TAB 3

TL 214 CONDITION ASSESSMENT AND RECOMMENDATIONS FOR UPGRADING

September 9, 2002

TRO – Engineering

SUMMARY

Transmission Line TL 214 is a 138 kV transmission line, which runs from Bottom Brook to Doyle's, a distance of 118 km. The line was constructed in 1968 and is a radial line serving Newfoundland Power Customers from Doyles to Port aux Basques and surrounding areas.

For the last number of years concerns have been expressed regarding the reliability of TL 214. The performance of a transmission line can be measured and compared by two statistics (1) delivery point and (2) equipment performance. Since this is the only line serving the area it is important to review both statistics.

Delivery point indices, System Average Interruption Duration Index and System Average Interruption Frequency Index (SAIDI and SAIFI), to Doyles and Port Aux Basques are a measure of the continuity and reliability of service to the customers. These statistics for this line are high. When compared to equivalent CEA indices, Doyles SAIFI and SAIDI of 4 and 5.34 hours is over double the CEA SAIFI of 1.7 and almost double the CEA SAIDI of 2.38 hours. TL 214 contributes a major portion of these statistics; therefore, improvements on TL 214 will improve these performance indices.

TL 214 performance is low when compared to other lines and contributes to reduced performance in the Doyles and Port Aux Basques areas served. The line has a very high transient trip out rate of 8.31 outages per 100 km/yr compared to a typical Hydro rate of 2.75 outages per 100 km/yr and the typical CEA rate of 1.15 outages per 100 km/yr for this class of line. The sustained trip out rate of 1.9 outages per 100 km/yr is better but still high compared to a typical Hydro rate of 1.08 outages per 100 km/yr and the CEA rate of 1.25 outages per 100 km/yr. The major causes of the transient trips were high winds (5.85 per 100 km/yr) and lightning (2.47 per 100 km/yr).

A condition assessment and analysis of the line recommended that four (4) areas of concerns be addressed to ensure the reliability of the line.

The four areas of concern are as follows:

1. There are four (4) locations where the combination of spans in excess of 500 m, conductor size and phase spacing create conditions that could cause conductor slapping. One of these locations has shown signs of conductor contact. The addition of structures is recommended to correct this problem.

2. There are 21 locations that have been identified with excessive wind/weight ratios. Installation of counterweights has been recommended at these locations.

3. In areas that have been identified as historically experiencing high wind, additional structures will be installed to reduce the span and to increase the wind/weight ratios. A total of 15 additional structures have been recommended.

4. The major portion of insulators on TL 214 are pre-1974 insulators manufactured by the Canadian Ohio Brass Company commonly referred to as COB. These insulators are part of the pre-1974 group that has experienced industry wide failures due to cement growth causing radial cracks in the porcelain. Complete replacement is recommended for the COB insulators on the line.

In order to carry out the above work, an alternative source of generation is required to preclude extended customer outages. Co-ordination will be made with Newfoundland Power to minimize the alternative generation requirements.

A capital budget proposal for $2,946,900.00 has been submitted for 2003-2004 to carry out the work. The planning and design will be undertaken in 2003, with the actual construction scheduled for 2004.

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1.0 Introduction

The condition assessment of transmission line TL 214 was carried out to address the issue of the number of outages that have been sustained and to review problem areas that historically have caused trouble on TL 214. Since this is the only line serving the area it is important to review its performance.

TL 214 is a 138 kV line, which was constructed in 1968, and runs from Bottom Brook to Doyles (See Figure 1.1), a distance of 118 km. TL 214 is a radial line serving the southwest coast and consequently any line outages will have a direct negative effect on the Newfoundland Power domestic and general service customers that the line services. It is also important to note that Newfoundland Power does have generation in the area at Rose Blanche and an emergency power supply from diesel and gas turbines, also serving the area.

Figure 1.1: TL 214 Location

This assessment study was conducted to determine the cause of the relatively high outage rate experienced by TL 214 and to determine what improvements could be made to reduce the various outages.

This study was carried out in a number of steps, the methodology of which is as follows;

1. Condition assessment of the full length of the transmission line.

   Discussions were held with field personnel and each tower was inspected for the condition of the structure, conductor, guys and hardware.

2. A complete design review of the line was completed.

   The plan and profile of the transmission line was reviewed with respect to conductor clearances, wind and ice loading and extreme wind areas along the line.

3. Performance Review.

   The performance of TL 214 was reviewed for the study period of 1990 to 2001. This included the number of trips, their causes, lightning performance and frequency and duration of delivery point interruptions.

4. Cost estimates for recommended solutions.

   The recommendations were then further studied and preliminary cost estimates prepared.

2.0 Transmission Line TL 214

A summary of TL 214 is provided in Table 2.1 below.

Table 2.1: TL 214 Summary

Voltage	138 kV
Year Constructed	1968
Construction (See Appendix G)	Aluminum Steel Wood
Length	118.22 km
Number of Wood Pole Structures	6
Number of Aluminum Towers	333
Number of Steel Towers	20
Total Number of Structures	359

See Appendix A: Line Routing TL 214 for a detailed location of the line.

General Routing

TL 214 generally follows the Trans-Canada Highway from Bottom Brook Terminal Station to Doyles Terminal Station. In some areas it is located up to 2 km from the TCH.

Historically, strong winds are encountered near Doyle's terminal station from structures 275 to 355. The strong prevailing easterly wind occurs in the area located just north of the Wreckhouse area. The Wreckhouse area is an area just north of Port aux Basques that is west of the Long Range Mountains where extreme wind conditions frequently occur due to the topography and the prevailing easterly wind direction.

Ten (10%) percent of the line is less than five kilometers from the coast, 32 % from five to ten kilometers from the coast and 58% is greater than ten kilometers from the coast.

While the line is generally a significant distance from the coast, there is a 22 km section of line near Bottom Brook Terminal Station (structure 100 to structure 165), which is near the coastline. In this area problems are encountered when winds blow westerly, opposite the prevailing wind direction. These winds blow in from the ocean and result in salt contamination on the line.

3.0 Conductor

In 1968, TL 214 was erected with a 266.8 kcmil, 26/7 ACSR (Aluminum Conductor Steel Re-enforced) conductor named, Partridge. A comparison of Partridge to other conductors is shown in table 3.1 below.

Table 3.1: Conductor Comparison

Conductor Size (kcmil)	**266.8**	**559.5**	**795**
Name	Partridge	Darien	Drake
Diameter (mm)	14.31	21.59	28.13
Strength (kN)	37.5	84.4	139
Weight (kg/km)	433	765	1623

As shown in Table 3.1 the 266.8 kcmil is a lightweight conductor. A light weight conductor used on long spans in a high wind area, such as TL 214, will not always supply enough self weight to prevent the insulator string from moving in towards the tower.

From the line inspection carried out, no areas of concerns were identified with the conductor. The line inspection indicates that the condition of the conductor on TL 214 is good and does not require replacement.

It is advised that in the future, if sections of the conductor are replaced, that these sections be visually inspected for fatigue, corrosion, and excessive wear.

4.0 Insulators

Canadian Ohio Brass (COB) insulators originally installed on TL 214, are presently in service on TL 214. These were manufactured prior to the early to mid nineteen seventies. It is generally accepted by other utilities across Canada, and from experiences on other lines, that over time, these COB insulators deteriorate causing an electromechanical loss.

The deterioration normally found is a loss of insulating strength, which stems from a radial fracture within the porcelain. These radial fractures produce volumetric changes resulting in cracks. This is commonly known as “cement growth”.

Temperature variations and mechanical stresses cause increased propagation of the cracks and accelerate the fracture in the porcelain. This electromechanical loss in a particular unit of a suspension string becomes serious when a number of the units in a string experience this loss of insulating value and the result is an electrical flash over.

The failure of the insulator string occurs when enough of the units contain cracks. These cracks cause the current to flow from the pin on the insulator through the crack in the cement and porcelain, and exits through the cap.

Because of this cement growth and porcelain cracking problem exists over the entire length of the line, complete insulator replacement is recommended.

5.0 Load Analysis

The original design loads for TL 214 were confirmed using a computer program, SAGTEN, a tool, which was not available at the time the line was originally designed. These loads are listed in Table 5.1 below. These design loads formed the basis of the analysis carried out on TL 214.

Table 5.1: TL 214 Original Design Load

Load	Wind	Ice	% Tension
Max Ice	0	275mm	70
Max Wind (Gust)	177 km/hr	0	50
Combined Wind & Ice	90 km/hr	137.5 mm	50
Everyday	0	0	20
Cold	0	0	33.5

Historically, major ice accumulation has not been a problem on TL 214.

The main area of concern has been and continues to be problems associated with high winds. There have been a number of outages associated with conductors touching each other and insulators swinging, due to high winds. If a heavier conductor had been used in the initial construction this problem may not be as severe.

The maximum wind value in Table 5.1 is a gust value and not a sustained wind load. The sustained wind value is obtained based on the gust value by factoring the gust value based on the physical properties of the line..

In 1982, a study was conducted by the Weather Engineering Corporation of Canada Ltd. on the Wreckhouse wind effect in the Codroy Valley and along the last 2-3 kilometers of TL 214. According to the report, a downslope wind mechanism is created by the Long Range Mountains into the Codroy Valley. The down-rushing air stream is extremely turbulent and gusty. The report concluded that, due to the amount of additional wind speed-up due to the channeling of the descending air in the tributary valleys, an extreme wind speed of 177 km/hr with gusts up to 235 km/hr would be a reasonable design value.

Given this conclusion the original design parameter of an extreme wind condition of gusts up to 177 km/hr is not adequate in this area, given the new wind data that has become available in the years since the line was built. The current design analysis was carried out using a sustained wind speed of 177 km/hr and gusts up to 235 km/hr.

The line analysis concentrated on checking the proper phase spacing and horizontal insulator swing to the supporting structure. The analysis also checked to determine if the conductor could provide enough weight to prevent the wind from moving the conductor in close to the cross-arm (wind to weight ratio).

Phase Spacing

Considering the new wind load based on wind data that is now available the phase spacing on TL 214 was analyzed. Using the current standard, CSA 22.3 “Overhead Line Design”, the maximum span length of 490 m would be allowed with the current phase spacing of 4.9 m.

There are four (4) spans on TL 214 that exceed this span length. In one of these locations, under high wind conditions, evidence of phases having made contact could be seen after an outage.

Insulator Swing

The horizontal conductor clearance to the supporting structure is reduced by insulator side swing under transverse wind pressure. Taking into consideration the revised wind load and the existing heights of the various structures, and the conductor characteristics, the insulator swing under high winds can cause the conductor to come in close contact with the structure.

In each case where the insulator swing was unacceptable, one of the following corrective steps can be taken:

1. Re-conductor line to increase self-weight of the conductor.
2. Add counter weights at the insulator to provide the needed vertical force.
3. Increase structure height or lower adjacent structures.
4. Relocate structure to lower the wind to weight ratio.
5. Use a different structure, with greater phase spacing.
6. Add a new structure between two existing structures (ie midspan) to decrease the wind to weight ratio.

In addition to these replacements, the last 2 kilometers of this line located to the north of the Wreckhouse area has historically experienced high wind conditions. Currently, structures in this section of line are heavily counterweighted. Midspan structures (10 in

total) are recommended in this section of line. The section will also be re-conductored with 266.8 kcmil due to the number of counterweights on each structure (most cases five (5) sets per structure) as counterweights in large quantities will cause wear on the existing conductor.

From the analysis there are five (5) possible improvements that can be made:

(a) Re-Conductor the entire line;

(b) There were twenty-one (21) locations where it is recommended that counterweights be added to the phase;

(c) Four (4) structures need to be changed out to increase the structure height.

(d) One (1) mid span structure needs to be installed

(e) Add ten (10) midspan structures on the last two (2) km of the line north of the Wreckhouse area.

Line Galloping

Galloping is a phenomenon where the transmission line conductors vibrate with very large amplitudes. During galloping the conductors oscillate elliptically at frequencies on the order of 1-Hz or less with vertical amplitudes of several feet.

Line Galloping on TL 214 was analyzed, taking into account the weight of iced conductor, the span length and conductor. This analysis was carried out in accordance with 1981 REA (Rural Electrification Administration) Design manual. The Engineering Standards Division of the United States Department of Agriculture publishes the REA manual. The manual is used across North America as comprehensive design guide for transmission line design. This analysis indicated that line galloping should not be a problem with the current design. The operating experience of the line confirms this.

6.0 Condition Assessment

A condition assessment of the full length of the transmission line was carried out. The scope of this assessment was;

- Assessment of the condition of guys and associated hardware;
- Assessment of the condition of tower and wood pole structures;
- Inspection of conductor;
- Inspection of dampers; and
- Inspection of Insulators.

This assessment was carried in 2001. The line remained energized during the inspection.

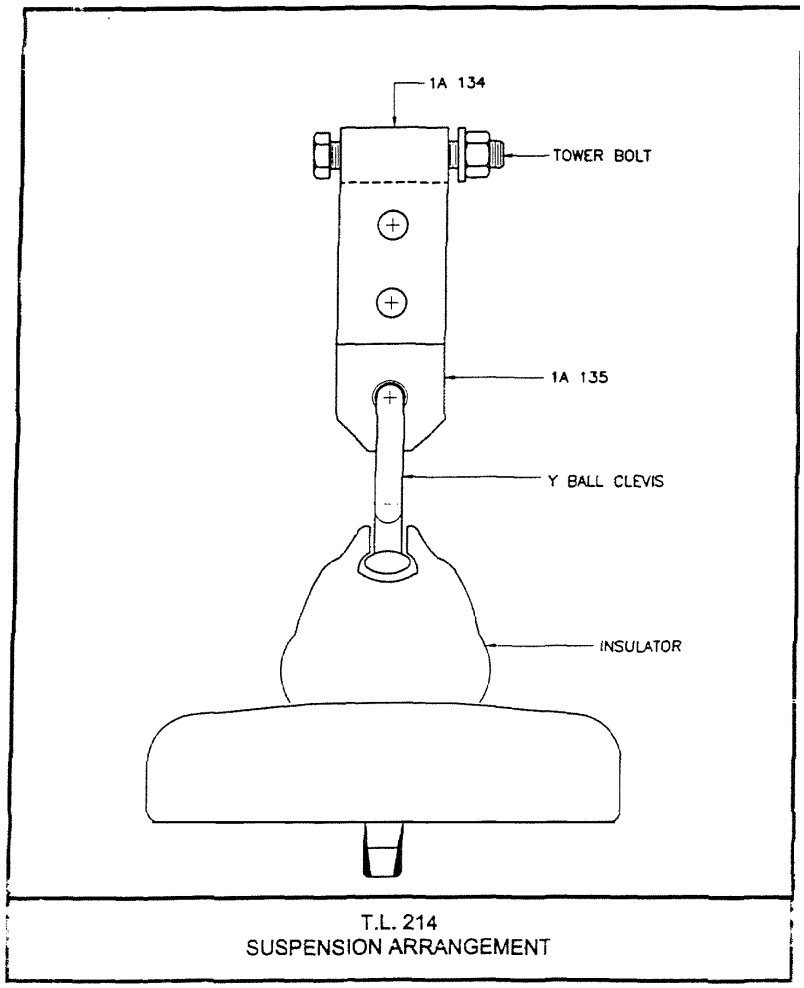
Any urgent repairs required were identified and action was taken to correct these deficiencies. All information was recorded and dated, complete with structure number and structure information. Pictures were provided where damage was recorded.

The results of the condition assessment are summarized in Appendix C.

In summary, the assessment indicated that the line is in good condition, with the one exception being the worn attachment plates (1A 135 plates), which currently are being replaced through regular maintenance in 2002.

The 1A 135 plates connect to the Y-Ball clevis, which holds the insulator string. This arrangement is connected to the tower by the connection plate (1A 134 plate), see figure 6.1. While replacing the 1A 135 plates it was found that the 1A 134 plates were also worn, which could not be determined from the initial assessment. Several locations have had the plates replaced and it is recommended that all plates identified as wearing be replaced. These plates primarily require replacement on Structures 275 to 355, which is the area identified as experiencing high wind conditions.

Figure 6.1 1A 134/135 Plates



7.0 Maintenance Records

The available maintenance records of TL 214 were also reviewed. A summary of these records is provided in Table 7.1 below. Detailed maintenance records are provided in Appendix E.

The maintenance records show that the majority of the maintenance problems are due to dampers, conductor, and insulators. These are indicators that the original design is not suitable for the environmental conditions under which the line is operating. The new design criteria will address these problems.

As well the maintenance records indicate that insulator problems may be an increasing area of concern of TL 214. In each insulator replacement occurrence COB insulators were replaced with NGK or Sediver insulators.

Table 7.1: TL 214 Maintenance Summary 1999 – 2001

Maintenance Performed	Frequency
Damper Replacement	14
Conductor Repairs	27
Insulator Replacement	61
Replaced 1A135 Plates	11
Suspension Clamp Replacement	5
Guy Repairs	13
Tower Repairs	10
Replace Ground Link	1
Emergency Repair	2

8.0 Performance Review

The performance of TL214 was reviewed for the study period of 1990 to 2001, which can be compared to the CEA reporting period of 1995 to 1999. This included the number of trips and their causes. In addition, lightning activity along the line was reviewed from August 1998 to February 2002, using the FALLS lightning detection system that was not in service prior to 1998.

Outage Causes/Trip-Out Rates

In the last 12 years (1990 to 2001) as shown in Table 8.1 below, there have been 145 outages on TL214. Of this total, 118 were transient and 27 were sustained (outages more than one minute duration). The reclosing rate for the line is 81% for this time period. In calculating outage rates per 100km/yr, two values were calculated. The transient outage rate per 100km /yr was 8.31 and sustained was 1.90 (for this time period). Both of these numbers are above the CEA statistics for the reporting period 1995 to 1999. The CEA values were 1.15 per 100 km/yr for transient and 1.25 per 100 km/yr for sustained. TL214 rates for the period from 1995 to 1999 were 4.74 per 100 km/yr for transient and 1.01 per 100 km/yr for sustained, see Table 8.2 below. The transient rate is significantly above the level of the CEA statistics but the sustained is below.

TL 214 also has a low performance compared to Hydro's transient and sustained rates of 2.75 and 1.08 per 100km/yr, respectively, for the 1995 to 1999 period, for this class of line. It is also a high outage rate when compared to other similar Hydro lines for this period, such as TL 250 with transient and sustained rates of 2.60 and 0.16 per 100 km/year; and TL 241 with rates of 2.37 and 0.91 per 100 km/year, respectively.

Please refer to the following tables, which show the cause of outage per year, number of momentary (transient) and sustained outages, and other information on TL214 outages.

Table 8.1 - TL214 Outage Causes 1990 to 2001

Outage Causes 1999-2001		
Cause of Outage	Number of Outages	Trip-Out Rate per 100km/yr
Lightning	35	2.47
Salt Contamination	11	0.78
Ice Build-up	2	0.14
Line Contact	1	0.07
High Winds	83	5.85
Malfunctioned Equipment	13	0.92
Total Outages	145	10.22
Total Transient Outages	118	8.31
Total Sustained Outages	27	1.90

Table 8.2 - TL214 Outage Causes 1995 to 1999 for CEA Comparison

Cause of Outage	Outage Causes 1995-1999 Number of Outages	Trip-Out Rate per 100km/yr	CEA Statistics
Lightning	16	2.71	
Salt Contamination	0		
Ice Build-up	0		
Line Contact	0		
High Winds	18	3.04	
Defective Equipment	0		
Total Outages	34	5.75	2.40
Total Transient Outages	28	4.74	1.15
Total Sustained Outages	6	1.01	1.25

In reviewing Table 8.1, on fault causes, it shows high winds as the largest fault cause at 83 or 57% of all outages on TL214. For some trips recorded as caused by high winds, it is possible that salt contamination may have played a factor, as high winds were prevalent and may have resulted in salt deposits on insulators, which resulted in flashovers. For cases where salt contamination resulted due to high winds, salt contamination was recorded as the cause. If salt contamination was suspected but high winds were prevalent, high winds was recorded as the cause. Salt contamination has been identified as causing 11 faults on TL214.

For the 1990-2001 period, the trip-out rate per 100 km/yr was 5.8 for high winds; 2.4 for lightning; 0.92 for defective equipment; and 0.77 for salt contamination. With high winds and lightning being the main contributor to the high transient outage rate.

On TL214, there have been three permanent faults since 1990, which were sustained outages of a long duration caused by a physical problem on the line. These are as follows:

- Two were caused by tower problems resulting from external damage
- One resulted from a broken jumper on the line

The three permanent faults along with failed recloses contribute to the sustained outage rate.

It is also important to note that the transient rate is increased substantially by one windstorm in 2001, resulting in 50 transient outages. At the time it was decided to continue to operate the line with reclosing during storms. The line could have been removed from service, which would have significantly lowered the transient rate and marginally increased the sustained rate. In reviewing Table 8.3 and 8.4, the 50 high winds faults during this one storm had a reclosing rate of 96%. This number is very significant to the statistics and depending on how this one occurrence evolved, the transient outage rate could have been significantly different, almost half. If the line had been left out of service after the initial recloses or faults, the transient rate would be significantly lower and a single sustained outage recorded with a marginal increase in the sustained outage rate. However, leaving the line out of service would not be acceptable to the customers serviced by the line.

Table 8.3 – TL 214 Fault Information from 1990 to 2001

Year	Lightning	Salt Contamination	Ice Buildup	Line Contact	High Winds	Defective Equipment
1990	12		2			
1991	1			1	6	2
1992	5				1	
1993						9
1994					4	1
1995						
1996	2				1	
1997	6					
1998	3				9	
1999	5				8	
2000	1	11			4	1
2001					50	
Totals	35	11	2	1	83	13

Notes: 1991 - Defective Equipment due to problems at Doyles
1993 - Defective Equipment caused by Tower twisting due to guy failure (Str # 314)
1994 - Defective Equipment caused by Tower damage caused by Ice in river
2000 - Defective Equipment - Jumper Failed (Str# 342)
2000 - Lightning - One set of Insulators and breaker problem
2001 – High Winds - One storm over 9 hour period

Table 8.4 - TL214 Performance from 1990 to 2001

	Total Faults	Momentary	Sustained	Reclosing Rate
1990	14	12	2	86%
1991	10	4	6	40%
1992	6	4	2	67%
1993	9	8	1	89%
1994	5	2	3	40%
1995	0			
1996	3	2	1	67%
1997	6	5	1	83%
1998	12	8	4	67%
1999	13	13		100%
2000	17	12	5	71%
2001	50	48	2	96%
Totals	145	118	27	81%

Of the 27 sustained outages three (3) were permanents faults on the line.

Delivery Point Indices

TL 214 serves two delivery points, Codroy (Doyles) and Port Aux Basques. Although the line is rated at 138 kV, the delivery point indices are based on 66 kV voltage class since Codroy and Port aux Basques are supplied at 66 kV. Performance indices for sustained outages to these delivery points and are shown in Table 8.5 below.

The TL 214 numbers in the table are an indication of the sustained interruption frequency and duration in hours for these delivery points which were attributed to faults on TL 214, particularly for the Codroy (Doyles) indices. The Port aux Basques SAIDI is smaller than the TL 214 number for the 1997 to 2001 period because local generation was available to supply this delivery point for some of the outages on TL 214.

Table 8.5: Delivery Point Indices (Sustained Outages)

Delivery Point	1997 to 2001 SAIFI	1997 to 2001 SAIDI	1993 to 2001 SAIFI	1993 to 2001 SAIDI
TL214*	2.40	4.41	1.78	4.10
Codroy (Doyles)	4.00	5.34	3.40	6.03
Port Aux Basques	5.00	3.00	4.10	4.16
Hydro Voltage Class 1 All 66 kV Points	4.73	3.09	4.35	4.46
	1996 to 2000 SAIFI	1996 to 2000 SAIDI		
CEA Voltage Class 1 All 66 kV Points	1.70	2.38		

* Delivery Point Codroy (Doyles) statistics calculated to indicate the proportion of the Doyles Delivery Point statistics that were caused by TL214 outage caused by faults.

SAIFI – System Average Interruption Frequency Index for sustained delivery point interruptions

SAIDI – System Average Interruption Duration Index in hours for sustained delivery point outages

Over half the SAIFI (2.4) and over 80% of the SAIDI (4.41 hours) to Codroy (Doyles) were caused by the loss of TL 214 for the 1997 to 2001 period. The indices are well above the CEA average, with the TL 214 contributions alone being higher than the CEA average. The indices are closer to the Hydro class 1 indices. The Codroy SAIDI of 5.34 hours is still significantly higher than the Hydro SAIDI of 3.09 hours.

TL 214 contributes significantly to the Codroy (Doyles) and Port aux Basques delivery point indices, which are high. Improvements to TL 214 performance will directly impact these indices and improve these statistics.

Lightning Performance and Analysis

There have been 35 faults on TL214 caused by lightning from 1990 to 2001. This corresponds to 25% of all faults on the line and is the second largest fault cause. The reclosing rate for these lightning caused faults is 86%. Therefore, most lightning strikes reclosed and only resulted in a transient outage to the customers. There has been only one sustained outage caused by lightning, which resulted in insulator damage. During this outage, there were problems with the breaker on TL214 at Bottom Brook. This extended the outage due to problems in finding the breaker problem. This occurred on June 28, 2000.

The TL 214 lightning trip out rate for the 1990 to 2001 period was 2.47 per 100 km/yr and for the 1995 to 1999 period was 2.71 per 100 km/yr. This compares to the 1995-1999 trip out rate for TL 250 of 2.43 per 100 km/yr. This line is a 138 kV line from Bottom Brook station to Burgeo built in 1987 and is in the same geographical area as TL 214. These lightning trip out rates are high in comparison to some other 138 kV lines for the same period, such as TL 241 (Northern Peninsula) with 2.0 per 100 km/yr, and TL 219 (Burin Peninsula) with 1.68 per 100 km/yr. However, TL 214 rates are consistent for a line with no overhead ground wire lightning protection and for ground flash densities of 0.1 to 0.15 flashes/km^2/yr, expected in that area.

The lightning patterns were studied using the FALLS lightning detection system. This system has only been in service since 1998. The line experienced six trips due to lightning during this period. Using a buffer zone around the line it can be estimated how many lightning strikes were close to the line but did not cause a trip. A 250-meter zone (125 meters on each side of the line) shows 17 strikes, while a 500-meter shows 32 strikes these strikes were distributed along the line with no areas of high activity noted.

Also the location of the five strikes causing trips were located as follows:

- Two strikes, June 28, 2000 & July 23, 1999 – hit 47 km from Bottom Brook

- One strike on August 19, 1999 – hit 77 km from Bottom Brook

- Two strikes, both on August 7, 1999 – hit 90 km from Bottom Brook

From the limited lightning location data significant lightning performance improvement would require application along the entire line. The application of arrestors or overhead wire with the grounding improvements required would be an expensive proposition. Also, the application and installation would be very difficult, if at all practical, and would pose some design challenges for the high wind areas. While arrestors or overhead ground wire would decrease the number of lightning related outages they would also increase the number of wind related outages.

At this time, it is recommended to continue to collect the lightning location data and review annually to attempt to identify any areas of high lightning activity and low performance, which may be assessed for possible future line improvements.

9.0 Problem Summary

From the line analysis and the detailed field assessment, the main areas of concern and potential solutions have been identified as:

1. Four locations phase spacing
    a) Re-conductor entire line
    b) Replace Str No. 155-156 with steel tower
    c) Replace Str No. 174-175 with steel tower
    d) Replace Str No. 188-189 with steel tower
    e) Replace Str No. 198-199 with steel tower
    f) Install midspan steel tower

2. Excessive Insulator Swing

    a) Reconductor entire line

    b) Install Counterweights: 8, 10,74, 102, 164, 157, 190, 193, 217, 234, 235, 239, 242, 243, 255, 266, 273, 314-1, 316-1, 317, 317-1(Total = 21)

    c) Increase Structure Height: 314-1, 316-1, 317, 317-1 (Total = 4)

    d) Install Mid Span Structures: 313-1, 343-355 (Total = 11)

3. Replace Aging Insulators: Along Entire Line

4. Lightning performance

10.0 Recommendations

Based on the foregoing information and accompanying analysis of TL 214, several solutions have been proposed to improve the performance of TL 214 and are discussed below.

10.1 Re-Conductor Line

It is not recommended that the line be re-conductored. If the line were to be re-conductored 559.5 kcmil would be the required replacement, at the minimum. Material costs for the conductor and associated hardware would be $1,500,000.00 and the installation cost would be $825,000.00.

The total cost of re-conductoring the line is $2,325,000.00.

The same benefits from re-conductoring the line can be achieved though targeting problem areas. Options such as installing steel towers, adding mid-span structures and counterweights, and the replacement of some existing structures will achieve the same benefit at a much lower cost.

As well, considering the existing conductor is in good condition re-conductoring is not recommended.

10.2 Installation of Additional Towers

There are four (4) span lengths on TL 214 which have been identified as not meeting the Canadian Standards Association (CSA) standards for minimum phase spacing. In only one of the identified locations can the installation of a midspan structure correct the problem. In the other locations, various structure alternatives were reviewed. From the preliminary work carried out to date, the only tower that will provide the required ground clearance and phase spacing at all three locations is the 230 kV, DD tower. During the detailed design stage of the proposed work, this tower selection will be refined to ensure that the least cost tower will be utilized for the remaining areas. Seven (7) additional towers will be required.

10.3 Excessive Insulator Swing

In the locations that were identified as having excessive swing it is recommended that:

(a) in twenty-one(21) locations additional weight be added to the phase using counterweights;

(b) four structures be replaced to increase the structure height; and

(c) one mid span structure be installed.

10.4 Upgrade of Section from Str 343 - 355

Historically, the section of line from Structures 343 to 355 (the last 2 kilometers near Doyles) has experienced high wind conditions. This is evident by the number of counterweights installed in this section.

Midspan structures (10 are estimated in total) will be required in this section of line and the section will require reconductoring with 266.8 kcmil. Combined with the five structures that are required for excessive insulator swing, 15 new structures will be required.

10.5 Re-Insulation

The majority of the insulators on the line are standard profile COB type insulators and are approximately 34 years old and it is evident from the maintenance records that the failure rate is increasing. In the sections identified as having salt contamination problems, extended leakage insulators (commonly known as fog units) will be used.

10.6 Lightning Protection

Once the insulators have been replaced, the lightning performance on TL 214 will be further studied to determine the requirement for additional lightning protection on the upgraded line.

11.0 Alternative Power Supply

All of the upgrading, outlined in the previous sections, require an outage be taken on TL 214. As TL 214 is a radial line, an alternative power source is required. A detailed analysis of alternative generation is provided in appendix F.

Alternative generation will involve rental of generation equipment and the purchase of required fuel along with the coordinated use of Newfoundland Power generation equipment in this area. The details of this co-ordination will be finalized during the detailed project design.

12.0 Cost Estimate

12.1 Installation of Additional Towers

Based on the analysis of TL 214, seven (7) additional structures are required. At two of the spans identified four, steel DD towers are required. For estimating purposes, the estimate is based on using DD towers.

Table 12.1 – Steel Tower Cost

Type	Qty	Cost Material	Cost Installation	
4-0	2	$39,596	$37,600	
4-5	2	$40,459	$37,800	
4-10	3	$41,594	$38,200	
TOTAL		$284,757	$265,400	$550,157

12.2 Installation of Counterweights

Twenty-one (21) structures on TL 214 require counterweight installation. The cost of counterweights is as follows:

Material	$17,000.00
Installation	$63,000.00
Total	$80,000.00

12.3 Installation of Additional H-Frame Structures

Based on the current analysis of TL 214, 15 structures would be required to correct excessive insulator swing.

For estimating purposes, an H-Frame structure utilizing a seventy-five (75) foot high structure was assumed for these structures. The quantity and height is the result of a review of the plan and profile.

Table 12.2 – H- Frame Structure Cost

Material Description	Material Cost	Construction Cost	Total Direct Cost
15 Mid Span Structures	$6000.00 (each)	$9,500.00 (each)	$292,500.00
6000 m Conductor	$16,500.00	$14,000.00	$ 30,500.00
TOTAL COST			$323,000.00

12.4 Insulator Replacement

In total, there are approximately 10,000 insulators on TL 214. These insulators are 15,000 lb glass units. To replace these insulators, the cost is as follows:

Table 12.3 – Insulator Replacement Cost

Type of Insulators	Qty	Unit Price	Material Cost	Labour	Total Cost
Standard	7738	$24.43	$189,039.34	$207,378.40	$396,417.74
FOG	2262	$34.31	$77,609.22	$60,621.60	$138,230.82
					TOTAL: $534,648.56

12.5 Alternative Power Supply

All solutions will result in additional cost for power generation while TL 214 is out of service.

The estimated cost of alternative power is $ 754,258.00.

It should be noted that the cost of the rental is fixed, but the cost of the fuel will vary depending on the generation available. For this study, it is considered prudent to assume that generation would be required. It is estimated that the recommended work could be completed in a one-month period, with sufficient pre-outage preparation by the contractor (i.e. distribution of material, installation of foundations and assembly of towers).

As previously stated, alternative generation will involve rental of equipment and the purchase of required fuel. An attempt to mitigate costs through the co-ordination of the outage with Newfoundland Power to reduce the amount of alternative generation required will be made.

See Appendix F for Cost of Alternative Power Supply.

12.6 Summary of Costs

The total cost of Upgrading TL 214 is budgeted as follows:

Description	Cost
Material Supply	$730,000.00
Labour	$740,000.00
Alternative Generation	$745,258.00
Engineering	$83,242.00
Environment	$70,000.00
Internal Construction	$40,000.00
Land & Survey	$10,000.00
Project Management	$80,000.00
Inspection and Commissioning	$20,000.00
Corporate Overhead, AFUDC, Escalation and Contingency	$428,400.00
Total	$2,946,900.00

13.0 Recommendations and Conclusion

The condition assessment and maintenance review did identify several areas that were of particular concern. Insulators were identified as the hardware causing the majority of material problems. The outage history indicates that salt contamination, high winds, and lightning are the major problem areas affected by outside physical forces.

In order to reduce the number of outages, the following recommendations should be carried out:

1) Installation of seven (7) CAC DD Towers at an estimated direct cost of $550,157.00;

2) Installation of counterweights on 21 structures at an estimated direct cost of $80,000.00;

3) Installation of 15 H-frame 138 kV wood pole structures at an estimated direct cost of $323,000.00; and

4) Total insulator replacement at an estimated direct cost of $534,649.00.

All recommendations will require alternative sources of generation, which is estimated as $754,258.00. Rental costs of the units are fixed but as previously discussed coordinating construction with existing generation may mitigate fuel costs.

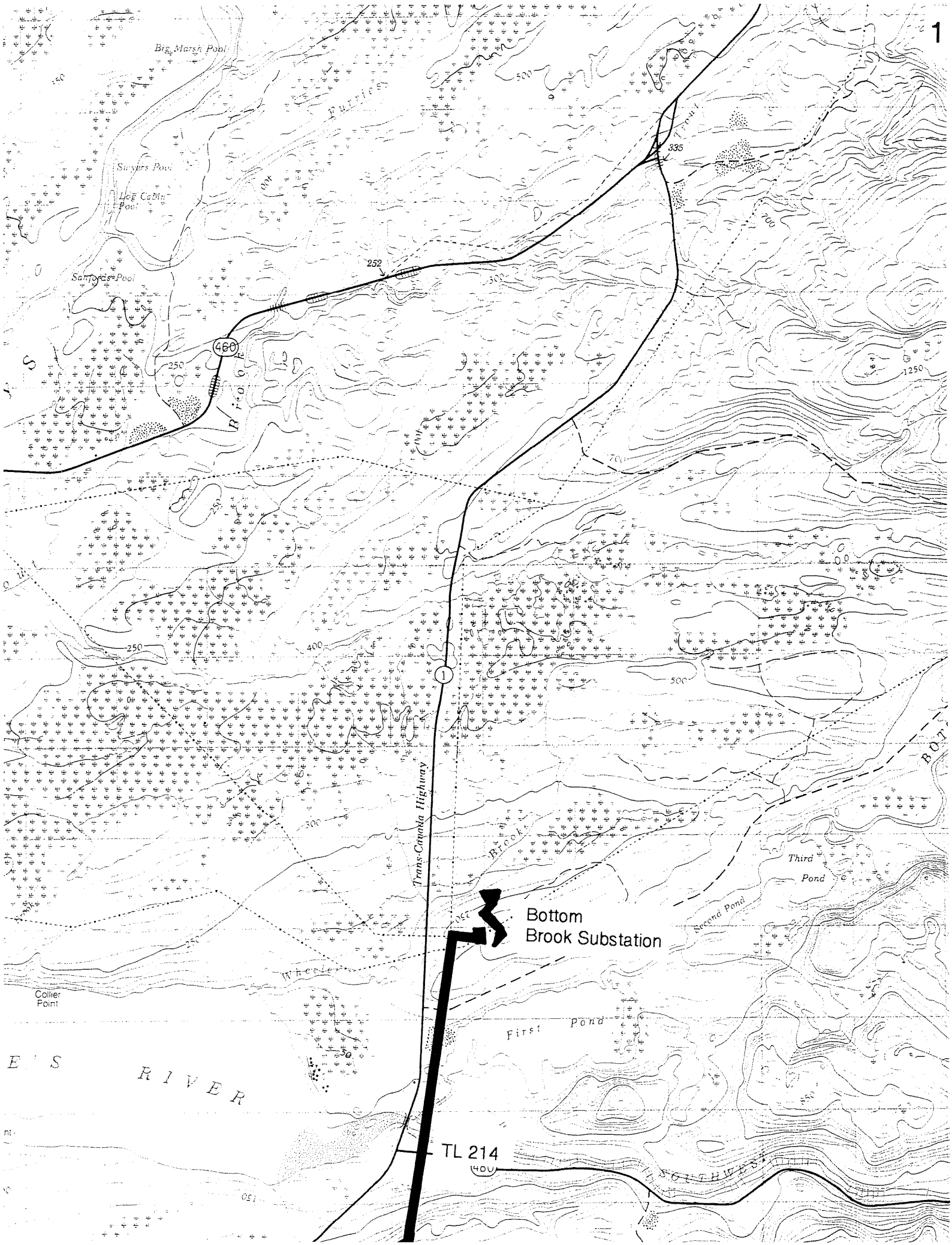
The total cost of the upgrading recommendation is $2,946,900.00.

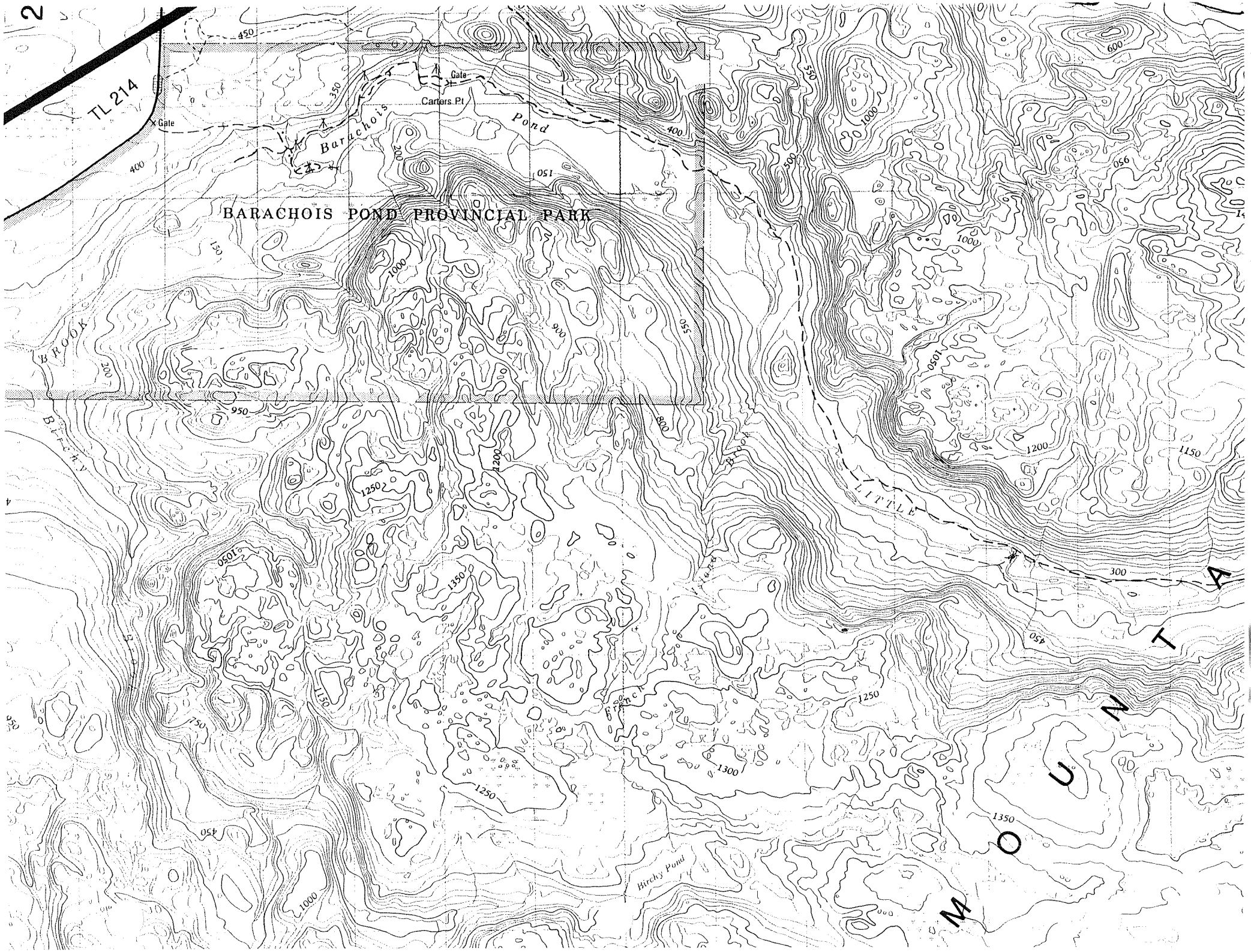
Improvements that mitigate the wind-related problems should have the most effect on performance improvement. However, aging insulators, if not replaced, will become the largest cause of outages.

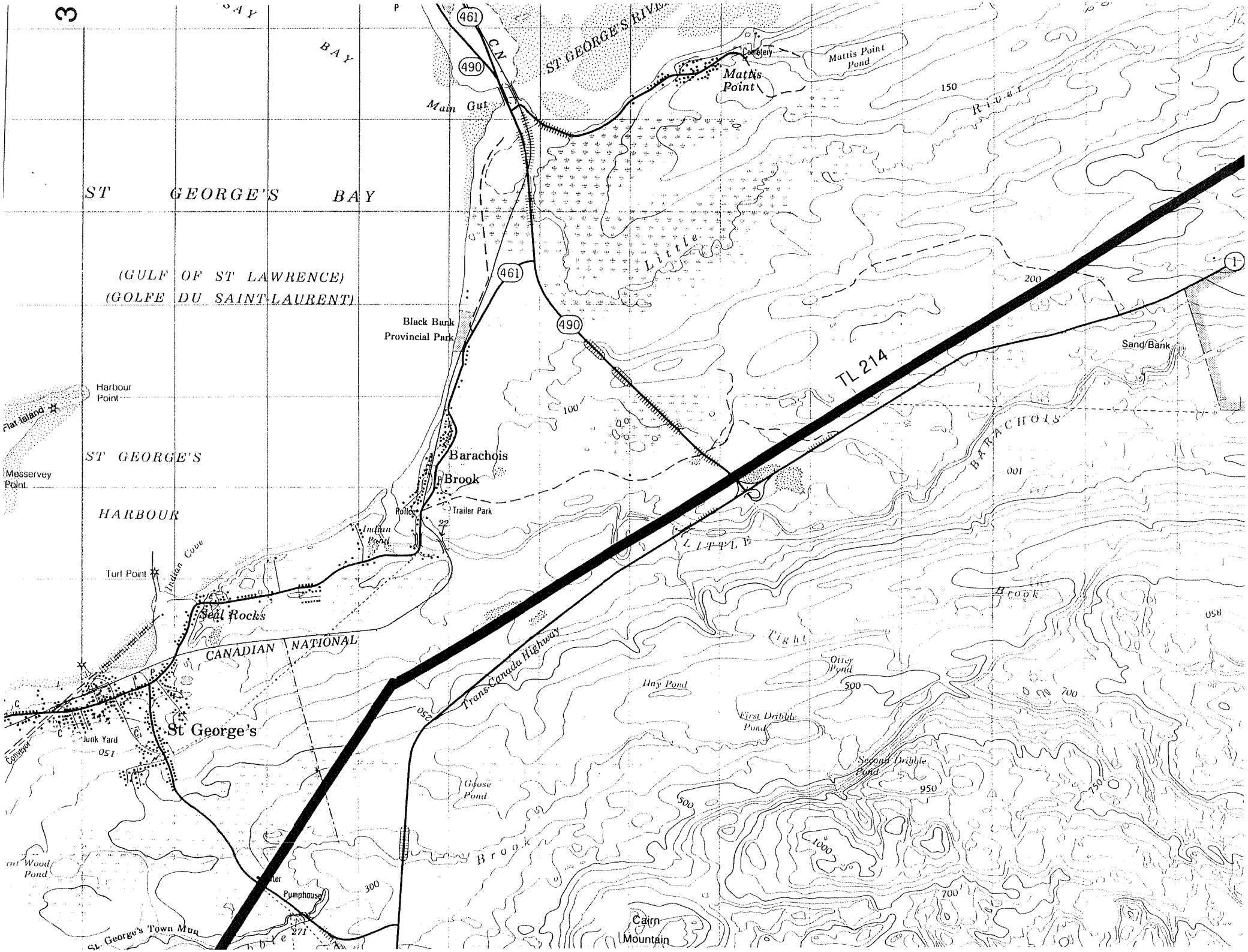
Further monitoring of the line to assess lightning related outages should be continued to determine if further upgrading for lightning protection would be required.

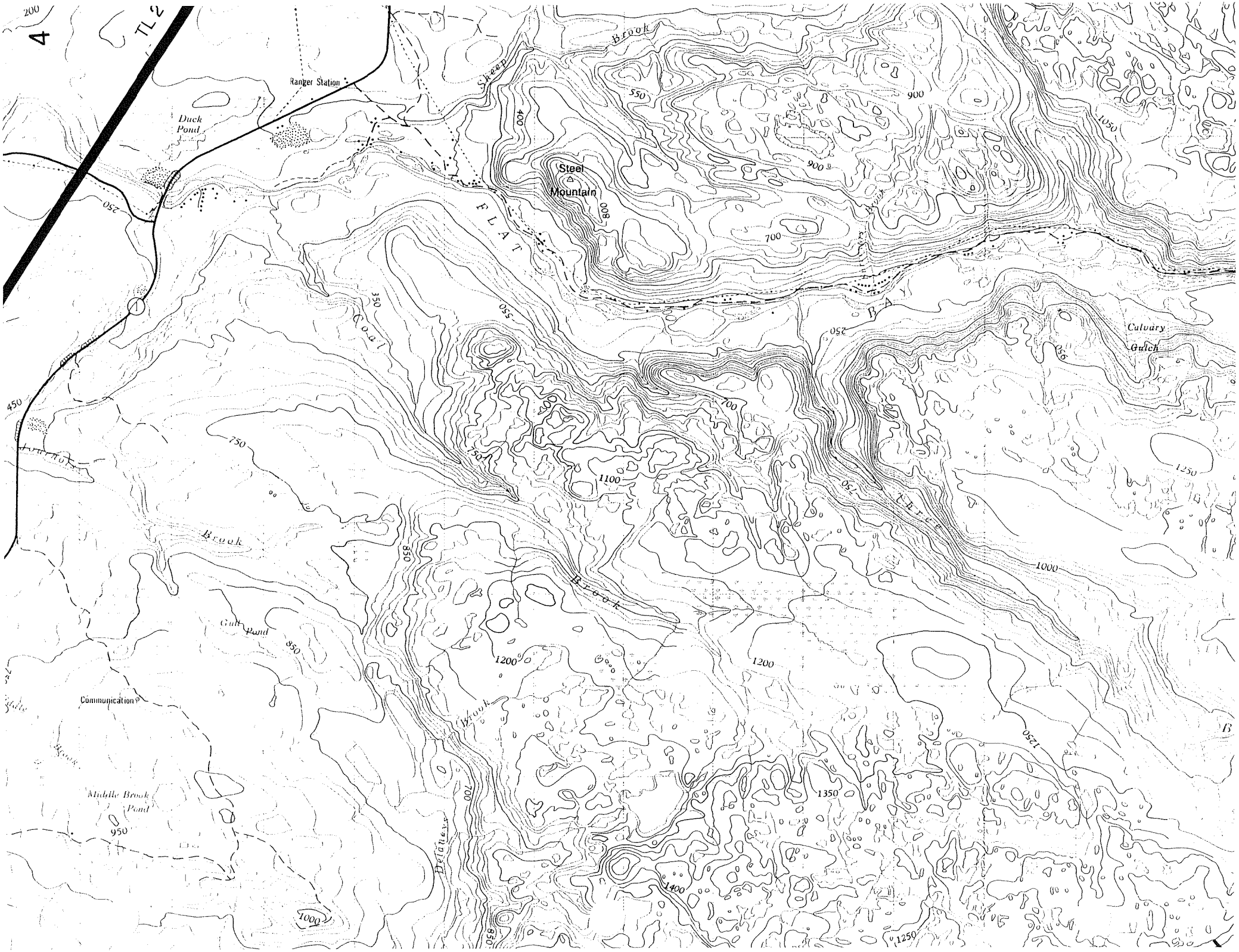
Four recommendations have been suggested to mitigate the outages on TL 214; installation of steel towers, installation of counterweights, installation of midspan structures, and insulator replacement.

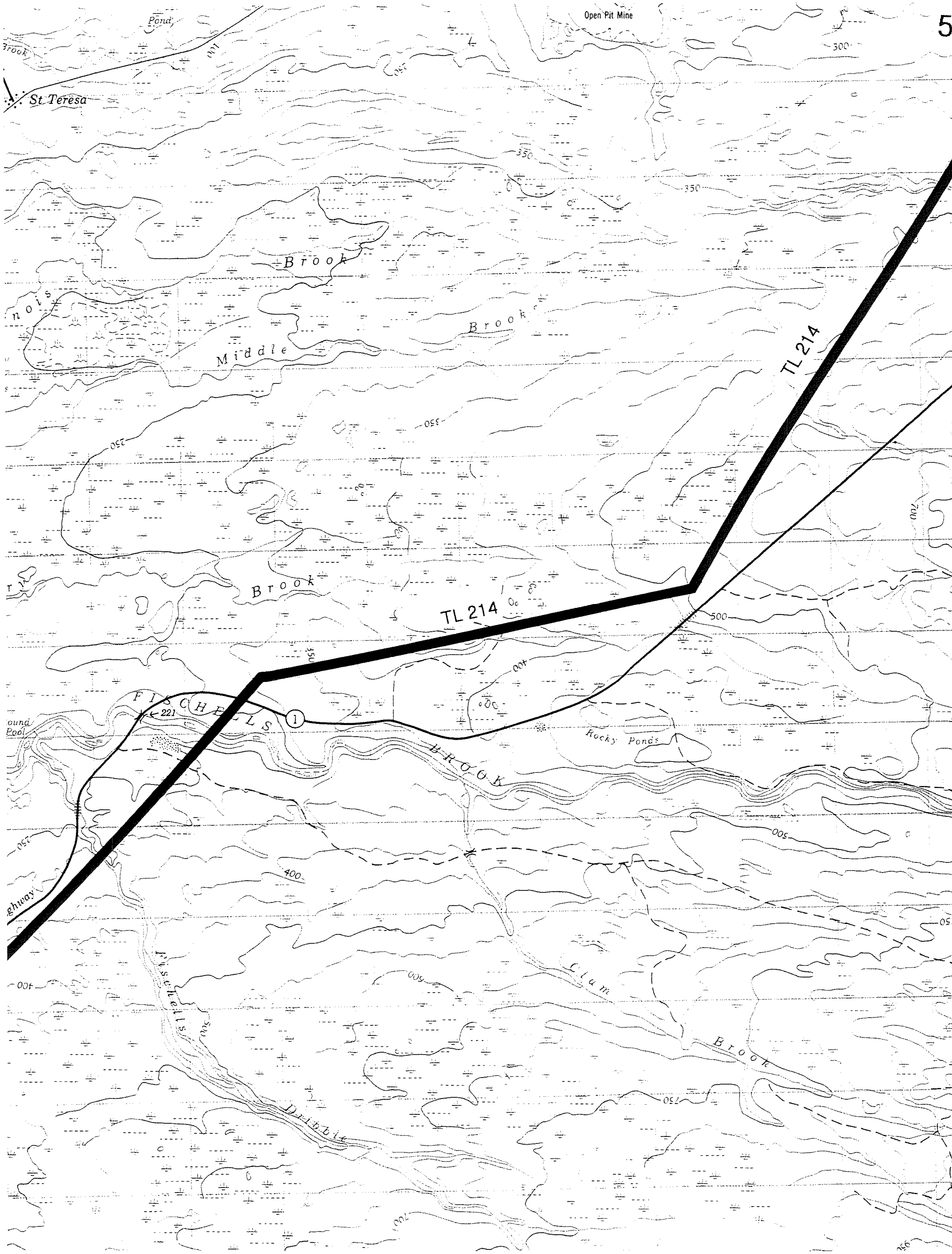
APPENDIX A
TL 214 LINE ROUTING


Big Marsh Pool
Surgers Pool
Log Cabin Pool
Sampsons Pool
Furrier
Trout
335
252
460
Trans-Canada Highway
Bottom Brook Substation
Third Pond
Second Pond
First Pond
Collier Point
Wheeler
TL 214
SOUTHWEST
RIVER

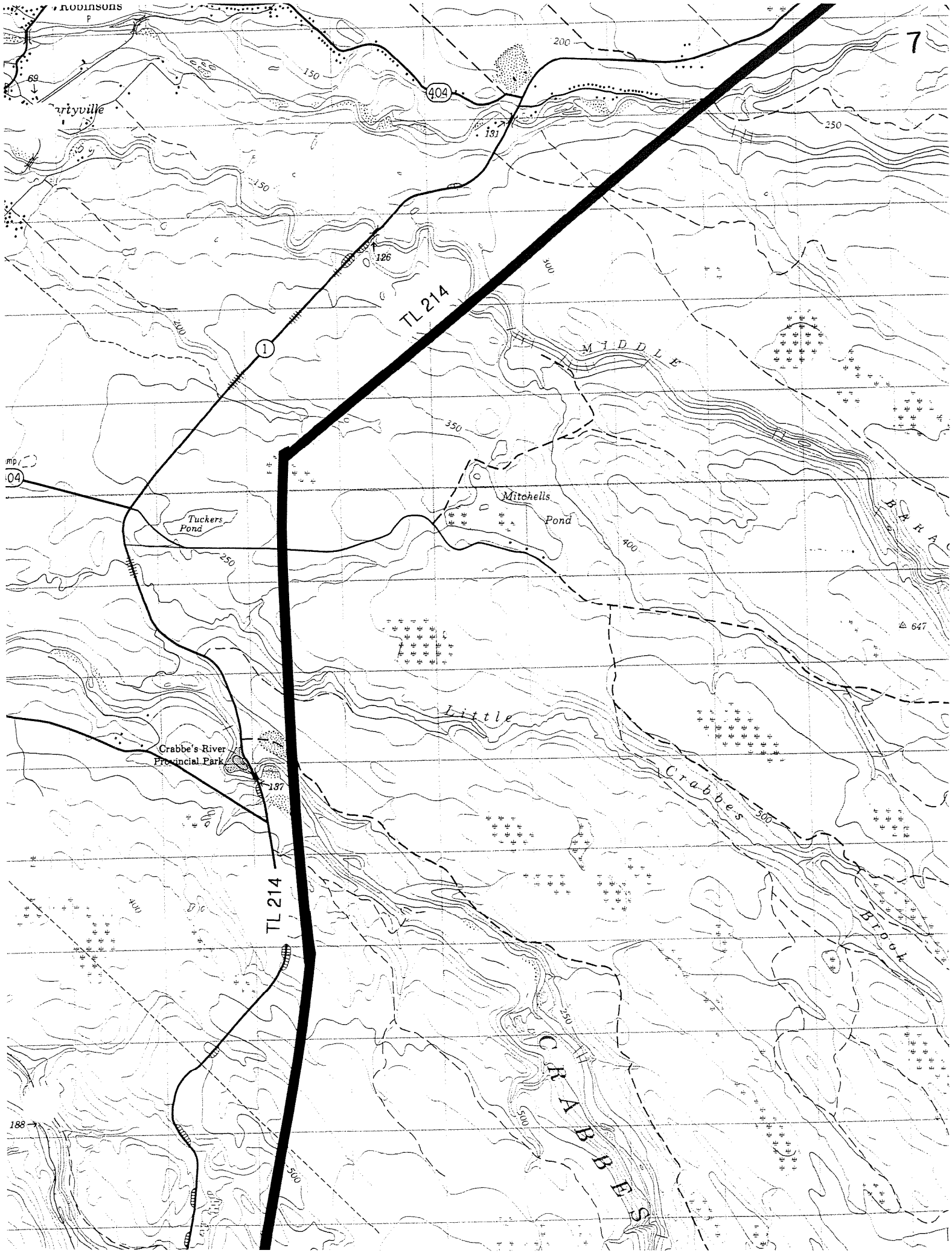

TL 214
Gate
Carters Pt
Barachois Pond
BARACHOIS POND PROVINCIAL PARK
BROOK
LITTLE
MOUNTAIN
Birchy Pond

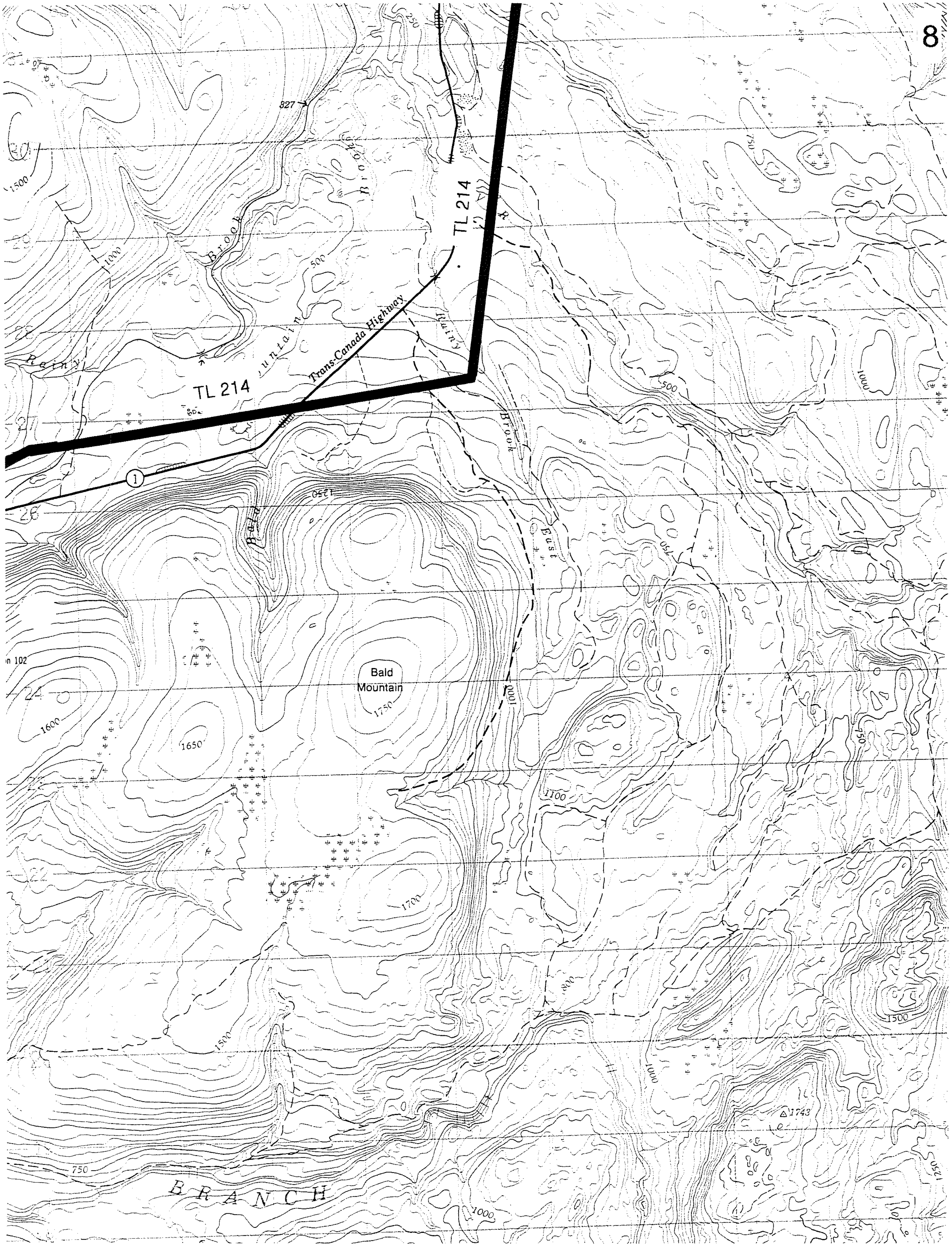

3
ST GEORGE'S BAY
(GULF OF ST LAWRENCE)
(GOLFE DU SAINT-LAURENT)
ST GEORGE'S HARBOUR
ST GEORGE'S RIVER
Main Gut
Mattis Point
Mattis Point Pond
Cemetery
Little River
Black Bank Provincial Park
Harbour Point
Flat Island
Messervey Point
Barachois Brook
Police
Trailer Park
Indian Pond
Indian Cove
Turf Point
Seal Rocks
CANADIAN NATIONAL
Trans-Canada Highway
TL 214
Sand Bank
BARACHOIS
LITTLE
Brook
Tight
Otter Pond
Hay Pond
First Dribble Pond
Second Dribble Pond
Goose Pond
St George's
Junk Yard
Conveyor
Pumphouse
Cairn Mountain
St. George's Town Mun
461
490
CN
100
150
200
300
500
700
750
950
1000

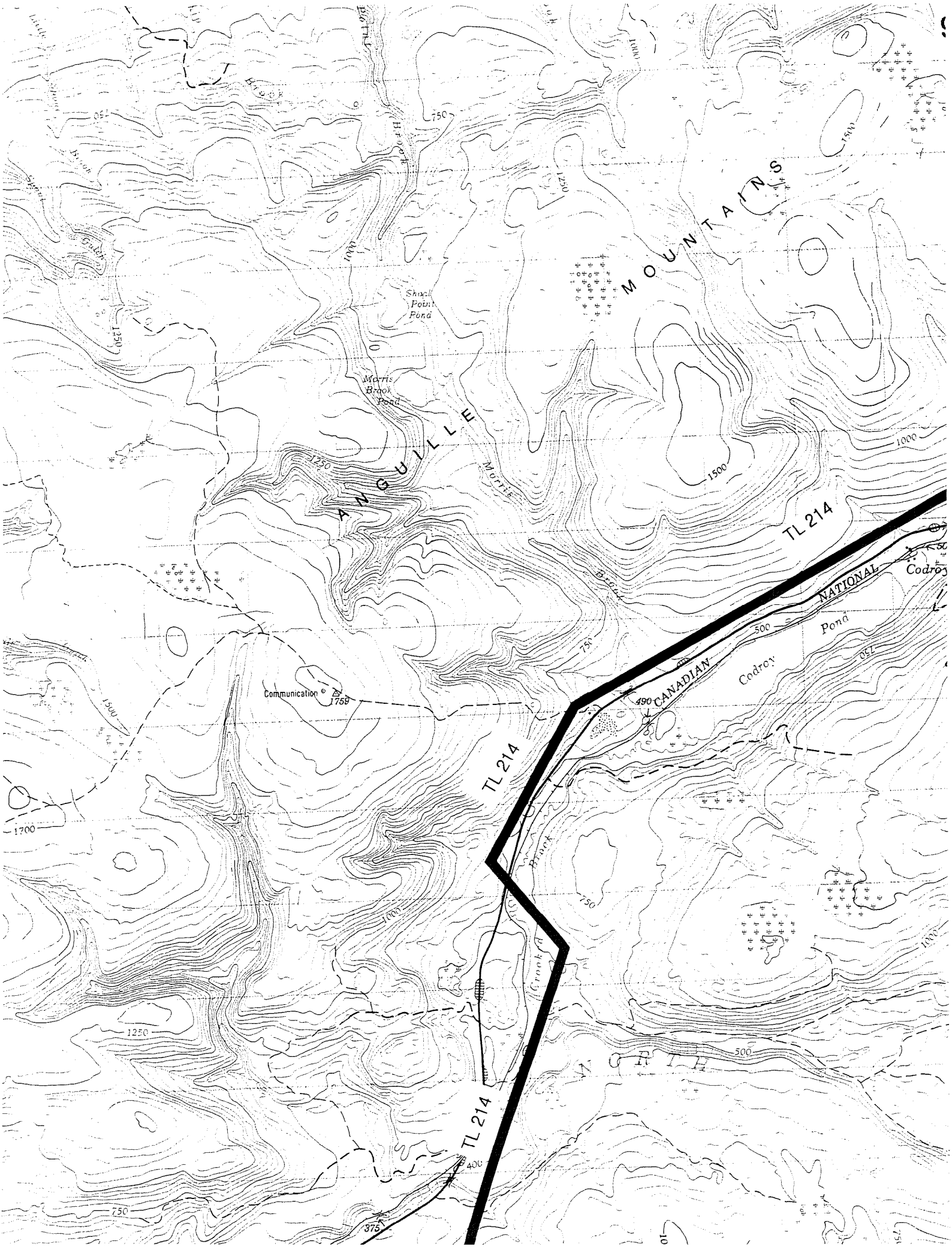

TL 2
Ranger Station
Duck Pond
Sheep Brook
Steel Mountain
FLAT
Brook
Calvary Gulch
Brook
Brook
Gull Pond
Communication
Middle Brook Pond
Brook
Brook
Brook
Brook
Delaney
200
250
350
400
450
550
700
750
800
850
900
950
1000
1050
1100
1200
1250
1350
1400

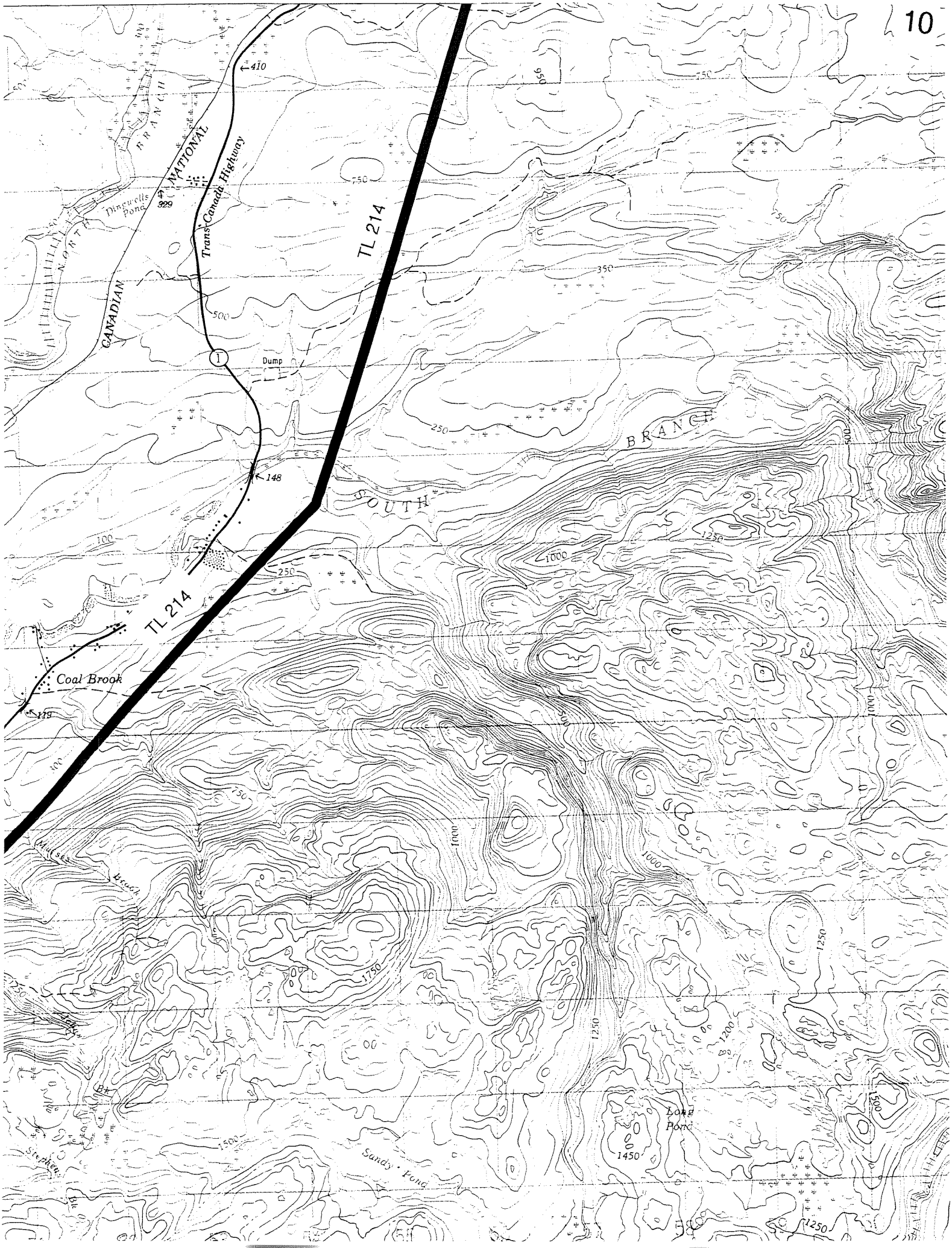

Open Pit Mine
Pond
Brook
St Teresa
Brook
Middle
Brook
TL 214
TL 214
Brook
FISCHELLS
BROOK
221
Rocky Ponds
Pool
ghway
Fischells
Clam
Brook
Dribble
350
300
250
400
500
600
700
750

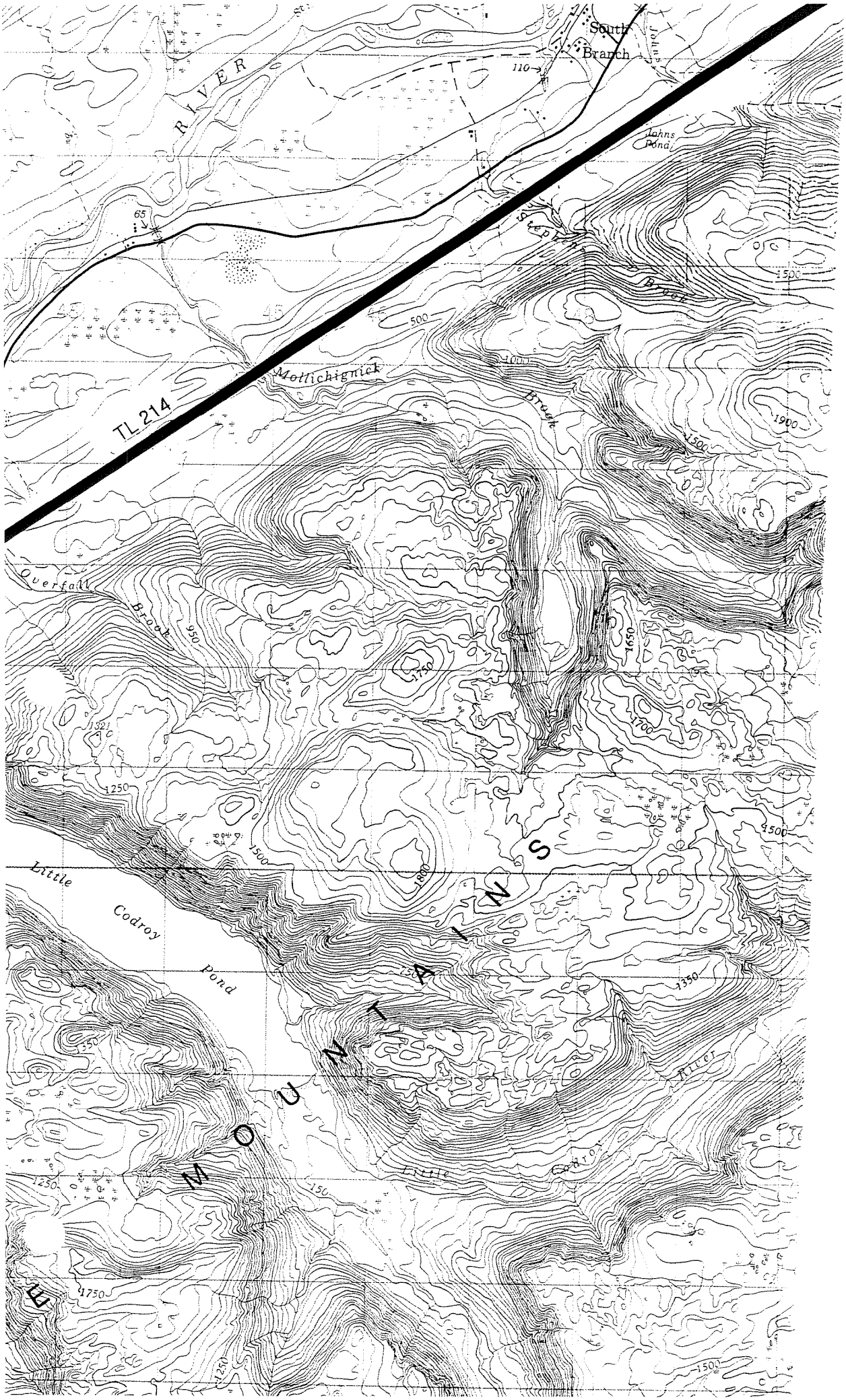

Bank Head Cove
Bank Head
Uncle Joes Pond
Journois
168
50
NATIONAL
150
Fischells
50
Berry Head
CANADIAN
200
150
Brook
Rattling
50
Seal
Brook
Heatherton
Red Bk
404
150
435
400

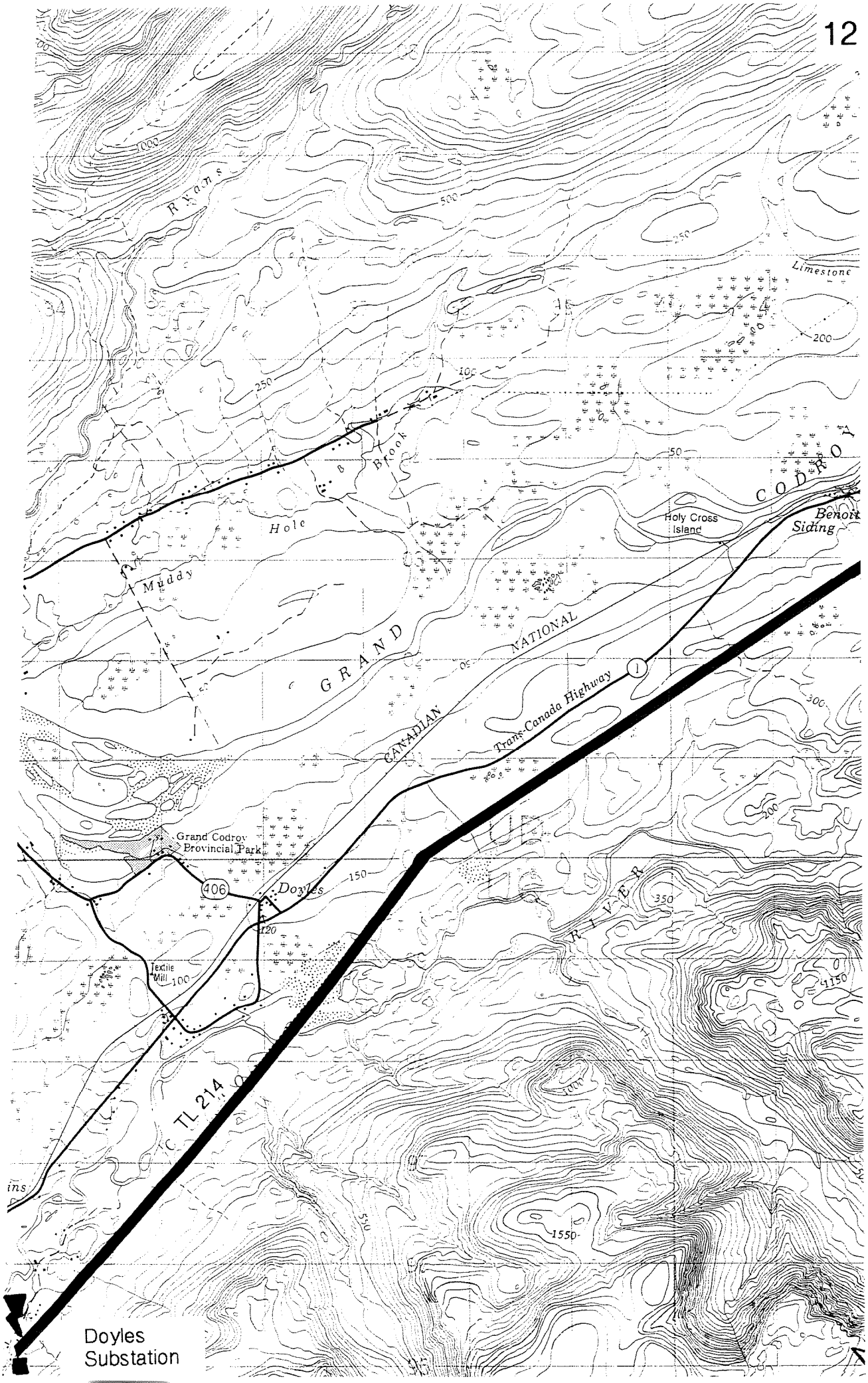

7
Robinsons
Tartyville
404
TL 214
1
MIDDLE
Mitchells
Pond
Tuckers
Pond
Crabbe's River
Provincial Park
Little
Crabbes
Brook
CRABBES
647
126
131
137
188


TL 214
TL 214
Trans-Canada Highway
Bald Mountain
1750
1700
1650
1600
1500
1000
750
500
1100
1300
Δ1743
Rainy
Brook
Bald
East
Brook
BRANCH
327


MOUNTAINS
ANGULLE
TL 214
TL 214
TL 214
NATIONAL
CANADIAN
Codroy
Pond
Codroy
Shoal Point Pond
Morris Brook Pond
Morris
Brook
Communication
1759
490
500
750
1000
1250
1500
1700
400
375


TL 214
TL 214
Trans-Canada Highway
NATIONAL
CANADIAN
NORTH BRANCH
SOUTH BRANCH
Dingwells Pond
329
410
148
119
Dump
Coal Brook
Sandy Pond
Long Pond
750
500
250
100
1000
1250
1750
1500
1450
1200


South
Branch
RIVER
Johns
Pond
65
Stephens
Brook
500
1000
1500
Mollichigmick
Brook
TL 214
1900
Overfall
Brook
950
1650
1750
1700
1250
1500
4500
1800
Little
Codroy
Pond
MOUNTAINS
1350
River
Little
Codroy
1750
1250
1500


Ryans
Limestone
Muddy Hole Brook
Holy Cross Island
Benoit Siding
CODROY
GRAND
NATIONAL
CANADIAN
Trans-Canada Highway
Grand Codroy Provincial Park
406
Doyles
Textile Mill
RIVER
TL 214
Doyles Substation

APPENDIX B
TL 214 STRUCTURE LIST

STRUCTURE LOCATION SCHEDULE ~ TL 214
BOTTOM BROOK TO D ..LES

Plan & Profile # S-2214-T-38-86

STR. # PERM.	STR. # TEMP.	STR. Type	Chainage (ft)	Span Length(ft)	Chainage (m)	Span Length (m)	Line Angle	Poles / Towers QTY.-LTH CL	Anchors	Dam-pers	Remarks
				230		70					BOTTOM BROOK TERMINAL STATION
1		AA	0	515	0	157		1-15			
2		DD	515	707	157	216	90°	4-0			
3		DD	1222	943	373	288	6°29	4-0			HUB #5
4		AA	2165	1088	660	332		1-25			
5		AA	3253	1162	992	354		1-40			
6		AA	4415	1200	1346	366	4°24	1-40			
7		AA	5615	1200	1712	366		1-35			HUB #6
8		AA	6815	1000	2078	305		1-40			HUB #6
9		AA	7815	1000	2383	305		1-30			
10		A	8815	1300	2688	396		1-40			
11		C	10115	1100	3084	335		4-20			
12		DD	11215	1250	3419	381	48°1730"	2-10 2-15			HUB #7
13		A	12465	1000	3800	305		1-40			
14		A	13465	1150	4105	351		1-35			
15		A	14615	848	4456	259		1-35			
16		A	15463	952	4714	290	1°20	1-35			HUB #8
17		A	16415	1150	5005	351		1-40			
18		A	17565	1250	5355	381		1-35			
19		A	18815	1100	5736	335		1-20			HUB #9
20		A	19915	1050	6072	320		1-40			
21		A	20965	1250	6392	381		1-40			
22		A	22215	1150	6773	351		1-40			
23		A	23365	1200	7123	366		1-35			
24		A	24565	1200	7489	366		1-35			
25		A	25765	1150	7855	351		1-35			
26		A	26915	1200	8206	366		1-25			
27		A	28115	1050	8572	320		1-30			
28		A	29165	1250	8892	381		1-35			
29		A	30415	1000	9273	305		1-35			
30		A	31415	1300	9578	396		1-35			HUB #11
31		A	32715	1050	9974	320		1-35			
32		A	33765	1000	10294	305		1-20			
33		A	34765	1100	10599	335		1-30			
34		A	35865	1200	10934	366		1-30			
35		A	37065	1100	11300	335		1-35			
36		A	38165	1100	11636	335		1-25			HUB #13
37		A	39265	950	11971	290		1-40			
38		A	40215	1400	12261	427		1-35			
39		A	41615	1000	12688	305		1-35			HUB #14
40		A	42615	800	12992	244		1-20			CROSSING ROAD
41		A	43415	1550	13236	473		1-25			

STRUCTURE LOCATION SCHEDULE ~ TL 214
BOTTOM BROOK TO DOLLES

Plan & Profile # S-2214-T-38-86

STR. # PERM.	STR. # TEMP.	STR. Type	Chainage (ft)	Span Length(ft)	Chainage (m)	Span Length (m)	Line Angle	Poles / Towers QTY.-LTH CL	Anchors	Dam-pers	Remarks
42		A	44965	850	13709	259		1-40			
43		A	45815	850	13968	259		1-20			HUB #15
44		A	46665	1000	14227	305		1-30			
45		A	47665	800	14532	244		1-25			
46		A	48465	1200	14776	366		1-30			
47		A	49665	1550	15142	473		1-40			
48		A	51215	650	15614	198		1-40			HUB #16
49		A	51865	1400	15813	427		1-40			CROSSING POND
50		A	53265	950	16239	290		1-40			
51		A	54215	950	16529	290		1-40			
52		A	55165	1100	16819	335		1-35			
53		A	56265	950	17154	290		1-40			
54		A	57215	1100	17444	335		1-35			
55		A	58315	1150	17779	351		1-35			
56		A	59465	1220	18130	372		1-40			
57		C	60685	1080	18502	329	26°17'30"	4-20			HUB #18
58		A	61765	1250	18831	381		1-35			HUB #19, GUYING MODIFICATIONS
59		A	63015	1025	19212	313		1-35			GUYING MODIFICATIONS
60		A	64040	1225	19524	373		1-40			GUYING MODIFICATIONS
61		A	65265	1150	19898	351		1-40			HUB #20, GUYING MODIFICATIONS
62		A	66415	1225	20248	373		1-40			GUYING MODIFICATIONS
63		A	67640	1075	20622	328		1-35			GUYING MODIFICATIONS
64		A	68715	775	20950	236		1-35			CROSSING TWO
65		A	69490	1125	21186	343		1-30			HUB #21
66		A	70615	1300	21529	396		1-40			CROSSING
67		A	71915	1100	21925	335		1-35			
68		A	73015	950	22261	290		1-40			
69		A	73965	1200	22550	366		1-30			HUB #22
70		A	75165	1200	22916	366		1-30			
71		A	76365	1050	23282	320		1-35			
72		A	77415	1150	23602	351		1-40			
73		A	78565	1100	23953	335		1-40			
74		A	79665	1150	24288	351		1-40			CROSSING FLAT & FLEET BAY
75		A	80815	1050	24639	320		1-35			
76		A	81865	850	24959	259		1-25			
77		A	82715	850	25218	259		1-30			
78		A	83565	750	25477	229		1-5			
79		A	84315	1050	25706	320		1-35			
80		A	85365	1165	26026	355		1-25			HUB #24
81		A	86530	1050	26381	320		1-30			CH EQ: 1053+15 = 1053+00
82		A	87580	1000	26701	305		1-35			
83		A	88580	1050	27006	320		1-35			
84		A	89630	950	27326	290		1-10			HUB #25, CH EQ: 1090+75

STRUCTURE LOCATION SCHEDULE ~ TL 214
BOTTOM BROOK TO D[illegible]LES

Plan & Profile # S-2214-T-38-86

STR. # PERM.	STR. # TEMP.	STR. Type	Chainage (ft)	Span Length(ft)	Chainage (m)	Span Length (m)	Line Angle	Poles / Towers QTY.-LTH CL	Anchors	Dam-pers	Remarks
85		A	90580	1350	27616	412		1-20			
86		A	91930	1050	28027	320		1-30			
87		A	92980	1200	28348	366		1-40			
88		A	94180	1200	28713	366		1-35			HUB #26, CH EQ: 1137+15
89		A	95380	1050	29079	320		1-40			
90		A	96430	1100	29399	335		1-30			
91		A	97530	1200	29735	366		1-35			
92		A	98730	1150	30101	351		1-35			HUB #27, CH EQ: 1186+25
93		A	99880	750	30451	229		1-35			
94		A	100630	1050	30680	320		1-25			
95		A	101680	1150	31000	351		1-25			
96		A	102830	1050	31351	320		1-40			CROSSING ROADS
97		A	103880	1169	31671	356		1-30			HUB #28, CH: 1227+00
98		A	105049	1250	32027	381		1-35			CH EQ: 1238+19 = 1238+00
99		A	106299	1150	32408	351		1-40			
100		A	107449	1240	32759	378		1-40			
101		DD	108689	1210	33137	369	47°42"30	4-20			HUB #29, CROSSING ROADS
102		A	109899	1150	33506	351		1-40			
103		A	111049	1250	33856	381		1-20			
104		A	112299	1150	34238	351		1-30			HUB #30, CH: 1311+00
105		A	113449	1200	34588	366		1-40			
106		A	114649	1150	34954	351		1-40			
107		A	115799	1200	35305	366		1-40			
108		A	116999	1150	35670	351		1-40			HUB #31, CH: 1362+80
109		A	118149	900	36021	274		1-25			
110		A	119049	1262	36295	385		1-40			
111		A	120311	900	36680	274		1-40			HUB #32,CH: 1397+60, CH: 1390+62=1
112		A	121211	800	36955	244		1-20			
113		A	122011	750	37198	229		1-40			
114		A	122761	1065	37427	325		1-40			
115		DD	123826	1235	37752	377		4-20			HUB #33, CROSSING ROAD & TL
116		A	125061	1100	38128	335		1-40			
117		B	126161	1550	38464	473		1-40			CROSSING FISHEL'S BROOK
118		B	127711	1270	38936	387		1-40			
119		A	128981	1120	39323	341		1-40			HUB #34, CH: 1479+80, CH: 1477+20=1
120		A	130101	1300	39665	396		1-40			CH EQ: 1488+20 = 1488+00
121		B	131401	1350	40061	412		1-40			CROSSING STREAM
122		A	132751	1050	40473	320		1-40			
123		A	133801	1100	40793	335		1-40			HUB #35, CH: 1531+30
124		A	134901	1150	41128	351		1-40			
125		A	136051	1200	41479	366		1-40			
126		A	137251	1200	41845	366		1-40			
127		A	138451	950	42211	290		1-40			

STRUCTURE LOCATION SCHEDULE ~ TL 214
BOTTOM BROOK TO D LES

Plan & Profile # S-2214-T-38-86

STR. # PERM.	STR. # TEMP.	STR. Type	Chainage (ft)	Span Length(ft)	Chainage (m)	Span Length (m)	Line Angle	Poles / Towers QTY.-LTH CL	Anchors	Dam-pers	Remarks
128		A	139401	850	42500	259		1-40			HUB #36, CH: 1538+85
129		A	140251	950	42759	290		1-25			
130		A	141201	850	43049	259		1-25			
131		A	142051	1350	43308	412		1-25			CROSSING POND
132		B	143401	1250	43720	381		1-40			HUB #37, CH: 1631+20
133		A	144651	1100	44101	335		1-40			CROSSING 2 ROADS, GUYING MODIF
134		A	145751	1150	44436	351		1-40			GUYING MODIFICATIONS
135		A	146901	1200	44787	366		1-40			GUYING MODIFICATIONS
136		A	148101	1005	45153	306		1-40			GUYING MODIFICATIONS
137		B	149106	1245	45459	380		1-40			HUB #38
138		A	150351	1100	45839	335		1-40			CROSSING WINTER TRACK GUYING MODIFICATIONS
139		A	151451	1300	46174	396		1-40			GUYING MODIFICATIONS
140		A	152751	1100	46570	335		1-40			GUYING MODIFICATIONS
141		A	153851	1200	46906	366		1-40			HUB #39, CH: 1729+30, GUYING MODI
142		A	155051	1100	47272	335		1-40			CROSSING WINTER TRACK, GUYING MODIFIC/
143		A	156151	900	47607	274		1-25			
144		A	157051	800	47881	244		1-40			
145		A	157851	1100	48125	335		1-30			
146		A	158951	1200	48461	366		1-40			CROSSING RIVER
147		A	160151	650	48827	198		1-35			
148		A	160801	1100	49025	335		1-40			
149		A	161901	1300	49360	396		1-40			
150		A	163201	1100	49756	335		1-40			CROSSING WINTER ROAD
151		A	164301	1200	50092	366		1-40			HUB #41, CH: 1834+50
152		A	165501	1150	50458	351		1-40			
153		A	166651	1150	50808	351		1-40			
154		A	167801	1025	51159	313		1-40			HUB #42, CH: 1874+30
155		B	168826	1975	51471	602		1-25			CROSSING RIVER
156		B	170801	1050	52073	320		1-40			
157		A	171851	1150	52394	351		1-40			
158		A	173001	950	52744	290		1-25			
159		A	173951	900	53034	274		1-20			HUB #43, CH:1934+70
160		A	174851	1000	53308	305		1-40			
161		A	175851	1414	53613	431		1-40			CH EQ: 1959+64 = 1959+50
162		A	177265	850	54044	259		1-40			
163		A	178115	860	54303	262		1-20			
164		DD	178975	778	54566	237	42°00'30"	4-20			HUB #44
165		A	179753	778	54803	237		1-20			CH EQ: 1984+50 = 1984+38
166		C	180531	1274	55040	388	12°30	4-20			HUB #45, TRANSPOSITION BETWEEN
167		A	181805	850	55428	259		1-40			CROSSING ROAD, CH EQ: 2005+00 =
168		A	182655	1365	55688	416		1-40			CH EQ: 2027+00 = 2027+45
169		A	184020	1061	56104	323		1-40			CH EQ: 2037+50 = 2037+61

STRUCTURE LOCATION SCHED'' LE ~ TL 214
BOTTOM BROOK TO D\ _ES

Plan & Profile # S-2214-T-38-86

STR. # PERM.	STR. # TEMP.	STR. Type	Chainage (ft)	Span Length(ft)	Chainage (m)	Span Length (m)	Line Angle	Poles / Towers QTY.-LTH CL	Anchors	Dam-pers	Remarks
170		A	185081	1163	56427	355		1-30			CROSSING STREAM, CH: 2049+00=20
171		A	186244	1265	56782	386		1-40			HUB #47, CH: 2066+30, CH EQ: 2061+
172		A	187509	900	57167	274		1-40			
173		A	188409	1100	57442	335		1-25			CROSSING POND
174		A	189509	800	57777	244		1-25			CROSSING RVER, TRANSPOSITION
175		C	190309	1675	58021	511		4-20			
176		B	191984	775	58532	236		1-40			HUB #48, CH: 2119+50
177		A	192759	700	58768	213		1-20			CROSSING ROAD
178		A	193459	1262	58981	385		1-20			CROSSING LAKE, CH: 2133+62=2133+
179		A	194721	1161	59366	354		1-40			
180		A	195882	700	59720	213		1-25			
181		A	196582	800	59934	244		1-20			HUB #49
182		B	197382	1150	60177	351	12°01	1-20			CROSSING ROAD
183		A	198532	1050	60528	320		1-40			
184		A	199582	1250	60848	381		1-40			HUB #50, CH: 2199+30
185		A	200832	1150	61229	351		1-40			
186		A	201982	1150	61580	351		1-40			
187		A	203132	800	61930	244		1-40			HUB #51, CH: 2236+30
188		A	203932	1600	62174	488		1-40			
189		A	205532	600	62662	183		1-40			CROSSING ROAD
190		A	206132	1113	62845	339		1-40			CH EQ: 2258+63 = 2258+50
191		A	207245	1012	63184	309		1-25			CH EQ: 2268+62 = 2268+50
192		A	208257	1164	63493	355		1-40			HUB #52, CH: 2285+80, CH EQ: 2280+
193		A	209421	850	63848	259		1-40			
194		A	210271	1200	64107	366		1-40			
195		A	211471	1050	64473	320		1-40			
196		A	212521	1300	64793	396		1-40			
197		A	213821	912	65189	278		1-40			HUB #53, CH:2327+85, CROSSING RO
198		B	214733	1685	65467	514		1-40			CH EQ: 2332+62=2332+50 CROSSING RIVER, CH: 2332+20
199		A	216418	715	65981	218		1-40			CH EQ; 2349+35 = 2349+00, CROSSING 2 ROADS, 4 TRAILS
200		A	217133	1500	66199	457		1-40			HUB #54, CH: 2360+00, CH EQ: 2356+15 = 2356+00
201		A	218633	900	66656	274		1-40			
202		A	219533	950	66931	290		1-20			
203		A	220483	1465	67220	447		1-30			CROSSING STREAM
204		DD	221948	985	67667	300	73°(approx	4-20			HUB #55, CROSSING ROAD
205		A	222933	900	67967	274		1-25			CROSSING ROAD
206		A	223833	1100	68242	335		1-30			
207		A	224933	1320	68577	402		1-40			CROSSING ROAD
208		A	226253	1130	68980	345		1-40			
209		A	227383	1000	69324	305		1-40			CROSSING TCH

STRUCTURE LOCATION SCHED'LE ~ TL 214
BOTTOM BROOK TO D\ _ES

Plan & Profile # S-2214-T-38-86

STR. # PERM.	STR. # TEMP.	STR. Type	Chainage (ft)	Span Length(ft)	Chainage (m)	Span Length (m)	Line Angle	Poles / Towers QTY.-LTH CL	Anchors	Dam-pers	Remarks
210		A	228383	1100	69629	335		1-40			
211		A	229483	1300	69964	396		1-40			CROSSING LAKE
212		A	230783	1100	70361	335		1-30			
213		A	231883	1050	70696	320		1-40			
214		A	232933	1300	71016	396		1-40			
215		A	234233	1000	71413	305		1-40			HUB #58, CH: 2530+00
216		A	235233	1413	71717	431		1-35			CROSSING ROAD
217		A	236646	1000	72148	305		1-40			CROSSING CNR, CH EQ: 2550+13=25
218		A	237646	650	72453	198		1-25			
219		C	238296	1050	72651	320	21°42	4-0			HUB #59
220		A	239346	1250	72971	381		1-40			
221		A	240596	900	73352	274		1-40			
222		A	241496	1100	73627	335		1-40			
223		A	242596	1300	73962	396		1-35			
224		A	243896	1100	74359	335		1-25			HUB #60, CH: 2623+30
225		A	244996	1000	74694	305		1-25			
226		A	245996	1200	74999	366		1-30			
227		A	247196	950	75365	290		1-20			
228		A	248146	1250	75654	381		1-35			HUB #61, CH: 2671+70
229		A	249396	1150	76035	351		1-40			
230		A	250546	1100	76386	335		1-25			
231		A	251646	1100	76721	335		1-40			
232		A	252746	1100	77057	335		1-35			
233		A	253846	1300	77392	396		1-40			CROSSSING RIVER
234		A	255146	800	77788	244		1-40			
235		A	255946	948	78032	289		1-40			
236		C	256894	1152	78321	351	30°25'30"	4-0			HUB #62
237		A	258046	1000	78673	305		1-40			
238		A	259046	1100	78977	335		1-40			
239		B	260146	1350	79313	412		1-40			CROSSING POND
240		B	261496	1435	79724	438		1-40			
241		DD	262931	1315	80162	401	66°30'30"	2-15 2-20			HUB #64, CROSSING ROAD & RAILWA CROSSING RIVER
242		A	264246	1050	80563	320		1-40			
243		A	265296	750	80883	229		1-15			
244		A	266046	935	81112	285		1-5			
245		DD	266981	1415	81397	431	55°22	4-20			HUB #65, CROSSING ROAD
246		A	268396	700	81828	213	1°40	1-40			
247		A	269096	850	82041	259		1-40			OFFSET 20.3'
248		A	269946	950	82301	290	2°58	1-40			OFFSET 45'
249		A	270896	1190	82590	363		1-40			OFFSET 23.6'
250		A	272086	910	82953	277	1°18	1-40			
251		A	272996	1172	83230	357		1-40			HUB #66, CH: 2909+00

STRUCTURE LOCATION SCHEDULE ~ TL 214
BOTTOM BROOK TO D ES

Plan & Profile # S-2214-T-38-86

STR. # PERM.	STR. # TEMP.	STR. Type	Chainage (ft)	Span Length(ft)	Chainage (m)	Span Length (m)	Line Angle	Poles / Towers QTY.-LTH CL	Anchors	Dam-pers	Remarks
252		A	274168	1228	83588	374		1-40			
253		A	275396	1035	83962	316		1-20			
254		A	276431	1215	84278	370		1-30			CROSSING ROAD
255		A	277646	1100	84648	335		1-25			HUB #67, CH: 2955+00
256		B	278746	1100	84984	335		1-15			CROSSING ROAD
257		A	279846	950	85319	290		1-25			
258		A	280796	950	85609	290		1-30			
259		A	281746	1400	85898	427		1-40			HUB #68, CH: 3007+65
260		A	283146	700	86325	213		1-40			
261		A	283846	600	86538	183		1-15			
262		A	284446	1325	86721	404		1-40			
263		A	285771	700	87125	213		1-15			
264		A	286471	1125	87339	343		1-40			
265		A	287596	1050	87682	320		1-35			
266		A	288646	950	88002	290		1-20			
267		A	289596	1000	88291	305		1-40			GUYING MODIFICATION
268		A	290596	1250	88596	381		1-25			GUYING MODIFICATION
269		A	291846	1150	88977	351		1-40			GUYING MODIFICATION
270		A	292996	1050	89328	320		1-40			GUYING MODIFICATION
271		A	294046	750	89648	229		1-15			GUYING MODIFICATION
272		A	294796	800	89877	244		1-25			HUB #70, CH: 3129+40 GUYING MODIFICATION
273		A	295596	1150	90121	351		1-40			CROSSING RIVER, GUYING MODIFICA
274		A	296746	1250	90471	381		1-40			CROSSING BROOK, GUYING MODIFIC
275		C	297996	1350	90852	412	22°43'30"	4-20			HUB #71
276		A	299346	1050	91264	320		1-40			GUYING MODIFICATION
277		A	300396	755	91584	230		1-25			GUYING MODIFICATION
278		A	301151	1295	91814	395		1-25			HUB #72, CH: 3200+700 GUYING MODIFICATION
279		A	302446	1050	92209	320		1-40			GUYING MODIFICATION
280		A	303496	1150	92529	351		1-30			GUYING MODIFICATION
281		A	304646	900	92880	274		1-20			GUYING MODIFICATION
282		A	305546	1400	93154	427		1-40			GUYING MODIFICATION
283		A	306946	1000	93581	305		1-40			HUB #73, CH:3253+40, GUYING MODI
284		A	307946	1390	93886	424		1-40			CROSSING RIVER, GUYING MODIFICA
285		A	309336	1010	94310	308		1-40			GUYING MODIFICATION
286		A	310346	1090	94618	332		1-40			GUYING MODIFICATION
287		B	311436	810	94950	247	13°53'30"	1-25			HUB #74
288		A	312246	1350	95197	412		1-35			GUYING MODIFICATION
289		A	313596	1000	95609	305		1-40			GUYING MODIFICATION
290		A	314596	950	95913	290		1-40			HUB #75, CH: 3328+40 GUYING MODIFICATION
291		A	315546	1215	96203	370		1-40			GUYING MODIFICATION

STRUCTURE LOCATION SCHEDULE ~ TL 214
BOTTOM BROOK TO D LES

Plan & Profile # S-2214-T-38-86

STR. # PERM.	STR. # TEMP.	STR. Type	Chainage (ft)	Span Length(ft)	Chainage (m)	Span Length (m)	Line Angle	Poles / Towers QTY.-LTH CL	Anchors	Dam-pers	Remarks
292		A	316761	1235	96573	377	small angle	1-40			HUB #76, GUYING MODIFICATION
293		A	317996	1100	96950	335		1-40			GUYING MODIFICATION
294		A	319096	1150	97285	351		1-30			GUYING MODIFICATION
295		A	320246	1200	97636	366		1-40			CROSSING RIVER, GUYING MODIFICA
296		A	321446	1200	98002	366		1-40			GUYING MODIFICATION
297		A	322646	885	98368	270		1-40			GUYING MODIFICATION
298		A	323531	1215	98638	370	small angle	1-40			HUB #77, TRANSPOSITION, GUYING MODIFICA
299		A	324746	1050	99008	320		1-40			GUYING MODIFICATION
300		A	325796	1250	99328	381		1-40			CROSSING ROAD, GUYING MODIFICA
301		A	327046	1150	99709	351		1-40			GUYING MODIFICATION
302		A	328196	1250	100060	381		1-40			GUYING MODIFICATION
303		A	329446	1150	100441	351		1-40			GUYING MODIFICATION
304		A	330596	1150	100791	351		1-40			GUYING MODIFICATION
305		A	331746	1250	101142	381		1-40			GUYING MODIFICATION
306		A	332996	1100	101523	335		1-40			GUYING MODIFICATION
307		A	334096	1100	101859	335		1-15			HUB #79, CH: 3519+65, GUYING MODI
308		A	335196	1250	102194	381		1-40			GUYING MODIFICATION
309		A	336446	900	102575	274		1-40			GUYING MODIFICATION
310		A	337346	1000	102849	305		1-40			CROSSING MOLLY CHIGNIC BROOK GUYING MODIFICATION
311		A	338346	950	103154	290		1-40			GUYING MODIFICATION
312		A	339296	910	103444	277		1-35			GUYING MODIFICATION
313		A	340206	1090	103721	332		1-15			HUB #80, CH: 3585+60 SMALL ANGLE GUYING MODIFICATIO
314		AW	341296	645	104054	197		2-75			TOWER FAILURE, REPLACED BY WO
314-1		AW	341941	605	104250	184		2-55			TOWER FAILURE @314, REPLACED BY WOOD
315		A	342546	1150	104435	351		1-40			GUYING MODIFICATION
316		A	343696	740	104785	226		1-40			GUYING MODIFICATION
316-1		AW	344436	510	105011	155		2-55			TOWER FAILURE @317, REPLACED BY WOOD
317		AW	344946	400	105166	122		2-60			TOWER FAILURE @317, REPLACED BY WOOD
317-1		AW	345346	750	105288	229		2-45			TOWER FAILURE @317, REPLACED BY WOOD
318		A	346096	1200	105517	366		1-40			GUYING MODIFICATION
319		A	347296	1150	105883	351		1-40			CROSSING BROOK, GUYING MODIFIC
320		A	348446	1200	106234	366		1-40			GUYING MODIFICATION
321		A	349646	1200	106599	366		1-40			HUB #82, CH: 3679+90, GUYING MODI
322		A	350846	1050	106965	320		1-20			GUYING MODIFICATION
323		A	351896	1250	107285	381		1-40			GUYING MODIFICATION
323-1		AW									
324		A	353146	1050	107666	320		1-40			GUYING MODIFICATION
325		A	354196	1200	107987	366		1-40			GUYING MODIFICATION
326		A	355396	1200	108352	366		1-40			GUYING MODIFICATION
327		A	356596	1200	108718	366		1-40			GUYING MODIFICATION
328		A	357796	1200	109084	366		1-35			GUYING MODIFICATION

STRUCTURE LOCATION SCHEDULE ~ TL 214
BOTTOM BROOK TO DOYLES

Plan & Profile # S-2214-T-38-86

STR. # PERM.	STR. # TEMP.	STR. Type	Chainage (ft)	Span Length(ft)	Chainage (m)	Span Length (m)	Line Angle	Poles / Towers QTY.-LTH CL	Anchors	Dam-pers	Remarks
329		A	358996	1150	109450	351		1-40			GUYING MODIFICATION
330		A	360146	1150	109801	351		1-40			GUYING MODIFICATION
331		A	361296	1250	110151	381		1-40			GUYING MODIFICATION
332		A	362546	1150	110532	351		1-40			GUYING MODIFICATION
333		A	363696	950	110883	290		1-40			GUYING MODIFICATION
334		A	364646	900	111173	274		1-25			GUYING MODIFICATION
335		A	365546	890	111447	271		1-15			GUYING MODIFICATION
336		B	366436	1110	111718	338		1-20			ANGLE
337		A	367546	1200	112057	366		'1-40			GUYING MODIFICATION
338		A	368746	1200	112423	366		1-40			GUYING MODIFICATION
339		A	369946	850	112788	259		1-40			GUYING MODIFICATION
340		A	370796	1085	113048	331		1-40			CROSSING ROAD, GUYING MODIFICA
341		A	371881	1115	113378	340		1-30			CROSSING PIT, GUYING MODIFICATI(
342		C	372996	1400	113718	427		4-20			CROSSING RIVER
343		C	374396	1150	114145	351		4-20			
344		A	375546	1050	114496	320		1-35			CROSSING RIVER, GUYING MODIFICA
345		A	376596	925	114816	282		1-10			GUYING MODIFICATION
346		A	377521	1275	115098	389		1-40			GUYING MODIFICATION
347		A	378796	1100	115487	335		1-10			GUYING MODIFICATION
348		A	379896	1250	115822	381		1-40			GUYING MODIFICATION
349		A	381146	1000	116203	305		1-40			GUYING MODIFICATION
350		AA	382146	1100	116508	335		1-40			
351		AA	383246	1350	116843	412		1-35			
352		AA	384596	1235	117255	377		1-40			
353		DD	385831	1015	117631	309		4-20			
354		AA	386846	775	117941	236		1-20			
355		DD	387621	190	118177	58		4-20			DOYLE TERMINAL STATION

APPENDIX C

TL 214 DETAILED CONDITION ASSESSMENT RESULTS

Results of TL 214 Condition Assessment

Deficiency	Number of Structures
Loose Members	4
Footing Eroded	1
Damper Loose	2
Member Missing	1
Need New Guys	1
Insulator Flashed	1
Damaged Conductor due to Lightning Strike	1
Keeper Cracked	1
Worn Bolt 1A 135	38
Dead Insulator	1
Bent Member	1
Bullet Holes in Members	1
Insulator Damaged	1
Worn Member	1
Suspension Clamp Worn	1
Standoff Worn	1
Total	57

APPENDIX D

(SEPARATE DOCUMENT)

TL 214 CONDITION ASSESSMENT

APPENDIX E
TL 214 MAINTENANCE REPORT

01/10/03

Work Order Description & Actual Work

Supervisor: SVL Transmission Line Mtce De

WO#	Comp. Date	Description/Actual Work	Item Description:	St	Pri
12495	00/08/22	Replace Insulators on Str. 234, R Ph. & C Ph. Flashed.	STRUCTURE #234, LINE TL 214, (	80	3
24099	00/08/23	Replace insulators L Ph. Load #4; R Ph. Load #6; R Ph. Source #9. (Defective)	STRUCTURE #236, LINE TL 214, (	80	3
66122	00/08/22	Replace insulators on L Ph. #4; C Ph. #5; and R Ph. #6, Str. #238, TL214.	STRUCTURE #238, LINE TL 214, (	80	3
66131	00/08/22	Replace insulators on C Ph. #5 and L Ph. #2, Str. #239, TL214. Loose brace first section joining plate. Needs washer for brace.	STRUCTURE #239, LINE TL 214, (	80	3
66134	00/08/22	Replace insulators on L Ph #4 and C Ph #2,#3 & L Ph. #4.This is a B type str. with brackets between insulator and arm.	STRUCTURE #240, LINE TL 214, (	80	3
87910	99/07/22	Remove damper from mid-span, Str. 333, TL214. Installed on Str. #333. Completed by G. Stride/R. Curnew/ P. MacIsaac.	STRUCTURE #333, LINE TL 214, (	80	3
87913	99/07/27	Replace conductor mid-span, all three phases, 400' per span, Str. 323 - 324, TL214. Replaced 400' of conductor between Str. #s 323 & 324. Str. #323-1 wooden structure installed new armor rods & clamps & counterweight 200 lbs. per phase. Completed by: Stride/MacIsaac/Canning	TRANSMISSION LINE 214, BBK TO	80	3
96824	00/08/22	Replace insulators (defective) L Ph. #8. C Ph. Complete string flashed.	STRUCTURE #248, LINE TL 214, (	80	3
96826	00/08/23	Replace insulator (defective) R Ph. #1 & C Ph. #3.	STRUCTURE #242, LINE TL 214, (	80	3

Supervisor: SVL Transmission Line Mtce De

96828	00/08/23	Replace insulators (defective) R Ph. #3.	STRUCTURE #243, LINE TL 214, (	80	3
96833	00/08/23	Replace insulator (defective) L Ph. #7.	STRUCTURE #244, LINE TL 214, (	80	3
96959	00/08/23	Replace defective insulators: L Ph. complete string Doyles side; L Ph. #3 BBK; C Ph. complete string Doyles side; R Ph. #8 Jumper string; R Ph. #8 BBK.	STRUCTURE #241, LINE TL 214, (	80	3
96991	00/08/22	Replace defective insulators: R Ph. BBK complete string; R Ph. Doyles #4; C Ph. BBK #7; C Ph. Doyles #9; L Ph. BBK #7; L Ph. Doyles #8 & 9.	STRUCTURE #245, LINE TL 214, (	80	3
102164	99/11/19	INSTALL CLASH RODS ON GUYS - ROAD SIDE. COMPLETED BY R. CURNEW/G. STRIDE/P. MACISAAC.	STRUCTURE #140, LINE TL 214, (	80	3
102167	01/09/12	REMOVE OLD DAMPERS ON R PH AND C PH. INSTALL NEW DAMPERS. REMOVED OLD DAMPERS ON RIGHT AND CENTER PHASES.INSTALLED NEW DAMPER. COMPLETED BY: K.LUSH COMPLETED DATE: 01-09-12	STRUCTURE #130, LINE TL 214, (	80	3
102170	99/11/15	INSTALL CLASH RODS ON GUYS - SOURCE SIDE. COMPLETED BY S'VILLE CREW.	STRUCTURE #131, LINE TL 214, (	80	3
103120	99/11/22	INSTALL CLASH RODS ON STR. 160, TL214. COMPLETED BY G. STRIDE/R. CURNEW/J. CANNING/ P. MACISAAC.	STRUCTURE #160, LINE TL 214, (	80	3
103143	99/11/24	INSTALL A SET OF CLASH RODS ON STR. 171, TL214. COMPLETED BY R. CURNEW/P. MACISAAC/J. CANNING/ L. LEARNING.	STRUCTURE #171, LINE TL 214, (	80	3
104247	00/09/20	INSTALL CLASH RODS ON STR. 194, TL214. COMPLETED BY G. STRIDE/J. CANNING/L. LEARNING.	STRUCTURE #194, LINE TL 214, (	80	3
104248	99/12/16	INSTALL CLASH RODS ON STR. 188, TL214. COMPLETED BY R. CURNEW/P. MACISAAC/J. CANNING.	STRUCTURE #188, LINE TL 214, (	80	3
104251	00/09/21	INSTALL CLASH RODS ON STR. 186, TL214. COMPLETED BY G. STRIDE/R. CURNEW/T. BEATON.	STRUCTURE #186, LINE TL 214, (	80	3
104252	99/12/03	INSTALL CLASH RODS ON STR. 185, TL214. COMPLETED BY T. BEATON/F. REID/L. LEARNING.	STRUCTURE #185, LINE TL 214, (	80	3
104255	99/11/30	INSTALL CLASH RODS ON STR. 179, TL214. COMPLETED BY T. BEATON/F. REID/L. LEARNING.	STRUCTURE #179, LINE TL 214, (	80	3

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107959	00/01/07	REPAIR GUYS - CROSSED OVER ON ANCHOR. COMPLETED BY G. STRIDE/R. CURNEW/P. MACISAAC.	STRUCTURE #205, LINE TL 214, (	80	3
107974	00/02/18	REPLACE BRACES 1A27 AND 1A28, STR. 30, TL214. COMPLETED BY F. REID.	STRUCTURE #30, LINE TL 214, (3	80	3
110362	00/08/23	REPLACE INSULATORS R PH, STR 261, TL214.	STRUCTURE #261, LINE TL 214, (	80	3
110374	00/08/23	REPLACE DEFECTIVE INSULATORS L PH AND C PH., STR 263, TL214.	STRUCTURE #263, LINE TL 214, (	80	3
110377	00/08/23	REPLACE DEFECTIVE INSULATOR R PH., STR 265, TL214.	STRUCTURE #265, LINE TL 214, (	80	3
110381	00/08/23	REPLACE DEFECTIVE INSULATORS R PH AND L PH, STR 264, TL214.	STRUCTURE #264, LINE TL 214, (	80	3
110383	00/08/23	REPLACE INSULATORS R & L PH., STR 266, TL214.	STRUCTURE #266, LINE TL 214, (	80	3
110385	00/08/23	REPLACE INSULATORS L PH, STR 259, TL214.	STRUCTURE #259, LINE TL 214, (	80	3
110386	00/08/22	REPLACE INSULATORS L PH, STR 257, TL214.	STRUCTURE #257, LINE TL 214, (	80	3
110395	00/08/22	REPLACE DEFECTIVE INSULATORS C PH., STR 249, TL214.	STRUCTURE #249, LINE TL 214, (	80	3
116610	01/09/12	REPLACE INSULATORS L PH, STR 271, TL214. INSTALLED 8 15,000 LB INSULATORS. COMPLETED BY: T.BEATON/F.REID/L.LEARNING COMPLETED DATE: 01-09-12	STRUCTURE #271, LINE TL 214, (	80	3
117450	01/09/12	RETRIEVE AND REINSTALL R PH DAMPER (OUT 10' FROM TOWER), STR 136, TL214. RETRIEVED AND REINSTALLED RIGHT PHASE DAMPER. COMPLETED BY: B.RIDEOUT COMPLETED DATE: 01-09-12	STRUCTURE #136, LINE TL 214, (	80	3
119878	00/01/12	REPLACE JUMPER (STRANDS BROKEN). COMPLETED BY S'VILLE CREW.	STRUCTURE #57, LINE TL 214, (0	80	3
120002	01/02/16	COMPLETE CLIMBING/GROUND INSPECTION FROM STRUCTURE 275 TO 355 TL214	TRANSMISSION LINE 214, BBK TO	80	3
120003	00/09/05	COMPLETE GROUND INSPECTION FROM STRUCTURE 1 TO 274	TRANSMISSION LINE 214, BBK TO	80	3
121155	00/08/22	REPLACE JUMPERS, STR 57, TL214.	STRUCTURE #57, LINE TL 214, (0	80	3
124190	00/08/22	REPLACE DEFECTIVE INSULATORS C PH #9 DOYLES; R PH #8 BOTTOM BROOK; R PH #7 & 8 DOYLES, STR. 204, TL214.	TRANSMISSION LINE 214, BBK TO	80	3

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149154	00/08/22	STR. TYPE: A.	TRANSMISSION LINE 214, BBK TO	80	3
149156	00/08/23	REPLACE DEFECTIVE INSULATOR R PH #5 BB. STR. TYPE: C.	TRANSMISSION LINE 214, BBK TO	80	3
149157	00/06/15	REPLACE INSULATOR L PH #3. TIGHTEN LOOSE BRACE 1A29S. STR. TYPE: A. COMPLETED BY L.LEARNING/R.CURNEW/P. MACISAAC/F. REID.	TRANSMISSION LINE 214, BBK TO	80	3
149158	00/06/14	REPLACE FLASHED INSULATOR L & C PH. TIGHTEN BRACE 1A30. STR. TYPE: A. COMPLETED BY L. LEARNING/P. MACISAAC/R. CURNEW/F. REID.	TRANSMISSION LINE 214, BBK TO	80	3
151661	00/07/07	REPLACE INSULATORS ON C & L PHASES (FLASHED). "A" TYPE STR. (16 - 15,000 LBS INSULATORS) COMPLETED BY T. BEATON/J. CANNING/P. MACISAAC.	TRANSMISSION LINE 214, BBK TO	80	3
151662	00/06/30	REPLACE INSULATORS ON C PH. "A" TYPE STR. (8 - 15,000 LBS INSULATORS) COMPLETED BY G. STRIDE/T. BEATON/L. LEARNING/ D. COURTNEY.	TRANSMISSION LINE 214, BBK TO	80	3
155555	00/06/27	REPLACE INSULATOR, C PH #5, STR. 197, TL214. COMPLETED BY G. STRIDE/L. LEARNING/R. CURNEW.	TRANSMISSION LINE 214, BBK TO	80	3
156005	00/10/27	TIGHTEN BRACES 1A29, S185, TL214. TIGHTENED BRACES 1A29, S185, TL214.	TRANSMISSION LINE 214, BBK TO	80	3
156026	00/08/22	REPLACE INSULATORS R PH, S190, TL214.	TRANSMISSION LINE 214, BBK TO	80	3
156037	00/08/22	REPLACE INSULATORS ON L PH & C PH, S186, TL214.	TRANSMISSION LINE 214, BBK TO	80	3
158721	00/06/28	TL214,EMERG.REPAIRS,LIGHTNING COMPLETED BY S'VILLE LINE CREW.	TRANSMISSION LINE 214, BBK TO	80	1
159614	00/08/31	CUT BRUSH AROUND STR. 110, TL214.	TRANSMISSION LINE 214, BBK TO	80	3
166445	00/08/22	CHANGE OUT JUMPERS ON TRANSPOSITION, S175, TL214.	TRANSMISSION LINE 214, BBK TO	80	3
167186	00/08/23	REPLACE ALL INSULATORS ON TOWER STR. #175, TL214. "C" TYPE STR.	TRANSMISSION LINE 214, BBK TO	80	3
169781	01/09/12	REPLACE DAMPER ON PHASE 70 TO 80 FT FROM TOWER, STR. 136, TL214. REMOVED OLD DAMPER AND INSTALLED NEW DAMPER TL214,S136. COMPLETED BY: B.RIDEOUT COMPLETED DATE: 01-09-12	TRANSMISSION LINE 214, BBK TO	80	3
169783	00/09/27	REPLACE GUY, STR. 135, TL214.	TRANSMISSION LINE 214, BBK TO	80	3

THE - 11001 ' ' 50FT 35.95
TL 11002 2" x 50 ft

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169783	00/09/27	COMPLETED BY T. BEATON/J. CANNING/L. LEARNING.	TRANSMISSION LINE 214, BBK TO	80	3
169790	00/09/28	RETENSION GUYS, STR. 146-1, TL214. (ONLY 3/8 GUY WIRE ON ONE SIDE OF STORM GUYS, ALL OTHERS ARE 9/16.) COMPLETED BY G. STRIDE/P. MACISAAC/J. CANNING.	TRANSMISSION LINE 214, BBK TO	80	3
169800	00/09/21	INSTALL CLASH RODS, BOTTOM BROOK SIDE, STR. 94, TL214. COMPLETED BY G. STRIDE/R. CURNEW/J. CANNING.	TRANSMISSION LINE 214, BBK TO	80	3
169805	00/09/21	INSTALL CLASH RODS, BOTTOM BROOK SIDE, STR. 92, TL214. COMPLETED BY G. STRIDE/R. CURNEW/J. CANNING.	TRANSMISSION LINE 214, BBK TO	80	3
169816	00/09/25	INSTALL CLASH RODS, BOTTOM BROOK SIDE, STR. 89, TL214. COMPLETED BY G. STRIDE/R. CURNEW/P. MACISAAC.	TRANSMISSION LINE 214, BBK TO	80	3
169817	00/09/25	INSTALL CLASH RODS, DOYLES SIDE, STR. 87, TL214. COMPLETED BY T. BEATON/J. CANNING/L. LEARNING.	TRANSMISSION LINE 214, BBK TO	80	3
169818	00/09/29	INSTALL CLASH RODS, BOTTOM BROOK SIDE, STR. 80, TL214. COMPLETED BY R. CURNEW/L. LEARNING/J. CANNING.	TRANSMISSION LINE 214, BBK TO	80	3
169837	00/10/25	REPLACE PREFORM, DOYLES SIDE, (3/8), STR. 109, TL214. COMPLETED BY R. CURNEW/P. MACISAAC/G. STRIDE.	TRANSMISSION LINE 214, BBK TO	80	3
170023	00/09/28	REPLACE PREFORM AND RETENSION GUYS, STR. 175, TL214. COMPLETED BY G. STRIDE/J. CANNING/P. MACISAAC.	TRANSMISSION LINE 214, BBK TO	80	3
170027	01/01/11	RETENSION GUYS, DOYLES SIDE, STR. 171, TL214. RETENSIONED GUY, STR. 171, TL214. COMPLETED BY T. BEATON/F. REID/L. LEARNING/J. CANNING.	TRANSMISSION LINE 214, BBK TO	80	3
170411	00/10/25	REPLACE PREFORM, DOYLES SIDE, STR. 210, TL214. COMPLETED BY R. CURNEW/G. STRIDE/P. MACISAAC.	TRANSMISSION LINE 214, BBK TO	80	3
171914	01/09/12	REMOVE & REPLACE DAMPER MID-SPAN, STR. 309, TL214. REMOVED AND REPLACED DAMPER MID-SPAN. COMPLETED BY: T.KENDALL COMPLETED DATE: 01-09-12	TRANSMISSION LINE 214, BBK TO	80	3
171915	01/08/08	CODROY ACCESS ROAD #11, TL214. CUT BRUSH ON ACCESS ROAD #11. COMPLETED BY: L LEARNING COMPLETED DATE: 01-08-03	TRANSMISSION LINE 214, BBK TO	80	3

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173930	01/01/05	TL214,CHECK ROAD CLEARANCE AND ANY CONCERNS FOR REQUEST FROM CORNER BROOK PULP AND PAPER TO UPGRADE OLD FOREST ACCESS ROAD NEAR STR.#254. REMARKS:REPORT FINDINGS TO CLAUDE QUINTON.	TRANSMISSION LINE 214, BBK TO	80	3
176120	00/10/23	REMOVE DANGER TREES (MIDWAY MOTEL), S139-140, TL214. COMPLETED BY R. CURNEW/G. STRIDE/P. MACISAAC.	TRANSMISSION LINE 214, BBK TO	80	3
183672	01/05/10	COMPLETE CLIMBING INSPECTION FROM STRUCTURE # 76 TO # 159. COMPLETED CLIMBING INSPECTION FROM STRUCTURE #76 TO #159. COMPLETED BY: R.CURNEW/P.MACISAAC/T.BEATON COMPLETED DATE: 01-05-08	TRANSMISSION LINE 214, BBK TO	80	3
183673	01/04/27	COMPLETE SNOWMOBILE PATROL FROM STRUCTURE # 1 TO # 355.	TRANSMISSION LINE 214, BBK TO	80	3
188036	01/09/11	REPLACE INSULATOR L PH, STR. 341, TL214. "A" TYPE STR. REPLACED INSULATOR. COMPLETED BY: R.CURNEW/P.MACISAAC/F.KENNEDY COMPLETED DATE: 01-09-11	TRANSMISSION LINE 214, BBK TO	80	3
188038	01/09/12	REPLACE INSULATOR C PH, STR. 339, TL214. "A" TYPE STR. REPLACED INSULATOR. COMPLETED BY: R.CURNEW/P.MACISAAC/F.KENNEDY COMPLETED DATE: 01-09-12	TRANSMISSION LINE 214, BBK TO	80	3
188061	01/09/12	REPLACE 1A135 ASSEMBLY (ALL PHASES), STR. 351, TL214. "A" TYPE STR. REPLACED INSULATORS ON ALL PHASES. COMPLETED BY: R.CURNEW COMPLETED DATE: 01-09-12	TRANSMISSION LINE 214, BBK TO	80	3
190261	00/12/26	EMERGENCY REPAIRS (SALT CONTAMINATION) ON TL214. COMPLETED EMERGENCY REPAIRS ON TL214. COMPLETED BY R. CURNEW/G. STRIDE/P. MACISAAC/D. COURTNEY.	TRANSMISSION LINE 214, BBK TO	80	1
190610	00/12/29	TL214, INSPECT AND TEST INSULATORS STR 128 TO 132 AS A RESULT OF AN OUTAGE AND MULTIPLE RECLOSES FROM DEC 23 TO DEC 27, 2000 DISTANCE RELAY INDICATED FAULTS TO BE AT STRUCTURE 132.	TRANSMISSION LINE 214, BBK TO	80	2

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190610	00/12/29	INSPECTED AND TEST INSULATORS, STR. 128 TO 132, TL214. COMPLETED BY P. MACISAAC/R. CURNEW/G. STRIDE.	TRANSMISSION LINE 214, BBK TO	80	2
190619	01/01/02	TL214, STR 132,REPLACE RIGHT PHASE INSULATORS AS A RESULT OF TESTING CONDUCTED ON DEC 28, 2000 REPLACED INSULATORS, STR. 132, TL214. COMPLETED BY R. CURNEW/P. MACISAAC/G. STRIDE/T. BEATON/ D. COURTNEY.	STRUCTURE #132, LINE TL 214, (	80	2
190641	01/01/02	TL214, STR 134,REPLACE RIGHT PHASE INSULATORS AS A RESULT OF TESTING CONDUCTED ON DEC 28, 2000 REPLACED INSULATORS, STR. 134, TL214. COMPLETED BY L. LEARNING/P. MACISAAC/G. STRIDE.	STRUCTURE #134, LINE TL 214, (	80	2
190660	01/01/02	TL214, STR 135,REPLACE RIGHT PHASE INSULATORS AS A RESULT OF TESTING CONDUCTED ON DEC 29, 2000 REPLACED INSULATORS, STR. 135, TL214. COMPLETED BY R. CURNEW/G. STRIDE/L. LEARNING/ P. MACISAAC.	STRUCTURE #135, LINE TL 214, (	80	2
196153	01/04/27	TL214,COMPLETE LINE ASSESSMENT AS PER GUIDELINES SET FORTH BY ENGINEERING. COMPLETED TL214 LINE ASSESSMENT. COMPLETED BY S'VILLE LINE CREW.	TRANSMISSION LINE 214, BBK TO	80	3
201561	01/09/17	INSTALL TWO 3/8 GUYS ON STRUCTURE #63, TL214. INSTALLED TWO 3/8 GUYS ON STRUCTURE #63 TL214. COMPLETED BY: R.CURNEW/P.MACISAAC/L.LEARNING K.DORAN COMPLETED DATE: 01-09-17	STRUCTURE #63, LINE TL 214, (3	80	3
205113	01/09/11	TL214, STR. #154. REPLACE INSULATOR, CENTER PHASE #8. REPLACED CENTER PHASE INSULATORS. COMPLETED BY: L.BRENTON COMPLETED DATE: 01-09-11	TRANSMISSION LINE 214, BBK TO	80	3
205115	01/09/11	TL214, STR. #156. REPLACE INSULATOR, LEFT PHASE. REPLACED INSULATOR. COMPLETED BY: T.BEATON	TRANSMISSION LINE 214, BBK TO	80	3

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205115	01/09/11	COMPLETED DATE: 01-09-11	TRANSMISSION LINE 214, BBK TO	80	3
205116	01/09/11	TL214, STR. #152. REPLACE INSULATOR, CENTER PHASE #8. REPLACED CENTER PHASE INSULATORS. COMPLETED BY: L.BRENTON COMPLETED DATE: 01-09-11	TRANSMISSION LINE 214, BBK TO	80	3
205117	01/09/12	TL214, STR. #136. REPLACE DAMPER, RIGHT PHASE. REPLACED DAMPER,RIGHT PHASE. COMPLETED BY: B.RIDEOUT COMPLETED DATE: 01-09-12	TRANSMISSION LINE 214, BBK TO	80	3
205121	01/08/17	TL214, STR. #151. REPLACE CLASH RODS. REPLACED CLASH RODS. COMPLETED BY: R. CURNEW/P. MACISAAC/F. REID COMPLETED DATE: 01-08-17	TRANSMISSION LINE 214, BBK TO	80	3
205122	01/09/11	TL214, STR. #144. REPLACE INSULATORS, RIGHT PHASE #8. REPLACED RIGHT PHASE INSULATORS. COMPLETED BY: L.BRENTON COMPLETED DATE: 01-09-11	TRANSMISSION LINE 214, BBK TO	80	3
205141	01/09/12	TL214, STR. #124. REPLACE INSULATOR, LEFT & RIGHT PHASE. REPLACED LEFT AND RIGHT PHASE INSULATORS. COMPLETED BY: K.LUSH COMPLETED DATE: 01-09-12	STRUCTURE #124, LINE TL 214, (	80	3
205147	01/09/12	TL214, STR. #125. REPLACE INSULATORS. REPLACED INSULATORS. COMPLETED BY: K.LUSH COMPLETED DATE: 01-09-12	STRUCTURE #125, LINE TL 214, (	80	3
205164	01/09/11	TL214, STR. #128. REPLACE RIGHT PHASE #7 INSULATOR AND LEFT PHASE INSULATORS. REPLACED 8 C.O.B INSULATORS LEFT PHASE WITH 8 N.G.K. REPLACED 8 C.O.B INSULATORS RIGHT PHASE WITH 8 N.G.K. COMPLETED BY: K.LUSH COMPLETED DATE: 01-09-11	STRUCTURE #128, LINE TL 214, (	80	3

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205168	01/09/11	TL214, STR. #127. REPLACE INSULATORS LEFT PHASE. REPLACED INSULATORS LEFT PHASE. COMPLETED BY: K.LUSH COMPLETED DATE: 01-09-11	STRUCTURE #127, LINE TL 214, (	80	3
205169	01/08/11	TL214, STR. #138. REPLACE INSULATOR #5 RIGHT PHASE. REPLACED RIGHT PHASE INSULATORS. COMPLETED BY: L.BRENTON COMPLETED DATE: 01-09-11	STRUCTURE #138, LINE TL 214, (	80	3
205672	01/09/12	TL214, STR. #167. REPLACE INSULATOR, LEFT PHASE FLASHED. REPLACED LEFT PHASE INSULATORS. COMPLETED BY: L.BRENTON COMPLETED DATE: 01-09-12	STRUCTURE #167, LINE TL 214, (	80	3
205946	06/08/01	TL214,S174,GUYS,RETENSION,BOTTOM BROOK SIDE. REPLACE PREFORM, DOYLES SIDE. RETENSION STORMS GUYS BOTTOM BROOK SIDE. REPLACED PREFORM, DOYLES SIDE. COMPLETED BY: R.CURNEW/D.COURTNEY/P.MACISAAC COMPLETED DATE: 01-06-06	STRUCTURE #174, LINE TL 214, (	80	3
209721	01/06/06	TL214,S30,GUYS,RETENSION BOTTOM BROOK SIDE RETENSIONED GUYS, S30, TL214. COMPLETED BY: T. BEATON/D. COURTNEY COMPLETED DATE: 01-06-06.	STRUCTURE #30, LINE TL 214, (3	80	3
210092	01/09/11	TL214,S226,INSULATOR,REPLACE,LEFT PHASE FLASHED REPLACED INSULATOR. COMPLETED BY: K.ANTLE COMPLETED DATE: 01-09-11	STRUCTURE #226, LINE TL 214, (	80	3
210286	01/09/12	TL214,S187,INSULATORS,REPLACE,LEFT PHASE FLASHED REPLACED LEFT PHASE INSULATOR STRING. COMPLETED BY: K.ANTLE COMPLETED DATE: 01-09-12	STRUCTURE #187, LINE TL 214, (	80	3
210301	01/09/11	TL214,S208,INSULATOR,REPLACE,RIGHT PHASE FLASHED	STRUCTURE #208, LINE TL 214, (	80	3

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210301	01/09/11	REPLACED RIGHT PHASE INSULATOR STRINGS. REPAIRED DAMAGED CONDUCTOR ON RIGHT PHASE WITH PATCH RODS. COMPLETED BY: K.ANTLE COMPLETED DATE: 01-09-11	STRUCTURE #208, LINE TL 214, (	80	3
210308	01/09/11	TL214,S195,INSULATOR,REPLACE,RIGHT PHASE FLASHED REPLACED RIGHT PHASE INSULATOR STRING. COMPLETED BY: K.ANTLE COMPLETED DATE: 01-09-11	STRUCTURE #195, LINE TL 214, (	80	3
211458	00/01/01	TL214,S38,BRACE,TIGHTEN,1A108,TL214 LOOSE BRACE TIGHTEN BRACE TL214,S38. COMPLETED BY: T.BEATON/F.REID/L.LEARNING COMPLETED DATE: 01-06-08	STRUCTURE #38, LINE TL 214, (3	80	3
211472	01/06/08	TL214,S43,BRACE,TIGHTEN,1A29 TIGHTEN BRACE TL214,S43 COMPLETED BY: T.BEATON/F.REID/L.LEARNING COMPLETED DATE: 01-06-08	STRUCTURE #43, LINE TL 214, (2	80	3
211616	01/07/23	TL214,S34,FOOTING,BACK FILL,FOOTING 14-16 INCHES OUT OF THE GROUND,NEEDS A COUPLE LOADS OF FILL BACK FILLED FOOTING. COMPLETED BY: R.CURNEW/P.MACISAAC/L.LEARNING/D.COURTNEY COMPLETED DATE: 01-07-23	STRUCTURE #34, LINE TL 214, (3	80	3
211617	01/06/01	TL214,S37,FOOTING,BACK FILL FILLED FOOTING. COMPLETED BY: J.STRIDE COMPLETED DATE: 01-06-01	STRUCTURE #37, LINE TL 214, (4	80	3
212665	01/09/12	TL214,S93,INSULATOR,REPLACE,LEFT PHASE #4 REPLACED 6 DEFECTIVE INSULATORS ON LEFT PHASE. COMPLETED BY: B.RIDEOUT COMPLETED DATE: 01-09-12	STRUCTURE #93, LINE TL 214, (3	80	3
212669	01/09/11	TL214,S92,INSULATOR,REPLACE,CENTER PHASE #6,LEFT PHASE #4 REPLACED 8 DEFECTIVE INSULATORS ON LEFT PHASE AND 8 DEFECTIVE INSULATORS ON CENTER PHASE. COMPLETED BY: B.RIDEOUT COMPLETED DATE: 01-09-11	STRUCTURE #92, LINE TL 214, (3	80	3

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213090	01/09/11	TL214,S78,DEFECTIVE INSULATOR,REPLACE,RIGHT PHASE #3 REPLACED 8 DEFECTIVE INSULATORS ON RIGHT PHASE. COMPLETED BY: B.RIDEOUT COMPLETED DATE: 01-09-11	STRUCTURE #78, LINE TL 214, (5	80	3
213091	01/09/11	TL214,S101,DEFECTIVE INSULATOR,REPLACE,TYPE "DD", RIGHT PHASE #2 DOYLES REPLACED INSULATOR. COMPLETED BY: K.LUSH COMPLETED DATE: 01-09-11	STRUCTURE #101, LINE TL 214, (	80	3
213101	01/09/12	TL214,S96,DEFECTIVE INSULATOR,REPLACE,TYPE "A", LEFT PHASE #8 REPLACED 8 DEFECTIVE INSULATORS ON LEFT PHASE. COMPLETED BY: B.RIDEOUT COMPLETED DATE: 01-09-12	STRUCTURE #96, LINE TL 214, (4	80	3
226591	01/09/12	TL214,S183,INSULATOR,REPLACE.INSULATORS FLASHED ON LEFT PHASE,ALSO CHECK ALL 3 PHASES. REPLACED ALL INSULATORS. COMPLETED BY: K.ANTLE COMPLETED DATE: 01-09-12	TRANSMISSION LINE 214, BBK TO	80	3
226594	01/09/12	TL214,S256,INSULATOR,REPLACE.INSULATORS ON RIGHT PHASE FLASHED,ALSO CHECK ALL 3 PHASES FOR FLASH MARKS. REPLACED INSULATOR. COMPLETED BY: L.LEARNING/F.REID/T.BEATON COMPLETED DATE: 01-09-12	TRANSMISSION LINE 214, BBK TO	80	3
226599	01/09/11	TL214,S79,INSULATOR,REPLACE.INSULATORS FLASHED ON LEFT PHASE ALSO CHECK ALL 3 PHASES AND REPLACE IF NECESSARY. REPLACED 8 INSULATORS ON LEFT PHASE, 8 INSULATORS ON CENTER PHASE AND 8 INSULATORS ON RIGHT PHASE. COMPLETED BY: B.RIDEOUT COMPLETED DATE: 01-09-11	STRUCTURE #79, LINE TL 214, (3	80	3
226628	01/09/12	TL214,S136,DAMPER IN MIDSPAN ON RIGHT PHASE. COMPLETED DAMPER IN MIDSPAN ON RIGHT PHASE. COMPLETED BY: B.RIDEOUT COMPLETED DATE: 01-09-12	TRANSMISSION LINE 214, BBK TO	80	3

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226635	01/09/12	TL214,S308,DAMPER IN MIDSPAN ON RIGHT PHASE REMOVED DAMPER IN MIDSPAN ON RIGHT PHASE. COMPLETED BY: T.KENDALL COMPLETED DATE: 01-09-12	TRANSMISSION LINE 214, BBK TO	80	3
229014	01/09/11	TL214,S155-S156,CONDUCTOR,REPLACE. "B" TYPE STRAND EITHER SIDE OF SPAN (BARACHOIS BROOK). REPLACED CONDUCTOR TL214, STRS. 155-156. COMPLETED BY: T.BEATON COMPLETED DATE: 01-09-11	STRUCTURE #155, LINE TL 214, (	80	3
233518	01/09/13	TL214,S308,INSULATOR,CHANGE. C PHASE. REPLACED INSULATOR. COMPLETED BY: T.KENDALL COMPLETED DATE: 01-09-13	STRUCTURE #308, LINE TL 214, (	80	3
233523	01/09/13	TL214,S310,INSULATOR,CHANGE. RIGHT PHASE. CHANGED INSULATOR. COMPLETED BY: T.KENDALL COMPLETED DATE: 01-09-13	STRUCTURE #310, LINE TL 214, (	80	3
233540	01/09/14	TL214,S350,CONDUCTOR,REPAIR. MAY BE BROKEN UNDER COUNTERWEIGHT. LEFT PHASE. REPAIRED CONDUCTOR. COMPLETED BY: R.CURNEW/F.KENNEDY/P.MACISAAC COMPLETED DATE: 01-09-14	STRUCTURE #350, LINE TL 214, (	80	3
237030	01/09/12	TL214,S155,INSULATORS,REPLACE. ALL PHASES FLASHED. REPLACED ALL INSULATORS. COMPLETED BY: T.KENDALL COMPLETED DATE: 01-09-12	STRUCTURE #155, LINE TL 214, (	80	3
11579	99/07/27	BARN DOOR TYPE SUSPENSION CLAMP, REPLACE. (WEARING) 11431 - Reported by: Completed by: Curnew/Courtney/Loveless	STRUCTURE #274, LINE TL 214, (	80	1
11580	01/09/12	INSULATORS, REPLACE ON C PH.	STRUCTURE #276, LINE TL 214, (	80	1

Supervisor: SVL Transmission Line Mtce De

11580	01/09/12	(FLASHED) 11432 - Reported by: REPLACED INSULATOR. COMPLETED BY: T.KENDALL COMPLETED DATE: 01-09-12	STRUCTURE #276, LINE TL 214, (	80	1
11581	99/07/22	DAMPERS, REPLACE ON R & L PHASES. 11433 - Reported by: Completed by G. Stride/R.Cumew/ P. MacIsaac.	STRUCTURE #284, LINE TL 214, (	80	1
11588	99/07/27	NUT, REPLACE ON BOLT IN THROUGH BOLT ON CONDUCTOR CLAMP - L PH. 11471 - Reported by: Installed 3 bolts . Completed by: Cumew/Courtney/Loveless	STRUCTURE #344, LINE TL 214, (	80	1
11589	99/07/30	3/4 BOLT, REPLACE (1A135'S WORN) 11472 - Reported by: Replaced 1A135 & installed new bolts. Completed by: Beaton/Farrell	STRUCTURE #333, LINE TL 214, (	80	1
11591	99/07/30	1A135'S, WORN. 3/4 BOLT Replaced 1A135 & installed new bolts. Completed by: Cumew/Loveless	STRUCTURE #325, LINE TL 214, (	80	1
11592	99/07/27	BOLT, REPLACE (1A135'S WORN - 3/4 BOLT) 11486 - Reported by: Completed by: Bealon/Farrell/Learning	STRUCTURE #340, LINE TL 214, (	80	1
11593	99/07/27	BOLT, REPLACE (1A135'S WORN - 3/4 BOLT) 11487 - Reported by: Completed by: Bealon/Farrell/Learning	STRUCTURE #341, LINE TL 214, (	80	1
11594	99/07/30	BOLT, REPLACE (1A135'S WORN - 3/4 BOLT) 11488 - Reported by:	STRUCTURE #339, LINE TL 214, (	80	1

APPENDIX F
POWER SUPPLY DURING TL 214 OUTAGE

HYDRO
THE POWER OF COMMITMENT

INTEROFFICE MEMORANDUM

Date: July 23, 2002

To: T. Gardiner, M. Organ

From: P. Thomas

Subject: **Power Supply During TL214 Outage**

As per your request, I have revisited the power and energy requirements of the Doyles/ Port-aux-Basques system with TL214 out of service for insulator replacement to determine if a period exists where production from Rose Blanche Brook can be used to reduce the fuel costs provided in my January 18, 2002 memo. You may recall that the January 18th memo was in response to your request for alternate energy supply costs during the summer months. These costs were to be incorporated in the total cost of alternatives using outages to upgrade TL214 for comparison with upgrade alternatives that did not require outages to TL214. It is my understanding that your technical review of TL214 and its performance indicates a need to changeout the existing insulation and add a number of structures. This being the case, rebuild or rerouting of entire line sections is unwarranted. The end result is that upgrade work on the existing line can be accomplished during daily outages to TL214.

You will recall that Rose Blanche Brook is a run of the river hydroelectric facility with four-day storage. Operating experience indicates that following spring runoff there is insufficient flow for operation of the plant on any "firm" basis during the summer months. As a result, the plant was not considered when determining the fuel costs for the July-August time frames in my January 18th memo. Available data on the production at Rose Blanche was reviewed as part of this analysis. The attached graph provides the hourly production from Rose Blanche Brook during the month of May for the years 2000 to 2002. From the plot it appears that Rose Blanche should be capable of producing 5.6 MW during the proposed daily outages to TL214 in the month of May given proper water management. Again, it is important to stress that Rose Blanche is a run of the river facility and its daily production is dependent upon inflows. Lack of snow cover and/or a dry spring will have a substantial impact upon the plant's output.

The following assumptions have been used for this review:

- upgrade work to be completed during the month of May;
- outages start at 0600 hours and finish at 1900 hours daily;
- Grand Bay mobile gas turbine capacity of 7,200 kW;
- Port-aux-Basques diesel capacity of 2,500 kW;
- Rose Blanche Brook capacity of 5,600 kW;
- NP mobile transformer NP200135 (10 MVA, 4.16/66 kV) is available for connection of rented mobiles to system;
- diesel plant fuel efficiency of 3.0 kWh/litre; and
- fuel costs of 0.348$/litre.

A review of hourly load data from the EMS for the past three years indicates that a maximum peak of 18.51 MW occurred in May of 2002 for the Doyles/Port-aux-Basques system. Given the installed generation, an additional 3.21 MW of mobile generation will be required to meet the system peak during the outage to TL214. It is proposed to rent two 2000 kW mobile diesels from Toromont to supply the required peaking capacity. Renting one 2000 kW and one 1250 kW for a total of 3250 kW would leave insufficient margin (i.e. 40 kW) between generation and expected peak. Note that additional rentals would be required to cover loss of unit contingencies. Rental costs based on Toromont's January 2002 quote are as follows:

Estimate of Mobile Diesel Plant Rentals for May Outage to TL214

Item	Unit Cost	Quantity	Item Cost
2000 kW Genset	57,612	2	115,224
600/4160 V Transformer	12,500	2	25,000
Power Cable	20,000	2	40,000
Freight	200,000		200,000
Subtotal			380,224
Taxes			57,034
Total (2002$)			437,258

The fuel consumption estimate is based upon the assumption that Rose Blanche Brook will supply 2,256,800 kWh during theTL214 outage. The net load to be supplied by gas turbine and diesel is 12.91 MW at a load factor of 52.47% for an energy requirement of 2,729,873 kWh.

Based upon a fuel efficiency of 3.0 kWh/litre and a fuel cost of 0.348$/litre, the fuel cost is estimated at $317,000 in 2002 dollars.

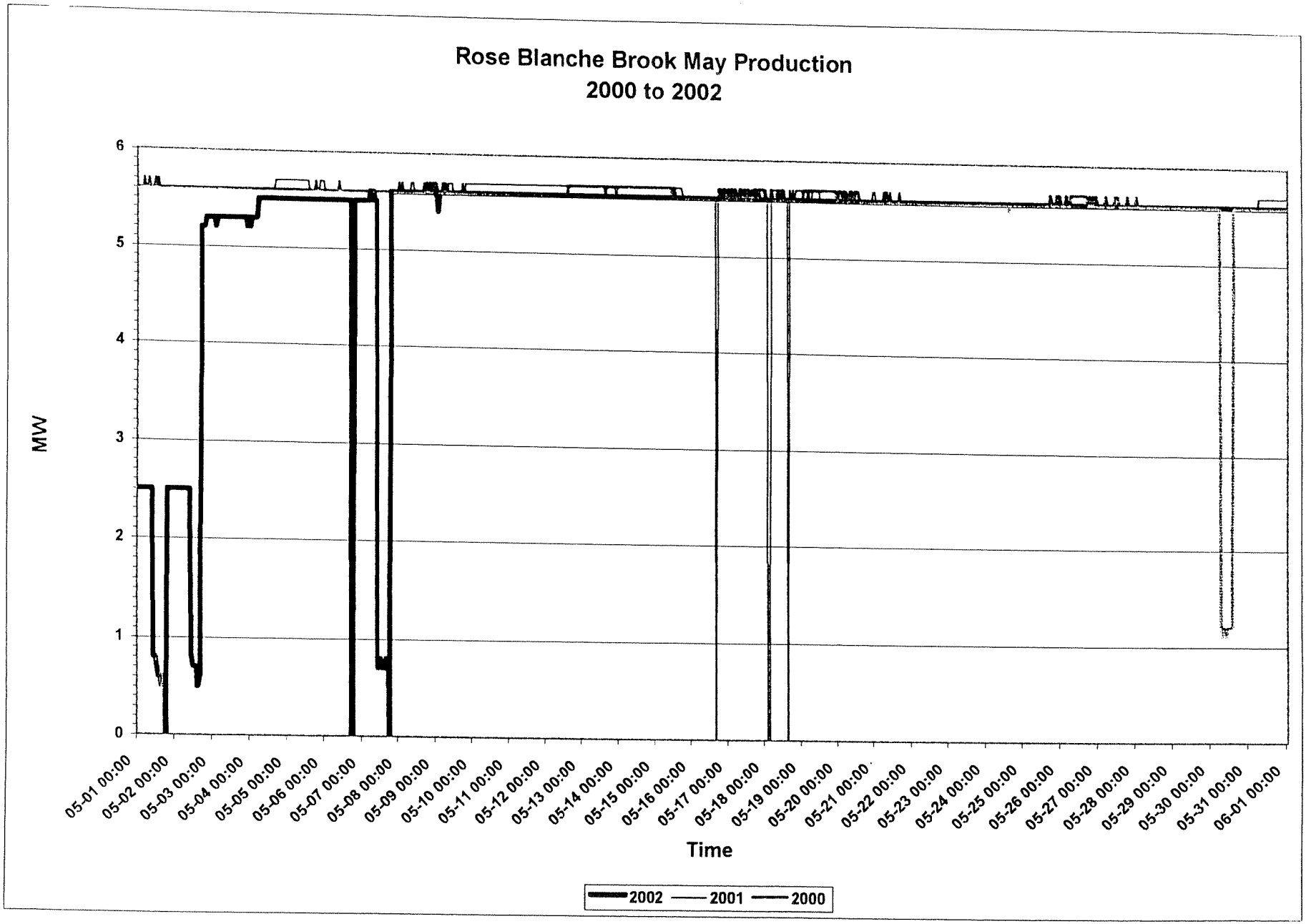
As noted in my January 18th memo, TRO would be in a better position to estimate the cost of an operator for the mobile facilities. As well, terminals design should provide the costs associated with use of the NP portable transformer and any necessary temporary structures to facilitate connection of the mobile equipment.

Should you have any questions, please do not hesitate to call.

Peter W. Thomas, P.Eng., MBA
Sr. Planning Engineer – Transmission

PWT:cfh

cc PWH/214.63.00


Rose Blanche Brook May Production
2000 to 2002
MW
6
5
4
3
2
1
0
05-01 00:00
05-02 00:00
05-03 00:00
05-04 00:00
05-05 00:00
05-06 00:00
05-07 00:00
05-08 00:00
05-09 00:00
05-10 00:00
05-11 00:00
05-12 00:00
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05-20 00:00
05-21 00:00
05-22 00:00
05-23 00:00
05-24 00:00
05-25 00:00
05-26 00:00
05-27 00:00
05-28 00:00
05-29 00:00
05-30 00:00
05-31 00:00
06-01 00:00
Time
2002
2001
2000

APPENDIX G
TL 214 STRUCTURES

FIGURE 2.1 - TL 214 – TANGENT “A” STRUCTURE

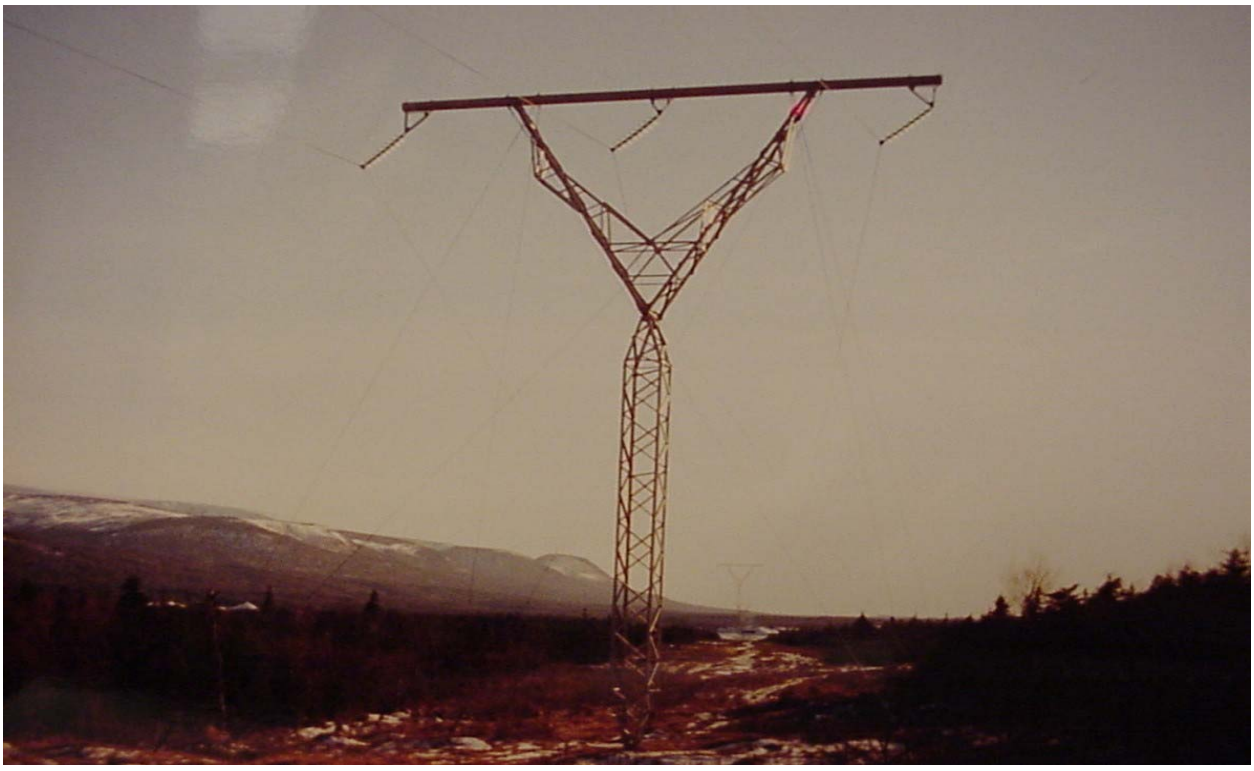

FIGURE 2.2 - TL 214 – ANGLE “B” STRUCTURE