The application of advanced technology to improve water quality while optimizing urban land utilization

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Use of Advanced Treatment Technologies to Optimise Land Utilisation

- Many STPs in developed cities facing issues of:
  - Encroaching neighbours with intolerance of STPs (!!!!)
  - Restricted land availability for expansion and/or upgrade
  - Land value placing further restriction or incentive on STP development

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Asset Encroachment

This is a growing region. More people mean more new homes, schools and businesses, which Anglian Water has a legal duty to provide with water and sewerage services.

That duty means we need room to grow and space to expand our sewage treatment works and pumping stations. This will provide a growing population with services that are vital to our health and well-being. In order to give them room to grow and

Summary of Proposed Wessex Water Planning Policies

1. Proximity Consultation Zones

1.1 Outline Policy Suggestion:
Development proposals in close proximity to existing operational wastewater or water supply infrastructure should be subject to consultation with the infrastructure provider to ensure that the residential or commercial amenity of the proposed development will not be adversely affected by the continued operation of the existing wastewater or water supply infrastructure.

In particular, development proposals which are sensitive to unpleasant odour emissions within 400m of sewage treatment works or 25m of sewage pumping stations will be subject to consultation with Wessex Water to ensure that the proposed development can reasonably co-exist. Within the 400m and 25m consultation zones, development proposals will be assessed against the potential for odour emissions from the facilities and where such emissions would have an unacceptable detrimental impact on the amenity of the proposed development, development will not be permitted unless adequate mitigation is agreed.

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Hartamas STP local Development / Encroachment

- Hartamas STP surrounded by residential and commercial property
- Development continues over last 10 years.
- Development of high class/value properties.

Feb 2004 Jan 2007 Jan 2008 Jan 2010 Dec 2014

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Drivers for Advanced Treatment Technologies

- In addition to the space driver for change:
  - And the associated required improvement in aesthetics, odour and noise,
  - Increased effluent standards
  - Increasing capacity demand
  - Realisation of water value

Parameter	Standard A	Modified Standard A
BOD	20 mg/l	5 mg/l
COD	120 mg/l	60 mg/l
TSS	50 mg/l	50 mg/l
NH_4-N	10 mg/l	2 mg/l
NO_3-N	20 mg/l	-- mg/l

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Currently Applied Treatment Technologies

- From current prescribed technologies:
  - e.g. conventional ASP, TFs SBRs
  - Achieve: Standard A ✓ Modified Standard A ✗
  - Limitation: Actual effluent TSS too high ⇒ BOD (COD) ✗
  - Further challenged by verification (grab sample / absolute)

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Solutions – Application of Advanced Treatment Technologies

- Limited range of technologies that can routinely attain Modified Standard A
- Membranes provide one option.
- For Hartamas this will be developed as a MBR
- Other schemes in Kuala Lumpur catchment: MBR & Tertiary ‘membranes’

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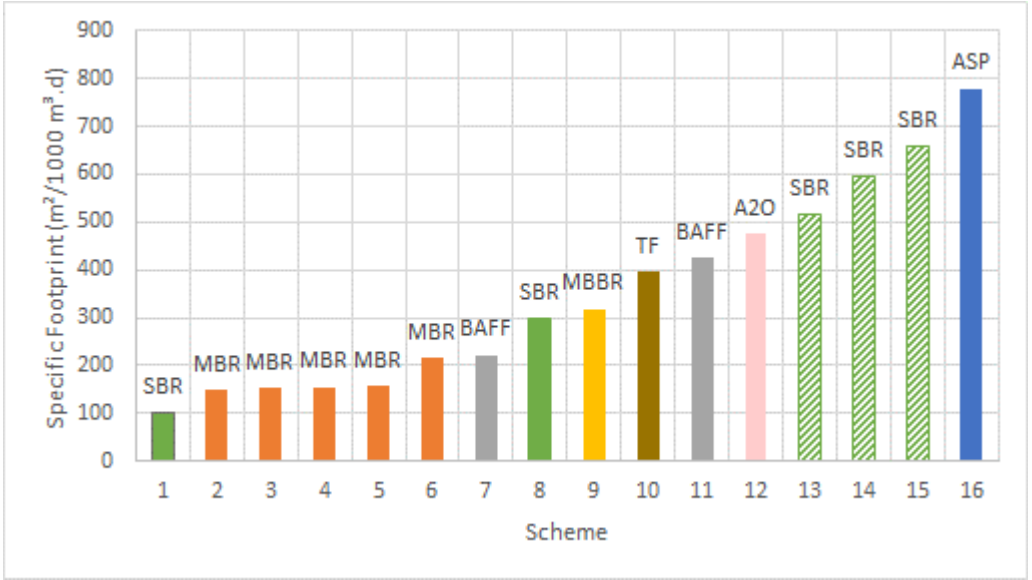
Technology as a Footprint Solution

- Common for Advanced Technologies is a lower specific footprint (m²/1000m³)
- MBRs: typically ≤170 m²/1000m³
- For Hartamas this equates to:
  - ~5,548m² (inc. setbacks), or
  - 154 m²/1000m³.
- ~3.8x smaller than “new” SBR design
- Small footprint frees up 28,774 m² or ~84% of the current plot.



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Hartamas MBR – the solution

- Integration with the local environment
  - Plant fully enclosed to shield purpose
  - Equipment shrouded to suppress noise
  - Process covered where necessary to contain and treat odour.

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Hartamas MBR – the solution

- Compliance with Modified Standard A parameters
- Provision of 2000 m³/d water for non-potable reuse
  - On-site
  - Within development
  - Toilet flushing, cooling, irrigation….

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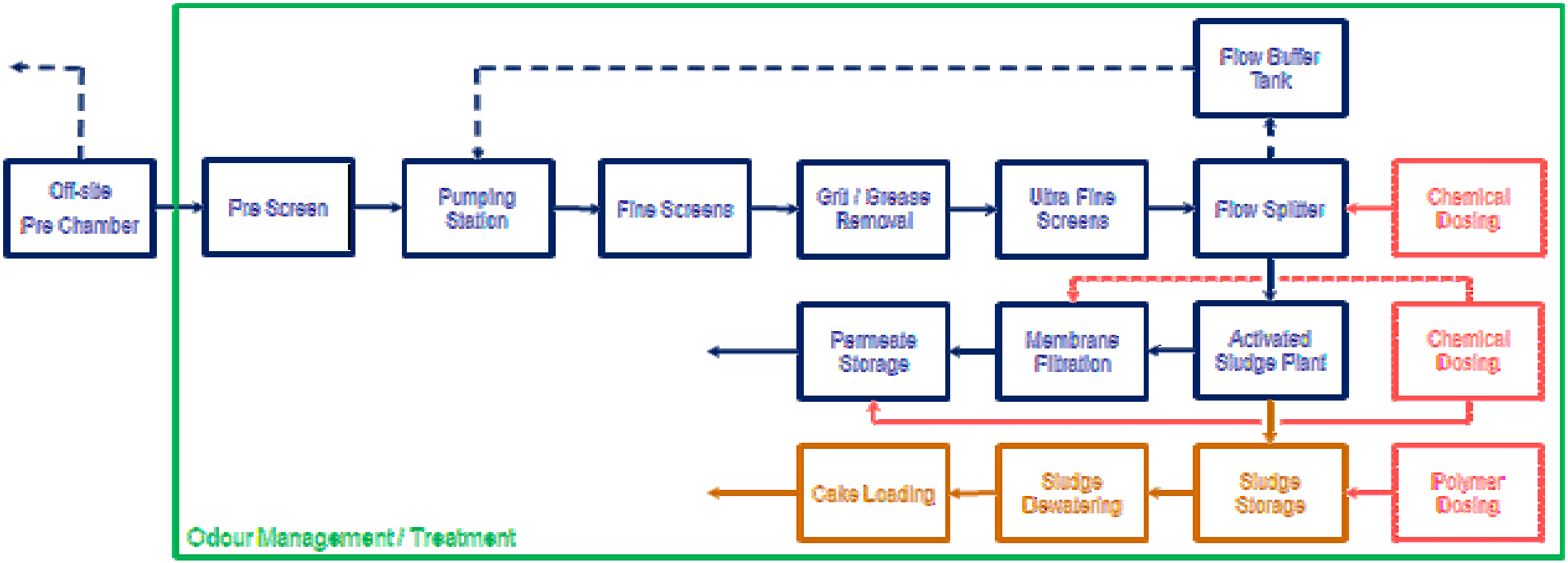
Hartamas MBR – the solution



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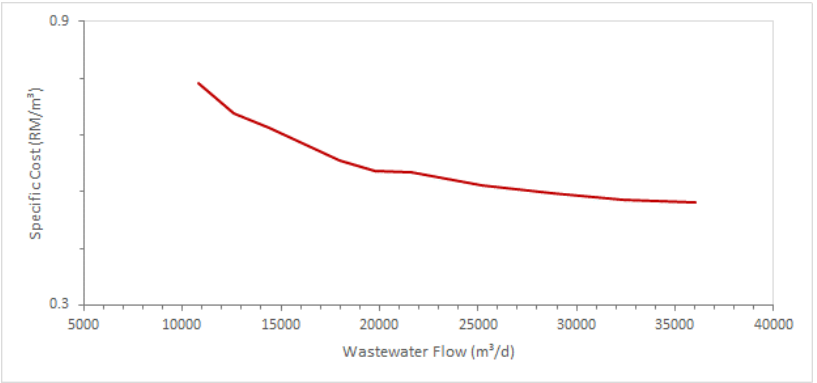
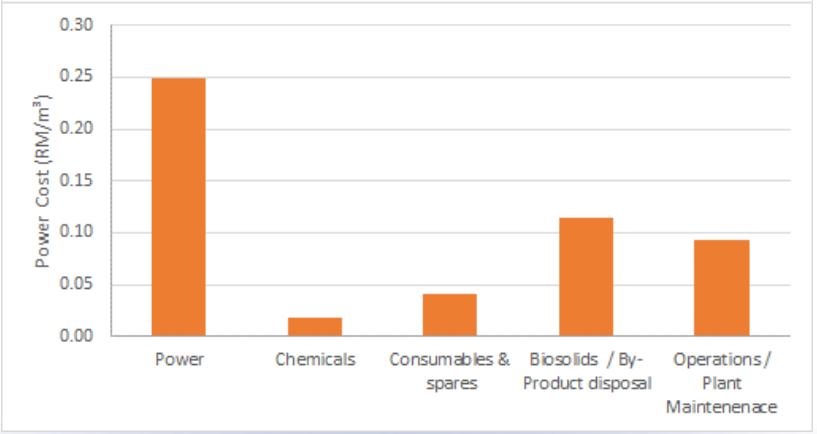
The Design Balance

- Incorporation of advanced technologies requires careful design to minimise the impact on operations.
- Plant opex costs driven by:
  - Flow compared to design
  - Selection of equipment to match actual demand (versus specified design parameters)
  - Intensification and enclosure of the plant.





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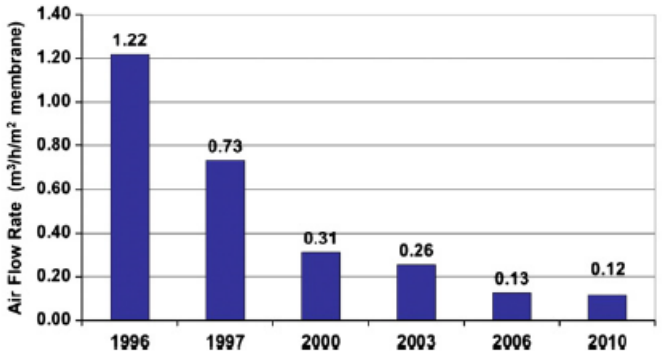
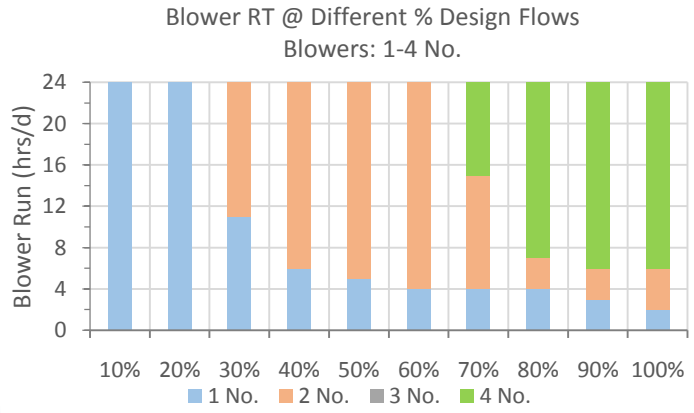
The Design Balance

- Power costs:
  - Process air – removal of BOD/NH_4-N
    - minimised by provision of anoxic recovery, maintenance of sludge age, blower sizing/type.
  - Scour air – maintenance of membranes
    - minimised by control of on/off line membrane trains, blower sequencing and blower sizing/type.



Ref.: Hollow Fibre membrane life in membrane bioreactors, (2012), Desalination, 228, p145-151.



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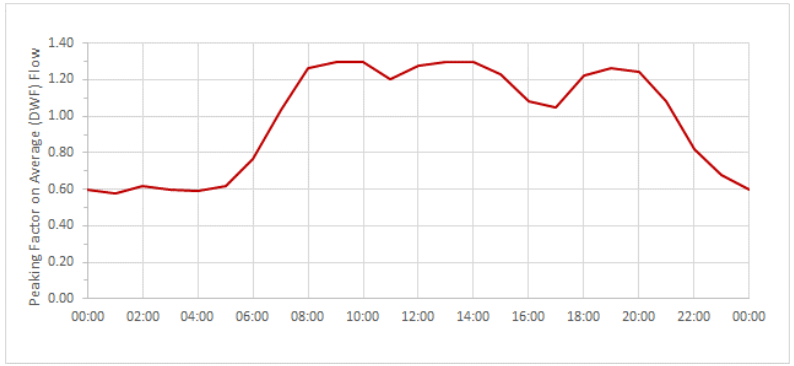
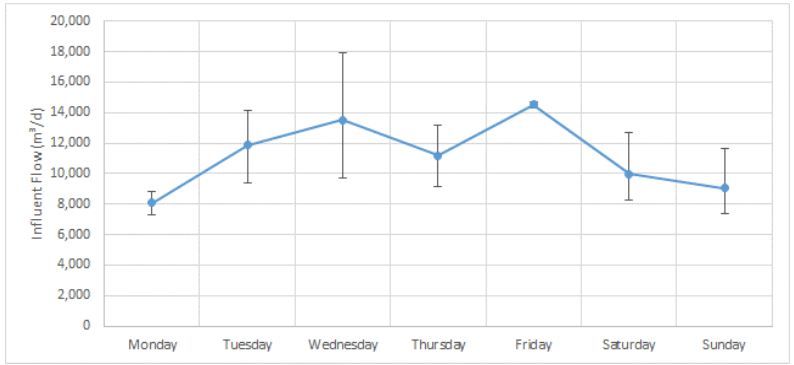
The Design Balance

- Selection of the appropriate equipment size:
  - Detailed understanding of the influent characteristics
    - Flows (m^3/d, m^3/hr), BOD, COD, TKN, NH_4-N, Alkalinity, T°
  - Operation under minimum loads as important as peak
    - Loads (BOD & NH_4-N) govern process air demand
    - Alkalinity and NH_4-N (+ BOD) govern the sludge return rate and process air demand
    - Hydraulic loads governs (in the case of MBRs) the membrane blower and return sludge pump use.
- e.g. No. blowers: (2+1 or 4+1 duty/standby), type (turbo / PD/centrifugal)….





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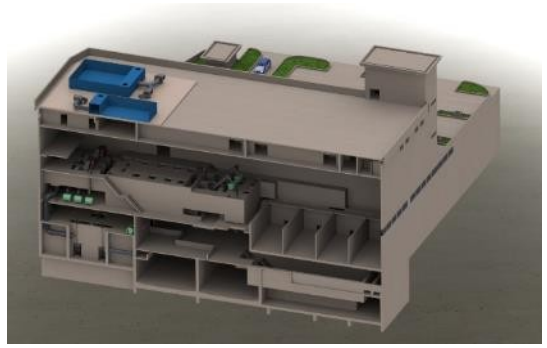
Advanced Technologies as a Niche Solution

- For Hartamas
  - Small footprint solution is able to finance solution,
  - The solution *(inc. other similar Advance Technology schemes under design)*:
    - STP to enhance the local environment – no external evidence of sewage.
    - Compliance to Modified Standard A with:
      - Reliable equipment selection
      - Attentive process and M&E operations
      - Careful sampling and analysis.
    - Effluent reuse is possible:- to be made available.
    - The impact on opex costs of the solution can minimised by design:
      - Balance capex design with actual opex requirements.
      - Process considerations included within the design.



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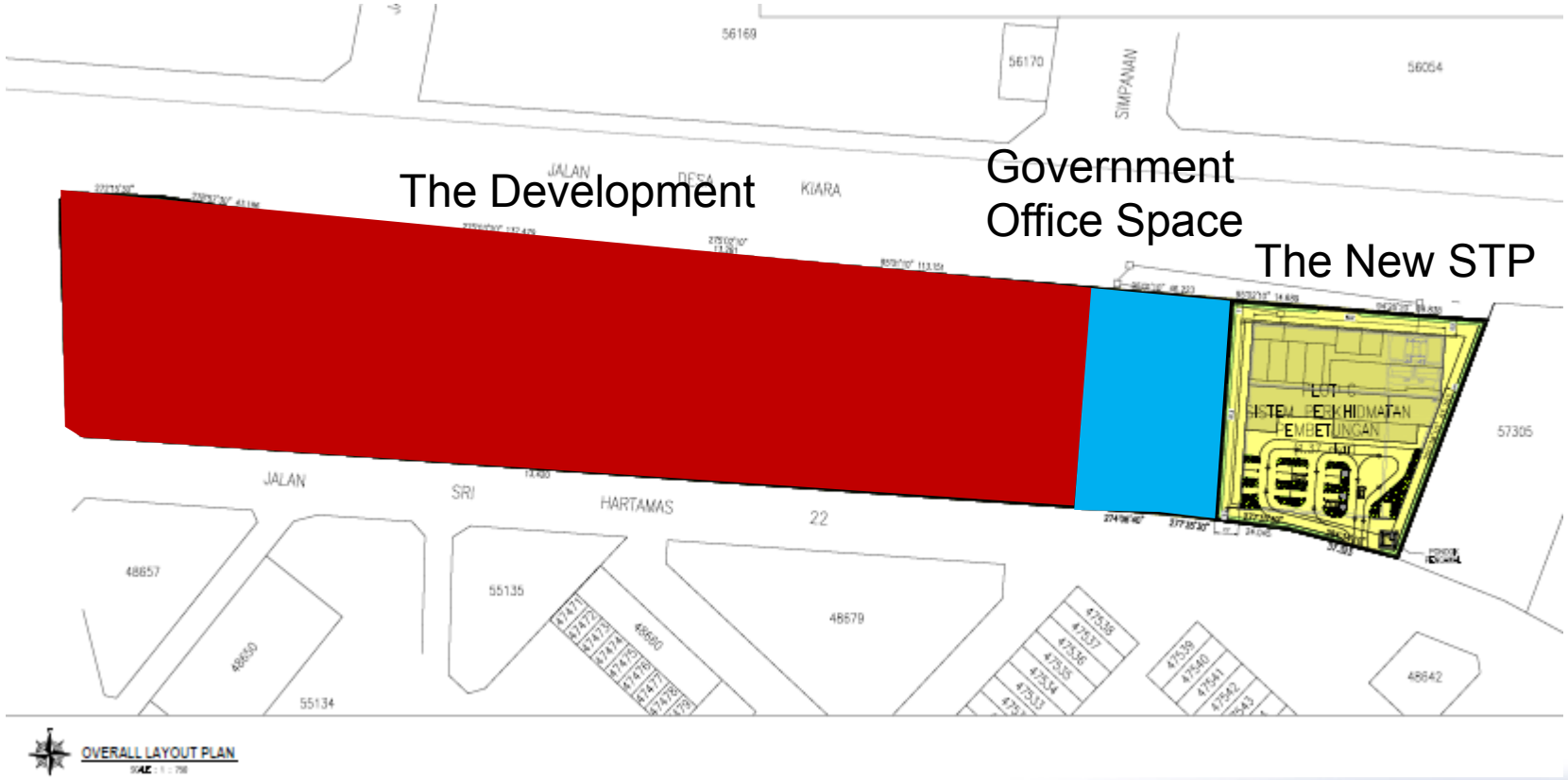
The Hartamas Solution



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