Dewberry

TECHNICAL MEMORANDUM 1

Date: February 18, 2020

To: City of Louisville

From: Patrick Radabaugh, PE, Sam Franzen, PE - Dewberry Engineers Inc.

Subject: City of Louisville and Redtail Ridge Development Flows and Loads - Updated February 2020

BACKGROUND

The City of Louisville is located in southern Boulder along the Front Range in central Colorado. A general location map for the planning area is shown on **Figure 1**. The City of Louisville was founded in 1878 and incorporated in 1882. During its early days, Louisville was a coal mining town that was composed of many immigrant neighborhoods. The City is named after Louis Nawatny, a landowner during the City's early mining days, who platted a portion of his farmland and named it after himself. The City was a mining town until the closure of the last mine during the 1950s. Since that time, the City has transitioned to a suburban residential community.

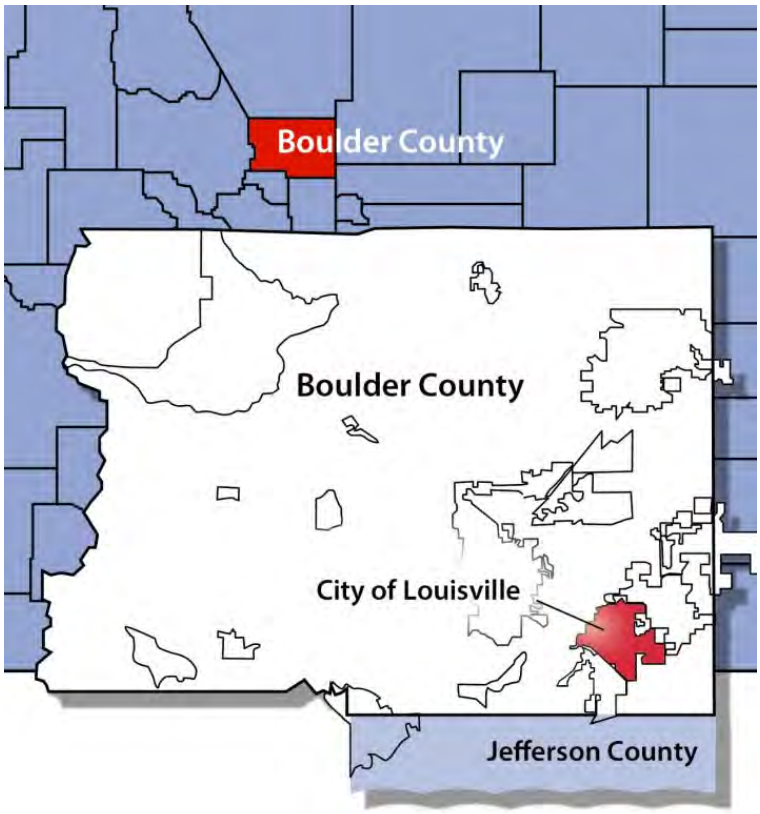

Figure 1 - City of Louisville Location Map

INTRODUCTION

The City of Louisville owns and operates its own wastewater treatment plant (WWTP) and secures water rights for its residents. The City also provides non-potable (wastewater reuse) to the Coal Creek Golf Course, Louisville Sports Complex, Miner's field, and Louisville Community Park.

SERVICE AREA AND POPULATION

The service area is the City of Louisville's border. It encompasses 8.6 square miles and in addition to residences and commercial space, contains 26 parks and approximately 1,700 acres open space. **Figure 1** shows the City boundary and the service area. The City's Boundaries are US 36 to the south, the City of Broomfield to the southeast, City of Lafayette to the north, the Davidson Mesa Open Space/Unincorporated Boulder County to the west, and Broomfield County to the east. The City is

comprised of primarily residential (single family and multifamily homes) with some industrial, commercial and retail space.

POPULATION

The City of Louisville has a current population of approximately 21,363. The City experienced rapid growth during the 1980s and 1990s, but growth slowed in the 2000s. In 1980, the population was 5,550. By Year 1990, the population had more than doubled to 12,870. By Year 2000, the population grew by approximately 50 percent to 19,051. Since Year 2000, the population of the City of Louisville has slowly grown to over 21,000 residents. Historical population from the US Census Bureau and estimated populations from recent years is given in **Table 1**.

Table 1 - City of Louisville Historical Populations

Year	Population
1980	5,550
1990	12,870
1998	18,177
1999	18,062
2000	19,051
2001	19,088
2002	18,747
2003	18,419
2004	18,574
2005	18,427
2006	18,723
2007	18,989
2008	19,461
2009	19,656
2010	18,376
2011	18,410
2012	19,014
2013	19,499
2014	19,993
2015	20,264
2016	20,719
2017	21,128
2018	21,205
2019	21,363

Notes:
1. Population from Years 2000, 2010 from U.S. Census Bureau.
2. Population from years 1980 and 1990 from www.Citydata.com which sites the US Census Bureau.
3. Population from years 2001-2009, 2011 from PRJCTNS spreadsheet from City of Louisville.

4. Population from years 2012-2019 from https://www.google.com/publicdata/explore?ds=kf7tgg1uo9ude_&met_y=population&idim=sub_county:0846355:0841835&hl=en&dl=en

WASTEWATER INFRASTRUCTURE

The WWTP is located at 1555 Empire Road in Louisville; approximately 0.6 mile east of downtown Louisville. The WWTP is shown in **Figure 2**. The plant currently treats an average of approximately 1.8 million gallons per day (mgd) and 4,334 pounds per day (ppd) of five-day biological oxygen demand (BOD_5). The plant is rated for 2.53 mgd and 5,515 ppd of BOD_5. The plant is currently operating at about 71 percent its rated hydraulic capacity and 79 percent of its rated organic capacity.

Figure 2 - City of Louisville Wastewater Treatment Plant

The headworks has two mechanical screens, one manual bar screen, a grit removal system, and flow measurement. The lift station has five sewage lift pumps, four of which are normally in operation. The secondary treatment process is a Johannesburg process consisting of three aeration basins, three secondary clarifiers, and the associated process equipment (pumps and blowers). UV units provide disinfection in two channels prior to all flow exiting the effluent flume. The solids handling process consists of a solids holding tank, a rotary drum thickener, an aerobic digester, and one dewatering centrifuge.

PLANNED FUTURE GROWTH

The City of Louisville has planned for growth in the future. New forecasted growth will be infill within the City limits. In the near term, growth contemplated master plan buildout by 2025 in the City; the forecasted growth is expected to come from infill development including the Coal Creek Ranch, Club Homes, Cherrywood, Centennial Heights, Tamarisk, and North End Developments. Planned commercial developments are primarily on the south end of town.

Table 2 - City of Louisville Population Projection

Year	Population	Reference
2019	21,163	U.S. Census Bureau
2020	21,649	Projected Growth at 1.013%
2021	21,938	Projected Growth at 1.013%
2022	22,231	Projected Growth at 1.013%
2023	22,529	Projected Growth at 1.013%
2024	22,830	Projected Growth at 1.013%
2025	23,000	Buildout per Master Plan

POPULATION PROJECTIONS

The current population of the City of Louisville is about 21,163 people per the most recent U.S. Census Bureau website. The town has planned for a population build-out of 23,000 people. Based on available data and trends, the current population growth Population projections for the City of Louisville are given in **Table 2**.

Table 3 - Projected Commercial Connection Growth

Year	Connections
2019	559
2020	570
2025	576
2030	604

Commercial and industrial connections to the City wastewater system typically increase by one tap per year. Growth in commercial/industrial connections is projected to increase between Year 2019 and Year 2030 to a total number of connections of 604 in Year 2030. Projected commercial/industrial connections are provided in **Table 3**.

FLOW SUMMARY

The City of Louisville provided wastewater flow data from 2015 through July 2019. Trends in data were reviewed from 2015 through 2019. **Figure 3** is a summary of data from late 2014 to mid-2019.

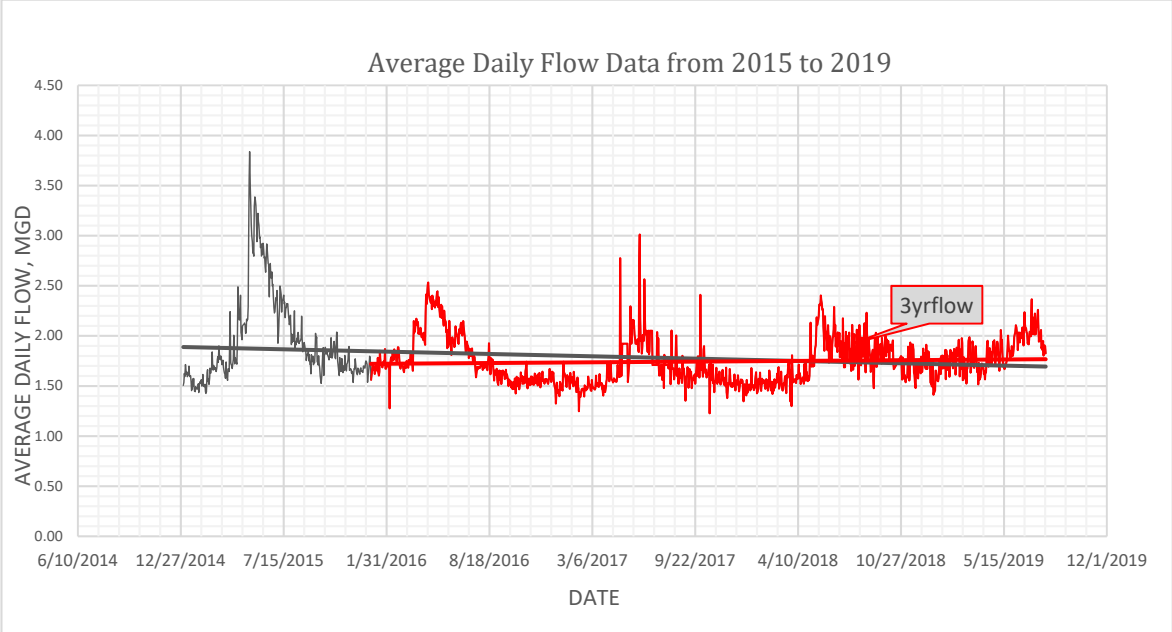

Figure 3 - Flow Data for City of Louisville WWTP from January 2015 through August 2019

Wastewater practitioners typically examine 3 to 5 years of flow data to make recommendations for flow capacity. Data from year 2015 was more variable than the remaining years considered. These initial irregularities may be a result of the construction project that ended in 2015. Dewberry considered the high variability of flow data in 2015 by comparing its effect to the trendline for four years and 8 months of total data. Including 2015 results in a downward overall flow trend. If 2015 is left out of the data and three years and 8 months of data are examined, the data shows a slightly positive trend. A gradually

increasing trend is what a typical wastewater treatment facility sees in a municipality with a population increase of about 1.1 percent per year. If a downward trend were to be believable a downward trend in gallons per person would need to decrease accordingly. Historically the City of Louisville has seen a gallons per capita (gpcd) flow rate of about 90.1 gpcd. The most recent data supports this historical consumptive use, thus the corresponding logic is for flow to continue to increase. The trend line from January 2016 through August 2019 confirms this logic and it has been used to support flow projection calculations.

LOAD SUMMARY

Load projections are based on five-day BOD (BOD_5) historical loading data, population projections, and flow projections. The historical data includes observed average annual BOD_5 from which maximum monthly averages can be calculated. The Colorado Department of Public Health and Environment (CDPHE) determines a treatment plant's maximum loading capacity based on the highest maximum monthly load the facility can treat while still meeting in-stream standards and state regulations. The plant's treatment process is considered as well as historical loading data. The following figure (Figure 4) shows the historical (2014 through mid-2019) and projected maximum month loading for the Louisville WWTP.

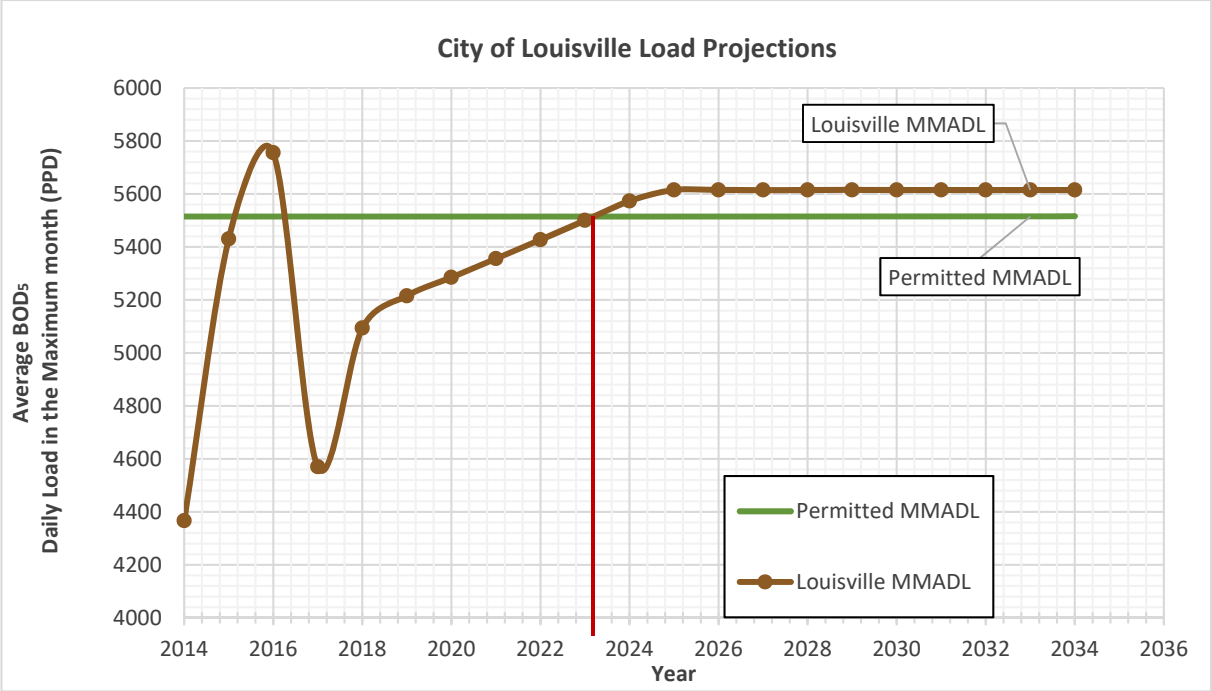

Figure 4 - Flow Data for City of Louisville WWTP from January 2015 through August 2019

Figure 4 shows a major swing in loading data in 2015 and 2016. This correlates with the discussion on flow changes and the commissioning of the expanded wastewater treatment plant. The average per capita BOD_5 loading per person for a municipality typically ranges between 0.18 and 0.22 pounds per

day. The historical BOD_5 loading at the City of Louisville is 0.207 pounds per day. This value was used in conjunction with population projections to calculate the max month BOD_5 load projections in **Figure 4**.

REDTAIL FLOW AND LOADS

Dewberry was hired to provide an existing capacity evaluation and evaluate the feasibility of adding flows and loads from the proposed Redtail Ridge Development. Four phases of development are planned. The timing of these developments is unknown at this time and are likely contingent on a number of factors.

Dewberry used the historical City of Louisville per capita wastewater flow and load values to estimate the flows and loads for the Redtail Ridge proposed development. HKS Engineering also provided a traffic planning study which included details of the proposed four phases of developments. Each phase of development includes residential and commercial zoning. Residential is comprised of continuing care retirement communities and commercial is comprised of general office buildings, business hotels, and shopping centers.

Dewberry developed a range of projections anticipating low, mid, and high level growth. These projections were developed from several commonly accepted literature sources, historical population and flow and load data in Louisville, and state and county regulations. **Table 4** summarizes our engineering assumptions:

Table 4 – Flow and Loading per Capita Contribution Assumptions

Commercial or Residential Units	Flow per Unit per Day	BOD^5 per Unit per Day
Continuing Care Retirement Community[1,2,3], flow per capita, BOD per capita	90	0.207
Shopping Center[1,2,3], gal/ft^2, lb BOD/ft^2	0.38	0.001
Business Hotel[1,2,3], gal per day person, lb BOD per person	45	0.15
General Office[1,2,3], gal/day-person, lb BOD/day-person	20	0.05

[1] *Town of Louisville Historical Data*

[2] *CDPHE Onsite Wastewater System Regulations*

[3] *Boulder County Onsiste Wastewater System Regulations*

Table 4 above includes the assumptions for per capita contributions for commercial and residential units. The 90 gallons per capita day flow per unit (gpcd) and 0.207 pounds per unit (PPD) is based on historical wastewater flows and loads. CDPHE and Boulder County also have standards for determining per unit contributions in onsite wastewater system regulations. These regulations are conservative and generally used for sizing typical onsite wastewater systems. A typical onsite wastewater system is generally defined as a leachfield or drain system that is treated by onsite soils. These guides tend to have higher

values to enlarge soil based systems to ensure proper treatment. In some instances, the guide values had to be reduced to avoid overly conservative estimates.

Table 5 provides projection assumptions for low, medium, and high flow contributions. These projections assumptions were adjusted based on U.S. Census Bureau Data and typical office space per person in the Denver metropolitan area.

Table 5 – Flow and Loading per Capita Contribution Assumptions

Commercial or Residential Unit Assumptions	Low	Medium	High
Residents per Unit[1]	2	2.5	3
Hotel Occupants per Unit	1	1.5	2
Office Space sq ft/person	350	300	250

Table 5 above is instrumental for development of low, medium, and high flow and load projections. The assumptions relate to population density. The City of Louisville has an average of 2.45 residents per dwelling per the U.S. Census Bureau. Typical hotel rooms generally have 1 to 2 occupants per night per room. Office space per person is based on the assumption of a 15 foot wide by 15 foot long office with accounting for common space use such as conference room space, hallways, restrooms, stairwells, breakrooms, kitchens, and shipping and receiving areas.

The results of this flow and load are included in the following tables. **Tables 6 and 7** provide low, medium, and high flow and load estimated projections associated with the Redtail Ridge Development.

Table 6 Redtail Ridge Flow Projections

Flow	ADF, GPD			MMF, GPD		
	LOW	MID	HIGH	LOW	MID	HIGH
Phase 1	240,314	298,333	359,400	302,796	375,900	452,844
Phase 2	165,414	202,533	241,900	208,422	255,192	304,794
Phase 3	80,600	96,517	114,300	101,556	121,611	144,018
Phase 4	30,643	34,167	39,100	38,610	43,050	49,266
SUM	**516,971**	**631,550**	**754,700**	**651,384**	**795,753**	**950,922**

Note: ADF = average day flow, MMF = average day in max month flow, gpd = gallons per day

Table 7 Redtail Ridge Load (BOD_5) Projections

LOAD	ADL, PPD			MML, PPD		
	LOW	MID	HIGH	LOW	MID	HIGH
Phase 1	623	771	931	747	925	1,117
Phase 2	389	476	568	467	571	681
Phase 3	194	231	273	232	277	328
Phase 4	78	87	99	93	104	119
SUM	**1,283**	**1,564**	**1,870**	**1,540**	**1,877**	**2,245**

Note: ADL = average day load, MMF = average day in max month load, ppd = pounds per day

Tables 6 and 7 includes estimated flow projections from Redtail Ridge ranging from 0.51 to 0.95 mgd for the maximum month. The maximum month organic loading from Redtail Ridge ranges from 1,540 to 2,245 ppd. The Louisville WWTP is currently rated for 2.53 MGD maximum month flow and 5,515 ppd of BOD_5. Four phases of development would consume approximately 26 percent to 38 percent of rated hydraulic capacity and 28 percent to 41 percent of rated biological capacity, both on a maximum month basis.

The facility has a current flow and load on an annual average basis of 1.8 mgd and 4,334 pounds per day (ppd) BOD_5 with a max month flow and load of 2.0 mgd and 4,850 ppd, or 80 percent and 88 percent, respectively. The Louisville WTTP periodically exceeds the CDPHE 80 percent capacity planning criteria threshold, but previous planning was for infill only and included only the previous contribution from the area now known as the Redtail Ridge development. The projected wastewater flows and loads from the Redtail Ridge development will exceed the City of Louisville's current rated wastewater treatment capacity and will require improvements to increase the capacity of the WWTP. The infrastructure improvements required are discussed in Technical Memorandum 2.