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*Engineering and Environmental Management*



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# Life Cycle Assessment of Management Options for Waste Farm Plastics

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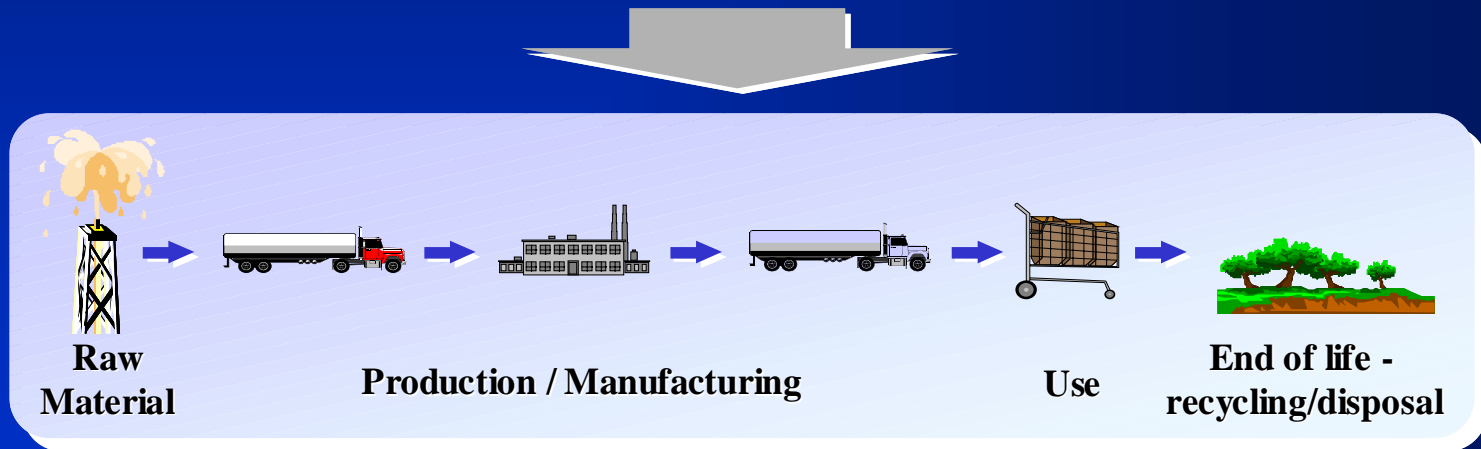
# Project Scope

- Life cycle assessment (LCA) of the different options for managing waste farm plastics
- HDPE chemical containers and LDPE film
- On-farm disposal options
- Off-farm recycling and disposal options

# What is LCA?

- LCA evaluates the environmental impacts associated with the whole life-cycle of a product or system

Inputs: raw materials and energy



Outputs: emissions to air, water and soil

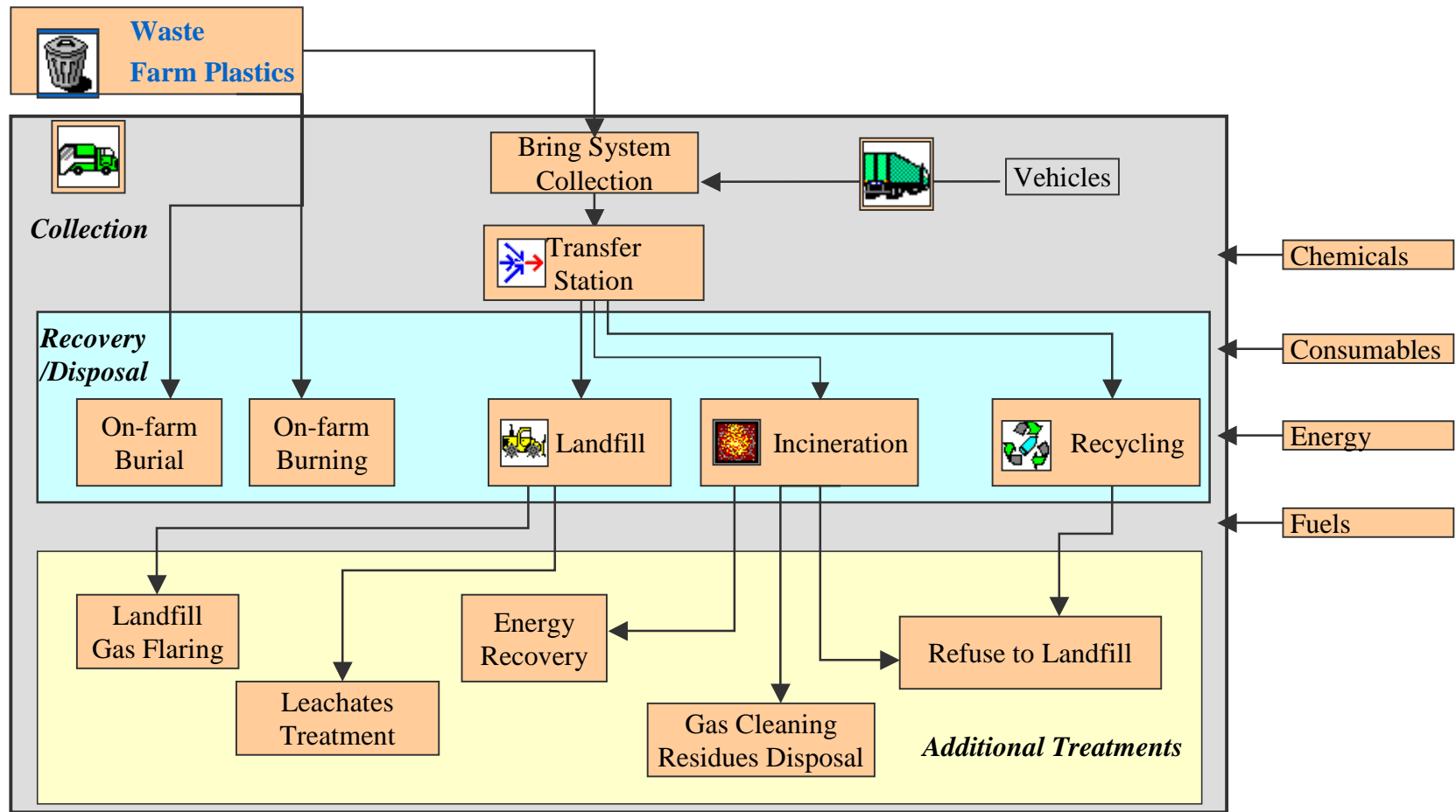
# Management Options

- On-farm burial
- On-farm burning
- Drop-off at transfer station for landfilling
- Drop-off at transfer station for incineration
- Drop-off at transfer station for recycling

# Functional Unit

- “The collection and treatment/disposal of waste farm plastics generated within a region over the period of one year.”
- Hawke’s Bay – 189 t HDPE, 227 t LDPE
- Canterbury - 520 t HDPE, 790 t LDPE

# System Boundaries



# Elements

- Collection
  - vehicles, including construction, use (fuel, oil) maintenance and end of life
  - Transfer stations, including construction maintenance operation and demolition
- Recovery/Disposal
  - landfill construction, maintenance and operation
  - incinerator construction, maintenance and operation (avoided burdens from energy recovery)
  - recycling process (avoided burdens from replacing virgin materials)



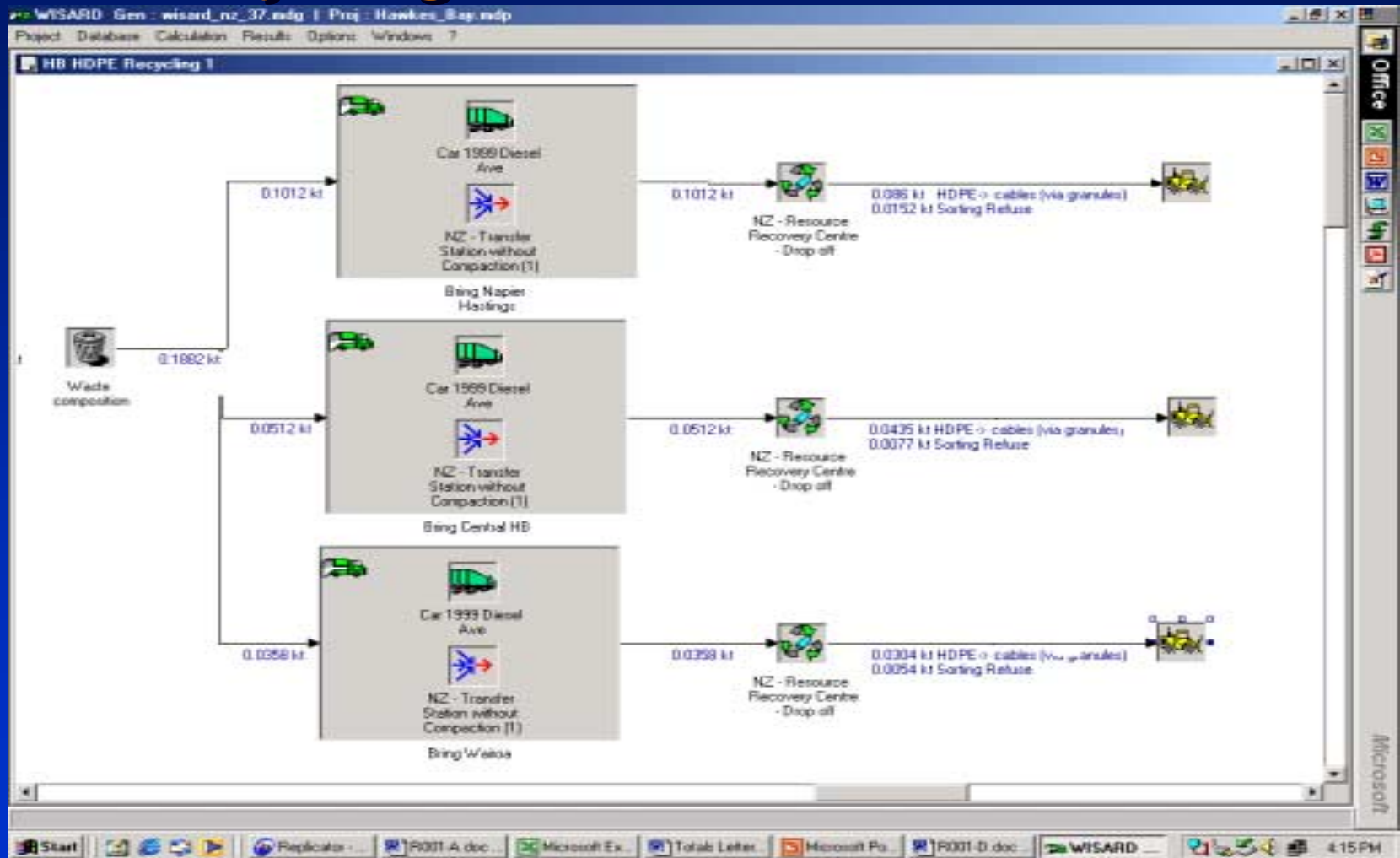
# Quantitative Assessment

- On-farm options
  - published emissions data for burning of plastics and farm machinery operation
  
- Off-farm options
  - WISARD (Waste Integrated Systems Assessment for Recovery and Disposal)
  - database includes
    - » recycling
    - » landfilling
    - » incineration

# Key Assumptions

- LDPE ~ HDPE
- Farmers clean chemical containers
- Bulldozer/tractor used for on-farm burial
- Diesel used for on-farm burning
- Farmers deliver plastics to transfer stations for landfill, incineration or recycling
- 15% rejects from recycling
- Plastics recycled only once
- Leachate and landfill gas negligible

# Recycling Scenario



# Assessment

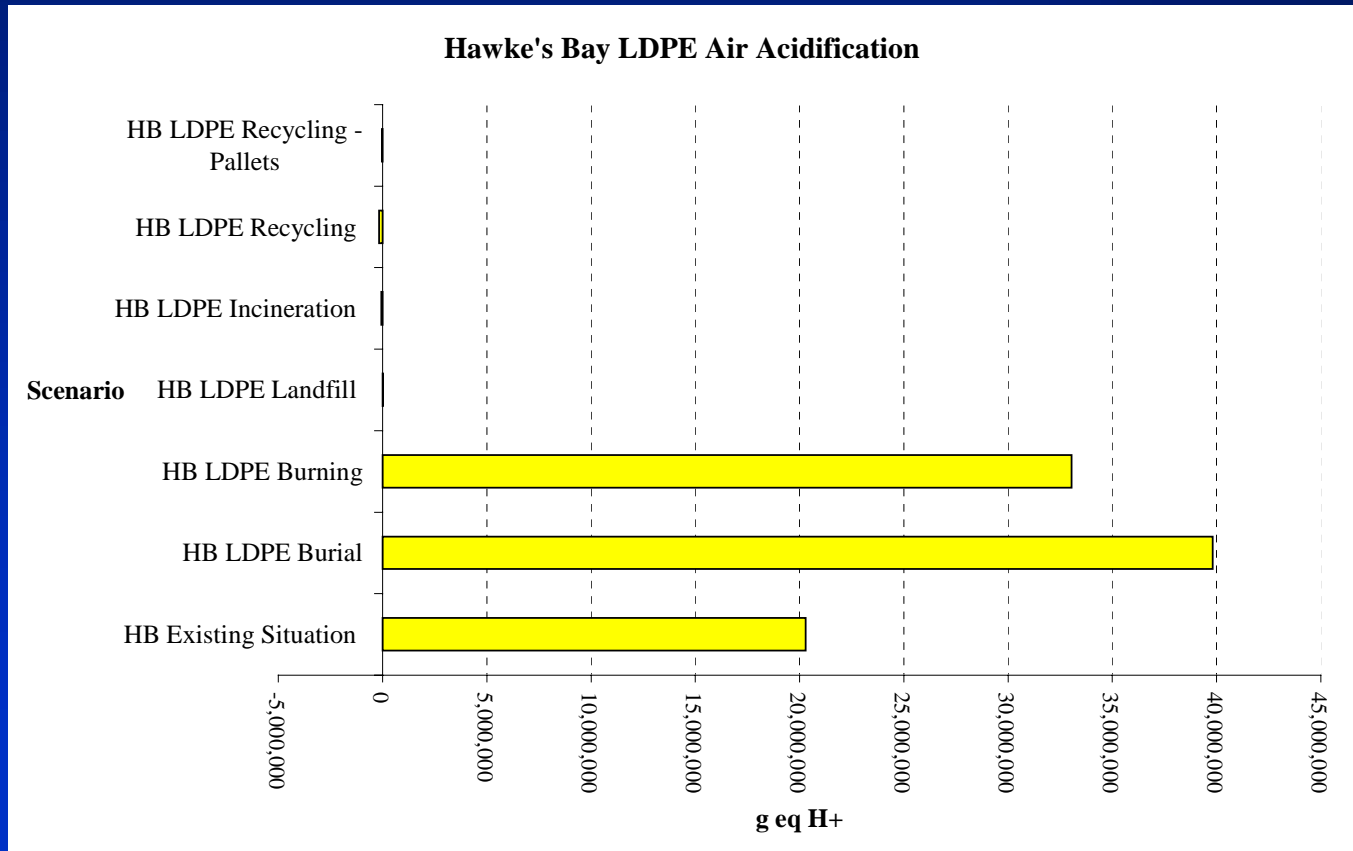
## ■ Environmental Indices

- Use equivalency factors to transpose quantified inputs/outputs in measures of the same environmental concern

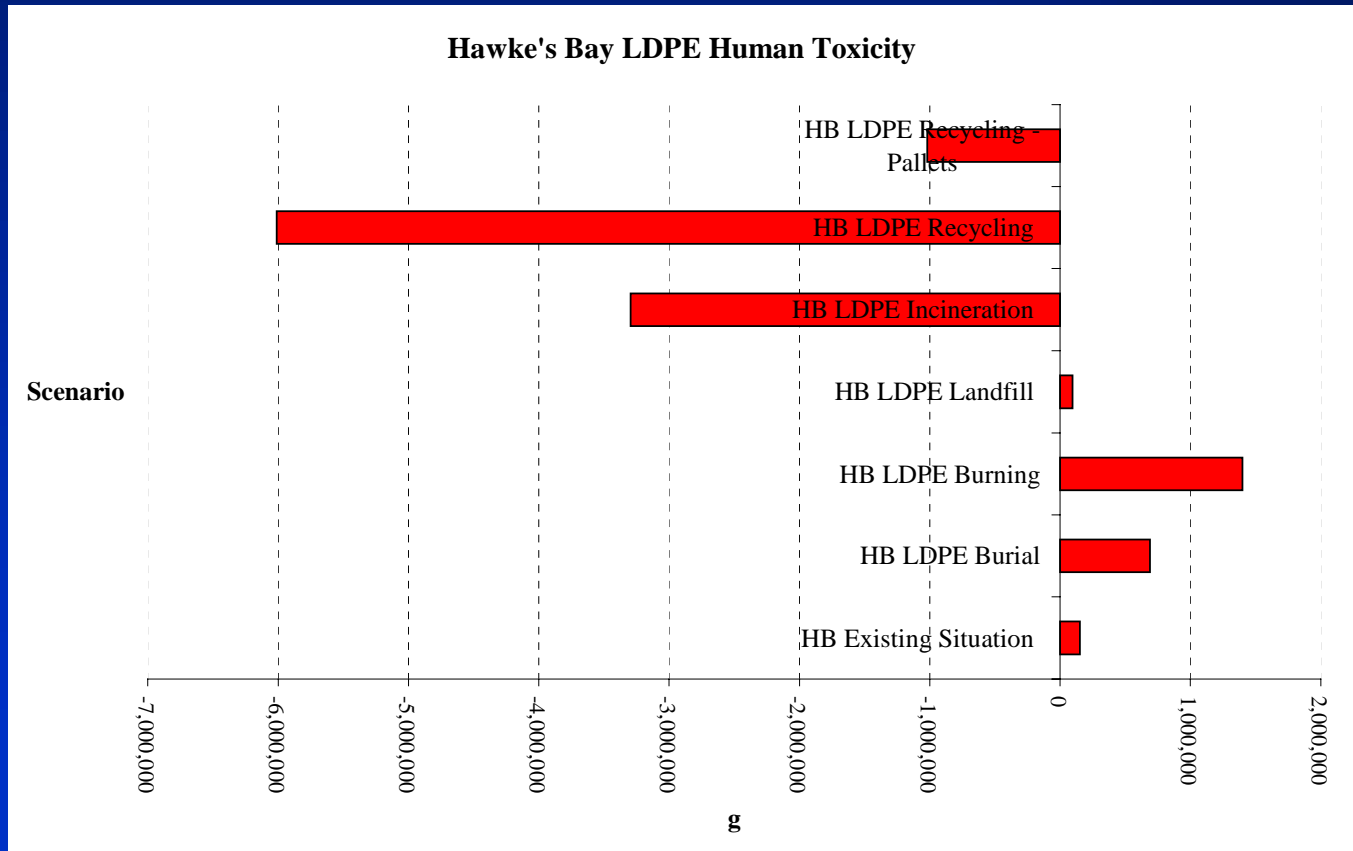
## ■ Assessment Indices

- Air acidification (g eq H<sup>+</sup>)
- Eutrophication (water) (g eq PO<sub>4</sub>)
- Human toxicity (g)
- Greenhouse gas effect (IPCC 100 year) (g eq CO<sub>2</sub>)
- Depletion of non-renewable resources (yr<sup>-1</sup>)

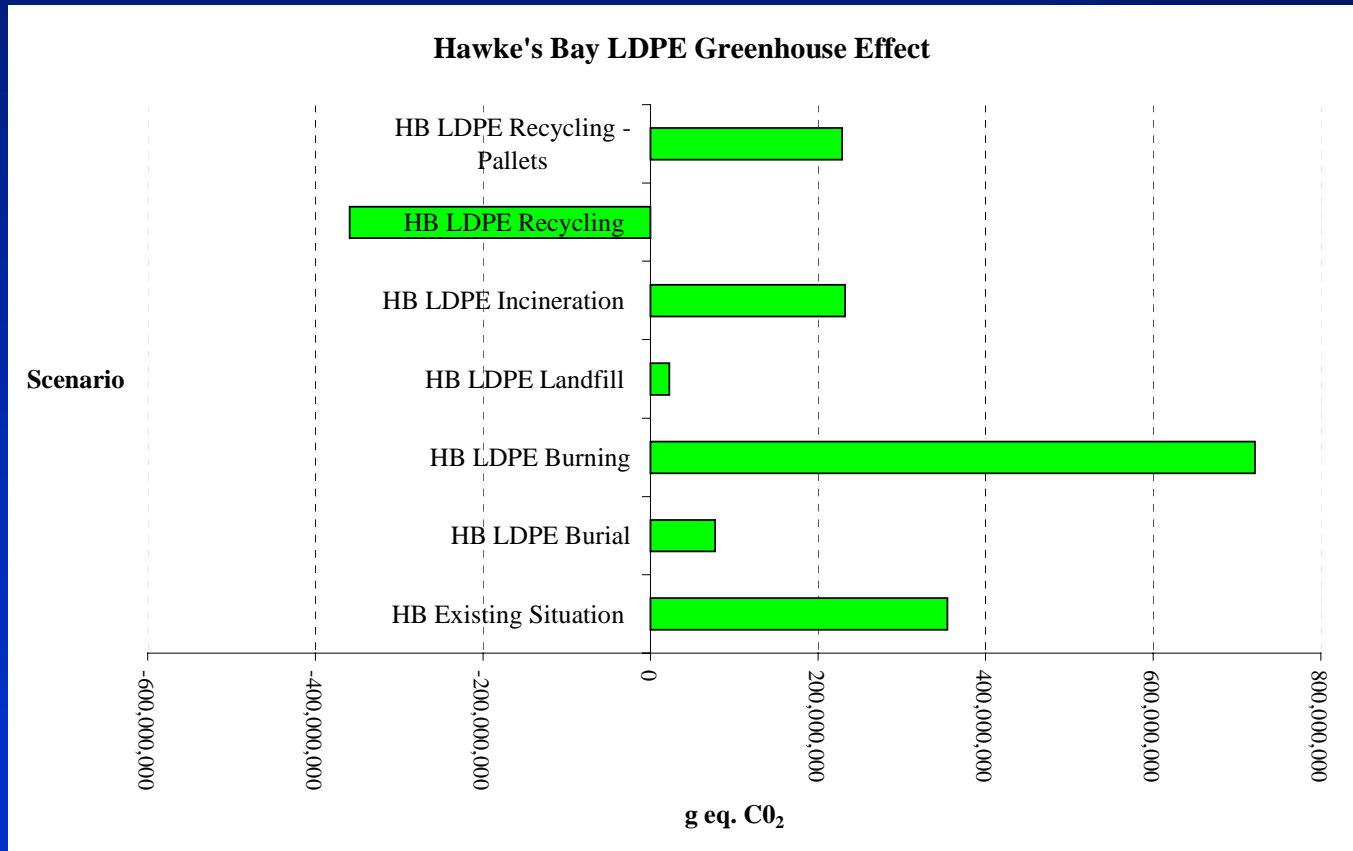
# Comparison of Scenarios



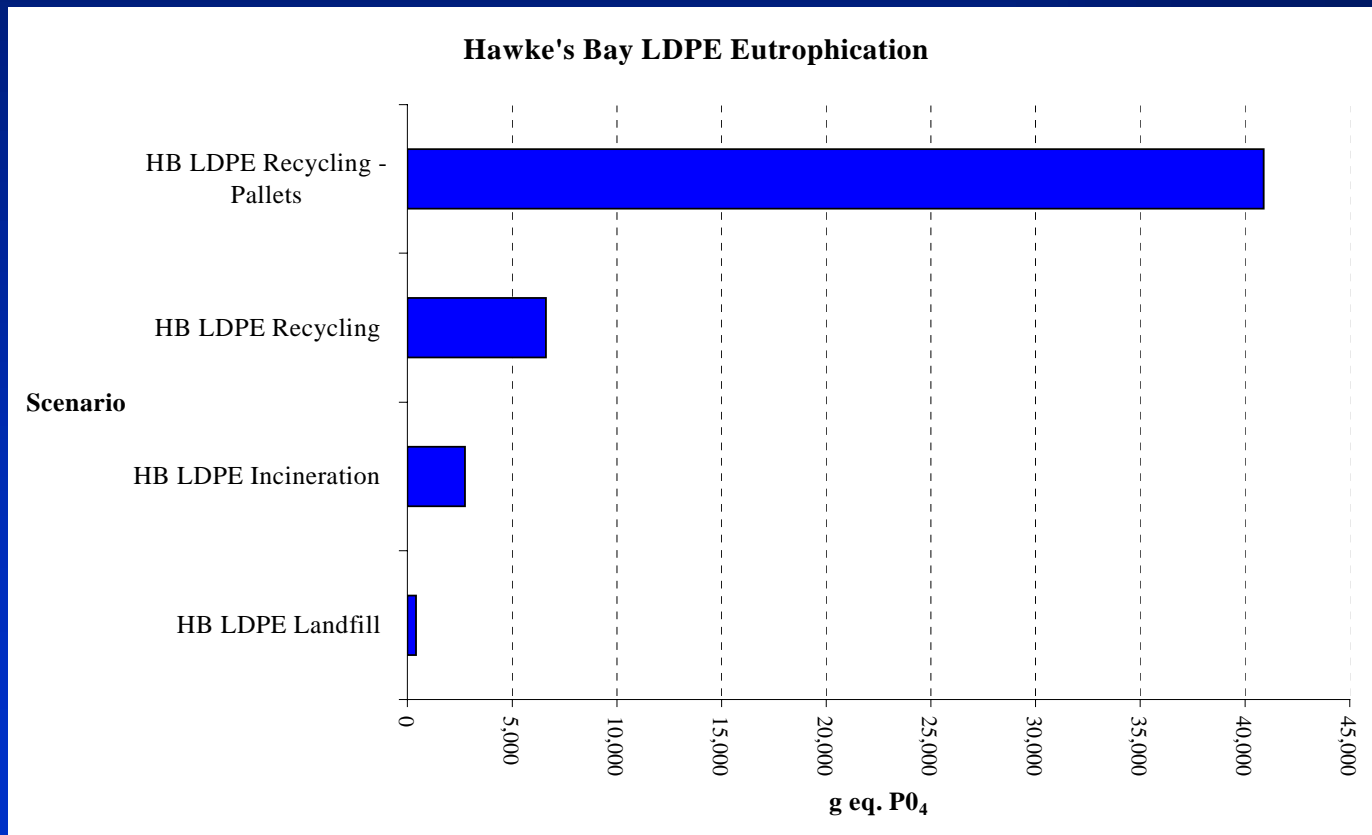
# Comparison of Scenarios



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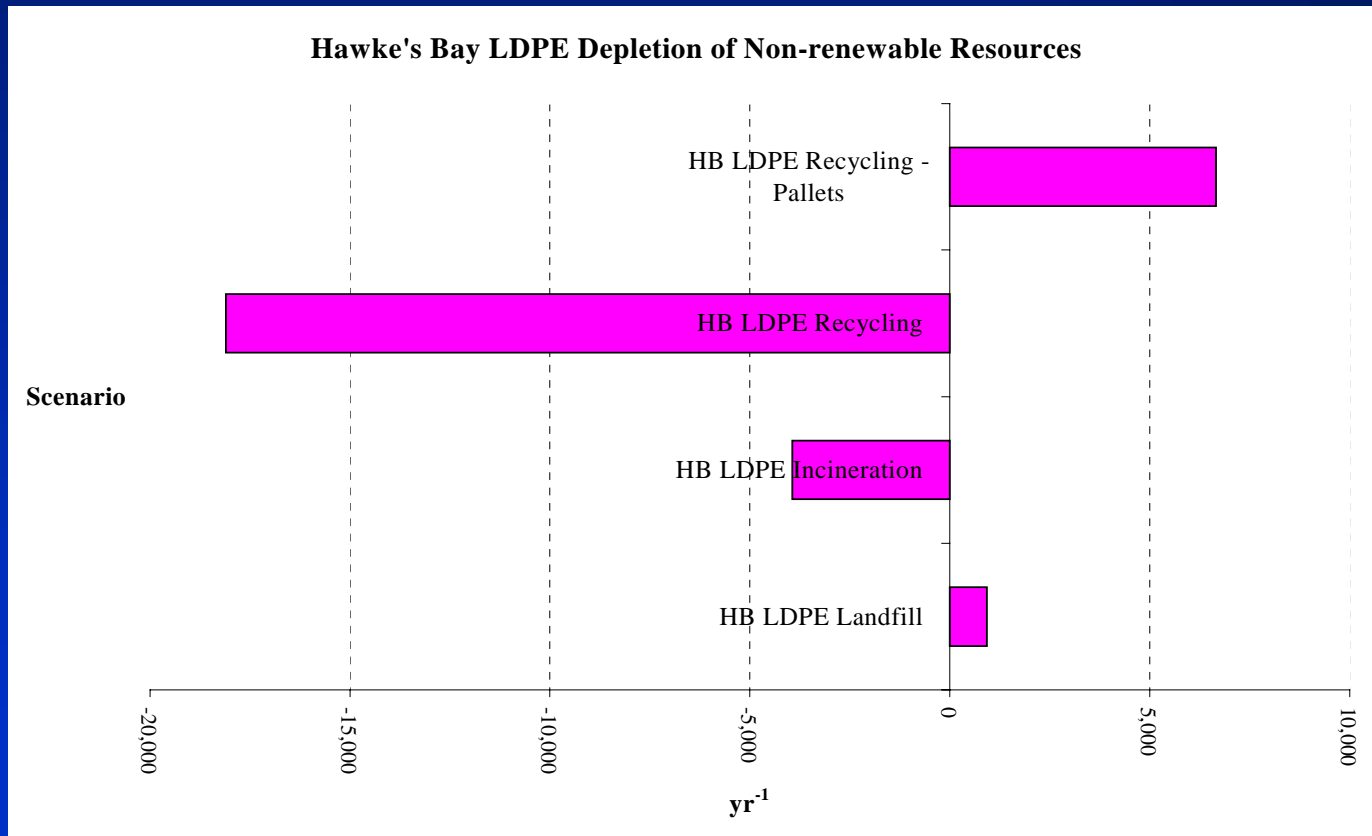


# Comparison of Scenarios





# Comparison of Scenarios



# Qualitative Assessment

Issue/Risk Scenario	Planning Instrument Non Compliance	Health and Safety - Fires	Contamination /Residual Chemicals	Low Participation	Leachate Discharges
On-farm Burial	✓		✓		✓
On-farm Burning	✓	✓	✓		✓
Landfill			✓		
Recycling			✓	✓	
Incineration			✓		

# Conclusion

- Drop-off of waste farm plastics at transfer stations for recycling into products that replace products manufactured from virgin plastics will have the least adverse effect on the environment.