

# Oak Ridges Moraine

## (YPDT – CAMC) GW MANAGEMENT PROGRAM



Durham Region  
Nov. 19, 2019



# Team work.....many have helped.....

- **Russ Powell (CLOCA), Rick Gerber (ORMGP); Mike Doughty (ORMGP); Mason Marchildon (ORMGP); Albert Halder (ORMGP); Britt Smith (ORMGP); Rod Wilmot (CLOCA); Andrew Caky (CLOCA); Sylwia Kubrak (CLOCA); Annie Brough (CLOCA); David Krupicz (CLOCA);** Dirk Kassenaar (EFX); E.J. Wexler (EFX); Kelsy Brennan (EFX); Mike Fairbanks (York) Don Goodyear (York, LSRCA); Tom Bradley (York); Wendy Kemp (York); Luis Lasso (Peel); Erin Inhat (Peel); Pawandeep Sembhi (Peel); Rick Buckley (All Terrain); Dave Sharpe (GSC); Hazen Russell (GSC); Peter Barnett (OGS); Andy Bajc (OGS); Rilley Mulligan (OGS); Beata Golas (Durham); James Partridge (Durham); Bill Snodgrass (Toronto); Jennifer Stephens, (TRCA); Shelly Cuddy (CLOCA, Durham, LSRCA); Ryan Post (KRCA, NVCA); Mark Peacock (GRCA); Michael D'Andrea (Toronto); Don Ford (TRCA); Jehan Zeb (TRCA); Dan Banks (CVC); Gayle Soo Chan (CLOCA, CVC); Mike Police (All Terrain); Stephen DiBiase (Golder, Aquatech); Kerry Mulchansingh (CVC); Frank Liu (CVC); Chris Neville (S.S. Papadopulos); Daron Abbey (Matrix); Paul Martin (Matrix); Steve Davies (ORMGP, Matrix); Caroline Hawson (KRCA); Jessica Mueller (GRCA, KRCA); John Piersol (Golder); Barbara Anderson (MOECC); Scott Bates (MNR); Mike Garroway (MNR); Cam Baker (OGS, Matrix); Andre Pugin (GSC; Sue Pullan (GSC); Jim Hunter (GSC); Vince Gerrie (Quantec, DGI); Barb Jeffrey (York), Laura Atkins (York, Toronto); Mark Head (Peel); Beverley Thorpe (TRCA), Anthony Usher (Usher Planning); Kim Gilder (ORMGP), Simone Banz (Peel), Rob Baldwin (LSRCA); Simone Banz (Peel); Andrea Warren (Peel); Tim Warman (Golder); Amanda Morin (ORMGP); Brian Whitehead (Rural Development); Bruce Hietkamp (Geo Kamp); Mezmure Haile-Meskale (MOECC, ORMGP); John Ford (EFX); Clifford (Peel); Tim Beckenham (LTCA, WESA); Tom Killingbeck (BluMetric); Bob Betcher (GRCA); Brandi Boardman (CLOCA); Shan Mugalingam (LTRCA), Josie Calebrese (CLOCA); Heather Borodie-Brown (MOECC); Mary Prawecki (York), Patty Meyer (CVC, Matrix), Scott MacRitchie (MOECC); Frank Brunton (OGS); Fred Carpio (CLOCA); Tim Cheng (MOECC); Deb Conrod (MOECC); Kevin Cover (Ottawa); Terri Cox (ORCA); Cliff Curtis (Durham); Alex Georgieff (Durham); Nick Tunnacliffe (Peel); Bryan Tuckey (York); Erin Mahoney (York); Chris Darling (CLOCA); Sonja Loessl (Peel), Laurence Davidson (EFX); Brian Denney (TRCA); Gunther Funk (RWDI); Murray Gomer (MMM); Katie Thompson (LSRCA, Barrie); Phil Harrison (York); Marc Hinton (GSC); Ross Hodgins (MOECC, ORMGP); Frank Kenny (MNR); Esmael Khazaei (York); Phil Smart (CRA), Linda Laliberte (GRCA); Rob Messervey (KRCA); Gayle Wood (LSRCA, NVCA); Mark Majchrowski (KRCA); Stephanie McPhie (NVCA); John Presta (Durham); Andrew Farr (Peel); Blythe Reiha (York); Dave Rudolph (Waterloo); Glenda Rogers (LTRCA); David Schieck (GAPS); Mark Schiller (Peel); Tammy Silverstone (York); .....mom & dad, etc.etc.

## The Oak Ridges Moraine

Proposals for the Protection and Management of a Unique Landscape  
MAY, 2001



### GROUNDWATER MANAGEMENT STRATEGY STUDY YORK, PEEL AND DURHAM REGIONS PHASE 1 FINAL REPORT

Prepared by:

The York Peel Durham Steering Committee

and

AMEC Earth & Environmental Limited  
Totten Sims Hubicki Associates  
And  
Terraprobe Limited

May 2001

## Groundwater Strategy – Goal:

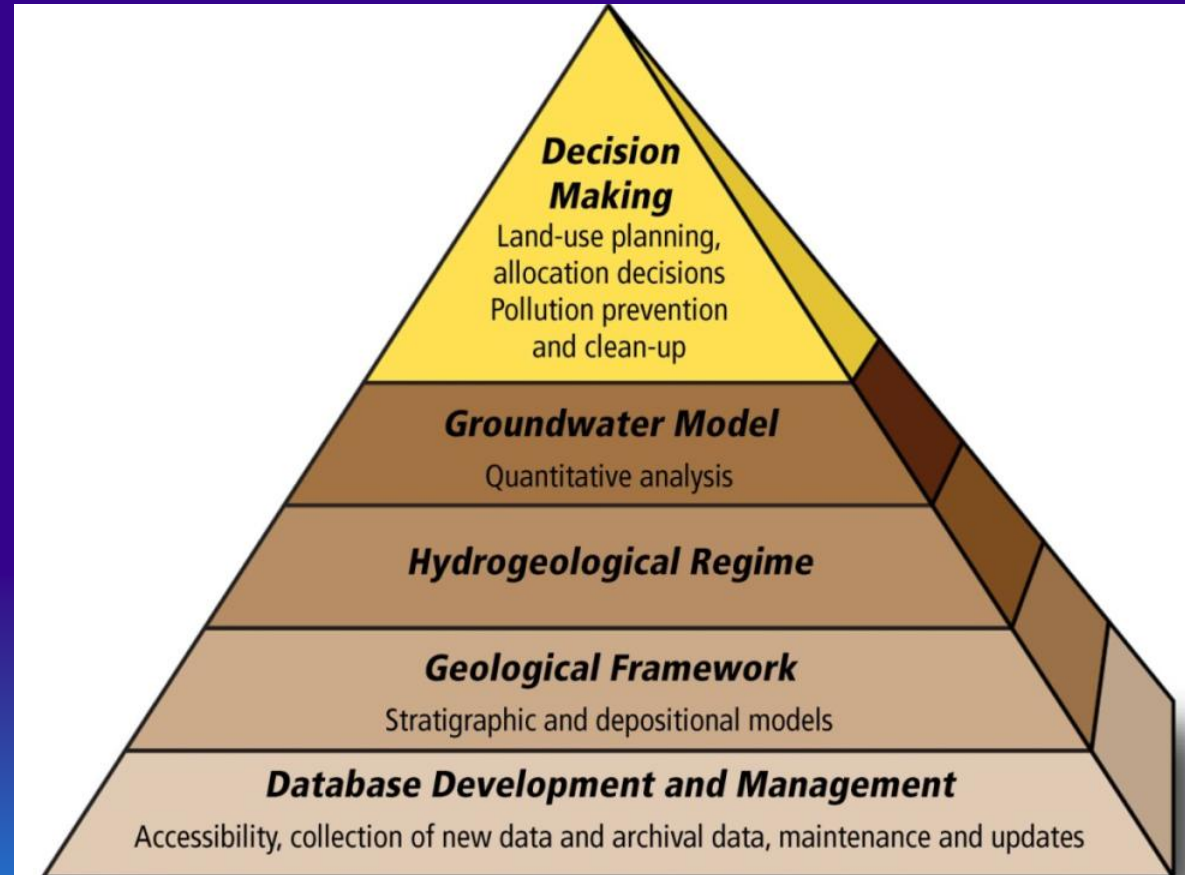
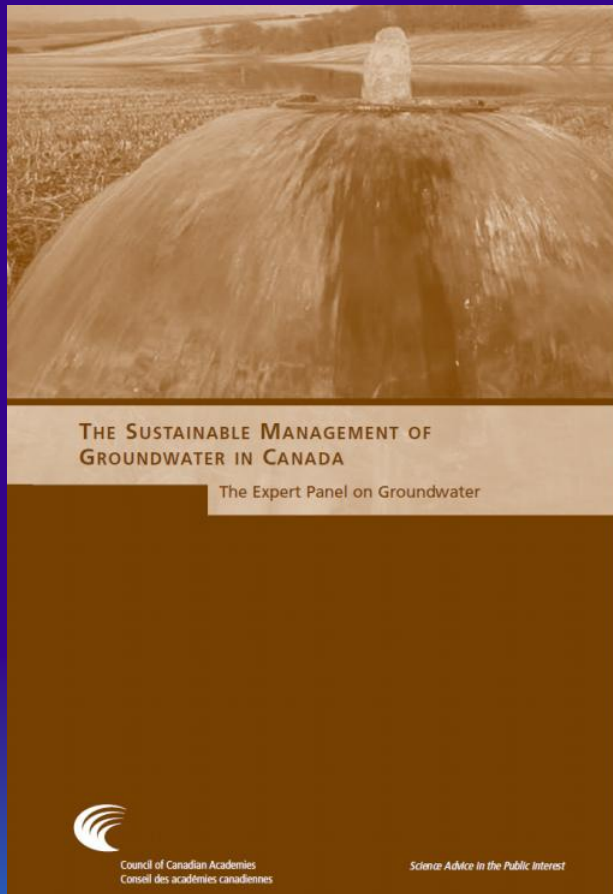
*“To establish consistent policies, data collection, data management standards, and analytical methods for groundwater management and to determine a framework for implementation across the three regions.”*

## RECOMMENDATIONS

Cooperatively work on.....

- Policy
- Data Collection/Management
- Technical Analysis/Studies
- Implementation Framework
- Monitoring, Evaluation and Program Refinement

# CCA – Sustainable GW Management



# Recent Context For GW Discussion

## ➤ *Perception*

If we have data, let's look at data.  
If all we have are opinions, let's go with mine.  
Jim Barksdale

### **Ontario needs better data on its groundwater supply, says environmental watchdog**

"We're making decisions with our eyes closed," said the environmental commissioner and warned that climate change will increase the amount of stress on water.

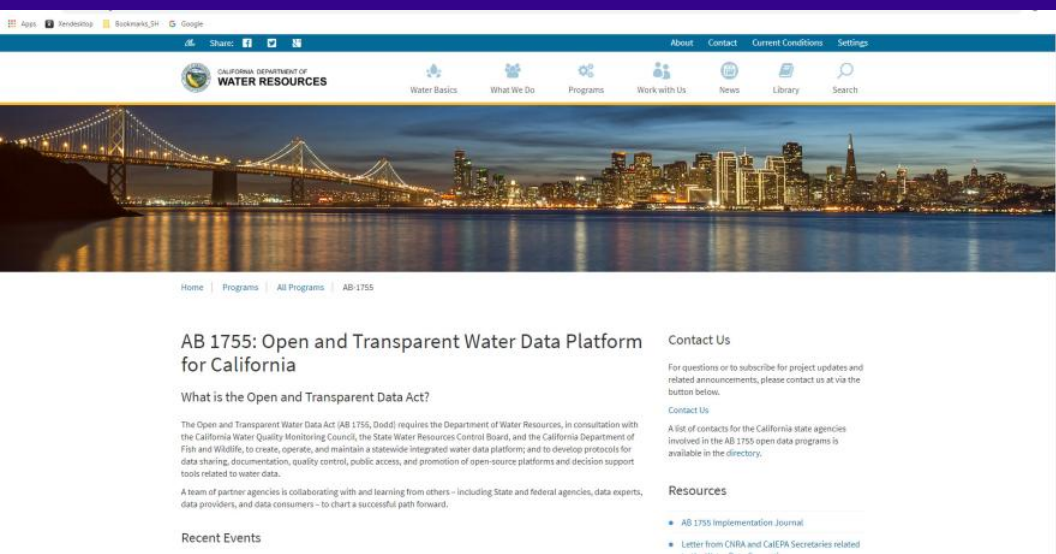
*Dianne Saxe (Toronto Star, Oct 27, 2016)*

The issue of getting good data on the groundwater, and other environmental concerns, is "challenging" for all governments right now, added Murray.

"Climate change is creating such rapidly changing situations with water quality, air and forests that the amount of data you need to manage these things is enormous," he said.

*Glen Murray (Toronto Star, Oct 27, 2016)*

## ➤ *Reality - Wealth of Information – not fully utilized*

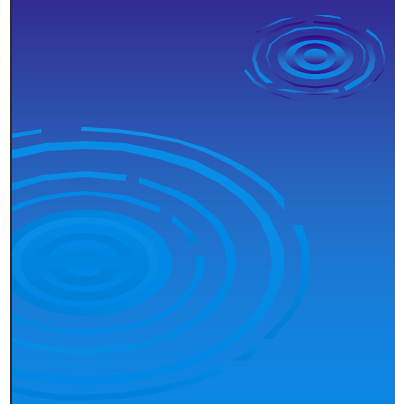


# Water Data Act

- California
- New Mexico

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ted material] = delete

1 HOUSE BILL 651  
2 54TH LEGISLATURE - STATE OF NEW MEXICO - FIRST SESSION, 2019  
3 INTRODUCED BY  
4 Melanie Ann Stansbury and Gail Armstrong  
5   
6  
7  
8  
9  
10 AN ACT  
11 RELATING TO WATER; ENACTING THE WATER DATA ACT; CREATING THE  
12 WATER DATA COUNCIL TO IDENTIFY AND INTEGRATE KEY WATER DATA  
13 SETS; PROVIDING DUTIES; DIRECTING THE ESTABLISHMENT OF A WATER  
14 DATA ACCOUNT; MAKING AN APPROPRIATION.  
15  
16 BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF NEW MEXICO:  
17 SECTION 1. [NEW MATERIAL] SHORT TITLE.--This act may be  
18 cited as the "Water Data Act".  
19 SECTION 2. [NEW MATERIAL] DEFINITIONS.--As used in the  
20 Water Data Act:  
21 A. "council" means the water data council;  
22 B. "data and information platform" means software,



# ORMGP - Application to Decisions

## PUBLIC WORKS

- Groundwater based supply
- Infrastructure
  - Storm Water
  - Road/Sewer Construction
  - Deep Foundations/Geotechnical

## PLANNING

- PPS/OP/Municipal Comprehensive Review (Water Systems/Flow Systems/Hydrological Function, etc.)
- Source Water Protection (WHPAs, HVAs, ESGRAs)
- PTTW

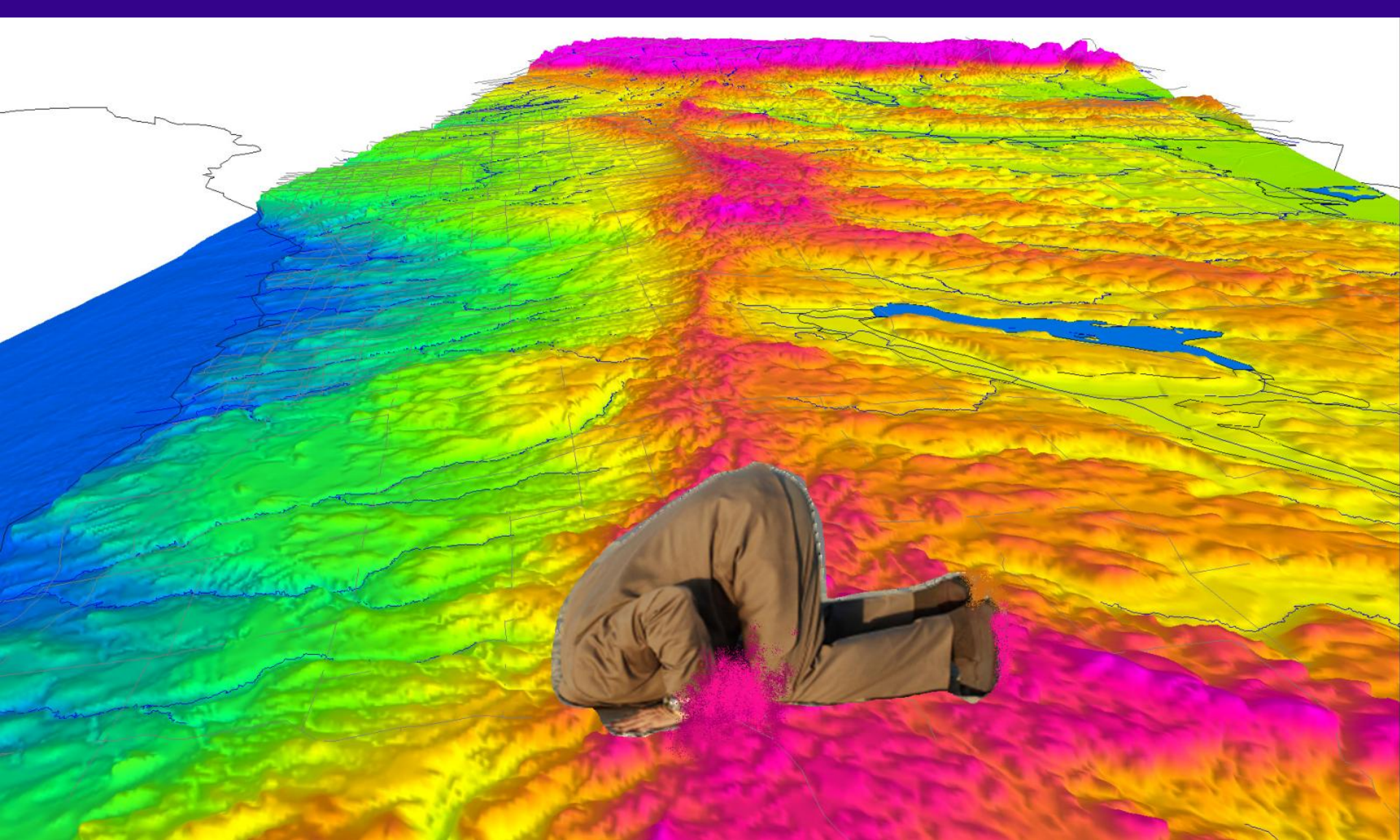
# ORMGP - Key Takeaways

- Very successful long term partnership
- Respect/appreciation for data (**Data driven decision-making**)
- Ability to 'torture' the data
- Money Saving Website/Program
- Website that Councillors can use and "show-off"
- Public accessibility to water related data - accountability
- Committed staff with vision, passion & dedication, willingness to work hard and smart
- Respect/appreciation for financial and logistical support

"If you torture the data long enough, it will confess."  
*Ronald Coase*

"Things get done only if the data we gather can inform and inspire those in a position to make a difference."

*Mike Schmoker*



OK – So What's In There?

## Completing the loop: from data to decisions and back to data

Stuart Hamilton\*

*Environment Canada, Meteorological Service, 401 Burrard Street, Vancouver, British Columbia, Canada*

\*Correspondence to:

Stuart Hamilton, Environment Canada, Meteorological Service, 401 Burrard Street, Vancouver, British Columbia, Canada.

E-mail: stuart.hamilton@ec.gc.ca

The role of science in decision-making has been compared to the role of meat in a hamburger. By itself, it is messy, but when contained by the bun of policy it becomes more palatable. Extending this metaphor, data can be thought of as the cow that is processed into meat by the scientific process. However, the topic of where the meat comes from rarely comes up in polite conversation.

Unfortunately, there is a 'tragedy of the commons' occurring—everyone wants a piece of the cow but no one wants to feed it. Furthermore, no one wants to buy a bull that will allow the cow to reproduce. The cow is languishing for the very reason that grain given to the cow is at the expense of the starving graduate students needed to produce prodigious volumes of output. In the meantime, information husbandry is left in the hands of bureaucrats who are accountable only for their ability to balance a budget and who are not held accountable for the legacy they leave.

There is incessant demand for quick answers to complex questions. This appetite for 'fast food' has resulted in resources being diverted from information husbandry to computer modeling (Hartemink *et al.*, 2001). Scientists have to resort to data scavenging—obtaining whatever 'road-kill' they can find to grind up into meat to serve policy objectives.

Contemporary environmental science is calorie-rich but low in essential nutrients. When more money is invested in science it results in a 'super-size' meal that has extra bulk provided by modeling, but with little added nutritional value. This is because the scientific community is focused on their contemporary needs—to fund graduate students and to publish papers, forgetting the ethics of their profession, which would have them leave a rich legacy upon which their protégés can build their careers. We are consuming the information legacies of previous generations, but leaving the soil barren for future generations.

Well-maintained data appreciate in value like a vintage car. In contrast, model output is like an ice cream cone on a hot summer day. It is intended for immediate consumption with no residual value. Many modelers view the world through the lens of their model algorithms, and sometimes this view of reality is as if seen through a kaleidoscope. In

Well-maintained data appreciate in value like a vintage car.

As our models increase in sophistication we should be investing in more comprehensive monitoring to shed light on how well the models reflect reality (Silberstein, 2006).

As reliable data supplies dry up, scientists are resorting to sophisticated data assimilation models (e.g. Rodell *et al.*, 2004; Fekete *et al.*, 2004)—models that produce numbers consistent with what we think the data would show if we actually had data.

Each and every hydrologist needs to imagine what their information needs might be in 20 years time, and from that perspective consider what monitoring decisions need to be made today in order to supply those information needs.

What gets measured, gets managed.

Peter Drucker

Data! Data! Data! I can't make bricks  
without clay!

Arthur Conan Doyle

You can have data without information,  
but you cannot have information without  
data.

Daniel Keys Moran

If we have data, let's look at data.  
If all we have are opinions, let's go with  
mine.

Jim Barksdale

Not everything that can be counted  
counts, and not everything that counts  
can be counted.

Albert Einstein

If you torture the data long enough, it  
will confess.

Ronald Coase

Errors using inadequate data are much  
less than those using no data at all.

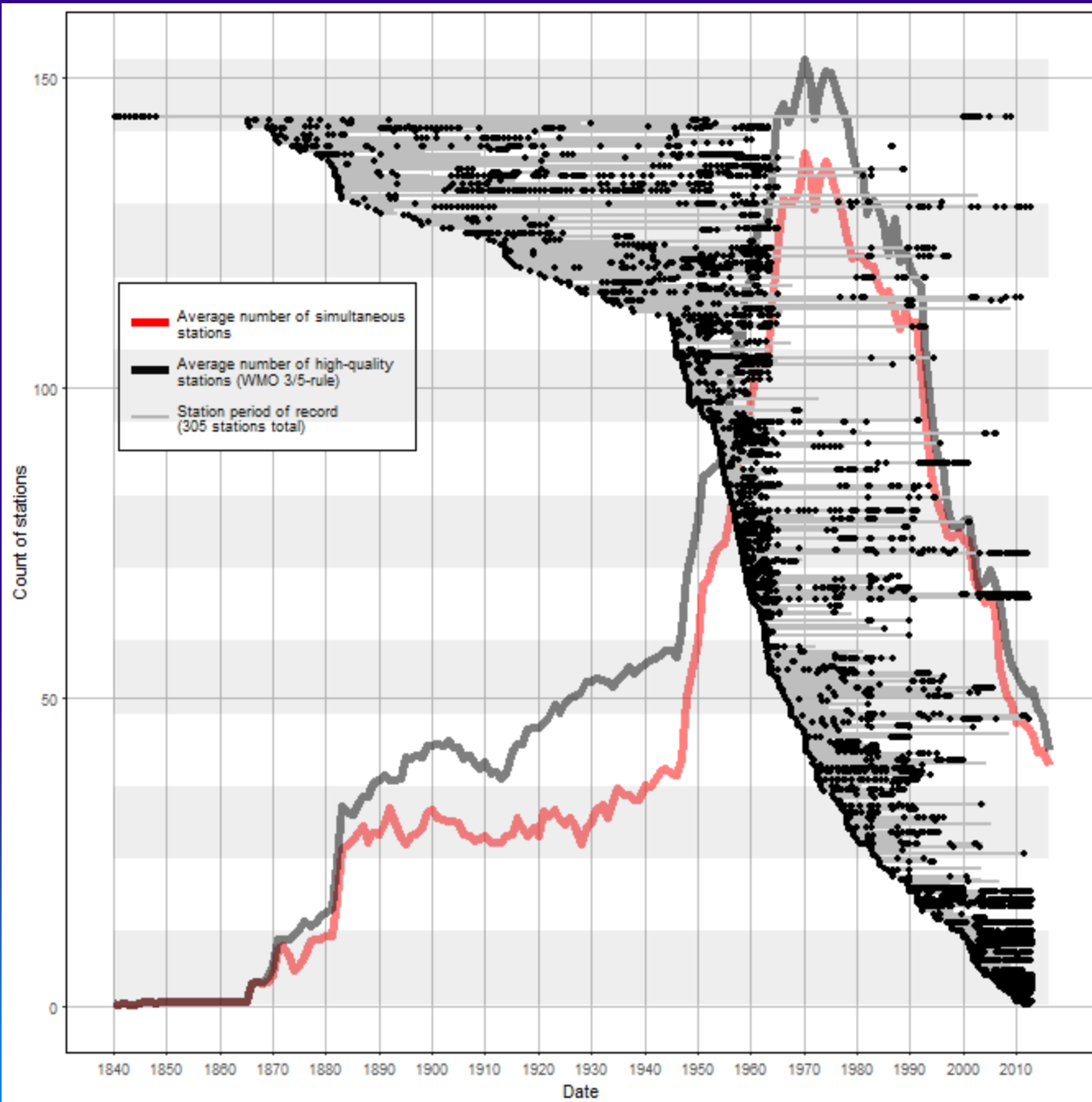
Charles Babbage

Statistics are like bikinis. What they  
reveal is suggestive, but what they  
conceal is vital.

Aaron Levenstein

Things get done only if the data we gather can  
inform and inspire those in a position to make a  
difference.

Mike Schmoker



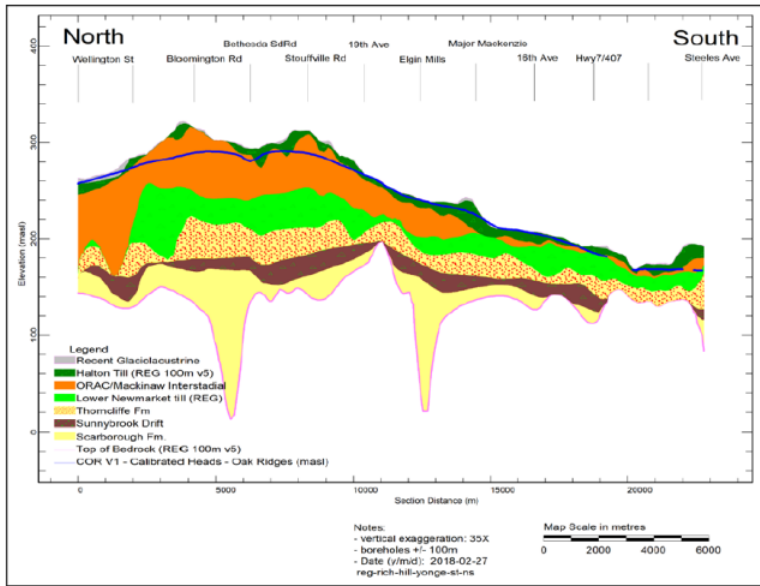


Figure 2: North-south cross-section along Yonge Street through Richmond Hill. Bedrock beneath the Town is mapped as shale. Interpreted ORAC shown in orange shading. Simulated shallow water table/potentiometric surface (COR V1 – Calibrated Heads – Oak Ridges (masl)) from Earthfx, 2006.

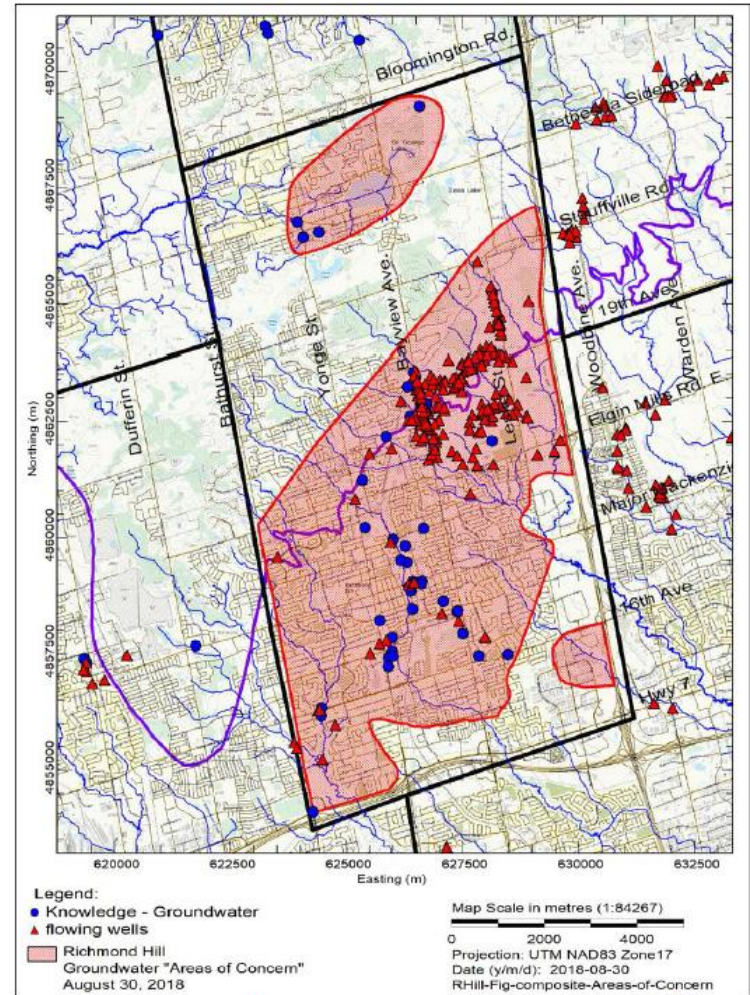


Figure 8: Town of Richmond Hill (only) groundwater "Areas of Concern" map (red shading). "Knowledge - Groundwater" locations are where groundwater issues or control measures (either temporary or in perpetuity) are known to have historically occurred.

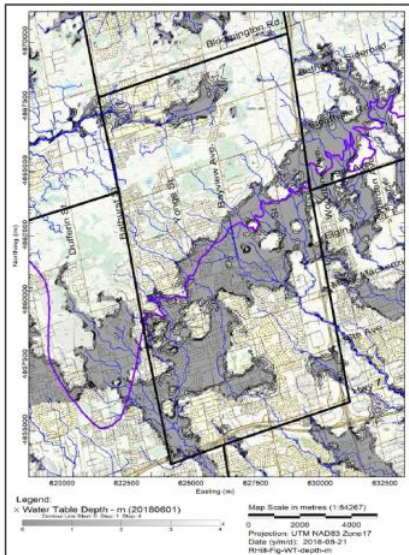


Figure 5: Current areas where interpreted water table and/or potentiometric surface is within 4 m of ground surface (grey shading). Interpreted from MCECC water well records and available consultant reports for piezometer depths less than or equal to 20 mbgs.

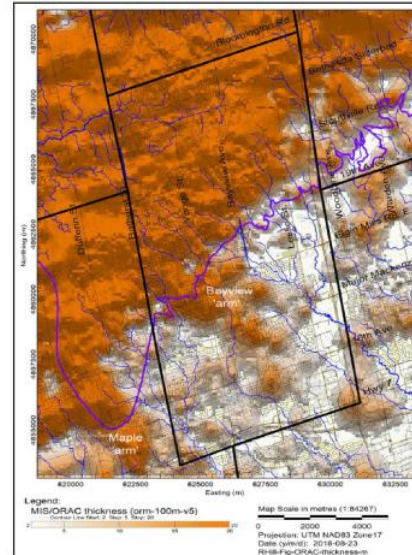


Figure 3: Areas where current interpreted thickness (m) of the Oak Ridges Aquifer Complex > 2 m (orange shade). ORAC = 20 m thick in northern half of Richmond Hill.

# Input to Development Related Decision-Making