

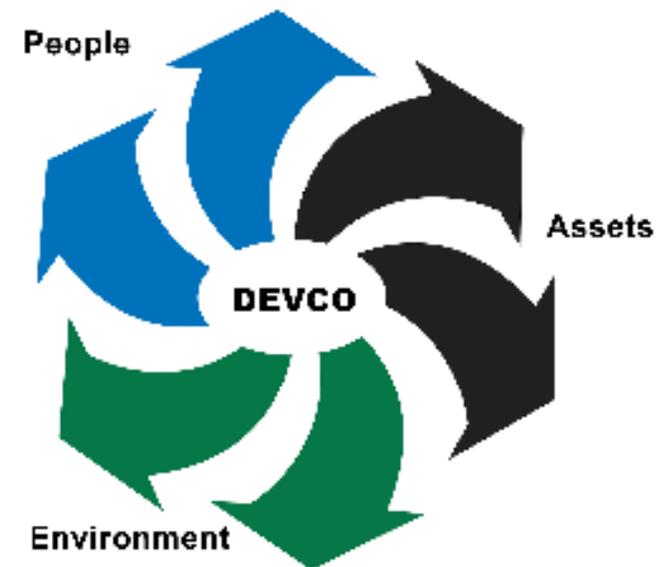
DEVCO

CAPE BRETON DEVELOPMENT CORPORATION

. . . for the community

Cape Breton Development Corporation

Mine Water Management And AMD



The top of the slide features a banner with a landscape image of a river valley. On the left side of the banner, the text 'DEVCO' is written in large white letters, with 'CAPE BRETON DEVELOPMENT CORPORATION' in smaller white letters below it, and '... for the community' in even smaller white letters further down. The banner has a curved bottom edge.

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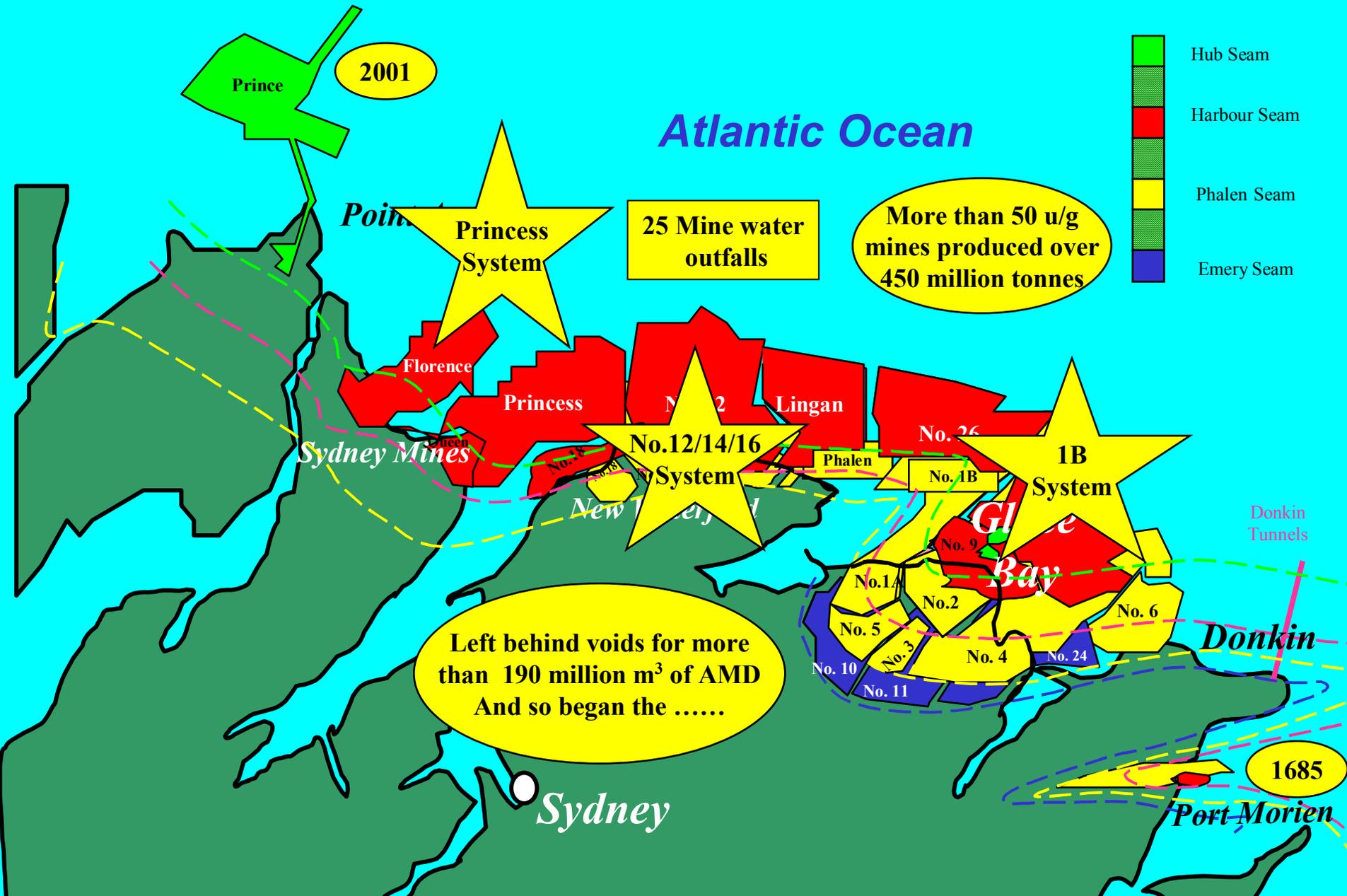
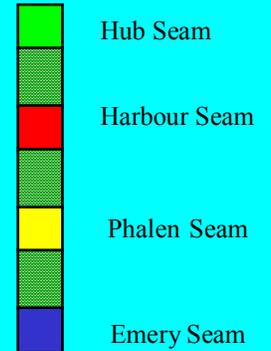
Table of Contents

- Introduction to the Mine Water Issue
- CBDC Mine Water Management Plan
- Conclusion



Sydney Coalfield

Sequence of Coal Seams



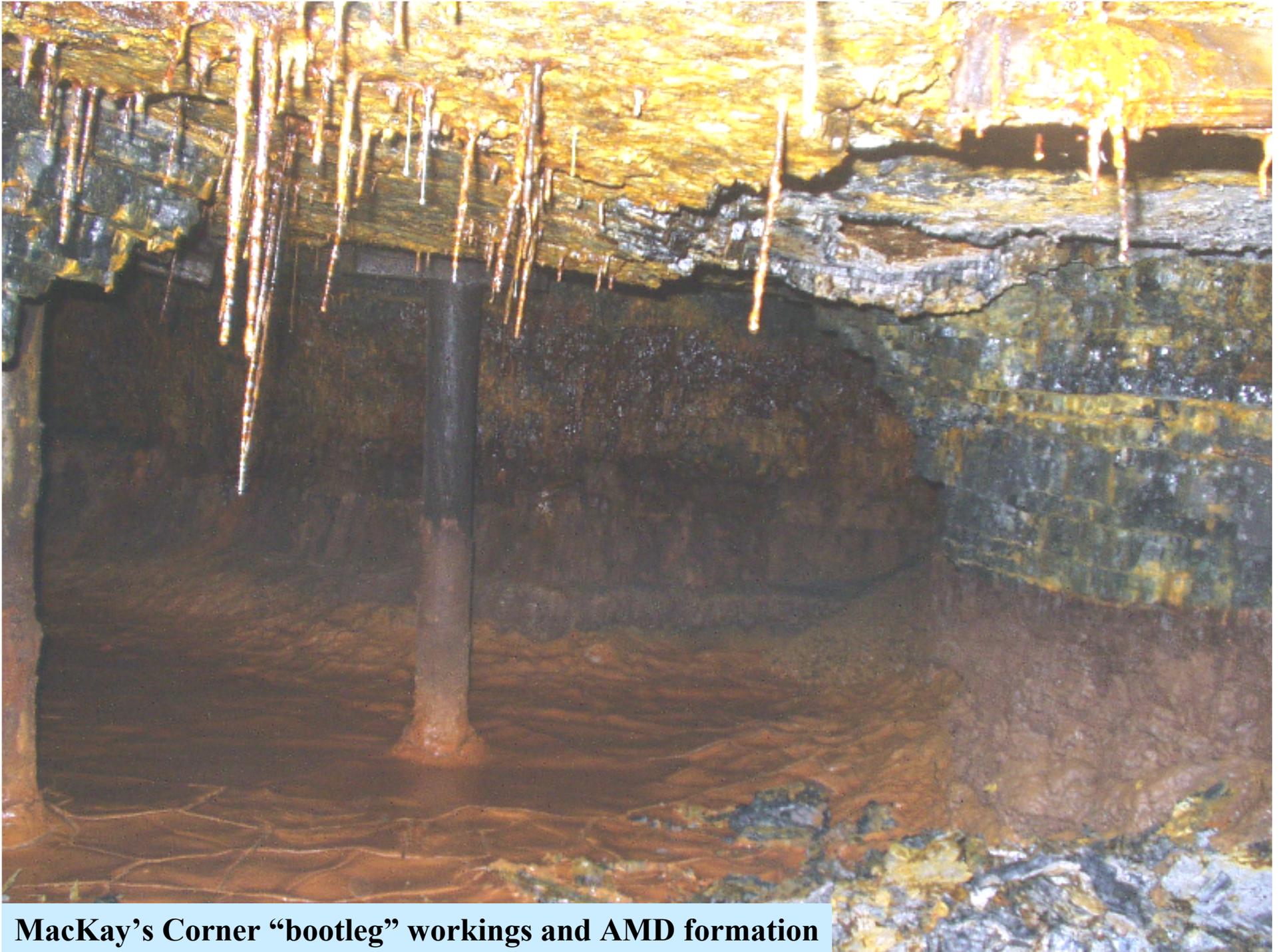
25 Mine water outfalls

More than 50 u/g mines produced over 450 million tonnes

Left behind voids for more than 190 million m³ of AMD
And so began the

What is mine water made up of ?

- As surface and groundwater enter the mine and contact the coal, a chemical reaction occurs between the water (H_2O) and the pyrite (FeS_2) in the coal, dissolving Fe into the mine water and releasing acidity (H^+). Hence the terminology AMD
- The acidity begins new chemical reactions that dissolve and release other secondary metals into the mine water such as Al and Mn
- These reactions will continue as long as there are reactants present



MacKay's Corner "bootleg" workings and AMD formation

Why Does Mine water Have to be Treated ?

- Mine water contains elevated levels of dissolved metals and acidity that is harmful to fish and aquatic life
- Typically, when mine water reaches the surface, either pumped or naturally, the dissolved metals begin to precipitate from solution and the acidity is released
- The precipitates have a very negative aesthetic value
- The precipitates can accumulate in brooks and streams causing a decrease in the biodiversity that was originally present

200 L/min at 600 mg/L Fe



8000 L/min at 1000 mg/L Fe



The top of the slide features a banner with a landscape background of green hills and a blue river. The text 'DEVCO' is prominently displayed in white, with 'CAPE BRETON DEVELOPMENT CORPORATION' and the tagline '... for the community' in smaller white text below it.

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CBDC Mine Water Management Program

- **Address mine water outfalls on CBDC property during remediation**







NO. 8 Colliery Outfall

PARAMETER	No. 8 Colliery 2002-08-20
pH units	7.8
Iron (mg/L)	<0.1
Alkalinity (mg/L)	202
Sulphate (mg/L)	441

The top of the slide features a banner with a blue and green landscape background. On the left, the word "DEVCO" is written in large white letters. Below it, "CAPE BRETON DEVELOPMENT CORPORATION" is written in smaller white letters. At the bottom left of the banner, the tagline "... for the community" is written in white.

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CBDC Mine Water Management Program

- Address mine water outfalls on CBDC property during remediation
- **Operate the Neville Street PTS to control the “1B Hydraulic System”**









The image shows a banner at the top of a slide. The banner has a background of a river valley with green hills and a blue river. On the left side of the banner, the word "DEVCO" is written in large, white, sans-serif capital letters. Below it, in smaller white capital letters, is "CAPE BRETON DEVELOPMENT CORPORATION". At the bottom left of the banner, the tagline "... for the community" is written in a smaller white font.

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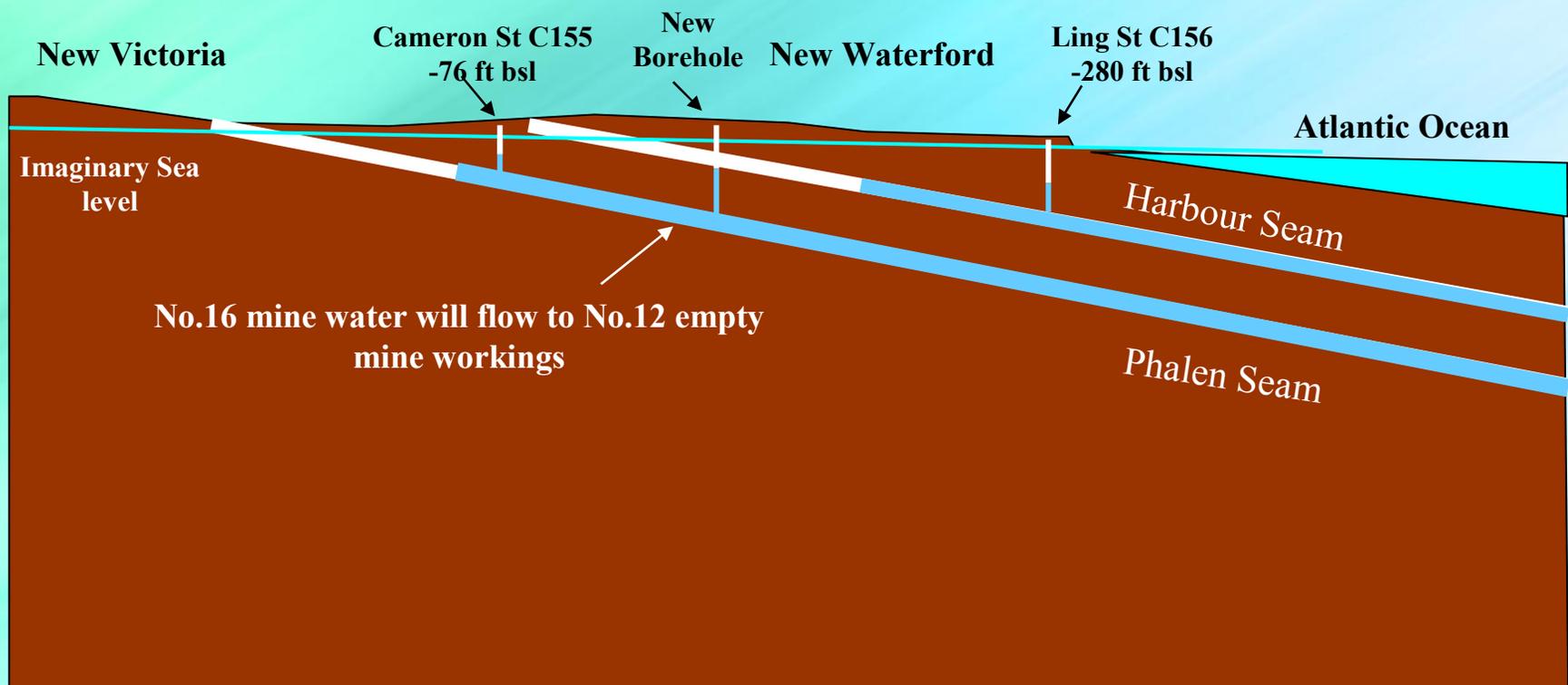
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CBDC Mine Water Management Program

- Address mine water outfalls on CBDC property during remediation
- Operate the Neville Street PTS to control the “1B Hydraulic System”
- **Monitor and plan for treatment of the “No.12/14/16 Hydraulic System” in 2011**

Connection to combine The No.12/14 and No.16 Hydraulic Systems
Total flow = 1200 L/min



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CORPORATION

Canada

The image shows a banner at the top of a slide. The banner has a background of a blue river valley with green hills. On the left side of the banner, the word "DEVCO" is written in large, white, sans-serif capital letters. Below it, in smaller white capital letters, is "CAPE BRETON DEVELOPMENT CORPORATION". At the bottom left of the banner, the tagline "... for the community" is written in a smaller white font.

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CBDC Mine Water Management Program

- Address mine water outfalls on CBDC property during remediation
- Operate the Neville Street PTS to control the “1B Hydraulic System”
- Monitor and plan for the treatment of the “No.12/14/16 Hydraulic System” in 2011
- **Monitor and plan for the treatment of the “Princess/Florence/Queen” Hydraulic System in 2013**



No-5 Mine

No-12 Mine

No-16 Mine

Prince Mine

Princess Mine

Phone Modem

-18.11

-279.19

-76.75

-462.07

-346.46

8.57

10.79

8.50

10.21!

10.51

Legend

- Invalid Data
- Alarm
- Normal

- Polling
- Fast Poll
- Comm. Error
- Polling Disabled
- Normal

DANGER
HIGH VOLTAGE



The top of the slide features a banner with a background image of a river valley. The river is blue and flows through a green valley. The sky is a light blue. The text 'DEVCO' is written in large, white, sans-serif capital letters in the upper left corner of the banner. Below it, in smaller white capital letters, is 'CAPE BRETON DEVELOPMENT CORPORATION'. Further down, in a smaller white font, is the tagline '... for the community'.

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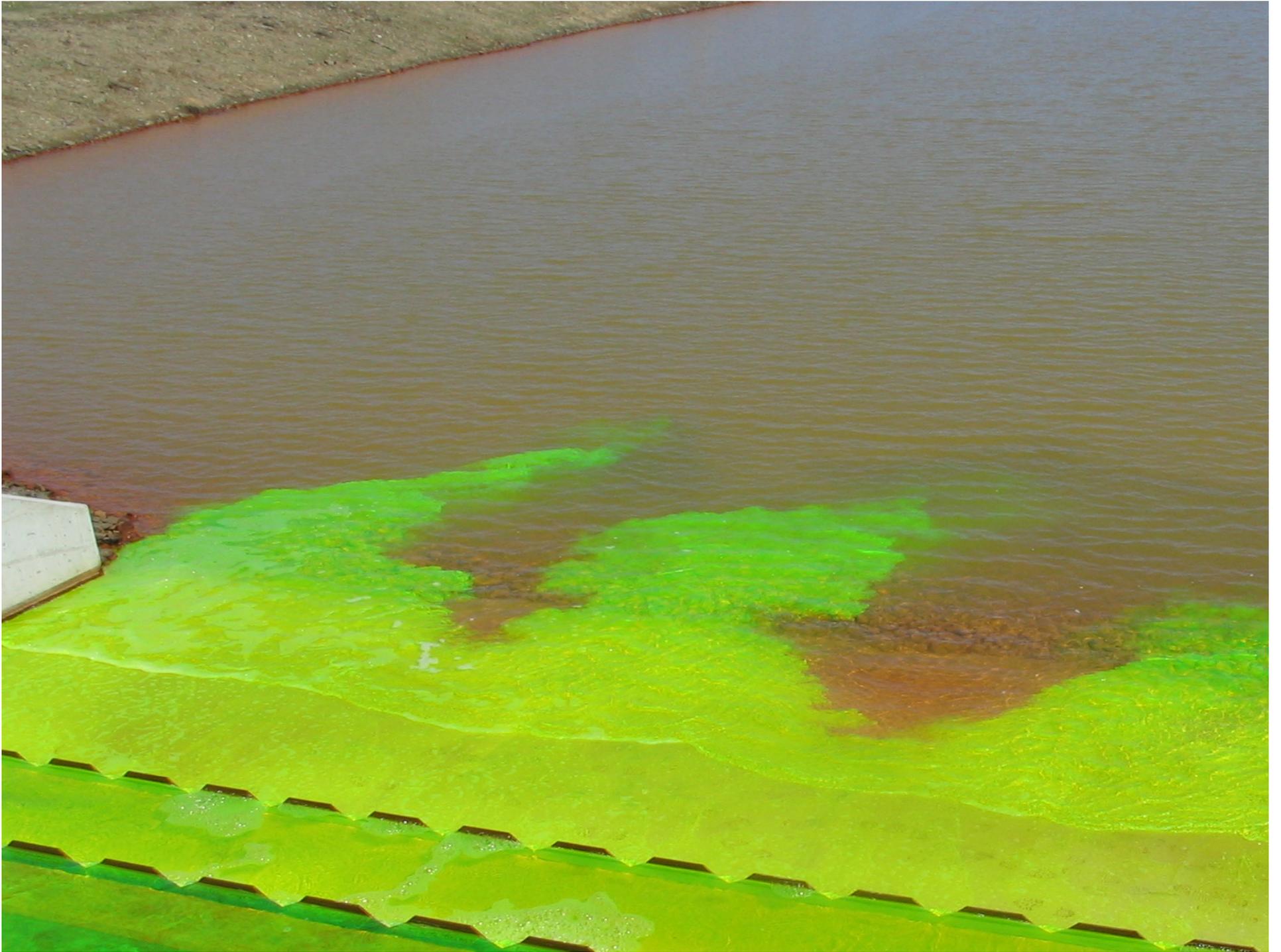
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CBDC Mine Water Management Program

- Address mine water outfalls on CBDC property during remediation
- Operate the Neville Street PTS to control the “1B Hydraulic System”
- Monitor and plan for treatment of the “No.12/14/16 Hydraulic System” in 2011
- Monitor and plan for treatment of the “Princess/Florence/Queen Hydraulic System in 2013
- **Utilize CBU Mine Water Research Program “MinWaReP” to enhance better understanding of mine water geochemistry and hydrodynamics through scientific research that will ultimately lead to passive discharges from our mines**





The top of the slide features a background image of a river valley with green hills and a blue river. In the upper left corner, the logo for DEVCO is displayed in large white letters. Below the logo, the text 'CAPE BRETON DEVELOPMENT CORPORATION' is written in smaller white letters. Further down, the tagline '. . . for the community' is visible in white. The main title 'CBDC Mine Water Management Program' is centered below the logo in large green letters.

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CBDC Mine Water Management Program

- Address mine water outfalls on CBDC property during remediation
- Operate the Neville Street PTS to control the “1B Hydraulic System”
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- Utilize CBU Mine Water Research Program “MinWaReP” to enhance better understanding of mine water geochemistry and hydrodynamics through scientific research that will ultimately lead to passive discharges from our mines
- **Ensure that budget and schedule are in place for long term management of mine water issues**

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CBDC Mine Water Budget

- Average of \$ 3 million/yr for next 10 years
- Includes new water treatment facilities for the No.12/14/16 and Princess Systems
- Annual funding for CBU Mine Water Research Program for the next 5 years

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Conclusion

- Mine water is a long term “legacy” issue
- Sound planning and engineering is required to prevent uncontrolled mine water discharges
- The CBU Mine Water Research Program will provide world class scientific research and solutions to aid the CBDC to it’s final objective of passive mine water discharge to the environment



**IMWA Symposium 2010:
September 5th — 12th 2010 Cape
Breton, Nova Scotia — Canada
www.imwa.info**

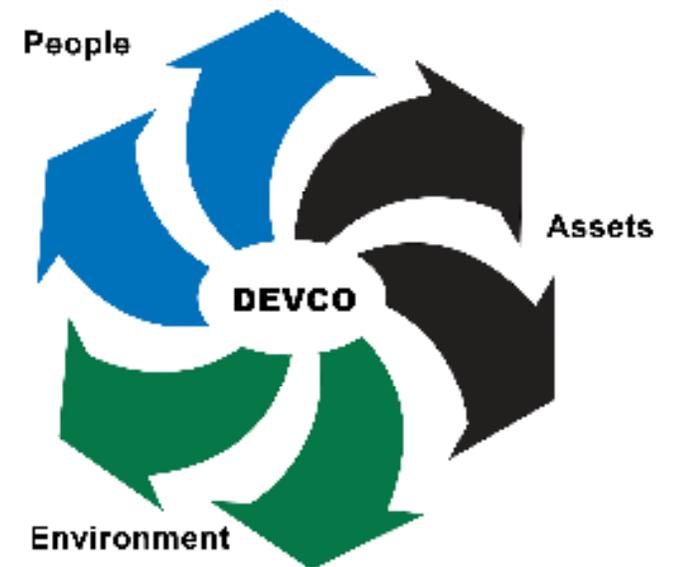
INGONISH
AIRSCAPES © R GARNETT

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Green Opportunities



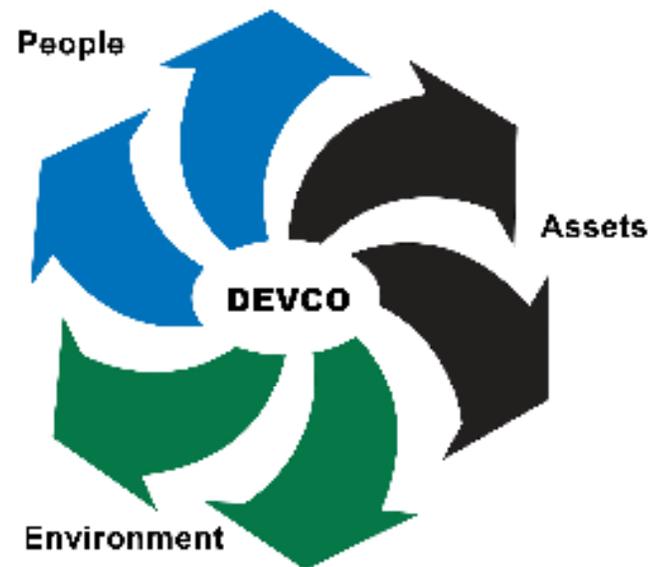
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Community Greening Initiatives

Green Energy Opportunities of the Sydney Coal Field



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Community Enhancement Devco's Legacy Strategy:

- 11000 acres of land be conveyed for new community opportunity: recreation and/or contributing to Island prosperity.

Community Enhancement

How do we do it?

- Work with community groups, residents, CBRM to determine their needs and desires. (solicited and unsolicited)
- Ensure the community needs are in keeping with the Devco remediation and closure strategy as well as the Legacy Strategy.
- Make it happen.







G. Langille 17^e June 08

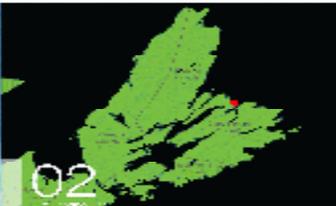


Franklin Yard Reclamation Project

North Sydney, Cape Breton

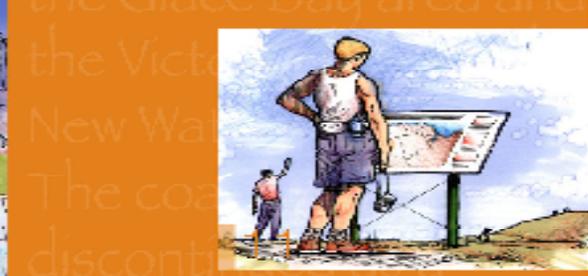
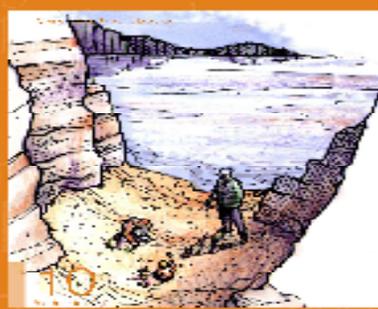
EKISTICS PLANNING & DESIGN

MAY 2009



The Legacy :

Princess Colliery is a legacy site, one that has shaped the city of Victoria for over a century. The site is a mix of residential, commercial, and industrial uses, and it is a testament to the city's rich history. The legacy of the site is a mix of positive and negative impacts, and it is a challenge to balance the two. The site is a mix of residential, commercial, and industrial uses, and it is a testament to the city's rich history. The legacy of the site is a mix of positive and negative impacts, and it is a challenge to balance the two.



PRINCESS COLLIERY RECLAMATION
 DEVCO Legacy Strategy

ERISTICS PLANNING & DESIGN

January 2009

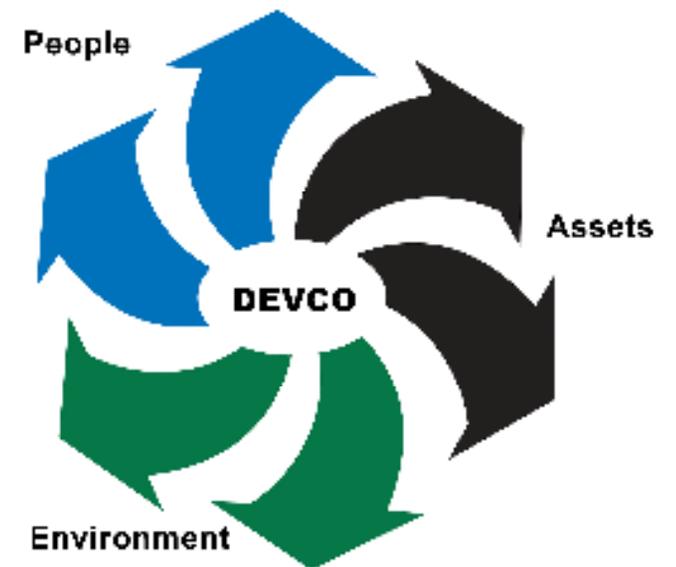


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Green Energy Opportunities



The logo for DEVCO, consisting of the letters 'DEVCO' in a bold, white, sans-serif font.

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Potential Energy Options

- Wind energy on former mine sites
- Geothermal energy from mine water
- Bio fuel crops on brownfields
- Mining clean energy of coal



Lingan Wind Farm



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Biofuel Crops on Marginal Lands



Four main target areas:

- Impact of Organic Residuals on Tailings
- Quantity and Quality of Biomass
- Economic Feasibility
- Communication, Public Education and Technology Transfer

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Broughton - CBDC



- **Crab shell compost**
- **Focus on switchgrass**
- **Solid (pellet) fuel**





- 350 years of mining left a vast underground void , more than 3200 km of roadway
- It is now flooded and contains 250 million liters of water with a temp range of 9 –16 deg C
- The challenge is be able to access this resource efficiently, economically and in keeping with the CBDC mine water management strategy.

DEVCO Divestiture Strategy

NOTES

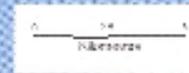
1. Applied to DEVCO's inventory of 1100+ parcels to determine the potential for geothermal energy and to identify areas for further study.
2. Geothermal Potential is based on the DEVCO website on April 6, 2020 using the information provided in the table.
3. Data disclosed is for general purposes only.

Legend

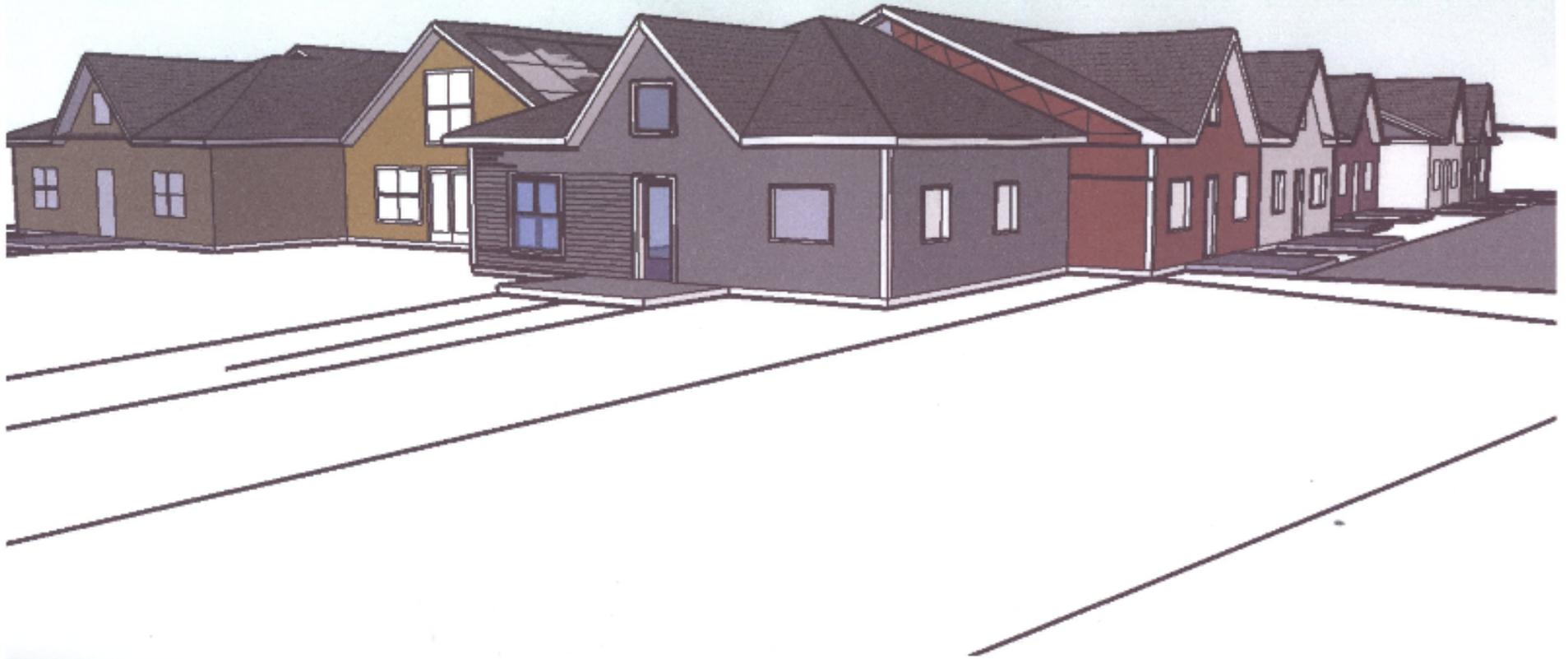
- Blue hatched: High Potential (100-200°C)
- Yellow: Medium Potential (50-100°C)
- Green hatched: Low Potential (20-50°C)

GeoThermal Potential

Map 8.0



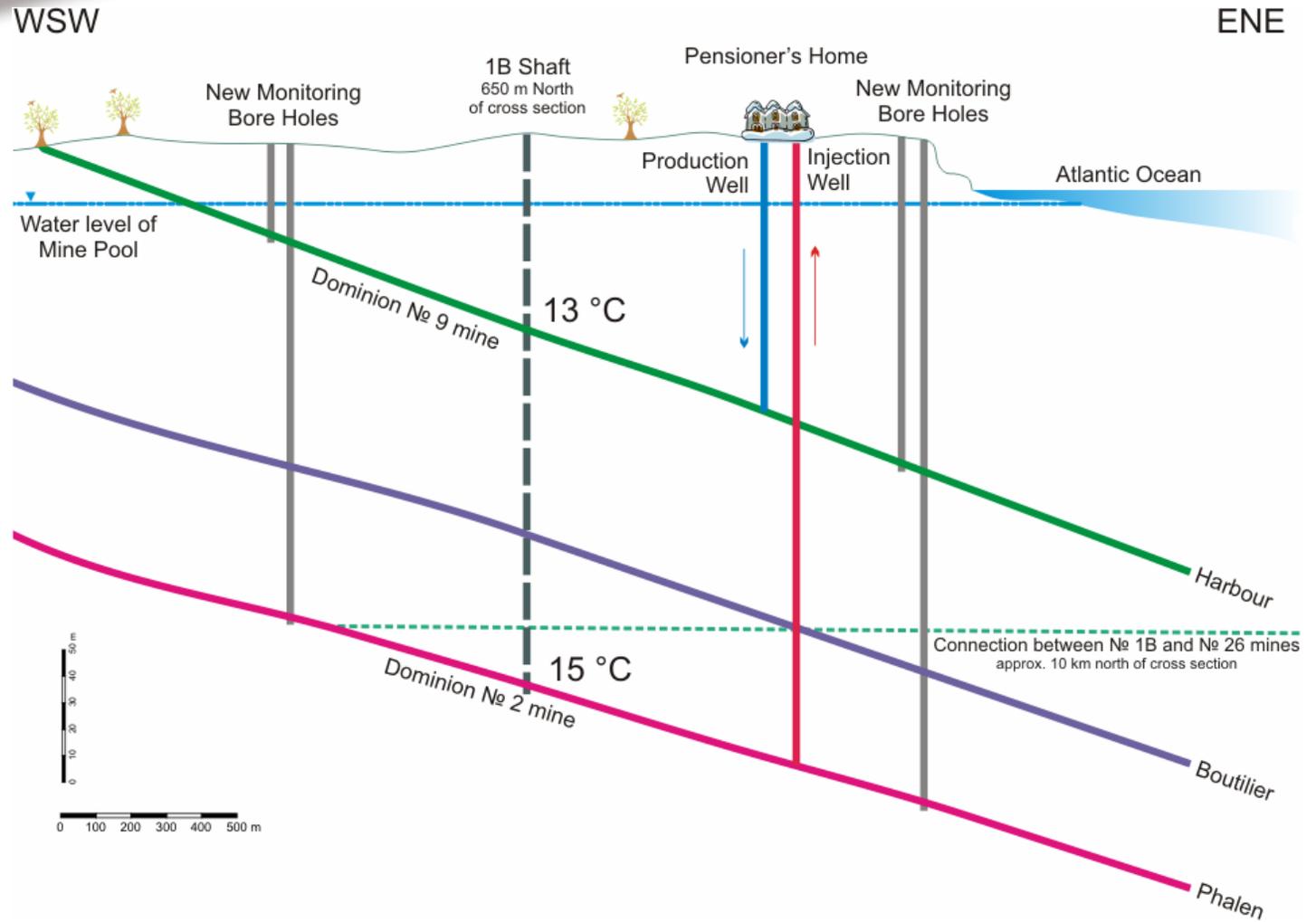
New Aberdeen Garden Townhouses



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Glace Bay Seniors Home Geothermal Pilot Project



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Potential Geothermal Use



- After 350 yrs of mining only 5% of the total coal resource has been extracted.
- This is too valuable a resource to remain untapped.

- Most of the coal is offshore, so underground mining after Xstrata is not practical.
- A new approach is required:

Mining the Energy – not the coal !

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Mining the Energy, *not the coal*

- Extracting Methane (natural gas) is becoming common
- Bioengineering: (enhancing methane production and/or turning coal into a liquid)
- Underground Coal Gasification (UCG) is becoming an important technology

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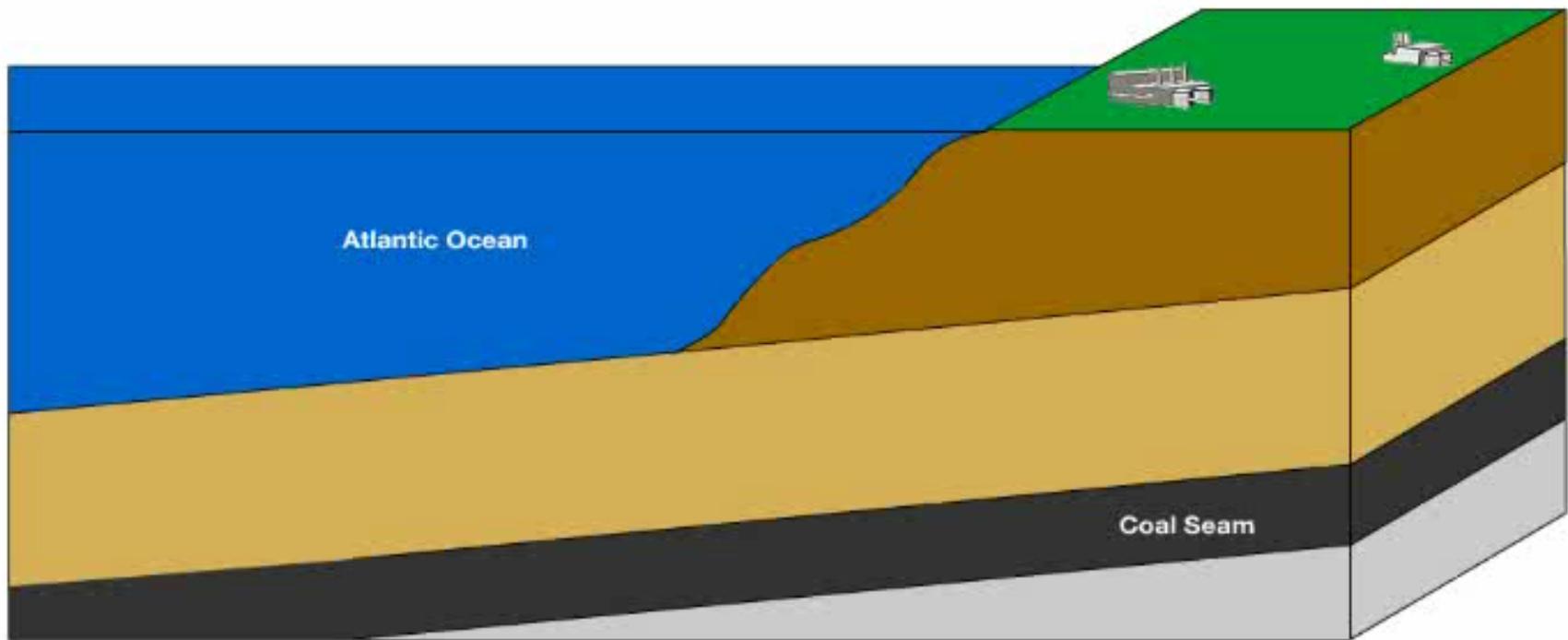
What do you choose to see?



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UCG - How does it work?



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What do we do with the gas?



Power generation

Liquid fuels

Chemicals

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But does it really work?

- Soviet Union, working since 1940's
- Sites in Australia and South Africa



Chinchilla, Australia



Majuba, South Africa



**It's not easy
being green.**