





#### **Emergency Management Planning Using A Hydraulic Water Model**

Presented by: Mark Buchanan, P.Eng.

Date: November 29, 2019



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#### Agenda

- Introduction to the Town of The Blue Mountains
- Emergency Planning
- Emergency Training Session
- Hydraulic Water Model
- Water Distribution System Constraints
- Water Model Setup
- Takeaways, Recommendations & Conclusions







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#### **Town of the Blue Mountains**









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#### Water Distribution System Overview









#### **Emergency Planning**

- Town interest in using the model to assess critical scenarios
- Identified weak points in the water distribution system
- Using historical demand data to predict trends
- Goal to create a model scenario that could be replicated in "real time" during an emergency training session
- Only the Director of IPW and one modeler knew the scenario
- Operators to direct 2<sup>nd</sup> modeler to respond to emerging events







#### **Emergency Training Session**

- Scenario led by Director of IPW
- Attended by Emergency Control Committee, Operators, Modelers
- Protocols and Procedures Including staff availability, notifications to residents and relevant agencies, investigations and repairs
- Using the model as a tool for predictive assessment of system conditions several days in advance
- Fire Chief questions available fire flow
- Worked through Daily Scenarios







### 2018 Emergency Exercise Scenario

### Water Supply Disruption

Town of The Blue Mountains November 14, 2018



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### Monday Feb 11, 2019 - Setting the Stage

- Two operators are on scheduled vacation until Tuesday, Feb. 19.
- Director of Infrastructure & Public Works (IPW) is also on vacation. He is not back until Saturday, Feb. 23 but may be available by phone.
- Acting Director of IPW is assigned.
- Weather trend since the beginning of Feb. 2019 has been colder than normal.
- All systems running normally but water operators note that water demands are trending higher than typical. Great skiing conditions, general increase in tourism and more than usual number of part-time residents being up is considered why.







## Tuesday, Feb. 12, 2019

- Water Demand yesterday was 60% of maximum day.
- Weather is sunny, -22°C night, -11°C day.
- All systems running normally but there seems to be an issue with the WTP standby generator starting during a temporary power outage overnight.
  Start-up didn't happen during the 30 minutes the power was off.
  Generator technician contacted to troubleshoot.
- At 8:00 a.m. Collingwood calls to say they are having ice crystals entering their intake the past few days and are having challenges maintaining treatment capacity. Since the coming weekend is Family Day, they need to ensure all reservoirs are full by end of Friday. All large water users are being told to reduce consumption. With apologies, they will have to turn off the connection to The Blue Mountains at 10:00 a.m.







### Wednesday, Feb. 13, 2019

- Water demand yesterday was 58% of maximum day.
- Weather is sunny, -23°C night, -10°C day. Blizzard conditions expected over the next few days.
- Several reports of no water on Huron St W between Elma and Lansdowne: 71, 98, 101, and 107 Huron Street affected.





### Thursday, Feb. 14, 2019

- Water demand yesterday was 67% of maximum day.
- Weather is blizzard conditions 30 cm snow, -20°C night, -9°C day.
- Generator technician determined that faulty starter wiring in transfer switch led to WTP standby generator not starting. It will be replaced on Friday, Feb. 15.
- Staff able to get water to three of the four residences reporting no water event on Huron Street. No water also reported at 77 and 102 Huron Street
- Permitted Hours of Work for two operators is being pushed to the limits. Both operators on vacation asked to return to work, but only one is able.
- A large icicle is reported hanging from the Beaver River Bridge. Roads operator investigates at 2 p.m. and sees icicle hanging from insulated watermain. He reports what he saw to the Water Supervisor.













## Friday, Feb. 15, 2019 – Prior to 8 a.m.

- Water demand yesterday was 70% of maximum day.
- Weather is heavy snow 25 cm, -15°C night, -12°C day.
- Transfer switch repaired and generator tested normally.
- WTP SCADA operator reports at 7 a.m. that Happy Valley Reservoir didn't seem to refill normally yesterday and overnight.







# Friday, Feb. 15, 2019 – 8 a.m. to 1 p.m.

- Roads Manager obtains access to bridge inspection truck and contractor.
  - Arrives at 9 a.m.
  - Icicle and some insulation removed by 11 a.m.
  - Find water dripping from watermain contains chlorine
  - More insulation removed
  - 200mm crack found at 1 p.m. on bridge side of watermain leaking water.
  - Watermain is frozen
- Collingwood continues to struggle to maintain their reservoir levels and can't provide water to the Town.









# Friday, Feb. 15, 2019 – After 1 p.m.

- The Director of IPW doesn't answer his phone accused of always being away when "stuff" happens and there's speculation on his usefulness anyways given his expected condition.
- Three more frozen water services reported in Thornbury along Huron Street, namely 69, 75, and 79.
- One operator has exceeded hours of work limits and is sent home.
- Acting Director of IPW calls Chief Administrative Officer at 2 p.m. to provide a situational update. CAO triggers the Community Control Group to meet at 4 p.m.
- Status update:
  - Collingwood off and can't be counted on.
  - 400mm across the Beaver River is suspected to be mostly or entirely frozen.







### Saturday, Feb. 16, 2019

- Family Day long weekend starts.
- Water Demand yesterday was 77% of maximum day.
- Weather is light snow 5 cm, -17°C night, -5°C day.
- Chief Administrative Officer calls the Community Control Group to meet at 11 a.m.
  - Acting Director of IPW provides status update:
    - Collingwood is still having their own challenges so we can't rely on them. In fact, they have asked us to send water to them.
    - Town of the Blue Mountains Happy Valley Reservoir didn't refill last night to normal levels.
  - Water Operator reports that water demand is high today and likely to be the most seen yet this year. It's like a hot summer day or Christmas break.
  - The Fire Chief asks what happens if there's a large fire at the Blue Mountain Village?







## Sunday, Feb. 17, 2019

- Water Demand yesterday was 95% of maximum day.
- Weather is overcast, -19°C night, -12°C day.
- CCG reconvenes at 9 a.m.
  - Status update:
    - Collingwood is off and can't estimate when they will be able to supply.
    - Beaver River Bridge is frozen solid. Operations is making calls but can't find a qualified repair crew.
    - Frozen water services along Huron being fed from adjacent street and units.
    - The water level in the Happy Valley Reservoir .....
    - Other notable findings are .....
    - Contingency plans are .....







#### **Summary of Emergency Planning Scenario**

- Town of Collingwood shuts off supply
- High demands near maximum day
- Beaver River bridge crossing frozen
- Fire at the Blue Mountain Resort







#### **Hydraulic Water Model**

- Originally developed and calibrated in 2010
- Model update undertaken in 2015
- Most recently updated in 2018 by JLR in support of the Town's Water Distribution Master Plan
- ~130 km watermain across +950 pipe segments









#### Water Distribution System Pressure Zones









#### **Model Features**









#### **Water Distribution System Constraints**









#### **Model Setup**









#### **Demand Patterns & Multipliers**









#### **Model Setup**



![](_page_25_Picture_5.jpeg)

![](_page_26_Picture_0.jpeg)

![](_page_26_Picture_2.jpeg)

#### **Beaver River Bridge Crossing**

![](_page_26_Picture_4.jpeg)

![](_page_26_Picture_5.jpeg)

![](_page_26_Figure_6.jpeg)

![](_page_26_Picture_7.jpeg)

![](_page_27_Picture_0.jpeg)

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#### **River Crossings**

![](_page_27_Figure_4.jpeg)

![](_page_27_Picture_5.jpeg)

![](_page_28_Picture_0.jpeg)

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#### **Model Setup**

![](_page_28_Figure_4.jpeg)

![](_page_28_Picture_5.jpeg)

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![](_page_29_Picture_0.jpeg)

![](_page_29_Picture_2.jpeg)

#### **Fire Flow**

![](_page_29_Picture_4.jpeg)

150 L/s Commercial Firefor 3 hours during lowest storage tank level

#### **Commercial Fire at Resort**

![](_page_29_Figure_7.jpeg)

![](_page_29_Picture_8.jpeg)

![](_page_30_Picture_0.jpeg)

![](_page_30_Picture_1.jpeg)

![](_page_30_Picture_2.jpeg)

### Happy Valley Reservoir Level Recovery After Weekly Pattern Reset

![](_page_30_Figure_4.jpeg)

![](_page_30_Picture_5.jpeg)

![](_page_31_Picture_0.jpeg)

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#### **Simultaneous Emergency Events**

![](_page_31_Figure_4.jpeg)

![](_page_31_Picture_5.jpeg)

![](_page_32_Picture_0.jpeg)

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#### **Happy Valley Reservoir Level**

![](_page_32_Figure_4.jpeg)

![](_page_32_Picture_5.jpeg)

![](_page_33_Picture_0.jpeg)

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#### Takeaways, Recommendations & Conclusions

- Model used as a predictive tool to plan for emergency conditions
- Model allows simulations of emergencies that would not otherwise be economical or practical to carry out
- Several factors can be analyzed (available storage, water quality, fire flow availability, multiple failures)
- Ensure EPS run times are of sufficient duration to allow the system to stabilize
- Very informative exercise for the Town to appreciate the versatility and resiliency of their water distribution system
- Town's Operations Staff are aware of the water model as a tool to assist with predictive analysis

![](_page_33_Picture_10.jpeg)

![](_page_34_Picture_0.jpeg)

![](_page_34_Picture_1.jpeg)

![](_page_34_Picture_2.jpeg)

### **Thank you! Questions?**

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