# WATER UTILITY FINANCIAL PLAN AND RATE STUDY

**CITY OF WHITEFISH, MT | MARCH 2016**


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City of Whitefish

## Executive Summary - Water

In May 2015, the City of Whitefish (City) retained AE2S to complete a Water and Wastewater Financial Plan and Rate Structure Study (Study). The completion of a comprehensive rate study is typically recommended every three (3) to five (5) years unless triggered by a major change to Utility operations or if significant capital improvements are planned. In line with these recommendations, the City initiated this Study for the following reasons:

- Greater than 10 years have passed since a comprehensive review of the water rates was completed and greater than 5 years have passed since wastewater rates were last comprehensively evaluated. The wastewater rates were last reviewed in 2009.
- The City desired a review of the equitability associated with current rates charged to different water service and wastewater service zones.
- The City is in the process of planning for a new wastewater treatment plant, which is expected to be commissioned in 2021. Based on preliminary engineering estimates for the facility, new debt associated with this facility is anticipated to be in the range of $15 million to $20 million.

The City of Whitefish provides water service to approximately 3,250 residential customers and 320 commercial customers within City limits, as well as 68 residential and seven (7) commercial customers located outside of City limits. Current policy requires that new users located outside of City limits are not eligible for connection unless annexation occurs. As the City has grown, significant growth has occurred in portions of the City that require significant pumping to provide adequate water pressure. As a result, the City's Water rate schedule distinguishes between three different service areas:

- Main pressure zone (referred to herein as "Baseline");
- High service pressure zones (referred to as "Pressure Zone" or "PZ"); and
- Outside City limits (referred to as "Outside").

The Water rate schedule includes a monthly fixed component that is scaled based on meter size and volumetric component that is charged per 1,000 gallons of metered water use. In addition to the water meters associated with each account, the City also makes irrigation meters available. The irrigation meters measure outdoor water use only, and are charged a fixed meter charge based on size for five months out of the year, as well as a volumetric rate per 1,000 gallons of metered usage year-round. The City currently serves approximately 530 irrigation meters.

Table ES.1 summarizes the current Water rate structure. The full rate schedule includes individual fixed rates by meter size, while Table ES.1 summarizes the range. In 2006, the City adopted a policy whereby the Water rates can be increased annually, if necessary, by the US

Department of Labor's Water, Sewer and Trash Collection Services Consumer Price Index for All Urban Consumers. For Fiscal Year 2016 (FY16), the Water rates were increased by 1.3 percent.

| User Class | 2016 Monthly Base Rate (Range - based on Meter Size) | 2016 Rate $/thousand gallons |
|---|---|---|
| **Non-Irrigation Usage** | | |
| Baseline | $24.85 - $521.83 | $3.92 |
| Pressure Zone | $28.39 - $61.53 | $4.98 |
| Outside | $31.95 - $307.65 | $5.76 |
| **Irrigation** | | |
| Baseline | $10.66 – $221.27 | $2.48 |
| Pressure Zone | $14.20 – $65.08 | $3.56 |
| Outside | $20.12 – $33.13 | $4.38 |

**Table ES.1: 2016 Water Rate Structure**

The City of Whitefish adopted a policy in 2006 that provides a 75 percent discount on the base (fixed) portion of the water bill to low income customers that receive assistance from the Montana Department of Public Health and Human Services, and also to Senior Citizens age 65 and over.

### Cost of Service Analysis

To evaluate the equitability of the existing rate structure, a Cost of Service Analysis (COSA) was completed to measure the cost attributable to each user class against the amount of revenue provided by each user class. The COSA comparison is made based on cost and revenue percentages calculated for a representative Test Year. For the purpose of this analysis, FY16 budget and capital expenditures were used as the basis for the Test Year. To develop Test Year projected revenue requirements, the number of accounts and metered water sales for calendar year 2014 were escalated to 2016. The FY16 water rates were then applied to the account and flow figures to develop Test Year revenues. Total Test Year 2016 revenue requirements are shown in Table ES.2. The COSA results are shown in Table ES.3.

| Revenue Requirement | Test Year 2016 |
|---|---|
| O&M-Related | $1,632,180 |
| Capital-Related | $1,586,296 |
| **Total Revenue Requirements** | **$3,218,476** |

**Table ES.2: Summary of Test Year 2016 Water Revenue Requirements**

| User Class | Test Year 2016 | | |
|---|---|---|---|
| | Cost Percentage | Revenue Percentage | % Difference |
| **Non-Irrigation** | | | |
| Baseline | 77.4% | 82.4% | 6.4% |
| Pressure Zone | 7.0% | 6.2% | -12.0% |
| Outside City | 2.6% | 2.5% | -3.9% |
| **Irrigation** | | | |
| Baseline | 9.8% | 7.4% | -24.4% |
| Pressure Zone | 3.1% | 1.5% | -52.0% |
| Outside City | 0.15% | 0.11% | -25.5% |
| **Total** | 100% | 100% | |

**Table ES.3: Test Year 2016 Cost of Service Analysis Results**

The results shown in Table ES.3 demonstrate the difference between cost and revenue associated with the City's user classes. The COSA results were used to develop a recommended rate approach that would work to align COSA allocated costs and revenues generated from each user class through the 2017 to 2021 planning period.

Given a typically recommended COSA target difference of ±10%, the detailed COSA results generally showed that the irrigation user classes are not generating revenue in line with the cost of service associated with irrigation water use. This result was not unexpected as information provided by City staff indicated that based on past Council policy, the irrigation rates have historically been set at a level less than the cost to provide the irrigation water in order to promote irrigation usage throughout the City. In addition, the results showed to a lesser degree that users in the high pressure zone areas are also not generating revenue adequate to cover the associated cost of providing service.

Correction of potential cost of service disparities were addressed in the rate design and revenue adequacy portions of the study. It should be noted that Montana Law specifies that rate increases applied to users outside of City limits cannot exceed those applied to similar users located within City limits. As a result, the City has limited ability to correct cost of service disparities associated with outside users without making similar inside City user base corrections.

**Findings and Recommendations**

The COSA results identified potential inequities within the existing rate structure. In particular, based on the assumptions utilized in the analysis, users in the high pressure zone portions of the system are not providing revenue in alignment with the amount of cost associated with service to the high pressure zones. This is in part due to irrigation usage in the pressure zone areas. Overall, the rates charged for irrigation usage area not adequate to recover the cost. The irrigation rates are less than indoor water rates, and irrigation usage generally occurs during the periods of highest water use, thereby driving up the peak day capacity requirements of the overall system.

To address cost of service inequities, support the funding of target reserve levels, and achieve overall revenue adequacy for the Water Utility, rate adjustments for the period of 2017 through 2021 were projected. Using the Test Year 2016 as the basis, revenue requirements were indexed to reflect inflationary effects and water sales and accounts were adjusted to reflect average increase in the user base over the past five years. To be conservative, reductions to irrigation water use were also assumed to recognize the pricing elasticity of disproportionate increases to this user class. Tables ES.4 and ES.5 summarize the projected monthly Base and volumetric rates, respectively. Table ES.6 summarizes the projected revenue requirements, revenues, and overall revenue adequacy. Figure ES.1 projects the future cash balances associated with the information presented in Tables ES.4 through ES.6.

| Meter Size | 2016 Rates | 2017 Recommended | 2018 Projected | 2019 Projected | 2020 Projected | 2021 Projected |
|---|---|---|---|---|---|---|
| **Baseline System Users – Non-Irrigation** | | | | | | |
| 5/8” | $24.85 | $25.10 | $25.40 | $25.70 | $26.00 | $26.30 |
| 3/4” | $36.68 | $37.00 | $37.40 | $37.80 | $38.20 | $38.60 |
| 1” | $52.06 | $52.60 | $53.10 | $53.60 | $54.10 | $54.60 |
| 1.5” | $159.74 | $159.80 | $159.80 | $159.80 | $159.80 | $159.80 |
| 2” | $263.88 | $263.90 | $263.90 | $263.90 | $263.90 | $263.90 |
| 3” | $315.93 | $319.10 | $322.30 | $325.50 | $328.80 | $332.10 |
| 4” | $521.83 | $527.00 | $532.30 | $537.60 | $543.00 | $548.40 |
| **Pressure Zone System Users – Non-Irrigation** | | | | | | |
| 5/8” | $28.39 | $29.80 | $31.30 | $32.20 | $33.20 | $34.20 |
| 3/4” | $42.60 | $44.70 | $46.90 | $48.30 | $49.70 | $51.20 |
| 1” | $61.53 | $64.60 | $67.80 | $69.80 | $71.90 | $74.10 |
| **Outside System Users – Non-Irrigation** | | | | | | |
| 5/8” | $31.95 | $32.30 | $32.60 | $32.90 | $33.20 | $33.50 |
| 3/4” | $46.15 | $46.60 | $47.10 | $47.60 | $48.10 | $48.60 |
| 1” | $68.63 | $69.30 | $70.00 | $70.70 | $71.40 | $72.10 |
| 1.5” | $185.77 | $185.80 | $185.80 | $185.80 | $185.80 | $185.80 |
| 2” | $307.65 | $307.70 | $307.70 | $307.70 | $307.70 | $307.70 |
| **Baseline System Users –Irrigation** | | | | | | |
| 5/8” | $10.66 | $12.30 | $12.50 | $12.80 | $13.10 | $13.40 |
| 3/4” | $15.39 | $16.00 | $16.20 | $16.70 | $17.10 | $17.40 |
| 1” | $26.03 | $26.10 | $26.10 | $26.10 | $26.10 | $26.20 |
| 1.5” | $65.08 | $65.10 | $65.10 | $65.10 | $65.10 | $65.10 |
| 2” | $110.04 | $110.10 | $110.10 | $110.10 | $110.10 | $110.10 |
| 4” | $221.27 | $239.60 | $243.40 | $251.60 | $256.20 | $261.50 |
| **Pressure Zone System Users –Irrigation** | | | | | | |
| 5/8” | $14.20 | $17.80 | $18.20 | $18.60 | $19.00 | $19.40 |
| 3/4” | $21.29 | $23.10 | $23.60 | $24.30 | $24.70 | $25.20 |
| 1” | $35.50 | $35.50 | $35.50 | $36.60 | $37.20 | $37.90 |
| 1.5” | $65.08 | $65.10 | $65.10 | $65.10 | $65.10 | $66.10 |
| **Outside System Users –Irrigation** | | | | | | |
| 3/4” | $20.12 | $15.70 | $16.00 | $16.30 | $16.60 | $16.90 |
| 1” | $33.13 | $33.20 | $33.20 | $33.20 | $33.20 | $33.20 |

**Table ES.4: Water Utility Monthly Base Rate Projections – Rate Adjustment Scenario**

| | 2016 Rates | 2017 Recommended | 2018 Projected | 2019 Projected | 2020 Projected | 2021 Projected |
|---|---|---|---|---|---|---|
| **Non-Irrigation Water Use** | | | | | | |
| Baseline | $3.92 | $3.92 | $3.92 | $3.92 | $3.92 | $3.92 |
| PZ | $4.98 | $5.23 | $5.49 | $5.77 | $6.06 | $6.36 |
| Outside | $5.76 | $5.76 | $5.76 | $5.76 | $5.76 | $5.76 |
| **Irrigation Water Use** | | | | | | |
| Baseline | $2.48 | $2.85 | $3.03 | $3.21 | $3.34 | $3.44 |
| PZ | $3.56 | $4.44 | $5.33 | $6.13 | $7.05 | $8.11 |
| Outside | $4.38 | $5.03 | $5.33 | $5.65 | $5.88 | $6.06 |

**Table ES.5: Water Utility Volumetric Rate Projections – Rate Adjustment Scenario**

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|
| **Projected Revenue Requirements** | | | | | | |
| O&M | $1,758,616 | $1,813,907 | $1,871,016 | $1,930,008 | $1,990,947 | $2,053,902 |
| Capital (Cash-Funded) | $1,882,400 | $1,571,000 | $760,000 | $108,500 | $950,000 | $1,222,000 |
| Capital (Debt-Funded) | $442,700 | $0 | $2,105,000 | $0 | $0 | $3,500,000 |
| Debt Service | $532,801 | $532,801 | $676,301 | $642,882 | $366,044 | $82,481 |
| Haskill Basin Loan | $0 | $0 | $0 | $0 | $0 | $0 |
| **Total Revenue Requirements** | **$4,616,517** | **$3,917,708** | **$5,412,317** | **$2,681,390** | **$3,306,991** | **$6,858,383** |
| **Projected Income and Funds from Other Sources** | | | | | | |
| Loan Proceeds | $442,700 | $0 | $2,105,000 | $0 | $0 | $3,500,000 |
| Other Revenue | $262,336 | $225,000 | $225,000 | $225,000 | $225,000 | $225,000 |
| Net Revenue Requirements | $3,911,481 | $3,692,708 | $3,082,317 | $2,456,390 | $3,081,991 | $3,133,383 |
| **Projected Revenue from Rates** | **$2,926,950** | **$2,965,572** | **$3,002,492** | **$3,045,506** | **$3,096,079** | **$3,147,337** |
| Revenue Surplus/(Deficiency) | **($984,531)** | **($727,136)** | **($79,825)** | **$589,116** | **$14,088** | **$13,953** |

**Table ES.6: Projected Water Utility Revenue Adequacy – Rate Adjustment Scenario**

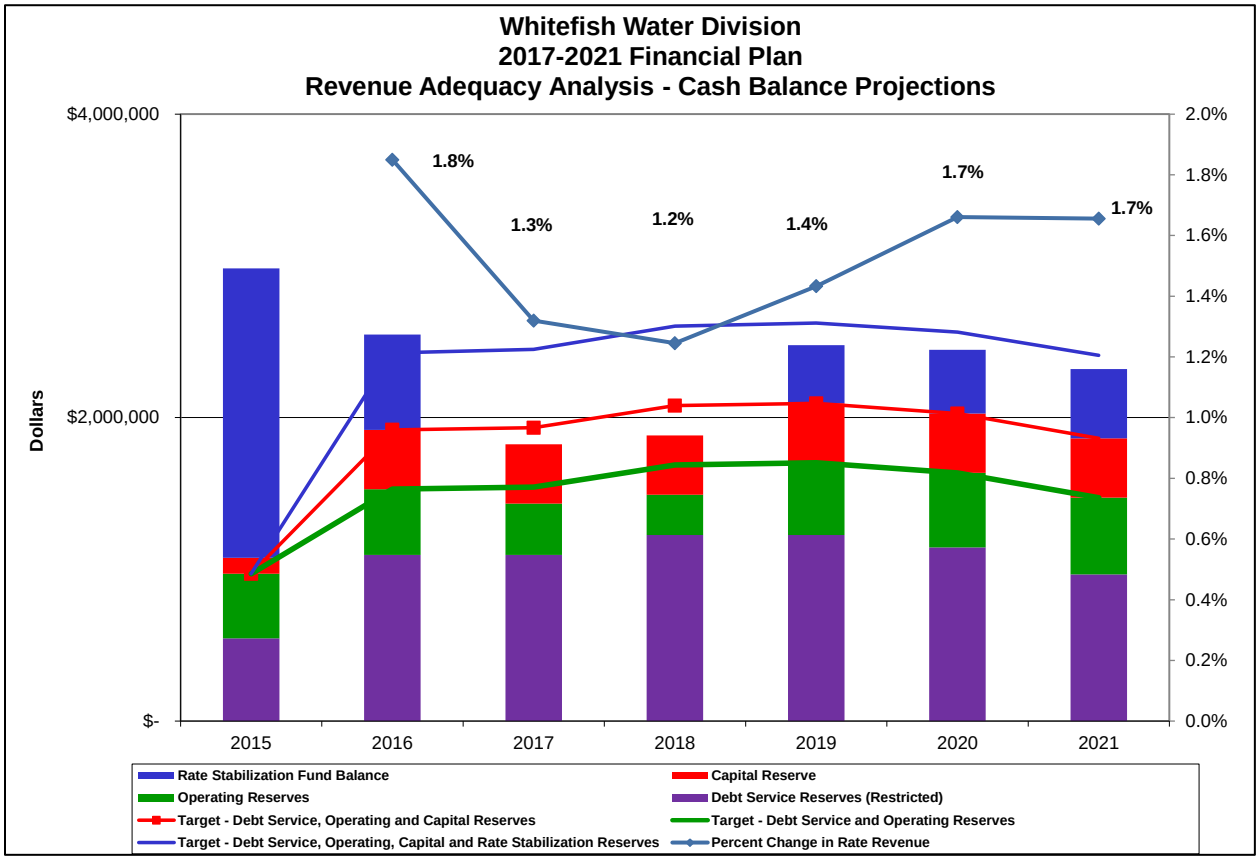


**Figure ES.1: Water Utility Cash Balance Projections – Rate Adjustment Scenario**

Based on the COSA, rate design, and revenue adequacy analyses completed, the following recommendations are offered for the Water Utility:

- **Strive to correct cost of service inequities by reducing system demand and increasing the cost of water used solely for seasonal irrigation.** By implementing the recommended changes to the water rates, the City will be making an effort to rectify existing cost of service inequities between Non-Irrigation and Irrigation-related water demand.
- **Link annual rate adjustments to Outside user rates to adjustments to Inside user rates.** It is recommended that City continue to adjust rates to Outside users consistent with those to Inside users. Due to the relatively small number of Outside users, it is very difficult to correct any cost of service disparity.
- **Review Water Revenue Adequacy annually.** The City of Whitefish has undertaken this project to develop a financial tool to assist in managing the financial health of the Water Utility. Although the projections herein contain proposed rate adjustments through 2021, a change in actual revenues or expenses from those projected could significantly impact the Utility. As a result, it is strongly recommended that the City closely monitor revenues and expenses as compared to those projected in the rate model, making adjustments as necessary, and update the projected rate adjustments based on the desired objective of achieving consistent revenue adequacy and meeting cash reserve target balances.
- **Monitor near-term revenue stability.** As the City works to achieve responsible water use, recommended increases to the Irrigation user classes will most likely result in changes in Irrigation usage. Some reduction in usage has been assumed in the analysis, but it will be important to make adjustments to the assumptions as actual usage information becomes available. Therefore, the City should closely monitor revenue stability associated with this change.
- **Establish Target Levels and Fund Operating Reserves.** In addition to Debt Service reserves required by bond covenants, it is recommended that the City strive to achieve and maintain the following reserve levels:
    - Operating Reserves: Target = 90 days of operating expenses
    - Capital Reserve: Target = 25 percent of average annual cash-funded capital expenditures
    - Rate Stabilization: Target = 15 percent of annual rate revenue.
- **Carefully Monitor Resort Tax Revenues.** Because the Haskill Basin loan is Water Utility backed debt currently being repaid through Resort Tax Revenues, it will be

important to closely monitor the availability of Resort Tax funds for debt repayment, and make adjustments, if necessary, to the projected rates to generate supplemental revenue for loan repayment.

- **Continue the policy of rate indexing as a minimum annual adjustment.** Although future rate adjustment projections contained herein are, for some user classes, less than average inflation, it is recommended that the City maintain its rate indexing policy, even though it is likely with an up-to-date financial model that in most years the City will be able to specifically dial in the necessary percentage.
- **Revise the existing Low Income/Senior Discount Policy.** It is recommended that the City revise its policy to require income-based qualification through the LIEAP to receive the discounted Utility rates.
- **Proactively communicate changes to the rate structure and increases to the periodic utility bills to the public.** It is recommended that once the City has approved Utility rates for 2017, it continue its proactive community outreach program to educate customers as to the new rates and rate impacts, and to promote the benefits of water conservation. It is suggested that outreach efforts involve information on the City website, press releases, and mailings. The information in Attachment A and that will be provided in a rate increases messaging worksheet (Rates 101) will be excellent resources in this effort. Table ES.7 presents the monthly change in dollar amount associated with rate projections. The change is compared to the monthly charge for the amount of water listed in the second column. The calculation has been completed for each year, with reference back to FY16 charges for service. Therefore, the monthly increase in the last column represents the projected monthly increase in 2021 as compared to the monthly charge in 2016. Table ES.8 presents the same information in percentage format.

It is important to remember that the cost of service is a one-time snapshot of cost causation associated with users of the utility. Setting rates for one to five years based on a cost of service analysis utilizing a Test Year costs and usage characteristics is a generally accepted practice. Corrections are then made periodically as COSA assumptions are updated. It is becoming more common to incorporate COSA into annual rate setting, which has been done for this project. This approach should help the City to adjust more quickly to changes in how the Utility is operated and how users are driving cost, thereby managing rate equitability on an on-going basis.

| | Avg Monthly Gallons | Existing Monthly Bill FY16 | 2017 $/Mth Increase from 2016 | 2018 $/Mth Increase from 2016 | 2019 $/Mth Increase from 2016 | 2020 $/Mth Increase from 2016 | 2021 $/Mth Increase from 2016 |
|---|---|---|---|---|---|---|---|
| Residential - 5/8" | | | | | | | |
| Inside | 4,000 | $ 40.53 | $ 0.25 | $ 0.55 | $ 0.85 | $ 1.15 | $ 1.45 |
| Inside Low Income | 4,000 | $ 21.89 | $ 0.09 | $ 0.19 | $ 0.19 | $ 0.29 | $ 0.39 |
| PZ | 5,500 | $ 55.81 | $ 2.78 | $ 5.72 | $ 8.13 | $ 10.71 | $ 13.38 |
| Outside | 4,000 | $ 55.01 | $ 0.35 | $ 0.65 | $ 0.95 | $ 1.25 | $ 1.55 |
| Outside Low Income | 4,000 | $ 31.05 | $ 0.11 | $ 0.21 | $ 0.21 | $ 0.31 | $ 0.41 |
| Residential - 3/4" | | | | | | | |
| Inside | 5,000 | $ 56.28 | $ 0.32 | $ 0.72 | $ 1.12 | $ 1.52 | $ 1.92 |
| Inside Low Income | 5,000 | $ 28.77 | $ 0.13 | $ 0.23 | $ 0.33 | $ 0.43 | $ 0.53 |
| PZ | 6,000 | $ 72.50 | $ 3.60 | $ 7.37 | $ 10.42 | $ 13.55 | $ 16.87 |
| Outside | 5,000 | $ 74.97 | $ 0.45 | $ 0.95 | $ 1.45 | $ 1.95 | $ 2.45 |
| Outside Low Income | 5,000 | $ 40.35 | $ 0.17 | $ 0.27 | $ 0.37 | $ 0.47 | $ 0.67 |
| Commercial | | | | | | | |
| Inside - 1" | 100,000 | $ 444.09 | $ 0.54 | $ 1.04 | $ 1.54 | $ 2.04 | $ 2.54 |
| Outside - 1" | 70,000 | $ 472.11 | $ 0.67 | $ 1.37 | $ 2.07 | $ 2.77 | $ 3.47 |
| Inside - 2" | 680,000 | $ 2,929.69 | $ 0.02 | $ 0.02 | $ 0.02 | $ 0.02 | $ 0.02 |
| Outside - 2" | 1,100,000 | $ 6,648.02 | $ 0.05 | $ 0.05 | $ 0.05 | $ 0.05 | $ 0.05 |
| Irrigation | | | | | | | |
| Inside - 5/8" | 10,000 | $ 35.48 | $ 5.37 | $ 7.28 | $ 9.39 | $ 10.98 | $ 12.28 |
| PZ - 5/8" | 10,000 | $ 49.76 | $ 12.49 | $ 21.78 | $ 30.18 | $ 39.78 | $ 50.76 |
| Inside - 3/4" | 10,000 | $ 40.21 | $ 4.34 | $ 6.25 | $ 8.56 | $ 10.25 | $ 11.55 |
| PZ - 3/4" | 16,000 | $ 78.18 | $ 16.03 | $ 30.75 | $ 44.25 | $ 59.37 | $ 76.80 |
| Outside - 3/4" | 33,000 | $ 164.53 | $ 21.94 | $ 32.31 | $ 43.37 | $ 51.13 | $ 57.36 |
| Inside - 1" | 27,000 | $ 93.04 | $ 10.12 | $ 14.74 | $ 19.64 | $ 23.11 | $ 25.91 |
| PZ - 1" | 18,000 | $ 99.50 | $ 16.00 | $ 32.01 | $ 47.51 | $ 64.67 | $ 84.41 |
| Outside - 1" | 6,000 | $ 59.38 | $ 4.01 | $ 5.83 | $ 7.75 | $ 9.10 | $ 10.16 |
| Inside - 1.5" | 105,000 | $ 325.67 | $ 39.11 | $ 57.10 | $ 76.15 | $ 89.62 | $ 100.13 |
| Inside - 2" | 130,000 | $ 432.68 | $ 48.45 | $ 70.72 | $ 94.31 | $ 110.99 | $ 124.00 |

**Table ES.7: Monthly Water Rate Increase Associated with Projected Rate Adjustments – Referenced to FY16**

| | Avg Monthly Gallons | Existing Bill FY16 | 2017 % Increase from 2016 | 2018 % Increase from 2016 | 2019 % Increase from 2016 | 2020 % Increase from 2016 | 2021 % Increase from 2016 |
|---|---|---|---|---|---|---|---|
| Residential - 5/8" | | | | | | | |
| Inside | 4,000 | $ 40.53 | 0.6% | 1.4% | 2.1% | 2.8% | 3.6% |
| Inside Low Income | 4,000 | $ 21.89 | 0.4% | 0.9% | 0.9% | 1.3% | 1.8% |
| PZ | 5,500 | $ 55.81 | 5.0% | 10.2% | 14.6% | 19.2% | 24.0% |
| Outside | 4,000 | $ 55.01 | 0.6% | 1.2% | 1.7% | 2.3% | 2.8% |
| Outside Low Income | 4,000 | $ 31.05 | 0.3% | 0.7% | 0.7% | 1.0% | 1.3% |
| Residential - 3/4" | | | | | | | |
| Inside | 5,000 | $ 56.28 | 0.6% | 1.3% | 2.0% | 2.7% | 3.4% |
| Inside Low Income | 5,000 | $ 28.77 | 0.5% | 0.8% | 1.2% | 1.5% | 1.9% |
| PZ | 6,000 | $ 72.50 | 5.0% | 10.2% | 14.4% | 18.7% | 23.3% |
| Outside | 5,000 | $ 74.97 | 0.6% | 1.3% | 1.9% | 2.6% | 3.3% |
| Outside Low Income | 5,000 | $ 40.35 | 0.4% | 0.7% | 0.9% | 1.2% | 1.7% |
| Commercial | | | | | | | |
| Inside - 1" | 100,000 | $ 444.09 | 0.1% | 0.2% | 0.3% | 0.5% | 0.6% |
| Outside - 1" | 70,000 | $ 472.11 | 0.1% | 0.3% | 0.4% | 0.6% | 0.7% |
| Inside - 2" | 680,000 | $ 2,929.69 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Outside - 2" | 1,100,000 | $ 6,648.02 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Irrigation | | | | | | | |
| Inside - 5/8" | 10,000 | $ 35.48 | 15.1% | 20.5% | 26.5% | 30.9% | 34.6% |
| PZ - 5/8" | 10,000 | $ 49.76 | 25.1% | 43.8% | 60.6% | 79.9% | 102.0% |
| Inside - 3/4" | 10,000 | $ 40.21 | 10.8% | 15.5% | 21.3% | 25.5% | 28.7% |
| PZ - 3/4" | 16,000 | $ 78.18 | 20.5% | 39.3% | 56.6% | 75.9% | 98.2% |
| Outside - 3/4" | 33,000 | $ 164.53 | 13.3% | 19.6% | 26.4% | 31.1% | 34.9% |
| Inside - 1" | 27,000 | $ 93.04 | 10.9% | 15.8% | 21.1% | 24.8% | 27.8% |
| PZ - 1" | 18,000 | $ 99.50 | 16.1% | 32.2% | 47.7% | 65.0% | 84.8% |
| Outside - 1" | 6,000 | $ 59.38 | 6.8% | 9.8% | 13.0% | 15.3% | 17.1% |
| Inside - 1.5" | 105,000 | $ 325.67 | 12.0% | 17.5% | 23.4% | 27.5% | 30.7% |
| Inside - 2" | 130,000 | $ 432.68 | 11.2% | 16.3% | 21.8% | 25.7% | 28.7% |

**Table ES.8: Monthly Water Rate Percentage Increase Associated with Projected Rate Adjustments – Referenced to FY16**

# 1.0 Introduction

In May 2015, AE2S was retained by the City of Whitefish to complete a Water and Wastewater Rate Study. Data from the 2014 Fiscal Year (FY14), which began July 1, 2013 and ended June 30, 2014, was utilized to develop the Test Year for the study. This Technical Memorandum summarizes the assumptions, analysis, results, and recommendations for the portion of the study related to the Water Utility.

## 1.1 Project Objectives

Primary objectives for completion of the Water Rate study included the following:

- Review appropriateness of rate structure given assumptions related to customer usage characteristics and the manner in which the different user classes drive cost (cost causation);
- Develop rate plan for 2017-2021; and
- Obtain a customized rate model that can be used by the City for future rate-setting activities.

## 1.2 Study Process and Deliverables

To meet the City's objectives, AE2S completed a study consisting of the following components:

- Develop Test Year Revenue Adequacy Requirements
- Evaluate Water Utility Rate Base
- Complete Cost of Service Analysis (COSA)
- Evaluate Rate Design Alternatives
- Project Five-Year Revenue Adequacy based on Recommended Rate Design

Throughout the study, the AE2S and City project team met via GoToMeeting or teleconference to discuss assumptions and intermediate results. In addition, AE2S participated in two (2) City Council Workshops to: 1) educate policy makers on the purpose and steps involved in a rate study, as well as what to the do with the results, and 2) to present preliminary results and solicit policy-related direction prior to developing final results and recommendations. A final presentation of the results and recommendations will also be made by AE2S at a City Council meeting concurrent with the delivery of this final report.

A primary objective of this study was to develop tools specifically tailored to the City of Whitefish that can be used annually by the City for rate planning and financial management of the utilities. The following deliverables for the Water Utility have been developed as part of this project:

- Water Utility Cost of Service and Revenue Adequacy Spreadsheet Model;
- Technical Memorandum for Water Rate Study (this memo); and

- Rates 101 Worksheet – to be used by City staff in explaining water rate analyses and water rate structure.

# 2.0 System Description, Customer Usage, and Rate Structure

## 2.1 Overview of System

The City of Whitefish uses two surface water source for its water supply – Haskill Creek (primary) and Whitefish Lake (supplementary). In recent years, contamination of the Haskill Creek source has been problematic. As a result, in early 2016 the City purchased a conservation easement to help preserve the quality of this water source. The City's water treatment plant (WTP) was constructed in 2000 and has a design capacity of 4.0 million gallons per day (MGD). Recent historical data shows that average and peak day operational values are 1.36 MGD and 2.94 MGD, respectively.

The Whitefish water system has five (5) pressure zones throughout the City, some of which require substantial pumping. The pressure zone system utilizes three (3) water storage and four (4) booster station facilities. The current capital improvement plan (CIP) calls for the construction of an additional water storage facility on the south end of town in 2018. The current water storage facilities include:

- 1.0 MGD tank at the WTP site, used both for chlorine contact time (disinfection) and general system storage and pressure;
- 0.75 MGD Lower Grouse Mountain tank for general system storage and pressure; and
- 0.30 MGD Upper Grouse Mountain tank that serves users in the higher pressure zones.

The City's rate structure designates different rates for users located within the main pressure zone, pressure zones requiring significant pumping, and outside the City limits. Throughout the study, the main pressure zone is referred to as the Baseline user class, the high pressure zones are referred to as PZ (pressure zone) user class, and outside City limits is referred to as Outside user class.

The City's transmission and distribution system consists of approximately 30 miles of transmission pipeline ranging in size from 10 to 30 inches in diameter, and greater than 55 miles of distribution pipelines four (4) to eight (8) inches in diameter.

## 2.2 Customers and Usage

The City of Whitefish provides water service to approximately 3,600 user accounts within City limits and 75 user accounts outside of the City. In addition, the City provides service to approximately 530 irrigation accounts. Based on a review of billed flow and account data from FY10 through FY14, FY14 accounts were increased by one (1) percent annually to estimated total accounts for Test Year 2016. Similarly, FY14 flow data was grown by one-half percent annually to project flow for Test Year 2016. The City's rate structure does not distinguish

between residential and commercial customers, and the City does not serve any large industrial users. The number of accounts (residential and commercial) by meter size and billed flow for the 2014 is shown in Table 2.1.

| User Type/Meter Size | Number of Accounts | Billed Flow (gallons) |
|---|---|---|
| **Non-Irrigation Accounts** | | |
| Baseline | 2,999 | 231,691,250 |
| Baseline – Low Income | 300 | 13,627,160 |
| Pressure Zone | 211 | 8,953,280 |
| Pressure Zone – Low Income | 54 | 2,590,830 |
| Outside | 67 | 5,333,070 |
| Outside – Low Income | 8 | 314,280 |
| **Irrigation Accounts** | | |
| Baseline | 429 | 65,875,070 |
| Pressure Zone | 94 | 8,714,990 |
| Outside | 4 | 614,420 |
| **Total** | **4,166** | **337,714,350** |

**Table 2.1: 2014 Accounts and Billed Water Data**

Although the results of this study do not present separate rates for residential and commercial users, data for each user type was available and was evaluated separately in the analysis and combined in the final results. In recognition of slight variations in peaking factors between residential and commercial users, the portion of the study that involved evaluation of peak day factors and assignment of cost associated with such factors did account for residential and commercial usage separately. Based on a review of usage data from 2010 through 2014, the following peaking factors were noted:

- Residential: 1.89
- Commercial: 1.55
- Irrigation: 1.95

## 2.3 Existing Water Rate Structure

The City's rate structure contains two components: a fixed monthly charge based on meter size and a volumetric rate based on location. The City provides water service to residents and businesses within City limits, as well as to some users located outside City limits. Current policy is such that the City does not provide water service to new users outside City limits unless the area becomes annexed. The existing volumetric and monthly base rate structures are shown in Tables 2.2 and 2.3, respectively.

| User Class | 2016 Rate $/thousand gallons |
|---|---|
| **Non-Irrigation Usage** | |
| Baseline | $3.92 |
| Pressure Zone | $4.98 |
| Outside | $5.76 |
| **Irrigation** | |
| Baseline | $2.48 |
| Pressure Zone | $3.56 |
| Outside | $4.38 |

**Table 2.2: 2016 Volumetric Water Rate Structure**

| Meter Size | Non-Irrigation | | | Irrigation* | | |
|---|---|---|---|---|---|---|
| | Baseline | Pressure Zone | Outside | Baseline | Pressure Zone | Outside |
| **5/8”** | $24.85 | $28.39 | $31.95 | $10.66 | $14.20 | |
| **3/4”** | $36.68 | $42.60 | $46.15 | $15.39 | $21.29 | $20.40 |
| **1”** | $52.06 | $61.53 | $68.63 | $26.03 | $35.50 | $33.13 |
| **1.5”** | $159.74 | | $185.77 | $65.08 | $65.08 | |
| **2”** | $263.88 | | $307.65 | $110.04 | | |
| **3”** | $315.93 | | | | | |
| **4"** | $521.83 | | | $221.27 | | |

* Irrigation base rates charged five (5) months out of the year

**Table 2.3: 2016 Monthly Water Base Rate Structure**

In 2006, the City adopted a policy regarding Low Income and Senior Citizen discounts on water, sewer, and solid waste bills. Qualification for the discounts was based on eligibility for low income assistance from the Montana Department of Public Health and Human Services or proof of age 65 or over. Those eligible for the discount receive a 75 percent reduction in the monthly base rate for water, wastewater, and solid waste. Table 2.4 presents the Low Income/Senior Citizen discounted base rates for 2016.

| Meter Size | Baseline – Low Income | Pressure Zone – Low Income | Outside – Low Income |
|---|---|---|---|
| **5/8”** | $6.21 | $7.10 | $7.99 |
| **3/4”** | $9.17 | $10.66 | $11.53 |
| **1”** | $13.02 | $15.39 | $17.16 |
| **1.5”** | $39.94 | | $46.44 |
| **2”** | $65.97 | | $76.91 |
| **3”** | $78.98 | | |
| **4"** | $130.46 | | |

**Table 2.4: 2016 Monthly Low Income/Senior Citizen Water Base Rate Structure**

# 3.0 Test Year Revenue Requirements and Revenues

Revenue requirements consist of expenses incurred for operation and maintenance (O&M) of the Water Utility, as well capital-related expenses such as debt service principal, capital outlays, and contributions to reserves. Because the City of Whitefish serves customers located outside of City limits, the utility method of determining revenue requirements was used. Based on the FY16 budget and the current CIP, Test Year revenue requirements were developed. The Test Year revenue requirements were then projected annually through 2021 based on assumed escalation factors, cash-funded capital in the CIP, and future debt associated with the CIP.

In addition to revenues, the COSA result also requires the development of Test Year revenues. These are presented in Section 3.4.

## 3.1 Operation and Maintenance Costs

For the purpose of developing water rates for FY17 through 2021, the O&M component of revenue requirements was based on the FY16 Water Budget. In determining net O&M revenue requirements, consideration is also given to non-rate operating revenue, which is applied to offset the operating costs. Table 3.1 summarizes total projected net O&M revenue requirements.

## 3.2 Capital Costs

Total capital-related revenue requirements were evaluated in terms of the cash-basis for the purpose of establishing the utility-basis capital requirements to be met with rate revenue. Completion of the Cost of Service Analysis (COSA) utilizing capital revenue requirements established on the utility basis is the recommended approach when a system provides service to users located outside of City limits, such as the case for the City of Whitefish. These steps are described below.

### 3.2.1 Development of Cash-Basis Capital-Related Revenue Requirements

The City provided information related to existing and anticipated debt service requirements, the five-year Capital Improvement Plan (CIP), and cash-funded capital outlays within the CIP. For the purpose of developing a representative Test Year, the annual average cash-funded CIP value was calculated. These values for the Test Year 2016 are shown in Table 3.2

| Budget Line Item | 2016 Budget |
|---|---|
| Personnel Services | $964,072 |
| Office Supplies/Materials | $4,000 |
| Operating Supplies | $28,975 |
| Chemicals | $28,000 |
| Repair/Maintenance Supplies | $170,784 |
| Postage & Freight | $13,500 |
| Printing | $2,500 |
| Publicity/Subscription | $19,010 |
| Utility Services | $14,950 |
| Electrical | $65,050 |
| Professional Services | $107,600 |
| Repair & Maintenance Services | $39,800 |
| Travel & Training | $10,600 |
| Other Purchased Services | $32,500 |
| Contract Services | $40,000 |
| Insurance | $31,000 |
| Rent | $8,961 |
| Special Assessments | $7,555 |
| Water Utility ROW Fee | $143,750 |
| Whitefish Lake Institute | $6,667 |
| Administrative Expense | $19,342 |
| **Total O&M Revenue Requirements** | **$1,758,616** |
| Less Non-Rate Operating Revenue | $126,436 |
| **Net O&M Revenue Requirements** | **$1,632,180** |

**Table 3.1: Summary of Net Water O&M Revenue Requirements – Test Year 2016**

| Capital Revenue Requirement | Test Year 2016 |
|---|---|
| Debt Service | $579,096 |
| Rate-Funded Capital | $1,007,200 |
| **Total Capital Revenue Requirements** | $1,586,296 |

**Table 3.2: Summary of Test Year 2016 Water Capital-Related Cash-Basis Revenue Requirements**

### 3.2.2 Development of Utility-Basis Capital-Related Revenue Requirements

To fairly assign the cost of only those assets in service and utilized by outside City user classes, the Utility-basis methodology was used to determine the capital-related portion of the net revenue requirements to be recovered from rates. The Utility-basis methodology calculates the capital-related component of revenue requirements based on depreciation of system assets in service and a return on capital investment made by the owners of the system. To complete this calculation, the City provided a listing of all assets, annual depreciation, and undepreciated asset value. Once capital-related revenue requirements have been established, methodology used throughout the industry and promoted by the American Water Works Association (AWWA) was followed to appropriately allocate the Utility-basis capital-related revenue requirements to all user classes. For Test Year 2016, the depreciation and calculated return on rate base total are $394,435 and $1,191,861, respectively, and are shown in Table 3.3.

| Revenue Requirement | Cash Basis | Utility Basis |
|---|---|---|
| Net O&M | $1,632,180 | $1,632,180 |
| Debt Service | $579,096 | -- |
| Rate-Funded CIP | $1,007,200 | -- |
| Depreciation | -- | $394,435 |
| Return on Rate Base | -- | $1,191,861 |
| **Total Revenue Requirements** | **$3,218,476** | **$3,218,476** |

**Table 3.3: Summary of Test Year 2016 Cash- and Utility-Basis Total Water Revenue Requirements**

As shown in Table 3.3, the cash- and utility-basis capital-related revenue requirements are equal. This is because in practice, the Water Utility must generate enough rate revenue to meet its cash-basis revenue requirements. It is how the cash-and utility-basis capital revenue requirements are ultimately allocated to user classes that distinguishes between the two approaches. Under the cash-basis, capital-related revenue requirements are ultimately assigned to user classes based on the specific application of the cost each year (treatment, transmission, etc.), while under the utility-basis, capital-related revenue requirements are assigned to specific user classes based on the value of the system from which the user classes benefit.

## 3.3 Total Revenue Requirements

Table 3.4 summarizes the total revenue requirements developed for the Test Year 2016. These form the basis for the Cost of Service Analysis (COSA) addressed in Section 4.0, and will be adjusted for anticipated future changes in the Revenue Adequacy Analysis in Section 6.0.

| Revenue Requirement | Test Year 2016 |
|---|---|
| O&M-Related | $1,632,180 |
| Capital-Related | $1,586,296 |
| **Total Revenue Requirements** | **$3,218,476** |

**Table 3.4: Summary of Test Year 2016 Water Revenue Requirements**

## 3.4 Rate Revenues

Table 3.5 summarizes the Test Year 2016 rate revenues, based on FY16 Water rates and projected FY16 accounts and water sales. To estimate Test Year 2016 accounts and water sales, the following assumptions were applied to the values in Table 2.1:

- Inside City meters greater than 5/8" were indexed by 1.0 percent per year from 2014 to 2016;
- Outside City meters were not indexed (new outside users will not be added without annexation); and
- Inside City Non-Irrigation water sales were indexed by 0.5 percent per year from 2014 to 2016.

| User Classes | Test Year 2016 Rate Revenue |
|---|---|
| **Non-Irrigation Users** | |
| Inside | $2,410,927 |
| PZ | $181,508 |
| Outside | $71,998 |
| **Irrigation Users** | |
| Inside | $216,419 |
| PZ | $42,876 |
| Outside | $3,221 |
| **Total** | **$2,926,950** |

**Table 3.5: Summary of Test Year 2016 Water Rate Revenues**

# 4.0 Cost of Service Analysis

This section summarizes the cost of service assumptions, analysis and results. Detailed tables summarizing the costs by ownership, cost type, and cost allocation to the user classes are found in the rate model.

## 4.1 Methodology

Following the establishment of total O&M and capital revenue requirements, the revenue requirements were taken through a series of steps to result in allocation to each user class. In the first step, revenue requirements were categorized into functional components based on information provided by City staff from the budget and from knowledge of operational practices. In the second step, costs were classified as to how the cost is related to usage characteristics – Max Day (Capacity), Average Day (Commodity), Customer, or Meter applicability. In the third step, costs were allocated to customer classes based on the system usage characteristics of each class. The following subsections describe the steps utilized in the Water COSA.

## 4.2 Analysis of O&M Component

### 4.2.1 Functionalization

Under the Utility-basis methodology, it is important to identify which costs are applicable to outside users and which are not. As a result, the functionalization is completed in two steps: evaluation of applicability of cost to inside and outside users and then categorization into functional components. Table 4.1 summarizes the functions associated with the O&M revenue requirements for the Whitefish Water Utility, and the applicability to each type of user.

| O&M Function | All Users | PZ Only | Outside Only |
|---|---|---|---|
| **Supply/Treatment – Fixed** | 100% | | |
| **Supply/Treatment – Variable** | 100% | | |
| **Storage** | 85.4% | 14.3% | |
| **Pressure Zone Pumping** | | 100% | |
| **Transmission** | 100% | | |
| **Distribution** | 100% | | |
| **Meter** | 100% | | |
| **Admin** | 100% | | |

**Table 4.1: Applicability of O&M Water Revenue Requirements to Users by Type**

The following assumptions form the basis for the values in Table 4.1:

- Revenue requirements related to Supply/Treatment, Transmission, Distribution, Meter, and Admin are driven by all system users, regardless of location.
- The 0.3 MGD storage tank at Upper Grouse Mountain does not benefit the main pressure zone or users outside the system. Therefore, the full capacity of that tank is assumed to only benefit the high pressure zone (PZ) users. The 0.3 MGD tank represents 14.3 percent of total system storage (0.3 ÷ 2.05 = 14.3%).
- Based on the scattered location of Outside City users and the fact that outside users are not served strictly by large diameter transmission pipelines, it was assumed the outside users benefit from the total distribution network in the same manner as inside City users. In addition, it is City policy that new service outside the City will not be provided unless annexation is completed.

Table 4.2 summarizes the functionalization of O&M budget line items based on how operations of various portions of the system drive the budgeted O&M expenditures. Table 4.3 summarizes the total functionalized net O&M revenue requirements for the Test Year 2016 based on the allocations in Table 4.2 and the values in Table 4.1.

### 4.2.2 Classification

Table 4.4 summarizes the classification percentages applied to functionalized O&M revenue requirements for the Test Year 2016. Table 4.5 summarizes the classified O&M revenue requirements. The following bullets highlight the assumptions behind the O&M classification percentages.

- Supply/Treatment – Fixed and Transmission: These expenses are associated with meeting maximum day demands as well as average day usage, and are split between Commodity and Capacity based on the system max day/average day value of 2.16 (1.94 MGD average max day ÷ 1.36 MGD average day 2010-2014). This resulted in a classification of 46.2 percent Commodity and 53.8 percent Capacity.
- Supply/Treatment – Variable: This expense varies directly with water usage and is assigned as a 100 percent Commodity cost.
- Storage: 14.3 percent was classified as a directly assignable cost to the PZ users based on the explanation provided in Section 4.2.1, and the remaining 85.7 percent was classified similar to Supply/Treatment – Fixed and Transmission. This resulted in a classification of 40.3 percent Commodity, 44.5 percent Capacity, and 14.3 percent PZ.
- Pressure Zone: Costs that are directly assignable to the PZ user class were classified as such.

| Budget Line Item | S/T Fixed | S/T Variable | Storage | PZ Pumping | Trans | Dist | Meter | Admin |
|---|---|---|---|---|---|---|---|---|
| Personnel Services | 35% | | 10% | 5% | 2% | 8% | 10% | 30% |
| Office Supplies/Materials | 25% | | | | | | | 75% |
| Operating Supplies | 80% | | | 5% | 5% | 10% | | |
| Chemicals | | 100% | | | | | | |
| Repair/Maintenance Supplies | 14% | | | 3% | 11% | 29% | 43% | |
| Postage & Freight | 5% | | | | | | | 95% |
| Printing | 50% | | | | | | | 50% |
| Publicity/Subscription | 50% | | | | 5% | 20% | | 25% |
| Utility Services | 57% | | | 19% | | 15% | | 9% |
| Electrical | | 87% | | 13% | | | | |
| Professional Services | | | | | | | | 100% |
| Repair & Maintenance Services | 75% | | | 25% | | | | |
| Travel & Training | 50% | | | | 5% | 20% | | 25% |
| Other Purchased Services | 80% | | | 10% | | 10% | | |
| Contract Services | 75% | | | | | 25% | | |
| Insurance | 48% | | | 4% | 42% | 7% | | |
| Rent | | | | | | 100% | | |
| Special Assessments | | | | | | | | 100% |
| Water Utility ROW Fee | | | | | | | | 100% |
| Whitefish Lake Institute | | | | | | | | 100% |
| Administrative Expense | | | | | | | | 100% |

**Table 4.2: Functionalization of Test Year 2016 Water O&M**

| O&M Function | All Users | PZ Only |
|---|---|---|
| Supply/Treatment – Fixed | $404,850 | $0 |
| Supply/Treatment – Variable | $78,679 | $0 |
| Storage | $59,251 | $10,157 |
| Pressure Zone | $0 | $64,150 |
| Transmission | $46,691 | $0 |
| Distribution | $133,813 | $0 |
| Meter | $137,295 | $0 |
| Admin | $697,294 | $0 |
| **Total O&M** | **$1,557,873** | **$74,307** |

**Table 4.3: Functionalized Water O&M – Test Year 2016**

| O&M Function | Capacity | Commodity | Customer | Meter | PZ Assigned |
|---|---|---|---|---|---|
| Supply/Treatment – Fixed | 53.8% | 46.2% | | | |
| Supply/Treatment – Variable | | 100% | | | |
| Storage | 44.5% | 40.8% | | | 14.3% |
| Pressure Zone | | | | | 100% |
| Transmission | 53.8% | 46.2% | | | |
| Distribution | 60.0% | 40.0% | | | |
| Meter | | | | 100% | |
| Admin | | | 100% | | |

**Table 4.4: Water Classification Percentages – Test Year 2016**

- Distribution: Distribution system costs are driven by peak hour and peak day requirements, in addition to average day. As a result, a portion of these costs were classified to Capacity and Commodity. Design of the distribution and storage systems is often similar; based on a review of the existing and recommended design storage components and professional knowledge of values commonly applied for similar systems, the distribution O&M costs were classified 60 percent Capacity and 40 percent Commodity for the purpose of this study.

| O&M Classification | All Users | PZ Only |
|---|---|---|
| **Capacity** | $365,201 | |
| **Commodity** | $349,412 | |
| **Customer** | $697,294 | |
| **Meter** | $137,295 | |
| **PZ** | $8,671 | $74,307 |
| **Total** | **$1,557,873** | **$74,307** |

**Table 4.5: Classified Water O&M – Test Year 2016**

### 4.2.3 Allocation

The final step in the analysis of O&M revenue requirements was to allocate the classified costs to the user classes. Table 4.6 summarizes the allocation factors applied to the O&M revenue requirements applicable to All Users. The allocation factors for costs classified as PZ, in the final column of Table 4.6, also was used to allocate PZ Only costs from Table 4.5. The Capacity cost allocation factors are based on the projected maximum day flow for each type of user. The Commodity factors are based on average day flows. The customer costs are based on the number of equivalent meters, as calculated using the equivalent meter cost basis developed by the AWWA. It should be noted that charges for irrigation accounts are billed on the non-irrigation bill associated with the same location. As a result, irrigation accounts were not allocated any Customer cost. However, because irrigation accounts do require a separate irrigation meter, they are allocated meter costs. The meter cost allocation factors are based on the AWWA equivalent meter capacity basis. Costs directly assignable to the PZ user classes were allocated between non-irrigation and irrigation PZ users based on average flow. Table 4.7 summarizes the O&M Revenue Requirements for Test Year 2016 based on the allocation factors in Table 4.6. Detailed allocation tables are found in the rate model.

| | Capacity | Commodity | Customer | Meter | PZ |
|---|---|---|---|---|---|
| **Non-Irrigation** | | | | | |
| Inside | 84.9% | 72.7% | 90.6% | 75.0% | 0% |
| PZ | 4.3% | 3.4% | 7.5% | 6.8% | 57.0% |
| Outside | 1.9% | 1.7% | 2.0% | 1.6% | 0% |
| **Irrigation** | | | | | |
| Inside | 7.8% | 19.4% | 0% | 14.1% | 0% |
| PZ | 1.0% | 2.6% | 0% | 2.5% | 43% |
| Outside | 0.1% | 0.2% | 0% | 0.1% | 0% |
| **Total** | 100% | 100% | 100% | 100% | 100% |

**Table 4.6: Factors for Allocation of Water O&M Revenue Requirements – Test Year 2016**

| | Capacity | Commodity | Customer | Meter | PZ |
|---|---|---|---|---|---|
| **Non-Irrigation** | | | | | |
| Inside | $296,652 | $265,601 | $631,501 | $102,956 | $0 |
| PZ | $15,033 | $12,499 | $52,016 | $9,311 | $49,430 |
| Outside | $6,699 | $6,084 | $13,766 | $2,192 | $0 |
| **Irrigation** | | | | | |
| Inside | $27,179 | $70,967 | $0 | $19,292 | $0 |
| PZ | $3,596 | $9,389 | $0 | $3,383 | $33,548 |
| Outside | $253 | $662 | $0 | $162 | $0 |
| **Total** | **$349,412** | **$365,201** | **$697,294** | **$137,295** | **$74,307** |

**Table 4.7: Allocated Water O&M Revenue Requirements – Test Year 2016**

## 4.3 Analysis of Capital Component

Section 4.2 described the COSA approach applied to the O&M-related revenue requirements. The COSA also involved the application of the same methodology to the capital-related revenue requirements. To do so, an additional step was first taken to evaluate the fixed asset base to determine which portions of the rate base provide a benefit to users located outside of City limits.

### 4.3.1 Fixed Asset Analysis

Section 3.2.2 presented the approach to determining the component of capital-related revenue requirements associated with the return on rate base. The rate base represents the total undepreciated value of the water system. Under the Utility method, it is only appropriate to include those assets that are in service during the year for which rates are calculated. Table 4.8 summarizes the total rate base by asset type for Test Year 2016. The asset types represent the functions that were evaluated as part of the COSA. Table 4.8 also shows projected future rate base adjusted for new capital placed in service and annual depreciation.

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|
| Supply/Treatment | $5,069,340 | $13,468,395 | 13,249,372 | 12,969,349 | 12,705,126 | $12,425,778 |
| Storage | $0 | $150,000 | $150,000 | $2,299,875 | $2,244,750 | $2,189,625 |
| Transmission | $4,431,619 | $4,732,721 | $5,566,123 | $5,399,526 | $5,232,928 | $5,066,330 |
| Distribution | $765,266 | $1,796,810 | $2,109,854 | $2,753,844 | $2,726,683 | $2,743,184 |
| Pressure Zone | $382,882 | $737,137 | $698,493 | $659,849 | $621,204 | $582,560 |
| Administrative | $0 | $0 | $0 | $6,400 | $4,800 | $3,200 |
| Meter | $11,005 | $17,982 | $15,460 | $12,937 | $10,414 | $7,891 |
| **Total Asset Value** | **$10,660,112** | **$20,903,047** | **$21,789,303** | **$24,101,780** | **$23,545,906** | **$23,018,569** |

**Table 4.8: Water Rate Base Projections – Test Year 2016 through 2021**

To determine the amount of the rate base upon which a rate of return can be fairly charged to outside users, the rate base in Table 4.8 was classified and allocated using the classification and allocation factors presented in Tables 4.4 and 4.6, respectively. The result of this process, for which detailed tables can be found in the rate model, is summarized in Table 4.9.

| User Classes | Test Year 2016 Rate Base |
|---|---|
| **Non-Irrigation Users** | |
| Inside | $8,153,948 |
| PZ | $185,232 |
| Outside | $619,800 |
| **Irrigation Users** | |
| Inside | $1,346,236 |
| PZ | $12,556 |
| Outside | $342,340 |
| **Total** | **$10,660,112** |

**Table 4.9: Allocation of Test Year 2016 Water Rate Base**

Table 3.3 showed the return on rate base needed to match cash requirements for the Test Year 2016 as $1,191,861. Standard rate-setting methodology allows a system to charge outside (non-owner) system users a higher percentage return on rate base than is charged for City (owner) system users to account for risk associated with serving a user that is not invested in the system, and to bring a reasonable return on investment to system owners. Rate of return percentages are often established in contracts for service to outside users. In the absence of a specified differential rate of return for outside users, measures such as the weighted average cost of capital (WACC) or the US Treasury rate are often used. For the purpose of this analysis, the WACC was calculated and applied as the difference in rate of return percentage for the outside users versus the inside users. When calculating the total asset base, it is common to include working capital and work in progress. Per industry standard, a working capital amount of 12.5 percent was used. This WACC calculation is shown in Table 4.10. The following information was needed for this calculation:

- Total Outstanding Debt (2016) = $3,274,409
- Effective Interest Rate on Debt (2016) = 2.2%
- Working Capital for 2016 (12.5%) = $219,827
- Work in Progress (2016) = $2,325,100
- 30-Year US Treasury Rate as of June 30, 2015 = 3.11%

| | | Test Year 2016 | Calculation |
|---|---|---|---|
| **A** | Outstanding Debt | $3,274,409 | |
| **B** | Effective Interest Rate on Debt | 2.2% | |
| | | | |
| **C** | Rate Base | $10,660,112 | |
| **D** | Working Capital | $219,827 | |
| **E** | Work in Progress | $2,325,100 | |
| **F** | Total Asset Value | $13,205,039 | C + D + E |
| **G** | 30-Year Treasury Rate | 3.11% | |
| | | | |
| | **WACC** | **2.9%** | A/(A+F)*B+F/(A+F)*G |

**Table 4.10: Calculation of WACC for Test Year 2016 – Water**

The calculated WACC was used as the difference between the return on rate percentages for the inside and outside City users. Based on a total rate base of $13,205,039 (including working capital and work in progress), a total rate of return of $1,191,861 results in an overall return on rate base percentage of 9.03 percent. Table 4.11 shows the calculated return on rate base for the inside and outside users.

| | Test Year 2016 |
|---|---|
| Total Rate Base | $13,205,039 |
| Inside User Rate Base | $12,966,743 |
| Outside User Rate Base | $238,296 |
| | |
| Inside User Return on Rate Base % | 8.97% |
| Outside User Return on Rate Base % | 11.89% |
| | |
| **Inside User Return** | **$1,163,520** |
| **Outside User Return** | **$28,341** |
| Total Return on Rate Base | $1,191,861 |

**Table 4.11: Summary of Calculation of Return on Water Rate Base – Test Year 2016**

Once the value of the return on rate base is established, it along with the depreciation, can be functionalized, classified, and allocated in a similar manner as the O&M revenue requirements.

### 4.3.2 Depreciation Analysis

Functionalization of the projected annual depreciation values are shown in Table 4.13. The values for 2017 through 2021 were developed based on existing depreciation, work in progress, and the CIP.

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|
| Supply/Treatment | $238,071 | $270,195 | $280,023 | $280,023 | $282,723 | $282,723 |
| Storage | $2,627 | $0 | $0 | $55,125 | $55,125 | $55,125 |
| Transmission | $103,054 | $141,598 | $166,598 | $166,598 | $166,598 | $166,598 |
| Distribution | $40,978 | $81,206 | $96,956 | $108,010 | $117,161 | $133,499 |
| Pressure Zone | $8,482 | $38,644 | $38,644 | $38,644 | $38,644 | $38,644 |
| Administrative | $0 | $0 | $0 | $1,600 | $1,600 | $1,600 |
| Meter | $1,223 | $2,523 | $2,523 | $2,523 | $2,523 | $2,523 |
| **Total Asset Value** | **$394,435** | **$534,165** | **$584,744** | **$652,523** | **$664,374** | **$680,712** |

**Table 4.12: Water Depreciation Projections – Test Year 2016 through 2021**

To determine the amount of the depreciation that can be fairly charged to outside users, the depreciation in Table 4.12 was classified and allocated using the classification and allocation factors presented in Tables 4.4 and 4.6, respectively.

### 4.3.3 Summary of Total Revenue Requirements

Table 4.13 summarizes the total revenue requirements for the Test Year 2016.

| User Classes | Test Year 2016 Total Rate Revenue Requirements |
|---|---|
| **Non-Irrigation Users** | |
| Inside | $2,491,335 |
| PZ | $226,865 |
| Outside | $82,395 |
| **Irrigation Users** | |
| Inside | $314,853 |
| PZ | $98,277 |
| Outside | $4,751 |
| **Total** | **$3,218,476** |

**Table 4.13: Summary of Test Year Total Water Rate Revenue Requirements by User Type**

## 4.4 Cost of Service Analysis Results

To understand the equitability of the existing rate structure based on the cost allocation assumptions and the current usage of the system by user class, the results of the COSA were reviewed in several ways. Tables 4.14 and 4.15 summarize the results in terms of Non-Irrigation versus Irrigation and Inside City versus Outside City, respectively. Table 4.16 summarizes the COSA results to the level of detail used to make rate recommendations for the planning period.

The percent difference column is calculated as the cost percentage minus the revenue percentage, divided by the cost percentage. A percent difference within +/- 10 percent is generally considered to be within an acceptable range. When the percent difference value is greater than +/- 10 percent, revision to the rates and/or structure are deemed appropriate to improve the cost-revenue relationship between the user classes.

| User Class | Test Year 2016 | | |
|---|---|---|---|
| | Cost Percentage | Revenue Percentage | % Difference |
| Non-Irrigation | 87.0% | 91.0% | 4.6% |
| Irrigation | 13.0% | 9.0% | -30.9% |
| **Total** | 100% | 100% | |

**Table 4.14: Test Year 2016 Water Cost of Service Analysis Results – Non-Irrigation versus Irrigation**

| User Class | Test Year 2016 | | |
|---|---|---|---|
| | Cost Percentage | Revenue Percentage | % Difference |
| **Inside User Classes** | | | |
| Baseline | 87.2% | 89.8% | 3.0% |
| Pressure Zone | 10.1% | 7.7% | -24.1% |
| **Outside User Classes** | | | |
| Outside City | 2.7% | 2.6% | -5.1% |
| **Total** | 100% | 100% | |

**Table 4.15: Test Year 2016 Water Cost of Service Analysis Results – Inside versus Outside**

| User Class | Test Year 2016 | | |
|---|---|---|---|
| | Cost Percentage | Revenue Percentage | % Difference |
| **Non-Irrigation** | | | |
| Baseline | 77.4% | 82.4% | 6.4% |
| Pressure Zone | 7.0% | 6.2% | -12.0% |
| Outside City | 2.6% | 2.5% | -3.9% |
| **Irrigation** | | | |
| Baseline | 9.8% | 7.4% | -24.4% |
| Pressure Zone | 3.1% | 1.5% | -52.0% |
| Outside City | 0.15% | 0.11% | -25.5% |
| **Total** | 100% | 100% | |

**Table 4.16: Test Year 2016 Water Cost of Service Analysis Results – Overall**

As expected, the results in Table 4.14 indicate that the Irrigation user classes are not generating revenue in line with the cost associated with irrigation usage. The results in Table 4.15 indicate that in general, Inside City users and Outside City users are generating revenue in line with their associated cost, while Inside City users in the high pressure zone areas are not generating sufficient revenue to match their cost. This is largely due to the irrigation in the high pressure zone areas, for which revenue, as shown in Table 4.16, is significantly less than associated cost.

# 5.0 Rate Design

Based on the results of the COSA, the following considerations were identified for design of the Water rates:

- Appropriateness of irrigation rates; and
- Relationship of scaled meter rates by size based on standard equivalent meter ratios.

## 5.1 Irrigation Rates

As shown in Table 4.18, the irrigation rate structure is not generating revenue commensurate with the cost attributable to irrigation water use. Historically, this approach was intentional to encourage lawn watering across the City. The City is currently re-evaluating that philosophy and although it is not desired to stop lawn watering, the City would like to promote responsible irrigation by commercial and residential property owners alike. Toward this end, changes to the existing rate structure are not recommended, but moderate increases to work toward obtaining full cost recovery is recommended. These rate recommendations are discussed in Section 6.0.

Incenting responsible watering practices is largely a public relations initiative. To assist with this initiative, resources from the Montana State University Extension Service are provided as an Attachment to this report. Highlights from the materials include the following recommendations:

- Avoid watering in wet or windy conditions;
- Utilize drip or soaker hoses, which can reduce evaporation by approximately 60 percent;
- The best time to water is when evaporation is lowest, which is in the early morning and early evening;
- Apply water slowly to avoid runoff and encourage deep root growth;
- Established lawns need one (1) to two (2) inches of water every three (3) to five (5) days; and
- Consider the use of timers, rain barrels, xeriscape, and rain gardens.

## 5.2 Base Structure Meter Ratios

To address the relative increase in cost associated with services to meters of increasing size, the American Water Works Association (AWWA) has established equivalent meter ratios that can be used as guidelines when setting meter rates that increase with meter size. There are two sets of ratios generally used. The first is the "cost-basis" ratio and he second is the "capacity basis" ratio. In this study, the cost-basis ratios were applied to Customer costs and the capacity-basis ratios were applied to Meter costs. Table 5.1 summarizes the AWWA cost and capacity equivalent meter ratios.

| Meter Size | Equivalent Meter Ratio – Cost Basis | Equivalent Meter Ratio – Capacity Basis |
|---|---|---|
| **5/8”** | 1.0 | 1.0 |
| **3/4”** | 1.1 | 1.5 |
| **1”** | 1.4 | 2.5 |
| **1.5”** | 1.8 | 5.0 |
| **2”** | 2.9 | 8.0 |
| **3”** | 11.0 | 16.0 |
| **4”** | 14.0 | 25.0 |

**Table 5.1: AWWA Equivalent Meter Ratios**

Systems may apply one or both when setting rates. To illustrate the use of these ratios, for a system applying only the cost-basis ratios to its rate structure, the monthly charge for a 3/4” meter would be 1.1 times the charge for a 5/8” meter. For the Whitefish analysis, both ratios were used. Based on the assumptions related to the amount of Customer versus Meter cost in the COSA (Tables 4.6 and 4.7), a composite equivalent meter factor accounting for both the cost-basis and capacity-basis was calculated for each user type and meter size. Table 5.2 summarizes the calculated meter FY16 ratios for the Inside City Baseline Non-Irrigation users under the current rate structure in comparison to the AWWA equivalent meter ratios.

A comparison of the ratios associated with the FY16 rate structure for each meter size to the calculated targets showed that most meter rates were within the range between the cost and capacity basis ratios, with only a few lying outside of the range. This is not uncommon, as blanket increases applied annually to all rates for all user classes without consideration to changes in costs and user characteristics will not necessarily keep rates that at one time matched the cost of service in line with the cost of service. This can eventually skew the rate structure and is one reason that periodic re-evaluation of the rate structure is recommended.

| Meter Size | Calculated FY16 Meter Ratio | AWWA Range (Cost – Capacity Ratios) | 2017 COSA-Based Target Ratio |
|---|---|---|---|
| **5/8”** | 1.0 | 1.0 | 1.0 |
| **3/4”** | 1.5 | 1.1 - 1.5 | 1.3 |
| **1”** | 2.1 | 1.4 - 2.5 | 1.9 |
| **1.5”** | 6.4 | 1.8 - 5.0 | 3.4 |
| **2”** | 10.6 | 2.9 - 8.0 | 5.4 |
| **3”** | 12.7 | 11.0 - 16.0 | 13.9 |
| **4”** | 21.0 | 14.0 - 25.0 | 19.5 |

**Table 5.2: Inside Baseline Non-Irrigation User Equivalent Meter Ratio Comparison**

The meter ratios associated with the City of Whitefish's existing rates are generally in line with the meter ratios. The rate model has been set up to calculate the target ratio each year based on the customer and meter costs. To avoid abrupt changes in meter charges, however, the model works toward realignment of the meter ratios over time.

### 5.3 Low Income/Senior Citizen Discount

As noted previously, the City of Whitefish currently offers a Low Income and Senior Citizen discount on water, sewer, and solid waste bills. Qualification for the discounts is based on eligibility for low income assistance from the Montana Department of Public Health and Human Services or proof of age 65 or over. Those eligible for the discount receive a 75 percent reduction in the monthly base rate for water, wastewater, and solid waste.

In 2014, the following numbers of accounts were charged according to the low income rate schedule:

- Baseline System: 300
- High Pressure Zone (PZ) System: 54
- Outside System: 8

Of these, it is estimated that at least 16 of these accounts will qualify for LIEAP based on current records.

In October 2015, the Attorney General issued an opinion regarding discounted or preferential rates to Senior Citizens, based on actions by the City of Bozeman to offer such a discount. The Attorney General found that it did not violate the statutory requirement under Montana law to provide uniform or equitable rates. The Attorney General did note, however, that age discrimination does violate the Montana Human Rights Act (Title 49 Chapter 2). This may be viewed as a warning for cities to consider the appropriateness of qualification by age. A search of other Senior Discount programs around the country showed the majority are associated with an income limit.

Based on the Risk Management concern associated with the potential for claims of age discrimination and based on practices by other utilities, the results of this study include a recommendation to revise the current policy to require qualification for the Low Income Energy Assistance Program (LIEAP) as a requirement for the Low Income/Senior Citizen Discount.

# 6.0 Revenue Adequacy Analysis

Revenue adequacy is evaluated to determine the short-term and long-term adequacy of the existing rates, and to propose potential rate adjustments to ensure that the existing rates and any proposed changes do not negatively impact the Utility's financial position in the future. This section summarizes background pertaining to revenue requirements, the assumptions used to evaluate revenue adequacy, specific recommendations for 2017 rates, and projected rates from 2018 to 2021 for the City of Whitefish's Water Utility.

## 6.1 Financial Model and Assumptions

A five-year financial model was developed for the Water Utility. The model was built using the City's current operations and funding policies, based upon financial information provided by the City. The model was used to project the net revenue requirements (total revenue requirements less miscellaneous operating and non-operating revenue), revenue generated from proposed rates, and the corresponding revenue surplus or deficiency. Since there is obvious uncertainty associated with projecting into the future, it is recommended that the rate assumptions should be re-evaluated and updated on an annual basis in conjunction with budget and capital planning. The revenue adequacy assumptions are noted below:

***O&M Assumptions***

- 2017 O&M based on 2016 budget projections.
- 3.0 percent annual inflation rate for General Inflation and Labor costs.
- 5.0 percent annual inflation for Chemicals, Fuel, Electricity, and Insurance.

***Capital Assumptions***

- CIP projections and based on the Capital Improvements Plan for 2017-2021. Based on projected reserve availability, the Karrow Loop project in 2017 and projected future WTP improvement in 2021 were assumed to be partially funded using cash instead of debt funds. Annual amounts by funding source include:
    - Cash/Impact Fees:
        - 2017: $1,571,000
        - 2018: $760,000
        - 2019: $108,500
        - 2020: $950,000
        - 2021: $1,222,000
    - State Revolving Fund Loan
        - 2017: $0

- 2018: $2,105,000
- 2019: $0
- 2020: $0
- 2021: $3,500,000

***Reserve Assumptions***

- An Operating Reserve was funded at a targeted level of 90 days O&M expense.
- A restricted Debt Service Reserve was funded based on existing debt figures provided by the City and values for new or future debt equal to 50 percent of an annual payment.
- A Capital Reserve Fund target equal to 25 percent of the average annual rate-funded capital value was established.
- A Rate Stabilization Fund target equal to 15 percent of annual rate revenue was established.

***Funding Assumptions***

- State Revolving Loan Fund:
  - Interest Rate: 2.5 percent (City of Whitefish).
  - Term: ten (10) years.
  - Annual coverage requirement = 110 percent.
  - Annual coverage based on highest year of debt service.
  - Restricted reserve amount equal to 50 percent of annual payment is rolled into loan issue.
- Debt requirements associated with the Haskill Basin loan will be met using Resort Tax revenues.

***Revenue Assumptions***

- 2017 usage characteristics based on 2014 accounts and flow, indexed:
  - Non-Irrigation flow growth projected at 0.5 percent annually.
  - Irrigation flow reduced by 25 percent in 2017, 10 percent in 2018, and 5 percent in 2019 in reaction to increases in rates.
  - Inside City User meter growth projected at 1.0 percent annually for meters greater than 5/8", based on current policy to install 3/4" meter as minimum size.
- It was assumed that the City will revise its Low Income/Senior Citizen Discount policy to require proof of low income eligibility. In anticipation of that change, any

low income accounts located in the high pressure zone areas of town (PZ) were assumed to convert to non-discounted rate accounts.

- Annual impact fee revenues projected to hold constant at $100,000.
- Impact Fee administrative revenue calculated as four percent annual impact fee based on 2016 budget projection.
- Other revenues were held constant 2017-2021.

***Utility Cash Balance Assumptions***

- The capital reserve balance at the end of FY15 was $104,378.
- The unrestricted Water Fund balance at the end of FY15 was $2,333,124.

## 6.2 Revenue Adequacy Model Projections

The evaluation of the Water Utility revenue adequacy entailed development of two (2) primary rate model scenarios:

- **Baseline Scenario –** This model reflects increasing O&M expenses, growth of both flow and meters, and the incorporation of the CIP, but holds rates at the current (2016) level throughout the five-year planning period. This is the "do nothing" scenario, and serves to illustrate the effect that delaying necessary utility rate increases may have on utility finances.
- **Rate Adjustment Scenario –** In addition to the adjustments to revenue requirements noted for the Baseline Scenario, this model incorporates recommended adjustments to the utility rates and projects utility finances over the five-year planning period based on the recommended rate adjustments. In addition to overall revenue adequacy, the rate adjustments account for the following:

    - Cost of service-based adjustments;
    - Reserve balances and targets; and
    - Debt Service coverage.

The Baseline and Rate Adjustment Scenario revenue adequacy models were completed through the year 2021. However, note that revenue and expense requirements for any utility can vary significantly over the course of five years. It is recommended that the City of Whitefish review and update the model within which the future rate projections have been made on an annual basis to make adjustments to the rate plan for the coming year, as appropriate.

### 6.2.1 Baseline Scenario

The Water Utility has been annually indexing rates by an inflationary factor since 2006. It appears this approach has placed the Utility in a favorable financial position. Although in the Baseline Scenario, in which no rate increases are applied but annual revenue requirements grow, a revenue deficiency exists in all but one year, the Utility fares better than would be expected due to the reserve funds available going into FY16. The results of the Baseline Scenario are summarized in Table 6.1 and Figure 6.1. Under this scenario, the objective of funding a self-sufficient Water Utility is not met.

It should be noted that although revenue requirements associated with the Haskill Basin loan are not anticipated to be met using Water Utility Funds, the debt is Water Utility debt and so a line item has been included in the revenue adequacy model in case the Utility should need the flexibility to incorporate a portion of the debt in the rate revenue requirements.

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|
| **Projected Revenue Requirements** | | | | | | |
| O&M | $1,758,616 | $1,813,907 | $1,871,016 | $1,930,008 | $1,990,947 | $2,053,902 |
| Capital (Cash-Funded) | $1,882,400 | $1,571,000 | $760,000 | $108,500 | $950,000 | $1,222,000 |
| Capital (Debt-Funded) | $442,700 | $0 | $2,105,000 | $0 | $0 | $3,500,000 |
| Debt Service | $532,801 | $532,801 | $676,301 | $642,882 | $366,044 | $82,481 |
| Haskill Basin Loan | $0 | $0 | $0 | $0 | $0 | $0 |
| **Total Revenue Requirements** | **$4,616,517** | **$3,917,708** | **$5,412,317** | **$2,681,390** | **$3,306,991** | **$6,858,383** |
| **Projected Income and Funds from Other Sources** | | | | | | |
| Loan Proceeds | $442,700 | $0 | $2,105,000 | $0 | $0 | $3,500,000 |
| Other Revenue | $262,336 | $225,000 | $225,000 | $225,000 | $225,000 | $225,000 |
| Net Revenue Requirements | $3,922,238 | $3,692,708 | $3,082,317 | $2,456,390 | $3,081,991 | $3,133,383 |
| **Projected Revenue from Rates** | **$2,926,950** | **$2,942,866** | **$2,958,917** | **$2,975,102** | **$2,991,423** | **$3,008,082** |
| Revenue Surplus/(Deficiency) | **($984,531)** | **($749,842)** | **($123,401)** | **$518,712** | **($90,568)** | **($125,302)** |

**Table 6.1: Projected Water Utility Revenue Adequacy – Baseline Scenario**

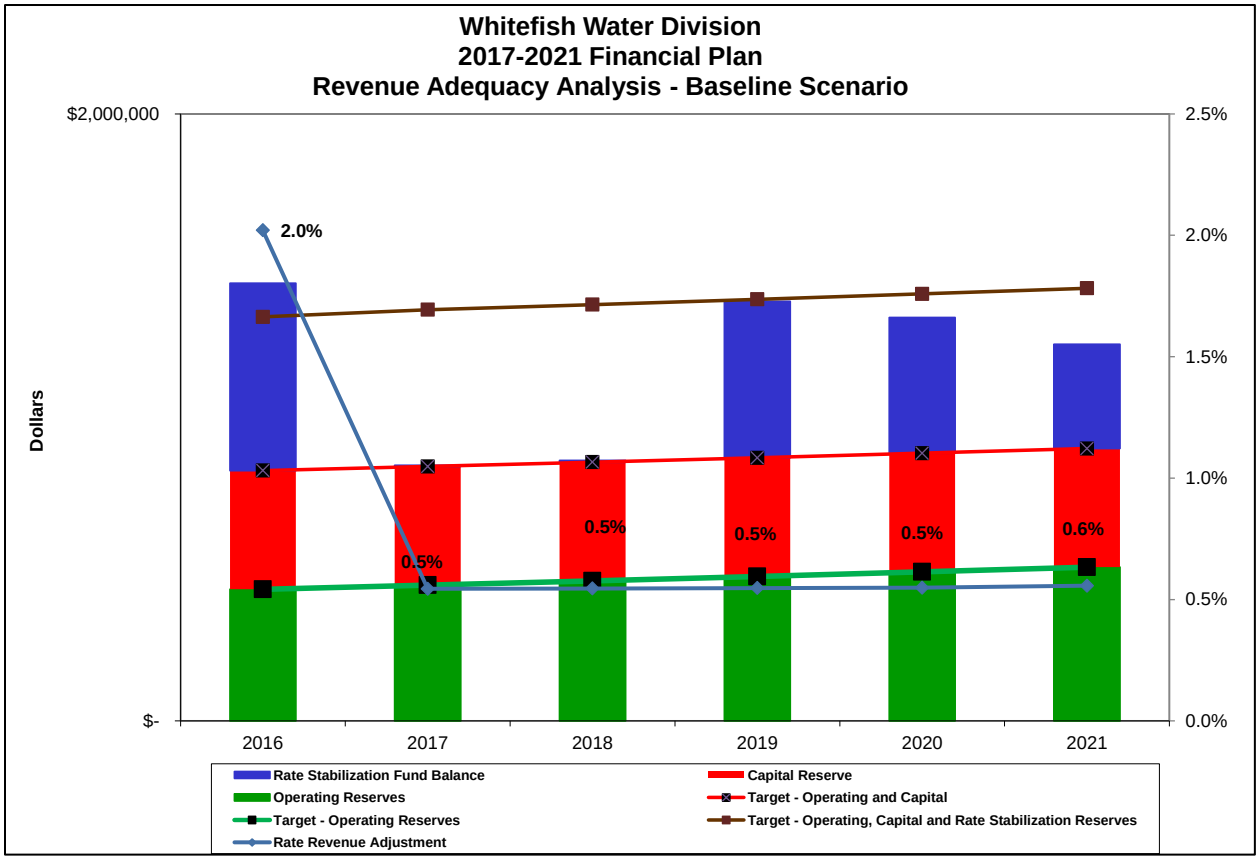


**Figure 6.1: Water Utility Cash Balance Projections – Baseline Scenario**

### 6.2.2 Rate Adjustment Scenario and Rate Projections

To address the objectives of meeting revenue requirements, building target reserve levels, and correcting cost of service inequities, the rate projections shown in Tables 6.2 and 6.3 were developed. Based on the implementation of the rate recommendations in Tables 6.2 and 6.3, Table 6.4 summarizes the overall projected revenue adequacy, including the coverage requirement to be achieved. Figure 6.2 depicts the cash balance projections associated with the values in Tables 6.2 and 6.3. It should be noted that although a revenue deficiency exists in the first three years of the period, this reflects the strategic use of cash reserves to allow the utility to grow into a revenue sufficient state and gradually make adjustments targeting cost of service goals for individual user classes. It should also be noted that the projected adjustments also grow the utility toward fully funding reserve levels over time. Should the Utility need to make partial payment on Haskill Basin debt obligations from rate revenue, the projected percentages will need to be adjusted upward to avoid depleting reserve levels.

It should also be noted that in accordance with Montana Law, adjustments to rates for Outside user classes have been linked to adjustments to rates for comparable Inside City users.

| Meter Size | 2016 Rates | 2017 Recommended | 2018 Projected | 2019 Projected | 2020 Projected | 2021 Projected |
|---|---|---|---|---|---|---|
| **Baseline System Users – Non-Irrigation** | | | | | | |
| 5/8” | $24.85 | $25.10 | $25.40 | $25.70 | $26.00 | $26.30 |
| 3/4” | $36.68 | $37.00 | $37.40 | $37.80 | $38.20 | $38.60 |
| 1” | $52.06 | $52.60 | $53.10 | $53.60 | $54.10 | $54.60 |
| 1.5” | $159.74 | $159.80 | $159.80 | $159.80 | $159.80 | $159.80 |
| 2” | $263.88 | $263.90 | $263.90 | $263.90 | $263.90 | $263.90 |
| 3” | $315.93 | $319.10 | $322.30 | $325.50 | $328.80 | $332.10 |
| 4” | $521.83 | $527.00 | $532.30 | $537.60 | $543.00 | $548.40 |
| **Pressure Zone System Users – Non-Irrigation** | | | | | | |
| 5/8” | $28.39 | $29.80 | $31.30 | $32.20 | $33.20 | $34.20 |
| 3/4” | $42.60 | $44.70 | $46.90 | $48.30 | $49.70 | $51.20 |
| 1” | $61.53 | $64.60 | $67.80 | $69.80 | $71.90 | $74.10 |
| **Outside System Users – Non-Irrigation** | | | | | | |
| 5/8” | $31.95 | $32.30 | $32.60 | $32.90 | $33.20 | $33.50 |
| 3/4” | $46.15 | $46.60 | $47.10 | $47.60 | $48.10 | $48.60 |
| 1” | $68.63 | $69.30 | $70.00 | $70.70 | $71.40 | $72.10 |
| 1.5” | $185.77 | $185.80 | $185.80 | $185.80 | $185.80 | $185.80 |
| 2” | $307.65 | $307.70 | $307.70 | $307.70 | $307.70 | $307.70 |
| **Baseline System Users –Irrigation** | | | | | | |
| 5/8” | $10.66 | $12.30 | $12.50 | $12.80 | $13.10 | $13.40 |
| 3/4” | $15.39 | $16.00 | $16.20 | $16.70 | $17.10 | $17.40 |
| 1” | $26.03 | $26.10 | $26.10 | $26.10 | $26.10 | $26.20 |
| 1.5” | $65.08 | $65.10 | $65.10 | $65.10 | $65.10 | $65.10 |
| 2” | $110.04 | $110.10 | $110.10 | $110.10 | $110.10 | $110.10 |
| 4” | $221.27 | $239.60 | $243.40 | $251.60 | $256.20 | $261.50 |
| **Pressure Zone System Users –Irrigation** | | | | | | |
| 5/8” | $14.20 | $17.80 | $18.20 | $18.60 | $19.00 | $19.40 |
| 3/4” | $21.29 | $23.10 | $23.60 | $24.30 | $24.70 | $25.20 |
| 1” | $35.50 | $35.50 | $35.50 | $36.60 | $37.20 | $37.90 |
| 1.5” | $65.08 | $65.10 | $65.10 | $65.10 | $65.10 | $66.10 |
| **Outside System Users –Irrigation** | | | | | | |
| 3/4” | $20.12 | $15.70 | $16.00 | $16.30 | $16.60 | $16.90 |
| 1” | $33.13 | $33.20 | $33.20 | $33.20 | $33.20 | $33.20 |

**Table 6.2: Water Utility Monthly Base Rate Projections – Rate Adjustment Scenario**

| | 2016 Rates | 2017 Recommended | 2018 Projected | 2019 Projected | 2020 Projected | 2021 Projected |
|---|---|---|---|---|---|---|
| **Non-Irrigation Water Use** | | | | | | |
| Baseline | $3.92 | $3.92 | $3.92 | $3.92 | $3.92 | $3.92 |
| PZ | $4.98 | $5.23 | $5.49 | $5.77 | $6.06 | $6.36 |
| Outside | $5.76 | $5.76 | $5.76 | $5.76 | $5.76 | $5.76 |
| **Irrigation Water Use** | | | | | | |
| Baseline | $2.48 | $2.85 | $3.03 | $3.21 | $3.34 | $3.44 |
| PZ | $3.56 | $4.44 | $5.33 | $6.13 | $7.05 | $8.11 |
| Outside | $4.38 | $5.03 | $5.33 | $5.65 | $5.88 | $6.06 |

**Table 6.3: Water Utility Volumetric Rate Projections – Rate Adjustment Scenario**

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|
| **Projected Revenue Requirements** | | | | | | |
| O&M | $1,758,616 | $1,813,907 | $1,871,016 | $1,930,008 | $1,990,947 | $2,053,902 |
| Capital (Cash-Funded) | $1,882,400 | $1,571,000 | $760,000 | $108,500 | $950,000 | $1,222,000 |
| Capital (Debt-Funded) | $442,700 | $0 | $2,105,000 | $0 | $0 | $3,500,000 |
| Debt Service | $532,801 | $532,801 | $676,301 | $642,882 | $366,044 | $82,481 |
| Haskill Basin Loan | $0 | $0 | $0 | $0 | $0 | $0 |
| **Total Revenue Requirements** | **$4,616,517** | **$3,917,708** | **$5,412,317** | **$2,681,390** | **$3,306,991** | **$6,858,383** |
| **Projected Income and Funds from Other Sources** | | | | | | |
| Loan Proceeds | $442,700 | $0 | $2,105,000 | $0 | $0 | $3,500,000 |
| Other Revenue | $262,336 | $225,000 | $225,000 | $225,000 | $225,000 | $225,000 |
| Net Revenue Requirements | $3,911,481 | $3,692,708 | $3,082,317 | $2,456,390 | $3,081,991 | $3,133,383 |
| **Projected Revenue from Rates** | **$2,926,950** | **$2,965,572** | **$3,002,492** | **$3,045,506** | **$3,096,079** | **$3,147,337** |
| Revenue Surplus/(Deficiency) | **($984,531)** | **($727,136)** | **($79,825)** | **$589,116** | **$14,088** | **$13,953** |
| Coverage (Target = 110%) | 110% | 135% | 137% | 139% | 141% | 144% |

**Table 6.3: Projected Water Utility Revenue Adequacy – Rate Adjustment Scenario**

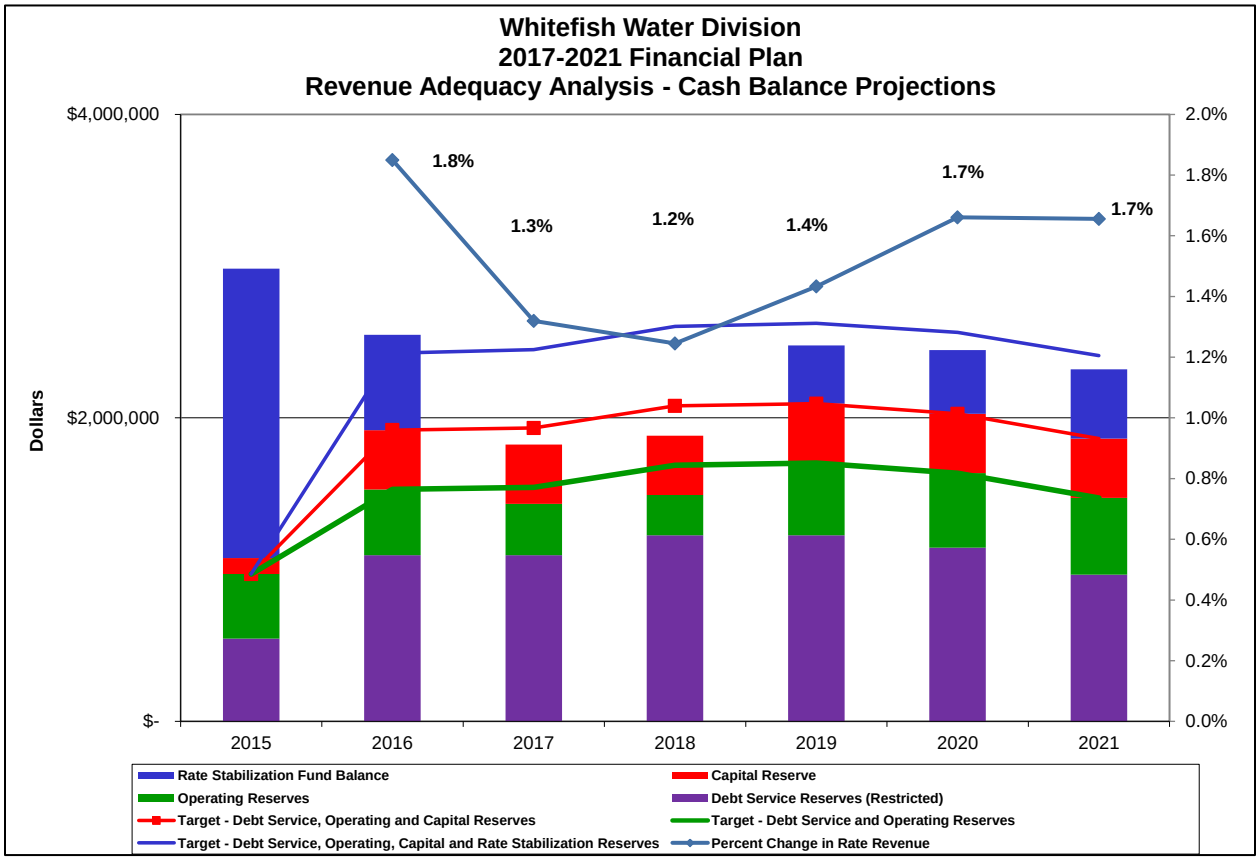


**Figure 6.2: Water Utility Cash Balance Projections – Rate Adjustment Scenario**

Table 6.4 summarizes the projected COSA difference between cost and revenue percentages. It should be noted that it is recommended to correct irrigation rate inequities over time, to avoid significant changes in water use that would negatively impact the Utility. The goal is to achieve a percent difference +/- 10 percent.

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|
| **Non-Irrigation Water Use** | | | | | | |
| Baseline | 6.4% | 3.6% | 2.5% | 2.1% | 1.5% | 0.9% |
| PZ | -12.0% | -4.3% | -0.4% | -2.6% | -2.3% | 0.6% |
| Outside | -3.9% | -8.2% | -9.2% | -8.5% | -7.0% | -8.0% |
| **Irrigation Water Use** | | | | | | |
| Baseline | -24.4% | -14.3% | -11.2% | -6.5% | -2.8% | -1.5% |
| PZ | -52.0% | -45.6% | -37.4% | -33.3% | -27.5% | -19.4% |
| Outside | -25.5% | -18.0% | -14.7% | -8.9% | -3.2% | -2.4% |

**Table 6.4: Projected Difference between Allocated Cost Percentage and Revenue Percentage**

### 6.2.3 Water Bill Impacts

To provide perspective on the magnitude of the rate projections in Tables 6.2 and 6.3, bill impacts have been estimated for average water use values specific to each type of user. Table 6.5 presents the monthly change in dollar amount associated with rate projections. The change is compared to the monthly charge for the amount of water listed in the second column. The calculation has been completed for each year, with reference back to FY16. Therefore, the monthly increase in the last column represents the projected monthly increase in 2021 as compared to the monthly charge in 2016. Table 6.6 presents the same information in percentage format.

| | Avg Monthly Gallons | Existing Monthly Bill FY16 | 2017 $/Mth Increase from 2016 | 2018 $/Mth Increase from 2016 | 2019 $/Mth Increase from 2016 | 2020 $/Mth Increase from 2016 | 2021 $/Mth Increase from 2016 |
|---|---|---|---|---|---|---|---|
| Residential - 5/8" | | | | | | | |
| Inside | 4,000 | $ 40.53 | $ 0.25 | $ 0.55 | $ 0.85 | $ 1.15 | $ 1.45 |
| Inside Low Income | 4,000 | $ 21.89 | $ 0.09 | $ 0.19 | $ 0.19 | $ 0.29 | $ 0.39 |
| PZ | 5,500 | $ 55.81 | $ 2.78 | $ 5.72 | $ 8.13 | $ 10.71 | $ 13.38 |
| Outside | 4,000 | $ 55.01 | $ 0.35 | $ 0.65 | $ 0.95 | $ 1.25 | $ 1.55 |
| Outside Low Income | 4,000 | $ 31.05 | $ 0.11 | $ 0.21 | $ 0.21 | $ 0.31 | $ 0.41 |
| Residential - 3/4" | | | | | | | |
| Inside | 5,000 | $ 56.28 | $ 0.32 | $ 0.72 | $ 1.12 | $ 1.52 | $ 1.92 |
| Inside Low Income | 5,000 | $ 28.77 | $ 0.13 | $ 0.23 | $ 0.33 | $ 0.43 | $ 0.53 |
| PZ | 6,000 | $ 72.50 | $ 3.60 | $ 7.37 | $ 10.42 | $ 13.55 | $ 16.87 |
| Outside | 5,000 | $ 74.97 | $ 0.45 | $ 0.95 | $ 1.45 | $ 1.95 | $ 2.45 |
| Outside Low Income | 5,000 | $ 40.35 | $ 0.17 | $ 0.27 | $ 0.37 | $ 0.47 | $ 0.67 |
| Commercial | | | | | | | |
| Inside - 1" | 100,000 | $ 444.09 | $ 0.54 | $ 1.04 | $ 1.54 | $ 2.04 | $ 2.54 |
| Outside - 1" | 70,000 | $ 472.11 | $ 0.67 | $ 1.37 | $ 2.07 | $ 2.77 | $ 3.47 |
| Inside - 2" | 680,000 | $ 2,929.69 | $ 0.02 | $ 0.02 | $ 0.02 | $ 0.02 | $ 0.02 |
| Outside - 2" | 1,100,000 | $ 6,648.02 | $ 0.05 | $ 0.05 | $ 0.05 | $ 0.05 | $ 0.05 |
| Irrigation | | | | | | | |
| Inside - 5/8" | 10,000 | $ 35.48 | $ 5.37 | $ 7.28 | $ 9.39 | $ 10.98 | $ 12.28 |
| PZ - 5/8" | 10,000 | $ 49.76 | $ 12.49 | $ 21.78 | $ 30.18 | $ 39.78 | $ 50.76 |
| Inside - 3/4" | 10,000 | $ 40.21 | $ 4.34 | $ 6.25 | $ 8.56 | $ 10.25 | $ 11.55 |
| PZ - 3/4" | 16,000 | $ 78.18 | $ 16.03 | $ 30.75 | $ 44.25 | $ 59.37 | $ 76.80 |
| Outside - 3/4" | 33,000 | $ 164.53 | $ 21.94 | $ 32.31 | $ 43.37 | $ 51.13 | $ 57.36 |
| Inside - 1" | 27,000 | $ 93.04 | $ 10.12 | $ 14.74 | $ 19.64 | $ 23.11 | $ 25.91 |
| PZ - 1" | 18,000 | $ 99.50 | $ 16.00 | $ 32.01 | $ 47.51 | $ 64.67 | $ 84.41 |
| Outside - 1" | 6,000 | $ 59.38 | $ 4.01 | $ 5.83 | $ 7.75 | $ 9.10 | $ 10.16 |
| Inside - 1.5" | 105,000 | $ 325.67 | $ 39.11 | $ 57.10 | $ 76.15 | $ 89.62 | $ 100.13 |
| Inside - 2" | 130,000 | $ 432.68 | $ 48.45 | $ 70.72 | $ 94.31 | $ 110.99 | $ 124.00 |

**Table 6.5: Monthly Water Rate Increase Associated with Projected Rate Adjustments – Referenced to FY16**

| | Avg Monthly Gallons | Existing Bill FY16 | 2017 % Increase from 2016 | 2018 % Increase from 2016 | 2019 % Increase from 2016 | 2020 % Increase from 2016 | 2021 % Increase from 2016 |
|---|---|---|---|---|---|---|---|
| Residential - 5/8" | | | | | | | |
| Inside | 4,000 | $ 40.53 | 0.6% | 1.4% | 2.1% | 2.8% | 3.6% |
| Inside Low Income | 4,000 | $ 21.89 | 0.4% | 0.9% | 0.9% | 1.3% | 1.8% |
| PZ | 5,500 | $ 55.81 | 5.0% | 10.2% | 14.6% | 19.2% | 24.0% |
| Outside | 4,000 | $ 55.01 | 0.6% | 1.2% | 1.7% | 2.3% | 2.8% |
| Outside Low Income | 4,000 | $ 31.05 | 0.3% | 0.7% | 0.7% | 1.0% | 1.3% |
| Residential - 3/4" | | | | | | | |
| Inside | 5,000 | $ 56.28 | 0.6% | 1.3% | 2.0% | 2.7% | 3.4% |
| Inside Low Income | 5,000 | $ 28.77 | 0.5% | 0.8% | 1.2% | 1.5% | 1.9% |
| PZ | 6,000 | $ 72.50 | 5.0% | 10.2% | 14.4% | 18.7% | 23.3% |
| Outside | 5,000 | $ 74.97 | 0.6% | 1.3% | 1.9% | 2.6% | 3.3% |
| Outside Low Income | 5,000 | $ 40.35 | 0.4% | 0.7% | 0.9% | 1.2% | 1.7% |
| Commercial | | | | | | | |
| Inside - 1" | 100,000 | $ 444.09 | 0.1% | 0.2% | 0.3% | 0.5% | 0.6% |
| Outside - 1" | 70,000 | $ 472.11 | 0.1% | 0.3% | 0.4% | 0.6% | 0.7% |
| Inside - 2" | 680,000 | $ 2,929.69 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Outside - 2" | 1,100,000 | $ 6,648.02 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Irrigation | | | | | | | |
| Inside - 5/8" | 10,000 | $ 35.48 | 15.1% | 20.5% | 26.5% | 30.9% | 34.6% |
| PZ - 5/8" | 10,000 | $ 49.76 | 25.1% | 43.8% | 60.6% | 79.9% | 102.0% |
| Inside - 3/4" | 10,000 | $ 40.21 | 10.8% | 15.5% | 21.3% | 25.5% | 28.7% |
| PZ - 3/4" | 16,000 | $ 78.18 | 20.5% | 39.3% | 56.6% | 75.9% | 98.2% |
| Outside - 3/4" | 33,000 | $ 164.53 | 13.3% | 19.6% | 26.4% | 31.1% | 34.9% |
| Inside - 1" | 27,000 | $ 93.04 | 10.9% | 15.8% | 21.1% | 24.8% | 27.8% |
| PZ - 1" | 18,000 | $ 99.50 | 16.1% | 32.2% | 47.7% | 65.0% | 84.8% |
| Outside - 1" | 6,000 | $ 59.38 | 6.8% | 9.8% | 13.0% | 15.3% | 17.1% |
| Inside - 1.5" | 105,000 | $ 325.67 | 12.0% | 17.5% | 23.4% | 27.5% | 30.7% |
| Inside - 2" | 130,000 | $ 432.68 | 11.2% | 16.3% | 21.8% | 25.7% | 28.7% |

**Table 6.5: Monthly Water Rate Percentage Increase Associated with Projected Rate Adjustments – Referenced to FY16**

## 7.0 Recommendations

In addition to the rate adjustment recommendations presented in Section 6.2, the following general recommendations were developed in conjunction with completion of the Water Utility Financial Plan and Rate Study:

- **Strive to correct cost of service inequities by reducing system demand and increasing the cost of water used solely for seasonal irrigation.** By implementing the recommended changes to the water rates, the City will be making an effort to rectify existing cost of service inequities Non-Irrigation and Irrigation-related water demand.
- **Link annual rate adjustments to Outside user rates to adjustments to Inside user rates.** It is recommended that City continue to adjust rates to Outside users consistent with those to Inside users. Due to the small number of Outside users, it is very difficult to correct any cost of service disparity.
- **Revise the existing Low Income/Senior Discount Policy.** It is recommended that the City revise its policy to require income-based qualification through the LIEAP to receive the discounted Utility rates.
- **Review Water Revenue Adequacy annually.** The City of Whitefish has undertaken this project to obtain a financial tool to assist in management financial health of the Water Utility. Although the projections herein contain proposed rate adjustments through 2021, a change in actual revenues or expenses from those projected could significantly impact the Utility. As a result, it is strongly recommended that the City closely monitor revenues and expenses as compared to those projected in the rate model, making adjustments as necessary, and update the projected rate adjustments based on the desired objective of achieving consistent revenue adequacy and meeting cash reserve target balances.
- **Monitor near-term revenue stability.** Recommended increases to the Irrigation user classes may result in changes in Irrigation usage. Some reduction in usage has been assumed in the analysis, but it will be important to make adjustments to the assumptions as actual usage information becomes available. Therefore, the City should closely monitor revenue stability.
- **Set Target Levels and Fund operating reserves.** In addition to Debt Service reserves required by bond covenants, it is recommended that the City strive to achieve and maintain the following reserve levels:
    - Operating Reserves: Target = 90 days of operating expenses

- Capital Reserve: Target = 25 percent of average annual cash-funded capital expenditures
- Rate Stabilization: Target = 15 percent of annual rate revenue.

- **Carefully Monitor Resort Tax Revenues.** Because the Haskill Basin loan is Water Utility debt, it will be important to closely monitor the availability of Resort Tax funds for debt repayment, and make adjustments to the projected rates as necessary to generate supplemental revenue for loan repayment, if necessary.
- **Continue the policy of rate indexing as a minimum annual adjustment.** Although future rate adjustment projections contained herein are, for some user classes, less than average inflation, it is recommended that the City maintain its rate indexing policy, even though it is likely that in most years the City will be able to specifically dial in the necessary percentage.
- **Proactively communicate changes to the rate structure and increases to the periodic utility bills to the public.** It is recommended that once the City has approved Utility rates for 2017, it continue its proactive community outreach program to educate customers as to the new rates and rate impacts, and to promote the benefits of water conservation. It is suggested that outreach efforts involve information on the City website, press releases, and mailings. The information in the Attachment and that will be provided in the Rates 101 worksheet will be excellent resources in this effort.

A Self-Learning Resource From MSU Extension

MONTANA STATE UNIVERSITY EXTENSION

MontGuide

# Yard and Garden Water Management

Original text by Larry Hoffman, Extension Agent for Lewis and Clark County; Jeff Jacobsen, Extension Soils Scientist; Kevin Laughlin, former Extension Agent for Toole County; Mike Vogel, Extension Housing and Home Energy Specialist; Terry Wolfe, 4-H Specialist.
Revised and edited by Amber Kirkpatrick and J.W. Bauder.

**This publication lists efficient water managment tips that benefit your plants as well as your water budget.**

MT198915AG Reviewed 3/10

**A WELL-MAINTAINED LAWN AND GARDEN ARE** something to be proud of; properly planned and maintained, they can be eye-catching parts of your landscape. Healthy, attractive landscaping helps visually tie your property together, can add value to your property, and actually improves your living environment. On hot, sunny days, your lawn and garden reduce sun glare, thereby reducing evaporation, keeping surrounding areas cooler and attracting birds and other wildlife. On windy and rainy days, your lawn and garden protect your property from erosion and soil loss.

In the semi-arid west, irrigation is often an important element in maintaining home landscapes. However, improper household lawn and garden irrigation uses millions of gallons of water each year. In addition, increasing demands on water resources are putting added focus on water conservation and management.

This guide outlines some lawn and garden Best Management Practices (BMPs) to help you minimize water use while maximizing lawn and garden production and aesthetics.

## Go Native

Landscaping with native plants makes good sense while saving a few cents. Native vegetation is a quality alternative to cultured lawns and landscapes featuring exotic, introduced species. Native vegetation is generally easy to maintain because native species have adapted to the regional climate; they are hardy, they can tolerate less than optimum soil and moisture conditions and they are less susceptible to pests and diseases - all good things for conservation. CAUTION: Not all native species have the same preferences for growing conditions; each plant species has defined water requirements and preferred site-specific conditions such as light and soil. Some native species, such as aspen (*Populus tremuloides Michx.*) and golden currant (*Ribes aureum*), flourish in low-lying areas where water collects, while others like serviceberry like it hot and dry. If you cannot find a native species to meet your needs, look for introduced species that are well-suited to the area, particularly those that can tolerate summers without extra water.

## Know your soils and their water holding capacity

The ability of a soil to store water is called water-holding capacity. Soil water-holding capacity is primarily controlled by soil texture (the amount of sand, silt and clay) and organic matter. Fine textured soils (more silt and clay) have a greater number of small spaces between soil particles than coarser, sandier soils. These pore spaces are what allow fine textured soils to hold more water than coarse textured soils. Organic matter holds and stores water, much like fine soil, and also insulates soil against heating and cooling.

Knowing a little bit about the soil where you intend to grow plants will improve your ability to effectively manage the water you have; clay soils have different water-holding capacities and watering needs than sandy soils, which are different from loamy soils. Contact your local county Extension agent or Natural Resources Conservation Service (NRCS) office to get information on obtaining a soil test and/or getting a report on your soil.

***Clay soil:*** clay soils absorb water very slowly, so apply water only as fast as it is absorbed by the soil. TIP: Till or spade your soil to help loosen the soil and add organic material such as compost or peat moss. Keep the soil surface rough and covered with some type of mulch. This will make it easier for water to enter the soil.

***Sandy soil:*** water can drain through sandy soils so quickly plants won't be able to absorb it. TIP: Add organic material to supplement sandy soil. Keep the soil covered with some type of mulch to minimize drying caused by evaporation. This will help water remain longer in sandy soil.



***Loam soil:*** this soil is a combination of sand, silt, and clay. Loam absorbs water readily and stores it for easy plant use.

## Water management and conservation

Different types of soil have different water management requirements. Overwatering can water-log some soils and cause excessive runoff, root rot problems and nitrate fertilizer loss. Overwatering can also be costly and can deplete water supplies. Some soils (sands and loams) can absorb abundant amounts of water before runoff occurs. Others (clays) absorb water more slowly and can only take brief periods of watering before ponding and/or runoff occurs. Insufficient watering can cause problems as well; if soil gets too dry, it can be time-consuming and costly to sufficiently re-wet the soil.

One way to conserve water is to develop a system prioritizing your lawn and garden's water needs. For example, your vegetable garden gets water before your flower beds, and they get water before your trees/shrubs, which get water before your lawn.

WATCH THE WEATHER. This is true if you're watering your lawn, garden, flower beds, trees/shrubs or acres upon acres of hay or cropland:

- Don't water when it's going to rain, has just rained or is raining. Just sit back and let Mother Nature take care of this round.
- Avoid watering when it's windy; windy conditions increase evaporation.

## Water conservation tips for lawns and flower beds

- Choose the irrigation system that is most efficient for your needs; micro-spray systems, sprinklers, soaker hoses, drip systems and timers all have advantages and disadvantages. Make a list to decide what's best for your situation.
- If you plan to use a timer system – make sure it's in good working condition and turn it off when it's raining or windy.
- Drip or soaker hoses cause minimal surface wetting while allowing water to penetrate to the root zone. Soaker hoses minimize evaporative loss and can reduce your water use by 60 percent or more. Plus, you can water longer without causing run-off.
- Drip or soaker hoses and micro-spray systems are good for areas which dry out quickly (i.e. foundation and border plantings, along sidewalks, driveways and streets).
- Position sprinklers so you're not watering the side of the house, sidewalk or street.
- You can get 'double-duty' out of your sprinkler by letting the kids play in the water while watering the lawn. However, this is NOT a good idea when watering the garden.
- Apply water slow enough so run-off doesn't occur.
- One deep watering to fill the root zone with water is much better than watering several times lightly.
- Brief watering does not allow water to saturate through the grass/surface layer and reach roots.
- Frequent, shallow watering encourages shallow roots, which are more susceptible to stress under extreme conditions.
- Whenever possible, water in the early morning and early evening when evaporation is lowest. Lawns watered under the hot midday sun lose as much as 30 percent of applied water to evaporation. Avoid watering late at night; plants can develop fungus from being wet and cold all night.
- Established lawns only need 1 to 2 inches of water every 3-5 days. Apply an inch of water about every 3 days if the weather is very hot. A quick and easy way to know how deep water has penetrated the soil is by using a soil probe. Push a ¼ or ⅜ inch metal rod into your soil after irrigating. When the rod hits dry soil it will stop; that is how deep water has infiltrated.
- WATCH YOUR PLANTS: They'll let you know when they need water...
  - They wilt.
  - Colors become dull
  - Footprints in your lawn stay compressed for more than a few seconds
- Ground cover (mulch, rocks, straw, bedding plants) will reduce evaporation from bare surfaces around trees, steep slopes and along sidewalks and driveways.
- Use a 1 to 2 inch layer of mulch or compost on the soil surface above the root area; mulch and compost will increase soil water holding capacity, keep soil cooler on hot summer days, reduce evaporation and weed growth, and prevent soil erosion.
- Set mower height to 2 inches; longer grass shades roots, keeps soil cooler, and reduces evaporative loss. CAUTION: Spread out piles of clippings to prevent the underlying lawn from being killed.
- Use a mulching mower and leave grass clippings to decompose on the lawn. Mulched clippings are fertilizer for grass, keep soil cooler, shade roots and help reduce evaporative loss.

- Dispose of fish tank water on your flower beds – the green algae and fish excrement are rich in phosphorus and nitrogen.
- Buy and install rain barrels. These help reduce runoff and collect rain water for plants and outdoor uses. Encourage your local home and garden store to stock rain barrels. For more information, check out www.rainbarrelguide.com.
- Raingardens conserve water; reduce run-off and potential water quality impairment while replenishing groundwater resources. For more information visit: http://www.mt.nrcs.usda.gov/technical/ecs/water/lid/rain.html.
- Use gardening techniques that take advantage of rain. Rain gardens are designed with a depression at the center to collect rain and snow melt from your roof, alleys, sidewalks, driveways and gutters and allow it to naturally seep into the ground. Rain gardens can provide a "living fence" between properties and channel runoff to gardens.
- Water efficient landscaping like xeriscape is landscaping which uses native and drought tolerant plants, shrubs, and ground cover. Xeriscaping is low maintenance, water wise and does not sacrifice beauty and color. Xeriscaping stresses proper soil preparation, efficient irrigation, and use of water stingy plants. For more information, visit http://www.mt.nrcs.usda.gov/technical/ecs/plants/xeriscp/intro.html
- Develop a landscape plan that uses natural conditions of the property and choose plants that are well-suited to your climate and soil type. Look for native ground cover plants like blanketflower (*Gaillardia* spp.) whenever possible.
- Here are a few plant species requiring less than 14-15 inches of rain/year:

  - Penstemons (*Penstemon* spp.), pussytoes (*antennaria* spp.), kinnickinnick dewberry (*Rubus multifer*), yarrow (*Achillea* spp.), and blue flax (*Linum perenne L.*) are native perennials with bright flowers

  - Indian rice grass (*Achnatherum hymenoides*), buffalo grass (*Bouteloua dactyloides* [Nutt.]), Idaho fescue (*Festuca idahoensis Elmer*) and green needlegrass (*Nassella viridula* [Trin.]) are native ornamental grasses

  - Mountain mahogany (*Cercocarpus* spp.), junipers (*Juniperus* spp.), chokecherries (*Prunus* spp.), sumacs (*Rhus* spp.) and currants (*Ribes* spp.) are native shrubs.

## Garden watering tips

Know your plants. Different plants have different water requirements; onions do not need as much water as carrots which don't need as much water as tomatoes, sweet corn or beans. Potatoes are very sensitive to insufficient soil water, but peppers like it hot and dry. Plant age also matters; mature plants require less water than plants in the middle of their growth cycle, and young plants should be watered immediately after transplanting.

- Timing of watering is important.
- The cool of the evening is the best time to soak or drip irrigate – this gives the soil all night to absorb the water.
- Early morning is the best time for sprinklers – leaves can absorb water and not be wet and cold all night.
- Loosen soil around plants so the soil can quickly absorb water.
- Apply water in furrows or basins around plants to reduce evaporation losses – dig furrows between plant rows about 4-6 inches deep.
- Place mulch between plant rows to reduce evaporation. Use small amounts at a time so you don't cause mold or root problems.
- Soak your garden once a week to a depth of 6-12 inches and don't water again until the top few inches begin to dry out.
- Eliminate weeds. Plastic mulch around plants not only saves water, but it promotes early plant growth and cuts down on weed establishment.
- Plant tomatoes, cucumbers, and squash in hills and group them up whenever possible.
- Raised beds are good ways to conserve water and space.

## Rules of thumb for watering shrubs and trees

Trees and shrubs need moist soil in order to grow, produce and remain robust against pests, injury, drought or disease. All woody plants need water from early spring through August, and newly planted trees and shrubs require water more often than established plants. Soak the soil approximately 30 inches deep and wet the entire root area – this can spread out as much as three times the spread of the limbs. In the fall, allow plants to "harden off" by gradually withholding water from September to mid-November. Prior to ground freezing (mid November), apply enough water to reach and saturate the root area; this helps prevent winter kill.



Know the water requirements of your trees and shrubs and water accordingly; some species such as poplar, aspen, willow maple and mountain ash need more water than lilac, cotoneaster, Douglas fir and pines, all of which are sensitive to excess water.

- To promote deep root establishment in new transplants or for deep rooted trees, a root feeder/irrigator may be used for deep watering.
- Berms to create basins around trees or shrubs can be filled with water for slow infiltration and percolation. CAUTION: Berms should be removed in the fall to prevent water collection and freezing during the winter. Freezing water can girdle or cause collaring.
- Reduce water loss through surface evaporation and prevent sunburn by wrapping young tree trunks.
- Do not water the foliage of fruit or deciduous trees; it encourages blight, rust and mildews. Evergreens, however, can take advantage of watering as needles absorb water more readily than leaves of deciduous trees.
- 2½ to 3 gallons of water a week will keep a 6-8 foot tree alive during droughts.

## How to measure applied water

Outlined here are two simple ways to measure/estimate how much water you are applying to your lawn or garden.

***Method 1:***

After watering for two hours (less if run-off occurs), push a spade or shovel into the soil and push the soil or sod back enough so you can observe the depth of moist soil, then lay the soil or sod back in place. This gives you a quick and easy determination of whether the water is reaching the depth you desire. Schedule your next watering when the top few inches of soil dry out or you observe signs of water stress in plants.

***Method 2:***

If you are using a sprinkler to water, place 3-5 straight-sided cans (coffee, tuna, cat/dog food) at even intervals and in a line running away from the sprinkler with the last can near the edge of the area being watered. Make sure your sprinkler placement gives consistent coverage or some areas may be water stressed. Now you have two choices:

1) Run the sprinkler for ½ hour, and then measure the depth of water in each can with a ruler. Add up the depth of water in all cans, divide by the number of cans and multiply by 2 to get inches of water applied per hour.

   ***Example:*** 4 cans got a total of 2 inches of water over ½ hour. 2 inches divided by 4 cans and multiplied by 2 = 1 inch of water per hour.

2) Check the time required to fill one can 1 inch deep with water. NOTE: length of time will vary depending on water pressure.

   ***Example:*** it took 1 hour to fill a can with 1 inch of water so application rate is 1 inch of water per hour. Now you know how much water is being applied per hour, but all the water caught in the can does not enter the soil.

If you've determined that you can irrigate for 1 hour before causing runoff, and you think you'll need to add 3 inches of water, then irrigate for 1 hour in the morning, early evening and the next morning to apply 3 inches of water to your lawn. Apply this method to your entire property and you'll see a drop in water use, lower water bills and all without sacrificing your landscaping.

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**File under: Yard and Garden (general)**
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A Self-Learning Resource From MSU Extension

# Successful Lawns

by Cheryl Moore-Gough, Extension Horticulture Specialist; Robert E. Gough, Professor of Horticulture; Tracy Dougher, Assistant Professor of Horticulture, Montana State University

MONTANA STATE UNIVERSITY EXTENSION
MontGuide

**Features insights and information on establishing and maintaining a lawn. Topics include seeding, fertilizers, mowing, water, disease, weed and insect control.**

MT199310AG reviewed 3/10

**LAWNS TIE MOST HOME LANDSCAPES TOGETHER,** control soil erosion, dampen traffic noise and cool the air. But these things only happen if the lawn has been installed and maintained correctly.

## Lawn Establishment

### *Provide Drainage*

Provide lawns with both surface and internal drainage during soil preparation. Allow at least a 1 percent slope (one foot drop per 100 linear feet or about 1 inch every 8 feet) away from the house. Slopes as great as 33 percent (one foot drop per three linear feet) will support turf, but mowing and runoff water will cause problems. Steeper grades won't do for lawns. Instead, choose a low-maintenance ground cover for these planting sites. Horizontal Junipers work well on steeper grades.

If you must change the grade of your lawn area, remove the top 6 inches of soil, make the grade changes, then replace the topsoil. This conserves topsoil and helps reduce unevenness in the growth and appearance of the lawn due to the presence of mixed soils. If you must raise the grade around trees and shrubs more than 2 inches, well the plant at the dripline to allow for proper aeration of the root system.

Roll, fill and rake low spots to level the surface after grading and before seeding.

### *Proper Soil*

Modify infertile and poorly textured soils before planting. Get a mechanical analysis of your soil from a soil testing laboratory or estimate it yourself using this method:

- Place a cup of representative soil into a large glass jar with a screw top and fill the jar with water.
- Swirl the soil and water until they are well-mixed, then let the soil settle overnight.
- Swirl it again the next day, then let it settle for a week. Soil particles of different sizes will settle in layers of sand (bottom), silt and clay (top). Organic matter will float.

Use this estimate of the proportions of sand, silt and clay in your soil to determine the need for soil modification. An ideal lawn soil is a sandy loam containing about 70 percent sand, 15 percent silt and 15 percent clay.

Modify clay soils by adding coarse sand for a total soil sand content of 70 percent. The cost will be high, but small quantities of sand are ineffective and may aggravate soil problems.

Adding organic matter such as sawdust, ground bark, manure or peat moss also improves the structure of clay soils but can lead to nitrogen deficiency problems. Thoroughly incorporating 33 percent by volume (2 inches) of rotted organic material into the top 6 inches of soil will substantially improve soil structure.

Organic matter also improves very sandy soils, thereby increasing water-holding capacity and fertility. To avoid the possibility of a future nitrogen deficiency caused by mulch decomposition, add about 24 pounds of actual nitrogen to each ton of organic matter to compensate for that lost to decomposition. For example, for each ton of organic matter added, you will need to apply 80 pounds of a 30-10-10, 240 pounds of 10-10-10, or about 150 pounds of 16-16-16 fertilizer.

### *Pre-Plant Fertilizers*

Use a soil test to determine the need for nutrients, the soil pH and the presence of high levels of soluble salts. Phosphorus is fairly insoluble and moves slowly in the soil, so incorporate it prior to seeding if your soil needs it. Nitrogen and potassium are soluble and can be added later. If your soil has enough nitrogen and you plant in the fall, you may not need to use fertilizer until spring. If you are planting in spring, add a nitrogen starter fertilizer at ½ pound of actual nitrogen per 1000 square feet prior to seeding.

### *Seedbed Preparation*

Bring soil to a very fine granular condition and remove all clods, sod, rocks and trash during final surface preparation. Settle loose soil with a light rolling. Adjust the weight of the roller so that only your sole prints appear on the soil surface. Soil must be firm and fine-textured.



### *Seeding*

You can seed a lawn in Montana in late April and May but seeding in mid-August to mid-September (around Labor Day) is better. Annual weeds do not have time to produce a crop of seed, and the grass has the entire fall and the early spring to become established before the heat and stress of summer.

For even coverage and seeding, sow half the seed in one direction and the other half at right angles to the first. Do this by hand or with a mechanical seeder.

Lightly rake and roll to incorporate the seed into the soil, but don't bury them more than ¼ inch. Use organic mulch, such as clean straw, or hydro-mulch, (wood fiber sprayed with water onto the new lawn surface) to hold moisture, reduce erosion and hasten germination. Be sure to apply it evenly and no thicker than ⅜ inch.

### *Grass Mixes*

It is better to plant a mix of species due to variations in microclimate and shade.

For general lawn use under moderate irrigation, sunlight and fertility levels, use a mix of Kentucky bluegrass or one of its improved cultivars, creeping red fescue or its Chewings variety, and perennial ryegrass. A typical mix consists of about 60 percent Kentucky bluegrass, 30 percent red or Chewings fescue, and 10 percent perennial ryegrass. The perennial ryegrass is not permanent and serves as a nurse grass, making its presence in the mix optional.

- For shaded lawns, use the same species, but let the fescue predominate. A shade-tolerant mix should contain about 60 percent creeping red fescue or Chewings fescue, 30 percent Kentucky bluegrass, and 10 percent perennial ryegrass. Maintain lawns of these mixes at heights of about 2½ to 3 inches. Lawn mixes that contain a large percentage of perennial ryegrass or annual (Italian) ryegrass make inferior lawns in Montana.
- For semi-dryland lawns in eastern Montana, try sheep fescue or its subspecies, hard fescue, or the newer turf-type tall fescues. Because these differ in growth habit and texture, they are best planted alone rather than as a mix. Many are also clump-forming grasses and must be seeded thickly to form a decent lawn.
- Under very dry conditions or in non-irrigated Montana lawns, Fairway crested wheatgrass, streambank wheatgrass, meadow bromegrass and smooth bromegrass are good choices. These will become brown during drought periods and should not be mowed to heights of less than 3 inches. Except for crested wheatgrass, all are rhizomatous (spreading laterally under the surface) and form a reasonably good sod. They all have similar characteristics and can be mixed. Buffalograss and blue grama grass will grow with little moisture and will form a sod that can be mown at about 2½ inches in height.

Both have less desirable blue-green leaf color and go dormant (brown) during cold weather. As a note of caution, neither buffalograss nor blue grama can compete with weeds or cool season grasses in high rainfall areas or irrigated lawns. Also note that buffalograss and blue grama green up slowly in the spring and will brown very soon after the first cold weather in the fall. Although zoysiagrass and Bermuda grass are advertised as cold- and drought-tolerant, they are not appropriate grasses for Montana lawns.

### *Seeding Rate*

Seed Kentucky bluegrass/fescue/perennial ryegrass mixes at the rate of 2 to 3 pounds per 1000 square feet. Seed dryland grasses at the rate of 3 to 5 pounds per 1000 square feet to obtain a reasonably fine sod. Heavy seeding rates are especially important for the tufted, non-spreading grasses like sheep fescue and crested wheatgrass.

## Lawn Maintenance

### *Fertilizers*

Rates of application are given in pounds of actual nitrogen and the oxides of phosphorus and potassium. A 30-10-10 fertilizer contains 30 percent nitrogen, 10 percent phosphorus pentoxide, and 10 percent potassium oxide. A 100-pound bag will contain 30 pounds of available nitrogen (actual N) and 10 pounds each of the oxides of phosphorus and potassium. The remaining 50 pounds is inert material.

To figure how much of a given fertilizer you need to apply, use this formula:

*lbs. of nitrogen you want*
÷ *the percentage of nitrogen in the fertilizer mix*
= *lbs. of fertilizer mix needed.*

For example, if you wished to apply 4 pounds of actual nitrogen using ammonium sulfate (21-0-0), you would need 19 pounds of the fertilizer. To get this value, divide the pounds of nitrogen wanted by the percent nitrogen in the fertilizer:

*4 (lbs. of nitrogen needed)*
÷ *.21 (decimal representing the percentage of nitrogen in the fertilizer mix)*
= *19.04 (lbs. of fertilizer mix needed)*

So, 19.04 lbs. of 21-0-0 provides 4 lbs. actual nitrogen. Similarly, if you wished to use ammonium nitrate (33-0-0):

*4 ÷ .33 = 12.1*

It will take 12.1 pounds of 33-0-0 to provide 4 pounds of actual nitrogen.

The cost per pound of actual nitrogen in slow release fertilizer is higher than that in readily available forms, but you can use it at higher application rates without danger of physiological burn. Also, loss of nutrients due to leaching is greatly reduced with this fertilizer form.

For most Montana conditions, apply 2 to 4 pounds of actual nitrogen per 1000 square feet of lawn per year. Make two to three applications so that no more than 1½ pounds of available nitrogen per 1000 square feet are applied at one time. The precise times for fertilizing lawns vary across the state, but fertilizing around Memorial Day, Labor Day and Columbus Day (after the last mowing but about four weeks before the soil freezes) are good rules of thumb. If you only apply fertilizer once or twice a season, the two fall applications are the key fertilizing times. Your lawn will green faster in spring if you remember the Columbus Day application.

Use a fertilizer containing sulfur to reduce soil pH and make your grass more resistant to certain diseases such as rust and red thread. Inorganic nitrogen sources give better results in spring and late fall when soils are not warm enough to allow breakdown of organic materials. Organic fertilizers such as treated sewage sludge and plant and animal byproducts work best when applied in the early fall.

### *Mowing*

For a healthy lawn, mow twice a week and don't catch the clippings.

Mowing frequently enough to remove only ⅓ of the grass blade eliminates the need to catch clippings. Instead, allow them to decompose on the lawn to return nitrogen to the soil. Clippings don't cause thatch.

Keep mower blades sharp to avoid tearing the blade and the whitish cast to the lawn that results from it.

Mow Kentucky bluegrass/fescue/ryegrass mixes no lower than 1½ inches. The Kentucky bluegrass will tolerate lower clipping, but the fescues and ryegrasses will thin when mowed short. Higher mowing heights help to conserve water. Set mowing heights high, particularly during hot spells.

### *Thatch*

Thatch is primarily the accumulation of dead, non-decomposed rhizomes. It interferes with the penetration of air, water and nutrients into the turf when it accumulates in a layer thicker than ½ inch.

In a healthy, well-maintained lawn, thatch will not accumulate. Most thatch problems are caused by over-vigorous growth and can be corrected by reducing nitrogen application and/or irrigation.

You must control excessive thatch. Mechanical thatch attachments and power rakes eliminate the need to hand rake thatch. The rotary mower blade with spring loaded "fingers" can scratch out thatch. To be effective, though, these and power rakes must be set to penetrate the thatch layer.

De-thatch before the grass has started to grow in the spring to reduce the damage to turf crowns which are also located in the thatch. Power raking after growth has started causes leaf bruising and requires more power to de-thatch through the vegetative cover.

### *Aeration*

Where thatch is heavy, removing a plug of soil will provide quicker results than de-thatching. Aerating is best done with coring machines which remove cores ¼ to ⅜ inches in diameter and 3 to 4 inches deep. Under extremely poor soil conditions, fill the holes with soil amendments such as sand, peat or calcined clay. (Only in rare cases should gypsum be used.) For best results, aerate when the soil is moist, to allow the tines to penetrate.

Devices that use solid spikes to "aerate" the lawn are not effective and actually contribute to soil compaction.

### *Watering*

Improper watering results in poor lawns. Frequent light watering forces shallow rooting that makes your lawn grass less able to tolerate drought conditions. Weeds such as annual bluegrass and rough stalk bluegrass thrive under frequent, light waterings.

**Always water as heavily as possible for the soil in question, and as infrequently as possible.**

Early morning is the best time to water.

Over-watering can starve the roots of oxygen by saturating the soil and leach valuable nutrients away from the rootzone. Estimate water needs for your lawn by observing the water loss from a free-water surface like the evaporation pans used by climatologists, or a wide-mouthed bucket or washtub. Well-maintained bluegrass lawns consume about as much water as that evaporating from the pan. For most of Montana this amounts to between one and 1½ inches of water per week early and late in the season but may be as high as 2½ inches of water per week in mid-summer. The amount you use to irrigate should be this value minus the amount of rainfall since the last irrigation. See the Montana Gardener's Book of Days (EB165) for more information on plant water use.

### *Disease Control*

Although they are a minor problem, you may encounter several diseases in your lawn. Most are caused by fungi that attack leaves and cause thinning of the grass. Fertilizers containing sulfur (a fungicide in itself) reduce disease incidence. Maintenance practices which favor lush lawns, e.g., over-fertilization, over-watering, excessive thatch control and mowing can all lead to disease development.

Here are several diseases that may affect lawn grass in Montana:

Gray Snow Mold (*Typhula* spp.) – A fungus disease occurring in early spring, visible just after snow melt. It appears as a white webby mass on the top of the grass in a patch from a few inches to a few feet in diameter. Gray snow mold damage disappears as the temperature warms and the grass begins to grow. Raking can speed recovery. Avoid over-fertilizing in the fall to protect your grass from infection.



Melting Out/Leaf Spot (*Drechslera poae* and *Drechslera triseptatum*) – A fungus disease occurring during moist, warm conditions in spring. It attacks Kentucky bluegrass/fescue lawns and results in thinning of the turf and a yellowing of the lower leaves. Reddish-black spots surrounded by a yellow zone appear on the leaves.

Control includes fertilizing to encourage moderate growth. Apply water in early morning and water deeply and infrequently. Mow as high as the grass selection will allow. Remove thatch in spring if it accumulates to more than ½ inch. Prune woody landscape plants to remove dense shade. Fungicides are effective if cultural controls fail but not usually recommended for home lawn use. Contact your local country extension agent for current recommendations. Fertilizer with high nitrogen and/or nitrogen in a rapid release form promote this disease.

Powdery Mildew (*Erysiphe graminis*) – Appears as small colonies of white dust on the leaves and leaf sheaths. These grow together and cover much of the leaf surface, generally the lower ones. Leaves may become puckered and eventually yellow. It is usually observed in spring and fall during cool humid periods and most often found in shaded areas where air circulation is poor. Heavy fertilization favors this disease.

Control strategy includes a mix of shade-tolerant grasses. Pruning woody plants to reduce shade intensity and allow better air movement also helps to control powdery mildew. Mowing higher during disease periods and reducing fertilizer applications will reduce infection.

Red Thread (*Laetisaria fuciformis*) – Seen occasionally in Montana on red fescue and Kentucky bluegrass, this disease usually occurs in spring and fall and attacks nitrogen-deficient turf grass. Plants appear water soaked and die rapidly. When air is moist, colorful red disease strands are produced at the leaf tips, giving the turf a reddish appearance.

Maintain a balanced fertilizer program and water to prevent stress. Prune trees to increase light penetration to the lawn and to increase air movement. Collect grass clippings to reduce spread of the disease spores.

Fairy Ring (many mushroom-forming fungi) – Symptoms include the formation of arcs or rings of lush green turfgrass, often with two green rings separated by a dead zone. Mushrooms grow from the rings. Rings usually don't cross each other but instead, unite to form larger rings.

Fairy rings are most severe on light-textured, infertile, droughty soils. Since they grow on organic matter, turf on soil containing much residue from previous crops and old plant roots, or turf allowed to become thatchy, is most susceptible.

There is no single, successful control. Heavy watering helps prevent drought stress of turfgrass above the fungus as well as encouraging development of microorganisms that fight the fungus. Aerating and properly fertilizing the lawn also help.

Another control method is to physically remove infected soil, replace it with clean soil and reseed.

Do not eat the mushrooms associated with fairy rings.

### *Weed Control*

A healthy lawn is too competitive for most weeds. Proper care will encourage dense turf growth that will crowd out weeds. If a problem exists, physically remove the weeds or use a recommended herbicide to kill them.

Always identify your weed problem, choose the right herbicide, and follow directions on the label. Spray when the air is calm and direct the spray away from desirable plants. Increasing the mowing height will help the grass resist weed invasion and will also shade out germinating weed seeds.

### *Insect Control*

There are few insect pests in Montana lawns. If you decide to apply an insecticide in some special circumstances, follow all label directions and keep children and pets off the lawn for a day after application.

If you apply insecticides to control root-feeding insects, the chemical may need several days to penetrate the soil and to become effective. Aeration will hasten penetration of the chemical into heavily thatched turf. The use of a surfactant will also help pesticide infiltration. Contact your county Extension agent for the latest information on pest control in lawns.


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