Planning for the Future

An Integrated Approach to Field Development Planning

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About the Presenters

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Presentation Objectives

To demonstrate the need for an integrated approach to field development planning

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Key Messages

- **A well thought out field development plan (FDP) can add value to a project, could be the difference between success and failure**
- An integrated approach is needed:
  - Understand the Resource: It all starts with the rocks
  - Understand the Markets: How to profit from the resource
  - Assess the Infrastructure: Link between Resource and Markets
- We will show you the benefits of an integrated FDP

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Why Create a Field Development Plan?

- Inter-related uncertainties
  - Understand Reservoir, Infrastructure and Markets
  - Recognize the risks and uncertainties within each
  - Recognize the inter-dependencies between each
- It's Complex
- **$$ Billions of investment are often required; a good FDP can mean the difference between success or failure**

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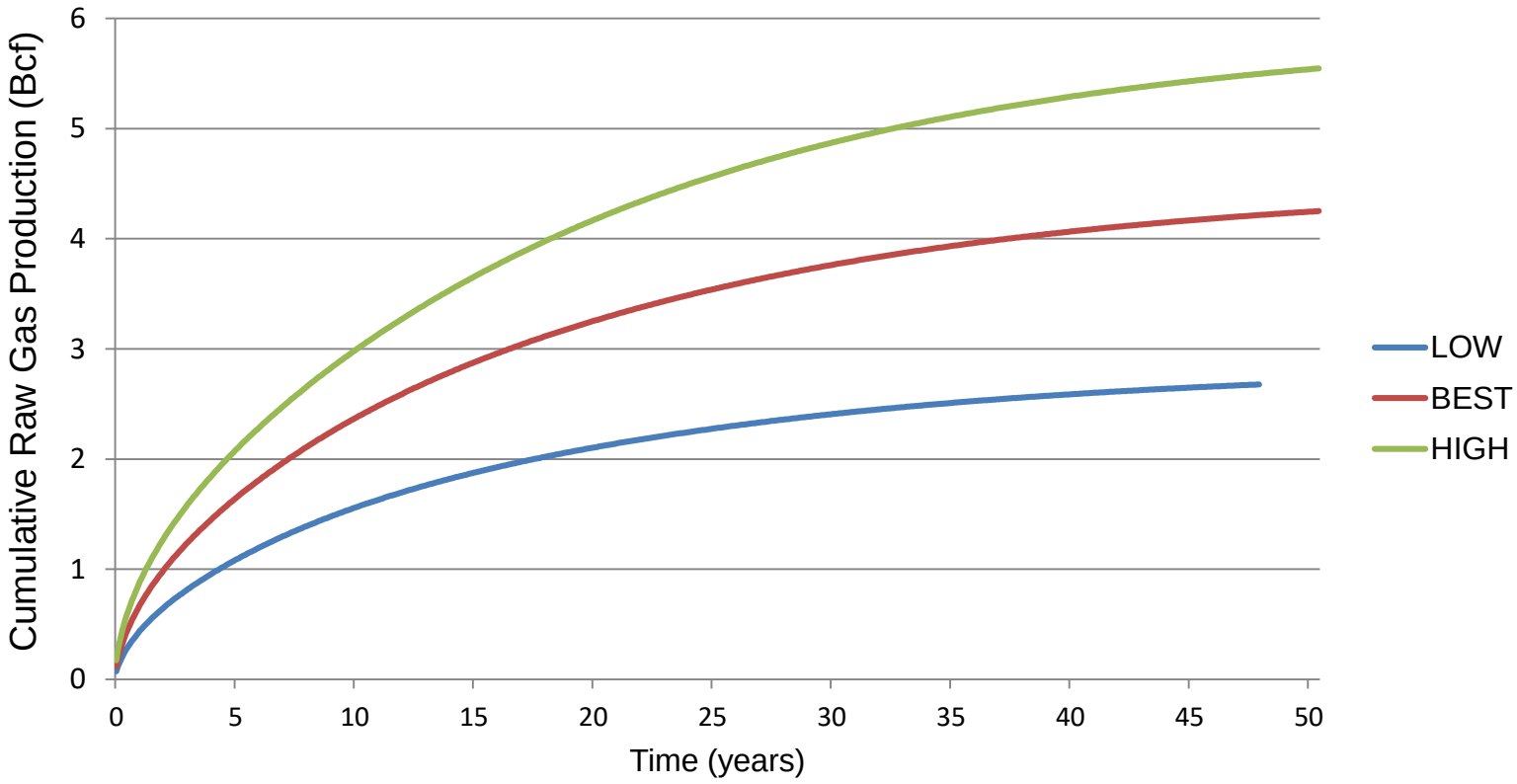
Understand the Resource

- Unconventional reservoirs are driving industry growth
- Many uncertainties related to:
  - Short and long term productivity – type curve development
  - Composition
  - Heterogeneity
  - Well spacing and depletion strategy
  - Cost to develop and produce
  - Surface constraints, environmental issues, etc.
- Uncertainties must be recognized and accounted for

Type Curves Bracket Uncertainty



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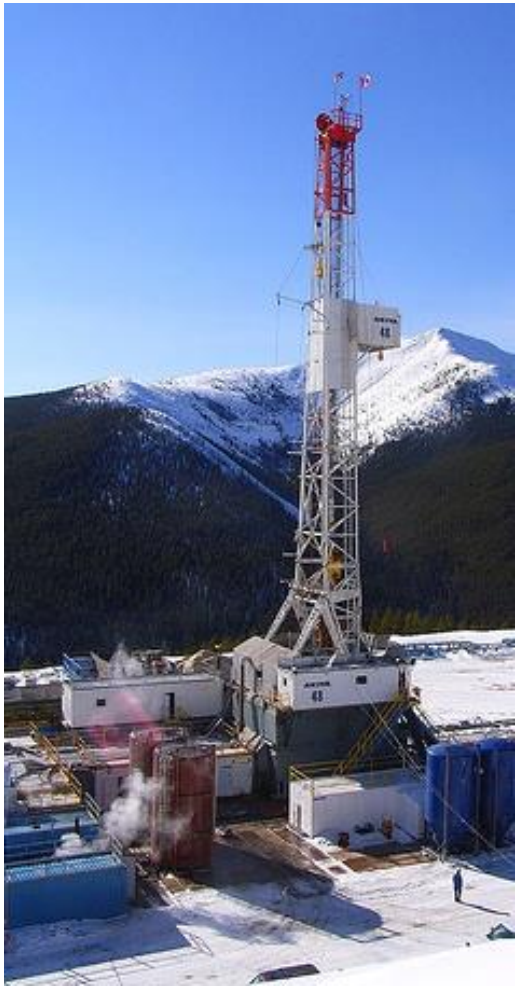
Understand the Markets



- **Paradigm Shift in North America**
- Natural gas glut
- Collapse of commodity prices
- Markets are demand constrained

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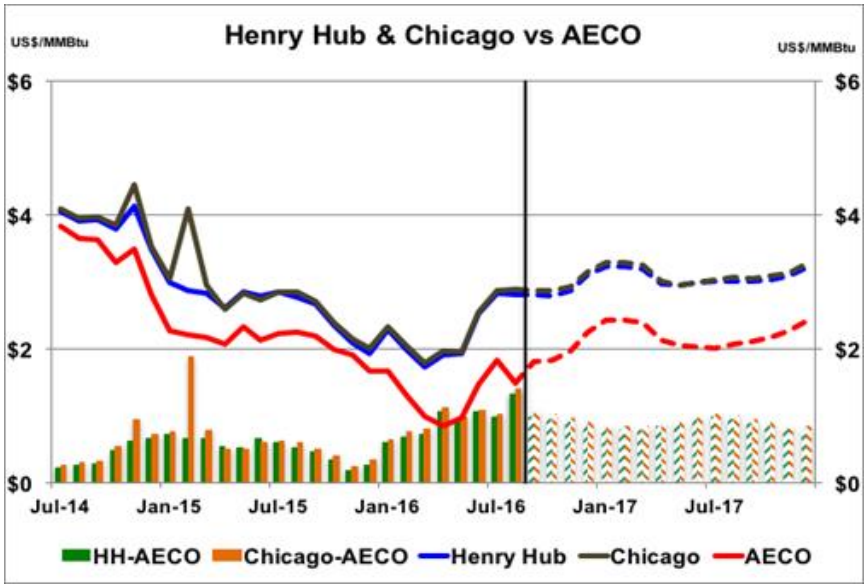
Understand the Markets

- Understanding the future outlook for gas and NGL markets is a critical step in determining what infrastructure is required and what markets to sell into.
  - Sales Gas
    - AECO (TCPL) vs Alliance (Chicago)
  - NGL's
    - High recovery vs low recovery
    - Pipeline take away specification
      - TCPL vs Alliance
    - C3+ delivered to Pembina (Ft Saskatchewan frac) vs Alliance vs fractionate in the field

Natural Gas Prices

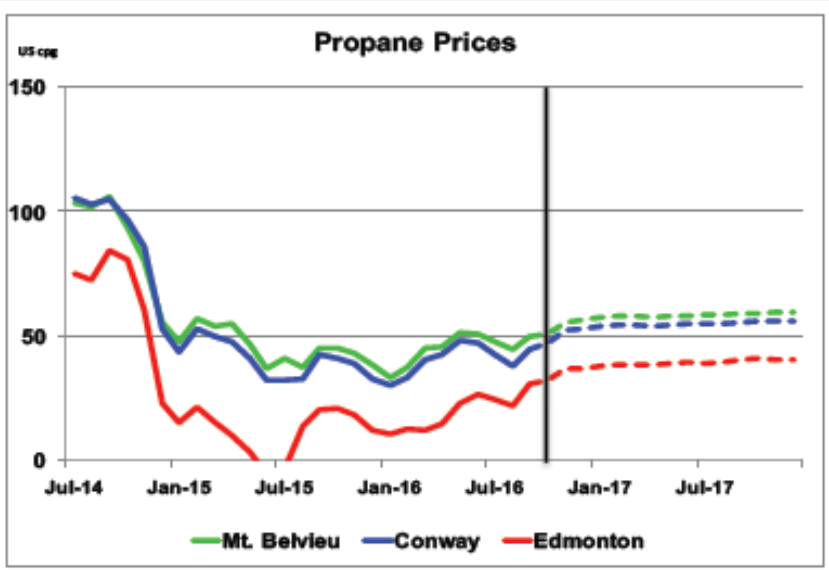
- Western Canadian gas prices remain significantly discounted to US prices
  - Transportation cost is >$US 1.00 /mmbtu
- We are a price taker because our main market is the U.S.

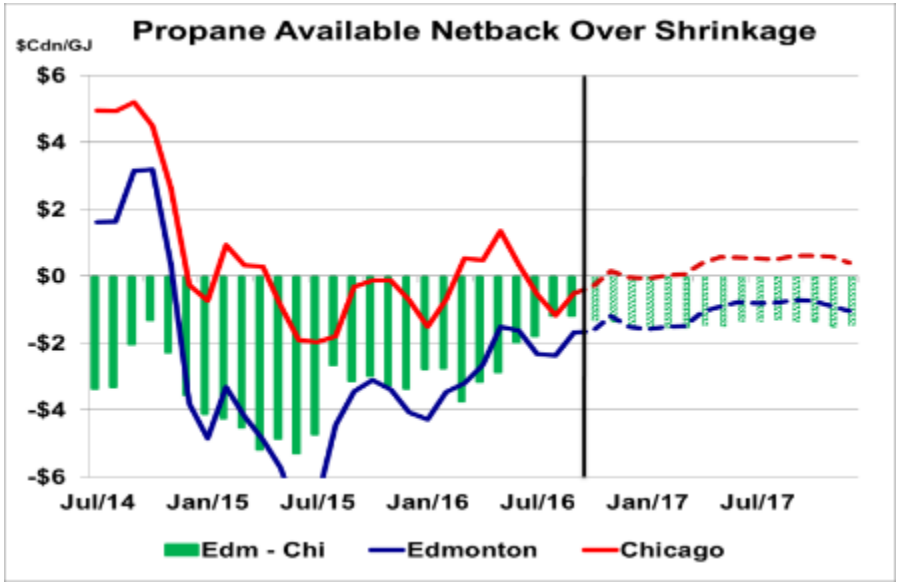


Source: GPMi NGL Report

Propane Netbacks

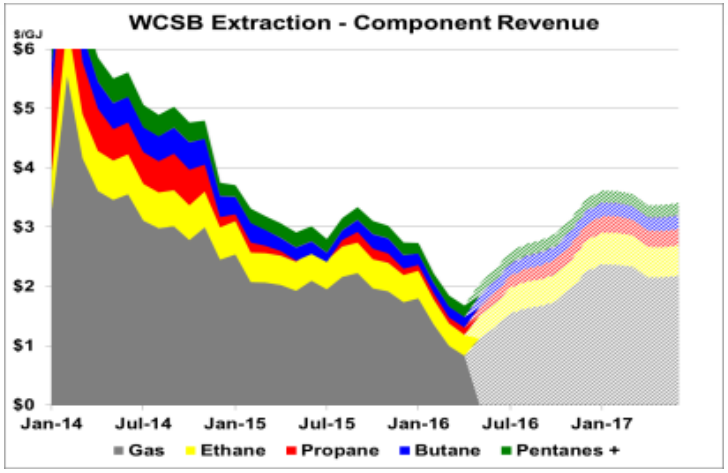
- Negative propane netbacks at Edmonton after fractionation and transportation
- The uplift from Edmonton to anywhere else is large

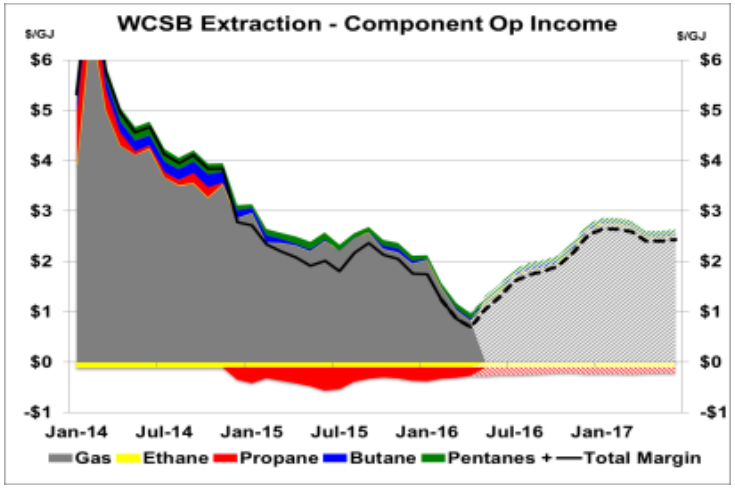




Source: GPMi NGL Report

Revenue and Operating Margins





Source: GPMi Monthly NGL Report

- Methane is still the largest revenue and margin component
- Ethane is near breakeven
- Propane is deep underwater
- Butanes and pentanes+ are profitable in Alberta
- The best strategy now is to dump ethane and propane into the gas

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Revenue and Operating Margins

- The reality is that the US no longer needs Canada to supply gas and NGLs
- This is a fundamental, permanent shift
- The glut will last until we develop alternative markets

Egress Considerations

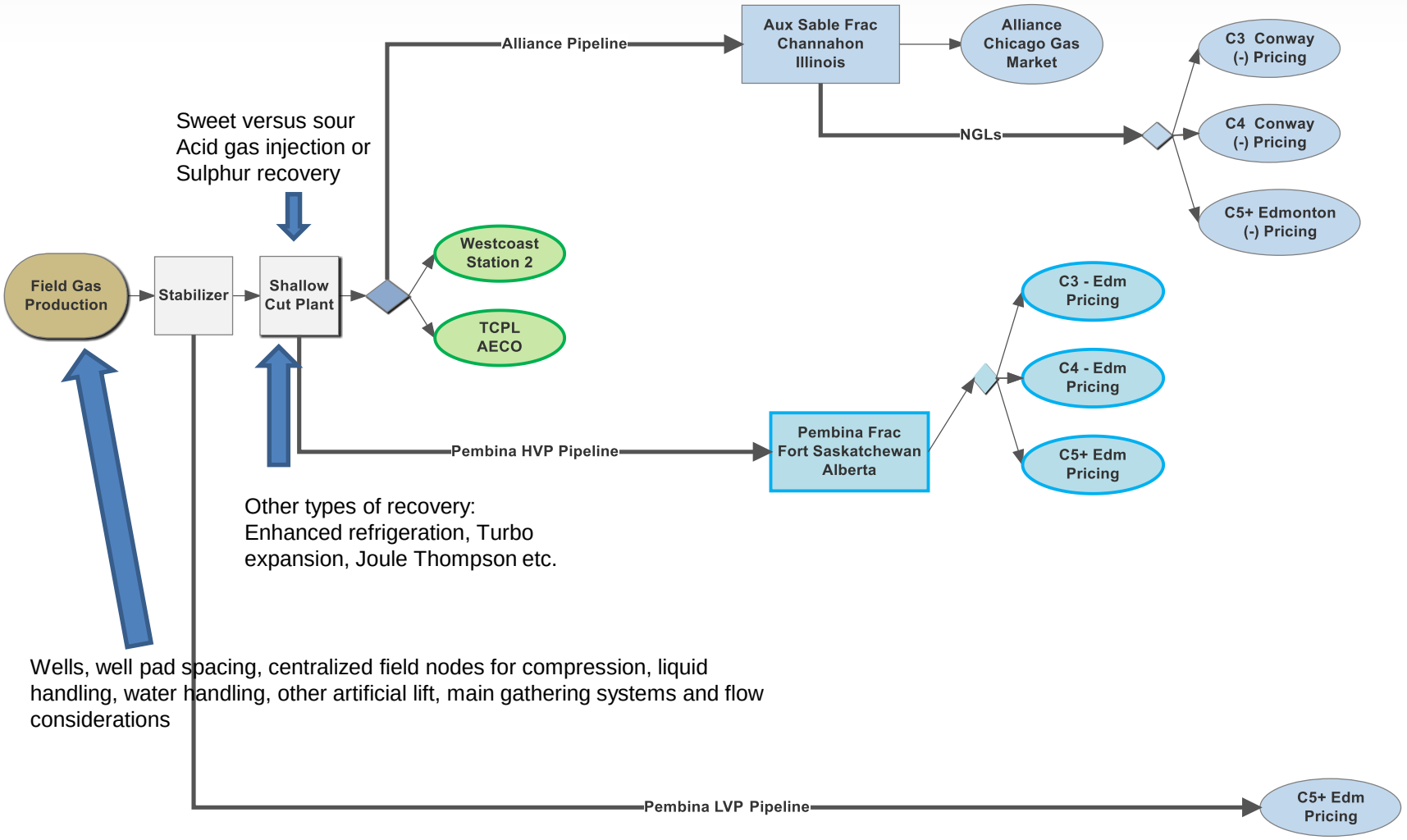
- Surplus of liquids flowing into the Edmonton hub
- Option to Deliver NGL's to Alliance
- Access to both require large take or pay commitments
- NGTL has also asked for firm export commitments
- **Difficult to commit to above with reservoir and pricing uncertainties**

Source: GPMi Monthly NGL Report

Understand the Infrastructure

- Types of Infrastructure
- Typical Configurations
- Alternative Egress Options
- Staged Modular Development
- Commercial Options
  - Fee versus ownership
  - Firm versus interruptible access to capacity
- Cost and Timing Uncertainty

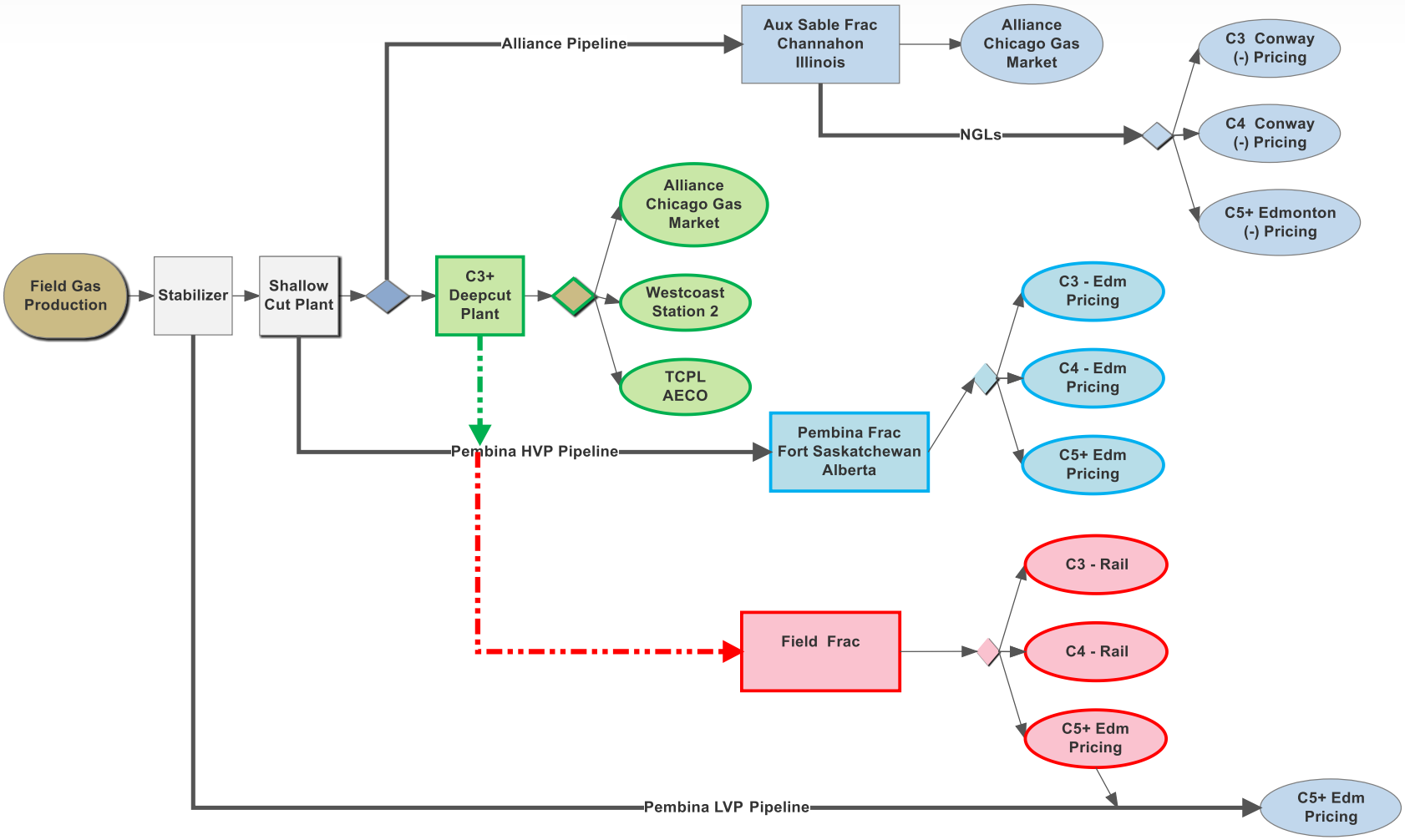
Shallow Cut


Alliance Pipeline
Aux Sable Frac
Channahon
Illinois
Alliance
Chicago Gas
Market
C3 Conway
(-) Pricing
C4 Conway
(-) Pricing
C5+ Edmonton
(-) Pricing
NGLs
Sweet versus sour
Acid gas injection or
Sulphur recovery
Field Gas
Production
Stabilizer
Shallow
Cut Plant
Westcoast
Station 2
TCPL
AECO
C3 - Edm
Pricing
C4 - Edm
Pricing
C5+ Edm
Pricing
Pembina HVP Pipeline
Pembina Frac
Fort Saskatchewan
Alberta
Other types of recovery:
Enhanced refrigeration, Turbo
expansion, Joule Thompson etc.
Wells, well pad spacing, centralized field nodes for compression, liquid
handling, water handling, other artificial lift, main gathering systems and flow
considerations
Pembina LVP Pipeline
C5+ Edm
Pricing

Field NGL Fractionation vs Pembina system

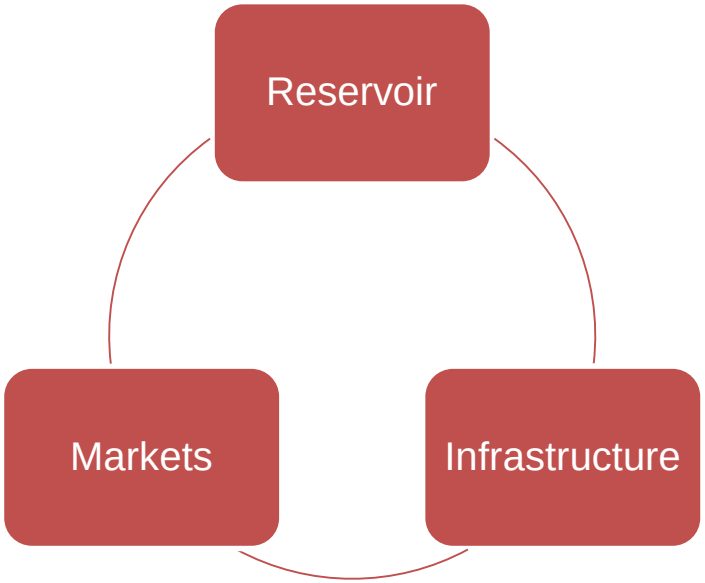
- Field NGL fractionation provides access to NGL markets other than Edmonton
- Western Canadian propane is severely discounted to Mount Bellvue and Conway
- Western Canadian propane & butane has a cost advantage serving the Pacific rim over the US
  - Future LPG markets should be off the BC coast

Field Frac Alternative



Field Development Planning

An integrated business plan from Reservoir to Market



- **Reservoir to Wellhead**
- **Mineral Rights**
- **Geology**
- **Prospectivity**
- **Productivity**
- **Reserves and Resource Potential**

- **Plant to Market**
- **Market Analysis**
- **Commercial Arrangements**
- **Long Term Commitments**

- **Wellhead to Plant**
- **Infrastructure**
- **Commercial Arrangements**
- **Area Potential**

Characteristics	• Updated periodically • From cradle to grave • Understanding of uncertainty/risk/opportunities/options • Robust economics, responsive to change, ability to adjust pace and scope

Why an Integrated Approach

- Reservoir, Infrastructure and Market considerations are inter-related
  - Starts with reservoir uncertainty on volumes, rates, and compositions
  - Coupled with market egress uncertainty on securing capacity for uncertain product volumes into the future
  - All of which creates uncertainty regarding the optimal size, cost, type and timing of gathering and processing infrastructure
- **An integrated approach ensures all inter-related components are explicitly recognized and addressed**

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Duvernay FDP Case Study

- Evaluated Reservoir: Low, Best, and High production cases were estimated
- Considered Egress Options: taking into account reservoir uncertainty
- Various infrastructure development options considered

Scenario 1: Full Upfront Build

- Build based on the High case prediction of reservoir performance

Scenario 2: Staged Build

- Build in stages, allow for future expansion if needed

Scenario 3: Staged plus 3rd Party

- Staged development, include 3rd party volumes

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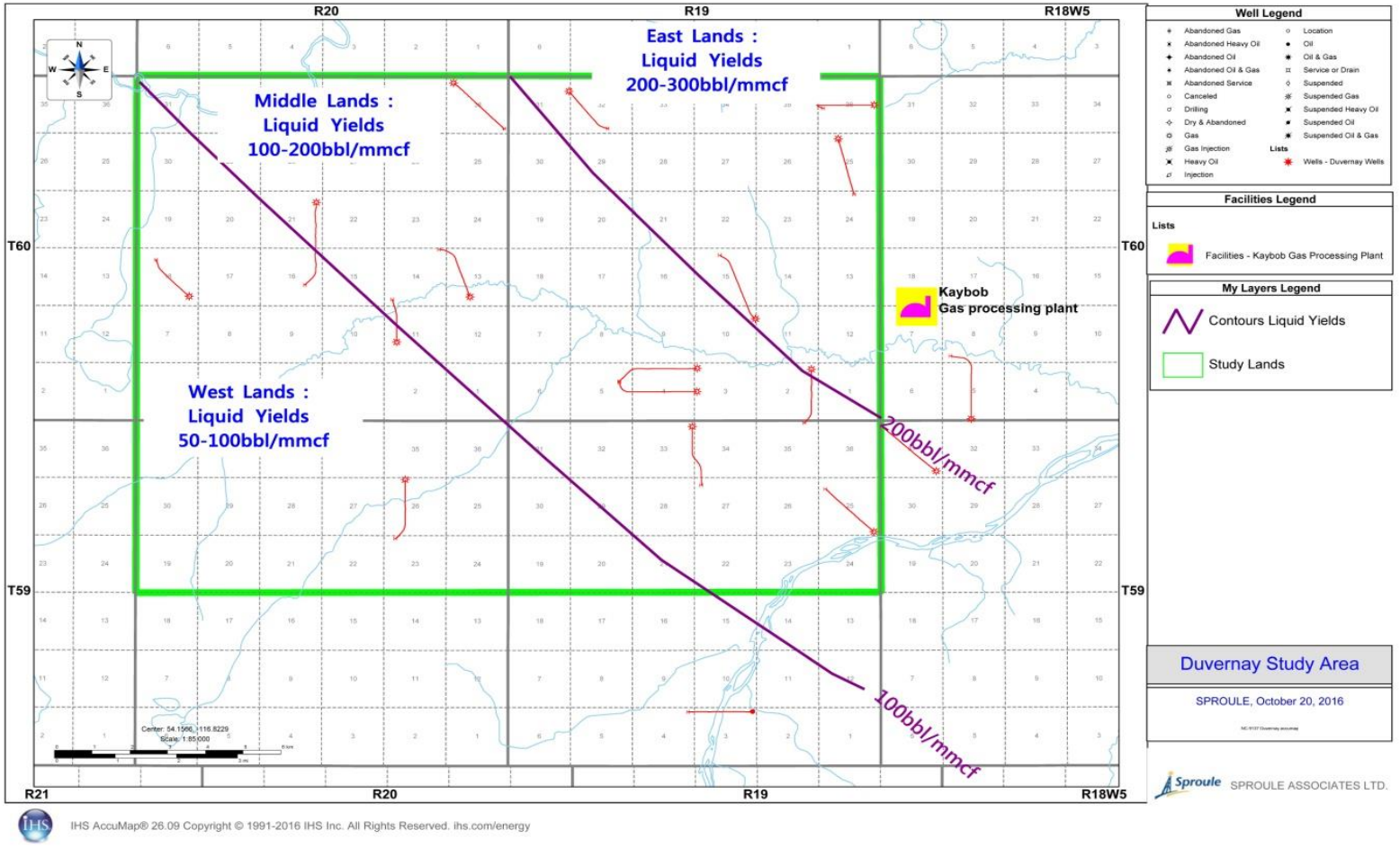
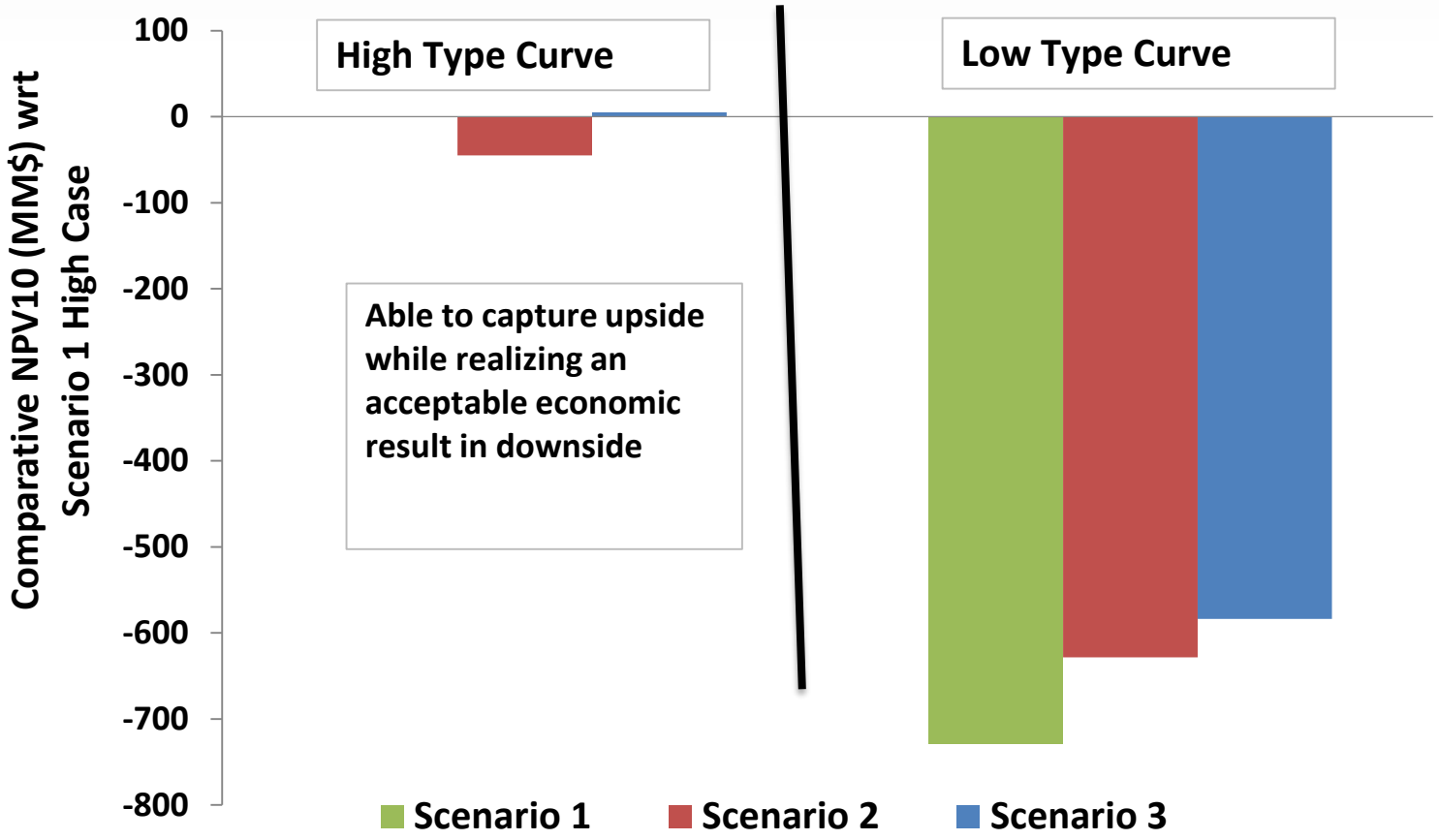
Duvernay Study Area



Duvernay Study Results



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Summary Field Development Plans

- It’s Complicated but required and doable
- An integrated approach is required
- Uncertainties are always present, but the impact can be mitigated
- Many other factors must be considered, some are unique to each development situation
- **A well thought out FDP can be the difference between success and failure of a project**

Questions

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