

Update on Electric U/G Equipment

Borden Gold

WSN Conference

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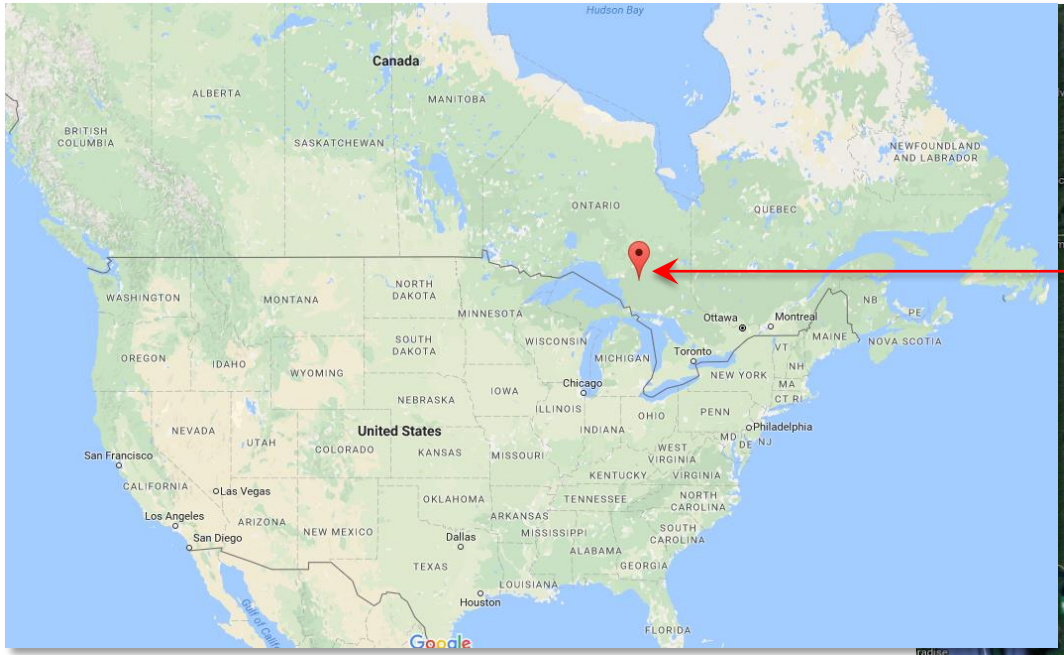
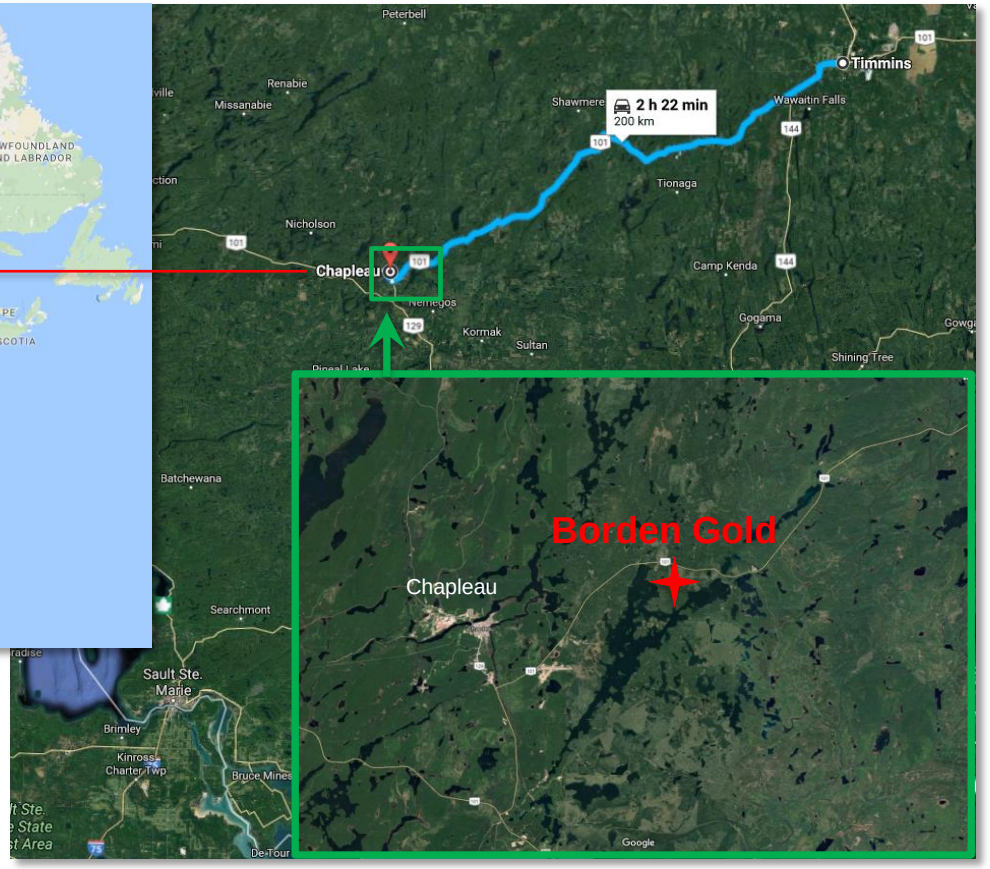
GOLDCORP

Agenda

1. **Background on Borden Gold (battery electric vehicle)**
2. **Why Electric Mine?**
3. **Process**
    1. BEV Literature/Industry Review
    2. Eng. Trade-Off (Diesel vs Electric)
    3. Analysis of Other Considerations
    4. Decision Point – BEV or not?
    5. Acquiring Equipment
    6. Other Opportunities
    7. Operational Planning & Implementation
4. **Experience – 5 Months On**

1 - Geography & Lands

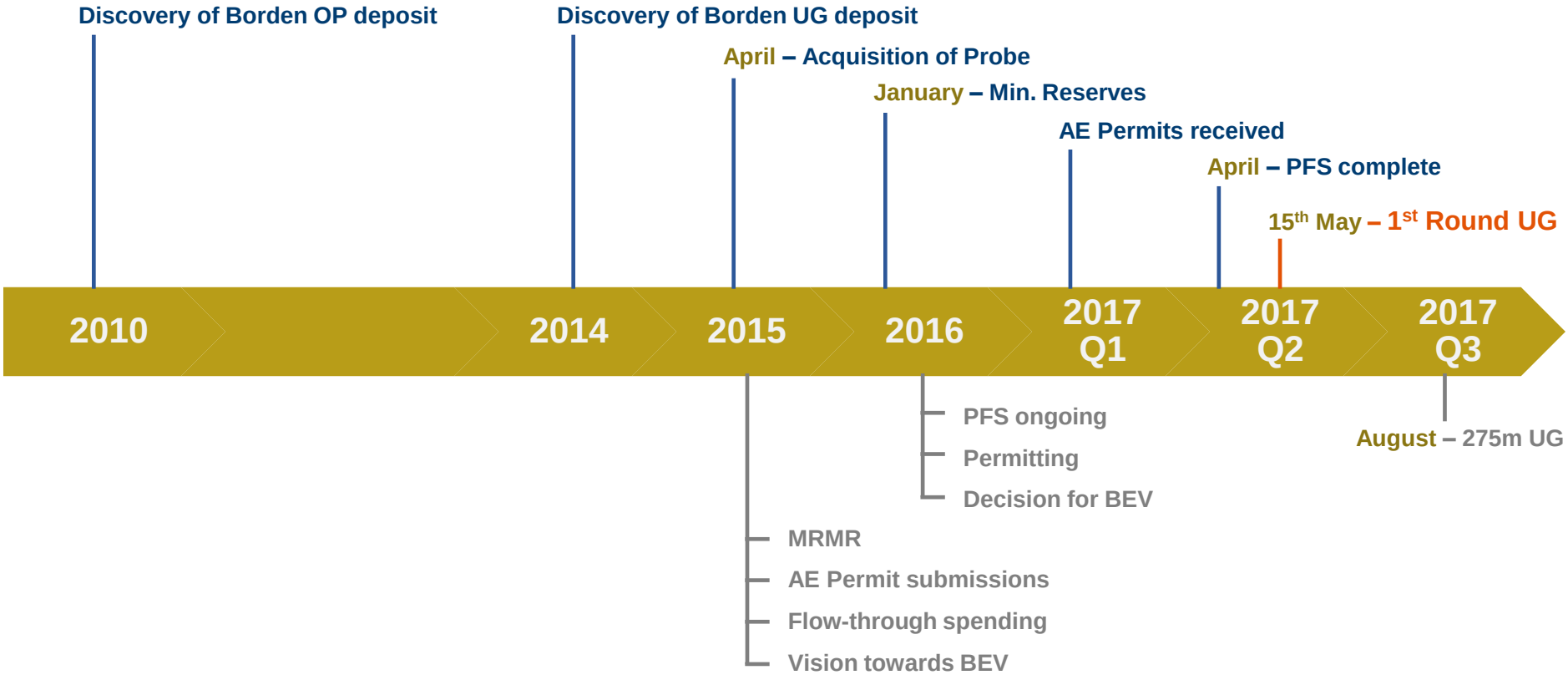




1 - Aerial Photography of Site

Borden Gold -Safe – Simple – Green – Silent – Invisible & Inclusive Project

1 - Timeline


Discovery of Borden OP deposit
Discovery of Borden UG deposit
April – Acquisition of Probe
January – Min. Reserves
AE Permits received
April – PFS complete
15th May – 1st Round UG
2010
2014
2015
2016
2017 Q1
2017 Q2
2017 Q3
PFS ongoing
Permitting
Decision for BEV
MRMR
AE Permit submissions
Flow-through spending
Vision towards BEV
August – 275m UG

- **Vision for future**
- **Sustainability** (safety, environment, community)
- **Economic** (energy & cost reduction)
- **“Greener”**
- **Improved social acceptance**
- **Technologically feasible**

Process 1: BEV Literature / Industry Review

1. Review of BEV in underground mining

a. Historically: trolley trucks & tethered LHDs

b. Locally: battery at KL Gold (small size), etc…

c. Block cave: large, tethered LHDs on drawpoint horizon

2. Equipment from OEMs

a. Availability on market & in development (proven vs concept, lead times, etc…)

b. Capability (size, duty cycle, etc…)

3. Other factors

a. Battery technology developing rapidly

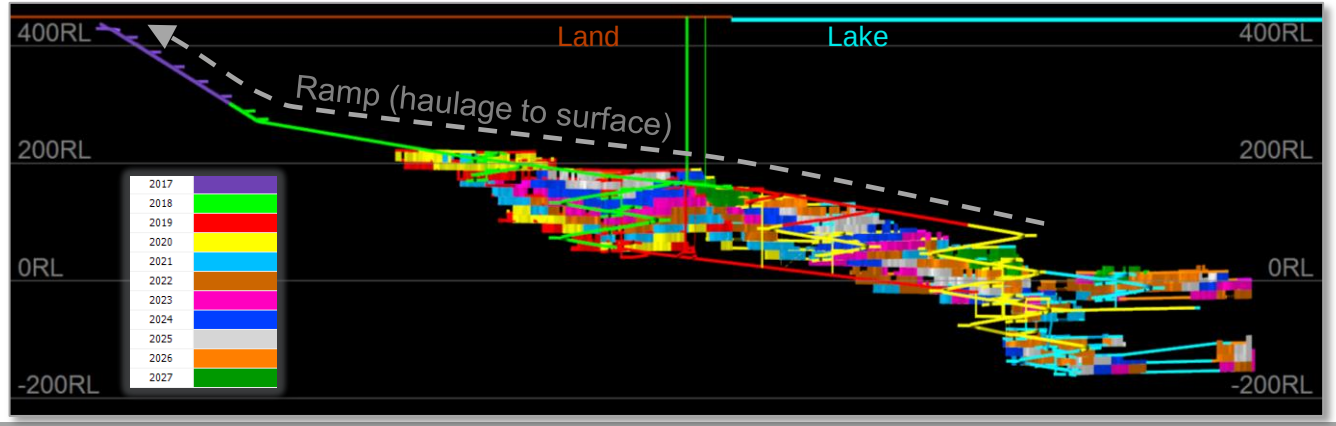
b. Interest from government and regulators

c. Industry trend towards reduction of contaminants in air underground

BEV Literature / Industry Review

1. **Advantages of BEV** Safety & sustainability, lower OPEX & CAPEX, project benefits
2. **Challenges of BEV** Initial CAPEX, engineering & operations, purchasing & maintenance, change
3. **Ideal mine for BEV**
   a. Long mine life
   b. Haul down ramp (loaded for regeneration)
   c. Deep & hot (vent. infrastructure)

Applies to Borden?



Engineering Trade-Off - Diesel vs Electric

1. Challenge to establish engineering criteria

a. Ventilation requirements (not direct as with diesel)

b. No empirical data for new equipment

   i. Power load estimation

   ii. Productivity

   iii. Maintenance

   iv. Safety requirements

2. Hired consulting firms & Goldcorp sites

a. AMC and Hatch

b. Benchmarking with conventional equipment

c. OEMs provided estimations

d. Produced financial models for comparison

Error – Auxiliary ventilation was excluded from all scenarios

Ventilation Criteria for Electric

What determines requirement?

a. No DPM/NOx

b. No heat issues from estimation

c. Dust – min./max. air velocities

d. Other considerations?

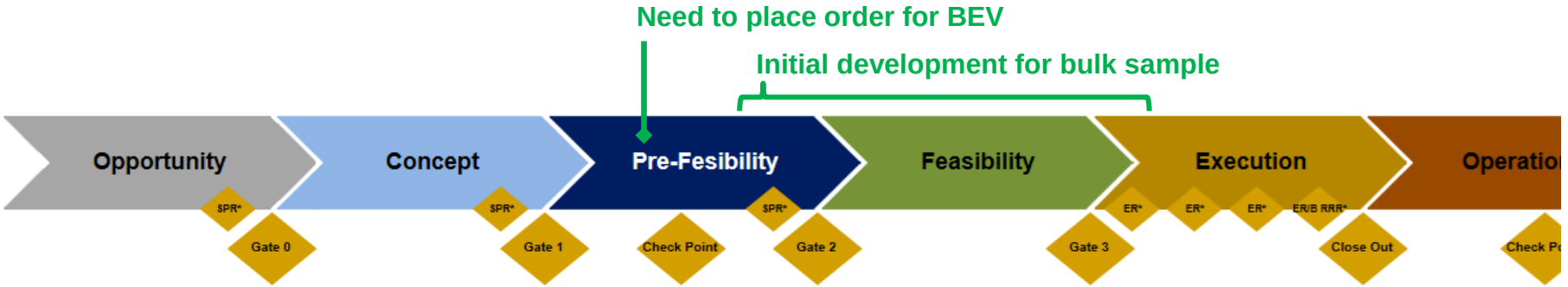
e. Benchmark vent. regulations for non-diesel (interprovincial, international)

- 0.25 m/s under usual operation
- Sized larger for blast clearing & VOD
- Planned for VOD on contaminants

Decision Point – BEV or not?

- **Equipment needed to be ordered prior to PFS completion**
  - Rental of equipment not possible
  - Lead times for equipment

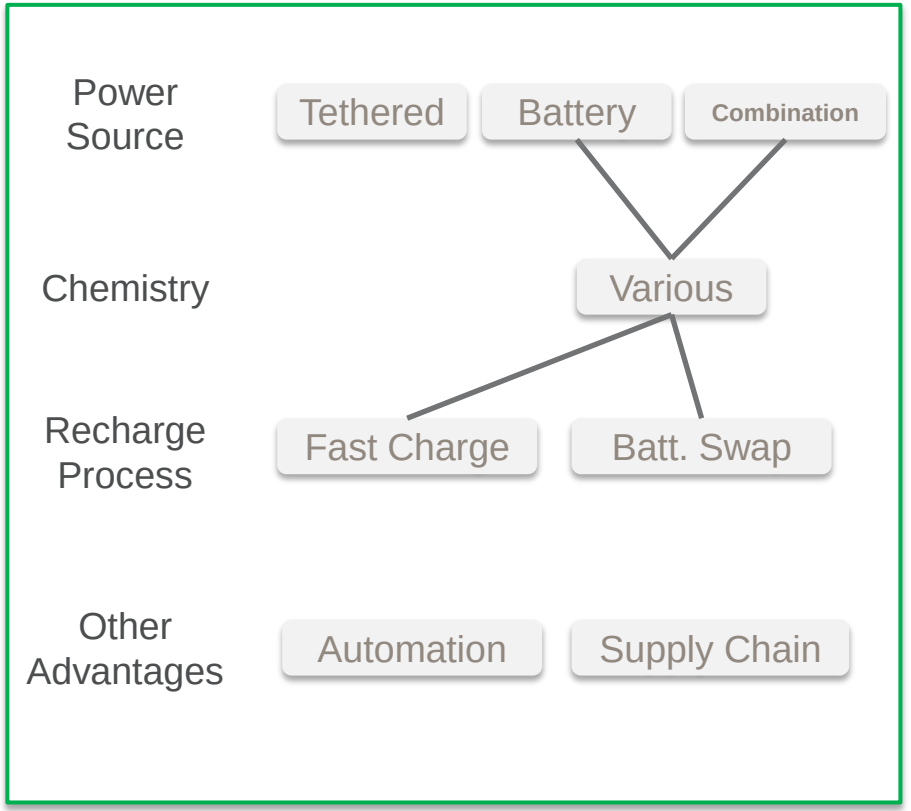
- **GIF process adapted to project**



- **Data presented to IC for approval of funding BEV equipment**

Acquiring Equipment

1. **Support from corporate procurement team**
2. **Typical RFP process considered less effective**
   - Direct conversation with suppliers individually
3. **Engage with OEMs**
   - Started during trade-off studies
   - Great interest in coming to market
   - Different philosophies & designs
   - R&D timelines
   - Reality vs Sales



Other Opportunities

1. Subsidies & Grants

a. Federal & Provincial governments (various programs)

b. Utility companies (IESO) – rebate

2. Corporate branding

a. Idea City – Designing Mines of the Future

b. BNN interviews

3. Leadership in updating standards/regulations

a. Fill a “void”

Operational Planning & Implementation

1. Operational redesign for equipment

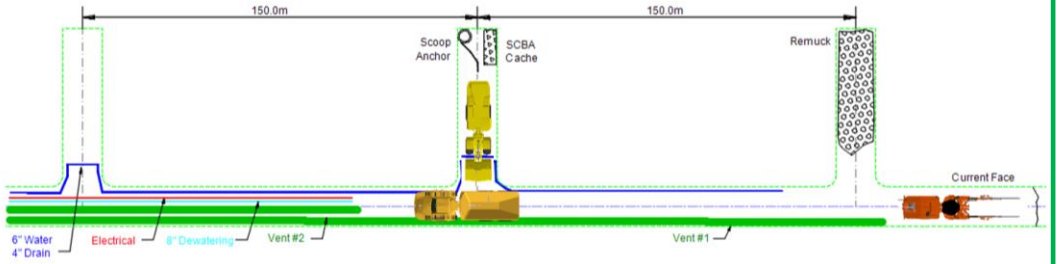
a. Tethered LHD

b. Power reticulation (more lines, charging locations, 1kV, etc…)

c. Cold climate parking (u/g, surface)

2. "Training Camp" at Hoyle Pond UG Mine

Sketch of Standard Remuck Configuration



Experience – 8 Months In

1. General

a. It worked relatively quickly!
b. Industry inquiring on project
c. Catalyst for Goldcorp sites

2. Detail

a. LHD is slower than expected
b. New habits: plug in after shift!
c. Difficulties with charging
d. LHD cable challenges

Experience – 8 Months In

Employee Satisfaction Survey conducted to determine the Miner's perspective. Two of the questions and answers below.

Question	The same	Somewhat better	Significantly better	A huge improvement	Total
Compared with an all diesel fleet of equipment, is the air quality at Borden's all-electric project…	0	1	15	28	44

Question	I wouldn't recommend working at Borden	I might recommend Borden	I would recommend Borden more than other places I've worked	I would strongly recommend Borden because there is a huge difference in air quality	Total
Considering ONLY the all-electric fleet, would you recommend working at Borden, over other diesel equipped mines?	0	9	11	23	43

Recap on Key Process & Lessons Learned

1. **Equipment is stealth quiet U/G**
2. **Workers pleased about air quality**
3. **Major support from equipment vendors**
4. **Opportunities “outside the box”**
5. **Learning curve was steep but new technology embraced**


Q & A