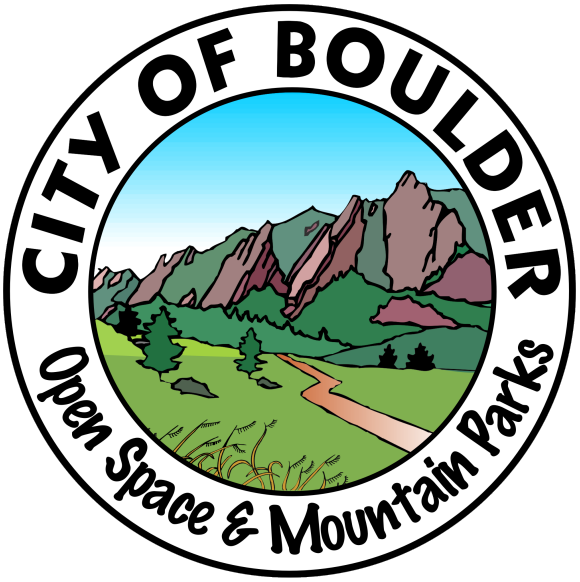


2021 - 2023 Visitation Estimate

City of Boulder
Open Space and Mountain Parks
Boulder, Colorado

OSMP Human Dimensions
Report prepared by: Colin Leslie

November, 2024

Contents

Acknowledgements

This report is the culmination of effort from many dedicated OSMP staff. We extend our sincere gratitude to the following individuals for their invaluable contributions:

- **Data Collection, Organization, and Review:** Chelsea Schroeder, Katie Wilson, Josie Kerrigan, Jay Cooney, and Shay Kole
- **Project Management and Data Analysis:** Colin Leslie, Deonne VanderWoude, Anna Reed, and Heidi Seidel

We also acknowledge the numerous other internal contributors and reviewers who provided valuable feedback and support throughout this project.

Suggested Citation

Leslie, C. (2024). 2021-2023 Visitation Estimate: City of Boulder Open Space and Mountain Parks. City of Boulder Open Space and Mountain Parks Department.

1 Executive Summary

Introduction and Methods

This report provides an overview of visitation patterns across the Open Space and Mountain Parks (OSMP) system, building upon previous efforts in 2004-2005 and 2016-2017. The 2021-2023 estimate incorporates data from 196 monitoring locations, including designated and undesignated trails, categorized by volume class and Management Area Designation (MAD). Automated trail counters, strategically placed and calibrated for accuracy, were used to collect data.

Overall Visitation and Temporal Trends

- **Modest Increase:** Retained monitoring locations (those consistently tracked since 2017) showed a modest increase of 180,000 annual visits (3.4%), from 5.30 million to 5.48 million annual visits.
- **New Locations:** The addition of 33 new monitoring locations, including reopened trails and new access points, contributed around 684,000 annual visits to the overall visitation estimate.
- **Current Estimate:** Factoring in new and retained locations, the current estimate for total annual visitation is 6.17 million.

Average Daily Visits by Month

- **Peak Season:** April through October is the peak visitation period, exceeding the annual daily average of 16,900 visits.
- **Busiest Months:** June and July are the busiest months, with average daily visits around 22,000.

Visitation by Volume Class

- **Predominance of Medium and Lower Use Trails:** Nearly 90% of the 196 monitored locations are classified as “Medium” or lower volume.
- **Significant Contribution of Medium-Use Trails:** Despite their moderate individual visitation levels, Medium use trails collectively contribute the most visits (2.5 million annually).

Visitation by Management Area Designation

- **Alignment with Management Intent:** The distribution of visitation generally aligns with the intended use levels for different Management Area Designations (MADs), with Passive Recreation Areas receiving the highest use and Habitat Conservation Areas the lowest.
- **Need for Monitoring in Sensitive Areas:** Some Habitat Conservation Areas have higher-use access points, indicating a need for continued monitoring and attention to site management to ensure impacts on these sensitive areas is appropriately managed.

Visitation by Access Type

- **Primary Entry Points:** Trailheads and designated access points serve as the primary entry points for most visitors, accounting for around 95% of all visits.
- **Undesignated Access Monitoring:** Monitoring visitation at undesignated access points helps identify areas where formalization or management actions might be needed to mitigate impacts or improve safety.

Temporal Patterns

- **Monthly Variations:** While June and July are the busiest months overall, peak visitation months vary across locations, likely due to factors like accessibility, landscape setting, weather, and types of recreational activities offered.

- **Daily Variations:** Peak visitation days do not necessarily correlate with peak visitation months, indicating fluctuations throughout the year.
- **Hourly Variations:** Hourly visitation patterns reveal that peak hours shift depending on the day of the week and the season.

Subarea Analysis

- **Range of Visitation Levels:** Subarea analysis shows a wide range of visitation levels, with Chautauqua being the busiest, followed by Wonderland Lake and Sanitas.
- **Shift in Visitation:** Increases in visitation in areas like Teller Farm, Doudy Draw, and Gunbarrel suggest potential shifts in visitor preferences or increased awareness of these areas.

Next Steps

- **Ongoing Monitoring:** OSMP is committed to ongoing visitation monitoring and has implemented a cyclical data collection approach, dividing locations into three sample groups for more continuous data collection and analysis.
- **Investigating Subarea Changes:** Further investigation into subarea visitation changes, in conjunction with visitor survey data, can provide insights into the reasons behind shifts in visitation levels and inform targeted management strategies.
- **Data Accessibility:** OSMP will continue developing interactive data explorers and reports to enhance the accessibility and usability of visitation data, promoting transparency and data-driven decision-making.

2 Introduction

The City of Boulder Open Space and Mountain Parks (OSMP) department is entrusted with the stewardship of a vast and diverse landscape encompassing over 46,000 acres. These lands serve a multitude of purposes, from preserving critical natural resources and supporting agricultural activities to providing opportunities for passive outdoor recreation. A network of 155 miles of designated trails provide recreation access to visitors who collectively engage in millions of visits annually.

Recognizing the critical role of visitation in shaping the management and preservation of these open spaces, the Human Dimensions team within the OSMP department operates a Visitation Statistics Program to support data-driven management around visitation. This proactive data collection approach aims to provide accurate and up-to-date visitation estimates, enabling informed decision-making and effective management strategies.

This report represents the third system-wide visitation estimate conducted by OSMP, with previous data collection efforts conducted in 2004-2005 and 2016-2017. While ideally these estimates would be conducted at regular intervals, capacity limitations and shifting priorities have resulted in uneven intervals between reporting periods.

Starting in 2019, the Human Dimensions team has been building capacity to support more consistent visitation monitoring. Despite these efforts, the 2021-2023 data collection period required an additional year due to the development and implementation of other priority projects. However, we are pleased to announce that starting in 2024, both the Visitation Statistics Program and the Public Opinion and Visitor Experience Survey (POVES) have transitioned to a cyclical (ongoing) monitoring framework. This transition will enable more regular reporting and ensure that OSMP has access to timely and relevant visitation data to inform management decisions.

To streamline comparisons between monitoring periods and to better reflect when each set of visitation data were analyzed, we have chosen to refer to each of the three study periods by the completion year of data collection (2005, 2017, and 2023), for their respective periods.

The purpose of this report is to step back from site or area-specific efforts and take a broader look at visitation across the OSMP system. By doing so, we hope to provide context for the current state of visitation, how it has changed over time, and what to keep an eye on for the future. To achieve these goals, the Human Dimensions team employs a robust visitation monitoring methodology, which is outlined in the following section.

3 Methods Overview

The following is an abbreviated overview of our visitation monitoring methodology.

Data Collection

The OSMP visitation monitoring program employs automated trail counters strategically positioned across the trail network. These unobtrusive devices are deployed across entry points and along key trails. Our monitoring network comprises a combination of continuously installed counters (22 locations as of 2023), providing long-term data trends, and short-term installations (generally 3-week long deployments), enabling flexible and cost-effective coverage of a wider area (Ryus et al., 2017). This dual approach allows for both in-depth analysis of specific locations and a broader understanding of visitation patterns across the entire OSMP system.

To ensure the accuracy and representativeness of our visitation estimates, each monitoring location contributes only one data collection estimate to the overall system-wide estimate per monitoring period. This means that even if a location was monitored multiple times during the 2021-2023 period, only one estimate — typically the most recent or the most reliable — is included in the final calculations. This approach prevents overcounting and ensures that each location's contribution to the overall visitation estimate is proportionally represented.

Sample Frame

Our sampling frame includes both designated and undesignated trails, accounting for the diverse entry points into the OSMP system. The 2021-2023 study period included 196 monitoring locations, which are shown in Figure 1. We periodically inventory and review monitoring datasets (such as the Undesignated Trails Inventorty) to identify all

potential locations where people may cross from non-OSMP lands onto OSMP lands. We then refine this inventory - such as placing counters after several short access trails converge - to optimize our data collection locations.

Site Selection and Counter Placement

Careful consideration is given to the placement of each trail counter to ensure accurate and reliable data collection. Factors such as trail width, visibility, potential for occlusion (when multiple people pass the counter simultaneously), and proximity to access points are all taken into account. Counters are typically installed on tree trunks, posts, or fences, and their placement follows established field guidelines to ensure consistency and quality across sites.

Calibrations

To further enhance data accuracy, we conduct regular calibrations of our trail counters. These calibrations involve comparing actual visitor counts observed by field staff to the counts recorded by the counter, allowing us to estimate and correct for any undercounting or overcounting ((Laws, 2013)). This process ensures that our visitation estimates are robust and reliable. We perform two types of calibrations: quick calibrations for initial setup and troubleshooting, and full calibrations for continuous installations, involving extended observation periods to calculate precise correction factors. Starting in 2024, we will also be conducting full calibrations for all short-duration locations that were estimated as "Medium" or higher visitation class.

Data Management

While the automated trail counters that we use have become industry standard, the raw count data must be reviewed and validated using a variety of procedures to prepare them for analysis. Data from our continuous counters are validated annually at the beginning of the year through a rigorous data validation process with our equipment vendor (Eco-Counter) while our short-duration count data are validated periodically by our Human Dimensions analyst staff. Missing or erroneous data are flagged, reviewed, and reconstructed prior to analysis.

Since short-duration data are collected across different times of the year, they also need to be seasonally adjusted. This is accomplished using a day-of-year factor approach ((Hankey et al., 2014)) where we first estimate the proportion of annual visitation that was received during the short-duration period using the validated and cleaned data from continuous counters. This estimate is then used to expand the short-duration count from a 3-week estimate into an annual estimate. This method allows us to adjust for both long-term seasonal effects as well as short-term isolated effects such as inclement weather days that might occur during the short-duration collection period.

Analysis

Our data analysis focuses primarily on monthly and daily visitation patterns, providing insights into how these patterns vary across different management areas and trail types. We also examine the overall annual visitation volume and how it has changed over time.

It is important to distinguish between "visits" and "visitors." A visit represents a single instance of a person visiting an OSMP trail or area, while a visitor refers to the individual person making the visit. Over time, a single visitor will likely contribute multiple visits. All results in this report are presented in terms of visits.

Although we don't have the exact number of unique individuals visiting OSMP lands annually, our visitor survey data sheds light on repeat visitation. Eighty-nine percent of survey respondents indicated they had visited at least once before, and of those repeat visitors, 70% reported visiting more than once per week. Furthermore, 12% of repeat visitors indicated they visit one or more times per day (VanderWoude et al., 2024).

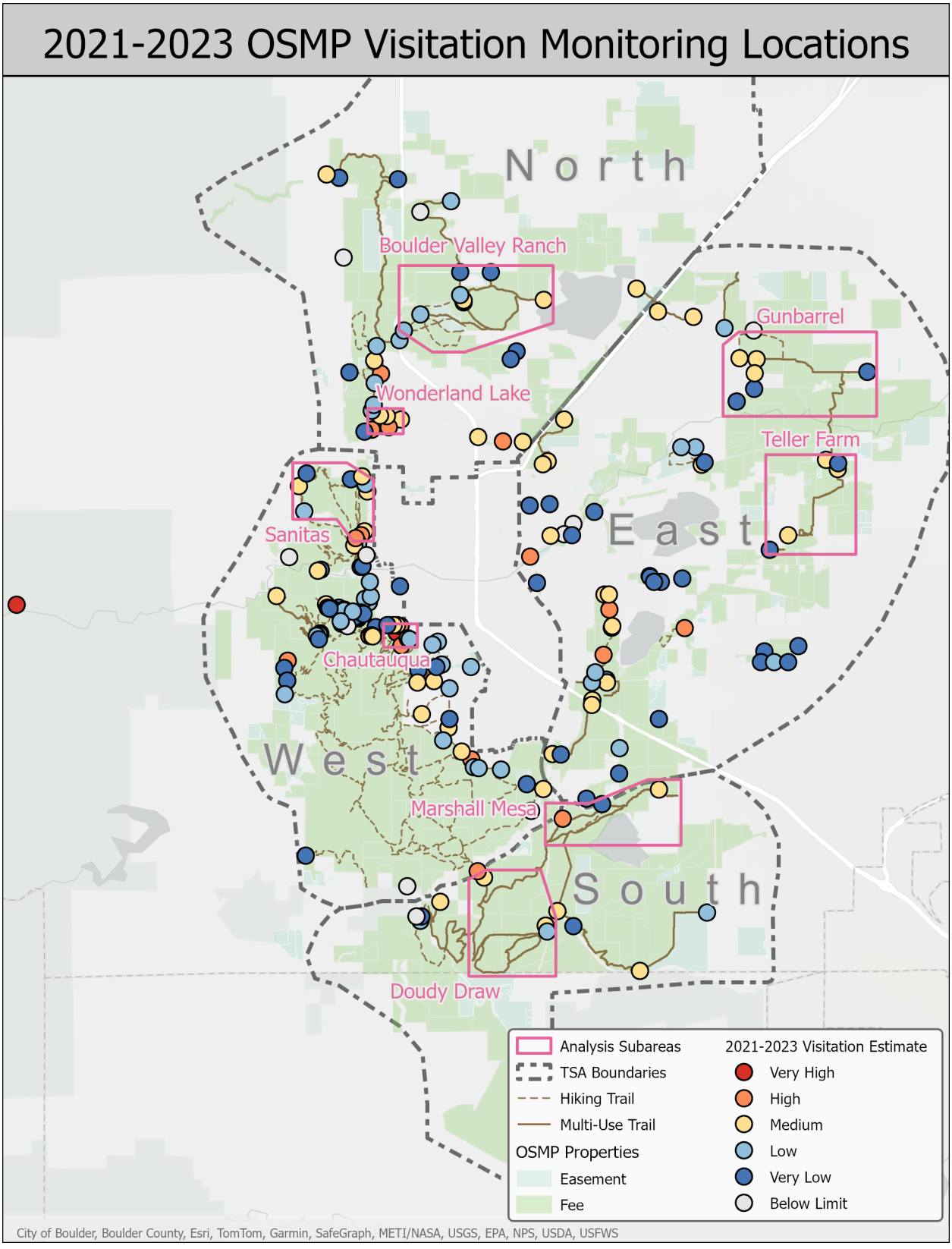


Figure 1: Data collection locations for the 2021-2023 visitation monitoring period, symbolized by visitation class.

4 Results

4.1 Annual Visits

To assess changes in visitation over time, we will first examine the 163 monitoring locations that were retained between the 2017 and 2023 reporting periods. Focusing on these repeated locations allows us to isolate actual changes in visitation patterns from the effects of adding or removing monitoring locations, providing a more accurate assessment of visitation trends. This is particularly valuable because this is the first time we have been able to compare direct measurements for so many locations. In the 2004-2005 study, many locations were assigned a visitation class by staff without direct measurement, limiting our ability to track changes over time.

As shown in Figure 2, the retained locations experienced a modest net increase of approximately 180,000 annual visits, or roughly 3.4%. This suggests a moderate increase in visitation at established access points and trailheads across the OSMP system.

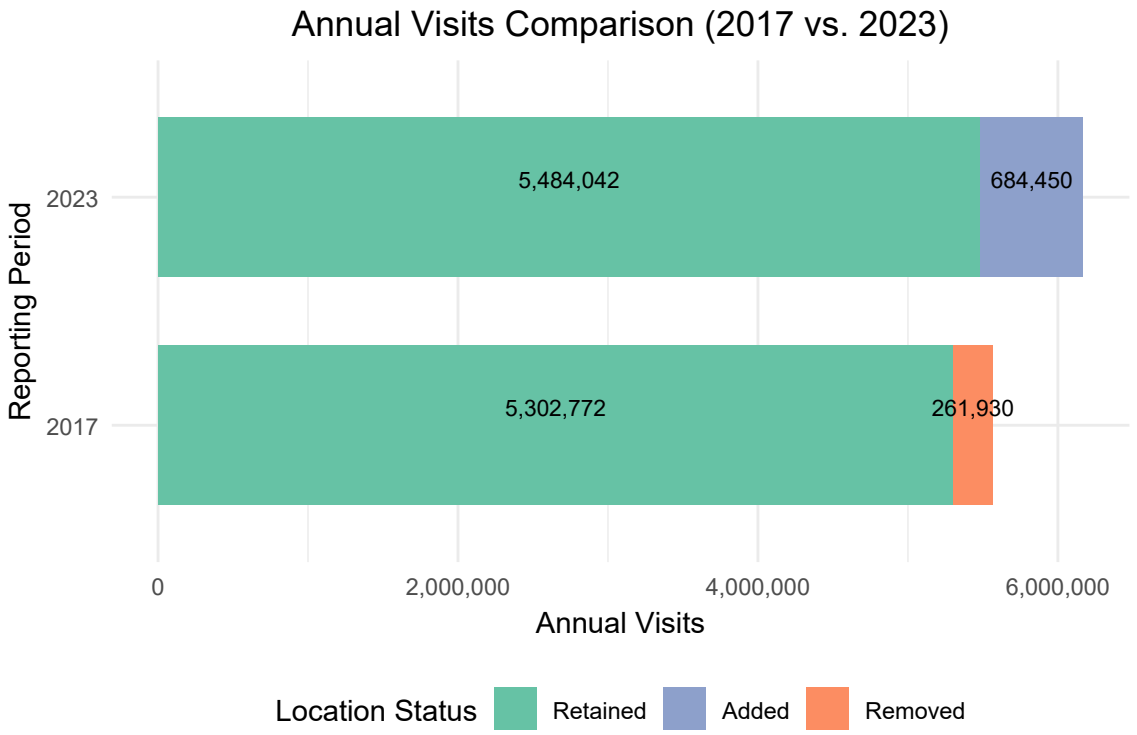


Figure 2: Total annual visitation estimates over time for the reporting periods of 2017 and 2023.

However, it is also important to consider that the overall monitoring network has expanded since the 2017 study. The Human Dimensions team periodically reviews OSMP property boundaries using GIS data and on-the-ground surveys to identify potential changes to access that might impact visitation. This process has led to the addition of 33 new monitoring locations for the 2023 reporting period, including new access points (e.g., 7th and 8th Street Connectors on Baseline Rd), reopened trails (Boulder Falls), and additional undesignated access locations. These new locations collectively add around 684,000 visits to the overall estimate.

Conversely, 4 locations were removed, including a high-traffic segment of the Boulder Creek Path near Arapahoe Ave and Foothills Pkwy[1] (accounting for around 245,000 visits). Collectively, these removed locations account for a decrease of around 262,000 visits.

[1] This particular location posed methodological challenges due to its use as a commuter corridor and the difficulty of isolating OSMP-related visitation from general path traffic. It also presented technical difficulties in obtaining reliable counts.

Table 1: Annual visits over time for reporting periods.

Reporting Period	Annual Visitation	Locations
2005	4,680,666	138
2017	5,564,702	167
2023	6,168,492	196

Taking all these factors into account, our 2023 reporting period estimate places overall annual visitation at 6.17 million. As illustrated in Table 1, this represents an change of around 684,000 annual visits, or about 10.8%, from the 5.56[2] million estimate for 2017 reporting period.

4.2 Average Daily Visits by Month

While the analysis of total annual visitation helps us understand the overall demand for OSMP trails, examining how visitation fluctuates throughout the year is crucial for determining when that demand occurs. This temporal understanding can inform many aspects of OSMP operations, such as the allocation of resources like staffing, maintenance, and educational outreach. These efforts allow us to manage various types of visitor use, promote sustainable recreation practices, and provide a positive visitor experience. While the current overall annual average daily visitation is 16,900 (calculated by dividing the total annual visits by 365), we know that visitation is not evenly distributed throughout the year.

Many of our locations are only monitored for a few weeks out of the year, making it impossible to precisely estimate daily visitation for every single day. Therefore, we'll take a middle-ground approach and utilize data from our continuous monitoring locations to examine monthly changes in average daily visitation. Specifically, we'll focus on 2023 data due to the increased number of continuous counter locations in that year, compared to previous years.

In essence, we're asking: if we distribute our estimated 6.17 million annual visits across the monthly patterns observed in 2023, how many daily visits would we expect across the OSMP system each month? These results are presented below in Figure 3.

[2] The 2017 estimate was revised in 2021, down from the original estimate of 6.26 million, which at the original time of its release followed a similar estimation methodology used for the 2005 study. However, subsequent analysis determined that this approach overestimated visitation from short-term counts. A re-analysis of the data, using improved statistical procedures for seasonal adjustments to the short-duration count data collected during that study, resulted in a reduced 2017 estimate of 5.57 million visits.

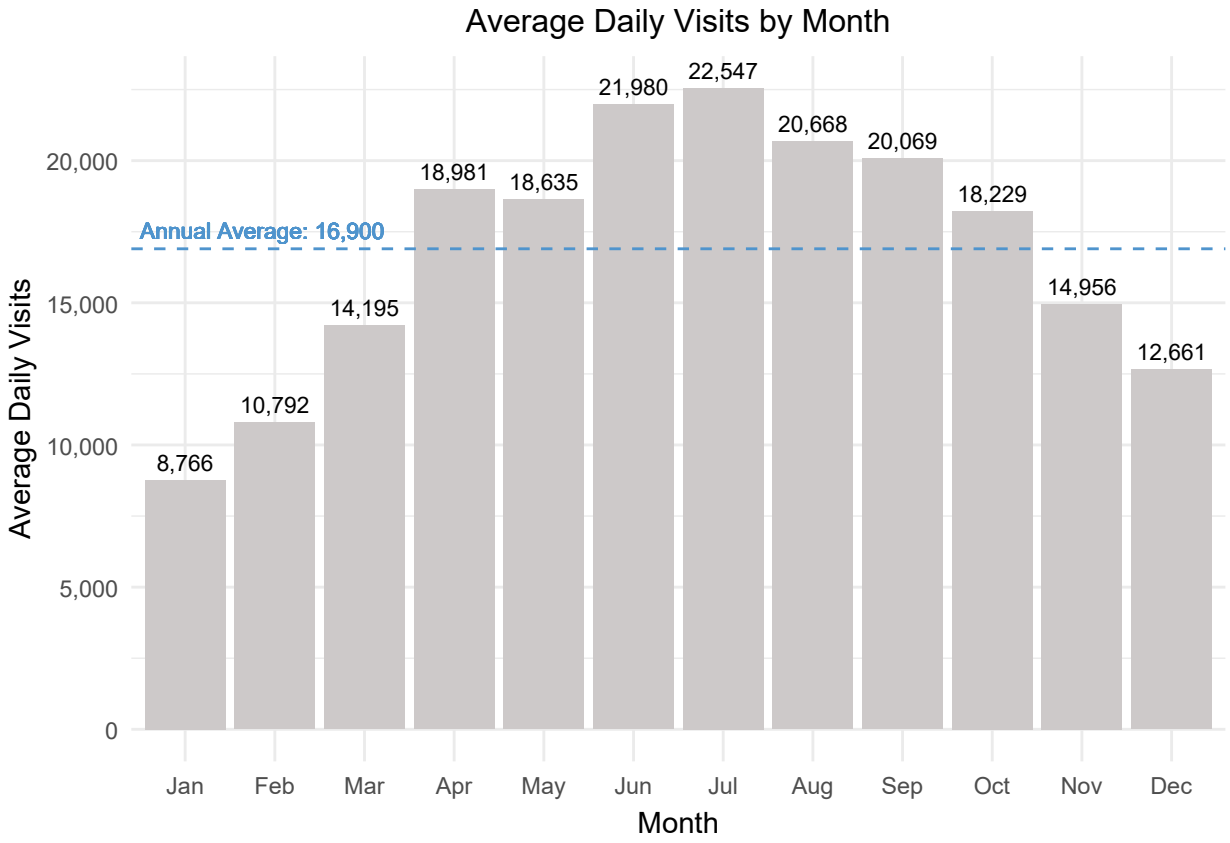


Figure 3: Average daily visits by month, based on patterns observed from 2023 continuous counters.

As the results show, June and July are our busiest months, with around 22,000 average daily visits. In contrast, average daily visitation in January and February is less than half of that, at around 8,600 and 10,600 average daily visits, respectively. While June and July are frequently the two busiest months (a similar pattern was observed during the 2017 study in terms of average daily visits), we can see that average daily visits for April through October all exceeded the annual daily average of 16,900. Based on these patterns, we can generally classify April through October as our period of on-peak visitation, and November through March as off-peak. That said, depending on spring and fall weather conditions, March and November may also be considered on-peak as they can sometimes approach or exceed the annual daily average.

To further understand the distribution of visitation across different locations, we can examine how visitation varies across different volume classes.

4.3 Visitation by Volume Class

To help us understand how visitation is distributed across different locations, we categorize trailheads and access points based on their annual visit levels. This categorization, which we call “volume classes,” ranges from “Very Low” to “Very High” (Table 2). These volume classes are used to inform various research, planning, and management efforts within OSMP.

For the purpose of visitation monitoring, we also include a sixth class called “Below Limit.” This class captures locations with very low visitation — fewer than 1,000 annual visits or an average of 3 daily visits. While these locations aren’t typically included in other visitor studies (such as on-site surveys) due to their low usage, we monitor them to track any potential increases in visitation that might warrant further investigation and monitoring efforts.

Table 2: Visitation class ranges for annual and daily visitation.

Class	Annual Min	Annual Max	Daily Min	Daily Max
Very High	200,000	500,000	548	1,369
High	75,000	199,999	206	547
Medium	25,000	74,999	69	205
Low	10,000	24,999	28	68
Very Low	1,000	9,999	3	27
Below Limit	0	999	0	2

Table 3: Summary statistics for monitoring locations by visitation class.

			Average Daily Visits		
Class	Count	Annual Visits	Average	Minimum	Maximum
Very High	2	598,685	820.1	716.4	923.9
High	19	1,936,481	279.2	208.5	451.5
Medium	58	2,456,612	116.0	68.5	205.4
Low	45	821,017	50.0	29.7	67.0
Very Low	60	349,974	16.0	3.7	27.4
Below Limit	12	5,724	1.3	0.2	2.7

As shown in Table 3, most of the 196 monitoring locations included in this study fall into the medium and lower volume classes. Nearly 90% of the locations are classified as “Medium” use or lower. Interestingly, despite their relatively moderate visitation levels, “Medium” use trails collectively contribute the largest number of visits among all classes—roughly 2.5 million annual visits, or about 40% of all system-wide visitation.

This highlights the importance of considering both the number of locations and their individual visitation levels when assessing overall visitation patterns. By examining visitation levels in conjunction with other factors, such as Management Area Designations, we can gain a more comprehensive understanding of whether current conditions align with our management goals for different areas.

4.4 Visitation by Management Area Designation

The 2005 Visitor Master Plan (VMP) established the concept of Management Area Designations (MADs) to guide how different areas within the OSMP system are managed for visitor use. These designations consider the primary purposes of each area and outline appropriate levels of public access and activity.

There are four main MADs:

- **Passive Recreation Areas:** Designed for high public access with a dense network of trails and trailheads, accommodating the highest levels of visitation.
- **Natural Areas:** Allow for moderate levels of visitor use and primarily low-impact activities, with trails designed to minimize resource impacts.
- **Agricultural Areas:** Public access and trails are managed to minimize impacts on agricultural operations and prioritize safety, with visitation levels varying depending on proximity to other areas.
- **Habitat Conservation Areas:** Prioritize the preservation of natural ecosystems and have the lowest levels of visitor use and limited access, with few trails.

Ideally, Passive Recreation Areas should have the highest visitation, while Habitat Conservation Areas should have the lowest. Figure 4 shows that the current distribution of visitation generally aligns with this intent. However,

some nuances are worth noting. For instance, some Habitat Conservation Areas have higher-use access points, such as the Lost Gulch Trail at Lost Gulch Overlook TH, which provides access to a popular overlook. Additionally, there are “Unassigned” locations, which may be properties without assigned MADs, areas located more than 300 feet from a designated MAD boundary, or special management areas like Boulder Falls.

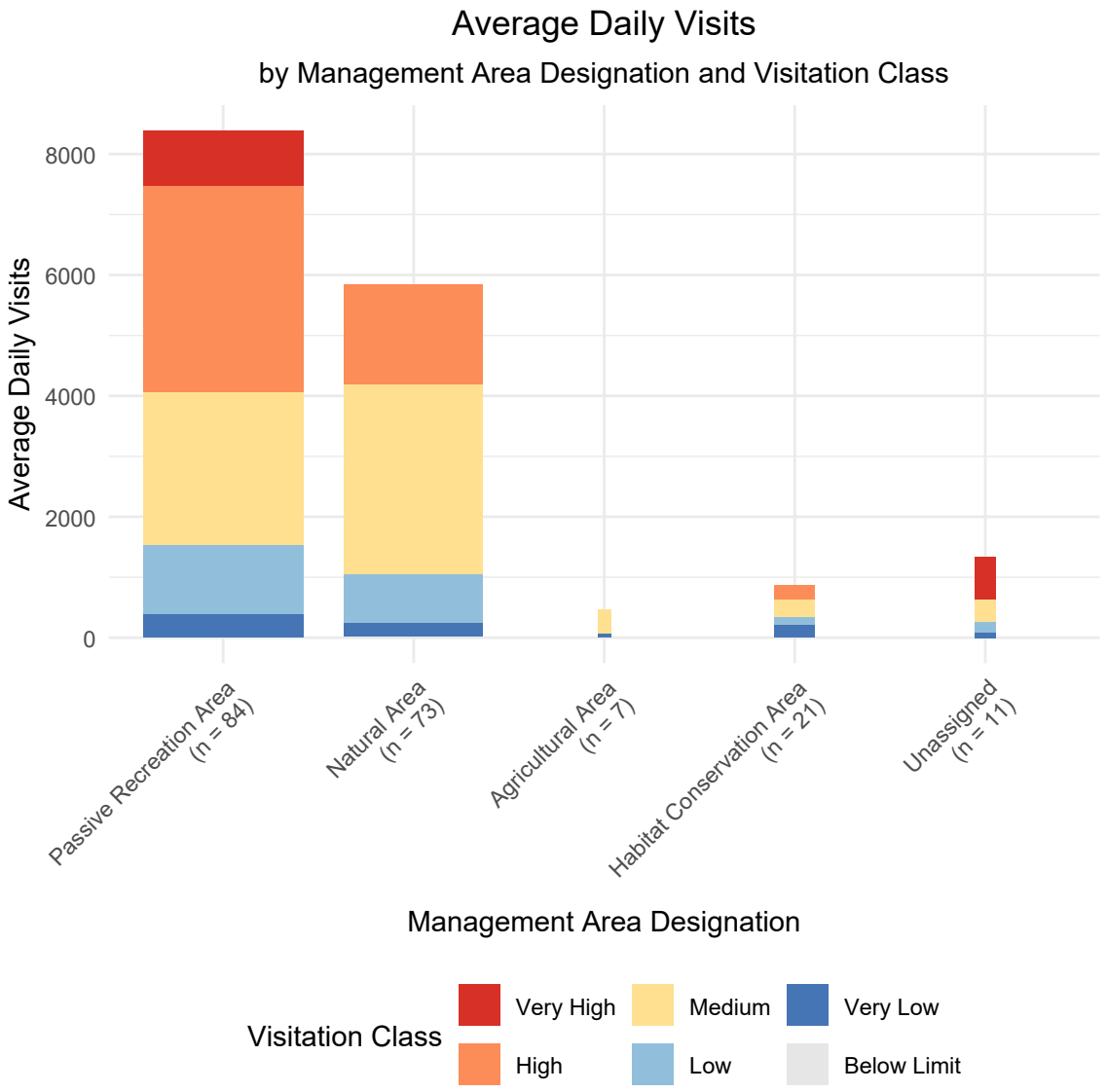


Figure 4: Average daily visits by management area designation and visitation class. Bar widths indicate the relative proportion of locations within each management area designation.

Table 4 lists the top 5 busiest locations by MAD, along with their visitation class and average daily visits, providing further insights into the distribution of visitation across different management areas.

Table 4: Average daily visits for top 5 busiest locations by MAD

Management Area Designation	Location	Class	Average Daily Visits
Passive Recreation Area	Chautauqua	Very High	924
	Bluebell Road at Bogess Cir Access	High	451
	Wonderland Lake at Quince	High	404
	Sanitas Valley	High	335
	Mesa (South Mesa)	High	334
Natural Area	Lehigh Connector - North	High	340
	S Boulder Creek Path at East Boulder Comm Center	High	337
	South Boulder Creek Path at Dimmit Dr	High	324
	Fourmile Canyon Creek Path at East Palo Park	High	227
	Boulder Creek Path at Foothills Pkwy Path	High	220
Agricultural Area	East Boulder - Teller Farm at Teller Farm North TH	Medium	131
	Sage at Boulder Valley Ranch TH - North	Medium	102
	East Boulder - Teller Farm at Teller Farm S	Medium	95
	East Boulder - White Rocks at Teller Farm North TH	Medium	75
	East Boulder-Teller Lake5 at Teller Farm North	Very Low	25
Habitat Conservation Area	Lost Gulch Trail at Lost Gulch Overlook TH	High	231
	Boulder Creek Path at Pearl Pkwy Path	Medium	119
	Chapman Drive Trail at Chapman Drive TH	Medium	98
	High Plains Trail at Coalton and Hwy 128 Access	Medium	69
	Green Mt West Ridge Tr at Green Mt West TH	Low	55
Unassigned	Boulder Falls at Boulder Canyon Dr	Very High	716
	NCAR Trail at NCAR TH	Medium	205
	Devils Thumb Access Trail at Bear Mt Dr	Medium	102
	Holly Berry Tr at Holly Berry Access	Medium	71
	Table Mesa Trail at Table Mesa Dr and Vassar Dr	Low	64

4.5 Visitation by Access Type

The OSMP system has a complex boundary, with numerous access points where visitors can enter and exit. While OSMP does not have an official classification for every type of location where a designated or undesignated trail crosses a property boundary, we have developed the following classification based on their level of formality and their role in visitor journeys.

Designated vs. Undesignated Access

- **Trailheads and Access Points:** These are officially designated OSMP Trailheads or Access Points with named locations and typically have designated parking areas or adjacent public street parking. They are often the primary entry points for visitors starting their trips.
- **Other designated access:** These are access points along designated trails that don't have formal names or parking areas. They might include connections to adjacent sidewalks or neighborhoods.
- **Undesignated Access:** These are informal access points that are not officially designated or maintained. They might include undesignated trails, informal paths, or connections to neighboring properties.

Primary vs. Jurisdictional Crossings

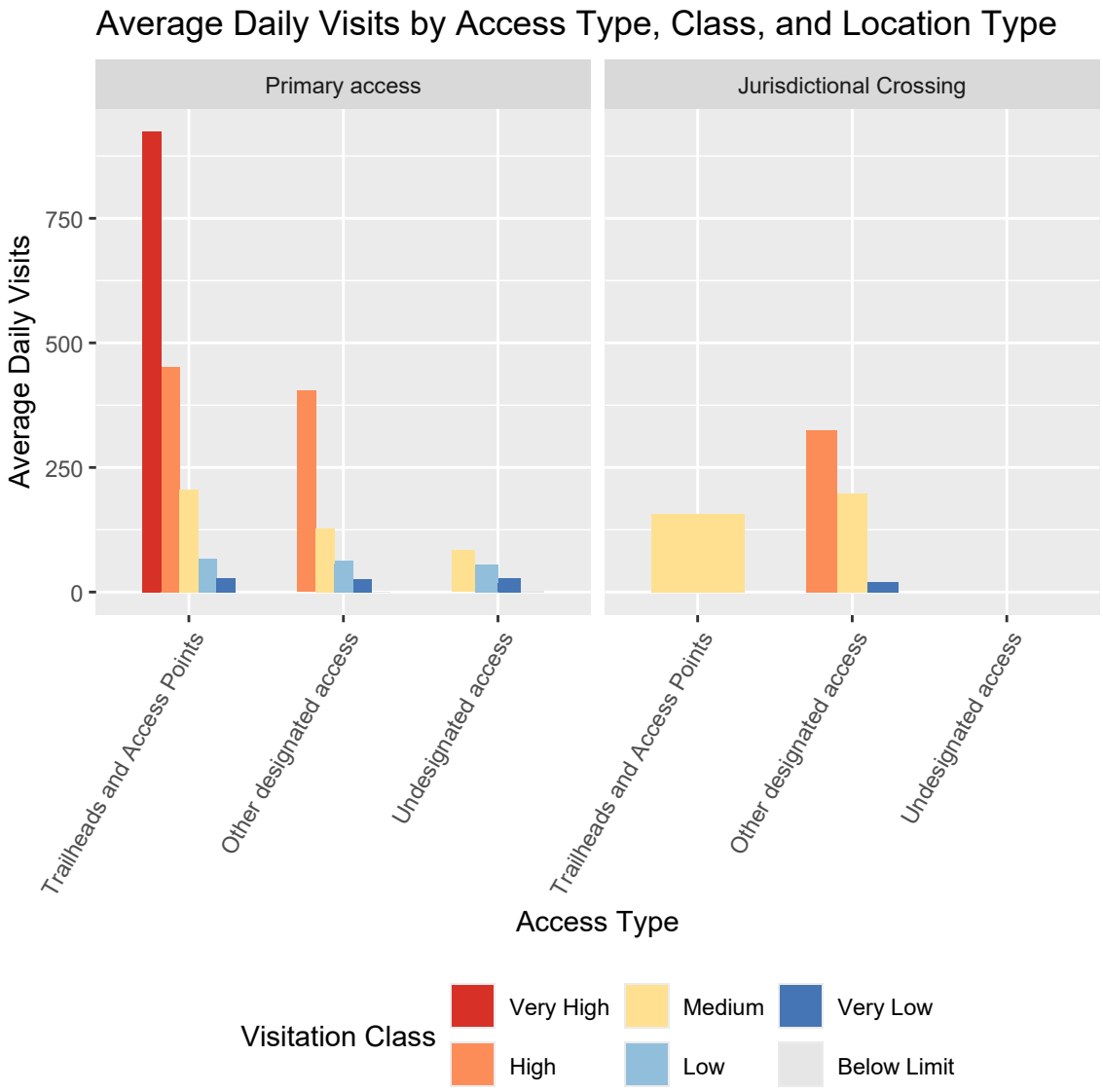
We also distinguish between two types of access based on their role in visitor journeys:

- **Primary Access:** These are typically the starting points for visitor trips, such as trailheads or major access points.
- **Jurisdictional Crossings:** These are points where visitors transition from lands managed by other agencies or departments onto OSMP property, often while already on an existing trail network.

Understanding the different types of access points and their usage patterns provides context to help us understand and manage visitor flow, trailhead capacity, and potential impacts on different areas. For example, monitoring visitation at undesignated access points can help identify areas where formalization or management interventions might be needed to mitigate impacts or improve visitor safety. Jurisdictional crossings on the other hand help us identify areas where we may see large volumes of visitation, but where access to OSMP properties may not be the primary intent of that visit (e.g. commuting, long-distance recreational outings).

Table 5: Proportion of annual visits by access type

Access Type	Annual Visits	Proportion
Trailheads and Access Points	4,823,859	78%
Other designated access	1,070,643	17%
Undesignated access	273,991	4%



4.6 Temporal Patterns

Our continuous counters allow us to delve deeper into how visitation is distributed across time, examining patterns at different scales: monthly, daily, and hourly.

4.6.1 Monthly Patterns

While June and July emerged as the busiest months overall in our earlier analysis (Figure 3), visitation patterns can vary across individual locations. Figure 5 illustrates this variation, showing that while many locations do indeed peak in June or July, others, such as Marshall Mesa and South Boulder Creek, sometimes experience peak visitation earlier in the year (May). Conversely, locations like Boulder Valley Ranch - Sage Trail and Dakota Ridge sometimes see their highest visitation later in the season (August or September). These variations likely reflect the unique characteristics of each location, such as accessibility, landscape setting, and the types of recreational activities they offer. Additionally, year-to-year variations in weather patterns, particularly during the spring and fall shoulder seasons, can also influence the timing and magnitude of peak visitation. For example, a late snowfall in May or an

early snowfall in October could shift visitation patterns and impact the overall distribution of use throughout the year.

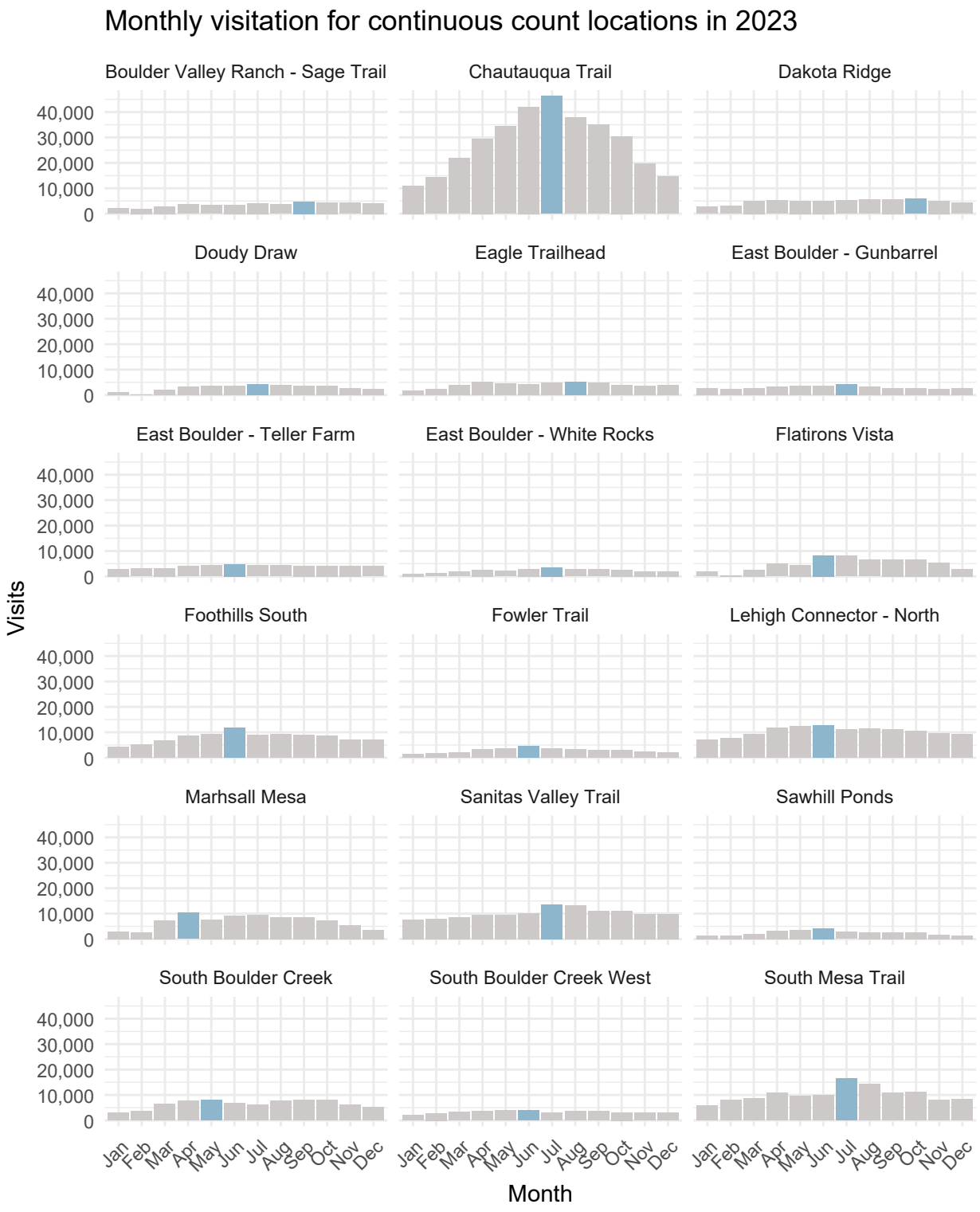


Figure 5: Monthly visitation for continuous count locations in 2023, with peak month highlighlited in blue.

4.6.2 Daily Patterns

We can also examine visitation patterns on a daily scale. One approach is to visualize daily counts as a continuous time series, as shown in Figure 6. The light blue shading highlights weekend days, revealing weekly visitation trends across different locations. Interestingly, peak visitation days occur throughout the year and do not necessarily correlate with peak visitation months. While this report includes a selection of locations, this type of visualization will be a key component of future interactive data explorers, allowing users to explore daily patterns for locations of interest.

Figure 6: Daily visits for select continuous locations in 2023, with weekends highlighted in blue and top 5 busiest days highlighted in red.

Another perspective on daily patterns is offered in Figure 7, which presents a weekly profile for each location. By rescaling each day of the week to represent the average percentage of weekly visitation, we can compare visitation patterns across weekdays and weekends. This reveals that certain locations, such as South Mesa Trail and Green Mountain West Ridge, tend to have a higher proportion of weekend visits, while others, like East Boulder - Gunbarrel and Dakota Ridge, exhibit more balanced usage throughout the week.

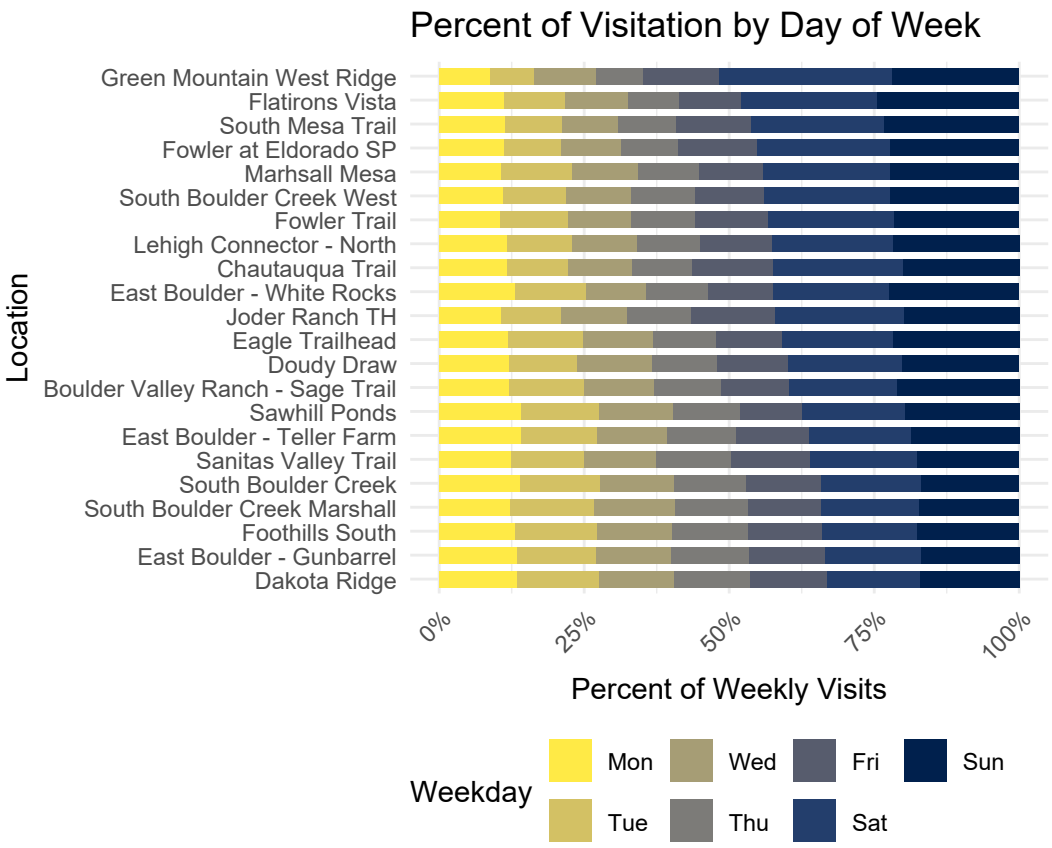


Figure 7: Percent of visitation by day of week for continuous locations in 2023, in descending order of percent of visits occurring on weekends, from highest percent to lowest.

4.6.3 Hourly Patterns

Finally, we can zoom in further to examine hourly visitation patterns, which reveal insights into the ebb and flow of visitor activity throughout the day. These patterns can highlight peak visitation hours, the distribution of use across different time periods, and how these patterns may shift depending on the day of the week or the season.

For example, Figure 8 shows distinct hourly patterns for several locations, including South Mesa Trailhead and Lehigh Connector - North. South Mesa Trailhead, a destination access location that requires visitors to travel to reach, typically sees visitation peak in the middle of the day across most days of the week and seasons. This pattern likely reflects the planning and travel time required to access this location, with visitors arriving and staying for extended periods during the day.

In contrast, Lehigh Connector - North, which is located closer to residential areas, exhibits a different pattern. During the summer, visitation peaks mid-morning, suggesting that visitors may be using this access point for shorter trips toward the beginning of the day. A smaller secondary peak appears towards the end of the day, potentially indicating use for after-work recreation or dog walking. This contrast highlights how access type, proximity to residential areas, and daily work patterns can influence hourly visitation trends.

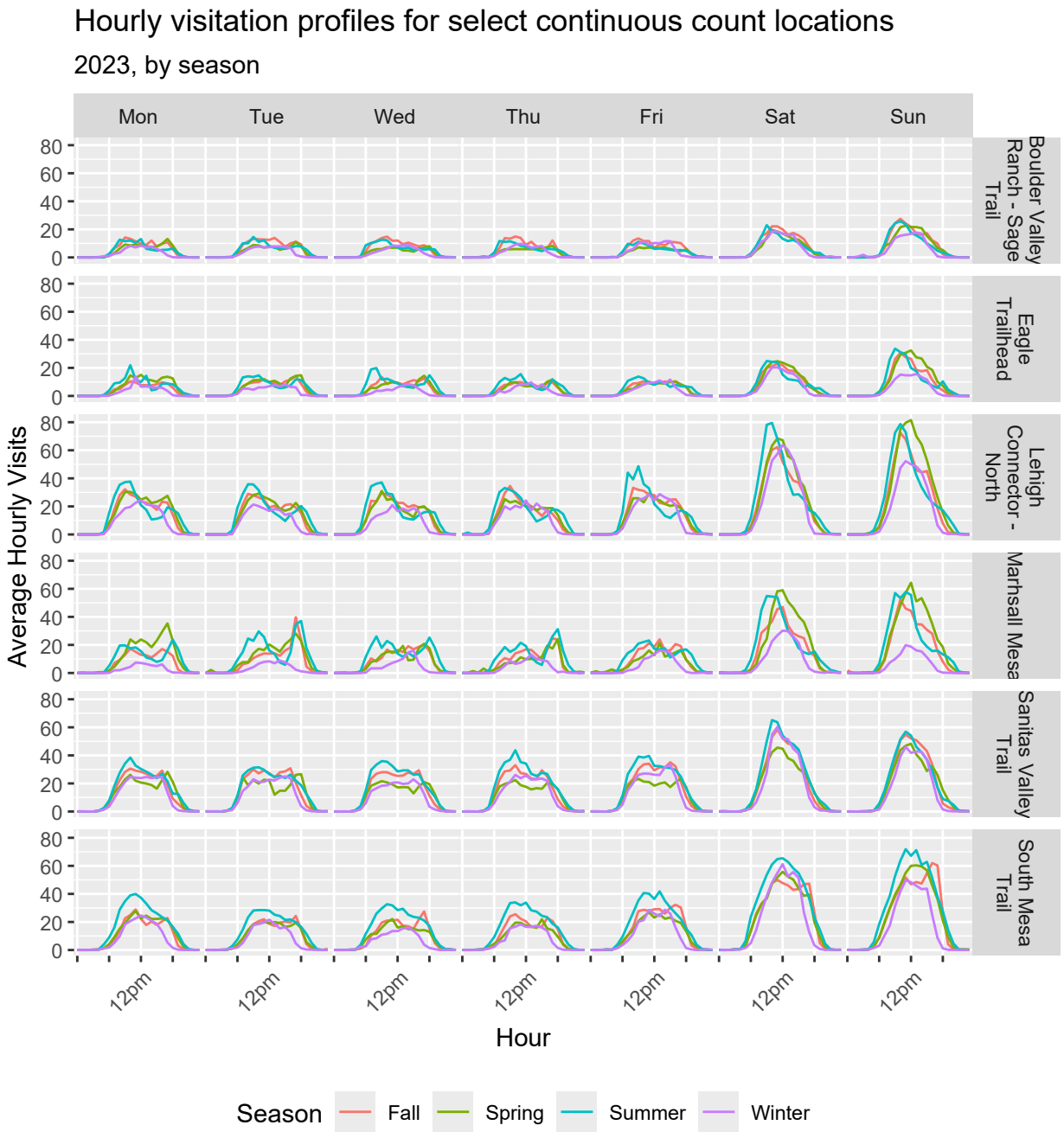


Figure 8: Hourly profiles for select continuous locations in 2023.

4.7 Subarea Analysis

While our previous analyses have focused on system-wide trends and patterns, we also want to examine how visitation varies across different subareas within the OSMP system (Figure 1). These subareas represent distinct geographic regions or trail networks that offer particular recreation opportunities and often experience unique visitation pressures and management concerns.

By grouping monitoring locations into subareas, we can gain a more localized perspective on visitation patterns.

This is particularly valuable for areas that have been the subject of public or management inquiries, as well as those that function as regional visitation units with multiple access points feeding into a common trail network. Analyzing visitation at the subarea level can provide a more representative picture of trail usage and visitor behavior compared to examining individual access points alone.

Figure 9 illustrates the wide range of visitation levels across different subareas. Chautauqua stands out as the busiest subarea, with nearly 750,000 annual visits, a level similar to that observed in the 2017 study period. In contrast, Wonderland Lake and Sanitas subareas show a slight decrease in visitation compared to the previous estimate. Interestingly, Teller Farm, Doudy Draw, and Gunbarrel areas have all experienced an increase in visitation, suggesting a potential shift in visitor preferences or increased awareness of these areas.

These variations in subarea visitation highlight the importance of considering local contexts and factors when developing management strategies. Understanding the characteristics and trends of each subarea rather than looking at access points in isolation can help us develop more comprehensive management strategies.

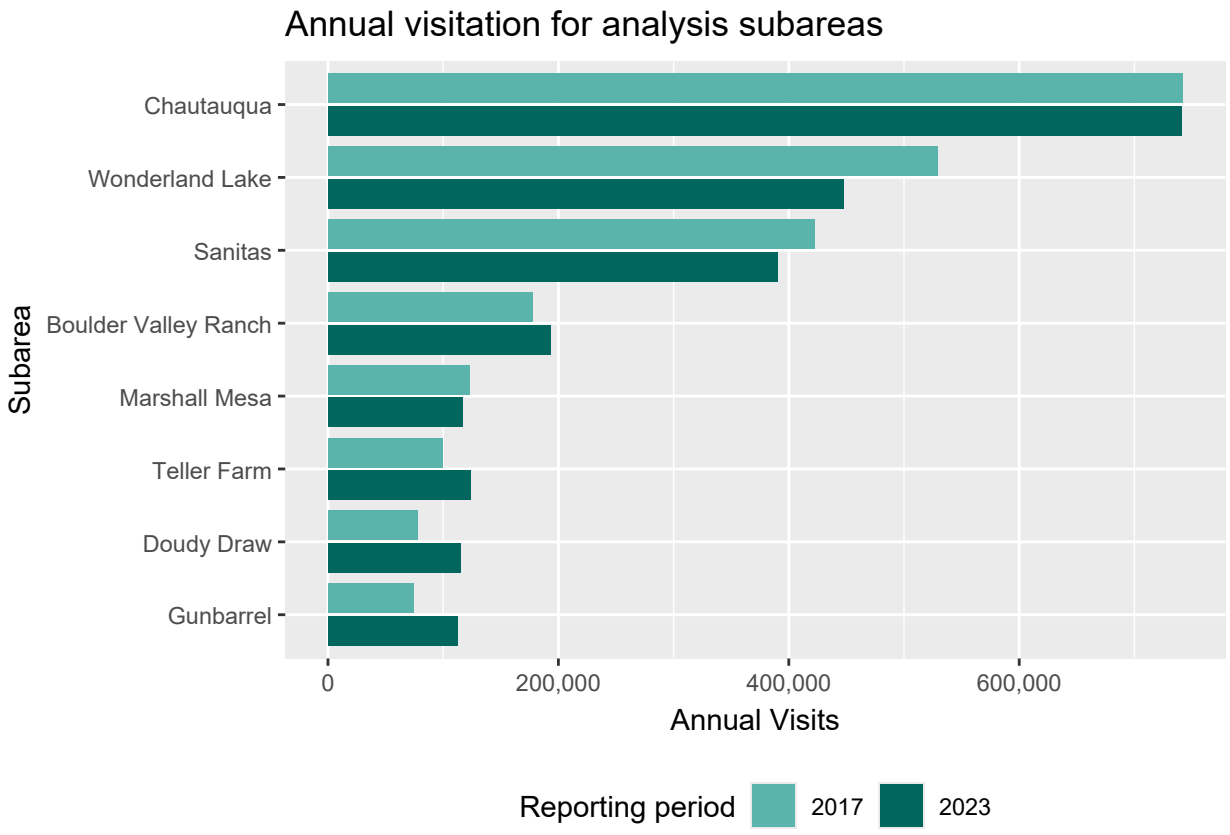


Figure 9: Analysis subareas ranked from highest annual visitation (Chautauqua) to lowest (Gunbarrel).

5 Discussion

This report provides a comprehensive overview of visitation patterns across the OSMP system, drawing on data collected between 2021 and 2023. Our analysis reveals several key trends and insights that can inform management decisions and enhance visitor experiences.

Overall Visitation and Temporal Trends

We observed a notable increase in total annual visitation compared to the previous study period (2017), likely due to a combination of new monitoring locations, increased visitation to individual locations, and potential shifts in recreation patterns. This highlights the continuing popularity of OSMP and the need for continued monitoring and adaptive management strategies to support visitor experience and conservation goals.

Our analysis of average daily visits revealed distinct seasonal patterns, with June and July being the busiest months and January and February experiencing the lowest visitation. This information can inform operation decisions and communication efforts to manage visitor flow and minimize impacts during peak periods.

Visitation Patterns by Location Characteristics

The examination of visitation by volume class highlighted the importance of considering both the number of locations and their individual visitation levels. While "Medium" use trails collectively contribute the most visits, even moderate changes to high-use locations can significantly influence overall visitation patterns.

The analysis of visitation by Management Area Designation (MAD) shows that our current distribution of visitation is generally aligned with the intended use levels for different areas. However, the presence of some higher-use access points within Habitat Conservation Areas suggests the need for careful monitoring and potential management interventions to ensure the preservation of these sensitive areas.

Understanding the different types of access points and their usage patterns can also help OSMP manage visitor flow and trailhead capacity. Monitoring visitation at undesignated access points can inform decisions about formalization or management interventions to mitigate impacts or improve visitor safety.

Temporal and Subarea Variations

The analysis of temporal patterns revealed variations in monthly, daily, and hourly visitation across different locations. These variations highlight the importance of considering local contexts and factors when developing management strategies.

The subarea analysis demonstrated the value of examining visitation trends at a more localized level. The observed variations in subarea visitation underscore the need for tailored management approaches that address the unique characteristics and challenges of each area.

6 Next Steps

OSMP is committed to ongoing visitation monitoring and, as of this year (2024), has formally implemented a cyclical data collection approach. This approach involves dividing both visitor survey and visitation monitoring locations into three sample groups or panels, with locations randomly allocated to each panel.

Essentially, this means that instead of collecting data from all locations every few years, we will collect data from one-third of the locations each year, cycling through all three panels over a three-year period. This strategy allows for more continuous data collection and analysis, providing a more up-to-date understanding of visitation trends while also reducing the burden of conducting large-scale data collection efforts every few years.

This panel-based approach offers several benefits:

- **More frequent data:** Provides more frequent insights into visitation patterns, enabling more responsive management decisions.
- **Reduced workload:** Distributes the data collection effort over three years, making it more manageable.
- **Trend detection:** Allows for better detection of emerging trends and changes in visitation patterns.

To further enhance the accessibility and usability of visitation data, we are committed to continuing the development of interactive data explorers and reports for both visitor surveys and visitation monitoring data. These tools will empower OSMP staff and the public to explore visitation patterns and trends in greater detail, promoting transparency and data-driven decision-making.

By integrating these findings into planning and decision-making processes, OSMP can ensure the long-term sustainability and enjoyment of its valuable resources while providing high-quality experiences for all visitors.

7 References

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A Apendix A

Table 6: Annual Visits Comparison (2017 vs. 2023)

Location ID	Name	Analysis Subarea	Visits (2017)	Visits (2023)	Difference	Status (2023)
Retained						
373	6th Street Connector Trail at Baseline Road	Chautauqua	22,645	25,905	3,259	Retained
377	Amphitheater Trail at Gregory Canyon TH		53,520	40,396	-13,124	Retained
367	Artist Point Trail at Flagstaff Summit West TH		29,413	36,603	7,190	Retained
372	Baseline Trail at Bluebell Road	Chautauqua	71,249	76,753	5,504	Retained
374	Baseline-Gregory Connector Trail at Flagstaff Road		8,360	8,656	296	Retained
380	Bluebell Road at Bogess Cir Access	Chautauqua	175,064	164,796	-10,268	Retained
376	Bluebell-Baird Trail at Gregory Canyon TH		40,412	80,682	40,270	Retained
504	Boulder Creek Path at Pearl Pkwy Path		68,464	43,259	-25,205	Retained
7	Boulder Valley Ranch - Sage Trail	Boulder Valley Ranch	44,156	43,192	-964	Retained
363	Boy Scout Trail at Flagstaff Summit East TH		5,546	6,084	538	Retained
386	Boyscout Trail at Flagstaff Summit West TH		3,434	9,730	6,296	Retained
336	Centennial Trail Path		76,596	71,845	-4,751	Retained
368	Chapman Drive Trail at Chapman Drive TH		14,410	35,827	21,417	Retained
394	Chapman Drive Trail at Realization Point TH		12,437	21,401	8,963	Retained
8	Chautauqua Trail	Chautauqua	349,050	337,216	-11,835	Retained
410	Cherryvale Tr at South Boulder Creek Tr- East		13,179	51,648	38,469	Retained
411	Cherryvale Tr at South Boulder Creek Tr-West		17,262	22,592	5,330	Retained
56	Coal Seam at Marshal Mesa Trailhead	Marshall Mesa	99,556	83,431	-16,125	Retained
453	Coalton Trail		19,854	16,607	-3,247	Retained
472	Cottontail trail at 71st St		35,221	41,784	6,563	Retained
473	Cottontail trail at 75th St		13,027	15,336	2,310	Retained
471	Cottontail trail at IBM Connector		27,941	35,249	7,308	Retained
496	Cottonwood Path at Cottonwood TH - south		56,476	48,102	-8,374	Retained
495	Cottonwood Trail at Cottonwood TH - north		59,245	71,901	12,656	Retained
481	Cottonwood Trail at Jay Rd		41,242	50,318	9,076	Retained
446	Cowdry Draw Trail at S 66th St	Marshall Mesa	21,431	26,699	5,269	Retained

Table 6: Annual Visits Comparison (2017 vs. 2023) *(continued)*

Location ID	Name	Analysis Subarea	Visits (2017)	Visits (2023)	Difference	Status (2023)
433	Cragmoor Connector Trail at Cragmoor TH		37,902	51,386	13,484	Retained
359	Crown Rock Picnic Loop at Crown Rock TH		39,909	15,257	-24,652	Retained
10	Dakota Ridge	Sanitas	66,767	57,840	-8,927	Retained
331	Degge at Broadway St	Boulder Valley Ranch	15,022	19,362	4,340	Retained
431	Devils Thumb Access Trail at Bear Mt Dr		30,301	37,150	6,849	Retained
1	Doudy Draw	Doudy Draw	23,628	34,581	10,953	Retained
30	Dry Creek		44,918	80,576	35,658	Retained
324	Eagle at Broadway St	Boulder Valley Ranch	21,290	18,306	-2,984	Retained
11	Eagle at Eagle Trailhead	Boulder Valley Ranch	42,958	48,235	5,278	Retained
292	East Boulder - Gunbarrel	Gunbarrel	39,963	36,039	-3,923	Retained
288	East Boulder - Teller Farm	Teller Farm	35,948	47,700	11,752	Retained
289	East Boulder - White Rocks	Teller Farm	12,139	27,521	15,381	Retained
485	East Boulder Trail at White Rocks	Gunbarrel	3,935	6,359	2,424	Retained
493	East Boulder-Teller Farm Trail at Teller Farm Sout	Teller Farm	35,047	34,660	-388	Retained
492	East Boulder-Teller Lake5 at Teller Farm North	Teller Farm	10,836	9,084	-1,753	Retained
494	East Boulder-Teller Spur at Willow Creek Dr	Teller Farm	5,264	4,879	-385	Retained
448	Eldorado Canyon Trail - west		8,987	4,768	-4,219	Retained
381	Enchanted Mesa Trail at Enchanted Mesa TH	Chautauqua	95,653	51,520	-44,133	Retained
365	Flagstaff Summit Rd at Amphitheater North		26,902	30,248	3,346	Retained
366	Flagstaff Summit Rd at Amphitheather South		48,982	20,995	-27,986	Retained
391	Flagstaff Trail at Baseline Picnic Area Access		16,265	14,632	-1,633	Retained
360	Flagstaff Trail at Crown Rock TH		19,201	13,262	-5,939	Retained
375	Flagstaff Trail at Gregory Canyon Road		15,647	7,858	-7,789	Retained
4	Flatirons Vista	Doudy Draw	32,113	58,943	26,830	Retained
342	Foothills - Wonderland Lake Spur at Locust Pl	Wonderland Lake	12,279	13,628	1,349	Retained
346	Foothills Community Path at Foothills Dog Park		12,435	22,696	10,261	Retained
348	Foothills Nort at Second and Denver		20,134	13,366	-6,768	Retained

Table 6: Annual Visits Comparison (2017 vs. 2023) *(continued)*

Location ID	Name	Analysis Subarea	Visits (2017)	Visits (2023)	Difference	Status (2023)
23	Foothills North at Foothills TH		17,812	15,017	-2,795	Retained
347	Foothills North at Second and Dakota Blvd		28,808	29,965	1,157	Retained
12	Foothills South		69,515	95,753	26,238	Retained
343	Foothills South at Locust Ave		14,201	20,213	6,012	Retained
401	Four Pines Trail at 17th St		18,658	13,285	-5,373	Retained
402	Four Pines Trail at Sierra Drive		19,430	18,252	-1,178	Retained
478	Fourmile Canyon Creek Path at 28th St		71,701	60,382	-11,318	Retained
479	Fourmile Canyon Creek Path at East Palo Park		53,502	82,947	29,445	Retained
457	Fowler Trail		23,583	33,959	10,377	Retained
352	Goat Trail at Hawthorne Ave	Sanitas	18,358	15,376	-2,982	Retained
350	Goat at 3rd and Forest Ave	Sanitas	34,558	32,089	-2,469	Retained
422	Green Mountain West Ridge		16,039	19,983	3,944	Retained
27	Greenbelt Plateau		20,574	43,181	22,607	Retained
437	Greenbriar Connector Trail at Greenbriar Blvd		16,418	23,527	7,109	Retained
25	Gregory Canyon		63,057	83,073	20,015	Retained
395	Gregory Canyon Spur Trail at Ranger Trail Access		16,167	9,937	-6,230	Retained
357	Halfway House at Halfway House TH		21,076	13,734	-7,341	Retained
434	Hardscrabble Connector Trail at Hardscrabble Dr		12,870	23,857	10,987	Retained
455	High Plains Trail - West		14,474	6,909	-7,566	Retained
454	High Plains Trail at Coalton and Hwy 128 Access		9,739	25,010	15,272	Retained
405	Holly Berry Tr at Holly Berry Access		13,986	26,094	12,108	Retained
344	Joder Ranch TH		9,505	9,931	426	Retained
345	Joder Ranch at Old Stage Road		6,350	8,375	2,026	Retained
497	KOA Lake Trail at 57th St.		1,108	3,067	1,960	Retained
403	Kohler Spur Trail at NIST Service Rd		10,588	6,910	-3,679	Retained
330	Left Hand at Beech Pavilion		1,885	251	-1,634	Retained
326	Left Hand at Boulder Valley Ranch TH	Boulder Valley Ranch	12,125	16,727	4,601	Retained
24	Left Hand at Left Hand TH		9,905	11,927	2,022	Retained
290	Lehigh Connector - North		79,252	124,268	45,016	Retained
435	Lehigh Connector South Trail		23,868	24,451	582	Retained
503	Lions Lair Spur Trail at Sunshine Canyon Dr	Sanitas	18,852	25,185	6,332	Retained
398	Long Canyon Trail at Long Canyon TH		4,239	4,546	307	Retained
396	Lost Gulch Trail at Lost Gulch Overlook TH		124,258	84,405	-39,853	Retained
438	Lower Big Bluestem Trail at Thomas Ln		7,974	8,084	110	Retained

Table 6: Annual Visits Comparison (2017 vs. 2023) *(continued)*

Location ID	Name	Analysis Subarea	Visits (2017)	Visits (2023)	Difference	Status (2023)
452	Marshall Valley Tr at Old Marshall Mesa TH	Marshall Mesa	1,496	6,718	5,222	Retained
371	Mattie Dean Trail at Pleasant St		2,127	3,148	1,021	Retained
382	McClintok Lower Trail	Chautauqua	28,211	22,988	-5,223	Retained
2	Mesa Trail at South Mesa Trailhead		121,639	122,020	381	Retained
55	Mount Sanitas	Sanitas	117,800	79,914	-37,886	Retained
430	NCAR Trail at NCAR TH		94,296	74,980	-19,316	Retained
404	NCAR-Skunk Canynon Tr at Skunk Canyon Tr		16,035	25,189	9,154	Retained
327	North Rim at Pebble Beach Dr	Boulder Valley Ranch	7,713	7,371	-342	Retained
474	Old Kiln Spur at Ridge Rd		8,018	4,599	-3,418	Retained
355	Panorama Trail at Flagstaff Rd		15,483	15,592	109	Retained
456	Prairie Vista Trail at Flatirons Vista TH	Doudy Draw	21,742	21,268	-473	Retained
387	Range View Trail at Flagstaff Summit West TH		7,029	9,826	2,798	Retained
54	Red Rocks		60,330	64,914	4,584	Retained
53	Red Rocks Spur		21,625	16,511	-5,113	Retained
52	Red Rocks Spur at The People		11,461	6,003	-5,459	Retained
51	Red Rocks at The People		87,898	43,935	-43,964	Retained
408	S Boulder Creek Path at East Boulder Comm Center		104,828	122,871	18,044	Retained
325	Sage at Boulder Valley Ranch TH - North	Boulder Valley Ranch	32,946	37,322	4,376	Retained
13	Sanitas Valley Trail	Sanitas	132,758	122,361	-10,397	Retained
353	Sanitas Valley at S Cedar Brook Rd	Sanitas	9,436	9,439	3	Retained
287	Sawhill Ponds		20,901	29,104	8,204	Retained
489	Sawhill Ponds Tr at Sawhill Access Northeast		8,705	23,313	14,608	Retained
490	Sawhill Ponds Trail at Sawhill Access North		8,149	18,281	10,132	Retained
388	Sensory Trail at Flagstaff Summit West TH		7,274	6,335	-940	Retained
413	Sombrero Marsh Tr at Sombrero Marsh Access- West		1,473	2,311	838	Retained
14	South Boulder Creek		103,297	76,108	-27,188	Retained
439	South Boulder Creek Marshall		61,290	55,289	-6,002	Retained
400	South Boulder Creek Path at Bobolink TH		68,801	57,263	-11,538	Retained
335	South Boulder Creek Path at Dimmit Dr		11,861	118,209	106,348	Retained
337	South Boulder Creek Path at Old Tale Rd		35,282	65,495	30,213	Retained
441	South Boulder Creek Tr at US 36 North		16,976	65,188	48,211	Retained
442	South Boulder Creek Tr at US 36 South		12,872	36,530	23,658	Retained

Table 6: Annual Visits Comparison (2017 vs. 2023) *(continued)*

Location ID	Name	Analysis Subarea	Visits (2017)	Visits (2023)	Difference	Status (2023)
440	South Boulder Creek Tr on U. of C. Gateway Propert		4,038	3,905	-132	Retained
26	South Boulder Creek West		18,731	39,146	20,415	Retained
429	Table Mesa Trail at Table Mesa Dr and Vassar Dr		28,982	23,352	-5,630	Retained
393	Tenderfoot Trail at Realization Point TH		18,146	23,530	5,384	Retained
432	Undesignated Tr at Fern Meadow Cragmoor Tr -West		7,824	13,147	5,323	Retained
409	Undesignated Tr at SBC Path and S Boulder Rd		44,797	2,554	-42,242	Retained
451	Undesignated Tr on Richardson1 Prop at Cherryvale		1,990	3,555	1,565	Retained
418	Undesignated Tr on Steinbach at Ridge Rd		3,485	3,645	159	Retained
383	Undesignated tr at Capstan Rock - north		13,252	637	-12,616	Retained
443	Undesignated tr at Cherryvale Rd & Church Pond No2		18,878	15,783	-3,095	Retained
500	Undesignated tr at Cottonwood Grove Lake-southeast		7,934	9,376	1,442	Retained
384	Undesignated tr at Flagstaff Rd and Capstan Rock-E		3,429	6,996	3,568	Retained
397	Undesignated tr at Flagstaff Rd and Cathedral ARF		8,112	7,106	-1,006	Retained
390	Undesignated tr at Flagstaff Rd and Contact Corner		26,859	11,506	-15,353	Retained
407	Undesignated tr at Skunk Creek Path and NIST CE		14,138	16,011	1,873	Retained
416	Undesignated tr at Sombrero Marsh and Ravenwood Rd		5,650	9,992	4,342	Retained
421	Undesignated tr on Oconnor-Hagman Property		5,347	6,149	802	Retained
417	Undesignated tr on Steinbach at Fairview Rd		4,242	4,541	299	Retained
420	Undesignated tr on Steinbach at Louisville Res		9,851	7,676	-2,175	Retained
419	Undesignated tr on Steinbach at W Azure Way		16,584	19,118	2,534	Retained
362	Undesignated trail at Baseline Picnic Area Access		13,459	8,023	-5,436	Retained
483	Undesignated trail at Cambridge and Heatherwood	Gunbarrel	22,795	30,628	7,833	Retained
514	Undesignated trail at Eldo PO Trail - east		1,132	2,095	963	Retained
515	Undesignated trail at Eldo PO Trail - west		28,344	965	-27,379	Retained
369	Undesignated trail at Elephant Buttress - east		11,941	6,315	-5,627	Retained

Table 6: Annual Visits Comparison (2017 vs. 2023) *(continued)*

Location ID	Name	Analysis Subarea	Visits (2017)	Visits (2023)	Difference	Status (2023)
501	Undesignated trail at Goat Tr on Cunningham prop	Sanitas	23,699	25,473	1,774	Retained
517	Undesignated trail at Harrison Ave		4,506	4,255	-251	Retained
487	Undesignated trail at Heatherwood and Aberdeen	Gunbarrel	2,459	2,470	12	Retained
486	Undesignated trail at Heatherwood and Kincross	Gunbarrel	4,956	6,671	1,715	Retained
476	Undesignated trail at Kelso Rd - north		1,157	2,168	1,011	Retained
477	Undesignated trail at Kelso Rd - south		2,458	8,009	5,551	Retained
412	Undesignated trail at Ontario Pl		14,490	10,837	-3,653	Retained
328	Undesignated trail at Pebble Beach Dr	Boulder Valley Ranch	1,155	2,236	1,080	Retained
349	Undesignated trail at Spring Valley Rd		8,360	5,048	-3,312	Retained
361	Undesignated trail at Upper Crown Rock Access		4,530	3,037	-1,494	Retained
364	Undesignated trail at Upper Flagstaff Trail Access		3,129	4,810	1,681	Retained
392	Ute Trail at Realization Point TH		20,600	19,288	-1,312	Retained
370	View Point Trail - North		31,442	18,082	-13,360	Retained
358	Viewpoint Trail at Panorama Point TH		25,076	24,434	-642	Retained
291	Wonderland Lake at Poplar Ave	Wonderland Lake	130,251	110,849	-19,402	Retained
338	Wonderland Lake at Quince	Wonderland Lake	118,746	147,344	28,598	Retained
340	Wonderland Lake at Utica - East	Wonderland Lake	114,880	74,303	-40,578	Retained
341	Wonderland Lake at Utica - West	Wonderland Lake	81,160	46,604	-34,555	Retained
15	Wonderland Lake at Wonderland Lake TH	Wonderland Lake	71,978	54,447	-17,531	Retained
Added						
538	7th Street Connector at Baseline Rd	Chautauqua	NA	27,165	NA	Added
537	8th Street Connector at Baseline Rd	Chautauqua	NA	29,266	NA	Added
540	Baseline Connector	Chautauqua	NA	5,561	NA	Added
505	Boulder Creek Path at Foothills Pkwy Path		NA	80,121	NA	Added
539	Boulder Falls at Boulder Canyon Dr		NA	261,469	NA	Added
467	Buckingham Park at Buckingham Park TH		NA	29,521	NA	Added
385	Flagstaff Road at Flagstaff Pulloff 1		NA	655	NA	Added
354	Fourmile Canyon Creek Path at 47th St		NA	32,346	NA	Added

Table 6: Annual Visits Comparison (2017 vs. 2023) *(continued)*

Location ID	Name	Analysis Subarea	Visits (2017)	Visits (2023)	Difference	Status (2023)
458	Fowler at Eldorado SP		NA	23,028	NA	Added
542	IBM Connector at 63rd Street		NA	38,649	NA	Added
546	Left Hand Ditch Path at Valmont Road		NA	7,450	NA	Added
543	Lions Lair at Sunshine Canyon	Sanitas	NA	20,942	NA	Added
535	NCAR - Bear Canyon at Wildwood Rd		NA	9,943	NA	Added
544	Skunk Creek Path at Hollyberry Lane		NA	7,841	NA	Added
414	Sombrero Marsh Tr at Sombrero Marsh Access-East		NA	6,164	NA	Added
444	Undesignated Tr at Cherryvale Rd on Hogan Brothers		NA	2,359	NA	Added
450	Undesignated Tr at SBCW Tr and Senda Rocosa St		NA	355	NA	Added
445	Undesignated road on Short Property at Whaley Dr		NA	1,390	NA	Added
498	Undesignated tr at Cottonwood Grove Lake - north		NA	913	NA	Added
499	Undesignated tr at Cottonwood Grove Lake - south		NA	247	NA	Added
491	Undesignated tr at Sawhill Ponds TH - north		NA	1,359	NA	Added
507	Undesignated trail at Baldwin Cir		NA	446	NA	Added
509	Undesignated trail at Boulderado Dr	Gunbarrel	NA	30,543	NA	Added
512	Undesignated trail at Canyonside Dr		NA	74	NA	Added
415	Undesignated trail at Crestmoor Dr		NA	2,727	NA	Added
513	Undesignated trail at Dartmouth Ave		NA	20,217	NA	Added
516	Undesignated trail at Elephant Buttress - west		NA	28,898	NA	Added
518	Undesignated trail at Knollwood Dr		NA	975	NA	Added
508	Undesignated trail at Lions Lair and Alder Ln	Sanitas	NA	1,646	NA	Added
519	Undesignated trail at Lookout Rd		NA	96	NA	Added
541	Undesignated trail at Swallow ln - north		NA	6,315	NA	Added
468	Undesignated trail on Beech-West at Old Stage Rd		NA	110	NA	Added
547	Wonderland Creek Path at Airport Road		NA	5,659	NA	Added
Removed						
480	Andrus Mesa	NA	1,068	NA	NA	Removed
6	Boulder Creek Path at Arapahoe Ave	NA	244,498	NA	NA	Removed
406	Skunk Canyon Trail	NA	15,197	NA	NA	Removed

Table 6: Annual Visits Comparison (2017 vs. 2023) *(continued)*

Location ID	Name	Analysis Subarea	Visits (2017)	Visits (2023)	Difference	Status (2023)
466	West Beech - Business Park	NA	1,168	NA	NA	Removed