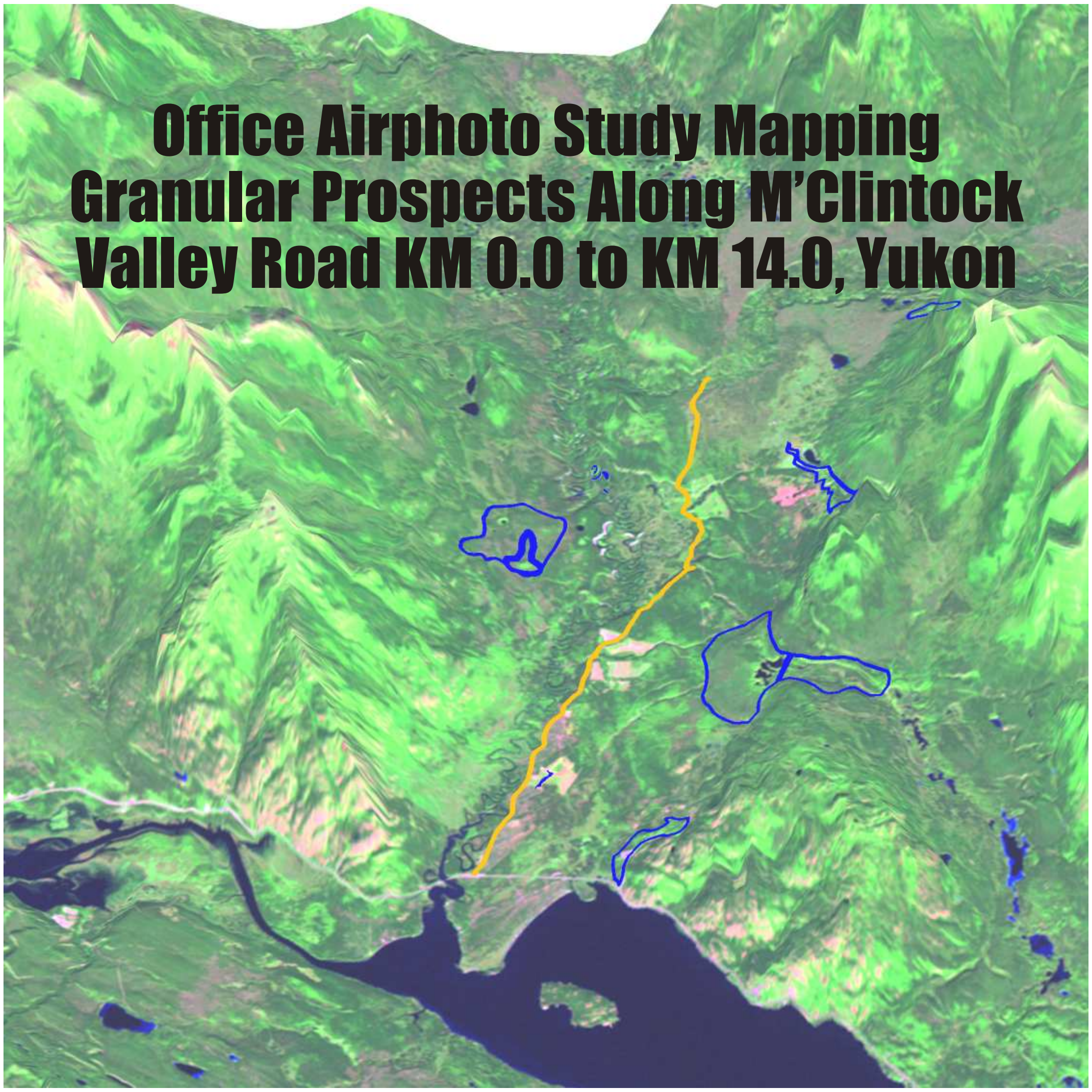
J.D. MOLLARD AND ASSOCIATES LIMITED

Office Airphoto Study Mapping Granular Prospects Along M'Clintock Valley Road KM 0.0 to KM 14.0, Yukon



Prepared for:

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Attention:

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25 March 2008

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ALONG
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M’CLINTOCK VALLEY ROAD
OFFICE AIRPHOTO STUDY

1.0 TERMS OF REFERENCE

1.1 Two copies of a final report presenting the results of the airphoto interpretation services will be submitted to the Engineer by 26 March 2008. The report will include but not be limited to the following:

1. 1:50,000 scale mapping of terrain types indicating potential granular deposit sites.
2. Terrain typing legend.
3. Airphoto photocopies (laser) detailing potential deposit outlines.
4. Narrative evaluations of granular deposit potential and general comments on potential site development problems.

2.0 PURPOSE OF STUDY

The purpose of this study is to delineate prospective granular (sand and gravel) prospect areas that can be explored and used by the Yukon government. We expect the use of such material will be as traffic gravel for the Km 0.0 to Km 14.0 segment of the M’Clintock Valley Road and thus will need to be of sufficient diameter (raw aggregate) such that, after crushing, it will be a suitable product for the purpose at hand. Accordingly, the mapped prospects will need to be explored by backhoe (or similar) equipment in order to find areas within the prospect boundaries that will provide the appropriate product after crushing.

The ancillary purpose of this airphoto study is to stereoscopically examine the airphotos to select prospective haul routes to the above-mentioned road and to suggest areas within the mapped prospect boundaries that may be most suitable for crusher sets. The preliminary selection of such areas may well be affected by the results of your backhoe testing operations at these sites and therefore our comments should be used as suggested set-up areas only if the backhoe results reveal suitable crushing material.

Possible access haul routes to the M’Clintock Road will also be shown. We assume that you will want to use existing “cleared” trails wherever it is practical to do so and our potential haul routes strongly favour utilizing portions or all of these existing trails where it is practical to do so. In nearly all cases, where old trails are going to be used as access clearing of newly grown trees will need to be undertaken. Any new access chosen would simply be a direct (shortest) route to the M'Clintock Valley Road (not shown).

3.0 AIRPHOTOS, MAPS AND SATELLITE IMAGES USED IN STUDY

The following airphotos, NTS maps and satellite images have been used during the course of this study:

- 1:60,000 (approx.) high-level July 25, 1979 airphotos
- 1:15,000 low-level 1993 airphotos
- NTS mapsheet 105D/9 at scale 1:50,000
- Landsat 7 ETM+, acquired August 15, 2001

4.0 NARRATIVE EVALUATION OF GRANULAR PROSPECTS MAPPED FROM 1:60,000 HIGH-LEVEL AIRPHOTOS

Prospect 1:

In 1979 high-level photography there appears to be a quite large area of granular material remaining. This prospect is not visible in the newer 1:15,000 low-level photography as it is outside the corridor this photography covers. If gravel remains here in 2008, it would have good access to the M'Clintock Valley Road using a short access trail south to the Alaska Highway and hence westerly to Km 0.0 of the M'Clintock Valley Road.

Several kettleholes exist in the prospect area at the 1979 date, indicating that granular material remained here in 1979.

This deposit was likely used on the Alaska Highway project but the entire prospect area may not have been tied up at that date of use. Haul distance to Km 0.0 of the M'Clintock Valley Road is only some 2 or 3 miles, probably 2.5 miles (4 km) to be more exact.

Pit workability: this would appear to be a difficult pit at which to set up a crusher swing. The area has a rugged contour on its surface with the chance of encountering bedrock knobs in the pit and during the excavation process. The crusher would need to be set up lower down on the slope surrounding the base of the prospect area and thus a large area may need to be levelled for the crusher and ancillary crusher works. This will of course add to the bid price of those bidding on the crushing job. Accordingly, from this aspect, this does not appear to be a totally desirable crushing site.

We do not have any data about aggregate quality or coarseness on Prospect 1 but since it has been used before one can assume it has sufficient raw aggregate coarseness to meet traffic gravel standards after crushing.

The Prospect 1 area is over a kilometre long in a northeast-southwest direction and perhaps a third of a kilometre wide in a northwest-southeast direction. It has a hummocky surface, as previously noted, with a chance of encountering bedrock during excavation. This possibility may make excavation difficult and likely expensive.

Prospect 1 appears to be an ice-contact kame-terrace type of deposit where deposition occurred during an ice-filled, but waning, M’Clintock Valley glacier. Deposition would be trapped between the melting glacier wall and the up-sloping mountainside. Deposition would in all likelihood be from off the glacier. Because this is an ice-contact type of deposit one would expect variable material within the body of the deposit. Though this aspect may make it more difficult to achieve uniformity of product for traffic gravel production it also presents the probability that various types of material could be processed, if this were desirable and useful.

We would expect several hundred thousand cubic yards of sand and gravel to be present in this deposit. This, of course, is a “guess” at this time and backhoe work would be required for any type of confirmation of this figure.

This deposit would be expected to be “pockety” with respect to the fineness/coarseness aspect, as opposed to any type of horizontal (stratification) uniformity that exists in other types of deposits. Prospect 2 is an example of this latter, more uniform, mode of deposition.

In summary, pit workability appears to be poor.

Prospect 2:

This is a classic fan delta deposited out the large mountainside drainage channel that exists above the Prospect 2 area. Fan deltas are vertically variable, each stratum being of a different coarseness often varying from coarse gravel to fine gravel or sand from layer to layer. But fan deltas tend to be horizontally uniform if one considers each layer individually. Removal of material from such a deposit for crushing, if done by front-end loader working a deep face of gravel, tends to mix these various layers of material and thus obviates any problem that variation in stratum-to-stratum coarseness or fineness may pose.

Fan deltas tend to vary in coarseness from the throat (upstream end) of the delta toward the distal end of the delta. That is, the coarsest material is located at the throat area grading to finest at the distal end. In the case of Prospect 2, this theme suggests the finest material will occur along the western or downstream end of the delta while the coarsest material may be found near the outlet throat (eastern end) of the deposit. The high-level 1 inch = 1 mile airphoto showing Prospect 2 indicates an area, called B, where we feel the coarsest material may be located.

This prospect (deposit) is a large flat-topped area some 2 miles (approx. 3 km) in extent along a north-south axis and approximately 1-km-wide along an east-west axis—a huge potential for volume of pit material.

The workability of this prospect provides interesting options. There is ample area to set up a crushing operation right on top of the deposit. Alternatively, one could set up the crusher at the base of the deposit, along the west edge of it, and take advantage of gravity to feed the crusher. This would be a money saver from the contractor's standpoint and may be reflected in the bid price.

On the other hand, where the crusher is actually set may be dictated by the coarseness of the material the Yukon government wishes to crush and thus may require that the contractor set up his crusher farther to the east (*i.e.,* nearer the delta throat) than closer to the distal end (west end) of the deposit. The coarsest material may, in fact, be located in the channel itself, slightly upstream of Area A of the fan delta proper.

In any event, there are a lot of options, from the pit workability aspect, for this granular prospect as well as for the selection of raw aggregate size for crushing. As such, this makes this prospect a top priority candidate for traffic gravel production.

If it is, in fact, traffic gravel requirements that the Yukon government requires (not clearly stated as such in RFP), then this prospect is a preferred candidate, not only from the availability of quantity and coarseness selection aspects, but also from the fact that it is located quite centrally within the 14-km segment of road it would service.

It's not likely the engineering branch of the Yukon Transportation Services would elect to use more than one pit to gravel this 14-km road segment. Average haul from Prospect 2 would be very good (short) for the entire 14-km section. As well, the opportunity to utilize existing cleared trails as access routes to the M'Clintock Valley Road are better from this pit location than from most of the other granular prospect candidates shown on our maps. (Old trails will all require re-clearing.)

It is interesting to note that the elevation of the surface area of Prospect 2 delta is likely the same as the level of the old glacial lake that existed in the M'Clintock Valley in glacial times—some 10,000 years ago. Sediment settlement in this glacial lake also accounts for the formation of the VP-FFP mapped deposits in the valley proper which are expected to be composed of clay, silt and sand in textures that may vary from area to area across the valley floor. These are so-called glaciolacustrine deposits and are not expected to be of value as a traffic gravel source.

Testing will be needed to support the airphoto-based assessments made for Prospect 2.

Prospect 3:

A very different geologic origin from that of Prospect 2, though it may contain some elements that are similar.

First of all, this deposit appears to be an ice-contact kame-like type of deposit that may have been dumped off the top of the ice sheet as it ablated. It does not appear to have been dumped into water (*i.e.*, deltaic) because it has a hummocky kame-like surface morphology. Again, it is more probably a kame moraine type deposit dumped onto dry land and trapped between the valley glacier wall and an abrupt sloping mountainside.

Kettleholes are present in the prospect indicating that chunks of ice were deposited simultaneously with the granular material and later, post-glacially, melted out to form kettles (depressions) within the body of the prospect.

This is a good-sized granular prospect that is not considered to be a strong candidate for M'Clintock Valley Road requirements because it is located on the wrong side of the M'Clintock River. This means that access to the Road would need to be built across the river floodplain with a bridge crossing or arch culverts installed for the river crossing—an expensive access road. The option, of course would be winter haul over ice.

Because the deposit belongs to the kame family (origin), it is expected to be variable in material size with pockets of sand and/or silt included in the gravel, very similar to raisins in a cake. This aspect of aggregate quality may indeed make it difficult to acquire a uniform crushed gravel product without a lot of mixing at the pit (an extra contractor cost). Whether bidding contractors would recognize this aspect of the crushing operation or not is open to question.

We would rate Prospect 3 as “difficult” with respect to workability as well as with respect to related access problems and resultant extra costs.

Prospect 4:

This is a very unusual type of granular prospect. It is very narrow and some 2 miles long, making it difficult to work. The prospect would need extensive backhoe testing to confirm exactly where gravel quantities are continuous enough and large enough to provide for a good-sized crusher set, before having to move the crusher and exploit an entirely new pit area.

There is absolutely no space on top of this prospect area for a crusher set, meaning the crusher would have to be set up near the bottom (base) of the ridge on sloping terrain that would require leveling before camp set-up.

This prospect, as with Prospects 1 and 3, is a kame terrace type of deposit although the lower northwest portion almost looks like an esker. In any case, the material in Prospect 4, again, appears to have been trapped between the valley glacier wall and the mountainside, classifying it as belonging to the kame terrace family of landforms.

Expect considerable variability of material in Prospect 4 with possible inclusions of sand and silt and perhaps even clay.

To summarize this prospect, I would say pit workability will be difficult and expensive; the material will be difficult to achieve uniformity of product. We see no existing trails where trees have been cleared leading to the M’Clintock Valley Road.

On the optimistic side of this prospect, because the crusher would need to set up at the base of the ridge, there would be the gravity advantage when feeding the crusher. This may be about the only substantial advantage to this prospect with the exception of its relative proximity to the road (short deadhaul distance).

Prospect 5:

This prospect is located on the inside of the bend where the M’Clintock River Valley meets the Michie Creek Valley. These channel systems would operate as a single continuous system in the glacial/postglacial period which is likely how this high level terrace became deposited at this location. Inside-of-valley bends are historically the most likely geomorphic location for gravel terraces to be formed. This deposit was likely deposited early in the glacial ablation time frame, earlier than the deposits of many of the other prospects we have shown.

This terrace will need to be tested to determine its coarseness. It will not be easy to get a backhoe up onto this terrace area as it is located relatively high above the main VP-FFP level.

Again, any crusher set here would need to be positioned near the base of the terrace, probably at the extreme west end of Prospect 5 and on the VP-FFP level. Gravity feed to the crusher could come into play as an advantage at this prospect as well.

Prospect 5 may be stratified with layers of varying quality (coarseness) making up its overall vertical thickness, much like Prospect 2. The strata should all be horizontal and uniform within each individual layer but may vary in coarseness from stratum to stratum.

The main disadvantage of Prospect 5 is its location relative to where the crushed product is needed (again, we assume the product requirement is for relatively coarse crushed traffic gravel either of 3/4-inch or 5/8-inch diameter.)

Haul road to the M’Clintock Road access may involve crossing some organic-covered terrain (O/VP-FFP) to arrive at the north terminal of the road. This could entail some costly haul road construction. We have not shown a preferred access road from Prospect 5 to the M’Clintock Valley Road but expect it would be a direct (shortest) route.

5.0 NARRATIVE EVALUATION OF GRANULAR PROSPECTS MAPPED FROM 1:15,000 LOW-LEVEL AIRPHOTOS

Prospect 1A

Easy to check ridge seems anomalous located on glaciolacustrine plain (that should be flat). May be a ridge of sand and/or gravel that would be at short haul if present. Very doubtful prospect but access is easy so try a couple of backhoe or auger holes. A very poor prospect. Our guess is that this is more likely a sand dune.

Prospect 3A

This prospect is in an area mapped as Kx on the high-level photography. Very doubtful there is any granular material here. Rated as a poor prospect.

Prospect 3B

These small treed terraces on the M'Clintock River may be worth a quick backhoe check because of their proximity to the road. If any gravel is present in these terraces (scrolls), quantities are likely small. Worth a check in any event. Rated doubtful-to-poor prospect. These four (4) small terraces are only a mile (1.6 km) off the M'Clintock Valley Road but if gravel is present the material from two of them would need to be hauled across the M'Clintock River. There may be one old winter trail (WT) that links directly to the M'Clintock Road from these small terraces. The trees would likely have to be cut out again on these trails to make winter travel feasible. If winter haul were used the river would not be a problem (ice crossing). An old trail plus a segment of muskeg haul (no trees) is proposed as a winter haul road east to the M'Clintock Valley road (in the event useable gravel is present here).

Prospects 1A, 3A and 3B are all mapped from the low-level 1:15,000 airphotos and are not regarded as prospects with the same potential as the high-level prospects numbered 1 through 5. But these three prospects should be quickly field-checked and eliminated (or confirmed as potential aggregate sources because of the short haul distance to the M'Clintock Valley Road).

6.0 DESCRIPTION AND FEASIBILITY OF ACCESS TO GRANULAR PROSPECTS 1 TO 5 AND LOW-POTENTIAL PROSPECTS 1A, 3A AND 3B

On Figure 2 we have shown most of the old (existing) trails that, at one time, have been cleared of trees but that now appear to be almost completely overgrown again.

The Department will need to make the decision on whether to try to use old trails (re-clearing required) or to select and establish new access that may be shorter and more direct and allow for higher haul speeds. This second option may be more practical given that use of the old existing trails will require re-clearing in any event. (New access routings are not shown on our maps because options are obvious and multiple.)

The environmental aspect of clearing new haul trails will likely be a consideration.

7.0 ADDITIONAL COMMENTS ON FEASIBILITY OF SITE DEVELOPMENT OF LOW-POTENTIAL PROSPECTS 1A, 3A AND 3B

Comments on site development at prospects 1 to 5 have been covered in the report sections above.

Stereoscopic examination of the scale 1:15,000 airphotos covering the narrow 1-km and 2-km corridors along either side of the M'Clintock Valley Road has not shown any good prospect areas that were not mappable earlier on the high-level 1:60,000 scale airphotos. However, on examination of the 1:15,000 photos there are three small areas that we have mapped as low-potential candidates for aggregate. We recommend that they be checked out. They are 1A, 3A and 3B.

You may decide that for a 14-km-long segment of road it is not practical or economical to open up more than one single pit area. If this is so, then the 1A, 3A and 3B candidates (even if they contain gravel) may not be selected as the single candidate that you would want to use. In this case you may elect to not test these three low-level airphoto prospects. This will be your department's decision to make.

Prospect 1A:

This small ridge (exposed in an old timber-cleared area) is a bit anomalous and can be easily checked out. The ridge may be simply a duned area with no value with respect to traffic gravel. But the ridge is very near the M'Clintock Valley Road and should be eliminated from contention if, in fact, it is sand only and thus proves negative.

Prospect 3A:

Prospect 3A lies on the west side of the M'Clintock River. This is also very doubtful but is anomalous as is prospect 1A, in that it lies on the fringe area of the M'Clintock fossil floodplain and hence it is either a kame (sand and gravel) or a chunk of colluvial debris. It's a poor prospect but, again, if its location has some specific advantage to your department, then it is worth checking out. Rating as a prospect is "poor-to-interesting."

Prospect 3B:

Prospect 3B comprises four (4) small terrace-like areas right on the M'Clintock River. They may be composed of sand only! But these areas are worth checking out because of their location close to the nearby M'Clintock Valley Road. These terrace-like areas appear to be small but would contain sufficient quantities to gravel the 14-km-long segment of road should they prove to be gravel. Their location may present crusher set problems. If so, an option would be to winter haul the raw aggregate "pit-run" to the highway and then stockpile and crush there.

8.0 TESTING OF MAPPED PROSPECTS

Though airphoto interpretation does get one into the right (prospective) areas in search of gravel deposits, one does not know, or is able to predict accurately, what the quality of the mapped material is going to be. Consequently, a field testing program is almost always warranted and required.

Though your own staff will be able to adequately handle this aspect of the study, we do warn our clients about something they may not know about with respect to testing for granular material.

The two most common methods of field investigation of airphoto-mapped sand/gravel prospects are by backhoe and by truck-mounted auger. The flight auger (often truck-mounted) is a good method of establishing that granular material is present at the site as well as outlining the boundary areas of the deposit and its thickness. However, it is NOT a very good way to get an accurate idea of the coarseness of the deposit. This may be very important to you. The flight auger tends to push the coarse fraction of the aggregate off to the sides of the augerhole and bring up only the finer fraction of the aggregate that is present. Accordingly, when the pit is opened, the material in the tested prospect area is almost always coarser than the auger-testing indicated.

In order to get an acceptable expectation of the actual coarseness of the material in the prospect area we highly recommend backhoe testing. You may wish to use a backhoe with an extension to reach to 5 metres or more.

9.0 TERRAIN LEGEND

Legend

Ad	alluvial delta; fine to medium aggregate; sands and gravels; expect uniformity of quality in each stratum but variable from stratum to stratum vertically
At	alluvial terrace; high level; sands and gravels
Af	alluvial fan; silt, sand and gravel; sloping; may overlie till; variable thickness and quality; often high in silts
AFP	active flood plain
Cx	colluvial fan debris (complex); variable materials including bedrock blocks, silt, sand, gravel and till inclusions
K	kettlehole; glacial ice melt-out depressions
Kt	kame terrace; sands and gravels; high-level setting; the location indicates early glacial-related deposition at high lake levels
Kx	kame complex; hummocky; sands and gravels; variable materials
TK	thermokarsted old fossil floodplain; postglacial melt-out of permafrost in clay, silt and sand valley fill
Mx	till moraine blanket over bedrock; includes areas of exposed bedrock; “x” indicates a complex mix of terrain units and materials
T	till moraine; 0- to 15-m thick till blanket over bedrock
VF-FFP	valley fill (VF) that likely operated as a fossil floodplain (FFP) post-glacially; now heavily treed; composed of glaciolacustrine clays, silts and sands; essentially flat surface. Not expected to contain granular material coarse enough for traffic gravel requirements
O	organic; peat locally overlies VF-FFP; expect thin swampy organic layer of approximately 1 m thickness; may also be dunes in this organic-covered area
R	exposed bedrock

TABLE 1
DESCRIPTION OF PROSPECT AREAS
(from 1:80,000 stereoscopic mapping)

PROSPECT NUMBER: 1

Geologic landforms/features: Esker; **kame**; outwash; **ice-contact**; **terrace**; delta; fan

Surface topography: **Ridge**; **hill**, flattish; in drainageway; **sloping**; bench

Source of data: Farm well (SWC or SRC); **stereoscopic airphoto mapping**

COMMENTS: *Open pit in this prospect in the 1979 photography. Likely used on Alaska Highway during/after WWII. Expect variable material raning from coarse to fine; pockety. Government of Yukon will be already aware of this prospect/deposit.*

PROSPECT NUMBER: 2

Geologic landforms/features: Esker; kame; outwash; ice-contact; terrace; **delta**; fan

Surface topography: Ridge; hill, **flattish**; in drainageway; sloping; bench

Source of data: Farm well (SWC or SRC); **stereoscopic airphoto mapping**

COMMENTS: *A huge prospect area. Very large quantity expected. May be coarser as you proceed easterly toward the "throat" of the deposit. May have coarser remnant areas farther east yet into channel proper.*

PROSPECT NUMBER: 3

Geologic landforms/features: Esker; **kame**; outwash; **ice-contact**; terrace; delta; fan

Surface topography: **Ridge**; **hill**, flattish; in drainageway; **sloping**; bench

Source of data: Farm well (SWC or SRC); **stereoscopic airphoto mapping**

COMMENTS: *Kame terrace or kame type of prospect. Variable material expected ranging from coarse to fine; areas of silt or till expected as inclusions in the sand and gravel matrix. May not be a candidate to consider because of its location.*

PROSPECT NUMBER: 4

Geologic landforms/features: Esker; **kame**; outwash; **ice-contact**; **terrace**; delta; fan

Surface topography: **Ridge**; **hill**, flattish; in drainageway; **sloping**; bench

Source of data: Farm well (SWC or SRC); **stereoscopic airphoto mapping**

COMMENTS: *Another ice-contact prospect that is likely of kame terrace origin (trapped between valley glacier and sloping mountainside. Esker-like as one proceeds northwesterly down the deposit. Expected to be difficult to work. Variable material likely ranging from coarse to fine. Crusher set-up may be difficult here.*

PROSPECT NUMBER: 5

Geologic landforms/features: Esker; kame; outwash; ice-contact; **terrace**; delta; fan

Surface topography: Ridge; hill, **flattish**; in drainageway; sloping; **bench**

Source of data: Farm well (SWC or SRC); **stereoscopic airphoto mapping**

COMMENTS: *Very high terrace; deposited when glacial lake occupying M'Clintock Valley was at or near its maximum elevation. Likely difficult to excavate because of its high location. Crusher set location may also difficult. Aggregate quality expected to be good. Near junction of Michie and M'Clintock River valleys.*

PROSPECT NUMBER: 1A

Geologic landforms/features: Esker; kame; outwash; ice-contact; terrace; delta; fan; **unknown**

Surface topography: **Ridge**; hill, flattish; in drainageway; sloping; bench

Source of data: Farm well (SWC or SRC); **stereoscopic airphoto mapping**

COMMENTS: *Very doubtful prospect that is more likely to be sand (perhaps a sand dune). Work a quick field check in case it is coarse enough to be of some value because of its proximity to the M'Clintock Valley Road.*

PROSPECT NUMBER: 3A

Geologic landforms/features: Esker; **kame**; outwash; **ice-contact**; terrace; delta; fan

Surface topography: **Ridge**; **hill**, flattish; in drainageway; **sloping**; bench

Source of data: Farm well (SWC or SRC); **stereoscopic airphoto mapping**

COMMENTS: *A large ridge/hill that may be composed of granular material or it may be just till. Located on wrong side of river but if winter road is used this is not a problem. Contents of this kame-like prospect are doubtful, at best.*

PROSPECT NUMBER: 3B

Geologic landforms/features: Esker; kame; outwash; ice-contact; **terrace**; delta; fan

Surface topography: **Ridge**; hill, **flattish**; **in drainageway**; **sloping**; **bench**

Source of data: Farm well (SWC or SRC); **stereoscopic airphoto mapping**

COMMENTS: *Four (4) small narrow terraces right on the M'Clintock River that may be gravel or sand or silt. This prospect needs considerable testing if the Department is, in fact, interested in this location (close to M'Clintock Valley Road).*

TABLE 2
PROSPECT RATINGS
(in absence of ground reconnaissance and field EM31 geophysical testing)

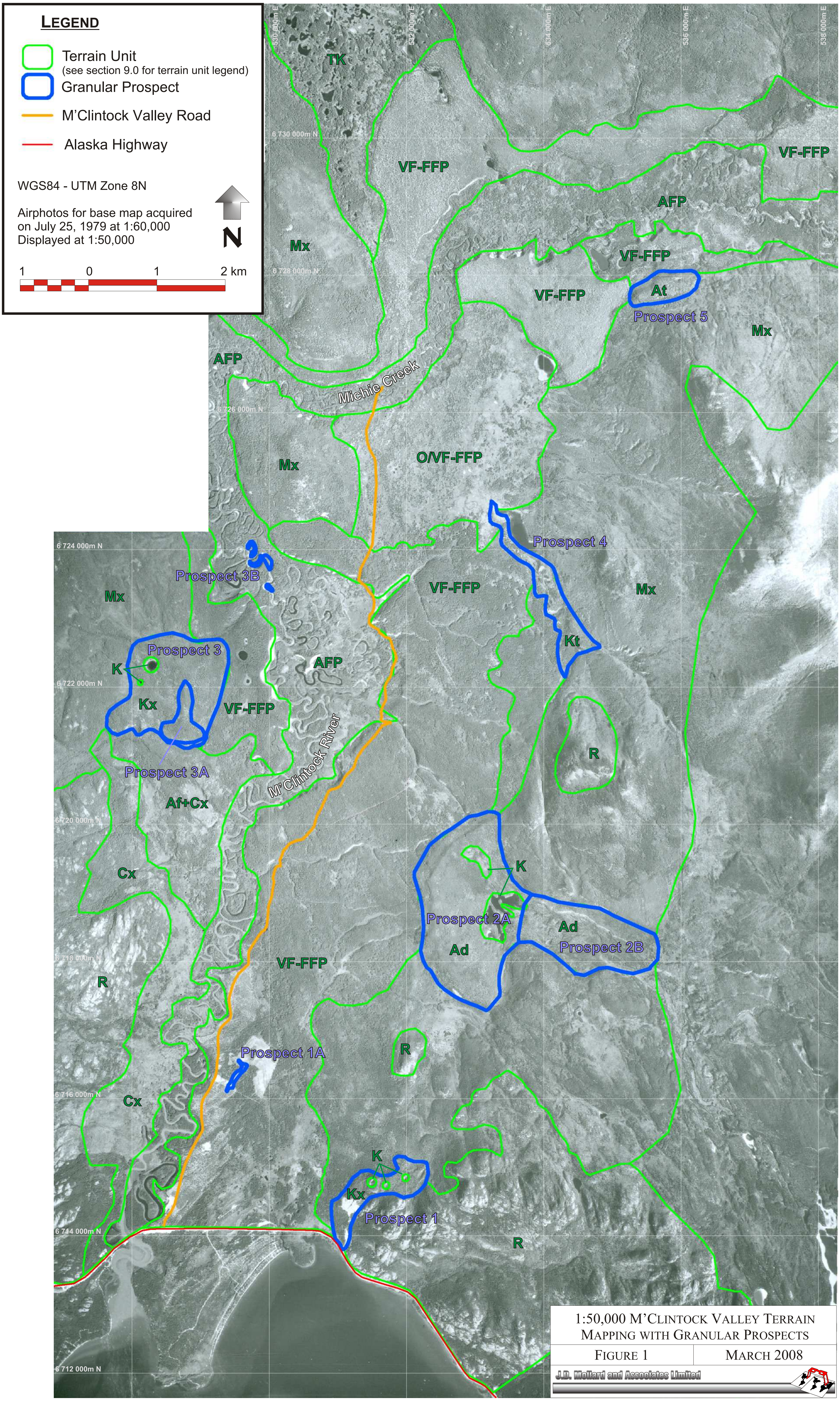
A) Scale 1:80,000 airphoto prospects

Excellent	Fair-Good	Fair	Poor-Fair	Poor	Very Poor	Interesting but Doubtful
	2	1, 3, 4, 5				

B) Scale 1:15,000 airphoto prospects

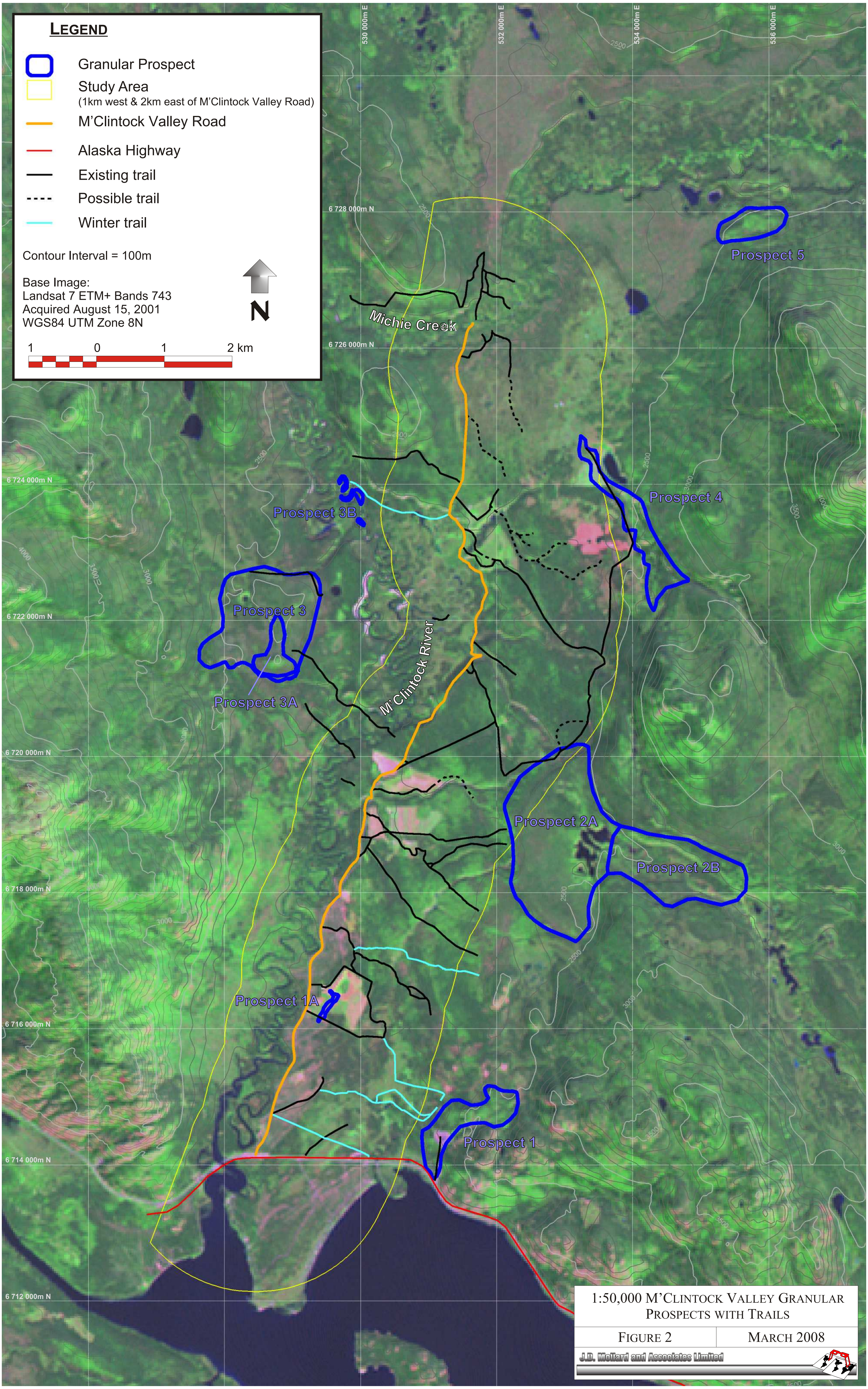
Excellent	Fair-Good	Fair	Poor-Fair	Poor	Very Poor	Interesting but Doubtful
		3A		3B	1A	

Figures



1:50,000 M'CLINTOCK VALLEY TERRAIN MAPPING WITH GRANULAR PROSPECTS

FIGURE 1 | MARCH 2008



1:50,000 M'CLINTOCK VALLEY GRANULAR PROSPECTS WITH TRAILS

FIGURE 2	MARCH 2008

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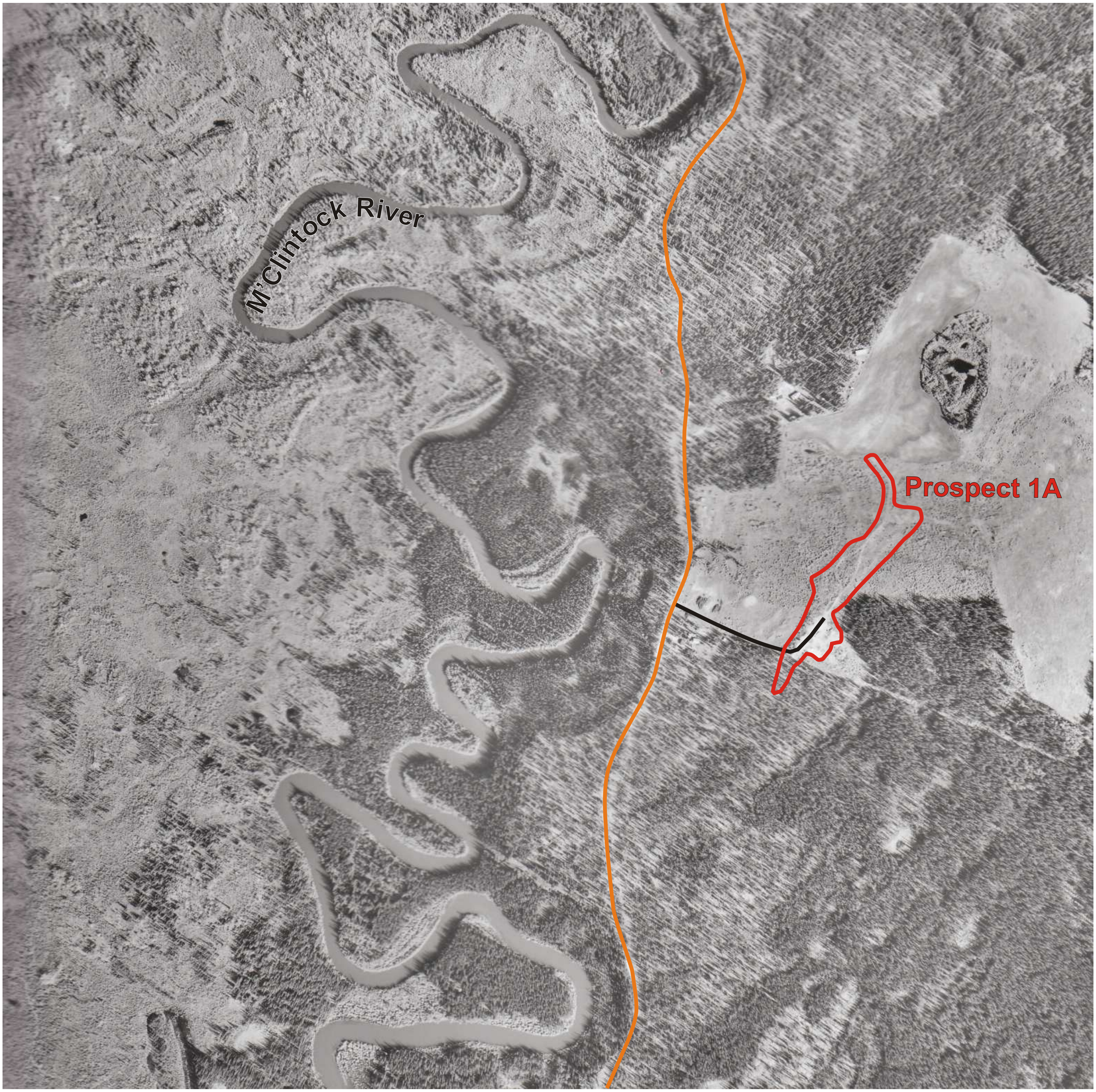

Airphoto date: August 27, 1993
Scale: approximately 1:15,000

LEGEND

- Granular prospect
- M'Clintock Valley Road
- Access to granular prospect

N

1:15,000 AIRPHOTO OF GRANULAR PROSPECT 1A WITH ACCESS ROUTE	
FIGURE 3A	MARCH 2008

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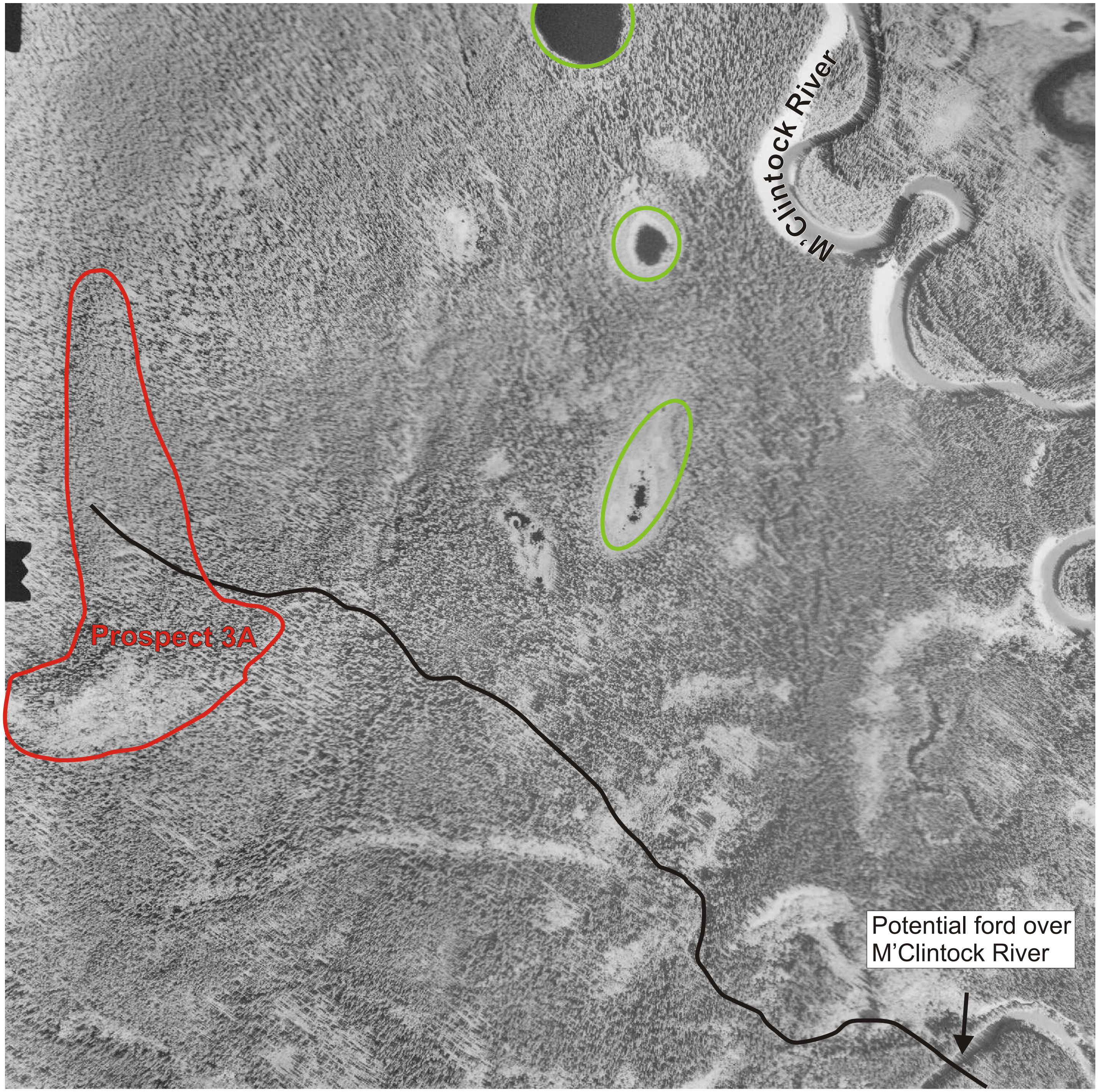
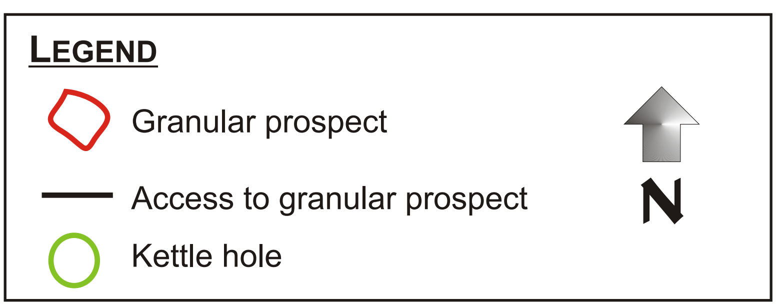
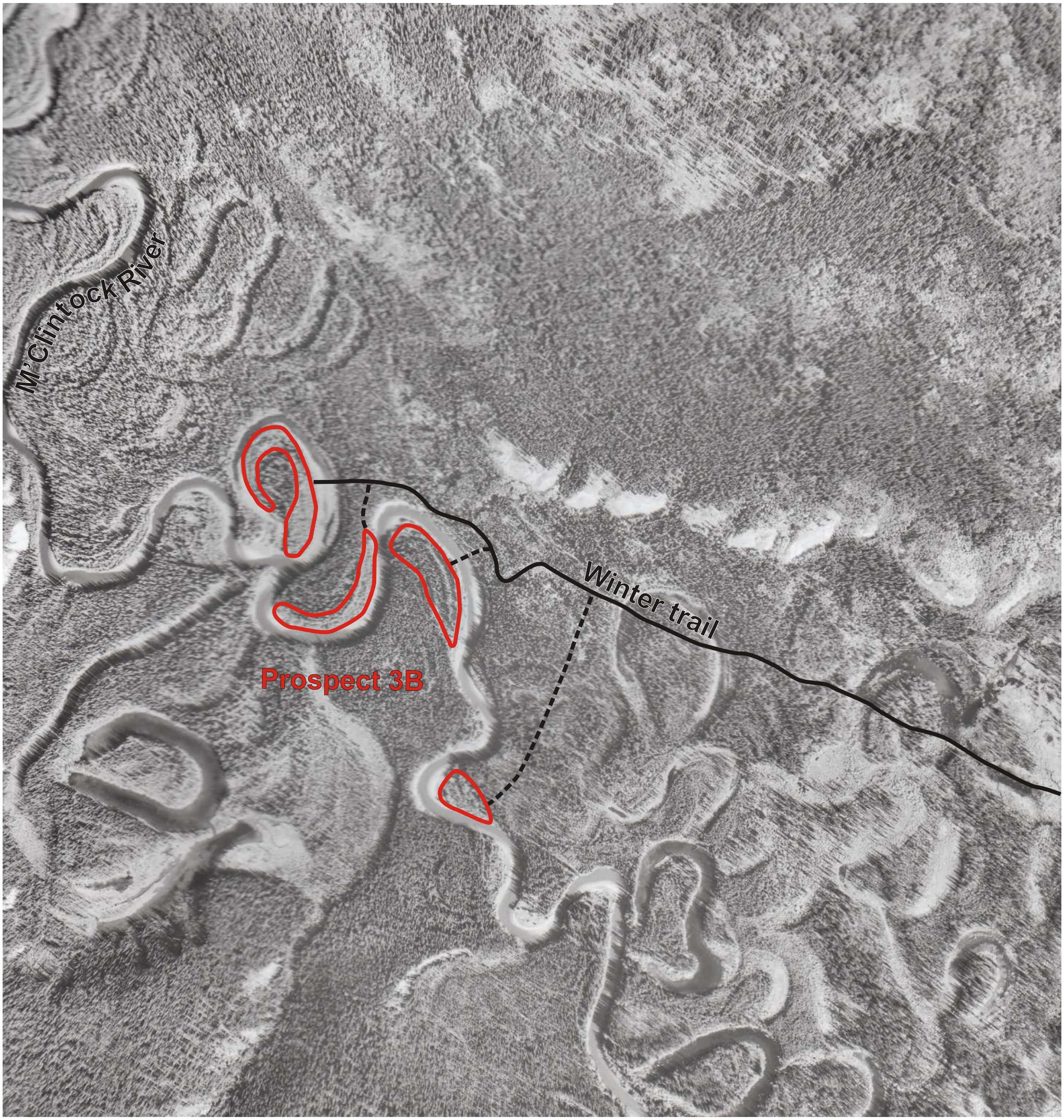


Airphoto date: August 27, 1993
Scale: approximately 1:15,000



1:15,000 AIRPHOTO OF GRANULAR PROSPECT 3A WITH ACCESS ROUTE	
FIGURE 3B	MARCH 2008

J.D. Mollard and Associates Limited



Airphoto date: August 27, 1993
Scale: approximately 1:15,000

LEGEND

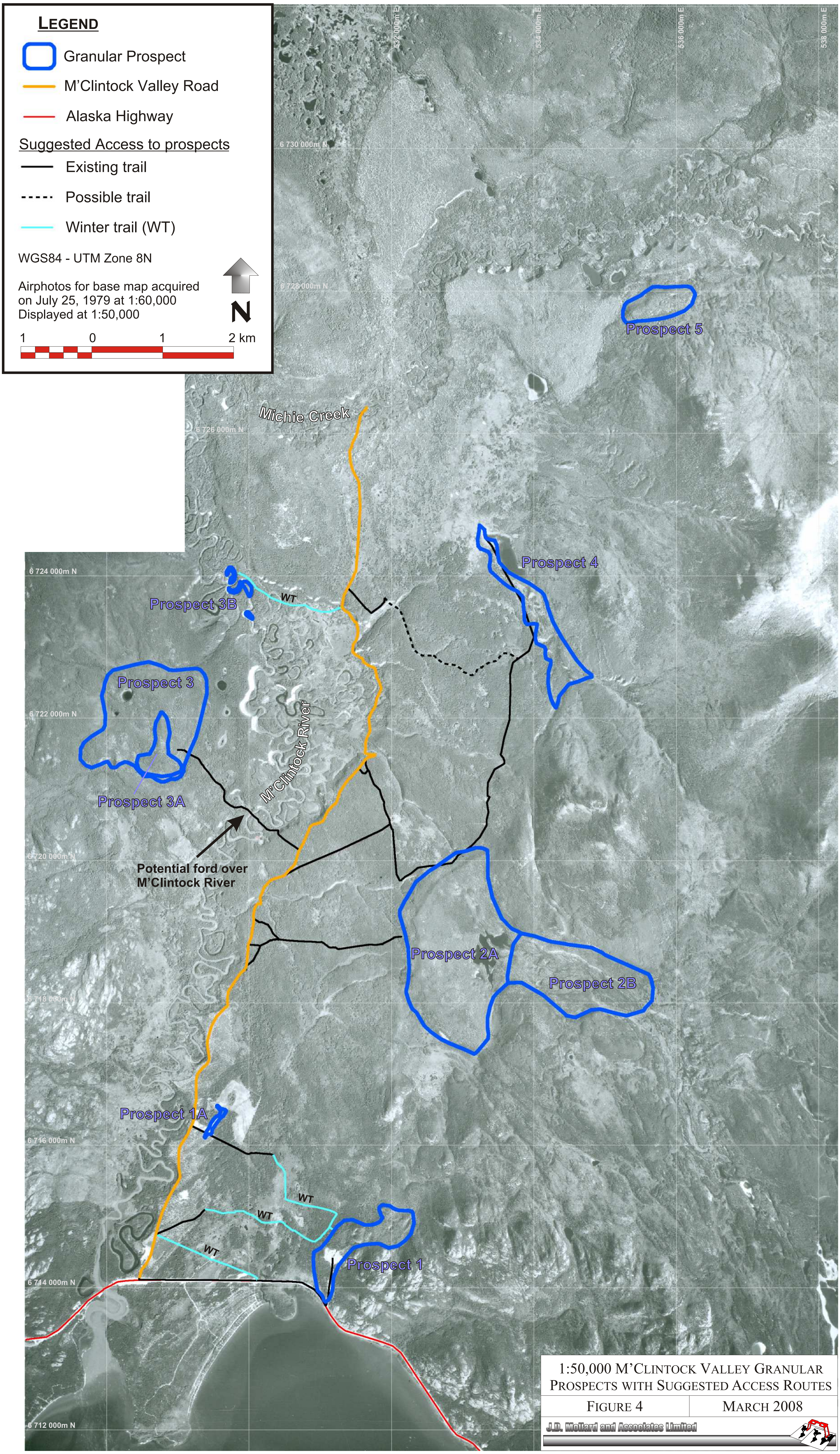
Granular prospect

Access to granular prospect

N

1:15,000 AIRPHOTO OF GRANULAR PROSPECT 3B WITH ACCESS ROUTE	
FIGURE 3C	MARCH 2008

J.D. Mollard and Associates Limited



1:50,000 M'CLINTOCK VALLEY GRANULAR PROSPECTS WITH SUGGESTED ACCESS ROUTES

FIGURE 4	MARCH 2008

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Appendix 1
Glossary of Rating Terms

GLOSSARY OF RATING TERMS

Following is an explanation of a few rating terms used in this report and the context in which they are used:

DEPOSIT A term used in the report to describe a proven source of sand and gravel. Usually the granular material has been proven with respect to quantity and gradation.

PROSPECT A term used to describe a potential source of sand or gravel that has not been tested or proven; the quantity and gradation of material is therefore inferred. Such prospects may be inferred from airphoto study, field reconnaissance observation, well data, or from a combination of these.

VERY POOR PROSPECT The term indicates that, based mainly on stereoscopic airphoto examination, the chance of finding a source of economically developable gravel appears to be very poor.

POOR PROSPECT The term indicates that, based mainly on stereoscopic airphoto examination, the chance of finding a source of economically developable gravel appears to be poor.

FAIR PROSPECT The term indicates that, based mainly on stereoscopic airphoto examination, the chance of finding a source of economically developable gravel appears to be fair.

GOOD PROSPECT The term indicates that, based mainly on stereoscopic airphoto examination, the chance of finding a source of economically developable gravel appears to be good.

EXCELLENT PROSPECT The term indicates that, based mainly on stereoscopic airphoto examination, the chance of finding a source of economically developable gravel appears to be excellent.

Appendix 2
Glossary of Geologic Terms

GEOLOGIC TERMS

(Used in the text of the report and in tables and on maps and mosaics)

AGGREGATE – Crushed rock, slag, gravel, sand, or similar inert material that forms a substantial part of concrete, asphalt, or other mixes and in engineering structures. Aggregate is described as gravel or coarse aggregate if it is retained on a 3/16-inch square mesh screen and as fine sand or fine aggregate if it passes this mesh size

ALLUVIAL TERRACE – Terraces composed of valley-fill sediments that were originally deposited by stream action in former geologic time and later cut through by the stream, leaving the former floodplain surface some distance above the bed of the present stream

BEDROCK – The in-place material older than Quaternary underlying the regolith in depths ranging from zero, where the bedrock is exposed by erosion, to several hundred feet. While commonly taken to imply hard rock, bedrock can actually refer to any lithological characteristic

CONFLUENCE – The junction of streams; the place where streams meet

CREVASSE FILING – A relatively straight ridge of stratified sand and gravel, till or other sediments, formed by the filling of a crevasse in a stagnant glacier which later melted. Crevasse fillings may resemble eskers, but are not generally as winding or branching

DEAD ICE – Stagnant glacier ice, usually covered with earth materials including boulders, especially the relatively thin and stationary marginal zone of a glacier

DEBRIS – Soil and rock materials carried or deposited by any agency of mass-wasting: gravity, ice, wind, water. Also, material resulting from the decay and disintegration of rocks

DELTA – A body of sediment deposited by a stream flowing into the standing water of a lake or the sea

DRIFT – Material of any sort deposited by geological processes in one place after having been removed from another; generally by processes connected with past glaciations but also, less commonly, by other processes, as in sand or snow drift. Glacial drift (usually the term drift is used alone without the adjective) includes all material moved by glaciers and by the action of meltwater streams and glacial lakes associated with them

EOLIAN – Eroded, transported, or deposited by wind action. Also spelled aeolian

ESKER – A long, narrow, commonly sinuous ridge composed of well- and partly-washed ice-contact granular drift—chiefly sand and gravel with minor silt, cobbles, boulders and till inclusions

ESKER DELTA – A chiefly sand and gravel deposit, usually having a level skyline and steep frontal and ice-contact slopes, formed where an esker stream enters a glacial lake

FLOODPLAIN – Flat land bordering a stream and subject to periodic flooding by the stream

FLUVIAL – Pertaining to streams

GLACIAL DRIFT – *See* DRIFT

GLACIAL LAKE – A lake fed predominantly by glacial meltwater or a lake in a depression in part closed by glacial ice

GLACIAL TILL – *See* TILL

GLACIATED – A region that has been worn down by glacial action or covered with glacial drift. Covered by or subjected to the action of a glacier

GRABAN – A block, generally long compared to its width, that has dropped along faults relative to the rocks on either side

GRADATION, GRAIN-SIZE DISTRIBUTION, or SOIL TEXTURE – Proportion of material or each grain size present in a given soil or aggregate, as determined by mechanical analysis

GRADED AGGREGATED – Aggregate containing selected proportions of different particle sizes

GRADED CURVE – A graph showing the grain size of a sample plotted on the horizontal logarithmic scale and the percentages passing (% finer) by weight plotted on the vertical arithmetic scale

GRANULAR – Consisting of or made up of grains, either fine or coarse

HUMMOCKY MORAINE – Moraine characterized by knob-and-kettle topography

IN SITU – In its natural position or place

KAME – A short, irregular ridge, hill, or mound of stratified drift deposited in contact with glacier ice by meltwater. Kames may form in holes and fissures on, in and under stagnant glacier ice as well as, more commonly, at the margin of the glacier on the adjoining deglaciated land surface

KAME MORAINE – Groups or elongated strings of hummocky mounds of irregularly bedded sand and gravel with subordinated till, deposited unevenly from meltwater flowing along or near a moving or decaying stagnant glacier. The inner faces of the kames represent slumped sediments that rested against the ice

KAME TERRRACE – A terrace-like body of stratified silt, sand and gravel along with slumped ablation till laid down by meltwater streams that discharged into the trough between a glacier and its enclosing valley walls

KETTLE or KETTLEHOLE – A sharply outlined closed depression in glacial drift created by the melting out of a mass of underlying ice

LANDFORM – A topographic feature of the earth's surface formed by natural causes and processes

LATERAL MORAINE – An elongate body of drift lying on the surface of a glacier near the valley wall or a moraine deposited at or near the lateral margin of a glacier

MELTWATER – Water resulting from the melting of snow and glacier ice

MORAINE – An accumulation of drift of initial constructional topography, built within a glaciated region, chiefly by the direct action of glacier ice along its margin

MOSAIC – A picture formed by matching together parts of a number of overlapping vertical aerial photographs taken from different camera positions

OUTWASH – Bodies of chiefly gravelly to sandy stratified drift that are washed out and deposited by meltwater streams issuing from and discharging beyond or adjacent to glacier ice

OUTWASH DELTA – A mass of outwash deposited into a body of still water, as a pond, lake or the ocean

OUTWASH PLAIN OR APRON – A body of outwash that forms a broad plain at and beyond the margin or former margin of a shrinking glacier and commonly consisting of a number of coalescing outwash fans

OUTWASH TRAIN – *See* VALLEY TRAIN

OVERBURDEN – Material of any nature—consolidated rock or unconsolidated soil deposits—that overlies useful materials such as sand and grave, coal, ore, et cetera

SANDSTONE – A cemented (with silica, calcite or iron) or compacted detrital sedimentary rock composed predominantly of quartz grains of sand size

SCALE – The ratio of a distance on a map or aerial photograph to a corresponding distance on the ground

SHALE – A fissile fine-grained sedimentary rock containing chiefly clay, which has been consolidated by the weight of the present or past overburden on it

SPILLWAY, GLACIAL – A channel through which glacial-lake water or meltwater flows now or has flowed, usually over a barrier, as glacial drift

STAGNANT ICE – A glacier in which the ice has ceased to move

STEREOSCOPE – An optical instrument for assisting the observer in obtaining stereoscopic vision using two properly oriented and mounted photographs

SURFICIAL – Characteristic of, pertaining to, formed on, situated at, or occurring on the earth's surface; as in surficial geology

TERRACE – A relatively flat, elongate, stair-stepped surface bounded by a steep ascending slope on one side and a steep descending slope on the other. Terraces may be erosional or depositional; cut in rock (rock-cut) or unconsolidated soil materials (valley-fill cut); may be paired or unpaired on opposite sides of a river; and may occur above an existing or former river, lake or ocean bed

TERRACE, KAME – *See* KAME TERRACE

TERRAIN – A loose and general term referring to the physical aspect and characteristics of an area or landscape under observation

TESTHOLE – An exploratory hole to determine subsurface materials and conditions better than can be done at the surface

TILL – Nonsorted and nonstratified relatively loose or compact drift deposited directly by glacier ice. Generally, till is composed of a wide range mixed grain sizes (clay to boulders)

VALLEY TRAIN – The deposit of rock material carried down by a stream originating from the melting ice of a glacier, and thus formed in a similar way to an outwash plain

WATER TABLE – A surface in the saturated zone below ground level along which the hydrostatic pressure is in equilibrium with the atmospheric pressure

WELL-GRADED – Soil material having a continuous distribution of grain sizes from coarsest to finest constituent in such proportions that successively smaller grains fill the pore spaces between the larger grains