NORANDA MINERALS WISCONSIN CORP.

SUMMARY GEOLOGIC AND GEOTECHNICAL REPORT

FOR THE

LYNNE PROJECT

ONEIDA COUNTY, WISCONSIN, U.S.A.

COMPILED BY:

NORANDA MINING AND EXPLORATION PERSONNEL - 1997

BASED ON WORK DONE BY Dr. Larry Kennedy

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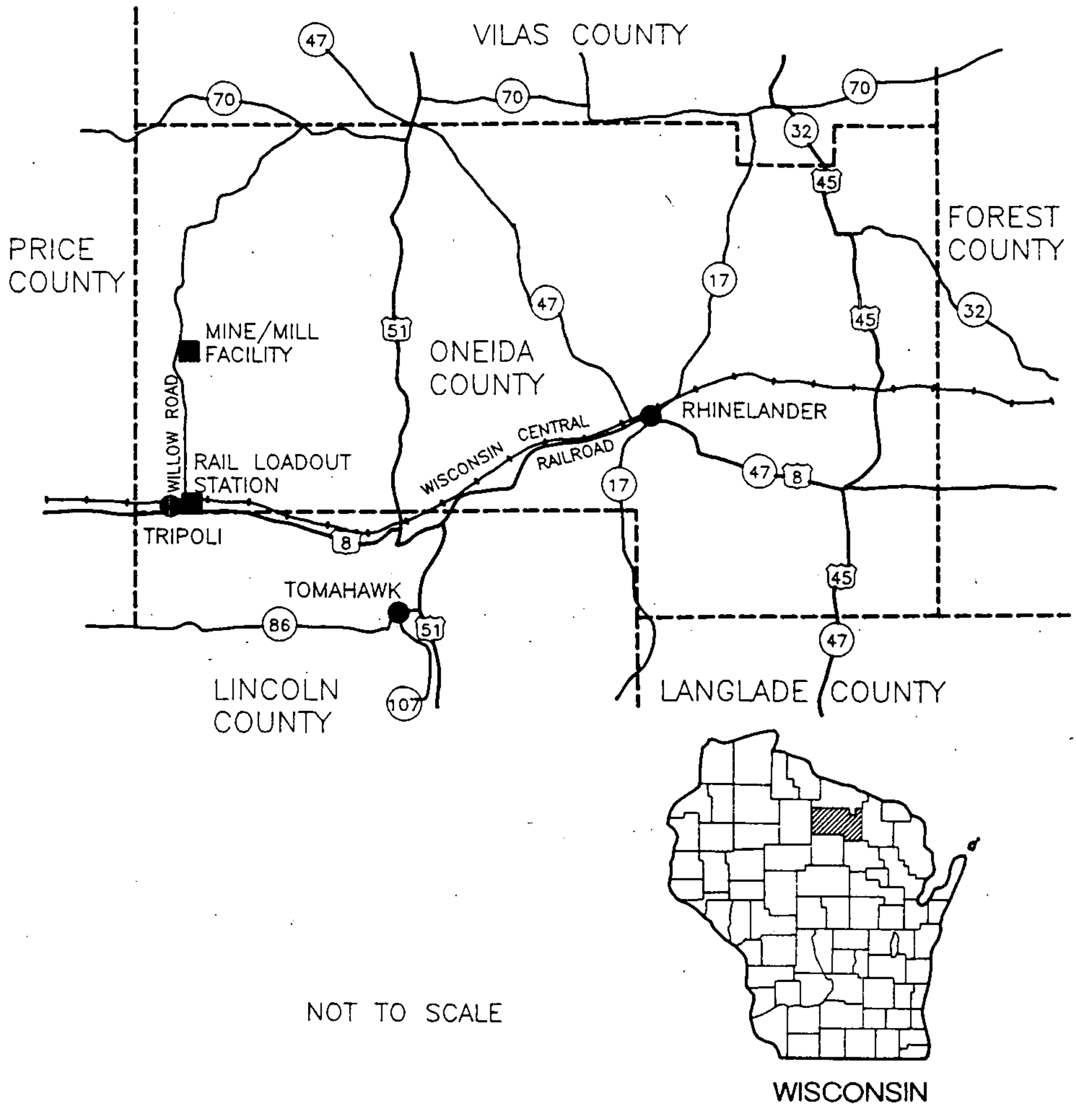
PART 1 - OVERVIEW

1.1 INTRODUCTION

The Lynne deposit was discovered early in 1990 by Noranda Exploration in westernmost Oneida County, Wisconsin **(Fig. 1)**. The deposit is located approximately 27 miles west of Rhinelander in Section 15 of Lynne Township, and is ~3000 feet south of the Willow River. It underlies public lands leased to Noranda by Oneida County. Exploration drilling completed in mid-1991 defined a 7.5 to 8 million ton massive sulfide deposit of which approximately 6 million tons is amenable to open pit extraction. Lynne is primarily a zinc deposit, but also has significant concentrations of lead, copper, silver, and minor gold.

On January 31, 1992, a Notification of Intent (NOI) to Collect Data and Proposed Scope of Study was filed with the Wisconsin Department of Natural Resources (WDNR) to initiate environmental studies and the permitting process for the Lynne Project. The proposed project would generate zinc, copper, and lead concentrates on site for shipment to smelter facilities located outside of Wisconsin. All facilities related to the mining and milling were to be located at the Lynne site.



noranda

LYNNE PROJECT
ONEIDA COUNTY
WISCONSIN

NORANDA MINERALS WISCONSIN CORP.

TITLE

PROJECT LOCATION AND ACCESS MAP

DATE	SCALE	DWG. NO.	FIGURE
JAN 1992	AS SHOWN	913-2295.140	1
ORIGINATOR Golder			

1.2 PROPERTY AND OBLIGATIONS

Noranda presently (1992) leases or owns approximately 2483 contiguous acres of public and private lands in Lynne Township. The mineral deposit and most of the surrounding ground is located on the leased property.

The Oneida County lands were first opened to mineral exploration in 1989, when the county conducted a closed-bid auction. Potential lease holders were instructed to bid in excess of a minimum 2% Net Proceeds Royalty (NPR), with the lease being awarded to the highest bidder. In late 1990, Noranda Exploration signed a lease covering 2419 acres of County land in sections 15, 16, 21, and 22 in Lynne Township. The exploration lease stipulates graduated annual payments of $5 per acre upon execution to $20 per acre in year 10, followed by a mining lease with annual payments of $35 per acre. All lease payments after the first year are adjustable for inflation. Under the terms of the agreement, the NPR is 5.31% and the Net Smelter Royalty (NSR) is set at 3%. All royalties and rental fees are payable to Oneida County.

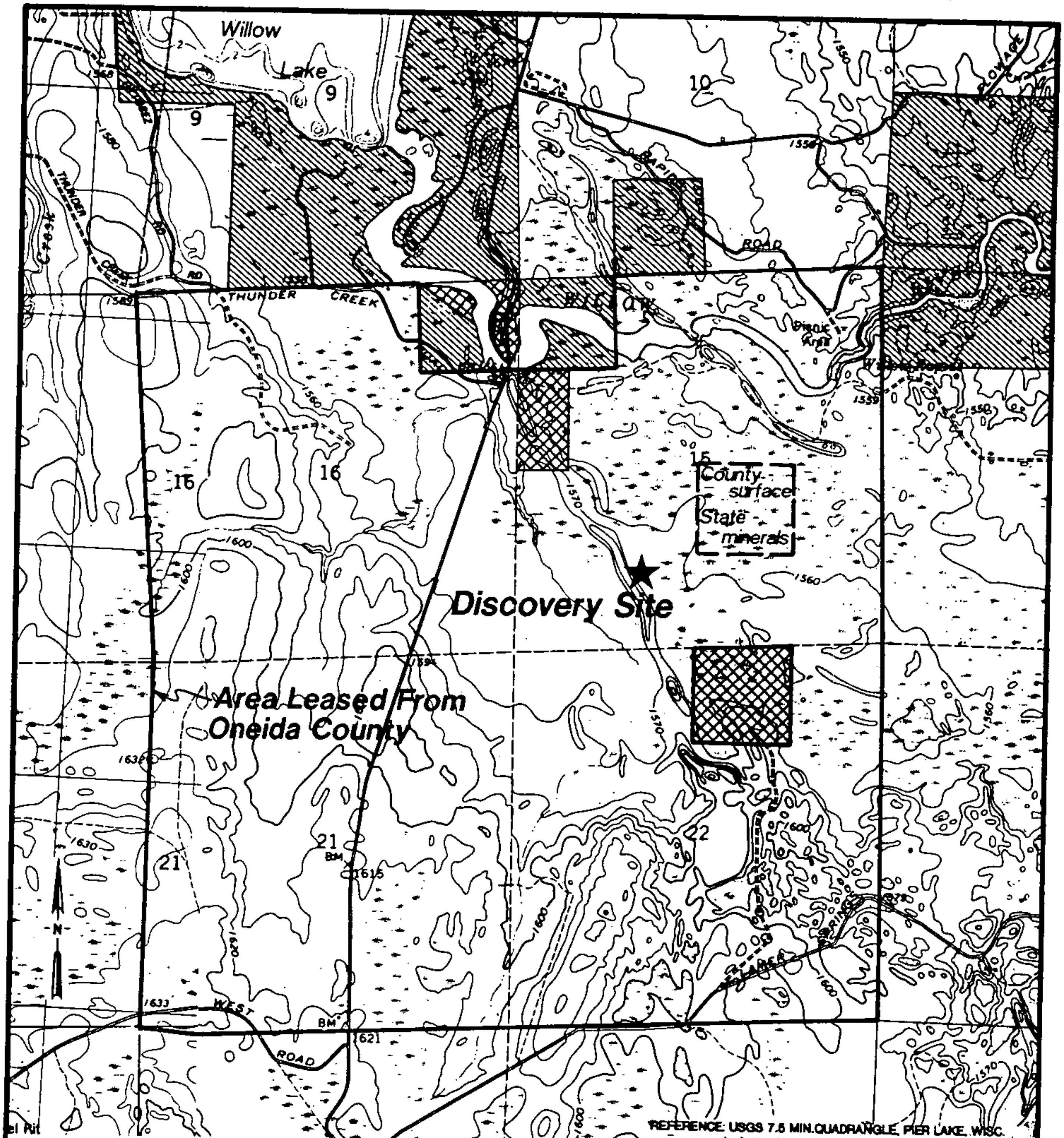
The leased property is presently zoned as forest cropland and is designated for multiple use, including timber cutting and various recreational activities. The county has sold the timber rights to a number of small parcels, commonly less than 10 acres, in section 15. Several other parcels in sections 15 and 22 are being offered in April 1992 for timber cutting ranging up to 10 acres. A well-used snowmobile trail traverses the northern part of the property near the Willow River, and hunters prowl the property in season.

Noranda has also purchased approximately 64 acres of private land within one mile of the proposed mine **(Figure 2)**. These purchases include the 20-acre Wilcott cabin and 20-acre tract, the Talbot home and three-acre tract, and the Hintz cabin and 40-acre tract.

1.3 LOCATION AND INFRASTRUCTURE

The Lynne deposit is approximately nine miles north of U.S. Highway 8 and the Soo Line Railroad in Tripoli, Wisconsin **(Figure 1)**. Willow Road, a paved, two-lane county road which runs through the leased property one-half mile west of the deposit, leads directly to Tripoli. The site is accessible from Willow Road on two and one-half miles of graded dirt roads, namely Lamer Springs and Al Hintz roads, which are maintained by Lynne Township **(Figure 2)**. Unimproved trails emanating from the former Wilcott tract provide limited access. A water well was installed near the discovery site to service the exploration drilling.

A railroad siding on the northeast side of Tripoli has been identified as a potential load-out facility for concentrates. The siding is approximately nine miles from the proposed millsite. Lamer Springs and Al Hintz roads, and some parts of Willow Road, will require upgrading to support concentrate haulage. The nearest "high tension" electrical power lines are located , approximately 10 miles from the proposed millsite.



EXPLANATION

- Private land
- Private land purchased by Noranda

Scale

0 — 2000 — 4000 feet

0 — 600 — 1200 meters

noranda

LYNNE PROJECT

ONEIDA COUNTY WISCONSIN

NORANDA MINERALS WISCONSIN CORP.

ORIGINATOR Noranda

LAND STATUS

DATE	FILE NO	DWG NO
JAN 1992		

SCALE		FIGURE
AS SHOWN		2

1.4 GEOLOGIC SETTING

Since 1968, five massive sulfide deposits of potential economic interest have been discovered in northern Wisconsin: Flambeau (May, 1977), Crandon (May and Schmidt, 1968), Bend (DeMatties, 1990?), Pelican, and Lynne. Numerous other occurrences have been located but are considered too small or low-grade to be of commercial interest. The orebodies are located in the central part of an east-trending belt of Proterozoic volcanic and derivative sedimentary rocks referred to as the "Rhinelander-Ladysmith Greenstone Belt" by explorationists (DeMatties, 1989).

The volcanic belt is approximately 275 km long, up to 150 km wide, and extends across northern Wisconsin into Michigan's Upper Peninsula. The belt's eastern and western projections are obscured by Paleozoic sedimentary rocks, and much of it is overlain by 40 to 150 feet of unconsolidated Pleistocene sediments. Hence, outcrop is sparse, and knowledge of the regional geology depends heavily on exploration drilling and interpretations of regional geophysical surveys.

In a recent synthesis of U-Pb zircon ages and regional geologic data, Sims et al. (1989) concluded that the volcanic rocks were deposited in an oceanic arc terrane between 1860 and 1889 Ma. Cogenetic to post-orogenic granitoids were emplaced from 1870 to 1760 Ma. The volcanic rocks range in composition from basalt to rhyolite, but the belt is essentially bimodal in character: basalt to basaltic andesite and rhyolite are predominant. Because of the poor outcrop and limited data base, there is no clear evidence of volcanic cycles or mafic to felsic transitions on a regional scale.

1.4a Surficial Geology

Bedrock at Lynne is overlain by 30 to 80 feet of unconsolidated Pleistocene to Recent sediments. The drilling of exploration drill holes and water monitoring wells demonstrated that the bedrock surface has low relief and slopes gently to the south in section 15. At an elevation of ~1540 feet just south of the Willow River, the bedrock surface varies from 1510 to 1520 feet in elevation in the vicinity of the orebody. Variations in the thickness of the sedimentary cover are associated with surficial, glacial landforms.

The sediments are essentially quartz-rich sands and gravels in glaciofluvial outwash and ablation till deposited on the peneplained bedrock surface. Several southeast-trending eskers occur in section 15; the most prominent one overlies the orebody and is responsible for 30 to 40 feet of topographic relief. Erosion from the subglacial stream responsible for this esker eroded a shallow depression in the bedrock surface. Exploration drill holes and sumps indicate that the esker is composed medium to coarse sand and pebble to cobble gravel bars. Cobbles and boulders up to 4 feet across tend to be abundant within ten feet of the bedrock surface. Except for organic-rich soils or humus occuring in the upper six inches of the soil profile, clay minerals are essentially absent. The esker merges with ablation tills southeast of the orebody in section 22.

In contrast to the gentle southerly slope of the bedrock surface, the topographic surface slopes gently to the north. A low, sandy ridge projects eastward from the esker and overlies the northern margin of the orebody; two subtle, east-trending ridges interrupt the gentle northerly slope to the river. These ridges mark thicker accumulations of glacial outwash or "mineral soil." The bog pond (lake #15-3) in eastern section 15 originated as a kettle hole.

The flat-lying areas and wetlands surrounding the esker and associated uplands in the vicinity of the orebody are underlain by 35 to 40 feet of sediments. The glaciofluvial deposits consist almost exclusively of fine- to medium-grained, quartz-rich sands, with little silt; cobbles and pebbles are common within several feet of bedrock. Up to five feet of organic soil or peat overlies the sandy sediments.

1.4b Bedrock Geology

Lynne is a stratabound massive sulfide deposit hosted by a gently-dipping, north-facing sequence of volcanic to volcaniclastic and sedimentary rocks. Rhyolite units up to 350 feet thick are interbedded with volcanosedimentary units composed of basaltic andesite to dacite flows, volcaniclastic rocks, and chemical sedimentary rocks. Carbonates probably constituted most of the original volume of the present orebody. Interpretation suggests that the Lynne deposit originated as a carbonate-rich hydrothermal mound which was progressively replaced by sulfides and other secondary minerals. Calc-silicate, magnesium silicate minerals and quartz are most abundant.

A tonalitic intrusion disrupts the orebody and underlies over three-quarters of the property. Drilling and aeromag-netic anomaly interpretation indicates that volcanosedimentary rocks are restricted to a pendant in section 15 and an embayment in the easternmost part of section 22. Folding of the stratigraphy which hosts the orebody into an east-trending syncline probably occurred during emplacement of the tonalite. A major shear zone cuts obliquely across the tonalite contact zone on the northern margin of the pendant.

The rhyolites underlying section 15 are predominantly fragmental rocks of pyroclastic origin. The interbedded volcanosedimentary (VCS) rocks are composed of andesitic to dacitic flows, derivative greywackes and siltstones, carbonate rocks, and chert. The VCS units accumulated during quiescent intervals separating pyroclastic rhyolite eruptions, and incorporate a variable amount of rhyolitic detritus.

For descriptive and mapping purposes, the stratigraphy has been subdivided into five major units. The **Lynne Horizon** is the lowermost VCS unit and hosts most of the sulfide mineralization at Lynne. Carbonate rocks are common in this unit, composing a major proportion of it within 300 to 500 feet of the orebody. The **Lower Rhyolite**, the oldest rock unit, occurs along the down-dip projection of the Lynne Horizon and interfingers with it.

The **Upper Rhyolite** overlies the Lynne Horizon, and is in turn overlain by the **Upper VCS**, which is composed of interbedded greywacke, siltstone, and andesite. The youngest rock unit, the **Hanging Wall (HW) Unit**, is a diverse package of epiclastic to pyroclastic rhyolite tuffs interbedded with andesite, greywacke, siltstone, and some distinctive agglomerates. Sulfide mineralization is most abundant within the Lynne Horizon, but base-metal sulfides, iron sulfides and some magnetite occur along the projection of mineralized lenses in some VCS interbeds within the Upper Rhyolite and in the Upper VCS.

The major units are more fully described in Part 2 of this report.

PART 2 - THE LYNNE DEPOSIT

2.1 VOLCANOSEDIMENTARY STRATIGRAPHY

Lower Rhyolite

The Lower Rhyolite is best known from holes drilled 1000 to 1800 feet north (down-dip) of the orebody. Any remnants of this rhyolite to the south, if it occurred in the vicinity of the orebody, must have been ingested by the tonalite. The Lower Rhyolite is composed of a thick sequence of white rhyolite lapilli tuff which appears to have contained abundant pumice and massive beds of fine, ashy debris. Some intervals of a coarse lapilli tuff composed largely of angular, shattered fragments may have originated as autobrecciated rhyolite flows. Chlorite is widespread to abundant in veinlets and in small, irregular patches.

The Lower Rhyolite is interpreted as a constructional volcanic feature, and may have originated as a flow-dome complex. Facies relationships and reconstruction suggests that the Lynne Horizon infilled a broad topographic low on its margin. The Lynne Rhyolite, a distinctive crystal tuff in the uppermost part of the Lynne Horizon, may have originated as an apron of pyroclastic debris emanating from the Lower Rhyolite and is tentatively correlated with it. In hole LYN91-56, which intersected the Lower Rhyolite ~1300 feet north of the orebody, the Lynne Horizon is only 45 feet thick. In areas where the paleorelief was more severe, or if accumulation of the Lynne

Horizon was insufficient, the Upper Rhyolite might rest directly on top of the Lower Rhyolite.

Hole LYS91-2, drilled on the southeast margin of section 22 as part of the Lynne Strat drill program, intersected over 130 feet of pyritic, muscovite-altered rhyolites which are similar in some respects to both the Lower and Upper Rhyolites. The hole was located on an aeromagnetic trend identified as that of the Lynne Horizon. Narrow intervals of lapilli tuff composed of angular clasts are reminiscent of the distinctive lapilli tuffs in the Lower Rhyolite, and fine-grained muscovite is virtually pervasive in the finer-grained tuffs. The interval also contains narrow, chloritic interbeds of altered andesite or andesitic greywacke. Whole rock geochemistry confirms that the rhyolites in LYS91-2 are pervasively altered, with marked potassium enrichment and sodium depletion: K_2O ranges from 3.23 to 4.35% K_2O, and Na_2O is commonly less than 0.35%. Elevated abundances of 0.07% Zn and 0.06 opt Ag are associated with a 4 ppm Cd anomaly.

Lynne Horizon

The Lynne Horizon has a maximum thickness of ~320 feet. It interfingers with the Lower Rhyolite approximately 1000 feet north of the orebody, where its down-dip projection is largely occupied by the Lower Rhyolite. The horizon ultimately pinches out to only 45 feet in thickness 1500 to 1800 feet north of the orebody. Reconstruction suggests that the Lynne Horizon accumulated to fill a broad topographic low on the margin of the Lower Rhyolite, and at least partially covers it.

The horizon is composed mainly of volcaniclastic and sedimentary rocks interbedded with andesite to dacite flows and less abundant rhyolite tuffs. A distinctive rhyolite crystal tuff, the Lynne Rhyolite, occurs in the uppermost part of the horizon north (down-dip) and east of the orebody. Chemical sedimentary rocks, predominantly carbonate rocks and less abundant, laminated cherts, are common within 500 feet of the orebody and occur up to 1500 feet from it. The volcanic and sedimentary rocks are extensively replaced by sulfides and silicate alteration minerals within the deposit, and are interbedded with sulfide mineralization on its down-dip and eastern projections. Base-metal and iron sulfide minerals are particularly abundant within 400 to 800 feet of the orebody in a chloritic, altered domain which extends for up to 1200? feet down-dip and 2000? feet east of the orebody.

The greywackes and laminated siltstones are largely composed of volcaniclastic or reworked volcanic material, and are interbedded with or grade into crystal to crystal-lithic tuffs. Graded beds in some volcaniclastic sandstones and tuffs demonstrate that the succession is rightside-up, with stratigraphic top to the north.

The Lynne Rhyolite occurs at or near the top of the Lynne Horizon along the northern (down-dip) and eastern projections of the orebody. It is a distinctive rhyolite crystal tuff characterized by abundant blue quartz "eyes" in a brown groundmass. Muscovite and phlogopite or biotite are abundant, with fine-grained muscovite replacing plagioclase. The Lynne Rhyolite consistently has 280-300 ppm Zr, a two-fold geochemical anomaly which is unique to it. Reconstruction suggests that it may constitute an apron of pyroclastic debris enveloping the Lower Rhyolite, and it is tentatively correlated with that unit.

Carbonate rocks and their recrystallized, metasomatic equivalents are also common within the Lynne Horizon. The carbonate rocks and metasomatic equivalents increase dramatically in thickness at the site of the orebody, where the cumulative thickness of carbonate and skarn exceeds 200 feet.

A very fine-grained, magnesian assemblage of secondary minerals extends down-dip and over 2000 feet east of the orebody within the volcaniclastic rocks. Mg-chlorite and phlogopite are the most abundant silicate alteration minerals, followed by tremolite; muscovite is also common within several hundred feet of the orebody. This fine-grained assemblage is very soft and was mapped as talc during much of the geologic logging of drill core. Subsequent work has shown that talc tends to be restricted to the immediate vicinity of the orebody. The "talcose" units peripheral to, and remote from, the deposit are chlorite and phlogopite rich, and have at most only minor amounts of talc. In andesites and dacites, Mg-chlorite, phlogopite, and actinolite are the most common secondary minerals in the magnesian alteration envelope.

The presence of cordierite replacing chlorite in some fine-grained beds signifies that the chloritic assemblage predated intrusion of the tonalite. A distinctive fabric mapped in drill core as "spherulitic" actually denotes the development of muscovite-rich, biotite-poor spots in chloritic sandstones or tuffs. The development of this fabric, and the occurrence of almandine or spessartine(?) garnet in some chloritic beds within 400 feet of the orebody, may also be attributable to contact metamorphism.

Base metal and iron sulfide minerals are particularly abundant within 400 to 800 feet of the orebody in the chloritic alteration envelope described above. Stringers and disseminations of pyrrhotite, sphalerite, pyrite, and minor amounts of galena and chalcopyrite occur in this chloritic domain. Appreciable galena occurs in this assemblage within 500 feet of the orebody, and is associated with gold mineralization in the range 0.04 to 0.07 opt Au. Massive beds or bedded intervals of pyrrhotite and/or sphalerite up to five feet thick were intersected in several holes within 1000? feet of the orebody.

<u>Upper Rhyolite</u>

The rhyolite is normally graded in beds up to tens of feet thick which commonly has a basal lapilli tuff with lithic clasts: center to east of orebody, <5 feet thick; thickens to east from several to 25 feet thick (10600E).

The Upper Rhyolite is composed largely of crystal-lapilli tuff and massive, feldspar-phyric rhyolite. Comparatively narrow interbeds of dacite or andesite and greywacke occur within the unit, and narrow horizons of chert and greywacke occur at its base. The crystal-lapilli tuffs contain embayed quartz and subhedral to broken feldspar crystals, including plagioclase and much less abundant alkali feldspar. Within several hundred feet of the orebody, the matrix and some plagioclase crystals may be replaced by fine-grained muscovite and less abundant chlorite.

The massive rhyolites are aplitic to weakly granophyric, and may have originated as sills or as the massive interiors of flows injected into consanguinous pyroclastic debris. In contrast to the tuffs, the massive rhyolites exhibit little or no alteration. It interfingers with uppermost half of orebody.

Upper Volcanosedimentary (VCS) Unit

This unit which overlies the Upper Rhyolite is composed of interbedded greywacke, laminated siltstone and andesite. It thickens to west and also to the north (hole 64 is >~200 ft. thick)and dissipates at the orebody. It grades into the siliceous, uppermost lens of sulfide mineralization.

Hanging Wall (HW) Unit

The HW Unit is a diverse package of epiclastic to pyroclastic rhyolite tuffs interbedded with andesite, greywacke, siltstone, and some distinctive agglomerates. Sulfide mineralization is most abundant within the Lynne Horizon, but base-metal sulfides, iron sulfides and some magnetite occur along the projection of mineralized lenses in some VCS interbeds within the Upper Rhyolite and in the Upper VCS.

2.2 GEOLOGY OF THE LYNNE DEPOSIT

Lynne is a stratabound massive sulfide deposit hosted by a gently-dipping, north-facing sequence of volcanic to volcaniclastic and sedimentary rocks. The deposit comprises lobes and lenses of disseminated to massive sulfide which coalesce in the central part of the orebody. It is essentially composed of sulfides, carbonates, calcsilicates, magnesium silicate minerals, and quartz. In fact, carbonate rocks probably constituted most of the original volume of the present orebody. Although some thin, altered beds of andesite or greywacke occur within the orebody, the paucity of aluminous minerals such as chlorite confirms that the proportion of volcanic detritus within it is minor. Pervasive alteration and replacement of detrital rocks is indicated by the presence of very fine flakes of Mg-chlorite in some domains of massive sulfide. Talc-rich ores and semi-massive to massive talc (abundant talc) occurs in immediate footwall to orebody and "basal envelope," and in narrow units separating Zn-rich ore from skarn and marble units on the orebody's northern flank.

Talc occurs in substantial amounts "only" in the above areas. Hydrothermal activity during Lynne Horizon time continued through Upper VCS time.

A tonalitic intrusion disrupts the underside of the orebody, incorporating parts of it in the lower levels of the deposit. A promontory in the tonalite culminates in the western part of the deposit (see section 9700E). Sill-like apophyses of tonalite occur in the orebody's footwall near this promontory, and the overlying orebody is flat-lying. Folding of the orebody accompanied emplacement of tonalite.

The orebody is also disrupted to a minor extent by a number of steeply-dipping to subvertical dikes and fault zones which largely postdate the tonalite. The dikes and faults trend east to east-southeast and commonly dip steeply to the south, although some subvertical structures dip to the north. The dikes are bimodal in composition, and are typically porphyritic: plagioclase phenocrysts are common in the rhyolites and in the less abundant basaltic to andesitic dikes. Aplitic to granophyric rhyolite dikes are also present.

2.3 DRILLING

The drilling of hole LYN90-2 in early 1990 confirmed the mineral discovery in hole LYN90-1. All drilling activity was then suspended until the 120 day waiting period confirming the legality of the exploration lease with Oneida County had passed.

Drilling resumed in June 1990, and soon indicated that the mineralized units strike east-southeast to southeast. It was determined that the existing grid with north-trending wing lines would be adequate for completion of the drill program.

Following the initial holes, a drill hole spacing of 100 feet on section was maintained throughout the deposit. A total of 134 diamond drill holes were completed in section 15 to delineate and define the sulfide mineralization. This total includes one hole drilled to the **north**, through the north pit wall on section 10000E, for structural and geotechnical studies.

All drill logs are found in Appendix B.

Appendix B comprises three large volumes:

Vol 1 Drill Logs Holes LYN90-1 to LYN90-44 incl.

Vol 2 Drill Logs Holes LYN90-45 to LYN90-46 incl. and LYN91-47 to LYN91-89 incl.

Vol 3 Drill Logs Holes LYN91-90 to LYN91-134 incl.

Plates which accompany this report are as follows:

Plate 1 is the drill hole location plan map which is at a scale of one inch equals 200 feet.

Plates 2 to 14 are vertical drill hole sections at a scale of one inch equals forty feet.

Plates 15 to 24 are mid-bench geologic level plans at a scale of one inch equals forty feet.

An explanation chart to accompany the geologic sections and level plans is given in Appendix C.

With one exception, transit surveys and down-hole gryoscopic surveys were completed to locate precisely all of the diamond drill holes in the vicinity of the orebody. No gyroscopic survey was done on LYN91-113, which is located northeast of the orebody in the wetland on section 10,600E.

At the request of the Wisconsin Department of Natural Resources, recirculation tanks were installed to collect drill cuttings at any drill sites where groundwater filled the sumps to within several feet of the ground surface. The cuttings were removed and buried in holes on or near the esker.

To overcome potential problems due to the difficult sedimentary cover, the overburden was drilled prior to diamond drilling in all of the holes located in the immediate vicinity of the orebody. Using a tricone bit, drilled continued two to three feet into bedrock where four inch casing was set. Subsequent diamond drilling entailed drilling five to ten feet or more of HQ core followed by NQ core drilling to complete the hole. A total of nine? overburden holes remain accessible, most of which are located within several hundred feet of the proposed pit wall.

None of the drill holes within 2000 feet of the orebody have been permanently abandoned. We anticipate that some of these holes will be accessed for packer tests to help assess groundwater infiltration into the area of the proposed pit.

2.4 LOGGING,SAMPLING AND ASSAY PROCEDURES

Geologic and Geotechnical Logging

Detailed geologic logging routinely involved determination of the sulfide minerals and their abundances, major and minor geologic units, structural criteria, and the presence of minerals such as talc, magnetite, carbonate, garnet, and epidote. Mineral abundances were established over minimum core lengths of two feet. Teresa Harding was principally responsible for the detailed geologic logging and mapping of the deposit, with additional work by John Schaff, Doug Stevens, and Peter Jongewaard. Descriptions of the geologic and geotechnical terms and abbreviations used in the drill hole logs are given with the drill logs in Appendix B.

Prior to sawing and assay sampling, all drill core was photographed and logged to document a range of geotechnical parameters. Craig Schramke completed all the photography and eighty to ninety percent of the geotechnical logging, and supervised the remainder of it. The drilling terms and geotechnical parameters logged include the core run, percent core recovery, Rock Quality Determination (RQD), intact rock strength, fracture frequency, the number of joints or fracture sets, and the orientation of the fracture sets with respect to the core axis. Geotechnical parameters were commonly established over minimum core lengths of two feet and summarized for each run. The surface roughness of the joints or fractures and their alteration characteristics were not recorded during routine geotechnical logging, but were determined during the core orientation studies.

Assay Sampling Procedure

Drill core in the first twelve holes was sampled continuously from the top of each hole through the orebody, continuing five to ten feet into the footwall tonalite. Core recovery typically began within four feet of the bedrock surface. Sampling of the earlier holes established that significant gold or silver may be associated with disseminated sulfides, particularly in magnetite-rich intervals and skarn and "talcose" units marginal to the massive sulfide deposit. Intervals of potential economic significance were readily identified by preliminary geologic logging.

In preparation for sampling, the core was sawed in half. Sampling was done on a geologic basis with a maximum sample interval of five feet, and proceeded 10-15 feet into unmineralized rock adjacent to mineralized intercepts. Half samples of core were submitted for assay. The assays were routinely compared with estimates of sulfide mineral abundances made during geologic logging, but only two assay "busts" were detected.

Confirmation Assays

Duplicate assays were undertaken at various facilities in 1990 to confirm assays of mineralized intercepts in the first 40 holes. Selected pulps and rejects from LYN90-1 and -2 were reassayed at Bondar-Clegg; composited reject samples of the twelve intervals in holes LYN90-1, -2, -3, -6, and -8 selected for metallurgical work were assayed at Lakefield Research; a suite of 188 rejects and 96 pulps originally assayed at Bondar-Clegg were reassayed at Skyline Laboratory. The assays at Skyline included 25 metallic screen assays to help evaluate the grain size distribution of native gold and silver. No systematic program of confirmation assays was initiated on samples taken from holes drilled in 1991.

In general, the duplicate assays confirmed the original assays within acceptable limits of five to 15 percent. The data base is comprised of the original assays, and has not been altered or replaced with any of the confirmation assays discussed below. All assay results are tabulated in Appendix A, a large single binder which accompanies this report.

Reassays at Bondar-Clegg of selected pulps and rejects from LYN90-1 and -2 indicated significantly greater Au concentrations in the majority of samples which had previously reported greater than 0.02 opt Au. Ore-grade Zn, Cu, and Pb assays were within 5 to 15 percent of the assays previously reported. Assays were most difficult to duplicate in the more heterogeneous samples, for example in brecciated ores with disseminated mineralization. Assays at Lakefield Research of the intervals composited for metallurgical tests are generally within five percent of the composited, original assays. The original assays of hole 6 may have been somewhat exaggerated: apparent corrections of six to eight percent for Zn and 10 percent for Pb, and up to 30 percent for Ag and 70 percent for Au in some low-grade intervals, are indicated. Incorporation or confirmation of these findings would not significantly affect the mineral inventory, however.

The confirmation assays at Skyline yielded Zn-Pb assays within 10 percent of the original assays, with the re-assays of Cu generally within 15 percent. Some appreciable discrepancies are associated with "talcose" (chloritic) intervals down-dip of the orebody, where the duplicate assays indicated 25 to 70 percent <u>lower</u> Cu than the original assays in a number of samples. Selected samples from LYN91-73 and -81 are being reassayed at Bondar-Clegg to confirm the copper assays in these holes. Duplicate assays are recommended on a limited suite of samples in the other holes drilled in 1991 in the orebody.

Metallic Screen Assays

Metallic screen gold or silver assays were undertaken on 25 selected samples at Skyline Laboratory, Denver, as part of the confirmation assay work in late 1990. In "talcose" ores containing disseminated to massive sulfides, 14 to 45 percent of the gold occurs in the 100 mesh fraction (see following table), corresponding to a minimum grain size of ~0.15 mm. The percentage tends to be higher in those samples containing $\geq$0.10 opt Au. As the mass of the 100 mesh fraction averages only six to seven percent of the total sample, the disproportionate distribution of gold in the coarse fraction suggests that it may be more amenable to recovery in the "talcose" ores than in the other ores tested at Lakefield.

Other gold-bearing lithologies, specifically Mt-Po skarn and carbonate-rich ores, show little or no evidence of gold concentration in the 100 mesh fraction. Silver also shows little or no evidence of a disproportionate variation in grain size.

2.5 MINEABLE RESERVE CALCULATIONS

Methodology

Under the direction of Dan Niosi, digitized outlines of the mineralized units and the outline of the most recent pit design (Pit Design #2) were used in conjunction with the revised block model to calculate the mineable reserve at Lynne. Two expansions of the pit are required to reach the ultimate bench at 1120 feet elevation, which lies 436 to 475 feet below the surface. The bedrock surface varies from 1510 to 1525 feet in elevation; hence, the 1520 bench is almost entirely comprised of overburden.

The contacts of the semi-massive to massive sulfide mineralization with the enclosing rocks are typically sharp. Where the orebody diffuses into disseminated mineralization, a $16 NSR/ton cut-off was used to establish the mineralized outline. Because appreciable gold or silver is commonly associated with the projections of massive sulfide lenses, some mineralized units project well into disseminated domains.

Tonnage factors and final assays for Zn, Cu, Pb, Ag, and Au were included for 130 drill holes, namely holes LYN90-1 through LYN91-128, LYN91-130, and LYN91-131. Hole LYN91-129, preserved for structural and geotechnical studies, was not assayed.

Results

Mineable reserves were calculated by Dan Niosi using Pit Design #2 and the January 1992 block model. The reserves calculated at cut-offs at $16 NSR/ton are listed below:

Sectional basis:

$16 NSR: 7.67 MT, 8.57 Zn, 0.51 Cu, 1.87 Pb, 2.38 Ag, 0.026 Au

in pit, 5.55 MT, 9.97 Zn, 0.54 Cu, 1.90 Pb, 2.61 Ag, 0.024 Au

between 9.85 - 10.35E,

4.69 M, 10.38 Zn, 0.62 Cu, 1,93 Pb, 2.69 Ag, 0.026 Au

Using the mineable reserve based on the $16 NSR cut-off, a base case mining production schedule was established to feed a 2000 ton/day (tpd), on-site concentrator (Niosi, Feb. 1992). Dan noted that the confined configuration of the mineralization over a limited strike length imposes capacity limitations on mining, and consequently on attaining ore production rates in excess of the 2000 tpd base case. To achieve the 2000 tpd rate, ore must be exposed with high initial stripping ratios which must be sustained during the initial four to five year period. All of the overburden, approximately 6.7 million tons, must be stripped before any rock can be excavated.

Respectfully Submitted,

NORANDA MINING AND EXPLORATION INC.

APPENDIX A
(one large separate volume)

and

APPENDIX B
(three large separate volumes)

accompany this report

APPENDIX C

Explanation - Lynne Geologic Sections

Disseminated to massive sulfide - commonly $\geq$ 25% base -metal sulfides

MS	Massive to semi-massive sulfide (not subdivided; commonly sphalerite rich)
MSch	Siliceous or cherty facies
MSca	Carbonate (dominantly calcareous) facies
MSp	Cherty, pyrrhotite-enriched facies

Other chemical sedimentary rocks and alteration

: : : : :	5% $\leq$ base-metal sulfides $<$ 10%
Chert	Massive to bedded chert
Chert-Di	Chert with diopside-rich laminae
Chert-Po	Chert with pyrrhotite laminae
Tufa	Massive to laminated carbonate rocks, commonly calcareous; includes interlaminated carbonate-volcaniclastic rocks, and some carbonate - altered tuffs
Talc	Talcose sediments and tuffs, including some units composed chiefly of talc
Talc-Po	Talcose sediments with disseminated to bedded pyrrhotite
< > > <	Garnetiferous calc-silicate alteration
> < < >	
BP	Massive to bedded pyrrhotite ($\geq$30% Po)
BPM	Massive to bedded pyrrhotite & magnetite

HOST ROCKS

Tonalite	Tonalitic to quartz dioritic pluton, footwall to the mineralized stratigraphy
pRd, pMd	Feldspar-phyric rhyolite or mafic dikes
VCS	Volcaniclastic and sedimentary rocks - chiefly sandstones, laminated siltstones, and finely spherulitic rhyolitic tuffs
Dacite	Dacitic to andesitic flows,tuffs, and volcaniclastic rocks; some sills

APPENDIX D

SUMMARY OF GEOLOGIC RESERVES BY ZONE

SUMMARY OF GEOLOGIC RESERVES BY ZONE

Cut-off: $16, strict

Minimum Width: none

Calculations: pushed

Area of Influence: Measured

Tonnage Factor: Measured

Includes holes: 1-132

	Tons:	NSV($)	Zn %	Cu %	Pb %	Ag opt	Au opt
ZONE D:	46865	46.20	7.45	0.04	3.22	3.06	0.005
ZONE C:	1595729	56.45	8.02	0.22	2.38	5.07	0.019
ZONE B:	2910193	61.30	10.94	0.34	1.89	1.77	0.020
ZONE A:	998483	68.96	10.37	1.68	1.07	1.10	0.044
TOTAL:	5551270	61.16	9.97	0.54	1.90	2.61	0.024

ZONE D:

Section	%Total	Tons:	NSV($)	Zn %	Cu %	Pb %	Ag opt	Au opt
9400	0.00	0						
9500	0.00	0						
9600	0.00	0						
9700	0.00	0						
9800	0.00	0						
9900	0.11	4967	23.96	4.15	0.08	1.09	0.98	0.006
10000	0.17	8013	118.43	18.59	0.05	8.47	8.56	0.016
10100	0.00	0						
10200	0.00	0						
10300	0.00	0						
10400	0.51	23985	37.61	6.06	0.03	2.94	2.55	0.001
10500	0.21	9900	19.70	3.45	0.03	0.74	0.88	0.005
10600	0.00	0						
Total/avg grade:		46865	46.20	7.45	0.04	3.22	3.06	0.005

ZONE C:

Section	%Total	Tons:	NSV($)	Zn %	Cu %	Pb %	Ag opt	Au opt
9400	0.00	0						
9500	0.01	15605	90.23	18.86	0.22	1.05	1.04	0.001
9600	0.02	35796	63.14	13.26	0.09	0.72	0.75	0.002
9700	0.00	0						
9800	0.09	136516	55.88	8.95	0.11	2.84	2.40	0.031
9900	0.06	95686	62.49	8.89	0.08	1.70	6.29	0.024
10000	0.24	384872	57.13	7.96	0.25	2.27	5.99	0.010
10100	0.20	312323	77.41	10.07	0.36	2.99	7.25	0.047
10200	0.13	200793	66.63	8.99	0.40	3.40	7.20	0.008
10300	0.17	272792	29.86	4.88	0.10	1.61	1.42	0.011
10400	0.06	94336	41.27	4.60	0.07	2.40	6.28	0.008
10500	0.03	41149	16.70	1.83	0.06	0.75	2.74	0.002
10600	0.00	5861	91.79	17.86	0.09	4.33	2.15	0.003
Total/avg grade:		1595729	56.45	8.02	0.22	2.38	5.07	0.019

ZONE B:

Section	%Total	Tons:	NSV($)	Zn %	Cu %	Pb %	Ag opt	Au opt
9400	0.00	0						
9500	0.00	0						
9600	0.02	56803	85.47	17.59	0.11	2.47	0.99	0.002
9700	0.03	77559	72.86	14.49	0.24	1.55	1.18	0.009
9800	0.03	93312	25.25	3.02	0.07	1.83	1.67	0.028
9900	0.14	411365	88.51	17.90	0.39	0.72	0.91	0.015
10000	0.20	575918	76.57	14.62	0.47	2.20	1.12	0.014
10100	0.16	476843	87.90	16.04	0.42	3.33	2.27	0.020
10200	0.21	607931	41.26	5.57	0.42	1.87	2.47	0.031
10300	0.14	404782	29.99	4.00	0.13	1.44	2.26	0.022
10400	0.06	174598	30.77	5.22	0.05	1.01	1.64	0.010
10500	0.01	31082	16.22	2.26	0.04	0.64	1.13	0.013
10600	0.00	0						
Total/avg grade:		2910193	61.30	10.94	0.34	1.89	1.77	0.020

ZONE A:

Section	%Total	Tons:	NSV($)	Zn %	Cu %	Pb %	Ag opt	Au opt
9400	0.00	0						
9500	0.02	22426	50.48	9.80	0.15	1.55	1.13	0.004
9600	0.00	0						
9700	0.00	0						
9800	0.04	40202	39.40	6.53	0.62	0.69	1.73	0.005
9900	0.03	27997	68.19	11.92	0.53	0.96	1.36	0.039
10000	0.12	121573	48.56	8.82	0.70	0.60	0.74	0.011
10100	0.38	377687	85.15	14.18	1.39	1.61	0.90	0.049
10200	0.18	180981	66.86	11.29	0.77	0.93	0.68	0.049
10300	0.23	227617	61.80	4.71	3.88	0.60	1.83	0.061
10400	0.00	0						
10500	0.00	0						
10600	0.00	0						
Total/avg grade:		998483	68.96	10.37	1.68	1.07	1.10	0.044

APPENDIX E

GEOLOGIC BLOCK MODEL

The Lynne open pit design involves eleven mining benches, each 40 feet in height, proceeding to a total depth of approximately 440 feet. The geologic model is consequently based on blocks 40 feet in height with sides 20 feet across. The model was revised on several occasions to improve the interpolation of metal values and tonnage factors in the high grade core of the orebody, which is associated with an inflection in the strike of the deposit. Revisions were also made to account for the flat-lying domain in the western part of the proposed open pit, and for the flaring out of mineralized zones to the west. Both of the latter characteristics are influenced by the tonalite promontory which emerges on the 1200 bench on section 9900E.

In the heart of the orebody where drill hole azimuths intersect the strike of the mineralized units at angles of 45 to 50 degrees, the distance between correlative intercepts on adjacent sections is on the order of 135 feet rather than 100 feet. The greater distance causes the interpolation to be very sensitive to the orientation of the major axis. This problem is not as critical in the eastern and western parts of the deposit, where the drilling azimuths cut the strike at angles of 60 to 72 degrees. The major and intermediate axes of the search ellipsoids were extended to 150 feet to account for the greater strike length, and to account for the wide spacing between intercepts in several of the early holes.

The geologic model was most recently revised in January 1992 with the cooperation of John Boyce and Dan Niosi. As described below, the model describes the deposit in terms of three fundamental orientations. A fourth subdomain accounting for the flat-lying block in the western part of the orebody impinges on the central and western domains.

Domain	Grid Location	Elevation	Strike, Dip	Plunge
East:	10150 -10700E	Inclusive	120 , 32	12 E
Center:	9850 -10150E	Inclusive*	133 , 44	--
West:	9300 - 9850E	Inclusive*	108 , 48	10 ENE
Flat:	9550 - 9940E, 10940N-11050N	1200-1300'	108 , 0	15 ESE

This model was used to calculate the mineable reserves reported in the following section. As anticipated, the revisions improved the interpolation of metal values and tonnage factors in the core of the deposit. For a variety of reasons, some mineralized units in the upper levels of the deposit were not interpolated. Some narrow units were not interpolated because they do not pass through the center point of a block. Modeling of the uppermost levels is also complicated by the flat lying or south facing orientation of units on the top and south flank of the orebody, and the abundance of disseminated mineralization where units narrow or flare out. Inclusion of these units in the mineable reserve would result in an estimated increase of 55,000 to perhaps 85,000 tons.

The drilling of two additional holes on sections 9800E and 10,000E should be considered prior to the completion of a detailed mining plan. On section 10,000E, the mineralized intercepts between holes LYN90-1 and -2 are separated by 130 to 160 feet. An additional hole between these two would better define the limits of mineralization in the uppermost and footwall domains, and would improve interpolation of metal values and tonnage factors in the high-grade core. On section 9,800E, the intercepts between LYN90-4 and -6 are 156 to 172 feet apart. The high grade core of the orebody appears to project between these two holes; an additional hole might identify an appreciable increase in tonnage and grade in that domain.

The tonnage calculated by the block model interpolation is similar to that calculated for the geologic reserve, but the metal grades are appreciably lower. For example, the zinc grade of 9.34% calculated by the block model is six to seven percent lower than the 9.97% Zn calculated on a sectional basis for the geologic reserves. Discrepancies in grade are common between these types of reserve calculations. It is uncertain to what extent the difference in calculated grades at Lynne may be attributable to difficulties in modeling the deposit caused by the oblique nature of the drill intercepts and the consequent separation of 115 to 135 feet between correlative intercepts.

APPENDIX F

DRILL HOLE DATA BASE

Tine Schramke was responsible for the computer entry and management of virtually all of the project data, ensuring that it was accurately exported into the NORMIN-GMS data base. Hardcopy geologic and geotechnical logs were entered on LOTUS spreadsheets and subsequently exported into NORMIN-GMS. The sample intervals, assays, and tonnage factors are also maintained in LOTUS spreadsheets to facilitate data import from assay labs and export into NORMIN-GMS. The drill hole data is therefore available in LOTUS spreadsheets or in GMS or ASCII format.

Down-hole gyroscopic survey data are included in the geologic logs and GMS data base. Gyroscopic surveys were completed on all but one of the diamond drill holes in the vicinity of the orebody. No survey was done on LYN91-113, a barren hole located northeast of the orebody in the wetland on section 10,600E.

All of the drill hole collars, monitoring wells, and other points of survey are presently located with respect to the 1927 North American Datum (NAD27) on the Wisconsin State Plane Coordinate System. The 1983 North American Datum (NAD83) was not available at Lynne until late 1991. We anticipate that the survey points will be re-calculated terms of NAD83 coordinates in the near future; as an interim measure, we have undertaken a transformation to provide approximate NAD83 locations.