WaterWise Landscaping Best Practices Manual

A companion guide to *Water Efficient Landscape Design*

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This best practices manual was prepared for communities along the Front Range. Owing to differernces in elevation, climate and soil composition, the lists of drought-tolerant landscaping materials contained within the manual may not be appropriate for all areas of the state. Please consult with your local landscape architects and master gardeners to ensure that landscaping materials are appropriate for your region.

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WaterWise Landscaping

Best Practices Manual

Section 1 – Introduction

Prevalent landscaping practices used in of development today have disregarded the long-term effects on the region's water supply. Nearly 75% of summer water use is consumed by outdoor vegetation. The drought in Colorado has highlighted the necessity of using WaterWise design practices in order to best use our limited water resources. Significant reductions can be gained through minor changes in the arrangement of plantings, alternative plant selection and soil preparation.

This spring, Lafayette and Erie have worked to draft a Landscape Ordinance that includes WaterWise landscape practices that will be mandatory for "new" development. This ordinance project will be used as a model for other Colorado towns, and is funded by a Heritage Grant from the State Department of Local Affairs. The purpose of the project is to:

1. move closer to use of landscaping that matches our semi-arid environment
2. include specific direction in choice of plant material
3. include illustrations
4. to the extent possible, make language of code easy to understand and apply
5. include both mandatory xeriscape requirements and aspirational practices

Besides requirements for new development, the process also includes this "Best Practices Manual" that all citizens can use in making choices about their home landscaping. These Best Practices for landscape design are derived from the seven principles of Xeriscaping, as well as GreenCo's Best Management Practices. This Manual also makes design recommendations based on the regulations outlined in the Landscape Ordinance.

The intention for these Best Practices is to inform home and property owners about landscape and irrigation needs unique to Colorado, and to assist in creating responsible landscape and irrigation design decisions.

WaterWise Landscaping

Best Practices

Section 2 – WaterWise Principles and Guidelines

DSW, Sources: GreenCo BMPs, Xeriscape Principles

This section focuses on eight "principles" that act as goals for smart planting and irrigating in the Colorado region. Each principle offers a series of design recommendations and techniques in the form of "guidelines". The guidelines function as steps to achieve the goals. Each guideline is not imperative but still important to ensure healthy plant growth, reduced water waste and increased cost savings over time. The following principles, if used properly, will help to create a useful, efficient and enjoyable WaterWise landscape.

Principle #1 – Plan and design landscaping comprehensively.

Guidelines

A. Start with an inventory and analysis plan of the site that identifies "existing conditions." Conditions such as drainage areas, sun exposure, soil types, good views, existing plants, etc. will affect how the site is used (Figure 1). Next develop a list of activities and areas, also called a "program," expected to occur on the site. For example a backyard program might include a lawn play area, dog run, dining patio, barbecue grill, shade trees and shrub beds. Continue by diagramming possible locations for the program activities, while also providing access and traffic patterns or screening as needed. Finally, use this information to develop a plan that integrates plants into the overall scheme (Figure 2).
B. Now with your overall plan, consider options on how you would like to conserve water. Several recommendations for water conservation are addressed throughout this document.
C. Calculate the water requirements for your landscape using the Water Budget Worksheet provided in Section Seven of this manual. Try not to exceed an average total of 15 gallons per square foot annually.
D. Incorporate trees into the landscape to provide shade, reduce stormwater runoff, stabilize soil and protect against wind. If considering the gross site area, a minimum goal of 20 percent tree canopy coverage (at trees' maturity) for Front Range communities is recommended.
E. When designing plant placement on slopes, place lower-water demand plants at the tops of slopes and higher-demand plants at the bottom.
F. Artificial flowers and grass are discouraged. Exceptions may be granted for special use areas such as synthetic turf athletic fields.

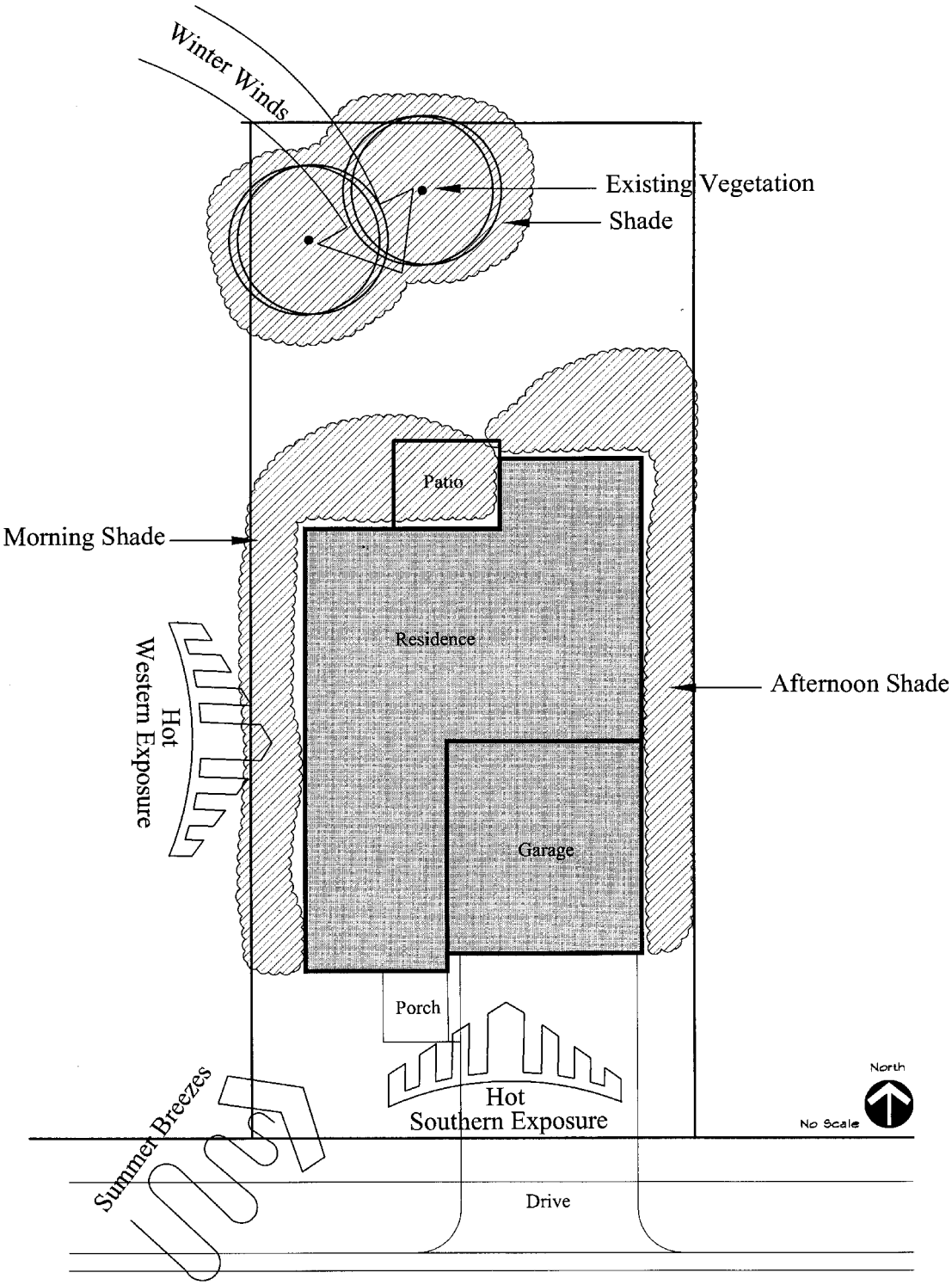

Figure 1. Inventory and Analysis Plan

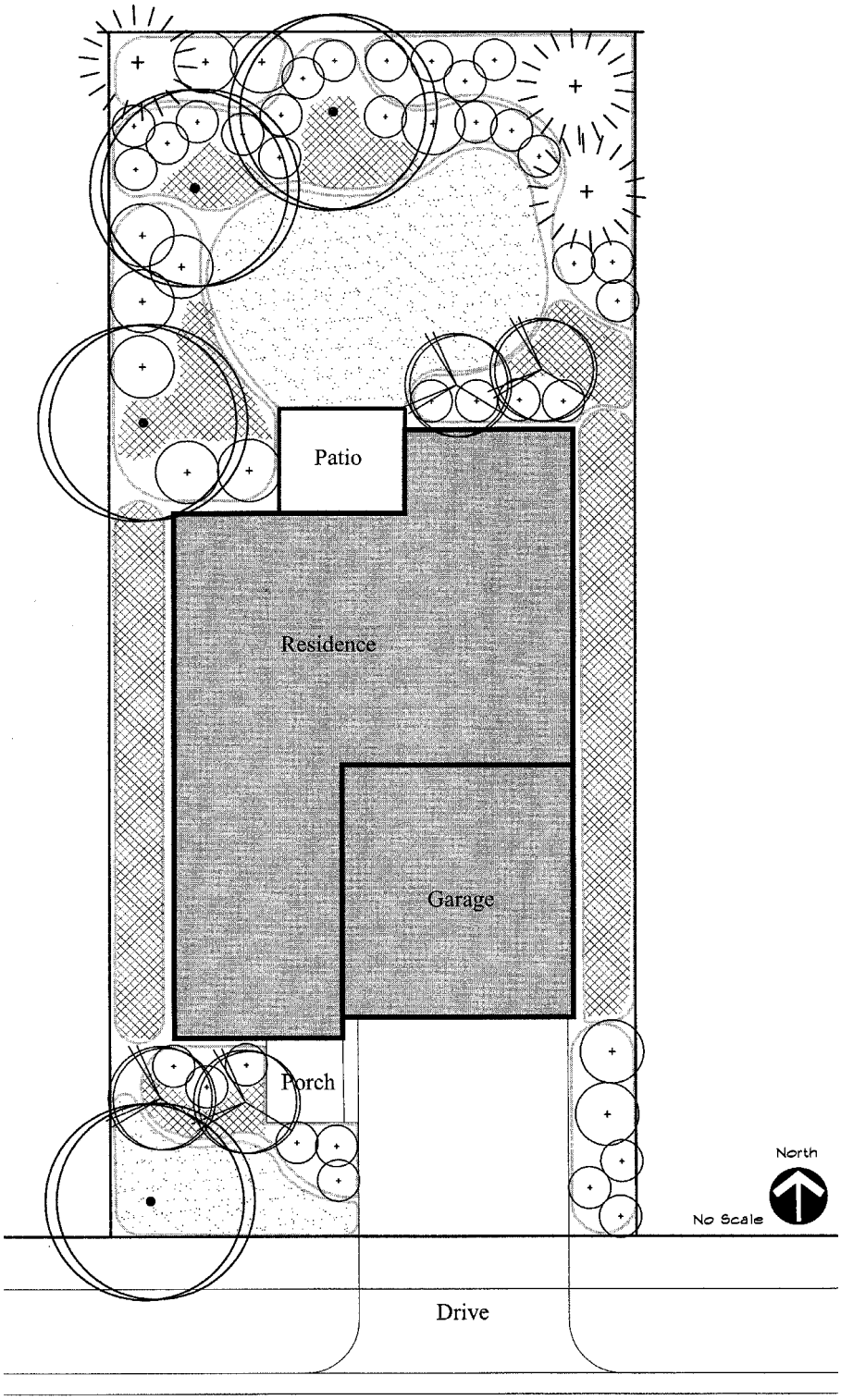

Figure 2. Overall Planting Plan

Principle #2 - Evaluate soil and improve, if necessary.

Guidelines

A. Soil suitability for planting should be evaluated to identify potential soil amendments that may improve plant health and survival (see Section Five).
B. Strip and stockpile existing topsoil prior to major site re-grading. Following completion of grading, replace topsoil and improve soil for planting with suitable soil amendments.
C. Improve soil as suitable (see Section Five) before planting and installing the irrigation system. Soil improvement promotes better absorption of water, improved water-holding capacity and drainage of the soils. It also allows for better oxygen transfer within the root zone.
D. Add organic material to the plant hydrozones, but only as needed. This typically means adding organic material for High and Moderate water zones, but not for Low and Very Low water zones. pH-balanced examples of organic materials are compost (from plants), sphagnum peat and animal manure (other than cow or horse).
E. Soil preparation should include the breaking up and loosening, or scarification, of soil to 6 inches, with incorporation of organic amendments, fertilizer, etc. as specified by a landscape designer, landscape architect or soil analysis (Figure 3).

For more information please refer to Section 5, Understanding Soils and Soil Preparation.

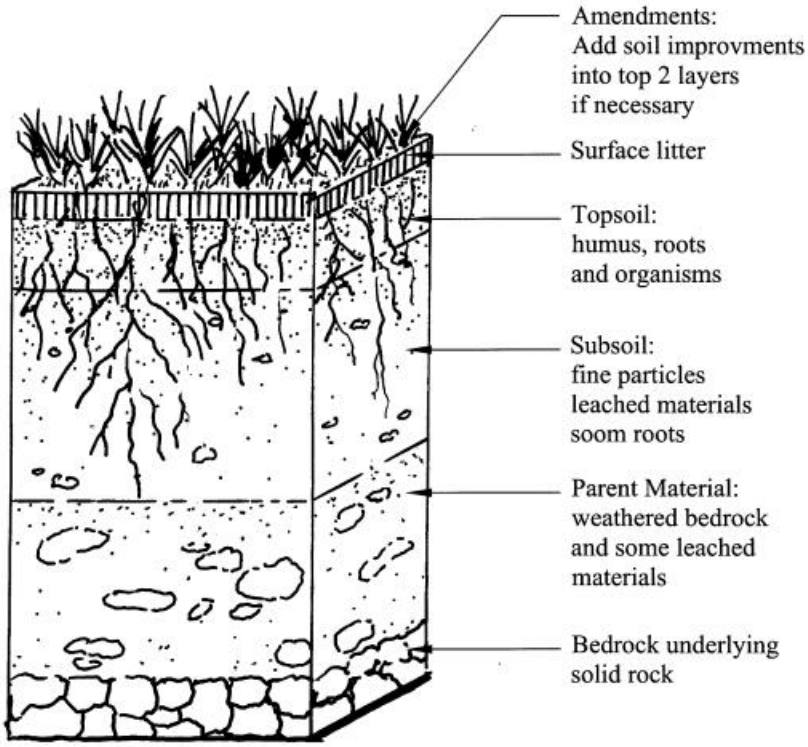

Figure 3. Soil Profile

Principle #3 - Create efficient turf areas.

Guidelines

A. Include turf areas where they provide defined functions (i.e., recreation, traffic areas, etc.). Plantings of trees, shrubs, ground covers and flowers are best separated from grass so they can be watered separately. Often, portions of turf areas can be replaced with more water-efficient ground covers and mulches (Figure 4).
B. When selecting turfgrass, consider the use, aesthetic and design goals of the site, estimated water use and maintenance budget. Alternative grass types, such as tall fescue, buffalograss, blue grama and wheat grass, may provide lower water and maintenance needs than bluegrass. In areas where irrigation is not planned for instance, a mix of mainly native bunch and sod-forming grasses might be used. (See Section Four for native seed mix options.)
C. Avoid using turf in areas less than 8 feet wide and on slopes steeper than 3:1. These areas require inefficient irrigation sprays. Consider using drip-irrigated shrubs or groundcovers with Low or Very Low water requirements as alternatives. A special exception may be streetscape tree lawns, where turfgrass may be most appropriate with careful consideration and monitoring of potential irrigation inefficiencies.
D. Some sites and turf areas with difficult irrigation or maintenance concerns may perform better with low water grass types or groundcovers. Consider street rights-of-way, industrial sites, drainageways and natural areas for such alternative grasses. (See Principle #8 below.)

Figure 4. Efficient Turf Area in Front Yard

Principle #4 - Use appropriate plants and group according to their water need, i.e. "hydrozoning".

Guidelines

A. Plants with lower water requirements, such as native species adapted to Colorado's climate, should be considered. However, other plants can have a place in xeriscape designs, even if they require larger amounts of water. The key is to use those plants in appropriate locations and not to interplant them with others that have very different, lower water requirements. In effect, the grouping of plants into "hydrozones" based on their water requirements allows them to be irrigated efficiently. A detailed list of Colorado landscape plants and their respective water requirements by "hydrozone category" is included in Section Three.
B. Group plants with like water needs together (Figure 5). Plants located within the drip line for large, mature trees and shrubs should have similar water requirements as the trees and shrubs. (A drip line is considered the outermost circle on the ground where water drips from the leaves of a tree or shrub canopy above.)
C. Plants of any water need may be used in the landscape, providing the total annual water use does not exceed Water Allowance for the ET (Evapo-Transpiration) Reference Location. For example, this allowance is 15 gallons/square foot/season in the Denver metro area. (See Section Six below for Water Budget calculations.)
D. High water zones should be separated from Low and Very Low water zones by Moderate water zones whenever possible.
E. Select plants that are well adapted to the climate, topographic and geologic conditions of the site.
F. Select plants with lower water requirements for areas with southern and western exposures.
G. Strips less than 8 feet wide should be landscaped with Low or Very Low water plants. (See Principle #3 above.)

Principle #5 - Water efficiently with a properly designed irrigation system

Guidelines

A. Irrigate according to the water need of each hydrozone, not solely on a fixed schedule (Figure 6). Well-planned sprinkler systems can save water when properly installed and operated. Turf areas should be watered separately from beds. Shrubs, flowers and ground covers can be watered more efficiently, by less frequent irrigation that is allowed to penetrate the root zone more deeply. (See Principle #4 above.)
B. Consider plant water requirements in irrigation design schemes.
C. Take into account the hydraulic principles when designing the irrigation system. Generally these principles deal with water volume, pressure and patterns of movement.

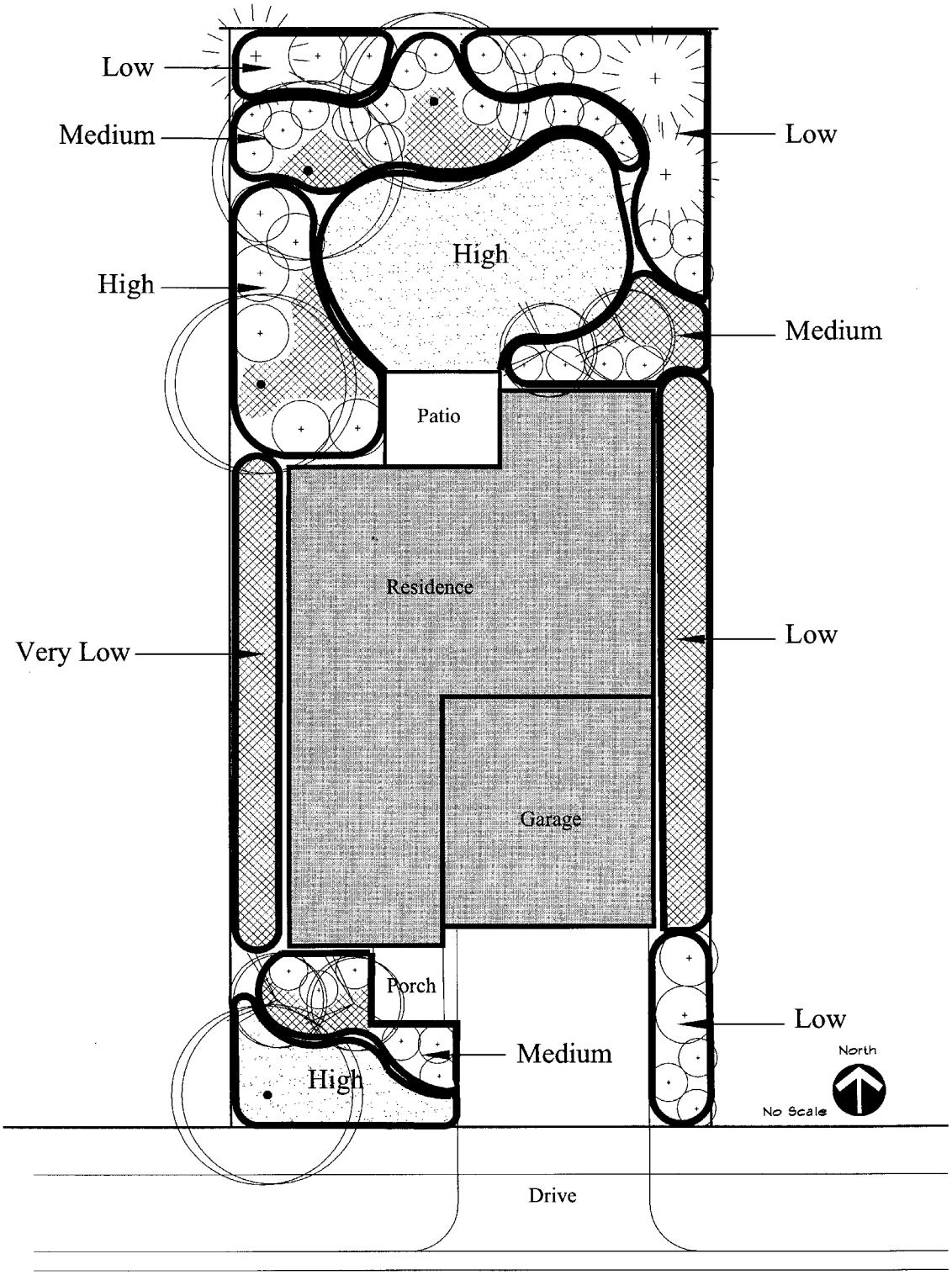

Figure 5. Hydrozone Outline Diagram with 4 water need types

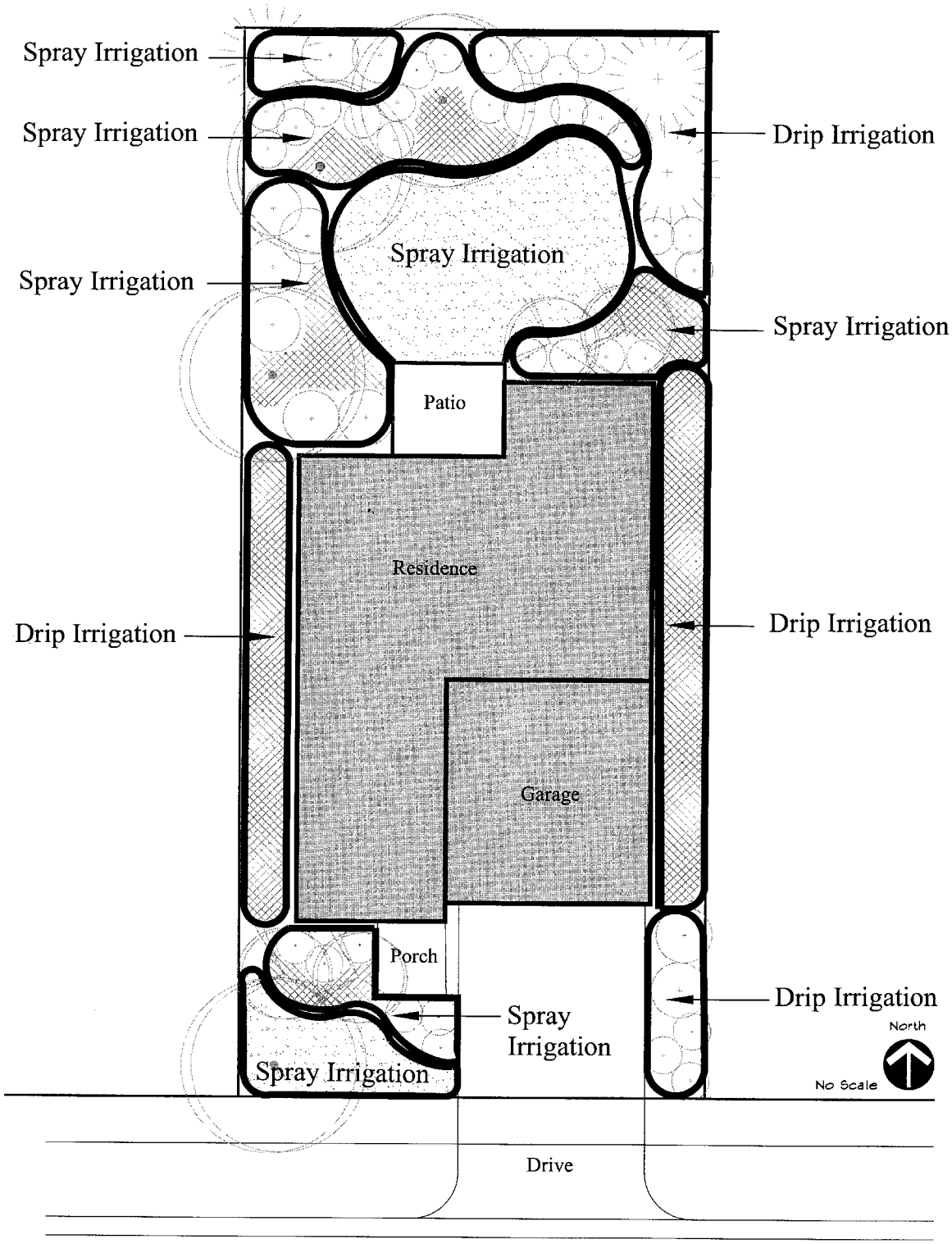

Figure 6. Irrigation Type Diagram

D. Install an irrigation controller that offers flexible programming. Landscapes should not need as much supplemental watering during a rainy period. Rain or moisture sensors are available to coordinate with controllers, and some controllers are self-adjusting based on weather conditions.
E. Ensure that the irrigation system is installed per plan and is accurate.
F. Provide "as-built" drawings of irrigation system after installation with dimensions shown for irrigation components. Such drawings will help to find and correct problems in the future.
G. Operate irrigation systems to maximize irrigation water efficiency.

For more information please refer to Section 6, Irrigation Design Techniques and Equipment.

Principle #6 - Use mulches to reduce surface evaporation of water and weeds.

Guidelines

A. Mulched planting beds are an ideal replacement for expansive turf areas. Mulches protect and reduce temperature extremes in the soil, minimize evaporation, reduce weed growth and slow erosion. Mulches also provide landscape interest. Organic mulches are typically bark chips, wood grindings, chopped leaves or pole peelings. Inorganic mulches include rock and various gravel products.
B. Organic mulches are generally recommended for the most benefit of the plants, but the roots of some plants perform better with inorganic mulch. Landscape professionals can help determine suitable mulches for selected plants. Inorganic mulches may also be preferred as more stable in especially windy locations, areas requiring high maintenance or those apt to erosion.
C. Place mulch directly on the soil or on breathable fabric (Figure 7). Do not use solid sheet plastic beneath mulched areas, as these keep out water and air – both of which are vital to plant health.
D. All plantable areas not covered with turf should be covered with a minimum of four inches (4") of a suitable mulch to retain water, and inhibit weeds.
E. Mulching exceptions for Low and Very Low hydrozones should be considered.

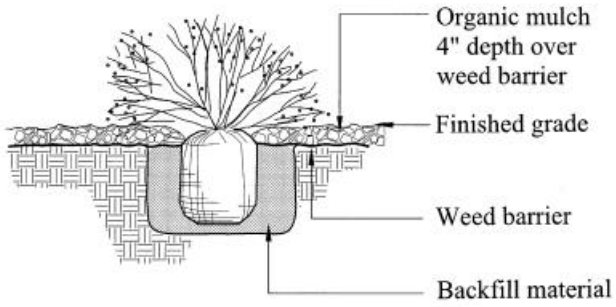

Figure 7. Shrub Planting in Mulch Bed

Principle #7 - Practice appropriate landscape maintenance.

Guidelines

A. Proper pruning, weeding, mowing and fertilization, plus attention to the irrigation system, are needed to maximize water savings. Regular maintenance of planting and irrigation system preserves the intended beauty of the landscape, and saves water and maintenance costs through efficient operations. Always water according to hydrozone need and current soil moisture conditions, rather than according to a rigid schedule.
B. Landscapes should be maintained to ensure water efficiency. A regular maintenance schedule should include but not be limited to checking, adjusting, and repairing irrigation equipment; resetting the automatic controller; aerating turf areas; replenishing mulch; fertilizing; pruning, and weeding in all landscaped areas.
C. Whenever possible, repair of irrigation equipment should be done with the originally specified materials or their equivalents so that original performance and efficiency can be maintained for longer periods. (See Section Six for more Irrigation information.)

Garden Maintenance

Principle #8 – Preserve existing landscape and natural areas.

Guidelines

A. Where possible preserve existing native remnant plant communities and site conditions that support them.
B. Where possible preserve healthy trees – established plants have often developed a root system that is adapted to lower water conditions.
C. Local native plants and plants with documented lower water requirements should be given priority in landscape design. A native plant is a species that "occurs naturally in a particular region, state, ecosystem, and habitat without direct or indirect human action" (Federal Native Plant Conservation Committee, 1994). A local native plant is derived from "a population or ecotype of the native plant species that was grown from genetically local plant materials" (Colorado Native Plant Society).
D. Use of native plants in the landscape supports local biodiversity, helps sustain local wildlife, enhances recreation experience, supports remnant native plant communities and reduces water consumption.

Natural Area

E. All landscapes have the potential to impact native plant communities through transport of seeds and plant propagules by wind and storm drainage. Landscapes adjacent to native sites are particularly critical due to the potential of direct spread, but all projects (public or private) should not harbor or install exotic horticultural plant species that are known to be invasive and therefore threaten natural areas. A complete list of threatening plants to avoid is provided by the Colorado Native Plant Society web site: <http://carbon.cudenver.edu/~shill/species_avoid.pdf>.
F. Landscapes adjacent to native areas should emphasize the use of species with low fuel volume of low flammability. Mowing management can be used to limit build up of flammable plant materials. Information on the fire-resistance of some native plants can be found at < www.ext.colostate.edu/PUBS/NATRES/06307.html>.
G. Remove species that are designated state noxious weeds, especially ornamental species such as purple loosestrife, oxeye daisy, tamarisk, myrtle spurge and yellow toadflax. See Section Four below for the 2003 list of noxious weeds for Colorado, or for more information see the "Noxious Weed List (Rules and Regulations)" at <www.ag.state.co.us/DPI/weeds/weed.html >.

For more information please refer to Section 4, Natural Areas and Native Plants.

WaterWise Landscaping

Best Practices

Section 3 – WaterWise Plant Lists

A. The Four Hydrozones – WaterWise Plant Groupings

The key to WaterWise landscaping is to arrange plants in appropriate locations and not to interplant them with others that have very different, lower water requirements. This grouping of plants into "hydrozones" is based on their water requirements, and allows them to be irrigated efficiently. The following list shows how to group plants based their water needs.

Due to variability in plant water requirements due to location of the plant on a site, a range of hydrozone categories has been shown for many plants. For purposes of calculating the water budget for each hydrozone, the lowest hydrozone category for each plant shall be used.

High Water need
example: Bluegrass turf – always wet at the surface
uses 18-20 gals./ S.F./season = 3 waterings per week totaling 5 inches (in July)

Moderate Water need
example: turf-type Tall Fescue – ½ the water of Bluegrass turf
uses 10 gals./S.F./ season = ¾ inches of water, once per week

Low Water need
example: Buffalograss turf – needs rain and occasional watering
uses 0-3 gals./S.F./season = ½ inch of water per 2 weeks, optional

Very Low Water need
example: too dry for any turf grass (drier than Denver)
no irrigation required

B. Colorado WaterWise Plant List Summary

1. Shrubs (Deciduous, Rocky Mountain Natives)
2. Shrubs (Deciduous, Introduced to the region)
3. Trees (Deciduous, Rocky Mountain Natives)
4. Trees (Deciduous, Introduced to the region)
5. Evergreens (Coniferous Trees)
6. Evergreens (Coniferous Shrubs)
7. Evergreens (Non-coniferous)
8. Vines
9. Groundcovers (Including turf & meadow grasses)
10. Selected Perennials

The complete Plant Lists are provided on the following pages.

Copying and use of this list is encouraged, only if the following note, & the water needs of plants are included.

For more information see...WaterWise Landscaping with Trees, Shrubs, and Vines
Jim Knopf, Chamisa Books

SHRUBS

(Deciduous Rocky Mountain Natives)

[Revised April '03]

WATER NEEDS OF PLANTS

The following chart shows how to group plants based on their water needs.
Reference Location: Denver. Numbers illustrate typical conditions.

***** = Plants with potential, but requiring caution due to limited history in Rocky Mountain landscaping.

HIGH WATER	MODERATE WATER	LOW WATER	VERY LOW WATER
Reference plant: Bluegrass turf (Always wet at surface)	Reference plant: Turf-type Tall Fescue (Half of Bluegrass turf)	Reference plant: Buffalograss turf (Like Denver without irrigation)	Reference plant: Too dry for any turf (drier than Denver)
18-20 gals./ S.F./season July: 5"-- 3 times per week	10_ gals./S.F./ season .75" -- once per week	0-3 gals./S.F./season .5" per 2 weeks, optional	No irrigation No irrigation

Acer•glabrum	Rocky Mountain Maple	(M-H)
Acer•grandidentatum	Bigtooth Maple, Wasatch Maple	(M)
Alnus•tenuifolia	Rocky Mountain Alder	(H)
Amelanchier•alnifolia	Rocky Mtn. Serviceberry	(M+/-)
Amelanchier•utahensis *	Utah Serviceberry	(VL- M)
Amorpha•canescens	Lead Plant	(L- M)
Amorpha•fruticosa	False Indigo	(M +/-)
Amorpha•nana	Dwarf Lead Plant	(L- M)
Atriplex•canescens	Four-wing Saltbush	(VL-L)
Atriplex•confertifolia	Shadscale	(VL-L)
Betula•fontinalis	Rocky Mtn. River Birch	(H)
Betula•glandulosa	Bog Birch	(H)
Ceratoides•lanata *	Winterfat	(L)
Cercocarpus•montanus	Deciduous Mountain Mahogany	(L- M)
Chamaebatiaria•millefolium	Fernbush	(VL-L)
Chrysothamnus•spp.	Rabbitbrush species	(VL-L)
Cornus•sericea (now C. stolonifera)		
Cornus•stolonifera	Redtwig Dogwood	(H)
Corylus•cornuta	Beaked Hazelnut	(H- M)
Crataegus.•var.•occidentalis *	Native Hawthorn	(M+/-)
Crataegus•erythropoda *	(syn.? C. s. var. occidentalis)	(M+/-)
Crataegus•succulenta•var.•macrantha *	Native Hawthorn	(M+/-)
Fallugia•paradoxa	Apache Plume	(VL-L)
Fendlera•rupicola	Cliff Fendlerbush	(L- M)
Forestiera•neomexicana	New Mexico Privet	(M+/-)
Fraxinus•anomala	Singleleaf Ash	(L)
Holodiscus•dumosus	Rock Spray	(L- M)
Jamesia•americana	Jamesia	(M - H)
Lonicera•involucrata	Twinberry	(H)
Lycium•pallidum *	Pale Wolfberry	(L)
Ostrya•knowltonii *	Western Hop Hornbeam	(M+/-)

Parryella•filifolia *	Dunebloom	(M+/-)
Pentaphylloides•floribunda	= Potentilla•fruticosa	
Peraphyllum•ramosissimum *	Squaw Apple	(L- M)
Philadelphus•lewisii	Lewis's Mockorange	(M+/-)
Philadelphus•microphyllus	Littleleaf Mockorange	(M+/-)
Physocarpus•monogynus	Mountain Ninebark	(M+/-)
Poliomintha•incana *	Purple Sage	(VL-L)
Potentilla•fruticosa	Shrubby Potentilla	(M - H)
Prunus•americana	Wild Plum	(M+/-)
Prunus•besseyi	Sand Cherry	(L-M)
Prunus•pensylvanica *	Pin Cherry	(M+/-)
Prunus•pensylvanica•saximontana *	Dwarf Pin Cherry	(M+/-)
Prunus•virginiana	Chokecherry	(M - H)
Ptelea•trifoliata	Hoptree	(M+/-)
Purshia•tridentata	Bitterbrush	(L - H)
Quercus•gambelii	Gambel's Oak	(M+/-)
Quercus•turbinella *	Turbinella Oak	(L - M)
Quercus•undulata *	Wavyleaf Oak	(L - M)
Rhamnus•smithii *	-----	(M+/-)
Rhus•glabra	Smooth Sumac	(L- M)
Rhus•glabra•var.•cismontana	Rocky Mountain Smooth Sumac	(L-M)
Rhus•glabra•'Laciniata'	Cutleaf Smooth Sumac	(L-M)
Rhus•microphylla *	Littleleaf Sumac	(L-M)
Rhus•trilobata	Three-leaf Sumac	(L - M)
Ribes•aureum	Golden Currant	(M+/-)
Ribes•cereum *	Squaw Currant	(M+/-)
Ribes•inerme	Whitestem Gooseberry	(M+/-)
Rosa•woodsii	Wood's Rose	(M+/-)
Rubus•deliciosus	Boulder Raspberry	(M+/-)
Rubus•idaeus•var.•strigosus	Wild Raspberry	(M - H)
Rubus•parviflorus *	Thimbleberry	(M - H)
Salix•irrorata	Bluestem Willow	(H)
Sambucus•caerulea *	Blue Elderberry	(H)
Sambucus•melanocarpa *	Blackbead Elderberry	(H)
Sambucus•racemosa *	Red Elderberry	(H)
Sarcobatus•vermiculatus *	Greasewood	(VL-L)
Shepherdia•argentea	Silver Buffaloberry	(M+/-)
Shepherdia•canadensis *	Buffaloberry	(M+/-)
Sorbus•scopulina *	Rocky Mtn. Mountain Ash	(M - H)
Symphoricarpos•albus	Snowberry	(M+/-)
Symphoricarpos•orbiculatus *	Coralberry	(M+/-)
Tetradymia•canescens *	Gray Horsebrush	(L)

SHRUBS

(Deciduous, Introduced)
[Revised April '03]

WATER NEEDS OF PLANTS

The following chart shows how to group plants based their water needs.
Reference Location: Denver. Numbers illustrate typical conditions.

***** = Plants with potential, but requiring caution due to limited history in Rocky Mountain landscaping.

HIGH WATER	MODERATE WATER	LOW WATER	VERY LOW WATER
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18-20 gals./ S.F./season July: 5"-- 3 times per week	10_ gals./S.F./ season .75" -- once per week	0-3 gals./S.F./season .5" per 2 weeks, optional	No irrigation No irrigation

Abelia•chinensis *	Chinese Abelia (China)	(M-H)
Abelia•x•grandiflora *****	Abelia (origin unknown)	(M-H)
Abeliophyllum•distichum *****	----- (Korea)	(M+/-)
Acanthopanax•senticosus *	Syn. Elentherococcus s.	
Acanthopanax•sieboldianus *****	= Elentherococcus•sieboldianus	
Acer•azimovii ***** (= A.•ovczimmikovii?)	Azimov Maple	(M+/-)
Acer•campestre *****	Hedge Maple (e. Europe & w. Asia)	(M-H)
Acer•ginnala	= Acer•tataricum•ssp.•ginnala	
Acer•maximowiczianum *****	----- (China-Mongolia-Korea)	(M-H)
Acer•semenovii *****	= Acer•tataricum•ssp.•semenovii	
Acer•tataricum	Tatarian Maple (A. Minor, se. Asia)	(L-M)
Acer•tataricum•ssp.•ginnala	Ginnala Maple (c. Asia)	(L-M)
Acer•tataricum•ssp.•semenovii *****	Turkestan Maple (c. Asia)	(L-M)
Aesculus•parviflora *****	Bottlebrush Buckeye (Ga., Ala.)	(H)
Aesculus•sylvatica *	----- (se. USA)	(H)
Alnus•cordata *****	Italian Alder (Corsica, s. Italy)	(H)
Alnus•glutinosa *****	European Alder (Eur., n. Africa, Turkey)	(H)
Alnus•rubra (was A.•oregona) *****	Oregon Alder (w. N. Am.)	(H)
Amelanchier•stolonifera *****	Running Serviceberry (ne. N. Am.)	(H)
Aralia•elata *****	Angelica Tree (Jap., Kor., Manch.)	(M-H)
Aralia•spinosa *****	Devil's Walkingstick (e. USA)	(M-H)
Aronia•melanocarpa	Chokeberry (e. N. America)	(M+/-)
Artemisia•abrotanum	Southernwood (s. Europe)	(M+/-)
Atraphaxis•caucasica *****	----- (Transcaucasica)	(M+/-)
Atraphaxis•pyrifolia *****	----- (c. Asia)	(L)
Berberis•koreana *****	Korean Barberry (Korea)	(M+/-)
Berberis•oblonga *****	----- (Turkestan)	(M-L)
Berberis•thunbergii	Japanese Barberry (Jap.)	(M-H)
Buddleja•alternifolia *****	Butterflybush (nw. China)	(M+/-)
Buddleja•davidii	Butterflybush (China)	(M+/-)
Buddleja•globosa *****	----- (Chile, Argentina, Peru)	(M+/-)
Buddleja•x•'Lochinch' *****	----- (hort. hybrid)	(M+/-)
Callicarpa•bodinieri *****	Beauty Berry (c. & w. China)	(M+/-)
Callicarpa•dichotoma *****	Korean Beautyberry (e. USA)	(H)
Calycanthus•occidentalis *	California Allspice (sw. USA)	(H)

Calycanthus•chinensis *	----- (e. China)	(H)
Calycanthus•floridus *	Carolina Allspice (se. USA)	(H)
Caragana•arborescens	Siberian Peashrub (c. Asia - Mongolia)	(L-M)
Caragana•aurantiaca *	Dwarf Peashrub (Sib., Afghan., Turkestan)	(L-M)
Caragana•frutex *	Russian Peashrub (c. Asia, Siberia)	(L-M)
Caragana•maximowicziana *	----- (Tibet, n. China)	(L-M)
Caragana•microphylla	----- (nw. China, Sib.)	(L-M)
Caragana•pygmaea *	----- (nw. China)	(L-M)
Caragana•sinica *	Chinese Peashrub (n. China)	(L-M)
Caryopteris•incana *	----- (China, Jap.)	(L-M)
Caryopteris•mongolica *	----- (n. China, Mong.)	(L-M)
Caryotperis•x•clandonensis	Bluemist Spirea (hort. hybrid)	(L-M)
Ceanothus•sanguineus *	Oregon Tea (Cal. to BC)	(H)
Cerasus•verrucosa *	----- (Tajikistan)	(L-M)
Cercis•griffithii *	Griffith's Redbud (c. Asia)	(L-M)
Chaenomeles•japonica *	Dwarf Quince (Japan)	(M+/-)
Chaenomeles•lagenaria	= C. speciosa	
Chaenomeles•speciosa *	Flowering Quince (China, Japan)	(M+/-)
Chamaecytisus•hirsutus *	----- (Sib.-n. China)	(M+/-)
Chilopsis•linearis*	Desert Willow (desert southwest)	(L-M)
Chimonanthus•praecox *	Fragrant Wintersweet (China)	(H)
Chionanthus•retusus	Chinese Fringe Tree (China, Kor. Taiwan)	(H)
Chionanthus•virginicus	Fringe Tree (e. N. America))	(M-H)
Clematis•heracleifolia•var.•davidiana *	----- (e. China)	(M-H)
Clerodendrum•trichotomum *	Glory Bower (Japan)	(H)
Clethra•alnifolia *	Summer-sweet (e. N. America)	(H)
Clethra•delavayi *	Summer-sweet (w. China)	(M+/-)
Cornus•alba•'Elegantissima'	Variegated R'twig Dog'd (Sib., n. Chi., Kor.)	(H)
Cornus•alternifolia	Pagoda Dogwood (e. N. America)	(H)
Cornus•amomum *	Silky Dogwood (e. N. America)	(M-H)
Cornus•controversa *	Giant Dogwood (Japan, China, Him.)	(H)
Cornus•kousa *	----- (Japan, Korea, China)	(M-H)
Cornus•kousa•var.•chinensis *	----- (China)	(H)
Cornus•mas *	Cornelian Cherry (c. Europe-w. Asia)	(M-H)
Cornus•racemosa *	Gray Dogwood (ne. N Am)	(M-H)
Cornus•sericea (now C.•stolonifera)	(See: Native Rocky Mtn. deciduous shrubs)	
Cornus•stolonifera•'Flaviramea'	Yellowtwig Dogwood (N. Am.)	(H)
Coronilla•emerus *	Scorpion Senna (s. Norway, Spain, Greece)	(M-H)
Corylopsis•pauciflora *	Winter Hazel (Japan, Taiwan)	(H)
Corylopsis•sinensis *	Chinese Winter Hazel (c. China)	(M+/-)
Corylopsis•spicata *	Japanese Winter Hazel (Japan)	(H)
Corylus•avellana *	European Hazel (Europe)	(M-H)
Corylus•chinensis *	Chinese Hazel (sw. China)	(H)
Corylus•maxima *	Filbert (se. Eur., A. Minor)	(H)
Cotinus•coggygria	Smoke Tree (s. Europe-Asia)	(M+/-)
Cotinus•obovatus *	American Smoketree (s. USA)	(M-H)
Cotoneaster•actuifolius	Peking Cotoneaster (n. China)	(M+/-)
Cotoneaster•apiculatus	Cranberry Cotoneaster (China)	(M+/-)
Cotoneaster•bullatus *	----- (w. China)	(M+/-)
Cotoneaster•divaricatus	Spreading Cotoneaster (China)	(M+/-)
Cotoneaster•franchetii *	----- (sw. China, Tibet)	(M-H)
Cotoneaster•horizontalis	Rock Cotoneaster (w. China)	(M+/-)
Cotoneaster•ignavus*	----- (e. Turkestan)	(M+/-)
Cotoneaster•multiflorus•	Many-flowered Cotoneaster (nw. China)	(M+/-)
Cotoneaster•racemiflorus•songaricus *	----- (c. Asia)	(M+/-)
Cotoneaster•simonsii *	----- (Himal., Sikkim, Nepal)	(M-H)
Crataegus•x•mordanensis•'Toba'	Toba Hawthorn (hort. hybrid)	(M+/-)
Cudrania•tricuspidata *	Chinese Silkworm Thorn (China)	(H)
Cydonia•oblonga *	Quince (n. Persia)	(M+/-)
Cydonia•sinensis *	= Pseudocydonia•sinensis	
Cyrilla•racemiflora *	Leatherwood (e. N. America)	(H)
Cytisus•albus *	= Cytisus•multiflorus	

Cytisus•decumbens *	Prostrate Broom (s. Europe)	(L-M)
Cytisus•hirsutus	= Chamaecytisus•hirsutus	
Cytisus•multiflorus *	Portuguese Broom (se. Europe)	(L-M)
Cytisus•purgans *	----- (s. Eur. - n. Afr.)	(L-M)
Cytisus•scoparius *	Scotch Broom (c. & s. Europe)	(L-M)
Cytisus•x•praecox *	Warminster Broom (hort. hybrid)	(L-M)
Dalea•formosa *	Feather Plume (w. Tex., Okl., Colo.)	(L
Dalea•frutescens *	Black Dalea (w. Tex., Okla.)	(L)
Dalea•scoparia *	Broom Dalea (w. Tex., N. Mex., Az.)	(L)
Daphne•caucasica *	Caucasian Daphne (Caucusus)	(M+/-)
Daphne•genkwa *	----- (China)	(M+/-)
Daphne•giraldii *	Daphne (nw. China)	(M+/-)
Daphne•mezereum *	February Daphne (Europe, w. Asia)	(M+/-)
Decaisnea•fargesii *	----- Bluebean Shrub (w. China)	(M-H)
Deutzia•gracilis *	Slender Deutzia (Japan)	(M-H)
Deutzia•scabra *	Fuzzy Deutzia	(M-H)
Deutzia•x•lemoinei *	Lemoine Deutzia (Hort. hybrid)	(M-H)
Diervilla•lonicera *	----- (e. N. America)	(H)
Diervilla•sessilifolia *	Southern Bush-honeysuckle (se. USA)	(H)
Dipelta•floribunda *	----- (c. & w. China)	(M+/-)
Dipteronia•sinensis *	----- (China)	(M+/-)
Disanthus•cercidifolius *	----- (China, Jap.)	(H)
Elaeagnus•multiflora *	Cherry Elaeagnus (Jap., China)	(M-H)
Elentherococcus•sieboldianus *	----- (Jap., China)	(M+/-)
Eleutherococcus•senticosus *	Siberian Ginseng (ne. Asia)	(M-H)
Elsholtzia•stauntonii *	Mint Shrub (n. China)	(M+/-)
Euonymus•atropurpureus *	Wahoo (NY to Fla, Minn. to Tex.)	(M-H)
Euonymus•alatus	Burning Bush Euonymus (China, Jap., Kor.)	(M+/-)
Euonymus•bungeanus *	Winterberry (China, Korea, Manch., Jap.)	(M+/-)
Euonymus•europaeus *	Spindletree (Europe)	(M-H)
Euonymus•nanus•v.•turkestanicus *	Turkestan Euonymus (Caucasus - w. China)	(M+/-)
Euonymus•phellomanus *	----- (n. & w. China)	(M+/-)
Euonymus•sachalinensis *	Sakhalin Euonymus (ne. Asia)	(M+/-)
Exochorda•albertii (now E. korolkowii)		
Exochorda•giraldii *	Pearlbush (c. China)	(M+/-)
Exochorda•korolkowii *	Pearlbush (Uzbekistan, Tajikistan)	(M+/-)
Exochorda•racemosa *	Common Pearlbush (n. China)	(M-H)
Exochorda•serratifolia *	Pearlbush (Korea, Manchuria)	(M+/-)
Exochorda•x•macrantha *	Pearlbush (hort. hybrid)	(M+/-)
Fontanesia•phillyreoides•ssp.•fortunei *	----- (China)	(M+/-)
Forsythia•mandschurica *	Manchurian Forsythia (Manch.)	(M+/-)
Forsythia•ovata *	Early Forsythia (Korea)	(M+/-)
Forsythia•suspensa *	Forsythia (China)	(M+/-)
Forsythia•x•intermedia	Forsythia (hort. hybrid)	(M+/-)
Fothergilla•gardenii *	Fothergilla (Va. - Ga.)	(H)
Fothergilla•major *	----- (Allegheny Mts.)	(H)
Genista•tinctoria *	----- (Europe, w. Asia)	(L-M)
Halimodendron•halodendron *	Salt Tree (se. Russia-c. & w. Asia)	(VL-L)
Hamamelis•japonica *	Japanese Witch Hazel (Japan)	(H)
Hamamelis•mollis *	Chinese Witch Hazel (w. China)	(H)
Hamamelis•vernalis *	Witch Hazel (s.e. N. America)	(H)
Hamamelis•virginiana *	Common Witch Hazel (Canada to Georgia)	(H)

Heptacodium•miconioides *	----- (China)	(M+/-)
Hibiscus•syriacus	Rose-of-Sharon Hibiscus (China, India)	(M+/-)
Hippophaë•rhamnoides	Sea Buckthorn (Eurasia)	(M-H)
Holodiscus•discolor *	Rock Spirea (s. Ore.-s. Calif.)	(M+/-)
Hydrangea•arborescens	Hills-of-snow Hydrangea (e. USA)	(H)
Hydrangea•involucrata *	----- (Japan)	(H)
Hydrangea•paniculata	Peegee Hydrangea (China, Japan)	(H)
Hydrangea•quercifolia *	Oakleaf Hydrangea (se. USA)	(H)
Hydrangea•serrata *	----- (Jap., Korea)	(M-H)
Indigofera•amblyantha *	Pink Indigo (China)	(M+/-)
Indigofera•decora *	White Chinese Indigo (China)	(M+/-)
Indigofera•gerardiana *	= Indigofera•heterantha	
Indigofera•heterantha *	----- (Afghan.-w. China)	(M+/-)
Indigofera•incarnata *	= Indigofera•decora	
Indigofera•kirilowii *	----- (n. China, Korea)	(M+/-)
Indigofera•potaninii *	Potanin Indigo (nw. China)	(M+/-)
Itea•virginica *	Sweetspire (e. USA)	(H)
Jasminum•nudiflorum *	Winter Jasmine (China)	(M+/-)
Kerria•japonica	Kerria (Japan)	(M-H)
Kolkwitzia•amabilis	Beautybush (China)	(M+/-)
Leptodermis•oblonga *	----- (n. China)	(M+/-)
Lespedeza•bicolor *	----- (Japan)	(M+/-)
Lespedeza•thunbergii *	----- (Japan, China)	(M+/-)
Ligustrum•vulgare	Common Privet (Medit. region)	(M+/-)
Lindera•benzoin *	Spicebush (e. USA)	(M)
Lindera•obtusiloba*	----- (KOr., Jap., China)	(M-H)
Lonicera.•spinosa *	----- (nw Him., Tibet, e. Turkestan)	(M+/-)
Lonicera•alberti *	----- (Turkestan, Tibet)	(M+/-)
Lonicera•caerulea *	----- (Tibet, e. Siberia)	(M+/-)
Lonicera•chrysantha *	----- (ne. Asia, c. Japan)	(M-H)
Lonicera•etrusca *	----- (Medit. to s. Switzerland)	(M+/-)
Lonicera•fragrantissima *	Winter Honeysuckle (China)	(M-H)
Lonicera•hispida *	----- (Turkestan)	(M+/-)
Lonicera•korolkowii	----- (Mts. c. Asia, Afghan. Pak.)	(M+/-)
Lonicera•maackia*	Amur Honeysuckle (e. Asia)	(M-H)
Lonicera•maximowiczii•v.•sachalinensis *	Sakhalin Honeysuckle (Manch, China, Kor.)	(M-H)
Lonicera•microphylla *	----- (nw. Him., Tibet, Sib.)	(M+/)
Lonicera•morrowii *	Morrow Honeysuckle (Jap.)	(M-H)
Lonicera•pileata *	----- (China)	(M+/-)
Lonicera•quinquelocularis *	----- (Afghan. to Yunnan)	(M+/-)
Lonicera•spinosa•var.•alberti *	Fragrant Turkestan Honeysuckle (c. Asia)	(M+/-)
Lonicera•standishii *	Fragrant Winter Honeysuckle (China)	(M+/-)
Lonicera•syringantha	Lilac-scented Honeysuckle (China, Tibet)	(M-H)
Lonicera•tatarica•'Zabelii'	Zabel's Honeysuckle (c. Asia, Afghan.)	(M+/-)
Lonicera•thibetica *	Tibetan Honeysuckle (Tibet., w. China)	(M+/-)
Lonicera•xylosteum *	European Fly Honeysuckle (Eurasia)	(M+/-)
Lonicera•x•Xylosteoides *	----- (garden orgin)	(M+/-)
Lycium•chinense *	Chinese Wolfberry (e. Asia)	(M-H)
Magnolia•sieboldii *	Oyama Magnolia (Jap., Korea, w. China)	(H)
Magnolia•stellata	Star Magnolia (c. Japan)	(H)
Myrica•pensylvanica *	Bayberry (e. N. America)	(H)

Neillia•thibetica *	----- (Himalaya Mts.)	(M+/-)
Nevieusii•alambamensis *	----- (se. USA)	(H)
Orixa•japonica *	----- (Japan, China, Korea)	(M+/-)
Paeonia•lutea *	Tree Peony (China, Tibet)	(M+/-)
Paeonia•suffruticosa *	Tree Peony (China, Tibet)	(M+/-)
Parrotia•persica *	----- (Persia)	(M+/-)
Parrotiopsis•jacquemontiana *	----- (Himalaya)	(M-H)
Philadelphus•coronarius +	Sweet Mockorange (Europe, sw. Asia)	(M+/-)
Philadelphus•x•virginalis +	----- (Hort. Hybrid)	(M+/-)
Photinia•villosa *	Oriental Photinia (China, Korea, Jap.)	(M-H)
Physocarpus•opulifolius	Dwarf Ninebark (e. N. America)	(M+/-)
Poncirus•trifoliata *	Trifoliate Orange (c. & n. China)	(M-H)
Prinsepia•sinensis *	----- (Manchuria)	(M+/-)
Prinsepia•uniflora *	----- (nw. China)	(M+/-)
Prunus•andersonii *	Desert Peach (sw. U.S.A.)	(L-M)
Prunus•cerasifera	Cherry Plum (A. Minor, Cauc.)	(M+/-)
Prunus•cerasifera•'Newport'	Newport Plum (garden origin)	(M+/-)
Prunus•fruticosa *	European Dwarf Cherry (Eur.., Siberia)	(M+/-)
Prunus•nigra *	Canada Plum (ne. N. Am.)	(M-H)
Prunus•padus *	Bird Cherry (Eurasia)	(M+/-)
Prunus•tomentosa	Nanking Cherry (n. w. China, Tib. Kashmir)	(M-H)
Prunus•x•cistena	Cistena Plum (hort. hybrid)	(M+/-)
Pseudocydonia•sinensis *	Quince (China)	(M+/-)
Purnus•fasciculata *	Desert Almond (sw. USA)	(VL-L)
x•Pyracomeles•vilmorinii *	(Pyracanthus•crenatoserrataXOsteomeles•subrotunda)	(M+/-)
Rhamnus•dahuricus *	Common Buckthorn (e. Russia to Japan)	(M+/-)
Rhamnus•frangula	Glossy Buckthorn (Eur., Turk., n. Afr.)	(M+/-)
Rhamnus•frangula•'Asplenifolia' *	----- (Hort. Cultivar)	(M+/-)
Rhodotypos•scandens *	Jetbead (Japan, China)	(H)
Rhus•punjabensis *	----- (c., w. China)	(M+/-)
Rhus•typhina	Staghorn Sumac (e. N. America)	(M+/-)
Rhus•typhina•'Laciniata'	Cutleaf Staghorn Sumac (?)	(M+/-)
Ribes•alpinum	Alpine Currant (w. Europe)	(M-H)
Ribes•nevadense *	Sierra Currant (Ore., Cal., Nev.)	(M+/-)
Rosa•banksiae *	Banksia Rose (w. & c. China)	(M+/-)
Rosa•davidii *	David's Rose (w. & c. China)	(M+/-)
Rosa•ecae *	----- (c. Asia)	(M+/-)
Rosa•filipes *	----- (w. China)	(M+/-)
Rosa•foetida•'Bicolor'	Austrian Copper Rose (c. Asia)	(M-L)
Rosa•foetida•'Persiana'	Persian Yellow Rose (s.w. Asia)	(M-L)
Rosa•glauca	Redleaf Rose (c. & s. Europe)	(M+/-)
Rosa•helenae *	Helen Wilson's Rose (c. China)	(M+/-)
Rosa•hugonis	= R.•xanthira•f.•hugonis	
Rosa•kokanica *	----- (c. Asia, China)	(M+/-)
Rosa•laxa *	----- (c. Asia, nw. China)	(M+/-)
Rosa•moyesii *	Moyes Rose (w. China)	(M+/-)
Rosa•moyesii *	Moyes Rose (w. China)	(M+/-)
Rosa•persica *	Persian Rose (Persia, Afghan., c. Asia)	(M+/-)
Rosa•pulverulenta *	----- (s. Eur. to Afghanistan)	(M+/-)
Rosa•rubrifolia (now R.•glauca)		
Rosa•rugosa	Rugosa Rose (e. Russia)	(M+/-)
Rosa•sericea *	----- (c. Asia, w. China)	(M+/-)
Rosa•setigera *	Prairie Rose (e. & c. USA)	(M+/-)
Rosa•webbiana	----- (c. Asia, Afghan, Kashmir.)	(M+/-)
Rosa•wichuriana *	----- (e. Asia)	(M+/-)

Rosa•xanthina•f.•hugonis	Father's Rose (c. China)	(M+/-)
Rosa•x•harisonii *	Harison's Yellow Rose (Hort. hybrid)	(M+/-)
Salix•discolor	Pussy Willow (e. N. America)	(H)
Salix•matsudana•'Tortuosa'	Corkscrew Willow (China, Japan)	(H)
Sambucus•canadensis	Elderberry (e. N. America)	(H)
Sibiraea•altaiensis *	----- (w. China to Balkans)	(L-M)
Sibireae•laevigata	= Siberaea•altaiensis	
Sophora•davidii *	Father David's Sophora (China)	(L-M)
Sorbaria•sorbifolia	Ural False Spirea (Sib., Manch., Korea, Jap.)	(M+/-)
Sorbaria•tomentosa•v.•angustifolia *	----- (Afghan., Pak., Kashmir)	(L-M)
Spiraea•betulifolia•var.•lucida *	----- (B.C., Ore., Wyo., Mon.)	(M+/-)
Spiraea•cantoniensis *	----- (China)	(M+/-)
Spiraea•douglasii *	----- (B.C. to n. Cal.)	(M+/-)
Spiraea•japonica *	----- (Japan, China)	(M+/-)
Spiraea•japonica•'Albiflora' *	----- (Japan)	(M+/-)
Spiraea•japonica•'Anthony•Waterer'	Anthony Waterer Spirea (garden origin)	(M+/-)
Spiraea•japonica•'Bumalda'	----- (Hort. cultivar)	(M+/-)
Spiraea•japonica•'Froebelii'	Froebel's Spirea (garden origin)	(M+/-)
Spiraea•nipponica *	----- (Japan)	(M+/-)
Spiraea•trilobata	----- (n. Sib., Turkestan, n. China)	(L-M)
Spiraea•wilsonii *	----- (c. & w. China)	(M+/-)
Spiraea•x•vanhouttei	Vanhoutte Spirea (hort. hybrid)	(M+/-)
Spirea•x•arguta*	Garland Spirea (garden origin)	(M+/-)
Staphleya•trifolia*	Bladdernut (e. USA)	(M-H)
Staphylea•holocarpa *	Oriental Bladdernut (China)	(H)
Staphylea•pinnata *	European Bladdernut (c., se. Eur. A. Minor)	(H)
Stephanandra•incisa *	Lace Shrub (Jap., Korea, Taiwan)	(H)
Stephanandra•tanakae *	Lace Shrub (Japan)	(M-H)
Stephylea•bumalda *	Japanese Bladdernut (Japan)	(M-H)
Symphoricarpos•x•chenaultii•'Hancock' +	Hancock Coralberry (garden origin)	(M+/-)
Symplocos•paniculata *	Sapphireberry (Pakistan to Korea)	(M +/-)
Syringa•amurensis *	= Syringa•reticulata•v.•mandschurica	
Syringa•joskiaea *	Hungarian Lilac (Hungary)	(M+/-)
Syringa•meyeri *	----- (n. China)	(M+/-)
Syringa•microphylla *	Littleleaf Lilac (n. China)	(M+/-)
Syringa•oblata *	Early Lilac (n. China)	(M+/-)
Syringa•patula *	----- (Korea, China)	(M+/-)
Syringa•persica	Persian Lilac (Persia)	(M+/-)
Syringa•persica•'Laciniata' *	Cutleaf Persian Lilac (Persia ?)	(M+/-)
Syringa•reflexa *	Nodding Lilac (c. China)	(M+/-)
Syringa•reticulata•'Miss•Kim'	Miss Kim Lilac (hort. hybrid)	(M+/-)
Syringa•sweginzowii *	Chengtu Lilac (nw. China)	(M+/-)
Syringa•velutina *	Korean Lilac (Korea)	(M+/-)
Syringa•villosa	----- (China)	(M+/-)
Syringa•vulgaris	Common Lilac (s.e. Europe)	(M+/-)
Syringa•wolfii *	Wolf's Lilac (Korea, Manchuria)	(M+/-)
Syringa•x•chinensis	----- (hort. hybrid)	(M+/-)
Syringa•x•laciniata	Cutleaf Lilac (sw. Asia)	(M+/-)
Syringa•x•prestoniae *	----- (Canadian hort. origin)	(M+/-)
Viburnum•burejaeticum *	----- (n. China, Korea, Russia)	(M-H)
Viburnum•carlesii	Korean Spice Viburnum (Korea, Jap.)	(M-H)
Viburnum•cassinoides *	Witherod Viburnum (e. N. Am.)	(H)
Viburnum•dentatum	Arrowwood Viburnum (e. N. America)	(H-M)
Viburnum•dilatatum *	Linden Viburnum (China, Jap.)	(H)
Viburnum•farreri *	Fragrant Viburnum (n. China)	(H)
Viburnum•lantana	Wayfaring Vib. (Eur., n. Afr., Cauc. A. Minor)	(M+/-)
Viburnum•lentago	Nannyberry (e. N. America)	(M-H)
Viburnum•opulus	European Highbush Cranberry (Eurasia)	(H)

Viburnum•opulus•'Compactum'	----- (cultivar)	(H)
Viburnum•opulus•'Roseum'	European Snowball Viburnum	(H)
Viburnum•plicatum *	----- (Jap., China) (H-M)	
Viburnum•plicatum•'Sterile' *	Japanese Snowball Viburnum (Jap. China)	(H)
Viburnum•plicatum•form•'tomentosum' *	Doublefile Viburnum (Jap., China)	(H)
Viburnum•prunifolium	Black Haw (e. N. Am.)	(M-H)
Viburnum•sargentii *	Sargent's Vib. (e. Sib., n. & w. China, Jap.)	(M-H)
Viburnum•setigerum *	Tea Viburnum (c. & w. China)	(M+/-)
Viburnum•sieboldii *	----- (Japan)	(H)
Viburnum•trilobum	American Highbush Cranberry (N. America)	(H)
Viburnum•trilobum•'Compactum'	----- (cultivar)	(H)
Viburnum•x•bodnantense•'Pink•Dawn' *	----- (hort. hybrid)	(M-H)
Viburnum•x•carlcephalum	----- (hort. hybrid)	(M-H)
Vitex•agnus-castus•f.•latifolia *	Hardy Chaste Tree (s. Europe to c. Asia)	(L-M)
Vitex•negundo•var.•heterophylla *	Cutleaf Chaste Tree(n. China, Mongolia)	(M+/-)
Vitex•rotundifolia *	----- (Asia to Australia)	(M+/-)
Weigela•florida	Weigela (n. China, Korea, Jap.)	(H)
Weigela•middendorffiana *	Middendorff Weigela (n. China, Jap.)	(H)
Xanthocerus•sorbifolium	Yellowhorn (n. China)	(M+/-)
Zanthoxylum•piperitum *	Pepper Tree (China, Korea, Jap.)	(M+/-)
Zanthoxylum•schinifolium *	Pepper Tree (China, Korea, Jap.)	(M+/-)
Zanthoxylum•simulan *	----- (China, Taiwan)	(M-H)
Zenobia•pulverulenta *	Dusty Zenobia (N. Carolina-Florida	

Trees

(Deciduous Rocky Mountain Natives)
[Revised April '03]

WATER NEEDS OF PLANTS

The following chart shows how to group plants based on their water needs.
Reference Location: Denver. Numbers illustrate typical conditions.

***** = Plants with potential, but requiring caution due to limited history in Rocky Mountain landscaping.

HIGH WATER	MODERATE WATER	LOW WATER	VERY LOW WATER
Reference plant: Bluegrass turf (Always wet at surface)	Reference plant: Turf-type Tall Fescue (Half of Bluegrass turf)	Reference plant: Buffalograss turf (Like Denver without irrigation)	Reference plant: Too dry for any turf (drier than Denver)
18-20 gals./ S.F./season July: 5"-- 3 times per week	10_ gals./S.F./ season .75" -- once per week	0-3 gals./S.F./season .5" per 2 weeks, optional	No irrigation No irrigation

Celtis•occidentalis	Hackberry	(M-H)
Celtis•reticulata	Netleaf Hackberry	(M-H)
Fraxinus•cuspidata *****	Fragrant Ash	(M+/-)
Fraxinus•pennsylvanica	Green Ash	(M-H)
Populus•angustifolia	Narrowleaf Cottonwood	(H)
Populus•deltoides	Plains Cottonwood	(H)
Populus•fremontii	Fremont's Cottonwood	(H)
Populus•tremuloides	Aspen	(H)
Populus•x•acuminata	Lanceleaf Cottonwood	(H)
Sapindus•drummondii *****	Soapberry	(L-M)

Trees

(Deciduous, Introduced)

[Revised April '03]

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HIGH WATER	MODERATE WATER	LOW WATER	VERY LOW WATER
Reference plant:	Reference plant:	Reference plant:	Reference plant:
Bluegrass turf	Turf-type Tall Fescue	Buffalograss turf	Too dry for any turf
(Always wet at surface)	(Half of Bluegrass turf)	(Like Denver without irrigation)	(drier than Denver)
18-20 gals./ S.F./season	10_ gals./S.F./ season	0-3 gals./S.F./season	No irrigation
July: 5"-- 3 times per week	.75" -- once per week	.5" per 2 weeks, optional	No irrigation

Acer•capillipes *	Snake-bark Maple (Japan)	(H)
Acer•cappadocicum *	Caucasican Maple (Cauc., A. Minor, n. India)	(M-H)
Acer•cissifolium *	Ivy-leafed Maple (c. China)	(M-H)
Acer•davidii *	Snake-bark Maple (n. China)	(M-H)
Acer•griseum *	Paperbark Maple (China)	(M-H)
Acer•heldreichii *	Greek Maple (Cauc., Balk., n. Turkey)	(M-H)
Acer•macrophyllum *	Oregon Maple (w. N. Am.)	(H)
Acer•mandschuricum *	Manchurian Maple (Korea, Manch.)	(M-H)
Acer•monspessulanum *	Montpelier Maple (Medit.- c. Asia)	(M+/-)
Acer•palmatum	Japanese Maple (Kor., Jap.)	(H)
Acer•pectinatum	----- (Tibet, w. & c. China)	(M-H)
Acer•platanoides	Norway Maple (Eur. to n. Persia)	M-H)
Acer•platanoides•ssp.•turkestanicum *	Turkestan Maple (c. Asia)	(M+/-)
Acer•pseudoplatanus *	Sycamore Maple (nw. c. Eur. to w. Asia)	(M-H)
Acer•pseudosieboldianum *	Korean Maple (Korea-Manch.)	(H)
Acer•rubrum	Red Maple (e. N. America)	(M-H)
Acer•saccharinum	Silver Maple (e. N. Am.)	(M-H)
Acer•saccharinum•'Laciniatum' +	Cutleaf Silver Maple (Hort. cultivar	(M-H)
Acer•saccharum	Sugar Maple (e. N. America)	(H)
Acer•triflorum *	Three-flowered Maple (Manch., Korea)	(M+/-)
Acer•truncatum *	Shantung Maple (n. China, Manch., Korea)	(H)
Acer•turkestanicum *	= A. platanoides ssp. turkestanicum	
Aesculus•flava	Sweet Buckeye (e. N. America)	(M-H)
Aesculus•glabra	Ohio Buckeye (e. N. America)	(M-H)
Aesculus•hippocastanum	Horse Chestnut (Eurasia)	(M-H)
Aesculus•octandra	= Aesculus•flava	
Aesculus•pavia *	Red Buckeye (se. USA)	(H)
Aesculus•turninata *	Japanese Horsechestnut (Japan)	(M-H)
Aesculus•x•carnea *	Red-flowered Horsechestnut (hort. hybrid)	(M+/-)
Ailanthus•altissima	Tree of Heaven (n. China)	(L-M-H)
Albizia•julibrissin*	Silk Tree (Iran-Japan)	(M+/-)
Amelanchier•asiatica *	Asiatic Serviceberry (China)	(M+/-)
Asimia•triloba *	Paw Paw (ec. USA)	(H?)
Betula•albosinensis *	Chinese Red Birch (c., w., nw. China)	(M-H)
Betula•ermanii *	Russian Rock Birch (ne. Asia)	(H)
Betula•mandshurica•var.•japonica *	Japanese White Birch (Jap., Sakhalin Is.)	(H)
Betula•maximowicziana *	Monarch Birch (Jap.)	(H)
Betula•nigra	River Birch (e. USA)	(H)

Betula•papyrifera	Paper Birch (e. N. America)	(H)
Betula•pendula•'Lacinata'	Cutleaf Weeping Eur.. Birch (hort. hybrid)	(H)
Betula•pendula	European Birch (Eur.-w. Asia)	(H)
Betula•utilis•var.•jacquemantii *	Whitebarked Himal. Birch (Kash., c. Nepal)	(M-H)
Carpinus•betulus *	European Hornbeam (Eur.-w. Asia)	(H)
Carpinus•carolinana *	American Hornbeam (e. N. America)	(H)
Carpinus•cordata *	Heartleaf Hornbeam (China)	(M-H)
Carpinus•henryana *	----- (c. China)	(M-H)
Carpinus•japonica *	Japanese Hornbeam (Japan)	(H)
Carpinus•laxiflora *	----- (Jap., Kor., n. & w. China)	(M-H)
Carpinus•orientalis *	Oriental Hornbeam (se. Eur., A. Minor)	(M-H)
Carpinus•tschonoskii *	Yeddo Hornbeam (ne. & sw. China)	(M-H)
Carpinus•turczaninovii *	----- (w. China)	(M+/-)
Carya•illinoinensis *	Pecan (Iowa s. to Mexico)	(M+/-)
Carya•laciniosa *	Shellbark Hickory (e. N. America)	(M-H)
Carya•ovata *	Shagbark Hickory (e. N. America)	(H)
Castanea•crenata *	Japanese Chestnut (Jap.)	(H)
Castanea•dentata	American Chestnut (e. N. America)	(H)
Castanea•mollissima *	Chinese Chestnut (China, Korea)	(M-H)
Catalpa•bignonioides *	Southern Catalpa (se. USA)	(H)
Catalpa•bungei *	----- (n. China)	(M+/-)
Catalpa•fargesii *	----- (w. China)	(M+/-)
Catalpa•ovata *	Chinese Catalpa (China)	(H)
Catalpa•speciosa	Catalpa (e. N. America)	(M-H)
Celtis•australis *	Mediterranean Hackberry (Medit., Mid East)	(M+/-)
Celtis•caucasica *	Caucasican Hackberry (Asia Minor-Afghan.)	(M+/-)
Celtis•laevigata	Sugarberry (se. USA)	(M-H)
Cercidiphyllum•japonicum *	Katsura Tree (Japan, w. China)	(H-M)
Cercis•canadensis	Eastern Redbud (e. N. America)	(M-H)
Cercis•reniformis *	Texas Redbud (N. Mex., Tex., Okla.)	(M+/-)
Chitalpa	= x•Chitalpa•tashkentensis	
Cladrastis•lutea *	Yellowwood (se. USA)	(H)
Cladrastis•platycarpa *	Japanese Yellowwood (Jap., China)	(H)
Cladrastis•sinensis *	Chinese Yellowwood (China)	(H)
Corlyus•colurna	Turkish Hazel (se. Europe, w. Asia)	(M+/-)
Cornus•walteri *	Walter Dogwood (c. China)	(M-H)
Corylus•americana *	American Hazel (e. N. America)	(H)
Crataegus•altaica•'Hissarica' *	Hissar Hawthorn (Tajikistan)	(M+/-)
Crataegus•ambigua +	Russian Hawthorn (se. Russia)	(M+/-)
Crataegus•arnoldiana *	----- (New England)	(M+/-)
Crataegus•azarolus *	Red Azarole (s. Eur., n. Afr., w. Asia)	(M+/-)
Crataegus•crus-galli	Cockspur Hawthorn (se. N. America)	(M+/-)
Crataegus•laevigata *	English Hawthorn (Eur., n. Afr., India)	(M-H)
Crataegus•maximowiczii *	----- (ne. Asia)	(M±)
Crataegus•mollis	Downy Hawthorn (e. N. America)	(M+/-)
Crataegus•monogyna *	Singleseed Hawthorn (Eur., n. Afr., w. Asia)	(M+/-)
Crataegus•pedicellata *	----- (ne. USA)	(M+/)
Crataegus•phaenopyrum	Washington Hawthorn (se. N. America)	(M+/-)
Crataegus•pinnatifida *	Chinese Hawberry (c. Asia, Korea)	(M+/-)
Crataegus•rivularis *	----- (Rocky Mtn. States)	(M+/-)
Crataegus•tianshanica *	Tien Shan Hawthorn (c. Asia)	(M+/-)
Crataegus•turkestanica *	Turkestan Hawthorn (Turkestan)	(M+/-)
Crataegus•viridis•'Winter•King' *	Winter King Hawthorn (e. USA)	(M+/-)
Crataegus•x•nitida *	Shining Hawthorn (s. USA)	(M+/-)
Cyrilla•racemiflora *	Leatherwood (e. N. Am. & e. S. Am.)	(H)
x•Chitalpa•tashkentensis *	Chiltalpa (Catalpa•bignonioides X Chilopsis•linearis)	(M+/-)
Diospyros•virginiana *	American Persimmon (e. USA)	(M-H)

Eucommia•ulmoides *	Hardy Rubber Tree (c. China)	(M+/-)
Evodia•daniellii *	= Tetradium•danielii *	
Evodia•hupehensis *	= Tetradium•hupehensis *	
Fagus•grandifolia *	American Beech (e. N. America)	(H)
Fagus•orientalis *	Oriental Beech (se. Eur.-Iran)	(M+/-)
Fagus•sylvatica	European Beech (Europe)	(H)
Fraxinus•americana	White Ash (e. N. America)	(M-H)
Fraxinus•americana•'Autumn•Purple'	Autumn Purple Ash (hort. cultivar)	(M-H)
Fraxinus•angustifolia•'Raywood' *	Raywood Ash (s. Europe-c. Asia, n. Afr.)	(M+/-)
Fraxinus•angustifolia•ssp.•syriaca *	Turkestan Ash (c. Asia, A. Minor)	(M+/-)
Fraxinus•chinensis *	Chinese Ash (China)	(M+/-)
Fraxinus•cuspidata *	Flowering Ash (N. Mex. to Mex.)	(L-M)
Fraxinus•excelsior *	European Ash (Europe, w. Asia)	(M+/-)
Fraxinus•latifolia *	Oregon Ash (w. US)	(M+/-)
Fraxinus•mandshurica *	Manchurian Ash (n. Asia)	(M+/-)
Fraxinus•nigra *	Black Ash (N. Am.)	(M+/-)
Fraxinus•ornus *	Flowering Ash (s. Europe-w. Asia)	(M+/-)
Fraxinus•oxycarpa•'Raywood' *	= F. angustifolia 'Raywood'	
Fraxinus•quandrangulata *	Blue Ash (Mich., to Ark.)	(M-H)
Fraxinus•sieboldiana *	----- (Japan, China)	(M-H)
Fraxinus•sogdiana *	= Fraxinus•angustifolia•ssp.•syriaca	
Fraxinus•velutina *	Velvet Ash (Ariz., N. Mex.)	(M+/-)
Ginkgo•biloba *	Ginkgo, Maidenhair Tree (se. China)	(M-H)
Gleditsia•caspica *	Caspian Honeylocust (Azerbaijan-n. Iran)	(M+/-)
Gleditsia•triacanthos•var.	Honeylocust varieties (c. & e. N. America)	(M-H)
Gymnocladus•dioica	Kentucky Coffeetree (c. & e. N. America)	(M-H)
Halesia•diptera *	Two-winged Silverbell (s. USA)	(H)
Halesia•tetraptera *	Silverbell Tree (se. USA)	(H)
Hemiptelea•davidii *	David Hemiptelea (n. China to Korea)	(M-H)
Hovenia•dulcis *		
Idesia•polycarpa *	----- (Sichuan)	M-H)
Juglans•ailanthifolia *	Japanese Walnut (Jap.)	(M+/-)
Juglans•ailantifolia *	Heartnut (Japan)	(H)
Juglans•cinerea *	White Butternut (N. America)	(M+/-)
Juglans•mandshurica *	Manchurian Walnut (Manchuria, ne. China)	(M+/-)
Juglans•microcarpa *	Little Walnut (OK., N. Mex., Tex., Kan., Mex.)	(M+/-)
Juglans•nigra	Black Walnut (e. USA)	(M-H)
Juglans•regia•varieties *	Carpathian Walnut varieties (se. Eur. - China)	(M+/-)
Kalopanax•pictus *	= Kalopanax•septemlobus	
Kalopanax•septemlobus *	Castor-aralia (China, Korea, Japan)	(M-H)
Koelreuteria•paniculata	Golden Raintree (n.China, Korea)	(M+/-)
Laburnum•alpinum *	Alpine Golden Chaintree (sc. Europe)	(M-H)
Laburnum•anagyroides *	Common Laburnum (c. & s. Eur.)	(M+/-)
Laburnum•X•'Waterer' *	Waterer Laburnum (hort. hybrid)	(H)
Larix•decidua	European Larch (Alps, Carpathian Mts.)	(H)
Larix•gmelinii *	Dahurian Larch (e. Asia)	(H)

Larix•kaempferi *	Japanese Larch (Japan)	(H)
Larix•laricina	Tamarack (n. N. America)	(H)
Larix•leptolepis *	= Larix•kaempferi	
Larix•occidentalis *	Rocky Mtn. Larch (B.C. to Montana)	(M-H)
Liquidambar•styraciflua *	Sweetgum (e. N. America to c. America)	(H)
Liriodendron•tulipifera *	Tulip Tree (e. N. America)	(H)
Maackia•amurensis *	Amur Maackia (Manchuria, Korea)	(M+/-)
Maackia•chinensis *	----- (c. China)	(M+/-)
Maclura•pomifera *	Osage Orange (Ark., Tex.)	(M+/-)
Magnolia•acuminata *	Cucmber Tree (e. N. AM)	(H)
Magnolia•kobus *	Tree Star Magnolia (Japan)	(M-H)
Magnolia•x•soulangiana	Saucer Magnolia (hort. hybrid)	(H)
Malus•'Hopa'	Hopa Crabapple (hort. cultivar)	(M+/-)
Malus•'Radiant'	Radiant Crabapple (hort. cultivar)	(M+/-)
Malus•'Snowdrift'	Snowdrift Crabapple (hort. cultivar)	(M+/-)
Malus•baccata	Siberian Crabapple (Manchuria, China)	(M+/-)
Malus•dolgo	Dolgo Crabapple (Siberia ?)	(M+/-)
Malus•ioensis	Prairie Crabapple (c. USA)	(M+/-)
Malus•ioensis•'Plena'	Bechtel Crabapple (hort. cultivar)	(M+/-)
Malus•sp.•'Golden•Delicious'	Golden Delicious Apple (hort. cultivar)	(M+/-)
Malus•sp.•'Red•Delicious'	Red Delicious Apple (hort. cultivar)	(M+/-)
Malus•sp.•'Winesap'	Winesap Apple (hort. cultivar)	(M+/-)
Malus•spp.	Common Apple (se. Europe, c. Asia)	(M+/-)
Mespilus•germanica *	Medlar (Europe-Asia Minor)	(M+/-)
Metasequoia•glyptostroboides *	Dawn Redwood (w. China)	(M-H)
Morus•alba	White Mulberry (Asia)	(M+/-)
Morus•australis *	----- (e. Asia)	(M+/-)
Morus•nigra *	Black Mulberry (sw. Asia)	(M+/-)
Morus•rubra *	Red Mulberry (e. N. America)	(M+/-)
Nothofagus•antarctica *	Southern Beech (Chile, Argentina)	(H)
Nyssa•sylvatica *	Blackgum (Ontario, Texas)	(H)
Ostrya•carpinifolia *	European Hop Hornbeam (s. Eur., se. Asia)	(M)
Ostrya•virginiana *	American Hop Hornbeam (e. N. America)	(H)
Paulownia•fortunei*	----- (China, Japan)	(H)
Paulownia•kawakamii*	----- (s. China, Taiwan)	(H)
Paulownia•tomentosa *	Empress Tree (c. & w. China)	(M-H)
Phellodendron•amurense *	Amur Cork Tree (n. China, Jap., Manch.)	(M-H)
Phellodendron•chinese *	Chinese Cork Tree (c. China)	(M-H)
Phellodendron•Japonicum *	Japanese Cork Tree (c. Japan)	(H)
Phellodendron•sachalinense *	Sakhalin Cork Tree (w. China, n. Jap., Kor.)	(H)
Pistacia•chinensis *	Chinese Pistachio (China, Taiwan)	(L-M)
Pistacia•vera *	Edible Pistachio (Persia, c. Asia)	(L-M)
Platanus•occidentalis *	Eastern Plane Tree (Ia., to Tex. to Mex.)	(H)
Platanus•orientalis *	Oriental Plane Tree (se. Eur., sw. Asia)	(M+/-)
Platanus•x•acerifolia *	London Plane Tree (hort. hybrid)	(H)
Prunus•armeniaca	Apricot (c. & e. Asia)	(M+/-)
Prunus•armeniaca•var.•mandshurica *	= Prunus•mandshurica	
Prunus•avium *	Bird Cherry (Eur.-A. Minor-e. Sib.)	(H-M)
Prunus•cerasus *	Pie Cherry (se. Eur., Iran, n. India)	(M+/-)
Prunus•cerasus•'Meteor'	Meteor Pie Cherry (hort. cultivar)	(M+/-)
Prunus•cerasus•'Morello'	Morello Pie Cherry (hort. cult.)	(M+/-)
Prunus•cerasus•x•'Montmorency'	Montmorency Pie Cherry (hort. cultivar)	(M+/-)
Prunus•cerasus•x•'North•Star'	North Star Pie Cherry (hort. cultivar)	(M+/-)
Prunus•maackii	Manchurian Cherry (Kor. Manch.)	(M-H)

Prunus•mahleb *	St. Lucie Cherry (Eur.-Asia Minor)	(M+/-)
Prunus•mandshurica *	Manchurian Apricot (Manchuria, Korea)	(M+/-)
Prunus•persica	Peach (c. & e. Asia)	(M+/-)
Prunus•salicina *	Japanese Plum (China, Jap.)	(H-M)
Prunus•sp.•'Green•Gage'	Green Gage Plum (hort. cultivar)	(M+/-)
Prunus•sp.•'Stanely'	Stanley Plum (hort. cultivar)	(M+/-)
Prunus•spp.	Domestic Plums	(M+/-)
Prunus•x•dasycarpa * (P. •armenica x P.•cerasifera)	Black Apricot (c. Asia-Asia Minor)	(M-L)
Pseudolarix•kaempferi *	Golden Larch (e. China)	(H?)
Ptelea•polyadenia*	----- (sw. USA)	(M+/-)
Pterocarya•fraxinifolia *	Caucasian Walnut (Caucasus, Persia)	(M+/-)
Pteroceltis•tartarianovii *	Tartar Wingceltis (n., c. China)	(M+/-)
Pterostyrax•hispida *	Fragrant Epaulette Tree (Japan, China)	(H?)
Pyrus•bucharica *	= Pyrus•korshinsky	
Pyrus•calleryana•'Bradford'	Bradford Pear (China)	(M+/-)
Pyrus•communis +	Common Garden Pear (Europe, w. Asia)	(M+/-)
Pyrus•communis•'Maxine'	Maxine Pear (hort. cultivar)	(M+/-)
Pyrus•communis•'Moonglow'	Moonglow Pear (hort. cultivar)	(M+/-)
Pyrus•korshinsky *	Buchara Pear (Turkestan)	(L-M)
Pyrus•salicifolia *	Willow-leafed Pear (se. Europe, w. Asia)	(M+/-)

Quercus•acutissima *	Sawtooth Oak (Japan, China, Korea)	(M-H)
Quercus•alba	White Oak (e. USA)	(M+/-)
Quercus•bicolor	Swamp White Oak (ne. N. Am.)	(M+/-)
Quercus•douglasii *	California Blue Oak (w. US)	(M+/-)
Quercus•frainetto *	Hungarian Oak (s. Italy, Balk., Turkey)	(M+/-)
Quercus•glandulifera *	----- (Jap., Korea, China)	(M+/-)
Quercus•imbricaria *	Shingle Oak (e. & c. USA)	(M-H)
Quercus•kelloggii *	California Black Oak (w. US)	(M+/-)
Quercus•macrocarpa	Bur Oak (c., ne. N. America)	(M+/-)
Quercus•mongolica *	Mongolian Oak (ne. Asia)	(M+/-)
Quercus•muehlenbergii *	Chinquapin Oak (e. USA)	(M-H)
Quercus•palustris	Pin Oak (ne. N. America)	(M-H)
Quercus•phellos *	Willow Oak (se. USA)	(M-H)
Quercus•prinus *	Chestnut Oak (e. USA)	(M-H)
Quercus•robur	English Oak (Europe, n. Afr., w. Asia)	(M-H)
Quercus•rubra	Northern Red Oak (ne. USA)	(M-H)
Quercus•sadleriana *	Deer Oak (w. USA)	(M+/-)
Quercus•shumardii *	Shumard's Oak (c. USA)	(M-H)
Quercus•vacciniifolia *	Huckleberry Oak (w. US)	(M+/-)

Salix•pentandra *	Laurel-leaf Willow (Eur.)	(H)
Sassafras•albidum *	Sassafras (e. N. Am.)	(H)
Sophora•davidii *	David's Sophora (China)	(L-M)
Sophora•japonica (aka Styphnolobium•japonicum)	Japanese Pagoda Tree (China, Korea)	(M+/-)
Sorbus*torminalis *	Chequer Tree (A. Minor, n. Africa, Eur. Asia)	(H)
Sorbus•alnifolia *	----- (Jap., Korea)	(H)
Sorbus•americana	American Mtn. Ash (ne. N. America)	(M-H)
Sorbus•aria*	Whitebeam Mtn. Ash (Eur.)	(H)
Sorbus•aucuparia	European Mtn. Ash (Eurasia)	(M-H)
Sorbus•cashmeriana *	Kashmir Mountain Ash (Himalaya)	(H)
Sorbus•commixta *	----- (Korea, Japan)	(M-H)
Sorbus•decora	Showy Mountain Ash (ne. N. America)	(M-H)
Sorbus•forrestii *	Forest's Mountain Ash (China)	(M-H)
Sorbus•hupehensis *	Hupeh Mtn. Ash (c., w. China)	(M-H)
Sorbus•intermedia *	Scandinavian Mtn. Ash (Scand.)	(H)
Sorbus•latifolia *	----- (Europe)	(M-H)
Sorbus•pohuashanensis *	----- (n. China)	(H)
Sorbus•prattii *	Pratt's Mountain Ash (w. China)	(M+/-)
Sorbus•tianschanica *	Tien Shan Mtn. Ash (c. Asian mtns.)	(H)

Sorbus•x•hybrida *	Oakleaf Mtn. Ash (hort. hybrid)	(H)
Stranvaesia•davidiana *	Chinese Stranvaesia (w. China)	(H)
Styphnolobium•japonicum	see Sophora•japonica	
Styrax•japonicum *	Japanese Snowball (Japan, China)	(H)
Styrax•obassia *	Fragrant Snowbell (Japan)	(H)
Syringa•pekinensis	Peking Tree Lilac (n. China)	(M+/-)
Syringa•reticulata	Japanese Tree Lilac (n. Japan)	(M-H)
Syringa•reticulata•var.•mandschurica	Manchurian Tree Lilac (Japan)	(M+/-)
Taxodium•ascendens *	Pond Cypress (se. USA)	(H)
Taxodium•distichum	Bald Cypress (se. N. America)	(H)
Tetradium•danielii *	Korean Evodia (China, Korea)	(H)
Tetradium•hupehensis *	Hupeh Bee Bee Tree (sw. China, Korea)	(M+/-)
Tilia•americana	Basswood (c., e. N. America)	(H)
Tilia•amurensis *	Amur Linden (Manch., Korea)	(M-H)
Tilia•cordata	Littleleaf Linden (Eur. to Caucasus)	(H)
Tilia•mongolica *	Mongolian Linden (Mon., e. Russia, n. China)	(M-H)
Tilia•platyphyllos *	Bigleaf Linden (se., Europe)	(M-H)
Tilia•tomentosa *	Silver Linden (se. Europe, w. Asia)	(M+/-)
Tilia•x•euchlora *	Crimean Linden (hort. hybrid)	(M-H)
Toona•sinensis	----- (China)	(M-H)
Ulmus•parvifolia *	Chinese Elm (China, Japan, Korea)	(M-H)
Ulmus•americana•cvs.	American Elm (DED resistant cultivars)	(L-M-H)
Zelkova•carpinifolia *	Caucasian Zelkova (Cauc.)	(M-H)
Zelkova•serrata *	Japanese Zelkova (Jap., Taiwan, e. China)	(H)
Zelkova•sinica *	Chinese Zelkova (e. China)	(H)
Ziziphus•jujuba *	Chinese Jujuba (temp. Asia)	(H-M)

EVERGREENS

(Coniferous Trees)
[Revised April '03]

WATER NEEDS OF PLANTS

The following chart shows how to group plants based on their water needs.
Reference Location: Denver. Numbers illustrate typical conditions.

***** = Plants with potential, but requiring caution due to limited history in Rocky Mountain landscaping.

HIGH WATER	MODERATE WATER	LOW WATER	VERY LOW WATER
Reference plant:	Reference plant:	Reference plant:	Reference plant:
Bluegrass turf (Always wet at surface)	Turf-type Tall Fescue (Half of Bluegrass turf)	Buffalograss turf (Like Denver without irrigation)	Too dry for any turf (drier than Denver)
18-20 gals./ S.F./season July: 5"-- 3 times per week	10_ gals./S.F./ season .75" -- once per week	0-3 gals./S.F./season .5" per 2 weeks, optional	No irrigation No irrigation

Abies•cilicica *	Cilician Fir (s. Turkey, nw. Syria, Lebanon)	(M-H)
Abies•concolor	White Fir (Colo. to Mex.)	(M-H)
Abies•holophylla *	Manchurian Fir (Manch., Korea)	(M-H)
Abies•homolepis *	Nikko Fir (Japan)	(H)
Abies•koreana *	Korean Fir (s. Korea)	(H)
Abies•lasiocarpa	Subalpine Fir (Rocky Mtns.)	(H)
Abies•nordmanniana *	Caucasian Fir (Greece, Cauc., Turkey)	(M)
Calocedrus•decurrens *	Incense Cedar (w. Ore.-Baja Calif.)	(M-H)
Cedrus•atlantica *	= Cedrus•libani•ssp.•atlantica	
Cedrus•deodara *	Deodara Cedar (Himilaya Mts. Afghan.-w. Nepal)	(M-H)
Cedrus•libani *	Lebanon Cedar (nw. Syria, se Turkey)	(M-H)
Cedrus•libani•ssp.•atlantica *	Atlas Cedar (Atlas Mts.)	(M-H)
Cedrus•libani•ssp.•stenocoma *	Hardy Turkish Cedar (s. Turkey)	(M-H)
Cupressus•arizonica *	Arizona cypress (Ariz., N. Mex., Tex., Mex.)	(L-M)
Cupressus•bakeri *	Modoc Cypress (Calif., Oregon)	(M+/-)
Picea•abies	Norway Spruce (n. & c. Europe)	(H)
Picea•engelmannii	Engelmann Spruce (B.C. to N. Mex.)	(H)
Picea•glauca	White Spruce (n. N. Am.)	(M-H)
Picea•glauca•'Black•Hills'	Black Hills Spruce (Black Hills S.Dak.)	(M-/-)
Picea•glauca•'Conica'	Dwarf Alberta Spruce (hort. cultivar)	(H)
Picea•omorika *	Serbian Spruce (Balk.)	(M-H)
Picea•pungens	Colorado Spruce (Wyo., Colo., N. Mex., Utah)	(M-H)
Picea•schrenkiana•ssp.•tianshanica *	----- (c. Asia)	(M+/-)
Pinus.•heldreichii (was P.•leucodermis) *	Bosnian Pine (w. Balkans - se. Italy - Greece)	(M+/-)
Pinus•aristata	Bristlecone Pine (Mts. Cal. to Colo.)	(M, H)
Pinus•bungeana *	Lacebark Pine (nw. China)	(M+/-)
Pinus•cembra *	Swiss Stone Pine (c. Eur. mtns.)	(M-H)
Pinus•contorta•ssp.•latifolia	Lodgepole Pine (Alaska, Cal., to Colo.)	(M-H)
Pinus•densiflora *	Japanese Red Pine (Jap., Korea)	(M-H)
Pinus•flexilis	Limber Pine (Albt. to Cal. to Tex.)	(M-H)
Pinus•nigra	Austrian Pine (se. Eur., w. Asia, n. Afr.)	(M-H)
Pinus•peuce *	Macedonian Pine (Balk.)	(M-H)
Pinus•ponderosa	Ponderosa Pine (w. North America)	(M+/-)
Pinus•pumila *	Dwarf Siberian Pine (ne. Asia)	(H)
Pinus•strobiformis	Southwestern White Pine (Colo., Ariz., n. Mex.	(M-H)

Pinus•strobus	Eastern White Pine (e. N. America)	(H)
Pinus•sylvestris	Scotch Pine (n. Eurasia)	(M-H)
Pinus•wallichiana *	Himalayan White Pine (Himalaya Mtns.)	(M-H)
Pseudotsuga•menziesii	Douglas Fir (B.C. to Mex. to Tex.)	(M-H)
Sequoiadendron•giganteum *	Giant Sequoia (Sierra Nevada Mts.)	(H)
Tsuga•canadensis	Canada Hemlock (ne. N. America)	(H)

EVERGREENS

(Coniferous Shrubs)
[Revised April '03]

WATER NEEDS OF PLANTS

The following chart shows how to group plants based on their water needs.
Reference Location: Denver. Numbers illustrate typical conditions.

***** = Plants with potential, but requiring caution due to limited history in Rocky Mountain landscaping.

HIGH WATER	MODERATE WATER	LOW WATER	VERY LOW WATER
Reference plant: Bluegrass turf (Always wet at surface)	Reference plant: Turf-type Tall Fescue (Half of Bluegrass turf)	Reference plant: Buffalograss turf (Like Denver without irrigation)	Reference plant: Too dry for any turf (drier than Denver)
18-20 gals./ S.F./season July: 5"-- 3 times per week	10 gals./S.F./ season .75" -- once per week	0-3 gals./S.F./season .5" per 2 weeks, optional	No irrigation No irrigation

Chamaecyparis•pisifera *****	----- (Japan)	(H)
Juniperus•chinensis	Chinese Juniper (e. Asia)	(L-M)
Juniperus•chinensis•'Hetzii•Glauca'	Hetzi Juniper (hort. cultivar)	(L-M)
Juniperus•chinensis•'Pfitzeriana'	Pfitzer Juniper (hort. cultivar)	(L-M)
Juniperus•chinensis•'Pfitzeriana•Compacta'	Compact Pfitzer Juniper (hort. cultivar)	(L-M)
Juniperus•chinensis•'Tortulosa' *****	Hollywood Juniper (hort. cultivar)	(L-M)
Juniperus•chinensis•var.•sargentii	Sargent's Juniper (e. Asia)	(L-M)
Juniperus•communis•saxatilis	Mountain Common Juniper (circumboreal)	(L-M)
Juniperus•horizontalis	Horizontal Juniper (Nov. Sc. to Alaska, N J., to Mon.,)	(L-M)
Juniperus•horizontalis•'Bar•Harbor'	Bar Harbor Juniper (hort. cultivar)	(L-M)
Juniperus•horizontalis•'Blue•Chip'	Blue Chip Juniper (e. Asia)	(L-M)
Juniperus•horizontalis•'Plumosa'	Andorra Juniper (hort. cultivar)	(L-M)
Juniperus•horizontalis•'Prince•of•Wales'	Prince of Wales Juniper (hort. cultivar)	(L-M)
Juniperus•horizontalis•'Wiltonii'	Wilton Carpet Juniper (hort. cultivar)	(L-M)
Juniperus•monosperma	Oneseed Juniper (Colo., Utah, Tex., Mex.)	(VL-L)
Juniperus•osteosperma	Utah Juniper (sw. USA)	(VL-L)
Juniperus•procumbens var. & cv.	Japgarden Juniper varieties and cultivars	(M-H)
Juniperus•sabina	Savin Juniper (w. Asia)	(L-M)
Juniperus•sabina•'Buffalo'	Buffalo Juniper (hort. cultivar)	(L-M)
Juniperus•sabina•'Skandia'	Skandia Juniper (hort. cultivar)	(L-M)
Juniperus•sabina•var.•tamariscifolia	Tam Juniper (hort. cultivar)	(L-M)
Juniperus•scopulorum	Rocky Mtn. Juniper (B.C. to s. Ariz., to Tex.)	(L)
Juniperus•squamata	----- (India, Tibet, Taiwan)	(M+/-)
Juniperus•squamata•'Meyeri'	----- (hort. cultivar)	(M+/-)
Juniperus•virginiana	Eastern Redcedar (e. N. Am.)	(M-H)
Microbiota•decussata *****	Siberian Cypress (Siberia)	(M+/-)
Pinus•edulis	Piñon Pine (Wyo., Cal., Mex.)	(VL-M)
Pinus•mugo	Mugo Pine (c. Eur. Balk.)	(M-H)
Platycladus•orientalis *****	Oriental Arborvitae (China, Korea)	(M+/-)
Taxus•baccata *****	English Yew (Eur., n. Afr., w. Asia)	(H)

Taxus•brevifolia *	Anticancer Yew (pnw. USA)	(H)
Taxus•cuspidata *	Japanese Yew (Jap., Kor., Manchuria)	(H)
Taxus•x•media *	----- (hort. hybrid)	(H)
Thuja•occidentalis•var.	Western Arborvitae varieties (e. N. Am.)	(H)
Thuja•orientalis (now Platycladus•orientalis)		
Thuyopsis•dolabrata *	False Arborvitae (Japan)	(H)

7. EVERGREENS

(Non-coniferous)
[Revised April '03]

WATER NEEDS OF PLANTS

The following chart shows how to group plants based on their water needs.
Reference Location: Denver. Numbers illustrate typical conditions.

***** = Plants with potential, but requiring caution due to limited history in Rocky Mountain landscaping.

HIGH WATER	MODERATE WATER	LOW WATER	VERY LOW WATER
Reference plant:	Reference plant:	Reference plant:	Reference plant:
Bluegrass turf (Always wet at surface)	Turf-type Tall Fescue (Half of Bluegrass turf)	Buffalograss turf (Like Denver without irrigation)	Too dry for any turf (drier than Denver)
18-20 gals./ S.F./season July: 5"-- 3 times per week	10_ gals./S.F./ season .75" -- once per week	0-3 gals./S.F./season .5" per 2 weeks, optional	No irrigation No irrigation

Agave•parryi *****	Parry's Agave (Cal., N.Mex., Mex.)	(VL-L)
Agave•utahensis *****	Utah Agave (Cal., Nev. Utah, Ariz.)	(VL-L)
Allenrolfea•occidentalis *	Iodine Bush (sw. USA, deserts)	(L-VL)
Arctostaphylos•patula *****	Greenleaf Manzanita (sw. USA)	(M+/-)
Artemisia•cana •(a.k.a. Seriphidium•canum)	Black Sage (w. USA)	(VL-M)
Artemisia•tridentata (a.k.a. S. tridentata)	Big Western Sage (intermtn. w. N. America)	(VL-M)
Aucuba•japonica *****	Spotted Laurel (China, Taiwan, s. Japan)	(H)
Berberis•candidula *****	Paleleaf Barberry (China)	(M+/-)
Berberis•julianae	Wintergreen Barberry (w. China)	(M+/-)
Berberis•triacanthophora *****	= Berberis•X•wisleyensis	
Berberis•verruculosa *****	Warty Barberry (w. China)	(M+/-)
Berberis•x•wisleyensis *****	Threespike Barberry (hort. hybrid)	(M+/-)
Bruckenthalia•spiculifolia *****	Spike Heath (se. Europe, Asia Minor)	(M+/-)
Buxus•microphylla•v.•koreana *****	Korean Boxwood (Jap., Korea)	(M-H)
Buxus•sempervirens *****	Common Boxwood (s. Eur., w. Asia , n. Afr.)	(M-H)
Ceanothus•fendleri	Fendler Ceanothus (Rocky Mtn. West)	(M+/-)
Ceanothus•integerrimus *****	Deerbrush (sw. N. America)	(M+/-)
Ceanothus•sanguineus *****	Oregon Tea (B.C. to Mont. to Calif.)	(M+/-)
Ceanothus•velutinus *****	Snowbrush Ceanothus (Western Mtns., USA)	(M-H)
Cercocarpus•breviflorus	= Cercocarpus•ledifolius•v.•paucidentatus	
Cercocarpus•intricatus	= Cercocarpus•ledifolius•v.•intracatus	
Cercocarpus•ledifolius	Curlleaf Mtn. Mahogany (Intermtn. USA)	(VL-L)
Cercocarpus•ledifolius•v.•intracatus	Littleleaf Mtn. Mahogany (Intermtn. sw. USA)	(VL-L)
Cercocarpus•ledifolius•v.•paucidentatus	Hairy Mtn. Mahogany (Ariz., N. Mex., Mex.)	(VL-L)
Chamaebatiaria•millefolium	Fernbush (Ore., e. Cal., Wyo., Ariz.)	(VL-L)
Cistus•laurifolius *****	Laurel Rock Rose (sw. Europe)	(M+/-)
Coronilla•emerus *****	Scorpion senna (c. & s. Europe)	(L-M)
Cotoneaster•congestus *****	Pyrenees Cotoneaster (Himilaya Mts.)	(M+/-)
Cotoneaster•conspicuus *****	Wintergreen Cotoneaster (c. China, se. Tibet)	(M+/-)
Cotoneaster•dammeri *****	Bearberry cotoneaster (c. China)	(M-/-)
Cotoneaster•glaucophyllus *	Brightbead Cotoneaster (w. China)	(L-M)
Cotoneaster•microphyllus *****	Littleleaf Cotoneaster (mtns. Afghan. to China)	(L-M)
Cowania•mexicana (syn. Purshia•mexicana)	Cliff Rose (intermtn. sw. USA & Mex.)	(VL-L)
Cytisus•scoparius *****	Scotch Broom (Europe)	(M+/-)

Cytisus•x•praecox *	Warminster Broom (hort. hybrid)	(M+/)
Daphne•cneorum	Daphne (mtns. c. & s. Europe)	(M+/-)
Daphne•retusa *	= Daphne•tangutica	
Daphne•tangutica *	----- (nw. & w. China)	(M+/-)
Daphne•x•burkwoodii	-----	(M+/-)
Daphne•x•burkwoodii•'Carol•Mackie'	Carol Mackie Daphne (hort. cultivar)	(M+/-)
Daphne•pontica *	----- (A. Minor, se. Eur., Cauc.)	(M+/-)
Elaeagnus•pungens *	----- (Jap., China)	(VL, M)
Ephedra•americana•v.•andina *+	----- (Andes, Ecuador. to Patagonia)	(VL-M)
Ephedra•equisetina +	----- (c. Asia, w. china)	(VL)
Ephedra•gerardiana *+	----- (China, Himalaya)	(VL-L)
Ephedra•glauca *	----- (c. Asia-Seravshan Mts.)	(VL-L)
Ephedra•minima *+	----- (China)	(VL-L)
Ephedra•minuta *	----- (c. Asia-Seravshan Mts.)	(VL-L)
Ephedra•nevadensis *+	Nevada Ephedra (Great Basin)	(VL-L)
Ephedra•regaliana *	----- (c. Asia-Pamir Mts.)	(VL-L)
Ephedra•torreyana +	Torrey Ephedra (intermtn. sw. USA)	(VL-L)
Ephedra•viridis +	Green Ephedra, Mormon Tea (Intermtn. sw. USA)	(VL-L)
Euonymus•fortunei•'Vegetus'	Euonymus (c. & w. China)	(M-H)
Euonymus•kiautschovicus•'Manhattan'	Manhattan Euonymus (hort. cultivar)	(M-H)

Fargesia•murielae, A. m., Sinarundinaria m. (see Thamnocalamus•spathaceus) *
Fargesia•nitida., Arundinaria n., Sinarundinaria n., Thamnocalamus•nitida (see Sinarundinaria•nitida) *
Fargesia•spathacea, Arundinaria s. (see Thamnocalamus•spathaceus) *

Fuchsia•magellanica *	Fuchsia (Peru, Chile, Argentina)	(H)
Garrya•flavescens *	Yellow Silktassel (e. Cal., w. Az., s. Utah, s. Nev.)	(L)
Garrya•fremontii *	Fremont's Silktassel (w. Wa., Ore., Cal.)	(M+/-)
Garrya•wrightii *	Wright's Silktassel (sw. AZ., s. N. Mex., w. Tex.)	(L)
Gelsemium•sempervirens *	Carolina Yellow Jasmine (s. USA to c. Am.)	(H)
Hesperaloe•parviflora +	Hesperaloe (sw. Texas)	(VL-M)
Iberis•sempervirens	Evergreen Candytuft (Eurasia)	(M-H)
Ilex•aquifolium *	English Holly (Eur., n. Afr., w. Asia)	(H)
Ilex•cornuta *	Chinese Holly (China, Korea)	(H)
Ilex•crenata *	Japanese Holly (Sakhalin Is., Jap., Korea)	(H)
Ilex•opaca *	American Holly (e. USA)	(H)
Ilex•wilsonii *	Wilson's Holly (c., w., e. China, Taiwan)	(M-H)
Ilex•x•meserveae var.	Blue Prince & Blue Princess Hollies etc. (hort. hybrids)	(H)
Jasminum•fruticans *	----- (Medit. Asia Minor)	(L-M)
Kalmia•angustifolia *	Lambkill Kalmia (Hudson Bay to Georgia)	(H)
Kalmia•latifolia *	Mountain Laurel (e. N. Am.)	(H)
Lavandula•angustifolia var.	English Lavender varieties (Medit.)	(VL-M)
Lavandula•stoechas *	Spanish Lavender (c. Spain, ne. Portugal)	(VL-M)
Leucophyllum•minus *	Cenzia, Texas Ranger (Texas, New Mexico)	(L)
Lonicera•nitida *	Boxleaf Honeysuckle (China)	(H)
Lonicera•pileata *	Privet Honeysuckle (China)	(H)

Mahonia•aquifolium +	Oregon Hollygrape (Cascade mtns.)	(M-H)
Mahonia•fremontii +	Fremont Mahonia (sw. USA)	(VL-L)
Mahonia•haematocarpa +	Redberry Mahonia (sw. USA)	(VL-L)
Mahonia•repens +	Creeping Mahonia (Rocky Mtn. West)	(L-H)
Mahonia•trifoliata *+	Three-leaf Mahonia, Algerita (Ariz., N. Mex., Tex., Mex.)	(L)
x•Mahoberberis•miethkeana *	----- (Berberis•julianae•X•Mahonia•aquifolium)	(M+/-)
Nandina•domestica *	Heavenly Bamboo (India to e. China)	(M-H)
Nolina•microcarpa *	Bear Grass (sw. USA)	(L)
Opuntia•imbricata	Cholla (Colo., Kan., Tex., & Mex., to Ariz.)	(VL-L)
Opuntia•polycantha ,etc.	Prickly Pear Cactus species (w. USA, Can., Mex.)	(VL-L)
Osmanthus•americanus *	Devilwood (se. USA)	(H)
Osmanthus•decorus•'Baki•Kasapligil' *	----- (Caucasus)	(H)
Osmanthus•heterophyllus *	Holly Osmanthus (Japan, Taiwan)	(H)
Osmanthus•x•burkwoodii *	----- (garden origin)	(H)
Paxistima•canbyi	Eastern Mtn. Lover (e. N. America)	(M+/-)
Paxistima•myrsinites	= Paxistima•myrtifolia	
Paxistima•myrtifolia *	Western Mtn. Lover (B.C. Cal., Mont., Colo., N. Mex.)	(M-H)
Phillyrea•vilmoriniana *	= Osmanthus•decorus	
Photina•villosa *	Oriental Photina (Japan, Korea, China)	(H)
Photinia•serrulata *	Chinese Photinia (China)	(H)
Photinia•x•fraseri *	Photina (hort. hybrid)	(H)
Phyllostachys•aureosulcata *	Yellow-groove Bamboo (ne. China)	(H)
Phyllostachys•nigra *	Black Bamboo (e., c. China)	(H)
Phyllostachys•nuda *	Bamboo (China)	(H)
Pieris•japonica *	Japanese Pieris (Jap., Taiwan, e. China)	(H)
Prunus•laurocerasus•'Schipkaensis' *	Schipkanensis Cherry Laurel (Bulgaria)	(M-H)
Prunus•laurocerasus•'Zabeliana'*	Zabeliana Cherry Laurel (garden origin)	(M-H)
Purshia•mexicana	= Cowania•mexicana	
Purshia•tridentata	Antelope Bitterbrush (Rocky Mtn. West)	(L-M)
Pyracantha•coccinea	Pyracantha (Eurasia)	(M+/-)
Quercus•grisea *	Gray Oak (Tex., N. Mex., Mex., s. Colo.)	(M+/-)
Quercus•turbinella *	Turban Oak (Cal., & n. Baja. Ca.. to w. Tex. & se. Colo.)	(M+/-)
Quercus•vacciniifolia *	Huckleberry Oak (w. US)	(M+/-)
Quercus•virginiana•v.•fusiformis *	Texas Shrub Live Oak (Ok., Tex., Mex.)	(L-M)
Rosmarinus•officinalis•'Arp' *	Rosemary 'Arp' (a hardy cultivar from Arp, Texas)	(L-M)
Santolina•chamaecyparissus	Santolina (w. & c. Medit.)	(VL-M)
Santolina•rosmarinifolia	Green Santolina (Portugal to France)	(L-M)
Santolina•viridis	= Santolina•rosmarinifolia	
Sasa•kurilensis *	Kurile Islands Bamboo (Jap. Kor.)	(H)
Sasa•palmata *	Palmate Bamboo (n. Japan)	(H)
Shepherdia•rotundifolia *+	Roundleaf Buffaloberry (Az., Utah)	(L-M)
Sinarundinaria•nitida *	Fountain Bamboo (c. China)	(H)
Thamnocalamus•spathaceus *	Umbrella Bamboo (c. China)	(H)
Viburnum•davidii *	David's Viburnum (w. China)	(M-H)

Viburnum•farreri *	Fragrant Viburnum (China)	(M-H)
Viburnum•rhytidophyllum *	Leatherleaf Viburnum (c. & w. China)	(M-H)
Viburnum•x•burkwoodii	Burkwood Viburnum (hort. hybrid)	(M-H)
Viburnum•x•rhytidophylloides•'Mohican'	Mohican Lantanaphyllum Viburnum (garden origin)	(M-H)

Yucca•baccata +	Banana Yucca (Colo. Plateau)	(VL-L)
Yucca•elata +	Soaptree Yucca (Az., N. Mex., Mex.)	(VL-L)
Yucca•glauca +	Front Range Yucca (w. Great Plains)	(VL-L)
Yucca•harrimaniae +	Harriman Yucca (Colo. Plateau)	(VL-L)

VINES

[Revised April '03]

WATER NEEDS OF PLANTS

The following chart shows how to group plants based on their water needs.
Reference Location: Denver. Numbers illustrate typical conditions.

***** = Plants with potential, but requiring caution due to limited history in Rocky Mountain landscaping.

HIGH WATER	MODERATE WATER	LOW WATER	VERY LOW WATER
Reference plant: Bluegrass turf (Always wet at surface)	Reference plant: Turf-type Tall Fescue (Half of Bluegrass turf)	Reference plant: Buffalograss turf (Like Denver without irrigation)	Reference plant: Too dry for any turf (drier than Denver)
18-20 gals./ S.F./season July: 5"-- 3 times per week	10 gals./S.F./ season .75" -- once per week	0-3 gals./S.F./season .5" per 2 weeks, optional	No irrigation No irrigation

Akebia•quinata *****	Five-leaf Akebia (Japan, Korea, China)	(M-H)
Akebia•trifoliata *****	Three-leaf Akebia (c. China, Jap.)	(M-H)
Akebia•x•pentaphylla *	(A. quinata x A. trifoliata) (Japan)	(M-H)
Ampelopsis•aconitifolia *****	Monkshood Vine (n. China, Mong.)	(M+/-)
Ampelopsis•brevipedunculata *****	Porcelain Vine (China, Jap., Korea)	(M+/-)
Ampelopsis•delavayana *	----- (w. China)	(M+/-)
Ampelopsis•humulifolia *****	----- (n.China)	(M+/-)
Ampelopsis•megalophylla *****	----- (w. China)	(M+/-)
Aristolochia•durior *****	= Aristolochia•macrophylla	
Aristolochia•macrophylla *****	Dutchman's Pipe (Appalachian Mts.)	(M-H)
Campsis•grandiflora *****	Chinese Trumpet Creeper (Jap., China)	(M-H)
Campsis•radicans +	Trumpet Creeper (e. USA)	(M-H)
Celastrus•loeseneri *****	Loeserner Bittersweet (c. China)	(M-H)
Celastrus•orbiculatus *	Oriental Bittersweet (ne. Asia)	(M-H)
Celastrus•scandens	Bittersweet (e. N. America)	(M-H)
Clematis (hort. varieties & hybrids)	----- (hort. hybrids & varieties)	(M-H)
Clematis•alpina *****	----- (Eurasia)	(M-H)
Clematis•brevicaudata *	----- (Jap., China., w. Mong.)	(M+/-)
Clematis•chrysocoma *****	----- (sw. China)	(M+/-)
Clematis•crispa *****	Curly Clematis (se. USA)	(H)
Clematis•fargesii *	----- (China)	(M+/-)
Clematis•flammula	----- (s. Eur., to Turkestan)	(M+/-)
Clematis•grata *****	----- (China, Himalaya)	(M+/-)
Clematis•ligusticifolia	Western Virgin's Bower (Man. to B.C., Mo., to Calif.)	(M+/-)
Clematis•macropetala *****	----- (Siberia, n. China, Mongolia)	(M+/-)
Clematis•maximowicziana	= Clematis•terniflora	
Clematis•montana var. *****	----- (Afghanistan. to sw. & c. China, Himalaya)	(M+/-)
Clematis•paniculata *****	New Zealand Clematis (New Zealand)	(H)
Clematis•paniculata	= Clematis•terniflora	
Clematis•rehderiana *****	Rehder's Clematis (w. China)	(M+/-)
Clematis•tangutica	Golden Lantern Clematis (Mongolia, nw. China)	(M+/-)
Clematis•terniflora	Sweet Autumn Clematis (Korea, China, Japan)	(M+/-)
Clematis•texensis *****	Texas Clematis (sw. USA)	(M+/-)
Clematis•tibetana *****	----- (Tibet, China, n. India)	(M+/-)
Clematis•vernayi (now C. tibetiana)		
Clematis•viorna *	Leather Flower (s. N. Am.)	(M-H)
Clematis•vitalba *****	Traveller's Joy (Eur., Cauc., c. Asia, n. Afr.)	(M+/-)

Clematis•viticella *	----- (s. Europe, w. Asia)	(M+/-)
Dicentra•scandens *	----- (Nepal, to se. China)	(M+/-)
Euonymus•fortunei var.	Wintercreeper varieties (China)	(M-H)
Hedera•colchica *	Persian Ivy (Cauc., Turkey)	(M+/-)
Humulus•americanus	= Humulus•lupulus	
Humulus•lupulus	Hop Vine (n. Temperate regions worldwide)	(M+/-)
Hydrangea•anomala *	Climbing Hydrangea (Himalaya, China)	(H)
Hydrangea•anomala•ssp.•petiolaris*	= Hydrangea•petiolaris	
Hydrangea•petiolaris *	Climbing Hydrangea (Japan, China, Korea, Taiwan)	(H)
Jasminum•beesianum *	----- (China)	(M+/-)
Lathyrus•latifolius	Perennial Sweetpea (c. & e. Europe)	(M+/-)
Lonicera•alesuosmoides *	Evergreen Honeysuckle (w. China)	(M+/-)
Lonicera•caprifolium *	Italian Honeysuckle (Eur., s. Asia)	(M+/-)
Lonicera•flava *	Yellow Honeysuckle (se. USA)	(H)
Lonicera•henyri *	----- (w. China)	(M+/-)
Lonicera•japonica•'Halliana'	Hall's Honeysuckle (e. Asia)	(M-H)
Lonicera•periclymenum	Woodbine Honeysuckle (Eur., w. Asia)	(M+/-)
Lonicera•periclymenum•'Graham•Thomas'	Graham Thomas Honeysuckle (hort. cultivar)	(M+/-)
Lonicera•prolifera *	Grape Honeysuckle (c. USA)	(M+/-)
Lonicera•sempervirens	Scarlet Trumpet Honeysuckle (e. & s. USA)	(M-H)
Lonicera•sempervirens•'Alabama•Crimson'	-----	(M-H)
Lonicera•sempervirens•'Sulphurea	-----	(M-H)
Lonicera•tragophylla *	Chinese Woodbine (w. China)	(M+/-)
Lonicera•x•brownii•'Dropmore•Scarlet'	(L.s. x L. brownii)	(M+/-)
Lonicera•x•heckrottii	Heckrottii Honeysuckle (hort. hybrid)	(M-H)
Lycium•halimifolium *	Common Matrimony Vine (se. Europe, w. Asia)	(M+/-)
Mennispermum•canadense *	Moonseed Vine (e. N. America)	(M-H)
Parthenocissus•quinquefolia	Virginia Creeper (e. N. America to Rocky Mtns.)	(M-H)
Parthenocissus•tricuspidata	Boston Ivy (Japan, c. China)	(M-H)
Passiflora•incarnata *	Passion Flower (c. USA)	(H)
Polygonum•aubertii	Silver Lace Vine (w. China, Tibet, Tajikistan)	(M+/-)
Polygonum•baldschuanicum *	Buchara Fleeceflower (c. Asia, Tajikistan)	(M+/-)
Schisandra•chinensis *	Magnolia Vine (China)	(H)
Schizophragma•hydrangeoides *	Hydrangea Vine (Japan, Korea)	(M-H)
Smilax•rotundifolia *	Common Greenbriar (e. USA)	(H)
Tripterygium•regelii *	Regel's Tripterygium (Manchuria, Japan, Korea)	(M-H)
Vitis•amurensis *	Amur Grape (Manchuria)	(M+/-)
Vitis•arizonica	Arizona Grape (w. Tex.- Cal. & Mex.)	(M+/-)
Vitis•coignetiae *	Gloryvine (Japan, Korea)	(M+/-)
Vitis•riparia	Riverbank Grape (Nov. Sc. - Man., Tenn. & Tex. - Rocky Mts.)	(M-H)
Vitis•vinifera•varieties *	Eurasian Grape varieties (Eur., A. Minor, Cauc. Turkestan)	(M+/-)

Wisteria•floribunda *	Japanese Wisteria (Japan)	(M-H)
Wisteria•macrostachys *	Kentucky Wisteria (c. USA)	(H)
Wisteria•sinensis *	Chinese Wisteria (China)	(M-H)

GROUND COVERS

(Icluding turf & meadow grasses)
[Revised April '03]

WATER NEEDS OF PLANTS

The following chart shows how to group plants based on their water needs.
Reference Location: Denver. Numbers illustrate typical conditions.

***** = Plants with potential, but requiring caution due to limited history in Rocky Mountain landscaping.

HIGH WATER	MODERATE WATER	LOW WATER	VERY LOW WATER
Reference plant: Bluegrass turf (Always wet at surface)	Reference plant: Turf-type Tall Fescue (Half of Bluegrass turf)	Reference plant: Buffalograss turf (Like Denver without irrigation)	Reference plant: Too dry for any turf (drier than Denver)
18-20 gals./ S.F./season July: 5"-- 3 times per week	10_ gals./S.F./ season .75" -- once per week	0-3 gals./S.F./season .5" per 2 weeks, optional	No irrigation No irrigation

Achillea•ageratifolia	Grecian Yarrow (Greece)	(L-M)
Achillea•serbica	Serbian Yarrow (Balkans)	(L-M)
Aegopodium•podagraria	Bishop's Weed (Europe)	(H)
Ajuga•reptans	Ajuga (Eur., Persia, Transcaucasia.)	(H)
Akebia•quinata *	Five-leaf Akebia (Jap., Korea, China)	(M-H
Andropogon•scoparius	Little Blue Stem (syn. Schizachyrium•scoparium)	(L-M+/-)
Anemopsis•californica *	Yerba Mansa (sw. USA, Mex.)	(M-H)
Antennaria•parvifolia	Pussytoes (G. Plains, w. to B.C., Wash., Ariz.)	(M+/-)
Antennaria•rosea	Pussytoes (Alaska to Cal. & N. Mex.)	(M+/-)
Arabis•alpina *	Alpine Rock-cress (Europe, Siberia)	(M+/-)
Arctostaphylos•uva-ursi	Kinnikinnick (circumpolar)	(M+/-)
Arenaria•balearica *	Corsican Sandwort (Balearic Is. & Corsica)	(M+/-)
Aronia•melanocarpa	Chokeberry (e. N. Am.)	(M-H)
Asperula•odorata	= Galium•odoratum	
Astroturfoides•ultradeceptiverous	Astro Turf (Houston, Texas)	(L+/M-)
Aurinia•saxatilis	Basket-of-gold (c. & se. Europe)	(L-M)
Bouteloua•gracilis	Blue grama (N. America)	(L+/-)
Buchloë•dactyloides	Buffalograss (Great Plains)	(L)
Campanula•poscharskyana	Poscharsky Bellflower (Dalmatia)	(M-H)
Cerastium•tomentosum	Snow-in-summer (Eur. to w. Asia)	(L-M)
Ceratostigma•plumbaginoides	Plumbago (w. China)	(M+/-)
Convallaria•majalis	Lily-of-the-valley (Eurasia, e. N. America)	(M-H)
Cotoneaster•apiculatus *	Cranberry Cotoneaster (China)	(M+/-)
Cotoneaster•dammeri *	Creeping Cotoneaster (China)	(M+/-)
Cotoneaster•microphyllus *	Littleleaf Cotoneaster (Mts. Afghan., China)	(L-M)
Delosperma•cooperi	Hardy Pink Ice Plant (s. Africa)	(M+/-)
Delosperma•nubigenum	Hardy Yellow Ice Plant (s. Africa)	(M+/-)
Duchesnea•indica	Mock Strawberry (Korea, Jap., to India)	(M-H)
Epimedium•alpinum *	Alpine Epimedium (s. & c. Europe)	(M-H)
Epimedium•grandiflorumum *	Longspur Epimedium (n. Japan, Korea, s. Manch.)	(M-H)
Euonymus•fortunei•'Coloratus'	Purpleleaf Wintercreeper (hort. cult.)	(M+/-)

Euonymus•obovatus *	Running Euonymus (e. USA)	(H)
Festuca•elatior•cvs.	Turf-type Tall Fescue (Eur., Siberia)	(M+/-)
Galium•odoratum	Sweet Woodruff (Eurasia)	(M-H)
Genista•pilosa *	Dwarf Broom (Europe)	(M+/-)
Geranium•spp.	Hardy Geraniums	(M+/-)
Hosta•spp.	Host species (Jap., China, Korea)	(H)
Juniperus•spp. & cultivars +	Juniper species and cultivars	(L-M)
Lamium•maculatum	Spotted Deadnettle, Lamium (Eur., n. Afr., w. Asia)	(M-H)
Lathyrus•latifolius	Perennial Sweetpea (c. & e. Europe)	(M-H)
Lonicera•japonica•'Halliana'	Hall's Honeysuckle (e. Asia)	(M+/-)
Lonicera•sempervirens	Scarlet Trumpet Honeysuckle (e.& s. N. America)	(M-H)
Lonicera•x•heckrottii	Heckrottii Honeysuckle (hort. hybrid)	(M+/-)
Lysimachia•nummularia	Moneywort (Europe)	(H)
Mahonia•repens	Creeping Mahonia (Rocky Mtn. West)	(L-M-H)
Mazus•reptans *	----- (Himalayas)	(M-H)
Marrubium•rotundifolium	----- (Asia Minor)	(L-M)
Poa•pratensis	Kentucky Bluegrass (Eurasia, n. Africa)	(H)
Osteospermum•berberae	South African Daisy (S. Africa)	(M+/-)
Pachysandra•terminalis	Pachysandra (Japan, nc. China)	(M-H)
Parthenocissus•quinquefolia	Virginia Creeper (e. N. America to Rocky Mts.)	(M-H)
Phlox•stolonifera	Creeping Phlox (se. USA)	(M+/-)
Phlox•subulata	Moss Phlox (Penn. to Ga.)	(M+/-)
Polygonum•affine•'Border•Jewel'	Himalayan Border Jewel (Himalayas)	(M-H)
Polygonum•japonicum•var.•compactum	Fleece Flower (e. Asia)	(M-H)
Polygonum•reynoutria	= Polygonum•japonicum•var.•compactum	
Potentilla•nevadensis	----- (Spain)	(L-M)
Potentilla•verna•'Nana'	Creeping Potentilla (hort. cult.)	(M-H)
Rhus•trilobata	Three-leaf Sumac (w. N. Am.)	(L-M)
Saponaria•ocymoides	Saponaria (mtns. sw. & sc. Europe)	(M+/-)
Schizachyrium•scoparium	= Andropogon•scoparius	
Symphoricarpos•x•chenaultii•'Hancock'	Hancock Coralberry (hort. cult.)	(M+/-)
Teucrium•chamaedrys	Germander (c. & s. Europe, w. Asia)	(M+/-)
Thymus•spp.	Thyme species (Eurasia, N. Africa)	(L-M)
Waldsteinia•fragarioides	Barren Strawberry (e. USA)	(H)

Veronica•liwanensis	Turkish Veronica (ne. Anatolia, Cauc.)	(M-H)
Veronica•pectinata	Woolly Veronica (e. Balkans, A. Minor)	(L-M)
Vinca•major	----- (Italy, Balk.)	(M-H)
Vinca•minor	Vinca (Europe , w. Asia)	(H)

SELECTED PERENNIALS

[Revised April '03]

WATER NEEDS OF PLANTS

The following chart shows how to group plants based on their water needs.
Reference Location: Denver. Numbers illustrate typical conditions.

***** = Plants with potential, but requiring caution due to limited history in Rocky Mountain landscaping.

HIGH WATER	MODERATE WATER	LOW WATER	VERY LOW WATER
Reference plant: Bluegrass turf (Always wet at surface)	Reference plant: Turf-type Tall Fescue (Half of Bluegrass turf)	Reference plant: Buffalograss turf (Like Denver without irrigation)	Reference plant: Too dry for any turf (drier than Denver)
18-20 gals./ S.F./season July: 5"-- 3 times per week	10_ gals./S.F./ season .75" -- once per week	0-3 gals ./S.F./season .5" per 2 weeks, optional	No irrigation No irrigation

Achillea x 'Coronation Gold'	Coronation Gold Yarrow	(VL)
Achillea x 'Moonshine'	Moonshine Yarrow	(VL-L-M)
Aesclepias•tuberosa	Butterfly Weed	M-H
Agastache cana	Double Bubble Mint	(M+/-)
Alchemilla•vulgaris	Lady's Mantle	M-H
Anthemis•tinctoria	Golden Margurerite	M-H
Aquilegia•spp.	Columbines	H
Arum•italicum	Italian Arum	M-H
Aster porteri	Porter's Aster	(VL-L)
Aster•novae-angliae	New England Aster	M-H
Aster•x•frikartii	Frikart's Aster	M-H
Aurinia saxatilis	Basket-of-gold	(L-M)
Baptisia•australis	Baptisia	M-H
Berlandiera lyrata	Chocolate Flower	(VL-L)
Boltonia•asteroides	Boltonia	H
Borago•laxiflora	Borage	M-H
Callirhoë involucrata	Poppy Mallow	(L-M)
Centranthus ruber	Centranthus	(L-M-H)
Cerastium tomentosum	Snow-in-summer	(L-M)
Chrysanthemum•x•morifolium	Chrysanthemums	H
Chrysanthemum•x•superbum	Shasta Daisy	M-H
Convallaria•majalis	Lily-of-the-valley	H
Crocosmia•x•crocosmiiflora	Crocosmia	H
Crocus spp. *	Crocus species	(L-M)
Datura meteloides	Sacred Datura	L-M
Delosperma cooperi	Hardy Pink Ice Plant	(M+/-)
Delphinium•x•elatum	Hybrid Delphiniums	H
Dianthus•spp.	Various Dianthus	L-M
Dicentra•eximia	Bleeding Heart	H
Dictamnus•albus	Gas Plant	L-M
Digitalis•purpurea	Common Foxglove	H
Echinacea•purpurea	Echinacea	M+/-
Echinops•ritro	Globe Thistle	H
Eremurus•spp.	Foxtail Lily	L-M
Eryngium•spp.	Sea Holly	L-M
Gaillardia aristata	Native Gaillardia	(L-M)
Geranium•spp.	Hardy Geraniums	M-H
Helianthemum•spp.	Sun-roses	M+/-
Helianthus maximiliani	Maximilian Sunflower	(M+/-)
Helianthus•spp.	Sunflowers	M+/-

Helleborus•spp.	Hellebores	M-H
Hemerocallis•spp.	Daylilies	M-H
Hosta•spp.	Hostas	H
Iberis•sempervirens	Candytuft	M+/-
Incarvillea•delavayii	Hardy Gloxinia	M+/-
Iris bucharica	Buchara Iris	(M+/-)
Iris germanica cvs..	Bearded Iris varieties	(L-M)
Kniphofia•spp.	Poker Plants	M-H
Lavandula spp.	Various Lavenders	(VL-M)
Liatris punctata	Dotted Gay Feather	(VL-L)
Liatris•punctata	Dryland Gayfeather	VL-L
Liatris•spicata	Wetland Gayfeather	H
Limonium•spp.	Sea Lavenders	L-M
Linum•perenne	Blue Flax	L-H
Lobelia•cardinalis	Cardinal Flower	H
Lobelia•syphilitica	Great Blue Lobelia	H
Lychnis•coronaria	Rose Campion	L-H
Malva•alcea	Hollyhocks	M+/-
Mirabilis multiflora	Native Four O'clock	(VL-L-M)
Monarda•spp.	Monardas	M-H
Narcissus spp.	Daffodils	(L-M)
Nepeta x faassenii	Faassen's Catnip	(L-M)
Paeonia•spp.	Peonies	M+/-
Papaver•orientale	Oriental Poppies	M-H
Penstemon pinifolius	Pineleaf Penstemon	(L-M)
Penstemon strictus	Rocky Mountain Penstemon	(L-M)
Perovskia atriplicifolia	Russian Sage	(VL-L)
Phlomis russeliana	Russel Phlomis	(M+/-)
Phlox subulata	Moss Phlox	(M+/-)
Phlox•paniculata	Garden Phlox	H
Platycodon•grandiflorus	Platycodon	H
Primula•spp.	Primroses	H
Ruta•graveolens	Rue	M+/-
Salvia azurea var. grandifora	Pitcher Sage	(L-M)
Salvia officinalis	Cooking Sage	(L-M)
Salvia•spp.	Salvias	M+/-
Santolina chamaecyparissus	Santolina	(VL-M)
Saponaria ocymoides	Soapwort	(L-M-H)
Saponaria•ocymoides	Rock Soapwort	M+/-
Scabiosa ochroleuca	Yellow Pincushion Flower	(L-M)
Scabiosa•ochroleuca	Yellow Scabiosa	L-H
Secum•spp.	Sedums	M+/-
Silene laciniata	Mexican Campion	(M+/-)
Tanacetum niveum	Silver Tansy	(L-M)
Verbascum•chaxii	Nettle-leaf Mullein	M+/-
Zauschneria arizonica	Arizona Zauschneria	(L-M)
Zinnia grandiflora	Prairie Zinnia	(VL-L)

WaterWise Landscaping

Best Practices

Section 4 – Natural Areas and Native Plants

A. Proactive Multi-Purpose Drainage Design

1. **Introducing the Opportunity**
   The Front Range prairie is frequently characterized as a rolling grassy landscape folded into meandering wooded drainages. The natural processes that developed this landscape can support the erosion control goals of the drainage design while providing enhanced recreational open space and habitat value. Proactively planned multipurpose drainage design can deliver these goals while saving installation costs and maintenance effort by working with the natural processes.

2. **Natural Landscape and Generative Processes**
   Expanding Front Range developments are covering upland prairies with homes and roads, but the regional landscape can still be seen in the natural drainages. The fundamental character of these drainage areas is defined by the distribution of the thickets of woody species. Wild Plum, Chokecherry, Golden Currant, Snowberry, Sandbar willow and Three-leaf sumac are scattered along the native drainages among occasional towering Plains cottonwoods and the smaller Peach-leaved willows. These species generally occupy the sub-irrigated zones intermediate between the moist central channel areas and the drier upland grasslands.

   The natural processes by which woody vegetation expands into upland drainages depend upon a connection to the larger riparian systems below. (Remember: nature abhors a vacuum.) A shallow, young grassy drainage will eventually develop into a deeper, wooded channel. In natural systems normal precipitation cycles coupled with disturbance (grazing, fire, or drought), eventually will lead to erosion and deposition along the grassy channels. In development areas the process is accelerated by the installation of roads or trails, pipelines, and drainage features. Any action that weakens a grassland root system can provide an opening for change.

   Seeds of woody species use either wind or wildlife to relocate into disturbed areas in drainages. Native deciduous trees such as the Plain cottonwood and Peach-leaved willow and the smaller Sandbar willows release seeds on the spring winds. When a newly exposed moist soil deposit occurs within a few miles of a well-vegetated river, stream or irrigation ditch, a few seeds from these species will blow into to the site. Once a tree has taken root, it will attract birds as well as raccoons, fox, coyote, and skunks. All these animals follow the drainages in their search for food. They eat the plums, chokecherries, currants, snowberries, hawthorns, sumac or any other wild fruits. As they travel, they rest in and under small trees. Seeds are dropped in these locations as the animals move

on. Droppings from animals are concentrated near existing trees. The shade and leaf litter beneath the trees provide a moist protected site favorable for establishment.

3. **Choices**
Engineers design channels for expected run off from the new paved surfaces (roofs and pavement) and existing or proposed vegetation. When a natural channel contains a well-developed woody plant community, the plans may accommodate the existing vegetation conditions, allowing the woody vegetation to remain. Woody vegetation supports to goals of the drainage program by decreasing peak flows, slowing flow rates, protecting slopes channel edges from excess erosion.

New developments, lacking historic drainage channels, must make decisions related to the establishment of woody vegetation. In a short time, windblown woody species will find suitable sites in new drainages. Heavier seeded plants will eventually follow. If plans do not create channels with adequate flow capacity for the natural process of woody plant establishment, they will predetermine a maintenance program including expensive woody vegetation control. The erosion control and recreational benefits possible from woody vegetation will be diminished in the battle to prevent the inevitable. Channels can be sized to accommodate woody vegetation to improve slope stabilization. If this is done well, the maintenance program will be able to allow the natural process of woody vegetation development to occur. This requires an approach acknowledging and working with the natural processes typical of these riparian corridors.

4. **Cost effectiveness**
Proactive, multipurpose drainage design is more cost effective that rigorous maintenance designed to remove all woody vegetation. The woody vegetation serves the underlying purpose of slope stability and erosion control, becoming an ally to the drainage program, instead of a problem. Installation costs of woody vegetation become part of the erosion control program. Costly maintenance aimed at prevention or removal of woody vegetation is no longer necessary. Mowing requirements may mostly be eliminated as perennial vegetation becomes well established. Multipurpose corridors can become more diverse, improving in habitat and passive recreational value, over time.

5. **Lower water usage**
In the interest of developing a more water efficient landscape, multipurpose designed drainages within a development can provide a cool, shady wooded retreat area without requiring installation and maintenance of a supporting irrigation system. Properly selected and placed native woody species can be largely self sufficient once installed.

6. **Urban Drainage and Flood Control Support**
UDFCD encourages the natural channel concept in drainage design (V. 1, MD-3-9). “Open channel planning and design objectives are often best met by using natural-like vegetated channels”. Guidance for planning and execution of this concept is included within the Drainage Criteria manual (V. 2.) revegetation section. Native seed mixtures for a variety of soil types as well as recommended uses and installation methods for trees and shrubs within drainage designs, are included.

7. **Success**
During the spring of the drought year of 2002, a number of drainage improvement projects were installed. Native woody plantings of trees and shrubs were successfully established in spite of limited or no irrigation. Marcy Gulch at Highlands Ranch, Niver Creek in Thornton, Cottonwood Creek in Greenwood Village, and Lilly Gulch in Littleton were successfully established in spite of many days of unseasonably hot dry conditions.

B. Native Seed Mixes

1. Colorado Native Seed Mix Summary

a. Short Grass Prairie (grasses & wildflowers)
b. Mixed Grass Prairie (grasses & wildflowers)
c. Tall Grass Prairie (grasses & wildflowers)
d. Moist or Wetland Soils (grasses & wildflowers)
e. Sandy Loam Soils (grasses & wildflowers)
f. Clay Loam Soils (grasses & wildflowers)
g. Select Shrubs and Trees for natural areas

The complete Native Seed lists are provided on the following pages.

Shortgrass prairie species Easter daisy/Townsendia grandiflorus

Heavily grazed native shortgrass prairie

Table 1. Native shortgrass mixture for loam to cloay loam dry upland sites. Some taller species included. Fall broadcast seed, rake or harrow to cover 1/10 to 1/3 inch, mulch recommended.

COMMON NAME	SCIENTIFIC NAME	VARIETY	MATURE HEIGHT	SEEDS/LB	PLS LBS/ACRE	SUGGESTIONS
GRASSES AND GRASS-LIKE PLANTS						
Buffalograss	*Buchloe dactyloides*	Sharp's	4-6"	56000	6.5	
Sideoats grama	*Bouteloua curtipendula*	Butte	18"	191000	3.0	
Blue grama	*Chondrosum gracile*	Hachita	6-8"	825000	8.0	
Western wheatgrass	*Pascopyrum smithii*	Barton	18"	110000	4.0	
Sand dropseed	*Sporobolus cryptandrus*	Native	18"	5,200,000	2.0	
TOTAL POUNDS/ACRE					**23.5**	
						1 acre=43560 square feet. Divide this per acre seed quantity by 20 to 40 for each to 1000 square feet to be seeded.
ADAPTED NATIVE WILDFLOWERS					OUNCES /ACRE	Double wildflower seeding rate for more color.
Purple prairieclover	*Dalea purpurea*		12"	210000	3.0	
Blanket flower	*Gailardia aristata*		12-18"	132000	4.0	
Golden aster	*Heterotheca villosa*		6-8"	920000	2.0	
Gayfeather	*Liatris punctata*		12-18"	138000	4.0	
Flax	*Linum lewisii*		18"	293000	2.0	
Bluemist penstemon	*Penstemon virens*		8"	850000	3.0	
Sidebells penstemon	*Penstemon secundiflorus*		18"	610000	2.0	
Scarlet globemallow	*Sphaeralcea coccinea*		6-8"	500000	3.0	
Easter daisy	*Townswndia grandiflora*		6-8"	1200000	0.5	
TOTAL OUNCES/ACRE					**23.5**	

AV - Arkansas Valley Seed 303-665-6642, WNS - Western Native Seed 719-942-3935. Prepared by The Restoration Group, Inc. 5/03.

Shortgrass Prairie

This vegetation type is typical of high plains areas with 10- 16 inches on annual precipitation. In native areas shallow soil depth, clay soil, low precipitation, alkaline conditions, heavy grazing or compaction all may contribute to a

Prairie coneflower/Ratibida columnifera in restored mixed grass prairie

Restored mixed grass prairie with wildflowers.

Table 2. Native mixed grass for sandy loam, loam, clay loam upland sites. Fall broadcast seed, rake or harrow to cover 1/10 to 1/3 inch, mulch recommended.

COMMON NAME	SCIENTIFIC NAME	VARIETY	MATURE HEIGHT	SEEDS/LB	PLS LBS/ACRE	SUGGESTIONS
GRASSES AND GRASS-LIKE PLANTS						
Sideoats Grama	*Bouteloua curtipendula*	Butte	18"	191000	4.8	
Buffalograss	*Buchloe dactyloides*	Texoca	4-6"	56000	5.0	
Blue Grama	*Chondrosum gracile*	Hachita	6-8"	825000	4.5	
Switchgrass	*Panicum virgatum*	Blackwell	24-36"	389000	2.0	
Western wheatgrass	*Pascopyrum smithii*	Ariba	18"	110000	3.0	
Little bluestem	*Schyzachrium scoparium*	Pastura	18-24"	260000	2.0	
Sand dropseed	*Sporobolus cryptandrus*	native	18"	5,200,000	0.5	
Green needlegrass	*Stipa viridula*	native	24"		1.5	
TOTAL POUNDS PLS/ACRE					**23.3**	
						1 acre=43560 square feet. Divide this per acre seed quantity by 20 to 40 for each to 1000 square feet to be seeded.
ADAPTED NATIVE WILDFLOWERS					OUNCES /ACRE	Double wildflower seeding rate for more color.
Smooth aster	*Aster laevis*				2.0	
Purple prairieclover	*Dalea purpurea*			210000	3.0	
Blanket flower	*Gaillardia aristata*			132000	6.0	
Golden aster	*Heterotheca villosa*				2.0	
Gayfeather	*Liatris punctata*			138000	4.0	
Flax	*Linum lewisii*			293000	2.0	
Penstemon	*Penstemon angustifolia*		24"	590000	2.0	
Prairie coneflower	*Ratibida columnifera*			1230000	2.0	
TOTAL OUNCES/ACRE					**23.0**	

*AV - Arkansas Valley Seed 303-665-6642, WNS - Western Native Seed 719-942-3935. Prepared by The Restoration Group, Inc. 5/03.

Mixed grass midgrass Prairie

Native areas with richer clay-loam to loamy soil, 14-18 inches of precipitation, and less grazing impact may exhibit the taller grasses typical of mixed grass prairie. Restored mixed grass prairie is possible on sites with g

Purple prairie clover/Dalea purpurea in restored tallgrass prairie. Grasses will later become 36" or more in height.

Table 3. Native tallgrass mixture for north and east facing sites, low areas. Fall broadcast seed, rake or harrow to cover 1/10 to 1/3 inch, mulch recommended.

COMMON NAME	SCIENTIFIC NAME	VARIETY	MATURE HEIGHT	SEEDS/LB	TOTAL LBS PLS/ACRE	SUGGESTIONS
GRASSES AND GRASS-LIKE PLANTS						
Big bluestem	*Andropogon gerardi*	Pawnee	3-4'	130,000	1.5	
Sideoats grama	*Bouteloua curtipendula*	Butte	18"	191000	2.8	
Blue grama	*Chondrosum gracile*	Hachita	6-8"	825000	3.5	
Switchgrass	*Panicum virgatum*	Blackwell	36"	389000	3.0	
Western wheatgrass	*Pascopyrum smithii*	Ariba	18"	110000	6.0	
Little bluestem	*Schizachyrium scoparium*	Pastura	24"	26000	3.4	
Yellow Indiangrass	*Sorghastrum avenaceum*	Holt	3-4'	170000	2.1	
TOTAL POUNDS PLS/ACRE					**22.3**	
						1 acre=43560 square feet. Divide this per acre seed quantity by 20 to 40 for each to 1000 square feet to be seeded.
ADAPTED NATIVE WILDFLOWERS					OUNCES /ACRE	Double wildflower seeding rate for more color.
Showy milkweed	*Asclepias speciosa*	native				
Blue aster	*Aster laevis*	native	18"		2.0	
Blanket flower	*Gailardia aristata*	native	12-18"	132000	2.0	
Prairie coneflower	*Ratibida columnifera*	native	18-24"	1230000	4.0	
Purple prairieclover	*Dalea (Petalostemum) purpurea*	native	12"	210000	4.0	
Flax	*Linum lewisii*	native	18"	293000	3.0	
Penstemon	*Penstemon strictus*	native	24"	590000	4.0	
TOTAL OUNCES /ACRE					**19.0**	
*AV - Arkansas Valley Seed 303-665-6642, WNS - Western Native Seed 719-942-3935. Prepared by The Restoration Group, Inc. 5/03.						

Tallgrass seed mixture

The taller grasses are limited to areas of higher precipitation 16-18 inches along the foothills and moist bottomlands near streams. Rocky soils may contribute to greater moisture availability and the presence of remnant tallgrass

Restored wetland area in small drainage on school grounds with outdoor classroom/boardwalk.

Restored floodplain meadow in Commons Park near downtown Denver.

Table 4. Native wetland mix for drainages, swales or detention ponds (soil is moist between precipitation events). Application rate 1/2 - 1 pound PLS/1000 ft. sq. Broadcast, harrow or rake to cover with 1/10 - 1/3 inch soil.

COMMON NAME	SCIENTIFIC NAME	VARIETY	MATURE HEIGHT	SEEDS/LB	PLS LBS/ACRE	SUGGESTIONS
ADAPTED NATIVE GRASSES AND GRASS-LIKE PLANTS						
Wooly sedge	*Carex lanuginosa*	Native	18"	322,340	0.1	
Nebraska sedge	*Carex nebraskensis*	Native	12"	534,100	0.1	
Inland saltgrass	*Disticlis stricta*	Native	8"-10"	603,820	0.5	
Baltic rush	*Juncus balticus*	Native	12-18"	12,300,000	0.1	
Prairie cordgrass	*Spartina pectinata*	Native	24"+	183,000	9.5	
Switchgrass	*Panicum virgatum*	Blackwell	36"+	389000	6.0	
Western wheatgrass	*Pascopyrum smithii*	Arriba	24"	110,000	8.0	
TOTAL POUNDS/ACRE					**24.3**	
					TOTAL OZ/ACRE	1 acre=43560 square feet. Divide this per acre seed quantity by 20 to 40 for each to 1000 square feet to be seeded.
ADAPTED NATIVE WILDFLOWERS						Double wildflower seeding rate for more color.
Aster	*Aster laevis*	native	18"	1216000	3.0	
Showy milkweed	*Asclepias speciosa*	native	30"	58,112	2.0	
Swamp milkweed	*Asclepias incarnata*	native	36"	68,100	2.0	
Nuttall's sunflower	*Helianthus nuttallii*	native	6'+	250,000	1.0	
Wild Bergamot	*Monarda fistulosa*	native	24"	1,400,136	3.0	
TOTAL OUNCES/ACRE					**11.0**	
* AV - Arkansas Valley Seed 303-665-6642, WNS - Western Native Seed 719-942-3935. Prepared by The Restoration Group, Inc. 5/03.						

Moist /wetland seed mixture

Damp soils along streams, near seeps, and in drainage swales supports wet meadow vegetation. Drainage channels, areas where water flows or pools after a storm are good sites for these moisture loving species. Using such speci

Scarlet globemallow/*Sphaeralcea coccina* and Western wheatgrass/*Agropyron smithii* in mixed grass prairie remnant along Coal Creek in Erie.

Restored shortgrass prairie with Sidebells penstemon/*Penstemon secundiflorus*.

Table 5. Recommended native sand prairie for sandy to sandy loam soil. Fall broadcast seed, rake or harrow to cover 1/10 to 1/3 inch, mulch recommended.

COMMON NAME	SCIENTIFIC NAME	VARIETY	MATURE HEIGHT	SEEDS/LB	TOTAL PLS /ACRE	SUGGESTIONS
GRASSES AND GRASS-LIKE PLANTS						
Sand bluestem	*Andropogon hallii*	Garden	36"	113300	2.0	
Sideoats grama	*Bouteloua curtipendula*	Butte	18"	191000	3.2	
Prairie sandreed	*Calamovilfa longifolia*	Goshen	24-36"	273000	2.1	
Blue grama	*Chondrosum gracile*	Hachita	6-8"	825000	2.5	
Switchgrass	*Panicum virgatum*	Blackwell	36"	389000	2.0	
Western wheatgrass	*Pascopyrum smithii*	Arriba	18-24"	110000	6.5	
Little bluestem	*Schizachyrium scoparium*	Pastura	24"	26000	3.0	
Sand dropseed	*Sporobolus cryptandrus*		18"	1758000	0.5	
TOTAL POUNDS/ACRE					**21.8**	
						1 acre = 43560 square feet. Divide this per acre seed quantity by 20 to 40 for each 1000 square feet to be seeded.
ADAPTED NATIVE WILDFLOWERS					TOTAL OZ/ACRE	Double wildflower seeding rate for more color.
Blue aster	*Aster laevis*		18"		2.0	
Blanket flower	*Gailardia aristata*		12-18"	132000	6.0	
Prairie coneflower	*Ratibida columnifera*		24"	1230000	3.0	
Purple prairieclover	*Dalea (Petalostemum) purpurea*		12"	210000	3.0	
Flax	*Linum lewisii*		18"	293000	4.0	
Penstemon	*Penstemon strictus*		18-24"	592000	4.0	
TOTAL OUNCES/ACRE					**22.0**	
* AV - Arkansas Valley Seed 303-665-6642, WNS - Western Native Seed 719-942-3935. Prepared by The Restoration Group, Inc. 5/03.						

Sandy loam seed mixture

Isolated areas of sandy soil are better suited to these deep rooted species. Some native shrubs such as Yucca/Yucca glauca, Rabbitbrush/Chrysothamnus nauseosus, and Sand sagebrush/Artemisia filifolia are well suited to these areas

Needle-and-threadgrass/*Stipa comata* with Blanketflower/*Gaillardia aristata* in mixedgrass prairie.

Table 6. Native seed mixture for use on clay loam soils. Application rate on clean seed bed 1/2-1 pound PLS/1000 sq. ft. Fall broadcast seed, rake or harrow to cover 1/10 to 1/3 inch, mulch recommended.

COMMON NAME	SCIENTIFIC NAME	VARIETY	MATURE HEIGHT	SEEDS/LB	PLS LBS/ACRE	SUGGESTIONS
GRASSES AND GRASS-LIKE PLANTS						
Buffalograss	*Buchloe dactyloides*	Sharp's	6"	56000	7.6	
Sideoats grama	*Bouteloua curtipendula*	Butte	18"	191000	3.5	
Blue grama	*Chondrosum gracile*	Hachita	6-8"	825000	6.0	
Western wheatgrass	*Pascopyrum smithii*	Barton	18"	110000	4.8	
TOTAL POUNDS/ACRE					**21.9**	
						1 acre=43560 square feet. Divide this per acre seed quantity by 20 to 40 for each to 1000 square feet to be seeded.
ADAPTED NATIVE WILDFLOWERS					0Z/ACRE	Double wildflower seeding rate for more color.
Purple prairieclover	*Dalea purpurea*		12"	210000	3.0	
Blanket flower	*Gailardia aristata*		12-18"	132000	3.0	
Gayfeather	*Liatris punctata*		12-18"	138000	3.0	
Flax	*Linum lewisii*		18"	293000	4.0	
Prairie coneflower	*Ratibida columnifera*		18-24"		3.0	
Scarlet globemallow	*Sphaeralcea coccinea*		6"		4.0	
TOTAL OUNCES/ACRE					**20.0**	
* AV - Arkansas Valley Seed 303-665-6642, WNS - Western Native Seed 719-942-3935. Prepared by The Restoration Group, Inc. 5/03.						

Clay loam seed mixture

The shortgrass prairie species are well adapted to clay loam soils.

Native woody shrubs and trees stabilize stream channel in Front range open space area. Shade, habitat, and passive recreational value area also enhanced. No irrigation water is required for this amenity.

Table 7. Native shrub and tree species adapted to the Front Range high plains area. Little or no water is required for these species if properly located on landscape. Useful for erosion control, shade, and habitat improvement in drainages.

COMMON NAME	SCIENTIFIC NAME	VARIETY	MATURE HEIGHT	SEEDS/LB	PLS LBS/ACRE	LOCATION
NATIVE WOODY VEGETATION						
Rabbitbrush	*Chrysothamnus nauseosus*	Native	2-4'			Upland areas, establishment watering. Use smaller plants or seed for best results.
Plains Cottonwood	*Populus sargentii*	Native	45-60'			Naturally subirrigated lowlands, moist areas, open space drainages. Plant rootball 2-4' into saturated soil, monthly deep watering if planted in upland areas.
Chokecherry	*Padus virginiana*	Native	10-12'			Naturally subirrigated lowlands, shady sites, northfacing slopes, open space drainages. Deep water once a month in upland areas.
Wild plum	*Prunus americana*	Native	6-8'			Naturally subirrigated lowlands, shady sites, northfacing slopes, open space drainages. Deep water once a month in upland areas.
Golden current	*Ribes aureum*	Native	3-4'			Naturally subirrigated lowlands, shady sites, northfacing slopes, open space drainages. Deep water once a month in upland areas.
Three-leaf sumac	*Rhus trilobata*	Native	4-8'			Upland areas, water monthly 1 year to establish
Peachleaf willow	*Salix amygdaloides*	Native	15-35'			Naturally subirrigated lowlands, moist areas, open space drainages.
Sandbar willow	*Salix exigua*	Native	5-6'			Naturally subirrigated lowlands, moist areas, open space drainages.
Snowberry	*Symphoricarpos occidentalis*	Native	2'			Naturally subirrigated lowlands, shady sites, northfacing slopes, open space drainages.
Yucca	*Yucca glauca*	Native	2'			Upland areas, water 1 year to establish
TOTAL POUNDS PLS/ACRE					0	
WaterWise Landscaping						
* AV - Arkansas Valley Seed 303-665-6642, WNS - Western Native Seed 719-942-3935. Prepared by The Restoration Group, Inc. 5/03.						

Woody plants

Most native woody vegetation are adapted to drainages and sites with elevated moisture, such as springs or north-facing slopes. These species provide critical habitat for wildlife, shade and diversity, and erosion control in drainage areas.

Best Practices

Section 4 – Natural Areas and Native Plants

C. Plants to Avoid – The 2003 State Noxious Weed List

The following noxious weed listings have been excerpted from the Rules and Regulations Pertaining to the Administration and Enforcement of the Colorado Weed Management Act, as of May 2003. The full text and current listing are available at <www.ag.state.co.us/DPI/weeds/weed.html>.

"Noxious weed" means an alien plant or parts of an alien plant that have been designated by rule as being noxious or has been declared a noxious weed by a local advisory board, and meets one or more of the following criteria:

(a) Aggressively invades or is detrimental to economic crops or native plant communities;
(b) Is poisonous to livestock;
(c) Is a carrier of detrimental insects, diseases, or parasites;
(d) The direct or indirect effect of the presence of this plant is detrimental to the environmentally sound management of natural or agricultural ecosystems.

The following weed species, listed in alphabetical order, are identified as the State Noxious Weeds. They have been identified by individual counties as problem weeds in the county's area or have been recommended for management through public testimony. These weed species should be considered by each local advisory board and local governing body in the development, adoption and enforcement of their noxious weed list and noxious weed management plan. The State Noxious Weeds are:

Absinth wormwood (*Artemisia absinthium*)
African rue (*Peganum harmala*)
Black henbane (*Hyoscyamus niger*)
Black nightshade (*Solanum nigrum*)
Blue mustard (*Chorispora tenella*)
Bouncingbet (*Saponaria officinalis*)
Bull thistle (*Cirsium vulgare*)
Camelthorn (*Alhagi pseudalhagi*)
Canada thistle (*Cirsium arvense*)
Chicory (*Cichorium intybus*)
Chinese clematis (*Clematis orientalis*)
Coast tarweed (*Madia sativa*)
Common burdock (*Arctium minus*)
Common crupina (*Crupina vulgaris*)
Common groundsel (*Senecio vulgaris*)
Common mullein (*Verbascum thapsus*)
Common St. Johnswort (*Hypericum perforatum*)
Common tansy (*Tanacetum vulgare*)
Common teasel (*Dipsacus fullonum*)
Cypress spurge (*Euphorbia cyparissias*)
Dalmatian toadflax, broad-leaved (*Linaria dalmatica*)
Dalmation toadflax, narrow-leaved (*L. genistifolia*)
Dame's rocket (*Hesperis matronalis*)
Diffuse knapweed (*Centaurea diffusa*)
Downy brome (*Bromus tectorum*)
Dyer's woad (*Isatis tinctoria*)
Eurasian watermilfoil (*Myriophyllum spicatum*)
Field bindweed (*Convolvulus arvensis*)
Flixweed (*Descurainia sophia*)
Giant salvinia (*Salvinia molesta*)
Green foxtail (*Setaria viridis*)
Hairy nightshade (*Solanum sarrachoides*)
Meadow knapweed (*Centaurea pratensis*)
Mediterranean sage (*Salvia aethiopis*)
Medusahead rye (*Taeniatherum caput-medusae*)
Moth mullein (*Verbascum blattaria*)
Musk thistle (*Carduus nutans*)
Myrtle spurge (*Euphorbia myrsinites*)
Orange hawkweed (*Hieracium aurantiacum*)
Oxeye daisy (*Chrysanthemum leucanthemum*)
Perennial pepperweed (*Lepidium latifolium*)
Perennial sowthistle (*Sonchus arvensis*)
Plumeless thistle (*Carduus acanthoides*)
Poison hemlock (*Conium maculatum*)
Puncturevine (*Tribulus terrestris*)
Purple loosestrife (*Lythrum salicaria*)
Quackgrass (*Elytrigia repens*)
Redstem filaree (*Erodium cicutarium*)
Rush skeletonweed (*Chondrilla juncea*)
Russian knapweed (*Centaurea repens*)
Russian-olive (*Elaeagnus angustifolia*)
Russian thistle (*Salsola collina and S. iberica*)
Saltcedar (*Tamarix parviflora and T. ramosissima*)
Scentless chamomile (*Anthemis arvensis*)
Scotch thistle (*Onopordum acanthium and O. tauricum*)
Sericea lespedeza (*Lespedeza cuneata*)
Shepherdspurse (*Capsella bursa-pastoris*)
Spotted knapweed (*Centaurea maculosa*)
Spurred anoda (*Anoda cristata*)
Squarrose knapweed (*Centaurea virgata*)
Sulfur cinquefoil (*Potentilla recta*)
Swainsonpea (*Sphaerophysa salsula*)
Tansy ragwort (*Senecio jacobaea*)
Velvetleaf (*Abutilon theophrasti*)

Halogeton (*Halogeton glomeratus*)
Hoary cress (*Cardaria draba*)
Houndstongue (*Cynoglossum officinale*)
Hydrilla (*Hydrilla hydrilla*)
Johnsongrass (*Sorghum halepense*)
Jointed goatgrass (*Aegilops cylindrica*)
Kochia (*Kochia scoparia*)
Leafy spurge (*Euphorbia esula*)
Mayweed chamomile (*Anthemis cotula*)
Venice mallow (*Hibiscus trionum*)
Wild caraway (*Carum carvi*)
Wild mustard (*Brassica kaber*)
Wild oats (*Avena fatua*)
Wild proso millet (*Panicum miliaceum*)
Yellow foxtail (*Setaria glauca*)
Yellow nutsedge (*Cyperus esculentus*)
Yellow starthistle (*Centaurea solstitialis*)
Yellow toadflax (*Linaria vulgaris*)

The following weed species are recognized as the top ten prioritized weed species for the State of Colorado. After analysis of a statewide survey of counties, these species are acknowledged to be the most widespread and to cause the greatest economic impact in the State of Colorado. These species shall be considered by each local advisory board and local governing body in the development, adoption and enforcement of their noxious weed list and noxious weed management plan. They are listed in alphabetical order:

Canada thistle (*Cirsium arvense*)
Dalmation toadflax (*Linaria dalmatica* and *L. genistifolia*)
Diffuse knapweed (*Centaurea diffusa*)
Field bindweed (*Convolvulus arvensis*)
Hoary cress (*Cardaria draba*)
Houndstongue (*Cynoglossum officinale*)
Leafy spurge (*Euphorbia esula*)
Musk thistle (*Carduus nutans*)
Russian knapweed (*Centaurea repens*)
Yellow toadflax (*Linaria vulgaris*)

The following weed species may not be present or are not yet widespread or causing great economic impact within the State of Colorado. However, counties and local advisory boards are encouraged to contain and eradicate these species before they proliferate and significantly impact the economic and environmental values of the lands of the State. They are listed in alphabetical order:

Absinth wormwood (*Artemisia absinthium*)
African rue (*Peganum harmala*)
Bouncingbet (*Saponaria officinalis*)
Camelthorn (*Alhagi pseudalhagi*)
Coast tarweed (*Madia sativa*)
Common crupina (*Crupina vulgaris*)
Common teasel (*Dipsacus fullonum*)
Cypress spurge (*Euphorbia cyparissias*)
Dyer's woad (*Isatis tinctoria*)
Eurasian watermilfoil (*Myriophyllum spicatum*)
Giant salvinia (*Salvinia molesta*)
Hydrilla (*Hydrilla hydrilla*)
Meadow knapweed (*Centaurea pratensis*)
Moth mullein (*Verbascum blattaria*)
Myrtle spurge (*Euphorbia myrsinites*)
Orange hawkweed (*Hieracium aurantiacum*)
Rush skeletonweed (*Chondrilla juncea*)
Sericea lespedeza (*Lespedeza cuneata*)
Spurred anoda (*Anoda cristata*)
Squarrose knapweed (*Centaurea virgata*)
Sulfur cinquefoil (*Potentilla recta*)
Tansy ragwort (*Senecio jacobaea*)
Venice mallow (*Hibiscus trionum*)
Yellow starthistle (*Centaurea solstitialis*)

WaterWise Landscaping

Best Practices

Section 5 – Understanding Soils and Soil Preparation

A. Introduction to Soils (See Native Plant Revegetation Guide available at: *http//parks.state.co.us/cnap/revegetation-guide/reveg_index.html*)

Prairie soils have developed over thousands of years. Native topsoil is a living material containing soil microorganisms, seeds, plant roots, and invertebrate animal in a matrix of minerals (derived from rocks) and dead organic matter (developed from the breakdown of dead plants and animals). Areas with adequate topsoil are better able to develop and support healthy vegetation. Native drought tolerant vegetation may be adapted to a broad or narrow range of soil types. Successful native and drought tolerant landscapes should consider soil properties when designing planting areas. Soil properties include texture, chemistry, and structure. Soil pH, salinity, and percent organic matter may be more critical to the establishment of native and drought tolerant vegetation than soil macronutrient levels (nitrogen, phosphorus, and potassium). In order to better plan for specific soils, consult the reference above.

Topsoil may be recognized in general by its darker color (very dark to deeper brownish earth tones). The distinct transition to brighter earth tones may mark the boundary with subsoil. Recent precipitation may color surface soils darker and should not be mistaken for topsoil. In general topsoil may be 6 to 12 inches deep, deeper in drainages and shallower on slopes and hilltops. Old agricultural fields may have less distinct boundaries due to years of mixing of upper soils and accelerated erosional loss. Pits may be dug to identify topsoil depths prior to removal

B. Salvage of Soils

Topsoil is a living material and must be handled carefully to preserve its quality. Planned developments are frequently re-graded. Topsoil should be salvaged from all areas and stockpiled prior to grading. Topsoil under roads and staging areas should also be removed and stock piled. All salvaged topsoil should be reapplied to the portions of the development site to be revegetated. Salvage topsoil in drainages before erosion of denuded upland areas can contaminate them.

Topsoil is best if it can be removed and hauled directly to the placement site. If storage is necessary it should be for as short a time as possible. The topsoil should be placed in a low mound, in a weed free area, with side slopes of 7:1 or less. A ditch and berm structure around the pile will help reduce loss to erosion. If the pile is to remain for more than four weeks, it should be seeded with a sterile hybrid wheatgrass such as “Regreen”. The depth of the pile should be no greater than 2-3 feet to minimize loss of living microbial components. In general it is best to move topsoil when it is moist. Avoid moving wet soils (may harden to brick-like consistency) or overly dry soils. Dormant hauled soils preserve residual native seed and propagules.

C. Topsoil Sources

If topsoil is to be imported to a site a soil sample or recent soil test should be obtained from the supplier. If possible the source site should be visited to check for weed contamination. Soil sources should be free of noxious weed species. If a prepared soil is to be used, the organic content should only be 2 percent for native seeding areas. (Conventional lawns and higher water usage areas may utilize higher organic matter.)

D. Topsoil Testing

Imported topsoil should be a sandy loam or loam soil as defined by the USDA Soil Conservation Service soil Classification system, as follows:

Textural Class	% Total Weight	Average %
Sand (0.05-2.0 mm dia. Range)	45 to 75	60
Silt (0.002-0.05 mm dia. range)	15 to 35	25
Clay (less than 0.002 mm dia. range)	5 to 25	15

Topsoil should be free of stones over 1" in diameter (lawns and gardens) or over 4" (native seeded areas). Topsoil should be free of debris and excessive plant litter.

Topsoil should have a pH of 6-7.5 and salinity less than 4 mmhos/cm.

Soil Testing is available through the **Colorado State University Extension Service:**

Contact Information:	CSU Soil Testing Lab, Ft. Collins, Colorado
	Phone: 970-491-5061
	Fax: 970-491-2930
	Web: www.colostate.edu/Depts/SoilCrop/soillab.html
Cost:	Routine Analysis = $18.00 (as of 6/03)
Procedure:	Application & Instruction Forms follow

E. Soil Amendments

It is best to plan native and drought tolerant vegetation around the existing soil conditions. If extreme soil conditions exist, some amendments may improve the soil conditions:

1. pH

If the pH is very high it may be possible to adjust by adding aluminum sulfate. Soil in the Front Range tends to have a high pH and thus, does not generally require the addition of lime, which would further elevate the pH value.

2. Texture

Soil texture effects water availability within soils. Very sandy soils do not retain water well. Very clayey soils do not allow water to penetrate or drain easily. Organic matter may improve both of these extreme soils. Native or to low water usage landscapes generally no more than 2 percent organic matter. Generally, if sandy or

clay soils are amended, 2 cubic yards of composted organic matter/1000 square feet is adequate. To improve deep root penetration in a heavy clay or sandy subsoil (under all water usage levels of landscape) apply 2 cubic yards of compost prior to re-application of topsoil. All compost should be deeply ripped into the soil at least 12 inches. This helps with root penetration into the deeper layers of the soil and makes all landscape types more drought tolerant. Avoid over-working the soil to preserve the soil structure.

3. **Organic Amendment**
   Organic amendments should be composted. Compost may be a mixture of manures (not from stock yards, which may be high in salts), yard wastes (ground grass clippings, leaves and branches), organic byproducts such as brewery wastes, and sewage sludge (should not be used alone due to a high clay content.) Prepared topsoil companies maintain sanitary controlled compost production and are a good source of organic amendments.

4. **Nutrient Amendment**
   Nutrient amendments may not be required for native vegetation. Macro nutrient (N,P,K) levels are low in native prairies. Addition of nutrients to native and drought tolerant planting areas may encourage weeds and damage root systems. If topsoil is very poor or lacking, a slow release organic amendment such as Biosol may be added at a rate of 800 to 1200 pounds per acre to improve plant growth.

SUGGESTED INSTRUCTIONS FOR SUBMITTING SOIL SAMPLES
Use the following steps to submit soil samples:

1. Obtain a spade, trowel, soil tube, or soil auger free of rust and soil.

2. Dig 5-10 samples (depending on the size of the area) from the soil depth where your plants will be rooting. The samples should represent a uniform area consisting of land that is similar in slope, texture, drainage, or other characteristics that make the soil the same. A front and back yard would most likely be very similar to each other, however a garden area may be different from a turf grass area.

3. Place all of the samples into a plastic container and mix well to get your final sample for submittal to the lab. If possible, air dry the sample by spreading it out on paper towels.

4. Remove about 1 1/2 - 2 pints of soil from the container and place it in a plastic bag or soil sample bag.

5. Seal the bag and label the sample with name, address and location of the sample.

6. Complete this soil sample information form as much as possible and include it with the soil sample.

7. Mail the sample to the lab using the following address:

   Soil, Water and Plant Testing Laboratory
   Colorado State University
   Room A 319 NESB
   Fort Collins, CO 80523-1120

8. Be sure to keep samples cool before mailing. If samples heat up; the nitrogen readings can change dramatically. Keeping the samples in the shade will prevent excessive heating.

9. **DO NOT PREPAY**, you will be billed for the analysis.

10. The lab **DOES NOT** do herbicide or pesticide analysis.

11. If you have additional questions please contact the lab at: (970) 491-5061 or your local county Cooperative Extension agent.

SOIL TESTS AVAILABLE	
TEST	**COMMENTS**
Routine- pH, soluble salts, organic matter, nitrate-nitrogen, phosphorus, potassium, zinc, iron, lime (estimate), texture, copper and manganese.	Basic evaluation for characterizing the soil fertility status for growing crops. a fertilizer recomendation is given. Normally this test is sufficient unless a special problem is suspected.
Subsoil Nitrate	Evaluation of nitrate supply below soil surface. Fertilizer nitrogen recommendation based on routine soil test of surface soil is adjusted if subsoil nitrate is unusually high.
Subsoil Salinity	It is important to determine the salt content of subsoil for crop management.
Sodium Evaluation - sodium adsorption ratio (ratio of sodium to calcium and magnesium), gypsum, and % lime.	Some Colorado soils contain excess sodium. This test determines whether or not chemical amendments such as gypsum or sulfur will be effective and the amounts of these materials needed.
Routine plus Sodium Evaluation	See above explanations. A recommendation for fertilizer and/or amendments for sodium reclamation is given.
Boron, Sulfate and Molybdenum	Colorado soils usually have sufficient quantities of these nutrients. However, in some soils near mine sites, boron or molybdenum may be found in toxic quantities.

Form from the CSU Soil-Water-Plant Laboratory website
<www.colostate.edu/Depts/SoilCrop/soillab.html>

SOILSAMPLEINFORMATIONFORHORTICULTURALAPPLICATIONS - **PLEASE PRINT IN LANDSCAPE MODE!**

See the reverse side for sampling information

DATE:_____

FULL NAME:_____

SSN:_____

ADDRESS:_____

_____

CITY: _____STATE:_____

ZIPCODE:_____

PHONE:_____ FAX:_____

COUNTY:_____SAMPLEID:_____

SOIL, WATER & PLANT TESTING LABORATORY

CLIENTTYPE(Check One)

Homeowner	Operator
Dealers/Distributor	Extension Agent
Lawn Care Company	Regulatory Agency
Golf Course	Consultant
Nursery /Garden Center	Government/School
Other_____	

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

PLEASECIRCLE ANALYSISDESIRED

Routine(pH, conductivity, organic matter, NO_3, P, K, Zn, Fe Cu, Mn, lime estimate, texture estimate)

Routine + Sodium Evaluation (SAR)

Routine + Boron, Molybdenum, Cadmium, Lead

Routine + Nitrate OR Salinity on Subsoil

Routine + Salinity + Nitrate on Subsoil

NOTE: A subsoil is a separate sample taken 6" underneath your surface sample.

MINIMUM CHARGE

The following information will help us give you a written explanation of the laboratory results:

PLEASECIRCLEALLTHATAPPLY.

1. The sample is from:

A. Lawn	E. Golf course
B. Vegetable garden	F. Container plantings
C. Flower bed	G. Reclamation site
D. Greenhouse	H. Other (please specify)_____

2. What do you plan to grow at the site or what is currently growing at the site?

A. Vegetables B. Flowers C. Turfgrass (How old is the lawn?)____ D. Trees E. Other_____

If you are growing turf please answer the following :

Is this site to be____ Seeded_____Sodded?

Is it an existing lawn? _____

If the lawn is established was it:

Seeded_____ Sodded_____

3. Will this site be irrigated/watered?

Yes____or No_____

4.If yes which method?

A. Sprinkler C. Drip

B. Flood D. Other please specify_____

5.If sprinkler is used is it:

A. Automatic C. Hose end

B. In ground D. Other_____

6. About how much water do you apply each time you irrigate/water?

A. Less than 1 inch. B. 1-3 inches C. 4-6 inches D. More than 6 inches

7. How often do you irrigate/water?Daily_____ Once per week___ Twice per week_____ Other_____

8.If possible, indicate the types of previous crops or plants that grew at this site._____

9. What have you added or plan to add to the soil?_____

10. Is there a specific problem with this site? Yes_____ No_____

If yes, please describe the problem, what caused the problem and why you think it was the cause (use a separate sheet if necessary).

_____

11. If you wish to have a fertilizer recommendation based on organic fertilizers please answer the following questions.

What is the type of material that will be used for organic fertilizer?

A. Composted manure B. Composted sludge C. Other_____

Do you know the nutrient levels in the organic fertilizer?Yes_____No_____

If so please supply the following information for the organic fertilizer.

% nitrogen	% phosphorus	% potassium	pH	Salts (mmhos/cm)

Additional Comments: _____

By accepting service or goods, I agree to submit payment in full to Colorado State University upon receipt of invoice or University Billing Statement.Late payment charges of 1.5% per month and other penalties specified may be assessed for late payment.

Please call lab for prices.

revised 10-11-2001

Form from the CSU Soil-Water-Plant Laboratory website
<www.colostate.edu/Depts/SoilCrop/soillab.html>

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Best Practices

Section 6 – Irrigation Design Techniques and Equipment

The following information builds upon some of the Guidelines described above in Section 2, Principle #5.

A. Consider plant water requirements in irrigation design schemes

1. Each valve should irrigate a landscape with similar site, slope and soil conditions and plant material with similar watering needs.
2. Soil types, infiltration rate & slopes should be considered in order to avoid runoff, & overspray, where water flows onto adjacent property, non-irrigated areas, walks, roadways, or structures. Proper irrigation equipment, schedules, and repeat cycles should be used to minimizing runoff.
3. Special attention should be given to avoid runoff from slopes, and to avoid overspray in planting areas with a width less than ten feet, like medians.
4. Turf and non-turf areas should be irrigated on separate valves.
5. Drip emitters and sprinklers should be place on separate valves.
6. Bubblers for trees should be placed on a separate valve. Bubbler selected should not exceed 1.5 gallons per minute (gpm) for each device.
7. Hand watering may be considered for Low and Very Low hydrozones.

B. Employ hydraulic principles when designing the irrigation system.

1. The irrigation system should be designed to provide peak season irrigation within a six night, six hour per night watering period.
2. The tap size should be based on the water demand of the site and will take into consideration the areas of each plant type (i.e., turf, native seed, perennials and annuals and shrubs), the evapotranspiration for the site, the water demand of each plant type at peak season, and the water window.
3. The maximum flow rate required for the site should be based on the tap size:

¾” meter	15 gallons per minute
1” meter	25 gpm
1.5” meter	50 gpm
2” meter	80 gpm

4. The mainline system should be designed such that velocities within the mainline piping do not exceed five feet per second.
5. A reduced pressure backflow preventer should be used on all systems. Where the irrigation point of connection is from the domestic water service, the irrigation tap and backflow preventer shall be installed after the water meter but before any backflow or pressure-reducing valve for the building.
6. A pressure-reducing valve should be used when the static water pressure exceeds the pressure needed by the system by 15 pounds per square inch (psi). Pressure reducing valves can be installed within the project, on the mainline or at the valve, if elevation changes require it.

7. Turf and grass area design principles:
    a. No single zone should mix head types, such as rotors and pop-up spray heads on the same zone.
    b. Sprinklers should be spaced for “head-to-head” coverage, where the spray pattern from one head will reach to the next head. (Another way to describe this is that all sprinkler heads should be spaced at a maximum of 50% of design performance diameter of the sprinkler.) Spacing should be reduced below 50% of design performance diameter when conditions demand.
    c. No overhead sprinkler irrigation systems should be installed in strips less than 8 feet wide.
    d. Small areas (25 ft wide or less) should be irrigated with fixed nozzle pop-up spray heads with matched precipitation nozzles. Nozzles should be sized to provide head to head coverage. Heads shall pop-up a minimum of 4” in turf areas. Heads can be specified with pressure reducing features, where needed.
    e. Large areas (wider than 25 ft) should be irrigated with gear driven rotor heads with a minimum precipitation rate of 0.45” per hour for a full circle head. Heads should pop-up a minimum of 4” in turf areas.
    f. Check valves should be included in heads or valves where low-head drainage will occur due to elevation changes. See irrigation head catalogs for elevation change tolerances.
8. Shrub bed areas with plant material one gallon in size or larger should be irrigated with a drip or subsurface system.
9. Perennial and annual beds should be spray irrigated with 12” pop-up spray heads with a maximum spacing of 10’ on center.
10. Booster pumps should be installed on systems where supply pressure does not meet minimum recommended pressure of the irrigation system, based on hydraulic calculations.
11. Where the water supplied will be from secondary or other non-potable water sources, the use of non-potable color indicators on the equipment is recommended. This includes purple handles on quick coupler valves and gate valve, caps for irrigation heads, valve box lids and marker tape buried above the mainline.
12. All systems should be equipped with an automatic rain shut-off device.
13. All wire connections should be made with watertight connectors and contained in a valve box.

C. Employ irrigation control systems that offer flexibility in programming.

1. All irrigation systems should include an electric automatic controller with multiple programs and multiple repeat and rest cycle capabilities and a flexible calendar program.
2. All controllers should be capable of temporarily shutting down the system by utilizing internal/external options such as rain and wind sensors.
3. The controller should have the ability to adjust run times based on a percentage of maximum ET (evapotranspiration) rate.
4. Each zone/valve should have its own station on the controller. The exception is drip valves, which can be doubled on the controller.

D. Ensure installation of irrigation system is per plan and is accurate.

1. Irrigation system should be installed per plans.

2. The irrigation system should be monitored during installation, especially to verify mainline and lateral line depth, spacing of irrigation heads and construction of valve clusters and quick coupler components.
3. Mainline should be tested to ensure its ability to maintain required pressure for 2 hours.
4. Before acceptance, each zone should be operated and each valve box opened to verify accurate installation.

E. Provide "as-built" drawings of irrigation system after installation with dimensions shown for irrigation components.

1. The "as-built" drawings should show all points of connection, including tap size, line size and static water pressure of service. Dimensions that will be used to locate components shall be shown on plans. Components to be located include meters, backflow preventers, all valves, including quick coupler, control, gate, and manual drain valves, and controller locations.
2. The drawings should also show zone number, valve size and gallons per minute.

F. Operate systems to maximize irrigation water efficiency.

1. Irrigation should be scheduled to operate between 10 PM and 8 AM to reduce water loss from wind and evaporation and to take advantage of the better water pressure.
2. The target efficiency for rotor heads should be 70%, and 55% for spray heads.
3. Program valves for multiple repeat cycles to reduce runoff, especially on slopes and with soils with slow infiltration rates.
4. All zone run times should be determined based on the precipitation rate of the heads on that zone. The run times should be adjusted seasonally and at least once a month to accommodate the ET rate.
5. System should be winterized in the fall using a compressor to remove water in the lines and components. System should be reopened and adjusted for proper operation in the spring.
6. After each mowing, each zone should be operated for a very short period of time to verify the heads are operating as designed and no damage has occurred.
7. When repairs are made, the new components installed should match exactly those damaged and removed.
8. Run times for zones should be adjusted based on exposure (north and east vs. south and west), slope and soil types to reduce overwatering.

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Best Practices

Section 7 – Water Budgeting

A. Calculating a Water Budget

A Water Budget is the target amount of water a landowner should use in a typical watering season. This target provides simple-to-achieve, realistic goals for landscape irrigation. Water Budgeting focuses less on watering time limits, and is more concerned with a user's water allotment and reducing over-watering. This form can help any user create a target Water Budget from which to work.

The information below will help guide you through the Water Budget Worksheet on the following page.

Step 1. ET Reference Location:
Because climate conditions vary throughout Colorado, the rate at which water evaporates (evaporation) and the rate at which plants use water (transpiration) varies in different areas of the state. Based on those climatic differences, it is important to identify the general Evapo-Transpiration (ET) Reference Locations in which you are located. The four largest regions can be categorized as: Denver, Colorado Springs, Grand Junction and Pueblo.

Step 2. Gallons of Water Needed by Plant Category:
Different plants have different water needs. A plant list that identifies the water needs of landscape plants (High, Moderate, Low, Very Low) is included in Section Three of this Best Practices Manual. The ET Rates are provided on the worksheet, and will need to be applied in the calculations in Step 4 below.

Step 3. Irrigation Areas (zones) based on Plant Water Need Category:
Both automatic irrigation systems and hand-placed yard sprinklers deliver water to plants by watering areas or "zones", and have set watering amounts determined by you, the user. If you have High water need plants within Low or Very Low water plant groupings, the entire area must be considered a High-water area and irrigated as such; however some plants may be over-watered if this occurs. The area of each watering zone can be determined by physically measuring the zone, and multiplying Length (in feet) by Width (in feet). The resulting areas (in square feet, or S.F.) can be entered in Step 4 below.

Step 4. Water-Use Calculations:
Fill in the blanks with area and water need per zone. For example, in the Denver region you might have an area of 300 S.F. in a High Water Zone that would require 20 gallons of water per S.F. After multiplying you would find that area requires 6,000 gallons of water per season.

After calculating the irrigation needs of all areas, determine your average overall water needs per season. To do this, add the total gallons needed for all zones, and divide by the total Square Footage for all zones. The average for the overall site needs to be no more than 15 gallons per S.F. per season. If your average is more than this, you might consider modifying your planting layout to create more Low/Very Low Water Zones that would balance your High/Moderate Water Zones, and reduce over-watering.

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B. Water Budget Worksheet

1. ET Reference Location:

Identify the general Evapo-Transpiration (ET) Reference Location in which you are located. The four largest regions are listed below and include surrounding metropolitan areas:

__Denver __Colorado Springs __Grand Junction __Pueblo

2. Gallons of Water Needed by Plant Category:

Determine the water needs of the various plants in your design. A plant list that identifies water needs (High, Moderate, Low, Very Low) is included in Section Three of this Best Practices Manual.

Plant Water Need Category		Gallons of Water used (ET Rate)*
H =	**High water plants**	(20 gallons/SF/season -- Denver)
M =	**Moderate water plants**	(10 gallons/SF/season -- Denver)
L =	**Low water plants**	(0-3 gallons/SF/season -- Denver)
VL =	**Very Low water plants**	(no irrigation needed; typical rainfall is sufficient)

The ET Rates for regions other than Denver are not yet accurate. One might assume that the ETR for Colorado Springs is 10% less than Denver's, and those for Grand Junction and Pueblo may be as much as 25% higher than Denver's.

3. Irrigation Areas (zones) based on Plant Water Need Category:

Identify each zone requiring irrigation, and calculate the area (in square feet) of each zone. If plants are already installed and/or not grouped together by water need, pick the highest water need category included in each zone.

4. Water-Use Calculations:

HIGH WATER ZONES: _____S.F. x (_____ gals./S.F.) =_____gals / season

MODERATE WATER ZONES: _____S.F. x (_____ gals. /S.F.) =_____gals / season

LOW WATER ZONES: _____S.F. x (_____ gals./S.F.) =_____gals / season

VERY LOW WATER ZONES: _____S.F. x (_____ gals./S.F.) =_____gals / season

TOTAL gallons needed by ALL ZONES: =_____gals / season

TOTAL Square Feet (S.F.) of ALL ZONES: =_____S.F.

***AVERAGE GALS./S.F./SEASON, ALL ZONES:** Total Gals / Total SF **=_____gals / season**

**The average needs to be a maximum of 15 gals. / S.F. / season.*

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Best Practices

Section 8 – Additional Resources

Water Conservation Internet Sources

- Waterwiser, National Water Efficiency Clearinghouse, www.waterwiser.org
- Water Saver Home, www.h2ouse.org
- U.S. Geologic Survey, Water use in the United States, www.water.usgs.gov/watuse
- Western States Water Council, www.westgov.org/wswc
- Colorado Water Conservation Board, www.cwcb.state.co.us
- Colorado Nonpoint Source Program, www.ourwater.com
- Denver Water, www.water.denver.co.gov/indexmain.html
- WaterSaver from Denver Water, www.watersaver.org

WaterWise Landscaping Internet Sources

- GreenCO Best Management Practices, www.grennco.org/bmp_list.html
- National Association of Irrigation Design/ Certification, www.irrigation.org/certification.html
- American Nursery and Landscape Association, www.anla.org
- Associated Landscape Contractors of Colorado, www.alcc.com
- Smart Gardening, www.smartgardening.com
- Xeriscaping, www.xeriscape.org
- Colorado State University Horticulture Department, www.hla.agsci.coloradostate.edu
- CSU Cooperative Extension Service, www.ext.colostate.edu/garden
- Colorado Nurseries, www.colorado-nusery-assn.org

- Gardening Colorado, www.gardeningcolorado.com
- Xeriscape Gardening, www.xratedgardening.com

Seed and Plant Sources

- Garden Centers of Colorado, www.gardencentersofcolorado.org
- Colorado Native Plant Society, www.carbon.cudenver.edu/~shill/conps.html
- High Country Gardens, www.highcountrygardens.com
- Arkansas Valley Seed Solutions, www.seedsolutions.com
- Rocky Mountain Sod Growers Association, www.rockymountainsodgrowers.com

Demonstration Gardens

- Colorado Xeriscape Demonstration Gardens, www.xeriscape.org/demogardens.html

Waterwise Gardening Books

- *The Xeriscape Flower Gardener*, Jim Knopf, Boulder, CO, Johnson Books, 2003
- *Waterwise Landscaping with Trees, Shrubs, and Vines*, Jim Knopf
- *Xeriscape Plant Guide*, Rob Proctor/David Winger, Fulcrum Publishing, 1996
- *Xeriscape Handbook*, Gayle Weinstein/ David Winger, Fulcrum Publishing, 2003
- *Xeriscape Color Guide*, David Winger/Denver Water, Fulcrum Publishing, 1998
- *Western Garden Book*, Kathleen Norris Brenzel, Sunset Publishing, 2001
- *Water-Efficient Landscape Guidelines*, Richard E Bennett/ Michael S. Hazinski, American Water Works Association, 1993
- *The Rocky Mountain Perennial Plant Guide*, Colorado Nursery Association, 1995
- *Rocky Mountain Plant Guide*, Colorado Nursery Association, 1993