

Section 1

Introduction

Many people consider drought to be a rare and random event; however, it is a normal, recurrent, and insidious climatic event. Although it has many different definitions, a drought usually originates from a deficiency of precipitation over a season or more. Drought is not solely a physical phenomenon; it affects society's water supply and water demand associated with agricultural, urban, and environmental uses.

The Butte County Department of Water and Resource Conservation (DW&RC) is developing the Butte County Drought Preparedness and Mitigation Plan (Drought Plan) to protect the County from the effects of a drought. The Drought Plan includes:

- Butte County's drought background (Section 1);
- An institutional framework to approach drought (Section 2);
- A monitoring plan (Section 3);
- A response and mitigation plan (Section 4); and
- A discussion of water transfers during a drought (Section 5).

1.1 Purpose

The DW&RC developed an Integrated Water Resources Program (Program) that will recommend actions for consideration by the Butte County Water Commission and Board of Supervisors. Development of the Program focuses on actions that lead to a long-term sustainable supply of water during all hydrologic conditions. To facilitate water resource planning, it is necessary to understand the effects of and prepare for drought.

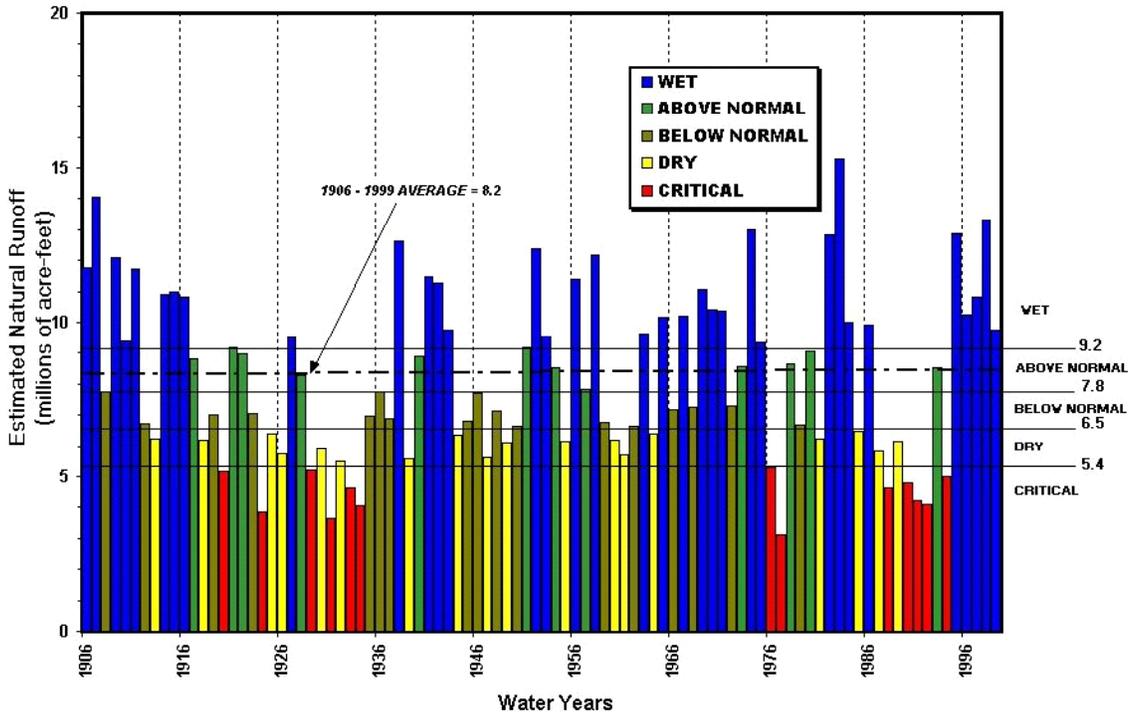
The purpose of the Drought Plan is to provide an efficient and systematic process for Butte County that results in a short- and long-term reduction in drought impacts to the citizens, economy, and environment in Butte County. In addition, the Drought Plan will identify mitigation that can help with the reliability of water supply for other California communities when resources are available.

1.2 Background

Drought conditions in Butte County have reoccurred numerous times throughout history. Table 1-1 summarizes the time and duration of droughts in Butte County during the twentieth century.

Drought Years	Duration (Years)
1912-1913	1
1918-1920	2
1923-1924	1
1929-1934	5
1947-1950	3
1959-1961	3
1976-1977	1
1987-1992	5
1993-1994	1

Droughts exceeding three years occurred two times during the 1900s. Figure 1-1 presents hydrologic year types from 1906 through 2000 based on the Sacramento 40-40-30 Water Supply Index. Severe droughts in Butte County occurred during periods of extended dry and critical years.



(Source: Department of Water Resources)

**Figure 1-1
Sacramento River 40-40-30 Water Supply Index**

Because of the minimal data available for hydrologic conditions prior to 1900, it is difficult to determine prior drought occurrences. However, scientists have used various other methods to document severe droughts in early California history. Scientific evidence shows the reoccurrence of drought throughout history and confirms the possibility for a future drought. For example, trees appear to have grown 6000 years ago in areas now submerged under Lake Tahoe, suggesting a drier climate. Other tree ring dating studies suggest a sustained drought during the mid-1500s.

Another early drought indicator is the presence and disappearance of civilization. For example, the Anasazi civilization flourished (in what is called the Medieval Warm Period from 900-1300) when monsoonal rains supported its irrigations systems. In contrast, the Anasazi culture declined and disappeared during the Little Ice Age (1300-1800), which is attributed in part to drought conditions that made irrigated agriculture infeasible.

Given the limited knowledge of the fairly recent past, it is difficult to understand the full ramifications of drought conditions. The County should plan for a worst-case scenario based on a 1987 to 1994 drought, which would have occurred if not for an above normal water year in 1993.

1.3 Drought Impacts

Drought is not initially recognized as a problem because it normally originates in what is considered good weather, which typically includes a dry late spring and summer in Mediterranean climates, such as in California. This is particularly true in Northern California where drought impacts are delayed for most of the population by the wealth of stored surface and ground water.

The drought complications normally appear more than a year after a drought begins. In most areas of California, ranchers that rely on rainfall to support forage for their livestock are the earliest and most affected by drought. Even below normal water years could affect ranchers depending on the timing and duration of precipitation events. In fact, the earliest indicator of drought in Butte County has been a "State of Emergency" declared for economic impact on livestock industries.

It is difficult to quantitatively assess drought impacts to Butte County because not many county-specific studies have been conducted. Some factors to consider include: the impacts of fallowed agricultural land, habitat loss and associated effects on wildlife, and the drawdown of the groundwater table. The most direct and likely most difficult drought impact to quantify is to local economies, especially agricultural economies. The State has conducted some empirical studies on the economic effects of fallowed lands with regard to water purchased by the State's Water Bank; but these studies do not quantitatively address the situation in Butte County. It can be assumed,

however, that the loss of production in one sector of the economy would affect other sectors.

The drawdown of the groundwater table is one factor that has been recognized to occur during repeated dry years. Lowering of groundwater levels results in the need to deepen wells, which subsequently lead to increased pumping costs. These costs are a major consideration for residents relying on domestic wells and agricultural producers that irrigate with groundwater and/or use it for frost protection.

1.4 Drought Water Supply

Northern Sacramento Valley counties, including Butte County, generally have sufficient groundwater and surface water supplies to mitigate even the severest droughts of the past century. Many other areas of the State, however, also place demands on these water resources during severe drought. For example, Northern California agencies, including those from Butte County, were major participants in the Governor's Drought Water Bank of 1991, 1992 and 1994.

Section 2

Drought Institutions

The Drought Plan provides a systematic institutional setting for Butte County to implement and reduce the impacts of drought-induced water shortages. The plan consists of a monitoring and assessment component and a response and mitigation component. These actions are designed to work within the existing framework of government, pulling together key personnel from private, local, State, and federal sectors. The Drought Plan forms several committees to implement the aforementioned components. The committees include:

- Drought Task Force;
- Interagency Coordination Group; and
- Specialized Working Groups.

2.1 Drought Task Force

An effective drought plan requires an entity that is responsible for instituting actions and reports to the Chief Administrative Officer and the Board of Supervisors. The Board of Supervisors will form a Drought Task Force (DTF) and assign the responsibility of leading the Task Force to the Director of the DW&RC. The DW&RC is an established entity with experience in managing such tasks. The DTF will be made up of various Department Directors (or their designee) and others in the County as shown in Table 2-1. The Board of Supervisors can also modify membership as necessary.

Table 2-1
Members of the Butte County Drought Task Force*

Director, Department of Water & Resource Conservation-Chair Emergency Services Officer-Vice Chair Chair, Butte County Water Commission Chair, Butte Basin Water Users Association Deputy Chief Administrative Officer Director, Department of Public Works Director, Division of Environmental Health Agricultural Commissioner Director, UC Cooperative Extension/County Farm Advisor California Department of Forestry/Butte County Fire District Conservationist, Natural Resource Conservation Service President, Butte County Resource Conservation District
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*Others may be added as suggested by the Board of Supervisors

The DTF will monitor hydrologic conditions throughout the water year and report the findings to the Water Commission and the Board of Supervisors annually in non-drought situations, and biannually, quarterly, or monthly as a drought progresses. The DTF will monitor and report the following information:

1. Drought forecasts and climate conditions;
2. Projections based on:
 - a. Snow-pack/precipitation
 - b. Stream flow
 - c. Reservoir levels
 - d. Groundwater levels;
3. Requirements for routine and special reports;
4. Resource information gaps and recommendations to address them;
5. Information needs of the coordination group and working groups (if activated);
and
6. Responses to information needs of the coordination group and working groups (if activated).

2.2 Interagency Coordination Group

A Butte County Drought Interagency Coordination Group (ICG) will be activated in the second phase of a drought emergency. The ICG will assess drought impacts, initiate general actions to respond to impacts, activate specialized working groups as necessary, and serve as the primary liaison with appropriate local, State and federal agencies. The members of the ICG (or their designee) are those shown in Table 2-2.

Table 2-2
Butte County Drought Interagency Coordination Group*

Chair, Board of Supervisors-Chair
Chief Administrative Officer-Vice Chair
Drought Task Force Members
Butte County Sheriff
President, Butte County Farm Bureau
Executive Director, Butte Environmental Council
California Department of Water Resources
California Department of Fish & Game
Executive Director, Private Industry Council

*Others may be added as suggested by the Board of Supervisors

2.3 Specialized Working Groups

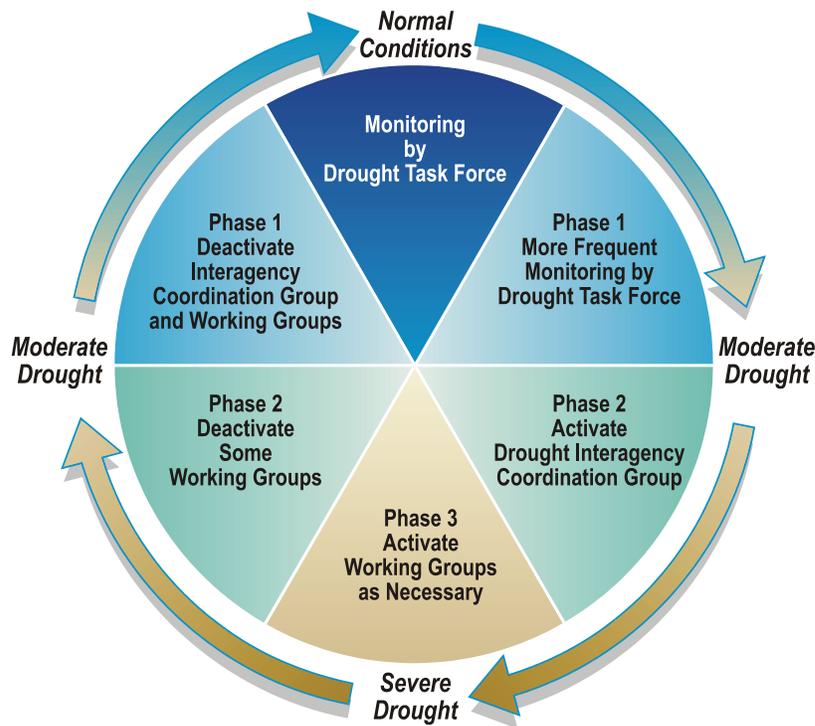
The ICG can also activate specialized working groups as needed to coordinate the assessment of drought impacts, as well as appropriate response and mitigation actions. Such working groups can include, but not be limited to:

- Water Availability;
- Municipal Water;
- Rural Communities;
- Environmental Protection;
- Agricultural Water;
- Tourism;
- Wildlife;
- Economic Impacts;
- Energy Loss;
- Health; and
- Review and Reporting;

The working groups will provide policy recommendation to the ICG for monitoring and assessment needs, and appropriate mitigation and response measures. The recommendations will then be directed to the Board of Supervisors for their approval.

2.4 Institutional Sequence

The general sequence of actions to be carried out will be in accordance with Figure 2-1. The first approximation of drought severity in relation to a 1987-1994 drought scenario is that Phase 1 would occur in years 1-3, Phase 2 in years 4-6, and Phase 3 in years 6 and beyond. Expenses to support activities are subject to normal fiscal constraints of respective agencies. Requests for special funding will be forwarded through the appropriate lead agency, and recommended by the ICG to the Board of Supervisors.



*Adapted from State of Colorado 2001

Figure 2-1
Drought Planning Phases

During all phases of a drought emergency, the DTF will collect data on snow-pack, reservoir levels, stream flow, precipitation, and temperatures. The DTF will meet biannually, quarterly, or monthly depending on the drought phase to share the information, discuss projections, and evaluate drought-related water conditions.

The ICG will be activated based on DTF data and discussions. Activation of the ICG will initiate Phase 2 of the Drought Plan. When activated, the Chair of the ICG will comment on the DTF's data and can then activate any working group as necessary (Phase 3).

The working groups will assess potential drought impacts and the ICG will comment on any observed or potential impacts identified by the working groups. The ICG will then recommend what actions, if any, should be taken to the Board of Supervisors for their approval. The Chair of the ICG, through the Director of the California Office of Emergency Management, will then relay the information to the Office of the Governor.

Section 3

Drought Monitoring

The Drought Plan establishes a continuous monitoring and reporting system. Drought-related monitoring and reporting activities provide a baseline of information and, more importantly, provide a barometer of change in climatic conditions that may indicate the inception of drought. Implementing a relatively simple monitoring program would help avoid a late diagnosis of an upcoming drought. The Drought Task Force is responsible for monitoring and reporting hydrologic conditions throughout the water year with increased activity during drought.

Drought indicators synthesize complex water availability data for planners and decision-makers. Because a single indicator does not easily assess drought, the County could utilize several indicators, including:

- Standardized Precipitation Index (SPI);
- Surface Water Supply Index (SWSI); and
- Palmer Drought Index (PDI requires soil moisture data and may be more difficult to use).

The following sections include a brief description of these indicators.

3.1 Standardized Precipitation Index (SPI)

The Colorado Climate Center uses the SPI (Colorado Climate Center 2004), which measures the precipitation deviation from the average for a particular location. The SPI quantifies the precipitation deficit over multiple time scales, typically three, six, twelve, and twenty-four month periods. The SPI provides an early warning of drought and an intensity level for each month in which the drought occurs. Table 3-1 displays the SPI for various drought levels.

2.0 and greater	Extremely Moist
1.5 to 1.99	Very Moist
1.0 to 1.49	Unusually Moist
0.99 to -0.99	Near Normal
-1.0 to -1.49	Moderate Drought
-1.50 to -1.99	Severe Drought
-2.0 and less	Extreme Drought

This index would be relatively easy to quantify for several weather stations in Butte County, including those stations used in the Butte County Water Inventory and Analysis (CDM 2001) and two at higher elevations. The stations include:

- Chico University Farm, 185 feet above mean sea level (msl);

- Oroville, 171 feet above msl;
- Paradise, 1750 feet above msl;
- De Sabla, 2,710 feet above msl;
- Forbestown, 2,840 feet above msl; and
- Brush Creek, 3,560 feet above msl.

3.2 Surface Water Supply Index (SWSI)

The SWSI is an indicator of surface water conditions for a major river basin. Table 3-2 lists the rating for varying surface water conditions. The index summarizes snow pack, stream flow, precipitation, and reservoir storage for a particular month. The weighting factors change from winter to summer as follows:

November-April SWSI = observed reservoir storage + precipitation + snow pack + April - July stream flow forecast; and

May-October SWSI = observed reservoir storage + precipitation + stream flow.

Table 3-2	
SWSI Ratings for Various Conditions	
4.0 and more	Extremely Moist
3.0 to 3.9	Very Moist
2.0 to 2.9	Unusually Moist
1.9 to -1.9	Near Normal
-2.0 to -2.9	Moderate Drought
-3.0 to -3.9	Severe Drought
-4.0 and less	Extreme Drought

For the Sacramento River Basin the stream flow component of SWSI is calculated using the Sacramento Valley Water Year Type Index (or 40-30-30 Index), available from DWR’s Division of Flood Management, Cooperative Snow Surveys through the California Data Exchange Center (CDEC). The Index equals 40 percent of the current April-July unimpaired runoff, plus 30 percent of the October-March unimpaired runoff plus 30 percent of the previous year’s index.¹

The Index calculates runoff as the sum of unimpaired flows from the Sacramento, Feather, Yuba, and American River Basins, and sets a maximum for the previous year’s index at 10 million acre feet (AF). The water year type is characterized as wet, above normal, below normal, dry, or critically dry and historically range between 3.1

¹ Unimpaired runoff represents the natural water production of a river basin, unaltered by upstream diversions, storage, or by export or import of water to or from other watersheds (DWR Bulletin 120-4-03, May 1,2003).

million AF (1977) and 15.3 million AF (1983) with a 1951-2000 average of 8.5 million AF. Table 3-3 illustrates the type of water year in relation to unimpaired runoff.

Table 3-3 Water Year Classification and Unimpaired Runoff	
Wet	= to or > 9.2 MAF
Above Normal	> 7.8 MAF and < 9.2 MAF
Below Normal	> 6.5 MAF and = to or < 7.8 MAF
Dry	> 5.4 MAF and = to or < 6.5 MAF
Critical	= to or < 5.4 MAF

MAF – million acre feet

The County could work with DWR to analyze the SWSI index with more focus on the Feather River Basin. This step would require additional effort; however, once established, this index would be relatively easy to use and update.

3.3 Palmer Drought Index (PDI)

The Palmer Drought Index is widely used across the United States primarily to gauge impacts on agriculture. It is based on precipitation and temperature data and the available-water content of local soils. This index was developed for areas of the country with more homogeneous climates than Butte County. Agencies such as the U.S. Department of Agriculture may use the PDI, and once calculated, the County could report the PDI with minimal effort. Otherwise, the PDI should not be considered as an active part of the Butte County’s drought planning.

Section 4

Drought Response and Mitigation

The primary reason for establishing an ongoing Drought Task Force (DTF) and monitoring program is to prepare for timely response and mitigation to a drought. The Interagency Coordination Group (ICG) is the lead agency for drought response and mitigation. Fortunately, there have been some statewide initiatives in certain areas that require drought contingency planning. For example, compliance with the Urban Water Management Planning Act is voluntary, but the drought contingency planning requirements are necessary to apply for loan and grant programs related to drought emergencies. This section focuses on response and mitigation efforts for urban, agricultural, environmental water uses, the specialized needs of remote communities, and potential help with statewide drought supply.

4.1 General Response

The ICG will initiate general responses to specific drought impacts. These efforts would begin in Phase 2, or the moderate stage, of a drought. The ICG will:

- Respond to drought impacts, in accordance with local needs, report unmet needs, and request assistance through appropriate local departments and agencies (to include working groups);
- Request assistance from appropriate State and federal agencies, when needs cannot be met locally;
- Address drought-related problems through normally established program activities and cooperate with lead response agencies upon their designation;
- Act as lead drought response agency when activated, and take action within assigned sectors of responsibility;
- Consider and recommend water conservation practices to lead agencies;
- Provide direction and integration of effort to all agencies concerned with drought response within assigned sector or responsibility, utilizing normal programs and resources available; and
- Develop, coordinate, and recommend solutions to drought-related impact problems involving:
 - Interdepartmental or outside support (possible State and federal Declaration of Emergency). This could also include recommending the appointment of an ICG member to a regional or State coordination group; and
 - Contacts with local State legislators regarding the need for State legislative actions, to include requests for funding.

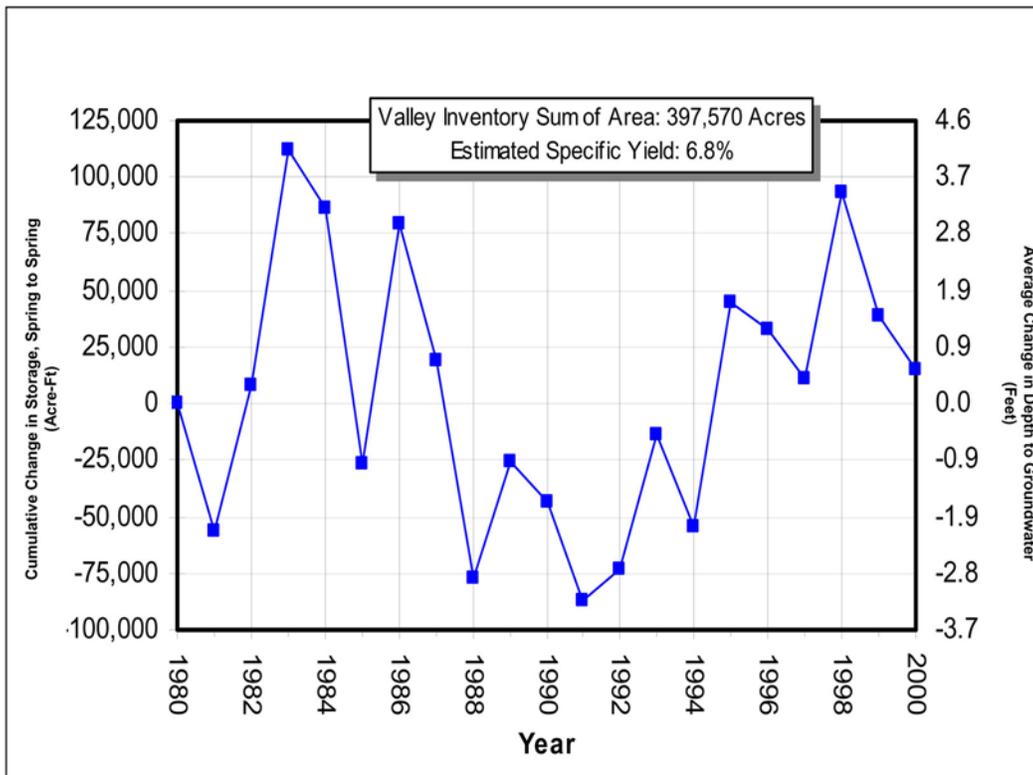
The ICG will form specific working groups as necessary in Phase 3, or the severe stage, of a drought.

4.2 Agricultural Response and Mitigation

To respond to agricultural drought impacts, the ICG itself or through its working groups will:

- Provide coordination and liaison with U.S. Department of Agriculture agencies, State agencies, local government, and agricultural industry groups;
- Review guidelines and procedures;
- Collect and evaluate impact data;
- Assess current and potential severity of impacts;
- Make projections for various scenarios;
- Analyze barriers and needs to meet projected threats;
- Identify sources of assistance;
- Recommend response levels and activities;
- Estimate and report on costs of needed augmentation activities;
- Maintain supporting data and records of activities;
- Review drought reporting in relationship to current and /or potential threats;
- Inventory additional or special resource availability, costs, and procedures for utilization;
- Identify key contact points with support service agencies and agricultural industries;
- Identify and describe response actions that are available;
- Project impacts of drought to the agricultural economy;
- Recommend response to drought impacts;
- Identify procedure for coordination between working groups; and
- Make requests and recommendations regarding needs to the Governor.

Many impacts on irrigated agriculture are mitigated by the strong surface water rights held by Butte County agricultural water purveyors. Almost all have pre-1914 water rights that are stronger than the more recent rights. For example, the Joint Districts in the south County have a contractual agreement with the California Department of Water Resources (DWR), wherein they can only be cut back to 50 percent of their normal deliveries once in a seven-year period. In most areas of the county, there are sufficient groundwater supplies to mitigate losses of surface water during even a severe drought period. The year to year average *change* in depth to groundwater and change in storage between 1980 and 2000 are shown in Figure 4-1.



Sources: Department of Water Resources

Figure 4-1
Changes in Groundwater Storage

The Butte County Inventory and Analysis showed that certain agricultural areas, particularly in the southwest portion of the county, lacked sufficient infrastructure to effectively use groundwater resources. The primary reason is there are not enough wells to produce the required amount of groundwater. Table 4-1 summarizes drought year water shortages.

Table 4-1 Drought Year Water Shortages			
Inventory Unit	Sub-Unit	Shortage (TAF)	Total Demand (TAF)
East Butte	Biggs-West Gridley	37.4	208.2
	Butte	13.5	111.5
	Butte Sink	3.1	52.2
	Cherokee	3.2	31.9
	Richvale	33.6	252.9
	Total	90.8	655.7
Foothill	Cohasset	0.1	0.5
	Ridge	1.2	13.1
	Total	1.3	13.6
Total		92.1	669.3

It is important to note that the drought scenario described in the Butte County Inventory and Analysis was for a single drought year that was more severe than 1977. The severity was increased by assuming higher evapotranspiration rates because 1977 had a cooler than normal spring and summer. For a seven-year drought scenario, as described in Section 1, the situation would be much worse. In addition, there were many rangelands that suffered losses early on.

During the drought of the late 1980s and early 1990s, and even more recently, there were initial impacts to agriculture. A State of Emergency was declared to deal with losses to dry-land farms and ranches. Having an effective drought plan in place can help manage even severe drought conditions. Local landowners can now work with the newly formed Butte County Resource Conservation District (RCD), and the local office of the federal Natural Resource Conservation Service (NRCS) to develop a conservation plan. The plan should also include a drought contingency element, which is keyed to the County's monitoring effort.

The NRCS and the RCD can suggest mitigation measures that may be included in a drought contingency plan. Table 4-2 illustrates potential measures. Another, readily available source of drought management information is the office of the Butte County Farm Advisor. The University of California Cooperative Extension developed a number of drought tips in cooperation with the NRCS and DWR. Table 4-3 lists available drought tips.

Table 4-2 Drought Planning Mitigation Measures	
Management Category	Mitigation Measure
Water	Evaluate appropriate irrigation system types that will help reduce evaporation, percolation, and runoff
	Examine ways to make the existing irrigation system more efficient and easy to maintain
	Build an emergency water storage system
	Build a tail-water return system
	Store water in water supply and drainage ditches
	Install water measurement devices to track water use
	Drill wells or deepen existing ones to tap deeper groundwater aquifers
Land	Use conservation tillage to increase soil moisture and reduce evaporation
	Use conservation practices that reduce runoff and increase infiltration
	Closely monitor soil moisture using the “feel” method at a minimum
	Contract early for supplemental feed and examine alternate feed sources
Crop	Examine and revise schedules for culling herds
	Consider more drought tolerant crops if feasible
	Consider new crop rotations if feasible
	Evaluate other cropping systems that require less water if feasible
	Practice stress management of orchards or remove older, less productive trees if possible

Table 4-3 Drought Tips Publications*	
1.	Drought Related Toxicoses in Cattle
2.	Leaching of Salts
3.	Water Quality Guidelines for Vegetable and Row Crops
4.	Water Quality Guidelines for Trees and Vines
5.	Water Balance Irrigation Scheduling Using CIMIS ET
6.	Furrow Irrigation
7.	Sprinkler Irrigation
8.	Irrigation Water Management Made Simple
9.	Assessing Water Quality for Livestock Under Drought Conditions
10.	Reclaiming Sodic and Saline/Sodic Soils
11.	Citrus Irrigation Scheduling During a Drought
12.	Field Use of Tensiometers
13.	Deciding How Much to Plant During a Drought
14.	Irrigating Crops Efficiently With Sprinklers
15.	How Much Water Are You Applying With Your Low Volume Irrigation System?

*Should be available from DWR District Offices, local Farm Advisor’s, and NRCS offices.

In addition, Appendix A includes two of the better drought mitigation articles on range management from the Animal and Range Sciences, Extension Service of Montana State University and Texas A&M.

4.3 Urban Response and Mitigation

The local urban water supplier manages most residential, commercial, and industrial drought responses. Local urban water suppliers that deliver over 3,000 acre-feet of water, or who have over 3,000 connections, are required to prepare urban water management plans under Section 10610 et seq. of the California Water Code (CWC). This CWC section, however, does not cover individuals and businesses that supply their own groundwater. Further, Butte County is not required to develop an urban water management plan, because the County delivers only 1,200 acre-feet of water to retail agencies. Section 10632 of the CWC states:

The plan shall provide an urban water shortage contingency analysis, which includes each of the following elements which are within the authority of the urban water supplier:

- a) Stages of actions to be undertaken;*
- b) An estimate of water requirements;*
- c) Actions to be undertaken;*
- d) Additional mandatory prohibitions;*
- e) Consumption reduction methods;*
- f) Penalties or charges for excessive use;*
- g) Analysis of the impacts;*
- h) A draft water shortage contingency resolution; and*
- i) A mechanism for determining actual reductions.*

Appendix B includes the entire text of the urban water management sections of the CWC.

DWR has developed water demand reduction goals in its model urban water management plan (new Albion 2000 Urban Water Management Plan, January 21, 2000). Appendix C includes the sections of the model plan relating to drought contingency planning. The model plan suggests four action stages that can be adapted to the three-phase approach outlined in this plan. Table 4-4 relates the DWR water shortage stages to the Drought Plan phases.

Table 4-4 Water Shortage Stages and Reduction Goals				
Shortage Condition	Stage	Phase	Customer Reduction Goal	Type of Demand Reduction
Less than 15%	I	2	15%	Voluntary
15 – 25%	II	2	25%	Voluntary
25 – 35%	III	3	35%	Mandatory
35 – 50%	IV	3	50%	Mandatory

The various stages will be implemented in cooperation with the DTF and ICG as the monitoring information is evaluated. The normally considered order of priority for potable water use is as follows:

1. Minimum health and safety standards for interior water use in residential and commercial facilities (hospitals, rest homes, etc.), fire, and public safety;
2. Commercial, industrial, and governmental facility operations where to maintain jobs and economic base (does not include landscapes);
3. Existing landscaping; and
4. New customers.

Chapter 19, Section 20, of the Butte County Code specifies that “gray water” may be used for on-site plant irrigation where the Board of Supervisors finds by resolution that 1) a critical water shortage exists in a specified year, and 2) strict conservation measures are necessary in said areas. “Gray water” is liquid household waste associated with the kitchen sink, laundry, bathtub, shower and wash basin. “Gray water” excludes toilet and urinal waters.

4.4 Environmental Response and Mitigation

The National Drought Policy Commission’s report of March 2000 highlighted the devastating impacts drought can have on aquatic and terrestrial environmental resources. Aquatic ecosystems are exceptionally vulnerable to drought-induced reductions in stream flows. Drought conditions also place stress on terrestrial wildlife populations. Habitat quality and quantity gradually decline from lack of moisture, increasing the competition for limited resources. Wildlife species eventually suffer from lack of drinking water, forage, and cover resulting in heat stress.

The biotic impacts of drought are particularly acute for threatened, endangered, and sensitive species of fish and wildlife that are characteristically found in low population densities. In many cases, such species have already encountered damage to or destruction of their natural environments because of factors such as suburban sprawl, conversion of land to agricultural or industrial uses, and construction of large dams or other impoundments. During a Phase 2 drought emergency the ICG can activate an environmental working group or work with a regional group to:

- Assess short- and long-term impacts to public land;
- Recommend/estimate costs of implementing program;
- Determine reporting needs;
- Evaluate impact on water rights/water releases;
- Assess alternatives to in-stream flow;
- Assess fish/fishery resources;
- Assess fish and wildlife needs;
- Determine susceptibility to dewatering;
- Establish intergovernmental dialogue regarding wildlife;
- Identify major vulnerable areas of concern; and
- Monitor water quality to determine effects on fish and wildlife.

The environmental working group will also consider the response actions in cooperation with resource agencies to:

- Evaluate in-stream rights/programs to allow in-stream flow;
- Cooperate with State and federal drought assistance programs;
- Identify appropriate grant and loan programs;
- Evaluate deprivation of forage and water quality;
- Encourage use of water diversions that will be more compatible with wildlife;
- Recommend the installation of temporary gauges to monitor stream flow;
- Evaluate hatchery water delivery system to solve water quality problems;
- Provide food and water for drought-stressed wildlife; and
- Evaluate priorities/new compliance dates for environmental regulations.

The environmental working group can suggest various mitigation programs as follows:

- Help develop policy to increase/protect in-stream flows/wetlands;

- Help develop plans to minimize fish and wildlife impacts;
- Identify critical facilities and habitats;
- Cost-share improvements in fisheries/habitat;
- Develop alternative water supplies for critical habitats where feasible;
- Investigate effects of alternative hunting seasons;
- Monitor stream dewatering/fish habitats and effects of stream flow; and
- Cooperate with regional drought action reporting system if available.

Appendix D includes a Utah Division of Wildlife Resources paper discussing drought needs for the environment. Butte County's response to environmental degradation during a drought will be significant because of the abundance of wildlife and wildlife habitat that exists naturally and in association with agriculture.

4.5 Rural Communities Response and Mitigation

In November 1987, DWR Northern District Office in Red Bluff, identified some specific drought issues for the communities of Berry Creek, Cherokee, Cohasset, and within the Lime Saddle Community Services District. Currently, the DWR Drought Preparedness Office has provided workshops for assisting individual well owners and small communities develop options for enhancing water supplies.

Berry Creek

Berry Creek dried up during the one-year drought of 1976-1977. An alternative water supply was available by using water from Brown Creek.

Cherokee

There were over 60 groundwater wells in the Cherokee community. The number of wells had already stressed the sustainable supply of groundwater in 1987 at the time of the report. There had been instances of water hauling during periods of drought conditions.

Cohasset

Water shortages during drought conditions have been experienced in the past. However, there is the ability to use part of one of the 15,000-gallon storage tanks as an emergency source of water.

Lime Saddle

There are landowners in the Lime Saddle area existing on marginal groundwater supplies. However, this situation will be improving in the near future, as the Del Oro Water Company is now in the environmental review and design phase of a Lime

Saddle pipeline. The project will pump water from Lake Oroville to an intertie with Paradise Irrigation District.

The Governor's Drought Advisory Panel produced recommendations in the Critical Water Shortage Contingency Plan (December 2000). Past droughts have demonstrated that those most impacted early in a drought were remote communities (like those noted above) and individuals relying on marginal groundwater resources. The report made recommendations relating to assistance to small water systems and homeowners in rural counties. The recommendations focused largely on technical assistance and information programs to be carried out by DWR. However, the panel did recognize that many problems were related to the variability in groundwater supply reliability in fractured rock aquifers. The panel did recommend that legislation was necessary to ensure that sellers of single-family homes served by private wells describe the water source and potentials for shortages in drought years.

Section 5

Water Transfers During Drought

The State of California continues to look towards the Sacramento Valley as a source of additional water supply in drought years. The DWR publication, *Preparing for California's Next Drought – Changes since 1987-92* (July 2000) noted that changes in laws, regulations, and institutional conditions are limiting the ability to transfer water. For example, there is currently over 1 million acre feet of water that has been reallocated from urban and agricultural use to environmental use. In addition, county groundwater management ordinances have been enacted in about one-third of California's counties, including Butte County. This section reviews Butte County's ability to deal with transfers during drought contingencies in conjunction with State plans.

5.1 California's Critical Water Shortage Contingency Plan (CCWSCP)

The CCWSCP outlines a number of recommendations made by the Governor's Panel, which included Butte County Supervisor Jane Dolan. The Panel recommended that DWR develop a Critical Water Shortage Reduction Marketing Program (CWSRMP) that was an outgrowth of the State Water Bank. The Panel generally concurred that the CWSRMP should be a secondary tool used after water users had already made substantial efforts on their own behalf. The CWSRMP would establish a three tiered set of actions relating to water transfers, which are consistent to the three phases used in Butte County's Drought Plan.

- Tier 1 (consistent with Butte County's Phase 1) would largely develop guidelines, criteria, and action plans to increase the ability of local agencies to manage water shortages.
- Tier 2 (consistent with Phase 2) would be implemented in the early stages of a drought. Local agencies would make a declaration of impending critical water shortages and demonstrate they are maximizing their own resources.
- Tier 3 (consistent with Phase 3) would be implemented in the later stages of a drought, and be triggered by a declaration of emergency by a water agency, by a city or county, or by the Governor.

The Governor's Panel also recommended that integrated resource planning is an essential aspect of drought preparedness. The County is currently preparing an Integrated Water Resource Program, which includes the Drought Plan.

5.2 Chapter 33 of the Butte County Code

In 1996 Butte County passed Measure G, which is now Chapter 33 of the Butte County Code. Chapter 33 requires a permit to transfer groundwater outside of the County. Chapter 33 does not cover surface water transfers, unless groundwater

substitution is proposed. Surface water transfers are the purview of the State Water Resources Control Board. A transfer during a drought year can be viewed from two perspectives 1) a water-rich county helping others in the State, and 2) in-county agricultural and urban communities, and the environment have adequate drought supplies before the county considers groundwater transfers. Butte County will take into account both these perspectives when considering a water transfer in a drought contingency. It should be one of the activities of the DTF to examine the recommendations of the Governor's Drought Panel and ensure that Chapter 33 works efficiently during a drought emergency for the County and others in need.

5.3 BMO Ordinance

The County Board of Supervisors enacted a Groundwater Management Ordinance (Ordinance 3869) in February 2004 that includes the development and monitoring of basin management objectives (BMOs) associated with groundwater levels, groundwater quality, and land subsidence. BMOs are locally-developed guidelines for groundwater management that describe actions to be taken by well owners in response to well-monitoring data. The emphasis of the BMO development process is local control, as representatives (including well owners) from each area will be developing their own BMOs. Each area can set its own BMO for one or more wells within the area and pursue its specific groundwater management goals as long as their actions do not negatively affect neighboring areas. The BMO concept overcomes many of the common difficulties associated with defining safe yield and overdraft in a groundwater basin.

5.4 Emergency Services Act

Section 8550 et seq. of the California Government Code authorizes the Governor to proclaim a state of emergency because of drought. However, these conditions of emergency must be beyond the control of any city or county. Generally, the act is triggered by a local emergency proclamation, but the Governor can proclaim an emergency without a local request. The act gives the Governor the authority to respond by:

- Writing orders and regulations which have the force and effect of law;
- Suspending regulatory statutes;
- Commandeer or use private property;
- Exercising police powers; and
- Redirecting staff and equipment of State agencies.

Section 6

Recommendations and Plan Completion

This section presents a summary of the Drought Plan's major policy recommendations and discusses the process for completion and approval of the Drought Plan.

6.1 Policy Recommendations

The Drought Plan presents an approach, consisting of monitoring, assessment, response, and mitigation components, to address future drought effects. The Drought Plan recommends the formation of three committees to carry out implementation:

- A Drought Task Force responsible for continuous monitoring and reporting of hydrologic conditions throughout the water year with increased monitoring during drought.
- A drought monitoring method based upon the Standard Precipitation Index and the Sacramento River 40-40-30 Water Supply Index.
- An Interagency Coordination Group (ICG) to be activated in Phase 2 of a drought event. The ICG will assess drought impacts, initiate general actions to respond to impacts, activate specialized working groups as necessary, and serve as the primary liaison with appropriate local, State and federal agencies.
- Specialized working groups activated by the ICG as needed to coordinate the assessment of drought impacts, as well as appropriate response and mitigation actions.

6.2 Public Review and Completion

Public review copies of the Drought Plan are available at Butte County libraries in Biggs, Chico, Durham, Gridley, Oroville, Paradise, and in the Meriam Library Special Collections Section on the campus of California State University-Chico. Copies of these plans are also available at the DW&RC's library, at www.buttecounty.net/waterandresource, or at Butte Environmental Council's office at 116 West 2nd Street, Suite 3 in Chico.

DW&RC staff plans to conduct public outreach meetings throughout the community during the summer of 2004 beginning in July. After the DW&RC receives public comments, they will incorporate the comments into the Draft Drought Plan and present the plan to the Butte County Water Commission, then to the Board of Supervisors for future consideration and policy direction.

Section 7

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MANAGEMENT AND RANGE RECOVERY FOLLOWING DROUGHT

To put things in order, before we can discuss management following a drought, we need to determine when there is not a drought. It is interesting that during the current drought several media people have called me with the same question - how will we know when the drought is ended? Even more interesting is the diversity of answers that they received from people. A statewide news release on the drought from Texas A&M referred to aquifer levels and reservoir levels - if they are not full, the drought is probably not over. While low surface and ground water levels are indicators of extended drought, in my opinion the drought is not ended until we have rainfall sufficient to replenish deep soil moisture in our pastures. Heavy rainfall that provides runoff for reservoirs may not recharge subsoil moisture levels. It is the deep moisture in soil profiles that extends the time between rains to get forage growth and production through dry periods. If rainfall is sufficient in amount and over a long enough time period to replenish soil moisture to 60 inches or more, many other drought symptoms, like low reservoirs, will likely be cured as well.

There was a lighter side offered by Joe Fohn of the San Antonio Express-News for determining when a drought is over. His suggestions may be as good as any:

- They stop seeding the clouds and you start seeding the lawn.
- After three years, the spider in your rain gauge has moved out.
- The stock tank gets enough water in it to start leaking again.
- At the coffee shop, more people are talking about politics than the weather.
- Someone knocks at your door - and he's in a boat.
- There's concern that those creatures living in the springs might get swept away by the current.
- You tell the kids you're going to fix water gaps, and they have no idea what you're talking about.
- Your friends complain that something is discoloring their lawns - you explain that it's just new, green leaves.
- Thank goodness, people have quit asking how you coped with the Dust Bowl of the '30s - because you are only in your 40s.

REINSTATE SOIL SURFACE COVER WITH VEGETATION

Assuming that restoring soil moisture is a reasonable goal of postdrought management, the first and foremost objective must be to restore vegetation on the soil surface. The kind and density of plants covering the soil to intercept rainfall and provide retardance for surface flow is critical. Chances are that when the first significant rains come during drought, the soil surface will be have little standing crop or mulch to absorb the energy of hard-falling rain, reduce the sealing of the soil surface, promote infiltration and reduce runoff and erosion. This may be true even if pastures have been deferred from grazing to protect soil cover. If the drought is long enough, weather and time will cause vegetation to deteriorate. Therefore, the critical task for range managers is to rebuild vegetation levels as quickly as possible in order to capture and retain precipitation. It should be noted that droughts tend to end with periods of above average precipitation. The drought of the 50s ended in 1957 with the second wettest year on record in San Antonio. Such large amounts of rainfall occur at a time when the soil lacks protective cover.

It is common practice for grazing lands to be fully stocked on the basis of the average or better than average season before a drought. Consequently, if grazing is not immediately reduced in proportion to the decline in forage production, there will be heavy overgrazing with subsequent injury to the forage species. We should take a lesson from history, the heavy overgrazing that contributed to degradation of our southwestern rangelands is correlated with protracted drought periods.

The best way to restore vegetation after drought is to help nature to the greatest extent possible. Let her have a chance to put cover on the soil before you begin to harvest new growth. IT DOESN'T RAIN GRASS. It rains water, and we must then optimize that moisture to grow vegetation. Therefore, once the drought breaks it is important not to restock too quickly. The range should be allowed to recuperate and gain in strength and vigor, and nature helps us with a little known phenomenon. Several studies have shown that there are often large pools of total nonstructural carbohydrates (TNC) in drought-stressed plants that appear to enhance production when the drought breaks (Busso et al. 1990). Carbohydrates accumulate in water-stressed plants because growth is impaired before photosynthesis declines. If carbohydrates limit plant growth when an adequate number of active meristems are present, carbohydrate accumulation could stimulate growth following drought or drought plus defoliation by grazing.

Some sage advice warns against restocking too early. Following the drought in southwest Texas that began in 1982, good fall rain in 1984 and spring of 1985 caused rapid growth of weeds on soils bared from the drought. A lot of ranchers restocked too quickly. The weeds were dominant in pastures because the grass was weak and couldn't compete. When the weeds dried up, stockmen were faced with another critical situation - a lot of bare ground. So, the restocking speed and intensity must be determined by the perennial grass in the pastures, not a flush of annual weeds (Emmert 1985).

Ranges that enter drought in good to excellent condition probably will not be adversely affected by droughts of one year, even if they are intense droughts, as long as stocking rates are reduced commensurate with adequate standing crop to provide soil cover. Ranges that are in fair condition could be seriously affected by a year long drought, producing very little desirable forage during drought and greatly less than good condition ranges afterward. Ranges in poor condition are always at the outset of a drought and allow little time to managers for stocking decisions when precipitation falls below normal, even for very short time periods. Unfortunately, a lot of Texas rangelands are in fair and poor categories in the composition of plants that they support. This means that many ranchers got into trouble early as rainfall dropped below normal and did not make stocking decisions in time to provide adequate soil protection.

How much soil cover do I need to be adequate? It varies with different soil textural characteristics and topography, but a good general rule is a minimum of 50-60% organic material covering the soil surface (Fig. 1). Drought management should start well before the minimum cover level is reached and destocking should take place when cover declines to 50%. How much vegetation do I need to give up to equal the minimum cover level for good plant health, effective rainfall infiltration and soil protection? This table from Texas Agricultural Extension Service, L-5141 shows optimal amounts of ungrazed forage for different types of rangeland.

Optimal amounts* of ungrazed forage for different types of rangeland.**

Desert 250 lb./A	Shortgrass 300-500 lb./A	Midgrass 750-1000 lb./A	Tallgrass 1,200-1,5
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*The higher amounts of each category should be left ungrazed if improvement is desired and to reduce risk.

**To promote midgrass over shortgrass, midgrass amounts are required to begin accumulating organic matter, nutrients, and soil moisture to support the midgrass component.

Texas Agricultural Extension Bulletin 1646, "How much forage do you have" is a photographic guide to estimating the amount of forage on the range and will be helpful. The bottom line is to rebuild the vegetation cover on the range as quickly as possible with perennial grasses. This is the best way to cause the next rains you get to stay on the range, go deeper and grow more forage. Many years ago, Dr. E. J. Dyksterhuis stated the situation very well. The man who has a short pasture needs a rain much worse than his neighbor who has ample forage on the range. But, when the rains come, it will do the least good for the fellow who needs it most.

Vegetation type influences surface runoff, sediment loss and infiltration (Fig. 2). Bunchgrasses, such as sideoats grama, little bluestem, Indiangrass and others have a deeper root system that creates an environment more conducive to water infiltration than plants with shallow root systems. Thus, sites with vegetation composed of deep-rooted perennial bunchgrass generally have a higher rate of infiltration than similar sites occupied with perennial sodforming grasses. Vegetation also acts as a physical barrier to runoff. Water moves more rapidly across closely grazed grass than grasses left with several inches of stubble. Hoffman and Ries (1991) concluded that of all factors relating to soil erosion on rangeland, including, soil bulk density, root weight, soil aggregation and soil particle size, vegetation and ground cover were the primary influences of soil loss and runoff.

Your range sites and how you graze your pastures will also dramatically effect the amount of precipitation that you can expect to capture from drought-breaking rain. Deep sites usually have higher infiltration rates compared to intermediate and shallow sites (Fig. 3). You can't change the sites that you have on the ranch, but you can control grazing animals. In a study at the Texas A&M Agricultural Research Station at Sonora, infiltration rates averaged by pastures showed an enclosure and a moderately grazed 4-pasture system to have almost identical infiltration curves and terminal infiltration rates, while both had greater than twice the values of the heavy continuously grazed pasture (Fig. 4). The other, obvious reason for leaving stubble after grazing, is that you can realize greater subsequent production. This figure shows the influence of beginning standing crop on total annual production of buffelgrass in South Texas (Fig. 5). Stubble mass is very important when considering plant-moisture-grazing relationships. Pastures with greater than 400 lbs./acre outproduced those with less than 400 lbs./acre regardless of rainfall amounts received. Nearly 17 inches of rainfall on pastures with only 200 lbs./acre stubble resulted in less than half the production of pastures that received only ten inches of rainfall but had 1,500 lbs./acre stubble.

Deferment of some kind, better in a planned system on a regular basis, is critical to range management but even more so to drought preparation. Remember that moderate or even light grazing is no substitute for deferment because animals will eat all they can find of the most preferred species and reduce range improvement and production. Grazing management and grazing systems that incorporate effective deferments help build the range forage base. There are many, effective grazing systems to use. Select the one that best fits your specific circumstances.

PLAN CONTINUOUSLY FOR THE NEXT DROUGHT

The best time to think about drought conditions is when it's raining straight down. During favorable years you have to control your optimism and enthusiasm and be able to look into the future - to see the next drought coming. Start planning now, because when you realize you are in a drought it is too late to plan for drought - your options have been spent.

The best management at the end of a drought is to insulate yourself as best as possible against the next one. Fortunately, there are options available to reduce the impact of droughts. Unfortunately, the most effective of these options are strategic in nature, that is, they require long-term decisions and commitments prior to drought. This may force us to think about bad times when we are having good times, which is not always easy for folks among whom "hope springs eternal." Of course, there are things you can do when you are six months into a drought, but we seldom like the alternatives at that point in time.

Strategic objectives that can mediate the effects of drought and that should be an integral part of total ranch management include:

1. Building the range forage base.
2. Maintaining or creating diversity of plant and animal populations.
3. Improving efficiency of range utilization through better grazing distribution.
4. Matching animal nutrient requirement with range nutrient availability.
5. Developing alternate sources of feedstuffs.
6. Building cash equity position.
7. Developing less drought sensitive on- and off-ranch alternative income sources.
8. Don't forget wildlife!
9. Contingency (including drought) planning.

There are other things we can do in the early post-drought period that can help the next time around. Several of these involve management decisions on the livestock operation, and drought may provide a good time to reevaluate goals. Drought, and attendant herd reduction, offers the unexpected possibility of reviewing an entire livestock production enterprise.

1. Is your breeding season short enough? A short breeding season (no more than 90 days) is the key management tool around which other ranch programs are built. It is difficult to correctly supplement, select heifers or cows on a performance basis, efficiently market animals when cows calve year-round or over an extended period of time.
2. Is the breeding system right for you, purebred vs. crossbreeding.
3. Are you using the right breed or breeds?
4. Is there an opportunity for combination stocking that you have overlooked?
5. Is the supplement program you use the most efficient? Consider the use of NIRS technology and "fecal profiling" your herds to improve the efficiency of your feeding program.
6. Revisit your marketing options - are they the best they can be?

Build the Range Forage Base

Observations verify that going into dry periods on deep soils, the short grasses brown up first, followed by mid-grasses and finally the tall grasses, only when deep moisture is completely exhausted. A poor condition range is generally occupied by vegetation that is much less drought resistant than the climax decreaser species for the same site. Red grama, red lovegrass and hairy tridens are just a few perennial grass species that are more shallow-rooted than climax decreaser species that could occupy the same soil profile. These invader species may look good during wet times, but they fade fast during droughts, compounding the problem of low forage availability. Results of a 6-year study at the Texas Experimental Ranch at Throckmorton clearly show that long-term heavy continuous grazing reduces potential range forage production because of a shift in plant species composition from a midgrass to a shortgrass dominant community. During drought or winter induced dormancy, nutrient intake of livestock was restricted on these areas, requiring either greater amounts of supplement compared to

moderately grazed areas or destocking (Tex. Agr. Exp. Sta. 1988). When we consider that most droughts are of one year of less duration, managing for the right plants on the range simply eliminates the effects of most droughts and ameliorates the effects of longer ones.

The first strategic post-drought consideration should be what management can do to influence change in vegetation composition. This will depend on many factors, including range site potential, current range condition, technically feasible alternatives, economic feasibility, kinds of livestock, and wildlife habitat requirements. The information needed to make these and other strategic management decisions must come from a comprehensive resource inventory of the soil, water, vegetation and physical facilities that exist on the ranch. Subsequent range management should produce the highest quality range possible under the natural limitations of climate and soils, and based on the requirement established by management goals.

How important is the forage base? A range producing 4000 pounds per acre of forage would obviously carry more grazing animals than range producing only 1000 pounds per acre. but it will also produce more future forage on the same rainfall. This means that the same 3" rain means different things to different ranches based on their past management and efforts to improve range condition. Assuming range proper use (removal of about one-half of total production), there would also be several times more forage left on the 4000 pound range at the end of the grazing season that could be used to carry animals during drought, 2000 lbs vs. 500 lbs. The 4000 pound range could be grazed again after proper use during the dormant season or during drought enforced dormancy and, if conditions dictated, as long as the integrity of the watershed characteristics were maintained. The 1000 pound range would probably be below the minimum for preserving soil cover if one-half of the total yield was used. It offers no opportunity for further grazing use without potential loss of soil and/or reduction in soil moisture to support future plant growth.

Investing in range improvements, such as fencing and water development for grazing systems, or mechanical or chemical brush treatments that will speed up secondary succession, or revegetation in severe circumstances, can help overcome low range productivity and provide a more stable forage base. There is often a great difference, however, in where this money is spent on improvements in relation to potential benefits and economic payback. Research by Scifres et al. (1988) in South Texas shows clearly that the most productive sites on the ranch respond more positively in internal rate of return on investment from tebuthiuron treatments. Matching range management problems with the appropriate technology and putting dollars where they will be most effective is good business. Increasing the productivity of range sites with improvement practices can improve the cushion of reserve forage available during drought.

Diversity of Vegetation and Animals

Good range management is good drought management. It balances the amount and kind of forage with the number and kind of domestic animals grazed and/or wildlife resident on the range. Most efficient use of diverse plant components on the range is accomplished by combinations of livestock to utilize the broadest spectrum possible of the vegetation (Savory and Parson 1980, Taylor 1981). In some instances, one type of animal in a combination can suppress as well as effectively utilize those plants which are a problem in single stocking programs. If the livestock enterprise is diversified to include more than one kind of livestock, such as a combination of cattle, sheep and goats, drought risk is lowered as animals will draw on a larger segment of total range vegetation. It may also mean that one or more kinds of animals can be kept on the ranch to produce income while another kind is necessarily marketed.

Diversity of vegetation and of the animals that use this vegetation is a significant factor in reducing

drought impact. For example, during droughts the forb component may be dramatically reduced and, under severe conditions, even grasses may not green up, leaving deep-rooted woody plants as the primary source of nutritious forage. Not having the right animals to take advantage of woody plants, however, limits the advantage of having this forage component. Independent studies in South Texas on the use of brush by cattle indicate that cattle will significantly increase use of woody plants only after herbaceous forage supply has dropped to less than 1000 pounds per acre in most seasons (Mastel 1987, Hanson 1987). Normal use of brush when herbaceous material was not limited was about 10% or less. As the levels of woody plant use increased to about 15-20% of diet due to limited herbage, cattle condition began to decline and stress became obvious. The high lignin content of browse reduced rate of passage and simply did not allow the cattle to ingest enough nutrients to supply minimum requirements. Brush has value to grazing animals, even cattle, if they are able to use it by selection when there is adequate herbaceous forage present on the range.

The balance between forage supply and livestock demand, or stocking rate, is the single most important factor in grazing management. Stocking rate expresses the land area allotted to an animal unit for the duration of the stocking period in order to supply the forage requirement for satisfactory levels of animal production without range condition degradation. Satisfactory animal production includes such things as conception rate, and costs, such as variable costs to keep the cow (ewe, nanny). As drought depresses forage supplies below the expectation based on current stocking rate, the number of animals must be reduced to regain balance with forage availability or supplemental feed provided if target production levels are to be maintained. Reducing stocking rate can be very traumatic, particularly if good breeding females must go to market and bring a fraction of their value.

A nucleus cow herd provides stability, but a portion of ranch carrying capacity should be devoted to "resale animals". The appropriate proportion will vary between ranches, but a 60-40 or even a 50-50 ratio of brood animals to those that can be moved quickly on or off the ranch as forage conditions dictate would be a reasonable balance. Steers are commonly used as stockers, however, heifers certainly provide another option (Holloway 1985). They can be sold as slaughter animals, open, bred or calved out and sold as pairs. This gives a great deal of flexibility in opportunities to keep or sell in relation to forage resources, as well as marketing advantages. In severe droughts, that part of ranch forage resources that would normally be used for resale animals can usually be made available for breeding herds, thus reducing feed supplement requirements, preserving herd integrity, and reducing risk of forced sale.

Grazing Distribution

Stocking rate is the most important decision in good grazing management, but it is not the only one. Even if stocked correctly for total carrying capacity, a pasture may be very inefficiently used because of poor grazing distribution. When this happens, you lose two ways; areas where livestock overuse forage will decline in range condition and productivity and areas underused by livestock represent valuable forage lost. The primary reason for poor grazing distribution is distance from water sources, but others as topography, heavy brush, prevailing wind, and preference for sites by different kinds of animals are also important. Most of these can be mitigated by improvement practices or management techniques. A significant element of post-drought planning should be to improve grazing distribution.

Match Animal Requirements with Forage Supply

Range management following drought should include a review of the match between range forage and animal demand based on their physiological status. Range forage production varies dramatically over the year in amount produced per unit of time and in nutritive quality. Animal requirements vary

dramatically over their production cycle. It makes sense to try and match the highest nutritional requirements of grazing animals with the periods of greatest nutrient supply from range vegetation. Forage production can be plotted in relation to precipitation and temperature, since they are the most significant influences on range vegetation. A chart such as the following is helpful in identifying critical livestock requirements with forage availability and quality and should influence decisions about herd management, including breeding season and subsequent calving and weaning (Fig. 6).

Alternate Feedstuffs

The bottom line of drought impact as it affects livestock production often relates to the nutritional plane just prior to and during breeding season. Herd productivity in the next calving season can be the single most disastrous effect of drought; that is, reduction in conception rate and subsequent loss of income.

Providing the feed supplements necessary to maintain cow energy levels and insure breed-back may be a very economical investment compared to potential conception rate loss. However, if you are going to buy feed for livestock during drought, be sure that you feed for the right reasons, at the right time and in the right amount to do the job. I like the reference made by a younger rancher to the old timer that told him how to survive a drought - not to borrow money and to sell cattle to pay drought expenses (John Northcut 1985). This is similar to the quotation credited to a banker advising a rancher on drought feeding: "feed your cattle what they need; just be sure that you sell enough cattle to pay for the feed" (Merrill 1985).

Supplemental forage produced on the ranch is often used to offset the impact of reduced standing crop caused by drought and can become an important ranch enterprise. The most common of these feeds is hay, put up in good times to stretch resource productivity through the lean times. Silage is another, though less popular, reserve feed material. Both of these materials capture nutrients within feedstuffs and allow long-term storage without significant loss. The longevity of hay and silage quality depends in large part on management expertise in the culture, harvest, and storage of each crop, and they require large investments in land, equipment, labor, and storage facilities.

It behooves us to give much thought and serious analysis before deciding that an enterprise of producing feedstuffs on the ranch is as economical as purchasing hay and protein supplements. Dependency on annual forage crops, such as warm-season forage sorghum or cool-season small grains, or even perennial grass pastures is risky during drought, because they are also affected by poor growing conditions. Reserve feed that is likely to help the most is what you have in the barn or in a pit for some time period before drought conditions prevail - as a result of strategic planning.

Equity Position

Survival during droughts may well depend upon cash equity position. We have probably all known ranchers that were able to make it through rough times better than others because they had good cash reserves on hand. Among the better managers, this is no accident. Providing for financial reserves to handle drought-related expenses when they occur should be part of any strategic ranch plan in the southwest. It is not a question of whether or not we will need such funds, it is only a question of when. As long as they are drawing interest, let them grow and be glad they are there when you need them. Some people find other ways to make it through drought. I can't help but think of the fellow that said, "You know my wife has always had to work for us to keep this place, but with this drought she is going to have to find a second job."

Alternate Income Sources

Almost all ranch related activities are affected by drought, but some more than others. For example, income generated from wildlife or ecotourism may be less influenced by reduced forage production associated with droughts than livestock income. However, waiting until drought comes may be too late to increase income from wildlife operations or other alternate income source if it is not already in place and functioning. We also have a tendency to think about the traditional income producing wildlife enterprises, such as deer, turkey and quail, but there are significant others, such as feral hogs, javelina, doves, and one that is apparently catching on, trophy fishing.

I like to use the example of a friend that cuts firewood from oak stands on the ranch to sell to backhaul truckers. One year he cut 950 cords from the same pasture and estimated he had cut only about 10% of the total oak available. The cut oak promotes sprouting from the base that becomes accessible, palatable browse for livestock and wildlife and that is more dependable than the herbaceous component in very dry times.

Stabilizing income through drought periods may also require that a greater portion of available capital be invested in off-ranch, non-agricultural investments. For example, the interest on a CD is paid whether it rains or not.

Don't forget Wildlife

We often spend time and effort concerned about the nutritional status of wildlife when times get tough. Water is the most important of all nutrients. An animal can lose almost all of its fat and half of its body protein and survive, but a loss of as little as one-tenth of the body's water will result in death. Water for the various bodily processes can come from three sources: free, preformed or bound, and oxidative or metabolic. Free water is contained in ponds, streams, etc. Preformed water is contained within plants (Brown 1985). Metabolic water is formed upon the oxidation of proteins, carbohydrates and fats within the body for energy. Wildlife species tend to be better at adapting to their environment than do domestic animals. Some animals, such as pronghorn antelope, can survive without free water when forbs are lush and plentiful. Mule deer and bighorn sheep have an estimated consumption of three to six quarts of water per day of free water. White-tailed deer seem to have about the same requirement. It is not clear if deer can survive without any free water during lush forb growth. Collared peccary have no need for free water because of their use of high quantities of cactus that is >75% water. In drier climates they may require about 1.25 liters per day and will die if they lose 17% of their body water.

Free water is essential for wild turkeys during the warmer months. Most flocks range with a mile of water and hens often nest within a half mile of water. Water may be crucial for the survival of poult during hot, dry periods. Bobwhite quail get a lot of water from the foods they eat in years with at least 16 inches of rain. What happens in drought years when green plants, insects and berries are scarce? Laying hens have high water requirements which makes up 70% of an egg. If laying hens are deprived of water for one day, egg production stops temporarily and remains low for six to eight weeks. In dry springs, hens must have access to surface water if they are going to be productive. Although it won't be needed every year, water availability may increase productivity and survival during droughts. A water hole per 300 acres may be a minimum need (Guthery 1985). Guthery measured a high bobwhite density with a watering source per 100 acres in a fairly dry year. Density of waterers probably need not exceed this figure.

The bottom line for wildlife as you plan for the next drought is to improve the density and distribution, as well as the reliability, of water points.

Contingency Planning

A wise rancher I know repeats to himself the saying "It is our responsibility to be successful under conditions as we find them (instead of what we wish they were)." Ranch plans need to be flexible enough to adjust for changing circumstances on a continuous basis. The components of range, livestock, market, and money management are interrelated and almost inseparable. Is your plan one that can accommodate changes from "normal" conditions, such as drought? In many parts of Texas, as much as two-third to three-fourths of the total annual forage is produced by June 30. At that time you can foresee what changes should be made immediately or by fall. Timely recognition and action to make needed stocking rate adjustments protects both forage and livestock performance, preserves flexibility and avoids forced sales on distressed markets. Timely stocking rate adjustments in small increments spread marketing opportunities and risks and maintain steadier numbers and cash flow, as opposed to massive selloff or expensive relocation.

Example drought plan statements could include (Merz 1985):

1. Ranch is stocked at 25% below average forage production on good condition range. Only during extended dry periods are adjustments necessary. However, forage will be evaluated during July and adjustments made at shipping time on October 1. When adjustments are initiated, priorities will be as follows for increasing drought severity; a) cull heifers, b) sell 10% of breeding herd, c) feed stored hay, d) move top 50% of registered breeding herd to alternate feed, and e) liquidate herd.
2. If at least 5 inches of rain is not received by June 1, plan will be initiated to cull bottom 15% of herd. If short duration system begins to cycle too fast because of dry weather (less forage), plan will continue to cull stock to get cycling back into line with dates on the grazing plan. Five inches of rain by June 1 is 25% below normal for this time of year based on average annual rainfall.
3. Continuously evaluate forage and moisture conditions. In October, standing hay and Texas wintergrass will be inventoried as to AUM of forage. Livestock will be adjusted, as needed, so that forage will not be overused by beginning of growing season in April.

Management

Walt Richburg of The Uvalde Bank always "tells it like it is" when talking to producers about their financial management. Walt stresses MANAGEMENT as the single most important factor in surviving drought and his admonishments make sense for post-drought management strategy. He strongly recommends building equity position. The good manager will be just a conscientious in the easy times as in the hard times (Richburg 1985). He is putting aside a reserve rather than spending all he makes (this must reflect on the biblical story of Joseph and how he prepared for drought by storing surplus during the seven good years which allowed him to survive and prosper during the seven lean years.) Walt also stresses cutting costs - there is always another way to cut costs. During droughts when we are in a survival mode pull the belt up several more notches. Get serious about business management. When the next drought comes and you want or need financial assistance, have a current financial statement, profit and loss statement, projection and production records to back them up. Even if these records paint less than a rosy picture, the fact that you have them, know how to develop them and are aware of what they say is a plus in dealing with bankers.

New Models May Help Decisions

The Ranching Systems Group at Texas A&M University is testing a climate and hydrology-based model called PHYGROW for simulating daily plant growth on rangeland. It can be used to predict peak standing crop herbage yields from plant growth parameters, climatic data records and hydrologic information. PHYGROW can utilize current climatic data to simulate ongoing processes or long-term

weather records to simulate runoff and herbage production under a range of climatic conditions and management practices. When the model becomes available, it should help ranchers with early stocking decisions based on predicted changes in forage availability.

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Grazing Management During and After Extended Drought

From "Beef: Questions & Answers" newsletter*

by Dr. Jeff Mosley, Extension Range Management Specialist, Department of Animal & Range Sciences, Montana State University, Bozeman

To me, drought and taxes have a lot in common: they're both facts of life that must be dealt with periodically; they're both royal pains in the rear; and they both carry serious consequences if we choose to ignore them.

Most ranch businesses can readily adjust to one or two dry years in a row, and I don't believe that short-term drought necessitates major changes to most ranch grazing plans. However, three or more successive dry years challenge even the best graziers, and unfortunately, many range livestock producers across our state now face this situation. Besides the immediate concerns about how to feed the livestock, serious drought also stresses the land, often to the brink of change.

Years can pass without much apparent change to seeded pastures and rangelands, but extended drought can cause dramatic shifts in vegetation. The land then remains relatively unchanged until the next environmental trigger occurs. Drought conditions over the last three or four years have created an environmental trigger for Montana's pastureland and rangeland, and failure to care for the land during this year may create serious consequences for decades to come.

Assess Drought Impact

How much of an adjustment is needed to your ranch grazing plan for Spring and Summer 2001? The answer depends, of course, upon how hard you've been hit by drought. The drought has not impacted everyone to the same extent, and even pastures or portions of pastures within one ranch have not been affected equally. Consider these questions to assess drought's impact:

Were weeds a problem before the drought? If weeds were a problem before the drought, they'll probably be even worse after drought. Drought stresses all plants, but weeds are usually stressed less than desirable forage plants because most weeds grow earlier in the growing season before soil moisture is fully depleted. Also, weeds are usually grazed less than other plants. When rainfall does occur, weeds are in better shape to respond and they get a jump-start on the desirable plants. Producers need to be especially vigilant about new weed infestations if they brought in hay from new sources this past fall and winter. Inspect areas where the hay was fed and plan to control new infestations this summer - before weeds get well established and before weed control becomes more costly.

Were poisonous plants common before the drought? Poisonous plant problems often worsen during or after an extended drought, especially early in the growing season. Many poisonous plants are "weeds" that survive drought better than desirable forage plants, and many poisonous plants green up early in the season (e.g., low larkspur, death camas, and locoweed). Poisonous plant infestations tend to thicken after serious drought, but toxicity problems can be more common after drought even when poisonous plants don't increase in density. One reason for increased toxicity



Early planning will enable you to carefully consider potential alternatives for your grazing plan this summer.



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problems is that after a dry year there is less (if any) residual carry-over forage from the year before to buffer the toxins. Thus, dietary concentrations can reach toxic levels even when livestock don't increase their consumption of poisonous plants. A related concern for this spring is [grass tetany](#). Without last year's residual carry-over grass to buffer the new green growth in the gut, grass tetany becomes more likely and strategic supplementation will be warranted.

When was the area grazed last year? One silver lining about drought years is that much more of the grazing season usually occurs after seeds ripen and when plants are dormant. Plants are more tolerant of grazing during these later stages of plant development, so some plants may have endured less stress from grazing than in normal years. The plants stressed most by last year's drought were those grazed in early summer, because they were unable to regrow before soil moisture was depleted.

How heavily was the area grazed last year and in previous years? Light or moderate grazing doesn't harm most plants, nor does heavy (< 60% utilization) or severe use in one year if the plants are given an opportunity to recover. Plants are stressed when heavy or severe use occurs for two or more years in a row. When drought breaks, plants grazed lightly to moderately in the past will recover from drought faster than plants that have been heavily grazed for many years.

Do plants appear stressed this spring? Stressed plants begin growth later and grow slower in spring, and most plants will be stressed after three or four drought years. Consequently, turnout in spring will likely need to be later this year in many areas across our state. The rooting depth of your forage plants and the length of drought in your area can help you judge how long plant growth will be delayed this spring. After one or two dry years, growth usually begins earlier in deep-rooted versus shallow-rooted plants because deep-rooted plants had access to more soil water and were less stressed. After an extended drought, however, deep-rooted plants may rebound slower because they remained green longer into the growing season and probably received extra grazing pressure during drought.

Grazing Strategies

Early planning will enable you to carefully consider potential alternatives for your grazing plan this summer. Waiting to plan until June or July will leave fewer options available. Some potential options include:

Reduce the Amount of Forage Needed

- Cull more heavily before the grazing season begins and before the market becomes glutted. Reduce the number of replacements, if possible. Mature cows will survive and reproduce better than young cows or heifers that are still growing.
- Wean calves early. Dry cows consume about 35% less forage than lactating cows and 400-lb calves consume about one-third as much as mature cows.

Graze Somewhere Else

- Lease additional pasture.
- Use tame pastures, especially subirrigated or irrigated ones, more heavily than usual. The improved forage species can tolerate heavy grazing more so than native rangeland, so allocate more of the load to those pastures that can tolerate it best.
- Try to graze areas this year that didn't get much or any grazing use last year. For

example, consider areas near reservoirs and springs that went dry last year. These areas may have been grazed less than in a normal year when water is available. Herding, supplemental feeding, hauling or piping water, temporary fencing or shutting off water in over-used areas can all be used to control where livestock graze. Be sure to carefully evaluate the costs and benefits of these practices versus the costs and benefits of reducing livestock numbers.

Adjust the Timing of Grazing

- Delay turnout in spring so that forage plants can recover vigor. Delayed turnout will also lessen problems with poisonous plants and grass tetany.
- In rotational grazing systems, rotate more frequently.
- Consider using any rested pastures and thereby spreading the use this year across all of your pastures.
- For early season grazing this year, try to graze any areas that were ungrazed last year or those areas that were grazed after plant dormancy during last summer's drought.
- For late season grazing this year, try to use those areas that were grazed heavily last year before plant dormancy.

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Each issue of Beef: Questions & Answers this year will include a profile of ranch operations around Montana.

* Beef: Questions & Answers is a joint project between MSU Extension and the Montana Beef Council. This column informs producers about current consumer education, promotion and research projects funded through the \$1 per head checkoff. For more information, contact the Montana Beef Council at (406) 442-5111 or at beefcncl@mt.net

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Established: AB 797, Klehs, 1983

Amended: AB 2661, Klehs, 1990

AB 11X, Filante, 1991

AB 1869, Speier, 1991

AB 892, Frazee, 1993

SB 1017, McCorquodale, 1994

AB 2853, Cortese, 1994

AB 1845, Cortese, 1995

SB 1011, Polanco, 1995

AB 2552, Bates, 2000

SB 553, Kelley, 2000

SB 610, Costa, 2001

AB 901, Daucher, 2001

SB 672, Machado, 2001

SB 1348, Brulte, 2002

SB 1384 Costa, 2002

SB 1518 Torlakson, 2002

CALIFORNIA WATER CODE DIVISION 6 PART 2.6. URBAN WATER MANAGEMENT PLANNING

CHAPTER 1. GENERAL DECLARATION AND POLICY

10610. This part shall be known and may be cited as the "Urban Water Management Planning Act."

10610.2. (a) The Legislature finds and declares all of the following:

- (1) The waters of the state are a limited and renewable resource subject to ever-increasing demands.
- (2) The conservation and efficient use of urban water supplies are of statewide concern; however, the planning for that use and the implementation of those plans can best be accomplished at the local level.
- (3) A long-term, reliable supply of water is essential to protect the productivity of California's businesses and economic climate.
- (4) As part of its long-range planning activities, every urban water supplier should make every effort to ensure the appropriate level of reliability in its water service sufficient to meet the needs of its various categories of customers during normal, dry, and multiple dry water years.

- (5) Public health issues have been raised over a number of contaminants that have been identified in certain local and imported water supplies.
- (6) Implementing effective water management strategies, including groundwater storage projects and recycled water projects, may require specific water quality and salinity targets for meeting groundwater basins water quality objectives and promoting beneficial use of recycled water.
- (7) Water quality regulations are becoming an increasingly important factor in water agencies' selection of raw water sources, treatment alternatives, and modifications to existing treatment facilities.
- (8) Changes in drinking water quality standards may also impact the usefulness of water supplies and may ultimately impact supply reliability.
- (9) The quality of source supplies can have a significant impact on water management strategies and supply reliability.

(b) This part is intended to provide assistance to water agencies in carrying out their long-term resource planning responsibilities to ensure adequate water supplies to meet existing and future demands for water.

10610.4. The Legislature finds and declares that it is the policy of the state as follows:

- (a) The management of urban water demands and efficient use of water shall be actively pursued to protect both the people of the state and their water resources.
- (b) The management of urban water demands and efficient use of urban water supplies shall be a guiding criterion in public decisions.
- (c) Urban water suppliers shall be required to develop water management plans to actively pursue the efficient use of available supplies.

CHAPTER 2. DEFINITIONS

10611. Unless the context otherwise requires, the definitions of this chapter govern the construction of this part.

10611.5. "Demand management" means those water conservation measures, programs, and incentives that prevent the waste of water and promote the reasonable and efficient use and reuse of available supplies.

10612. "Customer" means a purchaser of water from a water supplier who uses the water for municipal purposes, including residential, commercial, governmental, and industrial uses.

10613. "Efficient use" means those management measures that result in the most effective use of water so as to prevent its waste or unreasonable use or unreasonable method of use.

10614. "Person" means any individual, firm, association, organization, partnership, business, trust, corporation, company, public agency, or any agency of such an entity.

10615. "Plan" means an urban water management plan prepared pursuant to this part. A plan shall describe and evaluate sources of supply, reasonable and practical efficient uses, reclamation and demand management activities. The components of the plan may vary according to an individual community or area's characteristics and its capabilities to efficiently use and conserve water. The plan shall address measures for residential, commercial, governmental, and industrial water demand management as set forth in Article 2 (commencing with Section 10630) of Chapter 3. In addition, a strategy and time schedule for implementation shall be included in the plan.

10616. "Public agency" means any board, commission, county, city and county, city, regional agency, district, or other public entity.

10616.5. "Recycled water" means the reclamation and reuse of wastewater for beneficial use.

10617. "Urban water supplier" means a supplier, either publicly or privately owned, providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually. An urban water supplier includes a supplier or contractor for water, regardless of the basis of right, which distributes or sells for ultimate resale to customers. This part applies only to water supplied from public water systems subject to Chapter 4 (commencing with Section 116275) of Part 12 of Division 104 of the Health and Safety Code.

CHAPTER 3. URBAN WATER MANAGEMENT PLANS

Article 1. General Provisions

10620.

- (a) Every urban water supplier shall prepare and adopt an urban water management plan in the manner set forth in Article 3 (commencing with Section 10640).
- (b) Every person that becomes an urban water supplier shall adopt an urban water management plan within one year after it has become an urban water supplier.

- (c) An urban water supplier indirectly providing water shall not include planning elements in its water management plan as provided in Article 2 (commencing with Section 10630) that would be applicable to urban water suppliers or public agencies directly providing water, or to their customers, without the consent of those suppliers or public agencies.
- (d)
 - (1) An urban water supplier may satisfy the requirements of this part by participation in areawide, regional, watershed, or basinwide urban water management planning where those plans will reduce preparation costs and contribute to the achievement of conservation and efficient water use.
 - (2) Each urban water supplier shall coordinate the preparation of its plan with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies, and relevant public agencies, to the extent practicable.
- (e) The urban water supplier may prepare the plan with its own staff, by contract, or in cooperation with other governmental agencies.
- (f) An urban water supplier shall describe in the plan water management tools and options used by that entity that will maximize resources and minimize the need to import water from other regions.

10621.

- (a) Each urban water supplier shall update its plan at least once every five years on or before December 31, in years ending in five and zero.
- (b) Every urban water supplier required to prepare a plan pursuant to this part shall notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan. The urban water supplier may consult with, and obtain comments from, any city or county that receives notice pursuant to this subdivision.
- (c) The amendments to, or changes in, the plan shall be adopted and filed in the manner set forth in Article 3 (commencing with Section 10640).

Article 2. Contents of Plans

10630. It is the intention of the Legislature, in enacting this part, to permit levels of water management planning commensurate with the numbers of customers served and the volume of water supplied.

10631. A plan shall be adopted in accordance with this chapter and shall do all of the following:

- (a) Describe the service area of the supplier, including current and projected population, climate, and other demographic factors affecting the supplier's water management planning. The projected population estimates shall be based upon data from the state, regional, or local service agency population projections within the service area of the urban water supplier and shall be in five-year increments to 20 years or as far as data is available.
- (b) Identify and quantify, to the extent practicable, the existing and planned sources of water available to the supplier over the same five-year increments described in subdivision (a). If groundwater is identified as an existing or planned source of water available to the supplier, all of the following information shall be included in the plan:
 - (1) A copy of any groundwater management plan adopted by the urban water supplier, including plans adopted pursuant to Part 2.75 (commencing with Section 10750), or any other specific authorization for groundwater management.
 - (2) A description of any groundwater basin or basins from which the urban water supplier pumps groundwater. For those basins for which a court or the board has adjudicated the rights to pump groundwater, a copy of the order or decree adopted by the court or the board and a description of the amount of groundwater the urban water supplier has the legal right to pump under the order or decree.

For basins that have not been adjudicated, information as to whether the department has identified the basin or basins as overdrafted or has projected that the basin will become overdrafted if present management conditions continue, in the most current official departmental bulletin that characterizes the condition of the groundwater basin, and a detailed description of the efforts being undertaken by the urban water supplier to eliminate the long-term overdraft condition.
 - (3) A detailed description and analysis of the location, amount, and sufficiency of groundwater pumped by the urban water supplier for the past five years. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.
 - (4) A detailed description and analysis of the amount and location of groundwater that is projected to be pumped by the urban water supplier. The description and analysis shall be based on information

that is reasonably available, including, but not limited to, historic use records.

- (c) Describe the reliability of the water supply and vulnerability to seasonal or climatic shortage, to the extent practicable, and provide data for each of the following:

- (1) An average water year.
- (2) A single dry water year.
- (3) Multiple dry water years.

For any water source that may not be available at a consistent level of use, given specific legal, environmental, water quality, or climatic factors, describe plans to supplement or replace that source with alternative sources or water demand management measures, to the extent practicable.

- (d) Describe the opportunities for exchanges or transfers of water on a short-term or long-term basis.

(e)

- (1) Quantify, to the extent records are available, past and current water use, over the same five-year increments described in subdivision (a), and projected water use, identifying the uses among water use sectors including, but not necessarily limited to, all of the following uses:

- (A) Single-family residential.
- (B) Multifamily.
- (C) Commercial.
- (D) Industrial.
- (E) Institutional and governmental.
- (F) Landscape.
- (G) Sales to other agencies.
- (H) Saline water intrusion barriers, groundwater recharge, or conjunctive use, or any combination thereof.
- (I) Agricultural.

- (2) The water use projections shall be in the same five-year increments described in subdivision (a).

- (f) Provide a description of the supplier's water demand management measures. This description shall include all of the following:

- (1) A description of each water demand management measure that is currently being implemented, or scheduled for implementation,

including the steps necessary to implement any proposed measures, including, but not limited to, all of the following:

- (A) Water survey programs for single-family residential and multifamily residential customers.
 - (B) Residential plumbing retrofit.
 - (C) System water audits, leak detection, and repair.
 - (D) Metering with commodity rates for all new connections and retrofit of existing connections.
 - (E) Large landscape conservation programs and incentives.
 - (F) High-efficiency washing machine rebate programs.
 - (G) Public information programs.
 - (H) School education programs.
 - (I) Conservation programs for commercial, industrial, and institutional accounts.
 - (J) Wholesale agency programs.
 - (K) Conservation pricing.
 - (L) Water conservation coordinator.
 - (M) Water waste prohibition.
 - (N) Residential ultra-low-flush toilet replacement programs.
- (2) A schedule of implementation for all water demand management measures proposed or described in the plan.
 - (3) A description of the methods, if any, that the supplier will use to evaluate the effectiveness of water demand management measures implemented or described under the plan.
 - (4) An estimate, if available, of existing conservation savings on water use within the supplier's service area, and the effect of the savings on the supplier's ability to further reduce demand.

- (g) An evaluation of each water demand management measure listed in paragraph (1) of subdivision (f) that is not currently being implemented or scheduled for implementation. In the course of the evaluation, first consideration shall be given to water demand management measures, or combination of measures, that offer lower incremental costs than expanded or additional water supplies. This evaluation shall do all of the following:
 - (1) Take into account economic and noneconomic factors, including environmental, social, health, customer impact, and technological factors.
 - (2) Include a cost-benefit analysis, identifying total benefits and total costs.
 - (3) Include a description of funding available to implement any planned water supply project that would provide water at a higher unit cost.
 - (4) Include a description of the water supplier's legal authority to implement the measure and efforts to work with other relevant agencies to ensure the implementation of the measure and to share the cost of implementation.
- (h) Include a description of all water supply projects and water supply programs that may be undertaken by the urban water supplier to meet the total projected water use as established pursuant to subdivision (a) of Section 10635. The urban water supplier shall include a detailed description of expected future projects and programs, other than the demand management programs identified pursuant to paragraph (1) of subdivision (f), that the urban water supplier may implement to increase the amount of the water supply available to the urban water supplier in average, single-dry, and multiple-dry water years. The description shall identify specific projects and include a description of the increase in water supply that is expected to be available from each project. The description shall include an estimate with regard to the implementation timeline for each project or program.
- (i) Urban water suppliers that are members of the California Urban Water Conservation Council and submit annual reports to that council in accordance with the "Memorandum of Understanding Regarding Urban Water Conservation in California," dated September 1991, may submit the annual reports identifying water demand management measures currently being implemented, or scheduled for implementation, to satisfy the requirements of subdivisions (f) and (g).
- (j) Urban water suppliers that rely upon a wholesale agency for a source of water, shall provide the wholesale agency with water use projections from

that agency for that source of water in five-year increments to 20 years or as far as data is available. The wholesale agency shall provide information to the urban water supplier for inclusion in the urban water supplier's plan that identifies and quantifies, to the extent practicable, the existing and planned sources of water as required by subdivision (b), available from the wholesale agency to the urban water supplier over the same five-year increments, and during various water-year types in accordance with subdivision (c). An urban water supplier may rely upon water supply information provided by the wholesale agency in fulfilling the plan informational requirements of subdivisions (b) and (c).

10631.5. The department shall take into consideration whether the urban water supplier is implementing or scheduled for implementation, the water demand management activities that the urban water supplier identified in its urban water management plan, pursuant to Section 10631, in evaluating applications for grants and loans made available pursuant to Section 79163. The urban water supplier may submit to the department copies of its annual reports and other relevant documents to assist the department in determining whether the urban water supplier is implementing or scheduling the implementation of water demand management activities.

10632. The plan shall provide an urban water shortage contingency analysis which includes each of the following elements which are within the authority of the urban water supplier:

- (a) Stages of action to be undertaken by the urban water supplier in response to water supply shortages, including up to a 50 percent reduction in water supply, and an outline of specific water supply conditions which are applicable to each stage.
- (b) An estimate of the minimum water supply available during each of the next three water years based on the driest three-year historic sequence for the agency's water supply.
- (c) Actions to be undertaken by the urban water supplier to prepare for, and implement during, a catastrophic interruption of water supplies including, but not limited to, a regional power outage, an earthquake, or other disaster.
- (d) Additional, mandatory prohibitions against specific water use practices during water shortages, including, but not limited to, prohibiting the use of potable water for street cleaning.
- (e) Consumption reduction methods in the most restrictive stages. Each urban water supplier may use any type of consumption reduction methods in its water shortage contingency analysis that would reduce water use, are

appropriate for its area, and have the ability to achieve a water use reduction consistent with up to a 50 percent reduction in water supply.

- (f) Penalties or charges for excessive use, where applicable.
- (g) An analysis of the impacts of each of the actions and conditions described in subdivisions (a) to (f), inclusive, on the revenues and expenditures of the urban water supplier, and proposed measures to overcome those impacts, such as the development of reserves and rate adjustments.
- (h) A draft water shortage contingency resolution or ordinance.
- (i) A mechanism for determining actual reductions in water use pursuant to the urban water shortage contingency analysis.

10633. The plan shall provide, to the extent available, information on recycled water and its potential for use as a water source in the service area of the urban water supplier. The preparation of the plan shall be coordinated with local water, wastewater, groundwater, and planning agencies that operate within the supplier's service area, and shall include all of the following:

- (a) A description of the wastewater collection and treatment systems in the supplier's service area, including a quantification of the amount of wastewater collected and treated and the methods of wastewater disposal.
- (b) A description of the recycled water currently being used in the supplier's service area, including, but not limited to, the type, place, and quantity of use.
- (c) A description and quantification of the potential uses of recycled water, including, but not limited to, agricultural irrigation, landscape irrigation, wildlife habitat enhancement, wetlands, industrial reuse, groundwater recharge, and other appropriate uses, and a determination with regard to the technical and economic feasibility of serving those uses.
- (d) The projected use of recycled water within the supplier's service area at the end of 5, 10, 15, and 20 years, and a description of the actual use of recycled water in comparison to uses previously projected pursuant to this subdivision.
- (e) A description of actions, including financial incentives, which may be taken to encourage the use of recycled water, and the projected results of these actions in terms of acre-feet of recycled water used per year.
- (f) A plan for optimizing the use of recycled water in the supplier's service area, including actions to facilitate the installation of dual distribution

systems, to promote recirculating uses, to facilitate the increased use of treated wastewater that meets recycled water standards, and to overcome any obstacles to achieving that increased use.

10634. The plan shall include information, to the extent practicable, relating to the quality of existing sources of water available to the supplier over the same five-year increments as described in subdivision (a) of Section 10631, and the manner in which water quality affects water management strategies and supply reliability.

Article 2.5 Water Service Reliability

10635.

- (a) Every urban water supplier shall include, as part of its urban water management plan, an assessment of the reliability of its water service to its customers during normal, dry, and multiple dry water years. This water supply and demand assessment shall compare the total water supply sources available to the water supplier with the total projected water use over the next 20 years, in five-year increments, for a normal water year, a single dry water year, and multiple dry water years. The water service reliability assessment shall be based upon the information compiled pursuant to Section 10631, including available data from state, regional, or local agency population projections within the service area of the urban water supplier.
- (b) The urban water supplier shall provide that portion of its urban water management plan prepared pursuant to this article to any city or county within which it provides water supplies no later than 60 days after the submission of its urban water management plan.
- (c) Nothing in this article is intended to create a right or entitlement to water service or any specific level of water service.
- (d) Nothing in this article is intended to change existing law concerning an urban water supplier's obligation to provide water service to its existing customers or to any potential future customers.

Articl 3. Adoption and Implementation of Plans

10640. Every urban water supplier required to prepare a plan pursuant to this part shall prepare its plan pursuant to Article 2 (commencing with Section 10630).

The supplier shall likewise periodically review the plan as required by Section 10621, and any amendments or changes required as a result of that review shall be adopted pursuant to this article.

10641. An urban water supplier required to prepare a plan may consult with, and obtain comments from, any public agency or state agency or any person who has special expertise with respect to water demand management methods and techniques.

10642. Each urban water supplier shall encourage the active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of the plan. Prior to adopting a plan, the urban water supplier shall make the plan available for public inspection and shall hold a public hearing thereon. Prior to the hearing, notice of the time and place of hearing shall be published within the jurisdiction of the publicly owned water supplier pursuant to Section 6066 of the Government Code. The urban water supplier shall provide notice of the time and place of hearing to any city or county within which the supplier provides water supplies. A privately owned water supplier shall provide an equivalent notice within its service area. After the hearing, the plan shall be adopted as prepared or as modified after the hearing.

10643. An urban water supplier shall implement its plan adopted pursuant to this chapter in accordance with the schedule set forth in its plan.

10644.

- (a) An urban water supplier shall file with the department and any city or county within which the supplier provides water supplies a copy of its plan no later than 30 days after adoption. Copies of amendments or changes to the plans shall be filed with the department and any city or county within which the supplier provides water supplies within 30 days after adoption.
- (b) The department shall prepare and submit to the Legislature, on or before December 31, in the years ending in six and one, a report summarizing the status of the plans adopted pursuant to this part. The report prepared by the department shall identify the outstanding elements of the individual plans. The department shall provide a copy of the report to each urban water supplier that has filed its plan with the department. The department shall also prepare reports and provide data for any legislative hearings designed to consider the effectiveness of plans submitted pursuant to this part.

10645. Not later than 30 days after filing a copy of its plan with the department, the urban water supplier and the department shall make the plan available for public review during normal business hours.

CHAPTER 4. MISCELLANEOUS PROVISIONS

10650. Any actions or proceedings to attack, review, set aside, void, or annul the acts or decisions of an urban water supplier on the grounds of noncompliance with this part shall be commenced as follows:

- (a) An action or proceeding alleging failure to adopt a plan shall be commenced within 18 months after that adoption is required by this part.
- (b) Any action or proceeding alleging that a plan, or action taken pursuant to the plan, does not comply with this part shall be commenced within 90 days after filing of the plan or amendment thereto pursuant to Section 10644 or the taking of that action.

10651. In any action or proceeding to attack, review, set aside, void, or annul a plan, or an action taken pursuant to the plan by an urban water supplier on the grounds of noncompliance with this part, the inquiry shall extend only to whether there was a prejudicial abuse of discretion. Abuse of discretion is established if the supplier has not proceeded in a manner required by law or if the action by the water supplier is not supported by substantial evidence.

10652. The California Environmental Quality Act (Division 13 (commencing with Section 21000) of the Public Resources Code) does not apply to the preparation and adoption of plans pursuant to this part or to the implementation of actions taken pursuant to Section 10632. Nothing in this part shall be interpreted as exempting from the California Environmental Quality Act any project that would significantly affect water supplies for fish and wildlife, or any project for implementation of the plan, other than projects implementing Section 10632, or any project for expanded or additional water supplies.

10653. The adoption of a plan shall satisfy any requirements of state law, regulation, or order, including those of the State Water Resources Control Board and the Public Utilities Commission, for the preparation of water management plans or conservation plans; provided, that if the State Water Resources Control Board or the Public Utilities Commission requires additional information concerning water conservation to implement its existing authority, nothing in this part shall be deemed to limit the board or the commission in obtaining that information. The requirements of this part shall be satisfied by any urban water demand management plan prepared to meet federal laws or regulations after the effective date of this part, and which substantially meets the requirements of this part, or by any existing urban water management plan which includes the contents of a plan required under this part.

10654. An urban water supplier may recover in its rates the costs incurred in preparing its plan and implementing the reasonable water conservation measures included in the plan. Any best water management practice that is included in the plan that is identified in the "Memorandum of Understanding Regarding Urban Water Conservation in California" is deemed to be reasonable for the purposes of this section.

10655. If any provision of this part or the application thereof to any person or circumstances is held invalid, that invalidity shall not affect other provisions or

applications of this part which can be given effect without the invalid provision or application thereof, and to this end the provisions of this part are severable.

10656. An urban water supplier that does not prepare, adopt, and submit its urban water management plan to the department in accordance with this part, is ineligible to receive funding pursuant to Division 24 (commencing with Section 78500) or Division 26 (commencing with Section 79000), or receive drought assistance from the state until the urban water management plan is submitted pursuant to this article.

10657.

- (a) The department shall take into consideration whether the urban water supplier has submitted an updated urban water management plan that is consistent with Section 10631, as amended by the act that adds this section, in determining whether the urban water supplier is eligible for funds made available pursuant to any program administered by the department.
- (b) This section shall remain in effect only until January 1, 2006, and as of that date is repealed, unless a later enacted statute, that is enacted before January 1, 2006, deletes or extends that date.

Supplemental Water Supplies

To offset future potential water shortages due to drought or disaster, the City is considering the following supplemental water supplies.

Desalination

NACWA has commissioned a study on whether to construct a seawater desalination plant. The City is participating in the discussion and analysis to determine if desalination would be cost-effective for drought water shortage mitigation and/or as an emergency water supply. Preliminary analysis indicates that since desalination remains both expensive and energy intensive, it would probably be cost effective only if the City's other water supplies were greatly reduced or not available at all. Desalinated water would probably only be made available to meet health and safety needs (one would probably not use desalination to wash a car, for instance).

Challenges include that the current water distribution system is not designed for potable water to be input at ocean level, and therefore desalination water would have to be pumped up into the service area. There are a number of potential desalination plant sites, including the proposed tertiary treatment plant site adjacent to the RTP. In the event of a major disaster, electric service could be disrupted, so desalinated water might have to be produced and distributed using diesel power. Achieving all necessary permits, arranging funding and actual construction could be time consuming and would probably take years. Feasibility study results are expected by early 2001.

Water Transfers

See the Transfer or Exchange Opportunities section.

Long Term Additional Water Supply Options

To meet future long-term water demand beyond 2020, the City is participating in two water supply proposals. NACWA is negotiating for additional imported water, via a proposed additional imported water aqueduct or pipeline. Although very expensive, this will help "disaster proof" the imported water system, and may also increase water supply availability.

Drake Reservoir is being evaluated for two storage enhancement options: the first, to raise Drake Dam, could increase the storage capacity from 140,000 acre-feet to 170,000 acre-feet. The second, dredging Drake, is also being evaluated. Both appear to be very expensive.

The following table summarizes the actions the water agency will take during a water supply catastrophe.

Table 14 Preparation Actions for a Catastrophe	
Examples of Actions	Check if Discussed
Determine what constitutes a proclamation of a water shortage.	✓
Stretch existing water storage.	✓
Obtain additional water supplies.	✓
Develop alternative water supplies.	✓
Determine where the funding will come from.	✓
Contact and coordinate with other agencies.	✓
Create an Emergency Response Team/Coordinator.	✓
Create a catastrophe preparedness plan.	✓
Put employees/contractors on-call.	✓
Develop methods to communicate with the public.	✓
Develop methods to prepare for water quality interruptions.	✓

Water Shortage Contingency Ordinance/Resolution

Law

10632. The plan shall provide an urban water shortage contingency analysis which includes each of the following elements which are within the authority of the urban water supplier:

10632 (h) A draft water shortage contingency resolution or ordinance.

City of New Albion Water Shortage Response

As mentioned earlier, the City adopted a "No-Waste" Ordinance in 1983, and based on rationing experience, the City has developed a Resolution to Declare a Water Shortage Emergency. The City adopted a policy in 1991 to implement a Moratorium on New Connections during declared water shortages see Appendix C.

Stages of Action

Law

10632. The plan shall provide an urban water shortage contingency analysis which includes each of the following elements which are within the authority of the urban water supplier:

10632 (a) Stages of action to be undertaken by the urban water supplier in response to water supply shortages, including up to a 50 percent reduction in water supply and an outline of specific water supply conditions which are applicable to each stage.

Rationing Stages and Reduction Goals

The City has developed a four stage rationing plan (see Table 15) to invoke during declared water shortages. The rationing plan includes voluntary and mandatory rationing, depending on the causes, severity, and anticipated duration of the water supply shortage.

Shortage Condition	Stage	Customer Reduction Goal	Type of Rationing Program
Up to 15%	I	15%	Voluntary
15 – 25%	II	25%	Mandatory
25 - 35%	III	35%	Mandatory
35 - 50%	IV	50% or >	Mandatory

Priority by Use

Priorities for use of available potable water during shortages were based on input from the City Emergency Response Team, citizen groups, and legal requirements set forth in the California Water Code, Sections 350-358. Water allocations are established for all customers according to the following ranking system:

- Minimum health and safety allocations for interior residential needs (includes single family, multi-family, hospitals and convalescent facilities, retirement and mobile home communities, and student housing, and fire fighting and public safety)
- Commercial, industrial, institutional/governmental operations (where water is used for manufacturing and for minimum health and safety allocations for employees and visitors), to maintain jobs and economic base of the community (not for landscape uses)
- Permanent agriculture (orchards, vineyards, and other commercial agriculture which would require at least five years to return to production).
- Annual agriculture (floriculture, strawberries, other truck crops)
- Existing landscaping
- New customers, proposed projects without permits when shortage declared.

Note: It is not expected that any potable water supply reductions would result in recycled water shortages. However, this may change in the future, as more customers use recycled water and if the proposed groundwater recharge project is built.

Health and Safety Requirements

Based on commonly accepted estimates of interior residential water use in the United States, Table 16 indicates per capita health and safety water requirements. In Stage I shortages, customers may adjust either interior or outdoor water use (or both), in order to meet the voluntary water reduction goal.

However, under Stage II, Stage III and Stage IV mandatory rationing programs, the City has established a health and safety allotment of 68 gpcd (which translates to 33 HCF per person per year), because that amount of water is sufficient for essential interior water with no habit or plumbing fixture changes. If customers wish to change water use habits or plumbing fixtures, 68 gpcd is sufficient to provide for limited non-essential (i.e. outdoor) uses.

Stage IV mandatory rationing, which is likely to be declared only as the result of a prolonged water shortage or as a result of a disaster, would require that customers make changes in their interior water use habits (for instance, not flushing toilets unless “necessary” or taking less frequent showers).

	Non-Conserving Fixtures		Habit Changes 1		Conserving Fixtures 2	
Toilets	5 flushes x 5.5 gpf	27.5	3 flushes x 5.5 gpf	16.5	5 flushes x 1.6 gpf	8.0
Shower	5 min x 4.0 gpm	20.0	4 min x 3.0 gpm	12.0	5 min x 2.0	10.0
Washer	12.5 gpcd	12.5	11.5 gpcd	11.5	11.5 gpcd	11.5
Kitchen	4 gpcd	4.0	4 gpcd	4.0	4 gpcd	4.0
other	4 gpcd	4.0	4 gpcd	4.0	4 gpcd	4.0
Total (gpcd)		68.0		48.0		37.5
HCF per capita per year		33.0		23.0		18.0
1 Reduced shower use results from shorter and reduced flow. Reduced washer use results from fuller loads. 2 Fixtures include ULF 1.6 gpf toilets, 2.0 gpm showerheads and efficient clothes washers.						

Water Shortage Stages and Triggering Mechanisms

As the water purveyor, the City of New Albion must provide the minimum health and safety water needs of the community at all times. The water shortage response is designed to provide a minimum of 50% of normal supply during a severe or extended water shortage. The rationing program triggering levels shown below were established to ensure that this goal is met.

Rationing stages may be triggered by a shortage in one water source or a combination of sources. Although an actual shortage may occur at any time during the year, a shortage (if one occurs) is usually forecasted by the Water Department on or about April 1 each year. If it appears that it may be a dry year, the City contacts its agricultural customers in March, so that they can minimize potential financial impacts.

The City's potable water sources are groundwater, local surface, and imported. Rationing stages may be triggered by a supply shortage or by contamination in one source or a combination of sources. Because shortages overlap Stages, triggers automatically implement the more restrictive Stage. Specific criteria for triggering the City's rationing stages are shown in Table 17.

Table 17				
Water Shortage Stages and Triggering Mechanisms				
Percent Reduction of Supply	Stage I Up to 15%	Stage II 15 - 25%	Stage III 25 - 35%	Stage IV 35 - 50% >
Water Supply Condition				
Current Supply	Total supply is 85 – 90% of “normal.” And Below “normal” year is declared. Or	Total supply is 75 – 85% of “normal.” Or Below “normal” year is declared Or	Total supply is 65 – 75% of “normal.” Or Fourth consecutive below “normal” year is declared. Or	Total supply is less than 65% of “normal.” Or Fifth consecutive below “normal” year is declared. Or
Future Supply	Projected supply insufficient to provide 80% of “normal” deliveries for the next two years. Or	Projected supply insufficient to provide 75% of “normal” deliveries for the next two years. Or	Projected supply insufficient to provide 65% of “normal” deliveries for the next two years. Or	Projected supply insufficient to provide 50% of “normal” deliveries for the next two years. Or
Groundwater	No excess groundwater pumping undertaken. Or	First year of excess groundwater pumping taken, must be “replaced” within four years. Or	Second year of excess groundwater pumping taken, must be “replaced” within four years. Or	No excess groundwater pumping available. Or Reduced groundwater pumping due to replenishment of previously pumped groundwater. Or
Water Quality	Contamination of 10% of water supply (exceeds primary drinking water standards)	Contamination of 20% of water supply (exceeds primary drinking water standards)	Contamination of 30% of water supply (exceeds primary drinking water standards)	Or
Disaster Loss				Disaster Loss

Water Allotment Methods

The City has established the following allocation method for each customer type. See Appendix C for sample water shortage rationing allocation method.

Single Family	Hybrid of Per-capita and Percentage Reduction
Multifamily	Hybrid of Per-capita and Percentage Reduction
Commercial	Percentage Reduction
Industrial	Percentage Reduction
Gvt/Institutional	Percentage Reduction
Agricultural-Permanent	Percentage Reduction - vary by efficiency
Agricultural-Annual	Percentage Reduction - vary by efficiency
Recreational	Percentage Reduction - vary by efficiency
New Customers	Per-capita (no allocation for new landscaping during a declared water shortage.)

Based on current and projected customer demand, Appendix C indicates the water allocated to each customer type by priority and rationing stage during a declared water shortage.

Individual customer allotments are based on a five-year period. This gives the City a more accurate view of the usual water needs of each customer and provides additional flexibility in determining allotments and reviewing appeals. However, no allotment may be greater than the amount used in the most recent year of the five-year base period.

The Water Department Manager shall classify each customer and calculate each customer's allotment according to the Sample Water Rationing Allocation Method. The allotment shall reflect seasonal patterns. Each customer shall be notified of their classification and allotment by mail before the effective date of the Water Shortage Emergency. New customers will be notified at the time the application for service is made. In a disaster, prior notice of allotment may not be possible; notice will be provided by other means. Any customer may appeal the Water Department Manager's classification on the basis of use or the allotment on the basis of incorrect calculation.

Prohibitions, Consumption Reduction Methods and Penalties

Law

10632. The plan shall provide an urban water shortage contingency analysis which includes each of the following elements which are within the authority of the urban water supplier:

10632 (d) Additional, mandatory prohibitions against specific water use practices during water shortages, including, but not limited to, prohibiting the use of potable water for street cleaning.

10632 (e) Consumption reduction methods in the most restrictive stages. Each urban water supplier may use any type of consumption reduction methods in its water shortage contingency analysis that would reduce water use, are appropriate for its area, and have the ability to achieve a water use reduction consistent with up to a 50 percent reduction in water supply.

10632 (f) Penalties or charges for excessive use, where applicable.

Mandatory Prohibitions on Water Wasting

The New Albion "No Waste" Ordinance (see Appendix C) includes prohibitions on various wasteful water uses such as lawn watering during mid-day hours, washing sidewalks and driveways with potable water, and allowing plumbing leaks to go uncorrected more than 24 hours after customer notification.

Examples of Consumption Reduction Methods	Stage When Method Takes Effect
Demand reduction program	All stages
Reduce pressure in water lines	
Flow restriction	IV
Restrict building permits	II, III, IV
Restrict for only priority uses	
Use prohibitions	All stages
Water shortage pricing	All stages
Per capita allotment by customer type	IV
Plumbing fixture replacement	
Voluntary rationing	I
Mandatory rationing	II, III, IV
Incentives to reduce water consumption	
Education Program	All Stages
Percentage reduction by customer type	II, III, IV
Other	
Other	

See Appendix C, the "No Waste" Ordinance and Moratorium on New Connections - which details the reduction methods - regarding Table 18.

Excessive Use Penalties

Any customer violating the regulations and restrictions on water use set forth in the "No Waste" Ordinance shall receive a written warning for the first such violation. Upon a second violation, the customer shall receive a written warning and the district may cause a flow-restrictor to be installed in the service. If a flow-restrictor is placed, the violator shall pay the cost of the installation and removal. Any willful violation occurring subsequent to the issuance of the second written warning shall constitute a misdemeanor and may be referred to the Albion County District Attorney's office for prosecution pursuant. If water service is disconnected, it shall be restored only upon payment of the turn-on charge fixed by the Board of Directors.

Revenue and Expenditure Impacts and Measures to Overcome Impacts

Law

10632. The plan shall provide an urban water shortage contingency analysis which includes each of the following elements which are within the authority of the urban water supplier:

10632 (g) An analysis of the impacts of each of the actions and conditions described in subdivisions (a) to (f), inclusive, on the revenues and expenditures of the urban water supplier...

10632 (g) [An analysis of the impacts of each of the] proposed measures to overcome those [revenue and expenditure] impacts, such as the development of reserves and rate adjustments.

All surplus revenues that the City collects are currently used to fund the Rate Stabilization Fund, conservation, recycling, and other capital improvements. The City estimated projected ranges of water sales by shortage stage to best understand the impact each level of shortage will have on projected revenues and expenditures by each shortage stage.

This analysis is undertaken first with no additional water purchases and no rate increases and then with a 25% rate increase at Stage II; 50% at Stage III, and a 100% increase at Stage IV. To cover increased expenses and decreased sales, rate increases would need to be "severe".

See Appendix D for the City's efforts to establish an Emergency Fund and a Rate Stabilization Fund.

Reduction Measuring Mechanism

Law

10632. The plan shall provide an urban water shortage contingency analysis which includes each of the following elements which are within the authority of the urban water supplier:

10632 (i) A mechanism for determining actual reductions in water use pursuant to the urban water shortage contingency analysis.

Mechanism to Determine Reductions in Water Use

Under normal water supply conditions, potable water production figures are recorded daily. Totals are reported weekly to the Water Treatment Facility Supervisor. Totals are reported monthly to the Water Department Manager and incorporated into the water supply report.

During a Stage I or Stage II water shortage, daily production figures are reported to the Supervisor. The Supervisor compares the weekly production to the target weekly production to verify that the reduction goal is being met. Weekly reports are forwarded to the Water Department Manager and the Water Shortage Response Team. Monthly reports are sent to the City Council. If reduction goals are not met, the Manager will notify the City Council so that corrective action can be taken.

During a Stage III or Stage IV water shortage, the procedure listed above will be followed, with the addition of a daily production report to the Manager.

During emergency shortages, production figures are reported to the Supervisor hourly and to the Manager and the Water Shortage Response Team daily. Daily reports will also be provided to the City Council and the New Albion County Office of Emergency Services.

Water Recycling

Wastewater System Description

Law

10633. The plan shall provide, to the extent available, information on recycled water and its potential for use as a water source in the service area of the urban water supplier. To the extent practicable, the preparation of the plan shall be coordinated with local water, wastewater, groundwater, and planning agencies and shall include all of the following:

10633 (a) A description of the wastewater collection and treatment systems in the supplier's service area...

Participation in a Regional Recycled Water Planning

The City along with NACWA, NACRSD, and the Edisto Basin Watermaster are active participants in the Regional Recycled Water Planning. The committee meets monthly to discuss plans and reach agreements on the future development and marketing of recycled water. As mentioned in the WATER SOURCE section of this plan, the committee is also collaborating on a study that will evaluate the potential use of recycled water as part of a groundwater recharge program.

WaterReuse Association Membership

The City is an active member of the California WaterReuse Association, which helps implement water recycling in California.

Wastewater Collection and Treatment in New Albion

The New Albion County Regional Sanitation District (NACRSD) manages wastewater collection and treatment for New Albion County. All of the wastewater flows from the City (excluding storm water run-off), and is collected and treated at the NACRSD Regional Treatment Plant (RTP). Because the City sewer mains are not separately metered, an exact inflow calculation is not possible, but about 4 million gallons per day (mgd) is estimated from within the City.

When NACRSD and the City began to study water-recycling opportunities, the team followed the Water Recycling Planning Outline included in Appendix H. The County of New Albion established a dual plumbing ordinance in 1994, which requires that all new office buildings are dual plumbed, so recycled water can be used to flush toilets and urinals. The County also adopted a mandatory recycled water use ordinance, addressing Points to Include in a Recycled Water Use Ordinance (see Appendix E).

The City currently purchases 1000 AFY of disinfected Secondary 2.2 recycled water from NACRSD and distribute it for approved uses within the City. (Wastewater treated to "disinfected Secondary 2.2" means that the maximum coliform level is 2.2 organisms per 100 milliliters.) It is likely that a new wastewater treatment facility (adjacent to the RTP) will be built within the next five years -- it will produce recycled water at tertiary treatment levels. There appear to be more than enough potential uses and customers for all tertiary water that will be produced. The new plant is planned to expand incrementally to increase production as customer demand increases in the next twenty or so years.

Posted Wednesday, August 14, 2002

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Utah Division of Wildlife Resources drought response plan for wildlife

Approved by the Utah Wildlife Board on August 13, 2002

Introduction

The State of Utah is experiencing an extended drought with only occasional wetter years. Conditions for fish and wildlife have gradually deteriorated over this period throughout much of the state. Already this year range conditions have deteriorated to critical, nearly unprecedented levels. Stream flows and reservoir levels are in fair shape depending on where they occur, and angling appears good in many locations despite drought circumstances. Continuing drought conditions will no doubt worsen in some areas, although outdoor recreation including angling is expected to remain popular and enjoyable in many parts of the state. Southern Utah is experiencing particularly severe conditions, although almost every part of the state is affected to some degree. Conditions are tough, and there will be impacts although hunting and fishing should still provide good enjoyment throughout the year.

The purpose of this response plan is to inform Division personnel and others concerning the drought, its impacts on wildlife, actions needed to cope with drought conditions, key Division policies for dealing with critical issues, and appropriate means for disseminating information. This is necessary to ensure consistency and accuracy in informing the public of drought impacts on wildlife and related recreational opportunities which may interest them.

Our foremost concern is for the welfare of wildlife. We are also concerned about drought impacts on revenue to the Division and our ability to carry out Division programs that benefit wildlife. We want to emphasize the quality of time spent recreating outdoors, regardless of whether a drought is on-going. We should encourage participation in hunting and angling among those who enjoy participating in these sports.

Summary of drought impacts on wildlife

Fisheries

A prolonged drought may cause severe losses of fish in many streams, lakes, and reservoirs. Much of this loss is not preventable, and angling quality may be temporarily reduced. At present, the impacts have not grown to severe levels in most locations and angling opportunities remain very good. Low stream flows and lake levels typically result in increased water temperature and consequent decreased dissolved oxygen content. Increased biochemical oxygen demand, due to greater organic debris relative to the volume of water present, may further deplete oxygen levels and cause additional fish losses due to suffocation.

Low stream flows in populated or industrialized areas can concentrate pollutants beyond fish tolerance levels and cause further mortality.



Low stream flows and resulting water shortages for crop irrigation usually results in increased efforts to chemically control aquatic vegetation in canals and ditches. Improper use of herbicides can result in extensive fish kills.

Low water levels in lakes resulting from extended drought can jeopardize fish populations in many reservoirs, and especially in small high mountain lakes, by a threat of winter kill.

As water levels diminish in lakes, reservoirs and streams, fish carrying capacity also declines. If levels are significantly reduced, excess fish either move, are caught by anglers, or simply die. Obviously, given those choices, an increased harvest is most desirable, since there is usually little opportunity for movement to better water conditions, and fish may be concentrated and easy to harvest. This fact produces good angling opportunities where conditions are right, and anglers can benefit during early months of the summer.

Given the above impacts of drought on our fisheries, the fisheries outlook for the future hinges on the moisture received between now and winter. Angling after all is fun, and the quality of the experience can be emphasized over the catch rate.

Wildlife

Adverse impacts of drought on terrestrial wildlife can most simply be summarized as depletions of cover, food, and water and the effects of these depletions on productivity and populations.

Impacts on individual species vary, but it is safe to assume that extended severe drought will cause significantly reduced reproductive success and declining populations of most species. This is unavoidable except in areas where wildlife water developments may provide some respite from the drought, although vegetation growth is still affected in those areas.

Greatest impacts of the current drought have been observed with those species found primarily in desert and desert mountain areas where forage and drinking water supplies are limiting, even in normal moisture years. Reduced plant growth and vigor has also been significant on seasonal ranges for migratory species such as mule deer and elk.

A lack of sufficient spring and summer rainfall for several years has had an adverse effect on vegetation growth and resulting range condition and trend over much of the state. Forage supplies for many wildlife species are extremely low, except in some of the higher mountains which naturally receive higher precipitation. Competition for forage between livestock and wildlife is much greater than normal, as forage is reduced. This has intensified agricultural depredation in certain areas.

Big game — Mule deer, elk, pronghorn, and bison herds appear to reflect the impacts of prolonged drought and deteriorating range conditions: i.e., winter kill, reduced production of young, and decreased fawn/calf survival through summer. Pronghorn production has been particularly hard hit for the past three years on many of the state's wildlife management units. Some units have shown almost no recruitment into the population for three years.

Drought impacts are clearly demonstrated in mule deer productivity data for the past several years. For the first time in several years, estimated statewide deer population numbers in 2002 have decreased from about 10,000 animals this past year after previously steady increases since the winter of 1992-93. Most of the decreases have occurred in the southern and eastern deer management units.

Big game animals, especially antelope and deer in dry areas, are also adversely affected by the

loss of springs, seeps, and other drinking water sources. A secondary, significant effect can be heavy forage use by animals forced to concentrate around remaining water supplies. These habitat impacts can last many years longer than the drought itself. Concentration of big game animals around water sources also can increase the transmission likelihood of certain diseases (e.g., blue-tongue virus in mule deer).

Drought conditions invariably result in increased depredation of private irrigated croplands. Such damage poses serious problems and economic impacts to both the farmers and the Division.

A most serious concern in big game management in Utah, that is magnified in drought years, is big game/livestock competition for forage on critical big game ranges. Winter ranges are of particular concern as such areas are typically used by livestock in spring, prior to moving to higher summer ranges, and again in fall. During drought years, very little growth occurs on plant species important to big game. Much of the available growth is used by livestock prior to winter when big game descend to the winter range.

This causes extensive wildlife losses, particularly of mule deer, during winters following drought years. This phenomenon has caused significant mortality in deer populations across the state and can be especially devastating if followed by severe winter conditions as occurred in the winter of 1992-93. With continued drought situations, livestock permittees often see their numbers cut substantially which lessens support for maintaining big game numbers on these same ranges.

Upland game — Upland game populations typically fluctuate widely over time. Such **fluctuations are primarily** a reflection of annual reproductive success. Reproductive success, on a short-term basis, is principally a function of weather conditions, with the most critical time period being late winter and early spring. Weather affects production either through a direct impact on reproductive success or indirectly through forage production. Extreme weather conditions (temperature and precipitation) generally have a detrimental effect on reproduction; however, not all species are influenced in the same way.

Game birds of relatively dry habitats, such as the chukar, greater sage grouse, and Gambel's quail, are very dependent on the production of annual forbs and grasses. They therefore usually respond well to cool, wet spring weather that produces abundant forage. Forest species — including the ruffed grouse, blue grouse, and wild turkey — tend to respond to mild spring weather with less rainfall. Those associated with irrigated areas, such as the ring-necked pheasant, California quail, and Hungarian partridge are most affected by breeding season temperature rather than precipitation. Cold April weather is usually detrimental to these species.

Extreme drought conditions which significantly reduce vegetation growth, forage production, and available drinking water will undoubtedly adversely impact all upland game species.

Waterfowl — Drought invariably results in a drying up of many natural wetlands and reduced water levels and decreasing water quality in managed marshes. Extensive drought in waterfowl production areas always results in population declines due to the loss and degradation of nesting and brood-rearing habitat.

Extensively developed wetlands can temper impacts on local waterfowl numbers to the extent that water levels and marsh conditions can be maintained.

Waterfowl habitat not associated with the Great Salt Lake, has been and will continue to be adversely affected by drought in three basic ways: (1) reduced inflows, (2) increased evaporation, and (3) reduced water quality. Impacts will be less in spring-fed marshes than in

those dependent upon surface flows.

Because most waterfowl management areas are at the "end-of-the-ditch" we can expect not only reduced flows, but also substantially poorer water quality. The extent to which this will impact waterfowl production and use of the areas will depend on the extent of the drought in any given area.

Another major waterfowl threat that is often linked with poor water quality and reduced flows is avian botulism. This disease can kill literally hundreds of thousands of waterfowl and shorebirds in a few week period and is extremely difficult to control. This disease tends to recur in the same general area when conditions are suitable. Historic hot spots include most wetlands along the eastern shore of the Great Salt Lake and Provo Bay on the Utah Lake system.

Sensitive species — Animals categorized as sensitive species include fish, mammals, amphibians, reptiles, and birds which are typically not harvested. There is great variation among species insofar as habitat requirements are concerned, and consequent diverse responses to drought. Even so, it is safe to conclude that prolonged drought will not benefit any species, even those well adapted to dry conditions. Impacts on food supplies should affect them if nothing else. Smaller mammals and larger predators which depend on smaller mammals, especially those associated with desert/upland areas, will be adversely impacted.

There is particular concern for those species known to be endangered, threatened, or of known sensitive status. Severe drought reflected in greatly reduced stream flows or forage production could set back recovery efforts. Low flows may diminish spawning success of endangered fishes in the Colorado River system.

Natural biotic communities have evolved with an ability to cope with drought. While population levels may fluctuate widely, they can be expected to recover.

The drying of wetlands, riparian, grassland, and rangeland habitat reduces nesting areas and decreases insect food bases, which diminish avian productivity. Wetland and riparian habitats are particularly rich in avian diversity and are affected the greatest by drought conditions.

In addition to drought effects described above under *Fisheries*, reproduction and recruitment of sensitive species fishes is adversely affected by low stream flows and reduced water quality associated with their spawning and rearing periods. Low flows have seriously impacted spawning of the endangered June sucker during past dry years.

Drought mitigation alternatives

Fisheries

The current drought has already adversely affected stream flows, reservoir storage, water temperature, and water quality in many areas. As it continues we can expect further declines and possible fish losses. Nothing can be done to restore lost stream flows. Despite the effects of drought, fishing remains good in many areas.

The Aquatics Section has already adjusted hatchery production and fish distribution schedules to compensate for drought conditions. Regional fisheries managers have been given full authority to modify stocking quotas and schedules within constraints imposed by drought conditions.

Despite the drought, there are many opportunities for good fishing. It is extremely important that we apprise the public of these opportunities now, and throughout the summer and fall. This

will require a joint effort by Aquatics, Conservation Outreach, and Law Enforcement to monitor water conditions and fishing success and inform the public accordingly.

We must closely monitor conservation pool levels and prescribed minimum stream flows to assure compliance with contract or permit conditions and to ensure the Division's water rights are protected.

Hatchery personnel and regional fisheries managers must evaluate fish stocking needs in light of the current drought in order to program hatchery production schedules.

Division personnel must be prepared to respond to fish kills when assigned. Such losses can be expected as a result of low water levels, excessive diversions, low oxygen levels, and chemical treatments to control aquatic vegetation. Each incident must be investigated by appropriate personnel, making certain to notify appropriate contact people in the Department of Environmental Quality as is typically done in these matters.

We must anticipate losses in perennial problem areas and initiate efforts to avoid losses to the extent possible. Regions must take the lead in this effort. Cooperative efforts with irrigation companies may prevent or minimize losses.

Wildlife

Reduced production and subsequent wildlife population declines have already somewhat lessened grazing pressures on rangelands to some degree. This is expected to continue through this year, and in some ways matches the cuts which livestock producers have been forced to take. The Wildlife Board has established harvest regulations for 2002 that have taken into consideration potential problems with continued drought, and harvest numbers reflect these considerations. It is essential that wildlife managers further monitor range conditions to ensure an appropriate future balance between herd size and carrying capacity. This must be done in concert with the federal land management agencies who control the dominant share of habitat.

Water developments installed for wildlife must be maintained in good working order. Consideration should be given to the feasibility of hauling water in critical situations. Land management agencies should be encouraged to ensure proper maintenance of water developments benefiting wildlife.

It is expected that depredation problems will escalate and every effort — within legal, funding, and work force constraints — must be made to assist farmers and ranchers in minimizing wildlife impacts on crop production. In areas where big game herds are substantially below management objective, killing of animals that move into agricultural lands during drought should be minimized where possible.

The new tools we have to deal with big game depredation on private cultivated land will help alleviate some problems. These tools were not available in 1993, and include the changes in the Utah Code for irrigation equipment and fence damage, antlerless mitigation permits for landowners, the development of a statewide depredation account, and the hiring of many full-time/seasonal personnel by the Division to deal with landowners' needs and their depredation problems in the regions.

Drought usually increases nuisance beaver complaints in canals and ditches. A diligent effort will be required to control these problems at a time when water is in short supply.

Dry, unproductive rangelands may cause unusual dispersal of young bears. Increased

human/bear conflicts can be expected and must be handled promptly and within policy guidelines.

In the final analysis, little can be done to significantly alter the impact of extreme drought on wildlife populations. We must work with the public in an informational mode to provide accurate information on drought and its effects on wildlife. Management efforts should focus on diminishing or avoiding human-caused disturbances that further stress populations whose status is already tenuous.

Waterfowl management area superintendents must closely monitor inflows and adjust water levels in individual units in a way that maximizes habitat quantity and quality. They will also need to closely monitor waterfowl populations for signs of botulism and implement remedial actions required to minimize losses and diminish public concerns.

Guidelines for dissemination of information

Concerning drought impacts on fish and wildlife

Information should be provided to the media and the public so that it becomes clear the Division is aware of the many drought-related problems, and that steps have been and will continue to be taken to cope to the extent feasible.

The public should understand that the Division has considered drought impacts in the establishment of harvest regulations, and that prescribed harvests are within harvestable surpluses of game species.

News releases should stress that hunting and fishing will not be detrimental to populations, and that a reasonable harvest will minimize natural mortality next winter. This is especially true of big game populations that must be kept within management objectives. An adequate harvest not only will tend to minimize potential winter loss, but at the same time will relieve pressure on short forage supplies and help conserve range conditions for the future.

We must be candid in explaining potentials for mitigating drought impacts on widespread populations of fish and wildlife. Drought conditions are natural, wildlife species are generally adapted to them, but drought is often unpleasant. We must be sensitive to deep-seated public concern for the welfare of wildlife during drought, and take the appropriate actions where we can.

Concerning fishing

Drought conditions dictate a need to increase our conservation outreach efforts over a "normal" year. We must make an extra effort to inform the public of promising fishing opportunities which in fact can be quite good during drought conditions, at least in certain areas. Aquatics personnel, Habitat and Wildlife staff, and conservation officers must take the initiative to provide our Conservation Outreach staff with needed information and guidance on drought matters. We need to help the public identify the waters which are providing good angling during different times through the year, and Conservation Outreach staff need detailed up-to-the-minute reports they can use in various information releases which should help the public during this drought period.

The following key points should be considered in the preparation of news releases:

- Be positive and upbeat about fishing opportunities.
- Identify current hot spots that can sustain pressure, and the increased fishing

- opportunities in reservoirs and lakes subject to fishing proclamation changes.
- Make timely news releases.
 - Emphasize opportunities on the larger reservoirs and in fisheries below reservoirs.
 - Stress that even with the drought, fishing is one of the greatest outdoor recreational opportunities available, and at the best price.
 - Encourage use of relatively unfished areas that provide good opportunity, such as the high mountain lakes of the Uintas and Starvation Reservoir for walleye.
 - Place greater emphasis on the growing smallmouth bass fisheries in Rockport, Flaming Gorge, and Lake Powell.
 - Identify regional variation in drought conditions and fishing opportunities.
 - Be honest, absolutely honest as at all times, but be prudent. It is not dishonest to state that fishing is always good, but sometimes it is better than at other times. Advise the public in the way you would want to be advised if the roles were reversed.
 - In communicating with the mass media, be sure your information is accurate. If you do not know, tell them that; seek to find the answers the press needs.

Concerning hunting

As with fishing, a concerted Conservation Outreach effort will be needed to inform the public of hunting opportunities. Wildlife Managers must work closely with Conservation Outreach to provide needed information.

It is important that we emphasize that a harvestable surplus exists in hunted populations, even during drought years. It is important that hunting be used in critical situations where wildlife populations can potentially exceed a drought reduced carrying capacity.

The following key points should be considered in the preparation of news releases during the continuing drought conditions:

- If dry conditions persist, a major effort will be needed to warn of fire danger and possible local closures as fire prevention measures.
- Stress the importance of annual harvest of big game in maintaining a proper balance between herd size and available forage. Habitat damage is long term.
- Stress that antlerless permits authorized for big game species are intended to ensure keeping herd size in balance with available forage.
- Emphasize species which should provide good hunting.
- Avoid predictions of hunter success which becomes very hard to predict during times of drought.

Drought-related policies

Protection of fish conservation pools

Drought-caused declines in stream flows and reservoir water levels inevitably result in local government requests for using water reserved in fish conservation pools for culinary and irrigation use. The Division is obligated to protect conservation ("C") pools purchased for fish using sportsmen's money after all, drought conditions are the only time when conservation pools are needed! Nonetheless, we must also be sensitive to critical human needs.

Regional supervisors will take the lead in negotiating "C" pool protection and possible diversion to satisfy critical human needs, if, when, and where it becomes necessary. It must be understood that the Division is willing to work cooperatively with local government in seeking solutions to their problems, but we will only surrender water in fish conservation pools *as a last*

resort in meeting critical needs. The following guidelines apply to such negotiations:

1. Fish conservation pool water will be relinquished only for critical culinary use, not for irrigation or industrial purposes.
2. Conservation pool water will not be provided in lieu of strict water conservation measures being implemented by local government.
3. Any use of conservation pools for culinary purposes will be kept to the minimum required to meet an existing crisis. As much water as possible should be retained in a "C" pool to protect the fishery.
4. The minimum conditions for relinquishing "C" pool water will be that the Division receive first priority replacement from subsequent increased stream flows, at no cost to the Division.

Compensation at fair market value for water provided or for fishery replacement costs may be required in some situations. Such decisions will be made by the Director on a case-by-case basis, in consultation with the Regional Supervisor.

5. A written agreement between the Division Director and local officials must be executed before relinquishing any "C" pool water. Such agreement must specify the quantity of water to be used, the timing of use, and compensation required.

Failure to adequately protect conservation pools purchased with Federal Aid funds will jeopardize future Federal Aid appropriations, and as such the Director will secure approval from Federal Aid prior to any such agreement being made.

Following is a list of conservation pools and stabilized lakes owned by the Division. Regional Supervisors and Aquatics Managers must review this list and identify potential areas of conflict. If a local demand for water is anticipated, supervisors should consider initiating contacts with community/water company officials to advise them of actions required before submitting requests for "C" pool water: e.g., implementation of strict water conservation measures. Without having first exhibited strict water conservation measures being put in place and enforced, no water will be relinquished.

Occasionally, a demand for "C" pool water will coincide with Division goals to treat or repair reservoirs. In such instances, Regional supervisors are granted the latitude to negotiate the best interest of the Division, aside from the above guidelines.

Conservation pools/stabilized lakes

The Division of Wildlife Resources has in the past and is presently pursuing opportunities to enhance fishing recreation on Utah's lakes and reservoirs. In an effort to preserve aquatic habitat, "Conservation Pools" and "Stabilized Lakes" are acquired to provide the environment needed to sustain fish populations on a year-round basis.

The term conservation pool refers to a given volume of water that is maintained in a reservoir basin. In most cases, conservation pools are acquired from irrigation companies to provide needed fish habitat. Generally speaking, this amounts to the minimum water level to which the company may release water from the reservoir.

Stabilized lakes on the other hand are reservoirs that are maintained at a given water level to provide recreational fishing. These reservoirs, or lakes, are kept at a constant volume and water

level is fluctuated only when it becomes necessary to protect fish populations or satisfy dam safety requirements.

Conservation pools and stabilized lakes are extremely important in the management of Utah's fisheries program. The following is a list of conservation pools and stabilized lakes that have been acquired by the Division of Wildlife Resources in an effort to preserve aquatic habitat.

CONSERVATION POOLS

Name of water	Year acquired	Acre feet	County	Region
Yankee Meadows Res.	1940	300	Iron	Southern
Upper Enterprise Res.	1942	200	Washington	Southern
Scotfield Res.	1944	8,000	Carbon	Southeast
Navajo Lake	1958	3,000	Kane	Southern
Red Creek Res.	1959	128	Duchesne	Northeast
Lower Bown Res.	1959	725	Garfield	Southern
East Park Res. (F-13-D)	1960	1,300	Uintah	Northeast
Porcupine Res.	1960	1,500	Cache	Northern
Blanding Res. No. 3	1961	64	San Juan	Southeast
Woodruff Narrows Res. (F-16-D)	1962	4,000	Wyoming	Northern
Tibble Fork Res.	1963	166	Utah	Central
Big Sandwash Res. (F-19-L)	1965	1,200	Duchesne	Northeast
Blanding Res. No.4 (F-4-D-1, *APW)	1965	219	San Juan	Southeast
Minersville Res. (F-20-L), Rocky Ford	1965	2,000	Beaver	Southern
Johnson Valley Res. (F-18-D)	1965	2,500	Sevier	Southern
Pelican Lake (F-21-L)	1966	4,500	Uintah	Southeast
Whitney Res.	1967	500	Summit	Northern
Upper Woodruff Res. (F-23-L)	1968	450	Rich	Northern
(Additional acquired) (F-57-L4)	1989	249		
Birch Creek Res. (F-23-L)	1968	400	Rich	Northern
Mill Site Res. (F-25-L)	1968	2,000	Emery	Southeast
Gunlock Res. (F-27-D)	1970	1,014	Washington	Southern
Silver Lake Flat Res.	1971	100	Utah	Central
Newcastle Res.	1974	500	Iron	Southern
Brough Res. (F-33-L)	1975	1,145	Uintah	Northeast
Kents Lake Res.	1977	300	Beaver	Southern
Paragonah Res. (F-36-D)	1980	350	Iron	Southern
Long Park Res. (F-35-D)	1980	3,000	Daggett	Northeast
Oak Creek Res. (F-37-D)	1982	370	Garfield	Southern
Cottonwood Res.	1983	700	Uintah	Northeast
Woods Pond (F-57-L-6)	1989	6	Iron	Southern
Upper Kents Lake (F-57-L-13)	1992	80	Beaver	Southern
Sand Hollow (F-27-D)**	2002	1,086	Washington	Southern

*APW (Applied Public Works) **From July 2002 until February 15, 2003, some or all of this conservation pool may be retained in Kolob Reservoir where valuable fisheries exist, and warrant protection

STABILIZED LAKES

Name of water	Year acquired	Surface acres	County	Region
Burraston Ponds (3)	1901	17.3	Juab	Central
Gooseberry Pond	1938	25.0	Sanpete	Southeast
Duck Creek Springs	1939	7.5	Kane	Southern
Aspen-Mirror Lake	1939	3.0	Kane	Southern
Pine Lake (F-31-D)	1947	80.0	Garfield	Southern
Monticello Lake (F-6-D)	1954	3.5	San Juan	Southeast
Browne Lake (F-10-D)	1958	54.0	Daggett	Northeast
Anderson Meadow Lake (F-11-D)	1958	8.7	Beaver	Southern
Sheep Creek Lake (F-12-D)	1959	80.0	Daggett	Northeast
Barker Res. (F-34-D)	1960	12.0	Garfield	Southern
Lower Barker Res.	1960	5.0	Garfield	Southern
Long Willow Bottom Res. (F-34-D)	1960	5.0	Garfield	Southern
Round Willow Bottom Res. (F-34-D)	1960	9.0	Garfield	Southern
Joe Lay Res. (F-34-D)	1960	4.0	Garfield	Southern
Mill Hollow Lake (F-15-D)	1962	17.1	Wasatch	Central
LeBaron Lake (F-2-D-1, *APW)	1965	23.0	Beaver	Southern
Crouse Res.	1966	115.0	Uintah	Northeast
Foy Lake	1966	4.9	San Juan	Southeast
Ferron Res. (566 **SWP)	1974	65.0	Sanpete	Southeast
Bullock Res.	1977	90.0	Uintah	Northeast
Duck Fork Res. (566 **SWP)	1977	42.0	Sanpete	Southeast
Willow Lake (566 **SWP)	1977	25.0	Sanpete	Southeast
Wrigley Springs Res. (F-25-L)	1980	12.7	Sanpete	Southeast
Calder Res. (F-40-L)	1980	100.0	Uintah	Northeast
Matt Warner Res. (F-40-L)	1980	356.0	Uintah	Northeast
Manning Meadow Res. (F-57-L1)	1988	55.0	Piute	Southern
Barney Lake (F-57-L1)	1988	19.0	Piute	Southern
Deep Lake (F-57-L2)	1988	5.0	Sanpete	Central
Shingle Mill Lake (F-57-L2)	1988	2.0	Sanpete	Central
Daggett Lake	1989	44.0	Daggett	Northeast
Jesson Lake	1989	22.0	Daggett	Northeast
Tamarack Lake	1989	64.0	Daggett	Northeast
Wellsville Res. (F-57-L2)	1989	6.0	Cache	Northern
Pacer Lake (F-57-L8)	1996	33.0	Garfield	Southern
Spirit Lake	2000	42.8	Daggett	Northeast
Little Montes Cr. Res. (Ottosen Res.)	2000	16.3	Uintah	Northeast
Gates Lake	2001	5.0	Sevier	Southern
Lake Canyon Lake	2002	25.5	Duchesne	Northeast

*APW (Applied Public Works) **SWP (Small Watershed Project)

Protection of prescribed instream flows and flow rights

Historically, instream flows were not recognized as a beneficial use of water under Utah law. Of course that has changed to permit both the Division of Wildlife Resources and the Division of Parks and Recreation to hold instream flow rights. Several have been established, and they are important. However, even before the instream flow rights, through the years a number of instream flow requirements were established on various waters throughout the state, as

stipulated by operating agreements associated with federally-funded water projects. Other flows were derived from hydroelectric licensing requirements or protection of endangered species. In time of drought, the pressure to reduce or eliminate the required instream flows mounts. In almost all cases, the instream flow required is already at the minimum level needed to protect the existing fishery. We should therefore resist efforts to reduce these flows. In most cases the required flows are mandated by federal regulation and the Division therefore has only partial responsibility for making such decisions.

Regional supervisors will take the lead in negotiating any modification to instream flows to satisfy critical human need. It must be understood that the Division is willing to work cooperatively with local government in seeking solutions to their problems, but we will allow reductions in stream flow only *as a last resort* in meeting critical human needs. The following guidelines apply to such negotiations:

1. Instream flow reductions will be agreed to only for critical culinary use, not for irrigation or industrial purposes.
2. Instream flow reductions will not be agreed to in lieu of strict water conservation measures being implemented by local government.
3. Any reduction of instream flow will be kept to the minimum needed to meet an existing crisis.
4. Compensation for the instream flow reduction shall be subsequent increases in instream flow during other critical periods, pending approval by the Division Director. In-kind, in-place compensation is preferred, but other kinds may be considered. The Director will make such decisions on a case-by-case basis.
5. Any reductions in instream flow shall be time-limited to 30 days maximum duration, and require written agreement specifying amounts and durations. Involved parties shall reconvene after 30 days to reassess conditions. Agreements may be revoked, modified, or extended at that time.

Fish salvage

Drought conditions this year will be severe in most parts of the state which will lead to dewatering of streams and lakes. This may cause stranding and/or concentrations of fish. The Division will no longer attempt to salvage fish from one water and move them to another water. This activity is not cost effective, and risk of moving diseases is just too great. This is particularly true since the discovery of whirling disease in the state.

Regional aquatic managers, conservation officers and other Division personnel should carefully monitor areas where fish are likely to become stranded. These sites need to be publicized and anglers encouraged to take a legal limit. In cases where the fish cannot be utilized by maintaining standard regulations, consideration will be given to liberalizing the bag limit. It will be very important for the field personnel to act quickly if these types of situations develop. We can usually amend the proclamation within a 24-hour period if an emergency situation develops.

For further information contact: Bill James, Habitat Section Chief, at (801) 538.4752 or Bill Bradwisch, Aquatic Habitat Coordinator, at (801) 538.4866. See the Division's Web site at <http://www.wildlife.utah.gov> and thank you for helping to conserve Utah's wildlife and natural diversity.

Appendix E
Staff Summary

Board of Supervisors Resolution authorizing the
County of Butte to adopt the butte County
Drought Preparedness Plan



INTERDEPARTMENTAL MEMORANDUM

TO: Drought Preparedness Plan File

FROM: Ed Craddock, Director of Water and Resource Conservation

SUBJECT: Staff summary -- Drought Preparedness Plan

DATE: February 7, 2005

The "Drought Preparedness Plan" is one element of the Department of Water and Resource Conservation's Integrated Water Resources Plan. The public review draft of the plan was available for review since early June 2004. The closing date for receiving comments was August 20, 2004. There have been no comments on this plan to date. We also announced the plan at five evening public meetings during the last two weeks in July 2004. The full plan includes this staff summary report as Appendix E. The Water Commission recommended approval of the plan at their September 7, 2004 meeting with suggested changes. Comments of the Commissioners and public attendees are included in this report.

SUMMARY AND CONCLUSIONS

Drought conditions in Butte County have reoccurred numerous times throughout history. Droughts exceeding three years have occurred twice in the 1900s during 1929-34 and 1987-92. While there is minimal hydrologic data available to evaluate drought before 1900, indicators such as tree rings and oxygen isotope dating show prolonged drought in earlier centuries. It's apparent that worse droughts than we have experienced have occurred in the past, so it may be reasonable for Butte County to use 1987-94 as a typical severe drought scenario. This situation would have occurred if not for an above normal water year in 1993. However, we must recall that Butte County has large water supplies to help us weather droughts.

The plan also provides a systematic institutional setting for Butte County to implement and reduce the impact of drought-induced water shortages. Three levels of institutions could be formed as a response to drought emergencies:

1. The Drought Task Force would be an ongoing group that reports annually to the Board of Supervisors on the status of drought monitoring, and could become part of a higher level group if the drought worsens;
2. The Interagency Coordination Group could include the Drought Task force, higher-level officials and those with a more regional approach to evaluate potential mitigation needs; and
3. The working groups would deal with mitigation of impacts in their specific areas such as wildlife, economics, agriculture and others.

To better understand the institutional setting, envision the six pieces of a pie with the typical piece at the top. Only an annual monitoring report is required in this piece. The second piece to its right (called Phase 1) contains more frequent monitoring as a moderate drought is neared. The third piece initiates Phase 2 in which the drought gets more severe and the Interagency Coordination Group could be formed if the Board agrees. In the fourth piece (Phase 3) we are in the most severe portion of the drought cycle and working groups are established. It would be assumed that a drought of this magnitude could last 7 years. As the drought moderates we re-enter Phase 2 and deactivate some working groups. As Phase 1 is entered the Interagency Coordination Group and any remaining workgroups are deactivated. Finally we return to the top of the pie in typical situations.

In order to implement the institutions above, a monitoring program is the key to tracking the inception and progress of a drought. It is suggested that the Standard Precipitation Index and the Surface Water Supply index are used to track the progress of the drought. Both of these indices have readily available data that is already calculated. The categories will have to be adjusted slightly to fit the various phases.

Finally, there is a wide-range of mitigation measures that can be employed in the agricultural, urban and environmental sectors. Examples of many such measures are found in the plan. However, many mitigation measures will rely on local expertise, so there are many variations of measures than those examples found in the plan. The primary reasoning behind the Drought Task Force and monitoring program is to prepare for timely response and mitigation to a drought emergency.

RECOMMENDATIONS of the BOARD OF SUPERVISORS

The Board of Supervisors approved the plan at their October 26, 2004 meeting. The Board suggested that an early warning system could be useful, but that the Water Commission could be used instead of forming more committees. *Staff will use the Water Commission to discuss drought issues and report to the Board as necessary.*

RECOMMENDATIONS of the WATER COMMISSION

The Department requested that that the Water Commission recommend that the Board of Supervisors adopt the “*Drought Preparedness and Mitigation Plan*” and the policies it includes as follows.

- Include a drought-monitoring program under the Department of Water & Resource Conservation.
- Form a Drought Task Force with the Director of the Department as Chair (Board suggestion to use the Water Commission).
- Authorize the formation of an Interagency Coordination Group to be activated in Phase 2 of a drought by the Board of Supervisors if deemed necessary.

These recommendations were contingent upon the Department adding modifications suggested at the September 7, 2004 Water Commission meeting.

#1) Commissioner Jones: How does the surface water and precipitation Indexes match up?

Normally, the Surface Water Supply Index will lag a year behind the Standard Precipitation Index. That is why our large amount of surface storage lulls us into a false sense of security at times. This information will refer to page 3-1 of the text.

#2) Commissioner Carlon: What’s the motivation behind the plan: to be pro-active?

Yes. My observation is that if you don’t have a plan and you’re in a drought its already late and you’re in a reactive mode. The text will refer to Section 1.1 to state the pro-active nature of the plan.

#3) Commissioner Carlon: How do water transfers work if Southern California dries up?

We assume that Chapter 33 handles groundwater transfers, but surface water transfers are the purview of the State Water Resources Control Board. The only input the County would have is through the EIR process. However, if the Governor declared a State of Emergency during a drought it would override local initiatives. This information will relate to page 5-1 of the text.

#4) Commissioner Tennis: So we’re trying to define a potential problem and have a plan in place to help develop the appropriate response?

Yes. This drought plan is a preventative measure, and we will refer this comment to the introduction in Section 2 to ensure Appendix E clearly states that.

#5) Commissioner Tennis: Will this plan answer all questions about who gets to pump today?

No. Groundwater users make that decision. However, local landowners will hopefully make more informed decisions with the Basin Management Objectives (BMO) in place. This concept is covered in Section 5.3.

#6) Commissioner Tennis: What are other areas of the state doing regarding groundwater pumping?

We know a few areas have, or are considering, BMOs. Another 150 have AB 3030 Plans, and some areas have adjudicated basins. This information will be noted to refer to Section 5.3.

#7) Commissioner Jones: Who controls groundwater?

The overlying landowner controls the groundwater. Responses to #5 and #6 above will cover this question as well.

#8) Commissioner Carlon: Is there a way to correlate the Precipitation Index and Surface Water Supply Index? Could they be correlated with groundwater levels?

These are good questions and ideas. We will add this suggestion as modifying Section 3.4.

#9) Walt Zwicker, Paradise: (1) Has anyone in Butte County been monitoring MD's Drought Plan; (2) has anyone been monitoring the California Water shortage Contingency Plan; and 3) has Butte County been coordinating with its neighbors about dealing with groundwater usage?

MWD has developed a drought contingency element to its Urban Water Management Plan that includes water transfers in its actions. The same is true for the California Critical Water Shortage Contingency Plan, which relies on water marketing and groundwater use as two of its major actions. As far as coordinating with our neighboring counties, we just began working on a groundwater management MOU with Tehama, Glen and Colusa counties.

#10) Commissioner Skinner: How will the questions raised today be addressed?

The staff report, including the responses to these questions, will become Appendix E of the Drought Preparedness and Mitigation Plan.

#11) Commissioner Tennis: In moving to adopt this plan, we want to ensure that Butte County does not become the local "water czar."

No, we propose in this plan not to become a water czar, but instead to provide a preventive measure to become an early warning.

#12) Commissioner Carlon: The mitigations introduced in Section 4 could scare people. Water allocation will concern and confuse people as what the intent is.

This plan primarily focuses on drought preparedness by establishing a monitoring program and an institutional arrangement. Chapter 4 only lists some of the practices that may be undertaken as examples that others have used and are not requirements. It is envisioned experts in the working groups would promulgate the actual mitigation measures. Any suggested measures would be taken to the Board of Supervisors for approval. The primary focus of the plan is drought preparedness and the name will be changed to, "Drought Preparedness Plan".



BOARD OF SUPERVISORS
COUNTY OF BUTTE, STATE OF CALIFORNIA

Resolution No. 04-200

**RESOLUTION AUTHORIZING THE COUNTY OF BUTTE TO ADOPT THE
BUTTE COUNTY DROUGHT PREPAREDNESS AND MITIGATION PLAN**

WHEREAS, the County considers it imperative that the understanding, enhancement, and protection of water and other resources occur during drought contingencies; and

WHEREAS, the County seeks a comprehensive approach to planning for drought contingencies that protects the agricultural, ecological, and economic health as much as possible, while improving resource management for all beneficial uses; and

WHEREAS, the County participated in the development of the California Drought Contingency Plan; and

WHEREAS, Section 19632 of the California Water Code requires drought contingency planning in Urban Water Management Plans; and

WHEREAS, the County has approved the gray-waster use for on-site plant irrigation during critical water shortages in Chapter 19-20 of the Butte County Code; and

WHEREAS, the Department of Water Resources (DWR) has required the County of Butte to complete a Drought Preparedness Plan as a part of Contract # 4600001634, "The Butte County Integrated Watershed and Resource Conservation Plan;" and

WHEREAS, the Butte County Water Commission recommended the approval of the "Butte County Drought Preparedness and Mitigation Plan."

NOW, THEREFOE, BE IT RESOLVED by the Board of Supervisors that the County accept the recommendation of the Butte County Water Commission to adopt the Butte County Drought Preparedness and Mitigation Plan, with the changes suggested by the Commission.

PASSED AND ADOPTED by the Butte County Board of Supervisors this 26th day of October 2004 by the following vote:

AYES: Supervisors Dolan, Houx, Josiassen, Yamaguchi and Chair Beeler

NOES: None

ABSENT: None

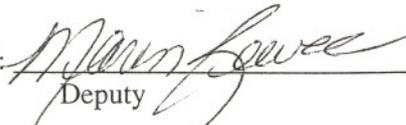
NOT VOTING: None



R. J. BEELER, Chair

ATTEST:

PAUL MCINTOSH, Chief Administrative Officer
And Clerk of the Board of Supervisors

By: 

Deputy