Using GIS to model where Wellington grows

Wellington City Council's experience in modelling capacity for the National Policy Statement on Urban Development Capacity

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Absolutely Positively Wellington City Council
Me Heke Ki Pōneke

What we will cover

- What is the NPS: UDC?
- What is our model?
- The “Black Box” of capacity modelling
- Key issue
- Working with Eagle
- What we learnt
- What happens now?

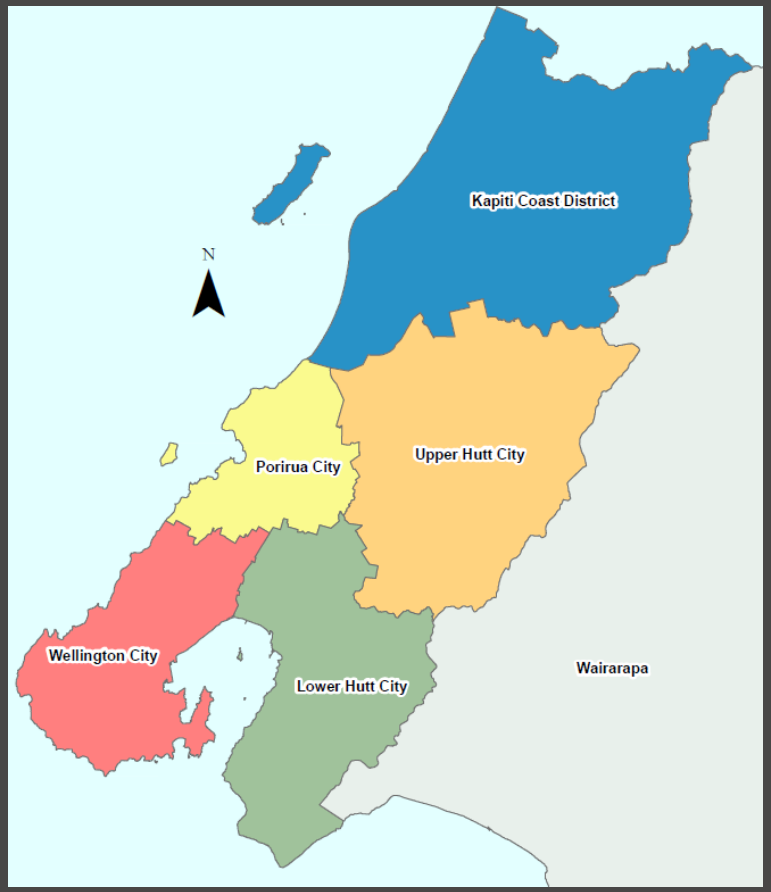
What is the NPS: UDC?

The National Policy Statement on Urban Development Capacity requires councils to test:

- Residential Demand
- Residential Capacity
- Business Demand
- Business Capacity
- Feasibility and realisation

What is the WCC model?

- Infill and Redevelopment Model
- Tests 3 typologies at 3 sizes
- Parcel by parcel
- 5 Council areas

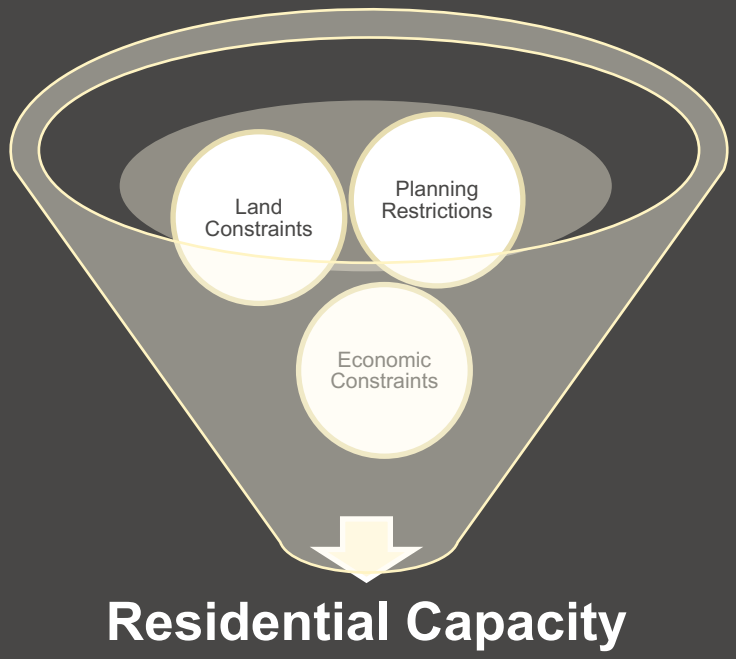


Who's helped us?

- **Eagle:** Yongji Zhang and Zorko Sostaric
- **Economists:** Peter Nunns (MRCagney), Tim Heath and Phil Osbourne (Property Economics)
- **Quantity Surveyors:** Vaughan Plant (Rider Levett Bucknall)
- **Planners, GIS** and **other staff** from the other councils

The “Black Box”

- Data processing
- 3D procedural modelling
- Feasibility
  - Open space
  - Car parking
  - Economic tests



Data Processing

Collect and prepare information from:

- District Plan
- Rates databases
- Other property information
- Terrain Data

Zone	Inner Residential	Outer Residential
Size of open space required	35	50
Front yard required	1m	3m
Site cover limit	50%	35%
Height limit	10m	8m
Building recession plane	2.5m + 45’	2.5m + 45’

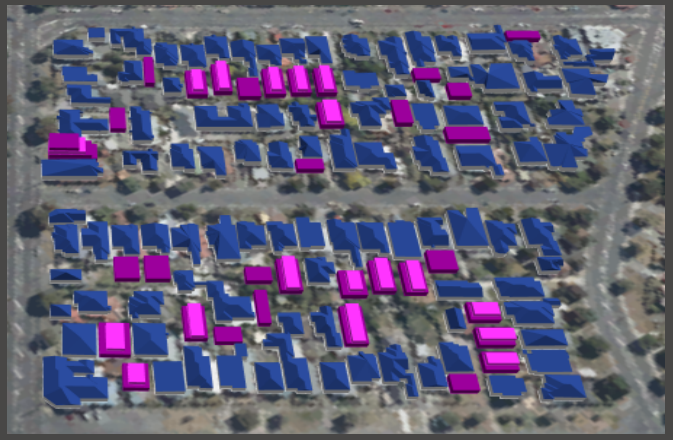
3D Procedural Modelling

- CityEngine
- Test key District Plan provisions:
  - Site coverage
  - Setbacks and recession planes
  - Height limits

3D Procedural Modelling

- Input processed data
- Apply the user-set parameters (e.g. zone, height limits, etc.)
- Run a range of tests and geometric operations

```
1576     case scope.sz < MinimumDimension : NIL
1577     case TrueHeightLimit < FloorHeight : NIL
1578     else : Lot8.4
1579
1580 Lot8.4 -->
1581     alignScopeToAxes(y)
1582     set(WorkingBuildingHeight,scope.sy-PositiveFoundationHeight)
1583     set(WorkingBuildingFootprint,geometry.area(object.bottom))
1584     set(WorkingBuildingFloorspace, floor(WorkingBuildingHeight/FloorHeight) * WorkingBu
1585     MultiunitTest
1586
1587 MultiunitTest -->
1588 #   case (WorkingBuildingFloorspace > 2*Median_Floorspace_Multiunit) :
1589 #       set(MultiSingle, "Multi")
1590 #       set(Dwelling_Size, Median_Floorspace_Multiunit)
1591 #       Lot8.5 RedundantAreas
1592 #   else :
1593         set(MultiSingle, "Single")
1594         set(Dwelling_Size, Median_Floorspace_Standalone)
1595         Lot8.5 RedundantAreas
1596
1597 Lot8.5 -->
1598     case BuildingEnvelopeOnly == true : NIL
1599     else : Lot9
1600
1601 Lot9 -->
1602     case FixedRandomNumber <= PercentageRedeveloped :
1603         alignScopeToGeometry(yUp, any, longest)
1604         SplitCheck
1605     else : NIL
1606
```



3D Procedural modelling

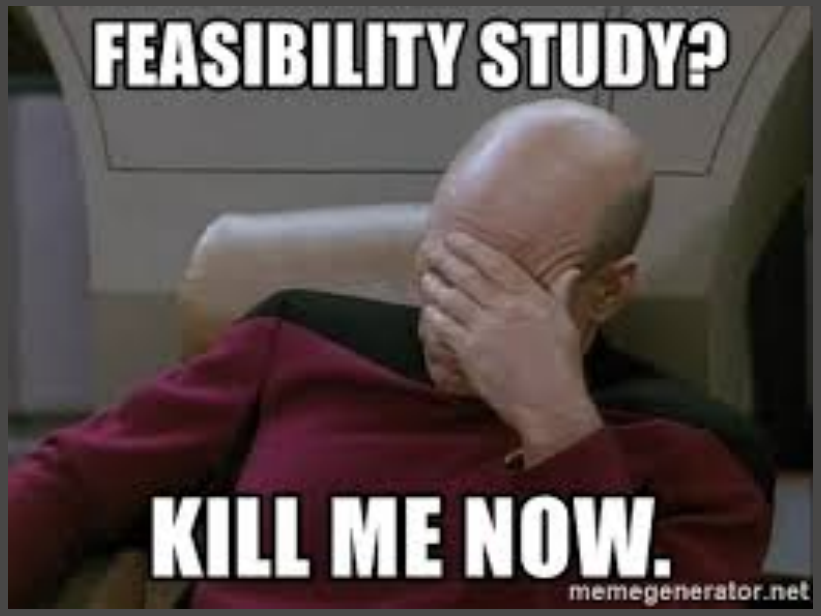
- Produce models of what could be built
- Produce reports on key statistics
- Export the results into ArcMap

Size	CV_Multiplier	Total_Yield	ResidentialConstructionCostPSM
1698.757314	1.3	10	1881
626.246588	1.3	10	2116
901.332909	1.3	10	2116
696.185814	1.3	9	2116
742.141468	1.3	9	2116
854.881621	1.3	9	1881
850.245736	1.3	9	1881
541.811169	1.3	9	2116
820.65533	1.3	9	2116
726.033096	1.3	9	2116
542.873227	1.3	9	2116
868.538829	1.3	9	2116
1149.965368	1.3	8	1950
1686.833266	1.3	8	1722
621.514079	1.3	8	2155
574.346926	1.3	8	2155
752.169563	1.3	8	2155

Feasibility

Test in ArcMap:

- Open space requirements
- Car parking requirements
- “Maximisation”
- Economic tests



Feasibility

- What could ‘realistically’ be built by a developer
- We consider a range of construction, site, professional, and administrative costs.
- The output: Plan enabled and economically feasible development capacity.

	A	B
1	PV WUFI	1093992
2	Res/NonRes	Mixed
3	Dwelling Type	Apartment
4	Development Type	Infill
5	Hard Landscaping	5
6	Soft Landscaping	5
7	Dwelling Size	103.0
8	Total Floorspace	387
9	Total Residental Floorspace	129
10	Useable Residential Floorspace	103
11	Total Non-Residential Floorspace	258
12	Useable Non-Residential Floorspace	206
13	Existing Dwelling Count	1
14	Existing Dwelling Size	360
15	Economies of Scale	1.00
16		
17	Potential Infill Yield	1
	Potential Comprehensive	
18	Redevelopment Yield	
19	Total Potential Yield	1
20		
21	Existing Improvements Value	$240,000
22	Existing Land Value	$670,000
23	Existing Capital Value	$910,000
24	Dwelling Sale Price	$482,965
25		
26	Residential Building Cost per m2 (labour+materials)	$3,138
27	Total Residential Building Cost (labour+materials)	$404,118.97
28	Non-Residential Building Cost per m2 (labour+materials)	$2,000
29	Total Non-Residential Building Cost (labour+materials)	$515,641.95
30	Total Building Cost	$919,761
31		
32	Site Purchase Price	$1,183,000
33	Demolition Cost	$0
34	Landscaping	$2,684
35	Civil Work	$8,946
36	Driveway	$11,808
37	Telephone	$7,156
38	Power	$8,051
39	Water and Wastewater	$16,102
40	Project Manager	$27,593
41	Town Planner	$4,599
42	Engineer	$27,593
43	Architect	$55,186
44	Surveyor	$9,198
45	Geotech	$9,198
46	Legal	$4,599
47	Real Estate Agent	$80,636
48	Resource and Building Consents	$10,735
49	Development Levy	$18,990
50	Rates	$0
51	Construction Costs	$1,486,071
52		
53	Finance	$153,973
54	Contingency	$240,583.18
55	Total Dev Costs	$2,800,388
56		
57	Revenue from existing houses	$1,687,608
58	Revenue from new houses	$482,964.67
59	Revenue from commercial uses	$517,292
60	Revenue	$2,687,865
61	Gross Profit	-$112,524
62	GST	$225,730
63	Net Profit	-$338,253
64	% Net Profit	-12.1%

Key Issue

Maximisation

Conflict between:

- A model that maximises development
- District Plans that control them

Working with Eagle

Eagle provide technical support and development

- WCC diagnose the issue and understand what needs to be done
- WCC then draft a GIS response
- Eagle make it work

What we learnt!

A lot…

- Technical knowledge
- Better processes
- Flexibility is key
- Managing scope is critical
  - Walk before you can run!

What happens now?

A lot…

- Results for 5 Councils
- New assessments due every 3 years
- But most importantly… we use this as a planning tool.