Water Conservation Plan

Meridian Metropolitan District

Douglas County, Colorado

January 2011
(revised July 2012)

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List of Abbreviations

ABBREVIATION	DESCRIPTION
acre-foot (AF)	Unit of volume to measure water, equivalent to an acre of area covered with one foot of water (325,850 gallons)
AFY	Acre-feet per year
AMR	Automated meter reading
AWE	Alliance for Water Efficiency
AWWA	American Water Works Association
BMP	Best Management Practice
BP	Best Practice
CWCB	Colorado Water Conservation Board
E-T	Evapotranspiration, a combination of water evaporation from soil and exposed surfaces and plant transpiration which is the loss of water from plants
GPM	Gallons per minute
GPCD	Gallons per capita per day
HET	High efficiency toilet (no more than 1.28 gallons per flush)
HOA	Home Owner's Association
IWA	International Water Association
MG	Million gallons
MGD	Million gallons per day
RO	Reverse Osmosis
RWCPP	Regional Water Conservation Planning Program
SMWSA	South Metro Water Supply Authority
SFH	Single family housing
SWSI	Statewide Water Supply Initiative
ULFT	Ultra Low Flow Toilet
WTP or WWTP	Water Treatment Plant or Wastewater Treatment Plant
WCP	Water Conservation Plan
WSD	Water and Sanitation District

Section 1: Introduction

1.1 Purpose

The **Meridian Metropolitan District (MMD or the District)** has reformatted its water conservation plan (WCP, the Plan) based in part upon the model provided by Nolte Associates in the Douglas County Regional Water Conservation Planning Program (RWCPP). The MMD Plan is consistent with the State's emphasis on regional planning in the Statewide Water Supply Initiative (SWSI) efforts.

The Plan meets the required water conservation plan elements (§37-60-126(4) C.R.S, July 1, 2005) listed below:

- Water-efficient fixtures & appliances, including toilets, urinals, showerheads, and faucets.
- Low water use landscapes, drought resistant vegetation, removal of phreatophytes, and efficient irrigation.
- Water-efficient industrial & commercial water-using processes.
- Water Reuse systems.
- Distribution system leak identification & repair.
- Dissemination of information regarding water use efficiency measures, including by public education, customer water use audits, and water-saving demonstrations.
- Water rate structures & billing systems designed to encourage use efficiency in a fiscally responsible manner.
- Regulatory measures designed to encourage water conservation.
- Incentives to implement water conservation techniques, including rebates to customers to encourage the installation of water conservation measures.
- Statement of the covered entity's best judgment of the role of water conservation plans in the covered entity's water supply planning.
- Steps to the covered entity used to develop, and will use to implement, monitor, review, and revise its water conservation plan.
- Time period, not to exceed seven years, after which the covered entity will review & update its adopted plan.
- Either as a percentage or in acre-foot increments, an estimate of the amount of water that has been saved through a previously implemented conservation plan and an estimate of the amount of water that will be saved through conservation when the plan is implemented.
- A public review and comment process must take place. If the covered entity does not have rules, codes, or ordinances to make a draft plan available for a public planning process, then the covered entity shall publish a draft plan, give public notice of the plan, make such plan publicly available, and solicit comments from the public for a period of not less than 60 days after the date on which the draft plan is made publicly available.

MMD's approach to water resource planning and management integrates four categories which are governed by the District: Water Supply and Production, Water Treatment and Distribution, Wastewater Collection and Treatment, and Water Reuse. Whereas the guidelines and criteria described by the CWCB tend to 'pin point' certain methodologies and practices, it is not possible to modify one category specifically without fully exploring the potential impacts to the others. MMD's philosophy is to provide a balanced program which provides enhanced resource management throughout.

Since 1982 MMD has delivered reliable and safe potable water to its commercial and residential customers for domestic use. MMD also treats 100% of the collected wastewater for use as reclaimed irrigation water within the District. The reclaimed irrigation water is currently used on the golf course, commercial properties, parks and common areas. Moreover, MMD has already acquired fully adjudicated water rights to continue to provide these resources through currently estimated complete build-out of the District.

MMD is committed to efficient use of all its water resources and will continue to implement this WCP and the covenants enforced by the Design Control Committee (DCC) as key elements of an integrated water resources planning and management approach. That planning also includes reviewing options with respect to additional water, both renewable and groundwater. The extent to which these options are pursued will be largely determined by a combination of economics, opportunities through partnerships and cost effectiveness to our customers.

This Plan describes ongoing water conservation measures and programs that will continue to promote, support and sustain efficient water use by the MMD customers. The Plan identifies the various stages of existing and potential water conservation for the next five to ten years, and follows the criteria of the Colorado Water Conservation Board (CWCB) listed above and, in part, the 'scope of work' Douglas County used in establishing the Douglas County RWCPP.

1.2 Organization

In keeping with that scope of work, this Plan is organized as follows:

1. Introduction
2. Existing system, water sources, and limitations
3. Current water use
4. Pricing structures and existing Conservation Efforts
5. Identification and screening of proposed conservation measures
6. Demand forecasts with different conservation programs
7. Impacts of conservation programs
8. Implementation and Monitoring Plan

Section 2: Existing System, Water Sources, and Limitations

2.1 District Formation

MMD is a quasi-municipal corporation and a political subdivision of the State of Colorado. MMD was created pursuant to Article 1 of Title 32 C.R.S. for the purpose of providing complete water supply and sanitary sewer systems for the MMD customers and was formed in 1980.

2.2 Geography and Demographics

The District is located in north central unincorporated Douglas County with its northernmost point bordering County Line Road and westernmost point bordering I-25. The service area is shown in Figure 2-1.

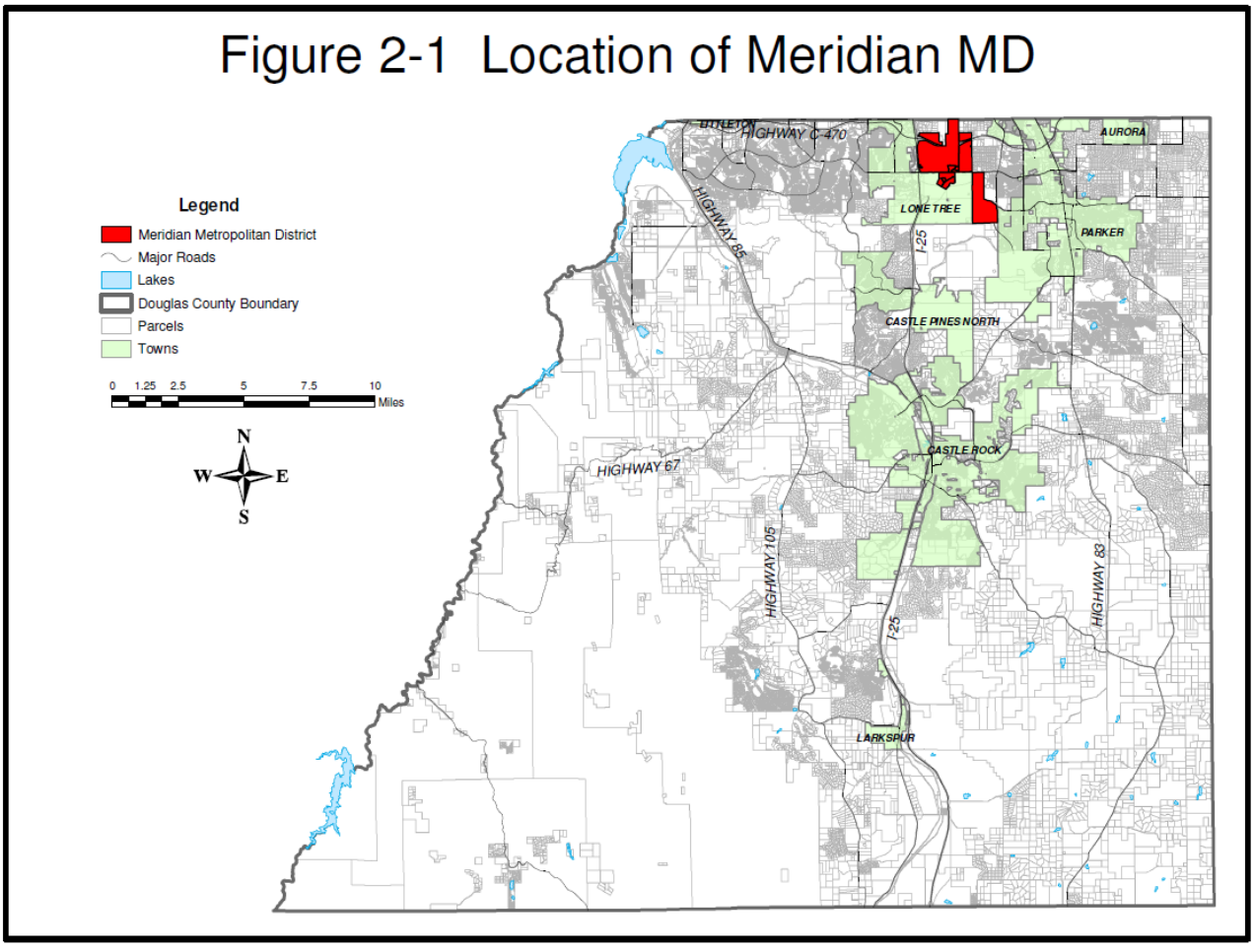

Figure 2-1
Location of MMD

2.3 Historical Water System Development

Cherry Creek, located to east of the District, is the largest stream in the area. Local streams in the vicinity of MMD have intermittent flow. Groundwater supplies in the Denver Basin formation, however, were readily available, required minimal treatment to meet drinking water standards and could be developed incrementally at a relatively low cost.

MMD consists of the approximately 1,600 acre Meridian International Business Center and 400 acre Cordillera Business Park with primarily commercial customers, and the approximately 800 acre Meridian Village. Permitted uses at MMD include residential, office buildings; commercial retail/hotels; research, development and light manufacturing; golf course and open space. The District serves numerous office building complexes, a golf course, several hotels and multi-family complexes and two single family residential developments. The District has an estimated residential population of over 4,500 in 372 single family homes and several multi-family complexes.

2.3.1 Groundwater Sources

MMD's existing groundwater supplies are derived from wells drilled in the Denver Basin. The Denver Basin aquifers underlying the service area include the Dawson, Denver, Arapahoe and Laramie-Fox Hills formations. Figure 2-3 is an illustrative cross-section of the Denver Basin aquifer formations.

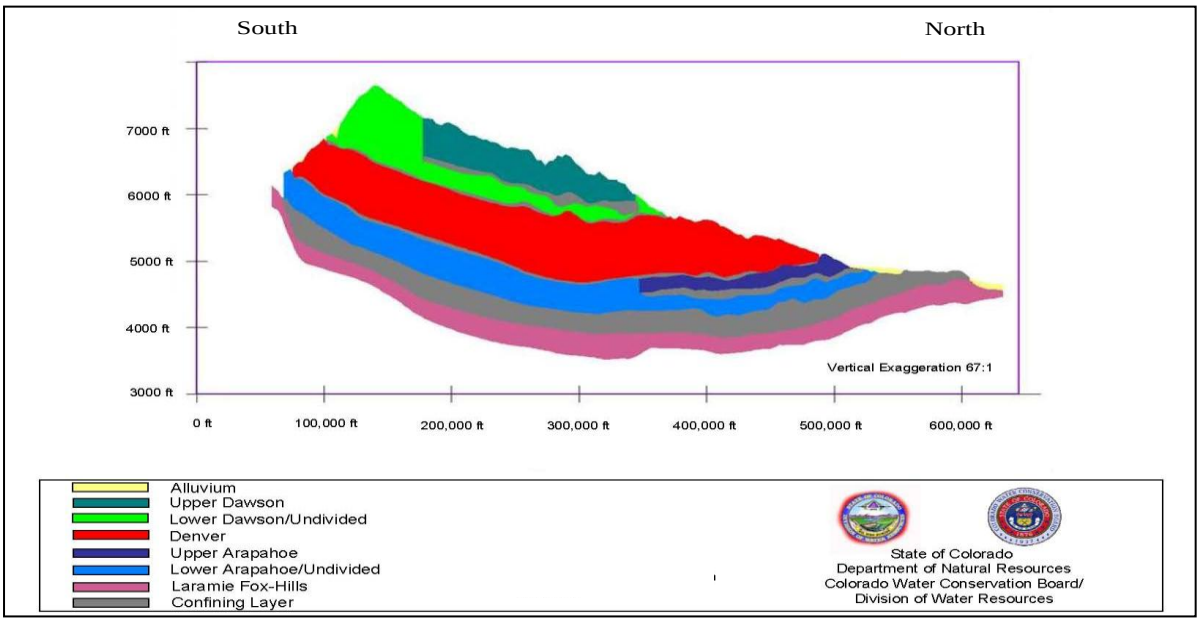

Figure 2-2
Denver Basin Aquifer South-North Cross Section
South Platte Basin
(Source: CWCB South Platte DSS)

All groundwater development to meet MMD's water demands occurs within the district boundaries. Wells are drilled incrementally as necessitated by development . The groundwater supplies developed by MMD require minimal treatment to meet drinking water standards. Treatment to meet regulatory requirements for disinfection is done at both booster pump stations. Table 2-1 provides information on the number, location and aquifer source of MMD's existing groundwater wells.

2.3.2 Reclaimed Irrigation System

Nonpotable water is used for nearly all non-residential irrigation in MMD. In fact, the District functions as a "closed system" with no wastewater discharge. All of MMD's wastewater flows to the Meridian WWTP for treatment then pumped to a storage reservoir located on the golf course. The District can also pump Denver Basin water into the reservoir to supplement its reuse supply, if needed. Water from that reservoir is used solely for reclaimed water irrigation throughout the District. Well water is currently pumped to the reservoir to partially supplement irrigation because the golf course, parks, and open space development were completed ahead of other development that will eventually create enough wastewater to supply all of the District's reuse needs.

2.3.3 Reuse of Wastewater Return Flows

As discussed in Section 2.3.2, the District fully reuses all of its wastewater as tertiary treated effluent and has no return flow to a surface stream.

2.4 Water Sources and Yields

A summary of the annual yield and water rights of the major water sources for MMD are summarized in Table 2-1.

Water Supply Source	Aquifer		Water Rights	Comments
District Groundwater Wells	Upper Dawson Lower Dawson Denver Arapahoe Laramie Fox Hills		300 628 1,270 1,535 739	---
Outside District Sources	Hock-Hawking Mine Portal Surface Water		25	Dedicated to post-pumping depletions per District's augmentation plan
Reclaimed Water Irrigation	Treated effluent from Wastewater Treatment Plant		N/A	The District maintains a 500 ac-ft reservoir for full reuse irrigation. Storage may be from previous year if not fully used.
Total	---		4,472	---

Table 2-1
Summary of Major Water Sources
Meridian Metropolitan District

2.5 Ability to Serve

MMD currently utilizes wells from the Denver Basin aquifers to meet its potable water supply, and a reclaimed water supply for its irrigation system. Groundwater is pumped from 12 wells. If all of the groundwater wells owned by MMD were drilled, connected to the system and producing their decreed amount, the aggregate yield would be approximately 4,472 AFY (including 25 AF for Hock Hawking). See Apendix of Exhibits for CO DWR letter; Water Supply Plan; Lytle review; etc.

MMD has conducted numerous and on-going forecasting studies for the raw and treated water systems that describe the planning of water supply acquisitions, treatment plants, pump stations, storage tanks and major distribution pipelines. Based on these analysis, MMD does not foresee an absolute necessity to acquire additional water, but through its membership in the South Metro Water Supply Authority (SMWSA), could acquire as much as 1,800 AFY additional supply. The MMD already owns 9,000 acft/year of delivery capacity in the East Cherry Creek Valley Pipeline that runs through the District along E-470. A summary of system conditions is shown in Table 2-2.

Planning Questions	Yes	No	Comments
Does the system frequently experience shortage of supply emergencies?		x	A second booster pump station and 2 MG tank for potable storage was completed 3 years ago in advance of development.
Does the system have substantial unaccounted-for and lost water?		x	As shown in Figure 3-1, MMD's unaccounted-for water of 8.3 percent is very much within the industry standard.
Is the system experiencing a high rate of population and/or growth?	x		According to Douglas County estimates, MMD experienced 20 percent growth in the number of residential units from 2008 to 2010. Note: the total units is still relatively small (making the percentage gain seem high) and well within the amount of water the District can physically produce today.
Is the system planning substantial improvements or additions?	x		The District is planning another reclaimed water reservoir, pump station, lift station and wells to serve Meridian Village and is accounted for in utility studies and current water rights.
Are increases to wastewater system capacity anticipated within the planning horizon?	x		The District recently completed an expansion to its wastewater treatment plant which will take it through build-out conditions.

Table 2-2
Summary of System Conditions
Meridian Metropolitan District

Section 3: Current Water Use

3.1 Annual Water Use by Customer Class

The current MMD customer base, as shown in Table 3-1 (billed sales at the point of use), consists of commercial and residential potable accounts. Commercial potable accounts are complemented with reclaimed irrigation accounts, as well. The baseline of 2008 was selected because it was fairly recent, has complete data readily available, and was a relatively average year with regard to precipitation. Commercial use represented 35 percent total billed water use with irrigation-only use at 41 percent (reclaimed water). Demands are shown with respect to total production in Figure 3-1 (including unaccounted-for water). As previously stated, more residential development has occurred since 2008.

General Class	2008 Total Sales (in 1,000 gal)	% of Total (2008)[1]	Service Taps							Total Taps			
			3/4"	1"	1.5"	2"	3"	4"	6"				
Single Family Residential	55,255	11.3%	372	---	---	---	---	---	---	372			
Multi-Family Residential	60,007	12.3%	---	44	63	37	1	1	---	146			
Residential Subtotal	**115,262**	**23.6%**	**372**	**44**	**63**	**37**	**1**	**1**	**---**	**518**			
Commercial, Industrial, Institutional	84,988	17.4%	---	20	19	19	17	2	---	77			
Irrigation for Parks[2] (Reclaimed water)	105,516	21.6%	---	---	---	---	---	---	---	---			
Irrigation for Commercial (Reclaimed water)	86,103	17.6%	1	16	9	5	1	---	---	32			
Irrigation for Golf Course (Reclaimed)	97,000	19.8%	---	---	---	---	2	---	1	3			
Non-Residential Subtotal	**373,607**	**76.4%**	**1**	**36**	**28**	**24**	**20**	**2**	**1**	**112**			
Total	488,869	100.0%	373	80	91	61	21	3	1	630			

[1] Percents may not equal 100% due to rounding.
[2] Currently MMD is upgrading meters within the park areas. Tap sizes vary per park and upgrades.

Table 3-1

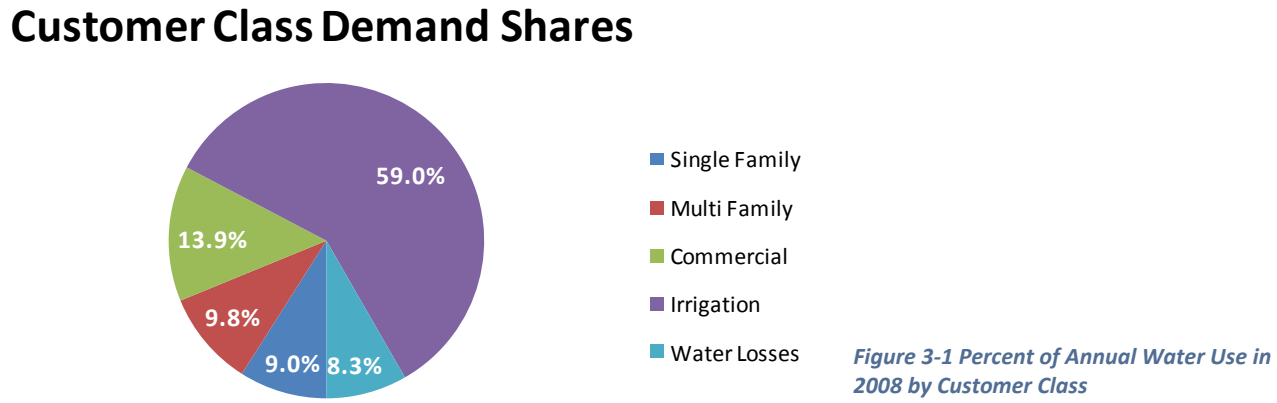

Figure 3-1 Percent of Annual Water Use in 2008 by Customer Class

3.2 Historical Water Demand

This subsection is based upon the portion of well water supply that went into the potable distribution system for domestic demand only. This demand analysis does not include the portion of well water that went into the non-potable system to temporarily supplement the demand for reclaimed irrigation. This is more representative of Meridians's water model because the reclaimed irrigation system will not be supplemented by any well water at buildout. This is due to the annually increasing amount of sewage generated by future growth that will be treated and used to supply the reuse irrigation system. Meridian is a zero-discharge facility which means ALL of the sewage is treated and effluent is reused. Meridian uses all of its tertiary-treated effluent for landscape irrigation.

Total annual water production (or supply needed to meet potable demand only) for 2005 through 2009 is shown in Figure 3-2. For the purposes of comparision, reclaimed water usage is not included in the total water production shown in this figure. As seen in Figure 3-2, demand increased 17.5 percent from 2005 to 2008, increasing from 205 MG to almost 241 MG; an increase of almost 36 MG largely associated with growth although construction water use has been a factor. In 2009, demand fell to approximately 233 MG.

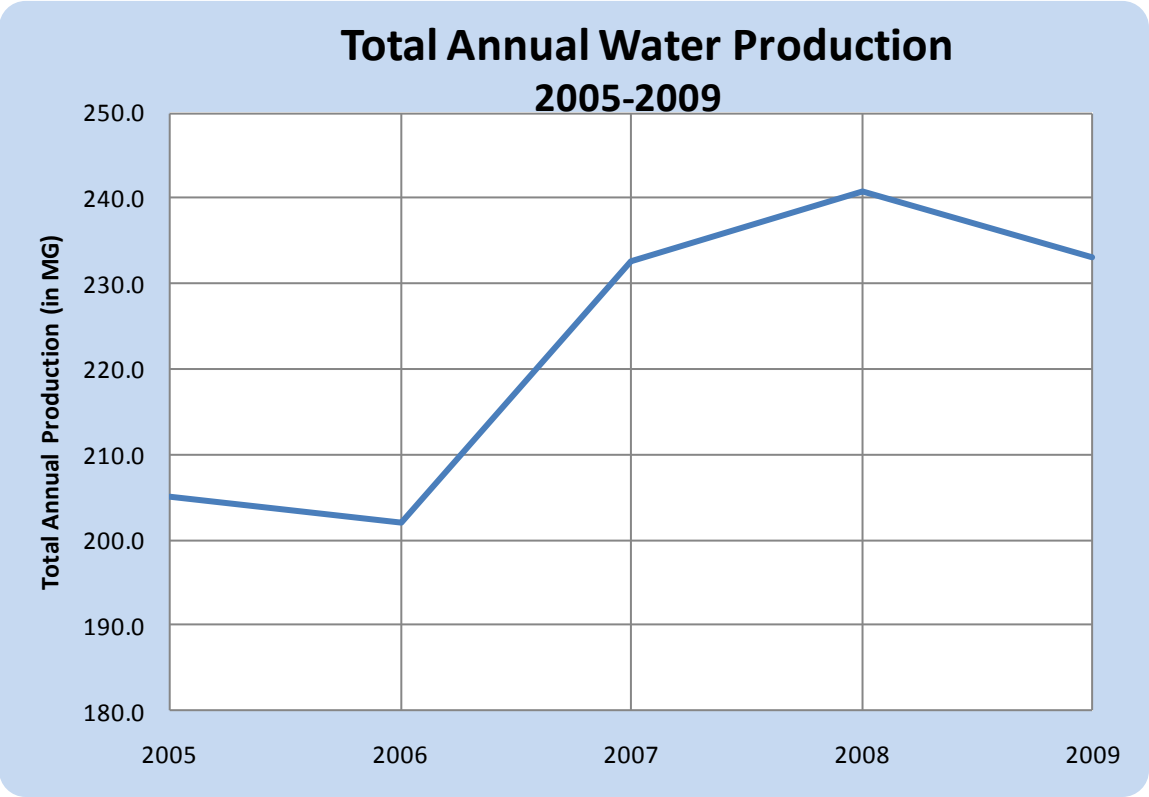

Figure 3-2
Total Annual Water Production

MMD tracks the number of water customers on an allotment basis. See Appendix for Design Criteria allotment schedule.

3.2.1 Current Unit Water Demands

An analysis of per capita water demand is a common measurement of water use. Average daily water demand divided Per Capita or TEs served provides the unit demand in gallons per day per TE (gpd/TE). Unit water demands by customer class have been calculated by Nolte Associates for 2008 and are shown in Table 3-1. Using the Nolte Associates estimates of 2.25 people per residence, the residential metered demand in 2008 was 133 GPCD (or 1056 TEs) including both single and multi-family. MMD, however, uses 2.8 people per single family residence and has tracked actual average annual use at about 119 GPCD. Again, regardless of measure – GPCD or TE – MMD budgets on a strict annual allotment per property basis.

MMD metered water demands for nonresidential classes can be analyzed on the basis of TEs. (All of the District's customers are metered.) Nonresidential demands can vary significantly, depending on the specific customer characteristics in each area. However, the analysis provided by Nolte Associates shows the MMD unit demands of 1,189 gpd/TE are comparable to billed nonresidential demands for Centennial WSD (Douglas County's largest water provider) in 2001 which averaged 1,180 gpd/TE. (Water Conservation Plan – CWSD, 2007, pg 22). Of note, again, all commercial properties are required to use reclaimed water for irrigation – an approximate savings of 33% on that number. See Appendix: Annual Residential Use Tracking.

3.2.2 Peak Water Demands

Monthly water production for the 2008 baseline year is shown in Figure 3-3. In the case of MMD, water production encompasses well production and reuse pumping for irrigation. The peak month production/demand for 2008 occurred in August. That month's production of 36 MG was 79 percent higher than the average annual production of 20 MG per month for a peak month to average month ratio of 1.8 to 1.

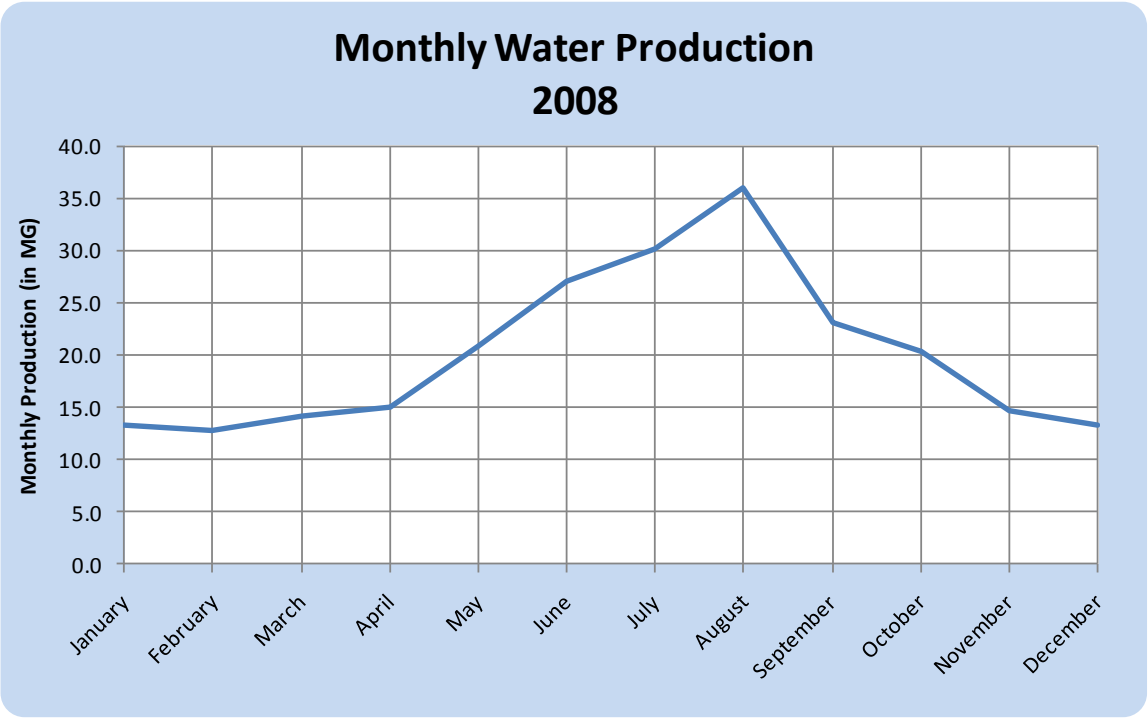

Figure 3-3
Monthly Water Production 2008

3.3 Water Loss Accounting

The description of current water use in this Plan was provided by Nolte Associates based upon data submitted by MMD and is meant to be consistent with the International Water Association (IWA) and American Water Works Association (AWWA) Water Balance approach, which was published in 2000 as part of the IWA publication Performance Indicators for Water Supply Services to provide utilities a consistent methodology for assessing water loss. Though the full assessment of a water balance is outside the realm of this report, the terminology is consistent. The main categories discussed for MMD are revenue (metered) and non-revenue (metered and unmetered) water, which are defined in Figure 3-4 below.

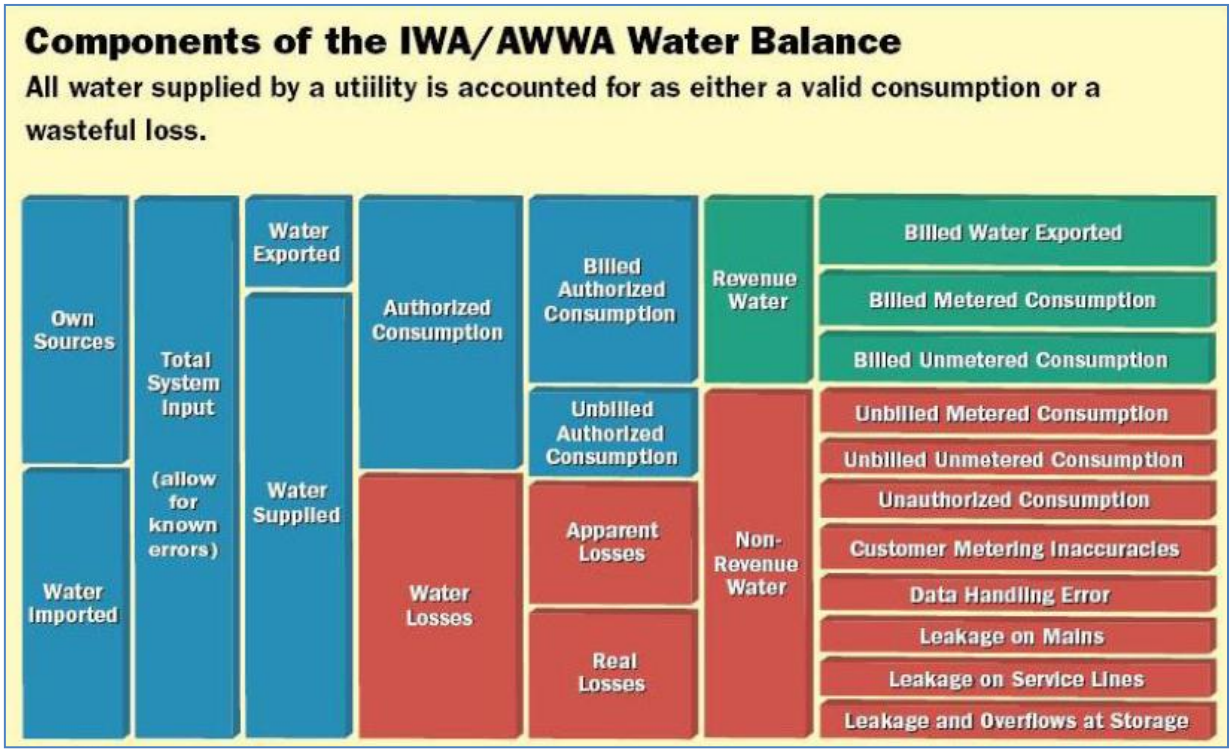

Figure 3-4
IWA/AWWA Water Balance Summary
(Source: AWWA Publication, Opflow, October 2007)

All of MMD's customer water use is metered and billed. There are no customers that receive water that is unbilled, and all metered water use is Revenue Water as defined in the IWA/AWWA Water Balance. The non-revenue water use for the MMD system includes:

- Unbilled consumption (see below)
- Customer metering inaccuracies
- Data handling errors
- Leakage on mains
- Leakage on service lines
- Leakage and overflows at storage

Unbilled consumption includes the following:

- Annual waterline and fire hydrant flushing program conducted by MMD
- Fire department operations filling fire trucks for firefighting. These fire departments are separate from MMD.

A comparison of estimated total water production vs. total water billed in 2008 is shown in Figure 3-1. The difference between total production and billed is water losses or unaccounted for water. This is the same as the non-revenue categories described above. Although AWWA now recommends evaluating non-revenue (or unaccounted-for) water without reference to percentage of water produced, such a reference has been a standard practice in the industry for many years ("Water Wiser," 2010) (Angers, 2001). At the level of analysis in this water conservation plan, it is helpful to consider the District's water system with respect to the accepted benchmark of up to 15 percent unaccounted-for water. As shown in Figure 3-1, MMD's unaccounted-for water of 8.3 percent is very much within the industry standard.

Section 4: Pricing Structure and Existing Conservation Efforts

MMD has used both design and water conservation measures to manage water demands to conserve water since it was formed. The MMD water conservation program offers a diverse range of programs and measures targeted at all water demand customer classes. Demand management strategies have included conservation measures designed to manage peak day demands and also measures designed to reduce total annual demands. MMD's Rules and Regulations are based on these strategies. Additionally, planning, design and approval are controlled by covenants and strictly enforced by the Design Control Committee.

4.1 Pricing Structure

Eight years ago MMD implemented a conservation-oriented water rate structure designed to encourage efficient use for all customers. Other measures include irrigation metering and full reuse. The current program is described in this section and summarized in Table 4-4.

Monthly billing – To increase customer awareness of water use, MMD has monthly billing for all commercial accounts. These bills show the customers remaining allotment.

High-use Customers – Through monitoring performance with respect to water budgets, MMD identifies those customers that use more water than allocated. When allotments are exceeded, the District imposes a rate surcharge (see Fee Schedule in Appendix). Also, annual meetings are held with these users, as required. If the annual irrigation allotment is exceeded by 100% for nonresidential commercial clients, the District will increase the rate to a multiple of five times the normal rate and may terminate service unless a plan and timetable of remediation are presented to the Board. Since District Staff also perform maintenance on all common areas, they are able to observe irrigation water usage within the District. If staff believe there to be an incidence of overwatering, the District may fine the user $250 per occurrence and can include termination of service.

Modifications to increasing block rate structure – In 2003, MMD implemented a tiered, increasing-block rate structure with water budgets in order to promote water conservation through pricing.

Rate Type	Monthly Base Rate	Monthly Use Fees (per 1,000 gal)	Surcharge for Excessive Use (Overages)
Single-Family Residential Rates	$25.00 for 4,000 gallons use	$3.89	For use over 170,000 gal/yr: • up to 50% Overage = 2X rate • 51% to 100% Overage = 3X rate • more than 100% Overage = 5X rate
Multi-Family Residential Rates	$45.00 for 8,000 gallons use	$3.89	For unit use over 95,000 gal/yr: • up to 50% Overage = 2X rate • 51% to 100% Overage = 3X rate • more than 100% Overage = 5X rate
Commercial Rates	1" Tap: $25 for 4,000 gallons use 1.5" Tap: $45 for 8,000 gallons use 2" Tap: $65 for 12,000 gallons use 3" Tap: $135 for 24,000 gallons use 4" Tap: $265 for 48,000 gallons use	$3.89	For the following uses: • Commercial Building - over 20.5 gal/yr/SF • Restaurant – over 153.3 gal/yr/SF • Office Warehouse - over 10.25 gal/yr/SF The following surcharge is applied for overage: • up to 50% Overage = 2X rate • 51% to 100% Overage = 3X rate • more than 100% Overage = 5X rate and service termination.

Table 4-1 Water Rate Tiers

4.2 Operational Utility Side Measures

Integrated Resources Planning – MMD has practiced integrated resources planning (IRP) as part of its overall water supply and demand management strategy. A least-cost analysis of demand and supply options such as well drilling, water storage methods such as well drilling, water storage methods resulted in the conclusion that water conservation and demand management options were cost-effective and, as a result, has for some time been incorporated into future supply planning. As implemented by MMD, the integrated resources planning approach is a comprehensive planning effort that incorporates water conservation as a key component for meeting future needs. The results of the integrated resources planning approach has resulted in savings to MMD as described in Section 7.

Full metering – All MMD customers and associated water use is metered and billed.

Conservation Coordinator –MMD has a designated person which serves as the District's water conservation coordinator, and he can draw on the resources of the Douglas County Water Resource Authority (DCWRA) as needed.

Water Use Based Irrigation Tap Sizing – All irrigation tap sizes are based on allotments predicated on lot size and Colorado agronomic application needs regardless of irrigated area and planting materials. Irrigators are not allowed to add water taps so they can irrigate more landscaping. The allotments are fixed, certified and the users are required to meet them as demonstrated during planning and design approval.

4.3 Water Loss Control Program

Water Loss Control Program – Total well production and reclaimed water together represent total water production. Total water production is compared to total water billed to determine water losses. MMD monitors water loss through meter readings. There are monthly readings for all but SFH meters. SFH meters are read every other month. When meter readings do not match with total water production, the District dispatches its on-staff meter technician and/or hires a company with monitoring equipment to locate leaks.

The District is described as a pressure sustaining system. This means the booster pump stations are equipped with pressure and flow sensors and will send an alarm if excessive flow is detected. The alarms are monitored 24/7 and answered by the operator on duty. Also, since the system is pressure sustained, leaks are usually readily apparent upon inspection of the District in the event an alarm is received. 0ne hundred percent of the District is monitored.

The District has an active annual fire hydrant and valve excersice program. In this program fire hydrants and water valves are located and checked for functionality. Routine repalcement of valves and hydrants are funded through the District's annaul budget.

The District has an active meter inspection and replacement program which is managed in two phases. In the first phase, technicians are dispatched throughout the year in response to customer inquiries. The meters are checked for leaks and functionality and replaced if needed. In the second phase, all meters are routinely checked on a rotating basis. This way all of the meters within the District are routinely checked within a three year period.

4.4 Education and Public Information

Conservation Public Information Campaign – Water conservation information is disseminated via bill inserts, brochures and website. Water conservation topics include information on irrigation management, landscaping tips from CSU extension program and other water saving tips. Staff responds to residential and

commercial customers with water use or billing questions and requests for water conservation information. Additionally, under its Colorado Regulation 84 Permit, conducts annual training, education and authorization of reclaimed water users. See Exhibits.

School Education Programs – MMD is a member of the DCWRA, and the education resources of DCWRA are available to customers. A DVD on Xeriscape prepared by DCWRA was distributed to every customer. The DCWRA website is www.dcwater.org. Education programs are tailored to elementary, middle and high school students. They also team with youth groups such as the Girl Scouts of Colorado and Brownies to provide materials (WOW! – Wonders of Water journey). DCWRA also spronsors a sprinkler head replacement program for residents in Douglas county. The website also lists resources and papers geared toward water topics and technical information

4.5 Indoor Efficiency

Water budgets for in-building accounts – Water budgets for in-building use were first implemented in 1982. Water allotments are set according to the attached schedule – which is based on conservative planning numbers. The allotments are set on an annual basis, so surcharges typically are applied later in the year, if allotments are exceeded.

4.6 Outdoor Efficiency - Landscapes and Irrigation

Water budgets for irrigation accounts – Water allotments for irrigation accounts have to be accompanied by a potable account and attendant allotment. Irrigation allotments are based on an allowance of 3.74 gal/sf parcel area/yr which provides for an "equivalency" of a maximum of 20 percent of the gross parcel area of each development site to be "irrigated" landscape. See Exhibits Annual Residential Use Tracking.

Irrigation System Water Conservation Requirements– Irrigation design and water use requirements have been established as a performance standard. All irrigation system designs must be submitted for review and approval prior to the issuance of an irrigation tap prior to any submittal to Douglas County. Irrigation systems are designed and approved during site plan review and inspected during installation. See Exhibits.

E-T Irrigation Controllers – The larger commercial customers in the District are using E-T Controllers. All commercial properties are required to have rain sensors as well. All irrigation controllers are required to have battery backup or be unaffected by a power interruption and be secured to prevent tampering.

4.7 Water Reuse Systems

Nonpotable irrigation system – As part of MMD's overall water management and conservation program, the District has implemented full reuse of its reclaimed water. The District has irrigation consisting of 34 percent of the total usage. This is accomplished via a reclaimed water irrigation system. The irrigation system includes pumping of treated effluent from its onsite WWTF to an approximately 500 acre foot central storage reservoir to serve irrigation needs throughout the District. Of note, the District is currently adding another storage reservoir of roughly 175 acre feet in size. Reuse water can be supplemented with well water if needed to meet the current irrigation demands in the District. At full build-out, the irrigation demand will be met 100% with reclaimed water.

Water Conservation Measure
Operational Utility Side Measures
Integrated Resources Planning
Full Metering
Monthly Billing (for commercial, bi-monthly for SFH)
High Use Customers

Water Conservation Measure
Modifications to Increasing Block Rate Structure
Conservation Coordinator
Water Use Based Irrigation Tap Fees
Water Loss Control Program
Tracking of Water Losses
Education and Public Information
Conservation Public Information Campaign
School Education Programs (via DCWRA)
Indoor Efficiency
Water Budgets for In-Building Accounts
High Use Customers
Outdoor Efficiency – Landscapes and Irrigation
Water Budgets For Irrigation Accounts
Irrigation System Water Conservation Requirements
E-T Controllers
Water Reuse Systems
Non-Potable Irrigation System

Table 4-2
Current Water Conservation Program

Section 5: Identification and Screening of Proposed Conservation Measures

MMD has implemented a comprehensive water conservation program described in Section 4. Significant water use savings have been realized. As part of this water conservation plan, existing water conservation measures and additional water conservation programs and measures were evaluated. It is important to note that as a water district, MMD does not have land use or building permit regulatory authority. As a result, MMD does not have the regulatory authority to require certain water conservation measures. Recently, however, the State of Colorado has introduced new legislature (HB 10-1358) which requires builders to offer homeowners water saving fixtures if the homeowner is willing to pay the additional costs.

In July, 2008, the CWCB awarded an efficiency grant to Colorado Water Wise, a water conservation non-profit group, to create a best management practices guidebook specific to Colorado. The guidebook will assist water providers with the selection and implementation of effective water conservation programs and measures. The Colorado WaterWise Guidebook of Best Practices for Municipal Water Conservation in Colorado (Best Practices Guidebook) (Colorado WaterWise, 2010) is a planning tool prepared for the purpose of improving and enhancing water efficiency in Colorado. The Best Practices Guidebook offers a detailed description of specific water conservation measures, program elements, regulations, policies, and procedures that can be implemented by Colorado water providers to help ensure reliable and sustainable water supplies for future generations.

The existing MMD water conservation measures were evaluated and compared to the Best Practices Guidebook to determine if there were potential best practices to be considered that are not part of the current MMD water conservation program. The Best Practices are shown in Table 5-1. The Best Practices Guidebook was also used to evaluate potential additional conservation measures.

[1] Each item and corresponding BP# is from the Best Practices Guidebook (Colorado WaterWise, 2010)

Table 5-1

Measure	Best Practice	Category or Sector Impacted
Full metering	BP 1	ALL
Conservation oriented rates	BP 1	ALL
Conservation oriented tap fees	BP 1	ALL
Integrated resource planning, goal setting and monitoring	BP 2	Utility
Water loss control	BP 3	Utility
Conservation coordinator	BP 4	ALL
Water waste ordinance	BP 5	ALL
Public information and education	BP 6	ALL
Landscape water budgets	BP 7	Outdoor irrigation
Rules and regulations for landscape design and installation	BP 8	Outdoor irrigation
Certification of landscape professionals	BP 8	Outdoor irrigation
Water efficient design, installation and maintenance practices for new and existing landscapes	BP 9	Outdoor irrigation
Irrigation efficiency evaluations	BP 10	Outdoor irrigation
Rules for new construction (residential and non-residential)	BP 11	County/State
High efficiency fixtures and appliances-Residential	BP 12	County/State
High efficiency fixtures and appliances-Non Residential	BP 12	County/State
Residential water surveys and evaluations, targeted at high demand customers	BP 13	Residential
Specialized non-residential surveys, audits, and equipment efficiency improvements	BP 14	CII

Water Conservation Best Practices from Guidebook

5.1 Operational Utility Side Measures

Integrated Resources Planning – This is an existing measure and will continue to be the foundation of MMD's water resource management strategy. As described in Section 7, this approach has resulted in significant savings in infrastructure and water rights development and O&M costs. **(BP #2)**

Full Metering – All MMD customers and associated water use will continue to be metered and billed**. (BP #1)**

Modifications to increasing block rate structure – MMD will continue to evaluate its water rate structure to promote water conservation. **(BP #1)**

Water Use Based Irrigation Tap Fees – MMD will continue to implement irrigation tap fees that are based on lot size only regardless of irrigated area and planting materials. **(BP #1)**

Mandatory Watering Days – The District currently restricts residential irrigation to 6pm to 6am, three days a week.

Conservation Coordinator – The District will continue to designate a water conservation coordinator with support from DCWRA. **(BP #4)**

Water surveys and evaluations, targeted at high demand customers – MMD has an existing water budget program and increasing water block rates that limit water use and discourage high water users. The District contacts high water users and assists them with better management of demands. **(BP #13)**

5.2 Water Loss Control Program

Water Loss Control Program – MMD had 8.3 percent water loss in 2008. As seen in Section 4, the District has a comprehensive Water Loss Control Program. Monthly readings are taken on all but SFH meters. SFH meters are read every other month. When meter readings do not match with total water production, the District hires a company with monitoring equipment to locate leaks. **(BP #3)**

5.3 Education and Public Information

Conservation Public Information Campaign – In addition to its existing in-house public education program, MMD will continue to use the services of the Douglas County Water Resource Authority for dissemination of water conservation information. **(BP #6)**

School Education Programs – MMD will continue to use the services of the DCWRA for implementation of school education programs. **(BP #6)**

5.4 Indoor – Residential

Low-Flow Fixture Rebates – This program can be implemented by the State and County. **(BP #12)**

The District has considered an active low-flow fixture rebate program and found that it may not be cost effective at this time and will not be part of this planning cycle. Residential contruction started in the District in 2004. This means the housing stock is relatively new to begin with and already incorporates low-flow type fixtures.

In addition, there is no need to accelerate because the District currently posseses adjudicated water rights adequate to serve all of its customer through buildout. Replacement of fixtures will occur naturally in future years providing the advantage of passive savings. Future natural replacement may also take advantage of

more efficient fixtures that are not currently available. Rebates may be re-evaluted in the next planning cycle.

Rules for New Construction – This program has been implemented by the State. **(BP #11)**

The District has always enforced an allotment system for indoor and out door use that it developed in the 1980s. This system already requires designers and builders to incorporate water conserving fixutures and methods at the planning and design stages of construction development in order to meet these allotments. The allotment system commits the building project to a water budget at the beginning of the design process rather than at the end when buying water and sewer tap. This is more effective since the District does not have control over the building code process.

Furthermore, since the District collects all of the sewage wastestream within its boundaries and reclaims 100% of the wastewater for reuse as landscape irrigation, the impact of wasteful or inefficient sewer generation is lessened. Nonetheless the District discourages inefficient use and, therefore, the volume of sewage generation is estimated and controlled by District plan review and closely monitored through the wastewater treatment process. Reuse irrigation provided by tertiary treated effluent is a major component of the District's overall water conservation plan

5.5 Indoor – CII

Rules for new construction - building codes requiring high efficiency fixtures and process equipment – This program is now required by State as an option. **(BP #11)**

The vast majority of the commercial construction started in the District after 1996. This means the building stock is relatively new to begin with and already incorporates high efficiency type fixtures and process equipment. The District has considered a rebate program and found that it may not be cost effective at this time and will not be part of this planning cycle. Rebates may be re-evaluated in the next planning cycle.

The same allotment system developed for residential use includes a commercial category, as well. The District has always enforced an allotment system for indoor and outdoor use that it developed in the 1980s. This system already requires designers and builders to incorporate water conserving fixtures and methods at the planning and design stages of construction development in order to meet these allotments. The allotment system commits the building project to a water budget at the beginning of the design process rather than at the end when buying a water, sewer and irrigation tap. This is more effective since the District does not have control over the building code process.

Furthermore, since the District collects all of the sewage wastestream within its boundaries and reclaims 100% of the wastewater for reuse as landscape irrigation, the impact of wasteful or inefficient sewer generation is lessened. Nonetheless the District discourages inefficient use and, therefore, the volume of sewage generation is estimated and controlled by District plan review and closely monitored through the wastewater treatment process. Reuse irrigation provided by tertiary-treated effluent is a major component of the District's overall water conservation plan

Specialized non-residential surveys, audits and equipment efficiency improvements – MMD will continue its billing reviews and support for reducing demands of high-use customers.

The District switched to a more sophisticated billing program several years ago. This program tracks the unique allotment of every account and reports the monthly total usage for comparison. High water users are notified annual by letter, if they have exceeded the allotment. These letters often require a follow up meeting with the water customer. Discussion items include: meter functionality checks; customer system inspections/audits; evaluation of the original allotment calculations, and comparison of site layout to approved plans including landscaping.

It should be noted residential customers are reminded annually by mail of residential landscape watering of three days per week. New residents are sent landscape guidelines developed by CSU to aid with landscape design.

5.6 Outdoor Efficiency - Landscapes and Irrigation

Water budgets for irrigation accounts – Water budgets for irrigation accounts will continue. **(BP #7)**

Irrigation System Water Conservation Requirements and Certification of Landscape Professionals– Irrigation design and water use requirements will continue as a performance standard. All irrigation system designs must be submitted for review and approval prior to the issuance of an irrigation tap for non-single family residential properties and inspected after installation. **(BP #8)**

E-T Irrigation Controllers – The District will continue to require rain sensors for all commercial irrigation accounts and encourage the use of E-T Controllers by large accounts. MMD has begun to switch to E-T Controllers on all common park areas All irrigation controllers must have battery backup or be unaffected by a power interruption and be secured to prevent tampering.. **(BP #9)**

Limits on turf landscaping for new construction – The planning and design of all landscaping are strictly controlled through covenants as approved by the DCC. Code enforcement is also handled by the DCC.

5.7 Water Reuse Systems

Nonpotable irrigation system – MMD will continue to fully reuse its treated wastewater for reclaimed water irrigation.

Reuse of consumable effluent return flows – MMD will continue to reuse all of its treated wastewater flows with no effluent discharge.

Water Conservation Measure	Existing - to be Continued	MMD has Regulatory Authority?	Best Practices Guidebook BP #	Retained for Continued and/or Future Implementation?
Operational Utility Side Measures				
Integrated Resources Planning	Yes	Yes	2	Yes
Full Metering	Yes	Yes	1	Yes
Modifications to increasing block rate structure	Yes	Yes	1	Yes
Mandatory Watering Days	Yes	Yes	1	Yes
Conservation Coordinator	Yes	Yes	4	Yes
Residential water surveys and evaluations, targeted at high demand customers	Yes	Yes	13	Yes
Water Loss Control Program				
Water Loss Control Program	Yes	Yes	3	Yes
Education and Public Information				
Conservation Public Information Campaign	Yes	Yes	6	Yes
School Education Programs (via DCWRA)	Yes	Yes	6	Yes
Indoor - Residential				
Low Flow Fixture Rebates	No	No	12	No

Water Conservation Measure	Existing - to be Continued	MMD has Regulatory Authority?	Best Practices Guidebook BP #	Retained for Continued and/or Future Implementation?
Rules for New Construction (Building Codes requiring high efficiency fixtures)	Yes	No	11	No
Indoor - CII				
Rules for new construction - building codes requiring high efficiency fixtures and process equipment	Yes	No	12	No
Specialized non-residential surveys, audits and equipment efficiency improvements	Yes	Yes	14	Yes
Outdoor Efficiency - Landscapes and Irrigation				
Water budgets for Irrigation Accounts	Yes	Yes	7	Yes
Irrigation System Water Conservation Requirements and Certification of Landscape Professionals	Yes	Yes	8	Yes
E-T Irrigation controllers	Yes	Yes	9	Yes
Limits on turf landscaping for new construction	Yes	Yes	9	Yes
Rebates for turf replacement	No	No		No
Water Reuse Systems				
Nonpotable system supplied by treated effluent	Yes	Yes		Yes

Table 5-2
Evaluated Water Conservation Program Activities

Section 6: Demand Forecasts

It should be pointed out that the Meridian system actually reduces demand on the aquifers by providing a total equivalent "supply" of 5,387 AF. Since Meridian is a zero discharge facility (and has been since its inception almost 30 years ago), all of the effluent treated at its waste water treatment plant has been and continues to be used for landscape irrigation. This reclaimed amount of 1,774 acre feet, at build out, far and away exceeds the plumbing code savings forecast by Nolte below. Further, the method of specific allotments of water to each user BEFORE construction, though the biggest driver of conservation, does not show up in any program savings.

The Alliance for Water Efficiency (AWE) Conservation Tracking Tool was used by Nolte Associates to project water demands. The Water Conservation Tracking Tool is an Excel-based spreadsheet tool for evaluating the water savings, costs, and benefits of urban water conservation programs

That said, the District's demand forecast is always a known quantity as it has a finite amount of permitted development and allocates a specific amount of water for each user.

Three demand forecasts were made using the Water Conservation Tracking Tool:

1. Baseline
2. Baseline + plumbing code savings
3. Baseline + plumbing code savings + existing and planned water conservation program savings

6.1 Baseline Demand Forecast

MMD utility planning reports show the estimated demand is 3,663 AF at buildout. The reuse effluent volume available for non-potable irrigation will be 1,774 AF. In other words, of the 3,663 AF of potable water that is "used", 1,774 AF can be used again or "reused". Regardless, the 3,663 ac-ft build-out demand is far less than the District's adjudicated 4,472 AF. For the purposes of comparisons, however, the following subsections are based on Meridians's 2008 baseline total well production of about 374 MG (generally 1148 AF).

6.2 Baseline + Plumbing Code Savings Forecast

The Baseline + Plumbing Code Savings forecast includes forecasted reductions in demand that have or will occur as a result of National Plumbing Code efficiency standards. For example, ULFT toilet requirements included in the National Energy Policy Act took effect in 1994. New efficiency requirements for clothes washers will take effect in 2011. Because the District's residential growth has all occurred since 2000, the plumbing fixtures all meet current standards and there is no projected conservation savings for fixtures; only for new clothes washers.

The Baseline + Plumbing Code Savings demand forecast is approximately 1,095 AFY in 2020, a savings of 53 AFY. Meridian's baseline total well production in 2008 was about 374 MG (generally 1148 AF). Note that some of this water was used to temporarily supplement the reuse irrigation system. Because more reuse water will be available through increase growth (increase sewage effluent), less well water will be needed to suppliement the irrigation system.

6.3 Baseline + Plumbing Code Savings + Program Savings Forecast

The Baseline + Plumbing Code Savings + Program Savings forecast includes forecasted reductions in demand from the existing and planned water conservation program in addition to the savings projected to occur as a result of National Plumbing Code efficiency standards.

The following existing and planned water conservation programs were included as inputs into the AWE Water Tracking Tool to estimate and forecast the water savings from the existing and planned programs. Water savings have been estimated for the major existing programs listed in Table 6.1. These programs are forecast to save an additional 82 AFY by 2020 for a total savings of 135 AFY. This represents an 11.8 percent total savings over the baseline water demands as shown in Table 6.2 (135 AF is about 12% of 1148 AF).

Customer Class	Water Conservation Activity Name
Residential (Passive-Included for comparison only)	Residential LF Washer, SF
Commercial	In-Building Water Budgets
Commercial	Large Landscape Water Budgets
Irrigation	Large Landscape Water Budgets
Irrigation	Large Landscape Irrigation Controllers

Table 6-1
Water Conservation Activities included in AWE Tool

Service Area Water Savings	Units	Average Annual Savings in 2020
Residential LF Washer, SF (Passive-Included for comparison only)	AF	53
Overall Plumbing Code Water Savings	AF	53
In-Building Water Budgets, Commercial*	AF	73
Large Landscape Water Budgets, Commercial	AF	8
Large Landscape Irrigation Controllers, Irrigation for Parks	AF	1
Overall Program Water Savings	AF	82
Total Water Savings	**AF**	**135**
% of Baseline Demands	**%**	**11.8%**

*Note: the District currently allots specific potable amounts based on square footage to each commercial development– therefore the projected savings may or may not result.

Table 6-2
Projected Water Conservation Savings

Section 7: Impacts of Conservation Programs

MMD implemented a comprehensive water conservation program in 1982 and plans to continue that program for future savings. The program has been very effective. It is not possible to pinpoint a representative, quantitative result in this manner since the MMD system involves all of its water resources and not just potable cost savings. This is due primarily to the reclaimed water system which is the backbone of the water conservation model. A qualitative comparison can be made by stating the reclaimed water system has provided the equivalent supply of roughly one groundwater well over the past 26 years (about 6,000 AF). This has the effect of holding back the need for the capital investment of drilling a well (among other options) and has preserved that same volume in the aquifer itself in this example. Moreover, if the plant is operating at 1.5 MGD at future build-out, as predicted by current modeling and data evaluation, utilization of the reclaimed water system has the equivalent effect of reducing the supply production by about 1,774 AFY. This is the equivalent demand of approximately 3,000 single family homes for the purposes of comparison.

As seen in the Exhibits section, the actual annual residential use is consistently lower than budgeted water allotments. The District believes this is largely attributable to the design criteria and the review process prior any property being issued a building permit.

Section 8: Implementation and Monitoring Plan

8.1 Implementation

MMD will continue its current water conservation programs.

Water Conservation Measure	Date of Implementation if New Measure
Operational Utility Side Measures	
Integrated Resources Planning	Ongoing
Full Metering	Ongoing
Modifications to increasing block rate structure	Ongoing
Renewable Water Supply Charge	Ongoing
Mandatory Watering Days	Ongoing
Planting Limits for Turf	Ongoing
Conservation Coordinator	Ongoing
Water Waste Ordinance	Ongoing
Residential water surveys and evaluations, targeted at high demand customers	Ongoing
Water Loss Control Program	
Water Loss Control Program	Ongoing
Education and Public Information	
Conservation public information campaign	Ongoing
School education programs (via DCWRA)	Ongoing
Annual water conservation meetings with HOAs	Ongoing
Customer water use history	Ongoing
CSU extension service Guidelines	Ongoing
Indoor - Residential	
Residential clothes washer rebates	County
Residential toilet rebates	County
Residential toilet rebates for WaterSense high efficiency only	County
Indoor - CII	
CII high efficiency toilet and urinal rebates	County
Specialized non-residential surveys, audits, and equipment efficiency improvements	Ongoing
Outdoor Efficiency - Landscapes and Irrigation	
Water budgets for residential and irrigation accounts	Ongoing
Irrigation System Water Conservation Requirements and Certification of Landscape Professionals	Ongoing
Water Efficient Maintenance Practices for New and Existing Landscapes	Ongoing
Rain and E-T Irrigation controllers	Ongoing
Water Reuse Systems	
Nonpotable system supplied by treated effluent	Ongoing

Table 8-1
Future Water Conservation Measures

8.2 Ongoing Monitoring

MMD will continue to track the impacts of the conservation plan annually. Monitoring of total and billed water usage will provide information on water use and progress toward the water conservation goals.

As described previously, the District switched to a more sophisticated billing program several years ago. This program tracks the unique allotment of every account and reports the monthly total usage for comparison. High water users are notified annual by letter, if they have exceeded the allotment. These letters often require a follow up meeting with the water customer. Discussion items include: meter functionality checks; customer system inspections/audits; evaluation of the original allotment calculations, and comparison of site layout to approved plans including landscaping.

It should be noted residential customers are reminded annually by mail of residential landscape watering of three days per week. New residents are sent landscape guidelines developed by CSU to aid with landscape design.

8.3 Plan Refinement

MMD will continue to periodically evaluate its program and implementation for conformance with this Plan. The time period will be every five years, not to exceed a period of seven years. The monitoring data described above will allow trends and comparisons to be made. The District may also adjust the programs identified in this Plan as warranted due to new technology or analysis of the effectiveness of individual programs.

During the next refinement, cycle the District will consider an active low-flow fixture rebate program for residential housing. In the meantime, replacement of fixtures will occur naturally in future years providing the advantage of passive savings. Future natural replacement may also take advantage of more efficient fixtures that are not currently available.

During the next refinement cycle, the District will consider a rebate program for high efficiency type fixtures and process equipment for commercial properties.

8.4 Compliance with State Planning Requirements

Colorado Statutes Title 37 Water and Irrigation – Colorado Water Conservation Board (CWCB) and Compacts 37-60-126 requires a state-approved water conservation plan for covered entities as a condition of seeking financial assistance from the CWCB. Currently, MMD is not categorized as a covered entity.

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MEMORANDUM

To: Doug Scott, General Manager
Randy Gabriel, PE

From: Leroy E. Tobler, PE-PLS
Troy L. Nedved, PE-PLS

Date: January 17, 2011

Subject: Potable Water Allotment Comparisons

Attached is a comparison with two water providers in the northern Douglas County area regarding the amount of water used by and designed for single family detached homes. That comparison resulted with single family detached homes averaging 0.45 acre feet per year. MMD allotted water demands are approximately 16% greater or 0.52 af/du (planning demands are 0.58 af/du with an actual usage averaging around 0.36 af/du).

It is our belief that MMD is not currently required to have an Approved Water Conservation Plan. Statute (37-60-126) required covered entities to develop state approved water conservation plans. Covered entities are those with a legal obligation to supply water at retail for domestic, commercial, industrial or public facility customers and with a total annual demand for customers of 2,000 af or more. MMD is currently around 1,100 af potable water production.

Please feel free to contact Leroy or myself with any questions or comments. Thank you.

Richmond Homes
Base - 214 Residences
Residentail Usage Summary
January 1, 2008 to December 31, 2008

Date Interval	Actual Gallons Used	Gallon/Capita Per Day		Ac-ft/Unit Per Year	
January - February	1,834,000	51.01		0.16	
March - April	2,307,000	63.12		0.20	
May - June	6,677,000	182.68		0.57	
July - August	7,782,000	209.47		0.66	
September - October	5,405,000	147.87		0.46	
November - December	2,031,000	55.57		0.17	
Total	**26,036,000**	118.73	Avg.	0.37	Avg.
Summer Usage					
May - June	6,677,000	182.68		0.57	
July - August	7,782,000	209.47		0.66	
September - October	5,405,000	147.87		0.46	
Total	**19,864,000**	180.17	Avg.	0.56	Avg.
Winter Usage					
January - February	1,834,000	51.01		0.16	
March - April	2,307,000	63.12		0.20	
November - December	2,031,000	55.57		0.17	
Total	**6,172,000**	56.60	Avg.	0.18	Avg.

SUMMARY

Average Annual Use (gal/capita/day)	118.7
Summer Average Use (gal/capita/day)	180.2
Winter Average Use (gal/capita/day)	56.6
Increase due to Average Irrigation Use (g/c/d)	124
Percent increase above winter use	218%
Average as a Percent Allotment (0.52 ac-ft/unit/yr)	71%
Average as a Percent Planning (0.58 ac-ft/unit/yr)	64%

Note: Average 119 gallons/capita/day
26,036,000 gal / 214 units = 121,664 gal/yr
* Less than allotment of 170,000

Richmond Homes
Base - 214 Residences
Residential Usage Summary
January 1, 2007 to December 31, 2007

Date Interval	Actual Gallons Used	Gallon/Capita Per Day	Ac-ft/Unit Per Year
January - February	1,730,000	48.12	0.15
March - April	1,994,000	54.55	0.17
May - June	5,490,000	150.20	0.47
July - August	6,654,000	179.11	0.56
September - October	5,349,000	146.34	0.46
November - December	1,826,000	49.96	0.16
Total	23,043,000	105.07	0.33
Summer Usage			
May - June	5,490,000	150.20	0.47
July - August	6,654,000	179.11	0.56
September - October	5,349,000	146.34	0.46
Total	17,493,000	158.66	0.50
Winter Usage			
January - February	1,730,000	48.12	0.15
March - April	1,994,000	54.55	0.17
November - December	1,826,000	49.96	0.16
Total	5,550,000	50.89	0.16

SUMMARY	
Average Annual Use (gal/capita/day)	105.1
Summer Average Use (gal/capita/day)	158.7
Winter Average Use (gal/capita/day)	50.9
Increase due to Average Irrigation Use (g/c/d)	107.8
Percent increase above winter use	211.8%
Average as a Percent Allotment (0.52 ac-ft/unit/yr)	63.4%
Average as a Percent Planning (0.58 ac-ft/unit/yr)	56.8%

Richmond Homes
Base - 214 Residences
Residential Usage Summary
January 1, 2006 to December 31, 2006

Date Interval	Actual Gallons Used	Gallon/Capita Per Day	Ac-ft/Unit Per Year
January - February	2,089,000	58.11	0.18
March - April	3,077,000	84.18	0.26
May - June	7,509,000	205.44	0.64
July - August	6,504,000	175.07	0.55
September - October	3,710,000	101.50	0.32
November - December	2,008,000	54.94	0.17
Total	**24,897,000**	**113.53**	**0.36**
Summer Usage			
May - June	7,509,000	205.44	0.64
July - August	6,504,000	175.07	0.55
September - October	3,710,000	101.50	0.32
Total	**17,723,000**	**160.75**	**0.50**
Winter Usage			
January - February	2,089,000	58.11	0.18
March - April	3,077,000	84.18	0.26
November - December	2,008,000	54.94	0.17
Total	**7,174,000**	**65.78**	**0.21**

SUMMARY	
Average Annual Use (gal/capita/day)	113.5
Summer Average Use (gal/capita/day)	160.7
Winter Average Use (gal/capita/day)	65.8
Increase due to Average Irrigation Use (g/c/d)	95.0
Percent increase above winter use	144.4%
Average as a Percent Allotment (0.52 ac-ft/unit/yr)	68.5%
Average as a Percent Planning (0.58 ac-ft/unit/yr)	61.4%

Richmond Homes
Base - 214 Residences
Residential Usage Summary
January 1, 2005 to December 31, 2005

Date Interval	Actual Gallons Used	Gallon/Capita Per Day	Ac-ft/Unit Per Year
January - February	1,623,000	45.14	0.14
March - April	2,013,000	55.07	0.17
May - June	6,096,000	166.78	0.52
July - August	7,540,000	202.96	0.64
September - October	4,859,000	132.94	0.42
November - December	1,917,000	52.45	0.16
Total	24,048,000	109.65	0.34
Summer Usage			
May - June	6,096,000	166.78	0.52
July - August	7,540,000	202.96	0.64
September - October	4,859,000	132.94	0.42
Total	18,495,000	167.75	0.53
Winter Usage			
January - February	1,623,000	45.14	0.14
March - April	2,013,000	55.07	0.17
November - December	1,917,000	52.45	0.16
Total	5,553,000	50.92	0.16

SUMMARY

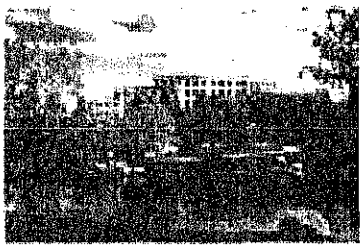
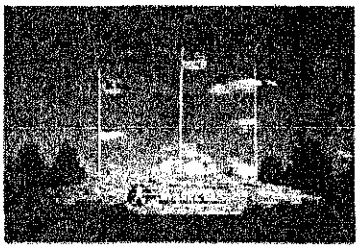
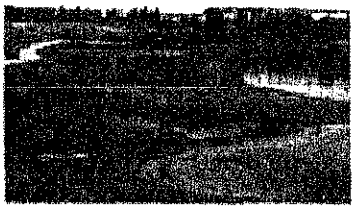
Average Annual Use (gal/capita/day)	109.7
Summer Average Use (gal/capita/day)	167.8
Winter Average Use (gal/capita/day)	50.9
Increase due to Average Irrigation Use (g/c/d)	116.8
Percent increase above winter use	229.4%
Average as a Percent Allotment (0.52 ac-ft/unit/yr)	66.1%
Average as a Percent Planning (0.58 ac-ft/unit/yr)	59.3%

Richmond Homes
Base - First 50 Residences
Residential Usage Summary
January 1, 2004 to December 31, 2004

Date Interval	Actual Gallons Used	Gallon/Capita Per Day	Ac-ft/Unit Per Year
January - February	456,000	54.29	0.17
March - April	540,000	63.23	0.20
May - June	1,550,000	181.50	0.57
July - August	1,546,000	178.11	0.56
September - October	1,084,000	126.93	0.40
November - December	525,000	61.48	0.19
Total	5,701,000	111.26	0.35
Summer Usage			
May - June	1,550,000	181.50	0.57
July - August	1,546,000	178.11	0.56
September - October	1,084,000	126.93	0.40
Total	4,180,000	162.27	0.51
Winter Usage			
January - February	456,000	54.29	0.17
March - April	540,000	63.23	0.20
November - December	525,000	61.48	0.19
Total	1,521,000	59.69	0.19

SUMMARY	
Average Annual Use (gal/capita/day)	111.3
Summer Average Use (gal/capita/day)	162.3
Winter Average Use (gal/capita/day)	59.7
Increase due to Average Irrigation Use (g/c/d)	102.6
Percent increase above winter use	171.8%
Average as a Percent Allotment (0.52 ac-ft/unit/yr)	67.1%
Average as a Percent Planning (0.58 ac-ft/unit/yr)	60.2%

MERIDIAN INTERNATIONAL BUSINESS CENTER
MERIDIAN COMMONS
MERIDIAN VILLAGE

DESIGN CONTROL COMMITTEE

DESIGN CRITERIA & SUBMITTAL PROCEDURES

1-01-10

6380 S. Fiddlers Green Circle * Suite 400 * Greenwood Village, CO 80111

Phone: 303-773-1700/ fax: 303-740-6954

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Email: design&development@sheaproperties.com

Poles should be placed in a landscape or walk (v.s. parking lot pavement) and mounted on a concrete base no more than six (6) inches in height above grade.

Driveway and Parking Lots

Driveway and parking lot lighting must be high-pressure sodium, utilize a "cutoff" type luminaire to assure that no light sources are visible and to minimize glare. At no point may the light level exceed eight (8) footcandles when measured at the ground, or an average of two (2) footcandles overall. Parking lot lighting must provide a uniformity ratio between 15:1 and 20:1.

Parking Structures

Interior lighting must be limited to driving lanes only, and the light source must be concealed or shielded and not visible from outside of the parking structure. Lighting levels for an exposed top deck must be the same as defined above for surface parking lots and fixtures and shall be a "cut-off" type, with pole heights not to exceed twenty (20) feet. Poles must be placed "interior" to the deck vs. mounted on or at the perimeter parapet. Special attention to parking deck lighting is required to assure that lighting does not produce an offsite "halo" effect. Wallpack lights are not permitted on any structures.

Buildings

Building flood lighting, (ground up), may be used to highlight architectural features. Such lighting must be designed with the intent of providing accent and interest and not to exhibit or advertise buildings or their sites.

All illumination sources must be located within the property boundaries and be shielded from public view so that light is controlled within the area to be illuminated. Lamp selection should ensure that the source color is compatible with the building color and texture.

Service and Storage Areas

Service area lighting should be contained within the service yard boundaries and enclosure walls. No light spillover can occur outside the service or storage area. The lighting source should not be visible from the street.

Landscape and Pedestrian Areas

Accent lighting of landscape elements is permitted within the Development Area, provided that it is low level, background in appearance and uses a concealed source. Colored accent lighting is not permitted.

Lighted pedestrian walk and exterior paved areas adjacent to buildings must use low intensity fixtures and the lamp color source must be compatible with surrounding area lighting.

Security

Any special security lighting should be confined to building entrances or outdoor pedestrian areas. With the exception of low intensity fixtures, the lighting source should not be visible from the street.

Specialty Areas

All fountain, artwork and seasonal/temporary lighting must be approved by the DCC prior to installation.

PARKING

Outside storage of recreational vehicles, such as motor homes, trailers, campers, and boats, is not permitted over a continuous period of more than twenty-four (24) hours.

Parking Ratios

Parking ratios must meet Douglas County zoning requirements.

Surfacing

Paved off-street parking must be provided for all developments. Parking areas must be paved with asphalt, concrete, masonry pavers, or a similar material approved by the DCC. All drives and surface parking areas are to be bordered by poured in place concrete curbs and gutters.

On-Street Parking

No parking shall be permitted on any street or access road, either public or private, or at any place other than the paved parking spaces provided. Each Property Owner shall be responsible for compliance with this requirement by its tenants, employees, and visitors. Owners or users of vehicles parked in violation of this provision will be subject to the sanctions provided by governmental ordinances, if any, that prohibit or restrict such parking, and regardless of the existence of any governmental sanctions, the vehicles so parked will be subject to fine and/or removal at the property vs. owner's expense. Notwithstanding the foregoing, governmental or quasi-governmental or public utility vehicles in use for normal maintenance and operations activities may park on streets or roads during such activities in the event convenient off-street parking is not available.

LANDSCAPE

The quality and extent of site landscaping is an integral element of Meridian's overall identity. The extent to which landscaping meets the desired standard and unifies the building and site within the overall Meridian area is considered a major review item for any DCC approval.

Concept

Meridian's landscape concept is to establish a **predominately "high plains" naturalized native landscape** character which transitions to a limited area of more formal irrigated landscaping in the immediate environs of buildings, entryways and streetscape. These landscape treatments contrast in terms of irrigation requirements, plant materials, use of hardscape elements and layout and **must be balanced with irrigation consumption allowances** (see Irrigation Consumption Limitations below).

Where appropriate, the naturalized landscape is to be established primarily through the use of native grasses, shrubs and groundcovers. A variety of trees are to be used and sited in a manner similar to that found in the native landscape. The arrangement of these plant materials is to be informal in nature and irrigation is to be used sparingly.

Landscape development must integrate with adjoining developed parcels. Smooth grading and planting transitions are essential in order to achieve the desired character. Grading and planting should be used to frame desirable views and to screen undesirable views within the naturalized landscape areas. Landforms and drainageways should be treated informally, simulating a more natural character. Consistent with this, the use of walls, walks, and other structural elements should be infrequent.

Irrigation Consumption Limitations

For each non-residential development site, the amount of non-potable "reuse" water for irrigation purposes is limited to an amount predicated on a design parameter based on a maximum of twenty percent (20%) of the gross site area being irrigated and an average rate of thirty (30) inches/year.

Verification is required at the Design Development phase that the site planting and irrigation design meets these requirements. (See "Landscape Irrigation Demand Certification" in the Processing Forms section,Chapter 4). **Exceeding allowable irrigation use allotments will result in substantial rate surcharges and/or denial of a landscape plan approval.**

Recycled Water

All non-residential irrigation within Meridian utilizes recycled waste water. Irrigation systems, particularly spray heads, must be designed to accommodate this type of water supply.

Moisture Detection

All commercial and multifamily area irrigation systems are required to have automated moisture detection devices (see Meridian Metropolitan District Rules and Regulations).

Landscape Types and Plant Materials

Two landscape types have been established for Meridian — "Naturalized" (i.e. native/mostly unirrigated) and "Formal" (mostly irrigated) — in order to provide guidelines for consistent landscape development among parcels, to manage water use and to establish the desired image of a naturalized high plains landscape character. These types should be used, along with the transition techniques described below, to provide for "seamless" landscape development.

Where sites adjoin the golf course, site landscaping must transition to and blend with the golf course landscaping.

Naturalized Landscape

For most sites, the "Naturalized" areas must be the predominant treatment for the open space area.

Primary plant materials shall be masses of hardy, attractive, informally arranged shrubs and trees. In order to achieve both screening and shrub massing, consideration should be given to restraining the spreading trait characteristics of shrubs recommended for this area. This may be accomplished through specific design applications or through required maintenance practices. Grasses should be hardy, drought-tolerant, lower-growing types that develop a high degree of soil coverage similar to the golf course rough mix at the golf course.

Provisions may be made for all "planted" areas to be irrigated. However, in any naturalized areas with native grasses this may only be done to aid in initial establishment or to provide supplemental water during prolonged dry periods.

Recommended plant materials include:

- **Trees.** Narrowleaf and Lanceleaf Cottonwood, Piñon Pine, Ponderosa Pine, Hackberry, Bur Oak, Green Ash, Catalpa, and Hawthorne.
- **Shrubs.** Native Serviceberry, sage varieties, rabbitbrush varieties, Wild Rose, Yucca, Three-leaf Sumac, Rocky Mountain Sumac, Willow, Four-wing Saltbush, Sea-buckthorn, Peashrubs, Gambel Oak, Bigtooth Maple, Mountain Mahoganies, American Plum, Western Sandcherry, Chokecherries, Antelope Bitterbrush, Shrub Roses, Salt Cedar, and New Mexico Cliffrose.

- **Native Seeding.** Native seeded areas should use the following mix to match those areas throughout Meridian: "Foothills Mix": 25% Crested Wheatgrass, 20% Slender Wheatgrass, 15% Hard Fescue, 15% Annual Ryegrass, 10% Kentucky Bluegrass, 5% Side Oats Grama, 5% Little Bluestem, 4% Blue Grama, and 1% Sand Dropseed.
- **Groundcovers.** Grass blends consisting of Bromes, Ryegrasses, Wheatgrasses, Buffalo grass, Blue Grama grass, Fescues, drought tolerant bluegrasses and wildflower mixes that are used in drifts and not mown during the growing season.

Formal (i.e. irrigated) Landscape

This landscape treatment should be confined to within the immediate building environs and entry areas. It must also be used in the designated streetscape between the sidewalk and adjoining street. In keeping with the intended naturalized character of Meridian, landscape development in these areas should demonstrate aesthetically acceptable transitions to the Naturalized Landscape areas.

Plant materials used should be hardy, attractive trees, shrubs, groundcovers and vines, arranged formally or informally. Grasses should be lower-water-demand varieties. While refined in appearance, plant materials may not be exotic or extremely lush in character, as exemplified by the extensive use of pure bluegrass lawns or plant materials such as Purple Plum trees or Golden Elder shrubs.

Formal recommended plant materials include:

- **Trees.** Maples, Hawthorne, Autumn Purple Ash, Green Ash, Oaks, Thornless and Seedless Honeylocusts, Lindens, Scotch Pine, Alder, Red Bud, Flowering Crabapples, Ornamental Pears, Ornamental Plums, and Pines.
- **Shrubs.** Serviceberry, Wild Shrub Roses, Cotoneaster, Shrub Dogwoods, Spreading Junipers, Mahonia, Viburnums, Barberries, Euonymus, Shrub Pines, Shrub Maples, Spireas, Quince, Broom, Chokecherries, Firethorns, Sumacs, Prunus, and Lilacs.
- **Groundcover.** Drought tolerant fescue turf, Vinca, most herbaceous groundcover plants, Creeping Junipers, annual and perennial flowers.

Plant Material Standards

The following criteria apply to all landscape areas:

Quantity and Spacing

A minimum of thirty (30) trees/acre comprised of fifty percent (50%) deciduous shade trees, twenty-five percent (25%) ornamental trees, and twenty-five percent (25%) coniferous trees must be provided. Note only the "open space" acreage is counted, but all trees, including street trees abutting a site, are included in the overal site tree count. The size of selected plant materials and their quantity and spacing must be appropriate for the associated landscape, especially in regard to initial appearance, projected appearance at time of maturity, and existing and projected level of finish of adjoining properties.

Minimum Plant Sizes

On-Site Deciduous Trees:	2-1/2" caliper (measured 4" above the ground)
Deciduous Street Trees:	3" caliper
Ornamental & Flowering Trees:	2" caliper measured 4" above the ground
Evergreen or Coniferous Trees:	Mix of 6-10 foot height

Shrubs:	5 gallon; max. spacing of 36"; evergreens must have 24" spread
Vines:	1 gallon

Use of Evergreens

Due to existing climate conditions, evergreen plant materials are a major source of visual interest for a significant time during the year. In selecting trees, Piñon, Ponderosa and Austrian Pine are to be used in lieu of such varieties as Colorado Spruce.

Quality

All plant material used must meet the minimum standards established by the American Association of Nurserymen, as published in the American Standards for Nursery Stock.

Annuals and Perennials

The use of annual and perennial flowers offers an opportunity to provide seasonal color and interest in an environment often lacking in such amenities. The use of such flowers is strongly encouraged in the Formal Landscape areas, especially at site and building entrances and as an accent to site furnishings such as signs and lighting.

A minimum of 500 square feet, per identity sign, of annual or perennial decorative flower beds, readily visible to the public, are required adjacent to the street frontage of each parcel, preferably in the vicinity of the identity signage.

Transitions

It is the intent of these guidelines that plant materials, grading, landforms and hardscape features be used to provide smooth transitions and overall "seamless" landscape development between different landscape types. As a means to accomplish this, the recommended plant materials lists contain a degree of overlap between adjacent landscape types. In addition, maintenance operations and the design of grading and landforms, walks, walls, fences, paths, roads and irrigation systems should seek to establish and maintain these transitions.

Parking Areas

Parking Screening

The periphery of all surface parking areas must be designed such that the major portions (heights) of automobiles are screened from street view.

Along street frontages, where screening is not accomplished by an architectural element, a three (3) foot high minimum earth berm with a maximum 4:1 external slope, supplemented by shrub, masses, or hedges and street trees is required.

Internal Parking Lot Planting

Surface parking areas must have internal landscaping equivalent in size to a minimum of five percent (5%) of the overall parking surface area as follows:

Parking bays must be separated by a landscaped island of at least six (6) feet in width (running laterally with the aisle), or a landscaped island at least six (6) feet in width at maximum intervals of every fifteen (15) contiguous parking spaces in a row.

For larger parking areas (i.e. those in excess of one hundred (100) contiguous parking spaces) internal landscaping may be aggregated to achieve more functional landscape screening areas at the discretion of the DCC.

Streetscape

Individual parcels must develop and maintain formalized streetscape adjacent to adjoining roadways as follows:

Irrigated turf

Must be provided between the roadway curb line and adjoining sidewalk; or, where the sidewalk adjoins the roadway, a minimum of twenty (20) feet to the inside of the sidewalk.

Street trees

- **Formalized patterns.** In linear (i.e. parallel to the street) groupings of identical species between sidewalk and curb consisting of:
- **Lincoln Blvd.** Redmond Linden; Autumn Purple Ash; Swamp White Oak; sequential groupings of three (3), four (4) and five (5); trees spaced at twenty-five (25) feet; groupings spaced at one-hundred (100) feet.
- **Oswego south of Lincoln:** Greenspire Linden; Swamp White Oak; Marshall Ash; sequential groupings of three (3), four (4) and five (5); trees spaced at twenty-five (25) feet; groupings spaced at one-hundred (100) feet.
- **Oswego north of Lincoln:** Shademaster Honeylocust; Redmond Linden; alternating groupings; trees spaced at forty (40) feet; groups at one-hundred (100) feet.
- **Meridian Blvd.:** Skyline Honeylocust; Swamp White Oak; Autumn Purple Ash; sequential groupings of three (3), four (4) and five (5); trees spaced at twenty-five (25) feet; groupings spaced at one-hundred (100) feet.
- **Peoria Street north of Lincoln:** Shademaster Honeylocust; Autumn Purple Ash; Swamp White Oak; sequential groupings of three (3), four (4) and five (5); trees spaced at twenty-five (25) feet; groupings spaced at one-hundred (100) feet.
- **Peoria Street south of Lincoln:** Autumn Purple Ash; Bur Oak; alternating groupings; trees spaced at forty (40) feet; groups at one-hundred (100) feet.
- **Mt. Belford:** Montmorency Sour Cherry; Swamp White Oak; Greenspire Linden; sequential groupings of three (3), four (4) and five (5); trees spaced at twenty-five (25) feet; groupings spaced at one-hundred (100) feet.
- **Jamaica:** Littleleaf Linden; Skyline Honeylocust; Swamp White Oak; sequential groupings of three (3), four (4) and five (5); trees spaced at twenty-five (25) feet; groupings spaced at one-hundred (100) feet.
- **Liberty Blvd.:** Greenspire Linden; groupings of five (5); trees spaced at twenty-five (25) feet; groupings spaced at one-hundred (100) feet.
- **Maroon Circle:** Washington Hawthorne; groupings of two (2) or three (3); trees spaced at twenty-five (25) feet; groupings spaced at one-hundred (100) feet.
- **Other Internal Streets:** Individual Greenspire Linden trees must be spaced thirty-five (35) feet on centers, on both sides of the street.
- **Informal patterns.** Evergreen trees placed in informal groupings to the rear and within twenty (20) feet of the sidewalk such that the number of street trees (combined formal and informal) equates to one (1) tree per thirty (30) feet of abutting street frontage.

E. LANDSCAPE ARCHITECTURAL CRITERIA

Meridian Village is located in a semi-arid region that requires water conservation and the establishment of a predominantly "high plains" naturalized native landscape. A principle objective of the landscape concept is to respond to the natural environment, both through preservation and enhancement of the natural landscape and the ordered placement of an introduced manicured landscape. The intention is to create a balance of the native landscape character that reflects historical regional development patterns of the Colorado prairie with manicured landscape areas that are located at high use and neighborhood forming areas. This landscape approach will rely heavily on using drought tolerant plant materials in new and creative ways, both within the natural areas as well as the more manicured areas. The plant palette selected for projects within Meridian Village must respond to low water irrigation requirements and water consumption allowances that will be integral to the implementation of the landscape concept.

INTENT

These Design Guidelines are intended as a framework to guide the landscape development in Meridian Village. Rather than serve as a set of rules, the primary purpose of the guidelines is to promote visual harmony and design continuity throughout the development. The guidelines are intended to provide minimum standards in creating neighborhood character as well as to address the implementation process. Refer to Chapter 2.A, Parking (p. 2-11) for the character of plant materials. The fundamentals that each parcel developer must respond to are noted below:

- Landscape Concept and Theme.
- Performance Standards which includes implementation, responsibility and phasing.
- Planting and grading transitions with adjacent open space and building parcels.

Final review and approval by the Design Control Committee should follow the Community Landscape Architectural Criteria Checklist as found in the Appendix, Section 3.F (p. 3-46).

LANDSCAPE CONCEPT

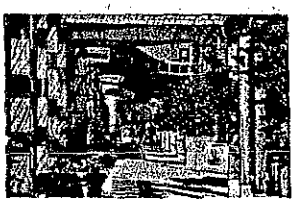
The landscape concept for Meridian Village is envisioned to blend the best aspects of the sites native Colorado prairie and agricultural heritage with a more enhanced manicured landscape at parks, neighborhoods, and community areas to create a unique "sense of place" and signature identity for the project.

The main landscape identity element for Meridian Village will be the Spine Road. The landscape treatment along the Spine Road will establish the blended look of native and manicured landscape tying the north and south halves of the project together via the use of bold swathes of ornamental and native grass plantings woven within more traditional manicured landscape palette. The residential neighborhoods will all be connected to the Spine Road and within these neighborhoods shaded streets and focal park spaces along with an interconnected pedestrian oriented network will emphasise a livable and walkable framework for the overall community.


Country


Park


Neighborhood


Village Centers

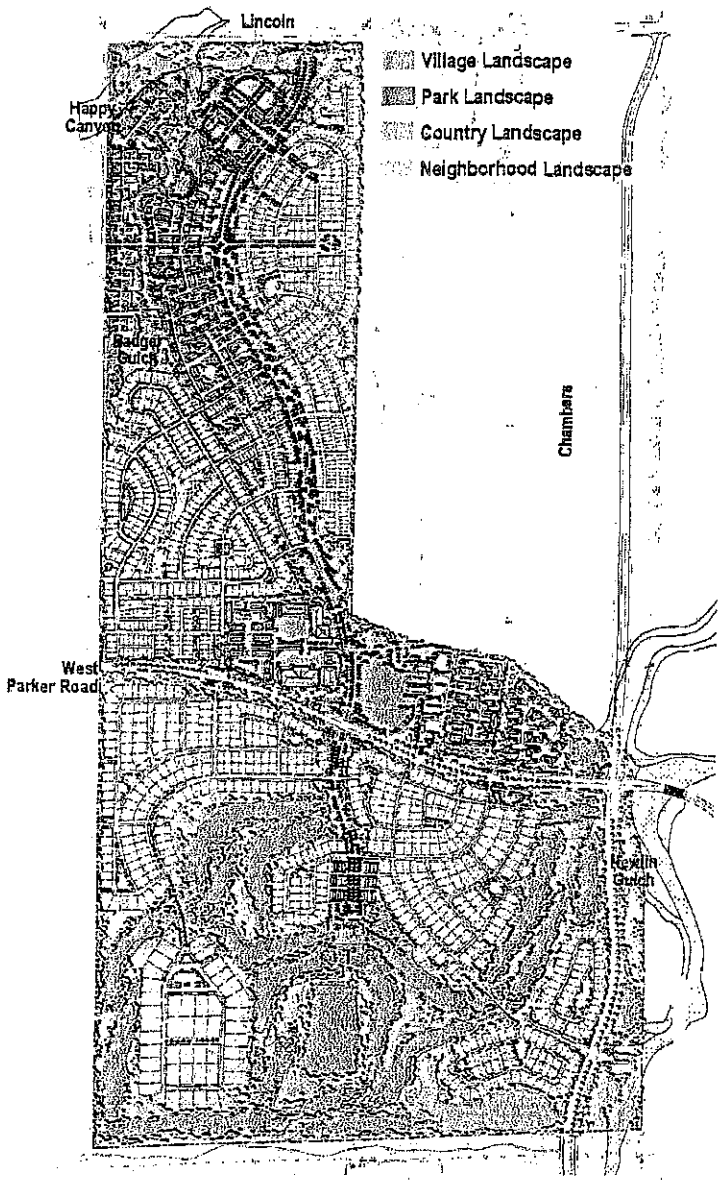
Four distinct landscape typology zones are identified here to create the basis for the landscape development. These distinct landscape zones reflect the concept of the blended landscape approach from existing native conditions to highly manicured and active use areas. These landscape typologies are defined as follows:

The Country Landscape: Should complement and reinforce the natural characteristics of the site and the prairie environment. Natural open space areas including the community buffer areas and trail connections, the gulch and riparian landscapes, will incorporate naturalistic flowing forms with the character of the prairie, utilizing organic forms and a predominantly native planting palette. This native landscape approach should also be utilized on the golf course and rely heavily on native grasses and rolling topography to create a "links type" signature for the golf course.

The Park Landscape: Provides a transitional setting that is based on a more traditional landscape character from the native gulch setting to a more active refined park context. The park landscape type should provide a greener, more lush character associated with more established high use recreational parklands.

The Village Centers Landscape: Describes a more ordered and manicured landscape character traditionally associated with urban retail areas. The village landscape will incorporate refined hardscape materials, furniture and lighting, with signature plantings.

The Neighborhood Landscape: Should assist in providing identity and character to the discrete neighborhoods within Meridian Village. Street tree color, form and texture should assist in reinforcing neighborhood identity as well as providing an attractive, shaded living and pedestrian environment. The small pocket parks located within each individual neighborhood parcel area should form a fitting destination/focal point where the combination of the landscape and hardscape create special places for rest, recreation and increased real estate value.



Landscape Framework Plan

PERFORMANCE STANDARDS

Residential Zones

Individual residential lot landscapes are broadly divided into three zones that involve specific planting applications. The landscape guidelines developed for each zone provides a seamless transition between adjoining lots.

Parkway Zone

The Parkway Zone is the area between the sidewalk and curb along all front or side yards and provides street trees and parkway planting. Planting design in the parkway is a significant component of the residential zone, as this provides the unifying landscape theme that identifies each neighborhood as an entity. Planting palettes for the parkway zone is predetermined and must be submitted as a Master Streetscape Planting Plan for each individual parcel by the developer to the DCC for approval. This plan must identify spacing type and size of street trees to be planted in the parkway zone. Landscaping within the parkway will be installed by the Home Builder. Irrigation and maintenance of parkways will be by the Homeowner

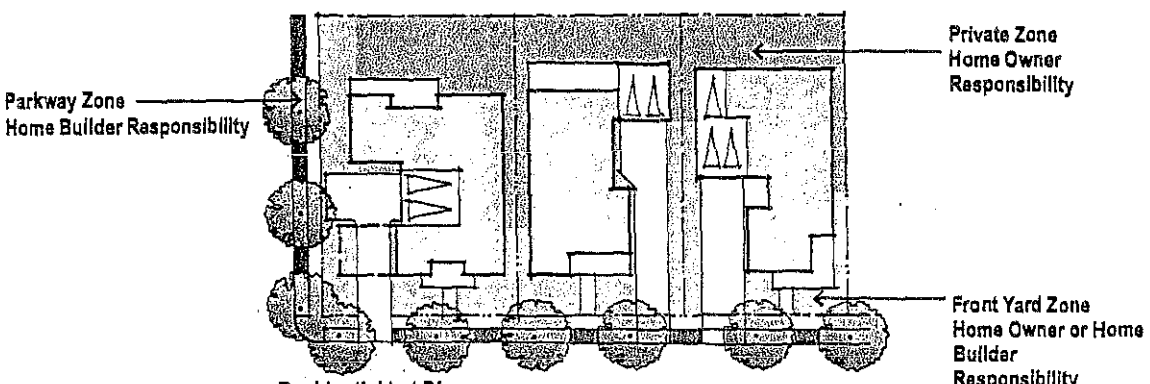
The design intent is shade trees for the streets, and a consistent look integrated with the adjacent parcel developers. The street trees in the Parkway Zone that typically occur along neighborhood streets must be uniformly spaced along the parkway in formal rows. Appropriate parkway shrub, groundcover, and turf planting must also be provided. The Home Builder will install all street trees for street parkways. Tree spacing anticipates coordination of all utilities, street lighting, fire hydrants and driveway locations. Irrigation systems are required to be installed and tied in with the Homeowner's Irrigation System.

Guidelines (Tree Plan to be inserted upon Schematic approval)

- Formal spacing of residential street trees should range from 25' to 35' on-center
- Trees shall be 3" caliper, planted in the center of the parkway.
- All street trees should be at least 10' from adjacent utility structures and street lights.
- Tree planting must consider sight lines and view triangles at intersections.

Front Yard Zone

The Front Yard Zone includes all privately owned landscape areas between the sidewalk and face of house and walls. Planting shall compliment parkway design by use of similar materials and densities. Front yard landscape design requirements vary based on housing type (detached or attached) and style.



Residential Lot Diagram

The landscape design in this zone should relate to the established parkway landscape. It should also be consistent with the architectural character of the residence. Typical front yard landscapes include a partial turf option and a non-turf option. Special lot conditions also demand special landscape treatments that maintain the quality and character of the community. These treatments will be described in detail in the following sections.

Criteria

- Front yard, and side yards abutting a street shall be landscaped within nine (9) months after initial occupancy of a unit. The balance of the lot shall be landscaped within one (1) year of occupancy. An underground sprinkler system shall be installed at the time of initial landscaping.
- The majority (i.e. unimproved areas) of the front, and side yard abutting a street, shall be landscaped with 'long lived' ground cover such as irrigated turf, shrubs, trees, or other planted materials. The balance of a yard shall be predominantly drought tolerant, low irrigation demand native or xeriscape plantings.
- No more than 60% of the Front Yard landscape area shall be irrigated turf grass.

Irrigation Guidelines & Criteria

The goal of the residential landscapes is to promote the smooth progression of landscape between adjoining lots without limiting the individuality and distinction between lots. Landscape water/irrigation services are provided throughout the Meridian Metropolitan District and employ strict consumption allowances for landscape irrigation. The allowances are based on normal irrigation requirements for Colorado climatological conditions and require liberal use of native or drought tolerant turf and shrub beds with drip irrigation in concert with a nominal amount of irrigated turf area. The District applies a progressive rate structure with accelerated use fees in the event such allowances are exceeded. This should be considered in each landscape planning and management of irrigation watering.

Landscape Irrigation Allocations:

All parcels within Meridian Villages must adhere to strict "allotments" for landscape irrigation. This will require a balance between irrigated turf and low-water-use plantings such as shrubs, ornamental grasses, and use of drip vs. spray irrigation. Individual lot and project landscape designs must be based on a plant palette that will enable all the landscape plantings to achieve proper growth within these allotments. These allotments are based on an average of 30" per year for normal Colorado climatological conditions and are outlined on the following chart based on individual lot size.

Table 3-2: Irrigation Percentages of Allowable Landscape Areas

Density Range -DU/AC-	Maximum Irrigated Landscape Areas of Total Lot	Turf - Spray -	Shrubs, Ornamental & Grasses -Drip-
RESIDENTIAL			
0-2	50%	60%	40%
2-6	55%	60%	40%
6-10	40%	60%	40%
10-18	20%	60%	60%
18-25	20%	40%	60%
COMMERCIAL			
	20%	15%	15%

Notes:
Refer to Section P of MIBC Design Guidelines for commercial standards.

Irrigation Criteria

- The sites 'high plains' native climatic conditions create a difficult environment for many species of plant material to survive. It is essential for the landscape irrigation system to utilize current technology in both product application and system design in order to accommodate the temperature extremes and low humidity.
- The irrigation system of the common areas of a neighborhood parcel shall be tapped into the potable or non-potable water supply down-stream of a water meter or flow meter, and must be isolated from the supply line with an isolation valve. The potable water supply must be protected with a backflow preventer, installed as specified by the manufacturer and Douglas County code. If effluent water is used, a backflow preventer must not be used, however a flow meter is required to monitor water use. All pipes, valve boxes and irrigation equipment carrying effluent water must be purple and meet non-potable water codes.
- The irrigation systems of individual homes shall be tapped into the potable residential water supply downstream of the water meter, and must be isolated from the supply line with an isolation valve. The potable water supply must be protected with a backflow preventer, installed as specified by the manufacturer.
- The irrigation system should be designed in conjunction with the landscape design and take into account elevation changes, and differing water requirements of the plants. Drip irrigation is recommended for most of the planting with spray irritation serving turf areas. Where spray irrigation is used, head-to-head coverage and matched precipitation head and design are required to eliminate dry and soggy areas.
- The irrigation systems shall be controlled by an automatic irrigation controller capable of running separate zones based on the planting plan. All zones should be controlled with an electric control valve, sized to accommodate the flow rates and pressure requirements of the zone.
- All irrigation pipes and control wires routed under driveways, walkways and other paved areas are to be sleeved with CLASS 200 PVC piping. The sleeve shall be sized two (2) nominal sizes larger than the pipe being sleeved. Provide a separate 2" min. PVC sleeve for control wires. Parcel Developers shall provide a master sleeving plan for review and approval prior to installation.
- In no case will an overhead spray system throw water on sidewalks, roadways, buildings or wall surfaces.

Planting Densities

Overall, the planting densities on each lot should be a minimum of 1 shrub/25 square feet of landscape area.

Trees

- No additional interior trees required for 35' or less width products.
- One additional tree per 45'/55' width product.
- Two additional trees per 65'/75' width product.
- All trees to be a minimum 2 1/2" caliper.
- All front yard and rear drive landscapes not within the private zone of a residence are to be installed and maintained by the Homeowner.
- Site furnishings and ornamental elements are to be consistent with the general character of the architecture.
- Standard irrigation systems for each residence must be provided.
- Turf to be sod contained by a hard surface header such as steel, extruded concrete or brick.
- All shrub areas shall be mulched with rock or wood mulch.
- Not more than 150 square feet of inorganic mulch may be exposed which is supplemented by plant material.
- All utility equipment shall be screened.
- When specified,
  - Large shrubs range 5-6' diameter
  - Medium shrubs range 3-4' diameter
  - Small shrubs range 1-2' diameter.
- Minimum plant sizes include 2 1/2" caliper shade trees, 2" caliper ornamental trees, 6'

Homebuilder Landscape Requirement

In order to implement the Meridian Village vision, all Homebuilders shall develop a typical landscape plan for their products and submit to the DCC for approval. For residential areas, the landscape criteria needs to be described and submitted in a general development plan enforced by applicable covenant regulations.

Submittal Requirements

- Overall project area plan indicating location of utilities and irrigation tie-ins with master irrigation system.
- Indicate recorded drainage easements.
- Overall project street tree plan indicating conformance with the Street Tree Planting Plan, Meridian Design Guidelines, and Plant List.
- Location and material of minor open space connectors to the overall master open space system area are to be indicated.

- Typical lot landscape with minimum landscape criteria.
- Non-turf and partial turf options.
- Where applicable, the rear yard landscape is to be submitted with the front yard landscape as one package.
- All submittals should include the material and location of planting, irrigation and hardscape elements.
- Additional documentation may be required to address special conditions as determined by the DCC and subject to further approval.
- Landscape plans should include architectural site plans with floor plan layouts, walks, driveways, retaining walls, steps, and auxiliary structures.

Responsibility Requirements

- Homeowners of specific product types may augment homebuilder base landscape or opt for an alternate front yard landscape from a landscape designer of their choice. Applications and design for alternate landscape must be submitted to the parcel HOA for permit and review.
- All front yard landscape must be installed within the first growing season of resident occupancy.
- Wrap landscape treatment and provide similar densities along the front as well as the exposed side yard on corner lots.
- Pool plans must be submitted for review.

Special Lot Conditions

- Landscaping in alleys should include one small tree or large shrub located adjacent to utility easements.
- Fencing in alleys must be setback a minimum of 3'-6" from the garage face and provide for a landscape area in front of the fence to soften the appearance of the alleys.
- Alley landscaping must be irrigated.
- Shared use easements and creative site plan layout are encouraged to maximize the use of side yard landscape space.
- Alley landscaping shall be installed by the parcel developer and maintained by the Home Owner.
- Green Court products must have the landscape installed by the Parcel Developer and maintained by an Home Owners Association.
- Low walls or hedges (max. 36") must enclose the green court.
- Where "image defining edges" have been identified in the Design Guidelines certain landscape treatments will be encouraged to reinforce these key edges.
- Installation of landscaping within mid-block pass through shall be enhanced with highedensity planting installed by the Parcel Developer and maintained by an HOA.

Common Areas

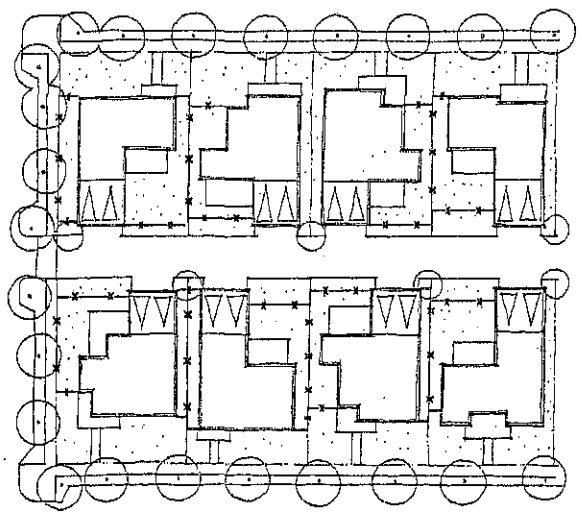
- Each neighborhood will be required to include neighborhood parks, bike/pedestrian paths, community identity features, perimeter walls and a streetscape planting plan as per the

Meridian Village Master Development Plan as shown. The development of these may be phased but all components must be completed prior to the fifty percent (50%) build-out stage of the parcel neighborhood.

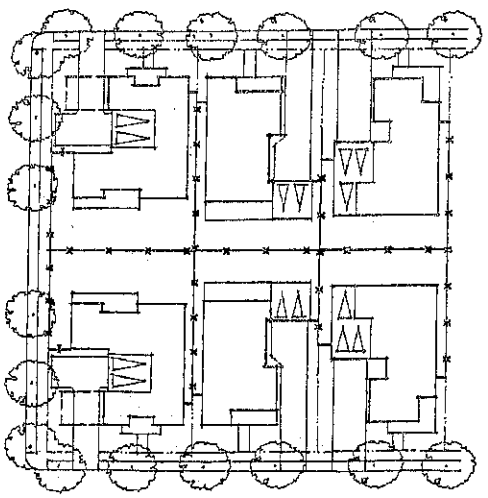
- Each neighborhood may be required to provide an easement to the Meridian Villages Metropolitan District for maintenance purposes.

Site Walls and Fences

- Solid masonry walls, view fencing or no fencing may occur along the parcel property lot lines of any neighborhood development abutting Lincoln Avenue, Chambers Road, West Parker Road, or the Spine Road. Said fencing or walls must be installed with the construction of any units in the designated neighborhood development. The view fencing or solid masonry fencing must be in conformance with the attached design drawings below. The respective HOA must provide an easement to the Meridian Villages Metropolitan District for purposes of maintaining the fencing/walls.
- View fencing along side lot lines shall not extend forward on the lot beyond a point that is approximately one half (1/2) of the distance between the front and rear elevation of the unit; excepting only that the side lot line fence may be placed in such a manner as to permit a side service door of a garage to be within the fenced area.
- Only wrought iron or open style fencing is permitted along the side lot of any unit abutting a street, park, school playground, open space, or internal bike/pedestrian path.
- Solid privacy fencing, internal to a lot, is permitted within the above parameters; providing that no such fencing shall extend forward beyond a point 1/3 of the depth of the side facade from the front building facade.
- Double fencing is not permitted.
- Solid privacy walls and view fences in areas of grade change should be level and stair stepped as required.
- Front or side yard retaining walls must have prior DCC approval. Materials must be compatible with building and overall architectural materials; wood (i.e. railroad ties etc.), unfinished concrete, or plain CMU blocks are not permitted.



Wall/Fencing Plan for Rear Loaded Single Family



Wall/Fencing Plan for Front Loaded Single Family

F. Meridian Village Guidelines Appendix

Neighborhood Wide Guidelines Checklist

Following is a list of issues to be addressed by each individual neighborhood or parcel builder. This check list will be used by the DCC upon review of proposals. Furthermore the attached criteria only applies to single family detached residential, whereby multi-family and commercial developments follow the site planning process per Douglas County Zoning.

The checklist is structured in two parts for the DCC review process. Preliminary review or Schematic Design (SD) is identified for the first phase submittal which will be the initial check of the project direction. The second phase Design Development (DD) submittal requires refinement to the initial Schematic Design (SD) information as well as additive detailed information as outlined below. Refer to Exhibit 12 and 13 in the Chapter 5, Exhibits, for review process and subdivision procedures at Meridian.

Site Plan Review Process

for Development within Meridian Village

Community Planning Criteria

Schematic Plan/ Preliminary Draft

- ☐ Street Layout
- ☐ Typical Lot Size
- ☐ Lot Setbacks (front, rear, side, & corner)
- ☐ Home Type
- ☐ Number Dwelling Units
- ☐ Density
- ☐ Garage Placement
- ☐ Parking Location and Quantity
- ☐ Lot Placement/Orientation
- ☐ Street Cross-Sections
    - o Sidewalk placement
    - o Tree planting
    - o Street lighting locations
- ☐ Open Space/Park Size Requirements Location and Connections

Design Development (DD)/ Final Plat

- ☐ Parcel Edge Treatments
- ☐ Driveway Placement + Entrances
- ☐ Easements
- ☐ Utility Placement
- ☐ Site Drainage and Grading

- ☐ Garage Details
  - o Door Design
  - o Windows
  - o Material Placement
  - o Scale

LANDSCAPE ARCHITECTURAL CRITERIA

Schematic Plan/ Preliminary Draft

- ☐ Character + Theme
- ☐ Builder/Homeowner/HOA responsibility
- ☐ Water Demand Calculations by Landscape Type
- ☐ Planting Plan identifying size, spacing and locations
- ☐ Surface Parking Lot Landscape Treatment
- ☐ Screening / Buffer
- ☐ Park/ Open Space Design
- ☐ Open Space use plan/integrated with planting plan

Design Development (DD)/ Final Plat

- ☐ Parcel Interior Privacy Walls/Fencing
- ☐ Signage
  - o Permanent
  - o Temporary
- ☐ Site Furnishings
  - o Mail boxes
  - o Play equipment
  - o Benches / seats / tables
  - o Site Amenities
- ☐ Landscape Lighting
  - o Trees
  - o Walks
  - o Planting Areas
  - o Open Space
  - o Security
- ☐ Typical planting plans for front and backyards
- ☐ Pavements: walks, drives, pads, edgings, and steps
- ☐ Retaining walls and slope stablizations

Design Control Committee
Meridian International Business Center

APPLICATION FOR PROJECT REVIEW

Project Name: _____ Parcel/Tract/Lot/Ref No.: _____

Address: _____

Type of Application:

- ☐ Building
- ☐ Landscape
- ☐ Signage
- ☐ Lighting
- ☐ Telecommunication
- ☐ Compliance Confirmation
- ☐ Minor Appurtenance

Submittal Phase:

- ☐ Sketch or GDP
- ☐ Schematic Design
- ☐ Design Development
- ☐ Construction Documents
- ☐ Site Plan
- ☐ Construction Logistics
- ☐ Permit Authorization
- ☐ Certificate of Compliance

Attached Plan References:

Date: _____
Prepared By: _____
No. of Sheets: _____
Project No.: _____
Revision Date: _____

Site Coverages:

	Area (sq.ft.)	(%)
Building / Structure (40% max)		
Parking (50% max)		
Open Space (30% min)		
TOTAL		
Irrigated Area (20% max)		

Please fill out applicable sections below:

BUILDING:

	☐ Office	☐ Retail	☐ Restaurant	☐ Hotel	☐ Multi-Family	☐ Single Family	☐ Other	☐ Totals
Gross Floor Area:*								
Net Floor Area:*								
Units:								

*Use zoning definitions

PARKING:

	Structured	Surface	Handicap	Carpool	Bike	Total
Number of Spaces:						

LANDSCAPE:

	Deciduous Trees (50%)	Ornamental Trees (25%)	Evergreen Trees (25%)	Shrub Areas	Flower Areas	Turf Areas
Number:						
Percentage:						
Size:						

SIGNAGE:

Temporary
Type: ☐Announcement ☐Lease ☐Directional ☐Event
Number: _____
Size: _____

Permanent
Type: ☐Monument ☐Bldg Mounted ☐Directional
Number: _____
Size: _____

APPLICANT CERTIFICATION:
I hereby attest that I am either an owner or a legally-designated agent of the owner and that the information contained in this application is true and correct; and further acknowledge that any approval action by the DCC based on inaccurate or incomplete information may be cause for invalidation of said approval.

Name: _____ Date: _____

5750 DTC Parkway * Suite 200 * Greenwood Village, CO 80111
Phone: 303-486-1369 / fax: 303-740-6954; Email: design&development@sheaproperties.com; Website: www.dtcmeridian.com

Design Control Committee
Meridian International Business Center

OWNER'S CERTIFICATION OF LANDSCAPE IRRIGATION DEMAND

Required with DD or Site Plan submittal

PROJECT:

Name _____

Address _____

Owner _____

DCC Site Plan Approval date _____

IRRIGATION DEMAND:

	Square Feet	% Parcel	Annual Consumption gallons
Open Space	_____	(%)	_____
Irrigated Turf	_____	(%)	_____
Irrigated Shrub/Flower Beds	_____	(%)	_____
Native	_____	(%)	_____
Hardscape	_____	(%)	_____
Other (specify)	_____	(%)	_____
TOTAL	_____	(%)	_____

IRRIGATION ALLOTMENT:* _____

*Based on gross land area of site with building with potable metered service
Office/retail/warehouse/other commercial @ 3.74 gal/yr/sq ft

CERTIFICATIONS/ACKNOWLEDGEMENTS:

A. The undersigned landscape architect, licensed to practice in the state of Colorado, certifies that, to the best of my knowledge, belief and professional opinion, that:
   1. I have reviewed and fully understand the Meridian DCC Design Criteria relative to landscape irrigation as referenced in the DESIGN CRITERIA MANUAL and Meridian Metropolitan District Rules and Regulations applicable at the time of this certification;
   2. The landscape design submitted in the above-referenced site plan fully complies with said criteria, including limitations relative to allowable irrigation consumption/demand;
   3. The above data is complete and accurate with respect to said plan.

NAME: (type) _____

COMPANY: _____

ADDRESS: _____

SIGNATURE: _____ DATE: _____

B. As the legally designated representative of the owner of the above-referenced development, I acknowledge the following:
   1. I have reviewed the above information and attest that, to the best of my knowledge, the information presented herein is a true and accurate representation of the owner's intended landscape consumption;
   2. I am fully aware that adherence to this allotment is a condition of continued irrigation service and, in the event the landscape irrigation allotment is exceeded on an annual basis, that the owner is subject to surcharges and penalties including termination of service in the event of continued noncompliance, per the service rules and regulations of the Meridian Metropolitan District.

OWNER'S REPRESENTATIVE NAME: (type) _____

BUSINESS ADDRESS: _____

SIGNED BY: _____ DATE: _____

C. Acknowledged by: Design Control Committee

SIGNED: _____ DATE: _____

Note: A fully executed and certified copy of the above must be submitted to the Meridian Metropolitan District along with a site connection and service application as a condition of service activation.

5750 DTC Parkway * Suite 200 * Greenwood Village, CO 80111
Phone: 303-486-1369/ fax: 303-740-6954
Website: www.dtcmeridian.com; Email: design&development@sheaproperties.com

MERIDIAN METROPOLITAN DISTRICT
12111 East Belford Avenue
Englewood, Colorado 80112
Phone: (303) 790-0345 Fax: (303) 790-1754

WATER DEMAND ANALYSIS FOR SINGLE FAMILY RESIDENTIAL SUBDIVISIONS

Date: _____

Plat Reference: _____

Total Land Area: _____

Number of lots: _____

Potable:	Acres	Allotment [aft/yr]*	Est demand [aft/yr]	Differential [aft/yr]
In house		_____	_____	_____
Lot area coverage:				
impervious	_____			
Landscape**	_____		_____	
streetscape adj to lots	_____		_____	
total	_____	_____	_____	_____
Non Potable Reuse: (parks/open space)				
irrigated	_____	_____***	_____	_____
non irrigated	_____			
total	_____			

* Potable; sfr = 170,000 gal/yr/unit; mfr = 95,000 gal/yr/unit both inclusive of adj streetscape irrigation needs;
** Maximum allowable landscape area per lot = 50% of lot area; Maximum of 60% of lot "landscape" area can be irrigated turf; balance must be drip irrigated shrubs or native grasses
*** Non Potable Reuse; park/open space = 24"/yr (i.e. 2 af/acre/yr)

Comments: _____

_____

_____

Certification (Landscape Architect) _____ Date: _____

Show date of approval: _____

Rev. 3/27/07

Meridian Design Control Committee

OWNER / ARCHITECT CERTIFICATION OF NET FLOOR AREA & VERIFICATION OF COMPLIANCE

IRRIGATION DEMAND:

	Square Feet	% Parcel	Annual Consumption inches	Annual Consumption gallons
Open Space		(%)		
Irrigated Turf		(%)		
Irrigated Shrub/Flower Beds		(%)		
Native		(%)		
Hardscape		(%)		
Other (specify)		(%)		
TOTAL		(%)		

IRRIGATION ALLOTMENT:* _____

*Based on gross land area of site with building with potable metered service
Office/retail/warehouse/other commercial @ 3.74 gal/yr/sq ft

OWNER CERTIFICATION:

I hereby attest that I am a legally designated agent of the owner, and that the information contained in this application is true and correct, and further acknowledge that any approval action by the DCC based on inaccurate or incomplete information may be cause for invalidation of said approval.

Name _____ Date: _____

STATE OF COLORADO)
) ss:
COUNTY OF _____)

The foregoing instrument was acknowledged before me this_____ day of _____, 20____.

Witness my hand and official seal.

My commission expires:

By:_____
Notary Public

ARCHITECT CERTIFICATION:

I hereby attest that I am the architect of record for the owner duly licensed to practice in the State of Colorado, and that the information contained in this application is true and correct, and further acknowledge that any approval action by the DCC based on inaccurate or incomplete information may be cause for invalidation of said approval.

Name _____ Date: _____

STATE OF COLORADO)
) ss:
COUNTY OF _____)

The foregoing instrument was acknowledged before me this_____ day of _____, 20____.

Witness my hand and official seal.

My commission expires:

By:_____
Notary Public

Meridian Design Control Committee Date: _____

_____
Raymond A. Bullock, Chairman Valid until: _____

5750 DTC Parkway * Suite 200 * Greenwood Village, CO 80111
Phone: 303-486-1369/ fax: 303-740-6954
Website: www.dtcmeridian.com; Email: design&development@sheaproperties.com

ARTICLE V

500 APPLICATION FOR SERVICE

.01 RULES APPLICABLE: Service will be furnished only to persons who and properties which are subject to the Rules.

.02 APPLICATION FOR SITE CONNECTION AND SERVICE PERMIT:

a. Application Required: In addition to the proper fees, the Customer seeking service shall submit a written application to the District in such form as the District may prescribe.

b. Permits and Assignability: Upon approval by the District, a Permit will be issued to the Customer, which shall, unless otherwise agreed by the District, designate the specific property to be served. Service connections are for use only on the property designated in the Permit. Permits and the rights enjoyed thereunder shall run with the property, and shall be automatically transferred by the owner of a property upon the sale or transfer of the property to a subsequent owner.

c. Failure to Connect/Nonuse: A Permit may be revoked if more than one year has elapsed between the date of the issuance of the permit unless the Customer either connected a service line to the District's Utility System pursuant to the permit, or has purchased a permit pursuant to a valid Agreement between the Customer and the District which specifies otherwise. Should any Permit become, through nonuse, destruction or abandonment of the property to which a service line is connected, inactive for a period of five years, the Permit may be revoked by the District.

Holders of permits may apply to the Board for a one-year extension, or reactivation, of the connection period. In the case of an application for extension of time such application shall be accompanied by a statement of facts that the Customer has proceeded with the development of the property with due diligence and has reasonable grounds to expect that a service line may be connected within the one-year extension period.

All applications for time extensions or reactivation shall be accompanied by a fee in the amount of the difference between the District's then current Site Connection and Service Fee and that previously paid by the Customer for the permit. The fee accompanying the application for extension shall be refunded in full if the Board fails to grant the extension of the connection period.

.03 DENIAL OF APPLICATION FOR SERVICE: The District may refuse to authorize service for any of the following reasons:

a. Misrepresentation: There has been misrepresentation in the application as to the extent of service required (demand), or the use to be made of the District's system;

b. Cross Connection: The Connection of the system to applicant's existing or planned connection would constitute a cross-connection;

c. Excessive Demand: The service would create an excessive demand on the District's facilities;

d. No Property Ownership: The applicant for the permit does not own property in the District;

e. Prohibited Discharge: The discharge would be prohibited by these Rules;

f. Inadequate Line or Facilities: The planned Service Line, Connection, or facilities are not, in the opinion of the District, adequate to service the property in question;

g. Emergencies: The Board finds an emergency exists;

h. Other Reasons: Other reasons determined by the Board to serve the best interests of the District, including but not limited to the nonpayment of fees or any other noncompliance with or violation of these Rules.

.04 ALLOTMENTS: Annual use allotments are specified for each site development at the time of site connection and service application approval as follows:

a. Potable Water Allotments:

Potable water allotments are based on average expected annual demands for the uses specified and are based on the net floor retail area of the building served for all uses except residential which are based on a per unit basis as follows:

Office /Retail: Other Commercial	20.5 gal/sq. ft. gross building floor area/year
Warehouse	10.75 gal/sq. ft. gross building floor area/year
Single Family Detached Residential	170,000 gals/year/unit (includes irrigation)
Multifamily Residential	95,000 gals/year/unit (includes irrigation)

b. Irrigation Allotments:

Non-potable irrigation is required for all uses except residential, unless otherwise approved by the Board due to mitigating conditions.

Non-potable allotments for all uses except residential are based on an allowance of 3.74 gal/sq ft parcel area/yr which generally provides for an "equivalency" of 20% of the gross parcel area of each development site to be "irrigated" landscape.

c. Surcharges:

Rate surcharges, as set forth in the District's fee schedule, will apply in the event of use in excess of the specified annual use as follows: Up to 50% over allotment, 2x base rate; in excess of 50% over allotment, 3x base rate.

d. Curtailment of Service Due to Exceeding Annual Allotments:

Service may be terminated in the event of annual overages in excess of 100% of allotments without a plan and timetable of remediation approved by the Board.

e. Grow in Period:

Variations of up to 50% overage of annual irrigation allotment may be granted for grow-in period of one full growing season for initial site landscaping.

f. Moisture Sensors:

All commercial and multifamily residential property irrigation systems shall provide for each irrigation controller to be monitored by an adjustable moisture sensor; adjustable for rainfall quantities in amounts of 1/8", ¼", ½", ¾" and 1". Monitoring capability shall be by direct wire or remote wireless methods such that the sensor shall act to break the circuit to the solenoid valves once moisture readings reach a preset level. The sensor wiring shall not affect the electronic or mechanical timer of the controller function, and allow the internal switch to return the circuit to normal operations once moisture levels drop to designated levels.

.05 IRRIGATION ONLY SERVICE CONNECTIONS:

Irrigation only service connections, i.e. without corresponding potable and wastewater use connections may only be approved by special request to and approval of the Board as to a hardship or unusual mitigating circumstance. If such connections are approved, the following will apply:

Connection fee:	Charged on same basis as full service fee; i.e. meter size and site area
Use fee:	Charged at 2x potable rate
Allocation:	Based on same formulas as for office commercial sites; note this may require multiple connections/fees

.06 PLAN REVIEW/SITE INSPECTION PROTOCOL:

Plan Review/Site Connection/Service Application

a. Construction plans, signed by an engineer, licensed in the State of Colorado, must be submitted for all proposed District owned facilities and approved in writing by the District prior to initiation of construction. Plans must contain sufficient information to assure compliance with the District's Rules and Regulations, including design criteria and construction specifications as well as estimate of cost.

b. Application for Site Connection and Service along with required payment for same, must be made prior to or coincident with any plan submittals and approval of same will be made a condition of any plan approvals.

c. Verification of the above is required prior to initiation of any construction of same, including site service connections (taps)

d. 48 hours advance notice must be made to the District office prior to any service connection or meter installation.

Meridian Metropolitan District
Emergency Water Supply Procedures

The purpose of this document is to provide a guide for dealing with water shortages at Meridian due to excessive demand during drought periods or supply shortfalls due to system malfunctions.

Meridian will follow a program of progressive restrictions to assure a reasonable balance between supply and demand in such situations. These restrictions will of necessity give priority to potable drinking water continuity to buildings vs. irrigation of landscaping, the one exception is that the Meridian Golf Club, due to the nature of its business, will receive priority in terms of being allowed to sustain reasonable irrigation usage; provided however that in no event will potable supplies be curtailed to allow continued irrigation.

Phase I:	Status:	Normal Operating Conditions
	Objective:	Maintain Normal Operations
	Targets:	Keep reuse irrigation use at or below annual potable drinking water demand over irrigation season

Meridian will follow good water conservation practices through the following means:

- Reuse or recycling of wastewater for irrigation where allowable by law
- Promulgation of landscape design standards to achieve target irrigation allotments through the Meridian Design Control Committee.
- Use of a progressive rate schedule wherein rates are increased for excessive usage over designated allotments; including termination of service for flagrant disregard of same
- Use of an "allotment" for both potable and irrigation water usage based on normal demands
- Annual correspondence with property owners that exceed designated allotment re-advising them of allowable operating parameters (see attached sample)
- Use of comparable practices for all District landscaping

Phase II:	Status:	High Potential of Excessive Irrigation Demand Due to Climate Conditions
	Objective:	Avoid Mandatory Use Restrictions Due to Excessive Demand
	Target:	Keep reuse irrigation use at or below annual potable drinking water demand over irrigation season

- Issuance of an **irrigation alert** to all customers asking for voluntary cooperation in irrigation practices including three day watering cycles, night irrigation, and rain adjustments (see attached sample); include reference to DWB irrigation advisory website.

- District initiates three day cycle on medians and park areas; limited irrigation in I/25 interchange and designated native areas; posts "well-irrigation" signage on heavily traveled streets with median landscaping for PR purposes); minimizes use of "construction" water by contractors; delays any scheduled District landscaping installations (until after August).

Phase III:	Status:	High Potential of Irrigation Reservoir Shortage (ie. Less Than 100 AFT Storage Balance in Irrigation Reservoir)
	Objective:	Avoid Potential for More Severe Irrigation Cutbacks
	Target:	Achieve 20% Reduction in Peak Day Irrigation Demand

- Issuance of a notice of initiation of **mandatory irrigation restrictions** including three day week allowable watering cycle (T., Th., S.) maximum 15 minute cycles; restricted nighttime only irrigation hours (6 p.m. – 6 a.m.); progressive fines for violations (see attached sample)

- Increased patrol for violations by District personnel

- Shut off of irrigation pumping station outside allowable hours if lack of compliance is evident

- Issuance of irrigation advisory to Golf Course reference overall supply status reaffirming 300 AF maximum allotment; request voluntary cooperation on water conservation

- District same as Stage II; also stops irrigation of I/25 interchange and designated native areas; restricts watering in park and ball fields to 2 days/week.

Phase IV:	Status:	Reservoir Storage Projected to Fall Below 100 aft Storage
	Objective:	Avoidance of Termination of Irrigation
	Target:	Achieve 50% Reduction in Peak Day Irrigation Demand

- Issuance of a notice of **more stringent mandatory irrigation restrictions** including two day/week allowable watering cycle (Monday and Friday); in addition to all Phase III provisions

- Terminate use of water for new construction, decorative fountains, car washes; delay new landscape installations

- Mandatory April 15 Startup/October 15 Irrigation Shutdown

- Increase fine levels for violation; including termination of irrigation service for continued noncompliance

- Issuance of irrigation notice to Golf Course advising of storage status and mandatory cutback on watering of driving range, practice holes and any native areas

- District goes to same restrictions including termination of irrigation in parks, ball fields

Phase V: Status: High Potential for Potable Service Cutbacks

Objective: Avoidance of Potable Service Cutbacks
Target: Achieve 100% Termination Irrigation; Balance Non Potable Irrigation with Waste Water Effluent Daily Flows for Golf Course

- Termination of all irrigation services*

- Restrict Golf Course to wastewater reuse inflows; use pump station shutoff to control

Phase VI: Status: Interruption of Potable Service

Objective: Sustain Fire Protection Capacity; Then Keep Residential and Crucial Commercial Properties Operational
Target: Sustain 3.0MG Level in Storage Tank

- Telephone alert to Fire District

- Email alert to all property owners

- 24 hour communication availability to assure property owner access to service restoration status

- Continue to restrict Golf Course irrigation to wastewater reuse flows.

* Potable irrigation is required in residential areas and can account for 30-50% of Meridian's potable demand during the irrigation season

Note that as long as potable service is achievable, there will be an equivalent amount of reuse water available for irrigation. The Golf Course, due to being an operating business will be given preference to extent that play can be maintained. Other areas will be allowed the balance on a proportionate basis with attendant irrigation periods allowed. This will be achieved through control on the irrigation pump station.

Phase I Notice

MERIDIAN
Metropolitan District

12111 East Belford Avenue
Englewood, Colorado 80112
303-779-4550
303-804-3912

NOTICE OF IRRIGATION ALLOTMENT OVERAGE

Addressed to those who have "substantially" exceeded their irrigation allotments

Date

Dear :

In reviewing your site irrigation usage through October, we note a significant overrun in your allotment as follows:

Parcel Annual Irrigation Allotment	_____ Gallons
Use Through October, 2001	_____ Gallons; Overage___%
Year 2000 Use	_____ Gallons; Overage___%

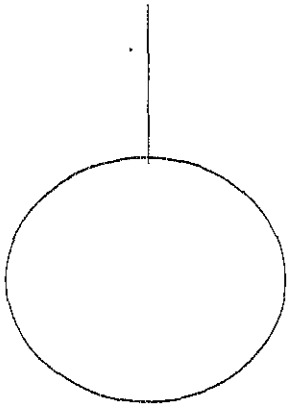
As you should be aware, a "surcharge" applies for use in excess of annual allotments. This year your surcharges have amounted to $_____.

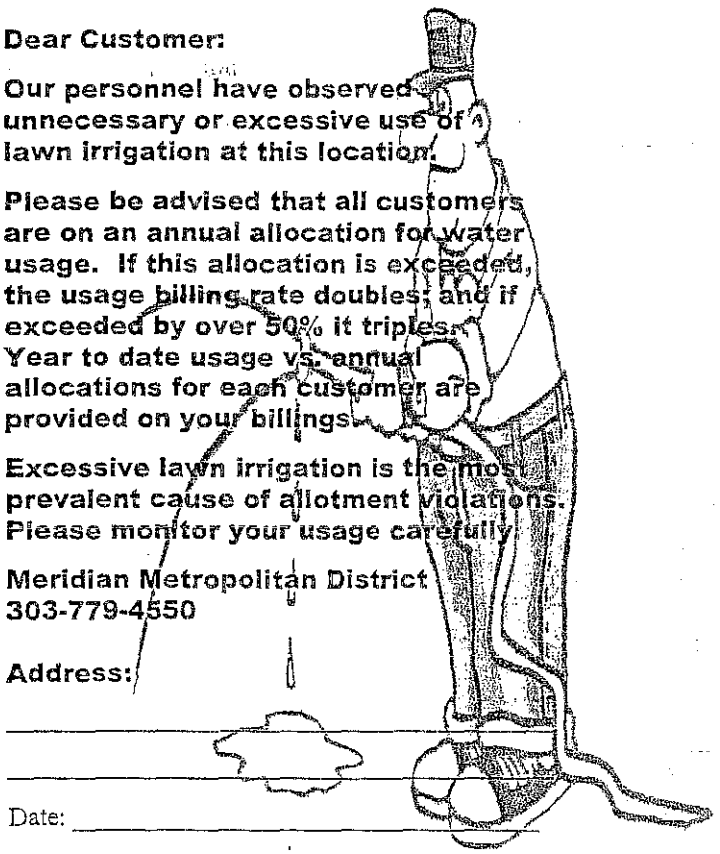
The irrigation allotments are based on reasonable average demands for irrigated turf in Colorado. While some overages could be expected to occur with year-to-year seasonal variations, usages at your rate seem to indicate issues with irrigation monitoring and management by landscape maintenance personnel.

The District simply cannot, nor will not, allow a continuation of such overages. We again ask that you review your usages and maintenance practices in this light.

Please be advised that effective January 1, 2002, an even more stringent surcharge will be in effect as shown on the attached rate sheet. Note also that continued overages in excess of 100% of an allocation may result in a termination of irrigation service until acceptable remediation is achieved.

Phase I Notice





Dear Customer:

Our personnel have observed unnecessary or excessive use of lawn irrigation at this location.

Please be advised that all customers are on an annual allocation for water usage. If this allocation is exceeded, the usage billing rate doubles; and if exceeded by over 50% it triples. Year to date usage vs. annual allocations for each customer are provided on your billings.

Excessive lawn irrigation is the most prevalent cause of allotment violations. Please monitor your usage carefully.

Meridian Metropolitan District
303-779-4550

Address:

_____

_____

Date: _____

Phase II Alert

MERIDIAN
Metropolitan District

12111 East Belford Avenue
Englewood, Colorado 80112
303-779-4550
303-804-3912

NON-POTABLE IRRIGATION WATER CONSERVATION ALERT

Date

Dear Meridian Customer:

As a result of the extremely dry weather conditions this year, many properties have activated their landscape irrigation earlier than usual. Application rates also appear to be running well above normal.

While there is no concern relative to potable water use, we are asking your cooperation in closely monitoring your landscape irrigation to avoid the potential for overtaxing our nonpotable storage reserves.

Please limit your watering schedule to every third day and irrigate only as much as absolutely necessary. Irrigation schedules should be closely monitored and adjusted to accommodate changed weather conditions (for example do not irrigate coincident with a rainfall).

While the District has the authority to impose mandatory irrigation restrictions in the event circumstances dictate, hopefully, with good cooperation and improved weather, this will not be necessary. In the event such restrictions do become necessary, you will receive immediate written notification of the specifics thereto.

Note: Up to date information on turf irrigation needs can be obtained through the Denver Water Board's web site www.denverwater.org

Phase III Restriction

MERIDIAN
Metropolitan District

12111 East Belford Avenue
Englewood, Colorado 80112
303-779-4550
303-804-3912

NOTICE OF MANDATORY LANDSCAPE IRRIGATION RESTRICTIONS

Date

This is to advise you that, due to the continuing extraordinarily dry conditions this season, and resultant demands on our irrigation storage reserves, effective .....(date) ..... the following mandatory use restrictions will apply until further written notice:

- Landscape irrigation will be allowed only 3 times per week. Permitted irrigation times for your parcel are Tuesday, Thursday, and Saturday only, between the hours of 6 p.m. and 6 a.m.
- Allowable irrigation time per zone is 15 minutes; duplicate cycles or recycling is not permitted during same 24-hour period.
- A fine will be added to monthly billings in the event of a violation ($50 for single family residential; $250 for all other accounts). Fines for repeat violations will be doubled for each occurrence.

The District will attempt to remove these restrictions as soon as conditions permit. In the meantime, your cooperation with these water conservation measures during this unusual period will be appreciated.

Meridian Metropolitan District

Note: Up to date information on turf irrigation needs can be obtained through the Denver Water Board's web site www.denverwater.org

Phase IV Increased Restrictions

MERIDIAN
Metropolitan District

12111 East Belford Avenue
Englewood, Colorado 80112
303-779-4550
303-804-3912

NOTICE OF ADDITIONAL MANDATORY LANDSCAPE IRRIGATION RESTRICTIONS

Date

This is to advise you that due to the continuing extraordinary dry conditions and attendant irrigation demands we are now experiencing shortfalls in our irrigation water storage and production. In order to allow us to sustain some degree of landscape irrigation supply for the balance of this season the following mandatory restrictions are effective immediately:

- Landscape irrigation will be allowed only two times per week. Permitted irrigation times for your parcel are Monday and Friday only between the hours of 6 p.m. and 6 a.m.
- Permitted irrigation times for your parcel are Monday and Friday only, between the hours of 6 p.m. and 6 a.m.
- Allowable irrigation time per zone is 15 minutes; duplicate cycles or recycling is not permitted.
- The following activities are prohibited until further notice: car wash facilities, installation of new landscaping, annual flower planting, decorative fountains
- A fine will be added to monthly billings in the event of a violation ($100 for single family residential; $500 for all other accounts). Fines for repeat violations will be doubled for each occurrence

Note: Up to date information on turf irrigation needs can be obtained through the Denver Water Board's web site www.denverwater.org

MERIDIAN
Metropolitan District

12111 Mt. Belford Avenue
Englewood, Colorado 80112
(303) 790-0345
Fax (303) 790-1754

2009
GUIDELINES

Dear Resident:

Welcome to your new home!

Your water and sewer utility service is provided by the Meridian Metropolitan District. Please note the following information which may be of assistance to you.

- Billings are "bimonthly" (every two months) and will be mailed to this address. Payment is required 30 days after the posted billing date.

- Our routine office hours are 7:00 a.m. to 3:30 p.m. weekdays. We can be reached at (303) 790-0345. Emergency calls for any service malfunction may be made to the same number. In the case of an after hours emergency, this number is forwarded to an emergency voice mailbox. Please leave your message and our operations personnel will call you back immediately. We maintain a 24 hours a day, 7 days a week emergency staff on-call policy.

- Your water meter is mounted on the interior of your house and will be read electronically from curbside by our personnel. There is no need to enter your house. The District's contractor for routine repairs and readings is Tech Center Maintenance. They are uniformed, drive marked vehicles and will have business card identification available at all times.

- The District uses a water "allotment" based on normal single family home residential use. Your annual water use allotment is 170,000 gallons. Rates double if this amount is exceeded, and triple if exceeded by more than 50%. The most typical cause of such overages is excessive lawn irrigation. Year to date usage versus annual allotments are spelled out on your billings. We suggest you monitor this carefully.

As always, if you have any questions, or if we can be of further assistance, please do not hesitate to call us.

Sincerely,

Meridian Metropolitan District

MERIDIAN
Metropolitan District

12111 East Belford Avenue
Englewood, CO 80112
303-779-4550
Fax 303-740-6954

Dear Meridian Homeowner:

As you are undoubtedly aware, this region of Colorado exists in a relatively arid climate subject to periodic drought conditions.

We in Meridian have atteninpted to recognize this through a unique approach to management of our water resources both in landscape design and water management guidelines.

For example, Meridian uses a very progressive recycling system wherein wastewater is, after appropriate treatment, reused for landscape irrigation on commercial properties and common areas within our service area as well as the Meridian Golf Course.

Although residential properties use "potable" vs. "reuse" water for landscape irrigation, all properties, including single family homes, operate under an "allotment" system wherein specific allocations are made available for landscape irrigation.

The Meridian Design Control Committee requires that each commercial property demonstrate that their landscape design will allow this criteria to be met. Here again, liberal use of native grasses and drought tolerant plants, compatible with Meridian's overall "high plains" landscape image, are encouraged for all properties.

For residential properties, the allowable allotment typically will not allow for a yard to be entirely turf. Because of this, we strongly recommend you consider liberal use of shrub and "xeriscape" treatments, particularly in your side and rear lot areas.

With attention to your initial landscape design, and subsequent irrigation practices, your irrigation allotment should be adequate under normal conditions. However, it is important to note that without proper management, irrigation allotments can easily be exceeded. In such situations, an aggressive surcharge is applied such that usage over the allotment is billed at 2X the normal rate; and, if usage exceeds 50% of the allotments, 3X the normal rate. Usage in excess of these amounts can result in termination of service.

The point to all of this is quite simple...every Meridian customer is asked to manage their landscape irrigation in a responsible manner such that they stay within their annual irrigation allotment. The enclosed material is being provided in an effort to assist you in doing this, and we would appreciate your cooperation in this regard.

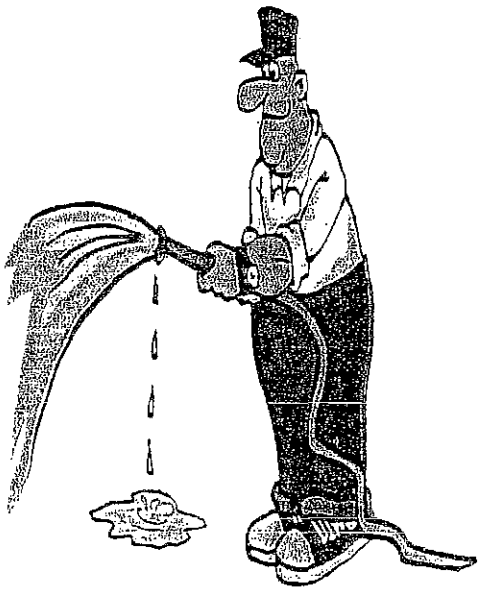
Board of Directors
Meridian Metropolitan District

Note: Information on irrigation needs for current weather conditions is available via Denver Water's website: www.denverwater.org

Managing Your Landscape

within

Meridian's Water Conservation Guidelines



Meridian Metropolitan District
12111 E. Belford Ave.
Englewood, CO 80112

Phone: 303-790-0345
Fax: 303-790-1754
Website: www.dtcmeridian.com

FEE SCHEDULE

Meter Size [1]	Connection and Service Fee [2](Gallons)	Min. Monthly Charge/Use	Use Fees [3] Potable Water	Use Fees [3] Sewer [4]	Use Fees [3] Non-Potable Irrigation
SF Residential	$17,500	$25/4,000	$3.89	$3.56	N/A
MF Residential	$ 5,500	$45/8,000	"	"	N/A
Commercial:	$ 9,500 per acre *plus*				
1"	$43,000	$25/4,000	"	"	$3.24
1.5"	$73,000	$45/8,000	"	"	"
2"	$113,000	$65/12,000	"	"	"
3"	$220,000	$135/24,000	"	"	"
4"	$333,000	$265/48,000	"	"	"

Surcharges apply for usages in excess of the following "allotments":

Water:

Use:	Potable Water		Non-potable Irrigation
Office/retail/other commercial building	20.5	gal/yr/sq. ft.[5]	3.74 gal/yr/sq. ft. [6]
Restaurant [7]	153.3	gal/yr/sq. ft.	3.74 gal/yr/sq. ft
Office warehouse	10.25	gal/yr/sq. ft.	3.74 gal/yr/sq. ft.
Single family residential	170,000	gal/yr (per unit-detached)	N/A
Multifamily residential	95,000	gal/yr (per unit attached)	N/A

The surcharge rate for exceeding the above allotments is: up to 50% overage...@ 2X applicable rate
in excess of 50% overage....@3X applicable rate
in excess of 100% overage...@5X applicable rate (irrigation only) or; termination of irrigation (only) service until reconciliation

Fire flow testing and temporary hydrant usage @ 2x potable rate

Sewer:
Concentrations in excess of 5.2% BOD mg/l and 0.14% SS mg/l over 250 and 200 mg/l respectively will be subject to surcharges @ 2X applicable rate

Notes:
(1) Based on potable water meter
(2) This is a one time fee payable prior to connection and is inclusive of potable water, sewer, and, where applicable, non-potable irrigation services
(3) Monthly fees, per thousand gallons
(4) Sewer fees based on potable water consumption
(5) Based on net floor area of building with potable service
(6) Based on gross land area of parcel with building with potable service
(7) With independent tap and meter

Special temporary use permits are required for fire hydrant usage and the applicable fee is specified on that permit

SITE CONNECTION AND SERVICE FEE:

Potable meter = $_____ Check Received By _____
_____ Acres @ $9,500 = $_____ Check Number _____
Total Fee Due = $_____ Check Date _____

Any future property or connection alterations, expansions or reactivations after more than one year in activity may be subject to added fees. All District fees, and the use by applicant of the District's systems, are subject to the District's Rules and Regulations, which are in turn subject to amendment from time to time as the Board of Directors of the District may, in its sole discretion, deem appropriate.

AUTHORIZATION:
The Meridian Metropolitan District hereby acknowledges that applicant has paid all applicable site connection and service fees and is hereby authorized to make the referenced connections. This authorization is valid for a period of one year from the date it is signed by the District. If actual connection is not made within that period, this authorization shall automatically terminate and all fees shall be subject to forfeiture or adjustment.

Meridian Metropolitan District

Not Valid unless
District Seal is applied.

By _____
As General Manager/Secretary
Dated_____

Note: The District requires 48 hrs. notice prior to a service connection being made. MMD Connection and Service Application

MERIDIAN
Metropolitan District

12111 East Belford Avenue
Englewood, CO 80112
303-790-0345
Fax 303-790-1754

2008 SUMMER LAWN IRRIGATION GUIDELINES

(June 1 through September 30)

Customers are reminded that all users within Meridian are subject to "use allotments" which provide for reasonable water use, but impose strict penalties when exceeded. The most common cause of exceeding allotments results from excess lawn irrigation.

In an effort to assist you in your lawn care, we are providing you with the enclosed watering guidelines developed by the Denver Water Board. Additional information is available via their website www.denverwater.org.

PLEASE NOTE THAT LAWN IRRIGATION MAY ONLY BE DONE A MAXIMUM OF THREE DAYS PER WEEK ON YOUR ASSIGNED DAYS PER BELOW:

Days When You May Water	Sun	Mon	Tues	Wed	Thurs	Fri	Sat
Even-Numbered Addresses							
Odd-Numbered Addresses							

Thank you for your cooperation.

Meridian Metropolitan District

no. 7.228

Xeriscaping: Creative Landscaping

by C. Wilson and J.R. Feucht [1]

Quick Facts...

- Proper planning is the first step in landscaping to reduce water use.
- Steep slopes with south and west exposures require more frequent water to maintain the same plant cover as east or north slopes.
- Terracing slopes reduces runoff.
- Limit irrigated bluegrass turf to small or heavily used areas.
- Soil preparation is a key to water conservation.
- Proper irrigation practices and system design can lead to 30 to 80 percent water savings.

Xeriscaping (zer-i-skaping) is a word originally coined by a special task force of the Denver Water Department, Associated Landscape Contractors of Colorado and Colorado State University to describe landscaping with water conservation as a major objective. The derivation of the word is from the Greek "xeros," meaning dry, and landscaping -- thus, xeriscaping.

The need for landscaping to conserve water received new impetus following the drought of 1977 throughout the western states and the recognition that nearly 50 percent of the water used by the average household is for turfgrass and landscape plantings.

Unfortunately, many homeowners have cut back on turfgrass areas by substituting vast "seas of gravel and plastic" as their answer to water conservation. This practice is not only self-defeating as far as water conservation is concerned, it also produces damaging effects to trees and shrubs. It is not xeriscaping.

Planning -- An Important First Step

Whether you want to redesign an old landscape or start fresh with a new one, a plan is a must. The plan does not have to be elaborate but should take into consideration the exposures on the site. As a rule, south and west exposures result in the greatest water losses, especially areas near buildings or paved surfaces. You can save water in these locations simply by changing to plants adapted to reduced water use. However, don't be too quick to rip out the sod and substitute plastic and gravel. Extensive use of rock on south and west exposures can raise temperatures near the house and result in wasteful water runoff.

Slope of Property

Slope or grade is another consideration. Steep slopes, especially those on south and west exposures, waste water through runoff and rapid water evaporation. A drought-resistant ground cover can slow water loss and shade the soil. See fact sheet 7.230, *Xeriscaping:*

Ground Cover Plants, for suggested ground-covers. Strategically placed trees also can shade a severe exposure, creating cooler soil with less evaporation. Terracing slopes helps save water by slowing runoff and permitting more water to soak in.

Reduce Irrigated Turf

Avoid narrow strips of turf, hard to maintain corners, and isolated islands of grass that need special attention. Not only is maintenance more costly, but watering becomes difficult, often wasteful. If your yard is already landscaped, see *7.234, Xeriscaping: Retrofit Your Yard*, for information on ways to evaluate and eliminate unneeded turfgrass areas.

Bluegrass turf can be reduced to areas near the house or that get high use. In outlying areas, use more drought-resistant grasses or even meadow mixes containing wildflowers, particularly if your property is large. Refer to *7.232, Xeriscaping: Turf and Ornamental Grasses*, for suggested alternatives to bluegrass.

Soil Preparation

Proper soil preparation is the key to successful water conservation. If the soil is very sandy, water and valuable nutrients will be lost due to leaching below the root zone. If your soil is heavy clay, common in this area, you will lose water through runoff.

A good soil, one that supports healthy plant life and conserves moisture, has a balance of rather coarse soil clusters (aggregates), sand and pore spaces. The "ideal" soil has as much as 50 percent by volume pore space, with the soil itself consisting of a good balance of sand, silt and clay.

A major problem with heavy soils is that clay tends to dominate the soil complex. Clay is composed of microscopic crystals arranged in flat plates. When a soil has a high number of these crystals, they act much like a glue, cementing the particles of sand and silt together and resulting in a compact, almost airless soil.

Such soils usually repel surface water, resulting in runoff. What water does get into these soils is held so tightly by the clay itself that plants cannot use it. Plants in a clay soil, even though it is moist, often wilt from lack of moisture. Plant roots also need air to thrive. In clay soils, air spaces are small and may be filled with water, so plant roots often suffer from oxygen starvation.

In very sandy soils, the opposite is true. Sandy soils have very large pore spaces. Because the particles are large, there is little surface area to hold the water, so sandy soils tend to lose water rapidly.

A good soil is not made in just one year. Add organic matter annually to Garden areas. In areas to be sodded or seeded, add organic amendments as a one-time procedure. Take advantage of this one time before seeding or sodding by doing a thorough, complete job. This encourages deep roots that tap the water stored in the soil and reduces the need for wasteful, frequent water applications.

Xerigation -- Saving Water with Proper Irrigation

Proper irrigation practices can lead to a 30 to 80 percent water savings around the home grounds. If a sprinkler system is already installed, check it for overall coverage. If areas are not properly covered or water is falling on driveways and patios, adjust the system. This may mean replacing heads, adding more heads, or changing heads to do a more efficient job.

With the system on, observe places that are receiving water where it is not needed. Overlaps onto paved areas or into shrub borders may result in considerable water waste. Overwatering trees and shrubs may lead to other problems.

Irrigate turf areas differently than shrub borders and flower beds. North and east exposures need less frequent watering than south and west exposures. Apply water to

slopes more slowly than to flat surfaces. Examine these closely and correct inefficiencies in irrigation system design.

If you do not have a sprinkler system and are just beginning to install a landscape, you can avoid the pitfalls of poorly designed and installed systems. Have a professional irrigation company do the job correctly. Make sure the system is designed to fit the landscape and the water needs of the plants and that it is zoned to reduce unnecessary applications of water. Coordinate the landscape design itself, selection of plants and the irrigation system to result in a sensible water-saving scheme.

Consider a drip system for outlying shrub borders and raised planters, around trees and shrubs, and in narrow strips where conventional above-ground systems would result in water waste.

If you use hoses instead of an underground system, you can observe water patterns. Instead of watering the entire lawn each time, spot water based on visible signs of need, such as turf that begins to turn a gray-green color.

Avoid frequent, shallow sprinklings that lead to shallow root development. Compact soils result in quick puddling and water runoff. They need aeration with machines that pull soil plugs.

Trees and shrubs separate from the lawn are best watered with deep root watering devices.

Xerimulch the Landscape

Properly selected and applied mulches in flower and shrub beds reduce water use by decreasing soil temperatures and the amount of soil exposed to wind. Mulches also discourage weeds and can improve soil conditions.

There are two basic types of mulches: organic and inorganic. Organic mulches include straw, partially decomposed compost, wood chips, bark, and even ground corncobs or newspapers. Inorganic mulches include plastic film, gravel and woven fabrics. Sometimes a combination of both organic and inorganic is used.

If soil improvement is a priority, use organic mulches. Wood chips and compost are most appropriate. As these materials break down, they become an organic amendment to the soil. Earthworms and other soil organisms help incorporate the organic component into the soil. Organic mulch is preferred because most soils in this area are low in organic content and need organic amendments to improve aeration and water-holding capacity.

Inorganic mulches, such as plastic film, effectively exclude weeds for a time, but they also tend to exclude the water and air essential to plant roots. Woven fabrics and fiber mats are preferred over polyethylene films. Fabrics and mats exclude weeds yet allow water and air exchange. Used in combination with decorative rock or bark chunks, they often outlast the less expensive but short-lived polyethylene films. For more information, refer to 7.214, *Mulches for Home Grounds*.

Selecting Plants

Carefully select plants to be compatible with soil, exposure and irrigation systems. For recommended plants, see:

- 7.229, *Xeriscaping: Trees and Shrubs*.
- 7.230, *Xeriscaping: Ground Cover Plants*.
- 7.231, *Xeriscaping: Garden Flowers*.
- 7.232, *Xeriscaping: Retrofit Your Yard*.

[1]J.R. Feucht, Colorado State University Extension landscape plants specialist and professor (retired). Prepared in cooperation with the Technical Advisory Committee for Xeriscape Front Range, an affiliate of the National Xeriscape Council, Inc. Reviewed by C. Wilson, Extension horticulture agent, Denver county. 3/96. Reviewed 10/07.

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no. 7.234

Xeriscaping: Retrofit Your Yard

by J.R. Feucht and C.R. Wilson[1]

Quick Facts...

- As much as 50 percent of household water is used for the yard and garden.
- Change turf areas on steep slopes, hard-to-water places and narrow mowing strips to low-water ground covers.
- Use or update an irrigation controller for cycle and soak irrigation to minimize runoff from slopes and compacted soils
- Modify sprinkler systems to water only turf areas, not hardscapes.
- A low pressure, micro-irrigation (drip) system can save water.
- Like any plants, xeric plants require more water for establishment.

The average home landscape uses as much as 50 percent of the water in a household. Even if you already have a well-established landscape, you can substantially reduce water use by following some simple steps.

Survey Your Yard

Observe turf grass areas that are difficult to water and maintain. These include:

- along fences;
- on steep slopes where water tends to run off;
- corners of lawns where it is hard to water without overlapping into other areas;
- narrow strips of lawn between the house and sidewalk or driveway; and
- irregularly shaped lawn areas that do not fit the normal pattern of most sprinklers.

If you have an underground sprinkler system, turn it on and observe where the water sprays . Better yet, place shallow containers, such as plastic margarine tubs or metal coffee cans, in various locations and measure the water depth after 10 minutes. If some areas don't receive as much water as others, your sprinkler system may require maintenance or renovation to water the landscape evenly without wasting water. Common sprinkler system problems include mis-matched nozzles or spray and rotor heads installed on the same zone. (For more information see fact sheet 7.239, *Operating and Maintaining a Home Irrigation System*.)

Adjust heads that are spraying concrete and other hardscape surfaces to water only plants. Sprinklers spraying wood fences cause unsightly water staining and rapid deterioration thus increasing financial costs. Relocate sprinkler heads near fences so water sprays towards plants, move heads further away so water doesn't wet fences, or switch to drip (micro-irrigation).

Steep slopes, especially those on south and west exposures, waste water through runoff and evaporation. Utilizing or installing a control timer that allows for cycle and soak

irrigation may solve the problem on gentle slopes. Another idea is to convert these areas to perennials or ground covers that tolerate the exposure and thrive on little water. They also are easier to maintain because unsafe mowing on steep slopes can be eliminated. Drip (micro-irrigation) that slowly applies water over longer periods of time may further minimize runoff. Another option to consider is terracing. Note that landscape berms where soil is deliberately mounded also waste water from sprinkler runoff. Drip (micro-irrigation) is a better way to irrigate berms.

Strips narrower than 8 feet are difficult to irrigate effectively. Size areas accordingly. Irregularly shaped areas should be re-shaped to fit sprinkler irrigation patterns and odd-shaped areas converted to drip irrigated, xeric plantings or hardscape.

Study the highly trafficked areas in your yard including play areas for children and exercise areas for pets. These areas are best left in turfgrasses that can take the wear. Note that bluegrass is one of the best-adapted grasses for wear tolerance. Xeric grasses such as buffalograss have less wear tolerance partly because they grow slowly on less water and don't replace worn-off grass. Other areas, however, can be converted to shrub borders, flower gardens and non-turf ground covers that use less water. Designated paths of worn turf may be altered to stepping stones or flagstones, perhaps with a dwarf groundcover planted among the stones.

Look for lawn areas that do poorly because of heavy shade from trees or structures. Rather than keep these areas in bluegrass, plant shade-tolerant fine fescue grass or alternative ground covers that tolerate shade and mulch them. If the location is appropriate, install a patio or raised deck.

Note that turf does play an important role in the landscape when placed in well thought out locations. Turf prevents soil from moving into the air, streams and homes. Turf is the best filter of runoff and scrubs pollutants from water. It builds soil for other plants and is one of the best means of urban fire control.

Removing Turf

Mark off unwanted turf areas with a string and stakes or a garden hose. Do not leave sharp angles or small strips that are difficult to water without overlapping into nonturf areas.

Modify your sprinkling system so water is applied only to the turf you retain. In some cases, this may involve changing the spray patterns of the heads from a full circle to a partial circle. In other cases, it may require reorienting heads to direct water away from the nonturf areas. Major changes, however, may require shutting off parts of zones and relocation or installation of complete sprinkler lines. Another method is to let the sprinkler pattern be your guide and renovate areas not covered by the spray pattern.

It is not necessary to strip unwanted sod. An easier method is to apply glyphosate (sold as Roundup, Kleenup, Kill Zall, Corn Pleet) to actively-growing grass. Use a spade to cut a slit between turf you want to save and that to be killed. Severing underground roots avoids movement of herbicide spray via the roots to turf designated for retention.

Glyphosate must be applied carefully, because even the slightest drift onto adjoining grass or other nontarget plants will damage them. Use a low-pressure, coarse-droplet spray with a handheld, cardboard or metal spray shield. Better yet, consider a wick-type applicator available at many garden centers. Apply only when you are certain it will not rain for at least eight hours after application. Wait seven to ten days, then plant to alternative ground covers, shrubs or flowers.

Another way to kill grass is to overlap black and white newsprint on the lawn you want to kill. Lay the newspaper on the grass in overlapping sections at least 10 sheets thick. Weigh it down with 4 inches of wood chips to keep it from blowing. You usually can purchase wood chips from tree service companies. Sprinkle the chips with water to settle them and keep them from blowing.

The newspaper and wood-chip mulch smothers the grass. After a few weeks the grass will be dead and the newspaper will begin to decompose, creating extra organic matter that is beneficial to the soil.

In areas where you plan to use mulches or you are going to plant on a steep slope, leave the killed grass in place. The dead grass and its roots and runners help reduce soil erosion until the new planting is established. To improve appearance and reduce future weed growth, cover the dead grass with about 4 inches of mulch, such as wood chips or bark chunks. Spot treat with glyphosate any grass and weeds that sprout through the mulch. As the dead grass decays, it contributes organic matter to the soil.

Where you want flower beds, it is best to till under the dead grass. Any glyphosate residue that comes into contact with soil will be deactivated and will not harm new plantings, except where direct seeding is done.

If you seed flowers, alternative grasses and vegetables, remove the dead grass and roots. Residue in the dead plant material can interfere with seed germination. An alternative is to thoroughly rototill the dead grass into the soil and wait until the grass has fully decomposed. If kept moist (but not wet), this may take one month to six weeks in warm weather.

Note that xeric plants are similar to high water plants during establishment. They require regular and relatively high amounts of water after transplanting or seeding. Only after xeric plants are well established can they be gradually weaned and watered more sparingly. Consider water availability when deciding the timing of a change from a moderate or high water using landscape to a xeriscape.

Drip (micro-irrigation) Systems

Drip or micro-irrigation systems can be a good way to water any type of plant except turf. Low pressure, micro-irrigation systems apply water slowly and close to the ground. This eliminates waste from water blowing off-target and reduces water use. The boundary between sprinklers and drip irrigation has blurred with advancements in micro-irrigation to include spray stakes. Most micro-irrigation systems are easy to install and modify. Drip irrigation kits are available at most garden centers. They allow you to water plants separately with emitters, or water groups of plants with micro-spray stakes or tapes that ooze water along their entire length. You can enlarge the system as plants grow or as new plants are added.

Use drip systems to maintain constant moisture in the plant root zone. Do not use them to "water in" new plantings. New plantings need rapid, deep watering that is best done by hand. Once the soil has settled around new plants, the drip system can maintain moisture. (See 4.702, *Drip Irrigation for Home Gardens.*)

Practices to Avoid

Do not group plants with different water needs together in the same irrigation zone. You will not be able to meet the water needs of any of the plants resulting in poor plant growth or death. A common mistake is to group a high water use plant such as a spruce together with a low water use pine. "Hydrozone" plants by grouping plants with similar water needs together so they can be effectively watered for best plant health.

When removing areas from turf, do not cover them with solid sheet plastic and gravel, rock or volcanic cinder. Plastics shed water and create wasteful runoff. They exclude water and essential air exchange to plant roots, increase evaporation from surrounding areas by raising local soil and air temperatures, and can cause root injury due to heat buildup.

Keep rock or gravel areas to a minimum. They tend to increase air and soil temperature. Use weed barrier fabrics (geotextiles) available in garden centers. These materials allow water penetration and air exchange. Cover landscape fabrics with mulch.

Instead of rock and gravel, consider organic materials such as wood chips and chunk bark. They give a natural look and help retain moisture, as well as hold weeds in check. Use mulch either with or without a landscape fabric to save water. Rock may be required to cover a steep slope where wood chips and gravel may wash away. In these cases, use natural riverbed cobble of varying sizes. Lay rock over a weed barrier fabric in much the same way as if you were constructing a rock wall.

Another option for steep slopes is to install a natural rock garden with water-conserving alpine plants. For more information, see 7.401, *Rock Gardens*. Terracing steep slopes is another option to consider.

Table 1: Low ground covers for hot, steep slopes.

Scientific Name	Common Name
Achillea tomentosa	Wooly yarrow
Artemisia schmidtiana 'Silver Mound'	Silver mound sage
Buchloe dactyloides	Buffalograss
Callirhoe involucrata	Prairie winecups
**Cerastium tomentosum*	Snow-in-summer
Delosperma species	Ice plant
Festuca ovina glauca	Blue fescue
Gazania linearis	'Colorado Gold'
Juniperus horizontalis 'Wilton' ('Blue Rug')	Blue rug juniper
Juniperus sabina 'Buffalo'	Buffalo juniper
Juniperus sabina 'Tamariscifolia'	'Tammy' juniper
Penstemon caespitosus	Creeping or mat penstemon
Penstemon pinifolius	Pineleaf penstemon
Phlox subulata	Creeping phlox
Santolina chamaecyparissus	Lavender-cotton
Sedum species	Stonecrop
Stachys byzantina	Lambs ear
Thymus pseudolanuginosus	Woolly thyme
Veronica prostrata	Prostrate speedwell
Veronica liwanensis	Turkish veronica

*Caution: These plants can be invasive if kept too moist.

Table 2: Plants for narrow planting strips.

Use any of the ground covers in Table 1 between walks and buildings or on parking strips between sidewalks and curbs, unless shaded. If the area is shaded, use one or more of the following:

Scientific Name	Common Name
**Aegopodium podagraria variegatum*	Bishop's weed
**Campanula carpatica*	Carpathian harebell
Ceratostigma plumbaginoides	Plumbago
**Convallaria majalis*	Lily-of-the-valley
**Galium odoratum*	Sweet woodruff
**Lonicera japonica* 'Halliana' Hall's	Japanese honeysuckle

Mahonia repens	Creeping Oregon grape
Polygonum affine	'Border Jewell' polygonum
Thymus pseudolanuginosus	Wooly thyme
Vinca minor	Periwinkle
*Caution: These plants can be invasive if kept too moist.	

[1].R. Feucht, Colorado State University Extension landscape plants specialist and professor (retired), horticulture. Reviewed by C.R. Wilson, Colorado State University Extension horticulture agent, Denver County. 3/96. Revised 5/06.

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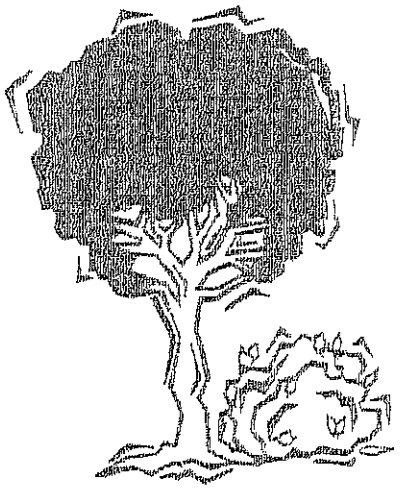

TREES & SHRUBS

Deciduous Shrubs

no. 7.415

by R.A. Cox and J.E. Klett [1]

Quick Facts...

Shrubs are multiple-stem plants that grow from 2 to more than 20 feet high.

Use shrubs for screening, privacy, windbreaks, wildlife habitats, and landscape color and texture.

Deciduous shrubs provide a seasonal change of interest in the landscape.

Well-placed shrubs take into account available space, exposure and soil conditions.

Table 1 lists shrubs for elevations below 6,000 feet that are widely available in garden centers and nurseries.

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Shrubs are immediately noticeable in the landscape because they are at eye level. Flower and fruit displays, interesting foliage shapes and colors, and even bark color and texture add outdoor interest. Shrubs can visually anchor a building to a site, guide the line of sight toward or away from certain views, and bridge the space between lower-growing perennials and taller trees to give a sense of completion to a landscape. Deciduous shrubs offer seasonal changes not found with evergreen shrubs.

Because of the range of heights available, pruning, and spacing possibilities, shrubs are versatile landscape performers. A 2-foot shrub can complement perennials in the flower bed, while a 20-foot hedge can screen even the largest property. Some shrubs may be pruned to a single or few stems for growth as small specimen trees. Pruning others flat to decorate a wall in an espalier can provide a focal point for a courtyard or walkway. Space shrubs singly or mass them in small groups to fill in a shrub border. Spacing closely in a line will allow plants to grow into a hedge or screen. The spacing at planting depends on the growth habit and mature size of the shrub species, as well as the intended purpose.

Before purchasing shrubs, decide the function you want the plants to perform in the landscape. Are you interested in screening an undesirable view, intercepting the glare of car headlights from the street, hiding the house foundation, reducing the wind velocity, attracting birds, or adding flowers or fall color?

After determining the function, write down a description of the intended planting site to include soil texture (clay, sand, etc.), available moisture, and exposure (compass direction and sunny vs. shady). Remember, as landscapes mature, a sunny site may change to a shady one.

Colorado growing conditions present both challenges and opportunities. Dry, sunny days and cool nights make plant diseases relatively rare and prolong or intensify flowering. Late frosts may damage the flowers of spring flowering shrubs. Soil conditions often are not conducive to growing certain species. Both climate and soil conditions vary widely across the state, meaning some shrubs may grow well in one area but not in others.

The following list, while not comprehensive, provides information on the more commonly available deciduous shrubs for elevations below 6,000 feet. For a listing of shrubs adapted to higher elevations, refer to fact sheet 7.423, *Trees and Shrubs for Mountain Areas*. Drought-tolerant shrubs are listed in 7.229, *Xeriscaping: Trees and Shrubs*.

Table 1: Most commonly available shrubs for elevations below 6,000 feet.

Plant Name	Soil Moisture[a]	Exposure[b]	Flower Color[c] and Month	Fruit[d]	Fall Color[e]	Comments
SMALL SHRUBS (less than 4 feet high when mature)						
Berberis thunbergii atropurpurea Purpleleaf Japanese barberry 'Crimson Pygmy'	L-M	S-PSh	NI	R	R-Pu	Reddish-purple foliage.
Caryopteris spp. Blue mist spirea	L-M	S-PSh	Bl-P/7-9	Tan	NI	Cut back in late winter.
Cornus sericea 'Kelseyi' Kelsey dogwood	H	S-PSh	NI	NI	R-Pu	Mounded; red stems.
Cotoneaster apiculatus Cranberry cotoneaster	M	S-PSh	P/5	R	R	Mounded habit.
Hydrangea arborescens Hydrangea						
'Annabelle'	M-H	Sh-PSh	W/7-9	NI	NI	Large, showy flowers.
Hypericum kalmianum Hypericum (St.John's-wort)	L-M	S-PSh	Y/7-9	NI	O-Pu	Blue-green foliage; hardier.
'Hidcote'	M	S-PSh	Y/7-9	NI	NI	Cut back to ground in fall.
Ligustrum vulgare 'Lodense' Privet, 'Lodense'	L-M	S-Sh	W/6-7	B	NI	Dark green foliage held late.
Lonicera spp. Honeysuckle						
'Emerald Mound'	M	S-Sh	W/5-6	R	NI	Mounded habit.
'Miniglobe'	M	S-Sh	W/5-6	R	NI	Hardy, compact.
'Clavey's Dwarf'	M	S-Sh	W/5-6	R	NI	Good hedge.
Potentilla fruticosa Potentilla (shrubby cinquefoil)	L-M	S-PSh	Y-W/6-9	NI	NI	Compact, rounded.
'Abbotswood'			W			Spreading.
'Coronation Triumph'			Bright Y			Upright.
'Gold Drop'			Golden Y			Compact.
'Jackmanii'			Deep Y			Upright.
'Katherine Dykes'			Light Y			Spreading.
Ribes alpinum Alpine currant	L-M	S-Sh	NI	NI	Y	Good for hedge.
Rhus aromatica 'Grow-low' 'Grow-low' sumac	L-M	S-PSh	Y/3-4	R	R-Pu	Vigorous, widespreading.
Spiraea x bumalda Bumald spirea	M-H	S-PSh	P-Pu/6-8	NI	Br-Pu	Spreading, flat-topped.
'Anthony Waterer'			R-rose			
'Froebelii'			P			Slightly taller.
'Goldflame'			P		R-O	Yellow-green foliage.
Spiraea japonica 'Little Princess' 'Little Princess' spirea	M	S-PSh	P/6-7	NI	Br	Delicate, mounded.
Symphoricarpos x chenaultii Hancock coralberry	M	S-PSh	NI	R-P	NI	Blue-green leaves; persistent fruit; lower growth.
MEDIUM SHRUBS (4-6 feet high when mature)						
Aronia melanocarpa Black chokeberry	M-H	S-PSh	W/5-6	B	O-R	Glossy green foliage.
Berberis thunbergii	L-M	S-PSh	NI	R	O-R	Spiny; hedges or barrier.
Berberis thunbergii atropurpurea *Purpleleaf* Japanese barberry					P-R	Reddish-purple foliage.
'Rose Glow'			R			Pink blotches on leaves.
Buddleia davidii Butterfly bush	M	S-PSh	L/6-7	NI	NI	Cut back in late winter.
Euonymus alatus 'Compacta' Dwarf burning bush	M	S-Sh	NI	P/O	R	Slightly winged twigs.
Chaenomeles speciosa Flowering quince	M	S-PSh	R/P/W/4	Y	NI	Spiny stems; large fruit only occasionally.
Cornus sericea 'Isanti' 'Isanti' dogwood	M-H	S-PSh	W/5-6	W	R-Pu	Red twigs; compact habit.
Ligustrum x vicaryi Golden vicary privet	M	S	W/6-7	NI	NI	May show winter dieback.
Perovskia atriplicifolia Russian sage	L	S	L-Pu/7-9	NI	NI	Very small, fine leaves; cut back to 6" in late winter.
Philadelphus coronarius 'Aureus' Golden mockorange	M-H	S	W/5-6	NI	NI	Yellow foliage all season.
Prunus x cistena Cistena plum (purpleleaf sand cherry)	M	S-PSh	P/5-6	B-Pu	Pu	Purple foliage all season.

Table 1, continued: Most commonly available shrubs for elevations below 6,000 feet.

Plant Name	Soil Moisture[a]	Exposure[b]	Flower Color[c] and Month	Fruit[d]	Fall Color[e]	Comments
Prunus glandulosa	M	S	P/4-5	NI	NI	Flowers precede leaves.
Dwarf flowering almond						
'Alba'			W			Single flowers.
'Rosea Plena'			P			Double flowers.
Rhus trilobata	L	S-PSh	Y/4	R	Y-O-R	Native; pungent foliage.
Threeleaf sumac (skunkbush)						
Ribes aureum	L-M	S-PSh	Y/4-5	B	R-Pu	Native; fragrant flowers
Golden currant						
Salix purpurea nana	M-H	S-PSh	NI	NI	NI	Fine texture; needs winter moisture.
Dwarf arctic willow						
Spiraea x vanhouttei	L-M	S-PSh	W/5-6	NI	Br	Graceful, arching habit.
Vanhoutte spirea						
Symphoricarpos albus	L-M	S-PSh	P-W/6-7	W	NI	Very adaptable.
Snowberry						
Syringa meyeri 'Palibin'	L-M	S-PSh	L-P/5-6	NI	NI	Rounded, dense habit.
Lilac, dwarf Korean						
Syringa patula 'Miss Kim'	L-M	S	Bl-L/5-6	NI	R-Pu	Rounded, dense habit.
'Miss Kim' lilac						
Viburnum opulus 'Compactum'	M-H	S-PSh	W/5-6	R	NI	Showy, persistent fruit.
Compact European cranberrybush viburnum						
Viburnum trilobum 'Compactum'	M-H	S-PSh	NI	NI	R	Dense, rounded.
Compact American cranberrybush viburnum						
Weigela florida	M	S-PSh	P/5-6	NI	NI	Trumpet-shaped flowers.
Weigela						
'Java Red'			P-R			Bronze-red foliage.
'Vanicek'			R			
LARGE SHRUBS (greater than 6 feet tall when mature)						
Amelanchier spp.	M	S-PSh	W/4-5	R-Pu	YOR	Shrub or small tree.
Serviceberry (Juneberry)						
Caragana arborescens	L	S	Y/5	NI	Y	Very adaptable.
Siberian peashrub						
Cornus sericea	M-H	S-PSh	W/5-6	W-Bl	R-Pu	Red stems in winter.
Redtwig dogwood						
'Baileyi'				W-Bl		Red stems in winter.
'Flaviramea' (yellowtwig dogwood)				W-Bl		Yellow stems in winter.
Cotinus coggygria	M	S-PSh	P-W/7	NI	Pu-O	Flowers like "pink smoke."
Smoketree						
'Royal Purple'						Purple leaves; less hardy.
'Nordine'						Purple leaves; hardier.
Cotoneaster acutifolia	L-M	S-PSh	NI	B	R-O	Screening or hedge use.
Peking cotoneaster						
Euonymus alatus	M	S-Sh	NI	P/R/O	R	Winged stems; pink fruit.
Burning bush (winged euonymus)						
Euonymus europaeus	M	S-Sh	NI	R-Pu/O	R-Pu	Shrub or small tree.
Spindletree (European euonymus)						
Forsythia spp.	M	S	Y/3-4	NI	Y-Pu	
Forsythia						
'Meadowlark'						Hardy flower buds.
'Northern Gold'						Smaller; flower buds hardy.
'Northern Sun'						Flower buds hardy.
Hibiscus syriacus	M	S-PSh	V/7-8	NI	NI	Showy, late flowers.
Rose-of-Sharon (shrub althea)						
Hydrangea paniculata 'Grandiflora'	M-H	S-PSh	W/7-8	NI	NI	Large flower clusters.
PeeGee hydrangea						
Kolkwitzia amabilis	L-M	S-PSh	P/5-6	NI	Br	Shredding bark; coarse.
Beautybush						
Ligustrum vulgare 'Cheyenne'	M	S-PSh	W/6-7	B	NI	If sheared, no flowers or fruit.
Cheyenne privet						
Lonicera korolkowii	L-M	S	P/5	R	NI	Resistant to aphids.
Blueleaf honeysuckle						
Lonicera tatarica						
Honeysuckle, Tatarian						
'Arnold Red'	L-M	S-PSh	R/5	R	NI	Some resistance to aphids.
Philadelphus x virginalis	M-H	S-PSh	W/5-6	NI	NI	Fragrant flowers; coarse.
Mockorange						
Physocarpus opulifolius	M	S	W/5-6	NI	Y-O	Shreddy bark; adaptable.
Common ninebark						
'Dart's Golden'						Yellowish-green foliage.
'Luteus'						Golden yellow foliage.

Table 1, continued: Most commonly available shrubs for elevations below 6,000 feet.

Plant Name	Soil Moisture[a]	Exposure[b]	Flower Color[c] and Month	Fruit[d]	Fall Color[e]	Comments
Prunus tomentosa Nanking (Manchu) cherry	L-M	S-PSh	P-W/4	R	Y	Edible fruit attracts birds.
Prunus triloba Double flowering plum	M	S-PSh	P/4	NI	NI	Double pink flowers.
Prunus virginiana Common chokecherry	M	S-PSh	W/5	R-Pu	Y	Suckering, attracts birds.
'Shubert' (Canada red cherry)						Green leaves turn maroon.
Rhamnus frangula 'Columnaris' Columnar buckthorn (Tallhedge)	M	S-PSh	NI	R-B	Y	Thornless; vertical habit.
Rhus glabra Smooth sumac	L-M	S-PSh	G-Y/5-6	R	R-O	Suckers; best in poor soil.
Rhus typhina Staghorn sumac	L-M	S-PSh	G-Y/5-6	R	R-O	Larger; suckers; poor soil.
'Laciniata'						Deeply cut leaves.
Salix discolor Pussywillow	H	S	Gray/3-4	NI	NI	Early catkins (flowers), very susceptible to canker.
Sambucus canadensis 'Aurea' Golden elder	M-H	S	W/6-7	R-B	NI	Golden leaves; edible fruit.
Sorbaria sorbifolia Ash-leaf spirea (Ural false-spirea)	M	S-PSh	W/6-7	NI	NI	Lush foliage; suckering.
Syringa x chinensis Chinese lilac	M	S	Pu/5	NI	Y	Small leaves, loose flowers.
Syringa x prestoniae Canada lilac	M	S	Bl-L-P-Pu/5-6	NI	Y	Blooms later.
'James McFarlane'			P			Upright growth habit.
'Minuet'			Pu			Slightly smaller shrub.
Syringa vulgaris Common lilac (includes "French hybrids")	M	S	V/5	NI	NI	Prone to powdery mildew.
'Charles Joly'			R-Pu			Double flowers.
'President Grevy'			Lt Bl			Double flowers.
Viburnum x burkwoodii Burkwood viburnum	M	S-PSh	P-W/4-5	R-B	NI	Leathery leaves persist.
Viburnum lantana Wayfaring tree viburnum	L-M	S-PSh	W/4-5	R-B	Pu-Br	Leathery leaves persist.
'Mohican'						More compact form.
Viburnum lentago Nannyberry viburnum	M	S-PSh	W/4-5	Bl	ROPu	Can be used as a small tree.
Viburnum opulus European cranberrybush viburnum	M-H	S-PSh	W/5-6	R	R-Pu	Fruit persists; aphid prone.
'Roseum' (Snowball)				NI		Showier flowers; aphid prone; no fruit.
Viburnum x rhytidophylloides 'Alleghany' 'Alleghany' viburnum	M	S-PSh	W/5-6	R-B	Pu-Br	Leathery leaves persist.
Viburnum trilobum American cranberrybush viburnum	M-H	S-PSh	W/5-6	R	R-Pu	Showy, persistent fruit; less aphid prone.

[a] Soil moisture: L=Low M=Medium H=High

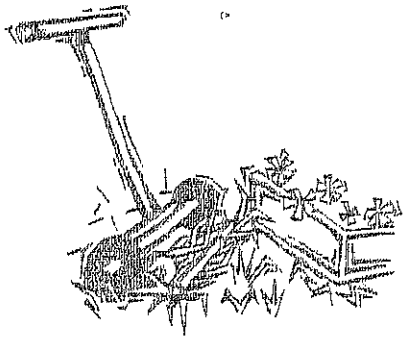
[b] Exposure: S=Sun PSh=Partial shade Sh=Shade

[c] Flower color: Bl=Blue G=Green L=Lavender P=Pink Pu=Purple R=Red W=White Y=Yellow
V=varies with cultivar NI=Not important
Months numbered 1 - 12

[d] Fruit: B=Black Bl=Blue O=Orange P=Pink Pu=Purple R=Red W=White Y=Yellow
NI=Not important

[e] Fall color: Br=Bronze O=Orange Pu=Purple R=Red Y=Yellow NI=Not Important

[1]*R.A. Cox, Colorado State University Extension horticulture agent, Arapahoe County; and J.E. Klett, Extension horticulture specialist, horticulture and landscape architecture.*



YARD

Xeriscaping: Ground Cover Plants no. 7.230

by J.E. Klett[1]

Quick Facts...

Ground covers are good alternatives where turfgrasses are impractical.

Suitable places for drought-tolerant ground covers include narrow strips between sidewalks or structures and steep slopes where mowing and irrigation are not practical.

Consider ground covers other than grasses on hot, dry exposures, as well as for dense shade beneath trees and shrubs.

Improve soils before planting most ground covers.

Ground cover plants are good alternatives to turfgrasses in some locations. They provide a variety of textures and colors, help reduce soil erosion, and can serve as a transition between turf areas and shrub or flower borders. Consider ground cover plants for areas where irrigation and mowing are difficult and require extra maintenance. Ground cover plants may be useful in areas such as:

- non-irrigated narrow strips between sidewalks and curbs or buildings;
- steep slopes that are impractical to mow;
- hot, dry areas along south and west exposures of walls or fences; and
- deeply shaded areas beneath trees or shrubs, along north sides of walls and fences, and in foundation plantings in front of low windows.

Ground covers also can enhance the beauty of shrub borders and can break up the monotony of areas previously covered with decorative gravel.

Soils and Exposure

The key to successful ground cover establishment is good soil conditions. Most ground covers spread by offshoots or runners and are more apt to fill in quickly where the soil has good aeration, drainage and organic matter content. Our typical heavy clay soils are not ideal, even for plants that can survive in poor soils, such as many Colorado native plants.

Pay attention to exposure. Most xeric ground covers do best in full sun, but a few thrive in partial shade. Tables 1 and 2 indicate those for sun and shade, respectively, along with some comments on their qualities as a ground cover.

Weed Control

Prior to planting ground covers, make sure that existing weeds are controlled. Perennial weeds can be especially troublesome later on if not eliminated prior to planting. Glyphosate (Roundup® or Kleenup®) controls most weeds if applied directly to actively growing weedy vegetation a few weeks prior to planting. This chemical does not leave a harmful residue in the soil, allowing planting in treated areas two weeks after spraying.

Weeds also can be discouraged by using weed barrier fabrics available in many garden centers. Anchor fabric edges with U-shaped wire pins about 6 inches long. Plant through slits cut into the barrier. Put a decorative mulch on top of the fabric. Avoid using plastic film for a weed barrier. Plastic films prevent weeds, but they also tend to suffocate plant roots and prevent water infiltration.

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Table 1. Ground cover plants for full sun.

Plant Name	Height (In)	Remarks
Achillea ageratifolia Greek yarrow	2-3	Gray-green foliage; spreading.
Achillea tomentosa Woolly yarrow	2-4	Grayish foliage in low mats.
Alyssum montanum Mountain alyssum	4-12	Yellow flowers; gray-green foliage; good for rock gardens.
Anacyclus pyrethrum var. *depressus* Mount Atlas daisy	1-3	White daisies with red undersides; silvery foliage.
Antennaria dioica Pussytoes	1-2	Persistent gray-green foliage in dense mats; excellent for rocky slopes.
Arabis caucasica (*alpina*) Rockcress	6-9	Soft, gray, spreading foliage; common variety is 'Snowcap'.
Artemisia spp. Sage	10-15	Silvery foliage; *A. schmidtiana* (silver mound sage) most common.
Aubrieta deltoidea False rockcress	4-6	Several varieties; mat-like foliage.
Aurinia saxatilis Basket-of-gold	8-18	Shear after bloom; good for rock gardens.
Callirhoe involucrata Poppy mallow, winecups	4-12	Trailing stems with saucer-like flowers.
Centaurea montana Perennial bachelor button	15-18	Grayish foliage; blue flowers.
Cerastium tomentosum Snow-in-summer	6	Gray foliage; white flowers; very aggressive.
Coreopsis auriculata Dwarf coreopsis	5-15	Stoloniferous mats of slender leaves; orange or yellow blooms in summer.
Delosperma cooperi Purple ice plant	2-4	Succulent foliage turns reddish in winter; purple flowers.
Delosperma nubigenum Yellow ice plant	1-2	Succulent, light-green foliage; yellow flowers.
Duchesnea indica Mock strawberry	4-6	Aggressive creeper; looks much like strawberry; yellow flowers; inedible, red fruit.
Eriogonum umbellatum Sulphur flower	6-12	Showy flower stalk to 8 inches tall; foliage in low mat.
Euphorbia polychroma Cushion spurge	12-18	Mounds of foliage that change from reddish to green in spring, then scarlet in fall.
Festuca ovina glauca Blue fescue	6-8	Tufts of grayish, grassy foliage.
Frangaria vesca Runnerless strawberry	2-6	Native strawberry; small edible berries.
Gypsophila repens Creeping baby's breath	4-6	Gray-green foliage; trailing.
Juniperus horizontalis Creeping juniper	4-10	Perhaps the best year-round cover; many clones and foliage hues available.
Some common clones include:		
'Bar Harbor'	10	Blue-green; purplish winter color.
'Blue Chip'	10	Bluish foliage year-round.
'Hughes'	10	Silvery-blue; distinct radial branching.
'Webberi'	4	Very low mat; fine texture.
'Wiltoni' ('Blue Rug')	4	Very low; silver-blue; purplish tinge in winter.
Nepeta x *faassenii* Catmint	15-36	Commonly sold varieties are 'Six Hills Giant' and 'Walker's Low'.
Oenothera speciosa Mexican evening primrose	6-12	Spreads quickly; may become invasive; pink blooms..
Parthenocissus quinquefolia Virginia creeper	Vine	Can use as vine or groundcover; aggressive; red fall color; commonly sold variety is 'Engelmannii'.
Penstemon pinifolius Pineleaf penstemon	6-10	Has needle-like leaves and orange-red flowers; takes heat well.
Phlox subulata Creeping phlox	6-8	Reddish, white or lavender flowers; moss-like foliage.
Polygonum affine Himalayan border jewel	12-18	Red, showy flowers late in season; excellent ground cover for dry areas.

Table 1 (continued): Ground cover plants for full sun.

Plant Name	Height (in)	Remarks
Polygonum aubertii Silverlace vine	Vine	Aggressive vine usable as ground cover.
Potentilla nepalensis 'Miss Willmott' Miss Willmott cinquefoil	10-16	Strawberry-like leaves; rosy-red flowers that bloom in June and July.
Potentilla neumanniana 'Nana' Dwarf creeping potentilla	2-4	Very low mat with yellow, showy flowers; aggressive.
Prunella grandiflora Self-heal	8-12	Dense mat; several varieties; can grow in part shade.
Prunella laciniata Lacy self heal	8-12	Fuzzy evergreen foliage; can grow in part shade.
Prunus besseyi Pawnee Buttes® Pawnee Buttes® sandcherry	15-18	Similar to native sandcherry but with a low, spreading habit; woody plant.
Rhus aromatica 'Gro-low' 'Gro-low' Fragrant sumac	24-26	Vibrant orange-red fall color; very drought tolerant; woody plant; can spread up to 8 feet in diameter.
Rosa x 'Sea Foam' White shrub rose	24-36	Double-white blooms; trailing groundcover or over walls; can spread up to 6 feet in diameter.
Santolina chamaecyparissus Lavender-cotton	12-18	Blue-gray, persistent foliage in dense mats.
Saponaria ocymoides Rock soapwort	6-12	Pink blooms in May and June; shear after bloom.
Sedum spp. Stonecrop (sedum)	1-15	Many forms available; not usually competitive with weeds.
Sempervivum spp. Houseleek, hen and chicks	2-4	Forms dense, evergreen mats; grows in very poor soils.
Stachys byzantina Lamb's ear	8-10	Furry, gray leaves resemble a lamb's ear; can be invasive unless flowerless varieties are used.
Symphoricarpos x *chenaultii* 'Hancock' Hancock coralberry	24-36	Can spread to 12 feet in diameter; stems root where they touch the ground; can grow in filtered shade.
Tanacetum densum amani Partridge feather	6-8	Finely-cut, silvery-white foliage; yellow blooms in May and June.
Teucrium chamaedrys Germander	8-12	Dark green leaves; evergreen; erect stems; can be sheared.
Thymus praecox Creeping thyme	1-4	Low growing, fragrant, evergreen foliage.
Thymus praecox 'Pseudolanuginosus' Woolly thyme	1-4	Mat-like, woolly-gray foliage; turns purplish in winter; sparse flowers.
Thymus serpyllum Mother-of-thyme	3-6	Low, mat-forming herb with tiny leaves; gray-green foliage.
Thymus x *citriodorus* Lemon thyme	6-12	Lemon-scented foliage.
Verbena bipinnatifida Plains verbena	3-6	Deeply-cut foliage; sprawling stems up to 18 inches.
Veronica filiformis Birdseye speedwell	1-3	Grows quickly; blue flowers bloom June through August.
Veronica liwanensis Turkish veronica	1-4	Dark green leaves and cobalt blue flowers bloom in May and June.
Veronica pectinata Woolly veronica	1-2	Low growing; gray foliage; evergreen some winters.
Veronica prostrata Prostrate speedwell	1-2	Dark green foliage; deep blue flowers in short spikes.
Veronica spicata incana Silver speedwell	12-18	Silvery foliage.
Zauschneria garrettii Orange Carpet® California fuchsia	4-12	Good for cascading over walls; orange tubular flowers in September and August.

Table 2: Ground cover plants for shade.

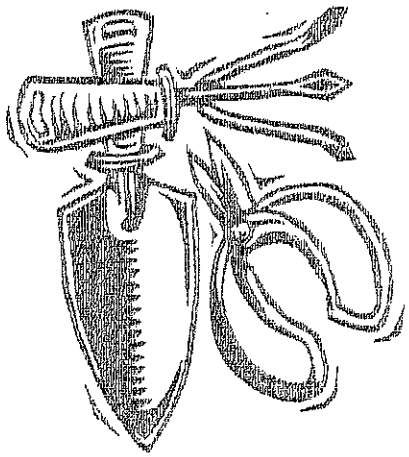
Plant Name	Height (In)	Remarks
Aegopodium podagraria 'Variegatum' Bishop's goutweed	10-12	Variegated, green and white foliage; aggressive.
Arctostaphylos uva-ursi Kinnikinnick	4-6	Evergreen; red, edible berries; use beneath established evergreens in acid soils.
Convallaria majalis Lily-of-the-valley	6-10	Fragrant, white flowers in May-June; inedible, red berries; aggressive.
Euonymus fortunei 'Coloratus' Purpleleaf wintercreeper	12-18	Foliage turns purple through winter; many other varieties available.
Galium odoratum Sweet woodruff	6-8	Very aggressive; one of the best covers under shrubs; white, fragrant flowers in May-June.
Lonicera japonica 'Halliana' Hall's Japanese honeysuckle	6-12	Will also grow in full sun, but forms denser mats in shade; fragrant white flowers.
Mahonia repens Creeping Oregon grape	6-12	Evergreen; yellow flowers in spring followed by bluish-purple berries; holly-like foliage.
Vinca minor Periwinkle	4-6	Semi-evergreen; white or purple flowers in spring.
Waldsteinia ternata Barren strawberry	4-10	Compact growth habit; fruit inedible.

Other Xeriscaping Fact Sheets

For more information on xeriscaping and plant selection, see these Colorado State University Extension fact sheets:

- 7.228, *Xeriscaping: Creative Landscaping.*
- 7.229, *Xeriscaping: Trees and Shrubs.*
- 7.231, *Xeriscaping: Garden Flowers.*
- 7.234, *Xeriscaping: Retrofit Your Yard.*

[1]*J.E. Klett, Colorado State University Extension landscape horticulturist and professor, department of horticulture and landscape architecture. Revised from original fact sheet authored by J.R. Feucht, retired.*



BASICS

Fall and Winter Watering

no. 7.211

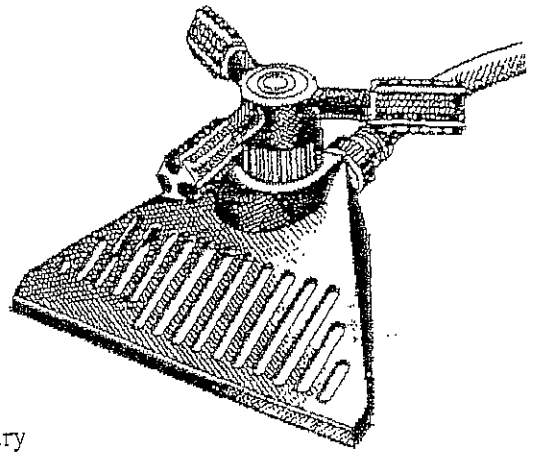
by J.E. Klett and C. Wilson [1]

Quick Facts...

Water trees, shrubs and lawns during prolonged dry fall and winter periods to prevent root damage that affects the health of the entire plant.

Water only when air and soil temperatures are above 40 degrees F with no snow cover.

Established large trees have a root spread equal to or greater than the height of the tree. Apply water to the most critical part of the root zone within the dripline.



Dry air, low precipitation, little soil moisture, and fluctuating temperatures are characteristics of fall and winter in many areas of Colorado. There often can be little or no snow cover to provide soil moisture, particularly from October through February. Trees, shrubs, perennials and lawns can be damaged if they do not receive supplemental water.

The result of long, dry periods during fall and winter is injury or death to parts of plant root systems. Affected plants may appear perfectly normal and resume growth in the spring using stored food energy. Plants may be weakened and all or parts may die in late spring or early summer when temperatures rise. Weakened plants also may be subject to insect and disease problems.

Plants Sensitive to Drought Injury

Woody plants with shallow root systems require supplemental watering during extended dry fall and winter periods. These include European white and paper birches; Norway, silver, red and Rocky Mountain and hybrid maples; lindens, alder, hornbeams, dogwood and mountain ash. Evergreen plants that benefit include spruce, fir, arborvitae, yew, Oregon grape-holly and Manhattan euonymus. Woody plants benefit from mulch to conserve soil moisture.

Herbaceous perennials in exposed sites are more subject to winter freezing and thawing. This opens cracks in soil that expose roots to cold and drying. Winter watering combined with mulching can prevent damage (See fact sheet 7.214, *Mulches for Home Grounds*.)

Lawns also are prone to winter damage. Newly established lawns, whether seed or sod, are especially susceptible to damage. Susceptibility increases for lawns with south or west exposures.

Watering Guidelines

Water only when air temperatures are above 40 degrees F. Apply water at mid-day so it will have time to soak in before possible freezing at night. A solid layer (persisting for more than a month) of ice on lawns can cause suffocation or result in matting of the grass.

Plants receiving reflected heat from buildings, walls and fences are more subject to damage. The low angle of winter sun makes this more likely in south or

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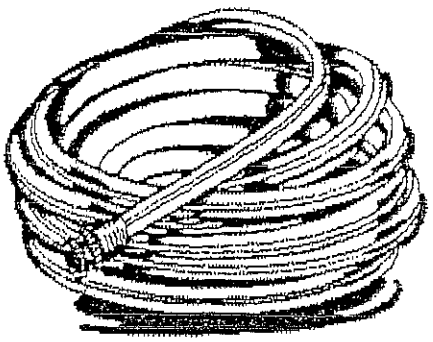
west exposures. Windy sites result in faster drying of sod and plants and require additional water.

Monitor weather conditions and water during extended dry periods—one to two times per month without snow cover.

Newly Planted vs. Established Plants



Newly planted trees are most susceptible to winter drought injury. Woody trees generally take one year to establish for each inch of trunk diameter. For example, a two inch diameter (caliper) tree takes a minimum of two years to establish under normal conditions. (See fact sheet 7.833, *The Science of Planting Trees*)

Trees obtain water best when it is allowed to soak into the soil slowly to a depth of 12 inches. Methods of watering trees include: sprinklers, deep-root fork or needle, soaker hose or soft spray wand. Apply water to many locations under the dripline and beyond if possible. If you use a deep-root fork or needle, insert no deeper than 8 inches into the soil. (See fact sheet 7.240, *Home Landscape Watering During Drought.*) As a general survival rule, apply 10 gallons of water for each diameter inch of the tree. For example, a two-inch diameter tree, needs 20 gallons per watering. Use a ruler to measure your tree's diameter.

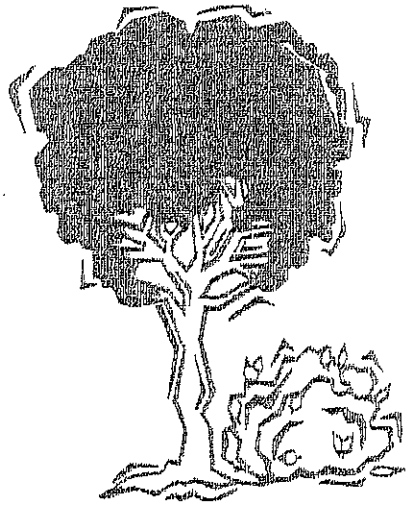
*For more information, see the following Plant*talk *Colorado™ script.*

1751, Fall and Winter Watering: during drought

Newly planted shrubs require more water than established shrubs that have been planted for at least one year. The following recommendations assume shrubs are mulched to retain moisture. In dry winters, all shrubs benefit from winter watering from October through March. Apply 5 gallons two times per month for a newly planted shrub. Small established shrubs (less than 3 feet tall) should receive 5 gallons monthly. Large established shrubs (more than 6 feet) require 18 gallons on a monthly basis. Decrease amounts to account for precipitation. Water within the dripline of the shrub and around the base.

Herbaceous perennial establishment periods vary. Bare root plants require longer to establish that container plants. Plants transplanted late in the summer or fall will not establish as quickly as plants planted in the spring. Winter watering is advisable with late planted perennials, bare root plants, and perennials located in windy or southwest exposures.

[1]J.E. Klett, Colorado State University Cooperative Extension horticulture specialist and professor, horticulture and landscape architecture; and C. Wilson, Extension horticulture agent, Denver County.



G A R D E N I N G S E R I E S

TREES & SHRUBS

Small Deciduous Trees

no. 7.418

by J.E. Klett and C. Wilson[1]

Quick Facts...

Consider available space, protection, growth rate and soil adaptability when selecting small trees.

If space allows, several kinds of small trees provide varied foliage, flowers, bark, fruit and fall color for year round interest.

Make sure the water requirements of the tree match the conditions at your site.

Look for new varieties of small trees that are continually introduced.

Selection and Planting

Examine the proposed site before planting trees. Allow adequate width to keep walkways, entryways, driveways or buildings clear of overhanging branches. Many small trees, although short, can spread as much laterally as vertically.

Soil. Prepare soil before planting. Loosen it several feet in all directions from the spot you wish to plant. If the soil is heavy clay and hard to work, add aged manure or compost, and work it into the soil at least 12 inches deep. A wider selection of trees is available for planting on long-cultivated soils than new sites.

Color and texture. For variety, plant several kinds of trees if space allows. Through careful selection, you can have flowers, colorful and interesting bark and fruits, varied foliage texture, and fall colors for year round interest. Coordinate with other plants and elements of your overall landscape design.

Water. Match the plant with the moisture conditions of the site. Low-moisture trees planted in an irrigated lawn grow too fast. On the other hand, trees that require moderate to heavy moisture do poorly in areas where little or no supplemental water can be applied.

Protection. Microclimate sites protected by buildings, fences and larger trees offer greater opportunities for tree selection than open, exposed locations.

Recommended Trees

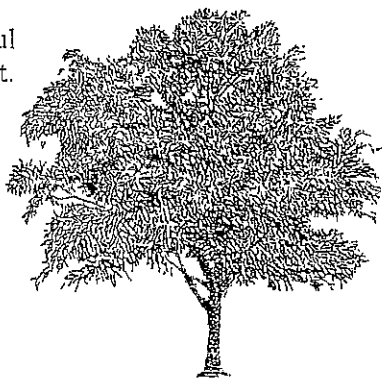


Table 1 includes small trees that are useful for privacy screening as well as landscape interest. Most can be used beneath power lines with little or no need for pruning to maintain clearance. For information on larger trees, see fact sheet 7.419, *Large Deciduous Trees*. The key to symbols used in the table is given below.

Growth rate:

- f = fast
- m = moderate
- s = slow

Soil moisture:

- L = low-water needs; can withstand drought.
- M = moderate water needs; normal lawn watering.
- H = heavy water needs; more than normal lawn watering.

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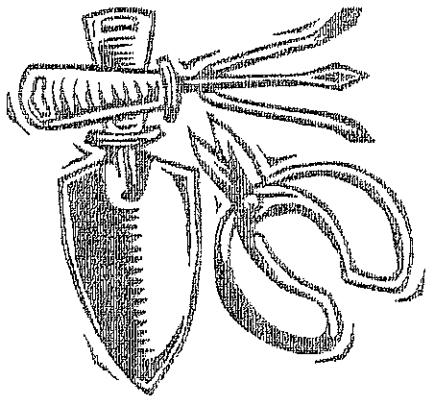
Table 1: Small deciduous trees for privacy and color.

Plant Name	Height (ft)	Spread (ft)	Shape	Growth Rate	Soil Moisture	Remarks
Acer campestre Hedge maple	25	25	Rounded	m	M	Dark green leaves, yellow fall color, tolerant of alkaline soils.
Acer ginnala Amur maple	20	15	Broad, spreading	m	M	Availiable as single-stemmed tree or multi-stemmed shrub; scarlet fall color; avoid alkaline soils.
Acer glabrum Rocky Mountain maple	15	15	Upright, oval	m	M	Native, small tree or large shrub, gray bark, yellow fall color, bright red winter buds.
Acer grandidentatum Wasatch maple	25	15	Broad, spreading	m	L	Survives in dry sites once established; orange--red fall color, more difficult to establish.
Acer tataricum Tatarian maple	20	20	Irregular, rounded	m	L	Single or multi-stemmed tree, pink to red winged seeds in summer, yellow fall color, tolerant of alkaline soils, more adaptable than Amur maple.
Alnus tenuifolia Thinleaf alder	15	12	Upright, oval	m	H	Use in moist sites; cone-like fruit clusters persist in winter, tend to form clumps.
Amelanchier canadensis Shadblow serviceberry	25	20	Upright, rounded	m	M	Showy, white flowers in spring; red fruits attract birds, red-orange fall color.
Amelanchier x grandiflora 'Autumn Brillance' Autumn Brilliance serviceberry	20	15	Rounded	m	M	White flowers, red to purple fruit, orange to red fall color, single-stemmed tree or multi-stemmed shrub.
Amelanchier laevis Allegheny serviceberry	20	15	Upright, irregular	m	M	Multi-stemmed tree, early spring white flowers, late purple fruits attract birds, tolerant of a kaline soils, yellow to orange fall color.
Betula occidentalis Rocky Mountain or water birch	20	15	Upright, rounded	m	H	Use in moist soils; yellow fall color, tends to form clumps, cherry-brown bark.
Carpinus caroliniana American hornbeam	25	25	Rounded, spreading	s-m	M	Low branched smooth gray bark, "muscled" branches, yellow-orange fall color.
Cercis canadensis Eastern redbud	25	25	Upright, spreading	m	M	Early pink flowers along twig before foliage; plant in part shade, heart shaped leaves.
Cornus alternifolia Pagoda dogwood	20	20	Rounded	m	M	Horizontal branching, creamy-white flowers followed by blue-black fruit, red to purple fall color.
Cornus mas Cornelian cherry dogwood	20	15	Rounded	m	M	Early yellow flowers before foliage, bright red fruit in summer.
Cornus racemosa Gray dogwood	15	15	Rounded	m	M	Available as a tree, creamy white flowers, white fruit with persistent red fruit stalks, purple fall color.
Crataegus ambigua Russian hawthorn	20	15	Upright, spreading	m	L	Finely cut, glossy leaves; white flowers; persistent, red fruit.
Crataegus crus-galli Cockspur hawthorn	20	20	Broad, rounded	m	L	Showy, white flowers; red fruit; glossy foliage; thorny; attracts birds.
var. *inermis* Thornless cockspur hawthorn	15	15	Broad, rounded	m	L	Thornless, other characteristics same as species.
Crataegus mollis Downy hawthorn	25	20	Broad globe	m	M	Showy, white flowers in spring; red fruit in late summer; bronze fall color, stout thorns.
Crataegus phaenopyrum Washington hawthorn	20	15	Upright, spreading	m	M	White flowers; showy, orange-red fruit; red-orange fall color; narrow thorns.
Crataegus x mordenensis 'Toba' Toba hawthorn	15	15	Rounded	m	M	Fragrant, double, white flowers, age to pink; red fruit, stout thorns.
Euonymus bungeanus Winterberry	20	18	Rounded	m	M	Horizontal to pendulous branching, yellow to red fall color, pink fruit capsules open to reveal orange seeds.
Euonymus europaeus European euonymus	15	15	Rounded	m	M	Pink to red fruit capsules open to expose orange seeds. Red to purple fall color.
Koelreuteria paniculata Goldenrain tree	25	20	Upright, rounded	m	L	Best grown on dry sites to avoid fast, brittle branch growth; large penicles of yellow flowers in summer; Chinese lantern-like pods.
Malus spp. Crabapple	Varies	Varies	Varies	m-f	M-L	Many varieties available.
'Brandywine'®	20	20	Rounded	m-f	M-L	Double pink flowers, large green fruit. More resistant to fireblight than 'Bechtel.'

Table 1: Small deciduous trees for privacy and color.

Plant Name	Height (ft)	Spread (ft)	Shape	Growth Rate	Soil Moisture	Remarks
'Centurion'	20	10	Upright	m-f	M-L	Pink to red flowers; red fruit; red to bronze foliage.
'Coralburst®'	15	15	Rounded	m-f	M-L	Red buds open to semi- double pink flowers, few bronze fruit. Resistant to fireblight.
'David'	15	15	Rounded	m-f	M-L	Pink buds open to white flowers, yellow-red fruit matures to red. Resistant to fireblight.
'Dolgo'	30	25	Spreading	m-f	M-L	White flowers; crimson fruit, yellow bark, resistant to fireblight.
'Indian Summer'	15	15	Rounded	m-f	M-L	Rose-red flowers, red fruits. Resistant to fireblight.
'Radiant'	20	20	Rounded	m-f	M-L	Single, pink-red flowers; red-purple fruit.
sargentii 'Tina'	8	10	Spreading	m-f	M-L	Dwarf, red buds open to white flowers, red fruit.
'Spring Snow'	20	15	Upright, rounded	m-f	M-L	White flowers, usually fruitless; dense foliage; yellow bark.
Populus tremuloides Quaking aspen	30	15	Upright, columnar	f	M	Best in moist, well-drained soil; pest prone and shorter lived at lower Front Range elevations and in heavy soils; root suckers form clumps.
Prunus cerasifera 'Newport' Newport plum	20	20	Upright, rounded	m-f	M	Pinkish-white flowers followed by maroon-red foliage; avoid wet sites.
Prunus maackii Amur chokecherry	25	25	Upright, rounded	m	M	Striking, shiny, orange-red bark; white flowers; black fruit, avoid heavy soils.
Prunus nigra 'Princess Kay' Princess Kay plum	15	10	Upright, vase	m	M	Double white flowers before leaves, orange-red fall color, dark brown-black bark.
Prunus padus var. commutata Mayday tree	30	15	Rounded	m	M	Fragrant chains of white flowers in spring; purple-black fruit.
Prunus virginiana 'Shubert' Shubert or Canadian red chokecherry	25	20	Rounded	f	M	New green growth turns purple-red, white; flowers, purple fruit, suckers like aspen.
Ptelea trifoliata Wafer ash, Hoptree	15	15	Rounded	m	M-L	Native multi-stemmed tree, persistent wafer-like fruit, golden-yellow fall color.
Pyrus calleryana Callery pear	Varies	Varies	Varies	m	M	
'Aristocrat'	25	20	Pyramidal, oval	m	M	Wave, cupped leaves, white flowers, red to bronze fall color.
'Autum Blaze'	30	15	Pyramidal, rounded	m	M	Good cold hardiness, white flowers, crimson red fall color.
'Chanticleer®' ('Cleveland Select')	25	15	Pyramidal, upright	m	M	White flowers, red-purple fall color.
'Redspire'	25	10	Pyramidal, upright	m	M	Large white flower clusters, crimson-purple fall color.
Pyrus ussuriensis 'Prairie Gem' Prairie Gem pear	20	18	Rounded	m	M-L	Yellowish-brown bark, many white flowers, thick glossy green leaves, golden-yellow fall color.
Quercus gambelii Gambel oak	15	10	Upright, clump	s	L	Forms groves by creeping root stocks; often shrubby; needs well-drained soils; golden-yellow fall color.
Robinia pseudoacacia 'Purple Robe' Purple Robe locust	30	25	Upright, rounded	f	M-L	Bronze-red new foliage turns blue-green, showy dark rose-pink flowers, can have small thorns, subject to locust borer and branch breakage.
Sorbus aucuparia European mountain ash	20	15	Oval	m	M	Smooth gray-brown bark, malodorous white flowers, persistent orange-red fruit, yellow to red-purple fall color.
'Cardinal Royal'	25	15	Narrow oval	m	M	Straight trunk, dark green leaves turn russet-red in fall, red fruit, best in well drained soils.
Syringa reticulata Japanese tree lilac	20	20	Rounded	m	M	Creamy panicles of fragrant flowers in late spring, red-brown shredding bark.
'Ivory Silk'	15	15	Compact, oval	m	M	Creamy white flowers, cherry-like bark.

[1]J.E. Klett, Colorado State University Cooperative Extension specialist and professor, horticulture and landscape architecture; and C. Wilson, Cooperative Extension horticulture agent, Denver County.



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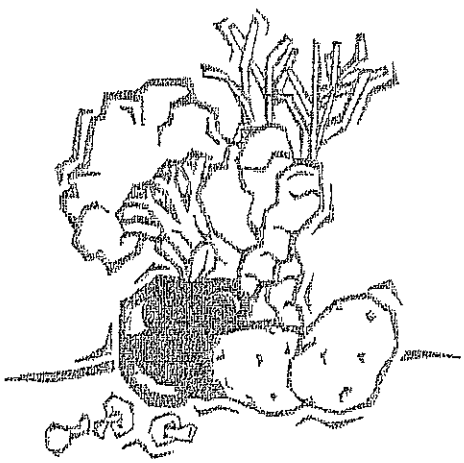

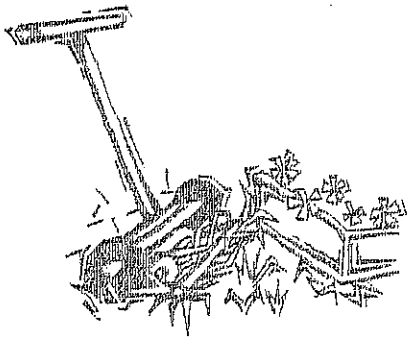

YARD

Control of Annual Grassy Weeds in Lawns no. 3.101

by Anthony J. Koski [1]

Crabgrass, foxtail, barnyardgrass and goosegrass can be important lawn weed problems at lower elevations (below 6,000 to 6,500 feet) in Colorado. These weeds belong to a group called summer annual grasses. It's important to understand their growth cycle if you want to control them.

Quick Facts...

Crabgrass, foxtail, barnyardgrass and goosegrass can be problem lawn weeds below 6,000 to 6,500 feet in Colorado.

In summer, mow grasses as high as practical for the grass species in your lawn.

Keep bluegrass, tall fescue, fine fescue and ryegrass at 2 1/2 to 3 inches during the summer.

Irrigate properly to help reduce annual weed infestation. Light, frequent irrigation encourages weed seed germination, even if a preemergence herbicide has been applied.

Growth

The seeds of summer annual grasses fall to the ground the previous autumn and germinate the following year, from midspring through midsummer. Germination depends on soil temperature, not air temperature, and generally begins when surface soil temperatures reach 55 to 60 degrees F. Soil temperatures optimal for the germination of crabgrass will closely coincide with the blooming of forsythia shrubs in the local area. Once germinated, these grasses grow quickly during the summer months. Their growth is favored by warm temperatures and a good supply of water. Each annual grass plant produces thousands of seeds from midsummer through the early fall, when the first frost kills them.

There are several approaches to managing annual grasses in the home lawn. They include both cultural (non-herbicidal) and chemical (herbicidal) techniques.

Non-Herbicidal Control

- Mow as high as practical during the summer months for the particular grass species present in your lawn. Mow bluegrass, buffalograss, tall fescue, fine fescue and ryegrass at 2 1/2 to 3 inches during the summer. The seeds of some weeds require high light intensity to germinate. The shaded environment near the soil surface in a high-mown lawn helps deter weed seed germination. In addition, the higher mowing height produces a healthier grass plant. Crabgrass and other annual grassy weeds are much more common and aggressive in lawns that are mowed less than 2 inches.
- Mow often enough so that no more than one-third of the grass blade is removed in a single mowing. Letting grass grow tall and then cutting it back to a low height reduces turf density, allowing weed seeds to germinate and grow more easily. It is especially important to mow a lawn more frequently in the spring, when the grass is growing faster. A lawn may require mowing every three to five days during the spring and early summer.
- Irrigate properly to help reduce annual weed infestation (see fact sheet 7.202, *Lawn Care*). Light, frequent irrigation encourages weed seed germination, even if a preemergence herbicide has been applied.
- Fertilize according to the needs of your lawn species. See 7.202 for information or proper fertilization of the common lawn grasses.

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- Core cultivate (aerate) the lawn at least once a year to reduce compaction and to control thatch.

Preemergence Herbicides

Preemergence herbicides control crabgrass by preventing seedling crabgrass from becoming established. To be effective, they must be applied before the crabgrass seed germinates. In southern and western Colorado, crabgrass seed can germinate from late March to early April. Along the northern Front Range, it can germinate from mid-April to mid-May.

Apply preemergence herbicides two to four weeks before the above dates. The actual germination of crabgrass varies from year to year, depending on the weather. Warm, moist springs cause earlier germination and cool, dry springs delay germination. A preemergence herbicide application will not control annual weedy grasses after the seed germinates and the weeds begin to form leaves. Preemergence herbicide applications made just before or at the time of forsythia blooming will provide effective annual grassy weed control.

Apply the herbicide uniformly across the lawn to establish a chemical barrier on the soil surface. Avoid skips and streaks, which may allow weeds to appear in the lawn later in the year. Preemergence herbicides break down during the summer months, most quickly when summers are warm and precipitation or irrigation is plentiful. Therefore, weather or watering that favors a faster than normal breakdown can lead to a lawn infested with a late germinating annual grass. Thus grassy weeds can become a problem in lawns that are not mowed, fertilized or irrigated properly, even when a preemergence herbicide is used.

Apply the herbicide uniformly across the lawn to establish a chemical barrier on the soil surface. Avoid skips and streaks, which may allow weeds to appear in the lawn later in the year.

With normal weather patterns, most preemergence herbicides give good to excellent control of crabgrass, foxtail and barnyardgrass. Control of goosegrass and field sandbur often is less satisfactory, depending on the herbicide used. For best weed control, use the following guidelines. In all cases, read the pesticide label for more detailed information before using the product.

- Do not use preemergence herbicides at the time of seeding except for a product containing siduron. Wait until the new grass is mowed three times before applying a preemergence herbicide.
- After using a preemergence herbicide, wait two to four months before seeding, depending on the product used. Refer to the label for the specific time that must elapse before it is safe to seed.
- Do not apply pre-emergent herbicides to the soil before laying sod or to new sod. Rooting may be restricted by some preemergence herbicides.
- Apply sufficient water (1/2 inch) to wash the herbicide off the grass onto the soil surface within one to two days of application.

Table 1: Preemergence herbicides for annual grass control and expected level of control.

Herbicide Name	Trade Name	Crabgrass Foxtail	Goosegrass	Barnyardgrass	Field Sandbur
benefin	Balan	G-E	F	G	NA
benefin/trifluralin	Team	E	G	G-E	NA
bensulide	Betasan	G-E	P-F	G-E	NA
corn gluten meal	Many	G	NA	NA	NA
dithiopyr	Dimension	E	G-E	G-E	NA
oxadiazon	Ronstar	G	E	NA	G
pendimethalin	Pre-M, Pendulum	E	E	G-E	G
prodiamine	Barricade	E	G	G	NA
siduron	Tupersan	F-G	P-F	F-G	NA

E=excellent, G=good, F=fair, P=poor, NA=information not available.

Exclusion of chemicals or product trade names does not imply criticism, nor does inclusion imply any endorsement, by Colorado State University or the author. Read all label directions before using any pesticide.

- Do not thatch the lawn after the preemergence herbicide application, as the herbicide barrier can be disturbed.
- Conventional core cultivation (aeration) does not reduce the effectiveness of pre-emergent herbicides that have already been applied.

Postemergence Herbicides

There are postemergence herbicides (applied AFTER the weeds have begun growing in the lawn) that can be used to control existing annual grasses.. One type that is easily obtained by homeowners from any garden center is called MSMA (monosodium methanearsonate). This product is often sold under the simple trades name "Crabgrass Killer." This material is most effective against young seedling weeds and can be applied only as a spray. Once the weeds become larger and more mature, MSMA is largely ineffective.

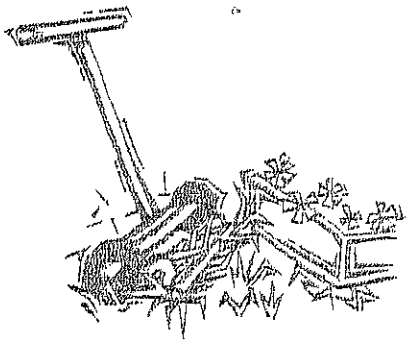
Other herbicides used for postemergence control of crabgrass and other annual grasses include quinclorac (sold under the trade name "Drive") and fenoxaprop ethyl (trade name "Acclaim Extra"). Both of these herbicides can provide excellent control of seedling annual grasses, and fair to good control of more mature (larger) weeds. Due to their higher product cost they have traditionally been used only by professional lawn care operators. However, quinclorac/Drive is now available to homeowners in a product sold by Ortho under the trade name Weed B Gon MAX® Plus Crabgrass Control Ready-to-Use. This ready-to-use (no mixing required) spray herbicide also contains 2,4-D, MCPP and dicamba, which provide control of broadleaf weeds like dandelion and clover.

The fenoxaprop-p-ethyl product is sold by Bayer Advanced under the name Bermudagrass Control for Lawns. This product will also control crabgrass, foxtail, barnyardgrass and field sandbur in cool-season (bluegrass, fescue, ryegrass) lawns. It should NOT be used on buffalograss, bermudagrass or zoysiagrass lawns.

Some points to consider when using MSMA (sometimes called MAMA or DSMA on the herbicide label) and other postemergence herbicides for annual grassy weed control include:

- These products may cause a temporary discoloration of the turf. If the soil is dry, apply enough water the day before the treatment to moisten the soil to a 3-inch depth. During hot, dry weather apply another 1/2 inch of water two days after the lawn has been sprayed.
- Do not apply postemergence crabgrass herbicides to a new seeding until it has been mowed at least three times.
- Follow ALL label instructions carefully in order to obtain greatest effectiveness and to avoid unintentional injury to the lawn and surrounding landscape plants.

[1]Colorado State University Cooperative Extension turfgrass specialist and professor, horticulture and landscape architecture.



YARD

Broadleaf Weed Control in Lawns no. 3.100

by A.J. Koski [1]

Quick Facts...

For a healthy lawn, plant the best-adapted turfgrass species and use accepted turf management practices.

A totally weed-free lawn is rarely attainable, even with herbicides

Indiscriminate use of herbicides can cause problems for trees and other landscape plants, is expensive in time and money, and may actually reduce the vigor of the lawn.

Postemergent herbicides can control broadleaf weeds such as dandelion, clover, thistle and bindweed.

A dense, healthy stand of grass is the best way to reduce broadleaf weeds in home lawns. To achieve a healthy lawn, plant the best-adapted turfgrass species and use accepted turf management practices (see fact sheet 7.202, *Lawn Care*). Even with proper management, however, the best-cared-for lawns can still be invaded by troublesome broadleaf weeds. These may require the careful and selective use of broadleaf weed control herbicides.

A totally weed-free lawn is rarely attainable, even with herbicides. It is better to maintain a healthy lawn and tolerate a few weeds rather than to make many applications of herbicides in an attempt to eliminate all weeds. Indiscriminate use of herbicides can cause problems for trees and other landscape plants, is expensive in time and money, and may actually reduce the vigor of the lawn.

Postemergent Herbicides

Postemergent herbicides can control existing broadleaf weeds such as dandelion, clover, thistle and bindweed. Postemergent herbicides do not prevent weed seeds from germinating and reinfesting a lawn.

Once the herbicide kills existing weeds, use good cultural practices (proper fertilization, mowing and irrigation) to encourage rapid fill-in of the turf. Otherwise, new weeds will quickly reinfest the bare soil left open by the recently killed weeds. For this reason, use herbicides as only one tool in the total weed control program.

Which Herbicide Do I Use?

Before using a postemergent herbicide for broadleaf weed control, identify the weed(s) you want to control. Not all weed species are easily controlled by the same herbicides. You may need to use a combination of two or more herbicides to control specific weeds.

If you cannot identify the weed(s) in question, seek help from your Colorado State University Cooperative Extension county agent or master gardeners, garden centers, or others knowledgeable about turfgrass weeds.

The chemicals most readily available to homeowners for selective postemergent control of broadleaf weeds include 2,4- D, 2,4-DP, MCPP, MCPA and dicamba. They are available singly and in various combinations with each other. Combination products are recommended for difficult-to-control weeds or when several weed species are present in the lawn. All are available in liquid formulations (sprayable) and often in granular formulations (generally with a fertilizer) that can be applied with a drop or broadcast spreader.

All of the chemicals listed above are safe for use on Kentucky bluegrass, perennial ryegrass, tall fescue and fine fescue lawns if you follow the directions on the label. Buffalograss and blue grama lawns that have greened up can be

Colorado State University Cooperative Extension

Putting Knowledge to Work

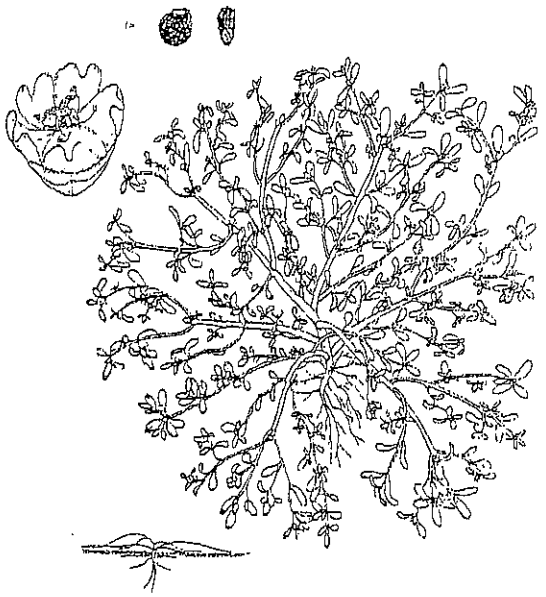


Figure 1: Purslane.

discolored or injured by summer applications of products containing 2,4-D, MCPP, MCPA or dicamba. Spring or fall applications to dormant buffalograss and blue grama lawns are safer, as long as you closely follow label directions.

When Do I Apply?

Applications of herbicides intended for postemergent broadleaf weed control kill only those weeds already present when the herbicide is applied. They do not prevent weed seeds from germinating and developing in the lawn at a later date.

For effective control, weeds must be actively growing when the herbicides are applied. Make spring applications from mid-April through early June, and fall applications in September and October. Applications during July and August are strongly discouraged because weed control is often poor and there is an increased risk of causing damage or discoloration to the lawn, as well as to trees, shrubs, flowers and vegetables.

How Do I Apply?

Liquid and granular formulations of herbicides can be equally effective if they are used properly. Do not apply either if rain is expected within 24 hours of application. For best results, do not mow the turf or water for at least 24 hours following application of either granular or liquid products.

Granular herbicides are the most effective if applied to grass that is moist from morning dew, rainfall or irrigation because the granules adhere to the wet surfaces. Application of granular products to dry turf generally controls few weeds. Be careful when applying herbicides near trees, shrubs, flower beds and vegetable gardens. Drift from spray applications or misdirected application of granular products can damage or kill these plants. Tree roots can absorb large amounts of herbicides, so be careful applying any herbicide within a tree's root zone, which extends far beyond the tree's "drip line."

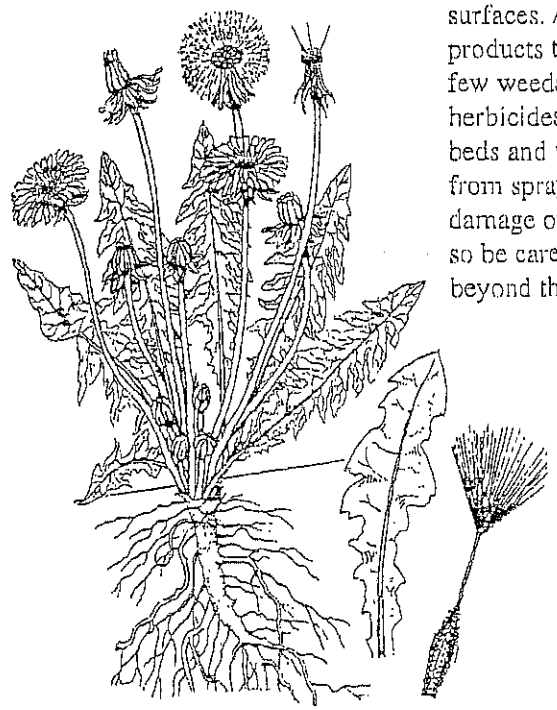


Figure 3: Dandelion.

In a mature, older landscape, roots of trees and shrubs often occur throughout the entire lawn area. Do not make more than two herbicide applications per growing season on lawns with trees growing in them. Two applications are probably unnecessary for most lawns. Specifically, dicamba may accumulate in the soil with frequent or extensive use and may result in damage to trees, shrubs or other ornamentals.

Table 1: Common broadleaf weeds and suggested herbicide control.

Weed Species	Life Cycle*	Herbicide**	Application Timing	Expected Control
Bindweed	P	4,5,6	Spring and fall	Fair to good
Black medic	A,B	3,4,5,6	Early spring, fall	Fair to good
Common chickweed	A	2,3,4,5	Fall, early spring	Good
Dandelion	P	1,3,4,5	Spring or fall	Good
Curly dock	P	1,3,4,5	Spring or fall	Good
Ground ivy	P	3,4,5,6	Spring, fall	Fair to good
Knotweed	A	1,3,4,5,6	Early spring, summer	Fair to good
Mallow	A,B	4,5,6	Spring, fall	Fair
Plantain	P	1,3,4,5	Spring, fall	Good
Purslane	A	1,3,4,5	Early summer	Fair to good
Speedwells	A,P	4,5	Spring, fall	Fair to good
Spurge	A	4,5,6	Summer	Poor to fair
Thistles	P	1,3,4,5,6	Spring, fall	Fair to good
White clover	P	2,3,4,5	Spring, fall	Good
Wild violet	P	4,5	Spring, fall	Poor
Wood sorrel (Oxalis)	A,P	4,5,6	Spring, fall	Fair
Yarrow	P	4,5,6	Spring, fall	Fair

* Key to life cycle: A = annual, B = biennial, P = perennial.

** Key to broadleaf herbicides:

1 = 2,4-D
2 = MCPP or MCPA
3 = 2,4-D plus MCPP/MCPA
4 = 2,4-D plus dichlorprop (Weedone)
5 = 2,4-D plus triclopyr (Turflon)
6 = dicamba, or products containing dicamba (Trimec or similar)

Exclusion of chemicals or product trade names does not imply criticism, nor does inclusion imply any endorsement, by Colorado State University or the author. Read all label directions before using any pesticide.

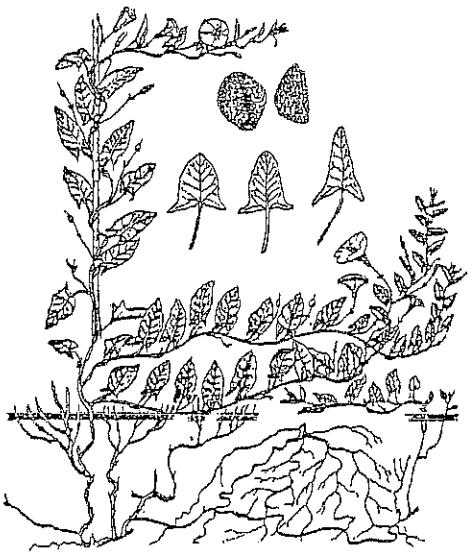


Figure 4: Field bindweed.

[1]*Colorado State University Cooperative Extension turfgrass specialist and professor, horticulture and landscape architecture.*

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Milan A. Rewerts, Director of Cooperative Extension, Colorado State University, Fort Collins, Colorado. Cooperative Extension programs are available to all without discrimination. No endorsement of products mentioned is intended nor is criticism implied of products not mentioned.

Winter/Spring Lawn Management Checklist for Colorado Lawns

Dr. Tony Koski
Extension Turf Specialist
Colorado State University Cooperative Extension
Fort Collins, CO

Many areas of the Front Range have experienced a drier than average spring, with March and April being significantly drier than normal. Irrigation restrictions vary widely from one community to the next. The homeowner is encouraged to irrigate whenever allowed, to offset the effects of a dry winter and spring. The following lawn care recommendations apply equally to both the commercial lawn care customer and those homeowners who care for their own lawns.

Fertilizing the Lawn

- Fertilization of lawns this spring (March-June) is a highly recommended practice
- The ideal fertilizer will contain a mixture of quickly and slowly available nitrogen sources Most lawn care companies use these type of fertilizer blends
- Excellent fertilizer blends are available to the homeowner from local nurseries and garden centers
- Fertilizer applied before watering is allowed will not cause a problem for lawns; adequate moisture from spring precipitation and irrigation (once it is allowed) will cause nutrients to be released to the turf

Aerating (Cultivating) the Lawn

- Lawn aeration is a highly recommended spring lawn care practice
- While deeper (2-3 inches) core holes provide the greatest benefit to the lawn, even shallow (1 inch) core holes will help to enhance water infiltration for the spring and summer watering periods
- Overseeding may be done in conjunction with lawn aeration; this may especially benefit those lawns thinned by drought conditions or winter mite activity (avoid using crabgrass preemergent herbicides at the time of overseeding)
- Lawn aeration will help to control thatch, an organic layer that often impedes proper water movement into the soil
- Lawn aeration, fertilization, and overseeding all can be done at the same time

Mowing the Lawn

- Set your mowing height at 2 ½ to 3 inches and mow at the same height all growing season
- Don't remove more than 3/4 inch of grass at any single mowing; recycle grass clippings into the lawn
- Use a sharp blade to reduce tearing of the grass leaves
- Whenever possible, mow during the cooler morning or evening hours to avoid turf damage

Weed Control in the Lawn

- The use of preemergent herbicides for prevention of crabgrass, foxtail, and other annual grassy weed problems is a recommended spring lawn care practice These products should NOT be used on those lawns being overseeded in the spring
- Any preemergent herbicide should be watered in with at least ½ inch of water as soon as possible after application
- Where a preemergent herbicide is not used in the spring for crabgrass prevention (perhaps when lawns are being overseeded), there are excellent postemergent herbicide products for the control of young annual grassy weeds These products are expensive and not generally available for homeowner use
- These crabgrass control products work most effectively when applied by lawn care professionals
- Control of dandelion, clover, bindweed and other perennial broadleaf weeds can be done in the spring; there are a variety of excellent products available at local garden centers
- The most effective broadleaf herbicides are those used by professional lawn care companies
- Spot treatment of individual weeds is the most effective method of controlling broadleaf weeds
- Broadleaf weeds are most effectively controlled when daytime temperatures are in the 50s to mid 70s and soil moisture is high enough that weeds are not drought-stressed

Watering the Lawn

- Follow watering programs encouraged or mandated in your community Begin irrigating the lawn as soon as it is allowed
- The less frequent irrigation regimes allowed in some communities, especially during the spring, may actually enhance turf drought resistance for the summer
- Where twice-weekly irrigation is allowed (especially if there are no time limitations), good lawn quality can be expected throughout the spring and summer
- Once-weekly irrigation can produce good turf quality for most of the spring, and will be sufficient to allow most lawns to survive even a hot and dry summer
- Disregard for required community watering practices can result in substantial fines and may encourage communities to enact even stricter watering restrictions
- As soon as irrigation is allowed in the spring, take time to refresh your understanding of how your irrigation system operates Learn how to program your control clock so that you irrigate according to the schedule mandated for your community
- Set the clock so that irrigation occurs between 6PM and 10 AM (or as otherwise mandated in your community or water district)
- Repair or replace broken irrigation heads
- Adjust irrigation heads to avoid throwing water on streets, driveways, and other hardscapes
- If you find that adjusting or repairing your irrigation system is too time-consuming or challenging, hire an irrigation or landscape management specialist to perform this important work
- Your lawn care company professional may be willing to program your irrigation control clock
- Contact your local water provider for information on conducting an irrigation audit; some lawn care companies, landscape management firms, or irrigation installation firms will conduct an audit of your irrigation system for a modest fee
- On your watering day, irrigate using the following technique (unless otherwise mandated by local regulations): Apply ¾ to 1 inch of water, slowly enough that runoff and puddling do not occur
- Cycling through irrigation stations or moving your sprinkler around the yard (applying smaller amounts of water) while irrigating helps water to soak more thoroughly and evenly into the lawn; repeat your cycle until the desired amount of water has been applied
- Hand-water small or isolated dry spots, where sprinklers don't overlap properly, to save water

Other Lawn Care Practices

- The application of wetting agents specifically developed for use on turf is recommended to reduce the occurrence of water repellent conditions in lawns Wetting agents can benefit lawns subjected to extreme drying over the past few months by promoting better infiltration of water into the soil; spring and summer use may reduce the occurrence and/or severity of dry spots in the lawn (but will NOT totally compensate for poor irrigation coverage)
- Wetting agents are available in both granular and liquid forms; granular formulations are often easier for homeowners to apply
- The use of dishwashing detergents and other soaps in place of turf-type wetting agents is not recommended and may damage heat- and drought-stressed lawns
- The incorporation of water-absorbing polymers (sometimes called "hydrogels") into new or existing lawns does NOT reduce lawn water requirements and is not recommended
- The application of green colorants to dormant lawns is safe, provided that paints or colorants developed for turf are used; professional application by a lawn care or landscape management company is recommended

Information contained in this fact sheet is intended for use from January 1-June 30.

Read and abide by all instructions before using any pesticide, fertilizer, or other turf care product. The use of products not labeled for or intended for use on lawns may damage turf, especially when lawns are under heat and drought stress.

For more information on lawn management go to: http://csuturf.colostate.edu

MERIDIAN
Metropolitan District

12111 East Belford Avenue
Englewood, CO 80112
303-790-0345

Account Number 12002425
Customer Name John Doe
Address 10505 Rutledge St
City,State,Zip Parker, CO 80134
Due Date 1/31/2010
Total Late Charges $ 0.00
Previous Balance $ 0.00
Total Due $ 91.80

Services	CURRENT READING	PREVIOUS READING	USAGE	USE CHARGES	SALES TAX	TOTAL CHARGES	BUDGET	TOTAL DUE
WATER	12000.0	0.0	12000	53.16	0.00	53.16		53.16
SEWER	12000.0	0.0	12000	38.64	0.00	38.64		38.64
	12000.0	0.0						

Previous Balance	Current Charges	Net Amount	Gross Amount
$0.00	$91.80	$91.80	$91.80 (After Due Date)

Billing Statistics

From: 10/31/2009 To: 12/31/2009
Number of Days This Billing: 61

Utility	Usage Per Day	Cost Per Day	Prior Month Change
WATER	197	$0.87	N/A
SEWER	197	$0.63	N/A
Total		$1.50	

USAGE ALLOTMENT REMAINING: 48,000

Special Messages

Payment Instructions

To help us improve efficiencies, please return your billing stub with payment to our P.O. Box.
Meridian Metropolitan District
P.O. Box 173796
Denver, CO 80217-3796

Important Notice

Please note your accruing water usage and annual allotment are now part of every statement. Any customer that exceeds their allotment will be billed surcharges.

Due Date 1/31/2010
Account Number 12002425
Late Charges 0.00
Previous Balance $ 0.00
Total Due $ 91.80

Detach this portion of statement and return with payment

12002425

John Doe
10505 Rutledge St.

Parker, CO 80134

Meridian Metropolitan District
PO Box 173796
Denver, CO 80217-3796

Meridian MD
2010 Drinking Water
Consumer Confidence Report
For Calendar Year 2009

Public Water System ID # CO0218015

Esta es información importante. Si no la pueden leer, necesitan que alguien se la traduzca.

We are pleased to present to you this year's water quality report. Our constant goal is to provide you with a safe and dependable supply of drinking water.

General Information About Drinking Water

All drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that the water poses a health risk. Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV-AIDS or other immune system disorders, some elderly, and infants can be particularly at risk of infections. These people should seek advice about drinking water from their health care providers. For more information about contaminants and potential health effects, or to receive a copy of the U.S. Environmental Protection Agency (EPA) and the U.S. Centers for Disease Control (CDC) guidelines on appropriate means to lessen the risk of infection by *Cryptosporidium* and microbiological contaminants call the EPA *Safe Drinking Water Hotline* at 1-800-426-4791.

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity. Contaminants that may be present in source water include:

- ***Microbial contaminants***, such as viruses and bacteria that may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- ***Inorganic contaminants***, such as salts and metals, which can be naturally-occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.
- ***Pesticides and herbicides*** that may come from a variety of sources, such as agriculture, urban stormwater runoff, and residential uses.
- ***Organic chemical contaminants***, including synthetic and volatile organic chemicals, which are byproducts of industrial processes and petroleum production, and also may come from gas stations, urban storm water runoff, and septic systems.
- ***Radioactive contaminants***, that can be naturally occurring or be the result of oil and gas production and mining activities.

In order to ensure that tap water is safe to drink, the Colorado Department of Public Health and Environment prescribes regulations limiting the amount of certain contaminants in water provided by public water systems. The Food and Drug Administration regulations establish limits for contaminants in bottled water that must provide the same protection for public health.

Our Water Source(s)

Source	Water Type
Well De1r	Ground Water
Well De2	Ground Water
Well De3	Ground Water
Well De4	Ground Water
Well De 13	Ground Water
Well A4	Ground Water
Well A2r	Ground Water
Well A3	Ground Water
Well Lfh1	Ground Water
Well Uda4	Ground Water
Well HS A 1	Ground Water
Well A5	Ground Water

The Colorado Department of Public Health and Environment has provided us with a Source Water Assessment Report for our water supply. You may obtain a copy of the report by visiting www.cdphe.state.co.us/wq/sw/swaphom.html or by contacting Doug Scott at 303-790-1498.

Potential sources of contamination in our source water area come from, but not limited to: EPA Chemical Inventory/Storage Sites; Above and Underground and Leaking Storage Tank Sites; Septic Systems; Road Miles. Also from High and Low Intensity Residential Use; and Various Land Cover Types.

The Source Water Assessment Report provides a screening-level evaluation of potential contamination that **could** occur. It does not mean that the contamination **has or will** occur. We can use this information to evaluate the need to improve our current water treatment capabilities and prepare for future

contamination threats. This can help us ensure that quality finished water is delivered to your homes. In addition, the source water assessment results provide a starting point for developing a source water protection plan.

Please contact Doug Scott at 303-790-1498 to learn more about what you can do to help protect your drinking water sources, any questions about the Drinking Water Consumer Confidence Report, to learn more about our system, or to attend scheduled public meetings. We want you, our valued customers, to be informed about the services we provide and the quality water we deliver to you every day.

Terms and Abbreviations

The following definitions will help you understand the terms and abbreviations used in this report:

- *Parts per million (ppm) or Milligrams per liter (mg/L)* - one part per million corresponds to one minute in two years or a single penny in $10,000.
- *Parts per billion (ppb) or Micrograms per liter (ug/L)* - one part per billion corresponds to one minute in 2,000 years, or a single penny in $10,000,000.
- *Parts per trillion (ppt) or Nanograms per liter (nanograms/L)* - one part per trillion corresponds to one minute in 2,000,000 years, or a single penny in $10,000,000,000.
- *Parts per quadrillion (ppq) or Picograms per liter (picograms/L)* - one part per quadrillion corresponds to one minute in 2,000,000,000 years or one penny in $10,000,000,000,000.
- *Picocuries per liter (pCi/L)* - picocuries per liter is a measure of the radioactivity in water.
- *Nephelometric Turbidity Unit (NTU)* - nephelometric turbidity unit is a measure of the clarity of water. Turbidity in excess of 5 NTU is just noticeable to the average person.
- *Action Level* (**AL**) - the concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.
- *Treatment Technique (TT)* - A treatment technique is a required process intended to reduce the level of a contaminant in drinking water.
- *Maximum Contaminant Level Goal* (**MCLG**) - The "Goal" is the level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.
- *Maximum Contaminant Level* (**MCL**) - The "Maximum Allowed" is the highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.
- *Maximum Residual Disinfectant Level Goal* (**MRDLG**) - The level of a drinking water disinfectant, below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.
- *Maximum Residual Disinfectant Level* (**MRDL**) - The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.
- *Running Annual Average (RAA)* - An average of monitoring results for the previous 12 calendar months.
- *Gross Alpha, Including RA, Excluding RN & U* - This is the gross alpha particle activity compliance value. It includes radium-226, but excludes radon 222 and uranium.
- *Microscopic Particulate Analysis (MPA)* - An analysis of surface water organisms and indicators in water. This analysis can be used to determine performance of a surface water treatment plant or to determine the existence of surface water influence on a ground water well.

Detected Contaminants

Meridian MD routinely monitors for contaminants in your drinking water according to Federal and State laws. The following table(s) show all detections found in the period of January 1 to December 31, 2009 unless otherwise noted. The State of Colorado requires us to monitor for certain contaminants less than once per year because the concentrations of these contaminants are not expected to vary significantly from year to year, or the system is not considered vulnerable to this type of contamination. Therefore, some of our data, though representative, may be more than one year old. The "Range" column in the table(s) below will show a single value for those contaminants that were sampled only once. Violations, if any, are reported in the next section of this report.

Note: Only detected contaminants appear in this report. If no tables appear in this section, that means that Meridian MD did not detect any contaminants in the last round of monitoring.

These tables show the results of our monitoring for the period of January 1 to December 31, 2009 unless otherwise noted.

Microbiological Contaminants

Contaminant	MCL	MCLG	Unit	Result	Violation (Yes or No)	Sample Date	Likely Source of Contamination
Total Coliform Bacteria for Systems that collects>40 samples per month	No more than 5% of monthly samples can be positive	0	Absent or Present				Naturally present in the environment
Total Coliform Bacteria for Systems that collects<40 samples per month	No more than 1 positive monthly sample	0	Absent or Present	Absent	No	1/1/09-12/31/09	Naturally present in the environment
Fecal coliform and E. Coli	A routine sample & a repeat sample are total coliform positive, & one is also fecal coliform or *E. coli positive*	0	Absent or Present	Absent	No	1/1/09-12/31/09	Human and animal fecal waste

Organics and Inorganics	Collection Date	Highest Value	Range	Unit	MCL	MCLG	Typical Source
BARIUM	8/25/2008	0.156	0.156	ppm	2	2	Discharge of drilling wastes; Discharge from metal refineries; Erosion of natural deposits
NITRATE AS NITROGEN	6/18/2009	0.04	0.04	0.04	10	10	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits
FLUORIDE	8/25/2008	0.11	0.11	ppm	4	4	Erosion of natural deposits; Water additive which promotes strong teeth; Discharge from fertilizer and aluminum factories

Disinfection By-Products	Date	Average	Range	Highest RAA	Unit	MCL	MCLG	Typical Source
TTHM	2009	6.01	4.62 - 7.4	7	ppb	80	N/A	By-product of drinking water chlorination

Lead and Copper	Collection Date	90^{TH} Percentile	Unit	AL	Typical Source
COPPER, FREE	2005 - 2007	0.3959	ppm	1.3	Corrosion of household plumbing systems; Erosion of natural deposits; Leaching from wood preservatives
LEAD	2005 - 2007	2	ppb	15	Corrosion of household plumbing systems; Erosion of natural deposits

Radionuclides	Collection Date	Highest Value	Range	Unit	MCL	MCLG	Typical Source
COMBINED RADIUM (-226 & -228)	10/11/2006	2	1.1 - 2	pCi/L	5		Erosion of natural deposits
COMBINED URANIUM	7/19/2006	1.4	1.4	ppb	30		Erosion of natural deposits
GROSS ALPHA, EXCL. RADON & U	10/11/2006	2.4	1.3 - 2.4	pCi/L	15	0	Erosion of natural deposits
GROSS BETA PARTICLE ACTIVITY	10/24/2005	1.1	1.1	pCi/L	4	0	Decay of natural and man-made deposits

Analyte	Facility Name	Highest Value	Unit	Monitoring Period

Secondary Contaminants/ Other Monitoring	Collection Date	Highest Value	Range	Unit	Secondary Standard
TDS	1/11/2006	152	152	MG/L	500

Secondary standards are non-enforceable guidelines for contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor or color) in drinking water. EPA recommends these standards but does not require water systems to comply.

Health Information About Water Quality

Infants and young children are typically more vulnerable to lead in drinking water than the general population. It is possible that lead levels at your home may be higher than other homes in the community as a result of materials used in your home's plumbing. If you are concerned about elevated lead levels in your home's water, you may wish to have your water tested and flush your tap for 30 seconds to 2 minutes before using tap water. Additional information is available from the Safe Drinking Water Hotline (800)426-4791.

There are no additional required health effects notices.

Violations

Type	Category	Analyte	Compliance Period
No Violations Occurred in the Calendar Year of 2009			

Information About the Above Violation(s)

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF WATER RESOURCES

Bill Ritter, Jr.
Governor

James B. Martin
Executive Director

Dick Wolfe, P.E.
Director/State Engineer

November 30, 2009

Curt Weitkunat
Douglas County Community Development
100 Third Street
Castle Rock, CO 80104

Re: **Meridian International Business Center Filing 7B, 1ST Amendment, SB 2009-044**
SW1/4, Sec. 18, NW1/4 of Sec. 19, all in Twp. 6S, Rng. 66W, 6th P.M.
Water Division 1, Water District 8

Dear Mr. Weitkunat:

We have reviewed your November 20, 2009 submittal concerning the above referenced proposal to subdivide a 31.470-acre parcel into 138 single family detached lots and 6 open space tracts. This is the first amendment to the Meridian International Business Center Filing 7B, which will increase the number of lots from 207 (as originally proposed) to 244 lots, an increase of 37 units.

Water Supply Demand

According to the information from the referral material the water supply for the additional 37 lots is estimated at 21.5 acre-feet per year. This amount was identified in the letter of commitment for service submitted by Meridian Metropolitan District ("District"). The District assumed that based on the proposed 37 single-family dwelling units and the District's standards water supply requirements of 0.58 acre-feet per year per single-family equivalent this project will require 21.5 acre-feet per year. The estimated potable water requirement at full-buildout totals 3790.4 acre-feet and the estimated non-potable irrigation water requirement totals 1,724 acre-feet annually. Therefore, the total water requirement at full-buildout is expected to be 5,514.4 acre-feet, which includes the 21.5 acre-feet required for this proposed subdivision. Sanitary sewer service will be provided by the District.

Source of Water Supply

The proposed water supplier is the Meridian Metropolitan District ("District"). The District has provided a letter stating that they intend to provide service to the proposed development. The District's letter states that Meridian has approximately 4,497 acre-feet of secure water supplies. The water supply currently consists of 25 acre-feet of non-tributary developed water from Hock Hawking Mine Portal, 3,134 acre-feet of nontributary Denver Basin ground water and 1,338 acre-feet of not nontributary Denver Basin ground water. There is an approved augmentation plan that was granted in case no. 2001CW257 for the 1,319.3 acre-feet of not nontributary groundwater. The nontributary and not-nontributary ground water will be used to meet the potable water requirements of the developments.

According to the Meridian Report, the District will use return flows from the wastewater treatment plant to meet the non potable water requirements of the developments. Also, according to the Meridian Report it is estimated that 1,774 acre-feet of return flows will be available to satisfy the non potable irrigation requirements.

The majority of the District's water supply is water from bedrock aquifers in the Denver Basin. The State Engineer's Office does not have evidence regarding the length of time for which this source will be a physically and economically viable source of water. According to 37-90-137(4)(b)(I), C.R.S., "Permits issued pursuant to this subsection (4) shall allow withdrawals on the basis of an aquifer life of one hundred years." Based on this allocation approach, the annual amounts of water decreed are equal to one percent of the total amount, as determined by rules 8.A and 8.B of the Statewide Nontributary Ground Water Rules, 2 CCR 402-7. Therefore, the water may be withdrawn in those annual amounts for a maximum of 100 years.

State Engineer's Office Opinion

Based upon the above and pursuant to Section 30-28-136(1)(h)(I) and Section 30-28-136(1)(h)(II), C.R.S., it is our opinion that the proposed water supply is adequate and can be provided without causing injury to decreed water rights. **Note however that the adequacy of the non potable irrigation system will depend on the amount of reuse water produced, the actual system losses and the design, construction and operation of the infrastructure. Therefore, the State Engineer's Office cannot provide an opinion on the adequacy of the non-potable irrigation system.**

Our opinion that the water supply is **adequate** is based on our determination that the amount of water required annually to serve the subdivision is currently physically available, based on current estimated aquifer conditions.

Our opinion that the water supply can be **provided without causing injury** is based on our determination that the amount of water that is legally available on an annual basis, according to the statutory allocation approach, for the proposed uses is greater than the annual amount of water required to supply existing water commitments and the demands of the proposed subdivision.

Our opinion is qualified by the following:

The Division 1 Water Court has retained jurisdiction over the final amount of water available under the decrees reference by the District, pending actual geophysical data from the aquifer.

The amounts of water in the Denver Basin aquifers, and identified in this letter, are calculated based on estimated current aquifer conditions. For planning purposes the county should be aware that the economic life of a water supply based on wells in a given Denver Basin aquifer may be less than the 100 years used for allocation due to anticipated water level declines. We recommend that the county determine whether it is appropriate to require development of renewable water resources for this subdivision to provide for a long-term water supply.

Should you have any questions, please contact Ioana Comaniciu of this office.

Sincerely,

Joanna Williams

Joanna Williams, P.E.
Water Resource Engineer

cc: Jim Hall, Division 1 Office
Water Supply Branch
Subdivision File

Jehn Water Consultants, Inc.
Water Resources Consulting

1565 Gilpin Street
Denver, Colorado 80218
(303) 321-8335
(303) 321-8346 (FAX)

January 17, 2011

Ms. Joanna Williams
Office of the State Engineer
Division of Water Resources
1313 Sherman St. - Room 818
Denver, Colorado 80203

Re: Meridian Metropolitan District Updated Water Supply Plan
Job No. 109.1

Dear Joanna:

The purpose of this letter is to provide your office with an update to the existing Water Supply Report on file for Meridian Metropolitan District. The last update submitted to your office was dated May 28, 2008 (2008 Update).

An updated version of Table 1, and Tables 2, 3 and 4 of the 2008 Update are attached. Table 1 was updated to include the final water right amounts from Case No. 06CW182. Table 1 summarizes a total of 4,471 af/yr available to Meridian Metropolitan District (District). Tables 2, 3 and 4 have not changed since the 2008 Update. The status of the wells and the overall plan for the District has not changed since the 2008 Update.

If there are any questions, please do not hesitate to contact me.

Sincerely,
JEHN WATER CONSULTANTS, INC.

Gina L. Burke, C.G.W.P.
Senior Project Manager/Principal

TABLE 1
MERIDIAN METROPOLITAN DISTRICT WATER RIGHTS SUMMARY

	Upper Dawson (af/yr) NT	Lower Dawson (af/yr) NNT	Lower Dawson (af/yr) NT	Denver (af/yr) NNT	Denver (af/yr) NT	Arapahoe (af/yr) NT	Laramie-Fox Hills (af/yr) NT	TOTAL (af/yr)	TOTAL NNT (af/yr)	TOTAL NT (af/yr)
Meridian Metropolitan District	300	50	230	265	258	742	370	2215	315	1900
So. Meridian Metropolitan District	-	-	-	-	-	299	-	299	0	299
No. Meridian Metropolitan District (Bradbury No. by Agreement) (1)	-	18	-	313	-	199	-	530	331	199
Cordillera	-	86	26	110	46	130	133	531	196	335
E-470 Parcel	-	2	-	5	-	0	3	9	7	3
Meridian Village	-	198	-	272	-	164	214	848	470	378
Morse/Hough/MB Land (2)	-	17	-	2	-	0	20	39	19	20
TOTAL	300	372	256	966	304	1535	739	4472	1338	3134

(1) By agreement dated December 9, 1991 - 530 af to Meridian
(2) Per Determinations of Fact for Case No. 06CW182. Decree pending.

The District also owns 25 acre-feet of surface water rights from the Hock Hocking Mine.
This water is to be utilized for post-pumping depletions in the District's augmentation plan (Case No.2001CW257).

TABLE 2
CURRENT WELL STATUS - OCTOBER 2005

Aquifer	Well	Permitted af/yr	Permitted gpm	Notes
Upper Dawson	UDA-4	75	75	
Denver	DE-1R	64.5	100	Case No. 01CW257 allows for DE-1, DE-2, DE-3 and DE-4 to pump a combination of 258 af/yr with each individual well not to exceed 160 af/yr at 100 gpm each.
	DE-2	64.5	100	
	DE-3	64.5	100	
	DE-4	64.5	100	
	DE-13	272	200	
Arapahoe	A-2R	250	400	125 af/yr W-7609 and in combination with A-2 and A-3 not to exceed an additional 220.9 af/yr 84CW620/Case No. 01CW145 - 800 af/yr in combination from wells A-2R and A-4 at 600 gpm each, not to exceed 500 af/yr from each well.
	A-3	466.9	400	246 af/yr 79CW238 and in combination with A-2 and A-3 not to exceed an additional 220.9 af/yr 84CW620/Case No. 01CW145 - 600 af/yr in combination from wells A-3 and A-6 at 750 gpm each, one in every five years this well can pump an average of 435 gpm, not to exceed 685 af.
	A-4 (A-1R)	250	400	150 af/yr W-7609 and in combination with A-2 and A-3 not to exceed an additional 220.9 af/yr 84CW620/Case No. 01CW145 - 800 af/yr in combination from wells A-2R and A-4 at 600 gpm each, not to exceed 500 af/yr from each well.
	A-5	300	350	Per 01CW145, one in every five years this well can pump an average of 435 gpm, not to exceed 685 af.
	HS-A-1	143	800	
Laramie-Fox Hills	LFH-1	234.4	200	Case No. 01CW257 - max. 484 af/yr at 300 gpm
	TOTAL	2,024.3		

TABLE 3
MERIDIAN METROPOLITAN DISTRICT- PLANNING DEMAND PROJECTIONS

Demand	Area	Office - Retail - Commercial (10 ksf)	Single Family Units	Multiple Family Units	Public Facilities or Other	Irrigated Acreage	Total
Potable (MMD & MV):							
	Meridian	1,500	330	2,170			
	Meridian Village	35	1,500	1,000		8.0	
	School				1		
	Fire Station				1		
	Recreation Center				1		
	Subtotal	1,535	1,830	3,170	3	8	
	Annual Demand (af/unit)*	0.70	0.58	0.32		2.05	
	School, Fire House, Rec. Center				46.0		
	Annual Demand Subtotal (af)	1,075	1,061	1,014	46.0	16	3,213
Potable (Cordillera):							
	Cordillera	643	0	0	0	0.0	
	Subtotal	643	0	0	0	0	
	Annual Demand (af/unit)**	0.70	0.58	0.32		2.05	
	Annual Demand Subtotal (af)	450	0	0	0.0	0	450
	POTABLE DEMAND TOTAL (af/yr)						3,663
REUSE IRRIGATION (af/yr):							
	Meridian & Meridian Village						
	Office/Commercial/Retail				575		
	Golf Course				300		
	District (Parks, ROW & Open Space)				578		
	Annual Demand Subtotal (af)	0	0	0	1,454	0	1,454
REUSE IRRIGATION (af/yr):							
	Cordillera (Office/Commericial/Retail)				270	0.0	
	Annual Demand Subtotal (af)	0	0	0	270	0	270
	IRRIGATION DEMAND TOTAL (af/yr)						1,724
	POTABLE & IRRIGATION TOTAL (af/yr)						5,386
REUSE RETURN:							
	Meridian	1,500	330	2,170			
	Meridian Village	35	1,500	1,000			
	Cordillera	643	0	0			
	Subtotal	2,178	1,830	3,170	0	0	
	Reuse Return (af/unit)	0.49	0.16	0.12			
	School, Fire House, Rec. Center				34.0		
	REUSE RETURN TOTAL (af/yr)	1,067	293	380	34.0	0	1,774
	WATER RIGHTS AVAILABLE (af/yr)						4,472
	NET OPERATING SURPLUS - POTABLE (af)						809
							22%

*Planning Demand is Shown (Allotment will include a 10% system loss).

**The service commitment to Cordillera is for a specified amount of potable supply (restricted to 450 af/yr).

Civil Design Group, Inc.

May 23, 2008

TABLE 4
MERIDIAN METROPOLITAN DISTRICT- CURRENT PLANNING DEMAND SUMMARY (MAY 2008)

Demand	Area	Office - Retail - Commercial (10 ksf)	Single Family Units	Multiple Family Units	Public Facilities or Other Demand (AF)	Irrigated Acreage	Total
Potable (MMD & MV):							
	Meridian	436	214	2,127			
	Meridian Village						
	Filing 7A (Platted)		297			1.5	
	Filing 7A - Pool (Platted)				2.5	0.3	
	Filing 7B (Platted)		204				
	Filing 7C (Prelim)		750		7.5		
	Filing 7D (Prelim)		130				
	Filing 7E (Prelim)		143				
	Subtotal	436	1,738	2,127		2	
	Annual Demand (af/unit)*	0.70	0.58	0.32		2.05	
	Current Planning Demand Subtotal (af)	**305**	**1,008**	**681**	**10**	**4**	**2,007**

LYTLE WATER SOLUTIONS, LLC

December 16, 2009

Douglas County Community Planning and Sustainable Development Department
100 Third Street
Castle Rock, Colorado 80104

Attn: Mr. Curt Weitkunat
Chief Planner

Subject: Will Serve Commitment from the Meridian Metropolitan District for Meridian Village Filing 7B, 1st Amendment, File No. SB 09-044.

Project No. 1182-09

Dear Curt:

As requested, Lytle Water Solutions, LLC (LWS) has reviewed the materials provided to us in a referral packet related to the Meridian Village Filing 7B, 1st Amendment, File No. SB 09-044. This property is 31.47 acres in size and it is proposed that there will be a total of 138 residential units on this parcel. However, only 37 residential units are the subject of this re-plat. Water service for the Meridian Village Filing 7B is proposed to be by the Meridian Metropolitan District (Meridian).

According to a November 18, 2009 letter from Meridian, its standard water supply requirement for residential units is 0.58 acre-feet per year (ac-ft/yr) per tap; therefore, the expected total demand for Meridian Village Filing 7B, 1st Amendment, is 21.5 ac-ft/yr. Meridian has complied with Section 1805A.01 relative to the requirements for water supply documentation, except as noted below.

In Meridian's November 18 will serve letter, Meridian currently has 4,472 ac-ft/yr of adjudicated Denver Basin aquifer water, all of which is available for use through its adjudicated augmentation plan. Meridian also has 25 ac-ft/yr of tributary water rights; however, no dry-year yield analysis was provided in the November 18 letter, as required in Section 1805A.01.(2)b. As such, LWS has assumed that the tributary water supply would have no dry-year yield. As part of its augmentation plan, Meridian estimates that re-use of Denver Basin aquifer water will provide an additional 1,774 ac-ft/yr of water which is proposed to be used for non-potable irrigation requirements. Therefore,

640 PLAZA DRIVE, SUITE 170
HIGHLANDS RANCH, CO 80129
WWW.LYTLEWATER.COM

PHONE: 303-350-4090
FAX: 303-350-4095
E-MAIL: LWS@LYTLEWATER.COM

the total water supply availability to Meridian is 5,646 ac-ft/yr. With the given buildout demand, this leaves an excess water supply of approximately 1,856 ac-ft/yr. Therefore, it appears that there is sufficient water for Meridian to serve Meridian Village Filing 7B, 1st Amendment, within its current water rights portfolio and its expected buildout demands.

If you have questions regarding our review of water supply availability for Meridian Village Filing 7B, 1st Amendment, please feel free to give us a call.

Yours truly,

Bruce A. Lytle, P.E.
President

BAL/pk

MERIDIAN
Metropolitan District

12111 East Belford Avenue
Englewood, CO 80112
303-779-4550
Fax 303-740-6954

November 18, 2009

Douglas County Planning Division
100 Third Street
Castle Rock, CO 80104

Re: MIBC Filing 7B (37 additional lots) Meridian Village

To Whom It May Concern:

Pursuant to Section 1808A.01 of the Douglas County *Zoning Resolution*, the Meridian Metropolitan District (the "District") acknowledges its willingness and ability to serve the proposed subdivision, MIBC Filing 7B (37 additional lots) Meridian Village. The subject parcel is within boundaries of the District and/or its allowed service area.

Commitment to Serve:

The District intends to provide service to this proposed development with the following conditions:

1. Terms and conditions as specified in the Service Agreement (on file) with the District including payment of any system fees and service charges.

Water Demand:

Based on the proposed 37 single-family dwelling units, and the District's standard water supply requirements of 0.58 acre-feet/year per single-family equivalent, the proposed subdivision will require 21.5 acre-feet of water per year.

This parcel is within the overall development projections for the District's Service Area which is used to determine the District entire estimated water demands as follows (Acre Feet/ Year):

Type of Development		Total Projected
SFR	units@0.58/unit	1830 > 1061.4
MFR	units@0.32/unit	3170 > 1014.4
O/C/R	gfa@0.70/10ksf	2178 > 1524.6
W/I/P	gfa@0.38/10ksf	500 > 190.0
Total		3,790.4 acft
Previously Approved Development		2,079.3 acft
This Parcel		21.5 acft
Demand Balance Available		1,689.6 acft

Water Supply:

The Districts total water supply, inclusive of water rights attendant to this parcel, if any, are as follows:

Aquifer	Tributary	Non Tributary	Not Non Trib.	Total acft
Hock Hawking	25	0	0	25.0
Arapahoe	0	1535.0	0	1535.0
Denver	0	304.0	966.0	1270.0
Dawson	0	556.0	372.0	928.0
Laramie/Fox Hills	0	739.0	0	739.0
Total Acre/Feet	25	3,134.0	1,338.0	4,497.0

All rights specified are fully adjudicated, decreed, permitted and augmentation plan dated February 24, 2004 (updated May 28, 2008) approved by the State Engineer has previously been submitted to and is currently on file with Douglas County.

Note: the District estimates it will have approximately 1,774 acre-feet per year of return flows to satisfy its non-potable irrigation requirements.

Water Quality:

The District is in compliance with the Colorado Department of Public Health and Environment testing and quality requirements, and provides a high-quality water supply to all of its customers.

Feasibility of Service:

It is physically and economically feasible for the District to extend service to the proposed subdivision.

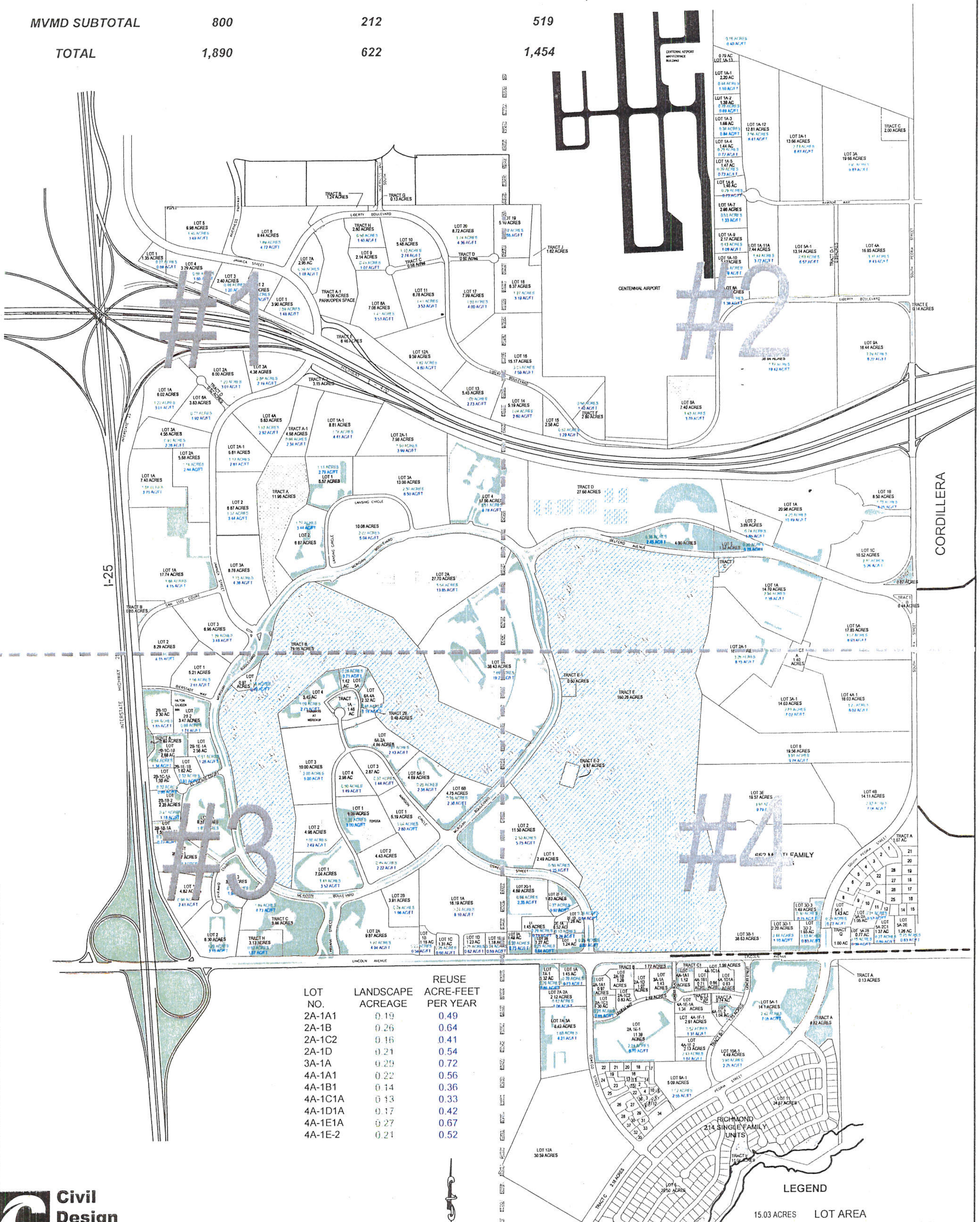
Sincerely,

Douglas C. Scott
General Manager
Meridian Metropolitan District

MER.DIAN METROPOLITAN DISTRICT

LOI REUSE IRRIGATION WATER EXHIBIT

LAND TYPE	TOTAL ACREAGE	LANDSCAPE ACREAGE	REUSE ACRE-FEET PER YEAR
FUTURE DEVELOPMENT	550	110	275
EXISTING DEVELOPMENT	321	100	160
PARKWAYS	80	80	200
GOLF COURSES	139	120	300
MMD SUBTOTAL	*1,090*	*410*	*935*
MVMD SUBTOTAL	*800*	*212*	*519*
TOTAL	*1,890*	*622*	*1,454*



LOT NO.	LANDSCAPE ACREAGE	REUSE ACRE-FEET PER YEAR
2A-1A1	0.19	0.49
2A-1B	0.26	0.64
2A-1C2	0.16	0.41
2A-1D	0.21	0.54
3A-1A	0.29	0.72
4A-1A1	0.22	0.56
4A-1B1	0.14	0.36
4A-1C1A	0.13	0.33
4A-1D1A	0.17	0.42
4A-1E1A	0.27	0.67
4A-1E-2	0.21	0.52

LEGEND

15.03 ACRES	LOT AREA
3.00 ACRES	LANDSCAPE ACREAGE
7.52 AC/FT	REUSE ACRE-FEET PER YEAR
	EXISTING LANDSCAPE
	EXISTING GOLF COURSE
	EXISTING POND
	EXISTING BUILDING

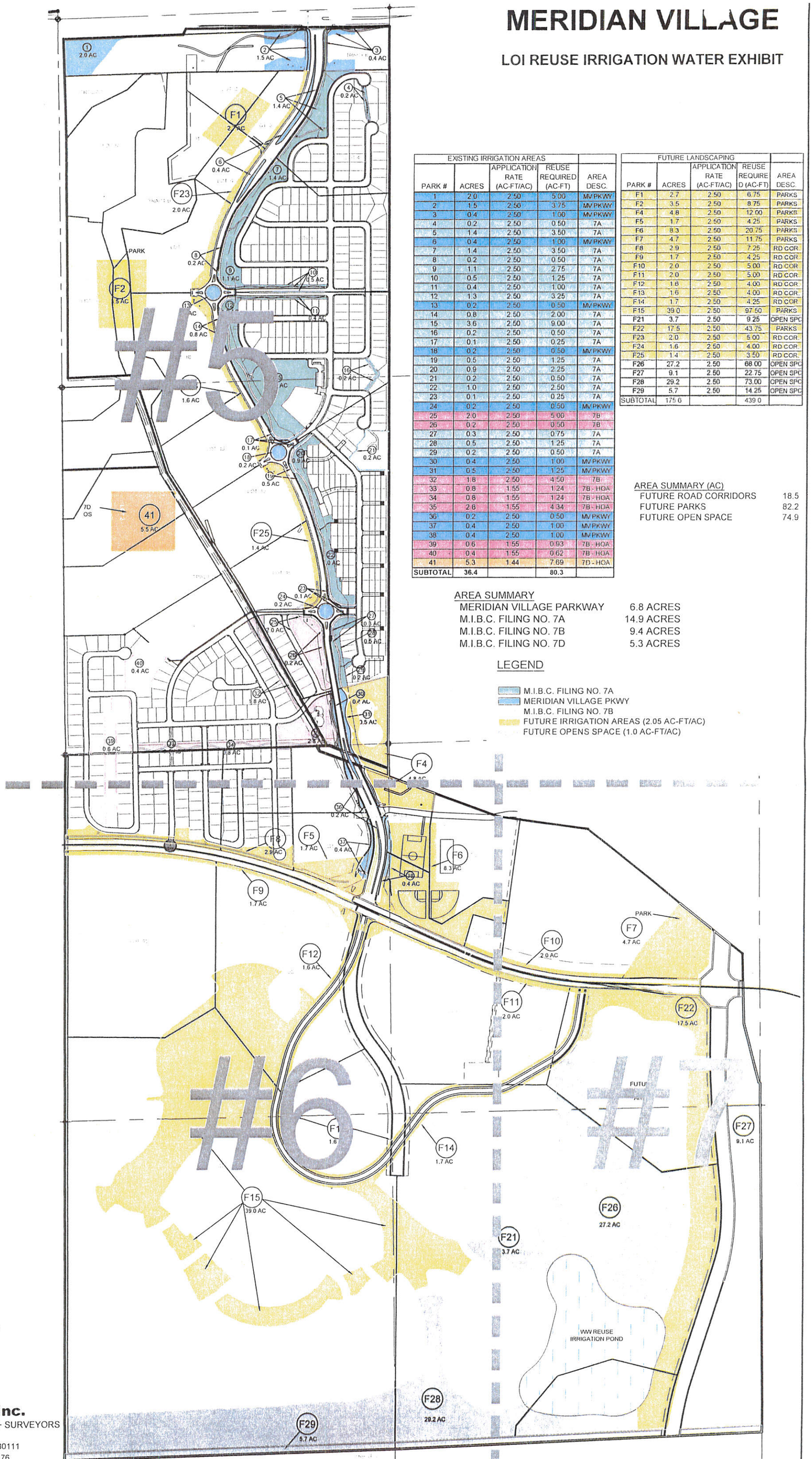
0' 1000' 2000' 3000'

SCALE: 1" = 1000'

Civil Design Group, Inc.
ENGINEERS + PLANNERS + SURVEYORS
7900 E. Berry Place, Suite 150
Greenwood Village, Colorado 80111
303.431.0505 Fax: 303-431-7176
e-mail: engineering@civildgroup.com

MERIDIAN VILLAGE

LOI REUSE IRRIGATION WATER EXHIBIT



SCALE: 1"=600'

EXISTING IRRIGATION AREAS				
PARK #	ACRES	APPLICATION RATE (AC-FT/AC)	REUSE REQUIRED (AC-FT)	AREA DESC.
1	2.0	2.50	5.00	MV PKWY
2	1.5	2.50	3.75	MV PKWY
3	0.4	2.50	1.00	MV PKWY
4	0.2	2.50	0.50	7A
5	1.4	2.50	3.50	7A
6	0.4	2.50	1.00	MV PKWY
7	1.4	2.50	3.50	7A
8	0.2	2.50	0.50	7A
9	1.1	2.50	2.75	7A
10	0.5	2.50	1.25	7A
11	0.4	2.50	1.00	7A
12	1.3	2.50	3.25	7A
13	0.2	2.50	0.50	MV PKWY
14	0.8	2.50	2.00	7A
15	3.6	2.50	9.00	7A
16	0.2	2.50	0.50	7A
17	0.1	2.50	0.25	7A
18	0.2	2.50	0.50	MV PKWY
19	0.5	2.50	1.25	7A
20	0.9	2.50	2.25	7A
21	0.2	2.50	0.50	7A
22	1.0	2.50	2.50	7A
23	0.1	2.50	0.25	7A
24	0.2	2.50	0.50	MV PKWY
25	2.0	2.50	5.00	7B
26	0.2	2.50	0.50	7B
27	0.3	2.50	0.75	7A
28	0.5	2.50	1.25	7A
29	0.2	2.50	0.50	7A
30	0.4	2.50	1.00	MV PKWY
31	0.5	2.50	1.25	MV PKWY
32	1.8	2.50	4.50	7B
33	0.8	1.55	1.24	7B - HOA
34	0.8	1.55	1.24	7B - HOA
35	2.8	1.55	4.34	7B - HOA
36	0.2	2.50	0.50	MV PKWY
37	0.4	2.50	1.00	MV PKWY
38	0.4	2.50	1.00	MV PKWY
39	0.6	1.55	0.93	7B - HOA
40	0.4	1.55	0.62	7B - HOA
41	5.3	1.44	7.69	7D - HOA
SUBTOTAL	36.4		80.3	

FUTURE LANDSCAPING				
PARK #	ACRES	APPLICATION RATE (AC-FT/AC)	REUSE REQUIRED (AC-FT)	AREA DESC
F1	2.7	2.50	6.75	PARKS
F2	3.5	2.50	8.75	PARKS
F4	4.8	2.50	12.00	PARKS
F5	1.7	2.50	4.25	PARKS
F6	8.3	2.50	20.75	PARKS
F7	4.7	2.50	11.75	PARKS
F8	2.9	2.50	7.25	RD COR.
F9	1.7	2.50	4.25	RD COR.
F10	2.0	2.50	5.00	RD COR.
F11	2.0	2.50	5.00	RD COR.
F12	1.6	2.50	4.00	RD COR.
F13	1.6	2.50	4.00	RD COR.
F14	1.7	2.50	4.25	RD COR.
F15	39.0	2.50	97.50	PARKS
F21	3.7	2.50	9.25	OPEN SPC
F22	17.5	2.50	43.75	PARKS
F23	2.0	2.50	5.00	RD COR.
F24	1.6	2.50	4.00	RD COR.
F25	1.4	2.50	3.50	RD COR.
F26	27.2	2.50	68.00	OPEN SPC
F27	9.1	2.50	22.75	OPEN SPC
F28	29.2	2.50	73.00	OPEN SPC
F29	5.7	2.50	14.25	OPEN SPC
SUBTOTAL	175.6		439.0	

AREA SUMMARY (AC)

FUTURE ROAD CORRIDORS	18.5
FUTURE PARKS	82.2
FUTURE OPEN SPACE	74.9

AREA SUMMARY

MERIDIAN VILLAGE PARKWAY	6.8 ACRES
M.I.B.C. FILING NO. 7A	14.9 ACRES
M.I.B.C. FILING NO. 7B	9.4 ACRES
M.I.B.C. FILING NO. 7D	5.3 ACRES

LEGEND

- M.I.B.C. FILING NO. 7A
- MERIDIAN VILLAGE PKWY
- M.I.B.C. FILING NO. 7B
- FUTURE IRRIGATION AREAS (2.05 AC-FT/AC)
- FUTURE OPENS SPACE (1.0 AC-FT/AC)

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