OPTIMIZING LANDFILL GAS RECOVERY THROUGH WASTE MOISTURE ENHANCEMENT

KEMPS CREEK CASE STUDY

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CLEANAWAY
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OVERVIEW

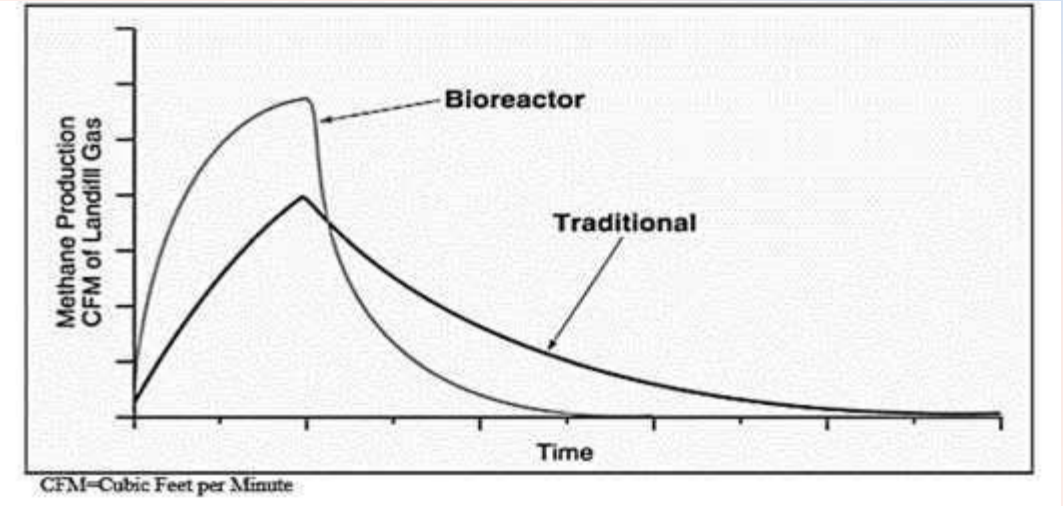
- Effects of moisture enhancement on landfill gas (LFG) at Kemps Creek Landfill.
- This work was completed by Blake Collins.
- Data supplied is based on the monthly monitoring data, which is subject to significant fluctuations.
- Data was collected over a period of 5 months, 2 months prior to the enhancement and the 3 months during.
- There are a significant number of factors that can affect LFG generation, in this case we can assume the catalyst to changes in LFG production is moisture enhancement due to the performance of other wells in the area.
- Overview of the injection system.
- Discussion of results.





MOISTURE ENHANCEMENT OF LANDFILLS

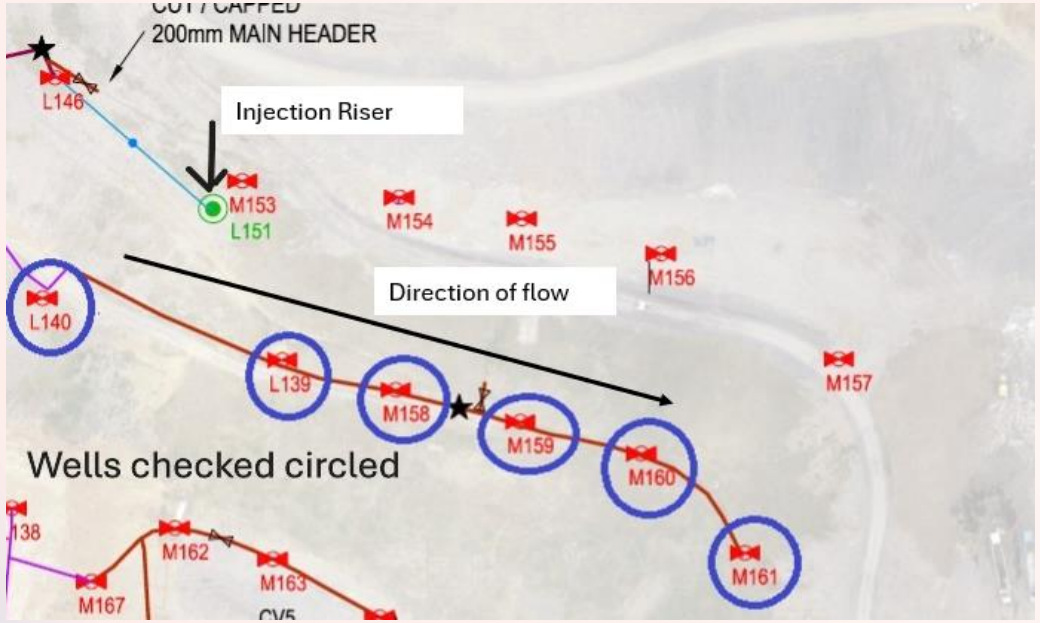
- Waste decay and landfill gas (LFG) generation are typically modelled as a first order decay (FOD), as seen in popular models such as LandGEM and NGERs.
- The rate of decay is dictated by several factors, typically represented by the value K in the FOD model.
- Moisture enhancement is a generally accepted method for increasing the rate (K) at which waste breaks down and LFG is generated.
- This is achieved by:
  - Increasing the rate of first order decay.
  - Enhancing transfer of nutrients and enzymes through the waste.
  - Enhancing the movement and distribution of bacteria through the waste.
- The total volume of LFG available is unchanged, this is dictated by the total waste mass.
- Benefits of accelerated methane production include:
  - Increased rate of settlement.
  - Improved LFG production.
  - Great viability/profitability of Biogas power stations/flares.



Miroslawa, Kaszubska & Wzorek, Małgorzata. (2017).

SET-UP/METHOD

- Liquid injection point L151 (450mm riser pipe) was installed specifically for the injection of moisture into the landfill.
- 5 pipes extend approx. 100m from the riser toward wells L139, L140 and L158-L161.
- These wells were selected due to their proximity to the injection lines.



Injection point – proximity to wells monitored

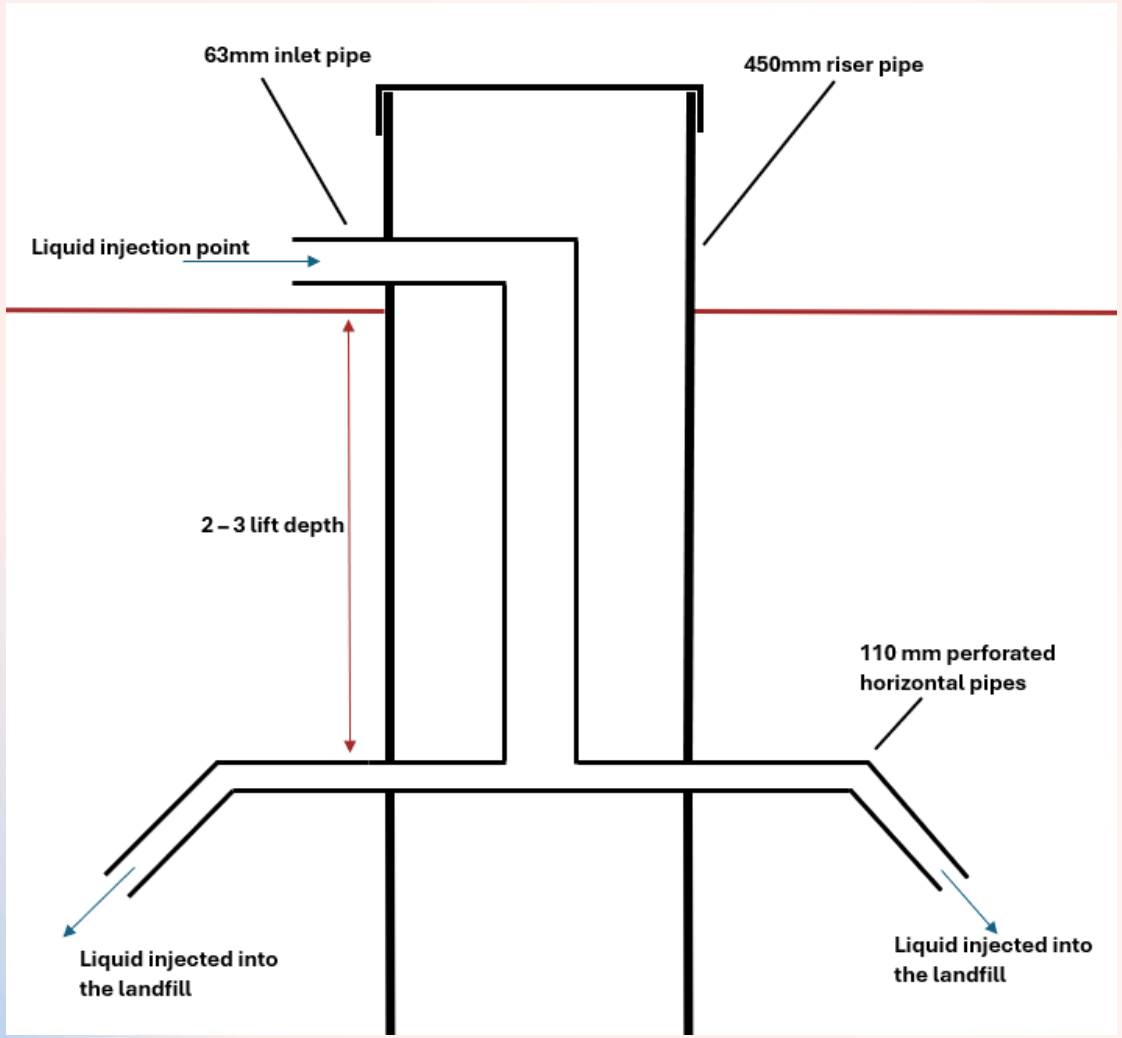


Horizontal injection lines - propeller



Horizontal injection lines

SET-UP/METHOD



Injection point overview



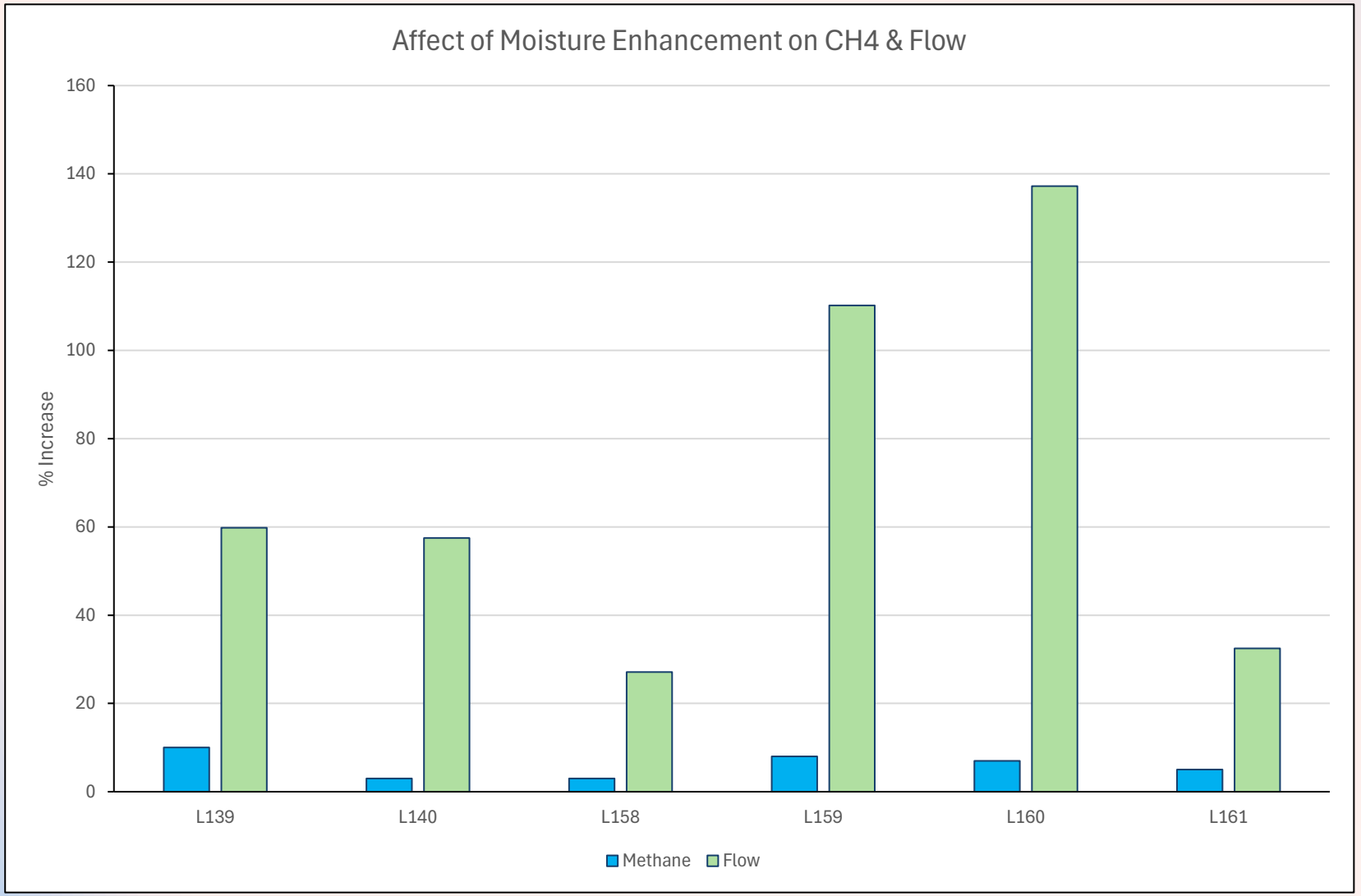
Liquid inlet



Liquid outlet

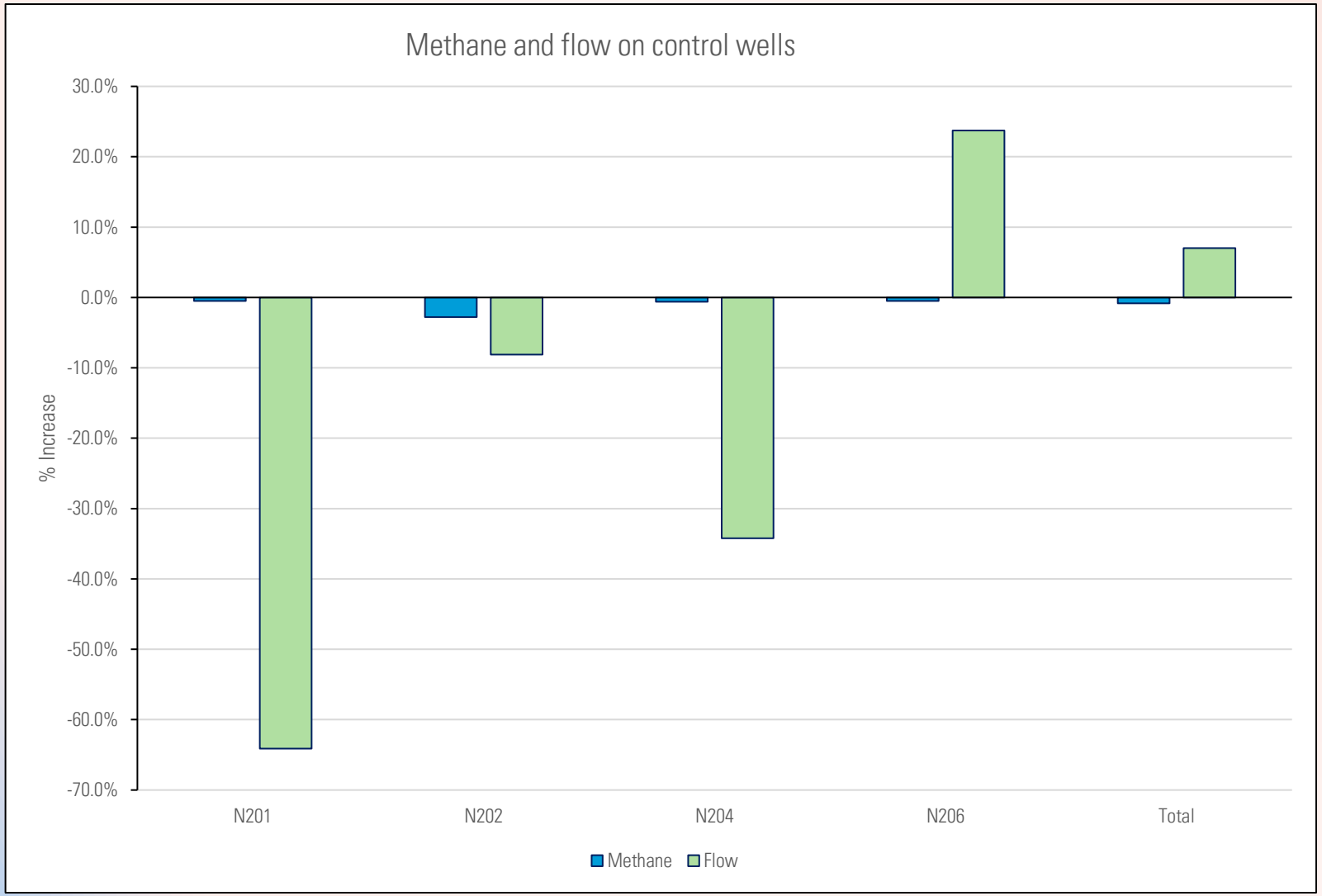
- Liquid pumps into the riser and is injected into the landfill through 5 horizontal pipes.
- The injection pipes currently extend a few lifts below the current height of the landfill.
- No data on the volume of liquid that was injected.

MOISTURE ENHANCED RESULTS



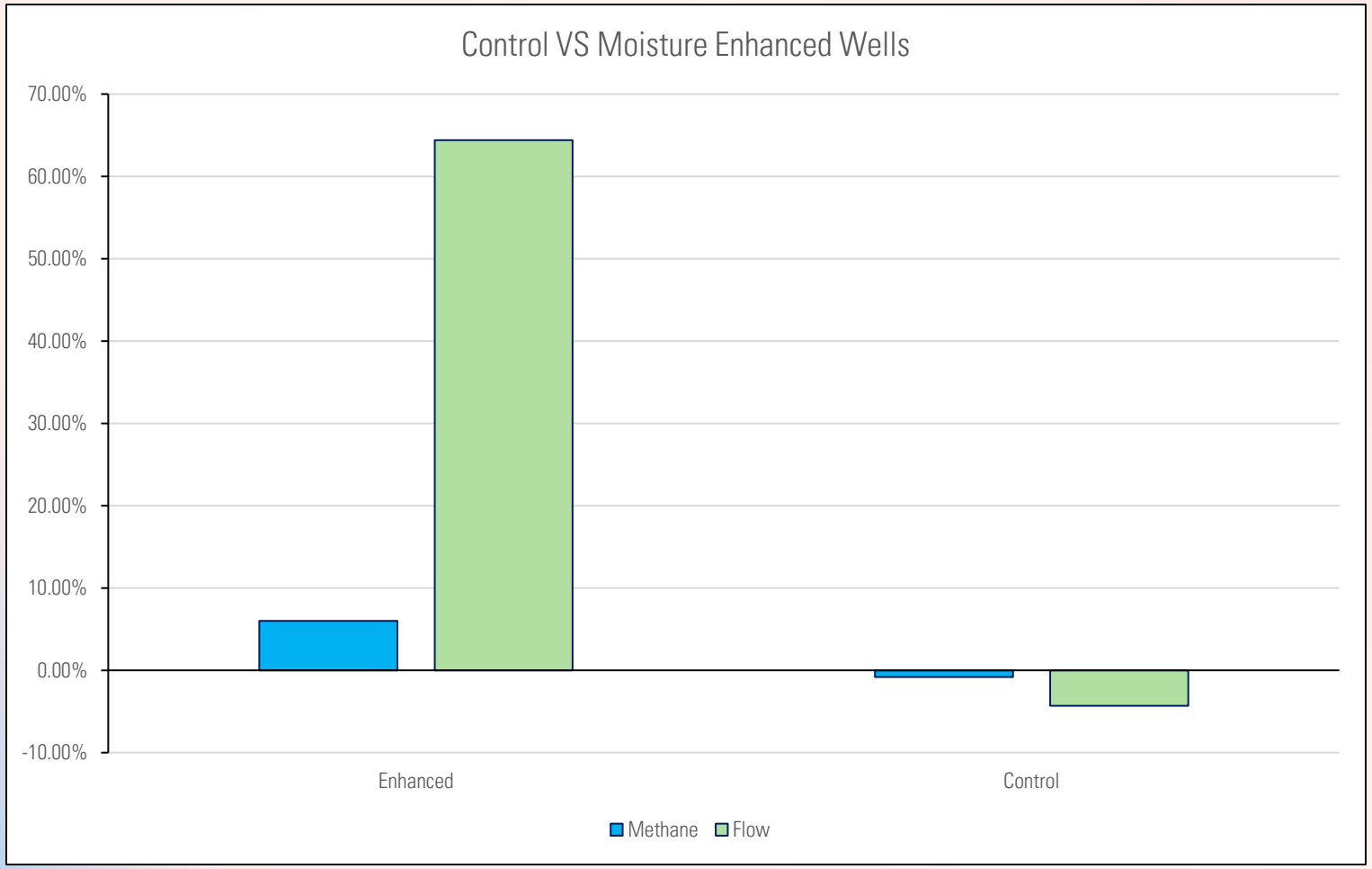
- Monitored wells saw combined CH4 increase of 6%, with individuals ranging between 3 and 10 percent.
- Total LFG flow increased by 64.4% with individual wells increasing between 27.1 and 137 percent.
- Initial flows ranged between 6.6 and 21.2 cubic meters per hour.
- Final flows ranged between 10.6 and 29.3 cubic meters per hour.

NON ENHANCED WELLS



- The average methane percentage decreased by 0.82%, with individual wells decreasing between 0.5 and 2.8%.
- Total LFG flow decreased by 4.3%, with individual wells varying between -64% and 23.7%.
- Initial flows ranged between 3.9 and 7.6 cubic meters per hour.
- Final flows ranged between 1.4 and 8.2 cubic meters per hour.
- N205 was selected as a control well but was excluded due to a ~300% increase in flow.
- N205 was surging and then shut prior to the testing occurring, which likely skewed the results.

COMPARISON



- Change in the total methane percentage and flow in control wells was minimal over the test period.
- There was a significant increase in methane percentage and total flow in the moisture enhanced wells.
- The moisture enhanced wells performed substantially better over time as compared to the control wells.
- Even including N205 the total flow for control wells only increases by 7% as compared to 64.4% for the enhanced wells.

CONCLUSIONS

- Gas wells that underwent moisture enhancement saw a substantial increase in methane quality and gas flow.
- There was no substantial change in gas quality or total flow in the control wells.
- When compared to the control wells, the gas wells that underwent moisture enhancement performed substantially better.
- Due to the high number of variables affecting landfill gas generation, the increase in flow and methane content cannot be solely attributed to the moisture enhancement, other factors affecting the gas generation could include (but not limited to):
    - Waste type.
    - Age of waste.
    - Weather conditions.
    - Cover thickness.
    - Quality of cover.
- Questions?