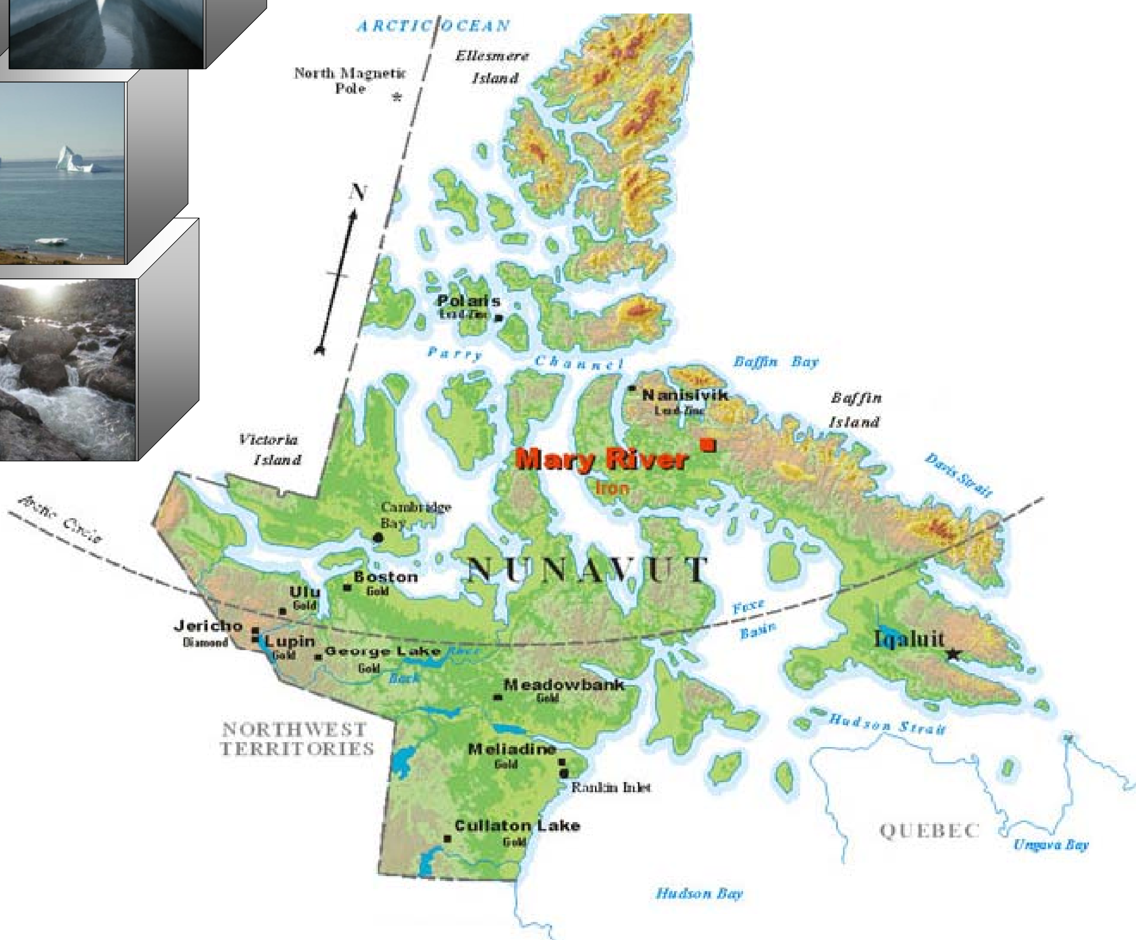
BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

Cockburn Lake –
Nuvuit Coastal Rail Link
Alignment Pre-Feasibility Design

Presented to:

Baffinland Iron Mines Corporation



RECEIVED
2011/11/25
DOCUMENT CONTROL
HATCH
E337697-2000-11-124-0002

CANARAIL

September 2011 ~ 11-030 07

Baffinland Iron Mines

Cockburn Lake – Nuvuit
Coastal Rail Link Alignment

Pre-Feasibility Design

Presented by:

CANARAIL
1140, de Maisonneuve Blvd. West
Suite 1050
Montréal (Québec)
H3A 1M8

Telephone: (514) 985-0930
Fax: (514) 985-0929
E-Mail: inbox@CANARAIL.com

Presented to:

Baffinland Iron Mines
Suite 1016,
120 Adelaide Street west
Toronto (Ontario)
Canada,
M5H 1T1
Telephone: (416) 364 8820

September 2011
11-030 07

TABLE OF CONTENTS

PAGE

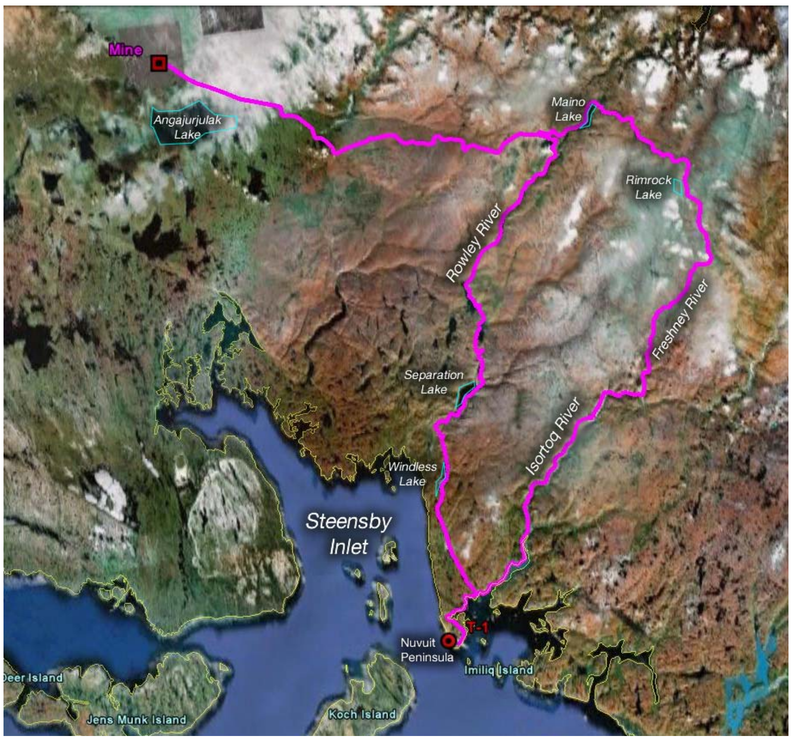
LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

In 2010 CANARAIL carried out a high level evaluation of two routes to a port site identified by QIA on the Nuvuit Peninsula, south of the preferred port site at Steensby. These routes crossed out of the Ravn River watershed to the east of the Mary River mine and then used either the Rowley River valley or the Isortoq River valley to approach the Nuvuit Peninsula.

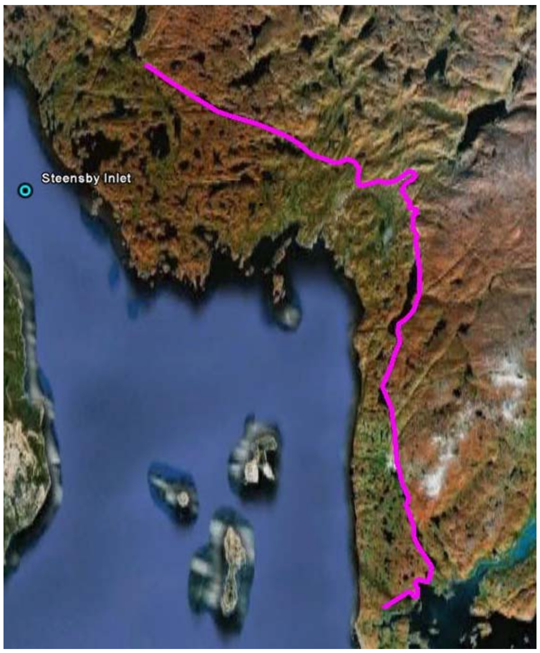
Figure 1.1 – General Location Map of Initial Routes to Nuvuit



These routes were initially evaluated on the basis of elevation data in the National 1:250,000 scale topographic map system. Subsequent visual reconnaissance from the air, carried out the 30th and 31st August, has indicated that the Rowley River route has a major obstacle approximately 6km upstream of Separation Lake, where a combination of topography and geology present a barrier that could require tens of kilometres of tunnelling should the route be used. The longer Isortoq River route also presents more difficulties than originally anticipated in that neither bank of Isortoq Lake presents a continuous practical location for the railway and several short tunnels would be required. In addition, for approximately 10km downstream of Isortoq Lake the river meanders backwards and forwards across the valley floor, requiring many more long span bridges than originally anticipated.

The QIA has requested that a route to the Nuvuit Peninsula from the southern end of the proposed railway alignment to Steensby be evaluated in sufficient detail to confirm, or not, a realistic rail route to the Nuvuit Peninsular. The route proposed for evaluation by the QIA during the workshop held at Mary River, August 31st and September 1st is shown in Figure 1.2 below.

Figure 1.2 – Anticipated Cockburn Lake – Nuvuit Route



To this end QIA has supplied 1:50,000 scale map tiff image files with 10m and 20m contour intervals that cover the proposed route from the southern end of Cockburn Lake to a point about 6km south of Fellside Lake. This information is supplemented by a visual reconnaissance of the area from the air carried out the 31st August, at which time the proposed route was only generally defined and site specific observations were not possible. The objectives of the evaluation include:

- Development of a pre-feasibility level railway alignment between the south end of Cockburn Lake and the south end of Nuvuit Peninsula based on 1:50,000 scale topographic mapping (if available), using the alignment criteria defined in the DFS Design Brief (2007/08).
- Evaluation of the topographic ground line, probable earth work volumes, number and length of bridges and cross-culverts.
- Estimation of the construction cost on the basis of average cost through similar topography developed for the base Steensby route.

- Evaluation of train size, train cycle time, and, fleet size for a railway operation providing transportation for the estimated 18 MT/yr between Mary River and Nuvuit.
- Estimation of the staff and maintenance facilities for the resulting railway.

This report outlines the approaches taken to meet the study objectives and documents the results. Excluded from the scope of this report is any evaluation of the effect of the Cockburn Lake -Nuvuit Coastal rail alignment on:

- The construction schedule.
- Operating costs.
- Capital cost associated with additional surface infrastructure required to support additional operations and maintenance workforce.
- Environmental baseline data collection.
- Environmental effects such as stream diversions, wildlife, land disturbance, marine disturbance at port, etc..
- Archaeological impacts.
- Shipping feasibility including local bathymetry.
- Port feasibility including usable area for stockpiles, lay-down areas, accommodations, maintenance facilities, etc..
- Geotechnical work needed to prove up rail route.
- Construction and operational risk assessment.

It should be noted that any and all of these factors could induce additional cost impacts that are not considered in this study.

2. ALIGNMENT

2.1 ALIGNMENT DESIGN CRITERIA

The pertinent alignment design criteria from the 2008 DFS Design Brief are listed below:

- Axle Loads 32.4 tonnes per axle
- Design Speed 75km/h
- Ruling grade in the loaded direction (ore car) – 0.5%
- Ruling grade in the empty direction (ore car) – 1.5%
- Distance between changes of direction of grade – 1700m
- Desirable minimum radius of curvature – 500m
- Absolute minimum radius of curvature – 250m

The alignment chapter of the DFS Design Brief is attached in Appendix A.

As with the design for the base route the elevation of the line has been designed to minimise cuts in potentially ice rich overburden and provide a minimum 2m cover of sound embankment material when not in cut.

2.2 ALIGNMENT DESIGN APPROACH

The tiff images provided by QIA were compared with the in-house coordinate correct Federal 1:250;000 scale map images and adjusted to scale and assembled to provide a continuous contour map covering the potential routes from Cockburn to Nuvuit. The tiff file provided by QIA of the area south of Fellside Lake contained no contour data and this area was analysed using data from the Federal 1:250,000 map series.

Routing options through the area were explored with the objective of providing a least-cost route between the Cockburn Lake and Nuvuit. Crossing points of the larger rivers were selected with a view to minimising bridge heights, spans and approach embankment heights. Short detours were considered to eliminate the need for long tunnels. For example a 10km tunnel that was originally identified as necessary to bypass the relatively high elevations around the Fellside Lake area was replaced with a route that was approximately 6km longer.

The optimised route was laid out on the topographic maps electronically, allowing specific distances to be read electronically and the corresponding elevations read manually from the map images. This data was then used in CANARAIL's proprietary Graderock model to generate a ground line and develop railway redline or grade line which is presented in Appendix B Conceptual Cockburn Lake – Nuvuit Route Profile. Drawings of the conceptual route at 1:50,000 scale are found in Appendix C.

2.3 ALIGNMENT DESCRIPTION

A direct route to the Rowley River running southeast along the base of the hills that terminate at the south end of Cockburn Lake proved to be challenging. The Steensby route alignment turns eastward around the bluff at the south end of Cockburn Lake at an elevation of 61m. This elevation is controlled by ground elevations and rock fall exposure as much as 3km earlier, and cannot be increased. If the natural valley at the base of the hills is followed, the railway needs to reach an elevation of approximately 185m within 15.5km, at a steady 0.5% grade the railway would only be able to climb to an elevation of 138m. Any solution using this route would require extensive tunnelling (at least 10km) which would involve the installation of facilities to provide forced ventilation of the tunnel(s) during operation.

The conceptual railway alignment between Cockburn Lake and a crossing of the Rowley River Peninsula follows the Steensby route alignment to Kp 131+700. Diverging away from the Steensby route it continues more or less southward for approximately 10km before turning eastward and with a short climb up to an elevation of 70m follows a natural valley towards the Rowley River. In this valley the route skirts two lakes of 1.5km and 10km, a short tunnel (300m) is needed at the eastern end of the longer lake. The side slopes of the hill on the north side of the shorter lake are very steep and geological concerns may eliminate the possibility of benching the track into the hillside (as occurred for tunnel #1 along the Cockburn); there is the possibility that a 1.5km tunnel would be needed.

Exiting the east end of the valley the route drops back down to an elevation of 60m and skirts the lowlands along the lower reaches of the Rowley River avoiding low wet areas and patches of tundra polygons. After approximately 43km the route crosses the Rowley River, (approximately 14km northeast of the river mouth) and immediately turns back towards the south.

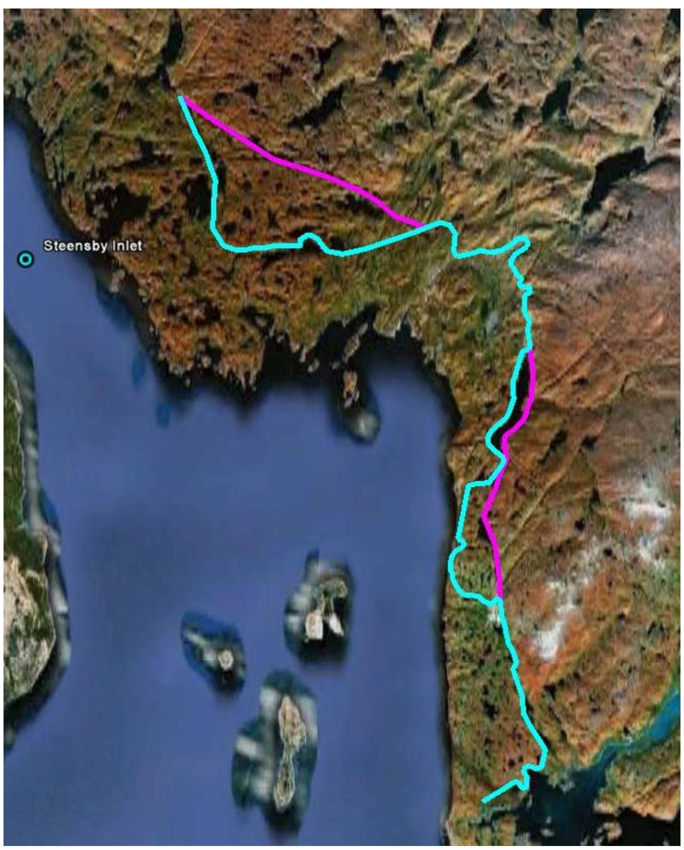
Steep cliffs overlook the ocean for significant stretches of the peninsula to the south, making a coastal route for the railway very problematic. An inland valley, occupied by Windless Lake, Fellside Lake and others, provides a more accessible route south for the railway. The route climbs 30m over a distance of 8km to gain entry to the valley and continues its route south towards Nuvuit following the west bank of Windless Lake.

At the southern end of Windless Lake the route must cross the outlet of the lake at an elevation of approximately 85m and is then faced with a topographic barrier further south in the valley. The valley floor climbs to an elevation of approximately 145m just 5km south of the Windless Lake outlet. At a 0.5% grade the railway would only be able to climb to an elevation of 110m, and although tunnelling would make it possible to avoid the barrier the combination of topography and railway ruling grade is such that the required tunnel would have to be almost 10km long, with all the associated ventilation issues.

The alternative route taken by the railway skirts the foot of the mountains to the south for about 2km and then turns west to climb towards the western side of the range of coastal hills. The route then runs more or less parallel to the coast for about 10km, a 2km stretch of this part of the route may also require tunnelling due to the steepness of the hill side slopes facing the ocean. The route then turns back towards the east and re-enters the inland valley which is then followed until the route can turn to the west and follow the coastal plain to the potential location for port facilities.

The conceptual route is shown in Figure 2.1 below, the conceptual route in pale blue is shown with the anticipated route (pink) for comparison purposes.

Figure 2.1 – Conceptual Cockburn Lake – Nuvuit Route



2.4 BRIDGES AND CULVERTS

The detailed topographic mapping provided by the QIA allows for identification of the larger bridges need for the railway. Comparing the river widths on the cartography against the bridges already designed for the Steensby route provided a benchmark for identifying probable total span requirements for all the large crossings. Eight major crossings were identified and their details are listed in Table 2.1 below. Their locations are indicated on the maps in Appendix C.

Table 2.1 – Bridge Crossing Lengths

Bridge No.	Kilometre Point	Total Span (m)	Identifier
1	4+500	50	
2	4+800	55	
3	18+500	220	
4	29++000	140	
5	43+800	130	Rowley River
6	60+700	120	Windless Lake Inlet
7	69+400	170	Windless Lake Outlet
8	93+400	50	

Based on the design of the drainage structures for the Steensby route it is evident that considerably more drainage structures are needed than watercourses shown on the topographic mapping, and that some of the smaller watercourses that are shown may need bridges. For this prefeasibility level of evaluation the crossing requirements through similar topography that have been designed for the Steensby route, have been used to define average requirements. The section of the Steensby route that runs south of Cockburn Lake as shown in the DEIS Railway plan and Profile drawings has been used as a typical section for this purpose. This is shown in Table 2.2 below.

Table 2.2 – Drainage Structures

	Steensby	Nuvuit
Section Length (km)	18	116
Total Drainage Structures	18	116
Rate of drainage structures per km	1	
Bridges	2	13
Bridges as % of total drainage structures	11%	
Culverts	16	103

The evaluation of the larger river crossings indicates that 8 of the predicted 13 bridges will be multi-span and that the remaining 5 are likely to be single span or two span plate deck girders or through plate girders.

2.5 EARTH WORK VOLUMES

CANARAIL's Graderock model permits a pre-feasibility level estimate of earthwork volumes base on ground elevations at the railway centreline, a standardised cross section geometry and depth to bedrock. In this particular exercise no site specific data has been available relative to depth to bedrock, or indeed whether cuts are in rock outcrops or overburden. Up to 2 years of baseline study and geotechnical drilling would be required to obtain the required information.

A standard 5m depth to bedrock has been applied throughout, with an earth shrinkage factor of 30%, a rock bulking factor of 30% and a volume contingency factor of 20%. The calculated volumes are shown in Table 2.3 below. The full output of the model is presented in Appendix D.

Table 2.3 – Earthwork Volumes

Common Excavation (cu.m.)	Rock Excavation (cu.m.)	Embankment (cu.m.)-
2,754,123	1,349,05	10,041,58

The geometry of the section used to define fill volumes is representative of that currently recommended for the general area of the project, however is does not accurately represent the cross sections that were used for the basis of the design during the DFS. Due to the limited time frame available for this evaluation it has not been possible to model the variation of cross section used in the DFS, consequently absolute volumes of earthwork have not been used as a basis for the development of a construction cost estimate.

3. CONSTRUCTION COSTS

3.1 APPROACH

The most complete resource for railway construction costs for this project is the January 2008 Construction Budget developed for the DFS, this estimate will be made available for inspection, it is not appended to this report due to issues of commercial confidentiality. The 2008 cost estimate grouped the costs into five categories:

- Support including: mobilization, demobilisation, camps, offices, helicopters and access roads
- Reach 1, Kp 0 to Kp 52.5 and the Mary River Terminal; including excavation, fill culverts and bridges
- Reach 2, Kp 52.5 to Kp 95.5; including excavation, fill culverts and bridges
- Reach 3, Kp 95.5 to Kp 143.5 and the Steensby Terminal; including excavation, fill, 2 tunnels, culverts and bridges
- Track; including purchase and preparation of track materials and track laying.

If an allowance of 4km is added to Reach 1 for the Mary River terminal and an allowance of 4.5km is added to Reach 3 to account for the Steensby Terminal the 2008 cost estimate provides the average costs shown in Table 3.1 below.

Table 3.1 – Average Construction Costs Derived from the 2008 Estimate

Sector	Average Cost per km ($000's)	Total Average Cost per km ($000's)
Construction Support	2,063	
Reach 1	3,778	7,443
Reach 2	1,641	5,036
Reach 3 without tunnels	2,012	5,676
Tunnels	79,687	
Trackwork	1,062	

Reach 1 predominantly covers an area comprising high terraces of ice rich sands and gravels requiring extremely high fills at most watercourse crossings. Reaches 2 and 3 are more representative of the conditions encountered in the route to Nuvuit and with the tunnel costs removed from Reach 3 the costs presented for Reaches 2 and 3 are the most applicable.

3.2 ESTIMATE

CANARAIL has assumed an average cost of $5.35M/km for the overall construction of the 116km of Nuvuit route. This results in the costs of the constriction of the railway as shown in Table 3.2 below.

Table 3.2 – Estimated Railway Construction Costs for the Complete Mary River - Nuvuit Route

	Cost in $M
Total Mary River - Steensby Route Railway Construction Cost	**$1,040M**
116km of additional route	621
300m tunnel	24
12 km Reach 3 not built	-68
Siding to ballast quarry (Kp 131.5 to Kp 133)	9
Total Mary River - Nuvuit Railway Construction Cost	**$1,626M**
Potential Additional Tunnels (3.5km)	$279M

It should be noted that these estimates are for direct costs and do not include indirect costs for environmental, engineering, geotechnical, travel, EPCM, permitting, etc.

4. OPERATIONS

The 2008 DFS Operating Plan documents the development of the train cycle times for an optimised train consist to transport 18Mtpa between Mary River and Steensby. The DFS Operating Plan is appended in Appendix E.

4.1 STEENSBY ROUTE TRANSIT TIMES

Due to the extreme temperatures that are typical of the region, the maximum recommended operating speed for the initial years of operation is 60km/h. The railway alignment has been designed to safely permit operating speeds up to 75km/h which will allow the railway to increase its operating speeds as experience is gained in the handling of issues related to very cold temperatures.

Transit times between Steensby Yard and Mary River Terminal were developed on the basis of minimum transit times calculated by computer simulation and allowances for main line meets, and temporary slow orders for both loaded and empty directions. Table 4.1 illustrates estimated transit times for both the loaded and empty directions for trains operating with a maximum track speed of 60 km/h.

Table 4.1 – Steensby Route Main Line Transit Times

	Direction	
	Empty	Loaded
Steensby to Mary River	03:00	03:25

It should be noted that a typographical error has reversed the empty and loaded times in the DFS Operating Plan which is appended in Appendix E, the correct times are shown in Table 4.1.

The operating plan was developed on a dispatching logic that fleeted the three train sets at a minimum operating interval (governed by loading rates at the mine) rather than dispatching them regularly spaced throughout the day. This dispatching philosophy provides for two almost continuous periods of loading and unloading at the mine and port, providing for more efficient use of labour at these facilities, provides significant work windows for track inspection and maintenance without disruption of the train operating pattern, and also minimises the number of main line train meets. Consequently not every train makes a meet, and the maximum number of meets a train will encounter on any trip under normal operations would be one. The transit times include a 10min meet allowance for empty trains (which would take the siding) and a 5 min meet allowance for the loaded train for every trip.

4.2 STEENSBY ROUTE TERMINAL TIMES

Terminal times are a function of loading and unloading times and additional times for terminal activities such as spotting the trains at the loading and unloading points, operating around the loop tracks, crew change, etc. Table 4.2 summarizes the terminal time for each trip.

Table 4.2 – Steensby Terminal Time per Trip

Terminal	Cars	Load/ Unload	Operations Time	Crew Change	Contingency	Total Time
Mary River	110	01:43	00:15	n/a	00:15	**02:13**
Steensby	110	01:50	00:15	00:06	00:15	**02:26**

4.3 STEENSBY ROUTE TRAIN INSPECTION

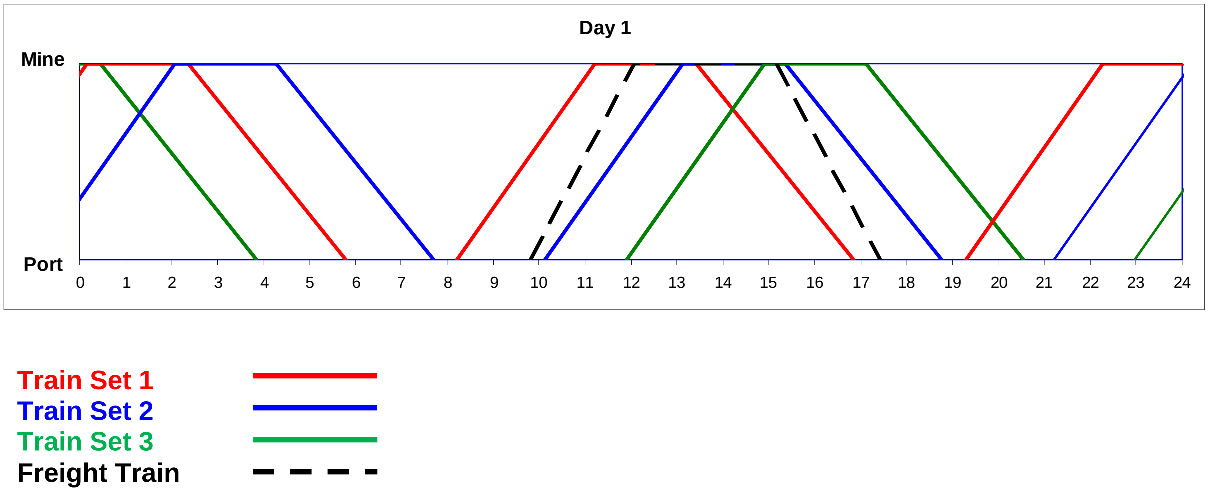
In addition to transit time and terminal times, a time allotment is made for locomotive fuelling and inspection as well as inspection of cars which are scheduled at the Steensby Yard. Since the trains operate in a unit train mode with no switching, locomotive fuelling and full standing train inspections will not be carried out on each trip.

No specific time allowance is allotted for the fuelling, as this will be done in conjunction with the standing inspection at Steensby, and locomotives may also be switched out with refuelled locomotives at the end of the unloading cycle. A full train standing inspections is planned after every 6th trip, approximately every 1,800 km (1,120 miles). The FRA maximum allowed operating distance between such inspections is 2,414 km (1,500 mile). To minimise the staffing requirements for the Rolling Stock Department, the operating plan provides for the full train inspections to occur on a daily basis during the day shift when car shop staff is available to assist in-train repairs. A four-hour minimum is required for fuelling and full train inspection.

4.4 STEENSBY ROUTE CYCLE TIME

A train cycle time of 11 hours and 4 minutes creates a three-day cycle if the allowance for the standing train inspection is increased to 5 hours and 36 minutes. The three-day cycle is comprised of six round trips for the rolling stock locomotive complete fuelling and full trip inspection. The longer time allowance for the standing inspection adds additional buffer time into the schedule to allow late and delayed trains to re enter the train cycle, permits the train standing inspection to occur at the same time every day during the Maintenance Centre’s day shift and allows for a standard schedule to be operated every day.

Figure 4.1 – Steensby Route Typical Daily Timetable



4.5 NUVUIT ROUTE TRANSIT TIMES

When the time allowances for meets are removed from the Steensby Route transit times the loaded train takes 3:20hrs and the empty train takes 2:50 hrs. These times include a 20 minutes allowance or slack to account for temporary slow orders and operational inefficiencies. The dominant factor influencing the 30 minute difference between the transit times is the long 30km climb for the loaded train between the Ravn River and the crest into the Cockburn River watershed, which for a great part is at or very close to the limiting loaded grade.

An examination of the Nuvuit route shows two segments of the route with loaded grades that are long enough to have a significant effect on train speeds; these together total 10km and can reasonably be assumed to add 10minutes to the running time.

The Nuvuit route is 116km long, but diverges from the Steensby route 12 km from Steensby itself: effectively the route will be 104km longer than the Steensby route. The longer Nuvuit route will require a four train set operation and all trains will make at least one main line meet per trip, and some will make two. Allowances for an extra meet and slack will be needed in the timetable to Nuvuit; and at a steady operating speed of 60km/h the Nuvuit route will be 1hr 44min longer. The effective Nuvuit route transit times are shown in Table 4.3 below.

Table 4.3 – Nuvuit Route Main Line Transit Times

	Direction	
	Empty	Loaded
Steensby to Mary River	**03:00**	**03:25**
Additional 104 km @ 60km/h	1:44	1:44
Grade allowance for loaded train		0:10
Additional meet	0:10	0:05
Additional Slack	0:10	0:10
Nuvuit to Mary River	**5:04**	**5:34**

4.6 NUVUIT ROUTE TERMINAL TIMES

The impact of the longer route is such that not only is an additional train set required but each of the train sets needs to have 118 cars rather than the 110 cars required on the Steensby route.

Given the impact of another 960 tonnes added to the train load this raises the concern relative to drawbar forces and drawbar failure at very low temperatures; a case could be made to operate five smaller train sets, however the increase in the robustness of the operational design with respect to cold weather drawbar failure is offset to some extent by the consequent increase in the number of main line train meets. This option will not be addressed in this review.

The loading rate is 6000 tonnes per hour and the unloading rate is one car per minute, the resulting terminal times are shown in Table 4.4 below. It is assumed that a terminal arrangement is possible at the Nuvuit site that does not differ substantially from that anticipated for the Steensby site.

Table 4.4 – Nuvuit Route Terminal Time per Trip

Terminal	Cars	Load/ Unload	Operations Time	Crew Change	Contingency	Total Time
Mary River	118	01:51	00:15	n/a	00:15	02:21
Nuvuit	118	01:58	00:15	00:06	00:15	02:34

4.7 NUVUIT ROUTE TRAIN INSPECTION

A full train standing inspections will be required by the Nuvuit route operation after every 4th trip, approximately every 2,000 km (1,242 miles). The FRA maximum allowed operating distance between such inspections is 2,414 km (1,500 mile). This requires the four train sets to be inspected over a three day period, and will require an increase in the number of car mechanics in the maintenance shop.

4.8 NUVUIT ROUTE CYCLE TIME

A train cycle time of 15 hours and 33 minutes creates a three-day cycle when the allowance for the standing train inspection is 6 hours and 45 minutes. The three-day cycle is comprised of just over 4 round trips for the rolling stock (1.4 trips per day per train set) and a trip inspection. This train cycle does not permit the train standing inspection to occur at the same time every day during the Maintenance Centre's day shift nor does it allow for a standard schedule to be operated every day. However this cycle does provide for a repeatable 3 day cycle, advantageous for managing the train crew roster, and a minimum over all capital investment.

Figure 4.2 – Nuvuit Route Day 1 Timetable

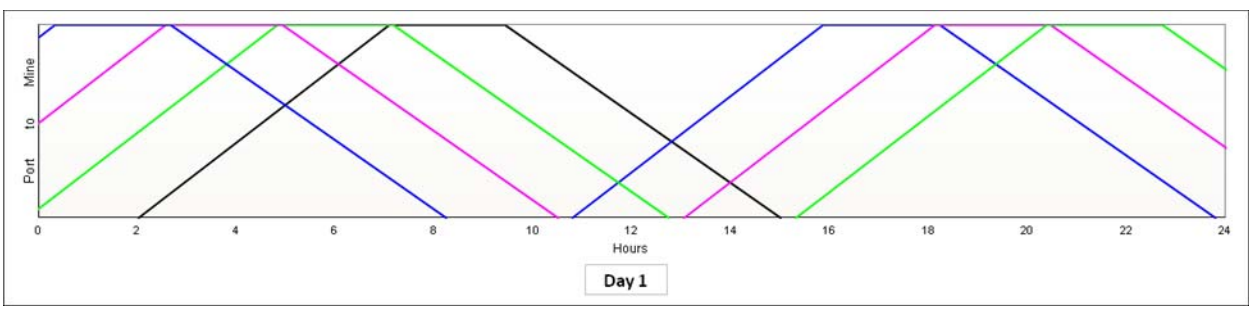


Figure 4.3 – Nuvuit Route Day 2 Timetable

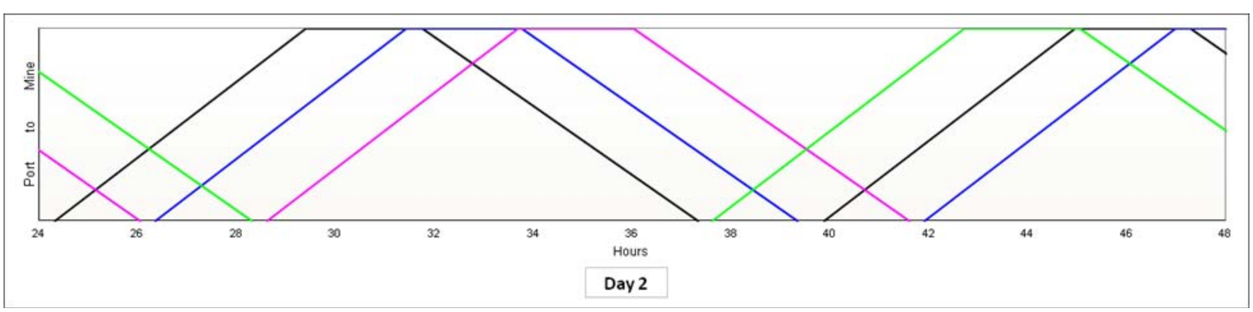
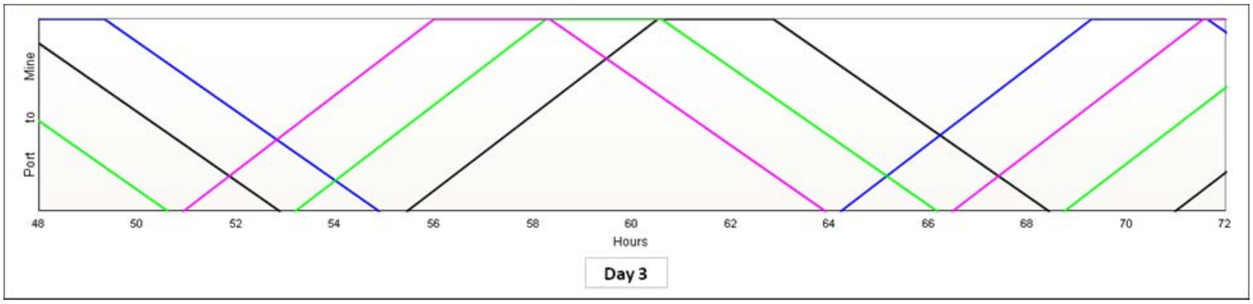


Figure 4.4 – Nuvuit Route Day 3 Timetable



Train Set 1
Train Set 2
Train Set 3
Train Set 4

4.9 NUVUIT MAIN LINE SIDINGS AND TRAIN MEETS

The conceptual operating plan for the Nuvuit line involves a maximum of two main line train meets for any given trip, however this requires major sidings in four different location. As in the operating plan for the Steensby route it is recommended that additional sidings be provided to permit the train cycle to re-establish itself quickly after disruptions have occurred and that six mainline sidings be provided for the Nuvuit route.

4.10 NUVUIT ROUTE FUEL REQUIREMENTS

Mainline fuel requirements for a 110 car train set over the 143km Mary River-Steensby route, per round trip was estimated at approximately 6,000 litres for the 2008 DFS OPEX. One thousand seven hundred and forty (1740) round trips are required to move 18 million tons if axle loads are limited to 30 tonnes (limiting axle loads to 30 tonnes has been recommended for initial operations), on this basis the Steensby route operation uses10.44M litres of fuel for ore train main line operations.

It is reasonable to assume that a 118 car train would use at least 10,400 litres per round trip over the 247km Nuvuit route (247km/143km x 6,000 litres). One thousand six hundred and twenty three (1623) round trips are required to move 18 million tons if axle loads are limited to 30 tonnes, on this basis the Nuvuit route operation would use 16.88M litres of fuel for ore train main line operations. Operations over the Nuvuit route would require 6.44M litres of fuel more than operations over the Steensby route; applying the $0.70/litre fuel cost assumed in the 2008 DFS, this would be an additional operating cost of $4,500,000 per year.

5. ROLLING STOCK AND FLEET SIZE

Based on the conceptual operating plan for the Nuvuit route four 118 car train set are proposed. The resulting fleet requirements are shown in Tables 5.1 and 5.2 below.

Table 5.1 – Nuvuit Route Locomotive Requirements

Requirement	Quantity
Four unit trains with two locomotives/consist	8
Supply train, MoW, extra trains, etc.	2
Spares for periodical inspection and repair	4
Total	**14**

Table 5.2 – Nuvuit Route Ore Car Requirements

Fleet Requirement	Start Up Operation
Ore cars for 4 train sets	456
Spares	52
Percent Availability	90%
Overall Total	**508**

This represents an increase in rolling stock of 3 locomotives (27%) and 141 cars (38%) over the fleet defined for the Steensby route. The 2008 DFS estimated locomotive costs at $3,000,000 each and wagon costs $89,400 each. If the 2008 estimated costs are applied this additional rolling stock will cost $21,600,000, not including shipping expenses.

6. STAFFING AND MAINTENANCE FACILITIES

The increase in route length and fleet size has a direct impact on the size of the staff required to operate the railway.

6.1 TRAIN CREWS

Current Canadian Railway operating rules and practices determine the duty hours for a train crew on mainline operations, the pertinent rules can be summarised as:

- On arrival at home terminal crewmen must have 8 hours rest to be considered "green" or good for next 18 hours duty in 24 hours.
- Maximum duty hours per week, per crewman, are 64 hours in 7 calendar days.

With a total mainline travelling time of 10hrs 38min for each round trip the crew will typically only be available 6 round trips a week. Each of 4 train sets averages 1.4 trips a day, and the fleet in total averages 39.2 round trips a week. Two freight service trains a week also operate so that the total train trips a week is 41.2, which requires 7 crews plus one standby crew. Eight crews need to be available this is not an increase over the requirements for operation over the Steensby route. However with all the mainline train crews service time dedicated to the mainline operation the Nuvuit route operation will require additional crews for all yard operations. Two yard crews will need to be available at all times at both terminals. This will require 11 extra crews.

The total crew requirement implies an increase of 22 persons for accommodation, on site and a total increase in the train crew roster of 44 including the away shift.

6.2 ROLLING STOCK MAINTENANCE BUILDING

The Steensby route maintenance building size should be adequate to handle the increased rolling stock since the practical number of spare locomotives rises from 3 to 4, however the increase in the number of wagons is such that the shop will have to operate with two adequately manned shifts, rather than the a day shift and skeleton night shift, as is required for the Steesby route operation.

6.3 ROLLING STOCK MAINTENANCE PERSONNEL

The Rolling Stock Department will require extra staff to handle the extra rolling stock and will also will also have to be adequately distributed to supply two fully functional shifts The Steensby route department functions with one full day shift and a skeleton shift at night. The rolling stock department manpower requirements for both routes are shown in Table 6.1 below.

Table 6.1 – Rolling Stock Department Manpower

Position	Steensby Route	Nuvuit Route
General Forman	1	1
Foreman	1	2
Locomotive Mechanic	4	5
Locomotive Electrician	1	2
Wagon Mechanic	11	16
Wheel Shop Mechanic	1	2
Helper (Fabrication Shop/Servicing)	1	2
Mine Site Wagon Mechanic	2	5
Total On-Site Rolling Stock Department	22	35
Total Rolling Stock Department with Shift Rotation	**44**	**70**

6.4 MAINTENANCE OF WAY DEPARTMENT (MOW)

The increased length of the Nuvuit route increases the track length beyond the point where it can be adequately and efficiently maintained from the two ends. A second self contained MoW shop will be required, preferably at Mary River which will need a building of approximately 1200 sq.m. with a 10 tonne overhead crane. The additional shop equipment and maintenance vehicles will cost approximately $10,000,000 and the shop itself approximately $5,000,000 based on an average cost of $4,300 per sq. m..

A small satellite MoW facility with an accommodation unit will be required also at or near the midpoint of the line to provide for 14 persons, 9 full time and 5 additional summer staff., this will require fuel tanks, maintenance facilities, power plant, airstrip, sewage treatment plant, potable water, catering, etc. These facilities will incur additional capital costs that would exceed the capital cost of the additional MoW shop and equipment at Mary River and incur additional operating costs for the project.

The MoW department manpower requirements for both routes are shown in Table 6.2 below.

Table 6.2 – MoW Department Manpower

Position	Steensby Route	Nuvuit Route
Railroad Infrastructure Dept		
Superintendent Track & Signal Dept	1	1
Track Foreman	2	3
Equipment Operator	5	8
Trackmen	10	15
Seasonal Trackmen (June - Sept)	5	10
Welder	1	2
Welder Helper	1	2
Signal & Telecoms Supervisor	1	1
Telecom Optic Technician	1	2
Telecom Radio technician	1	2
Telecom Computer Network Administrator	1	2
Signal Technician	2	4
MOW Mechanic	1	1
Total On-Site MoW Dept Personnel	32	53
Total MoW Dept Personnel with Shift Rotation	**64**	**106**

6.5 ANNUAL MANPOWER COSTS

The operation of the Nuvuit route requires an increase in the staff of the railway of 44 train crew, 26 members of the Rolling Stock Department and 42 member of the MoW Department, for a total staff increase of 112, at an average salary of $85,000 per year this is an increase in annual operating costs of $9,500,000 not including additional support staff (cleaning, cooking etc,) and the costs of on-site accommodation and shift rotation transportation costs.

7. CONCLUSION

The railway to Nuvuit is 104km longer than the route to Steenby and will cost between $585M and $864M more than the Steensby route, depending on tunnelling requirements. Based on the information on the steepness of the pertinent side slopes, indicated in the topographical data supplied by the QIA, the possibility that at least one of the two additional tunnels will be required is quite high. This is the construction capital cost of rail only and does not include locomotives, wagons, infrastructure, etc.

The impact of the increased route length on operations is such that an additional train set is required for a total of four, and the train sets themselves need to be lengthened to 118 cars, this results in a fleet size increase of 3 locomotives and 141 car at a cost of $21.6M not including shipping. The additional equipment and increased route length increases the fuel consumption by 6.44M litres of fuel per year for an annual cost increase of $4.5M.

Similarly the increase in rolling stock, train service and route length requires an increase in staff. The Transportation Department personnel increase from 32 to 76. The Rolling Stock department personnel increase from 44 to 70. The Maintenance of Way Department increases from 64 to 106. The total annual salary expense increases by $9.5M.

The biggest impact on maintenance requirements however is the need for a second MoW Shop (preferably at Mary River) which is estimated to increase capital costs by a further $15M. A satellite facility at some midpoint along the railway is also required with accommodation for personnel including fuel tanks, maintenance facilities, power plant, airstrip, sewage treatment plant, potable water, catering, etc. These facilities will also incur additional capital and operating costs for the project.

As indicated at the outset of this report these estimates excluded any evaluation of the effect of the Cockburn Lake -Nuvuit Coastal rail alignment on:

- The construction schedule.
- Operating costs.
- Capital cost associated with additional surface infrastructure required to support additional operations and maintenance workforce.
- Environmental baseline data collection.
- Environmental effects such as stream diversions, wildlife, land disturbance, marine disturbance at port, etc.
- Archaeological impacts.

- Shipping feasibility including local bathymetry.
- Port feasibility including usable area for stockpiles, lay-down areas, accommodations, maintenance facilities, etc.
- Geotechnical work needed to prove up rail route.
- Construction and operational risk assessment.

Any and all of these factors could induce additional cost impacts that are not considered here.

The longer route and increased fleet increases operating risks, in that it increases the number of operating train sets, the operating distance and the number of regular mainline train meets. The Nuvuit route presents a larger terrestrial footprint than the Steensby route, with the associated environmental impacts, both during construction and operation, not least of which will be the impact of the additional mid-rail facility for MoW.

Although a coastal railway route between the southern end of Cockburn Lake and the Nuvuit Peninsula can be identified, it is questionable whether this route is realistic within the constraints of providing an overall project that has sufficient economic robustness to justify the large investment required.

Appendix A

Alignment Chapter of the DFS Railway Design Brief

Chapter 4

Alignment

CHAPTER 4

4. ALIGNMENT

4.1 INTRODUCTION

4.1.1 Objectives

This chapter presents the design criteria used for the alignment of the railway portion of the Baffinland Iron Mines, Mary River Project.

These criteria have been developed to provide optimum operating conditions for a heavy haul mineral railway (low maximum grades and large radius curves) while simultaneously taking the local topography into consideration. They also provide a safe alignment for the operation of trains and, as far as possible, low maintenance costs.

The selected criteria are typical for heavy haul freight railways and are based on a maximum operating speed of 75 km/h for both loaded and unloaded trains. Most of the documented formulas are taken from AREMA; the design standard most commonly applied to North American railroads. They have been converted from the imperial system to the metric system, commonly used in Canada.

The alignment parameters defined in this chapter are horizontal geometry and vertical geometry.

4.2 HORIZONTAL GEOMETRY

4.2.1 Curve Radius

The larger a curve radius, the less the rail experiences wear, therefore curves should be designed with large radii which nevertheless remain easily maintainable with standard maintenance machinery. Where the application of large radii causes significantly increased excavation costs, smaller radii curves should be considered. Hence curves with radii between 500 m and 1,746 m may be used where topography or geotechnical conditions would impose unreasonable construction costs. Where a significant reduction of earthwork volumes can be achieved, curve radii as small as 230 m may be used, however, they shall be used on an exceptional basis only, and with the approval of the engineer.

Table 4.1 – Design Horizontal Curve

Mainline Curvature	Degrees and Minutes	Radius (m)
Target curvature	1˚ to 0˚ 30'	1,746 m to 3,493 m
Minimum curvature	3˚ 30'	≈500 m

Table 4.2 – Exceptional Horizontal Curve

Mainline Curvature *(To be used at the discretion of the Engineer)*	Degrees and Minutes	Radius (m)
Absolute minimum curvature	7˚ 36'	≈230 m

North American railway nomenclature defines the degree of a curve D as that angle which subtends a 100 ft chord (30.48 m). A one degree curve has a radius R of 1,746.40 m or 5,729.65 ft.

4.2.2 Spirals Transition Curves

A spiral or transition curve is used between tangent tracks and curves, or compound curves with different radii. It is used to progressively introduce curvature into the tracks and also acts as a transition between a flat tangent track and the canted track of the curve.

E_b is the balanced cant or superelevation in the curve and is speed specific. At any given speed it represents the cant that is required on the outside rail to ensure that equal loads are transmitted to both rails.

$$E_b = 11.99\, x \frac{V^2}{R}$$ (based on the AREMA simplified formula)

E_b = Balanced cant (super elevation in mm)

V = Velocity of train (km/h)

R = Curve radius (m)

E_u is the unbalanced superelevation; it may be positive or negative and is the difference between the balanced and actual superelevations.

E_a is the actual superelevation with which the track is constructed.

$$E_u = E_b - E_a$$

$$E_u = \text{Unbalanced cant (mm)}$$

$$E_b = \text{Balanced cant (superelevation in mm)}$$

$$E_a = \text{Actual cant (mm)}$$

AREMA defines the required spiral length L as the longest of the following two equations.

$$L = \frac{E_u \, x \, V}{82.66}$$

$$L = 0.744 \text{ x } E_a$$

$$L = \text{Length of spiral (m)}$$

$$V = \text{Velocity of train (km/h)}$$

In the case where the actual super elevation E_a given to the track is the balanced cant E_b:

$$L = 8.92 \text{ x } \frac{V^2}{R}$$

For an operating speed of 75 km/h $L_{75} = \frac{50{,}178}{R}$

The subgrade of a railway is designed to accommodate the spirals that are required in track to allow the full design speed of the project through every spiral. The required subgrade spiral should therefore be the longest spiral required, considering that both the actual cant and the unbalance cant on a spiral may vary between zero and E_b. During construction, spirals are normally staked in 30 m stations; preferably with an even number of stations. The spiral lengths presented in Table 4.3 include these requirements.

Table 4.3 - Design Spiral Lengths

Spiral Length (m)	Range of Curve Radius (m)
300	230 to 249
270	250 to 274
240	275 to 299
210	300 to 399
180	400 to 424

Spiral Length (m)	Range of Curve Radius (m)
150	425 to 549
120	550 to 699
90	700 to 1,099
60	1,100 to 2,099
30	2,100 and greater

In areas where topography and other physical constraints which imply significant costs are limiting factors to the design of the alignment, the design may consider the use of a minimum spiral length based on the assumption that the track is superelevated and maintained to the cant required.

Since spiral length L is defined as the longest of:

$$L = \frac{E_u \text{ x } V}{82.66}$$

$$L = 0.744 \text{ x } E_a$$

The minimum possible spiral length is achieved when both equations give the same value for L. hence when $V = 75 \text{ km/h}$

$$L = 0.91 \text{ x } E_u = 0.744 \text{ x } E_a$$

Since $E_u = E_b - E_a$ the minimum spiral length at 75 km/h requires that $E_{a75} = 55\% E_{b75}$ and $E_{u75} = 45\% \text{ x } E_{b75}$.

When these criteria are combined with the normal requirements for cant, relative to curve radius and speed, the minimum spiral lengths shown in Table 4.4 are developed, based on 30 m stations.

Table 4.4 - Minimum Spiral Lengths

Spiral Length (m)	Range of Curve Radius (m)
150	230 to 274
120	275 to 324
90	325 to 474
60	475 to 949
30	950 and greater

4.2.3 Minimal Tangent Length

A minimum tangent is required between the spirals of a reverse curve. This is determined by the length of the longest car, usually the locomotive, to ensure that bogies common to one vehicle are not exposed to cant in opposite directions.

4.3 VERTICAL GEOMETRY

4.3.1 Curve Lengths

A vertical curve is introduced between gradients in the longitudinal profile.

The superseded 1962 AREMA formulae for the definition of these vertical curves are the preferred criteria since the resulting vertical curves may be introduced into the vertical profile without consideration of the concurrent horizontal geometry. Using these criteria the minimum length of a vertical curve is:

Equation (I) $$L = \frac{D}{R}$$

$L = \text{Length of vertical curve in 30 m stations}$

$D = \text{Algebraic difference of rates of grade expressed as a percentage}$

$R = \text{Rate of change per station}$

The minimum allowable rates of change per station R are:

- 0.1% per station on summits, and
- 0.05% on sags.

In cases where the geometry of the vertical profile does not permit the use of the long vertical curves generated by the above criteria; the vertical curves prescribed by the current AREMA standards may be used. The minimum length of vertical curve is then defined by the equation

Equation (II) $$L = \frac{D \text{ x } V^2}{A \text{ x } K}$$

$L = \text{Length of vertical curve (m)}$

$D = \text{Absolute value of the difference in rates of grades expressed as a decimal}$

$A = \text{Permissible vertical acceleration } (0.03048 \text{ m/s}^2)$

$K = 12.96 \text{ factor}$

When the shorter vertical curve generated by Equation (II) is used, due consideration of the concurrent horizontal geometry must be taken. If at all possible the vertical curve should not coincide with a horizontal curve. However, if this cannot be avoided, the vertical curve shall be fully contained in the circular portion of the horizontal curve and no portion of the vertical curve shall overlap the horizontal spirals.

In all cases the vertical curve obtained should be rounded up to an even number of 30 m stations to arrive at the design length of the vertical curve. The lengths of vertical curve presented in Table 4.5 include these requirements.

Table 4.5 - Design Vertical Curves

Algebraic Difference in Grades	Unrestricted		Restricted
	Summits or Crests	Sags or Valleys	Summits and Sags
	Length of vertical curve (m)	Length of vertical curve (m)	Length of vertical curve (m)
2.0	600	1200	300
1.9	600	1140	300
1.8	540	1080	300
1.7	540	1020	300
1.6	480	960	240
1.5	480	900	240
1.4	420	840	240
1.3	420	780	240
1.2	360	720	180
1.1	360	660	180
1.0	300	600	180
0.9	300	540	180
0.8	240	480	120
0.7	240	420	120
0.6	180	360	120
0.5	180	300	120
0.4	120	240	60
0.3	120	180	60
0.2	60	120	60
0.1	60	60	60

Equation (I) and (II) give the minimum length of curve that can be used, but where it is possible to have a longer curve which follows the natural topography, this curve should be used.

4.3.2 Gradients

The maximum gradient selected for the design of a railway line has a direct impact on the composition of freight trains operating over the line, with steeper grades requiring shorter trains or additional locomotives.

It is important to recognize the potential of the locomotive to pull or push both loaded and empty cars up a grade. Typically, a loaded unit train weighs three times an empty one, which is reflected in the ratio of the maximum gradients in the loaded and empty directions

Experience has shown that a maximum grade of 0.5% loaded and 1.5% unloaded, permits an optimal operation for heavy haul operations.

Table 4.6 - Design Gradients

Characteristic	Loaded Direction	Empty Direction
Maximum main line gradient	0.5 %	1.5 %
Passing tracks and stations	0 to 0.3 %	0 to 0.3 %
Yard tracks	0 to 0.15 %	0 to 0.15 %
Loading and unloading facilities	0 to 0.1 %	0 to 0.1 %

Chapter 3, Operations, examines the impact of these grades on train size.

4.3.3 Exceptional Grades

In certain circumstances short sections of exceptional grade are permitted, if their application provides a significant reduction in construction cost. Their placement requires a careful evaluation of the operational impacts. The use of exceptional grades shall be subject to specific studies including the simulation of the operation with a train performance calculator.

4.3.4 Grade Directional Changes

The minimum length between changes of direction of grade shall be long enough to contain a full train length so that at no time is any train dealing with more than one change in direction of grade. When applying this criteria a section of profile that encompasses several different gradients that are either all positive, or all negative (including 0%), is considered a continuous positive or negative grade. This limits the number of sections of a long train that are placed simultaneously in compression and tension; reduces the difficulties of train handling and reduces the incidence of forces that lead to problems of wear at the couplers.

4.3.5 Grade Compensation

Compensation is the reduction of the gradient through a horizontal curve to ensure that the total resistance (curve plus grade) experienced by a train does not exceed the resistance of the ruling grade on tangent track.

The standard formula for curve compensation using curve radius in meters is:

Effective gradient $= ActualGradient - \left(C \text{ x } \frac{1.746}{R} \right)$

C = compensation varies between 0.04% and 0.05%

R = horizontal curve radius (m)

Given the climatic conditions of the project and the potential for loss of adhesion in very cold temperatures, the project will use 0.05%. This requires that the maximum gradient permitted on a 500 m radius curve be 0.325% in the loaded direction, and 1.325% in the unloaded direction.

The plans and profiles of the proposed railway installations, based on the criteria of this chapter are to be found in Appendix 4.

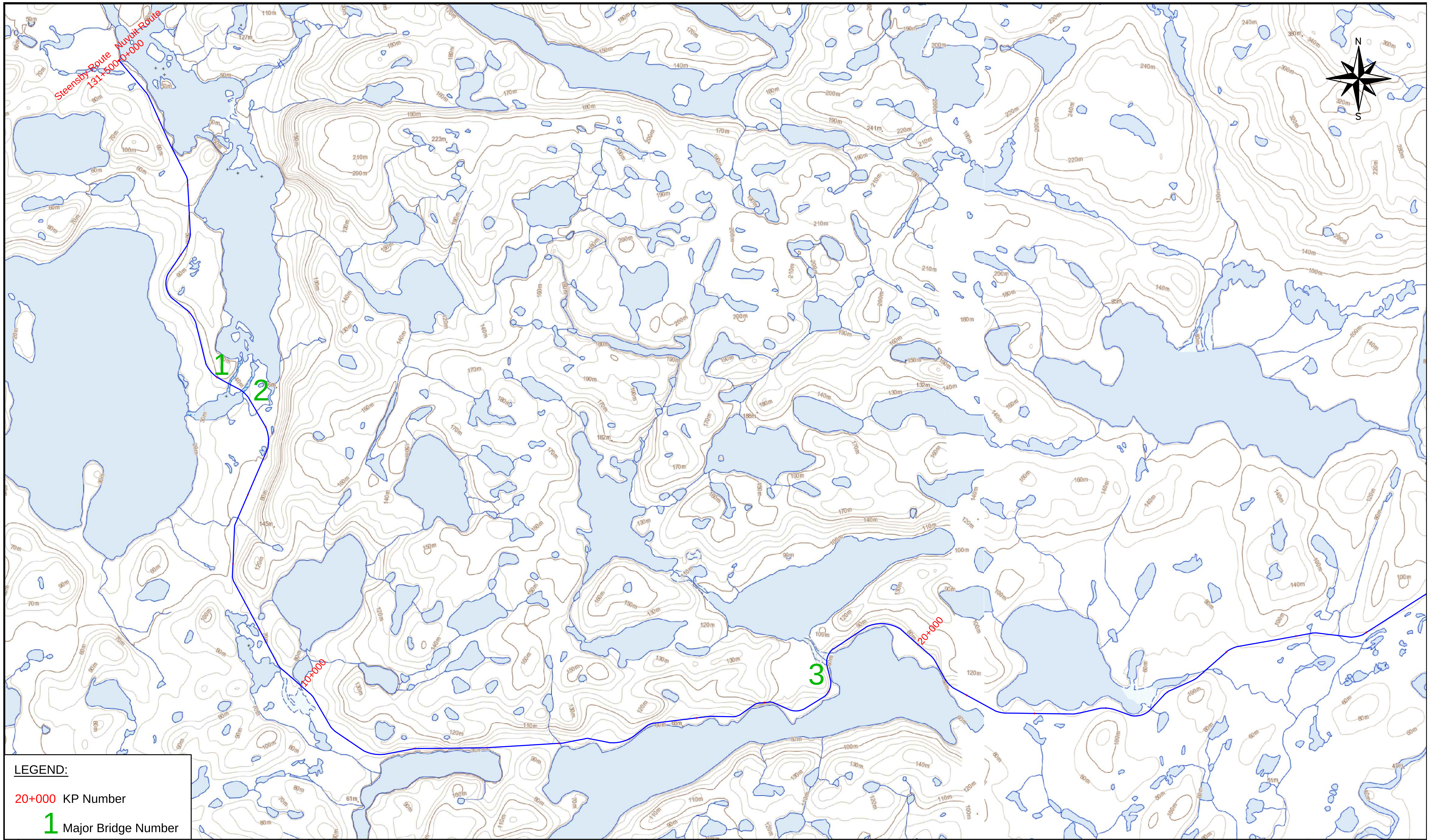
Appendix B

Conceptual Cockburn Lake – Nuvuit Route Profile

140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
Elevation (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
Kilometer Posts
Grade Line
Elevation

Appendix C

1:50,000 Scale Drawings of the Conceptual Cockburn Lake – Nuvuit Route



LEGEND:

20+000 KP Number

1 Major Bridge Number

REV.	YY/MM/DD	DESCRIPTION	PREP. BY	APPR. BY
0	11/09/13	ISSUED FOR INFORMATION ONLY	S.C.	C.F.

CANARAIL

Baffinland Iron Mines Corporation

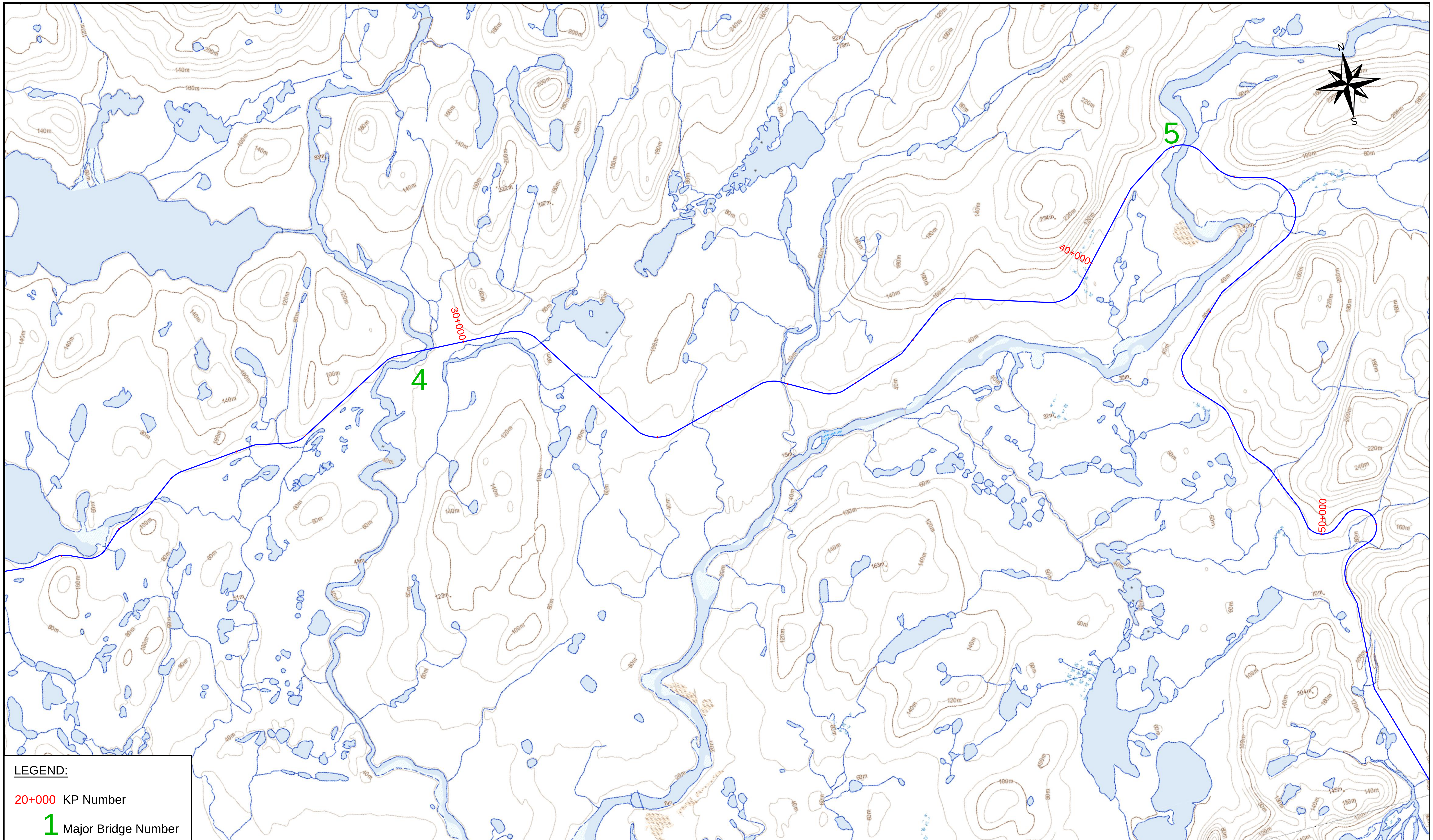
DRAWN BY:	DATE:
DESIGNED BY:	DATE:
CHECKED BY: C.F.	DATE:
APPROVED BY: C.F.	DATE:
SIZE: 11x17	SCALE: 1:50000
ISSUED DATE:	

NAME OF CLIENT: BAFFINLAND IRON MINES CORPORATION

PROJECT NAME: NUVUIT ROUTE EVALUATION

TITLE: PROPOSED NUVUIT ROUTE KP 0+00 - KP 27+000

PROJECT NO.:	DRAWING NO.:	REV.
11-030	11-030-DWG-AL-001	00



LEGEND:

20+000 KP Number

1 Major Bridge Number

REV.	YY/MM/DD	DESCRIPTION	PREP. BY	APPR. BY
0	11/09/13	ISSUED FOR INFORMATION ONLY	S.C.	C.F.

CANARAIL

Baffinland Iron Mines Corporation

DRAWN BY:
DESIGNED BY:
CHECKED BY: C.F.
APPROVED BY: C.F.
SIZE: 11x17
SCALE: 1:50000
ISSUED DATE:

NAME OF CLIENT: BAFFINLAND IRON MINES CORPORATION

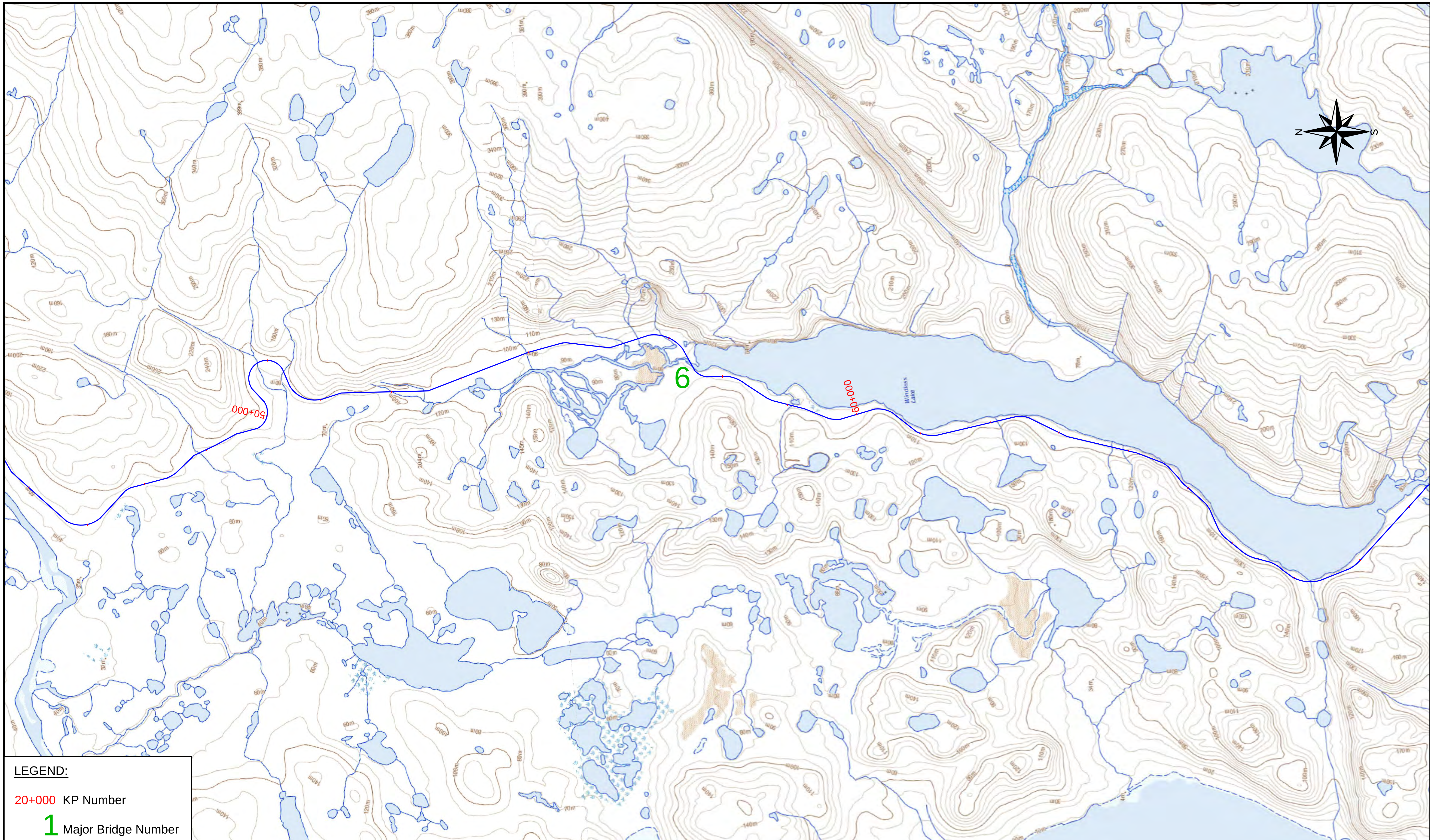
PROJECT NAME: NUVUIT ROUTE EVALUATION

TITLE: PROPOSED NUVUIT ROUTE KP 23+000 - KP 54+000

PROJECT NO.: 11-030

DRAWING NO.: **11-030-DWG-AL-002**

REV.: 00



REV.	YY/MM/DD	DESCRIPTION	PREP. BY	APPR. BY
0	11/09/13	ISSUED FOR INFORMATION ONLY	S.C.	C.F.

CANARAIL

Baffinland Iron Mines Corporation

DRAWN BY:
DESIGNED BY:
CHECKED BY: C.F.
APPROVED BY: C.F.
SIZE: 11x17
SCALE: 1:50000

NAME OF CLIENT: BAFFINLAND IRON MINES CORPORATION

PROJECT NAME: NUVUIT ROUTE EVALUATION

TITLE: PROPOSED NUVUIT ROUTE KP 46+000 - KP 69+000

PROJECT NO.: 11-030

DRAWING NO.: 11-030-DWG-AL-003

REV.: 00

LEGEND:

20+000 KP Number

1 Major Bridge Number

REV.	YY/MM/DD	DESCRIPTION	PREP. BY	APPR. BY
0	11/09/13	ISSUED FOR INFORMATION ONLY	S.C.	C.F.

CANARAIL

Baffinland Iron Mines Corporation

DRAWN BY: | DATE:
DESIGNED BY: | DATE:
CHECKED BY: C.F. | DATE:
APPROVED BY: C.F. | DATE:
SIZE: 11x17 | SCALE: 1:50000 | ISSUED DATE:

NAME OF CLIENT: BAFFINLAND IRON MINES CORPORATION

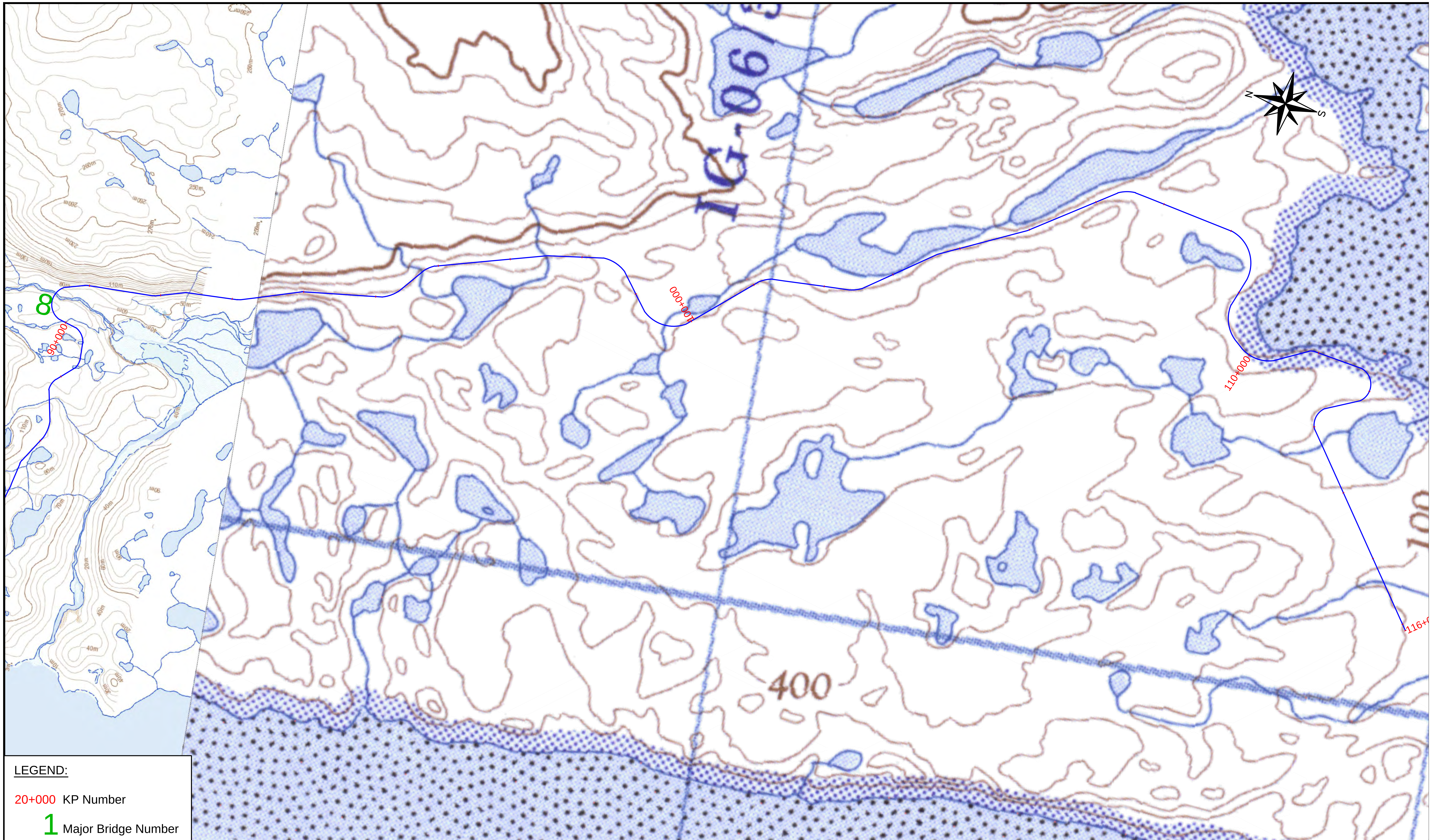
PROJECT NAME: NUVUIT ROUTE EVALUATION

TITLE: PROPOSED NUVUIT ROUTE KP 64+000 - KP 93+000

PROJECT NO.: 11-030

DRAWING NO.: 11-030-DWG-AL-00

REV.: 00



LEGEND:

20+000 KP Number

1 Major Bridge Number

REV.	YY/MM/DD	DESCRIPTION	PREP. BY	APPR. BY
0	11/09/13	ISSUED FOR INFORMATION ONLY	S.C.	C.F.

CANARAIL

Baffinland Iron Mines Corporation

CHECKED BY: C.F.

APPROVED BY: C.F.

SIZE: 11x17

SCALE: 1:50000

NAME OF CLIENT: BAFFINLAND IRON MINES CORPORATION

PROJECT NAME: NUVUIT ROUTE EVALUATION

TITLE: PROPOSED NUVUIT ROUTE KP 88+000 - KP 116+095

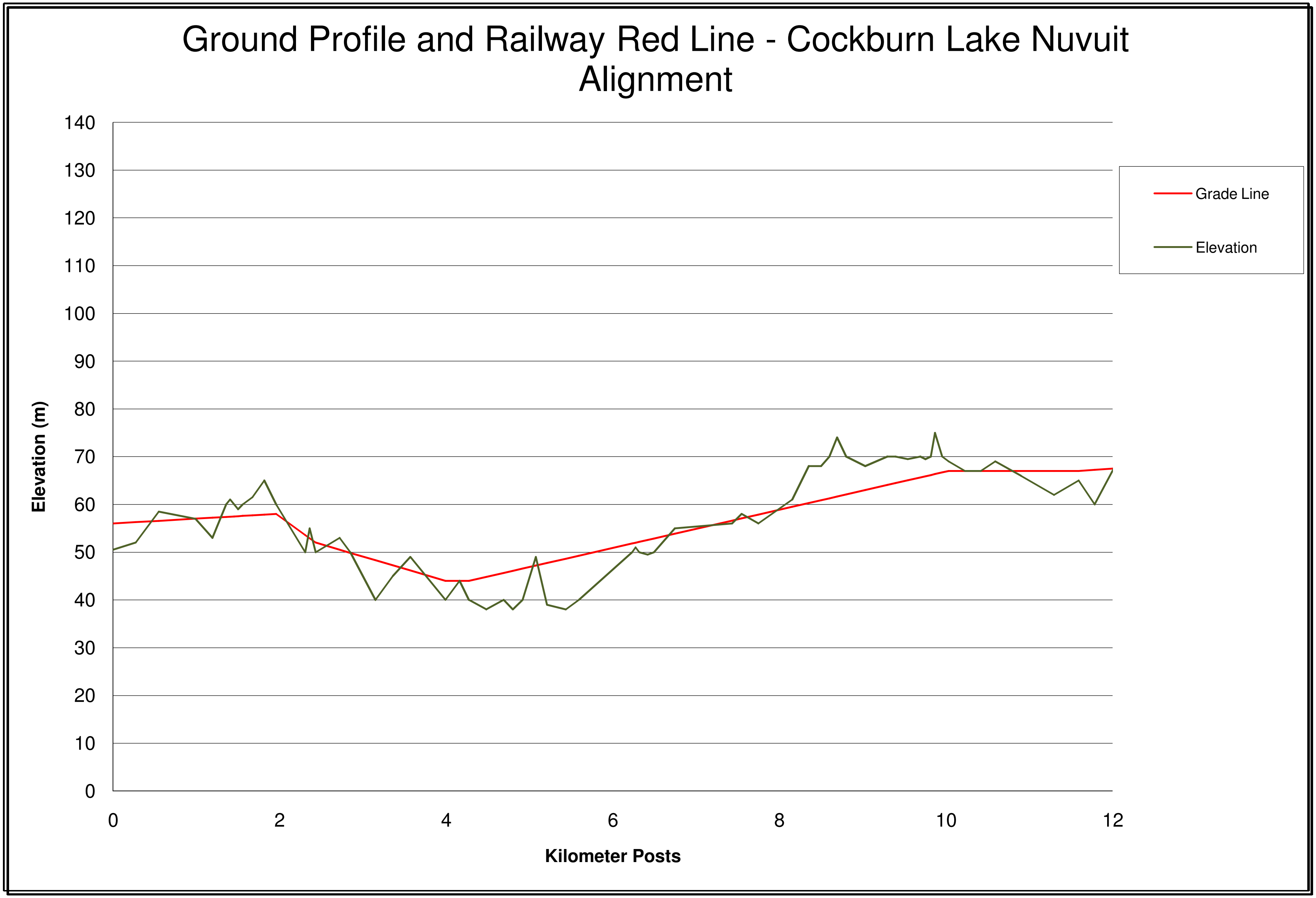
PROJECT NO.: 11-030

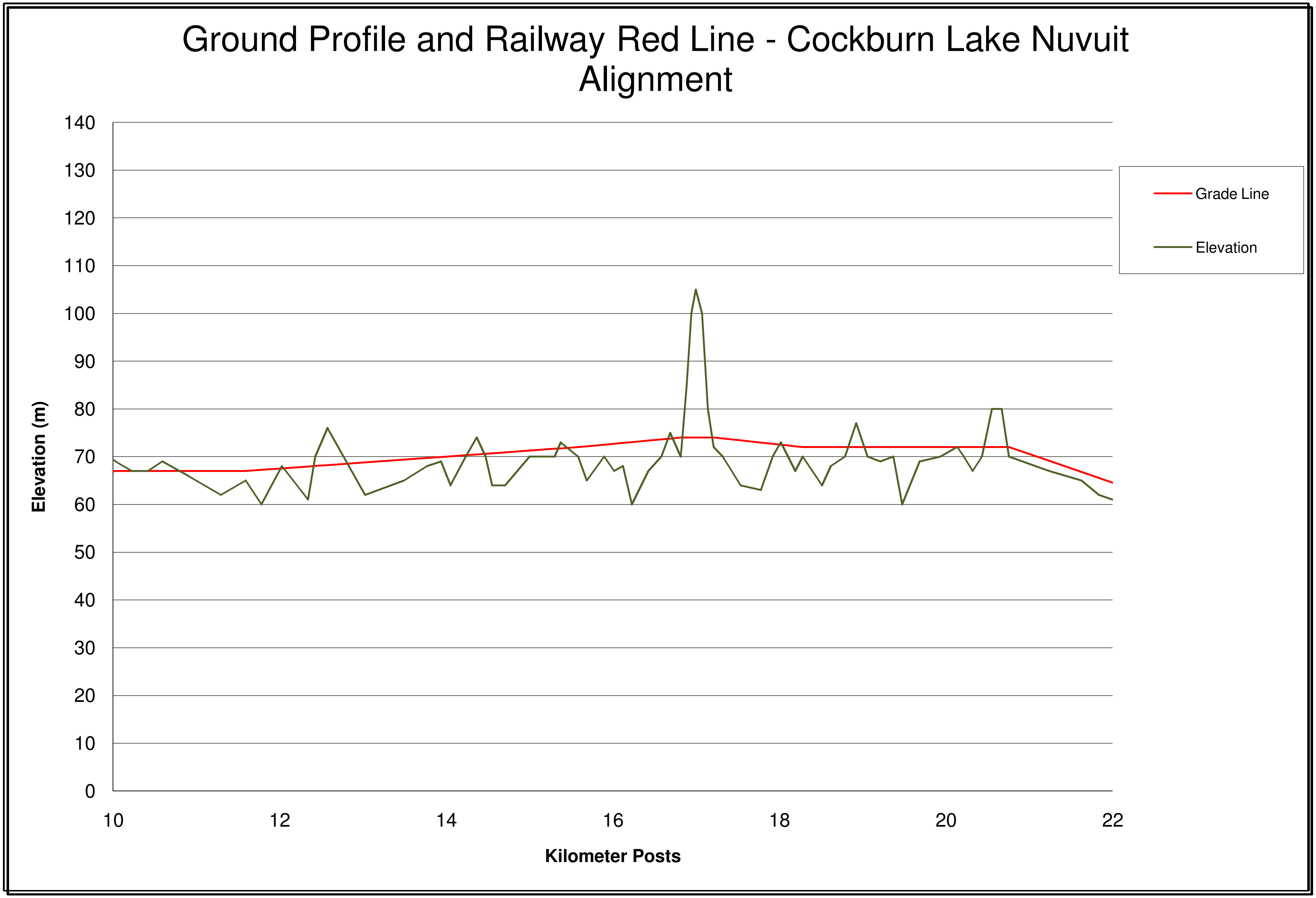
DRAWING NO.: 11-030-DWG-AL-00

REV.: 00

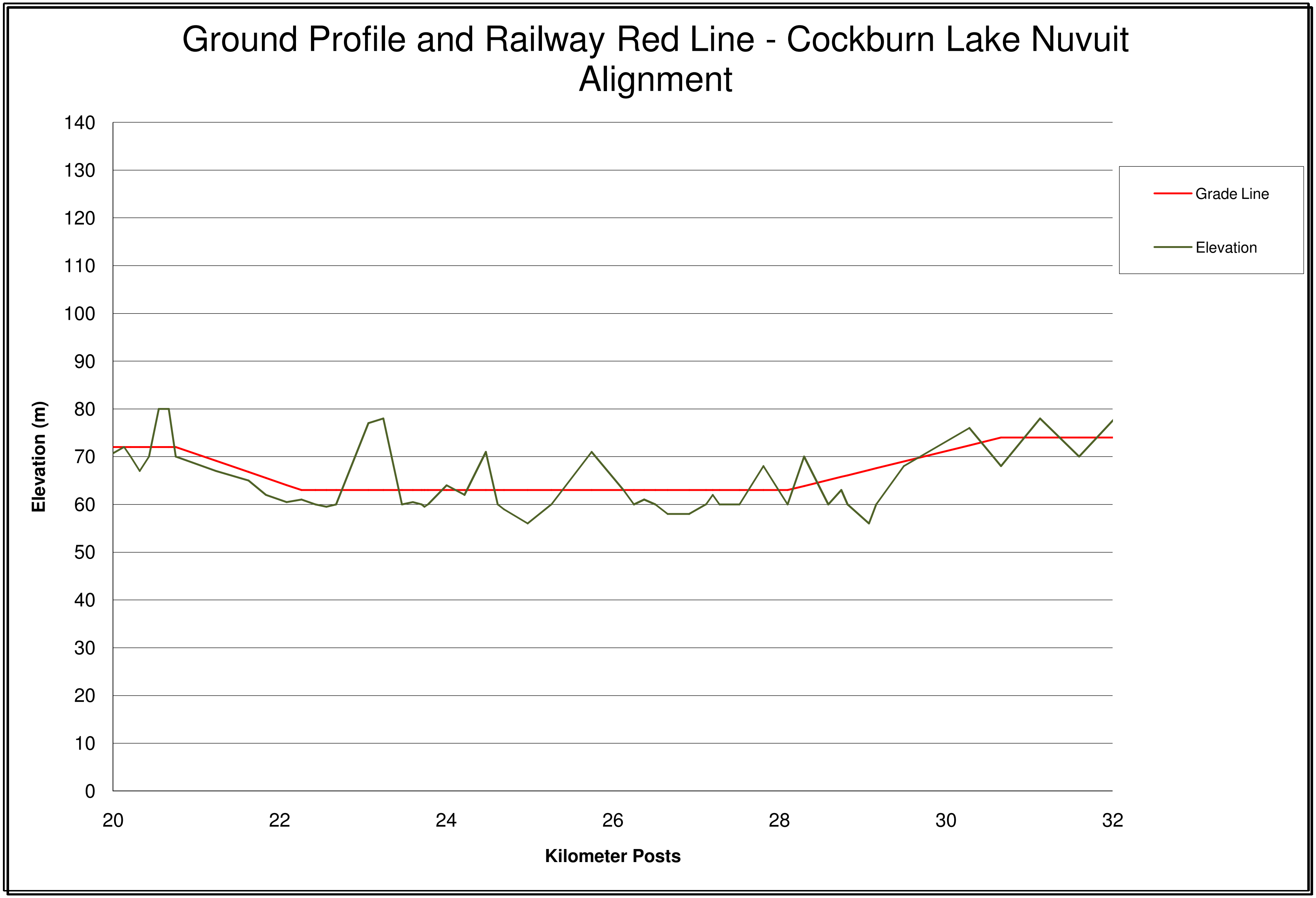
Appendix D

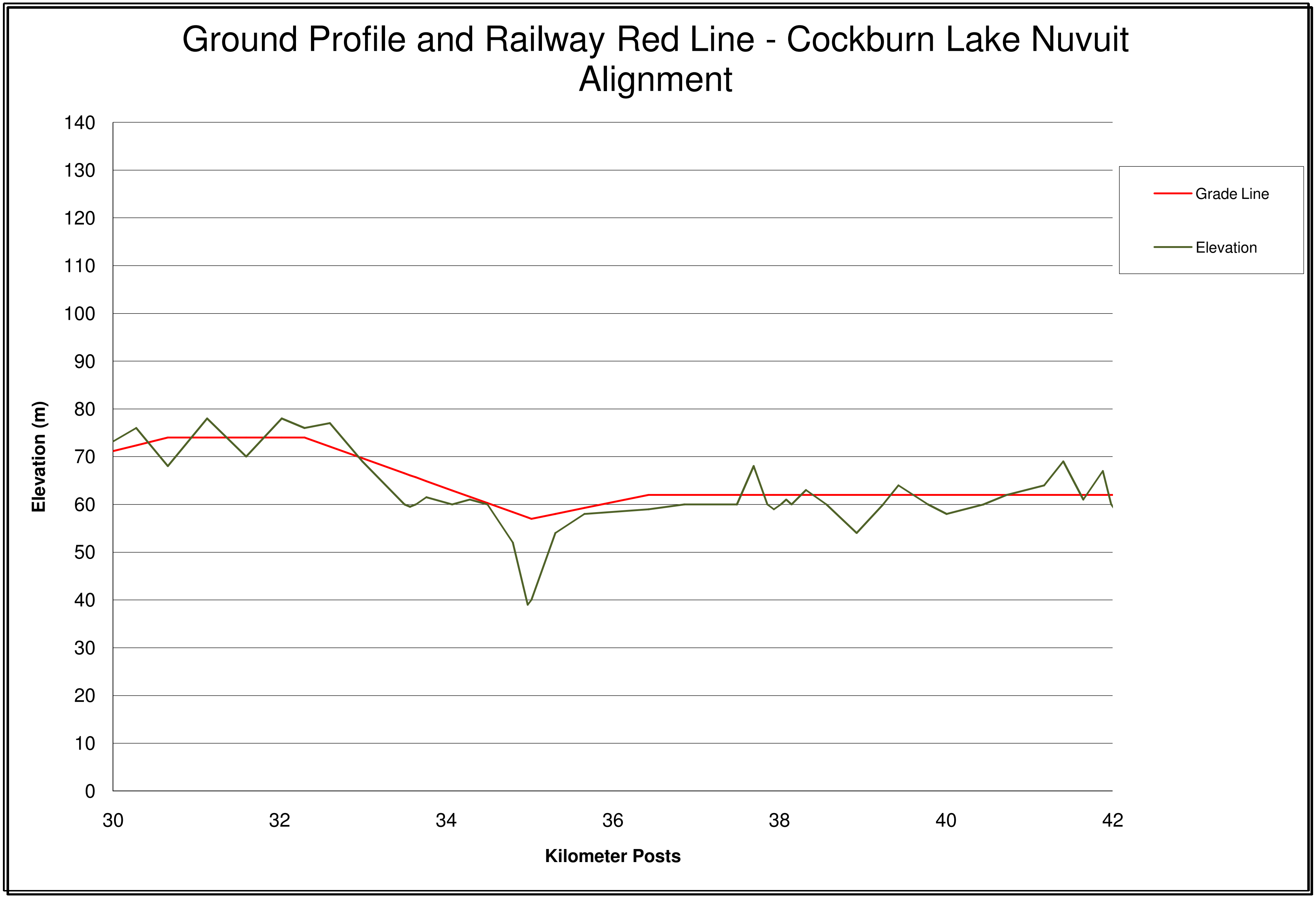
Graderock Output

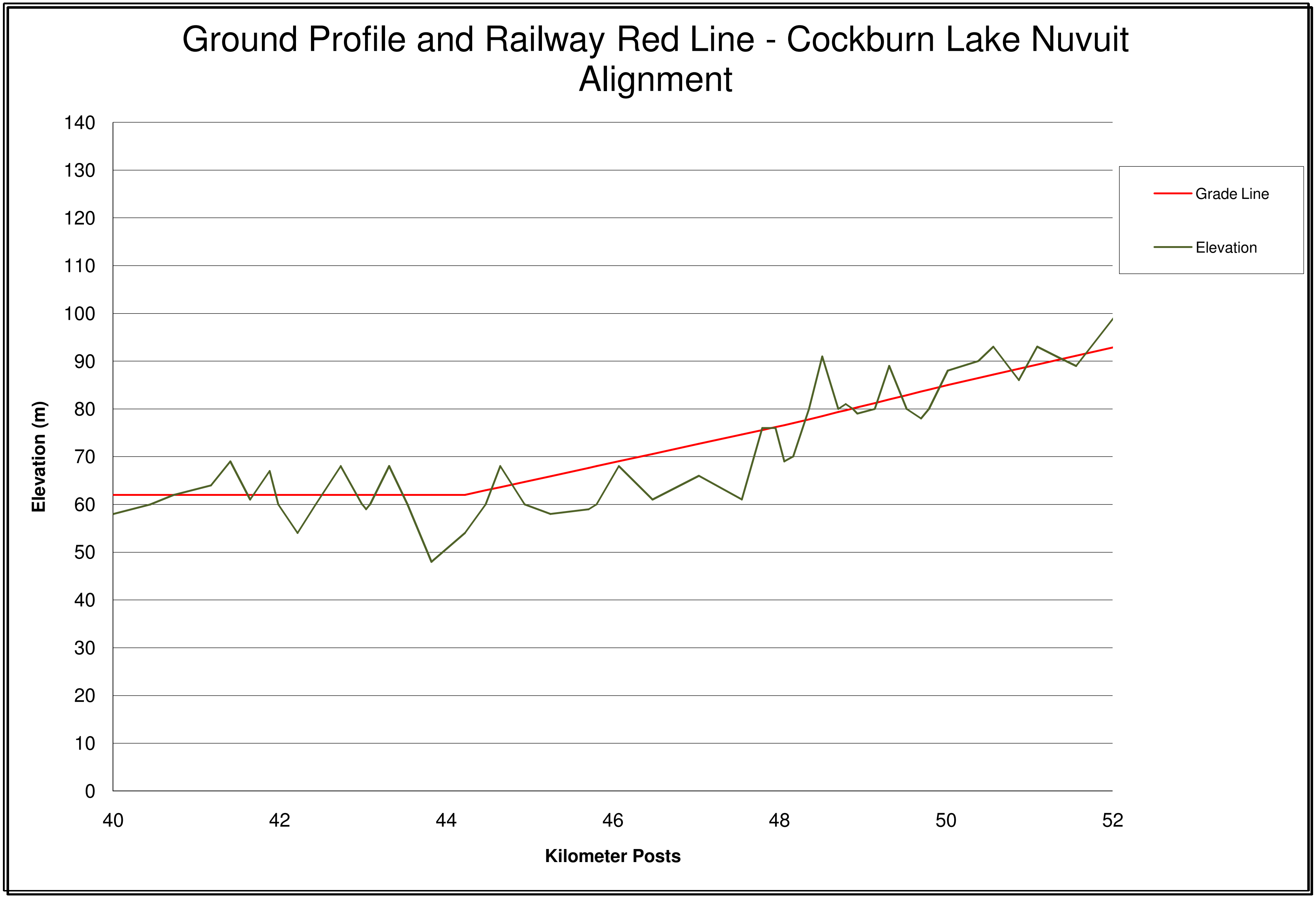

Ground Profile and Railway Red Line - Cockburn Lake Nuvuit Alignment
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
Elevation (m)
0
2
4
6
8
10
12
Kilometer Posts
Grade Line
Elevation

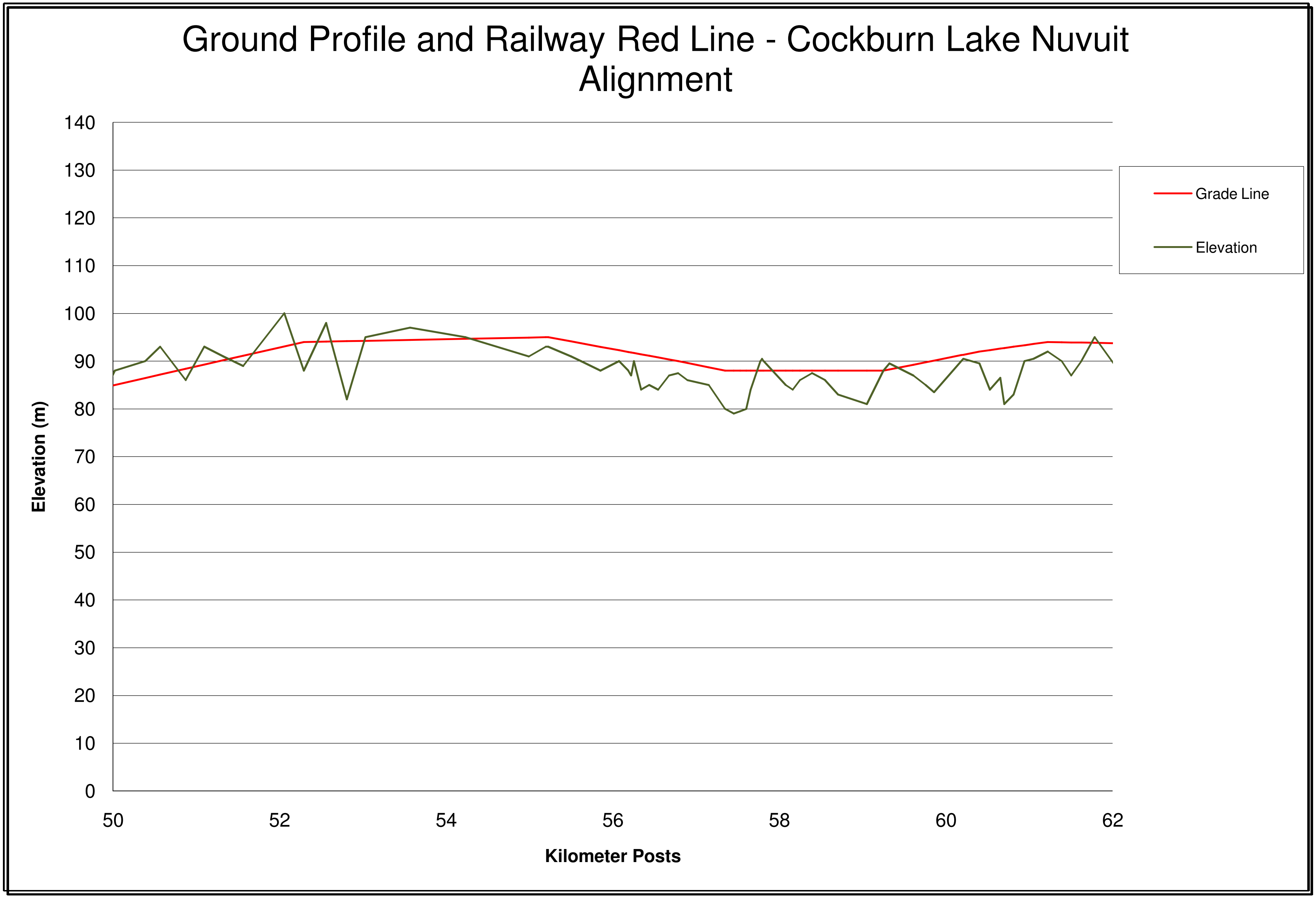


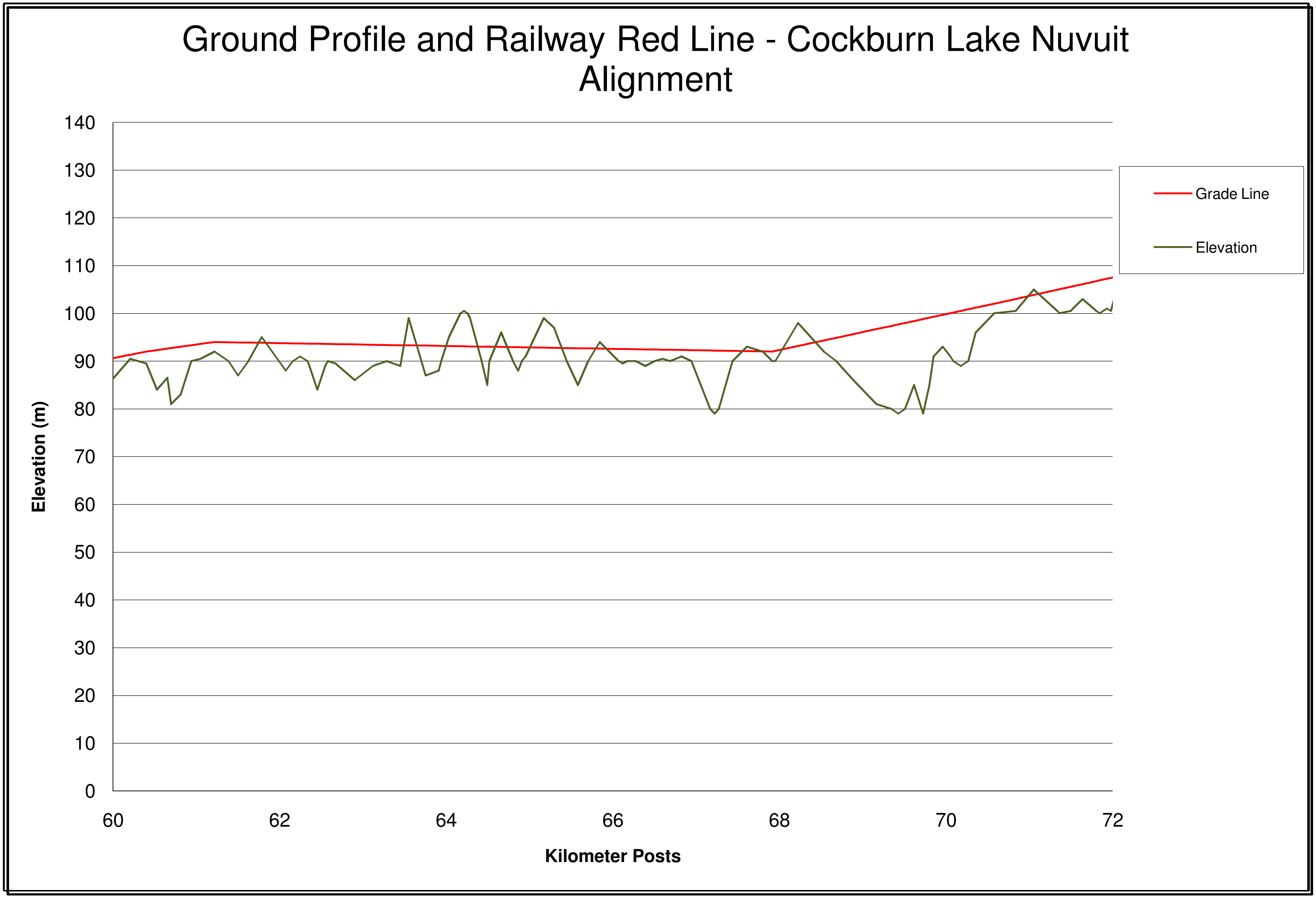
Ground Profile and Railway Red Line - Cockburn Lake Nuvuit Alignment
Elevation (m)
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
10
12
14
16
18
20
22
Kilometer Posts
Grade Line
Elevation

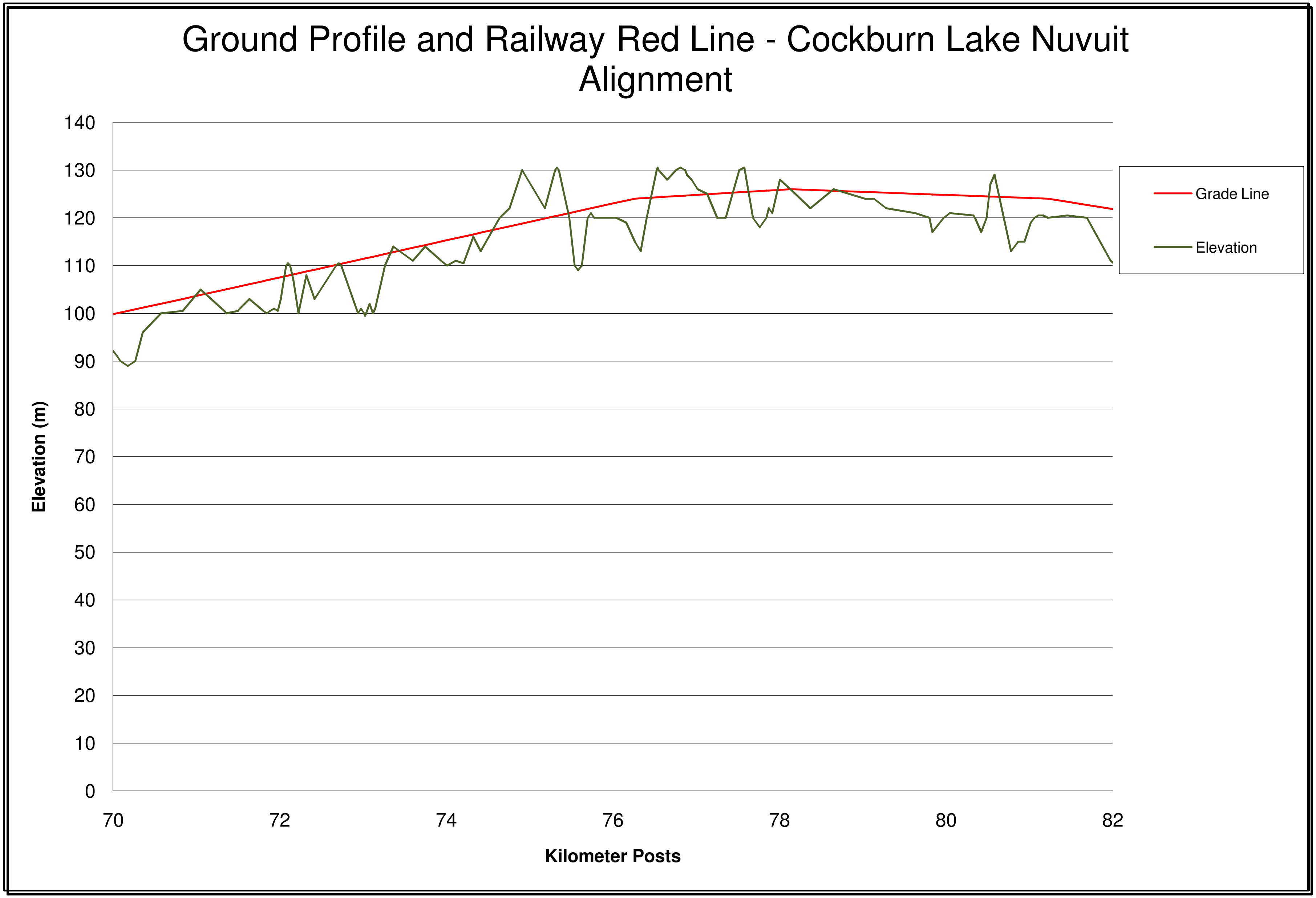

Ground Profile and Railway Red Line - Cockburn Lake Nuvuit Alignment
Elevation (m)
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
20
22
24
26
28
30
32
Kilometer Posts
Grade Line
Elevation


Ground Profile and Railway Red Line - Cockburn Lake Nuvuit Alignment
Elevation (m)
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
30
32
34
36
38
40
42
Kilometer Posts
Grade Line
Elevation

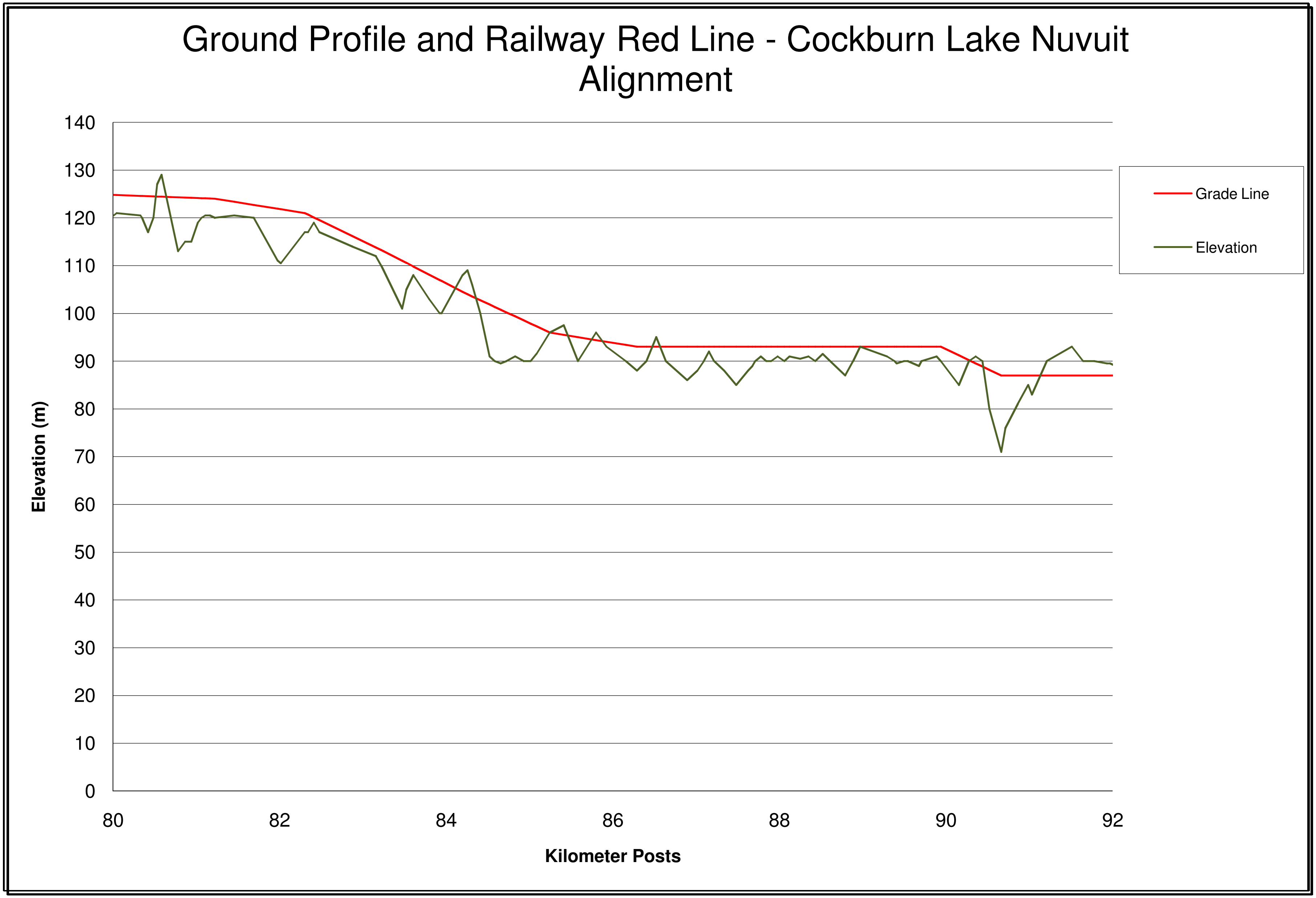

Ground Profile and Railway Red Line - Cockburn Lake Nuvuit Alignment
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
Elevation (m)
40
42
44
46
48
50
52
Kilometer Posts
Grade Line
Elevation

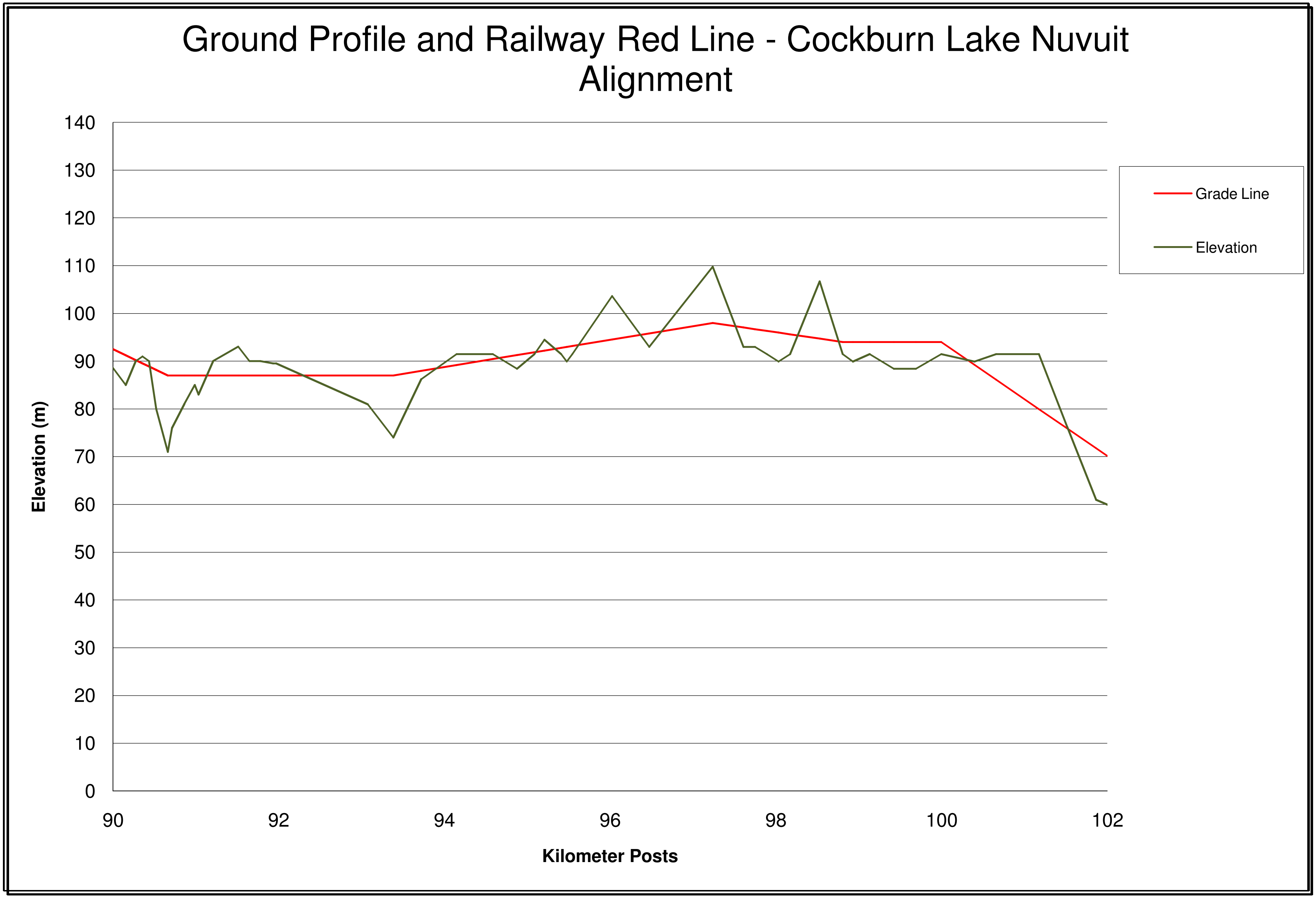

Ground Profile and Railway Red Line - Cockburn Lake Nuvuit Alignment
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
Elevation (m)
50
52
54
56
58
60
62
Kilometer Posts
Grade Line
Elevation

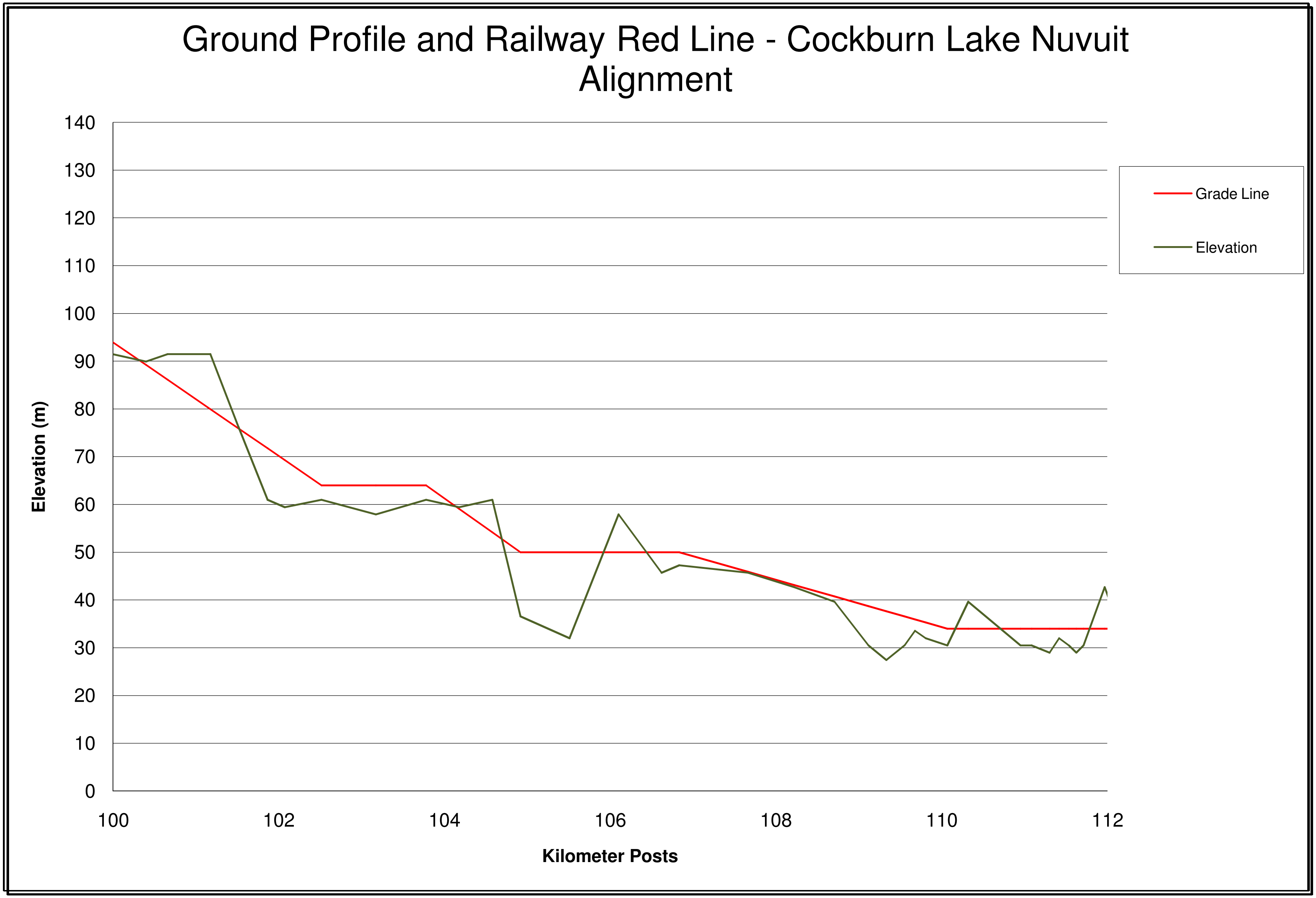

Ground Profile and Railway Red Line - Cockburn Lake Nuvuit Alignment
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
Elevation (m)
60
62
64
66
68
70
72
Kilometer Posts
Grade Line
Elevation



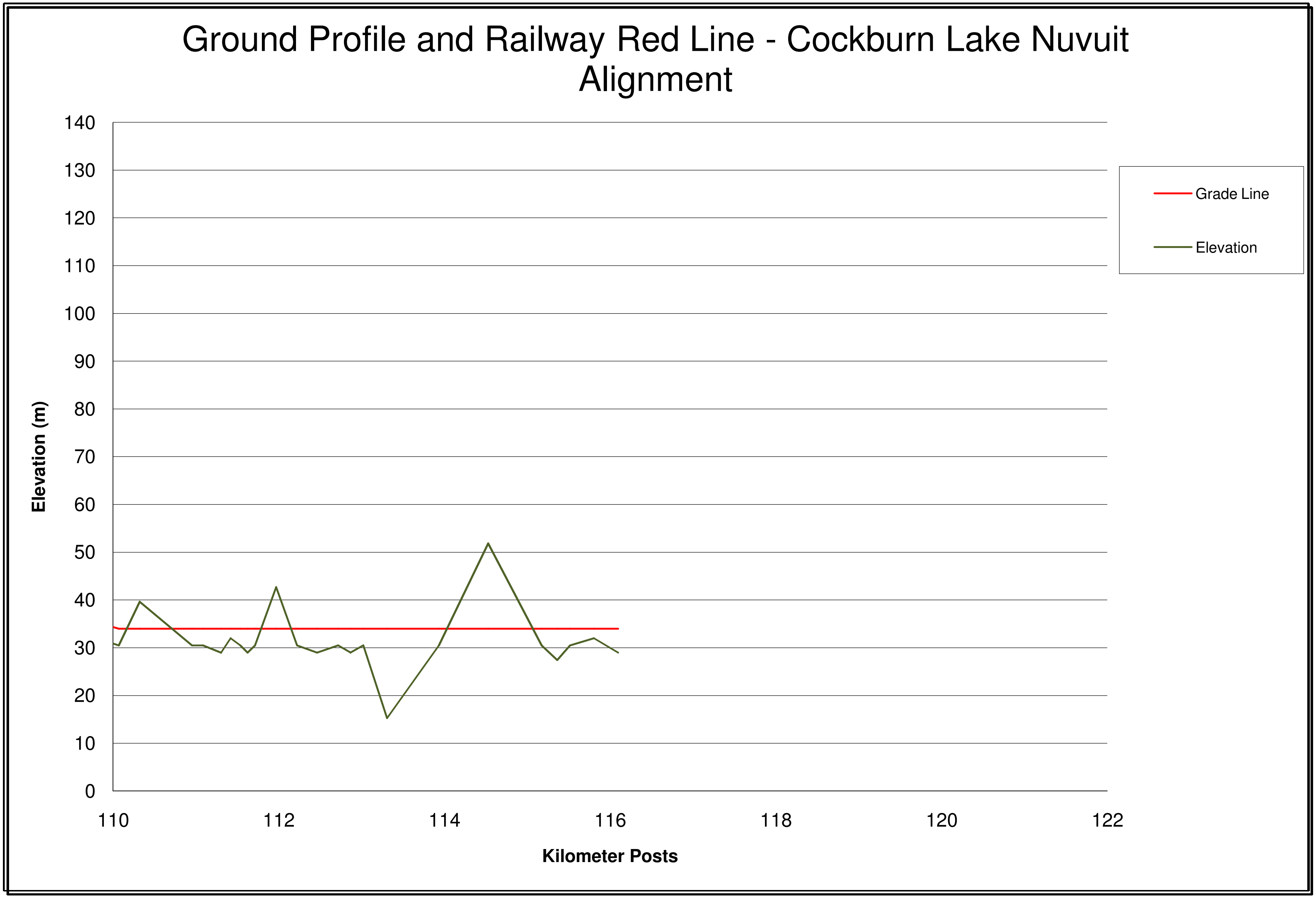
Ground Profile and Railway Red Line - Cockburn Lake Nuvuit Alignment
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
Elevation (m)
70
72
74
76
78
80
82
Kilometer Posts
Grade Line
Elevation


Ground Profile and Railway Red Line - Cockburn Lake Nuvuit Alignment
Elevation (m)
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
80
82
84
86
88
90
92
Kilometer Posts
Grade Line
Elevation


Ground Profile and Railway Red Line - Cockburn Lake Nuvuit Alignment
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
Elevation (m)
90
92
94
96
98
100
102
Kilometer Posts
Grade Line
Elevation



Ground Profile and Railway Red Line - Cockburn Lake Nuvuit Alignment
Elevation (m)
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
100
102
104
106
108
110
112
Kilometer Posts
Grade Line
Elevation


Ground Profile and Railway Red Line - Cockburn Lake Nuvuit Alignment
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
Elevation (m)
110
112
114
116
118
120
122
Kilometer Posts
Grade Line
Elevation

		Cut	Fill	
Width at grade line:		11.6	7.3	
Slope - Earth 1V:		1.50	1.50	H
Slope - Rock 1V:		2.00	2.00	H
Ditch / Crown Areas:		0.55	-0.45	

Limit up slope	0.501
Limit down slope	-1.5

Berm, meters:	1
Earth Shrinkage:	30%
Rock Bulking:	30%
Volume Contingency:	20%

baseline for mass haul	15
cumulative adjusted	100,000

to plot Kilometer Point (PK)	mark	to plot Grade Point	Grade Line	to plot Ground Profile Point	Ground Profile Line	Track Grade (%)	Cut Height	Depth to Rock	End Areas for Volumes: Earth Cut	Rock Cut	Fill	Segment Length (m)	Earthwork Volumes (m^3) from preceding PK: Common Excavation	Rock Excavation	Embankment	Adjusted Cumulative
0.00		56.000	56.00	50.5	50.500		-5.500	5.0	0.0	0.0	-86.0					
275			56	52.00	52.000	0.10	-4.281	5.0	0.0	0.0	-59.2	275.26	0	0	(23,975)	(23,975)
551			57	58.50	58.500	0.10	1.938	5.0	28.7	0.0	0.0	275.26	1,475	0	(6,729)	(29,672)
991			57	57.00	57.000	0.10	-0.012	5.0	0.0	0.0	-0.5	440.81	7,532	0	(1)	(24,401)
1196			57	53.00	53.000	0.10	-4.221	5.0	0.0	0.0	-58.0	204.18	0	0	(7,170)	(31,571)
1358			57	60.00	60.000	0.10	2.613	5.0	41.1	0.0	0.0	162.88	1,536	0	(3,500)	(33,996)
1407			57	61.00	61.000	0.10	3.564	5.0	60.9	0.0	0.0	48.13	2,947	0	0	(31,933)
1455			57	60.00	60.000	0.10	2.514	5.0	39.2	0.0	0.0	48.13	2,892	0	0	(29,909)
1501			58	59.00	59.000	0.10	1.467	5.0	20.8	0.0	0.0	46.46	1,673	0	0	(28,738)
1559			58	60.00	60.000	0.10	2.408	5.0	37.2	0.0	0.0	57.65	2,006	0	0	(27,334)
1674			58	61.50	61.500	0.10	3.791	5.0	66.1	0.0	0.0	115.19	7,136	0	0	(22,339)
1817			58	65.00	65.000	0.10	7.145	5.0	148.4	34.6	0.0	142.81	18,376	2,967	0	(5,619)
1958		58	58	60.00	60.000	0.10	2.000	5.0	29.8	0.0	0.0	141.68	15,143	2,944	0	8,808
2308			54	50.00	50.000	-1.26	-3.591	5.0	0.0	0.0	-46.0	349.27	2,230	0	(6,193)	4,176
2363			53	55.00	55.000	-1.26	2.102	5.0	31.6	0.0	0.0	54.91	384	0	(956)	3,489
2434		52	52	50.00	50.000	-1.26	-2.000	5.0	0.0	0.0	-21.1	71.16	690	0	(438)	3,534
2722			51	53.00	53.000	-0.51	2.478	5.0	38.5	0.0	0.0	287.93	3,682	0	(1,624)	4,487
2851			50	50.00	50.000	-0.51	0.142	5.0	2.2	0.0	0.0	129.29	3,160	0	0	6,699
3152			48	40.00	40.000	-0.51	-8.311	5.0	0.0	0.0	-164.7	301.33	7	0	(29,280)	(22,576)
3361			47	45.00	45.000	-0.51	-2.240	5.0	0.0	0.0	-24.3	208.48	0	0	(23,649)	(46,225)
3569			46	49.00	49.000	-0.51	2.830	5.0	45.4	0.0	0.0	208.48	3,169	0	(1,345)	(45,352)
3992		44	44	40.00	40.000	-0.51	-4.000	5.0	0.0	0.0	-53.7	422.68	4,770	0	(7,969)	(49,982)
4161			44	44.00	44.000	0.00	0.000	5.0	0.0	0.0	-0.5	169.45	0	0	(5,455)	(55,437)
4274		44	44	40.00	40.000	0.00	-4.000	5.0	0.0	0.0	-53.7	112.47	0	0	(3,620)	(59,057)
4483			45	38.00	38.000	0.40	-6.834	5.0	0.0	0.0	-120.4	208.75	0	0	(21,799)	(80,856)
4691			46	40.00	40.000	0.40	-5.668	5.0	0.0	0.0	-90.0	208.75	0	0	(26,353)	(107,209)
4801			46	38.00	38.000	0.40	-8.106	5.0	0.0	0.0	-158.2	109.59	0	0	(16,319)	(123,528)
4918			47	40.00	40.000	0.40	-6.574	5.0	0.0	0.0	-113.3	117.24	0	0	(19,094)	(142,622)
5075			47	49.00	49.000	0.40	1.798	5.0	26.3	0.0	0.0	157.17	532	0	(8,387)	(150,637)
5212			48	39.00	39.000	0.40	-8.747	5.0	0.0	0.0	-179.1	136.50	367	0	(12,165)	(162,545)
5436			49	38.00	38.000	0.40	-10.641	5.0	0.0	0.0	-248.0	223.78	0	0	(57,338)	(219,883)
5594			49	40.00	40.000	0.40	-9.273	5.0	0.0	0.0	-197.1	158.15	0	0	(42,234)	(262,117)
6231			52	50.00	50.000	0.40	-1.819	5.0	0.0	0.0	-18.7	637.35	0	0	(82,524)	(344,641)
6275			52	51.00	51.000	0.40	-0.994	5.0	0.0	0.0	-9.2	43.84	0	0	(733)	(345,374)
6319			52	50.00	50.000	0.40	-2.169	5.0	0.0	0.0	-23.3	43.84	0	0	(856)	(346,230)
6419			53	49.50	49.500	0.40	-3.070	5.0	0.0	0.0	-37.0	100.44	0	0	(3,636)	(349,866)
6493			53	50.00	50.000	0.40	-2.866	5.0	0.0	0.0	-33.7	74.09	0	0	(3,142)	(353,008)
6745			54	55.00	55.000	0.40	1.128	5.0	15.6	0.0	0.0	251.79	664	0	(3,652)	(356,195)
7431			57	56.00	56.000	0.40	-0.610	5.0	0.0	0.0	-5.5	685.37	4,151	0	(788)	(354,077)
7547			57	58.00	58.000	0.40	0.924	5.0	12.6	0.0	0.0	116.70	529	0	(152)	(353,859)
7748			58	56.00	56.000	0.40	-1.878	5.0	0.0	0.0	-19.5	200.73	499	0	(1,570)	(355,080)
8155			60	61.00	61.000	0.40	1.496	5.0	21.3	0.0	0.0	407.18	2,303	0	(2,645)	(356,113)
8354			60	68.00	68.000	0.40	7.702	5.0	159.5	46.5	0.0	198.68	21,553	5,543	0	(333,820)
8500			61	68.00	68.000	0.40	7.119	5.0	147.9	34.1	0.0	145.97	26,924	7,060	0	(305,795)
8600			61	70.00	70.000	0.40	8.718	5.0	179.9	71.3	0.0	100.51	19,764	6,357	0	(283,696)
8692			62	74.00	74.000	0.40	12.349	5.0	252.5	193.8	0.0	92.18	23,912	14,664	0	(247,894)
8802			62	70.00	70.000	0.40	7.910	5.0	163.7	51.3	0.0	109.94	27,454	16,166	0	(207,660)
9031			63	68.00	68.000	0.40	4.999	5.0	96.0	0.0	0.0	228.15	35,553	7,016	0	(173,652)
9296			64	70.00	70.000	0.40	5.939	5.0	124.3	13.2	0.0	265.35	35,074	2,102	0	(146,368)
9394			64	70.00	70.000	0.40	5.548	5.0	116.5	7.5	0.0	97.87	14,136	1,216	0	(134,892)
9543			65	69.50	69.500	0.40	4.453	5.0	82.0	0.0	0.0	148.91	17,727	671	0	(121,611)
9692			66	70.00	70.000	0.40	4.358	5.0	79.6	0.0	0.0	148.91	14,434	0	0	(111,507)
9755			66	69.50	69.500	0.40	3.605	5.0	61.9	0.0	0.0	63.30	5,373	0	0	(107,746)
9818			66	70.00	70.000	0.40	3.852	5.0	67.5	0.0	0.0	63.30	4,913	0	0	(104,307)
9868			66	75.00	75.000	0.40	8.655	5.0	178.6	69.7	0.0	49.54	7,315	2,070	0	(96,496)
9955			67	70.00	70.000	0.40	3.307	5.0	55.3	0.0	0.0	87.01	12,212	3,636	0	(83,221)
10032		67	67	69.00	69.000	0.40	2.000	5.0	29.8	0.0	0.0	76.85	3,923	0	0	(80,475)
10227			67	67.00	67.000	0.00	0.000	5.0	0.0	0.0	-0.5	195.59	3,491	0	0	(78,031)
10419			67	67.00	67.000	0.00	0.000	5.0	0.0	0.0	-0.5	191.76	0	0	0	(78,031)
10591			67	69.00	69.000	0.00	2.000	5.0	29.8	0.0	0.0	172.54	3,080	0	0	(75,875)
10902			67	66.00	66.000	0.00	-1.000	5.0	0.0	0.0	-9.3	310.13	3,691	0	(574)	(73,865)
11296			67	62.00	62.000	0.00	-5.000	5.0	0.0	0.0	-74.5	394.59	0	0	(19,816)	(93,681)
11593		67	67	65.00	65.000	0.00	-2.000	5.0	0.0	0.0	-21.1	297.26	0	0	(17,033)	(110,714)
11784			67	60.00	60.000	0.13	-7.238	5.0	0.0	0.0	-131.9	190.34	0	0	(17,465)	(128,179)
12030			68	68.00	68.000	0.13	0.453	5.0	6.1	0.0	0.0	246.09	53	0	(18,325)	(146,467)

Kilometer Point (PK)	Earth Height	Rock Cut Depth	Earth Cut Base	Earth Cut Top Area	La	Lb	Earth Va+	Rock Va+	Both Va-	Earth Vb+	Rock Vb+	Both Vb-	Baseline for Mass Haul	Cumul Adjtd
0.00	-5.5	0.0	11.6	0.6									15	#REF!
275	-4.3	0.0	11.6	0.6	275.3	275.3	0.0	0.0	-11833.2	0.0	0.0	-8146.2	15	14.8
551	1.9	0.0	11.6	0.6	189.5	85.8	0.0	0.0	-5607.8	1229.1	0.0	0.0	15	14.7
991	0.0	0.0	11.6	0.6	438.0	2.8	6276.8	0.0	0.0	0.0	0.0	-0.8	15	14.8
1196	-4.2	0.0	11.6	0.6	204.2	204.2	0.0	0.0	-55.1	0.0	0.0	-5920.2	15	14.7
1358	2.6	0.0	11.6	0.6	100.6	62.3	0.0	0.0	-2917.0	1279.8	0.0	0.0	15	14.7
1407	3.6	0.0	11.6	0.6	48.1	48.1	989.1	0.0	0.0	1466.5	0.0	0.0	15	14.7
1455	2.5	0.0	11.6	0.6	48.1	48.1	1466.5	0.0	0.0	943.3	0.0	0.0	15	14.7
1501	1.5	0.0	11.6	0.6	46.5	46.5	910.6	0.0	0.0	483.2	0.0	0.0	15	14.7
1559	2.4	0.0	11.6	0.6	57.7	57.7	599.6	0.0	0.0	1071.7	0.0	0.0	15	14.7
1674	3.8	0.0	11.6	0.6	115.2	115.2	2141.4	0.0	0.0	3805.3	0.0	0.0	15	14.8
1817	5.0	2.1	22.2	0.0	142.8	142.8	4717.7	0.0	0.0	10595.8	2472.8	0.0	15	14.9
1958	2.0	0.0	11.6	0.6	141.7	141.7	10511.9	2453.2	0.0	2107.5	0.0	0.0	15	15.1
2308	-3.6	0.0	11.6	0.6	124.9	224.3	1858.4	0.0	0.0	0.0	0.0	-5160.9	15	15.0
2363	2.1	0.0	11.6	0.6	34.6	20.3	0.0	0.0	-796.9	319.9	0.0	0.0	15	15.0
2434	-2.0	0.0	11.6	0.6	36.5	34.7	575.4	0.0	0.0	0.0	0.0	-365.2	15	15.0
2722	2.5	0.0	11.6	0.6	128.6	159.3	0.0	0.0	-1353.4	3068.1	0.0	0.0	15	15.0
2851	0.1	0.0	11.6	0.6	129.3	129.3	2489.5	0.0	0.0	144.2	0.0	0.0	15	15.1
3152	-8.3	0.0	11.6	0.6	5.1	296.3	5.6	0.0	0.0	0.0	0.0	-24400.4	15	14.8
3361	-2.2	0.0	11.6	0.6	208.5	208.5	0.0	0.0	-17170.0	0.0	0.0	-2537.1	15	14.5
3569	2.8	0.0	11.6	0.6	92.1	116.4	0.0	0.0	-1121.1	2640.7	0.0	0.0	15	14.5
3992	-4.0	0.0	11.6	0.6	175.1	247.5	3974.6	0.0	0.0	0.0	0.0	-6640.5	15	14.5
4161	0.0	0.0	11.6	0.6	169.5	169.5	0.0	0.0	-4545.5	0.0	0.0	0.0	15	14.4
4274	-4.0	0.0	11.6	0.6	112.5	112.5	0.0	0.0	0.0	0.0	0.0	-3017.0	15	14.4
4483	-6.8	0.0	11.6	0.6	208.8	208.8	0.0	0.0	-5599.7	0.0	0.0	-12565.7	15	14.2
4691	-5.7	0.0	11.6	0.6	208.8	208.8	0.0	0.0	-12565.7	0.0	0.0	-9394.8	15	13.9
4801	-8.1	0.0	11.6	0.6	109.6	109.6	0.0	0.0	-4932.1	0.0	0.0	-8666.9	15	13.8
4918	-6.6	0.0	11.6	0.6	117.2	117.2	0.0	0.0	-9272.2	0.0	0.0	-6639.5	15	13.6
5075	1.8	0.0	11.6	0.6	123.4	33.8	0.0	0.0	-6988.8	443.3	0.0	0.0	15	13.5
5212	-8.7	0.0	11.6	0.6	23.3	113.2	305.6	0.0	0.0	0.0	0.0	-10137.4	15	13.4
5436	-10.6	0.0	11.6	0.6	223.8	223.8	0.0	0.0	-20036.1	0.0	0.0	-27745.4	15	12.8
5594	-9.3	0.0	11.6	0.6	158.2	158.2	0.0	0.0	-19608.2	0.0	0.0	-15586.5	15	12.4
6231	-1.8	0.0	11.6	0.6	637.4	637.4	0.0	0.0	-62814.0	0.0	0.0	-5956.0	15	11.6
6275	-1.0	0.0	11.6	0.6	43.8	43.8	0.0	0.0	-409.6	0.0	0.0	-201.4	15	11.5
6319	-2.2	0.0	11.6	0.6	43.8	43.8	0.0	0.0	-201.4	0.0	0.0	-511.6	15	11.5
6419	-3.1	0.0	11.6	0.6	100.4	100.4	0.0	0.0	-1172.1	0.0	0.0	-1858.1	15	11.5
6493	-2.9	0.0	11.6	0.6	74.1	74.1	0.0	0.0	-1370.7	0.0	0.0	-1248.0	15	11.5
6745	1.1	0.0	11.6	0.6	180.7	71.1	0.0	0.0	-3043.4	552.9	0.0	0.0	15	11.4
7431	-0.6	0.0	11.6	0.6	444.9	240.4	3459.4	0.0	0.0	0.0	0.0	-656.4	15	11.5
7547	0.9	0.0	11.6	0.6	46.4	70.3	0.0	0.0	-126.6	441.2	0.0	0.0	15	11.5
7748	-1.9	0.0	11.6	0.6	66.2	134.5	415.5	0.0	0.0	0.0	0.0	-1308.2	15	11.4
8155	1.5	0.0	11.6	0.6	226.6	180.5	0.0	0.0	-2204.0	1919.2	0.0	0.0	15	11.4
8354	5.0	2.7	24.4	0.0	198.7	198.7	2112.0	0.0	0.0	15848.7	4619.3	0.0	15	11.7
8500	5.0	2.1	22.1	0.0	146.0	146.0	11644.0	3393.8	0.0	10793.0	2489.5	0.0	15	11.9
8600	5.0	3.7	28.5	0.0	100.5	100.5	7431.7	1714.2	0.0	9038.4	3583.7	0.0	15	12.2
8692	5.0	7.3	43.0	0.0	92.2	92.2	8289.3	3286.7	0.0	11637.3	8933.6	0.0	15	12.5
8802	5.0	2.9	25.2	0.0	109.9	109.9	13879.4	10654.8	0.0	8998.6	2817.2	0.0	15	12.9
9031	5.0	0.0	11.6	0.6	228.2	228.2	18674.1	5846.3	0.0	10953.5	0.0	0.0	15	13.3
9296	5.0	0.9	17.4	0.0	265.4	265.4	12739.5	0.0	0.0	16488.8	1751.3	0.0	15	13.5
9394	5.0	0.5	15.8	0.0	97.9	97.9	6081.5	645.9	0.0	5698.8	367.5	0.0	15	13.7
9543	4.5	0.0	11.6	0.6	148.9	148.9	8671.0	559.2	0.0	6101.6	0.0	0.0	15	13.8
9692	4.4	0.0	11.6	0.6	148.9	148.9	6101.6	0.0	0.0	5926.6	0.0	0.0	15	13.9
9755	3.6	0.0	11.6	0.6	63.3	63.3	2519.3	0.0	0.0	1958.2	0.0	0.0	15	13.9
9818	3.9	0.0	11.6	0.6	63.3	63.3	1958.2	0.0	0.0	2136.4	0.0	0.0	15	14.0
9868	5.0	3.7	28.2	0.0	49.5	49.5	1672.0	0.0	0.0	4423.7	1725.2	0.0	15	14.0
9955	3.3	0.0	11.6	0.6	87.0	87.0	7769.6	3030.1	0.0	2406.7	0.0	0.0	15	14.2
10032	2.0	0.0	11.6	0.6	76.9	76.9	2125.7	0.0	0.0	1143.1	0.0	0.0	15	14.2
10227	0.0	0.0	11.6	0.6	195.6	195.6	2909.4	0.0	0.0	0.0	0.0	0.0	15	14.2
10419	0.0	0.0	11.6	0.6	191.8	191.8	0.0	0.0	0.0	0.0	0.0	0.0	15	14.2
10591	2.0	0.0	11.6	0.6	172.5	172.5	0.0	0.0	0.0	2566.5	0.0	0.0	15	14.2
10902	-1.0	0.0	11.6	0.6	206.8	103.4	3075.5	0.0	0.0	0.0	0.0	-478.1	15	14.3
11296	-5.0	0.0	11.6	0.6	394.6	394.6	0.0	0.0	-1825.0	0.0	0.0	-14688.6	15	14.1
11593	-2.0	0.0	11.6	0.6	297.3	297.3	0.0	0.0	-11065.5	0.0	0.0	-3128.7	15	13.9
11784	-7.2	0.0	11.6	0.6	190.3	190.3	0.0	0.0	-2003.3	0.0	0.0	-12551.0	15	13.7
12030	0.5	0.0	11.6	0.6	231.6	14.5	0.0	0.0	-15270.9	44.4	0.0	0.0	15	13.5

		Cut	Fill	
Width at grade line:		11.6	7.3	
Slope - Earth 1V:		1.50	1.50	H
Slope - Rock 1V:		2.00	2.00	H
Ditch / Crown Areas:		0.55	-0.45	

Limit up slope	0.501
Limit down slope	-1.5

Berm, meters:	1
Earth Shrinkage:	30%
Rock Bulking:	30%
Volume Contingency:	20%

baseline for mass haul	15
cumulative adjusted	100,000

to plot Kilometer Point (PK)	mark	to plot Grade Point	Grade Line	Ground Profile Point	to plot Ground Profile Line	Track Grade (%)	Cut Height	Depth to Rock	End Areas for Volumes ------- Earth Cut	- Rock Cut	------ Fill	Seg-ment Length (m)	Earthwork Volumes (m^3) from preceding PK - Common Excavation	- Rock Excavation	- Embank-ment	- Adjusted Cumulative	Earth Height	Rock Cut Depth	Earth Cut Base	Earth Cut Top Area	La	Lb	Earth Va+	Rock Va+	Both Va-	Earth Vb+	Rock Vb+	Both Vb-	Baseline for Mass Haul	Cumul Adjtd
12341			68	61.00	61.000	0.13	-6.936	5.0	0.0	0.0	-123.2	310.67	70	0	(21,563)	(167,981)	-6.9	0.0	11.6	0.6	19.1	291.6	58.3	0.0	0.0	0.0	0.0	-17969.1	15	13.3
12429			68	70.00	70.000	0.13	1.953	5.0	28.9	0.0	0.0	88.89	339	0	(5,129)	(172,873)	2.0	0.0	11.6	0.6	69.4	19.5	0.0	0.0	-4274.1	282.4	0.0	0.0	15	13.3
12577			68	76.00	76.000	0.13	7.768	5.0	160.9	48.0	0.0	147.26	16,769	4,240	0	(155,623)	5.0	2.8	24.7	0.0	147.3	147.3	2129.4	0.0	0.0	11844.9	3533.5	0.0	15	13.4
13028			69	62.00	62.000	0.13	-6.797	5.0	0.0	0.0	-119.4	451.14	23,225	6,928	(15,077)	(145,436)	-6.8	0.0	11.6	0.6	240.6	210.5	19353.9	5773.6	0.0	0.0	0.0	-12564.1	15	13.5
13493			69	65.00	65.000	0.13	-4.380	5.0	0.0	0.0	-61.2	465.26	0	0	(50,402)	(195,838)	-4.4	0.0	11.6	0.6	465.3	465.3	0.0	0.0	-27766.7	0.0	0.0	-14234.6	15	13.0
13770			70	68.00	68.000	0.13	-1.727	5.0	0.0	0.0	-17.5	277.36	0	0	(13,100)	(208,938)	-1.7	0.0	11.6	0.6	277.4	277.4	0.0	0.0	-8485.8	0.0	0.0	-2431.1	15	12.9
13939			70	69.00	69.000	0.13	-0.938	5.0	0.0	0.0	-8.6	168.31	0	0	(2,641)	(211,579)	-0.9	0.0	11.6	0.6	168.3	168.3	0.0	0.0	-1475.2	0.0	0.0	-725.4	15	12.9
14053			70	64.00	64.000	0.13	-6.081	5.0	0.0	0.0	-100.3	114.03	0	0	(7,452)	(219,031)	-6.1	0.0	11.6	0.6	114.0	114.0	0.0	0.0	-491.5	0.0	0.0	-5718.6	15	12.8
14237			70	70.00	70.000	0.13	-0.311	5.0	0.0	0.0	-2.9	184.10	0	0	(11,396)	(230,427)	-0.3	0.0	11.6	0.6	184.1	184.1	0.0	0.0	-9232.6	0.0	0.0	-264.2	15	12.7
14367			70	74.00	74.000	0.13	3.525	5.0	60.1	0.0	0.0	130.55	4,324	0	(18)	(227,418)	3.5	0.0	11.6	0.6	10.6	120.0	0.0	0.0	-15.2	3603.4	0.0	0.0	15	12.7
14473			71	70.00	70.000	0.13	-0.608	5.0	0.0	0.0	-5.4	105.90	3,256	0	(51)	(225,190)	-0.6	0.0	11.6	0.6	90.3	15.6	2713.5	0.0	0.0	0.0	0.0	-42.3	15	12.7
14553			71	64.00	64.000	0.13	-6.708	5.0	0.0	0.0	-116.9	79.78	0	0	(5,856)	(231,046)	-6.7	0.0	11.6	0.6	79.8	79.8	0.0	0.0	-217.0	0.0	0.0	-4663.1	15	12.7
14708			71	64.00	64.000	0.13	-6.901	5.0	0.0	0.0	-122.3	154.81	0	0	(22,216)	(253,262)	-6.9	0.0	11.6	0.6	154.8	154.8	0.0	0.0	-9048.6	0.0	0.0	-9465.1	15	12.5
15002			71	70.00	70.000	0.13	-1.270	5.0	0.0	0.0	-12.1	293.83	0	0	(23,696)	(276,958)	-1.3	0.0	11.6	0.6	293.8	293.8	0.0	0.0	-17964.8	0.0	0.0	-1782.1	15	12.2
15303			72	70.00	70.000	0.13	-1.647	5.0	0.0	0.0	-16.5	301.29	0	0	(5,183)	(282,141)	-1.6	0.0	11.6	0.6	301.3	301.3	0.0	0.0	-1827.3	0.0	0.0	-2491.7	15	12.2
15376			72	73.00	73.000	0.13	1.261	5.0	17.6	0.0	0.0	73.12	334	0	(411)	(282,318)	1.3	0.0	11.6	0.6	41.4	31.7	0.0	0.0	-342.4	278.6	0.0	0.0	15	12.2
15585		72	72	70.00	70.000	0.13	-2.000	5.0	0.0	0.0	-21.1	208.74	851	0	(1,617)	(283,339)	-2.0	0.0	11.6	0.6	80.7	128.0	709.3	0.0	0.0	0.0	0.0	-1347.2	15	12.2
15686			72	65.00	65.000	0.16	-7.164	5.0	0.0	0.0	-129.7	101.42	0	0	(9,175)	(292,514)	-7.2	0.0	11.6	0.6	101.4	101.4	0.0	0.0	-1067.4	0.0	0.0	-6578.1	15	12.1
15898			73	70.00	70.000	0.16	-2.505	5.0	0.0	0.0	-28.2	211.92	0	0	(20,073)	(312,587)	-2.5	0.0	11.6	0.6	211.9	211.9	0.0	0.0	-13745.1	0.0	0.0	-2982.8	15	11.9
16016			73	67.00	67.000	0.16	-5.695	5.0	0.0	0.0	-90.7	117.77	0	0	(8,397)	(320,984)	-5.7	0.0	11.6	0.6	117.8	117.8	0.0	0.0	-1657.6	0.0	0.0	-5339.7	15	11.8
16122			73	68.00	68.000	0.16	-4.867	5.0	0.0	0.0	-71.5	106.25	0	0	(10,338)	(331,322)	-4.9	0.0	11.6	0.6	106.2	106.2	0.0	0.0	-4817.1	0.0	0.0	-3798.3	15	11.7
16229			73	60.00	60.000	0.16	-13.038	5.0	0.0	0.0	-350.6	106.25	0	0	(26,908)	(358,230)	-13.0	0.0	11.6	0.6	106.2	106.2	0.0	0.0	-3798.3	0.0	0.0	-18625.3	15	11.4
16426			73	67.00	67.000	0.16	-6.357	5.0	0.0	0.0	-107.5	197.48	0	0	(54,276)	(412,506)	-6.4	0.0	11.6	0.6	197.5	197.5	0.0	0.0	-34619.2	0.0	0.0	-10610.6	15	10.9
16583			74	70.00	70.000	0.16	-3.610	5.0	0.0	0.0	-46.4	157.32	0	0	(14,519)	(427,025)	-3.6	0.0	11.6	0.6	157.3	157.3	0.0	0.0	-8452.8	0.0	0.0	-3646.7	15	10.7
16688			74	75.00	75.000	0.16	1.220	5.0	16.9	0.0	0.0	105.02	270	0	(2,183)	(429,019)	1.2	0.0	11.6	0.6	78.5	26.5	0.0	0.0	-1819.4	224.7	0.0	0.0	15	10.7
16815			74	70.00	70.000	0.16	-3.984	5.0	0.0	0.0	-53.3	126.59	302	0	(3,101)	(431,909)	-4.0	0.0	11.6	0.6	29.7	96.9	251.4	0.0	0.0	0.0	0.0	-2584.4	15	10.7
16825		74	74	72.04	72.044	0.16	-1.956	4.0	0.0	0.0	-20.5	10.06	0	0	(446)	(432,355)	-2.0	0.0	11.6	0.6	10.1	10.1	0.0	0.0	-268.3	0.0	0.0	-103.0	15	10.7
16889			74	85.00	85.000	0.00	11.000	4.0	190.4	179.8	0.0	63.76	6,184	5,838	(118)	(420,555)	4.0	7.0	41.6	0.0	9.6	54.1	0.0	0.0	-98.5	5153.6	4865.4	0.0	15	10.8
16942			74	100.00	100.000	0.00	26.000	5.0	525.5	1126.2	0.0	53.73	23,079	42,100	0	(349,670)	5.0	21.0	97.6	0.0	53.7	53.7	5115.1	4829.0	0.0	14117.6	30254.0	0.0	15	11.5
16996		74	74	105.00	105.000	0.00	31.000	5.0	625.5	1654.2	0.0	53.06	36,643	88,514	0	(208,952)	5.0	26.0	117.6	0.0	53.1	53.1	13941.5	29876.8	0.0	16594.5	43884.6	0.0	15	12.9
17072			74	100.00	100.000	0.00	26.000	5.0	525.5	1126.2	0.0	76.08	52,541	126,915	0	(7,184)	5.0	21.0	97.6	0.0	76.1	76.1	23794.0	62923.9	0.0	19990.0	42838.7	0.0	15	14.9
17141			74	80.00	80.000	0.00	6.000	5.0	125.5	14.2	0.0	69.07	26,979	47,256	0	73,134	5.0	1.0	17.6	0.0	69.1	69.1	18148.1	38891.6	0.0	4334.1	488.7	0.0	15	15.7
17213		74	74	72.00	72.000	0.00	-2.000	5.0	0.0	0.0	-21.1	71.88	4,059	458	(227)	76,344	-2.0	0.0	11.6	0.6	53.9	18.0	3382.9	381.4	0.0	0.0	0.0	-189.1	15	15.8
17320			74	70.00	70.000	-0.19	-3.798	5.0	0.0	0.0	-49.8	107.90	0	0	(4,587)	71,757	-3.8	0.0	11.6	0.6	107.9	107.9	0.0	0.0	-1135.6	0.0	0.0	-2687.2	15	15.7
17535			73	64.00	64.000	-0.19	-9.397	5.0	0.0	0.0	-201.5	214.26	0	0	(32,307)	39,450	-9.4	0.0	11.6	0.6	214.3	214.3	0.0	0.0	-5336.1	0.0	0.0	-21586.7	15	15.4
17779			73	63.00	63.000	-0.19	-9.940	5.0	0.0	0.0	-221.2	243.98	0	0	(61,880)	(22,430)	-9.9	0.0	11.6	0.6	244.0	244.0	0.0	0.0	-24581.0	0.0	0.0	-26985.4	15	14.8
17920			73	70.00	70.000	-0.19	-2.676	5.0	0.0	0.0	-30.7	141.14	0	0	(21,334)	(43,764)	-2.7	0.0	11.6	0.6	141.1	141.1	0.0	0.0	-15610.8	0.0	0.0	-2167.9	15	14.6
18019			72	73.00	73.000	-0.19	0.510	5.0	6.9	0.0	0.0	99.30	65	0	(1,537)	(45,256)	0.5	0.0	11.6	0.6	83.4	15.9	0.0	0.0	-1281.0	54.6	0.0	0.0	15	14.5
18104			72	70.00	70.000	-0.19	-2.332	5.0	0.0	0.0	-25.6	84.42	62	0	(1,065)	(46,278)	-2.3	0.0	11.6	0.6	15.2	69.3	52.0	0.0	0.0	0.0	0.0	-887.6	15	14.5
18192			72	67.00	67.000	-0.19	-5.166	5.0	0.0	0.0	-78.2	88.56	0	0	(5,517)	(51,795)	-5.2	0.0	11.6	0.6	88.6	88.6	0.0	0.0	-1134.9	0.0	0.0	-3462.3	15	14.5
18281		72	72	70.00	70.000	-0.19	-2.000	5.0	0.0	0.0	-21.1	88.56	0	0	(5,273)	(57,068)	-2.0	0.0	11.6	0.6	88.6	88.6	0.0	0.0	-3462.3	0.0	0.0	-932.1	15	14.4
18510			72	64.00	64.000	0.00	-8.000	5.0	0.0	0.0	-154.9	229.65	0	0	(24,237)	(81,305)	-8.0	0.0	11.6	0.6	229.7	229.7	0.0	0.0	-2417.1	0.0	0.0	-17780.7	15	14.2
18618			72	68.00	68.000	0.00	-4.000	5.0	0.0	0.0	-53.7	107.85	0	0	(13,492)	(94,797)	-4.0	0.0	11.6	0.6	107.8	107.8	0.0	0.0	-8350.3	0.0	0.0	-2893.1	15	14.1
18788			72	70.00	70.000	0.00	-2.000	5.0	0.0	0.0	-21.1	169.62	0	0	(7,602)	(102,399)	-2.0	0.0	11.6	0.6	169.6	169.6	0.0	0.0	-4550.1	0.0	0.0	-1785.3	15	14.0
18923			72	77.00	77.000	0.00	5.000	5.0	96.1	0.0	0.0	135.03	5,558	0	(487)	(98,995)	5.0	0.0	11.6	0.6	38.6	96.4	0.0	0.0	-406.0	4631.8	0.0	0.0	15	14.0
19058		72	72	70.00	70.000	0.00	-2.000	5.0	0.0	0.0	-21.1	135.03	5,558	0	(487)	(95,591)	-2.0	0.0	11.6	0.6	96.4	38.6	4631.8	0.0	0.0	0.0	0.0	-406.0	15	14.0
19213			72	69.00	69.000	0.00	-3.000	5.0	0.0	0.0	-35.9	154.98	0	0	(5,291)	(100,882)	-3.0	0.0	11.6	0.6	155.0	155.0	0.0	0.0	-1631.2	0.0	0.0	-2778.0	15	14.0
19368			72	70.00	70.000	0.00	-2.000	5.0	0.0	0.0	-21.1	154.98	0	0	(5,291)	(106,173)	-2.0	0.0	11.6	0.6	155.0	155.0	0.0	0.0	-2778.0	0.0	0.0	-1631.2	15	13.9
19475			72	60.00	60.000	0.00	-12.000	5.0	0.0	0.0	-304.1	106.76	0	0	(20,825)	(126,998)	-12.0	0.0	11.6	0.6	106.8	106.8	0.0	0.0	-1123.6	0.0	0.0	-16230.2	15	13.7
19684			72	69.00	69.000	0.00	-3.000	5.0	0.0	0.0	-35.9	209.67	0	0	(42,760)	(169,758)	-3.0	0.0	11.6	0.6	209.7	209.7	0.0	0.0	-31875.1	0.0	0.0	-3758.3	15	13.3
19935			72	70.00	70.000	0.00	-2.000	5.0	0.0	0.0	-21.1	250.36	0	0	(8,547)	(178,305)	-2.0	0.0	11.6	0.6	250.4	250.4	0.0	0.0	-4487.7	0.0	0.0	-2635.0	15	13.2
20135			72	72.00	72.000	0.00	0.000	5.0	0.0	0.0	-0.5	199.92	0	0	(2,525)	(180,830)	0.0	0.0	11.6	0.6	199.9	199.9	0.0	0.0	-2104.2	0.0	0.0	0.0	15	13.2
20213			72	70.00	70.000	0.00	-2.000	5.0	0.0	0.0	-21.1	78.09	0	0	(986)	(181,816)	-2.0	0.0	11.6	0.6	78.1	78.1	0.0	0.0	0.0	0.0	0.0	-821.9	15	13.2
20321			72	67.00	67.000	0.00	-5.000	5.0	0.0	0.0	-74.5	108.13	0	0	(6,196)	(188,012)	-5.0	0.0	11.6	0.6	108.1	108.1	0.0	0.0	-1138.1	0.0	0.0	-4025.1	15	13.1
20433			72	70.00	70.000	0.00	-2.000	5.0	0.0	0.0	-21.1	111.92	0	0	(6,413)	(194,425)	-2.0	0.0	11.6	0.6	111.9	111.9	0.0	0.0	-4166.2	0.0	0.0	-1178.0	15	13.1
20551			72	80.00	80.000	0.00	8.000	5.0	165.5	53.4	0.0	117.86	9,363	3,018	(298)	(184,246)	5.0	3.0	25.6	0.0	23.6	94.3	0.0	0.0	-248.1	7802.3	2515.1	0.0	15	13.2
20669			72	80.00	80.000	0.00	8.000	5.0	165.5	53.4	0.0	118.51	23,536	7,587	0	(157,908)	5.0	3.0	25.6	0.0	118.5	118.5	9806.7	3161.3	0.0	9806.7	3161.3	0.0	15	13.4
20755		72	72	70.00	70.000	0.00	-2.000	5.0	0.0	0.0	-21.1	85.74	6,811	2,196	(217)	(150,503)	-2.0	0.0	11.6	0.6	68.6	17.1	5676.0	1829.7	0.0	0.0	0.0	-180.5	15	13.5
21238			69	67.00	67.000	-0.60	-2.117	5.0	0.0	0.0	-22.6	483.21	0	0	(12,664)	(163,167)	-2.1	0.0	11.6	0.6	483.2	483.2	0.0	0.0	-5085.8	0.0	0.0	-5467.5	15	13.4
21626			67	65.00	65.000	-0.60	-1.801	5.0	0.0	0.0	-18.5	388.26	0	0	(9,572)	(172,739)	-1.8	0.0	11.6	0.6	388.3	388.3	0.0	0.0	-4393.2	0.0	0.0	-3583.6	15	13.3
21836			66	62.00	62.000	-0.60	-3.551	5.0	0.0	0.0	-45.3	209.49	0	0	(8,012)	(180,751)	-3.6	0.0	11.6	0.6	209.5	209.5	0.0	0.0	-1933.6	0.0	0.0	-4742.9	15	13.2
22086			64	60.50	60.500	-0.60	-3.559	5.0	0.0	0.0	-45.4	250.12	0	0	(13,612)	(194,363)	-3.6	0.0	11.6	0.6	250.1	250.1	0.0	0.0	-5662.7	0.0	0.0	-5680.2	15	13.1
22263		63	63	61.00	61.000	-0.60	-2.000	5.0	0.0	0.0	-21.1	177.43	0	0	(7,076)	(201,439)	-2.0	0.0	11.6	0.6	177.4	177.4	0.0	0.0	-4029.4	0.0	0.0	-1867.5	15	13.0
22431			63	60.00	60.000	0.00	-3.000	5.0	0.0	0.0	-35.9	167.23	0	0	(5,709)	(207,148)	-3.0	0.0	11.6	0.6	167.2	167.2	0.0	0.0	-1760.1	0.0	0.0	-2997.6	15	12.9
22561			63	59.50	59.500	0.00	-3.500	5.0	0.0	0.0	-44.4	130.82	0	0	(6,297)	(213,445)	-3.5	0.0	11.6	0.6	130.8	130.8	0.0	0.0	-2344.9	0.0	0.0	-2902.9	15	12.9
22680			63	60.00	60.000	0.00	-3.000	5.0	0.0	0.0	-35.9	118.53	0	0	(5,706)	(219,151)	-3.0	0.0	11.6	0.6	118.5	118.5	0.0	0.0	-2630.2	0.0	0.0	-2124.7	15	12.8

	Cut	Fill			
Width at grade line:	11.6	7.3			
Slope - Earth 1V:	1.50	1.50	H	Limit up slope	0.501
Slope - Rock 1V:	2.00	2.00	H	Limit down slope	-1.5
Ditch / Crown Areas:	0.55	-0.45			

Berm, meters:	1
Earth Shrinkage:	30%
Rock Bulking:	30%
Volume Contingency:	20%

baseline for mass haul	15
cumulative adjusted	100,000

to plot Kilometer Point (PK)	mark	Grade Point	to plot Grade Line	Ground Profile Point	to plot Ground Profile Line	Track Grade (%)	Cut Height	Depth to Rock	End Areas for Volumes ------- Earth Cut	- Rock Cut	------ Fill	Seg-ment Length (m)	Earthwork Volumes (m³) from preceding PK - Common Excavation	- Rock Excavation	- Embank-ment	- Adjusted Cumulative	Earth Height	Rock Cut Depth	Earth Cut Base	Earth Cut Top Area	La	Lb	Earth Va+	Rock Va+	Both Va-	Earth Vb+	Rock Vb+	Both Vb-	Baseline for Mass Haul	Cumul Adjtd
23068			63	77.00	77.000	0.00	14.000	5.0	285.5	267.0	0.0	387.74	54,699	51,145	(1,472)	(115,845)	5.0	9.0	49.6	0.0	68.4	319.3	0.0	0.0	-1226.5	45582.3	42620.6	0.0	15	13.8
23246			63	78.00	78.000	0.00	15.000	5.0	305.5	316.6	0.0	178.09	63,151	62,349	0	9,414	5.0	10.0	53.6	0.0	178.1	178.1	25422.3	23770.6	0.0	27203.2	28187.2	0.0	15	15.1
23468			63	60.00	60.000	0.00	-3.000	5.0	0.0	0.0	-35.9	222.68	34,014	35,245	(798)	78,244	-3.0	0.0	11.6	0.6	185.6	37.1	28345.3	29370.6	0.0	0.0	0.0	-665.3	15	15.8
23601			63	60.50	60.500	0.00	-2.500	5.0	0.0	0.0	-28.1	132.36	0	0	(5,077)	73,167	-2.5	0.0	11.6	0.6	132.4	132.4	0.0	0.0	-2372.6	0.0	0.0	-1858.3	15	15.7
23705			63	60.00	60.000	0.00	-3.000	5.0	0.0	0.0	-35.9	104.25	0	0	(3,999)	69,168	-3.0	0.0	11.6	0.6	104.3	104.3	0.0	0.0	-1463.7	0.0	0.0	-1868.7	15	15.7
23739			63	59.50	59.500	0.00	-3.500	5.0	0.0	0.0	-44.4	33.67	0	0	(1,621)	67,547	-3.5	0.0	11.6	0.6	33.7	33.7	0.0	0.0	-603.5	0.0	0.0	-747.1	15	15.7
23781			63	60.00	60.000	0.00	-3.000	5.0	0.0	0.0	-35.9	42.07	0	0	(2,025)	65,522	-3.0	0.0	11.6	0.6	42.1	42.1	0.0	0.0	-933.5	0.0	0.0	-754.1	15	15.7
24005			63	64.00	64.000	0.00	1.000	5.0	13.7	0.0	0.0	223.91	458	0	(3,612)	62,231	1.0	0.0	11.6	0.6	167.9	56.0	0.0	0.0	-3010.2	382.0	0.0	0.0	15	15.6
24220			63	62.00	62.000	0.00	-1.000	5.0	0.0	0.0	-9.3	215.50	882	0	(598)	62,250	-1.0	0.0	11.6	0.6	107.8	107.8	735.4	0.0	0.0	0.0	0.0	-498.3	15	15.6
24476			63	71.00	71.000	0.00	8.000	5.0	165.5	53.4	0.0	255.67	22,567	7,275	(158)	87,346	5.0	3.0	25.6	0.0	28.4	227.3	0.0	0.0	-131.4	18805.9	6062.2	0.0	15	15.9
24619			63	60.00	60.000	0.00	-3.000	5.0	0.0	0.0	-35.9	143.10	10,334	3,331	(839)	98,071	-3.0	0.0	11.6	0.6	104.1	39.0	8612.0	2776.1	0.0	0.0	0.0	-699.6	15	16.0
24694			63	59.00	59.000	0.00	-4.000	5.0	0.0	0.0	-53.7	75.55	0	0	(4,057)	94,014	-4.0	0.0	11.6	0.6	75.5	75.5	0.0	0.0	-1354.2	0.0	0.0	-2026.6	15	15.9
24978			63	56.00	56.000	0.00	-7.000	5.0	0.0	0.0	-125.1	283.85	0	0	(30,434)	63,580	-7.0	0.0	11.6	0.6	283.8	283.8	0.0	0.0	-7614.1	0.0	0.0	-17747.4	15	15.6
25262			63	60.00	60.000	0.00	-3.000	5.0	0.0	0.0	-35.9	283.85	0	0	(27,402)	36,178	-3.0	0.0	11.6	0.6	283.8	283.8	0.0	0.0	-17747.4	0.0	0.0	-5087.9	15	15.4
25747			63	71.00	71.000	0.00	8.000	5.0	165.5	53.4	0.0	484.87	35,016	11,288	(2,844)	72,520	5.0	3.0	25.6	0.0	132.2	352.6	0.0	0.0	-2370.4	29180.4	9406.5	0.0	15	15.7
26128			63	63.00	63.000	0.00	0.000	5.0	0.0	0.0	-0.5	380.90	37,823	12,193	0	114,847	0.0	0.0	11.6	0.6	380.9	380.9	31519.5	10160.5	0.0	0.0	0.0	0.0	15	16.1
26253			63	60.00	60.000	0.00	-3.000	5.0	0.0	0.0	-35.9	125.02	0	0	(2,689)	112,158	-3.0	0.0	11.6	0.6	125.0	125.0	0.0	0.0	0.0	0.0	0.0	-2241.0	15	16.1
26378			63	61.00	61.000	0.00	-2.000	5.0	0.0	0.0	-21.1	124.67	0	0	(4,256)	107,902	-2.0	0.0	11.6	0.6	124.7	124.7	0.0	0.0	-2234.7	0.0	0.0	-1312.2	15	16.1
26511			63	60.00	60.000	0.00	-3.000	5.0	0.0	0.0	-35.9	133.28	0	0	(4,550)	103,352	-3.0	0.0	11.6	0.6	133.3	133.3	0.0	0.0	-1402.8	0.0	0.0	-2389.0	15	16.0
26658			63	58.00	58.000	0.00	-5.000	5.0	0.0	0.0	-74.5	147.42	0	0	(9,756)	93,596	-5.0	0.0	11.6	0.6	147.4	147.4	0.0	0.0	-2642.5	0.0	0.0	-5487.7	15	15.9
26918			63	58.00	58.000	0.00	-5.000	5.0	0.0	0.0	-74.5	259.85	0	0	(23,215)	70,381	-5.0	0.0	11.6	0.6	259.8	259.8	0.0	0.0	-9672.9	0.0	0.0	-9672.9	15	15.7
27119			63	60.00	60.000	0.00	-3.000	5.0	0.0	0.0	-35.9	200.56	0	0	(13,273)	57,108	-3.0	0.0	11.6	0.6	200.6	200.6	0.0	0.0	-7465.8	0.0	0.0	-3595.0	15	15.6
27200			63	62.00	62.000	0.00	-1.000	5.0	0.0	0.0	-9.3	81.65	0	0	(2,209)	54,899	-1.0	0.0	11.6	0.6	81.7	81.7	0.0	0.0	-1463.6	0.0	0.0	-377.6	15	15.5
27282			63	60.00	60.000	0.00	-3.000	5.0	0.0	0.0	-35.9	81.65	0	0	(2,209)	52,690	-3.0	0.0	11.6	0.6	81.7	81.7	0.0	0.0	-377.6	0.0	0.0	-1463.6	15	15.5
27521			63	60.00	60.000	0.00	-3.000	5.0	0.0	0.0	-35.9	238.54	0	0	(10,262)	42,428	-3.0	0.0	11.6	0.6	238.5	238.5	0.0	0.0	-4275.8	0.0	0.0	-4275.8	15	15.4
27808			63	68.00	68.000	0.00	5.000	5.0	96.1	0.0	0.0	287.13	10,342	0	(2,316)	47,351	5.0	0.0	11.6	0.6	107.7	179.5	0.0	0.0	-1930.1	8618.4	0.0	0.0	15	15.5
28099		63	63	60.00	60.000	0.00	-3.000	5.0	0.0	0.0	-35.9	291.60	10,503	0	(2,352)	52,351	-3.0	0.0	11.6	0.6	182.2	109.3	8752.6	0.0	0.0	0.0	0.0	-1960.1	15	15.5
28297			64	70.00	70.000	0.43	6.153	5.0	128.6	16.6	0.0	197.26	10,228	1,319	(1,391)	59,834	5.0	1.2	18.2	0.0	64.7	132.6	0.0	0.0	-1159.0	8523.1	1099.3	0.0	15	15.6
28588			65	60.00	60.000	0.43	5.101	5.0	0.0	0.0	-76.7	291.88	12,308	1,587	(6,090)	64,423	-5.1	0.0	11.6	0.6	159.6	132.3	10256.6	1322.9	0.0	0.0	0.0	-5075.3	15	15.6
28743			66	63.00	63.000	0.43	-2.764	5.0	0.0	0.0	-32.1	154.35	0	0	(10,077)	54,346	-2.8	0.0	11.6	0.6	154.3	154.3	0.0	0.0	-5920.9	0.0	0.0	-2476.5	15	15.5
28820			66	60.00	60.000	0.43	-6.094	5.0	0.0	0.0	-100.6	76.72	0	0	(6,110)	48,236	-6.1	0.0	11.6	0.6	76.7	76.7	0.0	0.0	-1231.0	0.0	0.0	-3860.6	15	15.5
29076			67	56.00	56.000	0.43	-11.197	5.0	0.0	0.0	-270.3	256.88	0	0	(57,168)	(8,932)	-11.2	0.0	11.6	0.6	256.9	256.9	0.0	0.0	-12926.2	0.0	0.0	-34713.5	15	14.9
29163			68	60.00	60.000	0.43	-7.568	5.0	0.0	0.0	-141.6	86.34	0	0	(21,338)	(30,270)	-7.6	0.0	11.6	0.6	86.3	86.3	0.0	0.0	-11667.6	0.0	0.0	-6113.7	15	14.7
29494			69	68.00	68.000	0.43	-0.990	5.0	0.0	0.0	-9.1	330.85	0	0	(29,927)	(60,197)	-1.0	0.0	11.6	0.6	330.8	330.8	0.0	0.0	-23427.5	0.0	0.0	-1512.0	15	14.4
30280			72	76.00	76.000	0.43	3.632	5.0	62.5	0.0	0.0	786.30	23,165	0	(923)	(44,905)	3.6	0.0	11.6	0.6	168.4	617.9	0.0	0.0	-769.4	19304.4	0.0	0.0	15	14.6
30660		74	74	68.00	68.000	0.43	-6.000	5.0	0.0	0.0	-98.3	380.00	5,372	0	(13,953)	(55,098)	-6.0	0.0	11.6	0.6	143.3	236.7	4476.7	0.0	0.0	0.0	0.0	-11627.9	15	14.4
31129			74	78.00	78.000	0.00	4.000	5.0	71.0	0.0	0.0	469.42	7,993	0	(16,603)	(66,106)	4.0	0.0	11.6	0.6	281.6	187.8	0.0	0.0	-13836.0	6661.0	0.0	0.0	15	14.3
31599			74	70.00	70.000	0.00	-4.000	5.0	0.0	0.0	-53.7	469.42	9,991	0	(7,555)	(66,667)	-4.0	0.0	11.6	0.6	234.7	234.7	8326.2	0.0	0.0	0.0	0.0	-6296.0	15	14.3
32026			74	78.00	78.000	0.00	4.000	5.0	71.0	0.0	0.0	427.74	9,104	0	(6,884)	(67,178)	4.0	0.0	11.6	0.6	213.9	213.9	0.0	0.0	-5737.1	7587.0	0.0	0.0	15	14.3
32300		74	74	76.00	76.000	0.00	2.000	5.0	29.8	0.0	0.0	273.14	16,503	0	0	(55,626)	2.0	0.0	11.6	0.6	273.1	273.1	9689.6	0.0	0.0	4063.0	0.0	0.0	15	14.4
32604			72	77.00	77.000	-0.62	4.900	5.0	93.4	0.0	0.0	304.44	22,495	0	0	(39,880)	4.9	0.0	11.6	0.6	304.4	304.4	4528.5	0.0	0.0	14217.3	0.0	0.0	15	14.6
32996			70	69.00	69.000	-0.62	-0.656	5.0	0.0	0.0	-5.9	391.68	19,357	0	(164)	(26,494)	-0.7	0.0	11.6	0.6	345.4	46.3	16130.5	0.0	0.0	0.0	0.0	-136.3	15	14.7
33499			67	60.00	60.000	-0.62	-6.518	5.0	0.0	0.0	-111.8	503.01	0	0	(35,504)	(61,998)	-6.5	0.0	11.6	0.6	503.0	503.0	0.0	0.0	-1481.4	0.0	0.0	-28105.7	15	14.4
33567			66	59.50	59.500	-0.62	-6.591	5.0	0.0	0.0	-113.7	68.41	0	0	(9,255)	(71,253)	-6.6	0.0	11.6	0.6	68.4	68.4	0.0	0.0	-3822.4	0.0	0.0	-3889.8	15	14.3
33636			66	60.00	60.000	-0.62	-5.664	5.0	0.0	0.0	-89.9	68.41	0	0	(8,359)	(79,612)	-5.7	0.0	11.6	0.6	68.4	68.4	0.0	0.0	-3889.8	0.0	0.0	-3075.7	15	14.2
33761			65	61.50	61.500	-0.62	-3.381	5.0	0.0	0.0	-42.3	125.53	0	0	(9,956)	(89,568)	-3.4	0.0	11.6	0.6	125.5	125.5	0.0	0.0	-5643.8	0.0	0.0	-2653.1	15	14.1
34073			63	60.00	60.000	-0.62	-2.937	5.0	0.0	0.0	-34.8	311.44	0	0	(14,409)	(103,977)	-2.9	0.0	11.6	0.6	311.4	311.4	0.0	0.0	-6582.3	0.0	0.0	-5425.3	15	14.0
34284			62	61.00	61.000	-0.62	-0.620	5.0	0.0	0.0	-5.6	211.17	0	0	(5,117)	(109,094)	-0.6	0.0	11.6	0.6	211.2	211.2	0.0	0.0	-3678.5	0.0	0.0	-586.0	15	13.9
34495			60	60.00	60.000	-0.62	-0.302	5.0	0.0	0.0	-2.8	211.17	0	0	(1,057)	(110,151)	-0.3	0.0	11.6	0.6	211.2	211.2	0.0	0.0	-586.0	0.0	0.0	-294.6	15	13.9
34800			58	52.00	52.000	-0.62	-6.395	5.0	0.0	0.0	-108.5	305.58	0	0	(20,403)	(130,554)	-6.4	0.0	11.6	0.6	305.6	305.6	0.0	0.0	-426.3	0.0	0.0	-16576.2	15	13.7
34978			57	39.00	39.000	-0.62	-18.285	5.0	0.0	0.0	-635.5	177.92	0	0	(79,418)	(209,972)	-18.3	0.0	11.6	0.6	177.9	177.9	0.0	0.0	-9651.3	0.0	0.0	-56530.5	15	12.9
35024		57	57	40.00	40.000	-0.62	-17.000	5.0	0.0	0.0	-558.1	45.72	0	0	(32,740)	(242,712)	-17.0	0.0	11.6	0.6	45.7	45.7	0.0	0.0	-14526.6	0.0	0.0	-12757.0	15	12.6
35312			58	54.00	54.000	0.36	-4.023	5.0	0.0	0.0	-54.1	287.60	0	0	(105,631)	(348,343)	-4.0	0.0	11.6	0.6	287.6	287.6	0.0	0.0	-80247.6	0.0	0.0	-7778.1	15	11.5
35660			59	58.00	58.000	0.36	-1.262	5.0	0.0	0.0	-12.1	348.68	0	0	(13,839)	(362,182)	-1.3	0.0	11.6	0.6	348.7	348.7	0.0	0.0	-9430.1	0.0	0.0	-2102.5	15	11.4
36430		62	62	59.00	59.000	0.36	-3.000	5.0	0.0	0.0	-35.9	769.91	0	0	(22,132)	(384,314)	-3.0	0.0	11.6	0.6	769.9	769.9	0.0	0.0	-4642.6	0.0	0.0	-13800.6	15	11.2
36859			62	60.00	60.000	0.00	-2.000	5.0	0.0	0.0	-21.1	428.78	0	0	(14,639)	(398,953)	-2.0	0.0	11.6	0.6	428.8	428.8	0.0	0.0	-7685.9	0.0	0.0	-4512.9	15	11.0
37490			62	60.00	60.000	0.00	-2.000	5.0	0.0	0.0	-21.1	631.15	0	0	(15,943)	(414,896)	-2.0	0.0	11.6	0.6	631.2	631.2	0.0	0.0	-6642.9	0.0	0.0	-6642.9	15	10.9
37691			62	68.00	68.000	0.00	6.000	5.0	125.5	14.2	0.0	201.22	11,364	1,281	(635)	(405,911)	5.0	1.0	17.6	0.0	50.3	150.9	0.0	0.0	-529.5	9469.9	1067.7	0.0	15	10.9
37857			62	60.00	60.000	0.00	-2.000	5.0	0.0	0.0	-21.1	165.50	9,347	1,054	(523)	(398,521)	-2.0	0.0	11.6	0.6	124.1	41.4	7788.8	878.2	0.0	0.0	0.0	-435.5	15	11.0
37933			62	59.00	59.000	0.00	-3.000	5.0	0.0	0.0	-35.9	76.12	0	0	(2,599)	(401,120)	-3.0	0.0	11.6	0.6	76.1	76.1	0.0	0.0	-801.2	0.0	0.0	-1364.5	15	11.0
38017			62	60.00	60.000	0.00	-2.000	5.0	0.0	0.0	-21.1	84.12	0	0	(2,872)	(403,992)	-2.0	0.0	11.6	0.6	84.1	84.1	0.0	0.0	-1507.9	0.0	0.0	-885.4	15	11.0
38082			62	61.00	61.000	0.00	-1.000	5.0	0.0	0.0	-9.3	65.13	0	0	(1,184)	(405,176)	-1.0	0.0	11.6	0.6	65.1	65.1	0.0	0.0	-685.5	0.0	0.0	-301.2	15	10.9
38147			62	60.00	60.000	0.00	-2.000	5.0	0.0	0.0	-21.1	65.13	0	0	(1,184)	(406,360)	-2.0	0.0	11.6	0.6	65.1	65.1	0.0	0.0	-301.2	0.0	0.0	-685.5	15	10.9
38320			62	63.00	63.000	0.00	1.000	5.0	13.7	0.0	0.0	172.34	470	0	(1,451)	(407,482)	1.0	0.0	11.6	0.6	114.9	57.4	0.0	0.0	-1209.3	392.1	0.0	0.0	15	10.9
38566			62	60.00	60.000	0.00	-2.000	5.0	0.0	0.0	-21.1	246.00	672	0	(2,071)	(409,083)	-2.0	0.0	11.6	0.6	82.0	164.0	559.7	0.0	0.0	0.0	0.0	-1726.1	15	10.9
38929		62	62	54.00	54.000	0.00	-8.000	5.0	0.0	0.0	-154.9	362.98	0	0	(38,309)	(447,392)	-8.0	0.0	11.6	0.6	363.0	363.0	0.0	0.0	-3820.4	0.0	0.0	-28103.7	15	10.5

	Cut	Fill	
Width at grade line:	11.6	7.3	
Slope - Earth 1V:	1.50	1.50	H
Slope - Rock 1V:	2.00	2.00	H
Ditch / Crown Areas:	0.55	-0.45	

Limit up slope	0.501
Limit down slope	-1.5

Berm, meters:	1
Earth Shrinkage:	30%
Rock Bulking:	30%
Volume Contingency:	20%

baseline for mass haul	15
cumulative adjusted	100,000

to plot		to plot			to plot				End Areas for Volumes			Seg-	Earthwork Volumes (m^3) from preceding PK																Baseline	
Kilometer Point (PK)	mark	Grade Point	Grade Line	Ground Profile Point	Ground Profile Line	Track Grade (%)	Cut Height	Depth to Rock	------- Earth Cut	- Rock Cut	------ Fill	ment Length (m)	- Common Excavation	- Rock Excavation	- Embank-ment	- Adjusted Cumulative	Earth Height	Rock Cut Depth	Earth Cut Base	Earth Cut Top Area	La	Lb	Earth Va+	Rock Va+	Both Va-	Earth Vb+	Rock Vb+	Both Vb-	for Mass Haul	Cumul Adjtd
39244			62	60.00	60.000	0.00	-2.000	5.0	0.0	0.0	-21.1	315.70	0	0	(33,319)	(480,711)	-2.0	0.0	11.6	0.6	315.7	315.7	0.0	0.0	-24443.1	0.0	0.0	-3322.7	15	10.2
39431			62	64.00	64.000	0.00	2.000	5.0	29.8	0.0	0.0	186.69	1,666	0	(1,179)	(480,724)	2.0	0.0	11.6	0.6	93.3	93.3	0.0	0.0	-982.5	1388.5	0.0	0.0	15	10.2
39785			62	60.00	60.000	0.00	-2.000	5.0	0.0	0.0	-21.1	353.88	3,158	0	(2,235)	(480,748)	-2.0	0.0	11.6	0.6	176.9	176.9	2632.0	0.0	0.0	0.0	0.0	-1862.3	15	10.2
40006			62	58.00	58.000	0.00	-4.000	5.0	0.0	0.0	-53.7	221.39	0	0	(9,923)	(490,671)	-4.0	0.0	11.6	0.6	221.4	221.4	0.0	0.0	-2330.1	0.0	0.0	-5938.8	15	10.1
40451			62	60.00	60.000	0.00	-2.000	5.0	0.0	0.0	-21.1	444.36	0	0	(19,916)	(510,587)	-2.0	0.0	11.6	0.6	444.4	444.4	0.0	0.0	-11920.0	0.0	0.0	-4676.9	15	9.9
40731			62	62.00	62.000	0.00	0.000	5.0	0.0	0.0	-0.5	279.80	0	0	(3,534)	(514,121)	0.0	0.0	11.6	0.6	279.8	279.8	0.0	0.0	-2944.9	0.0	0.0	0.0	15	9.9
41179			62	64.00	64.000	0.00	2.000	5.0	29.8	0.0	0.0	448.68	8,009	0	0	(508,515)	2.0	0.0	11.6	0.6	448.7	448.7	0.0	0.0	0.0	6674.1	0.0	0.0	15	9.9
41410			62	69.00	69.000	0.00	7.000	5.0	145.5	31.8	0.0	230.49	24,236	4,391	0	(485,842)	5.0	2.0	21.6	0.0	230.5	230.5	3428.5	0.0	0.0	16768.1	3659.0	0.0	15	10.1
41648			62	61.00	61.000	0.00	-1.000	5.0	0.0	0.0	-9.3	238.61	18,227	3,977	(166)	(468,079)	-1.0	0.0	11.6	0.6	208.8	29.8	15189.0	3314.4	0.0	0.0	0.0	-137.9	15	10.3
41881			62	67.00	67.000	0.00	5.000	5.0	96.1	0.0	0.0	233.06	11,193	0	(216)	(460,460)	5.0	0.0	11.6	0.6	38.8	194.2	0.0	0.0	-179.7	9327.3	0.0	0.0	15	10.4
41984		62	62	60.00	60.000	0.00	-2.000	5.0	0.0	0.0	-21.1	102.79	4,231	0	(371)	(457,869)	-2.0	0.0	11.6	0.6	73.4	29.4	3526.1	0.0	0.0	0.0	0.0	-309.1	15	10.4
42217			62	54.00	54.000	0.00	-8.000	5.0	0.0	0.0	-154.9	233.27	0	0	(24,619)	(482,488)	-8.0	0.0	11.6	0.6	233.3	233.3	0.0	0.0	-2455.2	0.0	0.0	-18060.9	15	10.2
42433			62	60.00	60.000	0.00	-2.000	5.0	0.0	0.0	-21.1	215.16	0	0	(22,708)	(505,196)	-2.0	0.0	11.6	0.6	215.2	215.2	0.0	0.0	-16658.8	0.0	0.0	-2264.6	15	9.9
42736			62	68.00	68.000	0.00	6.000	5.0	125.5	14.2	0.0	303.73	17,153	1,934	(959)	(491,634)	5.0	1.0	17.6	0.0	75.9	227.8	0.0	0.0	-799.2	14294.3	1611.7	0.0	15	10.1
42992		62	62	60.00	60.000	0.00	-2.000	5.0	0.0	0.0	-21.1	255.60	14,435	1,628	(807)	(480,220)	-2.0	0.0	11.6	0.6	191.7	63.9	12029.2	1356.3	0.0	0.0	0.0	-672.5	15	10.2
43039			62	59.00	59.000	0.00	-3.000	5.0	0.0	0.0	-35.9	46.97	0	0	(1,604)	(481,824)	-3.0	0.0	11.6	0.6	47.0	47.0	0.0	0.0	-494.4	0.0	0.0	-841.9	15	10.2
43086			62	60.00	60.000	0.00	-2.000	5.0	0.0	0.0	-21.1	46.97	0	0	(1,604)	(483,428)	-2.0	0.0	11.6	0.6	47.0	47.0	0.0	0.0	-841.9	0.0	0.0	-494.4	15	10.2
43315			62	68.00	68.000	0.00	6.000	5.0	125.5	14.2	0.0	229.06	12,936	1,459	(723)	(473,199)	5.0	1.0	17.6	0.0	57.3	171.8	0.0	0.0	-602.7	10780.1	1215.4	0.0	15	10.3
43537			62	60.00	60.000	0.00	-2.000	5.0	0.0	0.0	-21.1	221.77	12,524	1,412	(700)	(463,297)	-2.0	0.0	11.6	0.6	166.3	55.4	10437.1	1176.8	0.0	0.0	0.0	-583.5	15	10.4
43823			62	48.00	48.000	0.00	-14.000	5.0	0.0	0.0	-396.7	286.01	0	0	(71,680)	(534,977)	-14.0	0.0	11.6	0.6	286.0	286.0	0.0	0.0	-3010.3	0.0	0.0	-56722.9	15	9.7
44226		62	62	54.00	54.000	0.00	-8.000	5.0	0.0	0.0	-154.9	403.74	0	0	(133,598)	(668,575)	-8.0	0.0	11.6	0.6	403.7	403.7	0.0	0.0	-80071.7	0.0	0.0	-31259.6	15	8.3
44475			63	60.00	60.000	0.38	-2.945	5.0	0.0	0.0	-35.0	248.28	0	0	(28,276)	(696,851)	-2.9	0.0	11.6	0.6	248.3	248.3	0.0	0.0	-19223.1	0.0	0.0	-4339.9	15	8.0
44648			64	68.00	68.000	0.38	4.394	5.0	80.5	0.0	0.0	173.66	5,021	0	(1,462)	(694,798)	4.4	0.0	11.6	0.6	69.7	104.0	0.0	0.0	-1218.2	4183.8	0.0	0.0	15	8.1
44942			65	60.00	60.000	0.38	-4.724	5.0	0.0	0.0	-68.4	293.80	6,836	0	(6,249)	(696,262)	-4.7	0.0	11.6	0.6	141.6	152.2	5696.9	0.0	0.0	0.0	0.0	-5207.6	15	8.0
45251			66	58.00	58.000	0.38	-7.901	5.0	0.0	0.0	-151.8	309.08	0	0	(40,834)	(737,096)	-7.9	0.0	11.6	0.6	309.1	309.1	0.0	0.0	-10573.6	0.0	0.0	-23454.5	15	7.6
45710			68	59.00	59.000	0.38	-8.649	5.0	0.0	0.0	-175.8	459.20	0	0	(90,249)	(827,345)	-8.6	0.0	11.6	0.6	459.2	459.2	0.0	0.0	-34846.4	0.0	0.0	-40361.4	15	6.7
45806			68	60.00	60.000	0.38	-8.011	5.0	0.0	0.0	-155.2	95.12	0	0	(18,890)	(846,235)	-8.0	0.0	11.6	0.6	95.1	95.1	0.0	0.0	-8360.6	0.0	0.0	-7380.8	15	6.5
46072			69	68.00	68.000	0.38	-1.026	5.0	0.0	0.0	-9.5	266.68	0	0	(26,355)	(872,590)	-1.0	0.0	11.6	0.6	266.7	266.7	0.0	0.0	-20693.0	0.0	0.0	-1269.4	15	6.3
46476			71	61.00	61.000	0.38	-9.563	5.0	0.0	0.0	-207.4	403.75	0	0	(52,559)	(925,149)	-9.6	0.0	11.6	0.6	403.8	403.8	0.0	0.0	-1921.9	0.0	0.0	-41877.0	15	5.7
47033			73	66.00	66.000	0.38	-6.685	5.0	0.0	0.0	-116.3	557.37	0	0	(108,256)	(1,033,405)	-6.7	0.0	11.6	0.6	557.4	557.4	0.0	0.0	-57810.4	0.0	0.0	-32402.7	15	4.7
47550			75	61.00	61.000	0.38	-13.652	5.0	0.0	0.0	-379.7	516.83	0	0	(153,790)	(1,187,195)	-13.7	0.0	11.6	0.6	516.8	516.8	0.0	0.0	-30045.9	0.0	0.0	-98112.4	15	3.1
47793			76	76.00	76.000	0.38	0.422	5.0	5.7	0.0	0.0	243.18	25	0	(53,734)	(1,240,912)	0.4	0.0	11.6	0.6	235.9	7.3	0.0	0.0	-44778.7	20.9	0.0	0.0	15	2.6
47953			76	76.00	76.000	0.38	-0.186	5.0	0.0	0.0	-1.9	159.72	381	0	(54)	(1,240,699)	-0.2	0.0	11.6	0.6	111.0	48.8	317.4	0.0	0.0	0.0	0.0	-45.3	15	2.6
48059			77	69.00	69.000	0.38	-7.587	5.0	0.0	0.0	-142.2	105.56	0	0	(9,124)	(1,249,823)	-7.6	0.0	11.6	0.6	105.6	105.6	0.0	0.0	-98.2	0.0	0.0	-7504.8	15	2.5
48167		77	77	70.00	70.000	0.38	-7.000	5.0	0.0	0.0	-125.1	108.39	0	0	(17,380)	(1,267,203)	-7.0	0.0	11.6	0.6	108.4	108.4	0.0	0.0	-7706.0	0.0	0.0	-6777.1	15	2.3
48356			78	80.00	80.000	0.43	2.183	5.0	33.0	0.0	0.0	189.28	892	0	(10,825)	(1,277,404)	2.2	0.0	11.6	0.6	144.3	45.0	0.0	0.0	-9020.9	743.2	0.0	0.0	15	2.2
48514			78	91.00	91.000	0.43	12.503	5.0	255.6	200.2	0.0	157.72	27,310	18,943	0	(1,233,661)	5.0	7.5	43.6	0.0	157.7	157.7	2604.7	0.0	0.0	20153.5	15786.2	0.0	15	2.7
48708			79	80.00	80.000	0.43	0.665	5.0	8.9	0.0	0.0	194.19	30,817	23,324	0	(1,181,768)	0.7	0.0	11.6	0.6	194.2	194.2	24813.6	19436.5	0.0	867.1	0.0	0.0	15	3.2
48795			80	81.00	81.000	0.43	1.290	5.0	18.0	0.0	0.0	86.90	1,405	0	0	(1,180,785)	1.3	0.0	11.6	0.6	86.9	86.9	388.0	0.0	0.0	783.0	0.0	0.0	15	3.2
48882			80	80.00	80.000	0.43	-0.084	5.0	0.0	0.0	-1.1	86.90	882	0	(3)	(1,180,171)	-0.1	0.0	11.6	0.6	81.6	5.3	734.9	0.0	0.0	0.0	0.0	-2.9	15	3.2
48935			80	79.00	79.000	0.43	-1.313	5.0	0.0	0.0	-12.6	52.95	0	0	(435)	(1,180,606)	-1.3	0.0	11.6	0.6	52.9	52.9	0.0	0.0	-28.6	0.0	0.0	-334.1	15	3.2
49145			81	80.00	80.000	0.43	-1.220	5.0	0.0	0.0	-11.6	210.28	0	0	(3,055)	(1,183,661)	-1.2	0.0	11.6	0.6	210.3	210.3	0.0	0.0	-1326.9	0.0	0.0	-1218.6	15	3.2
49319			82	89.00	89.000	0.43	7.031	5.0	146.1	32.4	0.0	173.51	12,964	2,872	(178)	(1,171,031)	5.0	2.0	21.7	0.0	25.7	147.9	0.0	0.0	-148.7	10803.1	2393.0	0.0	15	3.3
49526			83	80.00	80.000	0.43	-2.864	5.0	0.0	0.0	-33.7	207.64	12,936	2,866	(1,214)	(1,159,464)	-2.9	0.0	11.6	0.6	147.5	60.1	10780.0	2387.9	0.0	0.0	0.0	-1011.8	15	3.4
49701			84	78.00	78.000	0.43	-5.619	5.0	0.0	0.0	-88.8	174.99	0	0	(12,862)	(1,172,326)	-5.6	0.0	11.6	0.6	175.0	175.0	0.0	0.0	-2946.0	0.0	0.0	-7772.2	15	3.3
49796			84	80.00	80.000	0.43	-4.026	5.0	0.0	0.0	-54.2	94.27	0	0	(8,087)	(1,180,413)	-4.0	0.0	11.6	0.6	94.3	94.3	0.0	0.0	-4187.0	0.0	0.0	-2552.4	15	3.2
50022		85	85	88.00	88.000	0.43	3.000	5.0	48.9	0.0	0.0	225.81	2,826	0	(4,204)	(1,182,639)	3.0	0.0	11.6	0.6	129.4	96.4	0.0	0.0	-3503.3	2355.0	0.0	0.0	15	3.2
50388			86	90.00	90.000	0.40	3.546	5.0	60.5	0.0	0.0	366.61	24,062	0	0	(1,165,796)	3.5	0.0	11.6	0.6	366.6	366.6	8954.4	0.0	0.0	11097.3	0.0	0.0	15	3.3
50568			87	93.00	93.000	0.40	5.831	5.0	122.1	11.6	0.0	180.11	19,739	1,250	0	(1,150,354)	5.0	0.8	16.9	0.0	180.1	180.1	5451.9	0.0	0.0	10997.5	1041.9	0.0	15	3.5
50874			88	86.00	86.000	0.40	-2.383	5.0	0.0	0.0	-26.4	306.06	15,920	1,508	(1,404)	(1,138,654)	-2.4	0.0	11.6	0.6	217.3	88.8	13266.4	1256.9	0.0	0.0	0.0	-1170.3	15	3.6
51096			89	93.00	93.000	0.40	3.738	5.0	64.9	0.0	0.0	221.53	5,266	0	(1,364)	(1,136,332)	3.7	0.0	11.6	0.6	86.2	135.3	0.0	0.0	-1136.7	4388.0	0.0	0.0	15	3.6
51327			90	91.00	91.000	0.40	0.822	5.0	11.1	0.0	0.0	230.97	10,528	0	0	(1,128,962)	0.8	0.0	11.6	0.6	231.0	231.0	7491.5	0.0	0.0	1281.9	0.0	0.0	15	3.7
51562			91	89.00	89.000	0.40	-2.111	5.0	0.0	0.0	-22.5	235.15	439	0	(2,289)	(1,130,944)	-2.1	0.0	11.6	0.6	65.9	169.3	365.7	0.0	0.0	0.0	0.0	-1907.5	15	3.7
52056			93	100.00	100.000	0.40	6.928	5.0	144.1	30.3	0.0	494.38	32,750	6,898	(1,562)	(1,100,614)	5.0	1.9	21.3	0.0	115.5	378.9	0.0	0.0	-1301.3	27291.5	5748.2	0.0	15	4.0
52290		94	94	88.00	88.000	0.40	-6.000	5.0	0.0	0.0	-98.3	233.86	10,832	2,281	(6,398)	(1,096,464)	-6.0	0.0	11.6	0.6	125.3	108.5	9026.3	1901.1	0.0	0.0	0.0	-5332.0	15	4.0
52560			94	98.00	98.000	0.03	3.908	5.0	68.8	0.0	0.0	269.85	4,393	0	(9,633)	(1,103,022)	3.9	0.0	11.6	0.6	163.4	106.4	0.0	0.0	-8027.7	3660.9	0.0	0.0	15	4.0
52809			94	82.00	82.000	0.03	-12.177	5.0	0.0	0.0	-311.8	248.80	2,495	0	(35,231)	(1,136,507)	-12.2	0.0	11.6	0.6	60.4	188.4	2079.2	0.0	0.0	0.0	0.0	-29359.2	15	3.6
53031			94	95.00	95.000	0.03	0.747	5.0	10.1	0.0	0.0	222.14	78	0	(39,148)	(1,175,600)	0.7	0.0	11.6	0.6	209.3	12.8	0.0	0.0	-32623.4	64.6	0.0	0.0	15	3.2
53568			94	97.00	97.000	0.03	2.565	5.0	40.2	0.0	0.0	536.56	16,168	0	0	(1,164,282)	2.6	0.0	11.6	0.6	536.6	536.6	2698.9	0.0	0.0	10774.1	0.0	0.0	15	3.4
54232			95	95.00	95.000	0.03	0.338	5.0	4.6	0.0	0.0	664.26	17,855	0	0	(1,151,784)	0.3	0.0	11.6	0.6	664.3	664.3	13338.3	0.0	0.0	1541.1	0.0	0.0	15	3.5
54994			95	91.00	91.000	0.03	-3.922	5.0	0.0	0.0	-52.2	762.05	168	0	(21,952)	(1,173,618)	-3.9	0.0	11.6	0.6	60.5	701.6	140.4	0.0	0.0	0.0	0.0	-18293.0	15	3.3
55195			95	93.00	93.000	0.03	-1.990	5.0	0.0	0.0	-20.9	201.39	0	0	(8,829)	(1,182,447)	-2.0	0.0	11.6	0.6	201.4	201.4	0.0	0.0	-5251.2	0.0	0.0	-2106.5	15	3.2
55224		95	95	93.00	93.000	0.03	-2.000	5.0	0.0	0.0	-21.1	28.63	0	0	(721)	(1,183,168)	-2.0	0.0	11.6	0.6	28.6	28.6	0.0	0.0	-299.5	0.0	0.0	-301.3	15	3.2
55500			94	91.00	91.000	-0.32	-3.117	5.0	0.0	0.0	-37.8	275.63	0	0	(9,729)	(1,192,897)	-3.1	0.0	11.6	0.6	275.6	275.6	0.0	0.0	-2901.0	0.0	0.0	-5206.7	15	3.1
55618			94	90.00	90.000	-0.32	-3.736	5.0	0.0	0.0	-48.7	118.86	0	0	(6,165)	(1,199,062)	-3.7	0.0	11.6	0.6	118.9	118.9	0.0	0.0	-2245.3	0.0	0.0	-2892.5	15	3.0
55852			93	88.00	88.000	-0.32	-4.990	5.0	0.0	0.0	-74.2	233.16	0	0	(17,192)	(1,216,254)	-5.0	0.0	11.6	0.6	233.2	233.2	0.0	0.0	-5673.9	0.0	0.0	-8652.6	15	2.8

	Cut	Fill		
Width at grade line:	11.6	7.3		
Slope - Earth 1V:	1.50	1.50 H	Limit up slope	0.501
Slope - Rock 1V:	2.00	2.00 H	Limit down slope	-1.5
Ditch / Crown Areas:	0.55	-0.45		

Berm, meters:	1
Earth Shrinkage:	30%
Rock Bulking:	30%
Volume Contingency:	20%

baseline for mass haul	15
cumulative adjusted	100,000

to plot Kilometer Point (PK)	mark	Grade Point	to plot Grade Line	Ground Profile Point	to plot Ground Profile Line	Track Grade (%)	Cut Height	Depth to Rock	End Areas for Volumes ------- Earth Cut	- Rock Cut	------ Fill	Seg-ment Length (m)	Earthwork Volumes (m^3) from preceding PK - Common Excavation	- Rock Excavation	- Embank-ment	- Adjusted Cumulative	Earth Height	Rock Cut Depth	Earth Cut Base	Earth Cut Top Area	La	Lb	Earth Va+	Rock Va+	Both Va-	Earth Vb+	Rock Vb+	Both Vb-	Baseline for Mass Haul	Cumul Adjtd
56074			92	90.00	90.000	-0.32	-2.276	5.0	0.0	0.0	-24.8	222.83	0	0	(13,243)	(1,229,497)	-2.3	0.0	11.6	0.6	222.8	222.8	0.0	0.0	-8269.2	0.0	0.0	-2766.4	15	2.7
56187			92	88.00	88.000	-0.32	-3.916	5.0	0.0	0.0	-52.0	112.24	0	0	(5,177)	(1,234,674)	-3.9	0.0	11.6	0.6	112.2	112.2	0.0	0.0	-1393.5	0.0	0.0	-2920.5	15	2.7
56220			92	87.00	87.000	-0.32	-4.809	5.0	0.0	0.0	-70.3	33.40	0	0	(2,451)	(1,237,125)	-4.8	0.0	11.6	0.6	33.4	33.4	0.0	0.0	-869.1	0.0	0.0	-1173.2	15	2.6
56253			92	90.00	90.000	-0.32	-1.702	5.0	0.0	0.0	-17.2	33.40	0	0	(1,753)	(1,238,878)	-1.7	0.0	11.6	0.6	33.4	33.4	0.0	0.0	-1173.2	0.0	0.0	-287.6	15	2.6
56340			91	84.00	84.000	-0.32	-7.426	5.0	0.0	0.0	-137.4	86.23	0	0	(7,999)	(1,246,877)	-7.4	0.0	11.6	0.6	86.2	86.2	0.0	0.0	-742.4	0.0	0.0	-5923.1	15	2.5
56438			91	85.00	85.000	-0.32	-6.111	5.0	0.0	0.0	-101.1	98.27	0	0	(14,060)	(1,260,937)	-6.1	0.0	11.6	0.6	98.3	98.3	0.0	0.0	-6750.2	0.0	0.0	-4966.6	15	2.4
56543			91	84.00	84.000	-0.32	-6.774	5.0	0.0	0.0	-118.7	105.34	0	0	(13,893)	(1,274,830)	-6.8	0.0	11.6	0.6	105.3	105.3	0.0	0.0	-5323.9	0.0	0.0	-6253.5	15	2.3
56675			90	87.00	87.000	-0.32	-3.352	5.0	0.0	0.0	-41.8	131.66	0	0	(12,680)	(1,287,510)	-3.4	0.0	11.6	0.6	131.7	131.7	0.0	0.0	-7816.0	0.0	0.0	-2750.4	15	2.1
56785		90	90	87.50	87.500	-0.32	-2.500	5.0	0.0	0.0	-28.1	109.93	0	0	(4,608)	(1,292,118)	-2.5	0.0	11.6	0.6	109.9	109.9	0.0	0.0	-2296.3	0.0	0.0	-1543.3	15	2.1
56895			90	86.00	86.000	-0.36	-3.610	5.0	0.0	0.0	-46.3	109.93	0	0	(4,908)	(1,297,026)	-3.6	0.0	11.6	0.6	109.9	109.9	0.0	0.0	-1543.3	0.0	0.0	-2547.0	15	2.0
57153			89	85.00	85.000	-0.36	-3.693	5.0	0.0	0.0	-47.9	258.02	0	0	(14,585)	(1,311,611)	-3.7	0.0	11.6	0.6	258.0	258.0	0.0	0.0	-5978.3	0.0	0.0	-6175.7	15	1.9
57348		88	88	80.00	80.000	-0.36	-8.000	5.0	0.0	0.0	-154.9	195.14	0	0	(23,735)	(1,335,346)	-8.0	0.0	11.6	0.6	195.1	195.1	0.0	0.0	-4670.7	0.0	0.0	-15108.7	15	1.6
57451			88	79.00	79.000	0.00	-9.000	5.0	0.0	0.0	-187.7	102.76	0	0	(21,117)	(1,356,463)	-9.0	0.0	11.6	0.6	102.8	102.8	0.0	0.0	-7956.2	0.0	0.0	-9641.5	15	1.4
57531			88	79.50	79.500	0.00	-8.500	5.0	0.0	0.0	-170.9	79.93	0	0	(17,194)	(1,373,657)	-8.5	0.0	11.6	0.6	79.9	79.9	0.0	0.0	-7499.4	0.0	0.0	-6829.2	15	1.3
57602			88	80.00	80.000	0.00	-8.000	5.0	0.0	0.0	-154.9	71.28	0	0	(13,931)	(1,387,588)	-8.0	0.0	11.6	0.6	71.3	71.3	0.0	0.0	-6090.2	0.0	0.0	-5518.9	15	1.1
57656			88	84.00	84.000	0.00	-4.000	5.0	0.0	0.0	-53.7	54.45	0	0	(6,812)	(1,394,400)	-4.0	0.0	11.6	0.6	54.4	54.4	0.0	0.0	-4215.8	0.0	0.0	-1460.6	15	1.1
57772			88	90.00	90.000	0.00	2.000	5.0	29.8	0.0	0.0	115.79	689	0	(2,485)	(1,396,403)	2.0	0.0	11.6	0.6	77.2	38.6	0.0	0.0	-2070.7	574.1	0.0	0.0	15	1.0
57792			88	90.50	90.500	0.00	2.500	5.0	38.9	0.0	0.0	19.55	805	0	0	(1,395,840)	2.5	0.0	11.6	0.6	19.5	19.5	290.7	0.0	0.0	380.4	0.0	0.0	15	1.0
57811			88	90.00	90.000	0.00	2.000	5.0	29.8	0.0	0.0	19.54	805	0	0	(1,395,277)	2.0	0.0	11.6	0.6	19.5	19.5	380.4	0.0	0.0	290.7	0.0	0.0	15	1.0
58076			88	85.00	85.000	0.00	-3.000	5.0	0.0	0.0	-35.9	264.61	1,889	0	(3,415)	(1,397,370)	-3.0	0.0	11.6	0.6	105.8	158.8	1574.4	0.0	0.0	0.0	0.0	-2845.9	15	1.0
58161			88	84.00	84.000	0.00	-4.000	5.0	0.0	0.0	-53.7	85.46	0	0	(4,589)	(1,401,959)	-4.0	0.0	11.6	0.6	85.5	85.5	0.0	0.0	-1531.9	0.0	0.0	-2292.5	15	1.0
58247			88	86.00	86.000	0.00	-2.000	5.0	0.0	0.0	-21.1	85.46	0	0	(3,830)	(1,405,789)	-2.0	0.0	11.6	0.6	85.5	85.5	0.0	0.0	-2292.5	0.0	0.0	-899.5	15	0.9
58392			88	87.50	87.500	0.00	-0.500	5.0	0.0	0.0	-4.5	145.28	0	0	(2,225)	(1,408,014)	-0.5	0.0	11.6	0.6	145.3	145.3	0.0	0.0	-1529.1	0.0	0.0	-325.4	15	0.9
58548			88	86.00	86.000	0.00	-2.000	5.0	0.0	0.0	-21.1	155.56	0	0	(2,383)	(1,410,397)	-2.0	0.0	11.6	0.6	155.6	155.6	0.0	0.0	-348.5	0.0	0.0	-1637.3	15	0.9
58703			88	83.00	83.000	0.00	-5.000	5.0	0.0	0.0	-74.5	155.56	0	0	(8,914)	(1,419,311)	-5.0	0.0	11.6	0.6	155.6	155.6	0.0	0.0	-1637.3	0.0	0.0	-5790.7	15	0.8
59051			88	81.00	81.000	0.00	-7.000	5.0	0.0	0.0	-125.1	347.74	0	0	(41,624)	(1,460,935)	-7.0	0.0	11.6	0.6	347.7	347.7	0.0	0.0	-12944.6	0.0	0.0	-21742.4	15	0.4
59250		88	88	88.00	88.000	0.00	0.000	5.0	0.0	0.0	-0.5	198.71	0	0	(14,909)	(1,475,844)	0.0	0.0	11.6	0.6	198.7	198.7	0.0	0.0	-12424.3	0.0	0.0	0.0	15	0.2
59321			88	89.50	89.500	0.35	1.251	5.0	17.4	0.0	0.0	71.57	748	0	0	(1,475,320)	1.3	0.0	11.6	0.6	71.6	71.6	0.0	0.0	0.0	623.0	0.0	0.0	15	0.2
59607			89	87.00	87.000	0.35	-2.243	5.0	0.0	0.0	-24.4	285.91	1,070	0	(2,683)	(1,477,254)	-2.2	0.0	11.6	0.6	102.4	183.5	891.3	0.0	0.0	0.0	0.0	-2236.2	15	0.2
59755			90	85.00	85.000	0.35	-4.757	5.0	0.0	0.0	-69.1	148.06	0	0	(8,306)	(1,485,560)	-4.8	0.0	11.6	0.6	148.1	148.1	0.0	0.0	-1804.1	0.0	0.0	-5117.7	15	0.1
59858			90	83.50	83.500	0.35	-6.614	5.0	0.0	0.0	-114.3	102.50	0	0	(11,283)	(1,496,843)	-6.6	0.0	11.6	0.6	102.5	102.5	0.0	0.0	-3542.9	0.0	0.0	-5859.9	15	0.0
60183			91	90.00	90.000	0.35	-1.246	5.0	0.0	0.0	-11.9	325.73	0	0	(24,666)	(1,521,509)	-1.2	0.0	11.6	0.6	325.7	325.7	0.0	0.0	-18622.0	0.0	0.0	-1933.2	15	-0.2
60207			91	90.50	90.500	0.35	-0.828	5.0	0.0	0.0	-7.5	23.70	0	0	(276)	(1,521,785)	-0.8	0.0	11.6	0.6	23.7	23.7	0.0	0.0	-140.7	0.0	0.0	-89.2	15	-0.2
60400		92	92	89.50	89.500	0.35	-2.500	5.0	0.0	0.0	-28.1	193.21	0	0	(4,128)	(1,525,913)	-2.5	0.0	11.6	0.6	193.2	193.2	0.0	0.0	-727.4	0.0	0.0	-2712.7	15	-0.3
60527			92	84.00	84.000	0.24	-8.308	5.0	0.0	0.0	-164.6	126.28	0	0	(14,600)	(1,540,513)	-8.3	0.0	11.6	0.6	126.3	126.3	0.0	0.0	-1772.9	0.0	0.0	-10393.7	15	-0.4
60653			93	86.50	86.500	0.24	-6.115	5.0	0.0	0.0	-101.2	126.28	0	0	(20,139)	(1,560,652)	-6.1	0.0	11.6	0.6	126.3	126.3	0.0	0.0	-10393.7	0.0	0.0	-6388.9	15	-0.6
60698			93	81.00	81.000	0.24	-11.726	5.0	0.0	0.0	-292.3	45.50	0	0	(10,742)	(1,571,394)	-11.7	0.0	11.6	0.6	45.5	45.5	0.0	0.0	-2302.1	0.0	0.0	-6649.8	15	-0.7
60811			93	83.00	83.000	0.24	-10.001	5.0	0.0	0.0	-223.5	112.97	0	0	(34,962)	(1,606,356)	-10.0	0.0	11.6	0.6	113.0	113.0	0.0	0.0	-16510.6	0.0	0.0	-12624.4	15	-1.1
60942			93	90.00	90.000	0.24	-3.319	5.0	0.0	0.0	-41.2	130.35	0	0	(20,702)	(1,627,058)	-3.3	0.0	11.6	0.6	130.4	130.4	0.0	0.0	-14566.6	0.0	0.0	-2685.2	15	-1.3
61052			94	90.50	90.500	0.24	-3.089	5.0	0.0	0.0	-37.3	110.64	0	0	(5,211)	(1,632,269)	-3.1	0.0	11.6	0.6	110.6	110.6	0.0	0.0	-2279.2	0.0	0.0	-2063.4	15	-1.3
61221		94	94	92.00	92.000	0.24	-2.000	5.0	0.0	0.0	-21.1	168.90	0	0	(5,913)	(1,638,182)	-2.0	0.0	11.6	0.6	168.9	168.9	0.0	0.0	-3150.0	0.0	0.0	-1777.7	15	-1.4
61388			94	90.00	90.000	-0.03	-3.950	5.0	0.0	0.0	-52.7	166.77	0	0	(7,379)	(1,645,561)	-4.0	0.0	11.6	0.6	166.8	166.8	0.0	0.0	-1755.3	0.0	0.0	-4393.6	15	-1.5
61503			94	87.00	87.000	-0.03	-6.916	5.0	0.0	0.0	-122.7	114.83	0	0	(12,083)	(1,657,644)	-6.9	0.0	11.6	0.6	114.8	114.8	0.0	0.0	-3025.2	0.0	0.0	-7043.7	15	-1.6
61626			94	90.00	90.000	-0.03	-3.879	5.0	0.0	0.0	-51.3	123.38	0	0	(12,882)	(1,670,526)	-3.9	0.0	11.6	0.6	123.4	123.4	0.0	0.0	-7568.1	0.0	0.0	-3167.2	15	-1.7
61785			94	95.00	95.000	-0.03	1.169	5.0	16.2	0.0	0.0	159.16	357	0	(3,768)	(1,674,044)	1.2	0.0	11.6	0.6	122.3	36.8	0.0	0.0	-3139.8	297.5	0.0	0.0	15	-1.7
61992			94	90.00	90.000	-0.03	-3.770	5.0	0.0	0.0	-49.3	206.96	475	0	(4,671)	(1,678,383)	-3.8	0.0	11.6	0.6	49.0	158.0	395.5	0.0	0.0	0.0	0.0	-3892.7	15	-1.8
62073			94	88.00	88.000	-0.03	-5.746	5.0	0.0	0.0	-91.9	80.35	0	0	(6,807)	(1,685,190)	-5.7	0.0	11.6	0.6	80.3	80.3	0.0	0.0	-1979.8	0.0	0.0	-3692.5	15	-1.9
62160			94	90.00	90.000	-0.03	-3.719	5.0	0.0	0.0	-48.4	87.53	0	0	(7,366)	(1,692,556)	-3.7	0.0	11.6	0.6	87.5	87.5	0.0	0.0	-4022.4	0.0	0.0	-2116.0	15	-1.9
62248			94	91.00	91.000	-0.03	-2.693	5.0	0.0	0.0	-31.0	87.81	0	0	(4,180)	(1,696,736)	-2.7	0.0	11.6	0.6	87.8	87.8	0.0	0.0	-2122.7	0.0	0.0	-1360.5	15	-2.0
62336			94	90.00	90.000	-0.03	-3.667	5.0	0.0	0.0	-47.4	87.81	0	0	(4,129)	(1,700,865)	-3.7	0.0	11.6	0.6	87.8	87.8	0.0	0.0	-1360.5	0.0	0.0	-2080.5	15	-2.0
62357			94	89.00	89.000	-0.03	-4.660	5.0	0.0	0.0	-67.1	21.64	0	0	(1,486)	(1,702,351)	-4.7	0.0	11.6	0.6	21.6	21.6	0.0	0.0	-512.8	0.0	0.0	-725.5	15	-2.0
62453			94	84.00	84.000	-0.03	-9.632	5.0	0.0	0.0	-209.9	95.85	0	0	(15,928)	(1,718,279)	-9.6	0.0	11.6	0.6	95.8	95.8	0.0	0.0	-3213.2	0.0	0.0	-10059.9	15	-2.2
62549			94	89.00	89.000	-0.03	-4.603	5.0	0.0	0.0	-65.8	95.85	0	0	(15,858)	(1,734,137)	-4.6	0.0	11.6	0.6	95.8	95.8	0.0	0.0	-10059.9	0.0	0.0	-3155.2	15	-2.3
62583			94	90.00	90.000	-0.03	-3.593	5.0	0.0	0.0	-46.1	33.48	0	0	(2,248)	(1,736,385)	-3.6	0.0	11.6	0.6	33.5	33.5	0.0	0.0	-1102.2	0.0	0.0	-770.9	15	-2.4
62671			94	89.50	89.500	-0.03	-4.067	5.0	0.0	0.0	-54.9	88.50	0	0	(5,363)	(1,741,748)	-4.1	0.0	11.6	0.6	88.5	88.5	0.0	0.0	-2037.7	0.0	0.0	-2431.1	15	-2.4
62902			93	86.00	86.000	-0.03	-7.498	5.0	0.0	0.0	-139.5	231.33	0	0	(26,988)	(1,768,736)	-7.5	0.0	11.6	0.6	231.3	231.3	0.0	0.0	-6354.6	0.0	0.0	-16135.3	15	-2.7
63121			93	89.00	89.000	-0.03	-4.432	5.0	0.0	0.0	-62.3	218.84	0	0	(26,493)	(1,795,229)	-4.4	0.0	11.6	0.6	218.8	218.8	0.0	0.0	-15264.1	0.0	0.0	-6813.6	15	-3.0
63286			93	90.00	90.000	-0.03	-3.383	5.0	0.0	0.0	-42.3	164.64	0	0	(10,331)	(1,805,560)	-3.4	0.0	11.6	0.6	164.6	164.6	0.0	0.0	-5126.1	0.0	0.0	-3483.0	15	-3.1
63451			93	89.00	89.000	-0.03	-4.334	5.0	0.0	0.0	-60.3	164.64	0	0	(10,132)	(1,815,692)	-4.3	0.0	11.6	0.6	164.6	164.6	0.0	0.0	-3483.0	0.0	0.0	-4960.6	15	-3.2
63550			93	99.00	99.000	-0.03	5.696	5.0	119.4	9.6	0.0	99.08	4,032	324	(1,548)	(1,813,996)	5.0	0.7	16.4	0.0	42.8	56.3	0.0	0.0	-1289.9	3359.7	269.8	0.0	15	-3.1
63753			93	87.00	87.000	-0.03	-6.244	5.0	0.0	0.0	-104.5	202.95	6,937	557	(6,654)	(1,815,070)	-6.2	0.0	11.6	0.6	96.8	106.1	5781.1	464.3	0.0	0.0	0.0	-5545.3	15	-3.2
63909			93	88.00	88.000	-0.03	-5.197	5.0	0.0	0.0	-78.9	156.80	0	0	(17,253)	(1,832,323)	-5.2	0.0	11.6	0.6	156.8	156.8	0.0	0.0	-8192.8	0.0	0.0	-6185.0	15	-3.3
63942			93	90.00	90.000	-0.03	-3.187	5.0	0.0	0.0	-39.0	32.28	0	0	(2,282)	(1,834,605)	-3.2	0.0	11.6	0.6	32.3	32.3	0.0	0.0	-1273.3	0.0	0.0	-628.7	15	-3.3
64032			93	95.00	95.000	-0.03	1.840	5.0	27.0	0.0	0.0	90.02	533	0	(1,334)	(1,835,566)	1.8	0.0	11.6	0.6	57.1	32.9	0.0	0.0	-1111.5	444.3	0.0	0.0	15	-3.4
64171			93	100.00	100.000	-0.03	6.882	5.0	143.1	29.5	0.0	139.57	14,245	2,467	0	(1,822,387)	5.0	1.9	21.1	0.0	139.6	139.6	1882.1	0.0	0.0	9988.3	2055.9	0.0	15	-3.2
64214			93	100.50	100.500	-0.03	7.394	5.0	153.4	39.8	0.0	42.63	7,583	1,771	0	(1,814,777)	5.0	2.4	23.2	0.0	42.6	42.6	3050.5	627.9	0.0	3269.1	848.0	0.0	15	-3.1

	Cut	Fill	
Width at grade line:	11.6	7.3	
Slope - Earth 1V:	1.50	1.50	H
Slope - Rock 1V:	2.00	2.00	H
Ditch / Crown Areas:	0.55	-0.45	

Limit up slope	0.501
Limit down slope	-1.5

Berm, meters:	1
Earth Shrinkage:	30%
Rock Bulking:	30%
Volume Contingency:	20%

baseline for mass haul	15
cumulative adjusted	100,000

to plot Kilometer Point (PK)	mark	Grade Point	to plot Grade Line	Ground Profile Point	to plot Ground Profile Line	Track Grade (%)	Cut Height	Depth to Rock	End Areas for Volumes: Earth Cut	Rock Cut	Fill	Segment Length (m)	Earthwork Volumes (m^3) from preceding PK: Common Excavation	Rock Excavation	Embankment	Adjusted Cumulative	Earth Height	Rock Cut Depth	Earth Cut Base	Earth Cut Top Area	La	Lb	Earth Va+	Rock Va+	Both Va-	Earth Vb+	Rock Vb+	Both Vb-	Baseline for Mass Haul	Cumul Adjtd
64256			93	100.00	100.000	-0.03	6.907	5.0	143.6	30.0	0.0	42.63	7,597	1,784	0	(1,807,140)	5.0	1.9	21.2	0.0	42.6	42.6	3269.1	848.0	0.0	3061.3	638.3	0.0	15	-3.1
64286			93	99.00	99.000	-0.03	5.916	5.0	123.8	12.9	0.0	29.12	4,673	748	0	(1,802,897)	5.0	0.9	17.3	0.0	29.1	29.1	2091.4	436.1	0.0	1802.8	187.1	0.0	15	-3.0
64425			93	90.00	90.000	-0.03	-3.043	5.0	0.0	0.0	-36.6	139.37	6,837	710	(1,038)	(1,798,226)	-3.0	0.0	11.6	0.6	92.0	47.3	5697.9	591.3	0.0	0.0	0.0	-865.1	15	-3.0
64495			93	85.00	85.000	-0.03	-8.022	5.0	0.0	0.0	-155.5	69.67	0	0	(8,029)	(1,806,255)	-8.0	0.0	11.6	0.6	69.7	69.7	0.0	0.0	-1273.2	0.0	0.0	-5417.9	15	-3.1
64518			93	90.00	90.000	-0.03	-3.015	5.0	0.0	0.0	-36.1	23.43	0	0	(2,694)	(1,808,949)	-3.0	0.0	11.6	0.6	23.4	23.4	0.0	0.0	-1822.0	0.0	0.0	-422.8	15	-3.1
64662			93	96.00	96.000	-0.03	3.028	5.0	49.4	0.0	0.0	143.90	2,139	0	(1,555)	(1,809,007)	3.0	0.0	11.6	0.6	71.8	72.1	0.0	0.0	-1295.4	1782.2	0.0	0.0	15	-3.1
64804			93	90.00	90.000	-0.03	-2.929	5.0	0.0	0.0	-34.7	142.49	2,148	0	(1,459)	(1,808,962)	-2.9	0.0	11.6	0.6	72.4	70.1	1790.1	0.0	0.0	0.0	0.0	-1215.5	15	-3.1
64864			93	88.00	88.000	-0.03	-4.911	5.0	0.0	0.0	-72.5	59.33	0	0	(3,816)	(1,812,778)	-4.9	0.0	11.6	0.6	59.3	59.3	0.0	0.0	-1029.4	0.0	0.0	-2150.4	15	-3.1
64908			93	90.00	90.000	-0.03	-2.898	5.0	0.0	0.0	-34.2	44.34	0	0	(2,839)	(1,815,617)	-2.9	0.0	11.6	0.6	44.3	44.3	0.0	0.0	-1607.1	0.0	0.0	-758.4	15	-3.2
64952			93	91.00	91.000	-0.03	-1.885	5.0	0.0	0.0	-19.5	44.34	0	0	(1,430)	(1,817,047)	-1.9	0.0	11.6	0.6	44.3	44.3	0.0	0.0	-758.4	0.0	0.0	-433.2	15	-3.2
65171			93	99.00	99.000	-0.03	6.180	5.0	129.1	17.0	0.0	218.33	12,960	1,710	(598)	(1,806,350)	5.0	1.2	18.3	0.0	51.0	167.3	0.0	0.0	-498.5	10800.3	1424.6	0.0	15	-3.1
65293			93	97.00	97.000	-0.03	4.217	5.0	76.1	0.0	0.0	122.36	15,069	1,250	0	(1,794,177)	4.2	0.0	11.6	0.6	122.4	122.4	7898.9	1041.9	0.0	4658.2	0.0	0.0	15	-2.9
65446			93	90.00	90.000	-0.03	-2.737	5.0	0.0	0.0	-31.7	153.27	4,246	0	(1,146)	(1,792,351)	-2.7	0.0	11.6	0.6	92.9	60.3	3538.2	0.0	0.0	0.0	0.0	-955.3	15	-2.9
65581			93	85.00	85.000	-0.03	-7.697	5.0	0.0	0.0	-145.5	134.58	0	0	(14,307)	(1,806,658)	-7.7	0.0	11.6	0.6	134.6	134.6	0.0	0.0	-2131.1	0.0	0.0	-9791.4	15	-3.1
65704			93	90.00	90.000	-0.03	-2.660	5.0	0.0	0.0	-30.5	123.16	0	0	(13,006)	(1,819,664)	-2.7	0.0	11.6	0.6	123.2	123.2	0.0	0.0	-8960.5	0.0	0.0	-1877.6	15	-3.2
65844			93	94.00	94.000	-0.03	1.382	5.0	19.4	0.0	0.0	140.33	559	0	(1,690)	(1,820,963)	1.4	0.0	11.6	0.6	92.4	48.0	0.0	0.0	-1408.1	466.2	0.0	0.0	15	-3.2
66070			93	90.00	90.000	-0.03	-2.551	5.0	0.0	0.0	-28.8	225.05	922	0	(2,526)	(1,822,844)	-2.6	0.0	11.6	0.6	79.1	146.0	768.5	0.0	0.0	0.0	0.0	-2105.1	15	-3.2
66121			93	89.50	89.500	-0.03	-3.036	5.0	0.0	0.0	-36.4	51.78	0	0	(2,028)	(1,824,872)	-3.0	0.0	11.6	0.6	51.8	51.8	0.0	0.0	-746.7	0.0	0.0	-943.2	15	-3.2
66173			93	90.00	90.000	-0.03	-2.520	5.0	0.0	0.0	-28.4	51.78	0	0	(2,013)	(1,826,885)	-2.5	0.0	11.6	0.6	51.8	51.8	0.0	0.0	-943.2	0.0	0.0	-734.5	15	-3.3
66277			92	90.00	90.000	-0.03	-2.489	5.0	0.0	0.0	-27.9	103.58	0	0	(3,498)	(1,830,383)	-2.5	0.0	11.6	0.6	103.6	103.6	0.0	0.0	-1469.3	0.0	0.0	-1446.0	15	-3.3
66390			92	89.00	89.000	-0.03	-3.455	5.0	0.0	0.0	-43.6	113.57	0	0	(4,872)	(1,835,255)	-3.5	0.0	11.6	0.6	113.6	113.6	0.0	0.0	-1585.5	0.0	0.0	-2474.8	15	-3.4
66504			92	90.00	90.000	-0.03	-2.421	5.0	0.0	0.0	-26.9	113.57	0	0	(4,804)	(1,840,059)	-2.4	0.0	11.6	0.6	113.6	113.6	0.0	0.0	-2474.8	0.0	0.0	-1528.7	15	-3.4
66597			92	90.50	90.500	-0.03	-1.893	5.0	0.0	0.0	-19.7	93.46	0	0	(2,611)	(1,842,670)	-1.9	0.0	11.6	0.6	93.5	93.5	0.0	0.0	-1257.9	0.0	0.0	-918.2	15	-3.4
66691			92	90.00	90.000	-0.03	-2.365	5.0	0.0	0.0	-26.1	93.46	0	0	(2,566)	(1,845,236)	-2.4	0.0	11.6	0.6	93.5	93.5	0.0	0.0	-918.2	0.0	0.0	-1220.1	15	-3.5
66825			92	91.00	91.000	-0.03	-1.325	5.0	0.0	0.0	-12.8	134.22	0	0	(3,130)	(1,848,366)	-1.3	0.0	11.6	0.6	134.2	134.2	0.0	0.0	-1752.2	0.0	0.0	-856.3	15	-3.5
66943			92	90.00	90.000	-0.03	-2.290	5.0	0.0	0.0	-25.0	118.30	0	0	(2,682)	(1,851,048)	-2.3	0.0	11.6	0.6	118.3	118.3	0.0	0.0	-754.8	0.0	0.0	-1480.5	15	-3.5
67170			92	80.00	80.000	-0.03	-12.222	5.0	0.0	0.0	-313.8	226.57	0	0	(46,054)	(1,897,102)	-12.2	0.0	11.6	0.6	226.6	226.6	0.0	0.0	-2835.5	0.0	0.0	-35543.2	15	-4.0
67221			92	79.00	79.000	-0.03	-13.207	5.0	0.0	0.0	-358.5	51.31	0	0	(20,694)	(1,917,796)	-13.2	0.0	11.6	0.6	51.3	51.3	0.0	0.0	-8048.5	0.0	0.0	-9196.4	15	-4.2
67272			92	80.00	80.000	-0.03	-12.192	5.0	0.0	0.0	-312.4	51.30	0	0	(20,652)	(1,938,448)	-12.2	0.0	11.6	0.6	51.3	51.3	0.0	0.0	-9196.4	0.0	0.0	-8013.8	15	-4.4
67436			92	90.00	90.000	-0.03	-2.143	5.0	0.0	0.0	-23.0	163.64	0	0	(32,929)	(1,971,377)	-2.1	0.0	11.6	0.6	163.6	163.6	0.0	0.0	-25560.6	0.0	0.0	-1880.2	15	-4.7
67611			92	93.00	93.000	-0.03	0.909	5.0	12.3	0.0	0.0	174.59	385	0	(1,690)	(1,972,798)	0.9	0.0	11.6	0.6	122.6	52.0	0.0	0.0	-1408.3	321.0	0.0	0.0	15	-4.7
67801			92	92.00	92.000	-0.03	-0.034	5.0	0.0	0.0	-0.7	190.68	1,361	0	(3)	(1,971,848)	0.0	0.0	11.6	0.6	183.9	6.8	1134.6	0.0	0.0	0.0	0.0	-2.4	15	-4.7
67914		92	92	90.00	90.000	-0.03	-2.000	5.0	0.0	0.0	-21.1	112.44	0	0	(1,467)	(1,973,315)	-2.0	0.0	11.6	0.6	112.4	112.4	0.0	0.0	-39.4	0.0	0.0	-1183.4	15	-4.7
67951			92	90.00	90.000	0.38	-2.141	5.0	0.0	0.0	-23.0	37.60	0	0	(993)	(1,974,308)	-2.1	0.0	11.6	0.6	37.6	37.6	0.0	0.0	-395.7	0.0	0.0	-431.6	15	-4.7
68223			93	98.00	98.000	0.38	4.838	5.0	91.8	0.0	0.0	272.09	10,387	0	(1,150)	(1,968,187)	4.8	0.0	11.6	0.6	83.5	188.6	0.0	0.0	-958.3	8655.5	0.0	0.0	15	-4.7
68535			94	92.00	92.000	0.38	-2.332	5.0	0.0	0.0	-25.6	311.86	11,587	0	(1,561)	(1,961,637)	-2.3	0.0	11.6	0.6	210.4	101.4	9655.9	0.0	0.0	0.0	0.0	-1300.5	15	-4.6
68681			95	90.00	90.000	0.38	-4.881	5.0	0.0	0.0	-71.8	146.07	0	0	(8,541)	(1,970,178)	-4.9	0.0	11.6	0.6	146.1	146.1	0.0	0.0	-1872.6	0.0	0.0	-5244.6	15	-4.7
68888			96	86.00	86.000	0.38	-9.657	5.0	0.0	0.0	-210.8	206.80	0	0	(35,069)	(2,005,247)	-9.7	0.0	11.6	0.6	206.8	206.8	0.0	0.0	-7425.2	0.0	0.0	-21798.8	15	-5.1
69165			97	81.00	81.000	0.38	-15.696	5.0	0.0	0.0	-484.6	276.85	0	0	(115,508)	(2,120,755)	-15.7	0.0	11.6	0.6	276.8	276.8	0.0	0.0	-29182.8	0.0	0.0	-67073.8	15	-6.2
69345			97	80.00	80.000	0.38	-17.373	5.0	0.0	0.0	-580.0	180.41	0	0	(115,231)	(2,235,986)	-17.4	0.0	11.6	0.6	180.4	180.4	0.0	0.0	-43708.8	0.0	0.0	-52317.1	15	-7.4
69427			98	79.00	79.000	0.38	-18.679	5.0	0.0	0.0	-660.2	81.70	0	0	(60,788)	(2,296,774)	-18.7	0.0	11.6	0.6	81.7	81.7	0.0	0.0	-23690.7	0.0	0.0	-26966.3	15	-8.0
69509			98	80.00	80.000	0.38	-17.986	5.0	0.0	0.0	-617.0	81.69	0	0	(62,602)	(2,359,376)	-18.0	0.0	11.6	0.6	81.7	81.7	0.0	0.0	-26966.3	0.0	0.0	-25201.7	15	-8.6
69617			98	85.00	85.000	0.38	-13.391	5.0	0.0	0.0	-367.2	107.90	0	0	(63,713)	(2,423,089)	-13.4	0.0	11.6	0.6	107.9	107.9	0.0	0.0	-33285.5	0.0	0.0	-19808.3	15	-9.2
69725			99	79.00	79.000	0.38	-19.796	5.0	0.0	0.0	-732.8	107.90	0	0	(71,208)	(2,494,297)	-19.8	0.0	11.6	0.6	107.9	107.9	0.0	0.0	-19808.3	0.0	0.0	-39531.9	15	-9.9
69802			99	85.00	85.000	0.38	-14.087	5.0	0.0	0.0	-401.0	77.66	0	0	(52,826)	(2,547,123)	-14.1	0.0	11.6	0.6	77.7	77.7	0.0	0.0	-28452.7	0.0	0.0	-15568.9	15	-10.5
69851			99	91.00	91.000	0.38	-8.271	5.0	0.0	0.0	-163.5	49.10	0	0	(16,627)	(2,563,750)	-8.3	0.0	11.6	0.6	49.1	49.1	0.0	0.0	-9843.3	0.0	0.0	-4012.7	15	-10.6
69959			100	93.00	93.000	0.38	-6.674	5.0	0.0	0.0	-116.0	107.34	0	0	(17,996)	(2,581,746)	-6.7	0.0	11.6	0.6	107.3	107.3	0.0	0.0	-8772.4	0.0	0.0	-6224.6	15	-10.8
70053			100	91.00	91.000	0.38	-9.026	5.0	0.0	0.0	-188.5	93.75	0	0	(17,129)	(2,598,875)	-9.0	0.0	11.6	0.6	93.8	93.8	0.0	0.0	-5436.6	0.0	0.0	-8837.8	15	-11.0
70089			100	90.00	90.000	0.38	-10.164	5.0	0.0	0.0	-229.6	36.95	0	0	(9,271)	(2,608,146)	-10.2	0.0	11.6	0.6	36.9	36.9	0.0	0.0	-3483.3	0.0	0.0	-4242.4	15	-11.1
70178			100	89.00	89.000	0.38	-11.498	5.0	0.0	0.0	-282.7	88.93	0	0	(27,337)	(2,635,483)	-11.5	0.0	11.6	0.6	88.9	88.9	0.0	0.0	-10210.5	0.0	0.0	-12570.3	15	-11.4
70267			101	90.00	90.000	0.38	-10.832	5.0	0.0	0.0	-255.5	88.93	0	0	(28,718)	(2,664,201)	-10.8	0.0	11.6	0.6	88.9	88.9	0.0	0.0	-12570.3	0.0	0.0	-11361.7	15	-11.6
70357			101	96.00	96.000	0.38	-5.169	5.0	0.0	0.0	-78.3	89.81	0	0	(17,986)	(2,682,187)	-5.2	0.0	11.6	0.6	89.8	89.8	0.0	0.0	-11474.1	0.0	0.0	-3514.3	15	-11.8
70579		102	102	100.00	100.000	0.38	-2.000	5.0	0.0	0.0	-21.1	221.46	0	0	(13,196)	(2,695,383)	-2.0	0.0	11.6	0.6	221.5	221.5	0.0	0.0	-8665.7	0.0	0.0	-2330.9	15	-12.0
70837			103	100.50	100.500	0.39	-2.503	5.0	0.0	0.0	-28.1	258.67	0	0	(7,631)	(2,703,014)	-2.5	0.0	11.6	0.6	258.7	258.7	0.0	0.0	-2722.5	0.0	0.0	-3636.9	15	-12.0
71054			104	105.00	105.000	0.39	1.158	5.0	16.0	0.0	0.0	216.41	657	0	(2,496)	(2,705,050)	1.2	0.0	11.6	0.6	148.0	68.5	0.0	0.0	-2080.3	547.3	0.0	0.0	15	-12.1
71336			105	100.50	100.500	0.39	-4.436	5.0	0.0	0.0	-62.4	282.25	561	0	(8,375)	(2,713,032)	-4.4	0.0	11.6	0.6	58.4	223.8	467.1	0.0	0.0	0.0	0.0	-6978.9	15	-12.1
71359			105	100.00	100.000	0.39	-5.026	5.0	0.0	0.0	-75.0	23.17	0	0	(1,910)	(2,714,942)	-5.0	0.0	11.6	0.6	23.2	23.2	0.0	0.0	-722.4	0.0	0.0	-869.3	15	-12.1
71502			106	100.50	100.500	0.39	-5.079	5.0	0.0	0.0	-76.2	142.55	0	0	(12,937)	(2,727,879)	-5.1	0.0	11.6	0.6	142.6	142.6	0.0	0.0	-5348.5	0.0	0.0	-5432.6	15	-12.3
71524			106	101.00	101.000	0.39	-4.665	5.0	0.0	0.0	-67.2	22.23	0	0	(1,912)	(2,729,791)	-4.7	0.0	11.6	0.6	22.2	22.2	0.0	0.0	-847.2	0.0	0.0	-746.4	15	-12.3
71639			106	103.00	103.000	0.39	-3.111	5.0	0.0	0.0	-37.7	115.07	0	0	(7,238)	(2,737,029)	-3.1	0.0	11.6	0.6	115.1	115.1	0.0	0.0	-3863.5	0.0	0.0	-2167.9	15	-12.4
71806			107	100.50	100.500	0.39	-6.259	5.0	0.0	0.0	-104.9	166.95	0	0	(14,281)	(2,751,310)	-6.3	0.0	11.6	0.6	166.9	166.9	0.0	0.0	-3145.3	0.0	0.0	-8755.7	15	-12.5
71846			107	100.00	100.000	0.39	-6.915	5.0	0.0	0.0	-122.7	40.32	0	0	(5,505)	(2,756,815)	-6.9	0.0	11.6	0.6	40.3	40.3	0.0	0.0	-2114.8	0.0	0.0	-2472.9	15	-12.6
71887			107	100.50	100.500	0.39	-6.571	5.0	0.0	0.0	-113.2	40.33	0	0	(5,706)	(2,762,521)	-6.6	0.0	11.6	0.6	40.3	40.3	0.0	0.0	-2472.9	0.0	0.0	-2282.2	15	-12.6
71933			107	101.00	101.000	0.39	-6.252	5.0	0.0	0.0	-104.7	46.73	0	0	(6,110)	(2,768,631)	-6.3	0.0	11.6	0.6	46.7	46.7	0.0	0.0	-2644.7	0.0	0.0	-2447.0	15	-12.7
71980			107	100.50	100.500	0.39	-6.934	5.0	0.0	0.0	-123.2	46.73	0	0	(6,390)	(2,775,021)	-6.9	0.0	11.6	0.6	46.7	46.7	0.0	0.0	-2447.0	0.0	0.0	-2878.1	15	-12.8
72016			108	103.00	103.000	0.39	-4.573	5.0	0.0	0.0	-65.2	35.98	0	0	(4,067)	(2,779,088)	-4.6	0.0	11.6	0.6	36.0	36.0	0.0	0.0	-2216.0	0.0	0.0	-1173.1	15	-12.8

	Cut	Fill
Width at grade line:	11.6	7.3
Slope - Earth 1V:	1.50	1.50 H
Slope - Rock 1V:	2.00	2.00 H
Ditch / Crown Areas:	0.55	-0.45

Limit up slope	0.501
Limit down slope	-1.5

Berm, meters:	1
Earth Shrinkage:	30%
Rock Bulking:	30%
Volume Contingency:	20%

baseline for mass haul	15
cumulative adjusted	100,000

to plot Kilometer Point (PK)	mark	Grade Point	to plot Grade Line	Ground Profile Point	to plot Ground Profile Line	Track Grade (%)	Cut Height	Depth to Rock	End Areas for Volumes ------- Earth Cut	- Rock Cut	------ Fill	Seg-ment Length (m)	Earthwork Volumes (m^3) from preceding PK - Common Excavation	- Rock Excavation	- Embank-ment	- Adjusted Cumulative	Earth Height	Rock Cut Depth	Earth Cut Base	Earth Cut Top Area	La	Lb	Earth Va+	Rock Va+	Both Va-	Earth Vb+	Rock Vb+	Both Vb-	Baseline for Mass Haul	Cumul Adjtd
72060			108	108.00	108.000	0.39	0.255	5.0	3.6	0.0	0.0	44.42	5	0	(1,646)	(2,780,731)	0.3	0.0	11.6	0.6	42.1	2.3	0.0	0.0	-1371.9	4.2	0.0	0.0	15	-12.8
72081			108	110.00	110.000	0.39	2.175	5.0	32.9	0.0	0.0	20.40	447	0	0	(2,780,418)	2.2	0.0	11.6	0.6	20.4	20.4	36.7	0.0	0.0	335.4	0.0	0.0	15	-12.8
72100			108	110.50	110.500	0.39	2.599	5.0	40.8	0.0	0.0	19.67	870	0	0	(2,779,809)	2.6	0.0	11.6	0.6	19.7	19.7	323.4	0.0	0.0	401.6	0.0	0.0	15	-12.8
72126			108	110.00	110.000	0.39	2.000	5.0	29.8	0.0	0.0	25.55	1,082	0	0	(2,779,052)	2.0	0.0	11.6	0.6	25.6	25.6	521.6	0.0	0.0	380.1	0.0	0.0	15	-12.8
72167			108	107.00	107.000	0.39	-1.158	5.0	0.0	0.0	-10.9	40.87	462	0	(98)	(2,778,827)	-1.2	0.0	11.6	0.6	25.9	15.0	385.0	0.0	0.0	0.0	0.0	-81.8	15	-12.8
72226			108	100.00	100.000	0.39	-8.389	5.0	0.0	0.0	-167.3	59.61	0	0	(6,373)	(2,785,200)	-8.4	0.0	11.6	0.6	59.6	59.6	0.0	0.0	-325.5	0.0	0.0	-4985.5	15	-12.9
72323			109	108.00	108.000	0.39	-0.764	5.0	0.0	0.0	-6.9	96.63	0	0	(10,099)	(2,795,299)	-0.8	0.0	11.6	0.6	96.6	96.6	0.0	0.0	-8082.1	0.0	0.0	-333.4	15	-13.0
72420			109	103.00	103.000	0.39	-6.139	5.0	0.0	0.0	-101.8	96.63	0	0	(6,302)	(2,801,601)	-6.1	0.0	11.6	0.6	96.6	96.6	0.0	0.0	-333.4	0.0	0.0	-4918.2	15	-13.0
72678			110	110.00	110.000	0.39	-0.141	5.0	0.0	0.0	-1.5	258.57	0	0	(16,026)	(2,817,627)	-0.1	0.0	11.6	0.6	258.6	258.6	0.0	0.0	-13159.9	0.0	0.0	-195.2	15	-13.2
72709			110	110.50	110.500	0.39	0.239	5.0	3.4	0.0	0.0	30.74	40	0	(10)	(2,817,609)	0.2	0.0	11.6	0.6	11.4	19.3	0.0	0.0	-8.6	33.0	0.0	0.0	15	-13.2
72740			110	110.00	110.000	0.39	-0.380	5.0	0.0	0.0	-3.4	30.74	24	0	(39)	(2,817,631)	-0.4	0.0	11.6	0.6	11.9	18.9	20.3	0.0	0.0	0.0	0.0	-32.4	15	-13.2
72941			111	100.00	100.000	0.39	-11.158	5.0	0.0	0.0	-268.7	200.76	0	0	(32,776)	(2,850,407)	-11.2	0.0	11.6	0.6	200.8	200.8	0.0	0.0	-345.3	0.0	0.0	-26968.1	15	-13.5
72977			111	101.00	101.000	0.39	-10.299	5.0	0.0	0.0	-234.8	36.43	0	0	(11,004)	(2,861,411)	-10.3	0.0	11.6	0.6	36.4	36.4	0.0	0.0	-4893.6	0.0	0.0	-4276.0	15	-13.6
73013			111	100.00	100.000	0.39	-11.441	5.0	0.0	0.0	-280.3	36.43	0	0	(11,258)	(2,872,669)	-11.4	0.0	11.6	0.6	36.4	36.4	0.0	0.0	-4276.0	0.0	0.0	-5105.7	15	-13.7
73027			111	99.50	99.500	0.39	-11.993	5.0	0.0	0.0	-303.7	13.41	0	0	(4,701)	(2,877,370)	-12.0	0.0	11.6	0.6	13.4	13.4	0.0	0.0	-1880.1	0.0	0.0	-2037.3	15	-13.8
73040			112	100.00	100.000	0.39	-11.545	5.0	0.0	0.0	-284.7	13.42	0	0	(4,736)	(2,882,106)	-11.5	0.0	11.6	0.6	13.4	13.4	0.0	0.0	-2037.3	0.0	0.0	-1909.3	15	-13.8
73080			112	102.00	102.000	0.39	-9.699	5.0	0.0	0.0	-212.4	39.74	0	0	(11,849)	(2,893,955)	-9.7	0.0	11.6	0.6	39.7	39.7	0.0	0.0	-5655.3	0.0	0.0	-4218.9	15	-13.9
73120			112	100.00	100.000	0.39	-11.853	5.0	0.0	0.0	-297.7	39.74	0	0	(12,160)	(2,906,115)	-11.9	0.0	11.6	0.6	39.7	39.7	0.0	0.0	-4218.9	0.0	0.0	-5914.8	15	-14.1
73147			112	101.00	101.000	0.39	-10.960	5.0	0.0	0.0	-260.6	27.61	0	0	(9,250)	(2,915,365)	-11.0	0.0	11.6	0.6	27.6	27.6	0.0	0.0	-4109.9	0.0	0.0	-3598.1	15	-14.2
73265			112	110.00	110.000	0.39	-2.417	5.0	0.0	0.0	-26.9	117.77	0	0	(20,315)	(2,935,680)	-2.4	0.0	11.6	0.6	117.8	117.8	0.0	0.0	-15347.8	0.0	0.0	-1581.1	15	-14.4
73367			113	114.00	114.000	0.39	1.189	5.0	16.5	0.0	0.0	101.70	331	0	(1,098)	(2,936,546)	1.2	0.0	11.6	0.6	68.2	33.5	0.0	0.0	-915.0	276.2	0.0	0.0	15	-14.4
73601			114	111.00	111.000	0.39	-2.718	5.0	0.0	0.0	-31.4	233.90	704	0	(3,062)	(2,939,115)	-2.7	0.0	11.6	0.6	71.2	162.7	586.3	0.0	0.0	0.0	0.0	-2552.1	15	-14.4
73748			114	114.00	114.000	0.39	-0.290	5.0	0.0	0.0	-2.7	147.71	0	0	(3,019)	(2,942,134)	-0.3	0.0	11.6	0.6	147.7	147.7	0.0	0.0	-2316.8	0.0	0.0	-199.4	15	-14.4
73940			115	111.00	111.000	0.39	-4.034	5.0	0.0	0.0	-54.3	191.64	0	0	(6,554)	(2,948,688)	-4.0	0.0	11.6	0.6	191.6	191.6	0.0	0.0	-258.7	0.0	0.0	-5203.0	15	-14.5
74014			115	110.00	110.000	0.39	-5.320	5.0	0.0	0.0	-81.7	73.88	0	0	(6,030)	(2,954,718)	-5.3	0.0	11.6	0.6	73.9	73.9	0.0	0.0	-2005.8	0.0	0.0	-3019.5	15	-14.5
74116			116	111.00	111.000	0.39	-4.714	5.0	0.0	0.0	-68.2	101.62	0	0	(9,142)	(2,963,860)	-4.7	0.0	11.6	0.6	101.6	101.6	0.0	0.0	-4153.2	0.0	0.0	-3464.7	15	-14.6
74210			116	110.50	110.500	0.39	-5.579	5.0	0.0	0.0	-87.9	94.10	0	0	(8,811)	(2,972,671)	-5.6	0.0	11.6	0.6	94.1	94.1	0.0	0.0	-3208.3	0.0	0.0	-4133.8	15	-14.7
74326			117	116.00	116.000	0.39	-0.529	5.0	0.0	0.0	-4.7	116.08	0	0	(6,449)	(2,979,120)	-0.5	0.0	11.6	0.6	116.1	116.1	0.0	0.0	-5099.4	0.0	0.0	-274.5	15	-14.8
74416			117	113.00	113.000	0.39	-3.879	5.0	0.0	0.0	-51.4	90.41	0	0	(3,042)	(2,982,162)	-3.9	0.0	11.6	0.6	90.4	90.4	0.0	0.0	-213.8	0.0	0.0	-2321.3	15	-14.8
74645			118	120.00	120.000	0.39	2.234	5.0	34.0	0.0	0.0	228.68	1,702	0	(4,471)	(2,985,442)	2.2	0.0	11.6	0.6	145.1	83.6	0.0	0.0	-3725.9	1418.5	0.0	0.0	15	-14.9
74762			118	122.00	122.000	0.39	3.780	5.0	65.8	0.0	0.0	116.99	7,005	0	0	(2,980,539)	3.8	0.0	11.6	0.6	117.0	117.0	1985.9	0.0	0.0	3851.3	0.0	0.0	15	-14.8
74912			119	130.00	130.000	0.39	11.199	5.0	229.5	149.3	0.0	149.86	26,554	13,426	0	(2,944,497)	5.0	6.2	38.4	0.0	149.9	149.9	4933.4	0.0	0.0	17194.9	11188.5	0.0	15	-14.4
75185			120	122.00	122.000	0.39	2.141	5.0	32.3	0.0	0.0	272.98	42,870	24,457	0	(2,882,694)	2.1	0.0	11.6	0.6	273.0	273.0	31321.7	20380.7	0.0	4403.2	0.0	0.0	15	-13.8
75308			120	130.00	130.000	0.39	9.664	5.0	198.8	98.2	0.0	122.94	17,042	7,241	0	(2,861,351)	5.0	4.7	32.3	0.0	122.9	122.9	1983.0	0.0	0.0	12219.0	6033.9	0.0	15	-13.6
75330			120	130.50	130.500	0.39	10.078	5.0	207.1	111.0	0.0	22.11	5,383	2,775	0	(2,853,975)	5.0	5.1	33.9	0.0	22.1	22.1	2197.0	1084.9	0.0	2288.6	1227.3	0.0	15	-13.5
75352			121	130.00	130.000	0.39	9.493	5.0	195.4	93.0	0.0	22.10	5,337	2,707	0	(2,846,720)	5.0	4.5	31.6	0.0	22.1	22.1	2288.6	1227.3	0.0	2159.1	1028.2	0.0	15	-13.5
75478			121	120.00	120.000	0.39	-0.995	5.0	0.0	0.0	-9.2	125.81	13,347	6,356	(66)	(2,829,180)	-1.0	0.0	11.6	0.6	113.9	11.9	11122.6	5296.8	0.0	0.0	0.0	-54.9	15	-13.3
75543			121	110.00	110.000	0.39	-11.247	5.0	0.0	0.0	-272.3	64.92	0	0	(10,965)	(2,840,145)	-11.2	0.0	11.6	0.6	64.9	64.9	0.0	0.0	-298.6	0.0	0.0	-8838.5	15	-13.4
75585			121	109.00	109.000	0.39	-12.412	5.0	0.0	0.0	-322.2	42.67	0	0	(15,217)	(2,855,362)	-12.4	0.0	11.6	0.6	42.7	42.7	0.0	0.0	-5808.6	0.0	0.0	-6872.3	15	-13.6
75628			122	110.00	110.000	0.39	-11.578	5.0	0.0	0.0	-286.0	42.66	0	0	(15,569)	(2,870,931)	-11.6	0.0	11.6	0.6	42.7	42.7	0.0	0.0	-6872.3	0.0	0.0	-6101.7	15	-13.7
75698			122	120.00	120.000	0.39	-1.849	5.0	0.0	0.0	-19.1	69.93	0	0	(12,801)	(2,883,732)	-1.8	0.0	11.6	0.6	69.9	69.9	0.0	0.0	-10001.0	0.0	0.0	-666.8	15	-13.8
75737		122	122	121.00	121.000	0.39	-1.000	5.0	0.0	0.0	-9.3	39.00	0	0	(663)	(2,884,395)	-1.0	0.0	11.6	0.6	39.0	39.0	0.0	0.0	-371.9	0.0	0.0	-180.4	15	-13.8
75776			122	120.00	120.000	0.38	-2.147	5.0	0.0	0.0	-23.0	39.00	0	0	(756)	(2,885,151)	-2.1	0.0	11.6	0.6	39.0	39.0	0.0	0.0	-180.4	0.0	0.0	-449.3	15	-13.9
76042			123	120.00	120.000	0.38	-3.155	5.0	0.0	0.0	-38.4	266.59	0	0	(9,831)	(2,894,982)	-3.2	0.0	11.6	0.6	266.6	266.6	0.0	0.0	-3071.1	0.0	0.0	-5121.2	15	-13.9
76163			124	119.00	119.000	0.38	-4.610	5.0	0.0	0.0	-66.0	120.26	0	0	(7,533)	(2,902,515)	-4.6	0.0	11.6	0.6	120.3	120.3	0.0	0.0	-2310.2	0.0	0.0	-3967.4	15	-14.0
76266		124	124	115.00	115.000	0.38	-9.000	5.0	0.0	0.0	-187.7	103.21	0	0	(15,706)	(2,918,221)	-9.0	0.0	11.6	0.6	103.2	103.2	0.0	0.0	-3404.9	0.0	0.0	-9683.7	15	-14.2
76336			124	113.00	113.000	0.11	-11.075	5.0	0.0	0.0	-265.3	69.88	0	0	(18,990)	(2,937,211)	-11.1	0.0	11.6	0.6	69.9	69.9	0.0	0.0	-6556.5	0.0	0.0	-9268.9	15	-14.4
76409			124	120.00	120.000	0.11	-4.153	5.0	0.0	0.0	-56.6	73.06	0	0	(14,112)	(2,951,323)	-4.2	0.0	11.6	0.6	73.1	73.1	0.0	0.0	-9690.7	0.0	0.0	-2069.1	15	-14.5
76528			124	130.00	130.000	0.11	5.719	5.0	119.9	9.9	0.0	119.61	4,983	412	(1,710)	(2,949,009)	5.0	0.7	16.5	0.0	50.3	69.3	0.0	0.0	-1425.1	4152.9	343.7	0.0	15	-14.5
76539			124	130.50	130.500	0.11	6.208	5.0	129.7	17.5	0.0	10.31	1,544	169	0	(2,947,709)	5.0	1.2	18.4	0.0	10.3	10.3	617.9	51.1	0.0	668.3	90.1	0.0	15	-14.5
76549			124	130.00	130.000	0.11	5.697	5.0	119.4	9.6	0.0	10.31	1,541	168	0	(2,946,412)	5.0	0.7	16.4	0.0	10.3	10.3	668.3	90.1	0.0	615.7	49.5	0.0	15	-14.5
76654			124	128.00	128.000	0.11	3.584	5.0	61.4	0.0	0.0	105.35	11,430	607	0	(2,937,622)	3.6	0.0	11.6	0.6	105.3	105.3	6291.0	505.7	0.0	3233.7	0.0	0.0	15	-14.4
76760			125	130.00	130.000	0.11	5.471	5.0	114.9	6.5	0.0	105.35	11,145	408	0	(2,929,290)	5.0	0.5	15.5	0.0	105.4	105.4	3233.7	0.0	0.0	6053.4	340.3	0.0	15	-14.3
76815			125	130.50	130.500	0.11	5.912	5.0	123.7	12.8	0.0	54.76	7,841	633	0	(2,922,978)	5.0	0.9	17.2	0.0	54.8	54.8	3146.2	176.9	0.0	3387.7	350.4	0.0	15	-14.2
76869			125	130.00	130.000	0.11	5.354	5.0	112.6	4.9	0.0	54.76	7,763	581	0	(2,916,789)	5.0	0.4	15.0	0.0	54.8	54.8	3387.7	350.4	0.0	3081.9	134.1	0.0	15	-14.2
76891			125	129.00	129.000	0.11	4.330	5.0	78.9	0.0	0.0	21.67	2,490	64	0	(2,914,963)	4.3	0.0	11.6	0.6	21.7	21.7	1219.7	53.1	0.0	855.0	0.0	0.0	15	-14.1
76946			125	128.00	128.000	0.11	3.271	5.0	54.5	0.0	0.0	55.44	4,439	0	0	(2,911,856)	3.3	0.0	11.6	0.6	55.4	55.4	2187.4	0.0	0.0	1511.8	0.0	0.0	15	-14.1
77018			125	126.00	126.000	0.11	1.194	5.0	16.5	0.0	0.0	71.46	3,048	0	0	(2,909,722)	1.2	0.0	11.6	0.6	71.5	71.5	1948.7	0.0	0.0	591.0	0.0	0.0	15	-14.1
77134			125	125.00	125.000	0.11	0.070	5.0	1.4	0.0	0.0	116.52	1,251	0	0	(2,908,846)	0.1	0.0	11.6	0.6	116.5	116.5	963.6	0.0	0.0	79.2	0.0	0.0	15	-14.1
77254			125	120.00	120.000	0.11	-5.059	5.0	0.0	0.0	-75.8	119.71	1	0	(5,368)	(2,914,213)	-5.1	0.0	11.6	0.6	1.6	118.1	1.1	0.0	0.0	0.0	0.0	-4473.1	15	-14.1
77357			125	120.00	120.000	0.11	-5.169	5.0	0.0	0.0	-78.3	102.99	0	0	(9,518)	(2,923,731)	-5.2	0.0	11.6	0.6	103.0	103.0	0.0	0.0	-3901.3	0.0	0.0	-4030.0	15	-14.2
77518			125	130.00	130.000	0.11	4.659	5.0	87.2	0.0	0.0	160.76	3,985	0	(3,970)	(2,924,912)	4.7	0.0	11.6	0.6	84.6	76.2	0.0	0.0	-3308.6	3320.7	0.0	0.0	15	-14.2
77579			125	130.50	130.500	0.11	5.093	5.0	107.4	1.6	0.0	61.68	7,198	61	0	(2,919,794)	5.0	0.1	14.0	0.0	61.7	61.7	2687.7	0.0	0.0	3310.7	50.6	0.0	15	-14.2
77684			126	120.00	120.000	0.11	-5.519	5.0	0.0	0.0	-86.4	104.04	3,216	49	(2,806)	(2,920,285)	-5.5	0.0	11.6	0.6	49.9	54.1	2680.0	40.9	0.0	0.0	0.0	-2338.1	15	-14.2
77764			126	118.00	118.000	0.11	-7.605	5.0	0.0	0.0	-142.7	80.29	0	0	(11,039)	(2,931,324)	-7.6	0.0	11.6	0.6	80.3	80.3	0.0	0.0	-3469.5	0.0	0.0	-5729.9	15	-14.3
77844			126	120.00	120.000	0.11	-5.691	5.0	0.0	0.0	-90.6	80.29	0	0	(11,239)	(2,942,563)	-5.7	0.0	11.6	0.6	80.3	80.3	0.0	0.0	-5729.9	0.0	0.0	-3636.2	15	-14.4

		Cut	Fill		
Width at grade line:		11.6	7.3		
Slope - Earth 1V:		1.50	1.50	H	
Slope - Rock 1V:		2.00	2.00	H	
Ditch / Crown Areas:		0.55	-0.45		

Limit up slope	0.501
Limit down slope	-1.5

Berm, meters:	1
Earth Shrinkage:	30%
Rock Bulking:	30%
Volume Contingency:	20%

baseline for mass haul	15
cumulative adjusted	100,000

to plot Kilometer Point (PK)	mark	Grade Point	to plot Grade Line	Ground Profile Point	to plot Ground Profile Line	Track Grade (%)	Cut Height	Depth to Rock	End Areas for Volumes ------- Earth Cut	- Rock Cut	------ Fill	Seg-ment Length (m)	Earthwork Volumes (m³) from preceding PK - Common Excavation	- Rock Excavation	- Embank-ment	- Adjusted Cumulative	Earth Height	Rock Cut Depth	Earth Cut Base	Earth Cut Top Area	La	Lb	Earth Va+	Rock Va+	Both Va-	Earth Vb+	Rock Vb+	Both Vb-	Baseline for Mass Haul	Cumul Adjtd
77871			126	122.00	122.000	0.11	-3.720	5.0	0.0	0.0	-48.4	27.38	0	0	(2,283)	(2,944,846)	-3.7	0.0	11.6	0.6	27.4	27.4	0.0	0.0	-1239.9	0.0	0.0	-662.2	15	-14.4
77914			126	121.00	121.000	0.11	-4.765	5.0	0.0	0.0	-69.3	42.08	0	0	(2,971)	(2,947,817)	-4.8	0.0	11.6	0.6	42.1	42.1	0.0	0.0	-1017.7	0.0	0.0	-1458.1	15	-14.5
78007			126	128.00	128.000	0.11	2.134	5.0	32.1	0.0	0.0	93.69	559	0	(2,691)	(2,950,117)	2.1	0.0	11.6	0.6	64.7	29.0	0.0	0.0	-2242.1	465.7	0.0	0.0	15	-14.5
78133		126	126	126.00	126.000	0.11	0.000	5.0	0.0	0.0	-0.5	125.36	2,417	0	0	(2,948,425)	0.0	0.0	11.6	0.6	125.4	125.4	2014.5	0.0	0.0	0.0	0.0	0.0	15	-14.5
78371			126	122.00	122.000	-0.06	-3.846	5.0	0.0	0.0	-50.7	238.58	0	0	(7,259)	(2,955,684)	-3.8	0.0	11.6	0.6	238.6	238.6	0.0	0.0	0.0	0.0	0.0	-6049.2	15	-14.6
78650			126	126.00	126.000	-0.06	0.335	5.0	4.6	0.0	0.0	278.69	62	0	(7,800)	(2,963,441)	0.3	0.0	11.6	0.6	256.4	22.3	0.0	0.0	-6500.3	51.3	0.0	0.0	15	-14.6
79027			125	124.00	124.000	-0.06	-1.421	5.0	0.0	0.0	-13.9	377.37	199	0	(2,538)	(2,965,840)	-1.4	0.0	11.6	0.6	72.0	305.4	165.5	0.0	0.0	0.0	0.0	-2115.0	15	-14.7
79135			125	124.00	124.000	-0.06	-1.352	5.0	0.0	0.0	-13.1	107.27	0	0	(1,732)	(2,967,572)	-1.4	0.0	11.6	0.6	107.3	107.3	0.0	0.0	-742.8	0.0	0.0	-700.5	15	-14.7
79282			125	122.00	122.000	-0.06	-3.256	5.0	0.0	0.0	-40.1	147.82	0	0	(4,717)	(2,972,289)	-3.3	0.0	11.6	0.6	147.8	147.8	0.0	0.0	-965.3	0.0	0.0	-2965.3	15	-14.7
79631			125	121.00	121.000	-0.06	-4.030	5.0	0.0	0.0	-54.2	348.89	0	0	(19,751)	(2,992,040)	-4.0	0.0	11.6	0.6	348.9	348.9	0.0	0.0	-6998.7	0.0	0.0	-9460.2	15	-14.9
79802			125	120.00	120.000	-0.06	-4.920	5.0	0.0	0.0	-72.7	170.81	0	0	(13,005)	(3,005,045)	-4.9	0.0	11.6	0.6	170.8	170.8	0.0	0.0	-4631.5	0.0	0.0	-6206.4	15	-15.1
79838			125	117.00	117.000	-0.06	-7.896	5.0	0.0	0.0	-151.6	36.27	0	0	(4,881)	(3,009,926)	-7.9	0.0	11.6	0.6	36.3	36.3	0.0	0.0	-1317.9	0.0	0.0	-2749.4	15	-15.1
79974			125	120.00	120.000	-0.06	-4.809	5.0	0.0	0.0	-70.2	135.27	0	0	(18,006)	(3,027,932)	-4.8	0.0	11.6	0.6	135.3	135.3	0.0	0.0	-10254.1	0.0	0.0	-4750.7	15	-15.3
80045			125	121.00	121.000	-0.06	-3.762	5.0	0.0	0.0	-49.2	71.56	0	0	(5,126)	(3,033,058)	-3.8	0.0	11.6	0.6	71.6	71.6	0.0	0.0	-2513.2	0.0	0.0	-1758.6	15	-15.3
80330			125	120.50	120.500	-0.06	-4.078	5.0	0.0	0.0	-55.2	285.02	0	0	(17,838)	(3,050,896)	-4.1	0.0	11.6	0.6	285.0	285.0	0.0	0.0	-7004.4	0.0	0.0	-7860.9	15	-15.5
80349			125	120.00	120.000	-0.06	-4.566	5.0	0.0	0.0	-65.0	18.95	0	0	(1,367)	(3,052,263)	-4.6	0.0	11.6	0.6	19.0	19.0	0.0	0.0	-522.6	0.0	0.0	-616.3	15	-15.5
80423			125	117.00	117.000	-0.06	-7.518	5.0	0.0	0.0	-140.1	74.13	0	0	(9,124)	(3,061,387)	-7.5	0.0	11.6	0.6	74.1	74.1	0.0	0.0	-2410.7	0.0	0.0	-5192.8	15	-15.6
80487			124	120.00	120.000	-0.06	-4.476	5.0	0.0	0.0	-63.2	64.09	0	0	(7,817)	(3,069,204)	-4.5	0.0	11.6	0.6	64.1	64.1	0.0	0.0	-4489.5	0.0	0.0	-2024.6	15	-15.7
80531			124	127.00	127.000	-0.06	2.552	5.0	39.9	0.0	0.0	43.37	377	0	(1,047)	(3,069,987)	2.6	0.0	11.6	0.6	27.6	15.7	0.0	0.0	-872.6	314.3	0.0	0.0	15	-15.7
80584			124	129.00	129.000	-0.06	4.586	5.0	85.3	0.0	0.0	52.96	3,979	0	0	(3,067,202)	4.6	0.0	11.6	0.6	53.0	53.0	1057.1	0.0	0.0	2258.7	0.0	0.0	15	-15.7
80695			124	120.00	120.000	-0.06	-4.342	5.0	0.0	0.0	-60.4	111.52	2,932	0	(1,966)	(3,067,116)	-4.3	0.0	11.6	0.6	57.3	54.2	2443.4	0.0	0.0	0.0	0.0	-1638.3	15	-15.7
80781			124	113.00	113.000	-0.06	-11.286	5.0	0.0	0.0	-273.9	85.48	0	0	(17,147)	(3,084,263)	-11.3	0.0	11.6	0.6	85.5	85.5	0.0	0.0	-2582.4	0.0	0.0	-11706.9	15	-15.8
80866			124	115.00	115.000	-0.06	-9.231	5.0	0.0	0.0	-195.7	85.48	0	0	(24,083)	(3,108,346)	-9.2	0.0	11.6	0.6	85.5	85.5	0.0	0.0	-11706.9	0.0	0.0	-8362.1	15	-16.1
80942			124	115.00	115.000	-0.06	-9.182	5.0	0.0	0.0	-193.9	75.99	0	0	(17,764)	(3,126,110)	-9.2	0.0	11.6	0.6	76.0	76.0	0.0	0.0	-7434.2	0.0	0.0	-7368.9	15	-16.3
81018			124	119.00	119.000	-0.06	-5.133	5.0	0.0	0.0	-77.4	75.99	0	0	(12,373)	(3,138,483)	-5.1	0.0	11.6	0.6	76.0	76.0	0.0	0.0	-7368.9	0.0	0.0	-2942.1	15	-16.4
81063			124	120.00	120.000	-0.06	-4.103	5.0	0.0	0.0	-55.7	44.92	0	0	(3,587)	(3,142,070)	-4.1	0.0	11.6	0.6	44.9	44.9	0.0	0.0	-1739.1	0.0	0.0	-1250.1	15	-16.4
81108			124	120.50	120.500	-0.06	-3.574	5.0	0.0	0.0	-45.7	44.92	0	0	(2,732)	(3,144,802)	-3.6	0.0	11.6	0.6	44.9	44.9	0.0	0.0	-1250.1	0.0	0.0	-1026.6	15	-16.4
81165			124	120.50	120.500	-0.06	-3.537	5.0	0.0	0.0	-45.0	57.46	0	0	(3,129)	(3,147,931)	-3.5	0.0	11.6	0.6	57.5	57.5	0.0	0.0	-1313.2	0.0	0.0	-1294.0	15	-16.5
81223		124	124	120.00	120.000	-0.06	-4.000	5.0	0.0	0.0	-53.7	57.46	0	0	(3,402)	(3,151,333)	-4.0	0.0	11.6	0.6	57.5	57.5	0.0	0.0	-1294.0	0.0	0.0	-1541.4	15	-16.5
81458			123	120.50	120.500	-0.28	-2.847	5.0	0.0	0.0	-33.4	234.90	0	0	(12,267)	(3,163,600)	-2.8	0.0	11.6	0.6	234.9	234.9	0.0	0.0	-6301.2	0.0	0.0	-3921.7	15	-16.6
81693			123	120.00	120.000	-0.28	-2.694	5.0	0.0	0.0	-31.0	234.90	0	0	(9,077)	(3,172,677)	-2.7	0.0	11.6	0.6	234.9	234.9	0.0	0.0	-3921.7	0.0	0.0	-3642.1	15	-16.7
81978			122	111.00	111.000	-0.28	-10.901	5.0	0.0	0.0	-258.3	285.37	0	0	(49,533)	(3,222,210)	-10.9	0.0	11.6	0.6	285.4	285.4	0.0	0.0	-4424.7	0.0	0.0	-36852.7	15	-17.2
82015			122	110.50	110.500	-0.28	-11.300	5.0	0.0	0.0	-274.5	36.47	0	0	(11,658)	(3,233,868)	-11.3	0.0	11.6	0.6	36.5	36.5	0.0	0.0	-4709.7	0.0	0.0	-5005.0	15	-17.3
82302		121	121	117.00	117.000	-0.28	-4.000	5.0	0.0	0.0	-53.7	287.79	0	0	(56,658)	(3,290,526)	-4.0	0.0	11.6	0.6	287.8	287.8	0.0	0.0	-39494.9	0.0	0.0	-7720.0	15	-17.9
82342			121	117.00	117.000	-0.84	-3.669	5.0	0.0	0.0	-47.4	39.19	0	0	(2,377)	(3,292,903)	-3.7	0.0	11.6	0.6	39.2	39.2	0.0	0.0	-1051.3	0.0	0.0	-929.2	15	-17.9
82413			120	119.00	119.000	-0.84	-1.066	5.0	0.0	0.0	-9.9	71.32	0	0	(2,455)	(3,295,358)	-1.1	0.0	11.6	0.6	71.3	71.3	0.0	0.0	-1691.0	0.0	0.0	-354.5	15	-18.0
82479			120	117.00	117.000	-0.84	-2.511	5.0	0.0	0.0	-28.2	65.76	0	0	(1,506)	(3,296,864)	-2.5	0.0	11.6	0.6	65.8	65.8	0.0	0.0	-326.8	0.0	0.0	-928.5	15	-18.0
82874			116	114.00	114.000	-0.84	-2.170	5.0	0.0	0.0	-23.4	395.45	0	0	(12,241)	(3,309,105)	-2.2	0.0	11.6	0.6	395.5	395.5	0.0	0.0	-5583.8	0.0	0.0	-4616.9	15	-18.1
83157			114	112.00	112.000	-0.84	-1.778	5.0	0.0	0.0	-18.2	283.12	0	0	(7,053)	(3,316,158)	-1.8	0.0	11.6	0.6	283.1	283.1	0.0	0.0	-3305.4	0.0	0.0	-2572.1	15	-18.2
83220			113	110.00	110.000	-0.84	-3.248	5.0	0.0	0.0	-40.0	62.80	0	0	(2,191)	(3,318,349)	-3.2	0.0	11.6	0.6	62.8	62.8	0.0	0.0	-570.5	0.0	0.0	-1255.4	15	-18.2
83249		113	113	109.00	109.000	-0.84	-4.000	5.0	0.0	0.0	-53.7	29.31	0	0	(1,647)	(3,319,996)	-4.0	0.0	11.6	0.6	29.3	29.3	0.0	0.0	-585.9	0.0	0.0	-786.2	15	-18.2
83472			111	101.00	101.000	-0.89	-10.004	5.0	0.0	0.0	-223.6	223.02	0	0	(37,101)	(3,357,097)	-10.0	0.0	11.6	0.6	223.0	223.0	0.0	0.0	-5982.5	0.0	0.0	-24934.8	15	-18.6
83522			111	105.00	105.000	-0.89	-5.560	5.0	0.0	0.0	-87.4	49.62	0	0	(9,260)	(3,366,357)	-5.6	0.0	11.6	0.6	49.6	49.6	0.0	0.0	-5547.8	0.0	0.0	-2168.9	15	-18.7
83605			110	108.00	108.000	-0.89	-1.813	5.0	0.0	0.0	-18.6	83.50	0	0	(5,313)	(3,371,670)	-1.8	0.0	11.6	0.6	83.5	83.5	0.0	0.0	-3649.8	0.0	0.0	-777.4	15	-18.7
83796			108	103.00	103.000	-0.89	-5.109	5.0	0.0	0.0	-76.9	190.45	0	0	(10,915)	(3,382,585)	-5.1	0.0	11.6	0.6	190.4	190.4	0.0	0.0	-1773.1	0.0	0.0	-7322.8	15	-18.8
83920			107	100.00	100.000	-0.89	-6.994	5.0	0.0	0.0	-124.9	124.58	0	0	(15,083)	(3,397,668)	-7.0	0.0	11.6	0.6	124.6	124.6	0.0	0.0	-4790.1	0.0	0.0	-7778.8	15	-19.0
83945			107	100.00	100.000	-0.89	-6.773	5.0	0.0	0.0	-118.7	24.65	0	0	(3,603)	(3,401,271)	-6.8	0.0	11.6	0.6	24.7	24.7	0.0	0.0	-1539.1	0.0	0.0	-1463.2	15	-19.0
84197			105	108.00	108.000	-0.89	3.483	5.0	59.2	0.0	0.0	252.18	3,039	0	(11,863)	(3,411,007)	3.5	0.0	11.6	0.6	166.5	85.6	0.0	0.0	-9885.8	2532.8	0.0	0.0	15	-19.1
84255		104	104	109.00	109.000	-0.89	5.000	5.0	96.1	0.0	0.0	57.76	5,379	0	0	(3,407,242)	5.0	0.0	11.6	0.6	57.8	57.8	1708.3	0.0	0.0	2773.9	0.0	0.0	15	-19.1
84313			104	106.00	106.000	-0.81	2.467	5.0	38.3	0.0	0.0	57.76	4,656	0	0	(3,403,983)	2.5	0.0	11.6	0.6	57.8	57.8	2773.9	0.0	0.0	1106.1	0.0	0.0	15	-19.0
84408			103	100.00	100.000	-0.81	-2.760	5.0	0.0	0.0	-32.0	95.56	1,036	0	(969)	(3,404,227)	-2.8	0.0	11.6	0.6	45.1	50.5	863.7	0.0	0.0	0.0	0.0	-807.8	15	-19.0
84520			102	91.00	91.000	-0.81	-10.858	5.0	0.0	0.0	-256.6	111.50	0	0	(19,307)	(3,423,534)	-10.9	0.0	11.6	0.6	111.5	111.5	0.0	0.0	-1785.1	0.0	0.0	-14303.8	15	-19.2
84582			101	90.00	90.000	-0.81	-11.357	5.0	0.0	0.0	-276.8	62.03	0	0	(19,851)	(3,443,385)	-11.4	0.0	11.6	0.6	62.0	62.0	0.0	0.0	-7957.5	0.0	0.0	-8585.3	15	-19.4
84654			101	89.50	89.500	-0.81	-11.273	5.0	0.0	0.0	-273.4	72.21	0	0	(23,835)	(3,467,220)	-11.3	0.0	11.6	0.6	72.2	72.2	0.0	0.0	-9993.5	0.0	0.0	-9868.6	15	-19.7
84726			100	90.00	90.000	-0.81	-10.189	5.0	0.0	0.0	-230.5	72.21	0	0	(21,830)	(3,489,050)	-10.2	0.0	11.6	0.6	72.2	72.2	0.0	0.0	-9868.6	0.0	0.0	-8323.1	15	-19.9
84827			99	91.00	91.000	-0.81	-8.374	5.0	0.0	0.0	-166.8	100.74	0	0	(24,014)	(3,513,064)	-8.4	0.0	11.6	0.6	100.7	100.7	0.0	0.0	-11612.3	0.0	0.0	-8399.7	15	-20.1
84928			99	90.00	90.000	-0.81	-8.559	5.0	0.0	0.0	-172.8	100.74	0	0	(20,526)	(3,533,590)	-8.6	0.0	11.6	0.6	100.7	100.7	0.0	0.0	-8399.7	0.0	0.0	-8704.9	15	-20.3
85016			98	90.00	90.000	-0.81	-7.842	5.0	0.0	0.0	-149.9	88.67	0	0	(17,171)	(3,550,761)	-7.8	0.0	11.6	0.6	88.7	88.7	0.0	0.0	-7662.0	0.0	0.0	-6647.6	15	-20.5
85085			97	91.50	91.500	-0.81	-5.791	5.0	0.0	0.0	-93.0	68.17	0	0	(9,938)	(3,560,699)	-5.8	0.0	11.6	0.6	68.2	68.2	0.0	0.0	-5110.7	0.0	0.0	-3170.6	15	-20.6
85244		96	96	96.00	96.000	-0.81	0.000	5.0	0.0	0.0	-0.5	159.58	0	0	(8,906)	(3,569,605)	0.0	0.0	11.6	0.6	159.6	159.6	0.0	0.0	-7422.1	0.0	0.0	0.0	15	-20.7
85412			96	97.50	97.500	-0.29	1.982	5.0	29.4	0.0	0.0	168.13	2,970	0	0	(3,567,526)	2.0	0.0	11.6	0.6	168.1	168.1	0.0	0.0	0.0	2474.8	0.0	0.0	15	-20.7
85580			95	90.00	90.000	-0.29	-5.036	5.0	0.0	0.0	-75.3	168.13	839	0	(5,447)	(3,572,386)	-5.0	0.0	11.6	0.6	47.5	120.6	699.0	0.0	0.0	0.0	0.0	-4539.1	15	-20.7
85800			94	96.00	96.000	-0.29	1.594	5.0	22.9	0.0	0.0	219.70	725	0	(7,534)	(3,579,413)	1.6	0.0	11.6	0.6	166.9	52.8	0.0	0.0	-6278.5	603.8	0.0	0.0	15	-20.8
85926			94	93.00	93.000	-0.29	-1.044	5.0	0.0	0.0	-9.7	126.04	1,045	0	(291)	(3,578,973)	-1.0	0.0	11.6	0.6	76.2	49.9	870.5	0.0	0.0	0.0	0.0	-242.2	15	-20.8
86156			93	90.00	90.000	-0.29	-3.386	5.0	0.0	0.0	-42.4	229.71	0	0	(7,177)	(3,586,150)	-3.4	0.0	11.6	0.6	229.7	229.7	0.0	0.0	-1115.2	0.0	0.0	-4865.3	15	-20.9
86290		93	93	88.00	88.000	-0.29	-5.000	5.0	0.0	0.0	-74.5	134.44	0	0	(9,422)	(3,595,572)	-5.0	0.0	11.6	0.6	134.4	134.4	0.0	0.0	-2847.4	0.0	0.0	-5004.5	15	-21.0

	Cut	Fill		
Width at grade line:	11.6	7.3		
Slope - Earth 1V:	1.50	1.50 H	Limit up slope	0.501
Slope - Rock 1V:	2.00	2.00 H	Limit down slope	-1.5
Ditch / Crown Areas:	0.55	-0.45		

Berm, meters:	1
Earth Shrinkage:	30%
Rock Bulking:	30%
Volume Contingency:	20%

baseline for mass haul	15
cumulative adjusted	100,000

to plot Kilometer Point (PK)	mark	Grade Point	to plot Grade Line	Ground Profile Point	to plot Ground Profile Line	Track Grade (%)	Cut Height	Depth to Rock	End Areas for Volumes ------- Earth Cut	- Rock Cut	------ Fill	Seg-ment Length (m)	Earthwork Volumes (m^3) from preceding PK - Common Excavation	- Rock Excavation	- Embank-ment	- Adjusted Cumulative	Earth Height	Rock Cut Depth	Earth Cut Base	Earth Cut Top Area	La	Lb	Earth Va+	Rock Va+	Both Va-	Earth Vb+	Rock Vb+	Both Vb-	Baseline for Mass Haul	Cumul Adjtd
86406			93	90.00	90.000	0.00	-3.000	5.0	0.0	0.0	-35.9	115.19	0	0	(7,623)	(3,603,195)	-3.0	0.0	11.6	0.6	115.2	115.2	0.0	0.0	-4287.9	0.0	0.0	-2064.8	15	-21.0
86521			93	95.00	95.000	0.00	2.000	5.0	29.8	0.0	0.0	115.82	827	0	(1,495)	(3,604,111)	2.0	0.0	11.6	0.6	69.5	46.3	0.0	0.0	-1245.6	689.1	0.0	0.0	15	-21.0
86637			93	90.00	90.000	0.00	-3.000	5.0	0.0	0.0	-35.9	115.82	827	0	(1,495)	(3,605,027)	-3.0	0.0	11.6	0.6	46.3	69.5	689.1	0.0	0.0	0.0	0.0	-1245.6	15	-21.1
86894			93	86.00	86.000	0.00	-7.000	5.0	0.0	0.0	-125.1	257.27	0	0	(24,837)	(3,629,864)	-7.0	0.0	11.6	0.6	257.3	257.3	0.0	0.0	-4611.6	0.0	0.0	-16085.8	15	-21.3
87016			93	88.00	88.000	0.00	-5.000	5.0	0.0	0.0	-74.5	121.96	0	0	(14,599)	(3,644,463)	-5.0	0.0	11.6	0.6	122.0	122.0	0.0	0.0	-7625.5	0.0	0.0	-4540.0	15	-21.4
87094			93	90.00	90.000	0.00	-3.000	5.0	0.0	0.0	-35.9	77.76	0	0	(5,146)	(3,649,609)	-3.0	0.0	11.6	0.6	77.8	77.8	0.0	0.0	-2894.6	0.0	0.0	-1393.8	15	-21.5
87156			93	92.00	92.000	0.00	-1.000	5.0	0.0	0.0	-9.3	61.60	0	0	(1,667)	(3,651,276)	-1.0	0.0	11.6	0.6	61.6	61.6	0.0	0.0	-1104.1	0.0	0.0	-284.9	15	-21.5
87217			93	90.00	90.000	0.00	-3.000	5.0	0.0	0.0	-35.9	61.60	0	0	(1,667)	(3,652,943)	-3.0	0.0	11.6	0.6	61.6	61.6	0.0	0.0	-284.9	0.0	0.0	-1104.1	15	-21.5
87278			93	89.00	89.000	0.00	-4.000	5.0	0.0	0.0	-53.7	60.39	0	0	(3,243)	(3,656,186)	-4.0	0.0	11.6	0.6	60.4	60.4	0.0	0.0	-1082.4	0.0	0.0	-1619.8	15	-21.6
87338			93	88.00	88.000	0.00	-5.000	5.0	0.0	0.0	-74.5	60.38	0	0	(4,641)	(3,660,827)	-5.0	0.0	11.6	0.6	60.4	60.4	0.0	0.0	-1619.8	0.0	0.0	-2247.8	15	-21.6
87481			93	85.00	85.000	0.00	-8.000	5.0	0.0	0.0	-154.9	143.22	0	0	(19,704)	(3,680,531)	-8.0	0.0	11.6	0.6	143.2	143.2	0.0	0.0	-5331.4	0.0	0.0	-11088.8	15	-21.8
87625			93	88.00	88.000	0.00	-5.000	5.0	0.0	0.0	-74.5	143.22	0	0	(19,704)	(3,700,235)	-5.0	0.0	11.6	0.6	143.2	143.2	0.0	0.0	-11088.8	0.0	0.0	-5331.4	15	-22.0
87677			93	89.00	89.000	0.00	-4.000	5.0	0.0	0.0	-53.7	52.49	0	0	(4,034)	(3,704,269)	-4.0	0.0	11.6	0.6	52.5	52.5	0.0	0.0	-1953.9	0.0	0.0	-1408.0	15	-22.0
87712			93	90.00	90.000	0.00	-3.000	5.0	0.0	0.0	-35.9	34.83	0	0	(1,870)	(3,706,139)	-3.0	0.0	11.6	0.6	34.8	34.8	0.0	0.0	-934.3	0.0	0.0	-624.3	15	-22.1
87777			93	91.00	91.000	0.00	-2.000	5.0	0.0	0.0	-21.1	65.25	0	0	(2,228)	(3,708,367)	-2.0	0.0	11.6	0.6	65.3	65.3	0.0	0.0	-1169.6	0.0	0.0	-686.8	15	-22.1
87842			93	90.00	90.000	0.00	-3.000	5.0	0.0	0.0	-35.9	65.25	0	0	(2,228)	(3,710,595)	-3.0	0.0	11.6	0.6	65.3	65.3	0.0	0.0	-686.8	0.0	0.0	-1169.6	15	-22.1
87899			93	90.00	90.000	0.00	-3.000	5.0	0.0	0.0	-35.9	57.08	0	0	(2,456)	(3,713,051)	-3.0	0.0	11.6	0.6	57.1	57.1	0.0	0.0	-1023.2	0.0	0.0	-1023.2	15	-22.1
87979			93	91.00	91.000	0.00	-2.000	5.0	0.0	0.0	-21.1	79.70	0	0	(2,721)	(3,715,772)	-2.0	0.0	11.6	0.6	79.7	79.7	0.0	0.0	-1428.5	0.0	0.0	-838.8	15	-22.2
88059			93	90.00	90.000	0.00	-3.000	5.0	0.0	0.0	-35.9	79.69	0	0	(2,721)	(3,718,493)	-3.0	0.0	11.6	0.6	79.7	79.7	0.0	0.0	-838.8	0.0	0.0	-1428.5	15	-22.2
88122			93	91.00	91.000	0.00	-2.000	5.0	0.0	0.0	-21.1	63.02	0	0	(2,152)	(3,720,645)	-2.0	0.0	11.6	0.6	63.0	63.0	0.0	0.0	-1129.6	0.0	0.0	-663.3	15	-22.2
88249			93	90.50	90.500	0.00	-2.500	5.0	0.0	0.0	-28.1	127.19	0	0	(3,749)	(3,724,394)	-2.5	0.0	11.6	0.6	127.2	127.2	0.0	0.0	-1338.7	0.0	0.0	-1785.7	15	-22.2
88350			93	91.00	91.000	0.00	-2.000	5.0	0.0	0.0	-21.1	101.17	0	0	(2,982)	(3,727,376)	-2.0	0.0	11.6	0.6	101.2	101.2	0.0	0.0	-1420.4	0.0	0.0	-1064.8	15	-22.3
88431			93	90.00	90.000	0.00	-3.000	5.0	0.0	0.0	-35.9	81.14	0	0	(2,770)	(3,730,146)	-3.0	0.0	11.6	0.6	81.1	81.1	0.0	0.0	-854.0	0.0	0.0	-1454.4	15	-22.3
88521			93	91.50	91.500	0.00	-1.500	5.0	0.0	0.0	-14.8	89.35	0	0	(2,714)	(3,732,860)	-1.5	0.0	11.6	0.6	89.4	89.4	0.0	0.0	-1601.7	0.0	0.0	-660.3	15	-22.3
88610			93	90.00	90.000	0.00	-3.000	5.0	0.0	0.0	-35.9	89.35	0	0	(2,714)	(3,735,574)	-3.0	0.0	11.6	0.6	89.4	89.4	0.0	0.0	-660.3	0.0	0.0	-1601.7	15	-22.4
88791			93	87.00	87.000	0.00	-6.000	5.0	0.0	0.0	-98.3	180.93	0	0	(14,558)	(3,750,132)	-6.0	0.0	11.6	0.6	180.9	180.9	0.0	0.0	-3243.2	0.0	0.0	-8888.2	15	-22.5
88885			93	90.00	90.000	0.00	-3.000	5.0	0.0	0.0	-35.9	94.46	0	0	(7,600)	(3,757,732)	-3.0	0.0	11.6	0.6	94.5	94.5	0.0	0.0	-4640.3	0.0	0.0	-1693.2	15	-22.6
88969			93	93.00	93.000	0.00	0.000	5.0	0.0	0.0	-0.5	83.55	0	0	(1,797)	(3,759,529)	0.0	0.0	11.6	0.6	83.6	83.6	0.0	0.0	-1497.6	0.0	0.0	0.0	15	-22.6
89292			93	91.00	91.000	0.00	-2.000	5.0	0.0	0.0	-21.1	322.96	0	0	(4,079)	(3,763,608)	-2.0	0.0	11.6	0.6	323.0	323.0	0.0	0.0	0.0	0.0	0.0	-3399.2	15	-22.6
89382			93	90.00	90.000	0.00	-3.000	5.0	0.0	0.0	-35.9	89.90	0	0	(3,069)	(3,766,677)	-3.0	0.0	11.6	0.6	89.9	89.9	0.0	0.0	-946.2	0.0	0.0	-1611.5	15	-22.7
89408			93	89.50	89.500	0.00	-3.500	5.0	0.0	0.0	-44.4	26.40	0	0	(1,271)	(3,767,948)	-3.5	0.0	11.6	0.6	26.4	26.4	0.0	0.0	-473.2	0.0	0.0	-585.8	15	-22.7
89496			93	90.00	90.000	0.00	-3.000	5.0	0.0	0.0	-35.9	87.71	0	0	(4,222)	(3,772,170)	-3.0	0.0	11.6	0.6	87.7	87.7	0.0	0.0	-1946.3	0.0	0.0	-1572.2	15	-22.7
89543			93	90.00	90.000	0.00	-3.000	5.0	0.0	0.0	-35.9	46.76	0	0	(2,012)	(3,774,182)	-3.0	0.0	11.6	0.6	46.8	46.8	0.0	0.0	-838.2	0.0	0.0	-838.2	15	-22.7
89676			93	89.00	89.000	0.00	-4.000	5.0	0.0	0.0	-53.7	133.15	0	0	(7,150)	(3,781,332)	-4.0	0.0	11.6	0.6	133.1	133.1	0.0	0.0	-2386.7	0.0	0.0	-3571.7	15	-22.8
89705			93	90.00	90.000	0.00	-3.000	5.0	0.0	0.0	-35.9	28.99	0	0	(1,557)	(3,782,889)	-3.0	0.0	11.6	0.6	29.0	29.0	0.0	0.0	-777.7	0.0	0.0	-519.6	15	-22.8
89887			93	91.00	91.000	0.00	-2.000	5.0	0.0	0.0	-21.1	182.01	0	0	(6,214)	(3,789,103)	-2.0	0.0	11.6	0.6	182.0	182.0	0.0	0.0	-3262.5	0.0	0.0	-1915.7	15	-22.9
89939		93	93	90.00	90.000	0.00	-3.000	5.0	0.0	0.0	-35.9	51.74	0	0	(1,766)	(3,790,869)	-3.0	0.0	11.6	0.6	51.7	51.7	0.0	0.0	-544.6	0.0	0.0	-927.4	15	-22.9
90155			91	85.00	85.000	-0.83	-6.202	5.0	0.0	0.0	-103.4	216.83	0	0	(18,119)	(3,808,988)	-6.2	0.0	11.6	0.6	216.8	216.8	0.0	0.0	-3886.7	0.0	0.0	-11212.3	15	-23.1
90275			90	90.00	90.000	-0.83	-0.209	5.0	0.0	0.0	-2.0	119.78	0	0	(7,579)	(3,816,567)	-0.2	0.0	11.6	0.6	119.8	119.8	0.0	0.0	-6193.8	0.0	0.0	-122.2	15	-23.2
90356			90	91.00	91.000	-0.83	1.461	5.0	20.7	0.0	0.0	80.74	877	0	(12)	(3,815,965)	1.5	0.0	11.6	0.6	10.1	70.6	0.0	0.0	-10.3	730.8	0.0	0.0	15	-23.2
90437			89	90.00	90.000	-0.83	1.130	5.0	15.6	0.0	0.0	80.74	1,757	0	0	(3,814,735)	1.1	0.0	11.6	0.6	80.7	80.7	835.3	0.0	0.0	628.6	0.0	0.0	15	-23.1
90522			88	80.00	80.000	-0.83	-8.164	5.0	0.0	0.0	-160.0	85.18	97	0	(7,183)	(3,821,850)	-8.2	0.0	11.6	0.6	10.4	74.8	80.6	0.0	0.0	0.0	0.0	-5986.2	15	-23.2
90662		87	87	71.00	71.000	-0.83	-16.000	5.0	0.0	0.0	-501.3	140.33	0	0	(55,677)	(3,877,527)	-16.0	0.0	11.6	0.6	140.3	140.3	0.0	0.0	-11227.1	0.0	0.0	-35170.2	15	-23.8
90714			87	76.00	76.000	0.00	-11.000	5.0	0.0	0.0	-262.3	52.01	0	0	(23,826)	(3,901,353)	-11.0	0.0	11.6	0.6	52.0	52.0	0.0	0.0	-13035.0	0.0	0.0	-6819.8	15	-24.0
90861			87	81.00	81.000	0.00	-6.000	5.0	0.0	0.0	-98.3	146.65	0	0	(31,720)	(3,933,073)	-6.0	0.0	11.6	0.6	146.6	146.6	0.0	0.0	-19229.5	0.0	0.0	-7204.2	15	-24.3
90988			87	85.00	85.000	0.00	-2.000	5.0	0.0	0.0	-21.1	126.79	0	0	(9,076)	(3,942,149)	-2.0	0.0	11.6	0.6	126.8	126.8	0.0	0.0	-6228.6	0.0	0.0	-1334.5	15	-24.4
91033			87	83.00	83.000	0.00	-4.000	5.0	0.0	0.0	-53.7	45.15	0	0	(2,024)	(3,944,173)	-4.0	0.0	11.6	0.6	45.2	45.2	0.0	0.0	-475.2	0.0	0.0	-1211.1	15	-24.4
91211			87	90.00	90.000	0.00	3.000	5.0	48.9	0.0	0.0	177.95	2,235	0	(3,273)	(3,945,882)	3.0	0.0	11.6	0.6	101.7	76.3	0.0	0.0	-2727.7	1862.8	0.0	0.0	15	-24.5
91512			87	93.00	93.000	0.00	6.000	5.0	125.5	14.2	0.0	301.18	31,506	2,557	0	(3,920,504)	5.0	1.0	17.6	0.0	301.2	301.2	7356.3	0.0	0.0	18899.0	2130.8	0.0	15	-24.2
91647			87	90.00	90.000	0.00	3.000	5.0	48.9	0.0	0.0	134.84	14,106	1,145	0	(3,909,141)	3.0	0.0	11.6	0.6	134.8	134.8	8461.2	954.0	0.0	3293.5	0.0	0.0	15	-24.1
91778			87	90.00	90.000	0.00	3.000	5.0	48.9	0.0	0.0	131.47	7,707	0	0	(3,903,746)	3.0	0.0	11.6	0.6	131.5	131.5	3211.2	0.0	0.0	3211.2	0.0	0.0	15	-24.0
91933			87	89.50	89.500	0.00	2.500	5.0	38.9	0.0	0.0	155.01	8,164	0	0	(3,898,031)	2.5	0.0	11.6	0.6	155.0	155.0	3786.1	0.0	0.0	3017.3	0.0	0.0	15	-24.0
91970			87	89.50	89.500	0.00	2.500	5.0	38.9	0.0	0.0	36.96	1,727	0	0	(3,896,822)	2.5	0.0	11.6	0.6	37.0	37.0	719.4	0.0	0.0	719.4	0.0	0.0	15	-24.0
93076			87	80.96	80.960	0.00	-6.040	5.0	0.0	0.0	-99.3	1106.00	7,563	0	(46,586)	(3,938,114)	-6.0	0.0	11.6	0.6	323.8	782.2	6302.2	0.0	0.0	0.0	0.0	-38822.1	15	-24.4
93385		87	87	74.008	74.008	0.00	-12.992	5.0	0.0	0.0	-348.5	308.66	0	0	(82,920)	(4,021,034)	-13.0	0.0	11.6	0.6	308.7	308.7	0.0	0.0	-15318.8	0.0	0.0	-53780.9	15	-25.2
93721			88	86.2	86.200	0.29	-1.760	5.0	0.0	0.0	-17.9	336.10	0	0	(73,892)	(4,094,926)	-1.8	0.0	11.6	0.6	336.1	336.1	0.0	0.0	-58562.1	0.0	0.0	-3014.8	15	-25.9
94147			89	91.44	91.440	0.29	2.265	5.0	34.5	0.0	0.0	425.61	4,963	0	(2,003)	(4,093,455)	2.3	0.0	11.6	0.6	186.1	239.5	0.0	0.0	-1669.0	4135.8	0.0	0.0	15	-25.9
94585			90	91.44	91.440	0.29	1.014	5.0	13.9	0.0	0.0	438.39	12,726	0	0	(4,084,547)	1.0	0.0	11.6	0.6	438.4	438.4	7568.8	0.0	0.0	3035.9	0.0	0.0	15	-25.8
94877			91	88.392	88.392	0.29	-2.868	5.0	0.0	0.0	-33.7	292.15	634	0	(4,368)	(4,088,471)	-2.9	0.0	11.6	0.6	76.3	215.9	528.3	0.0	0.0	0.0	0.0	-3640.4	15	-25.9
95086			92	91.44	91.440	0.29	-0.416	5.0	0.0	0.0	-3.8	208.65	0	0	(4,692)	(4,093,163)	-0.4	0.0	11.6	0.6	208.6	208.6	0.0	0.0	-3518.9	0.0	0.0	-391.2	15	-25.9
95209			92	94.488	94.488	0.29	2.280	5.0	34.8	0.0	0.0	123.34	2,177	0	(43)	(4,091,682)	2.3	0.0	11.6	0.6	19.0	104.3	0.0	0.0	-35.7	1814.5	0.0	0.0	15	-25.9
95410			93	91.44	91.440	0.29	-1.343	5.0	0.0	0.0	-13.0	201.26	2,644	0	(580)	(4,090,411)	-1.3	0.0	11.6	0.6	126.7	74.6	2203.3	0.0	0.0	0.0	0.0	-483.4	15	-25.9
95477			93	89.916	89.916	0.29	-3.058	5.0	0.0	0.0	-36.8	66.96	0	0	(1,999)	(4,092,410)	-3.1	0.0	11.6	0.6	67.0	67.0	0.0	0.0	-433.9	0.0	0.0	-1232.1	15	-25.9
95544			93	91.44	91.440	0.29	-1.725	5.0	0.0	0.0	-17.5	66.96	0	0	(2,182)	(4,094,592)	-1.7	0.0	11.6	0.6	67.0	67.0	0.0	0.0	-1232.1	0.0	0.0	-586.2	15	-25.9
96025			95	103.632	103.632	0.29	9.094	5.0	187.4	81.6	0.0	480.90	45,446	19,781	(806)	(4,037,871)	5.0	4.1	30.0	0.0	76.7	404.2	0.0	0.0	-671.3	37871.8	16484.3	0.0	15	-25.4
96473			96	92.964	92.964	0.29	-2.852	5.0	0.0	0.0	-33.5	447.73	38,319	16,679	(2,147)	(3,991,512)	-2.9	0.0	11.6	0.6	340.8	106.9	31932.7	13899.2	0.0	0.0	0.0	-1788.9	15	-24.9

	Cut	Fill	
Width at grade line:	11.6	7.3	
Slope - Earth 1V:	1.50	1.50	H
Slope - Rock 1V:	2.00	2.00	H
Ditch / Crown Areas:	0.55	-0.45	

Limit up slope	0.501
Limit down slope	-1.5

Berm, meters:	1
Earth Shrinkage:	30%
Rock Bulking:	30%
Volume Contingency:	20%

baseline for mass haul	15
cumulative adjusted	100,000

to plot Kilometer Point (PK)	mark	to plot Grade Point	Grade Line	Ground Profile Point	to plot Ground Profile Line	Track Grade (%)	Cut Height	Depth to Rock	End Areas for Volumes ------- Earth Cut	- Rock Cut	------ Fill	Seg-ment Length (m)	Earthwork Volumes (m³) from preceding PK - Common Excavation	- Rock Excavation	- Embank-ment	- Adjusted Cumulative	Earth Height	Rock Cut Depth	Earth Cut Base	Earth Cut Top Area	La	Lb	Earth Va+	Rock Va+	Both Va-	Earth Vb+	Rock Vb+	Both Vb-	Baseline for Mass Haul	Cumul Adjtd
97238		98	98	109.728	109.728	0.29	11.728	5.0	240.1	169.1	0.0	764.93	88,625	62,439	(3,005)	(3,851,309)	5.0	6.7	40.5	0.0	149.6	615.3	0.0	0.0	-2504.2	73853.8	52032.4	0.0	15	-23.5
97610			97	92.964	92.964	-0.26	-4.088	5.0	0.0	0.0	-55.4	371.67	39,697	27,968	(3,191)	(3,790,354)	-4.1	0.0	11.6	0.6	275.6	96.1	33080.6	23306.4	0.0	0.0	0.0	-2659.1	15	-22.9
97751			97	92.964	92.964	-0.26	-3.728	5.0	0.0	0.0	-48.5	141.26	0	0	(8,804)	(3,799,158)	-3.7	0.0	11.6	0.6	141.3	141.3	0.0	0.0	-3910.1	0.0	0.0	-3426.3	15	-23.0
97892			96	91.44	91.440	-0.26	-4.891	5.0	0.0	0.0	-72.1	141.26	0	0	(10,218)	(3,809,376)	-4.9	0.0	11.6	0.6	141.3	141.3	0.0	0.0	-3426.3	0.0	0.0	-5088.9	15	-23.1
98033			96	89.916	89.916	-0.26	-6.055	5.0	0.0	0.0	-99.7	141.26	0	0	(14,553)	(3,823,929)	-6.1	0.0	11.6	0.6	141.3	141.3	0.0	0.0	-5088.9	0.0	0.0	-7038.3	15	-23.2
98175			96	91.44	91.440	-0.26	-4.171	5.0	0.0	0.0	-57.0	141.26	0	0	(13,276)	(3,837,205)	-4.2	0.0	11.6	0.6	141.3	141.3	0.0	0.0	-7038.3	0.0	0.0	-4025.2	15	-23.4
98531			95	106.68	106.680	-0.26	11.978	5.0	245.1	178.9	0.0	356.39	38,868	28,373	(3,147)	(3,776,260)	5.0	7.0	41.5	0.0	92.0	264.3	0.0	0.0	-2622.9	32390.1	23644.2	0.0	15	-22.8
98806		94	94	91.44	91.440	-0.26	-2.560	5.0	0.0	0.0	-29.0	275.18	33,337	24,335	(842)	(3,722,131)	-2.6	0.0	11.6	0.6	226.7	48.5	27780.5	20279.3	0.0	0.0	0.0	-701.9	15	-22.2
98931			94	89.916	89.916	0.00	-4.084	5.0	0.0	0.0	-55.3	125.21	0	0	(6,329)	(3,728,460)	-4.1	0.0	11.6	0.6	125.2	125.2	0.0	0.0	-1813.7	0.0	0.0	-3460.8	15	-22.3
99132			94	91.44	91.440	0.00	-2.560	5.0	0.0	0.0	-29.0	200.51	0	0	(10,136)	(3,738,596)	-2.6	0.0	11.6	0.6	200.5	200.5	0.0	0.0	-5542.1	0.0	0.0	-2904.4	15	-22.4
99425			94	88.392	88.392	0.00	-5.608	5.0	0.0	0.0	-88.6	292.93	0	0	(20,657)	(3,759,253)	-5.6	0.0	11.6	0.6	292.9	292.9	0.0	0.0	-4243.0	0.0	0.0	-12970.8	15	-22.6
99693			94	88.392	88.392	0.00	-5.608	5.0	0.0	0.0	-88.6	267.81	0	0	(28,461)	(3,787,714)	-5.6	0.0	11.6	0.6	267.8	267.8	0.0	0.0	-11858.6	0.0	0.0	-11858.6	15	-22.9
99996		94	94	91.44	91.440	0.00	-2.560	5.0	0.0	0.0	-29.0	303.47	0	0	(21,400)	(3,809,114)	-2.6	0.0	11.6	0.6	303.5	303.5	0.0	0.0	-13437.7	0.0	0.0	-4395.8	15	-23.1
100399			89	89.916	89.916	-1.19	0.708	5.0	9.5	0.0	0.0	402.67	498	0	(5,483)	(3,814,248)	0.7	0.0	11.6	0.6	315.5	87.2	0.0	0.0	-4569.6	414.6	0.0	0.0	15	-23.1
100660			86	91.44	91.440	-1.19	5.336	5.0	112.2	4.7	0.0	260.88	19,054	731	0	(3,799,960)	5.0	0.3	14.9	0.0	260.9	260.9	1240.5	0.0	0.0	14638.0	609.2	0.0	15	-23.0
101176			80	91.44	91.440	-1.19	11.479	5.0	235.1	159.7	0.0	516.20	107,563	50,893	0	(3,658,505)	5.0	6.5	39.5	0.0	516.2	516.2	28964.0	1205.3	0.0	60671.6	41205.7	0.0	15	-21.6
101517			76	76.2	76.200	-1.19	0.296	5.0	4.1	0.0	0.0	340.94	48,928	32,659	0	(3,581,799)	0.3	0.0	11.6	0.6	340.9	340.9	40072.4	27215.5	0.0	700.6	0.0	0.0	15	-20.8
101866			72	60.96	60.960	-1.19	-10.784	5.0	0.0	0.0	-253.6	349.64	23	0	(51,781)	(3,633,564)	-10.8	0.0	11.6	0.6	9.3	340.3	19.2	0.0	0.0	0.0	0.0	-43151.1	15	-21.3
102073			69	59.436	59.436	-1.19	-9.854	5.0	0.0	0.0	-218.1	206.16	0	0	(58,341)	(3,691,905)	-9.9	0.0	11.6	0.6	206.2	206.2	0.0	0.0	-26141.1	0.0	0.0	-22476.6	15	-21.9
102517		64	64	60.96	60.960	-1.19	-3.040	5.0	0.0	0.0	-36.5	444.59	0	0	(67,902)	(3,759,807)	-3.0	0.0	11.6	0.6	444.6	444.6	0.0	0.0	-48471.4	0.0	0.0	-8113.8	15	-22.6
103174			64	57.912	57.912	0.00	-6.088	5.0	0.0	0.0	-100.5	656.42	0	0	(53,954)	(3,813,761)	-6.1	0.0	11.6	0.6	656.4	656.4	0.0	0.0	-11979.7	0.0	0.0	-32981.8	15	-23.1
103780		64	64	60.96	60.960	0.00	-3.040	5.0	0.0	0.0	-36.5	606.66	0	0	(49,864)	(3,863,625)	-3.0	0.0	11.6	0.6	606.7	606.7	0.0	0.0	-30481.6	0.0	0.0	-11071.5	15	-23.6
104179			59	59.436	59.436	-1.23	0.345	5.0	4.7	0.0	0.0	398.93	115	0	(7,846)	(3,871,391)	0.3	0.0	11.6	0.6	358.2	40.7	0.0	0.0	-6537.9	96.2	0.0	0.0	15	-23.7
104578			54	60.96	60.960	-1.23	6.779	5.0	141.1	27.5	0.0	398.93	34,898	6,585	0	(3,838,402)	5.0	1.8	20.7	0.0	398.9	398.9	943.5	0.0	0.0	28138.5	5487.3	0.0	15	-23.4
104918		50	50	36.576	36.576	-1.23	-13.424	5.0	0.0	0.0	-368.8	339.79	9,650	1,882	(49,954)	(3,879,154)	-13.4	0.0	11.6	0.6	114.0	225.8	8041.6	1568.2	0.0	0.0	0.0	-41628.3	15	-23.8
105510			50	32.004	32.004	0.00	-17.996	5.0	0.0	0.0	-617.6	591.99	0	0	(350,349)	(4,229,503)	-18.0	0.0	11.6	0.6	592.0	592.0	0.0	0.0	-109149.1	0.0	0.0	-182808.1	15	-27.3
106102			50	57.912	57.912	0.00	7.912	5.0	163.7	51.3	0.0	592.00	17,761	5,564	(152,377)	(4,362,214)	5.0	2.9	25.2	0.0	411.2	180.8	0.0	0.0	-126980.6	14801.1	4636.3	0.0	15	-28.6
106623			50	45.72	45.720	0.00	-4.280	5.0	0.0	0.0	-59.2	520.72	33,199	10,399	(6,490)	(4,331,946)	-4.3	0.0	11.6	0.6	337.9	182.8	27665.6	8666.0	0.0	0.0	0.0	-5408.1	15	-28.3
106835		50	50	47.244	47.244	0.00	-2.756	5.0	0.0	0.0	-32.0	212.30	0	0	(11,608)	(4,343,554)	-2.8	0.0	11.6	0.6	212.3	212.3	0.0	0.0	-6280.9	0.0	0.0	-3392.6	15	-28.4
107667			46	45.72	45.720	-0.49	-0.167	5.0	0.0	0.0	-1.7	831.59	0	0	(16,800)	(4,360,354)	-0.2	0.0	11.6	0.6	831.6	831.6	0.0	0.0	-13288.8	0.0	0.0	-711.0	15	-28.6
108222			43	42.672	42.672	-0.49	-0.466	5.0	0.0	0.0	-4.2	555.62	0	0	(1,964)	(4,362,318)	-0.5	0.0	11.6	0.6	555.6	555.6	0.0	0.0	-475.1	0.0	0.0	-1161.2	15	-28.6
108709			41	39.624	39.624	-0.49	-1.105	5.0	0.0	0.0	-10.3	487.15	0	0	(4,244)	(4,366,562)	-1.1	0.0	11.6	0.6	487.1	487.1	0.0	0.0	-1018.1	0.0	0.0	-2518.6	15	-28.7
109118			39	30.48	30.480	-0.49	-8.228	5.0	0.0	0.0	-162.1	408.45	0	0	(42,253)	(4,408,815)	-8.2	0.0	11.6	0.6	408.5	408.5	0.0	0.0	-2111.7	0.0	0.0	-33098.7	15	-29.1
109335			38	27.432	27.432	-0.49	-10.199	5.0	0.0	0.0	-231.0	217.70	0	0	(51,336)	(4,460,151)	-10.2	0.0	11.6	0.6	217.7	217.7	0.0	0.0	-17641.3	0.0	0.0	-25138.9	15	-29.6
109553			37	30.48	30.480	-0.49	-6.075	5.0	0.0	0.0	-100.2	217.70	0	0	(43,248)	(4,503,399)	-6.1	0.0	11.6	0.6	217.7	217.7	0.0	0.0	-25138.9	0.0	0.0	-10901.3	15	-30.0
109681			36	33.528	33.528	-0.49	-2.396	5.0	0.0	0.0	-26.6	127.40	0	0	(9,685)	(4,513,084)	-2.4	0.0	11.6	0.6	127.4	127.4	0.0	0.0	-6379.3	0.0	0.0	-1691.8	15	-30.1
109808			35	32.004	32.004	-0.49	-3.290	5.0	0.0	0.0	-40.7	127.40	0	0	(5,142)	(4,518,226)	-3.3	0.0	11.6	0.6	127.4	127.4	0.0	0.0	-1691.8	0.0	0.0	-2593.1	15	-30.2
110070		34	34	30.48	30.480	-0.49	-3.520	5.0	0.0	0.0	-44.7	261.67	0	0	(13,414)	(4,531,640)	-3.5	0.0	11.6	0.6	261.7	261.7	0.0	0.0	-5326.3	0.0	0.0	-5852.2	15	-30.3
110322			34	39.624	39.624	0.00	5.624	5.0	118.0	8.6	0.0	252.81	11,007	800	(2,612)	(4,525,507)	5.0	0.6	16.1	0.0	97.3	155.5	0.0	0.0	-2176.6	9172.4	666.3	0.0	15	-30.3
110954			34	30.48	30.480	0.00	-3.520	5.0	0.0	0.0	-44.7	631.16	27,479	1,996	(6,521)	(4,510,198)	-3.5	0.0	11.6	0.6	388.2	243.0	22899.6	1663.4	0.0	0.0	0.0	-5433.9	15	-30.1
111088			34	30.48	30.480	0.00	-3.520	5.0	0.0	0.0	-44.7	134.54	0	0	(7,222)	(4,517,420)	-3.5	0.0	11.6	0.6	134.5	134.5	0.0	0.0	-3009.0	0.0	0.0	-3009.0	15	-30.2
111305		34	34	28.956	28.956	0.00	-5.044	5.0	0.0	0.0	-75.4	216.98	0	0	(15,643)	(4,533,063)	-5.0	0.0	11.6	0.6	217.0	217.0	0.0	0.0	-4852.8	0.0	0.0	-8183.4	15	-30.3
111421			34	32.004	32.004	0.00	-1.996	5.0	0.0	0.0	-21.0	115.90	0	0	(6,705)	(4,539,768)	-2.0	0.0	11.6	0.6	115.9	115.9	0.0	0.0	-4371.0	0.0	0.0	-1216.9	15	-30.4
111537			34	30.48	30.480	0.00	-3.520	5.0	0.0	0.0	-44.7	115.90	0	0	(4,571)	(4,544,339)	-3.5	0.0	11.6	0.6	115.9	115.9	0.0	0.0	-1216.9	0.0	0.0	-2592.0	15	-30.4
111626			34	28.956	28.956	0.00	-5.044	5.0	0.0	0.0	-75.4	89.08	0	0	(6,423)	(4,550,762)	-5.0	0.0	11.6	0.6	89.1	89.1	0.0	0.0	-1992.4	0.0	0.0	-3359.8	15	-30.5
111715			34	30.48	30.480	0.00	-3.520	5.0	0.0	0.0	-44.7	89.09	0	0	(6,423)	(4,557,185)	-3.5	0.0	11.6	0.6	89.1	89.1	0.0	0.0	-3359.8	0.0	0.0	-1992.4	15	-30.6
111969			34	42.672	42.672	0.00	8.672	5.0	178.9	70.1	0.0	253.75	19,378	7,592	(1,966)	(4,535,717)	5.0	3.7	28.3	0.0	73.3	180.5	0.0	0.0	-1638.5	16148.3	6327.0	0.0	15	-30.4
112224			34	30.48	30.480	0.00	-3.520	5.0	0.0	0.0	-44.7	254.74	19,454	7,622	(1,974)	(4,514,165)	-3.5	0.0	11.6	0.6	181.2	73.5	16211.3	6351.7	0.0	0.0	0.0	-1644.9	15	-30.1
112464			34	28.956	28.956	0.00	-5.044	5.0	0.0	0.0	-75.4	240.53	0	0	(17,341)	(4,531,506)	-5.0	0.0	11.6	0.6	240.5	240.5	0.0	0.0	-5379.5	0.0	0.0	-9071.6	15	-30.3
112715			34	30.48	30.480	0.00	-3.520	5.0	0.0	0.0	-44.7	251.30	0	0	(18,118)	(4,549,624)	-3.5	0.0	11.6	0.6	251.3	251.3	0.0	0.0	-9477.8	0.0	0.0	-5620.3	15	-30.5
112869			34	28.956	28.956	0.00	-5.044	5.0	0.0	0.0	-75.4	153.42	0	0	(11,061)	(4,560,685)	-5.0	0.0	11.6	0.6	153.4	153.4	0.0	0.0	-3431.1	0.0	0.0	-5786.0	15	-30.6
113022			34	30.48	30.480	0.00	-3.520	5.0	0.0	0.0	-44.7	153.41	0	0	(11,061)	(4,571,746)	-3.5	0.0	11.6	0.6	153.4	153.4	0.0	0.0	-5786.0	0.0	0.0	-3431.1	15	-30.7
113308			34	15.24	15.240	0.00	-18.760	5.0	0.0	0.0	-665.3	285.65	0	0	(121,692)	(4,693,438)	-18.8	0.0	11.6	0.6	285.7	285.7	0.0	0.0	-6388.6	0.0	0.0	-95021.5	15	-31.9
113933			34	30.48	30.480	0.00	-3.520	5.0	0.0	0.0	-44.7	625.12	0	0	(266,312)	(4,959,750)	-3.5	0.0	11.6	0.6	625.1	625.1	0.0	0.0	-207946.2	0.0	0.0	-13980.8	15	-34.6
114528			34	51.816	51.816	0.00	17.816	5.0	361.8	477.7	0.0	595.54	107,957	142,539	(2,637)	(4,701,516)	5.0	12.8	64.9	0.0	98.3	497.3	0.0	0.0	-2197.4	89964.4	118782.3	0.0	15	-32.0
115175			34	30.48	30.480	0.00	-3.520	5.0	0.0	0.0	-44.7	646.82	117,253	154,812	(2,864)	(4,421,047)	-3.5	0.0	11.6	0.6	540.1	106.7	97710.9	129010.2	0.0	0.0	0.0	-2386.6	15	-29.2
115363			34	27.432	27.432	0.00	-6.568	5.0	0.0	0.0	-113.1	187.83	0	0	(17,787)	(4,438,834)	-6.6	0.0	11.6	0.6	187.8	187.8	0.0	0.0	-4200.8	0.0	0.0	-10621.8	15	-29.4
115516			34	30.48	30.480	0.00	-3.520	5.0	0.0	0.0	-44.7	152.89	0	0	(14,478)	(4,453,312)	-3.5	0.0	11.6	0.6	152.9	152.9	0.0	0.0	-8645.9	0.0	0.0	-3419.4	15	-29.5
115806			34	32.004	32.004	0.00	-1.996	5.0	0.0	0.0	-21.0	290.24	0	0	(11,446)	(4,464,758)	-2.0	0.0	11.6	0.6	290.2	290.2	0.0	0.0	-6491.2	0.0	0.0	-3047.5	15	-29.6
116097		34.000	34.00	28.956	28.956	-0.21	-5.044	5.0	0.0	0.0	-75.4	28384.64	0	0	(1,895,185)	(5,601,324)	-5.0	0.0	11.6	0.6	28384.6	28384.6	0.0	0.0	-508794.6	0.0	0.0	-1070526.6	15	-41.0
		FROM	TO				-19.796																								
		0.000	116096.52				17.816				-43568.6	144,190.913	2,754,123	1,349,058	(10,041,584)															

Appendix E

DFS Operating Plan

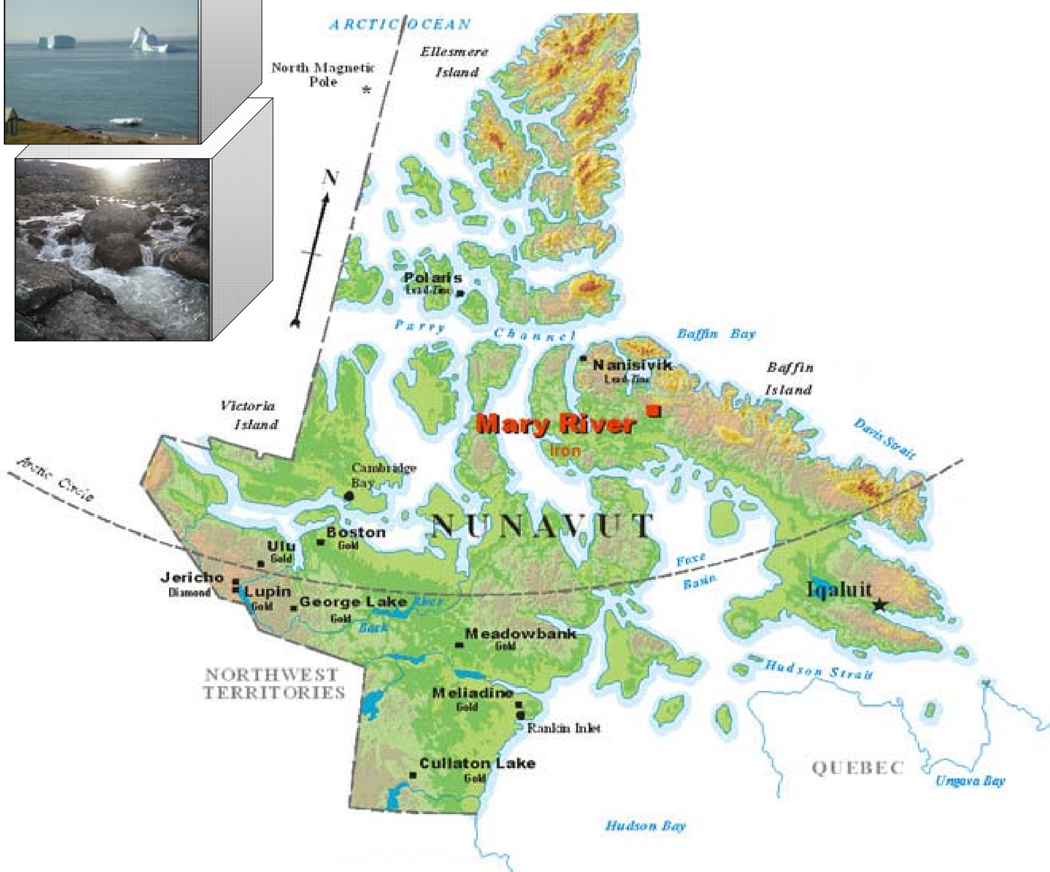
Issued as a separate report

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

RAILWAY OPERATING PLAN

Presented to: AKER KVÆRNER™

For: Baffinland Iron Mines Corporation



CANARAIL

March 2008 ~ 06-019

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Chapter 1

Introduction

CHAPTER 1

1. INTRODUCTION

1.1 REPORT CONTEXT

The Baffinland Iron Mines Corporation is considering using a railway to transport iron ore extracted from the mine at the Mary River on Baffin Island to port facilities situated to the south in Steensby Inlet. This Railway Operating Plan has been prepared by a team of CANARAIL's railway specialists to anticipate the operating procedures, associated staffing and building facilities that a Baffinland Iron Mines Corporation railway would require to meet the transport demand estimated for the project.

The Railway Operating Plan identifies the train scheduling approach, siding locations and lengths, as well as the signalling and telecommunications required to support the projected train services. It also addresses terminal and yard activities that are an integral part of any operating plan with its associated track layouts and other processing requirements. The locomotive and car fleet sizes are defined, as the maintenance facilities, equipment and staffing levels. Special considerations have been made regarding the arctic climate and the remoteness of the site. These have been governing factors in regards to facilities requirements, train speeds and staffing. In all, they have influenced the entire scheme of this Railway Operating Plan.

1.2 REPORT CONTENTS

This Railway Operating Plan comprises seven chapters. Chapter 2 describes the traffic needed to accommodate the desired yearly ore projections, the bulk and general freight traffic, and the employee service. Chapters 3, 4 and 5 describe the train operations with respect to the required infrastructure and rolling stock requirements to support the identified traffic demand. Chapter 6 discusses the building facilities necessary to support the staff and maintenance operations described previously. Chapter 7 defines the staff required to operate and maintain the railway.

Chapter 2

Traffic Demand

CHAPTER 2

2. TRAFFIC DEMAND

2.1 IRON ORE TRAFFIC

The Baffinland Iron Mines Corporation has requested CANARAIL to provide a Railway Operating Plan that assures the rail transportation of 18.36 million tonnes per year of wet iron ore (18 MTPY of dry ore) between the mine situated at Mary River and the port in Steensby Inlet. This encompasses 143.3 km of main line railway track, loading, unloading, and yard and maintenance facilities, which are described in this document with the pertinent operations.

2.2 BULK AND GENERAL FREIGHT TRAFFIC

Similar to many other mining railways, the railway will also be used for bulk and general freight traffic hauled to the Mine to supply the mining operations.

The estimated diesel fuel hauled to the Mine is 43,100,000 L per year. The maritime shipping plan for the project calls for ore carriers to be modified to back haul diesel. This way the total fuel requirement for the mine and port will arrive at the port regularly through the year. The design storage capacity at the port and the mine is predicated by the fuel requirements needed during construction of the mine, port and railway when deliveries of fuel will only be possible during the summer shipping season. There are consequently no constraints imposed by storage capacity at either location. In addition, 850, 000 L of Jet A fuel will also be transported to the Mine by rail, which is marginal compared to the diesel fuel requirements.

2.3 EMPLOYEE TRANSPORTATION

Personnel changes for the mine, port and rail operations will occur three times per week using a 60 seat aircraft which will land at the Mary River Mine site. The railway operations will provide a transit service for employees of the port and railway between Steensby and Mary River during these shift changes.

2.4 TRAFFIC DEMAND SUMMARY

Iron ore, general freight and employees will be transported on the railway. Table 2.1 summarises the employee and bulk and general freight traffic requirements.

Table 2.1 - Bulk and General Freight Traffic Requirements

Commodity	Annual Quantity
Iron ore	18 MTPY (dry) 18.36 MTPY (wet)
Diesel fuel	43,100,000 L
Jet A fuel	850,000 L
Ammonium nitrate	1,000 6 m containers
Other freight	Undefined
Employees	Three trips per week

Chapter 3

Operations

CHAPTER 3

3. OPERATIONS

3.1 OPERATIONS OVERVIEW

The rail operation for the transportation of iron ore from the Mine located in the vicinity of iron ore deposits on the Mary River property to the Port located at Steensby Inlet is a straightforward unit train operation similar to many worldwide heavy haul train operations. However, because of its extreme northern location, the rail operation must adapt to severe cold weather conditions during winter operation and, possibly, an unstable track bed on the thaw sensitive soils during summer operations. Due to potentially fragile track conditions, the maximum permissible speed at certain locations may be reduced as the weather becomes warmer during the summer months and will be increased, as the weather gets colder in the fall.

A structured approach to train scheduling has been developed where, rather than dispatching the units trains evenly through the day, they are dispatched so that as one train is preparing to leave the loading or unloading facility another train is arriving. This minimises the occurrence of mainline meets for the ore trains and improves the reliability of the operation. It also provides for two periods of continuous loading and unloading per day leaving significant blocks of time available for the maintenance of the loading and unloading facilities.

In addition to the iron ore unit trains, a bi-weekly supply train will operate to provide supplies to the Mine and a thrice weekly service will transport personnel between the Mine and Port. Employee rotation will be accomplished via chartered air service operating into an airstrip located at the Mine. The frequency and time of the employee train will coincide with the schedule of the charter air service. Both the supply train and employee train will be scheduled so as to not interfere or delay the structured unit train service.

The rail network consists of approximately 143 km of single main track with two terminals, one at the Mine and the other at the Port. Loading at the Mine uses a straight track and unloading at the Port uses a loop, obviating the need to turn the trains. Additional tracks and facilities are provided for handling employees and supplies. Tracks for storage and switching of rail cars and accessing the car and locomotive shops are included in the Yard at the Port.

3.2 IRON ORE TRAINS

3.2.1 Heavy Haul Conditions

The most economical rail transportation is provided by heavy haul unit train operations. This type of operation maximizes locomotive and operating crew productivity using long trains designed to operate at low locomotive horsepower to train weight ratios. These are commonly referred to as power to weight ratios and expressed as horsepower per tonne (hp/tonne).

Bulk commodity unit trains operate directly between loading and unloading sites without processing at intermediate yards. Transport volumes, and loading and unloading capabilities, are key factors in determining suitability for a unit train operation. In unit train operations, reliable transit time is essential but speed is not as important as in passenger and container services.

Both locomotives and cars are configured into sets or train consists which do not change from day to day. Locomotives represent a significant share of capital and operating costs so trains are designed around the capabilities of locomotive units. Therefore, cars per train are normally in multiples of locomotive unit capabilities, typically based on tonnage ratings. In North America, newly developed high horsepower, high adhesion locomotives are assigned to this type of service. In many cases distributive power, either in the middle or rear of the train is used to reduce drawbar stresses. Gradients, car type, weight, axle loading and siding lengths on single-track lines are the normal governing factors in determining the acceptable length and tonnage capabilities of unit trains.

The transportation of iron ore, with high volumes and rapid loading and unloading facilities at both the Mine and Port, as projected for this project, is exactly the type of service that qualifies for an economical unit train heavy haul operation.

3.2.2 Axle Loads

Axle load, the maximum weight permitted per car axle, is the key factor in determining the amount of tonnage a car can carry. Lower axle loads reduce the payload per car with the result that more cars are required to deliver the same tonnage. The three factors in determining the axle load limit are:

- Car bogie construction;
- Track infrastructure (rail weight, ballast depth, subgrade characteristics, and sleeper type and spacing); and
- Permissible train speeds.

Over the years, the axle load limits in North America have progressively increased from 20.1 tonnes in the 1920's to 32.4 tonnes in the 1990's. Today, many railways have axle load limits of 35.7 tonnes on their heavy haul routes. The evolution in maximum loads has produced innovations in steel wheel, bogie and axle design that make the higher load limits a standard design for many rail cars. Numerous studies of axle load increases generally indicate that a 10% increase in axle loads requires a 20% increase in infrastructure maintenance costs, yet still produces an 8% reduction in total transportation cost. In view of the savings in car costs demonstrated above and the proven operating efficiency gains from higher axle loads, it is clear that any new railway should be designed and built for the highest axle load that has a set of standards in common use.

With consideration to the climatic conditions, an initial 30 tonne axle load is recommended with the belief that operating experience will indicate that higher axle loads are feasible ; in view of the availability of standard cars with axle load limits of 32.4 tonnes these are the cars of choice.

3.2.3 Locomotives

Locomotives are designed for various types of operations. Passenger service locomotives require high horsepower for speed and to provide power for on-board services such as light, heating and air conditioning. Locomotives for heavy haul operation require high horsepower for hauling heavy tonnage. The difference in the two types is the gear ratio and adhesion factors.

High horsepower 6,000 hp locomotives are designed primarily for high speed in passenger and inter-modal train service. The 6,000 hp diesel-electric locomotives do not have an extensive record in heavy haul applications. Lower horsepower DC locomotives in the 3,000 hp to 3,800 hp range constitute a significant portion of aging locomotive fleets, but their lower adhesion ratings (25% to 28%) and higher level of required maintenance combine to make them less attractive despite their lower purchase cost.

The preferred locomotives for heavy haul operations in North America are 4,300 to 4,400 hp AC locomotives that provide on average 32% adhesion and fuel efficiencies. In the interest of brevity, they will be referred to as 4,400 hp AC locomotives in the remainder of this document . The changing technologies that have led to improvements in the adhesion of characteristics locomotives is an important factor in fuel efficiency; since it is directly related to the proportion of power that is translated into the forward motion of the train. The AC/AC locomotives are diesel-electric locomotives using AC traction motors with AC power generation from a main alternator.

Using lower horsepower units results in lower horsepower for pulling power, but also lower adhesion ratings. A 4,400 hp AC locomotive would have to be replaced by at least 1.5 DC locomotives of lower rated horsepower and adhesion percentage.

The 4,400 hp AC locomotives have an extensive record as a high-reliability, low-maintenance and fuel-efficient locomotive. The maintenance costs of the lower horsepower DC locomotives are greater than that of the high horsepower DC locomotives and their fuel efficiency is poor. Maintenance costs are based on the type and number of locomotives. The need to use a greater number of locomotives, which incur greater maintenance costs, will have a definite impact on the operating budget.

The ultimate decision on the type of power to use will be an economical one based on suitability for northern operation, availability, procurement and operating costs, however since 4,400 hp AC locomotives are the preferred locomotive type they have been used in the design of iron ore trains for the purposes of this Railway Operating Plan.

3.2.4 Train Size

Train size is an important factor in determining the overall cycle time of the equipment. In a unit train type operation, the locomotives and cars are configured into train sets, or consisti, with the locomotives remaining with the cars during the terminal activities. Train size directly impacts both the transit and terminal times of a train. Given a set locomotive consist, the more cars on a train will decrease the power to rate ratio, thus increasing the transit time of a train. Similarly, more cars on a train will increase its terminal time requirement for the loading and unloading processes.

A major expense in train operation is the locomotives. To maximize use of locomotives when determining train size, the number of cars on a given train are usually defined in incremental amounts that a locomotive can handle. For example, if a locomotive can handle 40 loaded cars, the strategy would be to establish the number of cars per train in increments of approximately 40 cars. The number of tonnes a locomotive can haul at an acceptable over the road time, to meet cycle time requirements, is determined by the track speed, type of locomotive and longitudinal profile of the proposed rail line. In train design, the power to weight ratio specification represents the relationship between the locomotive requirements (horsepower) and the tonnage limitations to ensure acceptable over the road time to meet the cycle requirement. A power to weight ratio target in the range of 0.60 is considered appropriate for this type of operation.

The traffic level is 18.36 MTPY of wet iron ore, the car fleet specification is an open gondola type car with a maximum weight limit of 130 tonnes (286,000 lbs) and a tare weight of 26 tonnes. This type of car provides a net load of approximately 104 metric tonnes. However, due to climatic conditions and to the presence of permafrost, the operation has been scoped out on the basis of an average net load of 94 metric tonnes. The lower net tonnage per car will allow the railway Maintenance-of-Way (MoW) Department to measure the effect of the winter operation on the rail and a summer operation on the roadbed and correct any problematic areas. After the first year, predicated on experience gained in the extreme northern climate, the net tonnage per car is expected to be increased to 104 tonnes.

3.2.5 Operational Days per Year

An important planning element in determining the number of trains per day required to handle a stipulated yearly tonnage is the number of operating days specified per year. To account for operational disruptions, unaccounted longer transit times and national holidays such as Christmas, a normal operating contingency of approximately 10% is included in the calculation to determine train frequency and size, which directly impacts rolling stock and crew requirements. This 10% contingency is normally provided for through a combination of a reduction in operating days per year and excess train capacity.

The process design criteria for the entire project stipulate the number of operational days per year as 300. Based on 365 days per year, this produces an 18% contingency. This is considered conservative, however, it is appropriate considering a planned five week shut down in December/January and until actual operating experience in the severe climate conditions indicates otherwise. Since a 18% contingency is provided for in the criteria of 300 operational days per year, additional contingency has not be a consideration in determining train requirements.

The northern location and permafrost terrain result in two different operating seasons. A 60 km/h maximum speed limit is anticipated for the period from September 1 to June 15. However, temporary slow orders and possible periodical lowering of maximum speed during the June to September period will extend trip times and reduce rail productivity. It has been considered that the loss of productivity during this period is accounted for in the reduced operational days per year considerations.

3.2.6 Iron Ore Train Definition

Based on the train cycle time (explained in Section 3.2.10) and the above factors, three train sets of 110 cars (30 tonne axle load) and two 4,400 hp AC locomotives will optimize rolling stock utilization for the handling of 18.36 MTPY wet iron ore.

A train of 110 cars with a net tonnage of 94 tonnes per car will carry 10,340 net tonnes of iron ore. Based on 18.36 MTPY of wet iron ore, 1,776 trains will be required.

A combination of 300 working days per year and average of 11 hour and 4 minutes cycle time (including inspection and fuelling time allotments) equates to 1,800 trips per year which represents 24 additional contingency trips per year.

When increasing axle loads from 30 to 32.4 tonnes become practical, a train of 100 cars with a net tonnage of 104 tonnes per car will carry 10,400 net tonnes of iron ore. Based on 18.36 MTPY of wet iron ore, 1,772 trains will be required which represents 28 additional contingency trips per year.

The following Table 3.1 defines the recommended train sets for 30.0 tonne and 32.4 tonne axle loads.

Table 3.1 - Iron Ore Train Set Characteristics with Various Maximum Axle Loads

Criteria	Loaded Direction (Mine to Port)		Empty Direction (Port to Mine)	
	30 tonne Axle Load	32.4 tonne Axle Load	30 tonne Axle Load	32.4 tonne Axle Load
Locomotives per train	2	2	2	2
Locomotive power (hp)	8,800	8,800	8800	8800
Maximum axle load (tonnes)	30	32.4	n/a	n/a
Cars per train	110	100	110	100
Train length (m)	1,210	1,096	1,210	1,096
Train gross weight (tonnes)	13,570	13,338	3,238	2,978
Train net weight (tonnes)	10,340	10,360	-	-
Required trips per year	1,776	1,772	1,776	1,772
Yearly gross-million tonnes	24.10	23.63	5.75	5.28
Power to weight ratio	0.65	0.66	n/a	n/a
Maximum speed	60 km/h	60 km/h	60 km/h	60 km/h

3.2.7 Iron Ore Train Transit Times

The analysis of train transit times between Steensby Yard and Mary River Terminal uses the minimum transit times for the designed train consists modelled over the plan and profile developed for the railway, calculated by computer simulation using the Train Performance Calculator. Standard allowances for main line meets, temporary slow orders and operational inefficiencies were added to this to determine average transit times for both loaded and empty directions. Table 3.2 illustrates estimated transit times for both the loaded and empty directions for trains as defined above, operating with a maximum track speed of 60 km/h.

Table 3.2 - Iron Ore Train Transit Time Estimates

	Direction	
	Loaded	Empty
Steensby to Mary River	03:00	03:25

3.2.8 Iron Ore Train Terminal Times

Required terminal times are taken into consideration when developing a train's cycle time. In a unit train operation, the required terminal time is a function of loading/unloading time, which correlates to the number of cars handled by the train and the unloading/loading time for each car. The loading rate for the iron ore is 6000 tonnes/h and the unloading time is 2 minutes to position and dump two cars. Based on a net train load of 10,340 tonnes and a 110 car train the loading time for one train is 1 hour 43 minutes and the unloading time is 1 hour 50 minutes. An operational allowance is added to this time to take into account activities such as operating around the loop tracks, crew change, etc associated with each train. Table 3.3 summarizes the terminal time for each trip, excluding locomotive fuelling and train inspection. Recommended fuelling and train inspections are described separately in Section 3.2.9.

Table 3.3 - Iron Ore Train Terminal Time per Trip

Terminal	Cars	Load/ Unload	Operations Time	Crew Change	Contingency	Total Time
Mary River Terminal	110	01:43	00:15	n/a	00:15	02:13
Steensby Yard	110	01:50	00:15	00:06	00:15	02:26

3.2.9 Locomotive Fuelling and Train Inspection

In addition to transit time and terminal times, a time allotment has been made for locomotive fuelling and inspection as well as inspection of cars. Normally these times are included in the terminal time at the main yard on a network. All locomotive fuelling and full train inspections are scheduled at the Steensby Yard. Due to the short distances involved and trains operating in a unit train mode with no switching, locomotive fuelling and full standing train inspections will not be carried out on each trip.

Based on fuel consumption simulations developed from Train Performance Calculations, the AC 4400 locomotives have sufficient fuel capacity to operate six round trips without the need for refuelling. There are no locomotive fuelling facilities at Mary River and fuelling is planned at Steensby, in conjunction with the crew change, as and when required. Either a partial fuelling will be accomplished or the locomotive consists will be changed out with fully fuelled locomotives. No time allowance is allotted for the fuelling, as this will be done simultaneous with the crew change. The time allotted for crew change, plus the terminal time at Steensby for operations and contingency (36 minutes in total), should be sufficient to either top up or change locomotive consists.

Federal Railroad Administration (FRA) and Transport Canada regulations as well as current practices employed by Canadian railways have been used as guidelines in the planning of the full train standing inspection. To aid in the planning and management of the Rolling Stock Department staff, it is desirable to have the full train inspection process occur during the day shift when car shop staff is available to assist in-train repairs. A four-hour minimum is required for fuelling and full train inspection.

A train cycle time of 11 hours and 4 minutes creates a three-day cycle if the allowance for the standing train inspection is increased to 5 hours and 36 minutes. The three-day cycle is comprised of six round trips for the rolling stock locomotive complete fuelling and full trip inspection. The longer time allowance for the standing inspection adds additional buffer time into the schedule to allow late and delayed trains to re enter the train cycle, permits the train standing inspection to occur at the same time every day, during the Maintenance Centre's day shift and allows for a standard schedule to be operated every day.

This schedule provides for full train standing inspections approximately every 1,800 km (1,120 miles). This is conservative in comparison with the FRA 2,414 km (1,500 mile) inspection and common Canadian railway inspection criteria particularly given that pull-by inspections will be performed every trip at the Steensby Yard, but is wise in light of the 90% availability factor for cars that has been used to determine the full fleet size. Bad order cars found during the pull-by inspection will be set off but not replaced until the next full train inspection.

3.2.10 Cycle Time

A railway operating plan must incorporate realistic and reliable cycle times. Cycle time is a key element in determining the capacity of a network and rolling stock requirements, it is the measurement of time it takes a train with the same set of rolling stock to reach the same status in successive trips. The most common measurement point is the available departure time from an originating terminal. It includes a combination of the transit time and terminal time.

Table 3.4 illustrates the basic trip cycles combining the above transit and terminal times.

Table 3.4 - Iron Ore Train Cycle

Station	Activity	Train	Time	Day	Remarks
Steensby Yard	Depart	E11	8:13	Day 1	
Mary River Yard	Arrive Depart	E11 L11	11:13 13:26	Day 1	Load & meet
Steensby Yard	Arrive Depart	L11 E12	16:51 19:17	Day 1	Unloading & meet

Note: Cycle commences with empties departing from the port (main yard).

With trip cycle times and the inspection time allotment there will be, on average, six daily trips of iron ore unit trains with three sets of equipment operating.

3.2.11 Recommended Iron Ore Train Operation

Given the northern conditions, anticipated slow order variances, and seasonal fluctuations, a defined train schedule will not be used. The short distance involved is conducive to a structured operation with defined periodical operational targets which is considered more achievable and measurable than defined schedules. With the structured operation, trains will operate when ready, thereby producing some opportunity for catch-up.

To eliminate delays due to meet requirements, it is recommended that a structured three train operation with identical train consists be established with trains operating approximately 1 hour 55 minutes behind the first train. Operating in this manner, the second train will arrive at the Mine just as the first train has finished loading and is preparing to depart the Mine, and the third train will arrive at the Mine as the second train is preparing to depart.

Tables 3.5, 3.6 and 3.7 illustrate the planned train cycles.

Table 3.5 - Iron Ore Train Cycles Day 1

Train Number	Activity	1	2	3	1	2	3
Trip Number		E11	E21	E31 Inspect	E12	E22	E32
Station		Day 1	Day 1	Day 1	Day 1&2	Day 1&2	Day 1&2
Port/Main Yard	Depart	08:13	10:08	11:54	19:17	21:11	22:58
Mine	Arrive	11:13	13:08	14:54	22:17	00:11	02:58
	Depart	13:26	15:21	17:07	00:30	02:24	04:11
Port/Main Yard	Arrive	16:51	18:46	20:32	03:55	05:49	07:36

Table 3.6 - Iron Ore Train Cycles Day 2

Train Number	Activiity	2	3	1	2	3	1
Trip Number		E23	E33	E13 Inspect	E24	E34	E14
Station		Day 2	Day 2	Day 2	Day 2&3	Day 2&3	Day 2&3
Port/Main Yard	Depart	08:16	10:02	11:57	19:20	21:06	23:01
Mine	Arrive	11:16	13:02	14:57	22:20	00:06	02:01
	Depart	13:29	15:15	17:11	00:33	02:19	04:14
Port/Main Yard	Arrive	16:54	18:40	20:35	03:58	05:44	07:39

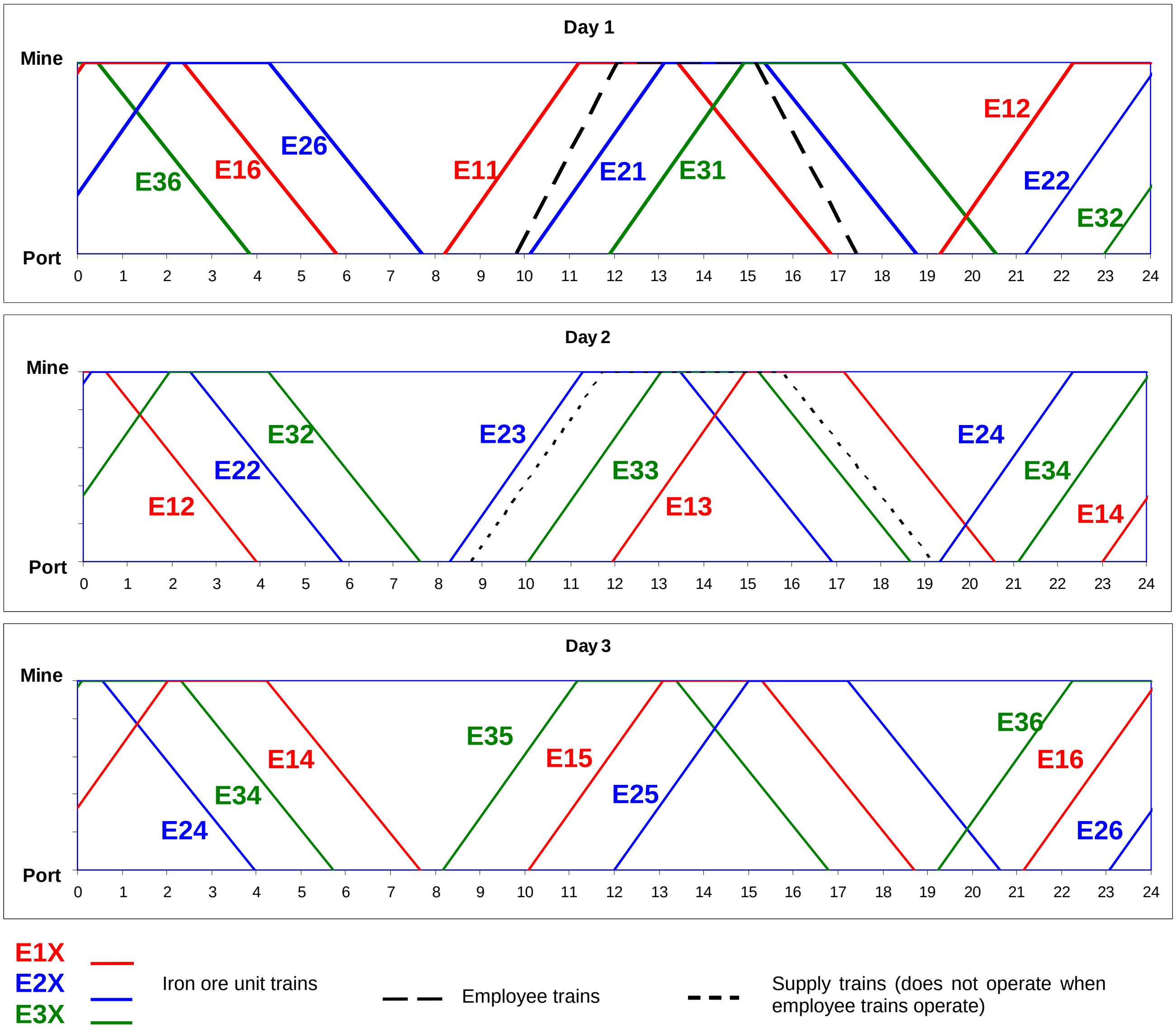
Table 3.7 - Iron Ore Train Cycles Day 3

Train Number	Activity	3	1	2	3	1	2
Trip Number		E35	E15	E25 Inspect	E36	E16	E36
Station		Day 3	Day 3	Day 3&1	Day 3&1	Day 3&1	Day 3&1
Port/Main Yard	Depart	08:10	10:05	12:00	19:14	21:09	23:04
Mine	Arrive	11:10	13:05	15:00	22:14	00:09	02:04
	Depart	13:23	15:18	17:13	00:27	02:22	04:17
Port/Main Yard	Arrive	16:48	18:43	20:38	03:52	05:47	07:42

Note: The three-day cycle-repeats so that the 4th day of operation runs a Day 1 schedule, etc.

The following three-day train schedule shown in Table 3.8 provides a graphic view of the interaction between the iron ore unit trains and the general freight and employee train services for 18 MTPY (dry). As schedules fluctuate on a day-to-day basis, the complete three-day cycle is shown.

Table 3.8 - Iron Ore Train Three-Day Schedule



X Is the trip number

3.2.12 Contingency Factors

From the rail operation perspective, the operation is based on 300 operational days per year providing approximately 18% contingency to allow for unplanned service disruption and delays and a shutdown period during the Christmas and New Year period. No further contingency has been included. Notwithstanding the foregoing, in case of a lengthy service disruption causing a severe catch-up situation, there are several reasonable operating options available on a short-term basis to ensure stock piles at the port are maintained for timely ship loading. The following options are listed in order of preference.

1. Add spare cars to existing train service. Based on 94 net tonne car load for every additional car pair, an additional 376 tonnes of iron ore will be shipped per day. Utilizing 36 of the spare cars, the daily net tonne total could be increased by 6,768 tonnes.

2. Increase axle load. The rail infrastructure and ore cars are designed for maximum weight limit of 129.6 tonnes. This equates to a 103.6 net tonnes per car. The planned operation is based on loading 94 net tonnes per car. An additional 9.4 net tonnes per car, utilizing all available ore cars, will increase the daily net tonnage by 13,800 tonnes. This assumes that the three spare locomotives are available to be put into service so that each unit train consist of three locomotives and 122 cars.

3. Increase train speed. The infrastructure is being designed and maintained to a 75 km/h operating speed. The planned initial operating speed is 60 km/h. By increasing maximum speed to 75 km/h, it is estimated that the average number of trains per day could increase to 6.75. An additional 0.75 trains per day, based on utilizing all available cars and 103.6 net tonnes per car, will increase daily tonnage capability by 15,500 tonnes. This also assumes that the three spare locomotives are available.

In summary, the peak maximum net tonnage per day is approximately 85,300 tonnes on a short term basis. The average interval between ships is every two days in August, which has the most sailings. The rail service, employing all the short term options, is capable of transporting approximately 170,000 tonnes in a two day period. This is greater than the largest ship capacity. Given that the minimum stockpile criteria at the Port is one million tonnes, the recommended rail operation should have sufficient capacity to ensure that ships will not be delayed waiting for loading due to rail related causes.

3.3 GENERAL FREIGHT AND EMPLOYEE TRAINS

3.3.1 Proposed General Freight Train Service

Supplies for both the Mine and the Port will arrive by ship and be stored at the Port. Supplies to the Mine, such as machinery, parts, ammonium nitrate, diesel fuel, etc., will be transported by the supply train which will operate separately from the ore unit trains. The basic consist of the supply train will be tank cars or flat cars loaded with containers, machinery, parts, etc. A bi-weekly train service will be sufficient. Although tonnages do not warrant two locomotives, they are assigned to the supply trains to provide reliability and insurance in the remote area. Only in case of locomotive shortage would one locomotive be assigned to the supply train.

The supply trains will be operated such that they not delay the iron ore unit trains. To minimize train crew requirements, supply trains will not operate on the same days that the employee train operates. The supply trains will have a schedule coordinated with the 3-day cycle of the ore trains. They will have defined day of week operation. On days the supply train operates it should departing the Port within a 1 hour window (08:30 – 09:30). At the Mine, terminal time for turnaround purposes should not be less than 3 hour 15 minutes. Transit times for the supply trains will match those of the unit ore trains to better fit into their cycle.

3.3.2 Proposed Employee Train Service

Employee Transportation is required between Mary River and Steensby. The Mary River airstrip will accept charter air service transporting employees and small goods to the project. The charter air service will determine the days of operation for the employee train.

From a purely railway operations point of view the employee train must be coordinated in a similar manner as the general freight to not delay the iron ore unit trains. The air service will determine the day of week operation, and will occasionally influence the timing of the employee train, given the sensitivity of air operations to inclement weather. Ideally, the employee service should depart the Port in an 08:30 – 09:30 window, providing a noon hour arrival time at the Mine. Alternative departure times will result in the employee train making a mainline meet with an ore train. Since the ore trains will have priority this will impact the journey time of the employee train. Departure time from the Mine will depend on airplane arrival times but the train must be dispatched such that does delay the iron ore unit trains.

Employee train transit time in both directions is based on a maximum speed of 75 km/h. During periods of the year where track conditions warrant severe temporary slow orders the transit time will be longer. This may necessitate adjustments to employee train departure times from Steensby Yard.

Table 3.9 demonstrates general freight and employee train definitions.

Table 3.9 - General Freight and Employee Train Definitions

Criteria (Port – Mine – Port)	General Freight	Employee
Locomotives per train	2	1
Locomotive (hp)	8,800	4,400
Cars per train	16	3 - 4
Train length (m)	305	90
Round trips per year	94	141
Maximum loaded speed (km/h)	60	75

3.3.3 General Freight and Employee Schedules

The following table demonstrates proposed general freight and employee schedules, which eliminate the need for meets with the iron ore trains.

Table 3.10 - General Freight and Employee Train Schedules

Station		General Freight Train	Employee Train
		S1	P1
		Day 1-3	Day 1-3
Steensby Yard	Depart	8:45	09:50
Mary River Yard	Arrival	11:45	12:05
Mary River Yard	Depart	15:45	15:10
Steensby Yard	Arrival	19:10	17:25

3.3.4 Railway System Analysis

In the scope of this study, a computer model of the operations has been developed with the use of the dynamic simulation package Planimate®[1]. The model allows detailed system simulation and analysis of the transport of iron ore, including the mine, railway, port, stock piles and shipping, applying all relevant data and defined operational processes to each part of the system.

The model was verified and validated as an accurate representation of corresponding basic operations and their interactions. The model was then extended to investigate targeted tonnages in project conditions. Simulation scenarios were carried out for defined railway, port and mine infrastructures and railway operating schedules. Randomly generated equipment breakdowns based on their statistical probability were also programmed into the model. The results indicate that defined railway requirements support the targeted production of 18 MTPY.

3.3.5 Extreme Cold Weather Operation

During a site visit to Fairbanks, Alaskan Railway officers indicated that on occasion they experienced delays in performing air brake tests due to extremely cold temperatures. These delays occurred after train make-up of long trains and complete train lines had to be charged. Often, the cause of the delay was moisture in the train line. The origin of moisture was attributed to cars originating in warmer climate interchanged to the Alaskan Railway at Seattle.

Supply trains are the only trains that will require complete make-up as the ore trains will operate in sets. The supply trains will be made up of cars that are 'acclimatized' and considered to be small in

[1] Planimate® is a registered trade mark of InterDynamics Pty Ltd.

length and number of cars, air brake delays caused by extreme cold weather should not be a problem in make-up of supply trains.

Iron ore unit trains will operate in train sets and not be subject to car to car train make-up. However, should it be necessary to reduce train length due to extreme cold weather, the local officers will have the option of operating a third train using the spare cars and locomotives with the cars that have been removed from the reduced ore train consist. These occasions will be extremely rare.

3.4 TRANSPORTATION DEPARTMENT

Train crews will be based at the Port and operate in a turnaround service between the Port and the Mine. The dispatcher and operations controller will also be based in the Maintenance Centre at the Steensby Yard, however both will have continual radio contact with the operating trains and the loading and unloading facilities at the Port and the Mine.

CHAPTER 4

Chapter 4

Infrastructure

4. INFRASTRUCTURE

4.1 MAIN TRACK

The purpose of the railway is to provide a network to haul iron ore from the Mary River iron ore deposits to Steensby Inlet approximately 145 km south. Final alignment of the main track generates a 143.7 km main track from the iron ore loading loop at Mary River to the unloading loop at Steensby Inlet.

4.1.1 Sidings

Sidings are an important element in determining the capacity a rail network. Not only are sidings key to determining the number of trains the network can handle, but they also determine the acceptable length of trains. In addition to train operational requirements, sidings are necessary for MoW personnel and equipment to clear trains when working on line.

The following siding characteristics are fundamental to the optimization of the financial and service aspects of the rail operation:

- Sidings shall be designed to allow the permissible speed in the siding to be equal to the permissible speed of the turnout to enter or exit the siding;
- Sidings, as a minimum, shall be built to accommodate the optimum train consists. In this operation this would be a consist of 126 cars and 2 locomotives. This represents approximately 1.36 km. To provide allowances for train handling, etc., the siding minimum length is set at 1.7 km; and
- Siding spacing, the distance between two consecutive sidings, is a key element in determining the train density a network can support. In single track territory, reduced siding spacing will be required proportional to the increase in train schedules if a constant, or acceptable service, is to be maintained. In this context, train schedules are the times a train operates. A schedule can represent a daily train or one that operates less than once a day. Regardless of the times trains are operated per day, each train will need a time slot in which to operate and will require sidings to pass or over take other trains. Each meet or pass will require a siding.

Basic train schedules and frequencies have been developed to move 18.36 MTPY and return equipment to the mine using a maximum track speed of 60 km/h for ore and freight trains and 75 km/h for employee trains. Time distance graphs were developed to determine train passes and overtakes. These graphs, shown in Figure 3.8, indicate that the train schedules are structured so that the majority of the trains meet opposing trains as they arrive or leave one of the terminals rather than on the mainline, only two mainline meets a day are required for the 18 MTPY traffic level.

Two mainline sidings are required to accommodate the two scheduled meets, however, should trains operate off their schedules or should the schedules at certain time of the year become elongated due to track conditions, meets with the employee and supply trains will be required.

In view of this, three equally spaced mainline sidings, that are long enough to accommodate the optimum train consist, are included in the design of the main line. Each of these sidings have a small back track built off each siding, for storing equipment and cars without blocking the siding for through movements. Two additional short sidings are provided to increase meet capabilities for the employee train, providing more flexibility to it's' schedule.

4.1.2 Hi-Rail Refuges

Sidings are also use by MoW personnel and machinery to clear trains. There will be no road for vehicular traffic so that there will be more than a normal amount of hi-rail traffic between Steensby Yard and Mary River Yard. Hi-rail refuges have therefore been included in the main line design to permit rubber tired hi-rail equipment to clear the main track without excessive loss of time due to having to travel extended distances to clear trains at the mainline sidings.

A hi-rail refuge comprises a short section (10 m) of embankment widened to allow a vehicle to stand clear of a passing train with planks installed between and beside the rails (much in the fashion of a private farm crossing) to permit the vehicle to leave the track on rubber tires. The refuges are available approximately every 10 km.

Table 4.1 illustrates the siding and refuge locations and the siding lengths as established from the time distance graphs shown in Table 3.8.

Table 4.1 – Sidings and Refuges

Type of Main-Line Installation	KP Start	KP End	Length (m)	Siding Spacing (km)
Switch to Loading Track	0+720			
Refuge	11+250		10	
Minor (Employee Train) Siding	20+220	20+52	300	
Major Siding	30+400	32+100	1,700	30.4
Refuge	45+450		10	
Refuge	56+750		10	
Major Siding	69+000	72+250	3,250	36.9
Refuge	79+200		10	
Refuge	90+120		10	
Refuge	100+170		10	
Major Siding	109+900	112+100	2,200	29.7
Refuge	122+700		10	
Minor (Ballast Quarry) Siding	133+030	133+880	850	
Minor (Employee Train) Siding	135+000	135+550	550	
Switch from Unloading Loop	134+760			22.7

4.2 TERMINALS

The project also includes the construction of rail terminals located at Steensby Inlet and Mary River. At Steensby Inlet due to the topographical features two terminals are built. The Steensby Yard is a railway support rail yard and is located approximately 3 km from Steensby Port Terminal which consists of the unloading loop and access tracks to liquid storage tanks and a container storage area. At Mary River a single terminal is required to support mine activities and employee travel associated with the air strip.

4.2.1 Steensby Yard

Steensby Yard is located on the mainline at KP143.8 and will be the centre of activity for rail operating purposes. The Transportation, Rolling Stock and MoW departments are headquartered in the Maintenance Centre at Steensby Yard.

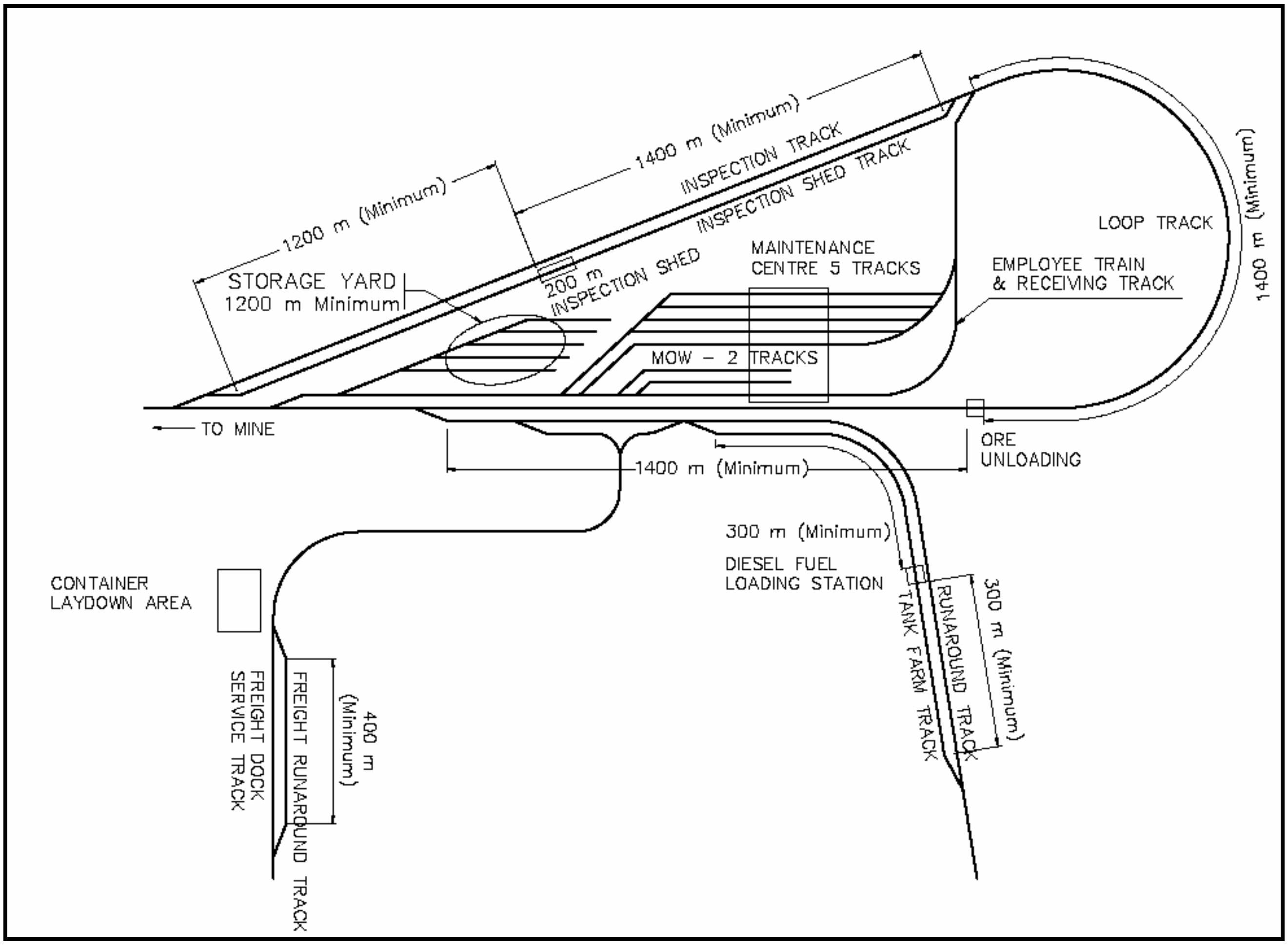
The exit from the unloading loop leads directly to a pair of inspection tracks in Steensby yard. These tracks total a 6,900 m, and one track is equipped with a 200 m inspection shed. The inspection shed is designed to protect the car department employees during train inspections. The full train standing inspection will commence with a pull by inspection as the train departs the unloading loop followed by a standing drive by inspection once the train is clear of unloading loop. During the drive by inspection car inspectors will note any defective cars and indicate if in-train repairs that can be made. The train will proceed, 18 or 19 cars at a time, through the inspection shed stopping to permit in-train repairs and additional inspection as required. Any cars that cannot be repaired in-train will be set-off either on the shop or storage leads. Track centres between the other tracks is sufficient to permit operating a small service vehicle between them – 8 m track centres are sufficient for this purpose. A small classification yard is available for classifying and storing spare and bad order cars and MoW cars. Adjacent to this is additional MoW track with a ground storage area for MoW equipment and supplies.

The locomotive facility is capable of performing all regularly scheduled maintenance inspections, and is serviced by two through tracks. One locomotive track is considered as a speed servicing track service-station type servicing with fuelling and sanding capabilities. The second locomotive track is for longer-term activities such as periodical inspections and major overhauls. The two tracks combined with the car shop have sufficient capacity to store the entire locomotive fleet inside the building during extended service shut down periods. A storage tank for locomotive fuel is located adjacent to the locomotive shop.

The car shop is of sufficient size to perform most major repairs, and has two repair tracks, one for speed repairs (repairs that can be completed within 8 hours) and one for longer type repairs. Storage tracks are also provided in the Maintenance Centre for MoW heavy track equipment, and portions of the employee train and emergency train that require protection from the extreme cold weather.

Steensby Yard requires approximately 14.5 km of yard trackage. Figure 4.1 presents a schematic of Steensby Yard and Terminal arrangements.

Figure 4.1 - Steensby Yard and Terminal Line Diagram



4.2.2 Steensby Terminal

An approach track to the unloading loop is located adjacent to the main support yard, this track and the unloading loop are approximately 5,200 m in length. An unloading shed contains a rotary dump capable of dumping two ore cars at a time. Combined with a car indexer the system is capable of positioning and dumping two cars in two minutes. The track exiting the unloading loop leads directly into the inspection tracks of the Yard.

The general freight dock and fuel storage facilities at Steensby port are located to the south and west of Steensby Yard; industrial tracks provide service for the storage tank farm and a small intermodal yard for container handling. A minimum 550 m track is needed for the tank farm and a minimum 400 m track with a side and end ramp for the intermodal yard.

In total, the trackage for Steensby Terminal is approximately 12 km. This includes the lead trackage from Steensby Yard. Figure 4.1 includes the terminal tracks required at Steensby.

Details of track lengths and switches are documented in Chapter 10 of the Design Brief Document Number DBR-5000-YT-210.

4.2.3 Train Operations in Steensby Yard and Terminal

The train movements through Steensby Yard and Terminal are briefly described below.

Unit Ore Train Operation

1. Loaded trains will pull down main track and proceed directly to the unloading area on the loop track;
2. Once the train is unloaded it will continue around the loop;
3. A pull by inspection will be performed as the train pulls towards the inspection shed on the inspection track;
4. The Crew Change will take place at the inspection shed;
5. Train servicing during the full standing inspection (minor repairs) will be performed on the inspection track;
6. Cars will be set off if they require repairs that cannot be completed on the inspection tracks during the full standing inspection;
7. Scheduled Locomotive fuelling (approx every 6 trip) will take place on the inspection track; and
8. Locomotive servicing (fuelling & sand) will be performed on the inspection track unless the locomotive consist is changed out.

Employee Train Operation

1. The Employee Train Service will arrive and depart from the Maintenance Centre;
2. The Employee Service Equipment will be stored in the Maintenance Centre when not in use.

Inbound General Freight Operation

1. On arrival at Main Yard the Supply Train will proceed though the inspection shed for inbound inspection;
2. After the inbound inspection the supply train will return to the main line with a reverse move and then go directly to the Port Terminal via the Port Terminal Lead;
3. Locomotives will cut off and run around train;
4. The crew will place tank cars and flat cars as required;
5. The locomotives and crew will proceed to the locomotive shop at main yard; and
6. Secondary switching, if required will be performed by a rail car mover.

Outbound General Freight Operation

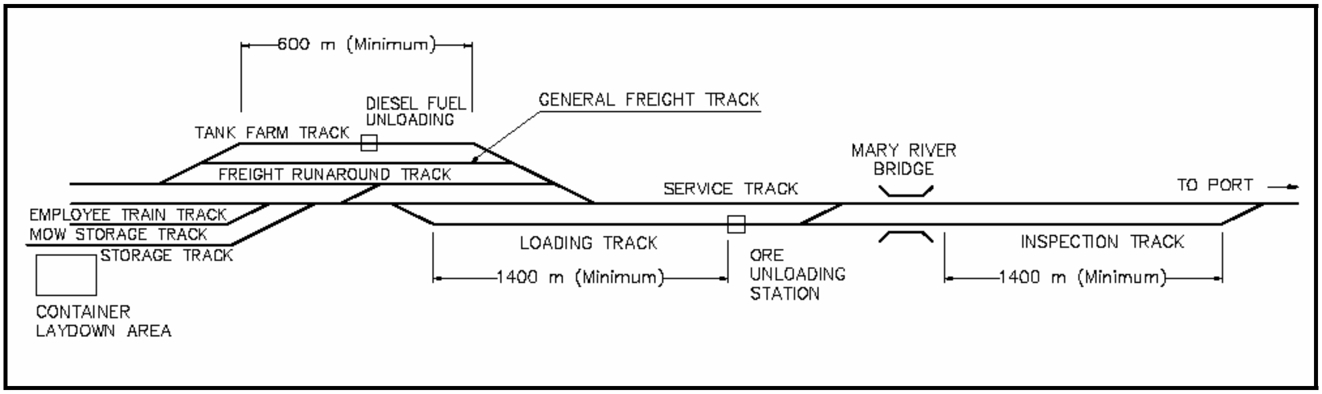
1. The locomotives and crew will proceed from the locomotive shop at main yard to the Port Terminal;
2. Tthe Crew will pull the loaded tank cars or loaded flats and place them on the lead track;
3. The crew will make sure that there is brake air pressure is in last car;
4. Tthe locomotives and outbound cars will proceed to the inspection shed at the main yard; and
5. The train will be inspected at the inspection shed and upon completion of the inspection will depart for the Mine.

4.2.4 Mary River Terminal

Located at the interior extremity (KP 0.7) of the railway, the Mary River Terminal consists of straight loading track , a run around track, three industrial tracks for the handling of containers and unloading of tank cars, a MoW shop track and a platform track for the employee train service between Mary River and Steensby.

The Mary River Terminal has approximately 7.6 km of yard trackage. Figure 4.2 presents a schematic of the track arrangements. Details of track lengths and switches are documented in Chapter 10 of the Design Brief Document Number DBR-5000-YT-210.

Figure 4.2 - Mary River Yard Line Diagram



4.2.5 Train Operations in Mary River Terminal

The train movements through the Mary River Terminal are briefly described below.

Unit Ore Train Operation

1. Upon arrival the empty ore train will pull directly into the service track and then take the crossover west of the Mary River Bridge into to loading track;
2. After loading is completed, the loaded train will move into the inspection track and a brake test will be performed; and
3. After completion of a drive by inspection and upon receiving proper authority from the dispatcher the train will depart

Supply Train Operation

1. The supply train will pull into the Service Track and cutoff cars either on the Tank Farm track or the General Freight Track;
2. The locomotives and crew will pull empty tank cars and flat cars as required;
3. Locomotives will couple onto empty tank cars on the Tank Farm Track or empty flats on the General Freight Track; and
4. After a brake testis completed and upon receiving proper authority from train dispatcher the supply train will depart.

Employee Train Operation

1. The employee train will enter the service track and proceed directly to the employee train track;
2. Once employees have disembarked, the train will reverse into the service track;
3. The locomotive will cut off and runaround the train on the run-around track and couple onto the other end of the train;
4. The train will reverse back into the employee train track and embark employees; and
5. The employee train will depart via the service track upon receiving proper authority from train dispatcher.

4.3 TRAIN CONTROL

The main purpose of train control is to safely manage the operation of the ore trains, freight trains and employee trains. Track occupation by any vehicle, train or road-rail (Hi-rail) equipment is based on the vehicle operator receiving exclusive authority to occupy the block, or specific section of track, from the Dispatcher. A railway dispatcher controls all movements on the railway through these authorities.

4.3.1 Radio-Based Signalling System

A Computer Assisted Manual Block System (CAMBS) is considered dark territory with no track circuitry indicating track occupancy, and no track-side devices such as signals to communicate track occupancy messages. Communication between the dispatcher and the locomotive driver is by voice, over radio. The CAMBS computer assists the dispatcher to verify that any authority issued is not in conflict with any other active authority. The system provides visual information on the status of the rail network and through its data base is able to verify the status of current occupancy authorities, ensuring that the dispatcher does not give overlapping authorities to two different train drivers.

The transportation of 18 MTPY dry iron ore requires a maximum of three trains operating at any given time on the main track. Considering this, and the minimal number of MoW vehicles that will be required at the same time, the dispatcher workload will be within the limits of a Computer Assisted Manual Block System. This type of system is dependant upon the driver being responsible for train movements, respecting his authorities for track occupancy and for train location data transmitted by voice to the dispatcher. Systems using voice transmitted authorities are widely used in North America and haven proven to be operationally safe for low levels of traffic. One CAMBS system is sufficient to control the entire territory for this railway.

However, should any increase in traffic be considered, it will be advisable to remove the human factor. A Communication Based Signalling (CBS) system is a an option that would be a cost effective solution. CBS systems are under development and are operating under special permissions in a testing mode. Proven and approved systems should be available by the time the Baffinland Iron Mines Corporation wishes to expand its mine productivity.

In a CBS systems the traffic control is based on cyclical communication with the radio block center sending messages to the trains, which always answer with their present position. The train location is established with either navigation satellite systems or by using distance measuring train on-board equipment calibrated by wayside transponders. The position reported are used for giving new movement authorities to trains, and limits on how far they are allowed to proceed. The central control computer continuously updates train positions on the dispatch display monitor. The train dispatcher, aided by the central computer, transmits all speed and distance authorities to each train by the same data radio system. The train's on-board computer compares its position and speed with that permitted in the latest authority, and takes action to enforce the authorized limits, if necessary.

This type of system significantly improves system flexibility, especially in terms of its ability to optimize operations for heterogeneous traffic. It does not require any signals along the track. All information to the driver is given on a graphical colour on-board display.

The important aspect of this type of system is its ability to control. The control system's capability and reliability ensure safe railway operations by:

- Preventing train-to-train collisions;
- Enforcing speed restrictions, including civil engineering restrictions (curves, bridges, etc.) and temporary slow orders; and
- Providing protection for railway maintenance employees and their equipment operating under specific authorities.

4.3.2 Point Machines

The railway will operate in cold and severe environmental conditions, all switches along the main line will be automatic and remote controlled.

4.3.3 Track Integrity

Rail integrity deals with the prevention and control of rail failures. Such defects form and grow in rails from the repeated action of wheel loads exerted on the rail by passing trains. Based on studies, the problems related to loss of rail integrity accounted for 30% of the harm resulting from train accidents.

Control of rail integrity is maintained by scheduled rail testing using specialized equipment. The process of rail testing is highly reliable but not perfect, especially at very low temperatures. Therefore, if higher traffic volumes are under consideration broken rail detection should be improved either by:

- The installation of track circuits, which are expensive but proven operational equipment. Their service and maintenance costs can be reduced by using long track circuits with lengths up to 8 km; or
- By installing on-board equipment that analyses the eddy current induced into the rail by the train. This system is not yet officially approved by the regulators but it is already under extensive tests and could be approved at the time of project implementation.

4.3.4 Defect Detectors

The main line will be equipped with strategically placed wayside detectors that monitor passing trains for defects. Observed defects, such as hot bearings/wheels and dragging equipment, may require immediate action or may require future maintenance. Wayside detectors provide information directly to the train, or to the dispatcher.

Hot box detectors which measure the temperature of bearings, and dragging detectors which identifies any dragging equipment, such as loose brakes, will be installed at three locations: KP30, KP69, and KP110. Both detectors are installed at the same location, sharing the same bungalow that houses all electronic and communication systems.

In addition, a Wheel Impact Load Detector (WILD site) capable of measuring defective wheels (flat spots, etc) will be located at the Port terminal to detect wheel defects as the trains exit the unloading loop. This allows for the electronic measurement of wheels prior to the crew change with the resulting information sent to the car department at the Port to assist in their inspection procedures.

4.3.5 Rolling Stock Management System

A rolling stock management system will be provided. This will include an Automatic Equipment Identification (AEI) System and a detector management system.

The AEI management software will track the movements of tagged vehicles passing AEI readers. It will be possible to locate any car at any given time (on main line, in the Port, in the Mine or in maintenance shop), and to determine the distance traveled by any car for maintenance purposes.

AEI readers shall be located with the wayside and WILD detectors. When a defect is detected on a car, the identity of the car is provided, and a Detector Management System provides the dispatcher with information regarding any detected defect.

4.3.6 Highway-rail grade crossings

Highway-rail grade crossings are required in the vicinity of the Mine and Port. Considering the low-density traffic situations, unmanned level crossings with automatic lights and sound alarm systems will be installed.

4.3.7 Weight-in Motion system

A weight-in-motion system will be installed at the Mine for safety purposes. The weighing system weighs the load of each car while the train is in motion, controlling axle overloading and identifying unbalanced loads.

Chapter 5

Rolling Stock

CHAPTER 5

5. ROLLING STOCK

5.1 LOCOMOTIVES

5.1.1 Locomotive Type

A 4,400 hp AC locomotives have been used as the power unit in the the railway operations model which is the basis of this report. The selection of this locomotive type is discussed in Chapter 14 of the Railway Design Brief for this project, document DBR-5000-RS-214. The basic characteristics of the locomotive are shown in Table 14.3, Chapter 14 of the Railway Design Brief.

The train crew consists of one locomotive driver only, and each locomotive shall be equipped for distributed power operation and remote control operation (belt-pack type) both ground and operated technology and the option for distributed power. In case of an emergency where a car is required to be set-off, the locomotive driver will be capable to set-off the bad order car using the remote control feature.

5.1.2 Locomotive Requirements

Due to the limited switching requirements of the network, special locomotives will not be obtained for switching purposes. Locomotives will be used for long cut switching and a mechanised carmover will be used for smaller switching requirements such as at the maintenance shop and for general freight requirements at both the Mine and Port. The use of only one type of locomotive reduces the extent of the knowledge, tools and parts required. The locomotive requirements are summarized in the Table 5.1.

Table 5.1 - Locomotive Requirements

Requirement	Quantity
Three iron ore unit trains with two locomotive consist	6
Employee/supply train, MoW, extra trains, etc.	2
Spares for periodical inspection and heavy repair	3
Total	**11**

5.2 MECHANISED CAR MOVERS

Mechanised car movers will be used for switching freight at both the Port and the Mine, and one car mover each shall be stationed at the Mine and the Port. They will place cars for off loading and loading and make-up the freight trains at both the Mine and the Port. At the Port, the car mover will also be used for switching at the car and locomotive shops and for the make-up of small trains such as the MoW work trains and emergency trains. Car movers are also suitable for MoW trains on the main track for off loading ballast, etc. The road locomotives will be used for switching bad order cars out of unit trains. The selection of this equipment is discussed in Chapter 14 of the Railway Design Brief for this project, document DBR-5000-RS-214.

5.3 IRON ORE TRAIN

5.3.1 Iron Ore Car

The preferred type of ore car for transporting iron ore is an open top steel gondola car fitted with rotary couplers, for use with a rotary dump unloading system in tandem pairs. The methods used for car loading are known to have a major impact on the maintenance and repair cost of freight cars, Loading should be along the centre line of the car and distribute the load evenly, this loading methodology will significantly reduce the life cycle maintenance cost of the ore car.

5.3.2 Iron Ore Car Requirements

The ore cars will be designed to for a maximum loaded axle load of 32.4 tonnes per axle, however in recognition of the climatic conditions; start up operations will use a reduced axle load of 30 tonnes. This will be maintained until significant operating experience in the extremely cold months of January, February and March have been obtained.

A 90% availability is projected for the ore cars and has been used to provide for spares required for bad order cars. Should operating experience indicate the possibility of increasing axle load to the design axle load of 32.4 tonnes, the increase in axle load will require fewer cars to handle the projected tonnage of 18 MTPY, thus generating additional spare cars. The additional spare cars may also be placed in service should a catch-up situation arise. The iron ore car requirements are summarized in Table 5.2 below.

Table 5.2 - Iron Ore Car Requirements

Fleet Requirement	Number of Units
Iron ore cars for train service	330
Spares	37
Overall total	**367**

5.4 SUPPLY TRAIN

In addition to the ore unit trains, a supply train will be operated on average twice a week. Supplies will be transported by ship arriving at the Steensby Port Terminal during the summer shipping season. The supplies will be either in bulk liquid form and stored in tanks at the Steensby Terminal or palletized (dry goods, drums, etc) in containers which will also be stored at the Steensby Terminal. Distribution to the Mary River Terminal and to a minor extent to the Railway Maintenance Centre at the Steensby Yard will be via rail tank car or rail flat car. The supply train will consist of tank cars containing diesel oil or flat cars with containers.

Normal operations of the freight train will consist of two round trips a week; one of which will deliver loaded tank cars to the Mine and return empty containers and empty flat cars to the Port; and the second which will which will deliver loaded flat cars to the Mine and return empty tank cars to the Port.

One thousand, 6 m (20 ft) containers of ammonium nitrate, 43.1 million litres of arctic diesel fuel and 850,000 litres of Jet A fuel will be transported annually to the Mine in addition to other supplies of spare parts for mine equipment, heavy machinery and general supplies. Due to the remoteness of the site and the severe climatic conditions; and in the interest of safety, one set of two locomotives will be assigned to supply train service.

The standard tank car size is typically 72,000 L (19,000 US gallons nominal) providing for cars that are close to 95 tonnes loaded. The required fuel supply can be transported by 599 tank carloads per year. The loading and unloading facilities for the diesel fuel are designed to handle five tank cars at a time and the tank car trains will be made up of sets of five cars. A 15 car train will make 40 trips a year, one tank car of Jet A fuel will be added to this basic train consist 12 times a year.

The one thousand containers of ammonium nitrate will be shipped to Steensby Port during the summer shipping period. They will be hauled to the mine by a 12 car train; two containers per flat car. The full complement of ammonium nitrate containers will be transported in 42 weekly trips leaving adequate haul capacity for other supplies and heavy equipment.

5.5 OTHER ROLLING STOCK

5.5.1 Employee Train

A train service will be provided to transport staff between the Port and the Mine, allowing the primary air service for bi-weekly shift changes of personnel, to operate out of the airfield at the Mary River Mine Site. Facilities are provided at both the Mine and the Steensby Yard to embark and disembark staff, and supplies.

The emplyee train will comprise one locomotive; one or two passenger coaches (as needed); a baggage car and a generator car. The generator car is required to provide hotel power to the passenger coach for heat and light. Hotel power is normally provided to passenger coaches by a passenger locomotive, which is designed to convert only a portion of its power to tractive effort for the train. This is not a desirable feature for a locomotive that is principally used in unit train service and is not recommended for this railway. The small size of this train makes the use of two locomotives for safety purposes unwise, however the generator car will be equipped with two generator sets, to provide a back up should a generator fail.

5.5.2 Emergency Train

Due to the remoteness of the rail network, an emergency train will be required to provide eating and sleeping accommodations for emergency personnel with kitchen and dormitory cars, and will carry its' own tools and supplies in box cars and on flat cars. The equipement of the emergency train will be permanently loaded, and with the attachment of a standby locomotive ready to go. In total, the emergency train will consist of 10 cars.

5.5.3 Maintenance-of-Way Cars

Rolling stock will be required for normal track maintenance, these cars consist of ballast bottom dump and side dump cars and flat cars for ties, rail and large items such as track panels.

5.6 ROLLING STOCK SUMMARY

The rolling stock required for the railway is summarized in Table 5.3 and Table 5.4.

Table 5.3 – Motive Power Type Requirements

Motive Power Type	Year 1
Locomotives	
2 locomotives per train for 3 iron ore unit trains	6
Supply train, Employee train, MoW, extra trains, etc.	2
Stand by, Spares (periodical inspection, heavy repair	3
Total	**11**
Car movers	**2**
Total motive power units	**13**

Table 5.4 – Car Type Requirements

Car Type	Year 1
Iron ore cars	
Iron ore cars train service	330
Spares – repairs, etc.	37
Total	**367**
Employee train	
Coaches	2
Generator car	1
Baggage/goods car	1
Total	**4**
Supply train	
Tank cars (including spares and dedicated Jet A)	18
48 ft container compatible flat cars (including spares)	14
Total	**32**
MoW cars	
48 ft general purpose flat cars	3
Bottom dump hopper	10
Side dump ballast car	3
Gondola car with removable end doors	2
Box car	1
Total	**19**
Emergency train	
Kitchen car	1
Dormitory car	2
Generator/water car	1
Tool car	1
Gondola car with removable end door	1
General purpose flat car	5
Total	**11**
Total cars	**433**

5.7 ROLLING STOCK MAINTENANCE

5.7.1 Locomotive Maintenance Requirements

The basic locomotive maintenance activities are itemised below.

It is to be noted that the following scheduled inspections are based on Transport Canada legal requirements and will always adhere to these minimum requirements, and, if adjusted, will only be added to if local running conditions and final locomotive configurations require it. If any of the prescribed checks reveal an unsatisfactory condition, remedial action must occur to rectify the situation, either repairs are executed in the time available or the locomotive is taken out of service.

Inspections are detailed in nature, the following examples indicate the type of activity they include.

5.7.2 Daily Locomotive Inspection Program

This program provides for a daily check of the locomotive during the crew change and prior to train departure. It will involve the following:

- Visually inspecting locomotives for loose or damaged components;
- Checking engine control panel for faults displayed and perform self-test;
- Checking engine oil level at idle speed;
- Checking engine coolant level and topping up with treated coolant as necessary;
- Visually examining engine for leakage or unusual sounds;
- Visually examining exhaust manifold for leakage; and
- Visually examining trucks for loose or dragging equipment, alignment of sanders, condition of motor cooling ducts and cables, excessive wear of brake rigging, worn brake shoes, slack adjuster and piston travel, worn or defective wheels.

5.7.3 90-day Locomotive Inspection Program

This program provides for a 90-day scheduled maintenance shop visit and will involve the following:

- Checking compressor in loading and unloading conditions;
- Cleaning batteries and checking electrolyte – topping up if required;
- Replacing air filters;

- Inspecting electrical control equipment for security, damage or signs of burning, shorts and grounds;
- Checking operation of air filter pressure switch;
- Running manual self-test;
- Checking dynamic brake blower motors for condition and damage;
- Checking radiator condition and running fans backward to clean debris;
- Checking condition and operation of windshield wipers;
- Draining sump tank and retention tank;
- Examining trucks for loose or dragging equipment, alignment of sanders, condition of motor cooling ducts and cables, excessive wear of brake rigging, worn brake shoes, slack adjuster and piston travel, worn or defective wheels;
- Checking gearcase oil level and filling as required;
- Cleaning metal particles from gearcase magnets;
- Examining truck wearplates for wear, cracks, weld condition;
- Removing lubricating oil filters, cleaning filter housing and fitting new filters; and
- Replacing fuel filter element.

5.7.4 Bi-annual Locomotive Inspection Program:

The following checks are in addition to the 90-day inspection and provide for a 180-day scheduled maintenance shop visit:

- Visually inspecting all crankcase components;
- Checking for carbon build-up in cylinder inlet ports, cleaning as appropriate;
- Checking and adjusting tappet clearance;
- Cleaning and qualifying fuel header; and
- Cleaning and inspecting radiator fan blades.

5.7.5 Annual Locomotive Inspection Program

The following checks are in addition to the 180-day inspection and provide for an annual scheduled maintenance shop visit:

- Cleaning compressor intercooler and inspecting for damage;
- Cleaning oil sump screen and replacing compressor oil;
- Replacing compressor air inlet filters;
- Checking the operation of all alarms and protective devices;
- Inspecting cooling system for oil content and corrosion;
- Vacuuming control equipment;
- Checking operation of control relays, contactors etc. replacing contact tips as necessary;
- Lubricating main alternator and radiator fan bearings;
- Inspecting and cleaning the cartridge of the coalescer filter;
- Greasing traction motor "U" tubes; and
- Draining and refilling traction motor gear cases.

5.7.6 Car Maintenance Requirements

In line with standard North American Railroad practices, freight cars are not subject to scheduled maintenance with the exception of brake testing and the replacement of brake hoses in accordance with domestic laws.

The ore cars are subject to visual inspections twice on every round trip. Once loading is completed at the Mine, and before the train enters the main line, a brake test is performed and the locomotive driver conducts a slow 'drive by' inspection accompanied by a car mechanic. After unloading a train-crew change takes place at Steensby Port Yard and the incoming driver inspects the train with a car mechanic during a pull-by inspection.

Due to the short distance between the Port and Mine and in light of the unit train operation, detailed inspections will not be conducted on a trip basis but rather at mileage intervals which adhere to FRA requirements and current practises in Canada. These inspections require walking around the consist and visually checking for any loose or dragging components, the condition of the brake shoes, keys, brake linkage, wheels, couplers, brake hoses, truck wearplates and springs.

Repairs are carried out either with the car in situ within the train consist in the case of minor repairs or by removing the car from the train consist and sending the car to the workshop to perform heavier repairs. Brake tests are performed on the train consist in accordance with local operating rules, but usually at the time of attachment of the locomotive to the train consist. Single car brake testing is performed every time a car is sent to the workshop. Where no interim repairs are performed cars are tested annually.

5.8 OTHER VEHICLES

5.8.1 Automotive Vehicles

The gangs assigned to infrastructure maintenance will require a mode of transportation. There are two viable modes for consideration, an automotive vehicle equipped to operate on rail or roadway and a rail-bound gang transporter. Due to the flexibility offered by the automotive vehicle, automotive vehicles complete with attached hi-rail gear have been selected. Table 5.5 and Table 5.6 provides a summary of the type and number of vehicles required by the Infrastructure Department.

Table 5.5 - Automotive Vehicles for Track Infrastructure Department

Vehicle Type	Quantity		Remarks
	Port	Mine	
Infrastructure manager vehicle	1		6 person full size suburban – 4 WD with Hi-Rail
Supervisor of track / signals & communications vehicle	1		3 person full size pickup, extended cab - 4 WD with Hi-Rail
Supervisor of contract services vehicle	1		3 person full size pickup, extended cab - 4 WD with Hi-Rail
Track maintenance vehicle	2	2	6 person cab, 14' steel side platform with crane – 4 WD with Hi-Rail
Track welder vehicle	1		3 person cab, welder's vehicle with service body and crane - 4 WD with hi-rail.
Signals and communications. maintenance vehicle	1		3 person cab, 10' steel side platform with crane - 4 WD with hi-rail
Field mechanic vehicle	1		3 person cab, mechanic's vehicle with service body and crane - 4 WD with hi-rail
Total	**8**	**2**	

It will be necessary to provide transport for a car mechanic and the locomotive crew to perform the slow drive–by inspection, performed in conjunction with the brake test after loading is completed at the Mine. Two persons are required, one on each side of the inspection track to perform the pull by inspection in the yard at crew change. One of these is the incoming crew member and the other will be a car mechanic from the car shop. In the interest of efficiency, both of these require a vehicle to give them access to the pull-by inspection point and to provide protection from the elements during the inspection. All three of these vehicles shall be provided with side mounted flood lights to permit night time inspections.

Table 5.6 - Automotive Vehicles for Rolling Stock and Transportation Departments

Type	Quantity		Remarks
	Port	Mine	
Vehicle for car mechanic for pull-by inspection	1	1	3 person full size pickup, extended cab - 4 WD with hi-rail and side mounted floods.
Vehicle for locomotive crew for pull-by inspection	1		3 person full size pickup, extended cab - 4 WD with hi-rail and side mounted floods.
Total	**2**	**1**	

The transportation department will occasionally require additional access to a hi-rail vehicle. There are sufficient vehicles that occasional access to a vehicle by the transportation department should not be problematic.

5.8.2 Heavy Track Equipment

For the Infrastructure Department to keep pace with the demands that will be placed on it, it is important that the labour force be complemented with the latest advancements in work equipment machinery. This refers to all machines and accessories that contribute to the mechanization of track maintenance. To this end, the engineering department shall be supplied with the work equipment identified in Table 5.7.

Table 5.7 - Proposed Heavy Track Equipment

Type	Quantity at Startup	Additional (Year 10)	Remarks
Cold air blower / truck	2		To remove snow from the turnouts in yards.
Combo - ballast / snow regulator - high speed	1		Combo Unit - Snow clearing in winter. Ballast regulating in summer.
Off track wheel loader	2		To handle snow, ballast and other material (Port & Mine)
20 tonnes industrial crane	2		Multi-purpose maintenance activities
Rail buggies with platform	2		To transport track material
Surfacing unit (production/switch)	1		To correct track alignment, cross-level and profile on the main line and turnouts
Portable tie exchanger	1		Replacement of rail sleepers

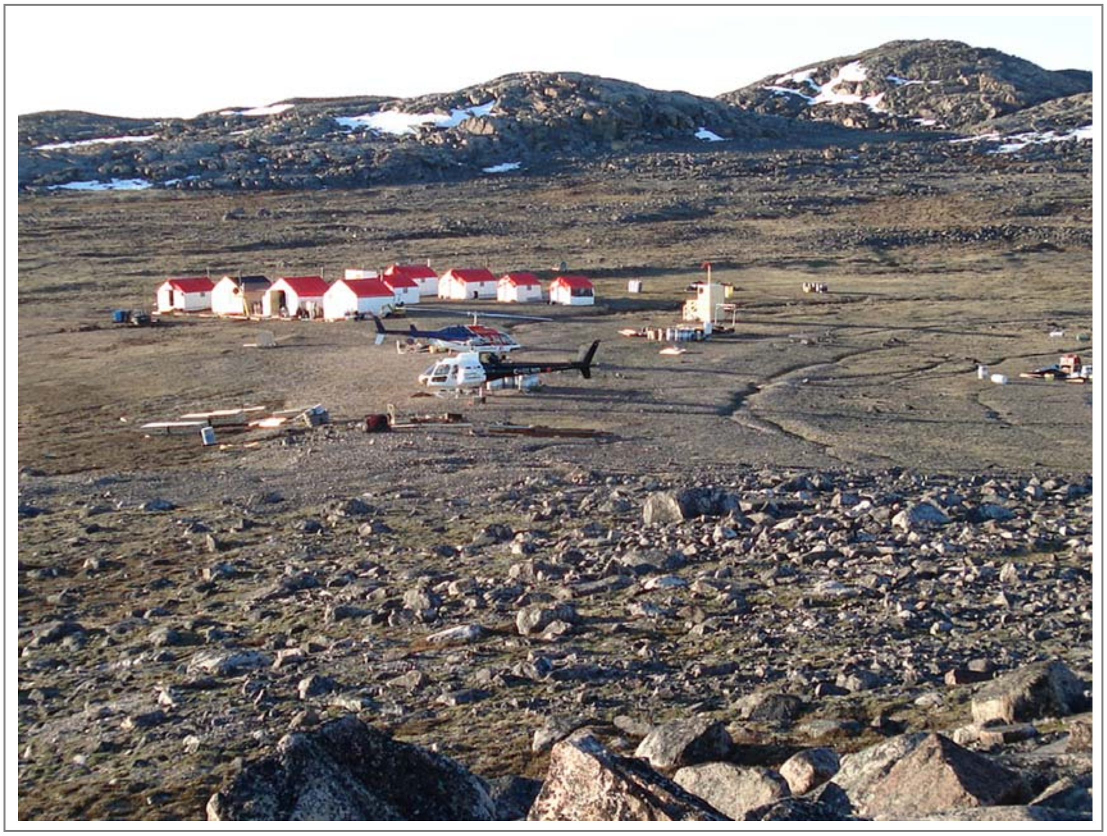
Type	Quantity at Startup	Additional (Year 10)	Remarks
Tie handler (1 production unit) required by year 10		1	To handle rail sleepers on track
Wheel excavator (on/off track)	1		To clear fouled right-of-way ditches and other excavation projects. (Rubber tired and equipped with Hi-rail gear)
Clip applicator (rail fasteners)	1		To install compression rail clips
Portable multi-spike screw driver (1 production unit required in Year 10)		1	To install lag screws
Portable multi-spike screw remover (1 production unit required in Year 10)		1	To remove lag screws
Dozer	1		To push material and snow
Ultrasonic rail inspection unit	1		To test rails for internal defects
Rail grinding unit	1		To re-profile rail heads in order to help prevent defects
Engine driven welder/generator	1		To be assigned to rail welding gang
Road grader (c/w snow plough and wing)	1		To open roadways at the port and mine sites
Lincoln arc welder	2		To free culvert inlets and outlets of ice
Steamer and generator	2		To free culvert inlets and outlets of ice
Total	**22**	**3**	

Work equipment identified will be the key components for the performance of track maintenance. Their use will increase productivity and ensure consistent uniformity of the maintenance work. However, work equipment must be properly used and maintained. To this end, it is important that the railway ensure they have qualified equipment operators field supervision that understands the designed purpose and capabilities of the equipment and qualified mechanics assigned to maintain the equipment. The qualifications of these employees will dictate the level of equipment productivity and reliability, and ultimately, the maintenance of the track standards required to support the rail operations.

Chapter 6

Railway Buildings and Shops

CHAPTER 6



6. RAILWAY BUILDINGS AND SHOPS

6.1 GENERAL

The facilities for the railway headquarters and all three railway departments shall be located at Steensby Yard and are combined in a Maintenance Centre with the car and locomotive shops and the MoW Gang Headquarters. The ground level of the building contains the workshop areas for the Rolling Stock Department shops (both locomotive and car maintenance shops). The Infrastructure department, materials store and indoor storage for MoW vehicles and employee train coaches. Two mezzanine levels provide employee washroom, locker and lunchroom facilities and general offices for the Railway General Manager, department heads, the train dispatching office and support staff.

6.2 FACILITY LOCATION

The location selected for the Maintenance Centre is approximately three km from the general port facilities and is operationally viable in that it permits a safety inspection after unloading, and reduces the transportation expense of supplying the facilities with equipment and fuel by being located in close proximity to the port. The Maintenance Centre is also in close proximity to the accommodation complex serving the port and railway personnel and the port electrical generating facility, providing for the relatively easy transfer of waste heat from the generators to the Maintenance Centre for heating purposes.

6.3 GENERAL ADMINISTRATION

The general administration requires offices for the General Manager, a Payroll and Contract Officer and a statistician. Work stations are required for a secretary and for contract employees. This section also includes a conference room and a training room.

6.4 TRANSPORTATION DEPARTMENT

6.4.1 Transportation Department Offices

The Transportation Department requires office space for the Superintendent, the Trainmaster/Master Mechanic, the Dispatcher, the Operations Coordinator and a workstation for a general clerk. Both the Dispatcher's office and the Operations Coordinator's Office have specific requirements in that the Dispatcher's Office requires adequate soundproofing and radio communications, and the Operations Coordinator Office will be equipped with monitors from cameras located at the Inspection Shed and both the loading and unloading areas.

6.5 INFRASTRUCTURE DEPARTMENT

The Infrastructure Department provides technical and maintenance support for the railway service.

6.5.1 Location of facilities

Office facilities for the Track Infrastructure Manager, Supervisors of Track and Signals & Communications and Supervisors of Contract Services will be located at the Port, in the Maintenance Centre. The rail line is approximately 143 km in length, under ideal conditions it would be normal to establish three Track Maintenance Gang (TMG) locations, one at each rail terminal and one at the centre location of the rail line. However, due to the remoteness of the rail line two TMG locations will be established, one at the Port Yard and one at the Mine Terminal. MoW facilities are provided at each of the two locations. These maintenance facilities must accommodate all staffing and work activities for a track segment. This included track maintainers, rail welders and signal & communications forces. Space is also provided for contract services field employees.

In addition to the general employee facilities provided at the Steensby Port Maintenance Centre the MoW department is also allocated foreman's offices, inside storage for small power tools, portable equipment and signals and communications components, and enclosed storage for heavy track equipment and automotive vehicles assigned to the various gangs. Track access is provided for rail-bound equipment as well as storage space for rubber-tired (On/Off Track) equipment. Space for an outdoor material compound for the storage a track components is also provided in the Steensby Port Yard.

A small MoW building with track access at the Mary River Mine Terminal provides Inside storage for small power tools, portable equipment and signals and communications components, and storage for heavy track equipment and automotive vehicles assigned to the various gangs. The foreman's office and employee lunchroom and washrooms are incorporated into the general accommodation and office facilities at the Mine site.

6.5.2 Heavy Equipment Maintenance Centre

The responsibility for maintenance of the heavy track equipment is assigned to the locomotive and car department and MoW equipment maintenance is incorporated into the Railway Maintenance Centre. This facility will be used to perform major overhaul repairs and cyclical maintenance on heavy track equipment and will serve as the repair centre for the automotive fleet.

The facility requires:

- Two work bays –measuring 6 m by 18 m , one with 15 tonne over head crane and track access and the second equipped with a hydraulic truck lift for automotive vehicles, and shall. It is not essential that the work bays have work pits;
- Material Stores Area ;
- General floor space – 6 m by 6 m for the repair of portable track equipment and tools;
- Office space for shop mechanics; and
- Rail yard storage tracks in close proximity of the work equipment shop with a total length equal to 460 m.

The work bays shall be designed with a minimum height of 7.6 m with a workstation from which the mechanics will plan work, order materials and record work performed.

Due to the emphasis that will be placed on work equipment productivity and reliability it will be important for the Railway to ensure that a well designed and documented equipment preventative maintenance program is implemented. This program shall be developed in conjunction with the supplier/manufacturer of the various pieces of equipment.

In addition to the above noted equipment, there will be specific demands for ancillary equipment and tools for each group of employees assigned to the rail line.

The tools required by the Infrastructure Department for track maintenance, can be broken into two categories; power tools and hand tools. Power tools include such items as rail drills, rail saws, track jacks, rail expanders and flood-lighting. Hand tools include lining bars, ballast forks, snow shovels, sledge hammers, tie tongs, and rail clip wrenches. In addition, typical workshop tools are also required for the maintenance and repair of track tools.

6.5.3 Track Maintenance Materials

The demand for track maintenance material can be separated into two categories; annual maintenance materials; and cyclical renewal materials.

Annual maintenance materials comprise those major track components required too meet the day-to-day operations of the railway. Materials considered under this category consist of rail, ties, and ballast and the associated other track materials required for the installation of these major components. Under day-to-day operations these materials are required to replace components that have failed in service. It is difficult to forecast the potential demand for these materials with a high level of accuracy so a weighted cost ratio, labour dollars vs. material dollars, is usually developed.

Cyclical Renewal Materials are the materials required because the in-track components have reached their useful life span. The following table summarizes a typical average life cycle of rail, turnouts, ties and ballast under the anticipated annual tonnages and axel loadings. It will be several years before the original components reach the end of their expected life and during this time the railway will have accumulated data on the behaviour of components and wear characteristics that will better represents their life cycle in this particular operation.

Table 6.1 - Life Cycle of Tangent Track Component

Track Components at 60 km/h	Axel Loading	Life Cycle (years)
		18.3 MPTY
Standard carbon rail	Initial axel load at 30 tonnes	19
	Long-term axel load at 32.4 tonnes	17
Main line turnouts	Initial axel load at 30 tonnes	7.5
	Long-term axel load at 32.4 tonnes	7
Ties (No. 1 soft wood)	Initial axel load at 30 tonnes	16
	Long-term axel load at 32.4 tonnes	14
Undercut ballast	Initial axel load at 30 tonnes	19
	Long-term axel load at 32.4 tonnes	17

6.6 ROLLING STOCK DEPARTMENT

The following section briefly describes the facilities required to provide the Rolling Stock maintenance operations described in section 5.7 of this Railway Operating Plan. Further description of facilities is provided in Chapter 12 of the Railway Design Brief, document number DBR-5000-BS-212.

The Rolling Stock Maintenance Shops have been combined into a single Maintenance Centre, nevertheless the following sections describe the shops independently from each other since they are used to execute independent tasks.

6.6.1 Inspection Shed

A 200 m long inspection shed is situated on one of the inspection tracks. This provides a protected and well lit environment for the execution of the detailed inspections that are required by the ore train on a regular (three day cycle) basis. The shed is sufficiently wide to permit the movement of service vehicles beside the train should car repairs be required in situ.

6.6.2 Locomotive Light Repair Shop

The light repairs shop consists of one track. This track will hold four locomotives to undertake minor repairs such as brakes, running gear, etc. and some of the periodic inspections to be done on the locomotives. The four inspection levels described above shall be provided. The lifting equipment in the shop will be a 20 tonne overhead crane spanning the track.

One track next to the car repair shop will include both a drop table and a wheel-truing machine.

6.6.3 Locomotive Heavy Repair Shop

The heavy repair shop consists of one track of which holds two locomotives. A 20 tonne crane with a 10 tonne auxiliary hook spanning over the track, associated with a jacking strips and hydraulic jacks constitutes the lifting equipment needed in the shop.

6.6.4 Car Heavy Repair Shop

The heavy repair area consists of one run through track holding up to six cars. Heavy work such as car body, car structure, and draft gear repairs will be performed in this area. One 5-tonne overhead crane will span this track.

Jacking strips and hydraulic jacks will be provided in this section of the shop. This track will be equipped to perform the maintenance of bogies, with A-frame cranes available to dismantle and assemble bogies.

6.6.5 Track Maintenance and Motorized Vehicles Maintenance Shop

This shop is incorporated to the Maintenance Centre and will maintain all motorized off-track vehicles. Two shall have hydraulic jacks to lift the vehicles. Repair benches behind each spot have an electric welding station and compressed air. The following facilities are required:

- Mechanical room for the compressor, the lube oil tank, the pumps and the grease tank;
- Tool room to provide the workers with the appropriate equipment;
- Store room for the parts needed for the repairs;
- Battery room;
- Appropriate air exhaust system at every work spot;
- Outside the shop fuel dispenser pump with an underground fuel tank; and
- Signals and telecoms stores.

The shop provides field and shop mechanics with a facility appropriately equipped with the necessary equipment and tools to also perform major running repairs and cyclical maintenance on heavy track equipment. The facility has a minimum of:

- Two - 25 m work bays with rail access; one complete with 25 tonnes over head crane;
- Hydraulics, electrical and engine rooms;
- Repair room for portable track equipment and tools;.

This shop also provides storage for the car mover. Each car mover will provide for backup for the other should the Port car mover or the Mine car mover need repair and be out of commission for any length of time, there is sufficient idle time for the locomotives from freight and employee trains to serve as back up to the car mover at the Port.

6.6.6 Auxiliary Services

An auxiliary services area shall be located between the locomotive and car shops. It shall be a two level structure. At the shop floor level the following auxiliary shops will be needed:

- Electric and the electronic shop;
- Air brake room;
- Tool storage room;
- Machine shop or maintenance room;
- Oil laboratory;
- Battery room; and
- Welding shop.

The upper floor level shall shelter the headquarters offices, general offices, a conference room, a training room, a lunchroom for approximately 50 persons, male and female locker rooms with approximately 200 lockers and washroom facility for approximately 35 people.

6.6.7 Material Stores

A storage department for car and locomotive components is located next to the car repair section of the main shop. A through track will enter the building providing the ability to offload a container from a flat car. There is also an offload ramp for unloading trucks. This ramp is at the level of the floor of the container to be offloaded. Trucks carrying containers will have the ability to drive into the bay, which is at floor level in order for the containers to be offloaded by an overhead crane for storage and eventual unloading of material contained within the container.

The stores will incorporate a shelving area for smaller parts as well as a larger, more open area for high-level racking used to store palletized loads and larger heavier material. There will be an area where containers can be stacked 3-high by use of an overhead crane.

6.6.8 Locomotive Fuelling Facility

Fuelling shall be done inside, at one end of the sheltered area of the inspection tracks. It is not necessary to heat this area. A reservoir will be placed along the track, with a capacity of 400 cubic meters (400,000 L). Each locomotive has a fuel capacity of 19,000 L (5,000 US gallons), thus a storage tank of this volume could fuel a total of 20 locomotives. This may vary depending upon how the fuel is delivered to the shop: If delivered by pipeline, then a smaller tank will be needed. A minimum storage temperature of -40°C will need to be maintained to prevent fuel clouding. Lower storage temperatures would require a higher quality, more expensive fuel such as jet fuel.

6.6.9 Rolling Stock Maintenance Equipment

The shop equipment required for by Rolling Stock Maintenance Centre is summarized in Table 6.2.

Table 6.2 - Rolling Stock Maintenance Equipment

Locomotive Shop	Qty
Portal wheel lathe	1
Overhead crane 10t, span 30.5 m	1
Overhead crane 20t, span 30.5 m	1
Filter crusher	1
Traction motor rack	5
Work bench	3
Parts washer	1
Self propelled floor sweeper	1
Portable hot water pressure washer	2

Storage Shop and General Receiving Area	Qty
Pallet Racks	7
Shelving low small material	16

Fueling Equipment	Qty
Servicing cabinet: water, oil, coolant	1
Pump house	1
Pneumatic sanding system	1
Vacuum cleaner	1
Toilet drainage system	1
Toilet effluent tank	1
Toilet recharging system	1
Fuel management system	1
Fueling cranes	2
Auto shutoff nozzles	2
Fuel storage	2

Maintenance-of-Way Shop	Qty
Heavy Jacking Equipment	1
Work Bench	2
Drill press	1
Welding Machine	1
Over Head Electric Hoist	1
Parts washer small	1
Parts Press - Machine	1
Compressor	1
High rack shelving low small material	3

Fabrication Shop	Qty
Overhead crane 2t, span 6.5 m	2
Work bench	3
Welding machine	2
Plasma machine	2
Shear with plate table	1
Brake press	1
Hydraulic press	1
Flame cutter with table	1
Horizontal band saw	1
Radial arm press drill	1
Hydraulic frame press	1
Turret lathe	1
Press drill	1
Grinder (large)	2
Grinder (small)	2
Press	1
Grit blast cabinet	1

Car Shop	Qty
Overhead crane 5t, span 17.25 m	1
Overhead crane 5t, span 8 m	1
Overhead crane 20t, span 14 m	2
"A" frame crane	4
Lifting jacks 40t (Set of 4)	2
Drop & transfer table	1
Welding positioner for side frames, bolster & couplers	1
Welding machine (5 x welding, 1 x gouging)	5
Work bench	5
RIP Jacks	2
6 inch (150 mm) dia. grinder	6
12 inch (300 mm) dia. grinder	6
Portable coupler lift jacking system	1
Rerailing equipment	1
Rail dolly	1
Mechanical wheel transporter	1
Portable jacks (set of 4)	2
Trestle	4
Car end positioner (turnover device)	2
Portable hot water pressure washer	2

Forklifts	Qty
Pneumatic tired forklift 3,000 lb, lpg	1
Pneumatic tired forklift 8,000 lb, lpg, 2 stage mast	1
Pneumatic tired forklift 15,000 lb, lpg, 2 stage mast	
Rough terrain pneumatic tired forklift 8,000 lb, lpg, 2 stg	

Chapter 7

Staffing

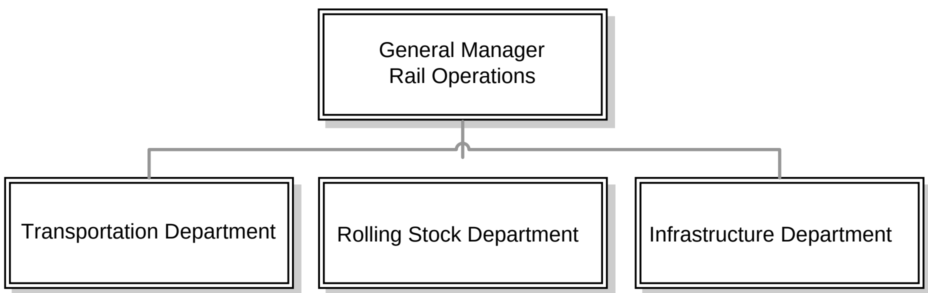
CHAPTER 7

7. STAFFING

7.1 STAFFING STRUCTURE AND SCHEDULE

The railway normally is structured with three departments: Operations, Maintenace of Way and Signalling and Telecommunications or Infrastructure and Rolling Stock. These are led as single entity by the General Manager Operations. Figure 7.1 outlines the railway organizational structure.

Figure 7.1 - Railway Organizational Structure



Other than the Railway General Managaer which is a position occupied only by one individual all year, most of the other positions of the railway permanent staff are based on a two weeks in; two weeks off rotational system. When working on site, two scheduled 12-hour shifts are assumed and are referred too as day shifts and night shifts.

7.2 GENERAL ADMINISTRATIVE STRUCTURE

The Railway General Manager is responsible for entire rail operation. He is ultimately responsible for everything from the health and welfare of his staff to the timely deliver of iron ore to the Port stockpiles.

The Secretary provides secretarial services principally to the General Manager and department heads. As the sole secretarial resource available to the railway's organisation the person fulfilling this function is required to be flexible and organised.

The Payroll Officer/Contract Administrator is responsible for railway payroll administration and contract negotiations with outside individuals and companies who provide service to the railway. This position also provides Human Resources functions and requires logistical support from the Iron Mine's Head Office.

The Statistician keeps records of budget, tonnages hauled and rolling stock mileages. The data collected, collated and processed by this individual provides information that will lead to system optimisation and assists in the timely ordering of supplies and the identification of repetitive problems.

The Storekeeper/Procurement Officer manages and orders supplies for the railway stores department. The isolated location of the railway provides for a particular challenge for this role, particularly with the major supplies relying on an annual delivery by sea in the months of August and September, support will be required from the Iron Mine's Head Office.

7.3 TRANSPORTATION DEPARTMENT

The Transportation Department is responsible for all the activities associated with the movement of rail cars. This includes the personnel involved with the actual movement of a car such as yard and train crews, documentation involved in car movement (waybill, train journal, switch list) and finally the coordination of train movements, this last function is performed by train dispatchers.

The Transportation Department is headed by a Superintendent Transportation who is responsible for all company officers who direct employees associated with the movement of trains and rail cars. The size and type of the rail operations enables all transportation officers to be centrally located at the Port. Also located at the Port are personnel involved in documentation and train coordination responsibilities.

7.3.1 Operating Crews

Operating crews are considered to be those employees that are engaged in Train and Yard Service. The train crew consists of one employee, a locomotive driver. The absence of switching enroute, at the Port, or at the Mine combined with no public crossings makes it operationally feasible to operate the iron ore unit trains with a locomotive driver only. This is similar to the operation on the Quebec North Shore & Labrador Railway in northern Quebec. Six locomotive drivers will be required on a daily basis to operate the iron ore unit trains.

Operation of the supply train with only one locomotive driver can be accomplished by providing a yard helper to set-off and pick-up cars at both the Port and Mine. Alternatively, since the supply train operates only twice a week, a second employee could be assigned to the crew of the supply train without increasing the weekly complement of locomotive drivers.

Operation of the employee train with only one driver only is also possible when considering any railway employee aboard the train can be instructed by the driver to perform helper manoeuvres.

In addition to the above drivers and due to the remoteness of the operation an additional standby driver is employed to cover emergencies, such as illness, train delay, etc. The extra driver would be assigned to the supply train as the second employee when not otherwise required. Locomotive drivers should be called on a rotation basis, so all drivers are “on call” during their shift.

7.3.2 Transportation Department Employee Requirement Summary

In total it is estimated that 15 transportation employees will be required to operate the above train service on a daily basis, working on a two weeks on and two weeks off basis this necessitates a total of 30 employees.

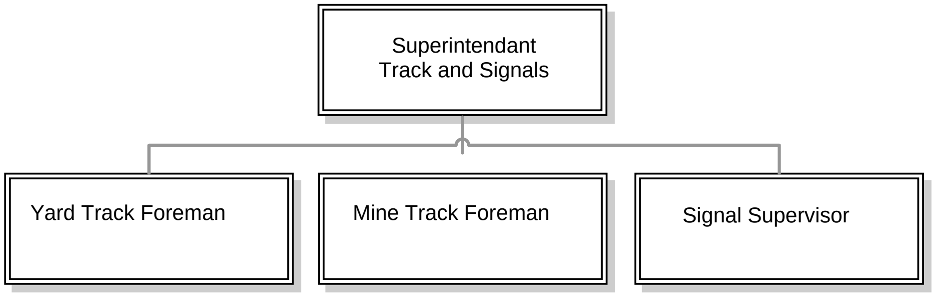
7.4 INFRASTRUCTURE DEPARTMENT

The Infrastructure Department otherwise referred to as the MoW Department will be aligned to provide the required technical and maintenance support for the railway. The department will be responsible for all activities associated with the day-to-day maintenance and capital replacement of track components, culverts, signalling and telecommunications. This includes personnel involved in any and all aspects of the duties related to the above activities such as managers, engineers, supervisors, foremen, labourers and clerical staff.

The department is led by a Superintendent Track and Signals and organized around three (3) key staff memmbers: Yard Track Foreman; Mine Track Foreman and Signal Supervisor. The contract officer in the railway’s general administration handles contract services for the MoW Department but contractual employees report directly to the Superintendent Track and signals when on site..

Figure 7.2 presents the organization the Infrastructure Department. Contract Services will be established for bridges and structures inspections, rail flaw detection and rail grinding requirements.

Figure 7.2 - Organization of the Infrastructure Department



7.4.1 Track Maintenance Employees

Under an established railway that has been in operation for many years the Infrastructure Maintenance Staff requirements are a function of two major responsibilities: that of maintaining the fixed plant of the railway, preserving the assets for safe, efficient operation, and that of directing construction and rehabilitation projects, either with its own or contracted forces. In the case of a new railway, the primary responsibility will be focused on maintaining the fixed plant and preserving the assets for an efficient operation.

Railway infrastructure maintenance usually follows one of two procedures; spot-renewal maintenance or out-of-face maintenance. Spot-renewal maintenance is more appropriate to a new railway since its procedures renews or improves only those portions of a track segment that have deteriorated below established standards for the railway. This type of maintenance follows into the categories of day-to-day maintenance and programmable maintenance. Day-to-day activities are the spot replacement of defective rail, sleepers, ballast and cleaning of right-of-way and etc. Programmable maintenance will consist of annual renewal of defective sleepers in each kilometre, defective rail in curve track and other identified locations, and surfacing and ballast renewal on those sections of track with the highest maintenance priority.

Under the spot renewal process it is important to implement a maintenance structure that can respond quickly and effectively to the day-to-day maintenance activities. To this end, two classifications of employees will be established; permanent and temporary. Permanent employees will be employed year-around and assigned to the Track Maintenance Gangs (TMG) and the Signal & Communications Gangs (SCG). Temporary employees will be employed during the summer months between June and August and assigned to a Programme Maintenance Gang (PMG).

With respect to track maintenance gang locations, gangs will be established at two locations, one at the Port and one at the Mine. Workload will be shared equally between the gang locations. There will be only one (1) Signals and Communications Gang, it will be located at the Port.

7.4.2 Infrastructure Department Staffing

Table 7.1 presents a summary of the proposed overall level of staffing for the Track Infrastructure Department at the start of operations.

Table 7.1 - Track & Signals Maintenance Gang Locations and Staffing Levels

Class of Employee	Port Location (PK 72.25 – PK 143.76 Port Tracks)		Mine Location (PK 0.00 – PK 72.25) Mine Tracks)	
	On-Shift (Shift-A)	**Off**-Shift (Shift-B)	**Off**-Shift (Shift-B)	**On**-Shift (Shift-A)
Track	7	7	6	6
Rail Maintenance (*)	2	2		
Work Equipment Operator (**)	2	2	3	3
Signals and Communications	5	5	1	1
Bridges and Structures	Proposed contract services**			
Rail Grinding	Proposed contract services**			
Total (permanent employees)	**16**	**16**	**10**	**10**
Total (temporary employees*)	**5**	**5**		
Work Equipment Mechanics ***	1	1		

(*) Employees identified for the programmable maintenance gangs will be temporary employees assigned to the summer work season.

(**) Contract Service employees will be predicated on terms and conditions of the applicable contract(s) approximately 128 contract employee days will be required to meet the proposed contract services for rail grinding, rail-flaw detection and bridge and culvert inspections.

(***)The Work Equipment Mechanics identified in this table will report to the Rolling Stock General Foreman Rolling Stock, however they will be responsible for the maintenance and repair workload associated with the operation of the track equipment, portable power tools/equipment and hi-rail vehicles assigned to the railway.

7.4.3 Telecommunications

Under the signals and telecoms supervisor, three full time telecommunication technicians are required during railway operations. The main function of these positions described hereafter is to assure constant functionality of the network and assuring rail operation and safety.

The Optic Technician will be responsible for maintaining, repairing, configuring, purchasing, installing and upgrading telecommunications equipments including:

- Optical multiplexers;
- Network interfaces;
- Network management tools;
- Power generation equipment.

The Radio Technician will be responsible for maintaining, repairing, configuring, purchasing, installing and upgrading telecommunications equipments including:

- Radio transmitters;
- Antennas;
- Portable radios;
- Power generation equipment.

The Computer Network Administrator will be responsible for:

- Local area network management;
- Systems data backup;
- Software installation;
- Software and computer systems upgrade;
- LAN equipment, computer, software troubleshooting.

Although the supervisor will be located at the Port, two technicians will be located at the Port and one at the Mine. Response time in the case of a network failure is important and in the anticipation of having multidisciplined personnel, having one Telecoms Technician at the Mine is key.

7.4.4 Signalling

The Signalling Department will be responsible for all activities associated with day-to-day scheduled maintenance of signalling system, its reconstruction, upgrade and related unscheduled work.

Under the signals and telecoms supervisor, two full time signalling technicians are required during railway operations, located at the Port. Their primary responsibility will be focused on preventative maintenance which is intended to ensure the reliable and safe operation of railway.

The Signalling Technicians will be responsible for the maintenance of the following installation:

- Pont machines;
- Track circuits;
- Object controllers located at the sidings and terminals;
- Detectors;
- Onboard equipment; and
- Signalling power supply equipment.

The signalling maintenance operations consist of:

- Inspection;
- Cleaning;
- Replacement of basic material items (paint, batteries, light bulbs, etc. due to normal wear);
- Troubleshooting;
- Repairing; and
- Purchasing and installing new equipment.

The team shall be composed of trained personnel, equipped with electronic equipment, hand tools, supplies and transport to carry out all of the daily, weekly and monthly inspections.

7.5 ROLLING STOCK MAINTENANCE STAFFING

Table 7.3 presents a summary of the proposed staffing for the rolling stock maintenance department at the Steensby Maintenance Centre. These levels of staffing correspond with levels in recent years with Class 1 North American Railroads. However,due to the relatively small scale of the railway operation and the remoteness of its location many members of the rolling stock maintenance team will be expected to be have multi-disciplinary skills and qualifications. The mine and port operations are based on twelve hour shifts for 14 days with rotation in and out of the site every two weeks as will the railway. Either a non-unionised Maintenance Centre will be needed, or specific contracts will be negotiated with the respective unions and compensation packages will be presented that reflect these requirements.

The general foreman and foreman supervise all maintenance centre operations. The maintenance of the 11 locomotives in the fleet will be maintained by 4 mechanics and 1 electrician. These employees will handle the fueling and servicing of locomotives when required. There is provision for 3 employees dedicated to the overhaul of locomotives, 2 mechanics and 1 electrician in years 5, 6 and 7 (repeating cyclically). Cars, mineral, freight, employee and MoW will be maintained by 11 employees. These employees will be responsible for conducting train inspections on an ongoing basis. One helper/fabrication shop employee will be required to provide support for this function. Total number of employees over 2 shifts initially will be 44 increasing to 52 during periods of overhaul of equipment.

Table 7.2 - Rolling Stock Maintenance Staffing

Position	Remarks	Year 1 to 5		Years 5	
		Number of Positions	Total Staff	Number of Positions	Total Staff
General foreman		1	2	1	2
Forman		1	2	1	2
Locomotive maintenance fuelling/servicing (included when required)	11 locomotives and 2 car movers	5	10	6	12
Overhauls	All locomotives Unit exchange of components 3 employees for 5 months/year			3	6
Car maintenance	367 iron ore cars, freight flat and tank cars, MoW, employee and emergency cars	9	18	9	18
Standing inspections	1 ore train a day 2 freight trains a week	2	4	2	4
Train inspections	Pull by and drive by inspections	2	4	2	4
Fabrication shop helper		1	2	1	2
MoW equipment		1	2	1	2
Total		**22**	**44**	**26**	**52**

7.6 OVERALL STAFFING LEVELS

The overall staffing levels of the railway are recapitulated In Table 7.3.

Table 7.3 - Railway Staff

Position	First Shift In	Second Shift In	Total with Rotation
Railway General Manager	1		1
Secretary Clerk	1		2
Payroll Officer/Contract Administrator	1		2
Statistician	1		2
Storekeeper	1		2
Superintendent Transportation	1		2
Trainmaster/ Master Mechanic	1		2
Operations Coordinator	1	1	4
Train Dispatcher	1	1	4
General Clerk (incl. Crews)	1	1	4
Iron Ore Train Crews	3	3	12
Supply and Employee Train Crews	1		2
Spare, Emergency Train Crew	1		2
Superintendent Track and Signals	1		2
Yard Track Foreman	1		2
Equipment Operator	3		6
Trackman	5		10
Trackman - Seasonal	5		10
Welder	1		2
Welder Helper	1		2
Mine Track Foreman	1		2
Mine-Equipment Operator	2		4
Mine-Trackman	5		10
MoW Mechanic	1		2
Signal Supervisor	1		2
Telecom Optic Technician	1		2
Telecom Radio Technician	1		2
Telecom Computer Admin	1		2
Signal Technician	2		4
General Foreman Rolling Stock	1		2
Foreman	1		2
Locomotive Mechanic	4		8
Locomotive Electrician	1		2
Car Mechanic	9	2	11
Helper Fabrication Shop	1		2
Mine Site Car Mechanic	1	1	2
Totals	**65**	**9**	**134**