
HOW TO MAKE A ZONING --- ATLAS:

A METHODOLOGY FOR
TRANSLATING & STANDARDIZING
DISTRICT-SPECIFIC REGULATIONS

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NATIONAL ZONING ATLAS

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I. INTRODUCTION

Zoning – the regulation of land uses, structures, and lots through distinctly-regulated districts – is the most important, yet most underappreciated, power of local governments. Adopted by perhaps 30,000 local governments across the country, zoning laws directly impact housing availability, transportation, education, the food supply, economic opportunity, and access to nature.

We must expand public understanding of zoning codes. To achieve that goal, we propose an online, user-friendly map that illustrates key features of zoning codes all over the country: a National Zoning Atlas.

A National Zoning Atlas will enable comparisons across jurisdictions, illuminate regional and statewide trends, and strengthen national planning for housing production, transportation infrastructure, and climate response. It will also broaden participation in land use decisions, identify opportunities for zoning reform, and narrow a wide information gap that currently favors land speculators, institutional investors, and homeowners over socioeconomically disadvantaged groups. We have explained more at www.zoningatlas.org.

This methodology has two purposes: first, to help you translate and standardize zoning information for your own regional or statewide atlas; and second, to ensure your atlas is compatible with and can be merged into the National Zoning Atlas.

The methodology focuses on individual zoning districts, each of which distinctively regulates allowed uses, structures, and lots. Collecting information on a district-specific basis enables users to visualize the prevalence of particular regulations, compare allowances and restrictions on multi-family housing, and distinguish as of right versus discretionary residential uses, among other things. It is based on the Connecticut Zoning Atlas, www.zoningatlas.org/connecticut, which collected data for, and then mapped, over 2,600 zoning districts statewide. The Connecticut atlas revealed zoning’s hidden levers stifling housing production, documented in “Zoning by a Thousand Cuts,” bit.ly/3pW9vAl. That atlas has also been used to analyze transportation planning, climate response, and economic growth, and to justify legal reforms at the statewide and local levels.

Through its home base at the Legal Constructs Lab at Cornell University, labs.aap.cornell.edu/bronin, the National Zoning Atlas is collaborating with regional and statewide teams running parallel atlas projects. In addition, the Lab is in the process of building (and fundraising for) a team to develop mapping, web-scraping, and machine learning protocols that will centralize the process of creating and maintaining this large volume of data. **Please let us know if you’d like to pitch in by emailing Sara Bronin at sara.bronin@cornell.edu.**

Now let’s proceed to the more detailed instructions. **Part II** explains how the project manager should set up your team, your files, your spreadsheet, and your division of labor.

Part III then turns to the building blocks of any zoning atlas: zoning districts. For reasons explained below, the seemingly simple task of listing zoning districts is harder than it appears. It is useful for the whole project team (including the geospatial analysts) to engage in this task.

Part IV provides instructions on how the zoning code analysts should classify zoning districts into certain categories. It also covers the substantive regulation of uses, lots, and structures.

Part V explains how the geospatial analysts can set up a map and includes instructions on cleaning and merging geospatial files. As noted above, we hope to raise sufficient funds to centralize this step, but in the interim, this information can get teams started.

Part VI concludes, with a few tips on how to verify and maintain your data, once collected.

II. SETTING UP

To start your atlas project, you need to assemble your team and set up systems so everyone can work efficiently and collaboratively. This Part will identify the ideal team composition and ideal qualities for team members. It will outline how to set up an online file sharing system all team members can access. It will explain the importance of collecting your information in a document available online at bit.ly/ZoningSheet. We'll refer to this as the "Spreadsheet." And this Part will suggest how to divide labor based on the information you have collected.

In this Part, you will fill out the following parts of the first two tabs of the Spreadsheet:

- **Jurisdiction Information:** The tab containing information about the jurisdiction.
 - **Jurisdiction:** The name of the jurisdiction.
 - **County:** The county in which the jurisdiction is located.
 - **Team Assignment:** The person on your team who has been assigned to collect information about the jurisdiction.
 - **Does It Have Zoning?:** A binary Yes/No entry indicating whether the jurisdiction has zoning.
 - **Type of Government:** The type of government used in the jurisdiction, using categories according to the official Census of Governments.
 - **# of Pages in the Zoning Code:** The number of pages in the zoning code.
 - **Approx. # of Districts:** The number of districts shown in the zoning map or in the table of contents, used to divide labor.
 - **Link to Zoning Code:** The public link for the zoning code on the internet.
 - **Link to Zoning Map:** The public link for the zoning map on the internet.
 - **Link to Downloadable GIS Layers:** The public link for GIS layer downloads on the internet.
 - **Staff Planner Name:** The name of a key planning/zoning staff member in the jurisdiction.
 - **Staff Planner Email:** The email address of a key planning/zoning staff member in the jurisdiction.
 - **Staff Planner Phone:** The phone number of a key planning/zoning staff member in the jurisdiction.
 - **Notes:** An open-ended column which explains or qualifies an entry in another column.
- **Zoning Information:** The tab containing information about the zoning codes.
 - **Jurisdiction:** The name of the jurisdiction.
 - **County:** The county in which the jurisdiction is located.

By the end of this Part, the Jurisdiction Information tab of the Spreadsheet will be complete. In Parts III and IV, you will complete the Zoning Information tab. Part V contains a short step to complete the Unmapped Districts tab, which is the third tab of the Spreadsheet.

A. YOUR TEAM

Building a zoning atlas requires a multi-disciplinary team of collaborators who have patience, are maniacal about detail, and can maintain a sense of humor. That’s because the only way to create a zoning atlas currently is to manually sift through text and maps – a frustrating and repetitive task. (We’re hoping to change that!)

A great zoning atlas production team requires someone to perform the roles of project manager, zoning code analyst(s), a geospatial lead, and geospatial analyst(s). If you’re only coding a small number of jurisdictions, one or two people with many talents may be all you need.

1. Project Manager

Someone – preferably someone with deep knowledge about zoning – needs to be in charge of coordinating all of the moving parts. Ideally, this person will be a full-time employee of a local or regional planning agency, a researcher at a nonprofit, or a university professor or student. (We say this both for practical purposes and for funding purposes.) That said, anyone with planning or legal background can be a great project manager.

The project manager should be ready to: manage all team members; coordinate outreach to statewide/regional/local entities; develop and maintain lists of jurisdiction-specific planning contacts; answer questions about how to code unique situations and maintain a log of such decisions; manage interim and final cross-checks internally and externally; and centrally organize all digital assets (including copies of zoning texts, copies of static zoning maps, and shapefiles) collected by the team.

The time required for most aspects of this job will vary greatly depending on the experience and accuracy of the zoning code and geospatial analysts and the complexity of the codes themselves. For project setup, managed by the project manager, note that we have found that it takes about thirty minutes per jurisdiction to complete Parts II.B. and II.C., that is, to upload copies of the text and map of the zoning code to an online repository and to fill out the “Jurisdiction Information” tab of the Spreadsheet.

2. Zoning Code Analyst(s)

Zoning code analyst(s) will review zoning codes and input information about uses, lots, and structures into your master spreadsheet using the how-to guide.

These team members could be professional planners or attorneys, but they could also be well-trained junior/senior college students, graduate students (preferably with planning or public policy backgrounds), or law students. Whoever they are, they have to be close readers with a

commitment to accuracy. They also should be the kind of person who is not afraid to ask lots of questions about how to characterize things they find.

To estimate the time required for zoning code analysis, we have found that (after the first jurisdiction or two, which can take a couple of hours!), zoning jurisdictions fewer than 20,000 people can typically take an hour each to input into the spreadsheet, and jurisdictions between 20,000-150,000 people take ninety minutes to two hours. Larger cities may require a few hours each; extremely large cities may take dozens of hours, or more.

3. Geospatial Lead

The geospatial lead will be responsible for finding, managing, cleaning, and merging GIS shapefiles, matching shapefiles with the zoning districts listed in the spreadsheet, identifying missing shapefiles (by reviewing the static zoning map), and hand-drawing any zoning districts that do not come to the team in digital form.

It pays for this person to be someone who is well-connected with fellow geospatial professionals in the region covered by your atlas.

To estimate the time required for geospatial cleaning, merging, and checking, estimate forty-five minutes per jurisdiction for shapefiles you have received in fairly clean form; you will still need to ensure that the GIS layers match the zoning map and match layer names to district names. For more complicated jurisdictions and shapefiles in worse shape, estimate a minimum of ninety minutes each. For jurisdictions with hand-drawn maps and for cities with more than 30 independent zoning districts, estimate several hours each, depending on their complexity.

4. Geospatial Analyst(s)

Depending on the size of the atlas and the shape of the data, additional geospatial analysts may be needed to assist the geospatial lead.

B. YOUR FILES

Once a team is assembled, you can start setting up a filing system and collecting key files for your atlas.

There are three key files to collect for each jurisdiction you intend to cover: the zoning text, the zoning map, and the zoning shapefiles. Zoning codes consist of both a text, explaining how each district within a given jurisdiction is regulated, and a map, showing the boundaries of each district. You will need the map in two formats: a PDF or image, and shapefiles. (A shapefile is a digital format for storing the geometric location and other information about a geographic feature.). Based on our experience in Connecticut, the zoning text is likely to be found online; it may run

anywhere from 30 to 500 pages, most frequently in PDF format. The zoning map will also likely be found online, most frequently in PDF format. The shapefiles are only infrequently found online; you will most likely need to request them from jurisdiction staff through the process described in Part II.B.3.

1. Starting Point: The Internet Search

You have to start looking for these three key files somewhere. First, try your luck with an internet search for “[Jurisdiction Name] Zoning Code” and “[Jurisdiction Name] Zoning Map.” Such a search may lead you straight to a PDF of the zoning text, and an image and GIS repository of the zoning map. If that is the case, you’ve struck gold! Skip down to Part II.B.4 to understand how to save the information.

You can also try navigating to the websites of any of the following entities, which tend to maintain copies of both the zoning text and the zoning map:

- Zoning Commission
- Planning Commission
- Planning and Zoning Commission
- Department of Development, Economic Development, or Community Development
- Department of Licenses and Inspections
- Department of Buildings, Real Estate, or Land Use

If no such entities exist or have websites, you will have to look separately for the text and map.

2. Zoning Text Search Tips

If you haven’t found the zoning text in an internet search, your next best bet is to navigate to the official website containing all local ordinances and regulations. This website may have any of the following titles:

- City Code or Municipal Code
- Ordinances or Code of Ordinances
- Laws
- Regulations
- Bylaws

NOTE: You may see an option to navigate to the town charter. It is unlikely that a town charter will contain a zoning code. The charter may dictate the basic structure, operation, or composition of the zoning commission administering the zoning code. As these characteristics are not logged in the zoning atlas, it is unlikely the charter will be a useful resource in creating your atlas.

If the jurisdiction does not maintain a website with its own laws, search for the name of the jurisdiction in one of these three leading online local law databases:

- Municode: *library.municode.com*
- Ecode360: *generalcode.com/library/#*
- American Legal: *codelibrary.amlegal.com*

If the jurisdiction you seek appears in one of these three databases, then search the jurisdiction's laws for the term "zoning." Scan for the appearance of this keyword in a section title, and you will very likely have found the section where the zoning code is located.

If you cannot find the zoning text online, you will need to contact the jurisdiction's staff. In smaller towns, the code enforcement officer or town clerk may be your best bet. In very small towns, note that some staff only work one day a week and may take a week or two to respond; plan accordingly.

A handful of jurisdictions may only distribute the zoning code to you in paper copy for a fee, or may require you to come to the office to make your own physical copy. In these cases, I suggest asking for the name of the town attorney, in the hopes that the attorney may be willing to send you an electronic copy. If someone tells you that they cannot provide the zoning code in any format, please gently remind them that zoning codes are public documents, subject to the freedom of information act, and that as a member of the public you have a right to inspect theirs.

3. Zoning Map & Shapefiles Search Tips

You will almost always be able to find a PDF or an image of the zoning map on an official website. If you do not, you will need to contact the jurisdiction staff for an electronic copy. See the last paragraph in the preceding section if the staff asks for a fee, asks you to come to the office, or refuses to provide the map in any format.

You might be able to download the shapefiles (GIS layers) related to the zoning map from the jurisdiction's website or from another resource like ESRI. However, you are more likely to come up short with a simple online search. More likely, you will need to contact the jurisdiction staff. Start with the staff member who administers the zoning code. Alternately, contact the Geospatial Information Services or Data Visualization Office of the jurisdiction, if any. As a third option, contact the regional planning agency or county office, which sometimes creates and maintains shapefiles for mid-sized and smaller municipalities.

Some jurisdictions will have neither shapefiles nor parcel data. Small and rural jurisdictions, in particular, may not digitize their maps. In these cases, you will have to manually draw layers using the official zoning map as a georeferenced base image.

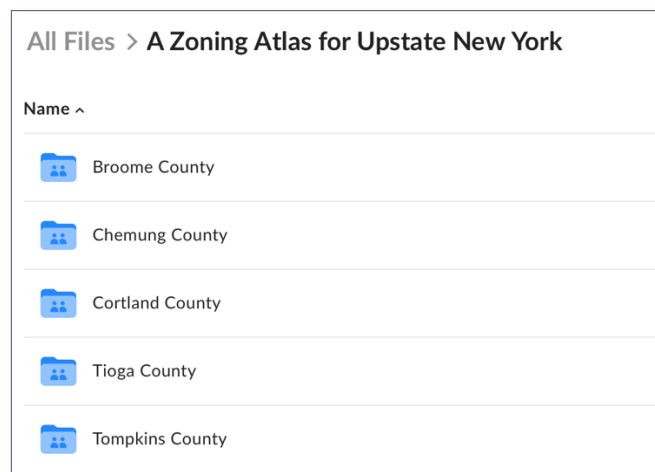
NOTE: Shapefiles provided by the jurisdiction are not the official zoning map. The official zoning map is a static document adopted by the zoning authority, showing where each of the districts is located. In limited situations, the shapefiles may be more accurate and updated than the publicly available zoning map; if you suspect this, please consult with the jurisdiction's staff.

There are times when sloppy shapefiles will cause serious issues. Parts V.B.4 and V.B.7 identify potential errors in the files and explain how to resolve these issues.

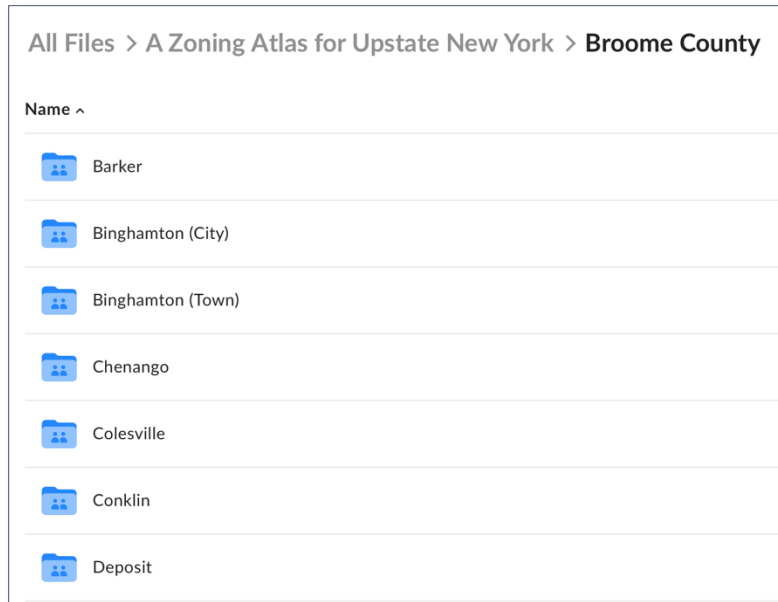
4. Saving Files

As you find copies of the zoning text, map, and shapefiles, you will need to save them to a filing system. For this, you should identify a system, such as Dropbox, Box, or Google Drive (referred to here collectively as “dropbox”) that enables sharing with people inside and outside your organization. Share everyone on the project team to your files. (If you are part of the National Zoning Atlas team, please contact us for instructions on how to share files with our team.)

If your atlas covers more than one county, create a folder for every county, as we did for the zoning atlas covering five counties in upstate New York state:



Then create folders for every jurisdiction. If you are dealing with a county that has some incorporated areas with zoning and other unincorporated areas subject to county zoning, title the folder as follows: “[X] County (Unincorporated Areas).” If there are jurisdictions with the same name (like Binghamton in the example below), please include an additional descriptor (such as “City,” “Town,” “Village,” “Township,” or “Borough” in parenthesis. See this example:



Then within each jurisdiction, create three sub-folders:

- Text
- Map
- GIS

With those folders created, you are ready to start saving three types of files in jurisdiction-specific folders. Within each of these three sub-folders, you may create an “Archive” sub-sub-folder, which you can use to file original or interim (i.e., non-current) versions of the various documents. The files need to be in a consistent format, as follows.

In the “Text” sub-folder, save zoning text in PDF or Word/text format and label the file with the name of the jurisdiction (adding the same parenthetical you used above, e.g., “City,” Town,” if needed to differentiate), the words “Zoning Text,” and the date on which you downloaded it, preferably date, month, and year in two-digit figures. For example, December 1, 2021 would be depicted as “12 01 21” at the end of the file name. Because zoning codes can be amended, you will want to know the point in time on which your atlas is based. You must only have one saved zoning text document per jurisdiction when your atlas is first created. If you found the zoning code in pieces (e.g., on several websites), manually append the pieces together into a **single** Word/text document or PDF. Having the zoning text in a stable, searchable format will be useful for future steps.

In the “Map” sub-folder, save zoning maps in PDF or graphic format (JPEG, PNG, etc.) and label the file with the name of the jurisdiction (adding the same parenthetical you used above, e.g., “City,” Town,” if needed to differentiate), the words “Zoning Map,” and the date on which you downloaded it. Use the same two-digit convention described above for the dates.

In the “GIS” sub-folder, save original zoning shapefiles and label the file with the name of the state, the name of the jurisdiction (adding the same word you used above, e.g., “City,” “Town,” if needed to differentiate), and again, the month and year of download. For example, ct-hartford-12-21.geojson is better than HtrdLayers.geojson. For another example for the town of Binghamton (as opposed to the city of Binghamton), use ny-binghamton-town-12-21.geojson. These files will become obsolete as you modify them or as the zoning code changes. Please do not simply delete these files, but rather put original and interim (i.e., non-current) copies of these shapefiles into the “Archive” sub-sub-folder.

NOTE: If your search yielded several different copies of any of these documents, check their dates to choose the most recent one. If the documents are undated, contact the jurisdiction’s staff to confirm you have the correct version.

C. YOUR SPREADSHEET

As you collect zoning texts and maps, you must turn to the Spreadsheet. If you have not already, create a copy of the document available online at bit.ly/ZoningSheet. We suggest you use Google Sheets or some other service that enables sharing with people inside and outside your organization. Share everyone on the project team to your Spreadsheet. (If you are part of the National Zoning Atlas team, please contact us for instructions on how to share the Spreadsheet with our team.)

Once you have your files in order, fill out all of the columns in the Jurisdiction Information tab of the Spreadsheet except Federal and State Land in Jurisdiction, which you can only complete after you assemble the shapefiles. Also fill out the Jurisdiction and County columns of the Zoning Information tab of the Spreadsheet. While the columns in the Jurisdiction Information tab seem tedious, they will prove useful as you summarize your atlas project and as we piece together information about zoning districts nationally. A few explanatory notes on some of these columns follow.

The Jurisdiction column requires you to input the jurisdiction name, without type-of-government descriptors such as “Town of,” “Village of,” and “Borough of.” Adding these descriptors will cause difficulties when you sort by jurisdiction name. However, in some instances, you will have multiple jurisdictions with the same name. In these cases only, you will need to include the additional descriptor in parentheses after the shared name. For example, in Courtland County in New York State, there are two places called “Marathon” with zoning, the town of Marathon and the Village of Marathon. Here is how they are shown in the Spreadsheet:

Jurisdiction	County
Marathon (Village)	Cortland
Marathon (Town)	Cortland

In some cases, you will find submunicipal jurisdictions: that is, small zoning authorities located within the boundaries of an existing municipality. These small zoning authorities may themselves be governments, carved out of the existing town, or they may be private associations to which the state legislature has granted zoning authority. For example, in Branford, Connecticut, there are two private beach associations with zoning authority. One is called South Beach Civic Association. Use a dash to separate the name of the larger municipality from the name of the submunicipal jurisdiction as follows:

Jurisdiction	County
Branford - Short Beach	New Haven

Use the same exact name for the Jurisdiction column in both the Jurisdiction Information and Zoning Information tabs.

The County column entries should not include the word "County." The project manager should ensure that any use of that word in this column should be deleted.

The Team Assignment column should show the most current team member assigned to a particular jurisdiction. The name of the person assigned to the jurisdiction may change after dividing labor as described in Part II.D.

The Does It Have Zoning? column is useful if you are in a part of the country with many unincorporated areas, or areas that do not have zoning. You may not know whether specific jurisdictions have zoning until you actually comb through local ordinances. In those cases, you may want to log your work to avoid duplicating the effort of ascertaining whether the particular jurisdiction has zoning. Jurisdictions without zoning would appear in the Jurisdiction Information tab of the Spreadsheet only, and as they do not have zoning, you would not include them in the Zoning Information tab.

The Type of Government column is important for our ability to track the types of governments that have enacted zoning. No one knows what these numbers are. The US Census conducts a Census of Governments, classifying local jurisdictions into the following categories: general-purpose county governments; general-purpose municipal governments; general-purpose township governments; and special districts. An explanation of these categories and how to classify local governments on a state-by-state basis can be found here: bit.ly/3xw0but. In New

York, for example, towns are considered general-purpose township governments, while villages and cities are considered general-purpose municipal governments. It is possible that special districts have been given zoning powers; for example, a fire district in Connecticut is one of the 11 submunicipal districts that have zoning powers. It is also possible that private entities have been granted zoning powers; in Connecticut, several homeowners associations in beachfront communities have zoning powers. That is why in the drop-down menu, you see an option for private entities.

The Number of Pages in the Zoning Code column is important for you and your team to be able to indicate how many pages of zoning codes you have read. In Connecticut, we read over 32,000 pages of zoning codes!

The Approximate Number of Districts column is intended to provide a general sense of the number of districts shown in the zoning map, so that the project manager can more accurately divide labor as described in Part II.D. Logging the approximate number of zoning districts, as best you can determine it in 15 seconds or less (e.g., through the map PDF or table of contents), will help you more fairly divide up jurisdictions. Some small jurisdictions may have just a few districts, while others might also have a dozen or more. Some large jurisdictions may have 50 or more districts, while others may have fewer than 10.

The three Links columns are intended to ensure that your team can retrace the steps of the person originally assigned to the jurisdiction. The project manager should skim over the links provided to identify any clear errors, such as links to zoning codes of towns with the same name but in another state.

The Staff Planner contact columns are intended to smooth the process for the entire team in obtaining information, and later, in finding and verifying information collected.

NOTE: There are columns grayed out in the Spreadsheet. Do not modify these columns! They will either automatically update or are automatically greyed out so you will not fill them out. Remember: “If it’s grey, go away.”

D. YOUR DIVISION OF LABOR

Once all the jurisdictions are filled out, the project manager should assess how to divide labor. To avoid confusion and minimize duplication of efforts, it is best to assign only one zoning code analyst and one spreadsheet analyst for each jurisdiction. But how many should each be assigned?

A good measure of how complicated each jurisdiction for zoning code analysts will be is the Approximate Number of Districts column. Jurisdictions have wildly different numbers of zoning districts. When the Cornell University team completed the first iteration of an atlas for five counties in and around Ithaca, New York, they found that the number of districts ranged from 3

to 53. To be fair to the students in the class, we needed to know the number of districts for each jurisdiction and allocate the jurisdictions to ensure an equal number of districts, so the student who had the town with 53 zoning districts was not unduly burdened. It is important to note that making this rough assessment is not definitive; you will not know the exact number of districts until you undergo the three-step process described in Part III.

Towns with larger populations tend to have more zoning districts. Interestingly, these jurisdictions tend to be less complicated for spreadsheet analysis, because they are more likely to have full-time staff and geospatial layers. So as the project manager is assigning jurisdictions, consideration might be paid to the Link to Downloadable GIS Layers column. Entries in that column with links might be assigned to a less experienced geospatial analyst, or be assigned in larger numbers; entries in that column left blank (meaning no downloadable GIS layers were found) might be assigned to more experienced geospatial analysts, or be assigned in smaller numbers.

III. LISTING ZONING DISTRICTS

Zoning districts are the building blocks of any zoning atlas, and properly identifying them is essential to the success of your project. Because this Part III is foundational to Parts IV and V, we suggest all team members – project manager, zoning code analysts, and geospatial analyst(s) – participate in gathering the names of zoning districts.

To do so, you must consult all three resources collected in Part II: the zoning text, the zoning map, and the GIS layers. Only after consulting all three resources can you accurately input the names of the districts into the Spreadsheet. All Spreadsheet columns listed in this Part are located in the Zoning Information tab, and not the Jurisdiction Information tab.

In this Part, you will fill out the following Spreadsheet columns for every district:

- **Abbreviated District Name:** The abbreviation used for the district, often two or three letters combined with numbers.
- **Full District Name:** The full name of the district.
- **District Mapped:** A binary Yes/No entry indicating whether the district is on the zoning map.
- **District Mapped but Extinct:** A binary Yes/No entry indicating whether the district is on the zoning map but not in the zoning text.
- **Overlay:** A binary Yes/No entry indicating whether the district is an overlay district, meaning that it is, or can be, layered on top of another district(s).

A. SEARCHING THE ZONING TEXT

Open the file containing the zoning text to begin making a preliminary list of the districts. While districts are sometimes called zoning districts, they can also be called districts, zones, or overlays.

Try one or more of these strategies to find a list of districts:

- Scan the table of contents (sometimes called “contents”): Sometimes, but not always, it will have a consolidated list of the districts.
- Search for the phrases “divided into,” “divides the,” “hereby,” “established,” and/or “following zoning districts.” There is often a page somewhere early in the code that says something like “[Jurisdiction X] is divided into the following districts:”
- Search for the words “zone” and/or “district”: If either of these words appears five or more times on a single page, scan the page to see if the page contains a list of the districts.
- Search for charts which show different district-specific characteristics, such as minimum lot sizes or lot coverage requirements: The rows or columns of these charts will be labeled with different districts.

NOTE: Even if you locate a consolidated list of districts using one of the means above, do not be lulled into a false sense of security that your job is done. Here are three reasons why you must continue:

- Consolidated lists may not include districts added to a zoning code after it is first adopted. We have found that many omitted districts are planned unit districts added after the original zoning code was implemented.
- Consolidated lists may include districts that have never made it to the zoning map, which means that such districts exist only in theory.
- The zoning text may not include districts that remain in the zoning map but have been eliminated from the zoning code.

Before moving on to the zoning map and GIS layers, scan the table of contents one last time for mentions of other districts not included in the list.

Once you have completed these steps, fill out the following Spreadsheet columns with the information so far:

- Abbreviated District Name
- Full District Name

In the Spreadsheet, every district must be a separate row. Often, you will see the abbreviation and name of the district together in one phrase or sentence in the zoning text. For example, you might see:

- R-40 Residential-40 Zoning District
- ID 2 Industrial District 2
- HOZ Housing Overlay Zone

For these districts, put “R-40,” “ID 2,” and “HOZ” in the Abbreviated District Name column. Before putting the longer district title in the Full District Name column, delete the words “Zone,” “Zoning District,” and “District.” Accordingly, in the examples given, you would put “Residential-40,” “Industrial 2,” and “Housing Overlay” in the Full District Name column.

Sometimes, you will only see the abbreviation of a district used in the zoning map, while the full name of the district is used in the zoning text. In these cases, use educated guesses and the process of elimination to determine which full name matches which abbreviation. Using the examples above, seeing “R-40” on the zoning map would clearly point you to the Residential-40 district.

Sometimes, you will see no abbreviations in either the zoning code or map. In that case, enter the full name of the district in the Abbreviated District Name column and the Full District Name column.

NOTE: As mentioned above in the discussion of the Jurisdiction and Type of Government columns, there will be situations where you will find small, submunicipal zoning jurisdictions,

including small villages or even private associations, within existing municipal boundaries. In logging the names of zoning districts within these areas, please include in the Abbreviated District Name and Full District Name columns a prefix that will enable the geospatial analysts and end users of the atlas to clearly see that these districts are associated with a submunicipal entity. In the case of the Branford Short Beach Civic Association example discussed above, there were three zoning districts, simply called District A, District B, and District C. Here is how we logged those three districts in the Spreadsheet:

Jurisdiction	County	Abbreviated District Name	Full District Name
Branford - Short Beach	New Haven	SB-A	Short Beach A
Branford - Short Beach	New Haven	SB-B	Short Beach B
Branford - Short Beach	New Haven	SB-C	Short Beach C

NOTE: There may be situations where you want to extract lists of districts that are in table format, or (later in Part IV) information from a use table or development table in Part IV. You may not be able to cut and paste from a Word or PDF document into the Spreadsheet. A few tools can help expedite data entry using optical character recognition of the relevant screenshot or PDF of the table. ImageToExcel, imager.toexcel.com, is one popular tool, though the free version is limited to 5 scans a day. For Microsoft 365 users, the Excel app for iOS and Android also has a picture to data conversion tool, bit.ly/3KmQCRI.

B. CONFIRMING WITH THE ZONING MAP

After completing your scan of the zoning text, turn next to the zoning map.

Open the file containing the zoning map and locate the legend. The legend shows the districts that actually appear in the zoning map. Often but not always, the legend will list both the full district name and the abbreviation for the district. This will help you continue to fill out the Abbreviated District Name and Full District Name columns of the Spreadsheet.

In addition, in this section, you will fill out the following Spreadsheet columns:

- District Mapped
- District Mapped but Extinct
- Overlay

Use the legend to cross-check the names of the districts you have already logged. If they appear in the map (i.e., actually attached to plots of land), log a “Yes” in the District Mapped column of

the Spreadsheet. If a district is listed in a map legend but has not “landed” on any land yet, then mark the district as “No” in the District Mapped column.

You are likely to find district names in the zoning map key which you did not notice in your scan of the zoning text. Enter these new districts in the Abbreviated District Name and Full District Name columns, and log a “Yes” in the District Mapped column of the Spreadsheet.

When you have completed your review of the zoning map, return to the zoning text to see if these newly discovered districts actually appear in the zoning text. If they do not appear in the zoning text, then log a “Yes” in the District Mapped but Extinct column of the Spreadsheet. It is uncommon for districts to appear on the map but not in the text: of 2,622 districts we logged in the Connecticut Zoning Atlas, only 11 were mapped but extinct. For each of these 11 districts, we contacted staff of the jurisdiction or staff of the regional councils of governments, or used online research to identify previous versions of zoning codes in which these districts appeared. In the Spreadsheet, we logged information about the 11 districts using the most recent zoning text in which they were mentioned. While this method is not perfect, it is the only option.

Finally, review the zoning map to discern whether any zoning districts are overlays, defined as districts which are overlain over another district and provide certain distinct regulatory characteristics that supplement (but do not entirely override) the regulations of the underlying district. Distinguishing between base and overlay districts is important for an accurate atlas, because there will be some cases where overlays override the depicted characteristics of underlying districts. As one example, a “historic overlay” might require different standards for historic housing than otherwise required for housing in the underlying residential district. Graphically, overlays are often depicted with a hatch (i.e., diagonal stripes), cross-hatch, or dots over an existing layer. They often include the word “overlay” in the title. The final determination as to whether a district is an overlay is the official PDF of the zoning map.

NOTE: Not every district labeled an overlay actually functions as an overlay; some so-called overlays actually function as base districts that replace underlying zoning altogether. The only districts which should be logged in the Spreadsheet as overlays are those that actually satisfy the definition of the overlay above and are depicted on the zoning map overlying another district. You will be able to confirm this status by looking at the zoning map for hatches or similar graphic conventions. For these districts, log a “Yes” in the Overlay column of the Spreadsheet.

NOTE: Planned residential developments (or PRDs, discussed in greater detail in Part IV.B.7. below) present special issues when it comes to overlays. In some zoning codes, PRDs will be allowed within a zoning district through special processes that change some, but not all, of the regulatory characteristics of the underlying zone. These PRDs satisfy the definition of an overlay. In other zoning codes, the creation of a PRD will trigger an override of all of the regulatory characteristics of the underlying zone. These PRDs are not overlays. If a PRD overriding the regulatory characteristics of the underlying zone has actually been created and mapped, and if you have a copy of the regulations governing development in that PRD, you should create a new

row in the Spreadsheet, marking a “No” in the Overlay column and a “Yes” in the PRD Treatment column, discussed further below.

NOTE: Zoning codes may sometimes note the presence of floodplain, wetlands, aquifer districts, and the like. These types of districts are often not included on the official zoning map, and may even lack fixed boundaries as floodplains and wetlands, for example, change. If they are mentioned in the zoning text as a district, log them as a district, in their own line, as you would any other district. If they do not appear in the zoning map, log a “No” in the District Mapped column of the Spreadsheet and treat them like other unmapped zoning districts, moving them to a new tab when instructed below. As you proceed with the analysis in Part IV, note that these districts will likely be marked as “Nonresidential” in the Type of Zoning District column, and “Prohibited” in the 1-Family Treatment, 2-Family Treatment, 3-Family Treatment, and 4+-Family Treatment columns.

C. CONFIRMING WITH THE GEOSPATIAL LAYERS

After completing your scan of the zoning map, you only have one last cross-reference to complete, that of the GIS layers. The geospatial analyst(s) may have to lead this task. They should do this task as part of their work in Part V.B.4. to clean and name the GIS layers. That may mean that the team will have to return to a handful of districts discovered in the shapefiles as you’re near the end of the project for the rest of the work. Never fear: you didn’t do anything wrong!

Part V.B.4 provides more technical details for the geospatial analyst(s), but for everyone’s sake, we’ll point out here that the reason you need to be sure you’ve done this task is that sifting through the shapefiles will yield more zoning districts than you found using just the zoning text and map. Here are three examples of zoning districts that might appear in the shapefiles but nowhere else:

- Layers that may not yet feature in the zoning text or the zoning map in PDF, because they were recently adopted and only the GIS layers were updated so far.
- Overlays that may not be clearly shown in the zoning map in PDF.
- Layers that once existed in the zoning text but were deleted from the text, and not from the map; i.e., Mapped but Extinct layers.

In addition, the shapefiles might reveal “holes” in a jurisdiction: areas that are blank and appear unzoned. In Connecticut, we found that the blank holes were, in fact, zoned – just under the authority of a new, submunicipal jurisdiction we had never heard of (such as “villages” within a town, or private associations granted zoning authority). We added 11 such jurisdictions to our Spreadsheet after inspecting the shapefiles. That meant going back to Part II to add them into the Jurisdiction Information tab.

As you cross-check with the GIS layers, continue to fill in the District Mapped column of the Spreadsheet. When a district is listed in the zoning text but not included in the official map or zoning shapefiles, be sure that the District Mapped column is marked “No.” Continue to collect

information about these unmapped districts, but note they will be omitted when you are finally assembling the user interface for your atlas, and you will be moving them over to a third Unmapped Districts tab when you are about to assemble your map, as described in Part V.C. This is because an unmapped district only has “paper” status until it is mapped.

Now you can see why reviewing all three resources – the zoning text, the zoning map, and the GIS layers – is necessary to finalize the list of districts you will use as the building block of your atlas. With this list of districts in hand, the project manager and zoning code analysts should proceed to Part IV. Geospatial analysts may wish to skim Part IV; their substantive work will begin in Part V.

IV. ANALYZING ZONING CODES

In Part III, you completed 7 critical columns in the Spreadsheet. The Jurisdiction and County columns, completed in Part II, involved basic information. The Abbreviated District Name and Full District Name columns, completed in Part III, resulted from the process (likely still ongoing as you read this) of searching the zoning text, map, and shapefiles for district names. In the last three columns – District Mapped, District Mapped but Extinct, and Overlay – you made assessments based on the way districts are depicted graphically.

This Part puts graphic depictions aside and relies solely on the zoning text. Zoning code analysts will be using the zoning text to: classify zoning districts; catalogue uses, lots, and structures; and verify data. All Spreadsheet columns listed in this Part are located in the Zoning Information tab, and not the Jurisdiction Information tab.

A. CLASSIFYING ZONING DISTRICTS

As you delve into the text, locate the definitions section of the zoning code so you have it handy.

In this Section, you will fill out the following Spreadsheet columns for every district:

- **Type of Zoning District:** One of the following three options, each indicating the general nature of the district: Primarily Residential, Mixed with Residential, or Nonresidential.
- **Affordable Housing District:** A binary Yes/No entry indicating whether the entire zoning district requires all of its housing to satisfy an affordable housing definition.
- **Elderly Housing District:** A binary Yes/No entry indicating whether the entire zoning district requires all of its housing to be occupied by elderly persons.

1. Type of Zoning District

Each zoning district allows or prohibits different specific uses – a topic we will delve into in further detail in Part IV.B. For now, we want to classify the districts based on the general uses they allow.

The Type of Zoning District column shows whether the district generally falls into one of three categories: Primarily Residential, Mixed with Residential, or Nonresidential. Distinguishing districts in this manner allows a more accurate assessment of the amount and nature of land devoted to residential and nonresidential uses.

NOTE: This classification is not clear-cut. It requires some judgment on your part as you weigh whether a particular district falls into these categories.

a. Where to Look

To assess whether residential uses are allowed in a particular district, you will need to locate in the zoning text:

- The “use table” (also sometimes called the “table of principal uses” or “table of allowed uses”), which is a chart listing the uses allowed in each district.
- If there is no use table, search for:
 - Chapters or sections of the code devoted to individual districts, which will likely list allowed uses.
 - Descriptions of each district, sometimes found at the beginning of the zoning code, which describe the overall nature of each district in a few sentences.

b. Principal and Accessory Housing Uses

To properly classify the districts, you must know that residential uses can be principal uses (i.e., the main use on a single zoning lot) or accessory uses (i.e. subordinate uses to a principal use on the lot). When you are evaluating whether a district is Primarily Residential or Nonresidential, you must only consider principal residential uses.

A jurisdiction permitting a single accessory dwelling unit per lot, and no other housing types, must be classified as Nonresidential. For example, a retail district that only allows a shopkeeper to have a single apartment for the shopkeeper over her store must be classified as Nonresidential; so must a factory that allows for a nightwatchman’s apartment and no other residential uses. (You will nonetheless log the regulations on that accessory dwelling unit in Parts IV.B. through IV.D.)

On the other hand, a retail district that allows for two apartments on the upper stories of a retail structure should be classified as Mixed with Residential, even if the apartments are limited in size to be smaller than the retail footprint. That is because two apartments will not be considered an accessory use. Thus where two or more housing units are allowed on the same lot as a non-housing use, such housing should be considered a principal use. In such a district, all categories related to 2-family housing should be filled out. We will discuss this further in Part IV.B.

NOTE: Assisted living facilities, congregate housing, group dwellings, other institutional residential settings, hotels, and motels must not be counted as residential uses in the Zoning Atlas. While many people live in these settings, the settings have different social, economic, and environmental implications than the non-institutional housing that tends to be the subject of inquiries about zoning and its effects. By contrast, elderly housing (where individuals or households occupy units as tenants or owners, without daily institutionalized care) and active adult communities must be counted as residential uses. This point is repeated below.

c. Primarily Residential

A Primarily Residential designation should be given to districts allowing: housing only; housing and assorted uses customarily allowed in residential areas, including religious institutions and schools; or housing and agricultural uses.

While you must always verify allowed uses with the zoning text, one of the easiest ways to preliminarily classify a Primarily Residential district is its name:

- Any district abbreviated R-1, R-2, R-3, R-4, R-5, R-6, R-15, R-20, R-40, or R-80 (where “R” stands for “Residential”) will almost certainly be a Primarily Residential district.
- Any district full name including the words “residence,” “residential,” “multifamily,” “housing,” “apartment,” or “mobile home” will likely be Primarily Residential – but not always. For example, a district called “Multifamily Residence-Retail” will not be Primarily Residential, even though it has the word “Residence” in the title.
- Any district full name including the words “agriculture” or “agricultural” will likely be Primarily Residential, and certainly if “residence” or “residential” also appears.
- Any district full name including the words “planned residential,” “planned residence,” “planned unit development,” or “active adult” will almost certainly be Primarily Residential.
- Any district full name including the words “elderly” or “elderly housing” may be Primarily Residential if the type of housing permitted allows occupancy by tenants or owners, without nursing or other daily supervision.
- Any overlay district full name including the words “residence,” “residential,” “multifamily,” “housing,” “apartment,” “active adult,” “elderly,” or “elderly housing” will almost certainly be a Primarily Residential district.

We debated how to treat the vast parts of rural America with zoning allowing both farms and homes (usually one or two per lot). Usually, zoning allows the subdivision of large lots into much smaller residential lots. If there are development pressures in the area, then residential sprawl can take over farmland. With that scenario in mind, we decided to classify agricultural-residential zoning as Primarily Residential, even if the amount of land occupied by housing is not as large as the amount of land occupied by agricultural uses. We felt that given national trends for agricultural lands to be converted to residential land, it would be misleading to classify this type of zoning as zoning where housing is an accessory use. For the most part, these districts’ hybrid purpose will be obvious from the name of the district.

d. Mixed with Residential

A Mixed with Residential designation should be given to districts allowing nonresidential uses and housing, whether the housing is stand-alone housing (e.g., apartment buildings) or housing integrated with nonresidential uses (e.g., buildings with retail on the ground floor and residential above). In assessing a district, remember to consider only principal uses, not accessory uses. If the district allows home occupations as an accessory use (e.g., where a resident can put an office or small shop on site), but does not allow stand-alone (principal use) nonresidential uses, then that district is Primarily Residential, not Mixed with Residential.

Again, while you must always verify allowed uses with the zoning text (and particularly the use table), you can get a sense of the likely classification based on the name of the district:

- Any district where the words “mixed use,” “mixed-use,” “village,” “main street,” “center,” or “central business” appear in the full name will likely be Mixed with Residential, but not always.
- Some districts with the words “commercial” or “industrial” in their titles also allow housing as a principal use, so do not dismiss these districts as Nonresidential.

A district allowing university, college, or institutional education uses which also allows dormitories built by the educational institution should not be classified as Mixed with Residential. The reason is that dorms are closed to the public and thus not truly a source of housing. If the same district allows apartments (including student apartments) owned by entities other than educational institutions (such as private developers), then it should be classified as Mixed with Residential.

NOTE: Overlay districts which are not limited as to where they may be located (e.g., not limited to only residential or only commercial uses or districts) should be marked as Mixed with Residential. An example of this is an overlay district called “Historic,” which the code says can be overlaid over places with buildings older than a certain number of years or buildings within a designated historic district. Unless the code limits the application of the Historic overlay district to only residential or only nonresidential areas, you must assume that it may be overlain over any district type in the jurisdiction. Thus you would input Mixed with Residential in the Type of Zoning District column. In Part IV.B., you will receive instructions on how to further treat the types of overlays that do not affect underlying housing characteristics.

e. Nonresidential

A Nonresidential designation should be given to districts: either prohibiting residential uses entirely; or allowing one accessory dwelling on the same lot as a nonresidential use and no other types of residential housing. Common examples of the latter included an apartment for a retailer to live above her shop or a caretaker apartment for a factory.

Again, while you must always verify allowed uses with the zoning text (and particularly the use table), you can get a sense of the likely classification based on the name of the district:

- Any district full name including the words “open space” or “conservation land” will almost certainly be Nonresidential, unless they include the words “development” or “subdivision,” which would likely render them Primarily Residential.
- Any district full name including the words “airport,” “office park,” “public utility,” “public service utility,” or “cemetery” will almost certainly be Nonresidential.

Once you have classified a district as Nonresidential, you can skip to Part IV.B.6. and focus only on whether the district allows accessory apartments.

NOTE: You could wait to fill out the Type of Zoning District column until after you have completed the analysis in Parts IV.B.1 to IV.B.5. Filling out this column first, though, will ensure familiarity with the zoning code of a particular jurisdiction, and may help you prioritize certain districts in the tasks ahead. If you fill out the Type of Zoning District column before the analysis in Part IV.B, do

not be surprised to find a few corrections will be needed in the Type of Zoning District column. That's OK!

2. Affordable Housing District

The Affordable Housing District column logs those Primarily Residential or Mixed with Residential districts that allow housing, but require that all housing satisfy certain affordability criteria – usually that all or some units be subject to rent caps, deed restrictions, or occupancy limitations. Note that many smaller jurisdictions lack affordable housing provisions, so do not worry if you do not find these provisions in every jurisdiction.

a. Where to Look

To start identifying districts that should be logged “Yes” in the Affordable Housing District column, search for these terms in the Full District Name column:

- Affordable
- Opportunity
- Workforce
- Incentive Housing
- Specialty Housing
- Acre: A district created to allow affordable housing on a specific site may include the size of the plot in the title of the district (e.g., the “3.7 Acre Affordable Housing District”).

Also search the districts for which you will log in Part IV.A.3. a “Yes” in the Elderly Housing District column, as elderly-only requirements sometimes also have affordable-only requirements.

Of course, there are some districts whose name will give you no indication as to what type of housing they allow. You will have to pick up these districts and modify the Affordable Housing District column as needed, in tandem with your efforts in Part IV.B.

For districts you have identified by name or any other means, once again locate the following components of the zoning text, if any, to confirm that affordable units are required:

- The “use table” or “table of [allowed] uses” (the chart listing of uses allowed in each district), which may have a column for affordable housing specifically
- Chapters or sections of the code devoted to individual districts, which will likely list allowed uses
- Descriptions of each district, sometimes found at the beginning of the zoning code, which describe the overall nature of each district in a few sentences

b. How to Log “Yes” and “No”

It is important to re-emphasize that the Affordable Housing District column signifies whether all housing developments in a particular district must meet certain affordability criteria. These

affordability criteria can include projects where a certain percentage of units must be affordable (e.g., 10% or 20%) and projects where all units (100%) must be affordable. Only such districts should be logged as a “Yes” in the Affordable Housing District column.

Certain districts are unlikely to be affordable-only districts. Likely “No” districts in the Affordable Housing District column are any districts called R-1, R-2, R-3, R-4, R-15, R-20, R-40, or R-80, and the “residential-agricultural” type districts – or really any district that covers a large area.

Some districts require affordability for only some types of housing. For example, some districts freely allow 1-family housing but limit multi-family housing to affordable housing. Such districts should be logged as a “No” in the Affordable Housing District column. In Part IV.B., you will have a chance to log affordable housing requirements for particular types of housing.

NOTE: Although mobile and manufactured homes are less expensive than other kinds of housing, they do not automatically count as affordable housing districts. Only log “Yes” in the Affordable Housing District column if the district has specific affordability criteria.

All districts for which the Type of Zoning District column is marked “Nonresidential” should also have a “No” in the Affordable Housing District column.

3. Elderly Housing District

The Elderly Housing District column logs those Primarily Residential or Mixed with Residential districts that allow housing, but restrict occupancy of that housing to people over a certain age. Note that many smaller jurisdictions lack elderly housing provisions, so do not worry if you do not find these provisions in every jurisdiction.

Whether the restriction starts at age 55, 65, or some other age, all such housing should be logged as “elderly” housing (with apologies to those in that age range who do not consider themselves “elderly”). This column proved important in the Connecticut Zoning Atlas because it illustrated how many communities restrict multi-family housing to elderly occupants. While elderly housing requirements benefit income-restricted and impoverished elderly people, they also exclude families with young children and younger adults.

1. Where to Look

To start identifying districts that should be logged “Yes” in the Elderly Housing District column, search for these terms in the Full District Name column:

- Elderly
- Age-Restricted
- Senior
- Active Adult: Note that searching for “adult” will likely lead to adult establishment zones with uses such as cabarets and adult bookstores.

- Older (e.g., “55 and Older District”)
- Golf
- Planned: A planned residential/unit development district has, I would guess, about a one in five chance of being elderly only.

Also search the districts for which you logged a “Yes” in the Affordable Housing District column, as affordable-only requirements sometimes also have elderly-only requirements. Of course, there are some districts whose name will give you no indication as to what type of housing they allow. You will have to pick up these districts and modify the Elderly Housing District column as needed, in tandem with your efforts in Part IV.B.

For districts you have identified by name or any other means, once again locate the following components of the zoning text, if any, to determine if housing is limited to occupancy by older adults:

- The “use table” (the chart listing of uses allowed in each district), which may have a column for elderly housing specifically
- Chapters or sections of the code devoted to individual districts, which will likely list allowed uses
- Descriptions of each district, sometimes found at the beginning of the zoning code, which describe the overall nature of each district in 2-4 sentences

2. How to Log “Yes” and “No”

It is important to re-emphasize that the Elderly Housing District column signifies whether all housing developments in a particular district must be occupied by older adults. Only such districts should be logged as a “Yes” in the Elderly Housing District column.

Certain districts are unlikely to be elderly-only districts. Likely “No” districts in the Elderly Housing District column are any districts called R-1, R-2, R-3, R-4, R-15, R-20, R-40, or R-80, any “residential-agricultural” type districts, and any district that covers a large area.

Some districts require elderly occupancy for only some types of housing. For example, some districts freely allow 1-family housing but limit multi-family housing to elderly occupants. Such districts should be logged as a “No” in the Elderly Housing District column. In Part IV.B., you will have a chance to log elderly housing requirements for particular types of housing.

NOTE: As noted above, assisted living facilities, congregate housing, group dwellings, other institutional residential settings, hotels, and motels must not be counted as residential uses in your atlas. Thus they should not be considered in whether a district requires elderly housing only. Generally, these facilities are multi-unit, multi-occupant institutionalized facilities with nursing or other daily supervision. In some cases, assisted living facilities will be defined to also include non-institutionalized living (where individuals or households occupy units as tenants or owners, without daily institutionalized care). If all non-institutionalized housing in assisted living facilities

is required to be elderly, then you will log the district as a “Yes” in the Elderly Housing District column.

All districts for which the Type of Zoning District column is marked “Nonresidential” should also have a “No” in the Elderly Housing District column.

B. CATALOGUING USES

By now, you have completed the first 10 columns in the Spreadsheet, which list the districts and then classify them. This Section now turns to the way zoning codes treat different housing uses and regulate occupancy of particular types of housing uses. It covers four principal uses as well as affordable housing, accessory dwelling units, and planned residential developments.

Four principal uses relate to the number of units permitted on the lot: 1-family, 2-family, 3-family, and four-or-more-family (symbolized as “4+”) housing. Logging the treatment of each of these principal uses separately is important because significant regulation variation exists among the categories. For example, through the Connecticut Zoning Atlas, we found that over a quarter of the land in the state allows 2-family housing as of right (i.e., without a public hearing, and after just a staff administrative review), while only about 2% of land allows 4+-family housing as of right. There were similarly dramatic differences between the regulation of 2-family and 3-family housing. Including 2-family, 3-family, and 4+-family housing in a general multi-family housing category would blur these distinctions and make further analysis less meaningful. For these reasons, try to avoid, where possible, the term “multifamily” or “multi-family,” such as in the Special Notes column, as this term blurs housing categories in a problematic way.

The fifth principal use is affordable housing, irrespective of the number of units permitted per lot. In other words, the affordable housing category is intended to encompass all 1-family, 2-family, 3-family, and 4+-family housing that happens to be designated affordable. It is intended to capture situations where affordable housing is regulated differently from housing that is not designated affordable. This can be revealing: for example, the Connecticut Zoning Atlas revealed that sometimes affordable housing requirements are more restrictive than requirements for housing that is not designated affordable.

This Section also covers housing as an accessory use, also called accessory dwelling units (or ADUs). An ADU is a housing unit located on the same lot as a principal use, required to be smaller than the principal use. Most often, the principal use is 1-family housing. But, as noted below, some jurisdictions permit housing as an accessory to industrial, commercial, or retail uses.

Finally, this Section covers planned residential developments, which allow for many residential units, often in different buildings, to be built on a single large lot.

In this Section, you will fill out the following Spreadsheet columns:

- **1-Family Treatment:** One of the following four options, each indicating the nature of the permission: Allowed/Conditional, Public Hearing, Prohibited, or Overlay.
- 2-family housing:
 - **2-Family Treatment:** One of the following four options, each indicating the nature of the permission: Allowed/Conditional, Public Hearing, Prohibited, or Overlay.
 - **2-Family Affordable Housing Only:** A binary Yes/No entry indicating whether all 2-family housing must be designated affordable.
 - **2-Family Elderly Housing Only:** A binary Yes/No entry indicating whether all 2-family housing must be occupied by elderly persons.
- 3-family housing:
 - **3-Family Treatment:** One of the following four options, each indicating the nature of the permission: Allowed/Conditional, Public Hearing, Prohibited, or Overlay.
 - **3-Family Affordable Housing Only:** A binary Yes/No entry indicating whether all 3-family housing must be designated affordable.
 - **3-Family Elderly Housing Only:** A binary Yes/No entry indicating whether all 3-family housing must be occupied by elderly persons.
- 4+-family housing:
 - **4+-Family Treatment:** One of the following four options, each indicating the nature of the permission: Allowed/Conditional, Public Hearing, Prohibited, or Overlay.
 - **4+-Family Affordable Housing Only:** A binary Yes/No entry indicating whether all four-or-more-family housing must be designated affordable.
 - **4+-Family Elderly Housing Only:** A binary Yes/No entry indicating whether all 4 four-or-more-family housing must be occupied by elderly persons.
- Affordable housing:
 - **Affordable Housing (AH) Treatment:** One of the following four options, each indicating the nature of the permission: Allowed/Conditional, Public Hearing, Prohibited, or Not Mentioned.
 - **AH Definition:** A quote containing the jurisdiction's definition of affordable housing.
 - **AH Elderly Housing Only:** A binary Yes/No entry indicating whether affordable housing must be occupied by elderly persons.
- Accessory housing:
 - **Accessory Dwelling Unit (ADU) Treatment:** One of the following four options, each indicating the nature of the permission: Allowed/Conditional, Public Hearing, Prohibited, or Overlay.
 - **ADU Employee or Family Occupancy Required:** A binary Yes/No entry indicating whether an ADU must be occupied by an employee or family member of the occupant of the principal unit.
 - **ADU Renter Occupancy Prohibited:** A binary Yes/No entry indicating whether an ADU may be occupied by a homerenter.

- **ADU Owner Occupancy Required:** A binary Yes/No entry indicating whether the principal unit or the ADU must be occupied by the owner of the lot.
- **ADU Elderly Only:** A binary Yes/No entry indicating whether ADUs must be occupied by elderly persons.
- Planned residential development:
 - **Planned Residential Development (PRD) Treatment:** One of the following four options, each indicating the nature of the permission: Allowed/Conditional, Special Permit, Prohibited, or Not Mentioned.
 - **Mobile or Manufactured Home Park:** A binary Yes/No entry indicating whether the PRD is primarily associated with mobile or manufactured homes.

Of these 20 columns, there are 6 that you must fill out for every district: 1-Family Treatment, 2-Family Treatment, 3-Family Treatment, 4+-Family Treatment, Affordable Housing (AH) Treatment, and Accessory Dwelling Unit (ADU) Treatment. These 6 bring the total mandatory columns for every district to 16. All of the mandatory columns are marked in green in row 2 of the Spreadsheet. Beyond these 16 columns, the remaining columns should only be filled in if there is a value to include; otherwise, they should be left blank.

You will also learn about this column, which can be programmed to appear when a public user of your atlas hovers over the district:

- **Special Notes:** An open-ended column which explains or qualifies an entry in another column, using the fewest words possible to communicate the point.

1. Principal Use: 1-Family

By far the most common type of residential housing is 1-family housing. Is there any jurisdiction in the country that declines to allow 1-family housing somewhere? Even in places that have “eliminated 1-family zoning” (e.g., Portland and Minneapolis), 1-family housing remains an allowed use.

This subsection focuses on the 1-Family Treatment column, but the explanations given in this subsection can be referenced when filling out the other five columns with the word “Treatment” in their titles.

a. Defining 1-Family Housing

1-family housing means a building, including a mobile home or a manufactured home, with only one dwelling unit, where only one such unit is permitted on a lot.

The following phrases typically denote 1-family housing (with or without hyphens):

- Single-family
- One- or 1-family
- Mobile

- Manufactured

A 1-family unit need not be fully detached (i.e., freestanding and not attached to another unit) to count as 1-family housing for purposes of the atlas. A townhouse or rowhouse type of building may be counted as 1-family housing where each townhouse or rowhouse is one unit each and the lot lines are the same as the “party wall” between townhouses and rowhouses. A mobile or manufactured home will usually be permitted as part of a larger park with a single owner, which will be covered below in Planned Residential Development (PRD) Treatment.

A single unit of housing located on an upper story only will generally not count as 1-family housing as a principal use, but rather accessory housing discussed in Part IV.B.6.

Now that you know what 1-family housing is, you can start to log its treatment.

b. Where to Look

To fill out the 1-Family Treatment column, you must locate one or more of the following parts of the zoning code:

- The “use table” or “table of [allowed] uses” (the chart listing of uses allowed in each district)
- A chapter or section of the code containing in its title the words: “Uses permitted,” “Permitted uses,” “Use regulations,” “Residential use,” “Residence zones,” “Residential zones,” or “Residential districts”
- The chapter or section of the code devoted to the district, which will likely list allowed uses

One of these parts will have the information necessary to complete the 1-Family Treatment column. Search them using the phrases suggested in the preceding subsection.

c. How to Log the Four Treatment Options

In the 1-Family Treatment column (and every column with the word “Treatment” in its title), you will input one of four options indicating the nature of the permission for such uses: Allowed/Conditional, Public Hearing, Prohibited, or Overlay. You must input only one of these four options. Please do not put new text in these boxes; hybrid cases are discussed below and covered in the Special Notes column.

An “Allowed/Conditional” entry means that 1-family housing is allowed without a public hearing. In other words, permission to build this type of housing is only subject to review by town planning staff. During this review, staff may or may not be required to apply explicit criteria laid out in the zoning code. These reviews are sometimes called “as of right” or “by right” processes, although neither of those phrases is typically used in a zoning code. Rather, the most common terms used in a zoning code to designate Allowed/Conditional housing is simply “permitted” or “allowed.”

A “Public Hearing” entry means that 1-family housing use is allowed, subject to a public hearing. Specifically, these public hearings are meetings, held in public, where other members of the public may provide comments, and where there is some discretion in decision-making. Public hearings for the purpose of the Atlas are not non-discretionary reviews, such as site plan reviews, which legally require approval after a review, by staff or a commission, yielding a conclusion that site plan provisions of the zoning code are satisfied. Logging public hearing requirements is important because when housing is subject to public hearings, the results tend to be different, and usually more contentious, than when housing undergoes simple Allowed/Conditional processes. Unfortunately, use tables and zoning code text rarely indicate clearly whether a public hearing is required. Instead, codes employ terms like “conditional use,” “special exception,” or “special permit.” To understand whether these require a hearing, you must find a definitional or administrative chapter or section of the zoning code. They will state the process required for each of these approvals. You can find these easily by searching for the name of the permit type (e.g., “conditional use”), or you can search for the terms “public hearing” or “hearing.” Make a note about what the permit type means in each jurisdiction for use in the other columns with the word “Treatment” in their titles.

NOTE: Knowing your state’s zoning rules might help you fill out this column more quickly. Some states may mandate public hearings for certain permit types; such is the case in Connecticut, which mandates public hearings for special permits, but which allows individual jurisdictions to determine whether conditional uses and special exceptions will require a public hearing. As another example, New York’s state enabling act allows, but does not require, local governments to hold public hearings on site plan reviews.

NOTE: As noted above, mobile and manufactured homes are detached dwellings for individual families that should be considered 1-family homes. When a district allows mobile or manufactured home parks but not conventional housing, then your entry for 1-family homes should be identical to your entry for Planned Residential Development (PRD) Treatment (which, as noted below, covers mobile and manufactured home parks). In other words, when the only 1-family homes that are allowed in the district must be a part of a mobile or manufactured home park with multiple homes on a single parcel, put “Allowed/Conditional” if a park is permitted as of right, and “Public Hearing” if a park is permitted pursuant to a public hearing. When a district allows both conventional 1-family housing and mobile or manufactured homes, then input into the 1-Family Treatment column the way that the conventional 1-family housing is treated, and make a note in the Special Note column that says, “[Mobile/Manufactured] housing also permitted as of right/after a public hearing].”

A “Prohibited” entry means that 1-family housing is prohibited. In codes with a use table, figuring out which districts prohibit 1-family housing is relatively easy: there will be an “X,” or the table will be left blank in that location. In codes without a use table, then you will have to manually search for the chapter or section of the code relevant to residential uses or the specific district, using the phrases identified above (or more simply “dwelling” or “housing”). It is hard to search for absence. The general rule of thumb of zoning interpretation is that if a use is not expressly

mentioned, it is not allowed. Instead, you will look for the omission of 1-family housing from a list of allowed uses.

NOTE: The treatment of housing on an upper story (above a nonresidential area) deserves special mention here. If stand-alone 1-family housing is not allowed in the district, then the 1-Family Treatment column should say “Prohibited.” If one unit of housing is only allowed over shops or some other nonresidential use, then the 1-Family Treatment column should say “Prohibited” and the ADU Treatment column should say “Allowed/Conditional” or “Public Hearing,” whichever is applicable. If more than one unit of housing (i.e., 2 or more units) is allowed, but is only allowed on the upper story over shops or some other nonresidential use, then mark “Prohibited” in the 1-Family Treatment column; and “Allowed/Conditional” or “Public Hearing,” whichever is applicable, in the 2-Family, 3-Family, and 4+ Family Treatment columns. If an ambiguous amount of housing (that is, if the code simply allows “housing” on upper stories) is allowed, but is only allowed on the upper story over shops or some other nonresidential use, then mark “Prohibited” in the 1-Family Treatment column; “Allowed/Conditional” or “Public Hearing,” whichever is applicable, in the 2-Family, 3-Family, and 4+ Family Treatment columns; and “Allowed/Conditional” or “Public Hearing,” whichever is applicable, in the ADU Treatment column.

An “Overlay” entry means that 1-family housing is treated the same way in the base district and the overlay district. This entry in the 1-Family Treatment column is only available for those districts marked as a “Yes” in the Overlay column. Take these steps to determine if an “Overlay” entry is appropriate for the 1-Family Treatment column:

- Double check there is a “Yes” in the Overlay column.
- Identify the base district(s) upon which the overlay district can be placed.
- Find the use table or the chapter or section of the code devoted to the overlay district to determine allowed uses.
- Determine whether there is a difference between permissions for 1-family housing in the overlay district and any base district(s) upon which it can be laid.

The last step will tell you how to mark the district. If the allowance for 1-family housing for the overlay district is always different from the allowance of housing under any base district, then do not mark “Overlay” in the 1-Family treatment column. Instead, mark “Allowed/Conditional,” “Public Hearing,” or “Prohibited” as appropriate given the overlay district’s requirements. For future reference, note that you will only fill out subsequent columns in the Spreadsheet where the overlay overrides the base district. If the cell is left blank, the base district’s characteristics prevail. This convention will reduce confusion in a public interface, especially as some types of overlay districts can be laid over many different kinds of base districts.

NOTE: What do you do if some 1-family housing is allowed by right, but other 1-family housing requires a public hearing? You should log just one entry signifying what you think is the most common permit type in the 1-Family Treatment column but make a one-sentence note in the Special Notes column about the alternate permit type. For example, let’s say you find a district that requires public hearings for 1-family homes if they are located in wetland areas. In that case, log “Approved/Conditional” in the 1-Family Treatment column and in the Special Notes column,

put: “Public hearing required for 1-family housing in wetlands.” Here’s an alternate scenario: The zoning code says that the zoning commission may, in its discretion, hold a public hearing for a certain kind of housing. In that case, log “Approved/Conditional” but make a one-sentence note in the Special Notes column: “Public hearing may be required for [housing].” Because the Special Notes column may include notes about several different columns, be clear about the applicability of your one-sentence note. Do not include the term “multifamily” or “multi-family” in the Special Notes column, as this term blurs housing categories in a problematic way. Instead use “1-family,” “2-family,” “3-family,” or “[#]+-family.”

2. Principal Use: 2-Family

In this section, you will complete three columns related to 2-family housing: 2-Family Treatment, 2-Family Affordable Housing Only, and 2-Family Elderly Housing Only.

a. Defining 2-Family Housing

2-family housing means two dwelling units, whether in one building or two separate buildings, permitted on a lot. True 2-family zoning allows for two dwellings of equal size (or is simply silent as to size). Zoning that allows for 1-family housing with a smaller unit should be treated as 1-family zoning with an accessory dwelling, which is considered below in the Accessory Dwelling Unit (ADU) Treatment section.

The following phrases typically denote 2-family housing (with or without hyphens):

- Two-family dwelling
- Two-family housing
- Two-family home
- Duplex
- No more than two units

If you do not see any of the above terms, search for the terms “multi-family,” “multi family,” “multifamily,” or “apartment.” To understand what those terms mean, go to the definition section of the zoning code or find some other location where the term is defined. In the absence of a definition identifying the minimum number of units included in such terms, assume it encompasses 2-family housing. Where a zoning code permits 1-family housing (or any other use or type of building) to be converted to 2-family housing, treat 2-family housing as permitted (and log it as Allowed/Conditional, Public Hearing, or Overlay, as appropriate).

You should now be able to identify the term(s) used by the zoning text to mean 2-family housing.

b. Where to Look

One of the parts of the zoning text identified in Part IV.B.1.b. will have the information necessary to complete the 2-Family Treatment column. Search the part(s) using the term(s) you know to connote 2-family housing.

c. How to Log the Four Treatment Options

Proceed with the analysis in Part IV.B.1.c. and input one of four options indicating the nature of the permission for such uses: Allowed/Conditional, Public Hearing, Prohibited, or Overlay.

NOTE: A district that includes only single-family housing may allow for the creation of a planned residential development (PRD) with 2-, 3-, and/or 4-family housing through a PRD-specific approval process. If 2-, 3-, and/or 4-family housing is only allowed through a PRD, mark the applicable 2-, 3-, and/or 4-Family Treatment column as “Prohibited.” There are two primary reasons for this suggestion: first, PRDs tend to be rare, so logging 2/3/4-family housing as permitted across the entire district would be misleading; second, PRDs tend to be open-ended in terms of area and dimensional regulation, so subsequent 2/3/4-Family columns on area and dimension may be devoid of information. That said, if an individual PRD has actually been created, and if you have a copy of the regulations governing development in that PRD, and if it overrides all of the regulations in the underlying district, you should create a new row in the Spreadsheet for a PRD district, marking the specific type of housing permitted in the PRD via the 1-, 2-, 3-, and/or 4-Family Treatment column, filling in any dimensional columns, marking a “No” in the Overlay column, and choosing the applicable permission (Allowed/Conditional or Public Hearing) in the PRD Treatment column. Please review carefully the notes in Part III.B. regarding overlay districts and Part IV.B.7. regarding PRDs.

d. How to Log Affordable and Elderly Treatment

The 2-Family Affordable Housing Only and 2-Family Elderly Housing Only columns should be marked either “Yes” or “No” if the 2-Family Treatment is Allowed/Conditional or Public Hearing. If 2-Family Treatment is Prohibited or Overlay, or if the Type of Zoning District column is marked “Nonresidential,” do not make an entry in the 2-Family Affordable Housing Only or 2-Family Elderly Housing Only columns. Leave them blank.

The 2-Family Affordable Housing Only column identifies (with a “Yes” entry) districts that require that all 2-family housing satisfy certain affordability criteria. If the Affordable Housing Only column is marked “Yes,” then the 2-Family Affordable Housing Only column should be marked “Yes” too. If the Affordable Housing Only column is marked “No,” then assess whether the district requires 2-family housing to satisfy affordability criteria, using techniques similar to those outlined in Part IV.A.2. In the Connecticut Zoning Atlas, we discovered at least 10 districts that only allowed 2-family housing if it were owned or operated by the town or a nonprofit developer.

The 2-Family Elderly Housing Only column identifies (with a “Yes” entry) districts that require that all 2-family housing be occupied by people over a certain age. If the Elderly Housing Only column is marked “Yes,” then the 2-Family Elderly Housing Only column should be marked “Yes” too. If

the Elderly Housing Only column is marked “No,” then assess whether the district restricts 2-family housing to elderly occupancy, using techniques similar to those outlined in Part IV.A.3.

3. Principal Use: 3-Family

In this section, you will complete three columns related to 3-family housing: 3-Family Treatment, 3-Family Affordable Housing Only, and 3-Family Elderly Housing Only.

a. Defining 3-Family Housing

3-family housing means three dwelling units, whether in one building or separate buildings, permitted on a lot.

The following phrases typically denote 3-family housing (with or without hyphens):

- Three-family dwelling
- Three-family housing
- Three -family home
- Triplex
- No more than three units

If you do not see any of the above terms, search for the terms “multi-family,” “multi family,” “multifamily,” or “apartment.” To understand what those terms mean, go to the definition section of the zoning code or find some other location where the term is defined. In the absence of a definition identifying the minimum number of units included in such terms, assume it encompasses 3-family housing. Where a zoning code permits 1-family housing (or any other use or type of building) to be converted to 3-family housing, treat 3-family housing as permitted (and log it as Allowed/Conditional, Public Hearing, or Overlay, as appropriate).

You should now be able to identify the term(s) used by the zoning text to mean 3-family housing.

b. Where to Look

One of the parts of the zoning text identified Part IV.B.1.b. will have the information necessary to complete the 3-Family Treatment column. Search the part(s) using the term(s) you know to connote 3-family housing.

c. How to Log the Four Treatment Options

Proceed with the analysis in Part IV.B.1.c. and input one of four options indicating the nature of the permission for such uses: Allowed/Conditional, Public Hearing, Prohibited, or Overlay. If you have questions about planned residential developments, also review the Note on planned residential developments in Part IV.B.2.c.

d. How to Log Affordable and Elderly Treatment

The 3-Family Affordable Housing Only and 3-Family Elderly Housing Only columns should be marked either “Yes” or “No” if the 3-Family Treatment is Allowed/Conditional or Public Hearing. If 3-Family Treatment is Prohibited or Overlay, or if the Type of Zoning District column is marked “Nonresidential,” do not make an entry in the 3-Family Affordable Housing Only or 3-Family Elderly Housing Only columns. Leave them blank.

The 3-Family Affordable Housing Only column identifies (with a “Yes” entry) districts that require that all 3-family housing satisfy certain affordability criteria. If the Affordable Housing Only column is marked “Yes,” then the 3-Family Affordable Housing Only column should be marked “Yes” too. If the Affordable Housing Only column is marked “No,” then assess whether the district requires 3-family housing to satisfy affordability criteria, using techniques similar to those outlined in Part IV.A.2.

The 3-Family Elderly Housing Only column identifies (with a “Yes” entry) districts that require that all 3-family housing be occupied by people over a certain age. If the Elderly Housing Only column is marked “Yes,” then the 3-Family Elderly Housing Only column should be marked “Yes” too. If the Elderly Housing Only column is marked “No,” then assess whether the district restricts 3-family housing to elderly occupancy, using techniques similar to those outlined in Part IV.A.3.

4. Principal Use: 4+-Family

In this section, you will complete three columns related to four-or-more-family housing: 4+-Family Treatment, 4+-Family Affordable Housing Only, and 4+-Family Elderly Housing Only.

a. Defining 4+-Family Housing

4+-family housing means four or more dwelling units, whether in one building or separate buildings, permitted on a lot.

The following phrases typically denote four-or-more-family housing:

- Multi-family/multi family/multifamily
- Apartment
- Quadplex

If you have not previously referenced the definition section of the zoning code, search “multi-family,” “multi family,” “multifamily,” or “apartment,” to confirm these terms allow four-or-more-family housing. Where a zoning code permits 1-family housing (or any other use or type of building) to be converted to 4+-family housing, treat 4+-family housing as permitted (and log it as Allowed/Conditional, Public Hearing, or Overlay, as appropriate).

In general, exclude from this category uses that: are incidental to employment or student tenure; are not typically leased or sold to the general public; are associated with the status of being unhoused; or lack a kitchen and bathroom in dwelling unit. Thus exclude from principal use consideration: seasonal farmworker housing, dormitories, homeless shelters, boardinghouses, and roominghouses.

You should now be able to identify the term(s) used by the zoning text to mean four-or-more-family housing.

b. Where to Look

One of the parts of the zoning text identified in Part IV.B.1.b. will have the information necessary to complete the 4+-Family Treatment column. Search the part(s) using the term(s) you know connote four-or-more family housing.

c. How to Log the Four Treatment Options

Proceed with the analysis in Part IV.B.1.c. and input one of four options indicating the nature of the permission for such uses: Allowed/Conditional, Public Hearing, Prohibited, or Overlay. If you have questions about planned residential developments, also review the Note on planned residential developments in Part IV.B.2.c.

d. How to Log Affordable and Elderly Treatment

The 4+-Family Affordable Housing Only and 4+-Family Elderly Housing Only columns should be marked either “Yes” or “No” if the 4+-Family Treatment is Allowed/Conditional or Public Hearing. If 4+-Family Treatment is Prohibited or Overlay, or if the Type of Zoning District column is marked “Nonresidential,” do not make an entry in the 4+-Family Affordable Housing Only or 4+-Family Elderly Housing Only columns. Leave them blank.

The 4+-Family Affordable Housing Only column identifies (with a “Yes” entry) districts that require that all four-or-more-family housing satisfy certain affordability criteria. If the Affordable Housing Only column is marked “Yes,” then the 4+-Family Affordable Housing Only column should be marked “Yes” too. If the Affordable Housing Only column is marked “No,” then assess whether the district requires four-or-more-family housing to satisfy affordability criteria, using techniques similar to those outlined in Part IV.A.2.

The 4+-Family Elderly Housing Only column identifies (with a “Yes” entry) districts that require that all four-or-more-family housing be occupied by people over a certain age. If the Elderly Housing Only column is marked “Yes,” then the 4+-Family Elderly Housing Only column should be marked “Yes” too. If the Elderly Housing Only column is marked “No,” then assess whether the district restricts four-or-more-family housing to elderly occupancy, using techniques similar to those outlined in Part IV.A.3.

5. Principal Use: Affordable Housing

The fifth principal use category is affordable housing. It encompasses 1-family, 2-family, 3-family, and four-or-more-family housing.

Affordable housing can only be indicated as permitted if the 1-Family Treatment, 2-Family Treatment, 3-Family Treatment, or 4+-Family Treatment columns indicate Allowed/Conditional or Public Hearing. The columns in the Spreadsheet dealing with affordable housing (labeled “AH”) are intended to identify zoning districts where affordable housing is treated differently than housing not designated affordable, or, in districts where only affordable housing is allowed, to articulate definitions and requirements for such housing.

In this section, you will complete three columns related to affordable housing: Affordable Housing (AH) Treatment, AH Elderly Housing Only, and AH Definition.

a. Starting Point: Look at Other Columns

Start by filling out the Affordable Housing (AH) Treatment column using the logic in this subsection, all of which depends on the way you have previously filled out certain other columns.

If a district is marked as Nonresidential or as an Overlay in the Type of Zoning District column, and if all entries for 1-Family Treatment, 2-Family Treatment, 3-Family Treatment, and 4+-Family Treatment are marked “Prohibited,” then mark the Affordable Housing (AH) Treatment column “Prohibited.”

If any remaining district has been marked “Yes” in the Affordable Housing District, 2-Family Affordable Housing Only, 3-Family Affordable Housing Only, or 4+-Family Affordable Housing only columns, then simply repeat the entry logged for 1-Family Treatment, 2-Family Treatment, 3-Family Treatment, or 4+-Family Treatment, as applicable, in the Affordable Housing (AH) Treatment column. In addition, simply repeat the entry in the AH Elderly Housing Only column. Then skip to the next subsection and fill out the AH Definition.

For all remaining districts marked as Primarily Residential, Mixed with Residential, or Overlay (allowing housing) in the Type of Zoning District column, but which have not been identified as affordable per the preceding paragraph, continue to the next subsection, where you will be given instructions on how to fill out the AH Definition column. You will wait to fill out the Affordable Housing (AH) Treatment column for these districts until after you find (or do not find) a definition of affordability that has regulatory consequence.

b. Defining Affordable Housing

So now onto how the zoning code defines affordable housing. This definition is important because it shows what the jurisdiction means by affordable housing and often contains substantive limitations on its nature and occupancy. You should copy the full, word-for-word definition of

affordable housing, usually 10-30 words long, and paste the description into the Affordable Housing Definition column.

Some components of this definition may include:

- A required percentage of area median income or average household income for residents, or a cap on the amount residents may pay for such housing
- Requirements as to the recordation of a covenant or deed that would render such housing affordable for an established period of time or in perpetuity
- Restrictions as to what types of entities can own or develop the units, most often limited to housing authorities, nonprofits, or the jurisdictional government itself
- Identification of specific federal or state agencies who must subsidize, finance, or sponsor the units
- Reference to a state affordable housing statute
- A percentage of housing units that must be set aside to satisfy affordability requirements
- Restrictions as to who may occupy affordable housing units, including some who limit such housing to employees of the jurisdiction or its school system, people who work in the jurisdiction, existing residents or relatives thereof, or specific types of workers (e.g., firefighters or ambulance personnel, as we have seen in several Connecticut towns)

To find such definitions, search for the following terms:

- Affordable housing
- Affordability
- Income-restricted
- Assisted housing
- Set-aside development
- Workforce
- Average income, annual income, median income, household income
- Pay: Captures definitions where residents' payments are capped at a percentage of income
- Convey, record, covenant deed-restrict, deed restrict: Capture definitions where affordability is tied to a covenant placed on the property; capture both "restricted" and "restrictions"
- Subsidized, financed, sponsored
- HUD, Housing and Urban Development
- Housing authority: Captures definitions limiting qualifying owners/developers to housing authorities
- Non-profit, nonprofit: May produce false positives in that nonprofit organizations may be mentioned in the use table or in other parts of the zoning code, but could capture definitions limiting qualifying owners/developers to nonprofits
- Statutes
- Specific numerical statutory reference to housing law dealing with affordable housing: e.g., in Connecticut, searching for "8-30g," the section number for the affordable housing provisions in state law, would locate definitions tied to those provisions

If none of these words or phrases appear in the zoning code, you can mark “Not Mentioned” in the Affordable Housing (AH) Treatment column. The “Not Mentioned” entry is meant to indicate a neutral stance on affordable housing – neither prohibiting the use, as would be the case in a Nonresidential district, nor expressly treating affordable housing differently than other types of housing. You will notice that the “Not Mentioned” option replaces the “Overlay” option of the other principal use housing Treatment columns, because you only fill out the Affordable Housing (AH) Treatment column if it is treated differently than other types of housing within the same district.

c. How to Log the Remaining Two Treatment Options

If the above words or phrases appear in the zoning code, proceed with the analysis in Part IV.B.1. and input one of two options indicating the nature of the permission for such uses: Allowed/Conditional or Public Hearing.

If either of these two options is marked, then at least one of the following four columns must also be marked as allowing housing: 1-Family Treatment, 2-Family Treatment, 3-Family Treatment, and 4+-Family Treatment. Thus a positive indication for affordable housing in the Affordable Housing (AH) Treatment column will always duplicate another housing entry.

d. How to Log Elderly Housing

The AH Elderly Housing Only column identifies (with a “Yes” entry) districts that require that all affordable housing be occupied by people over a certain age.

If the Elderly Housing Only column is marked “Yes” and the Affordable Housing (AH) Treatment column is marked “Allowed/Conditional” or “Public Hearing,” then the AH Elderly Housing Only column should be marked “Yes” too.

If the Elderly Housing Only column is marked “No,” then assess whether the district restricts affordable housing to elderly occupancy, using techniques similar to those outlined in Part IV.A.3.

6. Accessory Dwelling Units

In this section, you will complete five columns related to ADUs and their occupancy: Accessory Dwelling Unit (ADU) Treatment, ADU Employee or Family Occupancy Required, ADU Renter Occupancy Prohibited, ADU Owner Occupancy Required, and ADU Elderly Only.

a. Defining ADUs

An accessory dwelling unit (ADU) is a single unit of housing located on the same lot as a principal use, usually a 1-family home, and typically smaller than or in some other way subordinate to that principal use.

The following phrases typically denote ADUs:

- Accessory dwelling
- Accessory apartment
- In-law apartment
- Caretaker(s) apartment
- Garage apartment
- Carriage house
- Granny flat

Search the zoning text for these phrases to identify the term(s) used by the zoning text to mean an ADU.

b. Where to Look

To find out how ADUs are treated, first search for term(s) you found above in the table of contents. I suggest starting with the table of contents because there is often a single section in a zoning code that deals with ADUs.

If the term(s) does not appear in the table of contents, search the use table for that term(s). If you find it in the use table, you can easily complete the Accessory Dwelling Unit (ADU) Treatment column for all districts in the jurisdiction.

If there is no use table, search for the term(s) throughout the zoning code.

NOTE: Recall that ADU treatment is independent of your entry in the Type of Zoning District column. While a Nonresidential district prohibits principal-use housing, it may nonetheless allow an ADU to coexist with a commercial or industrial use. Thus you should search for accessory housing across all zoning districts, and not limit your search to Primarily Residential or Mixed with Residential Districts.

c. How to Log the Four Treatment Options

Proceed with the analysis in Part IV.B.1.c. and input one of four options indicating the nature of the permission for such uses: Allowed/Conditional, Public Hearing, Prohibited, or Overlay.

NOTE: The Connecticut Zoning Atlas suggests that most jurisdictions expressly enable ADUs in some form. Jurisdictions that do not expressly enable ADUs may allow them as a traditional and customary use pursuant to staff review. Accordingly, the number of districts that you log in your atlas may be an undercount of the districts where ADUs might be allowed.

What do you do if some ADUs are allowed by right, but other ADUs require a public hearing? You should log just one entry signifying what you think is the most common permit type in the Accessory Dwelling Unit (ADU) Treatment column but make a one-sentence note in the Special Notes column about the alternate permit type. For example, let's say you find a district that requires public hearings for ADUs only if they are over 1,000 square feet. In that case, log "Approved/Conditional" in the 1-Family Treatment column and in the Special Notes column, put: "Public hearing required for ADUs over 1,000 SF." Because the Special Notes column may include notes about several different columns, be clear about the applicability of your one-sentence note.

NOTE: The ADU category is intended to cover situations where one ADU is permitted per lot. More than one ADU may be permitted on a lot, particularly in commercial areas. Treat these uses as 2-family, 3-family, or 4+-family housing as a principal use, and do not account for multiple-ADU situations in the Accessory Dwelling Unit (ADU) Treatment column.

d. How to Log ADU Occupancy Rules

Once you have completed the Accessory Dwelling Unit (ADU) Treatment column, you can turn to the four columns regarding occupancy of ADUs. It is important to note these occupancy restrictions because excessive occupancy restrictions can limit the incentive, feasibility, or endurance of ADUs.

These occupancy requirements will not be found in a use table or any other chart, but rather in the section of the zoning text in which ADUs are generally described. To fill out the relevant columns, you will simply need to do some common-sense reading of the definitions and general requirements around ADUs.

The ADU Employee or Family Occupancy Required column tracks whether the jurisdiction requires an employment or familial relationship between the occupant of the ADU and the occupant of a principal dwelling. See if you can find phrases like "must be an employee" or "must be a relative." If the jurisdiction only requires one relationship but not both, still mark the column with a "Yes." If you feel the need to be more precise, feel free to separate this single column into two columns (one for an employment relationship and one for a familial relationship).

The ADU Renter Occupancy Prohibited column tracks whether the jurisdiction expressly prohibits renters from occupy ADUs. The ADU Owner Occupancy Required column confirms whether the jurisdiction allows renters to occupy both units, or whether one unit must be owner-occupied. While these two columns have similar effects, they are not the same. If a district allows ADU renter occupancy (that is, has a "No" in the ADU Renter Occupancy Prohibited column) but also requires owner occupancy (that is, has a "Yes" in the ADU Owner Occupancy Required column), then the ADU may be occupied by a renter but only if the principal home is occupied by the lot's owner. If a district prohibits renter occupancy but requires owner occupancy, then the owner may let any person occupy the ADU as long as they do not pay rent. In practice, this means that a family member or employee is most likely to occupy the ADU. That said, do not mark "Yes" in the ADU Renter Occupancy Prohibited column every time the ADU Employee or Family Occupancy

Required is a “Yes.” While these two columns have similar effects, they are not the same. Unless the zoning code expressly prohibits renters or rental arrangements, mark the ADU Renter Occupancy Prohibited column as a “No.”

The ADU Elderly Housing Only column confirms whether the jurisdiction requires that the ADU be occupied by people over a certain age. You should search for keywords and use techniques similar to those used in Part IV.A.3. to complete the ADU Elderly Housing Only column.

NOTE: The four ADU occupancy columns may seem puzzling in their framing. One column calls for you to log a prohibition on occupancy by renters, while the other three columns call for you to log affirmative occupancy requirements (owner, employee/family, and elderly). Even though they are phrased in what seem like opposite ways, a “Yes” answer to all of these columns indicates greater restrictiveness. Later, this framing will enable consistency in any public interface.

e. Other Notes

While perusing the portions of the zoning code dealing with ADUs, you might find that the jurisdiction requires permits to be renewed on an annual or periodic basis. If this information is of interest to you, please note the following in the Special Notes column: “ADU permit requires renewal every [X] years.”

One final tip: Often, all ADU-related provisions are located in the same section of the zoning code. Accordingly, you may wish to skip ahead to browse and complete the ADU-specific columns on lots and structures described in Parts IV.C. and IV.D.

7. Planned Residential Development

In this section, you will complete the Planned Residential Development (PRD) Treatment and Mobile and Manufactured Home column.

a. Defining PRDs

Planned residential developments (PRDs) allow for many residential units, often in different buildings, to be permitted at one time and built on a single large lot, or built on many smaller lots (e.g., a subdivision on a large tract of land). The aim of the PRD Treatment column is to capture situations where many units are permitted, or anticipated to be permitted, at once; an alternative to infill development in existing neighborhoods. For the purposes of the zoning atlas, PRDs also include mobile and manufactured home parks, which are owned by a single owner and contain detached single-family dwelling units.

The following phrases typically denote PRDs:

- Planned residential
- Planned unit

- Planned development
- Active adult
- Planned community
- Master planned
- Cluster
- Manufactured
- Mobile

Search the zoning text for these phrases to identify the term(s) used by the zoning text to mean a PRD.

b. Where to Look

To find out how PRDs are treated, first search for term(s) you found above in the table of contents. I suggest starting with the table of contents because very often, there is a single section in a zoning code that deals with PRDs.

If the term(s) does not appear in the table of contents, search the use table for that term(s). If you find it in the use table, you can easily complete the Planned Residential Development (PRD) Treatment column for all districts in the jurisdiction.

If there is no use table, search for the term(s) throughout the zoning code.

c. How to Log the Four Treatment Options

For PRDs, we should follow a similar logic to the logic we followed in logging the treatment of affordable housing.

If a district is marked as Nonresidential or as an Overlay in the Type of Zoning District column, and if all entries for 1-Family Treatment, 2-Family Treatment, 3-Family Treatment, and 4+-Family Treatment are marked “Prohibited,” then the Planned Residential Development (PRD) Treatment column must also be marked “Prohibited.”

If none of these words or phrases appear in the zoning code, you can mark “Not Mentioned” in the Planned Residential Development (PRD) Treatment column. The “Not Mentioned” entry is meant to indicate a neutral stance on PRDs – neither prohibiting the use, as would be the case in a Nonresidential district, nor expressly treating it differently than other types of housing. You will notice that the “Not Mentioned” option replaces the “Overlay” option of the other principal use housing Treatment columns, because you only fill out the Planned Residential Development (PRD) Treatment column if it is treated differently than other types of housing within the same district.

In the vast majority of districts, the zoning code will be silent on PRDs, so do not be surprised if this column is most often left blank (as I have marked it as an optional column) or indicated as “Not Mentioned.”

If, however, you find a section dealing with permission for these uses, you will proceed with the analysis in Part IV.B.1.c. and input one of two options indicating the nature of the permission for such uses: Allowed/Conditional or Public Hearing. Where PRDs are permitted, they are most often permitted pursuant to a public hearing, even if 1-family housing (individually developed and permitted) is permitted as of right. If the overall PRD requires a public hearing but after the PRD or PRD plan is approved individual housing is subject to staff review only, classify the nature of the treatment as “Public Hearing.”

As is the case with affordable housing, the PRD encompasses 1-family, 2-family, 3-family, and four-or-more-family housing. Thus in districts where PRDs are allowed, at least one of the four Treatment columns – 1-Family Treatment, 2-Family Treatment, 3-Family Treatment, and 4+-Family Treatment – must indicate Allowed/Conditional or Public Hearing. The columns in the Spreadsheet dealing with PRDs are intended to identify zoning districts where PRDs are expressly permitted in the zoning code.

One final tip: Often, all PRD-related provisions are located in the same section of the zoning code. Accordingly, you may wish to skip ahead to browse and complete the PRD-specific columns on lots and structures described in Parts IV.C. and IV.D.

C. CATALOGUING LOTS

At this point, you have completed 30 columns in the Spreadsheet, from the district names to their classification and uses, and you have been introduced to a 31st column, Special Notes, which you will continue to fill out.

This Section now turns to how zoning codes treat the way lots are developed. It logs the development of lots in all seven of the housing types discussed in Part IV.B.

Specifically, this Section covers minimum lot size requirements, maximum density, minimum parking requirements, lot coverage, and requirements that housing be connected to particular infrastructure or structures.

In this Section, you will mostly be logging numerical answers. Some of the numerical answers will differ depending on the number of bedrooms. Log these differences uniformly across the spreadsheet by using the following abbreviations: studios “0BR”; 1-bedroom units “1BR”; 2-bedroom units “2BR”; and so on. Where the code says “three or more bedrooms” or “four or more bedrooms,” use a plus sign “+” (for example, “3+BR” or “4+BR”). Use a slash “/” instead of the words “for” or “per” prior to the abbreviation used for bedrooms. Use a semicolon “;” to differentiate between entries related to different types of bedrooms (for example, “10/2BR; 20/3+BR”). Some of the numerical answers will differ depending on the nature of the housing,

most commonly elderly housing. Again, use the slash “/” instead of the words “for” or “per” prior to the descriptive word(s) (for example, “0.5/elderly; 1/non-elderly”).

NOTE: These requirements do not always exist. Where the zoning code is silent, leave the entry blank. You should also take care to not make entries in columns corresponding to housing that is not permitted in the zoning district.

In this Section, you will fill out the following Spreadsheet columns:

- Minimum lot size: The minimum acres of land required for residential development.
 - **1-Family Min. Lot**
 - **2-Family Min. Lot**
 - **3-Family Min. Lot**
 - **4+-Family Min. Lot**
 - **AH Min. Lot**
 - **ADU Min. Lot**
 - **PRD Min. Lot**
- Maximum density: The maximum number of units per acre.
 - **2-Family Max. Density**
 - **3-Family Max. Density**
 - **4+-Family Max. Density**
 - **AH Max. Density**
 - **PRD Max. Density**
- Minimum setbacks: The number of feet away from the front, side, and rear property lines in which construction may not generally occur.
 - **1-Family Front Setback**
 - **1-Family Side Setback**
 - **1-Family Rear Setback**
 - **2-Family Front Setback**
 - **2-Family Side Setback**
 - **2-Family Rear Setback**
 - **3-Family Front Setback**
 - **3-Family Side Setback**
 - **3-Family Rear Setback**
 - **4+-Family Front Setback**
 - **4+-Family Side Setback**
 - **4+-Family Rear Setback**
- Lot coverage: The percentage of land allowed to be covered by particular materials (buildings or buildings and impervious surface).
 - **1-Family Max. Lot Coverage – Buildings**
 - **1-Family Max. Lot Coverage – Buildings and Impervious Surface**
 - **2-Family Max. Lot Coverage – Buildings**
 - **2-Family Max. Lot Coverage – Buildings and Impervious Surface**
 - **3-Family Max. Lot Coverage – Buildings**
 - **3-Family Max. Lot Coverage – Buildings and Impervious Surface**
 - **4+-Family Max. Lot Coverage – Buildings**

- **4+-Family Max. Lot Coverage – Buildings and Impervious Surface**
- Parking minimum: The minimum number of parking spaces required per specific type of unit.
 - **1-Family Min. # Parking Spaces**
 - **2-Family Min. # Parking Spaces Per Studio or 1BR**
 - **2-Family Min. # Parking Spaces Per 2+ BR**
 - **3-Family Min. # Parking Spaces Per Studio or 1BR**
 - **3-Family Min. # Parking Spaces Per 2+ BR**
 - **4+-Family Min. # Parking Spaces Per Studio or 1BR**
 - **4+-Family Min. # Parking Spaces Per 2+ BR**
 - **AH Min. # Parking Spaces Per Studio or 1BR**
 - **AH Min. # Parking Spaces Per 2+ BR**
 - **ADU Min. # Parking Spaces**
- Connectivity requirements: A binary Yes/No entry indicating whether housing is required to be connected to particular infrastructure or structures.
 - **3-Family Connection to Sewer and/or Water Required**
 - **3-Family Connection or Proximity to Public Transit Required**
 - **4+-Family Connection to Sewer and/or Water Required**
 - **4+-Family Connection or Proximity to Public Transit Required**
 - **AH Connection to Sewer and/or Water Required**
 - **AH Connection or Proximity to Public Transit Required**
 - **ADU Restricted to Only Primary Structure**

Overlay districts require special instruction. If any district has a “Yes” in the Overlay column, then only complete subsequent columns for the district in the Spreadsheet if the overlay overrides the base district and is different than the base district. If the cell is left blank, the base district’s characteristics prevail. If the cell differs from the base district’s equivalent cell, then the overlay district will automatically override the base district.

NOTE: A district may have context-specific regulations instead of providing a specific number for parameters like lot size, setbacks, and lot coverage. For example, the zoning code might say that a front-yard setback must be the same as the average front-yard depth of the existing buildings within 200 feet on each side of the lot, or of the existing buildings on the same block. As another example, the zoning code might say that a setback will be some number of feet for lots of a certain length and another number of feet for lots of a different length. In cases where no number is provided and these context-specific regulations exist, please input the word “Contextual” in the relevant box. In addition, if not too onerous/lengthy, include the nature of the contextual regulation in the Special Notes column. This designation will signal the existence of a standard to those reviewing your inputted data, but will not clutter the database with extra words. If the district has a specific number *and* an exception that offers context-specific regulations, then please code it with the number and the words “& sometimes contextual.” For example, a provision that says “front setbacks are 10’ except along Morningside Avenue, where they must align with existing buildings,” should be coded in the relevant Front Setback column: “10, & sometimes contextual.”

1. Minimum Lot Size

Local jurisdictions can require that a certain parcel of land be a minimum size before being developed.

In this section, you will complete up to seven columns in the Spreadsheet, each relating to minimum lot size. These correspond to all seven of the housing types discussed in Part IV.B.

You will most often find the minimum lot size requirements in the zoning code chart that details certain district characteristics, sometimes contained in an appendix to the zoning code. These charts might be called:

- Lot Requirements
- Lot and Building Requirements
- Area Requirements
- Area and Bulk Requirements
- Dimensional Requirements

If you find such a chart, keep it handy for Parts IV.C. and IV.D.

You will also find minimum lot size requirements in district-specific sections of the zoning code. When it comes to ADUs and PRDs, you are more likely to find minimum lot size requirements in the sections of the zoning code dealing specifically with ADUs and PRDs. (Hence the notes in Parts IV.B.6. and IV.B.7. suggesting that you fill out ADU- and PRD-specific columns once you find the appropriate section of the zoning code.)

Where zoning codes require a minimum lot size, they will indicate the requirement as a number in square feet or in acres. Since people often think of residential lots in acres, convert square footages to acres, and extend your number to the hundredth place. Here's why: Many zoning codes using square feet use round numbers, like 40,000 square feet, instead of the 43,560 square feet contained in an acre. For this reason, after you convert, you will often see 1.84 acres instead of 2 acres, 0.92 acres instead of 1 acre, 0.46 acres instead of half an acre, or 0.23 acres instead of a quarter acre. Extending to the hundredth place can ensure you track these differences. The categories for the minimum lot size toggle in the Connecticut Zoning Atlas reflect those strangely-specific figures.

When you have your acreage number, input it into the Spreadsheet as a number only, without units (e.g., if the zoning district requires a 1-acre minimum lot size, insert "1" instead of "1 acre"). The higher the number, the more restrictive the lot size requirement.

When logging the 4+-Family Min. Lot column, AH Min. Lot column, or PRD Min. Lot column, you may find that there is a base minimum lot size for a certain number of units, and an additional minimum lot size required for every additional unit. For example, if the zoning code says "a half

acre minimum for 6 units, and an additional 1,000 SF lot for each unit over 6,” log it as: “0.5 /6 units + 0.023/additional unit.”

Not every district allowing housing will require a minimum lot size. That said, 1-family housing almost always has a minimum lot size: In Connecticut, we found that over 98% of 1-family land in Primarily Residential districts was subject to a minimum lot size. Four-or-more-family housing, by contrast, only had minimum lot sizes about half the time.

What do you do if a district requires one minimum lot size for apartment buildings generally, and a smaller lot size for, for example, elderly housing? You should log just one entry signifying what you think is the most common permit type in the 4+Family Min. Lot column but make a one-sentence note in the Special Notes column about the alternate lot size. For example, let’s say you find a district that requires a 4-acre minimum for large apartment buildings, but a 1-acre minimum for elderly housing. In that case, log “4” in the 4+-Family Min. Lot column and in the Special Notes column, put: “1-acre minimum lot for elderly 4+-family housing.” Because the Special Notes column may include notes about several different columns, be clear about the applicability of your one-sentence note.

NOTE: If a district requires one minimum lot size for apartment buildings generally, and a different (usually larger) lot size for affordable housing, you need not use Special Notes, because you have the AH Min. Lot column to indicate the different treatment. The same is true for planned residential developments, for which you have the PRD Min. Lot column to indicate different treatment.

2. Maximum Density

Minimum lot size is not the only way to regulate density. Alternatively, or sometimes simultaneously, zoning codes can also cap the number of units per acre.

In this section, you will complete up to five columns capping density on principal-use housing developments with two units or more.

You might find maximum density requirements in the chart you found in Part IV.C.1., if any. If you are not so lucky, search the zoning text for the following phrases:

- Units Per Acre or Units/Acre
- Dwellings Per Acre or Dwellings/Acre
- Density Per Acre or Density/Acre

When you find the ratio, input it into the Spreadsheet as a number only, without units (e.g., if the zoning district caps 4+-family housing at 6 units per acre, insert “6” instead of “6 units/acre”). The lower the number, the more restrictive the density requirement.

NOTE: A small number of jurisdictions will provide a *minimum* density requirement. In such a case, make a note in the Special Note column that says, “Minimum density of [X] [units/dwellings]/acre.”

NOTE: Separate from maximum density requirements, some jurisdictions will cap housing at bedrooms per acre, which usually has the effect of increasing the number of studio and one-bedroom units created. You may wish to log bedroom-per-acre caps that you see in the Special Notes column. For example, you might say: “Maximum density for [housing type] capped at [X] bedrooms/acre.” Maximum bedroom requirements will be further discussed in Part IV.D.4. As noted above, do not include the term “multifamily” or “multi-family” in the Special Notes column, as this term blurs housing categories in a problematic way. Instead use “1-family,” “2-family,” “3-family,” or “[#]+family.”

3. Minimum Setbacks

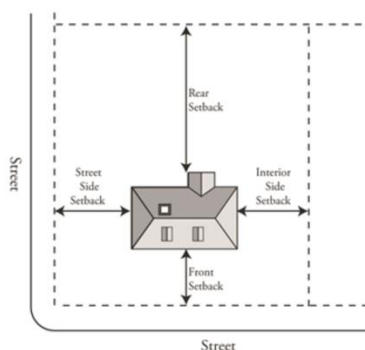
Minimum setbacks play a role in determining how much of a lot can be built upon. No buildings can be built within a setback. Typically a zoning code will provide different setbacks for the front yard (i.e., the street side of the lot), the side yard, and the rear yard (i.e., the back of the lot). For the purposes of this project, assume that setbacks are calculated from a public street or public right of way. In Ohio, we found zoning codes that provide setbacks from a public street (or public right of way) and different setbacks from a public sidewalk, project boundary, or utility line, but you need not log the latter. In the case of a setback given only in terms of number of feet from a public right of way, and without indication as to which setback (front, side rear) it applies to, log this number as the front setback (most likely to be located on a public right of way), but add in the Special Notes column, “Side and rear setbacks [X]’ away from any adjacent public right of way.” This will enable you to log the front setback but keep the side and rear setbacks blank since most of these will not be located on a public right of way.

Minimum setbacks should be logged in the Spreadsheet by the number of feet, inputting simply the number, and not the words “foot” or “feet.” The higher the setbacks, the smaller the amount of land that can be built upon. Places with no setbacks are permissive.

Some jurisdictions may use the term “building line” to define a setback, establishing a “building line” a certain number of feet away from the public street or public right of way. As long as these figures represent the minimum distance (number of feet) between the building and the public road/public right of way, you can input that number of feet in the setback columns.

If a zoning code establishes corner lot setbacks that differ from non-corner lot setbacks, log the non-corner lot setbacks in the various Setbacks columns but include the corner lot treatment in the Special Notes column. You could add, “Corner lot setbacks are [X#] feet in the front yard, [X#] feet for the street-side yard, [X#] feet for the interior side yard, and [X#] feet for the rear yard” or “Corner lot setbacks are [X#] feet for the front yards, [X#] feet for the interior side yard, and [X#]

feet for the rear yard.” Here’s a handy graphic from the Upland, California, zoning code depicting a corner lot with four different setbacks (i.e., the former example of the two in the prior sentence):



A jurisdiction may require a higher minimum number of square feet for both side yard setbacks than the sum of the individual side yard setbacks. For example, the code might require a minimum of 10-foot setbacks for each side yard, but require a total of 25 feet of side setback (i.e., the sum of both actual setbacks). In such cases, insert, “10/one, 25/both.”

Beyond corner lot specifications, some jurisdictions go wild with setback types. They might have formulas for setbacks for curvilinear lots, triangular lots, or multiple rear lots; or they may discuss “contextual setbacks” or “building spacing setbacks” which depend on neighboring buildings. Ignore these more complicated setback scenarios for the purposes of your columns, but feel free to make a note in the Special Notes column to the effect of “Various lot-specific setback scenarios also provided for.”

A very small number of jurisdictions tie setbacks to lot depth. For example, they might say that a house has to be set back from the front lot line at least 10% of lot depth and from the back lot line at least 20% of lot depth. Please log these setbacks as “[X]% lot depth,” until we find a better solution.

A very small number of jurisdictions will have context-specific regulations instead of providing a specific number for setbacks. For instructions on this, see the Note at the beginning of Part IV.C.

NOTE: Some jurisdictions, including those that have adopted form-based codes, have incorporated “build to” lines, namely the distance from the front lot line or the city-designated “building line” to which a building must be built. For example, a jurisdiction might say, “Buildings must be built to within 5 and 10 feet of the front lot line.” Build-to requirements should not be logged in the setbacks column. Can you see why these are different than setbacks? Build-to lines are concerned with the experience of the street as a whole, and they require buildings to be developed within a kind of aesthetic rhythm. Setbacks simply provide outer boundaries for building, and a building may be placed at any random location on the lot (other than within the setbacks). If the jurisdiction has build-to lines and not setbacks, indicate in the Special Notes column, “In lieu of setbacks, jurisdiction requires a build-to line [of X# feet].” Include the number

of feet only if it's easy to discern and is a uniform number for the district; if not, don't worry about it.

4. Maximum Lot Coverage

Lot coverage requirements cap the amount of land upon which buildings, or buildings and other impervious surfaces, can be constructed.

Lot coverage requirements are always expressed as a percentage of the lot as a whole. These requirements are common: In Connecticut, between two-thirds and three-quarters of districts had some kind of lot coverage requirements.

In this section, you will complete up to eight columns related to lot coverage, two each for each of the four principal housing types.

The first column will cover the amount of land that may be covered by buildings, and the second column will cover the amount of land that may be covered by buildings and other impervious surfaces, such as asphalt (e.g. driveways). While most jurisdictions will have figures for both columns, some will have one or the other, and some will have none. If the jurisdiction fails to mention lot coverage requirements, leave the relevant columns blank.

We only suggest logging the four principal housing types because we found in Connecticut that codes did not distinguish affordable housing, and we only saw a handful of additional lot-coverage requirements for ADUs. If you run across lot coverage requirements for ADUs, feel free to log in the Special Notes column as, "ADU maximum lot coverage [X]%."

You might find lot coverage requirements in the chart you found in Part IV.C.1., if any. If you are not so lucky, search the zoning text for district-specific provisions or search for the following phrases:

- Lot Coverage
- Building Coverage
- Impervious Surface
- Pervious Surface
- Coverage (if all else fails)

When you find the percentage of allowable lot coverage, input the whole number associated with the percentage into the Spreadsheet as a number only, without the percentage sign. The lower the number, the more restrictive the lot coverage requirement.

If you just see "lot coverage" or "impervious surface coverage" without reference to buildings, please include the percentage in the Lot Coverage – Buildings and Impervious Surface column; in other words, assume this figure encompasses both buildings and other impervious surfaces.

NOTE: Some codes may be silent on the maximum lot coverage and instead require a minimum percentage of the lot to be devoted to “green space.” If no other provisions specifically relate to lot coverage, please subtract the percentage from 100% and include the resulting percentage in the appropriate Lot Coverage – Buildings and Impervious Surface column. Note that you cannot rely on the term “open space” to find lot coverage figures, because open space often allows paved pathways, playgrounds, and other impervious surfaces.

5. Parking Requirements

Ah, parking requirements! Zoning codes will often mandate that each housing unit have a certain number of parking spaces.

Parking requirements impact housing production because the more parking spots required, the fewer housing units can be built on any given lot—and the more expensive it is to build that housing. Minimum parking requirements also impact cities because people are more likely to choose to drive when more parking is provided. Parking requirements are unfortunately common: 87% of the land allowing housing in Connecticut requires parking.

In this section, you will fill out 10 different columns related to parking requirements.

You will often find minimum parking requirements in a chart or table specifically relating to parking in the zoning text. Even where there is a chart or table specific to parking, you will need to search for the term “parking” and manually review the term each time it appears in the zoning code to be sure you have logged everything correctly.

Zoning codes will often differentiate between required parking for 1-family housing and required parking for duplexes, triplexes, or apartments.

There is only one column devoted to 1-family housing, because codes will not generally differentiate parking requirements based on the number of bedrooms in 1-family housing. However, you will sometimes find minimum parking requirements are different depending on the number of bedrooms for single-family housing. For example, say that the code requires 1 parking space for studio and 1-bedroom single-family homes, 2 for 2-bedroom or 3-bedroom homes, or 3 for 4-or-more-bedroom homes. For this example, you could input the following in the 1-Family Min. # Parking Spaces column: “1/0BR or 1BR; 2/2BR or 3BR; 3/4+BR.” If the code requires one parking space per bedroom, input “1/BR.” If the code requires one parking space per occupant, input “1/occupant.”

There are two columns each devoted to 2-Family, 3-Family, 4+-Family, and AH housing, because zoning codes often differentiate parking requirements based on the number of bedrooms in such housing. Similarly, you will sometimes find minimum parking requirements are different for 2-bedroom multi-family housing versus 3-bedroom or 4-bedroom multi-family housing. For example, say that the code requires 2 parking spaces for 2-bedroom triplexes, and 3 parking spaces

for 3-or-more-bedroom triplexes. For this example, you could input the following in the 3-Family Min. # Parking Spaces Per 2+ BR column: “2/2BR; 3/3+BR.”

There is also a column for ADUs, which logs the number of parking spaces additional to the main unit.

When you find the number of parking spaces required for the housing type, bedroom type, and district, input it into the Spreadsheet as a number only, without units. Take the number to the hundredth place, because you will see some zoning requirements with “.25” or “.75” parking spaces per unit. The higher the number, the more restrictive the parking requirement.

NOTE: Do not be surprised if you find instances where elderly housing has a different parking requirement than non-elderly housing. In such cases, follow the convention you have already heard several times, which is to log one entry signifying what you think is the most common parking requirement for that housing type in that zone but make a one-sentence note in the Special Notes column about the alternative. For example, let’s say you find a district that requires two parking spaces for 1-family housing, but only one parking space for 1-family housing designated for the elderly. In that case, log “2” in the 1-Family Min. # Parking Spaces column and in the Special Notes column, put: “1 parking space per elderly 1-family housing unit.” Because the Special Notes column may include notes about several different columns, be clear about the applicability of your one-sentence note.

NOTE: If minimum parking requirements are tied to floor area of housing units, then include a notation in the relevant parking column to the effect of, “[X]/[Y] square feet,” where X represents the number of parking spaces required.

6. Connectivity Requirements

In this section, you will complete up to seven columns requiring housing to be connected to other infrastructure or structures.

Three of the columns relate to whether the housing must be located near public transportation, and three relate to whether the housing must connect to existing water or sewer requirements. You will log these restrictions for three-family, four-or-more-family, and affordable housing. In Connecticut, we saw these connectivity requirements most often when related to four-or-more-family affordable housing—but they are rare. The seventh column relates to whether ADUs must be physically attached to or connected to the principal dwelling unit; such a requirement was found in about half of the districts allowing ADUs in Connecticut.

To complete these columns, search for the following phrases:

- Connected to
- Sewer
- Water

- Public transportation
- Public transit
- Attached to

These requirements will often be found within the description of an individual district or the ADU housing type description, and not in a chart.

NOTE: Even if the zoning code does not require connectivity to water/sewer or transit, the code may still make special provisions for housing near such areas. Where, for example, a district requires a different lot size or building height for lots near a train station, you can log a note in the Special Notes column stating as much.

D. CATALOGUING STRUCTURES

You're in the home stretch, having completed up to 79 columns in the Spreadsheet, plus the 80th Special Notes column, which you should continue filling in, as appropriate.

This Section concludes with the final 26 columns, all dealing with the way zoning codes treat the development of structures used for housing. It logs this treatment across all seven of the housing types discussed in Part IV.B.

This Section covers the maximum height of residential structures, floor to area ratios, unit size requirements, maximum bedroom requirements, and maximum units per development.

In this Section, you will mostly be logging numerical answers. Some of the numerical answers will differ depending on the number of bedrooms. Log these differences uniformly across the spreadsheet by using the following abbreviations: studios "0BR"; 1-bedroom units "1BR"; 2-bedroom units "2BR"; and so on. Where the code says "three or more bedrooms" or "four or more bedrooms," use a plus sign "+" (for example, "3+BR" or "4+BR"). Use a slash "/" instead of the words "for" or "per" prior to the abbreviation used for bedrooms. Use a semicolon ";" to differentiate between entries related to different types of bedrooms (for example, "10/2BR; 20/3+BR"). Some of the numerical answers will differ depending on the nature of the housing, most commonly elderly housing. Again, use the slash "/" instead of the words "for" or "per" prior to the descriptive word(s) (for example, "0.5/elderly; 1/non-elderly").

NOTE: Again, these structure-related requirements do not always exist. Where the zoning code is silent, leave the entry blank. Take care to not make entries in columns corresponding to housing that is not permitted in the zoning district.

In this Section, you will fill out the following Spreadsheet columns:

- Maximum height: The maximum height of residential construction.
 - **1-Family Max. Height (# of stories)**

- **1-Family Max. Height (# of feet)**
- **2-Family Max. Height (# of stories)**
- **2-Family Max. Height (# of feet)**
- **3-Family Max. Height (# of stories)**
- **3-Family Max. Height (# of feet)**
- **4+-Family Max. Height (# of stories)**
- **4+-Family Max. Height (# of feet)**
- Floor to area ratio: A single number which constrains building square footage relative to lot area by capping building square footage as a multiple of the lot area.
 - **1-Family Floor to Area Ratio**
 - **2-Family Floor to Area Ratio**
 - **3-Family Floor to Area Ratio**
 - **4+-Family Floor to Area Ratio**
- Unit size: The minimum or maximum square footage for a single dwelling unit.
 - **1-Family Min. Unit Size**
 - **2-Family Min. Unit Size**
 - **3-Family Min. Unit Size**
 - **4+-Family Min. Unit Size**
 - **AH Min. Unit Size**
 - **ADU Max Size (% of Main Unit)**
 - **ADU Max. Size (SF)**
- Maximum bedrooms per unit: The maximum number of bedrooms within a single dwelling unit.
 - **3-Family Max. # Bedrooms Per Unit**
 - **4+-Family Max. # Bedrooms Per Unit**
 - **AH Max. # Bedrooms Per Unit**
 - **ADU Max. # Bedrooms Per Unit**
- Maximum units: The maximum number of units per building or per development, as applicable.
 - **4+-Family Max. # Units Per Building**
 - **AH Max. # Units Per Building**
 - **PRD Maximum # Units Per Development**

Again, overlay districts require special instruction. any district has a “Yes” in the Overlay column, then only complete subsequent columns for the district in the Spreadsheet if the overlay overrides the base district and is different than the base district. If the cell is left blank, the base district’s characteristics prevail.

NOTE: A district may have context-specific regulations instead of providing a specific number for parameters like height and floor-to-area ratio. For example, the zoning code might say that a building’s height must be within ten percent of the number of linear feet, or must be the same number of stories, as the average of the existing buildings on the same side of the block. In cases where no number is provided and these context-specific regulations exist, please input the word “Contextual” in the relevant box. In addition, if not too onerous/lengthy, include the nature of the contextual regulation in the Special Notes column. This designation will signal the existence of a

standard to those reviewing your inputted data, but will not clutter the database with extra words. If the district has a specific number *and* an exception that offers context-specific regulations, then please code it with the number and the words “& sometimes contextual.” For example, a provision that says “heights are capped at 30’ except along Morningside Avenue, where they must be within 5’ of the heights of existing buildings on the block,” should be coded in the relevant Height (# of stories) column: “10, & sometimes contextual.”

1. Maximum Height

Zoning codes can restrict the height of buildings. Such a restriction can dampen housing supply by constraining the size of buildings that can be devoted to housing. In Connecticut, on average over 90% of districts permitting housing have height restrictions. Four-or-more-family housing is capped at around four stories, which means that even where apartment buildings are allowed, they are extremely limited.

In this section, you will fill out up to eight columns dealing with the maximum height of housing of the four principal housing types.

Some jurisdictions will cap height in terms of number of stories, while others will use linear feet; some will use both stories and feet and will say that whichever is shorter/smaller prevails. The Spreadsheet contains one column for stories and one for feet, for each of the four principal housing types. Fill out what you find and leave the rest blank.

You will most often find the maximum height requirements in the chart in the zoning text detailing certain district characteristics, sometimes contained in an appendix to the zoning code. These charts might be called:

- Area and Bulk Requirements
- Dimensional Requirements
- Lot and Building Requirements
- Area Requirements

If you do not find any such charts, search for height restrictions manually using the following phrases:

- Maximum height
- Height
- Stories
- Story

You could also search for the term “feet,” but this will give you a huge number of results, from the height of trees to the length of signs. See what you find with the first three terms before resorting to “feet.”

When you find the number of stories or feet, input it into the Spreadsheet as a number only, without units. You can input your number to the tenth place, because often height restrictions based on the number of stories will include half stories (0.5). The lower the number, the more restrictive the height requirement.

If there is a minimum height requirement, then include in the Special Notes column: “Minimum height [of [# feet]/[# stories] also required.”

A very small number of jurisdictions will have context-specific regulations instead of providing a specific number for heights. For instructions on this, see the Note at the beginning of Part IV.D.

NOTE: You may find zoning codes, especially form-based codes, that establish several different height maximums depending on the type of building. Identify the building types that allow residential uses, then identify the various maximum heights established. In the relevant Max. Height column, put the most common maximum found in the district, and then include in the Special Notes column either: (1) “Maximum height up to [# feet]/[# stories] for [other buildings]/[building types].” or (2) “Maximum height up to [# feet]/[# stories] for [other buildings]/[building types]; [# feet]/[# stories] for [other buildings]/[building types]; [and so on].”

NOTE: You may find zoning districts that allow affordable or elderly housing to have different heights than non-elderly, non-affordable types of housing. If so, include the more common number (i.e., for non-elderly/non-affordable housing) in the applicable maximum height column and in the Special Notes column include: “Maximum height for [elderly/affordable] housing [# feet]/[# stories].”

2. Floor-to-Area Ratio

Zoning codes, especially older codes, often offer what is called a “floor to area ratio,” which constrains building square footage relative to lot area by capping building square footage as a multiple of the lot area. In Connecticut, these ratios appear in about a quarter of districts allowing four-or-more-family housing, but only in about 15% of 1-family districts.

In this section, you will fill out up to four columns, each dealing with the floor to area ratio for the four principal housing types.

You might find floor-to-area requirements in the chart you found in Part IV.D.1., if any. If you are not so lucky, search the zoning text for these phrases:

- FAR
- F.A.R.
- Floor to area
- Floor-to-area
- Floor area ratio
- Floor-area ratio

On the last two search terms, be sure to include the word “ratio,” as the term “floor area” alone will give you false positives, capturing everything from minimum unit size (the subject of Part IV.D.3.) to cellar size. When you find a floor-to-area ratio, input it into the Spreadsheet as a number only, without units, and take it to the hundredth place. The lower the number, the more restrictive the floor-to-area requirement.

A very small number of jurisdictions will have context-specific regulations instead of providing a specific number for floor-to-area ratio. For instructions on this, see the Note at the beginning of Part IV.D.

NOTE: In Connecticut, we did not distinguish between gross and net floor area. Gross area includes all area within the outer exterior surfaces of a building, while net area often excludes unusable or mechanical space. There is no clever way to convert between gross and net floor area, and usually the distinction will only make a negligible difference to the actual amount of housing. If this matters to you, feel free to make a note in the Special Notes column.

NOTE: If floor-to-area ratio depends on lot size, please include in the relevant floor-to-area column: “[FAR] if lot between [X] & [Y] acres; [FAR] if lot between [Z] & [A] acres,” etc.

3. Unit Size

Zoning codes may also constrain the size of housing units. For principal-use housing, codes sometimes impose minimum unit sizes, which eliminate smaller (and more affordable) housing types. In Connecticut, 40% of districts requiring a minimum unit size for 1-family housing required a size of 1,000 square feet or more. For accessory dwelling units, codes very often impose maximum unit sizes; in Connecticut, about three-quarters of districts do. Maximum sizes can hinder the effectiveness of ADUs, rendering them too small to meet housing needs.

In this section, you will fill out up to seven columns dealing with unit size.

The first five columns deal with the four principal housing types and affordable housing, and require you to collect information in terms of square feet. For these five columns, you are collecting the minimum unit size, meaning the smallest number of square feet a housing unit is allowed to be. The last two columns deal with ADUs, and here, you are collecting the maximum unit size, meaning the largest number of square feet an ADU is allowed to be. One column logs maximum ADU size as a percentage of the principal dwelling, while the other logs maximum ADU size in square feet. Some jurisdictions will use a percentage, while others will use square feet; some will use both percentage and square feet and will say that whichever is smaller prevails.

You might find minimum unit size requirements in the chart you found in Part IV.D.1., if any. But more likely they will be found in district-specific sections of the zoning code. Search for these phrases:

- Unit size
- Minimum size
- Floor area

When you find a unit size as expressed in square feet, input it into the Spreadsheet as a whole number. When you find a maximum ADU size expressed as a percentage, input the whole number associated with the percentage into the Spreadsheet as a number only, without the percentage sign. For sixteen percent, you insert the number “16.” The higher the minimum unit size for principal-use housing, and the lower the maximum unit size for ADUs, the more restrictive the requirement.

Some regulations will not have a maximum size for an ADU. In such an instance leave the ADU Max. Size column blank.

NOTE: You may come across language indicating that an ADU can be the same size as the principal dwelling. If the jurisdiction allows an ADU to be the same size as a principal 1-family home on the lot, this is not an ADU at all. It is more accurately coded as 2-family housing. Return to Parts IV.B.2. and IV.B.6. and make changes accordingly.

4. Maximum Bedrooms

Some zoning codes will cap the number of bedrooms for three-or-more-family housing and for ADUs. The rationale for these caps appears to be to limit the number of schoolchildren who will impose themselves on public school systems. There are essentially no maximum-bedrooms caps on 1-family housing, calling into question why children living in multi-family housing or ADUs must be zoned out. In any event, these caps are more common than one would hope, and thus worth logging in your Spreadsheet.

In this section, you will complete up to four columns, relating to three-family housing, four-or-more-family housing, affordable housing, and accessory dwelling units.

This requirement may be tricky to find, but you could start by searching the phrases:

- Maximum bedroom
- Max. bedroom
- Maximum number of bedrooms

In addition, searching the ADU-related section of the zoning code for the term “bedroom” will give you what you need to fill out the ADU Max. # Bedrooms Per Unit column. The lower the number, the more restrictive the bedroom requirement.

When you find a maximum number of bedrooms, input it into the Spreadsheet as a whole number, without units. If needed, take the number to the tenth decimal place.

NOTE: You may find descriptions regarding a cap on a total number of rooms permitted in a housing unit, without reference to a particular number of bedrooms. Usually this total number of rooms excludes bathrooms and utility spaces. If given this number, you could take the total number of rooms and subtract 2 (for a kitchen and living room) to estimate the number of bedrooms that might be allowed. If you do this, include in the Special Notes column: “Maximum bedrooms estimated per cap of [#] total number of rooms.”

5. Maximum Units

Finally, some zoning codes will cap the number of housing units that can be developed in four-or-more-family housing, affordable housing, or planned residential developments. The rationale for this type of restriction may be purely exclusionary, or it may be genuinely related to some infrastructure concern. Collect the information regardless!

In this section, you will complete up to three columns. To complete them, search for any of the following phrases in the zoning text:

- Maximum units
- Max. units
- Maximum number of units

You could also search the word “maximum” in the section of the zoning code dealing with affordable housing and the section of the zoning code dealing with PRDs. While the term may give you false positives, it will be a manageable number if you limit the search to just those specific sections.

When you find a maximum number of units, input it into the Spreadsheet as a whole number, without units. The lower the number, the more restrictive the unit requirement.

E. VERIFYING COLLECTED DATA

No one is perfect. You will inevitably find errors in the data collected in your Spreadsheet. We suggest two parallel systems of internal verification and external verification.

1. Internal Verification

From an internal perspective, make sure the project manager or the zoning code analyst(s) review all of the data before it is handed off to the geospatial lead and analyst(s). Here were some of the biggest errors we tended to find:

- Districts marked “Nonresidential” in the Type of Zoning District column were marked “Allowed/Conditional” or “Special Permit” in the four Treatment columns

- Districts marked “Nonresidential” in the Type of Zoning District column were marked “Yes” in the Affordable Housing District or Elderly Housing District column
- Districts marked “Nonresidential” in the Type of Zoning District column or “Prohibited” in the four Treatment columns also had columns filled out suggesting that the districts allowed housing (e.g., a minimum lot size or parking requirement column was filled out)
- Districts that allow agricultural and residential use being classified as “Mixed with Residential” or “Nonresidential” in the Type of Zoning District column
- Numbers that did not make sense

We believe we have helped you avoid the first three errors by programming the Spreadsheet so that it automatically grays out columns that should not be filled out. We used conditional formatting rules, adding a custom formula to turn cells grey for columns that should not be filled out, for districts marked “Nonresidential” in the Type of Zoning District column or “Prohibited” in any of the four Treatment columns. If you have inputted data in a grey cell, then either the grey-cell data is incorrect or the Type of Zoning District or Treatment column is incorrect. You will have to go back to the zoning code to determine which is correct.

As for the fourth error, our reasons for classifying agricultural-residential lands as Primarily Residential in the Type of Zoning District column were explained in Part IV.A.1. This might take a visual scan to ensure no one coded this incorrectly.

Errors falling into the fifth category – numbers that do not make sense – may be easily identifiable by the project manager or someone with a strong zoning background. It may be quick to sort each column with numerical inputs in ascending order to identify outliers and errant inclusions of units. Sorting in this manner will enable you to see whether numbers are too small or too large to be appropriate to the unit of measurement. Less experienced analysts may wish to use this list of common numerical errors we found in our own work:

- A Min. # Parking Spaces column showing “4” or more. It is rare for a jurisdiction to require 4 parking spaces per unit; indeed, we did not find a single one in Connecticut, arguably a highly exclusionary state. We found that sometimes, a zoning code analyst will include a “4” for 2-family housing, where the code says, “Duplexes require 4 units of parking.” Because the measurement in the Min. # Parking Spaces column must be inputted on a per-unit basis, the number that should be included in that column should be 2. We suggest sorting these columns by number to see whether they contain a “4” or higher, and reviewing the zoning code to confirm.
- A Lot Coverage - Buildings or Lot Coverage - Buildings & Impervious Surface column where the numbers are expressed in decimals or percentages, rather than simply two-digit integers between, usually, 10 and 100. If upon sorting these columns a number lower than 10 or higher than 100 is identified, please review the zoning code again.
- Max Height (# of Stories) and Max Height (# of Feet) columns being swapped. It is easy here to slip and, for example, input a “3” in the Max Height (# of Feet) column, where the “3” is intended to be included in the Max Height (# of Stories) column. Sort these columns and reconcile any clear outliers by reviewing the zoning code.

While you're thinking about numbers, delete all zeroes your team may have inputted. If the zoning code was silent on a numerical measure, the cell should be left blank.

2. External Verification

External verification can also be valuable.

As an initial measure, the project team should proactively reach out to the staff planner listed in the Jurisdiction Information tab of the Spreadsheet. (This is where the information you collect for jurisdiction officials in Part II will come in handy!) The planner should be asked to peruse data collected *for their town only*. Do not send the planner access to the Spreadsheet, with editing privileges, or all heck will break loose. We suggest saving information for their jurisdiction in a separate document and sending just that information over. Not all will reply, but many will: Of the 180 jurisdictions in the Connecticut Zoning Atlas, sixty-three planners provided feedback improving the quality of our data. Note, however, that planners are fallible, too. Trust, but verify their suggestions with the text of the published zoning code and map. We found quite a few “helpful” suggestions that ended up being incorrect. You should also regularly (e.g., at six-month intervals) invite those planners to send you updates to their zoning regulations that may affect the map.

The other source of external verification is the public at large. When your atlas is posted online, it is worth circulating calls for community members to assist with map updates and corrections. Some members of the community may take a special interest in reviewing the map and keeping it updated.

Data verification takes time: time to locate any errant entries, and more to correct them, but this check will ensure that your data is clean down the line.

With the zoning code analysis completed, zoning code analysts may wish to skim Part V to understand what their geospatial analyst peers have been doing. Everyone's work concludes in Part VI.

V. CREATING THE MAP

This Part covers how to create the map that will display the regulatory information collected in Part IV. (Together, both parts make your atlas!) The geospatial lead and geospatial analyst(s) can start creating the map even while the zoning code analyst(s) are doing their work in Part IV. We begin by discussing what this map can show, and then we provide step-by-step details of its setup, including cleaning and merging the layers and building the actual map.

Please note that with funding, the National Zoning Atlas may be able to assist in some of the activities described in this Part. In the meantime, we want you to have the best information we can provide, for you to do it on your own.

A. FEATURES OF THE MAP

Before we get into the nuts and bolts of creating the map, let's talk about the key features it must show.

First, the map must display jurisdictional boundaries, streets, a satellite view, waterways, federal and state lands, and transit stations (i.e., fixed train, streetcar, monorail, and rapid bus transit stations). You may also wish to include sewer and water infrastructure in your atlas. These features will orient a public viewer and will enable researchers to gain deeper understanding of the impact of certain regulatory features.

Second, the map must depict key regulatory characteristics of the Spreadsheet. The National Zoning Atlas will, at a minimum, depict the same 28 columns on the Connecticut Zoning Atlas, online at zoningatlas.org/connecticut. That map shows the following columns:

- **Type of Zoning District**
 - Depicted on the base map in related shades of purple, which allows users to read “hits” as one yet still differentiate between Primarily Residential, Mixed with Residential, and Nonresidential districts.
- **Full District Name, Jurisdiction**
 - Featured together (with Full District Name in all caps, Jurisdiction in upstyle below) in a white box upon a user's hover over any particular zoning district.
- **1-Family Treatment, 2-Family Treatment, 3-Family Treatment, 4+-Family Treatment, Accessory Dwelling Unit (ADU) Treatment**
 - Shown in the legend as individual options, where the user can choose which type of housing to select and then further select between “Allowed As of Right” (corresponding to the Allowed/Conditional entry) and “Allowed Only After Public Hearing” (corresponding to the Public Hearing entry).

- **Elderly Housing District, 2-Family Elderly Housing Only, 3-Family Elderly Housing Only, 4+-Family Elderly Housing Only**
 - Shown after the user selects one of the four principal housing types, with the prompt “Not Restricted to Elderly Only” (to ensure that “hits” show permissiveness).
 - A “No” entry in the Spreadsheet appears as purple on the Atlas.
- **1-Family Min. Lot Size, 2-Family Min. Lot Size, 3-Family Min. Lot Size, 4+-Family Min. Lot Size**
 - Shown after the user selects one of the four principal housing types, with five prompts for users – None, .01-.46, .47-.91, .92-1.83, and 1.84+ – which correspond to the round numbers used by jurisdictions using square feet to measure lot size.
- **1-Family Min. Unit Size, 2-Family Min. Unit Size, 3-Family Min. Unit Size, 4+-Family Min. Unit Size**
 - Shown after the user selects one of the four principal housing types, with the prompt “No Minimum Unit Size Requirement” (to ensure that “hits” show permissiveness).
 - To depict these in the same way we do, you will need to convert these columns into a binary option (i.e., a Yes/No depending on whether the district requires a unit size for that particular principal use or not).
- **ADU Employee or Family Occupancy Required**
 - Shown after the user selects “Accessory Dwelling Units,” with the prompt “Allows Non-Family/Non-Employees” (to ensure that “hits” show permissiveness).
 - A “No” entry in the Spreadsheet appears as purple on the Atlas.
- **ADU Renter Occupancy Prohibited**
 - Shown after the user selects “Accessory Dwelling Units,” with the prompt “Allows Renters” (to ensure that “hits” show permissiveness).
 - A “No” entry in the Spreadsheet appears as purple on the Atlas.
- **ADU Owner Occupancy Required**
 - Shown after the user selects “Accessory Dwelling Units,” with the prompt “Allows Non-Owner Occupancy” (to ensure that “hits” show permissiveness).
 - A “No” entry in the Spreadsheet appears as purple on the Atlas.
- **ADU Elderly Only**
 - Shown after the user selects “Accessory Dwelling Units,” with the prompt “Not Restricted to Elderly Only” (to ensure that “hits” show permissiveness).
 - A “No” entry in the Spreadsheet appears as purple on the Atlas.
- **ADU Max Size (% of Main Unit), ADU Max. Size (SF)**
 - Shown after the user selects “Accessory Dwelling Unit,” with the prompt “No Maximum Size Limitation” (to ensure that “hits” show permissiveness).
 - To depict these in the same way we do, you will need to convert these columns into a binary option (i.e., a Yes/No depending on whether the district caps unit size or not).
- **ADU Restricted to Only Primary Structure**
 - Shown after the user selects “Accessory Dwelling Units,” with the prompt “Not Restricted to Primary Structure” (to ensure that “hits” show permissiveness).

- A “No” entry in the Spreadsheet appears as purple on the Atlas.

Third, through the District Tooltip – the white box that appears when a user hovers over any particular zoning district – the map must communicate essential notes about particular districts. The District Tooltip will display:

- **Jurisdiction**
- **Full District Name**
- The word “NOTE.”
- **Tooltip Notes**
 - You may wish specific information about particular districts, including some of the information referenced in the Special Notes column to appear in your public interface.
 - If so, then you must manually pull specific Special Notes text into the Tooltip Notes column, as the Special Notes column will not appear in the District Tooltip.

Fourth, through the Jurisdiction Information Box – the white box that appears when a user clicks on a jurisdiction – users can obtain information about their selected fields and about the jurisdiction. We describe how to pull information into the Jurisdiction Information Box in Part V.D.4 below. Here are the 6 pieces of information that should be displayed in this box:

- The number of acres satisfying the criteria chosen by the user in the legend.
- The percentage of zoned municipal area represented by these acres.
- The total number of acres zoned within the jurisdiction.
- Household income: The household income in the jurisdiction per table B19013 of the Census.
- % Population Other than White-Only: The percentage of jurisdiction's population not recognized as White, non-Hispanic per table B03002 in the 2019 ACS 5-year estimates.
- % Cost Burdened Households: The percentage of jurisdiction's population recognized as cost-burdened, that is, spending more than 30% of their income on housing.

So these are the end goals for our map: the minimum information an atlas compatible with the National Zoning Atlas must contain. Now let’s get to work on the technical steps required to get there.

B. CLEANING GEOSPATIAL FILES

By this point, your team should have collected all of the geospatial files for your zoning atlas into your online filing system, in accordance with the instructions in Part II.B.4.

You may be lucky to receive all GIS files with zoning districts neatly aligned, and district names matching the names of the Abbreviated District Name or the Full District Name column of the Spreadsheet. But chances are, the quality of files will vary greatly between jurisdictions, and you

will need to do extensive cleanup to standardize files before combining them into a single layer for the web map. That is what this Section aims to ensure you accomplish.

NOTE: Instructions in this Section primarily apply to shapefiles provided by a jurisdiction. As noted above, you may have to hand-draw zoning layers for some jurisdictions. Reading this Section thoroughly will help you avoid errors and ensure that the hand-drawn layers can smoothly be integrated into the atlas. The hand-drawing process may be easier if the jurisdiction provides parcel shapefiles for you. (A parcel is a piece of land with distinct property boundaries – essentially, a zoning lot.) If you are given information in this format, you will be able to do a short-cut by manually dissolving the parcels into zoning districts.

To complete this Section, you need to be familiar with basic GIS analysis using QGIS or ArcGIS. In this Section, you will learn key clean-up steps that will make your files acceptable for further processing with geopandas, discussed in the next Section. We will use QGIS, a leading free and open-source GIS software, but you can do all this in ArcGIS Pro if you prefer. If you're new to QGIS, take a look at the QGIS Quickstart tutorial.

NOTE: If your zoning map is an image (JPG, TIFF, PNG, PDF), and not a GIS file, you will need to use Georeferencer, bit.ly/3KAYIGN, to translate image pixels to real-world coordinates, and then use advanced digitizing in QGIS, bit.ly/3rj9fyO, to manually create zoning district polygons.

Often, these layers will use the abbreviation for the district, rather than the full district name. However, the layers will sometimes use full district names or have an entirely independent naming system. You will very likely have to consult with the official zoning map, and manually rename the layers.

1. Open Files in QGIS

With all of this in mind, we turn to the shapefiles. You will need to inspect every geospatial file in QGIS to ensure it contains appropriate polygons (or multipolygons) representing zoning districts, that geometries do not overlap and generally make sense, and that each district has “Name” as one of its attributes. This is a tedious but crucial step.

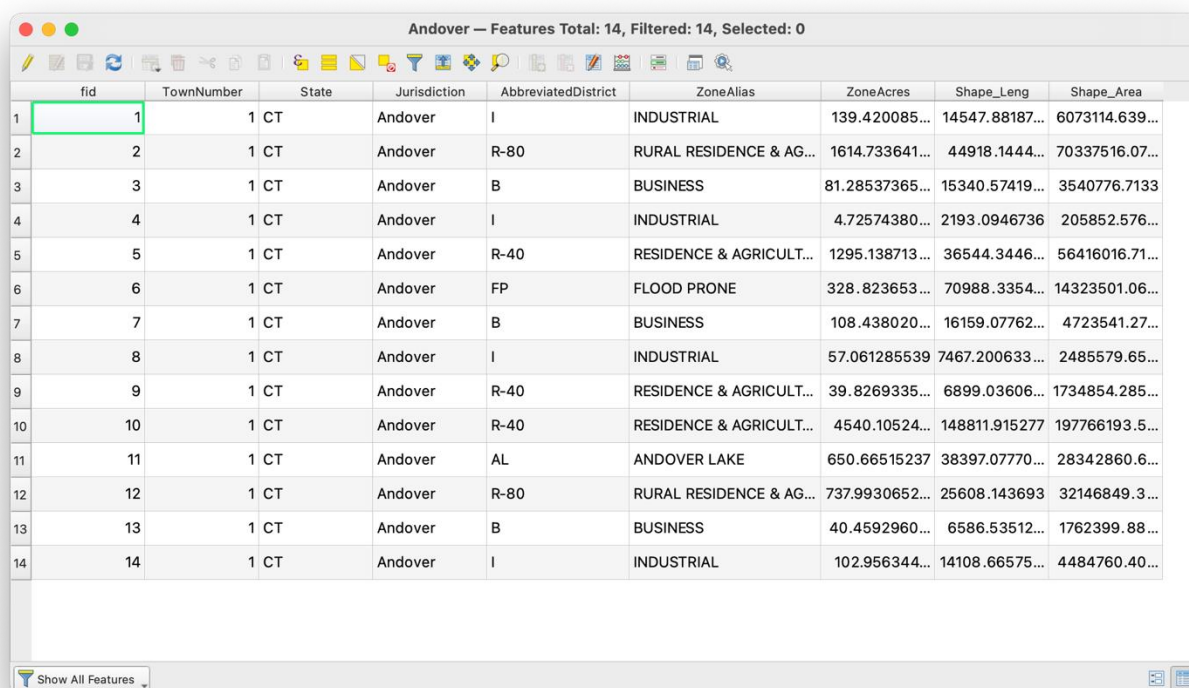
In QGIS, create a new project (Project > New), and drag and drop the zoning file for QGIS to import. Esri shapefiles (bit.ly/3jtDKxS) usually come as .zip archives, and you can drag and drop the entire archive. Alternatively, you can unzip (or unarchive) the file to create a folder with multiple shapefile components, and drag and drop the file with the .shp extension (and QGIS will import the remaining files, .shx, .dbf, and .prj, automatically). Other common formats, including GeoJSON .geojson, Geopackage .gpkg, and KML .kml come in single files.

Make the layer editable by right-clicking the layer name in the Layers panel, and clicking Toggle Editing.

2. Inspect the Attribute Table

Right-click the layer in the Layers panel, and Open Attribute Table. This will list all polygons as rows, and associated data, or attributes, as columns, also known as fields.

It might look something like the table for Andover, Connecticut:



	fid	TownNumber	State	Jurisdiction	AbbreviatedDistrict	ZoneAlias	ZoneAcres	Shape_Leng	Shape_Area
1	1	1	CT	Andover	I	INDUSTRIAL	139.420085...	14547.88187...	6073114.639...
2	2	1	CT	Andover	R-80	RURAL RESIDENCE & AG...	1614.733641...	44918.1444...	70337516.07...
3	3	1	CT	Andover	B	BUSINESS	81.28537365...	15340.57419...	3540776.7133
4	4	1	CT	Andover	I	INDUSTRIAL	4.72574380...	2193.0946736	205852.576...
5	5	1	CT	Andover	R-40	RESIDENCE & AGRICULT...	1295.138713...	36544.3446...	56416016.71...
6	6	1	CT	Andover	FP	FLOOD PRONE	328.823653...	70988.3354...	14323501.06...
7	7	1	CT	Andover	B	BUSINESS	108.438020...	16159.07762...	4723541.27...
8	8	1	CT	Andover	I	INDUSTRIAL	57.061285539	7467.200633...	2485579.65...
9	9	1	CT	Andover	R-40	RESIDENCE & AGRICULT...	39.8269335...	6899.03606...	1734854.285...
10	10	1	CT	Andover	R-40	RESIDENCE & AGRICULT...	4540.10524...	148811.915277	197766193.5...
11	11	1	CT	Andover	AL	ANDOVER LAKE	650.66515237	38397.07770...	28342860.6...
12	12	1	CT	Andover	R-80	RURAL RESIDENCE & AG...	737.9930652...	25608.143693	32146849.3...
13	13	1	CT	Andover	B	BUSINESS	40.4592960...	6586.53512...	1762399.88...
14	14	1	CT	Andover	I	INDUSTRIAL	102.956344...	14108.66575...	4484760.40...

We use this example on purpose, to illustrate that you will likely see a bunch of columns that are not relevant – including the “fid,” “TownNumber,” “ZoneAcres,” “Shape_Long,” and “Shape_Area” columns in the example above. Some attribute tables will be even more cluttered. Feel free to keep this in mind as you clean up the tables to suit this project.

Click the Save edits button.

3. Rename Relevant Columns

Now that you have the attribute table open, it’s time to create and/or rename 3 relevant columns and district names so that you can tie the attribute table to the Spreadsheet and so that you can create unique layer names for each zoning district.

It is likely that you will have to create two new columns: one for “State” and one for “Jurisdiction.” To create a new field called Jurisdiction with the value of “Andover” for all zoning districts (polygons), click the Field calculator button and fill in as follows:

- Output field name: Jurisdiction
- Output field type: Text (string)
- Expression: 'Andover'

Make sure you use single quotes for the text value. Click OK and ensure that the new column is listed as one of the fields in the Fields tab of the Layer Properties window.

Use a similar technique to add a “State” column, inserting the two-digit postal abbreviation for the state in each entry in the column.

NOTE: In the case of a submunicipal jurisdiction, include in the Jurisdiction column in this attribute table the name of the larger municipality within which the submunicipal district is located. Using the example of the Short Beach Civic Association in Branford, Connecticut, that we have used elsewhere, we would use “Branford” in the Jurisdiction column here – not “Branford – Short Beach,” as we would have used in the Spreadsheet.

Next, please find the column listing district names. Rename that column to the “AbbreviatedDistrict” column. You can rename an existing column (field) in the Fields tab of the Layer Properties window by double-clicking the layer to open the properties window.

4. Rename Abbreviated Zoning District Names

In this step, you will ensure that the abbreviated zoning district names in the attribute table exactly match the spelling and punctuation for the district in the Abbreviated District Name column from the Zoning Information tab in the Spreadsheet. This is critically important to the functioning of the program and the accuracy of the atlas, especially in the task of listing all zoning districts, as explained in Part III.C.

Click the AbbreviatedDistrict column header to sort values alphabetically. Go through the values to make attribute table and Spreadsheet names. You should be able to edit the values directly; if not, click “Toggle Editing.”

This last step may take a long time, and you’re likely to have issues. For the Connecticut Zoning Atlas, we found 1,917 GIS layers that matched the names of the zoning districts we had logged in the Spreadsheet. However, as many as 6 layers (usually depicting noncontiguous elements of a district) corresponded to a single zoning district. In these cases, we simply merged the multiple layers into one layer per district.

Unfortunately, you are likely to find more serious discrepancies between the GIS layers and the zoning map. From a legal perspective, the officially adopted zoning map prevails.

Here are some of the issues that you might spot in the GIS layers:

- Incomplete layer names (e.g., “A” instead of “R-A” or “D” instead of “T-3-D”)
- “Sliver” layers that are strewn about randomly, without corresponding to even a single lot
- Layers included in the shapefile that have no corresponding area on the zoning map (e.g., federal or state land, or layers recently adopted)
- Layers with realistic layer names that appear in the zoning map and in the shapefiles, but not in the zoning code
- Layers that are not designated as overlays on the zoning map but that nonetheless overlap other layers
- Layers labeled with both the name of the underlying district and the name of the overlay
- An entire neighborhood or area with entirely different, yet plausible, layer names than are in the surrounding jurisdiction’s zoning text or zoning map
- Areas in the overall region or state where you are looking for which there are no corresponding layers (i.e., an area is blank)

For the Connecticut Zoning Atlas, there were 810 layers with issues like the above. To resolve each issue presented, we consulted the zoning text and zoning map. Generally, here is how we resolved each of the issues:

- We manually consulted the zoning map against the shape and location of the GIS layer to match the name of the layer to an actual district name.
- We deleted virtually all “sliver” layers in a process described in Part V.B.7 below.
- We deleted layers without a corresponding area on the zoning map, except in the handful of cases where the layers were recently adopted (something we discerned either by scanning recent meeting minutes or by contacting jurisdiction officials).
- For layers that appeared in the map and shapefiles but not the code, we logged these as “Yes” in the District Mapped but Extinct column of the Zoning Information tab of the Spreadsheet. We then did everything possible to convince the staff planner to send us the version of the zoning code in which this district last appeared, and logged all relevant regulatory characteristics.
- We reconciled erroneous overlays by redrawing the boundaries for the overlapping districts after consulting with the zoning map.
- We separated layers with both the name of the underlying district and the name of the overlay into layers with the names of both.
- The last two issues listed above may expose submunicipal jurisdictions or unzoned areas. We originally believed that there were 169 zoning jurisdictions in Connecticut, corresponding to the 169 towns. Yet we realized we were incorrect after assembling the GIS layers and seeing that blank areas emerged or that neighborhoods with new layers appeared. In the end, we found 11 submunicipal jurisdictions: 5 private associations granted authority by special acts of the legislature; the rest boroughs, villages, or special districts granted zoning authority by special act of the Connecticut legislature.

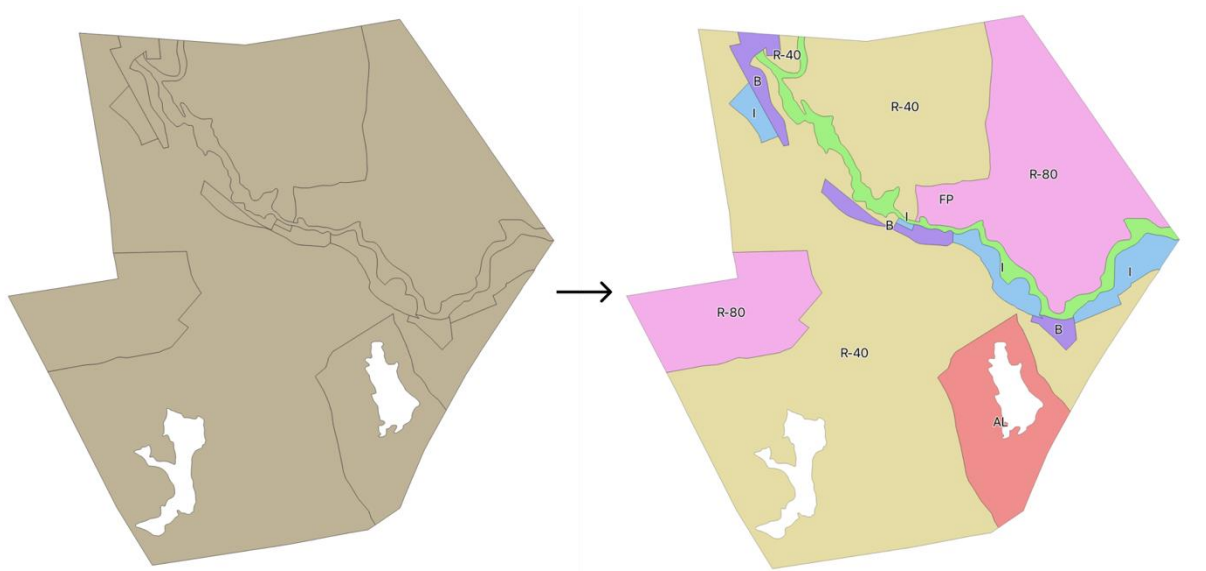
When finished, click the Save edits button.

5. Add Labels & Color

By default, QGIS will display all polygons in the same color, which is not very helpful for a visual assessment. You should assign different colors to distinct zones, and label them to see zoning better.

Double-click the layer in the Layers pane to open Layer Properties window. Navigate to the Symbology tab and select Categorized from the dropdown. For Value, choose the column that contains zoning district names (in the case of Andover above, it is AbbreviatedDistrict). In the Layer Rendering subsection, set Opacity to 50%, then press Classify followed by Apply. This will apply different colors to zoning districts with distinct names.

Navigate to the Labels tab, and select Single Labels from the dropdown. Once again, choose the appropriate column for Value, and hit Apply. The zoning should appear much clearer now.



6. Add a Basemap

A basemap can provide important context for the geospatial analysts creating the atlas.

In QGIS, navigate to Plugins > Manage and Install Plugins.... Search for "QuickMapServices" and hit Install Plugin. Once installation is complete, three buttons, including the one called QuickMapServices, will be added to the Toolbar. Click QuickMapServices > OSM > OSM Standard to add the OpenStreetMap raster layer. Because the zoning layer transparency was set up to 50% in the preceding step, you should be able to see roads and other features that help understand zoning boundaries.

In Part V.D.1., we will add a basemap for end users of the online interface.

7. Remove Slivers

Some geospatial files may contain slivers, or unwanted polygons which resulted from previous layer cropping or other vector operations. They may be large enough for you to notice along the edges, although they will typically be very small in area. To detect and remove such slivers, open the attribute table and create a new column in which you calculate polygon areas. To do so, click Open field calculator and fill in as follows:

- Output field name: area
- Output field type: Decimal number (real)
- Expression: \$area

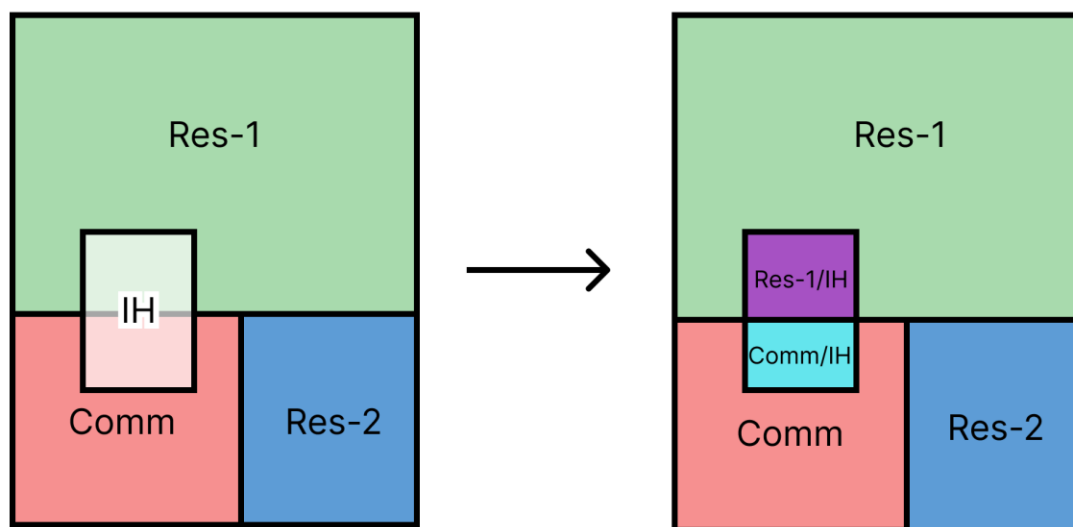
As soon as you hit OK, the new Area column will be added to the table. Sort it by clicking the column header and then inspect the polygons with the smallest areas. If any of them have areas that are 0 or very close to zero, delete them by selecting row numbers to the left of the leftmost column, and clicking Delete Selected Features. Save edits when you are finished.

You can read more about the working with the attribute table in the official QGIS guide, bit.ly/3O6rJf0.

8. Account for Overlays

In addition to regular continuous zoning districts, the geospatial file may include overlays, or special layers that fully or partially cover one or more zoning districts. The zoning code analysts will be noting Overlays in the Spreadsheet, so you will know which overlay districts modify the behavior of the underlying district. As one example, an overlay for incentive housing may allow construction of 4+ family homes in a district that would typically only allow 1-family housing. To keep the logic of the web map simple, you will need to cut zoning districts into sections that fall in and out of overlays, and adjust the names of parts of zoning districts that are overlaid.

Let's consider a hypothetical example of a zoning jurisdiction with three traditional zoning districts: Residential 1 (Res-1), Residential 2 (Res-2), and Commercial (Comm.). In the example, there is also an Incentive Housing Overlay (IH), which lies on the border of Res-1 and Comm, partially covering both.



You will need to carve out parts of the Residential 1 and Commercial districts that are overlaid, and rename them to Res-1/IH and Comm/IH to distinguish from the non-overlaid parts. If you need assistance in doing so, watch this video on advanced digitizing tools in QGIS, bit.ly/3LY2A4S. You can then delete the polygon representing the original overlay. Thus, your new zoning file contains 5 continuous polygons instead of 3 continuous + 1 overlying polygon.

9. Fix & Simplify Geometries

This step is optional.

Geospatial files may contain errors in polygon geographies that will prevent the files from opening by geopandas (discussed in the next Section). QGIS has a powerful tool to automatically detect and fix many of such issues. Ensure you have the Processing Toolbox open (Processing > Toolbox). Search for the Fix Geometries function from the Vector Geometry group. Double-click the function to open the Fix Geometries window, select your input layer, and click Run. This will create a virtual layer called Fixed Geometries, which is a copy of the original layer with fixed geometries where applicable.

For larger files, you may want to also simplify geometries to remove unnecessary points that define zoning polygons. In the Processing Toolbox, search for the Simplify function, which should also be under the Vector Geometry grouping, and double-click it. Select the correct input layer. If you just fixed the geometries, the appropriate input layer would be Fixed Geometries [EPSG:XXXX]. Choose your tolerance; the higher the value, the more points will be removed. Then hit Run. This will create a virtual layer that is the copy of your chosen input layer, with simplified geometries.

NOTE: As noted above, the atlas treats submunicipal districts as zoning districts within the municipality, tagged with a prefix that indicates the submunicipal nature of the districts. The code deals with this through the `create_id()` function definition above: from the jurisdiction name, we remove slashes and only use the part before the dash. For example, in the town of Branford, Connecticut, a “Branford - Short Beach” Jurisdiction name becomes just Branford in the display and in jurisdiction-wide calculations performed by the “% Satisfies” calculator discussed below.

10. Export as GeoPackage

Once you are done with editing, you can save your geospatial file as a GeoPackage by right-clicking the layer name, then Export > Save Features As.... Save this in the relevant dropbox folder within the gis folder. Use the conventions for naming the GeoPackage files (including state, jurisdiction, date, etc.) described in Part II.B.4.

C. MERGING GEOSPATIAL FILES WITH THE SPREADSHEET

At this stage, you should have all individual GIS files tidied and saved. Each file should have polygons that represent zoning districts, with two attributes that are common between the files: Jurisdiction and AbbreviatedDistrict. You will also have a Spreadsheet with all (or, for your test run, most) of the regulatory information you intend to display in the atlas.

In this Section, you will use geopandas (bit.ly/3js98MX), a Python library, to produce a single GeoJSON file that can be used in your online atlas. To complete this Section, you will need some Python programming experience.

Before proceeding, identify all of the districts for which the District Mapped column displays a “No.” Move the rows containing these districts to the Unmapped Districts tab of the Spreadsheet. This will ensure that you’ve kept this information for a later point, but that they aren’t cluttering your work area as you proceed to the map.

1. Using Geopandas

In principle, everything described in this section can be performed manually using QGIS or ArcGIS. Using geopandas in a Jupyter notebook, however, would allow you to create a workflow that is easily reproducible. That would make incorporating any future changes in regulations possible by simply running a script instead of performing manual manipulations, such as modifying the attributes or recalculating areas, in GIS software.

To get started with geopandas, you will need to install Anaconda, which is a suite of data science libraries for Python, followed by geopandas, bit.ly/3jv40Yp, itself.

Using Anaconda Navigator or the terminal, run this Jupyter notebook: <https://github.com/zoningatlas/combine-jurisdictions>. It contains all the necessary Python code to manipulate individual GIS files and combine them into a single GeoJSON layer for the atlas, with relevant attribute data from the zoning spreadsheet.

The notebook uses three well-known Python libraries, imported in the first cell:

- pandas (pandas.pydata.org/) to manipulate data as dataframes
- geopandas (geopandas.org/en/stable/) to read GIS files and perform geospatial operations, such as intersections and area calculations
- os (docs.python.org/3/library/os.html) to list all files in the gis folder created in Part II.B.4 above.

2. Read Individual GIS Files

The function below is used to read an individual GIS file, unite zoning districts with the same name into a single multipolygon, and calculate areas (in acres) of each zoning district. It assumes the jurisdiction name is stored in Jurisdiction column, and zoning district name is stored in AbbreviatedDistrict column. The function creates an Id column based on the two values in uppercase, separated by "--". For example, an R-1 zoning district in the city of Hartford would have an Id value of HARTFORD--R-1.

```
def read_zoning_file(
    filepath,
    juris_name_col='Jurisdiction',
    zone_name_col='Zone'
):
    try:
        # Read GIS file into dataframe
        gdf = (gpd
            .read_file(filepath)
            # remove null geometries
            .dropna(subset=['geometry'])
            # set projection to WGS 84 (lat/lon)
            .to_crs('EPSG:4326')
        )

        # Rename unnamed columns to "Unnamed"
        gdf[zone_name_col] = gdf[zone_name_col].fillna('Unnamed')

        # Create an ID column that combines jurisdiction & zone name
        gdf['id'] = gdf[juris_name_col].str.upper() + '--\'
```

```

        + gdf[zone_name_col].str.upper()

# Calculate area (in acres) for each geometry
gdf['TotalArea'] = (gdf
                    .to_crs('EPSG:6933') # reproject to equal area
                    .geometry.area
                    .apply(m2acres)
                    )

# Calculate total area by zone
total_area_by_zone = (gdf
                      .groupby('id')
                      ['TotalArea']
                      .sum()
                      )

# Combine (dissolve) geometries by zone
gdf_ = gdf.dissolve(by='id')
gdf_.TotalArea = total_area_by_zone # assign new total areas

return gdf_

except:
    print(f"Error when reading {filepath}.")

```

To read every single file in the gis folder and store the result in a single dataframe called “combined_df”, the following code can be used:

```

# Folder with all GIS files
zoning_folder = './gis'

# Read the folder to get all filenames
zoning_files = os.listdir(zoning_folder)

# Read all zones into a single pandas dataframe
combined_df = pd.concat(
    [ read_zoning_file(f"{zoning_folder}/{filename}")
      for filename in zoning_files ]
    ).reset_index()

```

To generate a zone Id from the state, jurisdiction name, and zoning district full name, use the # function as follows:

```
def create_id(s, j, ad):
    s = str(s).strip().upper()
    j = str(j).split('-')[0].strip().upper().split('/')[0] # clean up town name
    ad = str(ad).replace('-', '').upper() # clean up zone name
    return f'{s}--{j}--{ad}'
```

We use double dashes to quickly determine what is coming from which column. For example, “ct-new-haven-district-1” can be interpreted in five different ways with just single dashes. Using double dashes ensures that the state, jurisdiction name, and zoning district full name are separated.

3. Calculate Zoned Lands

For a variety of reasons, including the need to display this information on the Jurisdiction Information Box, it is important to accurately define the amount of zoned land. For ease of calculation, we settled on calculating the amount of land geopandas calculates as encompassed in the jurisdiction, minus the amount of federal and state land (such as national and state parks), as generally such land cannot be zoned.

NOTE: Some jurisdictions provide zoning shapefiles that excise roads from zoning districts, which has the specific consequence of making the total zoned area of the jurisdiction less than what would be the total jurisdiction area according to the U.S. Census. In addition, some jurisdictions include bodies of water, such as lakes and rivers, from some zoning districts, while others exclude them. Another issue is that a handful of jurisdictions exclude non-buildable area, such as area zoned for open space, from their zoned areas. In theory, someone could take the time to excise out all the streets across a jurisdiction and remove bodies of water to be consistent, but it would be incredibly time-consuming. Thus it’s fair to say we neglected to find a perfect way to reconcile these discrepancies.

For federal and state land, you will need to obtain a GIS file with polygons from a public source. As for federal lands, try the ArcGIS USA Federal Lands layer, which includes lands of the Bureau of Land Management, Bureau of Reclamation, Department of Defense, National Park Service, Fish and Wildlife Surface, and Forest Service. You should be able to get the state public lands layers from your state GIS office or state environmental agency. It is hard to list all of the possible layers for federal and state lands, because these may be kept in a variety of land types.

Once you obtain all relevant layers, dissolve them into a single shape (multipolygon) in QGIS to speed up calculations.

In addition to TotalArea calculated by the “read_zoning_file” function, we need to produce two more estimates:

- FedStateAcres, which represents the number of acres covered by federal/state zones
- ZonedArea, which is the difference between TotalArea and FedStateAcres

ZonedArea is the number we really care about.

Assuming the multipolygon with state/federal land is located in federal-state-singleparts.geojson, we can estimate ZonedArea using the following code:

```
# Read federal-state-land GeoJSON
fed_state_land = gpd.read_file(
    './federal-state-singleparts.geojson'
).to_crs(epsg=4326)

# Intersect with all zones
fed_state_land_ = gpd.overlay(
    combined_df,
    fed_state_land,
    how='intersection'
)

# Calculate acres
fed_state_land_['FedStateAcres'] = (fed_state_land_
    .to_crs(epsg=6933)
    .geometry.area
    .apply(m2acres)
)

# Account for repeating zone IDs
fed_state_land_ = (fed_state_land_
    .dissolve(by='id', aggfunc={'FedStateAcres': 'sum'})
    .reset_index()
    .filter(['id', 'FedStateAcres'])
)

# Add federal/state area per zoning district
combined_df = combined_df.merge(
    fed_state_land_,
    on='id',
    how='left'
)

# Calculate municipal (=zoneable) acres
combined_df.FedStateAcres = combined_df.FedStateAcres.fillna(0)
combined_df['ZonedArea'] = combined_df.TotalArea - \
    combined_df.FedStateAcres
```

NOTE: In Connecticut, the submunicipal jurisdictions fit neatly within town boundaries, so the Jurisdiction Information Box calculations for a single town may show combined totals for as many as three different submunicipal districts, in addition to the primary local government. (Such is true in Groton, where there are four jurisdictions: the Town of Groton, the City of Groton, Groton-Long Point, and Groton-Noank.). Members of the public will not need to distinguish between these various types of political subdivisions, so for simplicity's sake, we collapsed submunicipal jurisdictions in the display and in these area calculations into the larger jurisdiction.

4. Read Zoning Regulations in a Dataframe

You are now ready to read zoning regulations from the Spreadsheet into a “pandas” dataframe, which can later be merged with zoning polygons using the common Id column. In this step, the Tooltip Notes column will also be prepared to appear in the Jurisdiction Information Box, the white box which will appear when a user clicks within a jurisdiction.

```
spreadsheet_path = './gis-districts-zoning-data.csv'

zoning = pd.read_csv(spreadsheet_path)\
    .loc[:, 'Jurisdiction': 'Tooltip Notes']

zoning['Tooltip Notes'] = zoning['Tooltip Notes'].fillna("")

# Remove spaces from column names
zoning.columns = [x.strip() for x in zoning.columns.tolist()]

# Trim all strings in the dataframe
str_columns = zoning.select_dtypes(['object'])
zoning[str_columns.columns] = str_columns.apply(lambda x: x.str.strip())

# Generate zone ID
zoning['id'] = zoning.Jurisdiction.str.upper() + '--' + zoning.FullDistrict.str.upper()
```

5. Derive New Columns in Zoning Regulations

You need to simplify and combine certain columns in the Spreadsheet into values that can be easily interpreted by the web map. For example, to determine if regulations limit the maximum size of accessory dwelling units (ADUs), you will need to look at the values of two columns – the ADU Max. Size (% of Main Unit) and ADU Max. Size (SF) columns – to decide if the value of the AduMaxSizeLimit column should be `True` (maximum size is limited by regulations) or `False` (no limit is mentioned in regulations), as follows:

```
zoning['AduMaxSizeLimit'] = \
    ~zoning['ADU Max. Size (% of MAIN UNIT)'].isna()
```

```
| ~zoning['ADU Max. Size (SF)'].isna()
```

The Jupyter notebook lists all the manipulations necessary to create new fields.

Once all new fields are created, you can merge zoning data with the zoning polygons into a new dataframe called “final” using the “pandas” merge function:

```
final = combined_df.merge(zoning, on='id', how='left')
```

6. Additionally Process Overlaid Zones

In the previous section, you split zoning districts covered by overlays into sections, and renamed those sections that are covered by an overlay. As a result, these “new” zones could not be matched on the Id. To fix this, you will need to create an “overlay” function that combines regulations from two zoning districts (with the overlay's regulations taking precedence), and apply that function to all such zones.

An example of such function is shown below (the actual implementation in Jupyter is slightly longer, as it performs additional checks and renaming). This function acts directly on the “final” dataframe.

```
def overlay(juris, zone, base=None, overlay=None, sep='/'):
```

```
    if not base:
```

```
        base = zone.split(sep)[0].strip()
```

```
    if not overlay:
```

```
        overlay = zone.split(sep)[1].strip()
```

```
    col_from = 'Type of Zoning District'
```

```
    col_to = 'PK' # Parking text column created above
```

```
    # Get proper zoning values from the spreadsheet
```

```
    base_values = zoning.loc[
        zoning.Jurisdiction.eq(juris)
        & zoning.FullDistrict.eq(base),
        col_from : col_to ].values
```

```
    overlay_values = zoning.loc[
        zoning.Jurisdiction.eq(juris)
        & zoning.FullDistrict.eq(overlay),
        col_from : col_to ].values
```

```

base_values = base_values[0]
overlay_values = overlay_values[0]

combined_values = [ o if (o == o and o != " and o != 'Overlay')
                    else b for b, o in zip(base_values, overlay_values) ]

final.loc[
    final.Jurisdiction.eq(juris)
    & final.AbbreviatedDistrict.eq(zone),
    col_from : col_to ] = combined_values

```

If you used the “/” separator to separate underlying district names and overlay names, you can run the function by simply passing the jurisdiction and zoning name. The two function calls below are equivalent:

`overlay('Hartford', 'MX-1/Campus Overlay')` Should these be single quotation marks?

```

overlay(
    'Hartford',
    'MX-1/Campus Overlay',
    base='MX-1',
    overlay='Campus Overlay'
)

```

7. Shorten Column Names & Save to GeoJSON

Finally, you can shorten attribute names for polygons to keep the output file tidy, and JavaScript code for the web map concise. For example,

```

cols_xwalk = {
    ...
    'ADU Restricted to ONLY Primary Structure (i.e., No Outbuildings like Garages)':
    'APrim',
    'AduMaxSizeLimit': 'ASize',
    ...
}

```

You can also shorten values, for example "Allowed/Conditional" → "A", or "Mixed with Residential" → "M":

```

# Values to shorten
vals_xwalk = {
    'Allowed/Conditional': 'A',

```

```

'Public Hearing': 'P',
'Prohibited': 'X',
'Primarily Residential': 'R',
'Mixed with Residential': 'M',
'Nonresidential': 'N',
}

```

Once renamed, filter the “final” dataframe to only include the relevant columns, and save as a GeoJSON. You can use a built-in “simplify” function in geopandas.

```

(final
  .filter( list(cols_xwalk.keys()) + ['geometry'] )
  .rename(columns=cols_xwalk)
  .replace( vals_xwalk )
  .assign(geometry=lambda df_: df_.geometry.simplify(0.00004))
  .to_file('./final.geojson', driver='GeoJSON')
)

```

D. FINALIZING THE MAP

Finally, you’re ready to take your cleaned and merged files and put them online. You will be using Leaflet.js, a free and open-source JavaScript library for web mapping. This Quick Start Guide, bit.ly/3K0tOuV, is an excellent starting point if you haven’t used Leaflet before.

The map is reliant on the GeoJSON you generated in the previous section. The file has all relevant attribute data attached to each zoning district, so very few additional JavaScript computations are needed. Leaflet can efficiently load and display a GeoJSON of up to ~100Mb, which should be enough to show zoning in a single state.

If you want faster load times, consider using a compressor tool such as minify-geojson, npmjs.com/package/minify-geojson, which limits coordinate precision, and removes unnecessary blank spaces. You can limit the precision to 5 decimal point, which is about 1 meter. In addition, you can simplify the GeoJSON geometries using Mapshaper (mapshaper.org/) or QGIS (bit.ly/3uxml8a).

If your GeoJSON is much bigger than 100Mb, you will need to use a platform such as Mapbox Tiling Server, mapbox.com/mts, or ArcGIS Online to host it as vector tiles.

The front-end code is located in this GitHub repository: <https://github.com/zoningatlas/web-map>. You will be dealing with two main files:

- index.html loads all JavaScript and CSS, defines filters (checkboxes), and the map itself. The in-line CSS is from the tachyons (tachyons.io/) library.

- `js/map.js` initializes the map, loads and styles the GeoJSON, and adds logic to the user interactions, such as filtering behavior.

To complete this Section, you need to be familiar with front-end web development (HTML, CSS, and JavaScript).

1. Initialize the Map

The first step is to initialize the map, and center it around your geographic area of focus. The map is initialized using `L.map()` function:

```
const map = L.map('map', {
  zoomControl: false,
  tap: false,
  maxZoom: 15,
}).setView([41.5744, -72.67], 10); // center on Connecticut
```

You can then add a zoom control to the top-right corner of the map:

```
L.control.zoom({ position: 'topright' }).addTo(map);
```

To support the comprehension of end users, we suggest including both a traditional map and satellite imagery as your basemap, which can also enable people to search by address. We recommend using a popular CartoDB Positron, at bit.ly/3E6UFji, layer without labels, as it is clean and does not interfere with the zoning polygons that will be added later:

```
var cartoTiles = L.tileLayer('{s}.basemaps.cartocdn.com/light_nolabels/{z}/{x}/{y}{r}.png', {
  attribution: '&copy; OpenStreetMap contributors &copy; CARTO',
  href="www.openstreetmap.org/copyright">OpenStreetMap</a> contributors &copy; <a href="carto.com/attributions">CARTO</a>',
  subdomains: 'abcd',
  maxZoom: 19
}).addTo(map);
```

You can add other baselayers, such as Esri satellite imagery, and create a switch between the layers like this:

```
var esriTiles =
L.tileLayer('server.arcgisonline.com/ArcGIS/rest/services/World_Imagery/MapServer/tile/{z}/{y}/{x}', {
  attribution: 'Tiles &copy; Esri &mdash; Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, UPR-EGP, and the GIS User Community'
});
```

```
// Add base layer switch
L.control.layers({
  'Map': cartoTiles,
  'Satellite': esriTiles
}, {}, {
  position: 'bottomright',
  collapsed: false
}).addTo(map);
```

2. Load the GeoJSON

The GeoJSON is loaded in js/map.js using jQuery's “\$.getJSON()” function, passing the contents of the file to the “loadZones” function.

```
$.getJSON('./data/final.20220315.geojson', loadZones);
```

You can inspect the function in the source code. The function colors polygons (zoning districts) according to the “style” function:

```
var zone2color = {
  'R': '#645097', // primarily residential, satisfied
  'M': '#815196', // mixed with residential, satisfied
  'N': '#BA6CA4', // nonresidential, satisfied
  'NS': '#d0d0d0', // not satisfied
}

var style = function(filters, feature) {
  var opacity = $('input[name="opacity"]').val() / 100;

  return {
    fillOpacity: opacity,
    fillColor: satisfiesFilters(filters, feature) ? zone2color[feature.properties[zType]] :
    zone2color['NS'],
    weight: 0
  }
}
```

The “style” function is, in turn, relying on “satisfiesFilters” function which returns “True” if a given polygon satisfies current filtering criteria (user-selected checkboxes) according to the polygon's attributes, and “False” otherwise.

3. Create Filters

At the heart of the zoning atlas is what we call filtering. Filtering is a set of checkboxes that end users can select to modify the display of the zoning districts. The districts that satisfy selected zoning criteria are shown in their original color, and those that don't are shown in grey.

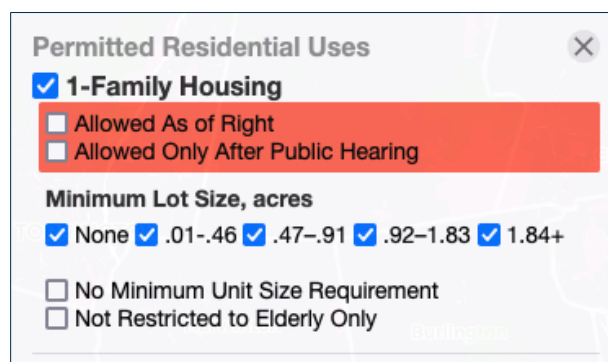
Checkboxes are designed to be "restrictive" and serve as constraints. In other words, the more checkboxes you click, the fewer zoning districts should satisfy the criteria. This is why a checkbox should say, "Not restricted to elderly" as opposed to "allows elderly", but "Accessory dwelling units allows renters" as opposed to "do not allow renters." By default, no checkboxes are checked, and all zoning districts appear to "satisfy" the filtering criteria.

All filters are checkboxes (HTML's `<input type="checkbox">` elements), and are defined in `index.html`. Checkboxes have a "Name" and a "Value" attribute, which specify which attribute in GeoJSON they apply to, and which value to expect if the polygon is to "satisfy" the filter.

For example, if you want the user to be able to see only those districts that allow construction of 3-family homes (attribute ``3F`` in the GeoJSON) after public hearing (abbreviated as ``P`` in the GeoJSON), use the following HTML code:

```
<input type="checkbox" name="3F" value="P">
```

Checkboxes can be grouped and hidden behind a parent checkbox with a class `.main-in-group`. For example, a top-level 1-Family Housing checkbox, when clicked, opens a subgroup that consists of 9 other checkboxes, from "Allowed as of Right" to "Not Restricted to Elderly Only". Those checkboxes, in turn, can be further combined into an `.at-least-one-checked` group. This warns users that at least one checkbox should be checked by highlighting the group in red if none are. For example, if the user checks a top-level 1-Family Housing checkbox but unchecks both Allowed As of Right and Allowed Only After Public Hearing, the red highlight will appear as such filtering is contradictory to common sense.



Permitted Residential Uses [X]

☒ **1-Family Housing**

☐ Allowed As of Right

☐ Allowed Only After Public Hearing

Minimum Lot Size, acres

☒ None ☒ .01-.46 ☒ .47-.91 ☒ .92-1.83 ☒ 1.84+

☐ No Minimum Unit Size Requirement

☐ Not Restricted to Elderly Only

Add `.checked-by-default` CSS class to those filters you want checked on start.

4. Design the “% Satisfies” Calculator

One of the most useful features of the National Zoning Atlas will be the ability to see what percentage of zoned area allows certain types of housing in a municipality (jurisdiction). This will be displayed in the Jurisdiction Information Box, a pop-up window in the top-middle of the atlas that appears when a user clicks the map. These instructions will help you create this Jurisdiction Information Box.

When the “loadZones” function creates the main GeoJSON layer with zoning districts, you need to add 'on click' event listeners to each layer (polygon) that will define the map's behavior when a zoning district is clicked.

As soon as zoning district is clicked, the map establishes which jurisdiction the district belongs to, and stores the name of the jurisdiction in the “jurisdictionActive” variable. The acreage calculations can be performed in “calculateActiveArea” function and look like the following:

```
...
dataLayer.eachLayer(function(l) {
    if (l.feature.properties[zJurisdiction] === jurisdictionActive) {
        totalAcres += l.feature.properties[zAcres] || 0;
        if (satisfiesFilters(filters, l.feature)) {
            satisfiesAcres += l.feature.properties[zAcres] || 0;
        }
    }
});
...
```

In the code block above, “dataLayer” is a Leaflet GeoJSON layer that contains all zoning districts as polygons. We iterate through all zoning districts; for those that belong to the “jurisdictionActive”, we aggregate total jurisdiction acres in “totalAcres” variable, and we aggregate acres of the districts that satisfy filtering criteria (as determined by the “satisfiesFilters” function) in the “satisfiesAcres” variable.

Then, we can calculate the percentage, rounded to 1 decimal, using a simple formula:

```
var satisfiesPerc = (satisfiesAcres / totalAcres * 100).toFixed(1);
```

We can then populate the <div> element of the calculator using jQuery:

```
$('#activeAreaCalculator').html( ... );
```

In addition to showing the acreage, this calculator can be useful to show demographic data. In the Connecticut Zoning Atlas, we show median household income, percent of population

identifying as BIPOC (non-white), and percent of population who are cost-burdened in the Jurisdiction Information Box, the white box that pops up when a user clicks within a jurisdiction.

The variables are placed inside a demographics.js file that has the following structure:

```
var demographics = {
  "Bethel": {
    "income": 101968,
    "bipoc": 19.0,
    "burdened": 34.3
  },
  "Bridgeport": {
    "income": 46662,
    "bipoc": 80.0,
    "burdened": 52.9
  },
  ...
}
```

It was generated using this Jupyter notebook, <https://github.com/zoningatlas/get-demographics>, and loaded in index.html along with other JavaScript files. One can retrieve median household income for the currently selected municipality using:

```
demographics[jurisdictionActive]['income']
```

5. Add Transit, Federal/State Land, & Other Layers

Your atlas will benefit from more context, including the following three features:

- Federal and state public lands
- Waterways, including rivers and lakes
- Transit stations

The first two features can help illustrate lands not subject to zoning. Portraying these in green and blue, respectively, can help people visually see how much land is dedicated to open space and natural features. We have indicated above where to find the federal and state public land layers. You should be able to get the waterway layers from your state GIS office or state environmental agency. And for transit stations (which for Connecticut included passenger rail and bus rapid transit stations), try your state transit authority or department of transportation.

To add any of these layers, save each as a GeoJSON file to the “data/” folder. Then in js/map.js, create a function that would load this file and style it appropriately. For federal and state land, for example, we can do the following:

```

var loadFederalState = function() {

$.getJSON('./data/federal-state.min.geojson', function(geojson) {

var stripes = new L.StripePattern({
  height: 2,
  width: 2,
  weight: 1,
  spaceWeight: 1,
  angle: 30,
  color: '#5cc649',
});
stripes.addTo(map);

overlays['fs'] = L.geoJSON(geojson, {
  interactive: false,
  stroke: false,
  pane: 'overlays',
  style: {
    fillOpacity: 1,
    fillPattern: stripes
  }
});

});
}

```

Make sure to call this function once the map is initialized: “loadFederalState()”.

6. Host for Free on Github Pages

Your zoning atlas does not have a back-end, so you choose any of the many free hosting providers. We recommend GitHub Pages (pages.github.com/), although Netlify (netlify.com/) or AWS S3 (aws.amazon.com/s3/) are good alternatives.

Sign up for a GitHub account (github.com/signup) if you don't already have one. Create a new repository and move the map/ folder there. Go to Settings > Pages tab, then use the main (or master) branch as a Source. After you hit Save, GitHub will generate a URL with your map available to view for all. This is the URL you can embed in your website for the general public to view.

VI. CONCLUSION

You're now up and running with your zoning atlas, with a significant amount of substantive information in the Spreadsheet, a file full of relevant documents, a clean and merged collection of shapefiles to match, and an online public interface. Congrats!

How to Make a Zoning Atlas was intended to encourage and empower you to embark on the process of creating a zoning atlas for your town, region, or state. We wish we could say we followed the orderly instructions laid out here, but the reality is that the path described here was clearest only in retrospect.

We end with a cautionary note: zoning codes change. Even if you are successful in assembling all relevant data, your atlas will quickly become obsolete if you do not develop a system for updating it. We suggest:

- Contacting staff planners on the Jurisdiction Information tab of your Spreadsheet every six months and asking them for updates
- Setting up an email address or webpage so that planners and the public can proactively make your team aware of any errors
- Identifying a single person charged with collecting and effectuating both textual and graphic updates. If you have an independent data visualization team, as we did, be sure you fairly anticipate and communicate your future needs for their time.

In addition, special efforts must be made after any statewide enabling act change that affects the jurisdictions in your atlas. If this happens, you should comprehensively update relevant components of your atlas. For example, in Connecticut, after we completed the Connecticut Zoning Atlas, the state legislature passed a law legalizing accessory dwelling units, unless a jurisdiction opted out by supermajority votes of its planning and zoning commission and legislative body. As different jurisdictions responded to this new state law, we updated our atlas.

A full update to the data should be done every three to five years.

Thank you for collecting zoning data in your community. With your help, we can get one step closer to a national zoning dataset that can help us better understand the impact of zoning, and in turn help us make better decisions about the regulatory constraints that dictate our lives.

**NATIONAL
ZONING
ATLAS**

www.zoningatlas.org