

Utilities Kingston Pole Collapse Investigation

John Counter Blvd

(Sir John A. MacDonald Blvd. to west of Indian Road)

For Utilities Kingston, Kingston, Ontario.



Prepared By: C.J.Uyede, P.Eng.

Date: July 15, 2016

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Attachment #2 – Pole Analysis Results

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Kingston Pole Failure Investigation

John Counter Blvd

(Sir John A. MacDonald Blvd. to west of Indian Road)

1. SCOPE:

Utilities Kingston has procured the services of UTS Consultants Inc., to investigate the utility pole line collapse that occurred on June 17th at approximately 11:50am on John Counter Boulevard in the city of Kingston. There were no obvious reasons or events that would support why these poles collapsed on June 17th and Utilities Kingston has reached out to have an independent industry expert assist with the investigation.

The following scope for the investigation was accepted by Utilities Kingston:

- Gather information (including topo survey)
- Test failed poles
- Test adjacent poles (Polux only) still standing
- Existing conditions at time of collapse
- Create report to capture findings of the investigation and analysis

2. Qualifications of Industry Expert:

UTS Consultants Inc. and in particular Clayton Jamison Uyede, P.Eng., Vice President and Consulting Engineer are recognized industry leaders in utility pole design and the Construction Verification Program (CVP) under ESA22/04 (Ontario Regulation Electrical Safety Association 22/04). Clayton Jamison Uyede, P.Eng., is the engineer of record for UTS Consultants and as a company have designed and stamped several thousands of utility poles since the inception of ESA22/04. Mr. Uyede has also issued several hundred ESA22/04 P.Eng., stamped utility pole CVP certificates. These certificates verify that the as built construction meets ESA22/04 safety standards. Under the guidance of Clayton Jamison Uyede P.Eng., UTS Consultants is recognized for their knowledge, due diligence and skilled analysis in utility pole design and inspection within the province of Ontario.

3. Data Submitted for Review:

On Thursday June 23, 2016, the UTS investigation team met with Utilities Kingston and was presented with information and the investigative work that they had performed to date. Utilities Kingston prepared a drawing that showed what circuits were on the poles and any known pole heights and types. Utilities Kingston provided copies of drawings, photos, and a copy of the police report. Utilities Kingston provided access to the yard where any available salvageable pole

stubs were stored and tagged. The drawing that Utilities Kingston provided to UTS can be found in Attachment #6 – Utilities Kingston Drawing. This drawing shows the aftermath of the pole collapse and gives an overall perspective of which poles collapsed and where they were positioned on John Counter Boulevard.

At the time of the collapse, Utilities Kingston was in the process of replacing the aerial poles on the south side of John Counter Boulevard with a new aerial pole line on the north side of John Counter Boulevard and a buried conduit run on the south side in preparation for a road widening. The new poles on the north side already had most of the circuits attached, just waiting to be energized which greatly increased the speed in which service was restored. Due to replacement communications poles being located in the exact location as the collapsed Utilities Kingston poles, many of the pole stubs were removed by the installation contractor and were not recoverable for analysis. The top sections of the utility poles were also disposed.

The police report can be found in Attachment #3. – Police Report. Eyewitness accounts cannot confirm which pole fell first. No one witnessed any vehicle hitting a pole or hitting a mid-span communication span.

4. Data Obtained and Analyzed:

- Survey:
 - The poles on the south side of John Counter Boulevard that were involved in collapse were no longer in place as they were removed and replaced with communication owned poles. However since it appeared that the communication poles were installed in the same location as the utility poles, the RTK (Real Time Kinematic) GPS (Geographical Positioning System) survey was conducted assuming the new communication poles were installed in the same location as the Utilities Kingston poles.
 - The survey results can be found in Attachment #4 – UTS Drawing (pole locations, angles, span distances). The UTS drawing was used in the pole calculations to ensure correct span distances, angles and elevations were used (Attachment #2 – Pole Analysis Results).
- Pole Testing:
 - The pole testing results can be found in Attachment #2 – Pole Analysis Results
 - Polux pole testing is a non-intrusive test that relies on various parameters like wood species and age of pole.
 - The Polux test is performed at the ground line and is considered a failure if there is less than 60% of the ultimate pole strength remaining.
 - A general observation on the pole butts recovered found that sections of the poles below ground level were insect infested and deteriorated on the inside. Pole P#3284 failed the core drill tests as it produced no shavings and very little effort (little resistance) was required during the drill test. Just below the ground line, the interior of the pole was deteriorated, with the base of the pole severely deteriorated.

- The adjacent pole P#3276 on the traffic island on the south west corner of Sir John A. MacDonald and John Counter Boulevard that did not collapse passed the Polux test with 80% remaining strength and no signs of insects as well as passing the drill test.
- On P#3279 there were signs of insect infestation 1.219m to 1.524m above the ground line.
- Pole Calculations:
 - According to Utilities Kingston there have been no applications submitted for pole attachments from 3rd parties and no major work performed by Utilities Kingston on these poles since the inception of ESA 22/04 and as such there have been no calculations performed on these poles in recent years.
 - Age of the poles has been established based on information provided by Utilities Kingston.

The pole analysis was performed for the ambient condition of each pole. Originally the plan was to evaluate the poles under the June 17, 2016 ambient conditions and then recalculate them with the reduced strength found from the Polux testing. This plan was abandoned when it was found that poles were weakened from insect infestation causing rot from the centre of the pole out and that this was found at the butt of the pole, below the ground line. The pole analysis results can be found in Attachment #2 – Pole Analysis Results. The results indicate the loading of the poles under ambient condition using the full pole strength.

For all poles, guying and anchoring pass under the ambient conditions seen on June 17, 2016. This would indicate that if the poles were at 100% strength they should not have collapsed on June 17, 2016. The percent usage ranges from 5% to 25% of the poles ultimate strength under the ambient conditions on the day, which is well below the pole's capacity. Since there have been no recent additions to the pole line, these poles are grandfathered under ESA 22/04 and as such would not have been required to be calculated since the inception of ESA 22/04.
 - For ambient conditions at 100% strength, the stability check built into the analysis indicated that the poles would pass.
- Conditions on June 17, 2016:
 - There was no significant wind and no rain on the day of the pole collapse (see Attachment #5 – Weather Report).
- Site observations:
 - Hydro buried construction in boulevard on south side of John Counter.
 - Open pits for handholes and trenches.
 - Open trench from handhole towards base of P#3284, P#3284 now replaced with a third party communication pole and pit around base of old P#3284 has been backfilled and compacted. Earlier photos show that the pit was not backfilled at time of pole line collapse.
 - On June 23rd, 2016 a resident that witnessed the pole collapse approached the author and indicated that he saw P#3284 fall first and second was P#3283. Contact information was documented and forwarded to Utilities Kingston.

5. Possible Contributing Factors:

- Service drop damage on June 15, 2016 at P#3230 on the north side of John Counter Blvd.:
 - See Attachment #7 – Damage Report, which outlines the incident.
 - This incident happened 2 days before the pole line collapse, however, when the service was hit and broken, it would have increased tension forces on P#3230 to the north and possibly increased tension on P#3284 to the north as well. This could have caused damage to P#3284 which was already deteriorated below the ground line and was exposed by the pit not being backfilled.
- Construction of the new underground conduit run on the south side of John Counter:
 - Machinery (Backhoes, Dump Trucks) in the vicinity of the poles on the south side of John Counter could have come in contact with poles or disturbed the ground surrounding the base of the poles in question.
- Open pit on the south side of P#3284:
 - During the construction of the Utilities Kingston buried vault a trench was excavated to the base of P#3284. The exposed pole base on the south side was left open.
 - The photo of this pole (see Attachment #1 Pole Testing Results for P#3284) shows that the failure (break) occurred below the ground line where it was deteriorated from the inside out.
 - There was a 3 phase slack span primary and secondary circuit between P#3284 and P#3230 which would cause forces that would deflect the pole to the north.
- Anchor failure at P#3226:
 - During the investigation by Utilities Kingston, it was found that the dead end anchor at P#3226 had pulled out of the ground and the pole shifted to the east by approximately 5cm. It is not known if this happened before or after the pole collapses to the east of this location. If it happened before it could have contributed to the collapse, although to a minor extent.
- Insufficient depth of set P#3280:
 - Depth of set was established at approximately 0.91m (3'). Depth of set should be 1.8m (6').
- Sounds of pole cracking:
 - There were some witnesses that reported the sounds of poles cracking before the poles collapsed.
 - There were numerous poles that broke above the ground line such as P#3285 and P#3286 which could be the ones where cracking could be heard.
- Possible communication over-lash activity:
 - There is a possibility that a fibre communications cable was over-lashed to existing strand. Installing additional infrastructure on pole lines imparts stress on the poles during the installation in addition to the added force of the cabling. The act of lashing a new fibre to the existing strand and lashing as well as the possibility of the installers using ladders that would rest on the strand and possibly

put lateral forces (north or south) could have weakened (an unknown at the time) a deteriorated pole line.

6. Conclusions:

After performing all the calculations and data collection, there are a number of factors contributing to the pole line failure on June 17, 2016 on a clear, sunny, minimal wind, summer day.

The factors identified by this investigation include:

- 1) The service drop hit at P#3230.
- 2) Exposed construction pit on the south side at the base of P#3284.
- 3) Buried construction activity in the south boulevard of John Counter Boulevard.
- 4) Deterioration from age.
- 5) Deterioration from insect infestation.
- 6) Anchor failure at P#3226.
- 7) Possible fibre over-lash construction.
- 8) Insufficient depth of set at P#3280. Depth of set should be at 1.8m (6').

The most likely scenario is that P#3284 was the first to collapse and fall across John Counter Boulevard, causing the other poles to collapse as the forces from the weight of the collapsed pole on the circuits exceeded the remaining strength in the other poles causing them to collapse.

Attachment #1 – Pole Testing Results

POLE TESTING OVERVIEW

Pole testing using the Polux System which does measurements at the groundline and visual inspections were carried out on the broken poles in the Utilities Kingston yard as well as on two poles that remained standing in the field. Core drilling was also performed on select poles when deemed necessary after visual inspection. For the purposes of the Polux test, the age of the poles was determined based on information provided by Utilities Kingston.

POLE TESTING RESULTS

HP #3230



- passed Polux test with 75% remaining strength
- no sign of insects
- passed core drill testing

HP #3276



- passed Polux test with 80% remaining strength
- no sign of insects
- passed core drill testing

HP #3279



-failed Polux test (strength too low to record)

-severe insect infestation above ground line

-no core drill test was performed as the pole butt was missing

HP#3280



-passed Polux test with 62% remaining strength

-depth of set approximately 0.91m (3'). Should be at 1.8m (6').

HP#3281



-failed Polux test with 56% remaining strength

HP #3282



-passed Polux test with 73% remaining strength

-insect infestation

HP #3283



-failed Polux test with 52% remaining strength

-insect infestation

HP #3284



-failed Polux test with 41% remaining strength

-severe insect infestation

-failed core drill test, drilling produced no shavings and required very little effort

HP #3285



-failed Polux test (strength too low to record)

-severe insect infestation

HP #3286



-failed Polux test with 57% remaining strength

-no sign of insects

HP #3287



-failed Polux test (strength too low to record)

-insect infestation

Attachment #2 –Pole Analysis Results

SCOPE:

The purpose of this report is to evaluate the structural loading of recently removed Utilities Kingston-owned poles that failed on June 17th, 2016. The route includes poles on John Counter Blvd from Sir John A. MacDonald Blvd to west of Indian Rd.

In the absence of recent and specific test data on the condition of the poles within this project, all calculations have been based on the load factors outlined in Table 31 of CSA standard C22.3-No. 1-15, for the weather conditions on the day of the incident.

DATA COLLECTION:

A field survey was conducted and photos were taken to document the existing conditions. The survey took place on June 23, 2016 and was performed by UTS using laser meters and Total Station or RTK (Real Time Kinematic) GPS survey. All communications bundle, down guy, and anchor data and information was obtained from an experienced technician using ground level observation.

For the poles that had recently been removed at the time of survey, the existing (prior to June 17th, 2016) framings were assumed based on USF standards. Google Street View was used as reference for adjusting the USF standard separations and assuming attachment heights based on CSA standard depth settings. Hydro circuit information was provided by Utilities Kingston.

CALCULATIONS:

All poles were evaluated with geometric non-linear SPIDACalc software using the ambient conditions from the day of the incident (31km/h winds, 17.8°C air temperature, no ice loading).

All poles were evaluated under the analysis condition that 100% of their residual strength remained.

Poles were checked for stability as required for non-linear analysis by section 8.1.3 of CSA C22.3 No. 1-15. Load non-linearity on the pole due to deflection was enabled in the analysis as permitted by section A.8.1.3 of Annex A.

The following assumptions were made prior to analysis:

- All anchors with rods buried below ground were assumed to be 10" Helix with 3/4" rod.
- All anchors with 1" rods were assumed to be 10" Helix.
- Class 4 soil conditions were assumed.
- All span guys were assumed to be 3/8" grade 180 steel.
- All unknown Bell down guys were assumed to be 3/8" grade 160 steel, unknown Cogeco down guys were assumed to be 1/4" grade 180.
- Directions and lengths of utility service drops to buildings were assumed based on Utilities Kingston records and images.
- Poles on the south side of John Counter Blvd were assumed to be class 3 unless otherwise noted, according to Utilities Kingston.

The following pole-specific assumptions were made:

HP3279:

Assumed three-phase primary tap to north (HP3233) to be at slack tension (20% of full initial tension), based on images.

HP3233:

Assumed 35' class 4 pole based on height above grade and ground line circumference.

HP3284:

Assumed three-phase primary tap to north (HP3230) to be at slack tension (20% of full initial tension), based on images.

HP3230:

Assumed 40' class 3 pole based on height above grade and ground line circumference.

HP3228:

Assumed 35' class 4 pole based on height above grade and ground line circumference.

SUMMARY:

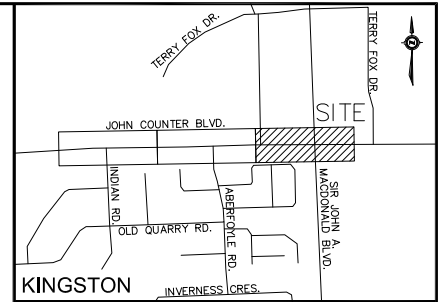
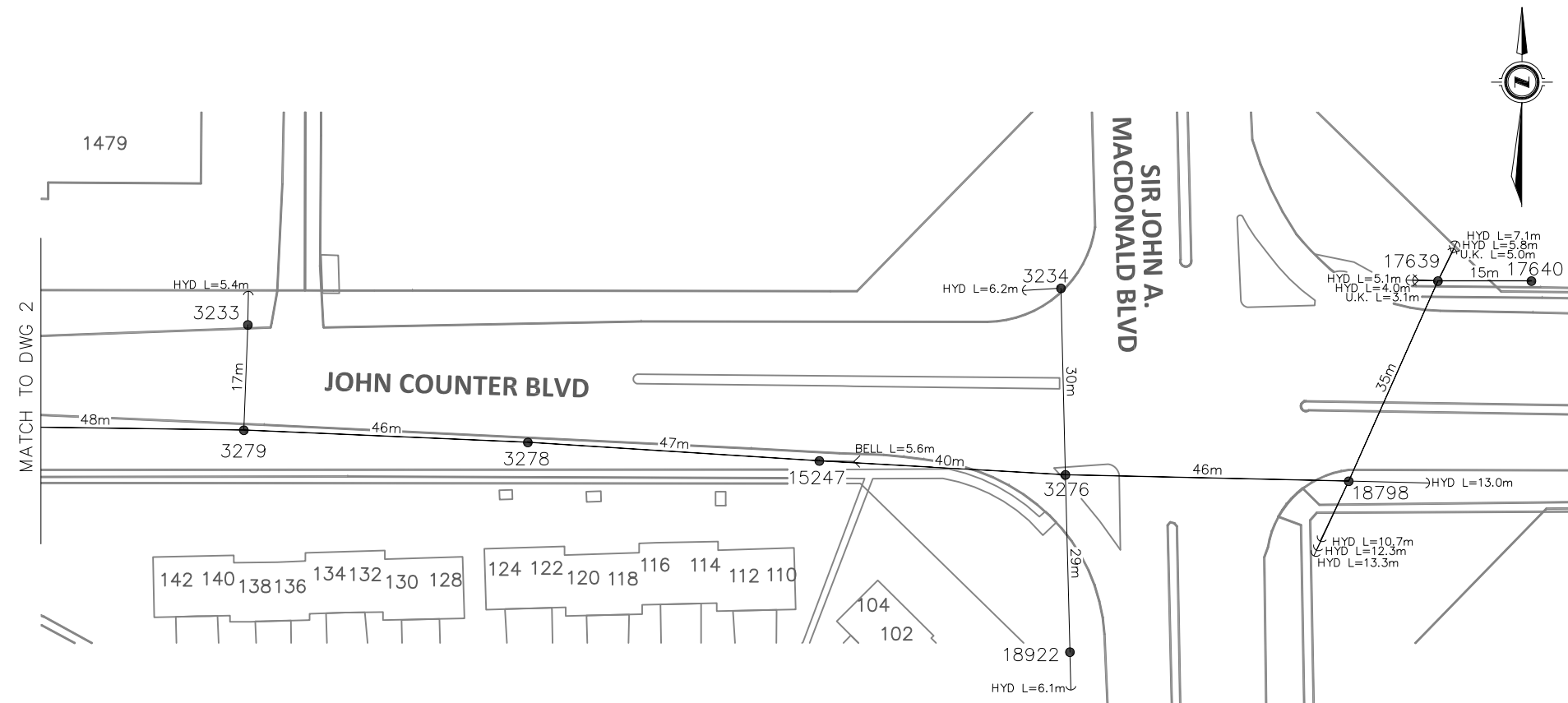
The poles were analyzed based on 100% of their strength remaining. All of the poles evaluated were compliant for the weather loading based on the ambient conditions from the day of the incident. On June 17th, 2016, the wind gust speed in Kingston was recorded to be 31km/h with an average air temperature of 17.8°C. This was modeled in SPIDACalc as a wind pressure of 0.05 kilopascals.

Poles	Year of Pole	Polux Pole Strength Results	
		Pass/Fail	Remaining Strength
John Counter Blvd.			
HP3276	1983	pass	80%
HP15247	n/a	n/a	n/a
HP3278	n/a	n/a	n/a
HP3279	1966	fail	too low to measure
HP3280	1966	pass	62%
HP3281	1966	fail	56%
HP3282	1966	pass	68%
HP3283	1966	fail	46%
HP3284	1966	fail	36%
HP3285	1966	fail	too low to measure
HP3286	1966	fail	50%
HP2866	n/a	n/a	n/a
HP3287	1966	fail	too low to measure
HP3288	n/a	n/a	n/a
HP3289	n/a	n/a	n/a
HP3290	n/a	n/a	n/a
Non-Tangent Poles			
HP18922	n/a	n/a	n/a
HP3233	n/a	n/a	n/a
HP3232	n/a	n/a	n/a
HP3231	n/a	n/a	n/a
HP3230	1966	pass	69%
HP4353	n/a	n/a	n/a
HP3228	n/a	n/a	n/a
HP3227	n/a	n/a	n/a

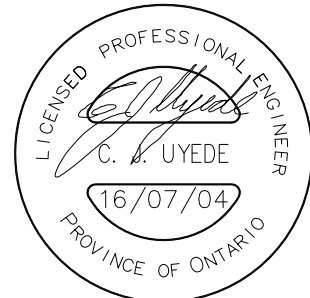
NOTE: the remaining strength of some poles was below the measurable level for the testing equipment. All poles were modeled to determine their structural loading based on having 100% of their rated strength.

Attachment #3 – Police Report

Attachment #4 – UTS Drawings (pole locations, angles, distances)



KEY MAP - NTS



PROJ. REF.: CSWAN-001
ENGINEER'S SEAL

HAND DIG WITHIN
1 METER
OF UNDERGROUND SERVICES

ISSUE	DATE	REASON FOR ISSUE	BY

REVISIONS



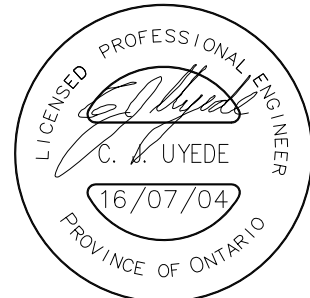
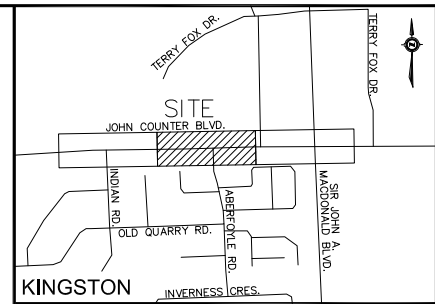
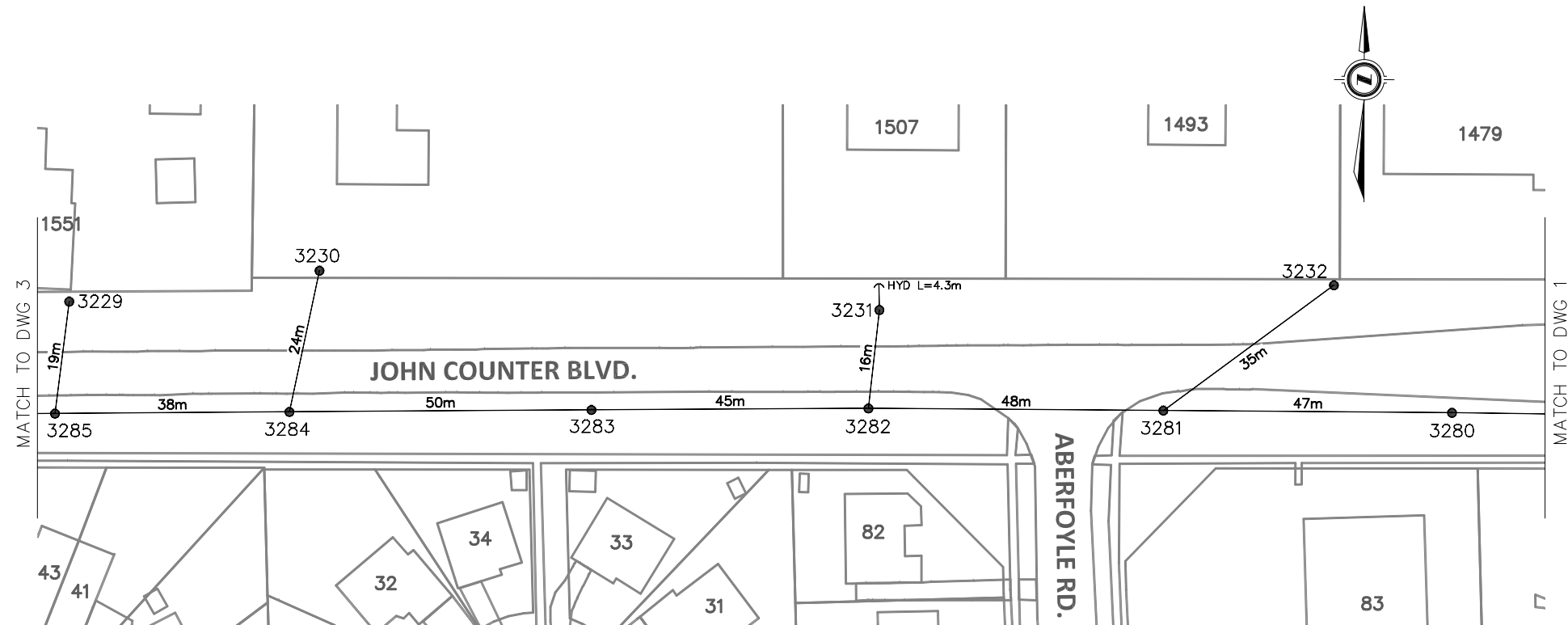
PROJECT NAME:
POLE LINE INVESTIGATION
JOHN COUNTER BLVD. AND
SIR JOHN A. MACDONALD BLVD.
CITY OF KINGSTON

LEGEND	
P9.....P9A	UTS POLE NUMBERS
---	EXIST. STRAND
---	OVERLASH
---	NEW STRAND
---	QR 860 CABLE
---	QR 715 CABLE
---	QR 540 CABLE
---	FIBRE CABLE
---	P3.875 CABLE
---	P3.750 CABLE
---	P3.625 CABLE
---	P3.500 CABLE
---	TRANSFER
---	NON TANGENT
---	NEW BOND
---	NEW GROUND
---	EXISTING COMM GUY AND ANCHOR
---	PROPOSED COMM GUY AND ANCHOR
---	EXISTING GUY AND ANCHOR
---	PROPOSED GUY AND ANCHOR
---	EXISTING HYDRO GUY AND ANCHOR
---	PROPOSED HYDRO GUY AND ANCHOR

CAUTION	
OBSERVE SAFETY PRECAUTIONS	
DRAWN M.H.	ENG. TECH. B.D.
UTS FILE CSWAN-001	DATE ESTABLISHED JUNE 28, 2016
	PLOT DATE JULY 4, 2016

SCALE 1:500
1:1000 (11x17)

DWG NO. **36 of 49**
DWG 1 OF 3



PROJ. REF.: CSWAN-001
ENGINEER'S SEAL

HAND DIG WITHIN
1 METER
OF UNDERGROUND SERVICES

ISSUE	DATE	REASON FOR ISSUE	BY

REVISIONS



LEGEND

P9.....P9A	UTS POLE NUMBERS	-----	P3.625 CABLE
-----	EXIST. STRAND	-----	P3.500 CABLE
-----	OVERLASH	-----	TRANSFER
-----	NEW STRAND	-----	NON TANGENT
-----	QR 860 CABLE	-----	NEW BOND
-----	QR 715 CABLE	-----	NEW GROUND
-----	QR 540 CABLE	-----	EXISTING COMM GUY AND ANCHOR
-----	FIBRE CABLE	-----	PROPOSED COMM GUY AND ANCHOR
-----	P3.875 CABLE	-----	EXISTING GUY AND ANCHOR
-----	P3.750 CABLE	-----	PROPOSED GUY AND ANCHOR
-----		-----	EXISTING HYDRO GUY AND ANCHOR
		-----	PROPOSED HYDRO GUY AND ANCHOR

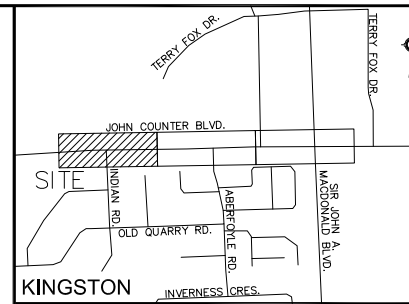
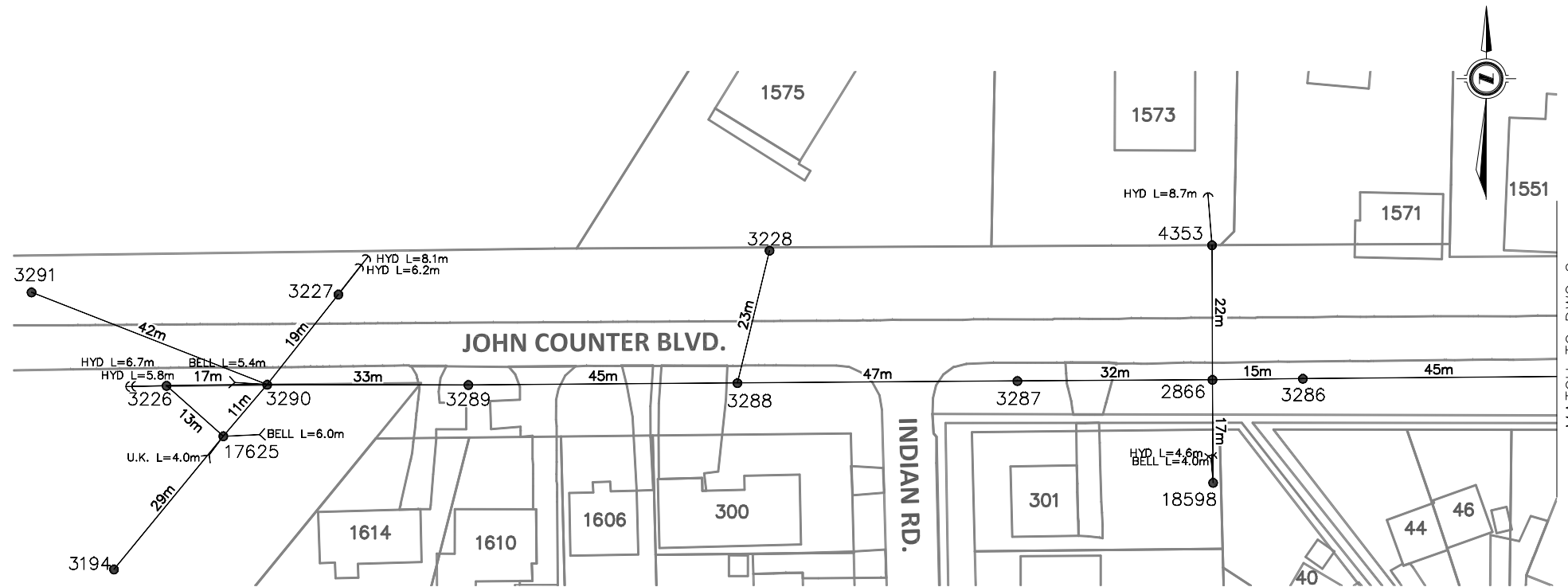
CAUTION
OBSERVE SAFETY PRECAUTIONS

DRAWN M.H.	ENG. TECH. B.D.	UTS FILE CSWAN-001	DATE ESTABLISHED JUNE 28, 2016
PLOT DATE JULY 4, 2016		SCALE 1:500 1:1000 (11x17)	

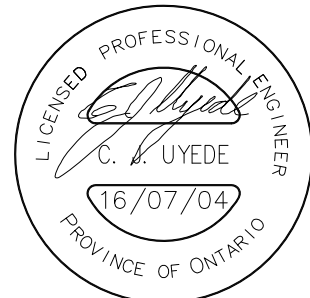
PROJECT NAME:
POLE LINE INVESTIGATION
JOHN COUNTER BLVD.
AND ABERFOYLE RD.
CITY OF KINGSTON

SCALE 1:500
1:1000 (11x17)

DWG NO. **37 of 49**
DWG 2 OF 3



KEY MAP - NTS



PROJ. REF.: CSWAN-001
ENGINEER'S SEAL

HAND DIG WITHIN
1 METER
OF UNDERGROUND SERVICES

ISSUE	DATE	REASON FOR ISSUE	BY

REVISIONS



PROJECT NAME:
POLE LINE INVESTIGATION
JOHN COUNTER BLVD.
AND INDIAN RD.
CITY OF KINGSTON

LEGEND	
P9.....P9A	UTS POLE NUMBERS
---	EXIST. STRAND
---	OVERLASH
---	NEW STRAND
---	QR 860 CABLE
---	QR 715 CABLE
---	QR 540 CABLE
---	FIBRE CABLE
---	P3.875 CABLE
---	P3.750 CABLE
---	P3.625 CABLE
---	P3.500 CABLE
---	TRANSFER
---	NON TANGENT
---	NEW BOND
---	NEW GROUND
---	EXISTING COMM GUY AND ANCHOR
---	PROPOSED COMM GUY AND ANCHOR
---	EXISTING GUY AND ANCHOR
---	PROPOSED GUY AND ANCHOR
---	EXISTING HYDRO GUY AND ANCHOR
---	PROPOSED HYDRO GUY AND ANCHOR

CAUTION	
OBSERVE SAFETY PRECAUTIONS	
DRAWN M.H.	ENG. TECH. B.D.
UTS FILE CSWAN-001	DATE ESTABLISHED JUNE 28, 2016
	PLOT DATE JULY 4, 2016

SCALE 1:500
1:1000 (11x17)

DWG NO. 38 of 49
DWG 3 OF 3

Attachment #5 – Weather Report

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Kingston, Canada Local Weather 20°C

Personalized Forecasts: **Migraine**

Now

Weekend

Extended

Month

Radar

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May 2016

View: [List Icon] [Calendar Icon]

June

2016

July 2016

SUN 5/29 Actual Temp 27°/17° Hist. Avg. 19°/9°	MON 5/30 Actual Temp 27°/16° Hist. Avg. 19°/9°	TUE 5/31 Actual Temp 27°/11° Hist. Avg. 19°/9°	WED 6/1 Actual Temp 22°/8° Hist. Avg. 19°/10°	THU 6/2 Actual Temp 19°/14° Hist. Avg. 19°/10°	FRI 6/3 Actual Temp 24°/11° Hist. Avg. 19°/10°	SAT 6/4 Actual Temp 24°/12° Hist. Avg. 20°/10°
SUN 6/5 Actual Temp 21°/16° Hist. Avg. 20°/10°	MON 6/6 Actual Temp 22°/14° Hist. Avg. 20°/10°	TUE 6/7 Actual Temp 19°/12° Hist. Avg. 20°/11°	WED 6/8 Actual Temp 16°/9° Hist. Avg. 20°/11°	THU 6/9 Actual Temp 22°/8° Hist. Avg. 20°/11°	FRI 6/10 Actual Temp 21°/6° Hist. Avg. 21°/11°	SAT 6/11 Actual Temp 25°/10° Hist. Avg. 21°/11°
SUN 6/12 Actual Temp 21°/12° Hist. Avg. 21°/11°	MON 6/13 Actual Temp 21°/8° Hist. Avg. 21°/12°	TUE 6/14 Actual Temp 21°/5° Hist. Avg. 21°/12°	WED 6/15 Actual Temp 21°/7° Hist. Avg. 21°/12°	THU 6/16 Actual Temp 28°/12° Hist. Avg. 21°/12°	FRI 6/17 Actual Temp 25°/10° Hist. Avg. 22°/12°	SAT 6/18 Actual Temp 26°/10° Hist. Avg. 22°/12°
SUN 6/19 Actual Temp 25°/13° Hist. Avg. 22°/13°	MON 6/20 Actual Temp 28°/18° Hist. Avg. 22°/13°	TUE 6/21 Actual Temp 24°/14° Hist. Avg. 22°/13°	WED 6/22 Actual Temp 22°/12° Hist. Avg. 22°/13°	THU 6/23 Actual Temp 22°/9° Hist. Avg. 23°/13°	FRI 6/24 Actual Temp 24°/11° Hist. Avg. 23°/13°	SAT 6/25 Actual Temp 26°/13° Hist. Avg. 23°/14°
YESTERDAY Actual Temp 27° /13° Hist. Avg. 23°/14°	TODAY 6/27 Actual Temp 25° /17° Rather cloudy and humid Hist. Avg. 23°/14°	TUE 6/28 Actual Temp 23° /14° A morning shower or t-storm Hist. Avg. 23°/14°	WED 6/29 Actual Temp 22° /14° Pleasant with periods of sun Hist. Avg. 23°/14°	THU 6/30 Actual Temp 23° /15° Sunny and pleasant Hist. Avg. 23°/14°	FRI 7/1 Actual Temp 24° /14° Couple of thunderstorms Hist. Avg. 24°/14°	SAT 7/2 Actual Temp 21° /14° Partly sunny Hist. Avg. 24°/15°

May 2016

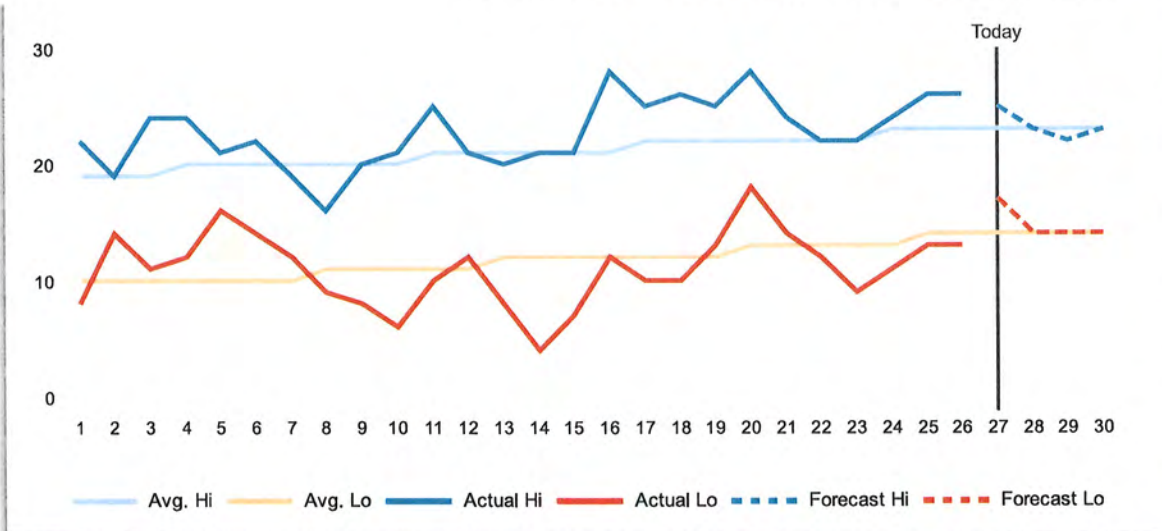
July 2016

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silversea.com/Offici...

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Temperature Graph June 2016



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► Notices

Daily Data Report for June 2016

KINGSTON CLIMATE ONTARIO

<u>Latitude:</u>	44°13'24.000" N
<u>Longitude:</u>	76°35'58.000" W
<u>Elevation:</u>	93.00 m
<u>Climate ID:</u>	6104142
<u>WMO ID:</u>	71820
<u>TC ID:</u>	TKG

	<u>Max Temp</u> °C 	<u>Min Temp</u> °C 	<u>Mean Temp</u> °C 	<u>Heat Deg Days</u> 	<u>Cool Deg Days</u> 	<u>Total Rain</u> mm 	<u>Total Snow</u> cm 	<u>Total Precip</u> mm 	<u>Snow on Grnd</u> cm 	<u>Dir of Max Gust</u> 10's deg	<u>Spd of Max Gust</u> km/h
01 ±	21.9	8.2	15.1	2.9	0.0	<u>M</u>	<u>M</u>	0.0			<31
02 ±	19.2	13.9	16.6	1.4	0.0	<u>M</u>	<u>M</u>	4.3		17	41
03 ±	23.5	10.9	17.2	0.8	0.0	<u>M</u>	<u>M</u>	0.0		20	33
04 ±	23.5	11.9	17.7	0.3	0.0	<u>M</u>	<u>M</u>	0.0			<31
05 ±	20.8	15.9	18.4	0.0	0.4	<u>M</u>	<u>M</u>	18.4		18	50
06 ±	22.2	14.1	18.2	0.0	0.2	<u>M</u>	<u>M</u>	0.0		23	50
07 ±	18.9	12.2	15.6	2.4	0.0	<u>M</u>	<u>M</u>	2.6		27	44
08 ±	15.7	8.8	12.3	5.7	0.0	<u>M</u>	<u>M</u>	0.2		29	41
09 ±	19.6	8.3	14.0	4.0	0.0	<u>M</u>	<u>M</u>	0.0		27	48

10 ±	21.3	6.1	13.7	4.3	0.0	<u>M</u>	<u>M</u>	0.0	20	35
11 ±	24.9	10.8	17.9	0.1	0.0	<u>M</u>	<u>M</u>	17.4	28	39
12 ±	21.4	11.6	16.5	1.5	0.0	<u>M</u>	<u>M</u>	0.0	35	44
13 ±	20.5	7.8	14.2	3.8	0.0	<u>M</u>	<u>M</u>	0.0	34	69
14 ±	20.9	4.5	12.7	5.3	0.0	<u>M</u>	<u>M</u>	0.0	19	32
15 ±	21.0	7.3	14.2	3.8	0.0	<u>M</u>	<u>M</u>	0.0		<31
16 ±	28.4	12.4	20.4	0.0	2.4	<u>M</u>	<u>M</u>	0.0	9	37
17 ±	25.3	10.3	17.8	0.2	0.0	<u>M</u>	<u>M</u>	0.0		<31
18 ±	25.7	9.9	17.8	0.2	0.0	<u>M</u>	<u>M</u>	0.0		<31
19 ±	25.3	13.1	19.2	0.0	1.2	<u>M</u>	<u>M</u>	0.0		<31
20 ±	28.0	17.6	22.8	0.0	4.8	<u>M</u>	<u>M</u>	27.3	27	69
21 ±	24.0	14.0	19.0	0.0	1.0	<u>M</u>	<u>M</u>	0.6	26	41
22 ±	22.1	12.3	17.2	0.8	0.0	<u>M</u>	<u>M</u>	2.2	30	39
23 ±	21.7	9.2	15.5	2.5	0.0	<u>M</u>	<u>M</u>	0.0		<31
24 ±	23.8	10.7	17.3	0.7	0.0	<u>M</u>	<u>M</u>	0.0		<31
25 ±	<u>M</u>	<u>M</u>	<u>M</u>	<u>M</u>	<u>M</u>	<u>M</u>	<u>M</u>	<u>M</u>		<31
26 ±	26.5	12.8	19.7	0.0	1.7	<u>M</u>	<u>M</u>	0.0		<31
Sum				40.7 [^]	11.7 [^]	<u>M</u>	<u>M</u>	73.0 [^]		
Avg	22.6 [^]	11.0 [^]	16.8 [^]							
Xtrm	28.4 [^]	4.5 [^]							27 [^]	69 ^{^S}

Summary, average and extreme values are based on the data above.

Legend

- A = Accumulated
- C = Precipitation occurred, amount uncertain
- E = Estimated
- F = Accumulated and estimated
- L = Precipitation may or may not have occurred
- M = Missing
- N = Temperature missing but known to be > 0
- S = More than one occurrence
- T = Trace
- Y = Temperature missing but known to be < 0
- [empty] = No data available

- ^ = The value displayed is based on incomplete data
- † = Data for this day has undergone only preliminary quality checking
- ‡ = Partner data that is not subject to review by the National Climate Archives

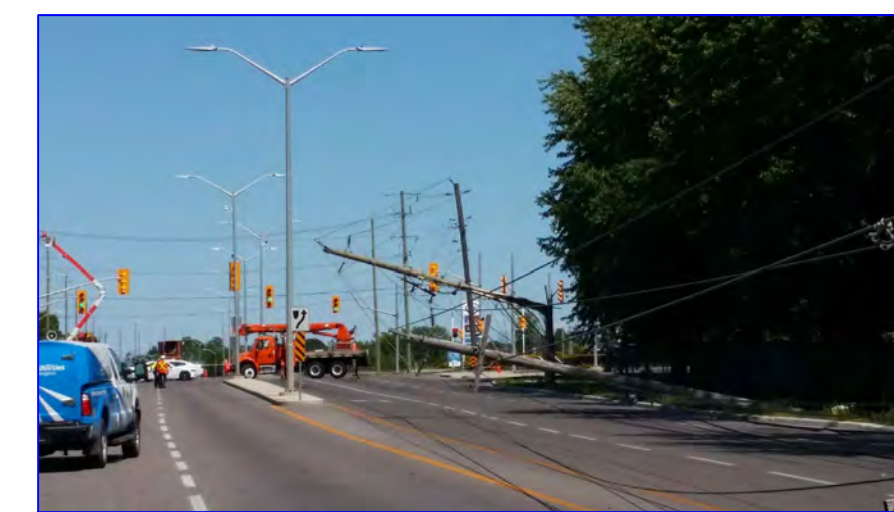
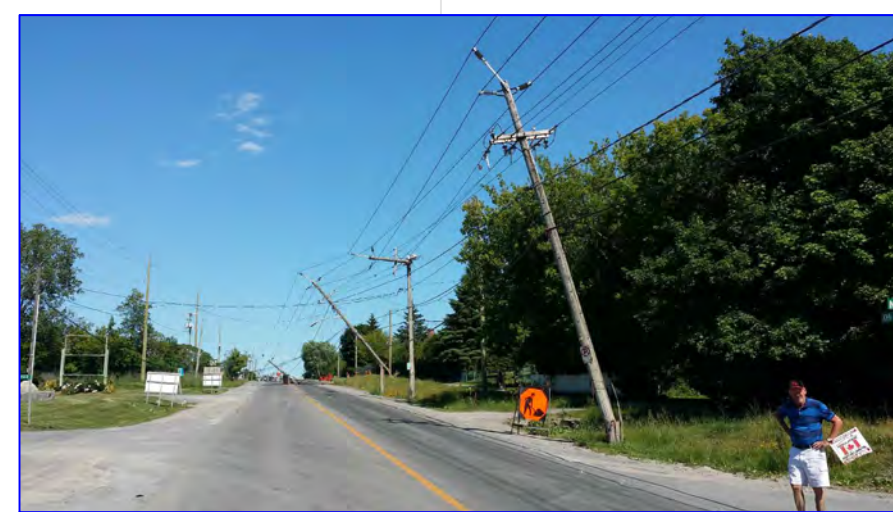
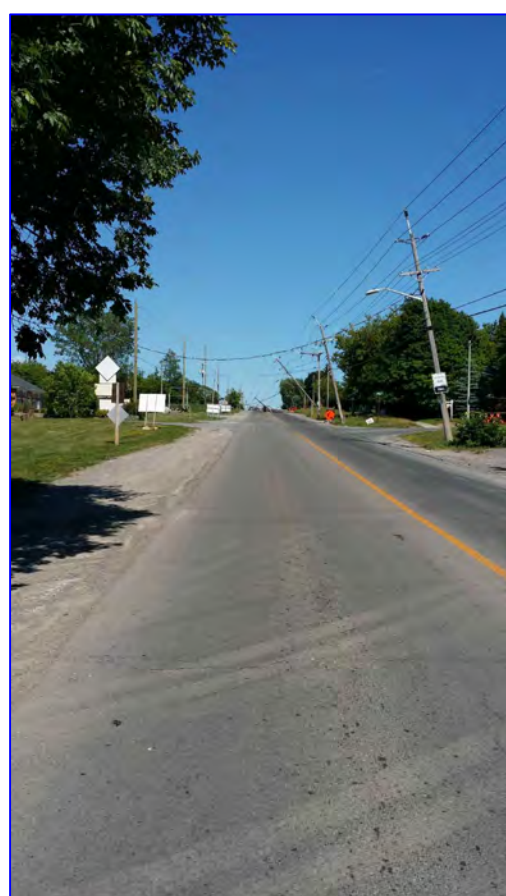
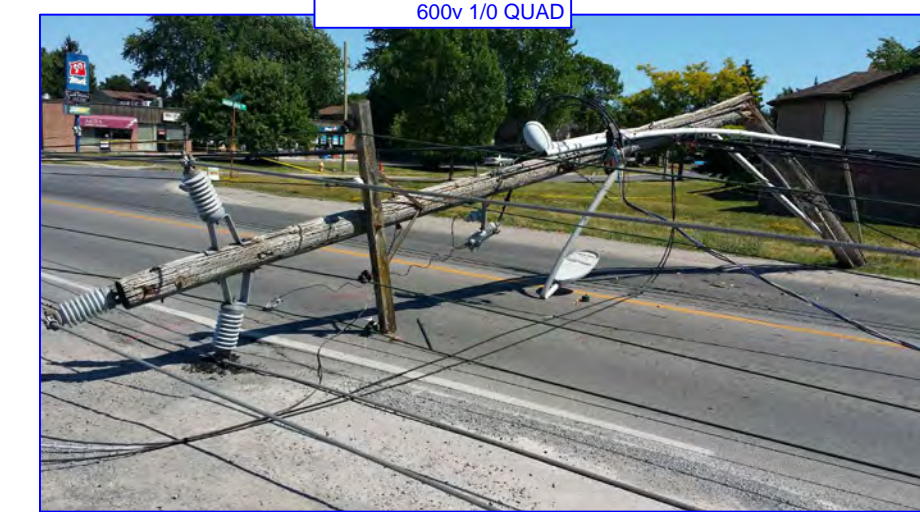
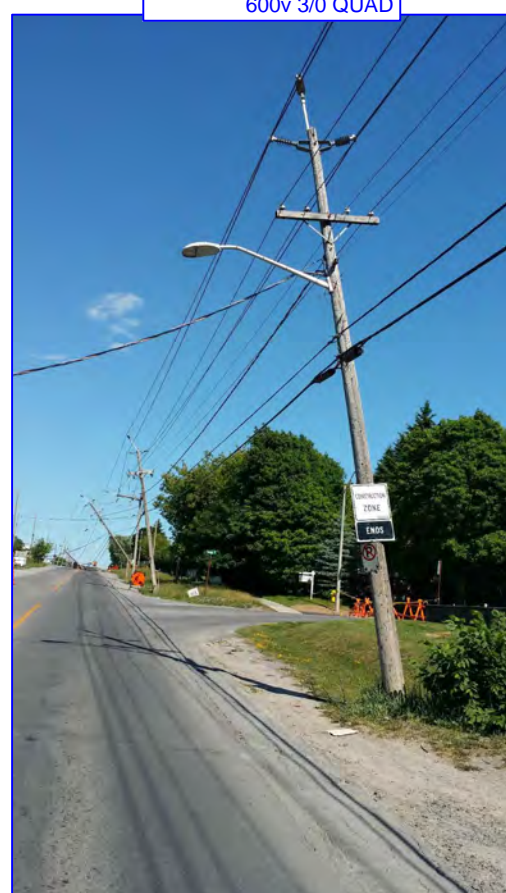
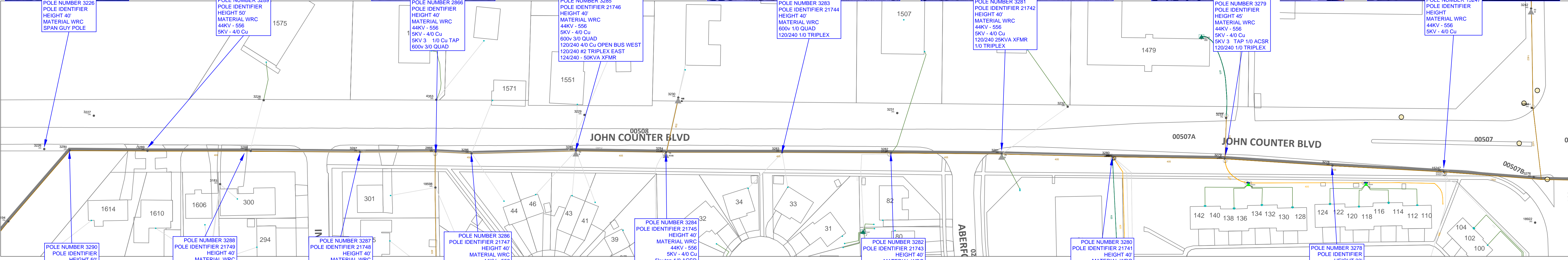
Date modified:

2015-10-20

Attachment #6 – Utilities Kingston Drawing

DRAWING No. John Counter Blvd

N:\K_Electric\K01_Electric System\K01_05_External Requests\K01_05_22 John Counter Realignment\Phase 2 Pole Failures June 22 2016.dwg



Water	
Gas	
Electric	
Bell	
Cable TV	
Detail	
-	
As Built	

LEGEND	
	SINGLE PH PAD MOUNTED TRANSFORMER
	HAND HOLE
	LOAD BREAK CENTRE
	RESIDENTIAL METER
	EXISTING THREE PH UNDERGROUND 5KV
	SINGLE PH UNDERGROUND 5KV
	UNDERGROUND SERVICE 120/240
	NEW PRIMARY
	NEW SECONDARY
	PRIMARY DEADEND
	SECONDARY DEADEND
	TRANSFER PRIMARY
	TRANSFER SECONDARY
	REMOVE
	NEW PRIMARY UNDERGROUND
	NEW SECONDARY UNDERGROUND
	UNDERGROUND STREETLIGHT
	JUMPER
	SPAN GUY
	TRANSFER STREETLIGHT
	NEW STREETLIGHT
	NEW POLE
	REMOVE POLE
	NEW ANCHOR

BENCH MARKS	
No. 1 ELEVATION	
No. 2 ELEVATION	

APPROVED	
Signature	Date
	June 22, 2016
Title	C.E.T.

Certificate of Approval			
This is to certify that the information recorded in this document meets the requirements of the safety standards of Regulation 22/04.			
Name	Date		
	June 22, 2016		
Signature	Date		

No.	By	Date	Revision	Checked
CORPORATION OF THE CITY OF KINGSTON 				
John Counter Blvd Sir John A Macdonald to Portsmouth				
SCALE	N.T.S.	DATE OF ISSUE	June 22, 2016	CONTRACT
APPROVED FOR RELEASE				REV. 1

Attachment #7 – Damage Report