Build-Out Analysis

Projecting the Impact of Current Law on Future Development

PENNSYLVANIA LAND TRUST ASSOCIATION

A build-out analysis projects the development that could occur in an area under current law. It enables a community to test the reality of its development regulations against its vision for its future.

Introduction 1
Conservation Impact 1
Challenges 1
The Basics of a Build-Out Analysis 2
  Two Phases 2
  GIS 2
  Future Street Scenes 2
  Scale 2
Conducting a Build-Out Analysis 2
  Micro-Scale Analysis 2
  Large-Scale Analysis 4
  Other Options 4
Response to Results 5
Resources at ConservationTools.org 5

Introduction

A build-out analysis answers basic questions: If existing land development ordinances and open space programs (or lack thereof) remain unchanged, how much land might ultimately be developed? At what density and where? And with what impact on the community?

Residents often assume that their community's zoning regulations will prevent inappropriate development, but zoning regulations often allow development on *all* buildable land. A build-out analysis projects the maximum residential and commercial development allowed under law in a given area. Analysis can also explore the impact of development on things like tax base, traffic, school enrollment, natural and historic resources, and quality of life. The results are usually conveyed through maps and charts.

By providing a glimpse of a potential future, a build-out analysis shows the implications of existing development regulations and raises important questions for a community. Are beloved natural or historic resources threatened? What steps should be taken to accommodate future growth? Do current municipal regulations match the community's aspirations? The findings enable local leaders to better plan for the future and alter municipal regulations and open space protections to shape a more desirable development path.

Build-out analysis has long been used by local governments. Examples of analyses are provided with the on-line edition of this guide.

Conservation Impact

Because a build-out analysis evaluates the long-term consequences of a municipality's ordinances, it shows much more development occurring than residents—who may be unaware of local zoning rules, or haven't considered their implications—generally expect. By painting a picture of how current zoning laws could result in undesirable changes to the community, an analysis can inspire citizens, officials, and local organizations to advocate for changes to municipal regulations so that open space and particular places important to communities are protected from development. An analysis can also inspire the establishment or expansion of a municipal open space protection program.

Challenges

A build-out analysis is only effective if municipalities use the findings to revise land use ordinances and/or inform future growth. If the analysis is not attached to a specific point in time, it may not provide a clear timeframe or sense of urgency for implementing changes. In some cases, the analysis faces a negative reaction because people believe that a full build-out scenario will never actually occur.

While a build-out analysis can be conducted by people with no expertise or special tools, familiarity with fiscal impact analysis and access to geographic information system (GIS) software is extremely helpful. Municipalities or organizations with minimal staff and resources may find the process to be more challenging. See "Conducting a Build-Out Analysis" below for more information.

The Basics of a Build-Out Analysis

Two Phases

There are typically two phases in conducting a build-out analysis:

- Phase I visually depicts changes on a map and measures additional housing units and non-residential square footage that could be built under existing zoning regulations.
- Phase II quantifies the impact of the additional development. A summary presents the critical information and conclusions in an easy-to-understand way.

GIS

Though not necessary, a geographic information system (GIS) is often used to conduct an analysis. GIS allows users to combine, manage, manipulate, and analyze data in ways that are difficult or impossible with traditional maps. GIS can be used to determine the number of additional dwelling units that could be built on developable land under the existing zoning regulations, or provide a model for electronically layering maps to let viewers easily visualize where development in a community might occur. Depending on the software, analysts can then share this information online to be viewed by anyone (including those without GIS software.)

Future Street Scenes

If a community wants to take the analysis one step further, a graphic artist can prepare sketches of possible future street scenes based on Phase I results. CommunityViz®, a GIS-based planning tool, also has the capability to construct street scenes. See the guide *CommunityViz®* for more information.

Scale

Users must determine the scale at which they will conduct the analysis. While more comprehensive analysis generates more accurate and detailed results, it also requires the investment of greater resources (both time and money), as well as more data inputs.

In a more comprehensive (micro-scale) analysis, each parcel in the area is analyzed individually to account for zoning requirements and actual physical constraints, producing the most accurate results. A simpler (but still generally accurate) approach involves estimating the physical constraints using parameters applied equally across the study area.

In a less comprehensive (large-scale) analysis, parcels are not analyzed individually; instead, they are categorized by zoning district or other criteria, and each category is evaluated as a whole. Although this approach is useful for those with limited resources and/or data availability, its accuracy and effectiveness depends on how it is used. For example, this level of analysis will not allow a community to know where exactly development can occur.

See the paper "Build-Out Analysis in GIS as a Planning Tool With a Demonstration for Roanoke County, Virginia" by Mary A. Zirkle for more information about scale.

Conducting a Build-Out Analysis

Community planners, engineers, or laypersons can conduct an analysis. If a goal is to calculate fiscal impacts, fiscal impact expertise is desirable. Access to GIS software or GIS-based community planning tools like CommunityViz®, while not necessary, is helpful. Municipalities or organizations that lack the knowledge or time to conduct their own analysis may determine that hiring a consultant is the best strategy.

This section describes the different approaches to analysis that a community can take.

Micro-Scale Analysis

Phase I

First, construct a base map of the specified area. The base map should show the basics, such as:

- the perimeter of the area
- north arrow
- scale of the map
- existing roads
- surface water (lakes, rivers, streams)
- zoning districts.

The base map should delineate land that:

- cannot be developed due to public ownership, deed restrictions, and utility easements.
- cannot be developed due to environmental constraints such as wetlands, floodplains, or steep slopes. (Do not include steep slopes that could be graded into developable land.) Some parcels may be partially developable, due to restrictions such as utility easements.
- has already been developed with existing structures and lot lines.
- will be developed in the near future (indicated by building proposals expected to be approved shortly, approved building proposals, and land under construction). Add this new development to the new development estimated from the build-out analysis to determine the total number of new housing units and non-residential square footage. The total number of new housing units and non-residential square footage is used to determine future impacts.

After creating the base map, the next step is to create overlay maps that show land that could be developed further. Then, calculate what development may occur by applying the zoning regulations to the total acres developable. This will yield total buildable dwelling units and/or total buildable non-residential square feet by zoning district.

- For land zoned residential, apply road standards and minimum lot size and frontage requirements as if the land was developed to the maximum extent allowable. Subtract 10% from the developable residential zoning districts to account for streets and infrastructure, with the remainder equaling the net total acres developable by zoning district.
- For land zoned commercial, apply the largest amount of floor space allowed under the zoning regulations.
- For a mixed-use district, assume the greatest percentage of non-residential uses and higher density residential uses permitted per development.

Communities with lots of undeveloped or underdeveloped land may want to create staggered overlays showing the possible progression of growth. For instance, the first overlay might show growth along major roads and on large parcels. The next might show growth on the next most desirable parcels. The last could show growth on the least desirable parcels.

Phase II

Phase II is a quantitative analysis of the impact of the changes detailed in Phase I. Impacts to calculate might include changes in:

- the amount of impermeable surface, which impacts water quality
- acreage farmed
- jobs
- population/number of school-age children
- housing units/housing density
- traffic
- tax revenues
- demands on schools, water supply, sewage, electrical production, police force, etc.

Convert the number of additional dwelling units to population based on current or projected household sizes per municipality. Convert the number of additional non-residential square feet to employees based on employment generation standards from *The Fiscal Impact Handbook* by Robert W. Burchell and David Listokin.

The following standards can be applied to a district's most prominent uses:

- Shopping Centers: 1 employee per 500 SF gross leasable area
- Offices: 1 employee per 250 SF net leasable area
- Industrial Plants: 1 employee per 300 SF net leasable area
- Warehouses: 1 employee per 750 SF gross leasable area.

Additional Impact Analysis

Depending on the priorities and capacity of the community, additional analysis may be pursued. For

example, the community might investigate the impacts of:

- allowable building heights on scenic views
- development on noise levels
- increased automobile use on parking needs and resulting spillover parking onto streets or other parking lots.

Large-Scale Analysis

A large-scale build-out analysis is typically constructed using GIS to determine the number of additional dwelling units and non-residential square feet that could be built on developable land in the study area under the existing zoning regulations.

Phase I

First, gather GIS data sets, including parcel data, land use, environmental constraints such as floodplains and wetlands, and zoning districts. Calculate the acreage of developable land[1] by zoning district. Then, for each zoning district, subtract:

- the acreage of environmentally constrained land[2] from the developable acres
- land where development is in progress, or a development application has been approved
- in residential zones, an additional 10% to account for streets and infrastructure.

The remainders are the net total acres developable by zoning district.

Apply the particular zoning regulations of each district to the net total acres for that district to determine the total buildable dwelling units and total buildable non-residential square feet. This requires many assumptions in interpreting the zoning regulations; for example, in a mixed-use district, assume the greatest percentage of non-residential uses and higher density residential uses permitted per development. Then, add the actual data from land where development is in progress or approved (if available).

To calculate the achievable Floor Area Ratio (FAR), which is often different than the permitted FAR, use the formula:

$$FAR = \frac{Impervious\ Coverage\ Ratio}{\frac{1}{\#\ of\ stories} + \frac{400\ SF}{Parking\ Ratio}}$$

Impervious Coverage Ratio: The maximum percentage of the site that may be covered by impervious surfaces (buildings, parking lots, driveways, etc.) stated in the zoning ordinance.

Number of Stories: Manufacturing and warehousing-type uses are always assumed to be built as one story. Likewise, retail is assumed to consume one floor only. Generally, only offices are likely to be built on more than one story, for which the maximum number of stories permitted, stated in the ordinance, should be used.

400 SF (square feet): A standard amount of impervious coverage per parking space, aisle, and associated driveway space.

Parking Ratio: The ratio stated in the zoning ordinance per gross square feet of building space. For example, a common parking ratio requirement for office use is one space per 200 SF of building space. The parking ratio in this case would be 200, meaning 200 SF per one parking space.

Phase II and Additional Impact Analysis

The quantitative analysis component of a large-scale analysis is similar to that of micro-scale analysis; however, conclusions will be less exact due to the generalized, less accurate nature of the data inputs.

Other Options

For a step-by-step guide to conducting a build-out analysis by hand, using paper maps and drafting tools instead of computer software, see Jeff Lacy's "Manual of a Build-Out Analysis" (1990). Though old-fashioned, this method is still valid.

[1] All undeveloped land (vacant, wooded, and agricultural) and land deemed appropriate for redevelopment is considered "developable" for purposes of this calculation.

[2] Floodplain, wetlands, steep slopes, and other areas that regulations deem unsuitable for development are considered "environmentally constrained."

For instructions to alternative GIS-based methods, including using the CommunityViz® tool, see "About Buildouts: A Brief Guide to Buildout Analysis, and Why and How to do Them" (2008). This technical report analyzes data from a single town using three different methods, ranging from simple to complex. Readers can compare the difficulty and accuracy of each method, and see how actual numbers are used in the calculations.

Response to Results

The level of development potential identified by an analysis often frightens people, who never thought their community could absorb so much growth. The traditional fix is to reduce development by down-zoning;[3] however, this method is problematic because owners of undeveloped land may protest the potential loss of property value. And while it may reduce the density of development, it may accelerate the consumption of land for development and introduce other problems. Zoning changes that utilize Transfer of Development Rights, Conservation by Design, and Traditional Neighborhood Development can be more effective approaches to managing future development pressure.

Resources at ConservationTools.org

To find related resources, see the right column of the on-line edition at:

http://conservationtools.org/guides/42.

***

[3] Down-zoning means modifying a zoning ordinance to reduce the number of residential lots or non-residential square feet that are permitted to be built in a given area.

Submit Comments

Help improve the next edition of this guide. Email your suggestions to the Pennsylvania Land Trust Association at aloza@conserveland.org. Thank you.

Acknowledgements

A substantial portion of the first edition's text was quoted directly or adapted from the U.S. Environmental Protection Agency website (2009). Patty Elkis, PP, AICP, of the Delaware Valley Regional Planning Commission prepared the initial draft, and PALTA staff prepared the final draft. Nate Lotze greatly reworked the guide for its second edition, restructuring it and adding new material; Andrew M. Loza edited it.

The Pennsylvania Land Trust Association published this guide with support from the William Penn Foundation and the Community Conservation Partnerships Program, Environmental Stewardship Fund, under the administration of the Pennsylvania Department of Conservation and Natural Resources, Bureau of Recreation and Conservation.