

APPENDICES TO THE METRO REGIONAL BROWNFIELD SCOPING PROJECT

A—BROWNFIELD INVENTORY DATA GAP ANALYSIS

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APPENDIX A

BROWNFIELD INVENTORY DATA GAP ANALYSIS





METRO BROWNFIELD SCOPING PROJECT

Brownfield Inventory Data Gap Analysis & Extrapolation Methodology

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1. Purpose

The purpose of the brownfield inventory was to estimate the number of brownfields in the Metro region and understand their characteristics. There are existing databases of known and potentially contaminated sites, but these databases are limited and cannot be considered a comprehensive inventory of sites. Thus, a Data Gap Analysis (DGA) was conducted within the seven Study Areas selected throughout the Metro region, and the results have provided information to refine our understanding of the scale, extent, and impact of brownfield properties.

2. Objectives of the Data Gap Analysis

- Identify properties based on existing land use characteristics that have a higher probability of suspect contamination
- Develop more accurate history and use information on potential brownfield properties in selected Study Areas
- Match potential brownfield properties to Typologies (1-4)
- Extrapolate from subareas to the Metro region to provide more accurate estimate of brownfields in the Metro region

3. Principles and Assumptions

Utilizing the U.S. Environmental Protection Agency's definition for a brownfields, the DGA is based on the following assumptions:

- A brownfield site is characterized as:
 - Impacted by real or perceived environmental contamination
- And property that is vacant, partially vacant, or underutilized

This definition also complemented the economic development goals for Metro's brownfield efforts. Thus, intensive records research and field study focused on properties that are currently vacant, considered underutilized, or are considered to have suspect contamination.

4. Data Gap Analysis Methodology (See attachment B Workflow Diagram.)

The table below provides the definitions used in the DGA.

Definitions	Description
DEQ ECSI/LUST Database	Oregon DEQ's database of recorded sites with potential and confirmed contamination.
Metro Regional Land Information System (RLIS) (March, 2012)	Metro's extensive land use GIS database.
Buildable Lands Inventory (July, 2011)	Metro's buildable lands inventory that identifies vacant and partially vacant, along with underutilized properties zoned commercial and industrial.
Vacant Lands (July, 2011)	Metro's vacant lands inventory that identifies areas appearing unimproved on 2011 aerial photography.
Brownfield Typologies	Categories of brownfield properties based on historical use, size, and location/market potential.
Historical Use Documents	Historical aerial photographs (USACE, Metro), Sanborn Fire Insurance Maps, and Polk City Directories.
Site Reconnaissance	Information collected during windshield surveys of all parcels included in the DGA.
Brownfield Status Determination Information	Additional information created through the analysis of all data resources and resulting in brownfield status determinations.

The DGA methodology included the following components:

4.1 Identified Study Areas (completed by Metro)

- Study Areas:
 - Albina district: historic industrial area and main street
 - Tigard town center: historic downtown and main street
 - Industrial Way: mid-century industrial area
 - McLoughlin corridor: mid-century corridor
 - Aloha town center: newer town center and corridor

- Tualatin-Sherwood Road: newer industrial area
- Urban reserve: rural agricultural and resource-based industries (community of Boring, Clackamas County)
- Factors considered in selecting Study Areas:
 - Representative of a range of land use, development pattern, and contamination types
 - Representative of different geographic areas in the Metro region
 - Representative of different access / transportation facilities
 - Areas with significant redevelopment needs or investment goals
 - Represent different populations

4.2 Applied the criteria listed below in order to filter down the tax lots in the Study Areas to select parcels with a higher probability of having suspect contamination (candidate parcels). Careful consideration was given to taxlots that are currently vacant, partially vacant, and/or underutilized. Underutilized determinations were made, in part, from Metro's 2011 Buildable Lands Inventory (BLI).

Excluded:

- Parcels identified within the existing Oregon DEQ ECSI and/or LUST databases were recorded, and thus, excluded from the subsequent extrapolation exercise.

Included:

- Parcels located within one of the seven Study Areas
 - Parcels located within a 2040 Center , Corridor, Title 4 Employment or Industrial area, or designated as Resource Land or within a Rural Reserve.
 - 2040 Center: defined as the central city, regional centers, and town centers.
 - 2040 Corridor: defined as major streets that serve as key transportation routes for people and goods.**
 - Title 4 Employment and Industrial land: defined as areas where land use is restricted to employment areas, regionally significant industrial land areas, or industrially zoned areas
 - Rural Reserve: defined as lands currently outside the urban growth boundary that is suitable for accommodating urban development over the next 50 years.
 - Resource Land: defined as rural land zoned for agriculture or forest use.
- **Please note that an additional 750ft buffer was applied to Concept Corridors in order to include small areas between neighboring corridors that were previously excluded (approximately 1 city block)

- Parcels with a zoning classification of: COM, IND, MUR, RI, RC, RRFU, or VAC¹
- Parcels defined as vacant: if the parcel appears to be unimproved on 2011 aerial photography, without regard to accessibility or redevelopment feasibility, and on partially developed parcels, only undeveloped areas .5 acres or larger are included.
- Parcels that are Underutilized:
 - As defined by Metro's BLI (zoned COM or IND only)
 - Applicable Study Areas: Downtown Tigard, McLoughlin Corridor, Aloha / TV Highway, Albina Neighborhood, Johnson Road/Industrial Way, Tualatin/Sherwood

OR

- As defined by having a building to land value ratio of $\leq .5$.**
 - Applicable Study Area: Boring
- ** Please note that the BLI was conducted within the Metro UGB. As a result, the Boring Study Area is not covered by this inventory. To assist in determining if commercial and industrial properties are underutilized, a building-to-land value ratio will be calculated. In cases where this ratio is less than 50%, an underutilized determination was applied.

4.3 Selected Focal Areas for Intensive Study

- Due to several Study Areas having a large number of parcels matching the criteria described above, random sampling was applied to select a number of taxlots within a given Study Area for more intensive study. The sample size selected through random sampling within the set of parcels meeting the criteria listed above (candidate parcels) was carefully chosen to ensure that an appropriate statistical confidence would be achieved. A breakdown of sample size by Study Area is provided below.

Study Area	Total Parcel Count	Candidate Parcels for DGA	Final Sample Size
Tigard	178	33	33
Albina	1983	170	45
Aloha/TV Highway	231	60	30
Johnson/Industrial	89	12	12
Tualatin/Sherwood	170	35	35
McLoughlin Corridor	203	32	32
Boring	383	92	30
Totals	3237	434	217

¹ The project team and Technical Review Team excluded Heating Oil Tanks from the scope of this project given the relatively simple and inexpensive nature of the cleanup on these sites, which is typically resolved solely by the private market. As such, parcels in and zoned for single family residential use were also removed from our analysis.

- 4.4 Created DGA database in ArcGIS (i.e., StudyArea_DGA feature class) to store information collected during the records and field research.
- 4.5 Conducted DGA history and use research on the sample taxlots using available historical record sources and through field reconnaissance. The historical records review identified site uses, including businesses and/or activities that may result in the determination of a given property having suspect contamination. Record sources and field research included:
- Historical aerial photos obtained from the US Army Core of Engineers (USACE) and Metro
 - Polk City Directories obtained from local sources, including public libraries and city governments
 - Sanborn Fire Insurance maps obtained from local sources and EDR
 - Field reconnaissance (i.e., windshield surveys) of focal taxlots to assess the current condition and to identify ‘underutilized’ properties

**Please note that in some cases historical records were not available for a given parcel or were determined not to be applicable due to adequate information being present, through field reconnaissance and through a partial review of available historical record sources, to make a brownfield determination.

A complete list of record sources used for each Study Area is provided in a table below.

Study Area	Aerial Photos		Polk City Directories	Sanborn Fire Insurance Maps
	USACE	Metro		
Tigard	1936, 1940, 1953, 1968, 1977, 1983	1996, 2005, 2011	NA	1950
Albina	1936, 1948, 1955, 1966, 1970, 1974, 1983	1996, 2005, 2011	1936, 1955, 1973	1889, 1901, 1909, 1924, 1950, 1969
Aloha / TV Highway	1936, 1940, 1963, 1972, 1983	1996, 2005, 2011	1959, 1965, 1975, 1978	NA
Johnson / Industrial	1936, 1944, 1955, 1969, 1977, 1983	1996, 2005, 2011	NA	NA
Tualatin / Sherwood	1936, 1940, 1953, 1963, 1977, 1983	1996, 2005, 2011	NA	NA
McLoughlin Corridor	1936, 1944, 1956, 1966, 1972, 1983	1996, 2005, 2011	1962, 1969, 1974, 1987	NA
Boring	1935, 1956, 1976, 1981, 1989	1996, 2005, 2011	NA	NA

Table Notes:

*NA = Records not available or not applicable to study area parcels included in the DGA.

*S = Suspect Brownfield site

*U = Unknown

*N = Non-Suspect Brownfield site

4.6 Describe step of determining suspect sites.

Best professional judgment was used by MFA's environmental professionals to field-verify sites according to the following categories:

Suspect Brownfield site – Site that due to historical uses and current status indicates a higher probability of contamination issues.

Unknown – No enough information was available and field verification could not conclusively determine probability of contamination.

Non-Suspect Brownfield site – Site was determined to be in use and not detrimentally impacted by real or perceived contamination.

4.7 Suspected brownfields identified through the records research and field reconnaissance were assigned an appropriate Typology designation based on its location, land use, and parcel size.

Type 1—Small Commercial Sites. Common historical uses were gas stations, repair shops, and dry cleaners, characterized by small parcel size and located along highways, arterials, and in commercial centers, including main streets and small downtowns.

Type 2—Industrial Conversion Sites. These properties range in size and are historically found in areas that have transitioned from industrial to office, retail, and mixed use centers. Change of zoning and location often drives redevelopment of these properties.

Type 3—Ongoing Industrial. These properties are located in areas with an industrial past that continues today, particularly through regulatory controls such as Metro's Title 4 requirements and local employment sanctuary overlays. The types of historical uses vary, but they share constraints on land value and future use that can be a challenge to redevelopment opportunities.

Type 4—Rural Industry Sites. These properties are associated with rural natural resource extraction industries and agriculture. They are typically large and located on the edge of urban growth boundary, especially within urban and rural reserves.

4.8 Suspect brownfields from the seven Study Areas were then aggregated by Typology and used to collect basic information, such as:

- Types of sites identified in DGA (e.g., size, zoning classification, historical activities).

4.9 Based on the proportion of sites identified as Suspect Brownfields to Candidate Parcels through the DGA, the number of suspected brownfield sites was extrapolated to the Metro region. A complete description of the extrapolation methodology is described in Section 7 below.

5. Taxlot Dataset Preparation

The preparation of the taxlot dataset was conducted by Metro's Data Resource Center (DRC) and completed using ESRI's ArcGIS desktop suite using the following methodology:

5.1. Subset Metro taxlot dataset to the extent of each Study Area

- Used "select by location, centroid in" to select the taxlots in the study areas
- Output feature class: Study_area_taxlots_1

5.2. Added ECSI/LUST columns (i.e., 'Is_ECSI', 'Is_Lust') to Study_area_taxlots_1

- Identified suspected or confirmed contaminated sites from the ECSI/LUST database
 - LUST residential heating oil sites were previously removed from the suspected or confirmed list. These sites are not relevant to the brownfield study.¹
- Used "select by location" tool and calculate presence (= 1) or absence (= 0)

5.3. Added building/land ratio column (BL_ratio)

- Selected where landval > 0, then calculated

5.4. Added zoning columns (i.e., 'City', 'Zone', 'Zone_Class', 'ZoneGen_Cl') to temporary point dataset (point dataset represents centroid of taxlots)

- Created "study_area_pt" feature class with "feature to point" tool. Only kept the TLID field to be used for joins. "Inside" box checked.
- Used "spatial join" tool to add zoning values to temporary point dataset using Metro's RLIS Zoning feature class. (City, zone, zone_class and zonegen_cl fields).
- Output feature class: Study_area_pt_zone

5.5. Identified vacant properties within the Study Areas

- Vacant is defined as having no building, improvements or identifiable land use or is considered to be partially vacant (i.e., a developed tax lot that has 0.5 acre or greater portion that is vacant)
- Added vacant land columns (i.e., 'Vac', 'Photo_year') to temporary point dataset.
 - Used "spatial join" tool to add these vacant land values to temporary point dataset using Metro's RLIS Vacant feature class. Calculate vac = 0 where vac is NULL
 - Output feature class: Study_area_pt_zone_vac

5.6. Identified underutilized properties within the Study Areas

¹ The project team and Technical Review Team excluded Heating Oil Tanks from the scope of this project given the relatively simple and inexpensive nature of the cleanup on these sites, which is typically resolved solely by the private market. As such, parcels in and zoned for single family residential use were also removed from our analysis.

- Underutilized is defined according to Metro's July, 2011 Buildable Lands Model and pertains to COM and IND zoned taxlots only.
- Added underutilized land columns (i.e., 'DevStatus', 'COMAcreFin', 'INDAcreFin') to temporary point dataset
 - DevStatus = development status, derived from the RLIS vacant land inventory;
 - COMAcreFin = future commercial capacity in acres, from Metro's 2011 Buildable Land Inventory (includes both vacant and redevelopment land supplies);
 - INDAcreFin = future industrial capacity in acres, from Metro's 2011 Buildable Land Inventory (includes both vacant and redevelopment land supplies)
 - Used "spatial join" tool to add these underutilized land values to temporary point dataset using Metro's Land Supply geodatabase
 - Output feature class: Study_area_pt_zone_vac_bld
 - Underutilized taxlots were identified by selecting where any of these fields were NOT NULL: 'DevStatus', 'COMAcreFin', 'INDAcreFin'.

5.7. Add study area column (Name)

- Used "spatial join" tool to add study area field to points.
- Output FC: Study_area_pt_zone_vac_bld_sa

5.8. Join Study_area_pt_zone_vac_bld feature class to Study_area_taxlots_1 feature class.
Output feature class: Study_area_taxlots.

5.9. Query Study_area_taxlots feature class to get unfiltered taxlots for Data Gap Analysis

- Removed ECSI/LUST taxlots for Study Area taxlots
 - Selected not ECSI/LUST "Is_ECSI" = 0 and "Is_Lust" = 0.
- Selected desired zoning and vacant lands
 - Selected from Current Selection "ZONEGEN_CL" = 'COM' OR "ZONEGEN_CL" = 'IND' OR "ZONEGEN_CL" = 'MUR' OR "ZONE" = 'RI' OR "ZONE" = 'RC' OR "ZONE" = 'RRFU' OR "VAC" = 1
- Selected underutilized land
 - Selected from Current Selection
 - ((("COMAcreFin" > 0 OR "INDAcreFin" > 0) AND "Name" <> 'Boring') OR ((("BL_ratio" <= .5 or "BL_ratio" IS NULL) AND "Name" = 'Boring'))
 - Compared 1996 to 2011 zoning in order to identify and include taxlots that where zoning designations have changed from a desirable zoning class to an undesirable zoning class (e.g., 1996 = VAC and 2011 = MFR). This comparison did not result in the addition of any taxlots back into the study areas for inclusion in the Data Gap Analysis.

- Cross-reference taxlots with those identified during the Polk City Directories analysis. If taxlots with undesirable zoning (e.g., SFR, MFR) are found to have Polk data, add the taxlots back to the Study_area_taxlots feature class layer.
- Output feature class: StudyArea_DGA

6. Data Gap Analysis Results

The results of the Data Gap Analysis are provided below.

Study Area	Sample Size	Type 1			Type 2			Type 3			Type 4		
		S	U	N	S	U	N	S	U	N	S	U	N
Tigard	33	3	1	25	0	1	3	0	0	0	0	0	0
Albina	45	14	3	20	0	2	4	0	0	2	0	0	0
Aloha/TV Highway	30	3	3	20	2	0	1	0	1	0	0	0	0
Johnson/Industrial	12	0	0	0	0	0	0	3	2	7	0	0	0
Tualatin/Sherwood	35	0	0	0	0	0	0	1	0	34	0	0	0
McLoughlin Corridor	32	6	6	19	0	0	1	0	0	0	0	0	0
Boring	30	0	0	0	0	0	0	0	0	0	9	2	19
Total	217	26	13	84	2	3	9	4	3	43	9	2	19

Table Notes:

*S = Suspect Brownfield site

*U = Unknown

*N = Non-Suspect Brownfield site

**Please note that the total number of sites identified by Study Area, Typology type, and brownfield designation category were not actually used in the final extrapolation methodology in some cases. The final extrapolation methodology is described in detail below in Section 7.

7. Brownfield Inventory Extrapolation Methodology

7.1. Objective:

The objective of the Brownfield Inventory Extrapolation was to apply the DGA findings to provide an estimate of the number and character of brownfields across the Metro region by applying the DGA. The process for completing the Metro region-wide extrapolation consisted of two parts, Study Area Extrapolation and Metro Region extrapolation, each of which is explained in detail below.

7.2. Study Area Extrapolation:

As described in sub-section 4.1, study areas were selected to represent the different types of places and brownfields found in the region. Since these different places experience different rates and types of undiscovered brownfields, there was a need to calculate an extrapolation

rate for each type of place (represented by the study areas) in order to estimate the number and character of brownfields across the region.

The Study Area extrapolation methodology included:

- Estimating the total suspected brownfield sites by Study Area
 - Defined as: Suspect, Non-Suspect, or Unknown
- Assigning Typology types (as listed in sub-section 4.7) to all sampled sites
- Creating a Year Built dataset, by Census tract, which defines the earliest year built for each parcel throughout the Metro region, as geographically defined above in Section 4.2. The Year Built dataset was classified to create four time periods, including:
 - 1900 to 1929
 - 1930 to 1959
 - 1960 to 1989
 - 1990 to 2012
- Correlating all sampled sites within each of the seven Study Areas to the Year Built dataset. The table below provides an overview of how each Year Built range is represented by Study Area and Typology type. Please note that a given Study Area may represent more than one Typology type, as is the case with Albina. This is due to the diverse development types and mix of uses in the Study Area that were included in the DGA. Additionally, Typology 4 was not subjected to this specific methodology, due to its relatively homogeneous sample set. Instead, Typology 4 was subdivided by zoning classification, as described later in this section.

Year Built	Type 1	Type 2	Type 3	Type 4
1900 to 1929	Tigard, Albina*	Albina	Albina	NA
1930 to 1959	McLoughlin	Johnson	Johnson	NA
1960 to 1989	Aloha	Tualatin	Tualatin	NA
1990 to 2012	Aloha	Tualatin	Tualatin	NA

Table Notes:

* Tigard study area was applied to areas outside the City of Portland; Albina was applied to areas within the City

NA = Typology 4 parcels were not subdivided 'Year Type'

- Validating and removing erroneous parcel outliers from each Typology type and Year Built range as necessary. The results of the updated DGA analysis post-validation are provided below. The removed outliers are shown in grey for a given Study Area and Typology type.

Study Area	Sample Size	Type 1			Type 2			Type 3			Type 4		
		S	U	N	S	U	N	S	U	N	S	U	N
Tigard	33	3	1	25	0	0	0	0	0	0	0	0	0
Albina	45	14	3	20	0	2	4	0	0	2	0	0	0
Aloha/TV Highway	30	3	3	20	0	0	0	0	0	0	0	0	0
Johnson/Industrial	12	0	0	0	0	0	0	3	2	7	0	0	0
Tualatin/Sherwood	35	0	0	0	0	0	0	1	0	34	0	0	0
McLoughlin Corridor	32	6	6	19	0	0	0	0	0	0	0	0	0
Boring	30	0	0	0	0	0	0	0	0	0	9	2	19
Total	217	26	13	84	0	2	4	4	2	43	9	2	19

- Calculating the ratio of expected suspect brownfield sites to the total number of candidate sites for each Study Area, and according to Typology type, and Year Built.
 - A sample confidence as applied to the ratio of suspected brownfield sites
- Validation of proportions assigned to each Year Built time period, Typology type, and according to zoning classifications. As a result of careful validation by both Metro staff and MFA, the following adjustments were made to the final DGA:
 - The DGA results for Typology 2 and 3 were combined into one sample set due to similarities between their respective land use types. This resulted in both Typology 2 and 3 having the same proportion rates for each Year Built time period.
 - The calculated proportion rates for Typology types 1-3 and for the Year Built time period of 1960 to 1989 were used as the proportion rates for their respective 1990 to 2012 time periods. This was due to the parcels within the Study Areas and included in the DGA not having parcels that were correlated to this later time period.
 - Typology 4 proportion rates were subsetted into two categories according to the following zoning classes: RRFU and RI/RC. When extrapolated, the individual proportion rates calculated for each of the two categories will more closely represent estimated Brownfields for Typology 4.
- Based upon the methodology described above, the resulting DGA Study Area extrapolation rates were calculated and are provided in Attachment B.

7.3. Metro Region Extrapolation:

Each extrapolation rate was then applied to areas in the region similar to the type of place and time period for which that extrapolation rate was calculated. For example, the extrapolation rate for the mid-century corridor study area (McLoughlin Boulevard) was applied to candidate sites in other mid-century corridors in the region. Likewise, the newer industrial area rate (Tualatin-Sherwood Road) was applied to all newer industrial areas in the

region. Since different places experience varying rates and types of undiscovered brownfields, this methodology enabled a region-wide extrapolation to estimate the number and character of brownfields across the region. The application of the extrapolation ratio resulted in a population range of suspect sites throughout the region. These steps are outlined in the tables below.

As with the Study Areas, Candidate Sites were identified for the Metro region using the following methodology:

- Metro region parcels were selected that met the Typology 1-4 criteria, as described above in Section 4.2.
- The Portland Superfund site was removed from the Candidate Site list, due to complexities associated with Oregon DEQ and USEPA involvement in the area. This area begins at approximately the Interstate 405 bridge and travels downstream approximately to the mouth of the Columbia River and includes all Industrial and Commercially zoned properties on either side of the river.

Please note that extrapolation best represents the geographic extents covered by Typology 1-4. This leaves out areas that are not captured in centers, corridors, employment/industrial areas, or urban reserve/resource areas. Based on our validation research, this represents a small portion of the overall potential sites. A summary table of Candidate Sites matching Typologies 1-4 and that are available for inclusion into the region-wide extrapolation is provided below.

Typology	Inventory Extrapolation - Candidate Sites					DGA Results
	Year Built	Total Parcel Count	% of Total	Total Acreage	Ave Acre/Site	Proportion (Extrapolation Factor)
Typology 1	1900 to 1929	2514	47%	807	0.32	29%
	1930 to 1959	1,783	33%	800	0.45	29%
	1960 to 1989	940	17%	972	1.03	17%
	1990 to 2012	153	3%	232	1.52	NA
	New Total	5,390	100%	2,811	1	--
Typology 2	1900 to 1929	8	6%	5	0.67	13%
	1930 to 1959	17	12%	195	11.50	33%
	1960 to 1989	91	65%	461	5.07	3%
	1990 to 2012	25	18%	105	4.20	NA
	New Total	141	100%	767	5.44	--
Typology 3	1900 to 1929	113	8%	160	1.42	13%
	1930 to 1959	362	27%	1,314	3.63	33%
	1960 to 1989	595	44%	3,193	5.37	3%
	1990 to 2012	275	20%	1,745	6.35	NA
	New Total	1,345	100%	6,412	4.77	--

Typology 4	RRFU	917	96%	3,118	3.40	13%
	RI/RC	36	4%	54	1.51	41%
Any Typology	--	7,829	--	13,163	1.68	23%

8. Inventory Extrapolation Results

The results of the Inventory Extrapolation are provided below.

Typology	Year Built	Candidate Sites	DGA Results		Inventory Extrapolation Results		
			Proportion (Extrapolation Factor)	Error Rates (a)	Suspected Brownfields	Low Estimate	High Estimate
Typology 1	1900 to 1929	2514	29%	11	724	645	803
	1930 to 1959	1,783	29%	16	518	435	600
	1960 to 1989	940	17%	15	163	139	186
	1990 to 2012	153	NA	NA	26	23	30
	New Total	5,390	--	--	1431	1241	1620
Typology 2	1900 to 1929	8	13%	23	1	1	1
	1930 to 1959	17	33%	27	6	4	7
	1960 to 1989	91	3%	6	3	2	3
	1990 to 2012	25	NA	NA	1	1	1
	New Total	141	--	--	10	8	12
Typology 3	1900 to 1929	113	13%	23	14	11	17
	1930 to 1959	362	33%	27	121	88	153
	1960 to 1989	595	3%	6	17	16	18
	1990 to 2012	275	NA	NA	8	7	8
	New Total	1,345	--	--	160	123	196
Typology 4	RRFU	917	13%	23	115	88	141
	RI/RC	36	41%	21	15	12	18
Any Typology	--	7,829	23%	--	1,730	1,472	1,987

Table Notes:

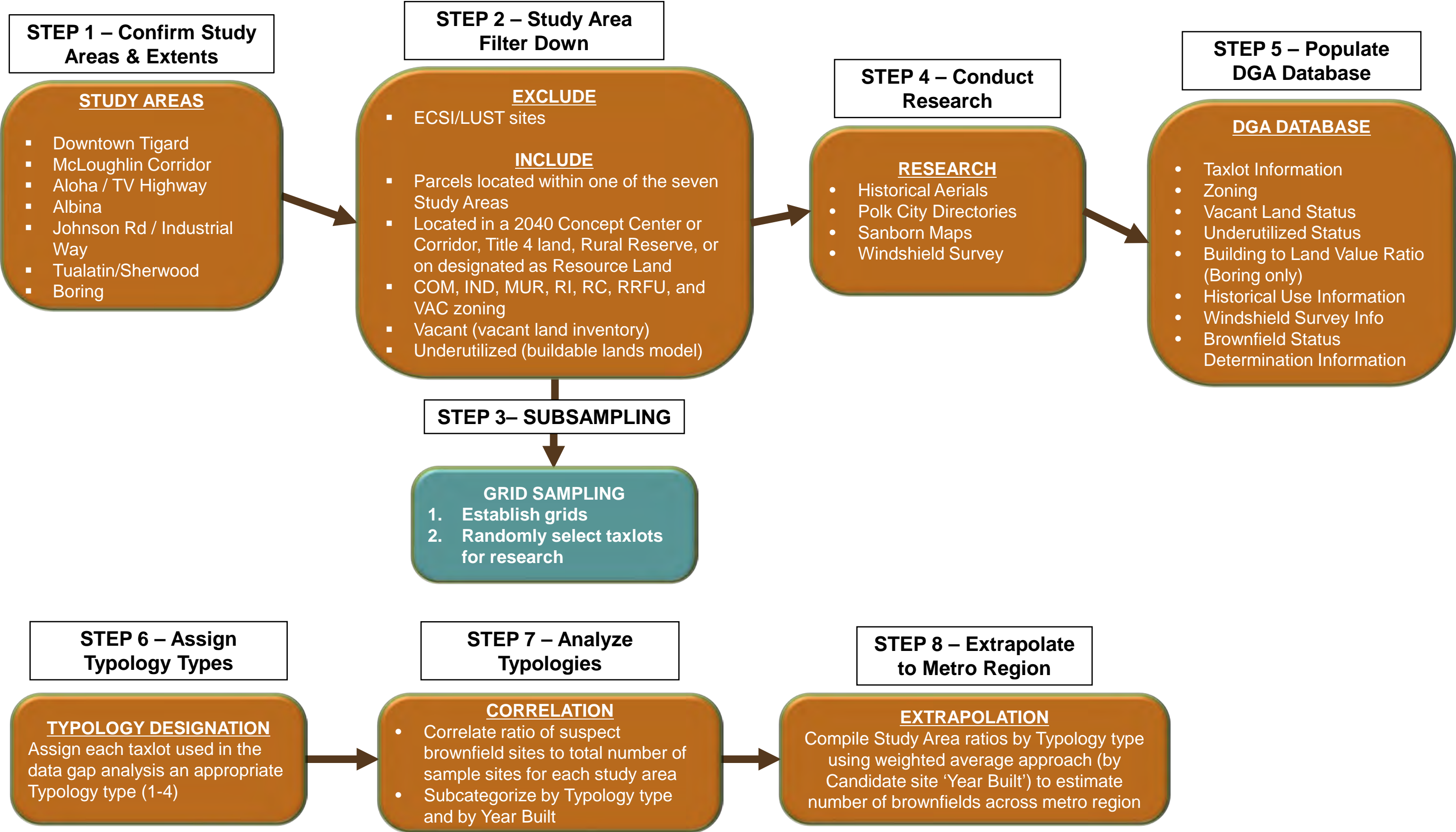
*NA = The calculated proportion rates for Typology types 1-3 and for the Year Built time period of 1960 to 1989 were used as the proportion rates for their respective 1990 to 2012 time periods.

*(a) = Confidence Interval margin of error based on 95% confidence interval, where error = $1.96 \cdot (p(1-p)/n)^{1/2}$. p is proportion of hits, n is sample size.

Extrapolation results for suspected brownfields were added to documented, known DEQ sites to produce an estimation of total potential brownfield sites in the Metro region and is provided below.

Typology	Suspected Brownfields	Reported Brownfields (Known DEQ Sites and Underutilizes)	Total Estimated Potential Brownfields
Typology 1	1,431	367	1,798
Typology 2	10	67	77
Typology 3	160	140	300
Typology 4	318	6	324
<i>Any Typology</i>	<i>1,730</i>	<i>580</i>	<i>2,310</i>

REGIONAL BROWNFIELD PROJECT INVENTORY DATA GAP ANALYSIS (DGA) & EXTRAPOLATION



Attachment B

Typology	Data Gap Analysis										
	Year Type	95% CI with margin error 15% (a)	Actual Sample Size	Study Areas	Suspect	Unknown	Non Suspect	Typology Hit Score	Proportion (Extrapolation Factor)	Error rates (b)	Error rates (c)
Typology 1	1900 to 1929	44	66	Tigard, Albina	17	4	45	19	29%	11%	9%
	1930 to 1959	43	31	McLoughlin	6	6	19	9	29%	16%	13%
	1960 to 1989	42	26	Aloha	3	3	20	4.5	17%	15%	12%
	1990 to 2012	34	0	Aloha	NA	NA	NA	NA	NA	NA	NA
	New Total	44	123	Tigard, Albina, Aloha, McLoughlin	--	--	--	--	--	--	--
Typology 2	1900 to 1929	7	8	Albina	0	2	6	1	13%	23%	19%
	1930 to 1959	12	12	Johnson	3	2	7	4	33%	27%	22%
	1960 to 1989	30	35	Tualatin	1	0	34	1	3%	6%	5%
	1990 to 2012	16	0	Tualatin	NA	NA	NA	NA	NA	NA	NA
	New Total	34	6	Albina, Johnson, Tualatin	--	--	--	--	--	--	--
Typology 3	1900 to 1929	32	8	Albina	0	2	6	1	13%	23%	19%
	1930 to 1959	40	12	Johnson	3	2	7	4	33%	27%	22%
	1960 to 1989	41	35	Tualatin	1	0	34	1	3%	6%	5%
	1990 to 2012	38	0	Tualatin	NA	NA	NA	NA	NA	NA	NA
	New Total	43	49	Albina, Johnson, Tualatin	--	--	--	--	--	--	--
Typology 4	RRFU	42	8	Boring	1	0	7	1	13%	23%	19%
	RI/RC	20	22	Boring	8	2	12	9	41%	21%	17%
Any Typology		44	208	All	39	19	150	48.5	23%	6%	5%

Notes:

*Data Gap Analysis Brownfield determination scoring system: Hit= 1 for "suspect", 0.5 for "unknown", 0 for "non-suspect"

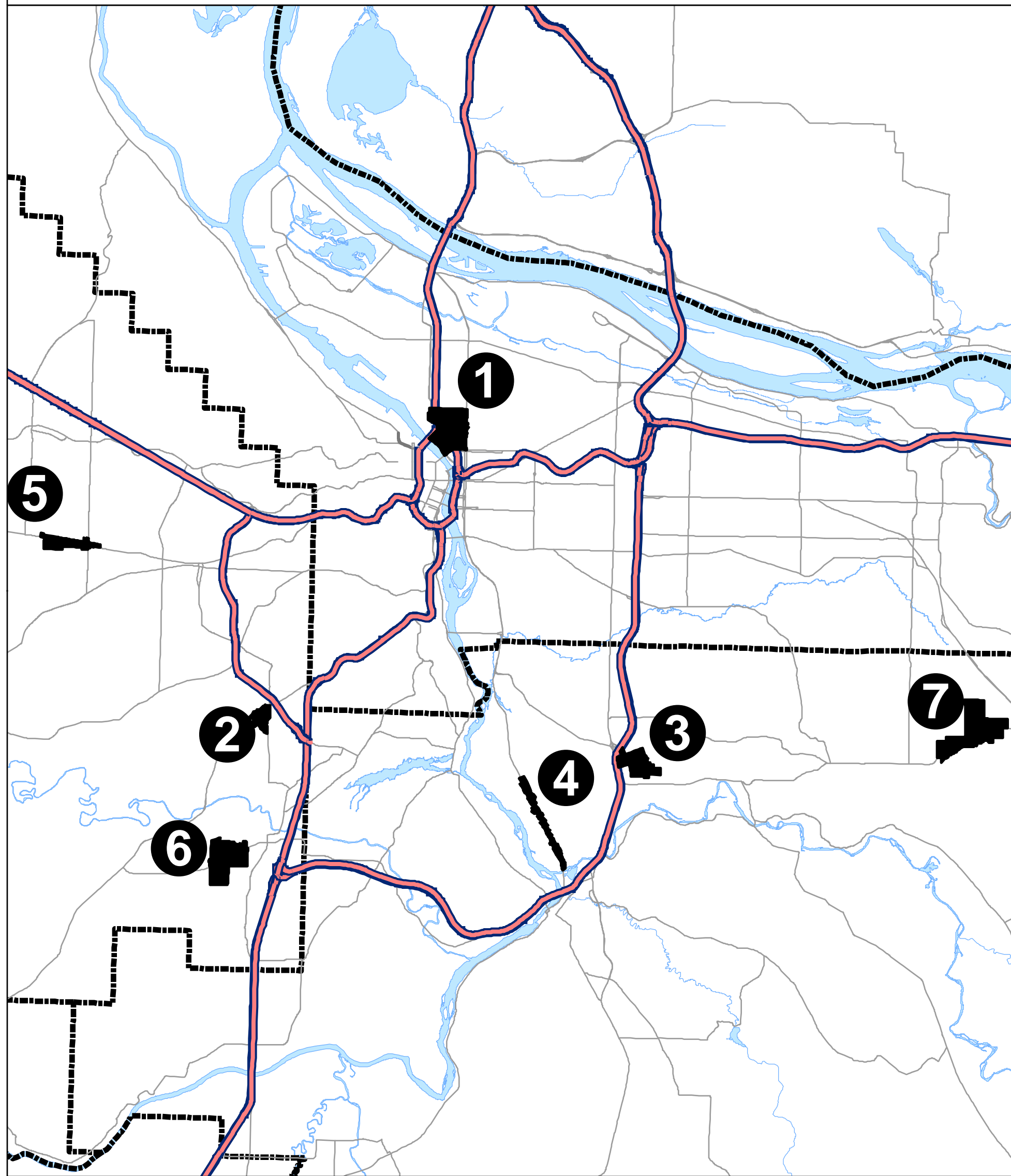
*NA = Extrapolation factor estimated using the proportion rate calculated for the 1960 to 1989 year range for Typologies 1-3

*a Calculation for 95% CI with margin error 15% sample size estimation based on simplified formula in: Yamane, 1967. Statistics, An Introductory Analysis, 2nd Ed., New York: Harper and Row.

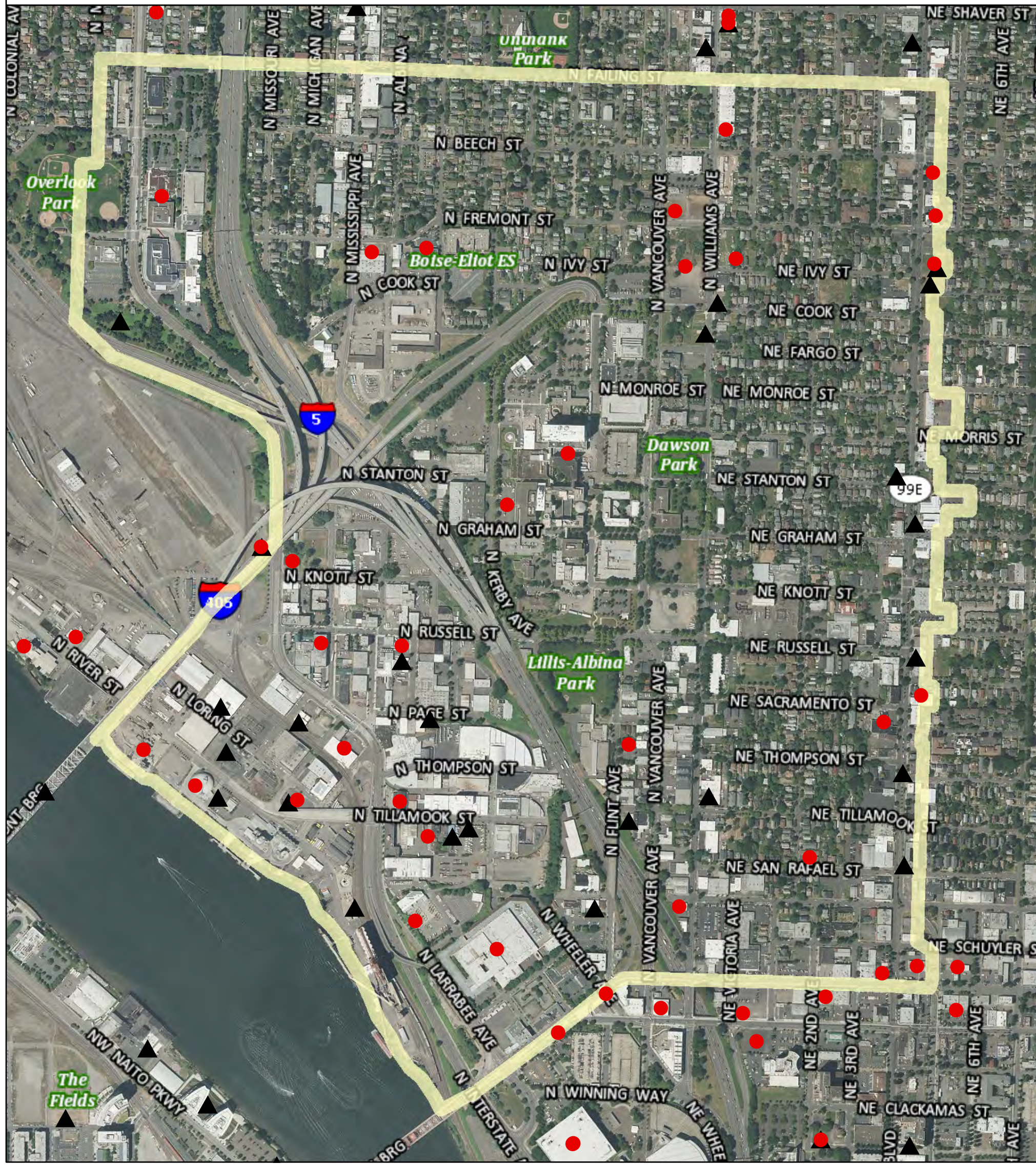
*b Confidence Interval margin of error based on 95% confidence interval, where error = $1.96 * (p(1-p)/n)^{1/2}$. p is proportion of hits, n is sample size.

*c Confidence Interval margin of error based on 90% confidence interval, where error = $1.96 * (p(1-p)/n)^{1/2}$. p is proportion of hits, n is sample size.

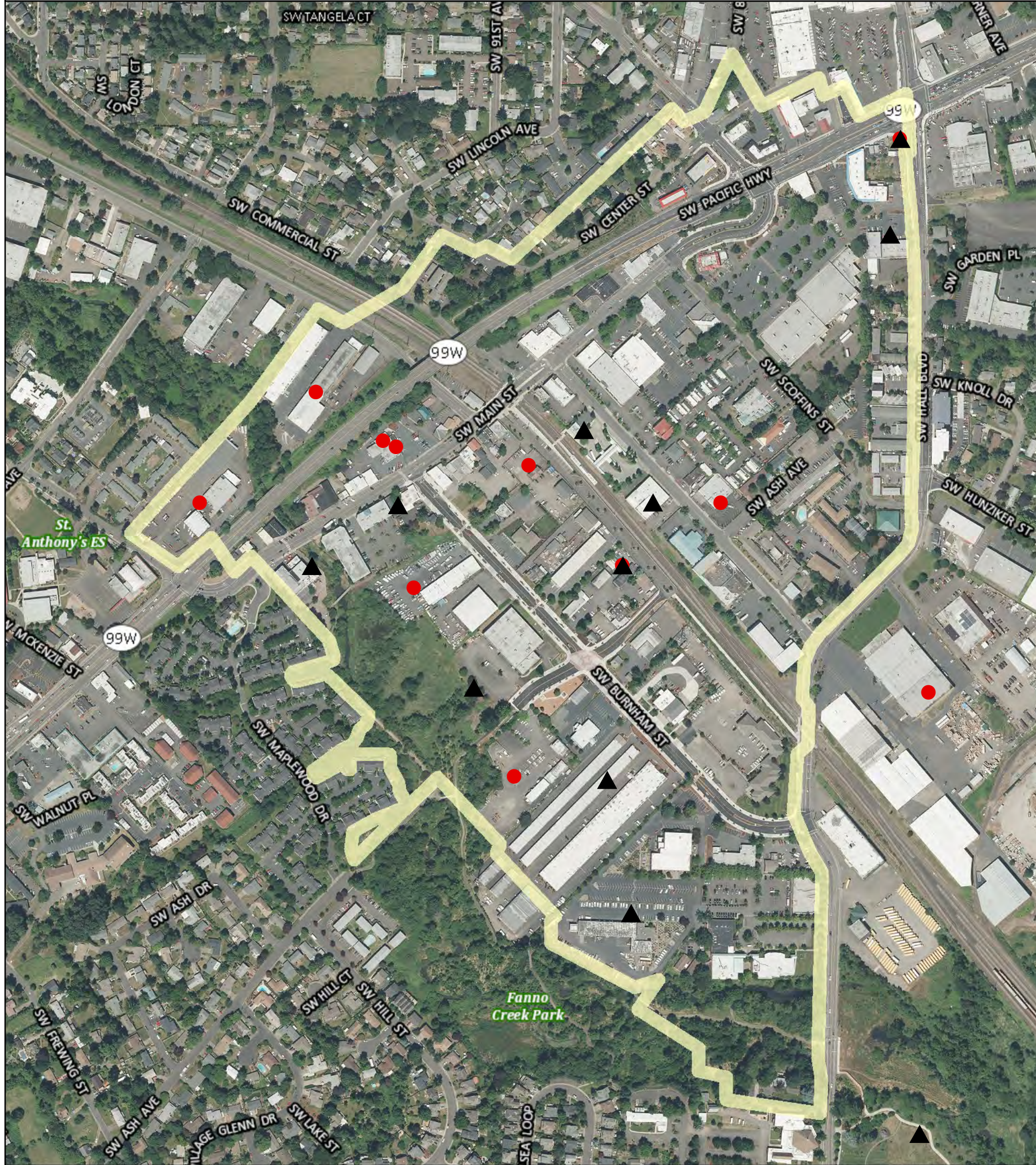
Study Area Locations



1. Albina district:
Historic industrial area and main street
City of Portland



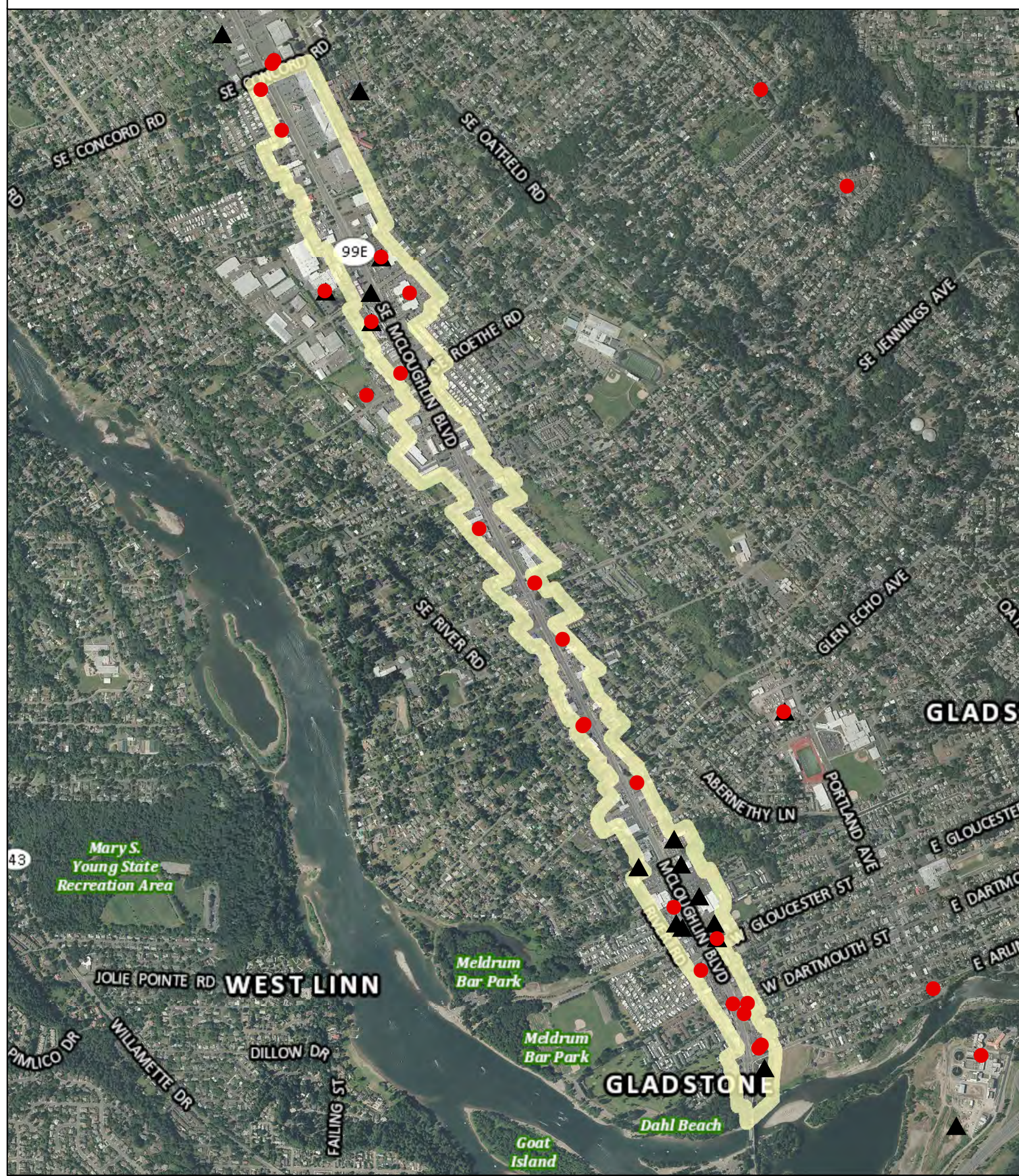
2. Tigard town center:
Historic downtown and main street
City of Tigard



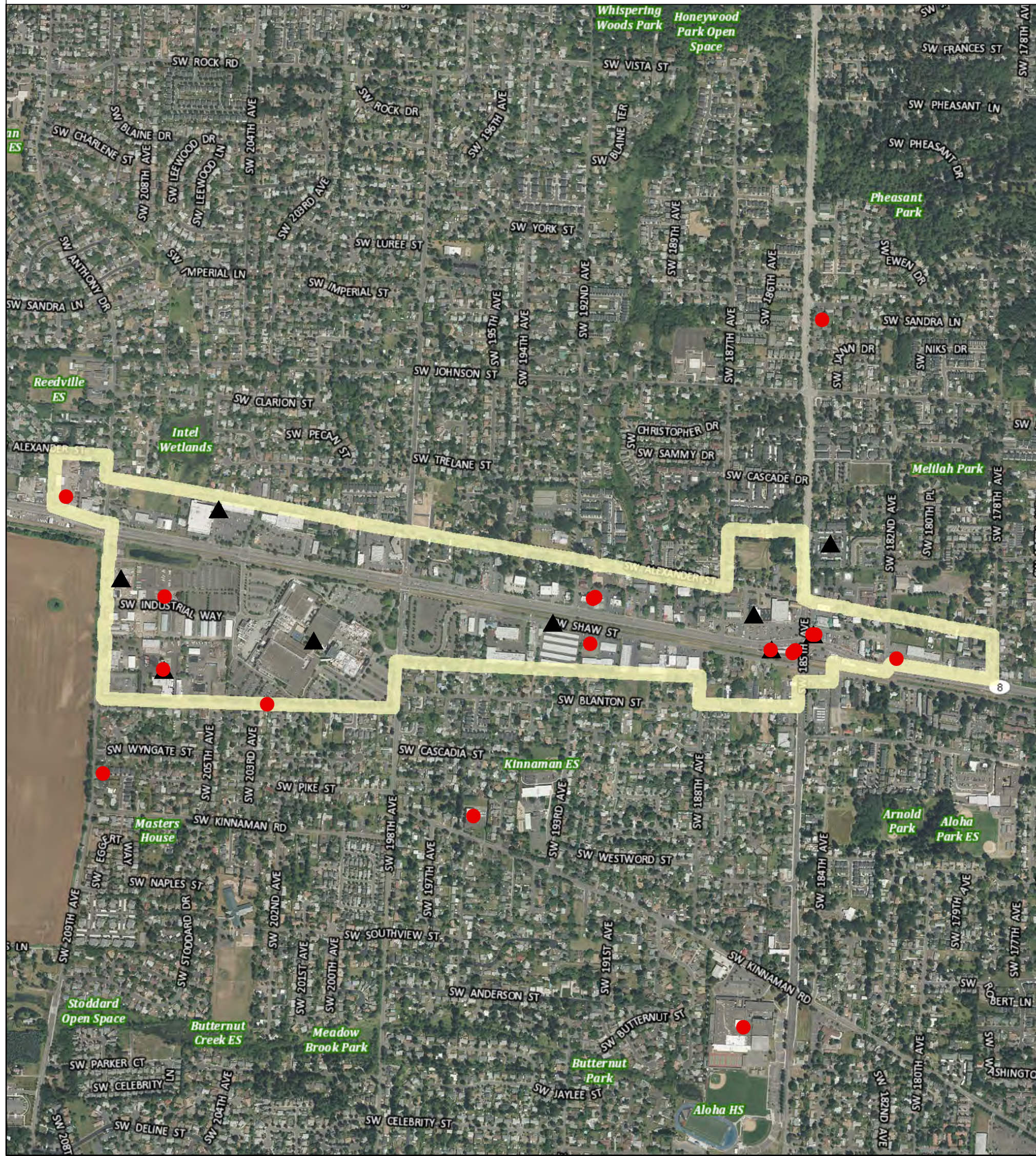
3. Industrial Way:
Mid-century industrial area
Clackamas County



4. McLoughlin Boulevard:
Mid-century corridor
Clackamas County



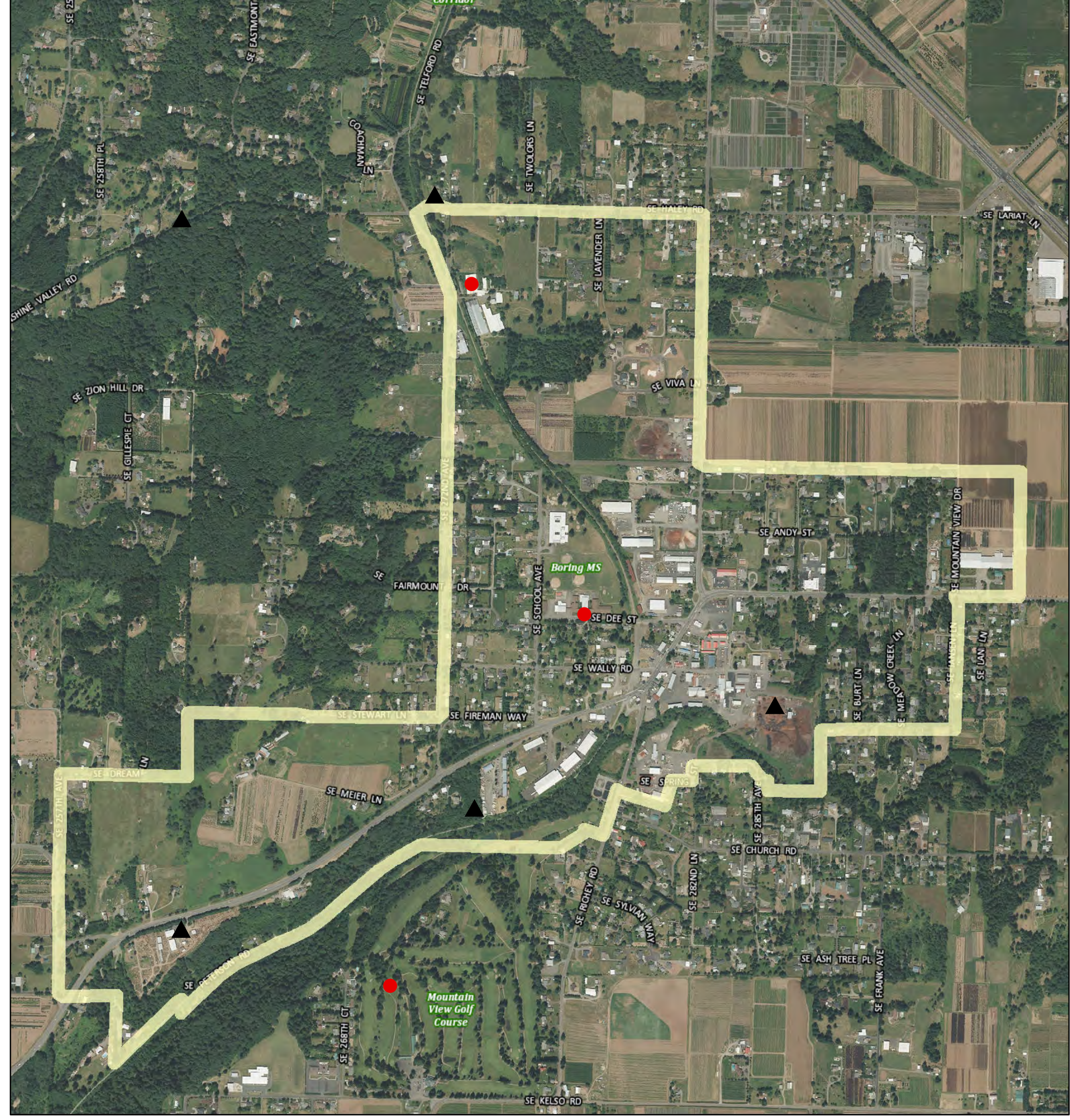
5. Aloha town center:
Newer town center and corridor
Washington County



6. Tualatin-Sherwood Road:
Newer industrial area
City of Tualatin



7. Urban reserve:
Rural agricultural and resource-based industries
Community of Boring, Clackamas County



R L I S
REGIONAL LAND INFORMATION SYSTEM

Study Areas

Metro Brownfield Scoping Project
June 2012

- ▲ Known or potential hazardous substance contamination (DEQs Environmental Cleanup database)
- Reported petroleum releases (DEQs leaking underground storage tanks database)
- Study Area Extent

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METRO

METRO DATA RESOURCE CENTER

600 NORTHEAST GRAND AVENUE
TEL (503) 797-1742
drc@oregonmetro.gov

PORTLAND, OREGON 97232-2736
FAX (503) 797-1909
www.oregonmetro.gov