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A Water-Efficient Landscape: Public Lands Center, Montrose, CO

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A WATER-EFFICIENT LANDSCAPE

Public Lands Center, Montrose, CO

By Marcus Pulsipher

Thesis submitted in partial fulfillment
of the requirements for the degree of

DEPARTMENTAL HONORS

LANDSCAPE ARCHITECTURE
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HONORS THESIS PROJECT
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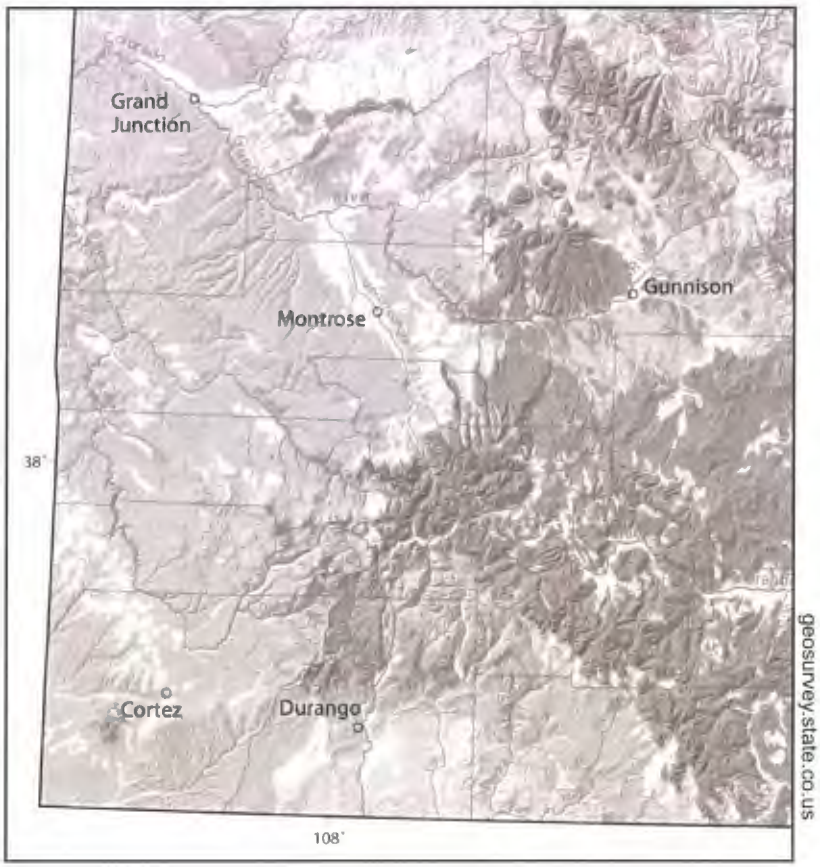
INTRODUCTION

The problem of water-wasting landscapes is prevalent throughout the western United States. For decades western settlers struggled to turn their arid lands into the more familiar settings of lush vegetation found in their native New England and Western Europe. This mind set has been passed down through generations and has transformed into the basis of the current western water crisis (Brundin and Pearson 2001). Only in the last few decades has this mentality been challenged and we've seen the emergence of several water-efficient landscape models. Through careful application of water-efficient landscape principles, western communities can greatly extend the life of their water resources.

For the public to act responsibly, they first need to be taught how to do so. Several educational gardens have been created throughout western towns teaching responsible landscaping practices. These have done much to inform the public about the water problem, however, beyond education, the public needs to see water-efficient landscaping in practice.

An example of this can be found in Montrose, CO. A piece of government land in Montrose, called The Public Lands Center, houses the regional field offices of both the Bureau of Land Management and the National Forest Service. Despite these two agencies' reputation for championing environmental responsibility, the center has one of the most inefficient and wasteful landscapes found in one of the country's most arid regions. Occupied by a large expanse of turf and several shade trees, the present site is in dire need of a redesign that will not only reflect their commitment to responsible stewardship of the land but also demonstrate proper landscaping techniques for the town's residents.

PROJECT DESCRIPTION



Montrose is located in the Uncompahgre Valley in the west half of Colorado. It lies about sixty miles south of Grand Junction and a little over a hundred miles north of Durango. Located at the junction of Highway 50 and the Scenic Byway Highway 550, it serves as the primary gateway to the Black Canyon of the Gunnison National Park as well as an access to the scenic San Juan Mountains located just 25 miles to the south. At 5,794 feet in elevation Montrose has very mild summers. However, due to its arid climate, it also enjoys very little snow accumulation in the winter. This mild and dry climate and the variety of community activities and regional attractions have made Montrose the home to many retirees and those seeking recreational lifestyles (Montrose Visitors and Convention Bureau).

www.googlemaps.com

The town was first settled 1882 by Joseph Selig who named it for Sir Walter Scott's "Legend of Montrose" because of the landscape's similarity to the Scottish Highlands. For years it served as a frontier freight center and the hub of many mining operations in the San Juan Mountains. It's now home to over 13,000 residents with another 30,000 in the surrounding area. The city averages between 227 to 274 days of sunshine a year with a growing season of 150 days. However, the area only gets about 9.5 inches of rain per year making it one of the most arid regions in the country (Montrose Visitors and Convention Bureau).

Due to the rich variety of terrain and resources surrounding the area it was decided in the 1970's to use Montrose as the base for the Uncompahgre Field Office of the Bureau of Land Management. The field office was situated on the south end of town well outside the extent of city development. Over the years the center has expanded to include offices for the Gunnison Gorge National Conservation Area staff, the Montrose Interagency Fire Management Unit, the US Forest Service (USFS) Ouray Ranger District Office, and National Park Service (NPS) staff affiliated with the Black Canyon of the Gunnison National Park and Curecanti National Recreation Area (Dahlkamp 2006).

With the expansion of the city, the Public Lands Center now finds itself in a more urban context, surrounded by new development. This setting gives the center an unique opportunity to bring an example of water-efficient landscaping into the heart of a city in need of practical landscaping solutions.

Photo provided by BLM

The extent of the Public Lands Center's property.

BACKGROUND ON XERISCAPING

Water-efficient landscapes are generally referred to as "xeriscapes." This term was coined by the Denver Water Department in order to describe landscaping that uses water conservation as the primary driver of form and content. The term combines the Greek word "xeros," meaning "dry," with the word "landscape" (Feucht and Wilson 2006).

Water-efficient landscaping became a social concern in the 1970's when expanding populations in the western United States proved to be overtaxing local water resources. Many citizens responded by installing landscapes of gravel and plastic (Feucht and Wilson 2006). A quick drive through Montrose's neighborhoods reveals that most residents are still at a loss for what to do with their yards. Not knowing how to plan a xeriscape, many residents appear to have adopted a "zero-scape" approach by filling their yards with oddly-shaped swaths of multi-colored gravel. What these citizens don't realize is that these yards are in many ways just as environmentally irresponsible as the wasteful "thirsty" landscapes of before.

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An example of current landscaping practices in Montrose. The lack of vegetative cover in the neighborhood makes for an hostile environment for residents.

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Some residents try to incorporate plants into their yards, however, with little success

While less water is indeed being used on these landscapes, the use of rock instead of plant material increases both water runoff and on-site temperatures. This means less water absorption into the ground because of both run-off and increased evaporation. By removing plants home-owners also diminish air quality by eliminating the photosynthetic process in their neighborhoods. The lack of shade-giving trees and shrubs also mean hotter houses which, in turn, mean increased usage of air conditioning and swamp coolers. Not only does this lead to more energy consumption, but also the release of even more harmful chemicals into the air (Feucht and Wilson 2006).

It was these types of landscapes that inspired the development of various programs back in the 1970's that were designed to educate the public about more efficient landscaping and it's benefits. Over thirty years later this education is still taking place as more and more commercial businesses, government complexes, and private citizens see the need to transition towards a more responsible approach to landscape management (Feucht and Wilson 2006).

Types of Xeriscaping

There are two principle ways to design a xeric landscape. The first involves using only plants which are native to the region in which the site is located. One of the advantages of using native plants is that they are largely already adapted to the climate and soil conditions found on

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A strictly native landscape on the campus of Utah State University.

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An example of a mixed xeric landscape is available to Montrose residents in their own botanical garden.

the site. Being so adapted there is very little maintenance that must be done to keep them up. Another advantage is that contextually the plants fit in with the rest of surrounding landscape unifying the site with the general regional landscape character.

The second way to design a xeriscape is to use a variety of drought tolerant plants native to several different places. Doing so allows for greater variety of plant choices. However, when planning a mixed xeric landscape it is important to find plants that match existing climate, elevation, and soil conditions. Not doing so can result in increased maintenance that may include regular soil adjustment, trunk wrapping for protection against winter burn, and additional pruning.

EXAMPLES OF WATER-EFFICIENT LANDSCAPING IN THE WEST

Since it's inception as a social concern, water-efficient landscaping has produced several excellent examples throughout the western states. These examples can be found in every type of landscape: from privately owned commercial and residential sites to government controlled campuses and institutions. We will take a look at what kinds or landscapes are being produced through the implementation of xeriscape principles.

Residential Communities

One of the best examples of responsible residential landscaping in the arid west can be found in a small community called Kayenta, located just outside of Ivins, Utah, a few miles north of St. George. Kayenta is unique among most new residential developments in southern Utah because of it's landscaping and architectural regulations (Kayenta Community in Southern Utah, 2007).

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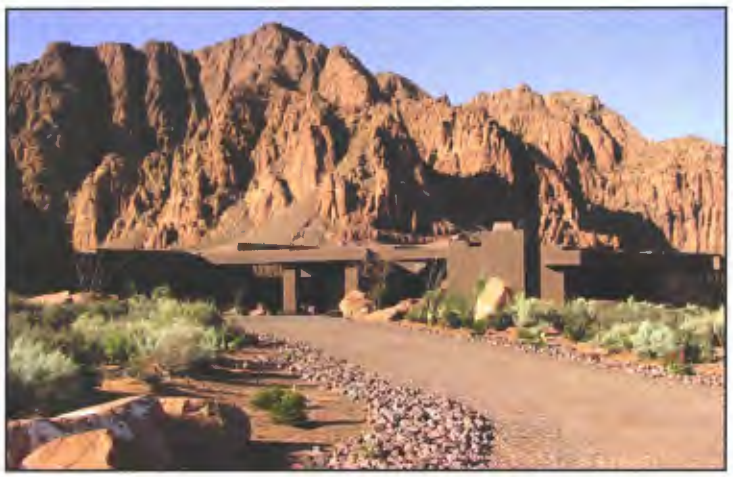
Architectural and landscape regulations ensure that Kayenta fits into the surrounding environment both aesthetically and environmentally.

Desiring to create a community that really fit into the landscape the original planners of Kayenta laid down restrictions regarding building height,



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Use of native plants, materials and colors keep the buildings from "intruding" into the landscape.

architectural style, and materials. Buildings can't exceed 13 feet above finished grade and must be designed by in-house architects to ensure stylistic harmony. They also imposed landscaping guidelines. Generally only 25 percent of a resident's property can be developed. This allows for the continued use of the land by native plant and animal communities. Desert plants are used around the houses as well. Residents are allowed to plant a limited amount of sod, but it must be done out of the view of neighboring houses and the general public (Kayenta Community in Southern Utah, 2007).

Through adherence to these regulations Kayenta has become a highly sustainable community which aesthetically and environmentally relates to the land on which it is built.

Private Commercial

An excellent example of sensitive commercial landscaping is located just a few miles from Kayenta at the Tuacahn Amphitheatre and Center for the Arts. Built out in the canyons of souther Utah, Tuacahn potentially could have built an extremely wasteful landscape. However, through the skillful blending of native plants with watered turf areas, the center was able to create a landscape that invites activities such as before-performance picnicking and intermission socializing without resorting to conventional, water-wasting methods.

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Red rock materials blend with desert plants to create a tasteful and inviting outdoor experience.

Institutional

A standout example of institutional design is found at the Cuyamaca College Water Conservation Garden in San Diego, California. Conceptualized in 1991 and complete in 1999, the Water Conservation Garden was created as an educational component in an over all strategy to solve California's growing water crisis. Not only would the garden serve to put water-efficient plants on display but it would also help educate the public in how to use them effectively in their gardens at home (The Water Conservation Garden, 2007).

Michael Timmons

An exhibit demonstrating the different turf that can be used in arid climates and detailing their water consumption.

Several exhibits throughout the garden teach the public in a variety of water-conservation practices including: proper turf selection, use of groundcovers and hardscape, composting, xeric vegetable gardening, and container plant gardening. The garden also has an example of a water-efficient residential yard design as well as a variety of specific gardens highlighting native plants, cacti and succulents, and bird and butterfly attracting plants (The Water Conservation Garden, 2007).

Michael Timmons

An exhibit showing how xeric plants can be effectively used in the context of a home garden.

The Water Conservation Garden, along with other educational gardens, have gone a long way in educating people about proper xeric landscaping techniques. All are trying to accomplish the same goal: to solve the water crisis through public awareness. An excellent example of one of these gardens can also be found in Montrose itself (The Water Conservation Garden, 2007).

Government Sites

Even more pertinent to understanding how xeriscape principles can be applied to the Public Lands Center in Montrose is looking at what is being done on other, similar government campuses. A variety of Bureau of Land Management and National Forest Service field offices throughout the west have installed new, water-efficient landscapes.

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An exhibit demonstrating the different turf that can be used in arid climates and detailing their water consumption.

Some of these offices have chosen to focus their landscape design on providing interpretive experiences for their visitors such as the Grand Staircase Visitor Center in Kanab, Utah and the BLM office in Canonville, Utah. Both offices use the landscape as an educational tool to inform visitors about the unique aspects of the area. The Kanab landscape illustrates the geological uplift of the Grand Staircase through rock placement while the Canonville site demonstrates the practices of the Native American tribes of the area.

Other sites simply aim to fit in with their surroundings such as the National Forest Service Visitor Center at Red Canyon, Utah and the BLM field office in Escalante, Utah. These landscapes use native plants simply as a backdrop for their offices. Interpretation either isn't present or is limited to simple acknowledgement of the use of native plants such as at Escalante.

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An exhibit demonstrating the different turf that can be used in arid climates and detailing their water consumption.

THE PUBLIC LANDS CENTER PROJECT

Any attempt at effective xeriscaping and site design will require extensive analysis and planning. The Public Lands Center's design is no exception. Responsible landscapes don't just happen. They must be carefully planned based upon a solid understanding of both the physical characteristics as well as the intended uses of the site. Beyond serving as a public demonstration garden, the Public Lands Center is first and foremost a corporate campus. Any landscape designed around it must accommodate and facilitate that primary function. All of the factors that must be accommodated within the new design of the Public Lands Center can be understood through a combination of research, discussion with users, and empirical data gathering through site visitation.

Photo Provided by BLM

Aerial view of the garden area's 6 acres.

Analysis of the Site

As the function of the Public Lands Center is largely utilitarian, the majority of the property is currently filled with wareyards, parking lots, and storage sheds. A very small portion of it (approximately 6 acres) has been set aside for aesthetic purposes. Most of this area (save for a small employee recreation area to

the west) is found immediately surrounding the two principal buildings and extending to the east eventually abutting Highway 550. The primary focus of the project will center around redesigning this area.

Upon visiting with the staff of the BLM and other agencies, some important considerations were brought up that needed to be taken into account when designing the area:

- The current site entrance and public parking area is very confusing and inadequate and should be included in the redesign of the project site.
- The abutting highway will eventually include an island median which will only allow access and egress to and from the site from southbound traffic lanes.

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Presently there is vast turf area dotted with shade trees and varying shrubs.

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The current entrance is ambiguous and confusing.

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A view of the west employee parking lot looking south.

- Traffic speeds will increase on the highway making it necessary to have both deceleration and acceleration lanes connected to the site.
- Some minor changes can occur to the western employee parking area, however its basic dimensions can't change due to restrictions regarding its use as a staging area for large vehicles and equipment.

- Any changes made to the employee parking lot must also take into account storm water drainage issues and existing access to adjacent uses such as the helipad and wareyards.
- Safety concerns are very important and therefore the employee-only area to the west of the two principal buildings (including the parking lot and all wareyards and storage buildings) should be cut off from public access.
- A vehicular connection must be maintained between Highway 550 and the west employee parking area and it must allow for two-way traffic.
- There may possibly be a future expansion of the southern public building to accommodate a larger visitor center. Therefore, no essential landscape elements should be located in this area.
- The site must be designed in such a way that there is an obvious connection between the new public parking lot and the public building. Visitors should be discouraged from going to the administrative building.
- Pedestrian cross connections between the two buildings must be maintained
- The public parking lot must be able to accommodate large vehicles such as RVs, trucks with trailers, and buses.
- There should be a small turf area for visiting families. This could be planted with drought tolerant grasses.

While visiting the site other factors that will influence the design were observed:

- Many non-native trees are present and will need to be removed to accommodate the new design.
- Almost all shrubs will also need to be removed as most are not native or water-efficient.
- Many of the junipers are too big and should be removed.

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One of the non-native trees (Bradford Pear) along with severely pruned non-native shrubs.

• The extensive turf area surrounding both buildings will need to be replaced with either native plants or native grasses.

• The south east nook of the public building could be an interesting area for a future courtyard or private space, though safety concerns must still be considered.

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The southeast nook of the public building.

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The public entrance to the public building.

• There is a mixture of planting styles (formal vs. naturalized) that make the site feel disjointed. Judicious plant removal could fix that.

• The entrance to the public building isn't readily recognizable as a public entrance. Some signage exists on site that helps with that. However, it could be strengthened.

• Current signage from the street is ineffective and outdated. It could be strengthened by consolidating signs and emphasized with selective planting and lighting.

• Both buildings and all parking lots need to be shaded to conserve energy and reduce harmful emissions.

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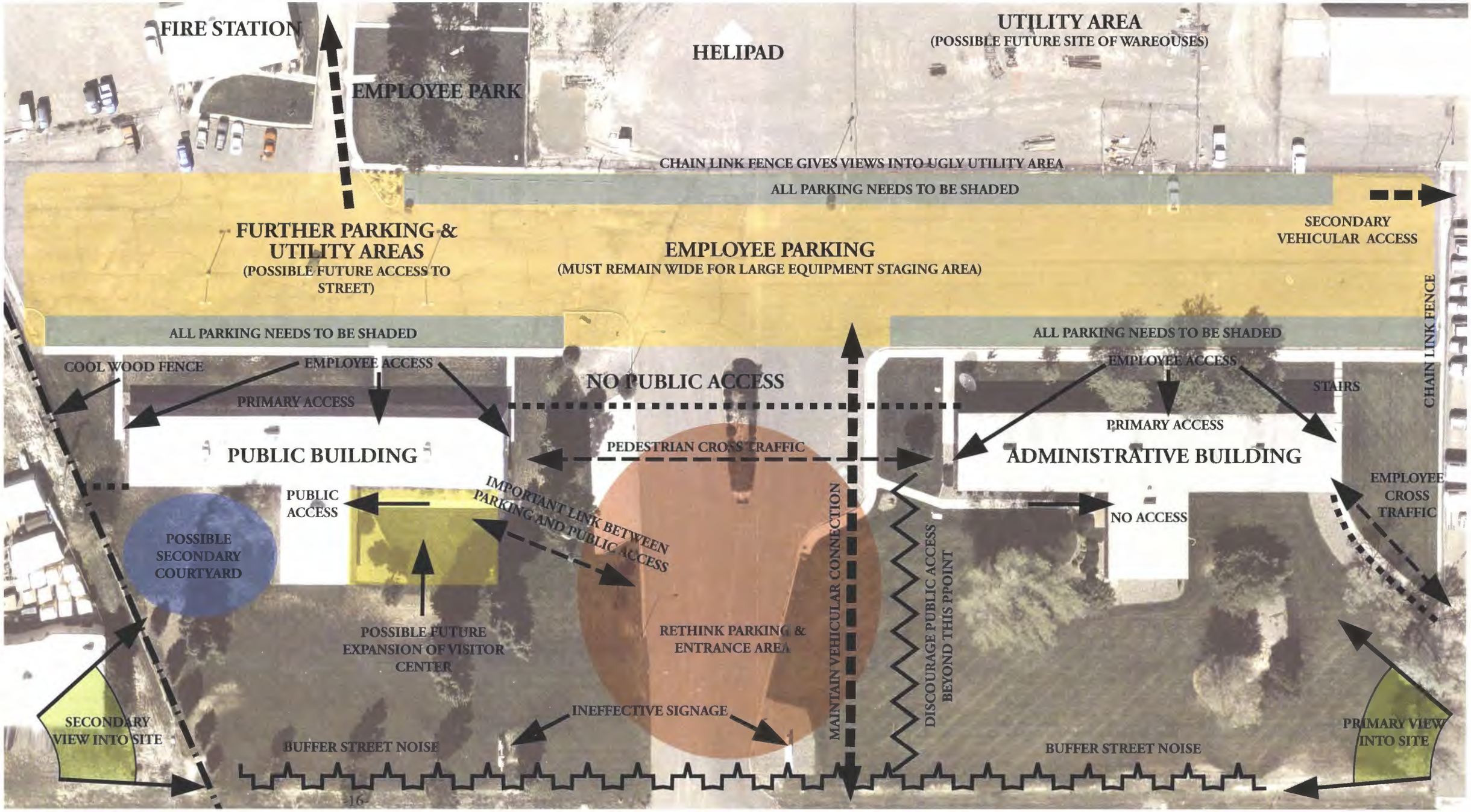
Three different signs can be confusing for motorists.

SITE ANALYSIS MAP



SOILS & PLANTS ANALYSIS

As Montrose sits in a geologically unique area of Colorado, distinctive soil and plant conditions are present. In order to understand how best to go about designing the landscape of the Public Lands Center, it is best to have some understanding regarding the soil type present on site as well as what kinds of plants can and will grow on site. Since the purpose of the project is to use a plant pallet that is representative of the plant communities found in and around Montrose, some additional research will also have to be done.

Soil Conditions

The city of Montrose sits at the southern end of a very large valley known as the Uncompahgre Valley. Over millions of years, the Colorado river carved this valley out of the sediments laid down by an ancient inland sea known as the Mancos Sea. Through the course of its history the sea advanced and retreated at least 29 times, each time depositing layers of salty soil which eventually hardened into the geologic formation known as Mancos Shale. By the time the sea fully retreated it had deposited about 4,150 feet of shale which now forms the walls and canyons of the bluffs and mountains surrounding Montrose (Swift 2007).

The Uncompahgre Valley (approximate area highlighted in yellow) was carved out by the Colorado River.

3dparks.wr.usgs.gov

A typical Mancos Shale bluff showing the deep layers of sediment deposits from the ancient Mancos Sea.

Mancos Shale breaks down into a highly productive, clay-based soil which has a high water and nutrient carrying capacity. The disadvantage of this soil is its extremely high levels of salinity. The salts found in the soil comes from the ancient sea water present during its formation. The primary salts found in the soil are calcium sulfate (gypsum) and calcium carbonate (calcite). Calcium carbonate has low solubility, meaning it doesn't easily transfer into plants through water. However, this low solubility aside, calcium carbonate directly affects the acidity of soils not only making them very alkali but also difficult to effectively acidify (Swift 2007).

Calcium sulfate, on the other hand, is highly soluble and consequently can greatly affect the salinity levels of soils and the salt uptake of plants. Calcium sulfate is abundant throughout the region's soils and it varies greatly in quantity. Some areas have 16 tons of gypsum per acre slice (an area of ground 6 inches deep encompassing 1,000 tons of soil) and others have up to 70 tons. Soils high in calcium sulfate can easily be identified because in periods of extreme dryness the salt within the soil will often travel upward to the surface leaving a thin white crust, giving it the appearance of a light dusting of snow. This high salt content can be very detrimental to plants by altering the plants' ability to take up water or by causing ion-specific toxicities or imbalances. In the case of planning a native gardens, such soil problems are usually non-factors as the plants used have already adapted to such conditions (Swift 2007).

www.coopext.colostate.edu

A thin snow-like layer of salt will often rise to the surface of Mancos Shale soils in times of extreme dryness.

Southwest Colorado Plant Communities

The plants found in southwest Colorado are among the toughest and most interesting plants in the country. They've some how managed to adapt to live in scorching hot temperatures during the long, dry summer and then go to the other extreme to endure snow and frost in the winter. Despite these harsh conditions an extremely diverse plant pallet exists in the region. These plants band together to form distinct communities with other plants of similar growth requirements. The differing characteristics between these communities primarily consist of average precipitation levels, elevation ranges, and prevailing soil conditions.

With a varied geological history, areas surrounding Montrose provide plenty of differing elevations and soil types creating a wide variety of plant communities. These different communities can be simplified into six primary categories: Montane, Mountain Scrub, Pinyon Juniper, Shrub Steppe, Salt Desert, and Riparian (Mee, Wendy, et al., 2003; Clements, 2007; Austin 1995).

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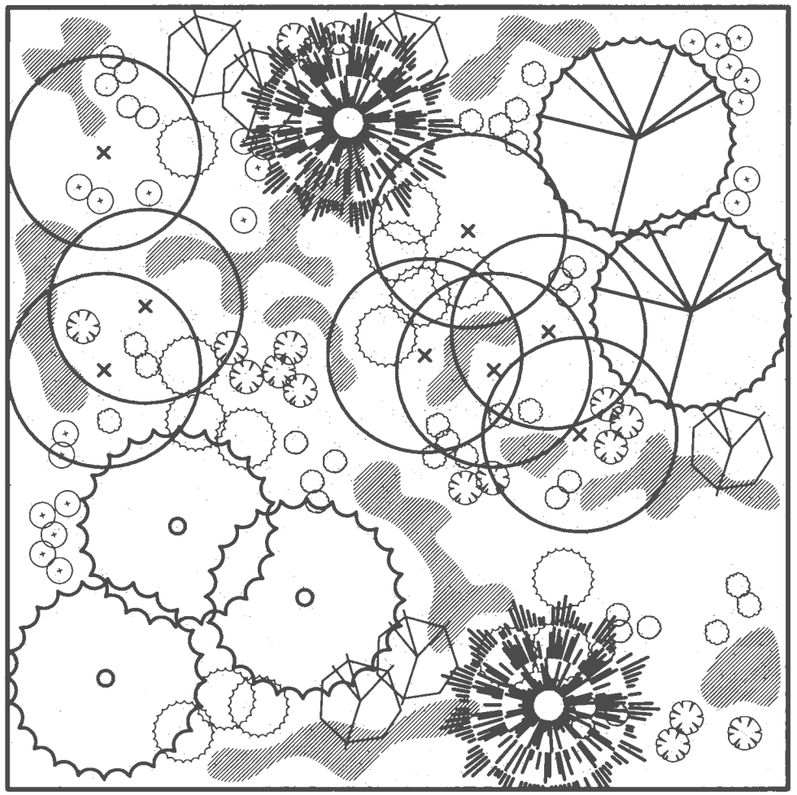
A view of one of the native plant communities in the mountains near Montrose, Colorado.

A closer examination of each of these plant communities along with plants suggested for use in the garden will occur in the following pages:

MONTANE PLANT COMMUNITY

The Montane plant community occurs between elevations of 6,000 and 9,000 feet. It's association with mountainous areas gives it relatively high precipitation amounts (16-20 inches per year), consequently most Montane plants require supplemental irrigation in lower elevation desert valleys. The dominant plant species are Douglas Fir (*Pseudotsuga menziesii*) and Quaking Aspen (*Populus tremuloides*) with an understory of a variety of shade-tolerant mountain shrubs and forbs. Plant cover is generally fairly dense ranging between 75-95 percent converge (Mee, Wendy, et al., 2003; Clements, 2007; Austin 1995).

TYPICAL MONTANE PLANT ASSOCIATIONS



SCALE: 1" = 20'

TREES

Symbol	Botanical Name	Common Name
	Amelanchier utahensis	Utah Serviceberry
	Picea pungens	Colorado Blue Spruce
	Pinus Ponderosa	Ponderosa Pine
	Populus tremuloides	Quaking Aspen
	Pseudotsuga menziesii	Douglas fir

SHRUBS

	Artimisea cana	Silver Sagebrush
	Juniperus communis	Common Juniper
	Potentilla fruticosa	Shrubby Cinquefoil
	Symphoricarpos albus	Mountain Snowberry

FORBS MIX

	Iris missouriensis	Missouri Iris
	Lathyrus sp.	Sweet Pea
	Thermopsis montana	Golden Banner

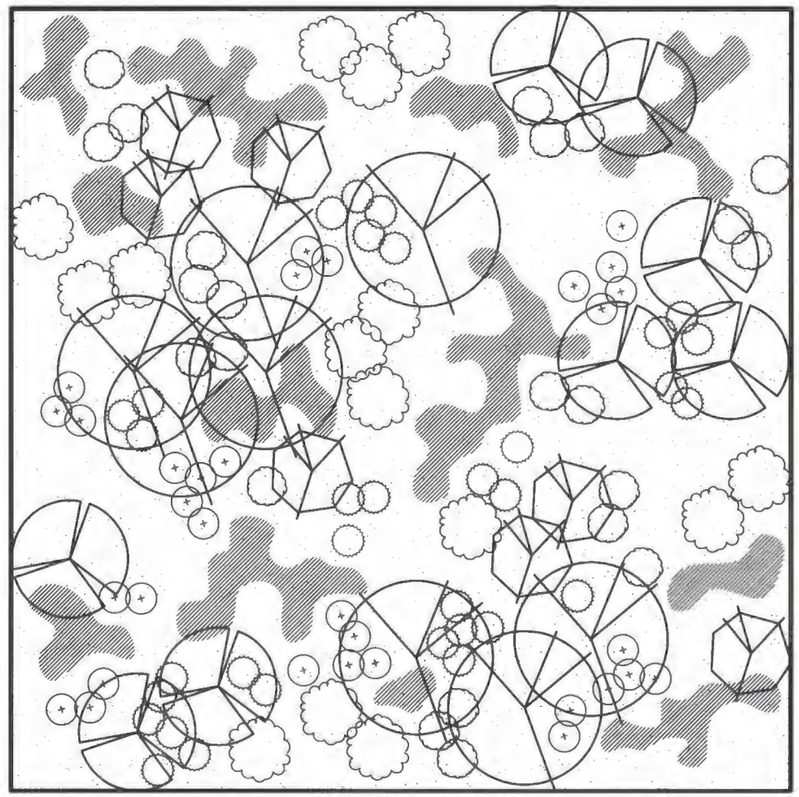
GRASS

	Thinopyrum intermedium	Intermediate Wheatgrass

MOUNTAIN SCRUB PLANT COMMUNITY

The Mountain Scrub plant community occurs between elevations of 4,000 and 7,000 feet. It is generally found anywhere along these elevations where 14-18 inches of precipitation falls each year. It is typically covered with stands of Gambel Oak (*Quercus gambelii*) however both Chokecherry (*Prunus virginiana*) and Utah Serviceberry (*Amelanchier utahensis*) are also commonly found. Several shade and sun loving shrubs and forbs are found in the understory amongst a wide and varied pallet of grasses. Plant cover is moderately dense (60-80 percent) (Mee, Wendy, et al., 2003; Clements, 2007; Austin 1995).

TYPICAL MOUNTAIN SCRUB PLANT ASSOCIATIONS



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TREES

Symbol	Botanical Name	Common Name
	Amelanchier utahensis	Utah Serviceberry
	Prunus virginiana	Chokecherry
	Quercus gambelii	Gambel Oak

SHRUBS

	Cercocarpus betuloides	Birchleaf Mountain Mahogany
	Mahonia repens	Creeping Oregon Grape
	Rhus glabra	Smooth Sumac
	Rhus trilobata	Squawbush

FORBS MIX

	Allium cernuum	Nodding Onion
	Artemisia ludoviciana	Prairie Sage
	Penstemon strictus	Rocky Mountain Penstemon
	Solidago canadensis	Goldenrod

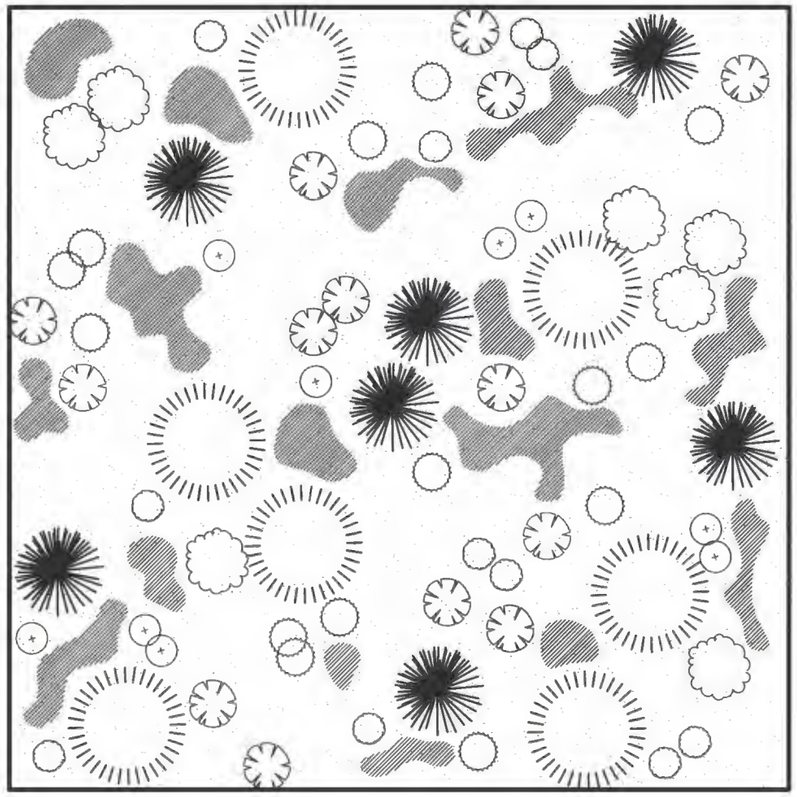
GRASSES MIX

	Bromus marginatus	Mountain Brome
	Carex geyeri	Elk Sedge
	Elymus elymoides	Bottlebrush Squireltail
	Poa arida	Mutton Grass
	Pascopyrum smithii	Western Wheatgrass

PINYON JUNIPER PLANT COMMUNITY

Occupying the same elevation range as the Mountain Scrub, Pinyon Juniper communities tend to occur in drier areas (12-16 inches). Consequently, it is the dominant forest type in the desert southwest. Utah Juniper (*Juniperus osteosperma*) dominates the community followed closely by the Pinyon Pine (*Pinus edulis*). Shrub and forb diversity is significantly less than in the Mountain Scrub, with the area mostly dominated by grass species. Despite this apparent lack of plant diversity Pinyon Juniper forests still manage to have a moderate amount of plant cover (40-70 percent) (Mee, Wendy, et al., 2003; Clements, 2007; Austin 1995).

TYPICAL PINYON JUNIPER PLANT ASSOCIATIONS



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TREES

Symbol	Botanical Name	Common Name
	Juniperus osteosperma	Utah Juniper
	Pinus edulis	Pinyon Pine

SHRUBS

	Artemisia tridentata	Big Sagebrush
	Cercocarpus betuloides	Birchleaf Mountain Mahogany
	Fendlera rupicola	Cliff Fendlerbush
	Purshia mexicana	Cliffrose
	Purshia tridentata	Antelope Bitterbrush

FORBS MIX

	Eriogonum umbellatum	Sulpher Flower
	Mirabilis multiflora	Showy Four o' Clock
	Penstemon caespitosus	Mat Penstemon
	Petradoria pumila	Rock Goldenrod
	Sphaeralcea coccinea	Scarlet Globemallow

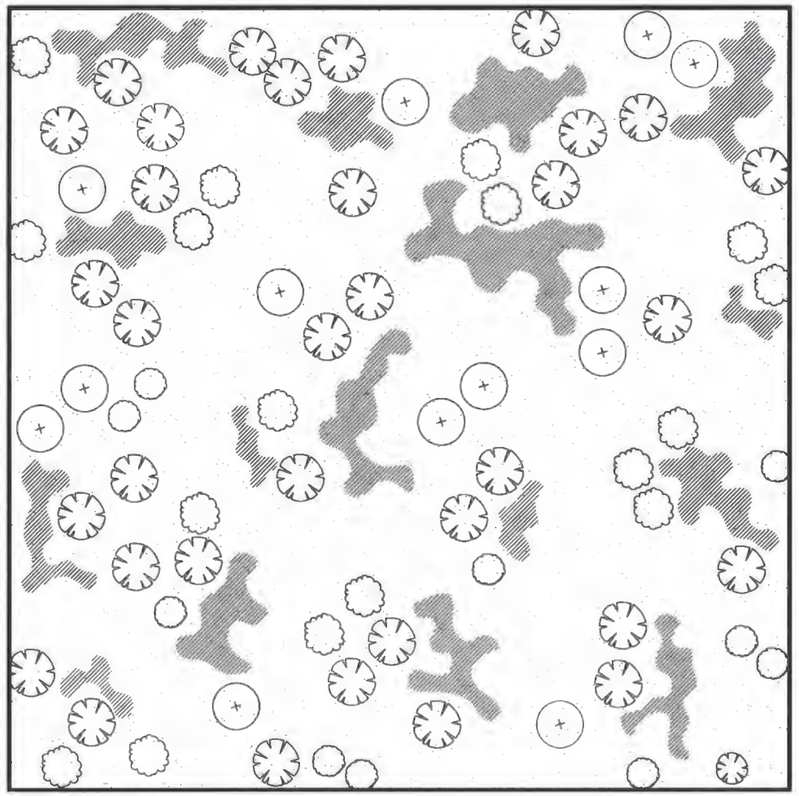
GRASSES MIX

	Achnatherum hymenoides	Indian Ricegrass
	Bouteloua gracilis	Blue Grama
	Hilaria jamesii	Galleta Grass
	Poa arida	Mutton Grass
	Stipa comata	Needle and Thread

SHRUB STEPPE PLANT COMMUNITY

Shrub Steppe communities generally occupy the fringes of the Mountain Scrub and Pinyon Juniper forests. They usually range between 3,000 to 6,000 feet in elevation and tolerate fairly low precipitation levels (12-16 inches) along with hotter temperatures. Generally devoid of trees the Shrub Steppe is dominated by Big Sagebrush (*Artemisia tridentata*). Other drought tolerant shrubs and forbs exist in clumped arrangements along with a variety of grasses. Despite it's lack of trees Shrub Steppe communities usually have a moderate to moderately dense coverage (50-75 percent) (Mee, Wendy, et al., 2003; Clements, 2007; Austin 1995).

TYPICAL SHRUB STEPPE PLANT ASSOCIATIONS



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SHRUBS

Symbol	Botanical Name	Common Name
	Artemisia tridentata	Big Sagebrush
	Atriplex canescens	Fourwing Saltbrush
	Chrysothamnus nauseosus	Rubber Rabbitbrush
	Purshia mexicana	Cliffrose

FORBS MIX

	Eriogonum umbellatum	Sulphur Flower
	Penstemon lentus	Handsome Penstemon
	Senecio multilobatus	Lobeleaf Groundsel
	Sphaeralcea coccinea	Scarlet Globemallow

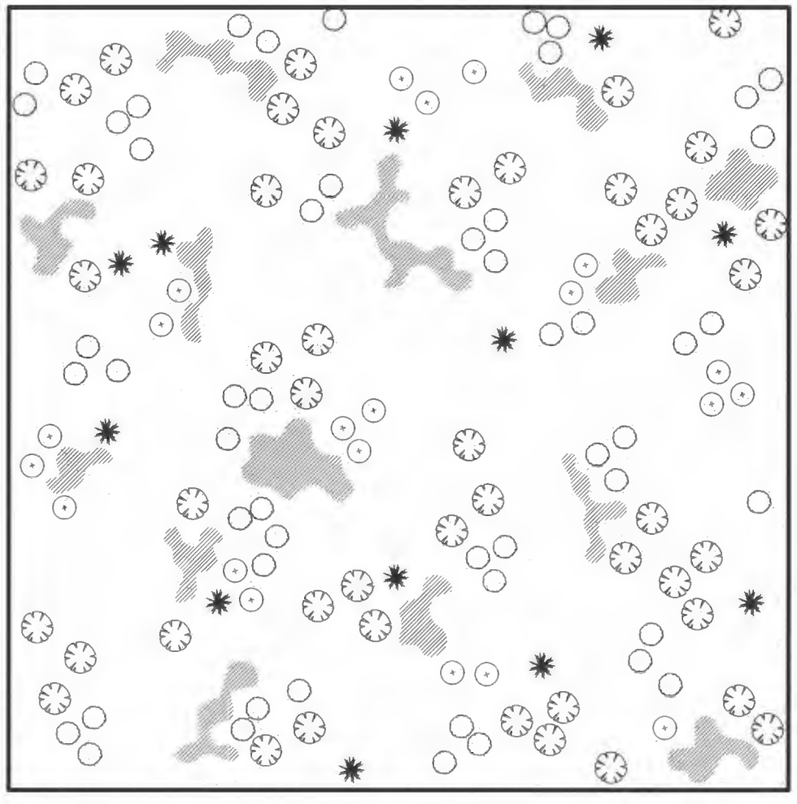
GRASSES MIX

	Achnatherum hymenoides	Indian Ricegrass
	Bouteloua gracilis	Blue Grama
	Elymus elymoides	Bottlebrush Squireltail
	Hilaria jamesii	Galleta Grass
	Koeleria macrantha	Junegrass
	Stipa comata	Needle and Thread

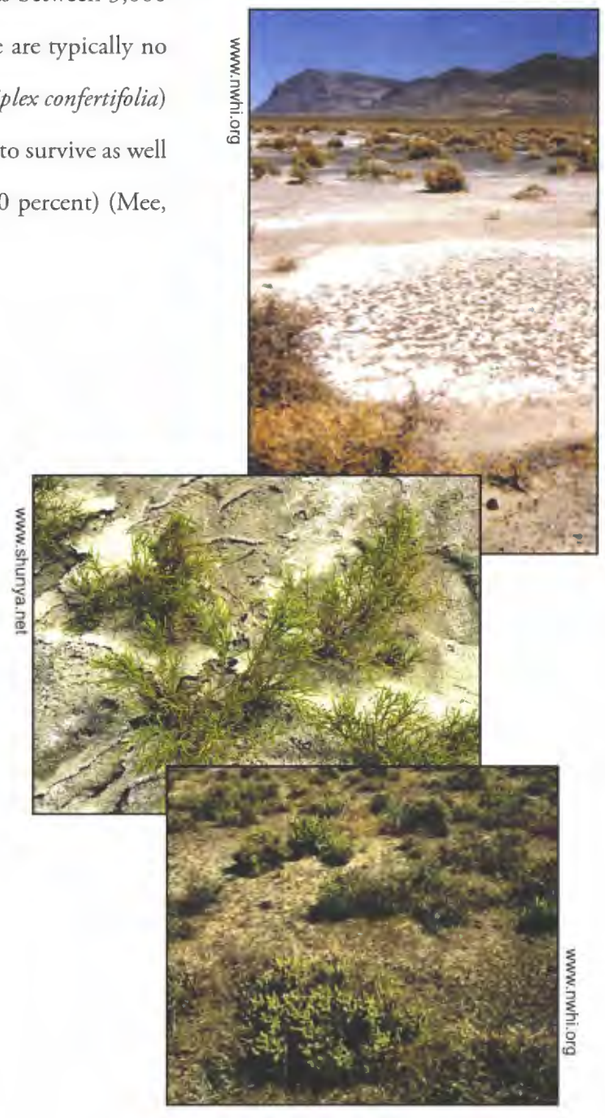
SALT DESERT PLANT COMMUNITY

The Salt Desert plant community can be found through most of southwester Colorado and is typical to clay-based, salty soils such as those found in Montrose. It occupies low, flat areas between 3,000 and 6,000 feet and endures only 5-10 inches of precipitation. For this reason there are typically no trees found in Salt Desert Communities. Dominant shrub species are Shadscale (*Atriplex confertifolia*) and Lacy Buckwheat (*Erigonum corymbosum*). Some other shrubs and forms are able to survive as well as some grasses. Despite this, the vegetative coverage is typically fairly sparse (10-40 percent) (Mee, Wendy, et al., 2003; Clements, 2007; Austin 1995).

TYPICAL SALT DESERT PLANT ASSOCIATIONS



SCALE: 1" = 20'



SHRUBS

Symbol	Botanical Name	Common Name
○	*Atriplex confertifolia*	Shadscale
⊙	*Ceratoides lanata*	Winterfat
✺	*Erigonum corymbosum*	Lacy Buckwheatbrush
✸	*Yucca harrimaniae*	Harriman Yucca

FORBS MIX

▨	*Sphaeralcea coccinea*	Scarlet Globemallow
	Stanleya pinnata	Princes Plume

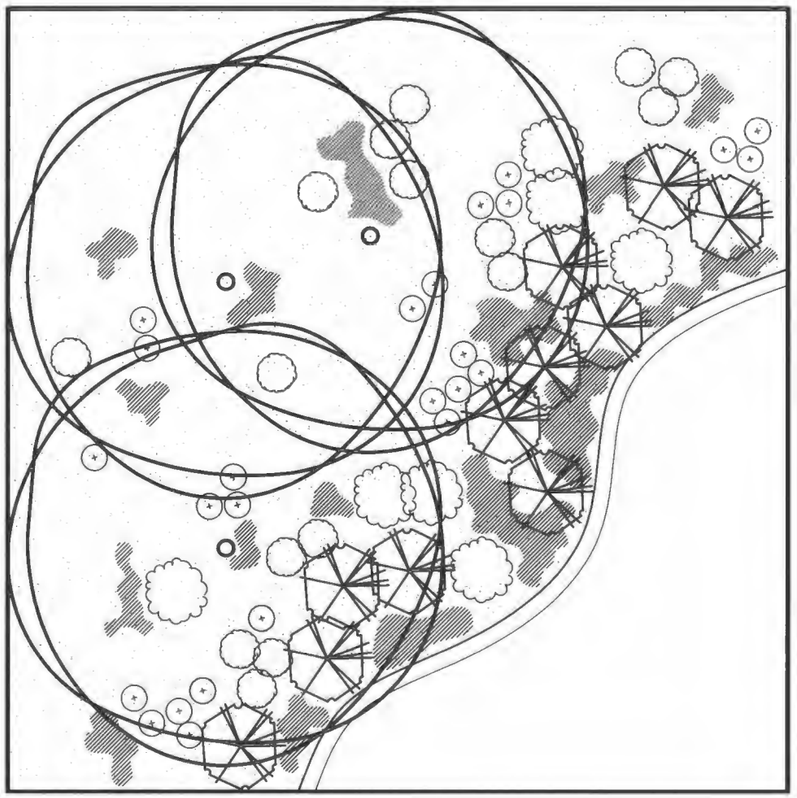
GRASSES MIX

▭	*Distichlis stricta*	Desert Saltgrass
	Elymus elymoides	Bottlebrush Squireltail
	Pascopyrum smithii	Western Wheatgrass
	Sporobulus airoides	Alkali Sacaton

RIPARIAN PLANT COMMUNITY

Riparian communities aren't bounded by elevation so much as by water availability. Ranging between 3,000-10,000 feet, riparian communities will typically occur along rivers. At lower elevations, these communities are dominated by Cottonwoods (*Populus fremontii, P. angustifolia*) and small trees like Coyote Willow (*Salix exigua*). Other shrubs and forbs will generally grow around stream banks leaving a relative dearth of vegetation behind. This space is generally occupied by a variety of forbs, grasses and sedges. Plant cover in Riparian areas is dense (85-100 percent) (Mee, Wendy, et al., 2003; Clements, 2007; Austin 1995).

TYPICAL RIPARIAN PLANT ASSOCIATIONS



SCALE: 1" = 20'

TREES

Symbol	Botanical Name	Common Name
	Populus fremontii	Fremont Cottonwood
	Populus angustifolia	Narrow-Leaf Cottonwood
	Salix exigua	Coyote Willow

SHRUBS

	Rhus trilobata	Squawbush
	Rosa woodsii	Woods Rose
	Sheperdia argentea	Silver Buffaloberry

FORBS MIX

	Apocynum cannabinum	Indian Hemp

GRASSES MIX

	Carex aquatilis	Sedge
	Equiseum arvense	Scouring Rush

SITE PREPARATION

Prior to implementing the design several things will need to occur at the site: some of the existing infrastructure (sidewalks and roads) will need to be removed, some existing vegetation will also need to be removed, and the soil will need to be prepared.

Removal of Existing Site Elements

In order to accommodate the new design a number of existing infrastructure elements and plants will need to be removed. As new pathways, using new materials, are proposed for the entire site all existing sidewalks will eventually need to be removed and replaced, including those that are already found in areas where new sidewalks are proposed (such as along the eastern edge of the west employee parking lot). The entire front vehicular entrance area will also need to be removed as the form and circulation of the area will change radically. The only portion of the entrance that may possibly remain is that of the north parking stalls due to fact that the new employee access road will run through it. Existing signs will also need to be removed as they will not be visible within the context of the new design.

All shrubs and several trees will need to be removed as well. This is due to either to their not being native or their interfering with proposed infrastructure design. Unfortunately, several large trees will have to be removed as part of this process, however, an abundance of new trees and shrubs will more than make up for their loss.

All existing site elements that must be removed are graphically shown on the following maps:

EXISTING VEGETATION REMOVAL

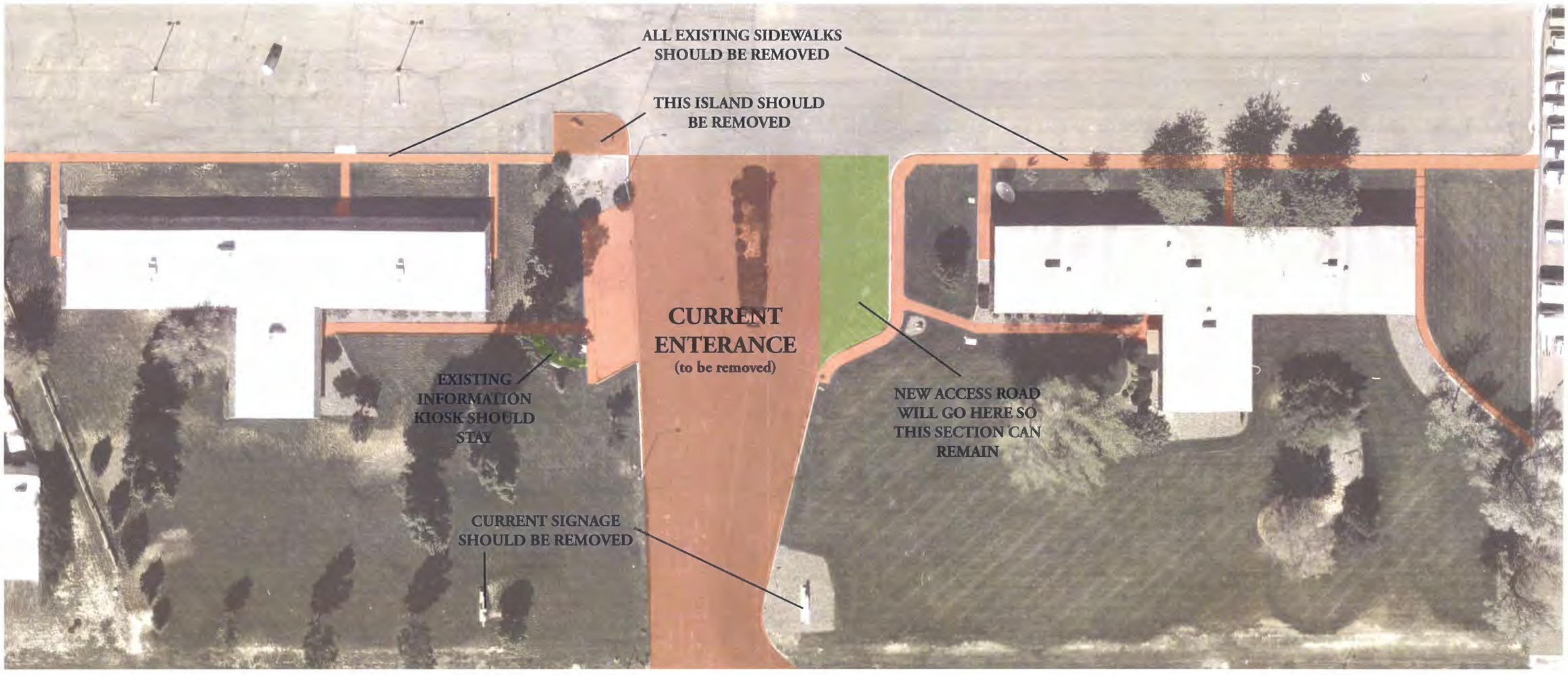
NOTES:

- The row of Honeylocust trees to the west of the administration building should be removed because they are not native nor will they work with the proposed planting in that area.
- All the trees in the northwest part of the site should be removed to accommodate the native plant communities garden which will use strictly native plants arranged in natural planting arrangements (the Utah Juniper there will fit in with the "Pinyon juniper" plant community and may stay).
- The four cottonwoods on the southeast corner of the site will be located within a drought-tolerant planting area and will not survive or match proposed plant types.
- Two Colorado Spruces are to be removed from the south end of the lot in order to break up the unnatural line and the remaining will be incorporated into a more naturalized arrangement.
- The two cottonwoods and pinyon pines situated in the south/central part of the site will conflict with the new parking arrangement.

TREE TO REMAIN

TREE TO BE REMOVED

EXISTING INFRASTRUCTURE REMOVAL



NOTES:

- As new materials (stamped concrete and Crushed Granite) will be used for paths, all existing concrete paths and pads must be removed, including those located in the same locations as proposed paths.
- The existing information kiosk will be incorporated into the new design and therefore should remain.

Soil Preparation

While the plant types proposed for the Public Lands Center are native to the Uncompahgre region, the great majority of them (aside from the Salt Desert plants) are not accustomed to such high salinity levels. For this reason measures must be taken to reduce the amount of soil salts throughout the majority of the site.

Salinity cannot be fixed through soil amendments, conditioners, or fertilizers. Salts must be removed in order to bring a soil's salinity down to acceptable levels. The most sensible method of salt extraction for the Public Lands Center is that of leaching. This method involves removing salts by washing them away from plants and draining them into underground aquifers. Regular and heavy irrigation will usually accomplish this, however, heavy irrigation would defeat the purpose of designing a water efficient garden (Cardon 2007).

With this problem in mind, two recommendations are put forth. First, it is suggested that heavy irrigation occur only during times when plants are especially susceptible to salinity-related problems. The two most significant times when this occurs is when plants are seedlings or are first becoming established and as plants enter and leave their dormancy periods. Therefore, during installation and at the beginning and end of each growing season irrigation levels should be bumped up for a short period of time.

The second recommendation is to aid soil drainage by balancing the high levels of clay in the soil with additional measures of organic material throughout most of that garden. Not only will this help the soil to leach salt away from plants but it will also bring the soil closer to the ideal conditions of the majority of plant types (Pinyon Juniper and Shrub Steppe) proposed throughout the garden.

A WATER-EFFICIENT LANDSCAPE FOR THE PUBLIC LANDS CENTER

Taking all factors into consideration the new design for the Public Lands Center has been completed. The following pages delineate the various aspects of this new design. Five different plans have been created in order to graphically communicate the proposal. While extensive thought and planning has gone into the creation of these plans, many design elements (such as bench designs, information kiosk design, site construction methods, etc.) have been left to the discretion of BLM engineers and construction staff. Consequently the following plans are largely conceptual and are open to further interpretation.

ORDER OF PLANS:

1- Overall Illustrative Plan

2- General Infrastructure Plan

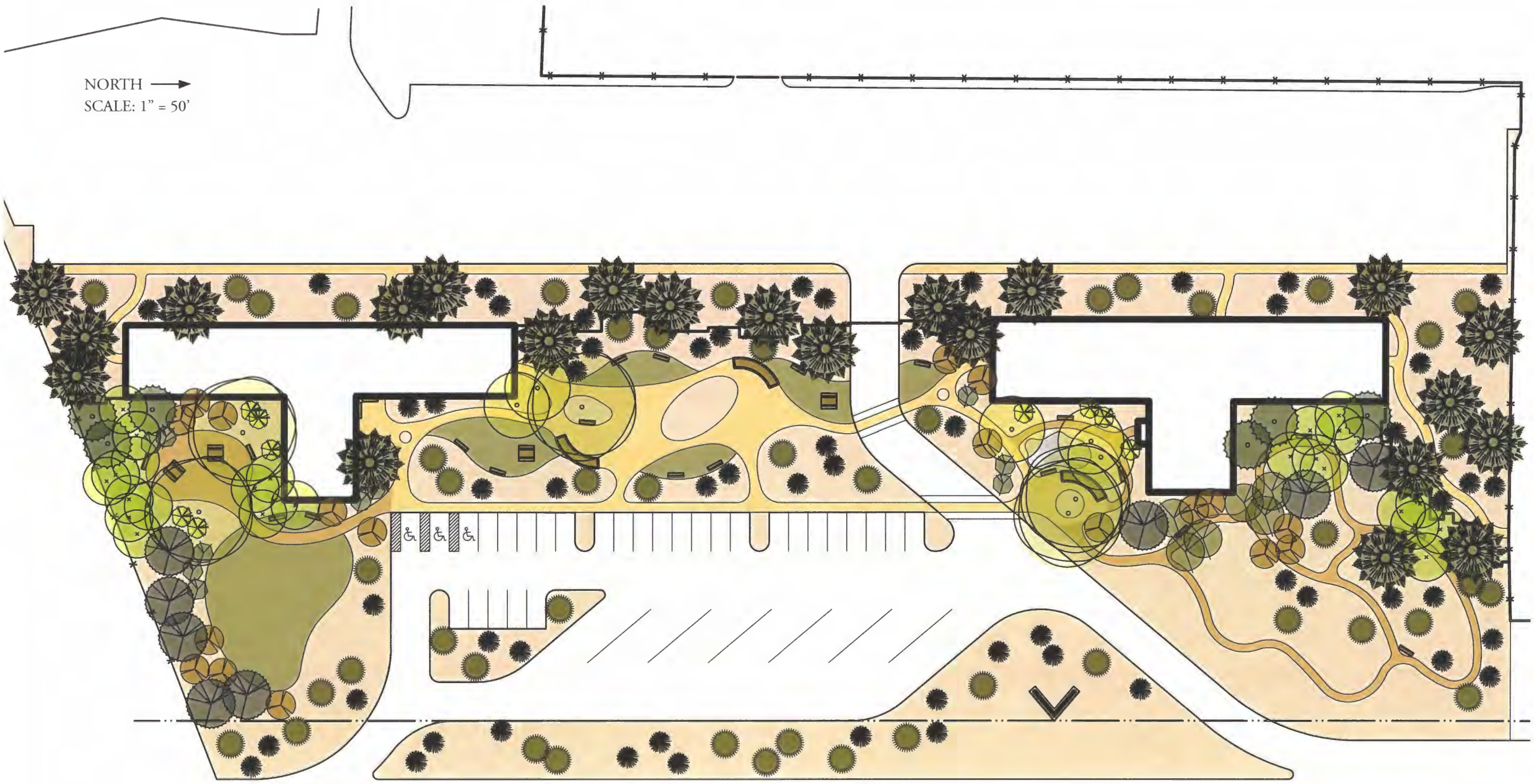
3- Native Plant Community Garden Plan

4- General Planting Plan

5- Hydrozoning Plan

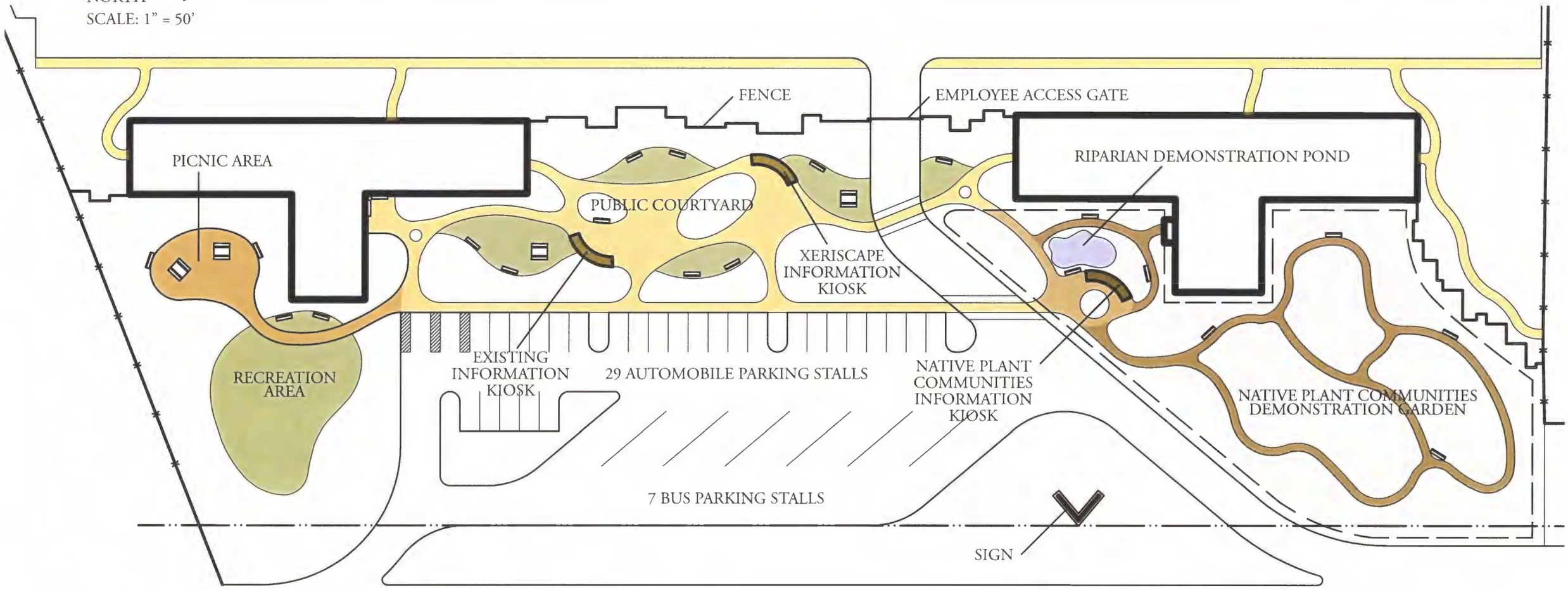
GENERAL ILLUSTRATIVE PLAN

NORTH →
SCALE: 1" = 50'



GENERAL INFRASTRUCTURE PLAN

NORTH →
SCALE: 1" = 50'



STAMPED, COLORED CONCRETE PATHS AND COURTYARD

CRUSHED GRANITE GRAVEL PATHS AND PICNIC AREA

GRASS TURF AREAS

NOTES:

• The turf to be used should be Buffalo Grass (*Buchloe dactyloides*) as it is a very drought tolerant grass which requires less irrigation and maintenance than more traditionally used turf.

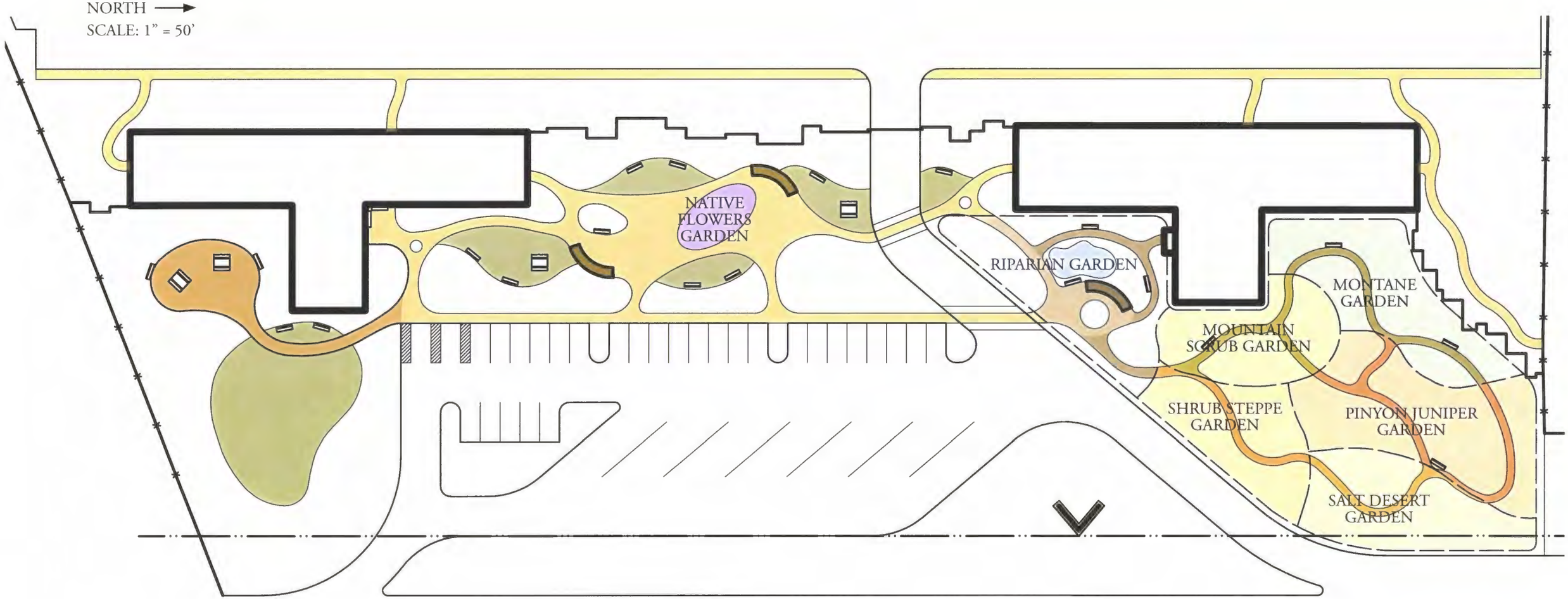

www.toddsservices.com
Example of stamped concrete.


www.rta.nsw.gov.au
Crushed granite surfacing


www.sbs.utexas.edu
Buffalo Grass

NATIVE PLANT COMMUNITY GARDEN PLAN

NORTH →
SCALE: 1" = 50'

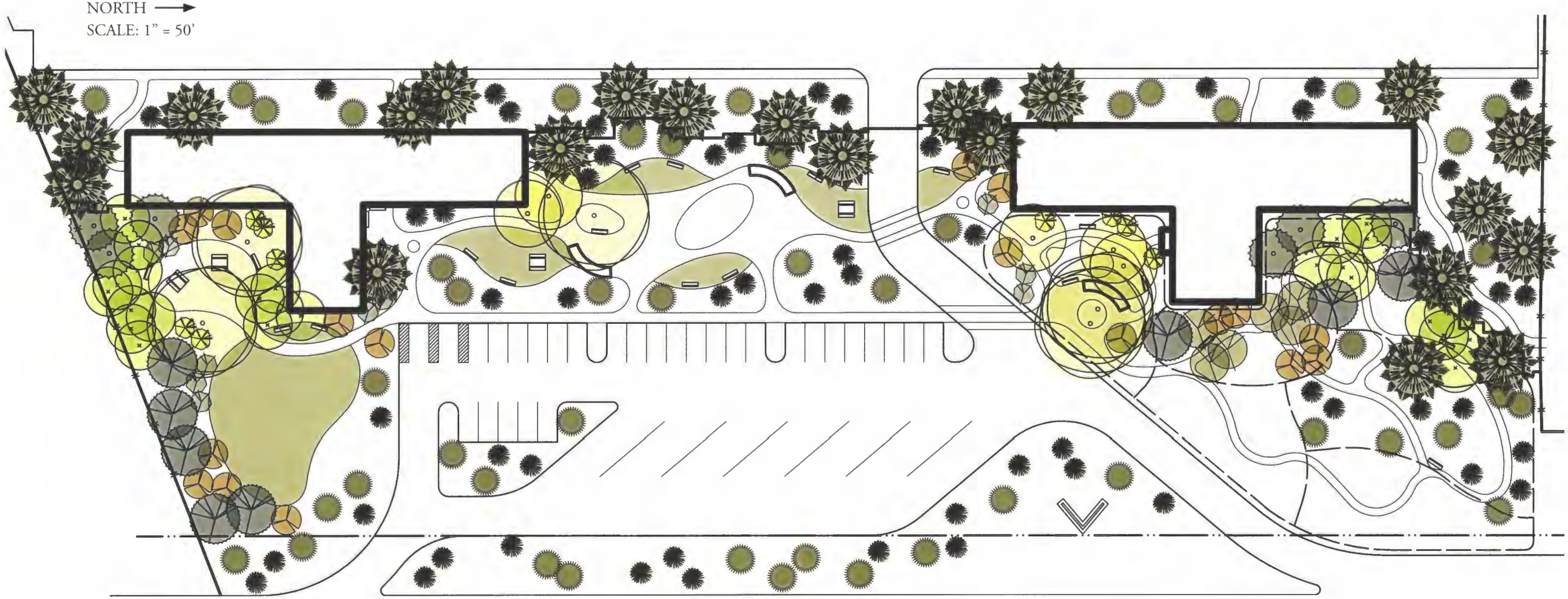


NOTES:

- Plant selection and placement within the different gardens should follow the natural planting patterns as indicated in the profiles of the different communities.
- Tree locations should follow placement as indicated on the following planting plan.
- The Native Flower Garden should include flowers from each of the plant communities and also include additional flowers which are not specified within the plant community profiles but can be found from various sources (www.conps.org, www.ext.colostate.edu/PUBS/Garden/07233.html, www.westernnativeseed.com).
- Each garden should have an information panel discussing the characteristics of the respective community including climate and soil conditions as well as plant and animals types.

GENERAL PLANTING PLAN

NORTH →
SCALE: 1" = 50'

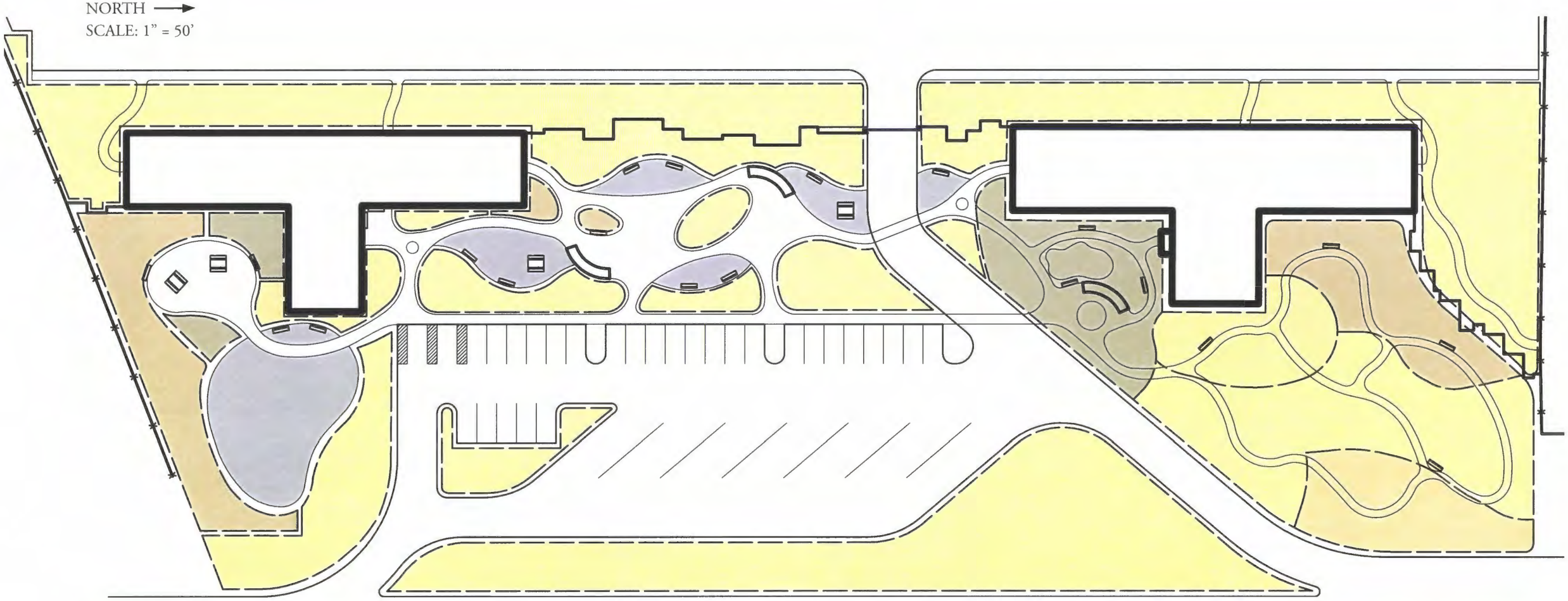


NOTES:

- Plant selection throughout the site should follow according to the plant lists indicated on the Hydrozoning Plan
- Plant placement should match planting patters of the native plant communities corresponding with hydrozone requirements.
- Interpretation should be present on both a large scale by creating an additional information Kiosk detailing the xeriscape approach to the garden design and on a limited scale by adding small plant identification plaques detailing the common and botanical name of plants.

HYDROZONING PLAN

NORTH →
SCALE: 1" = 50'



Zone 1 – Standard Turf Irrigation

Zone 2 – 20-30 Inches of Supplemental Irrigation

Zone 3 – 10-15 Inches of Supplemental Irrigation

Zone 4 – 7-10 Inches of Supplemental Irrigation

Zone 5 – 4-7 Inches of Supplemental Irrigation

Zone 6 – No Supplemental Irrigation

ZONE 2 SHRUBS & FORBS:

Apocynum cannabinum	Indian Hemp
Carex aquatilis	Sedge
Equiseum arvense	Scouring Rush
Rhus trilobata	Squawbush
Rosa woodsii	Woods Rose
Sheperdia argentea	Silver Buffaloberry

ZONE 3 SHRUBS & FORBS:

Artimisea cana	Silver Sagebrush
Iris missouriensis	Missouri Iris
Juniperus communis	Common Juniper
Lathyrus sp.	Sweet Pea
Potentilla fruticosa	Shrubby Cinquefoil
Symphoricarpos albus	Mountain Snowberry
Thermopsis montana	Golden Banner
Thinopyrum intermedium	Intermediate Wheatgrass

ZONE 4 SHRUBS & FORBS:

Allium cernuum	Nodding Onion
Artemisia ludoviciana	Prairie Sage
Bromus marginatus	Mountain Brome
Carex geyeri	Elk Sedge
Cercocarpus betuloides	Birchleaf Mtn. Mahogany
Elymus elymoides	Bottlebrush Squireltail
Mahonia repens	Creeping Oregon Grape
Pascopyrum smithii	Western Wheatgrass
Penstemon strictus	Rocky Mountain Penstemon
Poa arida	Mutton Grass
Rhus glabra	Smooth Sumac
Rhus trilobata	Squawbush
Solidago canadensis	Goldenrod

ZONE 5 SHRUBS & FORBS:

Achnatherum hymenoides	Indian Ricegrass
Artemisia tridentata	Big Sagebrush
Atriplex canescens	Fourwing Saltbrush
Bouteloua gracilis	Blue Grama
Cercocarpus betuloides	Birchleaf Mtn. Mahogany
Chrysothamnus nauseosus	Rubber Rabbitbrush
Elymus elymoides	Bottlebrush Squireltail
Eriogonum umbellatum	Sulpher Flower
Fendlera rupicola	Cliff Fendlerbush
Hilaria jamesii	Galleta Grass
Koeleria macrantha	Junegrass
Mirabilis multiflora	Showy Four o' Clock
Penstemon caespitosus	Mat Penstemon
Penstemon lentus	Handsome Penstemon
Petradoria pumila	Rock Goldenrod
Poa arida	Mutton Grass
Purshia mexicana	Cliffrose
Purshia tridentata	Antelope Bitterbrush
Senecio multilobatus	Lobeleaf Groundsel
Sphaeralcea coccinea	Scarlet Globemallow
Stipa comata	Needle and Thread

ZONE 6 SHRUBS & FORBS:

Atriplex confertifolia	Shadscale
Ceratoides lanata	Winterfat
Erigonum corymbosum	Lacy Buckwheatbrush
Yucca harrimaniae	Harriman Yucca
Sphaeralcea coccinea	Scarlet Globemallow
Stanleya pinnata	Princes Plume
Distichlis stricta	Desert Saltgrass
Elymus elymoides	Bottlebrush Squireltail
Pascopyrum smithii	Western Wheatgrass
Sporobulus airoides	Alkali Sacaton

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