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City of Fort Collins
BLIP - Buildable Land Inventory Project

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Paper Abstract

The City of Fort Collins, Colorado has developed a procedure to create, track, and maintain an inventory of vacant and buildable land inside the urban growth area. Ideally, this would be a clean and seamless system that would be updated as needed. But in reality, it is a time consuming assembly of various data from different sources that needs to be cleaned, massaged, and wedged into a GIS format. Then the fun begins. The data is run through a series of geoprocessing procedures that create the buildable land inventory.

City Statistics

The City of Fort Collins is located at the eastern foot of the Rocky Mountains in the northern part of the Colorado Front Range. The population of Fort Collins is currently estimated to be about 130,566 with a growth rate of 2.9 percent in 2003.

BLIP Summary

City Plan is a long-term comprehensive planning tool, implemented in 1997. This plan is designed to manage the growth and development of the City over 20 years. It contains a mechanism evaluate. The buildable land inventory is one of those indicators. The buildable land inventory is set of GIS data and development assumptions that ultimately provide the City with an estimate of how much time the City has before it experiences a build-out situation in terms of population growth, jobs and housing demand. The BLIP is an on-going project that is updated annually, by City Planning staff and GIS staff. This paper discusses the processes that occur to assemble and update this information, and ultimately describes why the City does this.

City Plan

A key issue for the City is how to manage growth in light of significant development pressures and a historically high rate of population growth. The most important policy tool for managing growth is City Plan, Fort Collins' comprehensive plan (1). The Plan provides guidance for the growth of the City over the next 20 years.   It attempts to retain a high quality of life for existing residents as well as provide for a logical, compact development pattern.

In addition to setting policy, City Plan establishes a system of performance measures to track how well policies are being implemented.   This is done through a systematic process called the City Plan Monitoring Project (CPMP). The CPMP consists of a biannual report containing seventeen performance indicators that relate directly to City Plan goals and policies (2, 3). The intent is to assess the City's progress towards

achieving the goals of the Plan, provide justification for amending the Plan, and to assess the need for changes in implementation measures.

Monitoring indicators report on population, land use, employment, housing, environment, and transportation factors.   One of the most critical indicators, land absorption, tracks the amount of vacant land remaining in the City's GMA (Growth Management Area).   This indicator provides information on the growth potential in the City's various zoning districts and, based on population growth projections, how quickly land will be absorbed into housing and employment.   This indicator has proven to be very valuable in answering community-wide questions; such as whether or not a balance between housing and employment will be retained in the future as well as project specific issues that would include the impact of rezoning employment land to residential land. The Buildable Lands Inventory is the mechanism for tracking vacant land absorption.

Buildable Land
Buildable land is defined as undeveloped land inside the GMA minus floodplains, zoning, and other natural resource constraints. A further refinement to the dataset is the application of development assumptions. This dataset provides a fairly accurate depiction of what areas are considered developable. It is important to consider that there is a certain amount of error introduced during the process, so we use this information to develop capacity estimates only. This is updated periodically by gathering and assembling a series of GIS data starting with vacant land.

Vacant Land Inventory
To assemble the buildable land inventory, we started with determining what land is vacant. That data is then shaped into the buildable land inventory incrementally by applying additional GIS layers to that dataset.

The inventory was first created through a base dataset of land use using assessor's abstract codes. Types of uses, size of parcels and other factors were considered in determining vacancy. This provided a generalized current condition of the land.

Each year, we apply new development projects to this dataset that have occurred over the past year. Development projects are large sections of land that have gone through the City development process and are approved for construction, like a subdivision of houses, or a shopping plaza. These areas are removed from the vacant land inventory, although recent housing units approved by the City are later factored into the supply of future residential development potential. In addition, building permits are used as another indication of development activity.   Permits are geocoded and matched against vacant parcels to remove individual lots from the inventory

Public land is another factor in determining non-developable land. The City makes considerable purchases of open space each year through its natural areas program, so it's important to track these areas and remove them from the inventory. Public land is overlaid on top of vacant lands and removed from the inventory.

Finally, vacant land status is verified by reviewing any recent aerial photograph, which helps to identify any development that might have been missed during the all-too-human effort of collecting and tracking information. This last step is the most laborious step but extremely valuable because it allows site verification without extensive field work.

Natural Resource Constraints

There are several sources of constraints that are applied to the inventory. These are what help determine if the vacant land is buildable and to what extent. The types of natural constraints typically encountered by developers include floodplains and natural habitats and features. Each of these have been mapped and disaggregated into subsets – floodways and floodplains for separate drainage basins and various types of habitats and features such as wetlands, riparian areas, grasslands, etc. The City has extensive land use and stormwater regulations tied to these mapped resources. These regulations help to determine the development potential for each area.

The constraints are applied to the refined vacant land dataset through a slicing and dicing process. Vacant land is disaggregated from parcels into chunks of constrained and unconstrained land, each coded to indicate the type of constraint (See Attachment A).

Most vacant land is still considered buildable even when constrained, but some types of contraints limit development more than others. We assume that each type of constraint reduces down the development potential by a specific percentage. In some cases this percentage is tied to a specific development regulation while in other cases it is a best guess or based on past experience. For instance, the Poudre River floodway is assumed to allow no development per City regulations, while other floodplains are assumed to allow 50% development, which is not specifically identified in the regulations.

Often many different types of constraints overlap. In these cases, the most constrained resource is used to determine the actual development potential of a specific parcel of land. For example, a chunk of vacant land within a floodplain allowing 50% development value, and a natural habitat providing 10% development value would retain only 10% of its development value based on the maximum constraint.

Zoning

Zoning provides the ultimate determination of the types and intensity of land uses on each parcel of vacant land. Like natural resource constraint process, the refined vacant land is assigned to its underlying zone district.

A series of assumptions were created for each zone district in order to calculate potential housing unit and employment yield (See Appendix A). These assumptions address factors including split between residential and commercial uses, netting out of arterial streets and outdoor spaces, and density expressed in dwelling units per acre or square feet per employee.

Calculation of Development Yield
The development yield represents the supply of housing units and employment generated through development on vacant land, through redevelopment, and from approved but not yet built housing units.

A customized Visual Basic macro within ArcGIS was developed to translate land area, zoning, and constrained land into housing units and jobs. The macro calculates non-constrained land separately from constrained land, but re-aggregates them in the final vacant land yield. Approved residential units are then added to the dwelling units/population. Finally, a redevelopment assumption provide additional supply of housing units and jobs, resulting a final, potential development picture for the City's Growth Management Area.

With this data, staff is able to compare the City's supply of vacant land with its population and employment projections. A fairly good picture of when the City will reach "build-out", or consumption of all vacant land, results from this assessment.

The Constraint Development Process
The buildable land inventory is created using a series of geoprocessing steps that are illustrated in Attachment A. Most of these involve combining the datasets using the intersect command in workstation ArcINFO. This overlaps all the geographic features in each dataset that is input into an output feature dataset that contains all geographic features and table items from both into one output. This is a perfect application to use in ArcMap using the Model Builder because of the iterative nature of this project. The next update that we will perform on the BLIP; we will test it out and see how it works.

The first kind of constraint that is very common is floodplain regulations. Some areas of the floodplain are available for commercial development with some modifications of the land. The floodway, however, is not available for any type of building. These areas are clipped and removed from the dataset. The remaining floodplain categories remain and are coded within each portion of vacant land appropriately. We apply the identity command that combines this floodplain information with the vacant land areas. The output is a dataset that contains all of the vacant land with each portion carved out of those that fall within the floodplain. And those sections of the vacant land are coded appropriately with the particular floodplain designation it falls into. A constraint value is applied to each category (Appendix B) that indicates a factor that is applied for residential and commercial development. Then we continue on and process the next constraint to this same dataset, which are natural resources.

The City land use code provides us with regulations to guide us in the development process to account for and protect any natural resources we have in the City. This includes several aspects including raptor nest locations, wetland areas, waterways, and other natural habitat areas. Some of these have buffers that are applied. For example, there cannot be any building within a quarter-mile of a raptor nest location. So in the datasets we apply these buffers around each nest location. Then we assemble those with the identity command and combine that information to the previous dataset that was assembled with floodplains and vacant land. So now we have a dataset that has all

natural resources constraints (Appendix B), and floodplains applied to the vacant land inventory. We go on to process the next dataset, which is zoning.

Every city has zoning to help regulate land use. Zoning categories are applied to the previous dataset using the identity command. This helps to indicate the type of development that is allowed on that piece of vacant land. Assumptions are applied to each zoning category to get an overall calculation of the amount of land available for jobs and housing (Appendix A).

Areas outside city limits are developed in accordance with the City's Structure Plan. The City's Structure Plan is focused primarily on the physical form and development pattern of the city. The Plan is a map that sets forth a basic framework, showing how Fort Collins should grow and evolve over the next 20 years. These areas that are vacant outside of the current City limits need to be assigned a zoning category as well. In this case it is based on the structure plan category. Because of the difference in zoning, areas outside the GMA are assigned a city zoning category based on the County zoning that is there currently. The point is to create an equivalent City category for those areas in the County that are not inside the GMA. Once this layer is categorized inside and outside the City, it is combined with the previous dataset using the intersect command.

BLIP Results
This program is one more valuable tool for decision-makers when making policy decisions about the growth of the community. Since 1999, the BLIP has provided guidance to the City's Planning and Zoning Board and City Council on community-wide land use decisions. The following paragraph explains specific results of the project and an estimation of what could occur in the future.

The BLIP was recently used extensively to evaluate changes to the City's Growth Management Boundary and the resulting effects on supply of residential and employment land in a recent update to the City's comprehensive plan. In 2003, the buildable land indicator provided information to planners that showed build-out occurring earlier than expected in the original City Plan, in the order of 15 – 20 years. In the 1997 City Plan, we had a goal to provide enough land to accommodate projected growth over the next twenty years. However, in the 2004 update, because of the low likelihood of meeting the 20 year supply and public resistance to expanding the boundary, this goal was removed. The Citizen's Advisory Committee and City Council decided to halt outward growth and limit GMA expansions; thus the supply will continue to dwindle over time with some limited growth occurring in targeted redevelopment areas (e.g., downtown). Of course the million dollar question is when the supply of buildable land will be used up? More than likely, if there are no more GMA expansions; the rate of development on remaining lands will slow, since the cost of that land is greater (i.e., simple economics - decrease the supply, cost rises). Some redevelopment will occur after the easiest vacant sites are developed, although costs and barriers to redevelopment are high. The built-out year is very theoretical - it assumes an average rate of growth. This will certainly not occur - the rate will definitely decline with less land available. The impacts that will occur as we get

built-out are: expensive housing, declining tax base, and fewer services. We are not taking actions to increase the buildable land supply. It's more about trying to address the future impacts of declining buildable land supply, such as identifying ways to strengthen the economy, promote redevelopment, and provide more affordable housing.

Appendix A – Zoning Assumptions

Zone	Percent Res-idential	Percent Non-res-idential	Res-idential Land Use Ratio	Non-Residential Land use Ratio	Percent Retail	Percent Non-retail	Dwelling units per acre	Jobs per acre	Source
C	0	1	0	0.65	0.6	0.4	0	12	City Plan assumption
CC	0.33	0.67	0.7	0.65	0.375	0.625	15	25	City Plan assumption
CCN	0.33	0.67	0.7	0.65	0.375	0.625	5	25	City Plan assumption
CCR	0.33	0.67	0.7	0.65	0.375	0.625	5	25	City Plan assumption
CL	0	1	0	0.8	0.6	0.4	0	12	City Plan assumption
CN	0	1	0	0.65	0.6	0.4	0	12	City Plan assumption
CSU	0	0	0	0	0	0	0	0	Code
D	0.33	0.67	0.85	0.85	0.19	0.81	4.5	30	City Plan assumptions/Existing
E	0.15	0.85	0.7	0.65	0.1	0.9	8	20	City Plan assumption
HC	0.15	0.85	0.7	0.65	0.1	0.9	8	20	City Plan assumption (for employment districts)
HMN	0.97	0.03	0.8	0.65	0.25	0.75	20	0.2	Code
I	0	1	0	0.65	0.1	0.9	0	9	City Plan assumption
LMF	0.97	0.03	0.6	0.65	0.25	0.75	3	0.2	Fossil Creek Area Plan
LMN	0.97	0.03	0.6	0.65	0.25	0.75	5	0.2	City Plan assumption/Code
MMN	0.97	0.03	0.7	0.65	0.25	0.75	12	0.2	City Plan assumption/Code
NC	0.33	0.67	0.7	0.65	0.8	0.2	5	25	City Plan assumption
NCB	0.5	0.5	0.85	0.85	0	1	8	12	Code
NCL	1	0	0.85	0.85	0	0	3.5	0	Code
NCM	1	0	0.85	0.85	0	1	5	0	City Plan assumption (for existing residential)
OUT	0	0	0	0	0	0	0	0	CSU, school land
POL	0	0	0	0	0	0	0	0	Code
RC	0	1	0	0.65	0.2	0.8	0	2	Code/Existing patterns
RDR	0.33	0.67	0.7	0.65	0.375	0.625	5	20	City Plan assumption (for mixed-use districts)
RE	1	0	0.8	0	0	0	0.025	0	Staff assumption - County zoning 1 unit/40 ac.
RF	1	0	0.8	0	0	0	0.4	0	City Plan assumption
RL	1	0	0.6	0	0	0	3.5	0	City Plan assumption (for existing residential)
UE	1	0	0.8	0	0	0	1.5	0	City Plan assumption/Code
UEN	1	0	0.8	0	0	0	0.5	0	Staff assumption - County north area urban estate

Note: The figures given above are used to convert vacant land (in acres) to dwelling
units and jobs.
- Percent residential or non-residential = the amount of residential land versus non-residential land
- Land use ratio = the netting out of local streets, schools, parks, layout inefficiencies, etc.
- Percent retail/non-retail = used for TAZ calculations of retail and non-retail jobs
- Dwelling units/jobs per acre = The number of dwelling units or jobs per acre calculated after the reduction for the items listed above
- Source = where the assumption originated

<p style="text-align:center">Appendix B – Environmental Constraint Assumptions</p>

Constraint	Type	Residential factor	Commercial factor	Description
0	none	1	1	No constraints
1	floodplain	0	0	500-year product corridor
2	floodplain	0	0.5	Poudre River 100-year floodplain
3	floodplain	0.5	0.5	Non-Poudre River 100-year floodplain
4	buffer	0.1	0.1	Natural feature buffer
5	floodplain	0	0.1	Poudre River floodplain and natural feature buffer

Note: Environmental constraints reduce the development potential of vacant lands. The figures above represent the percent reduction applied to vacant lands falling within each type of constraint. The source of these figures is the City's Land Use Code.

Attachment A – A Visio Diagram showing the geoprocessing steps called "BLIDiagramSummary.jpg".

Bibliography

1. City Plan, Fort Collins, Colorado Comprehensive Plan. February 18, 1997. Community Planning and Environmental Services Planning Department, City of Fort Collins, Colorado.

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