# Centre Wellington Scoped Tier Three Water Budget Assessment

**Community Liaison Group Meeting #3**

Aboyne Hall, Wellington County Museum

Tuesday, May 15, 2018, 7:00 – 9:30 pm

Drinking Water Source Protection – Act for Clean Water

Lake Erie Source Protection Region

Centre Wellington

# MEETING PURPOSE

- Provide a refresh of the study process, scope and key participants
- Provide an overview of the groundwater flow model development
- Receive feedback on the Groundwater Flow Model Development and Calibration Report
- Provide an update on the Long Term Water Supply Master Plan
- Address any questions about the process overall

# ROLES & RESPONSIBILITIES

- **Tier 3 Water Budget Project Team**:
  - leads the Tier 3 Water Budget
  - responsible for all decisions related to this project
- **Provincial Peer Review Team**:
  - provides an external, independent, third party peer review of the technical findings at each major milestone
- **Project Consultant Team**:
  - responsible for conducting the Tier 3 Water Budget with direction from the Project Team

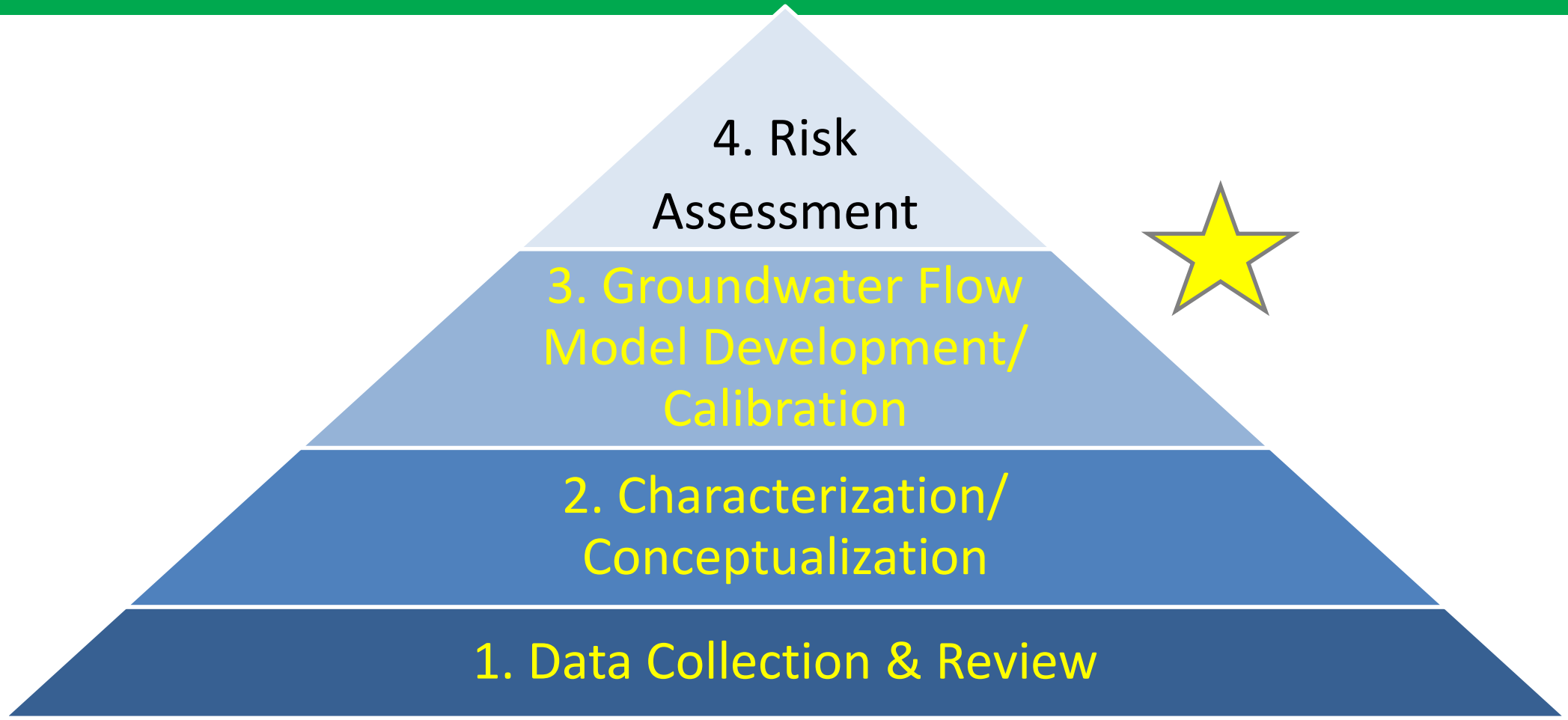
# ROLES & RESPONSIBILITIES

- **Community Liaison Group (CLG)**:
  - provides a forum for the community to be informed
  - provide input on the Tier 3 Water Budget and its progress
  - abide by Terms of Reference and the code of conduct
- **Third Party Facilitator**:
  - chairs the CLG meetings
  - provides facilitation and secretariat services
- **General Public**:
  - informed about the Tier 3 Water Budget
  - provide input on the Tier 3 Water Budget (via public representatives)
  - observers at CLG meetings

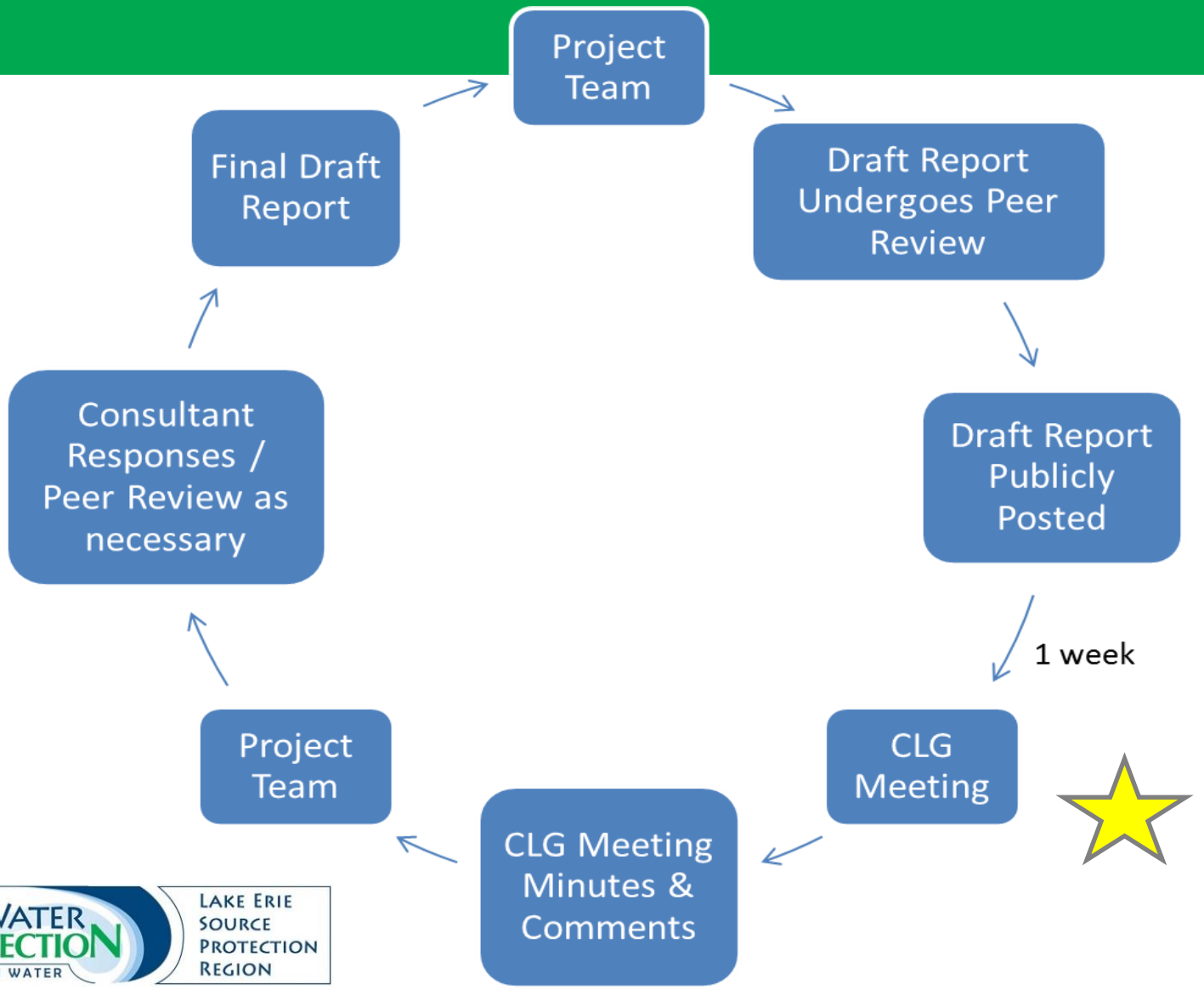
# AGENDA

| | |
|---|---|
| 7:00 pm | Welcome |
| 7:05 pm | Agenda Review, Introductions and Roles |
| 7:15 pm | Context and Process Review |
| 7:30 pm | Groundwater Modelling Overview |
| 8:00 pm | **Breakout Groups – Discussion #1** |
| 8:30 pm | Long Term Water Supply Master Plan Overview |
| 8:45 pm | Process Moving Forward – Risk Assessment |
| 9:00 pm | **Breakout Groups – Discussion #2** |
| 9:25 pm | Wrap up and Next Steps |
| 9:30 pm | Adjourn |

# PROJECT COMPONENTS



# CLG INPUT & PEER REVIEW

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# PEER REVIEW INPUT

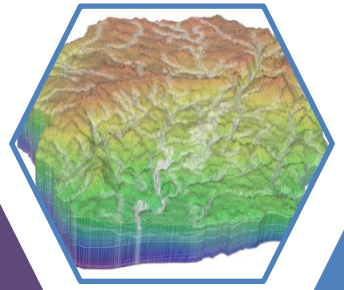
- Dr. Rob Schincariol:
  - *"The Peer Review meeting last week at Matrix was excellent - just what a collaborative effort should be to get the best report we can with the available resources. For me when I see how Patricia and Paul handled the presentation and discussion it gives me confidence in the work".*
  - *"I agree the groundwater flow model is suitably well calibrated to steady-state and transient conditions, and suitable for use in making predictions regarding the long-term sustainability of the water supplies in the Fergus and Elora area."*
- Dr. David Rudolph:
  - *"The document is very well-written and clearly presented."*
  - *"The work is excellent, it is hard to find much to comment on!"*
- Dr. Hugh Whiteley
  - *"I judge the Groundwater Flow Model Development and Calibration Report to be fully satisfactory."*

# PEER REVIEW INPUT

- Matrix added the following sections and subsections to the report in response to Peer Review comments:
  - Flow System and Water Budget Insights (Section 7)
  - Data Gaps (Section 8)
  - Discussion of Karst Features (Section 2.2.1)
  - Model Verification (Section 5.1.4)
- Editorial suggestions to improve readability and clarity

# REGULATORY PROCESSES

Private Wells
- PHU
- MOECC



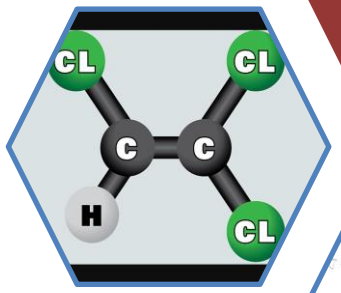
WSMP
- Municipal

Planning Act / PPS
- Municipal


Contamina-ted Sites
- MOECC

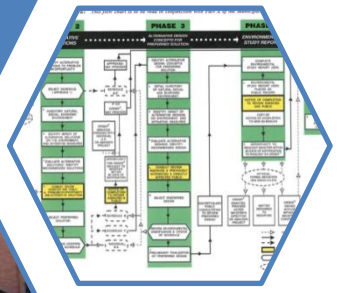
SP-Quantity
- GRCA
- Municipal
- MOECC

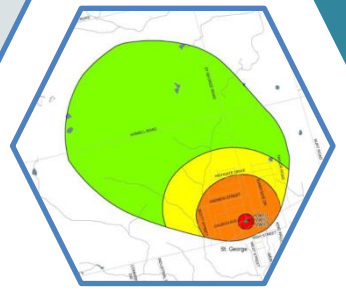
Class EA
- Municipal




SP-Quality
- GRCA
- Municipal
- MOECC

PTTW
- MOECC





SDWA
- Municipal
- MOECC

- Permit To Take Water (PTTW)
- Safe Drinking Water Act (SDWA)
- Water Supply Master Plan (WSMP)
- Provincial Policy Statement (PPS)
- Class Environmental Assessment (EA)

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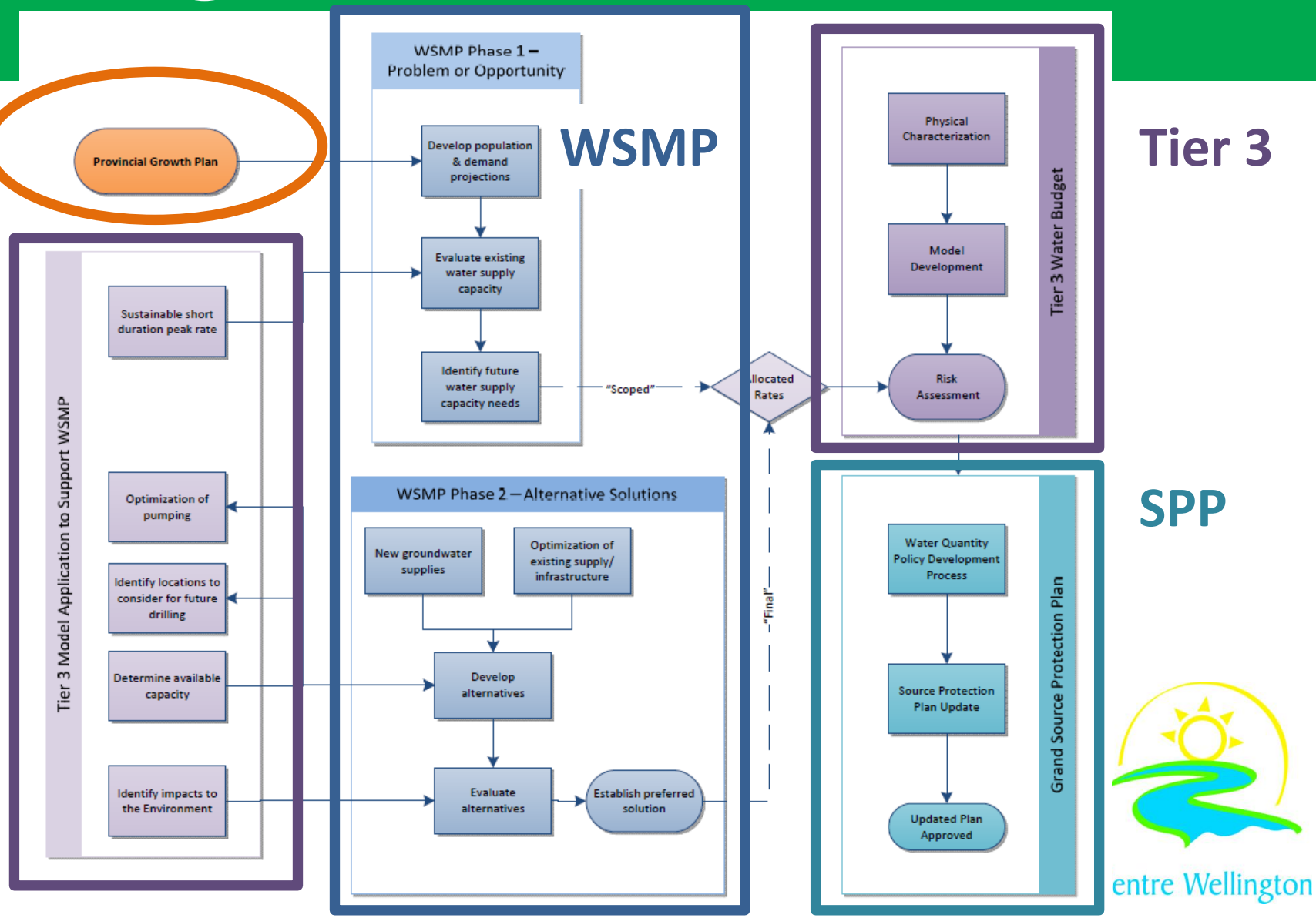
# WSMP-TIER 3

## Linkages

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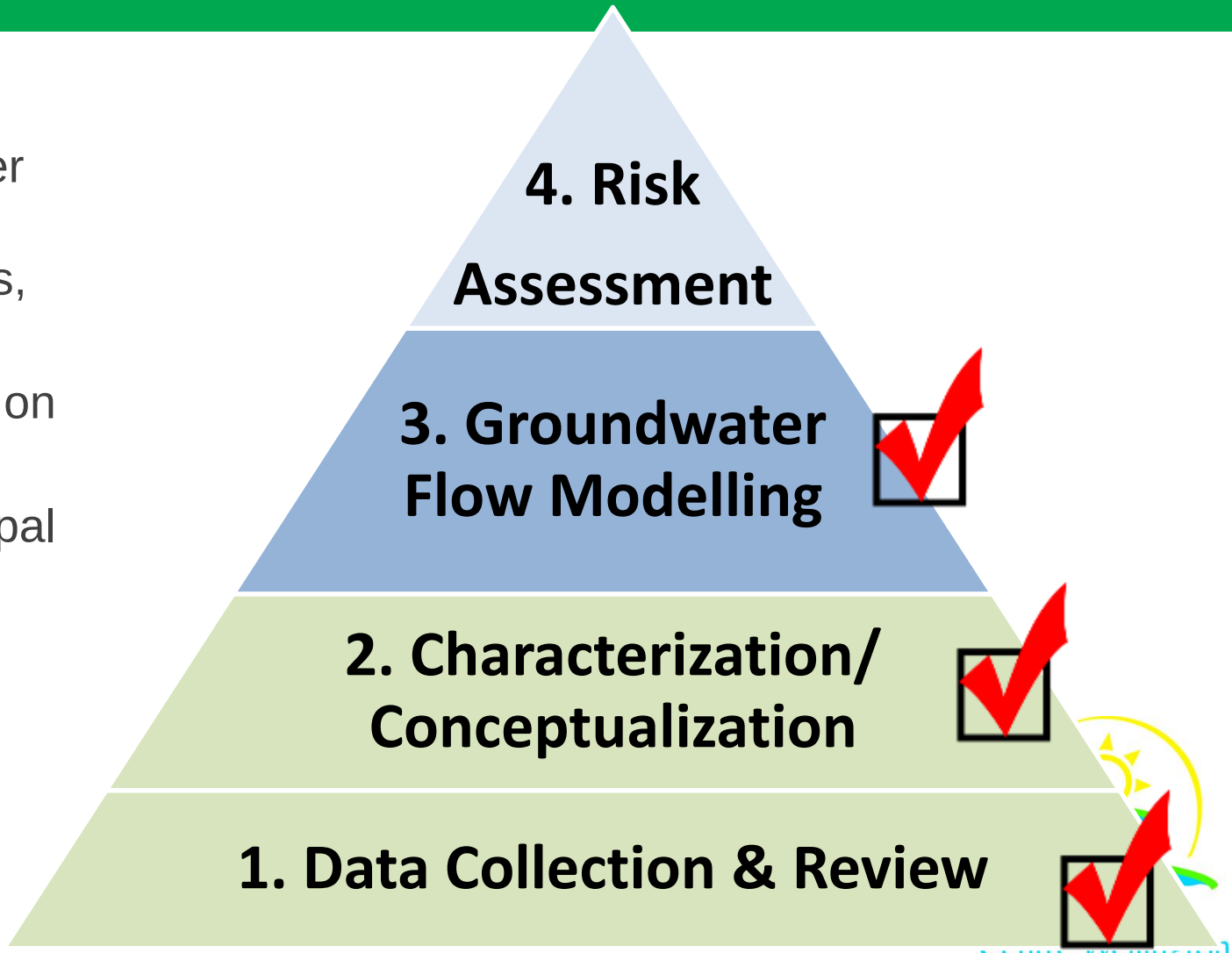
# NUMERICAL MODEL DEVELOPMENT AND CALIBRATION

# PROJECT OVERVIEW

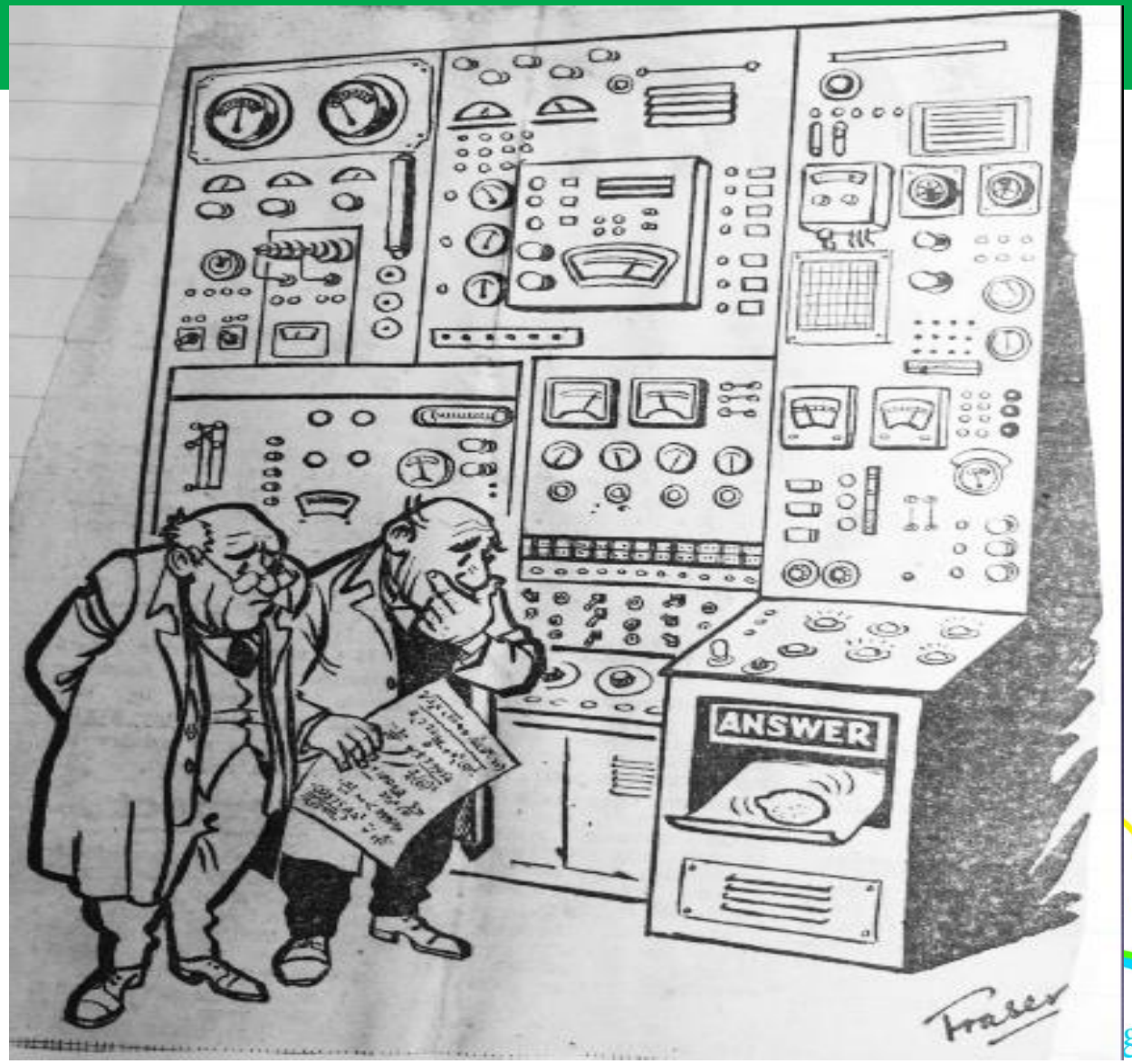
- Cumulative Assessment
  - Assess the impact of long-term water takings on municipal wells and ecosystems (e.g., coldwater streams, Provincially Significant Wetlands)
  - Assess impact of land development on municipal wells.
  - Assess impact of drought on municipal wells.



# MODEL TRANSPARENCY

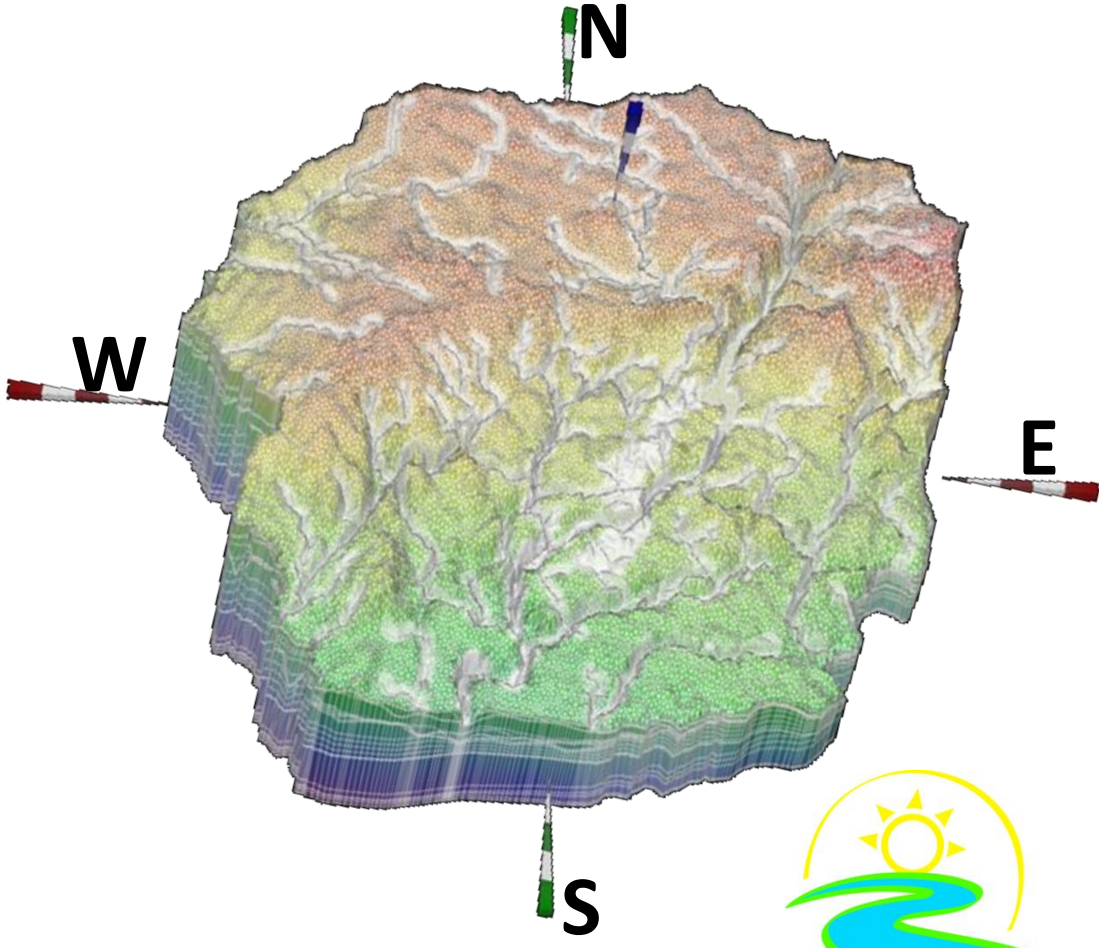
- For stakeholders to accept the output and results of our model, the inputs and assumptions should be clear

- Aim for transparency

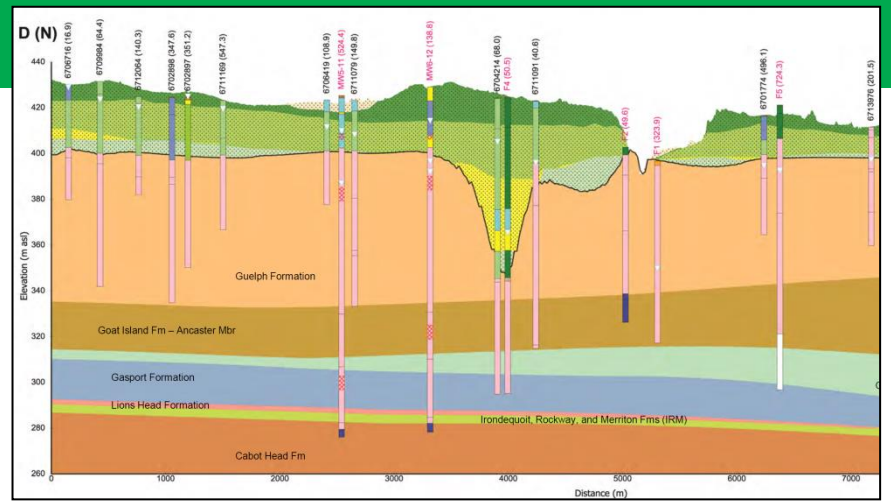


# WHY GENERATE MODELS?

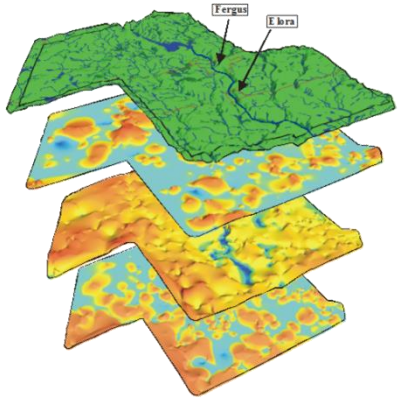
- Tools that contain our knowledge and understanding
- Give us insight into groundwater flow conditions
- Help answer questions that cannot be tested in the field.
  - What if we pumped all municipal wells at their highest rates for 20+ years coinciding with a long term drought?
- Municipal asset



# CHARACTERIZATION → GW FLOW MODEL



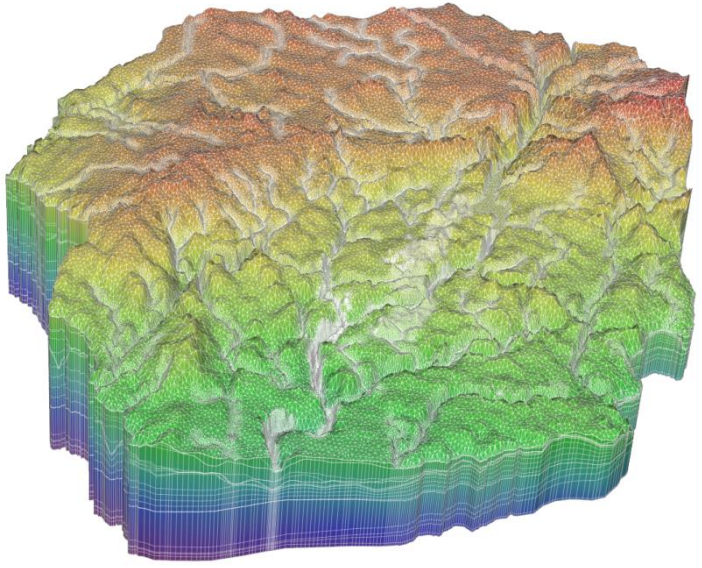

*Layer interpretations*




*Layer Property Interpretations*

*Water Demand Water Level Data*


*Groundwater Flow Model*



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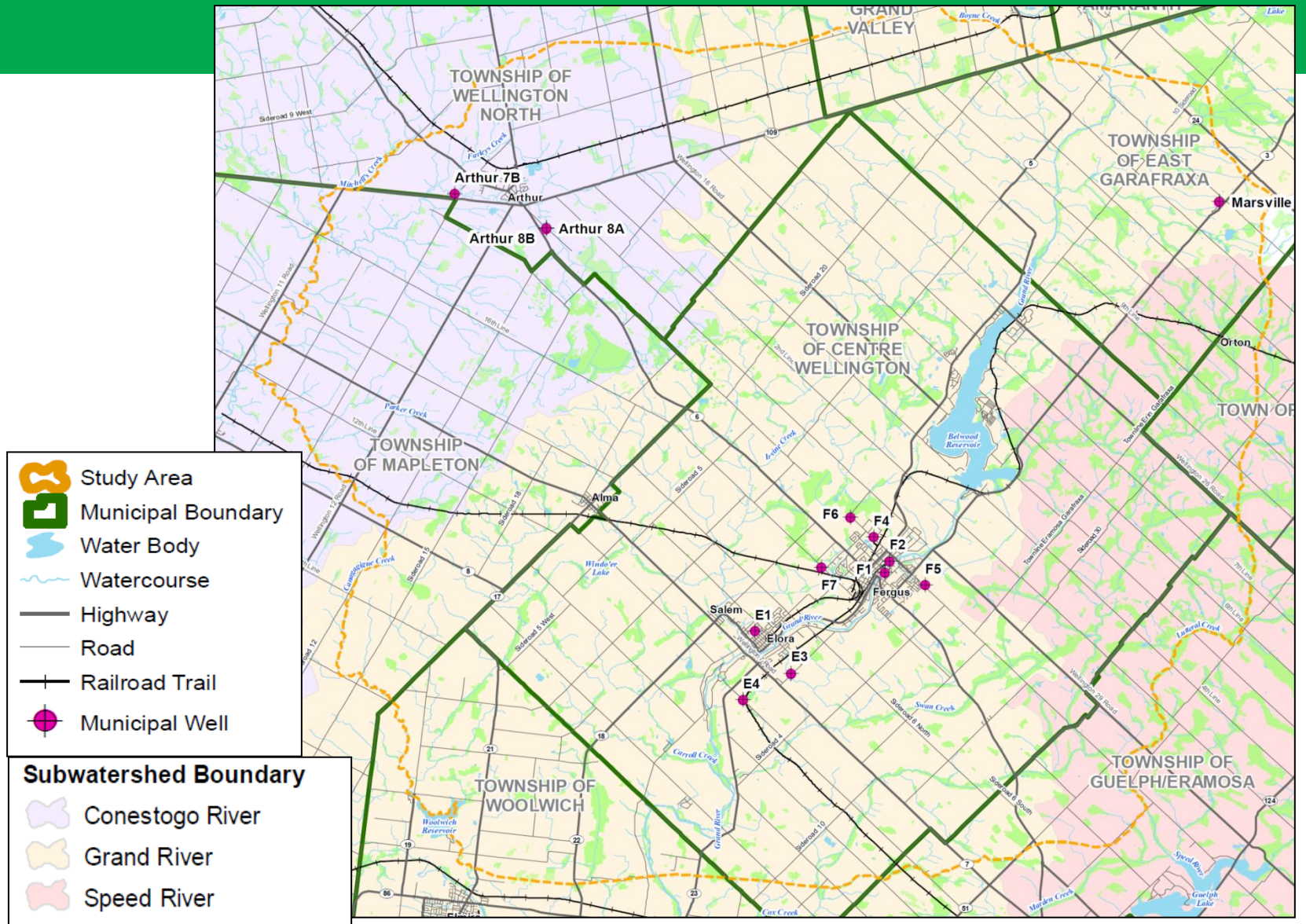
# CLG - THANK YOU

- Members shared data:
  - Highland Pines/ Pine Meadows (water level data)
  - Nestle Waters Canada (water level data)
  - Save our Water (domestic water demand estimates)
- Many provided comments and feedback on reports and during meetings.

# STUDY AREA

- 9 municipal water supply wells (bedrock)
- 2017 water taking ~ 5,500 $m^3/d$

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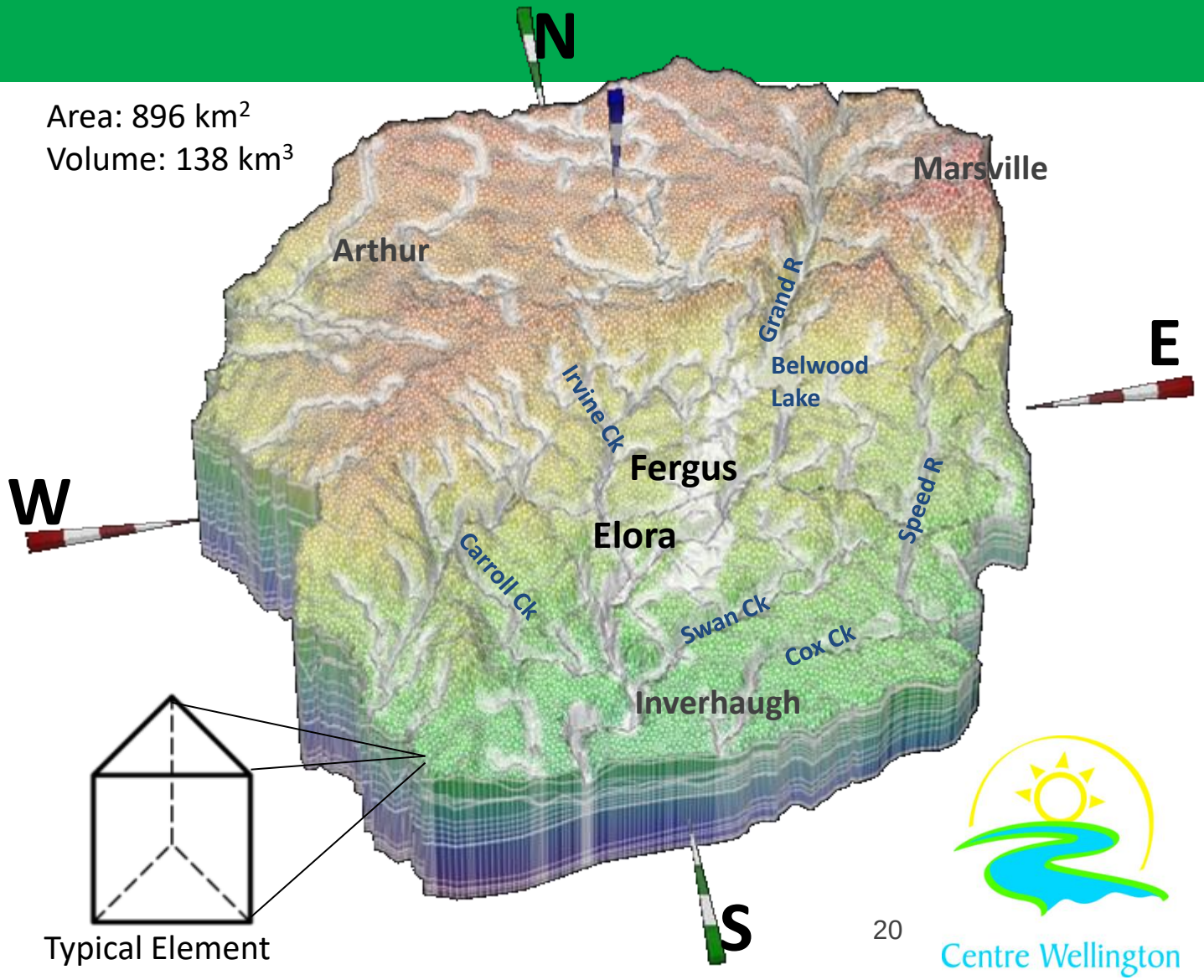
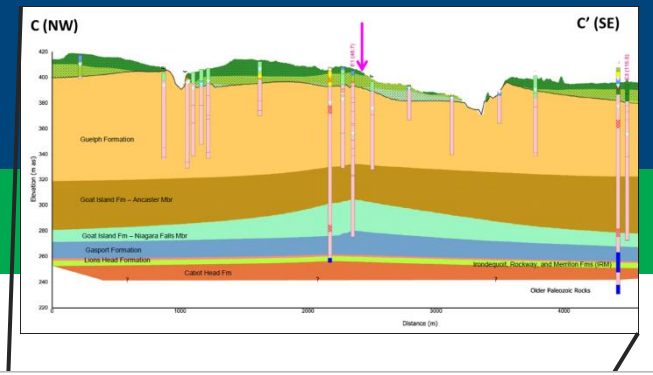
# FINITE ELEMENT MODEL

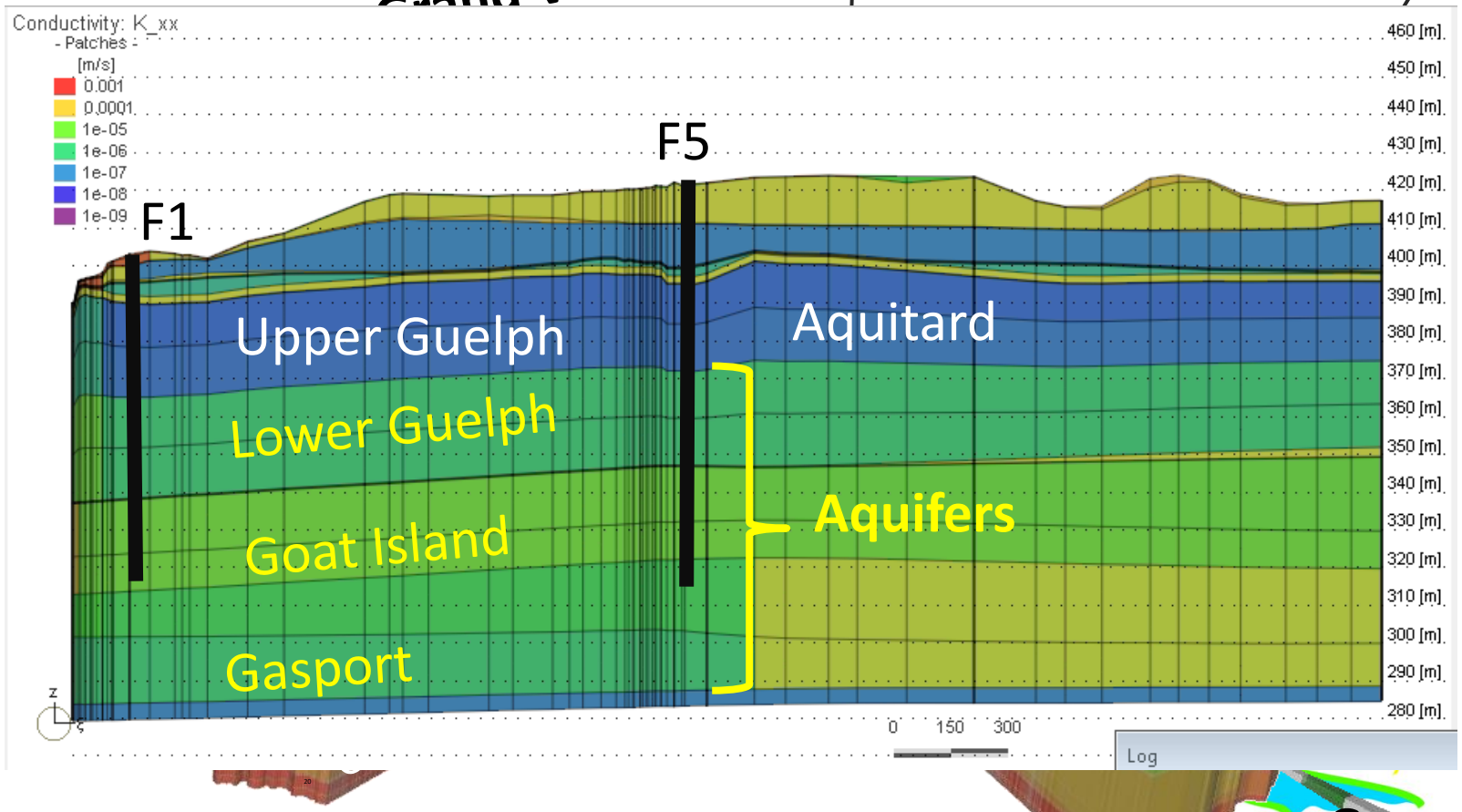
- 3D numerical model
- Subdivided into millions of elements (3,383,898!)
- Aim: provide insight into where and how much groundwater is flowing through different aquifers



# MODEL STRUCTURE

- Overburden and bedrock layers
- Bedrock aquifers:
  - Lower Guelph, Goat Island, Gasport formations
- Bedrock aquitard:
  - Upper Guelph formation




Vertical Exaggeration: 50

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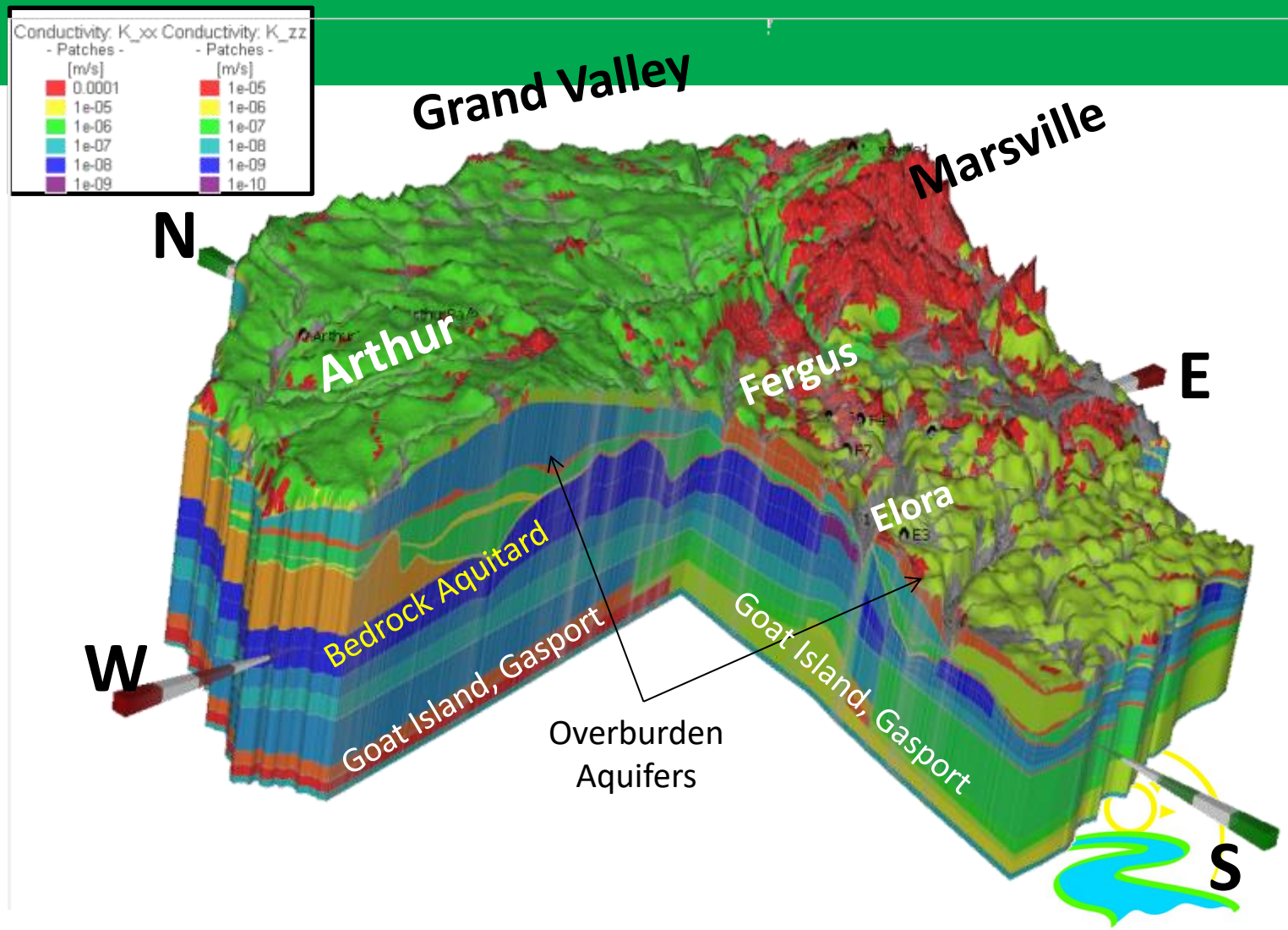
# HYDRAULIC CONDUCTIVITY

- Ease that water moves through subsurface
- Key values applied in the model
- Aquifers:
  - Red, orange yellow, green
- Aquitards:
  - Blue and purple




Vertical Exaggeration: 50



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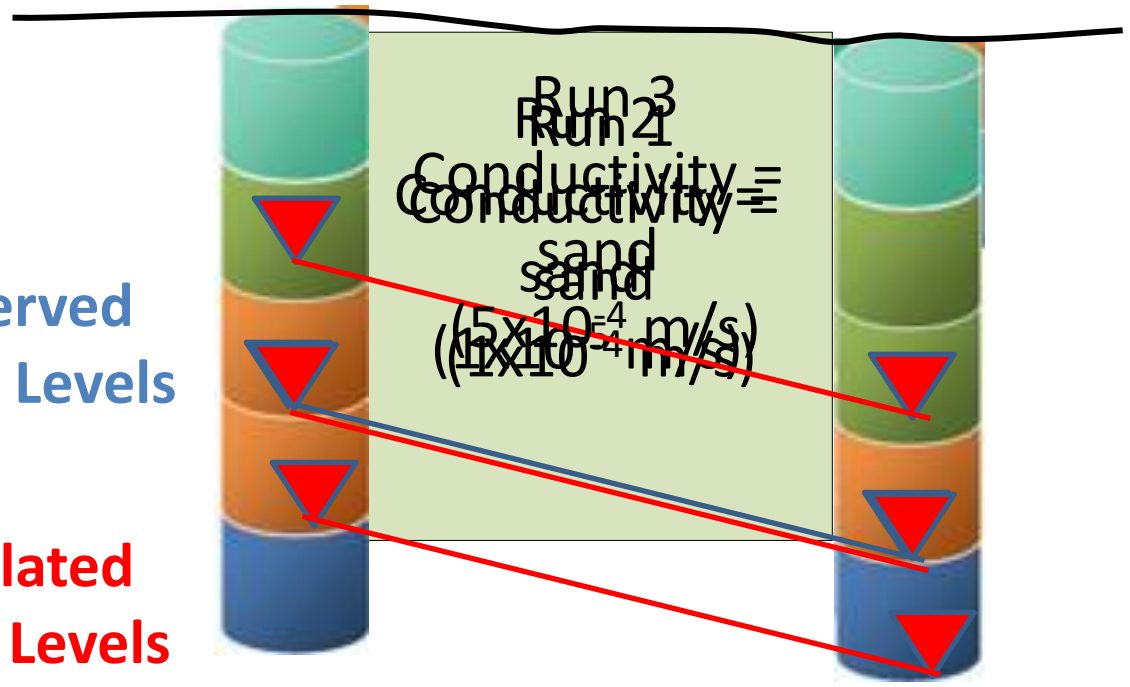
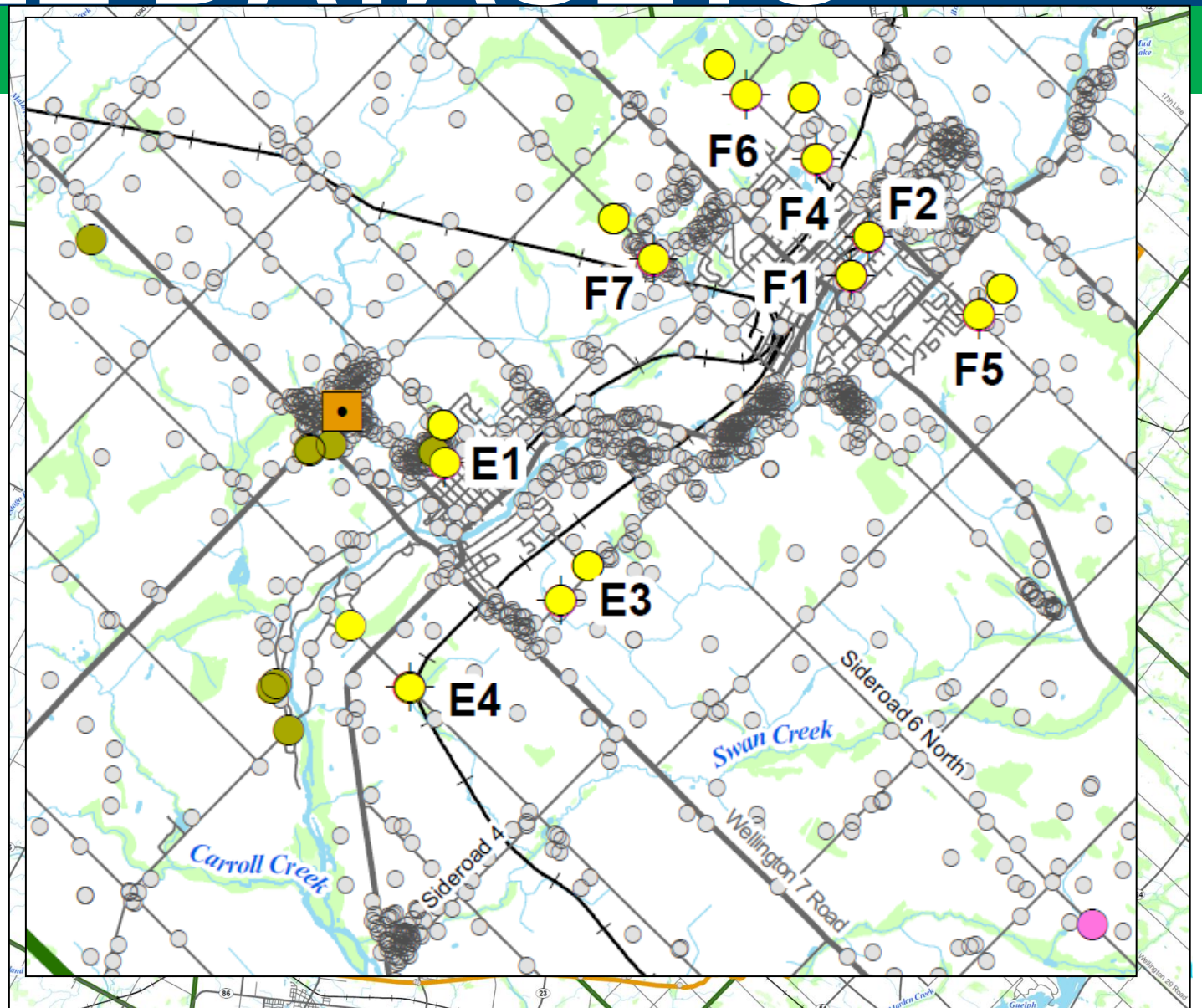
# CONCEPT OF CALIBRATION

- What is calibration? How does it work?
- Change values in the model and see how water levels respond; aim to see simulated water levels match observed water levels
- Over 400 unique runs developed to calibrate the model



# WATER LEVEL DATASETS

- So many data points!
  - > 4,100 water wells
  - 48 monitoring wells
- Used all the available data

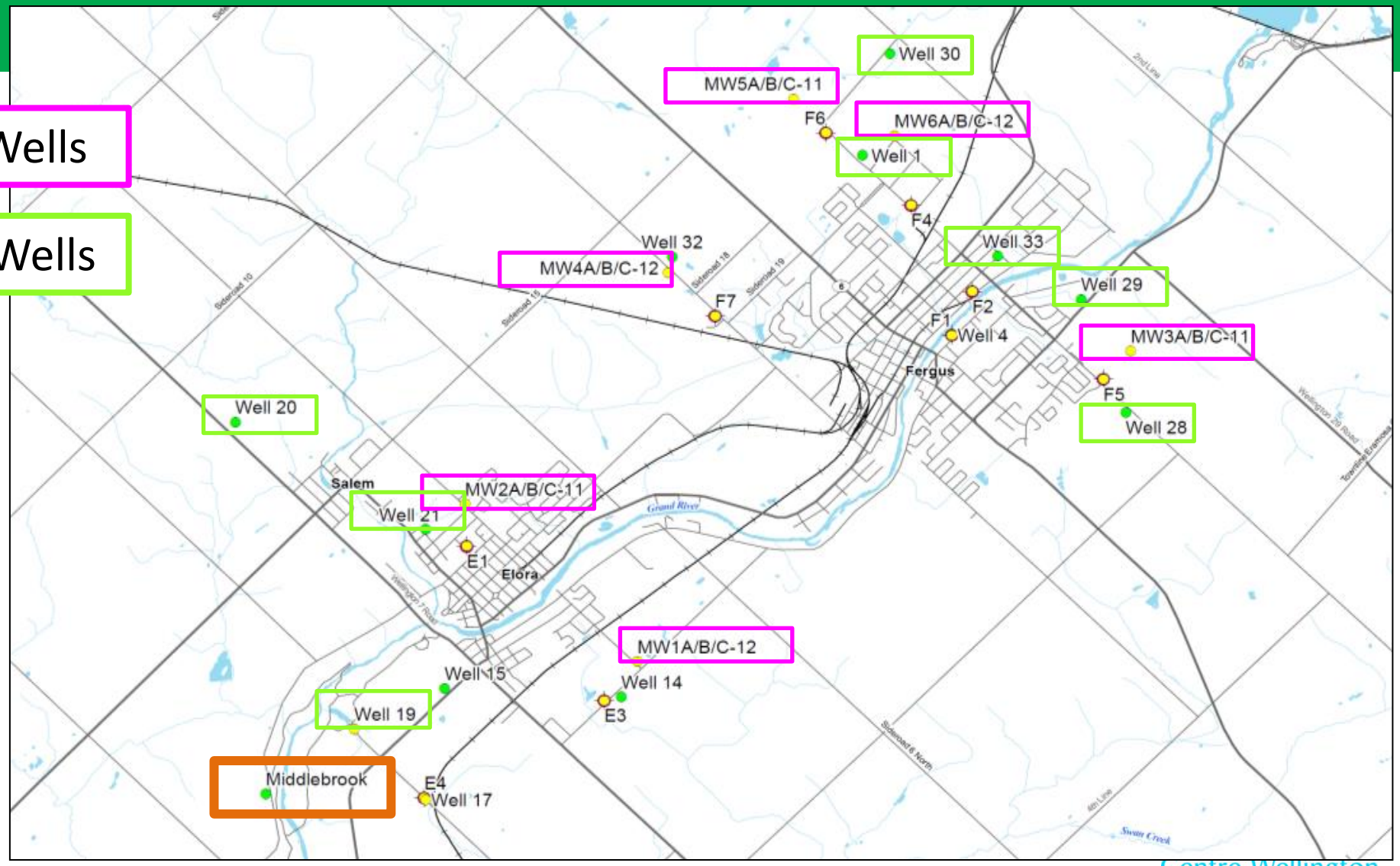


# WELLS MONITORING

## 6 week pumping test

Multi-level Wells

Domestic Wells

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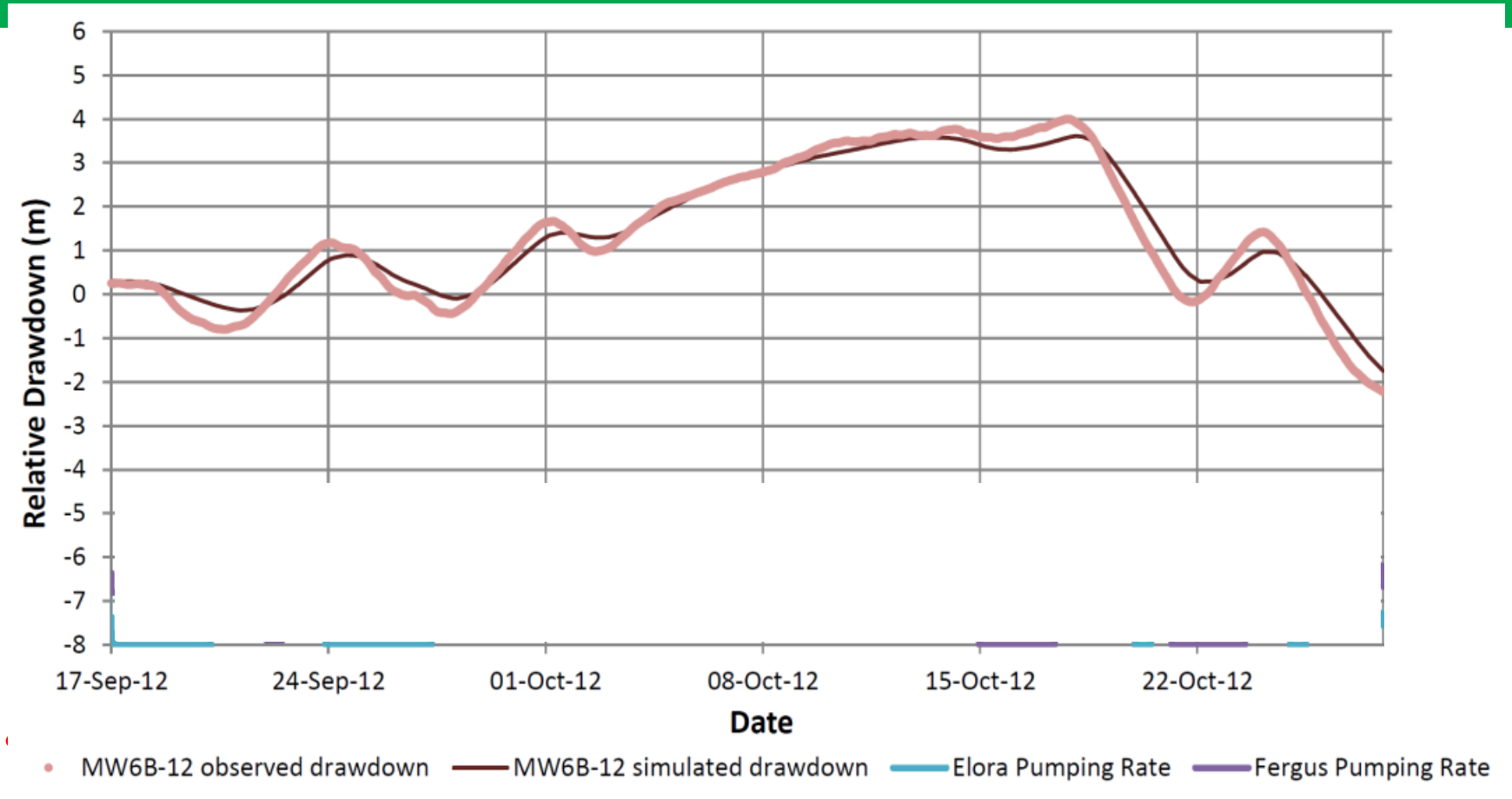
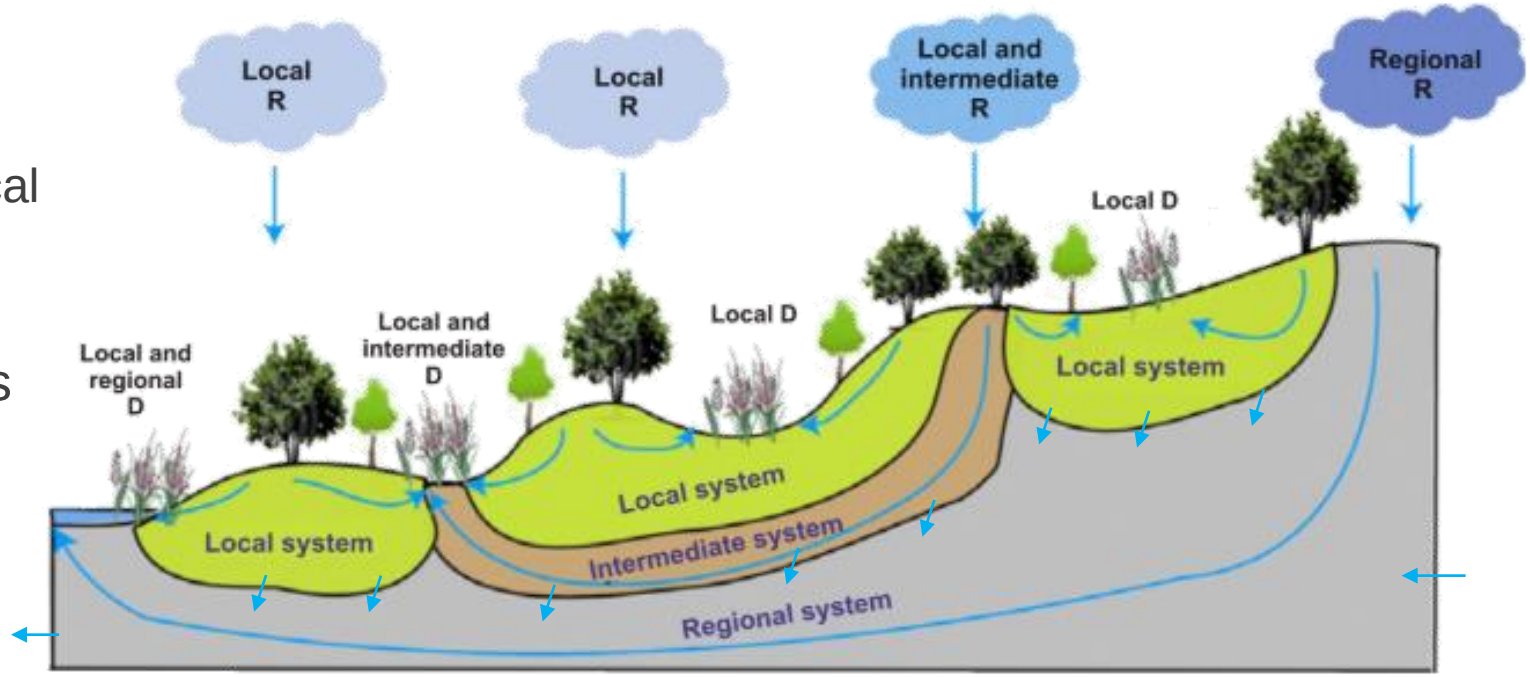
# TRANSIENT CALIBRATION



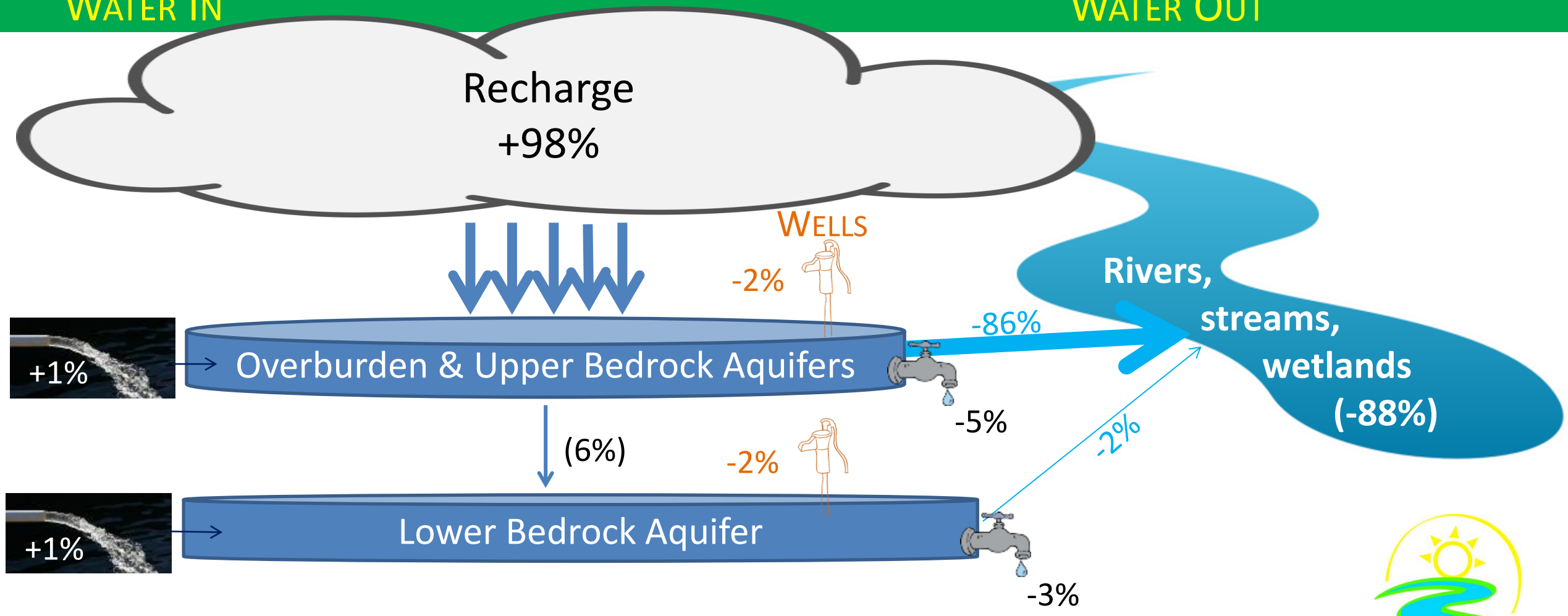
# GROUNDWATER FLOW

- Water infiltrates and moves to the water table in the upland areas
- Most (88%) of water moves from groundwater into nearby streams (local and intermediate)
- Some (4%) water is removed from shallow and deeper aquifers via wells
- Some water leaves the area in upper aquifers (5%) and lower bedrock aquifers (3%)




Typical Flow System (after Brown et al., 2007)

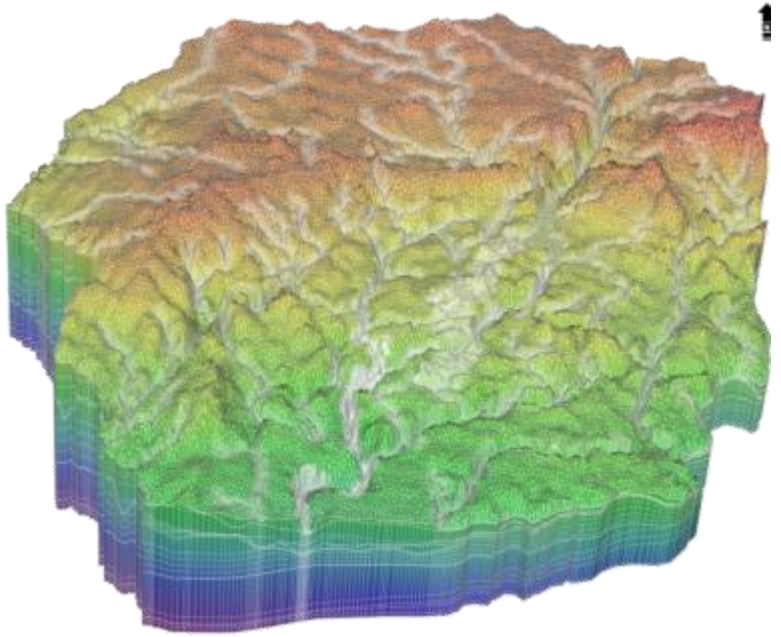
# SOURCES OF WATER FOR THE AQUIFERS



# MODEL APPLICATION

## How can we use the model?

- Evaluate:
  - Change in water levels due to new water wells
  - Change in water levels due to land development
  - Change in groundwater flow into rivers and streams due to increase/ decrease in pumping rates
  - Others…
- What do we change in the model when we apply it?
  - Pumping rates (increase/ decrease)
  - Add or remove pumping wells
  - Change groundwater recharge rates to simulate impact of land development
  - Change groundwater recharge rates to simulate drought/ changing climate

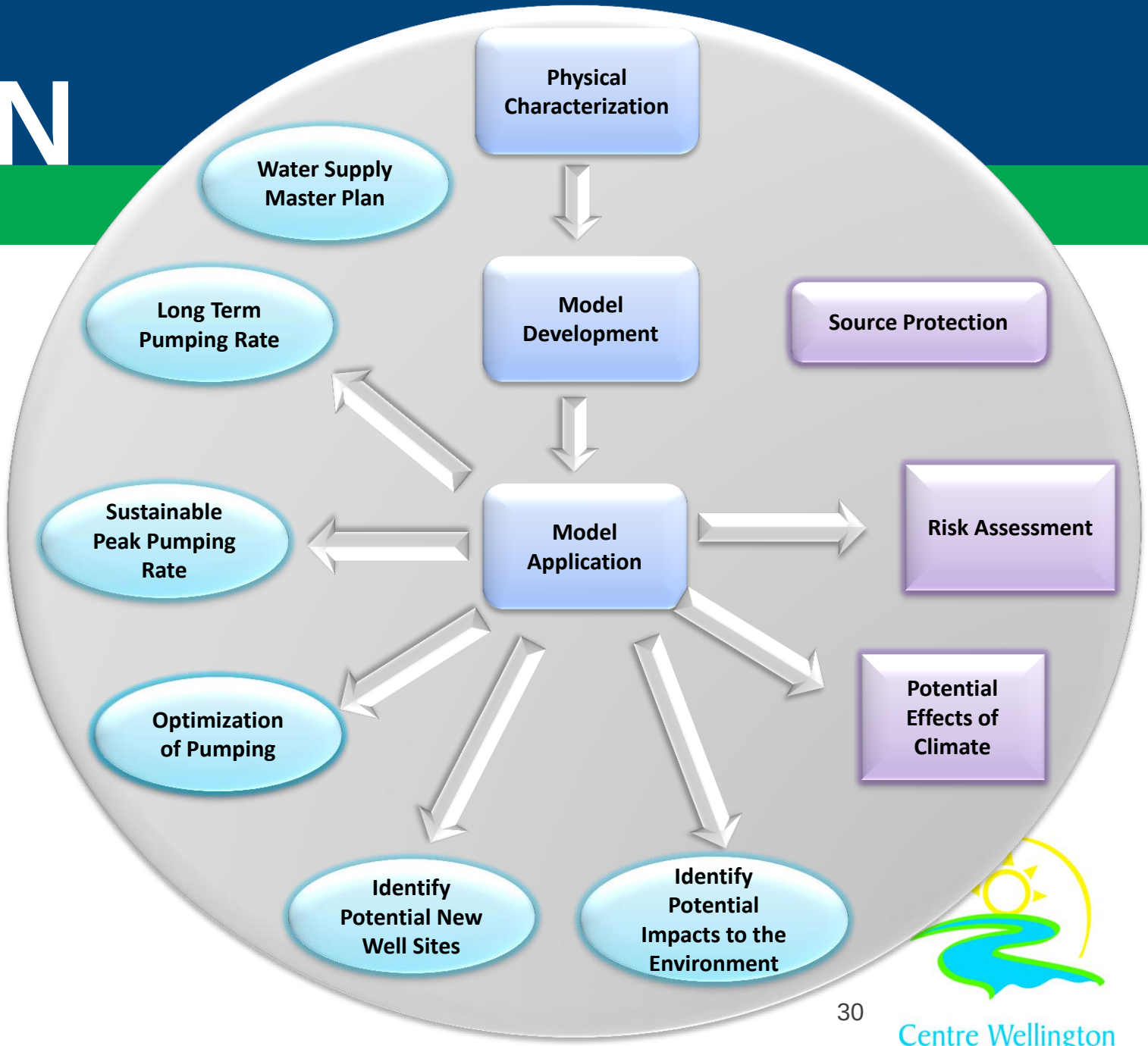


# APPLICATION

## Where do we go from here?

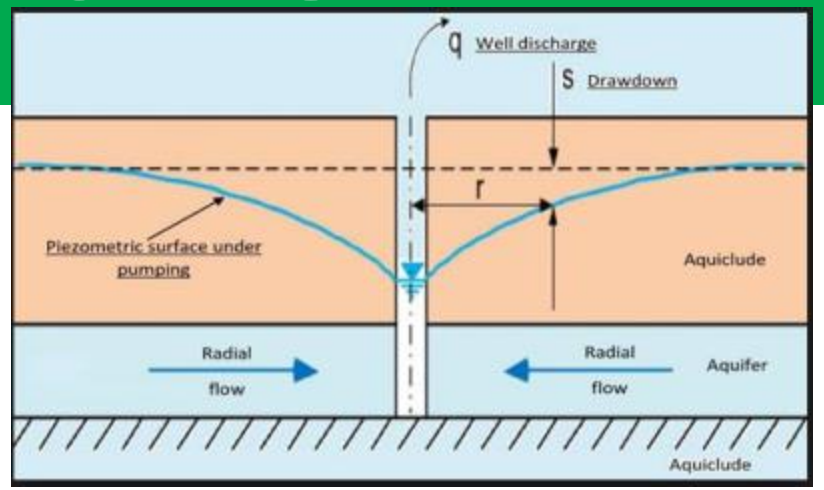
A. Water Supply Master Plan (WSMP)
- Working with Township and AECOM

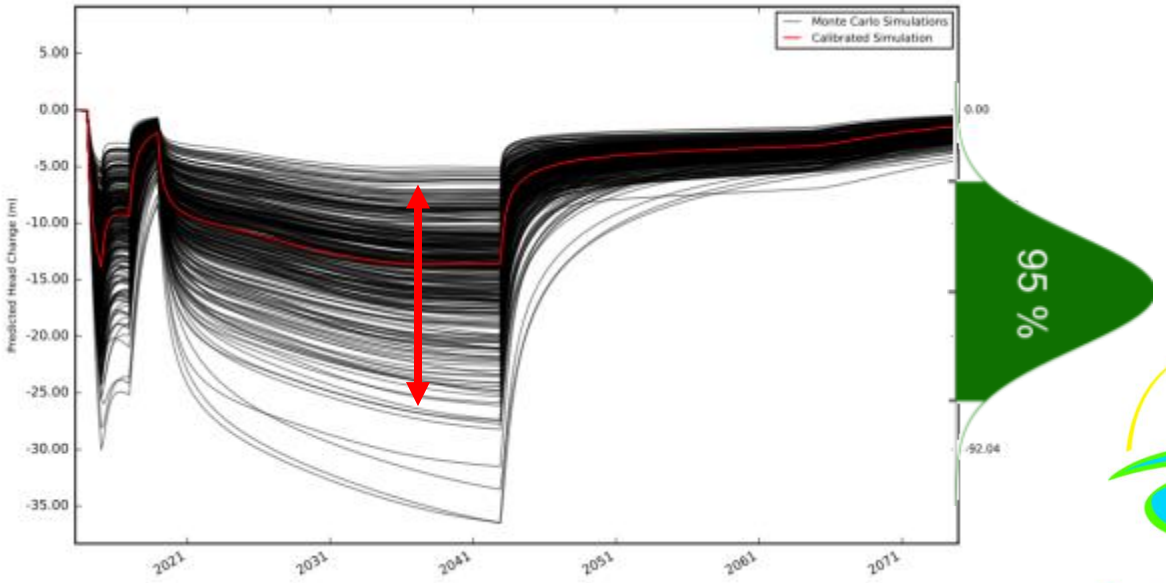
B. Risk Assessment and Climate Change Scenarios
- Evaluate change in water levels in municipal wells, and change in groundwater flow into rivers, streams and wetlands under different scenarios
- Understand the range of potential model results



# RANGE OF PREDICTIONS

- Model incorporates all data
- Model is calibrated
  - Long term & time varying
- Predictions: Best Available
  - cannot fully replicate nature
- Analysis:
  - Range of predictions
  - Enhances confidence
  - Identify important data gaps

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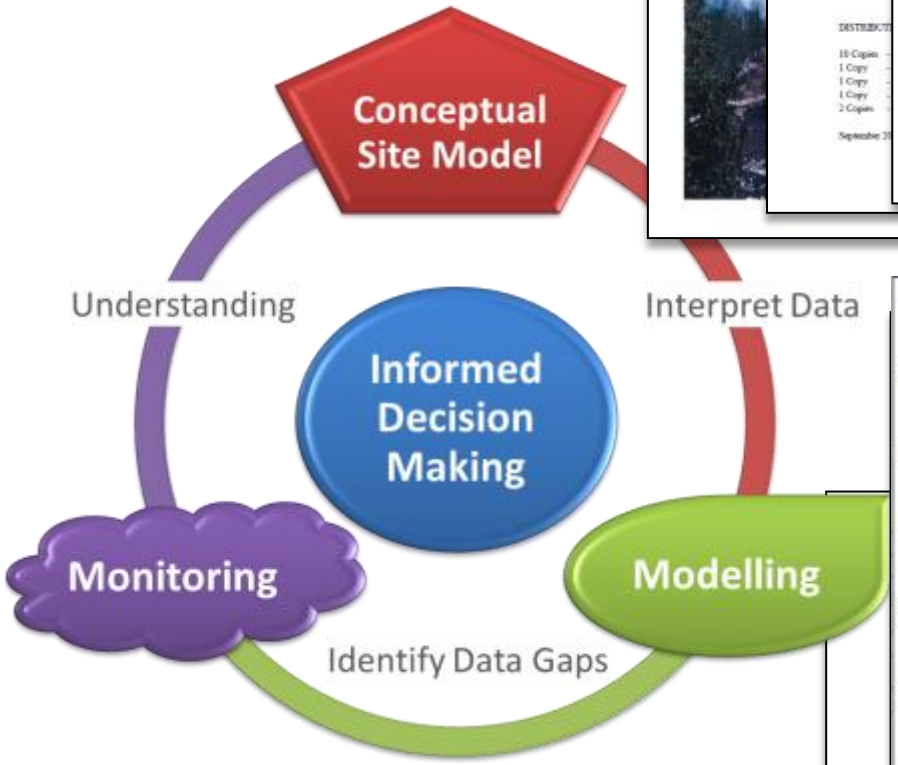
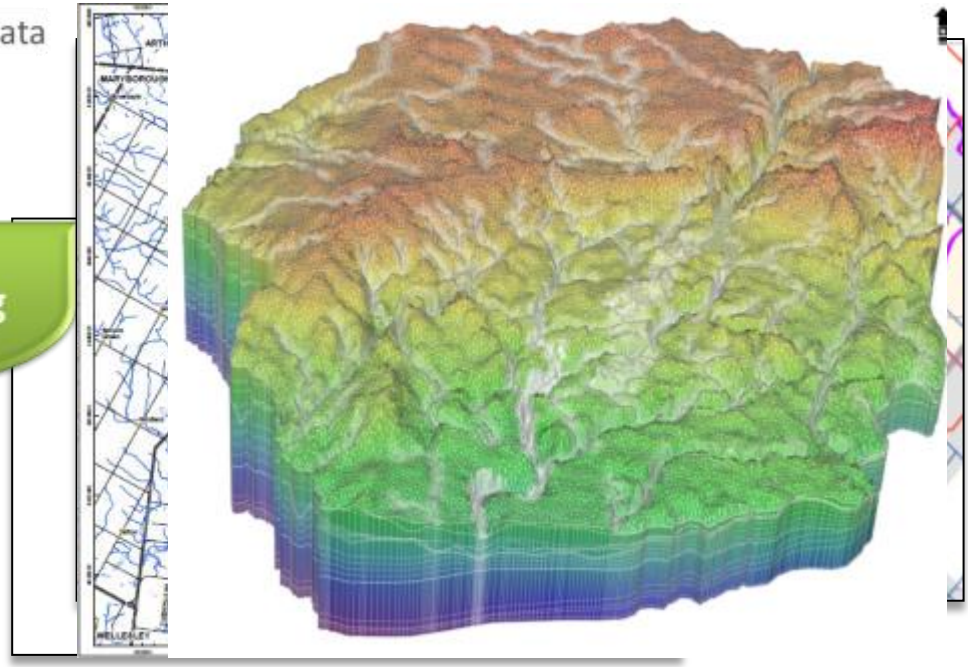
# CONTINUOUS IM T

## Continuous Improvement Process





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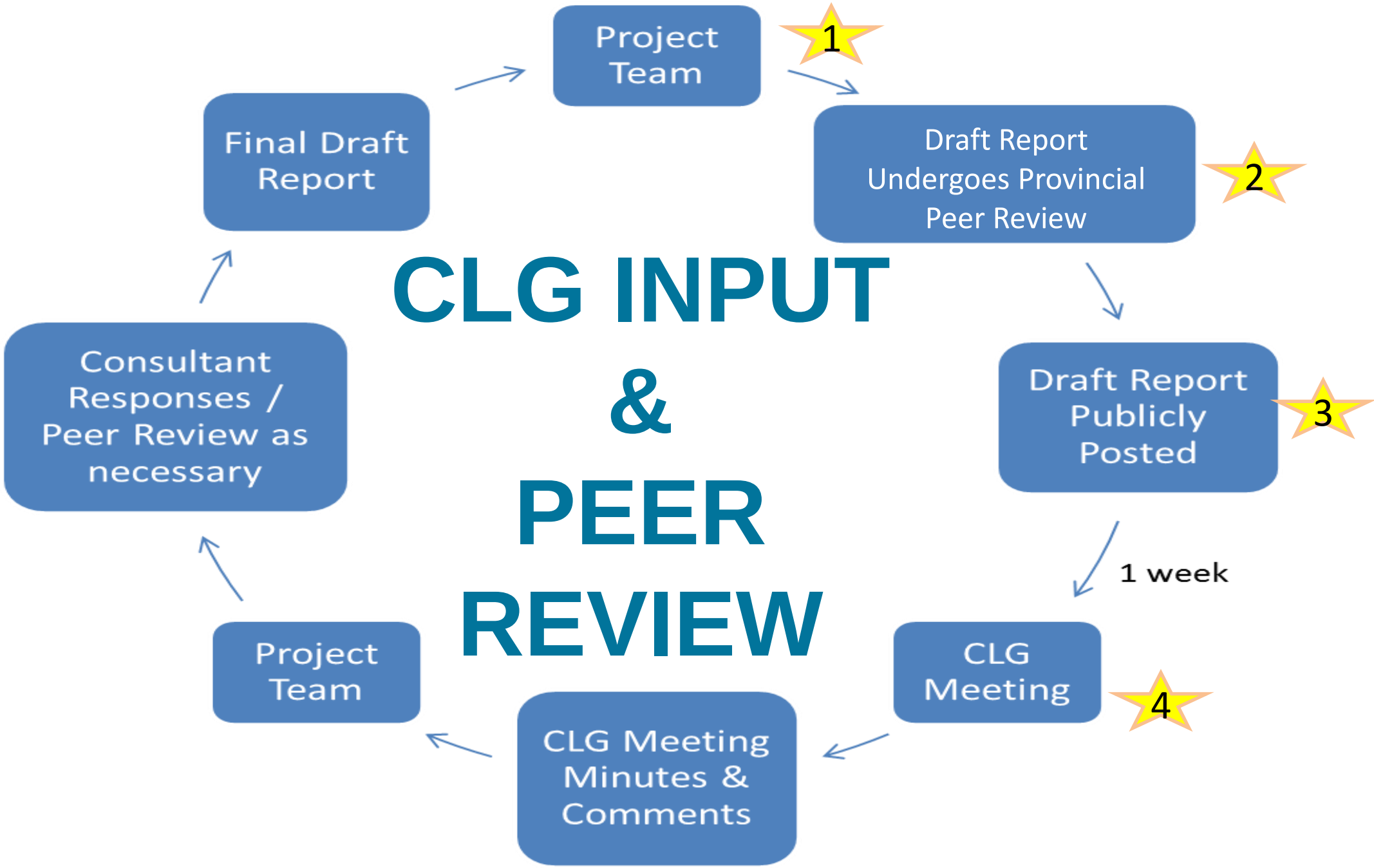
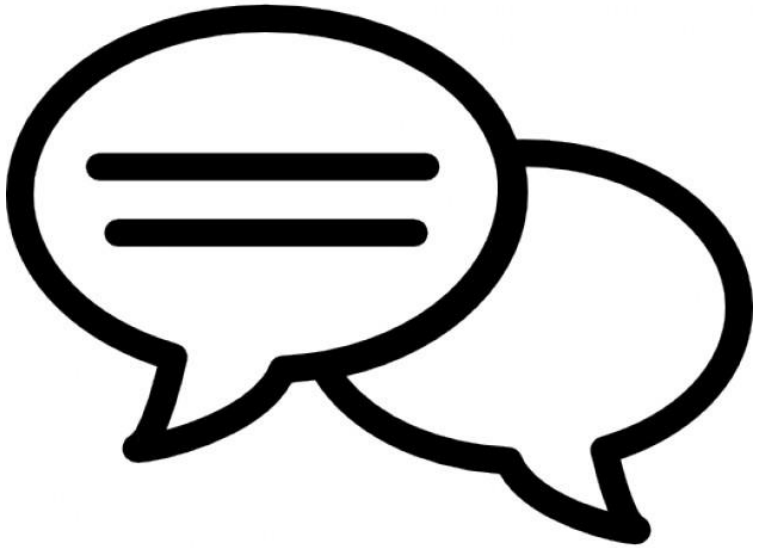

Project Team
1
Draft Report Undergoes Provincial Peer Review
2
Draft Report Publicly Posted
3
1 week
CLG Meeting
4
CLG Meeting Minutes & Comments
Project Team
Consultant Responses / Peer Review as necessary
Final Draft Report
CLG INPUT & PEER REVIEW

# DISCUSSION # 1

## Groundwater Flow

- **What questions, issues, comments or concerns do you have relating to the model (or report)?**

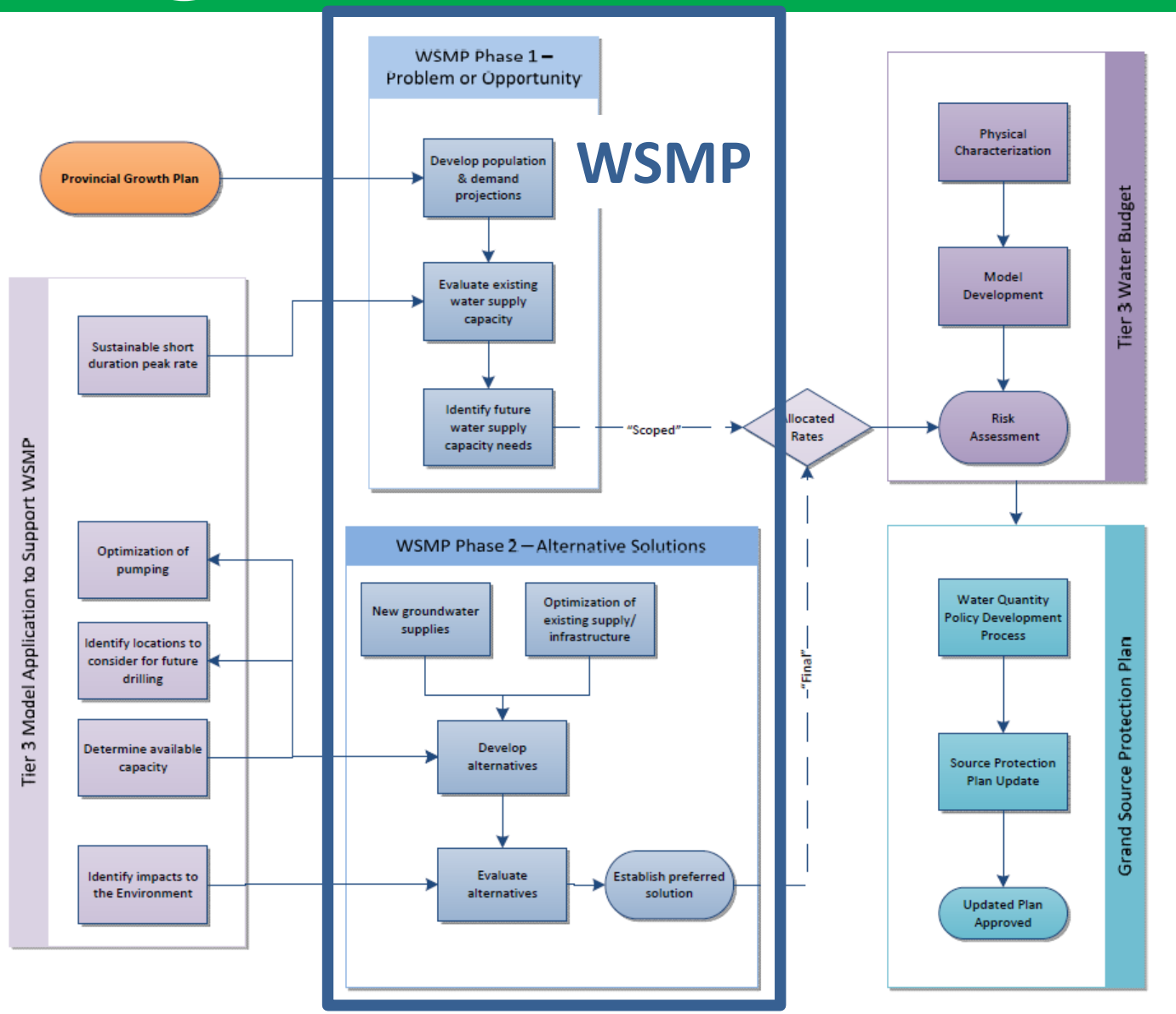


# WSMP-TIER 3

## Linkages

**Growth Plan**

**Tier 3 Model Application**

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# CENTRE WELLINGTON
# WATER SUPPLY MASTER PLAN

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WATER SUPPLY MASTER PLAN

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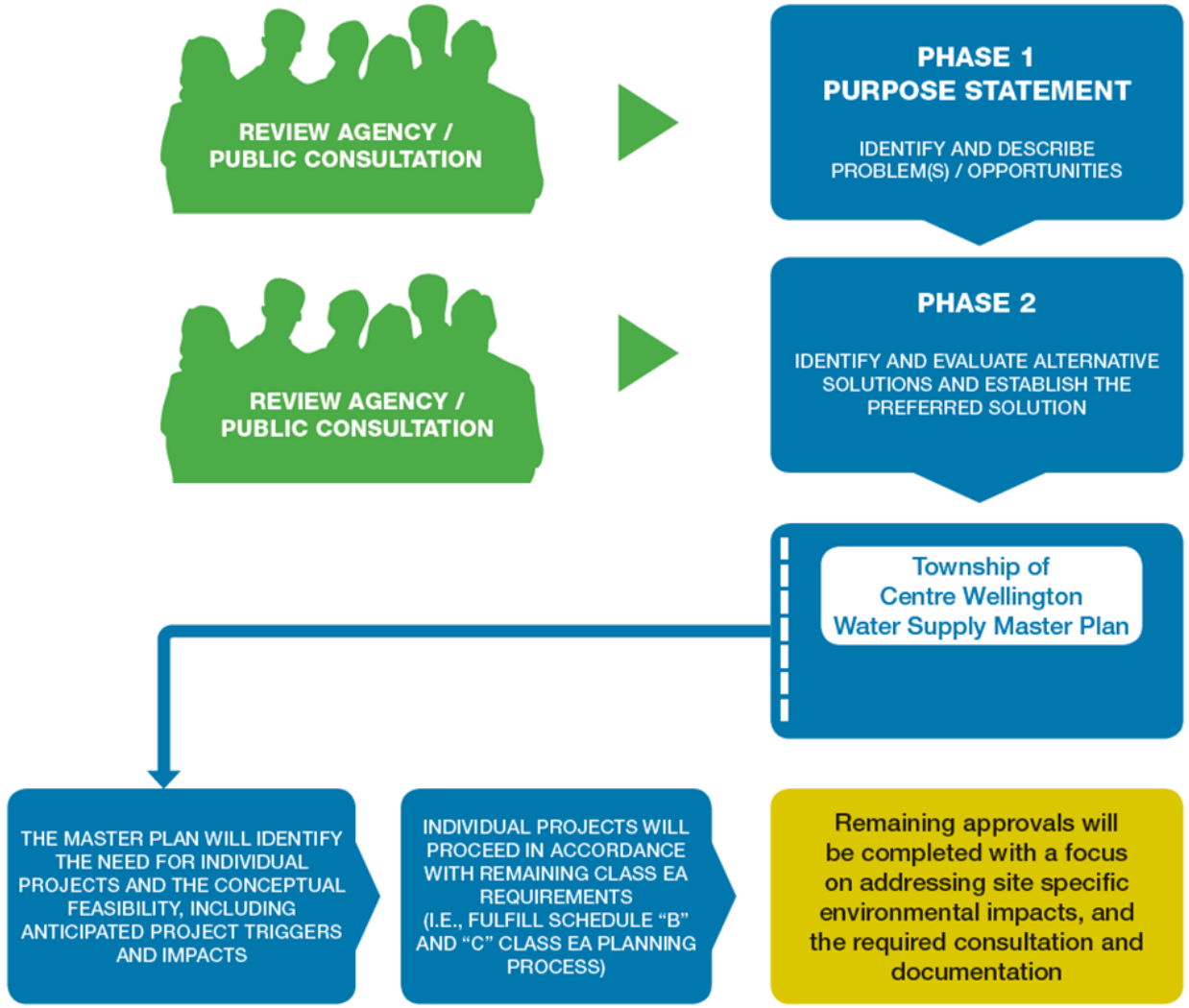
# MUNICIPAL CLASS EA PROCESS

- Follows the Municipal Class EA process
- Provides opportunities for public consultation

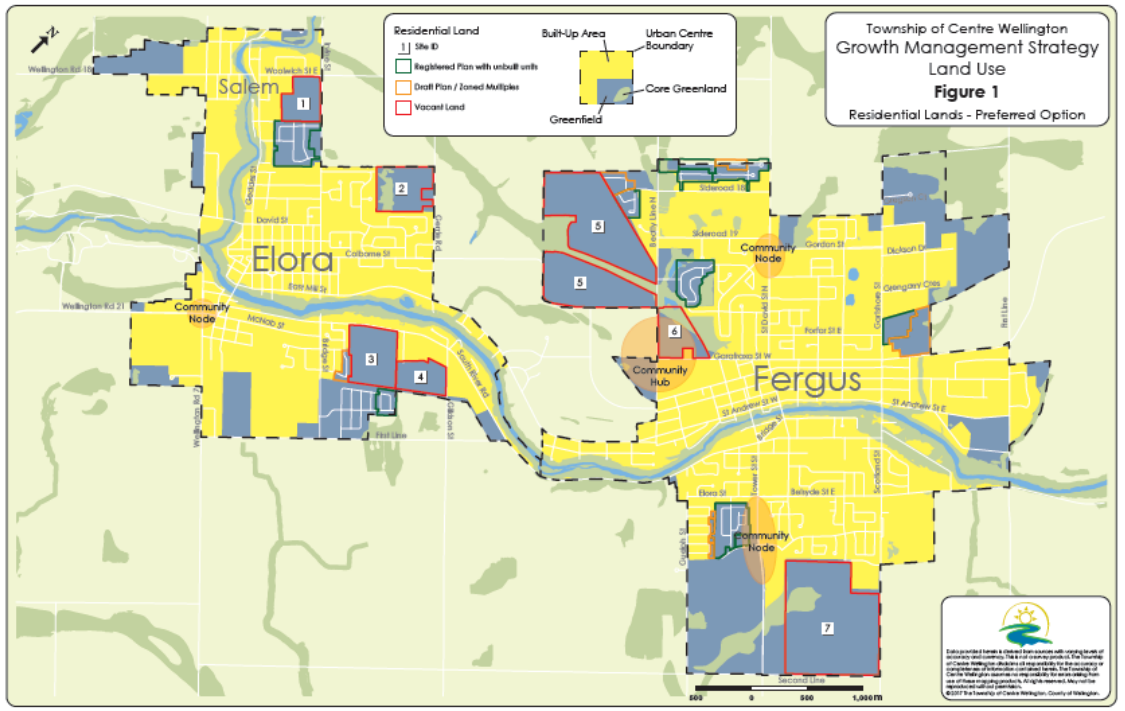


# WSMP – PROCESS OVERVIEW

## WHAT'S INVOLVED IN THE WATER SUPPLY MASTER PLAN?

### Estimate Demand

We are planning for the anticipated growth in Centre Wellington to 2041. This means we will be providing safe and reliable water to more residential, industrial, commercial and institutional customers in our urban centres.




**Source: Growth Management Strategy Land Use, May 29, 2017**

### Determine Need

The amount of water the Township's current water supply system can provide will be reviewed for various scenarios including the potential impact of climate change, and compared to the estimated future demand for water. This will determine how much additional water supply is needed.

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# WSMP – PROCESS OVERVIEW

## Identify and Evaluate Alternatives

In addition to considering water conservation and demand management, we will be developing and evaluating alternatives for additional supplies, including optimization of existing wells and developing new supply opportunities.

## Develop Preferred Long-Term Solution

Long-term recommendations will include implementation of defined projects.

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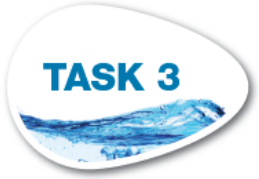
Project start-up, background data collection and gap analysis


Water demand projections




Update present capacity and determine future capacity requirements


Water supply alternatives


Water Supply Master Plan document

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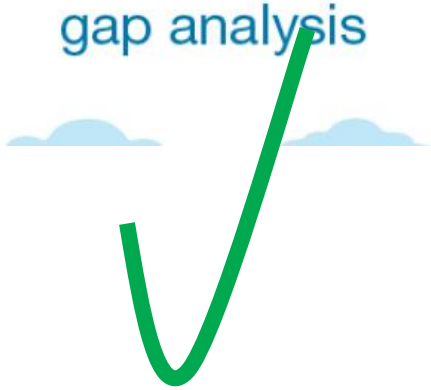
# WORK COMPLETED TO DATE

**Phase 1** **Phase 2**

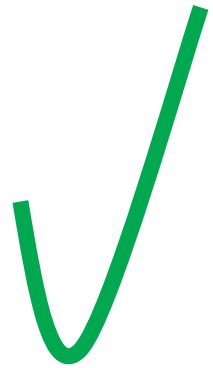
**TASK 1**

Project start-up, background data collection and gap analysis



**TASK 2**

Water demand projections



**TASK 3**

Update present capacity and determine future capacity requirements

**TASK 4**

Water supply alternatives

**TASK 5**

Water Supply Master Plan document

DRINKING WATER SOURCE PROTECTION ACT FOR CLEAN WATER

LAKE ERIE SOURCE PROTECTION REGION



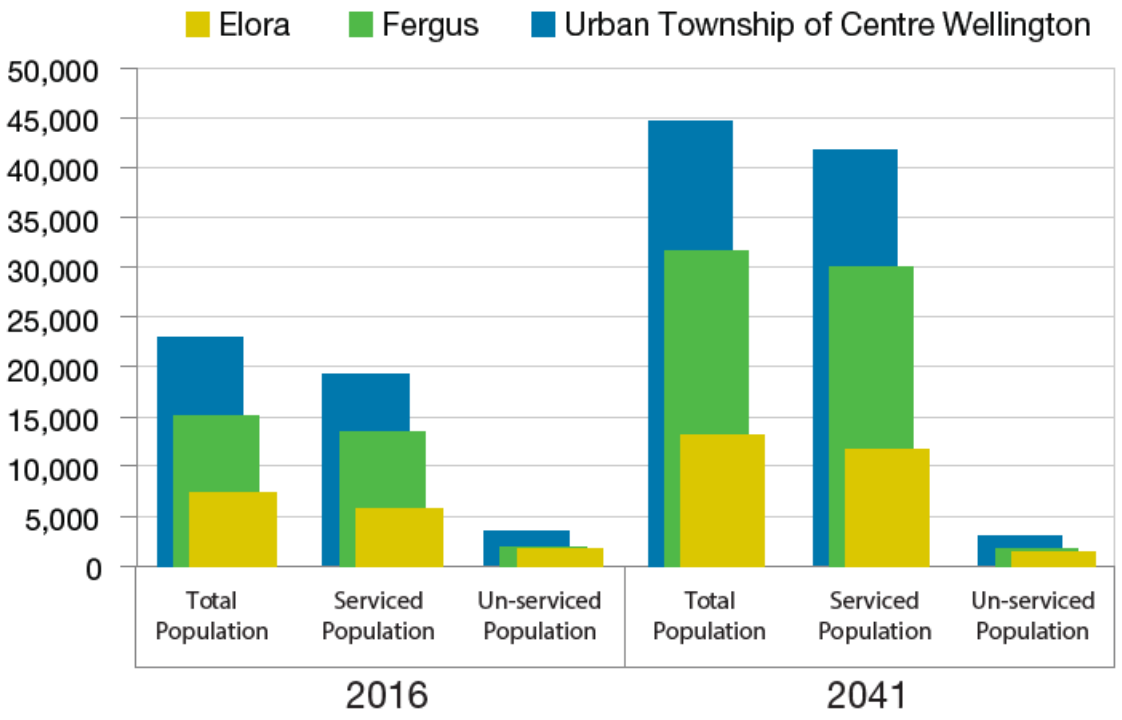
Centre Wellington

# DEMAND PROJECTIONS (TASK #2)

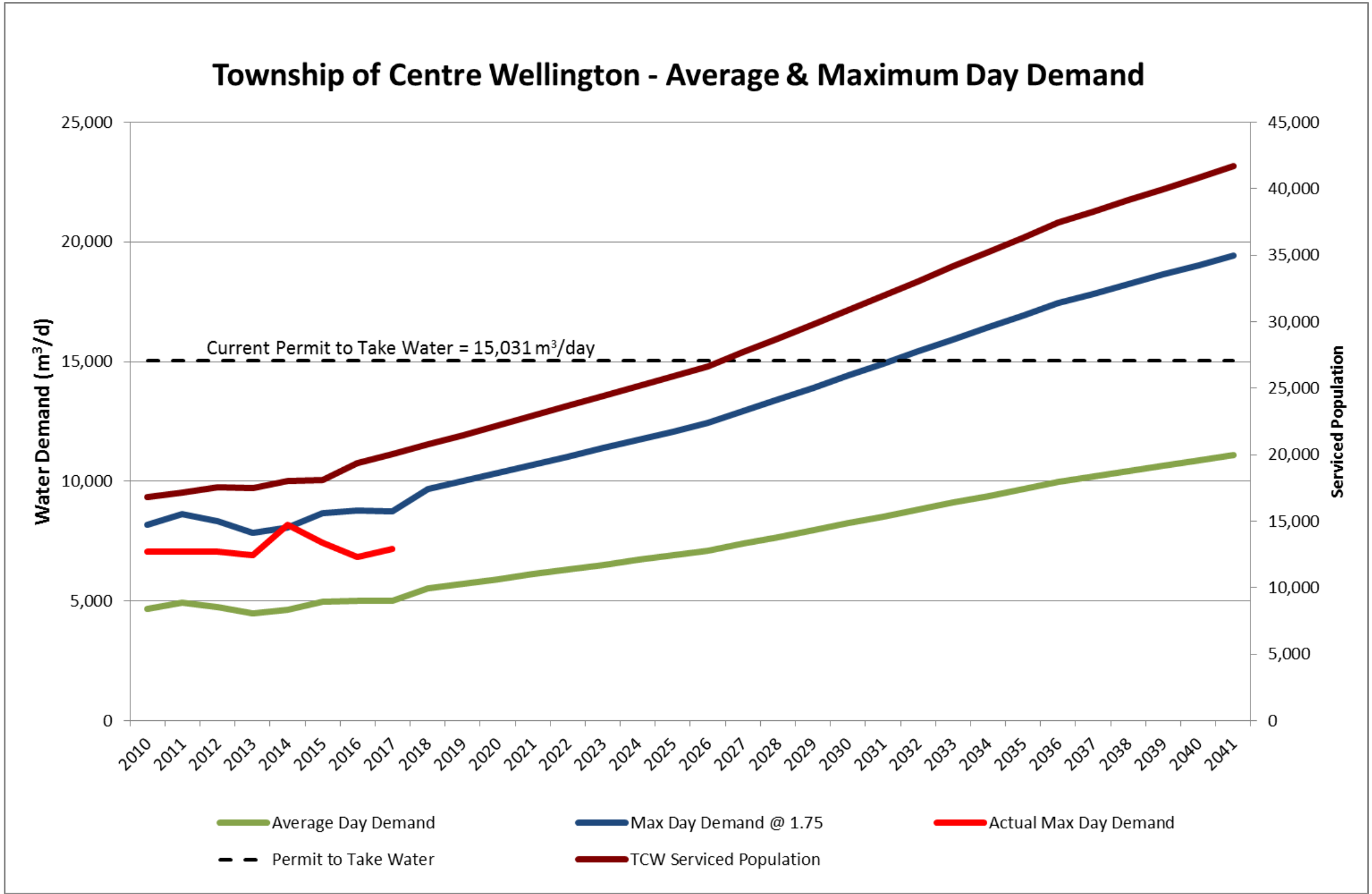
## HOW MUCH WATER DO WE NEED?

### Projected Serviced Population

While Fergus and Elora have relatively low per capita water demands compared to many Ontario municipalities, water demands in these two communities are expected to increase as the serviced population – that portion of the population serviced by the municipal water system – continues to increase.




Source: Amendment No. 99 to the County of Wellington Official Plan, 2016


Township of Centre Wellington - Average & Maximum Day Demand
Water Demand (m³/d)
Serviced Population
Current Permit to Take Water = 15,031 m³/day
25,000
20,000
15,000
10,000
5,000
0
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
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2038
2039
2040
2041
Average Day Demand
Max Day Demand @ 1.75
Actual Max Day Demand
Permit to Take Water
TCW Serviced Population

# EXISTING CAPACITY (TASK #3)

## Centre Wellington Water Supply

**Average** daily system pumping (2010-2017): 4,742 to 5,688 $m^3$/day

**Peak** daily system pumping (2010-2017): 6,976 to 8,645 $m^3$/day

| Wells | Permit to Take Water - Maximum per Day ($m^3$/d) | Water Quality |
|---|---|---|
| **Fergus Wells** | | |
| F1 | 1,833 | Well water quality meets Ontario Drinking Water Standards (ODWS) except Trichloroethylene (TCE). Well facility has an air stripper treatment to remove TCE. |
| F2 | 409 | The well is not in use because it is Groundwater Under the Direct Influence of Surface Water (GUDI) and there is a history of impacts to domestic wells when the well is in use. |
| F4 | 1,964 | Well water quality meets ODWS except for iron. Well facility has biological filtration process for removal of iron. |
| F5 | 1,963 | Well water quality meets ODWS. There is an increase in turbidity and silt if the well drawdown is below certain elevation. |
| F6 | 1,964 | Well water quality meets ODWS. Taste and odour issues have been noted. |
| F7 | 1,964 | Well water quality meets ODWS. In future, treatment may be needed if iron levels increase above aesthetic objective of 0.03 mg/L. |
| **Elora Wells** | | |
| E1 | 1,741 | Well water quality meets ODWS. |
| E3 | 1,964 | Well water quality meets ODWS. |
| E4 | 1,228 | Well water quality meets ODWS. |
| **Total permitted capacity = 15,031 $m^3$/day** | | |

# EXISTING CAPACITY

## WSMP – Desktop Review

- ***Existing water supply capacity assessment completed considering***:
  - Previous technical studies
  - Municipal pumping volume data
  - Municipal groundwater level data
  - Groundwater quality data
  - Potential pumping impacts:
    - Interference drawdown
    - Surface water baseflow reduction
    - Effects on water quality
- ***Preliminary Assessment Results (DRAFT)***:
  - Estimated average annual system capacity: 6,800 $m^3/d$ (approx.)
  - Estimated peak system capacity (30 day period): 12,000 $m^3/d$ (approx.)

# HOW MUCH MORE DO WE NEED?

## WSMP – Desktop Review: Preliminary Assessment Results

***Estimated well supply capacity versus projected demand***

| Year | Total Population | Average Demand ($m^3/d$) | Surplus/Deficit* ($m^3/d$) | Max Day Demand ($m^3/d$) | Surplus/Deficit* ($m^3/d$) |
|---|---|---|---|---|---|
| 2011 | 17,141 | 4,936 | 3,388 | 8,638 | 1,850 |
| 2016 | 19,331 | 5,021 | 3,240 | 8,786 | 1,765 |
| 2021 | 22,905 | 6,110 | 1,334 | 10,692 | 676 |
| 2026 | 26,632 | 7,105 | -408 | 12,434 | -319 |
| 2031 | 31,970 | 8,523 | -2,890 | 14,916 | -1,738 |
| 2036 | 37,429 | 9,969 | -5,419 | 17,445 | -3,184 |
| 2041 | 41,698 | 11,104 | -7,407 | 19,433 | -4,319 |

***DRAFT FOR DISCUSSION**

## Centre Wellington WSMP

### Phase 1 – Problem or Opportunity

- Develop population & demand projections
- **Evaluate existing water supply capacity**
  - **Desktop assessment**
  - **Confirmation**
- Identify future water supply capacity needs

### Phase 2 – Alternative Solutions

- Develop alternatives
  - Do Nothing; Limit Growth
  - Water conservation & demand management
  - **Existing groundwater supply – optimization**
  - **New groundwater supply**
  - Surface water supply
- Identify & mitigate impacts to natural, social, cultural environments
- Evaluate alternative solutions
- Establish preferred solution
- Develop implementation strategy

## Tier 3 Model

**Confirm existing water supply capacity - model scenarios**:

- Recommended sustainable rates long term
- Peak rates short term duration (30 days)

**Determine optimized well capacity - Replace wells F2 and F5 – model scenario**:

- Recommended sustainable rates long term

**Determine new groundwater supply capacity - model scenario**:

- Recommended sustainable rates long term

**Determine impacts & mitigation - model outputs**:

- Well locations
- Baseflow estimates & reduction
- PSW drawdown
- Aquifer drawdown

# DEVELOPMENT OF ALTERNATIVES

## Model Applications for the WSMP

***Scenario 1: Existing Municipal Well System***

- Average annual pumping rates (average climate/drought)
- Peak demand pumping rates (average climate/drought)
- System performance with largest well out of service long term

***Scenario 2: Well Optimization / Replacement***

- Average annual pumping rates at existing wells, replacement wells at F2 and F5 (average climate)

***Scenario 3: System Expansion***

- Average annual pumping rates at existing wells, new wells to meet future demand (average climate)

# DEVELOPMENT OF ALTERNATIVES

## Model Outputs for the WSMP

***Model outputs will inform the WSMP about available groundwater capacity to meet future demands and locating future wells to minimize potential impacts:***

***1) Potential Impacts to Municipal Supply System***

- Locating future wells to minimize interference with existing and proposed municipal wells
- Locating future wells to avoid potential threats to water quality
- Change in water level in each pumping well under modeled scenarios
- Comparison of pumping water level to well Safe Drawdown Level

***2) Potential Impacts to the Natural Environment***

- Locating future wells to mitigate potential impacts to natural heritage features (e.g. Provincially Significant Wetlands)
- Estimate change in groundwater discharge contribution to stream flow
- Comparison under current pumping conditions and under future pumping conditions

# DEVELOPMENT OF ALTERNATIVES

## Model Outputs for the WSMP

***Model outputs will inform the WSMP about available groundwater capacity to meet future demands and to locating future wells to minimize potential impacts:***

***3) Potential Impacts to the Social Environment***

- Locating future wells to minimize interference with private wells
- Review of drawdown in aquifer water levels

***The groundwater model will also provide direction to future groundwater exploration programs & proposed Class EA undertakings***

# WSMP NEXT STEPS

- Confirm existing capacity
- Develop water supply alternatives
- Evaluate water supply alternatives
- Identify ‘preliminary’ preferred water supply solution, consisting of a series of proposed projects with associated Class EA schedules, along with timeline and cost estimates
- Public and agency consultation & confirmation of preferred solution
- Document process and implementation strategy in a Water Supply Master Plan report
- Master planning is a process of continuous renewal – the Master Plan will be updated to reflect new information e.g., population and water demand forecasts, groundwater model updates

# WSMP PUBLIC CONSULTATION

## Opportunities for Participation

### NEXT STEPS

Thank you for your interest in learning about the Township of Centre Wellington's Water Supply Master Plan.

### Ways To Participate


DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER
LAKE ERIE SOURCE PROTECTION REGION



Centre Wellington

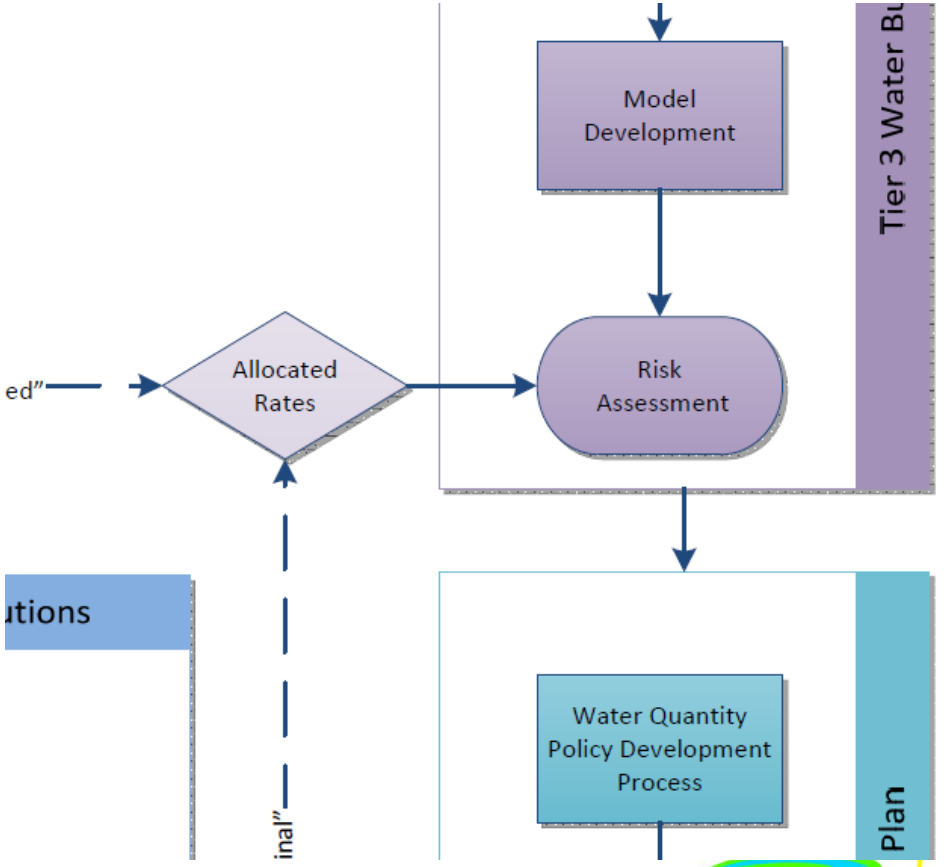
# PROCESS MOVING FORWARD

# RISK ASSESSMENT

## Testing future scenarios

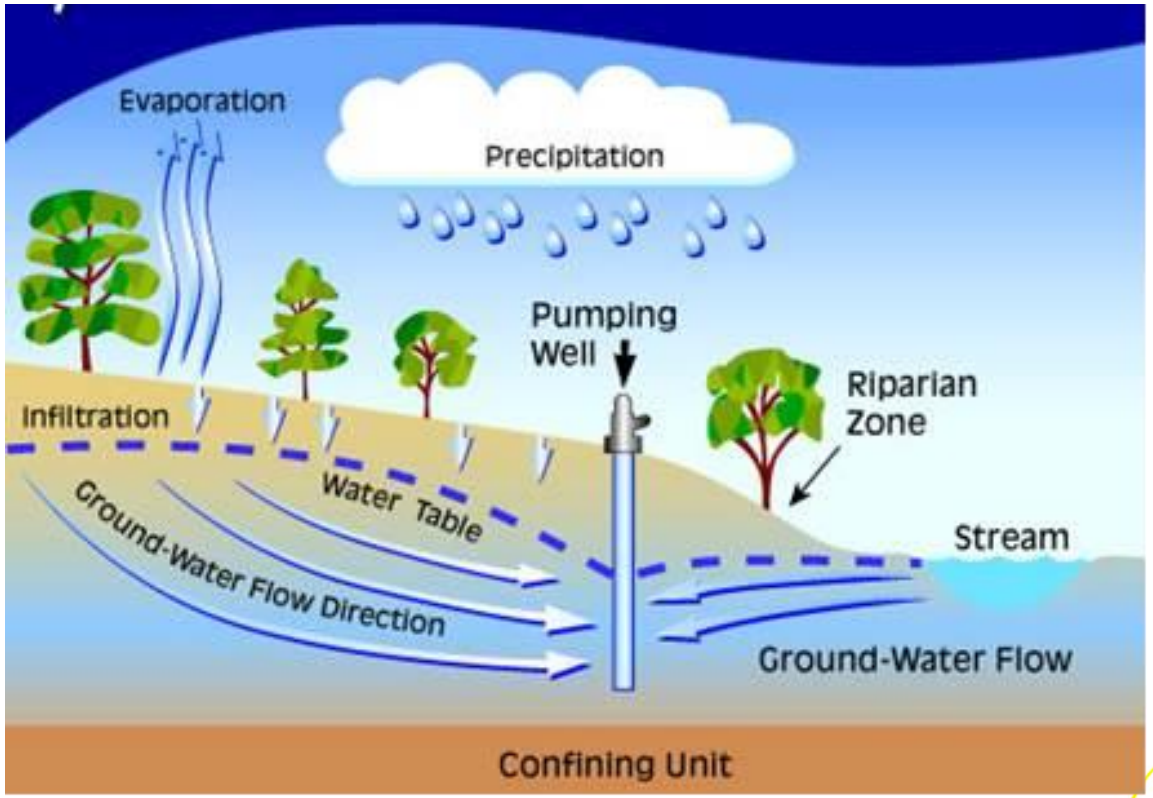
- Can the current well infrastructure supply enough water …
  - …during a prolonged drought?
  - …with projected population growth (i.e., increased pumping rates)?
  - …with increased development (i.e., more impervious areas -> less groundwater recharge)

- What are the impacts to cold water streams and Provincially Significant Wetlands?



# HOW IS RISK MEASURED

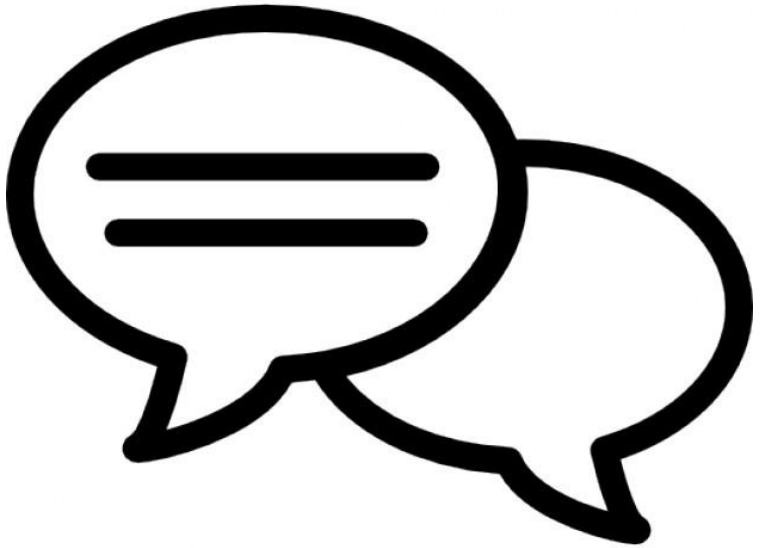
- Model predicts water level at each of the municipal wells for each scenario
- Risk is assessed based on
  - water level in municipal wells and whether water can still be pumped
  - Impacts to surface water features (coldwater streams, wetlands)



# DISCUSSION #2

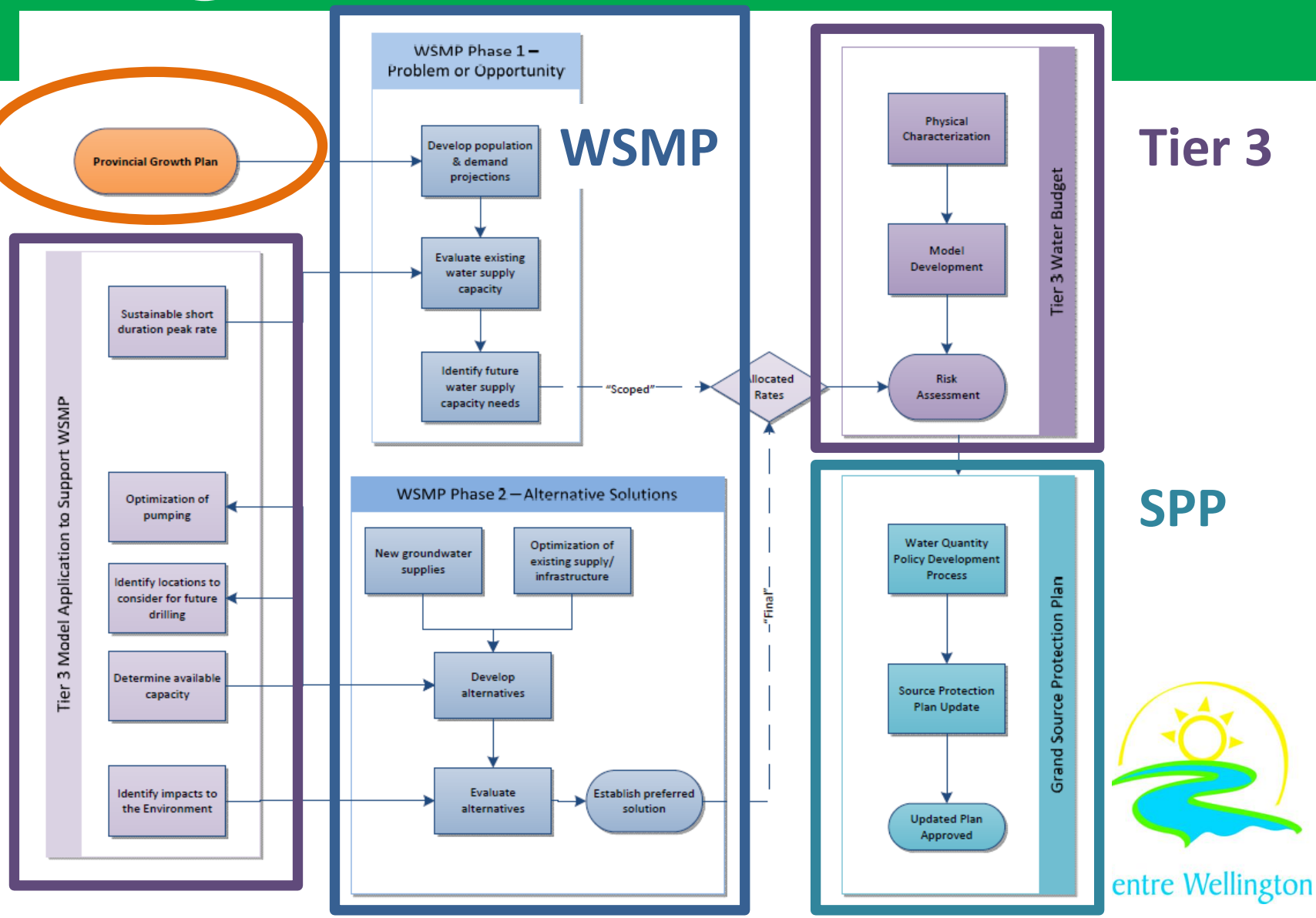
## Process

- **What questions do you have relating to the process going forward?**



# WSMP-TIER 3

## Linkages




DRINKING WATER SOURCE PROTECTION
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# REFLECTION

- ✓ Data contribution from CLG members
  - ✓ water taking monitoring data,
  - ✓ well records,
  - ✓ water demand data from domestic wells
- ✓ CLG as forum for discussions and question/answer sessions
- ✓ CLG as vehicle to provide information to broader group of stakeholders
- ✓ Peer Review Process and Comments

- ➢ Emphasis: what is within the scope of the Tier Three Study

# NEXT STEPS

- Administrative
  - Circulate meeting summary
    - CLG provide comments on meeting summary; finalize meeting summary with comments; post meeting summary and presentation on website
- Technical
  - Start with Risk Assessment
  - Document preliminary results
  - Provincial Peer Review
  - CLG Meeting
- Source Protection Plan update- future