

Mark Cavanaugh

T2utility engineers

Mark Cavanaugh Manager, Utility Coordination and Design



Professional History

T2 Utility Engineers Inc. April 1, 2012 - present Sr. Utility Co-ordinator

TSH/TBE Subsurface Utility Engineers JV (a joint venture with AECOM) 2007 - April 1, 2012 Utility Coordinator / CAD Technician

2006-2007 **CAD Technician**

Plantec Inc. Consulting Engineers Markham, ON Project Co-ordinator, Survey Lead

Academic Training

Civil Eng. Technologist Program Seneca College 2004-2005

Cartographic Technologist Dipl. Fleming College 1997-2000

Mr. Cavanaugh has over 18 years of experience in the Utility industry, and currently assumes the key role as the Manager of the Utility Coordination and Design group within T2ue. Mark has lead the Utility Coordination and Design efforts on various types of projects such as Municipal / Regional Road improvements, Rail and Light Rail Transit, Subway builds, and large scale development projects. He is responsible for review of proposed Infrastructure improvement projects to determine potential utility related risks, and work to initiate and execute mitigation measures to reduce that risk to any given project. Mark uses his extensive background of Utility Coordination, telecommunications design and CAD drafting experience to support projects.

This diverse background enables Mark to understand all of the aspects of the utility relocation process, and strives to maintain close working relationships with utilities to ensure that every project is considered a success by all stakeholders.

Mark has vast experience working in many roles including Senior Utility Co-ordinator, Subsurface Utility Engineering (SUE) Project Co-ordinator, Utility Designer, Survey Lead and CAD Technician.

York Region - Bathurst Street Widening (Utility Coordination Pilot

Project Manager for a Utility Coordination pilot project. Project - Spring 2016 - Present) Responsible for assessment of potential utility risk on a contract that was designed to an approximate 80% completion. Scope of



Bell









WE ARE ALL UNIQUE... THAT IS WHAT MAKES US THE SAME.





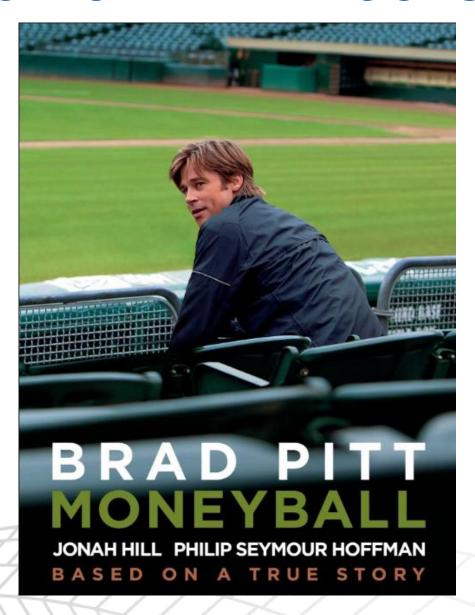




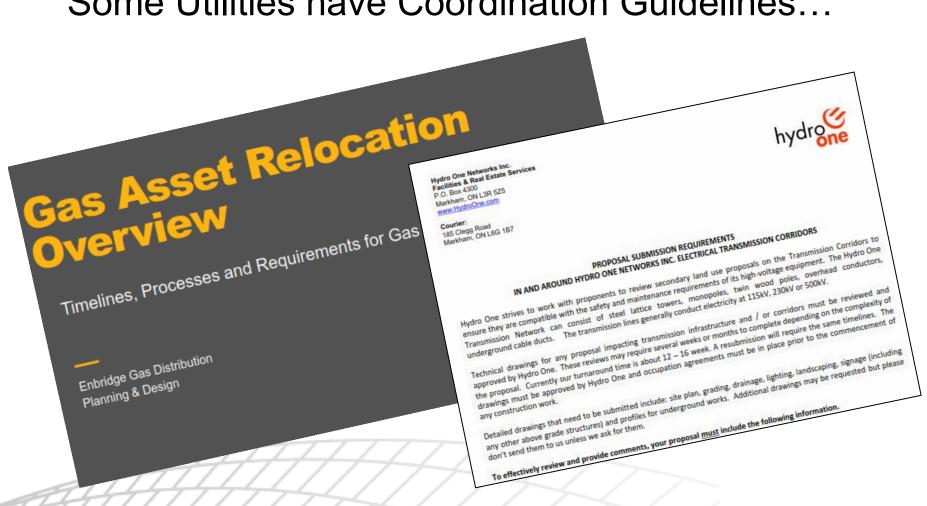


SO WHAT DO UTILITIES WANT?

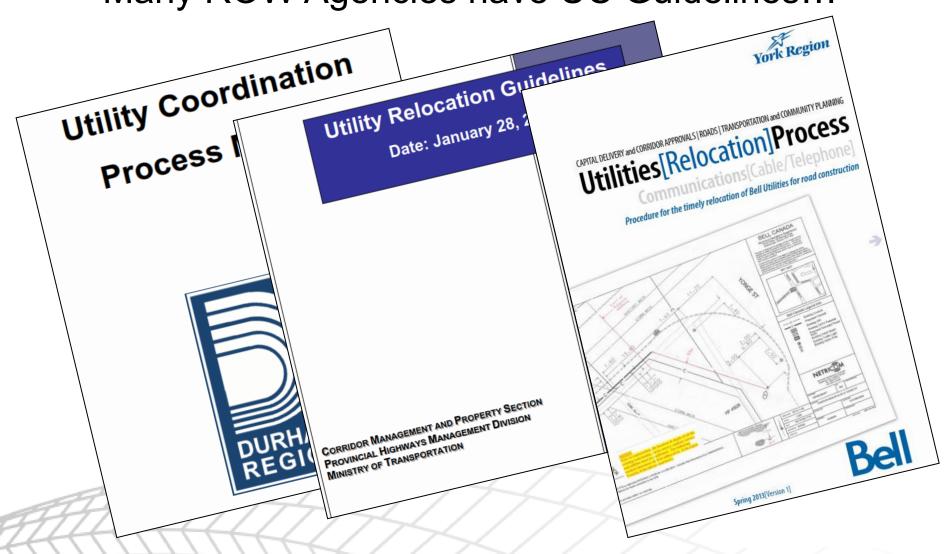
- 1. Follow the Process
- 2. Need to be Understood
- 3. Need Assistance with Conflict Identification
- 4. Need Clear Communication
- 5. Need TIME!



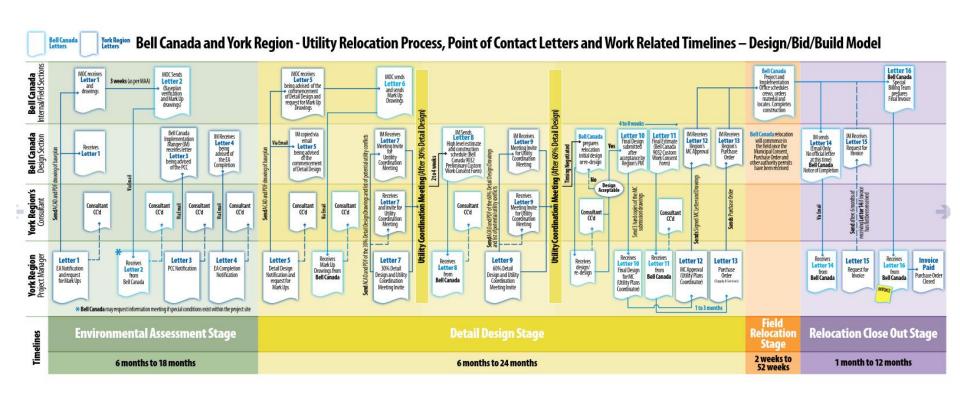
Some Utilities have Coordination Guidelines...



Many ROW Agencies have UC Guidelines...

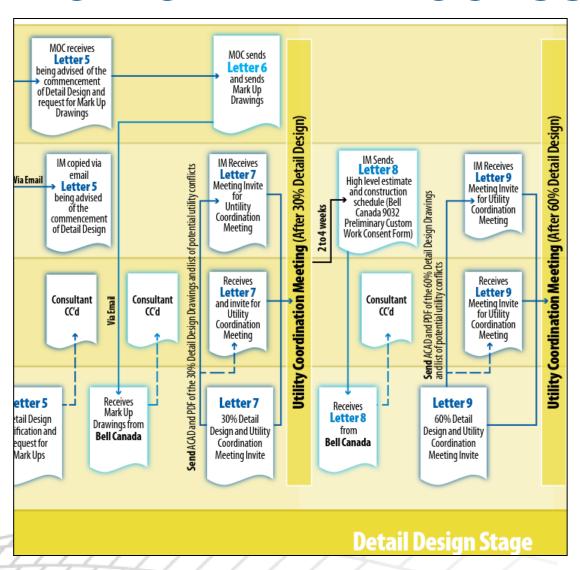


Many ROW Agencies have UC Guidelines...

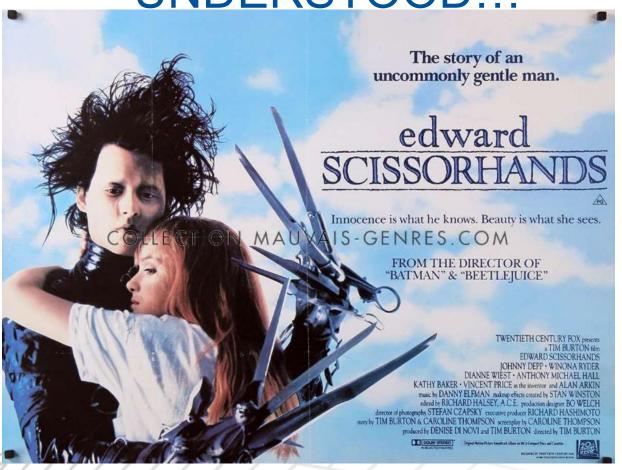


And there is TAC...





ALL UTILITIES ARE DIFFERENT, THEY JUST NEED TO BE UNDERSTOOD...













Hydro Distribution ***















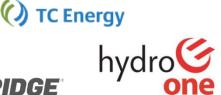
Gas Distribution **ENDRIDGE**



Transmission









Others



Telecoms

- Internal Design Standards
- CSA 22.3 No. 1 Overhead Systems
- CSA 22.3 No. 7 Underground Systems
- ROW Authority Standards
- Local Hydro Distribution Standards

Local Hydro Distribution

- Internal Design Standards
- ESA
- CSA 22.3 No. 1 Overhead Systems
- CSA 22.3 No. 7 Underground Systems
- ROW Authority Standards

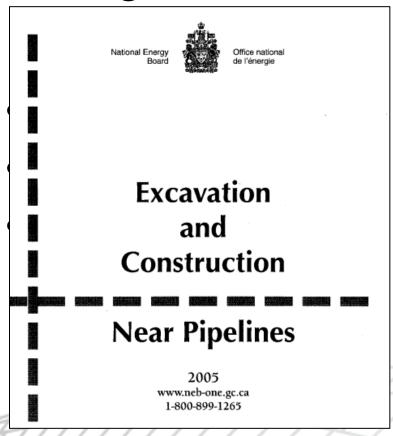
Gas Distribution

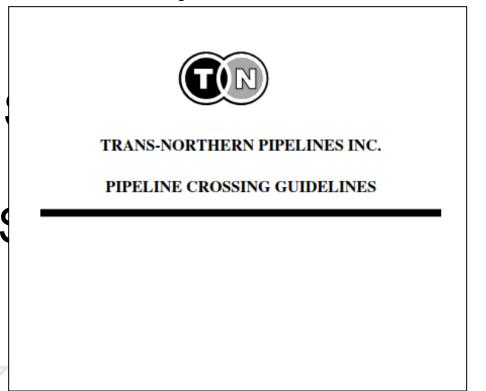
- Internal Design Standards
- National Energy Board (NEB)
- ROW Authority Standards

Hydro Transmission

- Internal Design Standards
- Electrical Safety Authority (ESA)
- ROW Authority Standards

Pipelines / Gas and Oil Transmission



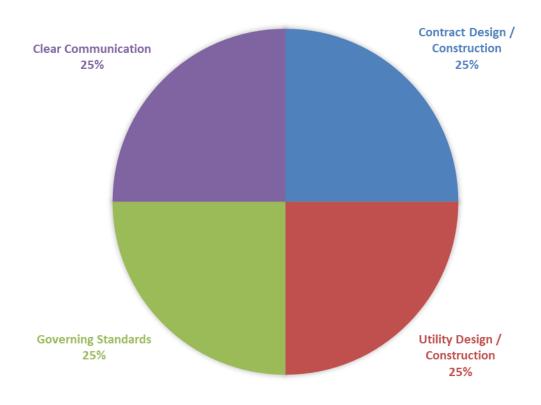






- Consultant knows Civil / Highway Design
- Utility Coordinator has knowledge of Utility standards, requirements, processes, and construction is needed to get you on the right road
- Utilities have to be included in all final assessments!

UTILITY CONFLICT IDENTIFICATION

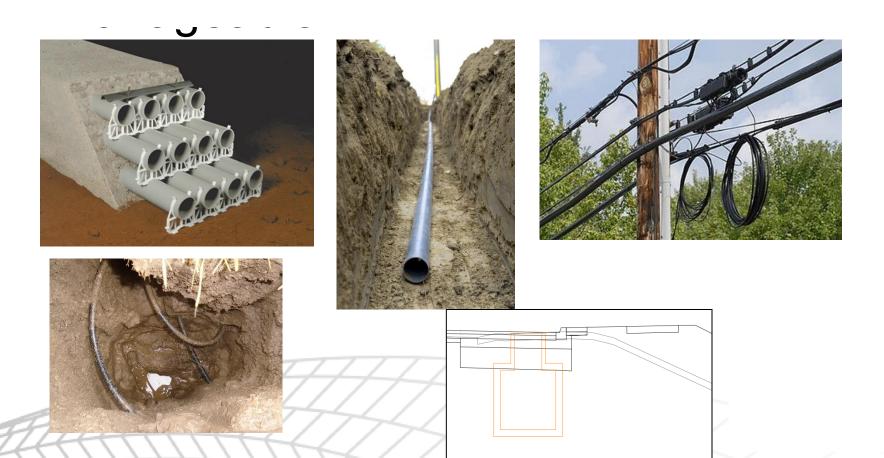


The Utility Coordinator must understand:

- The Project Scope
- Utilities Present
- Utilities Future
- Utility Outage Restrictions
- Utility Standards
- Working / Safety Standards
- Order of Relocations Predecessors?

Telecoms

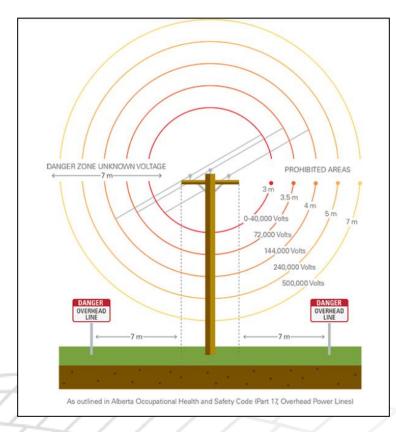
Lowest on the pole – got clearance?



Local Hydro Distribution Go underground – Real estate needed!



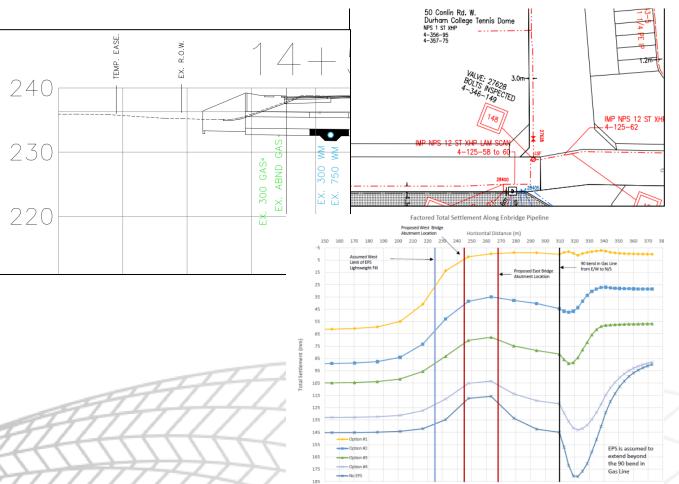






Gas Distribution

Don't settle...





Gas Distribution

They do have a cheat sheet!

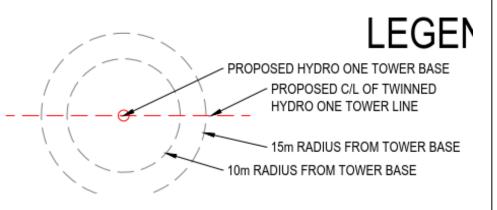
Third Party Requirements in the Vicinity of Natural Gas Facilities

V3.0 2018

Enbridge Gas Distribution

Hydro Transmission

If relocation is required – time is needed!



Hydro One Transmission Lines Minimum Vertical Clearance

The vertical clearances from high voltage transmission lines over or alongside land likely to be travelled by road vehicles including highways, streets, alleys, lanes, driveways and other road must meet the following Hydro One requirements:

Line Voltage (kV)	Required Vertical Clearance (m)
115	6.7
230	7.3
500	16.6

OHSA Safe Working Clearance

There is/are high voltage Transmission Line(s) in the vicinity of this proposal. The highest voltage(s) is/are indicated above. According to the Occupational Health & Safety Act (OHSA), section 188, the safe working clearance requirements are as follows:

Line Voltage (kV)	Required Vertical Clearance (m)
115	3.0
230	4.5
500	6.0

Hydro Transmission

They too have cheat sheets!

General Requirements

The vertical clearances from high voltage transmission lines over or alongside land likely Hydro One Transmission Lines Minimum Vertical Clearance to be travelled by road vehicles including highways, streets, alleys, lanes, driveways and other road must meet the following Hydro One requirements:

travelled by reet the following rivers	1 Vertical Clearance (III)
e travelled by foot or road must meet the following Hydre	Required Vertical Clearance (III)
Line Voltage (kV)	7.3
Line void	1.3
230	16.6
230	
500	The

There is/are high voltage Transmission Line(s) in the vicinity of this proposal. The Incre is/are nigh vonage Transmission Line(s) in the vicinity of this proposal. The highest voltage(s) is/are indicated above. According to the Occupational Health & Safety nightest voltage(8) is at a mancated above. According to the Occupational Regular Act (OHSA), section 188, the safe working clearance requirements are as follows:

nest voltage(s) is/all	tical Clearance (m)
nest voltage(s) is at (OHSA), section 188, the safe working of	Required Vertical Clearance (m)
Line Voltage (kV)	3.0
115	6.0
230	0.0
500	L day 38
	and lower each day as

The position of Transmission Line conductors is dynamic. They raise and lower each day as the ambient temperature and the electrical load changes. It is possible for the low point at mid-span to

All clearance requirements are based on the calculated maximum loaded condition (maximum vary by 4.6 meters (15 ft) as conditions change. sag) which can occur at any time due to system operating requirements. It is the Proponents responsibility to ensure that safe working clearances as specified in The Ontario responsionary to ensure that sale working clearances as specified in the Smarto Occupational Health & Safety Act (OHSA) for workers and equipment are maintained at The installation of signs warning of overhead high voltage power lines are required as per The all times during construction activities.

Hydro One Networks Inc. Facilities & Real Estate Services P.O. Box 4300 Markham, ON L3R 5Z5

185 Clegg Road Markham, ON L6G 1B7

PROPOSAL SUBMISSION REQUIREMENTS

IN AND AROUND HYDRO ONE NETWORKS INC. ELECTRICAL TRANSMISSION CORRIDORS Hydro One strives to work with proponents to review secondary land use proposals on the Transmission Corridors to Hydro One strives to work with proponents to review secondary land use proposals on the Transmission Corridors to ensure they are compatible with the safety and maintenance requirements of its high-voltage equipment. The Hydro One

ensure they are compatible with the sarety and maintenance requirements of its night-voltage equipment. The rygro one transmission Network can consist of steel lattice towers, monopoles, twin wood poles, overhead conductors, and the requirements of the requirements of the night of the requirements of the transmission network can consist of steel lattice towers, monopoles, twin wood poles, overheit underground cable ducts. The transmission lines generally conduct electricity at 115kV, 230kV or 500kV.

Technical drawings for any proposal impacting transmission infrastructure and / or corridors must be reviewed and Technical drawings for any proposal impacting transmission infrastructure and / or corridors must be reviewed and approved by Hydro One. These reviews may require several weeks or months to complete depending on the complexity of approved by Hydro Une. These reviews may require several weeks or months to complete depending on the complexity of the proposal. Currently our turnaround time is about 12 – 16 week. A resubmission will require the same timelines. The the proposal. Currently our turnaround time is about 12 – 16 week. A resubmission will require the same timelines. The drawings must be approved by Hydro One and occupation agreements must be in place prior to the commencement of

Detailed drawings that need to be submitted include: site plan, grading, drainage, lighting, landscaping, signage (including Detailed orawings that need to be submitted include: size plan, grading, drainage, lighting, landscaping, signage (including any other above grade structures) and profiles for underground works. Additional drawings may be requested but please

don't send them to us unless we ask for them.

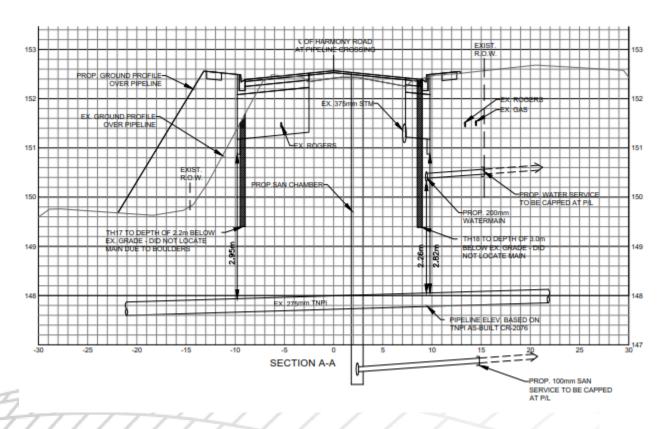
To effectively review and provide comments, your proposal <u>must</u> include the following information.

- LAND/EASEMENT PROPERTY LINES: On all plan drawings, indicate and label the Hydro corridor property limits in HYDRO ONE STRUCTURES: On all plan drawings, show all Hydro One towers, other structures and the overhead
- <u>MYUKU UNE SIKULIURES</u>: Un all plan drawings, show all riyoro one towers, unter structures and the overhead centreline of the towers, all clearly marked with colour. (Also indicate the tower numbers these numbers will be received by Livido (On).
- be provided by Hydro One)



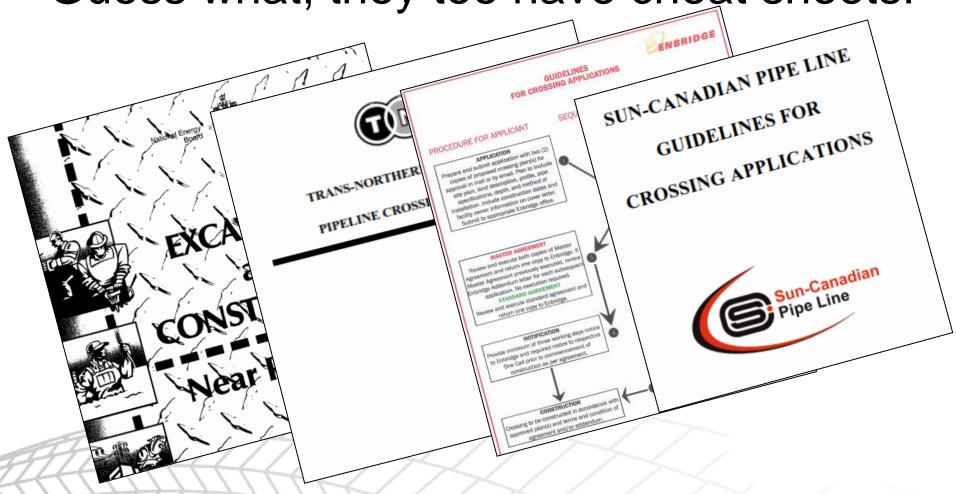
Pipelines / Gas Transmission

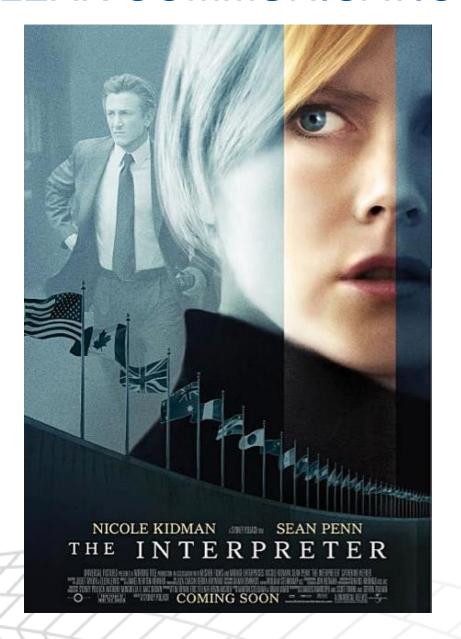
If relocations are required, you'll need time...



Pipelines / Gas Transmission

Guess what, they too have cheat sheets!





COMMUNICATION INCLUDES:

- Written (emails, letters)
- Composite Utility Plans
- Cross Sections / Profiles
- Conflict summaries (CUP's, Matrices)
- Meetings
 - Clear agenda and outcomes
- Meeting Minutes

Initial Consultation / Records Request:

- Reach everyone!
- Ensure Project scope is clear
- Ensure Project area is clear
- Request existing, proposed and abandoned records where available
- Ensure that intent is relayed

LETTER (2) Preliminary Design Report Initiation

October 26, 2017

To Whom it May Concern:

Re: MTO Contract No: 2016-E-0029-002

Location: Queen Elizabeth Way (QEW) and Glendale Avenue, Niagara-on-the-Lake, ON

Regarding: Interchange improvements and bridge replacement at QEW/Glendale Avenue
The Ministry of Transportation intends to rebuild the QEW / Glendale Avenue interchange. This work
includes replacing the existing overpass, operational improvements at the adjacent Glendale Avenue
intersections with York Road and Taylor Road, and realigning or reconfiguring the interchange ramps.

The limits of investigation:

Limits as shown in Figure 1 (Highlighted in yellow) include:

- · Queen Elizabeth Way
 - From 1.7km west of to 1.0km east of the Glendale Avenue overpass.
- Glendale Avenue

o From Taylor Road to York Road



Figure 1: Limit of Investigations

T2ue is providing Utility Coordination services for AECOM, who will be completing the Preliminary Design Report for the MTO on this contract. T2ue's role will include the following tasks:

- Complete a Subsurface Utility Engineering (SUE) investigation to Quality Level B accuracy
- Coordinate with local utilities to provide awareness of the project
- Identify Utility Impacts
- Coordinate with utilities to determine preliminary solutions to conflicting utility alignments, including scope, schedule and costing to perform any required relocations.

To aid us in our task, we are asking that all utilities provide us with the following information:

- 1. Record drawings illustrating the location, status and size of your existing infrastructure;
- Indication of any proposed infrastructure expansion or upgrades planned within the project area that should be considered within this project scope:
- 3. Awareness of other utilities either adjacent to or in joint build with your infrastructure;
- 4. Key personnel that will be assigned to this project.

T2ue will be utilizing the record information provided to create a utility base for conflict analysis with the resurfacing aspect of the project. At the proposed culvert replacement locations, T2ue will perform a Subsurface Utility Investigation to Quality Level B (QL-B) accuracy to define utility alignments within the project area. Test holes may be completed at key locations if necessary to aid in definition of conflicting utility locations. The information gathered through the records research, SUE investigation, and communication with all utilities will be reviewed with all stakeholders to determine appropriate action plans for each utility impact.

Upon completion of the QL-B investigation and Preliminary Conflict Analysis, we will provide a summary to all potentially impacted utilities. We will be reaching out to the key personnel identified in your response to arrange a meeting as required.

Sincerely.

T2 Utility Engineers Inc.

And Community

Mark Cavanaugh Senior Utility Coordinator markcavanaugh@t2ue.com

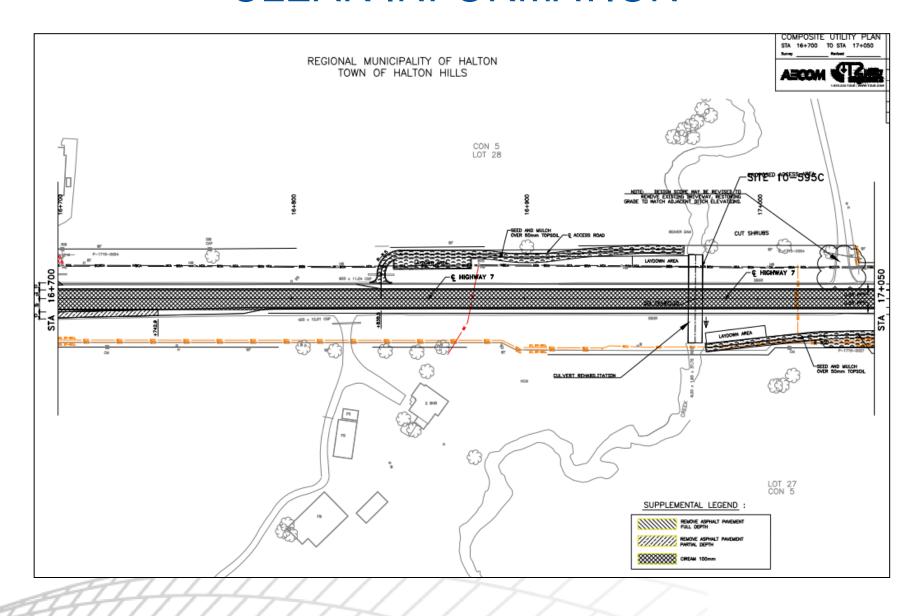
Initial Detailed Consultation - CUP's

- Show what is needed no more, no less
- Clearly Define Existing vs Proposed (base vs design)
- Focus on Utilities (coloured)
- SUE Quality Levels
- Reference Points (Sta.) for Matrix
- Detailed notes not needed

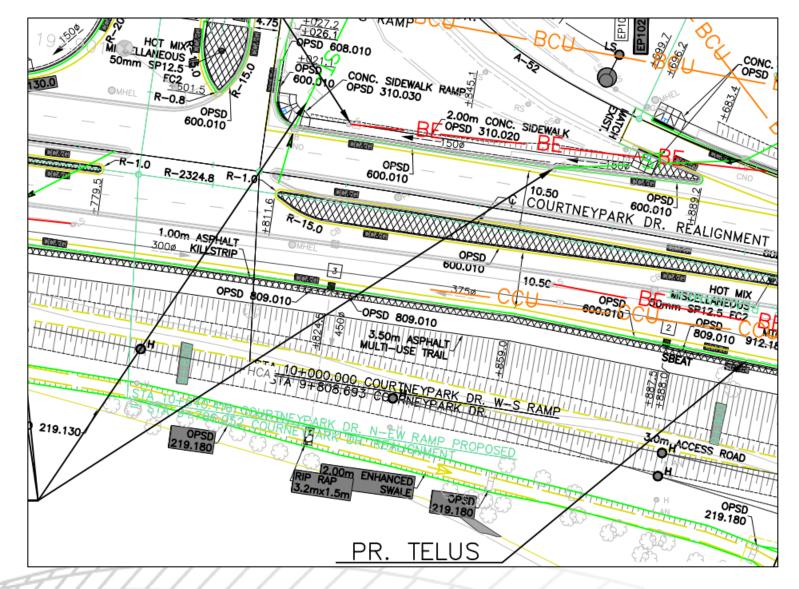
Consider...

- CAD vs DGN?
- References set it up, explain!
- CAD versions (3D, Vintages)
- PDF

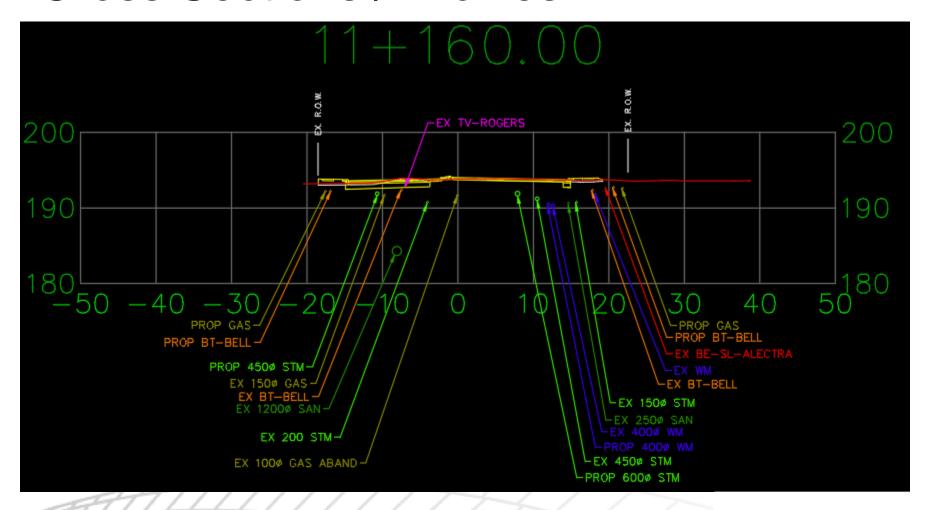
CLEAR INFORMATION

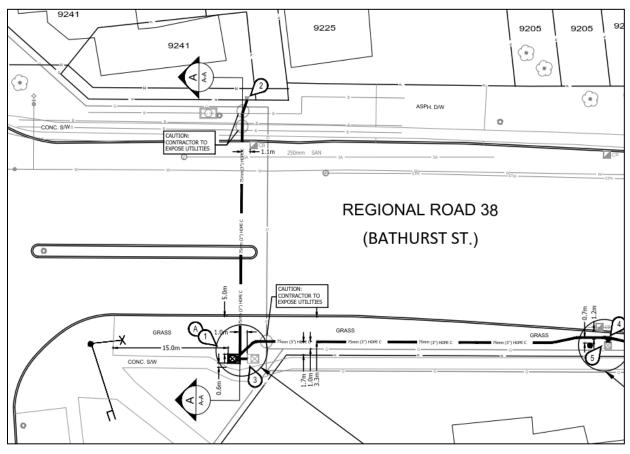


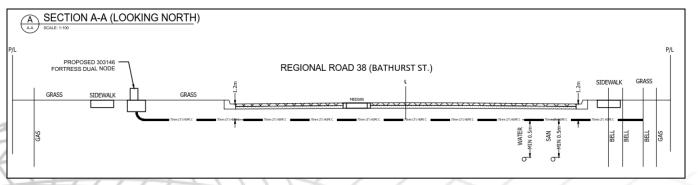
CLEAR INFORMATION

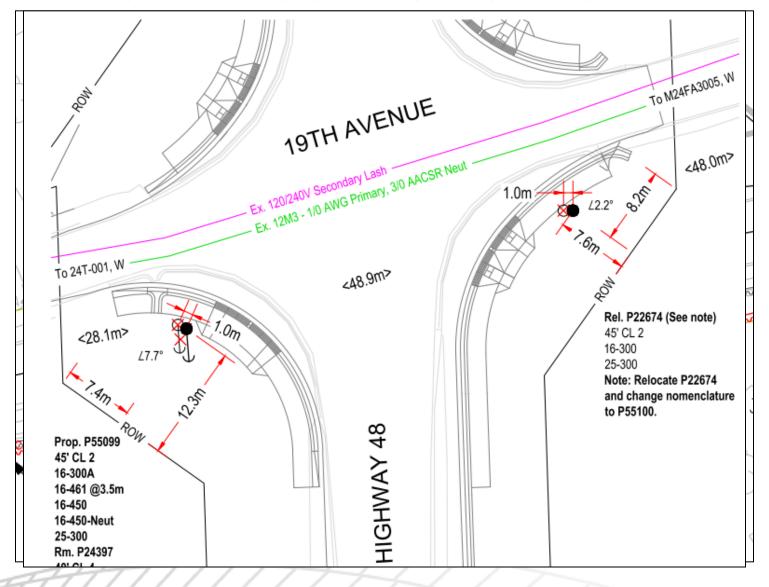


Cross Sections / Profiles









Detailed Consultation - Conflict Matrix

- Cater the Matrix to the Contract
- Allow sorting by Utility
- Track <u>ALL</u> Utility items within the project limits
- This is your conflict review log book set it up that way!
- Track assessment updates!
- Utilities have to be included in all final assessments!

City o	f Peterborough	Jackson (Creek floo	d diversion	, Bethune and Townsend	47	5 2.		
T2ue Pr	oject # 61000665					<i>(G.</i>)	engin	rtility eers	
					conflict resolved				
Updated	July 25, 2019				Streetscape Conflict				
					Road / Sewer Conflict				
Con #	Utility Information	* Existing Location (Station)	* Proposed Grade Change (m)	Location	Assessment of Effects	Completed Test Hole	Relocatio n Required	Resolve d	Action o
Bell/Atr	ia/Allstream/FOC/Cog	eco							
1	Bell Conduit	1+130		Bethune St - crossing EV	Existing Bell conduit will require support over proposed 4500x1750 Storm sewer concrete box culvert, test pit required to determine depth of Bell conduit and level of conflict, Bell to confirm size and number of conduits and cables. UPDATE: Test hole B1 confirms Bell will maintain 0.19m clearance from top of proposed box culvert. Support in place during construction.	Ві	No	Yes	
2	Atria (aerial)	1+145	-	Bethune St - crossing EV	Existing Atria crossing over proposed culvert aerially - no conflict. PDi poles not in conflict with proposed works.		No	Yes	
3	Bell PED	1+264		Bethune St - East Side	Existing Bell Ped might require protection or relocation due to close proximity to proposed sewer excavation - 0.7m from edge of sewer. UPDATE: Box culvert design altered; ped is now 0.43m from proposed box culvert. Bell to move back to property line.		Yes	No	Bell
4	Bell Conduit	1+419	-	Bethune St -	Existing Bell conduit & structure will require support over proposed 4500x1750 Storm sewer concrete box culvert and 900mm sanitary sewer, test pits required to determine depth of Bell conduit and level of conflict, Bell to confirm size and number of conduits and cables. UPDATE: Test holes indicate bottom of Bell structure is 0.02m above proposed box culvert. Contractor to breakout and raise by 0.2m during construction and reinstate following construction. Bell to provide design for breakout for inclusion in City of Peterborough contract. Breakout must be done by pre-approved Bell contractor. UPDATE-MaykJune 2019 - T2 prepared conduit breakout/raise plans and provided to Bell. T2 has followed up with Bell for number and size of conduits/cables for inclusion into construction contract spec.	B3, B4	No	No	Bell
5	Bell Conduit	1+420		Bethune St - crossing EW at	Existing Bell structure will require support over proposed 4500x1750 Storm sewer concrete box culvert and 900mm sanitary sewer, test bits required to determine depth of Bell conduit and level of conflict, Bell to confirm size and number of conduits and cables. JPDATE: Test holes indicate bottom of Bell structure is 0.02m above proposed box culvert. Contractor to breakout and raise by 0.2m during construction; reinstate following construction. Bell to provide design for breakout for inclusion into City of Peterborough contract. Breakout must be done by pre-approved Bell contractor. UPDATE: MayJolune 2019 - T2 prepared conduit breakout/raise plans and provided to Bell. T2 has followed up with Bell for number and size of conduits/cables for inclusion into construction contract spec.		No	No	Bell
6	Bell Conduit	1+420 to 1+500		Bethune St - West side	Existing Bell conduit in same alignment as proposed tree plantings, confirm depth of conduit to determine if conflict present with proposed plantings. UPDATE: Test hole B7 confirms Bell conduit and cable at 0.76m below ex. Grade. Bell to advise if root protection is required.	B7	Pending	No	Bell
7	Atria (aerial)	1+545	-	Bethune St - crossing EW	Existing Atria crossing over proposed culvert aerially - no conflict. PDi poles not in conflict with proposed works.		No	Yes	

Stationing: 19+380 to 13+900					Humber College to Alexdon Rd																	
UPDAT	PDATED:05/16/2016																					
EXISTIN				EXISTIN	NG	CONFLICT IDENTIFICATION				RELOCATION CONCEPT			PROTECTION		MISCELLANEOUS				QUANTITY			
CONF#	UTILITY TYPE (Table 1	LOCATION	STA. (Start)	STA. (Finish)	Size (number, size, mm and/or type)	Material (Table 2) ▼	Conflict Type (Table Ty	DCM Zone (See Note 1)	Conflict	Conflict To Be Determined (SUE)	May	Support/ Protect (From other:	Permanent Relocation	Permanent	Temporary	Comments	Test Holes Required	Enabling works	Type of Work	Number of Units	Length (m)	Comments from UC Meeting
1	OH-JU	Hwy 27 west side (Humber college)	19+384	19+691	Primary Pole / Rogers / Cogeco / NYH	-	II.	4	Y	N	8,13,14,16	N	Υ	N	N	Poles within 2m of proposed portal walls, large grade reduction at base. Conflict also likely with SOE installation. Relocate.	N	N	Pole	8		
2	TV-ROG	Hwy 27 west side (south of Humber Blvd)	19+400	19+405	UNK	UNK	Т	4	N	N	N/A	N	Υ	N	N	Utility not in conflict	N	N	Conduit			
3	GM	Highway 27 (west side)	19+415	19+938	200	SC HP	Т	NA	TBD	N	8,15	N	TBD	N	N	Utility running within 3m from proposed portal excavation. Confirm portal construction methodology and assess impacts with Enbridge Gas	N	N	Pipe		523	
4	OH-BELL	Hwy 27 east side (south of Humber college)	19+430	19+540	Bell Pole	-	0	NA	Υ	N	8,11	N	Υ	N	N	Pole conflicting with proposed pedestrian tunnel, relocate	N	N	Pole	3		
5	GM	Highway 27 (west side)	19+442	19+455	200	SC HP	0	NA	N	N	7a,8,15	N	N	N	N	Utility crossing proposed driveway. No conflict assumed with road base.	N	N	Pipe			
6	BE	Hwy 27 (south of humber college)	19+450		UNK	UNK	0	NA	TBD	Υ	7a, 8, 14	N/A	TBD	TBD	TBD	4 x BE ducts within area of road realignment; potential conflict w road base; TH's required to determine depth and conflict	Υ	N	Structure			
7	BT-BELL	Hwy 27 (East Side)	19+453	19+460	1 Duct	UNK	0	NA	Υ	N	8, 11	N	Υ	N	N	BT-Bell in conflict with proposed Station stairs; relocation required;	N	N	structure/ conduit		20	
8	ОН	Hwy 27 west side (Humber college)	19+455		Primary Pole	-	0	NA	Υ	N	8,14	N	Υ	N	N	Pole conflicting with proposed sidewalk, relocate	N	N	Pole	1		
9	ОН	Hwy 27 west side (Humber college)	19+520		Primary Pole	-	Т	NA	Υ	N	8,14	N	Υ	N	N	Pole conflicting with proposed portal - relocate.	N	N	Pole	1		

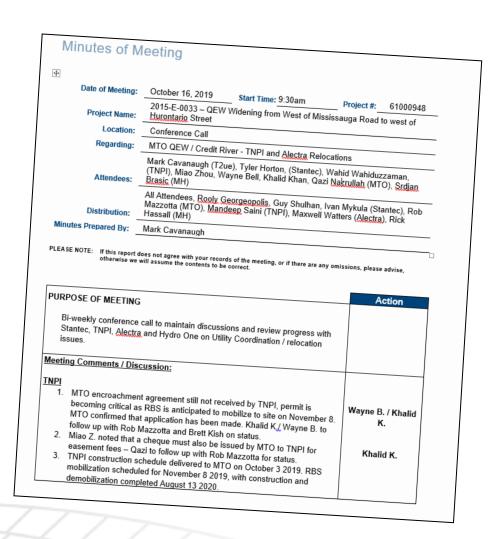
Meeting Agendas – Outcome Needed

Discussion Items

- Introductions
- Project Update:
 - a) Scope
 - b) Schedule
- Utility Conflict Review Per Utility
 - a) Review "Unknown" Utility alignments, determine ownership
 - b) Agree on proposed Test Hole locations
- Utility Designs
 - a) Field investigation requirements
 - b) Designers
 - c) Design Schedule
- Utility Scope to be included into Contract Scope
 - a) Utility Support / Protection
 - b) Other?
- Open Floor

Meeting Minutes

- Must clearly record key discussions
- Must identify next steps
- Identify and follow up on actions





Typical Contract Schedule...

The Consultant is expected to meet the following milestones:

Event – Milestones	Date				
30% Design Completion	May 2020				
60% Design Completion	August 2020				
90% Design Completion	December 2020				
100% Design Completion Including Tender	July 2021				
Tender Issued	July 2021				
Construction Commence Work Order	October 2021				
Construction Completion	October 2025				
Warranty Period Expiry	October 2027				

The Consultant shall recommend construction phasing necessary to meet the Project's schedule requirements.

So Let's Break This Down...

The Consultant is expected to meet the following milestones:

Event – Milestones	Date				
30% Design Completion	May 2020				
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Construction Commence Work Order	October 2021				
Construction Completion	October 2025				
Warranty Period Expiry	October 2027				

The Consultant shall recommend construction phasing necessary the Project's schedule requirements.

60% - 90% Design Phase (4 months allotted)

- 60% design project owner comments are returned, Highway design is adjusted
- Utility Coordination meeting 60% conflict review
- Additional test holes are selected (1-2 months to complete depending on complexity)
- Grading is refined
- Drainage design is refined
- Utility Conflict assessment updated based on test hole results
- Utilities typically start designing following the 60% Utility Coordination meeting

So Let's Break This Down...

The Consultant is expected to meet the following milestones:

Date
May 2020
August 2020
December 2020
July 2021
July 2021
October 2021
October 2025
October 2027

Add a second utility relocation and this 14 month schedule will quickly become unattainable

Following 60% - Utility Designs initiated (S-

- Enbridge Gas
 - 2-4 months
 - internal d
 - Consultan
 - If changes months)
 - Following de Municipal, M
 - Cost estimate
 - Issued to const avg)

SEPTEMBER
2021
2021
CONSTRUCTION
COMPLETE

tion is received.

5111CC1111

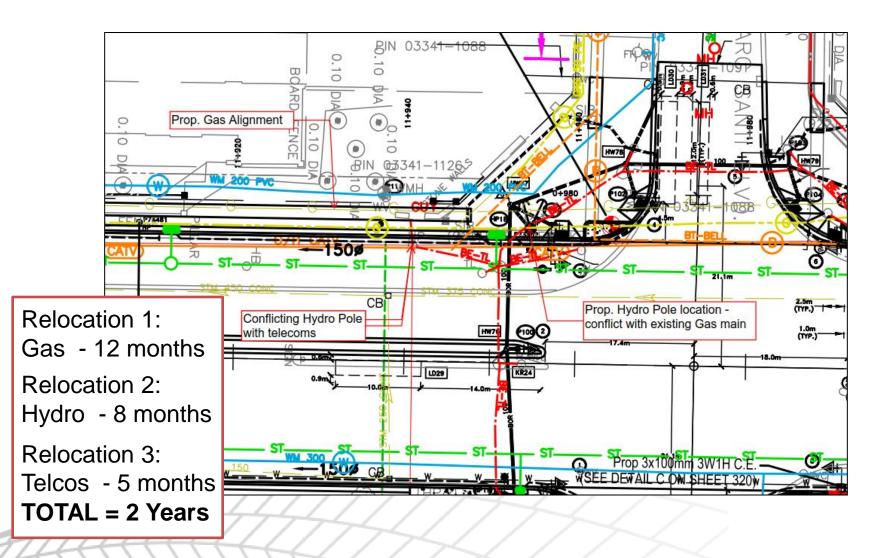
begins again (2-3

gional,

1-2 months)

months – 3 months

Are there Predecessors?



FINAL THOUGHTS

- Determine and follow the Processes
- Seek out Utility Manuals / Guidelines
- Involve the experts, no one knows everything
- Experience minimizes risk of delay
- Communication
 - Know what you need express it
 - Know what they need provide it
- Identify Schedule Issues Early and Often

FINAL THOUGHTS

Bumps will occur – persevere, you will get there!



Thank you!