



The data consortium consists of Denver Regional Council of Governments members and regional partners with an interest in geospatial data and collaboration. The data consortium newsletter improves communication among local geographic information systems professionals and features updates from all levels of government as they relate to data and geospatial initiatives in our region. This newsletter is published quarterly.

Update on the 2020 census and coronavirus outbreak

Article submitted by Kelly Roberts, community resource specialist at DRCOG. Kelly can be reached at 303-480-6787 or kroberts@drcog.org.

Due to the COVID-19 outbreak, the U.S. Census Bureau has made changes to the timeline and operations for the 2020 census. The deadline for census responses has been extended from July 31 to Aug. 14. Field operations, during which census takers drop off census forms to rural communities, have been suspended.

Households began receiving invitations to participate in the 2020 census online the week of March 12. Instructions included the web address for the online questionnaire in English as well as how to respond online in 12 other languages. Census invitations also include the toll-free number to call for assistance, but due to social distancing requirements, fewer census representatives are working in the call center, causing long wait times. The U.S. Census has revised its marketing to emphasize the ease of responding online.

As of April 2, Colorado has a self-response rate of 40.3%, which is higher than the national self-response rate of 38.4%. The U.S. Census Bureau will continue to monitor the coronavirus situation in consultation with public health officials and take appropriate steps on operations as needed.

Using DRCOG planimetric data to evaluate municipal storm drain improvements

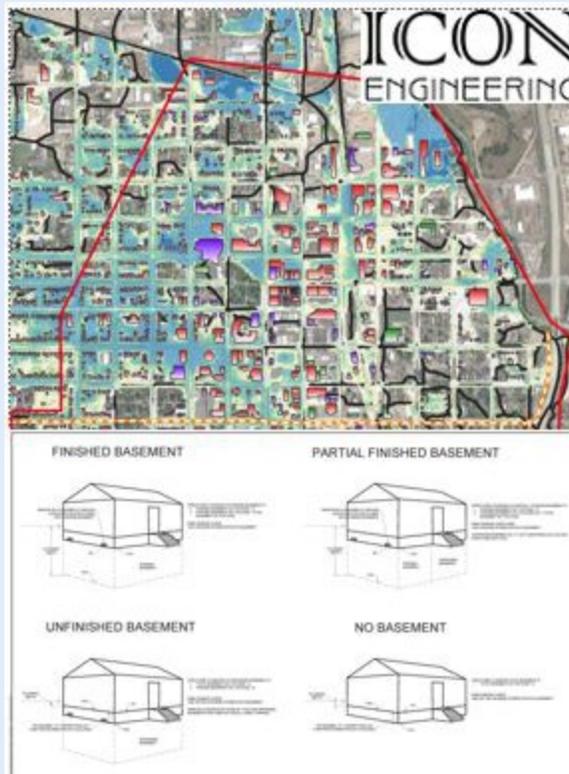
Article submitted by John Klier, geographic information systems specialist at Icon Engineering. John can be reached at 303-221-0802 or jklier@iconeng.com.

Front Range municipalities face numerous challenges when planning for infrastructure improvements to reduce damage in the event of a major storm. As a consultative civil engineering firm, Icon Engineering provides services to perform benefit cost analysis within a desired basin to assist in the evaluation of proposed storm drain improvements. DRCOG's planimetric data represents the effect quality geospatial data can have in performing a benefit cost analysis and translates to real-world improvement in the communities impacted by flooding.

A combination of hydraulic and hydrologic modeling is implemented to estimate potential runoff and inundation limits for flooding. Planimetric data, including building and sidewalk outlines, are used when developing land use parameters and blocked obstructions for hydraulic modeling.

On the GIS side, building data is paramount. There are several methodologies for determining damage against a given structure. The Federal Emergency Management Agency has set the standard with damage curves for a wide variety of building classifications. Building data is combined with additional tables, such as assessor's data, which help in classification. A series of zonal statistics is run against baseline terrain to determine the lowest adjacent grade on a structure and against the 2D hydraulic model results to sample projected water elevations and flooding depth on inundated structures. The results are brought into a database where calculations are run against all hypothetically inundated structures and then compared to existing conditions.

The evolution of data, including DRCOG's planimetric dataset, has allowed for more granular analysis. Estimating total flood damage provides a crucial basis in determining how funding will translate into community improvement.

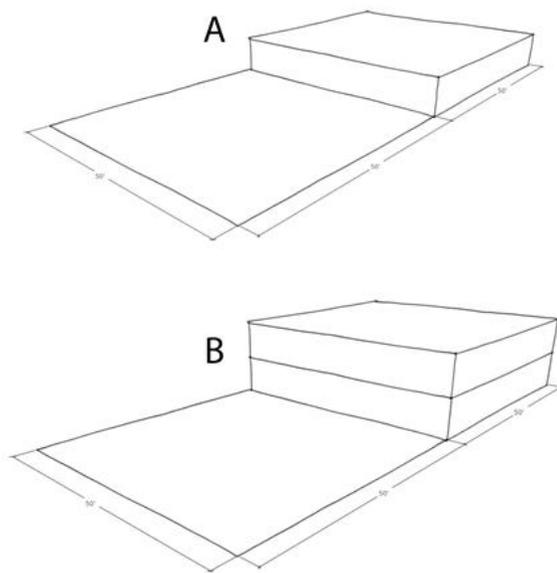


Using DRCOG building footprints to determine floor area ratio

Article submitted by Kristy Bruce, Master of Landscape Architecture, geographic information systems professional, planner at Logan Simpson. Kristy can be reached at 970-799-3232 or kbruce@logansimpson.com.

Effective community planning uses a comprehensive approach for visioning and problem solving through review of existing conditions, community priorities and best practices. In both large- and small-scale planning in the DRCOG region, application of detailed, full coverage data is critical to understanding trends and identifying opportunities. Logan Simpson, an environmental and community planning firm in Fort Collins, often uses DRCOG planimetric data to understand trends, changes in the built environment and development density through floor area ratios in planning projects along the Front Range.

Floor area ratio (FAR) is the total floor area in a building compared with the area of the lot on which the building is constructed, or floor area divided by lot area. For instance, if a one-story building takes up half of a parcel, it has an FAR of



0.5. (A) If a two-story building takes up half of a parcel, it has the same area as the parcel and it has an FAR of 1. (B)

In community planning, Logan Simpson uses FAR in conjunction with land use to understand where there might be room for additional density in a large parking lot, for example, or to understand average utility usage per square foot by land use type. A project example, illustrated below, shows how Logan Simpson used building footprints to reveal FARs that can support transit. FARs, combined with dwelling units or employees per acre, can indicate where there is enough activity to support a transit stop. Shown below, building footprints were used to determine an average FAR within a half-mile of a transit stop.



EXISTING DENSITY



The target FAR for a bus with frequent trips is two. Logan Simpson used DRCOG building footprints to estimate the existing number of stories for buildings near transit stops and calculate FAR to determine whether a transit stop is currently feasible, or if changes in land use regulations at key locations would support additional density to make the transit stop more successful.

A key element to the success of projects crossing multiple jurisdictions is the application of DRCOG's planimetric building footprint layer. Using current and accurate building

footprint data enables us to compare each transit stop equally. The data also aids in the recommendation of bus stop locations or changes to land use code to support higher densities around proposed bus stops based in real, on the ground conditions.

Mile High Flood District uses lidar for mapping flood hazards

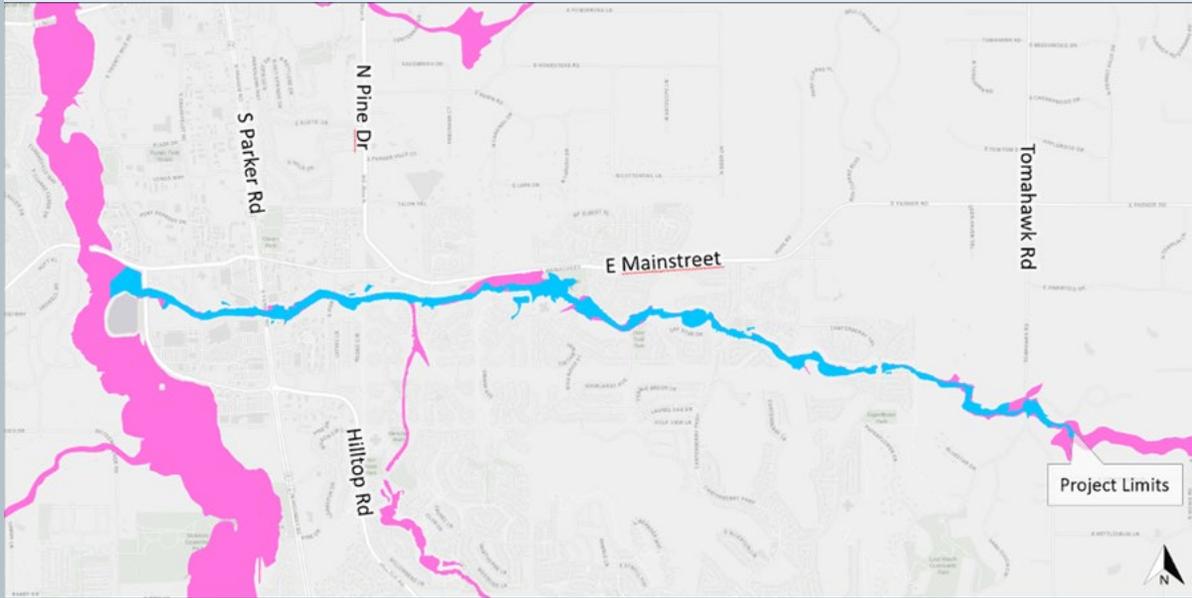
Article submitted by Katie Evers, geographic information systems analyst at Mile High Flood District. Katie can be reached at 303-455-6277 or kevers@udfcd.org.

The Mile High Flood District manages over 3,000 miles of major streams in Colorado. Understanding where people and property are exposed to flood hazards is central to the Mile High Flood District's mission of preservation, mitigation and education. The Mile High Flood District partners with seven counties and 35 municipalities to conduct stream studies and projects that help reduce the risk of flooding. All of its efforts rely on access to the best available elevation data. DRCOG's partnership with the U.S. Geological Survey to collect lidar provides the advantage of a reliable and consistent dataset whether a single stream or an entire watershed is studied. The Mile High Flood District uses U.S. Geological Survey quality level 2 lidar elevation products to evaluate risk through flood plain mapping, fluvial hazard zone mapping and in dam breach analysis studies.

Flood plain mapping

Reliable flood plain maps are critical for homeowners, governments and developers to understand where flooding may occur and identifying structures at risk. The Mile High Flood District conducts flood hazard area delineation studies to create and update flood plain maps, and watershed master planning studies to identify stream improvement required to accommodate changes to the built and natural environment over time. Both are dependent on lidar-derived digital elevation models. Master planning studies provide information that can be used to guide new land development projects on flood control and stream improvement needs. The modifications to a flood plain map from a flood hazard area delineation study are submitted to the Federal Emergency Management Agency for a physical map revision of the effective FEMA flood hazard information. Lidar-derived products are also used to supplement channel surveys on smaller scale flood plain mapping revisions.

A recently completed flood hazard area delineation along Sulphur Gulch, a tributary to Cherry Creek in Douglas County, revealed a reduction in the 100-year flood plain after the hydraulic model was developed with updated lidar-derived contours and survey of major structures in the area. Current lidar in and adjacent to the flood plain allowed for more accurate hydrologic and hydraulic modeling as well as mapping that reflected current conditions. As a result, zero insurable structures were located in the 100-year flood plain. Once the flood plain is approved by FEMA, the delineation will be reflected as the effective flood plain on FEMA flood insurance rate maps for local and federal regulation.



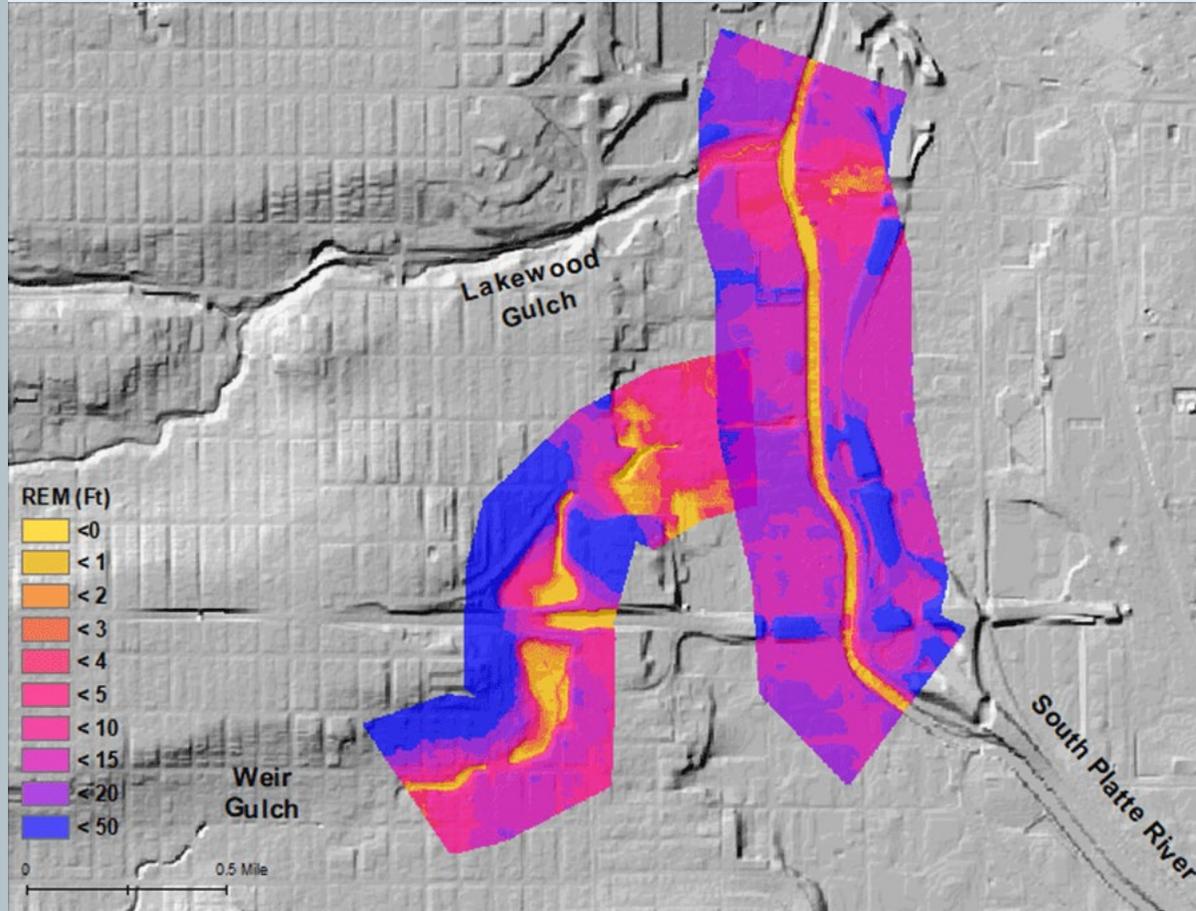
The modified flood plain from the Sulphur Gulch flood hazard area delineation is displayed in blue. The existing mapped flood plain is represented in pink.

Fluvial hazard zones

Traditional flood plain maps, although critical in flood risk assessment, do not consider dynamic river processes such as erosion and sediment deposition. Fluvial hazard zone mapping, used in conjunction with flood plain mapping, helps communities better understand where they have the potential for flooding. The Colorado Water Conservation Board developed a protocol for mapping fluvial hazard zones, and access to the U.S. Geological Survey quality level 2 standard lidar provides the Mile High Flood District with data at the level of accuracy needed to map fluvial hazard zones using the Colorado Water Conservation Board's protocol. The quality level 2 data allows for the creation of lidar-derived digital elevation models with 2-foot resolution, which identifies landforms most influenced by the natural dynamics of a stream. Digital elevation model-derived datasets that are important in fluvial hazard zone visualization and analysis are hillshade and slope rasters, as well as relative elevation models.

"The relative elevation model enhances visualization of the fluvial signature (i.e. relic channel scars, flood plain surfaces, alluvial terraces) particularly when laid over a hillshade raster." (Colorado Water Conservation Board, 2020).

By considering fluvial hazard zones during the design and construction of mitigation projects, the Mile High Flood District helps reduce the risk of flood damage and encourages municipalities to make more informed land use decisions.



Relative elevation model for South Platte River and Weir Gulch. Lower relative elevation values highlight areas that could have a higher risk for erosion during a flooding event.

Dam breach analysis

With several dams in the Mile High Flood District, conducting dam breach analysis and inundation mapping studies is critical for local emergency managers to understand the associated flood hazards. Significant development, both residential and commercial, downstream of the Pine Gulch Dam prompted the need for a dam breach analysis study to understand the flood risk to people, vehicles and structures if an overtopping event occurred. Lidar-derived 2-foot contours and lidar-derived digital elevation models were used to determine the reservoir's surface area, storage capacity and the watershed boundary upstream of the dam, all of which were used in the hydraulic model to simulate flooding under different conditions.



The Pine Gulch Dam was classified as high hazard because a dam failure could affect at least one resident downstream. Classifying dams as high hazard allows emergency managers to plan ahead and monitor higher-risk areas during an event.

Planimetric data provides insight into sidewalk infrastructure

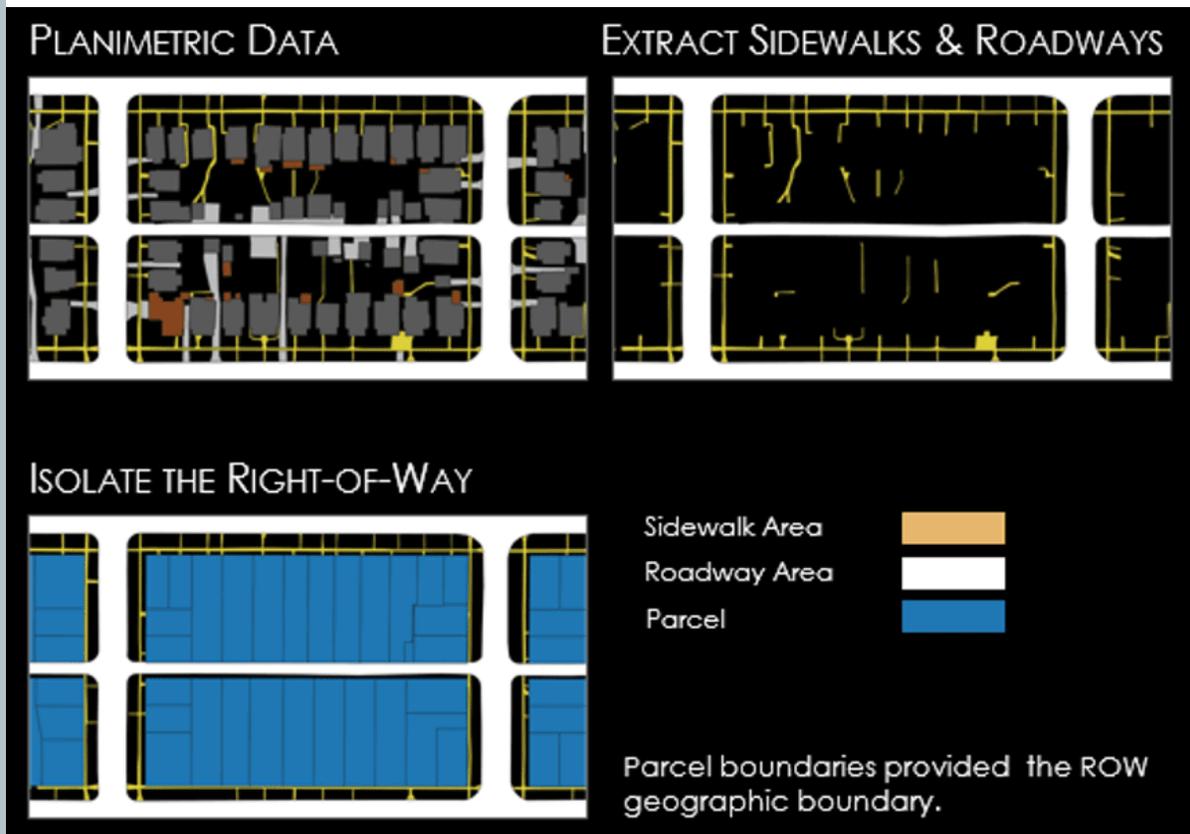
Article submitted by Dr. Wes Marshall and Nicholas Coppola, University of Colorado Denver. Wes can be reached at wesley.marshall@ucdenver.edu, and Nick can be reached at nicholas.coppola@ucdenver.edu.

Sidewalks are a fundamental yet under-researched topic in transportation. Most of the existing sidewalk papers tend to focus on relatively small areas due to a lack of comprehensive data. Recent advances in remote sensing technology – such as DRCOG’s planimetric dataset – are presenting us with new and innovative research opportunities.

The spatial accuracy and detailed sidewalk outlines provided by DRCOG’s planimetric sidewalk data sparked us to investigate additional cities with similar data. We found 24 cities from across the United States. We are digging into over 400,000 sidewalk segments to see what we can learn about characteristics such as availability and width. Next, we will compare these results against Americans with Disabilities Act requirements and guidelines from organizations such as the Federal Highway Administration, the American Association of State Highway and Transportation Officials, the Institute of Transportation Engineers and the National Association of City Transportation Officials. So far, we are finding an overall deficiency of sidewalk infrastructure. On average, U.S. cities have less than 50% sidewalk coverage. More than 40% of those are less than 4 feet wide, and at

least 10% aren't even 3 feet wide.

The sidewalk data gives us a newfound ability to quantify sidewalk characteristics at the city scale, and for dozens of cities at a time, which will help us advance mobility, accessibility and equity. Sidewalks have long been overlooked as transportation infrastructure and in terms of asset management, but thanks to DRCOG's planimetric data, studies like this are now possible.



DRCOG data acquisition updates

Article submitted by Ashley Summers, GISP, PMP, information systems manager at DRCOG. Ashley can be reached at 303-480-6746 or asummers@drcog.org.

Regional planimetric data project 2018

Since 2014, DRCOG has facilitated a planimetric data capture immediately following the completion of an imagery project. The 2018 iteration began in Feb. 2019 and completed in Feb. 2020.

Project deliverables – except for some premium attribution reserved for funding partners – are free for public download on [DRCOG's Regional Data Catalog](#). Learn more about [2018 project specifics](#) and [visit the webpage](#).

Denver regional aerial photography project 2020

DRCOG is scheduled to collect 6,000 square miles of high-resolution imagery in the spring and summer of 2020 on behalf of 48 partners. The project is currently experiencing

difficulty due to unsuitable ground conditions, airspace closure and COVID-19, but DRCOG staff are optimistic that project requirements can still be met. Additionally, DRCOG is offering a discounted Nearmap subscription to partners that want to pay for this streaming service.

If you are not a project partner and would like to be, reach out to me at asummers@drcog.org. Read more about DRCOG's [imagery projects](#) on the [website](#).

Historical imagery is available for download via the [Governor's Office of Information Technology FTP site](#).

Regional lidar project 2020

DRCOG received [a grant from the U.S. Geological Survey](#) in December 2019 to collect quality level 2 lidar in 5,000 square miles of the region and derive contours in most of the Denver metro area. Flights will occur throughout the spring and summer of 2020. Many thanks to our 32 local and state partners that committed funding to this project!

For more information, [visit the website](#).

Do you have an interesting use case for lidar data? Tell us about it by emailing me at asummers@drcog.org.

Planimetric and land use land cover project 2020

As noted above, plans are in motion for collecting a substantial amount of foundational data in 2020. DRCOG staff want to make sure they leverage the investment by preparing to create derivatives that would benefit the GIS community in the Denver region. With updated imagery and lidar, we can delineate, quantify and measure many aspects of the built and natural environments. [See some examples](#).

Discussions are happening now to shape the data products and determine potential partnerships for funding. If you're interested in knowing more, please reach out to me at asummers@drcog.org. Here's the tentative schedule:

- April 2020 – send preliminary quotes to partners for budgeting purposes
- Fall 2020 – letters of intent due from participating partners
- Winter 2021 – new imagery is delivered
- Spring 2021 – new lidar is delivered; derivative projects begin

Things you might have missed

- Check out the new [Colorado Geodetic Coordination website](#).
- The OpenStreetMap Colorado community continues to add DRCOG's regional building footprints to OpenStreetMap. You can help at the next Importathon on May 21. [View all OpenStreetMap Colorado meetups](#).
- Sign up to attend the GIS Colorado summer meeting on Aug. 15. [View all GIS](#)

[Colorado events.](#)

- [View Esri COVID-19 infographics by county.](#)

Engage with us

- This quarterly newsletter reaches more than 300 people, has a higher-than-average open rate, and is written by professionals like you. It's the perfect place to show off your projects, highlight your great work and contribute ideas to the GIS community in the Denver region. Newsletter release dates are the 15th of January, April, July and October (or the next business day afterward). Please contact Ashley Summers at 303-480-6746 or asummers@drcog.org to contribute.
- Did you miss a newsletter or a meeting? [Visit our website](#) for past newsletter issues and Denver Regional Data Consortium meeting materials.



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