comprises about 135 acres (1.35 hectares) having an estimated maximum depth of 40 ft (12 m) and an estimated average depth of 10 ft (3 m). Average grade of soil and saprolite is about 1.17% Ni, 0.10% Co, and 2.27% Cr. Estimated quantity of unweathered rock in soil is 40% by volume.

SUMMARY OF ACTIVITIES

Nickel exploration in the subject area began in the early 1950s; however, sytematic exploration did not begin until 1968 when Cominco-American, Inc. claimed the area. It maintained an interest in the area until 1970. During this period, the company mapped the area based on interpretation of color aerial photographs combined with results of trenching, augering, and churn drilling.

In 1973, Inspiration Development Company acquired the property. Until 1978, the company's work consisted of systematic seismic surveying to determine depth to unweathered bedrock, drilling, backhoe sampling, screening and weighing of samples to determine weight percent of unweathered rock larger than 6 in (15.2 cm) in the laterites, and metallurgical testing of bulk samples of soil and saprolite.

Currently, Walter B. Freeman owns and maintains the claims. He has performed road maintenance and some sampling as assessment work.

FIELD INVESTIGATION AND SAMPLING PROCEDURES

I visited the area of the subject lands on two occasions with John Nolan, Illinois Valley Ranger District Minerals Technician. On November 9, 1995, we were unable to ford Rough and Ready Creek at the stream crossing in the NE¼ of Section 15 with a 4x4 vehicle because the channel was too deep; therefore, we only visited the proposed excavation site located in Section 22. I observed the occurrence of metallic material that had the appearance of iron shot at several of the locations where prior sampling had been done near the road. On August 1, 1996, we again visited the subject lands and were able to successfully ford Rough and Ready Creek at the stream crossing in the NE¼ of Section 15 with a 4x4 vehicle. We attempted to ford the creek again at the stream crossing near the center of Section 15 to visit the proposed excavation site located in Section 16, but were unsuccessful because the channel was too deep (see photos 1, 2, and 3). We then attempted to drive the Alberg road to the proposed excavation site located in Section 8. Not far into Section 10 we had to stop because the roadbed was comprised almost exclusively of large boulders which had become difficult to traverse by vehicle (see photo 4). We then drove to the proposed excavation site located near the boundary between Section 11 and Section 14. From this location, I was able to get a good perspective of most of the area of proposed operations (see photos 6, 7, and 8). No samples were taken during either visit to the subject lands.

ANALYSIS AND EVALUATION OF SURFACE USE

Mr. Freeman's immediate proposal (Phase 1) is to remove 5,000 tons of nickel-bearing laterite over a span of 20 days and haul it to an offsite stockpile area not on Forest lands. As stated in his Plan of Operations, his long-range proposal (Phase 2) is to mine and transport to an offsite stockpile facility 400 tons of laterite per day from Jun 15 - Oct 30 of each year for an unspecified number of years. Phase 1 would be considered reasonable to attain the objective outlined in

Phase 2. The question is: Can this material alone be directly reduced to high-nickel, high-chrome stainless steel?

In his Plan of Operations, Mr. Freeman also discusses the need to improve approximately 14 miles (22.5 km) of primitive roads on Forest lands suitable for hauling laterite, crossing Rough and Ready creek in six locations on Forest lands, and crossing tributaries of Rough and Ready Creek in five locations on Forest lands. He estimated a cost of $40,000 to do this, which is significantly less than the actual cost because he doesn't consider the added cost of Forest Service road construction standards. In June, 1993, Siskiyou Forest engineers estimated construction/reconstruction and haul costs of $84,580 for constructing approximately 6 miles (9.7 km) of road proposed by Mr. Freeman in his original Plan of Operations dated March 16, 1992 for access to the single excavation site in Section 22. Based on these cost estimates, I expect estimated construction/reconstruction and haul costs for the current road proposal to be in excess of $160,000. Siskiyou Forest engineers also considered four alternatives in addition to Mr. Freeman's March 16, 1992 proposal. Construction/reconstruction and haul costs ranged from $51,194 for approximately 5.6 miles (9 km) of road requiring partial access through private lands without an easement to $103,481 for approximately 11 miles (17.7 km) of road over Lone Mountain Road and Forest roads 4402, 4402019, and 4402445. These costs could double under the present proposal.

Overall, the Plan of Operations submitted by Mr. Freeman does not provide an adequate basis for conducting a detailed analysis of the affects of the proposal on Forest surface resources. There are no development plans for the four sites where laterite is proposed for removal. There is no plan discussing the proposed improvements of existing primitive roads on Forest lands. There is no road maintenance plan. There is no plan detailing construction and maintenance of proposed washed rock crossings of Rough and Ready Creek. There is no plan of overall mine development and no mine reclamation plan. This inadequacy is not surprising considering that the objective of Phase 1 is to determine the feasability of producing high-nickel, high-chrome steel from this grade of laterite and, until this determination has been made, no serious consideration would ordinarily be given to mining the deposit. Additionally, the required Plan of Operations should address the following problems identified in his current Plan of Operations:

1. There is a reference on page 2a to a need for access roads having an approximate width of 10 feet (3 m). Forest engineers believe that 6-wheel drive articulated haul trucks will require a larger road width.
2. There is a reference on page 3 to the use of two 25-ton (22.7 tonne) articulated haul trucks during Phase 1 of the proposed operation; however, use of one haul truck is identified on page 4.
3. How much material is expected to be excavated to obtain 5,000 tons (4,535 tonnes) of 1"-minus laterite material for smelting?
4. There is a reference on page 3a to use of a 2 cubic yard (1.5 cubic meter) excavator in the proposed operations; however, use of a 1 cubic yard (0.75 cubic meter) excavator is identified on page 4.
5. Petroleum products will be needed for excavation site equipment. There is no discussion of storage of fuel, lubrication, hydraulic fluid, etc. in Item H, page 6. Will these be hauled to the site on a daily basis? There is no spill plan.
6. There is no discussion of scrubbing of nickel-bearing saprolite from +6-inch (+15.25 cm) boulders before discarding them. Will it be done? If so, presumably it would be done at the mine site. How will it be done? What equipment is necessary? Will water be used?
7. What facilities will be used for smelting the 5,000-ton (4,535 tonnes) sample of laterite material? Are they currently available? The purpose of 36 CFR 228, Subpart A is to assure that mining activities be conducted so as to minimize adverse environmental impacts on National

Forest System surface resources. According to Mr. Freeman's NICORE Project Plan dated December 1, 1992 given by him to Reb Bennett, Regional Mining Engineer, the purpose for removing 5,000 tons (4,535 tonnes) of nickel-bearing laterite from National Forest lands is for use in developing a pilot-prototype facility suitable for direct reduction of the material to high-nickel, high-chrome steel. Consequently, the Forest should require information in the Plan of Operations regarding the location of this facility and when it will be available for the proposed use. The Forest should also require that it be constructed and available for the proposed use or a signed contract with a smelter be executed for this purpose as a condition for approval of the Plan of Operations.

8. The purpose of a pilot facility such as this is to refine the metallurgical process for the grade of laterite available and to determine whether a production-scaled operation is feasible. Can this be achieved using less than 5,000 tons (4,535 tonnes) of laterite?

9. What is the reason for wanting to remove laterite from four locations in such an environmentally sensitive area for use in the pilot facility? There appears to be ample sample data on laterite grade in all of the four chosen locations. Why can't feasibility determination and metallurgical refinement be achieved utilizing nickel-bearing laterite from the location in Section 22 as proposed in the original Plan of Operations dated March 16, 1992? There is no proposal in Phase 2 of the proposal to mine and reduce laterite from all four sites simultaneously, so it does not appear that the material from the four locations will be blended before reduction. This would be considered a sensible alternative to the proposal because it would entail four crossings of Rough and Ready Creek on Forest lands rather than six crossings on Forest lands and one crossing of a tributary on Forest lands for sampling purposes.

According to BLM Medford District Geologist, Gerry Capps, there is no Plan of Operations for use of the millsite as a stockpile or reduction facility. Mr. Freeman has a patent application on file with BLM for numerous mining claims on the deposit; however, first half final certificate has not been issued. According to Dean Delavan, BLM Oregon State Office, the patent application does not appear to include millsites.

In evaluating this proposal, I also examined a copy of Mr. Freeman's NICORE Project Plan dated December 1, 1992. It was not submitted by Mr. Freeman as part of his Plan of Operations. I consider the NICORE Project Plan to contain information of a proprietary nature. Several items discussed in this Surface Use Determination are based on what I believe to be proprietary information and have been removed from this copy of the report.

The NICORE Project Plan discusses delineation of reserves, metallurgy of the laterite, project development, production and marketing of final product stainless steel, and a discussion of environmental considerations. Two reports of metallurgical analysis of samples of lateritic material submitted for testing are attached to the report as appendices. One was prepared by Ralph H. Nafziger, U.S. Bureau of Mines, Albany, Oregon on September 10, 1992 and entitled *Preparation of a master alloy from a southern Oregon laterite*. The other was prepared by INTERPRO, Denver, Colorado on August 14, 1990 and identified as Project No. 902001, *Stainless steel production by direct smelting of nickel laterite ore*. I have several comments with regard to statements made in the NICORE Project Plan. They are:

1. As reported by Nafziger, nickel and chromium contents of laterite samples submitted by NICORE for direct smelting feasability testing by Bureau of Mines were in excess of 1% of each element; yet reserves are reported by Mr. Freeman to grade 0.80% nickel and ore cutoff grade is reported by him to be 0.50% nickel. Specifications for nickel content in stainless steels range from 3.50 to 22 weight percent. Alloys produced during testing met specifications for nickel at the low end of the range. Specifications for chromium content in stainless steel range from 11.5 to 26

weight percent. Addition of FeCr would be required to attain suitable chromium levels; therefore, reported reserves containing 1.2% chromium do not contain a sufficient amount of the element to produce the desired grade of stainless steel discussed by Mr. Freeman under MARKETS on page 7 of the NICORE Project Plan. In his conclusion Mr. Nafziger states, "After refining, it is possible that the product alloys could find some applications based on their 'as produced' metal content. In a refining operation, supplementary additions of nickel-bearing and chromium-bearing materials, such as FeNi and FeCr, also could be added to achieve the desired stainless steel compositions." (emphasis added) *Note*: Mr. Nafziger's analysis is based on treatment of a material fraction that is -20 mesh; significantly smaller than the 1"-minus (2.5 cm minus) material fraction proposed by Mr. Freeman in the Plan of Operations.

2. INTERPRO's conclusion has been edited from this copy of my report because it contains proprietary information. Where will additional FeCr be obtained? These facts would not seem to support the viability of direct smelting the grade of stainless steel, as proposed by Mr. Freeman under MARKETS on page 7 of the NICORE Project Plan, from the laterite material in the identified project area.

3. A second test of laterite samples submitted by NICORE was performed by INTERPRO. INTERPRO's conclusion has been edited from this copy of my report because it contains proprietary information. I presume that the firing of mined laterite in a rotary kiln, as proposed in the Plan of Operations, will have the same effect.

4. INTERPRO states in the last paragraph of page 1 of their report: "The fired ore was mixed with _____ and fed directly to the 50 KVA electric arc furnace for the second test." The identity of this component appears to have been intentionally masked. This sentence has been edited from this copy of my report because it contains proprietary information. What is the component? Was it made a part of the samples submitted later to Nafziger for testing? Was the cost of this component accounted for in the cost of production on pages 8 and 12 of the NICORE Project Plan? If so, where? At Riddle, Glenbrook Nickel Company adds ferrosilicon to the reaction ladle as molten nickel ore is being poured from the furnace into the ladle to promote a rapid exothermic reduction reaction, allowing for greater recovery of the nickel.[1] Is this the component that was later masked in their report?

5. This sentence has been edited from this copy of my report because it contains proprietary information. He describes *Inferred Reserves* as those where sufficient sample data exists to make reasonable projections of tonnages and grades based on geologic factors. He describes *Possible Reserves* as those based on geologic probability and are not verified by conclusive sample data. These terms are not in conformance with the U.S. Geological Survey Classification of Mineral Resources described in USGS Bulletin 1450-A and illustrated in Figure 4 of this report.

Measured resources describe resources of a particular deposit for which quantity is computed from dimensions revealed in outcrops, trenches, workings, or drill holes; grade is computed from the results of detailed sampling. Sampling sites are spaced so closely and the geologic character is so well defined that size, shape, depth, and mineral content of the resource are well established. *Proven reserves* is a term commonly used by industry to refer to measured resources. *Indicated resources* describe resources of a particular deposit where quantity and grade are computed from information similar to that used for measured resources, but sample sites are farther apart or are otherwise less adequately spaced. The degree of assurance, although lower than that for measured reserves, is high enough to assume continuity between sample points. *Probable reserves* is a term commonly used by industry to refer to indicated resources. *Inferred resources* describe resources based on assumed continuity beyond

[1]Spickelmier, K., *Glenbrook Nickel - Can New Caledonian ore save the only US nickel producer?*: Mining Engineering, September, 1993, p. 1143.

measured and/or indicated resources, for which there is geologic evidence. They might be supported by samples. *Possible reserves* is a term commonly used by industry to refer to inferred resources.

I believe that Mr. Freeman's use of the term indicated reserves is consistent with that described by USGS as indicated resources because the samples are too widely spaced at 250-foot centers to afford the degree of assurance associated with measured resources, as depicted in Figure 4. For this reason, I do not believe that he has demonstrated the existence of measured resources. His use of the terms inferred (USGS classification) reserves and possible reserves (industry classification) is confusing and suggest different levels of geologic assurance; however, they refer to the same degree of geologic assurance as represented by the term inferred resources in Figure 4. Also, because there is a question as to whether the nickel and chromium grades of the laterite are sufficient to produce the desired product, I do not believe that he has demonstrated that these laterites have a higher degree of economic feasibility than that associated with conditional resources, as depicted in Figure 4.

6. I calculated laterite grades based on information provided in the NICORE Project Plan. While I disagree with Mr. Freeman's resource classifications for reasons stated above, I will use it here to avoid confusion. These laterite grades are:

	Grade of Indicated Reserves	Grade of Inferred Reserves	Grade of Possible Reserves	Overall Grade
Fe Ni Cr Co	This table has been edited to delete reference to proprietary information.			
Total tons				

7. On page 5 of the NICORE Project Plan, stated inferred reserves located in the Woodcock Mountain and Free and Easy Pass areas are based upon a very limited amount of sampling done by Bureau of Mines and Oregon Dept. of Mines and Geology. Again, while I disagree with Mr. Freeman's resource classification for reasons stated above, I will use it here to avoid confusion. When Inferred Reserves located in the Woodcock Mountain and Free and Easy Pass areas and Possible Reserves are not considered, grades calculated on information provided in the report are:

	Grade of Indicated Reserves	Grade of Inferred Reserves	Overall Grade
Fe Ni Cr Co	This table has been edited to delete reference to proprietary information.		
Total tons			

8. This clause has been edited from this copy of my report because it contains proprietary information; yet there is no discussion of the range of grades available in the deposit. Presumably

the cutoff grade was determined based on the grade range of the laterite and the amount of material that has been determined to be above the target grade. It should be noted that when stated Inferred Reserves located in the Woodcock Mountain and Free and Easy Pass areas and stated Possible Reserves are not considered, the grade of remaining Inferred Resources appears to be less than the cutoff grade.

9. On page 6 of the NICORE Project Plan under the heading METALLURGY, Mr. Freeman stated that the furnace tests confirm that the project laterites can be directly reduced to high-nickel, high-chrome steel. Contrarily, the conclusion of these tests performed by INTERPRO and Nafziger is that the amount of chrome in the ore is not sufficient for this purpose.

10. On page 7 of the NICORE Project Plan under the heading MARKETS, Mr. Freeman's statement has been edited from this copy of my report because it contains proprietary information. In the metal analysis for laterite smelting tests reported by Nafziger, the average Ni content was 3.62 weight percent and the average Cr content was 2.43 weight percent. Alone, these cannot sustain the target requirements.

11. In the Glenbrook operation at Riddle, ore moisture control is critical for minimizing smelter energy costs. Free moisture is reduced to zero and loss of ignition moisture is reduced from a range of 7 - 11.5% to less than 2%. Are these a problem in the subject proposal and, if so, are the costs considered on page 12 of the project plan?

12. On page 10 of the NICORE Project Plan, there is a statement that it should be possible to make 304-grade stainless steel. This cannot be done by direct reduction of this laterite alone. This grade of stainless steel is comprised of about 8% Ni and 18% Cr.

13. On page 10 of the NICORE Project Plan, there is a statement that the slag will be granulated and crushed or, if possible, cast into some usable form. Assuming there is no usable form, how will slag be disposed? Can it pass the Environmental Protection Agency toxicity test? Is this cost accounted for on page 12 of the NICORE Project Plan?

14. The primary purpose of the pilot facility is to determine whether a production-scaled operation is feasible and to refine the metallurgical process for the grade of material available; not to sustain a profit. The revenue figures stated on page 8 of the NICORE Project Plan really have no bearing on this phase of the project and are probably not very reliable. It also gives the impression that this pilot phase of the operation will span a period of years. When is the pilot phase of the operation scheduled to end and the mining phase of the operation scheduled to begin?

15. Taxes, depreciation of equipment, plant amortization, marketing costs, shipping costs, and overhead costs are not identified as costs of production on page 12 of the NICORE Project Plan. Reclamation costs are probably not adequate. I have not verified the accuracy of the stated operating costs.

16. I have not verified the accuracy of the estimated capital costs on page 13 of the NICORE Project Plan; however, the sum of capital costs is not correct. This sentence has been edited from this copy of my report because it contains proprietary information. It should be noted that no working capital has been identified. It should also be noted that the stated capital costs are only start-up costs. Capital and amortization costs to be recovered over the life of the mine would also include replacement of equipment and renovation of facilities.

I believe that the proposal to remove a satisfactory amount of nickel-bearing laterite for use in developing an offsite pilot-prototype smelting facility for its direct reduction to stainless steel is reasonable for this stage of Mr. Freeman's proposed operations. I question the need for 5,000 tons of ore to accomplish this.

The laterite resource within the subject lands appears to contain enough nickel to meet specifications for a lower grade stainless steel; however, it appears to lack sufficient chromium for this purpose. This does not entirely discount the value of this material for production of stainless

steel; but identifies an apparent need for additional sources of chromium.

In his original Plan of Operations dated March 16, 1992, Mr. Freeman proposed to remove laterite for this purpose from the single location in Section 22, believing this to be sufficient for his purposes. In his current Plan of Operations, he now proposes to remove this material from four locations instead of the one location. I question the need to remove this material from four locations in such an environmentally sensitive area because there appears to be a sufficient amount of sample data on grade of the nickel-bearing laterite in all the locations and he does not propose to blend the material from the four locations in the smelter feed.

To my knowledge, Mr. Freeman does not have a facility for smelting 5,000 tons (4,535 tonnes) of nickel-bearing laterite. The Forest has the responsibility to assure that mining and related activities are conducted so as to minimize adverse environmental impacts to National Forest System surface resources. This means that Forest approval of any activities associated with road construction/reconstruction, excavation of the sample, and hauling of the sample to the stockpile facility is based on the assumption that the sample will be smelted within a reasonable period of time after excavation. If smelting of the sample does not occur, there is no need for its removal. Consequently,the Forest should require as part of the Plan of Operations information regarding the location of this facility and when it will be constructed and available for the proposed use. The Forest should consider the liklihood that the facility will be available for this purpose prior to acceptance of the Plan of Operations and beginning work on the EIS. The facility should be available and ready for reduction of nickel-bearing laterite or a signed contract with a smelter be executed as a condition for approval of the Plan of Operations.

The EIS should consider a reasonable scenario of development to be presented by Mr. Freeman. The scenario of development presented thus far is not reasonable because in addition to proposing bulk-sampling for determining the feasibility of the metallurgical process for direct reduction of the laterite to the desired grade of stainless steel, he proposes full-scale mine production which is not certain to occur. The Plan of Operations should be limited to addressing bulk-sampling associated with determining the feasibility of the metallurgical process for direct reduction of the laterite to an acceptable grade stainless steel. This would entail analysis of the effects associated with access, excavation, and transportation of the bulk sample to the stockpile facility.

Dependent on the success of Phase 1, submission of a comprehensive mine development and reclamation plan is warranted. For this later comprehensive mine development and reclamation plan to be considered acceptable for analysis of its environmental effects, it should adequately discuss the long-range plans for depleting the deposit. It should identify an amount of mineable material based on reasonably foreseeable demand projections for the product. It should identify how the deposit will be depleted and over what span of time. It should address in sufficient detail how reclamation is to be conducted. This is the basis for calculating a sufficient reclamation bond.

It is possible that the proposed activity will not occur subsequent to approval of the Plan of Operations. Consequently, approval of the Plan of Operation should be limited to beginning work within one or two years after issuance of the Decision Notice.

_____

Geologist
October 1, 1996

REFERENCES

Broeker, Lawrence D., 1994, Mineral potential of land involved in the Recreation Section of the Elk Wild and Scenic River proposed mineral withdrawal: USDA, Forest Service, Siskiyou National Forest, 15 p.

Close, Terry, et al, date unknown, Mineral resources of the Illinois River Basin, Oregon: U.S. Bureau of Mines/Oregon Dept of Geology and Mineral Industries.

Ferns, M.L., Huber, D.F., 1984, Mineral Resources Map of Oregon: Oregon Department of Geology and Mineral Industries, GMS-36, pl. 1:500,000.

Freeman, Walter B., 1992, NICORE Project, 13 p. and 3 appendices.

Harper, G.D., Wright, J.E., 1984, Middle to Late Jurassic tectonic evolution of the Klamath Mountains, California-Oregon: Tectonics, Vol. 3, No. 7, pp. 759-772.

Oregon Department of Geology and Mineral Industries, 1940, Oregon metal mines handbook, Bulletin No. 14-C, Vol. 1, Coos, Curry, and Douglas Counties, pp. 80-90.

Orr, E., Orr, W.M., Baldwin, E.M., 1992, Geology of Oregon, 4th ed: Kendall/Hunt Publishing Co., pp. 51-69.

Peters, William C., 1987, Exploration And Mining Geology, 2nd edition; John Wiley & Sons Publishers, New York; pp. 214-216.

Ramp, Len, 1978, Investigations Of Nickel In Oregon: Oregon Dept. of Geology and Mineral Industries, Miscellaneous Paper 20, pp. 35-39, pl. 1:250,000.

Siskiyou National Forest, 1993, Road construction/reconstruction of Nicore mining area, 7 p.

U.S. Geological Survey, 1980, Principles of Resource/Reserve Classification of Minerals; Geological Survey Circular 831; pp. 1-5.

Wells, Francis G., et al, 1949, Premiminary description of the geology of the Kerby Quadrangle, Oregon: Oregon Dept. of Geology and Mineral Industries, Bulletin No. 40, 23 p., pl. 1:96,000.