APPENDIX 2 – 2024 BUILDABLE LAND INVENTORY (BLI) AND CAPACITY ESTIMATES

Introduction

This appendix presents the *draft* data in the 2024 Buildable Land Inventory (BLI). This 2024 BLI draft provides a range of potential future scenarios acknowledging the uncertainty in future markets for development capacity. Indeed, the BLI should be considered a forecast in its own right given that uncertainty. Capacity estimates explore a combination of difference scenarios for both vacant and redevelopable land. Additionally, there are several expansion areas added to the UGB in the last several years that are currently in various stages of being made ready for development. In some cases, (i.e. River Terrace 2.0 and Cooper Mountain) urban level zoning do not exist in these areas, so the BLI relies on anticipated capacity from concept plans submitted when areas were added to the Urban Growth Boundary (UGB). In other areas (Witch Hazell Village, South Hillsboro, Frog Pond) master planning is far enough along as to have solid unit estimates. This category also includes estimates for known development sites which override the model estimates.

Local Review

All cities and counties in the region were given several opportunities to review preliminary versions of this data. This draft incorporates edits submitted by the local jurisdictions as a result of their review. Review opportunities were provided to local jurisdictions:

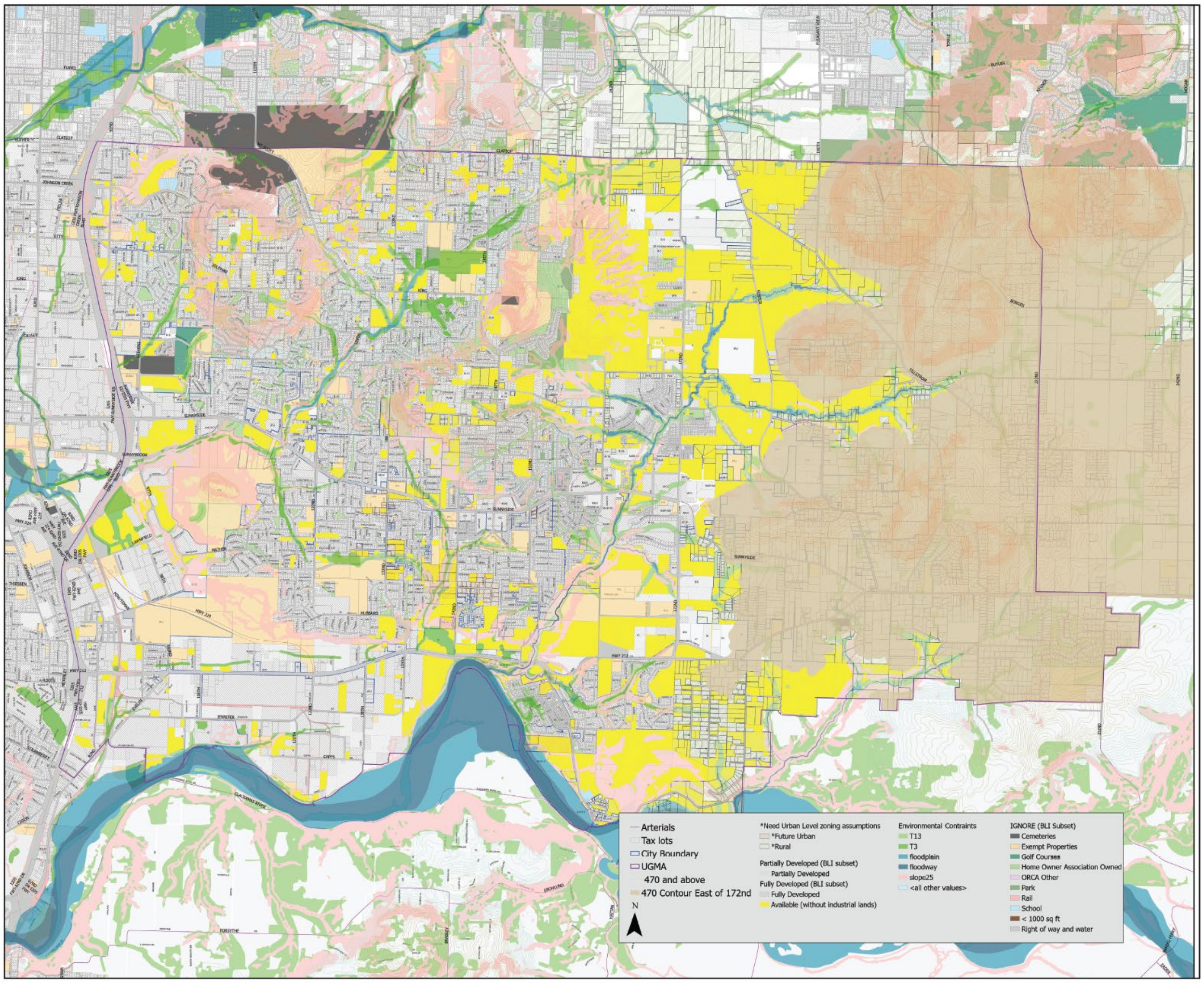
1. After refreshing Metro's regional zoning classifications
2. The tax lot base GIS layer was provided to verify development status, proper zoning assumptions and removal of constraints
3. After the preliminary capacity model runs.
4. After revised model runs.

Damascus BLI Note

Since the last UGR, the City of Happy Valley has committed to eastward expansion into the former City of Damascus. Due to challenges providing urban level utility services, Happy Valley can only commit to developing to the 470-foot elevation contour, a limit set by the Sunrise Water Authority. All other areas to the east are assumed to have rural level zoning in the 20-year timeframe. While those areas contain buildable lands, Metro has not calculated urban growth capacity in those areas to the east.

Map 1, next page, illustrates the foreseeable limits to urban level zoning east of Happy Valley (provided by City of Happy Valley).

Map 1: Limit of development potential in the former City of Damascus area



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- Residential BLI – Vacant land scenarios
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2024 Buildable Lands Inventory Housing Units

Residential Vacant Land Capacity

Expected Density Method - Heavy Middle Housing Mix

Row Labels	Single Family Detached	Middle Housing	Multi-family	Total
BEAVERTON	1,660	2,312	8,283	12,255
CORNELIUS	43	186	557	786
DURHAM	14	20	-	34
FAIRVIEW	101	157	426	683
FOREST GROVE	751	1,460	749	2,959
GLADSTONE	23	30	31	83
GRESHAM	2,050	2,514	881	5,445
HAPPY VALLEY	3,354	5,120	3,378	11,852
HILLSBORO	1,555	2,438	4,077	8,070
JOHNSON CITY	-	-	-	-
KING CITY	5	5	-	9
LAKE OSWEGO	236	365	676	1,277
MAYWOOD PARK	1	1	-	2
MILWAUKIE	442	274	373	1,088
OREGON CITY	2,181	2,348	769	5,298
PORTLAND	3,044	3,496	12,513	19,052
RIVERGROVE	7	11	-	18
SHERWOOD	250	480	187	916
TIGARD	1,823	840	3,413	6,076
TROUTDALE	422	520	62	1,003
TUALATIN	14	82	98	194
UNINCORP CLACKAMAS CO	3,249	4,688	1,538	9,475
UNINCORP MULTNOMAH CO	489	735	24	1,248
UNINCORP WASHINGTON CO	3,785	4,299	772	8,856
WEST LINN	318	543	125	986
WILSONVILLE	359	422	576	1,357
WOOD VILLAGE	24	142	117	282
Grand Total	**26,197**	**33,486**	**39,621**	**99,304**
Percent of Total	26%	34%	40%	100%

Expected Density Method - Heavy SFR Mix

Row Labels	Single Family Detached	Middle Housing	Multi-family	Total
BEAVERTON	1,952	1,818	8,668	12,438
CORNELIUS	50	173	557	779
DURHAM	16	4	-	20
FAIRVIEW	120	47	426	592
FOREST GROVE	931	760	749	2,440
GLADSTONE	26	14	31	71
GRESHAM	2,548	940	881	4,369
HAPPY VALLEY	4,106	1,369	3,378	8,853
HILLSBORO	1,832	1,356	4,077	7,265
JOHNSON CITY	-	-	-	-
KING CITY	6	1	-	7
LAKE OSWEGO	289	96	676	1,061
MAYWOOD PARK	-	-	-	-
MILWAUKIE	516	142	767	1,424
OREGON CITY	2,607	1,056	769	4,432
PORTLAND	3,977	825	14,860	19,662
RIVERGROVE	13	3	-	16
SHERWOOD	312	249	187	748
TIGARD	2,096	292	3,413	5,801
TROUTDALE	533	130	62	725
TUALATIN	16	66	98	180
UNINCORP CLACKAMAS CO	4,276	1,398	1,538	7,212
UNINCORP MULTNOMAH CO	626	162	24	813
UNINCORP WASHINGTON CO	7,128	1,846	995	9,968
WEST LINN	399	214	125	738
WILSONVILLE	540	154	576	1,270
WOOD VILLAGE	28	113	117	258
Grand Total	**34,944**	**13,228**	**42,970**	**91,142**
Percent of Total	35%	13%	43%	92%

2024 Buildable Lands Inventory Housing Units

Redevelopment Scenarios

Baseline Scenario

Jurisdiction	Single Family Detached	Middle Housing	Multi-family	Total
BEAVERTON	2	87	1,504	1,593
CORNELIUS		39	222	261
DURHAM		35	4	39
FAIRVIEW		2	60	62
FOREST GROVE		124	585	709
GLADSTONE		21	2	24
GRESHAM		1,328	2,019	3,346
HAPPY VALLEY	-	1,231	1,578	2,809
HILLSBORO	4	1,596	1,149	2,749
JOHNSON CITY			0	0
KING CITY		0	0	1
LAKE OSWEGO	2,654	61	498	3,213
MAYWOOD PARK		-		-
MILWAUKIE	124	434	516	1,073
OREGON CITY		580	723	1,302
PORTLAND	5,957	812	11,734	18,503
RIVERGROVE	4	8		12
SHERWOOD		782	638	1,420
TIGARD	0	118	872	990
TROUTDALE	3	5	16	23
TUALATIN	7	126	286	418
UNINCORP CLACKAMAS CO	1,027	2,345	1,102	4,474
UNINCORP MULTNOMAH CO	1,489	16	-	1,505
UNINCORP WASHINGTON CO	855	1,291	688	2,835
WEST LINN	2	643	147	792
WILSONVILLE	166	43	19	228
WOOD VILLAGE		0	20	20
Grand Total	**12,292**	**11,727**	**24,382**	**48,400**
Percent of Total	25%	24%	50%	100%

Market Recovery Scenario

Jurisdiction	Single Family Detached	Middle Housing	Multi-family	Total
BEAVERTON	9	202	2,123	2,334
CORNELIUS		88	318	406
DURHAM		59	4	63
FAIRVIEW		9	155	164
FOREST GROVE		314	921	1,236
GLADSTONE		22	22	43
GRESHAM		2,131	2,841	4,972
HAPPY VALLEY	-	2,439	1,766	4,206
HILLSBORO	4	2,398	1,466	3,869
JOHNSON CITY			24	24
KING CITY		1	1	2
LAKE OSWEGO	3,159	61	586	3,807
MAYWOOD PARK		0		0
MILWAUKIE	127	707	609	1,443
OREGON CITY		1,043	928	1,971
PORTLAND	8,112	1,168	20,159	29,439
RIVERGROVE	12	8		20
SHERWOOD		925	739	1,663
TIGARD	26	320	1,151	1,497
TROUTDALE	11	10	45	66
TUALATIN	14	201	370	585
UNINCORP CLACKAMAS CO	1,304	3,593	1,763	6,660
UNINCORP MULTNOMAH CO	1,626	68	-	1,694
UNINCORP WASHINGTON CO	1,531	2,182	1,084	4,796
WEST LINN	7	946	204	1,157
WILSONVILLE	231	56	41	329
WOOD VILLAGE		0	75	75
Grand Total	**16,175**	**18,951**	**37,397**	**72,522**
Percent of Total	22%	26%	52%	100%

Market Erosion Scenario

Jurisdiction	Single Family Detached	Middle Housing	Multi-family	Total
BEAVERTON	-	42	815	858
CORNELIUS		6	135	141
DURHAM		11	1	13
FAIRVIEW		1	0	1
FOREST GROVE		55	276	331
GLADSTONE		-		-
GRESHAM		678	1,144	1,822
HAPPY VALLEY	-	417	1,139	1,556
HILLSBORO	1	892	809	1,702
JOHNSON CITY		-		-
KING CITY		0	-	0
LAKE OSWEGO	2,098	55	328	2,480
MAYWOOD PARK		-		-
MILWAUKIE	120	230	386	736
OREGON CITY		233	395	629
PORTLAND	4,122	453	6,110	10,685
RIVERGROVE	1	5		5
SHERWOOD		653	510	1,163
TIGARD		48	582	630
TROUTDALE	-	0	-	0
TUALATIN	3	73	222	298
UNINCORP CLACKAMAS CO	749	1,506	623	2,877
UNINCORP MULTNOMAH CO	1,358	10	-	1,368
UNINCORP WASHINGTON CO	424	605	357	1,386
WEST LINN	0	375	106	481
WILSONVILLE	102	11	11	125
WOOD VILLAGE		0	-	0
Grand Total	**8,978**	**6,360**	**13,950**	**29,288**
Percent of Total	31%	22%	48%	100%

SCENARIOS	
Market Recovery	ELEVATED PRICING
	- Residential pricing elevated 5% for all parcels
Market Erosion	DEPRESSED PRICING
	- Residential pricing decreased 5% for all parcels

2024 Buildable Lands Inventory Housing Units

New Urban and Other Planned Developments

New Urban Areas

Concept Plan Area	Single Family Detached	Middle Housing	Multi-family	Total	Planning Jurisdiction	Current Jurisdiction
North Cooper Mt	255	45	-	300	Beaverton	WashCo
Cooper Mt.	2,200	1,450	1,350	5,000	Beaverton	WashCo
Kingston Terrace	1,788	572	1,216	3,576	King City	WashCo
River Terrace 2.0a	546	1,775	410	2,731	Tigard	WashCo
River Terrace 2.0b	362	1,177	272	1,810	Tigard	WashCo
Frog Pond South	224	249	25	498	Wilsonville	WashCo
Frog Pond East	436	381	272	1,089	Wilsonville	WashCo
Frog Pond Ridge	63	8	-	71	Wilsonville	Wilsonville
Frog Pond Crossing	29	-	-	29	Wilsonville	Wilsonville
Frog Pond Oaks	41	-	-	41	Wilsonville	Wilsonville
Frog Pond Vista	41	-	-	41	Wilsonville	Wilsonville
Frog Pond Estates	17	-	-	17	Wilsonville	Wilsonville
Frog Pond Other	299	21	-	320	Wilsonville	WashCo
Clermont Wilsonville	89	-	-	89	Wilsonville	Wilsonville
Total	**6,390**	**5,678**	**3,544**	**15,612**		
Percent of Total	41%	37%	23%	100%		

Other Planned Development*

Plan/Area Name	Single Family Detached	Middle Housing	Multi-family	Total	Planning Jurisdiction	Current Jurisdiction
	36			36	Durham	Durham
	300	50		350	Cornelius	Cornelius
	141	80		221	Forest Grove	Forest Grove
	133	32		165	Forest Grove	Forest Grove
	123	62	348	533	Beaverton	WashCo
	118			118	Forest Grove	WashCo
	93			93	Forest Grove	WashCo
Alpenrose	135	172		307	Portland	Portland
Pop Blocks			1,130	1,130	Portland	Portland
Lloyd District			5,000	5,000	Portland	Portland
OMSI District			1,200	1,200	Portland	Portland
Broadway Corridor			2,500	2,500	Portland	Portland
South Hillsboro Area	1,122	578	-	1,700	Hillsboro	WashCo
Witch Hazel Village S	640	182	246	1,068	Hillsboro	WashCo
Total	**2,841**	**1,156**	**10,424**	**14,421**		
Percent of Total	20%	8%	72%	100%		

*Projects in the approval stages that bypassed modeling due to known unit quantities

Total New Urban and Planned

	Single Family Detached	Middle Housing	Multi-family	Total
Total	**9,231**	**6,834**	**13,968**	**30,033**
Percent of Total	31%	23%	47%	100%

Housing type split based on concept plans and/or feedback from local staff

2024 Buildable Lands Inventory

Employment Acres Summary (10% slope exclusion for industrial)

	Commercial Acres						Industrial Acres					
Jurisdiction	**Vacant**	**MUR Vacant**	**Infill**	**Redevelopment**	**New urban and planned**	**Total Commercial**	**Vacant**	**Infill**	**Redevelopment**	**New urban and planned**	**Total Industrial**	**Total Employment**
BEAVERTON	3.8	2.3	3.4	8.9	-	18.5	9.2	6.4	2.3		17.9	36.4
CORNELIUS	6.5	0.1	6.3	-	-	12.9	17.5	4.6			22.1	35.0
DURHAM	-	-	-	-	-	-	0.8				0.8	0.8
FAIRVIEW	0.4	10.6	-	-	-	11.0	72.2	22.8	2.3		97.2	108.2
FOREST GROVE	-	8.5	-	-	-	8.5	77.2	121.6			198.8	207.3
GLADSTONE	0.5	-	-	0.2	-	0.7	0.5	38.3	-		38.7	39.4
GRESHAM	4.9	53.9	1.0	-	-	59.8	185.5	222.7	12.5		420.8	480.6
HAPPY VALLEY	0.0	16.3	-	0.0	-	16.4	179.9	92.3	0.6		272.8	289.1
HILLSBORO	15.3	5.8	6.7	8.1	-	35.8	298.4	419.3	6.0		723.6	759.5
JOHNSON CITY	-	-	-	-	-	-	-	-	-	-	-	-
KING CITY	-	-	3.6	0.5	-	4.1	-	-	-	-	-	4.1
LAKE OSWEGO	-	1.3	-	0.0	-	1.3	-	-	-	-	-	1.3
MAYWOOD PARK	-	-	-	-	-	-	-	-	-	-	-	-
MILWAUKIE	0.1	0.3	-	0.0	-	0.4	0.6	7.0	0.7		8.3	8.7
OREGON CITY	0.4	10.3	10.8	0.7	-	22.2	27.9	56.1	1.8		85.7	107.9
PORTLAND	1.8	26.9	4.4	1.2	-	34.4	521.1	464.6	1.4	65.0	1,052.2	1,086.6
RIVERGROVE	-	-	-	-	-	-	-	-	-	-	-	-
SHERWOOD	4.2	0.3	8.4	1.0	-	13.9	36.9	41.9	3.8		82.6	96.6
TIGARD	2.6	1.5	21.0	13.1	-	38.2	10.7	6.6	5.1		22.4	60.6
TROUTDALE	43.9	4.7	9.7	-	-	58.3	139.0	56.6	0.3		195.8	254.1
TUALATIN	10.6	0.0	5.9	5.3	-	21.8	108.7	94.0	10.2		212.9	234.8
UNINC-CLACK	0.6	6.2	4.5	0.1	4.9	16.3	51.1	146.1	3.5		200.7	217.0
UNINC-MULT	7.7	2.0	35.6	-		45.2	35.0	291.3	(1.5)		324.8	370.1
UNINC-WASH	6.7	0.5	25.7	4.7	28.0	65.5	568.0	608.0	9.2		1,185.2	1,250.7
WEST LINN	-	0.4	-	0.1	-	0.5	3.5	1.2	1.0		5.7	6.2
WILSONVILLE	4.0	0.5	-	2.1	-	6.6	58.4	96.7	(0.5)		154.6	161.2
WOOD VILLAGE	-	21.4	-	-	-	21.4	2.4	4.8	0.0		7.1	28.5
Total	**114.0**	**173.9**	**146.8**	**46.0**	**32.9**	**513.6**	**2,404.5**	**2,802.8**	**58.6**	**65.0**	**5,330.9**	**5,844.5**
Percent Total	22%	34%	29%	9%	6%		45%	53%	1%	1%		

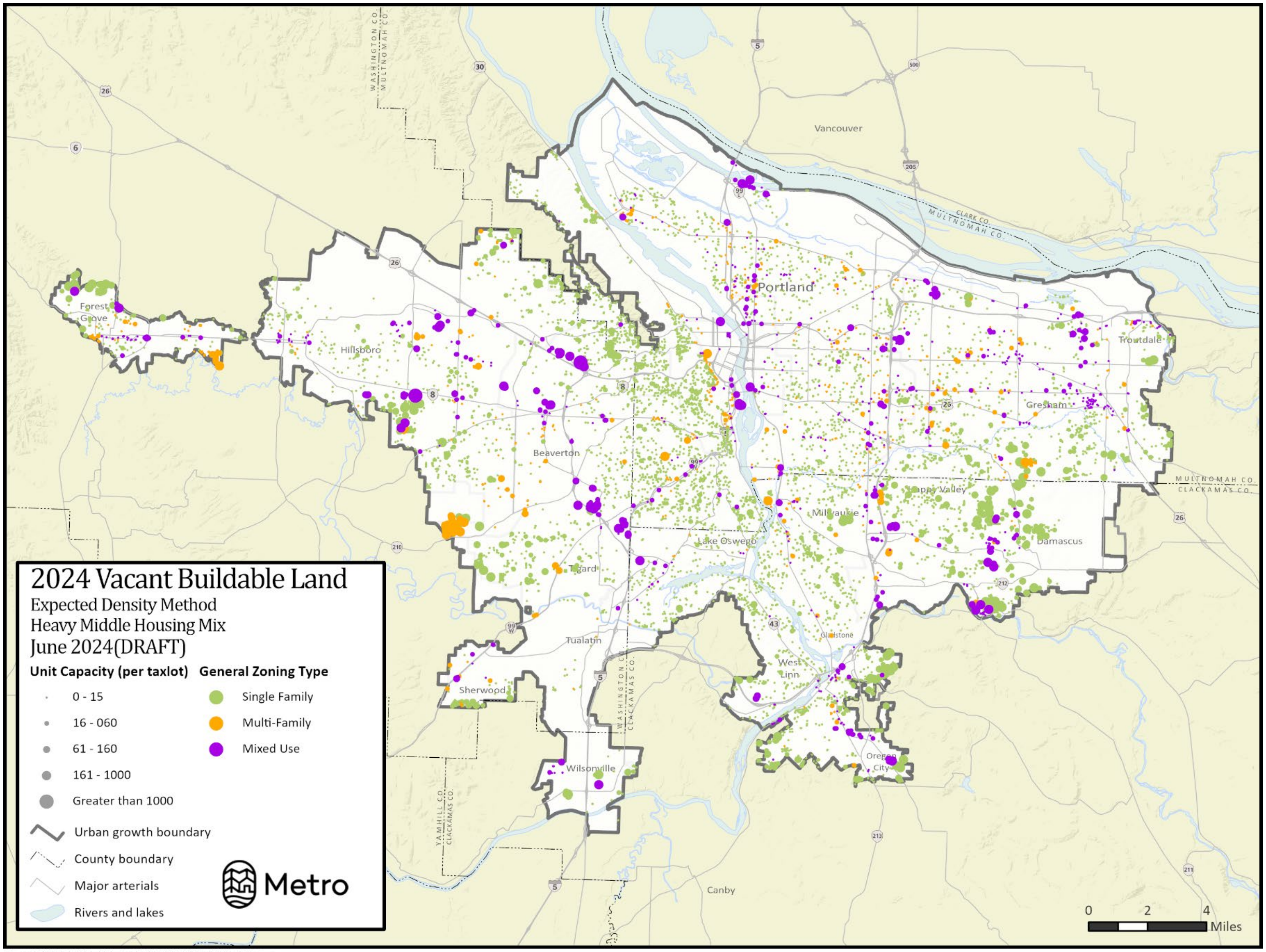
New urban and planned Employment Acres

Development	Acres	Type
Frog Pond East	4.9	Mixed Use (commercial)
River Terrace 2.0	28.0	Mixed Use (commercial)
Riverside Golf	65.0	Industrial

Conversions and accessory dwelling units (ADUs)

	Baseline	Low	High	Housing Type
Office-to-residential conversions	1,000	250	1,500	Multifamily
ADUs and internal conversions	8,692	4,955	11,716	Middle housing

Vacant Residential Map – Expected Density Method, Heavy Middle Housing Mix



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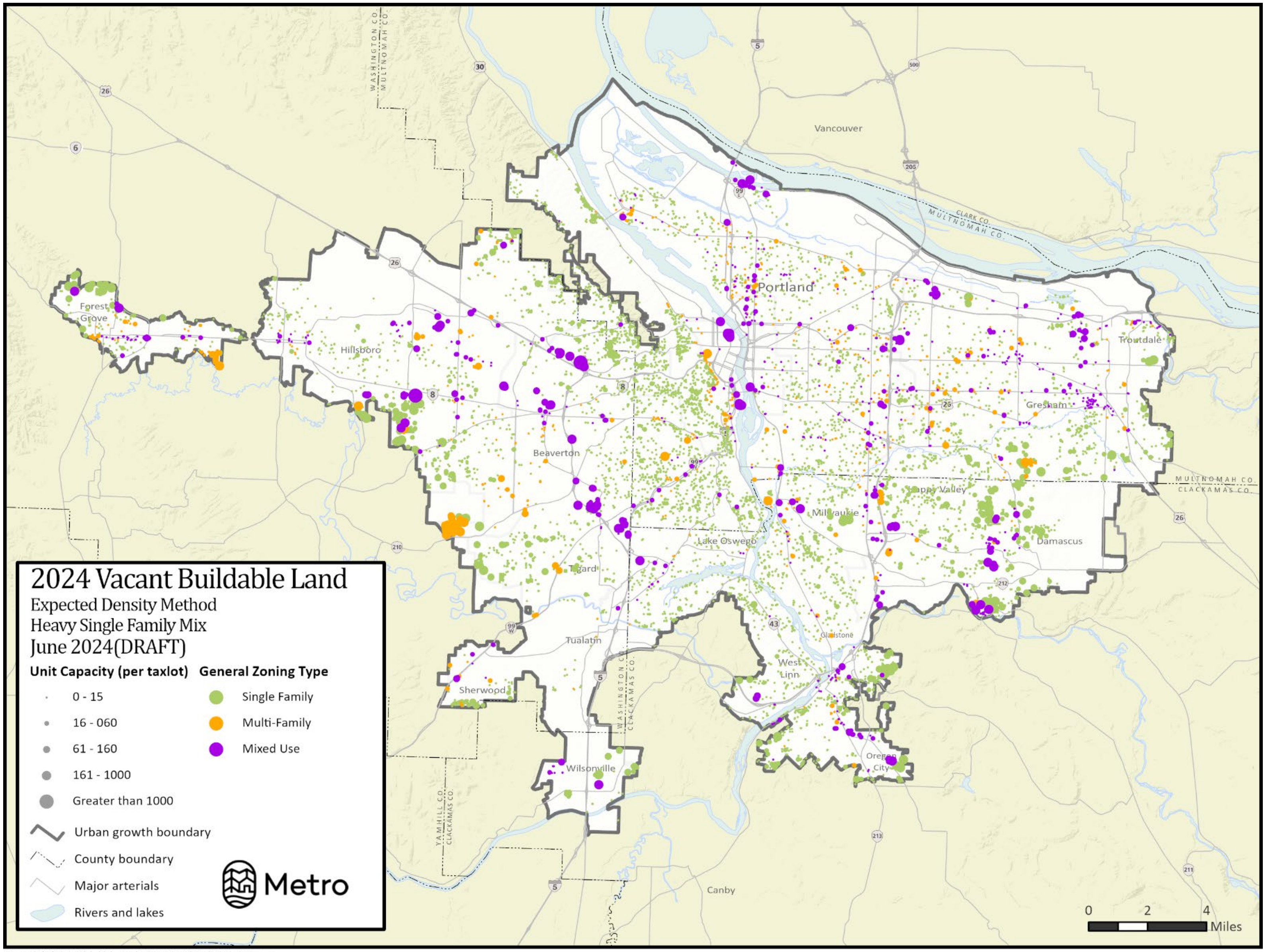
Vacant Residential Map – Expected Density Method, Heavy Single Family Housing Mix



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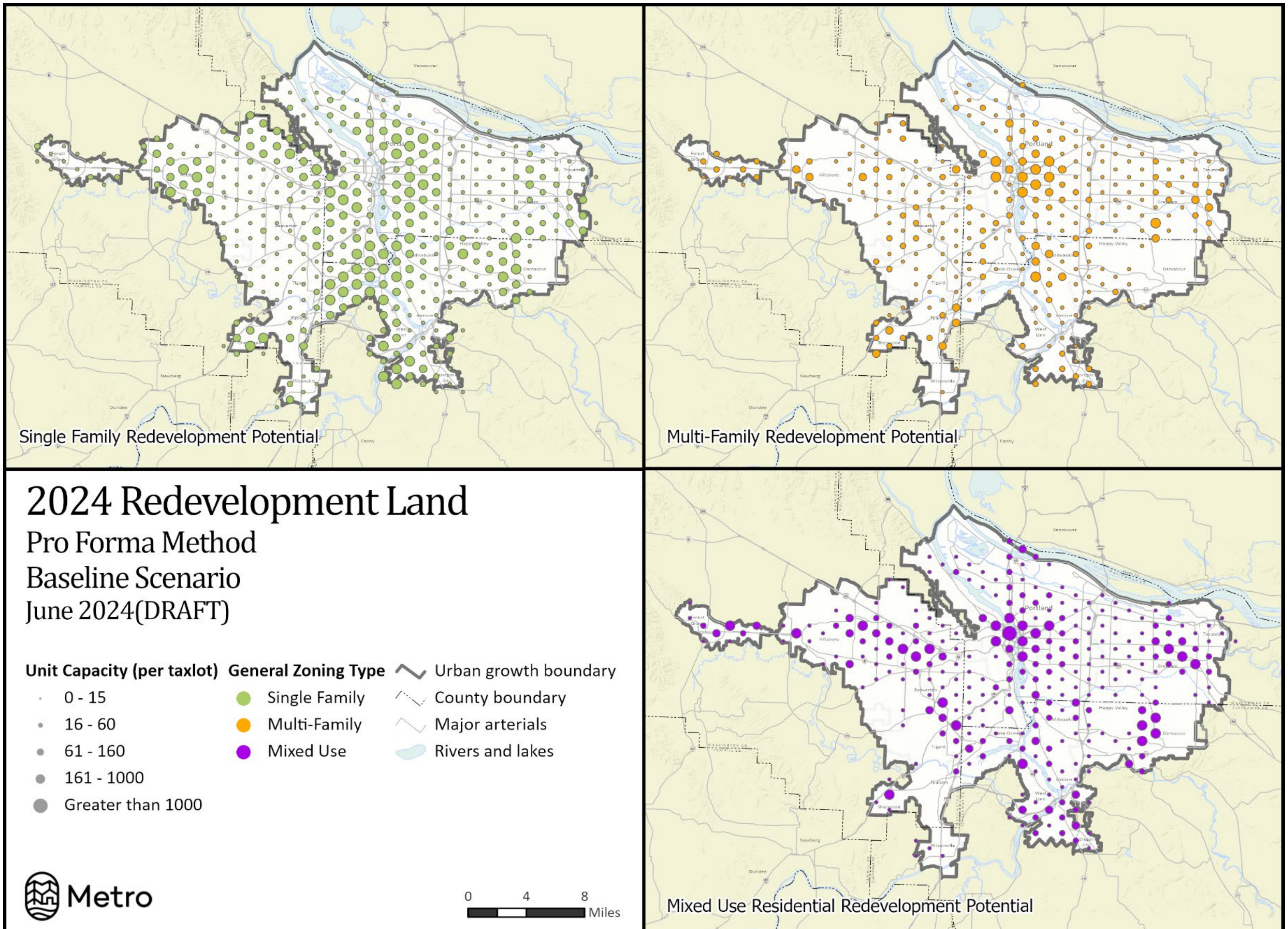
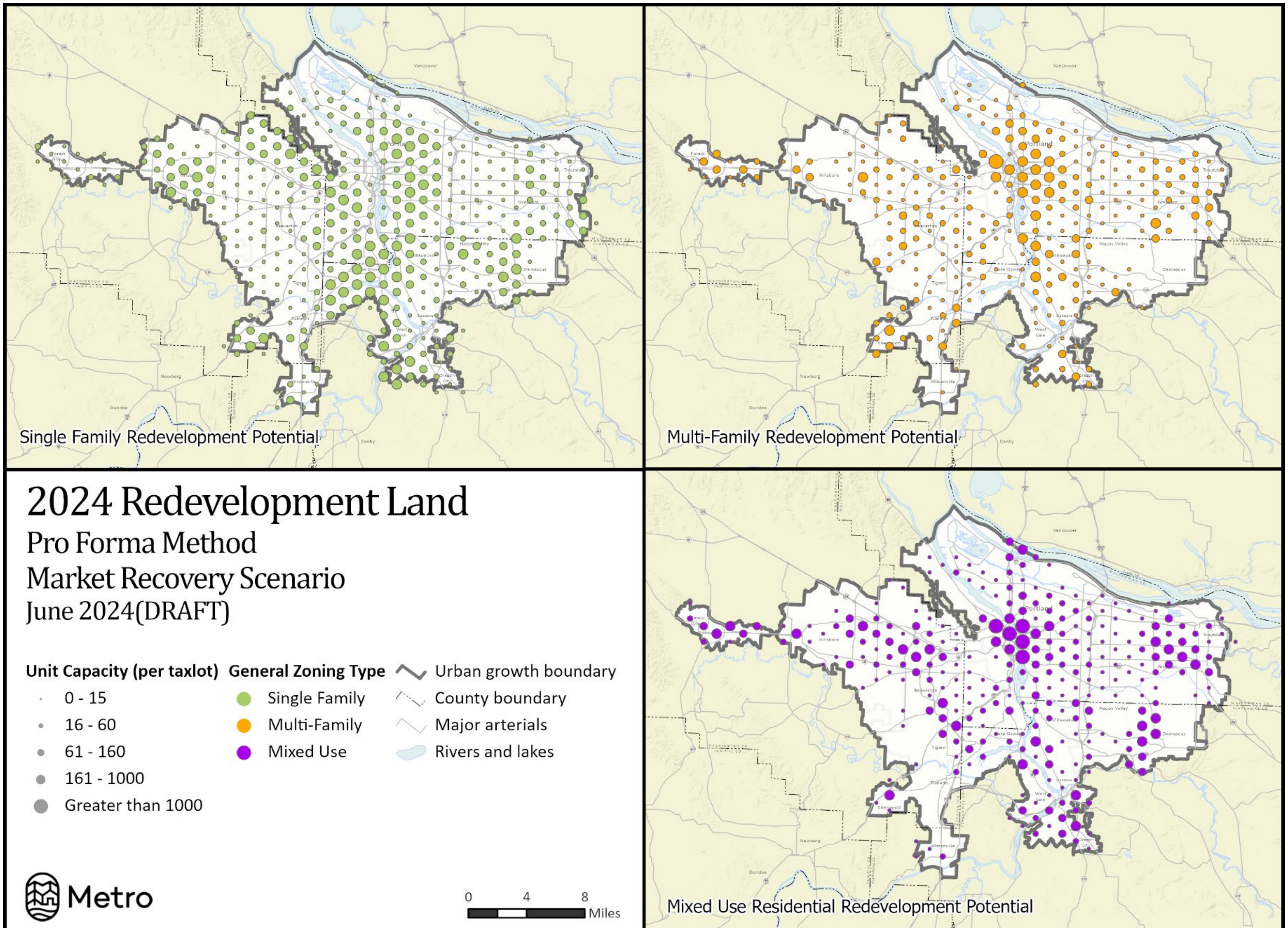
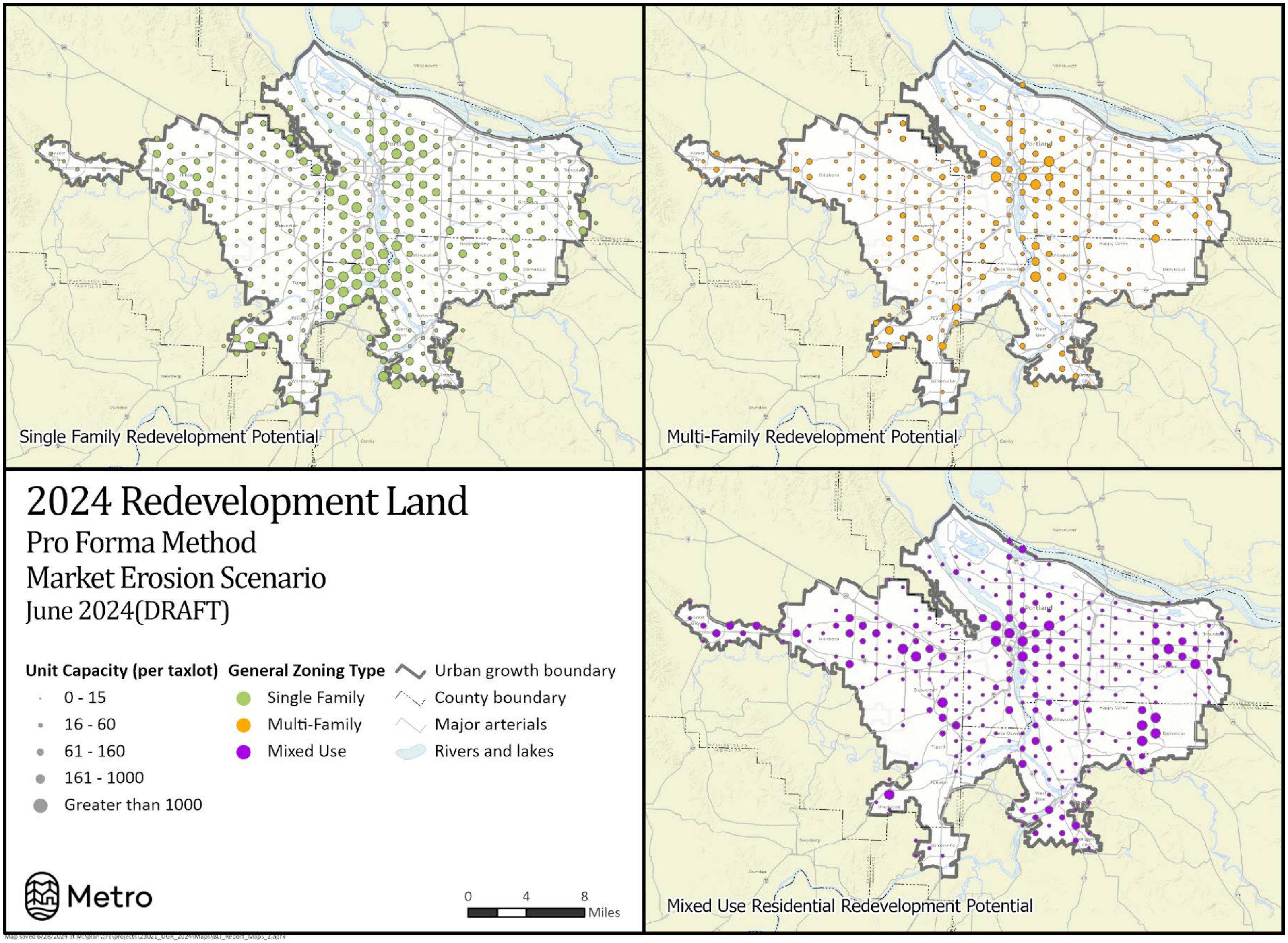
Residential Redevelopment Maps – Baseline Scenario



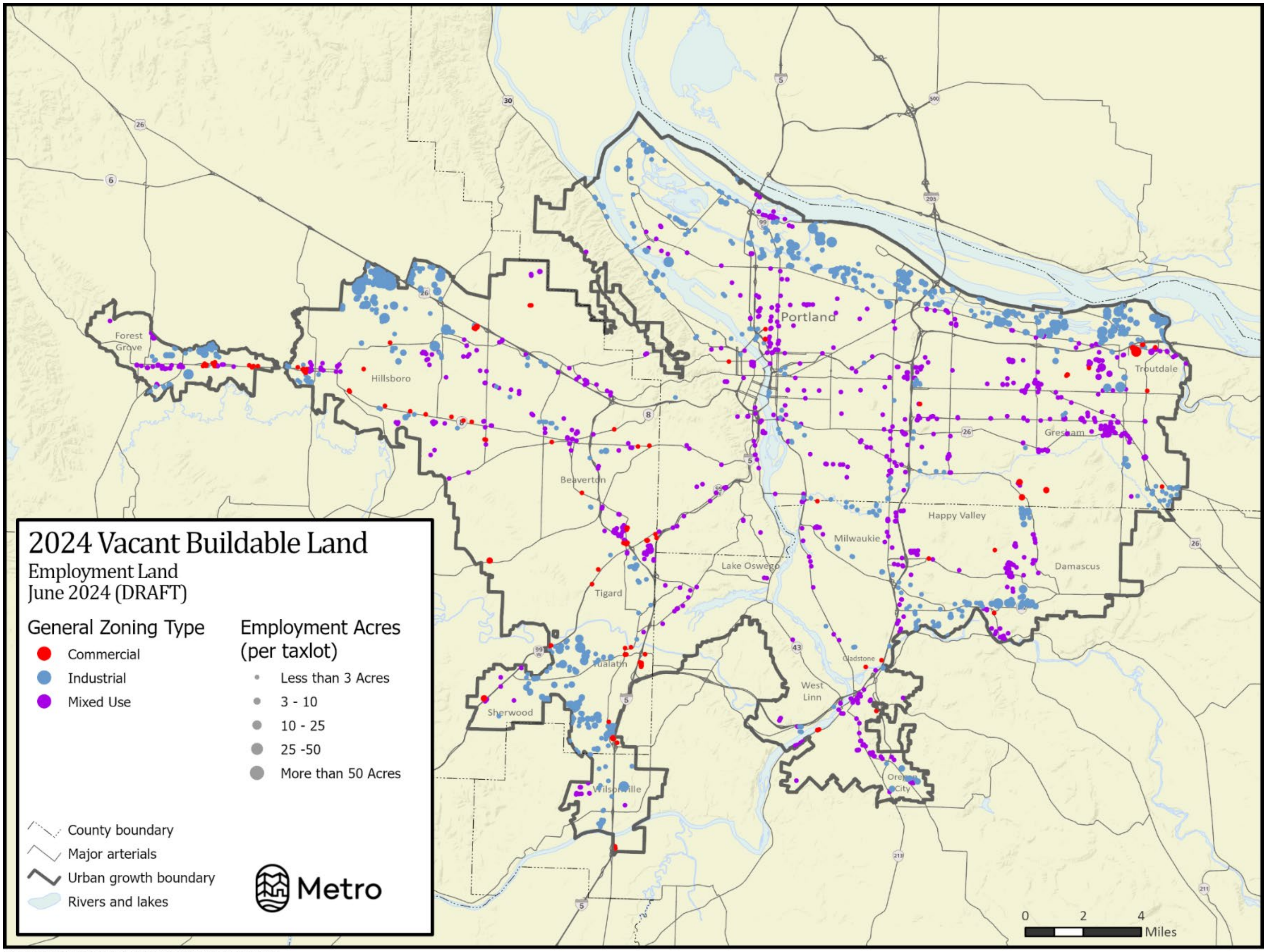
Residential Redevelopment Maps – Market Recovery Scenario



Residential Redevelopment Maps – Market Erosion Scenario



Vacant Employment Map



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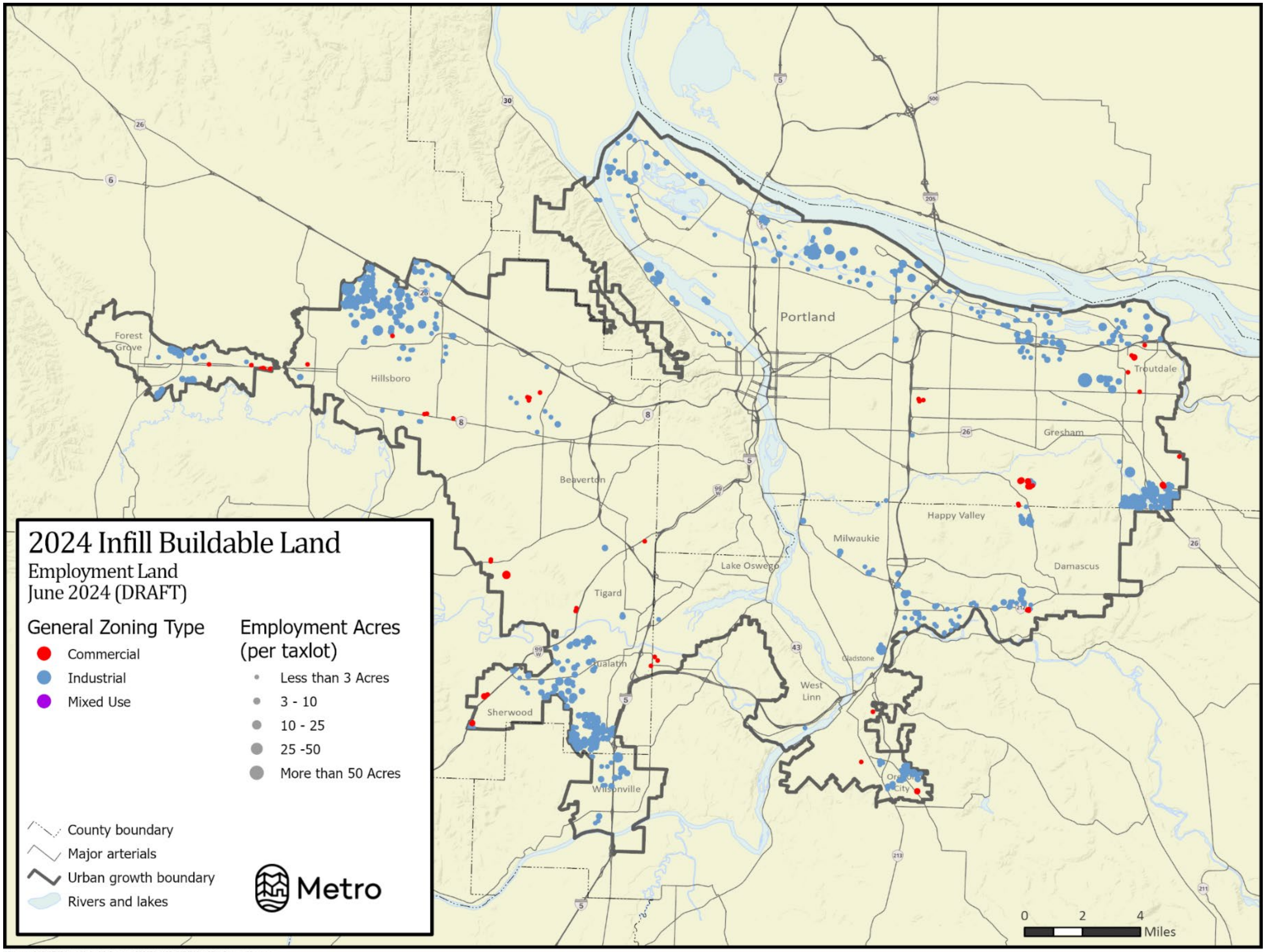
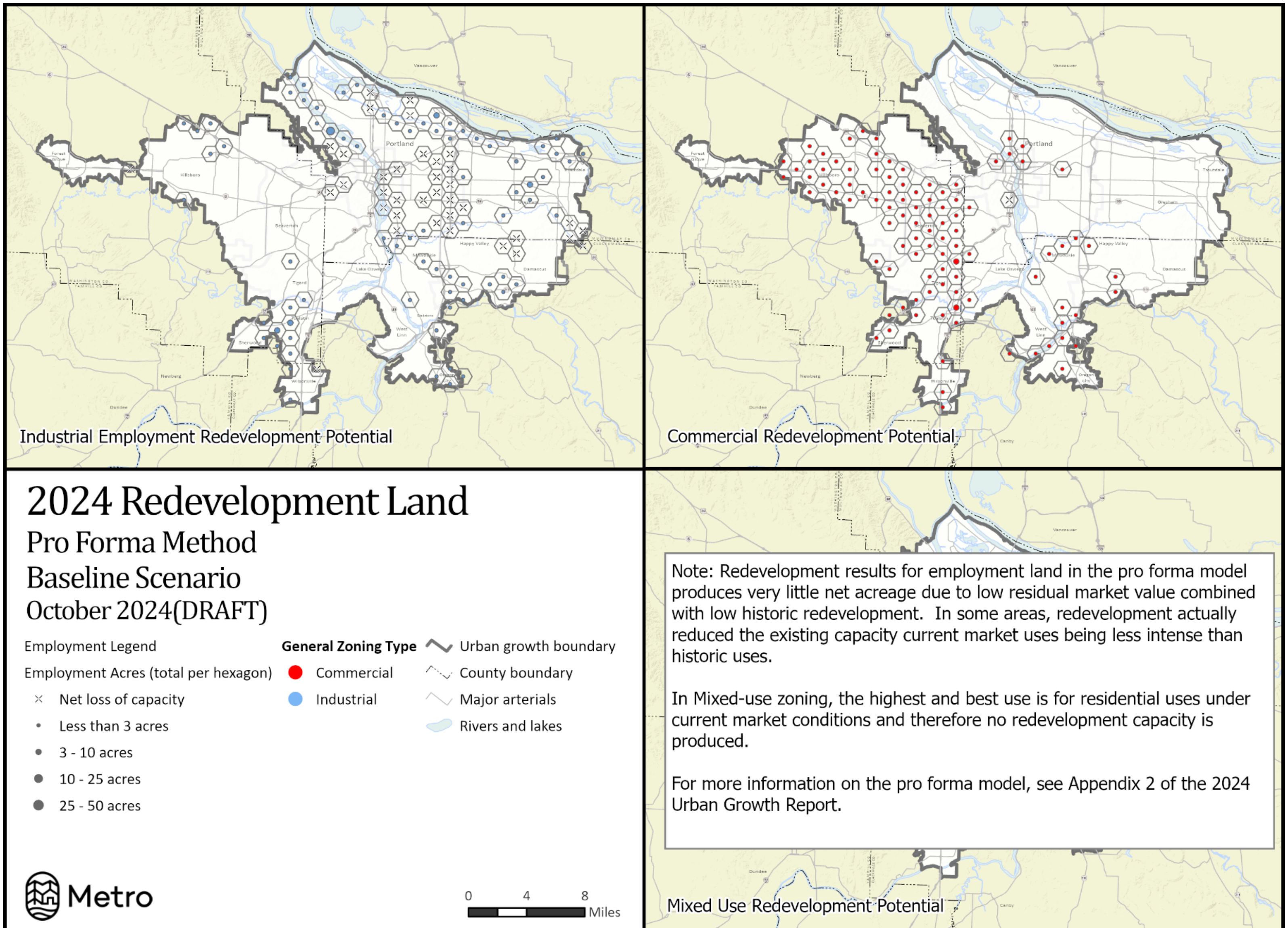
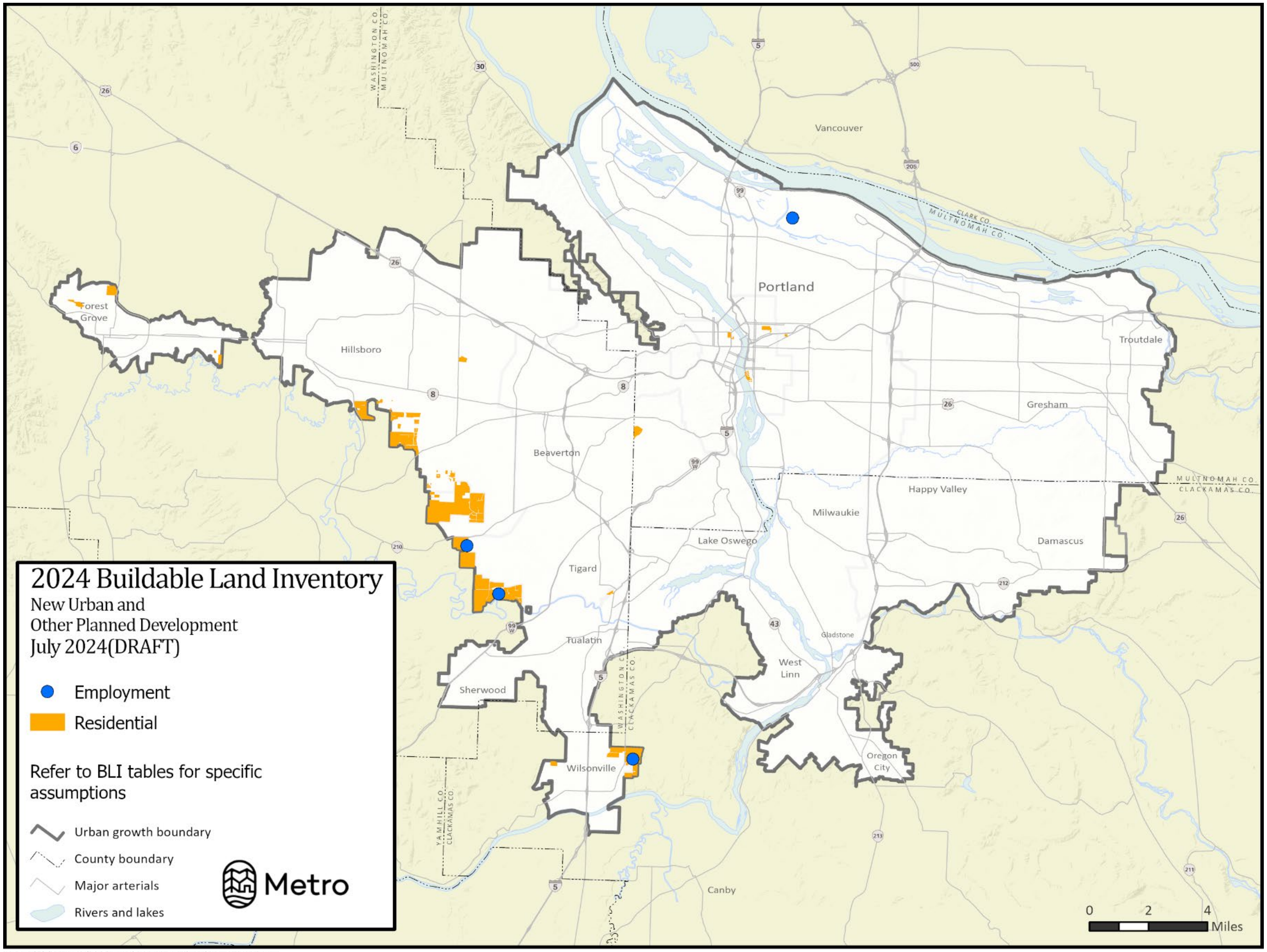
Infill Employment (Land Banked) Map



Redevelopable Employment Map



New Urban and Other Planned Development Map



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GENERAL METHODOLOGY FOR DETERMINING THE 2024 URBAN GROWTH REPORT'S BUILDABLE LAND INVENTORY (BLI)

Background

Under state land use regulations, Metro is required to ensure that its regional plan contains sufficient buildable land within the urban growth boundary (UGB) to accommodate estimated housing needs for 20 years. Metro is mandated to conduct this analysis at least every 6 years in its Urban Growth Report (UGR). The UGR is a basis for the Metro Council's urban growth management (UGM) decision. A technical underpinning of the UGR is its buildable land inventory (BLI) which includes vacant and redevelopable land supply estimates. This document provides a summary of the capacity assumptions and a methodology description of how land supplies are estimated.

During the winter of 2023/2024, all local governments in the region were given an opportunity to review the draft BLI and to suggest revisions to the results. These revisions reflect local knowledge about specific tax lots and properties. More detailed information on recent development trends can be found in Appendix 5.

Forecast analytics for the UGR go through additional steps to determine how much of this buildable land inventory may be market feasible in the 20-year planning timeframe. See Appendix 1 for forecast results.

Peer review of methods

Beginning in the summer of 2023, Metro staff worked closely with a land use technical advisory group (LUTAG) that included about 20 planners from jurisdictions around the region as well as other stakeholders to update the regional BLI methodology originally developed in 2018. The 2018 BLI also benefited from that extensive engagement with local jurisdiction planners. The 2018 advisory group discussed the ambiguity inherent in developing 20-year capacity estimates, particularly on a regional scale. On several topics, the group advised Metro that there was not a clear "right" or "wrong" answer, but helped Metro staff to arrive at methods that are, on the whole, reasonably sound for a regional analysis, and that use the best available information. These assumptions were reviewed by LUTAG (2024) and, except as noted below, the assumptions and methods from the 2018 BLI were used in this BLI.

Uncertainty in the BLI

From the Great Recession to the year-over-year double-digit gains in housing prices preceding and during the Covid-19 Global Pandemic to the highest inflation in 40 years, the last two decades remind us that unforeseen economic and societal changes affect our ability to accurately forecast the future.

Therefore, Metro has produced a range of scenarios for the BLI which, taken together present high-end and a low-end estimates. The range of scenarios acknowledges the uncertainty around future market conditions as well as how developers and property owners will respond to those conditions. While this BLI attempts to establish a whether a 20-year supply of land exists within the current UGB, State law requires periodic review specifically to account for potential future changes to underlying conditions.

GENERAL METHODOLOGY

Step 1: Identify vacant and developed tax lots and classify by regional zoning classification

Step 2: Remove tax lots from the BLI that don't have the potential to provide residential or employment growth capacity (e.g., parks)

Step 3: Calculate deductions for environmental resources[1]

Step 4: Calculate deductions for "future streets"[2]

Step 5: Calculate BLI estimates (BLI includes capacity estimates for vacant and redevelopment)

a) Single Family Residential (SFR)
b) Multifamily residential (MFR) and Mixed Use Residential Capacity (MUR)
c) Employment (industrial and commercial)

Identify vacant and developed land by zoning (or comp plan)

Issue:
The BLI methodology treats vacant and redevelopment as separate categories for clarity and to avoid any double counting of capacity on the partially vacant lots. However, Metro's vacant lands inventory (a basis for the BLI) includes some "partially vacant" land.

Solution:
The region's buildable land inventory is sorted into either *vacant* or *developed* tax lots. A categorization as *developed* does not, however preclude the possibility of redevelopment. For the purposes of this analysis, infill and redevelopment are accounted for by subjecting to economic screens (described in this document) to determine whether they should be counted as **potential** redevelopment capacity.

Vacant land definition[3]:

- Any tax lot that is fully vacant (Metro aerial photo)
- Tax lot with less than 2,000 sq. ft. developed AND developed part is under 10% of entire tax lot
- Tax lots that are 95% or more "vacant" from the GIS vacant land inventory[4]

Developed land definition:

[1] Environmental resources considered include Metro's Title 3, Title 13, FEMA flood way and flood plain, and steep slopes over 25%.
[2] The BLI accounts for future streets on a tax lot-by-tax lot basis. The buildable area of each tax lot is reduced on the basis of individual tax lot size.
[3] Small inconsistencies in the alignment of the tax lot GIS layer and the vacant/developed GIS layer create slivers along property boundaries. In order to deal with this issue, any tax lot that is 95% or more vacant is considered "fully vacant".
[4] GIS tax lot layers change over time as the counties update their parcel base. Because of this, over time, the vacant land layer may develop inconsistencies, resulting in slivers of vacant or developed land that intrude on adjacent tax lots. Setting a 95% threshold prevents full vacant tax lots from being categorized as "developed".

- Part vacant / part developed tax lots are considered developed and will be treated in the redevelopment filter

Rationale:
Categorizing tax lots as vacant or developed (and potentially redevelopable) more closely aligns the inventory approach with that of other local governments and state administrative rules, which refer to vacant and redevelopable land. A lot that might be considered "partially vacant" in older analysis methods are still inventoried but are simply redefined to fit into the vacant or developed categories. Tax lots with fewer than 2,000 sq. ft. developed and a developed part that is less than 10% of the entire tax lot are considered completely vacant with the understanding that tax lots with this condition resemble a fully vacant tax lot. The developed portion would minimally impact new development.

In case of tax lots in employment zones that do not pass through various redevelopment filters, for relatively large tax lots greater than 1 acre, we apply a final screen to include "land banked" parcels into the BLI. These tax lots are categorized as "infill" in the employment summaries of the BLI.

Remove tax-exempt lots, parks.

Issue:
Some vacant tax lots (e.g., parks) should not be recognized as carrying capacity for employment and/or housing going into the future.

Solution:
Remove the following types of tax lots from the residential (and employment) BLI based on Assessor PCA code designations, owner names, assessed values and other data sources:

- Tax exempt with property codes for city, state, federal and Native American designations
- Schools
- Churches and social organizations[5]
- Private[6] "streets"
- Rail properties
- Tax lots under 1,000 sq. ft. (0.023 gross acres)
- Parks, open spaces and where possible private residential common areas

Use the best available GIS data to remove parks, rail yards and railroad properties, major petroleum, natural gas lines and BPA power line right of ways. Parks is a data layer maintained by Metro that includes all parks in the region (e.g., community parks, regional parks, open space areas, golf courses, private common areas, and cemeteries).

<u>EXCEPTIONS:</u>
Included in Residential Capacity Calculations the following list of exemptions:

- Housing Authorities (not just Portland)

Included in Employment Capacity Calculations the following list of exemptions:

[5] Based solely on tax exempt codes.
[6] This was used for SFR, MFR and MUR zoning only. It proved problematic for COM and IND zoning

- Port of Portland
- Portland Development Commission

Rationale:
Tax lots that are not capable of supporting future employment and/or housing because of use restrictions should be removed from the BLI.

Calculate Environmental Constraints

Issue:
Local governments vary in how they implement environmental regulations found in Urban Growth Management Functional Plan Title 3 (Water Quality and Flood Management) and Title 13 (Nature in Neighborhoods). Moreover, estimation of residential housing capacity of tax lots (TL) with environmental impact may vary substantially on a case by case basis. Typically, ***density transfers*** from the environmentally impacted portion of a tax lot to the unconstrained part of the tax lot may vary significantly depending on the environmental impact and city regulations.

The capacity calculations for environmentally constrained tax lots recognize residential density transfers and Title 13's more flexible protections, which are applied on a site-by-site basis during the development review process. Generally, under Title 13, development is to avoid, minimize, or mitigate (in that order) designated habitat areas. Typically, precise delineations of habitat conservation areas are identified during the site development process. Therefore, the data and BLI calculation methods are more appropriate at a higher geographic scale than individual tax lots. The residential capacity computation (though accurate at a regional or subregional scale) may **NOT** accurately portray the precision needed to calculate the environmental deduction for each tax lot. This may also affect the calculation for the transfer of density from the environmentally constrained area to the unconstrained part for individual tax lots, but we believe that on balance, the variance in the calculation of net density and net residential capacity offset each other over the entire region.

For the 2018 BLI, a technical working group was asked to provide advice on how to handle capacity assumptions in Title 13 areas. The group agreed that counting full residential capacity was not appropriate, but that discounting all capacity was not appropriate either. Metro staff then sent an e-mail inquiry out to all local jurisdictions in the region to determine their jurisdictions' historic development experience in Title 13 areas. Metro staff received varied responses with many caveats that preclude meaningful summarization. In the end, this inquiry did not produce a clear answer. Aside from the fact that Title 13 gets interpreted on a site-by-site basis, another challenge is that local implementation of Title 13 is fairly recent, which means that there is not a lot of development experience from which to draw (particularly in light of the Great Recession). Given this ambiguity and the fact that Title 13 areas comprise a relatively small portion of the region's single-family zoned vacant land (approximately 5.5%) and even less of its multi-family zoned vacant land (approximately 0.5%), Metro staff determined that the most reasonable approach was to rely on percentages found in the Title 13 Model Ordinance. This is the best available information and is being used on the advice of the BLI technical working group. These assumptions were reviewed by LUTAG in late 2023, early 2024 and agreed that they were still the best approach for calculating environmental constraints.

Solution:
Most areas that are considered environmentally sensitive fall into multiple categories of overlap including Titles 3 and 13, or are in a floodway or flood prone soils, or include steep slopes or some other ecosystem feature. Metro employs an environmental hierarchy to classify the environmental features to avoid double counting the capacity deduction for the BLI. BLI reductions will reflect the higher assumed protections when environmental features are overlapping.

Methods differ for single-family, multi-family, and employment lands. Generally, using the best available GIS data:

- Remove 100% of the area of floodways
- Recognize environmental constraints such as slopes over 25% and as defined by cities and counties under Title 3 and Title 13. In many instances, the delineation of the environmental buffers are GIS modeled data; where available we utilize environmental buffers from local government GIS data
- By assumption, permit 1 dwelling unit (DU) per residentially-zoned (SFR, MFR, MUR) tax lot if environmental encumbrances would limit development such that by internal calculations no (zero) dwelling units would otherwise be permitted ("essentially avoid takings")

As a result, we define the following land area calculations (used in formulas below):
Vacant buildable = Calculated area of TL – utility easements – parks – railroads – tax exempt sites
Net unconstrained[7] = vacant buildable – environmental constraints

The "calculated area of TL" is the GIS calculation of area (sq. ft.) of the tax lot as defined in Metro's GIS tax lot data layer. (Generally, individual tax lots are not affected by utility easements, parks, railroads or other tax exempt uses, but on a regional scale, these factors add up to be somewhat significant and therefore handled in the regional BLI calculations for the UGR capacity estimates.) Environmental constraints are handled as follows (by land use type):

<u>Single-family residential</u>

1. Floodways: 100% removed
2. Slopes > 25% and Title 3 treated the same way: 100% removed
    a. If tax lot > (or equal to) 50% constrained, follow the "maximum capacity rule" (defined below) to add back units[8]
    b. If tax lot is <50% constrained, assume 90% of unconstrained area is in BLI (i.e., apply 10% discount to vacant buildable acres)[9]
3. Title 13: 50% of Title 13 constrained acres removed from BLI (consistent with Title 13 model Ordinance).
4. Floodplain: 100% removed

[7] This is the calculation for SFR, MFR and MUR. The calculation for COM and IND is a 100% deduction of environmental constraints.
[8] This add back represents Metro's approach for estimating / calculating the density transfer to mitigate the loss of potential development productivity for dwelling units.

[9] Based on feedback from 2018 BLI working group, including local experience.

5. Assume at least one unit per tax lot, even if fully constrained

Multi-family residential
1. Floodways: 100% removed
2. Slopes > 25%: 100% removed
3. Title 3: remove 50% of the constrained land with the other 50% considered buildable
4. Title 13: 15% of Title 13 constrained acres removed from BLI (consistent with Title 13 Model Ordinance)
5. Floodplain: 50% removed
6. Assume at least one unit per tax lot, even if fully constrained

Industrial and commercial
Employment zoned land applies a simple approach of netting out all constrained land. This is based on the input of the BLI technical working group, which indicated that constrained areas are typically avoided altogether by new commercial or industrial employment uses.

1. Floodways: 100% removed
2. Slopes:
   a. Mixed-use and Commercial - slopes greater than 25%: 100% removed
   b. Industrial - slopes greater than 10%: 100% removed.
3. Title 3: 100% removed except for the Portland Harbor Access Land where a 70% discount rate is applied[10]
4. Title 13: 100% removed

NOTE: Although State law does not provide any specific guidance on slopes in non-residential land, during the Draft Urban Growth Report comment period DLCD staff provided input to remove slopes greater than 10% for industrial zoned land based on industry trends.

Calculate deductions for "future streets"

This BLI methodology sets aside a portion of the vacant land supply (not redevelopment supply) in order to accommodate future streets and sidewalks. This assumption is calculated on a per tax lot basis:

- Tax lots under 3/8 acre assume 0% set aside for future streets
- Tax lots between 3/8 acre and 1 acre assume a 10% set aside for future streets
- Tax lots greater than an acre assume an 18.5% set aside for future streets
- Industrial (IND) zoning assumes a 10% set aside regardless of size.

The basis for these net street deduction ratios derive from previous research completed by the Data Resource Center and local jurisdictions for the 2002 UGR. These assumptions were presented to LUTAG and revalidated for this analysis.

[10] Based on input from City of Portland staff.

Vacant Land Calculations

Calculate single-family and middle housing residential capacity

Issue: In 2019, the Oregon Legislature passed House Bill 2001 which required cities and counties allow duplexes, triplexes, fourplexes/quadplexes, cottage clusters, and townhouses in residential areas by July 2022, essentially doing away with traditional "single family" zoning which previously limited uses to predominantly single unit detached homes. Collectively these housing types are referred to as "middle housing" and can develop at densities significantly higher than traditional detached single-family development. While some homebuilders are starting to make greater use of these types of dwellings in their portfolios in the last 2 years, the overall numbers are relatively small making traditional forecasting difficult. To address this inherent uncertainty, Metro relied on the expertise of ECOnorthwest, a consulting firm of planners and economists with extensive development and planning experience working in and with local jurisdictions in the Metro region to create a range of possible development scenarios resulting from HB2001.

Expected Density Methods

Expected Density Method – Heavy middle housing mix

This scenario anticipates higher use of middle housing within the Metro region as more affordable products. The assumed densities and housing mix in the table below were applied to Vacant SFR land as well as lower density multifamily and mixed-use residential zones (MFR1, MFR2, MUR1, MUR2).

Baseline Expected Density Method Assumptions

	Assumed Housing Mix			Assumed Density by Type			
	SF	MH	MF	SF	MH	MF	Weighted Avg
SFR1	40%	60%	0%	5.4	18.0		13.0
SFR2	50%	50%	0%	9.7	20.0		14.8
SFR3	70%	30%	0%	17.4	26.0		20.0
MFR1	0%	50%	50%		20.0	20.0	20.0
MFR2	0%	25%	75%		25.0	25.0	25.0
MFR3	0%	0%	100%			35.0	35.0
MFR4	0%	0%	100%			45.0	45.0
MFR5	0%	0%	100%			84.0	84.0
MFR6	0%	0%	100%			185.0	185.0
MFR7	0%	0%	100%			338.0	338.0
MFR5	0%	0%	100%			99.0	99.0
MFR6	0%	0%	100%			185.0	185.0
MFR7	0%	0%	100%			338.0	338.0
MUR1	0%	50%	50%		22.0	22.0	22.0
MUR2	0%	25%	75%		28.0	28.0	28.0
MUR3	0%	0%	100%			43.0	43.0
MUR4	0%	0%	100%			58.0	58.0
MUR5	0%	0%	100%			80.0	80.0
MUR6	0%	0%	100%			176.0	176.0
MUR7	0%	0%	100%			321.0	321.0

Heavy single family detached mix

Even with affordability issues in the detached single family housing market, demand for single family detached homes remains high. This scenario anticipates a lower mix of middle housing in SFR zones.

Detached Single Family Emphasis Method Assumptions

	Assumed Housing Mix			Assumed Density by Type			
	SF	MH	MF	SF	MH		Weighted Avg
SFR1	80%	20%	0%	5.4	18.0		8.0
SFR2	85%	15%	0%	9.7	20.0		11.2
SFR3	90%	10%	0%	17.4	26.0		18.3
MFR1	0%	50%	50%		20.0	20.0	20.0
MFR2	0%	25%	75%		25.0	25.0	25.0
MFR3	0%	0%	100%			35.0	35.0
MFR4	0%	0%	100%			45.0	45.0
MFR5	0%	0%	100%			84.0	84.0
MFR6	0%	0%	100%			185.0	185.0
MFR7	0%	0%	100%			338.0	338.0
MFR5	0%	0%	100%			99.0	99.0
MFR6	0%	0%	100%			185.0	185.0
MFR7	0%	0%	100%			338.0	338.0
MUR1	0%	50%	50%		22.0	22.0	22.0
MUR2	0%	25%	75%		28.0	28.0	28.0
MUR3	0%	0%	100%			43.0	43.0
MUR4	0%	0%	100%			58.0	58.0
MUR5	0%	0%	100%			80.0	80.0
MUR6	0%	0%	100%			176.0	176.0
MUR7	0%	0%	100%			321.0	321.0

Calculate multi-family residential capacity (including mixed-use residential)

If the tax lot is zoned MFR (or MUR) and vacant, the BLI capacity estimate is simply the number of units per acre permitted by the zoning class multiplied by the vacant buildable acres, which in the case of the unconstrained tax lot is the area of the tax lot.

In the case of the lowest density multi-family zoning (MFR1, MFR2, MUR1, MUR2) a portion of the resulting units were allocated to middle housing as described in the previous section.

<u>Formula for calculating density transfers on environmentally constrained tax lots (for MFR and MUR Redevelopment and Vacant tax lots):</u>
If (unconstrained > 50% of total lot) => apply zoning density to entire tax lot.
Else the **buildable** area = unconstrained area * 2: Apply zoning density to **buildable** area.

Note: the deduction for environmental constraints is defined in previous sections of this report.

Density Transfer Rationale:
A tax lot with a majority of it unconstrained, a full density transfer is assumed from the constrained portion to the unconstrained. Therefore, capacity is estimated as the zoned density and the lot size of the entire site.

The capacity estimated for a highly constrained tax lot is calculated differently. In this case, a density transfer is allowed, but the adjusted buildable capacity is based on the unconstrained area and multiplied by a factor of 2 and then applying the zoned density to this adjusted buildable area. For example, if a 10,000 sq. ft lot has a constrained area of 6,000 sq. ft., the method would assume that the zoned density would be applied to 8,000 sq. ft.

Vacant Employment Land Calculations

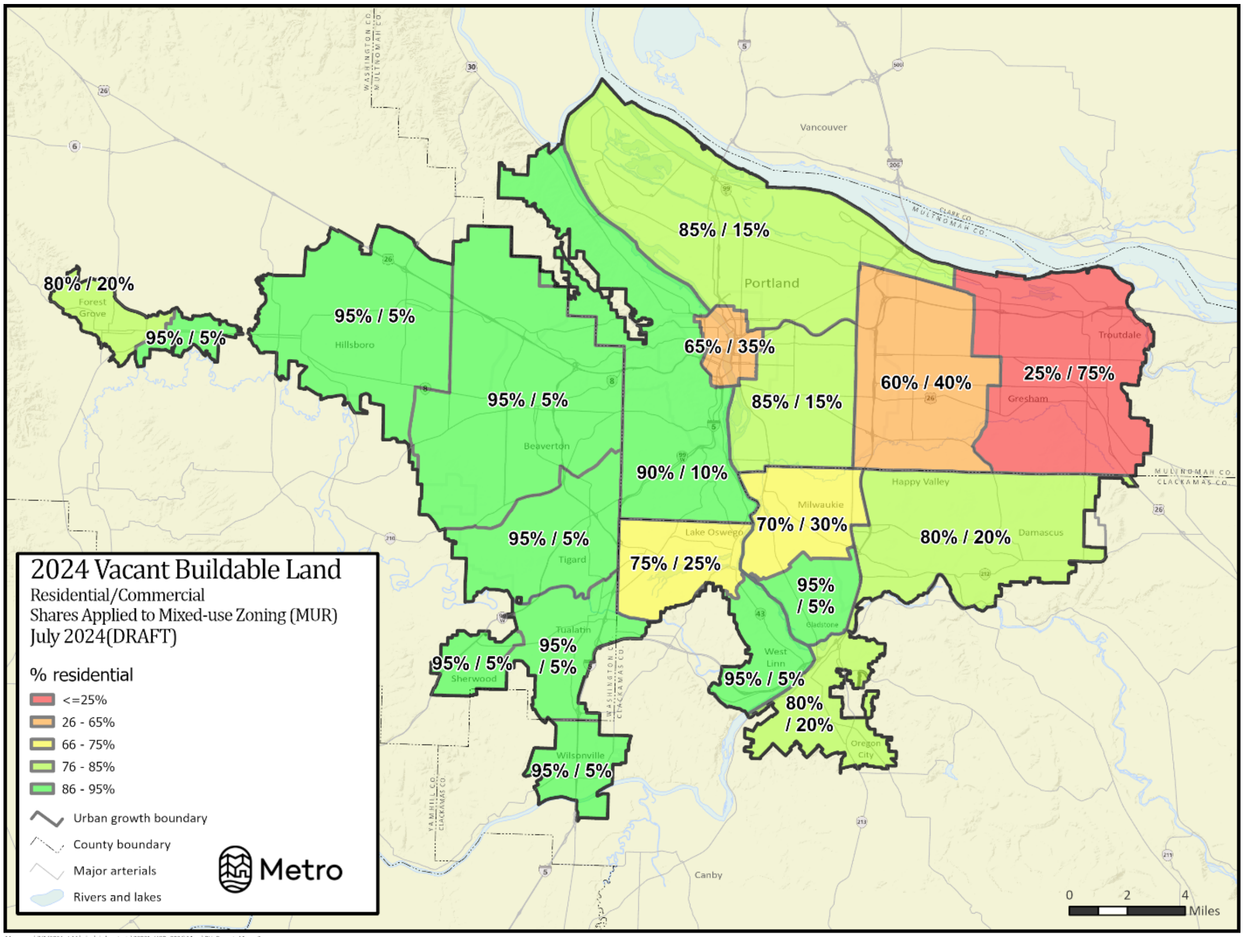
Vacant employment acres are simply the net area of tax lots after removing environmental constraints and right of way as described in previous sections.

Mixed Use capacity estimates (splitting residential and commercial capacity on MUR zoned tax lots)

More and more tax lots in the region are designated in mixed use residential (MUR) zones. Predicting whether MUR-zoned areas throughout the region will be developed as residential or commercial (or what mix of the two) is a challenge. MUR districts in the Metro region can allow *vertical mixed use*, (ground floor retail/service or office uses with housing units above). Horizontal mixed use can also occur, where a mix of retail, service, office and residential apartments occur in the same area, usually on separate tax lots.

MUR residential/non-residential capacity split formula:
Employment capacity in mixed use residential areas, measured in acres, is calculated from the dwelling unit capacity determined in the residential supply.

For the purposes of determining the residential/non-residential split, Metro performed an analysis of observed development from 2013 through 2022 in mixed use zones. Draft findings by sub-regions were developed presented to LUTAG for review and adjustment. The final splits are displayed in Map 2 below.



Map 2: Residential/Commercial Shares Applied to Mixed Use Residential (MUR) zoning in 2018 BLI Draft

These geographically-based residential/non-residential splits were then applied to MUR tax lots with capacity for vacant land. For vacant tax lots with MUR zoning:

- Total effective acres = Total additional units allowed if 100% of lot is used for residential * acres per unit required at maximum zoned density
- Residential effective acres = ResSplit * Total effective acres
- Employment effective acres = EmpSplit * Total effective acres

Mixed-Use-Residential (MUR) proportion assumptions

Metro staff analyzed the observed development data from the Land Development Monitoring System (LDMS) to update the assumed proportion of land zoned mixed-use-residential (MUR) that would develop as housing units. Metro applies this assumption to all vacant MUR lands to estimate the maximum possible residential and employment capacity in those lands for the BLI. Staff generally refer to these assumptions as the “MUR splits.”

Metro first used the 2013-2022 LDMS data to summarize and compute observed average proportions by jurisdiction, then reviewed those results with a Land Use Technical Advisory Group (LUTAG).

Staff summarized the identified tax lots by geography to compute the total acres and units (if applicable) of residential and non-residential properties by geography. Residential properties with on-site commercial space had their area counted only as residential acres. Staff computed the share of commercial and residential land within each geography from total acreage rounded to the nearest 5%. Staff made minor adjustments to some proportions based on input from LUTAG members based on their local knowledge of recent trends and future plans.

These splits were not applied to the redevelopment eligible land and instead deferred to the results of the pro forma model (described below) which evaluates the financial feasibility of both commercial and residential uses in MUR zones.

Redevelopable Residential and Employment Land Calculations

The “pro forma” model (also known in the technical documentation as the “developer supply preprocessor model” or DSP) is designed to predict what tax lots with existing development are likely to redevelop within the 20 year time frame. The model uses the existing real market values (RMV) as derived from tax assessor data against different development prototypes allowable in the underlying zone. The model uses assumptions about construction costs as well as achievable pricing (rental and sales) to determine if redevelopment of the tax lot would be financially feasible. The model then picks the “highest and best use” of the potential redevelopment prototypes that were determined to be financially feasible. Furthermore, the model applies a probability, based on past performance of similar tax lots; the higher the profit potential, the higher the likelihood of redevelopment. Finally, any existing development is subtracted from the achievable to produce a net capacity.

The same method is applied across all zoning types, with different prototypes allowed in each zone. A list of the eligible prototypes by zone can be found at the end of **Attachment A.**

<u>Example</u>: The model determines that a tax lot with an existing single-family home in a MFR zone can support several different prototypes. Of the available options, the most “profitable” are “ 3-story wood townhomes”. Due to the parcel size, the model determines that 5 townhomes (middle housing) could replace the existing single-family home for a net of 4 new dwelling units. The model predicts that there is a 19% chance of the tax lot redeveloping under this scenario, so the tax lot is assigned 0.76 units of middle housing capacity. In other words, approximately 1 in 5 similar tax lots would be expected to develop in this way, however that potential capacity is spread across all similar tax lots.

As demonstrated in the above example, totals from the model results should be aggregated to larger areas and not viewed at the tax lot level.

More detailed explanation of methods and prototypes can be found in **Attachment A**.

Infill employment land

Tax lots that have been identified as part vacant (at least ½ an acre undeveloped) are considered developed and are put through the pro forma model to test market feasibility for redevelopment. (See **Attachment A** for future explanation of the pro forma model.)

However, due in part to the relatively low value per square foot for employment land when compared to improvements, many tax lots that are partially developed still do not meet the threshold for redevelopment. There remain some tax lots with large vacant pieces that do not get through the pro forma model and into the redevelopment supply. The assumed values in the pro forma model which identify which tax lots have potential to be redeveloped are not well suited and calibrated to identify partially developed tax lots with significant amounts of undeveloped real estate.

A final screen for these so called "land banked" parcels was applied by adding back into the redevelopment supply the *net unconstrained* vacant portion of any lot with at least 1 acre of unconstrained vacant land. In the 2018 BLI, these tax lots were included in the redevelopment supply, however, in the 2024 BLI, they have been separated into their own category called "infill" for clarity.

New urban areas and planned development capacity

"New urban areas" are those areas that have been added to the UGB in recent years that do not yet have urban zoning or adopted comprehensive plans. Consequently, planning documents, rather than GIS analysis, are typically the basis for how capacity in new urban areas is handled in the BLI. Possible sources of information include:

- Draft comprehensive plans
- Adopted concept plans
- Draft concept plans
- Conditions of approval that were attached to the UGB expansion.

Additionally, there are several large developments which are currently in the approval and permitting processes with local jurisdictions. While these developments have urban zoning in place, their expected built-out capacity is known due to other planning processes so there is no need to estimate the capacity using various BLI methods. Additionally, while they are already committed to development, full build out will take at least several years, contributing to the 20-year supply.

Overall, this category adds approximately 30,000 units to the UGB land supply.

Office to residential conversion

With the post-pandemic transition to hybrid and remote work and the accompanying housing crisis, the prospect of converting vacant office space to residential units is a possibility. Metro contracted with ECOnorthwest to explore the prospect of office-to-residential conversions and how that might contribute to the future land supply for the region. Due to many market factors in the region, the magnitude of such conversions is likely to be small, with total expected units ranging between 250 and

1,500 total multi-family style units in the next 20 years regionwide. **Attachment B** details the methodology and rationale for these assumptions.

ADUs and internal conversions

Additional capacity in the region is also expected to come from the construction of detached ADUs, as well as conversions of garages, attics, and/or basements into additional units through internal partitions creating multi-unit buildings. Since the pro forma model only looks at complete redevelopment of a tax lot from one types of development to another (i.e.

Metro relied on ECOnorthwest to estimate the capacity potential from these development types. ECOnorthwest estimates a baseline of 8,692 units with a high-low range between 4,955 and 11,716 units possible over the next 20 years through this type of redevelopment. The following assumptions were used:

- **Low:** continue average annual ADU production for 2019-2022
    - This captures the trend since Portland changed its ADU SDC waiver policy to include a restriction on use for short-term rentals
    - Assumes that any additional middle housing conversion that isn't captured by the pro forma analysis would be instead of adding an ADU, so that there is no overall increase in units beyond what was happening with ADUs alone and the redevelopment component from the pro forma model.
- **Baseline:** continue average annual ADU production plus 10% of average annual middle housing from 2013-2022 (all available data years)
    - This assumes that roughly 10% of middle housing production was through conversion, and that longer-range past trends for ADUs and conversion will continue.
- **High:** continue average annual middle housing infill/redevelopment between 2014 and 2023
    - Assumes that as much conversion could take place per year (on top of redevelopment) as all middle housing infill/redevelopment during this period, most of which pre-dates HB2001

GIS Data and Metadata

The final GIS database and accompanying metadata are available upon request from Metro by contacting the Data Resource Center at:

503-797-1742
DRC@oregonmetro.gov
https://www.oregonmetro.gov/tools-partners/data-resource-center
Staff contact: Clint Chiavarini

Attachments

Attachment A: Office-to-Residential Conversion Potential; ECOnorthwest, April 2024
Attachment B: Documentation of Predictive Development/Redevelopment Model; Johnson Economics, June 2024

DATE: April 22, 2024
TO: Metro
FROM: ECONorthwest
SUBJECT: Residential Readiness Task 5: Office-to-Residential Conversion Potential

Overview

The Metro Regional Government (Metro) has contracted with ECONorthwest to evaluate residential readiness in preparation for its 2024 Urban Growth Management decision. ECONorthwest evaluated whether the growing interest in office-to-residential conversions could meaningfully contribute to housing capacity over the next 20 years.

In 2020, the onset of the COVID-19 pandemic accelerated work-from-home trends, raising questions about whether an oversupply of office space in some locations could be converted to residential uses. This memorandum documents opportunities and barriers to office-to-residential conversions in the Portland metropolitan area, including the continuity of work-from-home trends, office vacancy rates, market indicators to understand demand for space in different subareas, and general characteristics of viable residential conversions. It also estimates a range of housing units that could be accommodated through office-to-residential conversions over the next 20 years inside the Metro Urban Growth Boundary (UGB) and their likely price ranges.

This memorandum draws on national studies, articles, and reports; office market data for the Portland region collected in the first quarter of 2023; and findings from a January 2024 study by ECONorthwest for Prosper Portland that evaluated the financial feasibility of office-to-residential conversion for several example office buildings downtown as well as the impact of specific policies and incentives.

Key Findings

- **Lasting remote and hybrid work trends**[1] **have dramatically increased office vacancy rates**, particularly for older Class B and C office space.[2] This is expected to represent a lasting shift in office real estate. This national trend is present in Portland, where the vacancy rate downtown has exceeded 30%, with lower vacancy rates in the suburbs.[3]
- **Office-to-residential conversions are challenging and require specific building characteristics and market conditions to succeed**. Key factors affecting building conversations include the dimensions and floor plate, the configuration of internal

[1] Caitlin Gilbert et al., "Remote Work Appears to Be Here to Stay, Especially for Women," Washington Post, June 22, 2023, https://www.washingtonpost.com/wellness/2023/06/22/remote-work-family-socialization-time-use/.
[2] Emma Goldberg, "What Would It Take to Turn More Offices into Housing?," The New York Times, December 27, 2022, sec. Business, https://www.nytimes.com/2022/12/27/business/what-would-it-take-to-turn-more-offices-into-housing.html?partner=slack&smid=sl-share.
[3] Samuel Hatcher, Dan Peterson, and Jason Green, "Portland Office Figures Q1 2023" (Portland, OR: CBRE, May 7, 2023), https://www.cbre.com/insights/figures/portland-office-figures-q4-2022, 1.

systems, and window design.[4,5] In Portland, compliance with seismic requirements is another key consideration.[6] In addition, the building must have high office vacancy rates and it, and its surrounding context must be attractive as a place to live.

- **Nationally, some jurisdictions are offering incentives for conversions, sometimes tied to affordability requirements**.[7] Portland offers exemptions on System Development Charges (SDCs) for conversion projects that require seismic upgrades,[8] but does not exempt these projects from the City's Inclusionary Housing (IH) program. Other Metro jurisdictions do not have similar programs.
- **Units resulting from office-to-residential conversion are often high-end, though some have more moderate rents.**[9,10,11] In Portland, in the absence of compelling amenities, rents for conversion projects are expected to be below those of purpose-built new apartments,[12] which is helpful for affordability, but challenging for feasibility.
- **Potential for conversions in Downtown Portland is limited.** Despite challenges with large floorplates and utilities, large, modern office buildings are most likely to be financially feasible because they would avoid the cost of seismic upgrades. However, public subsidies or incentives beyond the City's existing SDC exemption program are likely necessary to support most office-to-residential conversion projects in Downtown Portland.[13]
- **Office-to-residential conversions are unlikely to happen in Portland's suburban markets**. Given the lower office vacancy rates in suburban markets (particularly in Class B and C offices)[14] and the lack of surrounding amenities near most office parks, it would take unique circumstances, a desirable location, and a willing developer to pursue a suburban conversion project. An underperforming suburban office building may be more attractive as a tear-down for new development or for conversion to other nonresidential uses.
- While it is difficult to predict the number of potential successful office-to-residential conversion projects over the next 20-years, it is **unlikely that more than a few downtown office buildings** would convert to residential use over the next 20 years.

[4] Anjali Kolachalam, "Office to Residential Conversions: Scalable Opportunity or Too Unique to a City Block?" (Washington DC: Up for Growth, November 2022).

[5] Jeffrey Havsy, Xiaodi Li, and Kevin Fagan, "Why Office-To-Apartment Conversions Are Likely a Fringe Trend at Best," Moody's Analytics CRE, January 3, 2023.

[6] ECOnorthwest to Prosper Portland: "Office to Residential Conversion Study – Feasibility Results Memo," January 5, 2024.

[7] Abu-Khalaf, Ahmad, and Ray Demers. "What Will It Take to Convert Offices to Housing?" Enterprise Community Partners, April 10, 2023, https://www.enterprisecommunity.org/blog/what-will-it-take-convert-offices-housing.

[8] Alex Zielinski, "Portland City Council approves incentives to help convert office buildings into apartments."

[9] Gensler, "Franklin Tower," n.d., https://www.gensler.com/projects/franklin-tower.

[10] Anita Kramer, Nolan Eyre, and Morgan Maloney, "Behind the Facade."

[11] Ximena Gonzalez, "Calgary's Adventure in Office Conversion," The Globe and Mail, May 5, 2023, https://www.theglobeandmail.com/real-estate/article-calgarys-adventure-in-office-conversion/.

[12] ECOnorthwest to Prosper Portland: "Office to Residential Conversion Study – Feasibility Results Memo," January 5, 2024.

[13] Ibid.

[14] Samuel Hatcher, Dan Peterson, and Jason Green, "Portland Office Figures Q1 2023" (Portland, OR: CBRE, May 7, 2023), https://www.cbre.com/insights/figures/portland-office-figures-q4-2022, 1.

This could result in somewhere between **200 to 1,500 new housing units** depending on the number of successful projects, size of individual buildings, level of efficiency in using interior space, and unit mix. Conversion in the suburban market is even less likely, but one or two suburban conversion projects could result in up to 500 units. This suggests that the region could potentially see **between a few hundred units and roughly 2,000 units of housing resulting from office-to-residential conversion projects**.

Why should Metro consider office-to-residential conversions?

Remote workplace trends are driving office tenants to smaller, higher quality spaces.

Remote and hybrid work trends that increased dramatically during the COVID-19 pandemic have continued to impact business operations and real estate demand, and are likely to persist into the future, albeit at a lower rate than during the peak of the pandemic. These impacts are largely concentrated in certain industries and occupations, including professional services like computer science and technology, business and finance, arts and design, legal services, and architecture and engineering, which have seen the highest rates of working from home in Oregon.[15]

Despite uncertainty about the future of remote work, data show a lasting trend particularly among white-collar workers: in 2022, 34 percent of workers nationwide reported working at least part of the week from home compared to only 24 percent pre-pandemic.[16] While this has declined from the 42 percent of workers doing remote jobs at the onset of the pandemic,[17] it indicates a lasting trend for at least some segments of workers. Trends in remote work are not evenly distributed among the workforce: women and workers with bachelor's degrees or higher work from home more compared to the workforce overall.[18]

In many professional service industries, expectations for locational flexibility have changed. In a survey done in New York for the city's Office Adaptive Reuse Task Force (one of the most comprehensive studies of worker and employer preferences at the city level), 77 percent of office-based employers indicated a hybrid schedule would be their preferred post-pandemic policy.[19] In Oregon, these trends vary across the state and region. In 2021, the Portland metro ranked 11th amongst metro areas nationwide for its high share of remote workers.[20] In the City

[15] Josh Lehner, "Working from Home during the Pandemic," Oregon Office of Economic Analysis, January 18, 2023, https://oregoneconomicanalysis.com/2023/01/18/working-from-home-during-the-pandemic/.
[16] Caitlin Gilbert et al., "Remote Work Appears to Be Here to Stay, Especially for Women," Washington Post, June 22, 2023, https://www.washingtonpost.com/wellness/2023/06/22/remote-work-family-socialization-time-use/.
[17] Ibid.
[18] Caitlin Gilbert et al., "Remote Work Appears to Be Here to Stay, Especially for Women," Washington Post, June 22, 2023, https://www.washingtonpost.com/wellness/2023/06/22/remote-work-family-socialization-time-use/.
[19] New York City Department of City Planning, "New York City Office Adaptive Reuse Study," January 2023, https://www.nyc.gov/site/planning/plans/office-reuse-task-force/office-reuse-task-force.page.
[20] Josh Lehner, "Working from Home during the Pandemic."

of Portland, over 35 percent of workers reported working from home in 2021, compared with about 25 percent of workers in the Portland suburbs, and 12 percent in rural areas.[21]

National level trends indicate that companies are gradually adjusting their space usage and real estate footprints in response to these trends. While many businesses in these industries have long-term leases (e.g., five to ten years), many of those with expiring leases are considering whether to maintain their existing space and footprint (e.g., because of attractive lease rates as property owners try to maintain occupancy), pursue a remote work environment and eliminate their office footprint altogether, or find a space (often smaller) that better fits their hybrid work arrangements.[22] These decisions are often driven by worker preferences so as to attract and retain quality employees, as well as economizing on real estate expenses.

For companies maintaining an office presence, higher quality space, smaller footprints, and flexible configurations are most in demand. Many employers who chose to retain a physical office space in the wake of the pandemic have changing needs for office space, and many are downsizing their total office footprints in exchange for higher-quality spaces as they adjust to new hybrid and flexible schedules. As a result, demand for premium Class A office space is stronger than older, Class B and C office spaces, many of which were constructed before the 1980s and are not seen as 'commute-worthy.' This is translating into higher vacancy rates for Class B and C offices.[23]

Developers and property owners are responding to changes in office tenant decisions.

Redevelopment trends are an indicator of this 'flight to quality,' as developers and property owners seek new opportunities for older Class B and C office space. In some cases, renovations and modern upgrades can transform older offices into more attractive spaces, but converting offices to other uses altogether is a growing trend. In 2021 and 2022, only 12 percent of redeveloped office space remained as office use, a decline from prior years.[24] Local government subsidies and incentives have made it more attractive to pursue residential conversions in some cities, including Chicago, Washington DC, and Los Angeles. However, many building owners have hesitated to sell their office properties or invest in conversion projects until they are more comfortable with hybrid work trends and the desires of companies.[25]

[21] Ibid.

[22] Patrick J. Kiger, "How to Make Office-To-Residential Conversions Work," Urban Land Magazine (Urban Land Institute, December 1, 2022), https://urbanland.uli.org/planning-design/how-to-make-office-to-residential-conversions-work/?utm_source=realmagnet&utm_medium=email&utm_campaign=HQ%20Urban%20Land%2012%2E05%2E2022.

[23] Emma Goldberg, "What Would It Take to Turn More Offices into Housing?," The New York Times, December 27, 2022, sec. Business, https://www.nytimes.com/2022/12/27/business/what-would-it-take-to-turn-more-offices-into-housing.html?partner=slack&smid=sl-share.

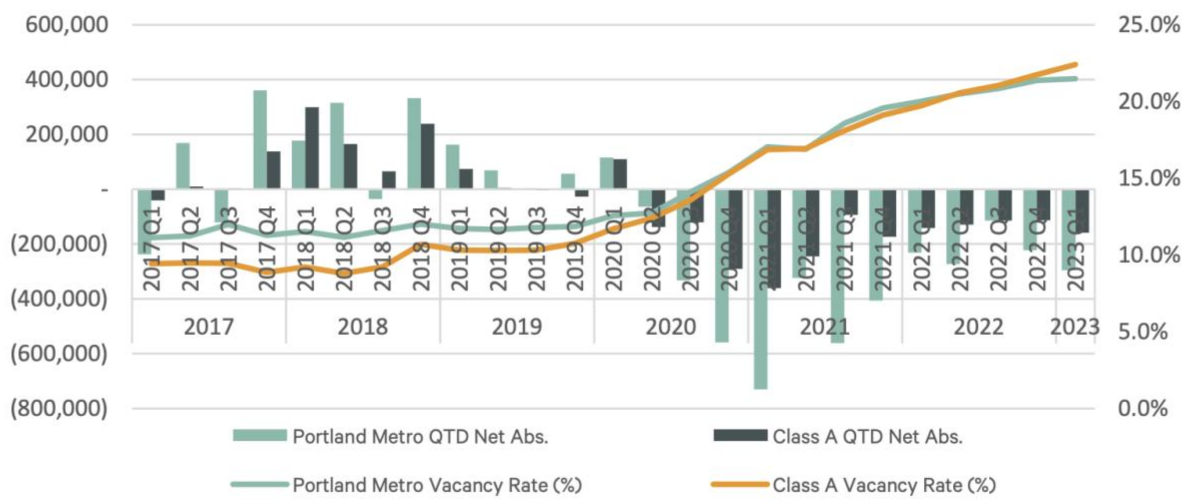
[24] Jacob Rowden and Elena Lanning, "Conversion Activity Gaining Momentum" (JLL Research, October 19, 2022), https://www.us.jll.com/en/trends-and-insights/research/office-research-snapshot-10-19-22.

[25] Richard McGahey, "Converting Offices to Residences Can Help Fight the Housing Shortage," Forbes, December 9, 2022, https://www.forbes.com/sites/richardmcgahey/2022/12/09/converting-offices-to-residences-can-help-fight-the-housing-shortage/?sh=139de24f7eb3.

Office vacancy rates in the Portland area are high and still increasing compared to pre-pandemic rates, especially downtown.

Downtown office vacancy remained high throughout 2022, showing the continued impacts of remote and hybrid work. Even as most workplaces lifted COVID-19 restrictions and pivoted to hybrid and return to in-person work, the Portland MSA ended the fourth quarter of 2022 with an overall office vacancy rate of 21.4 percent.[26] Rather than rebounding, trends in the first quarter of 2023 show continuing high vacancy rates (Exhibit 1), indicating an escalating trend rather than a receding one.

Exhibit 1. Portland MSA Office Absorption (1,000 SF) and Vacancy Rate, 2017-2023
Source: CBRE



Office vacancies are not evenly distributed across the Portland Metro.

The office vacancy rate remains higher in the Portland central business district (CBD) compared with suburban markets, sitting at 32 percent compared to roughly 19 percent in the suburbs.[27] Downtown and suburban offices in the Portland region show different trends in what type of office space is in demand. While downtown offices have lower vacancies in newer Class A space, offices in the suburban markets show the reverse, with higher vacancy in higher-quality spaces (Exhibit 2). Considering that the Portland suburbs have lower rates of remote work, this may indicate that suburban offices are losing fewer tenants in lower cost offices while Downtown businesses are seeking premium space. Nationally, many suburban areas with high quality of life indicators are attracting businesses, including offices.[28] This may be due to desires for shorter commutes and or generational demographic changes as Millennials move out of urban centers.[29]

[26] Samuel Hatcher, Dan Peterson, and Jason Green, "Portland Office Figures Q1 2023" (Portland, OR: CBRE, May 7, 2023), https://www.cbre.com/insights/figures/portland-office-figures-q4-2022, 1.
[27] Ibid.
[28] Marie Ruff, "What the Urban to Suburban Shift Means for the Office Sector" (National Association for Industrial and Office Parks, August 11, 2022), https://blog.naiop.org/2022/08/what-the-urban-to-suburban-shift-means-for-the-office-sector/.
[29] Ibid.

Exhibit 2. Downtown vs. Suburban Market Statistics in the Portland Metro Area (Q1 2023)
Source: CBRE

	Total SF	Vacant SF	Vacancy Rate	2023 Q1 Net Absorption	Average Direct Asking Rate (PSF)
	Downtown				
Class A	12.0 million	3.7 million	31.0%	(76,486)	$39.99
Class B	8.4 million	2.6 million	31.2%	(24,176)	$32.45
Class C	2.7 million	910,000	33.7%	(23,879)	$28.60
Class D	3.2 million	1.1 million	36.31%	8,025	$26.00
Total	**26.5 million**	8.4 million	**32.0%**	**(116,516)**	**$34.26**
	Suburban				
Class A	10.8 million	2.2 million	20.9%	(82,068)	$34.20
Class B	11.8 million	2.1 million	18.0%	(29,302)	$26.14
Class C	2.0 million	258,000	12.9%	16,399	$19.41
Class D	67,000	-	0.0%	-	-
Total	**24.7 million**	**4.6 million**	**18.8%**	**(94,971)**	**$29.47**

What makes for a successful office-to-residential conversion?

Successful office-to-residential conversion projects are site specific and depend on the existing building's physical configuration.

Converting vacant office space to housing may theoretically make sense given shifting demand trends, but successful office-to-residential conversion projects depend on physical and financial feasibility. Office buildings must have high vacancy rates and be underperforming financially, and they must also have a layout and design that can relatively easily meet residential building requirements, with considerations of the overall building size, configuration, and placement of internal systems.

Several studies use different methodologies to determine eligibility for residential conversion. This analysis references Up for Growth's Office to Residential Conversions Policy Brief which includes an analysis of office conversion viability in Denver[30] and a Moody's Analytics' survey of New York office buildings.[31] Exhibit 3 provides an overview of the parameters used to assess viability in these studies.

[30] Anjali Kolachalam, "Office to Residential Conversions: Scalable Opportunity or Too Unique to a City Block?" (Washington DC: Up for Growth, November 2022).
[31] Jeffrey Havsy, Xiaodi Li, and Kevin Fagan, "Why Office-To-Apartment Conversions Are Likely a Fringe Trend at Best," Moody's Analytics CRE, January 3, 2023.

Exhibit 3. Survey of Successful Office-to-Residential Conversion Metrics
Source: Up for Growth, Moody's Analytics

		Rationale	Metrics
Physical Factors	Building Size	Floor plates must be configurable into residential unit sizes.	• Floor plates between 5,000 to 14,000 SF (depending on building shape) • 5+ Stories
	Building Dimensions	Floor plates must be a sufficient depth to hold living area, but not limit access to natural light.	• Floor depth up to 100 feet • Space to hold at least 4 1,000 SF units per floor with a maximum depth of 50 ft for resulting units
	Internal Systems	Features limiting plumbing and electrical lines can make it difficult to reroute utilities to individual units.	• Open floorplans which support rerouting central utility lines
	Year Built	Newer office buildings will be too costly for acquisition and typically come with sealed windows.	• Built before 2010 • Operable windows
Market Factors	Rent	Conversions could be viable if they generate more effective revenue as apartments than offices.	• Office rent PSF below median price for apartment rent PSF
	Vacancy Rates	Buildings that are no longer attracting office tenants incentivize owners to convert.	• 25-30%+ office vacancy rate

Generally, existing studies find that **deeper floor plates, limited access to natural light, inoperable windows, and centralized utilities (like plumbing and HVAC systems) make office buildings difficult to redevelop to meet residential building code specifications.** Office building dimensions typically vary by their age:

- Older, turn-of-the century buildings which typically occupy roughly a quarter block are generally more suitable for redevelopment into residential units due to their configuration and scale. In some cases, they may also be eligible for historic tax credits to help with financing projects and provide unique character features which can attract higher rents.[32] In Portland, many turn-of-the century manufacturing spaces have been turned into residential lofts.
- Mid-century offices which may occupy about a half-block of space can have potential for conversion as the flight-to-quality trend continues, but these depend greatly on building shape and layout to be suitable candidates. [33] They may also not have the aesthetic or historical appeal to attract premium rents.
- Class B or C office spaces (many of which were built in the 1970s and 1980s) tend to be more easily converted as they have open floorplans, operable windows, and tall ceilings with smaller total square footage that provide more flexibility for redevelopment.

[32] Anita Kramer, Nolan Eyre, and Morgan Maloney, "Behind the Facade: The Feasibility of Converting Commercial Real Estate to Multifamily" (National Multifamily Housing Council and Urban Land Institute, February 21, 2023), https://www.nmhc.org/research-insight/research-report/behind-the-facade-the-feasibility-of-converting-commercial-real-estate-to-multifamily/.
[33] Miriam Hall, "Far from 'Easy Money': Experts on the Hurdles Facing Office-To-Residential Conversions," Bisnow, October 13, 2022, https://www.bisnow.com/national/news/construction-development/as-distress-comes-to-the-office-market-office-to-residential-conversions-may-prove-elusive-for-some-115846.

- Modern, Class A office buildings tend to occupy full city blocks and present cost and design challenges.[34] Many of the modern offices in Portland's CBD have floor plates that are too large, making it difficult to plan interior space in a way that meets building codes and tenant expectations. Even if building configuration does allow office spaces to meet code standards, many floor plates lead to long, narrow units that can also limit how attractive units may be to tenants. The Up for Growth and Moody's Analytics models capped the depth of floor plates between 80 and 120 ft. These buildings are also often more costly to acquire, even if they are seeing high vacancy rates. However, if these projects are successful, they hold potential to yield a greater number of units.

Office-to-residential conversion projects can be financially risky and depend on local market context and conditions.

Converting office space to residential units has different financial considerations than ground-up construction because it requires the acquisition of a performing asset; in most cases, this involves higher acquisition costs than vacant land or tear-down structures.[35] However, if vacancy rates in a building are higher than the local market and office rents are lower than achievable residential rents, property owners may have enough incentive to pursue conversion projects.

These projects are still risky, given the relatively small field of architectural and engineering experience related to office-to-residential conversion in the Portland region, the potential for unknown challenges with reconfiguring buildings, and the lingering uncertainty around remote and hybrid work trends. All else being equal, it is likely that most property owners and developers would prefer to upgrade existing offices than pursue conversion if it is viable. Building owners who might convert properties to residential uses likely have little to no debt on a building and a long-term hold on office properties in the Portland area market.

Jurisdictions can encourage office-to-residential conversions with regulatory flexibility and financial incentives like tax abatements, tax increment financing dollars, or housing subsidies.[36] In the Metro area, the City of Portland has already begun implementing some incentives, including SDC exemptions for conversions that include seismic retrofits.[37] However, the high cost of seismic retrofitting generally creates substantial additional costs for conversion projects.[38] While these incentives could be applicable for developers in the Downtown market, there are none available yet for developers in other surrounding jurisdictions (but also no seismic retrofit requirements).

[34] Anjali Kolachalam, "Office to Residential Conversions: Scalable Opportunity or Too Unique to a City Block?"
[35] Anjali Kolachalam, "Office to Residential Conversions: Scalable Opportunity or Too Unique to a City Block?"
[36] Abu-Khalaf, Ahmad, and Ray Demers. "What Will It Take to Convert Offices to Housing?" Enterprise Community Partners, April 10, 2023, https://www.enterprisecommunity.org/blog/what-will-it-take-convert-offices-housing.
[37] Ibid.
[38] Alex Zielinski, "Portland City Council approves incentives to help convert office buildings into apartments," OPB, https://www.opb.org/article/2023/03/15/portland-oregon-housing-city-council-apartments-vacant-office-buildings-conversion-incentives/ March 15, 2023.

What is the potential for office-to-residential conversions in the Metro area?

Because the scale and form of office space differs substantially between downtown Portland and suburban locations, the potential for residential conversion must be evaluated separately. As noted previously, office vacancies and remote work trends are generally higher in the CBD compared with suburban areas, though total office square footage is similar (Exhibit 2). This section summarizes the characteristics of office buildings that exist in both markets, and indicators potential of residential conversion projects.

Downtown Office Market

The Downtown Portland market encompasses office buildings in Portland's CBD. This market is generally characterized by taller, denser buildings than the suburban market, and a larger inventory of Class A office space that commands higher rents per square foot (Exhibit 2).

ECONorthwest analyzed the viability of office-to-residential conversion in downtown Portland on behalf of Prosper Portland, in partnership with Gensler Architects and Turner Construction (summary memorandum attached). This analysis considered three different representative types of office buildings in Portland, including a prototypical quarter-block, half-block, and full-block office building that characterize the range of older, mid-century, and modern office buildings found in the CBD. Given the range of office types in Downtown Portland, these are representative of buildings in the market that might be suitable for conversion, ranging from 35,000 to 305,000 square feet.

Suburban Office Market

Other cities in the Metro area also have small downtown districts. The building stock of suburban downtowns like Beaverton and Hillsboro tend to have a small inventory of mid-rise buildings, but none reach the same scale and employment density as the Portland CBD. The suburban office market in Portland is generally characterized by older, low- or mid-rise buildings in office parks with more lot area dedicated to surface parking lots as well as older, smaller standalone office buildings scattered outside of these areas. The suburban office market in the metro area has a greater inventory of Class B office space (Exhibit 2), which can lend itself well to residential conversion in some cases.[39]

However, the suburban market does not currently have the same high vacancy rates as downtown buildings. A greater share of suburban office space overall is still functioning as a performing asset for property owners, providing less incentive to pursue conversions. Class A offices have the highest vacancies in the suburban market (Exhibit 2), but these buildings are generally less feasible to convert to residential because of higher acquisition costs. Because suburban offices have a higher occupancy rate compared with the downtown market, the cost

[39] Jeffrey Havsy, Xiaodi Li, and Kevin Fagan, "Why Office-To-Apartment Conversions Are Likely a Fringe Trend at Best."

of acquisition would generally be higher on a per square foot basis, including the cost of relocating existing tenants.[40]

Suburban office parks developed around 1980's have opportunities for redevelopment or adaptive reuse, as more companies and workers perceive them as obsolete in terms of amenities and design.[41] Many of these buildings are part of sprawling corporate campuses with lower heights/wider footprints than offices in the CBD; many are also occupied by large, single tenants. Some of these buildings can be attractive for residential redevelopment from a physical and financial standpoint if they offer access to operable windows and have floor plates with open floor plans that can be configured into residential units (or low enough height for an atrium lightwell). However, office parks were not designed with residential uses in mind and may lack attractiveness for residential use, particularly if nearby buildings continue to serve corporate functions. Many office parks have large parking lots and few retail options nearby. Research with developers suggests that "the inefficiency of low-density, suburban land use means that they can do better by starting over these days. Compare that to a dense, built-up area, where the existing office footprint is typically maxed out."[42]

What kind of units could office-to-residential conversion produce in the Metro area?

Downtown Portland could see a modest number of office-to-residential conversion units; well-calibrated policy initiatives could increase those opportunities.

Given the physical and financial feasibility challenges associated with office-to-residential conversions, Downtown Portland could see a handful of projects but is unlikely to see a large wave of office-to-residential conversions. The City of Portland's current incentives for SDC exemptions may help to incentivize some property owners to consider conversion projects in Downtown, but the cost of seismic retrofits associated with the program remain prohibitively high (even with the flexibility provided by the City).[43]

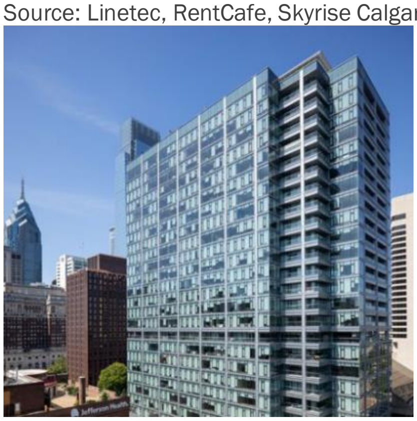
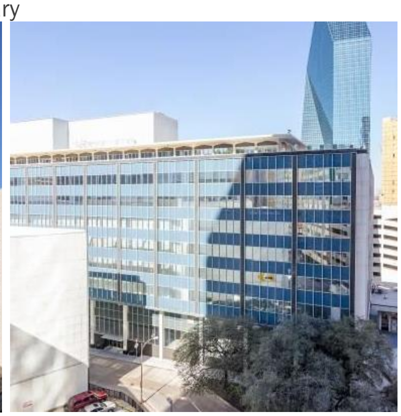
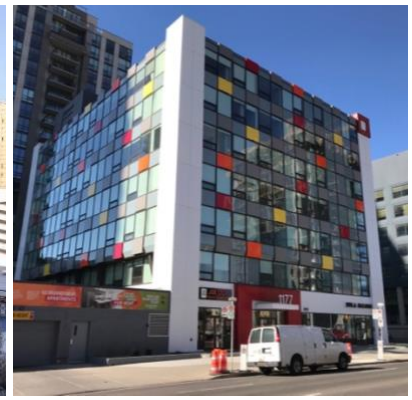
To understand the potential of office-to-residential conversion in the Portland Metro, this analysis uses successful examples in other cities to calculate (1) the average number of units produced by conversion projects and (2) the average gross square footage of building area per unit. Example conversions shown in Exhibit 4 have a wide range in the original building's characteristics, age, and location; all are within the central business district of their respective markets; and all were completed in the past decade.

[40] Anjali Kolachalam, "Office to Residential Conversions: Scalable Opportunity or Too Unique to a City Block?"
[41] Dustin C. Read, "Profiles in the Evolution of Suburban Office Parks" (National Association for Industrial and Office Parks, August 2019).
[42] Anita Kramer, Nolan Eyre, and Morgan Maloney, "Behind the Façade."
[43] Alex Zielinski, "Portland City Council approves incentives to help convert office buildings into apartments."

Exhibit 4. Example CBD Office-to-Residential Conversion Projects
Source: See individual citations

	508 West Apartments[44]	Franklin Tower[45]	Broadway Lofts[46]	Mayflower Apartments[47]	Lofts @ Centennial Yards South[48]	Stephenson Building[49]
Location	Spokane, WA	Philadelphia, PA	Los Angeles, CA	Dallas, TX	Atlanta, GA	Calgary, AB
Year Built	1964	1979	1906	1965	1908	1981
Year Converted	2022	2019	2014	2017	2021	2020
Building Gross SF	91,500	605,000	39,500	253,000	187,000	62,000
Units Produced	112	549	58	215	162	65
Gross Building SF/Unit	817	1,102	681	1,177	1,154	954
Rents	High-End	High-End	High-End	Mixed-Income	Mid-Market	Mid-Market

Exhibit 5. Example Projects (L to R: Franklin Tower, Mayflower Apartments, Stephenson Building)
Source: Linetec, RentCafe, Skyrise Calgary

On average across these examples, conversions yielded roughly one residential unit per 980 square feet of gross floor area in the existing office building, with a range from 681 to 1,177 square feet. Most of these examples include some amenities, including roof decks, lounges, fitness centers, pools, and bicycle rooms. These amenities are one way that the building can be configured to use space that is not suitable for conversion, while adding features that can help attract residents.[50] Given the type and size of office spaces that are most appropriate for conversion in the Portland Metro, variation exists depending on the original building:

[44] Anita Kramer, Nolan Eyre, and Morgan Maloney, "Behind the Facade."
[45] Gensler, "Franklin Tower," n.d., https://www.gensler.com/projects/franklin-tower.
[46] Anita Kramer, Nolan Eyre, and Morgan Maloney, "Behind the Facade."
[47] Ibid.
[48] Ibid.
[49] Ximena Gonzalez, "Calgary's Adventure in Office Conversion," The Globe and Mail, May 5, 2023, https://www.theglobeandmail.com/real-estate/article-calgarys-adventure-in-office-conversion/.
[50] Steven Paytner, "What We've Learned by Assessing More Than 300 Potential Office-to-Residential Conversions," Gensler, June 16, 2022, What We've Learned by Assessing More Than 300 Potential Office-to-Residential Conversions.

- **Quarter-block buildings** are typically older and meet the dimensions criteria described in Exhibit 3. This building type can be suitable for conversion projects on a case-by-case basis, yielding up to approximately 50 units per building depending on the efficiency of the layout, number of floors, and space dedicated to amenities. However, seismic retrofit requirements may make these more financially difficult to upgrade in line with Portland's standards.
- **Half-block buildings** include Downtown's medium-sized, mid-century offices which may be experiencing higher vacancy rates and could have some potential for conversion. Successful projects like these could yield between 100 to 200 units per building if an existing building has a shape that allows for more natural light. However, these buildings typically see challenges with floor plate and depend highly on the building's layout.
- **Large, modern full-block buildings** like those in Downtown Portland are difficult from a physical standpoint because of their large floorplates but are most likely to be financially feasible because they already comply with seismic retrofit requirements. These buildings could yield upwards of 300 units per building but would also likely face challenges with configuration and the location of building utilities.

Exhibit 6. Prototypical Building Configurations
Source: ECONorthwest analysis

	Quarter-Block	Half-Block	Full-Block
Building Square Footage	35,000-60,000 SF	150,000-250,000 SF	300,000-400,000 SF
Estimated Unit Yield (70-80% efficiency)	25-49 units	107-204 units	214-326 units

Suburban offices are less likely to see residential conversions that produce a measurable number of units.

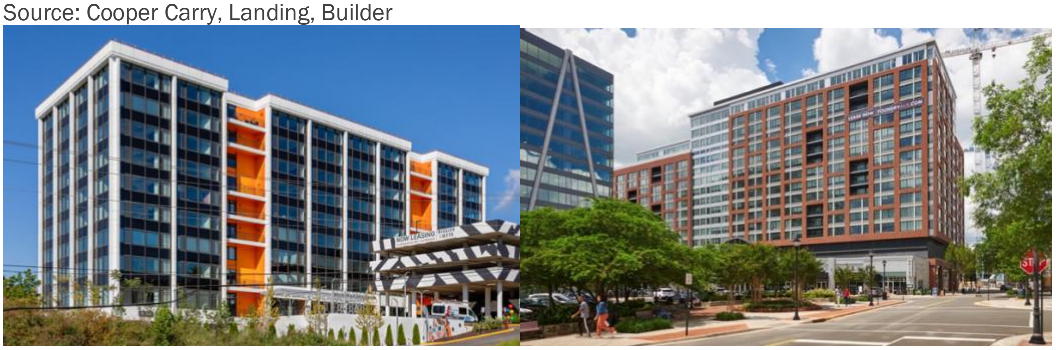
Given the lower vacancy rates in Portland's suburban office parks (particularly in Class B and C office spaces), it is unlikely that many office-to-residential conversion projects will take place in the suburban market. In this context, it may be more feasible to purchase underperforming offices as tear-down projects for new construction. If a suburban building had high vacancy rates, low rents, a physical layout suitable for conversion and it was in a desirable location (like near regional transit lines, a commercial hub, or higher education campus), and or standout historic/architectural character, conversion would be more likely.

Exhibit 7 shows some examples of office-to-residential conversion projects outside of central business districts, but these are primarily from larger east coast markets with different market dynamics and available building stock in suburban areas. The scale and context of these buildings and their surrounding markets do not reflect what is present or possible in most of Portland's suburbs. For example, the D.C./Maryland/Virginia suburban office market is not comparable with Portland's suburbs as it has 12+ story buildings, relatively high walk scores, and a large presence of national and international employers.

Exhibit 7. Example Suburban Office-to-Residential Conversion Projects
Source: National Multifamily Housing Council Research Foundation and Urban Land Institute

	The Foundry	Mission Lofts	Park + Ford
Location	Alexandria, VA	Falls Church, VA	Alexandria, VA
Year Built	1967	1968	1981
Year Converted	2020	2020	2021
Building Gross SF	660,000	178,000	450,000
Units Produced	520	156	435
Building Amenities	Yes	Yes	Yes
Gross Building SF/Unit	1,269	1,141	1,034
Rents	High-End	High-End	Mid-Market

Exhibit 8. Example Suburban Office-to-Residential Projects (L: The Foundry, R: Park + Ford)
Source: Cooper Carry, Landing, Builder



In some cases, conversion of office parking space to residential units has been successful in smaller cities and outside of major downtown areas (see Exhibit 9). However, these are typically either located near new public investments (such as trails/pedestrian improvements connecting to other commercial or mixed-use areas) or included components like ground floor retail.

Exhibit 9. Example Parking Conversion Projects
Source: Retrofit, UBC Sustainability Scholars Program, Urbanism Next

	508 West Apartments	Link Apartments	Broadway Autopark
Location	Spokane, WA	Charlotte, NC	Wichita, KS
Year Built	1964	1969	1949
Year Converted	2022	2020	2016
Parking Type	Structured	Surface	Structured
Building Gross SF	63,500 (building) 28,000 (garage)	555,000	55,000
Units Produced	85	533	44
Building Amenities	Yes	Yes	Yes
Gross Building SF/Unit	1,076	1,003	1,147
Rents	High-End	High-End	High-End

Example: Link Apartments (Charlotte NC)

The Link Apartments are located in Charlotte, North Carolina outside of the city's central business district. At the time of construction, the Little Sugar Creek greenway had recently been extended to the area (providing improved bike access) and another new renovation project nearby created a new anchor for dining and shopping within walking distance. In 2014, Grubb Properties purchased two old mid-century office buildings located in this developing area outside of Charlotte's downtown, including ten acres total of the two buildings and their large surface parking lots. In the following years, the developer first renovated the outdated offices into premium Class A spaces, and then repurposed the parking lots for new construction multifamily housing. The process involved rezoning the land for multifamily use and making a number of public realm improvements to sidewalks surrounding the buildings. The final project includes a shared parking garage to serve office and residential tenants.

Source: Grubb Properties

Without public incentives, most office-to-residential conversions are likely to be slightly below market rate apartments.

Office-to-residential conversions are different from new ground-up construction because their starting point is already a performing asset. Despite nationwide examples, office conversions in Portland are still seen by many property owners and developers a risky investment without many comparable examples or strong local industry expertise.[51] To be feasible and attractive to property owners and developers, these projects usually need to promise close to market rate rents or public incentives.

In some markets (particularly east coast cities), conversion projects can achieve top-of-the-market rents if they adapt historic buildings with distinctive features or offer high-rise units that are otherwise unavailable. Portland has availability of high-end purpose-built apartments with premium amenities and rents which suggests that converted units would face competition. Unless a building in Portland includes special, standout features or premium amenities, it will likely achieve only moderate rents (at or below 100 percent of area median income).

An analysis of office-to-residential conversion projects across the country found the median cost of conversion per unit was $255,000 (accounting for hard and soft costs), but costs vary widely and depend on the complexity of individual buildings.[52] In general, rents for converted units tend to track the market. While some examples show that converted units cost less than newly constructed units, local market factors, public incentives, and site-specific opportunities (such as historic tax credits) can have a large impact.[53]

[51] Anjali Kolachalam, "Office to Residential Conversions: Scalable Opportunity or Too Unique to a City Block?"
[52] Anita Kramer, Nolan Eyre, and Morgan Maloney, "Behind the Facade," 11.
[53] Macleans, "How this Calgary company is transforming empty offices into housing units" (December 2022) https://www.macleans.ca/society/how-this-calgary-company-is-transforming-empty-offices-into-housing-units/

Some jurisdictions are implementing affordability requirements with office-to-residential conversion incentives.

Within the Metro area, Portland is the only jurisdiction that currently offers incentives for office-to-residential conversions (SDC exemptions for some types of conversion projects).[54] However, the City of Portland's IH ordinance may apply for office-to-residential conversion projects that trigger the requirements (e.g., has at least 20 units). Jurisdictions across the Metro area have different regulations and incentives for affordable and mixed-income housing.

Financial incentives like tax abatements, local contributions, or SDC exemptions could help the financial feasibility of office-to-residential conversion projects that include affordable units. However, if the same incentives are also available for new construction projects that have less complexity and risk, they will likely be used for new buildings.[55]

Some jurisdictions throughout the country that are implementing public incentives for office-to-residential conversions are also including affordability requirements for a share of units (see Exhibit 10). However, this presents an extra financial hurdle. Since these are relatively new initiatives, most have not yet seen a significant number of new conversion projects completed. Chicago and Washington D.C. have begun to see hundreds of planned affordable units, the highest number coming from Chicago's program which proposes to contribute urban renewal funding to projects with affordable units. Public contributions can help to overcome financial feasibility hurdles and ensure that buildings transition to their highest and best use, but they require individual localities to allocate funds.

Exhibit 10. Office-to-Residential Conversion Incentives and Affordability Requirements
Source: Urban Redevelopment Authority of Pittsburgh, Urban Land Institute

Jurisdictions	Incentive	Affordability Requirements	Status/Units Produced or Planned
Pittsburgh, PA[56]	$60-100k/unit (depending on depth of affordability); <40% of total project costs	20% at 50 – 80% AMI	Program currently open for proposals
Washington, DC[57,58]	20-year property tax abatement	15% at 60% AMI in eligible area (min. 10 units in building)	1,100+ before incentive (projects with proposed affordable units upcoming)
Chicago, IL[59]	$188 million from tax increment financing	30% at 60% AMI	Proposals under review; Planned: 1,600+ units (600+ affordable)

[54] Ken Ray, "Portland City Council Adopts Two Ordinances to Assist in Office-To-Residential Conversions" (City of Portland Bureau of Development Services, March 17, 2023), https://www.portland.gov/bds/commercial-permitting/news/2023/3/17/portland-city-council-adopts-two-ordinances-assist-office.
[55] Connor Allen, "From Boardrooms to Bedrooms: The Challenge of Converting Vacant Office Space Into Housing," May 2, 2023, https://camoinassociates.com/resources/converting-vacant-office-space-into-housing/.
[56] Urban Redevelopment Authority of Pittsburgh, "Pittsburgh Downtown Conversion Program," accessed June 23, 2023, https://www.ura.org/pages/pittsburgh-downtown-conversion-program.
[57] Erica Williams, "Downtown Tax Abatement Tailor-Made for Developers at the Expense of DC Residents," DC Fiscal Policy Institute, April 21, 2023, https://www.dcfpi.org/all/downtown-tax-abatement-tailor-made-for-developers-at-the-expense-of-dc-residents/.
[58] Mimi Montgomery, "DC Area Leads the Way in Office-to-Apartment Conversions," *The Washingtonian*, November 14, 2022, https://www.washingtonian.com/2022/11/14/dc-area-leads-the-way-in-office-to-apartment-conversions/.
[59] Alby Gallun, "Converting Chicago Office to Mixed Use on LaSalle Street," Urban Land Institute, April 24, 2023, https://urbanland.uli.org/development-business/team-announced-for-lasalle-street-redesign/.

Partial building conversions could also be a more appealing option for building owners to add residential units to office buildings.

Although it would be less precise to estimate the potential number of units from partial conversions given the case-by-case nature of these projects, building owners and developers could explore partial rather than full building conversions. These projects may require a lower financial commitment than a full-building residential conversion. In downtown Portland, this could also be targeted to upper floors of larger office buildings where step-backs create smaller floorplates more suitable for residential units. In the suburban market, some developers could also pursue adding floors of residential to existing low-rise office buildings that have not yet maximized their allowed height and floor area ratios.

Adaptive reuse can help achieve climate goals.

The built environment is responsible for approximately 40 percent of global CO2 emissions, with new construction generating roughly 11 percent on its own.[60] Demolition is a large part of this equation, which the United States Environmental Protection Agency (EPA) estimates accounts for 90 percent of building debris, compared with only 10 percent from new construction.[61] In Portland, a 2019 report from the Oregon Department of Environmental Quality (DEQ) found that over 85 percent of materials were able to be salvaged from buildings that avoided demolition, significantly reducing carbon emissions, sequestering bioenergetic carbon in wood, and mitigating environmental pollution.[62]

Implications for Residential Capacity

Downtown Office Market

While it is difficult to predict the number of feasible conversion projects given the amount of public support estimated to be needed to make conversion feasible, it is **unlikely that more than a few downtown office buildings** would convert to residential use over the next 20 years. This could result in somewhere between **200 to 1,500 new units** depending on the number of successful projects, size of individual buildings, level of efficiency in using interior space, and unit mix.

Suburban Office Market

If a building in the suburban market with **high vacancy rates and low rents** were located near a **desirable location** (like regional transit lines or shopping centers) or with standout historic/architectural character, conversion could be likely. Likewise, underutilized parking space (either structured garages or surface lots) could have potential with a desirable location or new investments nearby.

[60] Architecture 2030, "Why the Built Environment?" 2018, https://architecture2030.org/why-the-building-sector/.
[61] US Environmental Protection Agency, "Advancing Sustainable Materials Management: 2018 Fact Sheet," December 2020, https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/advancing-sustainable-materials-management.
[62] Oregon Department of Environmental Quality, "Deconstruction vs. Demolition: An Evaluation of Carbon and Energy Impacts from Deconstructed Homes in the City of Portland" (Portland Bureau of Planning and Sustainability, March 2019), https://www.oregon.gov/deq/FilterDocs/DeconstructionReport.pdf.

If a building conversion were to happen with advantageous circumstances and a willing developer, the number of units produced would be highly dependent on the scale of the building. Based on example suburban office conversion projects in other places (including building and parking space conversions), in a larger building or parking lot, this could yield **up to 500 units** depending on the configuration of an individual property.

Total Potential Housing Capacity

Taken together, **the range of potential housing units that could result from office-to-residential conversion in the region could be between a few hundred units and roughly 2,000 units** over the next 20 years. Units would likely have mid-market rents unless the building had particularly desirable amenities or location that would lead to top-of-market rents.

Documentation of Predictive Development/Redevelopment Model

Prepared for Metro

June 2024

Johnson Economics

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I. INTRODUCTION

Metro contracted with Johnson Economics to develop a modeling tool to predict anticipated development and redevelopment activity. The model is designed from the perspective of a developer and is designed to generate a supply side response to key market parameters. At this time, the model is not dynamically matched with a demand side model, but demand limitations and input can be partially addressed with manual limitation functions incorporated into the model.

The following is a general overview of the model, assumptions utilized in the Urban Growth Report work, as well as instructions for use.

II. GENERAL MODEL OVERVIEW

The developer supply preprocessor model is designed to predict the magnitude and form of likely development or redevelopment activity over an assumed time frame. The primary metric used to predict likely development patterns is the relationship between the supportable residual land value for prospective entitled uses and the current value of the property (including land as well as improvements, if any). The underlying assumption is that when the value of a property for new development is high relative to the current value of the property, it will be more likely to see development or redevelopment over a defined period.

The model is designed to generate an estimated ratio between the current value of a parcel (land and improvements) and the underlying value of the parcel under potential development scenarios. This ratio is used as the primary indicator of the likelihood of development or redevelopment. Within the model, we use Real Market Value (RMV) from the assessors' office as a proxy for the value of the site. While we understand that this is an imperfect measure, it is readily available at the parcel level and any inherent bias is expected to be largely consistent. The residual land value is determined using a series of simplified pro formas that represent potential prototypical development forms. The resulting ratio between current and residual value has proven to be a strong predictor of the likelihood of development or redevelopment at the parcel level.

The model solves for a development solution that represents the highest and best use at the parcel level under the assumptions used, as well as outputting an associated residual property value. The highest and best use of each parcel is defined as the allowable land use program that yields the greatest return to the existing property, and the residual property value reflects the maximum acquisition value supported by that program under the assumptions used.

The model currently incorporates a total of 43 prototypical programs which cover a range of land use types and development forms. An entitlement screen narrows the allowed use types to reflect development forms entitled under existing zoning. In the model, this is done using a matrix that evaluates whether the theoretical programs are allowable under the range of zoning codes in the study area.

The probability of development/redevelopment activity is predicted by the model at the parcel level based on the ratio generated by dividing the current value (RMV) by the indicated residual land value. A shift in assumptions that increases the value of the property under a new development scenario, such as higher achievable pricing, will increase the denominator in this ratio as well as the likeliness of development or redevelopment. Sites with relatively high current values resulting from significant physical improvements will have a relatively high numerator and will be significantly less likely to redevelop.

The model evaluates the likelihood of development at the parcel level, although the results should be expressed publicly only in aggregated geographies. What the model solves for is probabilities to redevelop as well as anticipated development forms, and the results reflect the expected value of development/redevelopment activity. The model will not indicate that a specific parcel will or will not redevelop, it will change the probability of that occurrence as well as the likely form of development.

The following outline summarizes the data feeding into the model, as well as the general function of the model.

Data

Parcel Database

Assumptions

- Achievable Pricing by use type
    - Residential pricing gradient providing parcel specific solutions for rental and ownership units.
    - Commercial and industrial pricing by submarket, expressed in net annual lease rates per square foot.
- Capitalization Rates
    - Vary by use type.
- Threshold rates of return (targeted returns by development community)
- Construction Cost Estimates
- Assumed conversion rate by RMV/Residual ratio.

Entitlement screening matrix

Geographic screening columns

- Geographic submarkets for office, industrial, and retail markets

Parcel Level Data

- Select parcel from database.
- Populate assumptions.
    - Parcel ID
    - Site size (SF)
        - This should be net developable area, deducting slope and wetland.
    - RMV/SF
    - Pricing
        - Residential Pricing (lookup from gradient)
        - Remaining use types set pricing by market area.
    - Zoning (Metro simplified)
    - Current improvements expressed in residential units and/or square feet of commercial and industrial space.

Prototype Screening

- Determine prospective prototypes to run.
    - Screen by zoning designation and entitlement screen

Residual Land Value Calculations

- Run residual land value calculations for allowed prototypes.
- Determine highest and best use based on prototype supporting the greatest residual land value.
    - Establish preferred, as well as second and third options.

Residual land value represents the maximum supportable value and should not be confused with market clearing prices (which should be inherently lower).

Redevelopment Module

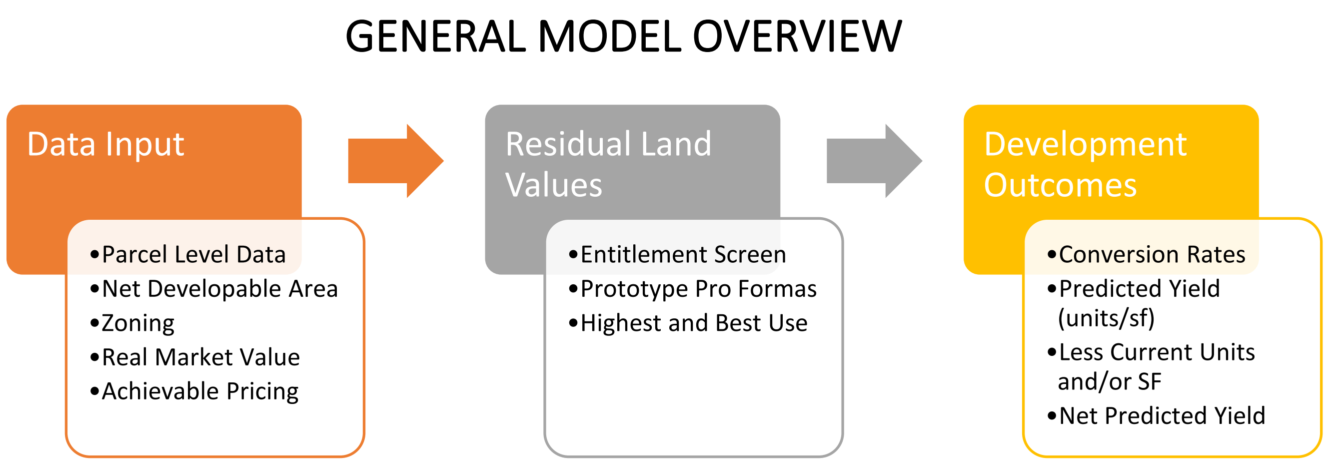
- Categorize parcels into bins based on RMV/Residual ratio and geographic code.
- Apply redevelopment probabilities.
- Predict expected development yield at parcel level.

Market Limit Parameters

- The model allows for demand limits to be placed on output based on a maximum solution for residential units by tenure, office space, retail space, and industrial space.
- The model will sort parcels by likelihood of redevelopment, and when the limit is met will shift the highest and best use determination to the next highest rated use.

Output

- Expected value of predicted development activity and yield within the designated time frame
- Expected value of deduction of current improvements
- Net incremental supportable development capacity
- Output data is printed into a .csv file, which can be imported into a GIS program for further output options.



The model's perspective is intended to mimic that of a developer's, and does not dynamically interact with the demand model. The model will have a tendency to identify a development prototype as highly viable, and this prototype will consistently out-bid alternative uses. The end result is a solution that is highly skewed towards a solution that is immediately viable under current market conditions. If the predicted development output is not consistent with market demand, we would expect the market to respond in ways that reduce the relative return of this product. The market limit parameters component of the model, part of the redevelopment module, is a feedback loop that limits prototype solutions to what can be suported from the demand side.

As an example the model may indicate that rental residential housing is the prevailing development form in most markets where allowed. This output needs to be evaluated in light of market support for this product type. If the model indicates a development output over the next five years of 70,000 new units, while projected demand for rental apartments is only 50,000 units, then the market would be expected to respond with some combination of higher vacancy rates, reduced lease rates, higher capitalization rates, and subsequently lower residual land values. The model in its current form cannot reset these variables dynamically, so we have included the market limit parameters to place demand side limits on the projected development yields. Conversely, if the development is underproducing a product that is demanded we would expect price signals to increase production of that product. A future refinement of this approach would mesh a demand-side model to this model (supply side), allowing for dynamic markt responses to production/demand mismatches.

The model populates a series of fields at the parcel level, which are added to the parcel attributes input from the baseline RLIS/GIS information and input assumptions such as market parameters, financing terms, and construction costs. The highest and best use calculations generate up to three highest and best solutions for each site, as well as the indicated residual land value associatd with each of these uses. The development prediction component of the model sets an assumed conversion rate during the time period based on the RMV/Residual ratio, and well as the predicted yield.

In summary, the model uses the relationship between current value of the property and the indicated value of the property under the highest and best use development prototype as the primary predictive measure of the likelihood of redevelopment.

III. Data

The model has a series of data requirements in order to run, and this section outlines the sources for this data as well as the processes required to get the data in a format that suports the model.

A. Parcel Database

The data requirements at the parcel level are relatively simple. This includes physical data such as net developable area, current real market value (RMV), zoning (Metro's simplified zoning), and parcel reference numbers. The parcel database is further refined to include market information. For residential uses, the model uses parcel-specific pricing data, which has been imported to the parcel database to populate the achievable pricing field for these uses. For retail, office, and industrial uses, the parcels are allocated into defined market areas, and assumed achievable pricing is set at the market level and imported into the parcel database for these uses. The parcel database also includes fields to account for current residential units as well as estimated square footage of commerical and industrial space.

The following is a list of the necessary content.

HEADER	CONTENT DESCRIPTION
reference	Tax lot ID
code	Generalized Metro code
code_general	Generalized code category
tract	Census tract
design type	Metro 2040 design type
vac_dev	Current development status
jurisdiction	Jurisdiction
rmv	Total RMV, land and improvements
net_no_row	Net developable area, deducting constraints and ROW
sf	Current sf of improvements
res_rent	Achievable residential rent psf
res_price	Achievable residential price psf
off_rent	Achievable rent psf for office
ret_rent	Achievable rent psf for retail
wd_rent	Achievable rent psf warehouse/distribution
flex_rent	Achievable rent psf industrial flex space
park_rent	Monthly rent for covered and secured parking
park_own	Value of covered and secured parking space
units	Current residential units

The model utilizes a generalized zoning code used by Metro. The codes of individual jurisdictions are converted into this generalized code using a bridge. This approach is required to keep the number of codes manageable at the metropolitan area leve but may not capture specific elements of a jurisdictions's development code. If used for a single jurisdiction or smaller study area, the actual codes could be used. This would require some minor customization.

The model requires an assumption of achievable pricing levels per square foot for residential uses at the parcel level. For the analysis completed in support of the Urban Growth Report these numbers were generated through the development of residential pricing surfaces, which allow for variation in pricing on the parcel level throughout the region. This variable does not require this level of analysis for all applications and can be generated using market areas and or single assumptions for smaller geographic areas.

The following is a summary of the methodology utilized to create the pricing surfaces.

B. Creating Residential Pricing Surfaces

The residential pricing at the site level was generated using the interpolated rental and ownership pricing surface developed in 2016, with the methodology summarized in Appendix A.

The residential pricing surfaces were adjusted upwards based on marginal shifts in rental and ownership residential pricing since the creation of the surfaces in 2016. Rental residential pricing was adjusted based on observed changes in same product pricing from 2016 through 2023 as reported by CoStar, a third-party data provider tracking a significant pool of rental apartment projects. The 2016 gradient was shifted to match the marginal change in rents during that period. The following is a summary of the approach and adjustments.

- Methodological Approach
  - Matched Pair Pricing
    - Observed current quoted pricing for new projects matched against those predicted in the model.
    - Used CoStar quoted rents for new construction and parcel level model predictions.
- Overall Median Market Shift of 111%
- Sharp Split Between Central PDX and Suburban Markets
  - Urban area rents averaged 123% of predicted.
    - Reduced marketability of many areas
    - Elevated vacancy levels in urban areas since 2017
  - Outside of Central PDX the pricing changes were generally consistent at roughly 150% of previously predicted.
    - Some market saw greater increase (Milwaukie)

Ownership pricing was adjusted based on observed sales of new product relative to the predicted achievable pricing in the 2016 gradients. This analysis indicated an overall upward shift in pricing of 11%, with pricing in the suburbs increasing 31% while those in central Portland decreased 10%. The pricing was further adjusted for several specific communities that have seen more significant pricing changes during this period.

Adjustments to Pricing

Overall Metro	
Median	111%
Average	112%
Central PDX	
Median	90%
Average	92%
Suburbs	
Median	131%
Average	127%

- Methodological Approach
  - Matched Pair Pricing
    - Observed last quarter new home sales matched against predicted in model.
    - Used recorded RMLS sales data and parcel level model predictions.
- Overall Median Market Shift of 111%
- Sharp Split Between Central PDX and Eastside/Suburban Markets
  - Likely reflects reduced marketability of urban area as well as interest in condominiums.

   - Outside of Central PDX the pricing changes were largely consistent.
- Final Adjusted Gradient split adjustment

The final pricing gradients were merged with the parcel level data for use in the model.

C. Office, Industrial, and Retail Pricing Analysis

In addition to the normalization of apartment rental data, the model requires lease rate assumptions for office, retail, and industrial properties. These assumptions were created using a submarket approach. Rent levels were adjusted to reflect triple-net (NNN) rents, i.e., rents in which ancillary costs are not factored.

The submarket approach can capture the differences in achievable lease rates throughout the Metro area but is not able to pick up the differences that exist on a more micro level. As residential pricing can differ substantially within a short distance, so, too, can rents for office, industrial, and retail properties, though not, perhaps, to the same extent as their prices are generally more homogenized across broader areas.

The following tables summarize the assumed pricing for the delineated submarkets for office, retail, and industrial uses.

Submarkets and Assumed Achievable Pricing, NNN Lease Rates

	Office	Retail
217 Corridor Beaverton	$28.00	$33.60
CBD	$32.00	$43.20
Close-In NE	$27.00	$33.60
Close-In SE	$29.00	$38.40
Close-in SW	$25.00	$36.00
Columbia Corridor	$23.00	$24.00
Cornelius Forest Grove	$19.00	$22.80
East-Mid	$24.00	$28.80
	$24.00	$28.80
I-5 South Corridor	$23.00	$28.80
Kruse Way	$26.00	$36.00
Milwaukie and Clackamas	$23.00	$26.40
Northwest	$28.00	$36.00
Outer NW	$19.00	$21.60
Outer SE	$20.00	$24.00
Sellwood-Westmoreland-Woodstock	$26.00	$31.20
Sunset Corridor	$22.00	$30.00

WD/Flex	W/D	Flex
217 Corridor Beaverton	$9.80	$19.60
CBD/NW/Guilds Lake	$13.30	$26.60
Milwaukie and Clackamas	$9.80	$19.60
Close-In Eastside	$17.50	$35.00
Cornelius Forest Grove	$6.30	$12.60
Hayden Island	$8.40	$16.80
I-5 South Corridor	$9.10	$18.20
Columbia Corridor	$9.10	$18.20
Outer SE	$10.50	$21.00
Rivergate	$7.00	$14.00
Sunset Corridor	$9.10	$18.20
Close-in SW	$11.90	$23.80
Swan Island	$8.40	$16.80

D. Use of Generated Achievable Pricing Assumptions

The pricing assumptions for residential, commercial, and industrial space were used to populate the parcel database that is fed into the model (parcel.csv file). Each parcel evaluated is assigned an achievable pricing parameter based on the preceding work, which then feeds into the prototype pro formas to generate associated supportable residual land values.

IV. Estimation of Redevelopment Probabilities/Backcasting

A key variable in estimating the likelihood of development/redevelopment activity is the assumed probability of development/redevelopment within a time frame. This factor is expected to vary by region and was established within the modeling framework using a backcasting exercise. This exercise was deemed necessary to calibrate the model by means of predicting development over an extended period and comparing that predicted level of development to *actual* observed rates of development. This approach was used for two time periods. The first of these was 2000 through 2015, with that analysis completed in 2017. A second analysis was completed for activity between 2015 and 2021. The two periods reflect several business cycles with significant recessions.

The approach used the modeling framework previously outlined to determine the RMV/residual value calculations at the parcel level in 2015, and then matched observed development activity at the parcel level through 2022. Market and financial variables used in the model were based on 2015 data provided by Johnson Economics, while construction activity was based on data collected by Metro. The modeling was done on five major zoning designations:

- Multifamily Residential
- Mixed-Use
- Single Family Residential
- Commercial
- Industrial

Parcel and pricing data at the parcel level was available from the 2017 analysis. Sites were aggregated based into five categories of RMV/Residual ratios:

- Less than 0.75
- 0.75 to 1.25
- 1.25 to 2.00
- 2.00 to 4.00
- Greater than 4.00

Over 178,000 parcels were evaluated, of which over 127,000 were single family residential, almost 30,000 multi-family, 16,700 mixed-use, 1,278 commercial, and over 3,400 industrial.

Calculation of Development/Redevelopment Conversion Rates

The observed development activity was matched with the parcels by RMV/Residual ratio, providing for an observed development/redevelopment rate by category. As summarized in the following table, the overall rate of development/redevelopment over the 6-year observation period was 2.58% of parcels, with the rate of redevelopment sharply higher on parcels with a low RMV/Redevelopment ratio. This is consistent with the expectations that parcels with a lower current value relative to the parcel's residual value would be expected to redevelop at a significantly higher rate. It should be noted that this category includes vacant land. The redevelopment rate when adjusted for acreage increases to 7.05%, reflecting a higher likelihood of redevelopment on larger parcels. This likely includes the inclusion of a number of larger vacant sites.

The resulting pattern of observed development relative to the RMV/Residual ratio was largely consistent with expectations. One notable exception was a higher observed rate of redevelopment for industrial properties with a ratio of .75-1.25. A potential explanation for this is shifting needs of industrial tenants necessitating significant investments in already improved properties.

The following figures summarize the observed rate of development/redevelopment, sorted by RMV/Residual ratio and broad land use category.

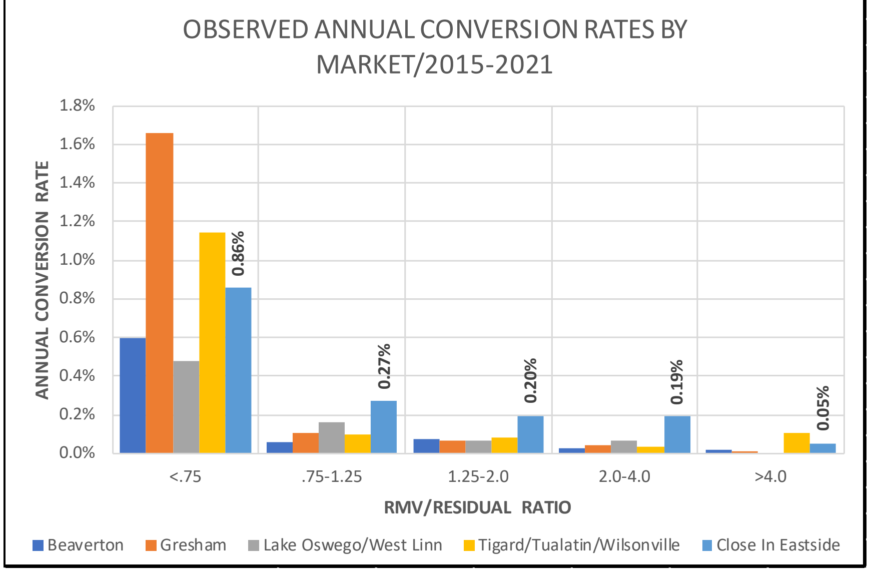
SUMMARY OF OBSERVED DEVELOPMENT RATE BY RMV/RESIDUAL RATIO, 2015-2021

	RMV/Residual Ratio					
	<.75	.75-1.25	1.25-2.0	2.0-4.0	>4.0	Total
TOTAL						
Total Parcels	78,222	50,505	24,751	12,697	12,302	178,477
Developed Parcels	3,879	509	135	48	26	4,597
% Developed	4.96%	1.01%	0.55%	0.38%	0.21%	2.58%
Total Acres	23,600	7,239	4,378	1,944	485	37,647
Developed Acres	2,371	199	47	34	4	2,654
% Developed	10.04%	2.74%	1.08%	1.73%	0.74%	7.05%
MFR						
Total Parcels	9,630	3,349	5,122	5,702	5,877	29,680
Developed Parcels	491	28	13	4	12	548
% Developed	5.10%	0.84%	0.25%	0.07%	0.20%	1.85%
Total Acres	1,484.0	481.6	486.0	195.5	96.4	2,743.5
Developed Acres	153.6	10.8	9.2	3.5	0.1	177.3
% Developed	10.35%	2.24%	1.89%	1.79%	0.12%	6.46%
MUR						
Total Parcels	6,693	2,315	1,509	1,906	4,318	16,741
Developed Parcels	729	117	52	13	10	921
% Developed	10.89%	5.05%	3.45%	0.68%	0.23%	5.50%
Total Acres	2,267.6	597.9	401.1	375.4	181.0	3,823.0
Developed Acres	367.7	29.1	23.9	10.0	0.9	431.5
% Developed	16.21%	4.87%	5.97%	2.65%	0.48%	11.29%
SFR						
Total Parcels	60,470	44,054	17,342	3,881	1,581	127,328
Developed Parcels	2,571	318	50	11	0	2,950
% Developed	4.25%	0.72%	0.29%	0.28%	0.00%	2.32%
Total Acres	16,680.9	5,325.1	2,403.5	423.6	27.8	24,861.0
Developed Acres	1,468.2	72.1	6.3	2.0	0.0	1,548.6
% Developed	8.80%	1.35%	0.26%	0.47%	0.00%	6.23%
COM						
Total Parcels	242	198	271	324	241	1,276
Developed Parcels	11	2	3	5	4	25
% Developed	4.55%	1.01%	1.11%	1.54%	1.66%	1.96%
Total Acres	416.7	128.0	245.2	367.6	97.2	1,254.7
Developed Acres	35.0	0.7	0.8	10.8	2.6	49.9
% Developed	8.40%	0.53%	0.34%	2.93%	2.69%	3.98%
IND						
Total Parcels	1,187	589	507	884	285	3,452
Developed Parcels	77	44	17	15	0	153
% Developed	6.49%	7.47%	3.35%	1.70%	0.00%	4.43%
Total Acres	2,751.1	706.5	842.5	581.9	82.3	4,964.5
Developed Acres	346.0	85.9	7.0	7.4	0.0	446.3
% Developed	12.58%	12.15%	0.83%	1.28%	0.00%	8.99%

The analysis was converted into an average annual conversion rate (% of parcels developed) for the period. The following tables summarize the results by selected jurisdictions and use categories.

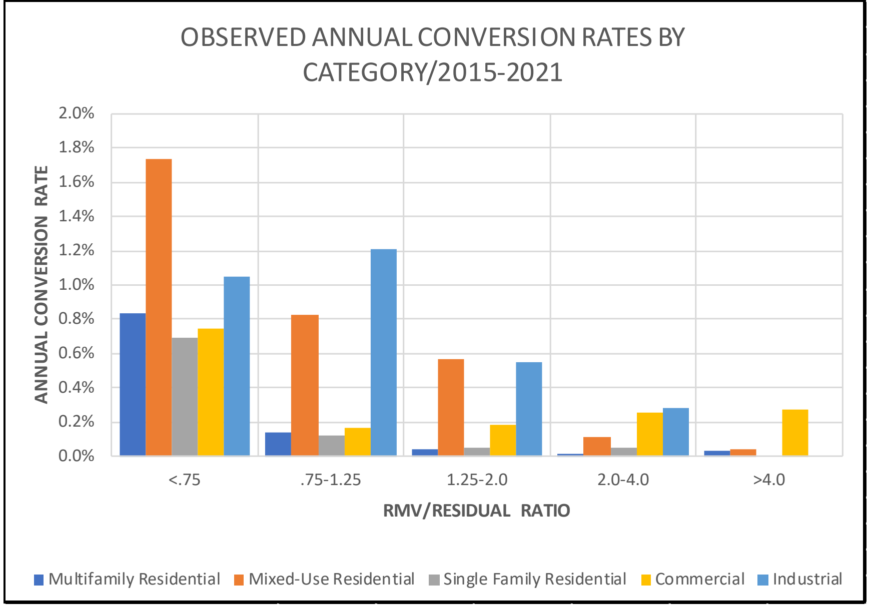
Summary of Annual Conversion Rates by RMV/Residual Ratio and Jurisdiction, 2015-2021

	RMV/Residual Ratio					
	<.75	.75-1.25	1.25-2.0	2.0-4.0	>4.0	Total
Beaverton	0.60%	0.06%	0.07%	0.02%	0.02%	0.14%
Gresham	1.66%	0.11%	0.07%	0.04%	0.01%	0.29%
Lake Oswego/West Linn	0.48%	0.16%	0.07%	0.07%	0.00%	0.33%
Tigard/Tualatin/Wilsonville	1.14%	0.09%	0.08%	0.04%	0.10%	0.40%
Close In Eastside	0.86%	0.27%	0.20%	0.19%	0.05%	0.62%
OVERALL	0.83%	0.17%	0.09%	0.06%	0.04%	0.43%



Summary of Annual Conversion Rates by RMV/Residual Ratio and Land Use Category, 2015-2021

	RMV/Residual Ratio					
	<.75	.75-1.25	1.25-2.0	2.0-4.0	>4.0	Total
Multifamily Residential	0.83%	0.14%	0.04%	0.01%	0.03%	0.31%
Mixed-Use Residential	1.74%	0.83%	0.57%	0.11%	0.04%	0.90%
Single Family Residential	0.70%	0.12%	0.05%	0.05%	0.00%	0.38%
Commercial	0.74%	0.17%	0.18%	0.26%	0.27%	0.32%
Industrial	1.05%	1.21%	0.55%	0.28%	0.00%	0.73%
OVERALL	0.83%	0.17%	0.09%	0.06%	0.04%	0.43%



The results of this analysis were joined with those of the preceding analysis to assess average redevelopment rates from 2000 through 2021. The combined annual conversion rates by RMV/Residual ratio for the period was as follows:

RMV/Residual Ratio	< 0.75	0.75-1.25	1.25-2.00	2.01-4.00	> 4.00
Annual Conversion Rate	0.964%	0.43%	0.16%	0.054%	0.054%

While the preceding methodology provides for a range of assumptions that are empirically derived, ongoing use of the model will ongoing data to update these assumptions in subsequent periods. When the model is run, it generates indicated RMV/Residual ratios at the parcel level for each parcel evaluated. This datafile should be dated and preserved. Metro currently tracks marginal development activity at the parcel level, which can be matched to the parcels evaluated with the model. Over time, an updated conversion ratio can be generated based on observed redevelopment patterns. This should be added to the base layer over time, modifying the results. Ideally the backcasting will include a rolling period of fifteen to twenty years, allowing for multiple business cycles. The rate and pattern of redevelopment varies significantly within a business cycle, and short-term patterns may not be indicative of what should be used for a longer-term forecast.

The model should continue to be refined going forward, and ongoing monitoring and backcasting of the model should increase its reliability.

V. Prototype Screening

The prototypes evaluated on individual parcels were limited based on entitlements. Current simplified zoning designations used by Metro and available for all parcels within the UGB were used. A matrix of allowed prototypes by zoning designation was used, which limits prototypes considered to those that are consistent with current entitlements.

The model is structured to evaluate a total of 43 prototypical development programs, covering a range of land use categories as well as construction types. The general use types evaluated include office, retail, industrial, rental residential, and ownership residential. These are modeled using simplified pro formas, which are designed to yield supportable residual property values associated with the development of each of the programs under the assumptions used.

The following are the basic program parameters of the prototypes used. The prototypical development programs are listed across the top, with assumptions for each listed in the column below:

Summary of Development Prototypes

	FAR	Efficiency Ratio	Parking Per 1,000	% Structured
INDUSTRIAL				
Warehouse / Distribution	0.33	100%	1.00	0%
Fullfillment Center	0.25	100%	3.50	0%
Data Center	0.33	100%	0.40	0%
Manufacturing	0.25	100%	3.00	0%
Multi-Tenant Flex	0.28	100%	1.00	0%
OFFICE				
Office high rise	7.50	90%	1.50	100%
Office mid/struc	3.75	90%	1.50	100%
Office mid / ext. struc	2.00	90%	1.50	85%
Office mid/surf	0.50	90%	1.50	0%
Office high rise - CC	7.50	90%	0.50	100%
Office mid/struc - CC	3.75	90%	0.50	85%
Office mid / ext. struc - CC	2.00	90%	0.50	85%
Office high rise - LP	7.50	90%	1.00	100%
Office mid/struc - LP	3.75	90%	1.00	100%
Office mid / ext. struc - LP	2.00	90%	1.00	85%
Office mid/surf - LP	0.50	90%	1.00	0%
Office low rise	0.30	100%	1.50	0%
RETAIL				
Multi-Story Structured	1.00	90%	3.50	85%
Single Story Structured	0.50	100%	3.50	85%
Single Story Surface	0.30	100%	3.50	0%

	Units/ Acre	Unit Size (SF)	Efficiency Ratio	Parking Ratio	% Structured
RENTAL RESIDENTIAL					
Rental high rise	400.0	725	85%	1.00	100%
Rental Mid Rise w/ Garage	225.0	750	85%	1.00	100%
Rental 5 over 2	225.0	750	85%	1.25	100%
Rental 4 over 1	170.0	750	85%	0.75	100%
Rental high rise-IZ	400.0	725	85%	0.25	100%
Rental Mid Rise w/ Garage - IZ	225.0	750	85%	0.25	100%
Rental 5 over 2 - IZ	225.0	750	85%	1.25	100%
Rental 4 over 1 - IZ	170.0	750	85%	0.75	100%
Rental 5-story wood w/surf	90.0	750	85%	1.25	0%
Rental 4-story wood w/zero	120.0	750	85%	0.00	0%
3-story garden w/surf	35.0	750	100%	1.50	0%
Rental Plexes	16.0	750	100%	1.25	50%
Rental 3-story Townhome	20.0	1,000	100%	1.50	50%
Rental_Middle_TypeV	16.0	750	100%	1.25	50%
OWNERSHIP RESIDENTIAL					
Condo residential high rise	400.0	775	83%	1.50	100%
Condo Mid Rise w/ Garage	250.0	775	83%	1.50	100%
Condo 5 over 2	210.0	775	85%	1.50	100%
Condo 4 over 1	170.0	775	85%	1.00	100%
Condo 3-story wood w/surf	35.0	800	100%	2.00	0%
3-story wood townhome	22.0	1,250	100%	2.00	50%
For-Sale Duplexes	16.0	1,250	100%	2.00	50%
Small Lot Detached	18.0	1,750	100%	2.00	50%
Detached Single Family	8.7	2,800	100%	2.00	50%

The 43 prototypes were cross referenced with Metro's 54 simplified zoning codes, enabling the model to determine which prototypes are entitled at the site level.

The prototype models are reliant upon a series of assumptions, many of which are highly variable over time. One of the key determinants of residual land value is the capitalization rate. This rate is a real estate valuation measure and is calculated as the ratio between the net operating income produced by an asset and the market value. As an example, an asset with an annual net income stream of $100,000 per year would be worth $1,000,000 if the capitalization rate was 10%, or $2,000,000 if the capitalization rate was 5%. The lower the rate, the lower the rate of return an investor will accept to hold that asset. The rate fluctuates based on the perceived risk in the asset class, as well as alternative available returns. Construction costs are also highly variable and are more difficult to establish.

For both capitalization rates and construction costs, we would recommend that periodic updates revise the assumptions based on a survey of local brokers and general contractors. A simple matrix of cost assumptions corresponding to the data included in the model could be circulated to update assumptions. As the model is intended for use in a regional forecasting context, with a forecasts period of decades, there is little input that these groups will likely be able to offer in terms of long-term assumptions. Setting the capitalization rate at a risk premium vis-à-vis a commonly forecasted variable such as treasury rates would allow for setting assumptions in out years.

Additional Comments

- The model does not address brownfield redevelopment, or other unusual site costs and infrastructure requirements to develop properties. While we recognize that these are important considerations, it is not within the scope to generate this specificity of analysis. There is a high level of uncertainty and wide cost variances, and it would require significant effort to refine these assumptions at the regional level. We would suggest that the results of the model be open to the input of jurisdictions and/or interested parties that either have or can generate information pertinent to specific properties.

- The model does not reflect any interaction to influence development outcomes. Market interventions such as active public investment to offset costs, property tax abatements, new market tax credits, and low-income housing tax credits can substantively impact development viability. As with brownfield and unusual site-specific costs, jurisdictions could be allowed the opportunity to provide additional information that can refine the output of the model.

VI. Residual Land Value Calculations

A series of simplified pro forma models are used to calculate supportable residual land values. These models incorporate the assumptions on cost, revenue, operating costs, and return parameters. The models are static and the unleveraged return on cost is used as the measure to establish supportable residual values. For income property types we use the net operating income (NOI) in the first stabilized year of occupancy, while ownership residential uses a return on cost after sales costs.

The model is structured to evaluate the allowed prototypical development programs, based on the market assumptions provided. These are modeled using highly simplified pro formas, which are designed to yield supportable residual property values associated with the development of each of the programs under the assumptions used. The output of the pro formas is evaluated and a highest and best use determination is made for each parcel. The full pro formas using a hypothetical set of assumptions is included in the appendix.

The pro formas for each of the land use types reflects a relationship between achievable pricing, development form, and indicated residual land values. The construction types vary in cost as well as yield, with construction types with high yields in terms of density typically being costlier to construct. In markets in which pricing is adequate to support higher density development forms, these forms will be able to outbid lower intensity development solutions for land. The residual land value in the model is a function of achievable pricing and yield by prototype, with the prototype that supports the highest residual land value representing the “highest and best use” of the property.

A total of up to three highest and best use solutions is derived for every parcel. The second and third alternatives will support lower residual land values, and therefore not represent the highest and best use in an unconstrained situation, there are instances in which the demand side of the equation will preclude the initial indicated use type.

Additional details on the pro forma models are included in Appendix B.

VII. Redevelopment Predictions

The highest and best use determination is reconciled with information specific to the study area to generate a prediction of new development activity. As outlined previously, each parcel is assumed to have a higher probability to develop or redevelop under the indicated highest and best use program when the market value of the property in its current use is close to or below the supportable residual property value.

The ratio generated by dividing the RMV/SF by the residual value per square foot is used as an indicator of a parcel's likelihood of development. The model sets expected values of development at a parcel level, as opposed to specific predictions. The output is best viewed at an aggregated level, as individual parcel information will reflect only a shift in development probability and the resulting expected value of development.

Individual parcels are evaluated based on their RMV/Residual ratio, as well as their indicated highest and best use development prototype. The model applies the development/redevelopment rates derived from the backcasting exercise summarized earlier and produces an expected value of development from these sites.

Market Limit Feedback

The previous steps in the model will solve for a highest and best use solution that is not limited by market demand. To the extent that the highest and best use solution delivers product in a quantity that is above what the market demands, then we would expect that market forces would shift in a way that reduces the yield for that development type. This would then reduce indicated residual land values, as the highest and best use would then shift to a prototype that supports less in terms of value.

The model allows the user to place limits on the predicted development output by major land use type. For each parcel, the model will output the highest and best use determination and associated indicated residual value, as well as a second and third option. These will be determined in the same manner as the initial highest and best use determination but will be restricted to a separate broad land use category. The following are the broad categories that output will be limited at:

- Industrial
- Office
- Residential Ownership
- Residential Rental
- Retail

The model has a cascading function which works as follows if limits are set:

- All the prototypes are calculated per parcel.
- The resulting rows are sorted descending by residual property value per square foot.
- Starting with the prototype that yielded the highest residual property value per square foot and working down, each prototype is compared to the limit if it is set for that prototype class.
    - Residential limits are expressed in number of units.
    - Commercial/Industrial limits are expressed in square feet.
- If the limit has not been reached, the row is preserved, and the counter is incremented.

- If the limit has been reached, the row is not included in the output file, and all remaining highest and best use solutions for that parcel are promoted. I.E the previous #2 use will be the new #1 use.

Conversion to Net

The model is designed to predict anticipated development/redevelopment activity. For the Urban Growth Report (UGR), it is necessary to convert this activity to net gain in capacity. The calculation to do this is a simple deduction of current capacity, expressed in terms of residential units, office, retail, and industrial space. The estimates of current capacity are developed in the baseline data file fed into the model.

An example of a net conversion would be redevelopment of a current single-family home into a tri-plex unit. The new development of three units would replace a single unit, yielding a net gain of two units.

Redevelopment of parcels does not always yield a net increase in capacity, as new development is not always at a higher intensity than previous development. This is primarily true for use types such as industrial space, with new development often having similar or lower floor area ratios (FAR) relative to existing development. As a result, the model may predict redevelopment of industrial property, which would yield development that is more marketable, but not necessarily representing a net increase in industrial space.

Appendix A: Pricing Gradient Methodology Details

The following documentation is from a 2017 study[1] prepared for Metro.

A. Creating an Interpolated Rental Surface from Rainmaker and Axiometrics Apartment Rental Data

Purpose

Johnson Economics has set forth to generate a map showcasing existing rents throughout the Metro area. Whereas previous versions of this analysis divided the Metro area into areas with set rental prices based on surveyed properties, this analysis would use interpolation methods in GIS software to set the rental prices at the tax lot level.

Obtain rental data

Before this project started, Johnson Economics had created an interpolated rental grid for use in other projects. To collect data, Johnson Economics surveys rental properties by using apartment complex websites and calling the complexes and talking to leasing agents directly. By obtaining rents, square footage and, most importantly, the number of each type of floor plan (sometimes given actual rental rolls), we can calculate accurate blended per-square-foot rental averages for the complexes. Though the process is more time consuming up front than, say, data obtained by web scraping, the data obtained is of very high quality, which makes interpolation of the rents after this collection very straightforward after normalization.

Metro provided Johnson Economics with two different rental data sets: Rainmaker and Axiometrics. Rainmaker is a web-scraping tool that searches apartment sites and other listing sites such as Craigslist for rents. Axiometrics is a survey-based panel that contains information on just under 400 different properties in the Oregon Metro area.

Cleaning of Rainmaker Data

The Rainmaker data consists of over 1.6 million observations from mid-2011 to mid-2016. Though large in number, the data is chaotic and includes several issues that need to be addressed. Though rents and square footage are included in the data, it is not possible to discern the number of each type of unit in each complex, making the previous method of attaining blended averages moot. Further complicating the issue is that individual properties have a wide range of observations, ranging from 1 to over 1,900. While we could evenly spread surveys geographically in our original interpolation method, this clustering of data presents problems. Using the data as is would mean not using apples-to-apples comparisons.

Johnson Economics and Metro communicated on several occasions to determine how best to move forward with this issue. The first idea was to round rents to the nearest $10 to $50 to see if that would make a difference. It was then suggested to just take averages for each complex, which makes some sense on the surface. However, upon further reflection, this proved to not be the correct way to proceed. In the Rainmaker data, we are presented with one rent per floor plan, not for an individual unit (at least, not in complexes; single family housing units in this data were another matter altogether). As such, we may see rents for one studio plan, two different one bedroom, and two different two bedrooms. Averaging them would, clearly, be better than not. However, it would also be misleading. What if, for instance, the above imagined complex had 40% of its units as studios? If that is the case, then the PSF averages calculated without that knowledge would vastly underestimate the PSF averages for that building.

Johnson Economics thus decided that the best course of action was to aggregate rents into larger areas. Aggregation was first tried at the census block group level, but that quickly proved too small for this analysis. Instead, aggregation by neighborhoods as defined in the Oregon Metro Regional Land Information System (RLIS) was determined to be the best course of action. While not perfect, the resulting numbers better reflect potential unit mixes in the areas and begin to give a better reflection of underlying rents in the Metro area. As will become clear in the following section, the Axiometrics data is much more streamlined and avoids many of these pitfalls.

[1] Johnson Economics, Developer Supply Preprocessor Documentation, Metro, December 2017

Before processing the data in Stata, it is necessary to preprocess the data using GIS. The CSV of the Rainmaker data is loaded into QGIS. The data expands beyond the boundaries of Oregon Metro proper, crossing the Columbia River and including such areas as Vancouver, Washington. These outlying areas are excluded by clipping the data with the Metro area's geographical boundaries. The data is then intersected with the Metro neighborhood and tax lot layers. By using the tax lot layer, we can join Metro's affordable housing layer for use in cleaning the data. The data is then exported into a new csv file.

The Rainmaker data we obtained from Metro had already been cleaned before it was given to Johnson Economics. Metro removed over 80% of the observations, reducing the final count to just over 300,000 from more than 1.6 million. The removed observations were deemed to be duplicates in the data after accounting for address, list year/quarter, bedrooms, and price. Square footage was not considered in this process as many of the Rainmaker observations were missing this variable.

Square footage, however, is an essential piece of this analysis. Because of this, one of the first steps in the cleaning process is to remove any listings without this information. After removing these, the next step in the cleaning process is to look at the rental types. Rainmaker classifies observations into several different categories, including apartments, single family residences, mobile homes, condominiums, and time-depended units such as executive suites. For our purposes, we wanted to whittle these categories down to apartments only.

Upon close inspection of the data, however, there are many instances where categories do not match the notes in the observation. For instance, there are quite a few instances where well known apartment complexes in the Portland Metro area are listed as single-family residences even though that is clearly not the case. As such, code needs to be written to cycle through the observations to search for key words and reclassify the rental types based on names of complexes and certain key words. So, for example, we search the notes column for the word "house" and relabel the rental type as SFR.

Observations listed as duplexes/triplexes, townhomes, time (short-term rentals, such as executive suites), single family residences, mobile homes, and condominiums are all removed from the data in the cleaning process. As this Rainmaker data is to be combined with data from Axiometrics—which has only apartment units—the decision to remove these is made for consistency across the data sets. Future iterations of this work could take advantage of the many different housing categories present in this database. For instance, it may be interesting and useful to compare how rents in single family residences are changing compared to those of condominiums and apartments.

Bedrooms and bathrooms in the Rainmaker data are presented as strings. Additionally—like the rental type variable—there are issues with consistency in the observations. For instance, apartments with 1 bath and a partial bath are listed as having either 1.2, 1.3, 1.5 or 1.7 baths. We call these "1.5" baths. Similarly, 2-bedroom units are listed as "21BR", "22BR", or "2BR". These are all simply renamed "2Bed" for the purposes of this analysis. The renamed strings are then turned into integers for use in hedonic regression analysis.

Given that we almost never see new apartments built with over 4 bedrooms or 3 baths, all observations with either of these are dropped. Similarly, almost all new units that we see are between 350 square feet and 1,600 square feet. As such, units outside of this range are eliminated. There is another reason for this as well. We have recently seen several "micro-apartments" being built in the Metro area. However, as these units are often no bigger than 150 square feet, the per-square-foot values (on which the interpolation is built) become problematic. These units can easily fetch $5-6 PSF or more, which is higher than penthouse units in high-end towers near the central business district.

We next concatenate year and quarter. After sorting it, it becomes clear that there are very few observations before the third quarter of 2011. As such, these, too, are dropped. At this point, we drop all observations that are identified in the data as affordable. As our model predicts market-rate apartment development, these need to be removed. After removing the layer, there are still many observations that fall well below what we observe to be market-rate in 2016. We rarely, regardless of size, see any apartments renting under $1.10 PSF, and certainly not below $1.00 PSF. These are conservative numbers. Still, we need to have a cut-off point and chose $1 for the purposes of this analysis.

This, of course, is just relevant for 2016 data. We assume a 10% gain in PSF per year and go backwards in time dropping anything below adjusted thresholds. Again, we are being very conservative here and are still likely keeping some observations that are not entirely relevant.

At this point, we need to think of the age of a property. If we include anything built before 2000, there is a strong possibility that renovations may have been done to the property. For example, Lumina apartments in Gresham was built in 1994 and just recently finished renovations in their buildings. PSF values shot up dramatically. As the Rainmaker data does not denote which complexes have been renovated, we simply drop any observations built before 2000.

Cleaning of Axiometrics Data

To expand the number of points for use in rent interpolation in GIS software, Metro obtained apartment rental data from Axiometrics. Unlike the web-scraped data from Rainmaker, Axiometrics data is a panel based on monthly surveys. In the Oregon Metro region (including Clark County, Washington), there are 388 properties with a combined 2,999 floor plans and 74,494 units represented in the dataset.

Whereas the Rainmaker dataset was missing a lot of data points, the Axiometrics dataset has complete information for all properties represented. So, for instance, square footage of every property floor plan is listed. More importantly, the Axiometrics data includes the unit count for each type of floor plan, which makes finding weighted per-square-foot rent averages much more straightforward to calculate. Despite the much more complete nature of the data, some cleaning of the data was necessary to keep assumptions like those of the Rainmaker data.

Before doing anything in Stata, the CSV file was imported into QGIS. The data was then clipped with the most recent Metro boundary layer to ensure that no points from Clark County or other outlying areas was included. Additionally, the data points were joined with Metro's RLIS neighborhood layer. After these adjustments, the data was imported into Stata for cleaning.

As the Rainmaker rent data was given as individual points, the Axiometrics data was expanded from floor plans into individual units. For instance, if an apartment's 1B/1b floor plan had 10 units, the data point was expanded into 10 identical data points. This has the benefit of matching the type of data with Rainmaker while simultaneously expanding the number of observations. Note: It is reasonable to assume that there is within floor plan variation of rents. For instance, premiums are often given to units that are on higher levels in a building as they often have a view. However, given that this information was not present, the decision was made to keep all expanded rent levels at the average listed in the Axiometrics data.

Secondly, as in the Rainmaker data, units with square footage of less than 350 or greater than 1,600 were removed. As mentioned previously, beyond a small amount of so-called "micro studios," apartments in these sizes are simply not being built and are not reflective of regular market rate rents that will likely be built in the future. Even if micro-studios are built in the future, we find that they are a much different product than the other market-rate units used for the purposes of this study; they tend to be priced no lower than $5-6 per square foot, well above even the highest levels seen in the Portland central core.

As stated above, we are interested in newer properties for this analysis. As we do not have data on the types of materials used for building the properties and the amenities that they may have, we use year built as a proxy for this. While the Axiometrics data includes whether a property has been rehabbed, we drop observations for apartments built prior to 2000 to keep as much consistency as possible with the Rainmaker dataset.

In the Rainmaker dataset, we removed any properties with per-square-foot rents of less than $1 to weed out potential affordable properties. However, after removing the properties built before 2000, no such observations existed. Consideration was taken to try and remove properties on the high end to try and account for penthouse units. However, given the wide spectrum on which different properties price their units, we did not feel that there was a sufficient foundation to decide on these price cutoffs. Given extra time, future studies could attempt to incorporate this information by doing more detailed surveys of properties. As it is, all remaining units were left in the data.

Normalization Process

Note, please see the appendix for output and a more detailed explanation of results. We also offer suggestions for future iterations of this work using quantile regression as there seems to be clear shifts in effects at difference price levels. Further information can be gleaned from Stata .do files for this project, which will likely be converted into R during future iterations of this work. We will now cover the process that we followed from a broader perspective.

Because of the spatial gaps present in the Rainmaker data, it was necessary to include observations further back than the current quarter. Future iterations should aim to simply include the most recent quarterly information, if possible, but it was our judgment that this was not ideal with the data given. As such, we needed to find a way to deal with the time variables.

The Axiometrics data is a balanced panel. Information is gathered on a set number of properties on a monthly basis by employees making direct calls to property management for the most current information. If a panel regression had been necessary (it was not), it would have been straightforward to implement. The Rainmaker data, on the other hand, is "scraped" from the web from a variety of sources. Whereas you have properties repeated on a consistent basis in Axiometrics, this is not so in the Rainmaker data. Some properties have one observation over several years of data while others have hundreds or—in some more extreme cases—thousands. One could, theoretically, create a panel from this, but it would be overwhelmingly unbalanced. We cannot justify use of panel regression.

Instead, attempt two different analyses with the creation of time indicator variables. The data given is quarterly. We create dummies for year, quarter, and a newly created variable YearQuarter, which is a combination of the two. In the first analysis, we use our intended independent variables plus year and quarter. In the second, we use the same variables and the YearQuarter variable. Both results are, not surprisingly, remarkably similar and included in the appendix. We would hope that future Rainmaker data is more thorough and only has to focus on the most recent quarter, eliminating the need for this process.

In addition to these time dummies, we control for spatial autocorrelation with the inclusion of an indicator variable for neighborhood. Neighborhoods are a catch-all of sorts for many variables that are often included in hedonic regressions, such as distance to schools, walk score, transit score, income levels, education levels, median age, etc. When one chooses a home to rent or own, they may certainly do so because of a single issue such as the strength of a school for their children. One might also simply choose a neighborhood because it is attractive for prospective renters/buyers at the aggregate level. Given time, future iterations could certainly be more detailed and include any number of variables. We do not do so at this stage.

Other than the time indicator variables (not shown below), the variables included in the Rainmaker and Axiometrics regressions are the same and follow the equation specified below:

$$PSF = \alpha+\beta_1*(SquareFeet)+ \beta_2*(Beds)+\beta_3*(Baths)+\beta_4*(YearBuilt)+ \beta_{5+}*(Neighborhood)+\varepsilon$$

Heteroscedasticity is assumed and, upon testing, shown to exist. We adjust for this by using the Huber-White Sandwich Estimator when running the regressions. Using the coefficients resulting from the regression, we normalize the current rent levels to that of a *newly built* 750 square foot, 1-bedroom, 1-bath apartment. This new variable, PSF750, is calculated using the following equation:

$$PSF750 = PSF+(750\text{-}sqft)*\ \beta_{SquareFeet}+(1\text{-}Beds)*\ \beta_{Beds}+(1\text{-}Baths)*\ \beta_{Baths}+(2016\text{-}year\_built)*\ \beta_{YearBuilt}$$

GIS Process

1. Interpolation of Rents (In QGIS; the steps will be similar, but not exactly the same in ArcGIS)
    a. Using the RLIS neighborhood layer, create neighborhood centroids.
    b. Join the information just generated in Stata to this centroid layer using the neighborhood name.

    Create Interpolated raster grid in QGIS

    c. Under Vector→Raster tools, click on "Multilevel B-Spline Interpolation"
    d. Choose the point layer (the MF Comp data)
    e. Choose normalized PSF as your Attribute on which to interpolate
    f. Under Method, change to "With B-Spline refinement"
    g. Leave Output Extent blank
    h. Make cell size no less than 100 feet, preferably a bit larger, say, 500 ft. Processing takes a much longer time the smaller the cells are.
2. Obtain relevant tax lot layer
    a. Do NOT clip to your final shape until the end.
    b. If you want to make processing quicker, you can create a ¼ mile buffer around your desired study area. However, clipping to the final shape proper will likely mean missing certain important lot centroids.
3. Create a layer for tax lot centroids.
4. Intersect the centroids layer with zoning.
5. Use the QGIS tool "Add Grid Values to Points"
    a. Under Raster→Vector tools
    b. Choose the Tax lot/Zoning points later.
    c. Choose the interpolated grid created in Step 3.
    d. Choose "Inverse Distance Interpolation" [2] as your interpolation method. There are several others if you so choose. The choice matters less the more input points you have.
6. Join the newly created point layer to the original tax lot polygon layer (or the clipped and buffered tax lot layer as explained in Step 4).
7. Save this as its own file, then remove the join.
8. Remove any duplicate columns.
    a. Make sure to leave in the zoning and PSF columns.
9. *Now* you can clip to the final shape.
10. Extract the table as a csv for use in the BLI modeling in Excel.
11. Display the PSF rent gradient with graduated colors. Use the following:
    a. Start with < $1.50 and then increase by $0.25 increments. End with >$3
    b. Alternatively, the map can be broken up with Jenks natural breaks. However, the former method would certainly be more intuitive for a wider audience should the maps be published.

B. Creating an Interpolated Ownership Residential Sales Surface from County Assessor Data

Purpose

Because the implementation of the interpolated multifamily rental surface for the Metro area was successful, Johnson Economics wanted to determine the potential of creating a similar surface for ownership residential sales. Instead of normalizing to a set home size and other characteristics, Johnson Economics thought that it would also be pertinent to normalize the pricing to lot square footage. As with the multi-family normalization, this process aimed to provide Metro with parcel-level detail on single-family home pricing instead of broader regions as seen in the office, industrial, and retail maps below. As home sales (and rents) can vary from neighborhood-to-neighborhood and, even, street to street, it is important to work towards this type of mapping to give a more accurate look at potential future redevelopment.

Obtain Sales Data

There are a limited number of ways to obtain sales data, and each has their plusses and minuses. For the use in these iterations of the interpolated sales surface, Johnson Economics, via Metro, obtained sales data by way of county assessor records. These obtained records went back to 1996 and consisted of sales records in Clackamas, Multnomah, and Washington Counties. However, for future iterations of this work, Johnson Economics recommends that Metro obtain sales data from a different source. The reasons for this will be discussed in the "Limitations and Suggestions for Future Iterations" section below.

Clean Sales Data

As with the multi-family data, the most time-consuming aspect of the interpolated sales map for single-family residential properties is the cleaning of the data. Also like the multi-family data—which came via Rainmaker and Axiometrics, two very differently organized data sources—the SFR sales data came from multiple sources, i.e., Clackamas, Multnomah, and Washington Counties. These three counties organize their data sets in different ways, which makes what could have been a straightforward process follow a more circuitous route.

To calculate sales price per square foot, the two most obvious variables needed are 1) sales price and 2) house square footage. While the former is in all three county assessor data sets, the latter is—somewhat surprisingly—not included in the Washington County records (this was later fixed by joining the assessor data to the RLIS tax lot layer, which does have square footage). Similarly, data on the attributes of single-family residences is sparse. Whereas we could consider variables such as number of bedrooms and number of bathrooms in the MFR properties, this is not possible with the available data. As such, the process of cleaning and normalization had to be done in a different manner.

As the data goes back to 1996, we are also presented with an interesting time issue. Because this map was to create the *current* SFR PSF landscape and because there were thousands of readily available recent data points, Johnson Economics decides to focus solely on sales in the second quarter of 2016, the last such quarter for which we had full data. However, the ultimate purpose of this model is to help determine what tax lots will be developed/redeveloped and the type of development it will serve to fit into a 20-year forecast. As prices will inevitably increase over the course of a two-decade extended period, future work should consider historic price fluctuations to help predict future price increases across different use types. Single-family residential rates and retail rental rates will, almost assuredly, grow at different rates in the future. The rates at which they grow could very well make the highest and best use of a certain property change over time. While this is not included in the scope of this current work, it should be looked at in the future as we work to merge the supply and demand models together.

We aimed to include only sales which were deemed to be arm's-length transactions. That is, we need to make sure that both the seller and buyer in an agreement are both working for their own interests. A transfer of deed from one family member to another, for instance, would not be included as such. Each of the three counties has different way of determining whether a transaction falls under this category. For instance, Clackamas County uses a "screening code" with different letters and symbols. By using guidelines from each of the counties, we could filter the transactions to those deemed to be arm's-length. In the limitations and suggestions section below, we offer a way for a much simpler solution to avoid this filtering process.

Any observations without sales price were dropped out of necessity as that is one of the key components to the analysis. Similarly, observations were—after joining the files to the RLIS tax lot file—dropped if they did not contain house square footage. As we use year built as a variable in the normalization process, observations lacking this information are dropped as well. The final step before the initial steps in GIS is to remove duplicates vis-à-vis multiple sales of the same property. As we limited this data to three months, this was not a big problem for the most part. However, another problem was presented in that some of the assessor data would list a sale multiple times if there were multiple sellers on record. So, for instance, if John and Jane Doe sold a house and were both on the deed, the sale could potentially be listed twice in the data. By collapsing the data on property id, sale date and sale price, we could remove these instances of multiple owners.

GIS Process I

The lack of house square footage in the Washington County assessor data throws a hiccup into an otherwise straightforward, albeit tedious, process. The way we chose to deal with this issue was to wait until after all the cleaning for each of the three counties was done. The one caveat here is that, whereas we could remove observations without house SF in the initial cleaning of the Multnomah and Clackamas County assessor data sets, we had to remove these same observations in Washington County after the join had taken place. This is a minor difference but needs to be pointed out as it just reemphasizes that the three data sets need to be treated differently to get matching variables that can be used in the normalization process.

Assuming the above cleaning has been completed, the next few steps should be followed to obtain lot size (and house size for Washington County), which is needed in the normalization process.

1. Bring the CSVs into ArcGIS.
2. Join the Clackamas and Washington County tax lots to the RLIS tax lot file via tax lot ids. The Multnomah County assessor data lacks tax lot ids, but it does include parcel ids (R numbers) which can be used as a joining mechanism.
    a. This could also be done via address matching. Alternatively, one could geocode all the addresses in the three files and spatially match them to parcels. However, this is likely much more time-consuming than simply joining based on the other columns mentioned.
3. Create a ¼ mile buffer around Metro.
    a. Depending on the future use of this information, we want to be able to clip to either the Metro boundary or the UGB. By using the buffer, we can assure that both are possible in the future.
4. Clip the tax lot layer with the joined variables by using the ¼ mile buffer Metro buffer.
    a. As the assessor data includes areas beyond Metro and the UGB, we can limit the dataset to only relevant observations by doing this.
5. Drop all observations that do not have information joined from the assessor data. This will drop the size of the data set dramatically from the hundreds of thousands in the full RLIS file.
6. Join the remaining file with the RLIS neighborhood layer.
    a. As with the multi-family layer, we need a component to help account for spatial autocorrelation as clustering is sure to be a problem with this type of data.

These are the only steps needed at this point. The file—to be exported in a CSV—now has the lot size and, for Washington County, house size.

Normalization Process

Because of all the joins that took place in the previous steps, some consolidation is necessary. We create a new variable simply named “SF” to represent square footage of a house. This takes in the values of square footage from the three counties and consolidates them into one column. Similarly, we created a “SalePrice” column to aggregate the sales prices from the three different counties. Using these two variables, we create a “PSF” column to detail sales price per square foot. In addition to these, we generate a “LotSF” variable from the acreage we have from the tax lot file. In addition to this we create natural log variables of the sale price, house size, and lot size. Neighborhood indicator variables are generated for use as controls for spatial autocorrelation in the regression analysis.

At this point, we double check arm’s length transactions and look for clear outliers that could end up causing problems in the normalization process. We do this on a county-by-county basis. Removing sales based on different counties’ sales codes was effective, but sorting the new PSF column presented us with quite a few observations with abnormally low values, such as $1 per square foot. While it is possible that this could technically be the case, we surmise that these instances are likely other types of transactions. For instance, there could be a property that has been deemed condemned. A sale may go through with the information on square footage, but the house would in this case be of zero value. Any residual value would be solely due to the land and/or development potential.

The result of this process is the elimination of all observations below the 5^{th} percentile. Similarly, we look at the reverse for outliers. Some houses sell for well more than surrounding houses. However, at the same time many of these sales could be simply due to where they are located. For instance, a 10,000-square foot house adjacent to Lake Oswego may well sell for $15 million, which would indicate a PSF of $1,500. We are wary of removing properties that have added value just because of an area, but still want to be able to remove observations that are abnormally high due to other reasons. We remove all observations at or above the 99^{th} percentile in PSF for each of the three counties. This process is repeated for lot size, which results in observations below 300 SF and above 1.69 acres to be dropped from analysis. Again, we offer a much simpler solution to this cleaning process in the sections below but present these steps as if they were the ones taken with the available data.

We changed our approach to the hedonic analysis from what we did with the multifamily rent data. One of the reasons for this is simply the fact that we do not have many variables to add to the equation. Whereas we had bedroom and bathroom data for the multifamily units, we do not have the luxury of this information from the data given to us. In this type of analysis for single-family residences, we would also generally look at potential variables such as number of fireplaces, view type, finishes, etc., but the assessor data given does not contain this information. The other change we have made is in terms of specification; we opt to use the natural log of price, square feet, and lot size in this model. Year built remains unchanged. We wish to make this analysis more complete in future iterations but are constrained by the data set we have at hand. Please see the limitations section for potential future work on this process. As it is, the regression equation stands as follows:

$$lnPrice = \alpha+\beta_1*(lnSquareFeet)+ \beta_2*(Year\ Built)+\beta_3*(lnLotSquareFeet)+ \beta_{4\text{-}238}*(Neighborhood)+\varepsilon$$

Though, as stated, we are lacking several common variables such as the number of bedrooms and bathrooms, the signs are no doubt significant, and the signs are in the theoretically correct direction. Using the resulting coefficients of square feet, lot size, and year built, we can normalize all house sales to a 1,200 SF home and 5,000 SF lot. We do not normalize for neighborhood as it is merely a control variable. A house is static. It cannot be moved. Normalizing a house in Laurelhurst to be priced as one from Lents could well make sense for a different type of analysis, but it does not make sense in this type of analysis where we need the sales to stay in their representative locations. If we did normalize for this, it would end up masking the spatial patterns that naturally underlie the existing market.

For the normalization, we first create a variable *lnNorm*, representing the natural log of the normalized price:

$$lnNorm = lnPrice + (ln(1200)-lnSF)* \beta_{lnSF}+(ln(5000)-lnLotSF)* \beta_{lnLotSF}+ (2016-YearBuilt)* \beta_{YearBuilt}$$

From there, we create the variable *NormSalePrice* by the straightforward process below:

$$NormSalePrice = exp(lnNorm)$$

The last step in achieving a sale per-square-foot variable is by simply dividing *NormSalePrice* by 1,200 square feet, as that is the size of the property after normalization.

GIS Process II

After normalization, the well-known-text (WKT) variable should still exist for each observation. All that needs to be done at this point is to bring the WKT and newly created normalized PSF variables into GIS software. From there, the interpolation should follow the same process that was used with the multifamily properties. The number of pricing categories should be debated. For the purposes of our early mapping, we have used seven graduated categories created with Jenks natural breaks. This is fine for internal mapping, though more clearly defined prices in, say, $50 or $100 increments may be more appropriate for clearer interpretation by a wider audience.

APPENDIX B

ENTITLEMENT SCREEN

Metro Regional Zone Class look up table

Standardized Regional Zones	Zone Class	Lot Size Min	Lot Size Max	Expected Density	PROTOTYPES: OFFICE												RETAIL			INDUSTRIAL					RENTAL RESIDENTIAL														OWNERSHIP RESIDENTIAL								
					Office high rise	Office mid/struc	Office mid / ext. struc	Office mid/surf	Office high rise - CC	Office mid/struc - CC	Office mid / ext. struc - CC	Office high rise - LP	Office mid/struc - LP	Office mid / ext. struc - LP	Office mid/surf - LP	Office low rise	Multi-Story Structured	Single Story Structured	Single Story Surface	Warehouse / Distribution	Fulfillment Center	Data Center	Manufacturing	Multi-Tenant Flex	Rental high rise	Rental Mid Rise w/ Garage	Rental 5 over 2	Rental 4 over 1	Rental high rise-IZ	Rental Mid Rise w/ Garage - IZ	Rental 5 over 2 - IZ	Rental 4 over 1 - IZ	Rental 5-story wood w/surf	Rental 4-story wood w/zero	3-story garden w/surf	Rental Plexes	Rental 3-story Townhome	Rental_Middle_TypeV	Condo residential high rise	Condo Mid Rise w/ Garage	Condo 5 over 2	Condo 4 over 1	Condo 3-story wood w/surf	3-story wood townhome	For-Sale Duplexes	Skinny Homes	Detached Single Family
Single Family Large Lot /Mid Options	SFR1	6,000	43,560		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	1	1	1	1
Single Family Standard Lot /Mid Optio	SFR2	3,500	6,000		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	1	1	1	1
Single Family Skinny Lot /Mid Options	SFR3	2,000	3,500		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	1	1	1	1
Multi-family-Very Low Density	MFR1	Approx. FA	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	0	0
Multi-family-Low Density	MFR2	Approx. FA	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	0	0
Multi-family-Moderate Density	MFR3	Approx. FA	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	1	1	1	0	0
Multi-family-Medium Density	MFR4	Approx. FA	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	1	1	1	1	0	0	0	1	1	1	1	0	0
Multi-family-Med. High Density	MFR5	Approx. FA	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	0	0
Multi-family-High Density	MFR6	Approx. FA	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	1	1	0	1	0	1	0	0	1	1	1	1	1	0	0	0
Multi-family-Very High Density	MFR7	Approx. FA	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	1	0	1	0	1	1	1	1	1	1	0	0	0
Multi-family-Med. High w/Min	MFR5	Approx. FA	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	1	1	0	1	1	1	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0
Multi-family-High w/Min	MFR6	Approx. FA	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0
Multi-family-Very High w/Min	MFR7	Approx. FA	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1		1	1	1	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0
Multi-family-Very Low Density	MFR1z	No Parking	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	0	0
Multi-family-Low Density	MFR2z	No Parking	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	0	0
Multi-family-Moderate Density	MFR3z	No Parking	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	1	1	1	0	0
Multi-family-Medium Density	MFR4z	No Parking	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	1	1	1	1	0	0	0	1	1	1	1	0	0
Multi-family-Med. High Density	MFR5z	No Parking	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	0
Multi-family-High Density	MFR6z	No Parking	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0
Multi-family-Very High Density	MFR7z	No Parking	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	1	1	0	0	0	1	1	1	1	1	0	0	0	0
Mixed-Use Comm. & Res.	MUR1	Approx. FA	0		0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
Mixed-Use Comm. & Res.	MUR2	Approx. FA	0		0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
Mixed-Use Comm. & Res.	MUR3	Approx. FA	0		0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0
Mixed-Use Comm. & Res.	MUR4	Approx. FA	0		0	1	1	1	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0
Mixed-Use Comm. & Res.	MUR5	Approx. FA	0		1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	1	1	0	1	0	0	0	0	0	0	1	1	0	0	0	0
Mixed-Use Comm. & Res.	MUR6	Approx. FA	0		1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	0	0	0	0	1	1	1	0	1	1	1	1	0	1	0	0	0	0	1	1	1	1	0	0	0	0
Mixed-Use Comm. & Res.	MUR7	Approx. FA	0		1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	0	0	0	1	1	1	1	1	1	1	1	0	0	1	0	0	0	1	1	1	1	1	0	0	0	0
Commercial - Central	CC	FAR < 1.0	0		0	0	0	1	0	0	0	0	0	0	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial - General	CG	FAR < 1.0	0		0	0	0	1	0	0	0	0	0	0	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial - Neighborhood	CN	FAR < 1.0	0		0	0	0	1	0	0	0	0	0	0	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial - Office	CO	FAR < 1.0	0		0	0	0	1	0	0	0	0	0	0	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial - Central	CC2	FAR 1.0 +	0		1	1	1	0	1	1	1	1	1	1	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial - General	CG2	FAR 1.0 +	0		1	1	1	0	1	1	1	1	1	1	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial - Neighborhood	CN2	FAR 1.0 +	0		1	1	1	0	1	1	1	1	1	1	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial - Office	CO2	FAR 1.0 +	0		1	1	1	0	1	1	1	1	1	1	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public & semi-public uses	PF	0	0		1	1	1	0	1	1	1	1	1	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial Campus	IC	0	0		0	0	0	1	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial Office	IO	0	0		0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial - Light	IL	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial - Heavy	IH	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial - Limited Dist.	IND	Distribution Limited			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial - Limited DataCenter	IND	Data Centers Limited			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Parks & Open Space	POS	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exclusive Farm Use	EFU	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rural Residential	RRFU	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Rural Commercial	RC	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rural Industrial	RI	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

OFFICE PROTOTYPES

	Office high rise	Office mid/struc	Office mid / ext. struc	Office mid/surf	Office high rise - CC	Office mid/struc - CC	Office mid / ext. struc - CC	Office high rise - LP	Office mid/struc - LP	Office mid / ext. struc - LP	Office mid/surf - LP	Office low rise
PROGRAM												
Property Assumptions												
Site Size (SF)	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Stories	10	5	4	4	10	5	4	10	5	4	4	1
FAR	7.50	3.75	2.00	0.50	7.50	3.75	2.00	7.50	3.75	2.00	0.50	0.30
Building Square Feet	300,000	150,000	80,000	20,000	300,000	150,000	80,000	300,000	150,000	80,000	20,000	12,000
Efficiency	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	100%
Leasable Area	270,000	135,000	72,000	18,000	270,000	135,000	72,000	270,000	135,000	72,000	18,000	12,000
Parking Ratio/000 SF	1.50	1.50	1.50	1.50	0.50	0.50	0.50	1.00	1.00	1.00	1.00	1.50
Parking Spaces	405	202	108	27	135	67	36	270	135	72	18	18
Parking Spaces - Surface	-	-	16	27	-	10	5	-	-	11	18	18
Parking Spaces - Structure	405	202	92	-	135	57	31	270	135	61	-	-
Structured Parking %	100%	100%	85%	0%	100%	85%	85%	100%	100%	85%	0%	0%
Cost Assumptions												
Base Construction Cost/SF	$275	$250	$250	$250	$275	$250	$250	$275	$250	$250	$250	$158
Tenant Improvement Allowance	$105	$105	$105	$105	$105	$105	$105	$105	$105	$105	$105	$105
Adjustment Factor	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Construction Cost/SF	$380	$355	$355	$355	$380	$355	$355	$380	$355	$355	$355	$263
Base Parking Costs/Space	$60,000	$45,000	$36,750	$5,500	$60,000	$45,000	$36,750	$60,000	$45,000	$36,750	$5,500	$5,500
Adjustment Factor	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Structured Parking Cost/Space	$60,000	$45,000	$36,750	$5,500	$60,000	$45,000	$36,750	$60,000	$45,000	$36,750	$5,500	$5,500
OPERATING ASSUMPTIONS												
Income Assumptions												
Base Income/Sf/Yr.	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00
Adjustment Factor	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Achievable Pricing	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00
Parking Charges/Space/Mo	$120	$120	$120	$120	$270	$270	$270	$120	$120	$120	$120	$120
Expense Assumptions												
Vacancy/Collection Loss	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
Base Operating Expenses	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Adjustment Factor	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Operating Expenses	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Valuation Assumptions												
Base Capitalization Rate	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%
Adjustment Factor	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Capitalization Rate	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%
SUPPORTABLE PROPERTY VALUE												
Cost												
Cost/Construct w/o prkg.	$114,000,000	$53,250,000	$28,400,000	$7,100,000	$114,000,000	$53,250,000	$28,400,000	$114,000,000	$53,250,000	$28,400,000	$7,100,000	$3,156,000
Total Parking Costs	$24,300,000	$9,090,000	$3,373,650	$0	$8,100,000	$2,562,750	$1,124,550	$16,200,000	$6,075,000	$2,249,100	$0	$0
Estimated Project Cost	$138,300,000	$62,340,000	$31,773,650	$7,100,000	$122,100,000	$55,812,750	$29,524,550	$130,200,000	$59,325,000	$30,649,100	$7,100,000	$3,156,000
Income												
Annual Base Income	$8,100,000	$4,050,000	$2,160,000	$540,000	$8,100,000	$4,050,000	$2,160,000	$8,100,000	$4,050,000	$2,160,000	$540,000	$360,000
Annual Parking	$583,200	$290,880	$132,192	$0	$437,400	$184,518	$99,144	$388,800	$194,400	$88,128	$0	$0
Gross Annual Income	$8,683,200	$4,340,880	$2,292,192	$540,000	$8,537,400	$4,234,518	$2,259,144	$8,488,800	$4,244,400	$2,248,128	$540,000	$360,000
Less: Vacancy & CL	$868,320	$434,088	$229,219	$54,000	$853,740	$423,452	$225,914	$848,880	$424,440	$224,813	$54,000	$36,000
Effective Gross Income	$7,814,880	$3,906,792	$2,062,973	$486,000	$7,683,660	$3,811,066	$2,033,230	$7,639,920	$3,819,960	$2,023,315	$486,000	$324,000
Less Expenses:												
Operating Expenses	$234,446	$117,204	$61,889	$14,580	$230,510	$114,332	$60,997	$229,198	$114,599	$60,699	$14,580	$9,720
Annual NOI	$7,580,434	$3,789,588	$2,001,084	$471,420	$7,453,150	$3,696,734	$1,972,233	$7,410,722	$3,705,361	$1,962,616	$471,420	$314,280
Property Valuation												
Return on Cost	5.48%	6.08%	6.30%	6.64%	6.10%	6.62%	6.68%	5.69%	6.25%	6.40%	6.64%	9.96%
Threshold Return on Cost	8.05%	8.05%	8.05%	8.05%	8.05%	8.05%	8.05%	8.05%	8.05%	8.05%	8.05%	8.05%
Residual Property Value	($44,133,123)	($15,264,370)	($6,915,468)	($1,243,851)	($29,514,283)	($9,890,586)	($5,024,765)	($38,141,337)	($13,295,668)	($6,268,780)	($1,243,851)	$748,099
RPV/SF	**($1,103.33)**	**($381.61)**	**($172.89)**	**($31.10)**	**($737.86)**	**($247.26)**	**($125.62)**	**($953.53)**	**($332.39)**	**($156.72)**	**($31.10)**	**$18.70**

RETAIL PROTOTYPES / INDUSTRIAL

	Multi-Story Structured	Single Story Structured	Single Story Surface	Warehouse / Distribution	Fullfillment Center	Data Center	Manufacturing	Multi-Tenant Flex
PROGRAM								
Property Assumptions								
Site Size (SF)	40,000	40,000	40,000	120,000	120,000	120,000	120,000	40,000
Stories	2	1	1	1	1	1	1	1
FAR	1.00	0.50	0.30	0.40	0.40	0.50	0.45	0.33
Building Square Feet	40,000	20,000	12,000	48,000	60,000	60,000	60,000	13,000
Efficiency	90%	100%	100%	100%	100%	100%	100%	100%
Leasable Area	36,000	20,000	12,000	48,000	60,000	60,000	60,000	13,000
Parking Ratio/000 SF	3.5	3.5	3.5	1.0	3.5	0.4	3.0	1.0
Parking Spaces	126	70	42	48	210	24	180	13
Parking Spaces - Surface	19	11	42	48	210	24	180	13
Parking Spaces - Structure	107	60	-	-	-	-	-	-
Structured Parking %	85%	85%	0%	0%	0%	0%	0%	0%
Cost Assumptions								
Base Construction Cost/SF	$150	$150	$150	$95	$95	$112	$122	$105
Tenant Improvement Allowance	$95	$95	$95	$0	$0	$0	$0	$0
Adjustment Factor	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*
Construction Cost/SF	$245	$245	$245	$95	$95	$112	$122	$105
Base Parking Costs/Space	$36,750	$36,750	$5,500	$5,500	$5,500	$5,500	$5,500	$5,500
Adjustment Factor	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*
Structured Parking Cost/Space	*$36,750*	*$36,750*	*$5,500*	*$5,500*	*$5,500*	*$5,500*	*$5,500*	*$5,500*
OPERATING ASSUMPTIONS								
Income Assumptions								
Base Income/Sf/Yr.	$30.00	$30.00	$30.00	$12.00	$12.00		$13.00	$13.00
Adjustment Factor	*0.00%*	*0.00%*	*0.00%*	0.00%	0.00%	0.00%	0.00%	0.00%
Achievable Pricing	*$30.00*	*$30.00*	*$30.00*	*$12.00*	*$12.00*	*$0.00*	*$13.00*	*$13.00*
Parking Charges/Space/Mo	$0	$0	$0	$0	$0	$0	$0	$0
Expense Assumptions								
Vacancy/Collection Loss	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
Base Operating Expenses	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Adjustment Factor	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*
Operating Expenses	*3.00%*	*3.00%*	*3.00%*	*3.00%*	*3.00%*	*3.00%*	*3.00%*	*3.00%*
Valuation Assumptions								
Base Capitalization Rate	7.00%	7.00%	7.00%	6.00%	6.00%	6.00%	6.00%	6.00%
Adjustment Factor	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Capitalization Rate	7.00%	7.00%	7.00%	6.00%	6.00%	6.00%	6.00%	6.00%
SUPPORTABLE PROPERTY VALUE								
Cost								
Cost/Construct w/o prkg.	$9,800,000	$4,900,000	$2,940,000	$4,560,000	$5,700,000	$6,720,000	$7,320,000	$1,365,000
Total Parking Costs	$4,630,500	$2,572,500	$231,000	$264,000	$1,155,000	$132,000	$990,000	$71,500
Estimated Project Cost	$14,430,500	$7,472,500	$3,171,000	$4,824,000	$6,855,000	$6,852,000	$8,310,000	$1,436,500
Income								
Annual Base Income	$1,080,000	$600,000	$360,000	$576,000	$720,000	$0	$780,000	$169,000
Annual Parking	$0	$0	$0	$0	$0	$0	$0	$0
Gross Annual Income	$1,080,000	$600,000	$360,000	$576,000	$720,000	$0	$780,000	$169,000
Less: Vacancy & CL	$108,000	$60,000	$36,000	$57,600	$72,000	$0	$78,000	$16,900
Effective Gross Income	$972,000	$540,000	$324,000	$518,400	$648,000	$0	$702,000	$152,100
Less Expenses:								
Operating Expenses	$29,160	$16,200	$9,720	$15,552	$19,440	$0	$21,060	$4,563
Annual NOI	$942,840	$523,800	$314,280	$502,848	$628,560	$0	$680,940	$147,537
Property Valuation								
Return on Cost	6.53%	7.01%	9.91%	10.42%	9.17%	0.00%	8.19%	10.27%
Threshold Return on Cost	8.05%	8.05%	8.05%	6.90%	6.90%	6.90%	6.90%	6.90%
Residual Property Value	($2,718,202)	($965,668)	$733,099	$2,463,652	$2,254,565	($6,852,000)	$1,558,696	$701,717
RPV/SF	**($67.96)**	**($24.14)**	**$18.33**	**$20.53**	**$18.79**	**($57.10)**	**$12.99**	**$17.54**

PROTOTYPE RENTAL RESIDENTIAL PROGRAMS

	Rental high rise	Rental Mid Rise w/ Garage	Rental 5 over 2	Rental 4 over 1	Rental high rise-IZ	Rental Mid Rise w/ Garage - IZ	Rental 5 over 2 - IZ	Rental 4 over 1 - IZ	Rental 5-story wood w/surf	Rental 4-story wood w/zero	3-story garden w/surf	Rental Plexes	Rental 3-story Townhome	Rental_Middle_TypeV
Property Assumptions														
Site Size (SF)	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	5,000	40,000	5,000
Density	400	225	225	170	400	225	225	170	90	120	35	30	20	30
Unit Count	367	206	206	156	367	206	206	156	82	110	32	3	18	3
Ave Unit Size	725	750	750	750	725	750	750	750	750	750	750	750	1,000	750
Efficiency Ratio	85%	85%	85%	87%	85%	85%	85%	87%	85%	85%	100%	100%	100%	100%
Building Square Feet	313,029	181,765	181,765	134,483	313,029	181,765	181,765	134,483	72,353	97,059	24,000	2,250	18,000	2,250
FAR	7.83	4.54	4.54	3.36	7.83	4.54	4.54	3.36	1.81	2.43	0.60	0.45	0.45	0.45
Parking Ratio/Unit	1.00	1.00	1.25	0.75	0.25	0.25	1.25	0.25	1.50	1.50	1.50	1.25	1.50	1.25
Total Parking Spaces	367	206	258	117	92	52	258	39	123	165	48	4	27	4
Parking Spaces - Surface	-	-	-	-	-	-	-	-	123	165	48	2	14	2
Parking Spaces - Structure	367	206	258	117	92	52	258	39	-	-	-	2	14	2
Structured Parking %	100%	100%	100%	100%	100%	100%	100%	100%	0%	0%	0%	50%	50%	50%
Cost Assumptions														
Base Construction Cost/SF	$450	$325	$300	$300	$450	$325	$300	$300	$300	$220	$220	$230	$230	$230
Adjustment Factor	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Construction Cost/SF	*$450*	*$325*	*$300*	*$300*	*$450*	*$325*	*$300*	*$300*	*$300*	*$220*	*$220*	*$230*	*$230*	*$230*
Base Parking Costs/Space	$60,000	$45,000	$36,750	$36,750	$60,000	$45,000	$36,750	$36,750	$5,500	$5,500	$5,500	$5,500	$21,125	$5,500
Adjustment Factor	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Structured Parking Cost/Space	*$60,000*	*$45,000*	*$36,750*	*$36,750*	*$60,000*	*$45,000*	*$36,750*	*$36,750*	*$5,500*	*$5,500*	*$5,500*	*$5,500*	*$21,125*	*$5,500*
Income Assumptions														
Base Income/Sf/Mo.	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$0.00	$2.50	$2.50
Adjustment Factor	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*
Achievable Pricing	*$2.50*	*$2.50*	*$2.50*	*$2.50*	*$2.50*	*$2.50*	*$2.50*	*$2.50*	*$2.50*	*$2.50*	*$2.50*	*$0.00*	*$2.50*	*$2.50*
Parking Charges/Space/Mo	$135	$135	$135	$70	$70	$70	$135	$135	$135	$135	$135	$0	$135	$135
Expenses														
Vacancy/Collection Loss	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Operating Expenses	32.5%	32.5%	32.5%	32.5%	32.5%	32.5%	32.5%	32.5%	32.5%	32.5%	32.5%	32.5%	32.5%	32.5%
Adjustment Factor	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Operating Expenses	*33%*	*33%*	*33%*	*33%*	*33%*	*33%*	*33%*	*33%*	*33%*	*33%*	*33%*	*33%*	*33%*	*33%*
Valuation														
Capitalization Rate	5.50%	5.50%	5.50%	5.50%	5.50%	5.50%	5.50%	5.50%	5.50%	5.50%	5.50%	5.50%	5.50%	5.50%
Adjustment Factor	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Capitalization Rate	5.50%	5.50%	5.50%	5.50%	5.50%	5.50%	5.50%	5.50%	5.50%	5.50%	5.50%	5.50%	5.50%	5.50%
Cost														
Cost/Construct w/o prkg.	$140,863,235	$59,073,529	$54,529,412	$40,344,828	$140,863,235	$59,073,529	$54,529,412	$40,344,828	$21,705,882	$21,352,941	$5,280,000	$517,500	$4,140,000	$517,500
Total Parking Costs	$22,020,000	$9,270,000	$9,481,500	$4,299,750	$5,520,000	$2,340,000	$9,481,500	$1,433,250	$676,500	$907,500	$264,000	$22,000	$570,375	$22,000
Estimated Project Cost	$162,883,235	$68,343,529	$64,010,912	$44,644,578	$146,383,235	$61,413,529	$64,010,912	$41,778,078	$22,382,382	$22,260,441	$5,544,000	$539,500	$4,710,375	$539,500
Income														
Annual Base Income	$7,982,250	$4,635,000	$4,635,000	$3,510,000	$7,982,250	$4,635,000	$4,635,000	$3,510,000	$1,845,000	$2,475,000	$720,000	$0	$540,000	$67,500
Annual Parking	$594,540	$333,720	$417,960	$98,280	$77,280	$43,680	$417,960	$63,180	$0	$0	$0	$0	$21,870	$3,240
Gross Annual Income	$8,576,790	$4,968,720	$5,052,960	$3,608,280	$8,059,530	$4,678,680	$5,052,960	$3,573,180	$1,845,000	$2,475,000	$720,000	$0	$561,870	$70,740
Less: Vacancy & CL	$428,840	$248,436	$252,648	$180,414	$402,977	$233,934	$252,648	$178,659	$92,250	$123,750	$36,000	$0	$28,094	$3,537
Effective Gross Income	$8,147,951	$4,720,284	$4,800,312	$3,427,866	$7,656,554	$4,444,746	$4,800,312	$3,394,521	$1,752,750	$2,351,250	$684,000	$0	$533,777	$67,203
Less Expenses:														
Operating Expenses	$2,648,084	$1,534,092	$1,560,101	$1,114,056	$2,488,380	$1,444,542	$1,560,101	$1,103,219	$569,644	$764,156	$222,300	$0	$173,477	$21,841
Annual NOI	$5,499,867	$3,186,192	$3,240,211	$2,313,810	$5,168,174	$3,000,204	$3,240,211	$2,291,302	$1,183,106	$1,587,094	$461,700	$0	$360,299	$45,362
Property Valuation														
Return on Cost	3.38%	4.66%	5.06%	5.18%	3.53%	4.89%	5.06%	5.48%	5.29%	7.13%	8.33%	0.00%	7.65%	8.41%
Threshold Return on Cost	6.05%	6.05%	6.05%	6.05%	6.05%	6.05%	6.05%	6.05%	6.05%	6.05%	6.05%	6.05%	6.05%	6.05%
Residual Property Value	($71,976,350)	($15,679,204)	($10,453,712)	($6,399,792)	($60,958,878)	($11,823,388)	($10,453,712)	($3,905,323)	($2,826,907)	$3,972,513	$2,087,405	($539,500)	$1,244,983	$210,286
RPV/SF	**($1,799.41)**	**($391.98)**	**($261.34)**	**($159.99)**	**($1,523.97)**	**($295.58)**	**($261.34)**	**($97.63)**	**($70.67)**	**$99.31**	**$52.19**	**($107.90)**	**$31.12**	**$42.06**

	Condo residential high rise	Condo Mid Rise w/ Garage	Condo 5 over 2	Condo 4 over 1	Condo 3-story wood w/surf	3-story wood townhome	For-Sale Duplexes	Skinny Homes	Detached Single Family
Property Assumptions									
Site Size (SF)	40,000	40,000	40,000	40,000	40,000	40,000	5,000	40,000	40,000
Density	400	225	225	170	35	30	18	18	9
Unit Count	367	206	206	156	32	27	2	16	8
Ave Unit Size	775	775	775	775	800	1,250	1,250	1,500	1,750
Efficiency Ratio	83%	83%	85%	85%	100%	100%	100%	100%	100%
Building Square Feet	342,681	192,349	187,824	142,235	25,600	33,750	2,500	24,000	14,000
FAR	8.57	4.81	4.70	3.56	0.64	0.84	0.50	0.60	0.35
Parking Ratio/Unit	1.3	1.3	1.50	1.00	2.0	2.0	2.0	2.0	2.0
Total Parking Spaces	459	258	309	156	64	54	4	32	16
Parking Spaces - Surface	-	-	-	-	64	27	2	16	8
Parking Spaces - Structure	459	258	309	156	-	27	2	16	8
Structured Parking %	100%	100%	100%	100%	0%	50%	50%	50%	50%
Cost Assumptions									
Base Construction Cost/SF	$473	$341	$315	$315	$231	$242	$242	$221	$221
Adjustment Factor	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Construction Cost/SF	*$473*	*$341*	*$315*	*$315*	*$231*	*$242*	*$242*	*$221*	*$221*
Base Parking Costs/Space	$60,000	$45,000	$36,750	$36,750	$5,500	$23,875	$5,500	$21,125	$21,125
Adjustment Factor	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Parking Cost/Space	*$60,000*	*$45,000*	*$36,750*	*$36,750*	*$5,500*	*$23,875*	*$5,500*	*$21,125*	*$21,125*
Income Assumptions									
Sales Price/SF	$390	$390	$390	$390	$390	$390	$390	$390	$390
Adjustment Factor	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Achievable Pricing	*$390*	*$390*	*$390*	*$390*	*$390*	*$390*	*$390*	*$390*	*$390*
Parking Charges/Space	$25,000	$25,000	$25,000	$19,500	$19,500	$19,500	$19,500	$19,500	$19,500
Expenses									
Sales Commission	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Cost									
Cost/Construct w/o prkg.	$161,916,642	$65,639,232	$59,164,412	$44,804,118	$5,913,600	$8,150,625	$603,750	$5,292,000	$3,087,000
Total Parking Costs	$27,540,000	$11,610,000	$11,355,750	$5,733,000	$0	$644,625	$11,000	$338,000	$169,000
Estimated Project Cost	$189,456,642	$77,249,232	$70,520,162	$50,537,118	$5,913,600	$8,795,250	$614,750	$5,630,000	$3,256,000
Income									
Gross Income - Units	$133,645,482	$75,016,265	$73,251,176	$55,471,765	$9,984,000	$13,162,500	$975,000	$9,360,000	$5,460,000
Gross Income - Parking	$11,475,000	$6,450,000	$7,725,000	$3,042,000	$0	$526,500	$39,000	$312,000	$156,000
Gross Sales Income	$145,120,482	$81,466,265	$80,976,176	$58,513,765	$9,984,000	$13,689,000	$1,014,000	$9,672,000	$5,616,000
Less: Commission	($5,804,819)	($3,258,651)	($3,239,047)	($2,340,551)	($399,360)	($547,560)	($40,560)	($386,880)	($224,640)
Effective Gross Income	$139,315,663	$78,207,614	$77,737,129	$56,173,214	$9,584,640	$13,141,440	$973,440	$9,285,120	$5,391,360
Property Valuation									
Return on Sales	-26.47%	1.24%	10.23%	11.15%	62.08%	49.42%	58.35%	64.92%	65.58%
Threshold Return	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%
Residual Property Value	($68,312,587)	($9,242,611)	($2,922,658)	($1,690,845)	$2,420,870	$2,632,089	$231,720	$2,444,017	$1,432,139
	($1,707.81)	**($231.07)**	**($73.07)**	**($42.27)**	**$60.52**	**$65.80**	**$46.34**	**$61.10**	**$35.80**